



**East Norwalk Blue**

PFAS (per- and poly- fluoroalkyl) substances study of the Norwalk River Watershed  
Funded by East Norwalk Blue and the Norwalk River Watershed Association  
Richard Harris and Peter Fraboni Primary Investigators



Site NR 21 on Farmingville Road in Ridgefield (the Great Swamp)

## **Introduction:**

A study of per- and polyfluoroalkyl substances (PFAS) was undertaken on water courses where artificial turf fields were being proposed in Wilton and Norwalk CT. Included in the study was the monitoring of PFAS levels found in a drainage pond discharge that serves the Wilton High School athletic fields. Also a PFAS sampling survey from other locations on the Norwalk and Silvermine Rivers was undertaken to assess the PFAS levels in the receiving waters. This is a report of the combined water quality monitoring activities by the Norwalk River Watershed Association (NRWA) and East Norwalk Blue (ENB) of Norwalk. The data presented here will eventually be incorporated into a more formal report once the research is completed on the potential turf sites within the Norwalk River and Silvermine River watersheds. NRWA is a partner with ENB in this endeavor and has shared expenses as well as initiating public seminars on the dangers of PFAS compounds.

The report contains a summary showing baseline surface water data on two proposed artificial turf sites, the Broad River site for three new fields in Norwalk (Figure 1, Figure 1A) and the Allen Meadow location for a single field in Wilton (Figure 2, Figure 2A). Several PFAS products (in parts per trillion (ng/L or ppt) are clearly present at both locations. Perfluorooctanoic sulfonate (PFOS) and perfluorooctanoic acid (PFOA), which are the most toxic PFAS products as recently designated by EPA, were detected at both sites (Figure 1, Table 1, Figure 2, Table 2). A third site analyzed for PFAS compounds is a drainage pond serving several playing fields to the immediate south of Wilton High School (Figure 3, Table 3A). One of the fields in proximity to the pond is an older artificial turf installation. Although identified PFAS compounds could come from a variety of sources, the PFAS compounds observed in the pond's discharge are what could be expected in stormwater runoff from artificial turf (attached Peaslee memo). Since all three locations ultimately discharge to the Norwalk River, both the Norwalk River and Silvermine River (a tributary) were analyzed for PFAS compounds (Figure 4, Figure 5). Results show PFAS compounds in both waterways with elevated concentrations in the Norwalk area (Figure 4, Figure 5A). All sample processing was done by York Environmental Laboratories in Stratford, CT as approved by the CT Department of Public Health (CT DPH). PFAS testing is complicated and very expensive which limited research.

## **Results:**

The data summary charts for the Norwalk turf fields (Figure 1, Table 1) and the Wilton turf field (Figure 2, Table 2) are arranged as follows: The first four columns contain the surface water site data in ng/L from the sampling locations as noted on the enclosed site drawings of the Broad River and Allen Meadows fields (Figures 1, Figure 2). The fifth column contains recently reduced drinking water standards employed by the CT Department of Public Health in response to new national regulations being formulated by the EPA for drinking water (Table 1, Table 2). The revised CT standards were issued by CT DPH (6/22) after the EPA posted a warning about greatly reduced safety levels for PFOS and PFOA as shown in column 6. As a result, each state has been left to its own interpretation as to how to regulate these "forever chemicals." We have since learned that Vermont, Maine and Michigan are working to eliminate turf fields and an array of other products containing PFAS compounds. Column 7 is a recent EPA assessment of human safety levels for PFOS and PFOA at 0.02 ppt and 0.004 ppt respectively. Column 8 is a listing of PFAS research listing PFAS compounds to be found in artificial turf (Table 1, Table 2) in an e-mail dated 11/23/22 (copy attached) by Dr. Graham Peaslee, a Ph.D. in Physics at the University of Notre Dame. Dr. Peaslee is a recognized expert on the hazards of PFAS chemicals found in artificial turf and based on his extensive research, we reached out to him regarding the proposed fields in Norwalk and Wilton. He approved of our running PFAS base lines in surface waters in proximity to these

sites and felt this might help identify and isolate other PFAS products in stormwater runoff from artificial turf. He suggests that a firehouse station located on the south side of the Broad River property (Figure 1A) of the proposed Broad River site may have been the source of the observed PFAS contamination from firefighters practicing with AAAF foam.

In late April, the EPA finally announced greatly reduced regulations for PFOS and PFOA in drinking water at 4 ng/L and is presently evaluating four more compounds for similar reduced safety levels. The new regulations for PFOS and PFOA are scheduled to go into effect September 2024, and then states have 9 months to comply with the regulations. Connecticut has removed AAAF foam from fire stations, airports and railroad yards. Connecticut Department of Public Health (CT DPH) has *yet to issue revised criteria for testing surface waters pending EPA guidance*. Revised quality assurance plans and testing criteria have not been officially issued by CT DPH. Our surface water test results routinely exceed the EPA 4 ng/L for PFOS and PFOA in drinking water concentration standard (proposed EPA mandate effective September 2024) at the Broad River site (Figure 1, Table 1).

### **Broad River Site, Norwalk (Figure 1, Table 1, Figure 1A):**

- 1) Three artificial fields are being proposed for the Broad River Site. The Kellogg Deering wells for the drinking water of the city of Norwalk are just a few hundred yards to the north (Figure 1, Figure 1A). The First Taxing District water company is having trouble meeting the original EPA mandated safety levels of 70 ng/L or less for PFAS and PFOA. Several of these wells were taken offline from time to time during 2022 because they had failed to meet the EPA mandated limits for these compounds. The wells have already been subject to a Superfund site designation and cleanup (1984) due to volatile organic compounds (VOCs) migrating from the site into the groundwater. This was due to careless disposal of solvents and plating chemicals from Zell Manufacturing and Elinco/Pitney Bowes/Matheis Court Complex. The well water was ultimately cleaned up with an air stripper. *The VOCs migrated to the wells from the manufacturing sites located over ½ mile away on the east side of Main Avenue*. The question remains, why add another documented source of PFAS compounds in stormwater runoff from turf fields in an area where ground water has already been shown to carry a variety of pollutants over long distances?
- 2) A firehouse station located on the south side of this property is suspected of using AAAF foam (a product of PFAS) in outdoor on-site practice drills which may have contributed to the elevated PFAS compound levels observed in surface water samples.
- 3) The proposed artificial turf sites are too near the Norwalk River and could have the potential of adding more PFAS pollution to the river via stormwater runoff (Figure 1, Figure 1A, and Table 1).
- 4) A stream is presently piped away under the proposed fields from the north and discharges to a large catch basin on the north side of Silvermine Avenue. Stormwater runoff from the artificial fields will most likely discharge to this same catch basin and the combined waters then flow east to be discharged to a marsh and then directly to the Norwalk River (Figure 1, Figure 1A, Table 1).



Figure 1. Map of the showing the drainage off the eastern edge of the proposed ball fields, piped stream with the Silvermine Avenue catch basin and the discharge to the small lagoon connecting with Norwalk River.

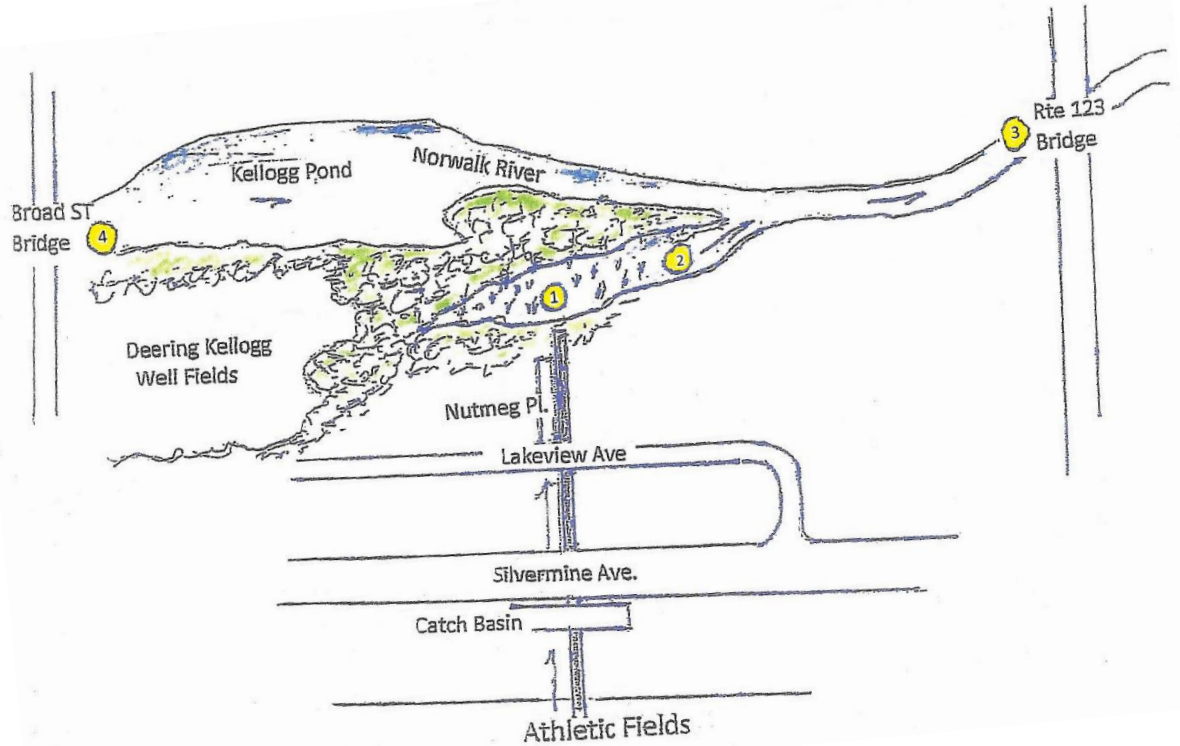


Table 1. PFAS data at the four sites at the proposed artificial turf sites in Figure 1. Revised drinking water regulations from the CT Department of Public Health (CT DPH), EPA posted safe levels for PFOS and PFOA, and PFAS products contained in storm-water runoff from artificial turf

Silvermine		Pipe Discharge Site 1 Time: 1050	Site 2 Time: 1108	CT Route 123 Bridge Site 3 Time: 1140	Board Street Site 4 Time: 1220	CT Revised DW Regs.	EPA Safe Levels alert 6/22*	PFAS Comp. in syn turf G. Peaslee
Broad River Fields	Component	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	
11/15/2022	PFBS	5.51	5.35	0.00	0.00			
	PFHxA (C6)	5.05	3.17	6.75	0.00			√
	PFHpA (C7)	2.38	2.66	2.69	3.00			√
	PFHxS	3.58	2.98	0.00	0.00	49.00		
	PFOA (C8)	8.25	9.62	5.10	6.20	16.00	0.004	√
	PFOS	7.69	43.50	4.46	4.08	10.00	0.020	
	PFPeA	4.81	5.19	8.65	7.42			
	PFBA (C4)	0.00	4.10	4.99	5.08			√
	PEPeA (C5)							√
	PFNA					12.00		

\*New EPA regulations effective September 2024 for PFOS and PFOA at 4 ng/L with an additional 9 months to implement



Figure 1A. Aerial photo showing locations of 3 proposed artificial turf fields, the location of the Kellogg Deering well fields, the location of a drainage pipeline crossing the site and the Norwalk River.





### **Allen Meadows, Wilton (Figure 2, Table 2, Figure 2A):**

- 1) The proposed athletic field was scheduled to be built over an existing aquifer. This proposed site is located on state land and Wilton has obtained permission to construct the field with an inflatable cover for inclement weather at an estimated cost of \$2,000,000.
- 2) Extensive community vegetable gardens are located just to the north of the proposed field. The proximity of artificial turf could add PFAS polluted runoff to the soil which has yet to be tested for PFAS compounds (Figure 2, Figure 2A, and Table 2).
- 3) Goetzen Brook skirts the perimeter of this property and enters the Norwalk River where runoff from the field to the brook would have direct access to the waterway (Figure 2 and Figure 2A).
- 4) Aquarion, Inc. has reserve drinking water well fields just to the east of Route 7 which could become polluted from PFAS compounds in surface water runoff. This potential pollution issue needs to be scientifically evaluated and remediated as necessary as reserve water supplies may be needed to meet future water demands (Figure 2).

The proposed turf field was voted down in a town referendum on 5/4/2023, due to excessive costs and environmental concerns about PFAS compounds discovered in surrounding surface waters by ENB.

### **Drainage Pond from Existing Wilton Athletic Fields (Figure 3, Figure 3A):**

A third area of research is a drainage pond that captures the storm water runoff from a large area of playing fields just south of Wilton High School. An artificial turf field of unknown vintage is included in the area in proximity to this pond (Figure 3, Figure 3A). A sampling of the pond discharge showed elevated levels of PFOA and PFOS (Table 3). Since the drainage comes from a wider area, the PFAS compounds observed in the pond discharge may be augmented from additional sources other than artificial turf. It is noted, however, that four of the identified compounds are those found in runoff from artificial turf (E-mail communication from Dr. Peaslee), *i.e.*, PFHxA, PFHpA, PFOA and PFPeA (Table 3). ENB was unable to locate other possible testing sites closer to the existing artificial turf. Further investigation is required for this area.

### **The Norwalk River (Figure 4, Table 4A):**

Based on elevated levels of PFAS compounds found in the Norwalk River near the two playing field sites, it was decided to perform rudimentary testing along the length of the Norwalk River from Ridgefield down to the Wall Street Bridge at the headwaters of Norwalk Harbor, 23 miles (Figure 4, Table 4). The PFAS testing started at Farmingville Road in Ridgefield and moved downstream with tests completed at five major river crossings (Figure 4 and Table 4). PFAS compounds were observed at all monitoring sites with the highest levels recorded in the Norwalk area (Figure 4 and Table 4). This limited survey is a first pass only and future research should be more comprehensive, related to variable weather conditions and concentrated on locations along the river that may produce PFAS contamination from anthropogenic activities. Nevertheless, the observed PFAS concentration levels should be of concern to the CT DPH and the local health departments and may be a hint as to what other nearby watersheds of the Saugatuck and Five Mile Rivers may contain. PFAS compounds found in the Wilton High School drainage pond discharge (Table 3) are also found throughout the length of the Norwalk River with highest concentrations observed downstream at the Broad St. and CT Route 123 bridge testing locations in Norwalk.

Figure 2. Map the proposed location of artificial turf field at Allen Fields in Wilton, CT. A small stream skirts half of the ball field on the east and south sides of the property and extensive community gardens.

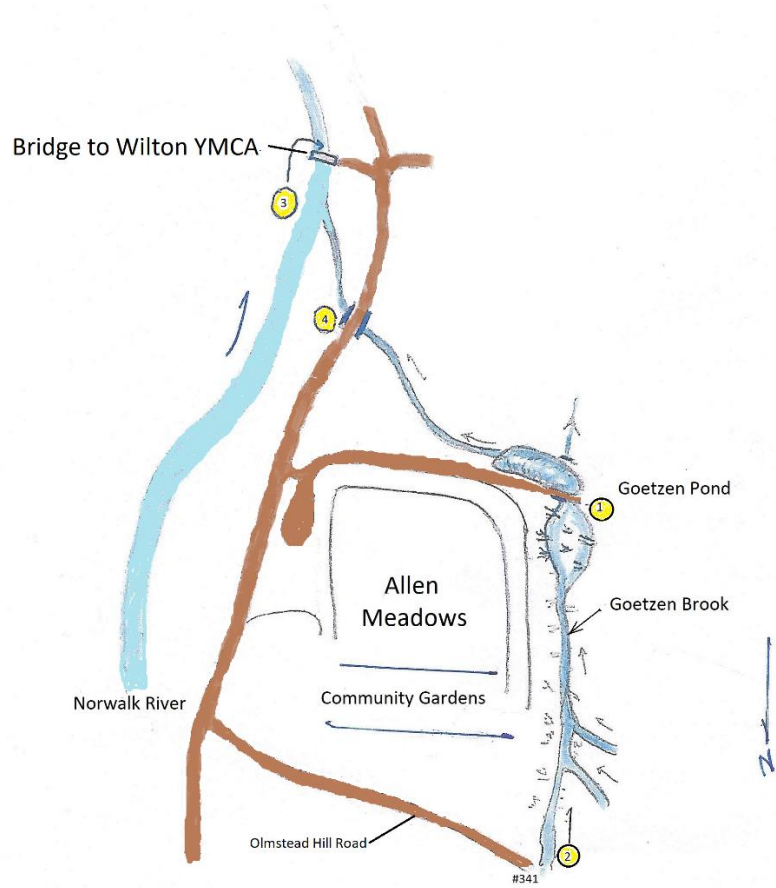


Table 2. PFAS data collected from four sites (Sites 1-4, Figure 2) around Allen Meadows where artificial turf installation is planned. Revised CT DPH regulations, EPA safe levels for PFOS and PFOA, and PFAS products from artificial turf found in stormwater runoff.

		Goetzen Brook bridge Site 1 Time: 1005	Olmstead Hill Road Site 2 Time: 1013	Norwalk River Site 3 Time: 1045	Route 7 Site 4 Time: 1210	CT Revised DW Regs.	EPA Safe Levels alert 6/22*	PFAS Comp. in syn turf G. Peaslic
		ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	
Wilton -Allen Meadow	PFBS							
12/22/2022	PFHxA (C6)	1.70		2.78				√
	PFHpA (C7)							√
	PFHxS	0.00	1.23			49.00		
	PFOA (C8)	1.99	2.25	2.47	2.46	16.00	0.004	√
	PFOS	1.43	1.23		2.89	10.00	0.020	
	PFPeA	2.08	2.66	4.42				
	PFBA (C4)							√
	PEPeA (C5)							√
	PFNA						12.00	

\*New EPA regulations effective September 2024 for PFOS and PFOA at 4 ng/L with an additional 9 months to implement

Figure 2A. Aerial photo of Allen Meadows showing proposed location of an artificial turf field with removal cover for inclement weather

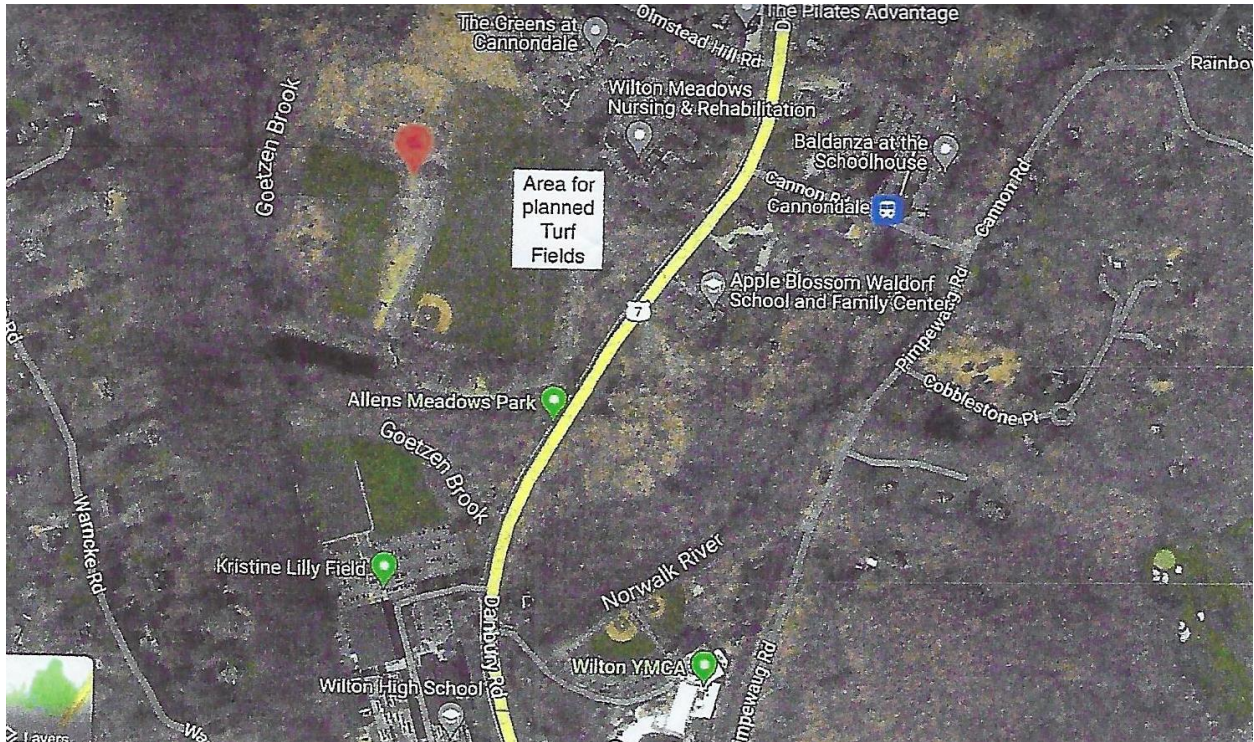




Figure 3. Map showing the drainage pond at the southern end of the Wilton athletic fields which contain one older artificial turf field just to the northwest of the pond.

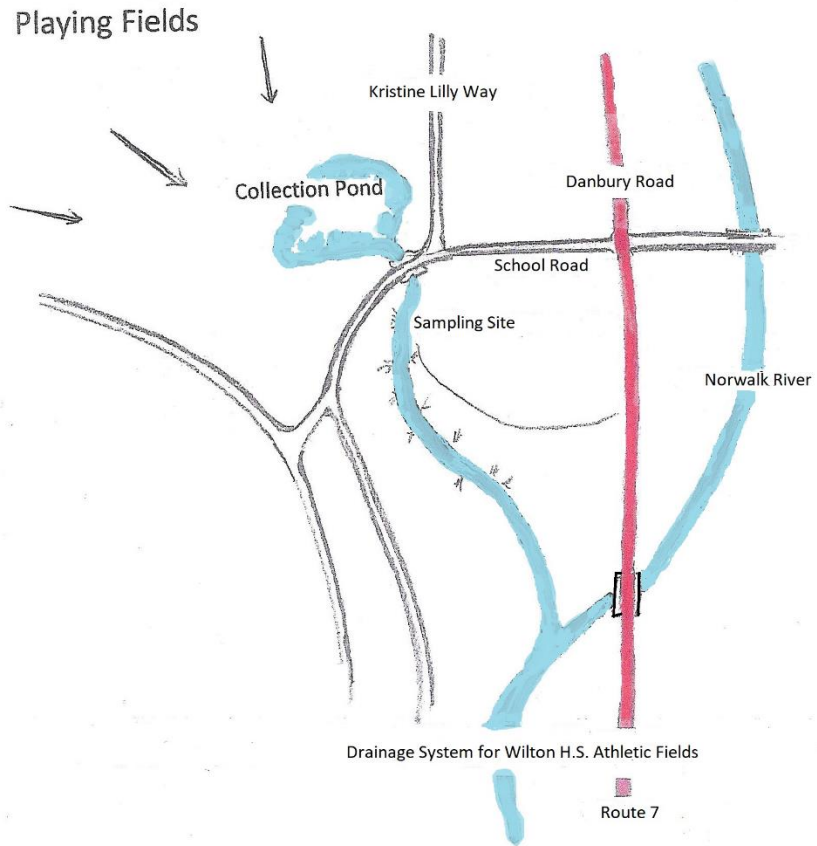


Table 3. PFAS components detected in the drainage of the collection pond near Wilton High School athletic artificial playing fields

2/2/2023 Time:1455	Concentration of PFAS Components	PFAS Components in artificial turf*
Component	ng/L	
PFHxA	2.23	√
PFHpA	2.15	√
PFHxS	1.59	
PFOA	4.22	√
PFOS	5.57	
PFPeA	2.28	√

\*Probable PFAS components that can infiltrate into stormwater runoff of artificial fields-Dr. Graham Peaslee

Figure 3A. Aerial photo of the drainage pond at Wilton High School showing spatial relation to artificial turf playing fields.

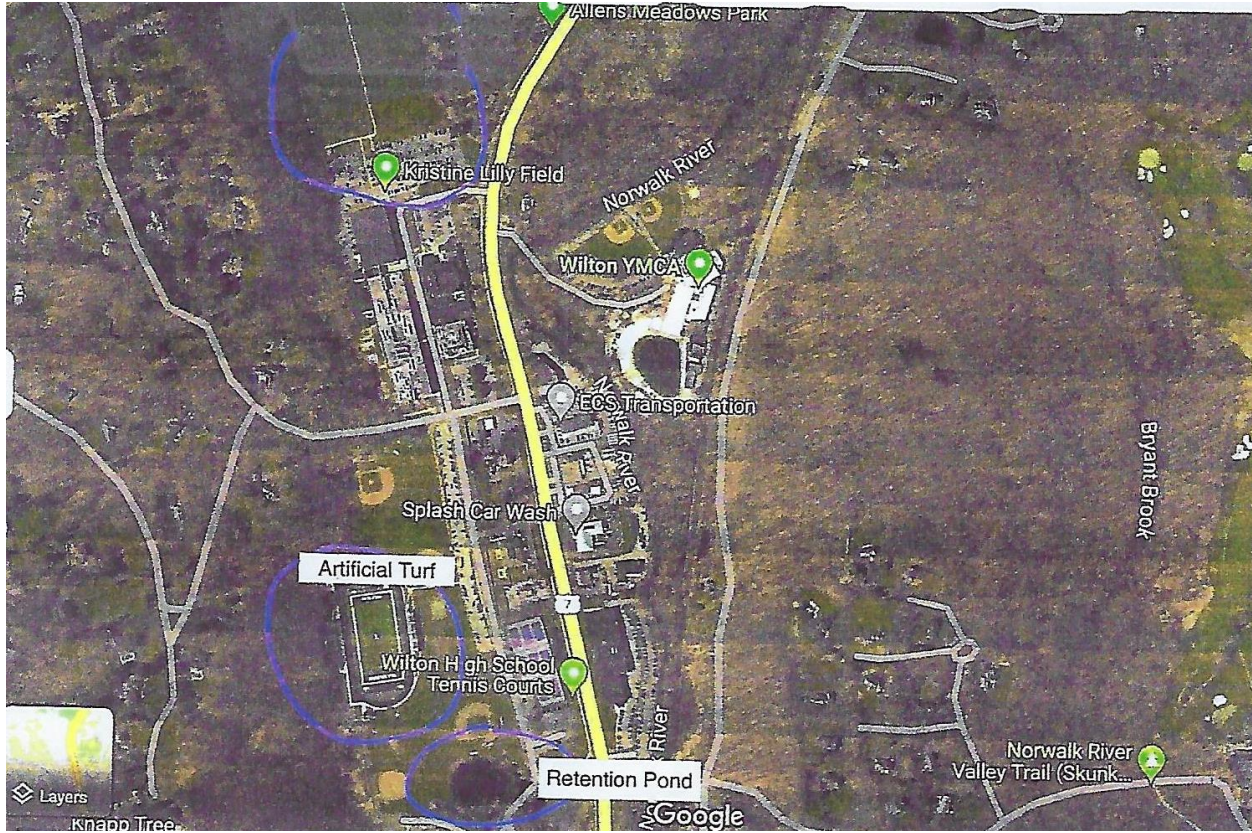


Figure 4. PFAS components (ng/L) and concentrations (six components) found in the Norwalk River test sites (Table 4) from Farmingville Road (Ridgefield) south to the Wall Street bridge at the head of the Norwalk Harbor, a distance of approximately 23 miles

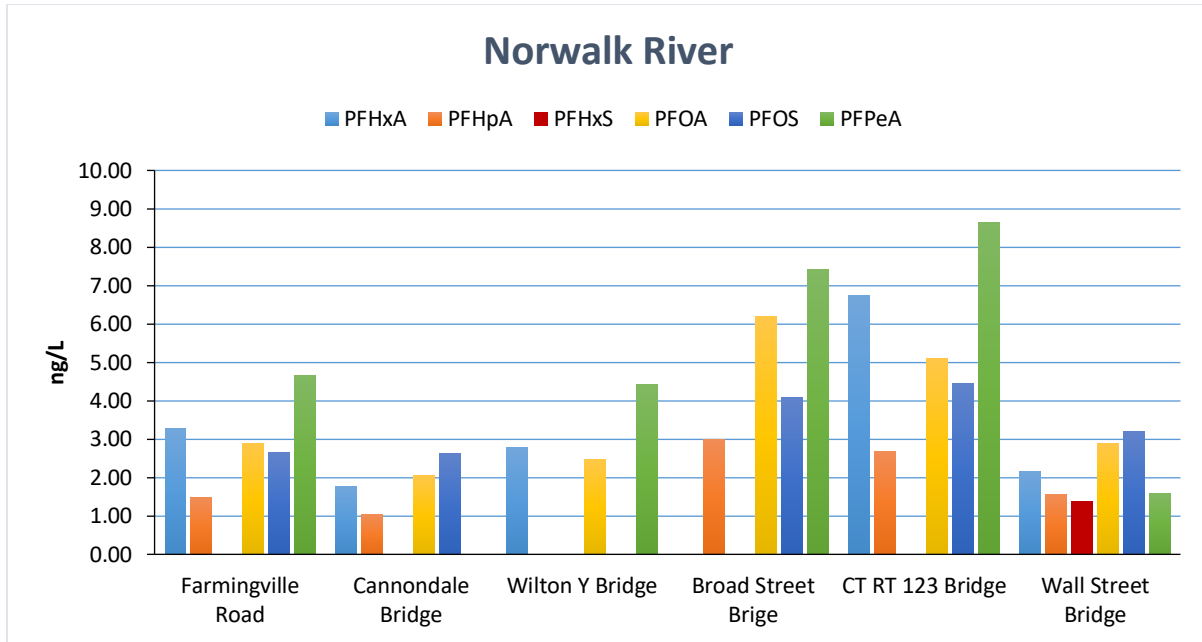


Table4. PFAS components and their concentration found at six test sites in the Norwalk River from Ridgefield to Norwalk and CT DPH Drinking Water (DW) regulations, EPA safe levels for PFOS and PFOA

	Farmingville Road 1/21/23 Time: 1032	Cannondale Bridge 1/21/23 Time: 1220	Wilton Y Bridge 12/22/22 Time: 1045	Broad Street Bridge 11/15/22 Time: 1220	CT RT 123 Bridge 11/15/22 Time: 1140	Wall Street Bridge 1/21/23 Time:1315	CT DPH Revised DW Regs.	EPA Safe Levels alert 6/22*
Component	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L
PFHxA	3.27	1.77	2.78	0.00	6.57	2.17		
PFHpA	1.47	1.05	0.00	3.00	2.69	1.57		
PFHxS	ND	ND	0.00	0.00	0.00	1.37	49.00	
PFOA	2.88	2.06	2.47	6.20	5.10	2.89	16.00	0.004
PFOS	2.66	2.64	0.00	4.08	4.46	3.20	10.00	0.020
PFPeA	4.66	ND	4.42	7.42	8.65	1.59		



### **The Silvermine River (Figure 5, Table 5A):**

Preliminary testing was done on the Silvermine River (January 31, 2023) which is a tributary to the Norwalk River. Concentrations of the same five PFAS compounds were lower and in one instance, the discharge from the Grupes reservoir was found to be free of any PFAS products. The John Milne Reservoir to the north does show some level of pollution from PFAS compounds (Figure 5 and Table 5).

### **Conclusions:**

Our testing for PFAS products at these sites is the first of its kind in this area to our knowledge and shows areas of concern for public health. Although PFAS measurements have been in parts per trillion it should be remembered that PFAS chemicals have the unique ability to remain in the human body for up to eight years and are cumulative in human tissue. Even though PFOS and PFOA were discontinued over 10 years ago, the two “forever chemical” products were prominently represented in most of our test results. EPA has just mandated safety limits for drinking water for both products at 0.02 ng/L and 0.004 ng/L respectively. The placement of additional artificial turf fields along the Norwalk River may only add to PFAS pollution problems, and ultimately pose a threat to freshwater fish in these waterways and marine life in the waters of Long Island Sound.

### **Voters Defeat the Wilton Artificial Turf Field Proposal:**

Our partnership with The Norwalk River Watershed Association has been very beneficial in bringing the knowledge of PFAS “forever chemicals” to attention of the public. The recent defeat of the proposed Wilton turf field by a public vote on 5/5/2023 can be related to three factors.

- 1) PFAS testing by East Norwalk Blue and subsequent distribution of positive testing results to Wilton’s town management and citizens by NRWA. This caused the Town management to hire Thunderbird Environmental for a second series of tests. Their monitoring results at the Allen Meadows site were the same as those provided by York Environmental Labs to East Norwalk Blue!
- 2) Louise Washer arranged for a presentation by two experts on artificial turf who advised the audience of 70 people that there is no safe field comprised of artificial turf and that it would be a bad idea to place a known source of PFAS compounds adjacent to community garden plots. Numerous other problems from public health issues to disposable issues of worn-out fields (8-year lifetime) were presented based on recent history and research. The Wilton town management team attended this presentation.
- 3) The town held a vote on the proposal for an artificial turf playing field complete with a cover for use in inclement weather for a total cost of \$2,000,000 after telling voters that \$1,250,000 would be sacrificed from the public-school budget and six mills would be added to real estate taxes to meet these expenses.

### **Forward Planning:**

- 1) Expand the present monitoring program to include the Saugatuck and Five Mile River watersheds and undertake more comprehensive monitoring of the Norwalk and Silvermine Rivers. The goal will be to demonstrate that a large area of these four watersheds which ultimately contribute to the health of Long Island Sound may have point sources of PFAS pollution that should be remediated or alternatively eliminated from future planning as more dangers and problems of PFAS products (forever chemicals) are being discovered as carcinogens daily.

Figure 5. PFAS components (ng/L) and concentrations (six components) found at four sites (Table 5) in the Silvermine River (1/31/2023) from the John Milne Reservoir south to the river’s confluence with the Norwalk River. Four sites include two reservoirs and two river crossings, a distance of approximately 13 miles. The Grupes Reservoir discharge contained no measurable PFAS components.

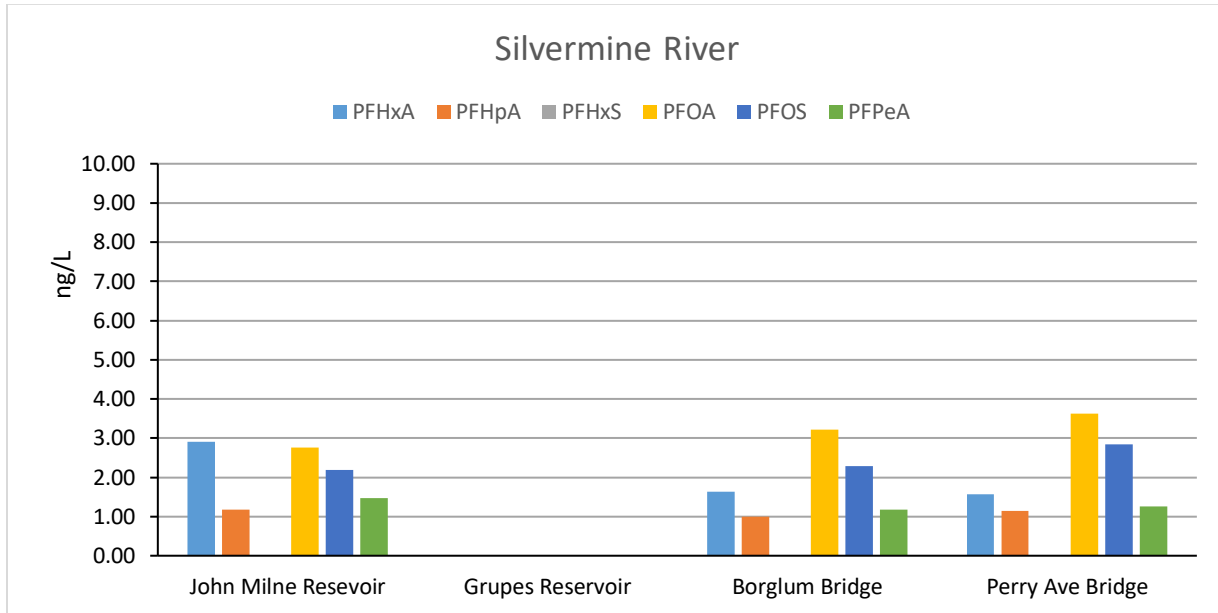


Table 5. PFAS components (ng/L) found at four test sites in the Silvermine River from the John Milne Reservoir to the Perry Avenue Bridge, and CT DPH Drinking Water (DW) regulations, and EPA safe levels for PFOS and PFOA in drinking water

	John Milne Reservoir Time: 1107	Grupes Reservoir Time: 1118	Borglum Road Bridge Time: 1135	Perry Ave Bridge Time: 1150	CT DPH Revised DW Regs.	EPA Safe Levels alert 6/22*
1/31/2023	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L
Component	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L
PFHxA	2.91	0.00	1.63	1.57		
PFHpA	1.18	0.00	0.989	1.14		
PFHxS	0.00	0.00	0.00	0.00	49.00	
PFOA	2.76	0.00	3.21	3.62	16.00	0.004
PFOS	2.18	0.00	2.29	2.84	10.00	0.020
PFPeA	1.47	0.00	1.18	1.26		

2) Obtain funding to continue this research in these closely related watersheds which, to our knowledge, has not been done by CT DPH or any other group.

3) Continue valuable public education seminars by NRWA to alert and inform the public to the cumulative dangers of PFAS products on watersheds and human health.

We would hope that any school or agency considering artificial turf would thoroughly consider and evaluate the surroundings as well as the potential health issues of these products before deciding to go this route.

Sincerely,

Richard Harris

Marine Scientist for East Norwalk Blue, a 501(c)(3) non-profit.  
3 Edgewater Place, Norwalk, CT 06855  
203 246-6696



## Acknowledgements:

This report would not have been possible without the help of Louise Washer, Director of the Norwalk River Watershed Association (NWRA). Not only did Louise bring the whole issue about the environmental problems and threats to human health that artificial turf fields bring with their installation to my attention, but she also identified where new locations in Norwalk and Wilton for their installation were being considered. It was because of her urging that East Norwalk Blue decided to evaluate areas around proposed artificial turf installation sites for PFAS components that could infiltrate into nearby watercourses in the Norwalk River Watershed. Louise also had NWRA provide funding to share the expense of these very expensive PFAS tests.

It is also important to acknowledge Louise and NWRA for providing an education opportunity for the public to the dangers of artificial turf. NWRA held a very important webinar (via Zoom March 2023) where experts (Dr. Kyla Bennett and Dr. Sarah Evans), who were familiar with the environmental dangers and human health concerns posed by artificial turf, shared their knowledge and experiences with the audience. Over seventy participants attended their presentations including many community leaders associated with the installation of these fields.

Peter Fraboni, who recently retired from Harbor Watch, donated many long hours of field work which helped to produce the PFAS baseline. Without his daily presence and advice on the many aspects of PFAS testing, the research would have moved at a much slower pace. He was a valuable partner throughout this whole project.

Finally, our thanks go to Dr. Graham Peaslee Ph.D., a professor of Physics at the University of Notre Dame. Dr. Peaslee is a recognized and renowned researcher in the field of PFAS contamination especially those components that shed off artificial turfs. His guidance and advice on our testing program for PFAS components was greatly appreciated.



Richard Harris <rbharris39@gmail.com>

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## Installation of artificial turf playing fields, Norwalk, CT

6 messages

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Richard Harris <rbharris39@gmail.com>

Tue, Nov 22, 2022 at 2:12 PM

To: gpeaslee@nd.edu, Louise Washer <lbwasher@gmail.com>

Hi Dr Peaslee,

My name is Richard Harris and I work for Copps Island Oysters here in Norwalk. Just in the past few weeks the City has announced the installation of three new athletic fields to be installed by Field Turf. They will be located close to the Norwalk River and one small drainage brook is piped directly under the proposed fields. The Deering Kellogg city well fields are on the west side of the Norwalk River and are about 500' upstream from the discharge of the small creek. Three wells have already been taken out of service because of possible PFOS contamination. Obviously we are concerned about adding an additional source of PFAS compounds to this sensitive area and to that end we have taken water samples to help establish a PFAS base line for the area. We need to know what PFAS compounds to ask our laboratory to look for in the samples. Since you already have the experience with PFAS in athletic fields we hope you can advise us as to what chemicals in the PFAS field we should be looking for in background water samples. Thank you!

Sincerely, Richard Harris

Marine Scientist For East Norwalk Blue an affiliate of Copps Island Oysters Inc.  
7 Edgewater Place, Norwalk, Ct 06855.  
203 246 6696

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Graham Peaslee <gpeaslee@nd.edu>

Wed, Nov 23, 2022 at 1:30 PM

To: Richard Harris <rbharris39@gmail.com>

Cc: Louise Washer <lbwasher@gmail.com>

Hi Richard,

Sorry for the slow response, I am in London at the moment on a different time zone. The types of PFAS you are most likely to see with a commercial analysis of run-off water from a turfgrass field are a category of PFAS called carboxylic acids ( PFCA's ). The specific names that these would be called under EPA Method 537.1 or Method 533 (both drinking water methods) include PFOA (C8), PFHpA (C7), PFHxA (C6), PFPeA (C5) and PFBA (C4). The number in parentheses I added is the carbon chain length for these acids...PFOA is the most notorious of these, but usually lower in abundance than the slightly shorter ones these days. The concentrations are not typically high....in the few ng/L range for most of these...though there can be exceptions. If you get a report back they are often hard to read and I would be happy to glance at it if you like.

Good job getting a baseline reading...there may be sulfonates or other types of PFAS present which would be good to rule out later on.

There are several other communities trying to do the same thing...if you would like to touch base with some of them let me know.

GRAHAM

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Richard Harris <rbharris39@gmail.com>

Wed, Nov 23, 2022 at 1:38 PM

To: Graham Peaslee <gpeaslee@nd.edu>

Hi Graham,

Thanks for getting back to me and your information is very helpful as we grapple with the unknown. If you have a few contacts in other areas involved with the same issue I would like to talk to them. Meanwhile you certainly added a degree of understanding to what we are trying to do  
Many Thanks, Dick Harris.

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