

**MICHIGAN DEPARTMENT OF NATURAL RESOURCES & ENVIRONMENT**  
WATER RESOURCES DIVISION  
JANUARY 2011

STAFF REPORT

BIOLOGICAL SURVEYS OF SELECTED SAGINAW RIVER TRIBUTARIES IN  
BAY, SAGINAW AND TUSCOLA COUNTIES  
JULY 2009

As part of the Water Quality Monitoring Program of the Water Bureau, staff of the Surface Water Assessment Section, conducted qualitative biological surveys of selected Saginaw River mainstem and tributary locations in Bay, Saginaw, and Tuscola Counties in July 2009. The Saginaw River mainstem is formed by confluence of flows from the Tittabawassee and Shiawassee Rivers and lies in the Huron-Erie Lake Plain ecoregion (Omernik, and Gallant, 1988). Qualitative macroinvertebrate, habitat and chemical surveys were conducted throughout the watersheds following the Great Lakes Environmental Assessment Section, Procedure 51 (MDEQ, 1990; and Creal et al., 1996), the nonwadeable assessment protocol (MDEQ, 2009, Draft), and the status and trend procedure (MDEQ, In preparation). Visual observations were also preformed at all locations (Figure 1, Table 1).

**OBJECTIVES**

The biological survey of the Saginaw River Tributaries located in Bay, Saginaw and Tuscola Counties was conducted to:

- Support water quality based effluent limit development for National Pollutant Discharge Elimination System permits.
- Identify nonpoint sources of water quality impairment.
- Evaluate the effectiveness of specific nonpoint source water quality improvement projects.
- Assess the current status and condition of individual assessment units and determine whether Water Quality Standards are being met.
- Evaluate biological integrity temporal trends.
- Area of Concern and/or specific contaminated site remediation monitoring.
- Satisfy 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 2010 Integrated Report (LeSage and Smith, 2010)

**BACKGROUND AND HISTORICAL SAMPLING EFFORT**

The Saginaw River main stem and tributaries are all located in the Huron-Erie Lake Plain Ecoregion. These watersheds drain streams that are commonly channelized and intermittent. The predominant land use consists primarily of agriculture and urban use (Omernik and Gallant, 1988).

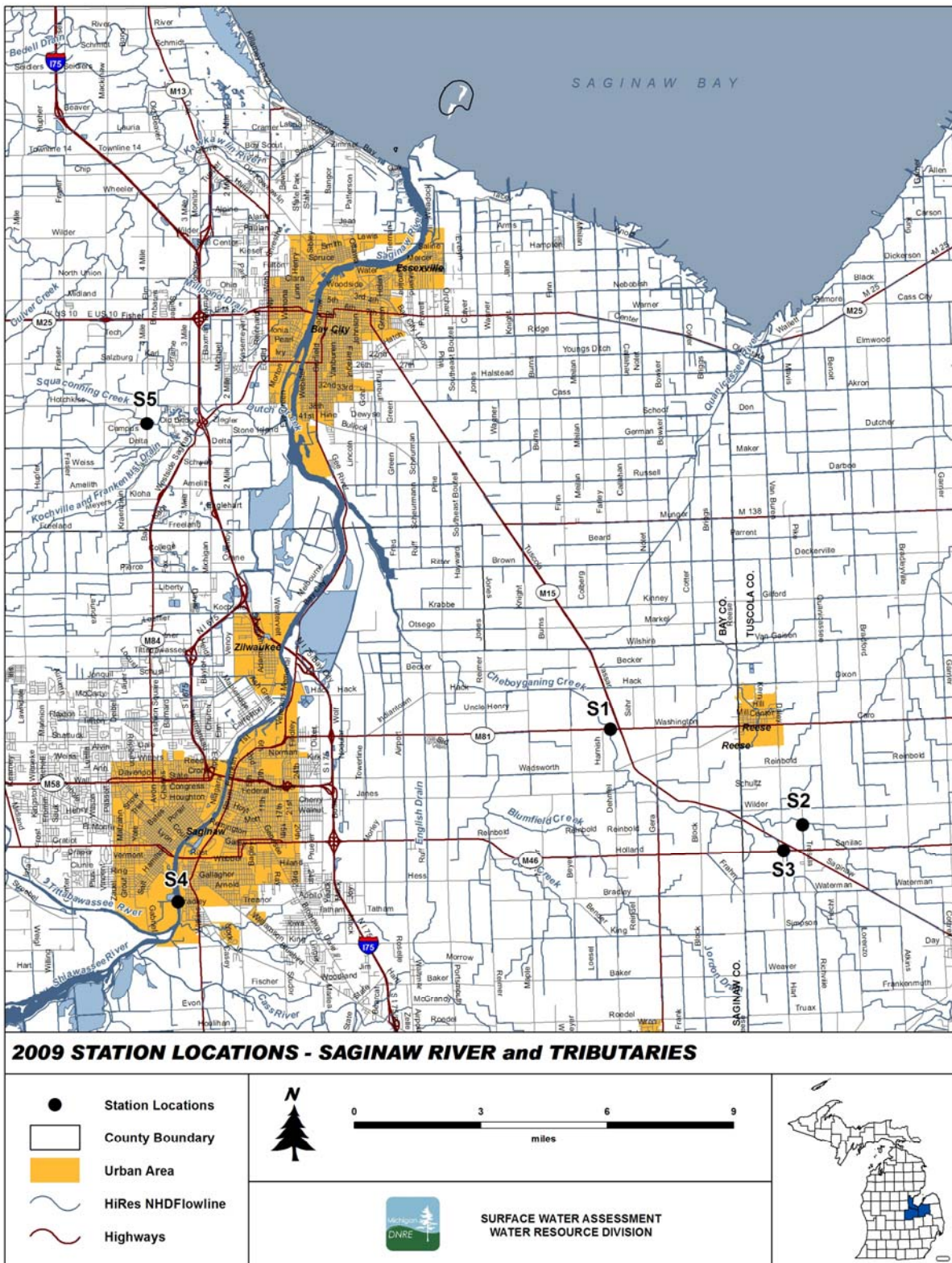


Figure 1. Selected 2009 random and targeted monitoring locations in the Saginaw River Watershed located in Bay, Saginaw, and Tuscola Counties, July 2009.

A 1994 survey by Morse included one station each on Squaconning Creek and Cheboyganing Creek. The fish community at both stations rated good although the numbers of species were limited at these stations. Squaconning Creek and Cheboyganing Creek, respectively, were dominated by bluntnose minnows and spottail shiners. The macroinvertebrate community rated fair at the Cheboyganing Creek station and poor at the Squaconning Creek station. Habitat was assessed as poor for both stations with impairment due in part to channelization, limited hard substrates and excessive deposition.

The 2004 study (Roush, 2008) at Squaconning and Cheboyganing Creek found poor macroinvertebrate communities. Flow encountered at both sites suggests that the communities reflected adverse flow regimes and that Procedure 51 might not have been an appropriate assessment tool under those conditions. Survey notes indicate stagnate conditions in several other drain and creek sites during the 2004 survey and one location was also observed to be flowing backwards indicating flow regimes which would adversely affect macroinvertebrate communities. The 2004 Squaconning Creek water sample had a number of analytes present at elevated levels, including a very high suspended solids concentration and a total copper concentration above Michigan Water Quality Standards.

## **METHODS**

Two site selection methods, stratified random and targeted, were used to design the 2009 Saginaw River assessment. A probabilistic monitoring approach based on a stratified random site selection process to address statewide and regional questions about water quality, was used to select sampling station locations within the Saginaw River and direct tributaries. Targeted site selection includes sites that are 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 National Pollutant Discharge Elimination System activities.

Rivers in Michigan have been delineated into smaller distinct ecological units (i.e. stream classes) based on an assemblage of attributes (Wehrly et al. 1997 and 1999; Seelbach and Wiley, 1997). The resulting stream classifications allow streams to be grouped into categories, or strata, such as cold small, cold medium, warm small, warm large, etc. This stream classification system was used to provide the strata from which sites could be randomly selected and distributed across the entire basin. The streams in each stratum were then divided into smaller segments and the final station locations were randomly selected from the pool of smaller segments within each stratum. The number of randomly selected stations assigned to each stratum in the basin is based on the relative proportion of stream miles falling into the respective stream classifications within the overall basin. The randomly selected sites in the 2009 Saginaw River and tributary watershed assessment included two stations in the “warm small” strata, one station in the “warm medium” strata, and one station in the “warm very large” strata which was assessed using the nonwadeable river procedure (MDEQ, 2009). In addition to the sites selected for the probabilistic based monitoring needs, the 2009 Saginaw River and Tributaries survey also included chemical sampling at one targeted location on Squaconning Creek, totaling five sampling locations (Table 1). Targeted sites were identified prior to random site selection. If targeted sites were subsequently chosen in the random draw, they are considered random.

Table 1. 2009 Saginaw River and Tributary Sampling Locations. M=macroinvertebrate, H=habitat, C=chemistry

Station	Waterbody Name	Stream Type	Location	STORET	Data	Latitude	Longitude
S1	Cheboyganing Creek	Warm Medium	M-81	730343	MH	42.69049	-82.76709
S2	Richville Drain	Warm Small	Tressla Road	790195	MH	42.67548	-82.78555
S3	Sheboygan Drain	Warm Small	Sanilac Road	790196	MH	42.73414	-82.80522
S4	Saginaw River	Warm Very Large	1/2 mile u/s of Center St.	730150	M	42.75045	-82.75621
S5	Squaconning Creek	-	4 Mile Road	090265	C	42.75956	-82.76471

Targeted sites that were not selected in the random selection process were surveyed in addition to the four random sites; however, the results of these surveys were not considered for the probabilistic analysis. Water quality samples were collected, preserved as required (MDNR, 1994), and transported to the Michigan Department of Environmental Quality Environmental Laboratory for analyses. There was no fish community sampling during the 2009 assessment.

## **SUMMARY**

Stations used for the biological, chemical and habitat evaluations, as well as visual observations are shown in Figure 1 and Table 1. The macroinvertebrate community and habitat assessment data are presented in Tables 2 and 3, respectively, with water chemistry data presented in Table 4. The numerous stream sites observed during the 2009 field season that were not suitable for Procedure 51 assessment due to dry, stagnant, or reversed flow conditions are listed in Appendix A.

## **RANDOMLY SELECTED WADEABLE SITES**

### **MACROINVERTEBRATES**

The macroinvertebrate community at the assessed wadeable streams rated “acceptable” at three stations, with scores ranging from -4 to -1 (Tables 2a, b). Stoneflies, which are typically associated with high quality waters, were not found at any station. Mayflies and caddisflies, insects which are considered to be sensitive to effects from pollution or environmental stresses were also found in low percentages at all three sites. Total taxa ranged from 21 to 23 with Chironomidae dominant at Station 1 and 3 while Simuliidae were dominant at Station 2. Communities dominated by one taxon are representative of stressful conditions.

In 2004, (Roush, 2008) a survey of this sub-watershed yielded a poor macroinvertebrate community rating at all 3 stations although marginal flow conditions were such that the 3 stations surveyed were probably not appropriate for a Procedure 51 assessment. Similar to the 2009 results, the 2004 assessments found very low mayfly densities, limited caddisflies, elevated numbers of tolerant and air breathing organisms, and a macroinvertebrate community dominated by one taxon at 2 of the 3 stations. The 1994 assessment of Cheboyganing and Squaconning Creeks (Morse, 1994) also found low mayfly densities, limited caddisflies, and elevated numbers of tolerant organisms resulting in fair and poor ratings respectively. This data review indicates that these tributary streams consistently have contained stressed communities.

## HABITAT

For all three Saginaw Bay Tributary stations, habitat quality scores rated marginal. These three streams lacked woody debris due to ditching and clearing of the banks and the riparian zone, bank undercuts were lacking, and gravel/cobble was limited in most cases. What hard substrates were present usually had a silt coating which sharply reduced their potential as habitat. Excessive growths of *Cladophora* were also common at these locations reducing flow through out the reach.

Cheboyganing and Squaconning Creeks sites were initially assessed in 1994 (Morse) and rated as poor. These poor ratings were due to the channelization of the headwaters and study reaches in each watershed as well as improper land use practices and poor road crossing maintenance. In 2004 (Roush 2008), habitat was reassessed at both locations and found to be rated marginal. Submergent vegetation and woody debris were absent with substrates noted as unstable and composed primarily of sand and small gravel. Flows at these locations were also found to be negligible with abundant algal growth.

## RANDOMLY SELECTED NONWADEABLE SITES

### MACROINVERTEBRATES

One site (Station S4) within the Saginaw River watershed was found to exceed the channel depth limitations for Procedure 51 in 2009. This site was assessed using the rapid bioassessment procedure for nonwadeable rivers (MDEQ 2009).

The macroinvertebrate community rated poor (Table 2) with a very low score of 2 out of a possible 100. This score reflects a depauperate macroinvertebrate community that was dominated by Chironomidae which constituted 94 percent of the total individuals collected.

## HABITAT

Habitat quality at the nonwadeable site, Station S4, was assessed but not rated. The assessment found much of the river bank in this segment is armored with broken concrete riprap placed for erosion control. Only limited amounts of fines, woody debris, and vegetation were present for macroinvertebrate sampling along the shoreline which had a narrow to nonexistent riparian zone. The channel thalweg substrate was dominated by thick, unstable deposits of sand which undergo natural cycles of being scoured and exported and then re-deposited. The quantities of moving sand can adversely affect the macroinvertebrate community by abrading both the organisms and the limited substrates within the reach.

## WATER CHEMISTRY

During the 2004 sampling of Squaconning Creek at Four Mile Road (Station S5), Roush 2008 found elevated concentrations of a number of analytes, such as copper at 29 ug/l, zinc at 73 ug/l, and suspended solids at 260 mg/l. The substrate also had a black silt coating; the stream had an observable oily sheen and was turbid from a preceding rain. The elevated analyte concentrations likely reflect the presence of the high suspended solids concentrations and influences from the rain event. During the 2009 water chemistry assessment (Table 4), no black silt was found coating the substrates, the water samples contained 9 mg/l of suspended solids, and copper and zinc concentrations were 2 ug/l and < 10 ug/l, respectively. Debris was also noted 6'-8' above the existing water level. For many of the shared analytes, the 1994 samples

(Morse, 1994) were also well below the 2004 results. Together, these comparisons suggest the 2004 conditions were somewhat anomalous and not representative of typical conditions.

### NONPOINT SOURCE

Although Station S5 was sampled for follow-up purposes, no stations in the 2009 survey were selected to help evaluate specific nonpoint source issues or effects. However, the information generated in this survey can serve to characterize existing conditions and can provide a comparison point for habitat and macroinvertebrate community conditions relative to future landscape or riparian feature changes.

### WATERSHED ATTAINMENT STATUS

Summary statistics were calculated from the probabilistic monitoring results to address regional attainment status for the Saginaw River Watershed Tributaries. However, streams such as Cheboyganing Creek and Squaconning Creek, tend to be more lentic in nature and function more like drowned river mouth segments due to the flat topography and low gradients. Because of these gradient conditions and reversed flow conditions (seiche), which can extend miles upstream into the tributaries, application of Procedure 51 assessments in this watershed can be problematic. The results indicate:

- Seventy-two percent of the watershed was supporting the other indigenous aquatic life designated use component of R 323.1100(e) of the Water Quality Standards.
- Confidence intervals can not be estimated from this data due to the number of sampling sites which are un-channelized or influenced by seiche effects from Saginaw Bay and application of Procedure 51 assessments in this watershed can be problematic.

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## REFERENCES

- Creal, W., S. Hanshue, S. Kosek, M. Oemke, and M. Walterhouse. 1996. Update of GLEAS Procedure 51 Metric Scoring and Interpretation. Michigan Department of Environmental Quality Staff Report No. MI/DEQ/SWQ-96/068. Revised May 1998.
- MDEQ. 1990. Surface Water Assessment Section Procedure 51 - Qualitative Biological and Habitat Survey Protocols for Wadeable Streams and Rivers. Revised June 1991, August 1996, January 1997, May 2002, and December 2008.
- MDEQ. In preparation. Macroinvertebrate Community Status and Trend Monitoring Procedure.
- MDEQ 2008 DRAFT. Qualitative Biological and Habitat Survey Protocols for Nonwadeable Rivers.
- MDEQ. 2009. Draft. Qualitative Biological and Habitat Survey Protocols for Nonwadeable Rivers.
- Morse, D. 1994. Biological Survey of Cheboyganing and Squaconning Creeks, Saginaw and Bay Counties. June 2, 1994. Surface Water Quality Division. Michigan Department of Natural Resources. Report No. MI/DNR/SWQ-94/031.
- MDNR. 1994. Quality Assurance Manual for Water, Sediment, and Biological Sampling. Surface Water Quality Division. Michigan Department of Natural Resources.
- LeSage, S. and J. Smith. 2010. Water Quality and Pollution Control in Michigan: 2010 Sections 303(d), 305(b), and 314 Integrated Report. Staff Report #MI/DEQ/WB-10/001.
- 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
- Roush, D. 2008. A Biological Assessment of Cheboyganing and Squaconning Creeks, Saginaw and Bay Counties. August, 2004. Water Bureau. Michigan Department of Environmental Quality. Report No. MI/DEQ/WB-08/038.
- Seelbach, P. and M. Wiley. 1997. Overview of the Michigan Rivers Inventory (MRI) Project. Department of Natural Resources, Fisheries Division. Technical Report #97-3.
- Wehrly, K., M. Wiley, and P. Seelbach. 1997. Landscape-Based Models that Predict July Thermal Characteristics of Lower Michigan Rivers, Department of Natural Resources, Fisheries Division Research Report #2037.
- Wehrly, K. M. Wiley, and P. Seelbach. 1999. A Thermal Habitat Classification for Lower Michigan Rivers. State of Michigan, Department of Natural Resources, Fisheries Division Research Report #2038.

Table 2A. Qualitative macroinvertebrate sampling results for Saginaw River and Saginaw River Tributaries in Saginaw and Tuscola Counties, July 20-21, 2009.

TAXA	M-81 7/20/2009 STATION S1	Tressla Road 7/21/2009 STATION S2	M-46 7/21/2009 STATION S3
<b>PLATYHELMINTHES (flatworms)</b>			
Turbellaria	1	7	5
<b>ANNELIDA (segmented worms)</b>			
Hirudinea (leeches)	1	1	4
Oligochaeta (worms)	1		5
<b>ARTHROPODA</b>			
<b>Crustacea</b>			
Amphipoda (scuds)	6	28	6
Decapoda (crayfish)	5		
Isopoda (sowbugs)	4	29	
<b>Arachnoidea</b>			
Hydracarina	1	9	6
<b>Insecta</b>			
<b>Ephemeroptera (mayflies)</b>			
Baetidae		18	6
Caenidae		1	4
Heptageniidae	1		
Tricorythidae	1		
<b>Odonata</b>			
<b>Anisoptera (dragonflies)</b>			
Aeshnidae	1	1	4
<b>Zygoptera (damselflies)</b>			
Coenagrionidae	4	32	11
<b>Hemiptera (true bugs)</b>			
Corixidae	11	37	171
Gerridae	1	1	5
Notonectidae	1	1	2
<b>Trichoptera (caddisflies)</b>			
Hydropsychidae	3		
Hydroptilidae	5	4	
Leptoceridae	17	1	10
<b>Coleoptera (beetles)</b>			
Dytiscidae (total)			1
Gyrinidae (adults)		1	
Haliplidae (adults)	1	3	1
Hydrophilidae (total)	17		1
Elmidae		1	16
<b>Diptera (flies)</b>			
Ceratopogonidae			2
Chironomidae	120	17	57
Culicidae		1	
Simuliidae		91	
Tipulidae	2		
<b>MOLLUSCA</b>			
<b>Gastropoda (snails)</b>			
Physidae	70		1
Planorbidae	1		
<b>Pelecypoda (bivalves)</b>			
Pisidiidae		1	
Sphaeriidae (clams)			1
<b>TOTAL INDIVIDUALS</b>	<b>275</b>	<b>285</b>	<b>319</b>



Table 2A. Qualitative macroinvertebrate sampling results for Saginaw River and Saginaw River Tributaries in Saginaw and Tuscola Counties, July 9, 2009.

TAXA	Saginaw River 7/9/2009 Center Street Station S4
ANNELIDA (segmented worms)	
Oligochaeta (worms)	2
ARTHROPODA	
Crustacea	
Amphipoda (scuds)	2
Arachnoidea	
Hydracarina	1
Insecta	
Ephemeroptera (mayflies)	
Tricorythidae	1
Odonata	
Zygoptera (damselflies)	
Coenagrionidae	1
Diptera (flies)	
Chironomidae	325
Ephydriidae	2
Simuliidae	1
MOLLUSCA	
Gastropoda (snails)	
Hydrobiidae	2
Physidae	3
Planorbidae	3
Pelecypoda (bivalves)	
Dreissenidae	1

Table 2B. Macroinvertebrate metric evaluation of Saginaw River and Saginaw River Tributaries in Saginaw and Tuscola Counties, July 20-21, 2009.

METRIC	M-81 7/20/2009 STATION S1		Tressla Road 7/21/2009 STATION S2		M-46 7/21/2009 STATION S3	
	Value	Score	Value	Score	Value	Score
	TOTAL NUMBER OF TAXA	23	0	21	1	21
NUMBER OF MAYFLY TAXA	2	0	2	1	2	1
NUMBER OF CADDISFLY TAXA	3	0	2	1	1	0
NUMBER OF STONEFLY TAXA	0	-1	0	-1	0	-1
PERCENT MAYFLY COMP.	0.73	-1	6.67	-1	3.13	-1
PERCENT CADDISFLY COMP.	9.09	0	1.75	-1	3.13	0
PERCENT DOMINANT TAXON	43.64	-1	31.93	-1	53.61	-1
PERCENT ISOPOD, SNAIL, LEECH	27.64	-1	10.53	0	1.57	1
PERCENT SURF. AIR BREATHERS	11.27	0	15.44	0	56.74	-1
TOTAL SCORE		-4		-1		-1
MACROINV. COMMUNITY RATING		ACCEPT.		ACCEPT.		ACCEPT.

Table 2B. Macroinvertebrate metric evaluation of Saginaw River and Saginaw River Tributaries in Saginaw and Tuscol Counties, July 9, 2009.

METRIC	Saginaw River 7/9/2009 Center Street Station S4	
	Value	
TOTAL ABUNDANCE	344	
TOTAL RICHNESS	12	
NUMBER OF EPHEMEROPTERA FAMILIES	1	
NUMBER OF PLECOPTERA FAMILIES	0	
NUMBER OF TRICHOPTERA FAMILIES	0	
NUMBER OF DIPTERA TAXA	3	
TRICHOPTERA ABUNDANCE	0	
ABUNDANCE OF DOMINANT TAXON	325	
SHREDDER ABUNDANCE	4	
SCRAPER ABUNDANCE	8	
COLL-FILTERER ABUNDANCE	2	
COLL-GATH ABUNDANCE	328	
PREDATOR ABUNDANCE	2	

METRIC	Metric Score
FFG DIVERSITY (25)	0
HABITAT STABILITY FFG SURROGATE (25)	0
% TRICHOPTERA (20)	0
EPT RICHNESS (8)	0
TOTAL RICHNESS (7)	0
DIPTERA RICHNESS (5)	2
PLECOPTERA RICHNESS (5)	0
% DOMINANCE (5)	0

**TOTAL SCORE (100)** 2

**MACROINVERTEBRATE COMMUNITY RATING** **POOR**

Table 3. Habitat evaluation for Saginaw River Tributaries in Saginaw and Tuscola Counties, July 20-21, 2009					
	Cheboyganing Creek	Richville Drain	Sheboygan Drain		
	M-81	Tressla Road	M-46		
	GLIDE/POOL	GLIDE/POOL	GLIDE/POOL		
STATION ID	S1	S2	S3		
<b>HABITAT METRIC</b>					
<b>Substrate and Instream Cover</b>					
Epifaunal Substrate/ Avail Cover (20)	6	10	7		
Embeddedness (20)*					
Velocity/Depth Regime (20)*					
Pool Substrate Characterization (20)**	10	15	12		
Pool Variability (20)**	10	7	7		
<b>Channel Morphology</b>					
Sediment Deposition (20)	13	12	13		
Flow Status - Maint. Flow Volume (10)	9	6	7		
Flow Status - Flashiness (10)	3	6	4		
Channel Alteration (20)	6	7	7		
Frequency of Riffles/Bends (20)*					
Channel Sinuosity (20)**	6	7	7		
<b>Riparian and Bank Structure</b>					
Bank Stability (L) (10)	6	9	6		
Bank Stability (R) (10)	6	9	6		
Vegetative Protection (L) (10)	6	6	8		
Vegetative Protection (R) (10)	5	6	8		
Riparian Veg. Zone Width (L) (10)	4	2	1		
Riparian Veg. Zone Width (R) (10)	3	1	1		
TOTAL SCORE (200):	93	103	94		
HABITAT RATING:	MARGINAL (MODERATELY IMPAIRED)	MARGINAL (MODERATELY IMPAIRED)	MARGINAL (MODERATELY IMPAIRED)		
Note: Individual metrics may better describe conditions directly affecting the biological community while the overall Habitat Rating describes the general riverine environment at the site(s)					
Date:	7/20/2009	7/21/2009	7/21/2009		
Weather:	Partly Cloudy	Sunny	Sunny		
Air Temperature:	73 Deg. F.	70 Deg. F.	76 Deg. F.		
Water Temperature:	70 Deg. F.	62 Deg. F.	63.5 Deg. F.		
Ave. Stream Width:	19.5 Feet	6 Feet	7 Feet		
Ave. Stream Depth:	0.83 Feet	0.4 Feet	0.5 Feet		
Surface Velocity:	0.15 Ft./Sec.	0.2 Ft./Sec.	0.13 Ft./Sec.		
Estimated Flow:	2.4 CFS	0.48 CFS	0.46 CFS		
Stream Modifications:	Dredged	Dredged, Canopy Removal Bank Stabilization	Dredged		
Nuisance Plants (Y/N):	N	N	N		
Report Number:	MI/DEQ/WB-10/	MI/DEQ/WB-10/	MI/DEQ/WB-10/		
STORET No.:	730343	790195	790196		
Stream Name:	Cheboyganing Creek	Richville Drain	Sheboygan Drain		
Road Crossing/Location:	M-81	Tressla Road	M-46		
County Code:	73	79	79		
TRS:	12N06E16	12N07E29	12N07E32		
Latitude (dd):	43.45051	43.41606	43.40717		
Longitude (dd):	-83.75888	-83.66983	-83.67894		
Ecoregion:	HELP	HELP	HELP		
Stream Type:	Warmwater	Warmwater	Warmwater		
USGS Basin Code:	4080206	4080206	4080206		
* Applies only to Riffle/Run stream Survey;					
** Applies only to Glide/Pool stream Survey;					
COMMENTS:					

Table 4. Water chemistry results for Squaconning Creek, Bay County, on July 20, 2009.

<b>Location</b>	4 Mile Rd	
<b>Station</b>	S5	
<b>STORET ID #</b>	090265	
<b>Parameter</b>	<b>Units</b>	
Calcium	mg/L	51.5
Hardness	mg/L	246
Magnesium	mg/L	28.4
Solids-Suspended	mg/L	9
Arsenic	ug/L	3.5
Barium	ug/L	32
Cadmium	ug/L	< 0.2
Copper	ug/L	2
Chromium	ug/L	< 1
Lead	ug/L	< 1
Selenium	ug/L	< 1
Silver	ug/L	< 0.2
Zinc	ug/L	< 10

Metal values given are as total metals.

Appendix A. Summary of dry to marginal flow stream observations in Saginaw River tributaries in Bay, Saginaw, and Tuscola Counties on July 20-21,2009.

Waterbody	County	Location	TRS	Latitude	Longitude	Flow Condition/Comments	Year	AUIDs
Cheboyganing Ck	Saginaw	off end of Ritter Rd	T13N R5E S27	43.50777	-83.8637	Lentic	2009	040802060103-01
Cheboyganing Ck	Saginaw	off end of Airport Rd	T13N R5E S34	43.48512	-83.85681	Lentic	2009	040802060103-01
Cheboyganing Ck	Saginaw	N. Portsmith Rd	T12N R5E S1	43.47561	-83.83752	Lentic	2009	040802060103-01
Cheboyganing Ck	Saginaw	Manning/Knight Rd	T12N R6E S8	43.46478	-83.79775	Stagnant to reverse flow; Ditch	2009	040802060103-01
Cheboyganing Ck	Saginaw	N. Beyer Rd	T12N R6E S9	43.46464	-83.77779	Flow only in narrow thread #; Ditch	2009	040802060103-01
Cheboyganing Ck	Saginaw	M-81	T12N R6E S16	43.45051	-83.75888	7-21-10: nearly stagnant u/s; flow only in narrow thread d/s of bridge. Much less Qr than 2009. Ditch	2010	040802060101-01
Blumfield Ck	Saginaw	M-81	T12N R6E S18	43.44994	-83.81769	Reversed flow on 7-21; Ditch	2009	040802060102-01
Blumfield Ck	Saginaw	Mueller Rd	T12N R6E S29	43.41625	-83.79232	Flow only in narrow thread #; Ditch	2009	040802060102-01
Blumfield Ck	Saginaw	Beyer Rd	T12N R6E S28	43.41708	-83.77729	Flow only in narrow thread #; Ditch	2009	040802060102-01
Cool Ck	Saginaw	Mueller Rd	T12N R6E S32	43.39669	-83.79247	Flow only in narrow thread #; Ditch	2009	040802060102-01
Rousch Drain	Tuscola	M-46 (Sanilac Rd)	T12N R7E S31	43.40704	-83.69538	Flow only in narrow thread #; Ditch	2009	040802060101-01
Rousch Drain	Tuscola	Waterman Rd	T11N R7E S6	43.39259	-83.69826	Flow only in narrow thread #; Ditch	2009	040802060101-01
King Road & Williamson Road Drain	Saginaw	M-13	T11N R4E S1	43.38483	-83.95537	Stagnant at M-13, farther u/s has shallow flow only in 25% of channel. Historic ditch	2009	040802060201-01
Dutch Ck	Bay	Euclid Rd	T13N R5E S5	43.55719	-83.91614	Lentic	2009	040802060203-01
Dutch Ck	Bay	3 Mile Rd	T14N R4E S36	43.57346	-83.95342	Stagnant; Ditch	2009	040802060203-01
Squaconning Ck	Bay	Ziegler	T13N R4E S1	43.56212	-83.94094	Lentic	2009	040802060203-01
Squaconning Ck	Bay	M-84	T13N R4E S1	43.55564	-83.95148	Lentic, reverse flow on 7-20	2009	040802060203-01
Squaconning Ck	Bay	Bay Valley(Reiss) Rd	T13N R4E S2	43.5557	-83.96428	Reverse flow on 7-20	2009	040802060203-01
Squaconning Ck	Bay	4 Mile Rd	T13N R4E S3	43.56012	-83.97434	Squa Ck dry - d/s flow only in narrow thread #; min. flow present d/s is from Klaus Drain. Ditch	2009	040802060203-01
Squaconning Ck	Bay	Fraser Rd	T14N R4E S32	43.57225	-84.01347	Flow only in narrow thread #; Ditch	2009	040802060203-01
Kochville & Franke Drain	Saginaw	Freeland Rd	T13N R4E S20	43.52392	-84.02734	Stagnant; ditch	2009	040802060203-01
Klaus Drain	Bay	Delta College	T13N R4E S3	43.55618	-83.98483	Flow only in narrow thread #; Ditch	2009	040802060203-01
Crow Island State Drain	Bay	2 Mile Rd	T13N R4E S13	43.52309	-83.93471	Reverse flow on 7-20; Ditch	2009	040802060202-01

**Flow only in narrow thread #** - means flow present only because algae or vegetation has focused a very marginal flow volume into a small part of the channel width. Cheboyganing @ M-81 revisited 7/10 - much less Qr than 2009. Nearly stagnant u/s, flow d/s of bridge  $\leq 3' \times \leq 1'$ , mostly exposed channel bottom.

Reverse flow: 2009

Dry, stagnant, or narrow flow thread: 2009, 2010

Lentic condition, no flow