MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY
WATER RESOURCES DIVISION
JUNE 2011

STAFF REPORT

BIOLOGICAL SURVEYS AND OBSERVATIONS ON FLOW FOR THE KAWKAWLIN-WISCOGGIN WATERSHED AND SELECTED SAGINAW BAY TRIBUTARIES IN ARENAC, BAY, GLADWIN, AND TUSCOLA COUNTIES JULY AND AUGUST 2010

As part of the Water Quality Monitoring Program of the Water Resources Division, staff of the Surface Water Assessment Section conducted qualitative biological surveys of selected Saginaw River tributaries locations in Arenac, Bay, Gladwin, and Tuscola Counties in July and August 2010. For purposes of this survey, the watershed area primarily addressed by these biosurveys and observations was collectively labeled as the Kawkawlin-Wiscoggin watershed. The Kawkawlin-Wiscoggin watershed area drains approximately 772 square miles of the Saginaw Bay basin, of which 82.5 percent is channelized or ditched. The largest portion of the watershed includes the Kawkawlin River basin and the smaller waterbody basins northward including the Pine River in southern Arenac County. The other hydrologic unit included in the 2010 surveys was the Wiscoggin-Pigeon watershed which contains the Wiscoggin Drain, the Quanicassee River and several other small subbasins between the Saginaw River and the Sebewaing River.

All streams surveyed were located within 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 performed at all locations (Figure 1, Table 1).

OBJECTIVES

The biological survey of the Kawkawlin-Wiscoggin watershed located in Arenac, Bay, Gladwin, 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)

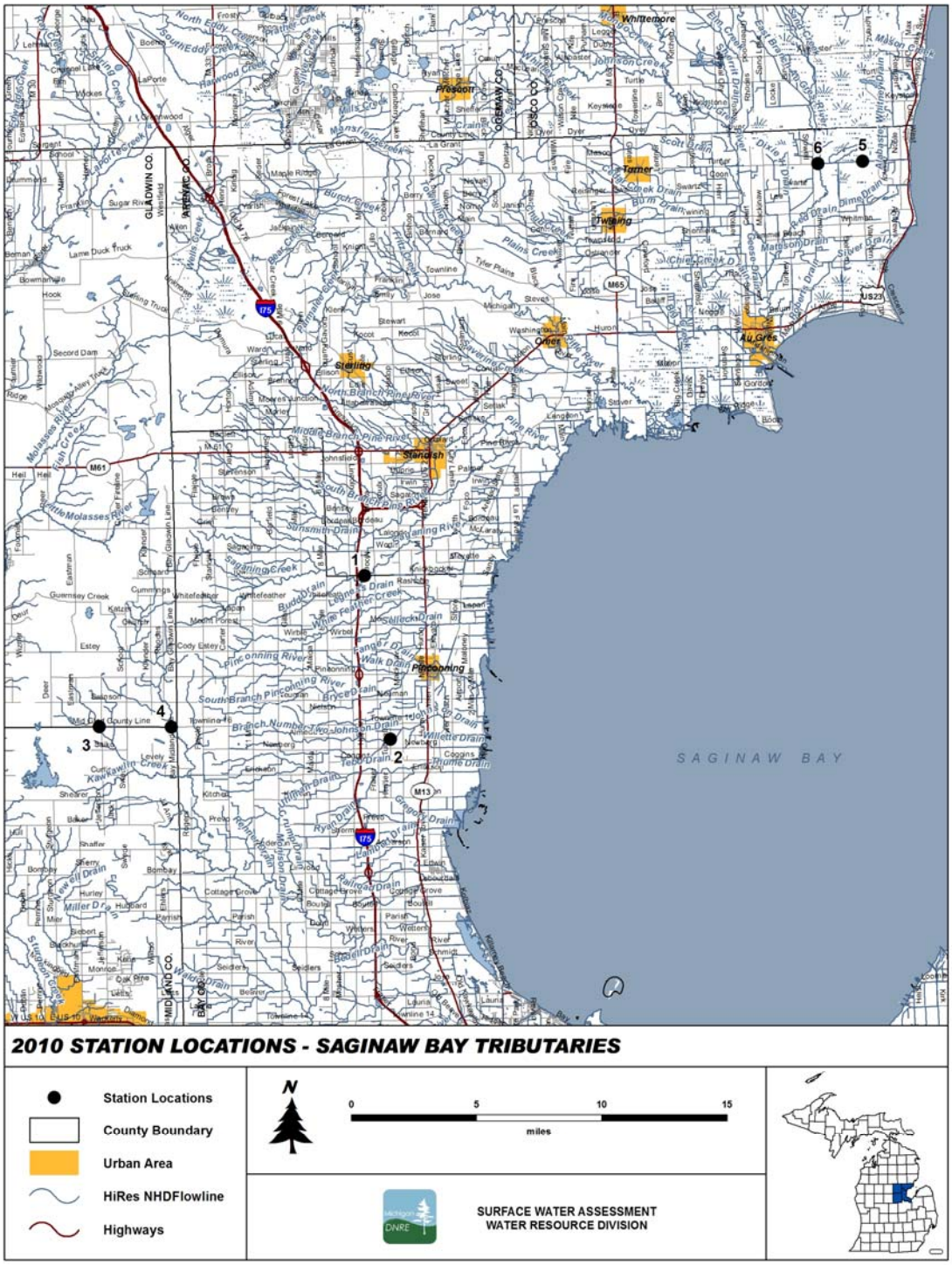

Figure 1. Selected 2010 random and targeted monitoring locations in the Kawkawlin- Wiscoggin watershed located in Arenac, Bay, Gladwin, and Tuscola Counties, July and August 2010.

METHODS

Two site selection methods, stratified random and targeted, were used to design the 2010 Kawkawlin-Wiscoggin 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 Kawkawlin-Wiscoggin watersheds. 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 strata were then divided into smaller segments and the final station locations were randomly selected from the pool of smaller segments within each strata. 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 2010 Kawkawlin-Wiscoggin watershed assessment included three stations in the "warm small," strata, one station in the 'warm medium" strata. In addition to the probabilistic based monitoring stations, the 2010 survey effort included sampling in one targeted stream, Whitney Drain in Arenac County (Table 1), where significant best management practice (BMP) stream improvement work had been completed subsequent to the last survey in 2006 (Roush, 2008).

Targeted sites were identified prior to random site selection. If targeted sites were subsequently chosen in the random draw, they are considered random. 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.

Table 1. 2010 Kawkawlin-Wiscoggin Watershed Sampling Locations. M=macroinvertebrate, H=habitat

Station	Water body Name	Stream Type	Location	STORET	Data	Latitude	Longitude
1	Saganing River	Warm Small	Knickerbocker Rd	90292	MH	43.91082	-84.01402
2	Johnson Drain, Br. No. 2	Warm Small	Turnell Rd	90293	MH	43.81608	-83.99663
3	Herner Drain	Warm Small	MidGlad Co. Line Rd	260136	MH	43.82708	-84.22897
4	N. Br. Kawkawlin River*	Warm Medium	MidGlad Co. Line Rd	260137	MH	43.82592	-84.17148
5	Whitney Drain	Warm Medium	Turner Road (E of Deland Rd)	60075	MH	44.14321	-83.60604
6	Whitney Drain	Warm Medium	Turner Road (W of Deland Rd)	60118	MH	44.14254	-83.64188

SUMMARY

Stations used for the biological 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 for the randomly selected sites with yearly macroinvertebrate community and habitat comparisons for Whitney Drain presented in Tables 4 and 5.

The four 2010 probabilistic Procedure 51 sites which were assessable each supported an acceptable macroinvertebrate community. For these stations, habitat quality rated good at three stations and marginal at Johnson Drain (Station 2). However, site revisits to some Kawkawlin-Wiscoggin watershed streams approximately two weeks after the Procedure 51 assessments found Johnson Drain (Station 2) stagnant with minimal water depth and Saganing River (Station 1) was dry. The nonwadeable station on the lower Kawkawlin River was not assessed due to the river being unduly affected by bay conditions in that reach.

The typical application of the probabilistic monitoring methodology to estimate the percent attainment for the “other indigenous aquatic life and wildlife” designated use was not appropriate with the 2010 Kawkawlin-Wiscoggin watershed dataset. Disallowing the two random Procedure 51 stations which became dry or stagnant shortly after the survey date leaves only two random stations from which to make up the statistical data set which is insufficient for conducting statistical analyses.

The two targeted Whitney Drain stations (Table 4) each supported an acceptable macroinvertebrate community which was similar to that observed in 2006. The overall habitat upstream at Station 6 rated marginal, similar to the 2006 results. While downstream at Station 5, the community rated good. At this point in time, the overall comparison of the pre and post project results for Stations 5 and 6 do not indicate an obvious change in the macroinvertebrate community or habitat conditions which could be attributed to the project BMPs.

Numerous observations throughout the Kawkawlin-Wiscoggin watershed in July and August 2010 showed many miles of stream channel are adversely affected by various combinations of minimal to absent summer base flows, unsuitable or unstable substrates, substantially altered channels from ditching and/or channelization activities, dramatic alterations to the bank and riparian zones, reaches with low gradients, and stagnant to reverse flow conditions. For assessments on stream stations such as Station 2 in Johnson Drain, which is representative of much of the Kawkawlin-Wiscoggin watershed, these factors are reflected in the low scores assigned to some of the individual habitat metrics and these habitat characteristics can result in substantial stresses that limit the biota in many of these Kawkawlin-Wiscoggin streams and drains.

Application of Procedure 51 assessments in this watershed can be problematic because flow conditions in many of the streams or reaches can be quite variable both within and between years. The absence of a consistent, unidirectional flow precludes the presence, or normal densities, of many macroinvertebrate taxa typically seen in streams with more stable flow regimes. The numerous stream sites observed during the 2010 field season that were not suitable for Procedure 51 assessment due to dry, stagnant, or reversed flow conditions are listed in Appendix A.

RESULTS

PROBABILISTIC, RANDOMLY SELECTED STATIONS

MACROINVERTEBRATE COMMUNITY

The macroinvertebrate community at the four probabilistic Kawkawlin-Wiscoggin stations rated "acceptable" (Table 2). Stoneflies, which are typically associated with high quality waters, were not found at any Kawkawlin-Wiscoggin watershed station. All stations had low community percentages of mayflies, with Stations 1 and 2 having very low densities and percentages of both mayflies and caddisflies. Caddisflies, and also mayflies to some degree, were much more abundant at Stations 3 and 4. Mayflies and caddisflies are insect orders which are generally considered to be sensitive to effects from pollution or environmental stresses. Total taxa were found to range from 21 to 28 with the macroinvertebrate community at Stations 1-3 dominated by one taxon with Station 3 dominated by the Caddisfly family Hydropsychidae. Stations 1 and 2 were each dominated by a tolerant taxon, Isopoda and Gastropoda (snails), respectively, and both stations also exhibited high overall community percentages of tolerant organisms. A community dominated by few taxa is a common result of stressful conditions, as is the abundance of tolerant and/or air breathing organisms which is also indicative of adverse conditions.

The macroinvertebrate communities at Stations three and four, in the headwater area of the North Branch Kawkawlin River, were much more balanced in their distribution across the taxa present and were notably higher quality compared to the macroinvertebrate communities at Stations 1 and 2. This is likely due to the presence of better habitat conditions as described in the Habitat section below.

The 2005 survey (Rockafellow, 2007) included macroinvertebrate data for 12 of the 16 sampling stations. In that survey, 5 of the 12 stations had macroinvertebrate community scores that rated acceptable, but tending toward poor (-1 to -4), while 5 other stations rated poor (-5 or -6), these ratings indicate that the corresponding sites have stressed aquatic communities. The low flow and depreciated habitat quality were common themes regarding the lower quality biota found in the 2005 survey as the river was noted as channelized throughout the watershed. Two streams assessed in 2005 were common with the 2010 assessments. The macroinvertebrate community rated acceptable for both the 2005 Saganing River at Worth Road (-3) and the 2010 Saganing River at Knickerbocker Road (-2). Johnson Drain is the other location sampled during both assessments with the 2005 data rating poor at Tower Beach Road, which is located downstream of the 2010 Turnell Road location, which was rated acceptable.

The nonwadeable, "warm very large" strata station on the lower Kawkawlin River was not assessed due to that reach of the river being unduly affected by conditions in Saginaw Bay.

HABITAT

Habitat quality rated marginal at Johnson Drain (Station 2) and good at the other three stations (Table 3). The woodland segment containing Saganing River (Station 1) had the best overall habitat score, although the river is impounded at the next road crossing downstream at Fraser Road. Johnson Drain, typical of many maintained drains, scored low in the metrics describing cover and substrate, the flow regime and channel alteration, and the riparian zone. These highly altered streams generally lacked woody debris due to ditching and clearing of the banks and riparian zone, bank undercuts were lacking, and gravel/cobble was limited in most cases. Herner Drain (Station 3) habitat assessment rated good, due to the historical channelization,

most of the channel, bank, and riparian areas were reverting to a less disturbed condition in the segment assessed. North Branch Kawkawlin River (Station 4) habitat also rated good and had the least altered channel, riparian zone and local watershed area of the probabilistic Kawkawlin-Wiscoggin sites visited in 2010.

Revisits to some Kawkawlin-Wiscoggin watershed stream sites approximately two weeks after the Procedure 51 assessments found Station 2 was stagnant with minimal water depth and Station 1 was dry. The initial presence of flow at Station 1, and at a number of other sites in the surrounding area in early August, was likely due in large part to the 4" of rain which fell on the area during the preceding week. Given these unstable flow situations, both stations supported acceptable communities present during the assessment. Finding stagnant and dry channel conditions two weeks after the survey date raises questions as to the appropriateness of relying on the habitat quality ratings derived for these two streams.

It is important to note that using these four individual station results to represent habitat quality, or the macroinvertebrate community, in the Kawkawlin-Wiscoggin watershed could be very misleading. Over the course of coming up with four stations which were appropriate for Procedure 51 assessment, many stream stations visited were disqualified from assessment due to dry or stagnant conditions. Cladophora growth was also observed at several locations where stagnant/low flow conditions were present, creating a narrow thread of flow within these reaches where Procedure 51 may not be appropriate.

The presence of summer flows can vary somewhat between years depending on the weather, but large portions of the Kawkawlin-Wiscoggin watershed stream channels are commonly flow limited. Rockafellow's 2007 report of this watershed made mention of adverse flow conditions in a number of streams, although not all streams or locations were specifically listed.

NONPOINT SOURCE TARGETED STATIONS

Whitney Drain, which reroutes the East Branch Au Gres River eastward directly to Lake Huron and prevents the flow from reaching the lower 10 to 12 miles of its natural river channel, was targeted for reassessment subsequent to installation of BMPs which were largely completed by 2008. The BMPs included different techniques for protecting and stabilizing stream banks to reduce sediment inputs to the river, for re-establishing channel dimensions, and for improving Whitney Drain channel conditions by creating a series of riffle-pool sequences along with increasing the available flood plain area. In 2006, Whitney Drain was assessed with Procedure 51 at two locations approximately 1.8 miles apart and these data (Roush, 2008) represent the "pre BMP" conditions. The same locations were reassessed in 2010 to determine if there were notable changes in habitat or macroinvertebrate community conditions due to the BMP work. 2010, Station 5 was the downstream location while Station 6 was the upstream survey reach which included the lower part of the bend and the segment located immediately below the 90° bend where Whitney Drain starts.

Macroinvertebrate Community

The 2010 and 2006 macroinvertebrate community data for the two Whitney Drain stations are shown in Table 4. Both Whitney Drain stations supported an acceptable macroinvertebrate community in 2010, each station had the same overall community score as in the 2006 survey, and each macroinvertebrate community was reasonably similar between the surveys. In 2010, both stations had higher Amphipoda numbers and more taxa observed than in 2006, with Station 6 showing a 50 percent increase in the number of taxa. It is not clear if the increase in

taxa at Station 6 was related to the BMPs as half of the new taxa were tolerant or air breathing organisms. In both years, Station 5 had a good number of mayfly taxa present but the community percentages were low as most families were represented by only one or a few individuals. Station 5 had abundant stoneflies in 2006 but much lower numbers were found in 2010. Station 6 similarly had a good number of mayfly taxa in both years but the mayfly community percentage was low in 2006 and higher in 2010; this metric score improvement in 2010 was offset by the presence of higher numbers of Corixidae which are air breathing organisms. The Station 6 Trichoptera community percentage showed a substantial decrease in 2010 due to a large decrease in the numbers of Brachycentridae present despite similar Brachycentridae numbers for both years at downstream Station 5.

Although some macroinvertebrate community variations are seen between the surveys, the results do not indicate an obvious community change which could be attributed to the BMP project. There are a number of reasons this could be the case. Procedure 51 is best suited to showing larger changes rather than subtle macroinvertebrate community shifts. In addition to the normal variation inherent in a non-quantitative biological sampling method, natural community variation also occurs year to year in even stable systems. Side by side comparisons of the data in Table 4 show some taxa were found in only one year and some taxa had abundances that were quite different between the years. Although both surveys of Whitney Drain were conducted in August within a 16 day difference on the Julian calendar, the more biologically significant environmental factor may be differences between the thermal regimes for the years being compared. A review of temperature data from a MSU agricultural weather station in Linwood, approximately 28 miles to the south, shows August 2010 was a warm period. On August 2, 2010, the total degree day accumulation (50° base) was approximately just 5.8 percent higher than on the August 2, 2006, survey date. However, by the August 18, 2010 survey date, the total degree day accumulation jumped to approximately 27 percent higher than the 2006 survey date. This amount of temperature difference will affect the rate of change in and the timing of life stages which in turn can affect, for example, whether an insect is present in a larval (observed) or egg phase (not observed) in a stream. Additionally, it is possible the BMPs have not been in place long enough for their potential effects to be reflected in the macroinvertebrate community.

Habitat

The 2010 and 2006 habitat data for the Whitney Drain stations are shown in Table 5.

At Station 6, the habitat rating was marginal and similar to the 2006 rating. The most notable difference in the metric scores was the pool variability metric (13 in 2006 versus 3 in 2010). This metric score difference may be due to differing water conditions. A very large rain event happened in late July 2010 and the drain flow was still coming down from that and a subsequent rain event when the drain was assessed. It appeared the peak water level had fallen 2'-2.5' by the time of the August 18th survey, but the 2010 water depth was still 2' higher than in 2006. The higher water resulted in primarily a deep run type channel with little variation. There was some moderate improvement in the 2010 sediment deposition metric score which possibly could be attributed to the BMPs. However, the thick leading edge of a large sand plume was observed about 25 yards upstream of the 90° bend where Whitney Drain starts, so it is not clear that the upstream BMPs had yet reduced sediments coming into the Station 6 reach.

As in 2006, the Station 5 habitat rated good although the 2010 score was somewhat higher than the 2006 result. Relative to Station 6, Station 5 is located in a much shallower and faster segment and the 2010 depth was similar to the 2006 depth. Moderately higher scores were

recorded for the substrate/cover and velocity/depth metrics, two metrics which can show improvements from sediment reduction BMPs. However, it is not clear if these changes were due to the BMPs because only minimal deposition was present in both surveys and the deposition metric was essentially the same both years. While there was some limited native rock in the stream, it appeared that the majority of the cobble/gravel present at Station 5 was from losses of the upstream, continuous limestone riprap armoring of the right bank. Because of the straight channel, upstream channel maintenance such as brush and tree removal, and the stream velocity, this largely hardpan clay bottom segment had no large woody debris. Woody debris is lacking in most of Whitney Drain. Some growths of Cladophora were present on the artificial riffles installed at a number of Whitney Drain locations.

The pre and post project results do not indicate an obvious change in Station 5 and Station 6 habitat conditions which could be attributed to the BMP project. As noted in the macroinvertebrate community data review, it is possible the BMPs have not been in place long enough for their potential effects to be reflected. Due to the noted Station 5 characteristics, Station 6 appears to be the location most likely to show eventual in-stream habitat improvements from BMPs.

WATERSHED ATTAINMENT STATUS

Summary statistics were calculated from the probabilistic monitoring results to address regional attainment status for the Kawkawlin-Wiscoggin watershed tributaries. However, due to the lake plain history, large portions of the Kawkawlin-Wiscoggin watershed area are low gradient and also are comprised of poorly drained soils. Consequently, because of low groundwater accrual, the effects from channelization and ditching, and the tiling of farm fields, many of the Kawkawlin-Wiscoggin watershed area streams and drains display ephemeral or intermittent flow regimes. These streams may also exhibit stagnant to reversed flow conditions frequently occur within these watersheds and can extend several miles upstream when wind sustains a seiche in Saginaw Bay. The downstream mouth segments of streams, such as the Kawkawlin River and the Quanicassee River, become more lentic in nature and function more like drowned river mouth segments. Because of these gradient conditions, application of Procedure 51 assessments in this watershed can be problematic and statistical estimates and confidence intervals may not be accurate due to the number of sites surveyed with unaltered flow regimes. The results indicate:

- Seventy-seven percent of the watershed was supporting the other indigenous aquatic life designated use component of R 323.1100(e) of Part 4. Water Quality Standards of Part 31, Water Resources Protection, of the Natural Resources and Environmental Protection Act, 1994 PA 451 as amended.

- Confidence intervals can not be estimated from this data due to the lacking number of sampling sites which are unaltered or influenced by seiche effects from Saginaw Bay and application of Procedure 51 assessments in this watershed can be problematic.

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Table 2A. Qualitative macroinvertebrate sampling results for selected Saginaw Bay tributaries in Bay and Gladwin Counties during July and August 2010.

TAXA	Saganing River Knickerbocker Road 7/28/2010 STATION 1	Branch #2 Johnson Drain Turnell Road 8/3/2010 STATION 2	Herner Drain MidGlad Co Line Rd 8/3/2010 STATION 3	N Br Kawkawlin River MidGlad Co Line Rd 8/3/2010 STATION 4
ANNELIDA (segmented worms)				
Hirudinea (leeches)		1	1	5
Oligochaeta (worms)	6			
ARTHROPODA				
Crustacea				
Amphipoda (scuds)	108	88		42
Decapoda (crayfish)	2		1	2
Isopoda (sowbugs)	131	76		31
Arachnoidea				
Hydracarina	1	1		
Insecta				
Ephemeroptera (mayflies)				
Baetidae	1	6	5	6
Caenidae		1	12	1
Ephemeridae				2
Heptageniidae	1		8	19
Odonata				
Anisoptera (dragonflies)				
Aeshnidae			1	4
Corduliidae				2
Libellulidae			1	
Zygoptera (damselflies)				
Calopterygidae		1	52	
Coenagrionidae		2		
Hemiptera (true bugs)				
Belostomatidae		1		
Corixidae	1	7		5
Gerridae		1	2	4
Notonectidae	1			1
Trichoptera (caddisflies)				
Hydropsychidae	1	3	82	32
Hydroptilidae		1		
Leptoceridae			4	
Molannidae			1	16
Phryganeidae	2		12	1
Polycentropodidae	1			
Coleoptera (beetles)				
Dytiscidae (total)	1	1		
Gyrinidae (adults)		1		
Haliplidae (adults)		4		
Hydrophilidae (total)	1	1		
Dryopidae	2			17
Elmidae			21	4
Diptera (flies)				
Ceratopogonidae	1			2
Chironomidae	20	6	19	6
Simuliidae	7	1	31	1
Tabanidae			4	5
Tipulidae				2
MOLLUSCA				
Gastropoda (snails)				
Ancylidae (limpets)			2	
Lymnaeidae	3	1		1
Physidae	18	105	3	22
Planorbidae	2		1	26
Pelecypoda (bivalves)				
Pisidiidae				1
Sphaeriidae (clams)			4	3
TOTAL INDIVIDUALS	311	309	267	263

Table 2B. Macroinvertebrate metric evaluation for selected Saginaw Bay tributaries in Bay and Gladwin Counties during July and August 2010.

	Saganing River Knickerbocker Road 7/28/2010 STATION 1		Branch #2 Johnson Drai Turnell Road 8/3/2010 STATION 2		Herner Drain MidGlad Co Line Rd 8/3/2010 STATION 3		N Br Kawkawlin River MidGlad Co Line Rd 8/3/2010 STATION 4	
METRIC	Value	Score	Value	Score	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	21	0	21	0	21	1	28	1
NUMBER OF MAYFLY TAXA	2	1	2	1	3	1	4	1
NUMBER OF CADDISFLY TAXA	3	1	2	0	4	1	3	1
NUMBER OF STONEFLY TAXA	0	-1	0	-1	0	-1	0	-1
PERCENT MAYFLY COMP.	0.64	-1	2.27	-1	9.36	-1	10.65	-1
PERCENT CADDISFLY COMP.	1.29	-1	1.29	-1	37.08	1	18.63	0
PERCENT DOMINANT TAXON	42.12	-1	33.98	-1	30.71	-1	15.97	1
PERCENT ISOPOD, SNAIL, LEECH	49.52	-1	59.22	-1	2.62	1	32.32	-1
PERCENT SURF. AIR BREATHERS	1.29	1	5.18	1	0.75	1	3.80	1
TOTAL SCORE		-2		-3		3		2
MACROINV. COMMUNITY RATING		ACCEPT.		ACCEPT.		ACCEPT.		ACCEPT.

Table 3. Habitat evaluation for selected Saginaw Bay tributaries in Bay and Gladwin Counties during July and August 201										
	Saganing River		Branch #2 Johnson Drain		Herner Drain		N Br Kawkawlin River			
	Knickerbocker Road		Turnell Road		MidGlad Co Line Rd		MidGlad Co Line Rd			
	RIFFLE/RUN		GLIDE/POOL		RIFFLE/RUN		RIFFLE/RUN			
	Station 1		Station 2		Station 3		Station 4			
HABITAT METRIC										
Substrate and Instream Cover										
Epifaunal Substrate/ Avail Cover (20)	9		2		9		6			
Embeddedness (20)*	11				13		7			
Velocity/Depth Regime (20)*	13				14		11			
Pool Substrate Characterization (20)**			4							
Pool Variability (20)**			1							
Channel Morphology										
Sediment Deposition (20)	14		15		16		12			
Flow Status - Maint. Flow Volume (10)	9		6		7		9			
Flow Status - Flashiness (10)	5		4		4		8			
Channel Alteration (20)	18		2		15		18			
Frequency of Riffles/Bends (20)*	10				11		11			
Channel Sinuosity (20)**			2							
Riparian and Bank Structure										
Bank Stability (L) (10)	8		7		7		9			
Bank Stability (R) (10)	8		7		7		9			
Vegetative Protection (L) (10)	9		8		8		10			
Vegetative Protection (R) (10)	9		8		8		10			
Riparian Veg. Zone Width (L) (10)	10		0		6		10			
Riparian Veg. Zone Width (R) (10)	10		0		6		10			
TOTAL SCORE (200):	143		66		131		140			
HABITAT RATING:	GOOD		MARGINAL		GOOD		GOOD			
	(SLIGHTLY		(MODERATELY		(SLIGHTLY		(SLIGHTLY			
	IMPAIRED)		IMPAIRED)		IMPAIRED)		IMPAIRED)			
	Note: Individual metrics may better describe conditions directly affecting the biological community while th									
	overall Habitat Rating describes the general riverine environment at the site(s)									
Date:	7/28/2010		8/3/2010		8/3/2010		8/3/2010			
Weather:	Partly Cloudy		Partly Cloudy		Partly Cloudy		Partly Cloudy			
Air Temperature:	78	Deg. F.	82	Deg. F.	87	Deg. F.	83	Deg. F.		
Water Temperature:	73.5	Deg. F.	75	Deg. F.	76	Deg. F.	71	Deg. F.		
Ave. Stream Width:	10	Feet	10.5	Feet	2.5	Feet	6.5	Feet		
Ave. Stream Depth:	0.67	Feet	0.5	Feet	0.17	Feet	0.33	Feet		
Surface Velocity:	0.65	Ft./Sec.	0.09	Ft./Sec.	0.4	Ft./Sec.	1	Ft./Sec.		
Estimated Flow:	4.4	CFS	0.47	CFS	0.17	CFS	2.1	CFS		
Stream Modifications:	Impounded		Dredged		Dredged		Dredged			
Nuisance Plants (Y/N):	N		N		N		N			
Report Number:	MI/DNRE/WRD-10/		MI/DNRE/WRD-10/		MI/DNRE/WRD-10/		MI/DNRE/WRD-10/			
STORET No.:	90292		90293		260136		260137			
Stream Name:	Saganing River		Branch #2 Johnson Drain		Herner Drain		N Br Kawkawlin River			
Road Crossing/Location:	Knickerbocker Road		Turnell Road		MidGlad Co Line Rd		MidGlad Co Line Rd			
County Code:	09		09		26		26			
TRS:	17N04E05		16N04E04		17N02E33		17N02E36			
Latitude (dd):	43.91082		43.81608		43.82708		43.82592			
Longitude (dd):	-84.01402		-83.99663		-84.22897		-84.17148			
Ecoregion:	HELP		HELP		HELP		HELP			
Stream Type:	Warmwater		Warmwater		Warmwater		Warmwater			
USGS Basin Code:	4080102		4080102		4080102		4080102			
* Applies only to Riffle/Run stream Surveys										
** Applies only to Glide/Pool stream Surveys										
COMMENTS:	impounded at next d/s crossing									

Table 4A. Qualitative macroinvertebrate sampling results for 2 locations in Whitney Drain, Arenac County, on August 2, 2006 and August 18, 2010.

TAXA	Whitney Drain Turner Road E of Deland Rd 8/18/2010 STATION 5	Whitney Drain Turner Road E of Deland Rd 8/2/2006	Whitney Drain Turner Road W of Deland Rd 8/18/2010 STATION 6	Whitney Drain Turner Road W of Deland Rd 8/2/2006
BRYOZOA (moss animals)			1	1
ANNELIDA (segmented worms)				
Oligochaeta (worms)	2		2	1
ARTHROPODA				
Crustacea				
Amphipoda (scuds)	27	1	34	3
Decapoda (crayfish)	1		2	1
Arachnoidea				
Hydracarina	5		3	4
Insecta				
Ephemeroptera (mayflies)				
Baetiscidae			2	
Baetidae	1	2	27	9
Caenidae	1		2	2
Heptageniidae	1	9	20	6
Isonychiidae		1		
Tricorythidae	2	3	4	
Odonata				
Anisoptera (dragonflies)				
Aeshnidae		1	1	4
Gomphidae		1	9	
Zygoptera (damselflies)				
Calopterygidae	3		1	1
Plecoptera (stoneflies)				
Perlidae	1	34	2	5
Pteronarcyidae	6	1	1	
Hemiptera (true bugs)				
Belostomatidae			1	
Corixidae		3	69	3
Megaloptera				
Corydalidae (dobson flies)	3		1	
Sialidae (alder flies)			6	
Trichoptera (caddisflies)				
Brachycentridae	66	60	22	155
Hydropsychidae	73	106	15	31
Hydroptilidae				1
Leptoceridae	7	1	5	7
Limnephilidae		2		4
Philopotamidae		1		
Polycentropodidae			1	1
Psychomyiidae	1			
Uenoidae	2			
Coleoptera (beetles)				
Dytiscidae (total)	1	1	8	
Gyrinidae (adults)			1	
Hydrophilidae (total)			5	1
Dryopidae			1	
Elmidae	14	8	4	14
Diptera (flies)				
Athericidae	2	2		
Chironomidae	53	20	31	23
Ptychopteridae				1
Simuliidae	1	1	2	2
Stratiomyidae	1		1	
Tabanidae	1	1	3	
Tipulidae	2			
MOLLUSCA				
Gastropoda (snails)				
Ancylidae (limpets)	1		2	
Physidae	11	1	2	2
Planorbidae			1	
Pelecypoda (bivalves)				
Pisidiidae			2	
TOTAL INDIVIDUALS	289	260	294	282

Table 4B. Macroinvertebrate metric evaluation for 2 locations in Whitney Drain, Arenac County, on August 2, 2006 and August 18, 2010.

	Whitney Drain Turner Road E of Deland Rd 8/18/2010 STATION 5		Whitney Drain Turner Road E of Deland Rd 8/2/2006		Whitney Drain Turner Road W of Deland Rd 8/18/2010 STATION 6		Whitney Drain Turner Road W of Deland Rd 8/2/2006	
METRIC	Value	Score	Value	Score	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	27	0	22	0	36	1	24	0
NUMBER OF MAYFLY TAXA	4	1	4	1	5	1	3	0
NUMBER OF CADDISFLY TAXA	5	1	5	1	4	1	6	1
NUMBER OF STONEFLY TAXA	2	1	2	1	2	1	1	1
PERCENT MAYFLY COMP.	1.73	-1	5.77	-1	18.71	0	6.03	-1
PERCENT CADDISFLY COMP.	51.56	1	65.38	1	14.63	0	70.57	1
PERCENT DOMINANT TAXON	25.26	-1	40.77	-1	23.47	-1	54.96	-1
PERCENT ISOPOD, SNAIL, LEECH	4.15	1	0.38	1	1.70	1	0.71	1
PERCENT SURF. AIR BREATHERS	0.69	1	1.54	1	28.91	-1	1.77	1
TOTAL SCORE		4		4		3		3
MACROINV. COMMUNITY RATING		ACCEPT.		ACCEPT.		ACCEPT.		ACCEPT.

Table 5. Habitat evaluation for 2 locations in Whitney Drain, Arenac County, on August 2, 2006 and August 18, 2010.										
	Whitney Drain		Whitney Drain		Whitney Drain		Whitney Drain			
	Turner Rd (E of Deland Rd)		Turner Rd (E of Deland Rd)		Turner Road (W of Deland Rd)		Turner Road (W of Deland Rd)			
	Station 5				Station 6					
	RIFFLE/RUN		RIFFLE/RUN		GLIDE/POOL		GLIDE/POOL			
	2010		2006		2010		2006			
HABITAT METRIC										
Substrate and Instream Cover										
Epifaunal Substrate/ Avail Cover (20)	12		7		6		8			
Embeddedness (20)*	16		16							
Velocity/Depth Regime (20)*	16		11							
Pool Substrate Characterization (20)**					6		8			
Pool Variability (20)**					3		13			
Channel Morphology										
Sediment Deposition (20)	17		16		16		12			
Flow Status - Maint. Flow Volume (10)	10		10		10		10			
Flow Status - Flashiness (10)	5		5		7		4			
Channel Alteration (20)	11		5		9		3			
Frequency of Riffles/Bends (20)*	6		8							
Channel Sinuosity (20)**					0		2			
Riparian and Bank Structure										
Bank Stability (L) (10)	9		9		9		9			
Bank Stability (R) (10)	9		9		9		7			
Vegetative Protection (L) (10)	9		6		8		9			
Vegetative Protection (R) (10)	9		6		3		6			
Riparian Veg. Zone Width (L) (10)	9		8		8		9			
Riparian Veg. Zone Width (R) (10)	2		8		1		1			
TOTAL SCORE (200):	140		124		95		101			
HABITAT RATING:	GOOD		GOOD		MARGINAL		MARGINAL			
	(SLIGHTLY		(SLIGHTLY		(MODERATELY		(MODERATELY			
	IMPAIRED)		IMPAIRED)		IMPAIRED)		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:	8/18/2010		8/2/2006		8/18/2010		8/2/2006			
Weather:	Sunny		Sunny		Partly Cloudy		Cloudy			
Air Temperature:	78.5	Deg. F.	91	Deg. F.	75.5	Deg. F.	91	Deg. F.		
Water Temperature:	65	Deg. F.	76	Deg. F.	61.5	Deg. F.	76	Deg. F.		
Ave. Stream Width:	30	Feet	20	Feet	28	Feet	25	Feet		
Ave. Stream Depth:	1.5	Feet	1.5	Feet	3.67	Feet	1.5	Feet		
Surface Velocity:	2.4	Ft./Sec.	1.5	Ft./Sec.	1.01	Ft./Sec.	1	Ft./Sec.		
Estimated Flow:	108	CFS	45	CFS	104	CFS	37.5	CFS		
Stream Modifications:	Dredged		Dredged, Relocated		Dredged		Dredged, Relocated			
Nuisance Plants (Y/N):	N		N		N		N			
Report Number:	MI/DNRE/WRD-10/		MI/DNRE/WRD-10/		MI/DNRE/WRD-10/		MI/DNRE/WRD-10/			
STORET No.:	60075		60075		60118		60118			
Stream Name:	Whitney Drain		Whitney Drain		Whitney Drain		Whitney Drain			
Road Crossing/Location:	Turner Rd (E of Deland Rd)		Turner Rd (E of Deland Rd)		Turner Road (W of Deland Rd)		Turner Road (W of Deland Rd)			
County Code:	06		06		06		06			
TRS:	20N07E10		20N07E10		20N07E09		20N07E09			
Latitude (dd):	44.14321		44.14321		44.14254		44.14254			
Longitude (dd):	-83.60604		-83.60604		-83.64188		-83.64188			
Ecoregion:	HELP		HELP		HELP		HELP			
Stream Type:	Coldwater		Coldwater		Coldwater		Coldwater			
USGS Basin Code:	4080101		4080101		4080101		4080101			
* Applies only to Riffle/Run stream Surveys										
** Applies only to Glide/Pool stream Surveys										
COMMENTS: Whitney Drain is the rerouting of the E. Br. AuGres River. Station 6 was at the head of the drain while Station 5 was approximately 1.8 miles downstream										

Appendix A. Summary of 2005 and 2010 Kawkawlin-Wiscoggin basin sites visited with dry, stagnant, or only in small thread flow conditions.

WATERBODY	COUNTY	LOCATION	TRS	LATITUDE	LONGITUDE	DATE	DATE/COMMENTS	YEAR	AUIDs
Kawkawlin River N to Pine River									
Kawkawlin system									
Kawkawlin River	Bay	Euclid Rd	T14N R5E S6	43.64356	83.91346	8/05	8/05 - **Reversed flow** (Rpt 07/043)	2005	040801020206-03
Kawkawlin River	Bay	Wheeler Rd (090009)	T14N R4E S10	43.63863	83.97628	8/10	8/10 - Stagnant, lentic wetland setting	2010	040801020206-02
Kawkawlin River	Bay	Mackinaw Rd	T14N R4E S16	43.61847	83.99217	8/10	8/10 - Stagnant. [Had Flow 1,100' u/s in 8/05 (Rpt 07/043)]	2010	040801020206-02
Culver Ck	Bay	North Union Rd	T14N R4E S21	43.61019	84.00578	8/10	8/10 - Stagnant, near dry. Nearly dry in 8/05 (Rpt 07/043)	2010	040801020206-01
Culver Ck	Bay	Fraser Rd	T14N R4E S20	43.60447	84.01203	8/05	8/05 - Stagnant. (Rpt 07/043)	2005	040801020206-01
Kawkawlin River	Bay	Fraser Rd	T14N R4E S17	43.61829	84.01165	8/10	8/10 - Stagnant.	2010	040801020204-01
Kawkawlin River	Bay	7 Mile Rd	T14N R4E S18	43.62432	84.03137	8/10	8/10 - Stagnant.	2010	040801020204-01
Kawkawlin River	Bay	8 Mile Rd	T14N R3E S12	43.62432	84.03137	8/10	8/10 - Stagnant.	2010	040801020204-01
Kawkawlin River	Bay	d/s Wheeler Rd	T14N R3E S12	43.63604	84.05943	8/10	8/10 - Stagnant channel about 0.6 mile d/s of Wheeler at given Lat/long. In 8/05, imperceptable flow 200 yds d/s of Wheeler (Rpt 07/043)	2010	040801020204-01
Dingman Drain	Bay	Garfield Rd	T14N R3E S3	43.65226	84.08853	7/10	7/10 - Stagnant	2010	040801020203-01
Davis Drain	Bay	Garfield Rd	T15N R3E S27	43.67197	84.08815	7/10	7/10 - Nearly stagnant; flow only in narrow threads through algae mats. 8/05 - Stagnant. (Rpt 07/043)	2010	040801020202-01
Dietline Drain	Bay	Garfield Rd	T15N R3E S27	43.68251	84.08781	7/10	7/10 - Stagnant	2010	040801020203-01
N. Br. Kawkawlin River	Bay	Beaver Rd	T15N R4E S27	43.66738	83.97025	8/10	8/10 - Nearly stagnant; flow only in very narrow thread.	2010	040801020205-02
N. Br. Kawkawlin River	Bay	Mackinaw Rd	T15N R4E S21	43.69277	83.98855	8/10	8/10 - Stagnant. Wide wetland channel, not P-51 material.	2010	040801020205-02
Hembling Drain	Bay	Mackinaw Rd	T15N R4E S28	43.66851	83.98912	8/10	8/10 - Stagnant.	2010	040801020205-03
N. Br. Kawkawlin River	Bay	7 Mile	T15N R4E S18	43.70142	84.02796	8/10	8/10 - Stagnant.	2010	040801020205-02
N. Br. Kawkawlin River	Bay	8 Mile	T15N R3E S13	43.70421	84.04789	8/10	8/10 - Stagnant.	2010	040801020205-02
Crump Drain	Bay	Garfield Rd	T16N R3E S34	43.75347	84.08732	7/10	7/10 - Nearly dry.	2010	040801020205-NA
N. Br. Kawkawlin River	Bay	Garfield Rd	T15N R3E S3	43.7263	84.08752	8/05	8/05 - Stagnant. (Rpt 07/043)	2005	040801020205-01
N. Br. Kawkawlin River	Bay	Anderson Rd	T16N R3E S32	43.75444	84.14496	8/05	8/05 - Stagnant. (Rpt 07/043)	2005	040801020205-01
N. Br. Kawkawlin River	Bay	Erickson Rd	T16N R3E S7	43.80104	84.15666	8/05	8/05 - Stagnant. (Rpt 07/043)	2005	040801020201-01

Individual Drains

Railroad Drain	Bay	7 Mile	T15N R4E S7	43.72191	84.0276	7/10	7/10 - Stagnant	2010	040801020106-08
Railroad Drain	Bay	Mackinaw Rd	T15N R4E S4	43.72878	83.98803	8/10	8/10 - Nearly stagnant; flow only in two 4" wide threads.	2010	040801020106-08
Railroad Drain	Bay	M-13	T15N R4E S3	43.73314	83.97517	8/05	8/05 - Stagnant (Rpt 07/043)	2005	040801020106-08
Railroad Drain	Bay	Elevator Rd	T15N R4E S2	43.73373	83.95831	8/05	8/05 - Stagnant (Rpt 07/043)	2005	040801020106-08
Tap-Gove Drn (to Railroad)	Bay	Mackinaw Rd	T16N R4E S33	43.74049	83.98808	8/10	8/10 - Stagnant.	2010	040801020106-08
Tap-Gove Drn (to Railroad)	Bay	M-13	T15N R4E S3	43.73769	83.97626	8/05	8/05 - Dry (Rpt 07/043)	2005	040801020106-08
Gregory Drain	Bay	Mackinaw Rd	T16N R4E S21	43.76775	83.98776	7/10	7/10 - Dry to Stagnant.	2010	040801020106-11
Gregory Drain	Bay	M-13	T16N R4E S27	43.76476	83.97695	8/10	8/10 - Stagnant.	2010	040801020106-11
Gregory Drain	Bay	Tower Rd	T16N R4E S27	43.76361	83.96822	8/05	8/05 - Dry (Rpt 07/043)	2005	040801020106-11
Erickson Drain trib	Bay	Garfield RD	T16N R3E S10	43.7982	84.08699	7/10	7/10 - Stagnant	2010	040801020109-NA
Erickson Drain trib	Bay	Garfield Rd	T16N R3E S10	43.80303	84.08699	7/10	7/10 - Stagnant	2010	040801020109-NA
Erickson Drain (to Tebo)	Bay	Garfield Rd	T16N R3E S10	43.80733	84.08699	7/10	7/10 - Stagnant	2010	040801020109-NA
Tebo Drain	Bay	M-13	T16N R4E S10	43.80169	83.96736	8/10	8/10 - Stagnant. Dry in 8/05 (Rpt 07/043)	2010	040801020109-01
Branch #2 Johnson Drain	Bay	11 Mile Rd	T16N R3E S4	43.82058	84.10606	8/10	8/10 - Dry	2010	040801020108-NA
Branch #2 Johnson Drain	Bay	8 Mile Rd	T16N R3E S1	43.81745	84.04595	7/10	7/10 - Nearly stagnant; flow only in narrow thread.	2010	040801020108-NA
Branch #2 Johnson Drain	Bay	Termell Rd	T16N R4E S4	43.81608	83.99663	8/10	8/10 - Stagnant. Had minimal thread Qr on 8-3.	2010	040801020108-NA
Johnson Drain	Bay	Mackinaw Rd	T16N R4E S4	43.8226	83.98664	8/05	8/05 - Stagnant (Rpt 07/043)	2005	040801020108-NA
Johnson Drain	Bay	M-13	T17N R4E S34	43.82724	83.967	8/10	8/10 - Stagnant. Had minimal thread Qr on 8-3.	2010	040801020108-01

Pinnconning System

S.Br Pinnconning	Bay	11 Mile Rd	T17N R3E S33	43.83285	84.10569	7/10	7/10 - Nearly stagnant; flow only in narrow thread.	2010	040801020107-NA
Hudson Branch Drain	Bay	Garfield Rd	T17N R3E S27	43.85415	84.08516	8/10	8/10 - Dry. On 7-28 was nearly stagnant, flow only in narrow thread.	2010	040801020107-NA
Pinnconning River	Bay	7 Mile Rd	T17N R4E S30	43.84417	84.02621	8/10	8/10 - Stagnant.	2010	040801020107-NA
Pinnconning River	Bay	Fraser Rd	T17N R4E S29	43.8442	84.00646	8/10	8/10 - Nearly dry; flow is only 7" by 1/4" thread.	2010	040801020107-NA
Pinnconning River	Bay	Mackinaw Rd	T17N R4E S28	43.85116	83.98636	7/10	8/10 - Stagnant disconnected pools	2010	040801020107-NA
Pinnconning River	Bay	Pinnconning Rd	T17N R4E S22	43.85366	83.98446	8/05	8/05 - Dry (Rpt 07/043). 8/10 - Stagnant disconnected pools	2010	040801020107-NA
Pinnconning River	Bay	Water St	T17N R4E S23	43.86082	83.95953	8/10	8/10 - Stagnant	2010	040801020107-01

Individual Drains/Creeks

Selleck Drain	Bay	Fraser	T17N R4E S17	43.87701	84.00616	7/10	7/10 - Stagnant	2010	040801020104-04
Selleck Drain	Bay	M-13	T17N R4E S15	43.88041	83.96617	7/10	8/10 - Stagnant	2010	040801020104-04

White Feather Ck	Bay	N. Tower Beach Rd	T17N R4E S11	43.89402	83.94658	8/05	8/05 - Dry (Rpt 07/043)	2005	040801020104-05
White Feather Ck	Bay	M-13	T17N R4E S3	43.89683	83.9664	8/10	8/10 - Stagnant	2010	040801020104-05
Wilson Drn (to White Feather)	Bay	Carter Rd	T17N R3E S20	43.86337	84.12511	8/10	8/10 - Stagnant	2010	040801020104-05
Wilson Drn (to White Feather)	Bay	Cody-Esty Rd	T17N R3E S20	43.86882	84.11671	8/10	8/10 - dry (d-s) to stagnant (u-s).	2010	040801020104-05
Saganing River	Arenac	North Rd	T18N R4E S25	43.93436	83.93676	8/05	8/05 - Stagnant (Rpt 07/043)	2005	040801020105-01
Saganing River	Arenac	M-13	T18N R4E S33	43.92524	83.98636	8/10	8/10 - Stagnant: u-s channel is Cladophora mats choked. 8/05 - Stagnant (Rpt 07/043).	2010	040801020105-01
Saganing River	Bay	Knickerbocker Rd	T17N R4E S5	43.91082	84.01402	8/10	8/10 - Stagnant disconnected pools; had flow (storm) on 7-28.	2010	040801020105-01
Saganing River	Bay	7 Mile Rd	T17N R4E S6	43.90948	84.0259	8/05	8/05 - Dry (Rpt 07/043)	2005	040801020105-01
Saganing River	Bay	8 Mile Rd	T18N R3E S36	43.91478	84.04484	8/05	8/05 - Dry (Rpt 07/043)	2005	040801020105-01

Pine River system

S. Br. Pine River	Arenac	Pine River Rd	T18N R5E S5	43.9831	83.89358	8/05	8/05 - Stagnant disconnected pools (Rpt 07/043)	2005	040801020102-NA
S. Br. Pine River	Arenac	Lincoln Rd	T18N R4E S19	43.94879	84.02666	8/05	8/05 - Dry (Rpt 07/043)	2005	040801020102-NA
Unnamed Ditch(trib to S. Br.)	Arenac	Bordeau Rd	T18N R4E S27	43.93952	83.97395	8/05	8/05 - Stagnant (Rpt 07/043)	2005	040801020102-NA
Middle Br. Pine River	Arenac	U.S. 23	T18N R4E S2	43.98731	83.95982	8/05	8/05 - Stagnant (Rpt 07/043)	2005	040801020101-NA
Middle Br. Pine River	Arenac	Lincoln Rd	T18N R4E S6	43.9876	84.02722	8/05	8/05 - Dry (Rpt 07/043)	2005	040801020101-NA

East of Saginaw River

AUID 40801030101-01									
Unnamed ditch to bay	Bay	Nolet Rd, just S of M-25	T14N R6E S27	43.58692	83.73993	7/10	7/10 - Stagnant	2010	040801030101-01
Unnamed ditch to bay	Bay	Finn & Nebobish Rds, SW corner	T14N R6E S20	43.60119	83.77996	7/10	7/10 - Stagnant to **reverse flow**	2010	040801030101-01
AUID 40801030105-01									
Unnamed ditch to bay	Tuscola	Bradleyville & Dickerson Rds, SE corner	T14N R7E S23	43.60863	83.6237	7/10	7/10 - Dry	2010	040801030105-01
Unnamed ditch to bay	Tuscola	Loomis Rd, E. of Thomas	T15N R8E S33	43.66741	83.54134	7/10	7/10 - Stagnant	2010	040801030105-01
AUID 40801030108-01									
Ackerman Drain	Tuscola	Loomis Rd, Mid Sxn 34	T15N R8E S34	43.66741	83.51633	7/10	7/10 - Nearly stagnant; flow only in narrow thread.	2010	040801030108-01
Unnamed ditch to Ackerman	Tuscola	Loomis & Ringle, SE corner, drain is u/s of Ackerman Drain.	T15N R8E S34	43.66739	83.52609	7/10	7/10 - Nearly stagnant; flow only in narrow thread. **Reverse flows** here, per farmer.	2010	040801030108-01

Northwest Drain	Tuscola	Bradford Rd, just N of M-81	T12N R7E S9	43.45238	83.64074	7/10	7/10 - Stagnant, nearly dry	2010	040801030103-03
	Tuscola	Dutcher Rd	T13N R7E S12	43.55184	83.5981	7/10	7/10 - Nearly stagnant; flow only in narrow thread.	2010	040801030103-03
	Tuscola	Dickerson Rd	T14N R7E S14	43.6094	83.6042	8/05	8/05 - **Reverse flow**	2005	040801030103-03
Allen Drain	Tuscola	Darbee Rd	T13N R8E S15	43.53801	83.52158	7/10	7/10 - Stagnant	2010	040801030104-02
	Tuscola	Dutcher Rd	T13N R8E S10	43.55239	83.51813	7/10	7/10 - Stagnant	2010	040801030104-02
	Tuscola	Ringle Rd	T13N R8E S4	43.5649	83.52451	7/10	7/10 - Stagnant	2010	040801030104-02
	Tuscola	Elmwood Rd	T14N R8E S32	43.58051	83.55016	7/10	7/10 - Nearly stagnant; flow only in narrow thread.	2010	040801030104-02
	Tuscola	M-25	T14N R8E S8	43.62374	83.56509	7/10	7/10 - Stagnant	2010	040801030104-02
E. Br. Wiscoggin Drain	Tuscola	Surin Rd	T14N R9E S16	43.63346	83.4225	7/10	7/10 - Nearly stagnant; flow only in narrow thread.	2010	040801030108-02

Quanicassee River (not a FY10 watershed)

Unnamed ditch to Q.R.	Bay	Cass Rd, ditch on S side	T13N R6E S1	43.56532	83.71413	8/10	8/10 - Stagnant	2010	040801030102-01
Nearing Drain	Bay	Nolet Rd	T13N R6E S10	43.54378	83.73934	8/10	8/10 - Stagnant	2010	040801030102-01
Redy Drain	Bay	Russell Rd	T13N R6E S14	43.53657	83.72429	8/10	8/10 - Stagnant	2010	040801030102-01
Unnamed ditch to Q.R.	Bay	Russell Rd	T13N R6E S13	43.53661	83.71668	8/10	8/10 - Stagnant	2010	040801030102-01
Halstead (Meiers) Drain	Bay	Finn Rd	T14N R6E S32	43.57232	83.77968	8/10	8/10 - Dry to stagnant	2010	040801030102-01
E.Br Quanicassee (or unnamed ditch)	Tuscola	Akron Rd	T13N R7E S5	43.56545	83.68273	8/05	8/05 - **Reversed flow** (Rpt 07/043)	2005	040801030102-01
--> The 2005 Quanicassee field notes mention presence of many dry ditches and stagnant river but locations were not detailed.									

Note: 8/05 listings include information from both Rpt 07/043 and the raw field notes in the 2005 survey file.
Note: 7/10 and 8/10 listings are from field notes based on numerous site visits during the 2010 survey effort.

Nearly stagnant; flow only in narrow thread --> Means vegetation, usually thick *Cladophora* mats, essentially fills the channel and focuses the limited water into a small part of the overall channel width resulting in minimal evidence of "flow". Channel otherwise would be stagnant due to insufficient water volume.

Reverse flow: 2005, 2010
Dry, stagnant, or nearly stagnant w/ only narrow flow thread: 2005, 2010

Ver 8/23/10