



# 2024 ANNUAL DRINKING WATER REPORT

## PANORAMA MOUNTAIN RESORT



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## Introduction

Panorama Mountain Resort is located approximately 18km west of Invermere, British Columbia. Bluestem owns and operates all the utility infrastructure associated with the water treatment and water distribution network. The distribution network currently serves approximately 360 connections.

Panorama's water treatment system and water distribution system are both classified as Level II facilities by the EOCP (Environmental Operators Certification Program). In 2024, Bluestem had three full time water treatment and distribution operators working on site. This ensured that at least one operator was on site every day, while also providing twenty-four-hour emergency on call coverage.

Providing clean, potable, and aesthetically pleasing drinking water to its customers is at the forefront of Bluestem's responsibilities. This is accomplished by maintaining a regular monitoring, sampling and maintenance schedule as outlined below.

## System Overview

### Source Water

Panorama's source water is from two, 10-inch diameter production wells near the Toby Creek. In 2020, Bluestem transitioned from a surface water source to a clean groundwater source to alleviate the high levels of turbidity in the water during spring runoff. Well 15-02 has a total depth of 32.5m (106.5 ft) and well 20-03 has a total depth of 37.9m (124.5 ft). Both wells have been drilled into the same semi-confined sand and gravel aquifer system. This system is overlain by sediments containing silt and clay, while it is underlain by bedrock.

Please refer to Appendix A for a full potability analysis for Well 20-03. This was completed August 14, 2024. Please refer to Appendix B for a full potability analysis for Well 15-02. This was completed June 12, 2024. This testing was completed prior to any treatment; therefore, it provides a very accurate representation of the water quality coming from the aquifer.



*Panorama Well Site*

### Treatment

Panorama's source water is continuously pumped to a treatment station located at 2130 Trappers Way. There is continuous online turbidity monitoring for all water entering the treatment station. The first stage of disinfection is UV. Bluestem operates two Trojan UV Swift SC units. This UV disinfection process provides 99.99% inactivation of pathogens such as *Cryptosporidium* and *Giardia*. The next stage of disinfection is accomplished with chlorine. Bluestem administers a dosage using 12% Sodium Hypochlorite. The level of chlorine leaving the treatment station is continuously monitored, and is usually around 0.90 mg/L. The combination of using UV technology and chlorine disinfection creates a very efficient disinfection process by inactivating many microorganisms.





*Panorama UV disinfection units*

After disinfection is accomplished, the water is pumped into a clear well, which is located underneath the treatment station. This acts as a holding tank, as two booster pumps then move the water from the treatment station to the main resort reservoir. As water demands increase and decrease all tank levels remain constant as well pumps and booster pumps act in unison and modulate their flow rate accordingly.



*Treatment Station Booster Pumps*

The main reservoir can hold approximately one million gallons. It is located partway up the ski hill near the top of the Discovery chair. The strategic location of the reservoir at that elevation allows the entire distribution system to maintain adequate pressure via gravity only.

### Water Distribution

In 2024, Bluestem treated and distributed approximately 161,567 cubic meters of water (161,567,000L). Figure 1 below illustrates the amount of water that was treated daily over the course of the year. As can be seen, there are fluctuations throughout the year. This is because Panorama is a seasonal resort destination. Higher flows can be expected through winter months (Dec – Apr) and summer months (Jul – Sept) due to higher occupancy rates. Summer irrigation also factors into a higher demand during summer months.

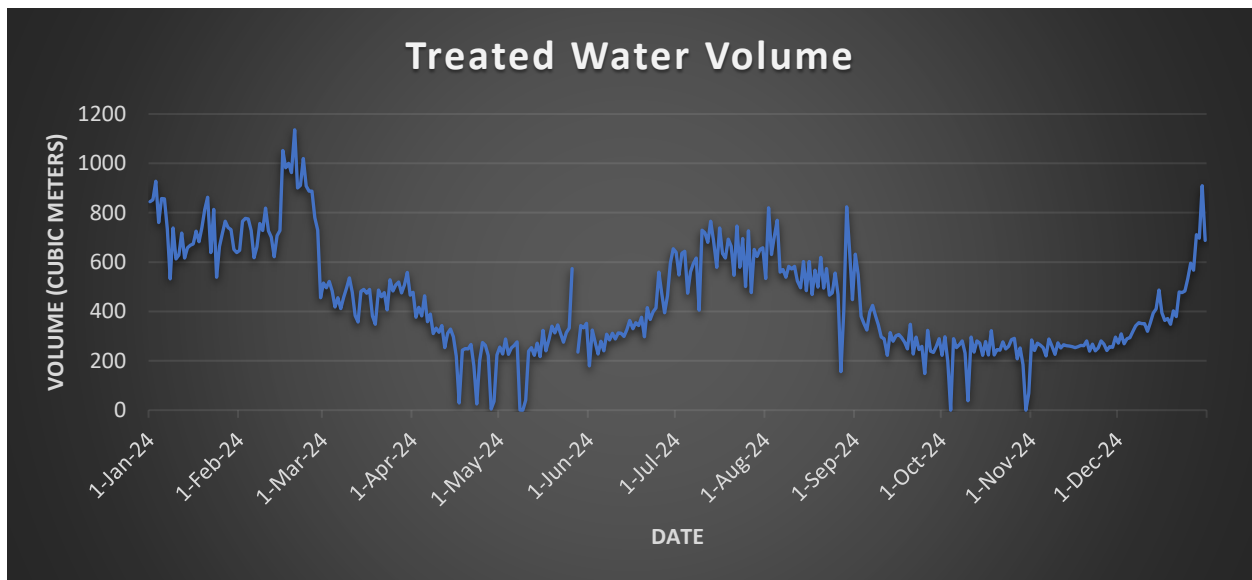


Figure 1

Due to the elevation of the reservoir, the distribution system is divided into multiple pressure zones. These pressure zones are controlled by PRV's (pressure reducing valves) located underground throughout the resort. These PRV's act to maintain a constant water pressure through all areas of the resort, regardless of water usage. Bluestem employees record operating pressure of these valves and conduct visual inspections on them monthly to ensure there are no leaks and proper operation is maintained.

## Water Quality Control

Every day, Bluestem operators perform a set of daily rounds consisting of operational checks of the well site and booster station. Turbidity and residual chlorine checks are also completed everyday by an operator. Please refer to Figure 2 and Figure 3 for a snapshot of chlorine and turbidity levels found at the start and near the end of the distribution system throughout 2024. By completing these checks at both the start and end of line, this ensures an adequate chlorine residual and turbidity level throughout the entire system.

Chlorine residual concentrations usually range from 0.20 to 2.0 mg/L in many Canadian drinking water distribution systems. Bluestem operators try to keep the residual around 0.80 mg/L through the system to ensure proper disinfection while minimizing the taste of chlorine for the customer. As noted in Table 1, the average chlorine residual at the start and the end of the distribution system were 0.78 mg/L and 0.74 mg/L respectively.

Turbidity is one of the most important measurements a water operator conducts. Turbidity is a measurement of the clarity of the water and gives an indication on the number of particles in the water that cannot be seen by the naked eye. A rise in turbidity can help alert an operator to changes in raw water quality. Higher turbidity (more particles) can harbor microorganisms, shielding them from disinfection. For a water system that uses ground water, turbidity levels should never exceed 1.0 NTU. As noted in Table 1, the average turbidity level at the start and the end of the distribution system were 0.08 NTU and 0.09 NTU respectively.

As seen in Figure 2 & 3 on the following page, chlorine and turbidity levels remained consistent throughout the year. The turbidity spike found on July 4, 2024, can be attributed to operator error in data entry as this was not detected by any continuous monitoring device, nor was it seen in other parts of the distribution system.

	Start of Line		End of Line	
	Chlorine (mg/L)	Turbidity (NTU)	Chlorine (mg/L)	Turbidity (NTU)
<b>Min.</b>	0.52	0.03	0.54	0.03
<b>Max.</b>	0.98	0.57	1.03	0.32
<b>Average</b>	0.78	0.08	0.74	0.09

Table 1

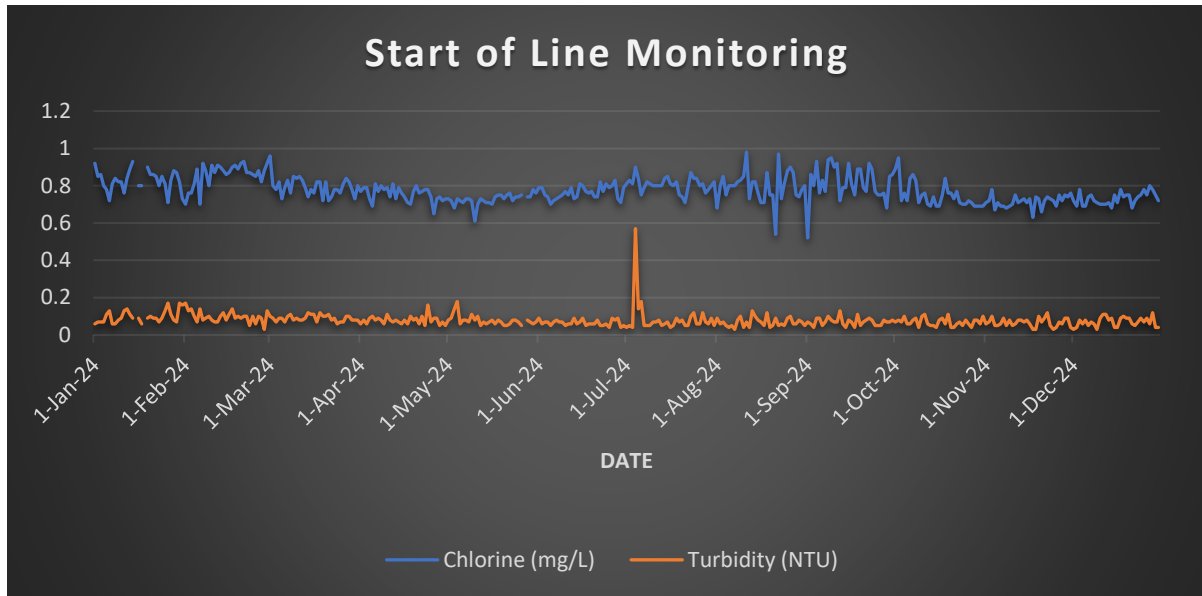


Figure 2

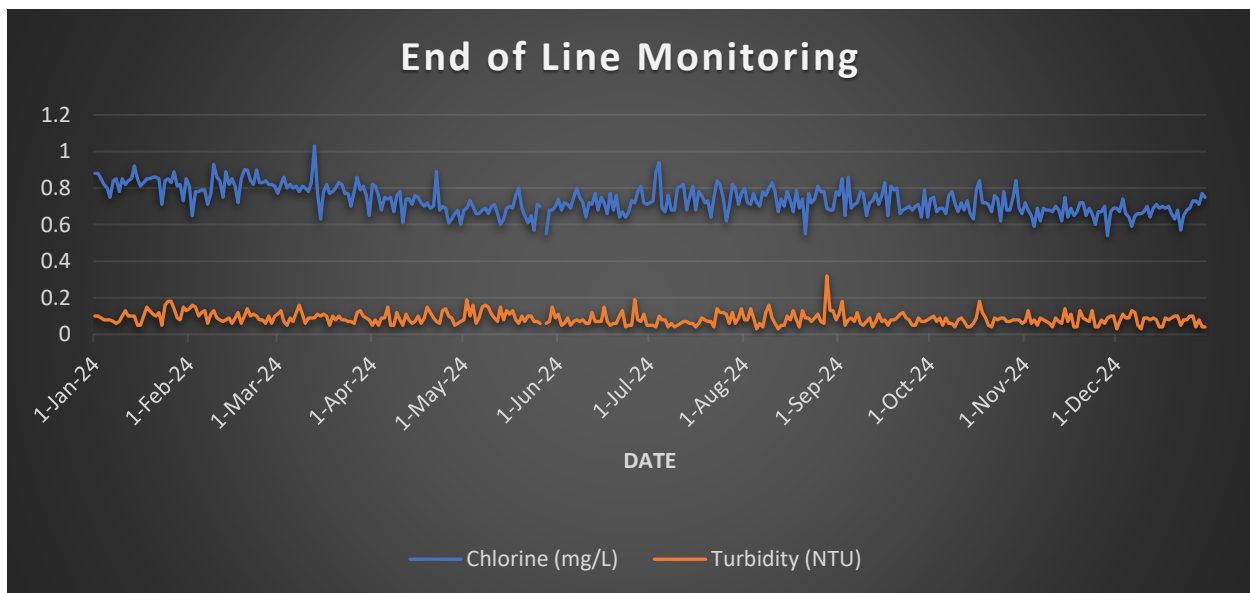


Figure 3

Bacteriological sampling was completed every other week at three different locations. These samples were sent to ALS Laboratories in Calgary where E. Coli bacteria and total coliforms were tested for. Twenty-five sets of bacteriological samples were taken in 2024. Bluestem received zero reports of any positive test results.

Sampling for trihalomethanes (THM's) and Halo acetic acids (HAA's) was also completed on a quarterly basis in 2024. Both THM's and HAA's are formed when chlorine reacts with organic material in water. The results found that the water treated at Panorama was well below the maximum acceptable concentration (MAC) dictated by Canada's "Guidelines for Canadian Drinking Water Quality".



## System Maintenance/Upgrades

In 2024 Bluestem undertook a comprehensive flushing program. On May 29, 2024, Bluestem operators strategically flushed from numerous hydrants throughout the resort. All hydrants at dead ends of distribution mains were prioritized. While flushing, operators tried to maximize the scouring velocity of the water to reduce any foreign material or bio film accumulation that could be present in the water mains.

Bluestem employees are responsible for the maintenance and the operational reliability of fifty-two fire hydrants at Panorama Mountain Resort. While moving systematically through the distribution system, Bluestem operators tested hydrants for static pressure and flow rates. The static pressure of all fifty-two hydrants was documented. This test ensures that the hydrant is exercised and does not leak when fully pressurized. Flow testing was carried out on thirty-two hydrants in 2024. This allowed operators to note the maximum flowrate of the hydrant and the residual pressure maintained during that flow. Full teardowns and inspections were completed on twenty-six hydrants in 2024. A full tear down includes the removal of the upper hydrant assembly and lower valve assembly. All parts are inspected and greased. Any worn parts are replaced. The operational goal is to complete full inspections on a bi-annual basis. All these practices combined help ensure that any fire suppression demand will be met.

Throughout 2024, annual valve exercising took place. This process helps to ensure the operational reliability of all isolation valves. There are sixty documented isolation valves throughout the distribution system. Fifty valves were successfully exercised. The remaining ten have documented issues which will have to be addressed in the coming year. Fifty-one fire hydrant isolation valves were exercised throughout the year. All water main pressure reducing valves have an upstream and downstream isolation valve. These were all successfully exercised in 2024.

On February 19, 2024, operators discovered a combination air valve in an underground vault that had cracked due to being exposed to sub zero conditions. This water leak engaged a water-powered backup sump pump. Therefore, all water from the cracked valve and water used to power the sump pump were discharged underground. This prevented operators from being able to quickly pin point the location of this leak. The spike in water usage seen in "Figure one" in February can be attributed to this. Upon discovery, operators isolated the leak and installed a new combination air valve.

In May 2024, security fencing was erected around the well heads as recommended by the Interior Health Authority Public Health Officer. This provides additional source water protection from contamination or vandalism.

On July 3, 2024, a section of the Greywolf Dr distribution system was isolated to facilitate a water connection for a new residential building. Due to the temporary loss of pressure a boil water advisory (BWA) was put into place. Water samples were collected on July 4 and July 5 and sent to ALS Laboratories in Calgary where bacteriological testing was completed. Both samples came back negative and the BWA was rescinded.

In August 2024, a significant wind event occurred at Panorama. This caused extensive damage to the freshwater reservoir. Large sections of siding were pulled off along with the accompanying insulation that was held behind. In December 2024, operators successfully tied down the remaining panels with aircraft cable to ensure there would be no further damage. Operators also removed all the damaged siding from the site. Repairs are scheduled for the Spring of 2025.

On October 30, 2024, a section of the Greywolf Dr distribution system was isolated in order to safely facilitate hydrant flow testing. Due to the temporary loss of pressure a BWA was put into place. Water samples were collected on October 30 and October 31 and sent to ALS Laboratories in Calgary where bacteriological testing was completed. Both samples came back negative and the BWA was rescinded.

### SCADA system

Bluestem utilizes a SCADA (Supervisory control and data acquisition) system to monitor all critical components and operations of the water treatment system. The SCADA system allows Bluestem operators to monitor alarms, adjust treatment processes and accumulate data. This allows the operator to respond to events or look at data trends, regardless of location. Below (Figure 3) is a screen shot of the Panorama water treatment process on SCADA. Pump controls, reservoir levels and crucial parameters such as chlorine and turbidity are all displayed.

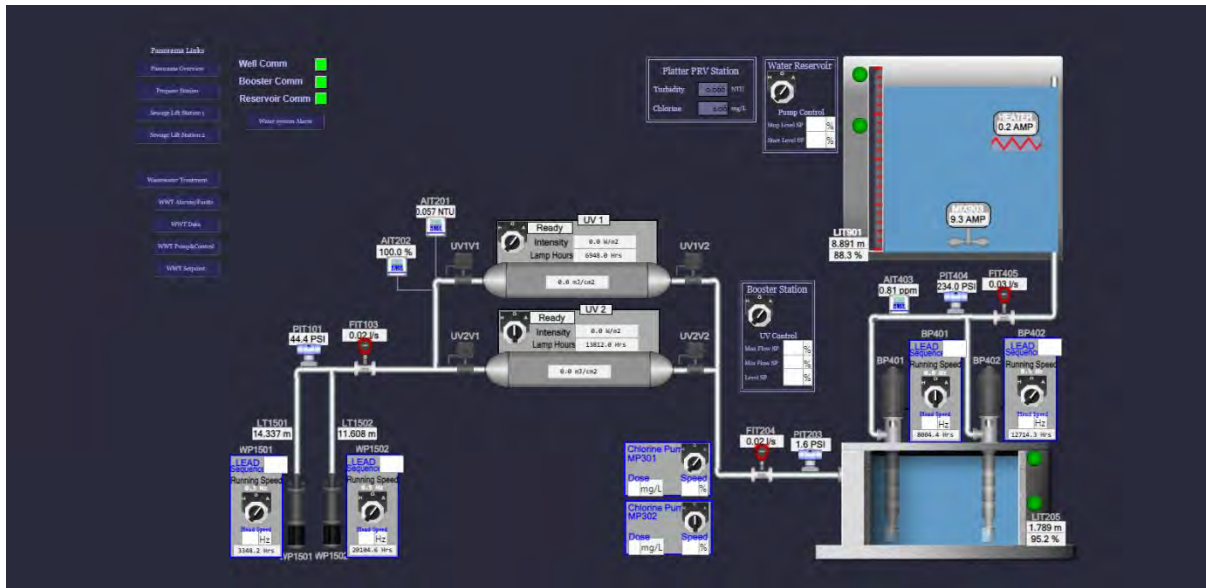


Figure 4

## Appendix A - Well 20-03 Full Potability Report

### Analytical Results

Sub-Matrix: Water

Client sample ID

LOCATION #1

(Matrix: Water)

					Client sampling date / time	14-Aug-2024 10:30
Analyte	CAS Number	Method/Lab	LOR	Unit	CG2411479-001	Result
<b>Physical Tests</b>						
Absorbance, UV (@ 254nm)	----	E404/CG	0.0050	AU/cm		<0.0050
Alkalinity, bicarbonate (as CaCO3)	----	E290/CG	1.0	mg/L		224
Alkalinity, carbonate (as CaCO3)	----	E290/CG	1.0	mg/L		<1.0
Alkalinity, hydroxide (as CaCO3)	----	E290/CG	1.0	mg/L		<1.0
Alkalinity, total (as CaCO3)	----	E290/CG	1.0	mg/L		224
Colour, true	----	E329/CG	5.0	CU		<5.0
Conductivity	----	E100/CG	2.0	µS/cm		500
Hardness (as CaCO3), from total Ca/Mg	----	EC100A/CG	0.50	mg/L		265
Langelier index (@ 4°C)	----	EC105A/CG	0.010	-		0.294
pH	----	E108/CG	0.10	pH units		7.87
Solids, total dissolved [TDS]	----	E162/CG	10	mg/L		321
Solids, total suspended [TSS]	----	E160-L/CG	1.0	mg/L		<1.5 <sup>DUS</sup>
Temperature, sample	----	E218/CG	0.10	°C		19.5
Turbidity	----	E121/CG	0.10	NTU		0.64
Transmittance, UV (@ 254nm)	----	E404/CG	1.0	% T/cm		100
<b>Anions and Nutrients</b>						
Ammonia, total (as N)	7664-41-7	E298/CG	0.0050	mg/L		<0.0050
Chloride	16887-00-6	E235.Cl-L/CG	0.10	mg/L		16.4
Fluoride	16984-48-8	E235.F/CG	0.020	mg/L		0.030
Nitrite (as N)	14797-65-0	E235.NO2-L/C G	0.0010	mg/L		<0.0010
Nitrogen, total organic	----	EC363/CG	0.050	mg/L		0.090
Phosphorus, total	7723-14-0	E372-U/CG	0.0020	mg/L		<0.0020
Sulfate (as SO4)	14808-79-8	E235.SO4-L/C G	0.050	mg/L		40.0
Nitrate (as N)	14797-55-8	E235.NO3-L/C G	0.0050	mg/L		0.706
Kjeldahl nitrogen, total [TKN]	----	E318/CG	0.050	mg/L		0.090
Nitrogen, total	7727-37-9	EC368/CG	0.050	mg/L		0.796
<b>Cyanides</b>						

## Appendix A Continued

### Analytical Results

Sub-Matrix: Water

Client sample ID

LOCATION #1

(Matrix: Water)

					Client sampling date / time	14-Aug-2024 10:30
Analyte	CAS Number	Method/Lab	LOR	Unit	CG2411479-001	
					Result	
<b>Cyanides</b>						
Cyanide, strong acid dissociable (Total)	----	E333/WT	0.0020	mg/L	<0.0020	
<b>Organic / Inorganic Carbon</b>						
Carbon, total organic [TOC]	----	E355-L/CG	0.50	mg/L	0.53	
<b>Microbiological Tests</b>						
Coliforms, total	----	E010/CG	1	MPN/100mL	<1	
Heterotrophic plate count [HPC]	----	E010.HPC/CG	1	MPN/100mL	60	
Bacteria, iron related, population estimate	----	E030.IRB/CG	1	CFU/mL	9000	
Coliforms, Escherichia coli [E. coli]	----	E010/CG	1	MPN/100mL	<1	
Bacteria, dominant	----	E030.IRB/CG	-	-	Enteric bacteria	
Aggressivity	----	E030.IRB/CG	-	-	Aggressive	
<b>Total Metals</b>						
Aluminum, total	7429-90-5	E420/CG	0.0030	mg/L	<0.0030	
Antimony, total	7440-36-0	E420/CG	0.00010	mg/L	<0.00010	
Arsenic, total	7440-38-2	E420/CG	0.00010	mg/L	0.00010	
Barium, total	7440-39-3	E420/CG	0.00010	mg/L	0.0626	
Boron, total	7440-42-8	E420/CG	0.010	mg/L	<0.010	
Cadmium, total	7440-43-9	E420/CG	0.0000050	mg/L	<0.0000050	
Calcium, total	7440-70-2	E420/CG	0.050	mg/L	56.5	
Chromium, total	7440-47-3	E420/CG	0.00050	mg/L	<0.00050	
Copper, total	7440-50-8	E420/CG	0.00050	mg/L	<0.00050	
Iron, total	7439-89-6	E420/CG	0.010	mg/L	0.079	
Lead, total	7439-92-1	E420/CG	0.000050	mg/L	<0.000050	
Magnesium, total	7439-95-4	E420/CG	0.0050	mg/L	30.1	
Manganese, total	7439-96-5	E420/CG	0.00010	mg/L	0.0188	
Mercury, total	7439-97-6	E508/CG	0.0000050	mg/L	<0.0000050	
Molybdenum, total	7439-98-7	E420/CG	0.000050	mg/L	0.000194	
Potassium, total	7440-09-7	E420/CG	0.050	mg/L	0.625	
Selenium, total	7782-49-2	E420/CG	0.000050	mg/L	0.000220	
Sodium, total	7440-23-5	E420/CG	0.050	mg/L	10.1	

## Appendix A Continued

### Analytical Results

 Sub-Matrix: **Water**

Client sample ID

**LOCATION #1**

 (Matrix: **Water**)

					Client sampling date / time	14-Aug-2024 10:30
Analyte	CAS Number	Method/Lab	LOR	Unit	CG2411479-001	
					Result	
<b>Total Metals</b>						
Strontium, total	7440-24-6	E420/CG	0.00020	mg/L	0.249	
Uranium, total	7440-61-1	E420/CG	0.000010	mg/L	0.000926	
Zinc, total	7440-66-6	E420/CG	0.0030	mg/L	<0.0030	



## Appendix B - Well 15-02 Full Potability Report

### Analytical Results

Sub-Matrix: Water

Client sample ID

Location #1

(Matrix: Water)

					Client sampling date / time	12-Jun-2024 09:35
Analyte	CAS Number	Method/Lab	LOR	Unit	CG2408042-001	Result
<b>Physical Tests</b>						
Absorbance, UV (@ 254nm)	----	E404/CG	0.0050	AU/cm		0.0150
Alkalinity, bicarbonate (as CaCO3)	----	E290/CG	1.0	mg/L		214
Alkalinity, carbonate (as CaCO3)	----	E290/CG	1.0	mg/L		6.8
Alkalinity, hydroxide (as CaCO3)	----	E290/CG	1.0	mg/L		<1.0
Alkalinity, total (as CaCO3)	----	E290/CG	1.0	mg/L		220
Colour, true	----	E329/CG	5.0	CU		<5.0
Conductivity	----	E100/CG	2.0	µS/cm		626
Hardness (as CaCO3), from total Ca/Mg	----	EC100A/CG	0.50	mg/L		268
Langelier index (@ 4°C)	----	EC105A/CG	0.010	-		0.748
pH	----	E108/CG	0.10	pH units		8.33
Solids, total dissolved [TDS]	----	E162/CG	10	mg/L		358
Solids, total suspended [TSS]	----	E160-L/CG	1.0	mg/L		<1.0 <sup>DUS</sup>
Temperature, sample	----	E218/CG	0.10	°C		20.9
Turbidity	----	E121/CG	0.10	NTU		<0.10
Transmittance, UV (@ 254nm)	----	E404/CG	1.0	% T/cm		96.6
<b>Anions and Nutrients</b>						
Ammonia, total (as N)	7664-41-7	E298/CG	0.0050	mg/L		<0.0050
Chloride	16887-00-6	E235.Cl-L/CG	0.10	mg/L		37.1
Fluoride	16984-48-8	E235.F/CG	0.020	mg/L		0.038
Nitrite (as N)	14797-65-0	E235.NO2-L/C G	0.0010	mg/L		<0.0010
Nitrogen, total organic	----	EC363/CG	0.050	mg/L		0.153
Phosphorus, total	7723-14-0	E372-U/CG	0.0020	mg/L		<0.0020
Sulfate (as SO4)	14808-79-8	E235.SO4-L/C G	0.050	mg/L		51.8
Nitrate (as N)	14797-55-8	E235.NO3-L/C G	0.0050	mg/L		2.87
Kjeldahl nitrogen, total [TKN]	----	E318/CG	0.050	mg/L		0.153 <sup>TKN</sup>
Nitrogen, total	7727-37-9	EC368/CG	0.050	mg/L		3.02
<b>Cyanides</b>						

## Appendix B Continued

### Analytical Results

Sub-Matrix: Water

Client sample ID

Location #1

(Matrix: Water)

					Client sampling date / time	12-Jun-2024 09:35
Analyte	CAS Number	Method/Lab	LOR	Unit	CG2408042-001	
					Result	
<b>Cyanides</b>						
Cyanide, strong acid dissociable (Total)	----	E333/WT	0.0020	mg/L	<0.0020	
<b>Organic / Inorganic Carbon</b>						
Carbon, total organic [TOC]	----	E355-L/CG	0.50	mg/L	<0.50	
<b>Microbiological Tests</b>						
Coliforms, total	----	E010/CG	1	MPN/100mL	<1	
Heterotrophic plate count [HPC]	----	E010.HPC/CG	1	MPN/100mL	3	
Bacteria, iron related, population estimate	----	E030.IRB/CG	1	CFU/mL	9000	
Coliforms, Escherichia coli [E. coli]	----	E010/CG	1	MPN/100mL	<1	
Bacteria, dominant	----	E030.IRB/CG	-	-	Enteric bacteria	
Aggressivity	----	E030.IRB/CG	-	-	Aggressive	
<b>Total Metals</b>						
Aluminum, total	7429-90-5	E420/CG	0.0030	mg/L	<0.0030	
Antimony, total	7440-36-0	E420/CG	0.00010	mg/L	<0.00010	
Arsenic, total	7440-38-2	E420/CG	0.00010	mg/L	<0.00010	
Barium, total	7440-39-3	E420/CG	0.00010	mg/L	0.109	
Boron, total	7440-42-8	E420/CG	0.010	mg/L	0.015	
Cadmium, total	7440-43-9	E420/CG	0.0000050	mg/L	<0.0000050	
Calcium, total	7440-70-2	E420/CG	0.050	mg/L	58.5	
Chromium, total	7440-47-3	E420/CG	0.00050	mg/L	<0.00050	
Copper, total	7440-50-8	E420/CG	0.00050	mg/L	<0.00050	
Iron, total	7439-89-6	E420/CG	0.010	mg/L	<0.010	
Lead, total	7439-92-1	E420/CG	0.000050	mg/L	<0.000050	
Magnesium, total	7439-95-4	E420/CG	0.0050	mg/L	29.7	
Manganese, total	7439-96-5	E420/CG	0.00010	mg/L	0.00023	
Mercury, total	7439-97-6	E508/CG	0.0000050	mg/L	<0.0000050	
Molybdenum, total	7439-98-7	E420/CG	0.000050	mg/L	0.000101	
Potassium, total	7440-09-7	E420/CG	0.050	mg/L	1.79	
Selenium, total	7782-49-2	E420/CG	0.000050	mg/L	0.000230	
Sodium, total	7440-23-5	E420/CG	0.050	mg/L	21.2	

## Appendix B Continued

### Analytical Results

Sub-Matrix: **Water**

Client sample ID

Location #1

(Matrix: **Water**)

					Client sampling date / time	12-Jun-2024 09:35
Analyte	CAS Number	Method/Lab	LOR	Unit	CG2408042-001	
						Result
<b>Total Metals</b>						
Strontium, total	7440-24-6	E420/CG	0.00020	mg/L	0.251	
Uranium, total	7440-61-1	E420/CG	0.000010	mg/L	0.000752	
Zinc, total	7440-66-6	E420/CG	0.0030	mg/L	<0.0030	