HRSD SWIFT Research Center (SRC) Quarterly Report on SWIFT Water Quality Targets

This report documents SWIFT Water Quality results for recharge operations from January 1 through March 31, 2025. The compliance requirements are documented in HRSD's SWIFT Underground Injection Control Inventory Information Package (UIC-IIP) submitted to EPA Region III in January 2018. These requirements are noted in Tables 1-4 and reflect an update to the monitoring and compliance evaluation for Total coliform.

Figures 1 and 2 and Table 6 provide a summary of the data from the referenced quarter of operations relative to the SWIFT Water Quality Targets. Table 6 represents a summary of all analytes that were present above the laboratory reporting limit. A detailed table identifying the parameters monitored for the purpose of evaluating compliance with the SWIFT Water Quality Targets can be found as an Appendix to this report.

Parameter	Proposed Regulatory Limit	Non-Regulatory Action/Goal
EPA Drinking Water Primary Maximum Contaminant Levels (MCLs)	Meet all primary MCLs	N/A
Total Nitrogen	5 mg/L Monthly Average; 8 mg/L Max Daily	Secondary Effluent Critical Control Point (CCP) Action Limit for Total Inorganic Nitrogen (TIN) = 5 mg/L-N; CCP Action Limit for SWIFT Water Total Nitrogen (TN) = 5 mg/L-N
Turbidity	Individual Filter Effluent (IFE) < 0.15 NTU 95% of time and never >0.3 NTU in two consecutive 15 min measurements	CCP Action Limit IFE of 0.15 NTU to initiate backwash or place a filter in standby
Total Organic Carbon (TOC)[1]	4 mg/L Monthly Average; 6 mg/L Maximum Daily	Critical Operating Point (COP) Action Limit to Initiate Granular Activated Carbon (GAC) Regeneration
Total Coliform (TC)[2]	<2 CFU/100 mL for 95% of calendar month observations, applied as the 95th percentile	N/A
E. coli	Non-detect	N/A
TDS[3]	N/A	Monitor PAS Compatibility

Table 1: SRC Regulatory and Monitoring Limits for SWIFT Water

[1] Regulatory limit applies to the TOC laboratory analysis which is collected at a minimum frequency of 3 times per week.

[2] The TC monitoring and compliance evaluation reflects an update effective in January 2020 following consultation with the Virginia Department of Health and EPA Region III UIC staff.

[3] No limit for Total Dissolved Solids (TDS) proposed as the primary driver is aquifer compatibility. The concentration of TDS in SWIFT Water at the SRC generally ranges from 500-850 mg/L.

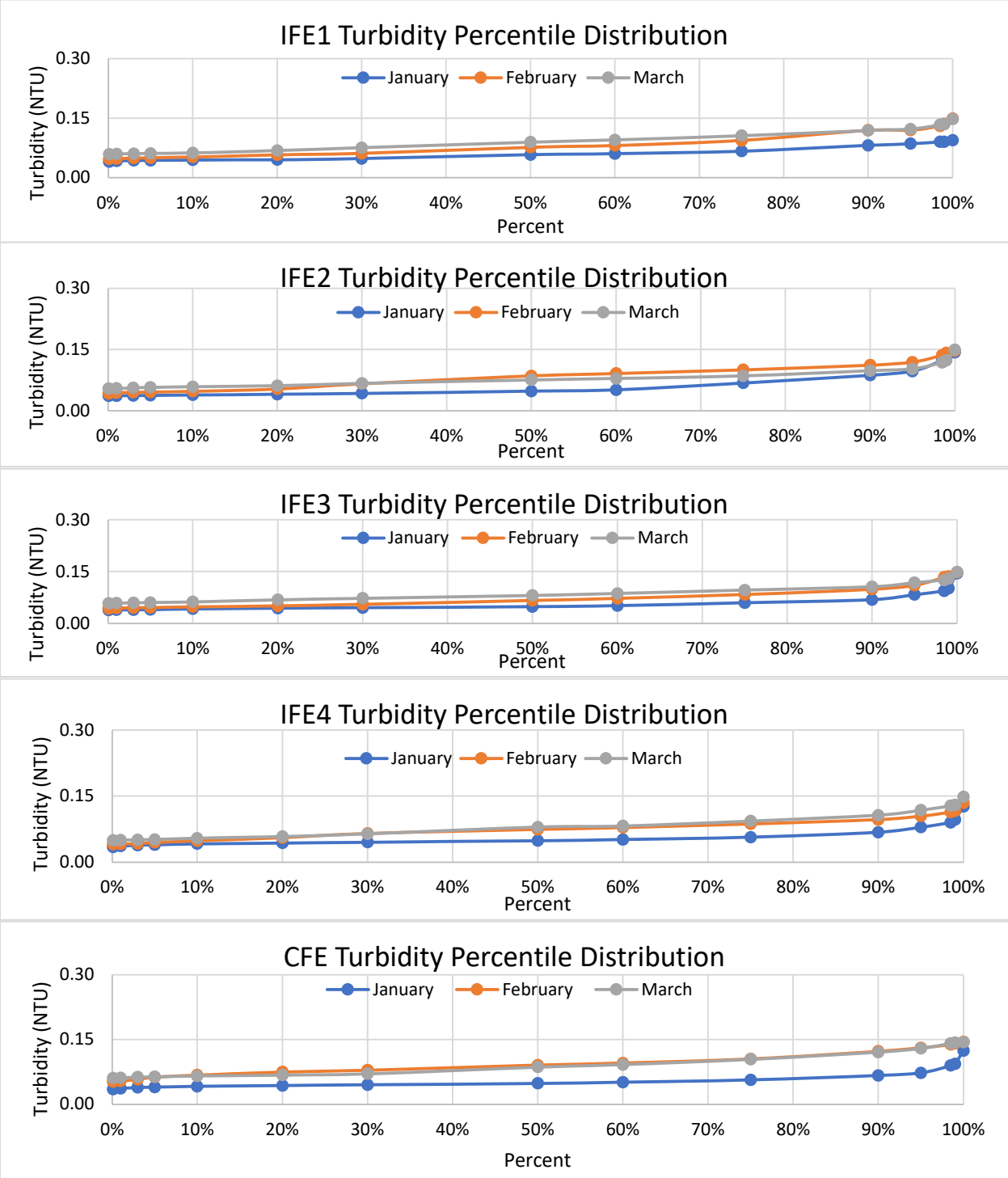

Figure 1: Percentile distribution of 15-minute average Individual Filter Effluent (IFE) Turbidities for Biofilters 1-4 (IFE1-4) and Biofilter Combined Filter Effluent (CFE). There were no 15-minute periods in this quarter with biofilter effluent turbidity values greater than 0.3 NTU. The 95% measured value for each biofilter IFE and the CFE was less than 0.15 NTU for each month in this quarter.

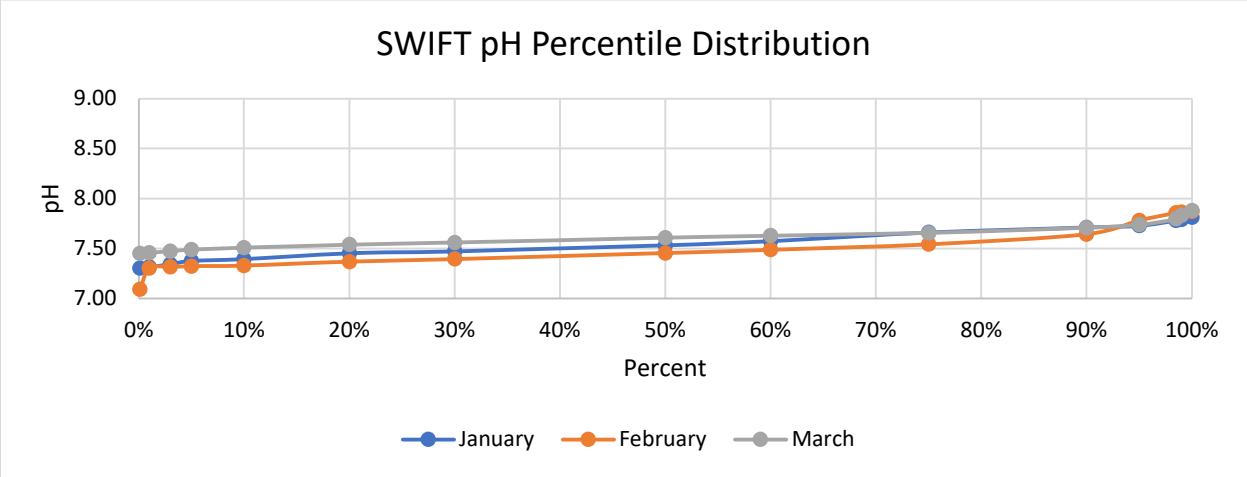

Figure 2: Distribution of Monthly SWIFT Water pH values.

Monitoring at the SRC also includes monitoring for performance indicators as documented in Table 2.

Constituent	Category	Trigger Value	Unit	Notes
1,4-Dioxane	Public Health	1	µg/L	CCL4; CA Notification Limit
17-β-Estradiol	Public Health	0.9[1]	ng/L	CCL4
DEET	Public Health	200	µg/L	MN Health Guidance Value
Ethinyl Estradiol	Public Health	280[1]	ng/L	CCL4
NDMA	Public Health	10	ng/L	CCL4; CA Notification Limit
Perchlorate	Public Health	6	µg/L	CA Notification Limit
TCEP	Public Health	5	µg/L	MN Health Guidance Value
Cotinine	Treatment Effectiveness	1	µg/L	Surrogate for low molecular weight, partially charged cyclics
Primidone	Treatment Effectiveness	10	µg/L	
Phenytoin	Treatment Effectiveness	2	µg/L	
Meprobamate	Treatment Effectiveness	200	µg/L	High occurrence in wastewater treatment plant effluent
Atenolol	Treatment Effectiveness	4	µg/L	
Carbamazepine	Treatment Effectiveness	10	µg/L	Unique structure
Estrone	Treatment Effectiveness	320	ng/L	Surrogate for steroids
Sucralose	Treatment Effectiveness	150	mg/L	Surrogate for water soluble, uncharged chemicals with moderate molecular weight
Triclosan	Treatment Effectiveness	2,100	µg/L	Chemical of interest

[1] Identified as "To Be Determined" in the UIC-IIP. Since that time, threshold values were identified in *Monitoring Strategies for Constituents of Emerging Concern (CECs) in Recycled Water, Recommendations of a Science Advisory Panel, 2018; SCCWRP Technical Report 1032.*

Table 2: SRC Non-Regulatory Performance Indicators

Pathogen Log Removal Value (LRV) is not strictly regulated but the SRC has been designed and is operated to achieve at least 12 LRV for viruses and 10 LRV for *Cryptosporidium* and *Giardia* through a combination of advanced treatment processes and soil aquifer treatment. Table 3 provides a treatment process pathogen LRV summary for recharge conditions. Table 4 provides additional monitoring that is being completed to document compliance with the LRVs for ozone and UV.

Parameter	Floc/Sed (+BAC)	Ozone	BAC+GAC	UV	Cl2	SAT	Total
Enteric Viruses	2	0-3 (TBD)	0	4	0-4	6	12-19
Cryptosporidium	4	0	0	6	0	6	16
Giardia	2.5	0-1.5 (TBD)	0	6	0	6	14.5-16

Table 3: SRC Pathogen LRV for Potomac Aquifer System (PAS) Recharge.

Ozone LRV
Ozone Influent Temperature
Ozone Influent Flow
Liquid Phase Ozone Concentration[1]
Contact Time
CT
UV LRV
UV Intensity, each reactor
UVT, GAC Combined Effluent
Reactor Flow, each
Calculated Dose, each Lamp
Status, each

[1] The ozone liquid phase probe is verified with lab grab samples performed at least once per week.

Table 4: Additional Monitoring to Support Ozone and UV LRV. All data are collected as continuous measurements. The 15-minute LRV data is submitted in Table 6.

Critical Control Points

The SRC incorporates Critical Control Points (CCP) throughout the treatment process, per Attachment G of UIC-IIP, to verify that treatment goals are being met at each of the individual processes. A violation of any CCP means that the SRC may not be producing water that meets the treatment goals and will trigger a diversion of the SWIFT Water so that it is not directed to the recharge well. In most instances, the SRC will continue to operate through the CCP violation, but the SWIFT Water will be diverted back to the Nansemond Plant chlorine contact tanks (CCT).

CCPs have alert values at which point the operator is expected to take action to correct the performance as well as the alarm values at which point an automated response will trigger action and prevent flow from going to the recharge well. Both the alert and alarm values will be measured consistently for a specified duration before action is taken so that blips in online analyzers do not trigger action. The specific values for the alert and alarm levels will be configured as adjustable set points in the Distributed Control System (DCS) and optimized as needed to meet the water quality requirements.

Table 5 shows the current CCPs in effect at the SRC. Modifications have been made to the CCPs since startup as compared to the original design documents in order to optimize their performance. On January 4, 2025, the "Influent Pump Station Total Inorganic Nitrogen" Critical Control Point (CCP), which automatically diverts flow to filter-to-waste mode when total inorganic nitrogen levels exceed 5 mg/L-N, was temporarily disabled to maintain continuous flow to the biofilters. This decision was made due to ongoing construction at the Nansemond Treatment Plant, which is intermittently impacting treatment processes. To prevent potential biological upsets in the biofilters during this period, the CCP will remain disabled until further notice. The SWIFT High Total Nitrogen CCP remains active and will continue diverting SWIFT water to the off-spec system if levels exceed 5 mg/L-N. Any other modifications from previous quarters were discussed in the relevant quarterly report for the period.

Parameter	Alert Value	Alarm Value	Unit	Action
Critical Control Points (CCPs)				
Influent Pump Station Conductivity	1,400	1,600	microSiemens per centimeter	Place Biofilters in Filter To Waste
Influent Pump Station Total Inorganic Nitrogen	4.0	Disabled	mg/L-N	No action
Influent Pump Station Turbidity	3.5	5.0	NTU	Place Biofilters in Filter To Waste
Preformed Chloramine Failure on Injection	N/A	Failure	mg/L	Divert SWIFT Water
Total Chlorine Post Injection upstream of ozone	2.0	1.0	mg/L	Divert SWIFT Water
Chloramine injection upstream of ozone	2.0	1.0	mg/L	Divert SWIFT Water
Ozone Feed	N/A	Failure	N/A	Open Biofilter Backwash Waste Valve
Ozone Contactor Calculated LRV – Virus	<120% LRV Goal	≤110% LRV Goal	%	Open Biofilter Backwash Waste Valve
Biofilter Individual Effluent Turbidity	0.1	0.15	NTU	Place That Biofilter in Filter To Waste
Biofilter Combined Filter Effluent Turbidity	0.1	0.15	NTU	Place Biofilters in Filter To Waste
GAC Combined Effluent TOC, instantaneous online analyzer	4.0	5.0	mg/L	Divert SWIFT Water
UV Reactor Dose	<120% of Dose Setpoint	<105% of Dose Setpoint	%	Divert SWIFT Water
GAC Combined Effluent Nitrite	0.25	0.50	mg/L-N	Divert SWIFT Water

Parameter	Alert Value	Alarm Value	Unit	Action
SWIFT Water TN	4.5	5.0	mg/L-N	Divert SWIFT Water
Ozone dose	70	80	lbs/day	Place Biofilters in Filter To Waste
Tasting System Free Chlorine CT	<110% of Required CT	<100% of Required CT	mg-min/L	Shut Down Tasting System
Tasting System Total Ammonia	0.1	0.3	mg/L-N	Shut Down Tasting System

Table 5. Critical Control Points for the SRC

Table 6. SWIFT Water Quality Monitoring

Parameter	Units	Maximum Contaminant Level (MCL) or MCL Goal (MCLG) where numerical MCL not expressed. Values noted for indicator compounds are non-regulatory screening values	Minimum Report Level[1]	Required Monitoring Frequency	January 2025			February 2025			March 2025		
					Average[2]	Maximum	Number of Samples	Average[2]	Maximum	Number of Samples	Average[2]	Maximum	Number of Samples
Regulatory Parameters													
Total Nitrogen (TN)	mg/L	NA	0.50	Daily[3]	4.59	4.90	4	4.08	5.55	18	2.86	4.13	20
NO_3	mg/L	10	0.20	Daily[3]	4.19	4.33	4	3.88	4.80	17	2.66	4.04	19
NO_2	mg/L	1	0.01	Daily[3]	<0.01	<0.01	4	<0.01	<0.01	17	<0.01	<0.01	19
Turbidity	NTU	NA	0.01	Continuous	**Figure 1**								
Total Organic Carbon (TOC)	mg/L	NA	1.00	3x/Wk[3]	1.44	2.00	3	2.05	2.27	14	2.68	3.58	14
pH		NA	NA	Continuous	**Figure 2**								
TDS[4]	mg/L	Potomac Aquifer System Range: 694-8,720	2.5	Monthly		558	1		478	1		522	1
Disinfection Byproducts[5]													
Bromate	µg/L	10	0.250	Monthly		0.594	1		0.653	1		1.14	1
Trihalomethanes													
Bromodichloromethane	µg/L		1.00	Monthly		<1.00	1		<1.00	1		1.04	1
Bromoform	µg/L		1.00	Monthly		3.34	1		2.37	1		3.07	1
Chloroform	µg/L		1.00	Monthly		<1.00	1		<1.00	1		<1.00	1
Dibromochloromethane	µg/L		1.00	Monthly		1.74	1		2.19	1		2.82	1
Total Trihalomethanes	µg/L	80				5.08	1		4.56	1		6.93	1
HAAs													
Dichloroacetic acid	µg/L		0.60	Monthly		0.79	1		1.17	1		1.18	1
Trichloroacetic acid	µg/L		0.20	Monthly		<0.20	1		0.25	1		0.26	1
Monochloroacetic acid	µg/L		0.60	Monthly		<0.60	1		0.89 (OR6)	1		<0.60	1
Bromoacetic acid	µg/L		0.40	Monthly		0.79	1		0.84	1		0.42 (OR6)	1
Dibromoacetic acid	µg/L		0.60	Monthly		5.22	1		6.17	1		6.32	1
Total Haloacetic Acids	µg/L	60				6.80	1		9.32	1		8.18	1
Disinfectants[5]													
Monochloramine (as Cl_2)	mg/L	4		Continuous	0.03	0.07		0.04	0.06		0.04	0.06	
Chlorine (as Cl_2)	mg/L	4		Continuous	2.38	3.86		2.64	3.55		2.77	3.45	
Inorganic Chemical													
Antimony	µg/L	6	0.50	Monthly		0.55	1		<0.50	1		<0.50	1
Arsenic	µg/L	10	1.00	Monthly		<1.00	1		0.47	1		<1.00	1
Barium	mg/L	2	0.005	Monthly		<0.005	1		<0.005	1		0.005	1
Fluoride	mg/L	4.0	0.050	Monthly	0.869	0.883	4	0.752	0.930	18	0.722	0.877	20
Organic Chemicals													
Perfluorobutanesulfonic acid (PFBS)	ng/L	2000*	2.0	Quarterly		<2.0	1		2.1	1		3.8	1
Radionuclides													
Beta particles and photon emitters	pCi/L	4 mrem/yr[6]	1.73^	Monthly		9.25	1		7.55	1		9.23	1
Strontium-90	pCi/L	NA	0.36^	Monthly		<0.360 (U)	1		<0.335 (U)	1		1.74	1

Table 6. SWIFT Water Quality Monitoring

Parameter	Units	Maximum Contaminant Level (MCL) or MCL Goal (MCLG) where numerical MCL not expressed. Values noted for indicator compounds are non-regulatory screening values	Minimum Report Level[1]	Required Monitoring Frequency	January 2025			February 2025			March 2025		
					Average[2]	Maximum	Number of Samples	Average[2]	Maximum	Number of Samples	Average[2]	Maximum	Number of Samples
Non-regulatory Performance Indicators													
Public Health Indicators		**Trigger Limits**											
1,4-dioxane	µg/L	1	0.03	Quarterly	0.14	0.14	1	0.11	0.12	4	0.10	0.12	3
Perchlorate	µg/L	6	0.50	Quarterly		0.54	1						
Treatment Efficacy Indicators		**Trigger Limits**											
Sucralose	ng/L	150,000,000	100	Quarterly		130	1		170	1		530	1
Additional Monitoring (Ozone & UV LRV)					**Average**	**Minimum**		**Average**	**Minimum**		**Average**	**Minimum**	
Ozone Virus LRV				Continuous	4.57	3.73		4.66	3.82		4.56	3.62	
Ozone Giardia LRV				Continuous	2.25	1.85		2.27	1.86		2.28	1.80	
UV Dose Reactor 1	mJ/cm^2			Continuous	>186	>186		>186	>186		>186	>186	
UV Virus LRV Reactor 1				Continuous	>4	>4		>4	>4		>4	>4	
UV Dose Reactor 2	mJ/cm^2			Continuous	>186	>186		>186	>186		>186	>186	
UV Virus LRV Reactor 2				Continuous	>4	>4		>4	>4		>4	>4	

[1] When minimum reporting limits varied during the quarter, the highest minimum reporting limit used is identified.

[2] Analytical results less than the reporting limit were treated as zero for the purposes of the averaging calculation.

[3] Daily samples are typically not collected on days in which recharge is not occurring or has ceased prior to sample collection. TOC sample collection occurs routinely on Monday through Friday when recharging. Limited or inconsistent recharge impacts the collection of daily samples, particularly for the microbiological samples collected for total coliform and E coli which have limited holding time requirements. In January, limited or no recharge impacted 27 days of sampling. In February, limited or no recharge impacted 11 days of sampling. In March, limited or no recharge impacted 11 days of sampling. There was one additional day in which NO_2, NO_3, Total Coliform, and E.coli were missed due to sample handling error. This error is being investigated to prevent future oversights.

[4] TDS of the Potomac Aquifer System is based on the averages within the upper, middle and lower Potomac Aquifer as determined during baseline monitoring.

[5] The maximum residual disinfectant level (or MRDL) MCL for monochloramine and chlorine are based on annual averages.

[6] The measurement unit for beta particles and photon emitters is pCi/L while the MCL is expressed as mrem/yr. Per EPA's Implementation Guidance for Radionuclides (EPA 816-F-00-002, March 2002), the screening threshold for beta particles and photon emitters is 50 pCi/L. If sample concentrations exceed 50 pCi/L, each individual beta particle and photon emitter is converted from pCi/L to mrem using the EPA designated conversion tables, currently available in the referenced document.

* The EPA set a Hazard Index MCL (unitless) based on the additive health effects when two or more of these four compounds are present together. Compliance with the Hazard Index MCL is determined by a running annual average. The annual average Hazard Index must be < 1. For specifics on the calculation, please refer to EPA's Fact Sheet "Understanding the Final PFAS National Primary Drinking Water Regulation Hazard Index Maximum Contaminant Level". The current Hazard Index was calculated beginning in April 2024 is 0.0. Note that EPA did not establish an independent MCL for PFBS. The value noted for PFBS is a health-based threshold.

^ MDC - Minimum Detectable Concentration (Radiochemistry).

Contract Laboratory Flags:
OR6 : > 50% Difference between analytical and confirmation GC columns. Lower value is reported.
U : Result is less than the sample detection limit.

Recharge Statistics

The total volume recharged during this operational period was 26.1 million gallons. The backflushed volume was 5.0 million gallons for a net recharge of 21.1 million gallons (Figure 3). Brief backflushing periods occur as part of routine well maintenance approximately two times a week. From the start of operation through the end of this reporting period, the SRC has recharged a total volume of 940.7 million gallons.

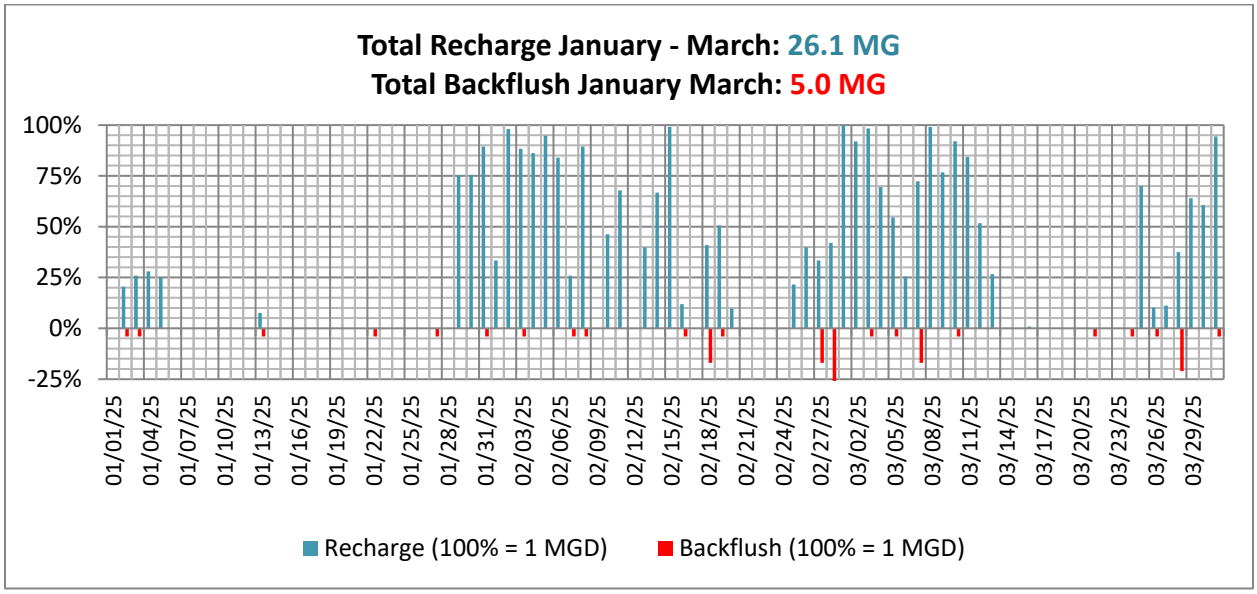

Figure 3: Recharge and Backflush Volumes, January 1 – March 31, 2025

HRSD has developed an internal target to recharge 75% of a SWIFT facility's operational capacity. This is a particularly relevant planning target for full-scale operations and HRSD is striving to meet this target at the SRC. Operational redundancies will exist at full-scale facilities (e.g., multiple recharge wells) which will likely result in a higher rate of recharge at full-scale. Integration of the new well, NP_MAR_01 into the SRC system is complete and the new well has been in operation since November 1, 2022. The recharge rate for NP_MAR_01 is currently 650 gpm (0.94 MGD).

Figure 4 depicts the operational activity for this monitoring period identifying the percentage of operational time spent in recharge as well as the general factors precluding recharge.

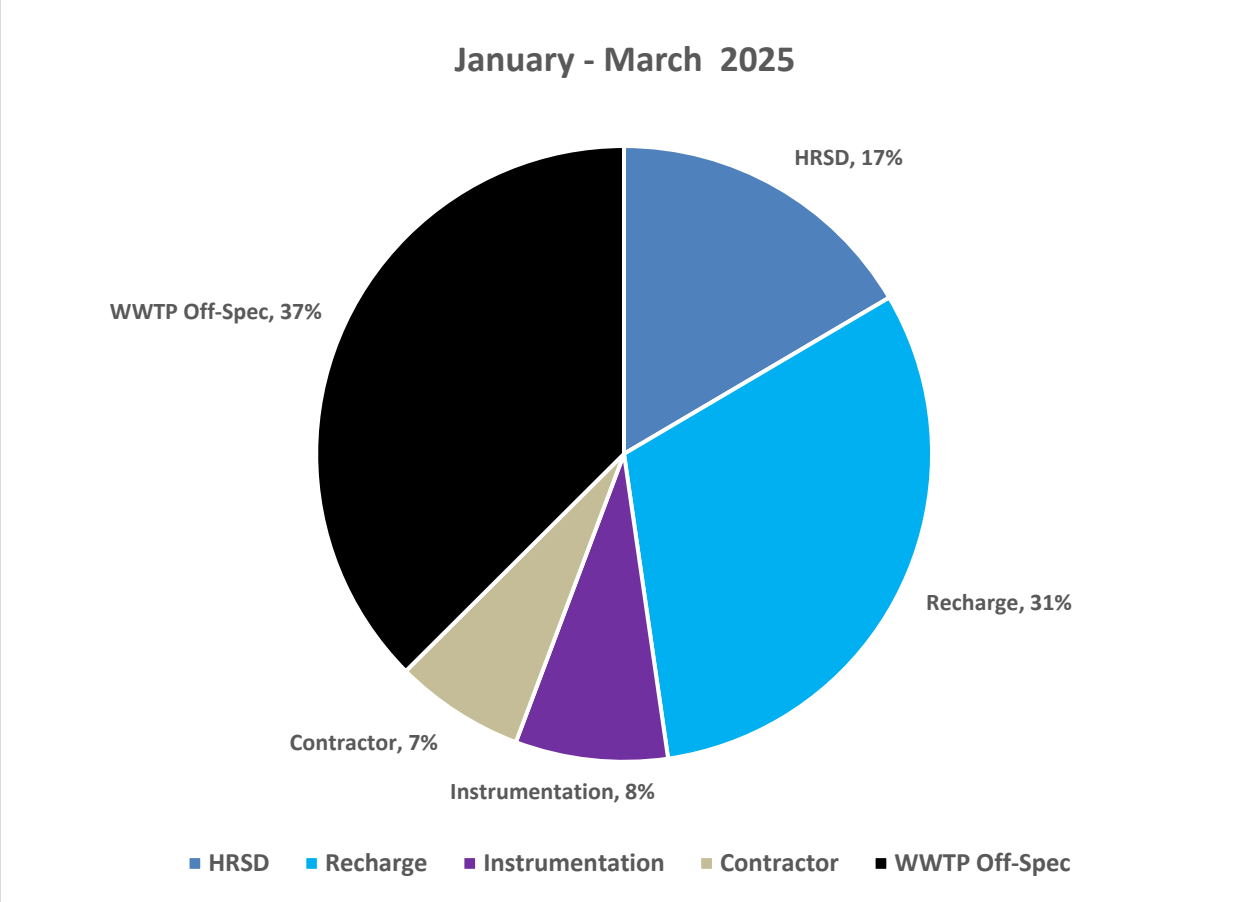

Figure 4: Operational activity for monitoring period. Notes: *HRSD*: Broad category covering activity within SWIFT facility that may lead to shut-down (e.g., maintenance and repairs, operational problems); *Recharge*: Recharge of SWIFT water; *Instrumentation*: On-line analyzer and/or instrumentation maintenance and repair; *Contractor:* Recharge suspended to accommodate contractor activity at the AWT and/or recharge well; *WWTP Off-Spec*: Influent to the SWIFT facility (wastewater facility secondary clarifier effluent) does not meet influent quality requirements (e.g., elevated TOC or TN, or WWTP repairs).

Conventional Monitoring Wells

The conventional monitoring wells located in the upper, middle and lower zones of the Potomac Aquifer (MW-UPA, MW-MPA, and MW-LPA, respectively) are located approximately 400 – 500 ft from the recharge well and have been routinely monitored to detect the arrival of the recharge front. Based upon TOC observations, the recharge front reached MW-UPA in late fall 2020 and MW-MPA in mid-late summer 2021 (Figure 5).

Travel time to MW-UPA was confirmed through a bromide tracer study initiated in July of 2020. Bromide from this tracer study was identified in MW-UPA beginning in April 2022. Travel time in days is difficult to estimate due to the frequent recharge stoppages. We can, however, relate travel time to a recharge volume equivalent. From July 2020

until the bromide appeared in MW-UPA in April 2022, approximately 230 million gallons of SWIFT water was recharged.

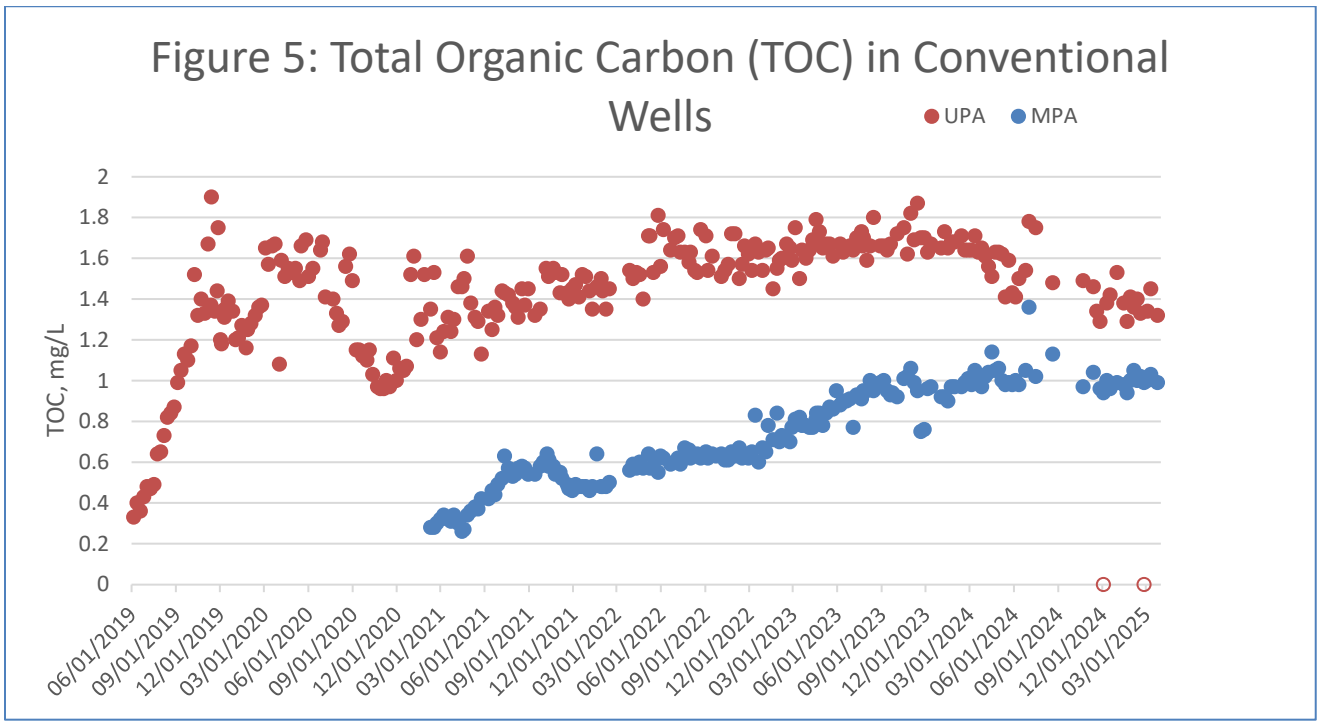

Figure 5: TOC concentration in the Upper and Middle Potomac conventional monitoring wells, MW-UPA and MW-MPA. Open circles represent data that is less than the reporting limit. Based on travel time studies using a conservative tracer, SWIFT water recharged in the 1st quarter of 2023 roughly approximates the groundwater represented in this quarter's conventional well monitoring. The SWIFT water average TOC concentration for January – March 2023 was 0.09 mg/L, with a maximum of 3.33 mg/L (n = 48).

In this monitoring period, two indicator compounds were observed in both conventional monitoring wells, MW-UPA and MW-MPA: 1,4-dioxane and sucralose. PFOA, no longer classified as an indicator compound with the finalized drinking water rule, continues to be detected in these same wells. 1,4-Dioxane and sucralose have been observed frequently in MW-UPA since November 2019 while PFOA was first observed in MW-UPA in Quarter 2 of 2022 and in MW-MPA during the 2nd quarter of 2023.

Using 230 million gallons of recharge volume as a proxy for travel time, we can estimate that the SWIFT water appearing in MW-UPA was recharged at some point during Quarter 1 of 2023. For TOC, the average concentration observed in SWIFT water during this time period was 0.09 mg/L. This represents a substantial reduction from the fourth quarter of 2022 in which the average TOC concentration was 2.36 mg/L. This is attributable to operation of the carbon vessels to target PFAS removal, which also facilitated improved removal of sucralose. The decreasing trend of 1,4-dioxane observed in MW-UPA (Figure 6) is consistent with the reduction seen in SWIFT water associated with these early efforts to optimize the process.

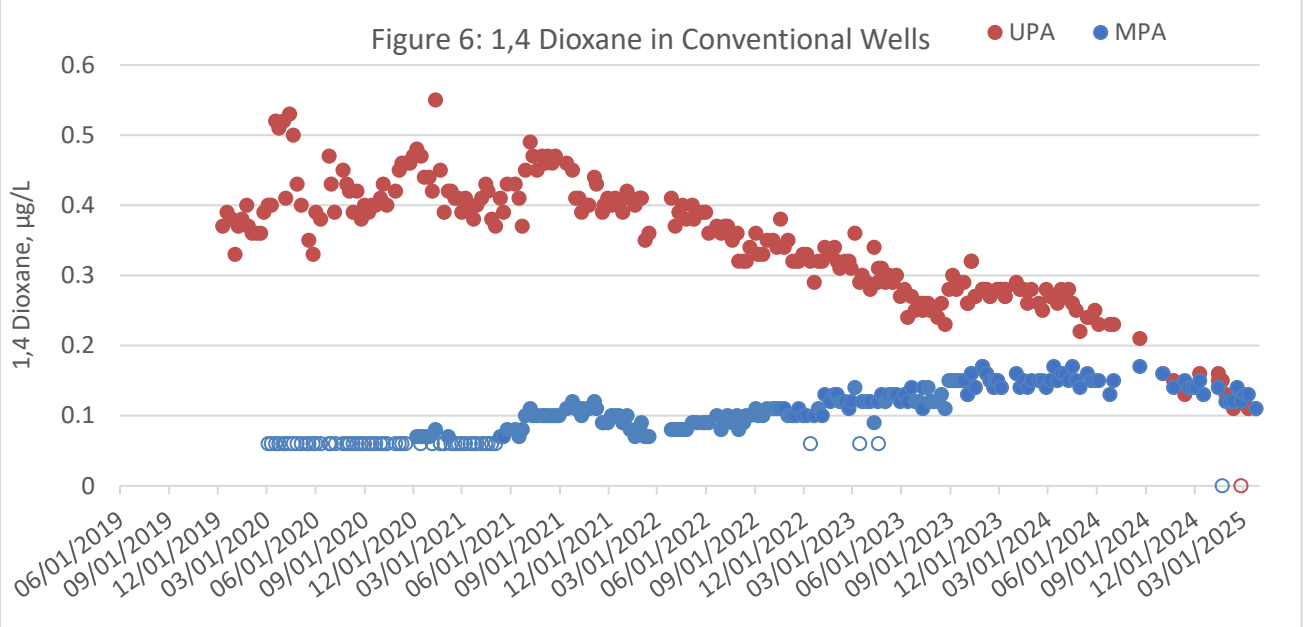

Figure 6: 1,4-Dioxane trending in MW-UPA and MW-MPA. Open circles represent data that is less than the reporting limit. Based on travel time studies using a conservative tracer, SWIFT water recharged in the 1st quarter of 2023 roughly approximates the groundwater represented in this quarter's conventional well monitoring. The SWIFT water average 1,4-dioxane concentration for January – March 2023 was 0.02 µg/L, with a maximum value of 0.17 µg/L (n = 11).

In Quarter 1 of 2023, the available data on sucralose and PFOA in SWIFT water is much more limited, with only three each for sucralose and PFOA. The trends for sucralose and PFOA in MW-UPA and MW-MPA are presented in Figures 7 and 8, respectively.

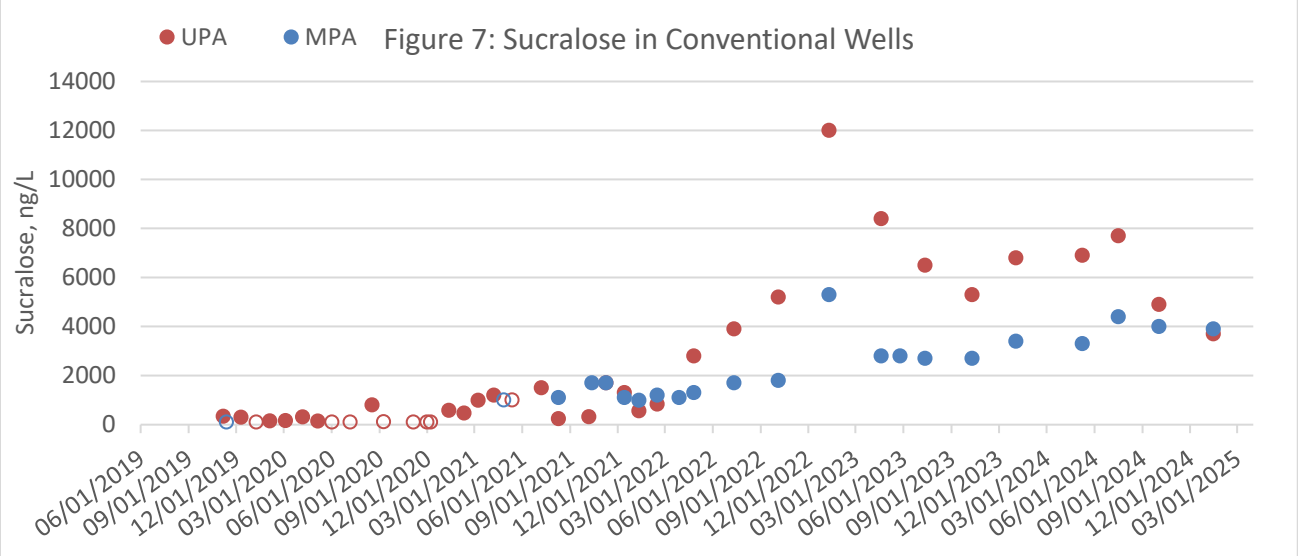

Figure 7: Sucralose trending in MW-UPA and MW-MPA. Open circles represent data that is less than the reporting limit. Based on travel time studies using a conservative tracer, SWIFT water recharged in

the 1st quarter of 2023 roughly approximates the groundwater represented in this quarter's conventional well monitoring. The SWIFT water average sucralose concentration for January – March 2023 was 1,133 ng/L, with a maximum value of 3,100 ng/L (n = 3). Note, the maximum value of 3,100 ng/L was flagged by the laboratory as high biased.

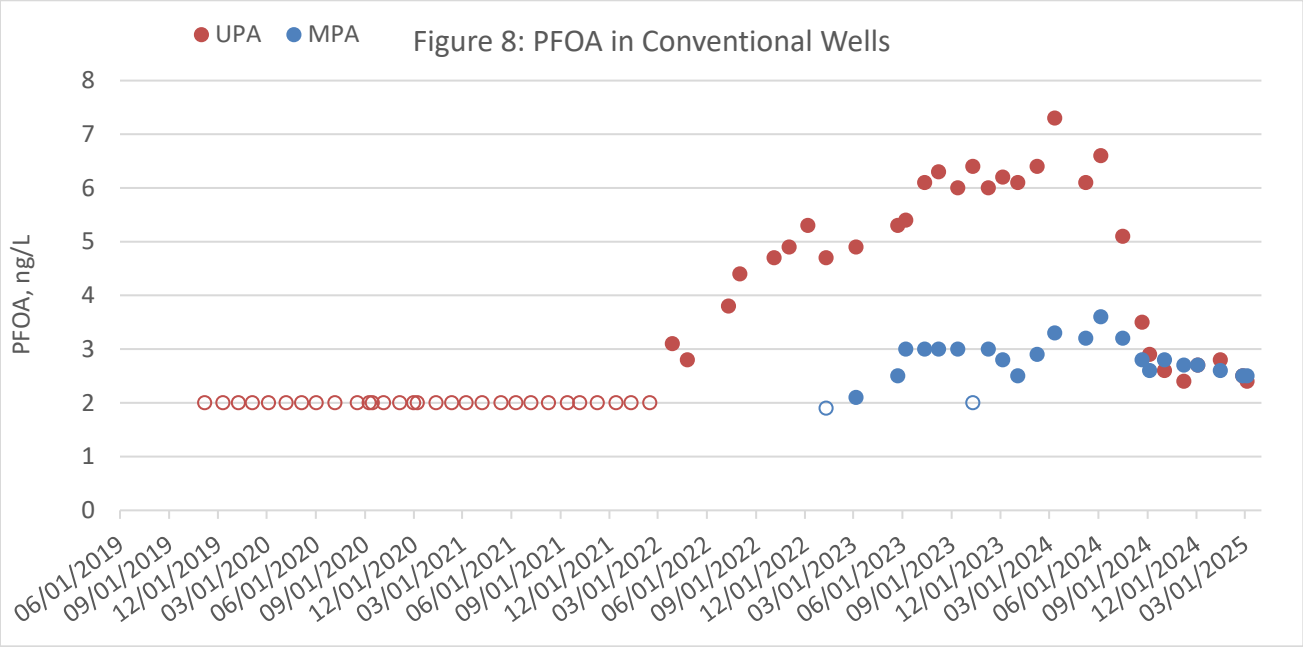

Figure 8: PFOA trending in MW-UPA. Open circles represent data that is less than the reporting limit. Based on travel time studies using a conservative tracer, SWIFT water recharged in the 1st quarter of 2023 roughly approximates the groundwater represented in this quarter's conventional well monitoring. The SWIFT water PFOA concentration for January – March 2023 was 1.1 ng/L, with a maximum value of 3.3 ng/L (n = 3). It is important to note that until July of 2022 when EPA released interim Health Advisory Limits (HAL) for PFOA and PFOS, HRSD's operational controls for these compounds were based upon the previous HAL of 70 ng/L FOA+PFOS. Since that time, HRSD has optimized GAC performance to maintain PFOA and PFOS below 4 ng/L.

It is important to note that until July of 2022 when EPA released interim Health Advisory Limits (HAL) for PFOA and PFOS, HRSD's operational controls for these compounds were based upon the previous HAL of 70 ng/L PFOA+PFOS. Since that time, HRSD has optimized GAC performance to maintain PFOA and PFOS below 4 ng/L, each (refer to Potomac Aquifer Recharge Oversight Committee Meeting Summary December 2022 for additional information). HRSD has consistently been able to maintain PFOA and PFOS below the 4 ng/L standard since December 2022.

On April 10, 2024, the EPA announced the final drinking water standards for PFOA and PFOS would be 4 ng/L, and 10 ng/L for PFxS, PFNA, and HFPO-DA (commonly known as GenX chemicals). Additionally, a Hazard Index MCL (unitless) was set based on the additive health effects of any mixtures containing two or more of PFHxS, PFNA, HFPO-DA, and PFBS. Compliance with the Hazard Index MCL is determined by a running annual average, which must be < 1. The current Hazard Index was calculated beginning in April 2024 and is 0.0. For specifics on the calculation, please refer to EPA's Fact

Sheet “Understanding the Final PFAS National Primary Drinking Water Regulation Hazard Index Maximum Contaminant Level”.

While public water systems must comply with these requirements by 2029, SWIFT Quarterly Reports will now include results for all six compounds.

Push-Pull testing with low dissolved oxygen

An injection-recovery or “push-pull” test was performed on recharge well NP_MAR_01 from November 8, 2024 through November 15, 2024. The objectives of this test were to 1) evaluate mixing effects and approximate characteristics of SWIFT Water migration, such as dispersion, and 2) observe subsurface geochemical and microbial reactions relevant to aquifer recharge with highly treated wastewater.

Approximately 3 million gallons (MG) of SWIFT Water was recharged over four days followed by another 24 hours of recharge with a conservative bromide (Br^-) tracer addition (0.8 MG, with approximately 110 mg/L Br^-) and 1.6 hours of chase water (0.12 MG). The recovery phase followed immediately after the injection phase and consisted of 41 hours of pumping, removing approximately 3.4 MG.

Water quality monitoring during the test included field measurements of temperature, pH, oxidation reduction potential (ORP), conductivity, and dissolved oxygen (DO), and periodic sampling for laboratory analyses for metals, alkalinity, PFAS, nitrate, sulfate, phosphate, chloride, fluoride, bromide, total organic carbon (TOC) and dissolved organic carbon (DOC). Comparison of the mass injected versus recovered for (TOC), dissolved oxygen, nitrate, sulfate, and various metals yielded estimates of reaction coefficients indicating potential microbial activity in the recharge well and aquifer. Bromide concentration was continuously monitored during pumping and supplemented with laboratory measurements. Full mass recovery of the bromide tracer was observed. Further data analysis is pending.

Appendix
SRC Monitoring Data for SWIFT Water Quality Regulatory Targets

Parameter	Units	Maximum Contaminant Level (MCL) or MCL Goal (MCLG) where numerical MCL not expressed. Values noted for indicator compounds are non-regulatory screening values	Minimum Report Level[1]	Required Monitoring Frequency	January 2025			February 2025			March 2025		
					Average[2]	Maximum	Number of Samples	Average[2]	Maximum	Number of Samples	Average[2]	Maximum	Number of Samples
Regulatory Parameters													
Total Nitrogen (TN)	mg/L	NA	0.50	Daily[3]	4.59	4.90	4	4.08	5.55	18	2.86	4.13	20
NO_3	mg/L	10	0.20	Daily[3]	4.19	4.33	4	3.88	4.80	17	2.66	4.04	19
NO_2	mg/L	1	0.01	Daily[3]	<0.01	<0.01	4	<0.01	<0.01	17	<0.01	<0.01	19
Turbidity	NTU	NA	0.01	Continuous	**Figure 1**								
Total Organic Carbon (TOC)	mg/L	NA	1.00	3x/Wk[3]	1.44	2.00	3	2.05	2.27	14	2.68	3.58	14
pH		NA	NA	Continuous	**Figure 2**								
TDS[4]	mg/L	Potomac Aquifer System Range: 694-8,720	2.5	Monthly		558	1		478	1		522	1
Microorganisms													
Total Coliform	MPN/100 mL	MCLG = 0	1	Daily[3]	<1	<1	4	<1	<1	17	<1	<1	19
E. coli	MPN/100 mL	NA	1	Weekly	<1	<1	4	<1	<1	17	<1	<1	19
Cryptosporidium	oocysts/L	Treatment Technique, MCLG = 0	0.1	Quarterly		<0.1	1						
Giardia lamblia	oocysts/L	Treatment Technique, MCLG = 0	0.1	Quarterly		<0.1	1						
Legionella	MPN/100 mL	Treatment Technique, MCLG = 0	1.0	Quarterly		<1.0	1						
Disinfection Byproducts[5]													
Bromate	µg/L	10	0.250	Monthly		0.594	1		0.653	1		1.14	1
Chlorite	mg/L	1.0	0.10	Monthly		<0.10	1		<0.10	1		<0.10	1
Trihalomethanes													
Bromodichloromethane	µg/L		1.00	Monthly		<1.00	1		<1.00	1		1.04	1
Bromoform	µg/L		1.00	Monthly		3.34	1		2.37	1		3.07	1
Chloroform	µg/L		1.00	Monthly		<1.00	1		<1.00	1		<1.00	1
Dibromochloromethane	µg/L		1.00	Monthly		1.74	1		2.19	1		2.82	1
Total Trihalomethanes	µg/L	80				5.08	1		4.56	1		6.93	1
HAAs													
Dichloroacetic acid	µg/L		0.60	Monthly		0.79	1		1.17	1		1.18	1
Trichloroacetic acid	µg/L		0.20	Monthly		<0.20	1		0.25	1		0.26	1
Monochloroacetic acid	µg/L		0.60	Monthly		<0.60	1		0.89 (OR6)	1		<0.60	1
Bromoacetic acid	µg/L		0.40	Monthly		0.79	1		0.84	1		0.42 (OR6)	1
Dibromoacetic acid	µg/L		0.60	Monthly		5.22	1		6.17	1		6.32	1
Total Haloacetic Acids	µg/L	60				6.80	1		9.32	1		8.18	1
Disinfectants[5]													
Monochloramine (as Cl_2)	mg/L	4		Continuous	0.03	0.07		0.04	0.06		0.04	0.06	
Chlorine (as Cl_2)	mg/L	4		Continuous	2.38	3.86		2.64	3.55		2.77	3.45	

Parameter	Units	Maximum Contaminant Level (MCL) or MCL Goal (MCLG) where numerical MCL not expressed. Values noted for indicator compounds are non-regulatory screening values	Minimum Report Level[1]	Required Monitoring Frequency	January 2025			February 2025			March 2025		
					Average[2]	Maximum	Number of Samples	Average[2]	Maximum	Number of Samples	Average[2]	Maximum	Number of Samples
Inorganic Chemical													
Antimony	µg/L	6	0.50	Monthly		0.55	1		<0.50	1		<0.50	1
Arsenic	µg/L	10	1.00	Monthly		<1.00	1		0.47	1		<1.00	1
Asbestos	MFL	7	0.177	Monthly		<0.177	1		<0.177	1		<0.177	1
Barium	mg/L	2	0.005	Monthly		<0.005	1		<0.005	1		0.005	1
Beryllium	µg/L	4	0.10	Monthly		<0.10	1		<0.10	1		<0.10	1
Cadmium	µg/L	5	0.10	Monthly		<0.10	1		<0.10	1		<0.10	1
Chromium (total)	µg/L	100	10.0	Monthly		<2.50	1		<2.50	1		<10.0	1
Copper	mg/L	1.3 (action level)	0.005	Monthly		<0.005	1		<0.005	1		<0.005	1
Cyanide (total)	µg/L	200	5	Monthly		<5	1		<5	1		<5	1
Fluoride	mg/L	4.0	0.050	Monthly	0.869	0.883	4	0.752	0.930	18	0.722	0.877	20
Lead	µg/L	15 (action level)	0.40	Monthly		<0.40	1		<0.20	1		<0.20	1
Mercury	µg/L	2	0.10	Monthly		<0.10	1		<0.10	1		<0.10	1
Selenium	µg/L	50	5.00	Monthly		<5.00	1		<5.00	1		<5.00	1
Thallium	µg/L	2	0.10	Monthly		<0.10	1		<0.10	1		<0.10	1
Organic Chemicals													
Acrylamide	µg/L	Treatment Technique, MCLG = 0	0.10	Monthly		<0.10	1		<0.10	1		<0.10	1
Alachlor	µg/L	2	0.05	Monthly		<0.049	1		<0.05	1		<0.05	1
Atrazine	µg/L	3	0.05	Monthly		<0.049	1		<0.05	1		<0.05	1
Benzo(a)pyrene (PAHs)	µg/L	0.2	0.02	Monthly		<0.02	1		<0.02	1		<0.02	1
Di(2-ethylhexyl) adipate	µg/L	400	0.60	Monthly		<0.59	1		<0.60	1		<0.60	1
Di(2-ethylhexyl) phthalate	µg/L	6	0.60	Monthly		<0.59	1		<0.60	1		<0.60	1
Hexachlorocyclopentadiene	µg/L	50	0.05	Monthly		<0.049	1		<0.05	1		<0.05	1
Hexachlorobenzene	µg/L	1	0.05	Monthly		<0.049	1		<0.05	1		<0.05	1
Simazine	µg/L	4	0.05	Monthly		<0.049	1		<0.05	1		<0.05	1
Carbofuran	µg/L	40	13	Monthly		<13	1		<0.50	1		<0.90	1
Oxamyl (Vydate)	µg/L	200	13	Monthly		<13	1		<0.50	1		<1.00	1
Chlordane	µg/L	2	0.100	Monthly		<0.100	1		<0.100	1		<0.100	1
Endrin	µg/L	2	0.0100	Monthly		<0.0098	1		<0.0099	1		<0.0100	1
Heptachlor	µg/L	0.4	0.0100	Monthly		<0.0098	1		<0.0099	1		<0.0100	1
Heptachlor Epoxide	µg/L	0.2	0.0100	Monthly		<0.0098	1		<0.0099	1		<0.0100	1
Lindane	µg/L	0.2	0.0100	Monthly		<0.0098	1		<0.0099	1		<0.0100	1
Methoxychlor	µg/L	40	0.050	Monthly		<0.049	1		<0.05	1		<0.05	1
Toxaphene	µg/L	3	0.51	Monthly		<0.50	1		<0.50	1		<0.51	1
PCB Arochlor1016	µg/L		0.071	Monthly		<0.070	1		<0.070	1		<0.071	1
PCB Arochlor1221	µg/L		0.100	Monthly		<0.100	1		<0.100	1		<0.100	1
PCB Arochlor1232	µg/L		0.100	Monthly		<0.100	1		<0.100	1		<0.100	1
PCB Arochlor1242	µg/L		0.100	Monthly		<0.100	1		<0.100	1		<0.100	1
PCB Arochlor1248	µg/L		0.100	Monthly		<0.100	1		<0.100	1		<0.100	1

Parameter	Units	Maximum Contaminant Level (MCL) or MCL Goal (MCLG) where numerical MCL not expressed. Values noted for indicator compounds are non-regulatory screening values	Minimum Report Level[1]	Required Monitoring Frequency	January 2025			February 2025			March 2025		
					Average[2]	Maximum	Number of Samples	Average[2]	Maximum	Number of Samples	Average[2]	Maximum	Number of Samples
Organic Chemicals (Cont.)													
PCB Arochlor1254	µg/L		0.100	Monthly		<0.100	1		<0.100	1		<0.100	1
PCB Arochlor1260	µg/L		0.071	Monthly		<0.070	1		<0.070	1		<0.071	1
Total Polychlorinated Biphenyls (PCBs)	µg/L	0.5				<0.10	1		<0.10	1		<0.10	1
2,4-D	µg/L	70	0.10	Monthly		<0.10	1		<0.10	1		<0.10	1
Dalapon	µg/L	200	1.00	Monthly		<1.00	1		<1.00	1		<1.00	1
Picloram	µg/L	500	0.10	Monthly		<0.10	1		<0.10	1		<0.10	1
2,4,5-TP (Silvex)	µg/L	50	0.10	Monthly		<0.10	1		<0.10	1		<0.10	1
Dinoseb	µg/L	7	0.20	Monthly		<0.20	1		<0.20	1		<0.20	1
Pentachlorophenol	µg/L	1	0.040	Monthly		<0.040	1		<0.040	1		<0.040	1
Dioxin (2,3,7,8-TCDD)	pg/L	30	5.00	Monthly		<4.80	1		<4.80	1		<5.00	1
Diquat	µg/L	20	0.40	Monthly		<0.40	1		<0.39	1		<0.39	1
Endothall	µg/L	100	5.00	Monthly		<5.00	1		<5.00	1		<5.00	1
Epichlorohydrin	µg/L	Treatment Technique, MCLG = 0	1.00	Monthly		<1.00	1		<0.10	1		<0.10	1
Glycophosphate	µg/L	700	6.0	Monthly		<6.0	1		<6.0	1		<6.0	1
Benzene	µg/L	5	1.00	Monthly		<1.00	1		<1.00	1		<1.00	1
Carbon Tetrachloride	µg/L	5	1.00	Monthly		<1.00	1		<1.00	1		<1.00	1
Chlorobenzene	µg/L	100	1.00	Monthly		<1.00	1		<1.00	1		<1.00	1
1,2-dibromo-3-chloropropane (DBCP)	µg/L	0.2	0.02	Monthly		<0.02	1		<0.02	1		<0.02	1
o-Dichlororbenzene	µg/L	600	1.00	Monthly		<1.00	1		<1.00	1		<1.00	1
p-Dichlorobenzene	µg/L	75	1.00	Monthly		<1.00	1		<1.00	1		<1.00	1
1,2-Dichloroethane	µg/L	5	1.00	Monthly		<1.00	1		<1.00	1		<1.00	1
1,1-Dichlororethylene	µg/L	7	1.00	Monthly		<1.00	1		<1.00	1		<1.00	1
cis-1,2-Dichloroethylene	µg/L	70	1.00	Monthly		<1.00	1		<1.00	1		<1.00	1
trans-1,2-Dichloroethylene	µg/L	100	1.00	Monthly		<1.00	1		<1.00	1		<1.00	1
Dichloromethane	µg/L	5	1.00	Monthly		<1.00	1		<1.00	1		<1.00	1
1,2-Dichloropropane	µg/L	5	1.00	Monthly		<1.00	1		<1.00	1		<1.00	1
Ethylbenzene	µg/L	700	1.00	Monthly		<1.00	1		<1.00	1		<1.00	1
Ethylene Dibromide (EDB)	µg/L	0.05	0.02	Monthly		<0.02	1		<0.02	1		<0.02	1
Styrene	µg/L	100	1.00	Monthly		<1.00	1		<1.00	1		<1.00	1
Tetrachloroethylene	µg/L	5	1.00	Monthly		<1.00	1		<1.00	1		<1.00	1
Toluene	µg/L	1,000	1.00	Monthly		<1.00	1		<1.00	1		<1.00	1
1,2,4-Trichlorobenzene	µg/L	70	1.00	Monthly		<1.00	1		<1.00	1		<1.00	1
1,1,1-Trichloroethane	µg/L	200	1.00	Monthly		<1.00	1		<1.00	1		<1.00	1
1,1,2-Trichloroethane	µg/L	5	1.00	Monthly		<1.00	1		<1.00	1		<1.00	1
Trichloroethylene	µg/L	5	1.00	Monthly		<1.00	1		<1.00	1		<1.00	1
Vinyl Chloride	µg/L	2	1.00	Monthly		<1.00	1		<1.00	1		<1.00	1
Total Xylene	µg/L	10,000	1.00	Monthly		<1.00	1		<1.00	1		<1.00	1
Perfluorooctanoic Acid (PFOA)	ng/L	4	2.00	Quarterly		<2.00	1		<2.00	1		<2.00	1
Perfluorooctanesulfonic Acid (PFOS)	ng/L	4	2.00	Quarterly		<2.00	1		<2.00	1		<2.00	1

Parameter	Units	Maximum Contaminant Level (MCL) or MCL Goal (MCLG) where numerical MCL not expressed. Values noted for indicator compounds are non-regulatory screening values	Minimum Report Level[1]	Required Monitoring Frequency	January 2025			February 2025			March 2025		
					Average[2]	Maximum	Number of Samples	Average[2]	Maximum	Number of Samples	Average[2]	Maximum	Number of Samples
Organic Chemicals (Cont.)													
Perfluorohexanesulfonic acid (PFHxS)	ng/L	10*	2.0	Quarterly		<2.0	1		<2.0	1		<2.0	1
Perfluorononanoic acid (PFNA)	ng/L	10*	2.0	Quarterly		<2.0	1		<2.0	1		<2.0	1
Hexafluoropropylene oxide dimer acid (HFPO-DA)	ng/L	10*	2.0	Quarterly		<2.0	1		<2.0	1		<2.0	1
Perfluorobutanesulfonic acid (PFBS)	ng/L	2000*	2.0	Quarterly		<2.0	1		2.1	1		3.8	1
Radionuclides													
Alpha particles	pCi/L	15	4.39^	Monthly		<4.19 (U G)	1		<4.16 (U G)	1		<4.39 (U G)	1
Beta particles and photon emitters	pCi/L	4 mrem/yr[6]	1.73^	Monthly		9.25	1		7.55	1		9.23	1
Radium 226	pCi/L	5 (226+228)	0.313^	Monthly		<0.116 (U)	1		<0.210 (U)	1		<0.313 (U)	1
Radium 228	pCi/L	5 (226+228)	0.792^	Monthly		<0.632 (U)	1		<0.792 (U)	1		<0.590 (U)	1
Uranium	µg/L	30	0.10	Monthly		<0.10	1		<0.10	1		<0.10	1
Strontium-90	pCi/L	NA	0.36^	Monthly		<0.360 (U)	1		<0.335 (U)	1		1.74	1
Tritium	pCi/L	NA	388^	Monthly		<388 (U)	1		<362 (U)	1		<351	1
Non-regulatory Performance Indicators													
Public Health Indicators		**Trigger Limits**											
1,4-dioxane	µg/L	1	0.03	Quarterly	0.14	0.14	1	0.11	0.12	4	0.10	0.12	3
17-β-estradiol	ng/L	0.9	10	Quarterly		<10	1		<10	1			
DEET	ng/L	200,000	10	Quarterly		<10	1						
Ethinyl estradiol	ng/L	280	10	Quarterly		<10	1		<10	1			
Tris(2-carboxyethyl)phosphine (TCEP)	ng/L	5,000	10	Quarterly		<10	1						
NDMA	ng/L	10	2.00	Quarterly		<2.00	1		<2.00	1		<2.00	1
Perchlorate	µg/L	6	0.50	Quarterly		0.54	1						
Treatment Efficacy Indicators		**Trigger Limits**											
Cotinine	ng/L	1,000	5.0	Quarterly		<5.0	1						
Primidone	ng/L	10,000	5.0	Quarterly		<5.0	1						
Phenytoin (Dilantin)	ng/L	2,000	10	Quarterly		<10	1		<10	1		<10	1
Meprobamate	ng/L	200,000	5.0	Quarterly		<5.0	1						
Atenolol	ng/L	4,000	5.0	Quarterly		<5.0	1						
Carbamazepine	ng/L	10,000	5.0	Quarterly		<5.0	1						
Estrone	ng/L	320	5.0	Quarterly		<5.0	1		<5.0	1			
Sucralose	ng/L	150,000,000	100	Quarterly		130	1		170	1		530	1
Triclosan	ng/L	210,000	50	Quarterly		<50	1		<50	1		<50	1

Parameter	Units	Maximum Contaminant Level (MCL) or MCL Goal (MCLG) where numerical MCL not expressed. Values noted for indicator compounds are non-regulatory screening values	Minimum Report Level[1]	Required Monitoring Frequency	January 2025			February 2025			March 2025		
					Average[2]	Maximum	Number of Samples	Average[2]	Maximum	Number of Samples	Average[2]	Maximum	Number of Samples
Additional Monitoring (Ozone & UV LRV)					**Average**	**Minimum**		**Average**	**Minimum**		**Average**	**Minimum**	
Ozone Virus LRV				Continuous	4.57	3.73		4.66	3.82		4.56	3.62	
Ozone Giardia LRV				Continuous	2.25	1.85		2.27	1.86		2.28	1.80	
UV Dose Reactor 1	mJ/cm^2			Continuous	>186	>186		>186	>186		>186	>186	
UV Virus LRV Reactor 1				Continuous	>4	>4		>4	>4		>4	>4	
UV Dose Reactor 2	mJ/cm^2			Continuous	>186	>186		>186	>186		>186	>186	
UV Virus LRV Reactor 2				Continuous	>4	>4		>4	>4		>4	>4	

[1] When minimum reporting limits varied during the quarter, the highest minimum reporting limit used is identified.

[2] Analytical results less than the reporting limit were treated as zero for the purposes of the averaging calculation.

[3] Daily samples are typically not collected on days in which recharge is not occurring or has ceased prior to sample collection. TOC sample collection occurs routinely on Monday through Friday when recharging. Limited or inconsistent recharge impacts the collection of daily samples, particularly for the microbiological samples collected for total coliform and E coli which have limited holding time requirements. In January, limited or no recharge impacted 27 days of sampling. In February, limited or no recharge impacted 11 days of sampling. In March, limited or no recharge impacted 11 days of sampling. There was one additional day in which NO_2, NO_3, Total Coliform, and E.coli were missed due to sample handling error. This error is being investigated to prevent future oversights.

[4] TDS of the Potomac Aquifer System is based on the averages within the upper, middle and lower Potomac Aquifer as determined during baseline monitoring.

[5] The maximum residual disinfectant level (or MRDL) MCL for monochloramine and chlorine are based on annual averages.

[6] The measurement unit for beta particles and photon emitters is pCi/L while the MCL is expressed as mrem/yr. Per EPA's Implementation Guidance for Radionuclides (EPA 816-F-00-002, March 2002), the screening threshold for beta particles and photon emitters is 50 pCi/L. If sample concentrations exceed 50 pCi/L, each individual beta particle and photon emitter is converted from pCi/L to mrem using the EPA designated conversion tables, currently available in the referenced document.

* The EPA set a Hazard Index MCL (unitless) based on the additive health effects when two or more of these four compounds are present together. Compliance with the Hazard Index MCL is determined by a running annual average. The annual average Hazard Index must be < 1. For specifics on the calculation, please refer to EPA's Fact Sheet "Understanding the Final PFAS National Primary Drinking Water Regulation Hazard Index Maximum Contaminant Level". The current Hazard Index was calculated beginning in April 2024 is 0.0. Note that EPA did not establish an independent MCL for PFBS. The value noted for PFBS is a health-based threshold.

^ MDC - Minimum Detectable Concentration (Radiochemistry).

Contract Laboratory Flags:
OR6 : > 50% Difference between analytical and confirmation GC columns. Lower value is reported.
U : Result is less than the sample detection limit.
G : The sample MDC is greater than the requested RL.