East Norwalk Blue

PFAS (per- and poly- fluoroakyl) substances study of the Saugatuck River
Funded by the Westport Shellfish Commission

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Bill Wright prepares to lower a Cyclopure cup off of the Silver Hill road bridge in Easton to collect water for PFAS analysis

Saugatuck River, Analysis for PFAS Compounds in Surface Waters by East Norwalk Blue (ENB) Using Cyclopure PFAS detection kits.

Abstract: A survey for pre-and poly-fluoroalkyl substances (PFAS) was conducted in the Saugatuck watershed (West Branch, the Main Branch and the Aspetuck River) by East Norwalk Blue (ENB). Levels of PFAS products in all three branches (Figure 1, Figure 2) were generally observed in low concentrations. The only PFAS products recovered in all three branches on a consistent basis were trace amounts of PFOS (Perfluorooctane sulfonate) and PFOA (Perfluorooctanoic acid) at levels that are below recent EPA drinking water proposals of 4 ppt for both products under the National Primary Drinking Water Regulation (NPDWR). The EPA proposals (3/14/23) for PFOS and PFOA are scheduled to be implemented during September 2024 with a nine-month grace period for water companies to comply with the new regulations. The mission for ENB is to identify potential sources of PFAS infiltration in the Saugatuck watershed and to provide information for possible remediation efforts. The three large reservoirs located in the Saugatuck Watershed are of great importance to the freshwater supply for the surrounding towns (Figure 3).

Introduction: Amid rising national and state concerns about the presence of “forever chemicals” in the environment, the Sierra Club initiated a statewide program to help expand random screening of PFAS compounds in the untested rivers and estuaries of the eastern and western portions of the state. The goal is to help define the scope and range of possible PFAS pollution in Connecticut’s waterways. Due to time and funding constraints the Connecticut Department of Energy and Environmental Protection (CT DEEP) have been unable to fully survey these areas for PFAS pollution. To this end, the Sierra Club distributed a limited number of Cyclopure PFAS testing kits to various environmental organizations to help sample waterways for PFAS compounds in the eastern and western portions of Connecticut.

East Norwalk Blue (ENB), a non-profit 501(c)(3) organization, decided to test the waters of the Saugatuck River watershed based on concerns expressed by the Westport Shellfish Commission. The Saugatuck River watershed discharges to Long Island Sound where the Commission has jurisdiction over Westport’s local shellfish beds. In addition, the watershed is home to three major reservoirs for drinking water. The Saugatuck reservoir is located on the Saugatuck Main Branch and the Aspetuck and Hemlock reservoirs are served by the Aspetuck River (Figure 2, Figure 3). The Aquarion Water Company draws water from all three to supply drinking water to surrounding towns in southwestern Fairfield County. In short, while the Saugatuck River watershed lacks the known sources for producing PFAS along its banks such as landfills, fire departments, wastewater discharges and industrial sites, ENB believed that a preliminary screening of the freshwater system could expose random PFAS hot spots in the watershed.

The watershed land area includes 89 square miles (Figure 1) and covers most of Westport, Weston and Redding townships (Figure 1) with smaller portions located in Norwalk, Wilton and Ridgefield on the west side. The east side of the watershed is flanked by portions of Easton and Fairfield with portions of Bethel to the north. A total of 33 sites were tested which covered 12 sites on the Main Branch, 7 sites on the West Branch,13 sites on the Aspetuck River and a single site on Poplar Plains Brook (Figure 2). All sampling sites were selected based on stations previously chosen by Harbor Watch at Earthplace for their testing for indicator bacteria levels.

Methods and Procedure: This EMB survey employed Cyclopure PFAS test kits to screen the freshwater portion of the watershed starting at the Lees Pond dam and heading north. The use of these kits in water sampling and ENB’s standard operating procedures (SOPs) are discussed in” *Standard Operating Procedures (SOPs) for Sampling Surface Waters for PFAS (per- and poly-fluoroalkyls) compounds found in the Saugatuck and Norwalk River Watersheds, of Fairfield County”* (Appendix1*)*. The scope of the research was limited to the freshwater portion of the Saugatuck watershed and does not include the estuary.

Figure 1. An overview of the Saugatuck River Watershed covering 89 square miles.

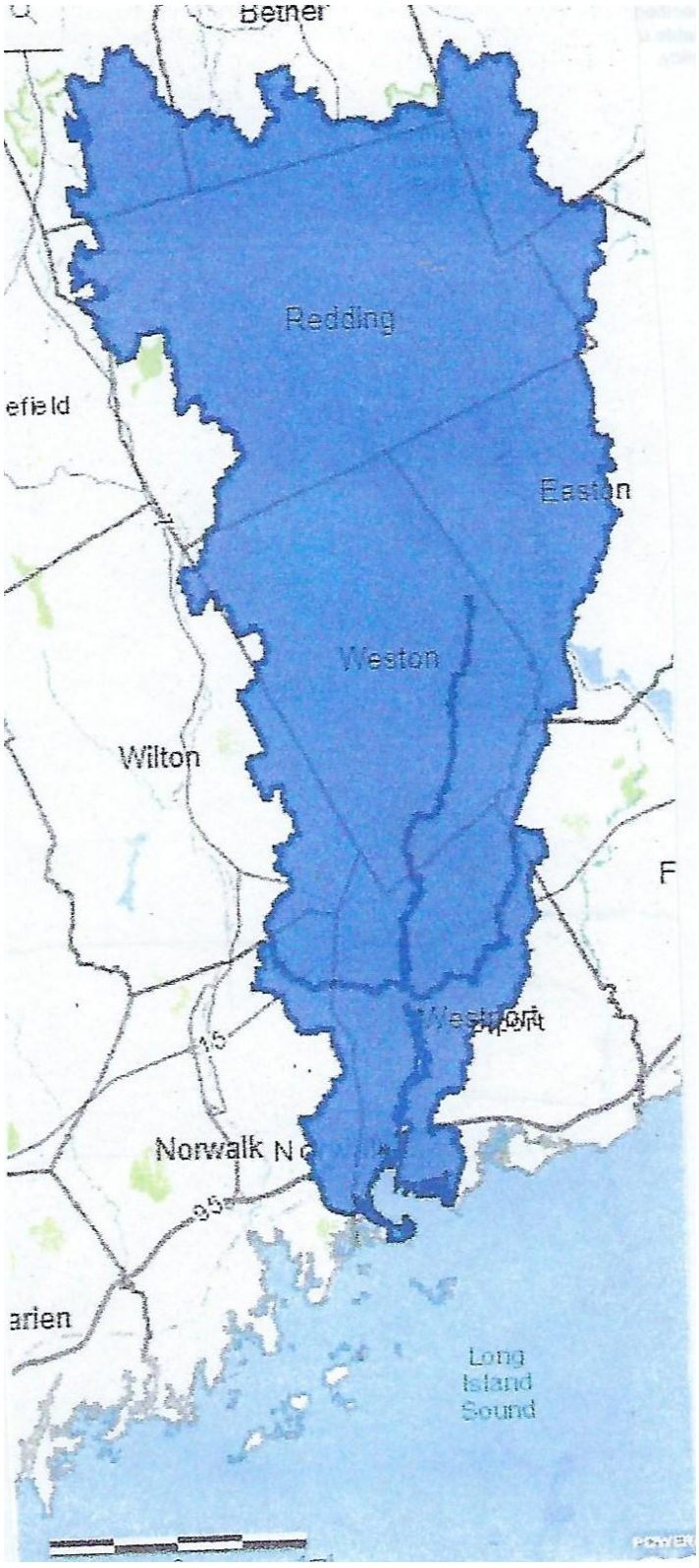


Figure 2. Map showing sample site locations that were used for PFAS sampling on the Aspetuck River, Saugatuck Main Branch River, Saugatuck West Branch River and Popular Plains Brook (red dot).

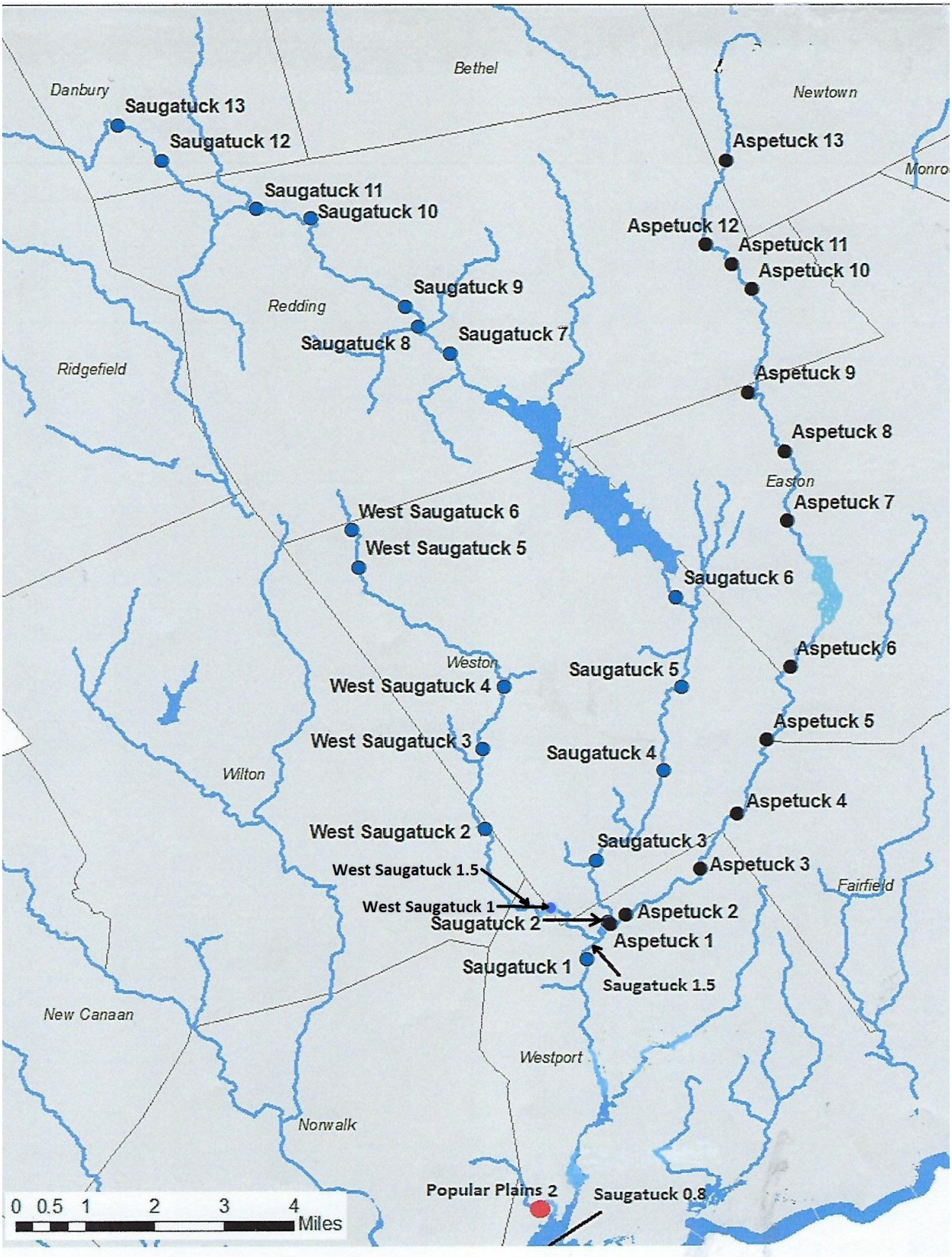
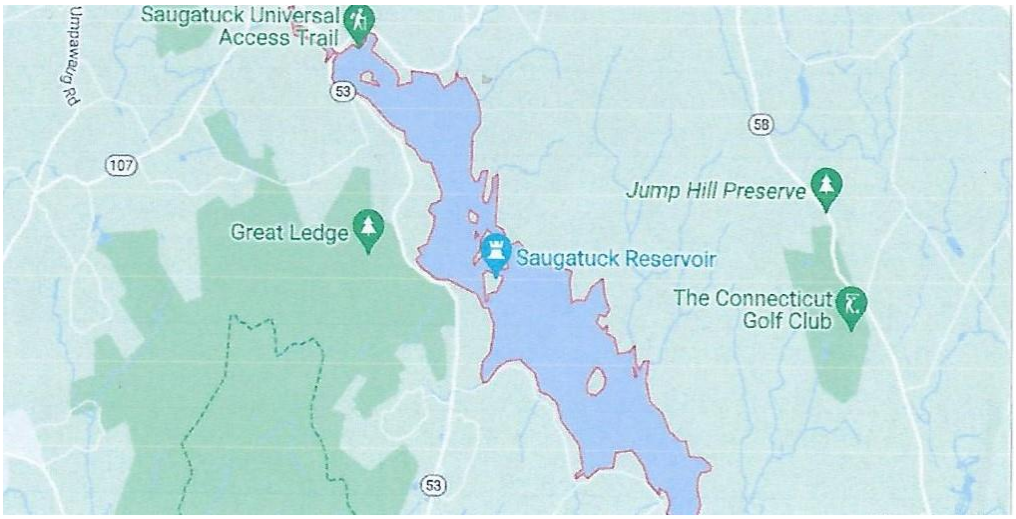
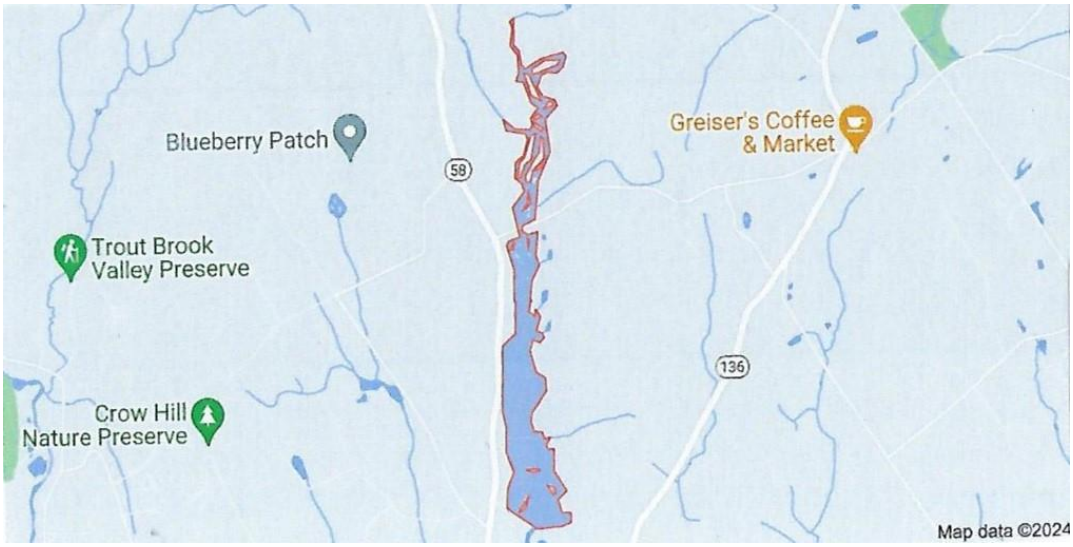


Figure 3. Maps of the Saugatuck reservoir on the Saugatuck Main Branch and the Aspetuck and Hemlock Reservoirs on the Aspetuck River.

Map of the Saugatuck Reservoir in Weston, CT. The reservoir is over 5 miles long, contains 12 billion gallons of water and provides drinking water to Redding, Weston, Easton and Bridgeport. The reservoir is owned and operated by Aquarion. The reservoir is protected by a large forested area on the west, The Centennial Watershed State Park in Easton. Trout Brook Valley, a 1009 acre preserve managed by the Aspetuck Land Trust lies to the east between the lower portion of the Saugatuck Reservoir and the upper west side of the Aspetuck Reservoir.



Map of the Aspetuck and Hemlock Reservoirs owned by Aquarion supply drinking water to Easton and Fairfield. The combined volume of both reservoirs is 3,285,000 Acre-Feet.



PFAS results for the Aspetuck River, Main Branch, and West Branch of the Saugatuck River.

Table 1. Aspetuck River PFAS Survey on 1/9 and 1/28 showing trace amounts of PFBA and PFOS

Aspetuck River	Sites	Aspetuck 1.0	Aspetuck 2.0	Aspetuck 3.0	Aspetuck 4.0	Aspetuck 5.0	Aspetuck 6.0	Aspetuck 7.0	Aspetuck 8.0	Aspetuck 9.0	Aspetuck 10.0	Aspetuck 11.0	Aspetuck11.0 Dupe	Aspetuck 12.0	Aspetuck 13.0
CT DPH Action Levels -ppt	Component	ppt	ppt	ppt	ppt	ppt	ppt	ppt	ppt	ppt	ppt	ppt	ppt	ppt	ppt
	PFBA	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	4.0	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	3.0	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	2.1	< 1.0 ppt	< 1.0 ppt
	PFPeA	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt
	PFHxA	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt
	PFHpA	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt
16	PFOA	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt
12	PFNA	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt
	PFDA	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt
	GenX	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt
	PFBS	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt
49	PFHxS	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt
10	PFOS	1.3	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	1.0	< 1.0 ppt
	Total PFAS	1.3	0	0	4.0	0	0	0	3.0	0	0	0	2.1	1.0	0
					1/9/24							1/28/24			

ppt = parts per trillion or nanograms per liter

Table 2. Rainfall records 3 days prior to PFAS testing dates of 1/9 and 1/29 for Aspetuck River

Rainfall records, Weston, 3 days prior to testing on 1/9
Aspetuck stations 1.0 through 8.0

24 hours 1/9	0.00”
48 hours 1/8	0.05”
72 hours 1/7	0.14”
Total	0.19”

Rainfall records, Redding 3 days prior to testing on 1/29
Aspetuck stations 9.0 through 13.0

24 hours 1/29	0.69”
48 hours 1/28	0.42”
72 hours 1/27	0.04”
Total	0.15”

Discussion. The Aspetuck River flows from Newtown south to a confluence with the Main Branch of the Saugatuck River in Westport, a little over 12 miles (Figure 2). Development along the river consists of randomly spaced single family homes on 2 acres or more. ENB took samples at 13 sites with a duplicate sample at Aspetuck11.0 (Table 3). Riparian buffer is undisturbed for most of the Aspetuck’s length, and many forested areas remain in depth along the shoreline. Two large lakes owned by Aquarion, the Aspetuck and the Hemlock reservoirs, supply drinking water to Easton and Fairfield (Figure 2). The Aspetuck River provides water to both systems. Trace amounts of PFBA were observed at Aspetuck sites 4,8 and 11and trace amounts of PFOS were observed at Aspetuck 1.0. The Aspetuck River is the least impacted by PFAS compounds of all three Saugatuck branches (Table 2, Table 3). Monitoring site details including GPS coordinates can be found on pages Aspetuck 1 through Aspetuck 13. Little rainfall (Table 2) preceded ENB’s sampling on 1/9 (0.19”) while heavy rainfall (1.15”) fell prior to sampling on 1/29. (Table 2). Since there was no observable increase in either PFBA or PFOS concentrations during the second testing date after the rain, it may be that the abundant natural buffering there, and/or a lack of PFAS sourcing may help to keep concentrations of PFAS at a steady state.

Table 3. Main Branch of the Saugatuck River, PFAS survey on 12/29/23 and 1/4/24 showing trace amounts PFBA, PFOA and PFOS.

Saugatuck River-main	Sites	Saugatuck 0.8	Popular Plains 2.0	Saugatuck 1.0	Saugatuck 1.5	Saugatuck 1.5 Dupe	Saugatuck 2.0	Saugatuck 3.0	Saugatuck 4.0	Saugatuck 5.0	Saugatuck 6.0	Saugatuck 7.0	Saugatuck 7.0 Dupe	Saugatuck 8.0	Saugatuck 9.0	Saugatuck 10
CT DPH Action Levels -ppt	Component	ppt	ppt	ppt	ppt	ppt	ppt	ppt	ppt	ppt	ppt	ppt	ppt	ppt	ppt	ppt
	PFBA	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	2.1	< 1.0 ppt	< 1.0 ppt
	PFPeA	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt
	PFHxA	< 1.0 ppt	1.8	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt
	PFHpA	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt
16	PFOA	1.7	4.4	1.2	1.3	1.5	1.5	1.4	1.0	1.1	1.1	1.0	1.0	1.1	1.0	1.3
12	PFNA	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt
	PFDA	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt
	GenX	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt
	PFBS	< 1.0 ppt	2.0	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt
49	PFHxS	< 1.0 ppt	1.3	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt
10	PFOS	1.8	2.8	1.7	1.5	1.4	1.3	1.3	1.1	1.0	< 1.0 ppt	< 1.0 ppt	1.0	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt
	Total PFAS	3.5	12.3	2.9	2.8	2.9	2.8	2.7	2.1	2.1	1.1	1.0	2.0	3.2	1.0	1.3
		12/29/23						1/4/24								

ppt = parts per trillion or nanograms per liter

Table 4. Rainfall records 3 days prior to PFAS testing dates of 12/29/23 and 1/4/24

Rainfall Records, Westport, 3 days prior to testing on 12/29/23
Main Branch Sites, 0.8 through 2.0

24 hours 12/29	0.05”
48 hours 12/28	1.80”
72 hours 12/27	0.00”
Total	1.85”

Rainfall Records. Weston, 3 days prior to testing on 1/4/2024
Main Branch Sites, 3.0 through 10.0

24 hours 1/4	0.00”
48 hours 1/3	0.00”
72 hours 1/2	0.00”
Total	0.00”

Discussion. The Main Branch of the Saugatuck River flows from Danbury to a confluence with the Saugatuck West Branch and the Aspetuck River at Westport where the combined waters flow over Lees Pond dam and then over a second dam further downstream near Canal Street before joining the saline waters of the estuary, approximately 32 miles (Figure 2). Development along the river consists of large, single-family homes randomly spaced on 2 or more acres. Riparian buffers are well established along most of the waterway and are interspersed with dense forests. The Saugatuck Reservoir (owned by Aquarion) holds over 12 billion gallons and is over 5 miles long and supplies water for the towns of Redding, Weston, Easton and Bridgeport (Figure 3). The reservoir is protected on the west by the Centennial Watershed State Park in Easton and on the east by Trout Brook Valley (Aspetuck Land trust) also in Easton which consists of 1009 acres of protected woodlands.

Trace amounts of PFOA were observed along the entire Main Branch with concentrations ranging from 1.0 ppt to 1.7 ppt with an exception noted at the Poplar Plains 2.0 offset tributary of 4.4 ppt (Figure 2, Table 3). The Poplar Plains test site utilized by ENB is approximately 100 yards to the east of Lees Pond (Figure 2). A site on Poplar Plains Brook closer to its discharge to the Main Branch was not possible to access due to private property limitations. Aside from the PFOS of 2.8 ppt observed at Poplar Plains 2.0, trace amounts of PFOS were observed at testing sites on the Main Branch from Saugatuck 0.8 (site is off the map Figure 2) north to Saugatuck 5.0 and again at site 7.0 with concentrations ranging from 1.0 ppt to 1.8 ppt (Figure2, Table 3). Trace amounts of PFBA were observed only at site Saugatuck 8.0. The highest concentrations of PFOA and PFOS were observed at the Poplar Plains 2.0 offset site which also contained additional PFAS compounds of PFBS at 2.0 ppt and PFHxS at 1.3 ppt for a PFAS total of 12.3 ppt (Table 3). Neither PFOA nor PFOS exceeded 4.0 ppt at the Main Branch's 12 test sites which is less than the new drinking water standards (4 ppt) for PFOS and PFAS as proposed by the EPA (3/14/23). The additional PFAS compounds observed in Poplar Plains Brook possibly reflect septic infiltration from the density of housing built along this small waterway in Westport and could also be the widespread use of yard maintenance products. Research by ENB did not include three testing sites at the north end of the Main Branch, i.e., Saugatuck 11.0, 12.0 and13.0 due to time and funding constraints. Heavy rains three days prior to testing on12/29 (1.85") followed by no rain in the three days prior to testing on 1/4 showed little variability in PFOA and PFOS concentrations in the river waters suggesting efficient natural buffering and/or very limited sourcing for both PFAS products (Table 3). Details for all Saugatuck Main Branch Monitoring sites including GPS coordinates can be found on pages Saugatuck 1 through 12.

Figure 4. Photo of Saugatuck Reservoir looking north showing acres of preserved forest land.

Table 5. West Branch of the Saugatuck River Survey on 1/3 showing trace amounts of PFOA and PFOS.

W.Branch Saugatuck River	Sites	W. Saugatuck 1.0	W. Saugatuck 1.5	W. Saugatuck 2.0	W. Saugatuck 2.0 Dupe	W. Saugatuck 3.0	W. Saugatuck 4.0	W. Saugatuck 5.0	W. Saugatuck 6.0
CT DPH Action Levels -ppt	Component	ppt	ppt	ppt	ppt	ppt	ppt	ppt	ppt
	PFBA	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt
	PFPeA	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt
	PFHxA	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt
	PFHpA	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt
16	PFOA	1.8	1.7	1.5	< 1.0 ppt	1.3	1.0	< 1.0 ppt	1.1
12	PFNA	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt
	PFDA	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt
	GenX	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt
	PFBS	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	2.7
49	PFHxS	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt
10	PFOS	2.2	1.9	1.7	< 1.0 ppt	1.1	< 1.0 ppt	< 1.0 ppt	< 1.0 ppt
	Total PFAS	4.0	3.6	3.2	0	2.4	1.0	0	3.8

ppt = parts per trillion or nanograms per liter

Table 6. Rainfall records 3 days prior to PFAS testing on 1/3/24.

Rainfall records, Weston, 3 days prior to testing on 1/3/24
Saugatuck West Branch, stations 1.0 through 6.0

24 hours 1/3	0.00”
48 hours 1/2	0.00”
72 hours 1/1	0.00”
Total	0.00

Discussion. The West Branch of the in Saugatuck starts at the northern end of Weston and flows to the southeast for 15 miles until it makes a confluence with the Saugatuck Main Branch at Westport (Figure 2). Development along the river consists mostly of large, randomly spaced, single family homes. The river skirts the west side of Devil’s Den and enters a large, dammed pond between the Weston Shopping Center and the Cobbs Mill Inn before continuing through wooded areas to its confluence with the Saugatuck’s Main Branch at Westport. Riparian buffers are well established along most of its route.

Trace amounts of PFOA were observed in the waterway at five of the six stations on the West Branch with testing site W. Saugatuck 5.0 free of any PFAS components (Table 6). Trace amounts of PFOS were observed at W. Saugatuck sites 1.0 through 3.0 only (Table 6). There was no rainfall during the three days prior to ENB's testing date (Table 6) of 1/3 so little comment can be made about the effect of rain on PFAS products in the waterway during increased flow. Since the Saugatuck West Branch also has well developed, natural buffers along most of its length like the Saugatuck's Main Branch and the Aspetuck River, it is possible that little to no PFAS increases would be observable during periods of heavy rain. Details for the West Branch monitoring sites including GPS coordinates can be found on pages W. Saugatuck 1 through W. Saugatuck 6.

Figure 5. View of the Hemlock Reservoir looking east and showing dense woodlands around the perimeter

Conclusions: Observable PFAS concentrations in all three branches of Saugatuck watershed are minimal and consist mainly of PFOA and PFOS and do not appear to be influenced by heavy rainfall in the Saugatuck's Main Branch and the Aspetuck River (Table 1, Table 3, Table 5). The Aspetuck River appears to be free of all PFAS compounds except for trace amounts of PFBA observed in three of the testing sites and PFOS found in a single site (Table 1). Possible reasons for the minimal amounts of PFAS in the Saugatuck watershed are that none of the usual source suspects such as fire houses, landfills, artificial turf and wastewater treatment plant (WWTP) discharges are found along the Saugatuck riverbanks.

Results show that the observed freshwater portion of the watershed shows only trace amounts (1 to 2.7 ppt) of PFOS, PF0A and PFBS) entrained in the waterway. Based on PFAS "forever chemicals" alone, all three reservoirs presently test for good water quality and should be carefully managed in the future to assure that harmful PFAS industrial practices do not have a place on or near the banks of the Saugatuck River watershed.

Although this survey was limited to the freshwater input from the Saugatuck watershed, concerns about damage to marine fisheries should be somewhat alleviated, although, the estuary receives treated effluent from Westport's WWTP and several freshwater brooks. A full PFAS assessment would include an analysis of these additional inputs and evaluation of the estuary shoreline to finally characterize the range and concentration of PFAS products on the Saugatuck River's watershed. Based on the present good condition of the Saugatuck's three reservoirs, at least as far as PFAS contamination is concerned, any shoreline facilities known to produce PFAS contaminants should be carefully considered and avoided where possible.

Acknowledgements: We wish to acknowledge those who contributed to this research for PFAS compounds in the Saugatuck watershed. Many thanks to the Westport Shellfish Commission for donating 25 Cyclopure PFAS test kits valued at $2000. The Sierra Club also donated an additional 5 kits valued at $350 and Copps Island Oyster donated 10 more kits valued at $470. As a result, East Norwalk Blue (ENB) was able to survey 33 sites on the waterway to give the river a preliminary screening for PFAS compounds. Many thanks also go to Peter Fraboni for the many hours he spent creating graphs and site detail sheets. Thanks also go to Harbor Watch at Earthplace for providing the Norwalk River watershed site map (Figure 2).

Sincerely.

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East Norwalk Blue

Standard Operating Procedures (SOPs) for Sampling Surface Waters for PFAS (per- and poly- fluoroalkyls) compounds found in the Saugatuck and Norwalk River Watersheds of Fairfield County, CT

With recent scientific discoveries concerning PFAS products in the aquatic environment and a growing list of associated human illnesses ranging from cancers to developmental problems in young people, we at East Norwalk Blue, (ENB) a 501(c)(3) non-profit believe that our local rivers should be assessed to determine the level of PFAS compounds in the local waterways and discover possible sources causing the contamination for possible remediation. ENB has already done a limited base line survey on the Norwalk River and has determined that two proposed artificial turf sites in Wilton and Norwalk were already contaminated with PFAS compounds and were not suitable locations for synthetic turf playing fields. Based on a donation of 25 Cyclopure test kits from the Westport Shellfish Commission, ENB has embarked on a full survey of the Saugatuck River system including the West Branch, the Main Branch and the Aspetuck River (Figure 1). The Saugatuck watershed encompasses 89 square miles and covers most of the townships of Westport, Weston and Redding. Other towns comprising parts of this large watershed include Bethel, Danbury, Easton, Newton, Ridgefield, and Newtown (Figure 2).

The Cyclopure Water Sampling Kits for PFAS:
The Cyclopure kit for sampling PFAS compounds in surface water is packed in a small cardboard container and contains a plastic cup and lid with a DEXSORB® (Appendix 1, Pg 6) filter attached to the bottom of the cup. An abbreviated instruction manual Is enclosed along with a site identification card and a pair of nitrile gloves (Figure 3). The kits are relatively inexpensive ($79 USD). The price includes return postage and all processing costs at Cyclopure. The sampling procedure is straight forward, and the enclosed nitrile gloves are used in testing to avoid any possible contamination from extraneous PFAS compounds in the environment (Appendix 1, Pgs. 1 through 9). Cyclopure does not have approval from the National Environmental Laboratory Accreditation Program (NELAP) which standardizes laboratory procedures for all 50 states for PFAS research (Appendix 1, Pg. 7). It does follow NELAP guidelines and practices in the lab according to EPA 533, 537 and1633 draft.

Figure 3, Components of a Cyclopure PFAS test kit.

Figure1. Harbor Watch map showing site detail for PFAS sampling on the Aspetuck River, Saugatuck Main Branch, Saugatuck West Branch and Popular Plains Brook (red dot)

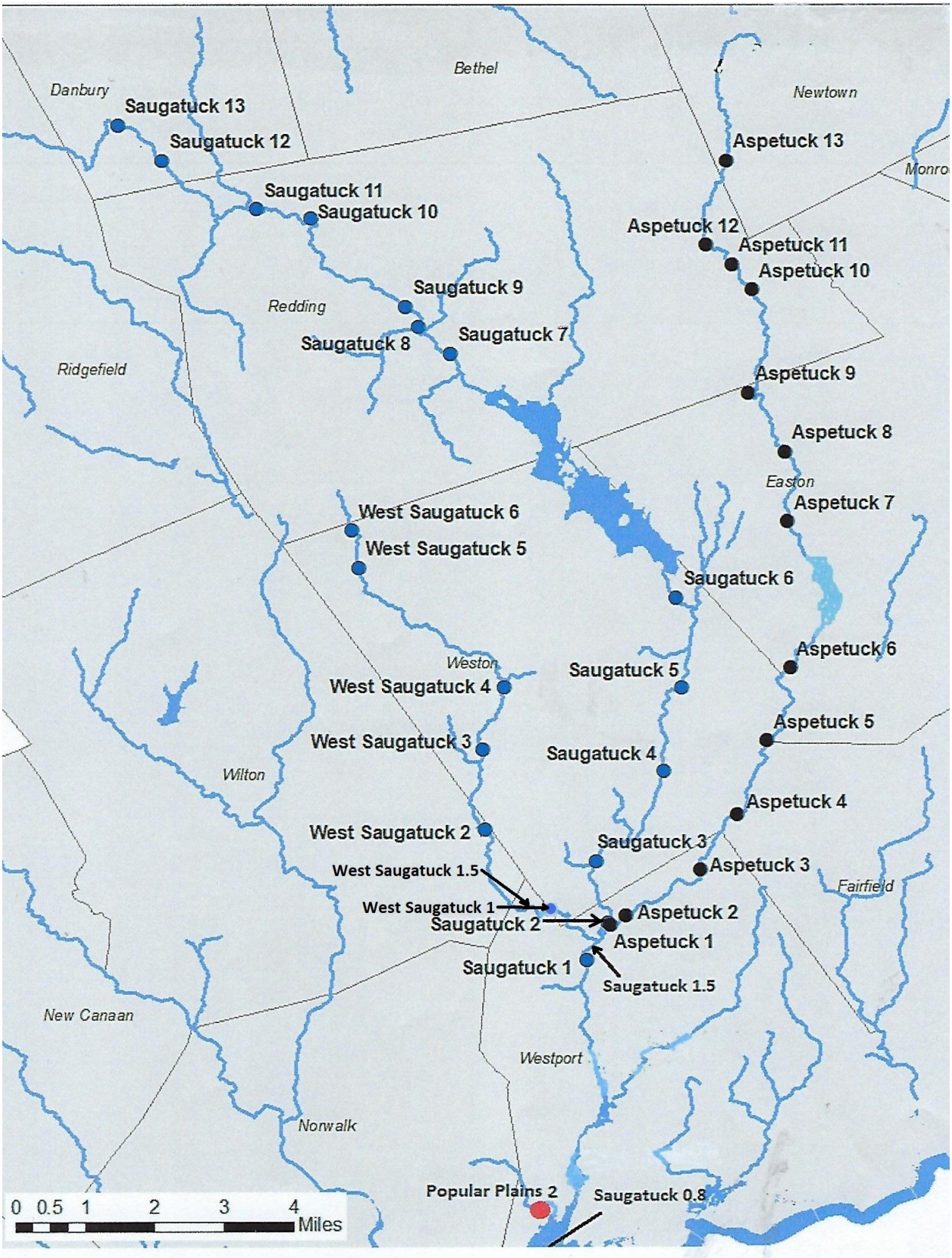
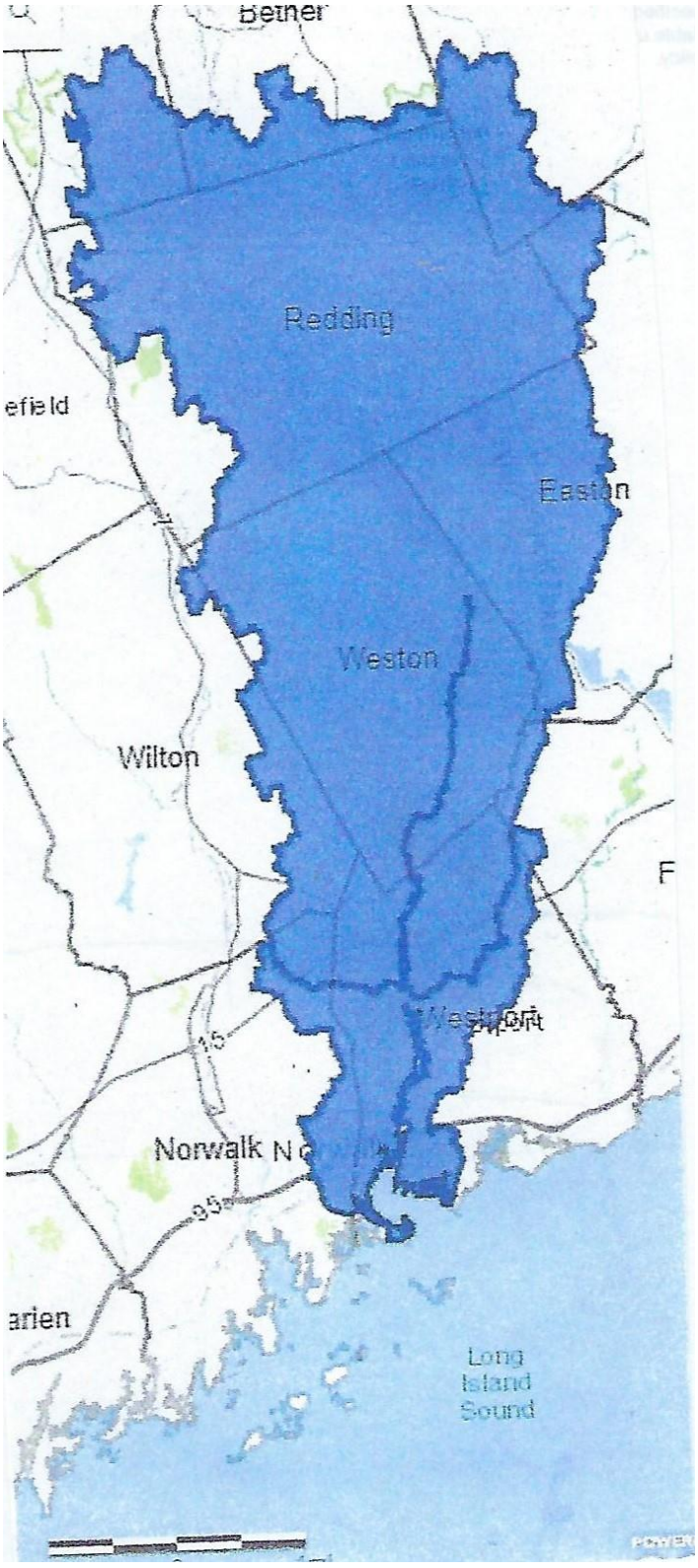


Figure 2. An overview of the Saugatuck River watershed covering 89 square miles



Based on previous field experience, ENB staff designed a stainless-steel collection tool to minimize PFAS contamination and to provide accuracy when duplicate samples are taken. Tools were fabricated in Norwalk by Artistic Iron Works.

Once a sampling site and sample cup is selected, the nitrile gloves (included with each kit) are placed on each hand and are worn for the duration of that test. The filtration cup is removed from the box and is placed in the stainless-steel collection fixture. Once the cup is seated, a stainless-steel pipe clamp is positioned on the blue filter disk (now below the fixture deck) and tightened to keep the cup in place when it is submerged (Figure 4). The cap is removed from the cup and the fixture is lowered on an adjustable handle into the water to collect the sample. Once the sample is retrieved, the cap is placed back on the cup. The stainless-steel clamp is removed, and the cup is then placed on a 500ml PP bottle for drainage. After the water sample filters through the cup (approximately 25 minutes), the cup is removed from the 500 mL bottle, shaken lightly to remove any remaining water and placed back in the original shipping container along with the completed identification card. The entry on the identification card will show city, state, zip code, collection date and time of collection. It is important to keep this card and the sample cup in the original box as all three are identified with the sample order number. The box is now closed and ready for the return shipment to the Cyclopure processing center. The nitrile gloves and the drainage water can now be safely discarded.

Figure 4, Shows the collection cup placed in the fixture and then positioned on the 500 mL drainage bottle:

Field Trip Blanks.

As part of quality control, a previously prepared (250 mL HDPE bottle containing filtered and sterile water) field trip blank (FTB) is taken on each sampling trip to the field to assure that it can be transferred in the field to a sterile Cyclopure sampling cup without attracting any PFAS contamination when subsequently processed with other samples in the laboratory. One of the Cyclopure sample kits serves as the field trip blank. The cup is removed from the box using the provided nitrile gloves and placed on top of a 500 mL HDPL drainage bottle. The lid is removed, and the cup is filled with 250 mLs of PFAS free water. The FTB is allowed to drain (Figure 5) until the cup is empty (approximately 25 minutes). The cup is then lightly shaken to remove any residual water and the cap is replaced. The cup is returned to the original shipping container, the enclosed identification card is completed, and the box is closed for shipment. The nitrile

gloves and drainage water used for the FTB can now be safely discarded. An FTB is to be taken each time ENB collects samples from a designated water body.

Figure 5, Preparation of a field trip blank showing the cup placed on a drainage bottle and filled with 250 mLs of PFAS free water.

Duplicate samples:

To promote quality control, duplicate samples are taken on each field sampling trip to assure accuracy. Two Cyclopure cups are removed from their respective containers with the provided nitrile gloves and placed in the two openings on the sampling fixture deck and secured underneath with stainless-steel pipe clamps (Figure 6). Each clamp on the underside of the fixture deck is tightened with a screwdriver around the projecting blue filter holder to keep the sampling cup from floating free. The fixture is then secured to an aluminum handle (Figure 6) and the caps on each sampler are removed. The apparatus is then lowered under the surface where both sampling cups are filled to the top with water. The collected samples are withdrawn, both sampler caps are carefully replaced on the cups, and the pipe clamps are removed with the screwdriver. Both sampling cups are then placed on the 500 mL drainage bottles where the sample passes through the DEXSORB® filters (Figure 6). Once both sample cups have drained (Approximately 25 minutes) they are removed, lightly shaken to remove any residual water, caps are replaced, and the cups returned to the original shipping containers. Both information cards are completed and returned to their respective shipping containers. The containers are

closed and prepared for shipping to Cyclopure. At this time the nitrile gloves and filtered sample water from both cups can be safely discarded.

Figure 6. Two Cyclopure sampling cups are placed on the stainless-steel fixture plate and secured with stainless-steel pipe clamps. The protective caps on both samplers are removed prior to sampling. Once the samples are retrieved, the caps are carefully replaced, the pipe clamps are removed and both Cyclopure cups are transferred to the 500mL drainage bottles.

Conclusion:

ENB believes that the approach outlined in this sampling SOP document is a reasonable approach to preserving the integrity of PFAS samples which are known to be easily contaminated from other PFAS compounds in the environment. The use of an all-metal fixture with stainless-steel pipe clamps as well as using a dedicated pair of nitrile gloves for handling each sample container should provide a true assessment of PFAS products in the sample. In addition, the short interval between gathering samples and the processing by Cyclopure in Chicago and the fact that samples are shipped dry should help keep samples from possible changing composition sometimes found in liquid samples due to holding times.

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Appendix 1, Cyclopure Instruction Manual for Using PFAS Kits in the Field the General Information (written by Cyclopure)

Glassfiber Membranes

Two 47-mm analytical grade glassfiber membranes are incorporated into the bottom of the WTK, before and after the DEXSORB® extraction disc. When water sample passes through the extraction disc, this unique design by Cyclopure provides a robust mechanical barrier! and prevents any possible particulates from getting into the DEXSORB® extraction disc and PFAS eluent sample.

DEXSORB® extraction disc

In addition, the highly selective PFAS extraction by our DEXSORB® media guarantees that other contaminates will not interfere with PFAS measurement. DEXSORB® media extracts PFAS from contaminated waters through a unique adsorption mechanism - host-guest complexations. This occurs in the uniform O.78-nm hydrophobic cavities of DEXSORB®, which are ideally suited to PFAS through size-inclusion, and excluding other contaminants like plastic particulates that are too large to fit (size-exclusion),

Q7. Can I use Cyctopure's Water Test Kit Pro to test surface waters? For ex: a private well near a landfill,

Cyclopure's Water Test Kit Pro can be used with equal performance and accuracy for surface waters, well water and tap water. Sample collection follows the same procedure of passing 250 mL of water through the collection cup.

Q8. What PFAS testing methods does Cyclopure recommend or use? Is this method proven to be effective?

Cyclopure has developed its own PFAS test method using its DEXSORB® adsorbent. The method is consistent and highly accurate. It is used by homeowners to test their tap water, by environmental organizations like the Waterkeeper Alliance, Sierra Club and others to test surface waters, and it is recommended and used by Michigan State to monitor PFAS operations.

Q9. Is there an assessment of safety or risk?

There is a box in the lower right of the reports which notes EPA lifetime health advisory levels (HALs) for PFOA, PFOS, PFBS, and GenX. EPA has a detailed FAQ regarding its PFAS HALs that you can access by this link.

Q10. What does certified mean, or what is NELAP?

NELAP (National Environmental Laboratory Accreditation Program) was developed by the NELAC (National Environmental Laboratories Accreditation Conference) institute (TNI). This program is a national set of standards accredited at the state level that ensures laboratories across the United States use the same EPA testing methods. These testing methods establish practices and quality control requirements to laboratories analyzing environmental samples.

While Cyclopure is not NELAP certified, we take pride in being a water technology laboratory that provides drinking water solutions at an affordable price for everyone through extensive research and development. Our DEXSORB material allows for accurate point-of-site PFAS extraction making it unnecessary to ship water. We provide quality products and services while staying friendly to your wallet and following NELAP guidelines and practices in the lab according to EPA Methods 533,537 and 1633 draft.

See Site Descriptions for each Sampling site in the Aspetuck, Main Branch and West Branch of the Saugatuck River.