



## MONTHLY REPORTING PERIOD - DECEMBER, 2022

### SUMMARY

This document provides a summary of the water quality information collected by BMID in December 2022. Documentation and figures are provided on the following pages to support this submission.

### WATER SUPPLY & USAGE SUMMARY

1. Water usage data for December is as follows:

Source	Total (US Gals)	Total (Mega Litres)
Mission Creek	65,635,911	248.43
Well 4	1,590,039	6.02
Well 5	0	0
Well 6 (Irrigation Only)	0	0
Scotty Creek (Irrigation Only)	0	0
Total	67,225,950	254.45

2. BMID's control gates on the high-elevation reservoirs are closed for the winter. The gates will remain closed until summer of 2023;
3. BMID's Scotty Creek source supplying irrigation water to the north-end of the service area, provided water from May 27<sup>th</sup>, 2022 to September 9<sup>th</sup> 2022 when irrigation demands in the north-end reduced from peak flows experienced earlier in summer;
4. Well #4, used as a primary source for domestic water in the north-end of the distribution system, was in operation throughout the month of December;
5. 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 October 12<sup>th</sup> and will remain in stand-by until flows increase in the spring of 2023;
6. Well #6, which supplies water to the north-end irrigation distribution system, ran from May 26 to September 25, 2022. Well #6 will remain in stand-by mode until irrigation demands increase in the spring/summer of 2023;
7. 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 is not moving;

## WATER QUALITY SUMMARY

1. The WTP operated from February 8<sup>th</sup>, 2022 until October 31, 2022. The WTP is in by-pass mode for the winter. By late October raw water quality in Mission Creek had improved to where it no longer required chemical treatment to reduce turbidity and colour. Barring an extreme weather event, the WTP will remain in by-pass mode until spring 2023;
2. Raw water turbidity levels in Mission Creek peaked at 1.31 NTU (average daily turbidity) on December 27<sup>th</sup>. Average daily raw water turbidity for December was 0.87 NTU at the Mission Creek intake;
3. The highest turbidity level at the Distribution Intake (end of Hadden Reservoir) was 0.52 NTU on December 11<sup>th</sup>, 2022. Average settled water turbidity for December was 0.42 NTU at the Distribution Intake at the lower end of Hadden Reservoir;
4. The highest turbidity level at the first customer (Booster #1) was 0.35 NTU on December 18<sup>th</sup> and 21<sup>st</sup>. Average monthly turbidity at the first customer was 0.32 NTU;
5. The highest turbidity daily average at the UV plant was 0.59 NTU on December 15<sup>th</sup>. However, the inline turbidity meter experienced faulty readings from December 15<sup>th</sup> until December 17<sup>th</sup>. Based on the normal readings from the other in-line turbidity meters at different sites, there is no indication of unusual turbidity at the UV station. Average monthly turbidity at the UV plant was 0.40 NTU throughout the month;
6. BMID's Ultraviolet Treatment Facility treated 248,459 m<sup>3</sup> of water, none of which was "Off-Spec" (0.00%);
7. UVT results from November 20 to December 13 were negatively affected by a fouling of the cuvettes used in the in-line analyser. The issue has since been resolved with no adverse effect on the treatment process. The fouling would have resulted in an artificially low UVT%, however, at all times the UVT% was within operational range even with the lowered results;
8. Regarding microbiological readings, the Mission Creek watershed was frozen over through much of the month of December resulting in a greater groundwater influence on the raw water quality. There was a notable drop in *E.Coli* and *Total Coliform* levels from prior months readings;
9. *E.Coli* levels at Mission Creek's Point-of-Diversion (creek intake prior to WTP) had low counts for December. Each of the four samples had 1 *E.Coli* present for the month. The average monthly *E.Coli* was 1.0, based on 4 samples;
10. *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 three of 4 samples. Only the December 19<sup>th</sup> sample had a count of 1 *E.Coli*. Reduction in *E.Coli* levels is due to the settling of particles as water passes through Stevens and Hadden Reservoirs;
11. No *E.Coli* or *Total Coliforms* were found in treated water in the distribution system through third-party analysis. In addition, zero positive samples were detected by BMID's in-house presence/absence testing throughout December;

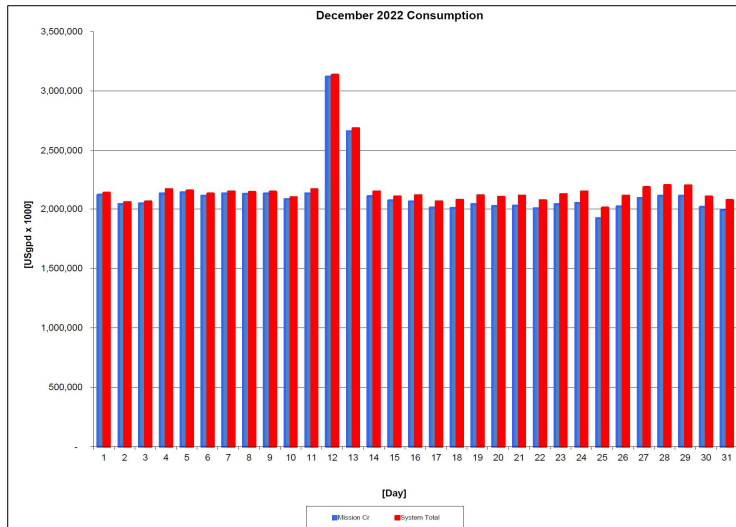
## 1.0 FLOWS - DECEMBER, 2022

The Maximum Daily Flow was on December 12<sup>th</sup>, at 3,135,669 US gallons (11.87 ML)

The Minimum Daily Flow was on December 25<sup>th</sup>, at 2,008,261 US gallons (7.60 ML)

Mission Creek provided just under 98% of domestic flow supplied in December.

**Figure 1.1 - Domestic Water System Flow**



**Table 1.2 - December 2022 - Daily Consumption Report**

Year	Mission Cr	Well #4	Well #5	System Total	System Total
2022	Usgpd	Usgpd	Usgpd	Usgpd	ML/Day
1-Dec	2,116,889	16,114	-	2,133,004	8.07
2-Dec	2,040,148	16,114	-	2,056,262	7.78
3-Dec	2,045,325	15,322	-	2,060,647	7.80
4-Dec	2,129,807	33,550	-	2,163,357	8.19
5-Dec	2,138,393	14,265	-	2,152,658	8.15
6-Dec	2,110,100	16,643	-	2,126,743	8.05
7-Dec	2,129,358	15,850	-	2,145,209	8.12
8-Dec	2,123,784	16,379	-	2,140,163	8.10
9-Dec	2,127,034	15,850	-	2,142,884	8.11
10-Dec	2,080,856	15,850	-	2,096,707	7.94
11-Dec	2,129,358	33,021	-	2,162,380	8.18
12-Dec	3,119,818	15,850	-	3,135,669	11.87
13-Dec	2,660,688	25,624	-	2,686,312	10.17
14-Dec	2,105,768	39,626	-	2,145,393	8.12
15-Dec	2,069,867	32,493	-	2,102,360	7.96
16-Dec	2,061,651	51,777	-	2,113,428	8.00
17-Dec	2,010,270	51,513	-	2,061,783	7.80
18-Dec	2,006,413	67,628	-	2,074,040	7.85
19-Dec	2,038,879	73,703	-	2,112,583	8.00
20-Dec	2,023,373	76,345	-	2,099,718	7.95
21-Dec	2,026,833	83,478	-	2,110,311	7.99
22-Dec	2,003,401	67,892	-	2,071,293	7.84
23-Dec	2,036,766	86,119	-	2,122,886	8.04
24-Dec	2,049,631	96,158	-	2,145,789	8.12
25-Dec	1,921,614	86,648	-	2,008,261	7.60
26-Dec	2,020,572	87,440	-	2,108,013	7.98
27-Dec	2,089,733	90,874	-	2,180,607	8.25
28-Dec	2,109,149	88,497	-	2,197,646	8.32
29-Dec	2,109,202	86,119	-	2,195,322	8.31
30-Dec	2,014,602	87,440	-	2,102,042	7.96
31-Dec	1,986,626	85,855	-	2,072,482	7.84
Totals Usgpd	65,635,911	1,590,039	0.00	67,225,950	254.45
Totals ML	248.43	6.02	0.00		
Avg's	2121642.82	8.03		2,171,782.29	8.22
Max	3119818.49	11.81		3,135,668.69	11.87
Min	1921613.55	7.27		2008261.31	7.60

## 2.0 RAW WATER QUALITY - BACTERIOLOGICAL MONITORING

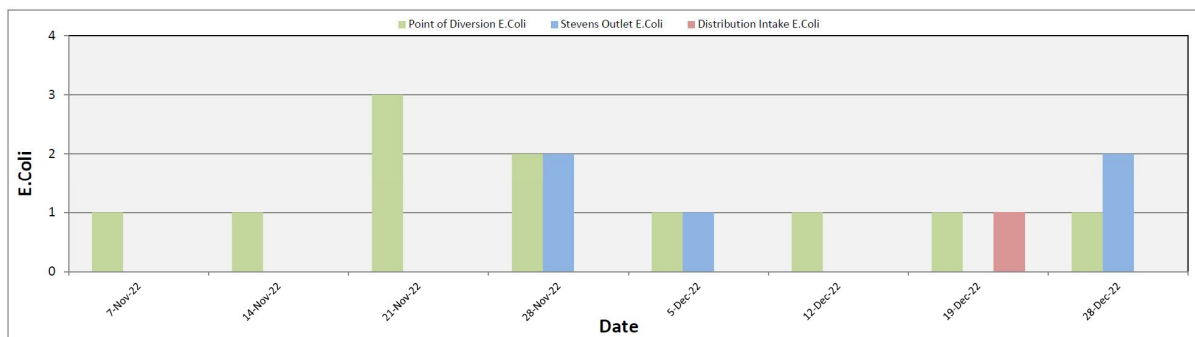
Raw water samples were taken at three points at BMID settling ponds before chlorination

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 watershed is frozen over with snow cover and no overland flow to the creeks in the watershed. The creek flow at this time of year is highly influenced by groundwater contributions. For this reason, coliform and *E.Coli* counts are lower than in prior months.

**Figure 2.1 - Raw Water *E.Coli* Readings (CARO Lab results) November 2022 - December 2022**



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

Date	Point of Diversion E.Coli	Stevens Outlet E.Coli	Distribution Intake E.Coli
7-Nov-22	1	0	0
14-Nov-22	1	0	0
21-Nov-22	3	0	0
28-Nov-22	2	2	0
5-Dec-22	1	1	0
12-Dec-22	1	0	0
19-Dec-22	1	0	1
28-Dec-22	1	2	0

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.)

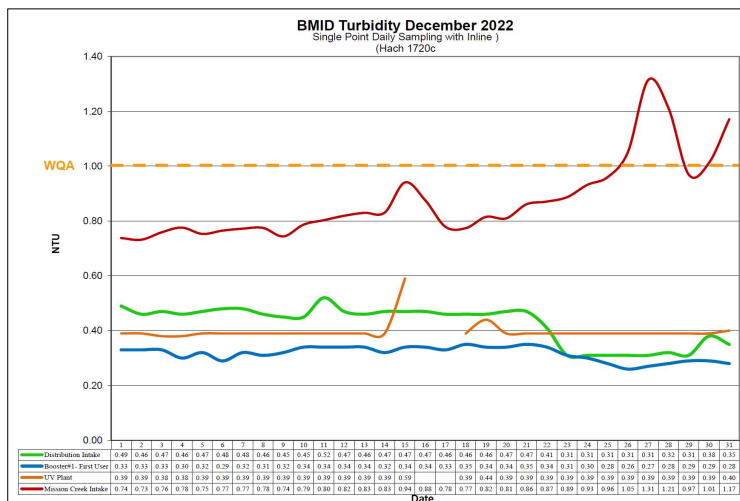
Hadden Outlet (Raw) - Sampling point after exiting 75,000 m<sup>3</sup> 2<sup>nd</sup> lower balancing reservoir (Hadden Res.)  
(Hadden Outlet = Distribution Intake - Point of Disinfection)

### 3.0 RAW AND TREATED WATER TURBIDITY

Through December 2022, 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 0.35 NTU on December 18<sup>th</sup> and 21<sup>st</sup>, 2022. The lowest turbidity level was 0.26 NTU and the average turbidity was 0.32 NTU.

The distribution intake is where the water leaves Hadden Reservoir and enters a closed conduit. 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 On-Line Turbidity Analysers**

Turbidity Point Sampling for December 2022				
Date	Mission Creek Intake Daily Average NTU	Distribution Intake Daily Average NTU	Booster#1- First User Daily Average NTU	UV Plant Daily Average NTU
1	0.74	0.49	0.33	0.39
2	0.73	0.46	0.33	0.39
3	0.76	0.47	0.33	0.38
4	0.78	0.46	0.30	0.38
5	0.75	0.47	0.32	0.39
6	0.77	0.48	0.29	0.39
7	0.77	0.48	0.32	0.39
8	0.78	0.46	0.31	0.39
9	0.74	0.45	0.32	0.39
10	0.79	0.45	0.34	0.39
11	0.80	0.52	0.34	0.39
12	0.82	0.47	0.34	0.39
13	0.83	0.46	0.34	0.39
14	0.83	0.47	0.32	0.39
15	0.94	0.47	0.34	0.59
16	0.88	0.47	0.34	NA
17	0.78	0.46	0.33	NA
18	0.77	0.46	0.35	0.39
19	0.82	0.46	0.34	0.44
20	0.81	0.47	0.34	0.39
21	0.86	0.47	0.35	0.39
22	0.87	0.41	0.34	0.39
23	0.89	0.31	0.31	0.39
24	0.93	0.31	0.30	0.39
25	0.96	0.31	0.28	0.39
26	1.05	0.31	0.26	0.39
27	1.31	0.31	0.27	0.39
28	1.21	0.32	0.28	0.39
29	0.97	0.31	0.29	0.39
30	1.01	0.38	0.29	0.39
31	1.17	0.35	0.28	0.40
AVG	0.87	0.42	0.32	0.40



#### 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, 2022.

Figure 4.1 - CT Trending – BMID Mission Creek Source – December 2022

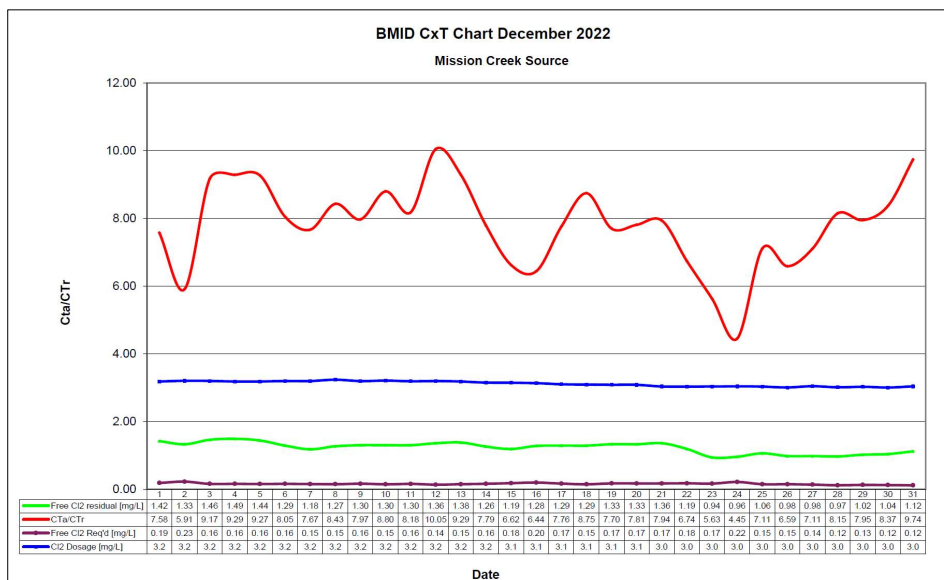


Table 4.2 - CT Table – Mission Creek Source

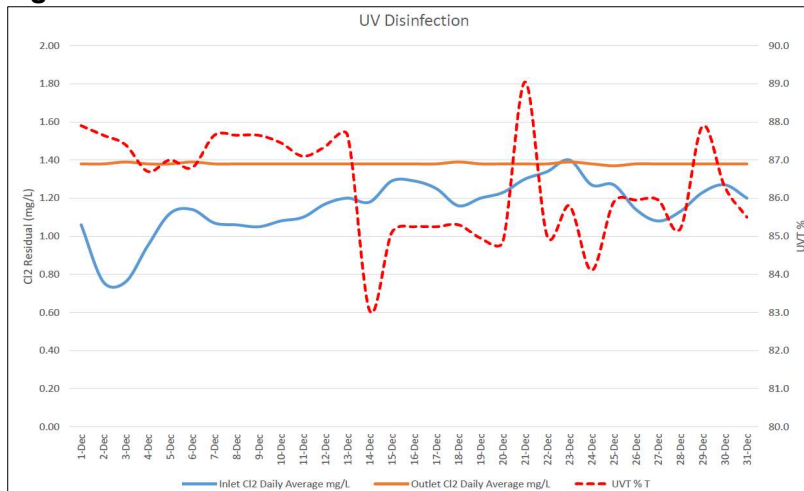
BMID December 2022 Mission Creek Source													
DATE	pH	TEMP	PEAK	Free Cl <sub>2</sub>	CT	CT	CTa/CTr	Free Cl <sub>2</sub>	Cl <sub>2</sub>	VOLUME	TIME	FLOW	CL <sub>2</sub> DOSAGE
	(Average)	Present	FLOW	residual	achieved	req'd		Req'd	Dosage	TOTAL	[mins]	Daily Average	Average
December		[°C]	[Usgpm]	[mg/L]				[mg/L]	[mg/L]	[USgal]		[USGPM]	[PPD]
1	7.59	4.6	2316	1.42	1624.7	214.5	7.58	0.19	3.2	2649600	1144	1500	57
2	7.57	4.4	2789	1.33	1263.6	213.8	5.91	0.23	3.2	2649600	950	1437	55
3	7.54	4.7	2008	1.46	1926.3	210.1	9.17	0.16	3.2	2649600	1319	1443	56
4	7.54	5.0	2059	1.49	1917.4	206.4	9.29	0.16	3.2	2649600	1287	1505	58
5	7.54	5.2	2032	1.44	1877.7	202.5	9.27	0.16	3.2	2649600	1304	1513	58
6	7.60	4.6	2001	1.29	1708.0	212.1	8.05	0.16	3.2	2649600	1324	1489	57
7	7.65	5.5	2037	1.18	1535.0	200.2	7.67	0.15	3.2	2649600	1301	1501	58
8	7.65	5.2	1931	1.27	1742.3	206.6	8.43	0.15	3.2	2649600	1372	1480	58
9	7.65	4.9	2041	1.30	1687.9	211.7	7.97	0.16	3.2	2649600	1298	1505	58
10	7.65	6.1	2009	1.30	1714.5	194.8	8.80	0.15	3.2	2649600	1319	1464	57
11	7.67	6.3	2176	1.30	1582.8	193.5	8.18	0.16	3.2	2649600	1218	1508	58
12	7.65	7.7	2042	1.36	1764.4	175.5	10.05	0.14	3.2	2649600	1297	1528	59
13	7.65	5.8	1961	1.38	1864.1	200.7	9.29	0.15	3.2	2649600	1351	1485	57
14	7.65	4.7	2006	1.26	1664.4	213.7	7.79	0.16	3.2	2649600	1321	1484	56
15	7.65	4.7	2247	1.19	1403.3	211.8	6.62	0.18	3.1	2649600	1179	1462	55
16	7.65	4.8	2476	1.28	1369.8	212.7	6.44	0.20	3.1	2649600	1070	1444	54
17	7.65	5.0	2097	1.29	1629.9	210.0	7.76	0.17	3.1	2649600	1264	1414	53
18	7.65	5.1	1874	1.29	1824.4	208.6	8.75	0.15	3.1	2649600	1414	1413	53
19	7.70	3.7	1947	1.33	1809.7	235.0	7.70	0.17	3.1	2649600	1361	1437	53
20	7.71	3.5	1886	1.33	1868.3	239.1	7.81	0.17	3.1	2649600	1405	1427	53
21	7.71	3.4	1879	1.36	1917.7	241.5	7.94	0.17	3.0	2649600	1410	1433	52
22	7.70	2.7	1889	1.19	1668.8	247.7	6.74	0.18	3.0	2649600	1402	1416	52
23	7.70	3.1	1902	0.94	1309.4	232.5	5.63	0.17	3.0	2649600	1393	1433	52
24	7.70	4.3	2662	0.96	955.5	214.6	4.45	0.22	3.0	2649600	995	1440	53
25	7.70	4.9	1890	1.06	1485.9	209.0	7.11	0.15	3.0	2649600	1402	1360	50
26	7.70	5.0	1922	0.98	1351.1	205.1	6.59	0.15	3.0	2649600	1379	1430	52
27	7.69	6.5	1983	0.98	1309.5	184.2	7.11	0.14	3.0	2649600	1336	1468	54
28	7.65	8.5	1997	0.97	1286.9	157.9	8.15	0.12	3.0	2649600	1327	1486	54
29	7.65	7.2	1953	1.02	1384.0	174.1	7.95	0.13	3.0	2649600	1357	1416	52
30	7.65	7.2	1885	1.04	1461.5	174.6	8.37	0.12	3.0	2649600	1405	1406	51
31	7.65	8.7	1916	1.12	1549.2	159.1	9.74	0.12	3.0	2649600	1383	1374	50
Averages	7.65	5.26	2058.50	1.23	1595.4	205.59	7.82	0.16	3.12	2649600	1300	1455	55

## 5.0 ULTRAVIOLET DISINFECTION

Total Water Treated: 248,459 m<sup>3</sup> 100.00%  
On-Spec Water: 248,459 m<sup>3</sup> 100.00%  
Off-Spec Water: 0 m<sup>3</sup> 0.00%

Average monthly chlorine residual before UV Treatment was 1.15 mg/L  
The average monthly chlorine residual after UV treatment and re-chlorination was 1.38 mg/L.

**Figure 5.1 - UV Disinfection – BMID Mission Creek Source – December 2022**



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

Date	Inlet Cl2 Daily mg/L	Outlet Cl2 Daily mg/L	UVT % T	Turbidity NTU	In Spec Water Volume Cubic Meters	Off Spec Water Cubic Meters	Off Spec % of Water Percentage
1-Dec	1.06	1.38	87.9	0.39	8,013	0	0.00%
2-Dec	0.76	1.38	87.7	0.39	7,723	0	0.00%
3-Dec	0.76	1.39	87.4	0.38	7,742	0	0.00%
4-Dec	0.95	1.38	86.7	0.38	8,062	0	0.00%
5-Dec	1.12	1.38	87.0	0.39	8,095	0	0.00%
6-Dec	1.14	1.39	86.8	0.39	7,988	0	0.00%
7-Dec	1.07	1.38	87.7	0.39	8,061	0	0.00%
8-Dec	1.06	1.38	87.7	0.39	8,039	0	0.00%
9-Dec	1.05	1.38	87.7	0.39	8,052	0	0.00%
10-Dec	1.08	1.38	87.5	0.39	7,877	0	0.00%
11-Dec	1.10	1.38	87.1	0.39	8,061	0	0.00%
12-Dec	1.17	1.38	87.4	0.39	11,810	0	0.00%
13-Dec	1.20	1.38	87.7	0.39	10,072	0	0.00%
14-Dec	1.18	1.38	83.0	0.39	7,971	0	0.00%
15-Dec	1.29	1.38	85.1	0.59	7,835	0	0.00%
16-Dec	1.29	1.38	85.3	NA	7,804	0	0.00%
17-Dec	1.25	1.38	85.3	NA	7,610	0	0.00%
18-Dec	1.16	1.39	85.3	0.39	7,595	0	0.00%
19-Dec	1.20	1.38	85.0	0.44	7,718	0	0.00%
20-Dec	1.23	1.38	84.9	0.39	7,659	0	0.00%
21-Dec	1.30	1.38	89.1	0.39	7,672	0	0.00%
22-Dec	1.34	1.38	85.0	0.39	7,584	0	0.00%
23-Dec	1.40	1.39	85.8	0.39	7,710	0	0.00%
24-Dec	1.27	1.38	84.1	0.39	7,759	0	0.00%
25-Dec	1.27	1.37	85.9	0.39	7,274	0	0.00%
26-Dec	1.14	1.38	86.0	0.39	7,649	0	0.00%
27-Dec	1.08	1.38	86.0	0.39	7,911	0	0.00%
28-Dec	1.13	1.38	85.2	0.39	7,984	0	0.00%
29-Dec	1.23	1.38	87.9	0.39	7,984	0	0.00%
30-Dec	1.27	1.38	86.3	0.39	7,626	0	0.00%
31-Dec	1.20	1.38	85.5	0.40	7,520	0	0.00%
Average	1.15	1.38	86.33		Total 248,459	0	0.000%

## 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
- 22 samples were found to be absent of Coliforms.
- 22 samples were found to be absent of *E. Coli*.

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

Date	2921 Beigo 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
7-Nov-22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14-Nov-22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21-Nov-22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28-Nov-22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Dec-22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12-Dec-22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19-Dec-22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28-Dec-22	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.
- All samples were found to be absent of both *Total Coliforms* and *E. Coli*.

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

Location	12/5/2022				12/12/2022				12/19/2022				12/28/2022			
	Cl2	Temp.	Pres.	Abs.	Cl2	Temp.	Pres.	Abs.	Cl2	Temp.	Pres.	Abs.	Cl2	Temp.	Pres.	Abs.
Sylvania Cres	0.94	8.6	-	X									0.92	11.2	-	X
170 Kneller Rd	0.79	2.6	-	X									0.99	8.4	-	X
2105 Morrison									0.65	9.8	-	X				
Staymen Rd									0.83	10.0	-	X				
260 Campion Rd					0.61	11.0	-	X								
Fenwick Rd					0.77	9.8	-	X								
Solly Ct	0.90	4.2	-	X									1.06	10.2	-	X

- 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
- Total tests sampled by BMID and tested by Caro Labs 22
- Total tests sampled in BMID treated distribution system = 32
- 0 Positive *E. Coli* and Total Coliform Samples