MICHIGAN DEPARTMENT OF ENVIRONMENT, GREAT LAKES, AND ENERGY
WATER RESOURCES DIVISION
MARCH 2020

STAFF REPORT

Biological Survey of the Kawkawlin-Wiscoggin Watershed and Selected Saginaw Bay Tributaries in Arenac, Bay, Gladwin, and Tuscola Counties, June-September 2015

Introduction

Biological and physical habitat conditions of selected water bodies in the Kawkawlin-Wiscoggin watershed were assessed by staff of the Michigan Department of Environment, Great Lakes, and Energy (EGLE), Surface Water Assessment Section (SWAS), from June-September 2015. The primary objectives of the assessments were to:

1) Assess the status and condition of individual water bodies and determine if Michigan Water Quality Standards (WQS) are being met.
2) Address monitoring requests submitted by internal and external customers.
3) Identify nonpoint sources (NPS) of water quality impairment.
4) Collect water quality data needed for Total Maximum Daily Load (TMDL) development or delisting.
5) Evaluate biological community temporal trends.

Watershed Information

The Kawkawlin-Wiscoggin watershed area drains approximately 772 square miles of the

Saginaw Bay basin. The largest portion of the watershed includes the Kawkawlin River basin and the Pine River basin to the north. The other hydrologic unit included in the Kawkawlin-Wiscoggin surveys is the Wiscoggin. The Wiscoggin basin contains the Wiscoggin Drain, Quanicassee River, and several other small sub-basins between the Saginaw River and Sebewaing River. All streams are located within the Huron-Erie Lake Plain (HELP) ecoregion (Omernik and Gallant, 1988).

Approximately 43 percent of land use in the Kawkawlin-Wiscoggin watershed is classified as agricultural and contains miles of channelized waterways. Land uses for the Kawkawlin-Wiscoggin watershed are listed in Table 1, along with land uses for nearby watersheds.

Table 1. Land use summary for the Kawkawln-Wiscoggin watershed and nearby watersheds.

Watershed	Natural Terrestrial	Wetland	Developed	Cultivated Agriculture	Hay/ Pasture	Water	Barren
Au Gres	45.97%	24.20%	7.86%	11.09%	8.51%	1.96%	0.42%
KawKawlin-Wiscoggin	28.9%	12.9%	8.2%	42.9%	5.1%	1.8%	0.3%
AuSable	73.41%	12.75%	8.48%	1.65%	1.63%	1.98%	0.10%
Rifle	50.19%	22.37%	8.56%	8.12%	9.28%	1.30%	0.18%

Historical Watershed Sampling Efforts and Information

Previous monitoring surveys were conducted within the Kawkawlin-Wiscoggin watershed in 2000, 2005, and 2010.

In general, macroinvertebrate communities score as low-acceptable to poor in the Kawkawlin-Wiscoggin watershed. Habitat typically scores between marginal and poor. Agricultural disturbance was noted as the predominant stressor and stations were channelized, receiving significant inputs of water from drainage tile. As a result, rivers in this watershed receive high inputs of nutrients and sediments. Widespread channelization also promotes flow extremes, with high flows in the spring and low flows in the summer dry months. In a given watershed year, many randomly selected status sites cannot be sampled for macroinvertebrates due to water stagnation and/or dry flow conditions. This necessitates the use of randomized backup sites.

Water chemistry data suggests nutrient enrichment is common throughout the watershed and water chemistry values were above ranges reported from Water Chemistry Monitoring Program probabilistic sites within the HELP ecoregion (Rockafellow, 2007). Total Dissolved Solids also exceeded WQS (Rule 51 [R 323.1051] of the Part 4 Rules, WQS, promulgated under Part 31, Water Resources Protection, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended) on the Saganing River, Johnson Drain, Railroad Drain, Kawkawlin River, and Pinconning River.

Methods

Macroinvertebrate communities and physical habitat were qualitatively assessed using SWAS Procedure 51 (Michigan Department of Environmental Quality [MDEQ], 2014) for wadeable streams. If a station was at a road crossing, it was sampled upstream unless otherwise noted.

The macroinvertebrate communities were assessed and scored with metrics that rate water bodies from excellent (+5 to +9) to poor (-5 to -9). Scores from +4 to -4 are rated acceptable. Negative scores in the acceptable range are considered tending towards a poor rating, while positive scores in the acceptable range are tending towards an excellent rating.

Habitat evaluations are based on 10 metrics, with a maximum total score of 200. A station habitat score of >154 is characterized as having excellent habitat, 105-154 is good, 56-104 is marginal, and <56 is poor. Macroinvertebrate community scores are used to determine attainment of the Other Indigenous Aquatic Life and Wildlife (OIALW) designated use. Habitat scores and individual metrics are used to help better understand the biological community scores.

Site Selection

Two site selection methods were used to assess the Kawkawlin-Wiscoggin watershed in 2015. These included (1) stratified random; and (2) targeted (MDEQ, 2015). A total of 15 randomly selected sites were assigned to support the SWAS Status (14 sites) and Trend (1 sites) Program (Figure 1, Table 2). Status sites are used to estimate the watershed attainment status for the OIALW designated use component of Rule 100 (R 323.1100(e)) of the Part 4 Rules. Trend sites are part of a statewide temporal trend analysis (MDEQ, 2015). Trend information cannot be summarized until a third monitoring cycle is complete and sufficient data will have been collected.

In addition to randomized sites, one station was selected for targeted monitoring to answer concerns about nuisance aquatic plants in the Saganing River.

2015 Sampling Results

Table 2. Summary of the aquatic habitat and macroinvertebrate community evaluations for selected stations in the Kawkawlin-Wiscoggin River, June-August 2015.

Station #	Stream Name	Road Crossing	STORET #	County	TRS	Latitude	Longitude	Habitat Evaluation Rating and Score		Macroinvertebrate Community Rating and Score	
S1	North Branch Pine River	Grove Road	60165	Arenac	19N04E35	44.0083	-83.95714	125	Good	Acceptable	3
S2	North Branch Pine River	Arenac State Road	60164	Arenac	18N05E05	43.9855	-83.888	100	Fair	Acceptable	3
S3	Saganing River	Arenac State Road	60163	Arenac	18N05E30	43.9328	-83.92255	103	Fair	Acceptable	-3
S4	White Feather Creek	Fraser Road	90315	Bay	17N04E08	43.8923	-84.00602	53	Fair	Acceptable	-3
S5	Unnamed Tributary to Willard Drain	Maida Road	90314	Bay	16N03E12	43.799	-84.057	72	Fair	Poor	-6
S6	North Branch Kawkawlin River	Mid Glad County Line Road	260137	Gladwin	17N02E36	43.8259	-84.17148	136	Good	Acceptable	1
S7	North Branch Kawkawlin River	8 Mile Road	90318	Bay	15N03E13	43.7037	-84.04863	160	Excellent	Acceptable	-2
S8	North Branch Kawkawlin River	d/s Fraser Rd. off River Rd.	90313	Bay	15N04E17	43.7006	-84.00623	161	Excellent	Poor	-5
S9	Waldo Drain	Beaver Rd.	90312	Bay	15N03E34	43.6682	-84.10106	82	Fair	Poor	-5
S10	Waldo Drain	Letts Road	560215	Midland	15N02E25	43.6691	-84.17479	103	Fair	Poor	-6
S11	Unnamed Tributary to Kawkawlin River	11 Mile Road	90316	Bay	14N03E4	43.6532	-84.10802	100	Fair	Acceptable	-4

Station #	Stream Name	Road Crossing	STORET #	County	TRS	Latitude	Longitude	Habitat Evaluation Rating and Score		Macroinvertebrate Community Rating and Score	
S12	Culver Creek	7 Mile Road	90317	Bay	14N04E30	43.5924	-84.03193	73	Fair	Acceptable	-4
S13	Wiscoggin Drain	Cass City Road	790228	Tuscola	14N08E25	43.5958	-83.47055	89	Fair	Acceptable	-2
S14	East Branch Wiscoggin Drain	French Rd.	790227	Tuscola	14N09E09	43.6463	-83.43311	75	Fair	Poor	-6
Tr1	Herner Drain	Mid Glad County Line Road	260136	Gladwin	17N02E33	43.8271	-84.22897	103	Fair	Acceptable	2
T	Saganing River	Huron Rd.	60161	Arenac	18N04E27	43.9267	-83.9664	NA	NA	NA	NA

S/Tr/T = status, trend, targeted station
NA = Not Applicable

Habitat Scoring Wadeable Stations
Poor < 56
Marginal 56-104
Good 105-154
Excellent >154

Macroinvertebrate Scoring Wadeable Stations
Poor < -4
Acceptable -4 to +4
Excellent > +4

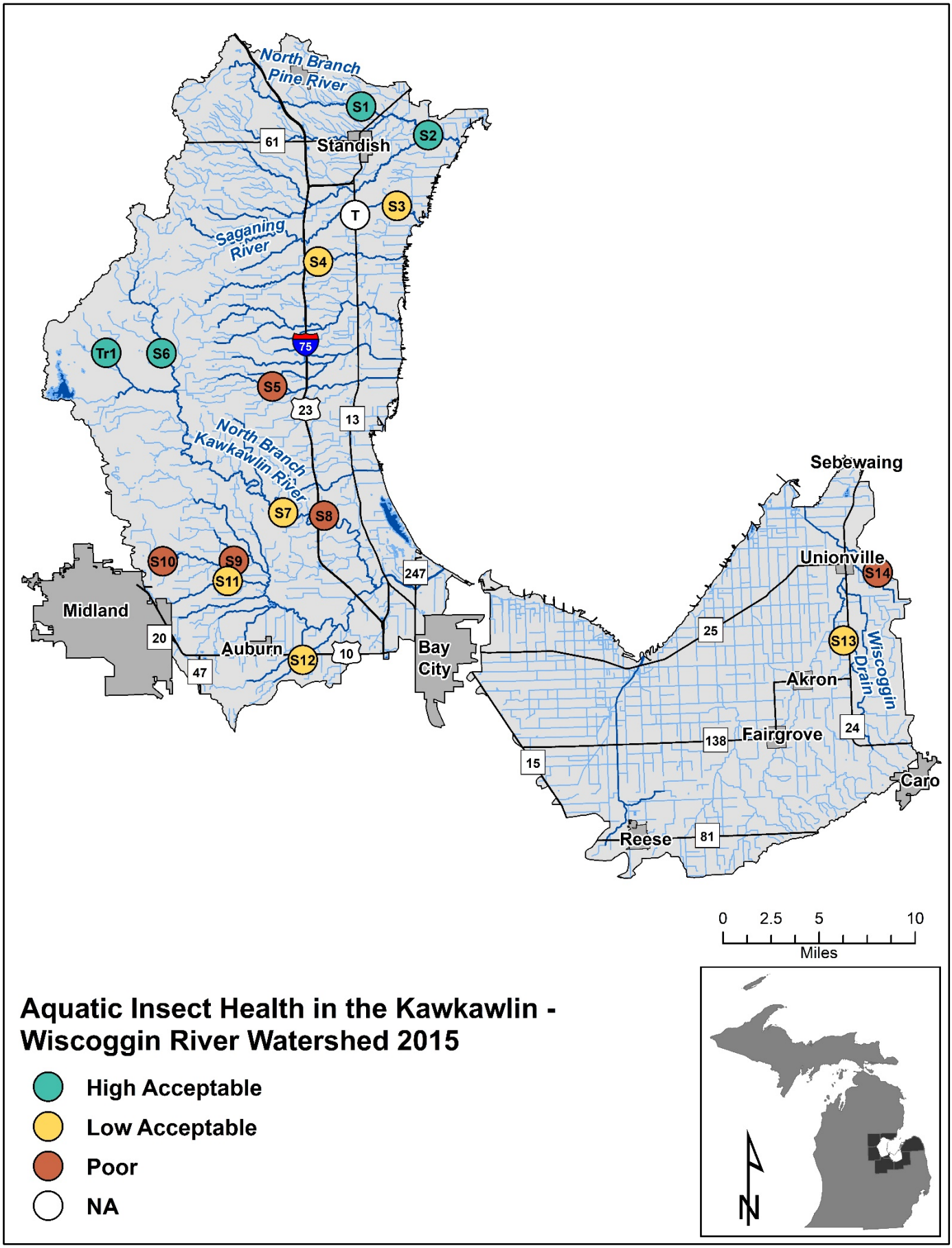

Figure 1. Kawkawlin-Wiscoggin watershed survey locations. Colored dots represent 2015 aquatic macroinvertebrate community station ratings. Colors reflect macroinvertebrate community scores.

Summary of Findings by Monitoring Objective

Objective 1: Assess the status and condition of individual waters of the state and determine whether Michigan WQS are being met.

Figure 2. Upstream view of status station S4 - White Feather Creek at Fraser Road, showing channelization, riparian removal and scarring from recent dredging.

In 2015, 14 randomly selected status sites were selected within the Kawkawlin-Wiscoggin watershed. Habitat and macroinvertebrates scores were negatively impacted by channel alteration, poor bank stability, riparian removal and flashy hydrology (Figure 2). Macroinvertebrate communities at poor sites were characterized by low diversity, lack of mayflies and caddisflies, and a high percentage of snails, leaches, and air breathing taxa. Habitat and biological community scores can be found in Tables 3 and 4, respectively.

Pine River Sub-Basin

Figure 3. Figure 3. Upstream view of station S9 - Waldo Drain at Beaver Road, showing riparian removal and erosion from flashy hydrology.

Five locations were located within the Pine River-Frontal Lake Huron sub-basin. Using biological monitoring procedures for macroinvertebrates, one location scored as poor and 4 out

of 5 locations scored as acceptable and supported the OIALW designated use. The station that scored as poor was in the southern portion of the sub-basin (Station 5). Station 5 was positioned on a straightened agricultural drain with limited macroinvertebrate habitat and a riparian zone that had been cleared for agriculture. Habitat was scored as fair (72) and the riparian zone was limited to herbaceous plants. Macroinvertebrate habitat was primarily limited to overhanging grasses. Stations that scored high acceptable were in the norther latitudes in areas with relatively intact riparian zones.

Kawkawlin River Sub-Basin

Seven locations were located within the Kawkawlin River sub-basin. Using biological monitoring procedures, three stations scored as poor and four scored as acceptable. Stations that scored as poor (Stations 8, 9, and 10) were located in downstream reaches of the sub-basin or agricultural drains that were manipulated by historic dredging and channelization. Macroinvertebrate habitat at these locations was further impacted by flashy flow regimes and riparian zone removal (Figure 3).

That being said, habitat at Station 8 (North Branch Kawkawlin at Fraser Road) scored as excellent habitat overall (161). The habitat score at this location scored as high because of a large swath of forested area along the right bank. Habitat on the left bank and areas upstream are primarily agriculture and residential lawn and the macroinvertebrate community score of poor (-5) reflected these upstream stressors.

Stations that scored highest were in headwater reaches of the sub-basin with intact riparian zones (Stations 6 and 7). The other two stations that scored as acceptable (Stations 11 and 12) were agricultural drains. These locations contained simplified macroinvertebrates communities comprised of tolerant taxa, with a score of low acceptable (-4).

Figure 4. Figure 4. Upstream view of Station S14 - East Branch Wiscoggin Drain at French Road, showing row crops planted to the edge of each bank.

Sebewaing River Sub-Basin

Two locations were sampled on the Sebawaing River sub-basin. One station scored as acceptable and the other scored as poor. The station that scored as acceptable was on Wiscoggin Drain upstream of Unionville. The station that scored as poor was on the east branch Wiscoggin Drain. Habitat at both locations was typical of agricultural areas within this region of Michigan. Wiscoggin Drain is straightened and channelized. Macroinvertebrate

habitat at both locations was dominated by overhanging grasses. The riparian zone consisted of herbaceous plants and row-crops were planted to within feet of each steam bank (Figure 4). Banks showed evidence of scarring from flashy hydrology.

Objective 2: Satisfy monitoring requests submitted by internal and external customers.

The Saganing River at Huron Road was visited for evaluation of nuisance aquatic plants and algae. The site was visited on June 9, 2015. The stream reach was wide and deep upstream of M-15, which slowed stream velocity and promoted the deposition of silts. Algae and plants were present in areas of open canopy, but nuisance conditions were not present, as described in Rule 60 (R 323.1060(2)) of the Part 4 Rules.

Objective 3: Identify NPS of water quality impairment.

There were no NPS issues investigated in the 2017 sampling season.

Objective 4: Collect water quality data needed for TMDL development or delisting.

There was no monitoring related to TMDL development or delisting.

Objective 5: Evaluate biological community temporal trends.

One trend site has been established for temporal trend analysis. Trend information cannot be summarized until a third cycle is complete and sufficient data will have been collected. However, results from 2015 are summarize below, with general comparisons to 2010.

Herner Drain at Midland Gladwin County Road scored as acceptable (2) for macroinvertebrates and fair (103) for habitat. The previous cycle, this site scored as acceptable (3) for macroinvertebrates and good (131) for habitat.

Conclusions and Future Monitoring Recommendations

Using Procedure 51, 9 of 14 sites met the OIALW designated use. Sources of impairment were similar to those described in Noffke (2011) and Rockafellow (2007). Sites scoring lower with Procedure 51 are generally agricultural drains that are impacted by riparian removal, channelization, and poor bank stability. As in previous years, stagnant flows impacted a large area of the watershed and backup sites were visited when initial sites were not flowing. Future surveys should confirm the presence of flow before conducting Procedure 51.

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Table 3. Habitat evaluation for selected stations in the Kawkawlin-Wiscoggin watershed, 2015.

	STATION S1	STATION S2	STATION S3	STATION S4
	North Branch Pine River	North Branch Pine River	Saganing River	White Feather Creek
	Grove Road	Arenac State Road	Arenac State Road	Fraser Road
	6/9/2015	7/1/2015	6/9/2015	6/9/2015
	RIFFLE/RUN	GLIDE/POOL	GLIDE/POOL	GLIDE/POOL
HABITAT METRIC				
Substrate and Instream Cover				
Epifaunal Substrate/ Avail Cover (20)	15	13	5	4
Embeddedness (20)*	13			
Velocity/Depth Regime (20)*	9			
Pool Substrate Characterization (20)**		11	10	8
Pool Variability (20)**		11	4	2
Channel Morphology				
Sediment Deposition (20)	11	16	18	1
Flow Status - Maint. Flow Volume (10)	8	0	10	8
Flow Status - Flashiness (10)	2	5	2	2
Channel Alteration (20)	16	16	11	5
Frequency of Riffles/Bends (20)*	18			
Channel Sinuosity (20)**		10	10	5
Riparian and Bank Structure				
Bank Stability (L) (10)	3	4	3	6
Bank Stability (R) (10)	4	4	5	8
Vegetative Protection (L) (10)	6	5	5	2
Vegetative Protection (R) (10)	7	5	7	2
Riparian Vegetation Zone Width (L) (10)	5	0	4	0
Riparian Vegetation Zone Width (R) (10)	8	0	9	0
TOTAL SCORE (200):	125	100	103	53
HABITAT RATING:	**GOOD**	**FAIR**	**FAIR**	**POOR**
Date:	6/9/2015	7/1/2015	6/9/2015	6/9/2015
Weather:	Sunny	Cloudy	Sunny	Sunny
Air Temperature: ºF	68	68	76	76
Water Temperature: ºF	64	64	69	70
Ave. Stream Width: Feet	14	25	27	9
Ave. Stream Depth: Feet	0.6	2.3	1.6	0.33
Surface Velocity: Feet/Second	0.44	0.52	0.22	1.28
Estimated Flow: Cubic Feet/Second	3.26	22.01	9.78	3.39
Stream Modifications:	Dredged	Canopy Removal	Dredged	Dredged
Nuisance Plants (Y/N):	Y	N	Y	N
STORET No.:	060165	060164	060163	090315
County Code:	06	06	06	09
TRS:	19N04E35	18N05E05	18N05E30	17N04E08
Latitude (dd):	44.00832	43.9855	43.93278	43.8923
Longitude (dd):	-83.95714	-83.888	-83.92255	-84.00602
Ecoregion:	HELP	HELP	HELP	HELP
Stream Type:				
USGS Basin Code:	4080102	4080102	4080102	4080102

Table 3 (continued). Habitat evaluation for selected stations in the Kawkawlin-Wiscoggin watershed, 2015.

	STATION S5	STATION S6	STATION S7	STATION S8
	Unnamed Tributary to Willard Drain	North Branch Kawkawlin River	North Branch Kawkawlin River	North Branch Kawkawlin River
	Maida Road	Mid Glad County Line Road	8 Mile Road	downstream Fraser Road
	6/10/2015	7/7/2015	7/7/2015	7/6/2015
	GLIDE/POOL	GLIDE/POOL	GLIDE/POOL	GLIDE/POOL
HABITAT METRIC				
Substrate and Instream Cover				
Epifaunal Substrate/ Avail Cover (20)	6	11	13	13
Embeddedness (20)*				
Velocity/Depth Regime (20)*				
Pool Substrate Characterization (20)**	6	15	15	11
Pool Variability (20)**	3	14	16	14
Channel Morphology				
Sediment Deposition (20)	10	10	17	16
Flow Status - Maint. Flow Volume (10)	9	9	9	9
Flow Status - Flashiness (10)	5	4	8	8
Channel Alteration (20)	8	18	17	20
Frequency of Riffles/Bends (20)*				
Channel Sinuosity (20)**	5	10	18	18
Riparian and Bank Structure				
Bank Stability (L) (10)	5	5	9	9
Bank Stability (R) (10)	5	6	9	9
Vegetative Protection (L) (10)	5	8	9	10
Vegetative Protection (R) (10)	5	8	8	10
Riparian Vegetation Zone Width (L) (10)	0	9	8	4
Riparian Vegetation Zone Width (R) (10)	0	9	4	10
TOTAL SCORE (200):	72	136	160	161
HABITAT RATING:	**FAIR**	**GOOD**	**EXCELLENT**	**EXCELLENT**
Date:	6/10/2015	7/7/2015	7/7/2015	7/6/2015
Weather:	Sunny	Cloudy	Cloudy	Sunny
Air Temperature: ºF	80	66	58	78
Water Temperature: ºF	64	66	67	70
Ave. Stream Width: Feet	3	8.5	39	45
Ave. Stream Depth: Feet	0.67	0.5	3.3	3.4
Surface Velocity: Feet/Second	0.52	0.39	0.27	0.14
Estimated Flow: Cubic Feet/Second	1.24	1.72	20.55	21.03
Stream Modifications:	Dredged	None	None	None
Nuisance Plants (Y/N):	Y	N	Y	N
STORET No.:	090314	260137	090318	090313
County Code:	09	26	09	09
TRS:	16N03E12	17N02E36	15N03E13	15N04E17
Latitude (dd):	43.79896	43.82592	43.70374	43.70061
Longitude (dd):	-84.057	-84.17148	-84.04863	-84.00623
Ecoregion:	HELP	HELP	HELP	HELP
Stream Type:		Warmwater		
USGS Basin Code:	4080102	4080102	4080102	4080102

Table 3 (continued). Habitat evaluation for selected stations in the Kawkawlin-Wiscoggin watershed, 2015.

	STATION S9	STATION S10	STATION S11	STATION S12
	Waldo Drain	Waldo Drain	Unnamed Tributary to Kawkawlin River	Culver Creek
	Beaver Road	Letts Road	11 Mile Road	7 Mile Road
	6/10/2015	6/10/2015	7/5/2015	7/6/2015
	GLIDE/POOL	GLIDE/POOL	RIFFLE/RUN	GLIDE/POOL
HABITAT METRIC				
Substrate and Instream Cover				
Epifaunal Substrate/ Avail Cover (20)	10	11	9	6
Embeddedness (20)*			13	
Velocity/Depth Regime (20)*			9	
Pool Substrate Characterization (20)**	11	9		11
Pool Variability (20)**	5	5		3
Channel Morphology				
Sediment Deposition (20)	10	10	10	8
Flow Status - Maint. Flow Volume (10)	8	7	8	9
Flow Status - Flashiness (10)	5	7	2	5
Channel Alteration (20)	8	14	9	6
Frequency of Riffles/Bends (20)*			11	
Channel Sinuosity (20)**	9	6		4
Riparian and Bank Structure				
Bank Stability (L) (10)	4	8	7	5
Bank Stability (R) (10)	2	8	6	4
Vegetative Protection (L) (10)	5	7	6	5
Vegetative Protection (R) (10)	4	6	5	4
Riparian Vegetation Zone Width (L) (10)	1	3	3	2
Riparian Vegetation Zone Width (R) (10)	0	2	2	1
TOTAL SCORE (200):	82	103	100	73
HABITAT RATING:	**FAIR**	**FAIR**	**FAIR**	**FAIR**
Date:	6/10/2015	6/10/2015	7/5/2015	7/6/2015
Weather:	Sunny	Sunny	Sunny	Sunny
Air Temperature: ºF	86	86	80	78
Water Temperature: ºF	75	80	73	66
Ave. Stream Width: Feet	11	10	5	3.7
Ave. Stream Depth: Feet	0.75			0.42
Surface Velocity: Feet/Second	0.55	0.68	0.18	0.26
Estimated Flow: Cubic Feet/Second	4.78	2.41	0.34	0.44
Stream Modifications:	Dredged	Dredged	Dredged	Dredged
Nuisance Plants (Y/N):	N	Y	N	Y
STORET No.:	090312	560215	090316	090317
County Code:	09	56	09	09
TRS:	15N03E34	15N02E25	14N03E4	14N04E30
Latitude (dd):	43.6682	43.66907	43.65316	43.59238
Longitude (dd):	-84.10106	-84.17479	-84.10802	-84.03193
Ecoregion:	HELP	HELP	HELP	HELP
Stream Type:				
USGS Basin Code:	4080102	4080102	4080102	4080102

Table 3 (continued). Habitat evaluation for selected stations in the Kawkawlin-Wiscoggin watershed, 2015.

	STATION S13	STATION S14	STATION Tr1
	Wiscoggin Drain	East Branch Wiscoggin Drain	Herner Drain
	Cass City Rd.	French Rd.	Mid Glad County Line Rd.
	7/1/2015	7/1/2015	7/27/2015
	GLIDE/POOL	GLIDE/POOL	RIFFLE/RUN
HABITAT METRIC			
Substrate and Instream Cover			
Epifaunal Substrate/ Avail Cover (20)	13	10	8
Embeddedness (20)*			11
Velocity/Depth Regime (20)*			14
Pool Substrate Characterization (20)**	12	8	
Pool Variability (20)**	2	5	
Channel Morphology			
Sediment Deposition (20)	13	5	6
Flow Status - Maint. Flow Volume (10)	9	9	7
Flow Status - Flashiness (10)	4	2	4
Channel Alteration (20)	7	9	11
Frequency of Riffles/Bends (20)*			10
Channel Sinuosity (20)**	5	1	
Riparian and Bank Structure			
Bank Stability (L) (10)	5	6	6
Bank Stability (R) (10)	4	6	6
Vegetative Protection (L) (10)	4	6	5
Vegetative Protection (R) (10)	4	6	6
Riparian Vegetation Zone Width (L) (10)	2	1	4
Riparian Vegetation Zone Width (R) (10)	5	1	5
TOTAL SCORE (200):	89	75	103
HABITAT RATING:	**FAIR**	**FAIR**	**FAIR**
Date:	7/1/2015	7/1/2015	7/27/2015
Weather:	Cloudy	Cloudy	Sunny
Air Temperature: ºF	66	62	77
Water Temperature: ºF	68	60	64
Ave. Stream Width: Feet	13	7	4
Ave. Stream Depth: Feet	0.42	1.2	0.5
Surface Velocity: Feet/Second	0.98	0.16	0.06
Estimated Flow: Cubic Feet/Second	4.18	0.90	0.11
Stream Modifications:	Dredged	Dredged	Dredged
Nuisance Plants (Y/N):	N	Y	Y
STORET No.:	790228	790227	260136
County Code:	79	79	26
TRS:	14N08E25	14N09E09	17N02E33
Latitude (dd):	43.59576	43.6463	43.82708
Longitude (dd):	-83.47055	-83.43311	-84.22897
Ecoregion:	HELP	HELP	HELP
Stream Type:			Warmwater
USGS Basin Code:	4080103	4080103	4080102

Table 4a. Qualitative macroinvertebrate community sampling results at selected stations in the Kawkawlin-Wiscoggin watershed, 2015.

	North Branch Pine River Grove Rd.	North Branch Pine River Arenac State Road Rd.	Saganing River Arenac State Rd.	White Feather Creek Fraser Rd.
	Station S1	Station S2	Station S3	Station S4
TAXA	**6/9/2015**	**7/1/2015**	**6/9/2015**	**6/9/2015**
ANNELIDA (segmented worms)				
Oligochaeta (worms)	5	16		11
ARTHROPODA				
Crustacea				
Amphipoda (scuds)	126	11	8	70
Decapoda (crayfish)	1	1	1	2
Isopoda (sowbugs)	6	13	16	35
Arachnoidea				
Hydracarina		2	23	1
Insecta				
Ephemeroptera (mayflies)				
Baetidae	10	16	16	2
Caenidae		3	19	
Ephemerellidae		1		
Heptageniidae	11	4	1	
Tricorythidae		4		
Odonata				
Anisoptera (dragonflies)				
Aeshnidae	1		3	1
Gomphidae	1			
Libellulidae		1		
Zygoptera (damselflies)				
Calopterygidae	4	5	1	
Coenagrionidae		4		
Plecoptera (stoneflies)				
Nemouridae	1			
Perlidae	4			
Perlodidae		3		10
Hemiptera (true bugs)				
Corixidae				7
Gerridae			1	
Mesoveliidae		30		
Notonectidae			1	
Pleidae		8		
Megaloptera				
Corydalidae (dobson flies)	3			
Trichoptera (caddisflies)				
Brachycentridae	5	7		
Helicopsychidae	1	1		
Hydropsychidae	14	16	1	
Hydroptilidae	1			
Leptoceridae	9	58	3	
Limnephilidae	3	1	1	1
Uenoidae	1	1		
Coleoptera (beetles)				

	North Branch Pine River Grove Rd.	North Branch Pine River Arenac State Road Rd.	Saganing River Arenac State Rd.	White Feather Creek Fraser Rd.
	Station S1	Station S2	Station S3	Station S4
TAXA	**6/9/2015**	**7/1/2015**	**6/9/2015**	**6/9/2015**
Dytiscidae (total)				26
Gyrinidae (adults)			1	
Haliplidae (adults)		1	1	2
Hydrophilidae (total)		1		
Dryopidae	1			1
Elmidae	20	17		
Diptera (flies)				
Ceratopogonidae		1	2	1
Chironomidae	43	21	156	83
Ephydridae				3
Simuliidae	1	3		4
Tabanidae	1		1	9
Tipulidae	1			
MOLLUSCA				
Gastropoda (snails)				
Hydrobiidae			2	
Lymnaeidae				1
Physidae	1	16	2	3
Planorbidae	1			1
Pelecypoda (bivalves)				
Sphaeriidae (clams)	6	1	1	2
TOTAL INDIVIDUALS	**282**	**267**	**261**	**276**

Table 4b. Qualitative macroinvertebrate community sampling results at selected stations in the Kawkawlin-Wiscoggin watershed, 2015.

	North Branch Pine River Grove Rd.		North Branch Pine River Arenac State Rd.		Saganing River Arenac State Rd.		White Feather Creek Fraser Rd.	
	Station S1		Station S2		Station S3		Station S4	
METRIC	Value	Score	Value	Score	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	28	0	30	0	22	0	22	1
NUMBER OF MAYFLY TAXA	2	1	5	1	3	0	1	0
NUMBER OF CADDISFLY TAXA	7	1	6	1	3	0	1	-1
NUMBER OF STONEFLY TAXA	2	1	1	1	0	-1	1	1
PERCENT MAYFLY COMPOSITION	7.45	-1	10.49	-1	13.79	-1	0.72	-1
PERCENT CADDISFLY COMPOSTITION	12.06	0	31.46	1	1.92	-1	0.36	-1
PERCENT DOMINANT TAXON	44.68	-1	21.72	0	59.77	-1	30.07	-1
PERCENT ISOPOD, SNAIL, LEECH	2.84	1	10.86	0	7.66	0	14.49	-1
PERCENT SURFACE AIR BREATHERS	0.00	1	14.98	0	1.53	1	12.68	0
TOTAL SCORE		**3**		**3**		**-3**		**-3**
MACROINVERTEBRATE COMMUNITY RATING	**Acceptable**		**Acceptable**		**Acceptable**		**Acceptable**	

Table 4a (continued). Qualitative macroinvertebrate community sampling results at selected stations in the Kawkawlin-Wiscoggin watershed, 2015.

	Unnamed Tributary to Willard Drain Maida Rd.	North Branch Kawkawlin River Mid Glad County Line Rd.	North Branch Kawkawlin River 8 Mile Rd.	North Branch Kawkawlin River downstream Fraser Rd.
	Station S5	Station S6	Station S7	Station S8
TAXA	**6/10/2015**	**7/7/2015**	**7/7/2015**	**7/6/2015**
PLATYHELMINTHES (flatworms)				
Turbellaria				21
ANNELIDA (segmented worms)				
Hirudinea (leeches)	5	1	1	2
Oligochaeta (worms)	8	1	6	
ARTHROPODA				
Crustacea				
Amphipoda (scuds)	1	73	28	28
Decapoda (crayfish)	1	1	1	4
Isopoda (sowbugs)	68	71	140	311
Arachnoidea				
Hydracarina	8	4		
Insecta				
Ephemeroptera (mayflies)				
Baetidae		6	3	
Caenidae			1	5
Heptageniidae		2	1	4
Leptophlebiidae				1
Odonata				
Anisoptera (dragonflies)				
Aeshnidae		1	1	1
Libellulidae	1	5		1
Zygoptera (damselflies)				
Coenagrionidae	2		1	10
Lestidae	1			
Plecoptera (stoneflies)				
Perlidae		4	1	
Hemiptera (true bugs)				
Belostomatidae	1		1	
Corixidae	21	1	2	5
Gerridae		1	1	
Notonectidae		7	1	1
Pleidae	1		1	
Megaloptera				
Corydalidae (dobson flies)				1
Sialidae (alder flies)				1
Trichoptera (caddisflies)				
Hydropsychidae		2		
Leptoceridae			2	
Limnephilidae		1	1	
Phryganeidae		1		
Lepidoptera (moths)				
Pyralidae			1	
Coleoptera (beetles)				
Dytiscidae (total)	12		1	4

	Unnamed Tributary to Willard Drain Maida Rd.	North Branch Kawkawlin River Mid Glad County Line Rd.	North Branch Kawkawlin River 8 Mile Rd.	North Branch Kawkawlin River downstream Fraser Rd.
	Station S5	Station S6	Station S7	Station S8
TAXA	**6/10/2015**	**7/7/2015**	**7/7/2015**	**7/6/2015**
Haliplidae (adults)	4	2	1	
Hydrophilidae (total)		3		
Dryopidae		9		
Elmidae		13	1	2
Haliplidae (larvae)	3			1
Diptera (flies)				
Chironomidae	65	62	17	7
Simuliidae	2	1		
MOLLUSCA				
Gastropoda (snails)				
Ancylidae (limpets)			3	
Hydrobiidae	31			
Lymnaeidae	1	1	22	1
Physidae	40	8	73	9
Planorbidae	6	1	11	3
Viviparidae			2	4
Pelecypoda (bivalves)				
Sphaeriidae (clams)		4	2	4
TOTAL INDIVIDUALS	**282**	**286**	**327**	**431**

Table 4b (continued). Qualitative macroinvertebrate community sampling results at selected stations in the Kawkawlin-Wiscoggin watershed, 2015.

	Unnamed Tributary to Willard Drain Maida Rd.		N.B. Kawkawlin River Mid Glad County Line Rd.		North Branch Kawkawlin River 8 Mile Rd.		North Branch Kawkawlin River downstream Fraser Rd.	
	Station S5		Station S6		Station S7		Station S8	
METRIC	Value	Score	Value	Score	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	20	1	27	1	29	0	24	0
NUMBER OF MAYFLY TAXA	0	-1	2	1	3	0	3	0
NUMBER OF CADDISFLY TAXA	0	-1	3	1	2	0	0	-1
NUMBER OF STONEFLY TAXA	0	-1	1	1	1	1	0	-1
PERCENT MAYFLY COMPOSITION	0.00	-1	2.80	-1	1.53	-1	2.32	-1
PERCENT CADDISFLY COMPOSTITION	0.00	-1	1.40	-1	0.92	-1	0.00	-1
PERCENT DOMINANT TAXON	24.11	-1	25.52	-1	42.81	-1	72.16	-1
PERCENT ISOPOD, SNAIL, LEECH	53.55	-1	28.67	-1	77.06	-1	76.57	-1
PERCENT SURFACE AIR BREATHERS	13.83	0	4.90	1	2.45	1	2.32	1
TOTAL SCORE		**-6**		**1**		**-2**		**-5**
MACROINVERTEBRATE COMMUNITY RATING	**Poor**		**Acceptable**		**Acceptable**		**Poor**	

Table 4a (continued). Qualitative macroinvertebrate community sampling results at selected stations in the Kawkawlin-Wiscoggin watershed, 2015.

	Waldo Drain Beaver Rd.	Waldo Drain Letts Rd.	Unnamed Tributary to Kawkawlin River 11 Mile Rd.	Culver Creek 7 Mile Rd.
	Station S9	Station S10	Station S11	Station S12
TAXA	6/10/2015	6/10/2015	7/5/2015	7/6/2015
PLATYHELMINTHES (flatworms)				
Turbellaria			3	
ANNELIDA (segmented worms)				
Hirudinea (leeches)		13	5	5
Oligochaeta (worms)	6	8	4	3
ARTHROPODA				
Crustacea				
Amphipoda (scuds)	17		352	1
Decapoda (crayfish)		1	2	
Isopoda (sowbugs)			62	1
Arachnoidea				
Hydracarina	1	1		9
Insecta				
Odonata				
Anisoptera (dragonflies)				
Aeshnidae		5	8	1
Zygoptera (damselflies)				
Coenagrionidae	2	5		1
Hemiptera (true bugs)				
Corixidae	13	6	1	10
Gerridae			1	
Trichoptera (caddisflies)				
Hydropsychidae			9	
Molannidae		1		
Polycentropodidae				1
Coleoptera (beetles)				
Dytiscidae (total)	2	4		7
Gyrinidae (adults)	1			1
Hydrophilidae (total)	1		1	1
Elmidae	2	1	16	
Gyrinidae (larvae)	1			
Haliplidae (larvae)				1
Diptera (flies)				
Ceratopogonidae		6		
Chironomidae	185	64		35
Simuliidae	6	24		47
Stratiomyidae		1		
Tabanidae	1	5	1	
Tipulidae	1	1		1
MOLLUSCA				
Gastropoda (snails)				
Lymnaeidae			2	31
Physidae	19	64	1	203
Planorbidae		3		120
Viviparidae		76		

	Waldo Drain Beaver Rd.	Waldo Drain Letts Rd.	Unnamed Tributary to Kawkawlin River 11 Mile Rd.	Culver Creek 7 Mile Rd.
	Station S9	Station S10	Station S11	Station S12
TAXA	**6/10/2015**	**6/10/2015**	**7/5/2015**	**7/6/2015**
Pelecypoda (bivalves)				
Sphaeriidae (clams)	7			6
TOTAL INDIVIDUALS	**265**	**289**	**468**	**485**

Table 4b (continued). Qualitative macroinvertebrate community sampling results at selected stations in the Kawkawlin-Wiscoggin watershed, 2015.

	Waldo Drain Beaver Rd.		Waldo Drain Letts Rd.		Unnamed Tributary to Kawkawlin River 11 Mile Rd.		Culver Creek 7 Mile Rd.	
	Station S9		Station S10		Station S11		Station S12	
METRIC	Value	Score	Value	Score	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	15	0	19	0	15	1	20	1
NUMBER OF MAYFLY TAXA	0	-1	0	-1	0	-1	0	-1
NUMBER OF CADDISFLY TAXA	0	-1	1	-1	1	0	1	0
NUMBER OF STONEFLY TAXA	0	-1	0	-1	0	-1	0	-1
PERCENT MAYFLY COMPOSITION	0.00	-1	0.00	-1	0.00	-1	0.00	-1
PERCENT CADDISFLY COMPOSTITION	0.00	-1	0.35	-1	1.92	-1	0.21	-1
PERCENT DOMINANT TAXON	69.81	-1	26.30	-1	75.21	-1	41.86	-1
PERCENT ISOPOD, SNAIL, LEECH	7.17	0	53.98	-1	14.96	-1	74.23	-1
PERCENT SURFACE AIR BREATHERS	6.42	1	3.81	1	0.64	1	3.92	1
TOTAL SCORE		**-5**		**-6**		**-4**		**-4**
MACROINVERTEBRATE COMMUNITY RATING	**Poor**		**Poor**		**Acceptable**		**Acceptable**	

Table 4a (continued). Qualitative macroinvertebrate community sampling results at selected stations in the Kawkawlin-Wiscoggin watershed, 2015.

	Wiscoggin Drain Cass City Rd.	East Branch Wiscoggin Drain French Rd.	Herner Drain Mid Glad County Line Rd.
	7/1/2015	7/1/2015	7/27/2015
TAXA	**Station S13**	**Station S14**	**Station Tr1**
ANNELIDA (segmented worms)			
Hirudinea (leeches)	1	12	
Oligochaeta (worms)	9	2	
ARTHROPODA			
Crustacea			
Amphipoda (scuds)	7	29	7
Decapoda (crayfish)			4
Isopoda (sowbugs)	1	176	
Arachnoidea			
Hydracarina	6	1	2
Insecta			
Ephemeroptera (mayflies)			
Baetidae	23		
Caenidae	1		6
Ephemeridae	1		
Heptageniidae	1		7
Tricorythidae	2		
Odonata			
Anisoptera (dragonflies)			
Aeshnidae	1		1
Corduliidae			1
Zygoptera (damselflies)			
Calopterygidae	4		
Coenagrionidae	4		1
Lestidae		1	
Hemiptera (true bugs)			
Belostomatidae		1	
Corixidae	4	1	1
Gerridae	2	1	2
Mesoveliidae	1	3	
Notonectidae			1
Trichoptera (caddisflies)			
Hydropsychidae			30
Leptoceridae	3		1
Limnephilidae			1
Phryganeidae			1
Coleoptera (beetles)			
Dytiscidae (total)	1	1	
Gyrinidae (adults)	2	1	1
Haliplidae (adults)	7		
Hydrophilidae (total)	1		5
Elmidae	1		82
Diptera (flies)			
Athericidae			1
Ceratopogonidae	1	1	

	Wiscoggin Drain Cass City Rd.	East Branch Wiscoggin Drain French Rd.	Herner Drain Mid Glad County Line Rd.
	7/1/2015	7/1/2015	7/27/2015
TAXA	**Station S13**	**Station S14**	**Station Tr1**
Chironomidae	86	73	112
Dixidae			3
Simuliidae	73		
Tabanidae			1
Tipulidae	1		1
MOLLUSCA			
Gastropoda (snails)			
Lymnaeidae		3	
Physidae	13	1	7
Planorbidae			1
Pelecypoda (bivalves)			
Sphaeriidae (clams)	1		5
TOTAL INDIVIDUALS	**258**	**307**	**285**

Table 4. Table 4b (continued). Qualitative macroinvertebrate community sampling results at selected stations in the Kawkawlin-Wiscoggin watershed, 2015.

	Wiscoggin Drain Cass City Rd.		East Branch Wiscoggin Drain French Rd.		Herner Drain Mid Glad County Line Rd.	
	Station S13		Station S14		Station T1	
METRIC	Value	Score	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	28	0	16	0	26	1
NUMBER OF MAYFLY TAXA	5	1	0	-1	2	1
NUMBER OF CADDISFLY TAXA	1	-1	0	-1	4	1
NUMBER OF STONEFLY TAXA	0	-1	0	-1	0	-1
PERCENT MAYFLY COMPOSITION	10.85	-1	0.00	-1	4.56	-1
PERCENT CADDISFLY COMPOSTITION	1.16	-1	0.00	-1	11.58	0
PERCENT DOMINANT TAXON	33.33	-1	57.33	-1	39.30	-1
PERCENT ISOPOD, SNAIL, LEECH	5.81	1	62.54	-1	2.81	1
PERCENT SURFACE AIR BREATHERS	6.98	1	2.61	1	3.51	1
TOTAL SCORE		**-2**		**-6**		**2**
MACROINVERTEBRATE COMMUNITY RATING	**Acceptable**		**Poor**		**Acceptable**	