

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY
WATER RESOURCES DIVISION
JANUARY 2015

STAFF REPORT

BIOLOGICAL SURVEY OF THE RIVER RAISIN WATERSHED
HILLSDALE, JACKSON, LENAWEE, MONROE, WASHTENAW, AND WAYNE COUNTIES
AUGUST 2013

As part of the five-year watershed monitoring cycle, staff from the Surface Water Assessment Section (SWAS) conducted biological sampling within the River Raisin watershed during August 2013. Qualitative macroinvertebrate and habitat surveys were conducted throughout the watershed (Figure 1, Table1) following the SWAS Procedure 51 (Michigan Department of Environmental Quality [MDEQ], 1990; Creal et. al., 1996), and the status and trend procedure (MDEQ, Draft).

OBJECTIVES

The biological surveys were conducted to:

- Support water quality-based effluent limit development for National Pollutant Discharge Elimination System (NPDES) permits.
- Identify nonpoint sources (NPS) of water quality impairment.
- Evaluate the effectiveness of specific NPS water quality improvement projects.
- Satisfy water quality monitoring requests submitted by internal and external customers.
- Support total maximum daily load development for surface waters of nonattainment and address nonattainment listings described in the 2012 Integrated Report (Goodwin et. al., 2012).
- Assess the current status and condition of individual assessment units and determine whether water quality standards (WQS) are being met.
- Evaluate macroinvertebrate community temporal trends.
- Evaluate the effectiveness of specific contaminated site remediation projects.
- Support Area of Concern-related beneficial use delisting decisions.

WATERSHED DESCRIPTIONS

The River Raisin watershed is a warmwater system composed of 10 subwatersheds, which drains approximately 1,070 square miles of river through the southeast counties of Hillsdale, Jackson, Lenawee, Monroe, Washtenaw, and Wayne as it flows to Lake Erie (Dodge, 1998). As of 2010, the River Raisin watershed land use is composed of 65 percent agriculture, 11 percent urban, 8 percent wetland, 7 percent forested, and 7 percent grassland (River Raisin Watershed Council, 2014). The watershed also incorporates three different ecoregions, Southern Michigan Northern Indiana Till Plain (SMNITP), Eastern Corn Belt Plain (ECBP), and Huron Erie Lake Plain (HELP) (Omernik and Gallant, 1988) (Figure 1).

SMNITP is characterized by many lakes and marshes as well as an assortment of landforms, soil types, soil textures, and land uses. Broad till plains with thick and complex deposits of drift, paleobeach ridges, relict dunes, morainal hills, kames, drumlins, meltwater channels, and

kettles occur. Feed grain, soybean, and livestock farming as well as woodlots, quarries, recreational development, and urban-industrial areas are common (United States Environmental Protection Agency [USEPA], 2010). The HELP is a broad, fertile, nearly flat plain punctuated by relic sand dunes, beach ridges, and end moraines. Originally, soil drainage was typically poorer than in the adjacent ECBP, and elm-ash swamp and beech forests were dominant. Oak savanna was typically restricted to sandy, well-drained dunes and beach ridges. Today, most of the area has been cleared and artificially drained and contains highly productive farms producing corn, soybeans, livestock, and vegetables; urban and industrial areas are also extensive. Stream habitat and quality have been degraded by channelization, ditching, and agricultural activities (USEPA, 2010). The ECBP is primarily a rolling plain with local end moraines; it has more natural tree cover and lighter colored soils than the Central Corn Belt Plains. The region has loamier and better drained soils than the HELP, and richer soils than the Erie/Ontario Hills and Lake Plain. Glacial deposits of Wisconsin age are extensive. They are not as dissected nor as leached as the pre-Wisconsin till, which is restricted to the southern part of the region. Originally, beech forests were common on Wisconsin soils while beech forests and elm-ash swamp forests dominated the wetter pre-Wisconsin soils. Today, extensive corn, soybean, and livestock production occurs and has affected stream chemistry and turbidity (USEPA, 2010).

BACKGROUND AND HISTORICAL SAMPLING EFFORTS

River Raisin

A biological survey was conducted in July 1972 by the Michigan Water Resources Commission staff to determine the effects of wastewater discharges on the aquatic community. A diverse warmwater community was found in the south branch of the River Raisin upstream of Adrian. However, it was concluded that storm sewer discharges in Adrian caused decreased aquatic habitat and water quality and reduced the diversity of aquatic animals not only within the city but downstream to the Adrian Wastewater Treatment Plant (WWTP). The addition of very low quality industrial wastewater via East Drain to the river further degraded the river but low levels of recovery occurred within two miles. Four miles below the WWTP discharge, water quality was similar to that immediately above the WWTP as reflected by their biotic indices (Evans, 1973).

During the summer of 1979, the River Raisin basin was monitored as part of the Michigan Department of Natural Resources (MDNR) biological monitoring program established by the USEPA under Public Law 95-217, Section 106. The purpose of that report was to analyze the various available data and determine changes in river quality. The south branch River Raisin downstream of Adrian remained degraded. Degradation was reflected in tainted fish and reduced macroinvertebrate communities. Previous biological studies have documented degradation downstream of the Adrian WWTP and Eastside Drain for 25 years. Previous studies indicated the problem to be a combination of organic loading from the Adrian WWTP and intermittent toxic discharges. The fish populations in the River Raisin from downstream of Tecumseh and Adrian to Lake Erie reflected degraded stream conditions. Within these 89.5 miles of river, nongame fish, such as carp and suckers, were the dominant species. In addition to industrial and municipal waste loadings, soil erosion from this portion of the river basin lowered stream quality and restricted the fishery even further. Only in the headwaters were conditions suitable for game fish management. Excessive ammonia and phosphorus levels were found downstream of the Adrian WWTP in 1973. Excessive ammonia levels were also found upstream of Deerfield and at the city of Monroe. Degraded conditions in Black Creek downstream of Weston existed in 1973 and 1977. Chlorine from the Stauffer Chemical

Company discharge was indicated as the probable cause in 1977 (Shauver, 1977). The Macon River was of good quality in the upstream reaches in 1973. However, a reduced macroinvertebrate community was found in the downstream reaches. No impacts on River Raisin qualities were detected (Creal, 1979).

On August 11, 1988, a biological survey of the Saline River was completed in the vicinity of the Saline WWTP. The macroinvertebrate and habitat quality was rated at three sites and found to be medium to high quality. Water chemistry results indicate copper was elevated downstream of the Saline WWTP outfall (Waggoner, 1989).

On August 7, 1989, Black Creek was surveyed near the town of Weston to evaluate stream conditions prior to permit reissuance for Akzo Chemicals, Inc. (formerly Stauffer Chemical Company). It was found that benthic macroinvertebrates were diverse and more abundant than in previous surveys. No difference was found between the upstream and downstream locations at the Akzo Chemicals, Inc. outfall. Water and sediment chemistry samples indicated that further evaluation was needed for vanadium (Oemke, 1989a).

Wolf Creek was surveyed at three locations on August 7, 1989, in response to a request from the Lenawee County Soil Conservation Service to evaluate stream quality. The macroinvertebrate community was found to have low diversity, and siltation appeared to be impacting the available habitat (Oemke, 1989b).

In August 1989, a biological survey of the River Raisin was carried out to assess the impacts from point sources and NPS as requested by the Jackson district staff. The south branch of the River Raisin showed a fairly diverse warmwater community downstream of Adrian and appeared not to be adversely impacted from the upstream urban NPS and point sources. The main branch of the River Raisin at Academy Road, 2-3 miles downstream of Adrian, showed lower macroinvertebrate diversities, possibly as a result of the poor macroinvertebrate habitat. Overall, the composition of the macroinvertebrate community had improved since the 1973 (Evans) and 1979 (Creal) surveys. Several mayfly taxa were reported at both stations in this study, which were not reported in the earlier studies, indicating a decrease in adverse effects due to point sources or NPS (Oemke, 1990).

On June 13, 1991, a biological survey of Black Creek was completed upstream and downstream from Akzo Chemicals, Inc. near the village of Weston as a follow-up to the survey conducted on August 3, 1989. A fish community assessment found poor fish communities at two sites. The macroinvertebrate community and habitat quality was impaired at two sites and found to be similar to previous assessments (Oemke, 1992a).

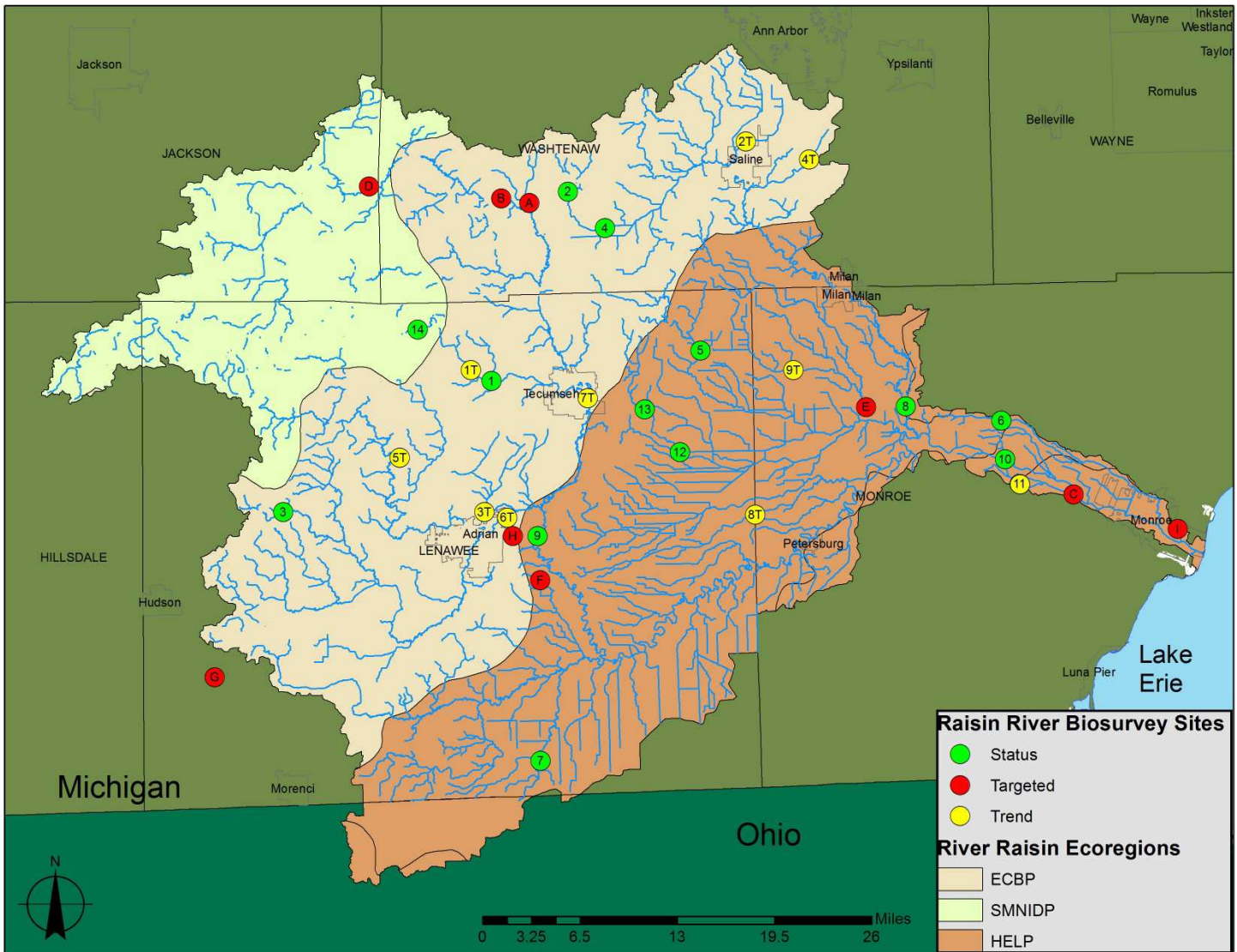


Figure 1. River Raisin watershed with sampling locations within Ingham, Livingston, Monroe, Oakland, Washtenaw, and Wayne Counties; 2013.

In July 1991, a biological survey was conducted on Macon Creek to assess NPS impacts and to assess impacts from reduced flow in the River Raisin due to consumptive water uses. A fish community assessment was completed at 5 locations and found fish communities good at 4 locations and poor at 1. The macroinvertebrate community assessment found 1 poor community and 4 fair communities. Many of the macroinvertebrates identified were surface dependent, indicating a possible dissolved oxygen problem. Habitat quality found poor conditions at 4 locations and fair conditions at 1 location (Oemke, 1992b).

As part of the point source and NPS inspections, a biological survey was conducted on the River Raisin in 1992 to carry out a comprehensive biological study and document water quality in the vicinity of point source discharges prior to NPDES issuance. The survey was also performed to develop Procedure 51 reference sites scores. Twenty-three locations were sampled throughout the River Raisin, Saline River, Macon Creek, and the south branch of the River Raisin for macroinvertebrate and fish communities as well as habitat quality. Macroinvertebrate communities were rated fair for the Saline River, fair to good for the River Raisin, and fair for Macon Creek and the south branch of the River Raisin. Fish

communities were rated good to excellent at two locations in the River Raisin, good to excellent in the Saline River, Macon Creek fish were not surveyed, and the south branch of the River Raisin rated fair to good. Habitat ranged from poor to excellent in the Saline River with 5 of the 8 sites rating poor. In the River Raisin, 8 of 11 habitat sites were rated poor and 1 of 2 sites rated poor in Macon Creek. The south branch of the River Raisin habitat sites were rated poor at 1 of 4 locations. Sites 3 and 4 from the River Raisin were used as Procedure 51 reference sites with all metrics rating good to excellent (Kosek and Jones, 1994).

As part of NPS inspections in 1996, a biological survey was conducted in the Little River Raisin and Raisin Creek in Monroe County. Fish communities rated acceptable at all three sampling locations (one in Raisin Creek and two in Little River Raisin); however, one site in each water body had fish communities tending toward poor. Macroinvertebrate communities were rated acceptable in Raisin Creek and unacceptable for both stations in the Little River Raisin, which were dominated by Corixids, Chironomids, and Gastropods. Habitat evaluations rated poor at all three locations with streambeds consisting of soft silts and areas with severe bank erosion (Kosek, 1996).

As part of the point source and NPS surveillance activities, 40 biological surveys were carried out on the River Raisin watershed to evaluate impacts due to point source discharges, document potential NPS impairments, and determine water quality status for biological communities. Two fish community locations on the River Raisin rated excellent and acceptable. The other 38 locations were not surveyed for fish due to budget constraints. The macroinvertebrate community was found to range from acceptable to excellent at all locations except for one, which rated poor. The one poor station was located on the north branch Macon Creek and was impacted due to permitted stream modification activities. Habitat was found to range from excellent to fair for the main river and all tributaries in the SMNITP ecoregion. However, habitats within the ECBP and HELP ecoregions ranged from good to poor and excellent to poor, respectively (Alexander, 2001).

Monitoring for *Cryptosporidium* was completed by the MDEQ in 2004 to determine if there was a presence of the pathogen in surface water tributaries that serve as public drinking water sources and to determine potential sources of this pathogen. Monitoring included 55 samples, 25 from ambient surface waters, 9 from field drainage structures, and 21 from intakes and finish waters at the Adrian, Blissfield, and Deerfield water treatment plants. The monitoring found that *Cryptosporidium* may be found in surface waters impacted by manure runoff and in waters that are minimally impacted by agricultural runoff (Sunday, 2005).

In September 2003, surveys were conducted to assess the biological communities and habitat quality within the River Raisin watershed. Forty-five stations were visited resulting in fish and macroinvertebrate community assessments as well as habitat evaluations. Fish communities were found to range from acceptable to poor. The East Side Drain at Oakwood Road rated poor with a score of -9, the lowest possible score using Procedure 51. This score was due to the lack of diversity in the fish community with only two species, Creek Chubs (*Semotilus atromaculatus*) and Blacknose Dace (*Rhinichthys atratulus*), found during the survey. Macroinvertebrate communities ranged from excellent to poor for all locations with 3 stations out of 45 rating poor. Two of these locations were in Black Creek and the other was in Bear Creek. All locations were rated good to marginal for their habitat evaluations (Wright, 2006).

During July and August 2008, the biological community and habitat quality was assessed within the River Raisin watershed. All forty stations were found to have macroinvertebrate community ratings between acceptable and excellent. No locations were rated as poor. However, four

locations (two on the Little River Raisin, Coats Drain, and Sutton Drain) were found to have poor habitat quality associated with them. East Side Drain near Academy Road was surveyed to evaluate degraded water quality conditions. Initial investigations found a sustained flow with a strong sewage-like odor, bacterial slimes covering the entire substrate, and anoxic conditions. A macroinvertebrate community assessment identified several taxa typically found in degraded conditions. Many areas in the reach assessed had large colonies of oligochaetes. Water chemistry results for *E. coli* collected as triplicate samples were reported as >10,000 Colony Forming Units per 100 milliliters. Water quality samples were analyzed for Base/Neutral Acid compounds and Volatile Organic compounds and were found not to be exceeding WQS. Several water bodies were monitored to assess nutrient conditions. All samples for nutrient parameters at these stations were at levels below WQS. Macon Creek and north branch Macon Creek were surveyed near the Holcim Quarry to investigate possible leachate seeps from cement kiln dust piles. No seeps were observed along the north branch Macon Creek. Seeps were found at two locations along Macon Creek. Holcim Quarry staff was notified of the location of the seeps and worked with staff of the MDEQ, Waste and Hazardous Materials Division, on isolating the seeps (Schmitt, 2010).

METHODS

This survey was performed according to Procedure 51 to measure habitat and macroinvertebrate community quality in the River Raisin watershed. Fourteen status sites were randomly selected (Table 1) within the River Raisin watershed using a stratified random site selection method to address statewide and watershed-specific water quality concerns and attainment status (MDEQ, Draft). Alternate sites were preselected to allow for contingencies in the field.

Ten trend sites were identified to determine statewide water quality trends as well as nine targeted sites. These targeted sites were selected to fulfill specific monitoring requests, assess known or potential areas of concern where more information is needed, achieve assessment coverage of the watershed, and provide information for NPDES activities. Targeted sites were identified prior to random site selection. If targeted sites were subsequently chosen in the random draw, they were considered random. Targeted sites that were not selected in the random selection process were surveyed in addition to the 14 random sites; however, the results of these surveys were not considered for the probabilistic analysis of attainment. Overall, 29 biological surveys were conducted within the River Raisin watershed during the 2013 field season. However, three targeted surveys could not be conducted during the 2013 field season due to lack of water.

Using Procedure 51, the macroinvertebrate communities were scored at all 29 locations with metrics that rate water bodies from excellent (greater than +4), acceptable (+4 to -4), and poor (less than -4). Negative ratings that are acceptable are indicative of water bodies that are strongly tending toward poor, while positive ratings that are acceptable indicate slight impairment (Creal et. al., 1996). Stream habitat was also qualitatively evaluated at each station using a scoring system, which ranged in value from 0 (poor) to 200 (excellent).

Water quality samples were collected at one location throughout the watershed, preserved, and transported according to procedures contained in the MDEQ, Water Resources Division's Quality Assurance Manual, unless otherwise indicated. All chemical analyses were conducted at the MDEQ, Environmental Laboratory, in Lansing, Michigan (Table 4).

SUMMARY

Stations used for the biological and habitat evaluations are shown in Figure 1 and Table 1. The macroinvertebrate community and habitat assessments were performed at 29 locations and the results are presented in Tables 2a, 2b, and 3, respectively, and water chemistry monitoring data can be found in Table 4.

RANDOMLY SELECTED WADEABLE SITES

RIVER RAISIN WATERSHED

Evans Creek was surveyed at Carson Highway (Station 1, Figure 2) west of the town of Tecumseh. Habitat quality rated excellent with moderate availability of rootwads and overhanging vegetation, undercut banks, and large woody debris present sparsely throughout the stream reach. The stream was approximately 12-feet wide with an average stream depth of 0.5 feet and dominated by gravel and sand. The riparian vegetative zone width was found to be marginal with a zone width of approximately 20 feet. All other habitat parameters rated either excellent or good. The macroinvertebrate community rated acceptable with 27 taxa identified including 2 mayfly and 5 caddisfly taxa. These taxa comprised 54 percent of the total number of individuals counted.



Figure 2. Evans Creek at Carson Highway.

The Saline River was surveyed at Austin Road (Station 2), which is located downstream of Columbia Lake, east of the town of Manchester. Habitat quality rated marginal with extensive overhanging vegetation present along the left bank. However, vegetation on the right bank was closely cropped to the ground with no overhanging vegetation present. The vegetative zone width was also poor on the right bank and only marginal on the left. The stream reach was 100 percent depositional zone composed mainly of silt with velocities in this 12-foot wide channelized stream less than 0.3 feet per second. There were moderate amounts of aquatic macrophytes, which were the dominant cover in the stream, as well as undercut banks and large woody debris distributed sparsely throughout the reach. The macroinvertebrate community rated acceptable with 22 macroinvertebrate taxa identified of which only 8 percent of the total individuals were made up of the Ephemeroptera, Plecoptera, or Trichoptera (EPT) taxa. The site was dominated by the families Chironomidae, Amphipoda, and Coenagrionidae.

Table 1. Status, trend, and targeted sample locations during the 2013 River Raisin biosurvey. (Colors indicate ecoregions: Tan-ECBP, Yellow-SMNITP, Orange-HELP, and Gray-Not Sampled).

Site ID	Waterbody Name	Location	Latitude	Longitude	AUID	Macroinvertebrate	Habitat	Chem		
Status Sites										
1	Evans Creek	Carson Highway	42.01624	-84.02513	041000020107-01	Acceptable	3	Excellent	155	--
2	Saline River	Austin Road	42.15208	-83.95123	041000020401-01	Acceptable	0	Marginal	84	--
3	Hazen Creek	Hawkins Highway	41.92186	-84.22648	041000020201-01	Acceptable	3	Good	128	--
4	Saline River	McCollum Road	42.12596	-83.91534	041000020401-01	Acceptable	4	Good	110	--
5	Macon Creek	Welch Road	42.03812	-83.82277	041000020404-01	Acceptable	1	Good	134	--
6	North Branch Willow Run	Baldwin Road	41.98765	-83.53188	041000020410-01	Acceptable	-2	Marginal	81	--
7	Bear Creek	Mulberry Road	41.74275	-83.97759	041000020304-01	Acceptable	-4	Good	106	--
8	Saline River	Day Road	41.99790	-83.62423	041000020409-02	Acceptable	1	Marginal	88	--
9	River Raisin	Academy Road	41.90481	-83.98042	041000020307-02	Acceptable	0	Good	110	--
10	River Raisin	USGS Gage off Custer Road	41.96000	-83.52834	041000020410-01	Acceptable	2	Good	151	--
11	River Raisin	off Dixon Road	41.94223	-83.51423	041000020410-01	Acceptable	4	Excellent	158	--
12	South Branch Macon Creek	Pocklington Road	41.96509	-83.84300	041000020405-01	Acceptable	4	Poor	54	--
13	South Branch Macon Creek	M50 (Monroe Road)	41.99580	-83.87693	041000020405-01	Acceptable	1	Good	117	--
14	Evans Creek	Tripp Road	42.05304	-84.09649	041000020410-01	Acceptable	1	Good	137	--
Trend Sites										
1T	Evans Creek	Wisner Hwy	42.02400	-84.04500	041000020107-01	Acceptable	1	Good	106	--
2T	Wood Outlet Drain	Downstream Maple Road	42.18800	-83.77900	041000020402-01	Acceptable	1	Good	120	--
3T	Beaver Creek	Carson Hwy	41.92200	-84.03200	041000020206-03	Acceptable	4	Good	135	--
4T	Koch-Warner Drain	Warner Rd	42.17500	-83.71800	041000020403-01	Acceptable	0	Marginal	89	--
5T	Wolf Creek	off Wolf Creek Hwy	41.96100	-84.11400	041000020204-03	Acceptable	2	Marginal	93	--
6T	S B River Raisin	Howell Hwy	41.91800	-84.01000	041000020206-01	Acceptable	4	Good	149	--
7T	River Raisin	M-50	42.00400	-83.93200	041000020108-01	Acceptable	4	Good	146	--
8T	Little River Raisin	N County Line Rd	41.92000	-83.77000	041000020309-01	Acceptable	1	Marginal	57	--
9T	Bear Swamp Creek	Dennison Rd	42.02400	-83.73300	041000020406-01	Poor	-6	Poor	27	--
10T	River Raisin	off Dixon Rd	41.94200	-83.51400	041000020410-01	Acceptable	4	Excellent	158	--
Targeted Sites										
A	Unnamed Tributary to River Raisin	Austin Road	42.14889	-83.98861	041000020105-02	Acceptable	4	Marginal	95	WC
B	River Raisin	Austin Road	42.14723	-84.01556	041000020105-02	Excellent	6	Good	152	--
C	River Raisin	Raisinville Road	41.93472	-83.46222	041000020410-01	Acceptable	2	Good	145	--
D	North Branch Macon Creek	Day Road	41.99750	-83.66290	041000020409-02	Acceptable	-2	Marginal	97	--
E	River Raisin	Pierce Road	41.15583	-84.14361	041000020102-02	Excellent	6	Good	110	--
F	Lenawee Drain No. 70	Humphries Highway	41.87278	-83.97806	041000020306-02	Dry, No P51	--	Dry, No P51	--	--
G	Medina Drain	Ingall Highway	41.80306	-84.29278	041000060106-03	Dry, No P51	--	Dry, No P51	--	--
H	East Side Drain	Academy Road	41.90470	-84.00430	041000020206-02	Visual Only	--	Visual Only	--	--
I	Mason Run & Clearwater Drains	Sterling State Park	Report: Noffke, 2014		041000020410-03	No P-51	--	No P-51	--	Sed



Figure 3. Hazen Creek at Hawkins Highway.

Upstream of Hawkins Highway (Station 3, Figure 3), Hazen Creek runs through a heavily vegetated wetland. The stream at Station 3 is was found to be 6-feet wide and approximately 8-inches deep which looks to be greatly influenced from the recent rain throughout the system. This stream looks to be no wider than 2 feet with water depth around 2 inches during low water flow. Vegetative protection and riparian zone width were excellent with more than 90 percent of the stream bank covered with trees, shrubs, and nonwoody vegetation. Sediments were dominated by clay and gravel, which was marginally embedded. Habitat quality was rated good with moderate overhanging vegetation and

sparse availability of large woody debris, aquatic macrophytes, and rootwads for macroinvertebrate colonization. The macroinvertebrate communities rated acceptable with a total of 29 macroinvertebrate taxa identified within this reach, of which, 15 percent were composed of EPT and dominated by Sphaerid clams and Elmid.

The Saline River at McCollum Road (Station 4) is located 4 miles below Columbia Lake and 3.3 miles downstream of Station 2. Sediments throughout this reach were dominated by sand and gravel but embeddedness rated poor with roughly 75 percent of the gravel surrounded by fine sediments. Overhanging vegetation was excessively available for macroinvertebrate colonization with aquatic macrophytes moderately available and large woody debris sparse within this reach of stream. Stream banks lacked mature trees and were dominated by shrubs and grasses with the riparian vegetative zone width approximately 20-feet wide. Overall, habitat quality was rated good. Macroinvertebrate communities rated acceptable with 19 total taxa and 44 percent of the total individuals were composed of EPT taxa. The dominant taxa within this reach were Baetids and Chironomids.

During the survey at Macon Creek at Welch Road (Station 5, Figure 4) the local landowner mentioned that the local water levels were approximately one-foot higher than normal due to the recent storm events. The habitat assessment at this location rated good with the creek flowing through predominantly agricultural land. The creek was protected on the west by a buffer strip, increasing the vegetative buffer zone. Very little other vegetation besides understory shrubs was present along the west stream bank. The east bank had a mix of trees, grasses, and various herbaceous plants but the riparian buffer width was poor, estimated at approximately 10-foot wide. Overhanging vegetation, undercut banks, and rootwads were moderate throughout this location with sparse large woody debris available for macroinvertebrate colonization. Sediments were composed of sand with some



Figure 4. Macon Creek at Welch Road.

gravel throughout the creek. Macroinvertebrate communities rated acceptable with 19 total taxa identified, dominated by Hydropsychids and Elmids. Sixty-five percent of the total individuals in the sample were composed of EPT taxa.

The north branch Willow Run at Baldwin Road (Station 6, Figure 5) was found to be seven-feet wide, a depth of approximately 1.5 feet with surface velocities of 0.1 feet per second. Staff who



Figure 5. North Branch Willow Run at Baldwin Road.

visited this location questioned whether this stream was perennial due to the recent rain events throughout the watershed. Upon sampling this site it was found that the sediments were composed of 100 percent silt with very little macroinvertebrate structures except for overhanging vegetation and some aquatic macrophytes. Habitat rated marginal due to several metrics, which scored poor, including: embeddedness, velocity/depth regimes, sediment deposition, riparian vegetative zone width, and frequency of riffles or bends. The macroinvertebrate community rated acceptable with the presence of 20 total taxa, dominated by Chironomids and Isopods. The EPT Orders composed 2.6 percent and the surface air breathers were found to

compose 1.9 percent (Corixids and Haliplids) of the total individuals identified in the sample.

Bear Creek at Mulberry Road (Station 7, Figure 6) is located approximately three miles from the Michigan-Ohio state border with the headwater portions of Bear Creek originating in Ohio. The watershed is dominated by agriculture with sediments almost completely hardpan clay with very little sand, gravel, and silt suggesting a flashy system. Very little in-stream habitat was found within the active channel at this location with sparse undercut bank, large woody debris, and

rootwads with no aquatic macrophytes or overhanging vegetation. The riparian vegetative zone width was good to excellent with a good mix of trees, grasses, and herbaceous vegetation. Habitat quality rated good with the macroinvertebrate community rating acceptable. However, the macroinvertebrate community was found to be minimally acceptable with a score of -4. Seventeen total taxa were identified in which 35 percent of the individuals were from the EPT Orders. The dominant taxa at this location were comprised of Hydropsychids and Chironomids. The numbers of organisms collected at this location (133) were sparse presumably due to the lack of available colonization structures found throughout this reach.



Figure 6. Bear Creek at Mulberry Road.

Saline River at Day Road (Station 8, Figure 7) was dominated by frequently disturbed, soft sediments including detrital material, fine organic muck, and sand/silt/clay, which composed of 95 percent of the benthos. Steep banks were found along the entire reach and propose a high erosion potential during high water events.



Figure 7. Saline River at Day Road.

The riparian vegetative zone width was also found to be marginal with approximately 50 feet of vegetation on either side of the river. The habitat quality rated marginal with large woody debris and rootwads moderately available for macroinvertebrate colonization. This section of river was found to be marginally flashy after rain events with the majority of the large woody debris found lying along the stream banks. Macroinvertebrate communities rated acceptable with a total of 19 taxa, dominated by Hydropsychids and Baetids and 56 percent of the total individuals identified were composed of the EPT taxa.

Substrates were dominated by clay at the River Raisin at Academy Road crossing (Station 9). In spite of the similar substrates throughout this section and lack of overhanging vegetation and aquatic macrophytes, the habitat quality rated good with sparse amounts of large woody debris, undercut banks, and rootwad structures present for macroinvertebrate colonization. The lack of channel retention devices from the main channel and buildup of woody debris dams on the margins suggest a flashy system. The macroinvertebrate communities were found to be composed of mainly Amphipods and Heptageniids with the EPT taxa composing 30 percent of the total individuals identified, resulting in a final rating of acceptable.

River Raisin off Custer Road (Station 10, Figure 8) was one of the larger stream sites in the survey. The stream at this location was 210-feet wide with surface velocities near 1 foot per second. Water depth averaged 2-feet deep and was wadeable at all locations at the site. Substrates were composed mainly of cobble with very little fine sediment present. Habitat communities rated good with aquatic macrophytes moderately available throughout the site for macroinvertebrate colonization but all other habitat structure types were sparse. Bank scour and the riparian vegetative zone width were found to be marginal with only 50 to 60 feet of buffer between the river and the road on the left bank and agricultural fields on the right bank. However, macroinvertebrate communities rated acceptable. A total of 31 taxa were identified during the survey with the dominant orders composed of the EPT orders, which made up 57 percent of the total individuals identified in the sample.



Figure 8. River Raisin off Custer Road.

River Raisin off Dixon Road (Stations 10T and 11) was both a status and trend sampling station. This location was 1.6 miles downstream of Station 10 at Custer Road and was a wadeable location with depth averaging 1.5 feet and surface velocities of 1.5 feet per second. Habitat quality at this site rated excellent. The macroinvertebrate community rated acceptable with 24 taxa identified during the survey. The dominant taxa were found to be Tricorythids and Baetids and EPT taxa composed 54 percent of the sample.

Habitat rated poor along the south branch Macon Creek at Pocklington Road (Station 12, Figure 9) due to the absence of any riparian vegetation besides grass, and heavy deposits of sand, which are frequently moving along the stream bed. The vegetative bank width was less than 10 feet and the dominant vegetation in the upland was corn. The stream had recently been channelized and was found to be a very flashy system with no retention devices present within the stream. Even with the poor habitat throughout the reach the macroinvertebrate community rated acceptable with 28 percent of the total individuals composed of EPT taxa and 19 taxa identified. The dominant taxa were identified as Chironomids and Elmids.



Figure 9. South Branch Macon Creek at Pocklington Road.

South Branch Macon Creek at M-50/Monroe Road (Station 13) is located between the towns of Tecumseh and Britton and is surrounded by agricultural fields. Substrates were composed mainly of sand with a little gravel present embedded over 75 percent. Habitat communities rated good with undercut banks moderately available throughout the site for macroinvertebrate colonization but all other habitat structure types were sparse or absent. The stability of both banks was found to be moderately unstable with high erosion potential during high water events. Macroinvertebrate communities rated acceptable with 25 taxa identified, dominated by Hydropsychids and Elmids with 29 percent identified as EPT taxa.

Station 14 on Evans Creek at Tripp Road is located approximately one mile downstream of Evans Lake, west of the town of Clinton. Habitat quality rated good with moderate overhanging vegetation and sparse large woody debris. Sediments were dominated by an even mix of sand and gravel with traces of clay and silt. The vegetation on the right bank has been removed and a manicured lawn reaches to the stream in the upper portions of the sample reach reducing the riparian zone width throughout this section. However, on the left bank, bank vegetation and the riparian zone are excellent to good with approximately 75 feet of buffer. Macroinvertebrate communities were also rated acceptable with 11 percent of the identified organisms a part of EPT orders. However, this site was dominated by Amphipods, which composed 65 percent of the entire sample collected.

TREND SITES

RIVER RAISIN WATERSHED

Evans Creek was surveyed at Wisner Highway (Station 1T) downstream of a landscaping business. The habitat rated good in this historically channelized stream, which had sediments dominated by sand with equal portions of embedded gravel and silt. Macroinvertebrate colonization structures were sparse for all types with no aquatic macrophytes present throughout this section of stream. The riparian zone was dominated by a few sparsely-placed trees, shrubs, and grasses approximately 10-feet wide and bordered by a well-kept residential lawn and an agricultural field. Macroinvertebrate communities within this reach rated acceptable with 23 total taxa identified at this location, dominated by Chironomids and Oligochaetes, which made up 60 percent of the total organisms identified. EPT constituted only 19 percent of the total sample collected.

Wood Outlet Drain was surveyed downstream of Maple Road (Station 2T, Figure 10) approximately four miles downstream at the Ann Arbor Municipal Airport where the stream originates. The drain is surrounded by, and flows through, several residential areas before emptying into the Saline River at Mill Park Pond in the town of Saline. It was found to have a good habitat community assessment. In-stream habitat was sparse with no aquatic macrophytes present throughout this sample reach. Sediments were composed of mainly sand and embedded gravel with some silt and cobble. Vegetative protection on the banks was good but the riparian zone width was found to be marginal with approximately 30 feet of buffer on each bank.



Figure 10. Wood Outlet Drain at Maple Road.

Macroinvertebrate communities rated acceptable with 17 total taxa identified, dominated by Chironomids and Hydropsychids with EPT taxa representing 30 percent of the total individuals collected.

The Beaver Creek at Carson Highway (Station 3T) location is immediately north of the town of Adrian in a residential area. The stream at the surveyed reach was found to have good habitat even with the lack of protective vegetation and virtually no vegetative buffer zone along the banks, roughly 5 feet on the left bank and 10 feet on the right. Overhanging vegetation was extensive while large woody debris and rootwads were sparse. Cladophora was found throughout the reach, which was dominated by gravel, but was not at nuisance levels. No aquatic macrophytes were present within this reach. Twenty-four macroinvertebrate taxa were identified during the survey and the community rated acceptable. The stream was dominated by Chironomids and Hydropsychids with EPT taxa representing 31 percent of the total individuals collected. During the field survey, the homeowner requested that the field personnel look at a potential sewage leak from a septic crock on the east side of the river across from his property. It was confirmed by visual inspection that the septic tank was in fact leaking raw sewage down the east bank of the creek. A detailed map and GPS coordinates were recorded as well as photo documentation of the leaking septic tank were taken and sent to Jennifer Krejcik in the Jackson District Office for further enforcement actions.



Figure 11. Koch-Warner Drain at Warner Road.

Habitat for the Koch-Warner Drain at Warner Road (Station 4T, Figure 11) rated marginal, displaying sparse habitat structures besides grassy overhanging vegetation, which were very extensive throughout this historically dredged section. This section of drain had heavy deposits of soft silty sediments, which inhibited movement throughout the reach. The local homeowner estimated it has been approximately 13 years since the channel was last dredged. Large woody debris and aquatic macrophytes within the stream were sparse with the only macroinvertebrate habitat available for colonization was the extensive overhanging grasses within this depositional zone. The riparian zone on

the right bank was minimal with less than 10 feet of riparian zone due to human disturbance, while the left bank was marginally better with approximately 75 feet of riparian zone, which was mostly shrubs and other nonwoody vegetation. The macroinvertebrate community rated acceptable, with 24 taxa identified within the reach. The dominant taxa were comprised of Chironomids and Hydropsychids. The EPT taxa made up 31 percent of the total individuals identified in the sample.

Wolf Creek off Wolf Creek Road (Station 5T) flows through a heavily agricultural area in which the habitat rated marginal. All macroinvertebrate colonization structures were sparse to absent except for large woody debris, which was moderately available and laying along the margins of the stream suggesting a flashy system. The stream substrate was dominated by heavy deposits of silt and clay with minimal amounts of sand and embedded gravel. Twenty-three total macroinvertebrate taxa were present resulting in an acceptable rating. EPT taxa represented 19 percent of the total survey collection, which was dominated by Amphipods and Corixids.

South branch River Raisin at Howell Highway (Station 6T) is immediately downstream of the city of Adrian WWTP. The habitat assessment within this reach of stream rated good with moderate amounts of large woody debris and sparse overhanging vegetation and rootwads available for colonization. Sediments were dominated by sand and gravel with some buildup of Coarse Particulate Organic Material on the margins. Riparian width was good with 150 feet of buffer on both banks. The macroinvertebrate community rated acceptable with 33 total taxa identified and dominated by Chironomids and Hydropsychids. EPT comprised 32 percent of the total individuals identified in the sample.

The River Raisin at M-50 (Station 7T) sample location is located upstream of the spillway confluence with the River Raisin at the Tecumseh City Park. A good habitat rating was assessed at this location where rootwads were moderately available with all other structures sparsely available for colonization. Sediments were mainly gravel and sand with some new increases in bar formation within this flashy section of river. The macroinvertebrate community was rated acceptable with EPTs comprising 39 percent of the total sample and dominated by Heptageniids and Corixids.

The Little River Raisin at North County Line Road (Station 8T, Figure 12) was recently dredged with a width of approximately 8 feet. Sediments were dominated by silt and sand with the overall habitat rating marginal. Overhanging vegetation along the stream was moderately available for macroinvertebrate colonization with large woody debris and aquatic macrophytes sparsely available. However, the large woody debris and aquatic macrophytes were covered with a layer of silt reducing the availability to macroinvertebrates. Canopy cover was nonexistent with riparian vegetative buffer zones less than 5-feet wide on each bank. The macroinvertebrate community rated acceptable with the dominant taxa including Chironomids and Coenagrionids with the EPT comprising less than five percent of the entire sample.



Figure 12. Little River Raisin at North County Line Road.



Figure 13. Bear Swamp Creek at Dennison Road.

Bear Swamp Creek at Dennison Road (Station 9T, Figure 13) was recently dredged with very little bank side vegetation, in-stream vegetation, or other macroinvertebrate colonization structures. The only vegetation present was comprised of grasses, which extended on both banks to a width of approximately 50 feet. The sediments were evenly split between heavy deposits of silt and clay. The creek seemed to the investigators to have been recently dredged due to the lack of macrophytes and a noticeable ridge running horizontal throughout the entire reach of the stream, which may be attributed to the reach of the backhoe used to dredge the system. Overall, the habitat of this reach rated poor as did the

macroinvertebrate community. Twenty-two taxa were identified during the survey, of which, only one mayfly family was identified (Caenid) and no caddisflies or stoneflies. Even with one EPT taxa present at this location it comprised 18 percent of the sample and the only taxa that was found more frequent were Physid snails.

(TARGETED) NPS POLLUTION SUMMARY

RIVER RAISIN WATERSHED

Three sites (Stations F, G, and H) were not surveyed using Procedure 51 due to low flow conditions. The Mason Run and Clearwater Drain sediment sampling (Station I) was written up

as a separate report (Noffke, 2014). Five targeted sites were successfully surveyed: Unnamed Tributary to River Raisin at Austin Road (Station A), River Raisin at Austin Road (Station B), River Raisin at Raisinville Road (Station C), the North Branch Macon Creek at Day Road (Station D), and River Raisin at Pierce Road (Station E).

The targeted monitoring of the Unnamed Tributary to River Raisin (Station A) was a public request to evaluate nutrients and the macroinvertebrate community, which were thought to have been impacted by runoff from neighboring farms. Water quality samples were collected during the visit and no WQS were found exceeded (Table 4). Habitat at the Austin Road location rated marginal with moderately available large woody debris and sparsely available overhanging vegetation, undercut banks, and rootwads along the margins of the creek. Sediments were composed of gravel and sand with silt covering all available structure, making it difficult for macroinvertebrates to colonize the habitat in the area. The riparian vegetative zone was nonexistent on both banks due to a plowed agricultural field right up to the small grass buffer aligning the tributary. The macroinvertebrate communities rated acceptable with a total of 21 taxa identified, dominated by Hydropsychids and Chironomids, with EPT taxa representing 33 percent of the total individuals collected.

River Raisin at Austin Road (Station B) and River Raisin at Raisinville Road (Station C) are both fixed trend sites for the MDNR's Status and Trend Monitoring Program and these locations were requested to have a macroinvertebrate survey conducted to accompany their trend data.



Figure 14. River Raisin at Austin Road.

River Raisin at Austin Road (Station B, Figure 14) was located approximately 0.5 miles east of the village of Manchester and downstream of Manchester Lake. Available habitat rated good at this location consisting of overhanging vegetation and large woody debris with spare amounts of undercut banks, rootwads, and aquatic macrophytes. The sediments are composed of gravel and sand. The macroinvertebrate community rated excellent with 30 taxa identified during this survey. This site was dominated by Calopterygids and Amphipods with 17 percent of the sample composed of EPT taxa. One Stonefly was identified at this location.



Figure 15. River Raisin at Raisinville Road.

The overall habitat assessment rated good at the River Raisin at Raisinville Road (Station C, Figure 15). This location is approximately seven miles above Lake Erie and two miles above the city of Monroe. The margins of the river are lined with residential buildings and groomed yards with only a small vegetative buffer strip present along the margins composed of large trees and grasses. The substrate is dominated by bedrock throughout this reach of stream with areas of sand and gravel,

which correspond to areas with thick emergent vegetation growth. However, it is only sparsely provided with large woody debris and overhanging vegetation; all other colonization structures for macroinvertebrate colonization are absent in this reach. The macroinvertebrate community survey rated acceptable, consisting of 31 taxa identified for the entire sample. Tricorythids and Hydropsychids dominated this site with 52 percent of the sample composed of EPT taxa.

The north branch Macon Creek at Day Road (Station D, Figure 16) location was targeted for a

macroinvertebrate community assessment due to being listed in the 2012 Integrated Report (Goodwin et al., 2012) as Not Supporting the Other Indigenous Aquatic Life and Wildlife metric due to historic dredging of the creek. The Holcim Quarry is located directly to the east of the sampling location with a control structure approximately one mile downstream holding water back. The banks of the stream are extremely steep associated with deep flashy water and soft sediments making this site difficult to sample. Habitat rated marginal at this location with sediments dominated by silt and clay with some organic detritus present. Moderate amounts of large woody debris, overhanging vegetation, and undercut banks were present but rootwad availability



Figure 16. North Branch Macon Creek at Day Road.

was sparse for macroinvertebrate colonization. No aquatic vegetation was present throughout this reach. The well-mixed vegetative buffer zone was approximately 20-feet wide on the right bank and 75-feet wide on the left bank. The macroinvertebrate community rated acceptable with only 17 taxa identified during this survey. The site was dominated by Coenagrionids and Chironomids. EPT taxa composed 14 percent of the total sample collected.

River Raisin at Pierce Road (Station E, Figure 17) was the minimally-impacted site requested by the Status and Trend Program. Habitat rated good with moderate amounts of large woody debris available for macroinvertebrate colonization with approximately 25 percent of the reach

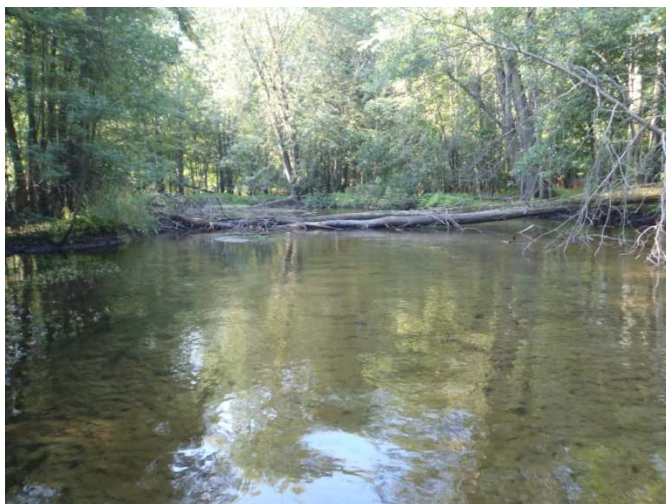


Figure 17. River Raisin at Pierce Road.

composed of detrital material. Undercut banks, overhanging vegetation, and aquatic macrophytes were sparse throughout the reach. Sediments were composed mainly of unstable sand, embedding the available gravel greater than 75 percent. Banks were moderately unstable with patches of bare soil common. The riparian vegetative zone width was excellent on the left bank (>150 feet) but the right bank was reduced to 50 feet due to the river running along Pierce Road. The macroinvertebrate community rated excellent with 32 taxa identified during this survey. The site was dominated by Amphipods and Elmids.

EPT taxa composed 26 percent of the total sample collected with 5 mayfly and caddisfly taxa and 1 stonefly taxon present within this reach of stream.

WATER CHEMISTRY

The results of the water chemistry analysis are presented in Table 4. Water samples were collected only at Station A and analyzed for general nutrients. All samples were found to meet Michigan WQS.

POTENTIAL AREAS OF FURTHER INVESTIGATION

Bear Creek at Mulberry Road (Station 7)

- Future macroinvertebrate surveys should be conducted to monitor the low acceptable rating received during this biosurvey.

Beaver Creek at Carson Highway (Station 3T)

- Follow-up visits will be requested to assure that the raw sewage leaking down the bank is properly dealt with.

Bear Swamp Creek at Dennison Road (Station 9T)

- Future macroinvertebrate and habitat surveys should be conducted to monitor the potential recovery of the poor ratings received during this biosurvey due to recent dredging within the creek.

WATERSHED ATTAINMENT

Based on the probabilistic monitoring aspect of this watershed survey, 100 percent of the randomly selected sites supported the other indigenous aquatic life and wildlife designated use component of R 323.1100(1)(e) of the Michigan WQS using Procedure 51. Percent attainment was calculated by dividing the number of random sites that met WQS by the total number of random locations ($14 / 14 = 1.00$).

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Table 1. Station summary for the River Raisin watershed sampled during August 2013 in Hillsdale, Jackson, Lenawee, Monroe, Washtenaw, and Wayne Counties.

Site ID	Waterbody Name	Location	Latitude	Longitude	AUID	Macroinvertebrate	Habitat	Chem		
Status Sites										
1	Evans Creek	Carson Highway	42.01624	-84.02513	041000020107-01	Acceptable	3	Excellent	155	--
2	Saline River	Austin Road	42.15208	-83.95123	041000020401-01	Acceptable	0	Marginal	84	--
3	Hazen Creek	Hawkins Highway	41.92186	-84.22648	041000020201-01	Acceptable	3	Good	128	--
4	Saline River	McCollum Road	42.12596	-83.91534	041000020401-01	Acceptable	4	Good	110	--
5	Macon Creek	Welch Road	42.03812	-83.82277	041000020404-01	Acceptable	1	Good	134	--
6	North Branch Willow Run	Baldwin Road	41.98765	-83.53188	041000020410-01	Acceptable	-2	Marginal	81	--
7	Bear Creek	Mulberry Road	41.74275	-83.97759	041000020304-01	Acceptable	-4	Good	106	--
8	Saline River	Day Road	41.99790	-83.62423	041000020409-02	Acceptable	1	Marginal	88	--
9	River Raisin	Academy Road	41.90481	-83.98042	041000020307-02	Acceptable	0	Good	110	--
10	River Raisin	USGS Gage off Custer Road	41.96000	-83.52834	041000020410-01	Acceptable	2	Good	151	--
11	River Raisin	off Dixon Road	41.94223	-83.51423	041000020410-01	Acceptable	4	Excellent	158	--
12	South Branch Macon Creek	Pocklington Road	41.96509	-83.84300	041000020405-01	Acceptable	4	Poor	54	--
13	South Branch Macon Creek	M50 (Monroe Road)	41.99580	-83.87693	041000020405-01	Acceptable	1	Good	117	--
14	Evans Creek	Tripp Road	42.05304	-84.09649	041000020410-01	Acceptable	1	Good	137	--

Site ID	Waterbody Name	Location	Latitude	Longitude	AUID	Macroinvertebrate	Habitat	Chem		
Trend Sites										
1T	Evans Creek	Wisner Hwy	42.02400	-84.04500	041000020107-01	Acceptable	1	Good	106	--
2T	Wood Outlet Drain	Downstream Maple Road	42.18800	-83.77900	041000020402-01	Acceptable	1	Good	120	--
3T	Beaver Creek	Carson Hwy	41.92200	-84.03200	041000020206-03	Acceptable	4	Good	135	--
4T	Koch-Warner Drain	Warner Rd	42.17500	-83.71800	041000020403-01	Acceptable	0	Marginal	89	--
5T	Wolf Creek	off Wolf Creek Hwy	41.96100	-84.11400	041000020204-03	Acceptable	2	Marginal	93	--
6T	S B River Raisin	Howell Hwy	41.91800	-84.01000	041000020206-01	Acceptable	4	Good	149	--
7T	River Raisin	M-50	42.00400	-83.93200	041000020108-01	Acceptable	4	Good	146	--
8T	Little River Raisin	N County Line Rd	41.92000	-83.77000	041000020309-01	Acceptable	1	Marginal	57	--
9T	Bear Swamp Creek	Dennison Rd	42.02400	-83.73300	041000020406-01	Poor	-6	Poor	27	--
10T	River Raisin	off Dixon Rd	41.94200	-83.51400	041000020410-01	Acceptable	4	Excellent	158	--

Site ID	Waterbody Name	Location	Latitude	Longitude	AUID	Macroinvertebrate	Habitat	Chem		
Targeted Sites										
A	Unnamed Tributary to River Raisin	Austin Road	42.14889	-83.98861	041000020105-02	Acceptable	4	Marginal	95	WC
B	River Raisin	Austin Road	42.14723	-84.01556	041000020105-02	Excellent	6	Good	152	--
C	River Raisin	Raisinville Road	41.93472	-83.46222	041000020410-01	Acceptable	2	Good	145	--
D	North Branch Macon Creek	Day Road	41.99750	-83.66290	041000020408-02	Acceptable	-2	Marginal	97	--
E	River Raisin	Pierce Road	41.15583	-84.14361	041000020103-02	Excellent	6	Good	110	--
F	Lenawee Drain No. 70	Humphries Highway	41.87278	-83.97806	041000020306-02	Dry, No P51	--	Dry, No P51	--	--
G	Medina Drain	Ingall Highway	41.80306	-84.29278	041000060106-03	Dry, No P51	--	Dry, No P51	--	--
H	East Side Drain	Academy Road	41.90470	-84.00430	041000020206-02	Visual Only	--	Visual Only	--	--
I	Mason Run & Clearwater Drains	Sterling State Park	Report: Noffke, 2014		041000020410-03	No P-51	--	No P-51	--	Sed

Table 2A. Qualitative macroinvertebrate sampling results for the River Raisin watershed. Hillsdale, Jackson, Lenawee, Monroe, Washtenaw, and Wayne Counties. Samples collected in August 2013.

TAXA	Evans Creek Carson Highway 8/13/2013 STATION 1	Saline River Austin Road 8/20/2013 STATION 2	Hazen Creek Hawkins Highway 8/12/2013 STATION 3	Saline River McCollum Road 8/20/2013 STATION 4
PLATYHELMINTHES (flatworms)				
Turbellaria		6		
ANNELIDA (segmented worms)				
Hirudinea (leeches)	1			
Oligochaeta (worms)	6		6	62
ARTHROPODA				
Crustacea				
Amphipoda (scuds)	8	156		4
Decapoda (crayfish)	1		1	3
Isopoda (sowbugs)		38	1	1
Arachnoidea				
Hydracarina	1	4	1	
Insecta				
Ephemeroptera (mayflies)				
Baetidae	6	2	1	122
Caenidae		50	4	1
Heptageniidae	1	1		1
Odonata				
Anisoptera (dragonflies)				
Aeshnidae	1	1	1	
Libellulidae		2	1	
Zygoptera (damselflies)				
Calopterygidae	7	1	36	1
Coenagrionidae		154	3	3
Hemiptera (true bugs)				
Belostomatidae	1	1		
Corixidae		1	1	
Gerridae	1	1	1	
Naucoridae				1
Nepidae		1		
Notonectidae			1	
Pleidae		1		
Veliidae	1			
Megaloptera				
Corydalidae (dobson flies)	3			
Sialidae (alder flies)	1	1	7	1
Trichoptera (caddisflies)				
Helicopsychidae	1			
Hydropsychidae	194		36	9
Hydroptilidae	2			1
Leptoceridae	1	1		
Limnephilidae	1			
Molannidae			4	
Coleoptera (beetles)				
Gyrinidae (adults)			1	
Haliplidae (adults)		1		1
Scirtidae (adults)	1			
Dryopidae			2	
Elmidae	38	55	57	7
Gyrinidae (larvae)		1		
Diptera (flies)				
Ceratopogonidae			1	
Chironomidae	59	189	22	72
Simuliidae	3			12
Tabanidae			2	
Tipulidae	2			
MOLLUSCA				
Gastropoda (snails)				
Ancylidae (limpets)			11	1
Hydrobiidae			1	
Physidae	19		33	
Planorbidae			4	
Pleuroceridae	10			
Viviparidae			1	
Pelecypoda (bivalves)				
Sphaeriidae (clams)	6		62	2
Unionidae (mussels)			2	
TOTAL INDIVIDUALS	376	668	304	305

Table 2B. Macroinvertebrate metric evaluation of the River Raisin watershed. Hillsdale, Jackson, Lenawee, Monroe, Washtenaw, and Wayne Counties. Samples collected in August 2013.

METRIC	Evans Creek Carson Highway 8/13/2013		Saline River Austin Road 8/20/2013		Hazen Creek Hawkins Highway 8/12/2013		Saline River McCollum Road 8/20/2013	
	STATION 1		STATION 2		STATION 3		STATION 4	
	Value	Score	Value	Score	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	27	1	22	1	29	1	19	1
NUMBER OF MAYFLY TAXA	2	0	3	0	2	1	3	1
NUMBER OF CADDISFLY TAXA	5	1	1	-1	2	1	2	0
NUMBER OF STONEFLY TAXA	0	-1	0	-1	0	-1	0	-1
PERCENT MAYFLY COMP.	1.86	0	7.93	0	1.64	0	40.66	1
PERCENT CADDISFLY COMP.	52.93	1	0.15	-1	13.16	0	3.28	0
PERCENT DOMINANT TAXON	51.60	0	28.29	1	20.39	1	40.00	0
PERCENT ISOPOD, SNAIL, LEECH	7.98	0	5.69	0	16.78	-1	0.66	1
PERCENT SURF. AIR BREATHERS	1.06	1	0.90	1	1.32	1	0.66	1
TOTAL SCORE		3		0		3		4
MACROINV. COMMUNITY RATING		ACCEPT.		ACCEPT.		ACCEPT.		ACCEPT.

Table 2A. Qualitative macroinvertebrate sampling results for the River Raisin watershed. Hillsdale, Jackson, Lenawee, Monroe, Washtenaw, and Wayne Counties. Samples collected in August 2013.

TAXA	Macon Creek Welch Road 8/14/2013 STATION 5	N Br Willow Run Baldwin Road 8/15/2013 STATION 6	Bear Creek Mulberry Road 8/12/2013 STATION 7	Saline River Day Road 8/21/2013 STATION 8
ANNELIDA (segmented worms)				
Hirudinea (leeches)	1	1		
Oligochaeta (worms)	3	4	5	8
ARTHROPODA				
Crustacea				
Amphipoda (scuds)		17		25
Decapoda (crayfish)	2		5	2
Isopoda (sowbugs)		96	12	1
Arachnoidea				
Hydracarina	1			
Insecta				
Ephemeroptera (mayflies)				
Baetidae		2		45
Caenidae	2	1	1	1
Ephemeridae			1	
Heptageniidae	11		44	15
Odonata				
Anisoptera (dragonflies)				
Aeshnidae	1	1	2	
Macromiidae				1
Zygoptera (damselflies)				
Calopterygidae	1	1	1	14
Coenagrionidae	1	1		
Hemiptera (true bugs)				
Corixidae	1	4	4	4
Gerridae			7	1
Notonectidae			1	
Veliidae	1			
Megaloptera				
Corydalidae (dobson flies)		2		
Trichoptera (caddisflies)				
Hydropsychidae	200	2		64
Hydroptilidae		2		
Leptoceridae				2
Philopotamidae	1			
Polycentropodidae				22
Coleoptera (beetles)				
Haliplidae (adults)		1	2	
Elmidae	50		5	10
Diptera (flies)				
Chironomidae	30	119	31	39
Simuliidae		1		4
Tabanidae	2			
MOLLUSCA				
Gastropoda (snails)				
Ancylidae (limpets)	3		3	
Bithyniidae		1		
Physidae	2		4	
Planorbidae		1		1
Pleuroceridae		4		
Pelecypoda (bivalves)				
Sphaeriidae (clams)	16	1	5	8
TOTAL INDIVIDUALS	329	262	133	267

Table 2B. Macroinvertebrate metric evaluation of the River Raisin watershed. Hillsdale, Jackson, Lenawee, Monroe, Washtenaw, and Wayne Counties. Samples collected in August 2013.

METRIC	Macon Creek Welch Road 8/14/2013 STATION 5		N Br Willow Run Baldwin Road 8/15/2013 STATION 6		Bear Creek Mulberry Road 8/12/2013 STATION 7		Saline River Day Road 8/21/2013 STATION 8	
	Value	Score	Value	Score	Value	Score	Value	Score
	TOTAL NUMBER OF TAXA	19	0	20	1	17	-1	19
NUMBER OF MAYFLY TAXA	2	1	2	1	3	1	3	0
NUMBER OF CADDISFLY TAXA	2	0	2	0	0	-1	3	0
NUMBER OF STONEFLY TAXA	0	-1	0	-1	0	-1	0	-1
PERCENT MAYFLY COMP.	3.95	-1	1.15	-1	34.59	1	22.85	0
PERCENT CADDISFLY COMP.	61.09	1	1.53	-1	0.00	-1	32.96	1
PERCENT DOMINANT TAXON	60.79	-1	45.42	-1	33.08	-1	23.97	-1
PERCENT ISOPOD, SNAIL, LEECH	1.82	1	39.31	-1	14.29	-1	0.75	1
PERCENT SURF. AIR BREATHERS	0.61	1	1.91	1	10.53	0	1.87	1
TOTAL SCORE		1		-2		-4		1
MACROINV. COMMUNITY RATING		ACCEPT.		ACCEPT.		ACCEPT.		ACCEPT.

Table 2A. Qualitative macroinvertebrate sampling results for the River Raisin watershed. Hillsdale, Jackson, Lenawee, Monroe, Washtenaw, and Wayne Counties. Samples collected in August 2013.

TAXA	River Raisin Academy Road 8/12/2013 STATION 9	River Raisin USGS Gage Custer Rd 8/15/2013 STATION 10	River Raisin Off Dixon Road 8/15/2013 STATION 11	South Branch Macon Creek Pocklington Road 8/14/2013 STATION 12
PORIFERA (sponges)		1		
PLATYHELMINTHES (flatworms)				
Turbellaria			1	
ANNELIDA (segmented worms)				
Oligochaeta (worms)	6	2		42
ARTHROPODA				
Crustacea				
Amphipoda (scuds)	60	20	5	
Decapoda (crayfish)	1	1		5
Isopoda (sowbugs)	15			
Insecta				
Ephemeroptera (mayflies)				
Baetidae	2	62	74	9
Caenidae			2	46
Ephemerellidae	2			
Ephemeridae	1			
Heptageniidae	21	28	29	3
Isonychiidae			1	
Tricorythidae		21	51	
Odonata				
Anisoptera (dragonflies)				
Gomphidae				1
Zygoptera (damselflies)				
Calopterygidae	1	2	1	
Coenagrionidae	1	11	5	9
Hemiptera (true bugs)				
Belostomatidae	1			
Corixidae	1	1		1
Gerridae	1	8	5	
Nepidae		1	1	
Veliidae	1			
Trichoptera (caddisflies)				
Brachycentridae	5			
Helicopsychidae		1	1	
Hydropsychidae	15	24	19	13
Hydroptilidae		2		4
Leptoceridae	2	1		5
Limnephilidae		1		
Philopotamidae	10	1	1	
Polycentropodidae		13	1	
Lepidoptera (moths)				
Pyridae		4	4	
Coleoptera (beetles)				
Dytiscidae (total)		1		
Haliplidae (adults)		5		3
Psephenidae (adults)		1	3	
Dryopidae				1
Elmidae	19	30	30	48
Diptera (flies)				
Chironomidae	11	20	5	59
Dixidae				1
Simuliidae	1		20	
Stratiomyidae		1		
MOLLUSCA				
Gastropoda (snails)				
Ancylidae (limpets)		1	1	3
Bithyniidae		5	10	
Physidae		1		7
Viviparidae		1	4	
Pelecypoda (bivalves)				
Corbiculidae	8			
Sphaeriidae (clams)	7	1	57	29
TOTAL INDIVIDUALS	192	272	331	289

Table 2B. Macroinvertebrate metric evaluation of the River Raisin watershed. Hillsdale, Jackson, Lenawee, Monroe, Washtenaw, and Wayne Counties. Samples collected in August 2013.

METRIC	River Raisin Academy Road 8/12/2013 STATION 9		River Raisin USGS Gage Custer Rd 8/15/2013 STATION 10		River Raisin Off Dixon Road 8/15/2013 STATION 11		S Br Macon Creek Pocklington Road 8/14/2013 STATION 12	
	Value	Score	Value	Score	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	23	0	31	0	24	0	19	1
NUMBER OF MAYFLY TAXA	4	1	3	0	5	1	3	1
NUMBER OF CADDISFLY TAXA	4	1	7	1	4	1	3	1
NUMBER OF STONEFLY TAXA	0	-1	0	-1	0	-1	0	-1
PERCENT MAYFLY COMP.	13.54	-1	40.81	1	47.43	1	20.07	0
PERCENT CADDISFLY COMP.	16.67	0	15.81	0	6.65	0	7.61	0
PERCENT DOMINANT TAXON	31.25	-1	22.79	-1	22.36	0	20.42	0
PERCENT ISOPOD, SNAIL, LEECH	7.81	0	2.94	1	4.53	1	3.46	1
PERCENT SURF. AIR BREATHERS	2.08	1	6.62	1	2.72	1	1.38	1
TOTAL SCORE		0		2		4		4
MACROINV. COMMUNITY RATING		ACCEPT.		ACCEPT.		ACCEPT.		ACCEPT.

Table 2A. Qualitative macroinvertebrate sampling results for the River Raisin watershed. Hillsdale, Jackson, Lenawee, Monroe, Washtenaw, and Wayne Counties. Samples collected in August 2013.

TAXA	S Br Macon Creek M50 8/14/2013 STATION 13
ANNELIDA (segmented worms)	
Oligochaeta (worms)	8
ARTHROPODA	
Arachnoidea	
Hydracarina	3
Insecta	
Ephemeroptera (mayflies)	
Baetidae	1
Caenidae	1
Odonata	
Anisoptera (dragonflies)	
Aeshnidae	8
Zygoptera (damselflies)	
Calopterygidae	25
Coenagrionidae	1
Hemiptera (true bugs)	
Gerridae	5
Veliidae	1
Trichoptera (caddisflies)	
Hydropsychidae	74
Leptoceridae	8
Coleoptera (beetles)	
Haliplidae (adults)	1
Dryopidae	2
Elmidae	70
Diptera (flies)	
Athericidae	11
Ceratopogonidae	1
Chironomidae	50
Culicidae	1
Dixidae	1
Simuliidae	2
Tabanidae	4
Tipulidae	2
MOLLUSCA	
Gastropoda (snails)	
Ancylidae (limpets)	1
Physidae	1
Pelecypoda (bivalves)	
Sphaeriidae (clams)	8
TOTAL INDIVIDUALS	290

Table 2B. Macroinvertebrate metric evaluation of the River Raisin watershed. Hillsdale, Jackson, Lenawee, Monroe, Washtenaw, and Wayne Counties. Samples collected in August 2013.

S Br Macon Creek M50 8/14/2013 STATION 13		
METRIC	Value	Score
TOTAL NUMBER OF TAXA	25	0
NUMBER OF MAYFLY TAXA	2	1
NUMBER OF CADDISFLY TAXA	2	0
NUMBER OF STONEFLY TAXA	0	-1
PERCENT MAYFLY COMP.	0.69	-1
PERCENT CADDISFLY COMP.	28.28	1
PERCENT DOMINANT TAXON	25.52	-1
PERCENT ISOPOD, SNAIL, LEECH	0.69	1
PERCENT SURF. AIR BREATHERS	2.76	1
 TOTAL SCORE		 1
 MACROINV. COMMUNITY RATING		 ACCEPT.

Table 2A. Qualitative macroinvertebrate sampling results for the River Raisin watershed. Hillsdale, Jackson, Lenawee, Monroe, Washtenaw, and Wayne Counties. Samples collected in August 2013.

TAXA	Evans Creek Tripp Road 8/13/2013 STATION 14
PORIFERA (sponges)	1
PLATYHELMINTHES (flatworms)	
Turbellaria	14
ANNELIDA (segmented worms)	
Hirudinea (leeches)	1
ARTHROPODA	
Crustacea	
Amphipoda (scuds)	183
Decapoda (crayfish)	1
Isopoda (sowbugs)	1
Insecta	
Ephemeroptera (mayflies)	
Heptageniidae	2
Odonata	
Anisoptera (dragonflies)	
Aeshnidae	1
Zygoptera (damselflies)	
Calopterygidae	2
Hemiptera (true bugs)	
Gerridae	2
Veliidae	1
Trichoptera (caddisflies)	
Hydropsychidae	28
Phryganeidae	1
Coleoptera (beetles)	
Elmidae	10
Diptera (flies)	
Chironomidae	5
MOLLUSCA	
Gastropoda (snails)	
Bithyniidae	1
Physidae	23
Pelecypoda (bivalves)	
Sphaeriidae (clams)	5
TOTAL INDIVIDUALS	282

Table 2B. Macroinvertebrate metric evaluation of the River Raisin watershed. Hillsdale, Jackson, Lenawee, Monroe, Washtenaw, and Wayne Counties. Samples collected in August 2013.

Evans Creek Tripp Road 8/13/2013 STATION 14		
METRIC	Value	Score
TOTAL NUMBER OF TAXA	18	1
NUMBER OF MAYFLY TAXA	1	1
NUMBER OF CADDISFLY TAXA	2	1
NUMBER OF STONEFLY TAXA	0	-1
PERCENT MAYFLY COMP.	0.71	-1
PERCENT CADDISFLY COMP.	10.28	0
PERCENT DOMINANT TAXON	64.89	-1
PERCENT ISOPOD, SNAIL, LEECH	9.22	0
PERCENT SURF. AIR BREATHERS	1.06	1
 TOTAL SCORE		 1
 MACROINV. COMMUNITY RATING		 ACCEPT.

Table 2A. Qualitative macroinvertebrate sampling results for the River Raisin watershed. Hillsdale, Jackson, Lenawee, Monroe, Washtenaw, and Wayne Counties. Samples collected in August 2013.

TAXA	Evans Creek Wisner Road 8/13/2013 STATION 1T	Wood Outlet Drain d-s Maple Road 8/20/2013 STATION 2T	Beaver Creek Carson Highway 8/12/2013 STATION 3T	Koch Warner Drain Warner Road 8/20/2013 STATION 4T
PLATYHELMINTHES (flatworms)				
Turbellaria			2	
ANNELIDA (segmented worms)				
Hirudinea (leeches)		1		4
Oligochaeta (worms)	61	8	4	35
ARTHROPODA				
Crustacea				
Amphipoda (scuds)	2		8	
Decapoda (crayfish)	1	9	3	
Arachnoidea				
Hydracarina	7	1	2	3
Insecta				
Ephemeroptera (mayflies)				
Baetidae	15	2	14	
Caenidae			3	
Heptageniidae	1		1	
Odonata				
Anisoptera (dragonflies)				
Aeshnidae	1			1
Libellulidae			1	3
Zygoptera (damselflies)				
Calopterygidae	2	10	5	31
Hemiptera (true bugs)				
Belostomatidae			1	
Corixidae		1	1	1
Gerridae	2	1	1	
Notonectidae		1		
Pleidae			1	
Veliidae	2			
Megaloptera				
Corydalidae (dobson flies)	1			
Trichoptera (caddisflies)				
Hydropsychidae	43	81	65	4
Hydroptilidae			3	4
Lepidostomatidae				1
Leptoceridae				2
Coleoptera (beetles)				
Dytiscidae (total)				3
Haliplidae (adults)			1	1
Elmidae	38	13	10	5
Gyrinidae (larvae)				1
Haliplidae (larvae)				1
Diptera (flies)				
Ceratopogonidae				1
Chironomidae	128	122	107	116
Culicidae	1			
Dixidae	1			
Ptychopteridae				1
Simuliidae	2	7	18	15
Stratiomyidae	2			
Tabanidae	1		1	2
Tipulidae			10	
MOLLUSCA				
Gastropoda (snails)				
Ancylidae (limpets)	2	1		6
Bithyniidae	1			
Physidae		1	11	7
Planorbidae		4		1
Viviparidae	2			
Pelecypoda (bivalves)				
Pisidiidae				6
Sphaeriidae (clams)	1	13	4	13

TOTAL INDIVIDUALS 317 276 277 268

Table 2B. Macroinvertebrate metric evaluation of the River Raisin watershed. Hillsdale, Jackson, Lenawee, Monroe, Washtenaw, and Wayne Counties. Samples collected in August 2013.

METRIC	Evans Creek Wisner Road 8/13/2013		Wood Outlet Drain d-s Maple Road 8/20/2013		Beaver Creek Carson Highway 8/12/2013		Koch Warner Drain Warner Road 8/20/2013	
	STATION 1T		STATION 2T		STATION 3T		STATION 4T	
	Value	Score	Value	Score	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	23	1	17	0	24	1	25	1
NUMBER OF MAYFLY TAXA	2	0	1	0	3	1	0	-1
NUMBER OF CADDISFLY TAXA	1	-1	1	0	2	0	4	1
NUMBER OF STONEFLY TAXA	0	-1	0	-1	0	-1	0	-1
PERCENT MAYFLY COMP.	5.05	0	0.72	-1	6.50	0	0.00	-1
PERCENT CADDISFLY COMP.	13.56	0	29.35	1	24.55	1	4.10	0
PERCENT DOMINANT TAXON	40.38	0	44.20	0	38.63	1	43.28	0
PERCENT ISOPOD, SNAIL, LEECH	1.58	1	2.54	1	3.97	0	6.72	0
PERCENT SURF. AIR BREATHERS	2.21	1	1.09	1	1.81	1	2.24	1
TOTAL SCORE		1		1		4		0
MACROINV. COMMUNITY RATING		ACCEPT.		ACCEPT.		ACCEPT.		ACCEPT.

Table 2A. Qualitative macroinvertebrate sampling results for the River Raisin watershed. Hillsdale, Jackson, Lenawee, Monroe, Washtenaw, and Wayne Counties. Samples collected in August 2013.

TAXA	Wolf Creek Off Wolf Creek Highway 8/13/2013 STATION 5T	South Branch Raisin River Howell Highway 8/13/2013 STATION 6T	River Raisin M-50 8/14/2013 STATION 7T
PLATYHELMINTHES (flatworms)			
Turbellaria		6	
ANNELIDA (segmented worms)			
Hirudinea (leeches)		1	
Oligochaeta (worms)	9	5	1
ARTHROPODA			
Crustacea			
Amphipoda (scuds)	97	48	22
Decapoda (crayfish)	2	1	3
Isopoda (sowbugs)	2	16	1
Arachnoidea			
Hydracarina	1		
Insecta			
Ephemeroptera (mayflies)			
Baetidae	18	5	12
Caenidae			4
Heptageniidae	16	2	65
Isonychiidae			1
Tricorythidae		2	
Odonata			
Anisoptera (dragonflies)			
Aeshnidae		1	2
Zygoptera (damselflies)			
Calopterygidae	1	1	4
Coenagrionidae	1	2	
Hemiptera (true bugs)			
Belostomatidae		1	
Corixidae	53	1	62
Gerridae	5	1	5
Notonectidae	1	1	
Pleidae		2	1
Veliidae	8	2	1
Megaloptera			
Sialidae (alder flies)	4		
Trichoptera (caddisflies)			
Brachycentridae			1
Hydropsychidae	20	81	14
Hydroptilidae		3	
Leptoceridae		2	
Limnephilidae	3		1
Philopotamidae		4	
Polycentropodidae		12	4
Coleoptera (beetles)			
Haliplidae (adults)			1
Hydrophilidae (total)		1	1
Elmidae	11	24	41
Diptera (flies)			
Ceratopogonidae	1	1	1
Chironomidae	32	81	7
Culicidae	1	2	1
Simuliidae		6	
Tabanidae	3		
Tipulidae		1	2
MOLLUSCA			
Gastropoda (snails)			
Ancylidae (limpets)	1	5	
Physidae	4		5
Pelecypoda (bivalves)			
Corbiculidae		22	1
Sphaeriidae (clams)		2	
TOTAL INDIVIDUALS	294	345	264

Table 2B. Qualitative macroinvertebrate sampling results for the River Raisin watershed. Hillsdale, Jackson, Lenawee, Monroe, Washtenaw, and Wayne Counties. Samples collected in August 2013.

METRIC	Wolf Creek Off Wolf Creek Highway 8/13/2013		S Br Raisin River Howell Highway 8/13/2013		River Raisin M-50 8/14/2013	
	STATION 5T		STATION 6T		STATION 7T	
	Value	Score	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	23	1	33	1	27	1
NUMBER OF MAYFLY TAXA	2	0	3	0	4	1
NUMBER OF CADDISFLY TAXA	2	0	5	1	4	1
NUMBER OF STONEFLY TAXA	0	-1	0	-1	0	-1
PERCENT MAYFLY COMP.	11.56	0	2.61	0	31.06	1
PERCENT CADDISFLY COMP.	7.82	0	29.57	1	7.58	0
PERCENT DOMINANT TAXON	32.99	1	23.48	1	24.62	1
PERCENT ISOPOD, SNAIL, LEECH	2.38	1	6.38	0	2.27	1
PERCENT SURF. AIR BREATHERS	23.13	0	3.19	1	27.27	-1
TOTAL SCORE		2		4		4
MACROINV. COMMUNITY RATING		ACCEPT.		ACCEPT.		ACCEPT.

Table 2A. Qualitative macroinvertebrate sampling results for the River Raisin watershed. Hillsdale, Jackson, Lenawee, Monroe, Washtenaw, and Wayne Counties. Samples collected in August 2013.

TAXA	Little River Raisin N County Line Highway 8/14/2013 STATION 8T	Bear Swamp Creek Dennison Road 8/15/2013 STATION 9T	River Raisin Off Dixon Road 8/15/2013 STATION 10T
PLATYHELMINTHES (flatworms)			
Turbellaria	1		1
NEMATOMORPHA (roundworms)			
		2	
ANNELIDA (segmented worms)			
Hirudinea (leeches)	1		
Oligochaeta (worms)	14	2	
ARTHROPODA			
Crustacea			
Amphipoda (scuds)	17		5
Decapoda (crayfish)	1	4	
Arachnoidea			
Hydracarina	1		
Insecta			
Ephemeroptera (mayflies)			
Baetidae	1		74
Caenidae	1	56	2
Heptageniidae			29
Isonychiidae			1
Tricorythidae			51
Odonata			
Anisoptera (dragonflies)			
Aeshnidae	1	1	
Libellulidae		1	
Zygoptera (damselflies)			
Calopterygidae	5		1
Coenagrionidae	57	8	5
Hemiptera (true bugs)			
Belostomatidae	1	1	
Corixidae	2	35	
Gerridae	1	1	5
Nepidae			1
Pleidae	1	3	
Trichoptera (caddisflies)			
Helicopsychidae			1
Hydropsychidae	2		19
Hydroptilidae	8		
Leptoceridae	1		
Philopotamidae			1
Polycentropodidae			1
Lepidoptera (moths)			
Pyralidae			4
Coleoptera (beetles)			
Haliplidae (adults)	1	40	
Hydrophilidae (total)	1	1	
Psephenidae (adults)			3
Elmidae		3	30
Diptera (flies)			
Ceratopogonidae	2	1	
Chironomidae	118	23	5
Culicidae	1	1	
Dixidae	1		
Simuliidae			20
Tabanidae	1		
Tipulidae		1	
MOLLUSCA			
Gastropoda (snails)			
Ancylidae (limpets)		1	1
Bithyniidae		2	10
Physidae	8	128	
Planorbidae	2	2	
Pleuroceridae	5		
Viviparidae	1		4
Pelecypoda (bivalves)			
Corbiculidae	1		
Sphaeriidae (clams)	4		57
TOTAL INDIVIDUALS	262	317	331

Table 2B. Macroinvertebrate metric evaluation of the River Raisin watershed. Hillsdale, Jackson, Lenawee, Monroe, Washtenaw, and Wayne Counties. Samples collected in August 2013.

METRIC	Little River Raisin N County Line Highway 8/14/2013 STATION 8T		Bear Swamp Creek Dennison Road 8/15/2013 STATION 9T		River Raisin Off Dixon Road 8/15/2013 STATION 10T	
	Value	Score	Value	Score	Value	Score
	TOTAL NUMBER OF TAXA	31	1	22	0	24
NUMBER OF MAYFLY TAXA	2	1	1	0	5	1
NUMBER OF CADDISFLY TAXA	3	1	0	-1	4	1
NUMBER OF STONEFLY TAXA	0	-1	0	-1	0	-1
PERCENT MAYFLY COMP.	0.76	-1	17.67	0	47.43	1
PERCENT CADDISFLY COMP.	4.20	0	0.00	-1	6.65	0
PERCENT DOMINANT TAXON	45.04	-1	40.38	-1	22.36	0
PERCENT ISOPOD, SNAIL, LEECH	6.49	0	41.96	-1	4.53	1
PERCENT SURF. AIR BREATHERS	3.05	1	25.87	-1	2.72	1
TOTAL SCORE		1		-6		4
MACROINV. COMMUNITY RATING		ACCEPT.		POOR		ACCEPT.
						ACCEPT.

Table 2A. Qualitative macroinvertebrate sampling results for the River Raisin watershed. Hillsdale, Jackson, Lenawee, Monroe, Washtenaw, and Wayne Counties. Samples collected in August 2013.

TAXA	Unnamed Trib to River Raisin Austin Road 8/19/2013 STATION A	River Raisin Austin Road 8/19/2013 STATION B
NEMATOMORPHA (roundworms)	1	
ANNELIDA (segmented worms)		
Oligochaeta (worms)	12	2
ARTHROPODA		
Crustacea		
Amphipoda (scuds)		61
Decapoda (crayfish)	11	
Arachnoidea		
Hydracarina	1	
Insecta		
Ephemeroptera (mayflies)		
Baetidae		8
Caenidae		3
Heptageniidae	12	13
Isonychiidae		2
Tricorythidae		3
Odonata		
Anisoptera (dragonflies)		
Aeshnidae		2
Gomphidae		1
Macromiidae		1
Zygoptera (damselflies)		
Calopterygidae	23	66
Coenagrionidae	1	8
Plecoptera (stoneflies)		
Perlidae		1
Hemiptera (true bugs)		
Gerridae	2	1
Naucoridae		1
Pleidae		1
Veliidae	11	4
Trichoptera (caddisflies)		
Hydropsychidae	56	13
Leptoceridae	2	1
Limnephilidae	1	2
Polycentropodidae		1
Coleoptera (beetles)		
Haliplidae (adults)	1	
Elmidae	11	16
Psephenidae (larvae)		3
Ptilodactylidae (larvae)	1	
Diptera (flies)		
Athericidae	22	
Chironomidae	32	8
Simuliidae		1
Tipulidae	3	2
MOLLUSCA		
Gastropoda (snails)		
Ancylidae (limpets)	7	29
Physidae	1	
Planorbidae		2
Pelecypoda (bivalves)		
Corbiculidae		8
Sphaeriidae (clams)	5	9
TOTAL INDIVIDUALS	216	273

Table 2B. Macroinvertebrate metric evaluation of the River Raisin watershed. Hillsdale, Jackson, Lenawee, Monroe, Washtenaw, and Wayne Counties. Samples collected in August 2013.

METRIC	Unnamed Trib to River Raisin		River Raisin	
	Austin Road		Austin Road	
	8/19/2013		8/19/2013	
	STATION A		STATION B	
	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	21	1	30	1
NUMBER OF MAYFLY TAXA	1	0	5	1
NUMBER OF CADDISFLY TAXA	3	1	4	1
NUMBER OF STONEFLY TAXA	0	-1	1	1
PERCENT MAYFLY COMP.	5.56	0	10.62	0
PERCENT CADDISFLY COMP.	27.31	1	6.23	0
PERCENT DOMINANT TAXON	25.93	1	24.18	1
PERCENT ISOPOD, SNAIL, LEECH	3.70	0	11.36	0
PERCENT SURF. AIR BREATHERS	6.48	1	2.56	1
TOTAL SCORE		4		6
MACROINV. COMMUNITY RATING		ACCEPT.		EXCELLENT

Table 2A. Qualitative macroinvertebrate sampling results for the River Raisin watershed. Hillsdale, Jackson, Lenawee, Monroe, Washtenaw, and Wayne Counties. Samples collected in August 2013.

TAXA	River Raisin	N Br Macon Creek
	Raisinville Road 8/15/2013 STATION C	Day Road 8/21/2013 STATION D
PLATYHELMINTHES (flatworms)		
Turbellaria	12	2
ANNELIDA (segmented worms)		
Hirudinea (leeches)	2	
Oligochaeta (worms)	9	9
ARTHROPODA		
Crustacea		
Amphipoda (scuds)	16	
Decapoda (crayfish)	1	2
Isopoda (sowbugs)	12	1
Arachnoidea		
Hydracarina	1	5
Insecta		
Ephemeroptera (mayflies)		
Baetidae	37	
Caenidae	7	2
Ephemeridae		1
Heptageniidae	17	
Isonychiidae	1	
Tricorythidae	79	
Odonata		
Anisoptera (dragonflies)		
Aeshnidae		1
Zygoptera (damselflies)		
Coenagrionidae	4	92
Lestidae	16	
Hemiptera (true bugs)		
Corixidae	1	
Gerridae	4	
Nepidae	1	
Pleidae		2
Trichoptera (caddisflies)		
Helicopsychidae	4	
Hydropsychidae	40	1
Hydroptilidae		19
Polycentropodidae	6	
Lepidoptera (moths)		
Pyalidae	6	
Coleoptera (beetles)		
Haliplidae (adults)	1	3
Psephenidae (adults)	1	
Elmidae	10	11
Diptera (flies)		
Chironomidae	40	11
Culicidae		1
Simuliidae	14	
MOLLUSCA		
Gastropoda (snails)		
Ancylidae (limpets)	1	
Bithyniidae	17	
Physidae	1	6
Viviparidae	1	
Pelecypoda (bivalves)		
Sphaeriidae (clams)	5	
TOTAL INDIVIDUALS	367	169

Table 2B. Macroinvertebrate metric evaluation of the River Raisin watershed. Hillsdale, Jackson, Lenawee, Monroe, Washtenaw, and Wayne Counties. Samples collected in August 2013.

METRIC	River Raisin		N Br Macon Creek	
	Raisinville Road		Day Road	
	8/15/2013		8/21/2013	
	STATION C		STATION D	
	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	31	0	17	-1
NUMBER OF MAYFLY TAXA	5	1	2	0
NUMBER OF CADDISFLY TAXA	3	0	2	0
NUMBER OF STONEFLY TAXA	0	-1	0	-1
PERCENT MAYFLY COMP.	38.42	1	1.78	-1
PERCENT CADDISFLY COMP.	13.62	0	11.83	0
PERCENT DOMINANT TAXON	21.53	0	54.44	-1
PERCENT ISOPOD, SNAIL, LEECH	9.26	0	4.14	1
PERCENT SURF. AIR BREATHERS	2.18	1	3.55	1
TOTAL SCORE		2		-2
MACROINV. COMMUNITY RATING		ACCEPT.		ACCEPT.

Table 2A. Qualitative macroinvertebrate sampling results for the River Raisin watershed. Hillsdale, Jackson, Lenawee, Monroe, Washtenaw, and Wayne Counties. Samples collected in August 2013.

TAXA	River Raisin Pierce Rd 8/19/2013 STATION E
ANNELIDA (segmented worms)	
Hirudinea (leeches)	1
Oligochaeta (worms)	7
ARTHROPODA	
Crustacea	
Amphipoda (scuds)	79
Decapoda (crayfish)	2
Insecta	
Ephemeroptera (mayflies)	
Baetidae	10
Caenidae	2
Ephemeridae	3
Heptageniidae	17
Tricorythidae	5
Odonata	
Anisoptera (dragonflies)	
Aeshnidae	3
Gomphidae	4
Zygoptera (damselflies)	
Calopterygidae	8
Coenagrionidae	1
Plecoptera (stoneflies)	
Perlidae	1
Hemiptera (true bugs)	
Corixidae	1
Pleidae	1
Veliidae	4
Trichoptera (caddisflies)	
Brachycentridae	3
Hydropsychidae	15
Leptoceridae	2
Limnephilidae	4
Polycentropodidae	3
Coleoptera (beetles)	
Dytiscidae (total)	2
Gyrinidae (adults)	1
Hydrophilidae (total)	1
Elmidae	27
Gyrinidae (larvae)	2
Diptera (flies)	
Ceratopogonidae	1
Chironomidae	18
Simuliidae	10
Tabanidae	1
MOLLUSCA	
Gastropoda (snails)	
Ancylidae (limpets)	7
Pelecypoda (bivalves)	
Sphaeriidae (clams)	6
TOTAL INDIVIDUALS	252

Table 2B. Macroinvertebrate metric evaluation of the River Raisin watershed. Hillsdale, Jackson, Lenawee, Monroe, Washtenaw, and Wayne Counties. Samples collected in August 2013.

METRIC	River Raisin Pierce Rd 8/19/2013 STATION E	
	Value	Score
TOTAL NUMBER OF TAXA	32	1
NUMBER OF MAYFLY TAXA	5	1
NUMBER OF CADDISFLY TAXA	5	1
NUMBER OF STONEFLY TAXA	1	1
PERCENT MAYFLY COMP.	14.68	0
PERCENT CADDISFLY COMP.	10.71	0
PERCENT DOMINANT TAXON	31.35	0
PERCENT ISOPOD, SNAIL, LEECH	3.17	1
PERCENT SURF. AIR BREATHERS	3.97	1
TOTAL SCORE		6
MACROINV. COMMUNITY RATING		EXCELLENT

Table 3. Habitat evaluation for the River Raisin watershed. Hillsdale, Jackson, Lenawee, Monroe, Washtenaw, and Wayne Counties. Samples collected in August 2013.

	Evans Creek Carson Highway RIFFLERUN Site 1	Saline River Austin Road GLIDE/POOL Site 2	Hazen Creek Hawkins Highway RIFFLERUN Site 3	Saline River McCollum Road RIFFLERUN Site 4
HABITAT METRIC				
Substrate and Instream Cover				
Epifaunal Substrate/ Avail Cover (20)	17	7	11	13
Embeddedness (20)*	16		9	5
Velocity/Depth Regime (20)*	14		8	13
Pool Substrate Characterization (20)**		13		
Pool Variability (20)**		1		
Channel Morphology				
Sediment Deposition (20)	18	2	16	6
Flow Status - Maint. Flow Volume (10)	9	9	9	9
Flow Status - Flashiness (10)	7	4	4	3
Channel Alteration (20)	15	9	13	7
Frequency of Riffles/Bends (20)*	18		10	16
Channel Sinuosity (20)**		5		
Riparian and Bank Structure				
Bank Stability (L) (10)	8	8	7	9
Bank Stability (R) (10)	9	8	7	9
Vegetative Protection (L) (10)	9	8	9	6
Vegetative Protection (R) (10)	9	5	9	6
Riparian Veg. Zone Width (L) (10)	3	4	7	4
Riparian Veg. Zone Width (R) (10)	3	1	9	4
TOTAL SCORE (200):	155	84	128	110

HABITAT RATING:	EXCELLENT (NON- IMPAIRED)	MARGINAL (MODERATELY IMPAIRED)	GOOD (SLIGHTLY IMPAIRED)	GOOD (SLIGHTLY IMPAIRED)
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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:	8/13/2013	8/20/2013	8/12/2013	8/20/2013
Weather:	Partly Cloudy	Sunny	Cloudy	Sunny
Air Temperature:	70 Deg. F.	70 Deg. F.	70 Deg. F.	85 Deg. F.
Water Temperature:	66 Deg. F.	70 Deg. F.	66 Deg. F.	64 Deg. F.
Ave. Stream Width:	12 Feet	12 Feet	6 Feet	7 Feet
Ave. Stream Depth:	0.5 Feet	1.3 Feet	0.7 Feet	1 Feet
Surface Velocity:	0.7 Ft./Sec.	0.3 Ft./Sec.	1 Ft./Sec.	1 Ft./Sec.
Estimated Flow:	4.2 CFS	4.68 CFS	4.2 CFS	7 CFS
Stream Modifications:	Dredged	Dredged	Dredged	Dredged
Nuisance Plants (Y/N):	N	N	N	N
Report Number:				
STORET No.:	460430	810467	460432	810491
Stream Name:	Evans Creek	Saline River	Hazen Creek	Saline River
Road Crossing/Location:	Carson Highway	Austin Road	Hawkins Highway	McCollum Road
County Code:	46	81	46	81
TRS:	05S03E23	04S05E04	06S02E30	04S04E14
Latitude (dd):	42.01624	42.1608	41.92186	42.12596
Longitude (dd):	-84.02513	-83.8444	-84.22648	-83.91534
Ecoregion:	ECBP	ECBP	ECBP	ECBP
Stream Type:	Warmwater	Warmwater	Warmwater	Warmwater
USGS Basin Code:	4100002	4100002	4100002	4100002

* Applies only to Riffle/Run stream Surveys

** Applies only to Glide/Pool stream Surveys

COMMENTS:

Table 3. Habitat evaluation for the River Raisin watershed. Hillsdale, Jackson, Lenawee, Monroe, Washtenaw, and Wayne Counties. Samples collected in August 2013.

	Macon Creek Welch Road GLIDE/POOL Site 5	North Branch Willow Run Baldwin Road RIFFLE/RUN Site 6	Bear Creek Mulberry Road GLIDE/POOL Site 7	Saline River Day Road GLIDE/POOL Site 8	River Raisin Academy Road RIFFLE/RUN Site 9
HABITAT METRIC					
Substrate and Instream Cover					
Epifaunal Substrate/ Avail Cover (20)	15	7	5	8	2
Embeddedness (20)*		0			2
Velocity/Depth Regime (20)*		1			8
Pool Substrate Characterization (20)**	15		8	6	
Pool Variability (20)**	8		11	3	
Channel Morphology					
Sediment Deposition (20)	19	2	10	2	18
Flow Status - Maint. Flow Volume (10)	9	9	9	9	9
Flow Status - Flashiness (10)	4	9	2	3	2
Channel Alteration (20)	15	15	16	18	18
Frequency of Riffles/Bends (20)*		2			3
Channel Sinuosity (20)**	8		7	11	
Riparian and Bank Structure					
Bank Stability (L) (10)	7	9	4	3	9
Bank Stability (R) (10)	9	9	4	3	9
Vegetative Protection (L) (10)	7	7	7	7	6
Vegetative Protection (R) (10)	9	9	7	7	6
Riparian Veg. Zone Width (L) (10)	3	1	9	4	9
Riparian Veg. Zone Width (R) (10)	6	1	7	4	9
TOTAL SCORE (200):	134	81	106	88	110

HABITAT RATING:	GOOD (SLIGHTLY IMPAIRED)	MARGINAL (MODERATELY IMPAIRED)	GOOD (SLIGHTLY IMPAIRED)	MARGINAL (MODERATELY IMPAIRED)	GOOD (SLIGHTLY IMPAIRED)
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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)

	8/14/2013	8/15/2013	8/12/2013	8/21/2013	8/12/2013
Date:	8/14/2013	8/15/2013	8/12/2013	8/21/2013	8/12/2013
Weather:	Sunny	Sunny	Rainy	Sunny	Sunny
Air Temperature:	70 Deg. F.	75 Deg. F.	70 Deg. F.	70 Deg. F.	76 Deg. F.
Water Temperature:	64 Deg. F.	67 Deg. F.	68 Deg. F.	70 Deg. F.	Deg. F.
Ave. Stream Width:	10 Feet	7 Feet	17 Feet	30 Feet	65 Feet
Ave. Stream Depth:	1 Feet	1.5 Feet	1.5 Feet	2 Feet	1.5 Feet
Surface Velocity:	0.75 Ft./Sec.	0.1 Ft./Sec.	0.1 Ft./Sec.	0.75 Ft./Sec.	0.5 Ft./Sec.
Estimated Flow:	7.5 CFS	1.05 CFS	2.55 CFS	45 CFS	48.75 CFS
Stream Modifications:	None	Dredged	None	None	None
Nuisance Plants (Y/N):	N	N	N	N	N
Report Number:					
STORET No.:	460352	580592	460431	580593	460310
Stream Name:	Macon Creek	North Branch Willow Run	Bear Creek	Saline River	River Raisin
Road Crossing/Location:	Welch Road	Baldwin Road	Mulberry Road	Day Road	Academy Road
County Code:	46	58	46	58	46
TRS:	05S05E15	06S08Exx	08S04E31	05S07E32	06S04E32
Latitude (dd):	42.038115	41.98765	41.74275	41.9979	41.904727
Longitude (dd):	-83.822772	-83.53188	-83.97759	-83.62423	-83.980004
Ecoregion:	HELP	HELP	HELP	HELP	HELP
Stream Type:	Warmwater	Warmwater	Warmwater	Warmwater	Warmwater
USGS Basin Code:	4100002	4100002	4100002	4100002	4100002

* Applies only to Riffle/Run stream Survey;

** Applies only to Glide/Pool stream Survey;

COMMENTS:

Table 3. Habitat evaluation for the River Raisin watershed. Hillsdale, Jackson, Lenawee, Monroe, Washtenaw, and Wayne Counties. Samples collected in August 2013.

HABITAT METRIC	River Raisin USGS Gage off Custer Road RIFLE/RUN Site 10	River Raisin Off Dixon Road RIFLE/RUN Site 11	S Br Macon Creek Pocklington Road GLIDE/POOL Site 12	S Br Macon Creek M50 RIFLE/RUN Site 13
Substrate and Instream Cover				
Epifaunal Substrate/ Avail Cover (20)	17	17	6	14
Embeddedness (20)*	18	19		5
Velocity/Depth Regime (20)*	8	8		8
Pool Substrate Characterization (20)**			10	
Pool Variability (20)**			1	
Channel Morphology				
Sediment Deposition (20)	16	15	2	7
Flow Status - Maint. Flow Volume (10)	9	9	9	9
Flow Status - Flashiness (10)	3	4	1	2
Channel Alteration (20)	18	19	2	16
Frequency of Riffles/Bends (20)*	18	19		11
Channel Sinuosity (20)**			3	
Riparian and Bank Structure				
Bank Stability (L) (10)	9	9	6	5
Bank Stability (R) (10)	9	9	6	4
Vegetative Protection (L) (10)	9	9	4	9
Vegetative Protection (R) (10)	9	9	4	9
Riparian Veg. Zone Width (L) (10)	4	8	0	9
Riparian Veg. Zone Width (R) (10)	4	4	0	9
TOTAL SCORE (200):	151	158	54	117
HABITAT RATING:	GOOD (SLIGHTLY IMPAIRED)	EXCELLENT (NON- IMPAIRED)	POOR (SEVERELY 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:	8/15/2013	8/15/2013	8/14/2013	8/14/2013
Weather:	Sunny	Sunny	Sunny	Sunny
Air Temperature:	70 Deg. F.	70 Deg. F.	65 Deg. F.	70 Deg. F.
Water Temperature:	69 Deg. F.	68 Deg. F.	64 Deg. F.	64 Deg. F.
Ave. Stream Width:	210 Feet	210 Feet	6 Feet	12 Feet
Ave. Stream Depth:	2 Feet	1.5 Feet	1 Feet	1 Feet
Surface Velocity:	1 Ft./Sec.	1.5 Ft./Sec.	1 Ft./Sec.	1 Ft./Sec.
Estimated Flow:	420 CFS	472.5 CFS	6 CFS	12 CFS
Stream Modifications:	None	None	Dredged	None
Nuisance Plants (Y/N):	N	N	N	N
Report Number:				
STORET No.:	580204	580572	460434	460435
Stream Name:	River Raisin	River Raisin	South Branch Macon Creek	South Branch Macon Creek
Road Crossing/Location:	USGS Gage off Custer Road	Off Dixon Road	Pocklington Road	M50
County Code:	58	58	46	46
TRS:	06S08Exx	06S08E19	06S05E09	05S05E31
Latitude (dd):	41.96	41.9422263	41.96509	41.9958
Longitude (dd):	-83.52834	-83.5142336	-83.843	-83.87693
Ecoregion:	HELP	HELP	HELP	HELP
Stream Type:	Warmwater	Warmwater	Warmwater	Warmwater
USGS Basin Code:	4100002	4100002	4100002	4100002

* Applies only to Riffle/Run stream Surveys

** Applies only to Glide/Pool stream Surveys

COMMENTS:

Table 3. Habitat evaluation for the River Raisin watershed. Hillsdale, Jackson, Lenawee, Monroe, Washtenaw, and Wayne Counties. Samples collected in August 2013.

Evans Creek Tripp Road RIFFLE/RUN Site 14	
HABITAT METRIC	
Substrate and Instream Cover	
Epifaunal Substrate/ Avail Cover (20)	13
Embeddedness (20)*	18
Velocity/Depth Regime (20)*	8
Pool Substrate Characterization (20)**	
Pool Variability (20)**	
Channel Morphology	
Sediment Deposition (20)	12
Flow Status - Maint. Flow Volume (10)	9
Flow Status - Flashiness (10)	7
Channel Alteration (20)	19
Frequency of Riffles/Bends (20)*	15
Channel Sinuosity (20)**	
Riparian and Bank Structure	
Bank Stability (L) (10)	8
Bank Stability (R) (10)	9
Vegetative Protection (L) (10)	9
Vegetative Protection (R) (10)	2
Riparian Veg. Zone Width (L) (10)	7
Riparian Veg. Zone Width (R) (10)	1
<hr/>	
TOTAL SCORE (200):	137

HABITAT RATING: 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: 8/13/2013
Weather: Partly Cloudy
Air Temperature: 70 Deg. F.
Water Temperature: 66 Deg. F.
Ave. Stream Width: 3 Feet
Ave. Stream Depth: 0.25 Feet
Surface Velocity: 1 Ft./Sec.
Estimated Flow: 0.75 CFS
Stream Modifications: None
Nuisance Plants (Y/N): N
Report Number:

STORET No.: 460433
Stream Name: Evans Creek
Road Crossing/Location: Tripp Road
County Code: 46
TRS: 05S03E08

Latitude (dd): 42.05304
Longitude (dd): -84.09649
Ecoregion: SMNITP
Stream Type:

USGS Basin Code: 4100002

* Applies only to Riffle/Run stream Surveys
** Applies only to Glide/Pool stream Surveys

COMMENTS:

Table 3. Habitat evaluation for the River Raisin watershed. Hillsdale, Jackson, Lenawee, Monroe, Washtenaw, and Wayne Counties. Samples collected in August 2013.

	Evans Creek Wisner Road RIFFLE/RUN Site 1T	Wood Outlet Drain Downstream Maple Road RIFFLE/RUN Site 2T	Beaver Creek Carson Highway RIFFLE/RUN Site 3T	Koch Warner Drain Warner Road GLIDE/POOL Site 4T	Wolf Creek Off Wolf Creek Highway RIFFLE/RUN Site 5T
HABITAT METRIC					
Substrate and Instream Cover					
Epifaunal Substrate/ Avail Cover (20)	8	12	13	6	4
Embeddedness (20)*	8	8	10		2
Velocity/Depth Regime (20)*	9	8	15		7
Pool Substrate Characterization (20)**				11	
Pool Variability (20)**				3	
Channel Morphology					
Sediment Deposition (20)	14	8	18	2	3
Flow Status - Maint. Flow Volume (10)	9	9	9	9	9
Flow Status - Flashiness (10)	1	4	9	4	1
Channel Alteration (20)	14	15	18	13	18
Frequency of Riffles/Bends (20)*	8	16	18		4
Channel Sinuosity (20)**				5	
Riparian and Bank Structure					
Bank Stability (L) (10)	9	8	7	9	8
Bank Stability (R) (10)	9	8	9	9	6
Vegetative Protection (L) (10)	7	8	2	6	8
Vegetative Protection (R) (10)	7	8	5	6	5
Riparian Veg. Zone Width (L) (10)	1	4	1	5	8
Riparian Veg. Zone Width (R) (10)	2	4	1	1	10
TOTAL SCORE (200):	106	120	135	89	93
HABITAT RATING:	GOOD (SLIGHTLY IMPAIRED)	GOOD (SLIGHTLY IMPAIRED)	GOOD (SLIGHTLY IMPAIRED)	MARGINAL (MODERATELY IMPAIRED)	MARGINAL (MODERATELY 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:	8/13/2013	8/20/2013	8/12/2013	8/20/2013	8/13/2013
Weather:	Sunny	Sunny	Partly Cloudy	Sunny	Sunny
Air Temperature:	73 Deg. F.	80 Deg. F.	67 Deg. F.	85 Deg. F.	70 Deg. F.
Water Temperature:	66 Deg. F.	69 Deg. F.	68 Deg. F.	72 Deg. F.	66 Deg. F.
Ave. Stream Width:	12 Feet	8 Feet	10 Feet	6 Feet	17 Feet
Ave. Stream Depth:	0.5 Feet	0.5 Feet	0.5 Feet	0.5 Feet	1 Feet
Surface Velocity:	1 Ft./Sec.	0.5 Ft./Sec.	1 Ft./Sec.	0.5 Ft./Sec.	0.3 Ft./Sec.
Estimated Flow:	6 CFS	2 CFS	5 CFS	1.5 CFS	5.1 CFS
Stream Modifications:	Dredged	Dredged	None	Dredged	None
Nuisance Plants (Y/N):	N	N	N	N	N
Report Number:					
STORET No.:	460417	810569	460414	810570	460410
Stream Name:	Evans Creek	Wood Outlet Drain	Beaver Creek	Koch Warner Drain	Wolf Creek
Road Crossing/Location:	Wisner Road	Downstream Maple Road	Carson Highway	Warner Road	Off Wolf Creek Highway
County Code:	46	81	46	81	46
TRS:	05S03E22	03S06E30	06S03E26	03S06E34	06S03E07
Latitude (dd):	42.0233974	42.18866	41.9222682	42.1757595	41.96087
Longitude (dd):	-84.0451684	-83.77338	-84.0322785	-83.7178876	-84.11412
Ecoregion:	ECBP	ECBP	ECBP	ECBP	ECBP
Stream Type:	Warmwater	Warmwater	Warmwater	Warmwater	Warmwater
USGS Basin Code:	4100002	4100002	4100002	4100002	4100002

* Applies only to Riffle/Run stream Surveys

** Applies only to Glide/Pool stream Surveys

COMMENTS:

Table 3. Habitat evaluation for the River Raisin watershed. Hillsdale, Jackson, Lenawee, Monroe, Washtenaw, and Wayne Counties. Samples collected in August 2013.

	South Branch Raisin River Howell Highway RIFFLE/RUN Site 6T	River Raisin M-50 RIFFLE/RUN Site 7T
HABITAT METRIC		
Substrate and Instream Cover		
Epifaunal Substrate/ Avail Cover (20)	13	13
Embeddedness (20)*	15	18
Velocity/Depth Regime (20)*	14	12
Pool Substrate Characterization (20)**		
Pool Variability (20)**		
Channel Morphology		
Sediment Deposition (20)	13	13
Flow Status - Maint. Flow Volume (10)	9	9
Flow Status - Flashiness (10)	2	4
Channel Alteration (20)	18	18
Frequency of Riffles/Bends (20)*	13	8
Channel Sinuosity (20)**		
Riparian and Bank Structure		
Bank Stability (L) (10)	9	7
Bank Stability (R) (10)	9	9
Vegetative Protection (L) (10)	9	9
Vegetative Protection (R) (10)	9	8
Riparian Veg. Zone Width (L) (10)	8	9
Riparian Veg. Zone Width (R) (10)	8	9
TOTAL SCORE (200):	149	146
HABITAT RATING:	GOOD (SLIGHTLY 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:	8/13/2013	8/14/2013
Weather:	Cloudy	Sunny
Air Temperature:	Deg. F.	50 Deg. F.
Water Temperature:	68 Deg. F.	67 Deg. F.
Ave. Stream Width:	50 Feet	50 Feet
Ave. Stream Depth:	1.5 Feet	3.5 Feet
Surface Velocity:	0.5 Ft./Sec.	1 Ft./Sec.
Estimated Flow:	37.5 CFS	175 CFS
Stream Modifications:	None	None
Nuisance Plants (Y/N):	N	N
Report Number:		

STORET No.:	460050	460212
Stream Name:	South Branch Raisin River	River Raisin
Road Crossing/Location:	Howell Highway	M-50
County Code:	46	46
TRS:	06S03E25	05S04E34
Latitude (dd):	41.917504	42.0039855
Longitude (dd):	-84.010281	-83.9316555
Ecoregion:	ECBP	ECBP
Stream Type:	Warmwater	Warmwater
USGS Basin Code:	4100002	4100002

* Applies only to Riffle/Run stream Surveys

** Applies only to Glide/Pool stream Surveys

COMMENTS:

Table 3. Habitat evaluation for the River Raisin watershed. Hillsdale, Jackson, Lenawee, Monroe, Washtenaw, and Wayne Counties. Samples collected in August 2013.

	Little River Raisin North County Line Highway GLIDE/POOL Site 8T	Bear Swamp Creek Dennison Road RIFFLE/RUN Site 9T	River Raisin Off Dixon Road RIFFLE/RUN Site 10T
HABITAT METRIC			
Substrate and Instream Cover			
Epifaunal Substrate/ Avail Cover (20)	6	1	17
Embeddedness (20)*		0	19
Velocity/Depth Regime (20)*		1	8
Pool Substrate Characterization (20)**	12		
Pool Variability (20)**	1		
Channel Morphology			
Sediment Deposition (20)	2	1	15
Flow Status - Maint. Flow Volume (10)	9	9	9
Flow Status - Flashiness (10)	2	0	4
Channel Alteration (20)	2	0	19
Frequency of Riffles/Bends (20)*		1	19
Channel Sinuosity (20)**	1		
Riparian and Bank Structure			
Bank Stability (L) (10)	5	3	9
Bank Stability (R) (10)	5	3	9
Vegetative Protection (L) (10)	5	0	9
Vegetative Protection (R) (10)	5	0	9
Riparian Veg. Zone Width (L) (10)	1	4	8
Riparian Veg. Zone Width (R) (10)	1	4	4
TOTAL SCORE (200):	57	27	158

HABITAT RATING:	MARGINAL (MODERATELY IMPAIRED)	POOR (SEVERELY IMPAIRED)	EXCELLENT (NON- IMPAIRED)
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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:	8/14/2013	8/15/2013	8/15/2013
Weather:	Sunny	Partly Cloudy	Sunny
Air Temperature:	68 Deg. F.	70 Deg. F.	70 Deg. F.
Water Temperature:	67 Deg. F.	67 Deg. F.	68 Deg. F.
Ave. Stream Width:	8 Feet	10 Feet	210 Feet
Ave. Stream Depth:	1 Feet	1.5 Feet	1.5 Feet
Surface Velocity:	0.2 Ft./Sec.	1 Ft./Sec.	1.5 Ft./Sec.
Estimated Flow:	1.6 CFS	15 CFS	472.5 CFS
Stream Modifications:	Dredged	Dredged	None
Nuisance Plants (Y/N):	N	N	N
Report Number:			

STORET No.:	460406	580567	580572
Stream Name:	Little River Raisin	Bear Swamp Creek	River Raisin
Road Crossing/Location:	North County Line Highway	Dennison Road	Off Dixon Road
County Code:	46	58	58
TRS:	07S05E36	05S06E29	06S08E19
Latitude (dd):	41.9200515	42.0240691	41.9422263
Longitude (dd):	-83.7704384	-83.7335789	-83.5142336
Ecoregion:	HELP	HELP	HELP
Stream Type:	Warmwater	Warmwater	Warmwater
USGS Basin Code:	4100002	4100002	4100002

* Applies only to Riffle/Run stream Surveys

** Applies only to Glide/Pool stream Surveys

COMMENTS:

Table 3. Habitat evaluation for the River Raisin watershed. Hillsdale, Jackson, Lenawee, Monroe, Washtenaw, and Wayne Counties. Samples collected in August 2013.

HABITAT METRIC	Unnamed Tributary to River Raisin Austin Road RIFFLE/RUN Site A	River Raisin Austin Road RIFFLE/RUN Site B
Substrate and Instream Cover		
Epifaunal Substrate/ Avail Cover (20)	8	16
Embeddedness (20)*	1	17
Velocity/Depth Regime (20)*	8	13
Pool Substrate Characterization (20)**		
Pool Variability (20)**		
Channel Morphology		
Sediment Deposition (20)	1	13
Flow Status - Maint. Flow Volume (10)	8	9
Flow Status - Flashiness (10)	3	6
Channel Alteration (20)	15	18
Frequency of Riffles/Bends (20)*	16	17
Channel Sinuosity (20)**		
Riparian and Bank Structure		
Bank Stability (L) (10)	9	8
Bank Stability (R) (10)	8	8
Vegetative Protection (L) (10)	9	7
Vegetative Protection (R) (10)	9	7
Riparian Veg. Zone Width (L) (10)	0	9
Riparian Veg. Zone Width (R) (10)	0	4
TOTAL SCORE (200):	95	152

HABITAT RATING: 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).

	8/19/2013	8/19/2013
Date:	8/19/2013	8/19/2013
Weather:	Sunny	Sunny
Air Temperature:	80 Deg. F.	80 Deg. F.
Water Temperature:	66 Deg. F.	72 Deg. F.
Ave. Stream Width:	7 Feet	55 Feet
Ave. Stream Depth:	0.25 Feet	1 Feet
Surface Velocity:	0.5 Ft./Sec.	1 Ft./Sec.
Estimated Flow:	0.875 CFS	55 CFS
Stream Modifications:	Dredged	Canopy Removal
Nuisance Plants (Y/N):	N	N
Report Number:		
STORET No.:	810590	810005
Stream Name:	Unnamed Tributary to River Raisin	River Raisin
Road Crossing/Location:	Austin Road	Austin Road
County Code:	81	81
TRS:	04S04E08	04S03E01
Latitude (dd):	42.143889	42.147226
Longitude (dd):	-83.988611	-84.01556
Ecoregion:	ECBP	ECBP
Stream Type:		Warmwater
USGS Basin Code:	4100002	4100002

* Applies only to Riffle/Run stream Surveys

** Applies only to Glide/Pool stream Surveys

COMMENTS:

Table 3. Habitat evaluation for the River Raisin watershed. Hillsdale, Jackson, Lenawee, Monroe, Washtenaw, and Wayne Counties. Samples collected in August 2013.

HABITAT METRIC	River Raisin Raisinville Road RIFFLERUN Site C	North Branch Macon Creek Day Road GLIDE/POOL Site D
Substrate and Instream Cover		
Epifaunal Substrate/ Avail Cover (20)	17	8
Embeddedness (20)*	18	
Velocity/Depth Regime (20)*	9	
Pool Substrate Characterization (20)**		6
Pool Variability (20)**		13
Channel Morphology		
Sediment Deposition (20)	12	8
Flow Status - Maint. Flow Volume (10)	9	9
Flow Status - Flashiness (10)	2	1
Channel Alteration (20)	19	13
Frequency of Riffles/Bends (20)*	18	
Channel Sinuosity (20)**		8
Riparian and Bank Structure		
Bank Stability (L) (10)	9	4
Bank Stability (R) (10)	9	4
Vegetative Protection (L) (10)	8	8
Vegetative Protection (R) (10)	9	6
Riparian Veg. Zone Width (L) (10)	3	6
Riparian Veg. Zone Width (R) (10)	3	3
TOTAL SCORE (200):	145	97
HABITAT RATING:	GOOD (SLIGHTLY IMPAIRED)	MARGINAL (MODERATELY 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:	8/15/2013	8/21/2013
Weather:	Sunny	Sunny
Air Temperature:	70 Deg. F.	80 Deg. F.
Water Temperature:	65 Deg. F.	68 Deg. F.
Ave. Stream Width:	400 Feet	35 Feet
Ave. Stream Depth:	2 Feet	3 Feet
Surface Velocity:	1 Ft./Sec.	0.1 Ft./Sec.
Estimated Flow:	800 CFS	10.5 CFS
Stream Modifications:	Bank Stabilization	None
Nuisance Plants (Y/N):	N	N
Report Number:		
STORET No.:	580594	580445
Stream Name:	River Raisin	North Branch Macon Creek
Road Crossing/Location:	Raisinville Road	Day Road
County Code:	58	58
TRS:	06S08Exx	05S06E36
Latitude (dd):	41.934722	41.9975
Longitude (dd):	-83.762222	-83.6629
Ecoregion:	HELP	HELP
Stream Type:	Warmwater	Warmwater
USGS Basin Code:	4100002	4100002

* Applies only to Riffle/Run stream Surveys

** Applies only to Glide/Pool stream Surveys

COMMENTS:

Table 3. Habitat evaluation for the River Raisin watershed. Hillsdale, Jackson, Lenawee, Monroe, Washtenaw, and Wayne Counties. Samples collected in August 2013.

River Raisin Pierce Rd RIFFLERUN Site E	
HABITAT METRIC	
Substrate and Instream Cover	
Epifaunal Substrate/ Avail Cover (20)	10
Embeddedness (20)*	1
Velocity/Depth Regime (20)*	9
Pool Substrate Characterization (20)**	
Pool Variability (20)**	
Channel Morphology	
Sediment Deposition (20)	4
Flow Status - Maint. Flow Volume (10)	9
Flow Status - Flashiness (10)	7
Channel Alteration (20)	18
Frequency of Riffles/Bends (20)*	9
Channel Sinuosity (20)**	
Riparian and Bank Structure	
Bank Stability (L) (10)	9
Bank Stability (R) (10)	9
Vegetative Protection (L) (10)	7
Vegetative Protection (R) (10)	5
Riparian Veg. Zone Width (L) (10)	9
Riparian Veg. Zone Width (R) (10)	4
<hr/>	
TOTAL SCORE (200):	110

HABITAT RATING: 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: 8/19/2013
 Weather: Sunny
 Air Temperature: 75 Deg. F.
 Water Temperature: 68 Deg. F.
 Ave. Stream Width: 35 Feet
 Ave. Stream Depth: 1.5 Feet
 Surface Velocity: 1 Ft./Sec.
 Estimated Flow: 52.5 CFS
 Stream Modifications: None
 Nuisance Plants (Y/N): N
 Report Number:

STORET No.: 380393
 Stream Name: River Raisin
 Road Crossing/Location: Pierce Rd
 County Code: 38
 TRS: 03S02E01
 Latitude (dd): 42.15583
 Longitude (dd): -84.14361
 Ecoregion: SMNITP
 Stream Type: Warmwater

USGS Basin Code: 4100002

* Applies only to Riffle/Run stream Surveys
 ** Applies only to Glide/Pool stream Surveys

COMMENTS:

Table 4. Water Chemistry Analysis for the River Raisin Watershed, August 22, 2013.

Unnamed Trib to River Raisin	
Austin Road	
Parameters	Station A
General Chemistry (mg/l)	
Ammonia	0.02
Kjeldahl Nitrogen	0.49
Nitrate/Nitrite	0.98
Ortho Phosphate	0.028
Total Dissolved Solids	330
Total Organic Carbon	5.0
Total Phosphorus	0.052