

2021 Annual Report

1.0 - Operator Certification

BMID is administered by Robert Hrasko and has EOCP classified facilities as Water Distribution (WD) level IV and Water Treatment (WT) level IV.

As required, BMID is undertaking an informal program to have level IV operators for both the Water Distribution System and the Water Treatment Plant as required by EOCP facility classifications. Currently, Scott Findlay, Bryan Vig and Jeff Clark are Level IV Water Distribution certified operators. In addition, Chase Elliott is a Level IV Water Treatment operator and Shayne Ermel is currently level III Water Treatment Plant operator and is working towards his level IV certification.

Table 1.1 – BMID Operator Certification

BMID's certified operators are as follows (End of 2021):

Name	WD Level	WT Level	Chlorine Handling
Scott Findlay	IV	I	Yes
Bryan Vig	IV	I	Yes
Chase Elliott	II	IV	Yes
Keith Jensen	II	-	Yes
Timothy Bauer	II	-	Yes
Geoffrey Caldwell	II	-	Yes
Jeff Clark	IV	I	Yes
Kurt Kover	II	-	Yes
Shayne Ermel	II	III	Yes
Scott Alexander	II	-	Yes
Mathew Poynter	I	-	
Tyler Bateman	II	-	
Dustin Pedherny	I	-	

2.0 - Cross-Connection Control Program

Working in partnership with the City of Kelowna, BMID staff help to ensure that all backflow prevention assemblies installed within our service area are tested annually by an approved tester to limit any potential hazards from entering the distribution system from commercial, industrial and institutional customers. As the program is run out of the City of Kelowna's offices using their Backflow Prevention Monitoring Software, BMID is in contact with the City when a backflow assembly is past-due for testing or when an assembly fails a test. At this point BMID contacts the customer to ensure compliance with the program.

BMID staff are in regular contact with City of Kelowna staff to confirm that all backflow assemblies installed in BMID's service area are tested and functioning. BMID works to maintain 100% compliance within our Cross-Connection program. In addition, new and renovated facilities are inspected by the building and inspection departments at the City of Kelowna to ensure that all backflow prevention assemblies are installed as required. Apart from new and renovated facilities, BMID's cross-connection control program continues to run in the same manner in 2021 as in previous years. There are 847 backflow assemblies currently found in the BMID system including 26 new installations in 2021. In total, there are 300 individual customers with a backflow prevention assembly located in 391 individual facilities.

3.0 - Water Monitoring Plan

BMID's 2021 water monitoring plan has only minor changes from the Monitoring Plan implemented in 2013. Recent changes to the Monitoring Plan are as follows:

1. For all of 2021, sampling only took place at Well No. 4 during the fall/winter when the well provided water for domestic consumption;
2. Sampling took place at Well No. 5 during the spring/summer when the well provided domestic water for the north-end of the system;
3. Well #6, used for irrigation in the north-end, is now sampled annually while in use. The source sampled for bacteria.
4. Both THM and HAA sampling in the distribution system were taken at the Pearson Rd sample station and the UV treatment plant downstream of the sodium hypochlorite injection point;
5. As in previous years, full parameters were carried out on all raw water sources and in BMID's high elevation drinking water reservoirs. Samples were also collected at the intakes of BMID's drinking water sources. Pearson Sample Station replaced Booster No.1 (first customer) as the location of BMID's comprehensive distribution samples for both February and July. Well water is used as a supplemental drinking water source in the north-end for both domestic use and irrigation use. Well 4, used as the low flow winter source, was sampled in December previously and took place in February 2021. Well 5, used as the high-flow summer source, was sampled in July 2021;
6. Weekly raw water samples at the Scotty Creek Intake are no longer being taken as the source is used only for irrigation. All domestic connections in the Scotty Creek subdivision and the north-end of BMID's distribution system are fed off of a combination of Mission Creek system water with supplemented supply well water after the water mains were twinned and separated for domestic and irrigation use in previous years;
7. Weekly raw water samples and comprehensive samples did not take place at the newly commissioned Well 6 as this well is only used as a source for irrigation water. However Well 6 was tested during the months of operation for bacteria;

Table 3.1 – BMID Water Sampling Summary

Watershed & Sources	Biological	Chemical	Full Parameters	Special Testing	Frequency	Sample By
Graystoke Reservoir			X		Annual	LARRATT
Fishhawk Reservoir			X		Annual	LARRATT
Loch Long			X		Annual	LARRATT
Belgo Reservoir			X		Annual	LARRATT
James Lake Reservoir			X		Annual	LARRATT
Mission (Crescent) Lake				X	Varies	BMID
St. Margaret's Lake				X	Varies	BMID
Mission Creek Intake			X		Semi-annual	CARO
Scotty Creek Intake				X	Varies	BMID
Cornish Well				X	Varies	BMID
Well No. 4			X		Annual	CARO
Well No. 5			X		Annual	CARO
Well No. 6				X	Varies	CARO
Raw Water Microbiological Monitoring						
Scotty Creek Intake					Varies	BMID
WTP Intake					Bi-Weekly	CARO-BMID
Stevens – Outlet					Weekly	CARO-BMID
Hadden Outlet (at Screens)					Bi-Weekly	CARO-BMID
Distribution System Monitoring						
Booster No. 1	X				Weekly	CARO
Screen Works	X	X			Weekly	CARO
2921 Belgo	X	X			Weekly	CARO
Ellison Blow-Off	X			X	Weekly	CARO
Pearson Rd	X	X	X	X	Weekly	CARO
3976 Hwy 97	X				Weekly	CARO
Prospect Reservoir	X				Weekly	CARO
Tower's Ranch Reservoir	X				Weekly	CARO
Kirschner Reservoir	X	X		X	Weekly	CARO
Ellison School	X				Weekly	CARO
Well 4	X		X		Weekly	CARO
Well 5	X		X		Weekly	CARO
Well 6	X			X	Monthly	CARO
7 Sites through WD System on a 3-week rotation			Sampled for Presence Absence		Rotation	BMID
On-Line Monitoring						
Point of Diversion (Mission Creek Intake)	On-line turbidity meter					
Water Treatment Plant	Parameters of turbidity, water consumption and particle charge (streaming current monitor) are all operating on-line at WTP					
Distribution Intake (Hadden Outlet at Screens)	On-line residual chlorine downstream of dosing location, pH and turbidity					
Surge Tower	On-line residual chlorine					
Booster Station No.1	On-line residual chlorine, pH, and turbidity					
BMID UV Reactor	On-line upstream/downstream chlorine, UV transmissivity, turbidity, pH and pressure					
Towers Reservoir	On-line residual chlorine					
Kirschner Reservoir	On-line residual chlorine					
Prospect Reservoir	On-line residual chlorine					
PRV No. 24	On-line residual chlorine					

Table 3.1 – BMID Water Sampling Summary (continued)

Biological Parameters						
Weekly Tests by CARO	<u>Free Chlorine Residual</u> (field) (mg/L)	<u>Temperature</u> (field) (degrees C)	<u>Total Coliforms</u> Colonies/10 0ml	<u>E.Coli</u> colonies/ 100ml		
Chemical Parameters						
Weekly Tests by CARO	<u>Turbidity</u> (NTU)	<u>Colour</u> (TCU)	<u>pH</u> (pH units)	<u>Alkalinity</u> (mg/L Caco3)	<u>Free Chlorine Residual</u> (field) (mg/L)	<u>Temperature</u> (field) (degrees C)
Monthly Tests By CARO	Disinfection Byproducts	Trihalomethanes	Haloacetic Acids			
Special Water Quality Parameters						
Mission Creek Source	UV Trans					
Mission Creek Source	TOC					
Screen Works	TOC					
Stevens Reservoir	Metals					
Full Parameters						
Carried out at Booster No. 1 on all raw water sources for consumption and on watershed drinking water reservoirs						
Parameter	Units					
Alkalinity (total)	mg/L as CaCO3					
Calcium (total)	mg/L					
Colour (true)	Colour units					
Conductivity	Umhos/cm					
Hardness	mg/L as CaCO3					
Iron (total)	mg/L					
Magnesium (total)	mg/L					
Manganese (total)	mg/L					
Nitrate & Nitrite	mg/L as N					
pH	pH units					
Potassium (total)	mg/L					
Sodium (total)	mg/L					
Sulfate	mg/L					
Total Dissolved Solids	mg/L					
Turbidity	NTU					
Ortho Phosphate	mg/L as P					
Dissolved Phosphorus	mg/L as P					
Total Phosphorus	mg/L as P					
Total Organic Carbon	mg/L					
Total Coliform	MPN/100ml					
E.Coli Coliform	MPN/100ml					
UV Transmissivity @ 254u	%/cm					
Ammonia	mg/L as N					
Total Kjeldahl Nitrogen	mg/L as N					
Chloride	mg/L					
Fluoride	mg/L					
Cyanide	mg/L					
Aluminum	mg/L					
Antimony	mg/L					
Arsenic	mg/L					
Barium	mg/L					
Boron	mg/L					
Cadmium	mg/L					
Calcium	mg/L					
Chromium	mg/L					
Cobalt	mg/L					
Copper	mg/L					
Lead	mg/L					
Mercury	mg/L					
Molybdenum	mg/L					
Nickel	mg/L					
Selenium	mg/L					
Uranium	mg/L					
Zinc	mg/L					
Total Coliforms	CFU/100 MI					
E.Coli Coliforms	CFU/100 MI					

3.2 – BMID Water Sampling Summary (continued)

BMID staff take weekly samples from 10 locations in the distribution system. For 2021, 337 samples were collected and taken to CARO Analytical for testing. Of the 337 samples collected all came back negative for *E.Coli* representing 100% of the total samples taken. Of the 337 samples taken for Total Coliforms, 337 came back as negative for Total Coliforms representing 100% of samples. The inactivation of total coliforms and *E.Coli* coliforms in the distribution system demonstrates the effectiveness of the Water Treatment Plant, Primary Chlorination works, Ultraviolet Disinfection Plant and the secondary sodium hypochlorite top up system currently employed by BMID.

In addition to the testing conducted by CARO, BMID staff also sampled for Presence/Absence (PA) of bacteria and incubated the samples in-house. These samples took place throughout the distribution system at 7 locations. In total 115 PA samples were collected and incubated with only 2 positive samples showing the presence of bacteria. Therefore, 98.2% of the samples coming back as negative for bacteria. The two samples that were positive were retested by CARO analytical and in both cases, the samples were found to be free of bacteria.

BMID staff also collected raw-water samples from three locations between Mission Creek and the point of chlorination. Samples at the Point of Diversion Intake (WTP intake or Stevens Pond intake depending on time of the year), Stevens Pond Outlet and the Distribution Intake at Hadden Pond Outlet (just prior to chlorination) are taken weekly. There is a substantive reduction in the number of *E.Coli* colonies present between the Mission Creek Intake and the Distribution Intake which demonstrates the effective settling of particles as the water moves through Stevens Reservoir and Hadden Reservoir. Only *E.Coli* results for these samples are as follows:

Location	Average <i>E.Coli</i> counts per sample	Max <i>E.Coli</i> count
Creek Intake	14.70	124
Stevens Outlet	0.87	11
Hadden Outlet	0.47	4

4.0 – Water Quality Events of Note

Water advisories, positive samples, loss of service, off-spec water and customer complaints were rare throughout 2021. However, BMID noted the following occurrences when water quality issues/changes did arise.

1. Beginning on April 16, BMID issued a voluntary Water Quality notice to its customers due to rising turbidity levels in the distribution system. The rise in turbidity was caused by increased flows resuspending particulates in the water main. Turbidity levels reduced to normal by April 21;
2. Throughout late spring and early summer, there were periodic “off-spec” events at the UV treatment facility. These were a result of short-term drops in the UV transmissivity in one of the two on-line UVT meters. BMID staff were able to address the UVT meter issues on-site. The UV treatment facility operated throughout all these events and primary disinfection remained in operation at all times;
3. In total, the UV treatment plant treated 11,604,925 m³ of water 2,391 m³ (0.0206%) of which was “off-spec”;
4. Two Presence/absence samples taken by BMID came back as positive for bacteria. Both samples (June 21 at Fenwick sample station and November 15 at Solly Ct sample station) were likely a result of operator error as BMID was forced to use a less user-friendly PA product due to supply chain issues from our distributor. In both cases, new samples were collected at the sample site, and these were analyzed by our third-party laboratory (CARO Analytical). Both samples were found to be negative for both *Total Coliforms* and *E. Coli*;
5. Stage 1 water restrictions were introduced on July 16 to help reduce consumption of water and conserve BMID’s upper storage. The restrictions were rescinded on September 30;
6. Between June 28 and July 8, BMID’s WTP had above capacity flows. As a result, raw Mission Creek water was added via a secondary intake to make up the shortfall between demand and WTP flows. It is estimated that approximately 10% of flows at this time were from the raw water source;
7. For 2021, BMID altered its disinfection byproducts (THMs and HAAs) testing by reducing the number of samples to quarterly testing. The sampling locations have also been changed to two locations (one in the middle of the distribution system and one after the sodium hypochlorite top-up system at the UV plant) for quarterly testing. Disinfection byproducts were found to be within the limits as set out by the Guidelines for Canadian Drinking Water Quality. The Water Treatment Plant was able to greatly reduce DBP precursors before chlorination, with only a single quarterly THM test above the guideline (see table 4.1)

Table 4.1 – Disinfection By-Product Testing

Sample number	THM		HAA	
	UV Plant	Pearson School	UV Plant	Pearson School
Additional sample	-	0.0902	-	0.0972
Q1	0.0525	0.0634	0.0284	0.0388
Q2	0.0515	0.0709	0.0420	0.0611
Q3	0.0487	0.0714	0.0717	0.0698
Q4	0.0823	0.1320	0.0479	0.0648
Average	0.05875	0.0856	0.0475	0.0663

5.0 - Annual Consumption Data

CONSUMPTION: Total annual consumption was 12,766 ML which was well above the ten-year average of 11,787 ML. The average daily flow for 2021 was 34.97 ML/day. The maximum daily flow was on July 1, 2021, when 130.23 ML of water was consumed.

WATERSHED: Graystoke, Fishhawk and Loch Long Reservoirs are normally used to keep water quality as high as possible through the summer months. BMID was required to utilize water from the high elevation storage reservoirs In July, weeks earlier than normal, as high consumption levels in early summer were above the natural flow of Mission Creek. Belgo Reservoir is utilized in early summer when the Water Treatment Plant is running because of the high levels of colour found in the water source. Water from James Lake Reservoir is only used as an irrigation source for the Scotty Creek area of the distribution network in BMID's north-end.

The reservoir levels at 2021 year-end are summarized below. At year end 20% of storage remained in place.

Table 5.1 – Watershed Reservoir Data

Reservoir	Capacity (ML)	Volume at Yr End (ML)	% Full
Belgo Reservoir	6,785	1,344	20%
Graystoke Reservoir	5,103	673	13%
Fishhawk Reservoir	2,353	465	20%
Loch Long Reservoir	625	401	61%
James Lake Reservoir	1,774	456	26%
TOTAL	16,640	3,339	20%

Graph 5.2 – Monthly Consumption

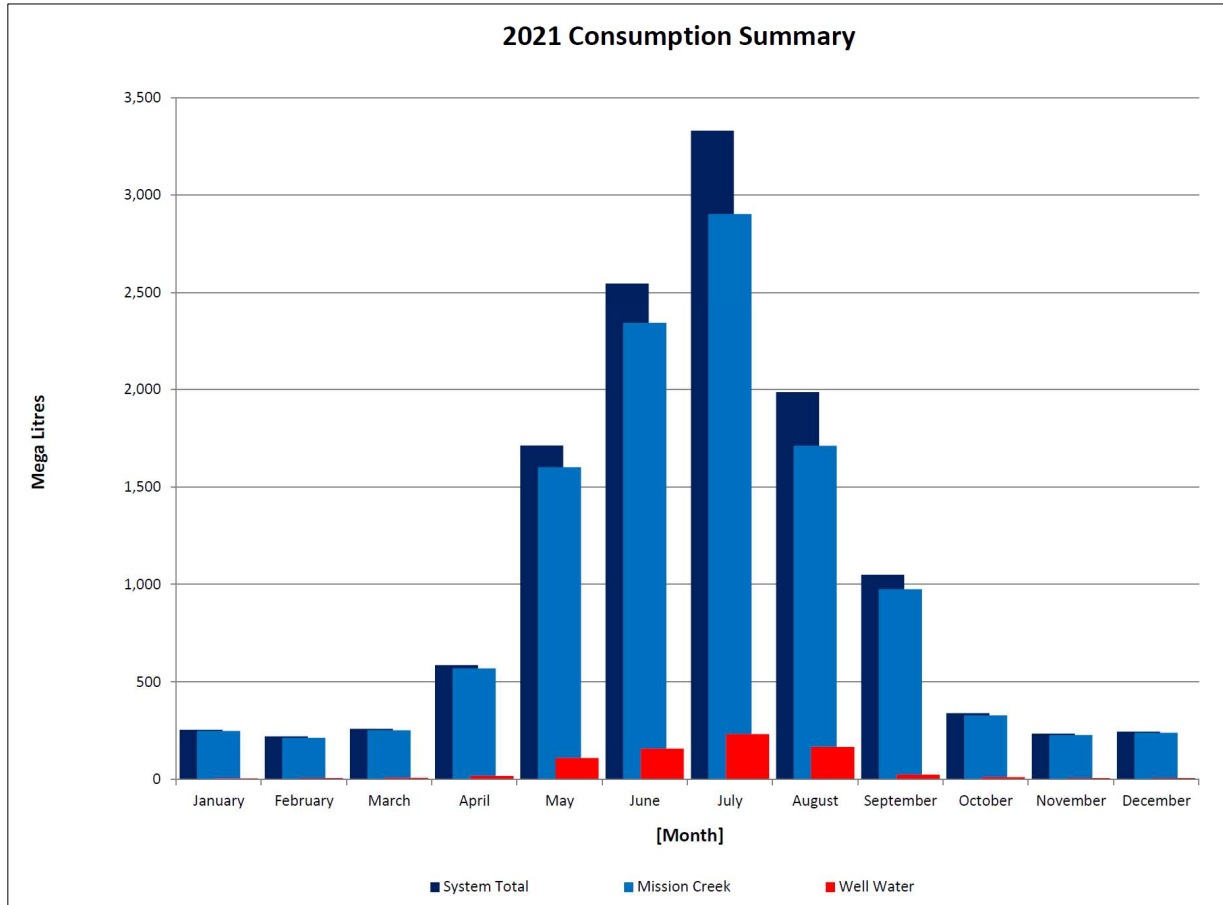


Table 5.3 – Monthly Consumption

BLACK MOUNTAIN IRRIGATION DISTRICT									
MONTHLY CONSUMPTION TOTALS AND YEAR END SUMMARY									
Year	Mission Creek	Well #4	Well #5	Well #6	Scotty Creek	NE Production	Well Water	Surface Water	System Total
2021	Mega Litres	Mega Litres	Mega Litres	Mega Litres	Mega Litres	Mega Litres	Mega Litres	Mega Litres	Mega Litres
January	248.90	5.30	0.00	0.00	0.00	5.30	5.30	248.90	254.20
February	213.64	7.03	0.00	0.00	0.00	7.03	7.03	213.64	220.68
March	251.56	8.61	0.00	0.00	0.00	8.61	8.61	251.56	260.18
April	568.89	17.71	0.00	0.00	0.00	17.71	17.71	568.89	586.60
May	1,600.54	12.54	83.32	13.65	1.35	110.86	109.50	1,601.89	1,711.40
June	2,340.08	0.00	113.08	45.09	48.31	206.48	158.17	2,388.39	2,546.56
July	2,902.69	0.00	117.23	115.44	194.79	427.46	232.67	3,097.48	3,330.15
August	1,710.36	8.09	102.51	56.25	108.16	275.02	166.85	1,818.52	1,985.37
September	974.70	24.42	0.15	0.00	50.11	74.69	24.58	1,024.81	1,049.39
October	328.17	11.84	0.00	0.00	0.00	11.84	11.84	328.17	340.01
November	227.88	7.27	0.00	0.00	0.00	7.27	7.27	227.88	235.14
December	239.40	6.67	0.00	0.00	0.00	6.67	6.67	239.40	246.06
Total	11,606.80	109.48	416.29	230.43	402.72	1,158.93	756.21	12009.53	12,765.73

6.0 – Completed and Ongoing Water Infrastructure Projects

- A project consisting of the installation of 3.8 Kilometers of 1050mm diameter transmission water main was completed in 2021. The main was installed to help reduce pressure and supply restraints at the east portion of the distribution system.
- Automated chlorine gas safety valves were installed at the primary chlorinator. These safety valves were a requirement from Work Safe BC and will provide protection to BMID operators in the unlikely event of a chlorine gas leak.
- BMID staff continue the process of winterizing as many aspects of the Water Treatment Plant as possible to ensure that the facility can remain on stand-by throughout the winter.
- Two new sludge drying lagoons have been constructed at the WTP to store additional sludge produced at the WTP. Decanting and evaporation processes will be utilized to dewater the sludge.
- Due to a slope failure along BMID's primary transmission water main east of the existing tunnel, BMID is investigating the possibility of extending the existing rock tunnel to bypass the unstable slope, thereby eliminate the possibility of a slope failure cutting off BMID's Mission Creek water supply.
- A new emergency generator and transfer switch is being installed at the WTP to provide for full operations during power outages. The project is projected to be complete in 2022.
- PRV # 3 located on McKenzie Rd was modified with a stairwell to eliminate the need for confined space entry. The long-term goal is to have all PRV stations located above-ground to eliminate as many confined spaces as possible throughout the district.

7.0 - WTP OPERATIONS

The Black Mountain Irrigation District's Class IV Water Treatment Plant (WTP) performed very well throughout the 2021 treatment season. Improved water quality was achieved in all water quality measurements, especially in the reduction of color, turbidity, total organic carbon levels, and disinfection by-products (Trihalomethanes and Haloacetic acids).

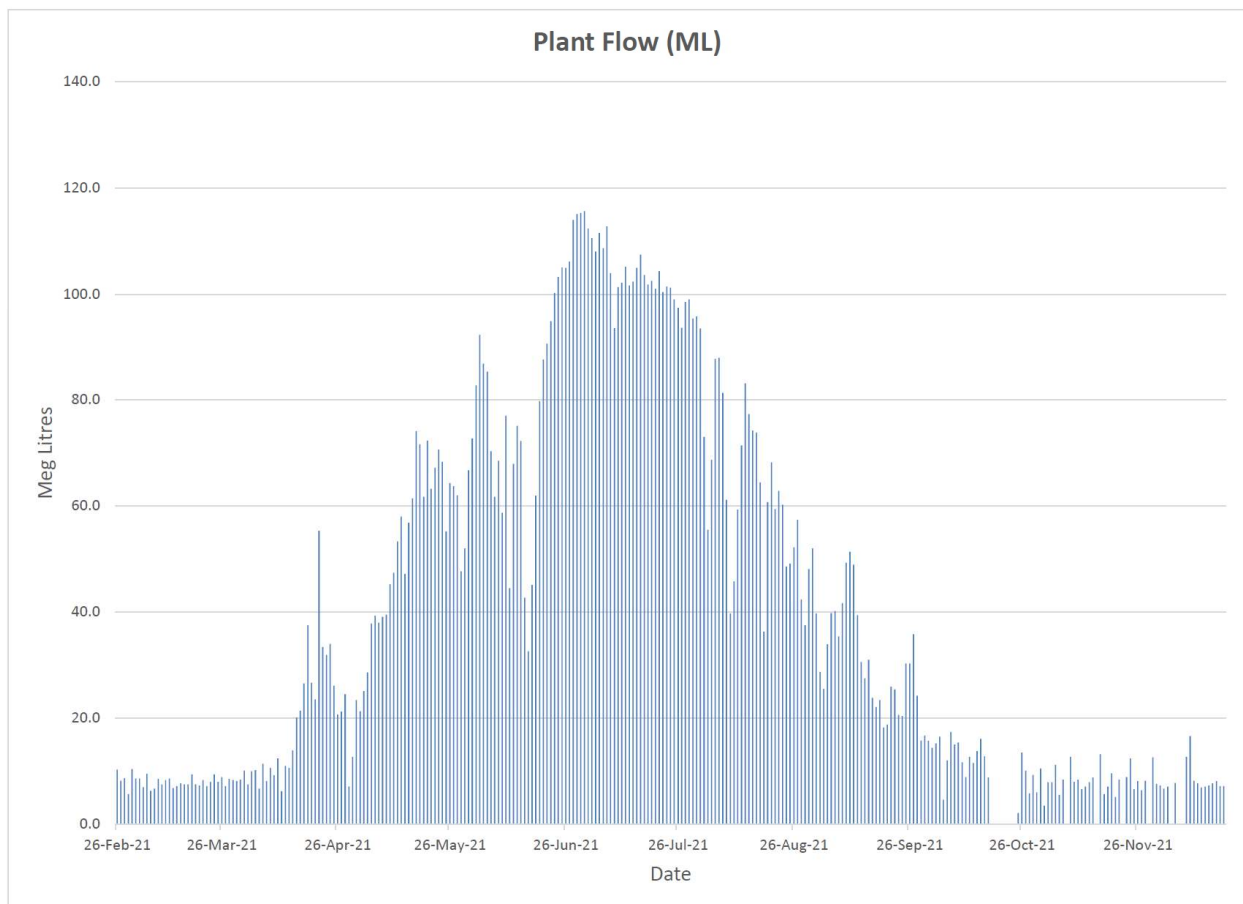
Mission Creek experienced an early melt in late winter/early spring requiring chemical treatment to lower turbidity and color levels beginning on February 26. The WTP remained in use until December 19 due to high turbidity and color in Mission Creek. Turbidity and color remained high throughout early winter as unseasonably warm weather and atmospheric rivers required the plant to run later than normal. During these atmospheric river events, Mission Creek flows and water quality were more typical of a spring freshet with turbidity spikes of 26.4 Nephelometric Turbidity Units (NTU) in mid-November, at a time when the plant is typically in bypass mode with creek turbidity under 1.50 NTU.

Turbidity spikes during freshet in Mission Creek were common, as experienced in the past. However, the 2021 season did not encounter the same significant flooding and high turbidity events that occurred in Mission Creek during the 2017 and 2018 seasons. Turbidity spikes were similar to the 2020 treatment season. The high temperatures in early summer had the effect of shortening the spring freshet which had eased by late-June. For the entire time in which the WTP was in operation, the Plant was able to maintain turbidity levels below 1.0 NTU at the point of disinfection (Hadden Reservoir outlet). However, there was a single day (April 17) where turbidity at Booster 1 was above 1.0 NTU. This was a result of increased flows when irrigation systems were turned on causing some stirring of watermain sediment.

7.1 - PLANT FLOW

For the Mission Creek source, peak daily water production of 115.7 ML (30,564,706 US gallons) occurred on July 1, 2021. This number is one of the largest daily-flows recorded at the WTP on record. The peak instantaneous demand was recorded at 1,319 L/s. For the 2021 season, 11,546.6 ML of water was treated compared to an average of 9,160 ML over the past five years. In 2021, the Water Treatment Plant was open for 281 days, up significantly from the 202 days during the 2020 season. The Water Treatment Plant was started on February 26, 2021, and ended on December 19, 2021, when the raw water quality had improved enough to no longer require chemical treatment.

Graph 7.2 – WTP Plant Flow



Daily plant flow ML for 2021 combined total for both trains

7.3 – TURBIDITY RESULTS

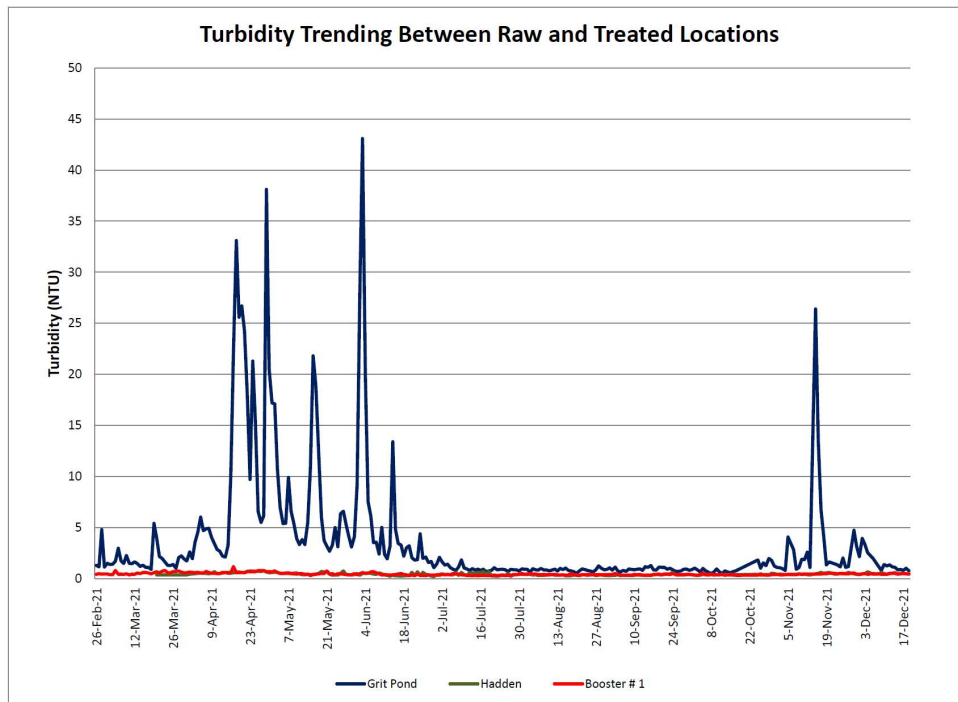
As set by the Canadian Drinking Water Guidelines, Black Mountain’s system turbidity is to be less than 1.0 NTU at its first customer (Booster 1). Throughout the treatment season, the Water Treatment Plant was able to maintain acceptable turbidity below this guideline. Turbidity at the first customer peaked at 1.17 NTU on April 17, when irrigation systems were activated for the year, causing a one-day increase in turbidity. However, this event was not associated with the treatment process. Peak turbidity at the first-customer as a result of the treatment process was on April 27 when turbidity was recorded at 0.80 NTU. During spring freshet, raw water turbidity at the Grit Pond peaked at 43.1 NTU on June 3, 2021.

In addition, the recorded highest turbidity at the Distribution Intake, Hadden Pond, was 0.76 NTU on April 23, 2021, with the data obtained through a single point grab sample.

Average turbidity levels over the treatment period at locations in the water supply system were as follows:

Location	Lab (NTU)	On-line (NTU)
Raw Grit Pond	3.60	-
Stevens Intake	0.40	-
Stevens Outlet	0.43	-
Hadden Outlet	0.43	-
Screen Works	0.43	0.47
Booster Stn No. 1	0.45	0.40

Graph 7.3 – WTP Turbidity Results



Daily turbidity (NTU) results between raw water (Grit Pond) and treated water (Steven’s Intake and Booster 1)