LOWER SAVAGE RIVER BENTHIC MACROINVERTEBRATE SEDIMENT IMPACT STUDY

Final Report

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Table of Contents

Background 2

Project description 4

Project methods 4

- Rationale for selection of sampling sites 4
- Habitat assessment 6
- Sample collections 6
- Sample processing 6
- Sample identification 7
- Metric and IBI calculation 7

Results 7

- Habitat and sediment 7
- Status of the lower Savage river 8
- Comparing the upper and lower Savage river communities 8
- Deviations from historical baseline data 8

Alternative explanations for reduced biological integrity 10

Evidence of impact from sediment transport 10

Literature cited 12

Appendix: Taxonomic counts and calculated metrics 13

Background

The Savage River Reservoir was constructed in 1952 by the United States Army Corps of Engineers and is currently operated by the Upper Potomac River Commission. The primary objectives of operation of the reservoir and dam are: 1) flood control, 2) drinking water storage for the town of Westernport and downstream intakes near Washington, D.C., and 3) provision of recreational activities including boating and fishing. The Savage River tail-water is designated a trophy trout water for the state of Maryland, and supports wild populations of native brook trout and introduced brown trout, in addition to stocked rainbow trout. In 2008, issues involving several of the service gates of the dam invoked inspections and an eventual consent-decree requiring replacement of the service gates and other necessary maintenance repairs. In order to replace the gates, the reservoir had to be completely drained and the Savage River was returned to run-of-the-river flow through the now empty reservoir. Draw-down of the reservoir began in October 2009 and all repair work was scheduled to be completed by May 2010. While the reservoir was drawn down, significant snow and rain events caused tremendous scouring of the accumulated fine sediments where the river was now cutting a channel (Figure 1). The scoured sediments were transported into the 12 km tail-water section of the Savage River and were observed with great trepidation by DNR Fisheries biologists. Those observations prompted the fisheries biologists to perform cross-section surveys of the channel and measure the sediment deposition in the tail-water and to document the occurrence of fish mortality and impacts to the riverine habitat (Figure 2). Repairs were completed ahead of schedule and service gates became operational on March 5, 2010, allowing the reservoir to re-fill and capture the spring melt of the accumulated snow-pack in the watershed. During re-fill, plans were made to release large flows in an effort to expel the accumulated sediments out of the tail-water section. A rain-on-snow event helped create a large flushing flow that peaked around 2,700 cfs on March 13, 2010. Flows remained elevated (above 100 cfs) into the first week of April. A hydrograph for the period between February 15 and May 15, 2010 is included in Figure 3. By the accounts of the DNR biologists and the Upper Potomac River

Figure 1 Photo of the drained Savage River Reservoir showing the beginning of a channel being cut by run-of-the-river flow.

Commission dam operators, the effort to expel the sediments was largely successful ([Alan Klotz], personal communication). Pre- and post-construction electro-shocking surveys were done to document the potential impacts to the standing population of trout species in the tail-water. To the surprise of the biologists who observed the sediment deposition, the population was fairly resilient and capture efficiencies were ~80% of the previous year's survey ([Alan Klotz], personal communication). Unknown, however, was the potential impact to the benthic macroinvertebrate community on which the trout populations depend. To that end, this series of events presented an opportunity to document how the input of fine sediments may have impacted the benthic community and possibly document succession after a disturbance.

Figure 2 MD DNR Fisheries Biologist, Alan Klotz, measures the depth of fine sediment deposited in the Savage River.

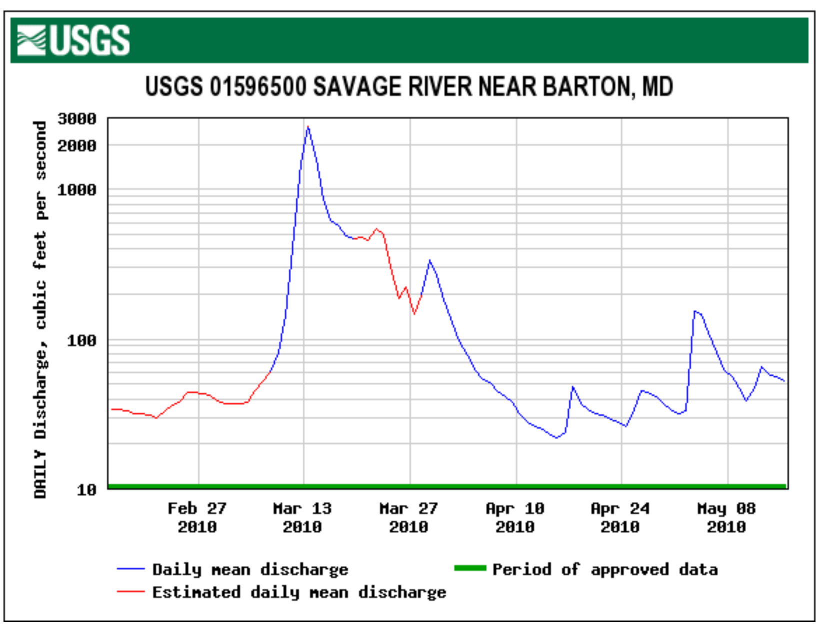


Figure 3 Hydrograph of the outflow from the Savage River Dam for the period between February 15 and May 15, 2010.

Project description

The Savage River is a well-studied river system with ample aquatic community baseline data. Researchers from the MD DNR Maryland Biological Stream Survey, the MD DNR Inland Fisheries, the University of Maryland (UMD) Appalachian Laboratory, and Frostburg State University have all studied aspects of the stream's ecology.

This project had three major research goals: 1) document the quality of the epifaunal habitat downstream of the reservoir, and 2) determine the health and status of the macroinvertebrate community above and below the reservoir and compare to pre-construction data; and 3) monitor potential macroinvertebrate re-colonization and habitat recovery over time, should impacts be detected.

Project methods

Rationale for selection of sampling sites

As this study was not concerned with determining the status of health in the overall watershed, but rather documenting the impact from a specific disturbance, a targeted sampling design was employed rather than a random sampling design. Four sites along the Savage River tail-water were originally targeted for sampling. The primary criteria for selection of the sites were comparability to historical data, and access, as large portions of the river are privately held or not easily accessible. Acquiring permission for access, not usually problematic when sampling streams, can be an issue where landowners are faced with high levels of recreational pressure and have become accustomed to denying access as they are along the Savage River. Two tributaries of the lower Savage River were also targeted to determine the invertebrate taxa that were likely to re-colonize the impacted reach through invertebrate drift.

In order to quantify change in the benthic community resulting from the sediment disturbance event, locations proximal to previously sampled MBSS sites were targeted to maximize data comparability. According to the data provided to us from MBSS, three former sites are located on the lower Savage River and are indicated on the map on the following page (Figure 3). It was not possible to gain access to two of these sites due to denial of permission from the landowners; however, the third site (SAVA-414-R) was targeted for sampling.

Two additional MBSS site locations, upstream of the reservoir and not affected by the sediment event, were selected as control sites in order to provide a measure of annual and seasonal fluctuation when comparing historical records. One site was located on the Savage River and the other on Crabtree Creek. The selected sites have multiple survey events associated with each of them and were selected primarily on their downstream location and comparable size and condition to sites within the lower affected reach. IN the available data, the most recent samples from the lower Savage were collected in 2002, while data from the upper reaches were collected more recently in 2007 and 2008. Comparisons made to sites along the affected reach are only comparable in as much as the biological communities of the upstream sites were comparable to those of the tail-water sites prior to the sediment disturbance event. Differences in condition exist as the streams above the reservoir are free-flowing natural streams compared to the regulated tail-water section of the Savage River.

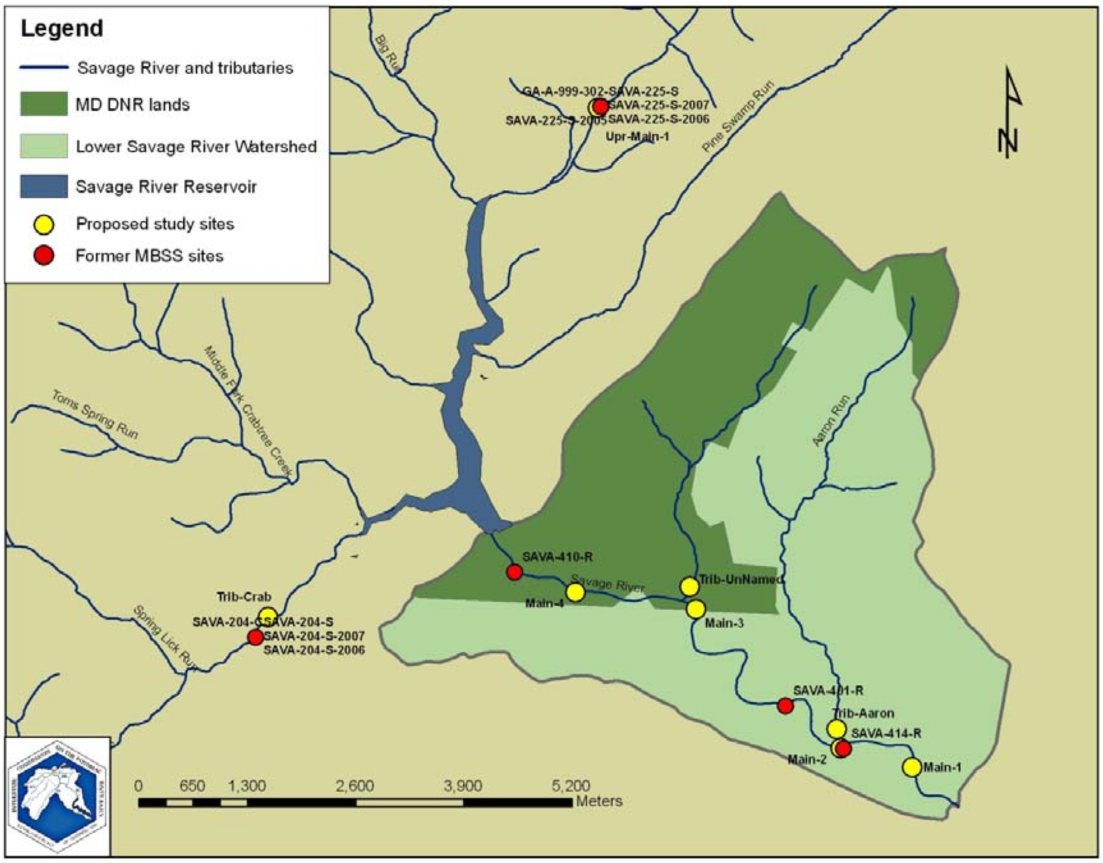


Figure 4 Map of the lower Savage River Watershed showing former MBSS and proposed study sites

Site ID	Latitude	Longitude
LWR-SVG-1	39.4841	-79.0734
LWR-SVG-2	39.4859	-79.0833
LWR-SVG-3	39.5004	-79.1048
LWR-SVG-4	39.5015	-79.1216
TRIB-AARON	39.4871	-79.0839
TRIB-UNK	39.5019	-79.1060
UPR-SVG	39.5540	-79.1212
CRABTREE	39.4969	-79.1647

Table 1 Site ID names and coordinates of study sites

Habitat assessment

Physical habitat assessments were intended to be used to document residual sediment and any impact it was causing to epifaunal substrate. At the start of this study, about 70 days after the new gates became operational, no significant deposits of sand or silt were noticeable in any of the study reaches and epifaunal habitat had returned to pre-construction conditions by means of the flushing flows. This observation was in agreement with those of the DNR Fisheries Biologists who measured and monitored the deposition and eventual evacuation of sediments. The dominant substrate types and epifaunal habitats were noted, however, for each benthic sample.

Sample collections

A total of eight sites were targeted for sample collections, however only five were sampled. The two sites located on the downstream tributaries were ephemeral streams and did not have flow sufficient for sampling under MBSS protocols. Additionally, site 4 along the lower Savage was not sampled due to hazardous conditions that made sampling by a one-man crew problematic. Site 2 along the lower Savage was only sampled once in the second window because it was a replacement site that was added after an earlier site was found to be inaccessible.

Benthic macroinvertebrate samples were collected according to the established sampling procedures outlined in the Maryland Biological Stream Survey Sampling Manual (MD DNR 2010). Along a 75 meter reach, epifaunal habitat was sampled proportionately to the amounts present within the sample area. Sampling was performed with a one foot d-frame net with a 500 µm mesh. 20 one-square foot samples were taken by disturbing the substrate to depth. The number of samples collected from each type of habitat was recorded on the sample ID card placed in the sample container. Samples were preserved in the field using ~ 75% denatured ethyl alcohol.

Initially, it was intended that samples would be collected monthly from each of the identified sample locations (See Figure 1) with the caveat that collections would discontinue if the benthic community was determined to be not significantly impacted according to best professional judgment of conditions in the field. The presence of mature larvae of several sensitive taxa in the sample reach, coupled with the lack of remaining sediment, contributed to the decision to halt sampling after just two months. Mature larvae of the families Perlidae, Heptageniidae, and Rhyacophilidae for example, were observed in the sample at stream side and later confirmed by lab identification. The presence of these mature larvae provided indications that the impact from the sediment transport was not as severe as predicted.

Sample processing

Benthic macroinvertebrate samples were processed in the Environmental Laboratory of Hood College (Frederick, MD). Samples were rinsed and spread on a gridded white tray and were sub-sampled according to randomly drawn numbers that corresponded to grids of the tray. One by one, grids were removed from the sample tray and inspected for macroinvertebrates. Three distinct sub-samples were collected, two (2) at a 100-level count, and a third 200-count sample. Sub-sampling continued until all three sub-samples were completed. Samples and unused material were preserved with ~70% Ethanol.

Sample identification

Macroinvertebrates were identified to the lowest possible taxonomic level with the exception of Chironomidae which were identified to family-level only. Identifications were performed by a certified taxonomist (NABS East-EPT) using a 4 – 90x compound dissecting scope and a variety of taxonomic keys.

Metric and IBI calculation

Attribute tables provided by staff of the MBSS allowed for assignments of tolerance values, habit types, and feeding guilds to be applied to the sample taxonomic counts in a manner consistent with that of the MBSS program. Metrics used in the MBSS "Highlands" benthic Index of Biotic Integrity (BIBI) were calculated for all collected samples and count levels with the exception of the % Tanytarsini metric would have relied on tribe-level Chironomidae identification. Calculated metrics included: Total Taxa Richness (Genus), EPT Taxa Richness, Ephemeroptera Taxa Richness, % Intolerant Urban, % Scraper, % Swimmer, and % Diptera. Additionally, the MBSS Highlands IBI was calculated using the scoring thresholds reported in the IBI development report (Southerland et al. 2005). The most recently acquired MBSS records from nearby stations were used to test for changes in the integrity of the biological community. In order to achieve maximum comparability, raw taxa counts were used to recalculate the individual metrics in the same manner as those samples collected for this study. Counts of genera of the family Chironomidae were combined to the family level to match the taxonomic resolution performed in this study.

Results

In total, 9 samples were collected from 5 of the 8 originally identified sample locations. At each location, habitat was assessed and biological samples collected. From those samples, three subsample counts of macroinvertebrates were performed and metrics calculated. The following results will discuss observations of the physical habitat and remaining impacts from the sediment event, the biological condition of lower Savage River and, comparisons between the lower Savage River and the upper Savage stations and to the historical MBSS data. Bar plots comparing the 100-level counts of this survey and the corresponding MBSS baseline surveys appear in Figures 4 – 12.

Habitat and sediment

Despite the significant immediate impacts to benthic and fish habitat observed by DNR Fisheries crews, no lasting effects were observed by the time sampling was performed for this project which was approximately 70 days after flows again became regulated and reservoir sediment scour stopped. At each site physical habitat surveys were performed and the quality and character of the epifaunal substrate was observed. At no site were sands or fines found to be a dominant substrate class. The evacuation flows were highly successful at moving the accumulated sediments through the reach and the visual nature of the river was not different to that which this observer was used to encountering over many previous visits.

Status of the lower Savage river

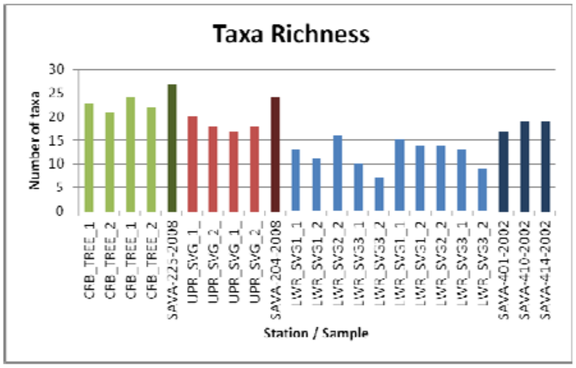
Genus-level taxa richness in the 100 count, post-construction samples ranged from 7 – 16 in the Lower Savage River. These numbers fluctuated by both sampling time and location. Generally, taxa richness was lower in the second sampling window for any particular site. With the exception of Site 2 (LWR_SVG2), EPT taxa (Ephemeroptera, Plecoptera, and Trichoptera) comprised more than half of the total taxa. The percent intolerant-urban, a Maryland specific metric based upon observed occurrences under urban stressor gradients, was high with such taxa comprising an average of 58.61% of the samples in the lower affected reach. The abundance of scrapers was low in the lower Savage River samples ranging from 0 – 13.68% with an average of 3.51%. The adjusted Maryland Highlands Benthic IBI scores were overall lower than those of historical MBSS samples and ranged from 1.86 – 3.86.

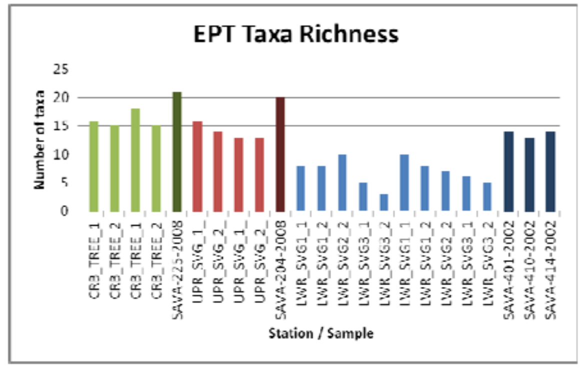
Comparing the upper and lower Savage river communities

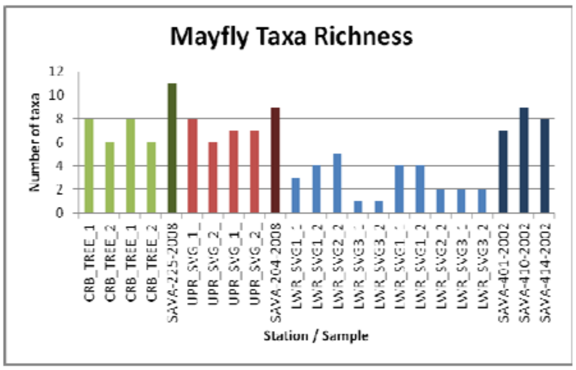
Considering both the historical MBSS data and the data collected under this study, it is possible to conclude that biological communities differ between the naturally-flowing systems of the upper Savage River and Crabtree Creek and the regulated dam-controlled lower Savage River. All three measures of richness indicate that the upper Savage River and Crabtree Creek are generally more diverse than the lower Savage River. Other metrics such as % Swimmer and % Intolerant and the B-IBI do not demonstrate a clear difference between the upper and lower communities. Still other metrics, such as % Scraper and % Diptera tend not to show a pattern between the upper and lower systems but rather differences between the baseline and current data.

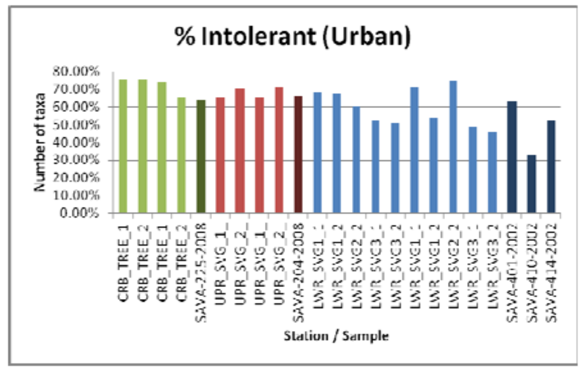
Deviations from historical baseline data

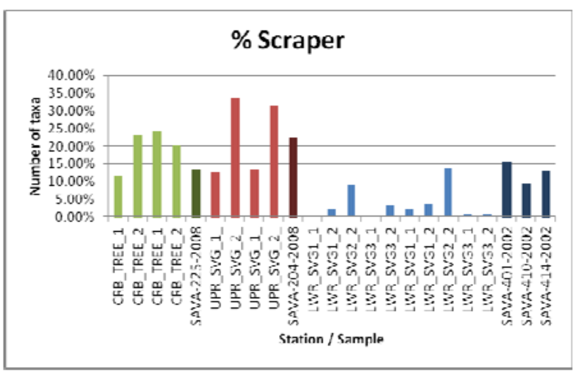
Taxa richness was overall lower at both the upstream control sites and lower Savage River sites when compared to historical MBSS data. Also lower was EPT and mayfly taxa richness among all sites compared to the corresponding MBSS baseline samples. The metrics of % Intolerant and % Swimmer did not seem to display a meaningful difference between the downstream sites or upstream sites and their respective MBSS baseline sites. The % Diptera and % Scraper metrics however show indications that some change has occurred in the system, with Dipterans making up more of the sample in the lower reaches but having been more abundant historically in the upper waters. While no discernible pattern emerged for scrapers in the upper reaches, they seem conspicuously less abundant in the lower Savage compared to baseline samples.

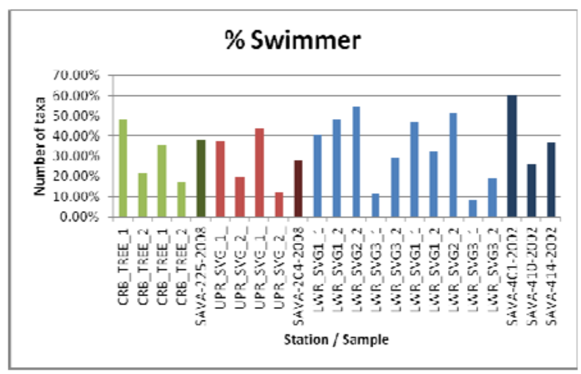


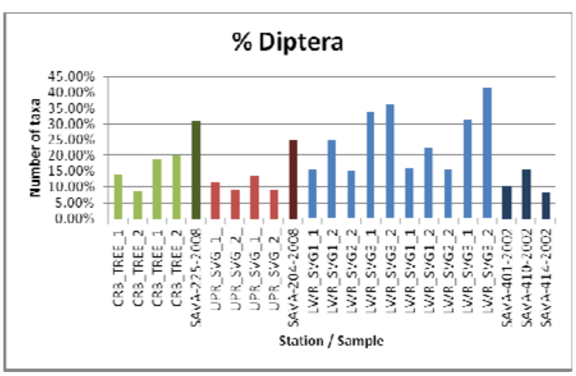


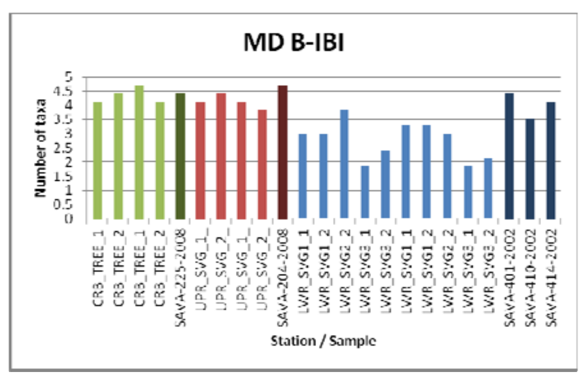












Figures 4 – 12 Bar plots of the seven calculated metrics and the adjusted B-IBI. All 100-level count samples are presented and the corresponding MBSS baseline samples appear as darker shades of the same color.

Alternative explanations for reduced biological integrity

Despite attempts to align the field methods used in this study with MBSS protocols, several divergences occurred which require mention and could potentially reduce the comparability of the results to those of the historical data. First, the MBSS Spring Index period extends from March 1 – April 30 and the metrics used to determine biological condition are based upon macroinvertebrate taxa that are typically encountered in benthic samples during that period. The sampling dates of this study ranged from May 14 – July 2. For this reason, the samples collected during this study, and particularly those of the second round, are not directly comparable to MBSS data. It was not possible to sample during the MBSS period because flows were high enough to preclude sampling and the project was waiting on approval of the Quality Assurance Project Plan. Secondly, the available MBSS data was collected in 2002 for those sites in the lower Savage. Eight years is a considerable amount of time and would allow for natural succession or fluctuation of the biological community. Whilst individual taxa may have changed, overall ecological function of the community may have not changed as dramatically. These changes however, which would be perfectly natural, could result in changes in individual metrics or the overall B-IBI. The MD IBI allows for such a fluctuation having observed shifts in the IBI scores of their sentinel site network (Southerland et al. 2005). Raw taxonomic counts for each site and the corresponding baseline MBSS samples are provided in the Appendix. In each table, taxa not recorded in both the current and baseline surveys are highlighted with the exception of those identifications that may have differed only in taxonomic resolution. Third, in-stream habitat conditions were not consistent between sites and may have been a driver of reduced biological integrity. Site 3 (LWR_SVG3) was located in a constrained channel and had sub-optimal habitat conditions for macroinvertebrates, consisting primarily of large boulders. Most substrate was not moveable and likely contributed to the overall lower metric scores observed at this site. Site 2 (LWR_SVG2) was dominated by cobble and small boulder and was most similar to that of the upstream control reaches. This site also had comparatively higher scores than the other lower Savage sites but was only sampled during the second sampling window which displayed overall lower biological condition scores. Site 1 (LWR_SVG1) was located at a braided channel and was dominated by cobble, however riffles gave way to runs and pools below the braided channel, limiting the amount of prime epifaunal habitat.

Evidence of impact from sediment transport

An insufficient number of baseline samples precluded the ability to statistically test for significant differences between the historical and post-construction benthic communities. Differences however were observed and examination of the individual species accounts indicates that the overall community has changed considerably from the historical data. For each site sampled and a corresponding baseline sample, individual taxa occurrences and counts are provided in Appendix 1 with . It is also likely that observed differences are not attributable to the sediment event and instead represent natural fluctuations or succession in the benthic community and its composition. Two metrics though suggest some effect from the sediment deposition and proceeding scour flows. The percentage of scrapers, organisms that scrape benthic periphyton off of substrate, were markedly lower in the lower Savage than in any of the historical samples or the concurrently collected upstream sites. Also, the percent Diptera (true flies) appeared to the higher in the lower affected reach than either the baseline samples or the unaffected upstream locations. Dipterans, an incredibly diverse order of insects with varied physical, morphological, and life-history attributes (Merritt et al. 2008), include taxa that are tolerant of both disturbance and the deposition of sediments due to relatively short developmental periods and burrowing habits. Similar studies have found that the transport of sediment causes catastrophic drift of certain taxa inhabiting substrate surfaces while those of deeper distributions are less impacted (Culp et al. 1986). This could explain the higher observed proportions of Chironomids in the collected samples.

Despite these slight shifts in the community, it seems clear that the movement of sediment through the Savage River tail-water did not drastically impact the benthic macroinvertebrate community. This is generally in agreement with other studies examining sediment event impacts to benthic macroinvertebrates, which have found reduced densities but little change in overall community structure (Lenat et al. 1981, Thomson et al. 2005). While individual taxa with particular sensitivities may have been reduced or even extirpated, the presence of late-instar individuals from several taxa with relatively long larval developmental periods indicated that the sediment did not cause a significant extirpation event. Examples of such taxa include: Acroneuria, Sweltsa, Rhyacophila, and Stenacron (See Appendix). The presence of these mature larvae indicates that they survived the movement of sediment and the scour flows that were used to flush the system. Additionally, the quick actions of management from the Upper Potomac River Commission, and the United States Army Corps of Engineers, in collaboration with the Maryland Department of Natural Resources Inland Fisheries and the observational data and management suggestions they provided, allowed for an expedient expulsion of the sediment that had been deposited in the system. It is likely that had immediate actions to restore the habitat not been taken, the damage to the ecological communities of the lower Savage River would have been greater.

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Appendix: Taxonomic counts and calculated metrics

PERIOD	STATION ID	LEVEL	# TAXA	# EPT TAXA	# EPHEM TAXA	% INT (URBAN)	% SCRAP	% SWIM	% DIPT
Spring	CRB_TREE_1	100A	23	16	8	75.53%	11.70%	47.87%	13.83%
Spring	CRB_TREE_1	100B	24	18	8	74.00%	24.00%	36.00%	19.00%
Spring	CRB_TREE_1	200A	24	19	9	73.87%	19.10%	44.72%	15.58%
Spring	CRB_TREE_1	200B	31	22	9	74.74%	18.04%	41.75%	16.49%
Spring	CRB_TREE_1	400X	35	25	10	74.30%	18.58%	43.26%	16.03%
Summer	CRB_TREE_2	100A	21	15	6	75.00%	23.00%	22.00%	9.00%
Summer	CRB_TREE_2	100B	22	15	6	65.71%	20.00%	17.14%	20.00%
Summer	CRB_TREE_2	200A	28	21	10	68.37%	26.53%	19.90%	12.76%
Summer	CRB_TREE_2	200B	29	20	8	70.24%	21.46%	19.51%	14.63%
Summer	CRB_TREE_2	400X	36	26	11	69.33%	23.94%	19.70%	13.72%
Spring	LWR_SVG1_1	100A	13	8	3	68.32%	0.00%	40.59%	15.84%
Spring	LWR_SVG1_1	100B	15	10	4	71.28%	2.13%	46.81%	15.96%
Spring	LWR_SVG1_1	200A	21	11	3	61.22%	1.02%	36.73%	20.92%
Spring	LWR_SVG1_1	200B	17	11	4	69.74%	1.03%	43.59%	15.90%
Spring	LWR_SVG1_1	400X	22	12	4	65.47%	1.02%	40.15%	18.41%
Summer	LWR_SVG1_2	100A	11	8	4	67.33%	1.98%	48.51%	24.75%
Summer	LWR_SVG1_2	100B	14	8	4	53.77%	3.77%	32.08%	22.64%
Summer	LWR_SVG1_2	200A	19	10	3	57.62%	4.76%	35.24%	30.48%
Summer	LWR_SVG1_2	200B	17	11	6	60.39%	2.90%	40.10%	23.67%
Summer	LWR_SVG1_2	400X	23	13	6	58.99%	3.84%	37.65%	27.10%
Summer	LWR_SVG2_2	100A	16	10	5	60.20%	9.18%	54.08%	15.31%
Summer	LWR_SVG2_2	100B	14	7	2	74.74%	13.68%	51.58%	15.79%
Summer	LWR_SVG2_2	200A	17	10	4	67.84%	7.54%	51.26%	19.10%
Summer	LWR_SVG2_2	200B	17	10	5	67.36%	11.40%	52.85%	15.54%
Summer	LWR_SVG2_2	400X	23	14	7	67.60%	9.44%	52.04%	17.35%
Spring	LWR_SVG3_1	100A	10	5	1	52.58%	0.00%	11.34%	34.02%
Spring	LWR_SVG3_1	100B	13	6	2	48.48%	1.01%	8.08%	31.31%
Spring	LWR_SVG3_1	200A	16	7	3	57.79%	3.02%	24.62%	31.66%
Spring	LWR_SVG3_1	200B	14	7	2	50.51%	0.51%	9.69%	32.65%
Spring	LWR_SVG3_1	400X	17	8	3	54.18%	1.77%	17.22%	32.15%
Summer	LWR_SVG3_2	100A	7	3	1	50.51%	3.03%	29.29%	36.36%
Summer	LWR_SVG3_2	100B	9	5	2	45.54%	0.99%	18.81%	41.58%
Summer	LWR_SVG3_2	200A	9	5	2	41.12%	0.51%	23.35%	45.18%
Summer	LWR_SVG3_2	200B	11	7	2	48.00%	2.00%	24.00%	39.00%
Summer	LWR_SVG3_2	400X	12	8	2	44.58%	1.26%	23.68%	42.07%
Spring	UPR_SVG_1	100A	20	16	8	65.26%	12.63%	37.89%	11.58%
Spring	UPR_SVG_1	100B	17	13	7	65.31%	13.27%	43.88%	13.27%
Spring	UPR_SVG_1	200A	28	22	9	65.00%	17.00%	39.00%	11.50%
Spring	UPR_SVG_1	200B	22	17	8	65.28%	12.95%	40.93%	12.44%
Spring	UPR_SVG_1	400X	36	28	11	65.14%	15.01%	39.95%	11.96%
Summer	UPR_SVG_2	100A	18	14	6	70.41%	33.67%	19.39%	9.18%
Summer	UPR_SVG_2	100B	18	13	7	71.43%	31.63%	12.24%	9.18%
Summer	UPR_SVG_2	200A	22	16	8	74.63%	26.34%	20.00%	10.73%
Summer	UPR_SVG_2	200B	22	17	8	70.92%	32.65%	15.82%	9.18%
Summer	UPR_SVG_2	400X	27	19	9	72.82%	29.43%	17.96%	9.98%
Spring	SAVA-204-2008	MBSS	24	20	9	66.15%	22.31%	27.69%	24.62%
Spring	SAVA-225-2008	MBSS	27	21	11	63.64%	13.64%	38.18%	30.91%
Spring	SAVA-401-2002	MBSS	17	14	7	62.96%	15.74%	60.19%	10.19%
Spring	SAVA-410-2002	MBSS	19	13	9	32.76%	9.48%	25.86%	15.52%
Spring	SAVA-414-2002	MBSS	19	14	8	51.85%	12.96%	37.04%	8.33%

TAXA	LWR-SVG-1 1-100A	LWR-SVG-1 1-100B	LWR-SVG-1 1-200A	LWR-SVG-1 2-100A	LWR-SVG-1 2-100B	LWR-SVG-1 2-200A	LWR-SVG-2 2-100A	LWR-SVG-2 2-100B	LWR-SVG-2 2-200A	SAVA-414-2002	SAVA-401-2002
Acroneuria	2		2	1		1			1		
Amphinemura		3	4								
Antocha			1			1		1		1	1
Baetidae	38	30	57	47	31	69	36	49	100	2	
Baetis							14			6	18
Blephariceria					1	2	1	2	8		
Caecidotea	4	2	2								
Cambarus			1			1			1		
Cheumatopsyche	1	3	5							2	2
Chironomidae	14	14	33	21	14	45	8	7	22	8	10
Chloroperlidae											3
Clinocera	1	1	1								
Crangonyx	2	1	5	2	3	11					
Dolophilodes	15	8	16	8	9	12	5	8	13		
Drunella					1						
Epeorus										9	12
Ephemerella	1	2	2							10	23
Gammarus										1	
Glossosoma						2					
Heptageniidae					2	5	4	4		2	1
Hexatoma	1		3			1	2	2			
Hydropsyche	14	8	25	4	10	9	5	3	15	31	1
Hydropsychidae										2	
Hydroptila							1	1			2
Isoperla										1	
Lepidostoma											1
Leptophlebia										10	
Leptophlebiidae	2	12	13	2	3	5	3		2		19
Leucrocuta		1								2	
Leuctra		1	3	9	10	23	7	7	15		
Leuctridae										6	2
Lumbriculidae										1	4
Maccaffertium							1				
Nemouridae									1		
Oligochaeta			3		11	5	4	1	4		
Oulimnius										1	
Paracapnia										1	
Paraleptophlebia										12	5
Perlodidae											2
Polycentropus						1					
Promoresia		1	2								
Rhyacophila			2		1	1	1	1	1		
Simulium			3	4	9	15	4	3	7		
Stenacron				1					1		
Stenelmis						1	2	6	3		
Stenonema				2					4		2
Sweltsa	6	7	13								
Tipula									1		

TAXA	UPR-SVG 1-100	UPR-SVG 1-200	UPR-SVG 1-400	UPR-SVG 2-100	UPR-SVG 2-200	UPR-SVG 2-400	SAVA-225-2008
Acerpenna							8
Acroneuria	2	1	2	1		1	1
Agnetina			1	1		1	
Amphinemura		1					
Antocha						1	1
Atherix						3	
Baetidae	9	1	12	13	8	33	
Baetis							2
Brachycentrus				3	3	8	
Caenis					2	4	
Cheumatopsyche	12	12	34	2	3	8	4
Chimarra			1				
Chironomidae		13	19	8	8	16	31
Cinygmula							9
Clinocera							1
Diphetor							1
Diplectrona	1						
Dolophilodes	6	8	8		1		
Drunella	5	5	21	3	2	7	
Epeorus							3
Ephemerella	10	16	37		1		9
Haploperla							1
Helicopsyche			2			1	
Heptageniidae			2				
Hexatoma			3	1	1	2	1
Hydropsyche	5	2	5	6	3	15	1
Isonychia	4	2	4	4	3	5	2
Isoperla			1				4
Lepidostoma							1
Leptaphlebiidae	8	24	23	2		3	12
Leucrocuta				15	12	31	1
Leuctra	4	2	4	22	32	44	1
Leuctridae							2
Maccafferteum	1	1				1	
Neoperla			1				
Nigronia	1				1		1
Oligochaeta			1				
Oulimnius							2
Paraleptophlebia	5		2				8
Paregnetina	1						
Perlidae							1
Philopotamidae			2				
Polycentropus			3	1			1
Psephenus	2	5	5	8	13	11	
Psilotreta	1			2	3	3	
Pteronarcyus			1				
Serratella	4	1		1	1	6	1
Simulium			1				
Stenacron			1				
Stenelmis	3	2	3	5	1		
Stenonema			1				
Stenus						1	
Suwallia		2					

TAXA	CRABTREE 1-100A	CRABTREE 1-100B	CRABTREE 1-200	CRABTREE 2-100A	CRABTREE 2-100B	CRABTREE 2-200	SAVA-204-S-2007
Acroneuria		1	2	1		4	
Agnetina				2			
Alloperla			1				
Amphinemura	1	2					1
Antocha	1						
Atherix				1			
Baetidae	17	12	19	8	12	21	7
Blephariceral		2					
Cambarus bartonii						1	
Cheumatopsyche	3		2	3	4	10	3
Chironomidae	8	12	20	6	14	18	28
Chloroperlidae							1
Cinygmula	4	10	17				4
Clinocera	1		6		1		2
Dicranota	1				2	2	
Dolophilodes	8	6	15	3	2	7	
Drunella	1	2	4	7	6	29	
Dubiraphia	2	2	7	5	6	8	
Epeorus	2	4	7		1	2	14
Ephemera		1				1	
Ephemerella	17	20	54		1	1	14
Ephemerellidae							2
Glossosoma		1			2	1	
Haploperla							3
Heptagenia				3			
Hexatoma	1	4		1	3	3	
Hydropsyche	7	7	12	8	9	19	4
Isonychia			2	5		3	
Isoperla		1					2
Leptaphlebiidae	11	4	14	6	5	14	9
Leucrocuta	1		1	6	6	6	3
Leuctra	2	2	2	28	24	24	1
Leuctridae							17
Maccafferteum	1	1	2			1	1
Neoperla				2			
Neophylax							1
Oligochaeta					1		
Oulimnius							5
Paraleptophlebia							4
Paregnetina	1	1			1	5	
Perlidae		1	2		1	3	
Perlodidae							1
Polycentropus			1			1	
Prosimulium							2
Psephenus		2		2		2	
Pteronarcyus	2		1			4	
Rhyacophila	1		3	1	1		
Simulium	1	1	1	1	1	2	
Stenonema						3	
Sweltsa		1				1	
Taenionema							1
Tallaperla				1	2		
Tipulidae			4				