Wilderness Mountain Water System

2021 Annual Report

CRD | Drinking Water

Introduction

This report provides a summary of the Wilderness Mountain Water Service for 2021 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 2021.

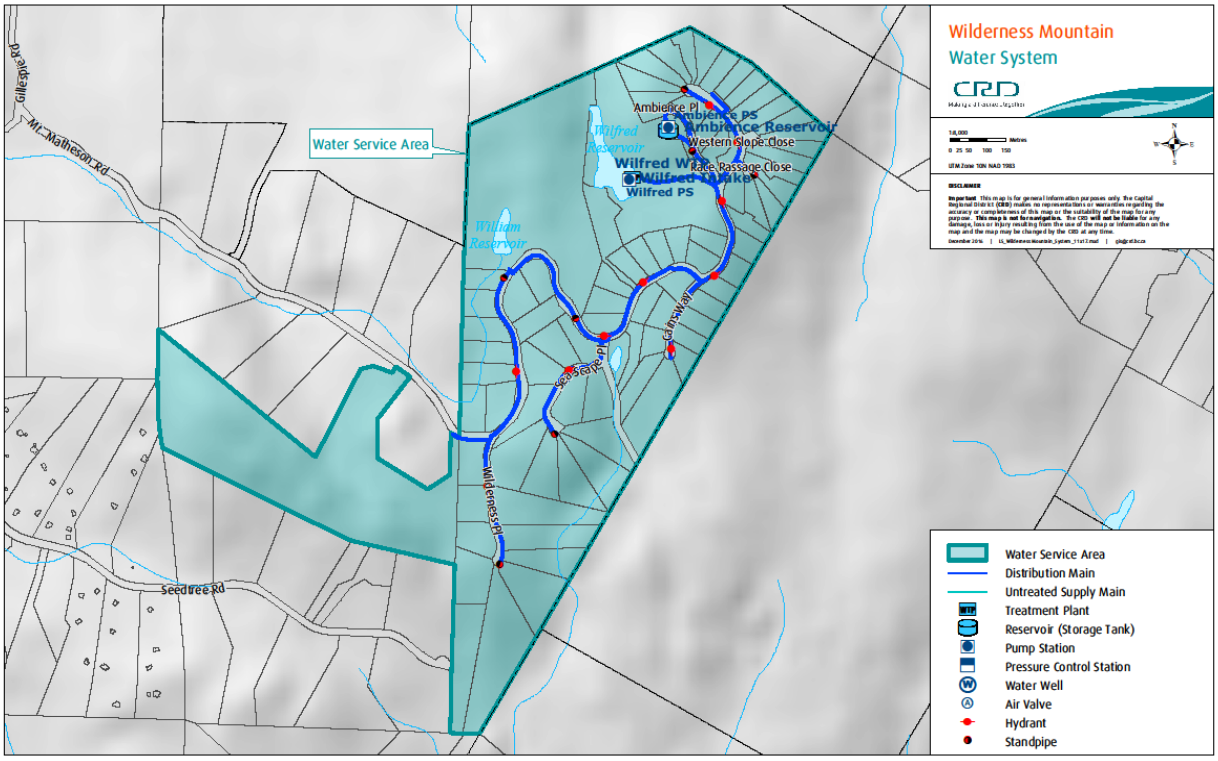

Figure 1: Map of the Wilderness Mountain Water Service Area

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 September and November. The reservoir reached full volume in January 2021.

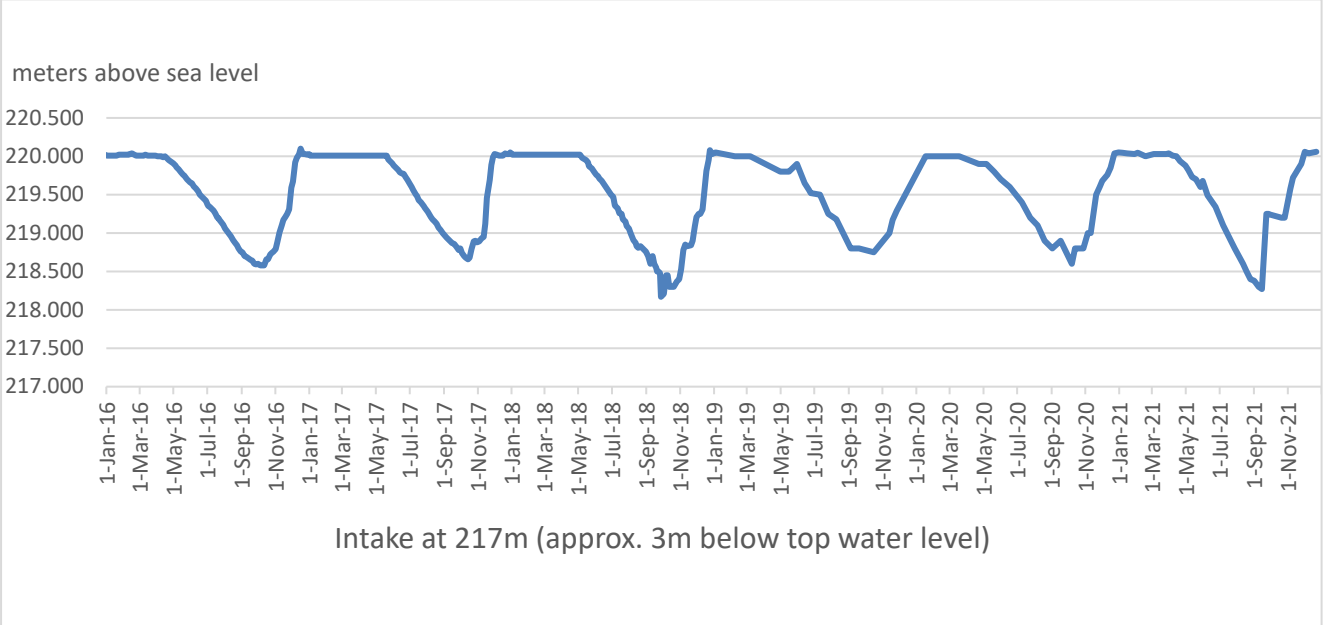

Figure 2: Wilfred Reservoir Water Level 2016-2021

Water Usage

The volume used by the community, or the water demand, is illustrated in Figure 3. The demand in 2021 was 19% higher than in 2020 and 29% higher than the five year average.

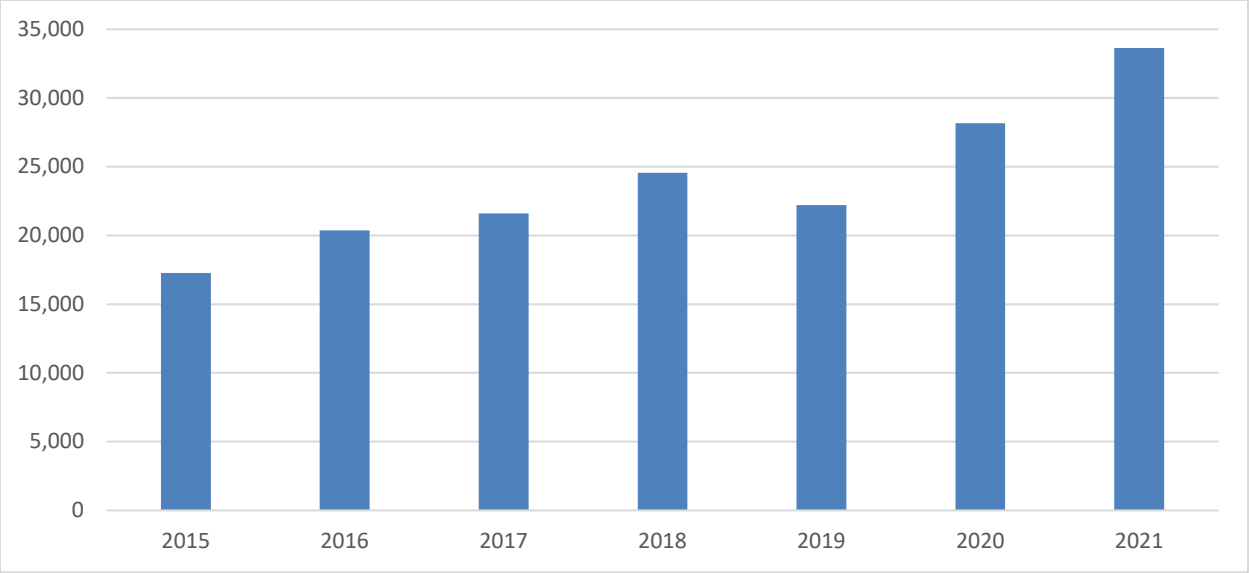

Figure 3: Wilderness Mountain Water Demand (cubic meters) 2015-2021

Drinking Water Quality

The Wilderness Mountain Water System was on a boil water advisory (BWA) for 224 days in 2021 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 record-long BWA for this system. Discussions with the Commission, Island Health, and CRD staff have taken 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. In the days following the extreme rainfall and runoff event on November 14 and 15, 2021, both iron and manganese concentrations in the reservoir reached unusually high levels. 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. In samples from November 19 following this extreme weather event, the manganese concentrations in the treated water even exceeded the maximum acceptable concentration (MAC), and the iron concentrations surpassed the aesthetic limit. 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 issue.

The data below provides a summary of the water quality characteristics in 2021:

Raw Water:

- Between June and August, the raw water exhibited medium to high concentrations of total coliform bacteria. Outside this timeframe, total coliform concentrations were low.
- *E. coli* bacteria concentrations were mostly low with higher concentrations in the fall and winter, which included one exceedance of the USEPA 20 CFU/100mL unfiltered surface water treatment criterion (26 CFU/100mL on Nov 19, following the extreme rainfall and runoff event).
- *Cryptosporidium* and *Giardia* parasites were tested twice in 2021 and neither were detected.
- The raw water was tested for metals in March, May, August and November and in all samples manganese was above the aesthetic objective and the sample from November above the MAC in the GCDWQ. Iron concentrations were elevated but only the November sample was in exceedance of the aesthetic objective. Concentrations of both metals are highest in the fall following events of high precipitation and runoff into the reservoir and during the lake turnover. No significant water discolouration was reported by customers.
- The mean annual raw water turbidity was 1.25 Nephelometric Turbidity Unit (NTU) and therefore significantly higher than in 2020. The maximum turbidity was 2.2 NTU (July to August). Most raw water turbidity spikes coincided with algal and/or zooplankton blooms in Wilfred Reservoir.
- The raw water was soft (median hardness 15.3 mg/L $CaCO_3$).
- The pH was neutral (median pH 7.1).
- The median total organic carbon (TOC) concentration was moderately high at 4.35 mg/L, slightly higher than in 2020; likely a result of higher algal activity in 2021.

Treated Water:

- The treated water was bacteriologically safe to drink outside the two BWA periods (first BWA April 20 to October 7; second BWA: October 26 to December 17). No *E. coli* bacteria were found in the treated water and only one of 112 bacteriological samples tested positive for total coliform bacteria throughout the year (October 4: 3 CFU/100mL at 719 Cains Way).
- The treated water turbidity was periodically above the GCDWQ turbidity limit of 1.0 NTU in particular during spring and summer. This led to the aforementioned prolonged BWAs. The short-term exceedances lasted only a few minutes and were usually related to pump starts or other operational activities.
- 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 1.54 mg/L.

Table 1 and 2 below provide a summary of the 2021 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
- Repair of 50 mm diameter service line leak on Cains Way
- Replacement of hypochlorite metering pump at the treatment plant
- Monthly dam inspections and maintenance

Capital Project Updates – 2021

- Source Water Protection Plan – Started in 2021 with completion expected in 2022.

Financial Report

Please refer to the attached 2021 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 added to any surplus or deficit carry forward from the prior year, yielding an Accumulated Surplus (or deficit) that is carried forward to the following year.

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Attachment: 2021 Statement of Operations and Reserve Balances

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

Table 1

Table 1: 2021 Summary of Raw Water Test Results, Wilderness Mountain Water System									
PARAMETER		**2021 ANALYTICAL RESULTS**				**CANADIAN GUIDELINES**	**2011 - 2020 RESULTS**		
Parameter Name	Units of Measure	Annual Median	Samples Analyzed	Range Minimum	Range Maximum	≤ = Less than or equal to	Median	Samples Analyzed	Range Minimum-Maximum
mg/L = parts per million ug/L = parts per billion									
Physical Parameters (ND means Not Detected by analytical method used)									
Alkalinity, Total	mg/L	**8.2**	1	8.2	8.2		8.78	28	7.28-13.3
Carbon, Dissolved Organic	mg/L as C	**4.2**	2	3.0	5.4		3.8	24	1.91 - 5.20
Carbon,Total Organic	mg/L as C	**4.35**	4	3.5	8.8	Guideline Archived	4	25	2.96 - 6.83
Colour, True	TCU	**14**	7	7	26	≤15 AO	12.0	78	2.1 - 23.0
Conductivity @ 25 C	uS/cm	Not tested in 2021					75.3	33	67.7-92.7
Hardness as $CaCO_3$	mg/L	**15.3**	4	14.2	16.9	No Guideline Required	16.6	31	11.1 - 20.6
pH	pH units	**7.1**	18	6.6	8.1	7.0 - 10.5 AO	6.845	44	6.14-7.36
Total Suspended Solids	mg/L	**7.2**	1	7.2	7.2		1.65	20	ND - 1.6
Total Solids	mg/L	**79.0**	2	70.0	88.0		49.45	20	42-58
Turbidity, lab tests	NTU	**1.25**	38	0.55	2.2		0.86	388	0.38 - 5.8
Ultraviolet Absorption, 5 cm	Abs.@254 nm	Last tested in 2015					0.425	22	0.345-0.659
Ultraviolet Transmittance	%	**74.5**	5	72.7	76		78.4	30	73.7 - 82.8
Water Temperature	degrees C	**10.5**	27	3.5	20.4	≤15 AO	11.0	461	1.7 - 21.2
Non-Metallic Inorganic Chemicals (ND means Not Detected by analytical method used)									
Ammonia, Total	ug/L as N	**ND**	2	ND	ND		12.6	20	ND - 71.0
Bromide	ug/L as Br	**0.036**	1	0.036	0.036		12.855	18	ND - 50
Chloride	mg/L as Cl	**14**	1	14	14	≤ 250 AO	11.0	8	11.0 - 12.1
Cyanide	mg/L as Cn	**ND**	1	ND	ND	0.2 MAC	ND	2	ND - 0.02
Fluoride	mg/L as F	**ND**	1	ND	ND	1.5 MAC	ND	8	ND - 0.02
Nitrogen, Nitrate	ug/L as N	**ND**	2	ND	0.03		ND	19	0.15 - 37.0
Nitrogen, Nitrite	ug/L as N	**ND**	2	ND	ND		ND	18	ND
Nitrogen, Total	ug/L as N	**122.0**	2	0.26	244		188.5	20	84.0- 263
Phosphate,Total	ug/L as P	**3.6**	2	0.005	7.2		6.2	22	ND - 71.0
Silica	mg/L as SiO_2	**5.1**	2	4.90	5.2		2.76	17	ND - 5.28
Silicon	mg/L as Si	**2375**	4	2040	2610		1430	20	380-2360
Sulphate	mg/L as SO_4	**5.45**	2	5.4	5.5	≤ 500 AO	7.139	20	4.9-19
Sulphide	mg/L as H_2S	**ND**	1	ND	ND	≤ 0.05 AO	ND	7	ND - 0.29
Sulphur	mg/L as S	**ND**	4	ND	ND		ND	21	ND - 5.94
Metals (ND means Not Detected by analytical method used)									
Aluminum	ug/L as Al	**44.4**	4	18.7	53.7	2900 MAC / 100 OG	24.9	20	7.8-81.5
Antimony	ug/L as Sb	**ND**	4	ND	ND	6 MAC	ND	20	ND
Arsenic	ug/L as As	**ND**	4	ND	0.12	10 MAC	ND	20	ND - 0.15
Barium	ug/L as Ba	**2.25**	4	1.5	2.3	1000 MAC	1.85	20	ND - 2.70
Beryllium	ug/L as Be	**ND**	4	ND	ND		ND	20	ND
Bismuth	ug/L as Bi	**ND**	4	ND	ND		ND	20	ND
Boron	ug/L as B	**ND**	4	ND	ND	5000 MAC	ND	20	ND
Cadmium	ug/L as Cd	**ND**	4	ND	ND	5 MAC	ND	20	ND - 0.117
Calcium	mg/L as Ca	**3.265**	4	2.97	3.66	No Guideline Required	3.425	20	2.91-4.56
Chromium	ug/L as Cr	**ND**	4	ND	ND	50 MAC	ND	20	ND
Cobalt	ug/L as Co	**ND**	4	ND	0.3		ND	20	ND
Copper	ug/L as Cu	**2.85**	4	1.97	4.85	2000 MAC / ≤ 1000 AO	3.135	20	1.95-14.6
Iron	ug/L as Fe	**147.5**	4	111	643	≤ 300 AO	178	20	115 - 471
Lead	ug/L as Pb	**0.27**	4	ND	0.4	5 MAC	0.27	20	ND - 1.01
Lithium	ug/L as Li	**ND**	4	ND	ND		ND	11	ND
Magnesium	mg/L as Mg	**1.745**	4	1.65	1.89	No Guideline Required	1.795	20	1.56-2.24
Manganese	ug/L as Mn	**39.25**	4	23.7	137	120 MAC / ≤ 20 AO	59.5	20	33-167
Mercury	ug/L as Hg	**ND**	4	ND	0.0023		ND	17	ND
Molybdenum	ug/L as Mo	**ND**	4	ND	ND		ND	20	ND
Nickel	ug/L as Ni	**ND**	4	ND	ND		ND	20	ND - 5.20
Potassium	mg/L as K	**0.306**	4	0.249	0.381		0.32	20	0.252 - 0.36
Selenium	ug/L as Se	**ND**	4	ND	ND	50 MAC	ND	20	ND - 0.12
Silver	ug/L as Ag	**ND**	4	ND	ND	No Guideline Required	ND	20	ND
Sodium	mg/L as Na	**6.74**	4	6.48	7.34	≤ 200 AO	7.01	20	6.25-10.9
Strontium	ug/L as Sr	**14.45**	4	13.9	16.1	7000 MAC	14.45	20	12.8-16
Thallium	ug/L as Tl	**ND**	4	ND	ND		ND	20	ND
Tin	ug/L as Sn	**ND**	4	ND	ND		ND	20	ND
Titanium	ug/L as Ti	**ND**	4	ND	ND		ND	20	ND
Uranium	ug/L as U	**ND**	4	ND	ND	20 MAC	ND	20	ND
Vanadium	ug/L as V	**ND**	4	ND	ND		ND	20	ND
Zinc	ug/L as Zn	**ND**	4	ND	7.5	≤ 5000 AO	ND	20	ND - 18.6
Zirconium	ug/L as Zr	**ND**	4	ND	ND		ND	20	ND
Microbial Parameters									
Indicator Bacteria									
Coliform, Total	Coliforms/100 mL	**112**	17	12	280		158	240	ND - 2419
E. coli	E.coli/100 mL	**3.5**	18	ND	26		ND	242	ND - 40
Hetero. Plate Count, 28C (7 day)	CFU/1 mL	Last analyzed in 2014				No Guideline Required	845	80	40 - 5800
Chlorophyll									
Chlorophyll, Total	ug/L	**5.41**	18	0.73	12.6		2.91	464	0.04 - 18.93
Parasites						No MAC Established			
Cryptosporidium, Total oocysts	oocysts/100 L	**ND**	2	ND	ND	Zero detection desirable	**ND**	35	ND
Giardia, Total cysts	cysts/100 L	**ND**	2	ND	ND	Zero detection desirable	**ND**	31	ND - 1.2

Table 2

Table 2: 2021 Summary of Treated Water Test Results, Wilderness Mountain Water System									
PARAMETER		**2021 ANALYTICAL RESULTS**				**CANADIAN GUIDELINES**	**2011-2020 RESULTS**		
Parameter Name	Units of Measure	Annual Median	Samples Analyzed	Range Min.	Range Max.	≤ = Less than or equal to	Median	Samples Analyzed	Range Min.-Max.
mg/L = parts per million ug/L = parts per billion									
Physical Parameters									
Colour, True	TCU	**10.15**	6	5	18	≤ 15 AO	8.3	73	3.0 - 18.0
Conductivity @ 25 C	uS/cm	Not tested in 2020					91.8	31	82.2-100.3
Hardness as CaCO3	mg/L	**15.35**	4	14.2	17.1		16.05	10	13.9-18.1
pH	pH units	**7.52**	17	6.86	9.1	7.0 - 10.5 AO	6.96	48	6.31-8.86
Total Organic Carbon	mg/L	**4.35**	4	3.5	8.7		3.45	4	2.5-4.3
Turbidity, lab tests	NTU	**0.73**	38	0.35	1.7	1 MAC and ≤ 5 AO	ND	463	0.17 - 3.6
Water Temperature	degrees C	**11.05**	276	2.8	21.1	≤ 15 AO	11.0	1904	1.8 - 20.9
Microbial Parameters									
Indicator Bacteria									
Coliform, Total	CFU/100 mL	**ND**	112	ND	3	0 MAC	ND	826	ND - 16
E. coli	CFU/100 mL	**ND**	112	ND	ND	0 MAC	ND	920	ND
Hetero. Plate Count, 28C (7 day)	CFU/1 mL	**7700**	14	690	ND	No Guideline Required	510	145	0 - 32400
Disinfectants									
Disinfectants									
Chlorine, Total Residual	mg/L as Cl_2	**1.54**	325	0	3.24	No Guideline Required	1.01	1974	ND-5.2
Monochloramine, Field - 1 Station	mg/L	**2.46**	32	0.45	2.81		2.23	30	0.17 - 1.16
Disinfection By-Products (ND means Not Detected by analytical method used)									
Trihalomethanes (THMs)									
Bromodichloromethane (BDCM)	ug/L	**ND**	4	ND	ND		ND	57	ND - 26.0
Bromoform (BRFM)	ug/L	**ND**	4	ND	ND		ND	57	ND
Chloroform (CHLF)	ug/L	**2.3**	4	1.8	2.9		5.9	57	ND - 256
Chlorodibromomethane (DBCM)	ug/L	**ND**	4	ND	ND		ND	57	ND - 3.10
Total Trihalomethanes (TTHM)	ug/L	**2.3**	4	1.8	2.9	100 MAC	5.8	57	ND - 274
Haloacetic Acids (HAAs)									
Haloacetic Acids (*5 Total, HAA5)	ug/L	**14**	4	7.7	21	80 MAC	10	51	0.75-262
Metals (ND means Not Detected by analytical method used)									
Aluminum	ug/L as Al	**29.9**	4	13.2	44.1	2900 MAC / 100 OG	24	10	4.5-62.1
Antimony	ug/L as Sb	**ND**	4	ND	ND	6 MAC	ND	10	ND
Arsenic	ug/L as As	**ND**	4	ND	ND	10 MAC	ND	10	ND - 0.14
Barium	ug/L as Ba	**2**	4	1.3	2.3	1000 MAC	1.25	10	ND-2.6
Beryllium	ug/L as Be	**ND**	4	ND	ND		ND	10	ND
Bismuth	ug/L as Bi	**ND**	4	ND	ND		ND	10	ND
Boron	ug/L as B	**ND**	4	ND	ND	5000 MAC	ND	10	ND
Cadmium	ug/L as Cd	**ND**	4	ND	ND	5 MAC	ND	10	ND
Calcium	mg/L as Ca	**3.275**	4	2.98	3.89	No Guideline Required	3.44	10	2.93-3.95
Chromium	ug/L as Cr	**ND**	4	ND	ND	50 MAC	ND	10	ND
Cobalt	ug/L as Co	**ND**	4	ND	0.23		ND	10	ND
Copper	ug/L as Cu	**8.1**	4	3.75	13.1	2000 MAC / ≤ 1000 AO	11.85	10	5.16-92.7
Iron	ug/L as Fe	**102.65**	4	81.7	573	≤ 300 AO	119	10	52-902
Lead	ug/L as Pb	**0.345**	4	0.2	0.4	5 MAC	0.48	10	0.38-0.99
Lithium	ug/L as Li	**ND**	4	ND	ND		3.5	6	ND
Magnesium	mg/L as Mg	**1.72**	4	1.63	1.84	No Guideline Required	1.8	10	1.6-2.07
Manganese	ug/L as Mn	**20.2**	4	17.6	136	120 MAC / ≤ 20 AO	36.25	10	11.9-364
Mercury	ug/L as Hg	**ND**	4	ND	0.0032		ND	7	ND
Molybdenum	ug/L as Mo	**ND**	4	ND	MD		ND	10	ND
Nickel	ug/L as Ni	**ND**	4	ND	ND		ND	10	ND
Potassium	mg/L as K	**0.3055**	4	0.241	0.388		0.341	10	0.257-0.423
Selenium	ug/L as Se	**ND**	4	ND	ND	50 MAC	ND	10	ND
Silicon	mg/L as Si	**2260**	4	2160	2640		1375	10	408-2400
Silver	ug/L as Ag	**ND**	4	ND	ND	No Guideline Required	ND	10	ND
Sodium	mg/L as Na	**9.105**	4	8.3	10.3	≤ 200 AO	9.86	10	8.73-11.4
Strontium	ug/L as Sr	**14**	4	13.7	16.4	7000 MAC	14.35	10	13-17.2
Sulfur	mg/L as S	**ND**	4	ND	ND		ND	10	ND - 4.60
Thallium	ug/L as Tl	**ND**	4	ND	ND		ND	10	ND
Tin	ug/L as Sn	**ND**	4	ND	ND		ND	10	ND
Titanium	ug/L as Ti	**ND**	4	ND	ND		ND	10	ND
Uranium	ug/L as U	**ND**	4	ND	ND	20 MAC	ND	10	ND
Vanadium	ug/L as V	**ND**	4	ND	ND		ND	10	ND
Zinc	ug/L as Zn	**ND**	4	ND	5.4	≤ 5000 AO	ND	10	ND - 21.3
Zirconium	ug/L as Zr	**ND**	4	ND	ND		ND	10	ND

CAPITAL REGIONAL DISTRICT

WILDERNESS MOUNTAIN WATER
Statement of Operations (Unaudited)
For the Year Ended December 31, 2021

		2021	2020
Revenue			
Transfers from government		59,520	63,859
User Charges		70,239	65,659
Water Sales		17,760	17,520
Fees and Charges		256	200
Other revenue from own sources:			
Interest earnings		60	33
Other revenue		61	72
Grant revenue		-	3,255
Total Revenue		147,896	150,598
Expenses			
General government services		5,607	5,487
Contract for services		2,436	3,575
CRD Labour and Operating costs		68,625	71,532
Debt Servicing Costs		23,648	23,659
Other expenses		40,630	36,133
Total Expenses		140,946	140,387
Net revenue (expenses)		6,950	10,211
Transfers to own funds:			
Capital Reserve Fund		-	-
Operating Reserve Fund		9,882	1,640
Annual surplus/(deficit)		(2,932)	8,571
Accumulated surplus/(deficit), beginning of year		2,932	(5,639)
Accumulated surplus/(deficit), end of year	$	-	2,932

CAPITAL REGIONAL DISTRICT

WILDERNESS MOUNTAIN WATER
Statement of Reserve Balances (Unaudited)
For the Year Ended December 31, 2021

	Capital Reserve	
	2021	**2020**
Beginning Balance	50,130	40,732
Transfer from Operating Budget	-	-
Transfers from Completed Capital Projects	-	8,620
Transfer to Capital Projects	(3,500)	-
Interest Income	722	778
Ending Balance	47,351	50,130

	Operating Reserve	
	2021	**2020**
Beginning Balance	1,657	-
Transfer from Operating Budget	9,882	1,640
Transfer to Operating Budget	-	-
Interest Income	73	17
Ending Balance	11,613	1,657