Ministry of Municipal Affairs and Housing

University Endowment Lands

2024 Drinking Water Quality Monitoring Report

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EXECUTIVE SUMMARY

The University Endowment Lands (UEL) implemented a Drinking Water Quality Monitoring Program in 2002. The UEL adopted the Water Quality Monitoring and Reporting Plan developed by the Greater Vancouver Regional District (GVRD), its member municipalities, and the region's Medical Health Officers. With this approved monitoring program in place, the UEL has collected and analyzed water quality data since 2002. This report provides an outline of the program and its water quality testing results for the year 2024.

The implementation of the Drinking Water Quality Monitoring program continues to be a significant commitment by the UEL to monitor the delivery of safe and high-quality water. It generates valuable data for gaining an understanding of the UEL's water distribution system and for evaluating the historic performance of the system in a reliable and systematic way. Most importantly, it allows for potential health hazards to be identified and consumers' water concerns to be addressed.

The sampling analysis demonstrates that during 2024, all 162 samples taken met the bacteriological standards set out in the *British Columbia Drinking Water Protection Act* (BCDWPA) and the *British Columbia Drinking Water Protection Regulation* (BCDWPR). Additionally, all but two (2) samples of the 162 samples taken met the health standards specified in the *Guidelines for Canadian Drinking Water Quality* (GCDWQ). These GCDWQ exceedances were two turbidity results. All subsequent samples fell within acceptable turbidity levels.

The UEL is committed to delivering water of the highest quality and will continue to make the necessary effort to ensure its continued success.

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1.0 INTRODUCTION

In 2002, the University Endowment Lands (UEL) implemented a Drinking Water Quality Monitoring Program to monitor the delivery of safe and high-quality water. This annual Water Quality Monitoring Report is required under the program and as a requirement of the *British Columbia Drinking Water Protection Act* (BCDWPA).

The provision of drinking water is governed by the *British Columbia Drinking Water Protection Regulation* (BCDWPR), pursuant to the BCDWPA. This regulation requires drinking water suppliers in BC to:

- Develop a protocol to notify the Drinking Water Officer (DWO) of situations or conditions that render or could render the water unsuitable to drink.
- Implement a plan for collecting, shipping, and analyzing water samples in compliance with the standards set by the DWO.
- Implement a plan for reporting monitoring results to the DWO and to water users, including the preparation of an annual report.

In 2024, the UEL operated ten (10) sampling stations, as shown in the map provided in Appendix A. One (1) of these stations (S-W) underwent bi-monthly testing to assess the quality of the water supply sourced from the emergency well located at the UEL Public Works Yard.

The remaining nine (9) sampling stations were dedicated to monitoring water quality in the UEL's water distribution system.

Seven (7) stations (S-A, S-B, S-D, S-E, S-F, S-G, S-J) were sampled fortnightly. Summary results are displayed in Table 6. A graphic summary of the fortnightly test results for 2024 can be found in Appendix B. Of these stations, two (2) stations (S-B and S-E) were also sampled quarterly for disinfection by-products and pH. Results are displayed in Table 8.

Two (2) stations (S-C and S-H) underwent biannual testing to measure the total concentration of various metals in the distribution system. Results are summarized in Table 9.

Additional samples were collected from stations S-A and S-C to analyze vinyl chloride concentrations. Kerr Wood Leidal completed the biannual sampling of vinyl chlorides at stations S-A and S-C.

This document provides an overview of the UEL's water distribution system, along with its drinking water monitoring and testing program. Furthermore, it consolidates the analyses and outcomes from water samples gathered in 2024, while also evaluating the distribution system's efficacy in ensuring the delivery of safe drinking water.

2.0 WATER DISTRIBUTION SYSTEM

The UEL is responsible for the installation, operation, and maintenance of its water distribution system which includes: 24 km of watermains, 640 service connections, 523

water meters, 97 hydrants, 295 open line valves, 15 closed valves, and two pressure reducing valve stations.

The UEL sources water from Metro Vancouver through two (2) supply points: one (1) located at Blanca Street and West 16th Avenue, and the other located at Drummond Drive and West 6th Avenue. Water is then supplied to the UEL's customers through its distribution system. The UEL also supplies water to the University of British Columbia (UBC) through two (2) connection points: one (1) located at Wesbrook Mall and University Boulevard, and the other located at West 16th Avenue between Blanca Street and Wesbrook Mall. The UEL has adopted a comprehensive watermain replacement program and an operations and maintenance (O&M) program for the water distribution system to ensure the highest quality water is delivered in ample quantity and pressure to its customers.

The watermain replacement program systematically replaces aging infrastructure in the water distribution system to ensure the system continues to meet the needs of the UEL. In 2024, the UEL replaced 200 m of aging Ø150 ductile iron (DI) watermain with new Ø200 polyvinyl chloride (PVC) watermain along NW Marine Drive, and 272m of aging Ø300 asbestos cement (AC) watermain with new Ø300 PVC watermain along Western Parkway. Looking forward to 2025, the following water main replacement projects have been identified for Construction.

Table 1. 2025 Watermain Replacement Program

DESCRIPTION	STATUS
Replacement of Ø300mm cast iron watermain on University Boulevard (from Cleveland Trail to Allison Rd.)	Construction 2025
Replacement of Ø200mm cast iron watermain on Hamber Road	Construction 2025

The UEL's O&M program includes an annual watermain unidirectional flushing (UDF) program, a hydrant inspection and maintenance program, a comprehensive cross connection control program, and the Drinking Water Quality Monitoring Program. The watermain UDF program was conducted between May 21st and June 24th in 2024. The UEL intends to continue the watermain UDF program on an annual basis.

There are 494 total cross connection control backflow devices registered in the UEL with 325 from single family dwellings and 169 from multi-family or commercial land uses. Test reports are required to be submitted annually proving the devices have been tested and meet the required standards. The UEL insists on compliance with their cross-connection control bylaw with letters of non-compliance being issued to addresses delinquent in submitting inspection reports.

In 2024, there was a total compliance rate of 78% as shown in Table 2. Compared to 2023, there was a 56% increase in overall compliance. The increase in compliance could be associated with the UEL sending out reminder letters and subsequently following up with delinquent accounts during the summer.

Table 2. Cross Connection Control Backflow Devices

AREA	INSTALLED	TESTED	OUTSTANDING	COMPLIANCE (%)
Single Family	325	260	65	80
Multi-Family/ Commercial	169	127	42	75
Total	**494**	**387**	**107**	**78**

3.0 TESTING AND MONITORING PROGRAM

Drinking water quality is a function of source water quality, water treatment and water quality changes after treatment. As a result, monitoring of drinking water quality consists of three (3) components: source water monitoring, monitoring after treatment, and monitoring in the distribution system. While Metro Vancouver carries out testing of water at the source and after treatment, the UEL's Drinking Water Quality Monitoring Program focuses on monitoring the water quality within its own water distribution system.

The monitoring and testing program consists of routine monitoring (for obtaining an accurate overview of water quality within the distribution system), and non-routine monitoring (for handling complaint and emergency situations). Monitoring involves three (3) components: the collection of samples, the laboratory analyses of those samples, and the review and analysis of the results by the UEL, Metro Vancouver, and Vancouver Coastal Health (VCH).

3.1 Routine Monitoring

Samples were collected from sampling stations within the UEL on a regular basis and then forwarded to laboratories for various analyses. The collection, transportation, and analysis of the samples were performed in accordance with the *Standard Methods for the Examination of Water and Wastewater 23rd Edition*, 2017, published by the American Public Health Association, the American Water Works Association, and the Water Environment Federation. All analyses were conducted by laboratories accredited by the Canadian Association of Environmental Analytical Laboratories or an equivalent certification program for the other tests performed, as approved by the Provincial Health Officer.

All testing parameters except vinyl chloride were analyzed by the laboratories of Metro Vancouver. Analysis of vinyl chloride, a volatile organic compound, was tested by Kerr Wood Leidal in 2024.

3.1.1 Sampling Parameters

The parameters that were analyzed are summarized in Table 3.

Table 3. Sampling Parameters

PARAMETERS	
Microbiological	Total Coliforms, Escherichia Coli, Heterotrophic Plate Count (HPC)
Chemical and Physical	Turbidity, Temperature, Free Chlorine Residual, pH, Aluminum, Antimony, Arsenic, Barium, Boron, Cadmium, Calcium, Chromium, Cobalt, Copper, Iron, Lead, Magnesium, Manganese, Mercury, Molybdenum, Nickel, Potassium, Selenium, Silver, Sodium, Zinc, Haloacetic Acids (HAAs), Trihalomethanes (THMs), Vinyl Chloride

The most relevant parameters are briefly discussed below. Further details regarding the parameters listed in the above table can be found by accessing the supporting documents

of the *Guidelines for Canadian Drinking Water Quality* (GCDWQ) through the following web site or by contacting Health Canada at **(613) 957-2991.**
https://www.canada.ca/en/health-canada/services/environmental-workplace-health/water-quality/drinking-water/canadian-drinking-water-guidelines.html

Total Coliforms

One of the primary concerns in water quality is the growth of coliform bacteria. The presence of coliforms indicates a possibility of regrowth of the bacteria in biofilms or the intrusion of untreated water.

Escherichia Coli (E. coli)

E. coli is used as an indicator of microbiological safety of drinking water; if detected, enteric pathogens may also be present. *E. coli* monitoring is used, in conjunction with other indicators, as part of a multi-barrier approach to producing drinking water at an acceptable quality.

Heterotrophic Plate Counts

Heterotrophic Plate Counts (HPC) are a useful operational tool for monitoring general bacteriological water quality through the treatment process and in the distribution system. HPC results are not an indicator of water safety and should not be used as an indicator of potential adverse human health effects. Increases in HPC concentrations above baseline levels are considered undesirable.

Free Chlorine Residual

Chlorine is the most commonly used drinking water disinfectant. As such, free chlorine residual provides a good indication of water quality within the distribution system. Low chlorine residual may indicate deteriorating water quality as a result of bacterial regrowth or stagnant water.

Turbidity

Turbidity in distribution systems is caused by naturally occurring particles consisting of inorganic and organic matter. Controlling turbidity is important for both health and aesthetic reasons. Bacteria, viruses, and protozoa can adhere to suspended particles in turbid water and interfere with disinfection. Excessive turbidity detracts from the appearance of treated water and has often been associated with unacceptable tastes and odours.

Disinfection By-products

Haloacetic acids (HAAs) and Trihalomethanes (THMs) are disinfection by-products (DBPs) and are formed in drinking water when chlorine reacts with organic matter that is naturally present in raw water supplies. Research suggests that HAAs have an adverse impact on human health and may possibly be carcinogenic. The most common THM is chloroform which is classified as being possibly carcinogenic. DBPs are maintained as low as possible without compromising the effectiveness of disinfection.

pH

pH is used as a measure of the acidity and basicity of water. pH is monitored in a distribution system because at low values water becomes corrosive while at high levels

chlorine disinfection is less effective and efficient. Health Canada guidelines state an optimal pH between 7.0 and 10.5.

Copper

Copper is used extensively in plumbing for domestic water systems. Although copper is frequently found in surface water, distributed water contains considerably more copper than the original water supply because of the dissolution of copper from copper piping. Copper can stain laundry and plumbing fixtures and cause an undesirable bitter taste in water. Copper intake at extremely high doses can result in adverse health effects.

Iron

Iron is naturally present in food and drinking water. However, there is no evidence to indicate that concentrations of iron commonly found in food or water constitute any hazard to human health. Iron can stain laundry and plumbing fixtures and cause undesirable tastes in beverages. The precipitation of excessive iron imparts an objectionable reddish-brown color to the water. Iron may also promote the growth of certain microorganisms, which can lead to the deposition of a slimy coat in piping.

Lead

Lead was used in drinking water plumbing and as solder in distribution systems. Older distribution systems may also be made from lead pipe or appurtenances. Lead is present in tap water as a result of dissolution from natural sources or from household plumbing systems. Lead is a cumulative general poison and has been classified as being potentially carcinogenic to humans. Fetuses, infants, young children, and pregnant women are most susceptible to adverse health effects caused by lead. In order to minimize exposure to lead introduced into drinking water from plumbing systems, it is recommended that only cold water be used, after an appropriate period of flushing to rid the system of standing water, for sampling, drinking, beverage preparation, and cooking.

Vinyl Chloride

The presence of vinyl chloride in potable water is associated mainly with the use of polyvinyl chloride (PVC) water pipes manufactured with incompletely polymerized vinyl chloride monomer. Acute exposure or chronic inhalation results in a variety of adverse effects in humans. Sufficient evidence has accumulated to implicate vinyl chloride as a human and animal carcinogen.

Zinc

Although zinc is present in surface waters at low concentrations, levels in domestic water systems can be considerably higher because of the use of zinc in plumbing materials. Water containing zinc in excessive concentrations has an undesirable astringent taste and may develop a greasy film upon boiling. Long-term ingestion of zinc in excess of the daily requirement has not shown to result in adverse effects.

3.1.2 Sampling Locations

Sampling locations are distributed in different areas within the UEL to obtain an accurate overview of water quality in the distribution system. Nine (9) locations were strategically selected based on land use and system configuration.

The sampling station supply types include:

- residential area supply;
- high-density residential area supply;
- institutional area supply; and,
- water source supply.

Sampling stations are summarized in Table 4 below and locations are illustrated in Appendix A.

Table 4. Drinking Water Sampling Stations

STATION	LOCATION	FLOW CATEGORY	SUPPLY TYPE
S-A	Drummond Dr. & W. 6th Ave.	Source	Water Source / Residential
S-B	Wycliffe Rd. & Tasmania Cres.	Low Flow	Residential
S-C[1,2]	Norma Rose Elementary	Service Connection	Institutional
S-D	Acadia Rd. & Toronto Rd.	Source	Water Source / High-Density Residential
S-E	Western Pkwy. South of Chancellor Blvd.	Medium Flow	Residential
S-F	NW Marine Dr. at the UEL boundary	Low Flow	Residential
S-G	Chancellor Blvd. East of Acadia	Medium Flow	Institutional
S-H[1]	University Hill Elementary	Service Connection	Institutional
S-J	East Side of NW Marine Dr.	Low Flow	Residential
S-W	Emergency Water Well at the UEL Public Works Yard	Source	Emergency

[1] Stations are taps located within schools. These stations are not used for weekly sampling.
[2] Norma Rose Elementary School is serviced through the UBC water distribution system.

3.1.3 Sampling Frequency

The UEL, as a purveyor of drinking water to a population of less than 5,000, is required to test at least four (4) samples per month as outlined in *Schedule B* of the BCDWPR. During 2024, the UEL tested twice the minimum required number of samples. The sampling frequency of different parameters from different sampling locations is summarized in Table 5.

Table 5. Sampling Frequency

FREQUENCY	FORTNIGHTLY	FOUR SAMPLES PER YEAR	TWO SAMPLES PER YEAR[1]	TWO SAMPLES PER MONTH
PARAMETERS	Total coliforms *E. Coli* HPC Free chlorine residual Turbidity Temperature	Haloacetic Acids pH Trihalomethanes	Aluminum Antimony Arsenic Barium Boron Cadmium Calcium Chromium Cobalt Copper Iron Lead Magnesium Manganese Mercury Molybdenum Nickel Potassium Selenium Silver Sodium Zinc Vinyl Chloride	Turbidity HPC Total Coliforms *E. Coli* Temperature
STATION NAMES	S-A, S-B, S-D, S-E, S-F[2], S-G, S-J	S-B, S-E	S-A, S-C, S-H	S-W
STATION CATEGORIES	Residential Areas	Residential Areas	Residential Areas & Taps in Building	Emergency

Notes: [1]S-A and S-C were sampled for vinyl chlorides while S-C and S-H were sampled for metals.
[2]S-F was not sampled in September or October and was only sampled once in August and November due to watermain installation on NW Marine Dr.

3.2 Non-routine Monitoring

A laboratory was on-call for monitoring for complaint and emergency situations. Consumer complaints were recorded so that water quality concerns could be tracked and responded to efficiently. In any emergency, the procedures outlined in the UEL Emergency Response Plan would be followed.

4.0 SAMPLE ANALYSIS RESULTS

A total of 162 samples were taken from the water distribution system to measure the weekly testing parameters shown in Table 5. Sample analysis results are summarized in Table 6 below and some of the parameters worth noting are discussed in this section. Detailed sample analysis results can be found in Appendix B. It is important to note that the limits specified in the GCDWQ are recommendations only and representative of best practices. These can become requirements if the DWO places a condition on the Operating Permit for the UEL. At present, there are no such DWO conditions placed on the UEL.

Table 6. Summary of Analysis Results

Sample Station	No. of Samples	HPC (CFU/mL)			Free Chlorine Residual (mg/L)			Turbidity (NTU)			Positive Coliform Tests	Positive *E. coli* Tests
		Low	Avg	High	Low	Avg	High	Low	Avg	High		
S-A	24	<2	2	4	0.45	0.54	0.73	0.09	0.14	0.24	none	none
S-B	24	<2	15	72	0.03	0.44	0.75	0.10	0.14	0.29	none	none
S-D	24	<2	5	60	0.55	0.65	1.26	0.10	0.19	0.56	none	none
S-E	24	<2	3	12	0.40	0.57	1.11	0.10	0.16	0.57	1	none
S-F	18	<2	28	220	0.16	0.39	0.69	0.10	0.32	2.70	none	none
S-G	24	<2	28	100	0.16	0.41	1.00	0.08	0.14	0.53	none	none
S-J	24	<2	4	20	0.23	0.56	1.76	0.10	0.30	3.20	none	none
Total	162		12			0.51			0.20		1	0

Total average values calculated using all samples collected in 2024 from all stations.

Total Coliforms

For total coliforms, the BCDWPR requires that 1) when there is one (1) sample in a 30-day period, the sample contains no total coliform bacteria per 100 mL and that 2) when there is more than one (1) sample in a 30-day period, at least 90% of samples have no detectable total coliform bacteria per 100 mL and no sample has more than 10 total coliform bacteria per 100 mL. Of the 162 samples tested for total coliforms, one (1) sample tested positive for total coliforms but more than 90% of samples taken in every 30-day period had no detectable total coliform per 100 mL.

The date and location of the sample that tested positive for total coliforms was September 18th from station S-E. The sample result was 2 CFU/100mL. This does not exceed the BCDWPR requirement of no sample having more than 10 total coliform bacteria. The next sample from station S-E on September 25th did not show any positive coliform tests.

E. coli

For *E. coli*, the BCDWPR requires that the samples contain no detectable colonies per 100 mL. No *E. coli* colonies were detected in the 162 samples analysed for microbiological criteria in 2024.

Heterotrophic Plate Count, HPC

The GCDWQ does not indicate a maximum acceptable concentration of HPC and instead states that unexpected increase outside the baseline range could indicate a change in the treatment process, a disruption or contamination in the distribution system, or a change in

the general bacteriological quality of the water. However, the National Primary Drinking Water Regulations (established by the United States Environmental Protection Agency), note that concentration in drinking water should be maintained below 500 CFU/mL to aid in the better maintenance of the treatment and distribution systems. In 2024, all 162 samples tested for HPC indicated levels below 500 CFU/mL.

Turbidity

The GCDWQ recommends that turbidity levels of no more than 1.0 Nephelometric Turbidity Units (NTU) be present for water entering the distribution system. Maintaining an NTU below 1.0 minimizes the potential for interference with disinfection and allows for adequate operation of the distribution system. Of the 162 samples tested for turbidity, two (2) samples measured greater than 1.0 NTU. Subsequent samples came back with turbidity readings lower than 1.0 NTU.

Free Chlorine Residual

Table 7 displays the percentage of samples for each station with a free chlorine residual less than 0.2 mg/L, while Appendix B shows individual results in tabular form. From 2023 to 2024, samples containing less than 0.2 mg/L of chlorine increased from 4% to 8% at station S-B, from 0% to 11% at station S-F, and from 0% to 8%. At station S-B on November 28th 2024 the free chlorine residual was measured at 0.03 mg/L, lower than the 0.04 mg/L threshold stated in GCDWQ. These stations will be monitored during 2025 to determine the causation of the lower chlorine residuals and whether any measures need to be taken. Station S-J had no samples containing less than 0.2 mg/L of chlorine, a decrease from 4% of samples in 2023.

Table 7. Summary of Free Chlorine Residual Results

Sample Station	Free Chlorine Residual
	% Of Samples <0.2 mg/L
S-A	0%
S-B	8%
S-D	0%
S-E	0%
S-F	11%
S-G	8%
S-J	0%

Disinfection By-products and pH

Two (2) sample stations, S-B and S-E were also tested for disinfection by-products and pH quarterly. Table 8 displays the analysis results.

Table 8. Disinfection By-products and pH Analysis Results

		THM (ppb)							HAA (ppb)						
Sample Location	**Sample Date**	**Bromodichloromethane**	**Bromoform**	**Chlorodibromomethane**	**Chloroform**	**Total Trihalomethanes**	**[1]Total THM Quarterly Running Annual Average**	**Dibromoacetic Acid**	**Dichloroacetic Acid**	**Monobromoacetic Acid**	**Monochloroacetic Acid**	**Trichloroacetic Acid**	**Total Haloacetic Acid**	**[1]Total HAA Quarterly Running Annual Average**	**pH**
S-B	30-Jan-24	<1	<1	<1	25	26	25	<0.5	9.0	<0.5	<0.5	11.0	20	18	8.0
S-B	26-Apr-24	<1	<1	<1	33	34	28	<0.5	8.4	<0.5	0.9	8.1	17	18	7.9
S-B	18-Sep-24	2	<1	<1	32	34	31	<0.5	5.6	<0.5	<0.5	6.8	12	17	8.1
S-B	28-Nov-24	<1	<1	<1	47	48	36	<0.5	1.7	<0.5	<0.5	11.0	13	16	8.3
S-E	30-Jan-24	<1	<1	<1	21	21	23	<0.5	11.0	<0.5	<0.5	8.3	19	19	8.0
S-E	26-Apr-24	<1	<1	<1	27	28	24	<0.5	12.0	<0.5	0.9	6.5	19	18	7.8
S-E	18-Sep-24	1	<1	<1	23	25	24	<0.5	8.9	<0.5	1.1	4.7	15	18	7.7
S-E	28-Nov-24	<1	<1	<1	28	29	26	<0.5	11.0	<0.5	<0.5	9.0	20	18	7.9

Average values for each station calculated by taking the average of the current and three previous quarters.

Both stations S-B and S-E meet the GCDWQ recommendation for the running annual average of quarterly samples for THM of 100 ppb (0.1 mg/L) and for HAA of 80 ppb (0.080 mg/L). The maximum THM concentrations sampled were 48 ppb (0.048 mg/L) and 29 ppb (0.029 mg/L) for stations S-B and S-E, respectively. The maximum HAA concentration sampled was 20 ppb (0.020 mg/L) for both stations S-B and S-E.

pH levels at both stations S-B and S-E were within the GCDWQ recommended range of 7.0 to 10.5 for water treatment related objectives.

Vinyl Chloride

Vinyl chloride concentration was tested twice in 2024, with the samples taken from stations S-A and S-C on June 12th and November 22nd. During sample testing, the vinyl chloride concentration was below 1 ppb (0.001 mg/L) on both occasions, which meets the recommendation from GCDWQ of less than 2 ppb (0.002 mg/L).

Metals

Two (2) sample locations, stations S-C and S-H, were tested twice for total concentration of various metals in 2024. Analysis results are presented below in Table 9, measured in µg/L (ppb or 0.001 mg/L). All metals with recommended limits, fall below the limits outlined in the GCDWQ.

Table 9. Metals Analysis Results

Sample Station		S-C		S-H		GCDWQ	
Sampled date		2024-05-17	2024-10-11	2024-05-17	2024-10-11	Health Guideline	Operational or Aesthetic Objective
Total Concentration (µg/L)	Aluminum	25	24	37	55	2900	100
	Antimony	<0.5	<0.5	<0.5	<0.5	6	n/a
	Arsenic	<0.5	<0.5	<0.5	<0.5	10	n/a
	Barium	2.9	3.3	2	2.2	2000	n/a
	Boron	<10	<10	<10	<10	5000	n/a
	Cadmium	<0.2	<0.2	<0.2	<0.2	7	n/a
	Calcium	8560	7960	9390	9620	n/a	n/a
	Chromium	0.08	<0.05	0.14	0.16	50	n/a
	Cobalt	<0.5	<0.5	<0.5	<0.5	n/a	n/a
	Copper	43.7	43	1.6	2.5	2000	1000
	Iron	9	12	11	19	n/a	≤100
	Lead	<0.5	<0.5	<0.5	<0.5	5	n/a
	Magnesium	219	286	167	183	n/a	n/a
	Manganese	1.6	8.7	1.3	6.9	120	≤20
	Mercury	<0.05	<0.05	<0.05	<0.05	1	n/a
	Molybdenum	<0.5	<0.5	<0.5	<0.5	n/a	n/a
	Nickel	<0.5	<0.5	<0.5	<0.5	n/a	n/a
	Potassium	151	235	170	232	n/a	n/a
	Selenium	<0.5	<0.5	<0.5	<0.5	50	n/a
	Silver	<0.5	<0.5	<0.5	<0.5	n/a	n/a
	Sodium	1600	2250	1670	2390	n/a	≤200,000
	Zinc	<3.0	<3.0	<3.0	<3.0	n/a	≤5000

5.0 EMERGENCY WATER SUPPLY

In 2019, the UEL started working on the commissioning and permitting process of the emergency water supply well located at the UEL Works Yard, as part of their commitment to emergency preparedness and planning. This work was based on recommendations from the UEL and was informed by the *Regional Temporary Provision of Drinking Water Guideline*, developed by the Metro Vancouver Regional Engineers Advisory Committee (REAC).

The purpose of the well is to supply water to residents in the event that the distribution system is inoperable. As part of the UEL's Water Provision Emergency Plan, the UEL plans to supply a minimum of 4 L of potable water per person per day in the immediate aftermath of a disaster, increasing to 10 L per day in the weeks following a disaster until the regular water supply is restored. The water would be supplied to residents through filling of individual containers at the UEL Work's Yard or if needed through community distribution points.

The well was initially constructed in March/April 2019 with compliance testing, as directed by DWO, completed in November 2021. The well is part of the UEL's Water Utility Emergency Plan and Water Provision Emergency Plan which have been approved by the DWO. An application has also been made to register the well under the Water Sustainability Act.

None of the samples collected in 2024 tested positive for bacteriological contamination. However, all except four (4) samples had turbidity levels of at least 1.0 NTU and two (2) of the samples collected had HPC levels above 500 CFU/mL.

The results of the testing are presented in Appendix C.

6.0 SUMMARY

The UEL implemented a Drinking Water Quality Monitoring Program in 2002 per requirements of BCDWPA and BCDWPR, and based on the standard program adopted by Metro Vancouver member municipalities and input from Vancouver Coastal Health (VCH). With this approved monitoring program in place, the UEL has collected and analyzed water quality data since 2002.

The implementation of the Drinking Water Quality Monitoring program is a significant commitment made by the UEL to deliver safe water to its consumers. It generates valuable data for gaining an understanding of the UEL's water distribution system and for evaluating the past performance of the system in a reliable and systematic way. Most importantly, it allows for potential health hazards to be identified and consumers' water concerns to be addressed.

The watermain replacement program systematically replaces aging infrastructure in the water distribution system to ensure the system continues to meet the needs of the UEL's residents. In 2024, the UEL replaced 200 m of aging ductile iron watermain with PVC watermain, 270 m of aging AC watermain with PVC watermain, and 90 m of aging steel watermain with PVC watermain.

A unidirectional flushing (UDF) program is conducted annually. This helps reduce the risk of sediment and corrosion by-products that build up in the watermains producing turbidity. Unidirectional flushing can help reduce the habitats where bacteria grow but does not address the underlying reasons for the bacterial growth or loss of disinfectant residual.

The UEL cross connection control program relies on user compliance. In 2024, 78% of all the registered devices were tested and proven to be functioning as intended to protect the public water system from contamination. The UEL requests compliance through their cross-connection control bylaw. In 2025, the UEL plans to continue their enforcement efforts through proactive issuance of notices and warning letters of non-compliance to properties that do not submit inspection reports.

The sampling analysis demonstrates that during 2024, all 162 fortnightly samples taken met the bacteriological standards set out in the BCDWPR pursuant to the BCDWPA. Additionally, all but two (2) of the 162 samples taken met the health recommendations specified in the GCDWQ . These GCDWQ exceedances were two turbidity results as outlined in Section 4.0. All subsequent samples fell within acceptable turbidity levels. The UEL will monitor the samples during 2025 and will react if results flag a potential issue in the system. The UEL is committed to delivering water of the highest quality and will continue to make the necessary effort to ensure its continued success.

As part of the UEL's Water Utility Emergency Plan and Water Provision Emergency Plan, the UEL has constructed an emergency potable water supply well to be used following a disaster that renders the piped water distribution system inoperable. The well is maintained and kept active throughout the year through different uses at the UEL Public Works Yards. Water quality samples are taken twice a month. The testing results returned no positive bacteriological contaminations, but out of the 23 samples taken, HPC levels of two (2) samples and turbidity levels of 19 samples exceeded the recommended maximum levels of 500 CFU/100 mL for HPC and 1.0 NTU for turbidity.

REFERENCES

British Columbia Drinking Water Protection Regulation. *British Columbia Drinking Water Protection Act* Reg. 47/2024, 2024

B.C. Guidelines (Microbiological) on Maintaining Water Quality in Distribution Systems. Drinking Water Officers' Guide 2024 – Part B: Section 7, February 23, 2024

Guidelines for Canadian Drinking Water Quality – Health Canada, March 2025 <https://www.canada.ca/en/health-canada/services/environmental-workplace-health/reports-publications/water-quality/guidelines-canadian-drinking-water-quality-summary-table.html>

National Primary Drinking Water Regulations – US Environmental Protection Agency, December 12, 2024 <https://www.epa.gov/ground-water-and-drinking-water/national-primary-drinking-water-regulations>

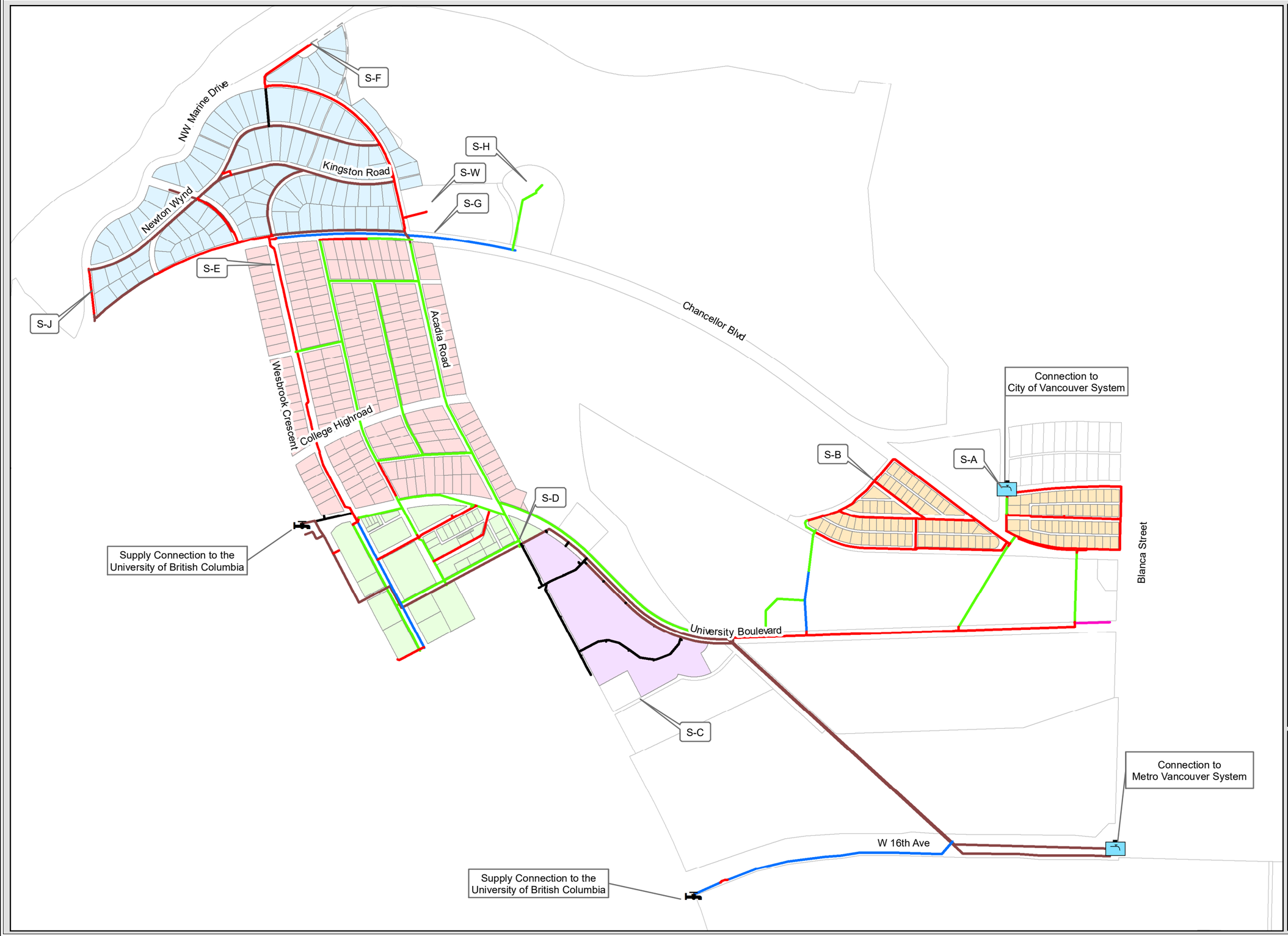
Regional Temporary Provision of Drinking Water Guideline - Metro Vancouver Regional Engineers Advisory Committee (2018).

Standard Methods for the Examination of Water and Wastewater, 23rd Edition. APHA, AWWA, WEF, 2017

Water Quality Monitoring and Reporting Plan for the GVRD and Member Municipalities. Regional Engineers Advisory Committee (REAC), May 2000

APPENDIX A

Water Sampling Stations Map



Legend

UEL Water Supply

Connection to UBC

Material

- Asbestos Cement
- Cast Iron
- Ductile Iron
- Polyvinyl Chloride
- Steel
- High Density Polyethylene

UEL Areas

- Area A
- Area B
- Area C
- Area D
- Ieləm'

Overview Map

N

W E

S

0 230 460

Metres

1:10,000

NAD 1983 UTM Zone 10N

2024 Water Quality Report
Location: University Endowment Lands

BRITISH COLUMBIA

Existing UEL Water System Sample Locations

March 2025
Project: 60639142 - 303

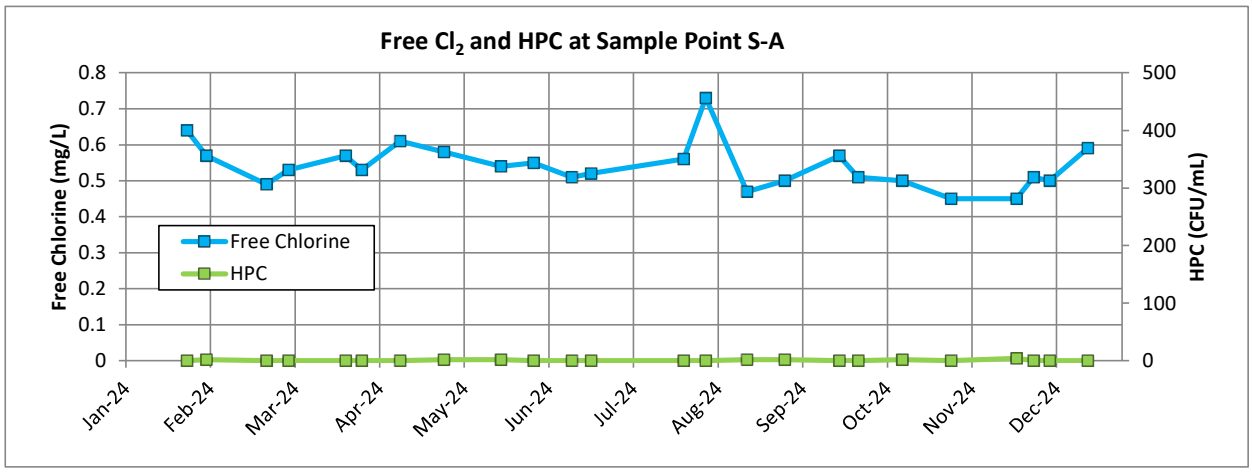
AECOM

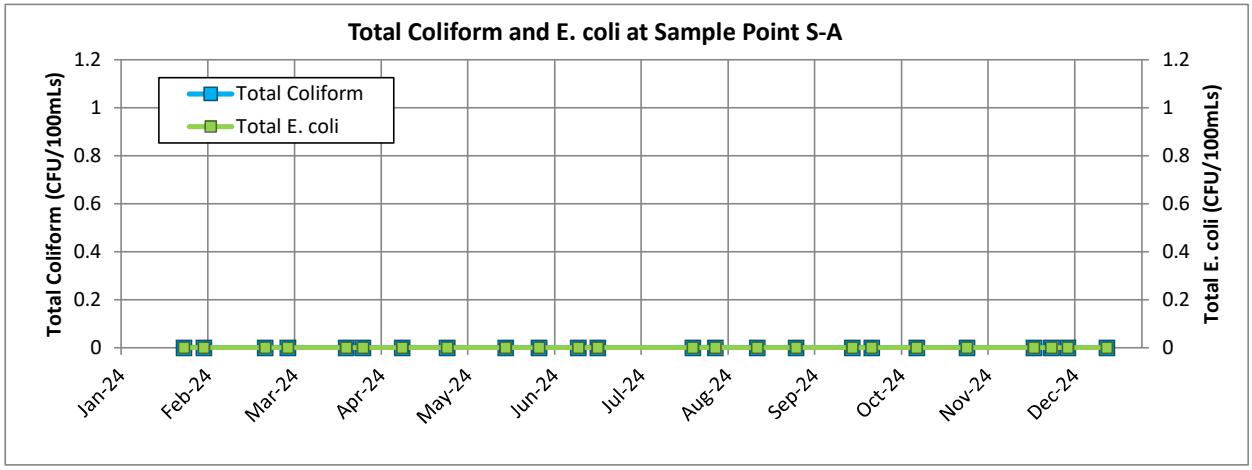
Appendix A

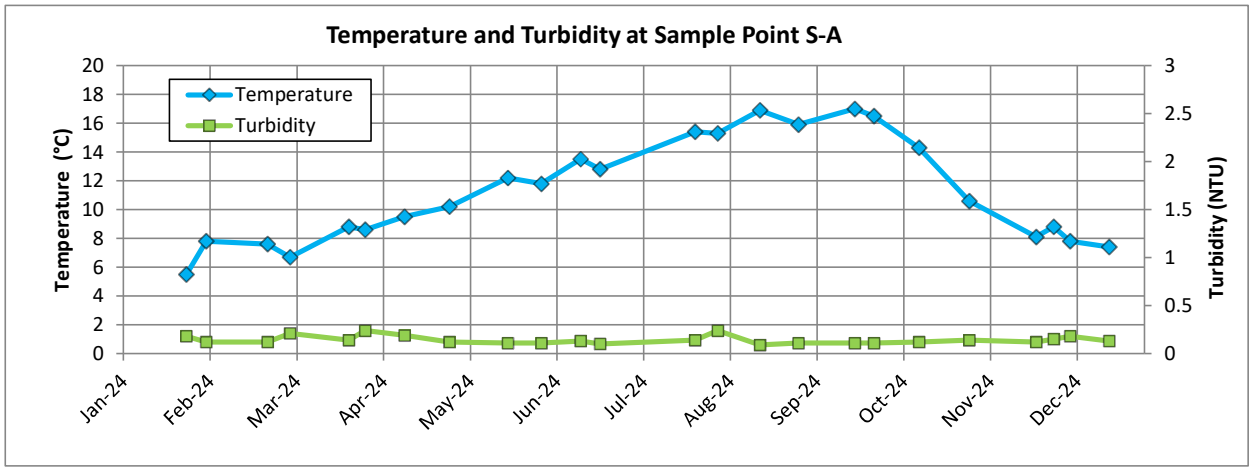
File Location: L:\Legacy\cabny1fp001\prod\Projects\60639142\900-CAD_GIS\920-GIS\02_Maps\303 - Water Quality Report\2024 Appendix A - ExistingUELWaterSystem 10-6.mxd Date Revised: March 27, 2025 Prepared by: susan.a.powell Project: 60639142 - 303

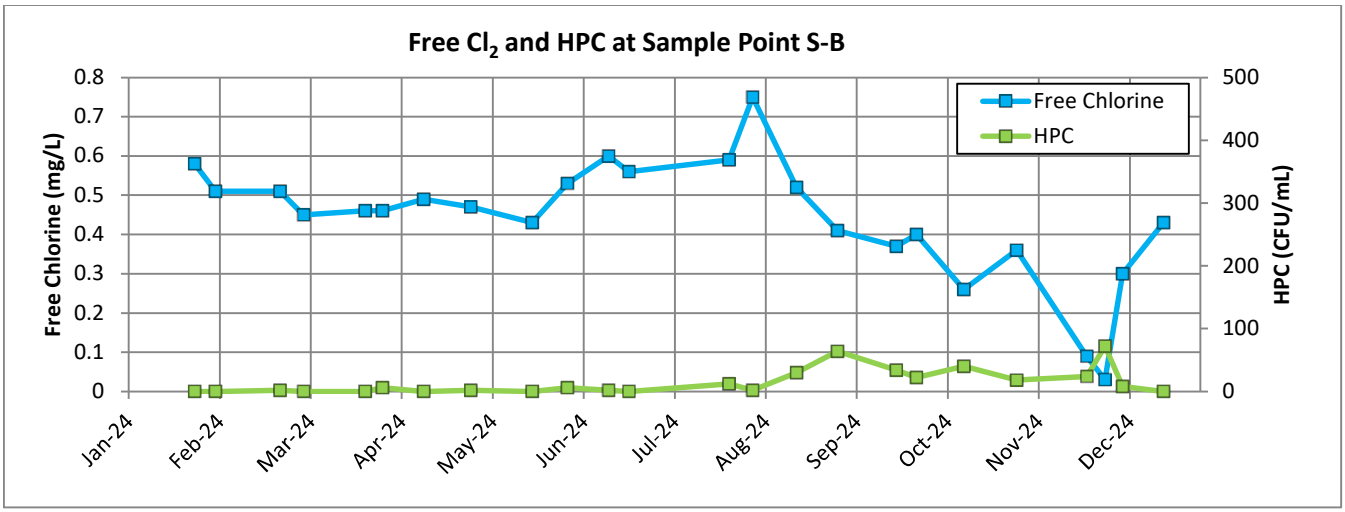
APPENDIX B

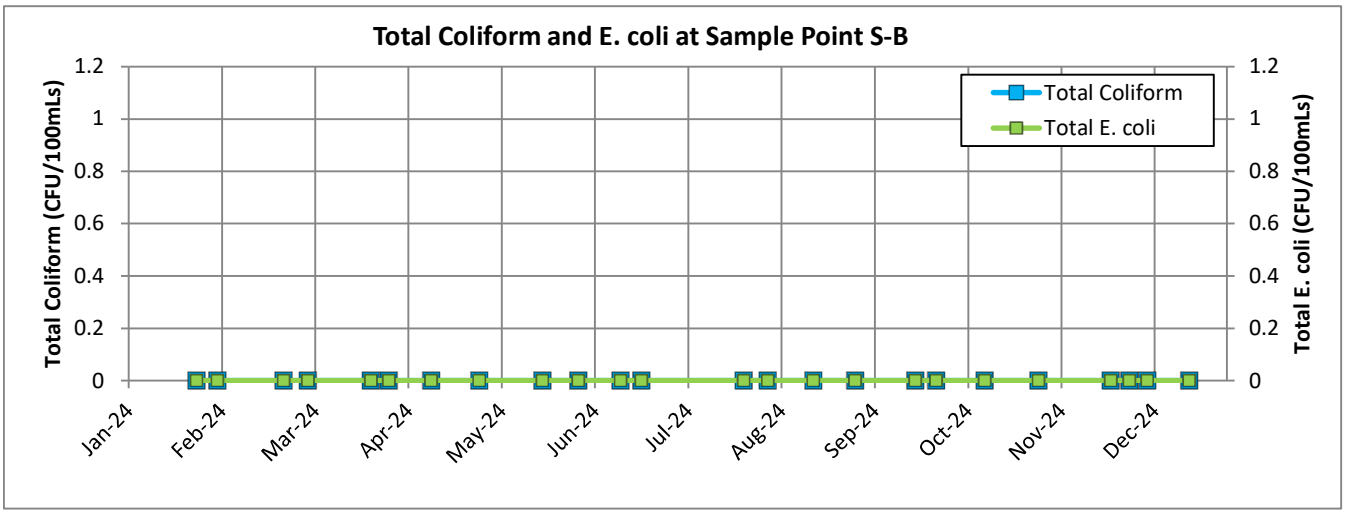
Sample Analysis Results

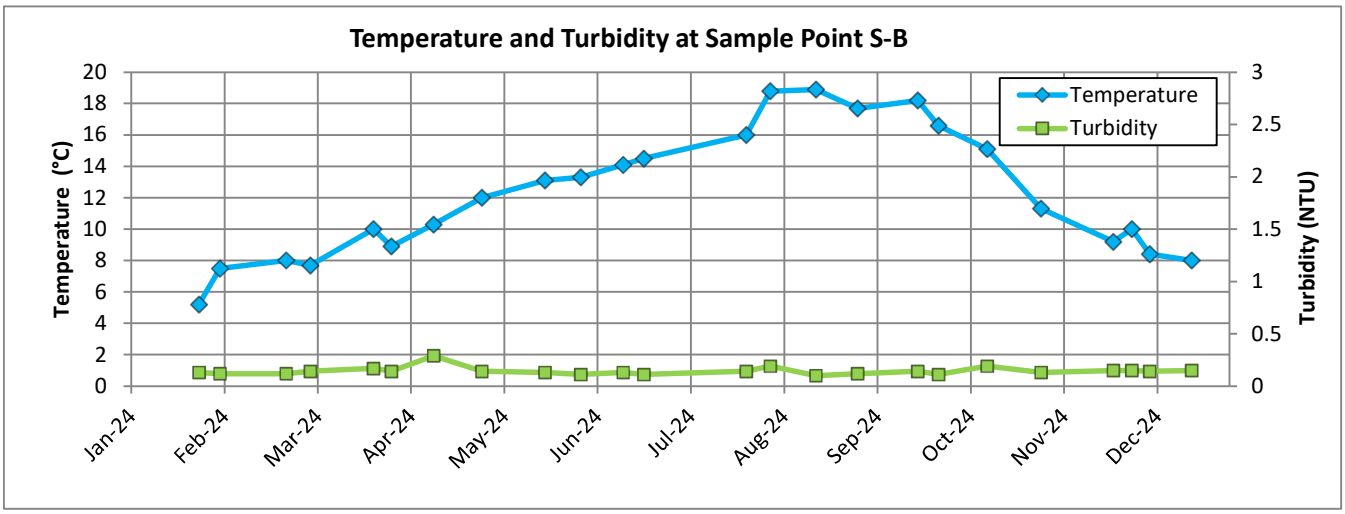

Free Cl2 and HPC at Sample Point S-A
Free Chlorine (mg/L)
HPC (CFU/mL)
Free Chlorine
HPC
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
500
400
300
200
100
0
Jan-24
Feb-24
Mar-24
Apr-24
May-24
Jun-24
Jul-24
Aug-24
Sep-24
Oct-24
Nov-24
Dec-24

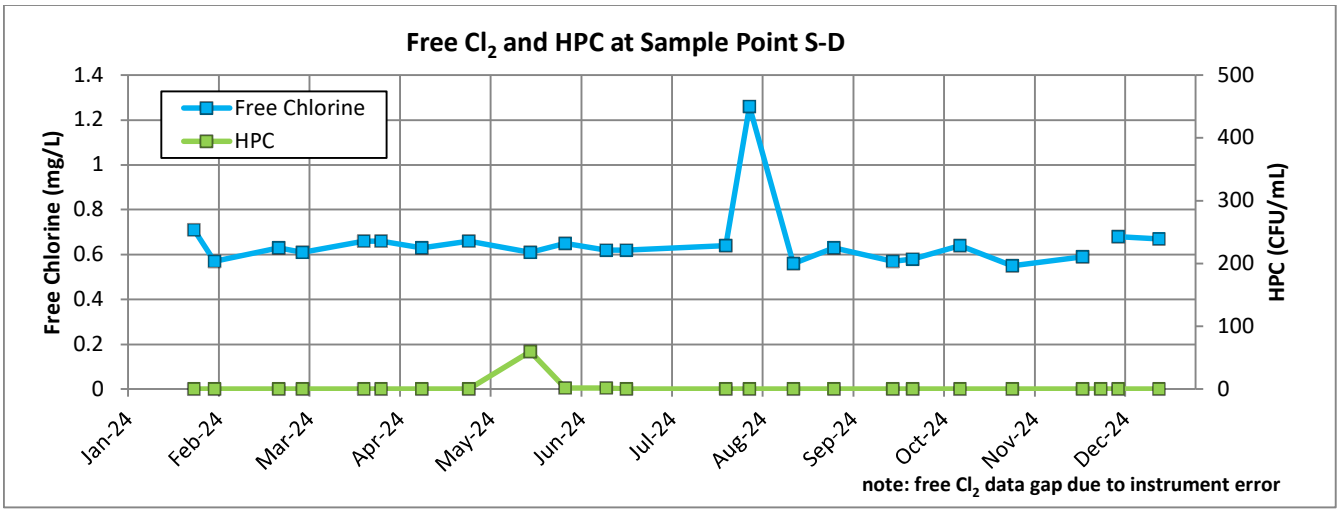

Total Coliform and E. coli at Sample Point S-A
Total Coliform (CFU/100mLs)
Total E. coli (CFU/100mLs)
Total Coliform
Total E. coli
1.2
1
0.8
0.6
0.4
0.2
0
Jan-24
Feb-24
Mar-24
Apr-24
May-24
Jun-24
Jul-24
Aug-24
Sep-24
Oct-24
Nov-24
Dec-24

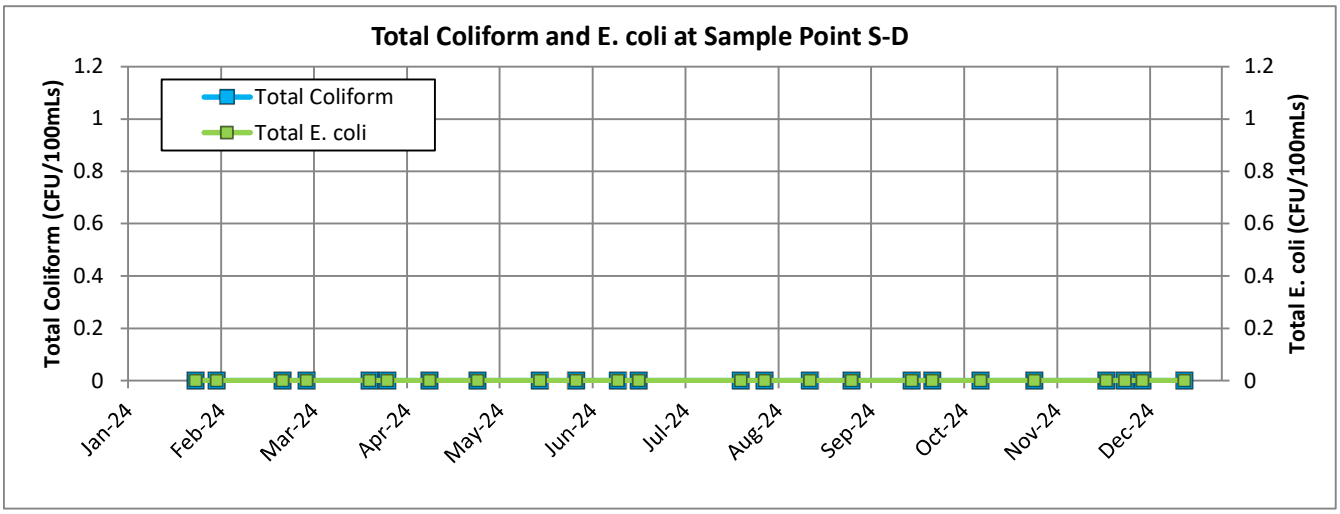

Temperature and Turbidity at Sample Point S-A
Temperature (°C)
Turbidity (NTU)
Temperature
Turbidity
20
18
16
14
12
10
8
6
4
2
0
3
2.5
2
1.5
1
0.5
0
Jan-24
Feb-24
Mar-24
Apr-24
May-24
Jun-24
Jul-24
Aug-24
Sep-24
Oct-24
Nov-24
Dec-24

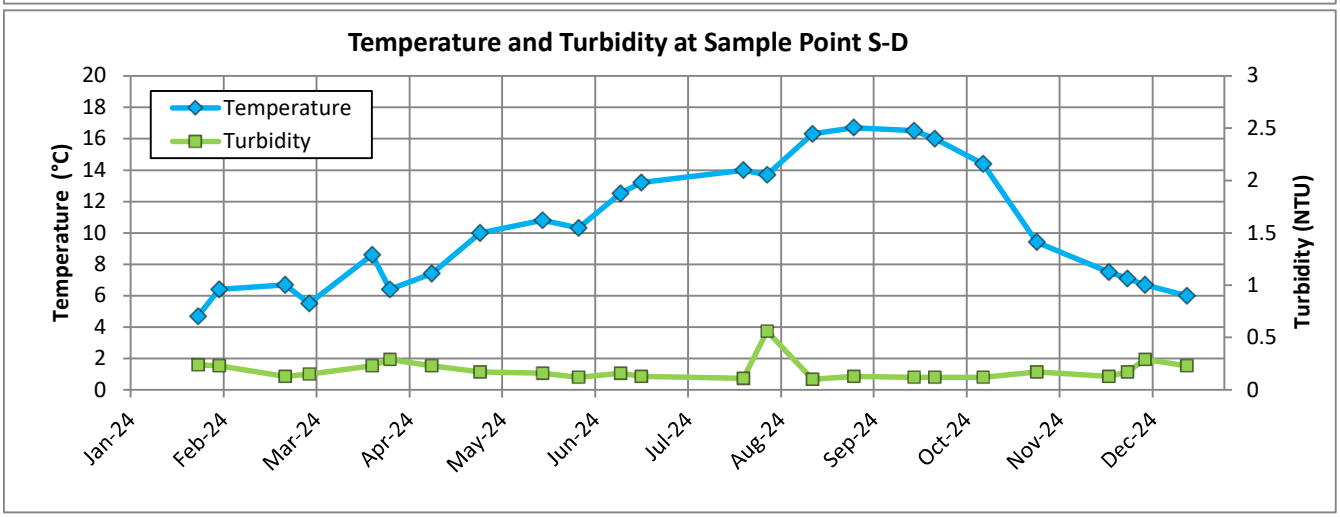

Free Cl2 and HPC at Sample Point S-B
Free Chlorine (mg/L)
HPC (CFU/mL)
Free Chlorine
HPC
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
500
400
300
200
100
0
Jan-24
Feb-24
Mar-24
Apr-24
May-24
Jun-24
Jul-24
Aug-24
Sep-24
Oct-24
Nov-24
Dec-24

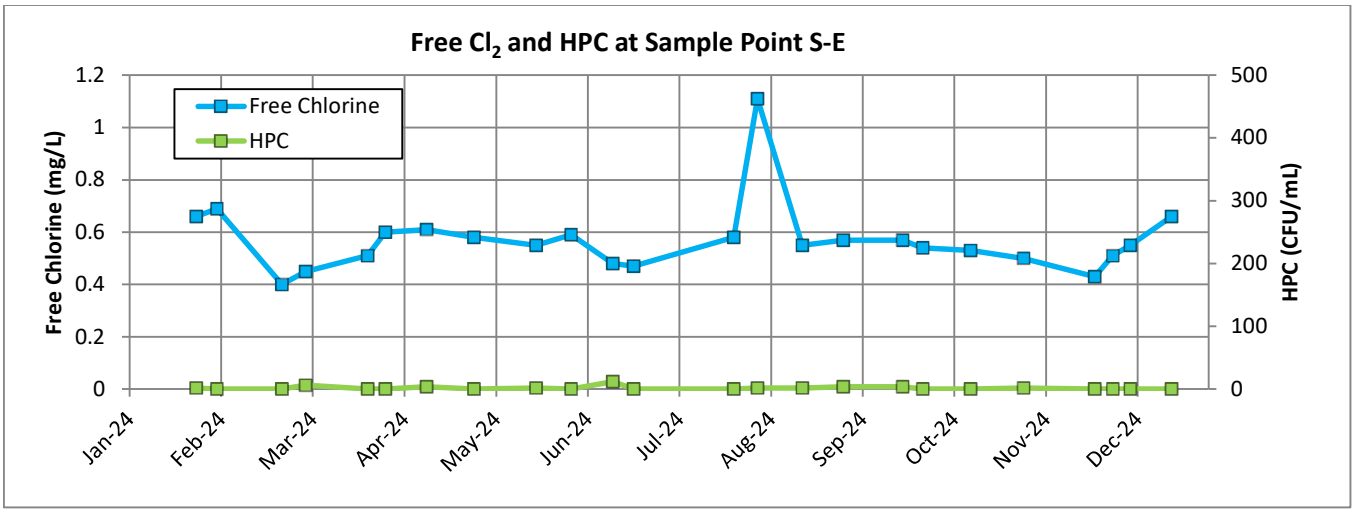

Total Coliform and E. coli at Sample Point S-B
Total Coliform (CFU/100mLs)
Total E. coli (CFU/100mLs)
Total Coliform
Total E. coli
1.2
1
0.8
0.6
0.4
0.2
0
Jan-24
Feb-24
Mar-24
Apr-24
May-24
Jun-24
Jul-24
Aug-24
Sep-24
Oct-24
Nov-24
Dec-24

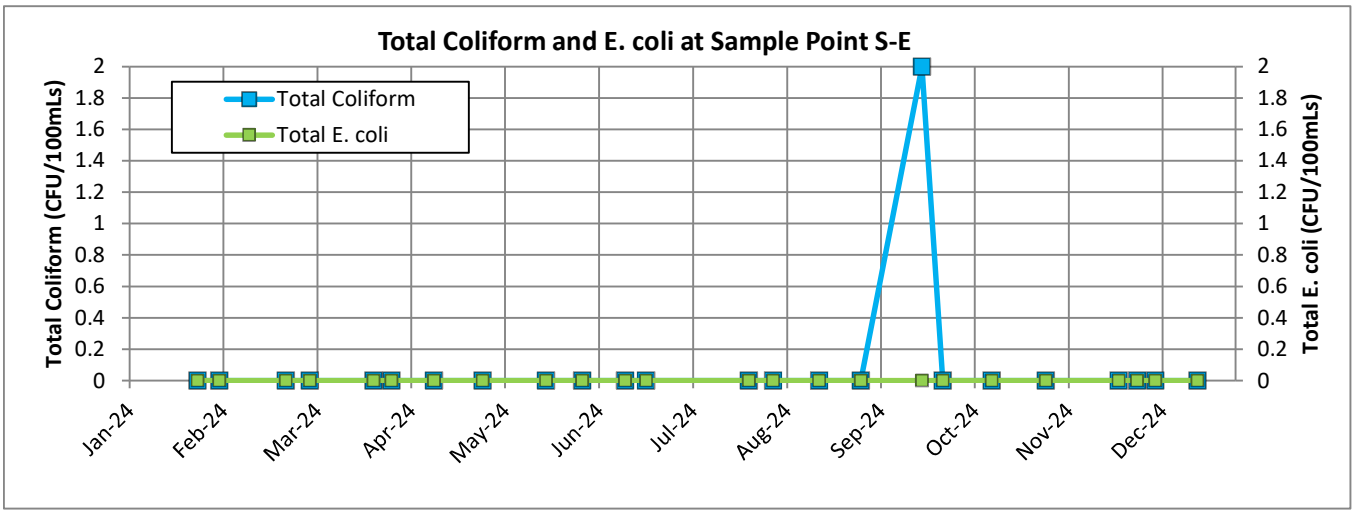

Temperature and Turbidity at Sample Point S-B
Temperature (°C)
Turbidity (NTU)
Temperature
Turbidity
20
18
16
14
12
10
8
6
4
2
0
3
2.5
2
1.5
1
0.5
0
Jan-24
Feb-24
Mar-24
Apr-24
May-24
Jun-24
Jul-24
Aug-24
Sep-24
Oct-24
Nov-24
Dec-24

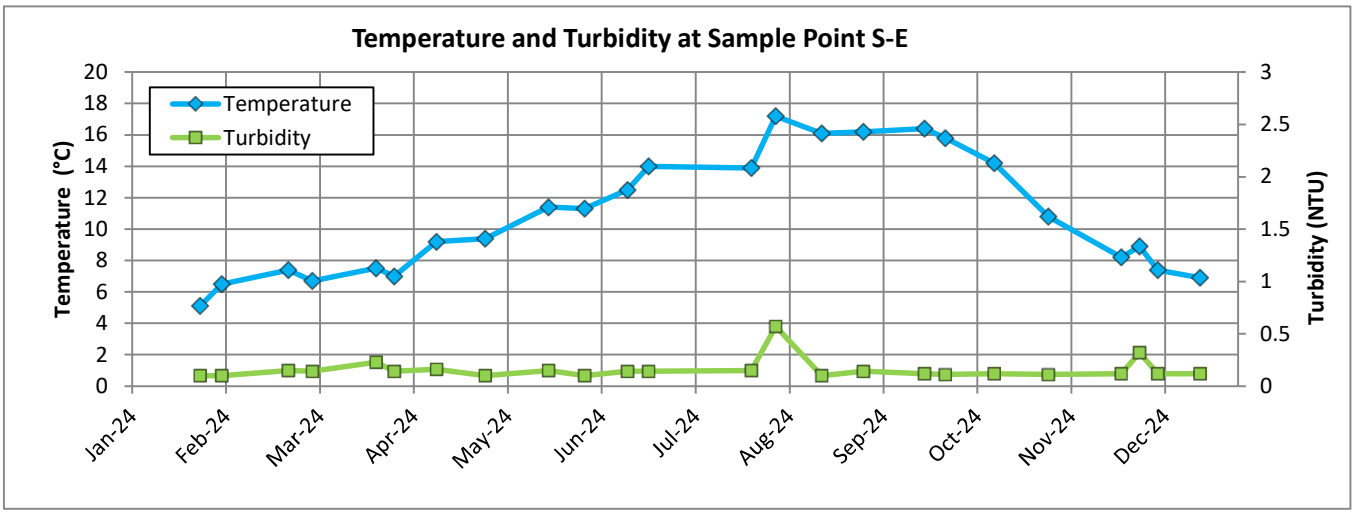

Free Cl2 and HPC at Sample Point S-D
Free Chlorine
HPC
Free Chlorine (mg/L)
HPC (CFU/mL)
1.4
1.2
1
0.8
0.6
0.4
0.2
0
500
400
300
200
100
0
Jan-24
Feb-24
Mar-24
Apr-24
May-24
Jun-24
Jul-24
Aug-24
Sep-24
Oct-24
Nov-24
Dec-24
note: free Cl2 data gap due to instrument error

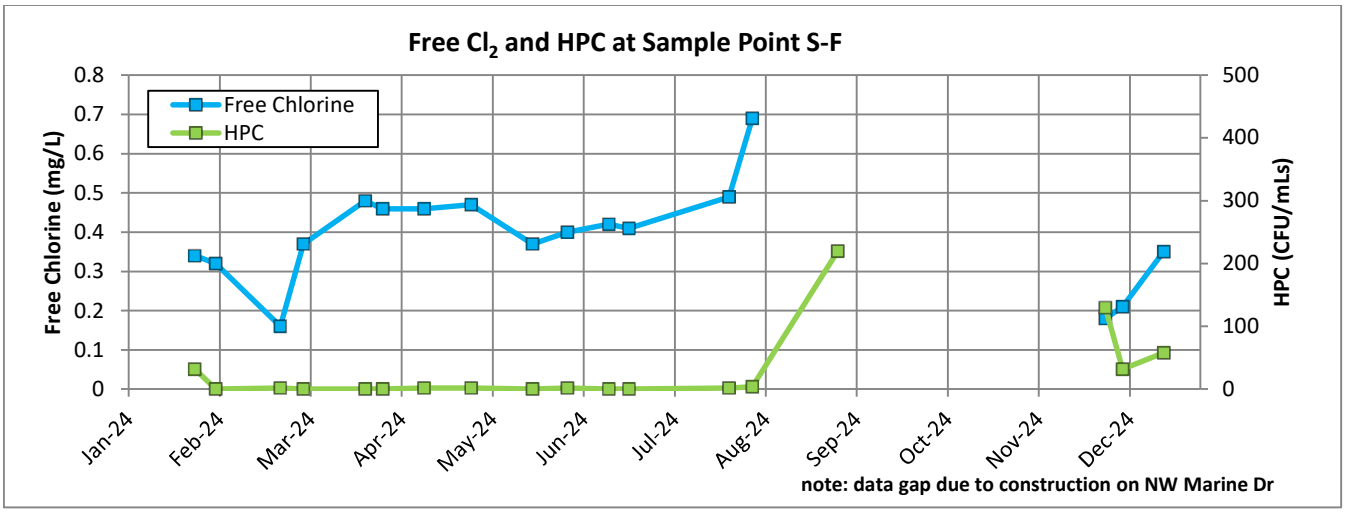

Total Coliform and E. coli at Sample Point S-D
Total Coliform
Total E. coli
Total Coliform (CFU/100mLs)
Total E. coli (CFU/100mLs)
1.2
1
0.8
0.6
0.4
0.2
0
Jan-24
Feb-24
Mar-24
Apr-24
May-24
Jun-24
Jul-24
Aug-24
Sep-24
Oct-24
Nov-24
Dec-24

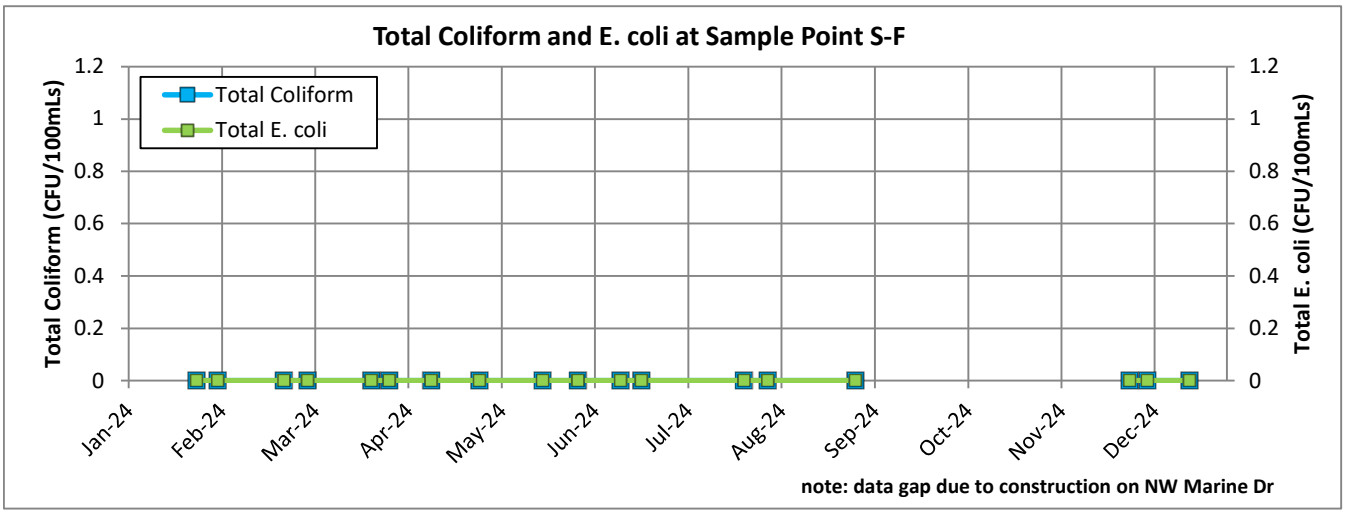

Temperature and Turbidity at Sample Point S-D
Temperature
Turbidity
Temperature (°C)
Turbidity (NTU)
20
18
16
14
12
10
8
6
4
2
0
3
2.5
2
1.5
1
0.5
0
Jan-24
Feb-24
Mar-24
Apr-24
May-24
Jun-24
Jul-24
Aug-24
Sep-24
Oct-24
Nov-24
Dec-24

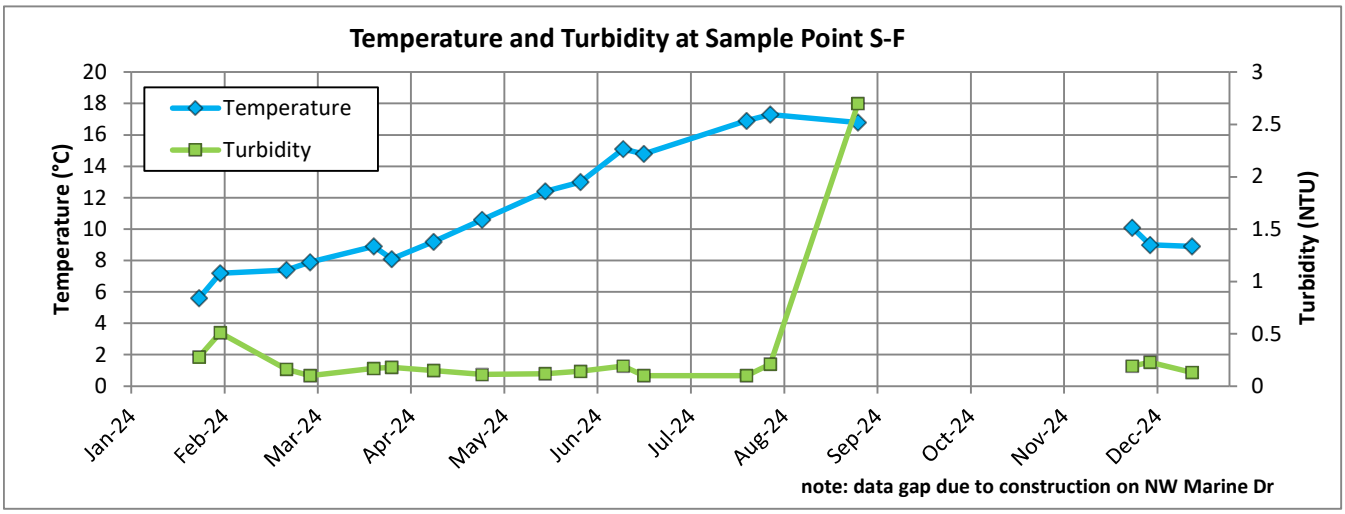

Free Cl2 and HPC at Sample Point S-E
Free Chlorine
HPC
Free Chlorine (mg/L)
HPC (CFU/mL)
1.2
1
0.8
0.6
0.4
0.2
0
500
400
300
200
100
0
Jan-24
Feb-24
Mar-24
Apr-24
May-24
Jun-24
Jul-24
Aug-24
Sep-24
Oct-24
Nov-24
Dec-24

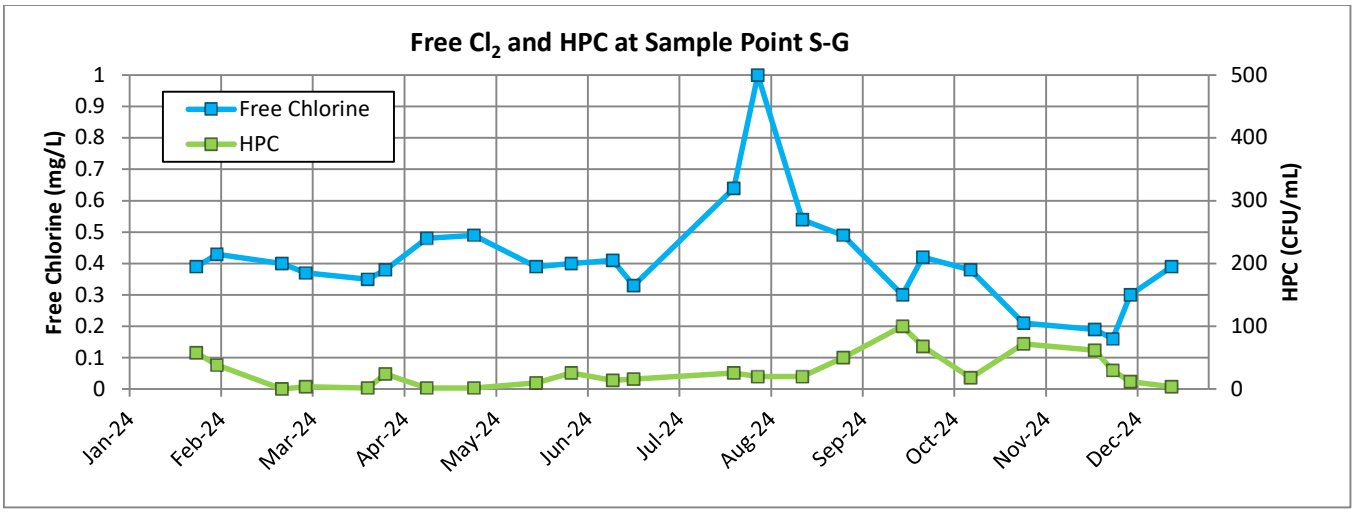

Total Coliform and E. coli at Sample Point S-E
Total Coliform
Total E. coli
Total Coliform (CFU/100mLs)
Total E. coli (CFU/100mLs)
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Jan-24
Feb-24
Mar-24
Apr-24
May-24
Jun-24
Jul-24
Aug-24
Sep-24
Oct-24
Nov-24
Dec-24

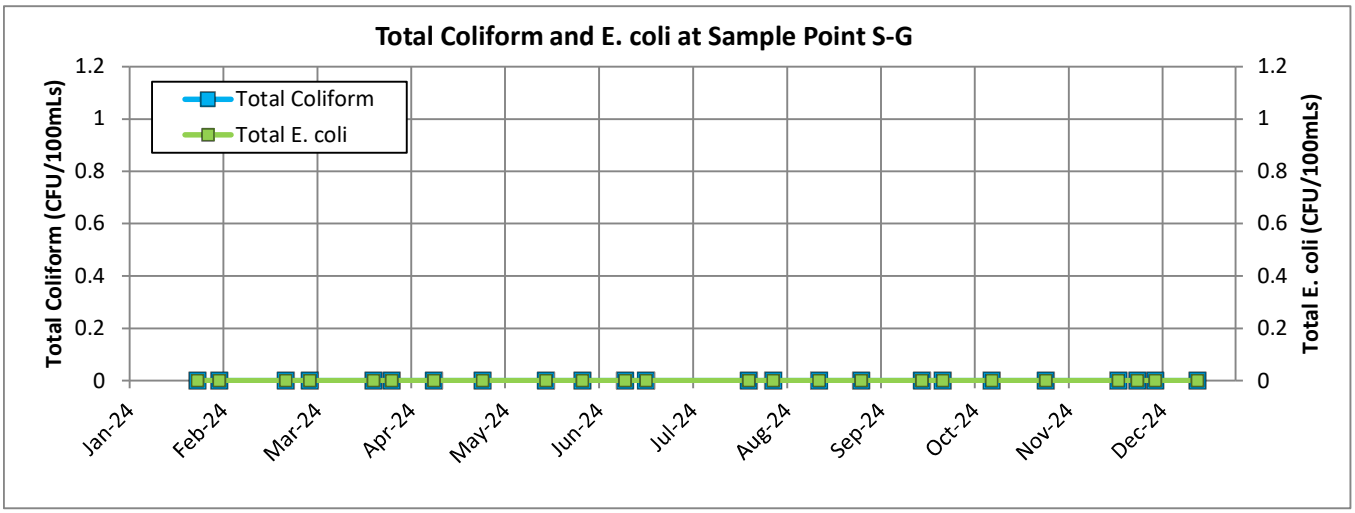

Temperature and Turbidity at Sample Point S-E
Temperature
Turbidity
Temperature (°C)
Turbidity (NTU)
20
18
16
14
12
10
8
6
4
2
0
3
2.5
2
1.5
1
0.5
0
Jan-24
Feb-24
Mar-24
Apr-24
May-24
Jun-24
Jul-24
Aug-24
Sep-24
Oct-24
Nov-24
Dec-24

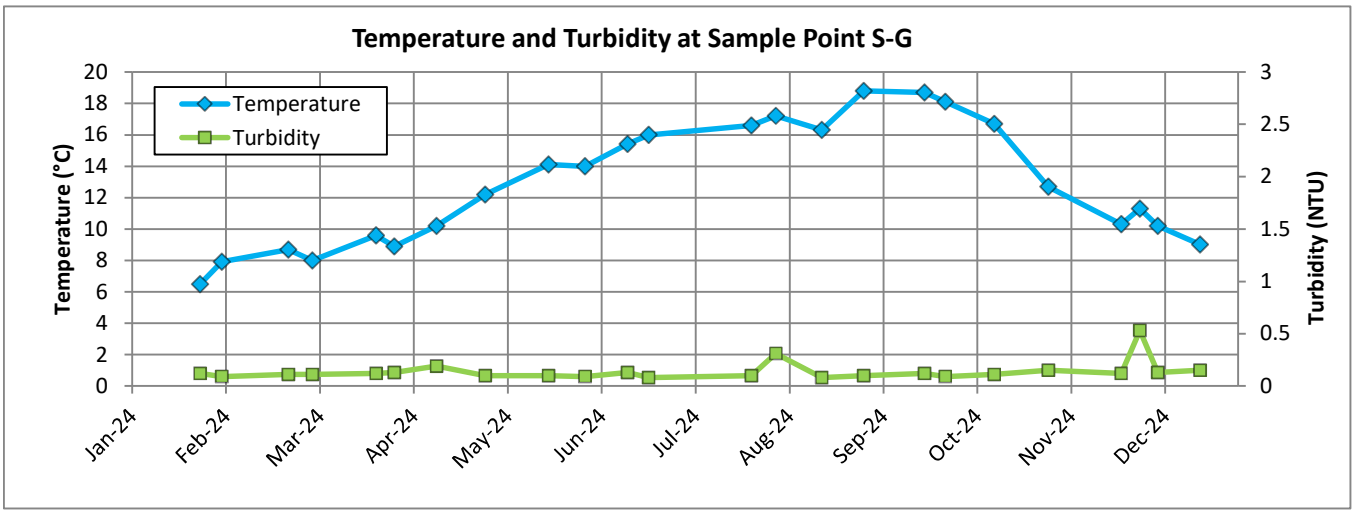

Free Cl2 and HPC at Sample Point S-F
Free Chlorine
HPC
Free Chlorine (mg/L)
HPC (CFU/mLs)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
500
400
300
200
100
0
Jan-24
Feb-24
Mar-24
Apr-24
May-24
Jun-24
Jul-24
Aug-24
Sep-24
Oct-24
Nov-24
Dec-24
note: data gap due to construction on NW Marine Dr

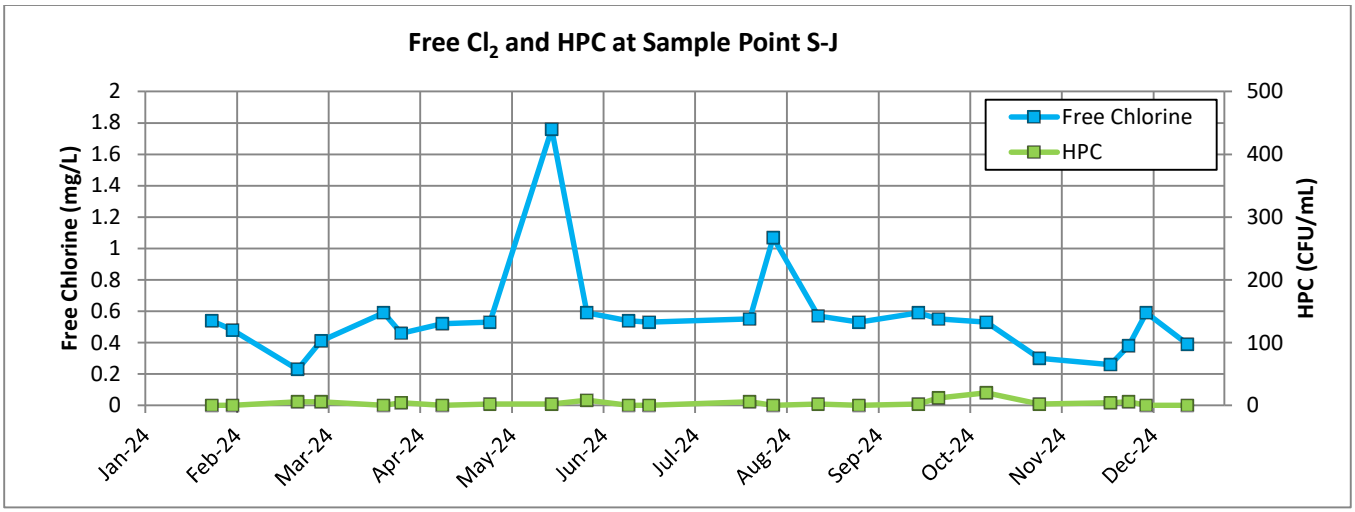

Total Coliform and E. coli at Sample Point S-F
Total Coliform
Total E. coli
Total Coliform (CFU/100mLs)
Total E. coli (CFU/100mLs)
1.2
1
0.8
0.6
0.4
0.2
0
Jan-24
Feb-24
Mar-24
Apr-24
May-24
Jun-24
Jul-24
Aug-24
Sep-24
Oct-24
Nov-24
Dec-24
note: data gap due to construction on NW Marine Dr

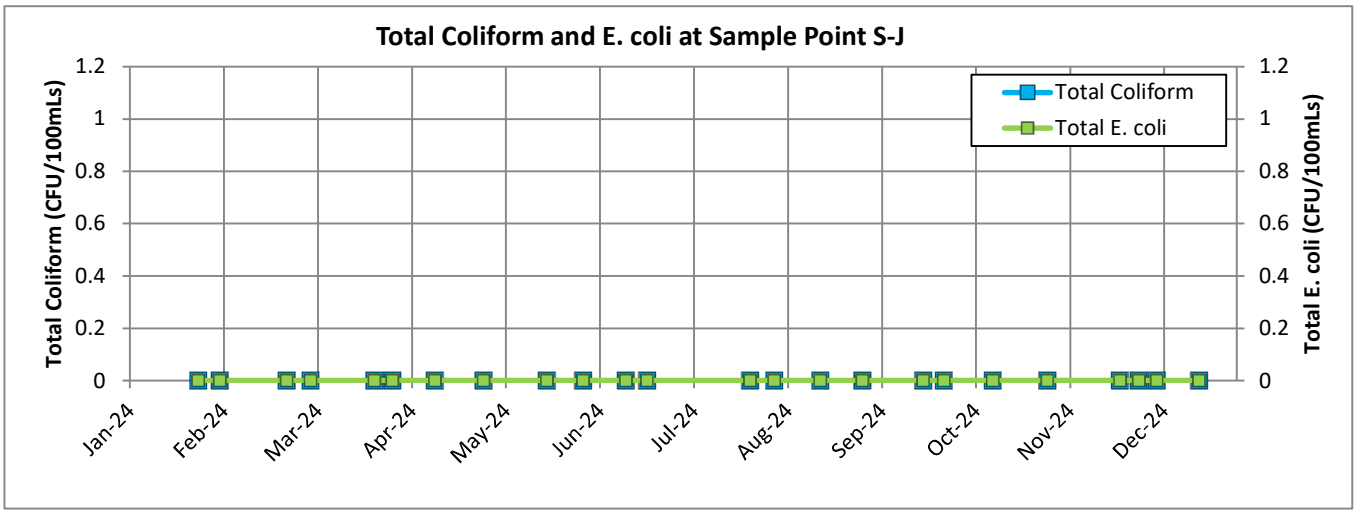

Temperature and Turbidity at Sample Point S-F
Temperature
Turbidity
Temperature (°C)
Turbidity (NTU)
20
18
16
14
12
10
8
6
4
2
0
3
2.5
2
1.5
1
0.5
0
Jan-24
Feb-24
Mar-24
Apr-24
May-24
Jun-24
Jul-24
Aug-24
Sep-24
Oct-24
Nov-24
Dec-24
note: data gap due to construction on NW Marine Dr

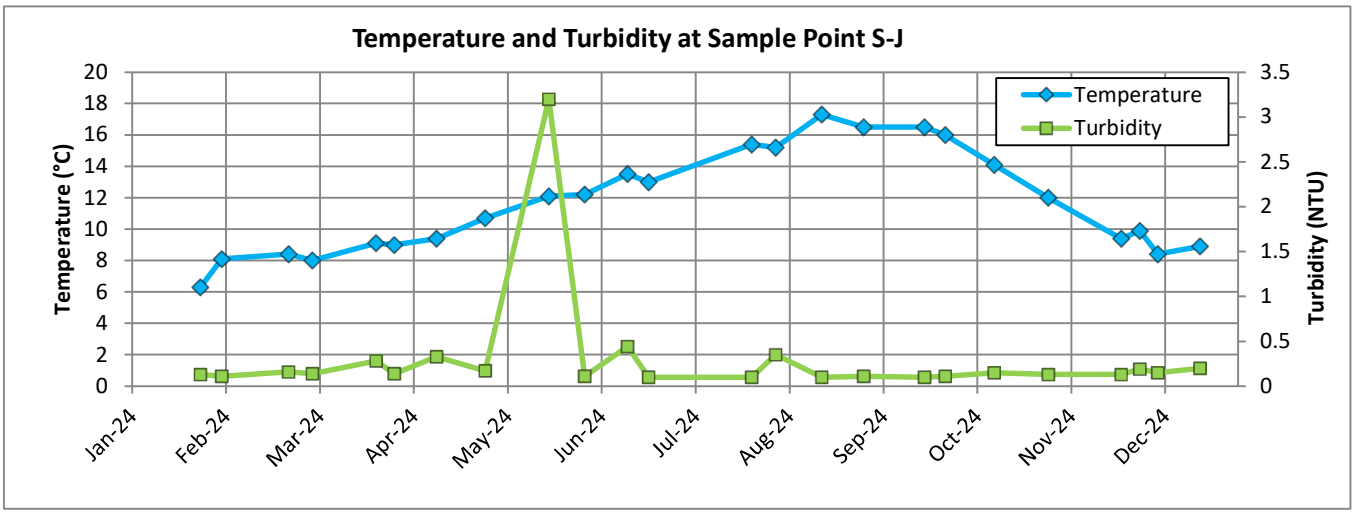

Free Cl2 and HPC at Sample Point S-G
Free Chlorine
HPC
Free Chlorine (mg/L)
HPC (CFU/mL)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
500
400
300
200
100
0
Jan-24
Feb-24
Mar-24
Apr-24
May-24
Jun-24
Jul-24
Aug-24
Sep-24
Oct-24
Nov-24
Dec-24


Total Coliform and E. coli at Sample Point S-G
Total Coliform
Total E. coli
Total Coliform (CFU/100mLs)
Total E. coli (CFU/100mLs)
1.2
1
0.8
0.6
0.4
0.2
0
Jan-24
Feb-24
Mar-24
Apr-24
May-24
Jun-24
Jul-24
Aug-24
Sep-24
Oct-24
Nov-24
Dec-24


Temperature and Turbidity at Sample Point S-G
Temperature
Turbidity
Temperature (°C)
Turbidity (NTU)
20
18
16
14
12
10
8
6
4
2
0
3
2.5
2
1.5
1
0.5
0
Jan-24
Feb-24
Mar-24
Apr-24
May-24
Jun-24
Jul-24
Aug-24
Sep-24
Oct-24
Nov-24
Dec-24


Free Cl2 and HPC at Sample Point S-J
Free Chlorine (mg/L)
HPC (CFU/mL)
Free Chlorine
HPC
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
0
100
200
300
400
500
Jan-24
Feb-24
Mar-24
Apr-24
May-24
Jun-24
Jul-24
Aug-24
Sep-24
Oct-24
Nov-24
Dec-24


Total Coliform and E. coli at Sample Point S-J
Total Coliform (CFU/100mLs)
Total E. coli (CFU/100mLs)
Total Coliform
Total E. coli
0
0.2
0.4
0.6
0.8
1
1.2
Jan-24
Feb-24
Mar-24
Apr-24
May-24
Jun-24
Jul-24
Aug-24
Sep-24
Oct-24
Nov-24
Dec-24


Temperature and Turbidity at Sample Point S-J
Temperature (°C)
Turbidity (NTU)
Temperature
Turbidity
0
2
4
6
8
10
12
14
16
18
20
0
0.5
1
1.5
2
2.5
3
3.5
Jan-24
Feb-24
Mar-24
Apr-24
May-24
Jun-24
Jul-24
Aug-24
Sep-24
Oct-24
Nov-24
Dec-24

APPENDIX C

Emergency Water Supply Well Water Quality Results

Emergency Water Supply Well Water Quality Results
Location: UEL Public Works Yard (UEL S-W)

Date Sampled	Parameters				
	Turbidity NTU	HPC CFU/mL	Field Temp. (°C)	Total Coliforms (MPN/100 mL)	E. coli (MPN/100 mL)
2024-01-23	8.7	350	9.0	<1	<1
2024-01-30	28.0	460	9.9	<1	<1
2024-02-21	10.0	230	10.2	<1	<1
2024-02-29	13.0	1400	10.2	<1	<1
2024-03-21	11.0	80	10.0	<1	<1
2024-03-27	22.0	180	9.7	<1	<1
2024-04-10	4.8	110	10.7	<1	<1
2024-04-26	7.7	260	10.9	<1	<1
2024-05-17	0.5	20	10.9	<1	<1
2024-05-29	0.7	20	12.5	<1	<1
2024-06-19	2.4	8	11.0	<1	<1
2024-07-23	0.2	2	12.0	<1	<1
2024-07-31	2.9	10	12.9	<1	<1
2024-08-15	0.6	<2	10.1	<1	<1
2024-08-29	24.0	74	13.4	<1	<1
2024-09-18	1.6	60	11.8	<1	<1
2024-09-25	22.0	220	11.1	<1	<1
2024-10-11	8.3	220	10.6	<1	<1
2024-10-29	11.0	96	9.2	<1	<1
2024-11-22	4.8	130	9.9	<1	<1
2024-11-28	15.0	370	10.3	<1	<1
2024-12-04	17.0	200	9.4	<1	<1
2024-12-18	13.0	830	9.5	<1	<1