Wilderness Mountain Water System

2023 Annual Report

CRD | Drinking Water

Introduction

This report provides a summary of the Wilderness Mountain Water Service for 2023 and includes a description of the service, summary of the water supply, demand and production, drinking water quality, operations highlights, capital project updates and financial report.

Service Description

The community of Wilderness Mountain is a rural residential development located on Mount Matheson in the Juan de Fuca Electoral Area. The area was originally serviced by a private water utility from about 1983, and in 2008 the service converted to the Capital Regional District (CRD). The Wilderness Mountain water service is made up of 82 parcels encompassing a total area of approximately 124 hectares. Of the 82 parcels, 74 were customers to the water system in 2023.

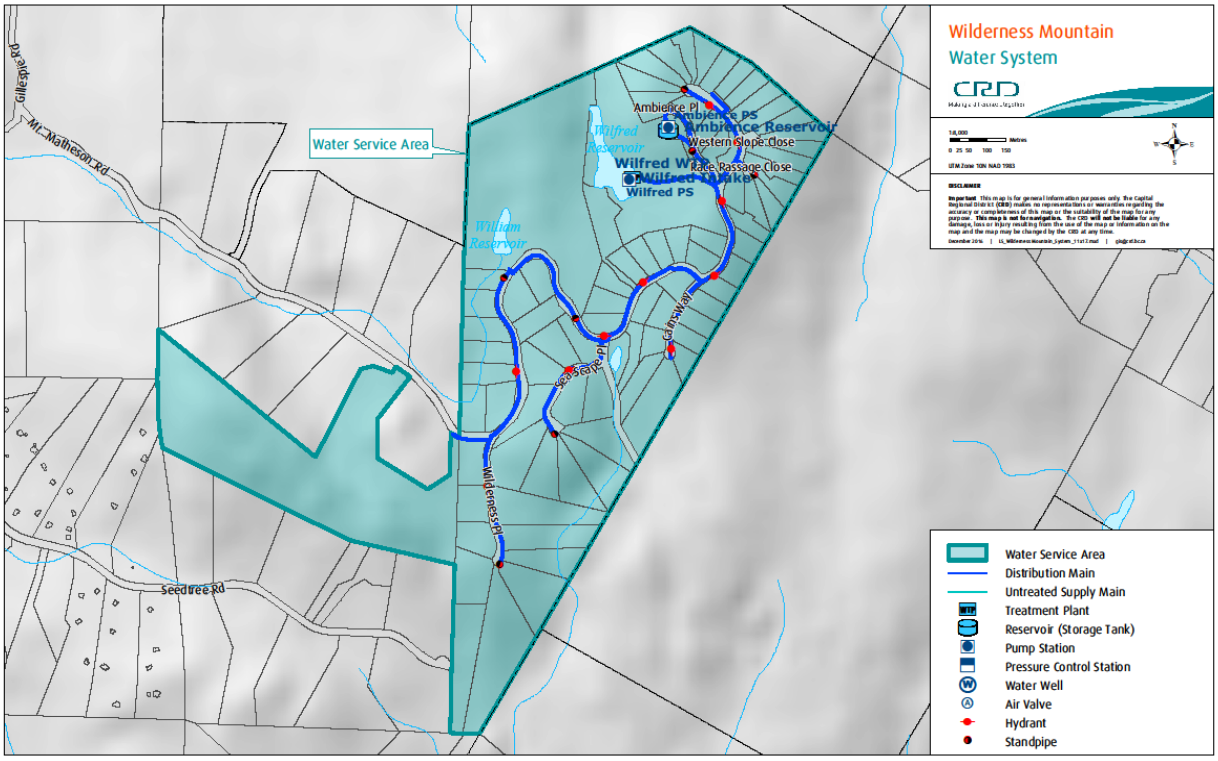

Figure 1: Map of the Wilderness Mountain Water Service Area

The Wilderness Mountain water system is primarily comprised of:

- Raw water obtained from Wilfred Reservoir, a small surface water body which lies within a protected watershed and was created by the construction of two dams.
- Water from Wilfred Reservoir is pumped to the treatment plant which consists of coarse cartridge filtration, ultraviolet disinfection and chloramine disinfection.
- The chloraminated water is then pumped to two distribution system storage tanks (combined capacity of 250 cubic metres or 66,000 US gallons) and the distribution system.
- Distribution system. 3,750 meter network of 150 millimeter (6 inch) and 100 mm (4 inch) polyvinyl chloride (PVC) water mains.
- Other water system assets: 74 service connections, 10 hydrants, six standpipes, 21 gate valves and a Supervisory Control and Data Acquisition (SCADA) system.
- Although the water system also includes the William Brook Dam and related water reservoir, this reservoir is no longer utilized for water supply.

Water Supply

The raw water supply level in Wilfred Reservoir is shown in Figure 2. The lake level was at its lowest point in October. The reservoir reached full volume in January 2023.

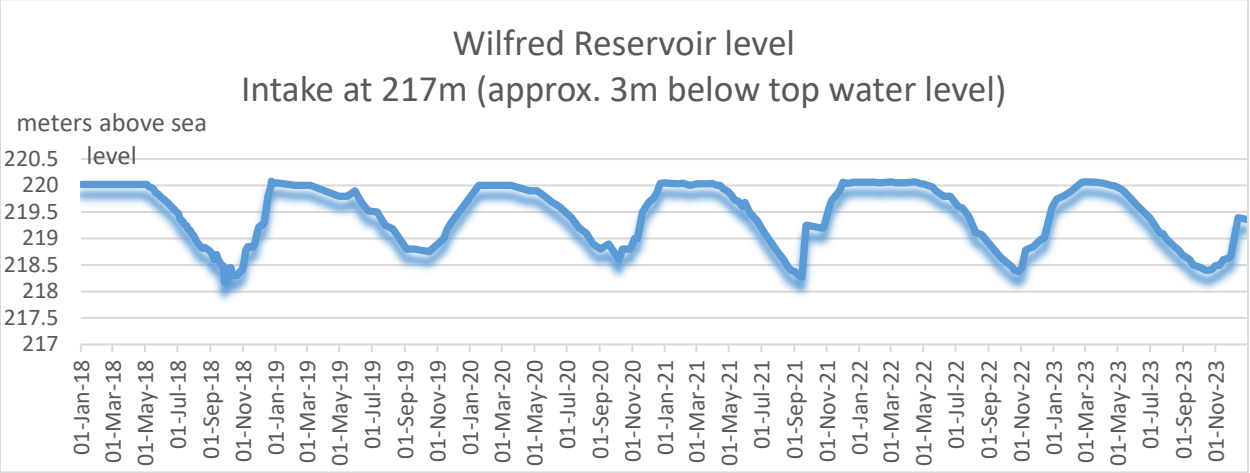

Figure 2: Wilfred Reservoir Water Level 2018-2023

Water Usage

The volume used by the community, or the water demand, is illustrated in Figure 3. The demand in 2023 was 14% lower than in 2022 and within 1% the five-year average.

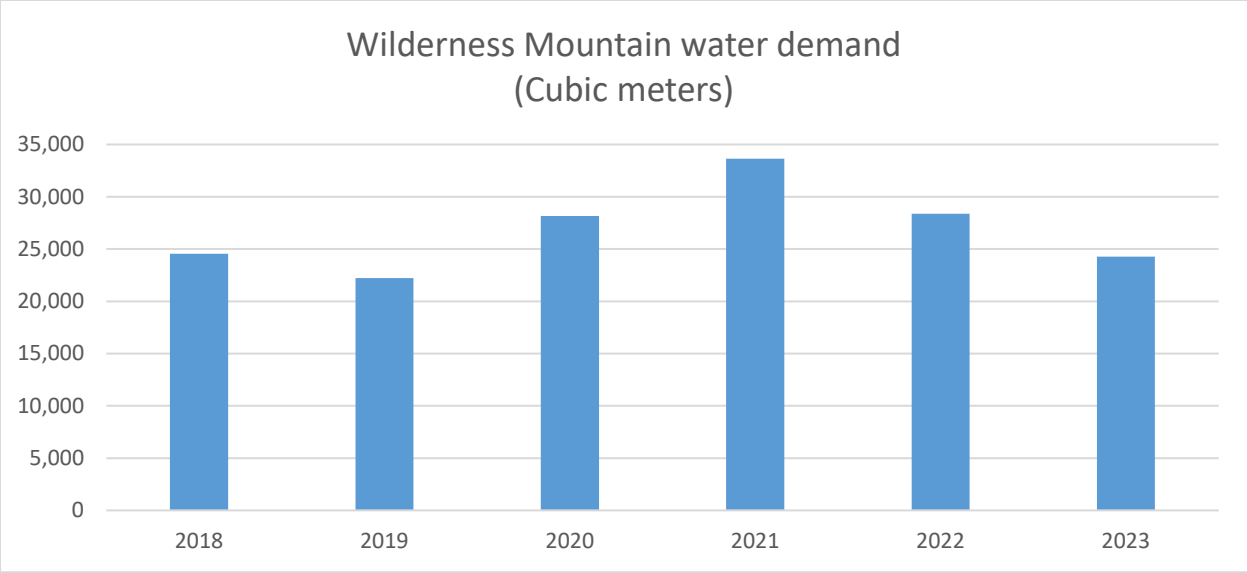

Figure 3: Wilderness Mountain Water Demand (cubic meters) 2018-2023

Drinking Water Quality

The Wilderness Mountain Water System was on a boil water advisory (BWA) for 65 days in 2023 due to elevated turbidity in the treated water. High algal activity and the inability of the existing filtration system to filter out very small algae species in bloom were the main factors for this long BWA for this system. Ongoing discussions with the Commission, Island Health, and CRD staff are taking place to plan upgrades in the near future to mitigate this situation.

Wilfred Reservoir raw water exhibited elevated iron and manganese concentrations throughout the entire year, but especially during the fall and winter. Lake turnover and rain-driven runoff events are the main causes. Without designated treatment in place to remove these metals from the raw water, the aesthetic objective for manganese, as per Guidelines for Canadian Drinking Water Quality (GCDWQ), was regularly exceeded in the treated water. Iron concentrations exceeded the aesthetic objective during the wet season. In samples from November 15, the manganese concentrations in the treated water even exceeded the maximum acceptable concentration (MAC), the health-related limit stipulated by the GCDWQ. Concentrations beyond the aesthetic limit can lead to water discolourations, while exceedances of the MAC can become a health issue with chronic exposure. Because the disinfection process in the Wilderness Mountain Water System utilizes chloramination, the effects on customers in terms of discoloured water may have been reduced. Additional treatment is required to mitigate this ongoing issue.

The data below provides a summary of the water quality characteristics in 2023:

Raw Water:

- In June and July, the raw water exhibited a very high spike of total coliform bacteria concentrations. Aside from that, total coliform concentrations were low throughout the year.
- *E. coli* bacteria concentrations were mostly low with higher concentrations in the fall following the first post-summer rainfall and runoff event.
- *Cryptosporidium* and *Giardia* parasites were tested twice in 2023 and neither were detected.

- The raw water was tested for metals in February, May, August and November. The results indicate that both iron and manganese concentrations are particularly high during the wet season in fall and winter. Cause for this is likely a combination of the lake turnover in October/November and runoff from rainfall events.
- The median annual raw water turbidity was 0.88 Nephelometric Turbidity Unit (NTU) and therefore slightly higher than in 2022. The turbidity was typically over 1 NTU during the wet season and during the peak of the summer. The maximum turbidity was 1.8 NTU (November). Most raw water turbidity spikes coincided with algal and/or zooplankton blooms in Wilfred Reservoir. Runoff and lake turnover events can also have an adverse effect on turbidity.
- The raw water was soft (median hardness 16.40 mg/L $CaCO_3$).
- The pH was slightly acidic (median pH 6.9).
- The median total organic carbon (TOC) concentration was moderately high at 4.25 mg/L, which is in line with historic results.

Treated Water:

- The treated water was safe to drink outside the 65-day BWA from October 28 into 2024. No *E. coli* bacteria were found in the treated water and only one of 56 bacteriological samples tested positive for total coliform bacteria throughout the year (November 15: 2 CFU/100mL, near 767 Cains Way).
- The treated water turbidity was above the GCDWQ turbidity limit of 1.0 NTU in November. This led to the aforementioned prolonged BWA.
- Manganese concentrations exceeded the aesthetic objective in the treated water during most parts of the year. Two treated water samples from November were above the MAC in the GCDWQ. Iron concentrations were elevated throughout the year and in November and February in exceedance of the aesthetic objective. Despite the exceedances, no significant water discolouration was reported by customers.
- The disinfection by-products Trihalomethanes (TTHM) and Haloacetic Acids (HAA) were well below the GCDWQ limits.
- The annual median total chlorine residual in the system was 1.51 mg/L.

Table 1 and 2 below provide a summary of the 2023 raw and treated water test results.

Water quality data collected from this drinking water system can be reviewed on the CRD website:

https://www.crd.bc.ca/about/data/drinking-water-quality-reports

Operational Highlights

The following is a summary of the operational issues that were addressed by CRD Integrated Water Services staff:

- Maintenance of all 10 fire hydrants
- Replace ammonia solution tank and added secondary containment
- Powerline to treatment plant, vegetation clearing monthly dam inspections and dam maintenance

Capital Project Updates – 2023

No Capital Projects were approved on the 2023 Capital Plan. CRD did initiate preliminary efforts that will support the replacement of the wooden intake platform, which was approved as a 2024 project. CRD recommends future Capital Projects to comply with Island Health's operating permit to achieve Drinking Water Treatment Objectives (Microbiological) for Surface Water Supplies in British Columbia (SWTO).

Financial Report

Please refer to the attached 2023 Statement of Operations and Reserve Balances.

Revenue includes parcel taxes (Transfers from Government), fixed user fees (User Charges), water sales and interest on savings (Interest earnings), and miscellaneous revenue such as late payment charges (Other revenue).

Expenses include all costs of providing the service. General Government Services include budget preparation, financial management, utility billing and risk management services. CRD Labour and Operating Costs include CRD staff time as well as the costs of equipment, tools, and vehicles. Debt servicing costs are interest and principal payments on long term debt. Other Expenses include all other costs to administer and operate the water system, including insurance, supplies, water testing and electricity.

The difference between Revenue and Expenses is reported as Net revenue (expenses). Any transfers to or from capital or reserve funds for the service (Transfers to own funds) are deducted from this amount and it is then added to any surplus or deficit carry forward from the prior year, yielding an Accumulated Surplus (or deficit). In alignment with Local Government Act Section 374 (11), any deficit must be carried forward and included in the next year's financial plan.

Increased system maintenance costs in 2023 resulted in an annual deficit of $3,000. The operating reserve balance was not sufficient to cover the deficit, therefore it must be carried forward and included in 2024 financial plan for immediate recovery. The service is experiencing ongoing drinking water quality issues, which requires system cyclical maintenance and capital upgrades to provide additional treatment to mitigate the ongoing water quality issues and potential risk of not meeting health regulatory requirements. The Commission will be engaged for ongoing discussions regarding sustainable service delivery, regulatory compliance requirement and prudent financial planning for future years.

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Attachments: Table 1
Table 2
2023 Statement of Operations and Reserve Balances

For questions related to this Annual Report please email IWSAdministration@crd.bc.ca

Table 1

Table 1: 2023 Summary of Raw Water Test Results, Wilderness Mountain Water System										
PARAMETER		**2023 ANALYTICAL RESULTS**				**CANADIAN GUIDELINES**	**2013 - 2022 ANALYTICAL RESULTS**			
Parameter Name	Units of Measure	Annual Median	Samples Analyzed	Range Minimum	Range Maximum	≤ = Less than or equal to	Median	Samples Analyzed	Range Minimum	Range Maximum
mg/L = parts per million ug/L = parts per billion										
Physical Parameters (ND means Not Detected by analytical method used)										
Carbon, Dissolved Organic	mg/L as C	**4.2**	2	4	4.4		3.8	21	1.91	5.4
Carbon,Total Organic	mg/L as C	**4.25**	4	3.9	4.6	Guideline Archived	4	27	2.96	8.8
Colour, True	TCU	**19.5**	6	15	28	≤15 AO	14	59	7	26
Hardness as $CaCO_3$	mg/L	**16.4**	4	15.3	17.2	No Guideline Required	15.85	32	11.1	20.6
pH	pH units	**6.86**	13	6.3	7.33	7.0 - 10.5 AO	6.9	67	6.14	8.1
Total Suspended Solids	mg/L	**2.4**	1	2.4	2.4		1.4	2	1.2	1.6
Total Solids	mg/L	**42**	1	42	42		49.9	15	42	88
Turbidity, lab tests	NTU	**0.875**	34	0.45	1.8		0.9	400	0.35	5.8
Ultraviolet Transmittance	%	**78.4**	6	74.1	80.4		76.65	32	69.9	82.1
Water Temperature	degrees C	**13.6**	24	4.8	20.8	≤15 AO	11.5	320	1.7	21.2
Non-Metallic Inorganic Chemicals (ND means Not Detected by analytical method used)										
Ammonia, Total	ug/L as N	**< 15**	2	< 15	< 15		< 15	18	< 0.61	71
Bromide	ug/L as Br	**0.035**	1	0.035	0.035		33	16	< 0.03	50
Chloride	mg/L as Cl	**12**	1	12	12	≤ 250 AO	11	10	10	14
Cyanide	mg/L as Cn	**< 0.0005**	1	< 0.0005	< 0.0005	0.2 MAC	0.00058	10	< 0.0005	0.0164
Fluoride	mg/L as F	**< 0.05**	1	< 0.05	< 0.05	1.5 MAC	< 0.05	10	< 0.05	< 0.05
Nitrogen, Nitrate	ug/L as N	**25**	2	< 20	< 15		0.028	18	< 0.45	37
Nitrogen, Nitrite	ug/L as N	**< 5**	2	< 5	< 15		< 5	18	< 0.005	< 5
Nitrogen, Total	ug/L as N	**244.5**	2	242	247		200	18	84	267
Phosphate,Total	ug/L as P	**6.45**	2	5.6	7.3		5.6	18	< 1	71
Silica	mg/L as SiO_2	**2.65**	2	2	3.3		3.6	17	<0.5	5.5
Silicon	mg/L as Si	**1149.5**	4	809	2190		1735	28	380	2920
Sulphate	mg/L as SO_4	**4.5**	3	4.3	5.2	≤ 500 AO	6.33	20	4	19
Sulphide	mg/L as H_2S	**< 0.0018**	1	< 0.0018	< 0.0018	≤ 0.05 AO	0.00275	2	< 0.0018	0.0037
Sulphur	mg/L as S	**< 3**	4	< 3	<3		< 3	29	< 3	5.94
Metals (ND means Not Detected by analytical method used)										
Aluminum	ug/L as Al	**16.85**	4	7.9	30.7	2900 MAC / 100 OG	28.95	28	7.8	81.5
Antimony	ug/L as Sb	**< 0.5**	4	< 0.5	< 0.5	6 MAC	< 0.5	28	< 0.5	< 0.5
Arsenic	ug/L as As	**< 0.1**	4	< 0.1	0.13	10 MAC	< 0.1	28	< 0.1	0.15
Barium	ug/L as Ba	**1.95**	4	1.8	2.4	1000 MAC	2	28	< 1	2.7
Beryllium	ug/L as Be	**< 0.1**	4	< 0.1	2.4		< 0.1	28	< 0.1	< 0.1
Bismuth	ug/L as Bi	**< 1**	4	< 1	< 1		< 1	28	< 1	< 1
Boron	ug/L as B	**< 50**	4	< 50	< 50	5000 MAC	< 50	28	< 50	< 50
Cadmium	ug/L as Cd	**< 0.01**	4	< 0.01	< 0.01	7 MAC	< 0.01	28	< 0.01	0.117
Calcium	mg/L as Ca	**3.515**	4	3.21	3.72	No Guideline Required	3.38	28	2.9	4.56
Chromium	ug/L as Cr	**< 1**	4	< 1	< 1	50 MAC	< 1	28	< 1	< 1
Cobalt	ug/L as Co	**< 0.2**	4	< 0.2	< 0.2		< 0.2	28	< 0.2	0.5
Copper	ug/L as Cu	**4.66**	4	2.86	28	2000 MAC / ≤ 1000 AO	3.135	28	1.95	28.5
Iron	ug/L as Fe	**276**	4	90.5	463	≤ 300 AO	174	28	111	902
Lead	ug/L as Pb	**0.435**	4	0.22	0.51	5 MAC	0.25	28	<0.2	1.01
Lithium	ug/L as Li	**< 2**	4	< 2	< 2		< 2	19	< 2	5
Magnesium	mg/L as Mg	**1.855**	4	1.76	1.94	No Guideline Required	1.735	28	1.48	2.24
Manganese	ug/L as Mn	**54.7**	4	19.7	179	120 MAC / ≤ 20 AO	54.85	28	23.7	364
Mercury	ug/L as Hg	**< 0.0019**	4	< 0.0019	< 0.0019		< 0.002	25	< 0.0019	< 0.05
Molybdenum	ug/L as Mo	**< 1**	4	< 1	< 1		< 1	28	< 1	< 1
Nickel	ug/L as Ni	**< 1**	4	< 1	< 1		< 1	28	< 1	5.2
Potassium	mg/L as K	**0.365**	4	0.342	0.395		0.32	28	0.249	0.423
Selenium	ug/L as Se	**< 0.1**	4	< 0.1	< 0.1	50 MAC	< 0.1	28	< 0.1	0.12
Silver	ug/L as Ag	**< 0.02**	4	< 0.02	< 0.02	No Guideline Required	< 0.02	28	< 0.02	< 0.02
Sodium	mg/L as Na	**6.73**	4	6.48	7.1	≤ 200 AO	6.83	28	6.18	10.9
Strontium	ug/L as Sr	**14.5**	4	14	15.5	7000 MAC	14.25	28	12.2	17.2
Thallium	ug/L as Tl	**< 0.01**	4	< 0.01	< 0.01		< 0.01	28	< 0.01	< 0.05
Tin	ug/L as Sn	**< 5**	4	< 5	< 5		< 5	28	< 5	< 5
Titanium	ug/L as Ti	**< 5**	4	< 5	< 5		< 5	28	< 5	< 5
Uranium	ug/L as U	**< 0.1**	4	< 0.1	<0.1	20 MAC	< 0.1	28	< 0.1	< 0.1
Vanadium	ug/L as V	**< 5**	4	< 5	<5		< 5	28	< 5	< 5
Zinc	ug/L as Zn	**8.4**	4	< 5	11.3	≤ 5000 AO	< 5	28	< 5	21.3
Zirconium	ug/L as Zr	**< 0.1**	4	< 0.1	< 0.1		< 0.1	28	< 0.1	< 0.5
Microbial Parameters										
Indicator Bacteria										
Coliform, Total	Coliforms/100 mL	**175**	14	55	53000		125	214	<1	A 4300
E. coli	E.coli/100 mL	**1.5**	16	< 1	20		< 1	221	<1	29
Hetero. Plate Count, 28C (7 day)	CFU/1 mL	Last analyzed in 2014				No Guideline Required	820	31	40	A 1950
Chlorophyll										
Chlorophyll A	ug/L	**2.9**	15	0.93	10.7		3.51	145	0.295	10.4
Parasites						No MAC Established				
Cryptosporidium, Total oocysts	oocysts/100 L	**< 0.1**	2	< 0.1	< 0.1	Zero detection desirable	**< 1**	6	< 0.1	< 1
Giardia, Total cysts	cysts/100 L	**< 0.1**	2	< 0.1	< 0.1	Zero detection desirable	**< 1**	6	< 0.1	< 1

Table 2

Table 2: 2023 Summary of Treated Water Test Results, Wilderness Mountain Water System										
PARAMETER		**2023 ANALYTICAL RESULTS**				**CANADIAN GUIDELINES**	**2013-2022 ANALYTICAL RESULTS**			
Parameter Name	Units of Measure	Annual Median	Samples Analyzed	Range Minimum	Range Maximum	≤ = Less than or equal to	Median	Samples Analyzed	Range Minimum	Range Maximum
mg/L = parts per million ug/L = parts per billion										
Physical Parameters										
Colour, True	TCU	**15.5**	6	11	24	≤ 15 AO	10	57	5	19
Hardness as CaCO3	mg/L	**17.2**	7	15.8	17.5		15.75	18	13.6	18.1
pH	pH units	**7.06**	14	6.9	8.5	7.0 - 10.5 AO	7.02	70	6.45	9.1
Total Organic Carbon	mg/L	**4.1**	4	3.7	4.5		3.85	13	2.5	8.7
Turbidity, lab tests	NTU	**0.65**	18	0.45	1.8	1 MAC and ≤ 5 AO	0.66	339	0.17	3.3
Water Temperature	degrees C	**9**	128	3.9	20.6	≤ 15 AO	11.35	1126	1.8	20.5
Microbial Parameters										
Indicator Bacteria										
Coliform, Total	CFU/100 mL	**< 1**	56	< 1	2	0 MAC	< 1	475	<1	330
E. coli	CFU/100 mL	**< 1**	56	< 1	< 1	0 MAC	<1	475	<1	40
Hetero. Plate Count, 28C (7 day)	CFU/1 mL	**7500**	7	1100	22000	No Guideline Required	1885	50	40	G 20000
Disinfectants										
Disinfectants										
Chlorine, Total Residual	mg/L as Cl_2	**1.505**	140	0	3.61	No Guideline Required	1.34	1188	0	5.2
Monochloramine, Field - 1 Station	mg/L	**2.935**	16	1.17	3.45		2.28	65	0.17	3.29
Disinfection By-Products (ND means Not Detected by analytical method used)										
Trihalomethanes (THMs)										
Bromodichloromethane (BDCM)	ug/L	**< 1**	4	< 1	< 1		< 1	48	<0.2	17
Bromoform (BRFM)	ug/L	**< 1**	4	< 1	< 1		< 1	48	< 0.1	< 2
Chloroform (CHLF)	ug/L	**1.8**	4	1	2.9		2.6	48	< 1	110
Chlorodibromomethane (DBCM)	ug/L	**< 1**	4	< 1	< 1		< 1	48	<0.1	<3
Total Trihalomethanes (TTHM)	ug/L	**1.8**	4	1	2.9	100 MAC	2.45	48	< 1	130
Haloacetic Acids (HAAs)										
Haloacetic Acids (*5 Total, HAA5)	ug/L	**12**	2	12	12	80 MAC	8	42	0.75	69
Metals (ND means Not Detected by analytical method used)										
Aluminum	ug/L as Al	**17.1**	7	5.6	28	2900 MAC / 100 OG	27.4	18	4.5	62.1
Antimony	ug/L as Sb	**< 0.5**	7	< 0.5	< 0.5	6 MAC	< 0.5	18	< 0.5	< 0.5
Arsenic	ug/L as As	**< 0.1**	7	< 0.1	0.12	10 MAC	< 0.1	18	< 0.1	0.14
Barium	ug/L as Ba	**2.2**	7	1.6	2.6	1000 MAC	1.7	18	< 1	2.6
Beryllium	ug/L as Be	**< 0.1**	7	< 0.1	< 0.1		< 0.1	18	< 0.1	< 0.1
Bismuth	ug/L as Bi	**< 1**	7	< 1	< 1		< 1	18	< 1	< 1
Boron	ug/L as B	**< 50**	7	< 50	< 50	5000 MAC	< 50	18	< 50	< 50
Cadmium	ug/L as Cd	**< 0.01**	7	< 0.01	< 0.01	5 MAC	< 0.01	18	< 0.01	< 0.01
Calcium	mg/L as Ca	**3.73**	7	3.35	3.93	No Guideline Required	3.355	18	2.93	3.89
Chromium	ug/L as Cr	**< 1**	7	< 1	< 1	50 MAC	< 1	18	< 1	< 1
Cobalt	ug/L as Co	**< 0.2**	7	< 0.2	< 0.2		< 0.2	18	< 0.2	< 0.5
Copper	ug/L as Cu	**15**	7	8.15	24.5	2000 MAC / ≤ 1000 AO	10.15	18	3.57	92.7
Iron	ug/L as Fe	**219**	7	49.7	383	≤ 300 AO	119	18	52	573
Lead	ug/L as Pb	**0.44**	7	0.25	0.65	5 MAC	0.395	18	0.2	0.99
Lithium	ug/L as Li	**< 2**	7	< 2	< 2		< 2	14	< 2	< 5
Magnesium	mg/L as Mg	**1.85**	7	1.76	1.96	No Guideline Required	1.735	18	1.52	2.07
Manganese	ug/L as Mn	**72.7**	7	8	167	120 MAC / ≤ 20 AO	32.45	18	8.8	208
Mercury	ug/L as Hg	**< 0.0019**	4	< 0.0019	< 0.0019		< 0.0019	15	< 0.0019	0.0032
Molybdenum	ug/L as Mo	**< 1**	7	< 1	< 1		< 1	18	< 1	< 1
Nickel	ug/L as Ni	**< 1**	7	< 1	< 1		< 1	18	< 1	< 1
Potassium	mg/L as K	**0.347**	7	0.339	0.397		0.3375	18	0.241	0.388
Selenium	ug/L as Se	**< 0.1**	7	< 0.1	< 0.1	50 MAC	< 0.1	18	< 0.1	< 0.1
Silicon	mg/L as Si	**1480**	7	805	2190		1960	18	408	2860
Silver	ug/L as Ag	**< 0.02**	7	< 0.02	< 0.02	No Guideline Required	< 0.02	18	< 0.02	< 0.02
Sodium	mg/L as Na	**9.66**	7	9.31	10.7	≤ 200 AO	9.52	18	7.22	11.4
Strontium	ug/L as Sr	**15.2**	7	14.3	16	7000 MAC	14.25	18	12.3	16.4
Sulfur	mg/L as S	**< 3**	7	< 3	< 3		< 3	18	< 3	4.6
Thallium	ug/L as Tl	**< 0.01**	7	< 0.01	< 0.01		< 0.01	18	< 0.01	< 0.05
Tin	ug/L as Sn	**< 5**	7	< 5	< 5		< 5	18	< 5	< 5
Titanium	ug/L as Ti	**< 5**	7	< 5	< 5		< 5	18	< 5	< 5
Uranium	ug/L as U	**< 0.1**	7	< 0.1	< 0.1	20 MAC	< 0.1	18	< 0.1	< 0.1
Vanadium	ug/L as V	**< 5**	7	< 5	< 5		< 5	18	< 5	< 5
Zinc	ug/L as Zn	**< 5**	7	< 5	8.7	≤ 5000 AO	< 5	18	< 5	18.6
Zirconium	ug/L as Zr	**< 0.1**	7	< 0.1	< 0.1		< 0.1	18	< 0.1	< 0.5