MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY
WATER RESOURCES DIVISION
MAY 2016

STAFF REPORT

BIOLOGICAL SURVEYS OF THE BIG SABLE AND LINCOLN RIVERS MASON AND LAKE COUNTIES AUGUST 2014

INTRODUCTION

Biological and physical habitat conditions of the Big Sable and Lincoln Rivers (BSLR) in Mason and Lake Counties were assessed by staff of the Michigan Department of Environmental Quality (MDEQ), Surface Water Assessment Section (SWAS), in 2014. The primary objectives of the assessments were to:

1. Identify nonpoint sources (NPS) of water quality impairment.
2. Assess the current status and condition of individual water bodies and determine if Michigan Water Quality Standards (WQS) are being met.
3. Collect data for statewide stream macroinvertebrate community status and trend monitoring.

The macroinvertebrate community and physical habitat were qualitatively assessed at four stations (Table 1; Figure 1) using the SWAS Procedure 51 (P51) (MDEQ, 1990; Creal et al., 1996) for wadeable streams.

The macroinvertebrate communities were assessed and scored with metrics that rate the communities on a scale from excellent to poor. Possible scores can range from 9 to -9. Stations with a score greater than or equal to +5 are considered excellent. Stations with a score less than or equal to -5 are classified as poor. Stations with a score of -4 through +4 are classified as acceptable (minimally to moderately impaired). Habitat evaluations are based on 10 metrics, with a possible maximum total score of 200. Stations are classified as excellent with a habitat score >154, good with a score between 105 and 154, marginal with a score between 56 and 104, and poor with a score <56.

Random and targeted site-selection methods were used in the BSLR in 2014. A probabilistic monitoring approach, using random site selection to address statewide questions about water quality in Michigan rivers, was used to select two sites within the BSLR watersheds. The sites were chosen randomly from a combined selection pool including the BSLR watersheds and the Manistee River watershed. A total of 14 sites were selected from the broader area. The two other sites surveyed in 2014 were a Big Sable River statewide trend station and a BSLR regional trend site on the Lincoln River. There were no targeted monitoring requests in the BSLR in 2014.

WATERSHED INFORMATION

The BSLR are comprised of largely coldwater rivers and streams, which are dominated by sand substrate. The watersheds are in both the Southern Michigan Northern Indiana Till Plains and the Northern Lakes and Forest (NLF) ecoregions (Omernik and Gallant, 1988). Land use/cover is a mixture of forest and agriculture, with some residential uses. Water quality is generally

good in these rivers, but increases in agriculture have been noted in the recent past, likely due to the increase in corn prices. For more background information regarding these watersheds, see previous staff reports MI/DEQ/SWQ-02/046 (Walker, 2002a), MI/DEQ/SWQ-02/050 (Walker, 2002b), MI/DEQ/WB-08/044 (Roush, 2008), MI/DNRE/WB-10/016 (Lipsey, 2010), and MI/DEQ/WRD-13/012 (Knoll, 2013).

Currently, the Big Sable River and tributaries are considered to meet all WQS that have been assessed. Total and partial body uses have not been assessed. The headwaters of the Big Sable River met the mercury WQS based on 2005 and 2010 data (Roush, 2013). Two lakes in the watershed have been assessed in the past. Big Bass Lake is considered to be mesotrophic, or moderately productive. Hamlin Lake at the base of the Big Sable River is considered to be mesotrophic in the lower basin, but samples collected closer to the river outlet indicated the upper portion of the lake may be eutrophic, or more productive. As of 2015, there is a Hamlin Lake fish consumption advisory due to mercury in fish tissue. People are recommended to limit consumption of walleye to twice per month and northern pike, largemouth bass, and smallmouth bass to once per month. In 2010 Michigan Department of Natural Resources, Fisheries Division, staff conducted a survey of Hamlin Lake, which documented that the current sport fish community was in good condition and made recommendations for both future stocking in the lake and protection of fisheries habitat (Tonello, 2012).

The upper portion of the Lincoln River watershed does not meet the Total Body Contact WQS, due to high *E. coli* concentrations and will be included in the statewide *E. coli* Total Maximum Daily Load. The other rivers in the watershed meet every other assessed WQS. Six lakes in the Lincoln River watershed have been assessed; half are considered mesotrophic and the other half are considered eutrophic.

RESULTS

Big Sable River

The Big Sable River was sampled at two locations (Stations 1 and 2 in Figure 1 and Table 1) to assess the macroinvertebrate community and the habitat quality (Tables 2 and 3).

The Big Sable River downstream of Darr Road (Station 1) was found to have an excellent macroinvertebrate community P51 score (7), which is the same score from the 2009 survey at this site. Thirty-eight taxa were collected; however, a large proportion were classified as *Baetidae* and *Hydropsychidae*, which are more tolerant mayfly and caddisfly families. The glide pool habitat scored excellent and was dominated by sand with a small amount of gravel in the bottom of pools and silt along the margins. There was a moderate amount of aquatic macrophytes and large woody debris in the channel, which provided in-stream habitat. There were not any riffles in this section of river, but the flow was high and there was a good amount of stream depth variability. The banks were very stable, with excellent riparian vegetation. The large amount of sediment deposition (areas with soft sand) may slightly reduce the amount of available habitat for more sensitive macroinvertebrate taxa.

The Big Sable River upstream of Branch Road (Station 2) is the only station in this survey in the NLF ecoregion. The sampling area was deep, even along the edge of the channel, which was lined with cattails. The macroinvertebrate community received an acceptable P51 macroinvertebrate score (3), which is very similar to the 2004 score (2) at this location. Only 19 taxa were collected in 2014 and the community was dominated by *Batidae* and *Chironomidae*. The glide pool habitat scored excellent, in part, because of the excellent riparian area and flow. Sediment deposition and epifaunal habitat were rated as moderate or low good in the habitat

evaluation. There was an extensive amount of aquatic macrophytes at this site. The substrate was almost exclusively sand, with small amounts of silt.

Lincoln River

The Lincoln River was sampled at two locations (Stations 3 and 4 in Figure 1 and Table 1) to assess the macroinvertebrate community and the habitat quality (Tables 2 and 3).

The North Branch of the Lincoln River upstream of Victory Corner Road (Station 3) was found to have an excellent macroinvertebrate community P51 score (7). Thirty-six taxa were collected, including five mayfly and seven caddisfly families. The riffle run habitat scored good, but had significant reaches of eroding banks and possibly flashier flows than were noted at this site compared to the sites in the Big Sable River watershed. The substrate was dominated by sand, with small amounts of gravel, cobble, and silt. There were a few riffles, but the largest was man-made using concrete blocks. There was a moderate amount of large woody debris and no macrophytes at this site. The riparian area had marginal bank stability and marginal or poor riparian vegetative protection and riparian zone width. The right bank was noted to have a more highly impacted riparian zone because it was mostly mowed yard.

The South Branch of the Lincoln River upstream of Victory Corner Road (Station 4) was found to have an acceptable macroinvertebrate community (4), with a score one point below the excellent category. Twenty-six taxa were collected, including a total of eight mayfly and caddisfly taxa. The macroinvertebrate community was heavily dominated by amphipods, 39% of the counted organisms, which are generally more tolerant to in-stream stressors than other invertebrates. The riffle run habitat scored good. This site was also assessed in 2010 and 2000 and received macroinvertebrate community scores of 2 and 8, respectively. The reason for the drop in score from 2000 to 2010 is unknown. The substrate had more sand than any other substrate, but there was also a mixture of cobble, gravel, silt, and clay. Some bank erosion was present on the right bank and there were moderate amounts of large woody debris and rootwads providing in-stream habitat.

SUMMARY

Agricultural land use and road-stream crossings are likely NPS sources of pollution into streams in the BSLR watersheds. There was some evidence of bank erosion throughout the watersheds, which could be related to high flows following snow melt or other causes, including sandy soils. However, the remaining forested land cover and the large groundwater inputs into these rivers, have helped maintain relatively healthy stream habitats and macroinvertebrate communities, despite sand substrate deposition. All sites monitored in 2014 had acceptable or excellent macroinvertebrate communities and were determined to support the Other Indigenous Aquatic Life and Wildlife designated use.

Field Work By: Sarah Holden, Aquatic Biologist
Dawn Roush, Aquatic Biologist
Surface Water Assessment Section
Water Resources Division

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

REFERENCES

Creal, W., S. Hanshue, S. Kosek, M. Oemke, and M. Walterhouse. 1996. Update of GLEAS Procedure 51 Metric Scoring and Interpretation. MDEQ Staff Report No. MI/DEQ/SWQ-96/068. Revised May 1998.

Knoll, M. 2013. A Biological Survey of the Pere Marquette River and Lincoln River Watersheds. Newago, Lake, Oceana, and Mason Counties, Michigan. July, August, and September 2010. Report No. MI/DEQ/WRD-13/012.

Lipsey, T. 2010. Biological and Water Chemistry Surveys of Selected Stations in the Manistee, Little Manistee, and Big Sable River Watersheds. Grand Traverse, Kalkaska, Lake, Manistee, Mason, Osceola, and Wexford Counties, Michigan. June and July 2009. Revised 8-8-12. Report No. MI/DNRE/WB-10/016.

MDEQ. 1990. SWAS Procedure 51 - Qualitative Biological and Habitat Survey Protocols for Wadeable Streams and Rivers, April 24, 1990. Revised June 1991, August 1996, January 1997, May 2002, and December 2008.

Omernik, J.M. and A.L. Gallant. 1988. Ecoregions of the upper Midwest states. United States Environmental Protection Agency, Environmental Research Laboratory, EPA/600/3-88/037.

Roush, D. 2008. Biological Survey of the Big Sable River and the Lincoln River, Mason and Lake Counties, July 2004. Report No. MI/DEQ/WB-08/044.

Roush. D. 2013. Michigan's Water Chemistry Monitoring Program: A Report of Statewide Spatial Patterns. Report No. MI/DEQ/WRD-13/005.

Tonello, M. A. 2012. Hamlin Lake, Mason County, Big Sable River watershed, surveyed 2010. MDNR Report No. 2012-132. Accessed here on 3/8/2016:
(The link provided was broken and has been removed)

Walker, B. 2002a. A Biological Survey of the Lincoln River, Mason County, June 6-7, 2000. Report No. MI/DEQ/SWQ-02/046.

Walker, B. 2002b. A Biological Survey of the Big Sable River, Mason and Lake Counties, June 5-6 and September 12, 2000. Report No. MI/DEQ/SWQ-02/050.

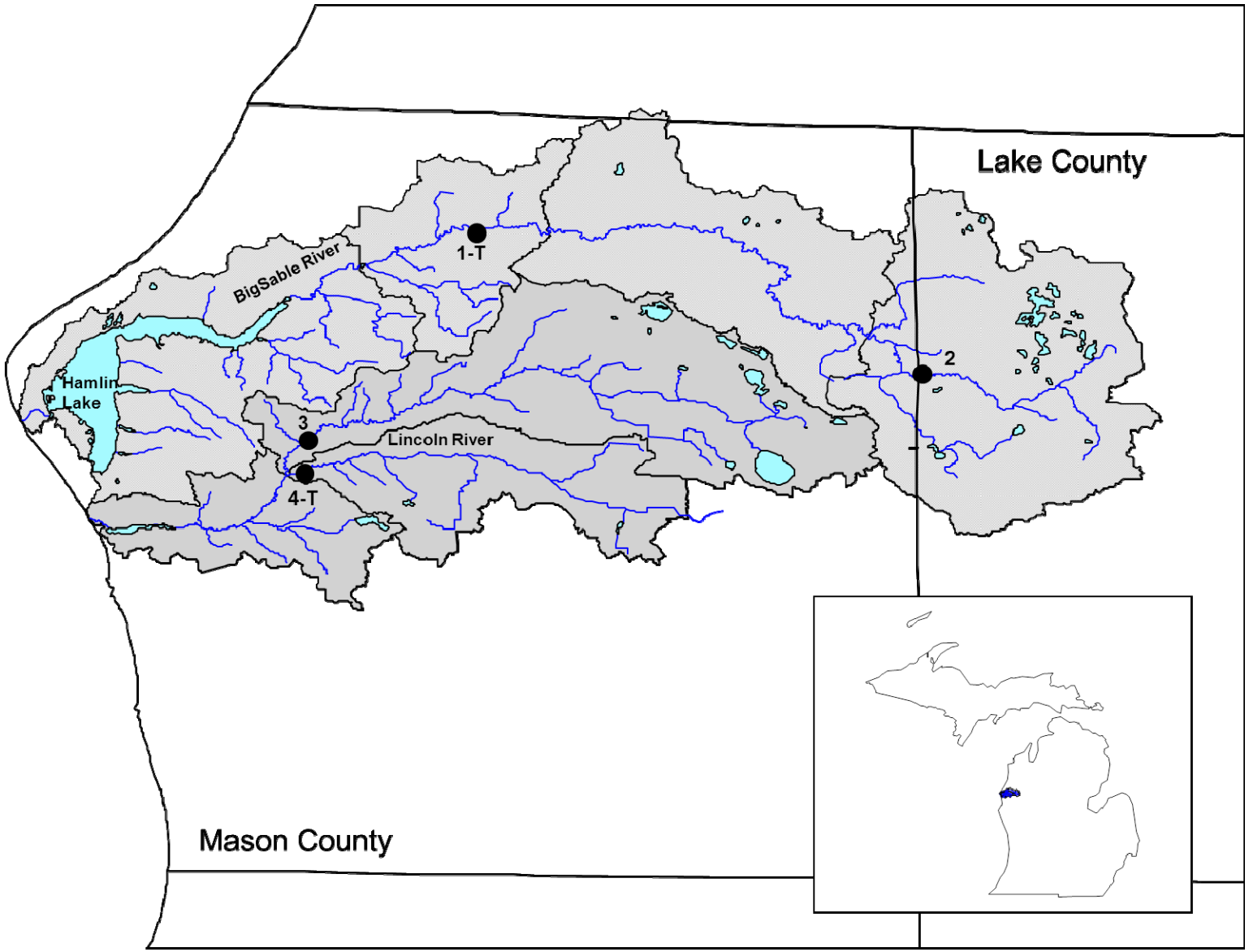

Figure 1. Big Sable and Lincoln Rivers 2014 monitoring locations.

Table 1. Big Sable and Lincoln Rivers 2014 monitoring locations and results summary.

Station	Status/ Trend	River	Location	Lat	Lon	County	AUID	STORET	Habitat		Macroinvertebrate	
									Rating	Score	Rating	Score
1	Trend	Big Sable River	d/s Darr Rd	44.1209	-86.2625	Mason	040601010103-01	530292	Excellent	170	Excellent	7
2	Status	Big Sable River	Branch Road	44.0502	-86.0391	Lake	040601010101-01	430567	Excellent	160	Acceptable	3
3	Status	North Branch Lincoln River	Victory Corner Road	44.0201	-86.3605	Mason	040601010201-01	530300	Good	118	Excellent	7
4	Trend	South Branch Lincoln River	Victory Corner Road	44.0075	-86.3601	Mason	040601010202-01	530211	Good	145	Acceptable	4

Table 2A. Qualitative macroinvertebrate sampling results for the Big Sable and Lincoln Rivers, August, 2014.

TAXA	Big Sable River downstream Darr Road 8/5/2014 STATION 1		Big Sable River County Line Road (Branch Rd) 8/5/2014 STATION 2		North Branch Lincoln Victory Corner Road 8/6/2014 STATION 3		South Branch Lincoln Victory Corner Road 8/6/2014 STATION 4	
ANNELIDA (segmented worms)								
Hirudinea (leeches)	1							
Oligochaeta (worms)	5		2		6		1	
ARTHROPODA								
Crustacea								
Amphipoda (scuds)	4				30		116	
Decapoda (crayfish)	1				2		2	
Isopoda (sowbugs)					3			
Arachnoidea								
Hydracarina	4		7		2			
Insecta								
Ephemeroptera (mayflies)								
Baetiscidae	1		6					
Baetidae	95		92		24		39	
Caenidae			1		1			
Ephemerellidae							4	
Ephemeridae			1		1			
Heptageniidae	10				14		11	
Isonychiidae	10				1			
Tricorythidae	1		3					
Odonata								
Anisoptera (dragonflies)								
Aeshnidae	1				2		1	
Gomphidae	1				1			
Zygoptera (damselflies)								
Calopterygidae	4		3		2		2	
Plecoptera (stoneflies)								
Perlidae	4		1		1		1	
Perlodidae	1							
Pteronarcyidae	6				1			
Hemiptera (true bugs)								
Belostomatidae	1							
Corixidae	1		1		1			
Gerridae					1		1	
Nepidae					1			
Megaloptera								
Corydalidae (dobson flies)	2				1			
Sialidae (alder flies)							1	
Trichoptera (caddisflies)								
Brachycentridae	2				1		17	
Glossosomatidae					2		2	
Helicopsychidae	1							
Hydropsychidae	42		27		36		38	
Hydroptilidae	5		16		19			
Leptoceridae	2		1		1			
Limnephilidae					3		4	
Polycentropodidae	6				1		1	
Uenoidae	1							
Coleoptera (beetles)								
Dytiscidae (total)	2							
Gyrinidae (adults)	1							
Hydrophilidae (total)	1				1			
Dryopidae							2	
Elmidae	6		2		8		2	
Diptera (flies)								
Athericidae	2				18		3	
Ceratopogonidae					4			
Chironomidae	40		46		42		24	
Dixidae	4		1					
Simuliidae	8		92		41		17	
Tabanidae			4		3		1	
Tipulidae	1		1		7		1	
MOLLUSCA								
Gastropoda (snails)								
Ancylidae (limpets)	1						1	
Physidae	9				2		4	
Pelecypoda (bivalves)								
Sphaeriidae (clams)	1				2		1	
TOTAL INDIVIDUALS	288		307		286		297	

Table 2B. Macroinvertebrate metric evaluation of the Big Sable and Lincoln Rivers, August, 2014.

	Big Sable River downstream Darr Road 8/5/2014 STATION 1		Big Sable River County Line Road (Branch Rd) 8/5/2014 STATION 2		North Branch Lincoln River Victory Corner Road 8/6/2014 STATION 3		South Branch Lincoln River Victory Corner Road 8/6/2014 STATION 4	
METRIC	Value	Score	Value	Score	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	38	1	19	0	36	1	26	1
NUMBER OF MAYFLY TAXA	5	1	5	1	5	1	3	0
NUMBER OF CADDISFLY TAXA	7	1	3	0	7	1	5	1
NUMBER OF STONEFLY TAXA	3	1	1	0	2	1	1	1
PERCENT MAYFLY COMP.	40.6	1	33.6	1	14.3	0	18.2	0
PERCENT CADDISFLY COMP.	20.5	0	14.3	0	22.0	0	20.9	0
PERCENT DOMINANT TAXON	33.0	0	30.0	-1	14.7	1	39.1	-1
PERCENT ISOPOD, SNAIL, LEECH	3.8	1	0.0	1	1.7	1	1.7	1
PERCENT SURF. AIR BREATHERS	2.1	1	0.3	1	1.4	1	0.3	1
TOTAL SCORE		7		3		7		4
MACROINV. COMMUNITY RATING	EXCELLENT		ACCEPTABLE		EXCELLENT		ACCEPTABLE	

Table 3. Habitat evaluation for Big Sable and Lincoin Rivers, 2014.

HABITAT METRIC	Big Sable River downstream Darr Road GLIDE/POOL	Big Sable River County Line Road (Branch Rd) GLIDE/POOL	North Branch Lincoln Victory Corner Road RIFFLE/RUN	South Branch Lincoln Victory Corner Road RIFFLE/RUN
Substrate and Instream Cover				
Epifaunal Substrate/ Avail Cover (20)	15	11	13	13
Embeddedness (20)*			15	16
Velocity/Depth Regime (20)*			18	14
Pool Substrate Characterization (20)**	16	12		
Pool Variability (20)**	13	13		
Channel Morphology				
Sediment Deposition (20)	11	8	12	10
Flow Status - Maint. Flow Volume (10)	10	10	9	9
Flow Status - Flashiness (10)	10	10	3	8
Channel Alteration (20)	19	19	16	18
Frequency of Riffles/Bends (20)*			7	12
Channel Sinuosity (20)**	16	17		
Riparian and Bank Structure				
Bank Stability (L) (10)	10	10	3	6
Bank Stability (R) (10)	10	10	3	6
Vegetative Protection (L) (10)	10	10	6	9
Vegetative Protection (R) (10)	10	10	4	9
Riparian Veg. Zone Width (L) (10)	10	10	7	8
Riparian Veg. Zone Width (R) (10)	10	10	2	7
TOTAL SCORE (200):	170	160	118	145
HABITAT RATING:	EXCELLENT (NON-IMPAIRED)	EXCELLENT (NON-IMPAIRED)	GOOD (SLIGHTLY IMPAIRED)	GOOD (SLIGHTLY IMPAIRED)

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

Date:	8/5/2014	8/5/2014	8/6/2014	8/6/2014
Weather:	Sunny	Sunny	Sunny	Sunny
Air Temperature:	74 Deg. F.	70 Deg. F.	60 Deg. F.	50 Deg. F.
Water Temperature:	74 Deg. F.	62 Deg. F.	60 Deg. F.	55 Deg. F.
Ave. Stream Width:	44 Feet	27.8 Feet	27 Feet	20 Feet
Ave. Stream Depth:	1.8 Feet	2.1 Feet	1.5 Feet	1 Feet
Surface Velocity:	1.5 Ft./Sec.	1.1 Ft./Sec.	1 Ft./Sec.	1.1 Ft./Sec.
Estimated Flow:	118.8 CFS	64.218 CFS	40.5 CFS	22 CFS
Stream Modifications:	None	None	Bank Stabilization	None
Nuisance Plants (Y/N):	N	N	N	N
STORET No.:	530292	430567	530300	530211
Stream Name:	Big Sable River	Big Sable River	North Branch Lincoln	South Branch Lincoln
Road Crossing/Location:	downstream Darr Road	County Line Road	Victory Corner Road	Victory Corner Road
TRS:	20N16W19	19N14W07	19N17W29	19N17W28
Latitude (dd):	44.12086	44.050171	44.02006	44.007468
Longitude (dd):	-86.26247	-86.0391	-86.3605	-86.3600823
Ecoregion:	SMNITP	NLAF	SMNITP	SMNITP
Stream Type:	Coldwater	Coldwater	Coldwater	Coldwater
USGS Basin Code:	4060101	4060101	4060101	4060101

* Applies only to Riffle/Run stream Surveys
** Applies only to Glide/Pool stream Surveys