



## MONTHLY REPORTING PERIOD - NOVEMBER, 2021

### 1. SUMMARY

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

Source	Total (US Gals)	Total (Mega Litres)
Mission Creek	60,204,772	227.88
Well 4	1,920,000	7.27
Well 5	0	0
Scotty Creek (Irrigation Only)	0	0
Total	62,124,772	235.14

1. Being on the peripheral of the atmospheric river event in southern BC on November 14 and 15, Mission Creek experienced higher than normal flows for November with a corresponding spike in turbidity;
2. During the warm weather rain event on Nov. 14-15<sup>th</sup>, Mission Creek flows increased from 1.47 m<sup>3</sup>/s to 6.55 m<sup>3</sup>/s. BMID was fortunate that the event did not hit the Mission Creek watershed as hard as the Coldwater River watershed was hit. Both watersheds are of similar size;
3. For most of the second half of November, temperatures remained above seasonal resulting in continued high flow in the creek and higher than normal colour and turbidity levels;
4. A presence/absence sample collected on November 15 at Solly Ct sample station, was found to be positive for bacteria. A new sample was collected and taken into Caro Analytical for third-party analysis. The resample did not indicate any *Total Coliform* or *E.Coli* Bacteria. The original positive is likely due to contamination during sampling as chlorine levels were stable throughout.
5. 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.
6. The WTP started on March 21, 2021 and ran throughout all of November. It will continue to operate until raw water quality improves;
7. Raw water turbidity levels in Mission Creek peaked at 22.47 NTU (average daily turbidity) on November 15. Average daily raw water turbidity for November was 2.67 NTU at the Mission Creek intake;
8. Turbidity levels at the Distribution Intake (end of Hadden Reservoir) high reading was 0.62 NTU on November 17, 2021. Average clarified water turbidity for November was 0.51 NTU at the Distribution Intake at the lower end of Hadden Reservoir. The colder water temperatures make chemical treatment more challenging;
9. The highest recorded monthly turbidity level at the first customer (Booster #1) was 0.43 NTU on November 21, 2021. Average monthly turbidity at the first customer was 0.33 NTU for November;

10. BMID's Ultraviolet Treatment Facility treated 227,899 m<sup>3</sup> of water, none of which was "Off-Spec" (0.000%). Average UV Transmissivity was 91.71%. The average inlet chlorine residual level at the UV site was 1.35 mg/L. With the cold temperatures, minimum chlorine addition was required. The average outgoing chlorine was 1.40 mg/L after the sodium hypochlorite top-up system;
11. 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;
12. 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;
13. 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;
14. 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;
15. *E. Coli* levels at Mission Creek's Point-of-Diversion (creek intake prior to WTP) had variable counts for late autumn with a peak count of 124 on November 15, 2021 during the high flow event. The average creek *E. Coli* count was 34 for November based on 5 samples;
16. *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 all samples throughout November 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;
17. No *E. Coli* or *Total Coliforms* were found in treated water in the distribution system through third-party analysis. In addition, only one positive sample was detected by BMID's in-house presence/absence testing throughout November;

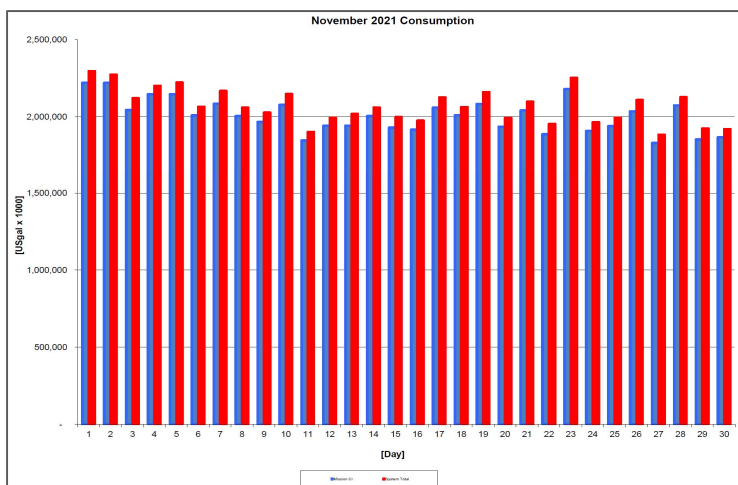
## 1.0 FLOWS - NOVEMBER, 2021

The Maximum Daily Flow was on November 1, at 2,296,493 US gallons (8.69 ML)

The Minimum Daily Flow was on November 27, at 1,888,368 US gallons (7.14 ML)

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

**Figure 1.1 - Domestic Water System Flow**



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

Year	Mission Cr	Well #4	Well #5	System Total	System Total
2021	Usgpd	Usgpd	Usgpd	Usgpd	ML/Day
1-Nov	2,219,494	77,000	-	2,296,494	8.69
2-Nov	2,219,573	54,000	-	2,273,573	8.61
3-Nov	2,044,084	77,000	-	2,121,084	8.03
4-Nov	2,146,292	55,000	-	2,201,292	8.33
5-Nov	2,146,345	77,000	-	2,223,345	8.42
6-Nov	2,008,685	57,000	-	2,065,685	7.82
7-Nov	2,084,423	84,000	-	2,168,423	8.21
8-Nov	2,004,828	55,000	-	2,059,828	7.80
9-Nov	1,966,972	61,000	-	2,027,972	7.68
10-Nov	2,077,079	71,000	-	2,148,079	8.13
11-Nov	1,846,008	57,000	-	1,903,008	7.20
12-Nov	1,941,902	54,000	-	1,995,902	7.55
13-Nov	1,942,430	78,000	-	2,020,430	7.65
14-Nov	2,004,537	56,000	-	2,060,537	7.80
15-Nov	1,929,565	70,000	-	1,999,565	7.57
16-Nov	1,916,674	60,000	-	1,976,674	7.48
17-Nov	2,059,749	67,000	-	2,126,749	8.05
18-Nov	2,009,081	55,000	-	2,064,081	7.81
19-Nov	2,083,181	77,000	-	2,160,181	8.18
20-Nov	1,936,037	58,000	-	1,994,037	7.55
21-Nov	2,040,940	58,000	-	2,098,940	7.94
22-Nov	1,886,954	68,000	-	1,954,954	7.40
23-Nov	2,180,291	73,000	-	2,253,291	8.53
24-Nov	1,908,801	57,000	-	1,965,801	7.44
25-Nov	1,939,604	55,000	-	1,994,604	7.55
26-Nov	2,035,815	74,000	-	2,109,815	7.99
27-Nov	1,830,369	55,000	-	1,885,369	7.14
28-Nov	2,073,829	54,000	-	2,127,829	8.05
29-Nov	1,853,114	73,000	-	1,926,114	7.29
30-Nov	1,868,119	53,000	-	1,921,119	7.27
Totals Usgpd	60,204,772	1,920,000	-	62,124,772	235.14
Totals ML	227.88	7.27	0.00		
Avg's	2006825.7	7.60		2070825.7	7.84
Max	2219573.1	8.40		2296493.9	8.69
Min	1830368.5	6.93		1885368.5	7.14

## 2.0 RAW WATER QUALITY - BACTERIOLOGICAL MONITORING

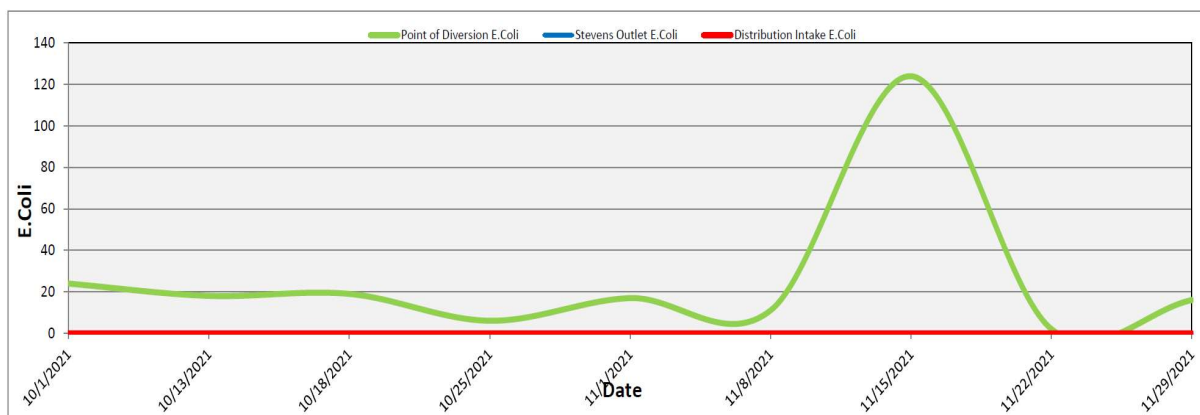
Raw water samples were taken at three points at BMID settling ponds before chlorination

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) October 2021 - November 2021**



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

Date	Point of Diversion E.Coli	Stevens Outlet E.Coli	Distribution Intake E.Coli
1-Oct-21	24	0	0
13-Oct-21	18	0	0
18-Oct-21	19	0	0
25-Oct-21	6	0	0
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

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.)

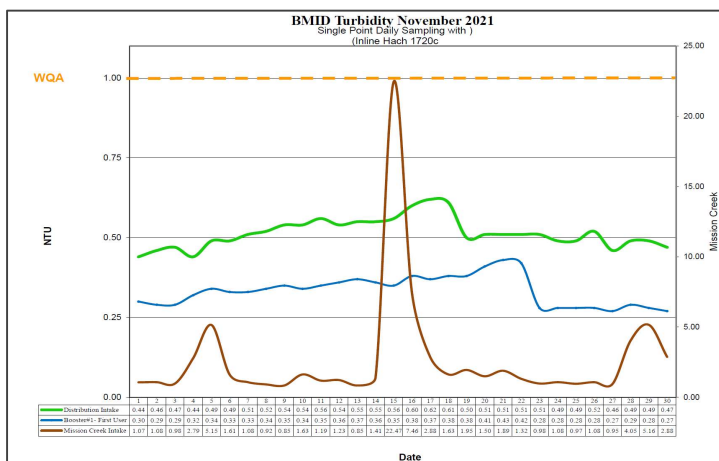
Hadden Outlet (Raw) - Sampling point after exiting 75,000 m<sup>3</sup> 2<sup>nd</sup> lower balancing reservoir (Hadden Res.)  
(Hadden Outlet = Distribution Intake - Point of Disinfection)

### 3.0 RAW AND TREATED WATER TURBIDITY

Through November 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 0.43 NTU on November 21, 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 November 2021			
Date	Mission Creek Intake	Distribution Intake	Booster#1- First User
	Daily Average [NTU]	Daily Average [NTU]	Daily Average [NTU]
1	1.07	0.44	0.30
2	1.08	0.46	0.29
3	0.98	0.47	0.29
4	2.79	0.44	0.32
5	5.15	0.49	0.34
6	1.61	0.49	0.33
7	1.08	0.51	0.33
8	0.92	0.52	0.34
9	0.85	0.54	0.35
10	1.63	0.54	0.34
11	1.19	0.56	0.35
12	1.23	0.54	0.36
13	0.85	0.55	0.37
14	1.41	0.55	0.36
15	22.47	0.56	0.35
16	7.46	0.60	0.38
17	2.88	0.62	0.37
18	1.63	0.61	0.38
19	1.95	0.50	0.38
20	1.50	0.51	0.41
21	1.89	0.51	0.43
22	1.32	0.51	0.42
23	0.98	0.51	0.28
24	1.08	0.49	0.28
25	0.97	0.49	0.28
26	1.08	0.52	0.28
27	0.95	0.46	0.27
28	4.05	0.49	0.29
29	5.16	0.49	0.28
30	2.88	0.47	0.27
AVG	2.67	0.51	0.33

#### 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 November, 2021.

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

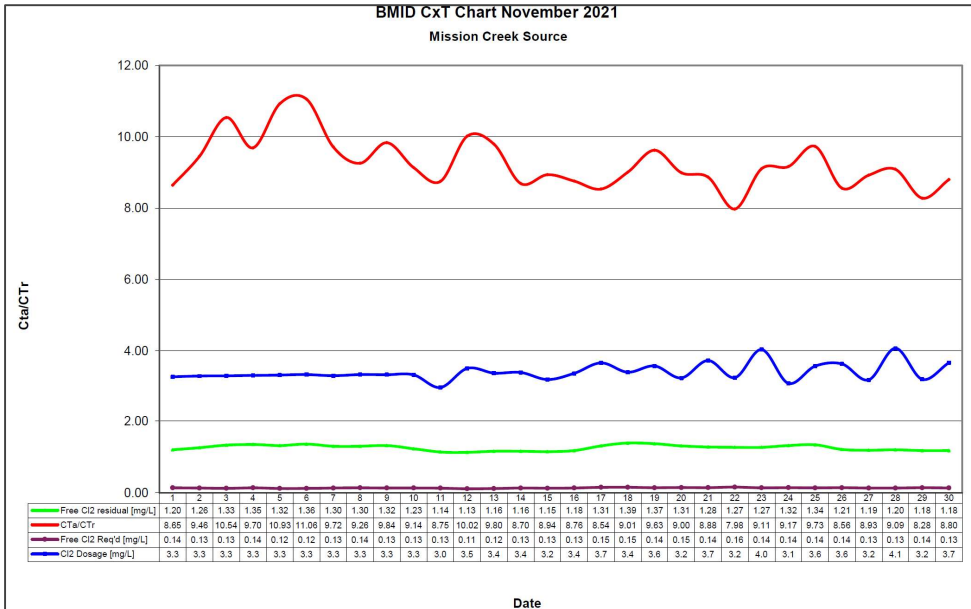


Table 4.2 - CT Table – Mission Creek Source

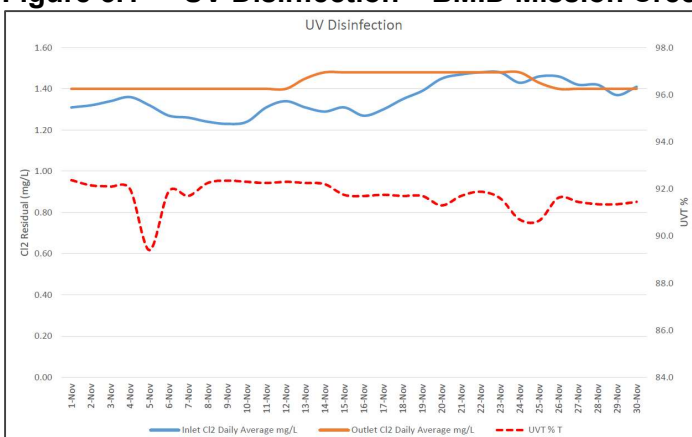
BMID November 2021													
Mission Creek Source													
DATE	pH	TEMP	PEAK	Free Cl <sub>2</sub>	CT	CT	CTa/CTr	Free Cl <sub>2</sub>	Cl <sub>2</sub>	VOLUME	TIME	FLOW	CL <sub>2</sub> DOSAGE
	(Average)	(Present)	FLOW	residual	achieved	req'd		Req'd	Dosage	TOTAL	[mins]	Daily Average	Average
November		[°C]	[Usgpm]	[mg/L]				[mg/L]	[mg/L]	[USgal]		[USGPM]	[PPD]
1	7.54	8.6	2362	1.20	1346.3	155.7	8.65	0.14	3.3	2649600	1122	1569	61.7
2	7.54	8.7	2267	1.26	1472.9	155.7	9.46	0.13	3.3	2649600	1169	1442	57.1
3	7.54	9.4	2235	1.33	1576.8	149.6	10.54	0.13	3.3	2649600	1186	1442	57.2
4	7.54	8.9	2378	1.35	1504.5	155.2	9.70	0.14	3.3	2649600	1114	1506	59.9
5	7.54	9.6	2172	1.32	1610.6	147.3	10.93	0.12	3.3	2649600	1220	1411	56.3
6	7.54	9.4	2172	1.36	1659.4	150.1	11.06	0.12	3.3	2649600	1220	1347	54.0
7	7.54	9.3	2362	1.30	1458.5	150.1	9.72	0.13	3.3	2649600	1122	1474	58.5
8	7.54	8.8	2393	1.30	1439.2	155.4	9.26	0.14	3.3	2649600	1107	1411	56.5
9	7.54	9.0	2314	1.32	1511.3	153.6	9.84	0.13	3.3	2649600	1145	1379	55.2
10	7.54	8.4	2251	1.23	1448.0	158.4	9.14	0.13	3.3	2649600	1177	1458	58.3
11	7.54	8.4	2203	1.14	1371.0	156.6	8.75	0.13	3.0	2649600	1203	1458	52.1
12	7.54	8.1	1870	1.13	1600.8	159.7	10.02	0.11	3.5	2649600	1417	1300	54.8
13	7.54	8.4	1997	1.16	1539.0	157.0	9.80	0.12	3.4	2649600	1327	1363	55.3
14	7.54	8.4	2251	1.16	1365.6	157.0	8.70	0.13	3.4	2649600	1177	1363	55.6
15	7.54	8.6	2203	1.15	1383.0	154.7	8.94	0.13	3.2	2649600	1203	1427	54.8
16	7.54	8.2	2235	1.18	1399.0	159.6	8.76	0.13	3.4	2649600	1186	1363	55.2
17	7.55	6.8	2267	1.31	1531.4	179.3	8.54	0.15	3.7	2649600	1169	1347	59.3
18	7.56	7.2	2314	1.39	1591.5	176.6	9.01	0.15	3.4	2649600	1145	1458	59.6
19	7.56	7.2	2140	1.37	1696.4	176.2	9.63	0.14	3.6	2649600	1238	1411	60.6
20	7.54	7.4	2251	1.31	1542.1	171.4	9.00	0.15	3.2	2649600	1177	1474	57.4
21	7.53	6.6	2124	1.28	1596.8	179.9	8.88	0.14	3.7	2649600	1247	1363	61.1
22	7.52	7.3	2473	1.27	1360.9	170.6	7.98	0.16	3.2	2649600	1072	1442	56.3
23	7.51	8.4	2346	1.27	1434.4	157.5	9.11	0.14	4.0	2649600	1129	1331	64.6
24	7.50	7.7	2302	1.32	1519.3	165.7	9.17	0.14	3.1	2649600	1151	1537	57.1
25	7.49	8.4	2314	1.34	1534.2	157.6	9.73	0.14	3.6	2649600	1145	1347	57.8
26	7.47	7.7	2314	1.21	1385.4	161.8	8.56	0.14	3.6	2649600	1145	1363	59.5
27	7.45	8.4	2314	1.19	1362.5	152.6	8.93	0.13	3.2	2649600	1145	1427	54.6
28	7.45	7.0	2076	1.20	1531.3	168.4	9.09	0.13	4.1	2649600	1276	1300	63.6
29	7.43	7.9	2409	1.18	1297.7	156.7	8.28	0.14	3.2	2649600	1100	1474	56.7
30	7.43	7.9	2267	1.18	1379.4	156.7	8.80	0.13	3.7	2649600	1169	1300	57.3
Averages	7.52	8.20	2252.5	1.26	1481.63	160.2	9.27	0.14	3.41			1410	57.6

## 5.0 ULTRAVIOLET DISINFECTION

Total Water Treated: 227,899.9 m<sup>3</sup> 100.00%  
 On-Spec Water: 227,899.9 m<sup>3</sup> 100.00%  
 Off-Spec Water: 0.0 m<sup>3</sup> 0.00%

Average monthly chlorine residual before UV Treatment was 1.35 mg/L  
 The average monthly chlorine residual after UV treatment and re-chlorination was 1.40 mg/L.

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



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

Date	Inlet Cl2	Outlet Cl2	UVT		In Spec	Off Spec	Off Spec %
	Daily	Daily			Water	Water	of Water
	mg/L	mg/L	% T		Cubic Meters	Cubic Meters	Percentage
1-Nov	1.31	1.40	92.4		8,402	0	0.00%
2-Nov	1.32	1.40	92.2		8,402	0	0.00%
3-Nov	1.34	1.40	92.1		7,738	0	0.00%
4-Nov	1.36	1.40	92.0		8,125	0	0.00%
5-Nov	1.32	1.40	89.4		8,125	0	0.00%
6-Nov	1.27	1.40	91.9		7,604	0	0.00%
7-Nov	1.26	1.40	91.7		7,890	0	0.00%
8-Nov	1.24	1.40	92.3		7,589	0	0.00%
9-Nov	1.23	1.40	92.4		7,446	0	0.00%
10-Nov	1.24	1.40	92.3		7,863	0	0.00%
11-Nov	1.31	1.40	92.3		6,988	0	0.00%
12-Nov	1.34	1.40	92.3		7,351	0	0.00%
13-Nov	1.31	1.45	92.3		7,353	0	0.00%
14-Nov	1.29	1.48	92.2		7,588	0	0.00%
15-Nov	1.31	1.48	91.7		7,304	0	0.00%
16-Nov	1.27	1.48	91.7		7,255	0	0.00%
17-Nov	1.30	1.48	91.8		7,797	0	0.00%
18-Nov	1.35	1.48	91.7		7,605	0	0.00%
19-Nov	1.39	1.48	91.7		7,886	0	0.00%
20-Nov	1.45	1.48	91.3		7,329	0	0.00%
21-Nov	1.47	1.48	91.7		7,726	0	0.00%
22-Nov	1.48	1.48	91.9		7,143	0	0.00%
23-Nov	1.48	1.48	91.6		8,253	0	0.00%
24-Nov	1.43	1.48	90.7		7,226	0	0.00%
25-Nov	1.46	1.43	90.7		7,342	0	0.00%
26-Nov	1.46	1.40	91.6		7,706	0	0.00%
27-Nov	1.42	1.40	91.5		6,929	0	0.00%
28-Nov	1.42	1.40	91.4		7,850	0	0.00%
29-Nov	1.37	1.40	91.4		7,015	0	0.00%
30-Nov	1.41	1.40	91.5		7,072	0	0.00%
<b>Average</b>	<b>1.35</b>	<b>1.40</b>	<b>91.71</b>	<b>Total</b>	<b>227,900</b>	<b>0</b>	<b>0.000%</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
- 29 samples were found to be absent of Coliforms.
- 29 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
1-Oct-21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13-Oct-21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18-Oct-21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25-Oct-21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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

### In-House Analysis (BMID Staff)

- Presence/Absence samples taken on a three-week cycle at seven sites around the BMID service area.
- 10 of 11 samples were found to be absent of both *Total Coliforms* and *E. Coli*. (One positive sample on November 15 at Solly Ct sample station)

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

Location	11/2/2021				11/8/2021				11/15/2021				11/22/2021				11/29/2021			
	Cl2	Temp.	Pres.	Abs.	Cl2	Temp.	Pres.	Abs.	Cl2	Temp.	Pres.	Abs.	Cl2	Temp.	Pres.	Abs.	Cl2	Temp.	Pres.	Abs.
Sylvania Cres									0.56	15.6	-	X								
170 Kneller Rd									0.72	15.0	-	X								
2105 Morrison	0.62	12.2	-	X									0.64	15.4	-	X				
Staymen Rd	0.66	12.4	-	X									0.79	13.4	-	X				
260 Campion Rd					0.41	9.2	-	X									0.16	12.6	-	X
Fenwick Rd					0.16	9.4	-	X									0.36	11.8	-	X
Solly Ct									0.66	14.2	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) = 11 – One positive
- Total tests sampled by BMID and tested by Caro Labs = 24
- Total tests sampled in BMID treated distribution system = 35 (One Positive Sample)