STUDY PERFORMANCE REPORT

State: Michigan **Project No.:** F-80-R-5

Study No.: 230702 **Title:** Effects of sediment traps on Michigan river channels

Period Covered: October 1, 2003 to September 30, 2004

Study Objectives: To quantify the effect of sediment removal efforts on the channel morphology of select Michigan streams. More specifically, to 1) identify the rate and spatial extent of change in riverbed elevation and substrate conditions, and 2) relate these data to hydrologic, gradient, and valley characteristics of each stream.

Summary: I identified one new stream reach (Twomile Creek) for a field survey in summer 2004, and completed the survey before the sediment trap was excavated. I established permanent transects for monitoring bed elevations and substrate characteristics through time in Twomile Creek, where run habitat and sand substrates predominated. I also re-surveyed previously-established transects on the Au Sable, East Branch Au Sable, and Boardman rivers, as well as Silver Lead Creek. Relatively little change in substrate occurred upstream or downstream of traps that have been operating in the Au Sable and Boardman Rivers. A noticeable decrease in sand substrate (34%) accompanied by an increase in gravel substrate (33%) was observed upstream of the sediment trap in the East Branch Au Sable River from 2002-2004, with a smaller decrease in sand (18%) and increase in gravel (9%) below the trap. As expected, little change occurred in the study reach of Silver Lead Creek from 2003-2004, prior to construction of a sediment trap after the 2004 field season. Pebble count data indicate that the majority of particle sizes measured in all rivers, both above and below the sediment traps, are sand or smaller substrates. Change in mean depth upstream and downstream of the sediment traps varied by river and transect location. Channel shape and lateral position was fairly constant from 2002 to 2004, and varied little by river and transect location (upstream or downstream of sediment trap).

Findings: Jobs 1 through 4 were active this year, and progress is reported below.

Job 1. Title: Identify study rivers and develop sampling design.–I gave rivers scheduled for new sediment traps highest priority for inclusion in this study, followed by rivers where sediment traps were recently excavated. I established transects to evaluate one new sediment trap that was installed late in the summer of 2004 in Twomile Creek (Dickinson Co.), north of the village of Channing. Twomile Creek is a medium-gradient, runoff-driven stream with moderate baseflow that runs through an unconfined alluvial valley (Seelbach et al. 1997). Data collected prior to sediment trap excavation in the summer of 2004 will serve as a baseline for comparison to post-excavation data collected in future visits.

Slight changes were made to the sampling design developed in 2002. All measurements made at permanent, benchmarked transects now include distances and elevations for top-of-bank and water's edge on the left and right banks. This will correct data interpretation problems related to differences in stream discharge between surveys and will provide more meaningful channel profiles. Also, all substrate measurements made at permanent, benchmarked transects now include pebble counts as well as visual classification of substrate composition. This will correct for possible between-observer bias in the visual classification of substrate and will allow for more repeatable substrate measurements during future surveys.

Job 2. Title: Survey bed elevations and substrate conditions.–I surveyed bed elevations and recorded substrate composition at newly-established transects on Twomile Creek. I noted the locations of benchmarks and transect pins and recorded their differentially-corrected GPS coordinates for future reference. I also re-surveyed transects for two traps installed in 2002, one in the Au Sable River in the reach formerly occupied by Salling Pond, and one in the East Branch Au Sable River downstream of Wilcox Bridge Road. Transects on the Boardman River at the Crofton sediment trap site, downstream of the mouth of Crofton Creek near Crofton Road, and on Silver Lead Creek, downstream of the former K.I. Sawyer Air Force Base, were also re-surveyed (Figure 1). The Crofton trap was installed in 2002, while the Silver Lead Creek trap was constructed late in the summer of 2004. I did not have time to conduct lineal mapping of substrate conditions in any surveyed reach.

Job 3. Title: Analyze data.–All of the newly-established study transects on Twomile Creek were located in areas of run habitat (defined similar to Armantrout, 1998). More than 80% of the reach above and below the sediment trap consisted of sand and finer substrates, as determined by both visual observation and pebble counts. Wood constituted 13.2 and 18% of the substrate above and below this site, respectively. Mean wetted depth above and below the sediment trap was close to 1 ft (Table 1).

Relatively little change (approximately 11% or less) in gravel or small cobble occurred upstream or downstream of traps in the Au Sable and Boardman Rivers. A noticeable decrease in sand substrate (34%) accompanied by an increase in gravel substrate (33%) was observed upstream of the sediment trap in the East Branch Au Sable River from 2002-2004. A smaller decrease in sand (18%) and increase in gravel (9%) was observed below the trap (Table 2). Pebble count data indicate that the majority of substrate in all four rivers, both above and below the sediment traps, are sand or smaller particles (Figure 2). Slight increases in mean depth above the sediment traps in the East Branch Au Sable and Boardman rivers suggested that headcutting occurred, while a slight increase in depth below the trap on the Au Sable River suggests downcutting. However, depth also changed slightly in Silver Lead Creek from 2003 to 2004 even though the trap was not excavated prior to my survey. The overall shape and lateral position of the channel cross sections showed little change in any river.

Overall, there was little change in substrates and mean depth upstream and downstream of the trap site in the Silver Lead Creek study reach. This was expected, as the sediment trap was not excavated until after the 2004 field season. Visual observation and pebble count data indicate that the majority of substrates are silt or sand (Figure 2). Small adjustments in the shape of the channel are noticeable at transects upstream and downstream of the trap; however, the lateral position of the channel remained stable.

Job 4. Title: Write annual performance reports.–This progress report was prepared.

Literature Cited:

Armantrout, N.B., compiler. 1998. Glossary of aquatic habitat inventory terminology. American Fisheries Society, Bethesda, Maryland.

Seelbach, P.W., M.J. Wiley, J.C. Kotanchik, and M.E. Baker. 1997. A landscape-based ecological classification system for river valley segments in Lower Michigan. Michigan Department of Natural Resources, Fisheries Division, Research Report 2036, Ann Arbor.

Prepared by: Todd C. Wills
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Table 1.–Summary of depth and visually classified substrate data for the study reach of Twomile Creek prior to sediment trap construction. Substrate categories (and dimensions in mm) were silt (0.004-0.063), sand (0.064-2), gravel (3-64), small cobble (65-128), large cobble (129-256), boulder (>256), and wood.

River	Up- or down-stream of trap	Mean wetted depth (ft)	Percent substrate composition						
			Silt or detritus	Sand	Gravel	Small cobble	Wood	Other	n[1]
Twomile Creek	u	0.84	32.2	54.7	0.0	0.0	13.2	0.0	258
	d	1.07	39.1	42.9	0.0	0.0	18.0	0.0	573

[1]Number of substrate observations.

Table 2.–Summary of change in depth and visually classified substrate data for study reaches of the Au Sable and East Branch Au Sable rivers over a two-year period, and the Boardman River and Silver Lead Creek over a one-year period. The Au Sable, East Branch Au Sable, and Boardman river sediment traps were installed in 2002, while the Silver Lead Creek sediment trap was installed following the 2004 field season. Pre-excavation data were not collected on the Boardman River in 2002. Negative values indicate a decrease in depth or percent substrate composition. Substrate categories (and dimensions in mm) were silt (0.004-0.063), sand (0.064-2), gravel (3-64), small cobble (65-128), and wood.

River	Years	Up- or down-stream of trap	Change in mean depth (ft)	Percent change in substrate composition					
				Silt or detritus	Sand	Gravel	Small cobble	Wood	n[1]
Au Sable	2002-04	u	-0.29	-11.9	-3.3	+11.3	0.0	+3.7	970
		d	+0.24	-7.9	-4.6	+3.7	0.0	+7.4	2012
E. Br. Au Sable	2002-04	u	+0.16	-1.3	-34.2	+33.2	0.0	+2.3	752
		d	-0.07	+4.8	-17.5	+9.4	+0.1	+2.5	1380
Boardman	2003-04	u	+0.12	-10.2	+7.8	+3.4	-1.4	+9.8	825
		d	-0.05	-7.7	+7.4	-5.8	-2.0	+8.0	1903
Silver Lead Creek	2003-04	u	+.12	-3.8	+12.3	-11.8	-0.2	+4.4	822
		d	0.00	-2.4	-5.3	-0.1	-6.2	+5.8	1626

[1]Total number of substrate observations used in the comparison.

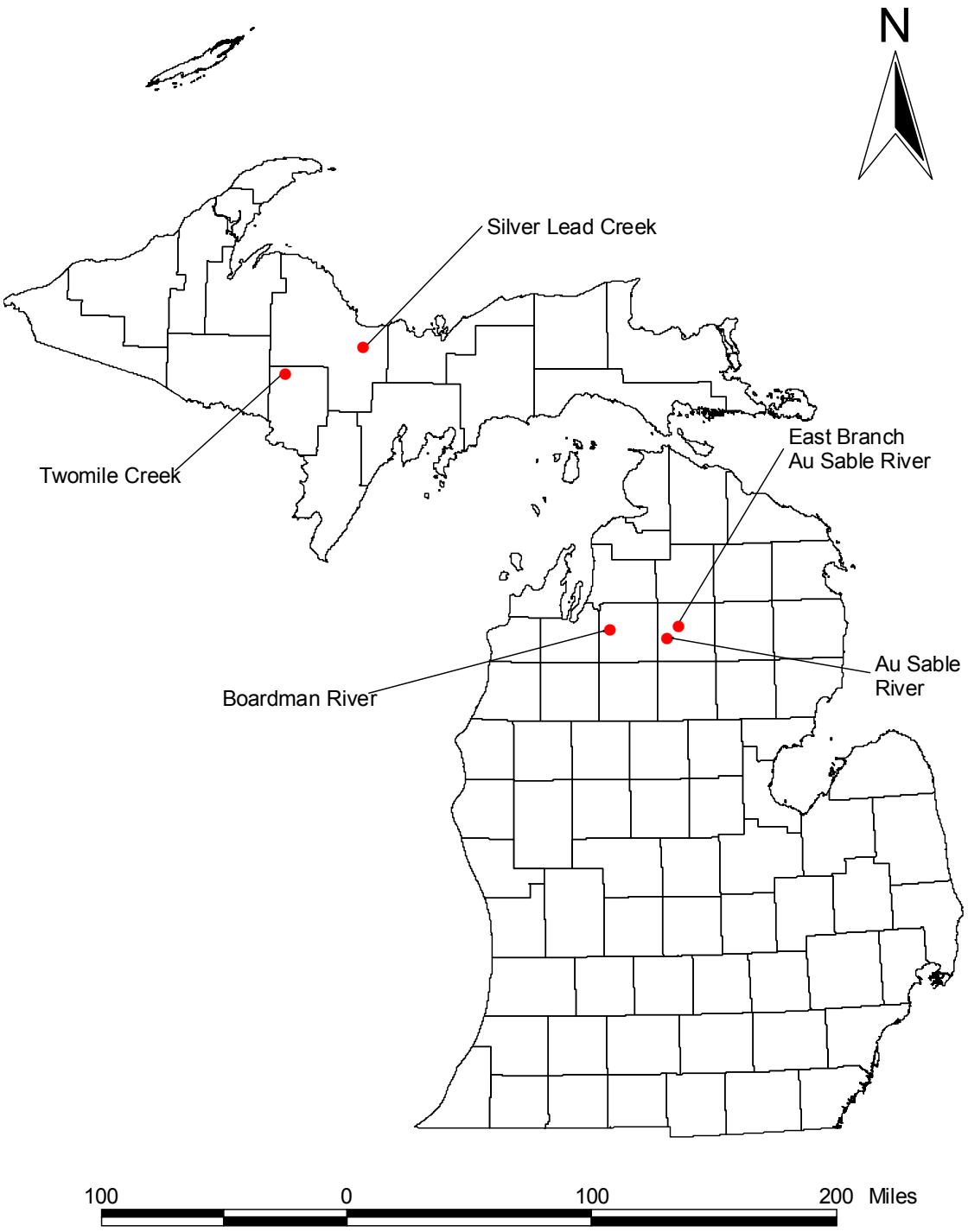

Figure 1.–Map of Michigan showing the location of sediment trap sites surveyed during the 2004 field season.

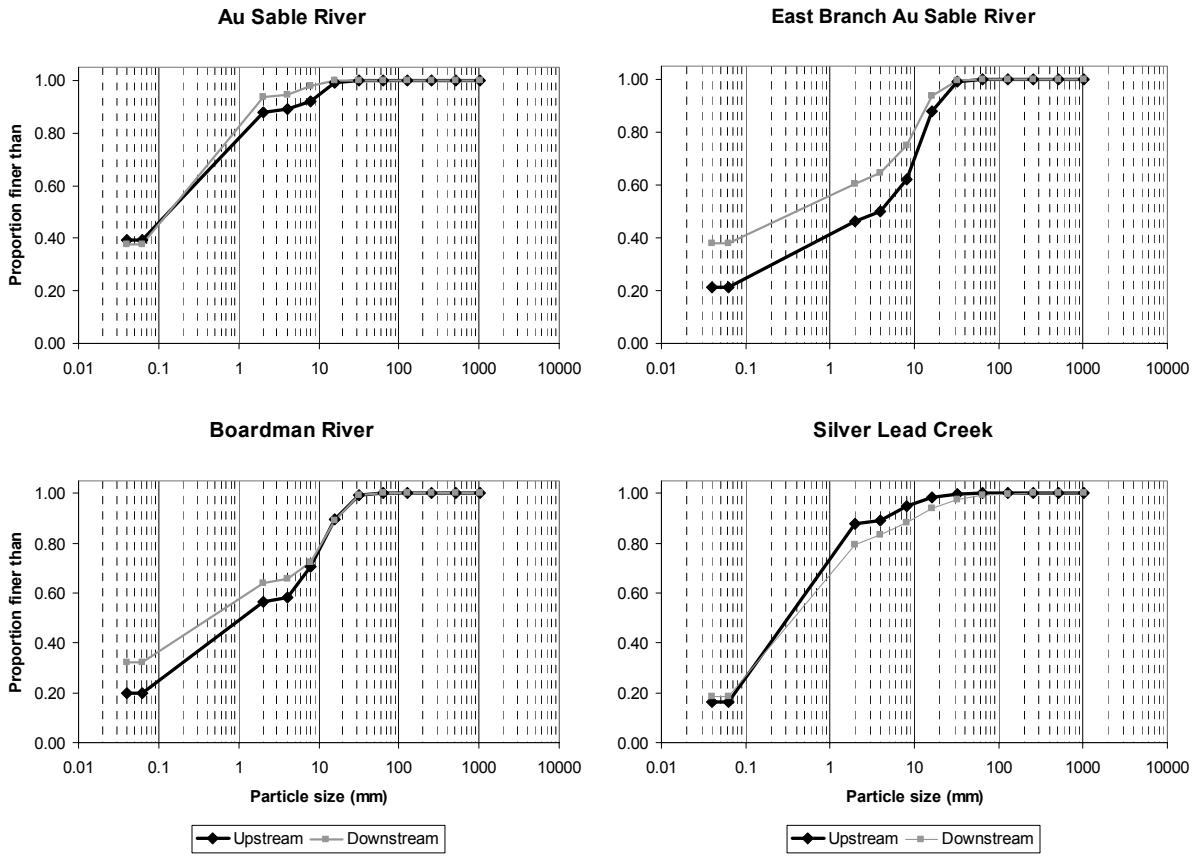

Figure 2.–Cumulative frequencies of substrate particle size from 2004 pebble counts in four study stream reaches. Substrate particle size categories (and dimensions in mm) were organic and clay (0-0.04mm), silt (0.05-0.062mm), sand (0.063-2mm), very fine gravel (2-4mm), fine gravel (5-8mm), medium gravel (9-16mm), coarse gravel (17-32mm), very coarse gravel (33-64mm), small cobble (65-128mm), large cobble (129-256mm), small boulder (257-512mm), and medium boulder (>512mm).