



## MONTHLY REPORTING PERIOD - AUGUST, 2019

### 1. SUMMARY

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

Source	Total (US Gals)	Total (Mega Litres)
Mission Creek	610,407,855	2,310.39
Well 4	0	0
Well 5	42,908,402	162.41
Well 6 (Irrigation Only)	23,155,597	87.64
Scotty Creek (Irrigation Only)	14,942,000	56.56
Total	691,413,854	2,617.00

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 August, continuing the trend seen in the previous months. Groundwater monitoring is showing a steady decline in groundwater levels since the fall of 2018. The hillside is being monitored for movement and groundwater levels every month.
2. As a contingency plan for the unstable slope, BMID has 300m of flexible 900mm diameter High-density Polyethylene (HDPE) pipe on-site. The pipe has been fused into longer sections and is stored on location. Should a slope failure occur, the pipe can be assembled in a short period of time to restore significant water service;
3. Turbidity levels at the Distribution Intake peaked at 0.32 NTU on August 28 and 31, 2019. Average turbidity for August was 0.26 NTU;
4. The highest monthly turbidity level recorded at the first customer (Booster #1) was 0.24 NTU on August 31. Average monthly turbidity was 0.19 NTU for August;
5. BMID's Ultraviolet Treatment Facility treated 2,132,536.7m<sup>3</sup> of water, with only 0.049% being "Off-Spec". Average UV Transmissivity was 90.79%. The average inlet chlorine residual was 1.42 mg/L compared to an average of 1.45 mg/L for the outlet after UV treatment (from BMID sodium hypochlorite top-up system);
6. Mission Creek had average natural flows for summer during August. Average rainfall occurred in the watershed in August however the rains of July helped offset potentially dry conditions in August;
7. BMID's Scotty Creek source, used for irrigation in the north-end, was used as a supplementary source throughout August 2019;
8. Well # 5 was the primary source of domestic water for the north-end for all of August;
9. Well #6 which supplies irrigation water to the twinned north-end of the system, was used consistently throughout August to supplement irrigation flow supplied from Well 5 and Mission Creek;
10. *E.Coli* levels at Mission Creek's Point of Diversion (creek intake prior to WTP) had high counts throughout August with a peak count of 240 on August 12, 2019. The Point of

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Diversion had an average *E. Coli* count of 44.3 CFU/100ml per sample based on the 7 samples taken throughout the last month;

11. *E. Coli* levels in the raw water at the distribution system intake, down-stream of the WTP, prior to disinfection, had low counts throughout most of August, 2019 with a peak counts of 3 *E-Coli* on August 19. Average *E. Coli* counts for the month was less than 1.0 (0.86) CFU/100ml based of the 7 samples taken. The reduction in *E. Coli* levels is credited to the performance of the WTP and settling of particles in the water after the water treatment plant;
12. No *E. Coli* or were found in treated water in the distribution system through third-party analysis;
13. One sample collected at the Ellison School sample site was found to have positive counts for Total Coliforms. The August 6 sample had Total Coliform counts of 40 CFU/100ml. No positive *E. Coli* counts were found in the water distribution system;
14. Once the positive samples were identified, the water mains in the affected area were thoroughly flushed and the chlorination dose was increased at Well 5 which is the primary domestic water source for the area. Subsequent testing took place on August 8 at six additional locations throughout the North-end of the distribution system. All of six samples had zero counts and all subsequent samples at Ellison School had zero Total Coliforms and *E. Coli* for the remainder of the month;
15. One positive presence/absence sample was found on August 6 at the Morrison Rd sample station. BMID crews thoroughly flushed the water mains in the area and retested the sample site for both in-house analysis and third-party analysis through CARO Analytical. All subsequent samples came back as negative for both Total Coliforms and *E. Coli*;
16. A new sample location was installed at Esquire Reservoir in the north end of the distribution system. The installation of this sample station will help to allow BMID crews to isolate the location of potential positive bacteria samples;
17. The WTP ran throughout August, 2019 as water quality conditions in Mission Creek required chemical treatment to reduce turbidity and colour levels associated with raw water quality in the early summer.

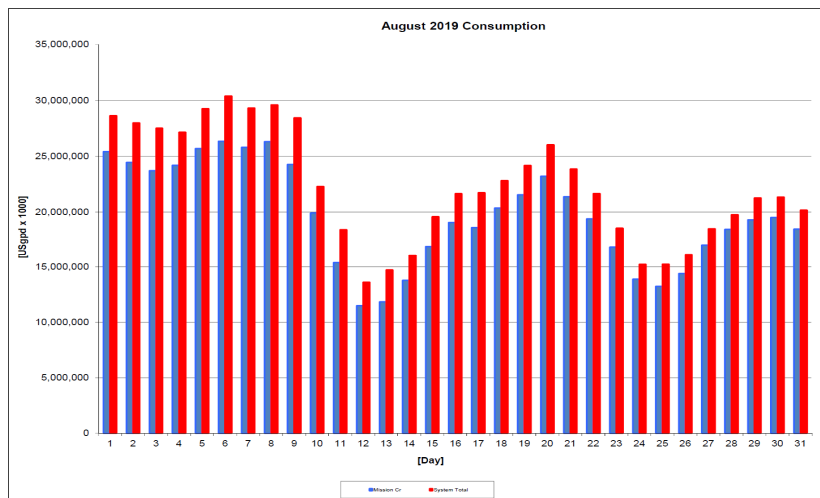
## 1.0 FLOWS - AUGUST, 2019

Maximum Daily Flow was on August 6, 2019 at 30,406,286 US gallons (115.09 ML)

Minimum Daily Flow was on August 12, 2019 at 13,619,291 US gallons (51.55 ML)

Mission Creek provided 88% of domestic flow throughout August.

**Figure 1.1 - Domestic Water System Flow**



**Table 1.2 - August 2019 - Daily Consumption Report**

Year	Mission Cr	Well #4	Well #5	Well #6	Scotty Crk	System Total	System Total
2019	Usgpd	Usgpd	Usgpd	Usgpd	Usgpd	Usgpd	ML/Day
1-Aug	25,416,934	0	1,230,074	1,042,265	947,000.0	28,636,273	108.39
2-Aug	24,457,014	0	1,517,469	1,056,800	961,000.0	27,992,283	105.95
3-Aug	23,712,354	0	1,735,433	1,197,840	876,000.0	27,521,627	104.17
4-Aug	24,198,488	0	1,462,752	994,424	505,000.0	27,160,664	102.80
5-Aug	25,688,932	0	1,518,496	1,029,280	1,033,000.0	29,269,708	110.79
6-Aug	26,344,334	0	1,501,520	1,028,432	1,532,000.0	30,406,286	115.09
7-Aug	25,811,240	0	1,552,272	1,077,095	890,000.0	29,330,607	111.02
8-Aug	26,304,066	0	1,354,272	934,718	1,017,000.0	29,610,056	112.07
9-Aug	24,273,170	0	1,775,247	1,231,292	1,162,000.0	28,441,709	107.65
10-Aug	19,922,203	0	1,172,593	821,752	379,000.0	22,295,548	84.39
11-Aug	15,391,030	0	1,523,776	1,031,368	476,000.0	18,422,174	69.73
12-Aug	11,500,242	0	1,051,217	994,832	73,000.0	13,619,291	51.55
13-Aug	11,852,894	0	1,701,867	1,158,175	14,000.0	14,726,936	55.74
14-Aug	13,789,259	0	975,212	1,093,020	261,000.0	16,118,491	61.01
15-Aug	16,914,742	0	1,013,791	925,311	735,000.0	19,588,844	74.14
16-Aug	19,074,379	0	1,347,092	960,271	273,000.0	21,654,742	81.96
17-Aug	18,611,322	0	1,930,331	1,103,618	93,000.0	21,738,271	82.28
18-Aug	20,365,768	0	951,378	907,912	598,000.0	22,823,058	86.39
19-Aug	21,562,768	0	1,011,495	1,092,675	509,000.0	24,175,938	91.51
20-Aug	23,216,621	0	1,143,347	1,000,239	673,000.0	26,033,207	98.54
21-Aug	21,383,010	0	1,143,348	1,000,238	342,000.0	23,868,596	90.34
22-Aug	19,404,803	0	1,162,171	1,025,608	72,000.0	21,664,582	82.00
23-Aug	16,861,275	0	1,071,295	448,332	181,000.0	18,561,902	70.26
24-Aug	13,891,328	0	1,030,573	100	315,000.0	15,237,001	57.67
25-Aug	13,244,955	0	1,856,480	0	144,000.0	15,245,435	57.70
26-Aug	14,410,031	0	1,741,121	0	37,000.0	16,188,152	61.27
27-Aug	17,043,912	0	1,260,490	0	203,000.0	18,507,402	70.05
28-Aug	18,456,211	0	1,312,771	0	0.0	19,768,982	74.83
29-Aug	19,306,336	0	1,515,549	0	454,000.0	21,275,885	80.53
30-Aug	19,524,211	0	1,644,480	0	181,000.0	21,349,691	80.81
31-Aug	18,474,023	0	1,700,490	0	6,000.0	20,180,513	76.38
Totals Usgpd	610,407,855	0	42,908,402	23,155,597	14,942,000	691,413,854	2617.00
Totals ML	2,310.39	0.00	162.41	87.64	56.56		
Avg's	19,690,576	74.53				22,374,445	84.42
Max	26,344,334	99.71				30,406,286	115.09
Min	11,500,242	43.53				13,619,291	51.55

## 2.0 RAW WATER QUALITY - BACTERIOLOGICAL MONITORING

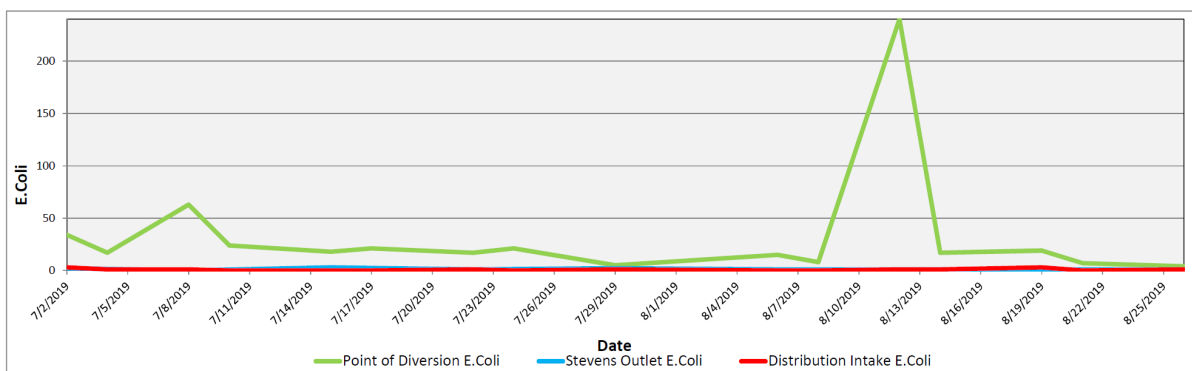
Raw water samples were taken at three points at BMID settling ponds before chlorination

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) July-August 2019**



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

Date	Point of Diversion E.Coli	Stevens Outlet E.Coli	Distribution Intake E.Coli
2-Jul-19	34	2	3
4-Jul-19	17	1	1
8-Jul-19	63	0	1
10-Jul-19	24	0	0
15-Jul-19	18	3	0
17-Jul-19	21	0	0
22-Jul-19	17	1	1
24-Jul-19	21	0	0
29-Jul-19	5	2	1
6-Aug-19	15	1	0
8-Aug-19	8	0	0
12-Aug-19	240	1	1
14-Aug-19	17	1	1
19-Aug-19	19	1	3
21-Aug-19	7	0	0
26-Aug-19	4	1	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.)

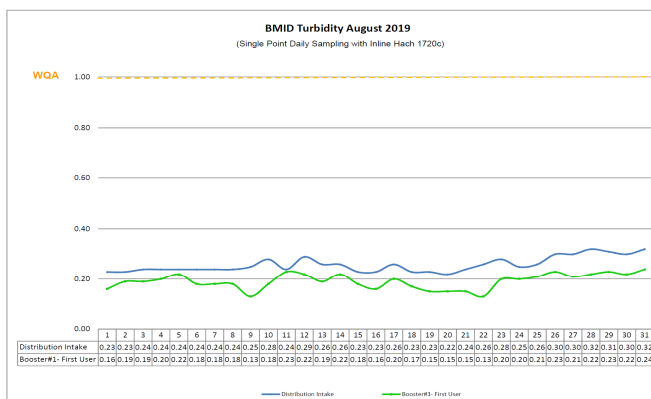
(Hadden Outlet = Distribution Intake - Point of Disinfection)

### 3.0 RAW AND TREATED WATER TURBIDITY

Through August, 2019, 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 recorded at this location was 0.29 NTU on August 6. The average turbidity for the month was 0.23 NTU during August.

The distribution intake is where the water leaves Hadden Reservoir.

**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 August 2019		
Date	Distribution Intake	Booster#1- First User
	Daily Average [NTU]	Daily Average [NTU]
1	0.23	0.16
2	0.23	0.19
3	0.24	0.19
4	0.24	0.20
5	0.24	0.22
6	0.24	0.18
7	0.24	0.18
8	0.24	0.18
9	0.25	0.13
10	0.28	0.18
11	0.24	0.23
12	0.29	0.22
13	0.26	0.19
14	0.26	0.22
15	0.23	0.18
16	0.23	0.16
17	0.26	0.20
18	0.23	0.17
19	0.23	0.15
20	0.22	0.15
21	0.24	0.15
22	0.26	0.13
23	0.28	0.20
24	0.25	0.20
25	0.26	0.21
26	0.30	0.23
27	0.30	0.21
28	0.32	0.22
29	0.31	0.23
30	0.30	0.22
31	0.32	0.24
AVG	0.26	0.19

### 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 August, 2019.

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

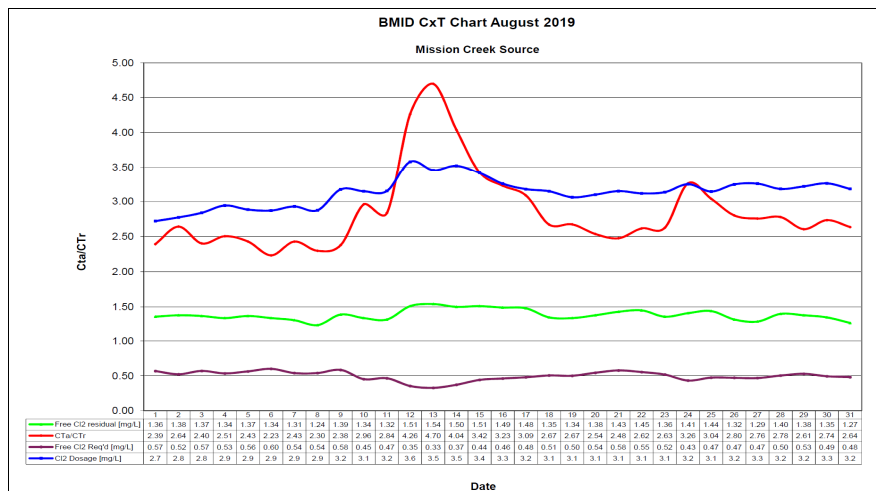


Table 4.2 - CT Table – Mission Creek Source

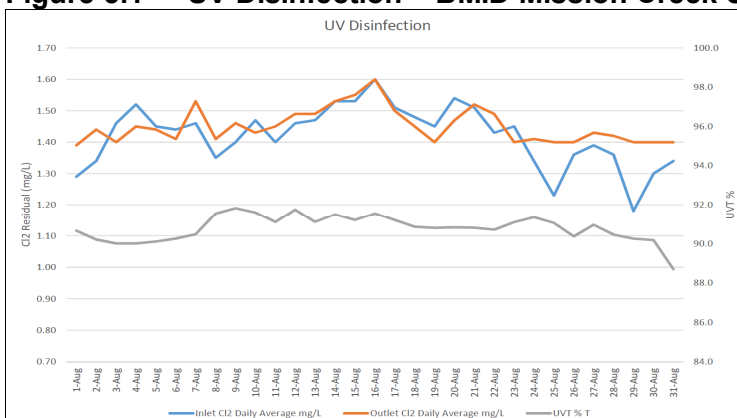
BMID August 2019 Mission Creek Source													
DATE	pH	TEMP	PEAK	Free Cl <sub>2</sub>	CT	CT	CTa/CTr	Free Cl <sub>2</sub>	Cl <sub>2</sub>	VOLUME	TIME	FLOW	Cl <sub>2</sub> DOSAGE
August	(Average)	(Present)	FLOW	residual	achieved	req'd		Req'd	Dosage	TOTAL	[mins]	Daily Average	Average
		[°C]	[USgpm]	[mg/L]				[mg/L]	[mg/L]	[USgal]		[USGPM]	[PPD]
1	7.23	18.7	21410	1.36	168.3	70.3	2.39	0.57	2.7	2649600	124	17672	578
2	7.21	18.8	19917	1.38	183.6	69.5	2.64	0.52	2.8	2649600	133	17009	567
3	7.26	18.4	20779	1.37	174.7	72.7	2.40	0.57	2.8	2649600	128	16504	563
4	7.25	18.3	19494	1.34	182.1	72.7	2.51	0.53	2.9	2649600	136	16818	595
5	7.24	18.4	20701	1.37	175.4	72.1	2.43	0.56	2.9	2649600	128	17858	619
6	7.23	18.2	21882	1.34	162.3	72.6	2.23	0.60	2.9	2649600	121	18307	632
7	7.22	18.9	20791	1.31	166.9	68.7	2.43	0.54	2.9	2649600	127	17919	631
8	7.24	19.6	21860	1.24	150.3	65.4	2.30	0.54	2.9	2649600	121	18320	633
9	7.21	18.9	22420	1.39	164.3	69.1	2.38	0.58	3.2	2649600	118	16905	645
10	7.23	19.2	17696	1.34	200.6	67.8	2.96	0.45	3.1	2649600	150	13866	524
11	7.26	19.2	18027	1.32	194.0	68.4	2.84	0.47	3.2	2649600	147	10735	407
12	7.27	18.2	12502	1.51	320.0	75.1	4.26	0.35	3.6	2649600	212	8005	344
13	7.30	18.9	11976	1.54	340.7	72.5	4.70	0.33	3.5	2649600	221	8232	342
14	7.29	18.5	13299	1.50	298.8	74.0	4.04	0.37	3.5	2649600	199	9586	406
15	7.27	18.7	16128	1.51	248.1	72.5	3.42	0.44	3.4	2649600	164	11721	481
16	7.21	18.6	17171	1.49	229.9	71.3	3.23	0.46	3.3	2649600	154	13271	519
17	7.23	18.1	17105	1.48	229.3	74.2	3.09	0.48	3.2	2649600	155	12935	494
18	7.25	17.8	17768	1.35	201.3	75.3	2.67	0.51	3.1	2649600	149	14122	534
19	7.26	17.6	17335	1.34	204.8	76.6	2.67	0.50	3.1	2649600	153	14998	552
20	7.27	17.5	18534	1.38	197.3	77.7	2.54	0.54	3.1	2649600	143	16094	599
21	7.28	17.7	19776	1.43	191.6	77.4	2.48	0.58	3.1	2649600	134	14901	564
22	7.30	17.3	18280	1.45	210.2	80.3	2.62	0.55	3.1	2649600	145	13457	504
23	7.31	17.0	16832	1.36	214.1	81.5	2.63	0.52	3.1	2649600	157	11763	443
24	7.33	17.3	14179	1.41	263.5	80.8	3.26	0.43	3.2	2649600	187	9649	377
25	7.36	16.2	14181	1.44	269.1	88.5	3.04	0.47	3.1	2649600	187	9203	348
26	7.34	16.1	14296	1.32	244.6	87.3	2.80	0.47	3.2	2649600	185	10029	391
27	7.32	16.1	14348	1.29	238.2	86.4	2.76	0.47	3.3	2649600	185	11811	462
28	7.30	16.5	15810	1.40	234.6	84.4	2.78	0.50	3.2	2649600	168	12847	491
29	7.30	16.5	16650	1.38	219.6	84.2	2.61	0.53	3.2	2649600	159	13406	518
30	7.26	17.2	16593	1.35	215.6	78.8	2.74	0.49	3.3	2649600	160	13571	532
31	7.25	17.2	16402	1.27	205.2	77.8	2.64	0.48	3.2	2649600	162	12849	491
Averages	7.27	17.92	17553	1.39	216.09	75.68	2.85	0.50	3.13				

## 5.0 ULTRAVIOLET DISINFECTION

Total Water Treated: 2,132,536.7 m 100.000 %  
 On-Spec Water: 2,131,487.5 m<sup>3</sup> 99.951 %  
 Off-Spec Water: 1,049.2 m<sup>3</sup> 0.049%

Average monthly chlorine residual before UV Treatment was 1.42 mg/L compared to 1.45 mg/L after UV disinfection and re-chlorination.

**Figure 5.1 - UV Disinfection – BMID Mission Creek Source – August 2019**



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

Date	Inlet Cl2 Daily mg/L	Outlet Cl2 Daily mg/L	UVT % T	In Spec Water Volume Cubic Meters	Off Spec Water Cubic Meters	Off Spec % of Water Percentage
1-Aug	1.29	1.39	90.7	86,283	0	0.00%
2-Aug	1.34	1.44	90.2	86,286	0	0.00%
3-Aug	1.46	1.40	90.0	81,601	0	0.00%
4-Aug	1.52	1.45	90.0	82,163	0	0.00%
5-Aug	1.45	1.44	90.1	85,846	0	0.00%
6-Aug	1.44	1.41	90.3	87,643	0	0.00%
7-Aug	1.46	1.53	90.5	87,646	0	0.00%
8-Aug	1.35	1.41	91.6	87,859	0	0.00%
9-Aug	1.40	1.46	91.8	87,861	0	0.00%
10-Aug	1.47	1.43	91.6	81,498	71	0.14%
11-Aug	1.40	1.45	91.1	67,184	71	0.14%
12-Aug	1.46	1.49	91.8	49,992	106	0.85%
13-Aug	1.47	1.49	91.1	37,739	106	0.86%
14-Aug	1.53	1.53	91.5	45,724	0	0.00%
15-Aug	1.53	1.55	91.2	56,818	505	1.68%
16-Aug	1.60	1.60	91.6	62,832	177	1.40%
17-Aug	1.51	1.50	91.2	62,657	0	0.00%
18-Aug	1.48	1.45	90.9	68,388	0	0.00%
19-Aug	1.45	1.40	90.8	70,896	0	0.00%
20-Aug	1.54	1.47	90.8	77,617	0	0.00%
21-Aug	1.51	1.52	90.8	77,626	6	0.01%
22-Aug	1.43	1.49	90.7	72,580	6	0.01%
23-Aug	1.45	1.40	91.1	64,083	0	0.00%
24-Aug	1.34	1.41	91.4	55,460	0	0.00%
25-Aug	1.23	1.40	91.1	46,152	0	0.00%
26-Aug	1.36	1.40	90.4	48,229	0	0.00%
27-Aug	1.39	1.43	91.0	57,086	0	0.00%
28-Aug	1.36	1.42	90.5	60,449	0	0.00%
29-Aug	1.18	1.40	90.3	64,216	0	0.00%
30-Aug	1.30	1.40	90.2	66,061	0	0.00%
31-Aug	1.34	1.40	88.7	66,063	0	0.00%
<b>Average</b>	<b>1.42</b>	<b>1.45</b>	<b>90.79</b>	<b>Total 2,132,536.70</b>	<b>1049.2</b>	<b>0.049%</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
- 45 samples were found to be absent of Coliforms.
- 45 samples were found to be absent of *E. Coli*.
- One positive (40 Total Coliforms) sample was found at Ellison School on August
- 6 Additional samples were taken on August 8 in the North-end of the distribution system. All samples were found to be absent of both *E. Coli* and Total Coliforms

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

Date	2921 Belgo Rd		Booster 1		Ellison Blow-Off		Ellison School		3976 Highway 97		Prospect Reservoir		Tower Reservoir		Well #5		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
2-Jul-19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8-Jul-19	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0
12-Jul-19	-	-	-	-	-	-	1	0	-	-	-	-	-	-	0	0	-	-	-	-
15-Jul-19	0	0	0	0	0	0	-	0	0	0	0	0	0	0	0	0	0	0	0	0
22-Jul-19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31-Jul-19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6-Aug-19	0	0	0	0	0	0	40	0	0	0	0	0	0	0	0	0	0	0	0	0
12-Aug-19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19-Aug-19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26-Aug-19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

**Table 6.2 – August 8 North-End distribution system testing**

8/8/2019 Special Testing		
Location	Coliforms	E.coli
Esquire Reservoir	0	0
2105 Morrison Rd	0	0
4730 Bulman Rd	0	0
3411 Esquire Rd	0	0
Ellison School	0	0
PRV 24	0	0

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

Location	THM	HAA
Kirschner Reservoir		0.0519
2921 Belgo Rd	0.0545	
Pearson School	0.0524	0.0395
3976 Highway 97	0.0558	

### In-House Analysis (BMID Staff)

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

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

Location	8/6/2019				8/8/2019				8/12/2019				8/19/2019				8/26/2019			
	Cl2	Temp.	Pres.	Abs.	Cl2	Temp.	Pres.	Abs.	Cl2	Temp.	Pres.	Abs.	Cl2	Temp.	Pres.	Abs.	Cl2	Temp.	Pres.	Abs.
Sylvania Cres													0.81	21.6	-	X				
170 Kneller Rd													0.89	24.4	-	X				
2105 Morrison	1.30	20.6	X	-	1.03	24.0	-	X									0.98	19.6	-	X
Staymen Rd	1.20	20.2	-	X													0.88	19.8	-	X
260 Campion Rd									0.27	23.8	-	X								
Fenwick Rd									0.35	23.6	-	X								
Solly Ct													0.94	21.2	-	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) = 10
- Total Positive PA Sampled by staff (presence/absence) = 1
- Total tests sampled by BMID and tested by Caro Labs = 46
- Total tests sampled in BMID treated distribution system = 56 (Two Positive Samples)