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BMID FILE: 486

MONTHLY REPORTING PERIOD - MARCH, 2019

1. SUMMARY

The list below provides a summary of the water quality information collected by BMID in March, 2019. Documentation and figures are provided on the following pages to support this submission.

Source	Total (US Gals)	Total (Mega Litres)
Mission Creek	59,510,848	225.25
Well 4	2,629,000	9.95
Well 5	0	0
Well 6 (Irrigation Only)	12,000	0.05
Scotty Creek (Irrigation Only)	0	0
Total	62,139,848	235.20

1. 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 throughout March, continuing the trend seen in the previous months. Groundwater monitoring is showing a steady decline in groundwater levels since the fall. The hillside continues to be continuously monitored going forward. Two new groundwater monitoring and slope indicator stations have been installed and work has begun to drill groundwater wells to reduce groundwater levels further;
2. In 2018, the hill side slope adjacent to the Kirschner Mountain Booster station experienced surficial sloughing due to high groundwater levels on the mountain. The City of Kelowna is undertaking remedial action to ensure the security of infrastructure, including BMID's booster station. Groundwater levels are much lower in 2019 and the slope appears to be stable for now;
3. Turbidity levels at the Distribution Intake peaked at 0.55 NTU on March 29 and 31, 2019. Average turbidity for March was 0.39 NTU;
4. The highest monthly turbidity level recorded at the first customer (Booster #1) was 0.51 NTU on March 30. Average monthly turbidity was 0.36 NTU for March;
5. BMID's Ultraviolet Treatment Facility treated 236,564.6 m^3 of water, with only 0.338% which was "Off-Spec". Average UVT% was 85.0%. The average inlet chlorine residual was 1.71 mg/L compared to an average of 1.51 mg/L for the outlet after UV treatment;
6. On March 5th, 800.11 m^3 (15.11%) of water that ran through the UV plant was categorized as "Off-Spec". This is because of a programming error in the UPS that did not alarm the operator as intended. This issue has been resolved going forward;
7. BMID staff began the installation process for a new sodium hypochlorite injection site downstream of the ultraviolet treatment reactors to increase disinfection redundancy in the system. The hypochlorite can also be used to increase free chlorine residual levels after UV treatment;

8. Mission Creek had average flows for March as the mid-elevation watershed began to thaw leading to the beginning of the spring freshet period for 2019;
9. BMID's Scotty Creek source, used for irrigation in the north-end, was shut off for the year on August 24 2018 and has not as of yet been brought on-line;
10. Well # 4 is currently the primary source of water for the north-end. Well #5 was placed on stand-by until consumption increases later in the spring;
11. Well #6 supplies irrigation water to the north-end of the system and was placed on stand-by until late spring;
12. *E.Coli* levels at Mission Creek's Point of Diversion had low counts throughout March with a peak count of 7 on the 25th, with an average count of 1.4 per sample during the 7 samples throughout the last month;
13. *E.Coli* levels in the raw water at the distribution system intake, down-stream of the WTP, prior to disinfection, had zero counts throughout all of March, 2019 with the exception of a count of 1 *E-Coli* on March 4;
14. No *E.Coli* or *Total Coliforms* were found in treated water in the distribution system through third-party analysis. In addition, no positive bacteria tests were found from the in-house presence-absence tests during routine testing;
15. The WTP resumed operations on March 18, 2019 as water quality conditions in Mission Creek required chemical treatment to reduce turbidity and colour levels associated with the early stages of spring freshet;

1.0 FLOWS - MARCH, 2019

Maximum Daily Flow was on March 28, 2019 at 2,417,853 US gallons (9.15 ML)

Minimum Daily Flow was on March 6, 2019 at 1,716,523 US gallons (6.50 ML)

Mission Creek provided 96% of domestic flow throughout March.

Figure 1.1 - Domestic Water System Flow

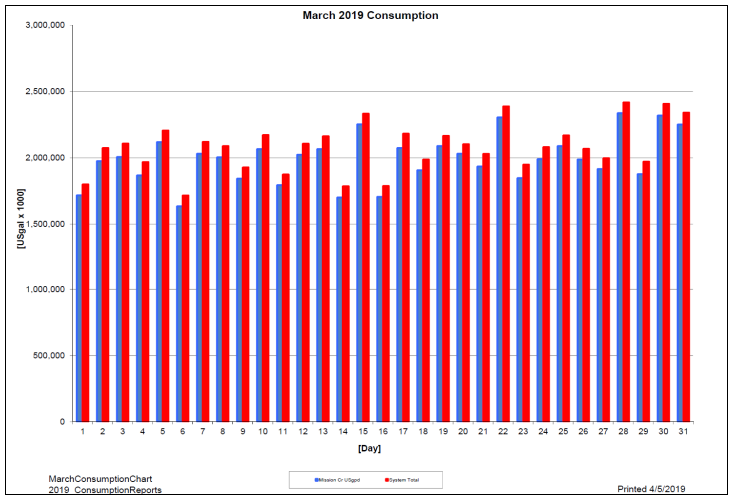


Table 1.2 - March 2019 - Daily Consumption Report

Year	Mission Cr	Well #4	Well #5	Well #6	System Total	System Total
2019	Usgpd	Usgpd	Usgpd	Usgpd	Usgpd	ML/Day
1-Mar	1,717,134	82,000	0.0	1,000.0	1,800,134	6.81
2-Mar	1,975,188	98,000	0.0	1,000.0	2,074,188	7.85
3-Mar	2,006,985	100,000	0.0	1,000.0	2,107,985	7.98
4-Mar	1,867,553	100,000	0.0	1,000.0	1,968,553	7.45
5-Mar	2,118,656	87,000	0.0	1,000.0	2,206,656	8.35
6-Mar	1,634,523	75,000	0.0	7,000.0	1,716,523	6.50
7-Mar	2,030,611	90,000	0.0	0.0	2,120,611	8.03
8-Mar	2,004,397	84,000	0.0	0.0	2,088,397	7.90
9-Mar	1,842,801	85,000	0.0	0.0	1,927,801	7.30
10-Mar	2,066,271	106,000	0.0	0.0	2,172,271	8.22
11-Mar	1,794,129	80,000	0.0	0.0	1,874,129	7.09
12-Mar	2,023,597	83,000	0.0	0.0	2,106,597	7.97
13-Mar	2,066,001	97,000	0.0	0.0	2,163,001	8.19
14-Mar	1,701,056	85,000	0.0	0.0	1,786,056	6.76
15-Mar	2,253,254	80,000	0.0	0.0	2,333,254	8.83
16-Mar	1,705,769	82,000	0.0	0.0	1,787,769	6.77
17-Mar	2,074,465	108,000	0.0	0.0	2,182,465	8.26
18-Mar	1,906,323	81,000	0.0	0.0	1,987,323	7.52
19-Mar	2,089,353	76,000	0.0	0.0	2,165,353	8.20
20-Mar	2,031,185	72,000	0.0	0.0	2,103,185	7.96
21-Mar	1,934,723	95,000	0.0	0.0	2,029,723	7.68
22-Mar	2,305,129	83,000	0.0	0.0	2,388,129	9.04
23-Mar	1,846,786	102,000	0.0	0.0	1,948,786	7.38
24-Mar	1,990,127	91,000	0.0	0.0	2,081,127	7.88
25-Mar	2,088,328	81,000	0.0	0.0	2,169,328	8.21
26-Mar	1,987,248	81,000	0.0	0.0	2,068,248	7.83
27-Mar	1,916,420	81,000	0.0	0.0	1,997,420	7.56
28-Mar	2,336,853	81,000	0.0	0.0	2,417,853	9.15
29-Mar	1,877,504	94,000	0.0	0.0	1,971,504	7.46
30-Mar	2,318,479	89,000	0.0	0.0	2,407,479	9.11
31-Mar	2,251,130	90,000	0.0	0.0	2,341,130	8.86
Totals Usgpd	59,510,848	2,629,000	0	12,000	62,139,848	235.20
Totals ML	225.25	9.95	0.00	0.05		
Avg's	1,983,695	7.51			2,071,728	7.84
Max	2,336,853	8.84			2,417,853	9.15
Min	1,634,523	6.19			1,716,523	6.50

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 E.Coli readings clearly show the effectiveness in risk reduction from the Water Treatment Plant and extended settling times in Stevens and Hadden Reservoirs.

Figure 2.1 - Raw Water *E.Coli* Readings (CARO Lab results) February-March 2018/2019

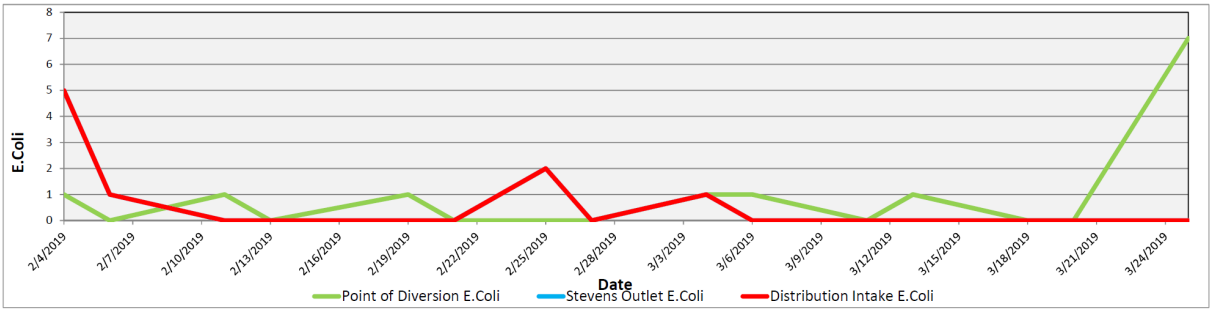


Table 2.1 - *E.Coli* Readings (CARO Labs)

Date	Point of Diversion E.Coli	Stevens Outlet E.Coli	Distribution Intake E.Coli
4-Feb-19	1	2	5
6-Feb-19	0		1
11-Feb-19	1	2	0
13-Feb-19	0		0
19-Feb-19	1	1	0
21-Feb-19	0		0
25-Feb-19	0	0	2
27-Feb-19	0		0
4-Mar-19	1	0	1
6-Mar-19	1		0
11-Mar-19	0	0	0
13-Mar-19	1		0
18-Mar-19	0	0	0
20-Mar-19	0		0
25-Mar-19	7	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^3 1st upper balancing reservoir (Stevens Res.)
Hadden Outlet (Raw) - Sampling point after exiting 75,000 m^3 2nd lower balancing reservoir (Hadden Res.)
(*Hadden Outlet = Distribution Intake - Point of Disinfection*)

3.0 RAW AND TREATED WATER TURBIDITY

Turbidity for the Mission Creek source was measured at Booster Station No. 1 on Gallagher's Road, the first-customer, through March 2019. The highest turbidity recorded at this location was 0.51 NTU on March 30. The average turbidity for the month was 0.36 NTU during March.

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

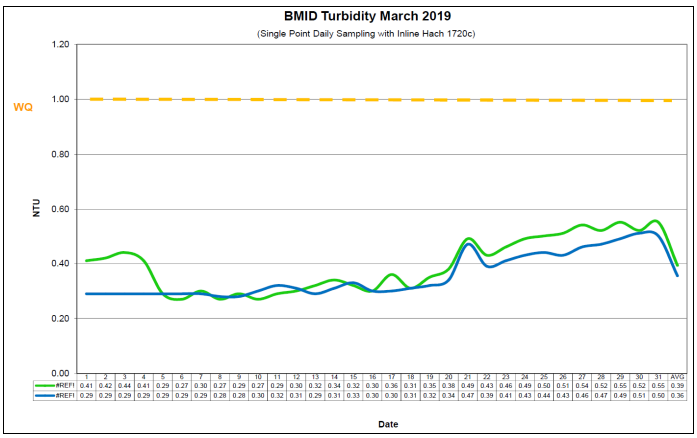


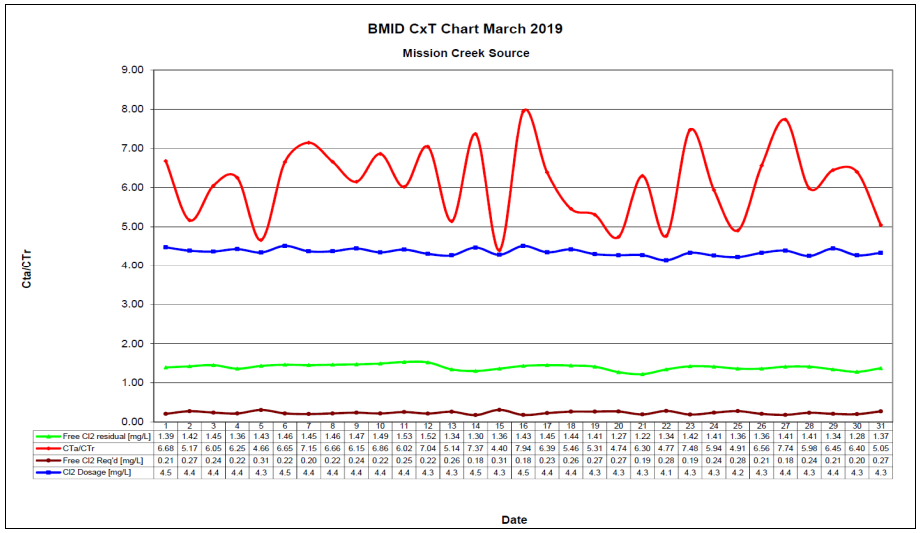
Table 3.1 - Daily Monitoring Record – Turbidity at Distribution Intake & Bst Stn 1

Turbidity Point Sampling for March 2019		
Date	Distribution Intake	Booster#1- First User
	Daily Average NTU	Daily Average NTU
1	0.41	0.29
2	0.42	0.29
3	0.44	0.29
4	0.41	0.29
5	0.29	0.29
6	0.27	0.29
7	0.30	0.29
8	0.27	0.28
9	0.29	0.28
10	0.27	0.30
11	0.29	0.32
12	0.30	0.31
13	0.32	0.29
14	0.34	0.31
15	0.32	0.33
16	0.30	0.30
17	0.36	0.30
18	0.31	0.31
19	0.35	0.32
20	0.38	0.34
21	0.49	0.47
22	0.43	0.39
23	0.46	0.41
24	0.49	0.43
25	0.50	0.44
26	0.51	0.43
27	0.54	0.46
28	0.52	0.47
29	0.55	0.49
30	0.52	0.51
31	0.55	0.50
AVG	0.39	0.36

4.0 CHLORINE CONTACT TIME

Temperature, pH, current 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 March, 2019.

Figure 4.1 - CT Trending – BMID Mission Creek Source – March 2019



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Free Cl2 residual [mg/L]	1.39	1.42	1.45	1.36	1.43	1.46	1.45	1.46	1.47	1.49	1.53	1.52	1.34	1.30	1.36	1.43	1.45	1.44	1.41	1.27	1.22	1.34	1.42	1.41	1.36	1.36	1.41	1.41	1.34	1.28	1.37
CTa/CTr	6.68	5.17	6.05	6.25	4.66	6.65	7.15	6.66	6.15	6.86	6.02	7.04	5.14	7.37	4.40	7.94	6.39	5.46	5.31	4.74	6.30	4.77	7.48	5.94	4.91	6.56	7.74	5.98	6.45	6.40	5.05
Free Cl2 Req'd [mg/L]	0.21	0.27	0.24	0.22	0.31	0.22	0.20	0.22	0.24	0.22	0.25	0.22	0.26	0.18	0.31	0.18	0.23	0.26	0.27	0.27	0.19	0.28	0.19	0.24	0.28	0.21	0.18	0.24	0.21	0.20	0.27
Cl2 Dosage [mg/L]	4.5	4.4	4.4	4.4	4.3	4.5	4.4	4.4	4.4	4.4	4.4	4.3	4.3	4.5	4.3	4.5	4.4	4.4	4.3	4.3	4.3	4.1	4.3	4.3	4.2	4.3	4.4	4.3	4.4	4.3	4.3

Table 4.2 - CT Table – Mission Creek Source

	BMID March 2019 Mission Creek Source												
DATE	pH	TEMP	PEAK	Free Cl_2	CT	CT	CTa/CTr	Free Cl_2	Cl_2	VOLUME	TIME	FLOW	CL_2 **DOSAGE**
	(highest)	(lowest)	FLOW	residual	achieved	req'd		Req'd	Dosage	TOTAL		AVERAGE	AVERAGE
March		[°C]	[Usgpm]	[mg/L]				[mg/L]	[mg/L]	[USgal]	[mins]	[USGPM]	[PPD]
1	7.69	2.3	2123	1.39	1734.8	259.7	6.68	0.21	4.5	2649600	1248	1219	65.6
2	7.69	2.2	2775	1.42	1355.8	262.4	5.17	0.27	4.4	2649600	955	1353	71.4
3	7.70	2.2	2404	1.45	1598.1	264.1	6.05	0.24	4.4	2649600	1102	1416	74.4
4	7.70	2.1	2188	1.36	1646.9	263.4	6.25	0.22	4.4	2649600	1211	1278	68.1
5	7.70	2.2	3084	1.43	1228.6	263.6	4.66	0.31	4.3	2649600	859	1466	76.6
6	7.70	2.3	2214	1.46	1747.3	262.6	6.65	0.22	4.5	2649600	1197	1159	62.9
7	7.70	2.5	2078	1.45	1848.9	258.7	7.15	0.20	4.4	2649600	1275	1391	73.2
8	7.70	2.3	2212	1.46	1748.8	262.6	6.66	0.22	4.4	2649600	1198	1395	73.4
9	7.70	2.4	2426	1.47	1605.5	261.0	6.15	0.24	4.4	2649600	1092	1274	68.1
10	7.70	2.2	2169	1.49	1820.1	265.2	6.86	0.22	4.4	2649600	1222	1448	75.7
11	7.71	2.2	2520	1.53	1608.7	267.2	6.02	0.25	4.4	2649600	1051	1246	66.2
12	7.71	2.2	2142	1.52	1880.2	266.9	7.04	0.22	4.3	2649600	1237	1407	72.9
13	7.72	2.2	2626	1.34	1352.0	262.8	5.14	0.26	4.3	2649600	1009	1435	73.7
14	7.73	2.3	1793	1.30	1921.1	260.7	7.37	0.18	4.5	2649600	1478	1189	63.9
15	7.73	2.6	3182	1.36	1132.5	257.1	4.40	0.31	4.3	2649600	833	1566	80.7
16	7.74	2.5	1822	1.43	2079.5	261.8	7.94	0.18	4.5	2649600	1454	1184	64.2
17	7.74	2.5	2292	1.45	1676.2	262.3	6.39	0.23	4.4	2649600	1156	1443	75.5
18	7.75	2.5	2657	1.44	1436.0	262.9	5.46	0.26	4.4	2649600	997	1322	70.3
19	7.75	2.5	2684	1.41	1391.9	262.1	5.31	0.27	4.3	2649600	987	1453	75.2
20	7.75	2.6	2769	1.27	1215.2	256.3	4.74	0.27	4.3	2649600	957	1405	72.2
21	7.75	2.7	2028	1.22	1593.9	253.0	6.30	0.19	4.3	2649600	1307	1347	69.3
22	7.75	2.8	2924	1.34	1214.2	254.8	4.77	0.28	4.1	2649600	906	1605	80
23	7.75	2.7	1945	1.42	1934.4	258.8	7.48	0.19	4.3	2649600	1362	1283	66.9
24	7.75	3.2	2519	1.41	1483.1	249.7	5.94	0.24	4.3	2649600	1052	1379	70.7
25	7.75	3.3	2977	1.36	1210.4	246.6	4.91	0.28	4.2	2649600	890	1454	73.9
26	7.72	3.7	2313	1.36	1557.9	237.4	6.56	0.21	4.3	2649600	1146	1383	72.1
27	7.69	3.8	2059	1.41	1814.4	234.6	7.74	0.18	4.4	2649600	1287	1337	70.6
28	7.67	4.0	2718	1.41	1374.5	229.7	5.98	0.24	4.3	2649600	975	1624	83.1
29	7.62	4.3	2510	1.34	1414.5	219.4	6.45	0.21	4.4	2649600	1056	1303	69.6
30	7.65	4.7	2473	1.28	1371.4	214.2	6.40	0.20	4.3	2649600	1071	1615	83
31	7.65	4.9	3370	1.37	1077.1	213.4	5.05	0.27	4.3	2649600	786	1558	81.2
Averages	7.71	2.80	2451	1.40	1451.0	253.4	5.96	0.23	4.3				

5.0 ULTRAVIOLET DISINFECTION

Total Water Treated	237,364.7 m^3	100%
On-Spec Water	236,564.6 m^3	99.662%
Off-Spec Water	800.1 m^3	0.338%

Average monthly chlorine residual before UV Treatment was 1.71 mg/L compared to 1.51 mg/L after UV disinfection.

Figure 5.1 - UV Disinfection – BMID Mission Creek Source – March 2019

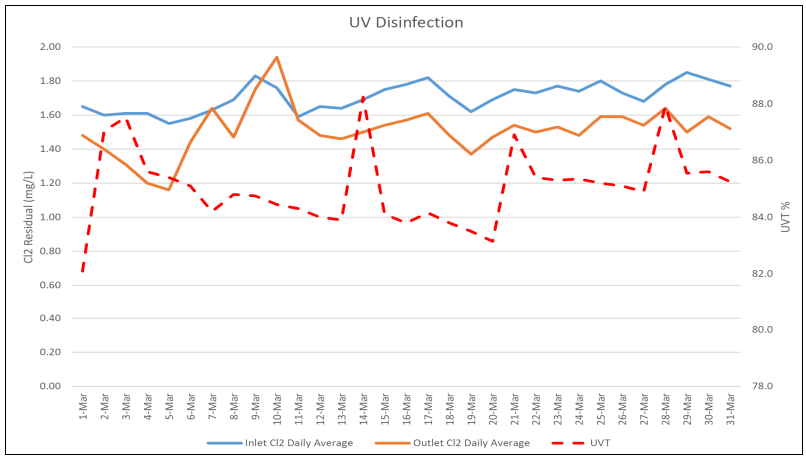


Table 5.2 - UV Disinfection Table – Mission Creek Source

	Inlet Cl2 Daily	Outlet Cl2 Daily	UVT		In Spec Water Volume	Off Spec Water Volume	Off Spec % of Water
Date	mg/L	mg/L	% T		Cubic Meters	Cubic Meters	Percentage
1-Mar	1.65	1.48	82.1		6677.0	0	0.00%
2-Mar	1.60	1.40	87.0		7392.7	0	0.00%
3-Mar	1.61	1.31	87.5		7719.9	0	0.00%
4-Mar	1.61	1.20	85.6		3880.1	0	0.00%
5-Mar	1.55	1.16	85.4		5295.7	800.1	15.11%
6-Mar	1.58	1.44	85.1		6355.5	0	0.00%
7-Mar	1.63	1.64	84.2		7653.0	0	0.00%
8-Mar	1.69	1.47	84.8		7648.1	0	0.00%
9-Mar	1.83	1.75	84.8		6987.0	0	0.00%
10-Mar	1.76	1.94	84.5		7603.2	0	0.00%
11-Mar	1.59	1.57	84.3		7835.3	0	0.00%
12-Mar	1.65	1.48	84.0		7718.7	0	0.00%
13-Mar	1.64	1.46	83.9		7845.1	0	0.00%
14-Mar	1.69	1.50	88.2		6509.2	0	0.00%
15-Mar	1.75	1.54	84.1		8552.0	0	0.00%
16-Mar	1.78	1.57	83.8		6509.2	0	0.00%
17-Mar	1.82	1.61	84.2		7901.4	0	0.00%
18-Mar	1.71	1.48	83.8		9262.2	0	0.00%
19-Mar	1.62	1.37	83.5		12513.5	0	0.00%
20-Mar	1.69	1.47	83.2		7717.5	0	0.00%
21-Mar	1.75	1.54	86.9		7371.5	0	0.00%
22-Mar	1.73	1.50	85.4		8744.5	0	0.00%
23-Mar	1.77	1.53	85.3		7058.1	0	0.00%
24-Mar	1.74	1.48	85.4		7554.0	0	0.00%
25-Mar	1.80	1.59	85.2		7970.7	0	0.00%
26-Mar	1.73	1.59	85.1		7567.8	0	0.00%
27-Mar	1.68	1.54	84.9		7326.6	0	0.00%
28-Mar	1.78	1.64	87.9		8862.8	0	0.00%
29-Mar	1.85	1.50	85.6		7176.1	0	0.00%
30-Mar	1.81	1.59	85.6		8820.1	0	0.00%
31-Mar	1.77	1.52	85.3		8536.1	0	0.00%
Average	1.71	1.51	85.0	Total	236564.6	800.1	0.338%

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

	2921 Belgo Rd		Booster 1		Ellison Blow-Off		Ellison School		3976 Highway 97		Prospect Reservoir		Tower Reservoir		Well #4		Kirschner Res		Pearson School	
Date	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
4-Feb-19	0	0	0	0	-	-	0	0	0	0	0	0	0	0	0	0	0	0	-	-
5-Feb-19	-	-	-	-	0	0	-	-	-	-	-	-	-	-	-	-	-	-	0	0
11-Feb-19	0	0	0	0	-	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12-Feb-19	-	-	-	-	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
19-Feb-19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25-Feb-19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4-Mar-19	0	0	0	0	-	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6-Mar-19	-	-	-	-	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11-Mar-19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18-Mar-19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27-Mar-19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 6.2 – Disinfection By-Products - THM and HAA Results

By-Product	19-Nov-18	12-Dec-18	11-Jan-19	5-Feb-19	4-Mar-19
THM mg/L	**0.132**	0.0974	**0.131**	**0.107**	0.0921
HAA mg/L	**0.0852**	0.037	0.0359	**0.122**	**0.0898**

In-House Analysis (BMID Staff)

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

Table 6.3 - BMID In-house Testing – Presence Absence

	3/4/2019				3/11/2019				3/18/2019				3/25/2019			
Location	Cl2	Temp.	Pres.	Abs.	Cl2	Temp.	Pres.	Abs.	Cl2	Temp.	Pres.	Abs.	Cl2	Temp.	Pres.	Abs.
Sylvania Cres									1.06	8.4	-	X				
170 Kneller Rd									1.08	8.4	-	X				
2105 Morrison					0.83	5.0	-	X								
Staymen Rd					0.84	3.6	-	X								
260 Campion Rd	0.81	6.0	-	X									0.79	8.4	-	X
Fenwick Rd	0.59	4.2	-	X									0.64	8.6	-	X
Solly Ct									1.15	7.4	-	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) = 9
- Total tests sampled by BMID and tested by Caro Labs = 40
- Total tests sampled in BMID treated distribution system = 49 (Zero Positive Samples)