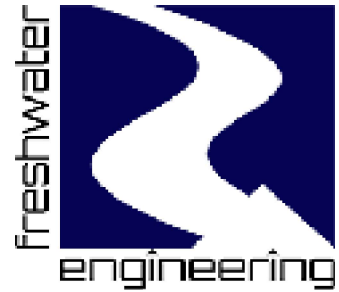


November 18, 2016

Friends of Starkweather Creek
P.O. Box 8442
Madison, WI 53708



WWW.FRESHWATERENG.COM

RE: SPMD Water Quality Sampling of Starkweather Creek

Dear Friends of Starkweather Creek and City of Madison Staff,

FreshWater Engineering is pleased to submit this report for the Semipermeable Membrane Device (SPMD) Water Quality Sampling Study of Starkweather Creek.

This report synthesizes the findings of the field study conducted using SPMD monitoring equipment at 8 locations throughout the Starkweather Creek Watershed. The SPMDs were deployed in the creek from May 16, 2016 to June 14, 2016. Upon removal from the creek, the SPMDs were sent to the Wisconsin State Laboratory of Hygiene (SLOH) for analysis. The lab results were received October 11, 2016.

The results from this 2016 study are also compared to the similar study performed in 2005 by the University of Wisconsin-Madison Water Resources Management Practicum students. Field and lab procedures during 2016 were matched as closely as possible to the study methodology performed in 2005. Overall, result comparison between the two studies shows there has been an improvement in water quality over the past decade.

FreshWater Engineering would like to thank the Friends of Starkweather Creek and the City of Madison for the opportunity to fulfill this scope of work. Please feel free to contact me at the number or email listed below should you have any questions or additional needs.

Sincerely,

A handwritten signature in blue ink that reads "Laura Rozumalski". The signature is fluid and cursive, with the first name being the most prominent.

LAURA ROZUMALSKI, P.E.
PRESIDENT AND PRINCIPAL ENGINEER
FRESHWATER ENGINEERING LLC
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SPMD Water Quality Sampling Starkweather Creek

Project Overview

The purpose of this project was to sample and analyze the current water quality conditions in Starkweather Creek and compare the results of the 2016 study to the previous study that was performed in 2005 by the UW-Madison Water Resources Management Practicum students. Semipermeable membrane devices (SPMDs) were used as the sampling mechanism for both studies. The SPMDs mimic fish tissue by accumulating hydrophobic organic compounds from the water column and, consequently, provide a snapshot of the sort of toxins an aquatic organism would potentially be affected by while living in the waterbody. Additionally, the SPMDs were analyzed for general toxicity as a broad comparison of which areas of the creek are more toxic than others.

SPMD Description

SPMDs are flattened tubes of low-density polyethylene filled with a thin layer of triolein, a neutral lipid that is found in most aquatic organisms (Figure 1). They provide a long-term, stationary sampling point by being fixed to the streambed during deployment, which allows contamination sources at different sections in the creek to be identified. SPMD study results are highly reproducible, can be standardized over different seasons and sites, and can be compared to results from other river and stream studies using SPMDs.

An advantage of SPMDs is that they indicate which chemicals are present in the waterbody that may be affecting the aquatic species that live in the water, without having to harm any of those aquatic species. In many types of sampling, fish or invertebrates are collected from the water body and processed in the lab to determine which compounds are accumulating in their bodies. SPMDs do not require the removal of already scarce biota, such as fish, for tissue analysis. Because they act like biological tissue, the SPMDs can be used to determine which compounds fish would bioconcentrate in their tissues as they pass contaminated water through their gills. With SPMDs, no species are harmed and study results give a time averaged sample of bioaccumulating chemical compounds found in the water column, as opposed to typical water quality grab samples which only capture a single point in time.



Figure 1: SPMD sampler in protective case during field deployment

Monitoring Site Selection

In total, 8 SPMDs were deployed in stream at various sites throughout Starkweather Creek. Compared to the study performed in 2005 by the University of Wisconsin-Madison, this study had two additional locations for SPMD monitoring (Figure 2). As in the 2005 study, a field blank was exposed to the air at each site during deployment and retrieval of the SPMDs in order to provide air quality data about which contaminants are being delivered to the creek via the atmosphere.

The “Above Airport” (the Dane County Regional Airport) and the “Above East Towne Mall” sites were chosen because they are far upstream on their respective branches of the creek. In theory, these would be the sites with the best water quality because they are upstream of most likely sources of contamination. The “Below Airport” and “Golf Course Ditch” sites were chosen as places of specific interest given the potential pollutants coming from each type of land use. Airports are commonly sources of organic pollutants, and the golf course ditch drains an abandoned dump site in addition to potential chemical use to maintain the golf course. The “West Branch Milwaukee Street” site was chosen because the U.S. Geological Survey has performed previous water-quality investigations there which could be compared to results from this study. Additionally, the “West Branch Milwaukee Street” site is further downstream in the watershed and representative of inputs throughout that branch of the watershed

The “Below Lien Marsh” site was chosen to compare to the upstream site above East Towne Mall to determine whether or not water quality increased or decreased as the creek passed through the wetlands associated with this reach. The new “East Branch Milwaukee Street” site

was chosen to monitor further downstream on the East Branch of Starkweather to represent inputs from that branch and to compare toxicity levels in relation to the Kipp Groundwater Treatment Site (discussed more later). The “Capital City Trail” site was chosen to monitor the confluence of the two branches of the creek and represent overall water quality in the creek being discharged to Lake Monona.

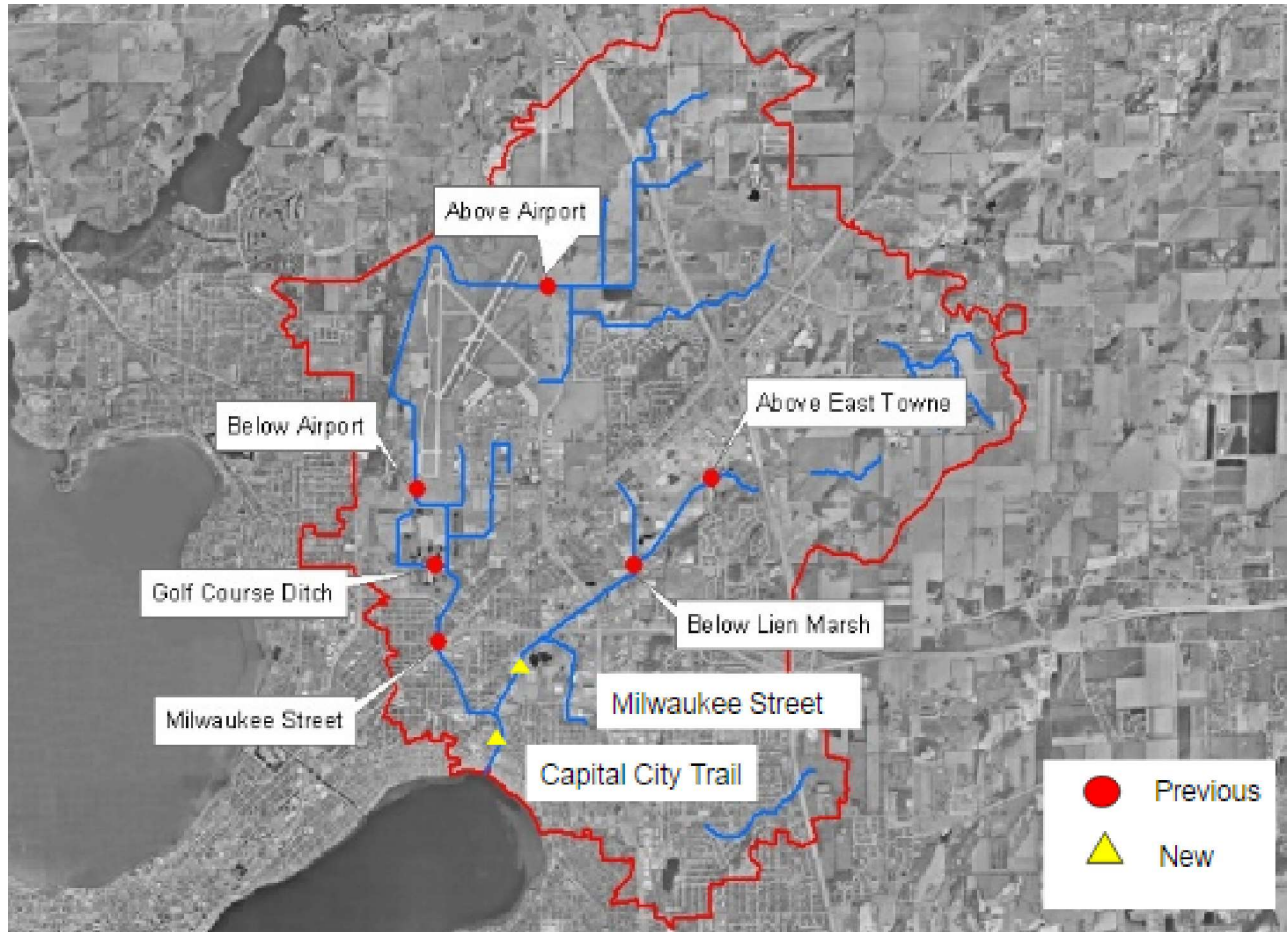


Figure 2: Starkweather Creek Watershed sampling locations for the 2016 study, includes 6 sites sampled during the 2005 study and 2 sampling sites added for the 2016 study.

Site Name	Location	Latitude	Longitude
Above Airport	Directly East of Highway 51	N 43° 08.792'	W 089° 19.387'
Below Airport	Directly South of Anderson Street	N 43° 12.094'	W 089° 34.0333'
Golf Course Ditch	Golf Course Ditch Tributary to Starkweather	N 43° 06.81'	W 089° 20.421'
West Br. Milwaukee Street	Below Railroad Tracks South of Milwaukee Street	N 43° 09.923'	W 089° 33.8069'
Below Lien Marsh	Syracuse Ave Below Lien Marsh North of Railroad	N 43° 06.832'	W 089° 18.617'
Above East Towne Mall	Centered Between E Springs Dr and Lien Rd	N 43° 07.479'	W 089° 17.717'
East Br. Milwaukee Street	East Branch of Starkweather Crossing Milwaukee	N 43° 09.955'	W 089° 33.152'
Capital City Trail (Confluence)	Directly South of Capital City Trail at Confluence	N 43° 09.3135'	W 089° 33.2673'

Figure 3: Sampling locations and descriptions

Field Study

Eight SPMDs were deployed on May 16, 2016 for a total of 30 days. All devices were successfully retrieved on June 14, 2016. According to the National Climate Data Center, 3.94 inches of rain fell during the time that the SPMDs were deployed. The SPMDs were protected in metal cases which prevented the membrane from being punctured, yet still allowed water to flow through the devices and contact the membrane. The metal cases were zip-tied to metal fence posts which had been pounded into the creek bed. Fence posts were located in areas where they wouldn't be an obstruction in-stream, couldn't be accessed by people onshore, and where the SPMD would remain submerged for the extent of the sampling. All fence posts were removed from the creek when the SPMDs were retrieved in June. Field notes from the deployment and retrieval efforts are recorded in the report appendix.



Figure 4: SPMD deployment at West Branch Milwaukee Street location



Figure 5: Field blank exposed to air at each site during deployment and retrieval



Figure 6: Typical biofouling buildup on SPMDs during deployment, observed during retrieval

Laboratory Processing and Analysis

Upon retrieval from the Starkweather Creek, all SPMDs were put on ice and sent to EST, Inc., for dialysis to extract the lipid from the membrane. Each SPMD was processed and ampulated (placed in vials) separately. There were no compounds added pre-deployment, nor were there surrogates added pre-processing. Following dialysis the samples were concentrated using the Kuderna-Danish method, evaporated under nitrogen gas to a volume of about 0.5mL, and filtered through glass fiber filter paper using Hexanes as the transfer solvent. The samples were again blown down under nitrogen and were then quantitatively transferred to 2mL amber ampules using hexane as the transfer solvent. The ampules were chilled in a dry ice solution and flame sealed.

After the extraction process, the SPMD samples were sent to the Wisconsin State Laboratory of Hygiene for analysis. Each of the samples underwent a Microtox test, a process that determines a value of general toxicity. In this test a beaker is filled with a known value of luminescent bacteria that produce light as a function of their cellular respiration. The strain *Vibrio fischeri* NRRL B-11177 is typically used because it is highly sensitive to the toxicity of a wide range of chemicals. When exposed to toxins in water samples, some of these bacteria die, decreasing the total level of light emitted. As the toxicity of a water sample increases, more of these bioluminescent bacteria die, further decreasing the level of light. Relative values of toxicity are determined by comparing the level of light emitted by the bacteria before and after

the addition of the SPMD extracts. In this case, bioluminescence was measured from the bacteria at the start of the test and given the value of 100 percent light remaining. The SPMD extract in the DMSO was then added to the beaker. After 15 minutes, the amount of light was measured again.

All of the samples that showed high levels of toxicity were additionally processed with a mass spectrometer. This testing was done in order to know which chemical compounds were present in the sample causing the additional toxicity and at what concentration they were present.

Microtox Test Results

The results from the Microtox analysis are illustrated in Figure 7. As noted, the relative toxicity between sites can be determined by comparing the bioluminescence values. The percent light remaining indicates how toxic the sample was, the higher the percent light remaining, the lower toxicity that exists. For the sample results, the least toxic sample (highest relative amount of light remaining) and therefore the site with the best water quality within the creek was just upstream of the Dane County Regional Airport (Above Airport site).

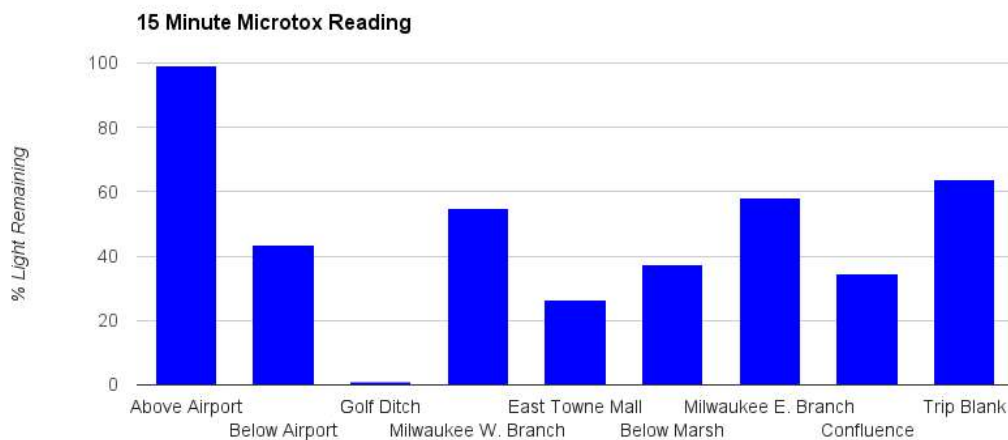


Figure 7: 2016 SPMD Microtox results

The golf course ditch was the area of worst toxicity with a reading of 1% light remaining. The “East Towne Mall” had the next highest toxicity, followed by the “Confluence” site and the “Below Airport” site. One improvement to notice is from the “East Towne Mall” location to the “Below Lien Marsh” location. As Starkweather Creek flows downstream through the marsh, the water quality improves, which indicates the marsh is acting as a natural water treatment area.

The trip blank, or control sample, was exposed to the atmosphere during SPMD deployment and retrieval, for a total exposure time of roughly 10 hours. The toxicity of this sample serves as a benchmark to compare to other site toxicities. Here, it is interesting to note the “Above Airport” sample had less toxicity than the trip blank sample, indicating there is likely a high impact on the creek coming from atmospheric sources.

Comparison to 2005 Study

The study done in 2005 by the UW-Madison Water Resources Management Practicum students can be directly compared to the 2016 study results. In 2005, the first round of SPMD samplers were deployed for 30 days beginning April 20, 2005. Over this period, the Starkweather Creek watershed received 3.85 inches of rain (National Climatic Data Center, 2006). Results are illustrated in Figure 8.

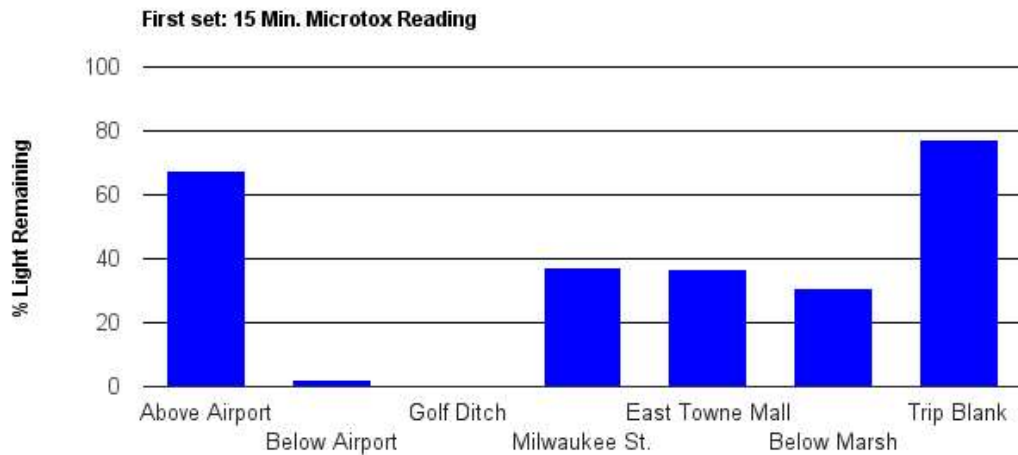


Figure 8: 2005 Microtox results from first round of sampling

The second round of SPMD samplers during 2005 were deployed for 30 days beginning on June 22, 2005. During this time, 2.97 inches of rain fell on the watershed (National Climatic Data Center, 2006). Results are illustrated in Figure 9.

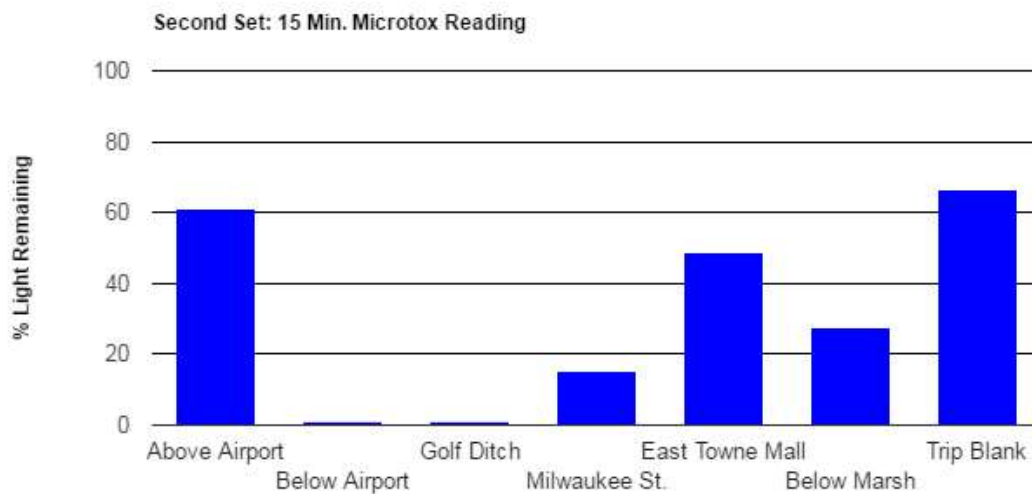


Figure 9: 2005 Microtox results from second round of sampling

For comparison to the 2016 study results, the Microtox test results from the two rounds of sampling were averaged at each sample site. The graph in Figure 10 depicts the averaged results.

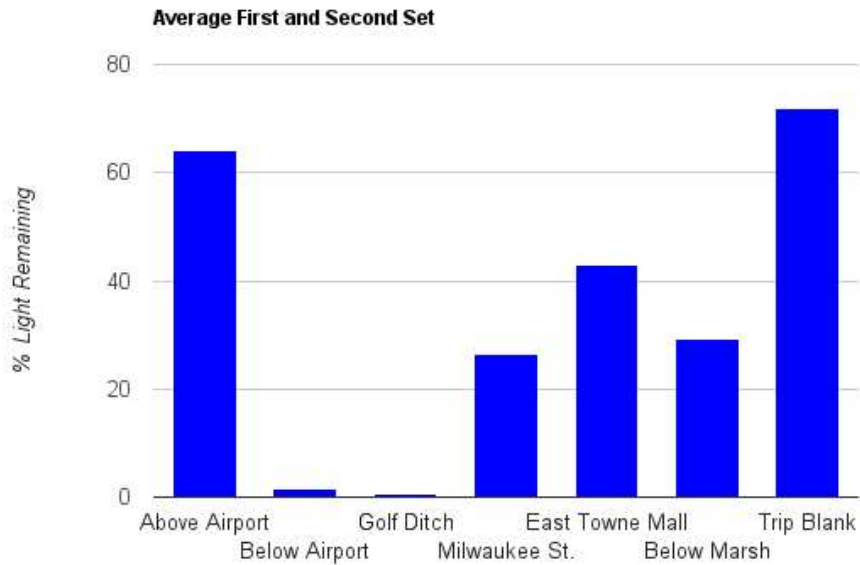


Figure 10: Averaged 2005 Microtox results

The averaged data from 2005 and the new data from 2016 are compared in Figure 11 and Figure 12. In Figure 11, the 2005 results values are subtracted from the 2016 values. A positive value indicates water quality has improved and a negative value indicates it has declined. The only in-stream sampling location that declined was the “East Towne Mall” location, but the toxicity of the trip blank, which sampled air quality, also decreased. All other locations saw an increase in water quality, though the Golf Course site only saw a very small improvement. The site below the airport saw the greatest increase in water quality. Figure 12 shows the toxicity values from each of the sample locations without averaging.

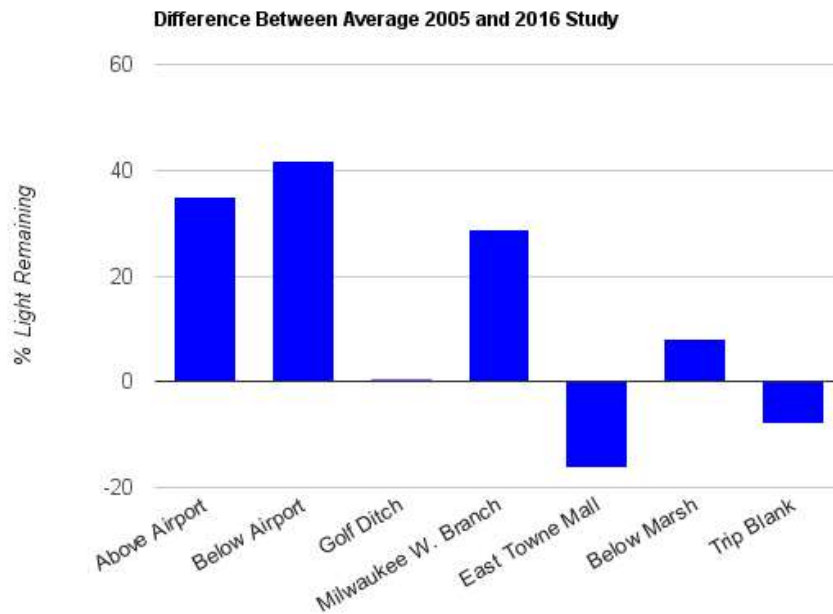


Figure 11: 2005 and 2016 studies - result comparison

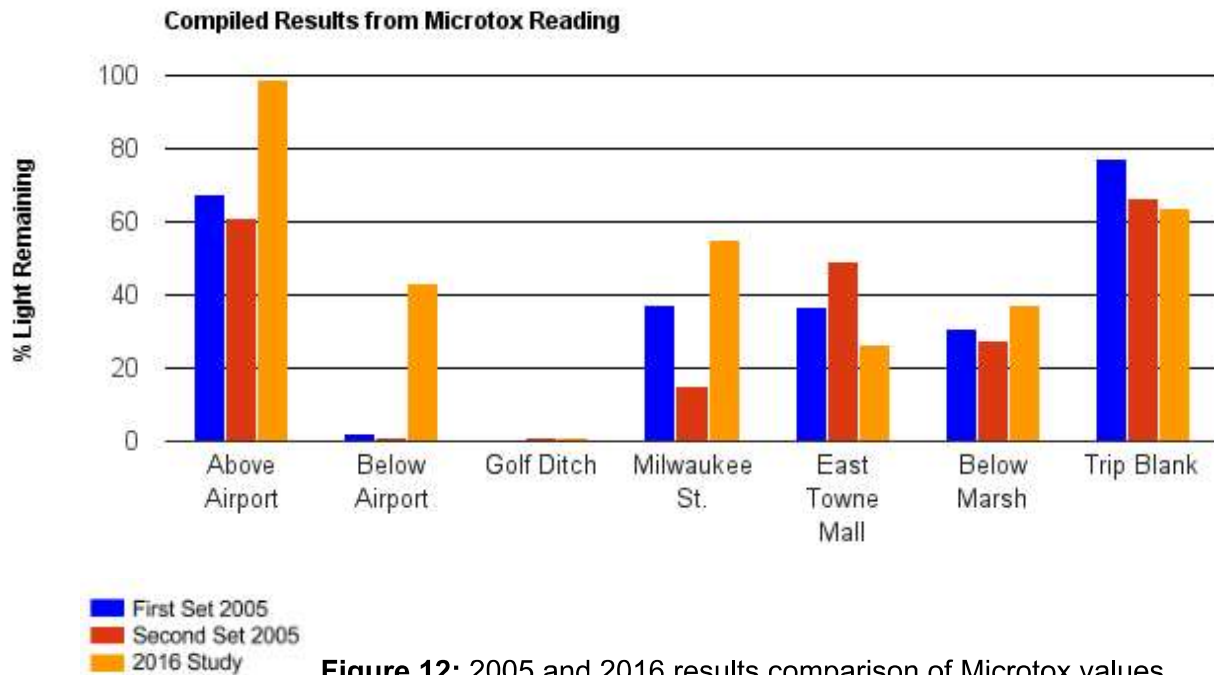


Figure 12: 2005 and 2016 results comparison of Microtox values

Mass Spectrometer Analysis Results

Five of the samples underwent a mass spectrometer analysis to detect polycyclic aromatic hydrocarbons (PAHs). This analysis duplicated the same sample processing as the 2005 study. PAHs are a group of over 100 different chemicals that are formed during the incomplete burning of coal, oil and gas, garbage, or other organic compounds. PAHs can also be found in petrochemicals, rubber, plastics, lubricants, antirust oil, paints, leather, and other products.

The results of the mass spectrometer analysis can be reviewed in Figure 13. In the results table, LOD stands for limit of detection and LOQ stands for limit of quantification. LOD refers to the lowest concentration of the measurand that can be detected at a specified level of confidence. LOQ refers to the lowest concentration at which the performance of a method or measurement system is acceptable for a specified use.

Analytes	Confluence	Below Airport	Golf Course Ditch	East Towne Mall	Below Marsh	LOD (ug/mL)	LOQ (ug/mL)
Naphthalene	0	0	0	0	0.284	0.120	0.382
2-methylnaphthalene	0	0	0	0	0	0.100	0.318
1-methylnaphthalene	0	0	0	0	0	0.100	0.318
2,7-dimethylnaphthalene	0	0	0	0	0	0.100	0.318
Acenaphthylene	0	0	0	0	0	0.100	0.318
Acenaphthene	0	0	0	0	0	0.100	0.318
Fluorene	0	0	0	0	0.159	0.100	0.318
Phenanthrene	0.349	0.104	0.219	0.286	0.483	0.100	0.318
Anthracene	0	0	0.126	0.379	0	0.100	0.318
Fluoranthene	0.922	0.226	0.652	0	1.212	0.120	0.382
Pyrene	0.368	0	0.197	0	0.576	0.120	0.382
Benzo(a)anthracene	0.195	0	0.175	0	0	0.120	0.478
Chrysene	0.192	0	0	0	0.355	0.150	0.478
Retene	0	0	0	0	0	0.150	0.382
Benzo(b)fluoranthene	0.227	0	0.219	0	0.254	0.150	0.478
Benzo(k)fluoranthene	0	0	0	0	0	0.150	0.478
Benzo(e)pyrene	0	0	0	0	0	0.150	0.478
Benzo(a)pyrene	0	0	0	0	0	0.150	0.478
Indeno(1,2,3-c,d)pyrene	0	0	0	0	0	0.200	0.637
Benzo(g,h,i)perylene	0	0	0	0	0	0.150	0.478
Dibenz(a,h)anthracene	0	0	0	0	0	0.200	0.637
Coronene	0	0	0	0	0	0.500	1.592

Figure 13: PAH test results

*Result reported in ug/1 mL of sample

Results between LOD and LOQ

PAH's Above LOQ:

PAH Compound	Typical Sources	Potential Local Source
Phenanthrene	<ul style="list-style-type: none"> Automotive exhaust Residential/industrial heating sources Natural gas processing Waste incineration 	High variability of sources Local landfill
Anthracene	<ul style="list-style-type: none"> Automotive exhaust Wood and coal fire Municipal wastewater treatment facility Aluminum smelting 	High variability of sources Local Wastewater Plant
Fluoranthene	<ul style="list-style-type: none"> Automotive exhaust Coal tar Coke ovens Spills of petroleum products 	High variability of sources
Pyrene	<ul style="list-style-type: none"> Residential wood burning Coal tar Automotive exhaust 	High variability of sources

Areas of Concern

Comparing the 2005 study to the 2016 study, one can see the water quality has improved in all sampling site locations except for the “East Towne Mall” location. With respect to general toxicity, the primary area of concern is the “Golf Course Ditch” location. This is by far the area where the water quality is the worst. The water within the creek throughout this reach is standing water during base conditions with little to no flow. The airport is also a concern as a source of pollution as the results show that between the above and below airport testing sites, there is a 55% light reduction over approximately 3.5 miles of creek length. The land adjacent to this length of creek is owned and operated by the Dane County Regional Airport and though it’s still in poor condition compared to the rest of the creek, this reach has shown improvement since the 2005 study.

Interest in the Kipp Corporation’s effluent discharging into Starkweather Creek was brought up as a potential source of contamination to the creek. Background information on the effluent discharge from treatment at the Kipp plant can be found in the appendix to this report or in extensive detail on the WDNR webpage. Sample analysis indicates, the Kipp Corporation effluent does not significantly decrease the water quality in Starkweather Creek with respect to the general toxicity or contribute additional PAHs to the waterbody.

Summary and Next Steps

Overall, the water quality of Starkweather Creek has improved since 2005 according to the results of this latest sampling. Given the relative toxicities in the creek, there is still ample room for additional improvement. General ways to improve water quality throughout the watershed include: promoting infiltration through the use of rain gardens and bioswales, street sweeping to reduce amount of chemical runoff delivered by sediment, creek cleanups, and creating riparian buffer zones along the banks of the creek to reduce contaminated runoff flowing into the creek. By addressing the areas of concern and implementing techniques to improve water quality, conditions throughout the watershed could continue to improve as they have over the past decade.

Next steps to consider for ways to continue the increase in water quality of the creek include:

- Investigate land management practices nearby the Golf Course Ditch to see if enhanced riparian buffers can be put in place to help filter runoff before entering the creek.
- Look into ways to increase baseflow in the Golf Course Ditch. This could be promoting infiltration upstream of the ditch throughout neighborhoods in the headwaters or promoting infiltration on the land owned by the golf course.
- Survey land use practices near the East Towne Mall and evaluate if new developments are contributing to a change in pollutants delivered to the creek.
- Engage with the airport staff to learn about their plans to reduce runoff to the creek and see if there are additional ways the Friends of Starkweather Creek could help implement better stewardship of the waterbody on airport property.
- Promote sustainable stormwater management throughout the watershed with the use of vegetated buffers and rain gardens where possible.

Appendix

Microtox Test - Detailed Results

MICROTOX CONTROL PERFORMANCE							
ORGANISM CONTROL							
Phenol RTT Passed? Yes							
COMMENTS: Two Phenol RTTs were run - one for each batch of Microtox bacteria reagent used. The first batch was used for all the screen tests and the second batch was used for all the dilution tests. Both RTTs met EC50 criteria of 13-26 mg/L. Phenol Test 1 had EC50 of 18.6 and Phenol Test 2 had an EC50 of 26.0%.							
MICROTOX TEST 5 MINUTE DATA							
LAB NO.	FIELD NO.	Concen.	SITE DESCRIPTION	Percent effect 5 min		5 Min Mean Effect	STND DEV
				Rep A	Rep B		
DMSO	DMSO	1%	DMSO Solvent Control	X	X	X	X
Saline	Saline	90%	Saline Lab Control (2% NaCl)	0.7	-2.6	-0.9	2.3
MB	MB	1%	DMSO Method Blank (went through solvent transfer)	4.5	-1.8	1.4	4.4
267838001	16-116	1%	Field Blank Exposed at Each Site	44.7	39.6	42.1	3.6
267838002	16-117	1%	Confluence of South Capitol City Bike Trail	67.7	70.4	69.0	1.9
267838003	16-118	1%	Downstream of Dane County Airport	63.4	65.6	64.5	1.5
267838004	16-119	1%	East Branch of Starkweather Creek crossing Milwaukee	51.2	56.1	53.6	3.5
267838005	16-120	1%	Golf Course Ditch draining into Starkweather Creek	97.5	97.2	97.4	0.2
267838006	16-121	1%	Above Marsh East Town Mall	76.4	77.8	77.1	1.0
267838007	16-122	1%	Below Marsh Syracuse Avenue	68.5	68.7	68.6	0.1
267838008	16-123	1%	Upstream of Airport off Highway 51	18.6	20.7	19.7	1.4
267838009	16-124	1%	West Branch Milwaukee beneath RR tracks	51.1	57.0	54.0	4.2
267838010	DB	1%	Dialysis Blank	24.4	22.8	23.6	1.1
A mean effect over 10% may indicate toxicity. A mean effect of 55% or greater would result in analysis of a basic test with dilutions to determine an EC50 for that sample.							
COMMENTS: Microtox reader and software used to analyze samples. Microtox Omni Software calculates percent effect of sample on bacterial reagent relative to DMSO (Dimethyl sulfoxide) solvent control sample 0, 5 and 15 minute light readings. Sample results highlighted in purple had over 55% effect and were run again with full dilution series to determine an EC50.							
MICROTOX TEST 15 MINUTE DATA							
LAB NO.	FIELD NO.	Concen.	SITE DESCRIPTION	Percent effect 15 min		15 Min Mean Effect	STND DEV
				Rep A	Rep B		
DMSO	DMSO	1%	DMSO Solvent Control	X	X	X	X
Saline	Saline	90%	Saline Lab Control (2% NaCl)	1.0	0.0	0	0.7
MB	MB	1%	DMSO Method Blank (went through solvent transfer)	1.1	-3.0	-1	2.9
267838001	16-116	1%	Field Blank Exposed at Each Site	41.4	34.2	38	5.1
267838002	16-117	1%	Confluence of South Capitol City Bike Trail	64.5	66.7	66	1.5
267838003	16-118	1%	Downstream of Dane County Airport	57.6	60.6	59	2.1
267838004	16-119	1%	East Branch of Starkweather Creek crossing Milwaukee	42.4	49.8	46	5.2
267838005	16-120	1%	Golf Course Ditch draining into Starkweather Creek	98.3	98.3	98	0.0
267838006	16-121	1%	Above Marsh East Town Mall	75.7	76.5	76	0.6
267838007	16-122	1%	Below Marsh Syracuse Avenue	66.1	66.1	66	0.0
267838008	16-123	1%	Upstream of Airport off Highway 51	12.4	15.0	14	1.9
267838009	16-124	1%	West Branch Milwaukee beneath RR tracks	49.2	55.1	52	4.2
267838010	DB	1%	Dialysis Blank	22.2	18.4	20	2.7
A mean effect over 10% may indicate toxicity. A mean effect of 55% or greater would result in analysis of a basic test with dilutions to determine an EC50 for that sample.							
COMMENTS: 5 and 15 minute readings provided as different toxicants can have effects at different time points. Sample results highlighted in purple had over 55% effect and were run again with full dilution series.							

Lab ID	Field Name
16-116	Trip Blank
16-117	Confluence
16-118	Below Airport
16-119	Milwaukee E Branch
16-120	Golf Ditch
16-121	East Towne Mall
16-122	Below Marsh
16-123	Above Airport
16-124	Milwaukee W Branch

Figure 14: Microtox 5 and 15 minute data

Field Notes - Site Conditions During Deployment and Retrieval

Site Name	Deployment (5/16/16)	Retrieval (6/14/16)
Above Airport	-Suspended sediment -2' water depth -Sampler 1.5' -Colorless water with low flow	-Heavily vegetated -3.5' water depth -Sampler 1' depth -Clear water with flow
Below Airport	-Solid vegetation -2' water depth -Sampler 1' depth -Clear water with some flow	-Solid vegetation -3' water depth -Sampler 1' depth -Clarity uncertain with no flow
Golf Course Ditch	-Some vegetation -1.5' water depth -Sampler depth 6" -Muddy water with no flow	-Heavily vegetated -2' water depth -Sampler 10" depth -Clarity uncertain with no flow, debris on SPMD
Milwaukee Street West Branch	-Gravel substrate -1.5' water depth -Sampler 8" depth -Clear water with floating debris	-Moderate vegetation -2' water depth -Sampler 1' depth -Good water clarity with slow flow -New railroad ties installed near site
East Towne	-Gravel cobble bottom -1' water depth -Sampler 9" depth -Clear water with no flow -Dry area downstream	-Minimal vegetation -10" water depth -Sampler 10" depth -Clear water with no flow -Sampler free of debris
Below Lien Marsh	-Gravel cobble bottom -1.5' water depth -Sampler 10" depth -Clear water with decent flow	-Minimal vegetation -1.5' water depth -Sampler 1' depth -Clear water with swift flow -Sampler wrapped in vegetation
Milwaukee Street East Branch	-No vegetation -3' water depth -Sampler 1' depth -Murky milky green water color -Rip rap bottom	-No vegetation -2.5' water depth -Sampler 10" depth -Blue cloudy water clarity -Sampler free of debris
Capital City Trail (Confluence)	-Minimal vegetation much debris -3' water depth -Sampler 10" depth -Cloudy water no to low flow -Mostly firm bottom	-Minimal vegetation -2.5' water depth -Sampler 1' depth -Slightly cloudy water -Sampler free of debris

NOAA Rain Data

May 2016

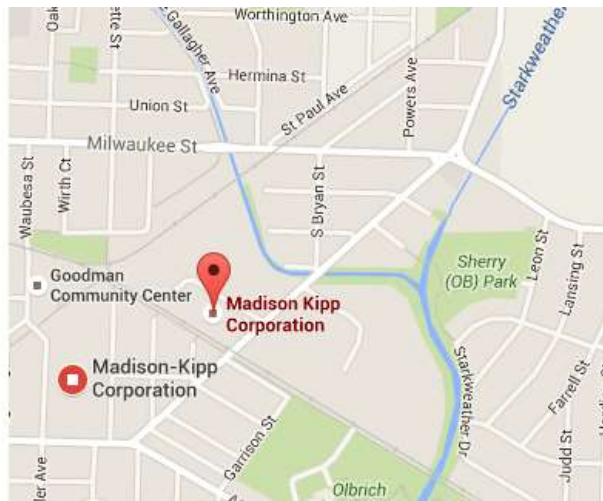
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1	2	3	4	5	6A	6B	7	8	9	10	11	12	13	14	15	16	17	18		
										12Z		AVG		MX		2MIN				
DY	MAX	MIN	AVG	DEP	HDD	CDD	WTR	SNW	DPTH	SPD	SPD	DIR	MIN	PSBL	S-S	WX	SPD	DR		
1	58	42	50	-2	15	0	T	0.0	0	12.6	20	50	M	M	10	1	37	80		
2	64	38	51	-2	14	0	T	0.0	0	4.9	15	10	M	M	4		26	360		
3	68	38	53	0	12	0	0.07	0.0	0	7.3	36	350	M	M	5	1	49	350		
4	60	40	50	-4	15	0	0.00	0.0	0	12.6	24	10	M	M	5	1	30	20		
5	67	34	51	-3	14	0	0.00	0.0	0	4.9	13	30	M	M	1		21	50		
6	86	44	65	11	0	0	0.02	0.0	0	5.0	15	360	M	M	4	38	19	360		
7	68	43	56	2	9	0	T	0.0	0	8.9	23	360	M	M	7		30	10		
8	71	36	54	-1	11	0	0.00	0.0	0	4.4	16	50	M	M	6	8	22	40		
9	64	43	54	-1	11	0	0.19	0.0	0	13.0	26	120	M	M	7	1	35	110		
10	52	49	51	-4	14	0	0.49	0.0	0	11.0	21	110	M	M	10	1	24	110		
11	66	49	58	2	7	0	0.06	0.0	0	6.3	14	140	M	M	10	128	16	110		
12	68	49	59	3	6	0	0.44	0.0	0	7.1	17	280	M	M	7	1	26	290		
13	60	41	51	-5	14	0	0.20	0.0	0	7.6	17	350	M	M	7	1	27	300		
14	45	32	39	-18	26	0	T	0.0	0	9.6	20	330	M	M	8		31	340		
15	58	30	44	-13	21	0	0.00	0.0	0	5.4	15	300	M	M	4		22	320		
16	71	48	60	3	5	0	0.02	0.0	0	7.5	20	220	M	M	6		28	220		
17	61	39	50	-8	15	0	T	0.0	0	7.4	16	30	M	M	5		21	30		
18	67	34	51	-7	14	0	0.00	0.0	0	4.1	16	140	M	M	2		21	140		
19	70	40	55	-3	10	0	0.00	0.0	0	3.8	14	190	M	M	2	1	19	180		
20	72	40	56	-2	9	0	0.00	0.0	0	3.5	13	110	M	M	6	8	19	90		
21	78	43	61	2	4	0	0.00	0.0	0	3.6	20	10	M	M	5	1	24	10		
22	83	47	65	6	0	0	0.00	0.0	0	3.1	13	140	M	M	3	8	17	40		
23	83	53	68	9	0	3	0.00	0.0	0	8.3	18	170	M	M	5		24	170		
24	82	58	70	10	0	5	T	0.0	0	4.9	14	160	M	M	5	8	16	170		
25	85	59	72	12	0	7	0.06	0.0	0	8.2	22	170	M	M	6	13	26	170		
26	84	62	73	13	0	8	0.08	0.0	0	5.5	17	180	M	M	5	138	22	170		
27	79	60	70	9	0	5	0.01	0.0	0	7.2	25	140	M	M	5	3	32	170		
28	83	64	74	13	0	9	0.30	0.0	0	12.3	23	190	M	M	8	138	31	240		
29	79	61	70	9	0	5	0.21	0.0	0	7.0	16	340	M	M	5	13	24	330		
30	82	56	69	7	0	4	0.00	0.0	0	3.4	12	310	M	M	3	12	15	330		
31	78	63	71	9	0	6	0.07	0.0	0	9.2	21	150	M	M	8	1	26	150		
SM	2192	1435			246	52	2.22	0.0	219.6				M		174					
AV	70.7	46.3							7.1	FASTST	M	M	6		MAX(MPH)					

June 2016

TEMPERATURE IN F:					:PCPN:			SNOW:			WIND			:SUNSHINE:			SKY		:PK WND	
1	2	3	4	5	6A	6B	7	8	9	10	11	12	13	14	15	16	17	18		
										12Z	AVG	MX	2MIN							
DY	MAX	MIN	AVG	DEP	HDD	CDD	WTR	SNW	DPTH	SPD	SPD	DIR	MIN	PSBL	S-S	WX	SPD	DR		
1	79	61	70	8	0	5	0.93	0.0	0	5.8	14	240	M	M	6	138	21	210		
2	74	53	64	1	1	0	0.00	0.0	0	3.7	12	300	M	M	3		15	230		
3	84	51	68	5	0	3	0.00	0.0	0	6.5	16	10	M	M	4	1	22	170		
4	78	61	70	7	0	5	T	0.0	0	5.8	15	300	M	M	7		23	300		
5	79	55	67	3	0	2	0.17	0.0	0	8.0	18	300	M	M	4	13	28	290		
6	73	54	64	0	1	0	T	0.0	0	9.2	22	310	M	M	5		30	300		
7	67	51	59	-5	6	0	0.00	0.0	0	7.7	20	350	M	M	6		28	340		
8	74	45	60	-5	5	0	0.00	0.0	0	4.5	13	270	M	M	4		21	290		
9	74	55	65	0	0	0	0.27	0.0	0	8.1	14	130	M	M	7	13	17	190		
10	90	65	78	12	0	13	0.39	0.0	0	9.9	29	330	M	M	5	13	39	330		
11	88	65	77	11	0	12	0.00	0.0	0	3.7	18	70	M	M	5	1	25	80		
12	71	58	65	-1	0	0	0.00	0.0	0	8.1	22	80	M	M	6	3	28	80		
13	84	53	69	3	0	4	0.03	0.0	0	5.9	13	180	M	M	6	3	15	50		
14	85	62	74	7	0	9	1.43	0.0	0	9.2	18	90	M	M	8	13	22	100		
SM	1100	789			13	53	3.22	0.0	96.1				M		76					
AV	78.6	56.4								6.9	FASTST	M	M	5	MAX(MPH)					
								MISC	---->	#	29	330			#	39	330			

Madison-Kipp Corporation

Madison-Kipp Corporation (MKC) has two locations - one between Waubesa and Marquette Streets and one at the intersection of South Fair Oaks Ave and Gateway Place on Madison's eastside.



MKC facilities in relation to Starkweather Creek

Environmental History

Until 1989, chlorinated degreasing solvents were used at Madison-Kipp Corporation. This use resulted in contamination of soil and groundwater. In 1994, DNR issued a formal notice to Madison-Kipp that identified them as the responsible party and informed them of their responsibilities under the state spill law. Since then, DNR has provided regulatory oversight of Madison-Kipp's efforts to clean up the contamination.

Treated Site Discharge

Treatment of contaminated groundwater is performed on an ongoing basis by Madison Kipp Corporation. Treated water is discharged into Starkweather Creek which flows into Lake Monona.

PAHs that exceed the WDNR's industrial direct contact residual contaminant level include:

- Benzo_a_pyrene
- Dibenz(a,h)anthracene

Groundwater contaminants that exceed State standards include:

- Methylene Chloride
- Tetrachloroethene
- Trichloroethene
- Vinyl chloride
- cis-1,2-Dichloroethene
- Naphthalene
- Benzene
- 1,2-Dibromoethane

- 1,2-Dichloropropane
- 1,1,2-Trichloroethane
- Chloroform

Soil samples that exceed State direct contact residual contaminant level include:

- Benzo(a)pyrene
- Arsenic
- Lead

Compared to SPMD Results

The SPMD samples were analyzed for PAHs. The four PAHs that were high in concentration and may be of concern are:

- Phenanthrene
- Anthracene
- Fluoranthene
- Pyrene

Of these four PAHs, two of them are similar to what the Kipp Corporation is treating for (anthracene and pyrene), but these two are not found at the site downstream of the Kipp treatment site. The sampling location downstream of the Kipp plant was the “Confluence” site, where the only PAH found in high concentration was phenanthrene, a chemical not found in contaminants at the Kipp plant. From the SPMD sampling results, no apparent water contamination in the form of PAHs is being caused by the discharge at the Kipp plant.