

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY
WATER RESOURCES DIVISION
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STAFF REPORT

A BIOLOGICAL SURVEY OF THE CENTRAL UPPER PENINSULA WATERSHEDS OF
THE AU TRAIN-CHOCOLAY, CEDAR-FORD, ESCANABA, RAPID-WHITEFISH, AND
FISH DAM-STURGEON RIVERS
MARQUETTE, ALGER, DICKINSON, DELTA, AND MENOMINEE COUNTIES
JUNE AND JULY 2015

Introduction

Staff of the Michigan Department of Environmental Quality (MDEQ), Surface Water Assessment Section, assessed the biological, chemical, and physical habitat conditions of the Central Upper Peninsula watersheds: Au Train-Chocolay (Hydrologic Unit Code [HUC] 04020201), Cedar-Ford (HUC 04030109), Escanaba (HUC 04030110), Rapid-Whitefish (HUC 04030111), and Fish Dam-Sturgeon (HUC 04030112) Rivers. Additionally, one targeted monitoring site was assessed outside of the Central Upper Peninsula in the Manistique River watershed (HUC 04060106). The objectives of this survey were to:

1. Evaluate the attainment status of the Other Indigenous Aquatic Life and Wildlife (OIALW) designated use.
2. Identify and investigate effects of nonpoint sources (NPS) of pollution.
3. Satisfy monitoring requests submitted by internal and external customers.

Methods

The macroinvertebrate communities were assessed and scored with metrics, which rate the communities on a scale from excellent to poor. Possible scores can range from 9 to -9. Stations with a score greater than, or equal to, +5 are considered excellent. Stations with a score less than, or equal to, -5 are classified as poor. Stations with a score of -4 through +4 are classified as acceptable (minimally to moderately impaired). Habitat evaluations are based on 10 metrics, with a possible maximum total score of 200. Stations are classified as excellent with a habitat score >154, good with a score between 105 and 154, marginal with a score between 56 and 104, and poor with a score <56 (MDEQ 1990, Creal et al., 1996).

Two site-selection methods were used to assess Central Upper Peninsula streams in 2015: stratified random and targeted. A probabilistic monitoring approach, using stratified random site selection to address statewide and regional questions about water quality, was used to select 14 sites within the Central Upper Peninsula watersheds. The sites were chosen randomly from a combined pool of streams within this sampling area. Ten sites were sampled to satisfy targeted monitoring requests that were submitted (described below). Nine sites were sampled as part of the statewide trend program.

At each water chemistry station, samples were collected mid-depth from the stream using 1 L amber glass bottles *under low flow conditions*. Water samples were preserved, kept on ice in a cooler, handled according to the Michigan Department of Natural Resources (MDNR) (1994)

and MDEQ Environmental Laboratory (2010) protocols, and analyzed by the MDEQ Environmental Laboratory. One sediment sample was collected using a metal spoon, homogenized in a metal bowl, placed in an 8 oz glass jar and kept on ice until it was analyzed at the MDEQ Environmental Laboratory.

Summary of Results

1. Evaluate the attainment status of the OIALW designated use.

Procedure 51 (P-51) biosurveys (MDEQ, 1990) were performed at 32 different stations (status/trend and targeted combined; Figure 1), and 1 site was only sampled for water quality, throughout the Central Upper Peninsula watersheds. Of those 32 biosurvey stations, 2 scored poor. The other stations ranged from low acceptable to excellent. Willow Creek and Portage Creek, which flow through urbanized sections of the city of Escanaba, were sampled at 4 different locations. Two of the Willow Creek locations scored low acceptable. The furthest upstream Willow Creek site and the 1 Portage Creek site scored poor and do not appear to be attaining the OIALW designated use. Willow Creek has been channelized and redirected from its original course as a result of development in the city of Escanaba. Willow Creek receives large amounts of surface runoff from urbanized areas of Escanaba and consequently has large amounts of bank erosion and in-stream sedimentation. Willow Creek is a tributary to Portage Creek, which was sampled below the confluence of Willow Creek. The Portage Creek station also showed signs of flashiness and impacts from draining large portions of the city of Escanaba and the Delta County Airport, and its macroinvertebrate population scored poor. Past surveys have also found poor and low acceptable macroinvertebrate and fish communities in Willow and Portage Creeks (Taft, 1996; Kohlhepp, 2007).

2. Identify and investigate effects of NPS of pollution.

Willow and Portage Creeks were targeted for sampling at 4 different sites to gather data prior to the construction of a new shopping center to the east of Willow Creek between 3rd Avenue and 6th Avenue. We found that both Willow and Portage Creeks are already severely impacted by storm water flows and sedimentation. Storm water runoff from an additional large building and parking lot will likely exacerbate what are already highly disturbed systems unless advanced best management practices are installed (e.g., low impact development storm water treatment structures). All of the other stations visited had minimal amounts of NPS pollution, or NPS sources were localized to small areas. At the East Branch Escanaba River at Iron Street (Station 19), some erosion from a beach area at Farquar-Metsa Tourist Park was observed. At the Escanaba River near Little West Road (Station 23), a two-track road enters the river on both sides, allowing trucks and off-road vehicles to drive through the river, which likely contributes localized erosion. At the Middle Branch Escanaba River off of County Road Ch (Station 3), old two-track roads were entering both sides of the river. Some bare soil was still exposed on the roads; however, they did not appear to have been driven on in a long time. Further away from the river the two-track was washed out and gully erosion is occurring. While the old road is likely eroding, the gully has also made the road impassable and is preventing trucks and other off-road vehicles from driving through the river.

The Willow and Portage Creek sites should be revisited during the next basin year when construction of the new shopping center is complete to assess any potential impacts the added development may have in the streams. Stations 19 and 23 are trend sites that will be revisited during the next basin year and the areas of erosion concern can be assessed again. Station 3

likely does not need to be revisited since the two-track that used to lead to the river is now impassable.

At the road crossing for an unnamed tributary to Tenmile Creek (River Road; Station 10), the stream is constricted by 2 perched culverts at the crossing (Figure 9). The perched culverts have created an unnatural plunge pool downstream of River Road and may be an impediment to fish movement.

Other non-NPS concerns:

At Hunters Brook, upstream of Boney Falls Road (Station 27), at least 3 stone dams had been placed across the stream by people. The small dams were altering the flow of the stream and may be an impediment to fish movement (Figure 5).

The Cedar River at 32 Road (Station 14) and Walton River at Westman Dam Road (Station 25) had moderate amounts of invasive rusty crayfish (*Orconectes rusticus*).

3. Satisfy monitoring requests submitted by internal and external customers.

All monitoring requests were generated internally and were fulfilled except for 1 site in the lower Escanaba River. The site in the lower Escanaba River was going to be monitored near the Holly Lane dead end near the mouth of the river because previous surveys of the lower Escanaba River had scored marginal under the old macroinvertebrate scoring methodology. However, when MDEQ personnel arrived to perform the biosurvey at that location, a large defunct railroad bridge was being removed by heavy machinery that was in the river. Because of safety concerns and the obvious disruption to ambient river conditions by the demolition activity, no sampling took place at that location.

Portage and Willow Creeks were sampled to gather data prior to a large shopping center being constructed next to Willow Creek. The Portage Creek macroinvertebrate community scored poor (-5) and habitat scored low good (107). The macroinvertebrate communities in Willow Creek scored either low acceptable or poor (-3, -4, and -6 at Old State Road/8th Avenue, 3rd Avenue, and 6th Avenue, respectively) and habitat scores were all marginal (88, 77, and 80 at Old State Road/8th Avenue, 3rd Avenue, and 6th Avenue, respectively). An unnamed tributary to Pickerel Lake, in the headwaters of the Fox River watershed (Alger County), was surveyed to follow up on conditions in the stream following the discovery of a gasoline release into the water body from buried fuel tanks. The macroinvertebrate community at that station scored acceptable (3) and the habitat scored good (115). The remaining targeted sites were surveyed because the water bodies had never been surveyed, had only "abbreviated site visits," or P-51 biosurveys had been performed using the old scoring methodology in the past. The macroinvertebrate communities at Beattie Creek, Walton River, and Black River all scored acceptable with scores of +1 for each station. Habitat at Beattie Creek scored good (116) and habitat at Walton River and Black River scored excellent (176 and 171, respectively). Both the macroinvertebrate community (score 8) and habitat (score 166) were excellent at Hunters Brook.

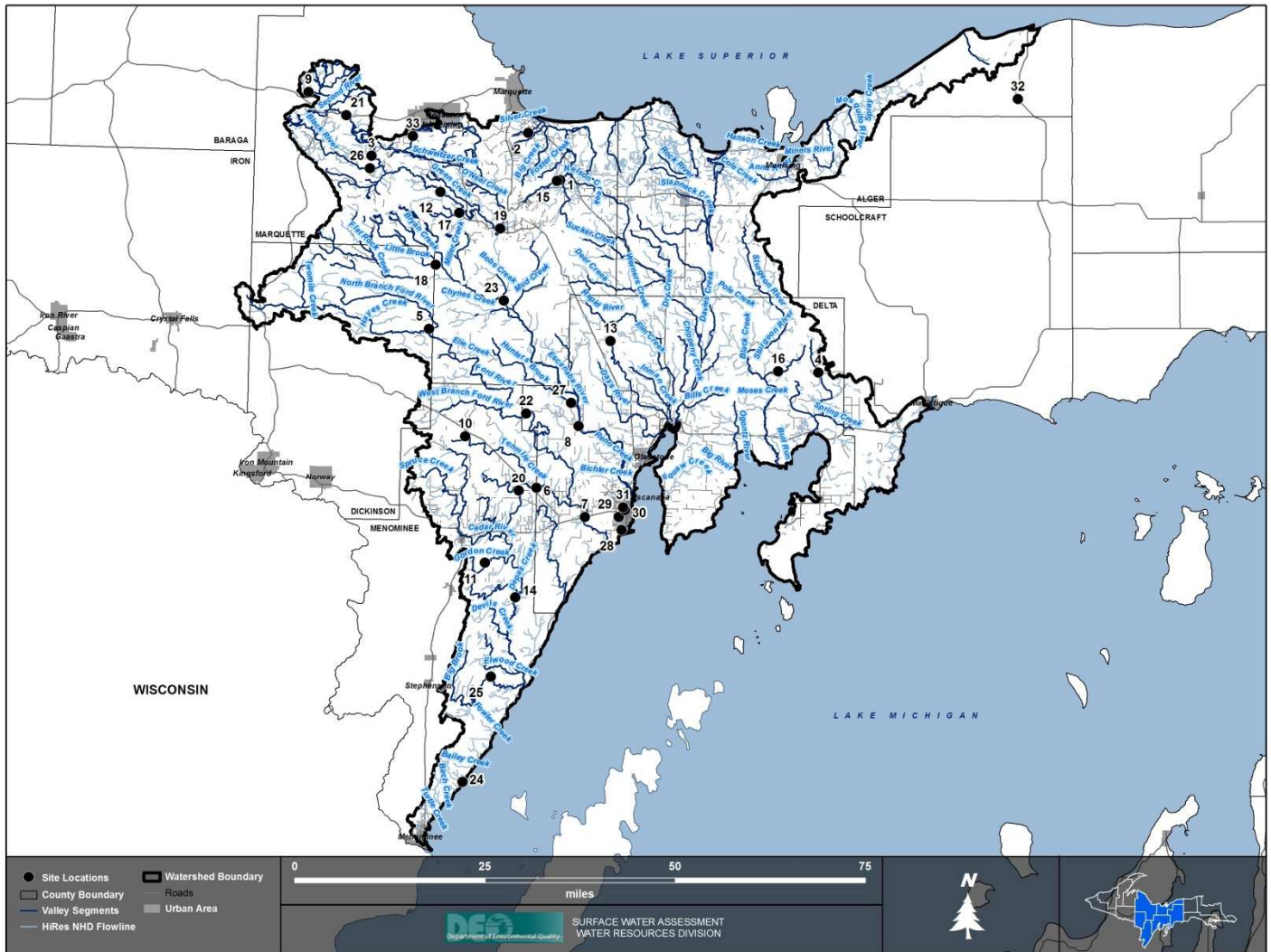


Figure 1. 2015 monitoring locations in the Central Upper Peninsula watersheds.

Watershed Information and Past Surveys

Extensive biological and water chemistry monitoring of the Central Upper Peninsula watersheds has been conducted by the MDEQ and Michigan Department of Natural Resources (MDNR) over the last 25 years (Cooper, 2006; Edly, 2008 and 2011; Godby, 2002; Hendrickson et al., 1973; Kohlhepp, 2007; Rippke, 2005a, 2005b; Suppnick, 2007; Taft, 1991a, 1991b, 1996, 2001, and 2006).

The Central Upper Peninsula watersheds monitored in 2015 are located in the central section of Michigan’s Upper Peninsula (Figure 1). This extensive area drains parts of five Michigan counties. The Central Upper Peninsula watersheds are sparsely populated; a high percentage of the land lies within the boundaries of the Michigan state forest system and Hiawatha National Forest. Escanaba, Gladstone, Rapid River, Munising, Ishpeming, and Powers are the primary communities within the Central Upper Peninsula watersheds.

The Central Upper Peninsula watersheds are located in the Northern Lakes and Forest Ecoregion (Omernik and Gallant, 1988); much of the land is forested. One exception is the Escanaba watershed, which flows through a large area of iron mining properties in the northern part of the watershed and agriculture/urban development located near the Lake Michigan shoreline. Many of the rivers and streams in the Central Upper Peninsula watersheds support coldwater fish communities.

Numerous large National Pollutant Discharge Elimination System (NPDES) permitted point source dischargers are found within the Central Upper Peninsula watersheds. These facilities include the Cliffs Mines in Empire and Tilden, NewPage Corp-Escanaba Paper Co, Kennecott-Humboldt Mill, Escanaba Wastewater Treatment Plant (WWTP), Gladstone WWTP, Neenah Papers, and the MDNR-Marquette Fish Hatchery.

Forestry, wood products, iron mining, and tourism continue to be the dominant industries in the Central Upper Peninsula watersheds. Major recreation activities include winter sports, swimming, fishing, hunting, camping, boating, fall color tours, and sightseeing.

Most of the small watersheds that flow through Delta and northern Menominee Counties drain areas of very thin soils that overlay dolomite bedrock, which outcrops all along the Lake Michigan shoreline. The dolomite bedrock historically was used for iron smelting in the area. This bedrock is so close to the soil surface that it causes very low base stream flows (Dorr and Eschman, 1970). The larger systems like the Escanaba, Ford, Chocolay, and Whitefish Rivers have good groundwater sources in their headwaters, which provide seasonal flow stability during dry periods for most of these systems. The majority of the river miles and lake acreage in the Central Upper Peninsula watersheds are attaining water quality standards (WQS) (Goodwin et al., 2014).

In 2010, Taft (2011) found that all of the sampled sites were attaining the OIALW designated use, although one site, Ely Creek, scored low acceptable (-4) for macroinvertebrates. Of the 32 sites sampled in 2015, 4 sites scored either low acceptable, or poor. Habitat at those 4 sites was also marginal. All of those sites were in the Willow-Portage Creek basin, which drains urbanized sections of the city of Escanaba. The majority of the remaining sites received either high acceptable or excellent macroinvertebrate scores (Table 1).

Table 1. Central Upper Peninsula watersheds 2015 monitoring locations and score summaries.

Site Number	Site Type	Waterbody Name	Location	County	Latitude	Longitude	P51	Water Sample	Macroinvertebrate score	Macroinvertebrate rating	Habitat score	Habitat rating
1	Status	West Branch Chocoday River	Town Hall RD	Marquette	46.3768	-87.2749	X		5	Excellent	144	Good
2	Status	Cherry Creek	Townline RD/ Co. RD BLA	Marquette	46.46600	-87.36480	X		1	Acceptable	166	Excellent
3	Status	Middle Branch Escanaba River	powerline two track off County Road Ch	Marquette	46.4169	-87.7947	X		7	Excellent	153	Good
4	Status	Fishdam River	Forest Road 2410/Olson Corridor	Delta	46.0164	-86.5609	X		4	Acceptable	144	Good
5	Status	North Branch Ford River	D/S Walker Rd	Dickinson	46.0889	-87.6268	X		3	Acceptable	155	Excellent
6	Status	Tenmile Creek	County Road 410	Menominee	45.7886	-87.3255	X		3	Acceptable	153	Excellent
7	Status	Ford River	US 2	Delta	45.735	-87.1925	X		0	Acceptable	157	Excellent
8	Status	Escanaba River	County Road 519	Delta	45.9095	-87.2132	X		5	Excellent	167	Excellent
9	Status	Unnamed Trib to Middle Branch Escanaba River	Two track off end of County Road Ada	Marquette	46.535	-87.9728	X		1	Acceptable	155	Excellent
10	Status	Unnamed Trib to Tenmile Creek	River Rd	Menominee	45.8863	-87.5222	X		3	Acceptable	182	Excellent
11	Status	Gordon Creek	36.5 Mile Rd	Menominee	45.6447	-87.4617	X		4	Acceptable	173	Excellent
12	Status	Middle Branch Escanaba River	County Road 565	Marquette	46.3508	-87.6034	X		5	Excellent	175	Excellent
13	Status	Tacoosh River	E. Maple Ridge Rd	Delta	46.0718	-87.1293	X		0	Acceptable	141	Good
14	Status	Cedar River	32 Rd	Menominee	45.58	-87.3782	X		4	Acceptable	155	Excellent
15	Trend	West Branch Chocoday River	CR 545/West Branch RD	Marquette	46.3753	-87.283	X		3	Acceptable	112	Good
16	Trend	Eighteen Mile Creek	D/S Forest Highway 13	Delta	46.018	-86.6707	X		4	Acceptable	171	Excellent
17	Trend	Bear Creek	County Road 565	Marquette	46.3119	-87.5506	X		0	Acceptable	161	Excellent
18	Trend	Big Brook	D/S Kates Grade Road/ CR Eaa	Marquette	46.212	-87.6123	X		4	Acceptable	162	Excellent
19	Trend	East Branch Escanaba River	Iron Street	Marquette	46.2834	-87.4367	X		4	Acceptable	162	Excellent
20	Trend	Fortyseven Mile Creek	Mott LN	Menominee	45.7832	-87.3735	X		6	Excellent	168	Excellent
21	Trend	Middle Branch Escanaba River	US 41	Marquette	46.4929	-87.8671	X		-1	Acceptable	159	Excellent
22	Trend	Ford River	Cedardale 28th Road	Delta	45.9313	-87.3567	X		6	Excellent	158	Excellent
23	Trend	Escanaba River	two-track off Little West Rd/CR SW	Marquette	46.1457	-87.4235	X		5	Excellent	171	Excellent
24	Targeted	Beattie Creek	M 35	Menominee	45.22702	-87.51228	X		1	Acceptable	116	Good
25	Targeted	Walton River	Westman Dam Rd	Menominee	45.42838	-87.44070	X		1	Acceptable	176	Excellent
26	Targeted	Black River	Two track off Island Lake Rd	Marquette	46.39269	-87.79860	X		1	Acceptable	171	Excellent
27	Targeted	Hunters Brook	Boney Falls Road	Delta	45.95321	-87.23449	X		8	Excellent	166	Excellent
28	Targeted	Portage Creek	M 35	Delta	45.71140	-87.09250	X		-5	Poor	107	Good
29	Targeted	Willow Creek	Old State Rd/8th Ave	Delta	45.73550	-87.10060	X	X	-3	Acceptable	88	Marginal
30	Targeted	Willow Creek	3rd AVE	Delta	45.74886	-87.08399	X	X	-4	Acceptable	77	Marginal
31	Targeted	Willow Creek	6th AVE	Delta	45.75370	-87.08917	X	X	-6	Poor	80	Marginal
32	Targeted	Unnamed tributary to Pickerel Lake	M-77 and Adams Truck Trail	Alger	46.5384	-86.0147	X	X	3	Acceptable	115	Good
33	Targeted	Unnamed Pond discharge to Ely Creek	Washington ST	Marquette	46.45557	-87.68225		X				

2015 Macroinvertebrate and Habitat Biosurvey Sampling Results

Au Train-Chocolay Rivers Watersheds

A large portion of the Au Train-Chocolay Rivers watersheds are managed for tourism, timber, and wildlife as the Hiawatha National Forest, Escanaba River State Forest, and Pictured Rocks National Lakeshore fall within its boundaries. The Pictured Rocks National Lakeshore spans 40 miles along the Lake Superior coastline in Alger County. Several waterfalls are located throughout the area, including the Au Train Falls, Miner's Falls, and Laughing Whitefish Falls. For a description of the geology, soils, climate, and land use of the watershed, refer to Rippke (2005b) and Mechenich et al. (2006).

West Branch Chocolay River

The West Branch Chocolay River off of CR 545 (Station 15) is located in an area where a sand trap was installed in the 1990s to reduce downstream sedimentation and improve habitat. In June 2005, biosurveys were performed before sand trap cleanout work took place in July 2006. Upstream of the sand trap (at STORET 520420) macroinvertebrate community and habitat scores were 1 and 149, respectively, while downstream of the sediment trap (at STORET 520421) scores were 1 and 167, respectively (Suppnick, 2007 and 2009). The upstream station (STORET 520420) was again monitored in 2010, with macroinvertebrate community and habitat scores of 3 and 116, respectively (Taft, 2011).

In 2015, due to an erroneous field note, the biosurvey was conducted upstream of County Road 545, but approximately 300 feet downstream of the 2005/2010 sampling location and, apparently, downstream of the sediment trap. It did not appear in 2015 that any recent sand trap maintenance (e.g., "clean-out") had taken place, and there was a lot of sand in the stretch of river that was sampled. The 2015 macroinvertebrate community score was 3 (acceptable) (Tables 2A and 2B). Overall, 24 total taxa were found, and the dominant taxa (Chironomidae) comprised 61% of the community. The % EPT (Ephemeroptera, Plecoptera, Trichoptera) taxa was 30% (Tables 2A and 2B). Habitat at this station rated good with a score of 112 (Table 3); it had poor substrate conditions and, in some locations, poor riparian vegetation conditions.

The West Branch Chocolay River at Townhall Road (Station 1) had a macroinvertebrate community score of 5 (excellent; Tables 2A and 2B). Overall, 24 total taxa were found, and the dominant taxa (Ephemerellidae) comprised 25% of the community. The % EPT taxa was 60% (Tables 2A and 2B). Habitat at this station rated good with a score of 144 (Table 3), with some evidence of flashiness and some moderate concerns about bank stability and riparian vegetation conditions.

Cherry Creek

Cherry Creek, upstream of the Marquette State Fish Hatchery (Station 2), had a macroinvertebrate community score of 1 (acceptable; Tables 2A and 2B). Overall 13 total taxa were found and the dominant taxa (Chironomidae) comprised 34% of the community. The % EPT taxa was 37% (Tables 2A and 2B). Habitat at this station rated excellent with a score of 166 (Table 3) and it was well shaded by intact, forested riparian vegetation. The presence of a small dam and weir (likely used by the hatchery for monitoring flow conditions) upstream of the sampling reach may have had some impact on the lotic biological community within the sampling reach.

Escanaba Watershed

The Escanaba River watershed is one of the largest watersheds in Michigan's Upper Peninsula totaling 924 square miles and has 508 miles of streams that flow year round (U.S. Environmental Protection Agency, 2011). This watershed starts in west central Marquette County, north of Lake Michigan, and flows southeast to Lake Michigan at Little Bay de Noc (Figure 1). The name of this large river system and the community of Escanaba were derived from an Ojibwa (Chippewa) Indian word meaning "flat rock." The majority of the limestone bedrock waterfalls found near Lake Michigan have been impounded for power generation and/or paper making.

Sites sampled in the Escanaba watershed included:

- Main stem Escanaba River at:
 - County Road 519 in Cornell Township (Station 8).
 - Two-track off of Little West Road in Ewing Township (Station 23).
- Middle Branch Escanaba River at:
 - Two track off of County Road Ch in Ely Township (Station 3).
 - County Road 565 in Richmond Township (Station 12).
 - US 41 in Humboldt Township (Station 21).
- An unnamed tributary to the Middle Branch Escanaba River at a two track off of County Road ADA in Champion Township (Station 9).
- East Branch Escanaba River at Iron Street in Forsyth Township (Station 19).
- Bear Creek at County Road 565 in Forsyth Township (Station 17).
- Big Brook at County Road Eaa in Forsyth Township (Station 18).
- Black River at a two track off of Island Lake Road in Ely Township (Station 26).
- Hunters Brook at Boney Falls Road in Cornell Township (Station 27).

Escanaba River

At Station 8 both the macroinvertebrate community and habitat scored excellent (macroinvertebrates: 5 [Tables 2A and 2b], habitat: 167 [Table 3]). Twenty-seven different macroinvertebrate taxa were collected, 12 of which were EPT taxa, indicating high water quality conditions. Kohlhepp (2007) sampled this site in 2005 and the macroinvertebrates rated acceptable using an older sub-sampling procedure and habitat rated excellent. The river is over 300 feet wide at this station, although the recorded average depth at the time of sampling was only 1.6 feet. The river bottom was largely bedrock. The station had a large riffle area that was almost 100 feet long and featured a "stair step" pattern of river bed elevation change. The series of drops in elevation increased the habitat heterogeneity of the station. Also scattered throughout the station was a mix of boulders, cobble, and gravel, which provided epifaunal substrate. Besides the various sizes of rocks, other habitat types such as undercut banks, woody debris, and vegetation were either absent or sparse. Immediate riparian vegetation was

somewhat fragmented by residential land use. The larger surrounding landscape is largely forested with some agricultural land use.

At Station 23 both the macroinvertebrate community and habitat scored excellent (macroinvertebrates: 5 [Tables 2A and 2B], habitat: 171 [Table 3]). This station was located within the Gwinn State Forest Area below where the West Branch Escanaba River enters the main stem Escanaba River. Twenty-seven different macroinvertebrate taxa were collected, 14 of which were EPT taxa, indicating high water quality conditions. The river is around 200 feet wide at that station, although the average depth was only around 1 foot. The river bottom was mostly bedrock with substantial amounts of gravel and cobble, along with some boulders. Aside from the various sizes of rocks, other stable substrate such as undercut banks, large woody debris, and plants were sparsely available. The two-track road off of Little West Road goes all the way to the edge of the river bank and a two-track going to the river is also present on the opposite side. Fresh tire tracks going into the river indicated that trucks and off-road vehicles are actively crossing the river. This is likely causing localized erosion at the road ends and localized disturbances to the river bottom. Aside from the road entry points, the riparian vegetation consisted of intact, mature forest. The greater surrounding area is largely intact forest.

Middle Branch Escanaba River

Station 3 was sampled at a two-track off of County Road Ch, although the site needed to be accessed from a two-track off of a county road to the east of the river because of impassable road conditions off of County Road Ch. The macroinvertebrate community scored excellent (7: Tables 2A and 2B) and habitat scored good (153: Table 3). Thirty-two different taxa were collected at that station, 18 of which were EPT, indicating good water quality conditions. The water temperature was cold at the time of sampling (58° F) despite an air temperature of 82° F. The bottom substrate was mostly gravel, which provided the most potential habitat for macroinvertebrates. The only other stable habitat that was moderately available was overhanging vegetation. Otherwise, habitat types such as large woody debris and undercut banks were generally lacking. The majority of the station had intact riparian vegetation and the surrounding landscape is mostly intact forest. There was, however, a ~90-foot wide powerline swath, devoid of large trees, that is immediately adjacent to the access point of the monitoring location. Also within the power line swath is a two-track road. The two-track went all the way down to the river and, at one time, trucks had obviously driven through the river, causing localized stream bank erosion on the left and right banks (Figure 2). Both of the two-tracks were largely impassable at steep inclines of the river valley, largely as a result of gully erosion in the two-tracks. Because of the impassability, there did not appear to be any recent vehicle activity at the road crossings. Some vegetation was starting to regrow in the eroded areas, although some bare soil spots were still present.



Figure 2. Left (left) and right (right) banks where trucks had driven through the river at Station 3.

At Station 12 both the macroinvertebrate community and habitat scored excellent (macroinvertebrates: 5 [Tables 2A and 2B], habitat: 175 [Table 3]). Thirty different taxa were collected at Station 12, 15 of which were EPT, indicating high water quality. The station was characterized by the presence of large boulders and cobble, with large, cascading rapids (Figure 3). Other than the predominance of rock substrate, other stable habitat types such as large woody debris and plants were either sparse or absent. Several residential lots in the immediate area diminished the amount of riparian vegetation; however, most of the surrounding area is intact forest.



Figure 3. Station 12: Middle Branch Escanaba River at County Road 565.

The macroinvertebrates at Station 21 scored acceptable (-1: Tables 2A and 2B) and habitat scored excellent (159: Table 3). The macroinvertebrate score was the same as Taft (2011) reported and the habitat score was very similar to Taft's (2011) score (163). Simuliidae larvae dominated the taxa found at Station 21. Simuliidae larvae have a wide tolerance range to stressors, but tend to dominate in systems with moderate amounts of organic matter input (Voshell, 2002). The Middle Branch Escanaba River above Station 21 drains an extensive wetland network and contains wetlands along the margins of the river, which likely provide organic matter to the river. Boulders and cobble made up approximately half of the substrate at the station, with sand and silt making up the other half. A thick stand of *Vallisneria* was along the left bank and a backwater area with *Vallisneria* and lily pad macrophytes was along the right bank. Other than the extensive aquatic plant beds and rocks, other habitat types such as woody debris and undercut banks were sparse. A snowmobile trail and a residential lot diminished the amount of local riparian vegetation; however, the greater surrounding area contains forest and wetland.

Unnamed Tributary to Middle Branch Escanaba River

The macroinvertebrates at Station 9 scored acceptable (1: Tables 2A and 2B) and habitat scored excellent (155: Table 3). The substrate was a mix of gravel and sand, with some silt. Moderate amounts of detritus were at Station 9, likely as a result of the swampy landscape that

it was flowing through. Flow was slow at this station and about half of the stream bottom was covered with *Vallisneria*. Simuliidae and Chironomidae dominated amongst the taxa, which is characteristic of streams with moderate amounts of organic matter (Voshell, 2002). Despite the low flow and swampy characteristics, 10 EPT taxa were collected, indicating good water quality. A powerline swath along the two-track at Station 9 diminished some of the immediate riparian vegetation; however, the greater surrounding landscape is forest and wetland.

East Branch Escanaba River

The macroinvertebrates at Station 19 scored high acceptable (4: Tables 2A and 2B) and habitat scored excellent (162: Table 3). The bottom substrate was mostly gravel (~70%) with the remaining substrate being sand with some cobble. Large woody debris was moderately available, but other habitat types such as undercut banks and overhanging vegetation were sparse. Thirty-one different taxa were collected, 13 of which were EPT, indicating high water quality. The macroinvertebrate score at this station was the same as Taft (2011) reported and the habitat score assigned in 2015 to this station was similar to the one given by Taft (2011; 159). Immediately upstream of Station 19 is a campground beach on the right bank. In one area of the beach, an erosional gully spans the campground parking lot to the water and it is actively eroding sand into the river (Figure 4). The surrounding landscape upstream of station 19 is a mix of intact forest and tree farms. The Sawyer Air Force Base and associated residential area is a prominent development upstream of Station 19.



Figure 4. Gully erosion at beach immediately upstream of Station 19.

Bear Creek

The macroinvertebrates at Station 17 scored acceptable (0: Tables 2A and 2B) and habitat scored excellent (161: Table 3). The bottom substrate was mostly sand and silt, with little gravel. Overhanging vegetation was heavy and large woody debris was moderately available. Water flow was slow and moderate amounts of detritus were present at the station. This station drains an extensive wetland system and has wetlands along the margins of the creek, which is the likely source of the organic matter. Twenty-three different taxa were collected. Seven Trichoptera and two Ephemeroptera taxa were collected, but no Plecoptera were found. Baetidae was the most abundant taxa at the station, which have a wide range of tolerances (Voshell, 2002). This station was sampled by Taft (2011) in 2010 who noted a beaver dam was present upstream of the station. It was not there in 2015 though. Also, the bridge on County Road 565 at Station 17 had been replaced in 2011. The 2015 scores were similar to the macroinvertebrate (1) and habitat (152) scores reported by Taft (2011). Because of the wetland habitat along the margins of Bear Creek, large trees were mostly absent in the immediate riparian area. The greater surrounding area upstream of Station 17 contains a mix of forest, agriculture, and residential land use around Horseshoe Lake.

Big Brook

At Station 18, the macroinvertebrate community scored high acceptable (4; Tables 2A and 2B) and habitat scored excellent (162: Table 3). Taft (2011) reported a macroinvertebrate score of 4 and a habitat score of 163 in 2010. The bottom substrate was mostly sand; however, overhanging vegetation was heavy and large woody debris and aquatic macrophytes were moderately available as macroinvertebrate habitat. The stream is very sinuous with many deep holes in the erosional areas. Fine and coarse organic matter were moderate, likely as a result of Big Brook draining an extensive wetland network. Twenty-five different taxa were collected, 11 of which were EPT taxa, indicating good water quality. Station 18 is a popular location for people to fish and some localized erosion was observed where anglers had accessed the stream. Because the stream is so sinuous, part of the stream runs along County Road Eaa for a short distance. The greater surrounding area is a mix of forest and wetland.

Black River

Station 26 was sampled because the Black River had not been sampled using a P-51 biosurvey. The Black River is aptly named as the water has an opaque black color. The black color is natural and is a result of the extensive swamp land draining into the river (Wiitala et al., 1967). The macroinvertebrate community scored acceptable (1: Tables 2A and 2B) and habitat scored excellent (171: Table 3). The river bottom was mostly sand and silt, although there was also a good mix of boulders, cobble, and gravel. Large woody debris was heavy and overhanging vegetation was moderate. Station 26 had all of the pool depth regimes, and in some places was too deep to sample. Simuliidae larvae made up almost half of the macroinvertebrates collected (47%). This is probably because of the large amount of organic matter in the river originating from the swampy headwaters. Twenty-four taxa were collected, of which 11 were EPT taxa, indicating good water quality. While the immediate riparian area consisted of intact forest with mature trees and the greater surrounding area is forest and wetland, heavy logging appears to have taken place in the last five years upstream of Station 26.

Hunters Brook

Station 27 was sampled because Hunters Brook was last sampled using the old P-51 methodology in 2000 (Godby, 2002). In 2015 Hunters Brook at Station 27 scored Excellent for both macroinvertebrates (8; Tables 2A and 2B) and habitat (166: Table 3). The stream bottom was mostly bedrock and cobble substrate. In three different places, rocks had been artificially placed across the stream by people, which was altering the flow and may be an impediment to fish passage (Figure 5). Other than rocks though, other stable habitat types such as large woody debris and undercut banks were sparse. Twenty-nine different taxa were collected, 15 of which were EPT, indicating high water quality. The riparian vegetation is mostly intact forest, which provides good canopy cover, although one residential lot near Station 27 did diminish local riparian vegetation. The greater surrounding area consists of forest and some agriculture.



Figure 5. One of three artificially placed, stone dams at Station 27.

Willow and Portage Creek Watershed

Willow and Portage Creeks are two heavily modified water bodies that flow to the west of the city of Escanaba. Both of these systems have been extensively channelized and are used largely for storm water conveyance for the city of Escanaba and the Delta County Airport. Willow Creek was formerly a small stream that flowed into a large cedar swamp west of Escanaba and was never a direct tributary to Portage Creek according to an 1846 plat map. However, by the time a 1932 United States Geological Survey (USGS) topographical map was produced, an approximately 4-mile long ditch had been excavated to connect Willow Creek to Portage Creek (Taft, 1996). Both Willow and Portage Creeks have been sampled in the past by the MDEQ (Taft, 1996 and 2001; Kohlhepp, 2007) and have revealed degraded macroinvertebrate communities and habitat in all sampled areas below US 2. Sampling in 2015 was performed at 3 stations in Willow Creek; (6th Avenue (Station 31), 3rd Avenue (Station 30), and Old State Road/8th Avenue (Station 29)), and at 1 station in Portage Creek below the Willow Creek confluence (Portage Creek at M 35 (Station 28)).

P-51 biosurveys were performed at all 4 stations and water chemistry samples were collected at all of the Willow Creek stations as pre-data to assess the potential impacts of a new shopping center that will be constructed between 6th Avenue and 3rd Avenue alongside Willow Creek. Water chemistry results at all 3 Willow Creek sites revealed no semivolatile organic compounds and low concentrations of diesel-range organics. Small amounts of barium were found at all 3 sites and copper was found in a low concentration at Station 29. None of those concentrations were above WQS. All three sites did have elevated nutrient concentrations that would be considered characteristic of eutrophic lake systems (Table 4). The samples were taken during ambient stream flow conditions, so there is a possibility that the concentrations of organics and nutrients are higher after significant rain events.

Station 31 was the furthest upstream site sampled in the Willow-Portage Creek system. The macroinvertebrate community scored poor (-6: Tables 2A and 2B) and habitat scored marginal (80: Table 3). Taft (1996) sampled this site in 1995 and reported that the macroinvertebrate community rated "fair" and habitat scored "poor" at the time. The bottom substrate was almost completely composed of sand. At the 6th Avenue road crossing, a large sand bar was constricting flow. Epifaunal substrate was only moderately available in the form of overhanging vegetation. Otherwise, most other habitat types were either sparse or unavailable. Signs of flashiness were evident by the amount of sedimentation and logs/debris that had been deposited on the floodplain. The macroinvertebrate community consisted mostly of Amphipods and Isopods. Amphipoda are facultative and have a tendency to dominate in degraded habitats and Isopoda are somewhat tolerant to organic pollution (Voshell, 2002). Only 13 different taxa were collected, which included only 1 Ephemeroptera and 2 Trichoptera families, indicating degraded conditions. The immediate riparian area consisted of intact forest that provides good canopy cover. Upstream land use consists of mostly wetlands to the west of Willow Creek and heavily urbanized areas to the east of the stream. Upstream of Station 31, Willow Creek serves as a ditch for North 30th Street for about 2/3 of a mile, which likely contributes to the flashiness of the stream.

Station 30, downstream of 3rd Avenue, is likely to be the most impacted by the future upstream development along Willow Creek. During this visit the macroinvertebrate community scored low acceptable (-4; Tables 2A and 2B) and habitat scored marginal (77; Table 3). The bottom

substrate was almost all sand and large sedimentation bars were present along the margins of the stream. Overhanging vegetation and rootwads were moderately available, otherwise, all other habitat types were sparse or absent. Garbage was prevalent in the stream and in some cases served as stable habitat that could be sampled for macroinvertebrates. Signs of flashiness were prevalent and the banks were raw and eroding more than 2 feet above the water surface. Amphipoda, Isopoda, and Chironomidae were the dominant taxa at Station 30. Amphipoda are facultative and Chironomidae have a wide range of tolerances. Typically, if they are the dominant taxa, that is an indication of disturbance. Isopoda are tolerant to organic pollution and their dominance in a stream is typically an indication of disturbance (Voshell, 2002). Nineteen different taxa were present, but included only 1 Ephemeroptera family and 1 Trichoptera family. Along both banks was a thin riparian area of tall trees that provides good canopy cover; however, beyond that is mostly impervious surfaces including a large parking lot on the east of the stream. At the time of sampling, upstream of 3rd Avenue was largely forest and wetlands, with only 1 business lot near the stream. After the new shopping center is constructed between 3rd and 6th Avenues, the flashiness of Willow Creek will likely increase.

Station 29, at Old State Rd/8th Avenue is the furthest downstream site sampled on Willow Creek. The macroinvertebrates scored low acceptable (-3: Tables 2A and 2B) and habitat scored marginal (88; Table 3). These scores are similar to those reported by Kohlhepp (2007) for this station in 2005 (Macroinvertebrates: -3 and habitat: 92). The substrate at Station 29 was almost all sand. Stable, natural substrate at this station was sparse. Some rocks had been placed in the stream to reduce the velocity of water discharging from a large drainage pipe. There was also a lot of garbage in the stream, which in some cases was sampled for macroinvertebrates given a lack of other substrate to sample. Amphipoda and Chironomidae were the dominant taxa at the station. Amphipoda are facultative and Chironomidae have a wide range of tolerances and typically if either one of those taxa are dominant, that is an indication of disturbance (Voshell, 2002). Seventeen different taxa were collected at Station 29, which only included 1 Ephemeroptera and 1 Trichoptera family. Signs of flashiness were evident by scoured, actively eroding banks more than 2 feet above the water surface. In 1 spot along the right bank, near a sediment island, a large volume of sod had slumped into the stream. Immediately along both banks, large trees are present, which provide good canopy cover. Land cover along the right bank consists of forest and field habitat. Along the left bank is a large apartment complex, which is the likely source of the large drain into the stream. The greater surrounding area consists of forest and wetlands to the west of Willow Creek and urbanized areas to the east of the stream. Willow Creek is channelized for a long distance by the time it reaches Station 29, including serving as a ditch for Willow Creek Road.

Station 28 in Portage Creek at M 35 is below the Confluence of Willow Creek. The macroinvertebrate community scored poor (-5: Tables 2A and 2B) and habitat scored low good (107: Table 3). These scores were similar to those reported by Kohlhepp (2007: Macroinvertebrates [-5], habitat [97]). The macroinvertebrate community was dominated by Amphipoda and Isopoda. Amphipoda are facultative and have a tendency to dominate in degraded habitats and Isopoda are somewhat tolerant to organic pollution (Voshell, 2002). Only 3 Trichoptera and 1 Ephemeroptera taxa were collected, which is also indicative of poor habitat conditions. Taft (1996) also found that the majority of invertebrates collected were Amphipoda and Isopoda, and recorded a "fair" score using the old scoring methodology. The substrate was dominated by sand. Large woody debris and rootwads were sparsely available as epifaunal substrate. There was also a lot of garbage in the stream, which we also sampled for macroinvertebrates given the lack of other stable habitat. The stream showed signs of flashiness with heavy amounts of sedimentation and raw, eroding banks. Along the right bank is a residential lot with a thin line of large trees on the stream bank. On the left bank is intact forest

with large trees. The large trees along both banks provide good canopy cover. Immediately upstream of Station 28 is the Delta County Airport. Portage Creek flows under a large runway in the airport and a drainage ditch along the runway is connected to Portage Creek. Beyond the airport, land use consists of urban areas in the city of Escanaba to the east of Portage Creek and a mix of forest and wetlands to the west of it.

Unnamed pond discharge to Ely Creek

A water sample was taken from the discharge channel of an unnamed pond near the town of National Mine. The water body was sampled for organics (diesel range organics/oil range organics and semivolatiles), nutrients, and metals. The sampling was performed because of the noticeable discoloration of the water (Figure 6). An ambient water sample was taken upstream from where we sampled. Upon walking in the small discharge stream, iron precipitation that was covering the rocks in the outlet was liberated and caused noticeable discoloration of the outlet and in Ely Creek when it flowed in there (Figure 6). No diesel range organics, oil range organics, or polyaromatic hydrocarbons were detected in the water sample (Table 4). Only 2 of the Michigan ten metals, barium and copper, were detected at low concentrations, and nutrients were also low (Table 4). The unnamed pond is a former mine pit and caving ground that is likely discolored by the oxidation/precipitation of iron (Steve Casey, Pers. Comm.).



Figure 6. Left: Aerial image of discolored, unnamed pond. Right: Liberated iron in pond discharge after bottom substrate was disturbed.

Cedar-Ford River Watershed

The Cedar-Ford River watershed drains parts of Delta, Dickinson, and Menominee Counties. At 1,018 square miles, the Cedar-Ford River watershed covers approximately one-third of the Central Upper Peninsula watersheds. Groundwater input is reduced dramatically in the downstream sections of these watersheds where the bedrock outcrops at the surface near the

Lake Michigan shoreline. Numerous tributaries within these watersheds were used extensively for log drives during the 1880s and 1890s.

Sites sampled in the Cedar-Ford River watershed included:

- North Branch Ford River downstream of Walker Road in West Branch Township (Station 5).
- Ford River at Cedardale Road in Cornell Township (Station 22).
- Ford River at US 2 in Ford River Township (Station 7).
- Tenmile Creek at County Road 410 in Harris Township (Station 6).
- An unnamed tributary to Tenmile Creek downstream of River Road in Spalding Township (Station 10).
- Gordon Creek at 36.5 Mile Road in Spalding Township (Station 11).
- Cedar River at 32 Road in Gourley Township (Station 14).
- Fortyseven Mile Creek at Mott 46 Lane in Harris Township (Station 20).
- Walton River at Westman Dam Road in Cedarville Township (Station 25).
- Beattie Creek at M 35 in Ingallston Township (Station 24; grouped into the Cedar-Ford watershed; however, it is a separate tributary to Lake Michigan).

North Branch Ford River

Station 5 was sampled downstream of Walker Road because the upstream section was too deep for wading. The macroinvertebrate community scored high acceptable (3; Tables 2A and 2B) and habitat scored excellent (155; Table 3). The substrate was mostly sand, although we were able to sample 1 gravel patch. Large woody debris and a bed of *Vallisneria* provided moderate amounts of habitat, but other habitat types were sparse. Twenty-nine different taxa were collected, including 12 EPT, indicating good water quality. Brachycentridae dominated the amount of macroinvertebrates collected (31%). The dominance by this 1 taxa reduced the macroinvertebrate score (Table 2B); however, Brachycentridae are very sensitive to stress/pollution (Voshell, 2002). Station 5 had alder-dominated wetland habitat immediately along its banks with intact forest further upland. The greater surrounding area upstream is mostly intact forest and wetland, although there is a large agricultural field close to the river upstream of Station 5.

Ford River

Both the macroinvertebrate community and habitat scored excellent at Station 22 (macroinvertebrates: 6 [Tables 2A and 2B], habitat: 158 [Table 3]). The 2015 habitat score was similar to what Taft (2011) reported at this station in 2010 (169) and the macroinvertebrate score was slightly better than what Taft (2011) reported (3). The river bed was mostly bedrock interspersed with gravel, boulders, and cobble. The rocks provided the majority of the habitat for macroinvertebrates since large woody debris, overhanging vegetation, and undercut banks

were sparse. Along the right bank, upstream of Cedardale Road, is a residential lot with an actively eroding bank and sod slumping into the river (Figure 7). A review of aerial photos from the last two decades (Figure 8) shows the flow pattern of the Ford River above Cedardale Road shifting. Photos from the 1990s appear to show a typical erosional (left bank)-depositional (right bank) pattern. However, recent photos show the main flow shifting along the right bank, and the former erosional channel largely closed off to water flow. The relatively recent shift in flow pattern may be what is causing the observed erosion on the right bank. Twenty-nine different taxa were collected including 13 EPT, indicating high water quality. A Unionidae mussel that was photographed and identified as *Eliptio complanata* was also found. Generally, Unionidae mussels are considered to be intolerant to stressors (Voshell, 2002). On both sides of the river are residential lots that diminish some of the riparian vegetation. The greater surrounding area consists of intact forest and wetlands.



Figure 7. Actively eroding bank and slumping sod at Station 22.

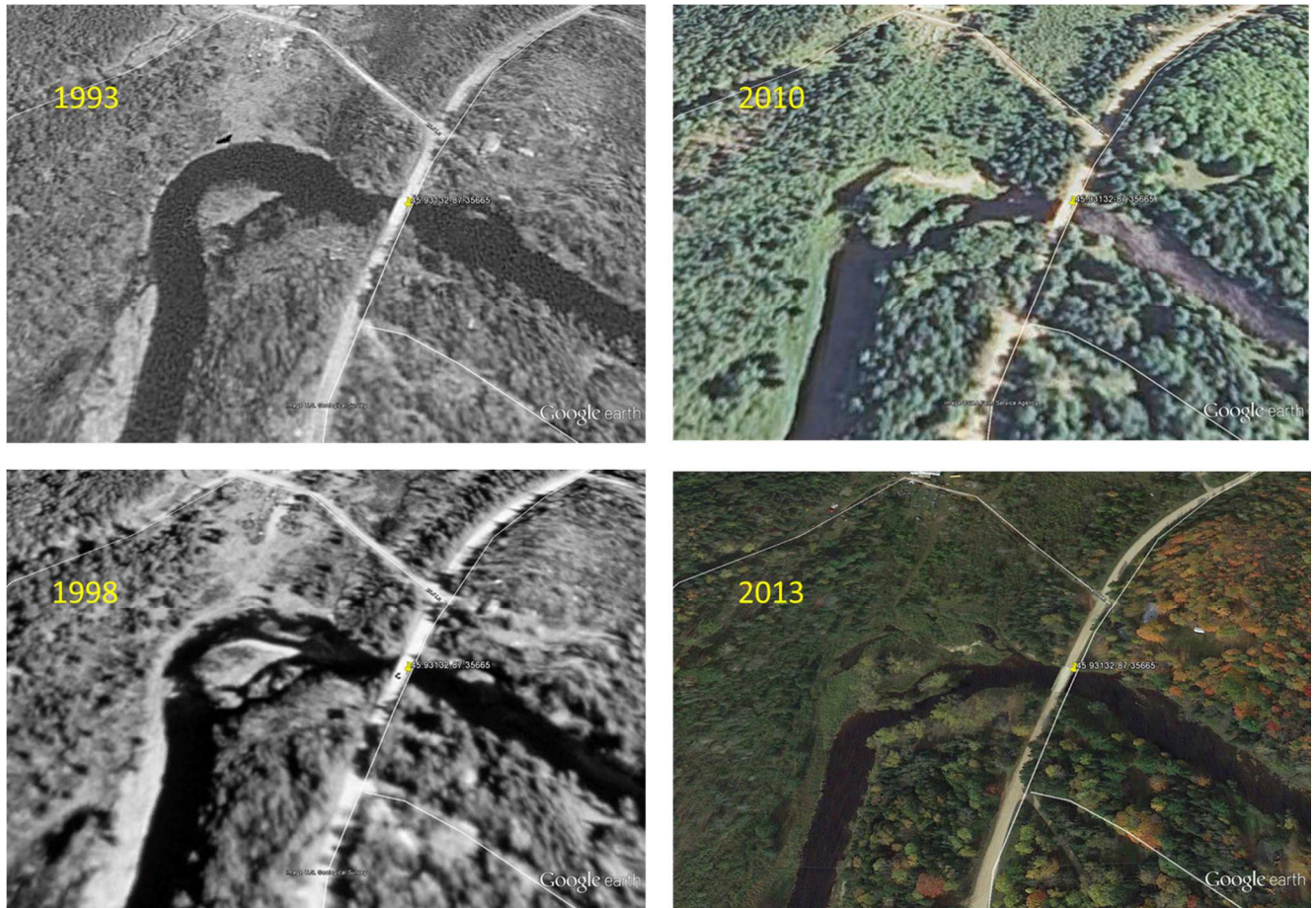


Figure 8. Changing flow pattern at Station 22 from 1993 to present. The river is flowing from left to right.

The main stem Ford River was also sampled upstream of US 2 (Station 7). The macroinvertebrate community scored acceptable (0; Tables 2A and 2B) and habitat scored excellent (157; Table 3). Taft (2001) sampled this site in 2000 and reported that the habitat was good and the macroinvertebrate community was excellent. The bottom substrate was mostly cobble with a mix of sand and gravel making up most of the remaining sediment. Other than the gravel and cobble substrate though, other stable habitat such as large woody debris and overhanging vegetation was sparse. Thirty-three different taxa were collected, including 8 EPT taxa and 1 Unionidae mussel (*Elliptio complanata*). Corixidae, which are considered to be tolerant to stressors (Voshell, 2002), were the most abundant taxa collected, which decreased the score. In contrast, Taft (2001) collected 14 different EPT taxa and only 2 individual Corixidae at this site in 2000. However, Taft (2001) used the old scoring methodology and sampled the site 1 month earlier than we did in 2015. Because this station has not been consistently sampled as a trend site, it is difficult to say whether or not conditions have deteriorated at this site. The immediate riparian area is mostly forest although a gravel road on the left bank reduces the amount of trees on that side. Upstream of Station 7 land use is a mix of forest, agriculture, and residential lots. Some of the agricultural fields are close to the river with little riparian vegetation between the crops and the river.

Tenmile Creek

At Station 6, the macroinvertebrate community scored high acceptable (3; Tables 2A and 2B) and habitat scored excellent (153; Table 3). The substrate was mostly cobble with a mix of sand, gravel, and boulders. Overhanging vegetation and rootwads were also moderately available as habitat. Thirty-six different taxa were collected, including 11 EPT, indicating relatively good water quality. The facultative Hydropsychidae was the most abundant taxa, which can dominate in moderately disturbed habitat (Voshell, 2002). Some flashiness was evidenced by bank scour 9-18 inches above the water surface. The immediate riparian vegetation was largely intact. The greater surrounding area upstream contains a mix of forest, agriculture, and residential land use.

An unnamed tributary to Tenmile Creek was sampled downstream of River Road (Station 10) and scored excellent (182; Table 3) for habitat and the macroinvertebrate community scored high acceptable (3; Tables 2A and 2B). The substrate was mostly sand and silt, which may have reduced the number of macroinvertebrates capable of inhabiting the stream. The stream had heavy amounts of large woody debris in it, along with moderate amounts of undercut banks and overhanging vegetation (Figure 9). The stream was very sinuous and contained a variety of pool depth regimes. Twenty-three different taxa were collected, 9 of which were EPT. Chironomidae larvae made up half of the invertebrates collected. Typically an abundance of Chironomidae is associated with poor conditions; however, Chironomidae larvae have a wide range of tolerances from pollution-tolerant to sensitive (Voshell, 2002). Also, the larvae that we collected were small, likely owing to the cold temperature of the stream (56° F at time of sampling), and red-colored individuals (indicative of anoxic conditions [Voshell, 2002]) were not observed. The abundance of Chironomidae larvae may have been because of the moderate amounts of organic matter being retained by the woody debris in the stream. The riparian area was an intact, mature forest that provided dense canopy cover. The culverts at the River Road crossing are undersized and perched (Figure 9). An unnatural plunge pool has formed below River Road and the perched culverts may be an impediment to upstream fish movement. The greater surrounding area is mostly forest.

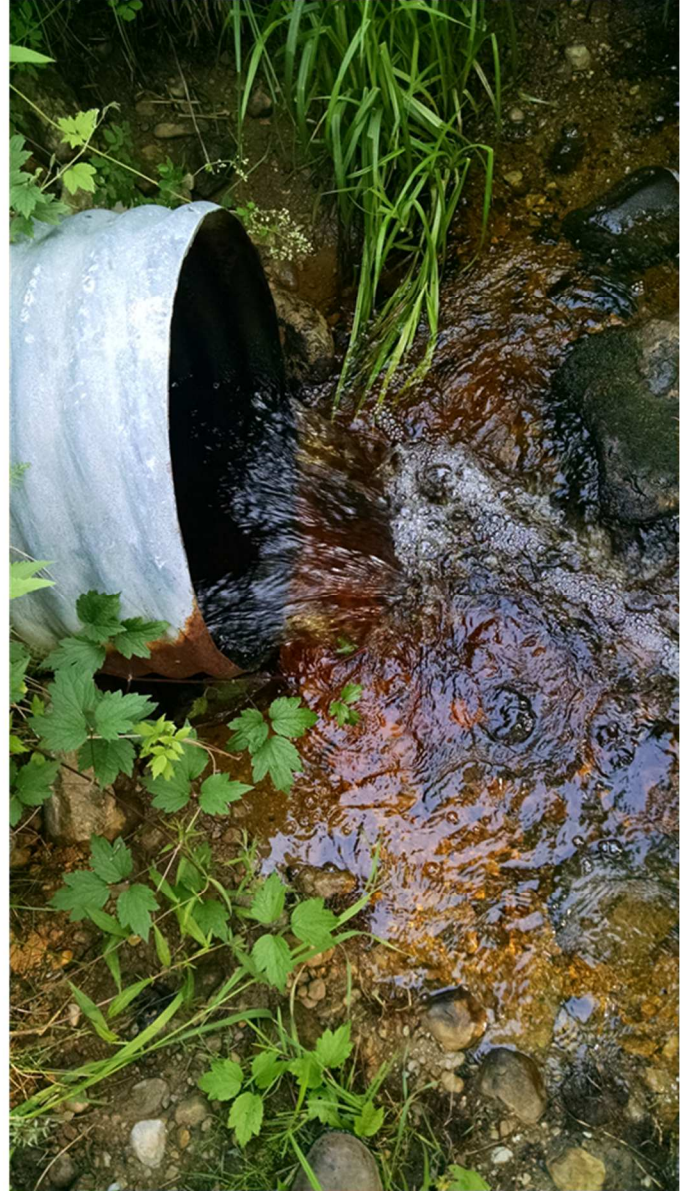
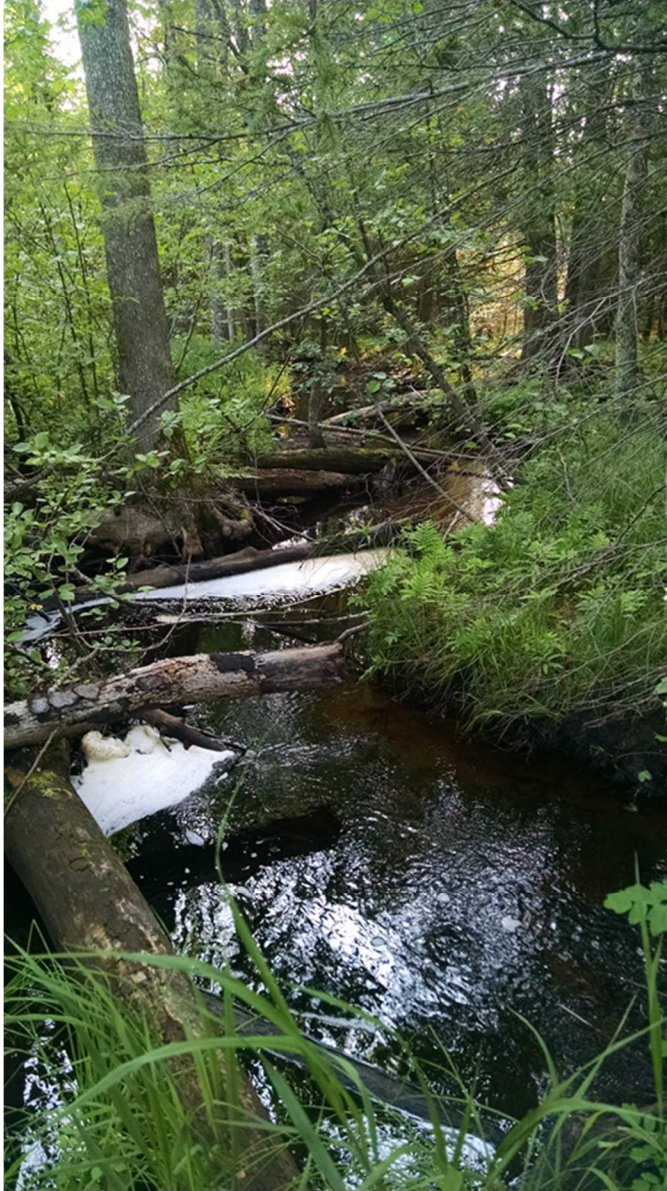


Figure 9. Left: Section of unnamed tributary to Tenmile Creek sampled. Right: Perched culvert at River Road crossing of unnamed tributary to Tenmile Creek.

Cedar River

The main stem Cedar River was sampled at 32 Road (Station 14). The macroinvertebrate community scored high acceptable (4; Tables 2A and 2B) and habitat scored excellent (155; Table 3). The bottom substrate was a mix of boulders, cobble, gravel, and sand. Other habitat types such as large woody debris, undercut banks, and overhanging vegetation were sparse. Twenty-five different taxa were collected, including 10 EPT taxa, indicating good water quality. The invasive rusty crayfish made up 13.5% of the invertebrates collected at Station 14. No native crayfish were collected. Rusty crayfish are known to displace native crayfish (Capelli, 1982) and reduce the numbers of benthic invertebrates including Diptera, Ephemeroptera, and Odonata orders either by direct consumption or competition for resources (McCarthy et al.,

2006). Residential lots and a row crop are on both sides of Station 14, which diminished the amount of riparian vegetation. However, large, mature trees were along the riverbank. The greater surrounding area contains a mix of forest, agriculture, and residential lots.

Gordon Creek

The macroinvertebrate community at Station 11 scored high acceptable (4; Tables 2A and 2B) and habitat scored excellent (173; Table 3). The substrate was a mix of boulders, cobble, gravel, and sand. Undercut banks, overhanging vegetation, and large woody debris were also moderately available for macroinvertebrate colonization. Thirty-five different taxa were collected, 14 of which were EPT, indicating good water quality and habitat. Immediately along the stream banks is alder-marsh habitat with larger trees further away from the stream that still provide some canopy cover. The greater surrounding area contains a mix of forest and agriculture.

Fortyseven Mile Creek

Both the macroinvertebrate community (score = 6; Tables 2A and 2B) and habitat (score = 168; Table 3) scored excellent at Station 20. Taft (2011) also reported excellent habitat at this station (189) and a high acceptable macroinvertebrate community score (3). The substrate consisted of bedrock with a mix of boulders, cobble, and gravel. Heavy amounts of large woody debris were available for macroinvertebrate colonization and undercut banks and overhanging vegetation were also moderately available. Thirty-seven different taxa were collected, 13 of which were EPT. Unionidae mussels that were identified as fat mucklets (*Lampsilis siliquoidea*) were also collected. The diversity, number of EPT taxa, and mussels are all indicators of high water quality and good habitat. Taft collected 27 different taxa in 2010 and Chironomidae made up half the individuals collected, which is why the 2010 and 2015 scores are different. Dense, mature forest is on both sides of the stream, which provides thick canopy cover. The greater surrounding land use is a combination of forest and agriculture.

Walton River

Walton River at Westman Dam Road (Station 25) was sampled because that water body had not been visited before. The Walton River is 12.2 miles long and discharges into the Cedar River only about a half mile upstream from the mouth of the Cedar River at Lake Michigan. The Walton River drains mostly forested land including large parts of the Escanaba River State Forest. Station 25 was sampled downstream of Westman Dam. The macroinvertebrate community scored acceptable (1; Tables 2A and 2B) and habitat scored excellent (176; Table 3). The substrate was mostly cobble with some gravel and sand. Other than the rocks, habitat types such as large woody debris, undercut banks, and overhanging vegetation were sparse. Twenty-two different taxa were collected, of which, only 6 were EPT. The majority of the macroinvertebrates were Hydropsychidae (46.5% of macroinvertebrates collected). Hydropsychidae are facultative, but tend to dominate in rivers with moderate amounts of nutrients and/or organic matter. Thirty rusty crayfish were also collected at Station 25. Rusty crayfish are known to displace native crayfish (Capelli, 1982) and reduce the numbers of benthic invertebrates in the Diptera, Ephemeroptera, and Odonata orders either by direct consumption or competition for resources (McCarthy et al., 2006). The river was warm at the time of sampling (70° F), which may have been because of the dam immediately upstream from where we were sampling. The immediate riparian area contains large trees, which provide good canopy cover. Some logging has occurred over a large area that would affect the river further downstream from where we sampled. The greater surrounding area contains a mix of forest and agriculture.

Beattie Creek

Beattie Creek is a small stream northeast of the city of Menominee that is a direct tributary to Lake Michigan. This water body was targeted because no biosurveys were previously conducted on this water body. Taft (2006) performed an abbreviated survey of the site we sampled at M 35 (Station 24) in 2005, noting the presence of EPT taxa and meeting WQS. The 2015 macroinvertebrate community scored acceptable (1; Tables 2A and 2B) and habitat scored low good (116; Table 3). Sampling was done downstream of M 35 because the property upstream had several “No trespassing” signs near the stream. Downstream of M 35, Beattie Creek flows straight alongside the highway for about 175 feet before making a sharp bend towards Lake Michigan. Along the right bank was a residential lot, although large trees were present on the stream bank. The left bank, alongside M 35, was an artificial embankment of gabion baskets in a “stair step” pattern that make up 168 feet of the stream bank (Figure 10). The gabion baskets were installed between Beattie Creek and M 35 in 2014 and replaced a soil embankment. The stream substrate was a mix of cobble, gravel, and sand. Twenty-one different taxa were collected, including 3 Ephemeroptera and 5 Trichoptera, indicating intermediate water and habitat quality. Amphipoda and Baetidae were the dominant taxa. Amphipoda are facultative and tend to dominate in disturbed systems. Baetidae have a wide tolerance to stressors, but we typically observe high numbers in intermediately disturbed systems. Upstream of Station 24, Beattie Creek drains mostly forested land with some residential use.



Figure 10. Beattie Creek along M 35 looking downstream.

Fish Dam-Sturgeon Rivers Watersheds

Most of the Fish Dam-Sturgeon Rivers watershed lies within the Hiawatha National Forest located in Delta and Schoolcraft Counties. Both watersheds drain to Big Bay de Noc. The landscape is dominated by a variety of forest and wetland types with a limited amount of agricultural land near US-2 along the Lake Michigan shoreline.

Fishdam River

The Fishdam River was sampled at Forest Service Road 2410/Olson Corridor (Station 4). The macroinvertebrate community scored high acceptable (4; Tables 2A and 2B) and habitat scored good (144; Table 3). The bottom substrate was mostly sand with some bedrock, cobble, and gravel. Undercut banks, large woody debris, and overhanging vegetation were moderately available for macroinvertebrate colonization. The stream banks were sandy and some areas of erosion were noted along with areas of sedimentation. Twenty-six different taxa were collected, including 5 Ephemeroptera and 6 Trichoptera, indicating good water quality. At the Olson

Corridor berm, many logs and other debris were deposited above the stream. Based on our limited observations, it was difficult to discern whether high water events are a regular occurrence at that station or not. The Olson Corridor is situated parallel to the Fishdam River for about a half mile, which may impact the river. The immediate riparian vegetation contains large trees that provide good canopy cover. The greater surrounding area is intact forest.

Eighteen Mile Creek

Eighteen Mile Creek, a tributary to the Sturgeon River, was sampled downstream of Forest Highway 13 (Station 16). The macroinvertebrate community scored high acceptable (4; Tables 2A and 2B) and habitat scored excellent (171; Table 3). These scores were similar to those reported by Taft (2011; macroinvertebrates; 2, habitat; 165). The substrate was all sand and silt; however, undercut banks, overhanging vegetation, and large woody debris were abundant. Moderate amounts of *Valisneria* offered additional macroinvertebrate habitat. Twenty-nine different taxa were collected, which included 12 EPT taxa, indicating good water quality. The immediate riparian vegetation contained large, mature trees that provided good canopy cover. The greater surrounding area is forested, although selective logging was occurring during our visit.

Tacoosh River

The Tacoosh River, which is a direct tributary to Lake Michigan, was sampled in its headwaters near the town of Rock (Station 13). The macroinvertebrate community scored acceptable (0; Tables 2A and 2B) and habitat scored good (141; Table 3). The river had very slow flow at the time of sampling (0.1 feet per second). The substrate was composed of sand and silt with heavy amounts of organic matter. Overhanging vegetation was very heavy and large woody debris and aquatic macrophytes were moderately available. Overall, a low number of individual macroinvertebrates were collected (133) despite sampling for the normal amount of time. Despite the low numbers, 25 different taxa were collected. Only 6 EPT taxa were collected, but of those, 3 were Plecoptera, which is an Order of mostly pollution sensitive taxa. Chironomidae were the dominant taxon, which is typical of organic matter-dominated systems (Voshell, 2002). The immediate riparian area is wetland/forest complex. A ditch that runs along East Maple Ridge Road flows into the river at Station 13. The greater surrounding area is a combination of wetland/forest, agriculture, and developed areas near the town of Rock. Past biosurveys performed further downstream from where we sampled at East Maple Ridge Road have had macroinvertebrate communities that scored excellent and high acceptable (Cooper, 2006). The lower score at Station 13 was likely because of the marshy headwater conditions and not necessarily a reflection of water or habitat quality.

Unnamed tributary to Pickerel Lake

An unnamed tributary to Pickerel Lake, which is in the headwaters of the Fox River (Station 32) was sampled to satisfy a targeted monitoring request. This site is in the Manistique watershed and was sampled out of its basin year because of a high priority monitoring request to assess the stream biota after a historic gas leak into the stream. Besides the P-51 biosurvey, a sediment sample and water sample were collected. In 1994, a fuel plume was discovered entering the stream. The plume was determined to be from abandoned fuel tanks (one 1,000 gallon tank and one 2,000 gallon tank). The fuel tanks have since been removed. While we were sampling the site, we noticed one area of the stream bank that emitted a fuel odor when disturbed. Later, we spoke with the owner of the property across M 77 from the stream, who indicated that the fuel tanks used to be directly across the road from where we noticed the

odor. We sampled macroinvertebrates mostly downstream of the discharge area; however, we had already collected some slightly upstream of that spot. To collect “worst case” scenario water and sediment samples, we collected water downstream of the odorous spot after disturbance, and collected sediment directly from where we detected the fuel odor.

The macroinvertebrate community scored high acceptable (3; Tables 2A and 2B) and habitat scored low good (115; Table 3). Twenty-five different taxa were collected, of which 7 were EPT. Chironomidae were the dominant taxa. Because Chironomidae larvae have such a wide tolerance range, it is difficult to use them as an indicator taxa, although, they tend to dominate in more disturbed systems (Voshell, 2002). The Chironomidae may have been abundant because of the heavy amounts of organic matter that were being retained by dense stands of cattail macrophytes in parts of the stream. The substrate was mostly sand with some silt. Overhanging vegetation and macrophyte habitat were heavy, and large woody debris was moderately available. The stream runs along M 77 for about 700 feet, and serves as a ditch for M 77 at Station 32. The right bank was completely devoid of tall vegetation and was mowed to the edge of the stream. Along the left bank, a thin line of tall trees was present, which provided some canopy cover. The greater surrounding area is mostly forest and wetland.

No polyaromatic hydrocarbons or oil range organics were detected in the water sample. Diesel range organics were detected at a low concentration (Table 4). Nutrients were low and only 1 metal, barium, was detected (Table 4). No polyaromatic hydrocarbons were detected in the sediment sample. Diesel and oil range organics were detected, but given the high organic carbon content of the sediment, were not likely to be biologically available and adversely affecting macroinvertebrate biota. Barium, chromium, copper, lead, and zinc were also detected at low levels, but again, given the high organic carbon content, are likely to stay bound to the sediment (Table 5).

Conclusions and Recommendations

In 2015, 14 randomly selected sites within the Central Upper Peninsula watersheds were sampled to support attainment status calculation. Based on the probabilistic monitoring aspect of this watershed survey, 100% +/- 19.3% of the randomly selected sites supported the OIALW designated use using biological monitoring procedures. Percent attainment was calculated by dividing the number of random sites that met WQS by the total number of random locations ((14/14)100 = 100%). This value is coupled with a 95% confidence interval to provide our estimation of certainty, meaning there is 95% certainty that the true proportion of attainment in the Central Upper Peninsula watersheds is between 80.7% and 100%. The 9 sites that were sampled for the statewide trend analysis and 7 of the targeted sites were also attaining the OIALW designated use. Two targeted sites in the Portage-Willow Creek watershed are not attaining OIALW. These results were similar to those reported by Taft (1996) and Kohlhepp (2006).

The majority of the sites sampled contained macroinvertebrate communities that either scored high acceptable or excellent. Some of the sites had localized, eroded areas, but with the exception of Willow and Portage Creeks, large-scale sedimentation issues from flashy conditions were largely absent from Central Upper Peninsula sites.

Future monitoring efforts in the Central Upper Peninsula watersheds should include:

- Resample the 9 trend sites within the watershed.

- Resample sites with rusty crayfish in the Cedar (Station 14) and Walton (Station 25) Rivers to assess any community changes as a result of the crayfish invasions.
- Resample sites in the Willow-Portage Creek watershed to assess possible NPS impacts of the new shopping center adjacent to Willow Creek.

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Table 2A. Qualitative macroinvertebrate sampling results for Central Upper Peninsula sites

TAXA	W B Chocolay River u/s sed trap off CR 545 6/26/2015 STATION 15	W B Chocolay River Townhall Road 6/26/2015 STATION 1	Cherry Creek u/s Fish Hatchery 6/26/2015 STATION 2
ANNELIDA (segmented worms)			
Oligochaeta (worms)	15	24	
ARTHROPODA			
Crustacea			
Amphipoda (scuds)		1	32
Isopoda (sowbugs)			1
Arachnoidea			
Hydracarina	5	3	12
Insecta			
Ephemeroptera (mayflies)			
Baetidae	69	22	45
Ephemerellidae	50	75	1
Heptageniidae	3	3	
Leptophlebiidae		1	
Odonata			
Anisoptera (dragonflies)			
Aeshnidae		1	
Gomphidae		1	
Zygoptera (damselflies)			
Calopterygidae		1	
Plecoptera (stoneflies)			
Perlidae		49	
Perlodidae			3
Pteronarcyidae	1	1	
Taeniopterygidae			1
Hemiptera (true bugs)			
Gerridae	1	1	
Mesoveliidae	1		
Megaloptera			
Corydalidae (dobson flies)		2	
Sialidae (alder flies)	1		
Trichoptera (caddisflies)			
Brachycentridae	24	5	54
Glossosomatidae	1		
Hydropsychidae		3	8
Hydroptilidae	3		
Leptoceridae		1	
Limnephilidae	4	10	12
Philopotamidae		3	
Rhyacophilidae	2	7	6
Sericostomatidae	1		
Coleoptera (beetles)			
Dytiscidae (total)	3		
Elmidae	4	14	
Diptera (flies)			
Athericidae	3	16	
Ceratopogonidae	3		
Chironomidae	326	48	119
Culicidae	4		
Simuliidae	7	8	55
Tabanidae	1		
MOLLUSCA			
Gastropoda (snails)			
Physidae	3		
TOTAL INDIVIDUALS	535	300	349

Table 2B. Macroinvertebrate metric evaluation of Central Upper Peninsula sites

METRIC	West Branch Chocolay River u/s sed trap off CR 545 6/26/2015 STATION 15		West Branch Chocolay River Townhall Road 6/26/2015 STATION 1		Cherry Creek u/s Fish Hatchery 6/26/2015 STATION 2	
	Value	Score	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	24	0	24	0	13	0
NUMBER OF MAYFLY TAXA	3	0	4	0	2	-1
NUMBER OF CADDISFLY TAXA	6	1	6	1	4	0
NUMBER OF STONEFLY TAXA	1	0	2	1	2	1
PERCENT MAYFLY COMP.	22.80	1	33.67	1	13.18	0
PERCENT CADDISFLY COMP.	6.54	0	9.67	0	22.92	0
PERCENT DOMINANT TAXON	60.93	-1	25.00	0	34.10	-1
PERCENT ISOPOD, SNAIL, LEECH	0.56	1	0.00	1	0.29	1
PERCENT SURF. AIR BREATHERS	1.68	1	0.33	1	0.00	1
TOTAL SCORE		3		5		1
MACROINV. COMMUNITY RATING		ACCEPT.		EXCELLENT		ACCEPT.

Table 2A. Qualitative macroinvertebrate sampling results for central Upper Peninsula sites

TAXA	M B Escanaba River two track off County Rd Ch 6/27/2015 Station 3	Fishdam River F S Road 2410/Olson Corridor 8/15/2015 Station 4	N B Ford River Walker Rd 6/28/2015 Station 5	Ten Mile Creek County Rd 410 7/14/2015 Station 6
PORIFERA (sponges)				3
ANNELIDA (segmented worms)				
Hirudinea (leeches)				1
Oligochaeta (worms)	6	4		1
ARTHROPODA				
Crustacea				
Amphipoda (scuds)			6	4
Decapoda (crayfish)			2	18
Arachnoidea				
Hydracarina	1	2		
Insecta				
Ephemeroptera (mayflies)				
Baetiscidae	1			
Baetidae	3	42	13	21
Caenidae		8	19	4
Ephemerellidae	16	9	16	1
Ephemeridae	2	16		
Heptageniidae	5	11		11
Isonychiidae			1	9
Leptophlebiidae	1			2
Odonata				
Anisoptera (dragonflies)				
Aeshnidae	2	1	11	12
Cordulegastridae		1		
Gomphidae	24		9	3
Zygoptera (damselflies)				
Calopterygidae	4	1	15	12
Plecoptera (stoneflies)				
Capniidae	8			
Perlidae	24		16	11
Pteronarcyidae	4			
Hemiptera (true bugs)				
Corixidae		6		
Gerridae		1		1
Mesoveliidae			1	
Veliidae				2
Megaloptera				
Corydalidae (dobson flies)	10		1	3
Sialidae (alder flies)		1		
Trichoptera (caddisflies)				
Brachycentridae	2	45	80	2
Glossosomatidae		3		
Helicopsychidae	1		1	1
Hydropsychidae	6		3	52
Hydroptilidae	1			
Lepidostomatidae		2		
Leptoceridae	17			
Limnephilidae	17	1	3	2
Molannidae	1			
Odontoceridae	1		2	
Philopotamidae		3	1	
Phryganeidae		11		
Rhyacophilidae	2		2	
Lepidoptera (moths)				
Pyrilidae				1
Coleoptera (beetles)				
Dytiscidae (total)			1	3
Gyrinidae (adults)				4
Hydrophilidae (total)			1	
Elmidae	7	19	18	8
Psephenidae (larvae)				3
Diptera (flies)				
Athericidae		1		7
Ceratopogonidae	1		8	2
Chironomidae	31	41	12	19
Culicidae	1			
Ephydriidae	3			
Simuliidae		30		1
Tabanidae	1	2		
Tipulidae				1
MOLLUSCA				
Gastropoda (snails)				
Ancylidae (limpets)		1	1	1
Hydrobiidae			10	
Physidae	2		3	4
Planorbidae				7
Viviparidae			1	
Pelecypoda (bivalves)				
Sphaeriidae (clams)	25	2	1	6
TOTAL INDIVIDUALS	230	264	258	243

Table 2B. Macroinvertebrate metric evaluation of central Upper Peninsula sites

METRIC	M B Escanaba River two track off County Rd Ch 6/27/2015 Station 3		Fishdam River F S Road 2410/Olson Corridor 7/15/2015 Station 4		N B Ford River Walker Rd 6/28/2015 Station 5		Ten Mile Creek County Rd 410 7/14/2015 Station 6	
	Value	Score	Value	Score	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	32	1	26	0	29	1	36	1
NUMBER OF MAYFLY TAXA	6	1	5	1	4	0	6	1
NUMBER OF CADDISFLY TAXA	9	1	6	1	7	1	4	0
NUMBER OF STONEFLY TAXA	3	1	0	-1	1	0	1	0
PERCENT MAYFLY COMP.	12.17	0	32.58	1	18.99	0	19.75	0
PERCENT CADDISFLY COMP.	20.87	0	24.62	0	35.66	1	23.46	0
PERCENT DOMINANT TAXON	13.48	1	17.05	0	31.01	-1	21.40	0
PERCENT ISOPOD, SNAIL, LEECH	0.87	1	0.38	1	5.81	0	5.35	0
PERCENT SURF. AIR BREATHERS	0.43	1	2.65	1	1.16	1	4.12	1
TOTAL SCORE		7		4		3		3
MACROINV. COMMUNITY RATING		EXCELLENT		ACCEPT.		ACCEPT.		ACCEPT.

Table 2A. Qualitative macroinvertebrate sampling results for central Upper Peninsula sites

TAXA	Ford River US-2 7/14/2015 Station 7	Escanaba River County Rd 519 6/29/2015 Station 8	Unnamed Trib to M B Escanaba River two track off County Rd ADA 6/28/2015 Station 9	Unnamed Trib to Ten Mile Creek River Rd 7/1/2015 Station 10
ANNELIDA (segmented worms)				
Hirudinea (leeches)			1	
Oligochaeta (worms)	3	9		5
ARTHROPODA				
Crustacea				
Amphipoda (scuds)	30	25	6	2
Decapoda (crayfish)	10	1	2	
Isopoda (sowbugs)		3		
Arachnoidea				
Hydracarina	2		4	
Insecta				
Ephemeroptera (mayflies)				
Baetidae	5	58	11	8
Caenidae			3	
Ephemerellidae		3	1	2
Ephemeridae	2			
Heptageniidae	10	50	11	2
Isonychiidae		6		18
Odonata				
Anisoptera (dragonflies)				
Aeshnidae	3		7	1
Corduliidae				3
Gomphidae	9	3		
Macromiidae	1			
Zygoptera (damselflies)				
Calopterygidae	10	1	10	
Plecoptera (stoneflies)				
Capniidae			27	
Chloroperlidae		2		
Perlidae	3	3	6	1
Hemiptera (true bugs)				
Corixidae	64	1	3	
Ceridae	1			1
Mesoveliidae		6		1
Veliidae	1			
Megaloptera				
Corydalidae (dobson flies)	3		6	
Sialidae (alder flies)			15	11
Trichoptera (caddisflies)				
Brachycentridae	12			
Glossosomatidae				
Helicopsychidae	2	1		
Hydropsychidae	12	14	1	
Lepidostomatidae		2		
Leptoceridae			1	
Limnephilidae	1	1	1	15
Molannidae		3		
Odontoceridae		19	2	31
Phryganeidae				6
Polycentropodidae				1
Coleoptera (beetles)				
Dytiscidae (total)	2			1
Gyrinidae (adults)	3			
Elmidae	7	3	6	1
Psephenidae (larvae)	1			
Diptera (flies)				
Ceratopogonidae	2		2	
Chironomidae	21	49	57	131
Culicidae				3
Ephydriidae		1		
Simuliidae			36	
Tabanidae	2		2	2
Tipulidae	2		1	1
MOLLUSCA				
Gastropoda (snails)				
Ancylidae (limpets)			1	
Bithyniidae	4	1		
Lymnaeidae			11	
Physidae	5			
Viviparidae	1	1		
Pelecypoda (bivalves)				
Sphaeriidae (clams)	9	7		1
Unionidae (mussels)	1			
TOTAL INDIVIDUALS	244	274	234	248

Table 2B. Macroinvertebrate metric evaluation of central Upper Peninsula sites

METRIC	Ford River US-2 7/14/2015 Station 7		Escanaba River County Rd 519 6/29/2015 Station 8		Unnamed Trib to M B Escanaba River two track off County Rd ADA 6/28/2015 Station 9		Unnamed Trib to Ten Mile Creek River Rd 7/1/2015 Station 10	
	Value	Score	Value	Score	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	33	1	27	0	27	0	23	1
NUMBER OF MAYFLY TAXA	3	0	4	0	4	0	4	1
NUMBER OF CADDISFLY TAXA	4	0	6	1	4	0	4	0
NUMBER OF STONEFLY TAXA	1	0	2	1	2	1	1	0
PERCENT MAYFLY COMP.	6.97	0	42.70	1	11.11	0	12.10	0
PERCENT CADDISFLY COMP.	11.07	0	14.60	0	2.14	-1	21.37	0
PERCENT DOMINANT TAXON	26.23	0	21.17	0	24.36	0	52.82	-1
PERCENT ISOPOD, SNAIL, LEECH	4.10	0	2.19	1	5.56	0	0.00	1
PERCENT SURF. AIR BREATHERS	29.10	-1	2.55	1	1.28	1	2.42	1
TOTAL SCORE		0		5		1		3
MACROINV. COMMUNITY RATING		ACCEPT.		EXCELLENT		ACCEPT.		ACCEPT.

Table 2A. Qualitative macroinvertebrate sampling results for central Upper Peninsula sites

TAXA	Gordon Creek 36.5 Mile Rd 6/30/2015 Station 11	M B Escanaba River County Rd 565 6/28/2015 Station 12	Tacoosh River E. Maple Ridge Rd 6/29/2015 Station 13	Cedar River 32 Rd 6/30/2015 Station 14
PORIFERA (sponges)	1			
ANNELIDA (segmented worms)				
Hirudinea (leeches)			10	
Oligochaeta (worms)	2		13	
ARTHROPODA				
Crustacea				
Amphipoda (scuds)	1		4	4
Decapoda (crayfish)	13	1		33
Arachnoidea				
Hydracarina	16			
Insecta				
Ephemeroptera (mayflies)				
Ametropodidae	2			
Baetidae	23	29	1	62
Caenidae	2			3
Ephemerellidae	3	4		
Ephemeridae				3
Heptageniidae	7	51		46
Isonychiidae		1		5
Leptophlebiidae	1			2
Odonata				
Anisoptera (dragonflies)				
Aeshnidae	3	12	4	
Cordulegastridae	1		6	
Corduliidae			3	
Gomphidae		1		1
Libellulidae	1		1	
Zygoptera (damselflies)				
Calopterygidae		4		1
Plecoptera (stoneflies)				
Capniidae		6		
Leuctridae			2	
Nemouridae			1	
Perlidae	20	12		20
Perlodidae		2	1	
Pteronarcyidae				2
Hemiptera (true bugs)				
Corixidae	2			3
Gerridae		1	1	
Mesoveliidae		10	4	
Veliidae	2		3	1
Megaloptera				
Corydalidae (dobson flies)	1	5		1
Sialidae (alder flies)			4	2
Trichoptera (caddisflies)				
Brachycentridae	1	5		
Glossosomatidae		7		
Hydropsychidae	13	8		6
Hydroptilidae	1			
Lepidostomatidae		2	8	
Leptoceridae	3			2
Limnephilidae	2	1	12	
Molannidae	1	2		
Philopotamidae		2		
Phryganeidae	1			
Rhyacophilidae		12		
Coleoptera (beetles)				
Dytiscidae (total)	4		2	
Hydraenidae (total)			1	
Hydrophilidae (total)	2			
Dryopidae		1		
Elmidae	32	8	1	23
Gyrinidae (larvae)	1			
Psephenidae (larvae)	2	1		6
Diptera (flies)				
Athericidae				3
Ceratopogonidae	3			
Chironomidae	71	7	31	7
Simuliidae		17		
Tabanidae		1	2	2
MOLLUSCA				
Gastropoda (snails)				
Ancylidae (limpets)			1	
Hydrobiidae		3		
Physidae	4		3	1
Planorbidae	1			
Pelecypoda (bivalves)				
Sphaeriidae (clams)	14	3	14	5
TOTAL INDIVIDUALS	257	219	133	244

Table 2B. Macroinvertebrate metric evaluation of central Upper Peninsula sites

METRIC	Gordon Creek 36.5 Mile Rd 6/30/2015 Station 11		M B Escanaba River County Rd 565 6/28/2015 Station 12		Tacoosh River Maple Ridge Rd (38th) 6/29/2015 Station 13		Cedar River 32 Rd 6/30/2015 Station 14	
	Value	Score	Value	Score	Value	Score	Value	Score
	TOTAL NUMBER OF TAXA	35	1	30	1	25	1	25
NUMBER OF MAYFLY TAXA	6	1	4	0	1	0	6	1
NUMBER OF CADDISFLY TAXA	7	1	8	1	2	-1	2	-1
NUMBER OF STONEFLY TAXA	1	0	3	1	3	1	2	1
PERCENT MAYFLY COMP.	14.79	0	38.81	1	0.75	-1	49.59	1
PERCENT CADDISFLY COMP.	8.56	0	17.81	0	15.04	0	3.28	0
PERCENT DOMINANT TAXON	27.63	-1	23.29	0	23.31	0	25.41	0
PERCENT ISOPOD, SNAIL, LEECH	1.95	1	1.37	1	10.53	0	0.41	1
PERCENT SURF. AIR BREATHERS	3.89	1	5.02	0	8.27	0	1.64	1
TOTAL SCORE		4		5		0		4
MACROINV. COMMUNITY RATING		ACCEPT.		EXCELLENT		ACCEPT.		ACCEPT.

Table 2A. Qualitative macroinvertebrate sampling results for central Upper Peninsula sites

TAXA	Eighteen Mile Creek d/s Forest Hwy 13 7/15/2015 Station 16	Bear Creek County Rd 565 6/28/2015 Station 17	Big Brook d/s Kates Grade Rd/County Rd Eaa 6/28/2015 Station 18	EB Escanaba River Iron St 6/26/2015 Station 19
ANNELIDA (segmented worms)				
Hirudinea (leeches)	1			1
Oligochaeta (worms)		6	1	25
ARTHROPODA				
Crustacea				
Amphipoda (scuds)	2			
Decapoda (crayfish)	1			
Isopoda (sowbugs)		13		9
Arachnoidea				
Hydracarina	3	3	1	1
Insecta				
Ephemeroptera (mayflies)				
Baetidae	8	66	34	90
Caenidae	1			
Ephemerellidae	2	2	4	22
Ephemeridae				1
Heptageniidae			1	3
Leptophlebiidae	1			
Odonata				
Anisoptera (dragonflies)				
Aeshnidae	2	2	1	1
Gomphidae			4	2
Zygoptera (damselflies)				
Calopterygidae	8			1
Plecoptera (stoneflies)				
Capniidae	2			11
Leuctridae			5	
Perlidae	1		2	5
Perlodidae				1
Pteronarcyidae	1		1	
Hemiptera (true bugs)				
Corixidae	2			1
Gerridae	1			
Mesoveliidae	1	4		
Megaloptera				
Corydalidae (dobson flies)	1	2	1	1
Trichoptera (caddisflies)				
Brachycentridae	91	32	33	12
Helicopsychidae				2
Hydropsychidae	21	6	3	10
Lepidostomatidae			4	
Leptoceridae		1		
Limnephilidae	1	13	4	1
Molannidae		1		
Odontoceridae		5	2	
Philopotamidae	1	2		
Phryganeidae	1			
Polycentropodidae				2
Rhyacophilidae				11
Coleoptera (beetles)				
Hydrophilidae (total)	7	4		
Psephenidae (adults)		2		
Dryopidae				1
Elmidae	4	1	5	14
Diptera (flies)				
Athericidae	4		4	1
Ceratopogonidae	2		5	1
Chironomidae	86	29	15	16
Simuliidae	4	31	9	2
Tabanidae	1		3	
Tipulidae		1	4	
MOLLUSCA				
Gastropoda (snails)				
Hydrobiidae				3
Physidae		2	2	2
Viviparidae			6	
Pelecypoda (bivalves)				
Sphaeriidae (clams)		2		4
TOTAL INDIVIDUALS	261	230	154	257

Table 2B. Macroinvertebrate metric evaluation of central Upper Peninsula sites

METRIC	Eighteen Mile Creek d/s Forest Hwy 13 7/15/2015 Station 16		Bear Creek County Rd 565 6/28/2015 Station 17		Big Brook d/s Kates Grade Rd/County Rd Eaa 6/28/2015 Station 18		E B Escanaba River Iron St 6/26/2015 Station 19	
	Value	Score	Value	Score	Value	Score	Value	Score
	TOTAL NUMBER OF TAXA	29	1	23	0	25	0	31
NUMBER OF MAYFLY TAXA	4	0	2	-1	3	0	4	0
NUMBER OF CADDISFLY TAXA	5	0	7	1	5	0	6	1
NUMBER OF STONEFLY TAXA	3	1	0	-1	3	1	3	1
PERCENT MAYFLY COMP.	4.60	0	29.57	1	25.32	1	45.14	1
PERCENT CADDISFLY COMP.	44.06	1	26.09	0	29.87	1	14.79	0
PERCENT DOMINANT TAXON	34.87	-1	28.70	-1	22.08	0	35.02	-1
PERCENT ISOPOD, SNAIL, LEECH	0.38	1	6.52	0	5.19	0	5.84	0
PERCENT SURF. AIR BREATHERS	4.21	1	4.35	1	0.00	1	0.39	1
TOTAL SCORE		4		0		4		4
MACROINV. COMMUNITY RATING		ACCEPT.		ACCEPT.		ACCEPT.		ACCEPT.

Table 2A. Qualitative macroinvertebrate sampling results for central Upper Peninsula sites

TAXA	Forty-Seven Mile Creek	M B Escanaba River	Ford River	Escanaba River
	Mott Ln 7/1/2015 Station 20	US41 6/28/2015 Station 21	Cedardale/28th Rd 7/1/2015 Station 22	two track off Little West Rd/ County Rd SW 6/29/2015 Station 23
ANNELIDA (segmented worms)				
Oligochaeta (worms)	2	59		
ARTHROPODA				
Crustacea				
Amphipoda (scuds)	6	11		
Decapoda (crayfish)	5	1	3	1
Isopoda (sowbugs)		11		
Arachnoidea				
Hydracarina	6	1		1
Insecta				
Ephemeroptera (mayflies)				
Baetidae	18	22	38	63
Caenidae			4	
Ephemerellidae	3	2	46	30
Ephemeridae	13	5	1	
Heptageniidae	6	6	18	20
Isonychiidae			1	3
Siphonuridae		1		
Odonata				
Anisoptera (dragonflies)				
Aeshnidae	6	1	4	1
Gomphidae	1		4	2
Zygoptera (damselflies)				
Calopterygidae	18	1	2	1
Plecoptera (stoneflies)				
Leuctridae	3			
Perlidae	10		3	6
Periodidae				8
Hemiptera (true bugs)				
Corixidae	1	8		
Gerridae	2			
Mesoveliidae	1	1	1	
Pleidae			1	
Veliidae	2			
Megaloptera				
Corydalidae (dobson flies)	6			
Sialidae (alder flies)	3	9		
Trichoptera (caddisflies)				
Brachycentridae			6	8
Glossosomatidae			3	4
Helicopsychidae		1	6	12
Hydropsychidae	11	1	48	16
Lepidostomatidae	1			2
Leptoceridae	5		7	12
Limmephilidae	10	1		5
Odontoceridae	1			
Phryganeidae	2		1	
Psychomyiidae	2			
Rhyacophilidae				3
Coleoptera (beetles)				
Dytiscidae (total)		1		
Halplidae (adults)				1
Dryopidae	4			
Elmidae	37	1	28	19
Lampyridae (larvae)			5	
Psephenidae (larvae)			3	1
Diptera (flies)				
Athericidae	1		3	
Ceratopogonidae	3		1	
Chironomidae	35	24	9	13
Culicidae	1			
Simuliidae	3	138		2
Tabanidae			6	3
Tipulidae	1			1
MOLLUSCA				
Gastropoda (snails)				
Ancylidae (limpets)		2		
Physidae	3		2	
Pelecypoda (bivalves)				
Sphaeriidae (clams)	1	2	2	2
Unionidae (mussels)	1		1	
TOTAL INDIVIDUALS	234	310	257	240

Table 2B. Macroinvertebrate metric evaluation of central Upper Peninsula sites

METRIC	Forty-Seven Mile Creek Mott 46 Ln/Mott Ln Station 20 7/1/2015		M B Escanaba River US41 Station 21 6/28/2015		Ford River Cedardale/28th Rd Station 22 7/1/2015		Escanaba River two track off Little West Rd/County Rd Station 23 6/29/2015	
	Value	Score	Value	Score	Value	Score	Value	Score
	TOTAL NUMBER OF TAXA	37	1	24	0	29	1	27
NUMBER OF MAYFLY TAXA	4	0	5	1	6	1	4	0
NUMBER OF CADDISFLY TAXA	7	1	3	0	6	1	8	1
NUMBER OF STONEFLY TAXA	2	1	0	-1	1	0	2	1
PERCENT MAYFLY COMP.	17.09	0	11.61	0	42.02	1	48.33	1
PERCENT CADDISFLY COMP.	13.68	0	0.97	-1	27.63	0	25.83	0
PERCENT DOMINANT TAXON	15.81	1	44.52	-1	18.68	0	26.25	0
PERCENT ISOPOD, SNAIL, LEECH	1.28	1	4.19	0	0.78	1	0.00	1
PERCENT SURF. AIR BREATHERS	2.99	1	3.23	1	0.78	1	0.42	1
TOTAL SCORE		6		-1		6		5
MACROINV. COMMUNITY RATING		EXCELLENT		ACCEPT.		EXCELLENT		EXCELLENT

Table 2A. Qualitative macroinvertebrate sampling results for central Upper Peninsula sites

TAXA	Beattie Creek M35 6/30/2015 Station 24	Walton River Westman Dam Rd 6/30/2015 Station 25	Black River two track off Island Lake Rd 6/28/2015 Station 26	Hunters Brook Boney Falls Rd 6/29/2015 Station 27
PORIFERA (sponges)				1
ANNELIDA (segmented worms)				
Hirudinea (leeches)		1		
Oligochaeta (worms)	1	2	3	1
ARTHROPODA				
Crustacea				
Amphipoda (scuds)	83	4		
Decapoda (crayfish)	1	30		2
Isopoda (sowbugs)	6	2		
Arachnoidea				
Hydracarina	8		2	4
Insecta				
Ephemeroptera (mayflies)				
Baetidae	88	2	15	26
Caenidae		5		
Ephemerellidae			2	17
Ephemeridae				2
Heptageniidae		56	1	15
Leptophlebiidae	3			1
Siphonuridae	1			
Odonata				
Anisoptera (dragonflies)				
Aeshnidae	1		4	4
Gomphidae		1	4	10
Zygoptera (damselflies)				
Calopterygidae			9	4
Plecoptera (stoneflies)				
Leuctridae			1	5
Perlidae		1	4	10
Pteronarcyidae			4	
Hemiptera (true bugs)				
Corixidae			1	
Gerridae	1	1		
Mesoveliidae		1		3
Veliidae		1		
Megaloptera				
Corydalidae (dobson flies)		1		6
Trichoptera (caddisflies)				
Brachycentridae	1		2	1
Glossosomatidae	1			8
Helicopsychidae				2
Hydropsychidae	15	140	12	40
Hydroptilidae	7	1		
Lepidostomatidae				3
Leptoceridae				7
Limnephilidae	1		2	9
Philopotamidae				1
Phryganeidae			6	
Rhyacophilidae			1	
Coleoptera (beetles)				
Elmidae	7	1	14	42
Diptera (flies)				
Athericidae	4			
Ceratopogonidae			1	
Chironomidae	27	14	14	21
Simuliidae	1	25	126	1
Tipulidae	1	1		
MOLLUSCA				
Gastropoda (snails)				
Hydrobiidae			12	
Lymnaeidae		1	2	
Physidae				3
Planorbidae	1			
Pelecypoda (bivalves)				
Sphaeriidae (clams)		10	25	1
TOTAL INDIVIDUALS	259	301	267	250

Table 2B. Macroinvertebrate metric evaluation of central Upper Peninsula sites

METRIC	Beattie Creek M35 6/30/2015 Station 24		Walton River Westman Dam Rd 6/30/2015 Station 25		Black River two track off Island Lake Rd 6/28/2015 Station 26		Hunters Brook Boney Falls Rd 6/29/2015 Station 27	
	Value	Score	Value	Score	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	21	0	22	0	24	0	29	1
NUMBER OF MAYFLY TAXA	3	0	3	0	3	0	5	1
NUMBER OF CADDISFLY TAXA	5	0	2	-1	5	0	8	1
NUMBER OF STONEFLY TAXA	0	-1	1	0	3	1	2	1
PERCENT MAYFLY COMP.	35.52	1	20.93	0	6.74	0	24.40	1
PERCENT CADDISFLY COMP.	9.65	0	46.84	1	8.61	0	28.40	0
PERCENT DOMINANT TAXON	33.98	-1	46.51	-1	47.19	-1	16.80	1
PERCENT ISOPOD, SNAIL, LEECH	2.70	1	1.33	1	5.24	0	1.20	1
PERCENT SURF. AIR BREATHERS	0.39	1	1.00	1	0.37	1	1.20	1
TOTAL SCORE		1		1		1		8
MACROINV. COMMUNITY RATING		ACCEPT.		ACCEPT.		ACCEPT.		EXCELLENT

Table 2A. Qualitative macroinvertebrate sampling results for central Upper Peninsula sites

TAXA	Portage Creek Cemetery along M-35 7/14/2015 Station 28	Willow Creek Old State Rd (8th Avenue) 7/15/2015 Station 29	Willow Creek 3rd Ave 7/16/2015 Station 30	Willow Creek 6th Ave 7/16/2015 Station 31
ANNELIDA (segmented worms)				
Oligochaeta (worms)		16	19	3
ARTHROPODA				
Crustacea				
Amphipoda (scuds)	150	99	92	150
Isopoda (sowbugs)	102	1	74	63
Arachnoidea				
Hydracarina			1	
Insecta				
Ephemeroptera (mayflies)				
Baetidae	3	11	18	7
Odonata				
Anisoptera (dragonflies)				
Aeshnidae		1	1	
Cordulegastridae	1			
Libellulidae	1	1	1	
Zygoptera (damselflies)				
Calopterygidae		1		
Hemiptera (true bugs)				
Corixidae	1		2	
Gerridae	2	6	5	1
Mesoveliidae	1			2
Veliidae	1	1		
Megaloptera				
Sialidae (alder flies)	3			
Trichoptera (caddis flies)				
Brachycentridae	3			
Hydropsychidae	1			
Leptoceridae		1		
Limnephilidae	5		1	3
Phryganeidae				1
Coleoptera (beetles)				
Dytiscidae (total)	1	1		1
Gyrinidae (adults)	4	1	1	1
Hydrophilidae (total)	1		1	
Elmidae	1		1	
Gyrinidae (larvae)	1	2		
Diptera (flies)				
Athericidae	1			
Chironomidae	13	70	76	4
Simuliidae	9	36	24	23
Tabanidae	1	1	1	3
Tipulidae		1	1	
MOLLUSCA				
Gastropoda (snails)				
Physidae	2	1	1	
Planorbidae			1	
Pleuroceridae	1			
TOTAL INDIVIDUALS	309	251	321	262

Table 2B. Macroinvertebrate metric evaluation of central Upper Peninsula sites

METRIC	Portage Creek Cemetery along M-35 7/14/2015 Station 28		Willow Creek Old State Rd (8th Ave) 7/15/2015 Station 29		Willow Creek 3rd Ave 7/16/2015 Station 30		Willow Creek 6th Ave 7/16/2015 Station 31	
	Value	Score	Value	Score	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	23	0	17	0	19	1	13	0
NUMBER OF MAYFLY TAXA	1	-1	1	-1	1	-1	1	-1
NUMBER OF CADDISFLY TAXA	3	0	1	-1	1	-1	2	-1
NUMBER OF STONEFLY TAXA	0	-1	0	-1	0	-1	0	-1
PERCENT MAYFLY COMP.	0.97	-1	4.38	0	5.61	0	2.67	-1
PERCENT CADDISFLY COMP.	2.91	-1	0.40	-1	0.31	-1	1.53	-1
PERCENT DOMINANT TAXON	48.54	-1	39.44	-1	28.66	-1	57.25	-1
PERCENT ISOPOD, SNAIL, LEECH	33.98	-1	0.80	1	23.68	-1	24.05	-1
PERCENT SURF. AIR BREATHERS	3.56	1	3.59	1	2.80	1	1.91	1
TOTAL SCORE		-5		-3		-4		-6
MACROINV. COMMUNITY RATING		POOR		ACCEPT.		ACCEPT.		POOR

Table 2A. Qualitative macroinvertebrate sampling results for central Upper Peninsula sites

TAXA	Unnamed tributary to Pickerel Lake M77 and Adams Trl 7/16/2015 Station 32
<hr/> <hr/>	
ANNELIDA (segmented worms)	
Hirudinea (leeches)	1
Oligochaeta (worms)	2
ARTHROPODA	
Crustacea	
Decapoda (crayfish)	1
Insecta	
Ephemeroptera (mayflies)	
Baetidae	12
Leptophlebiidae	15
Odonata	
Anisoptera (dragonflies)	
Aeshnidae	10
Cordulegastridae	1
Libellulidae	5
Zygoptera (damselflies)	
Calopterygidae	40
Plecoptera (stoneflies)	
Capniidae	1
Hemiptera (true bugs)	
Gerridae	1
Veliidae	4
Megaloptera	
Sialidae (alder flies)	2
Trichoptera (caddisflies)	
Hydropsychidae	7
Lepidostomatidae	1
Limnephilidae	4
Molannidae	2
Coleoptera (beetles)	
Gyrinidae (adults)	1
Hydrophilidae (total)	1
Diptera (flies)	
Ceratopogonidae	1
Chironomidae	113
Sciomyzidae	1
Simuliidae	7
Tabanidae	1
Tipulidae	1
<hr/> <hr/>	
TOTAL INDIVIDUALS	235

Table 2B. Macroinvertebrate metric evaluation of central Upper Peninsula sites

Unnamed tributary to Pickerel Lake M77 and Adams Trl Station 32 7/16/2015		
METRIC	Value	Score
TOTAL NUMBER OF TAXA	25	1
NUMBER OF MAYFLY TAXA	2	0
NUMBER OF CADDISFLY TAXA	4	0
NUMBER OF STONEFLY TAXA	1	1
PERCENT MAYFLY COMP.	11.49	0
PERCENT CADDISFLY COMP.	5.96	0
PERCENT DOMINANT TAXON	48.09	-1
PERCENT ISOPOD, SNAIL, LEECH	0.43	1
PERCENT SURF. AIR BREATHERS	2.98	1
 TOTAL SCORE		 3
 MACROINV. COMMUNITY RATING		 ACCEPT.

Table 3. Habitat evaluation for central Upper Peninsula sites						
	W B Chocoday River		W B Chocoday River		Cherry Creek	
	u/s sed trap off CR 545		Townhall Road		u/s Fish Hatchery	
	GLIDE/POOL		RIFLE/RUN		GLIDE/POOL	
	STATION 1		STATION 15		STATION 2	
HABITAT METRIC						
Substrate and Instream Cover						
Epifaunal Substrate/ Avail Cover (20)	6		17		14	
Embeddedness (20)*			19			
Velocity/Depth Regime (20)*			19			
Pool Substrate Characterization (20)**	7				9	
Pool Variability (20)**	1				18	
Channel Morphology						
Sediment Deposition (20)	7		10		11	
Flow Status - Maint. Flow Volume (10)	9		9		9	
Flow Status - Flashiness (10)	8		3		10	
Channel Alteration (20)	15		15		20	
Frequency of Rifles/Bends (20)*			16			
Channel Sinuosity (20)**	16				15	
Riparian and Bank Structure						
Bank Stability (L) (10)	9		5		10	
Bank Stability (R) (10)	9		5		10	
Vegetative Protection (L) (10)	3		7		10	
Vegetative Protection (R) (10)	10		7		10	
Riparian Veg. Zone Width (L) (10)	2		5		10	
Riparian Veg. Zone Width (R) (10)	10		7		10	
TOTAL SCORE (200):	112		144		166	
HABITAT RATING:	GOOD		GOOD		EXCELLENT	
	(SLIGHTLY		(SLIGHTLY		(NON-	
	IMPAIRED)		IMPAIRED)		IMPAIRED)	
Note: Individual metrics may better describe conditions directly affecting the biological community while the Habitat Rating describes the general riverine environment at the site(s).						
Date:	6/26/2015		6/26/2015		6/26/2015	
Weather:	Sunny		Sunny		Sunny	
Air Temperature:	72		70		63	
Water Temperature:	52		49		39	
Ave. Stream Width:	24.3		28.7		19.7	
Ave. Stream Depth:	1		1.2		1.4	
Surface Velocity:	1.27		1.31		1.42	
Estimated Flow:	30.861		45.1164		39.1636	
Stream Modifications:	None		Bank Stabilization		None	
Nuisance Plants (Y/N):	N		N		Y	
STORET No.:	520420		520530		520417	
Stream Name:	W B Chocoday River		W B Chocoday River		Cherry Creek	
Road Crossing/Location:	u/s sed trap off CR 545		Townhall Road		u/s Fish Hatchery	
County Code:	52		52		52	
TRS:	46N24W22		46N24W23		47N24W18	
Latitude (dd):	46.37527		46.37684		46.466	
Longitude (dd):	-87.28491		-87.27489		-87.3648	
Ecoregion:	NLAF		NLAF		NLAF	
Stream Type:	Coldwater				Coldwater	
USGS Basin Code:	4020201		4020201		4020201	
* Applies only to Rifle/Run stream Surveys						
** Applies only to Glide/Pool stream Surveys						
COMMENTS:						

Table 3. Habitat evaluation for central Upper Peninsula sites									
	M B Escanaba River	Fishdam River	N B Ford River	Ten Mile Creek	Ford River				
	two track off County Rd Ch	FF Road 2410	Walker Rd	County Rd 410	US-2				
	GLIDE/POOL	RIFFLE/RUN	GLIDE/POOL	RIFFLE/RUN	GLIDE/POOL				
	Station 3	Station 4	Station 5	Station 6	Station 7				
HABITAT METRIC									
Substrate and Instream Cover									
Epifaunal Substrate/ Avail Cover (20)	15	15	9	16	16				
Embeddedness (20)*		18		18					
Velocity/Depth Regime (20)*		10		10					
Pool Substrate Characterization (20)**	15		15		15				
Pool Variability (20)**	10		16		16				
Channel Morphology									
Sediment Deposition (20)	19	8	16	18	13				
Flow Status - Maint. Flow Volume (10)	10	7	9	9	9				
Flow Status - Flashiness (10)	9	6	7	5	7				
Channel Alteration (20)	19	18	19	19	19				
Frequency of Riffles/Bends (20)*		15		15					
Channel Sinuosity (20)**	10		10		10				
Riparian and Bank Structure									
Bank Stability (L) (10)	9	9	9	9	9				
Bank Stability (R) (10)	9	5	9	9	9				
Vegetative Protection (L) (10)	7	9	9	9	8				
Vegetative Protection (R) (10)	7	7	9	9	8				
Riparian Veg. Zone Width (L) (10)	7	8	9	9	8				
Riparian Veg. Zone Width (R) (10)	7	9	9	8	10				
TOTAL SCORE (200):	153	144	155	163	157				
HABITAT RATING:									
	GOOD	GOOD	EXCELLENT	EXCELLENT	EXCELLENT				
	(SLIGHTLY	(SLIGHTLY	(NON-	(NON-	(NON-				
	IMPAIRED)	IMPAIRED)	IMPAIRED)	IMPAIRED)	IMPAIRED)				
Note: Individual metrics may better describe conditions directly affecting the biological community while the Habitat Rating describes the general riverine environment at the site(s).									
Date:	6/27/2015	8/15/2015	6/28/2015	7/14/2015	7/14/2015				
Weather:	Sunny	Partly Cloudy	Partly Cloudy	Partly Cloudy	Sunny				
Air Temperature:	82	Deg. F. 72	Deg. F. 76	Deg. F. 68	Deg. F. 78	Deg. F.			
Water Temperature:	58	Deg. F. 55	Deg. F. 68	Deg. F. 72	Deg. F. 74	Deg. F.			
Ave. Stream Width:	24.3	Feet 14.3	Feet 32	Feet 28	Feet 124.3	Feet			
Ave. Stream Depth:	1.5	Feet 0.8	Feet 1.6	Feet 0.9	Feet 2.25	Feet			
Surface Velocity:	1.2	Ft./Sec. 1.6	Ft./Sec. 0.58	Ft./Sec. 1.1	Ft./Sec. 1.8	Ft./Sec.			
Estimated Flow:	43.74	CFS 18.304	CFS 29.696	CFS 27.72	CFS 503.415	CFS			
Stream Modifications:	None		None	None					
Nuisance Plants (Y/N):	N	N	N	N	N				
Report Number:									
STORET No.:	520528	210323	220152	550222	210015				
Stream Name:	M B Escanaba River	Fishdam River	N B Ford River	Ten Mile Creek	Ford River				
Road Crossing/Location:	two track off County Rd Ch	FF Road 2410	Walker Rd	County Rd 410	US-2				
County Code:	52	21	22	55	21				
TRS:	46N28W03	42N18W21	43N27W25	39N24W7	39N23W31				
Latitude (dd):	46.41691	46.01641	46.08894	45.78864	45.73449				
Longitude (dd):	-87.79475	-86.56093	-87.62684	-87.3255	-87.183893				
Ecoregion:	NLAF	NLAF	NLAF	NLAF	NLAF				
Stream Type:					Warmwater				
USGS Basin Code:	4030110	4030112	4030109	4030109	4030109				
* Applies only to Riffle/Run stream Surveys									
** Applies only to Glide/Pool stream Surveys									
COMMENTS:									

Table 3. Habitat evaluation for central Upper Peninsula										
	Escanaba River		Unnamed Trib to M B Escanaba River		Unnamed Trib to Ten Mile Creek		Gordon Creek		M B Escanaba River	
	County Road 519		two track off County Rd ADA		River Rd		36.5 Mile Rd		County Rd 565	
	RIFFLE/RUN Station 8		GLIDE/POOL Station 9		GLIDE/POOL Station 10		RIFFLE/RUN Station 11		RIFFLE/RUN Station 12	
HABITAT METRIC										
Substrate and Instream Cover										
Epifaunal Substrate/ Avail Cover (20)	15		14		15		16		10	
Embeddedness (20)*	20						19		19	
Velocity/Depth Regime (20)*	10						10		19	
Pool Substrate Characterization (20)**			16		15					
Pool Variability (20)**			7		18					
Channel Morphology										
Sediment Deposition (20)	19		16		15		18		19	
Flow Status - Maint. Flow Volume (10)	9		9		10		9		9	
Flow Status - Flashiness (10)	9		9		10		9		9	
Channel Alteration (20)	19		19		20		19		19	
Frequency of Riffles/Bends (20)*	19						19		19	
Channel Sinuosity (20)**			15		19					
Riparian and Bank Structure										
Bank Stability (L) (10)	9		9		10		9		10	
Bank Stability (R) (10)	9		9		10		9		10	
Vegetative Protection (L) (10)	9		9		10		9		8	
Vegetative Protection (R) (10)	6		8		10		9		8	
Riparian Veg. Zone Width (L) (10)	8		8		10		9		8	
Riparian Veg. Zone Width (R) (10)	6		7		10		9		8	
TOTAL SCORE (200):	167		155		182		173		175	
HABITAT RATING:	EXCELLENT (NON-IMPAIRED)		EXCELLENT (NON-IMPAIRED)		EXCELLENT (NON-IMPAIRED)		EXCELLENT (NON-IMPAIRED)		EXCELLENT (NON-IMPAIRED)	
Note: Individual metrics may better describe conditions directly affecting the biological community while the Habitat Rating describes the general riverine environment at the site(s).										
Date:	6/29/2015		6/28/2015		7/1/2015		6/30/2015		6/28/2015	
Weather:	Sunny		Sunny		Sunny		Partly Cloudy		Sunny	
Air Temperature:	78	Deg. F.	62	Deg. F.	62	Deg. F.	76	Deg. F.	78	Deg. F.
Water Temperature:	74	Deg. F.	62	Deg. F.	56	Deg. F.	68	Deg. F.	66	Deg. F.
Ave. Stream Width:	340.8	Feet	28	Feet	7	Feet	7.3	Feet	51.7	Feet
Ave. Stream Depth:	1.6	Feet	1.4	Feet	0.8	Feet	0.7	Feet	2	Feet
Surface Velocity:		Ft./Sec.	0.32	Ft./Sec.	0.9	Ft./Sec.	1	Ft./Sec.		Ft./Sec.
Estimated Flow:	444	CFS	12.544	CFS	5.04	CFS	5.11	CFS	173	CFS
Stream Modifications:	None		Bank Stabilization							
Nuisance Plants (Y/N):	N		N		N		N		N	
Report Number:										
STORET No.:	210059		520527		550221		550220		520485	
Stream Name:	Escanaba River		Unnamed Trib to M B Escanaba River		Unnamed Trib to Ten Mile Creek		Gordon Creek		M B Escanaba River	
Road Crossing/Location:	County Road 519		two track off County Rd ADA		River Rd		36.5 Mile Rd		County Rd 565	
County Code:	21		52		55		55		52	
TRS:	41N23W32		48N29W30		40N26W04		38N26W36		46N26W30	
Latitude (dd):	45.90953		46.53503		45.88631		45.54466		46.5083	
Longitude (dd):	-87.21317		-87.97276		-87.52225		-87.46175		-87.60339	
Ecoregion:	NLAF		NLAF		NLAF		NLAF		NLAF	
Stream Type:	Coldwater									
USGS Basin Code:	4030110		4030110		4030109		4030109		4030110	
* Applies only to Riffle/Run stream Surveys										
** Applies only to Glide/Pool stream Surveys										
COMMENTS:	Discharge from USGS gage								Discharge from USGS gage	

Table 3. Habitat evaluation for Central Upper Peninsula sites									
	Tacoosh River		Cedar River		Eighteen Mile Creek		Bear Creek		Big Brook d/s Kates Grade Rd/County Rd Eaa
	E. Maple Ridge Rd		32 Rd		d/s Forest Highway 13		County Rd 565		Rd/County Rd Eaa
	GLIDE/POOL		RIFLE/RUN		GLIDE/POOL		GLIDE/POOL		GLIDE/POOL
	Station 13		Station 14		Station 16		Station 17		Station 18
HABITAT METRIC									
Substrate and Instream Cover									
Epifaunal Substrate/ Avail Cover (20)	10		15		15		11		11
Embeddedness (20)*			19						
Velocity/Depth Regime (20)*			10						
Pool Substrate Characterization (20)**	11				13		15		13
Pool Variability (20)**	5				18		10		15
Channel Morphology									
Sediment Deposition (20)	16		19		18		15		16
Flow Status - Maint. Flow Volume (10)	9		9		9		9		9
Flow Status - Flashiness (10)	9		8		10		8		9
Channel Alteration (20)	19		19		19		19		19
Frequency of Riffles/Bends (20)*			10						
Channel Sinuosity (20)**	8				15		18		18
Riparian and Bank Structure									
Bank Stability (L) (10)	9		9		8		9		9
Bank Stability (R) (10)	9		9		8		9		9
Vegetative Protection (L) (10)	9		9		9		9		9
Vegetative Protection (R) (10)	9		9		9		9		8
Riparian Veg. Zone Width (L) (10)	9		5		10		10		9
Riparian Veg. Zone Width (R) (10)	9		5		10		10		8
TOTAL SCORE (200):	141		155		171		161		162
HABITAT RATING:									
	GOOD		EXCELLENT		EXCELLENT		EXCELLENT		EXCELLENT
	(SLIGHTLY IMPAIRED)		(NON- IMPAIRED)		(NON- IMPAIRED)		(NON- IMPAIRED)		(NON- IMPAIRED)
Note: Individual metrics may better describe conditions directly affecting the biological community while the Habitat Rating describes the general riverine environment at the site(s).									
Date:	6/29/2015		6/30/2015		7/15/2015		6/28/2015		6/28/2015
Weather:	Sunny		Partly Cloudy		Sunny		Sunny		Sunny
Air Temperature:	80	Deg. F.	72	Deg. F.	84	Deg. F.	80	Deg. F.	82
Water Temperature:	64	Deg. F.	68	Deg. F.	60	Deg. F.	58	Deg. F.	60
Ave. Stream Width:	4.7	Feet	65	Feet	20	Feet	12.7	Feet	18.7
Ave. Stream Depth:	0.7	Feet	1.7	Feet	1.4	Feet	1	Feet	2.2
Surface Velocity:	0.08	Ft./Sec.	1.7	Ft./Sec.	0.83	Ft./Sec.	0.95	Ft./Sec.	0.8
Estimated Flow:	0.2632	CFS	187.85	CFS	23.24	CFS	12.065	CFS	32.912
Stream Modifications:	None		None		None		None		None
Nuisance Plants (Y/N):	N		N		N		N		Y
Report Number:									
STORET No.:	210321		550219		210317		520500		520498
Stream Name:	Tacoosh River		Cedar River		Eighteen Mile Creek		Bear Creek		Big Brook
Road Crossing/Location:	Maple Ridge Rd (38th)		32 Rd		d/s Forest Highway 13		County Rd 565		d/s Kates Grade Rd/County Rd Eaa
County Code:	21		55		21		52		52
TRS:	43N23W36		38N25W27		42N19W22		45N26W10		44N26W18
Latitude (dd):	46.07172		45.58001		46.01797		46.31189		46.212
Longitude (dd):	-87.1293		-87.37821		-86.67072		-87.55107		-87.61227
Ecoregion:	NLAF		NLAF		NLAF		NLAF		NLAF
Stream Type:					Coldwater		Coldwater		Coldwater
USGS Basin Code:	4030111		4030109		4030112		4030110		4030110
* Applies only to Riffle/Run stream Surveys									
** Applies only to Glide/Pool stream Surveys									
COMMENTS:									

Table 3. Habitat evaluation for central Upper Peninsula										
	E B Escanaba River		Forty-Seven Mile Creek		M B Escanaba River		Ford River		Escanaba River	
	Iron St		Mott Ln		US41		Cedardale 28th Rd (E2)		two track off Little West Rd/County Rd SW	
	RIFFLE/RUN Station 19		GLIDE/POOL Station 20		GLIDE/POOL Station 21		RIFFLE/RUN Station 22		RIFFLE/RUN Station 23	
HABITAT METRIC										
Substrate and Instream Cover										
Epifaunal Substrate/ Avail Cover (20)	16		19		13		15		15	
Embeddedness (20)*	18						19		19	
Velocity/Depth Regime (20)*	16						19		10	
Pool Substrate Characterization (20)**			16		15					
Pool Variability (20)**			5		10					
Channel Morphology										
Sediment Deposition (20)	15		20		16		16		15	
Flow Status - Maint. Flow Volume (10)	9		10		9		9		9	
Flow Status - Flashiness (10)	9		10		8		6		9	
Channel Alteration (20)	15		20		19		19		19	
Frequency of Riffles/Bends (20)*	13						15		19	
Channel Sinuosity (20)**			8		13					
Riparian and Bank Structure										
Bank Stability (L) (10)	7		10		10		7		9	
Bank Stability (R) (10)	9		10		10		9		9	
Vegetative Protection (L) (10)	9		10		10		4		9	
Vegetative Protection (R) (10)	9		10		10		6		9	
Riparian Veg. Zone Width (L) (10)	10		10		8		6		10	
Riparian Veg. Zone Width (R) (10)	7		10		8		8		10	
TOTAL SCORE (200):	162		168		159		158		171	
HABITAT RATING:	EXCELLENT (NON-IMPAIRED)		EXCELLENT (NON-IMPAIRED)		EXCELLENT (NON-IMPAIRED)		EXCELLENT (NON-IMPAIRED)		EXCELLENT (NON-IMPAIRED)	
Note: Individual metrics may better describe conditions directly affecting the biological community while the Habitat Rating describes the general riverine environment at the site(s).										
Date:	6/26/2015		7/1/2015		6/28/2015		7/1/2015		6/29/2015	
Weather:	Sunny		Sunny		Sunny		Sunny		Sunny	
Air Temperature:	70 Deg. F.		76 Deg. F.		74 Deg. F.		74 Deg. F.		80 Deg. F.	
Water Temperature:	64 Deg. F.		66 Deg. F.		62 Deg. F.		66 Deg. F.		58 Deg. F.	
Ave. Stream Width:	53.7 Feet		26.3 Feet		44 Feet		58.3 Feet		184.7 Feet	
Ave. Stream Depth:	1.5 Feet		1.2 Feet		1.68 Feet		2.4 Feet		1 Feet	
Surface Velocity:	1.3 Ft./Sec.		0.5 Ft./Sec.		0.83 Ft./Sec.		2.40 Ft./Sec.		4.54 Ft./Sec.	
Estimated Flow:	104.715 CFS		15.78 CFS		61.3536 CFS		240 CFS		454 CFS	
Stream Modifications:	None				None		None		None	
Nuisance Plants (Y/N):	N		N		N		N		N	
Report Number:										
STORET No.:	520502		550211		520503		210316		520497	
Stream Name:	E B Escanaba River		Forty-Seven Mile Creek		M B Escanaba River		Ford River		Escanaba River	
Road Crossing/Location:	Iron St		Mott 46 Ln/Mott Ln		US41		Cedardale 28th Rd (E2)		two track off Little West Rd/County Rd SW	
County Code:	52		55		52		21		52	
TRS:	45N25W21		39N25W15		47N28W06		41N24W19		43N25W03	
Latitude (dd):	46.28336		45.78321		46.49291		45.93127		46.14574	
Longitude (dd):	-87.4367		-87.37344		-87.86711		-87.35679		-87.42352	
Ecoregion:	NLAf		NLAf		NLAf		NLAf		NLAf	
Stream Type:	Coldwater		Warmwater		Warmwater		Warmwater		Warmwater	
USGS Basin Code:	4030110		403109		4030110		403109		4030110	
* Applies only to Riffle/Run stream Surveys										
** Applies only to Glide/Pool stream Surveys										
COMMENTS:							Discharge from USGS gage		Discharge from USGS gage	

Table 3. Habitat evaluation for central Upper Peninsula

	Beattie Creek M35 RIFFLE/RUN Station 24	Walton River Westman Dam Rd RIFFLE/RUN Station 25	Black River two track off Island Lake Rd GLIDE/POOL Station 26	Hunters Brook Boney Falls Rd RIFFLE/RUN Station 27	Portage Creek Cemetery along M-35 GLIDE/POOL Station 28
HABITAT METRIC					
Substrate and Instream Cover					
Epifaunal Substrate/ Avail Cover (20)	13	15	15	15	8
Embeddedness (20)*	19	19		20	
Velocity/Depth Regime (20)*	15	16		10	
Pool Substrate Characterization (20)**			17		11
Pool Variability (20)**			18		8
Channel Morphology					
Sediment Deposition (20)	10	18	19	19	8
Flow Status - Maint. Flow Volume (10)	8	9	9	9	8
Flow Status - Flashiness (10)	8	9	9	9	3
Channel Alteration (20)	10	19	19	19	18
Frequency of Riffles/Bends (20)*	11	18		13	
Channel Sinuosity (20)**			11		9
Riparian and Bank Structure					
Bank Stability (L) (10)	5	9	9	9	4
Bank Stability (R) (10)	5	9	9	9	4
Vegetative Protection (L) (10)	8	9	9	8	9
Vegetative Protection (R) (10)	0	9	9	9	6
Riparian Veg. Zone Width (L) (10)	0	9	9	8	9
Riparian Veg. Zone Width (R) (10)	4	8	9	9	2
TOTAL SCORE (200):	116	176	171	166	107
HABITAT RATING:	GOOD (SLIGHTLY IMPAIRED)	EXCELLENT (NON- IMPAIRED)	EXCELLENT (NON- IMPAIRED)	EXCELLENT (NON- IMPAIRED)	GOOD (SLIGHTLY IMPAIRED)
Note: Individual metrics may better describe conditions directly affecting the biological community while the Habitat Rating describes the general riverine environment at the site(s).					
Date:	6/30/2015	6/30/2015	6/28/2015	6/29/2015	7/14/2015
Weather:	Rainy	Partly Cloudy		Sunny	Sunny
Air Temperature:	68 Deg. F.	72 Deg. F.	76 Deg. F.	82 Deg. F.	80 Deg. F.
Water Temperature:	62 Deg. F.	70 Deg. F.	71 Deg. F.	72 Deg. F.	66 Deg. F.
Ave. Stream Width:	12.7 Feet	43.7 Feet	36.7 Feet	26.7 Feet	21.7 Feet
Ave. Stream Depth:	0.6 Feet	0.7 Feet	2.6 Feet	0.7 Feet	0.5 Feet
Surface Velocity:	1 Ft./Sec.	3.5 Ft./Sec.	0.46 Ft./Sec.	1 Ft./Sec.	1 Ft./Sec.
Estimated Flow:	7.62 CFS	107.065 CFS	43.8932 CFS	18.69 CFS	10.85 CFS
Stream Modifications:	Bank stabilization, relocated	Impounded	None	Artificial stone placement	None
Nuisance Plants (Y/N):	N	N	N	N	N
Report Number:					
STORET No.:	550176	550143	520529	210322	210036
Stream Name:	Beattie Creek	Walton River	Black River	Hunters Brook	Portage Creek
Road Crossing/Location:	M35	Westman Dam Rd	two track off Island Lake Rd	Boney Falls Rd	Cemetery along M-35
County Code:	55	55	52	21	21
TRS:	33N26W28	35N25W18	46N28W10	41N23W18	38N23W01
Latitude (dd):	45.22702	45.428373	46.39267	45.9534	45.711393
Longitude (dd):	-87.51228	-87.440816	-87.7958	-87.23449	-87.092504
Ecoregion:	NLAF	NLAF	NLAF	NLAF	NLAF
Stream Type:					Warmwater
USGS Basin Code:	4030109	4030109	4030110	4030110	4030111
* Applies only to Riffle/Run stream Surveys					
** Applies only to Glide/Pool stream Surveys					
COMMENTS:					

Table 3. Habitat evaluation for central Upper Peninsula sites

	Willow Creek Old State Rd (8th Ave) GLIDE/POOL Station 29	Willow Creek 3rd Ave GLIDE/POOL Station 30	Willow Creek 6th Ave GLIDE/POOL Station 31	Unnamed tributary to Pickerel Lake M77 and Adams Trl GLIDE/POOL Station 32
HABITAT METRIC				
Substrate and Instream Cover				
Epifaunal Substrate/ Avail Cover (20)	7	6	8	15
Embeddedness (20)*				
Velocity/Depth Regime (20)*				
Pool Substrate Characterization (20)**	8	8	8	15
Pool Variability (20)**	8	0	1	3
Channel Morphology				
Sediment Deposition (20)	8	1	1	18
Flow Status - Maint. Flow Volume (10)	9	6	4	9
Flow Status - Flashiness (10)	2	1	1	9
Channel Alteration (20)	15	14	13	13
Frequency of Rifles/Bends (20)*				
Channel Sinuosity (20)**	3	3	2	0
Riparian and Bank Structure				
Bank Stability (L) (10)	3	9	7	9
Bank Stability (R) (10)	3	9	7	9
Vegetative Protection (L) (10)	5	8	5	7
Vegetative Protection (R) (10)	5	8	5	3
Riparian Veg. Zone Width (L) (10)	3	1	9	5
Riparian Veg. Zone Width (R) (10)	9	3	9	0
TOTAL SCORE (200):	88	77	80	115
HABITAT RATING:	MARGINAL (MODERATELY IMPAIRED)	MARGINAL (MODERATELY IMPAIRED)	MARGINAL (MODERATELY IMPAIRED)	GOOD (SLIGHTLY IMPAIRED)
Note: Individual metrics may better describe conditions directly affecting the biological community while the Habitat Rating describes the general riverine environment at the site(s).				
Date:	7/15/2015	7/16/2015	7/16/2015	7/16/2015
Weather:	Sunny	Partly Cloudy	Partly Cloudy	Sunny
Air Temperature:	78 Deg. F.	84 Deg. F.	80 Deg. F.	80 Deg. F.
Water Temperature:	60 Deg. F.	60 Deg. F.	66 Deg. F.	62 Deg. F.
Ave. Stream Width:	17 Feet	8 Feet	7.7 Feet	4.8 Feet
Ave. Stream Depth:	0.4 Feet	0.6 Feet	0.2 Feet	0.4 Feet
Surface Velocity:	0.9 Ft./Sec.	0.3 Ft./Sec.	0.8 Ft./Sec.	0.5 Ft./Sec.
Estimated Flow:	6.12 CFS	1.44 CFS	1.232 CFS	0.96 CFS
Stream Modifications:	None	None	None	Dredged
Nuisance Plants (Y/N):	N	N	N	N
Report Number:				
STORET No.:	210240	210324	210325	20166
Stream Name:	Willow Creek	Willow Creek	Willow Creek	Unnamed tributary to Pickerel Lake
Road Crossing/Location:	Old State Rd (8th Ave)	3rd Ave	6th Ave	M77 and Adams Trl
County Code:	21	21	21	
TRS:	39N23W36	39N23W25	39N23W24	NW481423
Latitude (dd):	45.73553	45.74886	45.7537	46.53843
Longitude (dd):	-87.10061	-87.08399	-87.08917	-86.01467
Ecoregion:	NLAF	NLAF	NLAF	NLAF
Stream Type:	Coldwater			
USGS Basin Code:	4030111	4030111	4030111	4060106
* Applies only to Riffle/Run stream Surveys				
** Applies only to Glide/Pool stream Surveys				
COMMENTS:				

Table 4. Water chemistry results for Willow Creek, unnamed tributary to Second Lake, and Unnamed pond outlet. ND = not detected

Site Number	29	30	31	32	33
Site Type	Targeted	Targeted	Targeted	Targeted	Targeted
Waterbody Name	Willow Creek	Willow Creek	Willow Creek	Unnamed tributary to Pickerel Lake	Unnamed Pond outlet
Location	Old State Rd/8th Ave	3rd AVE	6th AVE	M-77 and Adams Truck Trail	Washington ST
STORET	210240	210324	210325	20166	520534
Organics-DRO/ORO (µg/l)					
Diesel Range Org(C10-C20)	130	140	160	150	ND
Oil Range Organics (C20-C34)	ND	ND	ND	ND	ND
Organics-Semivolatiles (µg/l)					
2-Methylnaphthalene	ND	ND	ND	ND	ND
Acenaphthene	ND	ND	ND	ND	ND
Acenaphthylene	ND	ND	ND	ND	ND
Anthracene	ND	ND	ND	ND	ND
Benz[a]anthracene	ND	ND	ND	ND	ND
Benzo[a]pyrene	ND	ND	ND	ND	ND
Benzo[b]fluoranthene	ND	ND	ND	ND	ND
Benzo[g,h,i]perylene	ND	ND	ND	ND	ND
Benzo[k]fluoranthene	ND	ND	ND	ND	ND
Chrysene	ND	ND	ND	ND	ND
Dibenz[a,h]anthracene	ND	ND	ND	ND	ND
Fluoranthene	ND	ND	ND	ND	ND
Fluorene	ND	ND	ND	ND	ND
Indeno(1,2,3-c,d)pyrene	ND	ND	ND	ND	ND
Naphthalene	ND	ND	ND	ND	ND
Phenanthrene	ND	ND	ND	ND	ND
Pyrene	ND	ND	ND	ND	ND
Inorganics-General Chemistry (mg/l)					
Ammonia	0.50	0.22	0.17	0.03	ND
Kjeldahl nitrogen	1.70	0.90	0.80	0.46	0.13
Nitrate/nitrite	0.45	0.33	0.40	0.01	ND
Total organic carbon	29.00	17.00	15.00	14.00	2.00
Total phosphorus	0.031	0.027	0.027	ND	0.014
Inorganics-Metals (µg/l)					
Arsenic	ND	ND	ND	ND	ND
Barium	36	33	36	32	9.6
Cadmium	ND	ND	ND	ND	ND
Chromium	ND	ND	ND	ND	ND
Copper	3.2	ND	ND	ND	1.2
Lead	ND	ND	ND	ND	ND
Mercury	ND	ND	ND	ND	ND
Selenium	ND	ND	ND	ND	ND
Silver	ND	ND	ND	ND	ND
Zinc	ND	ND	ND	ND	ND

Table 5. Sediment chemistry results for unnamed tributary to Pickerel Lake. ND = not detected

Site Number	32		
Site Type	Targeted		
Waterbody Name	Unnamed tributary to Pickerel Lake		
Location	M-77 and Adams Truck Trail		
STORET	20166		
Organics-DRO/ORO ($\mu\text{g}/\text{kg}$ dry)			
Diesel Range Org(C10-C20)	100000		
Oil Range Organics (C20-C34)	300000		
Organics-Semivolatiles ($\mu\text{g}/\text{kg}$ dry)			
2-Methylnaphthalene	ND		
Acenaphthene	ND		
Acenaphthylene	ND		
Anthracene	ND		
Benz[a]anthracene	ND		
Benzo[a]pyrene	ND		
Benzo[b]fluoranthene	ND		
Benzo[g,h,i]perylene	ND		
Benzo[k]fluoranthene	ND		
Chrysene	ND		
Dibenz[a,h]anthracene	ND		
Fluoranthene	ND		
Fluorene	ND		
Indeno(1,2,3-c,d)pyrene	ND		
Naphthalene	ND		
Phenanthrene	ND		
Pyrene	ND		
Inorganics-General Chemistry			
% Total solids	48.4		
Total organic carbon (mg/kg dry)	11000		
Inorganics-Metals (mg/kg dry)			
Arsenic	ND		
Barium	7.3		
Cadmium	ND		
Chromium	2.5		
Copper	1.6		
Lead	13		
Mercury	ND		
Selenium	ND		
Silver	ND		
Zinc	7.0		