



Summary Report for MDE's PFAS Public Water System Study

Phase 3 (August 2021 – June 2022)

This document provides a summary of Phase 3 of the Maryland Department of the Environment's Public Water System (PWS) study for per- and polyfluoroalkyl substances (PFAS). A PWS provides water for human consumption to at least 15 service connections or serves an average of 25 people for at least 60 days a year. MDE determined that community water systems (CWS) were of the highest risk of long-term exposure, therefore the multi-phased PWS study would first focus on CWSs. A CWS is a PWS that supplies water to the same population year-round. From August 2021 to June 2022, MDE collaborated with the Maryland Department of Health (MDH) on the collection and analysis of 759 drinking water samples from 313 CWSs. These 313 CWSs provide drinking water to approximately 950,000 people, roughly one-sixth of Marylanders.

Phase 3 is an extension of MDE's previous PWS monitoring work (i.e., Phases 1 and 2). Reports and supporting documents for Phases 1, 2, and 3 are available on [MDE's PFAS website](#). Findings under Phase 3 are consistent with the conclusions under Phases 1 and 2. In all three phases, PFOA, PFOS, and other select PFAS are more consistently detected in springs and unconfined/ semi-confined groundwater sources than they are in groundwater being withdrawn from confined aquifers. Additionally, as with the other phases, replacement PFAS such as ADONA and GenX chemicals have not been detected in any of the samples collected under Phase 3 – which supports MDE's conclusion that PFAS occurrence in Maryland's drinking water is more of a legacy concern. Finally, certain PFAS, such as PFOA, PFOS, PFBS, and PFHxS, have frequently been detected throughout MDE's PWS Study. These compounds' toxicity assessments – and regulations in the case of PFOA and PFOS - have also been prioritized by the EPA as mentioned in the [EPA's PFAS Strategic Roadmap](#). The occurrence data for these compounds collected under MDE's PWS study will place the Department in a strong position to respond to forthcoming health assessments and regulations from the EPA.

In addition to sampling for PFAS in public drinking water systems, MDE continues to closely monitor the Environmental Protection Agency's (EPA) work regarding PFAS in drinking water. On June 15, 2022, the EPA released interim health advisories for PFOA and PFOS in drinking water at 0.0040 parts per trillion (ppt) and 0.020 ppt, respectively. In response to these lower levels, MDE initiated Phase 4 of sampling in August 2022 of CWSs with previous detections of PFOA and PFOS. Phase 4 has continued through the end of 2022. Depending on these results, MDE is recommending that systems conduct certain actions such as notifying their customers, continuing to monitor for PFAS in their drinking water, and considering PFAS reduction measures. MDE may reassess these recommendations once the proposed federal regulations for PFOA and PFOS in drinking water are released.



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MDE's Previous Public Water System Monitoring

In September 2020, the Maryland Department of the Environment (MDE) initiated its multi-phased Public Water System (PWS) study for per- and polyfluoroalkyl substances (PFAS) in drinking water. Phases 1 and 2 of MDE's PWS Study were completed in February and May 2021, respectively. Under Phases 1 and 2, water systems were selected and prioritized based on:

- Consumer potential for long term exposure to PFAS (if present) (i.e., CWS customers);
- Drinking water source water vulnerabilities (e.g., surface waters, and groundwater from unconfined and semi-confined aquifers).
- Proximity and relative risk to potential PFAS sources (i.e., CWS source water is located within 1,000 ft (Phase 1) or 1-mile (Phase 2) of one or more potential sources of PFAS).

Under Phase 1, PFOA or PFOS were detected in approximately three-quarters of samples; about half of the samples tested under Phase 2 detected PFOA and/or PFOS. Because of the high levels of detection for PFOA and PFOS, MDE continued its monitoring efforts (i.e., Phase 3).

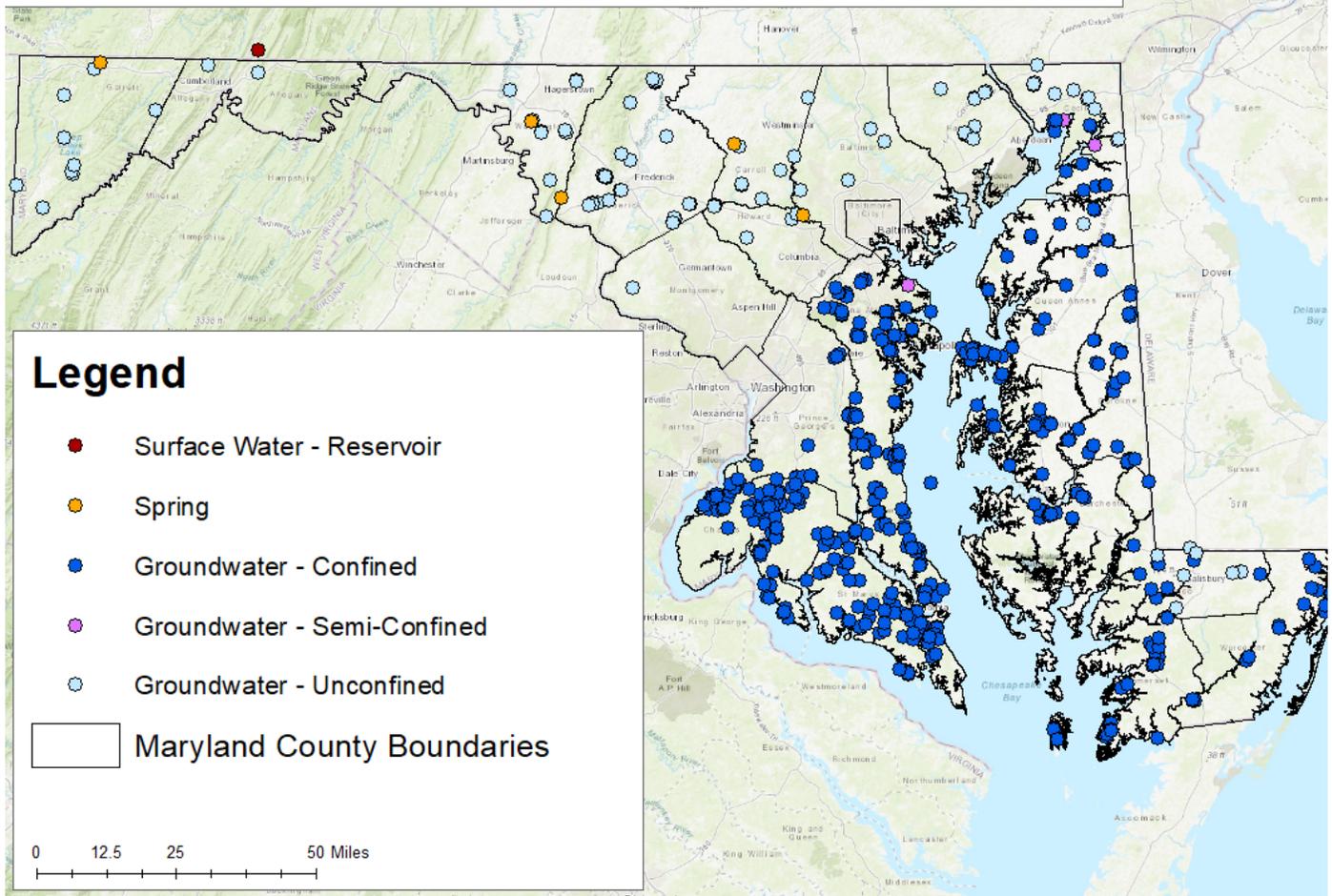
MDE PWS Study – Phase 3 Monitoring Approach

In August 2021, MDE initiated the third phase of its PWS study to evaluate the occurrence of PFAS in drinking water. During this phase, 759 drinking water samples were collected and tested for 18 PFAS under EPA Method 537.1 by the MDH-Laboratories Administration (MDH-LA). Samples collected under Phase 3 consisted of both finished and untreated water from a variety of groundwater sources withdrawing from confined, semi-confined, and unconfined aquifers, springs, and one surface water source.



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MDE PWS Study - Phase 3 Drinking Water Source Locations



In previous monitoring efforts, PFOA and PFOS were frequently detected in the samples consisting of groundwater from unconfined and/or semi-confined aquifers. Thus, MDE decided to sample the remaining CWS that withdraw and treat their own drinking water. This includes CWS that withdraw from unconfined, semi-confined, and confined aquifers.

Whenever possible, MDE Drinking Water Samplers collected an untreated water sample from individual water sources. When this was not possible, either an untreated, combined sample consisting of two or more groundwater sources, or a point of entry (POE) sample was collected. A POE sample is collected after the water treatment process but before the drinking water enters the CWS's distribution system.



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POE samples were also collected in response to certain elevated levels of Total PFOA and PFOS. The table below outlines the type and number of samples based on source water type and sample type.

Sample Type	Unconfined Groundwater	Semi-Confined Groundwater	Confined Groundwater	Spring	Surface Water	Total
Untreated (Discrete)	163	8	486	4	1	662
Untreated (Combined)	6	--	2	1	--	9
Finished Collected @ POE	22	--	66	--	--	88
Total	191	8	554	5	1	759

Table 1: Number of samples collected under Phase 3 based on source water and sample type.

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Results: Total PFOA + PFOS Concentrations

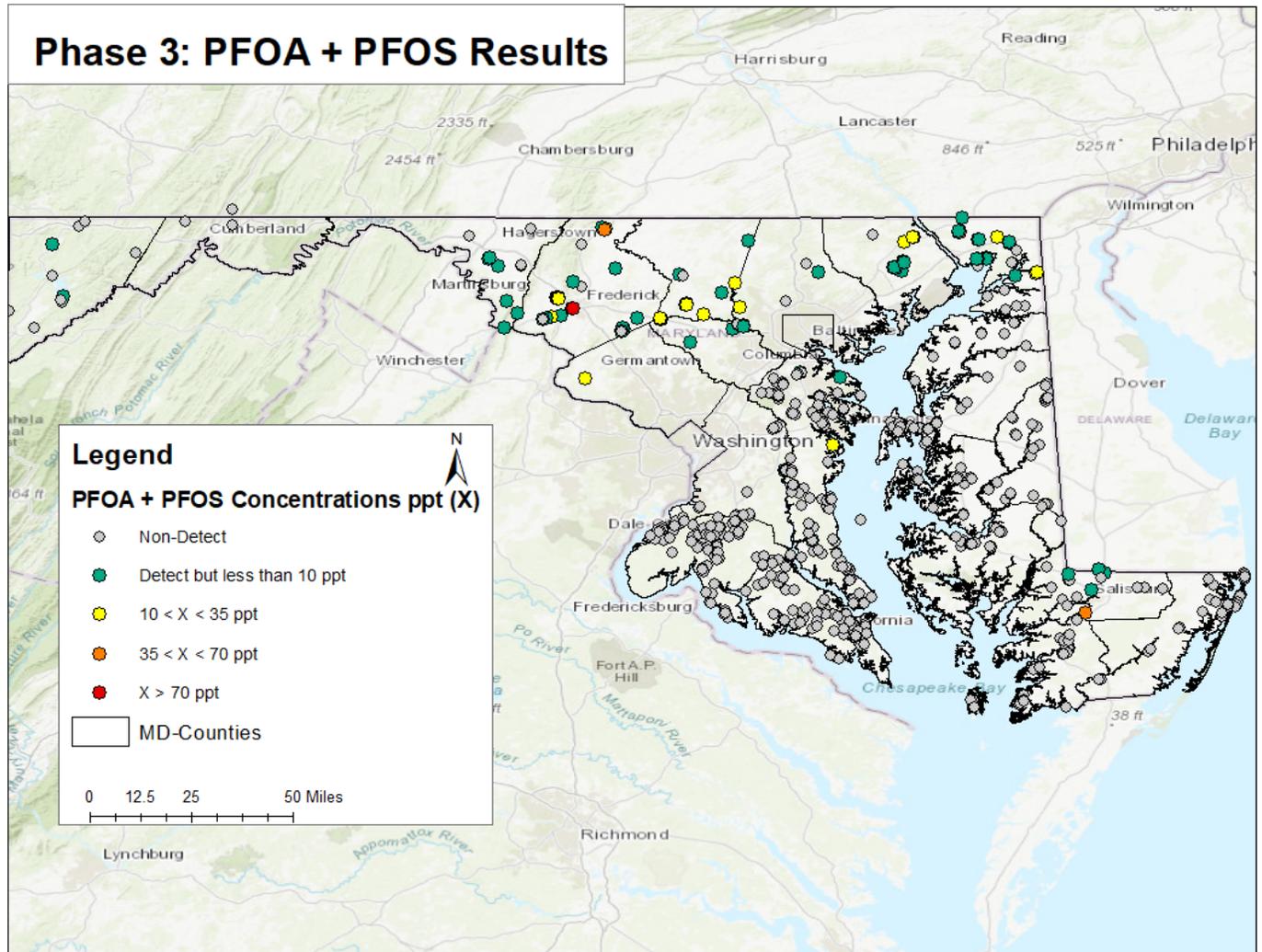


Figure 1: Location of PFOA + PFOS detects stratified by concentration.

(X) in Figure 1 refers to Total PFOA + PFOS concentration measured in the sample.

Under Phase 3, 662 untreated, discrete samples were collected. Table 2 outlines the range and percent detections of PFOA and PFOS in the untreated discrete samples collected under Phase 3 organized by source type.



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	Untreated Discrete Samples -- Source Water (n=662)				
	Unconfined Groundwater (n = 163)	Semi-Confined Groundwater (n = 8)	Confined Groundwater (n = 486)	Spring (n=4)	Surface Water (n = 1)
Percent Detection PFOA (%)	70%	63%	< 1%	50%	0
Range of Detections – PFOA (ppt)	1.12 - 34.91	1.22 – 4.91	1.30 – 2.99	2.58 – 3.94	ND
Percent Detection PFOS (%)	64%	38%	0	75%	0
Range of Detections – PFOS (ppt)	1.13 – 95.00	2.54 – 2.76	ND	1.73 – 4.44	ND

Table 2: Percent and range of detections for PFOA and PFOS in untreated discrete samples organized by source water type.

Under Phase 3, 9 untreated combined samples were collected. Table 3 outlines the range and percent detections of PFOA and PFOS in the untreated combined samples collected under Phase 3 organized by source type. No untreated-combined samples were collected from semi-confined aquifers or surface water sources under Phase 3.

	Untreated Combined Samples -- Source Water (n=9)		
	Unconfined Groundwater (n = 6)	Confined Groundwater (n = 2)	Spring (n=1)
Percent Detection PFOA (%)	67%	0	0
Range of Detections – PFOA (ppt)	0.995 – 14.80	ND	ND
Percent Detection PFOS (%)	33%	0	0
Range of Detections – PFOS (ppt)	12.90 – 13.50	ND	ND

Table 3: Percent and range of detections for PFOA and PFOS in untreated combined samples organized by source water type.

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Under Phase 3, 88 finished water samples were collected. Table 4 outlines the range and percent detections of PFOA and PFOS in the untreated combined samples collected under Phase 3 organized by source type. The finished water samples collected did not contain water from semi-confined groundwater, spring, or surface water sources.

	Finished Water Samples -- Source Water (n=88)	
	Unconfined Groundwater (n = 22)	Confined Groundwater (n = 66)
Percent Detection PFOA (%)	86%	3%
Range of Detections – PFOA (ppt)	2.67 – 29.30	1.49 – 1.55
Percent Detection PFOS (%)	90%	0
Range of Detections – PFOS (ppt)	1.27 – 93.10	ND

Table 4: Percent and range of detections for PFOA and PFOS in finished water samples organized by source water type.

Under Phase 3, three CWSs measured Total PFOA + PFOS greater than the EPA’s 2016 health advisory level (i.e., 70 ppt). These systems are listed below in Table 5 along with a brief description of MDE’s response.



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Community Water System	Impacted Source	Initial PFOA + PFOS concentration	Short-Term Solution	Long-Term Solution
WEST NOTTINGHAM ACADEMY (MD0070204)	MCGRAW HALL WTP - WELL 9 CE054001	74.54	<ul style="list-style-type: none"> - Issue Tier 2 Public Notification to customers - Provide bottled water 	<ul style="list-style-type: none"> - Explore treatment options - Consider interconnection to larger water system
MOUNT SAINT MARYS UNIVERSITY (MD0100019)	WELL 3 FR738096	72.74	<ul style="list-style-type: none"> - Issue Tier 2 Public Notification to Customers - Blend Wells 3 and 5 - Continue to monitor drinking water 	<ul style="list-style-type: none"> - Acquire alternate water source - Explore treatment options
SPRING VIEW MOBILE HOME PARK (MD0100212)	SPRING VIEW MHP WELL 1 FR056406	113.32	<ul style="list-style-type: none"> - Issue Tier 2 Public Notification to Customers - Provide bottled water - Continue to monitor drinking water 	Interconnection with a larger system

Table 5: Summary of actions taken at Phase 3 CWSs measuring Total PFOA + PFOS greater than 70 ppt (i.e., EPA 2016 HAL for PFOA and PFOS).

Results: Other PFAS

In addition to PFOA and PFOS, other PFAS have been detected under Phase 3 PWS monitoring. Other commonly detected PFAS include PFHxA, PFBS, PFHxS, and PFHpA.

The table below outlines the percent and range of detections for all PFAS that were detected under Phase 3.



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Analyte	Number of Detections	Total Number of Samples	Percent Detection (%)	Min. Detection (ppt)	Max. Detection (ppt)	Toxicity Information Available
PFOA	150	759	20%	0.995	34.91	2022 Interim Health Advisories for PFOA and PFOS (EPA)
PFHxA	139	759	18%	1.04	29.4	Forthcoming (EPA)
PFOS	133	759	18%	1.02	95.00	2022 Interim Health Advisories for PFOA and PFOS (EPA)
PFBS	133	759	18%	1.04	16.6	Final Health Advisory for PFBS
PFHxS	124	759	16%	1.01	173	ATSDR MRL Forthcoming (EPA)
PFHpA	106	759	14%	1.00	13.5	N/A
PFNA	23	759	3%	1.00	4.66	ATSDR MRL
PFDA	7	759	< 1%	1.07	5.78	N/A
N-EtFOSAA	4	759	< 1%	1.38	4.68	N/A
N-MeFOSAA	1	759	< 1%	3.67	3.67	N/A

Table 6: Overview of the occurrence of other PFAS in all Phase 3 samples and their toxicity information (if available).

Briercrest Apartments (MD0100004) measured elevated levels of PFHxS in their initial and finished water samples collected under Phase 3. Out of an abundance of caution MDH, issued its [Public Health Advisory for PFHxS in drinking water](#) on November 9, 2021. MDE worked with the system to issue a Tier 2 Public Notice to their drinking water customers, provide bottled water, and identify interconnection with a larger Frederick County water system as a long-term solution.

MDE’s Response to EPA’s Interim and Final Health Advisory Levels

In response to the EPA’s June 2022 interim health advisories for PFOA and PFOS in drinking water, MDE initiated Phase 4 of sampling in August 2022 of CWSs with previous detections of PFOA and/or PFOS under Phases 1, 2, and 3 of MDE’s PWS Study. Phase 4 has continued through the end of 2022. MDE has collected finished water samples from 126 CWSs, 58 of which were monitored under Phase 3. Depending on the concentrations of PFOA and PFOS measured in Phase 4, MDE is recommending



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certain actions to water systems such as notifying their customers, continued monitoring of their drinking water sources, and considering methods to reduce PFOA and PFOS in their drinking water. In addition to these interim health advisories, MDE anticipates the EPA will release proposed and final drinking water regulations for PFOA and PFOS by March 2023.

Additionally, the EPA announced two funding opportunities under the Bipartisan Infrastructure Law. PFAS-specific funding is available through the Drinking Water State Revolving Fund and Small and Disadvantaged Communities Program. MDE is working internally and with impacted CWSs to distribute these funds over the next five years, with priority being given to those systems with the highest levels of PFOA and PFOS.

In addition to the interim health advisories, the EPA released final health advisories for PFBS and GenX at 2,000 ppt and 10 ppt, respectively. Thus far under MDE's PWS Study, no CWSs have measured either compound above their final health advisory.

Additional Resources

Additional resources can be found through the following links:

- MDE's PFAS Webpage: <https://mde.maryland.gov/PublicHealth/Pages/PFAS-Landing-Page.aspx>
- MDE's Phase 1 Report: https://mde.maryland.gov/programs/water/water_supply/Documents/PFAS_Public_Water_System_Study-Phase1Report.pdf
- MDE's Phase 2 Report: https://mde.maryland.gov/PublicHealth/Documents/Phase2Report_Apr2022_Final.pdf
- EPA's Interim Health Advisories for PFOA and PFOS: [https://www.epa.gov/sdwa/drinking-water-health-advisories-pfoa-and-pfos#:~:text=On%20June%2015%2C%202022%2C%20EPA,and%20polyfluoroalkyl%20substances%20\(PFAS\).](https://www.epa.gov/sdwa/drinking-water-health-advisories-pfoa-and-pfos#:~:text=On%20June%2015%2C%202022%2C%20EPA,and%20polyfluoroalkyl%20substances%20(PFAS).)
- EPA Final Health Advisory for PFBS and GenX: <https://www.epa.gov/sdwa/drinking-water-health-advisories-genx-chemicals-and-pfbs>
- MDE's Factsheet on Interim Action Levels and Public Health Goals [INSERT LINK]
- MDH Factsheet on Public Health Advisory for PFHxS: https://mde.maryland.gov/PublicHealth/Documents/MDH_PFHxS%20Advisory%20Fact%20Sheet.pdf
- EPA Method 537.1: https://cfpub.epa.gov/si/si_public_record_Report.cfm?dirEntryId=343042&Lab=NERL



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Appendix 1 - Phases 1-3 Results Stratified by Total PFOA + PFOS Concentrations (X) (ppt)

