



## MONTHLY REPORTING PERIOD - DECEMBER, 2020

### 1. SUMMARY

The list below provides a summary of the water quality information collected by BMID in December, 2020. Documentation and figures are provided on the following pages to support this submission.

Source	Total (US Gals)	Total (Mega Litres)
Mission Creek	60,021,957	227.18
Well 4	2,123,000	8.04
Well 5	0	0
Well 6 (Irrigation Only)	0	0
Scotty Creek (Irrigation Only)	0	0
Total	62,144,957	235.22

1. A power outage took place throughout the day on December 21. The outage resulted in minor service interruptions in some areas of the District. Chlorination at the primary chlorinator was lost for a time, however, the unchlorinated water was held in reserve and the secondary chlorination and Ultraviolet disinfection remained in service. Treated water quality at the first-customer remained acceptable throughout the event;
2. 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 has been minimal over the past 12 months. Monitoring has showed minor variations in groundwater levels, but no substantial changes. The hillside is being monitored for surface movement on a monthly basis and groundwater levels as required.
3. The Water Treatment Plant started full operations in April, 2020, and the plant continued to run until it was placed on stand-by on November 18, when raw water was of sufficient quality to bypass treatment. For all of December, the facility remained in stand-by mode. The WTP is able to restart if poor raw water quality necessitates treatment;
4. Raw water turbidity levels in Mission Creek peaked at 1.12 NTU on December 18, 2020. Turbidity levels at the Distribution Intake (end of Hadden Reservoir) high reading was 0.51 NTU on December 2, 2020. Average turbidity for December was 0.43 NTU at the Distribution Intake at the lower end of Hadden Reservoir;
5. The highest recorded monthly turbidity level at the first customer (Booster #1) was 0.71 NTU on December 22, 2020. Average monthly turbidity at the first customer was 0.45 NTU for the month;
6. BMID's Ultraviolet Treatment Facility treated 233,793.1 m<sup>3</sup> of water, only 73.1 m<sup>3</sup> of which was "Off-Spec" (0.031%). Average UV Transmissivity was 86.17%. The average inlet chlorine residual level at the UV site was 1.15 mg/L. The average outgoing chlorine was 1.38 mg/L after the sodium hypochlorite top-up system;
7. BMID's Scotty Creek source, used for irrigation in the north-end, was placed on Stand-by in September 2020;

8. Well # 4 resumed operations as the primary domestic water source for the north-end on September 11, 2020. Well #4 will continue to operate until spring 2021;
9. Well #5, used as the primary domestic water source in the north-end of the system for both irrigation and domestic consumption was turned off for the year on September 11, 2020. Well #5 is began undergoing maintenance in the fall and the maintenance will continue throughout the winter;
10. Well #6, which supplies irrigation water to the twinned north-end water distribution systems, was placed in stand-by for the year in October. Well #6 will remain in stand-by mode for fire protection only until flows increase in spring 2021;
11. *E.Coli* levels at Mission Creek's Point-of-Diversion (creek intake prior to WTP) had low counts for fall with a peak count of 4 on December 29, 2020. The average *E.Coli* count was 1.13 for the month based on 9 samples;
12. *E.Coli* levels in the raw water at the water distribution system intake down-stream of the WTP, immediately prior to disinfection, had zero counts on all samples. The reduction in *E.Coli* levels is credited to the settling of particles in the water in Stevens and Hadden Reservoirs;
13. No *E.Coli* or *Total Coliforms* or 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;
14. Disinfection by-products (Haloacetic acids and Trihalomethanes) were not sampled for during December 2020. Disinfection by-product sampling will take place in January 2021;

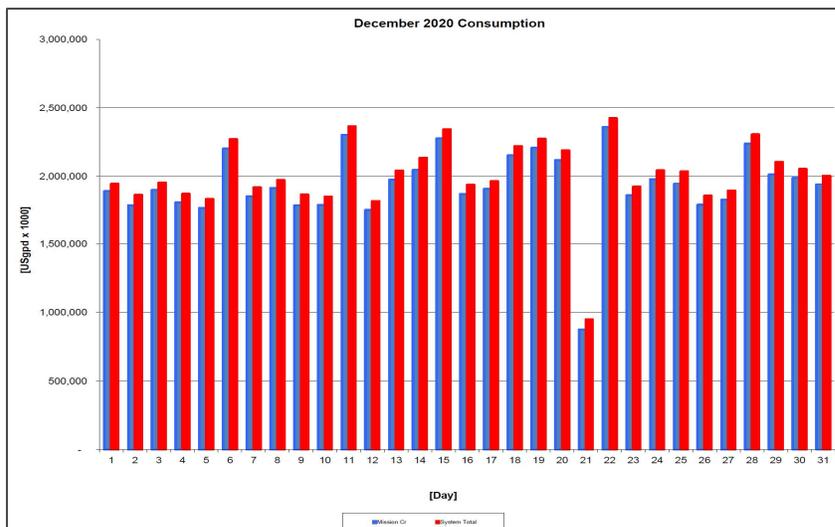
## 1.0 FLOWS - DECEMBER, 2020

The Maximum Daily Flow was on December 22, at 2,424,121 US gallons (9.18 ML)

The Minimum Daily Flow was on December 21, at 948,618 US gallons (3.59 ML)

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

**Figure 1.1 - Domestic Water System Flow**



**Table 1.2 - December 2020 - Daily Consumption Report**

Year	Mission Cr	Well #4	Well #5	System Total	System Total
2020	Usgpd	Usgpd	Usgpd	Usgpd	ML/Day
1-Dec	1,883,710	61,000	0.0	1,944,710	7.36
2-Dec	1,780,952	75,000	0.0	1,855,952	7.02
3-Dec	1,892,401	61,000	0.0	1,953,401	7.39
4-Dec	1,802,339	62,000	0.0	1,864,339	7.06
5-Dec	1,761,969	64,000	0.0	1,825,969	6.91
6-Dec	2,201,950	69,000	0.0	2,270,950	8.60
7-Dec	1,847,362	64,000	0.0	1,911,362	7.23
8-Dec	1,907,249	65,000	0.0	1,972,249	7.46
9-Dec	1,779,521	79,000	0.0	1,858,521	7.03
10-Dec	1,782,892	61,000	0.0	1,843,892	6.98
11-Dec	2,301,237	63,000	0.0	2,364,237	8.95
12-Dec	1,746,512	65,000	0.0	1,811,512	6.86
13-Dec	1,974,046	67,000	0.0	2,041,046	7.73
14-Dec	2,046,204	89,000	0.0	2,135,204	8.08
15-Dec	2,276,195	66,000	0.0	2,342,195	8.87
16-Dec	1,863,945	66,000	0.0	1,929,945	7.30
17-Dec	1,900,071	64,000	0.0	1,964,071	7.43
18-Dec	2,151,864	68,000	0.0	2,219,864	8.40
19-Dec	2,207,267	66,000	0.0	2,273,267	8.60
20-Dec	2,118,872	70,000	0.0	2,188,872	8.28
21-Dec	875,618	73,000	0.0	948,618	3.59
22-Dec	2,359,122	65,000	0.0	2,424,122	9.18
23-Dec	1,853,068	64,000	0.0	1,917,068	7.26
24-Dec	1,978,730	64,000	0.0	2,042,730	7.73
25-Dec	1,944,000	91,000	0.0	2,035,000	7.70
26-Dec	1,784,658	66,000	0.0	1,850,658	7.00
27-Dec	1,821,332	67,000	0.0	1,888,332	7.15
28-Dec	2,238,885	67,000	0.0	2,305,885	8.73
29-Dec	2,013,432	91,000	0.0	2,104,432	7.97
30-Dec	1,988,202	65,000	0.0	2,053,202	7.77
31-Dec	1,938,370	65,000	0.0	2,003,370	7.58
Totals Usgpd	60,021,975	2,123,000	0.00	62,144,975	235.22
Totals ML	227.18	8.04	0.00		
Avg's	1936120.17	7.33		2004720.17	7.59
Max	2359122.00	8.93		2424122.00	9.18
Min	875618.00	3.31		948618.00	3.59

## 2.0 RAW WATER QUALITY - BACTERIOLOGICAL MONITORING

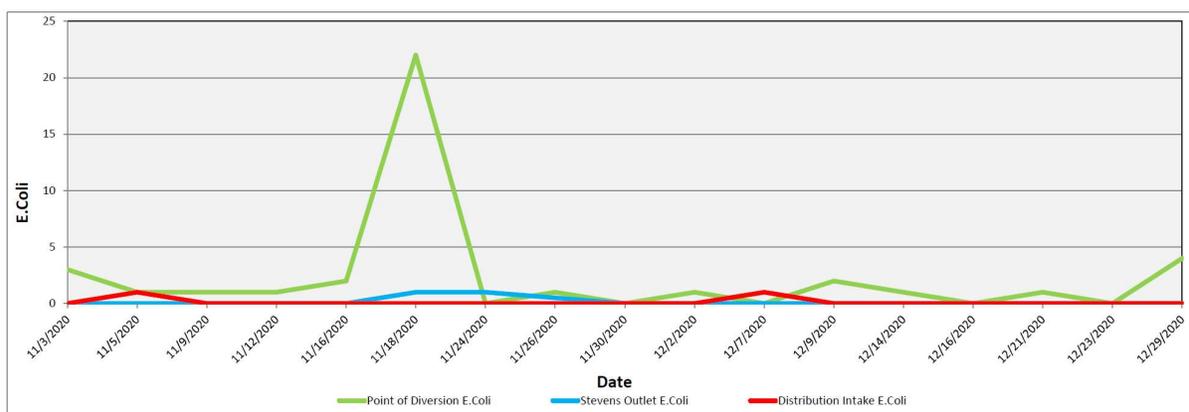
Raw water samples were taken at three points at BMID settling ponds before chlorination

Samples were taken twice per week at the Distribution Intake's Point of Disinfection and at the Mission Creek raw water Point of Diversion; one sample is taken per week 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 2019 -December 2020**



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

Date	Point of Diversion E. Coli	Stevens Outlet E. Coli	Distribution Intake E. Coli
3-Nov-20	3	0	0
5-Nov-20	1	0	1
9-Nov-20	1	0	0
12-Nov-20	1	0	0
16-Nov-20	2	0	0
18-Nov-20	22	1	0
24-Nov-20	0	1	0
26-Nov-20	1	0	0
30-Nov-20	0	0	0
2-Dec-20	1	0	0
7-Dec-20	0	0	1
9-Dec-20	2	0	0
14-Dec-20	1	0	0
16-Dec-20	0	0	0
21-Dec-20	1	0	0
23-Dec-20	0	0	0
29-Dec-20	4	0	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.)

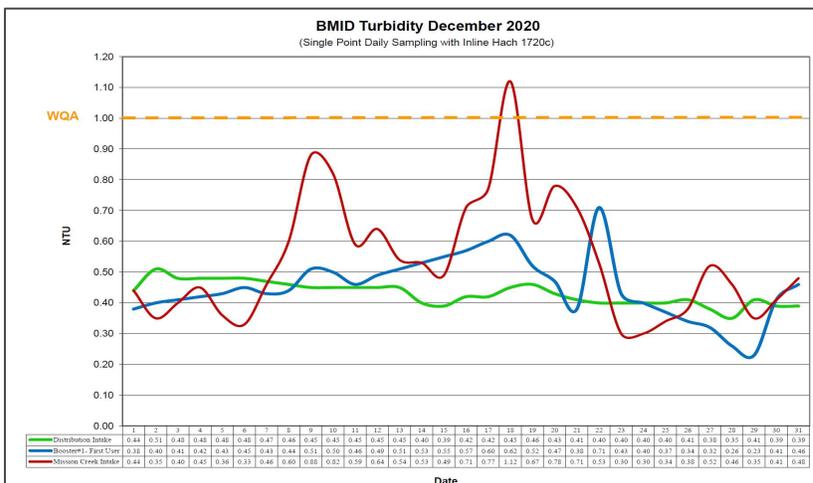
(Hadden Outlet = Distribution Intake - Point of Disinfection)

### 3.0 RAW AND TREATED WATER TURBIDITY

Through December 2020, 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 0.71 NTU on December 22.

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 2020			
Date	Mission Creek Intake	Distribution Intake	Booster#1- First User
	Daily Average [NTU]	Daily Average NTU	Daily Average NTU
1	0.44	0.44	0.38
2	0.35	0.51	0.40
3	0.40	0.48	0.41
4	0.45	0.48	0.42
5	0.36	0.48	0.43
6	0.33	0.48	0.45
7	0.46	0.47	0.43
8	0.60	0.46	0.44
9	0.88	0.45	0.51
10	0.82	0.45	0.50
11	0.59	0.45	0.46
12	0.64	0.45	0.49
13	0.54	0.45	0.51
14	0.53	0.40	0.53
15	0.49	0.39	0.55
16	0.71	0.42	0.57
17	0.77	0.42	0.60
18	1.12	0.45	0.62
19	0.67	0.46	0.52
20	0.78	0.43	0.47
21	0.71	0.41	0.38
22	0.53	0.40	0.71
23	0.30	0.40	0.43
24	0.30	0.40	0.40
25	0.34	0.40	0.37
26	0.38	0.41	0.34
27	0.52	0.38	0.32
28	0.46	0.35	0.26
29	0.35	0.41	0.23
30	0.41	0.39	0.41
31	0.48	0.39	0.46
AVG	0.54	0.43	0.45

### 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, 2020.

Figure 4.1 - CT Trending – BMID Mission Creek Source – December 2020

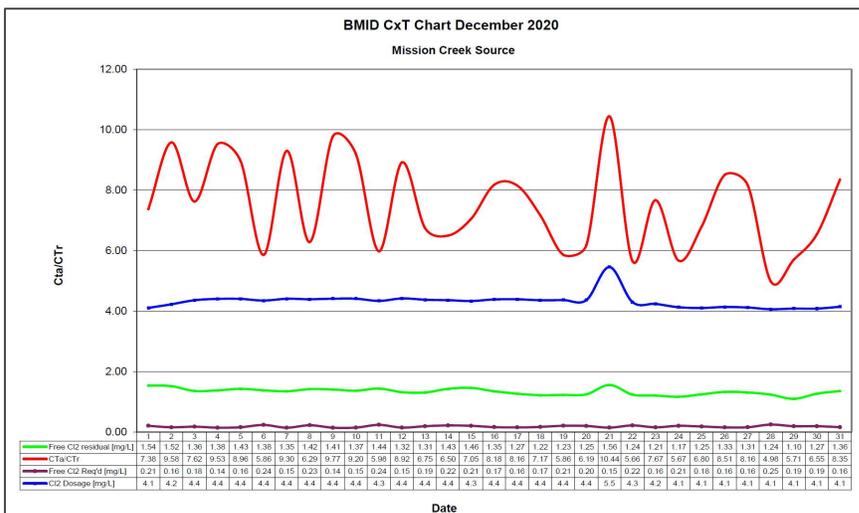


Table 4.2 - CT Table – Mission Creek Source

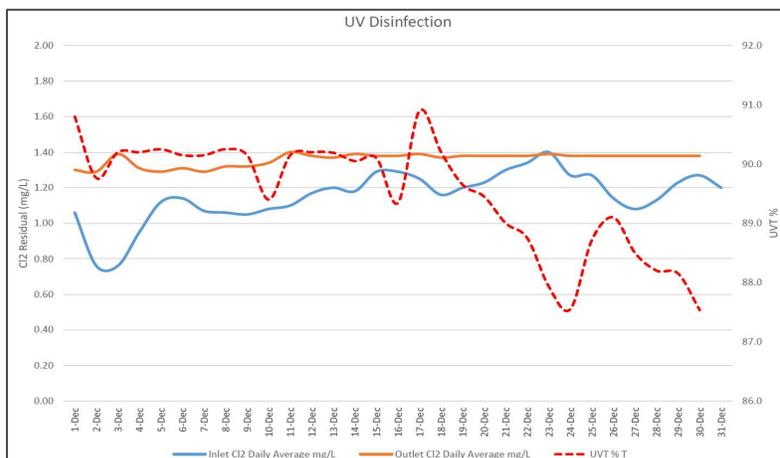
BMID December 2020 Mission Creek Source													
DATE	pH (Average)	TEMP Present [°C]	PEAK FLOW [Us gpm]	Free Cl2 residual [mg/L]	CT achieved	CT req'd	CTa/CTr	Free Cl2 Req'd [mg/L]	Cl2 Dosage [mg/L]	VOLUME TOTAL [USgal]	TIME [mins]	FLOW Daily Average [USGPM]	CL2 DOSAGE Average [PPD]
December													
1	7.94	6.1	2505	1.54	1628.9	220.9	7.38	0.21	4.1	2649600	1058	1307	65
2	7.97	6.7	1968	1.52	2046.4	213.6	9.58	0.16	4.2	2649600	1346	1238	63
3	8.02	5.6	2050	1.36	1757.8	230.6	7.62	0.18	4.4	2649600	1292	1320	69
4	7.98	5.8	1707	1.38	2142.0	224.8	9.53	0.14	4.4	2649600	1552	1248	66
5	7.98	5.9	1883	1.43	2012.2	224.5	8.96	0.16	4.4	2649600	1407	1224	65
6	7.98	5.9	2794	1.38	1308.7	223.3	5.86	0.24	4.4	2649600	948	1551	81
7	7.99	5.9	1722	1.35	2077.2	223.3	9.30	0.15	4.4	2649600	1539	1257	67
8	7.99	5.9	2660	1.42	1414.4	225.0	6.29	0.23	4.4	2649600	996	1329	70
9	8.00	5.4	1637	1.41	2282.2	233.5	9.77	0.14	4.4	2649600	1619	1237	66
10	8.00	5.4	1697	1.37	2139.0	232.5	9.20	0.15	4.4	2649600	1561	1237	66
11	8.01	5.3	2696	1.44	1415.2	236.6	5.98	0.24	4.3	2649600	983	1601	84
12	8.01	6.1	1774	1.32	1971.5	221.0	8.92	0.15	4.4	2649600	1494	1212	64
13	8.02	6.2	2338	1.31	1484.6	219.9	6.75	0.19	4.4	2649600	1133	1372	72
14	8.02	5.3	2458	1.43	1541.5	237.2	6.50	0.22	4.4	2649600	1078	1421	75
15	8.03	6.1	2428	1.46	1593.3	225.8	7.05	0.21	4.3	2649600	1091	1607	84
16	8.04	6.6	2022	1.35	1769.0	216.3	8.18	0.17	4.4	2649600	1310	1299	69
17	8.04	6.4	1898	1.27	1772.9	217.3	8.16	0.16	4.4	2649600	1396	1305	69
18	8.05	6.1	2037	1.22	1586.9	221.3	7.17	0.17	4.4	2649600	1301	1502	79
19	8.05	6.4	2561	1.23	1272.6	217.0	5.86	0.21	4.4	2649600	1035	1528	80
20	8.06	6.4	2453	1.25	1350.2	218.3	6.19	0.20	4.4	2649600	1080	1494	78
21	8.06	6.5	1766	1.56	2340.5	224.1	10.44	0.15	5.5	2649600	1500	1076	71
22	8.07	6.2	2619	1.24	1254.5	221.8	5.66	0.22	4.3	2649600	1012	1645	85
23	8.07	5.9	1852	1.21	1731.1	225.6	7.67	0.16	4.2	2649600	1431	1292	66
24	8.03	5.4	2383	1.17	1300.9	229.3	5.67	0.21	4.1	2649600	1112	1400	70
25	8.04	5.2	2068	1.25	1601.5	235.6	6.80	0.18	4.1	2649600	1281	1326	65
26	8.05	5.5	1772	1.33	1988.7	233.7	8.51	0.16	4.1	2649600	1495	1239	62
27	8.07	5.6	1824	1.31	1902.9	233.1	8.16	0.16	4.1	2649600	1453	1267	63
28	8.08	4.5	2633	1.24	1247.8	250.4	4.98	0.25	4.1	2649600	1006	1556	76
29	8.08	5.5	2226	1.10	1309.3	229.4	5.71	0.19	4.1	2649600	1190	1401	69
30	8.08	5.5	2192	1.27	1535.1	234.4	6.55	0.19	4.1	2649600	1209	1412	69
31	8.08	5.2	1785	1.36	2018.7	241.8	8.35	0.16	4.1	2649600	1484	1319	66
Averages	8.03	5.82	2142.19	1.34	1703.15	227.17	7.51	0.18	4.33				

## 5.0 ULTRAVIOLET DISINFECTION

Total Water Treated: 233,793.1 m<sup>3</sup> 100.0%  
 On-Spec Water: 233,720.0 m<sup>3</sup> 100.0%  
 Off-Spec Water: 73.1 m<sup>3</sup> 0.0310%

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 2020**



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

Date	Inlet Cl2 Daily	Outlet Cl2 Daily	UVT % T	In Spec Water Volume	Off Spec Water	Off Spec % of Water	
	mg/L	mg/L		Cubic Meters	Cubic Meters	Percentage	
1-Dec	1.06	1.38	87.9	7,189	0	0.00%	
2-Dec	0.76	1.38	87.7	6,820	0	0.00%	
3-Dec	0.76	1.39	87.4	7,293	0	0.00%	
4-Dec	0.95	1.38	85.6	6,869	0	0.00%	
5-Dec	1.12	1.38	87.0	6,739	0	0.00%	
6-Dec	1.14	1.39	86.8	8,510	0	0.00%	
7-Dec	1.07	1.38	87.0	6,923	0	0.00%	
8-Dec	1.06	1.38	87.7	7,333	0	0.00%	
9-Dec	1.05	1.38	87.7	6,806	0	0.00%	
10-Dec	1.08	1.38	87.5	6,812	0	0.00%	
11-Dec	1.10	1.38	87.1	8,789	0	0.00%	
12-Dec	1.17	1.38	87.4	6,680	0	0.00%	
13-Dec	1.20	1.38	87.7	7,541	0	0.00%	
14-Dec	1.18	1.38	85.3	7,794	0	0.00%	
15-Dec	1.29	1.38	85.1	8,817	0	0.00%	
16-Dec	1.29	1.38	85.3	7,135	0	0.00%	
17-Dec	1.25	1.38	85.3	7,175	0	0.00%	
18-Dec	1.16	1.39	85.3	13,622	0	0.00%	
19-Dec	1.20	1.38	85.0	8,383	0	0.00%	
20-Dec	1.23	1.38	84.9	8,216	0	0.00%	
21-Dec	1.30	1.38	85.0	9,358	62	0.66%	
22-Dec	1.34	1.38	85.0	9,026	11	0.12%	
23-Dec	1.40	1.39	85.8	7,099	1	0.01%	
24-Dec	1.27	1.38	84.1	7,705	0	0.00%	
25-Dec	1.27	1.37	85.9	7,294	0	0.00%	
26-Dec	1.14	1.38	86.0	6,838	0	0.00%	
27-Dec	1.08	1.38	86.0	6,970	0	0.00%	
28-Dec	1.13	1.38	85.2	8,538	0	0.00%	
29-Dec	1.23	1.38	85.6	7,696	0	0.00%	
30-Dec	1.27	1.38	86.3	7,751	0	0.00%	
31-Dec	1.20	1.38	85.5	7,278	0	0.00%	
<b>Average</b>	<b>1.15</b>	<b>1.38</b>	<b>86.17</b>	<b>Total</b>	<b>233,720</b>	<b>73.1</b>	<b>0.031%</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
- 40 samples were found to be absent of Coliforms.
- 40 samples were found to be absent of *E. Coli*.

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

Date	2021 Belgo 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
3-Nov-20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9-Nov-20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16-Nov-20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24-Nov-20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30-Nov-20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7-Dec-20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14-Dec-20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21-Dec-20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29-Dec-20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

**Table 6.3 – Disinfection By-Products - THM and HAA Results**

- No Samples Taken in December 2020.

### In-House Analysis (BMID Staff)

- Presence/Absence samples taken on a three-week cycle at seven sites around the BMID service area.
- All 11 samples were found to be absent of both Total Coliforms and *E. Coli*.

**Table 6.4 - BMID In-house Testing – Presence Absence**

Location	12/1/2020				12/9/2020				12/14/2020				12/21/2020				12/29/2020			
	Cl2	Temp	Pres.	Abs.	Cl2	Temp	Pres.	Abs.	Cl2	Temp	Pres.	Abs.	Cl2	Temp	Pres.	Abs.	Cl2	Temp	Pres.	Abs.
Sylvania Cres									0.91	6.1	-	X								
170 Kneller Rd									0.68	10.1	-	X								
2105 Morrison					0.54	12.4	-	X									0.51	10.6	-	X
Staymen Rd					0.39	11.6	-	X									0.41	9.6	-	X
260 Campion Rd	0.61	10.2	-	X									0.24	11.6	-	X				
Fenwick Rd	0.25	10.2	-	X									0.00	10.8	-	X				
Solly Ct									0.73	10.6	-	X								

- BMID Population = 25,000

#### RECOMMENDED TESTS

- Recommended number of samples per month = 25  
(as per Guide for Canadian Drinking Water Quality)

#### ACTUAL TESTS

- Total tests by BMID staff (presence/absence) = 11
- Total tests sampled by BMID and tested by Caro Labs = 40
- Total tests sampled in BMID treated distribution system = 51 (Zero Positive Samples)