UPPER POTOMAC **RIVERKEEPER®**

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Upper Potomac Riverkeeper PFAS Sampling Project
Antietam Creek

Summary

Upper Potomac Riverkeeper has investigated other areas in the Upper Potomac for the pollutant PFAS. PFAS is actually a family of over 3000 compounds that are associated with the Poly-flouro "forever chemical". The poly Florine chains have extremely strong bonds which make these chemicals water and heat resistant. PFAS is used in several products with Aqueous Film Forming Foam (AFFF) being the most prevalent and in high concentrations. AFFF is a firefighting foam that snuffs out intense jet fuel fires. AFFF was used for decades by military air bases like the Air National Guard base in Martinsburg, WV. In 2016, EPA set a drinking water guidance for PFAS at 70 parts per trillion. One of the source waters for the Martinsburg public drinking water was a spring near the Air National Guard base. The Martinsburg drinking water facility shut down to complete upgrades. The WV Department of Environmental Protection (DEP) completed a monitoring project to assess PFAS levels in the surrounding areas. The results of the DEP testing showed high levels of PFAS in two tributaries to the Opequon Creek.

The family of PFAS compounds have several properties that make it a useful ingredient in consumer products. However, those properties also lead to bioaccumulation in aquatic and terrestrial species, including humans. PFOS and PFOA are two compounds that have been found in various levels in most humans and several fish species. Research has shown that PFOS/PFOA accumulates in the fatty tissues because of its attraction to proteins, which means PFOS/PFOA levels can be extremely high in fish. UPRK reached out to the USGS Fish Health Research lab in Kearneysville, WV to see if there are any PFAS assessments of fish for the Opequon Creek. USGS responded "no", however, "there are test results for fish from the Antietam Creek."

The Antietam Creek watershed has some industrialization, but upon further research, there did not seem to be any direct sources of PFAS like the use of AFFF or chemical manufacturing. The goal of this sampling project was to test for PFAS compounds in the Antietam Creek and at two discharge points from a permitted source. The Hagerstown WWTP and the Smithsburg WWTP were chosen because of the two different sized discharges, 15 MGD on average for Hagerstown and 0.33 MGD for Smithsburg. The other goal was to develop a loading analysis based on flow and concentration of pollutants. The third sample site was to test background levels in the Antietam Creek. The location near a USGS gauge station was selected so that loading could also be assessed.

Methodology

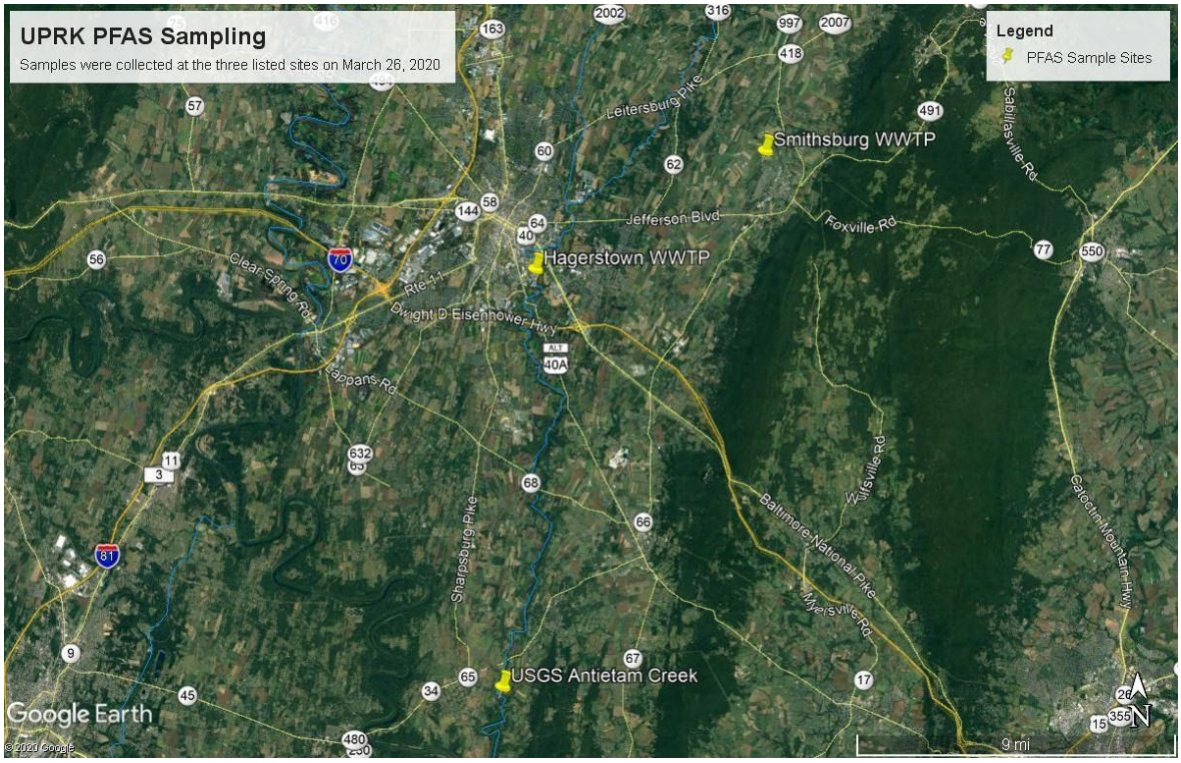
Water samples were collected on March 26, 2020. Samples and a blank were collected at each site, stored on ice, and packed in a cooler for shipping on March 26, 2020. The water samples

were analyzed by Eurofins Lancaster Laboratories Environmental in Lancaster, PA. The lab analyzed the water samples for 23 different compounds associated with PFAS.

The Hagerstown WWTP sample was collected at the discharge before mixing with the Antietam Creek. The site was accessed by kayaking upstream for 1.3 miles to the discharge point.

The Smithsburg WWTP sample was collected at the discharge pipe before mixing with Grove creek. Grove Creek is a tributary of Antietam Creek. The collection site was accessed by entering grove creek from Leitersburg Smithsburg Rd, near Stevenson rd.

The USGS Antietam Creek sample was collected at the USGS gauge station near the historic Burnside bridge in the Antietam National Battlefield. The collection site was accessed from the east side of Antietam Creek near the USGS gauge structure.



Sampling Results

The chart below highlights the PFAS compounds that were tested for in which had measurable results. The total PFAS is the level that is used to assess the potential health impacts to the public.

Analysis Name		Units		Hagerstown WWTP		Antietam Creek USGS		Smithburg WWTP

				Result		Result		Result
Perfluorobutanesulfonic acid	PFBS	ng/l	ppt	N.D.		1.3		N.D.
Perfluorobutanoic acid	PFBA	ng/l	ppt	25		N.D.		24
Perfluorodecanoic acid	PFDA	ng/l	ppt	5.4		N.D.		N.D.
Perfluoroheptanoic acid	PFHpA	ng/l	ppt	5.2		0.86		N.D.
Perfluorohexanesulfonic acid	PFHS CPD	ng/l	ppt	5.8		1.3		N.D.
Perfluorohexanoic acid	PFHXA	ng/l	ppt	21		2.5		17
Perfluorononanoic acid	PFNA	ng/l	ppt	8.4		N.D.		N.D.
Perfluorooctanesulfonamide	PFOSA	ng/l	ppt	N.D.		0.52		5.5
Perfluorooctanesulfonic acid	PFOS	ng/l	ppt	24		2.7		N.D.
Perfluorooctanoic acid	PFOA	ng/l	ppt	23		1.7		6.3
Perfluoropentanoic acid	PFPeA	ng/l	ppt	21		2.5		29
Total PFAS		ng/l	ppt	138.8		13.38		81.8

The chart below uses a calculation for the average flow of the two WWTPs and an event flow during or after a rain event. This loading analysis is an example of the impact from PFAS if the PFAS levels were consistent on a daily basis and that the average discharge of the two WWTPs and the flow of the Antietam creek at the USGS gauge station were consistent for each day of the year.

Sample site	PFAS ng/l	PFAS mg/l	MGD	lb/day	lb/yr
HagWWTP Annual Avg	138	0.000138	10	0.0115	4.20
HagWWTP Rain Event	138	0.000138	30	0.0345	12.60
SmithWWTP Annual Avg	82	0.000082	0.333	0.0002	0.08
SmithWWTP Rain Event	82	0.000082	0.6	0.0004	0.15
USGS Antietam (300 CFS)	13	0.000013	193.895	0.0210	7.67

External Data

Data from the USGS Fish Health Research Laboratory sampling project on the Antietam Creek in May and October 2018. According to USGS, "the fish were part of a fish health monitoring program for which [USGS] sampled fish in the spring, pre-spawn and sometimes in the fall. Smallmouth bass were captured by Maryland DNR personnel, euthanized, weighed, measured, a blood sample taken from the caudal vessels and a complete necropsy performed during which [USGS] preserved tissues for histopathology, immune function and gene expression."

"The plasma was analyzed by SGS AXYS Analytical Services Ltd, Sidney, BC, Canada for 13 compounds…which included PFNA, PFOSA, PFDA, PFDoA, PFOS and PFUnA. The data provided is considered provisional"

The concentration listed is in ng/ml, which is 1000 times greater than the EWG recommended PFAS level of 1 part per trillion. The results range from 220 to 574 ng/ml, which translates to 220,000 to 574,000 ppt.

Concentrations of Perfluorinated Compounds Measured in Smallmouth Bass Plasma Collected at the Antietam Creek Fish Health Collection Site

Fish No.	Sample Date	Sex	Age	T.L. (mm)	Wt (gms)	PFNA ng/ml	PFOSA ng/ml	PFDA ng/ml	PFDoA ng/ml	PFOS ng/ml	PFUnA ng/ml
MS5-101	5/5/2018	M	3	249	175	BD	BD	17.1	12.9	250	21.7
MS5-102	5/5/2018	M	6	337	524	0.519	1.10	37.3	27.4	346	54.8
MS5-103	5/5/2018	F	4	330	467	BD	0.52	19.4	9.1	373	20.3
MS5-104	5/5/2018	M	4	270	244	BD	BD	22.7	14.2	486	29.1
MS5-105	5/5/2018	M	4	304	346	0.924	0.55	28.6	17.9	499	40.7
MS5-106	5/5/2018	M	7	396	835	BD	0.94	36.0	28.4	385	54.3
MS5-107	5/5/2018	M	6	413	885	1.27	BD	26.8	18.6	538	34.0
MS5-108	5/5/2018	F	4	356	569	BD	0.66	31.2	11.5	574	26.5
MS5-109	5/5/2018	F	3	305	347	BD	0.50	24.9	11.9	498	23.5
MS5-110	5/5/2018	M	5	317	350	BD	BD	19.1	9.0	325	18.7
MS5-111	5/5/2018	F	4	336	460	BD	0.56	24.0	11.1	509	23.4
MS5-112	5/5/2018	F	3	255	195	0.721	0.80	19.2	12.1	344	22.5
MS5-113	5/5/2018	M	3	289	318	BD	0.52	20.1	11.5	398	22.6
MS5-114	5/5/2018	F	3	276	281	BD	0.59	18.9	10.6	449	21.2
MS5-115	5/5/2018	M	3	249	171	BD	BD	18.6	11.1	399	22.3
MS5-116	5/5/2018	F	3	261	233	0.535	0.68	21.1	12.5	372	24.0
MS5-117	5/5/2018	F	3	256	183	0.519	0.92	18.1	15.1	254	25.2
MS5-118	5/5/2018	M	3	277	288	0.662	0.54	21.2	12.0	427	27.6
MS5-119	5/5/2018	M	5	288	287	0.838	0.62	12.9	8.4	220	13.4
MS5-120	5/5/2018	F	4	287	323	BD	0.57	22.1	12.1	393	22.8
MS5-127	10/30/2018	F	4	345	484	BD	0.62	16.7	16.0	260	25.4
MS5-128	10/30/2018	F	7	311	356	BD	BD	16.1	10.9	255	22.7
MS5-129	10/30/2018	M	4	288	319	BD	BD	22.1	14.0	470	29.9
MS5-130	10/30/2018	M	3	288	305	BD	0.86	23.2	16.5	423	36.2
MS5-131	10/30/2018	M	4	334	534	BD	0.99	23.4	22.6	321	44.9
MS5-132	10/30/2018	F	5	332	454	BD	0.69	15.8	11.9	232	18.7
MS5-133	10/30/2018	F	4	325	468	BD	0.78	15.4	19.6	274	28.6
MS5-134	10/30/2018	F	5	322	469	BD	0.51	20.5	14.7	320	25.5
MS5-135	10/30/2018	M	4	331	482	BD	0.76	22.2	33.7	388	46.8
MS5-136	10/30/2018	F	2	248	176	0.595	0.56	13.3	10.1	361	18.1
MS5-137	10/30/2018	F	3	278	240	BD	BD	19.8	9.4	506	23.0
MS5-138	10/30/2018	M	4	327	434	BD	BD	17.8	19.2	339	30.3
MS5-139	10/30/2018	F	3	295	316	0.887	0.86	17.8	12.3	297	24.6
MS5-140	10/30/2018	M	2	261	216	BD	0.76	24.3	25.6	483	41.2

PFAS comparison with other Pollutants

The following chart is a selection of a full list of contaminates that the Environmental Working Group (EWG) has assembled to compare levels in drinking water that would cause harm to the public. The full list can be found at EWG drinking water standards. The EPA drinking water guidance in 70 ppt or 0.07 ppb.

Contaminant	Federal Limit	EWG Standard	Source of Standard	Health Effects
Aresnic	10 ppb	0.004 ppb	California Public health goal	Cancer; harm to central nervous system; harm to the brain; skin damage; change to heart and blood vessels; increase the risk of heart disease, stroke and diabetes
Atrazine	3 ppb	0.1 ppb	EWG-recommended health guideline	Harm to developing fetus; hormone disruption; harm to reproductive system; changes in the nervous system; changes in brain and behavior; cancer
Glphosate	700 ppb	5 ppb	EWG-recommended health guideline	Cancer; harm to fetal growth; harm to kidney
Heptachlor	0.4 ppb	0.008 ppb	California Public health goal	Cancer; hormone disruption; harm to brain and nervous system
Mercury (inorganic)	2 ppb	1.2 ppb	California Public health goal	Harm to brain and nervous system; harm to fetal growth and development; harm to kidneys; harm to the immune system
PFAS	Nonexistent	0.001ppb	EWG-recommended health guideline	Cancer; harm to immune system; hormone disruption; harm to fetal growth and child development; harm to liver
PCBs	0.5 ppb	0.09 ppb	California Public Health Goal	Breast Cancer; prostate cancer; harm to brain and nervous system; hormone disruption; harm to immune system
Trihalomethanes	80 ppb	0.15 ppb	EWG-recommended health guideline	Bladder cancer; skin cancer; harm to fetal growth and development

Conclusion

The smallmouth bass that was collected by MD DNR were located around the mouth of the Antietam at the confluence with the Potomac River. The range of smallmouth bass can be quite extensive, however, it has been suggested by MD DNR and the USGS Fish Health Lab, that most smallmouth bass will spend the majority of their time in the clearer tributaries. The levels of PFAS found in the background sampling of the Antietam creek or the levels in the two WWTPs may not account for all the bioaccumulation that exists in the fish that were captured

and tested. However, the levels found in the WWTP discharges are higher than the EPA guidance for drinking water and can be assumed to be a considerable source of PFAS.

In comparing the levels of PFAS in fish plasma found in the Antietam with that of other pollutants that already have a federal water quality standard, the discharge PFAS levels, fish plasma PFAS plasma levels and the background PFAS level in the Antietam should be cause for concern. At a minimum, all wastewater treatment plants should assess their contribution of PFAS levels and the State of Maryland should begin to assess the PFAS levels in other aquatic species that are considered a food source, like oysters and blue crabs. If the levels are this high in a rural area like Washington County, then what are the levels in more urban areas where commercial fishing exists?

Another concern is the use of sludge from wastewater treatment plants to be used as biosolids for commercial and residential fertilizers. PFAS is not a listed pollutant of concern in the Maryland biosolid assessment program to protect our food sources from being contaminated. Maryland should consider assessing PFAS levels in biosolids before use on farm fields or residential properties.