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MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY
WATER RESOURCES DIVISION
MARCH 2018

STAFF REPORT

A BIOLOGICAL SURVEY OF SITES ON TALMADGE CREEK NEAR THE ENBRIDGE OIL SPILL IN MARSHALL CALHOUN COUNTY, MICHIGAN 2016-2017

INTRODUCTION

On July 26, 2010, a 30-inch diameter pipeline ruptured and discharged heavy crude oil into Talmadge Creek, a tributary to the Kalamazoo River, which drains into Lake Michigan. The amount of oil discharged is estimated at 819,000 to 1,000,000 gallons. The oil flowed into a wetland and ultimately down 2.2 miles of Talmadge Creek, a small warmwater stream, before entering the Kalamazoo River downstream of Marshall, Michigan. The oil impacted approximately 35 miles of river downstream to Morrow pond where it was contained by the dam. The Kalamazoo River is also a warmwater stream that is bordered by wetland, forest, residential properties, farm land, and commercial properties in Calhoun and Kalamazoo Counties between Marshall and Morrow Lake.

In September 2010, staff of the Michigan Department of Environmental Quality (MDEQ), Water Resources Division (WRD), Surface Water Assessment Section (SWAS), with assistance from Entrix (currently Cardno ENTRIX), conducted qualitative macroinvertebrate community and stream habitat surveys on the Kalamazoo River and Talmadge Creek. The surveys documented that macroinvertebrate abundance and diversity were drastically reduced in both water bodies because of the oil spill and associated cleanup activities (Walterhouse, 2011). The SWAS and Entrix also assisted the Michigan Department of Natural Resources (MDNR), Fisheries Division, with fish collection efforts and quantitative stream habitat assessments. The MDNR, Fisheries Division, reported reduced fish abundance and diversity along with impacts to stream habitat in Talmadge Creek (Wesley & Walterhouse, 2010a). Fish community diversity and catch also declined at two of the three stations on the Kalamazoo River, which were impacted by the oil spill and cleanup activities.

In August 2011, SWAS staff again conducted qualitative macroinvertebrate community and stream habitat surveys on the Kalamazoo River and Talmadge Creek. The objective of these continued surveys was to monitor the short- and long-term effects of the oil spill and associated cleanup activities on macroinvertebrate communities and aquatic habitat. Macroinvertebrate abundance and diversity reported in 2011 (Walterhouse, 2012) in Talmadge Creek were found to have improved from results collected in 2010 (Walterhouse, 2011) in the sections of stream where cleanup activities were conducted, but were still found to be impacted when compared to upstream stations. No oil sheen or odor was noted in the stream during the 2011 surveys in Talmadge Creek, while both had been noted in 2010. Kalamazoo River macroinvertebrate abundance and diversity also improved compared to 2010, but abundance was still impacted when compared to historic data. Oil sheen and petroleum odor were noted at some Kalamazoo River site locations when sampling near depositional areas. Shallow riffle habitat at Stations K2 and K3 (Figure 1), which were described as having been severely disturbed by cleanup activities during the 2010 survey, were noted in 2011 as recovering with noticeable new colonization of periphyton and macroinvertebrates. Sediment deposition, particularly downstream of Battle Creek, was noted as appearing to have increased by both depth and

aerial coverage during the 2011 surveys. Complete results are available in the 2011 MDEQ report (Walterhouse, 2011). Additional cleanup and channel restoration activities in Talmadge Creek were conducted after the August 2011 survey was completed due to discoveries of undetected oil spill deposits that required removal.

Additional monitoring in September 2012 indicated improved conditions at impacted sites as restoration activities were nearly complete at most locations and traffic within the river drastically decreased. Macroinvertebrate scores and diversity were much better than 2010 and were similar to scores recorded in 2011 (Matousek J. J., 2013).

In August 2013, 2014, and 2015, SWAS staff repeated macroinvertebrate and habitat surveys. Scores for macroinvertebrates and habitat at all stations in these subsequent years were very similar to scores recorded in 2012 with some stations scoring slightly higher and some scoring slightly lower (Table 1). These slight changes were all within the expected range of variability. Conditions at impacted locations were noted as continuing to recover and improve as vegetation regrows and restoration activities have concluded (Matousek J. J., 2014), (Matousek J. J., 2015).

Yearly macroinvertebrate sampling on the Kalamazoo River concluded in 2015 and only stations on Talmadge Creek were monitored in 2016 and 2017. An additional station (T2.5) was added in 2016 to supplement the Talmadge Creek locations (Figure 1). This report will focus on those sampling efforts that took place in 2016 and 2017.

The MDNR, Fisheries Division, also concluded yearly monitoring of most locations on the Kalamazoo River in 2015 but continued monitoring of the same locations on Talmadge Creek as the MDEQ through 2017 (Figure 1). The MDNR, Fisheries Division, has completed a report regarding the quantitative stream habitat sampling efforts on the Kalamazoo River (Diana, 2017) and is preparing a separate report regarding efforts on Talmadge Creek.

METHODS

The sites selected for this survey were specifically chosen because of historic (i.e., baseline) surveys that were conducted prior to the oil spill (Wesley & Walterhouse, 2010a) and the fact that they were used in previous years for monitoring the long-term effects of the oil spill and associated cleanup activities. An additional site (Station T2, Figure 1) on Talmadge Creek was added in 2011 just upstream of the oil spill because stream flow at the historic control site further upstream (T1, Figure 2) at 17 Mile Road was minimal. Sampling at T1 was discontinued after 2011 due to low water. Station T2 (Figure 3) is similar in width and flow to the impacted reach at T3. Station T2.5 (Figure 1) is located between T2 and T3 and was added in 2016 to provide more information as to the condition of the impacted section of Talmadge Creek.

The surveys described in this report were conducted according to the SWAS Procedure 51 (MDEQ, 1990) (Creal, Hanshue, Kosek, Oemke, & Walterhouse, 1996). The macroinvertebrate communities were scored with metrics that rate water bodies from excellent (+5 to +9) to poor (-5 to -9). Macroinvertebrate ratings from +4 to -4 are considered acceptable. Negative ratings that are acceptable indicate water bodies that are tending toward poor, while positive ratings that are acceptable indicate slight impairment (Creal, Hanshue, Kosek, Oemke, & Walterhouse, 1996). Stream habitat was qualitatively evaluated at each station using a scoring system that ranged from 0 (poor) to 200 (excellent).

Sampling locations are shown in Figure 1.

SAMPLING RESULTS

Talmadge Creek – Macroinvertebrates

Detailed 2016-2017 macroinvertebrate community sampling results for stations on Talmadge Creek (T2, T2.5, T3) are presented in Appendix B. Procedure 51 scores and total taxa found at all sites are located in Table 1 and Table 2.

Stations T3 and T2.5 were highly disturbed by cleanup activities since 2010 and are in a continuing state of recovery. After the reconstruction of the stream channel, the macroinvertebrate community at Station T3 was fairly different in species composition when compared to the upstream control at Station T2 and contained species commonly associated with areas that have been disturbed and in the early stages of recolonization (Mackay, 1992). The removal of trees, shrubs, herbaceous plants and grasses during the response activity allowed for direct sunlight to reach the stream by opening the vegetated canopy (Figure 4). This increase in direct sunlight has allowed for the proliferation of filamentous algal growth at Stations T2.5 and T3. Blackflies (Simulidae), midges (Chironomidae), and mayflies (Baetidae), which are some of the first species to appear in highly disturbed areas (Mackay, 1992), were prevalent at T3 while being absent or at much lesser numbers at Station T2 (Appendix A).

Station T3 continues to report higher Procedure 51 scores than the upstream reference location, likely due to the open canopy (increased productivity) and available habitat (gravel, cobble, and wood) that was introduced to the site after restoration and not available in the same quantities at the upstream reference location. T2.5 Procedure 51 scores are slightly lower than the T3 station but also comparable to the reference location. In-stream habitat at Station T2.5 is much more similar to the reference location as it does not contain the same quantities of gravel found downstream at Station T3.

Station T3, which reported only 7 taxa in 2010 after the spill, reported 28 and 33 taxa in 2016 and 2017, respectively (Table 2). These numbers are similar to the upstream reference location (Station T2), which reported 30 taxa in 2016 and 2017. The number of taxa found at Station T2.5 in 2016 and 2017 is similar to that found at the reference location and Station T3. Taxa numbers at all three locations varied from 25-33 during the 2 years of sampling (Table 2). Baetidae mayfly numbers were also found to be similar at Stations T2.5 and T3 when compared to the upstream reference location (Station T2) in 2017. As early as 2016 the number of these early colonizer species were found to be many fold higher at the reconstructed sites.

Table 1. Macroinvertebrate metric scores from Procedure 51 surveys conducted over multiple years at Kalamazoo River (K) and Talmadge Creek (T) stations (Figure 1).

	Years												
Station	**1994**	**1999**	**2004**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
T1	--	2	--	--	--	-1	0	--[2]	--[2]	--[2]	--[2]	--[2]	--[2]
T2	--	--	--	--	--	1	1	0	2	0	-1	1	0
T2.5	-2	--	--	--	--	--	--	--	--	--	--	0	-2
T3	--	-3	--	--	--	-4	4	3	5	4	3	0	3
K1	--	4	6	--	--	5	6	3	5	4	5	--	--
K2	--	--	--	--	--	6	6	8	8	6	8	--	--
K3	--	--	6	2,4,3,2[1]	--	3	5	6	4	4	6	--	--
K4	4	--	2	--	6	2	1	4	3	2	4	--	--

(+5 to +9) Excellent (+4 to -4) Acceptable (-5 to -9) Poor
Surveys conducted prior to 2008 used a Procedure 51 protocol, which only required a macroinvertebrate sample size of 100 compared to the requirement of 300 after the revision
[1] Location was scored multiple times in 2008 as part of a QA/QC process
[2] Location was not sampled due to low water levels

Table 2. Total number of taxa recorded from Procedure 51 surveys conducted over multiple years at Kalamazoo River (K) and Talmadge Creek (T) stations (Figure 1).

	Years												
Station	**1994**	**1999**	**2004**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
T1	--	17	--	--	--	14	14	--[2]	--[2]	--[2]	--[2]	--[2]	--[2]
T2	--	--	--	--	--	27	26	28	30	34	24	30	30
T2.5	12											25	28
T3	--	19	--	--	--	7	24	30	36	36	33	28	33
K1	--	20	40	--	--	34	35	40	37	33	39	--	--
K2	--	--	--	--	--	38	42	38	43	31	43	--	--
K3	--	--	44	48,56,48,44[1]	--	31	36	42	40	36	32	--	--
K4	22	--	29	--	33	20	27	28	27	24	25	--	--

[1] Location was scored multiple times in 2008 as part of a QA/QC process
[2]Location was not sampled due to low water levels
Surveys conducted prior to 2008 used a Procedure 51 protocol, which only required a macroinvertebrate sample size of 100 compared to the requirement of 300 after the revision

Talmadge Creek – Stream Habitat

Qualitative stream habitat assessment results for 2016-2017 in Talmadge Creek are presented in Appendix A. All Talmadge Creek stations were rated “good” with Stations T2, T2.5, and T3 scoring 141, 124, and 153, respectively in 2016 and 143, 111, and 142 in 2017. Scores are out of a maximum of 200. The scores at the sampled locations have changed very little since shortly after the oil spill, when riparian vegetation conditions were very poor due to restoration and cleanup activities. Station T3, which scored 153 in 2017 had a score of 125 in 2012 just after the restoration. This recovery in score can be primarily attributed to the increased vegetated cover along the banks and the stabilization and colonization of in-stream habitat.

The stream banks and riparian zone continue to improve, but still lack heavier woody vegetation and trees close to the stream edge. The gravel that was introduced to the stream channel after restoration appears to be filling in slowly with sediment transported from upstream. Large woody debris, which was placed in the stream channel, adds to the habitat variability at some locations, but was placed poorly at others leaving the woody debris out of the water. Aquatic vegetation at the restored locations appears to be increasing.

In 2016, heavy aquatic vegetation and algal growth was noted at Stations T2.5 and T3 (Figure 5). Non-native, invasive Curly-leaf pondweed (*Potamogeton crispus*) was the primary species found at both sites. Curly-leaf pondweed was found in the past at these locations, but not in such quantities. Conditions in 2017 were found to be similar to years prior to 2016, suggesting that 2016 was likely an anomaly possibly caused by seasonal variability.

SUMMARY AND OBSERVATIONS

Qualitative macroinvertebrate scores and ratings alone do not adequately measure the impact of the oil spill and associated cleanup activities.

Overall, Procedure 51 scores and abundance of taxa reported in 2016-2017 were similar to reported results from several previous years of monitoring (Table 1, Table 2). Impacts to the Procedure 51 scores from the oil spill were apparent in years 2010 and 2011, but appear to have recovered and stabilized in the years following. Riparian vegetation (Figure 4) and in-stream habitat continue to recover from impacts related to the oil spill and cleanup activities. Because the restored stream channel has been nearly entirely exposed to sunlight for the past 4 years (Figure 4), it appears to have increased productivity at least in terms of taxa diversity (Table 2, Appendix B). For several years immediately following restoration activities, the

macroinvertebrate scores and taxa diversity at Station T3 were much different from Station T2 (upstream of the oil spill and cleanup activities Figure 3). Station T3 contained high proportions of species known to reach high densities during the early stages of recolonization (Mackay, 1992). Baetidae mayflies, in particular, were found in much higher proportions at Stations T2.5 and T3, than at the upstream reference station (T2). This difference in results from the reference location, T2, suggested that, although scoring higher and containing more diverse taxa, impacts from the spill and restoration activities were still apparent.

During the 2016 and 2017 sampling events the number of taxa and Procedure 51 scores at Stations T2.5 and T3 were found to be comparable to the numbers found at the upstream reference location (Station T2) (Table 1, Table 2). Early colonizer species, such as baetidae mayflies, appear to be declining and are closer to proportions found at the upstream reference station (T2).

While it was found in the first several years after the spill, oil sheen or odor was not noted during sampling at any of the Talmadge Creek stations in 2016 or 2017.

Future Surveys

Yearly monitoring of the oil spill-related sites was concluded in 2017 by both the MDEQ and MDNR. Continued sampling of the established locations on the Kalamazoo River and Talmadge Creek should be considered when the Kalamazoo River watershed is monitored as part of the MDEQ's 5-year monitoring cycle. The next scheduled monitoring cycle for the Kalamazoo River is 2019. Special attention should be paid to the conditions downstream of the recently removed Ceresco Dam and aquatic vegetation conditions at Stations T2.5 and T3 during future surveys.

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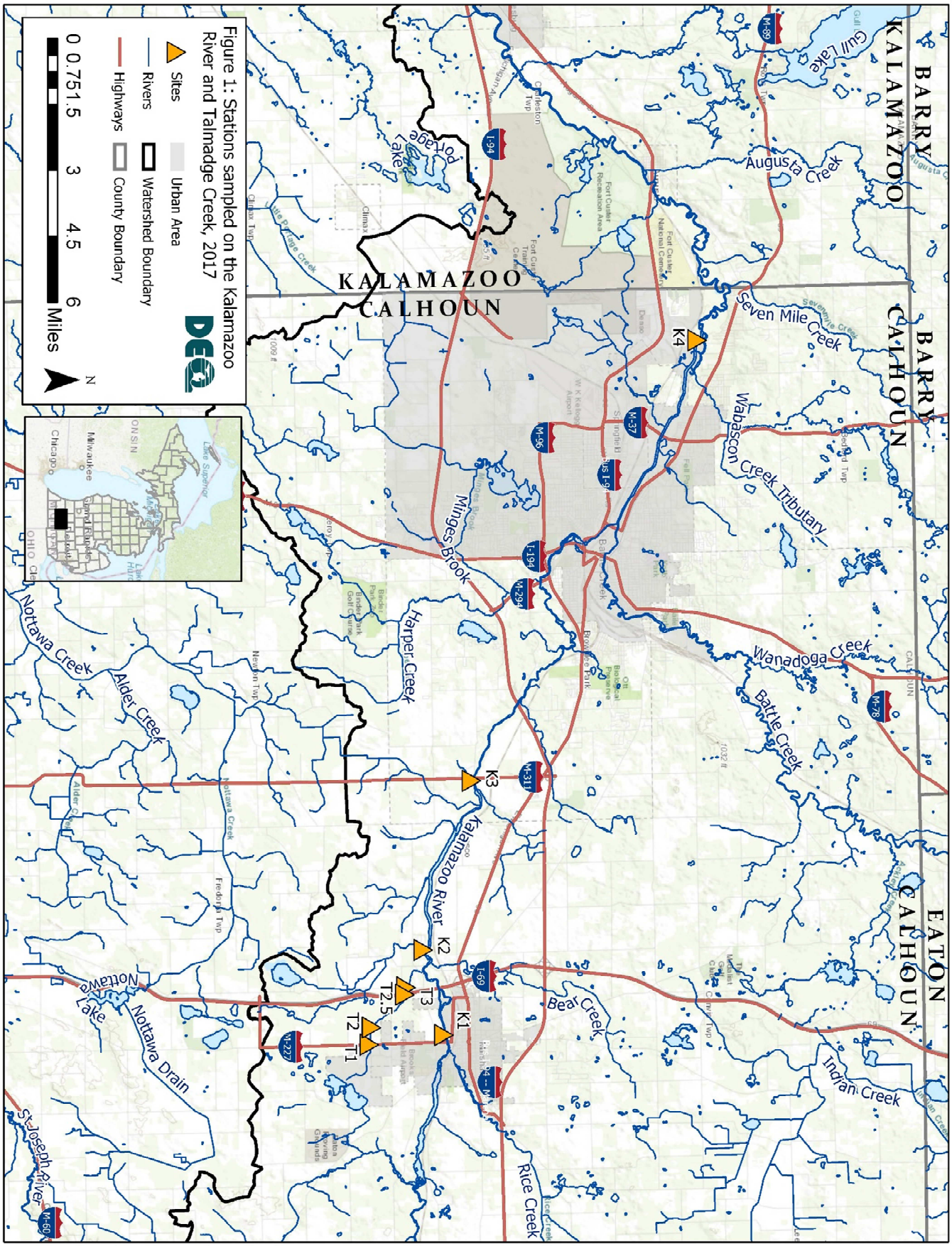

Figure 1. Oil Spill Related Sampling locations on the Kalamazoo River and Talmadge Creek 2010-2017.

Figure 2. Site T1 upstream reference site. This site is more of a wetland site than the more downstream locations (T2,T2.5, T3). Sampling at T1 was discontinued after 2011 due to low water levels. Photo taken by William Taft.

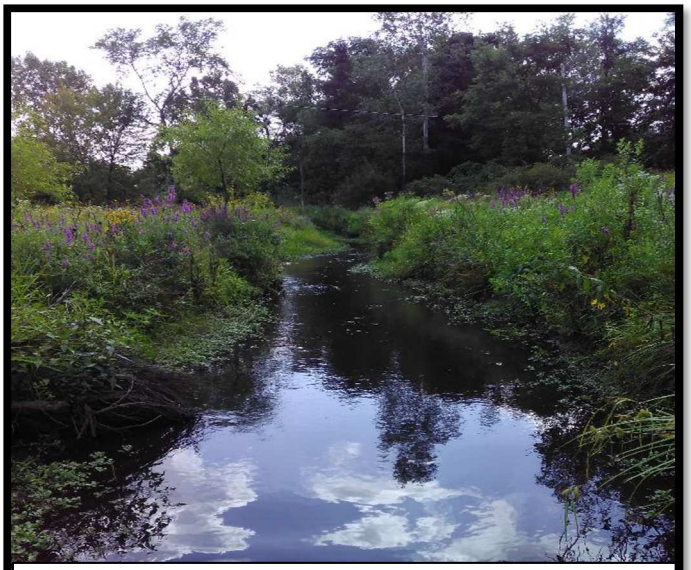

Figure 4. Site T3 on Talmadge Creek. Image shows open canopy and improved riparian vegetation. Photo by J. Matousek.

Figure 3. Site T2 upstream reference location. This site was sampled as a reference location 2011-2017. T2 is heavily vegetated and comparable in flow to T3 (impacted site). Photo by J. Matousek.

Figure 5. Site T3- Image shows the increased vegetation at site T3 during the 2016 sampling season. Photo by J. Matousek.

Appendix A

Talmadge Creek Habitat Scores (2016-2017)

	2016			2017		
	T2	**T2.5**	**T3**	**T2**	**T2.5**	**T3**
	Talmadge Creek	**Talmadge Creek**	**Talmadge Creek**	**Talmadge Creek**	**Talmadge Creek**	**Talmadge Creek**
	downstream 17 Mile Road	**16 Mile Rd**	**15 1/2 Mile Road**	**downstream 17 Mile Road**	**16 Mile Rd**	**15 1/2 Mile Road**
	8/30/2016	**8/31/2016**	**8/30/2016**	**8/30/2017**	**8/30/2017**	**8/30/2017**
	RIFFLE/RUN	**GLIDE/POOL**	**RIFFLE/RUN**	**RIFFLE/RUN**	**GLIDE/POOL**	**RIFFLE/RUN**
HABITAT METRIC						
Substrate and Instream Cover						
Epifaunal Substrate/ Avail Cover (20)	11	10	11	11	5	10
Embeddedness (20)*	12		17	12		10
Velocity/Depth Regime (20)*	11		19	11		15
Pool Substrate Characterization (20)**		13			11	
Pool Variability (20)**		8			5	
Channel Morphology						
Sediment Deposition (20)	8	10	15	10	6	15
Flow Status - Maint. Flow Volume (10)	8	9	10	8	9	10
Flow Status - Flashiness (10)	10	8	10	10	9	10
Channel Alteration (20)	20	6	5	20	6	6
Frequency of Riffles/Bends (20)*	7		16	7		16
Channel Sinuosity (20)**		16			16	
Riparian and Bank Structure						
Bank Stability (L) (10)	9	7	10	9	8	10
Bank Stability (R) (10)	9	7	10	9	8	10
Vegetative Protection (L) (10)	9	9	7	9	8	7
Vegetative Protection (R) (10)	9	9	7	9	8	7
Riparian Vegetation Zone Width (L) (10)	9	6	8	9	6	8
Riparian Vegetation Zone Width (R) (10)	9	6	8	9	6	8
TOTAL SCORE (200):	141	124	153	143	111	142
HABITAT RATING:	**GOOD**	**GOOD**	**GOOD**	**GOOD**	**GOOD**	**GOOD**
Date:	8/30/2016	8/31/2016	8/30/2016	8/30/2017	8/30/2017	8/30/2017
Weather:	Cloudy	Sunny	Partly Cloudy	cloudy	sunny	sunny
Air Temperature: °F	70	80	80	65	80	75
Water Temperature: °F	65	75	67	54	81	65
Ave. Stream Width: Feet	6.67	8.1	8.4	5.53	10.17	8.23
Ave. Stream Depth: Feet	0.4	0.4	0.4	0.23	0.387	0.39
Surface Velocity: Feet/Second	0.780952381	0.711146426	1.68765812	0.475015813	0.643939394	0.906318083
Estimated Flow: Cubic Feet/Second	2.038836338	2.437544151	5.571624975	0.613298194	2.531397306	2.885313968
Stream Modifications:	None	Relocated/Bank Stabilization/Habitat Improvement	Relocated/Bank Stabilization/Habitat Improvement	None	Relocated/Bank Stabilization/Habitat Improvement	Relocated/Bank Stabilization/Habitat Improvement
Nuisance Plants (Y/N):	N	N	N	N	N	N
STORET No.:	130405	130310	130335	130405	130310	130335
County Code:	13	13	13	13	13	13
TRS:	03S06W02	02S06W34	02S06W34	03S06W02	02S06W34	02S06W34
Latitude (dd):	42.2402	42.251389	42.251717	42.2402	42.251389	42.251717
Longitude (dd):	-84.97066	-84.98361	-84.9885712	-84.97066	-84.98361	-84.9885712
Ecoregion:	SMNITP	SMNITP	SMNITP	SMNITP	SMNITP	SMNITP
Stream Type:	Warmwater	Warmwater	Warmwater	Warmwater	Warmwater	Warmwater
USGS Basin Code:	4050003	4050003	4050003	4050003	4050003	4050003
* Applies only to Riffle/Run stream Surveys	** Applies only to Glide/Pool stream Surveys					

Note: Individual metrics may better describe conditions directly affecting the biological community while the Habitat Rating describes the general riverine environment at the site(s).

Appendix B

Talmadge Creek Invertebrate Scores (2016-2017)

2016

TAXA	Talmadge Creek downstream 17 Mile Road 8/30/2016 T2	Talmadge Creek 16 Mile Rd 8/31/2016 T2.5	Talmadge Creek 15 1/2 Mile Road 8/30/2016 T3
PLATYHELMINTHES (flatworms)			
Turbellaria		1	1
ANNELIDA (segmented worms)			
Hirudinea (leeches)	1	5	1
Oligochaeta (worms)	27	8	1
ARTHROPODA			
Crustacea			
Amphipoda (scuds)	107	49	86
Decapoda (crayfish)	2		2
Arachnoidea			
Hydracarina	2	12	11
Insecta			
Ephemeroptera (mayflies)			
Baetidae	6	76	50
Ephemerellidae		3	
Odonata			
Anisoptera (dragonflies)			
Aeshnidae	1	1	1
Libellulidae		3	
Zygoptera (damselflies)			
Calopterygidae	26	1	1
Coenagrionidae	1	7	1
Hemiptera (true bugs)			
Belostomatidae	1	1	1
Gerridae	1		
Mesoveliidae			2
Notonectidae	1	1	
Pleidae		2	
Veliidae	1		1
Megaloptera			
Sialidae (alder flies)	1		1
Trichoptera (caddisflies)			
Helicopsychidae			38
Hydropsychidae	6	1	28
Hydroptilidae			1
Leptoceridae		1	1
Molannidae	1		
Phryganeidae	12		
Coleoptera (beetles)			
Gyrinidae (adults)	2		
Haliplidae (adults)	1	2	
Elmidae	1	1	8
Diptera (flies)			
Ceratopogonidae	5	2	1
Chironomidae	67	40	31
Culicidae		1	1
Dixidae	5		1
Simuliidae	1	1	3
Stratiomyidae	1		
Tabanidae	1		1
Tipulidae	1		1
MOLLUSCA			
Gastropoda (snails)			
Physidae	4	51	22
Planorbidae		47	17
Pelecypoda (bivalves)			
Corbiculidae	1		
Sphaeriidae (clams)	4	12	
TOTAL INDIVIDUALS	291	329	314

2016

METRIC	Talmadge Creek downstream 17 Mile Road 8/30/2016 T2 Value	Score	Talmadge Creek 16 Mile Rd 8/31/2016 T2.5 Value	Score	Talmadge Creek 15 1/2 Mile Road 8/30/2016 T3 Value	Score
TOTAL NUMBER OF TAXA	30	1	25	1	28	1
NUMBER OF MAYFLY TAXA	1	0	2	0	1	0
NUMBER OF CADDISFLY TAXA	3	0	2	0	4	0
NUMBER OF STONEFLY TAXA	0	-1	0	-1	0	-1
PERCENT MAYFLY COMPOSITION	2.06	-1	24.01	1	15.92	0
PERCENT CADDISFLY COMPOSITION	6.53	0	0.61	-1	21.66	0
PERCENT DOMINANT TAXON	36.77	0	23.10	0	27.39	0
PERCENT ISOPOD, SNAIL, LEECH	1.72	1	31.31	-1	12.74	-1
PERCENT SURFACE AIR BREATHERS	3.09	1	2.74	1	1.59	1
TOTAL SCORE		1		0		0
MACROINVERTEBRATE COMMUNITY RATING		Acceptable		Acceptable		Acceptable

2017

TAXA	Talmadge Creek downstream 17 Mile Road 8/30/2017 T2	Talmadge Creek 16 Mile Rd 8/30/2017 T2.5	Talmadge Creek 15 1/2 Mile Road 8/30/2017 T3
PLATYHELMINTHES (flatworms)			
Turbellaria		1	1
ANNELIDA (segmented worms)			
Hirudinea (leeches)	4	2	3
Oligochaeta (worms)	4		5
ARTHROPODA			
Crustacea			
Amphipoda (scuds)	116	78	87
Decapoda (crayfish)	1	1	2
Arachnoidea			
Hydracarina	2	93	14
Insecta			
Ephemeroptera (mayflies)			
Baetidae		2	2
Caenidae			2
Heptageniidae			1
Isonychiidae			1
Odonata			
Anisoptera (dragonflies)			
Aeshnidae	1	1	2
Libellulidae		1	1
Zygoptera (damselflies)			
Calopterygidae	4	2	12
Coenagrionidae			1
Hemiptera (true bugs)			
Belostomatidae		1	
Gerridae	2	1	1
Mesoveliidae	3		
Nepidae	1	1	
Notonectidae	2		
Megaloptera			
Sialidae (alder flies)	9		1
Trichoptera (caddisflies)			
Brachycentridae	1		
Helicopsychidae		5	86
Hydropsychidae	3	1	28
Hydroptilidae	10	4	10
Leptoceridae	2	3	6
Limnephilidae			1
Molannidae	1	1	
Phryganeidae	2		1
Uenoidae		2	1
Coleoptera (beetles)			
Dytiscidae (total)	1	1	2
Gyrinidae (adults)		1	1
Haliplidae (adults)	1	13	1
Elmidae	2	2	4
Diptera (flies)			
Ceratopogonidae			1
Chironomidae	52	11	52
Culicidae		1	
Dixidae	1		
Ptychopteridae	1		
Simuliidae	2		
Tabanidae	6		
Tipulidae	2	1	1
MOLLUSCA			
Gastropoda (snails)			
Ancylidae (limpets)	3		
Physidae	2	47	6
Planorbidae		26	5
Pelecypoda (bivalves)			
Sphaeriidae (clams)	32	1	3
TOTAL INDIVIDUALS	273	304	345

2017

METRIC	Talmadge Creek downstream 17 Mile Road 8/30/2017 T2 Value	Score	Talmadge Creek 16 Mile Rd 8/30/2017 T2.5 Value	Score	Talmadge Creek 15 1/2 Mile Road 8/30/2017 T3 Value	Score
TOTAL NUMBER OF TAXA	30	1	28	1	33	1
NUMBER OF MAYFLY TAXA	0	-1	1	-1	4	1
NUMBER OF CADDISFLY TAXA	6	1	6	1	7	1
NUMBER OF STONEFLY TAXA	0	-1	0	-1	0	-1
PERCENT MAYFLY COMPOSITION	0.00	-1	0.66	-1	1.74	-1
PERCENT CADDISFLY COMPOSITION	6.96	0	5.26	0	38.55	1
PERCENT DOMINANT TAXON	42.49	-1	30.59	0	25.22	0
PERCENT ISOPOD, SNAIL, LEECH	3.30	1	24.67	-1	4.06	0
PERCENT SURFACE AIR BREATHERS	4.40	1	10.53	0	1.74	1
TOTAL SCORE		0		-2		3
MACROINVERTEBRATE COMMUNITY RATING		Acceptable		Acceptable		Acceptable