

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY  
WATER RESOURCES DIVISION  
MAY 2012

STAFF REPORT

A BIOLOGICAL SURVEY OF THE UPPER GRAND RIVER WATERSHED  
JACKSON, INGHAM, EATON, CLINTON, AND IONIA  
COUNTIES, MICHIGAN  
JULY - SEPTEMBER 2011

### Introduction

Biological and physical habitat conditions were assessed at 25 locations in the Upper Grand River watershed by Surface Water Assessment Section (SWAS) staff in 2011. For the purposes of this survey the Upper Grand River watershed is defined as the area upstream of the confluence with the Maple River watershed, excluding the Looking Glass and Red Cedar River watersheds. The objectives of the 2011 assessments were:

1. Assess the current status and condition of individual water bodies and determine if Michigan Water Quality Standards (WQS) are being met.
2. Gather water quality data needed for the fiscal year (FY) 2012 Section 303(d), 305(b) and 314 Integrated Report.
3. To support the development of water quality-based effluent limits (WQBELs) for National Pollutant Discharge Elimination System (NPDES) permits.
4. Identify nonpoint sources (NPS) of water quality impairment.
5. Evaluate the effectiveness of the NPS Program.
6. Satisfy monitoring requests submitted by internal and external customers.

The macroinvertebrate community and physical habitat were qualitatively assessed at 25 stations (Figure 1 and Table 1) using the SWAS Procedure 51 (available upon request, MDEQ, 1990; Creal et al., 1996) for wadeable streams. The macroinvertebrate communities were assessed and scored with metrics which rate the communities on a scale from excellent to poor. Macroinvertebrate scores can range from 9 to -9. Stations with a score greater than or equal to +5 are considered excellent. Stations with a score less than or equal to -5 are classified as poor. Stations with a score of -4 through +4 are classified as acceptable (moderately impaired). Habitat evaluations are based on 10 metrics, with a possible maximum total score of 200. Stations are classified as excellent with a habitat score >154, good with a score between 105 and 154, marginal with a score between 56 and 104, and poor with a score <56.

### Watershed History

The Grand River basin is the second largest watershed in Michigan and encompasses approximately 5,570 square miles (Michigan Water Resources Commission, 1961). The slope of the river bed is approximately 1.9 feet per mile from Jackson to Grand Ledge, and 3.2 feet per mile from Grand Ledge to Ionia (Michigan Water Resources Commission, 1961). The entire watershed is contained within the Southern Michigan Northern Indiana Drift Plains (SMNIDP) ecoregion (Omernik and Gallant, 1988). The upper portion of the watershed, from south of Jackson to Portland, was evaluated during this survey. The Upper Grand River flows through several urbanized areas including Jackson, Eaton Rapids, Dimondale, Lansing, Grand Ledge, and Portland.

The Grand River from Tompkins Road (in northern Jackson County) upstream to the city of Jackson has approved *E. coli*, dissolved oxygen, and suspended sediment Total Daily Maximum Loads (TMDLs), due to pathogen discharges, dissolved oxygen levels which do not attain the WQS, and biological communities that are considered poor. The Grand River in the vicinity of Lansing is not considered to support designated uses due to elevated *E. coli* concentrations and the violation of the dissolved oxygen WQS.

The Grand River upstream of Jackson has historically had good water quality with biological communities that would be characteristic of minimally impacted waterbodies (Sylvester and Grant, 1977; Goodwin, 2000; Rockafellow, 2003(a); Rockafellow 2003(b); Holden, 2007). The Grand River in Jackson has been channelized and was previously routed underground for approximately one half of a mile. This stretch of the river flows through a highly industrialized and urbanized area of Jackson. Downstream of Jackson, the Grand River flows through a rural mixture of natural land, agriculture, and light residential land uses before it enters the urbanized area around Lansing. Between Lansing and Portland, the Grand River goes through a natural area (Portland State Game Area). In the watershed included in this survey, most of the tributaries to the Grand River are small warmwater streams that are impacted by agriculture and historic dredging.

In addition to the main branch of the upper Grand River, the following tributaries were monitored during this survey: Center Lake Outlet, Portage River, Orchard Creek, Cahaogan Creek, Sandstone Creek, Albrow Creek, Spring Brook, Perry Creek, North Onondaga Drain, Silver Creek, Carrier Creek, Frayer Creek, and Goose Creek (Table 1). The sites were selected either randomly for the Status and Trend Program or for other targeted purposes (Table 1). Stations 1, 2, 10, 20, 21, and 22 were selected for targeted purposes.

## **2011 Macroinvertebrate and Habitat Survey Sampling Results**

### Grand River – Jackson County (040500040105 and 040500040106)

The Grand River was sampled at two locations in Jackson County; Reed Road (Station 1) upstream of the city of Jackson and West Monroe Street (Station 3) in the city of Jackson. Station 1 is a minimally impacted site for the Water Chemistry Monitoring Program. The glide/pool habitat at Station 1, scored good (125; Table 2). The substrate was dominated by soft sand, and only had a marginal amount epifaunal substrate or available cover. The channel was running through a residential lawn (one bank was mowed grass and the other was shrubs and tall grasses) and was very sinuous. There was a moderate amount of undercut banks, overhanging vegetation, large woody debris, and silty deposits in the channel. The macroinvertebrate community scored at the top end of the acceptable range (4; Table 3). Although no stoneflies were found, there were a good number of mayflies and caddisflies collected. The community was relatively diverse and balanced, indicating generally good water quality and habitat availability. However, if there had been better substrate and instream cover for macroinvertebrates the site likely would have received an excellent macroinvertebrate community score.

At Station 3, the Grand River's glide/pool habitat scored marginal (97; Table 2). The substrate was dominated by sand, with some gravel and silt present. There was a good amount of woody debris in the channel, but most of it was covered with silt. The river at this point in the city of Jackson is low gradient, has incised banks, and shows evidence of historic dredging. The channel was well shaded by riparian trees on both banks, but overall the riparian and bank structure is impacted being in an urban area that has not left much of a riparian buffer. The macroinvertebrate community scored in the upper portion of the acceptable range (2; Table 3).

Mayflies represented a lower portion of the community and there were a larger proportion of isopods/snails/leaches at Station 3, compared to upstream at Reed Road (Station 1), but otherwise the communities were not drastically different.

#### Center Lake Outlet (040500040103)

Center Lake Outlet was sampled downstream of Falahee Road (Station 2). The glide/pool habitat scored good (124; Table 2). The substrate was dominated by stable sand. There is a tree dominated riparian buffer and a few large beds of macrophytes immediately downstream of the bridge. There were no macrophytes where the canopy covered the channel. Nuisance plant conditions were not observed. The macroinvertebrate community scored in the lower half of the acceptable range (-2; Table 3). The community was dominated by amphipods and *Hydropsychidae* caddisfly larvae. There were no mayflies collected and only six caddisflies that were not hydropsychids which indicates a somewhat stressed community.

A site visit was also made on Center Lake Outlet at 5th Avenue on August 10, 2011, downstream of the Center Lake outlet and the Leoni Waste Water Treatment Plant outfall and nuisance plant conditions were not noted. There were few rooted macrophytes and there was a small to moderate amount of attached algae present.

#### Portage River (040500040207)

The Portage River joins the Grand River north of the city of Jackson and drains northeast Jackson County. In this survey Portage River was sampled at M-106 (Bunkerhill Road) (Station 4). The glide/pool habitat scored marginal (67; Table 2). The substrate was all silt, often multiple feet deep. Historic dredging of the River widened the channel, slowed the flows, and filled the channel with sediments from upstream wetland dredging. The minimal habitat for macroinvertebrates included wood that has accumulated in the channel and bank habitat. The macroinvertebrate community scored in the lower half of the acceptable range (-2; Table 3). Seventy two percent of the counted organisms were amphipods, which are tolerant to many instream stressors. There were 3 taxa of mayflies found, but they represented less than 2 percent of the community. Almost all of the caddisflies were *Polycentropodidae* larvae, which create homes by spinning cornucopia-shaped nets which collect food from the flow of the river and do not need much stable substrate to attach to or collect food. This portion of Portage River is included in the Grand River and Portage River Biota TMDL.

#### Orchard Creek (040500040203)

Orchard Creek is the upper half of the Portage River watershed. The name changes upstream of Dunn Road, where the outlets from Portage Lake and Little Portage Lake join Orchard Creek to form Portage River. Orchard Creek was sampled at three randomly selected locations, all approximately a mile apart; Coon Hill Road (Station 5), Kennedy Road (Station 6), and Plum Orchard Road (Station 7), going from south to north. During this survey the water level in Orchard Creek seemed to be only slowly recovering from large storm events several weeks earlier in the summer. It was not clear if the recent high water affected this survey, although even during higher flows, the velocity of the water did not appear to be fast.

The glide/pool habitat at Station 5 (Coon Hill Road) scored marginal (74; Table 2). The substrate was almost all silt, with a small amount of sand. There was a minimal amount of epifaunal substrate in the channel. The banks were moderately stable and the channel was very straight. The macroinvertebrate community scored poor (-6; Table 3). The community was dominated by isopods and surface breathing taxa (*Hemiptera*), indicating that there are significant environmental stressors affecting Orchard Creek at this location.

The glide/pool habitat at Station 6 (Kennedy Road) scored marginal (79; Table 2). The substrate was almost all silt, with a small amount of sand. There was a minimal amount of epifaunal substrate in the channel. The banks were also moderately stable and the channel was very straight. The macroinvertebrate community scored at the bottom of the acceptable range (-4; Table 3). The community was also dominated by isopods and surface breathing taxa (*Hemiptera*). The difference in the scores between Station 6 and 5 was that at Station 6, two individual organisms from two different mayfly families were found and the dominant taxa represented a slightly lower, but not likely significantly different, proportion of the community (38.1 percent at Station 5 versus 35.2 percent at Station 6).

The glide/pool habitat at Station 7 (Plum Orchard Road) scored marginal (85; Table 2). The substrate was mostly silt, but there was more stable sand compared to the two downstream stations. The channel was also straight and channelized, like downstream stations. Large woody debris was the main available habitat for macroinvertebrates. The macroinvertebrate community scored in the upper half of the acceptable range (2; Table 3), which is much higher than the two downstream stations. The most significant differences at Station 7 was that the macroinvertebrate community was made up of a higher proportion of mayflies (23 percent versus approximately 2 percent at Stations 5 and 6) and a lower proportion of isopods (less than 2 percent versus over 35 percent at Stations 5 and 6). Station 7 also had more caddisflies and a more even community. All of these things indicate that there may be less environmental stress at Station 7 compared to Stations 5 and 6.

#### Cahaogan Creek (040500040201)

Cahaogan Creek is a tributary that enters Orchard Creek just upstream of Plum Orchard Road. In this survey, Cahaogan Creek was sampled at Decamp Road (Station 8). The glide/pool habitat at Station 8 scored marginal (62; Table 2). The channel was totally full of wetland depositional silts with emerging plants throughout. There were only a few feet of riparian buffer between the channel and row crop fields. There were no pools and heavy deposits of silt. The macroinvertebrate community scored acceptable (0; Table 3). There were a large number of taxa found and the community was relatively even. There were two families of both mayflies and caddisflies found and the dominant taxon of the community was amphipods. In general, the macroinvertebrate community at Station 8 was similar to what would be expected in a wetland.

#### Sandstone Creek (040500040302 and 040500040303)

Sandstone Creek is a tributary to the Grand River west of the City of Jackson that was sampled at two locations in Jackson County: Cuff Road (Station 9) and Roth Road (Station 10). The glide/pool habitat at Station 9 scored good (154; Table 2) and had a wide natural riparian floodplain. The substrate was over 50 percent silt with a mixture of sand, gravel and cobble covering the rest of the stream bottom. There was an extensive amount of large woody debris and a moderate amount of undercut banks and rootwads. The macroinvertebrate community scored excellent (5; Table 3). The community had a large proportion of mayflies (over 30 percent) and was relatively even. *Hydropsychidae* larvae were the only taxa of caddisflies, which indicates that there may be some stresses affecting the creek even though the entire community rated excellent.

The glide/pool habitat at Station 10 scored good (132; Table 2) and had a mostly forested riparian area. The substrate was dominated by sand. The banks showed some evidence of flashiness with some erosion and bank slumping. There was a moderate amount of large woody debris (mostly large logs) and rootwads in the channel. The macroinvertebrate community scored excellent (6; Table 3). Over 38 percent of the community was mayflies and there were four caddisfly taxa found. Overall, Sandstone Creek is in relatively good condition

and effort should be made to protect the riparian buffer and to minimize impacts from urbanization in the headwaters.

#### Albrow Creek (040500040210)

Albrow Creek is a small tributary to the Grand River in Jackson County, north of the city of Jackson. Albrow Creek was sampled at Broughwell Road, upstream of Rives Junction (Station 11). The riffle/run habitat scored good (145; Table 2). The substrate was dominated by sand. The banks were stable with a good riparian zone. There were some piles of deposited sand in the channel. The macroinvertebrate community scored acceptable (0; Table 3) and was dominated by amphipods, which were almost half of the organisms counted. There was one taxon of mayfly and 5 taxa of caddisflies collected.

#### Spring Brook (040500040305)

Spring Brook is a tributary to the Grand River in Jackson and Eaton Counties. Spring Brook was assessed at Robbins Road (Station 12) in Jackson County, which is a Trend Site for the Status and Trend Program. The glide/pool habitat scored good (132; Table 2). The substrate was dominated by silt, with some sand present. The shrubs on the banks are overgrowing the channel giving the channel an extensive amount of overhanging vegetation. The banks were very stable with a moderate amount of undercut banks. The channel is sinuous and does not appear to have had extensive dredging historically. The macroinvertebrate community scored in the upper end of the acceptable range (3; Table 3). There was a relatively high proportion of caddisflies (mainly *Leptoceridae*) and a low proportion of surface breathers and isopod/snails/leaches.

#### Perry Creek (040500040210)

Perry Creek is a tributary to the Grand River in Ingham and Jackson Counties, west of the city of Leslie. Perry Creek was assessed downstream of Olds Road (Station 13) and at Bellevue Road (Station 14). Station 13 is approximately one mile upstream of Station 14. The glide/pool habitat at Station 13 scored marginal (98; Table 2). The substrate was dominated by sand, with more than 80 percent of the stream bottom changing frequently. The channel contained a moderate amount of large woody debris. The macroinvertebrate community scored acceptable (0; Table 3). There were 5 taxa of caddisflies found, but the community was dominated with amphipods, which were 52 percent of the organisms counted. There were also only four mayflies counted in the sample, with represented less than 2 percent of the community.

The glide/pool habitat at Station 14 scored good (111; Table 2). The substrate was dominated by sand, with a small amount of gravel and silt present. There was a wide relatively unimpacted riparian area at this site, but only a marginal amount of instream substrate and cover. The macroinvertebrate community scored in the lower half of the acceptable range (-2; Table 3). The macroinvertebrate community was not drastically different than Station 13, but there were two fewer caddisfly taxa and more snails found at Station 14. The macroinvertebrate community was still dominated by amphipods and had very few mayflies (only one mayfly was collected).

#### North Onondaga Drain (040500040304)

North Onondaga Drain is a tributary to the Grand River in Ingham and Eaton Counties. North Onondaga Drain was assessed at Aurelius Road (Station 15). The glide/pool habitat rated marginal (78; Table 2). The substrate was dominated by sand, with some silt and a small amount of gravel. There was only a narrow grass riparian buffer between the stream and row crop fields or open field/pasture. There was not much instream habitat and the channel has been dredged historically. The macroinvertebrate community scored acceptable (-1; Table 3)

and was dominated by amphipods and *Chironomidae* larvae (midges), which are both often tolerant to environmental stressors.

#### Grand River in Eaton and Ingham Counties (040500040702)

The Grand River was monitored at two locations between Eaton Rapids and Dimondale. Station 16 was upstream of Columbia Highway, in Eaton County, and Station 17 was off of Birchfield Park Road, in Ingham County. Station 16 was located upstream of Columbia Highway off of Waverly Road where the river is adjacent to the road. The glide/pool habitat scored good (145; Table 2). The substrate was a mixture of cobble, gravel, and sand. The banks near the road were falling in and some bank stabilization devices were falling into the river. There was approximately 3 feet of scour above the water level. There was a variable width of riparian trees on each bank, ranging from one tree width up to over 100 feet depending on how much land was between the river and either Waverly Road to the east or an open agricultural field on the west bank. The macroinvertebrate community scored excellent (8; Table 3). There were seven mayfly and five caddisfly taxa collected. Combined mayflies and caddisflies were approximately 90 percent of the organisms counted.

Station 17 is approximately 2.5 miles downstream of Station 16. The Grand River in Birchfield Park (Station 17) had a glide/pool habitat that scored good (124; Table 2). The substrate was dominated by sand with almost no gravel or cobble, giving much less epifaunal substrate compared to Station 16. The riparian areas were forested combined with some open park areas. The macroinvertebrate community scored excellent (6; Table 3). There were five taxa of mayflies and six taxa of caddisflies collected. Combined, the proportion of mayflies and caddisflies was approximately 45 percent, which is likely a reflection of the lack of gravel and cobble at this site. The two point difference in the scores between Stations 16 and 17 is because one stonefly was collected at Station 16 and none were collected at Station 17.

#### Silver Creek (04050004703)

Silver Creek is a tributary to the Grand River in Eaton County, which joins the Grand River in Dimondale. Silver Creek was assessed downstream of Bridge Highway because the upstream area was fenced off and it was not possible to access the stream (Station 18). The riffle/run habitat scored good (130; Table 2). The substrate was dominated by sand, with a good amount of gravel and cobble. Approximately 20 percent of the substrate was covered with rooted submergent macrophytes. The right bank was mainly lawn surrounding a house. The macroinvertebrate community scored in the lower portion of the acceptable range (-3; Table 3). Mayflies and caddisflies represented a very small proportion of the community, which was dominated by isopods. This community indicates that there may be some environmental stresses impacting Silver Creek.

#### Frayer Creek (04050004706)

Frayer Creek is a tributary to the Grand River in Eaton County, which joins the Grand River between Grand Ledge and the Portland State Game Area. Frayer Creek was sampled at Eaton Highway (Station 23). The riffle/run habitat scored marginal (101; Table 2). Frayer Creek has been regularly dredged and the channel is straight, with a minimum amount of riparian vegetation. The substrate is dominated by sand, but gravel was common. The stream appears to be very flashy. The macroinvertebrate community scored acceptable (0; Table 3), but was heavily dominated by amphipods (73 percent of the community). A few mayflies were collected and caddisflies comprised 10 percent of the community.

#### Grand River in Ionia County (040500040709)

The Grand River was sampled in Ionia County at the end of Erdman Road in the Portland State Game Area (Station 24). This sample location is one half of the river where it splits around a large island. The glide/pool habitat scored excellent (173; Table 2). The substrate was a mixture of sand, gravel, and silt. There was a lot of large woody debris and sticks along the edges of the channel. There were some deep pools and a patch of aquatic vegetation in the middle of the sample area. The upstream portion of the sample area had more cobble and boulders. There was a greywater smell detected while sampling, but the source was not clear. The macroinvertebrate community scored excellent (5; Table 3). There were six mayfly taxa and four caddisfly taxa collected. Collectively, mayflies and caddisflies comprised 56 percent of the macroinvertebrate community.

#### Goose Creek (040500040710)

Goose Creek is a coldwater tributary to the Grand River in Ionia County. Goose Creek was sampled at Pline Road (Station 25). The glide/pool habitat scored good (110; Table 2). The substrate was dominated by sand, with some silt present. The riparian area was vegetated, but there was a mowed area near the road crossing on the left bank. There was a moderate amount of woody debris in the channel and some evidence of flashiness. The macroinvertebrate community scored acceptable (-2; Table 3). The community was dominated by amphipods, which were over 30 percent of the organisms counted. There were only a few mayflies collected (two taxa and seven organisms).

#### Carrier Creek (040500040704)

Carrier Creek is a tributary to the Grand River in Delta Township. Carrier Creek has a United States Environmental Protection Agency approved TMDL (Cooper, 2002) because the biological community was threatened due to sedimentation from upland soil erosion. Since 2000, approximately \$1,000,000 has been spent on restoration activities on Carrier Creek.

In this survey, Carrier Creek was assessed at 4 locations. Moving from upstream to downstream they include: off of Williamsburg Road (Station 19), off of North Ridge Court (Station 20), off of Willow Woods Lane (Station 21), and Old River Trail (Station 22). The habitat at Station 19 received the only marginal score (80; Table 2), while Station 20, 21 and 22 all received good habitat scores (123, 136, 126; Table 2). Station 19 has had less restoration work than the other stations. Meanders and bank stabilization devices have been added to the channel. The glide/pool habitat at Station 19 is dominated by clay substrate, which does not provide much instream habitat. The stream appeared to be flashy at this location, even though it was also clear that stormwater from 7 to 9 days earlier was still being released from upstream wetland retention areas, which were installed as part of the stream restoration process. Station 20 has had artificial riffles added to the channel, but the substrate is dominated by sand and gravel. There was an extensive amount of undercut banks and very little large woody debris. Station 21 has had meanders added to the channel. There is sediment/silt fencing to add support to the banks, but some banks are failing. There was cobble added to the channel, but it is dominated by sand and gravel. Station 22 is at the base of Carrier Creek in Delta River Park, before it enters the Grand River. The stream was also restored in this area. There was a lot of gravel and cobble, but the substrate was dominated by sand. There was a moderate amount of sediment deposition and the moderate amount of woody debris was covered with silt. There were fewer riffles at Station 22, than at Stations 20 or 21.

The macroinvertebrate communities at all four stations scored acceptable, with scores ranging from 0 to -3. There were 23 to 28 taxa found at each location, with number of taxa increasing further downstream. There were between a total of 2 and 5 mayfly and caddisfly families found

at each station. Stations 21 and 22 had higher proportions mayflies than the upstream stations. Station 19 received a score of -1 (Table 3) and the community was dominated by *Hydropsychidae* caddisfly larvae, amphipods, and midge larvae (*Chironomidae*). Caddisflies are generally a more intolerant group of macroinvertebrates, but a community that is strongly dominated by hydropsychids can indicate that there are environmental stressors affecting the stream. Station 20 received a score of -3 (Table 3) and was dominated by midges and a family of damselfly larvae (*Coenagrionidae*). Station 21 received a score of 0 (Table 3) and was dominated by *Hydropsychidae* caddisfly larvae. Station 22 received a score of -1 (Table 3) and was dominated by *Coenagrionidae* damselfly larvae.

Tables 4a, 4b, and 4c present a historic summary of macroinvertebrate Procedure 51 scores, the number of taxa (also known as taxa richness) collected during Procedure 51 macroinvertebrate surveys, and the number and proportion of Ephemeroptera, Plecoptera, and Trichoptera (EPT) (which are generally more sensitive to environmental stressors) (Holden, 2011; Wuycheck, 2002; Hanshew, 1999; Goble and Masterson, 1990). Overall, there may have been some increase in the Procedure 51 macroinvertebrate community score and macroinvertebrate taxa richness when comparing 2009 and 2011 data to data from 2006 and earlier. The number of EPT taxa collected does not appear to have increased, but the proportion of the organisms counted may have increased some from 2001 and earlier compared to the 2009 and 2011 surveys.

## Conclusions

Overall, the five sites on the Grand River had acceptable to excellent scores for the macroinvertebrate community. The average Procedure 51 score for the five sites was 5 (scores ranged from 2 to 8). The station at Monroe Street (Station 17) was the most impacted, as would be expected of an urban river. The tributaries to the Grand River vary in quality, mainly because of the intensive amount of historic dredging that has occurred in the smaller rivers in the watershed. Only Sandstone Creek and Spring Brook received Procedure 51 macroinvertebrate scores in the upper acceptable or excellent range (Sandstone Creek at Stations 9 and 10 scored 5 and 6; Spring Brook at Station 12 scored 3). The macroinvertebrate scores at the remaining stations ranged from 0 to -6. These lower scores reflect the impacts of dredging which reduces habitat for macroinvertebrates, widens the stream channel, and reduces base flow stream velocity, all of which result in lower Procedure 51 values.

Future monitoring should target Sandstone Creek and Spring Brook Creek because they are currently in good condition and should be protected. Additional monitoring in the suspended sediment TMDL reach should be conducted to see if there has been enough work in the watershed to see an improvement in Procedure 51 score.

Field Work by: Sarah Holden, Aquatic Biologist  
Molly Rippke, Aquatic Biologist  
Tamara Lipsey, Aquatic Biologist  
Jeff Varricchione, Aquatic Biologist  
Michael McCauley, Aquatic Biologist  
Surface Water Assessment Section  
Water Resources Division

Report by: Sarah Holden, Aquatic Biologist  
Surface Water Assessment Section  
Water Resources Division



## REFERENCES

- Cooper, J. 2002. Total Maximum Daily Load for Biota of Carrier Creek, Eaton County.
- Creal, W., S. Hanshue, S. Kosek, M. Oemke, and M. Walterhouse. 1996. Update of GLEAS Procedure 51 Metric Scoring and Interpretation. MI/DEQ/SWQ-96/068. Revised May 1998.
- Goble, S. and M. Masterson. 1990. Biological survey of Carrier Creek, Eaton County, Michigan, July 18, 1989. MI/DNR/SWQ-89/132.
- Goodwin, K. 2000. Biological Assessment of the Upper Grand River, Jackson and Eaton Counties, Michigan September 10-13, 1996. MI/DEQ/SWQ-00/052.
- Hanshue, S. 1999. A Biological Assessment of Carrier Creek, Eaton County, July 25, 1996. MDEQ Report # MI/DEQ/SWQ-99/005.
- Holden, S. 2007. A biological survey of the Upper Grand River watershed, Jackson, Ingham, Eaton, Clinton, and Ionia Counties, Michigan, June-August, 2006. MI/DEQ/WB-07/072
- MDEQ. 1990. SWAS Procedure 51 - Qualitative Biological and Habitat Survey Protocols for Wadable Streams and Rivers, April 24, 1990. Revised June 1991, August 1996, January 1997, May 2002, and December 2008.
- Michigan Water Resources Commission. 1961. Water Resource Conditions and Uses in the Upper Grand River Basin. Report No. 25270.
- Omernik, J.M. and A.L. Gallant. 1988. Ecoregions of the Upper Midwest States. United States Environmental Protection Agency, Environmental Research Laboratory. EPA/600/3-88/037.
- Rockafellow, D. 2003 (a) A Biological Survey of the Grand River, Jackson, Ingham, Eaton, Clinton, and Ionia Counties, Michigan, Michigan August 2001. MI/DEQ/WD-03/024
- Rockafellow, D. 2003 (b) A Biological Survey of Tributaries to the Upper Grand River, Jackson, Ingham, Eaton, and Ionia Counties, Michigan, August and September, 2001. MI/DEQ/WD-03/049
- Sylvester, S. and J. Grant. 1977. Biological Survey of the Grand River Vicinity of Jackson, Michigan, 1977. MI/DNR/SWQ-90/060.
- Wuycheck, J. 2002. A Biological Community and Habitat Quality Assessment of Carrier Creek, Eaton County, Michigan July 28, 2001. MI/DEQ/SWQ-02/002.

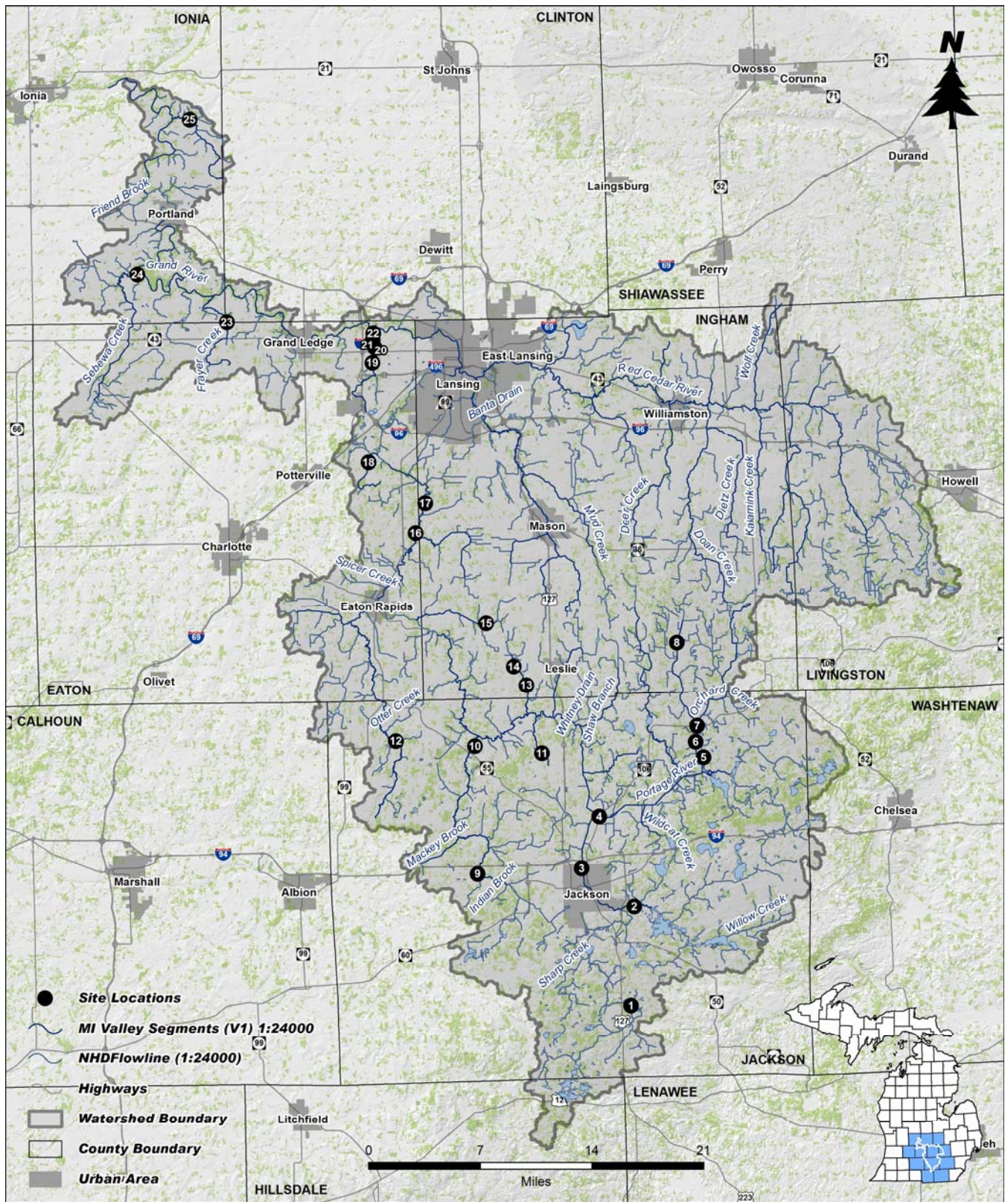


Figure 1. 2011 Upper Grand River watershed survey locations. Note: this survey did not include the Red Cedar or Looking Glass River watersheds.



Table 1. 2011 Upper Grand River watershed monitoring locations.

Site #	Status/ Trend/ Targeted	Storet Number	Waterbody Name	Location	Latitude	Longitude	Bug Score	Habitat Rating	Habitat Score	AUID
1	Targeted	380083	Grand River	Reed Road	42.13889	-84.35306	4	Good	125	040500040105-01
2	Targeted	380258	Ceter Lake Outlet	Falahee Road	42.229726	-84.346392	-2	Good	124	040500040103-01
3	Trend	380085	Grand River	W Monroe St	42.26525	-84.40987	2	Marginal	97	040500040106-01
4	Status/ Targeted	380404	Portage River	M106 (Cooper St/Bunkerhill Rd)	42.31202	-84.38720	-2	Marginal	67	040500040207-01
5	Status	380487	Orchard Creek	Coon Hill Road	42.36457	-84.25803	-6	Marginal	74	040500040203-01
6	Status	380420	Orchard Creek	Kennedy Road	42.37901	-84.26705	-4	Marginal	79	040500040203-01
7	Status	380486	Orchard Creek	Plum Orchard Road	42.39360	-84.26498	2	Marginal	85	040500040203-01
8	Trend	330422	Cahaogan Creek	Decamp Rd	42.47012	-84.28762	0	Marginal	62	040500040201-01
9	Status	380450	Sandstone Creek	Cuff Road	42.26212	-84.53741	5	Good	154	040500040302-01
10	Targeted	380416	Sandstone Creek	Roth Road	42.37878	-84.53773	6	Good	132	040500040303-01
11	Status	380488	Albrow Creek	Broughwell Road	42.37127	-84.45595	0	good	145	040500040210-02
12	Trend	380456	Spring Brook	Robbins Rd	42.38468	-84.63487	3	Good	137	040500040305-01
13	Trend	330419	Perry Creek	d/s Olds Rd	42.43391	-84.47350	0	Marginal	98	040500040210-03
14	Status	330455	Perry Creek	Bellevue Road	42.45108	-84.48849	-2	Good	111	040500040210-03
15	Trend	330418	North Onondaga Drain	Aurelius Rd	42.49110	-84.52165	-1	Marginal	78	040500040304-01
16	Status	230253	Grand River	0.6 miles u/s Columbia Road	42.57467	-84.60625	8	Good	145	040500040702-01
17	Trend	330433	Grand River	Birchfield Park	42.60230	-84.59364	6	Good	124	040500040702-01
18	Status	230251	Silver Creek	Bridge Highway	42.64009	-84.66247	-3	Good	130	040500040703-01
19	Status/ Trend/ Targeted	230233	Carrier Creek	off Williamsburg Rd	42.73104	-84.65596	-1	Marginal	80	040500040704-02
20	Targeted	230247	Carrier Creek	off of North Ridge Court	42.74477	-84.652437	-3	Good	123	040500040704-02
21	Targeted	230199	Carrier Creek	off of Willow Woods Lane	42.75237	-84.65516	0	Good	136	040500040704-02
22	Targeted	230136	Carrier Creek	Old River Trail	42.75837	-84.65417	-1	Good	126	040500040704-02
23	Status	230252	Frayer Creek	Eaton Highway	42.77049	-84.83450	0	Marginal	101	040500040706-03
24	Status	340243	Grand River	5.5 miles d/s Charlotte Highway	42.81490	-84.94448	5	Excellent	173	040500040709-01
25	Status	340202	Goose Creek	Pline Road	42.95657	-84.87701	-2	Good	110	040500040710-02

Table 2. Habitat evaluations for streams in the Upper Grand River watershed, 2011.

	<b>STATION 1</b> Grand River Reed Road GLIDE/POOL	<b>STATION 2</b> Center Lake Outlet Falahee Road GLIDE/POOL	<b>STATION 3</b> Grand River W Monroe Avenue GLIDE/POOL	<b>STATION 4</b> Portage River M-106 GLIDE/POOL	<b>STATION 5</b> Orchard Creek Coonhill Road GLIDE/POOL
<b>HABITAT METRIC</b>					
<b>Substrate and Instream Cover</b>					
Epifaunal Substrate/ Avail Cover (20)	10	13	12	2	5
Embeddedness (20)*					
Velocity/Depth Regime (20)*					
Pool Substrate Characterization (20)**	11	9	10	6	6
Pool Variability (20)**	12	5	6	3	2
<b>Channel Morphology</b>					
Sediment Deposition (20)	10	15	13	8	4
Flow Status - Maint. Flow Volume (10)	9	9	9	8	8
Flow Status - Flashiness (10)	8	6	3	2	3
Channel Alteration (20)	14	15	13	10	11
Frequency of Riffles/Bends (20)*					
Channel Sinuosity (20)**	20	11	9	6	2
<b>Riparian and Bank Structure</b>					
Bank Stability (L) (10)	5	9	3	2	6
Bank Stability (R) (10)	8	9	3	2	6
Vegetative Protection (L) (10)	1	8	5	5	6
Vegetative Protection (R) (10)	8	8	5	5	6
Riparian Veg. Zone Width (L) (10)	0	5	3	4	4
Riparian Veg. Zone Width (R) (10)	9	2	3	4	5
<b>TOTAL SCORE (200):</b>	<b>125</b>	<b>124</b>	<b>97</b>	<b>67</b>	<b>74</b>
<b>HABITAT RATING:</b>	<b>GOOD (SLIGHTLY IMPAIRED)</b>	<b>GOOD (SLIGHTLY IMPAIRED)</b>	<b>MARGINAL (MODERATELY IMPAIRED)</b>	<b>MARGINAL (MODERATELY IMPAIRED)</b>	<b>MARGINAL (MODERATELY IMPAIRED)</b>
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:	8/10/2011	8/10/2011	7/26/2011	7/26/2011	9/27/2011
Weather:	Sunny	Partly Cloudy	Sunny	Sunny	Cloudy
Air Temperature:	75 Deg. F.	70 Deg. F.	75 Deg. F.	80 Deg. F.	57 Deg. F.
Water Temperature:	69 Deg. F.	71 Deg. F.	75 Deg. F.	76 Deg. F.	57 Deg. F.
Ave. Stream Width:	15 Feet	50 Feet	35 Feet	45 Feet	40 Feet
Ave. Stream Depth:	1.5 Feet	1.5 Feet	1.5 Feet	2 Feet	2.9 Feet
Surface Velocity:	1.2 Ft./Sec.	0.5 Ft./Sec.	0.8 Ft./Sec.	0.1 Ft./Sec.	0.3 Ft./Sec.
Estimated Flow:	27 CFS	37.5 CFS	42 CFS	9 CFS	34.8 CFS
Stream Modifications:	Canopy Removal	Canopy Removal	Dredged	Dredged	Dredged
Nuisance Plants (Y/N):	N	N	N	N	N
Report Number:					
STORET No.:	380083	380258	380085	380404	380487
Stream Name:	Grand River	Center Lake Outlet	Grand River	Portage River	Orchard Creek
Road Crossing/Location:	Reed Road	Falahee Road	W Monroe Avenue	M-106	Coonhill Road
County Code:	38	38	38	38	38
TRS:	04S01E07	03S01E08	02S01W27	02S01W11	01S01E24
Latitude (dd):	42.1388	42.2297	42.26525	42.31195	42.36457
Longitude (dd):	-84.3531	-84.34622	-84.40987	-84.38716	-84.25803
Ecoregion:	SMNITP	SMNITP	SMNITP	SMNITP	SMNITP
Stream Type:	Warmwater	Warmwater	Warmwater	Warmwater	Warmwater
USGS Basin Code:	4050004	4050004	4050004	4050004	4050004

\* Applies only to Riffle/Run stream Survey;

\*\* Applies only to Glide/Pool stream Survey;

Table 2. Habitat evaluations for streams in the Upper Grand River watershed, 2011.

	<b>STATION 6</b> Orchard Creek Kennedy Road GLIDE/POOL	<b>STATION 7</b> Orchard Creek Plum Orchard Road GLIDE/POOL	<b>STATION 8</b> Cahaogan Creek Decamp Road GLIDE/POOL	<b>STATION 9</b> Sandstone Creek Cuff Road GLIDE/POOL	<b>STATION 10</b> Sandstone Creek Roth Road GLIDE/POOL
<b>HABITAT METRIC</b>					
<b>Substrate and Instream Cover</b>					
Epifaunal Substrate/ Avail Cover (20)	6	7	6	12	11
Embeddedness (20)*					
Velocity/Depth Regime (20)*					
Pool Substrate Characterization (20)**	6	7	6	12	9
Pool Variability (20)**	3	3	0	14	13
<b>Channel Morphology</b>					
Sediment Deposition (20)	2	3	1	11	6
Flow Status - Maint. Flow Volume (10)	8	8	8	9	9
Flow Status - Flashiness (10)	4	6	5	8	3
Channel Alteration (20)	11	11	8	16	17
Frequency of Riffles/Bends (20)*					
Channel Sinuosity (20)**	2	2	2	16	16
<b>Riparian and Bank Structure</b>					
Bank Stability (L) (10)	7	7	7	9	6
Bank Stability (R) (10)	7	7	7	9	6
Vegetative Protection (L) (10)	6	7	5	9	9
Vegetative Protection (R) (10)	6	7	5	9	9
Riparian Veg. Zone Width (L) (10)	6	6	1	10	10
Riparian Veg. Zone Width (R) (10)	5	4	1	10	8
<b>TOTAL SCORE (200):</b>	<b>79</b>	<b>85</b>	<b>62</b>	<b>154</b>	<b>132</b>
<b>HABITAT RATING:</b>	<b>MARGINAL (MODERATELY IMPAIRED)</b>	<b>MARGINAL (MODERATELY IMPAIRED)</b>	<b>MARGINAL (MODERATELY IMPAIRED)</b>	<b>GOOD (SLIGHTLY IMPAIRED)</b>	<b>GOOD (SLIGHTLY IMPAIRED)</b>
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:	9/27/2011	9/27/2011	7/25/2011	9/28/2011	9/28/2011
Weather:	Cloudy	Cloudy	Sunny	Cloudy	Cloudy
Air Temperature:	55 Deg. F.	57 Deg. F.	83 Deg. F.	58 Deg. F.	59 Deg. F.
Water Temperature:	57 Deg. F.	55 Deg. F.	83 Deg. F.	58 Deg. F.	56 Deg. F.
Ave. Stream Width:	45 Feet	40 Feet	12 Feet	45 Feet	40 Feet
Ave. Stream Depth:	2 Feet	2.5 Feet	0.5 Feet	1.5 Feet	1.5 Feet
Surface Velocity:	0.2 Ft./Sec.	0.2 Ft./Sec.	0.2 Ft./Sec.	0.8 Ft./Sec.	1.2 Ft./Sec.
Estimated Flow:	18 CFS	20 CFS	1.2 CFS	54 CFS	72 CFS
Stream Modifications:	Dredged	Dredged	Dredged	None	None
Nuisance Plants (Y/N):	N	N	N	N	N
Report Number:					
STORET No.:	380420	380486	330422	380450	380416
Stream Name:	Orchard Creek	Orchard Creek	Cahaogan Creek	Sandstone Creek	Sandstone Creek
Road Crossing/Location:	Kennedy Road	Plum Orchard Road	Decamp Road	Cuff Road	Roth Road
County Code:	38	38	33	38	38
TRS:	01S01E13	01S01E12	01N01E15	02S02W34	01S02W22
Latitude (dd):	42.379	42.3936	42.47012	42.2611	42.37878
Longitude (dd):	-84.26733	-84.26498	-84.28762	-84.5364	-84.53773
Ecoregion:	SMNITP	SMNITP	SMNITP	SMNITP	SMNITP
Stream Type:	Warmwater	Warmwater	Warmwater	Warmwater	Warmwater
USGS Basin Code:	4050004	4050004	4050004	4050004	4050004

\* Applies only to Riffle/Run stream Surveys

\*\* Applies only to Glide/Pool stream Surveys

Table 2. Habitat evaluations for streams in the Upper Grand River watershed, 2011

	<b>STATION 11</b> Albrow Creek Broughwell Road RIFFLE/RUN	<b>STATION 12</b> Spring Brook Robbins Road GLIDE/POOL	<b>STATION 13</b> Perry Creek Olds Road GLIDE/POOL	<b>STATION 14</b> Perry Creek Bellevue Road GLIDE/POOL	<b>STATION 15</b> North Onondaga Drain Aurelius Road GLIDE/POOL
<b>HABITAT METRIC</b>					
<b>Substrate and Instream Cover</b>					
Epifaunal Substrate/ Avail Cover (20)	13	11	10	8	5
Embeddedness (20)*	15				
Velocity/Depth Regime (20)*	10				
Pool Substrate Characterization (20)**		7	8	10	7
Pool Variability (20)**		9	6	8	9
<b>Channel Morphology</b>					
Sediment Deposition (20)	9	11	5	8	7
Flow Status - Maint. Flow Volume (10)	7	10	6	9	9
Flow Status - Flashiness (10)	6	9	4	8	5
Channel Alteration (20)	16	15	12	10	6
Frequency of Riffles/Bends (20)*	13				
Channel Sinuosity (20)**		15	5	6	4
<b>Riparian and Bank Structure</b>					
Bank Stability (L) (10)	9	9	7	7	5
Bank Stability (R) (10)	9	9	7	7	5
Vegetative Protection (L) (10)	10	10	9	6	5
Vegetative Protection (R) (10)	10	10	9	6	5
Riparian Veg. Zone Width (L) (10)	9	6	5	9	3
Riparian Veg. Zone Width (R) (10)	9	6	5	9	3
<b>TOTAL SCORE (200):</b>	<b>145</b>	<b>137</b>	<b>98</b>	<b>111</b>	<b>78</b>
<b>HABITAT RATING:</b>	<b>GOOD</b> (SLIGHTLY IMPAIRED)	<b>GOOD</b> (SLIGHTLY IMPAIRED)	<b>MARGINAL</b> (MODERATELY IMPAIRED)	<b>GOOD</b> (SLIGHTLY IMPAIRED)	<b>MARGINAL</b> (MODERATELY IMPAIRED)
<p>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)</p>					
<b>Date:</b>	7/26/2011	7/26/2011	7/25/2011	7/27/2011	7/27/2011
<b>Weather:</b>	Sunny	Sunny	Sunny	Sunny	Sunny
<b>Air Temperature:</b>	84 Deg. F.	83 Deg. F.	85 Deg. F.	68 Deg. F.	70 Deg. F.
<b>Water Temperature:</b>	74 Deg. F.	75 Deg. F.	72 Deg. F.	61 Deg. F.	61 Deg. F.
<b>Ave. Stream Width:</b>	5 Feet	15 Feet	11 Feet	7 Feet	7 Feet
<b>Ave. Stream Depth:</b>	0.3 Feet	1.5 Feet	0.5 Feet	0.4 Feet	0.6 Feet
<b>Surface Velocity:</b>	0.6 Ft./Sec.	0.5 Ft./Sec.	0.5 Ft./Sec.	0.8 Ft./Sec.	0.7 Ft./Sec.
<b>Estimated Flow:</b>	0.9 CFS	11.25 CFS	2.75 CFS	2.24 CFS	2.94 CFS
<b>Stream Modifications:</b>	None	Canopy Removal	Dredged	Dredged	Dredged
<b>Nuisance Plants (Y/N):</b>	N	N	N	N	N
<b>Report Number:</b>					
<b>STORET No.:</b>	380488	380456	330419	330455	330418
<b>Stream Name:</b>	Albrow Creek	Spring Brook	Perry Creek	Perry Creek	North Onondaga Drain
<b>Road Crossing/Location:</b>	Broughwell Road	Robbins Road	Olds Road	Bellevue Road	Aurelius Road
<b>County Code:</b>	38	38	33	33	33
<b>TRS:</b>	01S01W20	01S03WS14	01N01W31	01N02W24	01N02W11
<b>Latitude (dd):</b>	42.37127	42.38468	42.43391	42.45108	42.4911
<b>Longitude (dd):</b>	-84.45595	-84.63487	-84.4735	-84.48849	-84.52165
<b>Ecoregion:</b>	SMNITP	SMNITP	SMNITP	SMNITP	SMNITP
<b>Stream Type:</b>	Warmwater	Warmwater	Warmwater	Warmwater	Warmwater
<b>USGS Basin Code:</b>	4050004	4050004	4050004	4050004	4050004

\* Applies only to Riffle/Run stream Survey;  
 \*\* Applies only to Glide/Pool stream Survey;

Table 2. Habitat evaluations for streams in the Upper Grand River watershed, 2011

	<b>STATION 16</b> Grand River upstream Columbia Road GLIDE/POOL	<b>STATION 17</b> Grand River Off Waverly Road (Birchfield Park) GLIDE/POOL	<b>STATION 18</b> Silver Creek downstream Bridge Hwy RIFFLE/RUN	<b>STATION 19</b> Carrier Creek Off Williamsburg GLIDE/POOL	<b>STATION 20</b> Carrier Creek off North Ridge Court RIFFLE/RUN
<b>HABITAT METRIC</b>					
<b>Substrate and Instream Cover</b>					
Epifaunal Substrate/ Avail Cover (20)	16	6	14	5	11
Embeddedness (20)*			15		7
Velocity/Depth Regime (20)*			10		14
Pool Substrate Characterization (20)**	11	5		6	
Pool Variability (20)**	16	13		10	
<b>Channel Morphology</b>					
Sediment Deposition (20)	12	4	13	6	10
Flow Status - Maint. Flow Volume (10)	8	8	7	8	9
Flow Status - Flashiness (10)	2	2	4	2	8
Channel Alteration (20)	18	17	14	10	15
Frequency of Riffles/Bends (20)*			16		10
Channel Sinuosity (20)**	17	18		6	
<b>Riparian and Bank Structure</b>					
Bank Stability (L) (10)	8	8	8	4	7
Bank Stability (R) (10)	5	5	8	4	7
Vegetative Protection (L) (10)	10	9	7	4	6
Vegetative Protection (R) (10)	9	9	4	4	6
Riparian Veg. Zone Width (L) (10)	10	10	8	7	5
Riparian Veg. Zone Width (R) (10)	3	10	2	4	8
<b>TOTAL SCORE (200):</b>	<b>145</b>	<b>124</b>	<b>130</b>	<b>80</b>	<b>123</b>
<b>HABITAT RATING:</b>	<b>GOOD</b> (SLIGHTLY IMPAIRED)	<b>GOOD</b> (SLIGHTLY IMPAIRED)	<b>GOOD</b> (SLIGHTLY IMPAIRED)	<b>MARGINAL</b> (MODERATELY IMPAIRED)	<b>GOOD</b> (SLIGHTLY IMPAIRED)
Note: Individual metrics may better describe conditions directly affecting the biological community while the Habitat Rating describes the general riverine environment at the site(s)					
Date:	7/27/2011	7/27/2011	7/27/2011	8/5/2011	9/29/2011
Weather:	Partly Cloudy	Rainy	Cloudy	Sunny	Partly Cloudy
Air Temperature:	80 Deg. F.	80 Deg. F.	80 Deg. F.	80 Deg. F.	64 Deg. F.
Water Temperature:	76 Deg. F.	78 Deg. F.	70 Deg. F.	75 Deg. F.	58 Deg. F.
Ave. Stream Width:	80 Feet	100 Feet	8 Feet	14 Feet	14 Feet
Ave. Stream Depth:	1.5 Feet	2.5 Feet	0.3 Feet	1.8 Feet	1 Feet
Surface Velocity:	1 Ft./Sec.	0.5 Ft./Sec.	1 Ft./Sec.	1.1 Ft./Sec.	0.4 Ft./Sec.
Estimated Flow:	120 CFS	125 CFS	2.4 CFS	27.72 CFS	5.6 CFS
Stream Modifications:	Bank Stabilization	Bank Stabilization	Canopy Removal	Dredged	Habitat Improvement
Nuisance Plants (Y/N):	N	N	N	N	N
Report Number:					
STORET No.:	230253	330433	230251	230233	230247
Stream Name:	Grand River upstream Columbia	Grand River Off Waverly Road (Birchfield Park)	Silver Creek downstream Bridge Hwy	Carrier Creek Off Williamsburg	Carrier Creek off North Ridge Court
Road Crossing/Location:	Road				
County Code:	23	33	23	23	23
TRS:	02N03W12	03N02W31	03N03W16	04N03W15	04N03W10
Latitude (dd):	42.578802	42.6023	42.64009	42.7310422	42.74477
Longitude (dd):	-84.6027976	-84.59364	-84.66247	-84.6559573	-84.652437
Ecoregion:	SMNITP	SMNITP	SMNITP	SMNITP	SMNITP
Stream Type:	Warmwater	Warmwater	Warmwater	Warmwater	Warmwater
USGS Basin Code:	4050004	4050004	4050004	4050004	4050005

\* Applies only to Riffle/Run stream Survey;

\*\* Applies only to Glide/Pool stream Survey;

Table 2. Habitat evaluations for streams in the Upper Grand River watershed, 2011

	<b>STATION 21</b> Carrier Creek Willow Creek Drive RIFFLE/RUN	<b>STATION 22</b> Carrier Creek upstream Old River Road RIFFLE/RUN	<b>STATION 23</b> Frayer Creek Eaton Highway RIFFLE/RUN	<b>STATION 24</b> Grand River end of Erdman Road GLIDE/POOL	<b>STATION 25</b> Goose Creek Pline Road GLIDE/POOL
<b>HABITAT METRIC</b>					
<b>Substrate and Instream Cover</b>					
Epifaunal Substrate/ Avail Cover (20)	11	13	11	17	10
Embeddedness (20)*	8	12	13		
Velocity/Depth Regime (20)*	19	11	13		
Pool Substrate Characterization (20)**				11	8
Pool Variability (20)**				15	7
<b>Channel Morphology</b>					
Sediment Deposition (20)	13	10	10	16	8
Flow Status - Maint. Flow Volume (10)	9	9	9	10	8
Flow Status - Flashiness (10)	8	6	3	9	4
Channel Alteration (20)	15	15	10	20	11
Frequency of Riffles/Bends (20)*	19	11	12		
Channel Sinuosity (20)**				20	11
<b>Riparian and Bank Structure</b>					
Bank Stability (L) (10)	9	6	2	9	6
Bank Stability (R) (10)	6	6	2	9	6
Vegetative Protection (L) (10)	6	9	5	8	8
Vegetative Protection (R) (10)	6	5	7	10	8
Riparian Veg. Zone Width (L) (10)	5	9	1	9	6
Riparian Veg. Zone Width (R) (10)	2	4	3	10	9
<b>TOTAL SCORE (200):</b>	<b>136</b>	<b>126</b>	<b>101</b>	<b>173</b>	<b>110</b>
<b>HABITAT RATING:</b>	<b>GOOD</b> (SLIGHTLY IMPAIRED)	<b>GOOD</b> (SLIGHTLY IMPAIRED)	<b>MARGINAL</b> (MODERATELY IMPAIRED)	<b>EXCELLENT</b> (NON- IMPAIRED)	<b>GOOD</b> (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:	9/29/2011	9/29/2011	8/5/2011	9/29/2011	8/5/2011
Weather:	Cloudy	Cloudy	Sunny	Cloudy	Sunny
Air Temperature:	62 Deg. F.	65 Deg. F.	78 Deg. F.	58 Deg. F.	68 Deg. F.
Water Temperature:	58 Deg. F.	52 Deg. F.	67 Deg. F.	58 Deg. F.	65 Deg. F.
Ave. Stream Width:	9 Feet	18 Feet	14 Feet	110 Feet	12 Feet
Ave. Stream Depth:	1 Feet	2 Feet	0.5 Feet	3.5 Feet	1 Feet
Surface Velocity:	0.71 Ft./Sec.	0.5 Ft./Sec.	1 Ft./Sec.	1.25 Ft./Sec.	0.5 Ft./Sec.
Estimated Flow:	6.39 CFS	18 CFS	7 CFS	481.25 CFS	6 CFS
Stream Modifications:	no Improvement	Habitat Improvement	Dredged	None	Dredged
Nuisance Plants (Y/N):	N	N	N	N	N
Report Number:					
STORET No.:	230199	230136	230252	340243	340202
Stream Name:	Carrier Creek Willow Creek	Carrier Creek upstream Old	Frayer Creek	Grand River end of Erdman	Goose Creek
Road Crossing/Location:	Drive	River Road	Eaton Highway	Road	Pline Road
County Code:	23	23	23	34	34
TRS:	04N03W10	04N03W03	04N04W06	05N05W18	07N05W35
Latitude (dd):	42.75237	42.75955	42.77049	42.81445	42.9364
Longitude (dd):	-84.65516	-84.65486	-84.8345	-84.935973	-84.8754
Ecoregion:	SMNITP	SMNITP	SMNITP	SMNITP	SMNITP
Stream Type:	Warmwater	Warmwater	Coldwater	Warmwater	Coldwater
USGS Basin Code:	4050004	4050004	4050004	4050004	4050004

\* Applies only to Riffle/Run stream Survey;

\*\* Applies only to Glide/Pool stream Survey;



Table 3A. Qualitative macroinvertebrate sampling results for the Upper Grand River watershed, 2011.

TAXA	Grand River	Center Lake Outlet	Grand River	Portage River
	Reed Road 8/10/2011 STATION 1	Falahee Road 8/10/2011 STATION 2	W Monroe Avenue 7/26/2011 STATION 3	M-106 7/26/2011 STATION 4
<b>PLATYHELMINTHES (flatworms)</b>				
Turbellaria		4	2	
<b>ANNELIDA (segmented worms)</b>				
Hirudinea (leeches)		2	1	
Oligochaeta (worms)		4	12	8
<b>ARTHROPODA</b>				
<b>Crustacea</b>				
Amphipoda (scuds)	59	87	61	8
Decapoda (crayfish)	2	1	1	1
Isopoda (sowbugs)			9	229
<b>Arachnoidea</b>				
Hydracarina	1	1		3
<b>Insecta</b>				
<b>Ephemeroptera (mayflies)</b>				
Baetidae	20		1	1
Caenidae				1
Heptageniidae	41		14	4
Tricorythidae	13		5	
<b>Odonata</b>				
<b>Anisoptera (dragonflies)</b>				
Aeshnidae	2			
Gomphidae	9			
Libellulidae	1	1	1	
<b>Zygoptera (damselflies)</b>				
Calopterygidae	1	3	1	
Coenagrionidae		37	1	1
<b>Hemiptera (true bugs)</b>				
Belostomatidae				1
Corixidae	4			7
Gerridae	1	2	1	1
Nepidae		1		1
Notonectidae				2
Pleidae	2			1
<b>Megaloptera</b>				
Sialidae (alder flies)				1
<b>Trichoptera (caddisflies)</b>				
Brachycentridae	18		25	
Hydropsychidae	13	60	15	1
Hydroptilidae		2		
Leptoceridae	22	4	14	2
Limnephilidae	1		1	
Molannidae	1			
Philopotamidae	2		3	
Polycentropodidae			1	31
<b>Lepidoptera (moths)</b>				
Pyalidae		2		
<b>Coleoptera (beetles)</b>				
Dytiscidae (total)	1			
Gyrinidae (adults)	2		1	1
Halplidae (adults)				3
Elmidae	17	22	27	
Psephenidae (larvae)	1			
<b>Diptera (flies)</b>				
Chironomidae	9	19	25	8
Simuliidae	8			
Tabanidae		1	1	
<b>MOLLUSCA</b>				
<b>Gastropoda (snails)</b>				
Ancylidae (limpets)	1		1	
Hydrobiidae		1	7	1
Physidae	2	2	1	
Planorbidae		7		1
<b>Pelecypoda (bivalves)</b>				
Sphaeriidae (clams)		17	31	2
<b>TOTAL INDIVIDUALS</b>	254	280	263	320

Table 3B. Macroinvertebrate metric evaluation of the Upper Grand River watershed, 2011.

METRIC	Grand River		Center Lake Outlet		Grand River		Portage River	
	Value	Score	Value	Score	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	27	1	22	0	27	1	25	1
NUMBER OF MAYFLY TAXA	3	0	0	-1	3	0	3	0
NUMBER OF CADDISFLY TAXA	6	1	3	0	6	1	3	0
NUMBER OF STONEFLY TAXA	0	-1	0	-1	0	-1	0	-1
PERCENT MAYFLY COMP.	29.13	1	0.00	-1	7.60	0	1.88	-1
PERCENT CADDISFLY COMP.	22.44	0	23.57	0	22.43	0	10.63	0
PERCENT DOMINANT TAXON	23.23	0	31.07	0	23.19	0	71.56	-1
PERCENT ISOPOD, SNAIL, LEECH	1.18	1	4.29	0	7.22	0	72.19	-1
PERCENT SURF. AIR BREATHERS	3.94	1	1.07	1	0.76	1	5.31	1
<b>TOTAL SCORE</b>		4		-2		2		-2
<b>MACROINV. COMMUNITY RATING</b>		ACCEPT.		ACCEPT.		ACCEPT.		ACCEPT.

Table 3A. Qualitative macroinvertebrate sampling results for the Upper Grand River watershed, 2011.

TAXA	Orchard Creek Coonhill Road 9/27/2011 STATION 5	Orchard Creek Kennedy Road 9/27/2011 STATION 6	Orchard Creek Plum Orchard Road 9/27/2011 STATION 7	Cahaogan Creek Decamp Road 7/25/2011 STATION 8
<b>PLATYHELMINTHES (flatworms)</b>				
Turbellaria	1			
<b>ANNELIDA (segmented worms)</b>				
Hirudinea (leeches)	1			2
Oligochaeta (worms)	3	24	5	10
<b>ARTHROPODA</b>				
<b>Crustacea</b>				
Amphipoda (scuds)	7	22	22	78
Decapoda (crayfish)				1
Isopoda (sowbugs)	96	89	3	1
<b>Arachnoidea</b>				
Hydracarina	1			1
<b>Insecta</b>				
<b>Ephemeroptera (mayflies)</b>				
Baetidae		1	14	1
Caenidae		1		25
Heptageniidae	5	4	40	
<b>Odonata</b>				
<b>Anisoptera (dragonflies)</b>				
Aeshnidae				1
Gomphidae		1		1
Libellulidae				23
<b>Zygoptera (damselflies)</b>				
Calopterygidae	5	9	34	1
Coenagrionidae	4	1		10
<b>Hemiptera (true bugs)</b>				
Belostomatidae	8	4	2	8
Corixidae	43	39	17	4
Gerridae	1	1		1
Nepidae	1	1	3	1
Notonectidae	1	6	1	1
Pleidae	29	4	10	12
Veliidae				2
<b>Megaloptera</b>				
Corydalidae (dobson flies)			1	
Sialidae (alder flies)	1	2		2
<b>Neuroptera (spongilla flies)</b>				
Sisyridae				1
<b>Trichoptera (caddisflies)</b>				
Hydropsychidae	1	4	14	1
Leptoceridae			5	3
Limnephilidae	1		3	
Molannidae			1	
Polycentropodidae	1	1		
<b>Coleoptera (beetles)</b>				
Dytiscidae (total)	7	10		
Gyrinidae (adults)	2			
Haliplidae (adults)	12	1	9	10
Hydrophilidae (total)		1		2
Elmidae	1	1		1
Scirtidae (larvae)				1
<b>Diptera (flies)</b>				
Ceratopogonidae		1		2
Chironomidae	18	16	34	12
Culicidae				1
Simuliidae			3	
Stratiomyidae		3	1	1
Tabanidae	1	4		2
Tipulidae		2	1	
<b>MOLLUSCA</b>				
<b>Gastropoda (snails)</b>				
Physidae				4
Planorbidae			1	2
<b>Pelecypoda (bivalves)</b>				
Sphaeriidae (clams)	1		6	41
<b>TOTAL INDIVIDUALS</b>	<b>252</b>	<b>253</b>	<b>230</b>	<b>270</b>

Table 3B. Macroinvertebrate metric evaluation of the Upper Grand River watershed, 2011.

METRIC	Orchard Creek Coonhill Road 9/27/2011 STATION 5		Orchard Creek Kennedy Road 9/27/2011 STATION 6		Orchard Creek Plum Orchard Road 9/27/2011 STATION 7		Cahaogan Creek Decamp Road 7/25/2011 STATION 8	
	Value	Score	Value	Score	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	26	1	27	1	23	0	36	1
NUMBER OF MAYFLY TAXA	1	-1	3	0	2	0	2	0
NUMBER OF CADDISFLY TAXA	3	0	2	0	4	0	2	0
NUMBER OF STONEFLY TAXA	0	-1	0	-1	0	-1	0	-1
PERCENT MAYFLY COMP.	1.98	-1	2.37	-1	23.48	1	9.63	0
PERCENT CADDISFLY COMP.	1.19	-1	1.98	-1	10.00	0	1.48	-1
PERCENT DOMINANT TAXON	38.10	-1	35.18	0	17.39	1	28.89	0
PERCENT ISOPOD, SNAIL, LEECH	38.49	-1	35.18	-1	1.74	1	3.33	1
PERCENT SURF. AIR BREATHERS	41.27	-1	27.67	-1	18.70	0	15.93	0
<b>TOTAL SCORE</b>		<b>-6</b>		<b>-4</b>		<b>2</b>		<b>0</b>
<b>MACROINV. COMMUNITY RATING</b>		<b>POOR</b>		<b>ACCEPT.</b>		<b>ACCEPT.</b>		<b>ACCEPT.</b>

Table 3A. Qualitative macroinvertebrate sampling results for the Upper Grand River watershed, 2011.

TAXA	Sandstone Creek Cuff Road 9/28/2011	Sandstone Creek Roth Road 9/28/2011	Albrow Creek Broughwell Road 7/26/2011	Spring Brook Robbins Road 7/26/2011
	STATION 9	STATION 10	STATION 11	STATION 12
PLATYHELMINTHES (flatworms)				
Turbellaria				2
ANNELIDA (segmented worms)				
Hirudinea (leeches)		1	1	1
Oligochaeta (worms)	4	1	4	3
ARTHROPODA				
Crustacea				
Amphipoda (scuds)	25	51	113	27
Decapoda (crayfish)	2	1	1	
Isopoda (sowbugs)			1	
Arachnoidea				
Hydracarina		2		
Insecta				
Ephemeroptera (mayflies)				
Baetiscidae		1		
Baetidae	37	70		21
Caenidae	2			8
Heptageniidae	39	39	4	10
Isonychiidae		11		
Leptophlebiidae	6			
Odonata				
Anisoptera (dragonflies)				
Aeshnidae	1	1	13	1
Gomphidae		6		
Libellulidae			1	
Zygoptera (damselflies)				
Calopterygidae	40	8	21	19
Coenagrionidae				18
Plecoptera (stoneflies)				
Perlidae	4	4		
Hemiptera (true bugs)				
Belostomatidae	4	1		
Corixidae		2	1	1
Gerridae			1	2
Nepidae	1	1		
Veliidae			1	
Megaloptera				
Corydalidae (dobson flies)	2	1	1	
Sialidae (alder flies)			6	
Trichoptera (caddisflies)				
Brachycentridae		1		7
Glossomatidae			1	
Hydropsychidae	28	51	3	5
Hydroptilidae				5
Leptoceridae		2		74
Molannidae			1	
Philopotamidae		8		
Phryganeidae			1	
Polycentropodidae			1	
Coleoptera (beetles)				
Dytiscidae (total)				1
Hydrophilidae (total)			3	
Elmidae	16	13	8	29
Halplidae (larvae)				1
Diptera (flies)				
Ceratopogonidae	1			
Chironomidae	2	4	37	25
Culicidae				2
Dixidae				1
Simuliidae	35	25	11	14
Stratiomyidae				1
Tabanidae	1	1		
Tipulidae	13	5	1	
MOLLUSCA				
Gastropoda (snails)				
Physidae	1		2	3
Pelecypoda (bivalves)				
Sphaeriidae (clams)	1	3		3
<b>TOTAL INDIVIDUALS</b>	<b>265</b>	<b>314</b>	<b>238</b>	<b>284</b>

Table 3B. Macroinvertebrate metric evaluation of the Upper Grand River watershed, 2011.

METRIC	Sandstone Creek Cuff Road 9/28/2011		Sandstone Creek Roth Road 9/28/2011		Albrow Creek Broughwell Road 7/26/2011		Spring Brook Robbins Road 7/26/2011	
	Value	Score	Value	Score	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	22	0	27	1	25	1	26	1
NUMBER OF MAYFLY TAXA	4	1	4	1	1	0	3	0
NUMBER OF CADDISFLY TAXA	1	-1	4	0	5	1	4	0
NUMBER OF STONEFLY TAXA	1	1	1	1	0	-1	0	-1
PERCENT MAYFLY COMP.	31.70	1	38.54	1	1.68	-1	13.73	0
PERCENT CADDISFLY COMP.	10.57	0	19.75	0	2.94	-1	32.04	1
PERCENT DOMINANT TAXON	15.09	1	22.29	0	47.48	-1	26.06	0
PERCENT ISOPOD, SNAIL, LEECH	0.38	1	0.32	1	1.68	1	1.41	1
PERCENT SURF. AIR BREATHERS	1.89	1	1.27	1	2.52	1	2.46	1
<b>TOTAL SCORE</b>		<b>5</b>		<b>6</b>		<b>0</b>		<b>3</b>
<b>MACROINV. COMMUNITY RATING</b>		<b>EXCELLENT</b>		<b>EXCELLENT</b>		<b>ACCEPT.</b>		<b>ACCEPT.</b>

Table 3A. Qualitative macroinvertebrate sampling results for the Upper Grand River watershed, 2011.

TAXA	Perry Creek Olds Road 7/25/2011 STATION 13	Perry Creek Bellevue Road 7/27/2011 STATION 14	North Onondaga Drain Aurelius Road 7/27/2011 STATION 15	Grand River upstream Columbia Road 7/27/2011 STATION 16
<b>ANNELIDA (segmented worms)</b>				
Hirudinea (leeches)				1
Oligochaeta (worms)		1	11	2
<b>ARTHROPODA</b>				
<b>Crustacea</b>				
Amphipoda (scuds)	145	123	84	6
Decapoda (crayfish)	2	1	1	
Isopoda (sowbugs)			36	
<b>Arachnoidea</b>				
Hydracarina		1	2	
<b>Insecta</b>				
<b>Ephemeroptera (mayflies)</b>				
Baetidae	2	1	14	16
Caenidae				5
Ephemerellidae				1
Heptageniidae	2			70
Isonychiidae				15
Polymitarcyidae				7
Tricorythidae				2
<b>Odonata</b>				
<b>Anisoptera (dragonflies)</b>				
Aeshnidae	1	1		
Gomphidae				7
Libellulidae	1			
<b>Zygotera (damselflies)</b>				
Calopterygidae	1	1	2	
<b>Plecoptera (stoneflies)</b>				
Perlidae				1
<b>Hemiptera (true bugs)</b>				
Belostomatidae	1		2	
Corixidae	22	1		
Gerridae		2		1
Notonectidae	1	1		
Pleidae			2	
Velidae		1		
<b>Megaloptera</b>				
Sialidae (alder flies)	16	9	3	
<b>Trichoptera (caddisflies)</b>				
Brachycentridae				31
Hydropsychidae	19	20	29	31
Lepidostomatidae	1	1	2	
Leptoceridae				18
Molannidae	3	3		
Philopotamidae				4
Phryganeidae	1			
Polycentropodidae	1			5
<b>Coleoptera (beetles)</b>				
Dytiscidae (total)	1	2	1	
Gyrinidae (adults)		1		1
Halplidae (adults)	1	1	1	
Hydrophilidae (total)		4	1	
Dryopidae		1	1	
Elmidae	3	6	4	12
<b>Diptera (flies)</b>				
Chironomidae	19	34	72	15
Culicidae			1	
Dixidae		1		
Simuliidae	26	16	3	1
Tabanidae	1		1	3
Tipulidae		1		
<b>MOLLUSCA</b>				
<b>Gastropoda (snails)</b>				
Ancylidae (limpets)	1	2	1	
Lymnaeidae				1
Physidae	5	42	9	
Planorbidae			2	1
<b>Pelecypoda (bivalves)</b>				
Sphaeriidae (clams)	3	1		
<b>TOTAL INDIVIDUALS</b>	<b>279</b>	<b>279</b>	<b>285</b>	<b>257</b>

Table 3B. Macroinvertebrate metric evaluation of the Upper Grand River watershed, 2011.

METRIC	Perry Creek Olds Road 7/25/2011 STATION 13		Perry Creek Bellevue Road 7/27/2011 STATION 14		North Onondaga Drain Aurelius Road 7/27/2011 STATION 15		Grand River upstream Columbia Road 7/27/2011 STATION 16	
	Value	Score	Value	Score	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	25	1	28	1	24	0	25	1
NUMBER OF MAYFLY TAXA	2	0	1	0	1	0	7	1
NUMBER OF CADDISFLY TAXA	5	1	3	0	2	0	5	1
NUMBER OF STONEFLY TAXA	0	-1	0	-1	0	-1	1	1
PERCENT MAYFLY COMP.	1.43	-1	0.36	-1	4.91	0	45.14	1
PERCENT CADDISFLY COMP.	8.96	0	8.60	0	10.88	0	34.63	1
PERCENT DOMINANT TAXON	51.97	-1	44.09	-1	29.47	0	27.24	0
PERCENT ISOPOD, SNAIL, LEECH	2.15	1	15.77	-1	16.84	-1	1.17	1
PERCENT SURF. AIR BREATHERS	9.32	0	4.66	1	2.81	1	0.78	1
<b>TOTAL SCORE</b>		<b>0</b>		<b>-2</b>		<b>-1</b>		<b>8</b>
<b>MACROINV. COMMUNITY RATING</b>		<b>ACCEPT.</b>		<b>ACCEPT.</b>		<b>ACCEPT.</b>		<b>EXCELLENT</b>

Table 3A. Qualitative macroinvertebrate sampling results for the Upper Grand River watershed, 2011.

TAXA	Grand River	Silver Creek	Carrier Creek	Carrier Creek
	Off Waverly Road (Birchfield Park) 7/27/2011 STATION 17	downstream Bridge Hwy 7/27/2011 STATION 18	Off Williamsburg Road 8/5/2011 STATION 19	off North Ridge Court 9/29/2011 STATION 20
PLATYHELMINTHES (flatworms)				
Turbellaria		33		1
ANNELIDA (segmented worms)				
Hirudinea (leeches)		1	2	
Oligochaeta (worms)	13	9	1	14
ARTHROPODA				
Crustacea				
Amphipoda (scuds)	25	59	45	11
Decapoda (crayfish)			1	
Isopoda (sowbugs)		84		2
Arachnoidea				
Hydracarina	1	2		
Insecta				
Ephemeroptera (mayflies)				
Baetidae	27	2	2	3
Caenidae	48		4	1
Heptageniidae	16	1		
Isonychiidae	1			
Tricorythidae	4			
Odonata				
Anisoptera (dragonflies)				
Gomphidae	15			
Libellulidae	1		1	1
Zygotera (damselflies)				
Calopterygidae			12	11
Coenagrionidae	2		2	91
Hemiptera (true bugs)				
Belostomatidae	1			1
Corixidae	2		18	4
Gerridae	7	4		
Nepidae				2
Notonectidae		1	1	
Pleidae	3			3
Megaloptera				
Sialidae (alder flies)	1		1	
Trichoptera (caddisflies)				
Brachycentridae	9			
Glossosomatidae		3		
Hydropsychidae	8	1	60	17
Hydroptilidae	2	1	3	
Leptoceridae	21	1	3	
Philopotamidae	3			
Polycentropodidae	1			
Coleoptera (beetles)				
Dytiscidae (total)		1	1	
Gyrinidae (adults)		1		
Halplidae (adults)	1			6
Hydrophilidae (total)				2
Elmidae	23	9	17	1
Diptera (flies)				
Chironomidae	61	8	71	174
Culicidae	1		1	
Simuliidae	1	1	20	5
Tabanidae	9			
Tipulidae		4		2
MOLLUSCA				
Gastropoda (snails)				
Ancylidae (limpets)	1			17
Physidae	2	3	21	14
Planorbidae			1	
Pelecypoda (bivalves)				
Sphaeriidae (clams)	1	3	14	17
<b>TOTAL INDIVIDUALS</b>	<b>311</b>	<b>232</b>	<b>302</b>	<b>400</b>

Table 3B. Macroinvertebrate metric evaluation of the Upper Grand River watershed, 2011.

METRIC	Grand River		Silver Creek		Carrier Creek		Carrier Creek	
	Off Waverly Road (Birchfield Park) 7/27/2011 STATION 17	Value	Score	downstream Bridge Hwy 7/27/2011 STATION 18	Value	Score	Off Williamsburg Road 8/5/2011 STATION 19	Value
TOTAL NUMBER OF TAXA	31	1	22	0	23	0	23	0
NUMBER OF MAYFLY TAXA	5	1	2	0	2	0	2	0
NUMBER OF CADDISFLY TAXA	6	1	4	0	3	0	1	-1
NUMBER OF STONEFLY TAXA	0	-1	0	-1	0	-1	0	-1
PERCENT MAYFLY COMP.	30.87	1	1.29	-1	1.99	-1	1.00	-1
PERCENT CADDISFLY COMP.	14.15	0	2.59	-1	21.85	0	4.25	0
PERCENT DOMINANT TAXON	19.61	1	36.21	0	23.51	0	43.50	-1
PERCENT ISOPOD, SNAIL, LEECH	0.96	1	37.93	-1	7.95	0	8.25	0
PERCENT SURF. AIR BREATHERS	4.82	1	3.02	1	6.95	1	4.50	1
<b>TOTAL SCORE</b>		<b>6</b>		<b>-3</b>		<b>-1</b>		<b>-3</b>
<b>MACROINV. COMMUNITY RATING</b>		<b>EXCELLENT</b>		<b>ACCEPT.</b>		<b>ACCEPT.</b>		<b>ACCEPT.</b>

Table 3A. Qualitative macroinvertebrate sampling results for the Upper Grand River watershed, 2011.

TAXA	Carrier Creek	Carrier Creek	Frayer Creek	Grand River
	Willow Creek Drive 9/29/2011 STATION 21	upstream Old River Road 9/29/2011 STATION 22	Eaton Highway 8/5/2011 STATION 23	end of Erdman Road 9/29/2011 STATION 24
PORIFERA (sponges)				1
PLATYHELMINTHES (flatworms)				
Turbellaria	12	14	1	
ANNELIDA (segmented worms)				
Hirudinea (leeches)		1	1	
Oligochaeta (worms)	1	15	2	2
ARTHROPODA				
Crustacea				
Amphipoda (scuds)	35	11	250	18
Decapoda (crayfish)	1	1	1	
Isopoda (sowbugs)	14	13	2	
Arachnoidea				
Hydracarina	1	1	1	
Insecta				
Ephemeroptera (mayflies)				
Baetidae	37	32	1	67
Caenidae			1	
Ephemerellidae				12
Ephemeridae				1
Heptageniidae			1	30
Isonychiidae				11
Tricorythidae				11
Odonata				
Anisoptera (dragonflies)				
Aeshnidae	1	1	1	
Zygoptera (damselflies)				
Calopterygidae	9	4	1	1
Coenagrionidae	19	70		13
Plecoptera (stoneflies)				
Perlidae				2
Hemiptera (true bugs)				
Belostomatidae	1	1	2	1
Corixidae	1	5	1	20
Gerridae	1	1		2
Mesoveliidae	2	1		1
Nepidae	1	1		1
Pleidae	1	1		
Veliidae			1	
Megaloptera				
Sialidae (alder flies)			1	
Trichoptera (caddisflies)				
Brachycentridae				2
Helicopsychidae			14	
Hydropsychidae	64	22	18	15
Leptoceridae		1	1	3
Limnephilidae			1	
Polycentropodidae				2
Coleoptera (beetles)				
Dytiscidae (total)	3			1
Halplidae (adults)				1
Dryopidae		1		1
Elmidae	2	6	12	10
Halplidae (larvae)			1	
Psephenidae (larvae)	3			
Scirtidae (larvae)				2
Diptera (flies)				
Ceratopogonidae		1		1
Chironomidae	45	25	9	35
Culicidae				1
Dixidae			1	
Simuliidae	15	13	1	1
Stratiomyidae			1	
Tabanidae		1		
Tipulidae	1	1		1
MOLLUSCA				
Gastropoda (snails)				
Ancylidae (limpets)	1			1
Hydrobiidae			1	
Physidae		18	8	1
Pelecypoda (bivalves)				
Pisidiidae			3	
Sphaeriidae (clams)	1	4	3	2
Unionidae (mussels)				1
<b>TOTAL INDIVIDUALS</b>	<b>272</b>	<b>266</b>	<b>342</b>	<b>275</b>

Table 3B. Macroinvertebrate metric evaluation of the Upper Grand River watershed, 2011.

METRIC	Carrier Creek		Carrier Creek		Frayer Creek		Grand River	
	Willow Creek Drive		upstream Old River Road		Eaton Highway		end of Erdman Road	
	Value	Score	Value	Score	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	25	1	28	1	30	1	35	1
NUMBER OF MAYFLY TAXA	1	0	1	-1	3	0	6	1
NUMBER OF CADDISFLY TAXA	1	-1	2	0	4	0	4	0
NUMBER OF STONEFLY TAXA	0	-1	0	-1	0	-1	1	1
PERCENT MAYFLY COMP.	13.60	0	12.03	0	0.88	-1	48.00	1
PERCENT CADDISFLY COMP.	23.53	0	8.65	0	9.94	0	8.00	0
PERCENT DOMINANT TAXON	23.53	0	26.32	0	73.10	-1	24.36	0
PERCENT ISOPOD, SNAIL, LEECH	5.51	0	12.03	-1	3.51	1	0.73	1
PERCENT SURF. AIR BREATHERS	3.68	1	3.76	1	1.46	1	10.18	0
<b>TOTAL SCORE</b>		<b>0</b>		<b>-1</b>		<b>0</b>		<b>5</b>
<b>MACROINV. COMMUNITY RATING</b>		<b>ACCEPT.</b>		<b>ACCEPT.</b>		<b>ACCEPT.</b>		<b>EXCELLENT</b>

Table 3A. Qualitative macroinvertebrate sampling results for the Upper Grand River watershed, 2011.

TAXA	Goose Creek Pline Road 8/5/2011 STATION 25	
	Value	Score
ANNELIDA (segmented worms)		
Oligochaeta (worms)	3	
ARTHROPODA		
Crustacea		
Amphipoda (scuds)	80	
Decapoda (crayfish)	8	
Isopoda (sowbugs)	13	
Insecta		
Ephemeroptera (mayflies)		
Baetidae	5	
Heptageniidae	2	
Odonata		
Anisoptera (dragonflies)		
Aeshnidae	7	
Zygoptera (damselflies)		
Calopterygidae	4	
Hemiptera (true bugs)		
Corixidae	13	
Megaloptera		
Sialidae (alder flies)	1	
Trichoptera (caddisflies)		
Hydropsychidae	16	
Lepidostomatidae	2	
Limnephilidae	6	
Phryganeidae	1	
Coleoptera (beetles)		
Haliplidae (adults)	4	
Elmidae	33	
Diptera (flies)		
Chironomidae	40	
Culicidae	1	
Dixidae	1	
Tabanidae	4	
Tipulidae	1	
MOLLUSCA		
Gastropoda (snails)		
Ancylidae (limpets)	1	
Physidae	8	
Pelecypoda (bivalves)		
Sphaeriidae (clams)	1	
<b>TOTAL INDIVIDUALS</b>	<b>255</b>	

Table 3B. Macroinvertebrate metric evaluation of the Upper Grand River watershed, 2011.

METRIC	Goose Creek Pline Road 8/5/2011 STATION 25	
	Value	Score
TOTAL NUMBER OF TAXA	24	0
NUMBER OF MAYFLY TAXA	2	0
NUMBER OF CADDISFLY TAXA	4	0
NUMBER OF STONEFLY TAXA	0	-1
PERCENT MAYFLY COMP.	2.75	-1
PERCENT CADDISFLY COMP.	9.80	0
PERCENT DOMINANT TAXON	31.37	0
PERCENT ISOPOD, SNAIL, LEECH	8.63	0
PERCENT SURF. AIR BREATHERS	7.06	0
<b>TOTAL SCORE</b>		<b>-2</b>
<b>MACROINV. COMMUNITY RATING</b>		<b>ACCEPT.</b>

Table 4. A summary of historic and current P51 macroinvertebrate community scores (A), macroinvertebrate taxa richness (B), and Ephemeroptera, Plecoptera, and Trichoptera (EPT) taxa richness and proportion of the macroinvertebrate community (C).

<b>A</b>		<b>P51 Scores</b>					
		Year					
Station	#	1989	1996	2001	2006	2009	2011
off of Williamsburg Rd	A				-4	-2	-1
u/s Saginaw Hwy	B			-4			
off of North Ridge Court	C					-2	-3
Off of Willow Woods Lane	D			-2	-3	1	0
Willow Hwy	E		-2	-2			
Old River Road	F	not scored					-1

<b>B</b>		<b>Macroinvertebrate Taxa Richness</b>					
		Year					
Station	#	1989	1996	2001	2006	2009	2011
off of Williamsburg Rd	A				14	24	23
u/s Saginaw Hwy	B			13			
off of North Ridge Court	C					21	23
Off of Willow Woods Lane	D			19	18	22	25
Willow Hwy	E		15	12			
Old River Road	F	10					28

<b>C</b>		<b>EPT (taxa richness / % community)</b>					
		Year					
Station	#	1989	1996	2001	2006	2009	2011
off of Williamsburg Rd	A				2 / 0.76%	3 / 41.05%	5 / 23.84%
u/s Saginaw Hwy	B			2 / 10%			
off of North Ridge Court	C					3 / 18.1%	3 / 5.25%
Off of Willow Woods Lane	D			3 / 19.2%	3 / 18.38%	2 / 45.63%	2 / 37.13%
Willow Hwy	E		3 / 25.55%	2 / 20%			
Old River Road	F	not scored					3 / 18.68%