



## MONTHLY REPORTING PERIOD - DECEMBER, 2021

### 1. SUMMARY

The list below provides a summary of the water quantity information collected by BMID in December 2021. Documentation and figures are provided on the following pages to support this submission.

Source	Total (US Gals)	Total (Mega Litres)
Mission Creek	63,248,483	239.4
Well 4	1,761,000	6.7
Well 5	0	0
Scotty Creek (Irrigation Only)	0	0
Total	65,009,483	246.1

1. December had a considerable temperature change from early December to late December. Early December experienced above average temperatures including a high of 18 degrees in Kelowna on December 1<sup>st</sup>. However later December experienced below seasonal temperatures in later in the month with a low of -30 on December 27th;
2. BMID's UV facility had an off-spec event on December 20, 2021. The UVT meter experienced an artificial drop in UVT% that initiated an off-spec alarm. However, it was found that the UVT meter was malfunctioning as there was no change in water quality at the UV plant. There was no interruption of UV treatment throughout the event and chlorination before after the UV reactors remained in operation;
3. A portion of the BMID's transmission main west of the Mission Creek Intake and east of the tunnel is located on an unstable slope. Slope movement continues to be monitored. It is currently stable and not moving.
4. The WTP started on March 21, 2021 and was placed on bypass on December 20, 2021 as raw water quality in Mission Creek had improved enough to eliminate the necessity of chemical treatment upstream of the disinfection facilities. The WTP will remain in stand-by mode until raw water quality requires chemical treatment in the spring of 2022;
5. Raw water turbidity levels in Mission Creek peaked at 3.40 NTU (average daily turbidity) on December 2. Average daily raw water turbidity for December was 1.06 NTU at the Mission Creek intake;
6. Turbidity levels at the Distribution Intake (end of Hadden Reservoir) high reading was 0.49 NTU on December 1, 2021. Average clarified water turbidity for December was 0.45 NTU at the Distribution Intake at the lower end of Hadden Reservoir. Colder water temperatures make chemical treatment more challenging;
7. The highest recorded monthly turbidity level at the first customer (Booster #1) was 0.47 NTU on December 29, 2021. Average monthly turbidity at the first customer was 0.34 NTU for December;
8. BMID's Ultraviolet Treatment Facility treated 239,421 m<sup>3</sup> of water, 111.4 m<sup>3</sup> of which was "Off-Spec" (0.047%). Average UV Transmissivity was 89.64%. The average inlet chlorine residual level at the UV site was 1.15 mg/L. With the cold temperatures,

- minimum chlorine addition was required. The average outgoing chlorine was 1.28 mg/L after the sodium hypochlorite top-up system;
9. BMID's Scotty Creek source, used for irrigation in the north-end, ran from May 25, 2021 until it was placed in bypass mode on August 21. The Scotty Creek source will remain in bypass mode until irrigation begins again in the late spring of 2022;
  10. Well #4 resumed operations as a source for domestic water in the north-end of the distribution system on August 24 and will remain in operation until the spring of 2022 when Well #5 will be needed to meet demand;
  11. Well #5, used as the primary domestic water source in the north-end of the system for both irrigation and domestic consumption during the summer months, was placed in stand-by mode on September 1, 2021;
  12. Well #6, which supplies irrigation water to the twinned north-end water distribution systems, was placed in standby on August 21. This is a result of reduced irrigation demand in the north-end of the distribution system from the peak flows experienced in early summer. Well #6 will resume operations in 2022;
  13. *E.Coli* levels at Mission Creek's Point-of-Diversion (creek intake prior to WTP) had low counts for early winter with a peak count of 3 on December 20, 2021. The average creek *E.Coli* count was 1.5 for December based on 4 samples;
  14. *E.Coli* levels in the raw water at the water distribution system intake at the east end of Hadden Reservoir, immediately prior to disinfection, had zero counts on 3 out of 4 samples, with a peak count of 1 on December 28, 2021. The reduction in *E.Coli* levels is credited to the clarification process and the further settling of particles in the water in Stevens and Hadden Reservoirs;
  15. No *E.Coli* or *Total Coliforms* were found in treated water in the distribution system through third-party analysis. In addition, no positive samples were detected by BMID's in-house presence/absence testing throughout December;

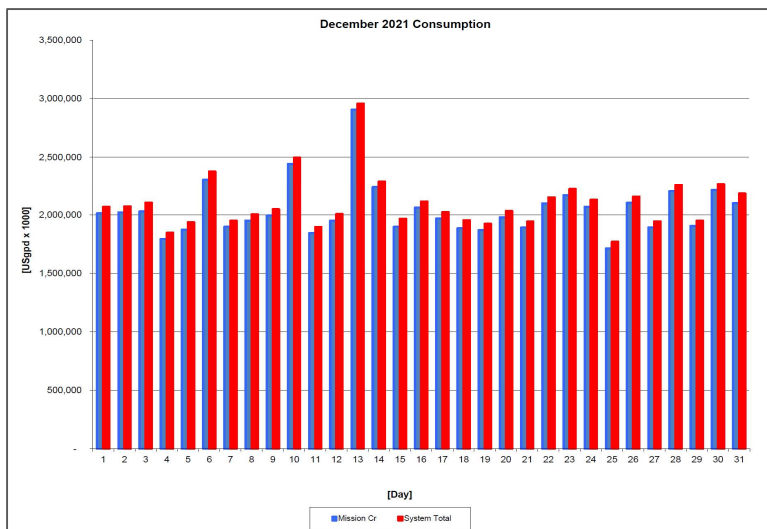
## 1.0 FLOWS - DECEMBER, 2021

The Maximum Daily Flow was on December 13, at 2,957,205 US gallons (11.19 ML)

The Minimum Daily Flow was on December 25, at 1,768,570 US gallons (6.69 ML)

Mission Creek provided 97% of domestic and irrigation flow throughout December.

**Figure 1.1 - Domestic Water System Flow**



**Table 1.2 - December 2021 - Daily Consumption Report**

Year	Mission Cr	Well #4	Well #5	System Total	System Total
2021	Usgpd	Usgpd	Usgpd	Usgpd	ML/Day
1-Dec	2,012,092	55,000	-	2,067,092	7.82
2-Dec	2,019,225	52,000	-	2,071,225	7.84
3-Dec	2,028,498	75,000	-	2,103,498	7.96
4-Dec	1,792,698	53,000	-	1,845,698	6.99
5-Dec	1,872,530	63,000	-	1,935,530	7.33
6-Dec	2,307,252	70,000	-	2,377,252	9.00
7-Dec	1,896,517	53,000	-	1,949,517	7.38
8-Dec	1,949,616	54,000	-	2,003,616	7.58
9-Dec	1,992,940	53,000	-	2,045,940	7.74
10-Dec	2,442,164	53,000	-	2,495,164	9.44
11-Dec	1,842,626	52,000	-	1,894,626	7.17
12-Dec	1,949,246	56,000	-	2,005,246	7.59
13-Dec	2,905,205	52,000	-	2,957,205	11.19
14-Dec	2,236,110	55,000	-	2,291,110	8.67
15-Dec	1,896,253	70,000	-	1,966,253	7.44
16-Dec	2,060,357	53,000	-	2,113,357	8.00
17-Dec	1,968,689	54,000	-	2,022,689	7.66
18-Dec	1,884,524	67,000	-	1,951,524	7.39
19-Dec	1,867,617	55,000	-	1,922,617	7.28
20-Dec	1,978,754	53,000	-	2,031,754	7.69
21-Dec	1,889,596	52,000	-	1,941,596	7.35
22-Dec	2,096,733	52,000	-	2,148,733	8.13
23-Dec	2,166,897	53,000	-	2,219,897	8.40
24-Dec	2,068,097	59,000	-	2,127,097	8.05
25-Dec	1,711,570	57,000	-	1,768,570	6.69
26-Dec	2,101,805	53,000	-	2,154,805	8.16
27-Dec	1,890,679	53,000	-	1,943,679	7.36
28-Dec	2,202,851	53,000	-	2,255,851	8.54
29-Dec	1,904,891	44,000	-	1,948,891	7.38
30-Dec	2,212,441	56,000	-	2,268,441	8.59
31-Dec	2,100,009	81,000	-	2,181,009	8.26
Totals Usgpd	63,248,483	1,761,000	0.00	65,009,483	246.06
Totals ML	239.40	6.67	0.00		
Avg's	2038282.47	7.71		2,094,282.47	7.93
Max	2905205.15	11.00		2,957,205.15	11.19
Min	1711570.39	6.48		1768570.39	6.69

## 2.0 RAW WATER QUALITY - BACTERIOLOGICAL MONITORING

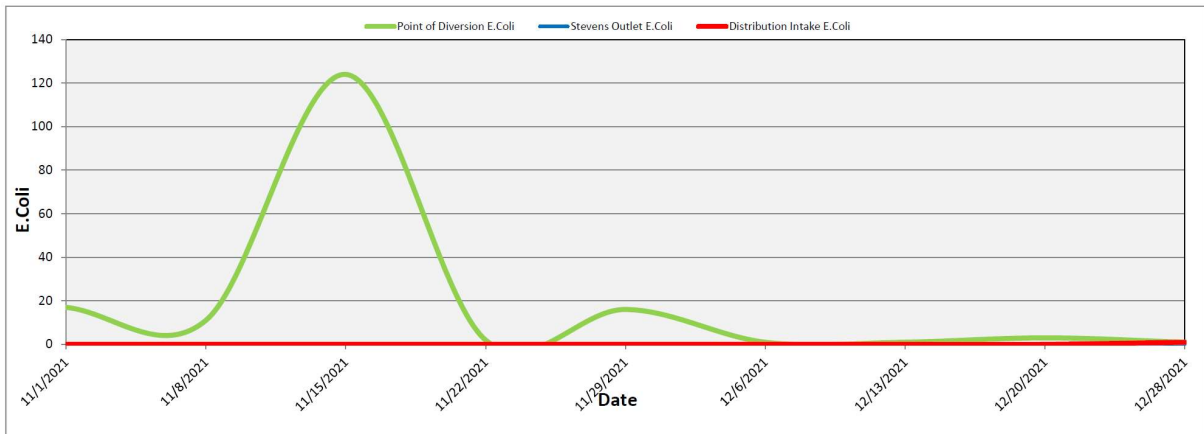
Raw water samples were taken at three points at BMID settling ponds before chlorination

Samples were taken at the Distribution Intake's Point of Disinfection and at the Mission Creek raw water Point of Diversion and at Stevens Pond outlet (point halfway between WTP Outlet and Distribution Intake).

Samples from the previous month are also provided to show a two-month trend

The WTP lowers colour, turbidity and particle counts in the raw water. The *E. Coli* readings are consistent with the reduction in those other parameters. The *E. Coli* readings confirm the WTP's effectiveness in reducing raw water quality risks with coagulation, flocculation, and sedimentation process followed by settling times across Stevens and Hadden Reservoirs.

**Figure 2.1 - Raw Water *E. Coli* Readings (CARO Lab results) November 2021 - December 2021**



**Table 2.1 - *E. Coli* Readings (CARO Labs)**

Date	Point of Diversion E.Coli	Stevens Outlet E.Coli	Distribution Intake E.Coli
1-Nov-21	17	0	0
8-Nov-21	11	0	0
15-Nov-21	124	0	0
22-Nov-21	2	0	0
29-Nov-21	16	0	0
6-Dec-21	1	0	0
13-Dec-21	1	0	0
20-Dec-21	3	0	0
28-Dec-21	1	0	1

Stevens or WTP Intake (Raw) - Sampling of raw water at intake from Mission Creek

Stevens Outlet (Raw) - Sampling point after exiting 142,000 m<sup>3</sup> 1<sup>st</sup> upper balancing reservoir (Stevens Res.)

Hadden Outlet (Raw) - Sampling point after exiting 75,000 m<sup>3</sup> 2<sup>nd</sup> lower balancing reservoir (Hadden Res.)

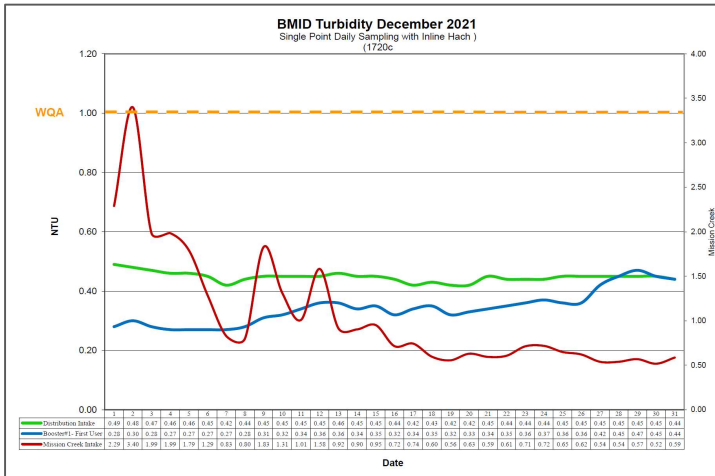
(Hadden Outlet = Distribution Intake - Point of Disinfection)

### 3.0 RAW AND TREATED WATER TURBIDITY

Through December 2021, turbidity for the Mission Creek source was measured at Booster Station No. 1 on Gallagher’s Road, which is the approximate location of the first-customer. The highest turbidity level recorded at this location was 0.47 NTU on December 29, 2021.

The distribution intake is where the water leaves Hadden Reservoir. Turbidity levels are greatly reduced through the settling process as Mission Creek treated water makes its way through the reservoirs.

**Figure 3.1 – Daily Turbidity Readings (Distribution Intake and Booster Station 1)**



**Table 3.1 - Daily Monitoring Record – Turbidity at Distribution Intake & Bst Stn 1**

Turbidity Point Sampling for December 2021			
Date	Mission Creek Intake	Distribution Intake	Booster#1- First User
	Daily Average [NTU]	Daily Average NTU	Daily Average NTU
1	2.29	0.49	0.28
2	3.40	0.48	0.30
3	1.99	0.47	0.28
4	1.99	0.46	0.27
5	1.79	0.46	0.27
6	1.29	0.45	0.27
7	0.83	0.42	0.27
8	0.80	0.44	0.28
9	1.83	0.45	0.31
10	1.31	0.45	0.32
11	1.01	0.45	0.34
12	1.58	0.45	0.36
13	0.92	0.46	0.36
14	0.90	0.45	0.34
15	0.95	0.45	0.35
16	0.72	0.44	0.32
17	0.74	0.42	0.34
18	0.60	0.43	0.35
19	0.56	0.42	0.32
20	0.63	0.42	0.33
21	0.59	0.45	0.34
22	0.61	0.44	0.35
23	0.71	0.44	0.36
24	0.72	0.44	0.37
25	0.65	0.45	0.36
26	0.62	0.45	0.36
27	0.54	0.45	0.42
28	0.54	0.45	0.45
29	0.57	0.45	0.47
30	0.52	0.45	0.45
31	0.59	0.44	0.44
AVG	1.06	0.45	0.34

### 4.0 CHLORINE CONTACT TIME

Temperature, pH, peak flow and chlorine residual levels are recorded to determine the CT levels that are required to provide 3 log inactivation of *Giardia*. Chlorine Contact times exceeded the CT levels required to provide 3 log (99.9%) inactivation of *Giardia Lamblia* throughout the month of December, 2021.

Figure 4.1 - CT Trending – BMID Mission Creek Source – December 2021

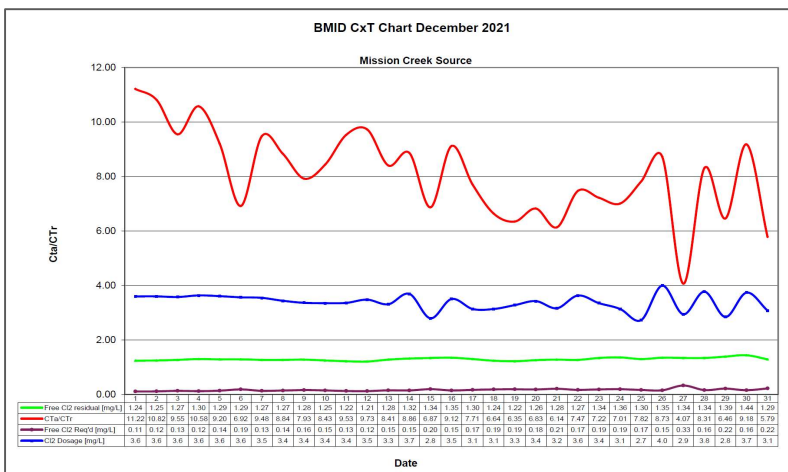


Table 4.2 - CT Table – Mission Creek Source

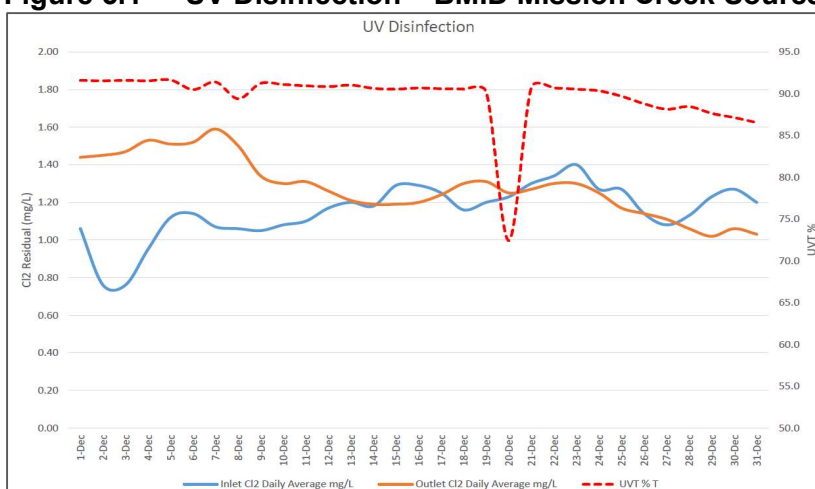
BMID December 2021													
Mission Creek Source													
DATE	pH	TEMP	PEAK	Free Cl <sub>2</sub>	CT	CT	CTa/CTr	Free Cl <sub>2</sub>	Cl <sub>2</sub>	VOLUME	TIME	FLOW	CL <sub>2</sub> DOSAGE
	(Average)	Present	FLOW	residual	achieved	req'd		Req'd	Dosage	TOTAL		Daily Average	Average
December		[°C]	[Usgpm]	[mg/L]				[mg/L]	[mg/L]	[USgal]	[mins]	[USGPM]	[PPD]
1	7.47	8.6	1920	1.24	1711.0	152.6	11.22	0.11	3.6	2649600	1380	1400	61
2	7.43	9.3	2134	1.25	1551.8	143.4	10.82	0.12	3.6	2649600	1241	1437	62
3	7.42	7.3	2141	1.27	1571.4	164.5	9.55	0.13	3.6	2649600	1237	1434	62
4	7.42	6.6	1878	1.30	1833.9	173.3	10.58	0.12	3.6	2649600	1411	1263	55
5	7.41	5.8	2037	1.29	1678.1	182.3	9.20	0.14	3.6	2649600	1301	1314	57
6	7.41	5.7	2690	1.29	1270.7	183.6	6.92	0.19	3.6	2649600	985	1615	69
7	7.41	5.7	1937	1.27	1737.3	183.2	9.48	0.13	3.5	2649600	1368	1323	56
8	7.40	5.8	2101	1.27	1601.6	181.3	8.84	0.14	3.4	2649600	1261	1345	56
9	7.40	5.2	2262	1.28	1499.4	189.2	7.93	0.16	3.4	2649600	1171	1367	55
10	7.40	5.3	2098	1.25	1578.8	187.2	8.43	0.15	3.4	2649600	1263	1373	55
11	7.39	5.9	1903	1.22	1698.8	178.3	9.53	0.13	3.4	2649600	1392	1306	53
12	7.39	5.6	1812	1.21	1768.8	181.8	9.73	0.12	3.5	2649600	1462	1308	55
13	7.39	5.3	2155	1.28	1573.9	187.2	8.41	0.15	3.3	2649600	1230	1374	55
14	7.38	6.0	2210	1.32	1582.3	178.5	8.86	0.15	3.7	2649600	1199	1386	62
15	7.38	5.3	2752	1.34	1290.3	187.8	6.87	0.20	2.8	2649600	963	1576	53
16	7.38	4.5	1973	1.35	1812.6	198.7	9.12	0.15	3.5	2649600	1343	1348	57
17	7.37	4.1	2207	1.30	1560.6	202.4	7.71	0.17	3.1	2649600	1200	1447	55
18	7.37	4.9	2601	1.24	1263.1	190.2	6.64	0.19	3.1	2649600	1019	1390	52
19	7.37	3.1	2370	1.22	1364.1	214.9	6.35	0.19	3.3	2649600	1118	1320	52
20	7.37	4.8	2548	1.26	1310.3	191.9	6.83	0.18	3.4	2649600	1040	1321	54
21	7.37	4.0	2718	1.28	1248.0	203.4	6.14	0.21	3.2	2649600	975	1374	52
22	7.37	4.5	2294	1.27	1466.6	196.2	7.47	0.17	3.6	2649600	1155	1328	58
23	7.37	3.5	2319	1.34	1531.1	212.0	7.22	0.19	3.4	2649600	1143	1479	60
24	7.37	4.0	2505	1.36	1438.4	205.2	7.01	0.19	3.1	2649600	1058	1518	57
25	7.37	4.1	2176	1.30	1582.8	202.4	7.82	0.17	2.7	2649600	1218	1465	48
26	7.37	3.5	1931	1.35	1852.8	212.2	8.73	0.15	4.0	2649600	1372	1209	58
27	7.37	3.5	4116	1.34	862.5	212.0	4.07	0.33	2.9	2649600	644	1485	53
28	7.37	3.3	1988	1.34	1786.3	215.0	8.31	0.16	3.8	2649600	1333	1331	60
29	7.37	3.2	2618	1.39	1406.5	217.6	6.46	0.22	2.8	2649600	1012	1558	53
30	7.37	3.6	1953	1.44	1953.9	212.8	9.18	0.16	3.7	2649600	1357	1344	60
31	7.37	3.4	2783	1.29	1228.0	212.3	5.79	0.22	3.1	2649600	952	1562	58
Averages	7.39	5.01	2294.55	1.30	1536.00	192.05	8.10	0.17	3.38				

## 5.0 ULTRAVIOLET DISINFECTION

Total Water Treated: 239,421 m<sup>3</sup> 100.00%  
 On-Spec Water: 239,310 m<sup>3</sup> 99.953%  
 Off-Spec Water: 111 m<sup>3</sup> 0.047%

Average monthly chlorine residual before UV Treatment was 1.15 mg/L  
 The average monthly chlorine residual after UV treatment and re-chlorination was 1.28 mg/L.

**Figure 5.1 - UV Disinfection – BMID Mission Creek Source – December 2021**



**Table 5.2 - UV Disinfection Table – Mission Creek Source**

Date	Inlet Cl2	Outlet Cl2	UVT	In Spec Water	Off Spec	Off Spec %
	Daily	Daily				
	mg/L	mg/L	% T	Cubic Meters	Cubic Meters	Percentage
1-Dec	1.06	1.44	91.6	7,617	0	0.00%
2-Dec	0.76	1.45	91.6	7,644	0	0.00%
3-Dec	0.76	1.47	91.6	7,679	0	0.00%
4-Dec	0.95	1.53	91.6	6,786	0	0.00%
5-Dec	1.12	1.51	91.7	7,088	0	0.00%
6-Dec	1.14	1.52	90.5	8,734	0	0.00%
7-Dec	1.07	1.59	91.4	7,157	22	0.31%
8-Dec	1.06	1.50	89.4	7,380	0	0.00%
9-Dec	1.05	1.34	91.3	7,544	0	0.00%
10-Dec	1.08	1.30	91.1	9,245	0	0.00%
11-Dec	1.10	1.31	91.0	6,975	0	0.00%
12-Dec	1.17	1.26	90.9	7,379	0	0.00%
13-Dec	1.20	1.21	91.0	10,997	0	0.00%
14-Dec	1.18	1.19	90.7	8,465	0	0.00%
15-Dec	1.29	1.19	90.6	7,178	0	0.00%
16-Dec	1.29	1.20	90.7	7,799	0	0.00%
17-Dec	1.25	1.24	90.6	7,452	0	0.00%
18-Dec	1.16	1.30	90.6	7,134	0	0.00%
19-Dec	1.20	1.31	90.2	7,070	0	0.00%
20-Dec	1.23	1.25	72.4	7,401	89	1.21%
21-Dec	1.30	1.27	90.8	7,153	0	0.00%
22-Dec	1.34	1.30	90.7	7,937	0	0.00%
23-Dec	1.40	1.30	90.6	8,203	0	0.00%
24-Dec	1.27	1.25	90.4	7,829	0	0.00%
25-Dec	1.27	1.17	89.7	6,479	0	0.00%
26-Dec	1.14	1.14	88.8	7,956	0	0.00%
27-Dec	1.08	1.11	88.2	7,157	0	0.00%
28-Dec	1.13	1.06	88.5	8,339	0	0.00%
29-Dec	1.23	1.02	87.7	7,211	0	0.00%
30-Dec	1.27	1.06	87.2	8,375	0	0.00%
31-Dec	1.20	1.03	86.6	7,949	0	0.00%
<b>Average</b>	<b>1.15</b>	<b>1.28</b>	<b>89.64</b>	<b>Total 239,310</b>	<b>111</b>	<b>0.047%</b>

## 6.0 WATER DISTRIBUTION SAMPLING (TREATED)

### Third Party Analysis (CARO Analytical Services)

- Samples taken once per week at ten locations around the BMID service area
- 24 samples were found to be absent of Coliforms.
- 24 samples were found to be absent of *E. Coli*.

**Table 6.1 - CARO Independent Lab Testing – Total Coliforms – E.Coli**

Date	2021 Belpo Rd		Booster 1		Elison Blow-Off		Elison School		3976 Highway 97		Prospect Reservoir		Tower Reservoir		Well #4		Kirschner Res		Pearson School	
	Coliforms	E.coli	Coliforms	E.coli	Coliforms	E.coli	Coliforms	E.coli	Coliforms	E.coli	Coliforms	E.coli	Coliforms	E.coli	Coliforms	E.coli	Coliforms	E.coli	Coliforms	E.coli
1-Nov-21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8-Nov-21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15-Nov-21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22-Nov-21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29-Nov-21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6-Dec-21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13-Dec-21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20-Dec-21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28-Dec-21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

### In-House Analysis (BMID Staff)

- Presence/Absence samples taken on a three-week cycle at seven sites around the BMID service area.
- 10 samples were found to be absent of both *Total Coliforms* and *E.Coli*.

**Table 6.2 - BMID In-house Testing – Presence Absence**

Location	12/6/2021				12/13/2021				12/20/2021				12/28/2021			
	Cl2	Temp.	Pres.	Abs.	Cl2	Temp.	Pres.	Abs.	Cl2	Temp.	Pres.	Abs.	Cl2	Temp.	Pres.	Abs.
Sylvania Cres	0.78	9.0	-	X									1.03	8.4	-	X
170 Kneller Rd	0.86	8.4	-	X									1.07	8.6	-	X
2105 Morrison					0.46	12.6	-	X								
Staymen Rd					0.66	11.2	-	X								
260 Campion Rd									0.40	9.6	-	X				
Fenwick Rd									0.41	7.6	-	X				
Solly Ct	0.80	9.6	-	X									1.05	8.2	-	X

### Table 6.3 - Disinfection By-Products

- The Pearson School sample was found to be above the 0.10 Mg/L threshold for THMs
- All other samples were within the limits for Disinfection By-Products

6-Dec-21		
Location	THM (mg/L)	HAA (mg/L)
UV Plant	0.0823	0.0479
Pearson School	<b>0.1320</b>	0.0648

- BMID Population = 28,000

#### RECOMMENDED TESTS

- Recommended number of samples per month = 28  
(as per Guide for Canadian Drinking Water Quality)

#### ACTUAL TESTS

- Total tests by BMID staff (presence/absence) = 10 (Zero Positive)
- Total tests sampled by BMID and tested by Caro Labs = 24
- Total tests sampled in BMID treated distribution system = 34 (Zero Positive Samples)