

# 2020 ANNUAL REPORT

---

## VERNON WATER RECLAMATION CENTRE



## Table of Contents

<b>Reclaimed Water Quality Requirements .....</b>	<b>3</b>
<b>VWRC Influent .....</b>	<b>4</b>
<b>VWRC Treated Effluent.....</b>	<b>6</b>
<b>Treated Effluent to Okanagan Lake .....</b>	<b>7</b>
VWRC Treated Effluent Quality to Okanagan Lake .....	8
<b>Lake Monitoring .....</b>	<b>11</b>
<b>Spray Irrigation Program.....</b>	<b>14</b>
MacKay Reservoir .....	14
Irrigation .....	15
<b>Groundwater Monitoring Program.....</b>	<b>16</b>
<b>Sanitary Sewer Use Bylaw .....</b>	<b>17</b>
<b>Contingency Plan .....</b>	<b>17</b>
<b>Authorized Works .....</b>	<b>17</b>
<b>Biosolids Management.....</b>	<b>17</b>
<b>Operation and Maintenance .....</b>	<b>17</b>
<b>List of Tables.....</b>	<b>18</b>
<b>List of Figures.....</b>	<b>18</b>
<b>Appendices .....</b>	<b>18</b>

## List of Acronyms and Measurement Units

BOD <sub>5</sub>	5-day Biochemical Oxygen Demand (mg/L)
FC	Fecal Coliform (MPN/100ml)
L	liters
mg	milligrams
m <sup>3</sup>	cubic meters
MPN	most probable number
OC	Operating Certificate
OP	Ortho Phosphate (mg/L)
TN	Total Nitrogen (mg/L)
TP	Total Phosphorus (mg/L)
TSS	Total Suspended Solids (mg/L)
VWRC	Vernon Water Reclamation Centre
Fasl	Feet above sea level
EMS	Environmental Monitoring System

## Introduction

This report is submitted as per Section 9.3.1 of the Ministry of Environment and Climate Change Strategy Operational Certificate ME 12215(OC) for the City of Vernon Water Reclamation Centre (VWRC)

The Vernon Water Reclamation Center (VWRC) is designated as a Class IV Wastewater Treatment Center. The current plant was commissioned in 2004 as a Modified Johannesburg Biological Nutrient Removal (BNR) process.

There are four major treatment stages that complete the VWRC process. First, pretreatment of the influent at the fine screen and grit removal. Second, primary settling where solids are further settled out and removed. Third, nutrients and BOD are removed by the organisms in the bioreactors and settled out in the secondary clarifiers. Lastly, sand filters and ultraviolet lights are utilized for disinfection and the fully treated reclaimed water is ready for discharge.

Under the provisions of the Operational Certificate, the Corporation of the City of Vernon is authorized to discharge reclaimed wastewater from the VWRC located at 2100 43rd Street, Vernon, B.C., to a water storage reservoir (MacKay Reservoir) and then to the ground by irrigation. The discharge of treated reclaimed water to Okanagan Lake via the deep lake outfall is only authorized when:

- a) Unforeseen conditions or circumstances beyond the City's control prevent the City from pumping treated reclaimed water from the Vernon Water Reclamation Centre to MacKay Reservoir. Such conditions would include but not be limited to power outages, pump station or pipeline failures,
- Or;
- b) The elevation in MacKay Reservoir exceeds 1935 feet above mean sea level and it is projected that the level of MacKay Reservoir will exceed 1939 feet above mean sea level prior to the start of the next irrigation season.

VWRC is further authorized to discharge biosolids. Biosolids from the VWRC are processed by the Regional Compost Facility located at 551 Commonage Road, Vernon, B.C., into a Class A soil compost.

## Reclaimed Water Quality Requirements

Reclaimed water discharged from the VWRC to MacKay Reservoir to be used for irrigation may not exceed the following limits:

- 26 mg/L 5-day Biochemical Oxygen Demand (BOD<sub>5</sub>) and
- 25 mg/L Total Suspended Solids (TSS)

Reclaimed water may be discharged from the VWRC to Okanagan Lake via the deep lake outfall if the quality is better than or equivalent to the following parameters:

- 10 mg/L 5-day Biochemical Oxygen Demand (BOD<sub>5</sub>)
- 10 mg/L Total Suspended Solids (TSS)
- Not to exceed 2.0 mg/L of Total Phosphorus (TP) (as P)
- Annual average of 0.25 mg/L of Total Phosphorus (TP) (as P)
- 6.0 mg/L Total Nitrogen (TN) (as N)
- 50 MPN /100ml Fecal Coliform (FC)

The analytical requirements stipulated by the OC and reported in this annual report were conducted by Caro Analytical Services in Kelowna, BC, ALS Environmental in Kamloops, BC, and Cordillera Consulting in Summerland, BC. The lab reports are attached in the appendices. Analysis data stipulated by the OC is downloaded annually to the Ministry of Environment and Climate Change Strategy Environmental Monitoring System (EMS) site.

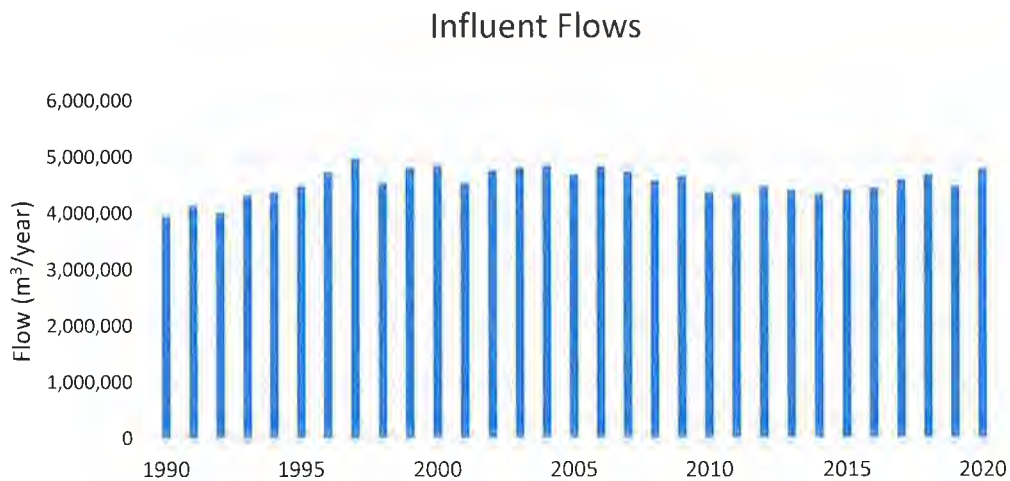
## VWRC Influent

The VWRC continuously monitors influent flow at the headworks parshall flume. Table 1 shows the average daily flow of 13,053 m<sup>3</sup> with a maximum daily flow of 16,623 m<sup>3</sup>/day occurring in June. The maximum authorized daily volume to discharge is 28,100 m<sup>3</sup>/day, as per section 2.1 of the OC. Figure 1 shows the total influent flows from 1990 to 2020. Figure 2 shows the seasonal flow changes from 2016 - 2020.

**Table 1. Influent Flow Table – EMS E228537**

2020	Average Daily flow (m <sup>3</sup> /day)	Min (m <sup>3</sup> /day)	Max (m <sup>3</sup> /day)	Monthly (m <sup>3</sup> )
January	12,808	11,740	14,210	397,045
February	13,509	12,514	16,004	391,747
March	13,290	12,270	14,255	411,993
April	12,082	11,741	12,423	362,445
May	12,925	12,254	14,229	400,689
June	14,059	12,957	16,623	421,757
July	13,765	12,744	14,836	426,724
August	13,322	12,251	13,955	412,973
September	12,744	12,060	13,168	382,333
October	12,884	12,246	13,662	399,417
November	12,706	12,207	13,974	381,171
December	12,556	11,550	12,962	389,238
Average 13,053		Min 11,550	Max 16,623	Total 4,777,531

**Figure 1. Annual Influent flow 1990 – 2020**



**Figure 2. Daily Influent Flows 2016 - 2020**

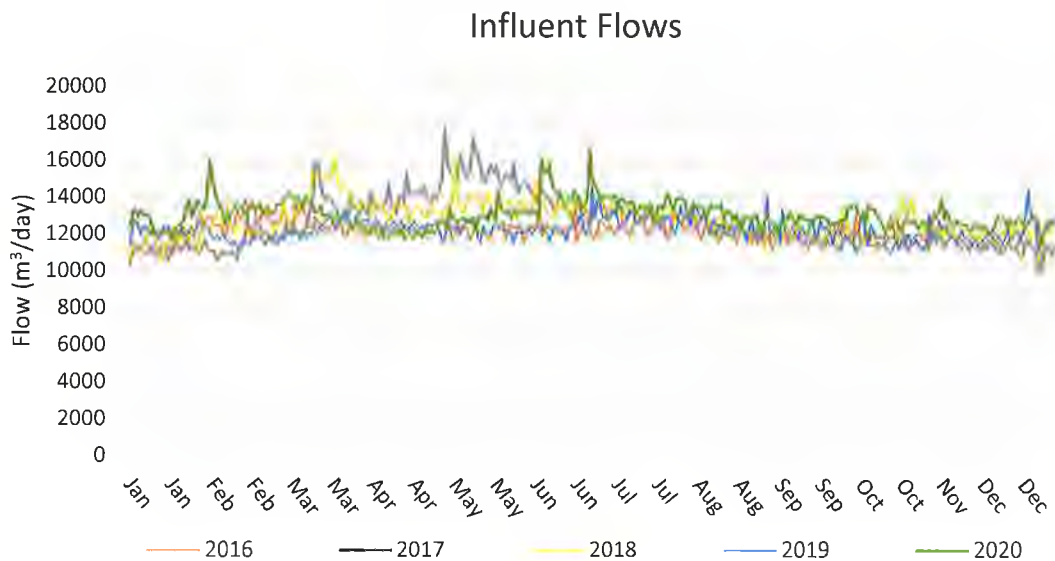


Table 2 summarizes the influent quality treated at the VWRC. The 24-hour composite sample is sent to CARO Analytical services monthly for analysis (Appendix A – Influent Results).

**Table 2. 2020 Monthly Sampling of Influent Quality EMS - E228537**

2020	BOD <sub>5</sub> (mg/L)	TSS (mg/L)	Total Phosphorus (mg/L)	Total Nitrogen (mg/L)	pH pH units
Jan	666	244	9.2	58.4	6.1
Feb	500	386	9.1	54.5	6.7
Mar	469	326	7.7	49.0	7.2
Apr	562	326	9.1	57.4	6.5
May	524	336	11.6	62.3	6.2
Jun	430	352	10.8	58.1	6.3
Jul	545	568	8.4	55.5	6.5
Aug	528	304	9.2	63.0	6.3
Sep	512	338	9.5	53.3	6.2
Oct	459	324	8.7	59.1	6.2
Nov	659	302	8.2	52.2	6.2
Dec	761	289	9.8	57.9	6.1
Yearly Average	551	341	9.3	56.7	6.4

## VWRC Treated Effluent

The VWRC has various distribution options for treated reclaimed water. The VWRC's primary goal is to send treated effluent to MacKay Reservoir throughout the year. In addition, during irrigation season, the sand filters, Ultra-Violet (UV) lights, and chlorination are utilized to ensure disinfection of VWRC reclaimed effluent being used for direct irrigation at the Rise Golf Course. Lastly, under certain conditions the VWRC can discharge to the lake following tertiary treatment (Appendix B – Discharge Plan). Table 3 summarizes the monthly distribution of the VWRC final treated effluent through 2020.

The quantity of reclaimed water discharged to Okanagan Lake is measured at the VWRC headworks parshall flume as per section 3 of the OC the EMS E229537. Additionally, the discharge quantity to MacKay Reservoir corresponds to EMS E229537 and measured at the headworks parshall flume as per section 2 of the OC.

**Table 3. 2020 Reclaimed Water Distribution**

2020	Plant Influent (m <sup>3</sup> )	Lake Discharge (m <sup>3</sup> )	Irrigation		
			MacKay Reservoir		Direct to Irrigation (m <sup>3</sup> )
			Inflow (m <sup>3</sup> )	Outflow (m <sup>3</sup> )	
January	397,045		397,045		
February	391,747	239,347	152,400		
March	411,993	395,757	16,236		
April	362,445	345,379	17,066		
May	400,689	249,788	145,395	267,720	5,506
June	421,757	83,493	330,435	338,240	7,829
July	426,724	29,645	387,235	523,820	9,844
August	412,973		378,078	1,012,980	34,895
September	382,333		364,557	801,460	17,776
October	399,417		399,417	100,230	
November	381,171		381,171		
December	389,238		389,238		
<b>Total</b>	<b>4,777,531</b>	<b>1,343,409</b>	<b>3,358,272</b>	<b>3,044,450</b>	<b>75,850</b>
<b>Daily Average (m<sup>3</sup>/day)</b>	<b>13,053</b>	<b>8,838</b>	<b>9,154</b>	<b>16,572</b>	<b>550</b>

Figure 3 shows the daily flow to Okanagan Lake. May 22 - 27 crews were making repairs to the effluent line and discharge resumed after that. May to July a smaller volume was discharged to Okanagan Lake due to direct irrigation being online.

**Figure 3. Daily Flow Released to Okanagan Lake February 2020 - July 2020**

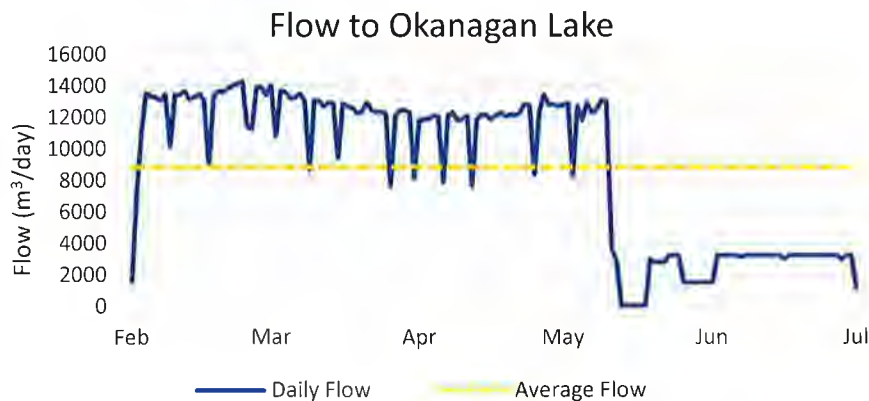


Table 4 displays the quality of VWRC effluent discharged to MacKay Reservoir. A 24-hr Composite sample was submitted to CARO Analytical Services on a monthly basis. The VWRC treated effluent met the OC permit requirements throughout 2020 as per section 2.2 for discharge to MacKay Reservoir and for direct use to irrigate.

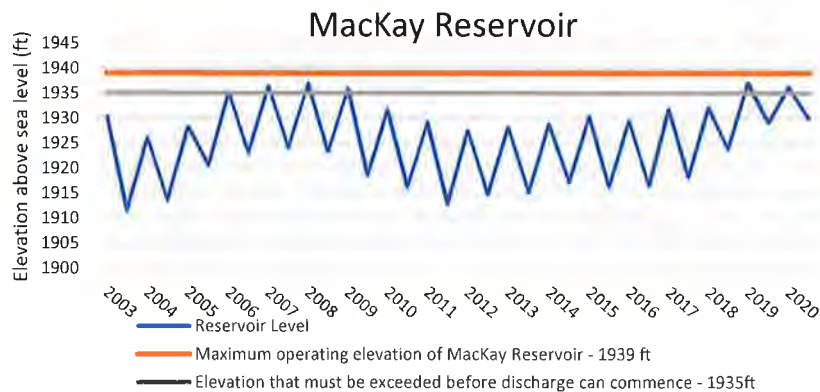
Table 4. Quality of the Final Treated Effluent to MacKay Reservoir in 2020. EMS E105004

VWRC Treated Effluent to MacKay Reservoir													
2020	OC Limit	Jan	Feb*	Mar*	Apr*	May*	Jun	Jul	Aug	Sept	Oct	Nov	Dec
BOD <sub>5</sub> (mg/L)	26	< 1.0	1.1	3.7	3.1	7.3	8.2	2.6	9.6	6.6	6.3	9.1	7.2
TSS (mg/L)	25	< 2.0	1.5	1.6	1.7	4.4	5.0	2.4	3.8	5.2	8.0	4.4	3.8
pH	ph units	7.8	7.8	7.7	7.9	7.6	7.9	8.0	8.0	7.9	7.9	7.5	7.9
Total Phosphorus (mg/L)		0.119	0.146	0.195	0.454	0.322	0.197	0.107	0.185	0.121	0.350	0.136	0.114
Total Dissolved Phosphorus (mg/L)		0.065	0.085	0.125	0.246	0.207	0.069	0.076	0.099	0.089	0.147	0.114	0.087
Orthophosphorus (mg/L)		< 0.005	0.009	0.017	0.081	0.102	0.016	< 0.005	< 0.005	0.010	0.030	0.011	0.006
Total Nitrogen (mg/L)		4.95	5.82	8.14	6.80	4.52	6.29	4.54	5.61	4.43	6.31	6.73	4.98
Organic Nitrogen (mg/L)		1.33	1.50	1.84	1.39	1.62	1.62	1.37	1.50	1.44	2.00	1.50	1.49
Ammonia Nitrogen (mg/L)		0.287	0.318	2.039	1.191	0.088	0.233	< 0.050	0.074	< 0.050	0.136	0.425	0.362
Nitrate Nitrogen (mg/L)		3.26	3.80	3.96	4.15	2.72	4.34	3.05	4.01	2.97	3.97	4.47	2.95
Nitrite Nitrogen (mg/L)		0.07	0.21	0.30	0.07	0.11	0.10	0.11	0.03	0.02	0.20	0.33	0.18
Sodium (mg/L)		90.6	89.0	94.1	83.3	67.8	71.4	87.1	76.2	79.0	83.0	71.3	76.2
Chloride (mg/L)		97.9	88.3	87.5	84.2	83.6	77.4	75.3	76.4	77.0	72.4	68.4	76.6
Specific Conductivity (µS/cm)		806	908	911	809	665	843	829	816	799	810	583	725

\*same test site as EMS E228121

## Treated Effluent to Okanagan Lake

The Vernon Water Reclamation Center commenced a lake discharge February 10, 2020 due to the elevation of MacKay Reservoir exceeding 1935 feet above sea level and was projected to reach 1939 feet prior to the irrigation season as per section 3.3 in Operational Certificate ME 12215 (Figure 4). Table 3 shows the total volume of treated effluent released to Okanagan lake via the deep lake outfall in 2020 was 1,343,409 m<sup>3</sup>. The VWRC sampled the final treated effluent at EMS site E228121 30 days prior to Lake Discharge (Appendix C – 30-day Effluent Results). Composite samples were sent to Caro Analytical Services for analysis as per section 8.5.2 of the OC.



## VWRC Treated Effluent Quality to Okanagan Lake

As per section 8.5 of the OC, monthly, weekly, and daily analysis are required while discharging. Table 5 summarizes the monthly average effluent quality results from CARO Analytical Services during discharge to Okanagan Lake. Samples were taken from a flow proportional 24-hour composite sample of the treated effluent (Appendix D - Effluent Data). In addition, Table 5 shows the monthly average of the daily sampling required for pH and orthophosphorus during the discharge taken from the 24-hour composite sample.

As per item 5 in the agreement between the Okanagan Indian Band and the City of Vernon the VWRC did not exceed 1.2 tonnes of Total Phosphorus discharged to Okanagan Lake per annum in 2020. The calculated nutrient loading to Okanagan Lake during the discharge period was 0.363 tonnes of total phosphorus and 8.567 tonnes of total nitrogen. The calculation was based on the total volume discharged and the monthly average for total nitrogen and total phosphorus shown in Table 5.

The VWRC completed two trout toxicity tests on the treated effluent. One sample was taken during the lake release and the second was submitted after the lake release ended. The tests were completed at Nautilus Environmental. Results from both tests concluded that over the 96-hour period there were zero rainbow trout fatalities (Appendix E – LT50 Trout Results).

**Table 5. Quality of the Final Treated Effluent During Lake Release in 2020 – EMS E228121**

2020	OC Limit	AVG	Feb	Mar	Apr	May	Jun	Jul
BOD5 (mg/L)	10	4.2	1.1	3.7	3.1	7.3	5.2	4.6
TSS (mg/L)	10	2.3	1.5	1.6	1.7	4.4	2.8	1.7
Total Phosphorus (mg/L)	0.25	0.25	0.146	0.195	<b>0.454</b>	<b>0.322</b>	0.138	0.098
Total Dissolved Phosphorus (mg/L)			0.0851	0.1255	0.2458	0.2072	0.0733	0.0792
Orthophosphorus (mg/L)			0.0089	0.0166	0.0807	0.1018	0.0155	0.0154
Total Nitrogen (mg/L)	6.0	5.6	5.82	<b>8.14</b>	<b>6.80</b>	4.52	4.20	4.16
Organic Nitrogen (mg/L)			1.50	1.84	1.39	1.62	1.44	1.01
Ammonia Nitrogen (mg/L)			0.318	2.039	1.191	0.088	0.086	0.025
Nitrate Nitrogen (mg/L)			3.80	3.96	4.15	2.72	2.60	3.07
Nitrite Nitrogen (mg/L)			0.205	0.304	0.069	0.106	0.097	0.078
Total Kjeldahl Nitrogen (mg/L)			1.82	3.88	2.58	1.70	1.51	1.01
Sodium (mg/L)			89.0	94.1	83.3	67.8	70.0	79.7
Chloride (mg/L)			88.3	87.5	84.2	83.6	77.1	74.0
Specific Conductivity (µS/cm)			908	911	809	665	739	801
Fecal Bacteria (MPN/100mL)	50	2.4	<1.0	9.8	<1.0	1	<1.0	2
Total Coliform Bacteria (MPN/100mL)			15.6	3.1	<1.0	49	<1.0	<1.0
Daily testing								
pH	ph units		7.4	7.3	7.2	7.2	7.3	7.6
Monthly average - Daily Orthophosphorus	mg/L		0.0570	0.0479	0.3979	0.2642	0.0734	0.0775

Table 5 shows that the average of Total Phosphorus discharged to the lake was 0.25 mg/L based on the weekly Total Phosphorus CARO Analytical Services results. Figure 5 shows the weekly total phosphorus results of 24-hour effluent composites. Moreover, Section 3.8 of the OC states the annual average limit for total phosphorus is 0.25mg/L and 99 percent of all daily values throughout the year are not to exceed 1.5 mg/L. The VWRC final treated effluent met the discharge requirements for total phosphorus during the lake release in 2020.

**Figure 5. Total Phosphorus Weekly Concentration During Lake Release in 2020**

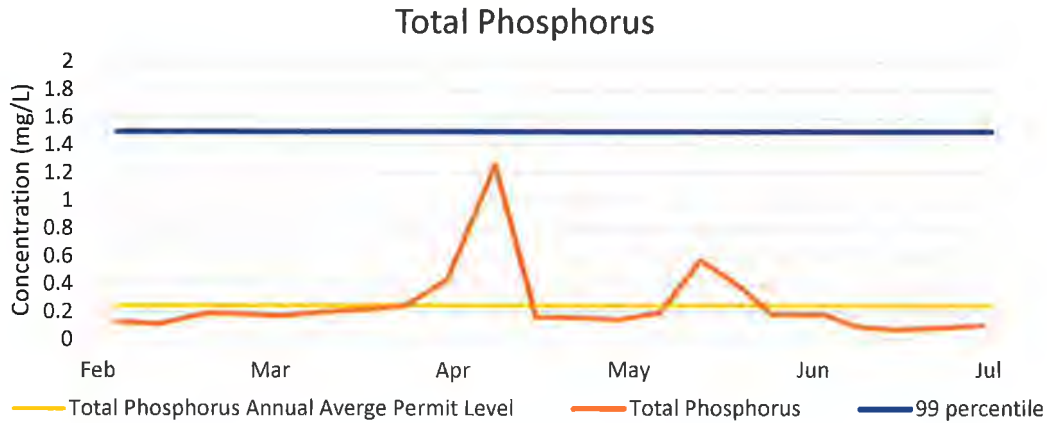


Figure 6 shows the monthly average BOD<sub>5</sub> of VWRC effluent taken during the discharge. All samples were below the 10mg/L BOD<sub>5</sub> permit level, except one on May 29<sup>th</sup>, 2020 was 20 mg/L for BOD<sub>5</sub>. The subsequent BOD<sub>5</sub> sample taken June 3 was 6.6 mg/L. The remainder of the BOD<sub>5</sub> results in May were ≤ 5mg/L with a monthly average of 7.3 mg/L.

**Figure 6. BOD<sub>5</sub> Monthly Average During Lake Release in 2020**

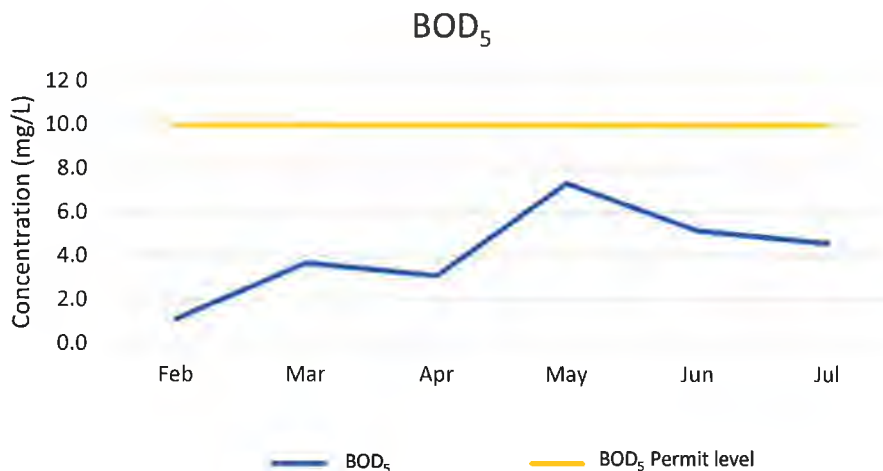


Figure 7 shows the weekly total nitrogen results of treated effluent (from CARO Analytical Services). Based on effluent results from 2017-2019 notice was given to the Ministry of Environment and Climate Change Strategy February 6, 2020 for rational for total nitrogen concentration exceeding the threshold of 6mg/L. The VWRC total nitrogen concentrations April through to June 2020 were less than 6mg/L.

**Figure 7. Total Nitrogen Concentrations During Lake Release in 2020**

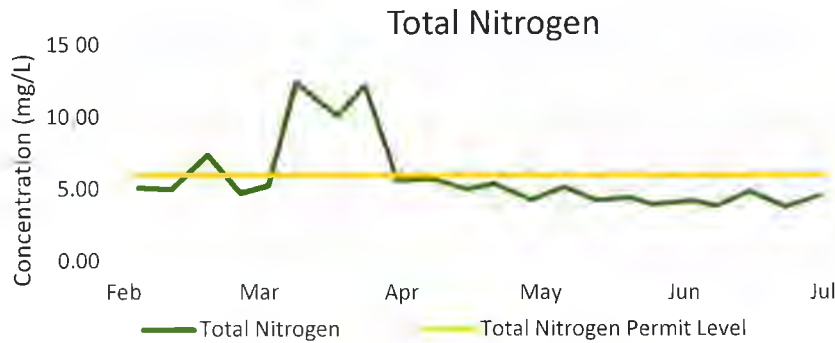


Figure 8 shows the monthly average of Total Suspended Solids (TSS). The VWRC treated effluent met OC limits for the lake discharge of 10mg/L for TSS.

**Figure 8. Monthly Average for Total Suspended Solids During Lake Release in 2020**

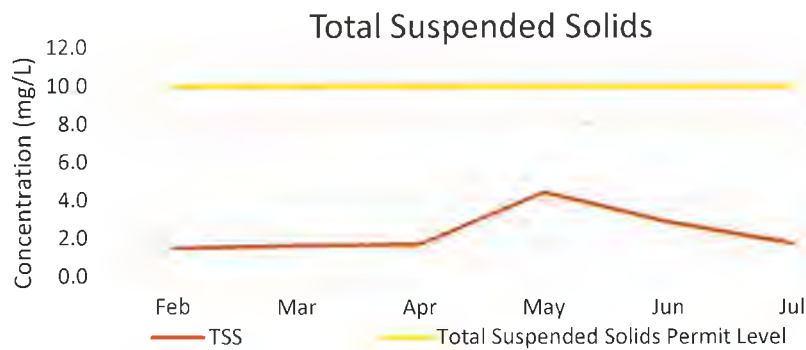
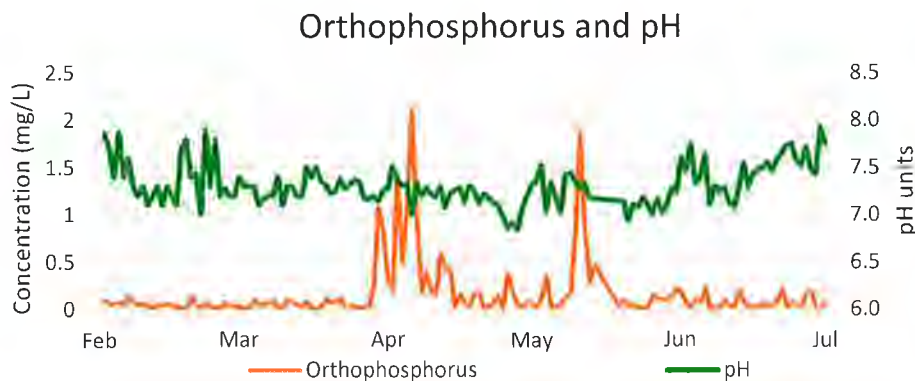


Figure 9 shows the daily pH and orthophosphorus results as per section 8.5.2 of OC ME 12215. Samples were collected daily and analyzed by the VWRC Laboratory Technician. The VWRC had the ALUM system online during the discharge to Okanagan Lake and closely monitored orthophosphorus. As concentrations increased the alum dosing rate was increased to aid in total phosphorus removal.

**Figure 9. Daily Results of Orthophosphorus and pH During Lake Release in 2020**



## Lake Monitoring

Lake sampling was completed by Urban Systems within 30 days prior to discharge and completed within 30 days at the end of discharge in July 2020 as per section 8.8 in the OC. Figure 10 shows the required sampling locations specified in section 8.8 of the OC Lake Sampling and Monitoring Program.

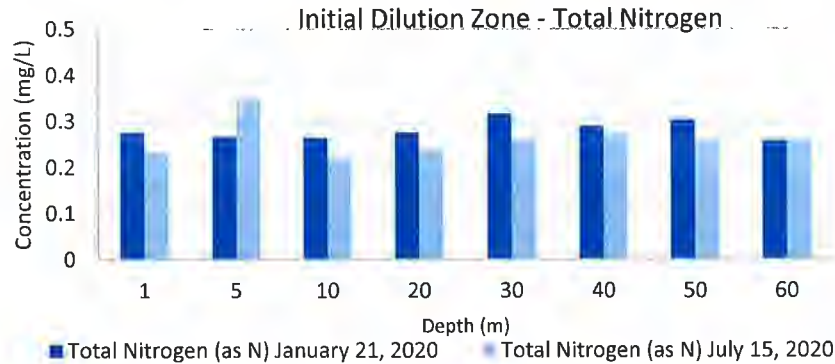
An additional sampling program began in June 2020 to assist with providing supplementary background information where the Vernon and Armstrong arms of Okanagan Lake meet. For this purpose, field data, lab analysis, and aquatic life analysis of phytoplankton and zooplankton was completed on an upgradient location, the deep lake outfall, and the edge of the IDZ. Sampling was completed by Urban Systems, laboratory analysis by ALS Environmental, and Zooplankton and Phytoplankton by Cordillera Consulting (Appendix F – Additional Lake Sampling Program). The City of Vernon is moving forward with efforts to participate in the Okanagan Lake Collaborative Monitoring Program in 2021.

**Figure 10. Lake Sampling Locations as per OC ME 12215**

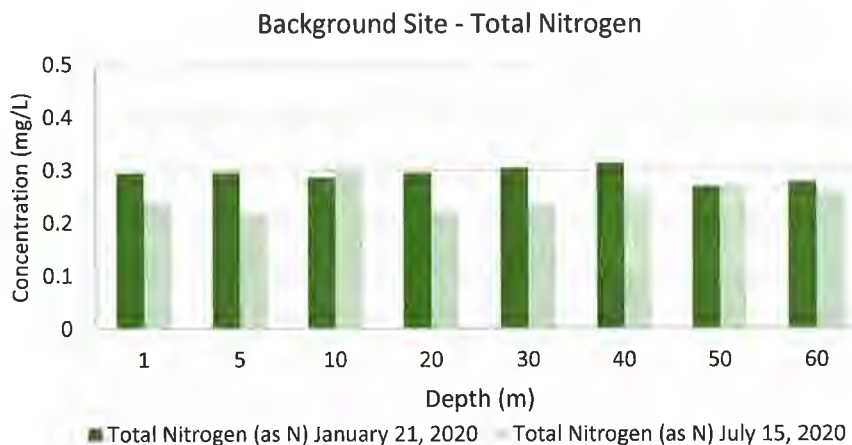


Figures 11 & 12 show total nitrogen trends at the edge of the IDZ and the background sample collection point. Overall, total nitrogen concentration slightly decreased at both sites after the lake discharge was complete. However, total nitrogen at 5m depth in January was 0.267mg/L and July was 0.347mg/L. This increase in total nitrogen was also observed in the background sample site of the 10m and 50m depths indicating a possible seasonal explanation (Appendix G – OC ME12215 Required Lake Sampling Data).

**Figure 11. The Edge of IDZ Total Nitrogen Results for January 2020 and July 2020. EMS E206611**

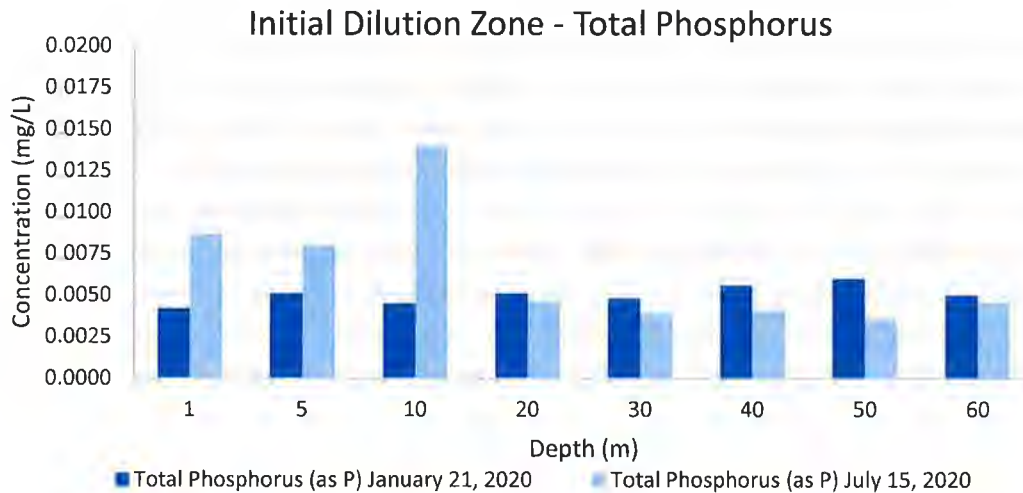


**Figure 12. Background Site Total Nitrogen for January 2020 and July 2020. EMS 0500730**

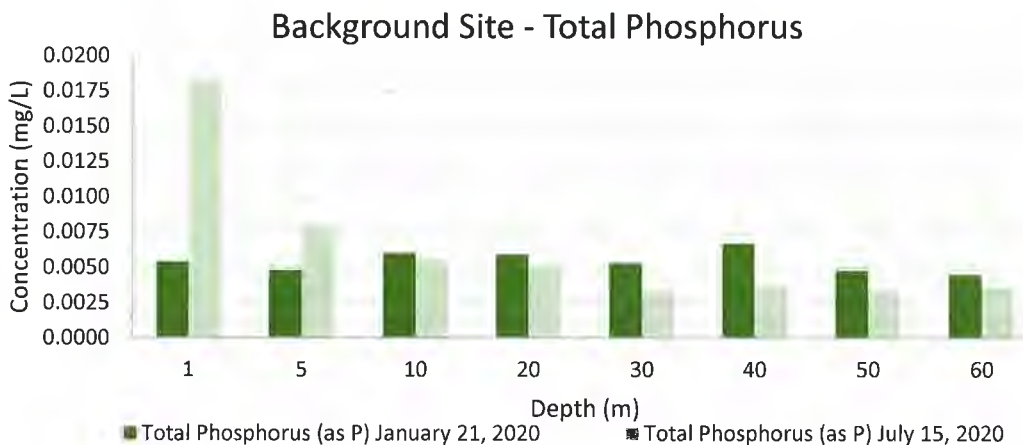


Figures 13 & 14 show total phosphorus trends at the edge of the initial dilution zone and background sample collection point. Overall, the total phosphorus concentration slightly decreased after the lake discharge was complete in the 20m – 60m range. There was an increase in total phosphorus at the IDZ between 1m - 10m depths, as well as an increase at the 1m and 5m depth at the Background site. The Background site and IDZ both showed a decrease in total phosphorus levels from 10m – 60m when comparing January to July sampling (Appendix G – OC Required Lake Sampling Data).

**Figure 13. Edge of IDZ Total Phosphorus for January 2020 and July 2020. EMS E206611**



**Figure 14. Background Site Total Phosphorus for January 2020 and July 2020. EMS 0500730**



## Spray Irrigation Program

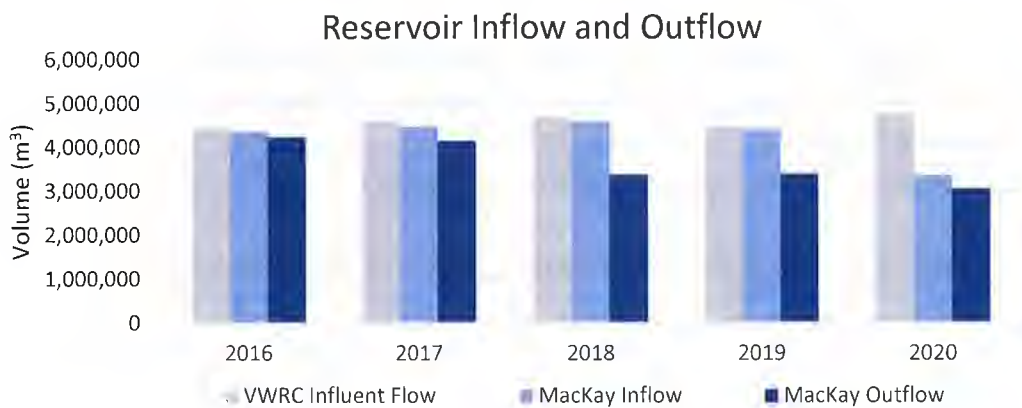
### MackKay Reservoir

In 1977, the City of Vernon began operating the Spray Irrigation Program. The Vernon Water Reclamation Center discharges treated effluent to MacKay Reservoir throughout the year for storage and re-use. Irrigation season is operational from May to October, as per section 7.2 of the OC.

The City of Vernon continues to look at the feasibility of extending the spray irrigation system to prospective customers that are cost beneficial. (Appendix H – Vernon Emergency Discharge Acknowledgment) Currently, beneficial reuse of reclaimed water is provided to four seed orchards, three golf courses, grazing lands, pastures, soccer fields, baseball diamonds, regional compost facility, and residential landscape irrigation (Appendix I – Spray Irrigation Areas).

MacKay Reservoir level is measured weekly during irrigation season and monthly during the remainder of the year at EMS E228540. Figure 15 shows the supply of reclaimed water and irrigation demand at MacKay Reservoir for the last 5 years. Irrigation has been declining due to weather related factors. Figure 16 shows the increase in MacKay Reservoir elevation 2016-2020.

**Figure 15. VWRC Influent Flow and Irrigation Usage 2016 - 2020**



**Figure 16. MacKay Reservoir Elevation Trend 2016 - 2020. EMS E228540**

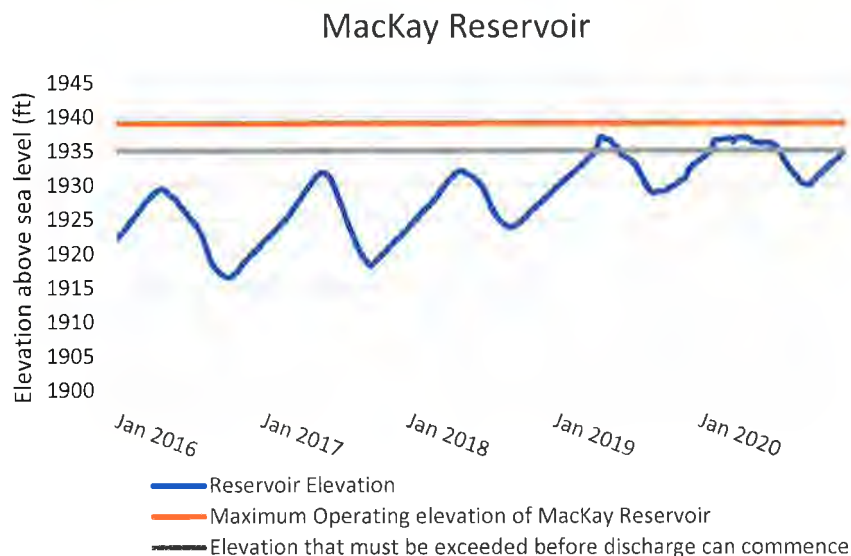


Table 6 summarizes the elevation changes in MacKay Reservoir during the past 11 years irrigation seasons. The 2018-2020 irrigation seasons experienced the lowest seasonal usage and elevation changes. In addition, as the elevation increases each season the outflow volume that is needed to reduce the elevation to prevent a lake discharge is significant.

**Table 6. 2010 – 2020 MacKay Reservoir Elevation Changes**

Date	Reservoir Elevation Change			
	Elevation (ft)	Irrigation Seasonal Usage		
		Outflow Volume (m <sup>3</sup> )	Elevation change (ft)	
2010	Max	1931.66	4,219,570	15.52
	Min	1916.14		
2011	Max	1929.10	4,104,530	16.30
	Min	1912.80		
2012	Max	1927.53	3,772,140	12.80
	Min	1914.73		
2013	Max	1928.15	3,642,410	12.99
	Min	1915.16		
2014	Max	1928.77	3,774,600	11.58
	Min	1917.19		
2015	Max	1930.32	4,152,970	14.05
	Min	1916.27		
2016	Max	1929.43	4,446,580	12.91
	Min	1916.52		
2017	Max	1931.86	4,141,730	13.66
	Min	1918.20		
2018	Max	1932.12	3,377,220	8.30
	Min	1923.82		
2019	Max	1937.04	3,390,550	7.91
	Min	1929.13		
2020	Max	1936.22	3,044,450	6.18
	Min	1930.04		

## Irrigation

Water is withdrawn from MacKay Reservoir and distributed to irrigation users during the irrigation season. The irrigation water is chlorinated prior to use. Chlorine residuals are tested weekly at Clay Valve #4 throughout the irrigation season and at all times the chlorine residual was above 0.5mg/L. As per section 2.2 of the OC, Table 7 displays the monthly water quality results from the distribution system at Clay Valve #4. EMS 228539 (Appendix J – Irrigation Water Quality Results).

**Table 7. 2020 Irrigation Quality at Clay Valve - #4**

Irrigation from MacKay Reservoir								
2020		OC Permit	May	June	July	Aug	Sept	Oct
BOD <sub>5</sub>	mg/L	10	< 6.7	< 6.0	< 9.4	< 6.8	< 6.0	< 7.0
TSS	mg/L	10	< 2.0	< 2.0	2.2	< 2.0	< 2.0	< 2.0
pH	pH units	6 to 9	8.16	7.66	8.03	8.18	8.03	7.95
Total Phosphorus	mg/L		0.908	1.04	1.09	1.12	1.13	1.13
Total Dissolved Phosphorus	mg/L		0.84	1.00	1.04	1.10	1.09	1.10
Ortho Phosphate	mg/L		0.632	0.632	0.702	0.681	0.745	0.682
Total Nitrogen	mg/L		2.31	2.23	2.52	2.74	2.42	2.37
Organic Nitrogen	mg/L		1.02	0.88	0.94	1.09	0.97	0.91
Ammonia N	mg/L		0.699	0.823	0.945	0.952	1.09	1.10
Nitrate N	mg/L		0.588	0.533	0.635	0.676	0.240	0.231
Nitrite N	mg/L		< 0.010	< 0.010	< 0.010	< 0.010	0.128	0.133
Total Coliform	(MPN/100mL)		3.1	1.0	< 1	< 1	< 1	< 1
Fecal Coliform	(MPN/100mL)	2.2	< 1	1.0	< 1	< 1	< 1	< 1

Reclaimed water for direct irrigation is supplied to the Rise Golf Course from VWRC following sand filtration, UV disinfection and chlorination. The turbidity samples taken were less than 2 NTU. As per section 2.2 of the OC, the reclaimed water quality used for direct irrigation meets the water quality standards.

**Table 8. 2020 Irrigation Quality to The Rise Golf Course - EMS 229578**

		Direct to Irrigation						
2020		OC Limits	May	Jun	Jul	Aug	Sept	
BOD <sub>5</sub>	(mg/L)	10	7.3	5.2	2.6	1.1	4	
TSS	(mg/L)	10	4.4	2.8	2.4	<2.0	2	
pH	ph units	6 to 9	7.2	7.3	8.0	7.0	7.7	
Fecal Coliforms	(MPN/100mL)	2.2	1	<1.0	<1.0	<1.0	<1.0	

## Groundwater Monitoring Program

Monthly samples of Bailey Springs EMS 0500578 are tested throughout the year. Table 9 summarizes the results of grab samples analyzed by CARO Analytical Services (Appendix K – Bailey Spring Water Quality Results). The annual groundwater monitoring program was completed by Associated Environmental and attached as Appendix L.

**Table 9. 2020 Analysis of Bailey Springs**

		Bailey Springs												
2020		AVG	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Total Phosphorus	mg/L	0.17	0.13	0.15	0.14	0.12	0.12	0.18	0.16	0.18	0.23	0.28	0.18	0.15
Total Dissolved Phosphorus	mg/L	0.14	0.12	0.14	0.11	0.11	0.10	0.12	0.13	0.15	0.17	0.22	0.15	0.15
Ortho Phosphorus	mg/L	0.06	0.06	0.09	0.06	0.05	0.05	0.03	0.07	0.04	0.06	0.05	0.04	0.06
Total Nitrogen	mg/L	1.07	0.86	1.70	1.77	1.11	1.04	0.92	0.73	0.88	0.98	1.09	0.79	0.94
Organic Nitrogen	mg/L	0.65	0.52	0.62	0.59	0.56	0.69	0.69	0.52	0.58	0.85	0.90	0.57	0.66
Ammonia Nitrogen	mg/L	0.08	0.03	< 0.02	< 0.02	< 0.05	< 0.05	0.08	0.17	< 0.05	0.06	0.06	0.06	< 0.05
Nitrate Nitrogen	mg/L	0.36	0.31	1.08	1.18	0.54	0.35	0.15	0.05	0.03	0.06	0.13	0.16	0.27
Nitrite Nitrogen	mg/L	<0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Sodium	mg/L	119	125	123	117	110	108	112	113	122	124	119	133	126
Chloride	mg/L	124	148	152	132	107	110	122	114	117	116	114	133	121
Specific Conductivity	µS/cm	1132	1260	1280	1220	1060	1060	1040	1080	1180	1210	1110	1060	1020
Total Coliform	MPN/100 mL	3344	285	278	287	387	1730	6130	> 2420	9210	9210	7910	548	804
Fecal Coliform	MPN/100 mL	181	1	4	287	1	6	54	687	349	488	276	13	10
pH	pH units	8.4	8.4	8.3	8.3	8.4	8.5	8.0	8.5	8.5	8.5	8.4	8.4	8.3

## Sanitary Sewer Use Bylaw

The City of Vernon Sanitary Use Bylaw (#4863) is attached as Appendix M – Sanitary Use Bylaw.

## Contingency Plan

An Emergency Response Manual is available for the Staff of the VWRC to refer to in such case of emergency.

## Authorized Works

Attached in Appendix N is an updated VWRC schematic of the treatment process which includes the new Septage Handling Facility.

## Biosolids Management

Biosolids from the Vernon Water Reclamation Center is made up of thickened primary sludge and secondary sludge. Regional Compost Facility processes the biosolids into nutrient rich Ogogrow Compost. The VWRC samples monthly for Biosolids from the Vernon Water Reclamation Center

## Operation and Maintenance

The City of Vernon staff at Vernon Water Reclamation Center performs routine preventive and corrective maintenance. Maintenance records are kept daily and use of software programs are used for tracking purposes.

To meet the discharge requirements set by the Ministry of Environment and Climate Change Strategy the Vernon Water Reclamation Plant completed a full service on the tertiary treatment processes that included a full inspection, cleaning and maintenance on two sand filter beds and ultraviolet disinfection system. The Alum system was brought online to manage phosphorus levels as needed.

**Table 10. Facility Staffing**

Position	Name	EOCP Designation
Manager	Serge Kozin	MWWT IV
Operator III	Mark Hawthorne	MWWT III
Operator II	Kevin Holman	MWWT III
Operator II	Nick Morrison	MWWT II
Operator II	Ryan Powell	MWWT III
Operator I	Amanda Summerfelt	MWWT III
Operator I	Kevin Walters	MWWT II
Operator I	Rob Morris	MWWT II
Reclaimed Operator	Derek Anderson	MWWT I
Reclaimed Operator	David McGean	WD II
Lab Technician	Hedy Brouwer	MWWT I
Instrumentation		
Tech/electrician	Darren Roesler	
Instrumentation		
Tech/electrician	Trevor Schikowski	

## List of Tables

Table 1. Influent Flow Table – EMS E228537 .....	4
Table 2. 2020 Monthly Sampling of Influent Quality EMS - E228537 .....	5
Table 3. 2020 Reclaimed Water Distribution .....	6
Table 4. Quality of the Final Treated Effluent to MacKay Reservoir in 2020. EMS E105004 .....	7
Table 5. Quality of the Final Treated Effluent During Lake Release in 2020 – EMS E228121 .....	8
Table 6. 2010 – 2020 MacKay Reservoir Elevation Changes.....	15
Table 7. 2020 Irrigation Quality at Clay Valve - #4 .....	15
Table 8. 2020 Irrigation Quality to The Rise Golf Course - EMS 229578 .....	16
Table 9. 2020 Analysis of Bailey Springs .....	16
Table 10. Facility Staffing.....	17

## List of Figures

Figure 1. Annual Influent flow 1990 – 2020 .....	4
Figure 2. Daily Influent Flows 2016 - 2020 .....	5
Figure 3. Daily Flow Released to Okanagan Lake February 2020 - July 2020 .....	6
Figure 4. MacKay Reservoir Minimum and Maximum Elevations 2003 - 2020 .....	7
Figure 5. Total Phosphorus Weekly Concentration During Lake Release in 2020 .....	9
Figure 6. BOD <sub>5</sub> Monthly Average During Lake Release in 2020 .....	9
Figure 7. Total Nitrogen Concentrations During Lake Release in 2020.....	10
Figure 8. Monthly Average for Total Suspended Solids During Lake Release in 2020 .....	10
Figure 9. Daily Results of Orthophosphorus and pH During Lake Release in 2020 .....	10
Figure 10. Lake Sampling Locations as per OC ME 12215 .....	11
Figure 11. The Edge of IDZ Total Nitrogen Results for January 2020 and July 2020. EMS E206611 .....	12
Figure 12. Background Site Total Nitrogen for January 2020 and July 2020. EMS 0500730 .....	12
Figure 13. Edge of IDZ Total Phosphorus for January 2020 and July 2020. EMS E206611.....	13
Figure 14. Background Site Total Phosphorus for January 2020 and July 2020. EMS 0500730.....	13
Figure 15. VWRC Influent Flow and Irrigation Usage 2016 - 2020 .....	14
Figure 16. MacKay Reservoir Elevation Trend 2016 - 2020. EMS E228540.....	14

## Appendices

Appendix A – Influent Results
Appendix B – Discharge Plan
Appendix C – 30-day Effluent Results
Appendix D – Effluent Results
Appendix E – Rainbow Trout LT50 Results
Appendix F – Additional Lake Sampling Program
Appendix G – OC Required Lake Sampling Data
Appendix H – Vernon Emergency Discharge Acknowledgement
Appendix I – Spray Irrigation Areas
Appendix J – Irrigation Water Quality Results
Appendix K – Bailey Springs Water Quality Results
Appendix L – Groundwater Monitoring Program
Appendix M – Sanitary Use Bylaw
Appendix N – VWRC Process Schematic

# Appendix A

## *Influent Results*

*Caro Analytical Services*



## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Influent (ME12215) - EMS

**CARO WO# REPORTED** 0010477  
2020-01-15 15:17

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
<b>VWRC Influent (24hr Comp.) E228537 (0010477-01)   Matrix: Wastewater   Sampled: 2020-01-07 00:00 To 2020-01-08 00:00</b>						
<b>Anions</b>						
Nitrate (as N)	< 0.010		0.010	mg/L	2020-01-09	
Nitrite (as N)	< 0.010		0.010	mg/L	2020-01-09	
<b>Calculated Parameters</b>						
Nitrate+Nitrite (as N)	< 0.0100		0.0100	mg/L	N/A	
Nitrogen, Total	58.4		2.00	mg/L	N/A	
<b>General Parameters</b>						
BOD, 5-day	666 ± 143		2.0	mg/L	2020-01-15	
Nitrogen, Total Kjeldahl	58.4 ± 7.4		0.050	mg/L	2020-01-11	
pH	6.06 ± 0.02		0.10	pH units	2020-01-13	HT2
Phosphorus, Total (as P)	9.18 ± 1.02		0.0020	mg/L	2020-01-11	
Solids, Total Suspended	244 ± 21		2.0	mg/L	2020-01-10	

**Sample Qualifiers:**

HT2 The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Influent (ME12215) - EMS

**CARO WO# REPORTED** 0020560  
2020-02-14 12:11

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
<b>VWRC Influent (24hr Comp.) E228537 (0020560-01)   Matrix: Wastewater   Sampled: 2020-02-06 00:00 To 2020-02-07 00:00</b>						FILT, PRES
<b>Anions</b>						
Chloride	92.0	± 5.1	0.10	mg/L	2020-02-09	
Nitrate (as N)	< 0.010		0.010	mg/L	2020-02-09	
Nitrite (as N)	< 0.010		0.010	mg/L	2020-02-09	
Phosphate (as P)	4.26	± 0.74	0.0050	mg/L	2020-02-09	
<b>Calculated Parameters</b>						
Nitrate+Nitrite (as N)	< 0.0100		0.0100	mg/L	N/A	
Nitrogen, Total	54.5		2.00	mg/L	N/A	
Nitrogen, Organic	28.1		2.00	mg/L	N/A	
<b>General Parameters</b>						
Ammonia, Total (as N)	26.4	± 2.4	0.020	mg/L	2020-02-10	
BOD, 5-day	500	± 105	2.0	mg/L	2020-02-13	
Conductivity (EC)	1140	± 27	2.0	µS/cm	2020-02-13	
Nitrogen, Total Kjeldahl	54.5	± 6.9	0.050	mg/L	2020-02-09	
pH	6.71	± 0.02	0.10	pH units	2020-02-13	HT2
Phosphorus, Total (as P)	9.05	± 1.00	0.0020	mg/L	2020-02-12	
Phosphorus, Total Dissolved	5.26	± 0.62	0.0020	mg/L	2020-02-12	
Solids, Total Suspended	386	± 31	2.0	mg/L	2020-02-12	
<b>Total Metals</b>						
Sodium, total	95.3	± 17.4	0.10	mg/L	2020-02-13	

### Sample Qualifiers:

FILT The sample has been filtered for TDP in the laboratory. Results may not reflect conditions at the time of sampling.

HT2 The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.

PRES Sample has been preserved for TDP in the laboratory and the holding time has been extended.

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Influent (ME12215) - EMS

**CARO WO# REPORTED** 0031107  
2020-03-19 14:55

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
<b>VWRC Influent (24hr Comp.) E228537 (0031107-01)   Matrix: Fresh Water   Sampled: 2020-03-11 00:00 To 2020-03-12 00:00</b>						FILT, PRES
<b>Anions</b>						
Chloride	104	± 6	0.10	mg/L	2020-03-12	
Nitrate (as N)	< 0.010		0.010	mg/L	2020-03-12	
Nitrite (as N)	< 0.010		0.010	mg/L	2020-03-12	
Phosphate (as P)	4.34	± 0.75	0.0050	mg/L	2020-03-12	
<b>Calculated Parameters</b>						
Nitrate+Nitrite (as N)	< 0.0100		0.0100	mg/L	N/A	
Nitrogen, Total	49.0		2.00	mg/L	N/A	
Nitrogen, Organic	25.2		2.00	mg/L	N/A	
<b>General Parameters</b>						
Alkalinity, Total (as CaCO <sub>3</sub> )	331	± 18	1.0	mg/L	2020-03-14	
Alkalinity, Phenolphthalein (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-03-14	
Alkalinity, Bicarbonate (as CaCO <sub>3</sub> )	331		1.0	mg/L	2020-03-14	
Alkalinity, Carbonate (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-03-14	
Alkalinity, Hydroxide (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-03-14	
Ammonia, Total (as N)	23.8	± 2.2	0.020	mg/L	2020-03-13	
BOD, 5-day	469	± 98	2.0	mg/L	2020-03-18	
Conductivity (EC)	1190	± 29	2.0	µS/cm	2020-03-14	
Nitrogen, Total Kjeldahl	49.0	± 6.3	0.050	mg/L	2020-03-17	
pH	7.18	± 0.02	0.10	pH units	2020-03-14	HT2
Phosphorus, Total (as P)	7.71	± 0.86	0.0020	mg/L	2020-03-16	
Phosphorus, Total Dissolved	5.13	± 0.61	0.0020	mg/L	2020-03-16	
Solids, Total Suspended	326	± 26	2.0	mg/L	2020-03-18	
<b>Total Metals</b>						
Sodium, total	111	± 20	0.10	mg/L	2020-03-19	

### Sample Qualifiers:

FILT The sample has been filtered for DP in the laboratory. Results may not reflect conditions at the time of sampling.

HT2 The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.

PRES Sample has been preserved for DP in the laboratory and the holding time has been extended.

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Influent (ME12215) - EMS

**CARO WO# REPORTED** 0041237  
2020-04-23 15:03

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
<b>VWRC Influent (24hr Comp.) E228537 (0041237-01)   Matrix: Fresh Water   Sampled: 2020-04-14 00:00 To 2020-04-15 00:00</b>						F2, FILT, PRES
<b>Anions</b>						
Chloride	75.4	± 4.2	0.10	mg/L	2020-04-17	
Nitrate (as N)	< 0.010		0.010	mg/L	2020-04-17	
Nitrite (as N)	< 0.010		0.010	mg/L	2020-04-17	
Phosphate (as P)	5.41	± 0.94	0.0050	mg/L	2020-04-17	
<b>Calculated Parameters</b>						
Nitrate+Nitrite (as N)	< 0.0100		0.0100	mg/L	N/A	
Nitrogen, Total	57.4		2.00	mg/L	N/A	
Nitrogen, Organic	29.5		2.00	mg/L	N/A	
<b>General Parameters</b>						
Alkalinity, Total (as CaCO <sub>3</sub> )	324	± 18	1.0	mg/L	2020-04-22	
Alkalinity, Phenolphthalein (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-04-22	
Alkalinity, Bicarbonate (as CaCO <sub>3</sub> )	324		1.0	mg/L	2020-04-22	
Alkalinity, Carbonate (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-04-22	
Alkalinity, Hydroxide (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-04-22	
Ammonia, Total (as N)	27.9	± 2.5	0.050	mg/L	2020-04-21	
BOD, 5-day	562	± 126	2.0	mg/L	2020-04-23	
Conductivity (EC)	1150	± 28	2.0	µS/cm	2020-04-22	
Nitrogen, Total Kjeldahl	57.4	± 7.3	0.050	mg/L	2020-04-17	
pH	6.54	± 0.02	0.10	pH units	2020-04-17	HT2
Phosphorus, Total (as P)	9.08	± 1.01	0.0020	mg/L	2020-04-21	
Phosphorus, Total Dissolved	6.33	± 0.75	0.0020	mg/L	2020-04-21	
Solids, Total Suspended	326	± 26	2.0	mg/L	2020-04-21	
<b>Total Metals</b>						
Sodium, total	92.9	± 17.0	0.10	mg/L	2020-04-21	

### Sample Qualifiers:

F2 The sample was not field-preserved with HNO<sub>3</sub> and was therefore preserved in the laboratory and held for at least 16 hours prior to analysis for total metals.

FILT The sample has been filtered for DP in the laboratory. Results may not reflect conditions at the time of sampling.

HT2 The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.

PRES Sample has been preserved for DP in the laboratory and the holding time has been extended.

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Influent (ME12215) - EMS

**CARO WO# REPORTED** 0050643  
2020-05-14 14:21

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
<b>VWRC Influent (24hr Comp.) E228537 (0050643-01)   Matrix: Fresh Water   Sampled: 2020-05-06 00:00 To 2020-05-07 00:00</b>						F2, FILT, PRES
<b>Anions</b>						
Chloride	77.7	± 4.3	0.10	mg/L	2020-05-08	
Nitrate (as N)	< 0.010		0.010	mg/L	2020-05-08	
Nitrite (as N)	< 0.010		0.010	mg/L	2020-05-08	
Phosphate (as P)	4.65	± 0.81	0.0050	mg/L	2020-05-08	
<b>Calculated Parameters</b>						
Nitrate+Nitrite (as N)	< 0.0100		0.0100	mg/L	N/A	
Nitrogen, Total	62.3		2.00	mg/L	N/A	
Nitrogen, Organic	33.1		2.00	mg/L	N/A	
<b>General Parameters</b>						
Alkalinity, Total (as CaCO <sub>3</sub> )	214	± 12	1.0	mg/L	2020-05-12	
Alkalinity, Phenolphthalein (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-05-12	
Alkalinity, Bicarbonate (as CaCO <sub>3</sub> )	214		1.0	mg/L	2020-05-12	
Alkalinity, Carbonate (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-05-12	
Alkalinity, Hydroxide (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-05-12	
Ammonia, Total (as N)	29.2	± 2.6	0.050	mg/L	2020-05-11	
BOD, 5-day	524	± 122	2.0	mg/L	2020-05-13	
Conductivity (EC)	971	± 23	2.0	µS/cm	2020-05-12	
Nitrogen, Total Kjeldahl	62.3	± 7.9	0.050	mg/L	2020-05-14	
pH	6.15	± 0.02	0.10	pH units	2020-05-12	HT2
Phosphorus, Total (as P)	11.6	± 1.3	0.0020	mg/L	2020-05-13	
Phosphorus, Total Dissolved	7.09	± 0.84	0.0020	mg/L	2020-05-13	
Solids, Total Suspended	336	± 27	2.0	mg/L	2020-05-13	
<b>Total Metals</b>						
Sodium, total	72.7	± 13.3	0.10	mg/L	2020-05-13	

### Sample Qualifiers:

F2	The sample was not field-preserved with HNO <sub>3</sub> and was therefore preserved in the laboratory and held for at least 16 hours prior to analysis for total metals
FILT	The sample has been filtered for TDP in the laboratory. Results may not reflect conditions at the time of sampling
HT2	The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.
PRES	Sample has been preserved for TDP in the laboratory and the holding time has been extended.



## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Influent (ME12215) - EMS

**CARO WO# REPORTED** 0060708  
2020-06-11 15:17

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
<b>VWRC Influent (24hr Comp.) E228537 (0060708-01)   Matrix: Fresh Water   Sampled: 2020-06-04 00:00 To 2020-06-05 00:00</b>						F2, FILT, PRES
<b>Anions</b>						
Chloride	75.4	± 4.2	0.10	mg/L	2020-06-06	
Nitrate (as N)	< 0.010		0.010	mg/L	2020-06-06	
Nitrite (as N)	< 0.010		0.010	mg/L	2020-06-06	
Phosphate (as P)	4.90	± 0.85	0.0050	mg/L	2020-06-06	
<b>Calculated Parameters</b>						
Nitrate+Nitrite (as N)	< 0.0100		0.0100	mg/L	N/A	
Nitrogen, Total	58.1		2.00	mg/L	N/A	
Nitrogen, Organic	34.0		2.00	mg/L	N/A	
<b>General Parameters</b>						
Alkalinity, Total (as CaCO <sub>3</sub> )	224	± 12	1.0	mg/L	2020-06-10	
Alkalinity, Phenolphthalein (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-06-10	
Alkalinity, Bicarbonate (as CaCO <sub>3</sub> )	224		1.0	mg/L	2020-06-10	
Alkalinity, Carbonate (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-06-10	
Alkalinity, Hydroxide (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-06-10	
Ammonia, Total (as N)	24.1	± 2.2	0.050	mg/L	2020-06-10	
BOD, 5-day	430	± 107	2.0	mg/L	2020-06-11	
Conductivity (EC)	990	± 24	2.0	µS/cm	2020-06-10	
Nitrogen, Total Kjeldahl	58.1	± 7.4	0.050	mg/L	2020-06-11	
pH	6.25	± 0.02	0.10	pH units	2020-06-10	HT2
Phosphorus, Total (as P)	10.8	± 1.2	0.0020	mg/L	2020-06-10	
Phosphorus, Total Dissolved	6.10	± 0.72	0.0020	mg/L	2020-06-10	
Solids, Total Suspended	352	± 28	2.0	mg/L	2020-06-10	
<b>Total Metals</b>						
Sodium, total	72.1	± 13.2	0.10	mg/L	2020-06-10	

### Sample Qualifiers:

F2 The sample was not field-preserved with HNO<sub>3</sub> and was therefore preserved in the laboratory and held for at least 16 hours prior to analysis for total metals.

FILT The sample has been filtered for DP in the laboratory. Results may not reflect conditions at the time of sampling.

HT2 The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.

PRES Sample has been preserved for DP in the laboratory and the holding time has been extended.



## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Influent (ME12215) - EMS

**CARO WO# REPORTED** 0070859  
2020-07-16 13:18

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
<b>VWRC Influent (24hr Comp.) E228537 (0070859-01)   Matrix: Fresh Water   Sampled: 2020-07-07 00:00 To 2020-07-08 00:00</b>						F2, FILT, PRES
<b>Anions</b>						
Chloride	81.5	± 4.5	0.10	mg/L	2020-07-12	
Nitrate (as N)	< 0.010		0.010	mg/L	2020-07-12	HT1
Nitrite (as N)	< 0.010		0.010	mg/L	2020-07-12	HT1
Phosphate (as P)	3.90	± 0.68	0.0050	mg/L	2020-07-12	HT1
<b>Calculated Parameters</b>						
Nitrate+Nitrite (as N)	< 0.0100		0.0100	mg/L	N/A	
Nitrogen, Total	55.5		2.00	mg/L	N/A	
Nitrogen, Organic	26.5		2.00	mg/L	N/A	
<b>General Parameters</b>						
Alkalinity, Total (as CaCO <sub>3</sub> )	285	± 16	1.0	mg/L	2020-07-15	
Alkalinity, Phenolphthalein (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-07-15	
Alkalinity, Bicarbonate (as CaCO <sub>3</sub> )	285		1.0	mg/L	2020-07-15	
Alkalinity, Carbonate (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-07-15	
Alkalinity, Hydroxide (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-07-15	
Ammonia, Total (as N)	29.0	± 2.6	0.050	mg/L	2020-07-13	
BOD, 5-day	545	± 131	2.0	mg/L	2020-07-15	
Conductivity (EC)	1020	± 25	2.0	µS/cm	2020-07-15	
Nitrogen, Total Kjeldahl	55.5	± 7.1	0.050	mg/L	2020-07-16	
pH	6.46	± 0.02	0.10	pH units	2020-07-15	HT2
Phosphorus, Total (as P)	8.37	± 0.93	0.0020	mg/L	2020-07-14	
Phosphorus, Total Dissolved	4.75	± 0.56	0.0020	mg/L	2020-07-14	
Solids, Total Suspended	568	± 47	2.0	mg/L	2020-07-14	
<b>Total Metals</b>						
Sodium, total	84.8	± 15.5	0.10	mg/L	2020-07-15	

### Sample Qualifiers:

F2 The sample was not field-preserved with HNO<sub>3</sub> and was therefore preserved in the laboratory and held for at least 16 hours prior to analysis for total metals.

FILT The sample has been filtered for DP in the laboratory. Results may not reflect conditions at the time of sampling.

HT1 The sample was prepared and/or analyzed past the recommended holding time.

HT2 The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.

PRES Sample has been preserved for DP in the laboratory and the holding time has been extended.



## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Influent (ME12215) - EMS

**CARO WO# REPORTED** 0080489  
2020-09-03 12:55

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
<b>VWRC Influent (24hr Comp.) E228537 (0080489-02)   Matrix: Fresh Water   Sampled: 2020-08-04 00:00 To 2020-08-05 00:00</b>						
<b>Anions</b>						
Chloride	72.5	± 4.0	0.10	mg/L	2020-08-07	
Nitrate (as N)	< 0.010		0.010	mg/L	2020-08-07	
Nitrite (as N)	< 0.010		0.010	mg/L	2020-08-07	
Phosphate (as P)	4.91	± 0.85	0.0050	mg/L	2020-08-07	
<b>Calculated Parameters</b>						
Nitrate+Nitrite (as N)	< 0.0100		0.0100	mg/L	N/A	
Nitrogen, Total	63.0		2.00	mg/L	N/A	
Nitrogen, Organic	34.8		2.00	mg/L	N/A	
<b>General Parameters</b>						
Alkalinity, Total (as CaCO <sub>3</sub> )	279	± 15	1.0	mg/L	2020-08-10	
Alkalinity, Phenolphthalein (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-08-10	
Alkalinity, Bicarbonate (as CaCO <sub>3</sub> )	279		1.0	mg/L	2020-08-10	
Alkalinity, Carbonate (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-08-10	
Alkalinity, Hydroxide (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-08-10	
Ammonia, Total (as N)	28.2	± 2.5	0.050	mg/L	2020-08-10	
BOD, 5-day	528	± 113	2.0	mg/L	2020-08-12	
Conductivity (EC)	1110	± 27	2.0	µS/cm	2020-08-10	
Nitrogen, Total Kjeldahl	63.0	± 7.9	0.050	mg/L	2020-08-11	
pH	6.27	± 0.02	0.10	pH units	2020-08-10	HT2
Phosphorus, Total (as P)	9.16	± 1.02	0.0050	mg/L	2020-08-11	
Phosphorus, Total Dissolved	7.69	± 0.91	0.0050	mg/L	2020-08-11	
Solids, Total Suspended	304	± 25	2.0	mg/L	2020-08-09	
<b>Total Metals</b>						
Sodium, total	93.0	± 17.0	0.10	mg/L	2020-08-11	

### Sample Qualifiers:

HT2 The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Influent (ME12215) - EMS

**CARO WO# REPORTED** 0090600  
2020-09-11 16:04

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
<b>VWRC Influent (24hr Comp.) E228537 (0090600-01)   Matrix: Fresh Water   Sampled: 2020-09-02</b>						<b>F2, FILT, PRES</b>
<b>Anions</b>						
Chloride	73.0	± 4.1	0.10	mg/L	2020-09-05	
Nitrate (as N)	< 0.010		0.010	mg/L	2020-09-05	
Nitrite (as N)	< 0.010		0.010	mg/L	2020-09-05	
Phosphate (as P)	5.12	± 0.89	0.0050	mg/L	2020-09-05	
<b>Calculated Parameters</b>						
Nitrate+Nitrite (as N)	< 0.0100		0.0100	mg/L	N/A	
Nitrogen, Total	53.3		2.00	mg/L	N/A	
Nitrogen, Organic	27.2		2.00	mg/L	N/A	
<b>General Parameters</b>						
Alkalinity, Total (as CaCO <sub>3</sub> )	276	± 15	1.0	mg/L	2020-09-11	
Alkalinity, Phenolphthalein (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-09-11	
Alkalinity, Bicarbonate (as CaCO <sub>3</sub> )	276		1.0	mg/L	2020-09-11	
Alkalinity, Carbonate (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-09-11	
Alkalinity, Hydroxide (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-09-11	
Ammonia, Total (as N)	26.1	± 2.4	0.050	mg/L	2020-09-08	
BOD, 5-day	512	± 113	2.0	mg/L	2020-09-10	
Conductivity (EC)	973	± 23	2.0	µS/cm	2020-09-11	
Nitrogen, Total Kjeldahl	53.3	± 6.8	0.050	mg/L	2020-09-09	
pH	6.20	± 0.02	0.10	pH units	2020-09-11	HT2
Phosphorus, Total (as P)	9.52	± 1.06	0.0050	mg/L	2020-09-08	
Phosphorus, Total Dissolved	6.14	± 0.73	0.0050	mg/L	2020-09-08	
Solids, Total Suspended	338	± 27	2.0	mg/L	2020-09-09	
<b>Total Metals</b>						
Sodium, total	78.2	± 14.3	0.10	mg/L	2020-09-10	

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Influent (ME12215) - EMS

**CARO WO# REPORTED** 20J0833  
2020-10-16 10:16

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
<b>VWRC Influent (24hr Comp.) E228537 (20J0833-01)   Matrix: Fresh Water   Sampled: 2020-10-06 00:00 To 2020-10-07 00:00</b>						FILT, PRES
<b>Anions</b>						
Chloride	69.1	± 3.8	0.10	mg/L	2020-10-11	
Nitrate (as N)	< 0.010		0.010	mg/L	2020-10-11	HT1
Nitrite (as N)	0.011	± 0.002	0.010	mg/L	2020-10-11	HT1
Phosphate (as P)	4.26	± 0.74	0.0050	mg/L	2020-10-11	HT1
<b>Calculated Parameters</b>						
Nitrate+Nitrite (as N)	0.0113		0.0100	mg/L	N/A	
Nitrogen, Total	59.1		2.00	mg/L	N/A	
Nitrogen, Organic	25.0		2.00	mg/L	N/A	
<b>General Parameters</b>						
Alkalinity, Total (as CaCO <sub>3</sub> )	286	± 16	1.0	mg/L	2020-10-14	
Alkalinity, Phenolphthalein (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-10-14	
Alkalinity, Bicarbonate (as CaCO <sub>3</sub> )	286		1.0	mg/L	2020-10-14	
Alkalinity, Carbonate (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-10-14	
Alkalinity, Hydroxide (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-10-14	
Ammonia, Total (as N)	34.0	± 3.1	0.050	mg/L	2020-10-10	
BOD, 5-day	459	± 101	2.0	mg/L	2020-10-15	
Conductivity (EC)	1060	± 25	2.0	µS/cm	2020-10-14	
Nitrogen, Total Kjeldahl	59.1	± 7.5	0.050	mg/L	2020-10-15	
pH	6.24	± 0.02	0.10	pH units	2020-10-14	HT2
Phosphorus, Total (as P)	8.68	± 0.96	0.0050	mg/L	2020-10-14	
Phosphorus, Total Dissolved	5.14	± 0.61	0.0050	mg/L	2020-10-14	
Solids, Total Suspended	324	± 26	2.0	mg/L	2020-10-14	
<b>Total Metals</b>						
Sodium, total	84.0	± 15.4	0.10	mg/L	2020-10-15	

### Sample Qualifiers:

FILT The sample has been filtered for TDP in the laboratory. Results may not reflect conditions at the time of sampling.

HT1 The sample was prepared and/or analyzed past the recommended holding time.

HT2 The 15 minute recommended holding time (from sampling to analysis) has been exceeded — field analysis is recommended.

PRES Sample has been preserved for TDP in the laboratory and the holding time has been extended.

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Influent (ME12215) - EMS

**CARO WO# REPORTED** 20K0771  
2020-11-13 17:04

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
<b>VWRC Influent (24hr Comp.) E228537 (20K0771-01)   Matrix: Fresh Water   Sampled: 2020-11-04 00:00 To 2020-11-05 00:00</b>						FILT, PRES
<b>Anions</b>						
Chloride	70.6	± 3.9	0.10	mg/L	2020-11-09	
Nitrate (as N)	< 0.010		0.010	mg/L	2020-11-09	HT1
Nitrite (as N)	< 0.010		0.010	mg/L	2020-11-09	HT1
Phosphate (as P)	2.77	± 0.48	0.0050	mg/L	2020-11-09	HT1
<b>Calculated Parameters</b>						
Nitrate+Nitrite (as N)	< 0.0100		0.0100	mg/L	N/A	
Nitrogen, Total	52.2		2.00	mg/L	N/A	
Nitrogen, Organic	22.4		2.00	mg/L	N/A	
<b>General Parameters</b>						
Alkalinity, Total (as CaCO <sub>3</sub> )	193	± 11	1.0	mg/L	2020-11-13	
Alkalinity, Phenolphthalein (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-11-13	
Alkalinity, Bicarbonate (as CaCO <sub>3</sub> )	193		1.0	mg/L	2020-11-13	
Alkalinity, Carbonate (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-11-13	
Alkalinity, Hydroxide (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-11-13	
Ammonia, Total (as N)	29.8	± 2.7	0.050	mg/L	2020-11-09	
BOD, 5-day	659	± 149	2.0	mg/L	2020-11-11	
Conductivity (EC)	764	± 18	2.0	µS/cm	2020-11-13	
Nitrogen, Total Kjeldahl	52.2	± 6.7	0.050	mg/L	2020-11-13	
pH	6.19	± 0.02	0.10	pH units	2020-11-13	HT2
Phosphorus, Total (as P)	8.20	± 0.91	0.0050	mg/L	2020-11-12	
Phosphorus, Total Dissolved	5.34	± 0.63	0.0050	mg/L	2020-11-12	
Solids, Total Suspended	302	± 25	2.0	mg/L	2020-11-10	
<b>Total Metals</b>						
Sodium, total	62.7	± 11.5	0.10	mg/L	2020-11-11	

### Sample Qualifiers:

FILT	The sample has been filtered for TDP in the laboratory. Results may not reflect conditions at the time of sampling.
HT1	The sample was prepared and/or analyzed past the recommended holding time.
HT2	The 15 minute recommended holding time (from sampling to analysis) has been exceeded — field analysis is recommended.
PRES	Sample has been preserved for TDP in the laboratory and the holding time has been extended.



## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Influent (ME12215) - EMS

**CARO WO# REPORTED** 20L0460  
2020-12-09 16:41

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
<b>VWRC Influent (24hr Comp.) E228537 (20L0460-01)   Matrix: Fresh Water   Sampled: 2020-12-02 00:00 To 2020-12-03 00:00</b>						F2, FILT, PRES
<b>Anions</b>						
Chloride	81.0	± 4.5	0.10	mg/L	2020-12-05	
Nitrate (as N)	< 0.010		0.010	mg/L	2020-12-05	
Nitrite (as N)	< 0.010		0.010	mg/L	2020-12-05	
Phosphate (as P)	3.60	± 0.63	0.0050	mg/L	2020-12-05	
<b>Calculated Parameters</b>						
Nitrate+Nitrite (as N)	< 0.0100		0.0100	mg/L	N/A	
Nitrogen, Total	57.9		2.00	mg/L	N/A	
Nitrogen, Organic	26.4		2.00	mg/L	N/A	
<b>General Parameters</b>						
Alkalinity, Total (as CaCO <sub>3</sub> )	256	± 14	1.0	mg/L	2020-12-09	
Alkalinity, Phenolphthalein (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-12-09	
Alkalinity, Bicarbonate (as CaCO <sub>3</sub> )	256		1.0	mg/L	2020-12-09	
Alkalinity, Carbonate (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-12-09	
Alkalinity, Hydroxide (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-12-09	
Ammonia, Total (as N)	31.5	± 2.8	0.050	mg/L	2020-12-04	
BOD, 5-day	761	± 155	2.0	mg/L	2020-12-09	
Conductivity (EC)	1090	± 26	2.0	µS/cm	2020-12-09	
Nitrogen, Total Kjeldahl	57.9	± 7.3	0.050	mg/L	2020-12-08	
pH	6.12	± 0.02	0.10	pH units	2020-12-09	HT2
Phosphorus, Total (as P)	9.81	± 1.09	0.0050	mg/L	2020-12-07	
Phosphorus, Total Dissolved	6.78	± 0.80	0.0050	mg/L	2020-12-07	
Solids, Total Suspended	289	± 22	2.0	mg/L	2020-12-06	
<b>Total Metals</b>						
Sodium, total	84.4	± 15.4	0.10	mg/L	2020-12-06	

### Sample Qualifiers:

- F2 The sample was not field-preserved with HNO<sub>3</sub> and was therefore preserved in the laboratory and held for at least 16 hours prior to analysis for total metals.
- FILT The sample has been filtered for TDP in the laboratory. Results may not reflect conditions at the time of sampling.
- HT2 The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.
- PRES Sample has been preserved for TDP in the laboratory and the holding time has been extended.

# Appendix B

## *Discharge Plan*

*Associated Environmental*



Associated  
Environmental

Associated Environmental Consultants Inc.  
Suite 200, 2800 29 Street  
Vernon, B.C., Canada, V1T 9P9

November 3, 2020  
File: 2020-8739.000

TEL: 250.545.3672  
FAX: 250.545.3654  
www.ae.ca | ISO 9001 & 14001 Certified

Serge Kozin  
Manager, Vernon Water Reclamation Centre  
City of Vernon  
1900 48th Ave  
Vernon, BC V1T 8Y7

**Re: PROJECTED LEVELS OF MACKAY RESERVOIR FOR WINTER 2020/2021 & PLANNED  
DISCHARGE TO OKANAGAN LAKE (OC#12215)**

Dear Mr. Kozin:

Associated Environmental Consultants Inc. (Associated) has prepared this letter for the City of Vernon (the City) to summarize the projected levels of MacKay Reservoir before the start of the 2021 irrigation season. This work was completed to support the City's notification to the Ministry of Environment and Climate Change Strategy (ENV) of a planned discharge to Okanagan Lake, as authorized under Operational Certificate ME 12215.

## **1 BACKGROUND**

Under Operational Certificate ME 12215 (the OC), the City is authorized to store municipal wastewater that has been treated to an advanced (tertiary) level at the Vernon Water Reclamation Centre (VWRC) in the MacKay Reservoir and beneficially reuse the reclaimed water for irrigation purposes. Section 3.3b of the OC also authorizes discharge to Okanagan Lake via the deep lake outfall when the elevation of MacKay Reservoir:

- exceeds 1935 feet above mean sea level (fasl); and
- is projected to exceed 1939 fasl prior to the start of the next irrigation season (MOE 2008).

In this scenario, the City must notify ENV by providing a discharge plan at least 60 days in advance of any lake discharge. Based on current reservoir levels and average historic influent flows to the VWRC, the City anticipates this condition will occur in winter 2020/2021. The City has retained Associated to review the available data, forecast reservoir levels, and prepare this letter for the City to submit to ENV as part of their notification.

Substantial work was completed in 2019, prior to the 2020 lake discharge, to provide the basis for the estimates presented herein and the rationale and challenges associated with maintaining the levels of MacKay Reservoir through irrigation alone (Urban Systems 2019, City of Vernon 2019). Therefore, the purpose of this letter is solely to document the projected reservoir levels and the allowable discharge volume, as required under OC Section 3.3b.



## 2 PROJECTED RESERVOIR LEVELS

The dates at which reservoir levels are anticipated to reach 1935 fasl and 1939 fasl were estimated based on a simple water balance method, following the approach used in 2019 (Urban Systems 2019, City of Vernon 2019). Weekly historical and current (as of October 21, 2020) reservoir levels were provided by the City. The inflow volume to MacKay Reservoir was estimated based on average historical influent flows to the VWRC (provided by the City)<sup>1</sup>. No output from MacKay Reservoir was considered, as reclaimed water is only extracted from the reservoir during the irrigation months. A stage-storage curve, obtained from Urban Systems (2019), was used to relate reservoir levels with reservoir storage.

Estimates of mean monthly and annual evaporation and precipitation directly from/to MacKay Reservoir for the 1981-2010 climate normal period were obtained from Climate BC (Wang et al. 2016). Based on the analysis, the influence of evaporation and direct precipitation on MacKay Reservoir volumes were deemed to be negligible and did not affect the likelihood of MacKay Reservoir exceeding the OC trigger levels before the start of the next irrigation season. Therefore, effects of evaporation and direct precipitation are not included herein.

Table 1 presents the input parameters and projected levels, and Figure 1 (attached) shows the projected reservoir levels and trigger thresholds.

**Table 1: Reservoir Level Projections for Winter 2020/2021**

Parameter	Unit	Result
Current reservoir elevation as of Oct. 21, 2020	fasl	1930.8
Estimated current reservoir volume at 1930.80 fasl <sup>1</sup>	ML	7,765
Estimated daily reservoir inflow (average influent to the VWRC) <sup>2</sup>	ML/day	12.4
Estimated reservoir volume at 1935 fasl <sup>1</sup>	ML	8,634
Available volume before reaching 1935 fasl (from current)	ML	869
Number of days until 1935 fasl is reached <sup>3</sup>	Days	~70
<b>Projected date at which 1935 fasl is reached</b>	Date	<b>~December 30, 2020</b>
Estimated reservoir volume at 1939 fasl <sup>1</sup>	ML	9,498
Available volume before reaching 1939 fasl (from current)	ML	1,733
Number of days until 1939 fasl is reached <sup>3</sup>	Days	~140
<b>Projected date at which 1939 fasl is reached</b>	Date	<b>~March 10, 2021</b>

Notes:

<sup>1</sup> Based on stage-storage curve from Urban Systems (2019).

<sup>2</sup> Represents the average daily influent volume from Jan 1, 2007 to Sept 30, 2020.

<sup>3</sup> Assuming an average daily input of 12.4 ML/day

<sup>1</sup> Based on the assumption that all flows entering the VWRC exit the VWRC, consistent with the 2019 approach (City of Vernon 2019). We understand there is no effluent flow meter.

The irrigation season start date varies by year, but typically begins in May (between 2017 and 2020, irrigation start dates ranged from May 8 to May 31). Therefore, **current projections indicate that 1939 fasl will be reached approximately two months (i.e., March 10, 2021) before the start of the next irrigation season.**

### 3 ALLOWABLE DISCHARGE VOLUME

When these conditions are met, OC Section 3.3b authorizes the City to discharge '*150% of the volume of reclaimed water necessary to prevent MacKay Reservoir from exceeding 1939 feet prior to the start of the irrigation season*'. Following the agreed approach with ENV in 2019, which is based on the trigger levels of 1935 and 1939 fasl in the OC<sup>2</sup>, we understand that the allowable discharge volume is calculated as:

$$(\text{MacKay Reservoir Volume at 1939 fasl} - \text{MacKay Reservoir Volume at 1935 fasl}) * 1.5$$

$$(9,498 \text{ ML} - 8,634 \text{ ML}) * 1.5 = \mathbf{1,296 \text{ ML}}$$

### 4 DISCHARGE PLAN

Based on the above calculations, and discussions with the City, we understand that the City's proposed discharge plan is as follows:

- Continue to monitor the reservoir level weekly.
- Discharge the full capacity (i.e., average of 12.4 ML/day) of the VWRC via the deep lake outfall once the elevation of MacKay Reservoir exceeds 1935 fasl and the 60-day notification period to ENV has been met.
- Continue to discharge to the deep lake outfall until the maximum allowable volume (calculated to be 1,296 ML) has been reached.
- Utilize reclaimed water for irrigation purposes when the irrigation season begins, following the OC requirements.

The City must meet all other requirements in the OC that pertain to the lake discharge including (but not limited to) meeting the discharge quantity (OC Sections 3.1 and 3.7) and quality limits (OC Section 3.8), conducting the required reclaimed water and Okanagan Lake sampling (OC Sections 8.5 and 8.8), and assessing nutrient loading to Okanagan Lake (OC Section 9.3.3).

<sup>2</sup> Kozin, S. Manager, Vernon Water Reclamation Centre. October 30, 2020. Personal communication (telephone conversation) with Nicole Penner of Associated.

**5 CLOSURE**

Please contact the undersigned at 250-545-3672 if you have any questions regarding the content of this letter.

Yours truly,



Nicole Penner, P.Ag.  
Environmental Scientist



Lawrence Bird, M.Sc.  
Environmental Scientist

**References:**

- British Columbia Ministry of Environment (MOE). 2008. Operational Certificate ME 12215. Issued to the Corporation of the City of Vernon. Date issued: October 31, 1997. Date amended: January 14, 2008.
- British Columbia Ministry of Environment and Climate Change Strategy (ENV). 2019. Re: Discharge Plan to Lake Okanagan During Winter 2019/2020. December 19, 2019.
- City of Vernon. 2019. Discharge Plan to Lake Okanagan during Winter 2019/2020. Submitted to Mr Bryan Vroom, Section Head Authorizations, Ministry of Environment and Climate Change Strategy. October 31, 2019.
- Urban Systems. 2019. Spray Irrigation Supply Conditions Review and Forecast for Use of Lake Outfall. Submitted to the City of Vernon. October 17, 2019.
- Wang T., Hamann A., Spittlehouse D., Carroll C. 2016. Locally Downscaled and Spatially Customizable Climate Data for Historical and Future Periods for North America. PLoS ONE 11(6): e0156720. doi:10.1371/journal.pone.0156720. [http://www.climatewna.com/ClimateBC\\_Map.aspx](http://www.climatewna.com/ClimateBC_Map.aspx)

**Attachments:**

Figure 1: Projected Reservoir Levels

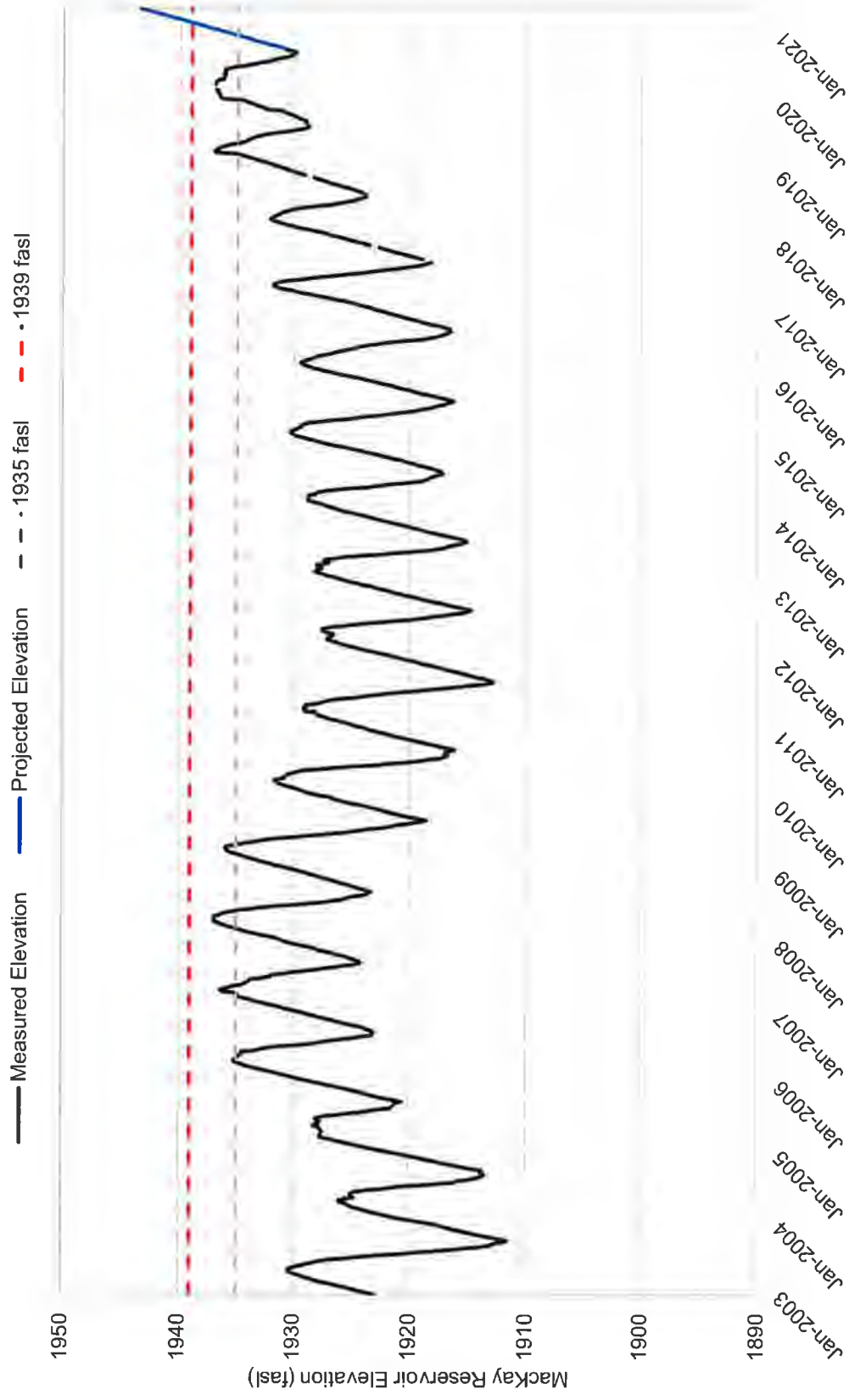


Figure 1: Historical and projected elevations of MacKay Reservoir (assuming no lake discharge)

File: 5350 Deep Lake Outfall

October 31, 2019

Mr. Bryan Vroom, Section Head Authorizations  
Ministry of Environment and Climate Change Strategy  
2080 A Labieux Road  
Nanaimo, BC V9T 6J9

Dear Mr. Vroom:

**RE: Discharge Plan to Lake Okanagan during Winter 2019/2020**

Vernon's *operational certificate* stipulates the requirements for operation of the Vernon Water Reclamation Centre (VWRC) including the spray irrigation program and any discharge to Okanagan Lake.

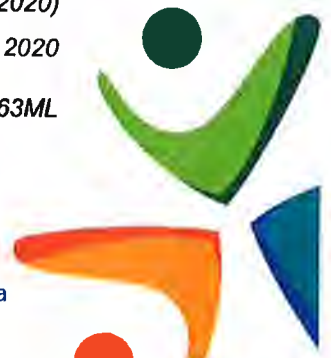
Generally, the operation of the spray irrigation system and the need to utilize the outfall is subject to two interconnected driving forces: the need and demand for irrigation supply based on customer usage, and, the amount of precipitation during the irrigation season. When irrigation demands are low and precipitation is high in any given year, the level in the Mackay Reservoir does not draw down adequately, putting greater pressure on the next irrigation season to make up the extra supply. When these oversupply conditions occur in back-to-back years, such as in 1996 and 1997, and similarly over the last three years (2017 through 2019), there is a heightened potential that reservoir levels will either exceed 1935 or 1939 feet above sea level (fasl). The operational certificate stipulates these two elevations as the trigger to consider, prepare and execute discharge plans.

At present, the top water elevation of the Mackay Reservoir is just over 1929 fasl. The last time the reservoir was 1929 fasl or greater at the end of irrigation season was in 1997. The City utilized the lake outfall the following spring, in 1998. Based on current storage volumes and average influent flows to the VWRC, the City will require use of the outfall prior to start of the 2020 irrigation season.

Table 1 outlines key supply conditions as of October 7, 2019 and the inputs to developing the forecast for use of the outfall to Okanagan Lake.

**Table 1: Storage and Flow Conditions for Forecasting**

<b>Forecast Condition</b>	<b>Finding</b>
Current Volume of Stored Water	7,401ML
Remaining Volume to elev. 1939 fasl	2,097ML
Avg. Influent to VWRC over last 2 Years	12.3ML/day
Days until start of next irrigation season	~207
Number of days of influent to reach elev. 1939 fasl (not including evaporation, infiltration or runoff)	~167 days (around March 19, 2020)
Forecast date for reaching elev. 1935 fasl	~January 20, 2020
Volume difference between elev. 1935 fasl and 1939 fasl	863ML



If runoff conditions this upcoming spring are like that of 2017, the impounded volume at Mackay can increase by 25% or more (in terms of depth during the runoff period) over the influent rate from VWRC. The result of the additional flows could advance the date to reach 1939 fasl by one week or more.

Regarding year-over-year spray irrigation balances, the trend in irrigation supply and demand suggests there is likely to be excess reclaimed water in the upcoming year (2020) for a fourth consecutive year, resulting in a net increase in stored volume at Mackay. For example, at average daily influent rates, the VWRC treats an estimated 4,490ML of reclaimed water each year. Yet the total irrigation demand in 2017 and 2018 was 4,141ML and 3,377ML, respectively (statistics for 2019 are still being calculated however the total volume is expected to be like the results of 2017 and 2018). Aside from precipitation during the irrigation season, it is important to note that prior to 2010, anecdotal reports of over-irrigation led to concerns of runoff from irrigation-served properties to neighboring lands. Since then and via the 2014 Liquid Waste Management Plan, there is an appropriate tone for beneficial reuse which shows a better alignment of irrigation demands with crop needs, thereby preventing runoff. Overall, the supply-demand imbalance over the last few years is a consistent trend. In 2017 and 2018, there was an imbalance of approximately 1,470ML or a depth impact of 8-10 feet in the reservoir. Given these supply conditions, there must be further consideration in this discharge plan to avoid a real risk of unnecessarily creating two discharge plans in the same calendar year.

In light of the above, the City proposes that the discharge during winter/spring 2020 recognize that annual supply outweighs demand and it is preferred to reposition the elevation in the reservoir at the end of the 2020 irrigation season (i.e. this time next year) near 1915 fasl. When the volume of the reservoir is around 1915 fasl at the end of an irrigation season, the storage conditions are closer to that of mid-volume (of the total) and more aligned with the year-over-year balancing required for the foreseeable future. For note, 19 of the last 30 years saw the reservoir elevation at the end of irrigation season below 1920 fasl.

Therefore, the proposed discharge plan for 2020 is to:

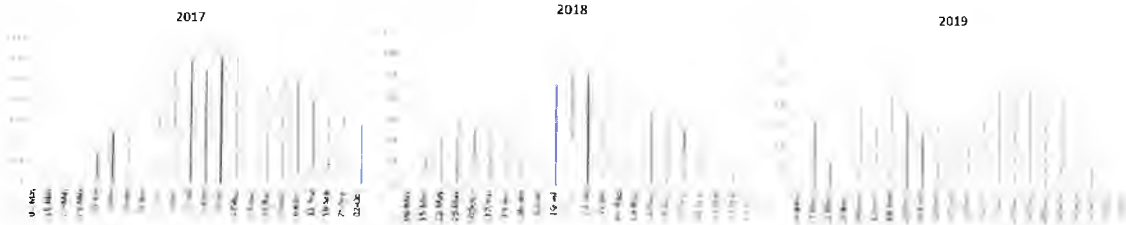
- release the full capacity of the plant once 1935 fasl is achieved, projected to occur around January 20, 2020;
- maintain an average release rate in line with the influent to the plant around 12.3 ML/day, which ensures the reservoir does not significantly exceed 1935 fasl nor does it reach 1939 fasl;
- allow the reservoir to drawdown from irrigation demands (gradual drop from 1935 fasl) throughout the growing season, projected to begin the first week of May 2020;
- maintain release to the outfall throughout the irrigation season at full plant capacity (there will be a <10% drop in lake discharge rate during the irrigation season as one of the system customers pulls directly from a plant distribution main rather than from the Mackay system);
- maintain a constant release from January 20, 2020 to October 7, 2020, which when coupled with a 3,600ML irrigation demand volume (average over the last 3 years) will realize a top water elevation in the reservoir near 1915 fasl - a key position for the start of winter refill, 2020;
- develop and implement a plan for discharge quality, and quantity monitoring, guided by the *operational certificate* and configured to suit present-day monitoring programming (of the City and others); and,
- maintain effluent quality to comply with the parameters of the operational certificate and will not exceed 1.2 tonnes of phosphorus loading to the Lake (over the duration of discharge).

The rationale for this discharge plan is to:

- a) recognize the trigger elevation for potential discharge of effluent via the outfall,
- b) avoid reaching 1939 fasl at any point in the year,
- c) prevent reaching 1935 multiple times in the same year (i.e. once in spring and again in fall),
- d) meet or exceed the effluent quality parameters for use of the outfall including a resulting phosphorus loading less than 1.2 tonnes; and,
- e) reposition the reservoir elevation near mid-volume to better accommodate the supply-demand deficit forecast for this and subsequent years.

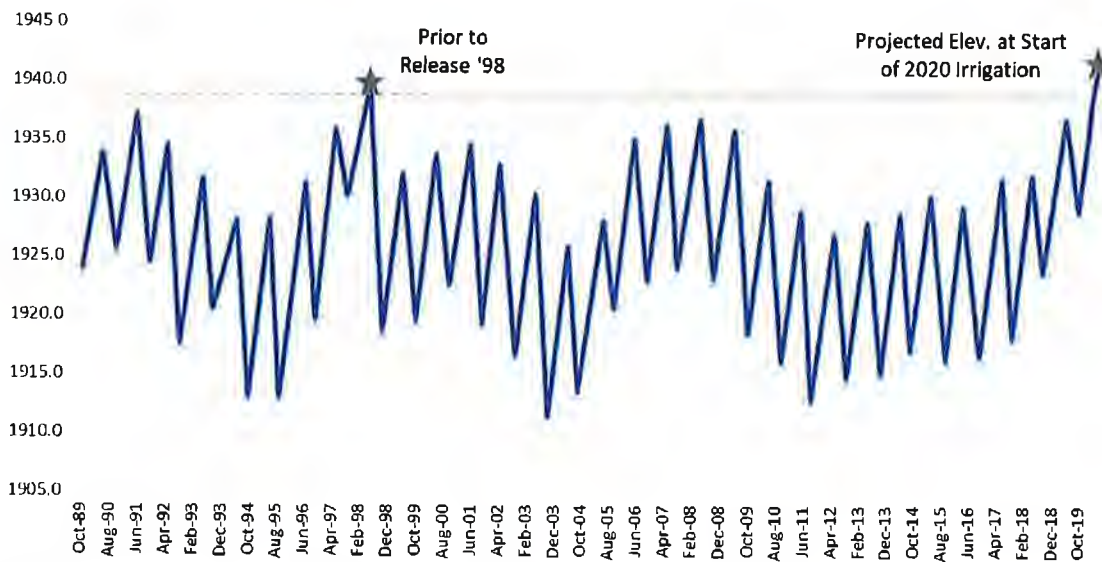
## Background Information

- Demand rates are measured at three junctions all located downstream of the reservoir. Figure 1 illustrates VVRC influent flow over the past two years. Figure 3 illustrates the weekly demands for spray irrigation for 2017, 2018 and 2019 (so far).



- Year-over-year weather trends and other precipitation considerations have a significant impact on the supply and demand balance. The last release to Okanagan Lake occurred in 1998 following:
  - o back-to-back years of low irrigation seasons in 1996 and 1997 due to the wet-weather and above normal precipitation conditions, coupled with
  - o high influent rates to the plant and Mackay Reservoir partly due to extraordinary inflow and infiltration throughout the City network) coupled with.

- Figure 4 illustrates the historical rise and fall of water elevations in Mackay Reservoir.



- If irrigation demands remain low and precipitation is considered higher than average, and this occurs for multiple years, there is an increased likelihood of exceeding the 1939 water elevation which triggers use of the lake outfall, typically in spring just before the start of irrigation.

Upon confirmation by the Ministry, this proposed plan for discharge would start once the reservoir level reaches 1935 fasl, which is projected to occur around January 20, 2020 and continue through to October 7, 2020.

Sincerely,



Will Pearce  
Chief Administrative Officer

*Encl: Sample Background Information*

cc: Shirley Koenig, Director of Operations  
Ehren Lee, Joanne Quarmby, Urban Systems  
Melanie Mamoser, Ministry of Environment and Climate Change Strategy

## Appendix C

### *30-Day Effluent Results*

*Caro Analytical Services*

# 30 Day Effluent Results Prior to Lake Discharge

2020	BOD <sub>5</sub>	TSS	pH	Total Phosphorus	Total Dissolved Phosphorus	Ortho Phosphorus	Total Nitrogen	Organic Nitrogen	Ammonia Nitrogen	Nitrate Nitrogen	Nitrite Nitrogen	Total Kjeldahl Nitrogen	Sodium	Chloride	Conductivity	Fecal Bacteria	Total Coliform Bacteria
	(mg/L)	(mg/L)	pH units	(mg/L as P)	(mg/L as P)	(mg/L as P)	(mg/L as N)	(mg/L as N)	(mg/L as N)	(mg/L as N)	(mg/L as N)	(mg/L as N)	(mg/L)	(mg/L)	µs/cm	MPN/100ml	MPN/100ml
7-Jan	3.7	<2.0	7.72	0.169	0.131	0.0062	5.09	1.26	0.059	3.71	0.054	1.32	81.5	77.0	621	3.6	36
8-Jan	4.2	<2.0	7.57	0.158	0.123	0.0089	5.14	1.47	0.075	3.51	0.081	1.55	88.6	93.5	734	<1.0	1.0
9-Jan	6.8	<2.0	7.53	0.158	0.113	0.0087	4.08	1.33	0.049	2.66	0.048	1.38	103.0	106.0	789	>1.0	2.0
10-Jan	<1.1	2.0	7.76	0.192	0.156	0.0159	3.98	1.58	0.068	2.29	0.05	1.64	93.8	97.5	743	<1.0	1.0
11-Jan	6.8	<2.5	7.67	0.170	0.112	0.0103	4.79	1.54	0.115	3.04	0.098	1.65	87.3	87.7	675	<1.0	1.0
12-Jan	<1.2	<2.0	7.54	0.154	0.104	0.0097	4.97	1.32	0.204	3.33	0.112	1.53	86.1	81.8	668	<3.0	3.6
13-Jan	<1.2	2.0	7.48	0.127	0.081	0.0095	6.58	1.48	0.399	4.54	0.152	1.88	75.8	79.8	631	<3.0	3.6
14-Jan	<1.0	2.6	7.37	0.143	0.078	0.0080	5.31	1.56	0.167	3.50	0.082	1.72	75.3	79.7	610	1.0	8.4
15-Jan	<1.0	2.8	7.40	0.212	0.084	0.0090	4.73	1.48	0.166	2.99	0.090	1.65	73.2	80.9	616	1.0	8.5
16-Jan	2.8	3.8	7.49	0.206	0.115	0.0150	4.27	1.52	0.150	2.51	0.087	1.67	76.1	81.0	635	<1.0	3.0
17-Jan	6.7	2.6	7.52	0.182	0.095	0.0598	4.29	1.61	0.093	2.58	0.023	1.71	70.0	85.2	627	<1.0	6.3
18-Jan	8.1	3.8	7.60	0.209	0.108	0.0515	4.70	1.77	0.125	2.74	0.066	1.90	73.5	86.2	644	1.0	13.0
19-Jan	6.5	3.8	7.70	0.193	0.109	0.0344	5.91	1.62	0.492	3.68	0.121	2.11	82.0	85.3	661	1.0	8.4
20-Jan	2.5	3.0	7.59	0.148	0.072	0.0238	7.15	1.82	0.755	4.44	0.120	2.58	71.5	86.7	644	1.0	4.1
21-Jan	2.3	2.2	7.47	0.156	0.076	0.0059	5.99	1.62	0.205	4.07	0.091	1.82	80.4	91.7	652	1.0	1.0
22-Jan	2.2	2.6	7.51	0.144	0.077	0.0540	4.77	1.51	0.078	3.15	0.035	1.58	86.8	98.5	663	<1.0	3.1
23-Jan	8.0	2.8	7.72	0.138	0.082	<0.0050	3.80	1.53	0.036	2.24	<0.010	1.57	88.7	98.4	690	11.0	53.8
24-Jan	8.6	<2.0	7.66	0.124	0.073	<0.0050	3.83	1.40	0.047	2.35	0.035	1.45	80.5	102.0	694	2.0	28.2
25-Jan	9.3	3.2	7.74	0.148	0.094	0.0415	5.00	1.56	0.205	3.12	0.105	1.77	86.1	100.0	733	1.0	3.0
26-Jan	<1.1	3.0	7.71	0.097	0.051	<0.0050	5.47	1.27	0.489	3.62	0.097	1.76	82.9	98.5	772	1.0	5.2
27-Jan	<1.1	<2.0	7.62	0.084	0.042	<0.0050	6.80	1.24	1.040	4.44	0.081	2.28	76.6	89.4	725	1.0	2.0
28-Jan	<1.0	<2.0	7.81	0.111	0.040	<0.0050	5.67	1.46	0.223	3.94	0.048	1.68	78.1	87.4	756	<1.0	<1.0
29-Jan	<1.0	<2.0	7.84	0.119	0.065	<0.0050	4.95	1.33	0.287	3.26	0.071	1.62	97.9	97.9	806	<1.0	1.0
30-Jan	<1.1	<4.0	7.92	0.154	0.065	0.0130	5.02	1.87	0.184	2.92	0.047	2.06	87.0	96.7	679	<1.0	6.2
31-Jan	<1.1	<4.0	7.98	0.153	0.073	0.0118	4.89	1.53	0.263	3.03	0.062	1.80	92.3	90.0	697	7.5	236
1-Feb	<1.1	<4.0	7.94	0.139	0.109	0.0074	6.06	1.57	0.926	3.48	0.080	2.50	96.4	89.8	692	<1.8	2
2-Feb	<1.0	<2.6	7.87	0.119	0.071	0.0098	7.09	1.46	1.680	3.88	0.063	3.14	90.9	82.8	673	1.0	30.5
3-Feb	<1.0	<2.3	7.90	0.095	0.062	0.0094	9.16	3.32	1.450	4.37	0.035	4.76	76.7	78.9	673	9.7	51.2
4-Feb	<1.0	<2.0	7.96	0.089	0.055	0.0067	6.76	1.23	1.230	4.26	0.029	2.46	82.4	81.2	659	1.0	2.0
5-Feb	<1.1	<2.0	7.86	0.095	0.056	0.0063	6.25	1.59	0.682	3.95	0.028	2.28	87.2	82.7	666	<1.0	2.0
6-Feb	<1.2	2.0	7.85	0.123	0.078	0.0069	5.99	1.39	0.736	3.83	0.031	2.12	82.6	91.6	696	<1.0	<1.0
7-Feb	<1.2	<2.0	7.89	0.110	0.080	0.0075	6.28	1.48	0.789	3.97	0.036	2.27	91.2	92.5	698	1.0	1.0



## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0010246  
2020-01-14 15:24

Analyte	Result	RL	Units	Analyzed	Qualifier
---------	--------	----	-------	----------	-----------

**VWRC Treated Effluent (FFE) Grab - E229578 (0010246-04) | Matrix: Wastewater | Sampled: 2020-01-07 08:30**

### Microbiological Parameters

Coliforms, Total (MPN)	36	3.0	MPN/100 mL	2020-01-07	
Coliforms, Fecal (MPN)	3.6	3.0	MPN/100 mL	2020-01-07	

### Sample Qualifiers:

FILT	The sample has been filtered for DP in the laboratory. Results may not reflect conditions at the time of sampling.
HT2	The 15 minute recommended holding time (from sampling to analysis) has been exceeded – field analysis is recommended.
PRES	Sample has been preserved for DP in the laboratory and the holding time has been extended.

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0010246  
2020-01-14 15:24

Analyte	Result	RL	Units	Analyzed	Qualifier
<b>VWRC Final Treated Effluent 24hr Comp. - E105004 (0010246-02)   Matrix: Wastewater   Sampled: 2020-01-06 00:00 To 2020-01-07 00:00</b>					FILT, PRES
<b>Anions</b>					
Chloride	77.0	0.10	mg/L	2020-01-07	
Nitrate (as N)	3.71	0.010	mg/L	2020-01-07	
Nitrite (as N)	0.054	0.010	mg/L	2020-01-07	
Phosphate (as P)	0.0062	0.0050	mg/L	2020-01-07	
<b>Calculated Parameters</b>					
Nitrate+Nitrite (as N)	3.76	0.0100	mg/L	N/A	
Nitrogen, Total	5.09	0.0500	mg/L	N/A	
Nitrogen, Organic	1.26	0.0500	mg/L	N/A	
<b>General Parameters</b>					
Ammonia, Total (as N)	0.059	0.020	mg/L	2020-01-09	
BOD, 5-day	3.7	2.0	mg/L	2020-01-13	
Conductivity (EC)	621	2.0	µS/cm	2020-01-09	
Nitrogen, Total Kjeldahl	1.32	0.050	mg/L	2020-01-09	
pH	7.72	0.10	pH units	2020-01-09	HT2
Phosphorus, Total (as P)	0.169	0.0020	mg/L	2020-01-09	
Phosphorus, Total Dissolved	0.131	0.0020	mg/L	2020-01-09	
Solids, Total Suspended	< 2.0	2.0	mg/L	2020-01-09	
<b>Total Metals</b>					
Sodium, total	81.5	0.10	mg/L	2020-01-09	

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0010468  
2020-01-15 15:17

Analyte	Result	RL	Units	Analyzed	Qualifier
<b>VWRC Treated Effluent (FFE) Grab - E229578 (0010468-03)   Matrix: Wastewater   Sampled: 2020-01-08 14:00</b>					
<b>Microbiological Parameters</b>					
Coliforms, Total	1.0	1.0	MPN/100 mL	2020-01-09	
Coliforms, Fecal	< 1.0	1.0	MPN/100 mL	2020-01-09	



## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0010468  
2020-01-15 15:17

Analyte	Result	RL	Units	Analyzed	Qualifier
<b>VWRC Final Treated Effluent - 24hr Comp. - E105004 (0010468-01)   Matrix: Wastewater   Sampled: 2020-01-07 00:00 To 2020-01-08 00:00</b>					FILT, PRES
<b>Anions</b>					
Chloride	93.5	0.10	mg/L	2020-01-10	
Nitrate (as N)	3.51	0.010	mg/L	2020-01-09	
Nitrite (as N)	0.081	0.010	mg/L	2020-01-09	
Phosphate (as P)	0.0099	0.0050	mg/L	2020-01-09	
<b>Calculated Parameters</b>					
Nitrate+Nitrite (as N)	3.59	0.0100	mg/L	N/A	
Nitrogen, Total	5.14	0.0500	mg/L	N/A	
Nitrogen, Organic	1.47	0.0500	mg/L	N/A	
<b>General Parameters</b>					
Ammonia, Total (as N)	0.075	0.020	mg/L	2020-01-10	
BOD, 5-day	4.2	2.0	mg/L	2020-01-15	
Conductivity (EC)	734	2.0	µS/cm	2020-01-10	
Nitrogen, Total Kjeldahl	1.55	0.050	mg/L	2020-01-11	
pH	7.57	0.10	pH units	2020-01-10	HT2
Phosphorus, Total (as P)	0.158	0.0020	mg/L	2020-01-11	
Phosphorus, Total Dissolved	0.123	0.0020	mg/L	2020-01-11	
Solids, Total Suspended	< 2.0	2.0	mg/L	2020-01-10	
<b>Total Metals</b>					
Sodium, total	88.6	0.10	mg/L	2020-01-12	



## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0010468  
2020-01-15 15:17

Analyte	Result	RL	Units	Analyzed	Qualifier
---------	--------	----	-------	----------	-----------

**VWRC Treated Effluent (FFE) Grab - E229578 (0010468-04) | Matrix: Wastewater | Sampled: 2020-01-09 08:00**

### Microbiological Parameters

Coliforms, Total	2.0	1.0	MPN/100 mL	2020-01-09	
Coliforms, Fecal	< 1.0	1.0	MPN/100 mL	2020-01-09	

### Sample Qualifiers:

FILT	The sample has been filtered for DP in the laboratory. Results may not reflect conditions at the time of sampling.
HT2	The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.
PRES	Sample has been preserved for DP in the laboratory and the holding time has been extended.

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0010468  
2020-01-15 15:17

Analyte	Result	RL	Units	Analyzed	Qualifier
<b>VWRC Final Treated Effluent - 24hr Comp. - E105004 (0010468-02)   Matrix: Wastewater   Sampled: 2020-01-08 00:00 To 2020-01-09 00:00</b>					FILT, PRES
<b>Anions</b>					
Chloride	106	0.10	mg/L	2020-01-10	
Nitrate (as N)	2.66	0.010	mg/L	2020-01-09	
Nitrite (as N)	0.048	0.010	mg/L	2020-01-09	
Phosphate (as P)	0.0087	0.0050	mg/L	2020-01-09	
<b>Calculated Parameters</b>					
Nitrate+Nitrite (as N)	2.70	0.0100	mg/L	N/A	
Nitrogen, Total	4.08	0.0500	mg/L	N/A	
Nitrogen, Organic	1.33	0.0500	mg/L	N/A	
<b>General Parameters</b>					
Ammonia, Total (as N)	0.049	0.020	mg/L	2020-01-10	
BOD, 5-day	6.8	2.0	mg/L	2020-01-15	
Conductivity (EC)	789	2.0	µS/cm	2020-01-10	
Nitrogen, Total Kjeldahl	1.38	0.050	mg/L	2020-01-11	
pH	7.53	0.10	pH units	2020-01-10	HT2
Phosphorus, Total (as P)	0.158	0.0020	mg/L	2020-01-11	
Phosphorus, Total Dissolved	0.113	0.0020	mg/L	2020-01-11	
Solids, Total Suspended	< 2.0	2.0	mg/L	2020-01-10	
<b>Total Metals</b>					
Sodium, total	103	0.10	mg/L	2020-01-12	



## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0010543  
2020-01-17 13:56

Analyte	Result	RL	Units	Analyzed	Qualifier
---------	--------	----	-------	----------	-----------

**VWRC Treated Effluent (FFE) Grab - E229578 (0010543-02) | Matrix: Wastewater | Sampled: 2020-01-10 08:30**

### Microbiological Parameters

Coliforms, Total	1.0	1.0	MPN/100 mL	2020-01-10	
Coliforms, Fecal	< 1.0	1.0	MPN/100 mL	2020-01-10	

### Sample Qualifiers:

FILT	The sample has been filtered for DP in the laboratory. Results may not reflect conditions at the time of sampling.
HT2	The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.
PRES	Sample has been preserved for DP in the laboratory and the holding time has been extended.



## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0010543  
2020-01-17 13:56

Analyte	Result	RL	Units	Analyzed	Qualifier
<b>VWRC Final Treated Effluent - 24hr Comp. - E105004 (0010543-01)   Matrix: Wastewater   Sampled: 2020-01-09 00:00 To 2020-01-10 00:00</b>					FILT, PRES
<b>Anions</b>					
Chloride	97.5	0.10	mg/L	2020-01-12	
Nitrate (as N)	2.29	0.010	mg/L	2020-01-12	
Nitrite (as N)	0.050	0.010	mg/L	2020-01-12	
Phosphate (as P)	0.0159	0.0050	mg/L	2020-01-12	
<b>Calculated Parameters</b>					
Nitrate+Nitrite (as N)	2.34	0.0100	mg/L	N/A	
Nitrogen, Total	3.98	0.0500	mg/L	N/A	
Nitrogen, Organic	1.58	0.0500	mg/L	N/A	
<b>General Parameters</b>					
Ammonia, Total (as N)	0.068	0.020	mg/L	2020-01-13	
BOD, 5-day	< 1.1	2.0	mg/L	2020-01-16	
Conductivity (EC)	743	2.0	µS/cm	2020-01-13	
Nitrogen, Total Kjeldahl	1.64	0.050	mg/L	2020-01-15	
pH	7.76	0.10	pH units	2020-01-13	HT2
Phosphorus, Total (as P)	0.192	0.0020	mg/L	2020-01-11	
Phosphorus, Total Dissolved	0.156	0.0020	mg/L	2020-01-11	
Solids, Total Suspended	2.0	2.0	mg/L	2020-01-15	
<b>Total Metals</b>					
Sodium, total	93.8	0.10	mg/L	2020-01-15	

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0010567  
2020-01-17 13:25

Analyte	Result	RL	Units	Analyzed	Qualifier
---------	--------	----	-------	----------	-----------

**VWRC Treated Effluent (FTE) Grab - E105004 (0010567-02) | Matrix: Wastewater | Sampled: 2020-01-11 09:00**

**Microbiological Parameters**

Coliforms, Total	1.0	1.0	MPN/100 mL	2020-01-11	
Coliforms, Fecal	< 1.0	1.0	MPN/100 mL	2020-01-11	

**Sample Qualifiers:**

HT2 The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.



## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0010567  
2020-01-17 13:25

Analyte	Result	RL	Units	Analyzed	Qualifier
<b>VWRC Final Treated Effluent - 24hr Comp. - E105004 (0010567-01)   Matrix: Wastewater   Sampled: 2020-01-10 00:00 To 2020-01-11 00:00</b>					
<b>Anions</b>					
Chloride	87.7	0.10	mg/L	2020-01-12	
Nitrate (as N)	3.04	0.010	mg/L	2020-01-12	
Nitrite (as N)	0.098	0.010	mg/L	2020-01-12	
Phosphate (as P)	0.0103	0.0050	mg/L	2020-01-12	
<b>Calculated Parameters</b>					
Nitrate+Nitrite (as N)	3.14	0.0100	mg/L	N/A	
Nitrogen, Total	4.79	0.0500	mg/L	N/A	
Nitrogen, Organic	1.54	0.0500	mg/L	N/A	
<b>General Parameters</b>					
Ammonia, Total (as N)	0.115	0.020	mg/L	2020-01-13	
BOD, 5-day	6.8	2.0	mg/L	2020-01-16	
Conductivity (EC)	675	2.0	µS/cm	2020-01-15	
Nitrogen, Total Kjeldahl	1.65	0.050	mg/L	2020-01-15	
pH	7.67	0.10	pH units	2020-01-15	HT2
Phosphorus, Total (as P)	0.170	0.0020	mg/L	2020-01-15	
Phosphorus, Total Dissolved	0.112	0.0020	mg/L	2020-01-15	
Solids, Total Suspended	< 2.5	2.0	mg/L	2020-01-16	
<b>Total Metals</b>					
Sodium, total	87.3	0.10	mg/L	2020-01-15	



## TEST RESULTS

**REPORTED TO PROJECT**    Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED**    0010622  
2020-01-20 15:16

Analyte	Result	RL	Units	Analyzed	Qualifier
<b>VWRC Treated Effluent (FTE) Grab - E105004 (0010622-03)   Matrix: Wastewater   Sampled: 2020-01-12 13:05</b>					
<b>Microbiological Parameters</b>					
Coliforms, Total (MPN)	3.6	3.0	MPN/100 mL	2020-01-13	
Coliforms, Fecal (MPN)	< 3.0	3.0	MPN/100 mL	2020-01-13	



## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0010622  
2020-01-20 15:16

Analyte	Result	RL	Units	Analyzed	Qualifier
<b>VWRC Final Treated Effluent - 24hr Comp. - E105004 (0010622-01)   Matrix: Wastewater   Sampled: 2020-01-11 00:00 To 2020-01-12 00:00</b>					FILT, PRES
<b>Anions</b>					
Chloride	81.8	0.10	mg/L	2020-01-14	
Nitrate (as N)	3.33	0.010	mg/L	2020-01-14	
Nitrite (as N)	0.112	0.010	mg/L	2020-01-14	
Phosphate (as P)	0.0097	0.0050	mg/L	2020-01-14	
<b>Calculated Parameters</b>					
Nitrate+Nitrite (as N)	3.44	0.0100	mg/L	N/A	
Nitrogen, Total	4.97	0.0500	mg/L	N/A	
Nitrogen, Organic	1.32	0.0500	mg/L	N/A	
<b>General Parameters</b>					
Ammonia, Total (as N)	0.204	0.020	mg/L	2020-01-14	
BOD, 5-day	< 1.2	2.0	mg/L	2020-01-20	
Conductivity (EC)	668	2.0	µS/cm	2020-01-15	
Nitrogen, Total Kjeldahl	1.53	0.050	mg/L	2020-01-16	
pH	7.54	0.10	pH units	2020-01-15	HT2
Phosphorus, Total (as P)	0.154	0.0020	mg/L	2020-01-15	
Phosphorus, Total Dissolved	0.104	0.0020	mg/L	2020-01-15	
Solids, Total Suspended	< 2.0	2.0	mg/L	2020-01-16	
<b>Total Metals</b>					
Sodium, total	86.1	0.10	mg/L	2020-01-19	



## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0010622  
2020-01-20 15:16

Analyte	Result	RL	Units	Analyzed	Qualifier
---------	--------	----	-------	----------	-----------

**VWRC Treated Effluent (FTE) Grab - E105004 (0010622-04) | Matrix: Wastewater | Sampled: 2020-01-13 08:30**

### Microbiological Parameters

Coliforms, Total (MPN)	3.6	3.0	MPN/100 mL	2020-01-13	
Coliforms, Fecal (MPN)	< 3.0	3.0	MPN/100 mL	2020-01-13	

### Sample Qualifiers:

FILT	The sample has been filtered for DP in the laboratory. Results may not reflect conditions at the time of sampling.
HT2	The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.
PRES	Sample has been preserved for DP in the laboratory and the holding time has been extended.



## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0010622  
2020-01-20 15:16

Analyte	Result	RL	Units	Analyzed	Qualifier
<b>VWRC Final Treated Effluent - 24hr Comp. - E105004 (0010622-02)   Matrix: Wastewater   Sampled: 2020-01-12 00:00 To 2020-01-13 00:00</b>					FILT, PRES
<b>Anions</b>					
Chloride	79.8	0.10	mg/L	2020-01-14	
Nitrate (as N)	4.54	0.010	mg/L	2020-01-14	
Nitrite (as N)	0.152	0.010	mg/L	2020-01-14	
Phosphate (as P)	0.0095	0.0050	mg/L	2020-01-14	
<b>Calculated Parameters</b>					
Nitrate+Nitrite (as N)	4.69	0.0100	mg/L	N/A	
Nitrogen, Total	6.58	0.0500	mg/L	N/A	
Nitrogen, Organic	1.48	0.0500	mg/L	N/A	
<b>General Parameters</b>					
Ammonia, Total (as N)	0.399	0.020	mg/L	2020-01-14	
BOD, 5-day	< 1.2	2.0	mg/L	2020-01-20	
Conductivity (EC)	631	2.0	µS/cm	2020-01-15	
Nitrogen, Total Kjeldahl	1.88	0.050	mg/L	2020-01-16	
pH	7.48	0.10	pH units	2020-01-15	HT2
Phosphorus, Total (as P)	0.127	0.0020	mg/L	2020-01-15	
Phosphorus, Total Dissolved	0.0813	0.0020	mg/L	2020-01-15	
Solids, Total Suspended	2.0	2.0	mg/L	2020-01-16	
<b>Total Metals</b>					
Sodium, total	75.8	0.10	mg/L	2020-01-19	

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0010816  
2020-01-22 15:19

Analyte	Result	RL	Units	Analyzed	Qualifier
<b>VWRC Treated Effluent (FTE) Grab - E105004 (0010816-03)   Matrix: Wastewater   Sampled: 2020-01-14 15:00</b>					
<b>Microbiological Parameters</b>					
Coliforms, Total	8.4	1.0	MPN/100 mL	2020-01-15	
Coliforms, Fecal	1.0	1.0	MPN/100 mL	2020-01-15	

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0010816  
2020-01-22 15:19

Analyte	Result	RL	Units	Analyzed	Qualifier
<b>VWRC Final Treated Effluent - 24hr Comp. - E105004 (0010816-01)   Matrix: Wastewater   Sampled: 2020-01-13 00:00 To 2020-01-14 00:00</b>					FILT, PRES
<b>Anions</b>					
Chloride	79.7	0.10	mg/L	2020-01-16	
Nitrate (as N)	3.50	0.010	mg/L	2020-01-16	
Nitrite (as N)	0.082	0.010	mg/L	2020-01-16	
Phosphate (as P)	0.0080	0.0050	mg/L	2020-01-16	
<b>Calculated Parameters</b>					
Nitrate+Nitrite (as N)	3.59	0.0100	mg/L	N/A	
Nitrogen, Total	5.31	0.0500	mg/L	N/A	
Nitrogen, Organic	1.56	0.0500	mg/L	N/A	
<b>General Parameters</b>					
Ammonia, Total (as N)	0.167	0.020	mg/L	2020-01-16	
BOD, 5-day	< 1.0	2.0	mg/L	2020-01-21	
Conductivity (EC)	610	2.0	µS/cm	2020-01-16	
Nitrogen, Total Kjeldahl	1.72	0.050	mg/L	2020-01-16	
pH	7.37	0.10	pH units	2020-01-16	HT2
Phosphorus, Total (as P)	0.143	0.0020	mg/L	2020-01-16	
Phosphorus, Total Dissolved	0.0781	0.0020	mg/L	2020-01-16	
Solids, Total Suspended	2.6	2.0	mg/L	2020-01-18	
<b>Total Metals</b>					
Sodium, total	75.3	0.10	mg/L	2020-01-19	

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0010816  
2020-01-22 15:19

Analyte	Result	RL	Units	Analyzed	Qualifier
---------	--------	----	-------	----------	-----------

**VWRC Treated Effluent (FTE) Grab - E105004 (0010816-04) | Matrix: Wastewater | Sampled: 2020-01-15 09:00**

### Microbiological Parameters

Coliforms, Total	8.5	1.0	MPN/100 mL	2020-01-15	
Coliforms, Fecal	1.0	1.0	MPN/100 mL	2020-01-15	

### Sample Qualifiers:

FILT	The sample has been filtered for DP in the laboratory. Results may not reflect conditions at the time of sampling.
HT2	The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.
PRES	Sample has been preserved for DP in the laboratory and the holding time has been extended.



## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0010816  
2020-01-22 15:19

Analyte	Result	RL	Units	Analyzed	Qualifier
<b>VWRC Final Treated Effluent - 24hr Comp. - E105004 (0010816-02)   Matrix: Wastewater   Sampled: 2020-01-14 00:00 To 2020-01-15 00:00</b>					FILT, PRES
<b>Anions</b>					
Chloride	80.9	0.10	mg/L	2020-01-16	
Nitrate (as N)	2.99	0.010	mg/L	2020-01-16	
Nitrite (as N)	0.090	0.010	mg/L	2020-01-16	
Phosphate (as P)	0.0090	0.0050	mg/L	2020-01-16	
<b>Calculated Parameters</b>					
Nitrate+Nitrite (as N)	3.08	0.0100	mg/L	N/A	
Nitrogen, Total	4.73	0.0500	mg/L	N/A	
Nitrogen, Organic	1.48	0.0500	mg/L	N/A	
<b>General Parameters</b>					
Ammonia, Total (as N)	0.166	0.020	mg/L	2020-01-16	
BOD, 5-day	< 1.0	2.0	mg/L	2020-01-21	
Conductivity (EC)	616	2.0	µS/cm	2020-01-16	
Nitrogen, Total Kjeldahl	1.65	0.050	mg/L	2020-01-16	
pH	7.40	0.10	pH units	2020-01-16	HT2
Phosphorus, Total (as P)	0.212	0.0020	mg/L	2020-01-16	
Phosphorus, Total Dissolved	0.0835	0.0020	mg/L	2020-01-16	
Solids, Total Suspended	2.8	2.0	mg/L	2020-01-18	
<b>Total Metals</b>					
Sodium, total	73.2	0.10	mg/L	2020-01-19	



## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0010907  
2020-01-22 15:24

Analyte	Result	RL	Units	Analyzed	Qualifier
<b>VWRC Treated Effluent (FTE) Grab - E105004 (0010907-02)   Matrix: Wastewater   Sampled: 2020-01-16 08:30</b>					
<b>Microbiological Parameters</b>					
Coliforms, Total	3.0	1.0	MPN/100 mL	2020-01-16	
Coliforms, Fecal	< 1.0	1.0	MPN/100 mL	2020-01-16	



## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0010907  
2020-01-22 15:24

Analyte	Result	RL	Units	Analyzed	Qualifier
<b>VWRC Final Treated Effluent - 24hr Comp. - E105004 (0010907-01)   Matrix: Wastewater   Sampled: 2020-01-15 00:00 To 2020-01-16 00:00</b>					FILT, PRES
<b>Anions</b>					
Chloride	81.0	0.10	mg/L	2020-01-16	
Nitrate (as N)	2.51	0.010	mg/L	2020-01-16	
Nitrite (as N)	0.087	0.010	mg/L	2020-01-16	
Phosphate (as P)	0.0150	0.0050	mg/L	2020-01-16	
<b>Calculated Parameters</b>					
Nitrate+Nitrite (as N)	2.60	0.0100	mg/L	N/A	
Nitrogen, Total	4.27	0.0500	mg/L	N/A	
Nitrogen, Organic	1.52	0.0500	mg/L	N/A	
<b>General Parameters</b>					
Ammonia, Total (as N)	0.150	0.020	mg/L	2020-01-20	
BOD, 5-day	2.8	2.0	mg/L	2020-01-22	
Conductivity (EC)	635	2.0	µS/cm	2020-01-20	
Nitrogen, Total Kjeldahl	1.67	0.050	mg/L	2020-01-17	
pH	7.49	0.10	pH units	2020-01-20	HT2
Phosphorus, Total (as P)	0.206	0.0020	mg/L	2020-01-17	
Phosphorus, Total Dissolved	0.115	0.0020	mg/L	2020-01-17	
Solids, Total Suspended	3.8	2.0	mg/L	2020-01-18	
<b>Total Metals</b>					
Sodium, total	76.1	0.10	mg/L	2020-01-17	

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0011010  
2020-01-28 09:07

Analyte	Result	RL	Units	Analyzed	Qualifier
<b>VWRC Treated Effluent (FTE) Grab - E105004 (0011010-03)   Matrix: Wastewater   Sampled: 2020-01-17 13:30</b>					
<b>Microbiological Parameters</b>					
Coliforms, Total	6.3	1.0	MPN/100 mL	2020-01-18	
Coliforms, Fecal	< 1.0	1.0	MPN/100 mL	2020-01-18	

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0011010  
2020-01-28 09:07

Analyte	Result	RL	Units	Analyzed	Qualifier
<b>VWRC Final Treated Effluent - 24hr Comp. - E105004 (0011010-01)   Matrix: Wastewater   Sampled: 2020-01-16 00:00 To 2020-01-17 00:00</b>					FILT
<b>Anions</b>					
Chloride	85.2	0.10	mg/L	2020-01-21	
Nitrate (as N)	2.56	0.010	mg/L	2020-01-21	HT1
Nitrite (as N)	0.023	0.010	mg/L	2020-01-21	HT1
Phosphate (as P)	0.0598	0.0050	mg/L	2020-01-21	HT1
<b>Calculated Parameters</b>					
Nitrate+Nitrite (as N)	2.59	0.0100	mg/L	N/A	
Nitrogen, Total	4.29	0.0500	mg/L	N/A	
Nitrogen, Organic	1.61	0.0500	mg/L	N/A	
<b>General Parameters</b>					
Ammonia, Total (as N)	0.093	0.020	mg/L	2020-01-20	
BOD, 5-day	6.7	2.0	mg/L	2020-01-22	
Conductivity (EC)	627	2.0	µS/cm	2020-01-22	
Nitrogen, Total Kjeldahl	1.71	0.050	mg/L	2020-01-22	
pH	7.52	0.10	pH units	2020-01-22	HT2
Phosphorus, Total (as P)	0.182	0.0020	mg/L	2020-01-21	
Phosphorus, Total Dissolved	0.0951	0.0020	mg/L	2020-01-21	
Solids, Total Suspended	2.6	2.0	mg/L	2020-01-22	
<b>Total Metals</b>					
Sodium, total	70.0	0.10	mg/L	2020-01-27	

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0011010  
2020-01-28 09:07

Analyte	Result	RL	Units	Analyzed	Qualifier
---------	--------	----	-------	----------	-----------

**VWRC Treated Effluent (FTE) Grab - E105004 (0011010-04) | Matrix: Wastewater | Sampled: 2020-01-18 09:00**

**Microbiological Parameters**

Coliforms, Total	13.0	1.0	MPN/100 mL	2020-01-18	
Coliforms, Fecal	1.0	1.0	MPN/100 mL	2020-01-18	

**Sample Qualifiers:**

FILT	The sample has been filtered for Diss Phosphorus in the laboratory. Results may not reflect conditions at the time of sampling.
HT1	The sample was prepared and/or analyzed past the recommended holding time.
HT2	The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0011010  
2020-01-28 09:07

Analyte	Result	RL	Units	Analyzed	Qualifier
<b>VWRC Final Treated Effluent - 24hr Comp. - E105004 (0011010-02)   Matrix: Wastewater   Sampled: 2020-01-17 00:00 To 2020-01-18 00:00</b>					FILT
<b>Anions</b>					
Chloride	86.2	0.10	mg/L	2020-01-21	
Nitrate (as N)	2.74	0.010	mg/L	2020-01-21	
Nitrite (as N)	0.066	0.010	mg/L	2020-01-21	
Phosphate (as P)	0.0515	0.0050	mg/L	2020-01-21	
<b>Calculated Parameters</b>					
Nitrate+Nitrite (as N)	2.81	0.0100	mg/L	N/A	
Nitrogen, Total	4.70	0.0500	mg/L	N/A	
Nitrogen, Organic	1.77	0.0500	mg/L	N/A	
<b>General Parameters</b>					
Ammonia, Total (as N)	0.125	0.020	mg/L	2020-01-20	
BOD, 5-day	8.1	2.0	mg/L	2020-01-22	
Conductivity (EC)	644	2.0	µS/cm	2020-01-22	
Nitrogen, Total Kjeldahl	1.90	0.050	mg/L	2020-01-22	
pH	7.60	0.10	pH units	2020-01-22	HT2
Phosphorus, Total (as P)	0.209	0.0020	mg/L	2020-01-21	
Phosphorus, Total Dissolved	0.108	0.0020	mg/L	2020-01-21	
Solids, Total Suspended	3.8	2.0	mg/L	2020-01-22	
<b>Total Metals</b>					
Sodium, total	73.5	0.10	mg/L	2020-01-27	

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0011065  
2020-01-28 09:08

Analyte	Result	RL	Units	Analyzed	Qualifier
---------	--------	----	-------	----------	-----------

**VWRC Treated Effluent (FTE) Grab - E105004 (0011065-03) | Matrix: Wastewater | Sampled: 2020-01-19 13:30**

**Microbiological Parameters**

Coliforms, Total	8.4	1.0	MPN/100 mL	2020-01-20	
Coliforms, Fecal	1.0	1.0	MPN/100 mL	2020-01-20	

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0011065  
2020-01-28 09:08

Analyte	Result	RL	Units	Analyzed	Qualifier
<b>VWRC Final Treated Effluent - 24hr Comp. - E105004 (0011065-01)   Matrix: Wastewater   Sampled: 2020-01-18 00:00 To 2020-01-19 00:00</b>					FILT, PRES
<b>Anions</b>					
Chloride	85.3	0.10	mg/L	2020-01-21	
Nitrate (as N)	3.68	0.010	mg/L	2020-01-21	
Nitrite (as N)	0.121	0.010	mg/L	2020-01-21	
Phosphate (as P)	0.0344	0.0050	mg/L	2020-01-21	
<b>Calculated Parameters</b>					
Nitrate+Nitrite (as N)	3.80	0.0100	mg/L	N/A	
Nitrogen, Total	5.91	0.0500	mg/L	N/A	
Nitrogen, Organic	1.62	0.0500	mg/L	N/A	
<b>General Parameters</b>					
Ammonia, Total (as N)	0.492	0.020	mg/L	2020-01-22	
BOD, 5-day	6.5	2.0	mg/L	2020-01-27	
Conductivity (EC)	661	2.0	µS/cm	2020-01-22	
Nitrogen, Total Kjeldahl	2.11	0.050	mg/L	2020-01-22	
pH	7.70	0.10	pH units	2020-01-22	HT2
Phosphorus, Total (as P)	0.193	0.0020	mg/L	2020-01-21	
Phosphorus, Total Dissolved	0.109	0.0020	mg/L	2020-01-21	
Solids, Total Suspended	3.8	2.0	mg/L	2020-01-22	
<b>Total Metals</b>					
Sodium, total	82.0	0.10	mg/L	2020-01-27	

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0011065  
2020-01-28 09:08

Analyte	Result	RL	Units	Analyzed	Qualifier
---------	--------	----	-------	----------	-----------

**VWRC Treated Effluent (FTE) Grab - E105004 (0011065-04) | Matrix: Wastewater | Sampled: 2020-01-20 08:30**

### Microbiological Parameters

Coliforms, Total	4.1	1.0	MPN/100 mL	2020-01-20	
Coliforms, Fecal	1.0	1.0	MPN/100 mL	2020-01-20	

### Sample Qualifiers:

FILT	The sample has been filtered for DP in the laboratory. Results may not reflect conditions at the time of sampling.
HT2	The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.
PRES	Sample has been preserved for DP in the laboratory and the holding time has been extended.

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0011065  
2020-01-28 09:08

Analyte	Result	RL	Units	Analyzed	Qualifier
<b>VWRC Final Treated Effluent - 24hr Comp. - E105004 (0011065-02)   Matrix: Wastewater   Sampled: 2020-01-19 00:00 To 2020-01-20 00:00</b>					FILT, PRES
<b>Anions</b>					
Chloride	86.7	0.10	mg/L	2020-01-21	
Nitrate (as N)	4.44	0.010	mg/L	2020-01-21	
Nitrite (as N)	0.120	0.010	mg/L	2020-01-21	
Phosphate (as P)	0.0238	0.0050	mg/L	2020-01-21	
<b>Calculated Parameters</b>					
Nitrate+Nitrite (as N)	4.57	0.0100	mg/L	N/A	
Nitrogen, Total	7.15	0.0500	mg/L	N/A	
Nitrogen, Organic	1.82	0.0500	mg/L	N/A	
<b>General Parameters</b>					
Ammonia, Total (as N)	0.755	0.020	mg/L	2020-01-22	
BOD, 5-day	2.5	2.0	mg/L	2020-01-27	
Conductivity (EC)	644	2.0	µS/cm	2020-01-22	
Nitrogen, Total Kjeldahl	2.58	0.050	mg/L	2020-01-22	
pH	7.59	0.10	pH units	2020-01-22	HT2
Phosphorus, Total (as P)	0.148	0.0020	mg/L	2020-01-21	
Phosphorus, Total Dissolved	0.0720	0.0020	mg/L	2020-01-21	
Solids, Total Suspended	3.0	2.0	mg/L	2020-01-22	
<b>Total Metals</b>					
Sodium, total	71.5	0.10	mg/L	2020-01-27	

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0011351  
2020-01-29 16:25

Analyte	Result	RL	Units	Analyzed	Qualifier
<b>VWRC Treated Effluent (FTE) Grab - E105004 (0011351-03)   Matrix: Wastewater   Sampled: 2020-01-21 14:00</b>					
<b>Microbiological Parameters</b>					
Coliforms, Total	1.0	1.0	MPN/100 mL	2020-01-22	
Coliforms, Fecal	1.0	1.0	MPN/100 mL	2020-01-22	



## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0011351  
2020-01-29 16:25

Analyte	Result	RL	Units	Analyzed	Qualifier
<b>VWRC Final Treated Effluent - 24hr Comp. - E105004 (0011351-01)   Matrix: Wastewater   Sampled: 2020-01-20 00:00 To 2020-01-21 00:00</b>					FILT, PRES
<b>Anions</b>					
Chloride	91.7	0.10	mg/L	2020-01-24	
Nitrate (as N)	4.07	0.010	mg/L	2020-01-24	
Nitrite (as N)	0.091	0.010	mg/L	2020-01-24	
Phosphate (as P)	0.0059	0.0050	mg/L	2020-01-24	
<b>Calculated Parameters</b>					
Nitrate+Nitrite (as N)	4.16	0.0100	mg/L	N/A	
Nitrogen, Total	5.99	0.0500	mg/L	N/A	
Nitrogen, Organic	1.62	0.0500	mg/L	N/A	
<b>General Parameters</b>					
Ammonia, Total (as N)	0.205	0.020	mg/L	2020-01-23	
BOD, 5-day	2.3	2.0	mg/L	2020-01-28	
Conductivity (EC)	652	2.0	µS/cm	2020-01-23	
Nitrogen, Total Kjeldahl	1.82	0.050	mg/L	2020-01-23	
pH	7.47	0.10	pH units	2020-01-23	HT2
Phosphorus, Total (as P)	0.156	0.0020	mg/L	2020-01-23	
Phosphorus, Total Dissolved	0.0756	0.0020	mg/L	2020-01-23	
Solids, Total Suspended	2.2	2.0	mg/L	2020-01-24	
<b>Total Metals</b>					
Sodium, total	80.4	0.10	mg/L	2020-01-29	



## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0011351  
2020-01-29 16:25

Analyte	Result	RL	Units	Analyzed	Qualifier
<b>VWRC Treated Effluent (FTE) Grab - E105004 (0011351-04)   Matrix: Wastewater   Sampled: 2020-01-22 08:00</b>					
<b>Microbiological Parameters</b>					
Coliforms, Total	3.1	1.0	MPN/100 mL	2020-01-22	
Coliforms, Fecal	< 1.0	1.0	MPN/100 mL	2020-01-22	

### Sample Qualifiers:

FILT The sample has been filtered for DP in the laboratory. Results may not reflect conditions at the time of sampling.  
 HT2 The 15 minute recommended holding time (from sampling to analysis) has been exceeded — field analysis is recommended.  
 PRES Sample has been preserved for DP in the laboratory and the holding time has been extended.

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0011351  
2020-01-29 16:25

Analyte	Result	RL	Units	Analyzed	Qualifier
<b>VWRC Final Treated Effluent - 24hr Comp. - E105004 (0011351-02)   Matrix: Wastewater   Sampled: 2020-01-21 00:00 To 2020-01-22 00:00</b>					
<b>Anions</b>					
Chloride	98.5	0.10	mg/L	2020-01-24	
Nitrate (as N)	3.15	0.010	mg/L	2020-01-24	
Nitrite (as N)	0.035	0.010	mg/L	2020-01-24	
Phosphate (as P)	0.0054	0.0050	mg/L	2020-01-24	
<b>Calculated Parameters</b>					
Nitrate+Nitrite (as N)	3.18	0.0100	mg/L	N/A	
Nitrogen, Total	4.77	0.0500	mg/L	N/A	
Nitrogen, Organic	1.51	0.0500	mg/L	N/A	
<b>General Parameters</b>					
Ammonia, Total (as N)	0.078	0.020	mg/L	2020-01-23	
BOD, 5-day	2.2	2.0	mg/L	2020-01-28	
Conductivity (EC)	663	2.0	µS/cm	2020-01-23	
Nitrogen, Total Kjeldahl	1.58	0.050	mg/L	2020-01-23	
pH	7.51	0.10	pH units	2020-01-23	HT2
Phosphorus, Total (as P)	0.144	0.0020	mg/L	2020-01-23	
Phosphorus, Total Dissolved	0.0771	0.0020	mg/L	2020-01-23	
Solids, Total Suspended	2.6	2.0	mg/L	2020-01-28	
<b>Total Metals</b>					
Sodium, total	86.8	0.10	mg/L	2020-01-29	



## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0011593  
2020-01-31 14:44

Analyte	Result	RL	Units	Analyzed	Qualifier
<b>VWRC Treated Effluent (FTE) Grab - E105004 (0011593-03)   Matrix: Wastewater   Sampled: 2020-01-23 13:00</b>					
<b>Microbiological Parameters</b>					
Coliforms, Total	53.8	1.0	MPN/100 mL	2020-01-24	
Coliforms, Fecal	11.0	1.0	MPN/100 mL	2020-01-24	

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0011593  
2020-01-31 14:44

Analyte	Result	RL	Units	Analyzed	Qualifier
<b>VWRC Final Treated Effluent - 24hr Comp. - E105004 (0011593-01)   Matrix: Wastewater   Sampled: 2020-01-22 00:00 To 2020-01-23 00:00</b>					FILT, PRES
<b>Anions</b>					
Chloride	98.4	0.10	mg/L	2020-01-25	
Nitrate (as N)	2.24	0.010	mg/L	2020-01-25	
Nitrite (as N)	< 0.010	0.010	mg/L	2020-01-25	
Phosphate (as P)	< 0.0050	0.0050	mg/L	2020-01-25	
<b>Calculated Parameters</b>					
Nitrate+Nitrite (as N)	2.24	0.0100	mg/L	N/A	
Nitrogen, Total	3.80	0.100	mg/L	N/A	
Nitrogen, Organic	1.53	0.100	mg/L	N/A	
<b>General Parameters</b>					
Ammonia, Total (as N)	0.036	0.020	mg/L	2020-01-28	
BOD, 5-day	8.0	2.0	mg/L	2020-01-30	
Conductivity (EC)	690	2.0	µS/cm	2020-01-27	
Nitrogen, Total Kjeldahl	1.57	0.050	mg/L	2020-01-25	
pH	7.72	0.10	pH units	2020-01-27	HT2
Phosphorus, Total (as P)	0.138	0.0020	mg/L	2020-01-25	
Phosphorus, Total Dissolved	0.0816	0.0020	mg/L	2020-01-25	
Solids, Total Suspended	2.8	2.0	mg/L	2020-01-28	
<b>Total Metals</b>					
Sodium, total	88.7	0.10	mg/L	2020-01-31	

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0011593  
2020-01-31 14:44

Analyte	Result	RL	Units	Analyzed	Qualifier
---------	--------	----	-------	----------	-----------

**VWRC Treated Effluent (FTE) Grab - E105004 (0011593-04) | Matrix: Wastewater | Sampled: 2020-01-24 08:00**

### Microbiological Parameters

Coliforms, Total	28.2	1.0	MPN/100 mL	2020-01-24	
Coliforms, Fecal	2.0	1.0	MPN/100 mL	2020-01-24	

### Sample Qualifiers:

FILT	The sample has been filtered for TDP in the laboratory. Results may not reflect conditions at the time of sampling.
HT2	The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.
PRES	Sample has been preserved for TDP in the laboratory and the holding time has been extended.

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0011593  
2020-01-31 14:44

Analyte	Result	RL	Units	Analyzed	Qualifier
<b>VWRC Final Treated Effluent - 24hr Comp. - E105004 (0011593-02)   Matrix: Wastewater   Sampled: 2020-01-23 00:00 To 2020-01-24 00:00</b>					FILT, PRES
<b>Anions</b>					
Chloride	102	0.10	mg/L	2020-01-25	
Nitrate (as N)	2.35	0.010	mg/L	2020-01-25	
Nitrite (as N)	0.035	0.010	mg/L	2020-01-25	
Phosphate (as P)	< 0.0050	0.0050	mg/L	2020-01-25	
<b>Calculated Parameters</b>					
Nitrate+Nitrite (as N)	2.39	0.0100	mg/L	N/A	
Nitrogen, Total	3.83	0.100	mg/L	N/A	
Nitrogen, Organic	1.40	0.100	mg/L	N/A	
<b>General Parameters</b>					
Ammonia, Total (as N)	0.047	0.020	mg/L	2020-01-28	
BOD, 5-day	8.6	2.0	mg/L	2020-01-30	
Conductivity (EC)	694	2.0	µS/cm	2020-01-27	
Nitrogen, Total Kjeldahl	1.45	0.050	mg/L	2020-01-25	
pH	7.66	0.10	pH units	2020-01-27	HT2
Phosphorus, Total (as P)	0.124	0.0020	mg/L	2020-01-25	
Phosphorus, Total Dissolved	0.0725	0.0020	mg/L	2020-01-25	
Solids, Total Suspended	< 2.0	2.0	mg/L	2020-01-28	
<b>Total Metals</b>					
Sodium, total	80.5	0.10	mg/L	2020-01-31	



## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0011624  
2020-02-03 18:23

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
---------	--------	-------------	----	-------	----------	-----------

**VWRC Treated Effluent (FTE) Grab - E105004 (0011624-02) | Matrix: Wastewater | Sampled: 2020-01-25 09:45**

**Microbiological Parameters**

Coliforms, Total	3.0		1.0	MPN/100 mL	2020-01-25	
Coliforms, Fecal	1.0		1.0	MPN/100 mL	2020-01-25	

**Sample Qualifiers:**

HT2 The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0011624  
2020-02-03 18:23

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
<b>VWRC Final Treated Effluent - 24hr Comp. - E105004 (0011624-01)   Matrix: Wastewater   Sampled: 2020-01-24 00:00 To 2020-01-25 00:00</b>						
<b>Anions</b>						
Chloride	100	± 6	0.10	mg/L	2020-01-25	
Nitrate (as N)	3.12	± 0.20	0.010	mg/L	2020-01-25	
Nitrite (as N)	0.105	± 0.011	0.010	mg/L	2020-01-25	
Phosphate (as P)	0.0415	± 0.0076	0.0050	mg/L	2020-01-25	
<b>Calculated Parameters</b>						
Nitrate+Nitrite (as N)	3.23		0.0100	mg/L	N/A	
Nitrogen, Total	5.00		0.100	mg/L	N/A	
Nitrogen, Organic	1.56		0.100	mg/L	N/A	
<b>General Parameters</b>						
Ammonia, Total (as N)	0.205	± 0.027	0.020	mg/L	2020-01-29	
BOD, 5-day	9.3	± 2.2	2.0	mg/L	2020-01-30	
Conductivity (EC)	733	± 18	2.0	µS/cm	2020-01-28	
Nitrogen, Total Kjeldahl	1.77	± 0.24	0.050	mg/L	2020-01-29	
pH	7.74	± 0.02	0.10	pH units	2020-01-28	HT2
Phosphorus, Total (as P)	0.148	± 0.016	0.0020	mg/L	2020-01-29	
Phosphorus, Total Dissolved	0.0944	± 0.0112	0.0020	mg/L	2020-01-29	
Solids, Total Suspended	3.2	± 1.0	2.0	mg/L	2020-01-30	
<b>Total Metals</b>						
Sodium, total	86.1	± 15.7	0.10	mg/L	2020-02-01	



## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0011690  
2020-02-03 18:27

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
---------	--------	-------------	----	-------	----------	-----------

**VWRC Treated Effluent (FTE) Grab - E105004 (0011690-03) | Matrix: Wastewater | Sampled: 2020-01-26 10:30**

**Microbiological Parameters**

Coliforms, Total	5.2		1.0	MPN/100 mL	2020-01-27	
Coliforms, Fecal	1.0		1.0	MPN/100 mL	2020-01-27	

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0011690  
2020-02-03 18:27

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
<b>VWRC Final Treated Effluent - 24hr Comp. - E105004 (0011690-01)   Matrix: Wastewater   Sampled: 2020-01-25 00:00 To 2020-01-26 00:00</b>						FILT, PRES
<b>Anions</b>						
Chloride	98.5	± 5.4		0.10 mg/L	2020-01-28	
Nitrate (as N)	3.62	± 0.23		0.010 mg/L	2020-01-28	
Nitrite (as N)	0.097	± 0.010		0.010 mg/L	2020-01-28	
Phosphate (as P)	< 0.0050			0.0050 mg/L	2020-01-28	
<b>Calculated Parameters</b>						
Nitrate+Nitrite (as N)	3.72			0.0100 mg/L	N/A	
Nitrogen, Total	5.47			0.0500 mg/L	N/A	
Nitrogen, Organic	1.27			0.0500 mg/L	N/A	
<b>General Parameters</b>						
Ammonia, Total (as N)	0.489	± 0.048		0.020 mg/L	2020-01-29	
BOD, 5-day	< 1.1			2.0 mg/L	2020-02-03	
Conductivity (EC)	772	± 19		2.0 µS/cm	2020-01-28	
Nitrogen, Total Kjeldahl	1.76	± 0.22		0.050 mg/L	2020-01-29	
pH	7.71	± 0.02		0.10 pH units	2020-01-28	HT2
Phosphorus, Total (as P)	0.0967	± 0.0108		0.0020 mg/L	2020-01-30	
Phosphorus, Total Dissolved	0.0506	± 0.0061		0.0020 mg/L	2020-01-30	
Solids, Total Suspended	3.0	± 0.9		2.0 mg/L	2020-01-30	
<b>Total Metals</b>						
Sodium, total	82.9	± 15.2		0.10 mg/L	2020-02-01	

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0011690  
2020-02-03 18:27

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
---------	--------	-------------	----	-------	----------	-----------

**VWRC Treated Effluent (FTE) Grab - E105004 (0011690-04) | Matrix: Wastewater | Sampled: 2020-01-27 08:00**

### Microbiological Parameters

Coliforms, Total	2.0		1.0	MPN/100 mL	2020-01-27	
Coliforms, Fecal	1.0		1.0	MPN/100 mL	2020-01-27	

### Sample Qualifiers:

FILT	The sample has been filtered for DP in the laboratory. Results may not reflect conditions at the time of sampling.
HT2	The 15 minute recommended holding time (from sampling to analysis) has been exceeded – field analysis is recommended.
PRES	Sample has been preserved for DP in the laboratory and the holding time has been extended.

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0011690  
2020-02-03 18:27

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
<b>VWRC Final Treated Effluent - 24hr Comp. - E105004 (0011690-02)   Matrix: Wastewater   Sampled: 2020-01-26 00:00 To 2020-01-27 00:00</b>						FILT, PRES
<b>Anions</b>						
Chloride	89.4	± 4.9	0.10	mg/L	2020-01-28	
Nitrate (as N)	4.44	± 0.28	0.010	mg/L	2020-01-28	
Nitrite (as N)	0.081	± 0.009	0.010	mg/L	2020-01-28	
Phosphate (as P)	< 0.0050		0.0050	mg/L	2020-01-28	
<b>Calculated Parameters</b>						
Nitrate+Nitrite (as N)	4.52		0.0100	mg/L	N/A	
Nitrogen, Total	6.80		0.0500	mg/L	N/A	
Nitrogen, Organic	1.24		0.0500	mg/L	N/A	
<b>General Parameters</b>						
Ammonia, Total (as N)	1.04	± 0.10	0.020	mg/L	2020-01-29	
BOD, 5-day	< 1.1		2.0	mg/L	2020-02-03	
Conductivity (EC)	725	± 18	2.0	µS/cm	2020-01-28	
Nitrogen, Total Kjeldahl	2.28	± 0.28	0.050	mg/L	2020-01-29	
pH	7.62	± 0.02	0.10	pH units	2020-01-28	HT2
Phosphorus, Total (as P)	0.0835	± 0.0093	0.0020	mg/L	2020-01-30	
Phosphorus, Total Dissolved	0.0424	± 0.0051	0.0020	mg/L	2020-01-30	
Solids, Total Suspended	< 2.0		2.0	mg/L	2020-01-30	
<b>Total Metals</b>						
Sodium, total	76.6	± 14.0	0.10	mg/L	2020-02-01	

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0011960  
2020-02-06 11:09

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
<b>VWRC Treated Effluent (FTE) Grab - E105004 (0011960-03)   Matrix: Wastewater   Sampled: 2020-01-28 13:30</b>						
<b>Microbiological Parameters</b>						
Coliforms, Total	< 1.0		1.0	MPN/100 mL	2020-01-29	
Coliforms, Fecal	< 1.0		1.0	MPN/100 mL	2020-01-29	

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0011960  
2020-02-06 11:09

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
<b>VWRC Final Treated Effluent - 24hr Comp. - E105004 (0011960-01)   Matrix: Wastewater   Sampled: 2020-01-27 00:00 To 2020-01-28 00:00</b>						
<b>Anions</b>						
Chloride	87.4	± 4.8	0.10	mg/L	2020-01-30	
Nitrate (as N)	3.94	± 0.25	0.010	mg/L	2020-01-30	
Nitrite (as N)	0.048	± 0.005	0.010	mg/L	2020-01-30	
Phosphate (as P)	< 0.0050		0.0050	mg/L	2020-01-30	
<b>Calculated Parameters</b>						
Nitrate+Nitrite (as N)	3.99		0.0100	mg/L	N/A	
Nitrogen, Total	5.67		0.0500	mg/L	N/A	
Nitrogen, Organic	1.46		0.0500	mg/L	N/A	
<b>General Parameters</b>						
Ammonia, Total (as N)	0.223	± 0.028	0.020	mg/L	2020-01-30	
BOD, 5-day	< 1.0		2.0	mg/L	2020-02-04	
Conductivity (EC)	756	± 18	2.0	µS/cm	2020-01-31	
Nitrogen, Total Kjeldahl	1.68	± 0.21	0.050	mg/L	2020-01-31	
pH	7.81	± 0.02	0.10	pH units	2020-01-31	HT2
Phosphorus, Total (as P)	0.111	± 0.012	0.0020	mg/L	2020-01-31	
Phosphorus, Total Dissolved	0.0398	± 0.0048	0.0020	mg/L	2020-01-31	
Solids, Total Suspended	< 2.0		2.0	mg/L	2020-01-30	
<b>Total Metals</b>						
Sodium, total	78.1	± 14.3	0.10	mg/L	2020-02-04	

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0011960  
2020-02-06 11:09

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
---------	--------	-------------	----	-------	----------	-----------

**VWRC Treated Effluent (FTE) Grab - E105004 (0011960-04) | Matrix: Wastewater | Sampled: 2020-01-29 08:30**

**Microbiological Parameters**

Coliforms, Total	1.0		1.0	MPN/100 mL	2020-01-29	
Coliforms, Fecal	< 1.0		1.0	MPN/100 mL	2020-01-29	

**Sample Qualifiers:**

HT2 The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.



## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0011960  
2020-02-06 11:09

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
<b>VWRC Final Treated Effluent - 24hr Comp. - E105004 (0011960-02)   Matrix: Wastewater   Sampled: 2020-01-28 00:00 To 2020-01-29 00:00</b>						
<b>Anions</b>						
Chloride	97.9	± 5.4	0.10	mg/L	2020-01-30	
Nitrate (as N)	3.26	± 0.20	0.010	mg/L	2020-01-30	
Nitrite (as N)	0.071	± 0.008	0.010	mg/L	2020-01-30	
Phosphate (as P)	< 0.0050		0.0050	mg/L	2020-01-30	
<b>Calculated Parameters</b>						
Nitrate+Nitrite (as N)	3.33		0.0100	mg/L	N/A	
Nitrogen, Total	4.95		0.0500	mg/L	N/A	
Nitrogen, Organic	1.33		0.0500	mg/L	N/A	
<b>General Parameters</b>						
Ammonia, Total (as N)	0.287	± 0.033	0.020	mg/L	2020-01-30	
BOD, 5-day	< 1.0		2.0	mg/L	2020-02-04	
Conductivity (EC)	806	± 19	2.0	µS/cm	2020-01-31	
Nitrogen, Total Kjeldahl	1.62	± 0.20	0.050	mg/L	2020-01-31	
pH	7.84	± 0.02	0.10	pH units	2020-01-31	HT2
Phosphorus, Total (as P)	0.119	± 0.013	0.0020	mg/L	2020-01-31	
Phosphorus, Total Dissolved	0.0650	± 0.0077	0.0020	mg/L	2020-01-31	
Solids, Total Suspended	< 2.0		2.0	mg/L	2020-01-30	
<b>Total Metals</b>						
Sodium, total	90.6	± 16.6	0.10	mg/L	2020-02-04	



## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0012184  
2020-02-07 15:14

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
<b>VWRC Treated Effluent (FTE) Grab - E105004 (0012184-03)   Matrix: Wastewater   Sampled: 2020-01-30 13:00</b>						
<b>Microbiological Parameters</b>						
Coliforms, Total	6.2		1.0	MPN/100 mL	2020-01-31	
Coliforms, Fecal	< 1.0		1.0	MPN/100 mL	2020-01-31	

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0012184  
2020-02-07 15:14

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
<b>VWRC Final Treated Effluent - 24hr Comp. - E105004 (0012184-01)   Matrix: Wastewater   Sampled: 2020-01-29 00:00 To 2020-01-30 00:00</b>						FILT, PRES
<b>Anions</b>						
Chloride	96.7	± 5.3	0.10	mg/L	2020-02-01	
Nitrate (as N)	2.92	± 0.18	0.010	mg/L	2020-02-01	
Nitrite (as N)	0.047	± 0.005	0.010	mg/L	2020-02-01	
Phosphate (as P)	0.0130	± 0.0033	0.0050	mg/L	2020-02-01	
<b>Calculated Parameters</b>						
Nitrate+Nitrite (as N)	2.97		0.0100	mg/L	N/A	
Nitrogen, Total	5.02		0.0500	mg/L	N/A	
Nitrogen, Organic	1.87		0.0500	mg/L	N/A	
<b>General Parameters</b>						
Ammonia, Total (as N)	0.184	± 0.026	0.020	mg/L	2020-02-03	
BOD, 5-day	< 1.1		2.0	mg/L	2020-02-06	
Conductivity (EC)	879	± 21	2.0	µS/cm	2020-02-01	
Nitrogen, Total Kjeldahl	2.06	± 0.26	0.050	mg/L	2020-02-04	
pH	7.92	± 0.02	0.10	pH units	2020-02-01	HT2
Phosphorus, Total (as P)	0.154	± 0.017	0.0020	mg/L	2020-02-06	
Phosphorus, Total Dissolved	0.0645	± 0.0077	0.0020	mg/L	2020-02-06	
Solids, Total Suspended	< 4.0		2.0	mg/L	2020-02-05	
<b>Total Metals</b>						
Sodium, total	87.0	± 15.9	0.10	mg/L	2020-02-06	

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0012184  
2020-02-07 15:14

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
---------	--------	-------------	----	-------	----------	-----------

**VWRC Treated Effluent (FTE) Grab - E105004 (0012184-04) | Matrix: Wastewater | Sampled: 2020-01-31 08:30**

### Microbiological Parameters

Coliforms, Total	236		1.0	MPN/100 mL	2020-01-31	
Coliforms, Fecal	7.5		1.0	MPN/100 mL	2020-01-31	

### Sample Qualifiers:

FILT	The sample has been filtered for DP in the laboratory. Results may not reflect conditions at the time of sampling.
HT2	The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.
PRES	Sample has been preserved for DP in the laboratory and the holding time has been extended.

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0012184  
2020-02-07 15:14

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
<b>VWRC Final Treated Effluent - 24hr Comp. - E105004 (0012184-02)   Matrix: Wastewater   Sampled: 2020-01-30 00:00 To 2020-01-31 00:00</b>						FILT, PRES
<b>Anions</b>						
Chloride	90.0	± 5.0	0.10	mg/L	2020-02-01	
Nitrate (as N)	3.03	± 0.19	0.010	mg/L	2020-02-01	
Nitrite (as N)	0.062	± 0.007	0.010	mg/L	2020-02-01	
Phosphate (as P)	0.0118	± 0.0032	0.0050	mg/L	2020-02-01	
<b>Calculated Parameters</b>						
Nitrate+Nitrite (as N)	3.09		0.0100	mg/L	N/A	
Nitrogen, Total	4.89		0.0500	mg/L	N/A	
Nitrogen, Organic	1.53		0.0500	mg/L	N/A	
<b>General Parameters</b>						
Ammonia, Total (as N)	0.263	± 0.031	0.020	mg/L	2020-02-03	
BOD, 5-day	< 1.1		2.0	mg/L	2020-02-06	
Conductivity (EC)	897	± 22	2.0	µS/cm	2020-02-01	
Nitrogen, Total Kjeldahl	1.80	± 0.22	0.050	mg/L	2020-02-04	
pH	7.98	± 0.02	0.10	pH units	2020-02-01	HT2
Phosphorus, Total (as P)	0.153	± 0.017	0.0020	mg/L	2020-02-06	
Phosphorus, Total Dissolved	0.0734	± 0.0087	0.0020	mg/L	2020-02-06	
Solids, Total Suspended	< 4.0		2.0	mg/L	2020-02-05	
<b>Total Metals</b>						
Sodium, total	92.3	± 16.9	0.10	mg/L	2020-02-06	



## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO#** 0020002  
**REPORTED** 2020-02-10 17:07

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
<b>VWRC Final Treated Effluent 24hr Comp. - E105004 (0020002-02)   Matrix: Wastewater   Sampled: 2020-02-01 09:00</b>						
<b>Microbiological Parameters</b>						
Coliforms, Total (MPN)	2.0		3.0	MPN/100 mL	2020-02-01	
Coliforms, Fecal (MPN)	< 1.8		3.0	MPN/100 mL	2020-02-01	

**Sample Qualifiers:**

HT2 The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.



## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0020002  
2020-02-10 17:07

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
<b>VWRC Final Treated Effluent - 24hr Comp. - E105004 (0020002-01)   Matrix: Wastewater   Sampled: 2020-01-31 00:00 To 2020-02-01 00:00</b>						
<b>Anions</b>						
Chloride	89.8	± 5.0	0.10	mg/L	2020-02-02	
Nitrate (as N)	3.48	± 0.22	0.010	mg/L	2020-02-02	
Nitrite (as N)	0.080	± 0.009	0.010	mg/L	2020-02-02	
Phosphate (as P)	0.0074	± 0.0027	0.0050	mg/L	2020-02-02	
<b>Calculated Parameters</b>						
Nitrate+Nitrite (as N)	3.56		0.0100	mg/L	N/A	
Nitrogen, Total	6.06		0.0500	mg/L	N/A	
Nitrogen, Organic	1.57		0.0500	mg/L	N/A	
<b>General Parameters</b>						
Ammonia, Total (as N)	0.926	± 0.086	0.020	mg/L	2020-02-03	
BOD, 5-day	< 1.1		2.0	mg/L	2020-02-06	
Conductivity (EC)	892	± 22	2.0	µS/cm	2020-02-01	
Nitrogen, Total Kjeldahl	2.50	± 0.31	0.050	mg/L	2020-02-05	
pH	7.94	± 0.02	0.10	pH units	2020-02-01	HT2
Phosphorus, Total (as P)	0.139	± 0.015	0.0020	mg/L	2020-02-06	
Phosphorus, Total Dissolved	0.109	± 0.013	0.0020	mg/L	2020-02-06	
Solids, Total Suspended	< 4.0		2.0	mg/L	2020-02-06	
<b>Total Metals</b>						
Sodium, total	96.4	± 17.6	0.10	mg/L	2020-02-07	

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0020076  
2020-02-10 13:06

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
<b>VWRC Treated Effluent (FTE) Grab - E105004 (0020076-03)   Matrix: Wastewater   Sampled: 2020-02-02 17:00</b>						
<b>Microbiological Parameters</b>						
Coliforms, Total	30.5		1.0	MPN/100 mL	2020-02-03	
Coliforms, Fecal	1.0		1.0	MPN/100 mL	2020-02-03	

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0020076  
2020-02-10 13:06

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
<b>VWRC Final Treated Effluent - 24hr Comp. - E105004 (0020076-01)   Matrix: Wastewater   Sampled: 2020-02-01 00:00 To 2020-02-02 00:00</b>						FILT, PRES
<b>Anions</b>						
Chloride	82.8	± 4.6	0.10	mg/L	2020-02-05	
Nitrate (as N)	3.88	± 0.24	0.010	mg/L	2020-02-05	
Nitrite (as N)	0.063	± 0.007	0.010	mg/L	2020-02-05	
Phosphate (as P)	0.0098	± 0.0029	0.0050	mg/L	2020-02-05	
<b>Calculated Parameters</b>						
Nitrate+Nitrite (as N)	3.94		0.0100	mg/L	N/A	
Nitrogen, Total	7.09		0.0500	mg/L	N/A	
Nitrogen, Organic	1.46		0.0500	mg/L	N/A	
<b>General Parameters</b>						
Ammonia, Total (as N)	1.68	± 0.15	0.020	mg/L	2020-02-05	
BOD, 5-day	< 1.0		2.0	mg/L	2020-02-10	
Conductivity (EC)	873	± 21	2.0	µS/cm	2020-02-04	
Nitrogen, Total Kjeldahl	3.14	± 0.39	0.050	mg/L	2020-02-05	
pH	7.87	± 0.02	0.10	pH units	2020-02-04	HT2
Phosphorus, Total (as P)	0.119	± 0.013	0.0020	mg/L	2020-02-07	
Phosphorus, Total Dissolved	0.0708	± 0.0084	0.0020	mg/L	2020-02-07	
Solids, Total Suspended	< 2.6		2.0	mg/L	2020-02-06	
<b>Total Metals</b>						
Sodium, total	90.9	± 16.6	0.10	mg/L	2020-02-07	

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0020076  
2020-02-10 13:06

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
---------	--------	-------------	----	-------	----------	-----------

**VWRC Treated Effluent (FTE) Grab - E105004 (0020076-04) | Matrix: Wastewater | Sampled: 2020-02-03 08:00**

### Microbiological Parameters

Coliforms, Total	51.2		1.0	MPN/100 mL	2020-02-03	
Coliforms, Fecal	9.7		1.0	MPN/100 mL	2020-02-03	

### Sample Qualifiers:

FILT	The sample has been filtered for DO in the laboratory. Results may not reflect conditions at the time of sampling.
FILT <sub>a</sub>	The sample has been filtered for DP in the laboratory. Results may not reflect conditions at the time of sampling.
HT2	The 15 minute recommended holding time (from sampling to analysis) has been exceeded – field analysis is recommended.
PRES	Sample has been preserved for DP in the laboratory and the holding time has been extended.

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0020076  
2020-02-10 13:06

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
<b>VWRC Final Treated Effluent - 24hr Comp. - E105004 (0020076-02)   Matrix: Wastewater   Sampled: 2020-02-02 00:00 To 2020-02-03 00:00</b>						FILTa, PRES
<b>Anions</b>						
Chloride	78.9	± 4.4	0.10	mg/L	2020-02-05	
Nitrate (as N)	4.37	± 0.27	0.010	mg/L	2020-02-05	
Nitrite (as N)	0.035	± 0.004	0.010	mg/L	2020-02-05	
Phosphate (as P)	0.0094	± 0.0029	0.0050	mg/L	2020-02-05	
<b>Calculated Parameters</b>						
Nitrate+Nitrite (as N)	4.40		0.0100	mg/L	N/A	
Nitrogen, Total	9.16		0.100	mg/L	N/A	
Nitrogen, Organic	3.32		0.100	mg/L	N/A	
<b>General Parameters</b>						
Ammonia, Total (as N)	1.45	± 0.13	0.020	mg/L	2020-02-05	
BOD, 5-day	< 1.0		2.0	mg/L	2020-02-10	
Conductivity (EC)	873	± 21	2.0	µS/cm	2020-02-04	
Nitrogen, Total Kjeldahl	4.76	± 0.59	0.050	mg/L	2020-02-05	
pH	7.90	± 0.02	0.10	pH units	2020-02-04	HT2
Phosphorus, Total (as P)	0.0948	± 0.0106	0.0020	mg/L	2020-02-07	
Phosphorus, Total Dissolved	0.0620	± 0.0074	0.0020	mg/L	2020-02-07	
Solids, Total Suspended	< 2.3		2.0	mg/L	2020-02-06	
<b>Total Metals</b>						
Sodium, total	76.7	± 14.0	0.10	mg/L	2020-02-07	

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0020298  
2020-02-12 15:18

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
---------	--------	-------------	----	-------	----------	-----------

**VWRC Treated Effluent (FTE) Grab - E105004 (0020298-03) | Matrix: Wastewater | Sampled: 2020-02-04 13:30**

**Microbiological Parameters**

Coliforms, Total	2.0		1.0	MPN/100 mL	2020-02-05	
Coliforms, Fecal	1.0		1.0	MPN/100 mL	2020-02-05	

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0020298  
2020-02-12 15:18

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
<b>VWRC Final Treated Effluent - 24hr Comp. - E105004 (0020298-01)   Matrix: Wastewater   Sampled: 2020-02-03 00:00 To 2020-02-04 00:00</b>						FILT, PRES
<b>Anions</b>						
Chloride	81.2	± 4.5	0.10	mg/L	2020-02-06	
Nitrate (as N)	4.26	± 0.27	0.010	mg/L	2020-02-06	
Nitrite (as N)	0.029	± 0.004	0.010	mg/L	2020-02-06	
Phosphate (as P)	0.0067	± 0.0027	0.0050	mg/L	2020-02-06	
<b>Calculated Parameters</b>						
Nitrate+Nitrite (as N)	4.29		0.0100	mg/L	N/A	
Nitrogen, Total	6.76		0.250	mg/L	N/A	
Nitrogen, Organic	1.23		0.250	mg/L	N/A	
<b>General Parameters</b>						
Ammonia, Total (as N)	1.23	± 0.11	0.020	mg/L	2020-02-10	
BOD, 5-day	< 1.0		2.0	mg/L	2020-02-11	
Conductivity (EC)	859	± 21	2.0	µS/cm	2020-02-08	
Nitrogen, Total Kjeldahl	2.46	± 0.38	0.050	mg/L	2020-02-07	
pH	7.96	± 0.02	0.10	pH units	2020-02-08	HT2
Phosphorus, Total (as P)	0.0891	± 0.0099	0.0020	mg/L	2020-02-08	
Phosphorus, Total Dissolved	0.0554	± 0.0066	0.0020	mg/L	2020-02-08	
Solids, Total Suspended	< 2.0		2.0	mg/L	2020-02-06	
<b>Total Metals</b>						
Sodium, total	82.4	± 15.1	0.10	mg/L	2020-02-11	



## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0020298  
2020-02-12 15:18

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
---------	--------	-------------	----	-------	----------	-----------

**VWRC Treated Effluent (FTE) Grab - E105004 (0020298-04) | Matrix: Wastewater | Sampled: 2020-02-05 08:00**

**Microbiological Parameters**

Coliforms, Total	2.0		1.0	MPN/100 mL	2020-02-05	
Coliforms, Fecal	< 1.0		1.0	MPN/100 mL	2020-02-05	

**Sample Qualifiers:**

FILT	The sample has been filtered for TDP in the laboratory. Results may not reflect conditions at the time of sampling
HT2	The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.
PRES	Sample has been preserved for TDP in the laboratory and the holding time has been extended.



## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0020298  
2020-02-12 15:18

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
<b>VWRC Final Treated Effluent - 24hr Comp. - E105004 (0020298-02)   Matrix: Wastewater   Sampled: 2020-02-04 00:00 To 2020-02-05 00:00</b>						FILT, PRES
<b>Anions</b>						
Chloride	82.7	± 4.6	0.10	mg/L	2020-02-06	
Nitrate (as N)	3.95	± 0.25	0.010	mg/L	2020-02-06	
Nitrite (as N)	0.028	± 0.004	0.010	mg/L	2020-02-06	
Phosphate (as P)	0.0063	± 0.0026	0.0050	mg/L	2020-02-06	
<b>Calculated Parameters</b>						
Nitrate+Nitrite (as N)	3.98		0.0100	mg/L	N/A	
Nitrogen, Total	6.25		0.250	mg/L	N/A	
Nitrogen, Organic	1.59		0.250	mg/L	N/A	
<b>General Parameters</b>						
Ammonia, Total (as N)	0.682	± 0.064	0.020	mg/L	2020-02-10	
BOD, 5-day	< 1.1		2.0	mg/L	2020-02-12	
Conductivity (EC)	866	± 21	2.0	µS/cm	2020-02-08	
Nitrogen, Total Kjeldahl	2.28	± 0.36	0.050	mg/L	2020-02-07	
pH	7.86	± 0.02	0.10	pH units	2020-02-08	HT2
Phosphorus, Total (as P)	0.0946	± 0.0105	0.0020	mg/L	2020-02-08	
Phosphorus, Total Dissolved	0.0562	± 0.0067	0.0020	mg/L	2020-02-08	
Solids, Total Suspended	< 2.0		2.0	mg/L	2020-02-06	
<b>Total Metals</b>						
Sodium, total	87.2	± 15.9	0.10	mg/L	2020-02-11	

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0020558  
2020-02-14 12:11

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
<b>VWRC Treated Effluent (FTE) Grab - E105004 (0020558-03)   Matrix: Wastewater   Sampled: 2020-02-06 13:00</b>						
<b>Microbiological Parameters</b>						
Coliforms, Total	< 1.0		1.0	MPN/100 mL	2020-02-07	
Coliforms, Fecal	< 1.0		1.0	MPN/100 mL	2020-02-07	

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0020558  
2020-02-14 12:11

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
<b>VWRC Final Treated Effluent - 24hr Comp. - E105004 (0020558-01)   Matrix: Wastewater   Sampled: 2020-02-05 00:00 To 2020-02-06 00:00</b>						FILT, PRES
<b>Anions</b>						
Chloride	91.6	± 5.1	0.10	mg/L	2020-02-09	
Nitrate (as N)	3.83	± 0.24	0.010	mg/L	2020-02-09	
Nitrite (as N)	0.031	± 0.004	0.010	mg/L	2020-02-09	
Phosphate (as P)	0.0069	± 0.0027	0.0050	mg/L	2020-02-09	
<b>Calculated Parameters</b>						
Nitrate+Nitrite (as N)	3.87		0.0100	mg/L	N/A	
Nitrogen, Total	5.99		0.100	mg/L	N/A	
Nitrogen, Organic	1.39		0.100	mg/L	N/A	
<b>General Parameters</b>						
Ammonia, Total (as N)	0.736	± 0.069	0.020	mg/L	2020-02-10	
BOD, 5-day	< 1.2		2.0	mg/L	2020-02-13	
Conductivity (EC)	896	± 22	2.0	µS/cm	2020-02-12	
Nitrogen, Total Kjeldahl	2.12	± 0.28	0.050	mg/L	2020-02-09	
pH	7.85	± 0.02	0.10	pH units	2020-02-12	HT2
Phosphorus, Total (as P)	0.123	± 0.014	0.0020	mg/L	2020-02-12	
Phosphorus, Total Dissolved	0.0781	± 0.0093	0.0020	mg/L	2020-02-12	
Solids, Total Suspended	2.0	± 0.9	2.0	mg/L	2020-02-12	
<b>Total Metals</b>						
Sodium, total	82.6	± 15.1	0.10	mg/L	2020-02-13	

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO#** 0020558  
**REPORTED** 2020-02-14 12:11

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
---------	--------	-------------	----	-------	----------	-----------

**VWRC Treated Effluent (FTE) Grab - E105004 (0020558-04) | Matrix: Wastewater | Sampled: 2020-02-07 08:30**

### Microbiological Parameters

Coliforms, Total	1.0		1.0	MPN/100 mL	2020-02-07	
Coliforms, Fecal	1.0		1.0	MPN/100 mL	2020-02-07	

### Sample Qualifiers:

FILT	The sample has been filtered for TDP in the laboratory. Results may not reflect conditions at the time of sampling.
HT2	The 15 minute recommended holding time (from sampling to analysis) has been exceeded – field analysis is recommended.
PRES	Sample has been preserved for TDP in the laboratory and the holding time has been extended.

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0020558  
2020-02-14 12:11

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
<b>VWRC Final Treated Effluent - 24hr Comp. - E105004 (0020558-02)   Matrix: Wastewater   Sampled: 2020-02-06 00:00 To 2020-02-07 00:00</b>						FILT, PRES
<b>Anions</b>						
Chloride	92.5	± 5.1	0.10	mg/L	2020-02-09	
Nitrate (as N)	3.97	± 0.25	0.010	mg/L	2020-02-09	
Nitrite (as N)	0.036	± 0.004	0.010	mg/L	2020-02-09	
Phosphate (as P)	0.0075	± 0.0027	0.0050	mg/L	2020-02-09	
<b>Calculated Parameters</b>						
Nitrate+Nitrite (as N)	4.01		0.0100	mg/L	N/A	
Nitrogen, Total	6.28		0.100	mg/L	N/A	
Nitrogen, Organic	1.48		0.100	mg/L	N/A	
<b>General Parameters</b>						
Ammonia, Total (as N)	0.789	± 0.074	0.020	mg/L	2020-02-10	
BOD, 5-day	< 1.2		2.0	mg/L	2020-02-13	
Conductivity (EC)	898	± 22	2.0	µS/cm	2020-02-12	
Nitrogen, Total Kjeldahl	2.27	± 0.29	0.050	mg/L	2020-02-09	
pH	7.89	± 0.02	0.10	pH units	2020-02-12	HT2
Phosphorus, Total (as P)	0.110	± 0.012	0.0020	mg/L	2020-02-12	
Phosphorus, Total Dissolved	0.0796	± 0.0095	0.0020	mg/L	2020-02-12	
Solids, Total Suspended	< 2.0		2.0	mg/L	2020-02-12	
<b>Total Metals</b>						
Sodium, total	91.2	± 16.7	0.10	mg/L	2020-02-13	

# Appendix D

## *Effluent Results*

*Caro Analytical Services*

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0011960  
2020-02-06 11:09

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
<b>VWRC Final Treated Effluent - 24hr Comp. - E105004 (0011960-02)   Matrix: Wastewater   Sampled: 2020-01-28 00:00 To 2020-01-29 00:00</b>						
<b>Anions</b>						
Chloride	97.9	± 5.4	0.10	mg/L	2020-01-30	
Nitrate (as N)	3.26	± 0.20	0.010	mg/L	2020-01-30	
Nitrite (as N)	0.071	± 0.008	0.010	mg/L	2020-01-30	
Phosphate (as P)	< 0.0050		0.0050	mg/L	2020-01-30	
<b>Calculated Parameters</b>						
Nitrate+Nitrite (as N)	3.33		0.0100	mg/L	N/A	
Nitrogen, Total	4.95		0.0500	mg/L	N/A	
Nitrogen, Organic	1.33		0.0500	mg/L	N/A	
<b>General Parameters</b>						
Ammonia, Total (as N)	0.287	± 0.033	0.020	mg/L	2020-01-30	
BOD, 5-day	< 1.0		2.0	mg/L	2020-02-04	
Conductivity (EC)	806	± 19	2.0	µS/cm	2020-01-31	
Nitrogen, Total Kjeldahl	1.62	± 0.20	0.050	mg/L	2020-01-31	
pH	7.84	± 0.02	0.10	pH units	2020-01-31	HT2
Phosphorus, Total (as P)	0.119	± 0.013	0.0020	mg/L	2020-01-31	
Phosphorus, Total Dissolved	0.0650	± 0.0077	0.0020	mg/L	2020-01-31	
Solids, Total Suspended	< 2.0		2.0	mg/L	2020-01-30	
<b>Total Metals</b>						
Sodium, total	90.6	± 16.6	0.10	mg/L	2020-02-04	



## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0021089  
2020-02-21 11:42

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
---------	--------	-------------	----	-------	----------	-----------

**VWRC Treated Effluent (FTE) Grab - E228121 (0021089-04) | Matrix: Wastewater | Sampled: 2020-02-13 08:30**

### Microbiological Parameters

Coliforms, Total	15.6		1.0	MPN/100 mL	2020-02-13	
Coliforms, Fecal	< 1.0		1.0	MPN/100 mL	2020-02-13	

### Sample Qualifiers:

FILT	The sample has been filtered for DP in the laboratory. Results may not reflect conditions at the time of sampling.
HT2	The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.
PRES	Sample has been preserved for DP in the laboratory and the holding time has been extended.

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0021089  
2020-02-21 11:42

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
<b>VWRC Final Treated Effluent - 24hr Comp. - E228121 (0021089-03)   Matrix: Wastewater   Sampled: 2020-02-12 00:00 To 2020-02-13 00:00</b>						FILT, PRES
<b>Anions</b>						
Chloride	90.0	± 5.0	0.10	mg/L	2020-02-14	
Nitrate (as N)	3.10	± 0.19	0.010	mg/L	2020-02-14	
Nitrite (as N)	0.109	± 0.011	0.010	mg/L	2020-02-14	
Phosphate (as P)	0.0119	± 0.0032	0.0050	mg/L	2020-02-14	
<b>Calculated Parameters</b>						
Nitrate+Nitrite (as N)	3.21		0.0100	mg/L	N/A	
Nitrogen, Total	5.10		0.100	mg/L	N/A	
Nitrogen, Organic	1.62		0.100	mg/L	N/A	
<b>General Parameters</b>						
Ammonia, Total (as N)	0.271	± 0.032	0.020	mg/L	2020-02-19	
BOD, 5-day	< 1.0		2.0	mg/L	2020-02-19	
Conductivity (EC)	919	± 22	2.0	µS/cm	2020-02-14	
Nitrogen, Total Kjeldahl	1.89	± 0.25	0.050	mg/L	2020-02-15	
pH	7.88	± 0.02	0.10	pH units	2020-02-14	HT2
Phosphorus, Total (as P)	0.131	± 0.015	0.0020	mg/L	2020-02-14	
Phosphorus, Total Dissolved	0.0878	± 0.0104	0.0020	mg/L	2020-02-14	
Solids, Total Suspended	2.4	± 0.9	2.0	mg/L	2020-02-19	
<b>Total Metals</b>						
Sodium, total	95.3	± 17.3	0.10	mg/L	2020-02-19	

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0021785  
2020-02-28 12:22

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
<b>VWRC Final Treated Effluent - 24hr Comp. - E228121 (0021785-01)   Matrix: Fresh Water   Sampled: 2020-02-20</b>						FILT, PRES
<b>Anions</b>						
Chloride	88.3	± 4.9	0.10	mg/L	2020-02-22	
Nitrate (as N)	3.30	± 0.21	0.010	mg/L	2020-02-22	
Nitrite (as N)	0.130	± 0.014	0.010	mg/L	2020-02-22	
Phosphate (as P)	< 0.0050		0.0050	mg/L	2020-02-22	
<b>Calculated Parameters</b>						
Nitrate+Nitrite (as N)	3.43		0.0100	mg/L	N/A	
Nitrogen, Total	5.00		0.0500	mg/L	N/A	
Nitrogen, Organic	1.43		0.0500	mg/L	N/A	
<b>General Parameters</b>						
Alkalinity, Total (as CaCO <sub>3</sub> )	194	± 11	1.0	mg/L	2020-02-22	
Alkalinity, Phenolphthalein (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-02-22	
Alkalinity, Bicarbonate (as CaCO <sub>3</sub> )	194		1.0	mg/L	2020-02-22	
Alkalinity, Carbonate (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-02-22	
Alkalinity, Hydroxide (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-02-22	
Ammonia, Total (as N)	0.149	± 0.024	0.020	mg/L	2020-02-25	
BOD, 5-day	< 1.0		2.0	mg/L	2020-02-27	
BOD, 5-day Carbonaceous	< 1.0		2.0	mg/L	2020-02-27	
Conductivity (EC)	891	± 22	2.0	µS/cm	2020-02-22	
Nitrogen, Total Kjeldahl	1.58	± 0.20	0.050	mg/L	2020-02-25	
pH	7.85	± 0.02	0.10	pH units	2020-02-25	HT2
Phosphorus, Total (as P)	0.115	± 0.013	0.0020	mg/L	2020-02-26	
Phosphorus, Total Dissolved	0.0765	± 0.0091	0.0020	mg/L	2020-02-26	
Solids, Total Suspended	< 2.0		2.0	mg/L	2020-02-25	
<b>Total Metals</b>						
Sodium, total	86.1	± 15.7	0.10	mg/L	2020-02-28	

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0022359  
2020-03-06 12:10

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
<b>VWRC Final Treated Effluent - 24hr Comp. - E228121 (0022359-02)   Matrix: Fresh Water   Sampled: 2020-02-27 00:00 To 2020-02-28 00:00</b>						FILT, PRES
<b>Anions</b>						
Chloride	86.6	± 4.8	0.10	mg/L	2020-02-29	
Nitrate (as N)	4.99	± 0.31	0.010	mg/L	2020-02-29	
Nitrite (as N)	0.376	± 0.039	0.010	mg/L	2020-02-29	
Phosphate (as P)	0.0123	± 0.0032	0.0050	mg/L	2020-02-29	
<b>Calculated Parameters</b>						
Nitrate+Nitrite (as N)	5.37		0.0100	mg/L	N/A	
Nitrogen, Total	7.36		0.0500	mg/L	N/A	
Nitrogen, Organic	1.46		0.0500	mg/L	N/A	
<b>General Parameters</b>						
Alkalinity, Total (as CaCO <sub>3</sub> )	207	± 11	1.0	mg/L	2020-02-29	
Alkalinity, Phenolphthalein (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-02-29	
Alkalinity, Bicarbonate (as CaCO <sub>3</sub> )	207		1.0	mg/L	2020-02-29	
Alkalinity, Carbonate (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-02-29	
Alkalinity, Hydroxide (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-02-29	
Ammonia, Total (as N)	0.534	± 0.052	0.020	mg/L	2020-03-03	
BOD, 5-day	2.4	± 1.2	2.0	mg/L	2020-03-05	
BOD, 5-day Carbonaceous	2.6	± 1.2	2.0	mg/L	2020-03-05	
Conductivity (EC)	913	± 22	2.0	µS/cm	2020-02-29	
Nitrogen, Total Kjeldahl	1.99	± 0.25	0.050	mg/L	2020-03-04	
pH	7.78	± 0.02	0.10	pH units	2020-02-29	HT2
Phosphorus, Total (as P)	0.191	± 0.021	0.0020	mg/L	2020-03-03	
Phosphorus, Total Dissolved	0.0910	± 0.0108	0.0020	mg/L	2020-03-03	
Solids, Total Suspended	< 2.0		2.0	mg/L	2020-03-05	
<b>Total Metals</b>						
Sodium, total	85.6	± 16.5	0.10	mg/L	2020-03-05	

### Sample Qualifiers:

FILT The sample has been filtered for DP in the laboratory. Results may not reflect conditions at the time of sampling.

HT2 The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.

PRES Sample has been preserved for DP in the laboratory and the holding time has been extended.

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0030309  
2020-03-10 14:25

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
---------	--------	-------------	----	-------	----------	-----------

**VWRC Treated Effluent (FTE) Grab - E228121 (0030309-03) | Matrix: Fresh Water | Sampled: 2020-03-04 10:30**

### Microbiological Parameters

Coliforms, Total	9.8		1.0	MPN/100 mL	2020-03-04	
Coliforms, Fecal	3.1		1.0	MPN/100 mL	2020-03-04	

### Sample Qualifiers:

FILT	The sample has been filtered for TDP in the laboratory. Results may not reflect conditions at the time of sampling.
HT2	The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.
PRES	Sample has been preserved for TDP in the laboratory and the holding time has been extended.

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0030591  
2020-03-13 15:38

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
<b>VWRC Final Treated Effluent - 24hr Comp. - E228121 (0030591-02)   Matrix: Fresh Water   Sampled: 2020-03-05 00:00 To 2020-03-06 00:00</b>						FILT, PRES
<b>Anions</b>						
Chloride	86.1	± 4.8	0.10	mg/L	2020-03-07	
Nitrate (as N)	3.03	± 0.19	0.010	mg/L	2020-03-07	
Nitrite (as N)	0.054	± 0.006	0.010	mg/L	2020-03-07	
Phosphate (as P)	0.0137	± 0.0034	0.0050	mg/L	2020-03-07	
<b>Calculated Parameters</b>						
Nitrate+Nitrite (as N)	3.09		0.0100	mg/L	N/A	
Nitrogen, Total	4.77		0.0500	mg/L	N/A	
Nitrogen, Organic	1.61		0.0500	mg/L	N/A	
<b>General Parameters</b>						
Alkalinity, Total (as CaCO <sub>3</sub> )	238	± 13	1.0	mg/L	2020-03-07	
Alkalinity, Phenolphthalein (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-03-07	
Alkalinity, Bicarbonate (as CaCO <sub>3</sub> )	238		1.0	mg/L	2020-03-07	
Alkalinity, Carbonate (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-03-07	
Alkalinity, Hydroxide (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-03-07	
Ammonia, Total (as N)	0.072	± 0.021	0.020	mg/L	2020-03-10	
BOD, 5-day	1.3	± 1.1	2.0	mg/L	2020-03-12	
BOD, 5-day Carbonaceous	1.2	± 1.0	2.0	mg/L	2020-03-12	
Conductivity (EC)	920	± 22	2.0	µS/cm	2020-03-07	
Nitrogen, Total Kjeldahl	1.68	± 0.21	0.050	mg/L	2020-03-10	
pH	7.51	± 0.02	0.10	pH units	2020-03-07	HT2
Phosphorus, Total (as P)	0.184	± 0.020	0.0020	mg/L	2020-03-12	
Phosphorus, Total Dissolved	0.0949	± 0.0112	0.0020	mg/L	2020-03-12	
Solids, Total Suspended	< 2.0		2.0	mg/L	2020-03-12	
<b>Total Metals</b>						
Sodium, total	84.1	± 14.9	0.10	mg/L	2020-03-11	

### Sample Qualifiers:

FILT	The sample has been filtered for TDP in the laboratory. Results may not reflect conditions at the time of sampling.
HT2	The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.
PRES	Sample has been preserved for TDP in the laboratory and the holding time has been extended.

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0031109  
2020-03-19 14:55

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
<b>VWRC Final Treated Effluent - 24hr Comp. - E228121 (0031109-03)   Matrix: Fresh Water   Sampled: 2020-03-11 00:00 To 2020-03-12 00:00</b>						FILT, PRES
<b>Anions</b>						
Chloride	84.6	± 4.7	0.10	mg/L	2020-03-12	
Nitrate (as N)	3.00	± 0.19	0.010	mg/L	2020-03-12	
Nitrite (as N)	0.274	± 0.028	0.010	mg/L	2020-03-12	
Phosphate (as P)	0.0100	± 0.0030	0.0050	mg/L	2020-03-12	
<b>Calculated Parameters</b>						
Nitrate+Nitrite (as N)	3.27		0.0100	mg/L	N/A	
Nitrogen, Total	5.30		0.0500	mg/L	N/A	
Nitrogen, Organic	1.33		0.0500	mg/L	N/A	
<b>General Parameters</b>						
Alkalinity, Total (as CaCO <sub>3</sub> )	233	± 13	1.0	mg/L	2020-03-14	
Alkalinity, Phenolphthalein (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-03-14	
Alkalinity, Bicarbonate (as CaCO <sub>3</sub> )	233		1.0	mg/L	2020-03-14	
Alkalinity, Carbonate (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-03-14	
Alkalinity, Hydroxide (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-03-14	
Ammonia, Total (as N)	0.694	± 0.066	0.020	mg/L	2020-03-13	
BOD, 5-day	4.1	± 1.3	2.0	mg/L	2020-03-18	
BOD, 5-day Carbonaceous	4.6	± 1.3	2.0	mg/L	2020-03-18	
Conductivity (EC)	927	± 22	2.0	µS/cm	2020-03-14	
Nitrogen, Total Kjeldahl	2.03	± 0.25	0.050	mg/L	2020-03-14	
pH	7.76	± 0.02	0.10	pH units	2020-03-14	HT2
Phosphorus, Total (as P)	0.173	± 0.019	0.0020	mg/L	2020-03-16	
Phosphorus, Total Dissolved	0.120	± 0.014	0.0020	mg/L	2020-03-16	
Solids, Total Suspended	< 2.0		2.0	mg/L	2020-03-18	
<b>Total Metals</b>						
Sodium, total	93.3	± 17.1	0.10	mg/L	2020-03-19	

### Sample Qualifiers:

FILT The sample has been filtered for DP in the laboratory. Results may not reflect conditions at the time of sampling.

HT2 The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.

PRES Sample has been preserved for DP in the laboratory and the holding time has been extended.

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0031689  
2020-03-26 14:58

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
<b>VWRC Final Treated Effluent - 24hr Comp. - E228121 (0031689-01)   Matrix: Fresh Water   Sampled: 2020-03-17 00:00 To 2020-03-18 00:00</b>						FILT, PRES
<b>Anions</b>						
Chloride	93.0	± 5.1	0.10	mg/L	2020-03-19	
Nitrate (as N)	4.45	± 0.28	0.010	mg/L	2020-03-19	
Nitrite (as N)	0.607	± 0.063	0.010	mg/L	2020-03-19	
Phosphate (as P)	0.0230	± 0.0047	0.0050	mg/L	2020-03-19	
<b>Calculated Parameters</b>						
Nitrate+Nitrite (as N)	5.06		0.0100	mg/L	N/A	
Nitrogen, Total	12.4		0.250	mg/L	N/A	
Nitrogen, Organic	2.40		0.250	mg/L	N/A	
<b>General Parameters</b>						
Alkalinity, Total (as CaCO <sub>3</sub> )	243	± 13	1.0	mg/L	2020-03-21	
Alkalinity, Phenolphthalein (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-03-21	
Alkalinity, Bicarbonate (as CaCO <sub>3</sub> )	243		1.0	mg/L	2020-03-21	
Alkalinity, Carbonate (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-03-21	
Alkalinity, Hydroxide (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-03-21	
Ammonia, Total (as N)	4.96	± 0.45	0.020	mg/L	2020-03-25	
BOD, 5-day	4.4	± 1.2	2.0	mg/L	2020-03-25	
BOD, 5-day Carbonaceous	5.6	± 1.6	2.0	mg/L	2020-03-26	
Conductivity (EC)	876	± 21	2.0	µS/cm	2020-03-21	
Nitrogen, Total Kjeldahl	7.36	± 0.93	0.050	mg/L	2020-03-20	
pH	7.85	± 0.02	0.10	pH units	2020-03-21	HT2
Phosphorus, Total (as P)	0.198	± 0.022	0.0020	mg/L	2020-03-20	
Phosphorus, Total Dissolved	0.134	± 0.016	0.0020	mg/L	2020-03-20	
Solids, Total Suspended	2.0	± 0.9	2.0	mg/L	2020-03-25	
<b>Total Metals</b>						
Sodium, total	94.8	± 17.3	0.10	mg/L	2020-03-24	

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0032255  
2020-04-03 15:34

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
<b>VWRC Final Treated Effluent - 24hr Comp. - E228121 (0032255-01)   Matrix: Fresh Water   Sampled: 2020-03-27</b>						FILT, PRES
<b>Anions</b>						
Chloride	86.4	± 4.8	0.10	mg/L	2020-03-27	
Nitrate (as N)	5.37	± 0.34	0.010	mg/L	2020-03-27	
Nitrite (as N)	0.281	± 0.029	0.010	mg/L	2020-03-27	
Phosphate (as P)	0.0198	± 0.0042	0.0050	mg/L	2020-03-27	
<b>Calculated Parameters</b>						
Nitrate+Nitrite (as N)	5.65		0.0100	mg/L	N/A	
Nitrogen, Total	10.1		0.100	mg/L	N/A	
Nitrogen, Organic	2.02		0.100	mg/L	N/A	
<b>General Parameters</b>						
Alkalinity, Total (as CaCO <sub>3</sub> )	223	± 12	1.0	mg/L	2020-03-28	
Alkalinity, Phenolphthalein (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-03-28	
Alkalinity, Bicarbonate (as CaCO <sub>3</sub> )	223		1.0	mg/L	2020-03-28	
Alkalinity, Carbonate (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-03-28	
Alkalinity, Hydroxide (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-03-28	
Ammonia, Total (as N)	2.43	± 0.22	0.050	mg/L	2020-03-31	
BOD, 5-day	4.9	± 1.3	2.0	mg/L	2020-04-02	
BOD, 5-day Carbonaceous	2.4	± 0.9	2.0	mg/L	2020-04-02	
Conductivity (EC)	921	± 22	2.0	µS/cm	2020-03-30	
Nitrogen, Total Kjeldahl	4.46	± 0.55	0.050	mg/L	2020-03-31	
pH	7.89	± 0.02	0.10	pH units	2020-03-28	HT2
Phosphorus, Total (as P)	0.223	± 0.025	0.0020	mg/L	2020-04-02	
Phosphorus, Total Dissolved	0.153	± 0.018	0.0020	mg/L	2020-04-02	
Solids, Total Suspended	2.4	± 0.9	2.0	mg/L	2020-04-01	
<b>Total Metals</b>						
Sodium, total	104	± 19	0.10	mg/L	2020-04-01	

### Sample Qualifiers:

FILT The sample has been filtered for DP in the laboratory. Results may not reflect conditions at the time of sampling.  
HT2 The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.  
PRES Sample has been preserved for DP in the laboratory and the holding time has been extended.

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0040286  
2020-04-14 15:25

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
<b>VWRC Treated Effluent (FTE) Grab - E228121 (0040286-01)   Matrix: Fresh Water   Sampled: 2020-04-01 00:00 To 2020-04-02 00:00</b>						FILT, PRES
<b>Anions</b>						
Chloride	82.6	± 4.6	0.10	mg/L	2020-04-04	
Nitrate (as N)	5.51	± 0.35	0.010	mg/L	2020-04-04	
Nitrite (as N)	0.256	± 0.026	0.010	mg/L	2020-04-04	
Phosphate (as P)	0.0312	± 0.0059	0.0050	mg/L	2020-04-04	
<b>Calculated Parameters</b>						
Nitrate+Nitrite (as N)	5.77		0.0100	mg/L	N/A	
Nitrogen, Total	12.2		0.250	mg/L	N/A	
Nitrogen, Organic	1.06		0.500	mg/L	N/A	
<b>General Parameters</b>						
Ammonia, Total (as N)	5.38	± 0.52	0.050	mg/L	2020-04-07	
BOD, 5-day	< 3.4		2.0	mg/L	2020-04-09	
BOD, 5-day Carbonaceous	< 3.7		2.0	mg/L	2020-04-09	
Conductivity (EC)	830	± 20	2.0	µS/cm	2020-04-06	
Nitrogen, Total Kjeldahl	6.44	± 0.82	0.050	mg/L	2020-04-07	
pH	8.05	± 0.02	0.10	pH units	2020-04-06	HT2
Phosphorus, Total (as P)	0.248	± 0.028	0.0020	mg/L	2020-04-04	
Phosphorus, Total Dissolved	0.185	± 0.022	0.0020	mg/L	2020-04-04	
Solids, Total Suspended	< 3.8		2.0	mg/L	2020-04-08	
<b>Total Metals</b>						
Sodium, total	89.2	± 15.5	0.10	mg/L	2020-04-07	

### Sample Qualifiers:

FILT The sample has been filtered for DO in the laboratory. Results may not reflect conditions at the time of sampling.

HT2 The 15 minute recommended holding time (from sampling to analysis) has been exceeded — field analysis is recommended.

PRES Sample has been preserved for DP in the laboratory and the holding time has been extended.

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0040836  
2020-04-20 16:17

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
<b>VWRC Final Treated Effluent - 24hr Comp. - E105004 (0040836-01)   Matrix: Fresh Water   Sampled: 2020-04-08 00:00 To 2020-04-09 00:00</b>						
<b>Anions</b>						
Chloride	81.4	± 4.5	0.10	mg/L	2020-04-09	
Nitrate (as N)	3.96	± 0.25	0.010	mg/L	2020-04-09	
Nitrite (as N)	0.029	± 0.004	0.010	mg/L	2020-04-09	
Phosphate (as P)	0.149	± 0.026	0.0050	mg/L	2020-04-09	
<b>Calculated Parameters</b>						
Ammonia, Un-Ionized (as N)	0.006		0.001	mg/L	2020-04-20	
Nitrate+Nitrite (as N)	3.99		0.0100	mg/L	N/A	
Nitrogen, Total	5.65		0.0500	mg/L	N/A	
Nitrogen, Organic	1.57		0.0500	mg/L	N/A	
<b>General Parameters</b>						
Alkalinity, Total (as CaCO <sub>3</sub> )	209	± 12	1.0	mg/L	2020-04-17	
Alkalinity, Phenolphthalein (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-04-17	
Alkalinity, Bicarbonate (as CaCO <sub>3</sub> )	209		1.0	mg/L	2020-04-17	
Alkalinity, Carbonate (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-04-17	
Alkalinity, Hydroxide (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-04-17	
Ammonia, Total (as N)	0.091	± 0.022	0.050	mg/L	2020-04-17	
BOD, 5-day	3.0	± 1.4	2.0	mg/L	2020-04-15	
Conductivity (EC)	866	± 21	2.0	µS/cm	2020-04-17	
Nitrogen, Total Kjeldahl	1.66	± 0.21	0.050	mg/L	2020-04-15	
pH	8.10	± 0.02	0.10	pH units	2020-04-17	HT2
Phosphorus, Total (as P)	0.436	± 0.048	0.0020	mg/L	2020-04-16	
Phosphorus, Total Dissolved	0.371	± 0.044	0.0020	mg/L	2020-04-16	
Solids, Total	516	± 171	20	mg/L	2020-04-14	
Solids, Total Suspended	< 2.0		2.0	mg/L	2020-04-16	
Temperature, at pH	23.6			°C	2020-04-17	HT2
Turbidity	0.68	± 0.07	0.10	NTU	2020-04-10	
<b>Total Metals</b>						
Sodium, total	87.3	± 15.2	0.10	mg/L	2020-04-16	

### Sample Qualifiers:

HT2 The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0040921  
2020-04-21 17:21

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
<b>VWRC Treated Effluent (FTE) Grab - E228121 (0040921-03)   Matrix: Fresh Water   Sampled: 2020-04-14</b>						
<b>Microbiological Parameters</b>						
Coliforms, Total	< 1.0		1.0	MPN/100 mL	2020-04-14	
Coliforms, Fecal	< 1.0		1.0	MPN/100 mL	2020-04-14	

### Sample Qualifiers:

FILT The sample has been filtered for DP in the laboratory. Results may not reflect conditions at the time of sampling.

HT2 The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.

PRES Sample has been preserved for DP in the laboratory and the holding time has been extended.

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0041341  
2020-04-27 15:32

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
<b>VWRC Final Treated Effluent - 24hr Comp. - E228121 (0041341-01)   Matrix: Fresh Water   Sampled: 2020-04-16 00:00 To 2020-04-17 00:00</b>						FILT, PRES
<b>Anions</b>						
Chloride	87.3	± 4.8	0.10	mg/L	2020-04-19	
Nitrate (as N)	4.02	± 0.25	0.010	mg/L	2020-04-19	
Nitrite (as N)	0.020	± 0.003	0.010	mg/L	2020-04-19	
Phosphate (as P)	0.180	± 0.031	0.0050	mg/L	2020-04-19	
<b>Calculated Parameters</b>						
Nitrate+Nitrite (as N)	4.04		0.0100	mg/L	N/A	
Nitrogen, Total	5.74		0.0500	mg/L	N/A	
Nitrogen, Organic	1.50		0.0500	mg/L	N/A	
<b>General Parameters</b>						
Alkalinity, Total (as CaCO <sub>3</sub> )	203	± 11	1.0	mg/L	2020-04-22	
Alkalinity, Phenolphthalein (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-04-22	
Alkalinity, Bicarbonate (as CaCO <sub>3</sub> )	203		1.0	mg/L	2020-04-22	
Alkalinity, Carbonate (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-04-22	
Alkalinity, Hydroxide (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-04-22	
Ammonia, Total (as N)	0.196	± 0.027	0.050	mg/L	2020-04-22	
BOD, 5-day	2.5	± 1.1	2.0	mg/L	2020-04-23	
BOD, 5-day Carbonaceous	1.9	± 1.3	2.0	mg/L	2020-04-23	
Conductivity (EC)	846	± 20	2.0	µS/cm	2020-04-22	
Nitrogen, Total Kjeldahl	1.70	± 0.21	0.050	mg/L	2020-04-22	
pH	7.66	± 0.02	0.10	pH units	2020-04-22	HT2
Phosphorus, Total (as P)	1.26	± 0.14	0.0020	mg/L	2020-04-23	
Phosphorus, Total Dissolved	0.455	± 0.055	0.0020	mg/L	2020-04-23	
Solids, Total Suspended	< 2.0		2.0	mg/L	2020-04-23	
<b>Total Metals</b>						
Sodium, total	86.9	± 15.9	0.10	mg/L	2020-04-24	

### Sample Qualifiers:

FILT	The sample has been filtered for TDP in the laboratory. Results may not reflect conditions at the time of sampling.
HT2	The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.
PRES	Sample has been preserved for TDP in the laboratory and the holding time has been extended.

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0041895  
2020-04-30 16:53

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
<b>VWRC Final Treated Effluent - 24hr Comp. - E228121 (0041895-01)   Matrix: Fresh Water   Sampled: 2020-04-23 00:00 To 2020-04-24 00:00</b>						FILT, PRES
<b>Anions</b>						
Chloride	87.0	± 4.8	0.10	mg/L	2020-04-25	
Nitrate (as N)	3.40	± 0.21	0.010	mg/L	2020-04-25	
Nitrite (as N)	0.010	± 0.002	0.010	mg/L	2020-04-25	
Phosphate (as P)	0.0284	± 0.0055	0.0050	mg/L	2020-04-25	
<b>Calculated Parameters</b>						
Nitrate+Nitrite (as N)	3.41		0.0100	mg/L	N/A	
Nitrogen, Total	5.01		0.100	mg/L	N/A	
Nitrogen, Organic	1.43		0.100	mg/L	N/A	
<b>General Parameters</b>						
Alkalinity, Total (as CaCO <sub>3</sub> )	184	± 10	1.0	mg/L	2020-04-30	
Alkalinity, Phenolphthalein (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-04-30	
Alkalinity, Bicarbonate (as CaCO <sub>3</sub> )	184		1.0	mg/L	2020-04-30	
Alkalinity, Carbonate (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-04-30	
Alkalinity, Hydroxide (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-04-30	
Ammonia, Total (as N)	0.162	± 0.025	0.050	mg/L	2020-04-29	
BOD, 5-day	6.4	± 1.6	2.0	mg/L	2020-04-30	
BOD, 5-day Carbonaceous	< 1.1		2.0	mg/L	2020-04-30	
Conductivity (EC)	817	± 20	2.0	µS/cm	2020-04-30	
Nitrogen, Total Kjeldahl	1.60	± 0.22	0.050	mg/L	2020-04-30	
pH	7.84	± 0.02	0.10	pH units	2020-04-30	HT2
Phosphorus, Total (as P)	0.164	± 0.018	0.0020	mg/L	2020-04-29	
Phosphorus, Total Dissolved	0.125	± 0.015	0.0020	mg/L	2020-04-29	
Solids, Total Suspended	2.4	± 0.9	2.0	mg/L	2020-04-29	
<b>Total Metals</b>						
Sodium, total	84.8	± 15.5	0.10	mg/L	2020-04-29	

### Sample Qualifiers:

FILT The sample has been filtered for TDP in the laboratory. Results may not reflect conditions at the time of sampling.

HT2 The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.

PRES Sample has been preserved for TDP in the laboratory and the holding time has been extended.

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0050063  
2020-05-08 12:13

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
<b>VWRC Final Treated Effluent - 24hr Comp. - E228121 (0050063-02)   Matrix: Fresh Water   Sampled: 2020-04-29 00:00 To 2020-04-30 00:00</b>						FILT, PRES
<b>Anions</b>						
Chloride	82.5	± 4.6	0.10	mg/L	2020-05-02	
Nitrate (as N)	3.85	± 0.24	0.010	mg/L	2020-05-02	
Nitrite (as N)	0.029	± 0.004	0.010	mg/L	2020-05-02	
Phosphate (as P)	0.0151	± 0.0036	0.0050	mg/L	2020-05-02	
<b>Calculated Parameters</b>						
Nitrate+Nitrite (as N)	3.88		0.0100	mg/L	N/A	
Nitrogen, Total	5.39		0.100	mg/L	N/A	
Nitrogen, Organic	1.38		0.100	mg/L	N/A	
<b>General Parameters</b>						
Alkalinity, Total (as CaCO <sub>3</sub> )	135	± 8	1.0	mg/L	2020-05-04	
Alkalinity, Phenolphthalein (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-05-04	
Alkalinity, Bicarbonate (as CaCO <sub>3</sub> )	135		1.0	mg/L	2020-05-04	
Alkalinity, Carbonate (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-05-04	
Alkalinity, Hydroxide (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-05-04	
Ammonia, Total (as N)	0.125	± 0.023	0.050	mg/L	2020-05-05	
BOD, 5-day	1.9	± 1.2	2.0	mg/L	2020-05-07	
BOD, 5-day Carbonaceous	1.8	± 1.2	2.0	mg/L	2020-05-07	
Conductivity (EC)	688	± 17	2.0	µS/cm	2020-05-04	
Nitrogen, Total Kjeldahl	1.51	± 0.21	0.050	mg/L	2020-05-07	
pH	7.70	± 0.02	0.10	pH units	2020-05-04	HT2
Phosphorus, Total (as P)	0.161	± 0.018	0.0020	mg/L	2020-05-07	
Phosphorus, Total Dissolved	0.0929	± 0.0110	0.0020	mg/L	2020-05-07	
Solids, Total Suspended	2.0	± 0.9	2.0	mg/L	2020-05-07	
<b>Total Metals</b>						
Sodium, total	68.1	± 12.4	0.10	mg/L	2020-05-08	



## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0050741  
2020-05-15 16:18

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
---------	--------	-------------	----	-------	----------	-----------

**VWRC Treated Effluent (FTE) Grab - E228121 (0050741-02) | Matrix: Fresh Water | Sampled: 2020-05-08 09:00**

**Microbiological Parameters**

Coliforms, Total	49.0		1.0	MPN/100 mL	2020-05-08	
Coliforms, Fecal	1.0		1.0	MPN/100 mL	2020-05-08	

**Sample Qualifiers:**

FILT	The sample has been filtered for TDP in the laboratory. Results may not reflect conditions at the time of sampling.
HT2	The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.
PRES	Sample has been preserved for TDP in the laboratory and the holding time has been extended.

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0050741  
2020-05-15 16:18

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
<b>VWRC Final Treated Effluent - 24hr Comp. - E228121 (0050741-01)   Matrix: Fresh Water   Sampled: 2020-05-07 00:00 To 2020-05-08 00:00</b>						FILT, PRES
<b>Anions</b>						
Chloride	81.2	± 4.5	0.10	mg/L	2020-05-09	
Nitrate (as N)	2.92	± 0.18	0.010	mg/L	2020-05-09	
Nitrite (as N)	0.017	± 0.003	0.010	mg/L	2020-05-09	
Phosphate (as P)	0.0191	± 0.0041	0.0050	mg/L	2020-05-09	
<b>Calculated Parameters</b>						
Nitrate+Nitrite (as N)	2.93		0.0100	mg/L	N/A	
Nitrogen, Total	4.26		0.100	mg/L	N/A	
Nitrogen, Organic	1.33		0.100	mg/L	N/A	
<b>General Parameters</b>						
Alkalinity, Total (as CaCO <sub>3</sub> )	118	± 7	1.0	mg/L	2020-05-12	
Alkalinity, Phenolphthalein (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-05-12	
Alkalinity, Bicarbonate (as CaCO <sub>3</sub> )	118		1.0	mg/L	2020-05-12	
Alkalinity, Carbonate (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-05-12	
Alkalinity, Hydroxide (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-05-12	
Ammonia, Total (as N)	< 0.050		0.050	mg/L	2020-05-11	
BOD, 5-day	< 1.1		2.0	mg/L	2020-05-14	
BOD, 5-day Carbonaceous	1.5	± 1.2	2.0	mg/L	2020-05-14	
Conductivity (EC)	652	± 16	2.0	µS/cm	2020-05-12	
Nitrogen, Total Kjeldahl	1.33	± 0.19	0.050	mg/L	2020-05-14	
pH	7.46	± 0.02	0.10	pH units	2020-05-12	HT2
Phosphorus, Total (as P)	0.148	± 0.016	0.0020	mg/L	2020-05-14	
Phosphorus, Total Dissolved	0.104	± 0.012	0.0020	mg/L	2020-05-14	
Solids, Total Suspended	2.4	± 0.9	2.0	mg/L	2020-05-13	
<b>Total Metals</b>						
Sodium, total	69.3	± 12.7	0.10	mg/L	2020-05-14	

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0051384  
2020-05-25 09:58

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
<b>VWRC Final Treated Effluent - 24hr Comp. - E228121 (0051384-01)   Matrix: Fresh Water   Sampled: 2020-05-14 00:00 To 2020-05-15 00:00</b>						FILT, PRES
<b>Anions</b>						
Chloride	84.3	± 4.7	0.10	mg/L	2020-05-17	
Nitrate (as N)	3.21	± 0.20	0.010	mg/L	2020-05-17	
Nitrite (as N)	0.274	± 0.028	0.010	mg/L	2020-05-17	
Phosphate (as P)	0.0171	± 0.0038	0.0050	mg/L	2020-05-17	
<b>Calculated Parameters</b>						
Nitrate+Nitrite (as N)	3.48		0.0100	mg/L	N/A	
Nitrogen, Total	5.16		0.0500	mg/L	N/A	
Nitrogen, Organic	1.62		0.0500	mg/L	N/A	
<b>General Parameters</b>						
Alkalinity, Total (as CaCO <sub>3</sub> )	127	± 7	1.0	mg/L	2020-05-20	
Alkalinity, Phenolphthalein (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-05-20	
Alkalinity, Bicarbonate (as CaCO <sub>3</sub> )	127		1.0	mg/L	2020-05-20	
Alkalinity, Carbonate (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-05-20	
Alkalinity, Hydroxide (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-05-20	
Ammonia, Total (as N)	0.054	± 0.021	0.050	mg/L	2020-05-22	
BOD, 5-day	5.0	± 1.5	2.0	mg/L	2020-05-21	
BOD, 5-day Carbonaceous	5.0	± 1.4	2.0	mg/L	2020-05-21	
Conductivity (EC)	639	± 15	2.0	µS/cm	2020-05-20	
Nitrogen, Total Kjeldahl	1.67	± 0.21	0.050	mg/L	2020-05-24	
pH	7.93	± 0.02	0.10	pH units	2020-05-20	HT2
Phosphorus, Total (as P)	0.194	± 0.022	0.0020	mg/L	2020-05-21	
Phosphorus, Total Dissolved	0.0818	± 0.0097	0.0020	mg/L	2020-05-21	
Solids, Total Suspended	3.4	± 1.0	2.0	mg/L	2020-05-22	HT1
<b>Total Metals</b>						
Sodium, total	70.9	± 13.0	0.10	mg/L	2020-05-21	

### Sample Qualifiers:

FILT	The sample has been filtered for TDP in the laboratory. Results may not reflect conditions at the time of sampling.
HT1	The sample was prepared and/or analyzed past the recommended holding time.
HT2	The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.
PRES	Sample has been preserved for TDP in the laboratory and the holding time has been extended.

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0051909  
2020-05-29 14:51

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
<b>VWRC Final Treated Effluent - 24hr Comp. - E228121 (0051909-02)   Matrix: Fresh Water   Sampled: 2020-05-21 00:00 To 2020-05-22 00:00</b>						FILT, PRES
<b>Anions</b>						
Chloride	85.3	± 4.7	0.10	mg/L	2020-05-23	
Nitrate (as N)	2.51	± 0.16	0.010	mg/L	2020-05-23	
Nitrite (as N)	0.044	± 0.005	0.010	mg/L	2020-05-23	
Phosphate (as P)	0.282	± 0.049	0.0050	mg/L	2020-05-23	
<b>Calculated Parameters</b>						
Nitrate+Nitrite (as N)	2.55		0.0100	mg/L	N/A	
Nitrogen, Total	4.25		0.0500	mg/L	N/A	
Nitrogen, Organic	1.63		0.0500	mg/L	N/A	
<b>General Parameters</b>						
Alkalinity, Total (as CaCO <sub>3</sub> )	136	± 8	1.0	mg/L	2020-05-27	
Alkalinity, Phenolphthalein (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-05-27	
Alkalinity, Bicarbonate (as CaCO <sub>3</sub> )	136		1.0	mg/L	2020-05-27	
Alkalinity, Carbonate (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-05-27	
Alkalinity, Hydroxide (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-05-27	
Ammonia, Total (as N)	0.070	± 0.021	0.050	mg/L	2020-05-26	
BOD, 5-day	3.7	± 1.5	2.0	mg/L	2020-05-28	
BOD, 5-day Carbonaceous	3.7	± 1.4	2.0	mg/L	2020-05-28	
Conductivity (EC)	699	± 17	2.0	µS/cm	2020-05-27	
Nitrogen, Total Kjeldahl	1.70	± 0.21	0.050	mg/L	2020-05-29	
pH	7.52	± 0.02	0.10	pH units	2020-05-27	HT2
Phosphorus, Total (as P)	0.575	± 0.064	0.0020	mg/L	2020-05-27	
Phosphorus, Total Dissolved	0.482	± 0.057	0.0020	mg/L	2020-05-27	
Solids, Total Suspended	3.2	± 1.0	2.0	mg/L	2020-05-27	
<b>Total Metals</b>						
Sodium, total	71.5	± 13.1	0.10	mg/L	2020-05-28	

### Sample Qualifiers:

FILT The sample has been filtered for TDP in the laboratory. Results may not reflect conditions at the time of sampling.

HT2 The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.

PRES Sample has been preserved for TDP in the laboratory and the holding time has been extended.

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0052554  
2020-06-05 16:42

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
<b>VWRC Final Treated Effluent - 24hr Comp. - E228121 (0052554-01)   Matrix: Fresh Water   Sampled: 2020-05-28 00:00 To 2020-05-29 00:00</b>						FILT, PRES
<b>Anions</b>						
Chloride	83.5	± 4.6	0.10	mg/L	2020-05-31	
Nitrate (as N)	2.25	± 0.14	0.010	mg/L	2020-05-31	
Nitrite (as N)	0.089	± 0.009	0.010	mg/L	2020-05-31	
Phosphate (as P)	0.0888	± 0.0156	0.0050	mg/L	2020-05-31	
<b>Calculated Parameters</b>						
Nitrate+Nitrite (as N)	2.34		0.0100	mg/L	N/A	
Nitrogen, Total	4.42		0.0500	mg/L	N/A	
Nitrogen, Organic	1.88		0.0500	mg/L	N/A	
<b>General Parameters</b>						
Alkalinity, Total (as CaCO <sub>3</sub> )	123	± 7	1.0	mg/L	2020-06-02	
Alkalinity, Phenolphthalein (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-06-02	
Alkalinity, Bicarbonate (as CaCO <sub>3</sub> )	123		1.0	mg/L	2020-06-02	
Alkalinity, Carbonate (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-06-02	
Alkalinity, Hydroxide (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-06-02	
Ammonia, Total (as N)	0.204	± 0.027	0.050	mg/L	2020-06-02	
BOD, 5-day	20.1	± 4.1	2.0	mg/L	2020-06-04	
BOD, 5-day Carbonaceous	22.2	± 4.3	2.0	mg/L	2020-06-04	
Conductivity (EC)	669	± 16	2.0	µS/cm	2020-06-02	
Nitrogen, Total Kjeldahl	2.08	± 0.26	0.050	mg/L	2020-06-05	
pH	7.31	± 0.02	0.10	pH units	2020-06-02	HT2
Phosphorus, Total (as P)	0.372	± 0.041	0.0020	mg/L	2020-06-04	
Phosphorus, Total Dissolved	0.161	± 0.019	0.0020	mg/L	2020-06-04	
Solids, Total Suspended	8.6	± 1.1	2.0	mg/L	2020-06-04	
<b>Total Metals</b>						
Sodium, total	59.5	± 9.9	0.10	mg/L	2020-06-04	

### Sample Qualifiers:

FILT	The sample has been filtered for TDP in the laboratory. Results may not reflect conditions at the time of sampling.
HT2	The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.
PRES	Sample has been preserved for TDP in the laboratory and the holding time has been extended.

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0060438  
2020-06-10 15:33

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
<b>VWRC Final Treated Effluent - 24hr Comp. - E228121 (0060438-03)   Matrix: Fresh Water   Sampled: 2020-06-02 00:00 To 2020-06-03 00:00</b>						FILT, PRES
<b>Anions</b>						
Chloride	77.5	± 4.3	0.10	mg/L	2020-06-04	
Nitrate (as N)	2.25	± 0.14	0.010	mg/L	2020-06-04	
Nitrite (as N)	0.050	± 0.006	0.010	mg/L	2020-06-04	
Phosphate (as P)	0.0094	± 0.0029	0.0050	mg/L	2020-06-04	
<b>Calculated Parameters</b>						
Nitrate+Nitrite (as N)	2.30		0.0100	mg/L	N/A	
Nitrogen, Total	3.94		0.0500	mg/L	N/A	
Nitrogen, Organic	1.64		0.0500	mg/L	N/A	
<b>General Parameters</b>						
Alkalinity, Total (as CaCO <sub>3</sub> )	131	± 7	1.0	mg/L	2020-06-05	
Alkalinity, Phenolphthalein (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-06-05	
Alkalinity, Bicarbonate (as CaCO <sub>3</sub> )	131		1.0	mg/L	2020-06-05	
Alkalinity, Carbonate (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-06-05	
Alkalinity, Hydroxide (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-06-05	
Ammonia, Total (as N)	< 0.050		0.050	mg/L	2020-06-05	
BOD, 5-day	6.6	± 1.6	2.0	mg/L	2020-06-09	
BOD, 5-day Carbonaceous	6.3	± 1.6	2.0	mg/L	2020-06-09	
Conductivity (EC)	647	± 16	2.0	µS/cm	2020-06-05	
Nitrogen, Total Kjeldahl	1.64	± 0.21	0.050	mg/L	2020-06-09	
pH	7.47	± 0.02	0.10	pH units	2020-06-05	HT2
Phosphorus, Total (as P)	0.187	± 0.021	0.0020	mg/L	2020-06-08	
Phosphorus, Total Dissolved	0.0789	± 0.0094	0.0020	mg/L	2020-06-08	
Solids, Total Suspended	2.8	± 0.9	2.0	mg/L	2020-06-09	
<b>Total Metals</b>						
Sodium, total	69.7	± 12.7	0.10	mg/L	2020-06-08	

### Sample Qualifiers:

FILT The sample has been filtered for TDP in the laboratory. Results may not reflect conditions at the time of sampling.

HT2 The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.

PRES Sample has been preserved for TDP in the laboratory and the holding time has been extended.

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0061409  
2020-06-19 10:08

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
<b>VWRC Final Treated Effluent - 24hr Comp. - E228121 (0061409-01)   Matrix: Fresh Water   Sampled: 2020-06-11 00:00 To 2020-06-12 00:00</b>						FILT, PRES
<b>Anions</b>						
Chloride	75.6	± 4.2	0.10	mg/L	2020-06-16	
Nitrate (as N)	2.21	± 0.14	0.010	mg/L	2020-06-16	HT1
Nitrite (as N)	0.162	± 0.017	0.010	mg/L	2020-06-16	HT1
Phosphate (as P)	0.0244	± 0.0049	0.0050	mg/L	2020-06-16	HT1
<b>Calculated Parameters</b>						
Nitrate+Nitrite (as N)	2.37		0.0100	mg/L	N/A	
Nitrogen, Total	4.19		0.100	mg/L	N/A	
Nitrogen, Organic	1.55		0.100	mg/L	N/A	
<b>General Parameters</b>						
Alkalinity, Total (as CaCO <sub>3</sub> )	138	± 8	1.0	mg/L	2020-06-18	
Ammonia, Total (as N)	0.270	± 0.031	0.050	mg/L	2020-06-18	
BOD, 5-day	8.4	± 1.9	2.0	mg/L	2020-06-17	
BOD, 5-day Carbonaceous	7.6	± 1.7	2.0	mg/L	2020-06-17	
Conductivity (EC)	700	± 17	2.0	µS/cm	2020-06-17	
Nitrogen, Total Kjeldahl	1.82	± 0.24	0.050	mg/L	2020-06-17	
pH	7.85	± 0.02	0.10	pH units	2020-06-17	HT2
Phosphorus, Total (as P)	0.186	± 0.021	0.0020	mg/L	2020-06-18	
Phosphorus, Total Dissolved	0.114	± 0.014	0.0020	mg/L	2020-06-18	
Solids, Total Suspended	3.5	± 1.2	2.0	mg/L	2020-06-17	
<b>Total Metals</b>						
Sodium, total	68.4	± 12.5	0.10	mg/L	2020-06-17	

### Sample Qualifiers:

FILT	The sample has been filtered for DP in the laboratory. Results may not reflect conditions at the time of sampling.
HT1	The sample was prepared and/or analyzed past the recommended holding time.
HT2	The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.
PRES	Sample has been preserved for DP in the laboratory and the holding time has been extended.

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0061964  
2020-06-25 11:30

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
---------	--------	-------------	----	-------	----------	-----------

**VWRC Treated Effluent (FTE) Grab - E228121 (1) (0061964-04) | Matrix: Fresh Water | Sampled:**  
2020-06-17 13:30

**Microbiological Parameters**

Coliforms, Total	1.0		1.0	MPN/100 mL	2020-06-18	
Coliforms, Fecal	< 1.0		1.0	MPN/100 mL	2020-06-18	

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0062665  
2020-07-03 14:18

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
<b>VWRC Secondary Treated Effluent - 24hr Comp. - E105004 (0062665-01)   Matrix: Fresh Water   Sampled: 2020-06-23 00:00 To 2020-06-24 00:00</b>						FILT, PRES
<b>Anions</b>						
Chloride	77.4	± 4.3	0.10	mg/L	2020-07-01	
Nitrate (as N)	4.34	± 0.27	0.010	mg/L	2020-07-01	HT1
Nitrite (as N)	0.097	± 0.010	0.010	mg/L	2020-07-01	HT1
Phosphate (as P)	0.0159	± 0.0037	0.0050	mg/L	2020-07-01	HT1
<b>Calculated Parameters</b>						
Nitrate+Nitrite (as N)	4.44		0.0100	mg/L	N/A	
Nitrogen, Total	6.29		0.0500	mg/L	N/A	
Nitrogen, Organic	1.62		0.0500	mg/L	N/A	
<b>General Parameters</b>						
Alkalinity, Total (as CaCO <sub>3</sub> )	204	± 11	1.0	mg/L	2020-06-29	
Alkalinity, Phenolphthalein (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-06-29	
Alkalinity, Bicarbonate (as CaCO <sub>3</sub> )	204		1.0	mg/L	2020-06-29	
Alkalinity, Carbonate (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-06-29	
Alkalinity, Hydroxide (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-06-29	
Ammonia, Total (as N)	0.233	± 0.029	0.050	mg/L	2020-06-30	
BOD, 5-day	8.2	± 1.8	2.0	mg/L	2020-06-30	
Conductivity (EC)	843	± 20	2.0	µS/cm	2020-06-29	
Nitrogen, Total Kjeldahl	1.85	± 0.23	0.050	mg/L	2020-06-30	
pH	7.94	± 0.02	0.10	pH units	2020-06-29	HT2
Phosphorus, Total (as P)	0.197	± 0.022	0.0020	mg/L	2020-07-02	
Phosphorus, Total Dissolved	0.0694	± 0.0084	0.0020	mg/L	2020-07-02	
Solids, Total Suspended	5.0	± 1.0	2.0	mg/L	2020-06-30	
<b>Total Metals</b>						
Sodium, total	71.4	± 12.5	0.10	mg/L	2020-07-01	

### Sample Qualifiers:

FILT	The sample has been filtered for DP in the laboratory. Results may not reflect conditions at the time of sampling.
HT1	The sample was prepared and/or analyzed past the recommended holding time.
HT2	The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.
PRES	Sample has been preserved for DP in the laboratory and the holding time has been extended.

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO#** 0070864  
**REPORTED** 2020-07-16 13:19

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
---------	--------	-------------	----	-------	----------	-----------

**VWRC Treated Effluent (FTE) Grab - E228121 (0070864-03) | Matrix: Fresh Water | Sampled: 2020-07-09 08:30**

### Microbiological Parameters

Coliforms, Total	2		1	MPN/100 mL	2020-07-10	
Coliforms, Fecal	< 1		1	MPN/100 mL	2020-07-10	

### Sample Qualifiers:

FILT	The sample has been filtered for DP in the laboratory. Results may not reflect conditions at the time of sampling.
HT1	The sample was prepared and/or analyzed past the recommended holding time.
HT2	The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.
PRES	Sample has been preserved for DP in the laboratory and the holding time has been extended.

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0070123  
2020-07-09 14:14

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
<b>VWRC Final Treated Effluent - 24hr Comp. - E228121 (0070123-01)   Matrix: Fresh Water   Sampled: 2020-07-01 00:00 To 2020-07-02 00:00</b>						FILT, PRES
<b>Anions</b>						
Chloride	72.7	± 4.0	0.10	mg/L	2020-07-06	
Nitrate (as N)	3.09	± 0.19	0.010	mg/L	2020-07-06	HT1
Nitrite (as N)	0.045	± 0.005	0.010	mg/L	2020-07-06	HT1
Phosphate (as P)	0.0283	± 0.0069	0.0050	mg/L	2020-07-06	HT1
<b>Calculated Parameters</b>						
Nitrate+Nitrite (as N)	3.14		0.0100	mg/L	N/A	
Nitrogen, Total	3.78		0.0500	mg/L	N/A	
Nitrogen, Organic	0.648		0.0500	mg/L	N/A	
<b>General Parameters</b>						
Alkalinity, Total (as CaCO <sub>3</sub> )	169	± 9	1.0	mg/L	2020-07-04	
Alkalinity, Phenolphthalein (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-07-04	
Alkalinity, Bicarbonate (as CaCO <sub>3</sub> )	169		1.0	mg/L	2020-07-04	
Alkalinity, Carbonate (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-07-04	
Alkalinity, Hydroxide (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-07-04	
Ammonia, Total (as N)	< 0.050		0.050	mg/L	2020-07-03	
BOD, 5-day	6.6	± 1.6	2.0	mg/L	2020-07-08	
BOD, 5-day Carbonaceous	6.9	± 1.7	2.0	mg/L	2020-07-08	
Conductivity (EC)	772	± 19	2.0	µS/cm	2020-07-04	
Nitrogen, Total Kjeldahl	0.648	± 0.092	0.050	mg/L	2020-07-09	
pH	7.93	± 0.02	0.10	pH units	2020-07-04	HT2
Phosphorus, Total (as P)	0.0899	± 0.0100	0.0020	mg/L	2020-07-06	
Phosphorus, Total Dissolved	0.0821	± 0.0097	0.0020	mg/L	2020-07-06	
Solids, Total Suspended	< 2.0		2.0	mg/L	2020-07-07	
<b>Total Metals</b>						
Sodium, total	72.2	± 13.2	0.10	mg/L	2020-07-06	

### Sample Qualifiers:

FILT	The sample has been filtered for DP in the laboratory. Results may not reflect conditions at the time of sampling.
HT1	The sample was prepared and/or analyzed past the recommended holding time.
HT2	The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.
PRES	Sample has been preserved for DP in the laboratory and the holding time has been extended.

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0070864  
2020-07-16 13:19

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
<b>VWRC Final Treated Effluent - 24hr Comp. - E228121 (0070864-02)   Matrix: Fresh Water   Sampled: 2020-07-08 00:00 To 2020-07-09 00:00</b>						FILT, PRES
<b>Anions</b>						
Chloride	75.3	± 4.2	0.10	mg/L	2020-07-12	
Nitrate (as N)	3.05	± 0.19	0.010	mg/L	2020-07-12	
Nitrite (as N)	0.111	± 0.012	0.010	mg/L	2020-07-12	
Phosphate (as P)	< 0.0050		0.0050	mg/L	2020-07-12	
<b>Calculated Parameters</b>						
Nitrate+Nitrite (as N)	3.16		0.0100	mg/L	N/A	
Nitrogen, Total	4.54		0.0500	mg/L	N/A	
Nitrogen, Organic	1.37		0.0500	mg/L	N/A	
<b>General Parameters</b>						
Alkalinity, Total (as CaCO <sub>3</sub> )	205	± 11	1.0	mg/L	2020-07-11	
Alkalinity, Phenolphthalein (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-07-11	
Alkalinity, Bicarbonate (as CaCO <sub>3</sub> )	205		1.0	mg/L	2020-07-11	
Alkalinity, Carbonate (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-07-11	
Alkalinity, Hydroxide (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-07-11	
Ammonia, Total (as N)	< 0.050		0.050	mg/L	2020-07-13	
BOD, 5-day	2.6	± 1.3	2.0	mg/L	2020-07-15	
BOD, 5-day Carbonaceous	2.5	± 1.4	2.0	mg/L	2020-07-15	
Conductivity (EC)	829	± 20	2.0	µS/cm	2020-07-11	
Nitrogen, Total Kjeldahl	1.37	± 0.17	0.050	mg/L	2020-07-16	
pH	8.03	± 0.02	0.10	pH units	2020-07-11	HT2
Phosphorus, Total (as P)	0.107	± 0.012	0.0020	mg/L	2020-07-14	
Phosphorus, Total Dissolved	0.0763	± 0.0091	0.0020	mg/L	2020-07-14	
Solids, Total Suspended	2.4	± 0.9	2.0	mg/L	2020-07-15	
<b>Total Metals</b>						
Sodium, total	87.1	± 15.9	0.10	mg/L	2020-07-15	

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0082032  
2020-08-26 13:07

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
<b>VWRC Final Treated Effluent - 24hr Comp. - E105004 (0082032-01)   Matrix: Fresh Water   Sampled: 2020-08-19 00:00 To 2020-08-20 00:00</b>						FILT, PRES
<b>Anions</b>						
Chloride	76.4	± 4.2	0.10	mg/L	2020-08-21	
Nitrate (as N)	4.01	± 0.25	0.010	mg/L	2020-08-21	
Nitrite (as N)	0.026	± 0.003	0.010	mg/L	2020-08-21	
Phosphate (as P)	< 0.0050		0.0050	mg/L	2020-08-21	
<b>Calculated Parameters</b>						
Nitrate+Nitrite (as N)	4.03		0.0100	mg/L	N/A	
Nitrogen, Total	5.61		0.0500	mg/L	N/A	
Nitrogen, Organic	1.50		0.0500	mg/L	N/A	
<b>General Parameters</b>						
Alkalinity, Total (as CaCO <sub>3</sub> )	209	± 12	1.0	mg/L	2020-08-22	
Alkalinity, Phenolphthalein (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-08-22	
Alkalinity, Bicarbonate (as CaCO <sub>3</sub> )	209		1.0	mg/L	2020-08-22	
Alkalinity, Carbonate (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-08-22	
Alkalinity, Hydroxide (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-08-22	
Ammonia, Total (as N)	0.074	± 0.021	0.050	mg/L	2020-08-24	
BOD, 5-day	9.6	± 2.1	2.0	mg/L	2020-08-26	
Conductivity (EC)	816	± 20	2.0	µS/cm	2020-08-22	
Nitrogen, Total Kjeldahl	1.58	± 0.20	0.050	mg/L	2020-08-25	
pH	8.00	± 0.02	0.10	pH units	2020-08-22	HT2
Phosphorus, Total (as P)	0.185	± 0.021	0.0050	mg/L	2020-08-25	
Phosphorus, Total Dissolved	0.0991	± 0.0117	0.0050	mg/L	2020-08-25	
Solids, Total Suspended	3.8	± 1.0	2.0	mg/L	2020-08-23	
<b>Total Metals</b>						
Sodium, total	76.2	± 13.9	0.10	mg/L	2020-08-24	

### Sample Qualifiers:

FILT The sample has been filtered for DP in the laboratory. Results may not reflect conditions at the time of sampling.

HT2 The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.

PRES Sample has been preserved for DP in the laboratory and the holding time has been extended.

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0090603  
2020-09-10 16:18

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
<b>VWRC Final Treated Effluent - 24hr Comp. - E105004 (0090603-01)   Matrix: Fresh Water   Sampled: 2020-09-03</b>						FILT, PRES
<b>Anions</b>						
Chloride	77.0	± 4.3	0.10	mg/L	2020-09-05	
Nitrate (as N)	2.97	± 0.19	0.010	mg/L	2020-09-05	
Nitrite (as N)	0.020	± 0.003	0.010	mg/L	2020-09-05	
Phosphate (as P)	0.0101	± 0.0030	0.0050	mg/L	2020-09-05	
<b>Calculated Parameters</b>						
Nitrate+Nitrite (as N)	2.99		0.0100	mg/L	N/A	
Nitrogen, Total	4.43		0.0500	mg/L	N/A	
Nitrogen, Organic	1.44		0.0500	mg/L	N/A	
<b>General Parameters</b>						
Alkalinity, Total (as CaCO <sub>3</sub> )	200	± 11	1.0	mg/L	2020-09-04	
Alkalinity, Phenolphthalein (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-09-04	
Alkalinity, Bicarbonate (as CaCO <sub>3</sub> )	200		1.0	mg/L	2020-09-04	
Alkalinity, Carbonate (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-09-04	
Alkalinity, Hydroxide (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-09-04	
Ammonia, Total (as N)	< 0.050		0.050	mg/L	2020-09-08	
BOD, 5-day	6.6	± 1.6	2.0	mg/L	2020-09-10	
Conductivity (EC)	799	± 19	2.0	µS/cm	2020-09-04	
Nitrogen, Total Kjeldahl	1.44	± 0.18	0.050	mg/L	2020-09-09	
pH	7.87	± 0.02	0.10	pH units	2020-09-04	HT2
Phosphorus, Total (as P)	0.121	± 0.013	0.0050	mg/L	2020-09-08	
Phosphorus, Total Dissolved	0.0886	± 0.0105	0.0050	mg/L	2020-09-08	
Solids, Total Suspended	5.2	± 1.0	2.0	mg/L	2020-09-09	
<b>Total Metals</b>						
Sodium, total	79.0	± 14.4	0.10	mg/L	2020-09-10	

### Sample Qualifiers:

FILT The sample has been filtered for TDP in the laboratory. Results may not reflect conditions at the time of sampling.

HT2 The 15 minute recommended holding time (from sampling to analysis) has been exceeded – field analysis is recommended.

PRES Sample has been preserved for TDP in the laboratory and the holding time has been extended.

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 20J2370  
2020-11-02 15:17

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
<b>VWRC Final Treated Effluent - 24hr Comp. - E105004 (20J2370-01)   Matrix: Fresh Water   Sampled: 2020-10-22 00:00 To 2020-10-23 00:00</b>						FILT, PRES
<b>Anions</b>						
Chloride	72.4	± 4.0	0.10	mg/L	2020-10-25	
Nitrate (as N)	3.97	± 0.25	0.010	mg/L	2020-10-25	
Nitrite (as N)	0.203	± 0.021	0.010	mg/L	2020-10-25	
Phosphate (as P)	0.0322	± 0.0061	0.0050	mg/L	2020-10-25	
<b>Calculated Parameters</b>						
Nitrate+Nitrite (as N)	4.18		0.0100	mg/L	N/A	
Nitrogen, Total	6.31		0.0500	mg/L	N/A	
Nitrogen, Organic	2.00		0.0500	mg/L	N/A	
<b>General Parameters</b>						
Alkalinity, Total (as CaCO <sub>3</sub> )	183	± 10	1.0	mg/L	2020-10-28	
Alkalinity, Phenolphthalein (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-10-28	
Alkalinity, Bicarbonate (as CaCO <sub>3</sub> )	183		1.0	mg/L	2020-10-28	
Alkalinity, Carbonate (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-10-28	
Alkalinity, Hydroxide (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-10-28	
Ammonia, Total (as N)	0.136	± 0.023	0.050	mg/L	2020-10-24	
BOD, 5-day	6.3	± 1.7	2.0	mg/L	2020-10-29	
Conductivity (EC)	810	± 20	2.0	µS/cm	2020-10-28	
Nitrogen, Total Kjeldahl	2.13	± 0.27	0.050	mg/L	2020-10-29	
pH	7.91	± 0.02	0.10	pH units	2020-10-28	HT2
Phosphorus, Total (as P)	0.350	± 0.039	0.0050	mg/L	2020-10-27	
Phosphorus, Total Dissolved	0.147	± 0.017	0.0050	mg/L	2020-10-27	
Solids, Total Suspended	8.0	± 1.1	2.0	mg/L	2020-10-27	
<b>Total Metals</b>						
Sodium, total	83.0	± 15.2	0.10	mg/L	2020-10-30	

### Sample Qualifiers:

FILT The sample has been filtered for TDP in the laboratory. Results may not reflect conditions at the time of sampling.

HT2 The 15 minute recommended holding time (from sampling to analysis) has been exceeded – field analysis is recommended.

PRES Sample has been preserved for TDP in the laboratory and the holding time has been extended.

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 20K2923  
2020-12-03 16:04

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
<b>VWRC Final Treated Effluent - 24hr Comp. - E105004 (20K2923-01)   Matrix: Fresh Water   Sampled: 2020-11-25 00:00 To 2020-11-26 00:00</b>						FILT, PRES
<b>Anions</b>						
Chloride	68.4	± 3.8	0.10	mg/L	2020-11-27	
Nitrate (as N)	4.47	± 0.28	0.010	mg/L	2020-11-27	
Nitrite (as N)	0.334	± 0.034	0.010	mg/L	2020-11-27	
Phosphate (as P)	0.0110	± 0.0031	0.0050	mg/L	2020-11-27	
<b>Calculated Parameters</b>						
Nitrate+Nitrite (as N)	4.81		0.0100	mg/L	N/A	
Nitrogen, Total	6.73		0.0500	mg/L	N/A	
Nitrogen, Organic	1.50		0.0500	mg/L	N/A	
<b>General Parameters</b>						
Alkalinity, Total (as CaCO <sub>3</sub> )	101	± 6	1.0	mg/L	2020-11-29	
Alkalinity, Phenolphthalein (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-11-29	
Alkalinity, Bicarbonate (as CaCO <sub>3</sub> )	101		1.0	mg/L	2020-11-29	
Alkalinity, Carbonate (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-11-29	
Alkalinity, Hydroxide (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-11-29	
Ammonia, Total (as N)	0.425	± 0.043	0.050	mg/L	2020-11-27	
BOD, 5-day	9.1	± 2.0	2.0	mg/L	2020-12-02	
Conductivity (EC)	583	± 14	2.0	µS/cm	2020-11-29	
Nitrogen, Total Kjeldahl	1.92	± 0.24	0.050	mg/L	2020-12-03	
pH	7.45	± 0.02	0.10	pH units	2020-11-29	HT2
Phosphorus, Total (as P)	0.136	± 0.015	0.0050	mg/L	2020-12-03	
Phosphorus, Total Dissolved	0.114	± 0.013	0.0050	mg/L	2020-12-03	
Solids, Total Suspended	4.4	± 1.0	2.0	mg/L	2020-11-29	
<b>Total Metals</b>						
Sodium, total	71.3	± 13.0	0.10	mg/L	2020-12-03	

### Sample Qualifiers:

FILT	The sample has been filtered for TDP in the laboratory. Results may not reflect conditions at the time of sampling.
HT2	The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.
PRES	Sample has been preserved for TDP in the laboratory and the holding time has been extended.

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 20L1416  
2020-12-21 10:49

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
<b>VWRC Final Treated Effluent - 24hr Comp. - E105004 - Duplicate (20L1416-03)   Matrix: Fresh Water  </b> <b>Sampled: 2020-12-10 00:00 To 2020-12-11 00:00</b>						FILT, PRES
<b>Anions</b>						
Chloride	76.6	± 4.2	0.10	mg/L	2020-12-13	
Nitrate (as N)	2.95	± 0.19	0.010	mg/L	2020-12-13	
Nitrite (as N)	0.179	± 0.019	0.010	mg/L	2020-12-13	
Phosphate (as P)	0.0061	± 0.0026	0.0050	mg/L	2020-12-13	
<b>Calculated Parameters</b>						
Nitrate+Nitrite (as N)	3.13		0.0100	mg/L	N/A	
Nitrogen, Total	4.98		0.0500	mg/L	N/A	
Nitrogen, Organic	1.49		0.0500	mg/L	N/A	
<b>General Parameters</b>						
Alkalinity, Total (as CaCO <sub>3</sub> )	172	± 10	1.0	mg/L	2020-12-18	
Alkalinity, Phenolphthalein (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-12-18	
Alkalinity, Bicarbonate (as CaCO <sub>3</sub> )	172		1.0	mg/L	2020-12-18	
Alkalinity, Carbonate (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-12-18	
Alkalinity, Hydroxide (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-12-18	
Ammonia, Total (as N)	0.362	± 0.038	0.050	mg/L	2020-12-15	
BOD, 5-day	7.2	± 1.7	2.0	mg/L	2020-12-17	
Conductivity (EC)	725	± 18	2.0	µS/cm	2020-12-18	
Nitrogen, Total Kjeldahl	1.85	± 0.23	0.050	mg/L	2020-12-17	
pH	7.92	± 0.02	0.10	pH units	2020-12-18	HT2
Phosphorus, Total (as P)	0.114	± 0.013	0.0050	mg/L	2020-12-17	
Phosphorus, Total Dissolved	0.0873	± 0.0104	0.0050	mg/L	2020-12-17	
Solids, Total Suspended	3.8	± 1.0	2.0	mg/L	2020-12-14	
<b>Total Metals</b>						
Sodium, total	76.2	± 13.9	0.10	mg/L	2020-12-17	

### Sample Qualifiers:

FILT The sample has been filtered for TDP in the laboratory. Results may not reflect conditions at the time of sampling.

HT2 The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.

PRES Sample has been preserved for TDP in the laboratory and the holding time has been extended.

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 20L1416  
2020-12-21 10:49

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
<b>VWRC Final Treated Effluent - 24hr Comp. - E105004 (20L1416-02)   Matrix: Fresh Water   Sampled: 2020-12-10 00:00 To 2020-12-11 00:00</b>						FILT, PRES
<b>Anions</b>						
Chloride	76.0	± 4.2	0.10	mg/L	2020-12-13	
Nitrate (as N)	3.03	± 0.19	0.010	mg/L	2020-12-13	
Nitrite (as N)	0.185	± 0.019	0.010	mg/L	2020-12-13	
Phosphate (as P)	0.0078	± 0.0028	0.0050	mg/L	2020-12-13	
<b>Calculated Parameters</b>						
Nitrate+Nitrite (as N)	3.22		0.0100	mg/L	N/A	
Nitrogen, Total	5.26		0.0500	mg/L	N/A	
Nitrogen, Organic	1.70		0.0500	mg/L	N/A	
<b>General Parameters</b>						
Alkalinity, Total (as CaCO <sub>3</sub> )	173	± 10	1.0	mg/L	2020-12-18	
Alkalinity, Phenolphthalein (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-12-18	
Alkalinity, Bicarbonate (as CaCO <sub>3</sub> )	173		1.0	mg/L	2020-12-18	
Alkalinity, Carbonate (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-12-18	
Alkalinity, Hydroxide (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-12-18	
Ammonia, Total (as N)	0.342	± 0.037	0.050	mg/L	2020-12-15	
BOD, 5-day	7.2	± 1.7	2.0	mg/L	2020-12-17	
Conductivity (EC)	724	± 18	2.0	µS/cm	2020-12-18	
Nitrogen, Total Kjeldahl	2.04	± 0.25	0.050	mg/L	2020-12-17	
pH	7.90	± 0.02	0.10	pH units	2020-12-18	HT2
Phosphorus, Total (as P)	0.115	± 0.013	0.0050	mg/L	2020-12-17	
Phosphorus, Total Dissolved	0.0886	± 0.0105	0.0050	mg/L	2020-12-17	
Solids, Total Suspended	3.8	± 1.0	2.0	mg/L	2020-12-14	
<b>Total Metals</b>						
Sodium, total	75.4	± 13.8	0.10	mg/L	2020-12-17	

# Appendix E

## *Rainbow Trout 96-hr LT 50 Results*

*Nautilus Environmental*

## SAMPLE INFORMATION

Sample ID	Dates		Rainbow trout test initiation	Receipt temperature
	Collected	Received		
TREATED EFFLUENT	28-Apr-20 at 0830h	29-Apr-20 at 1022h	30-Apr-20 at 1155h	12.9°C

## TESTS

- Rainbow trout 96-h LT50 test (median lethal time) with pH-stabilization using aeration with CO<sub>2</sub>-supplemented air (approximately 8.5% CO<sub>2</sub> gas mix)

## RESULTS

### Toxicity test results

Sample ID	LT50 (hours)
TREATED EFFLUENT	>96

LT = Lethal Time

## QA/QC

QA/QC summary	Rainbow trout
Reference toxicant LC50 (95% CL)	57.9 (43.4 – 77.2) µg/L Zn <sup>1</sup>
Reference toxicant historical mean (2 SD range)	96.8 (53.0 – 176.8) µg/L Zn
Reference toxicant CV	31%
Organism health history	Acceptable
Protocol deviations	None
Water quality range deviations	None
Control performance	Acceptable
Test performance	Valid

<sup>1</sup>Test Date: April 20, 2020, CL = Confidence Limits, LC = Lethal Concentration, SD = Standard Deviation, CV = Coefficient of Variation

### SAMPLE INFORMATION

Sample ID	Dates		Rainbow trout test initiation	Receipt temperature
	Collected	Received		
Treated Effluent	15-Jul-20 at 0900h	16-Jul-20 at 1022h	16-Jul-20 at 1355h	18.8°C

### TESTS

- Rainbow trout 96-h LT50 test (median lethal time) with pH-stabilization using aeration with CO<sub>2</sub>-supplemented air (approximately 3.5% CO<sub>2</sub> gas mix)

### RESULTS

#### Toxicity test results

Sample ID	LT50 (hours)
Treated Effluent	>96

LT = Lethal Time

### QA/QC

QA/QC summary	Rainbow trout
Reference toxicant LC50 (95% CL)	53.6 (43.2 – 66.4) µg/L Zn <sup>1</sup>
Reference toxicant historical mean (2 SD range)	90.1 (37.2 – 218.0) µg/L Zn
Reference toxicant CV	46%
Organism health history	Acceptable
Protocol deviations	None
Water quality range deviations	None
Control performance	Acceptable
Test performance	Valid

<sup>1</sup>Test Date: July 13, 2020, CL = Confidence Limits, LC = Lethal Concentration, SD = Standard Deviation, CV = Coefficient of Variation

## Appendix F

### *Additional Lake Sampling Program*

*Map, Field Data, Zooplankton, Phytoplankton, & ALS Environmental Analytical  
Results*

Coordinate (WKT)  
WKID: 4326 Lat Long

- 1 Lat: 50.24840° N  
Lon: 119.44040° W
- 2 Lat: 50.20900° N  
Lon: 119.42600° W
- 3 Lat: 50.21310° N  
Lon: 119.42410° W



### Okanagan Lake – Sampling Locations

1. Upgradient  
EMS # - E320491    GPS: 50.2484° N, 119.4404° W
2. Deep Lake Outfall  
(EMS Description - VERNON STP - DIFFUSER SECTION OF THE OUTFALL PIPE IN OK LAKE)  
EMS# - E228121    GPS: 50.2090° N, 119.4260° W
3. The Edge of the Initial Dilution Zone (IDZ)  
(EMS Description - OKANAGAN L NEAR VERNON OUTFALL)  
EMS# - E206611    GPS: 50.2131° N, 119.4241° W

# Additional Lake Sampling Program

## Lab Analysis

Analysis	Jun-20						Jul-20						Aug-20					
	Upgradient		Outfall		IDZ		Upgradient		Outfall		IDZ		Upgradient		Outfall		IDZ	
	Epimnion	Hypolimnion	Epimnion	Hypolimnion	Epimnion	Hypolimnion	Epimnion	Hypolimnion	Epimnion	Hypolimnion	Epimnion	Hypolimnion	Epimnion	Hypolimnion	Epimnion	Hypolimnion	Epimnion	Hypolimnion
Alkalinity	114	113	113	113	114	116	112	113	113	113	113	113	115	112	114	112	114	112
Hardness	122	124	123	128	122	126	123	122	124	121	122	122	130	128	121	133	126	128
pH	8.2	8.1	8.3	8.1	8.3	8.2	8.20	8.17	8.41	8.16	8.22	8.02	8.5	8.3	8.4	8.2	8.4	8.2
Total Kjeldahl Nitrogen	0.243	0.207	0.227	0.198	0.241	0.228	0.300	0.210	0.275	0.212	0.237	0.228	0.308	0.222	0.261	0.202	0.233	0.169
Ammonia	<0.0050	0.0104	<0.0050	0.011	0.0105	0.0112	0.0076	0.0052	0.0053	0.0064	0.0070	0.0238	0.0094	0.0193	<0.0050	<0.0050	<0.0050	<0.0050
Bromide	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050												
Chloride	5.08	5.21	5.34	5.17	5.37	5.12	5.54	5.39	5.85	5.62	5.69	5.43	5.83	5.58	5.67	5.48	5.94	5.50
Nitrate	<0.0050	0.0742	<0.0050	0.0572	<0.0050	0.0524	<0.0050	0.0849	<0.0050	0.0472	<0.0050	0.0800	<0.0050	0.0533	<0.0050	0.0936	<0.0050	0.0831
Nitrite	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Nitrogen	0.281	0.287	0.322	0.268	0.260	0.298	0.279	0.290	0.239	0.250	0.878	0.281	0.366	0.278	0.272	0.300	0.234	0.290
Orthophosphorus	<0.0010	<0.0010	<0.0010	0.0022	<0.0010	0.0012	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0012	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Phosphorus	0.0110	0.0061	0.0081	0.0065	0.0130	0.0104	0.0088	0.0082	0.0071	0.0040	0.0082	0.0048	0.0068	0.0087	0.0084	0.0047	0.0109	0.0044
Total Dissolved Phosphorus	0.0037	0.0023	0.0036	0.0024	0.0029	0.0033	0.0040	0.0025	0.0040	0.0024	0.0029	0.0022	0.0038	0.0027	0.0024	0.0027	0.0027	0.0021
Sulfate	28.7	29.8	29.6	29.8	29.8	29.4	28.6	28.5	29.5	29.0	29.0	28.6	30.8	30.5	30.3	30.4	30.4	30.5
E coli Coliform	<1	<1	<1	<1	<1	<1	1	<1	<1	<1	1	<1	<1	<1	<1	<1	<1	<1
Fecal Coliform	<1	<1	<1	<1	1.00	1	1	<1	<1	<1	1	<1	<1	<1	<1	<1	<1	<1
Calcium	32.8	34.3	33.1	35.2	33.1	34.5	33.0	33.8	33.5	32.9	33.0	33.7	34.4	34.5	32.3	36.4	33.0	34.5
Magnesium	9.60	9.38	9.91	9.81	9.67	9.64	9.87	9.19	9.82	9.45	9.58	9.32	10.70	10.10	9.89	10.30	10.50	10.00
Chlorophyll a	4.12		3.92		3.31		4.43		4.24		4.05		1.41		1.75		1.80	

## Field Data

Site Depth (m)	Jun-20						Jul-20						Aug-20					
	Upgradient		Outfall		IDZ		Upgradient		Outfall		IDZ		Upgradient		Outfall		IDZ	
	Temp (°C)	DO (mg/L)	Temp (°C)	DO (mg/L)	Temp (°C)	DO (mg/L)	Temp (°C)	DO (mg/L)	Temp (°C)	DO (mg/L)	Temp (°C)	DO (mg/L)	Temp (°C)	DO (mg/L)	Temp (°C)	DO (mg/L)	Temp (°C)	DO (mg/L)
0.5	17.9	10.32	18.6	10.53	18.6	10.57	21.2	9.89	20.8	9.57	19.8	9.64	21.3	8.59	21.6	8.58	21.3	8.88
1	17.2	10.46	18.4	10.58	18.1	10.62	20.8	9.85	20.1	9.70	19.9	9.83	21.7	8.53	21.5	8.58	21.4	8.57
2	16.4	10.69	17.7	10.55	17.9	10.56	20.3	9.83	18.1	9.87	19.7	9.63	21.7	8.53	21.5	8.59	21.5	8.56
3	15.4	10.84	17.3	10.57	17.8	10.59	19.7	10.01	18.9	9.98	18.8	9.88	21.7	8.53	21.4	8.59	21.5	8.58
4	15.3	10.87	17.0	10.68	17.4	10.65	19.2	10.08	18.6	9.98	18.8	9.86	21.7	8.53	21.2	8.59	21.5	8.55
5	14.7	10.74	16.9	10.70	16.9	10.74	18.8	10.25	18.3	9.82	18.5	9.86	21.7	8.52	21.1	8.60	21.4	8.54
6	14.4	10.47	16.8	10.69	14.9	10.93	18.5	9.98	18.0	9.77	18.4	9.78	21.7	8.52	21.0	8.60	21.4	8.54
7	14.3	10.29	15.0	10.77	14.4	10.45	18.2	9.72	17.9	9.77	18.2	9.68	21.7	8.52	20.9	8.60	21.4	8.53
8	14.0	10.05	14.2	10.31	14.2	10.28	17.7	9.39	17.7	9.62	17.8	9.64	21.7	8.51	20.6	8.59	20.9	8.56
9	13.9	10.01	13.9	10.26	14.0	10.20	17.1	9.26	17.5	9.74	17.6	9.55	21.0	8.38	19.4	8.74	20.8	8.56
10	13.8	9.98	13.6	10.04	13.8	10.11	16.3	9.03	17.2	9.58	16.7	9.38	19.8	8.42	17.9	8.74	18.9	8.72
11	13.5	9.89	13.4	10.27	13.8	10.19	15.4	8.85	16.9	9.50	16.3	9.28	19.2	8.41	16.0	8.64	16.3	8.55
13	13.0	10.13	12.4	10.34	13.4	10.31	12.9	8.67	14.5	9.09	13.8	9.07	16.6	8.13	15.0	8.38	14.4	8.38
14	12.7	10.07	11.7	10.39	12.8	10.30	12.5	8.83	12.9	9.19	12.4	9.07	15.7	8.05	14.5	8.34	13.8	8.05
15	12.3	10.08	11.4	10.38	12.5	10.35	12.0	8.85	12.3	9.21	11.8	9.07	15.1	7.59	13.9	8.17	13.4	8.01
16	12.0	10.25	11.0	10.50	12.1	10.39	11.8	8.73	11.4	9.12	11.2	9.15	15.1	7.58	13.5	7.98	12.9	8.16
17	11.8	10.23	10.7	10.52	11.1	10.39	11.4	8.75	10.5	9.32	10.4	9.15	14.8	7.47	13.1	7.91	12.6	8.23
18	11.4	10.00	10.3	10.56	10.8	10.41	10.8	8.66	10.3	9.38	9.6	9.43	13.9	7.43	12.1	7.99	11.9	8.30
19	11.1	10.30	10.0	10.60	10.3	10.59	10.4	8.82	9.4	9.75	9.0	9.68	13.4	7.64	11.3	8.32	11.3	8.45
20	10.2	10.23	9.7	10.56	10.2	10.59	10.0	9.22	9.0	9.95	8.6	10.03	12.7	7.42	10.3	8.92	10.7	8.51
21	10.2	10.06	9.5	10.54	9.8	10.61	9.5	9.37	8.6	10.02	8.3	10.07	12.4	7.41	10.1	8.95	10.0	8.90
22	9.6	10.19	9.3	10.55	9.4	10.59	9.1	9.45	8.1	10.16	7.9	10.32	12.0	7.84	9.9	8.06	9.6	8.89
23	9.4	10.38	9.0	10.85	8.9	10.68	8.8	9.53	7.7	10.32	7.6	10.28	11.8	7.34	9.4	9.12	8.4	9.17
24	9.1	10.38	8.7	10.73	8.7	10.73	7.9	9.75	7.5	10.37	7.2	10.28	10.7	7.82	8.6	9.27	8.1	9.33
25	8.7	10.41	8.3	10.80	8.1	10.82	7.4	9.88	7.4	10.38	7.0	10.32	9.5	8.54	8.0	9.43	7.8	9.39
30	7.8	10.53	6.7	11.16	6.5	11.12	6.7	10.20	6.7	10.48	6.4	10.55	7.8	8.08	7.1	9.84	6.8	9.79
35	6.7	10.75	5.6	11.33	5.8	11.22	6.2	10.33	6.1	10.69	6.0	10.66	6.9	8.44	6.5	10.12	6.4	10.12
40	6.1	10.88	5.5	11.34	5.8	11.31	5.8	10.40	5.8	10.82	5.8	10.77	6.3	9.85	6.1	10.28	6.0	10.36
45	5.7	10.88	5.3	11.37	5.3	11.36	5.8	10.50	5.7	10.85	5.6	10.82	5.9	10.19	5.9	10.32	5.7	10.51
50	5.4	10.84	5.2	11.34	5.2	11.37	5.5	10.57	5.5	10.87	5.4	10.88	5.8	10.28	5.7	10.38	5.5	10.62
55	5.1	10.85	5.1	11.31	5.1	11.35	5.3	10.57	5.4	10.81	5.3	10.89	5.5	10.28	5.6	10.44	5.4	10.82
60	5.1	10.84	5.0	11.31			5.2	10.58	5.3	10.92	5.1	10.90	5.4	10.24	5.5	10.48	5.3	10.58
	Site	Secchi Depth (m)				Site	Secchi Depth (m)				Site	Secchi Depth (m)						
	Upgradient	3.75				Upgradient	4.38				Upgradient	4.76						
	Outfall	4.20				Outfall	5.30				Outfall	5.07						
	IDZ	4.76				IDZ	5.41				IDZ	5.53						



**Project: Okanagan Lake Sampling**

Urban Systems

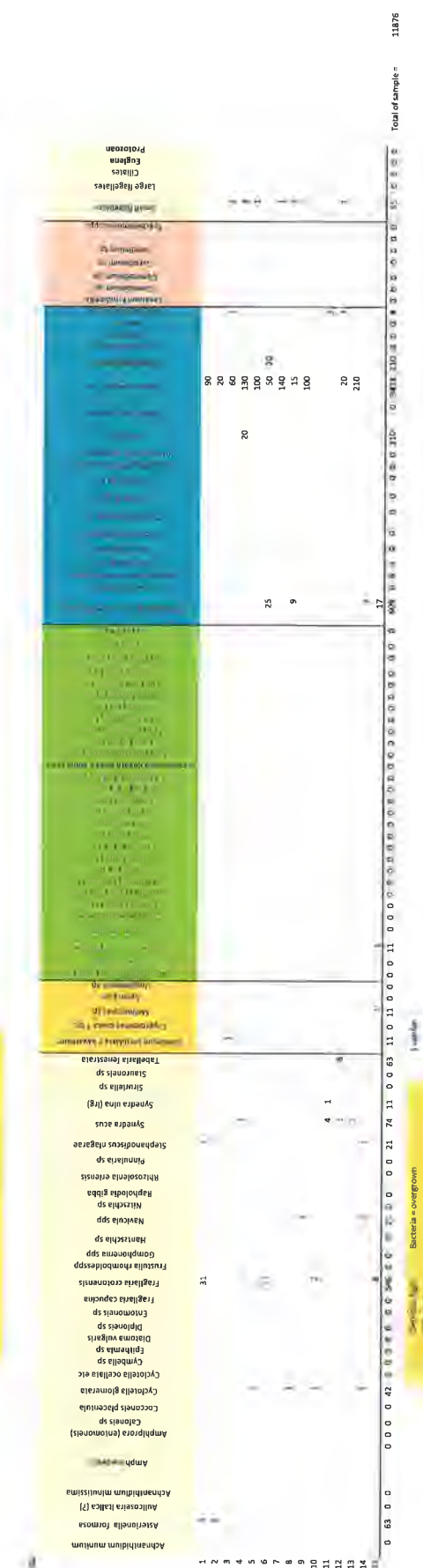
Taxonomist: Scott Finlayson

[scottfinlayson@cordilleraconsulting.ca](mailto:scottfinlayson@cordilleraconsulting.ca)

250-494-7553

Site:	2020	2020	2020	2020	2020	2020	2020	2020	2020
Sample:	Upgradient	Outfall	IDZ	Upgradient	Outfall	IDZ	Upgradient	Outfall	IDZ
Sample Collection Date:	22-Jun-20	22-Jun-20	22-Jun-20	15-Jul-20	15-Jul-20	15-Jul-20	12-Aug-20	12-Aug-20	12-Aug-20
EMS:									
Phylum: Arthropoda	0	0	0	0	0	0	0	0	0
Subphylum: Hexapoda	0	0	0	0	0	0	0	0	0
Class: Insecta	0	0	0	0	0	0	0	0	0
Order: Diptera	0	0	0	0	0	0	0	0	0
Family: Chironomidae	85	0	0	0	0	0	0	0	0
Subfamily: Orthocladiinae	0	0	0	0	0	64	0	0	0
Subphylum: Crustacea	0	0	0	0	0	0	0	0	0
Class: Branchiopoda	0	0	0	0	0	0	0	0	0
<i>Holopedium gibberum</i>	0	0	0	64	320	192	384	704	128
Order: Cladocera	427	1109	0	448	1728	2304	832	576	448
Family: Daphniidae	0	0	0	0	0	0	0	0	0
<i>Daphnia</i>	4181	7680	4949	8768	30464	26816	5056	6080	3648
Family: Sidae	0	0	0	0	0	0	0	0	0
<i>Diaphanosoma birgei</i>	1109	1621	2048	1280	7296	14528	6272	12096	4736
<i>Sida</i>	0	0	0	0	0	0	0	0	0
<i>Sida crystallina</i>	0	0	0	0	448	320	256	1472	1088
Order: Diplostraca	0	0	0	0	0	0	0	0	0
<i>Leptodora kindtii</i>	171	171	171	0	64	0	192	128	0
Family: Bosminidae	3328	2389	1280	832	1152	1536	6016	5760	4352
Class: Maxillipoda	0	0	0	0	0	0	0	0	0
Class: Copepoda	85	597	1877	6464	1856	1472	576	448	640
Order: Calanoida	7339	7765	11178	23936	34048	38976	32000	37376	25856
Family: Temoridae	0	0	0	0	0	0	0	0	0
<i>Epischura</i>	0	171	0	64	128	384	1088	1280	704
Order: Cyclopoida	0	0	0	0	0	0	0	0	0
Family: Cyclopidae	142077	122365	128253	118976	183872	202240	112128	125568	92992
Totals:	158802	143868	149756	160832	261376	288832	164800	191488	134592

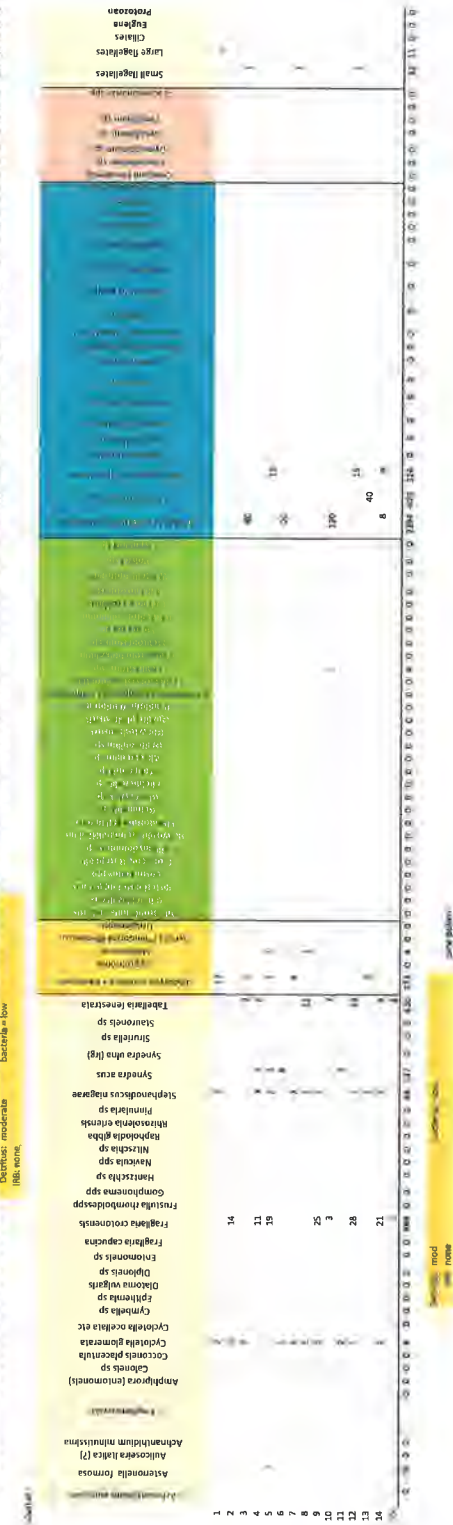
ND designation of a taxa represents a non-distinct taxa. This adjusts where the associated taxa fall in the metrics for this sample because the indiv





2582

total of prot



2583

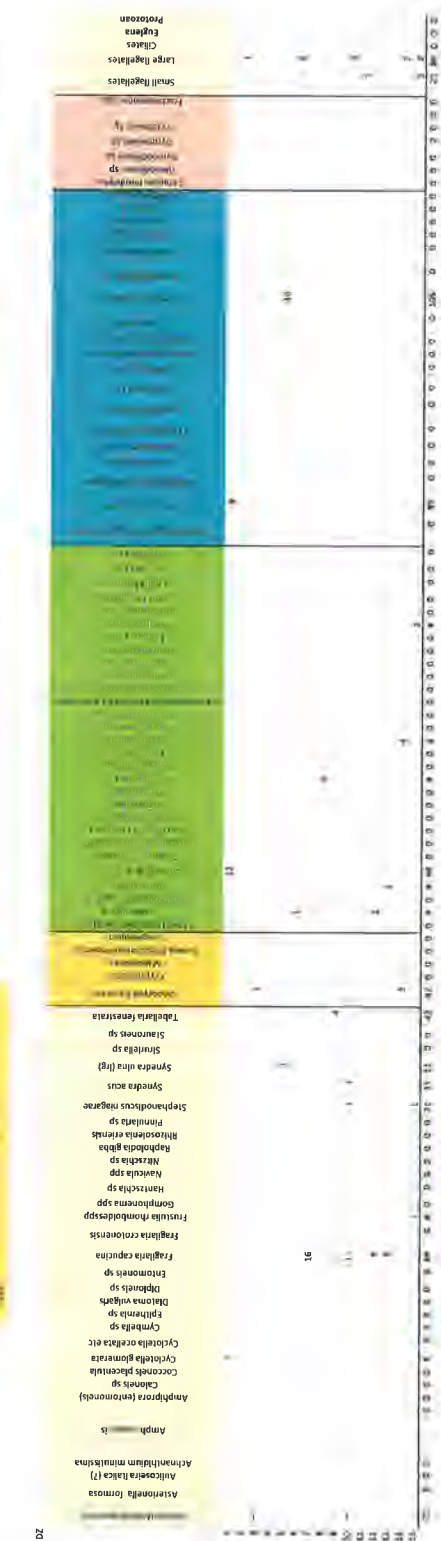
total of prot



2584

total of prot







## Analytical Results

Sub-Matrix: Water  
 (Matrix: Water)

Sub-Matrix: Water (Matrix: Water)			Client sample ID				Client sampling date / time				Epilimnion Upgradient of Discharge		Hypolimnion Upgradient of Discharge		Epilimnion Outfall		Hypolimnion Outfall		Epilimnion IDZ	
Analyte	CAS Number	Method	LOR	Unit	22-Jun-2020 10:15		22-Jun-2020 11:00		22-Jun-2020 12:30		22-Jun-2020 12:45		22-Jun-2020 14:14		22-Jun-2020 14:14		22-Jun-2020 14:14		22-Jun-2020 14:14	
					KS2000801-001	KS2000801-002	KS2000801-003	KS2000801-004	KS2000801-005											
Physical Tests																				
alkalinity, total (as CaCO3)	—	E290	1.0	mg/L	114	113	113	113	114	113	113	113	113	114	113	114	113	114	113	114
hardness (as CaCO3), dissolved	—	EC100	0.60	mg/L	122	124	124	123	122	123	123	128	122	122	123	122	128	122	128	122
pH	—	E108	0.10	pH units	8.20	8.10	8.10	8.26	8.20	8.26	8.26	8.08	8.20	8.26	8.26	8.26	8.08	8.26	8.08	8.26
Anions and Nutrients																				
ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L	<0.0050	0.0104	0.0104	<0.0050	<0.0050	<0.0050	0.0110	0.0110	0.0105	<0.0050	<0.0050	0.0105	<0.0050	<0.0050	<0.0050	<0.0050
bromide	24959-67-9	E235.Br-L	0.050	mg/L	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
chloride	16887-00-6	E235.Cl	0.50	mg/L	5.08	5.21	5.21	5.34	5.08	5.34	5.34	5.17	5.08	5.34	5.34	5.37	5.17	5.37	5.17	5.37
Kjeldahl nitrogen, total [TKN]	—	E318	0.050	mg/L	0.243	0.207	0.207	0.227	0.243	0.227	0.198	0.198	0.241	0.227	0.227	0.241	0.198	0.241	0.198	0.241
nitrate (as N)	14797-55-8	E235.NO3-L	0.0050	mg/L	<0.0050	0.0742	0.0742	<0.0050	<0.0050	<0.0050	0.0572	0.0572	<0.0050	<0.0050	<0.0050	<0.0050	0.0572	<0.0050	<0.0050	<0.0050
nitrite (as N)	14797-65-0	E235.NO2-L	0.0010	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
nitrogen, total	7727-37-9	E366	0.030	mg/L	0.261	0.287	0.287	0.322	0.261	0.322	0.268	0.268	0.260	0.322	0.322	0.260	0.268	0.260	0.268	0.260
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0010	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0022	0.0022	<0.0010	<0.0010	<0.0010	<0.0010	0.0022	<0.0010	<0.0010	<0.0010
phosphorus, total	7723-14-0	E372-U	0.0020	mg/L	0.0110	0.0061	0.0061	0.0081	0.0110	0.0081	0.0065	0.0065	0.0130	0.0081	0.0081	0.0130	0.0065	0.0130	0.0065	0.0130
phosphorus, total dissolved	7723-14-0	E375-U	0.0010	mg/L	0.0037	0.0023	0.0023	0.0036	0.0037	0.0036	0.0024	0.0024	0.0029	0.0036	0.0036	0.0029	0.0024	0.0029	0.0024	0.0029
sulfate (as SO4)	14808-79-8	E235.SO4	0.30	mg/L	28.7	29.8	29.8	29.6	28.7	29.6	29.6	29.6	29.6	29.6	29.6	29.6	29.6	29.6	29.6	29.6
Bacteriological Tests																				
coliforms, Escherichia coli [E. coli]	—	E012.EC	↑	CFU/100mL	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
coliforms, thermotolerant [fecal]	—	E012.FC	↑	CFU/100mL	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Dissolved Metals																				
calcium, dissolved	7440-70-2	E421	0.050	mg/L	32.8	34.3	34.3	33.1	32.8	33.1	35.2	35.2	33.1	33.1	33.1	33.1	35.2	33.1	35.2	33.1
magnesium, dissolved	7439-95-4	E421	0.0050	mg/L	9.60	9.38	9.38	9.91	9.60	9.91	9.81	9.81	9.67	9.91	9.91	9.67	9.81	9.67	9.81	9.67
dissolved metals filtration location	—	EP421	—	—	Laboratory	Laboratory	Laboratory	Laboratory	Laboratory	Laboratory	Laboratory	Laboratory	Laboratory	Laboratory	Laboratory	Laboratory	Laboratory	Laboratory	Laboratory	Laboratory
Plant Pigments																				
chlorophyll a	479-61-8	E870	0.010	µg/L	4.12	—	—	3.92	4.12	3.92	—	—	—	3.92	3.92	—	—	—	—	3.31

Please refer to the General Comments section for an explanation of any qualifiers detected.



## Analytical Results

Sub-Matrix: Water

(Matrix: Water)

Sub-Matrix: Water				Client sample ID		Hypolimnion IDZ	
[Main: Water]				Client sampling date / time			
Analyte	CAS Number	Method	LOR	Unit	22-Jun-2020 14:37		
KS2000801-006							
Result							
Physical Tests							
alkalinity, total (as CaCO3)	—	E290	1.0	mg/L	116	—	—
hardness (as CaCO3), dissolved	—	EC100	0.60	mg/L	126	—	—
pH	—	E108	0.10	pH units	8.19	—	—
Anions and Nutrients							
ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L	0.0112	—	—
bromide	24959-67-9	E235.Br-L	0.050	mg/L	<0.050	—	—
chloride	16887-00-6	E235.Cl	0.50	mg/L	5.12	—	—
Kjeldahl nitrogen, total [TKN]	—	E318	0.050	mg/L	0.228	—	—
nitrate (as N)	14797-55-8	E235.NO3-L	0.0050	mg/L	0.0524	—	—
nitrite (as N)	14797-65-0	E235.NO2-L	0.0010	mg/L	<0.0010	—	—
nitrogen, total	7727-37-9	E366	0.030	mg/L	0.298	—	—
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0010	mg/L	0.0012	—	—
phosphorus, total	7723-14-0	E372-U	0.0020	mg/L	0.0104	—	—
phosphorus, total dissolved	7723-14-0	E375-U	0.0010	mg/L	0.0033	—	—
sulfate (as SO4)	14808-79-8	E235.SO4	0.30	mg/L	29.4	—	—
Bacteriological Tests							
coliforms, Escherichia coli [E. coli]	—	E012.EC	1	CFU/100mL	<1	—	—
coliforms, thermotolerant [fecal]	—	E012.FC	1	CFU/100mL	1	—	—
Dissolved Metals							
calcium, dissolved	7440-70-2	E421	0.050	mg/L	34.5	—	—
magnesium, dissolved	7439-95-4	E421	0.0050	mg/L	9.64	—	—
dissolved metals filtration location	—	EP421	—	—	Laboratory	—	—

Please refer to the General Comments section for an explanation of any qualifiers detected

## Analytical Results

Sub-Matrix: <b>Water</b>		Client sample ID									
(Matrix: <b>Water</b> )											
Analyte	Client sampling date / time			IDZ Epilimnion		Outfall Epilimnion		Outfall Hypolimnion		Ugradient Epilimnion	
	CAS Number	Method	LOR	Unit	Result	Result	Result	Result	Result	Result	
Physical Tests											
alkalinity, total (as CaCO3)	—	E290	1.0	mg/L	113	113	113	113	113	112	
hardness (as CaCO3), dissolved	—	EC100	0.60	mg/L	122	122	124	121	121	123	
pH	—	E108	0.10	pH units	8.22	8.02	8.41	8.18	8.18	8.20	
Anions and Nutrients											
ammonia, total (as N)	7684-41-7	E298	0.0050	mg/L	0.0070	0.0238	0.0053	0.0064	0.0076		
chloride	16887-00-6	E235.Cl	0.50	mg/L	5.69	5.43	5.85	5.62	5.54		
Kjeldahl nitrogen, total [TKN]	—	E318	0.050	mg/L	0.237	0.228	0.275	0.212	0.300		
nitrate (as N)	14797-55-8	E235.NO3-L	0.0050	mg/L	<0.0050	0.0800	<0.0050	0.0472	<0.0050		
nitrite (as N)	14797-65-0	E235.NO2-L	0.0010	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010		
nitrogen, total	7727-37-9	E366	0.030	mg/L	0.678	0.281	0.239	0.250	0.279		
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0010	mg/L	<0.0010	0.0012	<0.0010	<0.0010	<0.0010		
phosphorus, total	7723-14-0	E372-U	0.0020	mg/L	0.0082	0.0048	0.0071	0.0040	0.0088		
phosphorus, total dissolved	7723-14-0	E375-U	0.0010	mg/L	0.0029	0.0022	0.0040	0.0024	0.0040		
sulfate (as SO4)	14808-79-8	E235.SO4	0.30	mg/L	29.0	28.6	29.5	29.0	28.6		
Bacteriological Tests											
coliforms, Escherichia coli [E. coli]	—	E012.EC	1	CFU/100mL	1	<1	<1	<1	1		
coliforms, thermotolerant [fecal]	—	E012.FC	1	CFU/100mL	1	<1	<1	<1	1		
Dissolved Metals											
calcium, dissolved	7440-70-2	E421	0.050	mg/L	33.0	33.7	33.5	32.9	33.0		
magnesium, dissolved	7439-95-4	E421	0.0050	mg/L	9.58	9.32	9.82	9.45	9.87		
dissolved metals filtration location	—	EP421	-	-	Field	Field	Field	Field	Field		
Plant Pigments											
chlorophyll a	479-61-8	E870	0.010	µg/L	4.05	—	4.24	—	4.43		

Please refer to the General Comments section for an explanation of any qualifiers detected.



## Analytical Results

Sub-Matrix: **Water**

(Matrix: **Water**)

Sub-Matrix: <b>Water</b>			Client sample ID			Upgradient Hypolimnion			15-Jul-2020 15:00		
(Matrix: <b>Water</b> )											
			Client sampling date / time								
Analyte	CAS Number	Method	LOR	Unit							
Physical Tests											
alkalinity, total (as CaCO3)		E290	1.0	mg/L						113	
hardness (as CaCO3), dissolved		EC100	0.60	mg/L						122	
pH		E108	0.10	pH units						8.17	
Anions and Nutrients											
ammonia, total (as N)	7684-41-7	E298	0.0050	mg/L						0.0052	
chloride	16887-00-6	E235.Cl	0.50	mg/L						5.39	
Kjeldahl nitrogen, total [TKN]		E318	0.050	mg/L						0.210	
nitrate (as N)	14797-55-8	E235.NO3-L	0.0050	mg/L						0.0649	
nitrite (as N)	14797-65-0	E235.NO2-L	0.0010	mg/L						<0.0010	
nitrogen, total	7727-37-9	E366	0.030	mg/L						0.290	
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0010	mg/L						<0.0010	
phosphorus, total	7723-14-0	E372-U	0.0020	mg/L						0.0062	
phosphorus, total dissolved	7723-14-0	E375-U	0.0010	mg/L						0.0025	
sulfate (as SO4)	14808-79-8	E235.SO4	0.30	mg/L						28.5	
Bacteriological Tests											
coliforms, Escherichia coli [E. coli]		E012.EC	1	CFU/100mL						<1	
coliforms, thermotolerant [fecal]		E012.FC	1	CFU/100mL						<1	
Dissolved Metals											
calcium, dissolved	7440-70-2	E421	0.050	mg/L						33.8	
magnesium, dissolved	7439-95-4	E421	0.0050	mg/L						9.19	
dissolved metals filtration location		EP421	-	-						Field	

Please refer to the General Comments section for an explanation of any qualifiers detected.



## Analytical Results

Sub-Matrix: **Water**  
 (Matrix: **Water**)

Client sample ID					Client sampling date / time				
Analyte	CAS Number	Method	LOR	Unit	UPGRADIENT EPILIMNION	UPGRADIENT HYPOLIMNION	IDZ EPILIMNION	IDZ HYPOLIMNION	OUTFALL EPILIMNION
					12-Aug-2020 07:45	12-Aug-2020 08:11	12-Aug-2020 09:45	12-Aug-2020 10:04	12-Aug-2020 11:33
					KS2001374-001	KS2001374-002	KS2001374-003	KS2001374-004	KS2001374-005
					Result	Result	Result	Result	Result
<b>Physical Tests</b>									
alkalinity, total (as CaCO <sub>3</sub> )	—	E290	1.0	mg/L	115	112	114	112	114
hardness (as CaCO <sub>3</sub> ), dissolved	—	EC100	0.60	mg/L	130	128	126	128	121
pH	—	E108	0.10	pH units	8.46	8.29	8.39	8.20	8.42
<b>Anions and Nutrients</b>									
ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L	0.0094	0.0193	<0.0050	<0.0050	<0.0050
chloride	16887-00-6	E235 Cl	0.50	mg/L	5.83	5.58	5.94	5.50	5.67
Kjeldahl nitrogen, total [TKN]	—	E318	0.050	mg/L	0.308	0.222	0.233	0.169	0.261
nitrate (as N)	14797-55-8	E235.NO <sub>3</sub> -L	0.0050	mg/L	<0.0050	0.0533	<0.0050	0.0831	<0.0050
nitrite (as N)	14797-65-0	E235.NO <sub>2</sub> -L	0.0010	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
nitrogen, total	7727-37-9	E366	0.030	mg/L	0.366	0.278	0.234	0.290	0.272
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0010	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
phosphorus, total	7723-14-0	E372-U	0.0020	mg/L	0.0068	0.0067	0.0109	0.0044	0.0084
phosphorus, total dissolved	7723-14-0	E375-U	0.0010	mg/L	0.0038	0.0027	0.0027	0.0021	0.0024
sulfate (as SO <sub>4</sub> )	14808-79-8	E235.SO <sub>4</sub>	0.30	mg/L	30.8	30.5	30.4	30.5	30.3
<b>Bacteriological Tests</b>									
coliforms, Escherichia coli [E. coli]	—	E012.EC	1	CFU/100mL	<1	<1	<1	<1	<1
coliforms, thermotolerant [fecal]	—	E012.FC	1	CFU/100mL	<1	<1	<1	<1	<1
<b>Dissolved Metals</b>									
calcium, dissolved	7440-70-2	E421	0.050	mg/L	34.4	34.5	33.0	34.5	32.3
magnesium, dissolved	7439-95-4	E421	0.0050	mg/L	10.7	10.1	10.5	10.0	9.89
dissolved metals filtration location	—	EP421	—	—	Field	Field	Field	Field	Field
<b>Plant Pigments</b>									
chlorophyll a	479-61-8	E870	0.010	µg/L	1.41	—	1.80	—	1.75

Please refer to the General Comments section for an explanation of any qualifiers detected.



## Analytical Results

Sub-Matrix: **Water**

(Matrix: **Water**)

Client sample ID					Client sampling date / time		OUTFALL	
CAS Number					Method	LOR	Unit	HYPOLIMNION
Physical Tests								
alkalinity, total (as CaCO <sub>3</sub> )					E290	1.0	mg/L	112
hardness (as CaCO <sub>3</sub> ), dissolved					EC100	0.60	mg/L	133
pH					E108	0.10	pH units	8.24
Anions and Nutrients								
ammonia, total (as N)					7664-41-7 E298	0.0050	mg/L	<0.0050
chloride					16887-00-6 E235.Cl	0.50	mg/L	5.48
Kjeldahl nitrogen, total [TKN]					E318	0.050	mg/L	0.202
nitrate (as N)					14797-55-8 E235.NO3-L	0.0050	mg/L	0.0936
nitrite (as N)					14797-65-0 E235.NO2-L	0.0010	mg/L	<0.0010
nitrogen, total					7727-37-9 E366	0.030	mg/L	0.300
phosphate, ortho-, dissolved (as P)					14265-44-2 E378-U	0.0010	mg/L	<0.0010
phosphorus, total					7723-14-0 E372-U	0.0020	mg/L	0.0047
phosphorus, total dissolved					7723-14-0 E375-U	0.0010	mg/L	0.0027
sulfate (as SO <sub>4</sub> )					14808-79-8 E235 SO4	0.30	mg/L	30.4
Bacteriological Tests								
coliforms, Escherichia coli [E. coli]					E012.EC	1	CFU/100mL	<1
coliforms, thermotolerant [fecal]					E012 FC	1	CFU/100mL	<1
Dissolved Metals								
calcium, dissolved					7440-70-2 E421	0.050	mg/L	36.4
magnesium, dissolved					7439-95-4 E421	0.0050	mg/L	10.3
dissolved metals filtration location					EP421	-	-	Field

Please refer to the General Comments section for an explanation of any qualifiers detected.

## Appendix G

### ***OC ME12215 Required Lake Sampling Data***

***Field Data & ALS Environmental Analytical Results***

		Background Site							
Date: January 21, 2020		EMS: 0500730 GPS: 50 0899,-119 4783							
Lab Analysis	units	Interval (m)							
		1	5	10	20	30	40	50	60
pH		8.11	8.10	8.10	8.10	8.09	8.10	8.06	8.11
Ammonia (as N)	mg/L	<0.0050	<0.0050	0.0082	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Chloride	mg/L	5.41	5.40	5.39					
Nitrate (as N)	mg/L	0.0988	0.0899	0.0892	0.0887	0.0894	0.0888	0.0876	0.0982
Nitrite (as N)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010
Total Kjeldahl Nitrogen (as N)	mg/L	0.226	0.226	0.213	0.209	0.214	0.218	0.193	0.187
Total Nitrogen (as N) January 21, 2020	mg/L	0.294	0.295	0.286	0.295	0.304	0.313	0.269	0.277
Total Organic Nitrogen (as N)	mg/L	0.226	0.226	0.205					
Orthophosphate	mg/L	<0.0010	<0.0010	0.0013	<0.0010	0.0017	0.0024	<0.0010	<0.0010
Total Dissolved Phosphorus	mg/L	0.0037	0.0035	0.0037					
Total Phosphorus (as P) January 21, 2020	mg/L	0.0054	0.0048	0.0060	0.0059	0.0053	0.0067	0.0048	0.0045
Fecal Coliforms	FU/100mL	<1	<1	1	<1	<1	<1	<1	<1
Sodium	mg/L	11.4	12.0	10.8	11.3	11.5	11.8	11.3	11.1
Chlorophyll a	ug/L	0.610	0.689	0.681					
Site Analysis									
pH		8.53	8.36	8.22	8.36	8.34	8.32	8.30	8.30
Temperature (°C)		4.5	4.4	3.7	3.6	3.6	3.6	3.5	3.4
Dissolved Oxygen	mg/L	11.8	11.1	12.0	11.9	11.9	11.9	11.9	12.1
Secchi Depth (m)	12								

Field Data						
Date: January 21, 2020						
Site	Background			Edge of IDZ		
Depth (m)	pH	perature	DO (mg/L)	pH	temperature	DO (mg/L)
1	8.53	4.5	11.8	8.45	2.4	12.2
5	8.36	4.4	11.1	8.40	2.7	11.8
10	8.22	3.7	12.0	8.50	2.6	12.3
20	8.36	3.6	11.9	8.43	3.0	12.2
30	8.34	3.6	11.9	8.38	3.0	12.3
40	8.32	3.6	11.9	8.39	3.3	12.1
50	8.30	3.5	11.9	8.34	3.2	12.2
60	8.30	3.4	12.1	8.36	3.4	12.1

		Edge of Intial Dilution Zone							
Date: January 21, 2020		EMS: E206611 GPS: 50.2111,-119 4241							
Lab Analysis	units	Interval (m)							
		1	5	10	20	30	40	50	60
pH		8.15	8.15	8.16	8.14	8.14	8.14	8.13	8.15
Ammonia (as N)	mg/L	0.0067	0.0025	0.0025	0.0025	0.0059	0.0098	0.0157	0.0054
Chloride	mg/L	5.59	5.52	5.52					
Nitrate (as N)	mg/L	0.0686	0.0700	0.0714	0.0757	0.0782	0.0777	0.0741	0.0802
Nitrite (as N)	mg/L	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Total Kjeldahl Nitrogen (as N)	mg/L	0.210	0.206	0.179	0.213	0.217	0.210	0.223	0.189
Total Nitrogen (as N) January 21, 2020	mg/L	0.276	0.267	0.264	0.276	0.316	0.289	0.302	0.257
Total Organic Nitrogen (as N)	mg/L	0.203	0.206	0.179					
Orthophosphate	mg/L	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Total Dissolved Phosphorus	mg/L	0.0025	0.0024	0.0026					
Total Phosphorus (as P) January 21, 2020	mg/L	0.0042	0.0051	0.0045	0.0051	0.0048	0.0056	0.0060	0.0050
Fecal Coliforms	FU/100mL	<1	<1	<1	<1	<1	<1	<1	<1
Sodium	mg/L	11.5	11.7	11.6	12.1	11.5	11.4	11	11.3
Chlorophyll a	ug/L	2.12	1.29	1.90					
Site Analysis									
pH		8.45	8.40	8.50	8.43	8.38	8.39	8.34	8.36
Temperature (°C)		2.4	2.7	2.6	3.0	3.0	3.3	3.2	3.4
Dissolved Oxygen	mg/L	12.2	11.8	12.3	12.2	12.3	12.1	12.2	12.1
Secchi Depth (m)	7								

### Background Site

Date: July 15, 2020

EMS: 0500730 GPS: 50.0899,-119.4783

Lab Analysis	units	Interval (m)							
		1	5	10	20	30	40	50	60
pH		8.40	8.34	8.33	8.17	8.20	8.20	8.19	8.20
Ammonia (as N)	mg/L	0.0062	<0.0050	<0.0050	0.0087	<0.0050	0.0054	<0.0050	<0.0050
Chloride	mg/L	5.53	5.49	5.45	5.39	5.44	5.46	5.46	5.46
Nitrate (as N)	mg/L	<0.0050	<0.0050	<0.0050	0.0374	0.0734	0.0909	0.0959	0.0900
Nitrite (as N)	mg/L	<0.0010	<0.0010	<0.0010	0.0017	<0.0010	<0.0010	<0.0010	<0.0010
Total Kjeldahl Nitrogen (as N)	mg/L	0.270	0.244	0.226	0.203	0.196	0.204	0.203	0.182
Total Nitrogen (as N) July 15, 2020	mg/L	0.241	0.217	0.307	0.222	0.234	0.261	0.272	0.262
Total Organic Nitrogen (as N)	mg/L	0.264	0.241	0.221					
Orthophosphate	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	0.0015
Total Dissolved Phosphorus	mg/L	0.0021	0.0025	0.0018					
Total Phosphorus (as P) July 15, 2020	mg/L	0.0183	0.008	0.0056	0.0051	0.0034	0.0037	0.0034	0.0036
Fecal Coliforms	CFU/100mL	<1	<1	<1	<1	<1	<1	<1	<1
Sodium	mg/L	12.2	11.6	12.1	11.2	11.4	11.4	11.4	12.1
Chlorophyll a	ug/L	3.30	4.46	3.84					
<b>Site Analysis</b>									
pH									
Temperature	(°C)	19.1	17.5	16.9	9.7	6.6	5.7	5.3	4.9
Dissolved Oxygen	mg/L	9.67	9.82	9.49	9.8	10.62	10.86	10.94	10.96
Secchi Depth (m)	4.46								

### Edge of Intial Dilution Zone

EMS: E206611

GPS: 50.2131,-

119.4241

Date: July 15, 2020

Lab Analysis	units	Interval (m)							
		1	5	10	20	30	40	50	60
pH		8.18	8.38	8.27	8.21	8.18	8.06	8.12	8.14
Ammonia (as N)	mg/L	0.0025	0.0025	0.0025	0.0088	0.0059	0.0025	0.0025	0.0025
Chloride	mg/L	5.84	5.66	5.46	5.41	5.44	5.43	5.44	5.42
Nitrate (as N)	mg/L	0.0025	0.0025	0.0025	0.0515	0.0882	0.0952	0.0968	0.1010
Nitrite (as N)	mg/L	0.0005	0.0005	0.0005	0.0020	0.0005	0.0005	0.0005	0.0005
Total Kjeldahl Nitrogen (as N)	mg/L	0.240	0.282	0.236	0.208	0.197	0.189	0.189	0.184
Total Nitrogen (as N) July 15, 2020	mg/L	0.234	0.347	0.222	0.239	0.260	0.272	0.256	0.260
Total Organic Nitrogen (as N)	mg/L	0.237	0.278	0.232					
Orthophosphate	mg/L	0.0005	0.0005	0.0005	0.0005	0.001	0.0005	0.0011	0.0016
Total Dissolved Phosphorus	mg/L	0.0026	0.0025	0.0019					
Total Phosphorus (as P) July 15, 2020	mg/L	0.0087	0.0080	0.0140	0.0047	0.0039	0.0041	0.0036	0.0046
Fecal Coliforms	CFU/100mL	<1	<1	<1	<1	<1	<1	<1	<1
Sodium	mg/L	12.1	11.4	11.6	11.6	11.7	11.7	11.9	12.6
Chlorophyll a	ug/L	3.60	4.98	3.61					
<b>Site Analysis</b>									
pH									
Temperature	(°C)	19.9	18.5	16.7	8.6	6.4	5.8	5.4	5.1
Dissolved Oxygen	mg/L	9.63	9.86	9.38	10.03	10.55	10.77	10.88	10.9
Secchi Depth (m)	5.41								

### Field Data

Date: July 15, 2020

Site	Background		Edge of IDZ (OC)	
Depth (m)	Temperature (°C)	DO (mg/L)	Temperature (°C)	DO (mg/L)
1	19.1	9.67	19.9	9.63
5	17.5	9.82	18.5	9.86
10	16.9	9.49	16.7	9.38
20	9.7	9.80	8.6	10.03
30	6.6	10.62	6.4	10.55
40	5.7	10.86	5.8	10.77
50	5.3	10.94	5.4	10.88
60	4.9	10.96	5.1	10.90

## ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L2408254-1 Water 21-JAN-20 10:00 BACKGROUND 1M	L2408254-2 Water 21-JAN-20 10:15 BACKGROUND 5M	L2408254-3 Water 21-JAN-20 10:30 BACKGROUND 10M	L2408254-4 Water 21-JAN-20 10:45 BACKGROUND 20M	L2408254-5 Water 21-JAN-20 11:00 BACKGROUND 30M
Grouping	Analyte					
<b>WATER</b>						
<b>Physical Tests</b>	pH (pH)	8.11	8.10	8.10	8.10	8.09
<b>Anions and Nutrients</b>	Ammonia, Total (as N) (mg/L)	<0.0050	<0.0050	0.0082	<0.0050	<0.0050
	Chloride (Cl) (mg/L)	5.41	5.40	5.39		
	Nitrate (as N) (mg/L)	0.0988	0.0899	0.0892	0.0887	0.0894
	Nitrite (as N) (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Total Kjeldahl Nitrogen (mg/L)	0.226	0.226	0.213	0.209	0.214
	Total Nitrogen (mg/L)	0.294	0.295	0.286	0.295	0.304
	Total Organic Nitrogen (mg/L)	0.226	0.226	0.205		
	Orthophosphate-Dissolved (as P) (mg/L)	<0.0010	<0.0010	0.0013	<0.0010	0.0017
	Phosphorus (P)-Total Dissolved (mg/L)	0.0037	0.0035	0.0037		
	Phosphorus (P)-Total (mg/L)	0.0054	0.0048	0.0060	0.0059	0.0053
<b>Bacteriological Tests</b>	Coliform Bacteria - Fecal (CFU/100mL)	<1	<1	1	<1	<1
<b>Total Metals</b>	Sodium (Na)-Total (mg/L)	11.4	12.0	10.8	11.3	11.5
<b>Plant Pigments</b>	Chlorophyll a (ug/L)	0.610	0.689	0.681		

\* Please refer to the Reference Information section for an explanation of any qualifiers detected.

## ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L2408254-6 Water 21-JAN-20 11:15 BACKGROUND 40M	L2408254-7 Water 21-JAN-20 11:30 BACKGROUND 50M	L2408254-8 Water 21-JAN-20 12:00 BACKGROUND 60M	L2408254-9 Water 21-JAN-20 13:00 VERNON OUTFALL 1M	L2408254-10 Water 21-JAN-20 13:15 VERNON OUTFALL 5M
Grouping	Analyte					
<b>WATER</b>						
<b>Physical Tests</b>	pH (pH)	8.10	8.06	8.11	8.15	8.15
<b>Anions and Nutrients</b>	Ammonia, Total (as N) (mg/L)	<0.0050	<0.0050	<0.0050	0.0067	<0.0050
	Chloride (Cl) (mg/L)				5.59	5.52
	Nitrate (as N) (mg/L)	0.0888	0.0876	0.0982	0.0686	0.0700
	Nitrite (as N) (mg/L)	<0.0010	<0.0010	0.0010	<0.0010	<0.0010
	Total Kjeldahl Nitrogen (mg/L)	0.218	0.193	0.187	0.210	0.206
	Total Nitrogen (mg/L)	0.313	0.269	0.277	0.276	0.267
	Total Organic Nitrogen (mg/L)				0.203	0.206
	Orthophosphate-Dissolved (as P) (mg/L)	0.0024	<0.0010	<0.0010	<0.0010	<0.0010
	Phosphorus (P)-Total Dissolved (mg/L)				0.0025	0.0024
	Phosphorus (P)-Total (mg/L)	0.0067	0.0048	0.0045	0.0042	0.0051
<b>Bacteriological Tests</b>	Coliform Bacteria - Fecal (CFU/100mL)	<1	<1	<1	<1	<1
<b>Total Metals</b>	Sodium (Na)-Total (mg/L)	11.8	11.3	11.1	11.5	11.7
<b>Plant Pigments</b>	Chlorophyll a (ug/L)				2.12	1.29

\* Please refer to the Reference Information section for an explanation of any qualifiers detected.

## ALS ENVIRONMENTAL ANALYTICAL REPORT

31-JAN-20 14:08 (MT)

Version: FINAL

Sample ID Description Sampled Date Sampled Time Client ID		L2408254-11 Water 21-JAN-20 13:30 VERNON OUTFALL 10M	L2408254-12 Water 21-JAN-20 13:45 VERNON OUTFALL 20M	L2408254-13 Water 21-JAN-20 14:00 VERNON OUTFALL 30M	L2408254-14 Water 21-JAN-20 14:15 VERNON OUTFALL 40M	L2408254-15 Water 21-JAN-20 14:30 VERNON OUTFALL 50M
Grouping	Analyte					
<b>WATER</b>						
<b>Physical Tests</b>	pH (pH)	8.16	8.14	8.14	8.14	8.13
<b>Anions and Nutrients</b>	Ammonia, Total (as N) (mg/L)	<0.0050	<0.0050	0.0059	0.0098	0.0157
	Chloride (Cl) (mg/L)	5.52				
	Nitrate (as N) (mg/L)	0.0714	0.0757	0.0782	0.0777	0.0741
	Nitrite (as N) (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Total Kjeldahl Nitrogen (mg/L)	0.179	0.213	0.217	0.210	0.223
	Total Nitrogen (mg/L)	0.264	0.276	0.316	0.289	0.302
	Total Organic Nitrogen (mg/L)	0.179				
	Orthophosphate-Dissolved (as P) (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Phosphorus (P)-Total Dissolved (mg/L)	0.0026				
	Phosphorus (P)-Total (mg/L)	0.0045	0.0051	0.0048	0.0056	0.0060
<b>Bacteriological Tests</b>	Coliform Bacteria - Fecal (CFU/100mL)	<1	<1	<1	<1	<1
<b>Total Metals</b>	Sodium (Na)-Total (mg/L)	11.6	12.1	11.5	11.4	11.0
<b>Plant Pigments</b>	Chlorophyll a (ug/L)	1.90				

\* Please refer to the Reference Information section for an explanation of any qualifiers detected.

## ALS ENVIRONMENTAL ANALYTICAL REPORT

		<b>Sample ID</b> <b>Description</b> <b>Sampled Date</b> <b>Sampled Time</b> <b>Client ID</b>	L2408254-16 Water 21-JAN-20 14:45 VERNON OUTFALL 60M				
Grouping	Analyte						
<b>WATER</b>							
<b>Physical Tests</b>	pH (pH)	8.15					
<b>Anions and Nutrients</b>	Ammonia, Total (as N) (mg/L)	0.0054					
	Chloride (Cl) (mg/L)						
	Nitrate (as N) (mg/L)	0.0802					
	Nitrite (as N) (mg/L)	<0.0010					
	Total Kjeldahl Nitrogen (mg/L)	0.189					
	Total Nitrogen (mg/L)	0.257					
	Total Organic Nitrogen (mg/L)						
	Orthophosphate-Dissolved (as P) (mg/L)	<0.0010					
	Phosphorus (P)-Total Dissolved (mg/L)						
	Phosphorus (P)-Total (mg/L)	0.0050					
<b>Bacteriological Tests</b>	Coliform Bacteria - Fecal (CFU/100mL)	<1					
<b>Total Metals</b>	Sodium (Na)-Total (mg/L)	11.3					
<b>Plant Pigments</b>	Chlorophyll a (ug/L)						

\* Please refer to the Reference Information section for an explanation of any qualifiers detected



## Analytical Results

Sub-Matrix: Water (Matrix: Water)		Client sample ID								
Analyte	CAS Number	Method	Client sampling date / time		Background 1m	Background 5m	Background 10m	IDZ OC 1m	IDZ OC 5m	
			LOR	Unit						Result
Physical Tests										
pH	—	E108	0.10	pH units	15-Jul-2020 08:14	15-Jul-2020 08:21	15-Jul-2020 08:26	15-Jul-2020 11:11	15-Jul-2020 11:15	
					KS2001076-001	KS2001076-002	KS2001076-003	KS2001076-004	KS2001076-005	
Anions and Nutrients										
ammonia, total (as N)	7684-41-7	E298	0.0050	mg/L	0.0062	<0.0050	<0.0050	<0.0050	<0.0050	
chloride	16887-00-6	E235.Cl	0.50	mg/L	5.53	5.49	5.45	5.84	5.66	
Kjeldahl nitrogen, total [TKN]	—	E318	0.050	mg/L	0.270	0.244	0.226	0.240	0.282	
nitrate (as N)	14797-55-8	E235.NO3-L	0.0050	mg/L	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	
nitrite (as N)	14797-65-0	E235.NO2-L	0.0010	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	
nitrogen, total	7727-37-9	E366	0.030	mg/L	0.241	0.217	0.307	0.234	0.347	
nitrogen, total organic	—	EC363	0.050	mg/L	0.264	0.241	0.221	0.237	0.278	
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0010	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	
phosphorus, total	7723-14-0	E372-U	0.0020	mg/L	0.0183	0.0080	0.0056	0.0087	0.0080	
phosphorus, total dissolved	7723-14-0	E375-U	0.0010	mg/L	0.0021	0.0025	0.0018	0.0026	0.0025	
Bacteriological Tests										
coliforms, thermotolerant [fecal]	—	E012.FC	1	CFU/100mL	<1	<1	<1	<1	<1	
Total Metals										
sodium, total	7440-23-5	E420	0.050	mg/L	12.2	11.6	12.1	12.1	11.4	
Plant Pigments										
chlorophyll a	479-61-8	E870	0.010	µg/L	3.30	4.46	3.84	3.60	4.98	

Please refer to the General Comments section for an explanation of any qualifiers detected.



## Analytical Results

Sub-Matrix: <b>Water</b> (Matrix: <b>Water</b> )			Client sample ID		IDZ OC 10m				
			Client sampling date / time		15-Jul-2020 11:21				
Analyte	CAS Number	Method	LOR	Unit	KS2001076-006				
Result									
Physical Tests									
pH	---	E108	0.10	pH units	8.27				
Anions and Nutrients									
ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L	<0.0050				
chloride	16887-00-6	E235.Cl	0.50	mg/L	5.46				
Kjeldahl nitrogen, total [TKN]	---	E318	0.050	mg/L	0.236				
nitrate (as N)	14797-55-8	E235.NO3-L	0.0050	mg/L	<0.0050				
nitrite (as N)	14797-65-0	E235.NO2-L	0.0010	mg/L	<0.0010				
nitrogen, total	7727-37-9	E366	0.030	mg/L	0.222				
nitrogen, total organic	---	EC363	0.050	mg/L	0.232				
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0010	mg/L	<0.0010				
phosphorus, total	7723-14-0	E372-U	0.0020	mg/L	0.0140				
phosphorus, total dissolved	7723-14-0	E375-U	0.0010	mg/L	0.0019				
Bacteriological Tests									
coliforms, thermotolerant [fecal]	---	E012.FC	1	CFU/100mL	<1				
Total Metals									
sodium, total	7440-23-5	E420	0.050	mg/L	11.6				
Plant Pigments									
chlorophyll a	479-61-8	E870	0.010	µg/L	3.61				

Please refer to the General Comments section for an explanation of any qualifiers detected.



## Analytical Results

Sub-Matrix: Water		Client sample ID		Background 20m		Background 30m		Background 40m		Background 50m		Background 60m	
(Matrix: Water)		Client sampling date / time		15-Jul-2020 08:31		15-Jul-2020 08:41		15-Jul-2020 08:47		15-Jul-2020 08:54		15-Jul-2020 09:00	
Analyte	CAS Number	Method	LOR	Unit	Result	Result	Result	Result	Result	Result	Result	Result	Result
<b>Physical Tests</b>													
pH	---	E108	0.10	pH units	8.17	8.20	8.20	8.20	8.19	8.20	8.20	8.20	8.20
<b>Anions and Nutrients</b>													
ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L	0.0087	<0.0050	0.0054	0.0054	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
chloride	16887-00-6	E235.Cl	0.50	mg/L	5.39	5.44	5.46	5.46	5.46	5.46	5.46	5.46	5.46
Kjeldahl nitrogen, total [TKN]	---	E318	0.050	mg/L	0.203	0.196	0.204	0.204	0.203	0.203	0.203	0.182	0.182
nitrate (as N)	14797-55-8	E235.NO3-L	0.0050	mg/L	0.0374	0.0734	0.0909	0.0909	0.0959	0.0959	0.0900	0.0900	0.0900
nitrite (as N)	14797-65-0	E235.NO2-L	0.0010	mg/L	0.0017	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
nitrogen, total	7727-37-9	E366	0.030	mg/L	0.222	0.234	0.261	0.261	0.272	0.272	0.262	0.262	0.262
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0010	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	0.0010	0.0015	0.0015	0.0015
phosphorus, total	7723-14-0	E372-U	0.0020	mg/L	0.0051	0.0034	0.0037	0.0037	0.0034	0.0034	0.0036	0.0036	0.0036
<b>Bacteriological Tests</b>													
coliforms, thermotolerant [fecal]	---	E012.FC	1	CFU/100mL	<1	<1	<1	<1	<1	<1	<1	<1	<1
<b>Total Metals</b>													
sodium, total	7440-23-5	E420	0.050	mg/L	11.2	11.4	11.4	11.4	11.4	11.4	11.4	12.1	12.1

Please refer to the General Comments section for an explanation of any qualifiers detected.



## Analytical Results

Sub-Matrix: **Water**

(Matrix: **Water**)

Client sample ID				IDZ OC 20m	IDZ OC 30m	IDZ OC 40m	IDZ OC 50m	IDZ OC 60m
Analyte	CAS Number	Method	LOR	Unit	Client sampling date / time	Result	Result	Result
<b>Physical Tests</b>								
pH	—	E108	0.10	pH units	15-Jul-2020 11:26	8.21	8.18	8.14
<b>Anions and Nutrients</b>								
ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L	15-Jul-2020 11:26	0.0088	0.0059	<0.0050
chloride	16887-00-6	E235.Cl	0.50	mg/L	15-Jul-2020 11:26	5.41	5.44	5.42
Kjeldahl nitrogen, total [TKN]	—	E318	0.050	mg/L	15-Jul-2020 11:26	0.208	0.197	0.184
nitrate (as N)	14797-55-8	E235.NO3-L	0.0050	mg/L	15-Jul-2020 11:26	0.0515	0.0882	0.101
nitrite (as N)	14797-65-0	E235.NO2-L	0.0010	mg/L	15-Jul-2020 11:26	0.0020	<0.0010	<0.0010
nitrogen, total	7727-37-9	E366	0.030	mg/L	15-Jul-2020 11:26	0.239	0.260	0.260
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0010	mg/L	15-Jul-2020 11:26	<0.0010	0.0010	0.0016
phosphorus, total	7723-14-0	E372-U	0.0020	mg/L	15-Jul-2020 11:26	0.0047	0.0039	0.0046
<b>Bacteriological Tests</b>								
coliforms, thermotolerant [fecal]	—	E012.FC	1	CFU/100mL	15-Jul-2020 11:37	<1	<1	<1
<b>Total Metals</b>								
sodium, total	7440-23-5	E420	0.050	mg/L	15-Jul-2020 11:30	11.6	11.7	12.6

Please refer to the General Comments section for an explanation of any qualifiers detected.

## Appendix H

### *Vernon Emergency Discharge Acknowledgment*

## 1. Introduction and Recent Conditions

Extensions to the reclaimed water system are typically driven by the need or interest of customers who seek an alternative to the regional water distribution system. Table 1 summarizes the types of customers of the reclaimed water system as of 2018.

**Table 1: Customer Summary for Spray Irrigation**

Classification	Count	Total Area (ha)	Est. Range % of Total Demand
Ag/Silviculture -Trickle	3	127	10-15%
Agriculture	33	1461	65%+
Commercial	4	502	15-20%
Landscape	3	6	1%
Public Recreational	1	83	2-5%

The commercial customers include three golf courses. Many of the agricultural customers are forage type, nurseries, or greenhouses. There were few if any new customer requests in the period from 2014 to 2019. During the last 12 to 18 months there have been a handful of service requests, with about half of them initiated by the City. The customer service requests include:

- Approximately 45 ha over multiple parcels located near the Ogorow Facility off Commonage Road
- A small rural property (a few hectares) with interest in an apple orchard near Bench Row Road, which requires further consideration given the use of the site and the regulations for food production with reclaimed water.
- A medium-sized agricultural customer, at the southernmost tip of the system, has inquired but not committed to re-starting reclaimed water reuse (a past customer who has not used water for the past 5 years). Note: Vernon invested capital funds to upgrade the south end pump station controls and installed a larger pump to supply water to this site.
- Predator Ridge expanded their on-site reclamation system by a length of about 800m to irrigate common areas in a new area of housing.
- A second subdivision at the westernmost portion of the system added some additional irrigation areas, about 1-2 ha or less.

Any new customers lessens the imbalance of supply over demand. Overall, however, the total volume of demand represented by these five sites is about 1-2% of the total program, and at least half the area reflects lands previously serviced.

Customer count and land area are important indicators for where and who the system serves. But the annual water supply and demand balance is more complicated than the inventory of customers. Factors that often lead to the imbalance between supply and irrigation demand include:

Lower demands due to weather conditions, which include cooler/wetter springs, smoky-sky conditions, and wet weather during the irrigation season. These weather-related, relatively low irrigation seasons have occurred each year for almost four years.

The approach to customer usage has adapted to encourage irrigation rates that are considerate to topography, vegetation type, soil capacity and weather-related factors, many of which are outlined in Provincial guidelines.

Vernon monitors irrigation methods and weather closely and makes regular adjustments to preserve the effectiveness of the program.

## 2. Feasibility of System Extensions

Vernon continues to explore ways to enhance the spray irrigation program and to find new customers. The cost-benefit and overall feasibility of a system extension can be unpacked into a series of challenges and opportunities.

### Challenges with System Extension

- **Scale of Need:** As a basic estimate, every 500,000 m<sup>3</sup> of reclaimed water requires ~120 to 160 ha of irrigable lands. Lands that warrant water supply of this scale are typically already serviced by a water system.
- **Broad Irrigation System Coverage:** Beyond customers adjacent to, or already within the service area of Vernon's reclaimed water system, all extensions require duplicate water supply and distribution systems. When offered a choice, even at a discounted price, most customers choose the higher-quality, relatively inexpensive water from the Duteau/Kalamalka Lake system. Near Swan Lake, a second wastewater treatment and reuse system constructed and operated by others is poised to serve agricultural and industrial customers there.
- **Cost of Extending the Reclaimed Water System:** The cost to extend to agriculture customers in Coldstream area was previously estimated at 300% the cost of expanding the regional supply system. Offering reclaimed water at a discount to agriculture rates at a cost that 3x the potable system makes the business case for extension very challenging.
- **Confirmed Servicing Strategy and Master Plan:** Given the interdependent nature of the regional water supply system, Vernon and RDNO meet regularly to discuss short-term and long-term supply and distribution programs for their constituents. The master plan for the regional system was design and initiated almost 10 years ago and many of their investments into new water supply works and expanded distribution infrastructure are complete. There are no regional plans to create a shared supply strategy and customer interest for this concept remains low.
- **Looming Asset Cost Pressures:** Many parts of the spray irrigation are nearing 50 years old. Vernon is preparing for asset renewal costs of the original infrastructure which are likely to occupy most capital budgets for the short term. Doing both - expanding the system while also replacing historic assets – is an extraordinary cost pressure.
- **Meeting Commitments to new Customers:** In a good year for irrigation, where precipitation is low and demand is high, Vernon is poised to strike a balance for supply and demand. Adding new customers should be done incrementally so as to not add more customers than cannot be serviced in one or more years of high irrigation.
- **High Costs to Serve Small, Urban Properties:** It is expensive to construct an additional network of pipes in urban areas given the need to restore the surface to urban standard (e.g. roadways). There are also few sites to serve because of their small size and because they already receive adequate service from the regional water system.
- **Regulatory Impediments:** Two key barriers to system expansion continue to be the (a) need to conduct site assessments alongside the Ministry for all new sites to be irrigated and (b) the spill reporting requirements when small, unplanned volumes of reclaimed water are released.
- **Lack of Nutrients:** Multiple, large-sized commercial and agriculture properties have expressed concerns over the long-term application of low-nutrient reclaimed water and the effect it can have on salt and copper levels in soil. One customer recently cited an annual fertilization costs near \$100,000 to rebalance soil properties.

There are multiple, significant obstacles to extending the system including to new industrial or commercial customers. Yet, City staff continue to seek out new customers and entertain new service requests. Vernon remains proud of its ability to reclaim a very high percentage of its annual volume of highly treated wastewater. There are some, albeit limited, opportunities to extend the system beyond the list of five new customers previously outlined.

### **Opportunities for System Extension**

Vernon continues to reach out to prospective customers and to explore reasonable, cost-beneficial methods to expand the reclaimed water system. The opportunity and degree of feasibility for an extension to the reclaimed water system can be captured by four conditions:

1. *The proximity to the existing system* e.g. the closer, and smaller the infrastructure to serve the areas, the better.
2. *The opportunity for large water demands for the long-term.*
3. *The ability to substitute for existing potable supply or to prevent new sources from being developed.*
4. *The opportunity to charge for at least regional agriculture water rates, and the preference to finding higher revenues that might come from industrial or commercial customers.*

Each of these conditions is intended to minimize the costs to the general rate payer, to secure beneficial reuse, and to minimize the cost- and carbon-footprint of extensions. Vernon mapped these opportunities informally during the 2014 Liquid Waste Management Plan. New customers have not readily emerged.

Also, Vernon continues to encourage water conservation programming to lessen the volume of influent flows to the plant to offset the imbalance of supply and demand. As noted above but now posited from a different perspective, if the water utility can reduce demands by 500,000 m<sup>3</sup> through conservation, it can offset the need for 120 to 160 ha of new lands. Grey water reuse too can fall under the large topic of conservation. While regulations permit the use of on-site reclamation of grey water, this has been deemed the most expensive option for water conservation in the City and will be pursued again after other high-impact, low-cost opportunities are completed. Like other municipalities in BC, while there is some public interest in the grey water concept, the costs for dual distribution systems in new buildings is cost prohibitive at the same that the costs of housing continue to rise. Vernon will continue to explore the potential with the development community. However, currently and for the medium term, the suitability for grey water reclamation in Vernon developments remains low. A study to review the feasibility of grey-water reuse is proposed again for 2023.

Overall, there are limited opportunities in the area that meet the feasibility conditions for extension. Vernon has reached out to the RDNO for supply partnerships and to the development community to market reclaimed water services, but customer interest has been very limited and the challenges to extend the system have become more acute.

### **Progress Reports and Timelines**

Vernon will continue to include updates on the various topics and related opportunities for reclaimed water use as part of its annual reporting to the Ministry of Environment. Any special references required to explain the need for use of the lake outfall in notifications will be made as per the Ministry's request.

Vernon has a long track record of recruiting customers and suitable lands to reclaim water. While some properties come and go in any given year, the customer base has remained relatively stable for the last 10 to 20 years. Flows to the Vernon Water Reclamation Centre have not risen significantly, largely due to water demand reductions that lead to stable influent flows all while Vernon has grown by thousands of people.

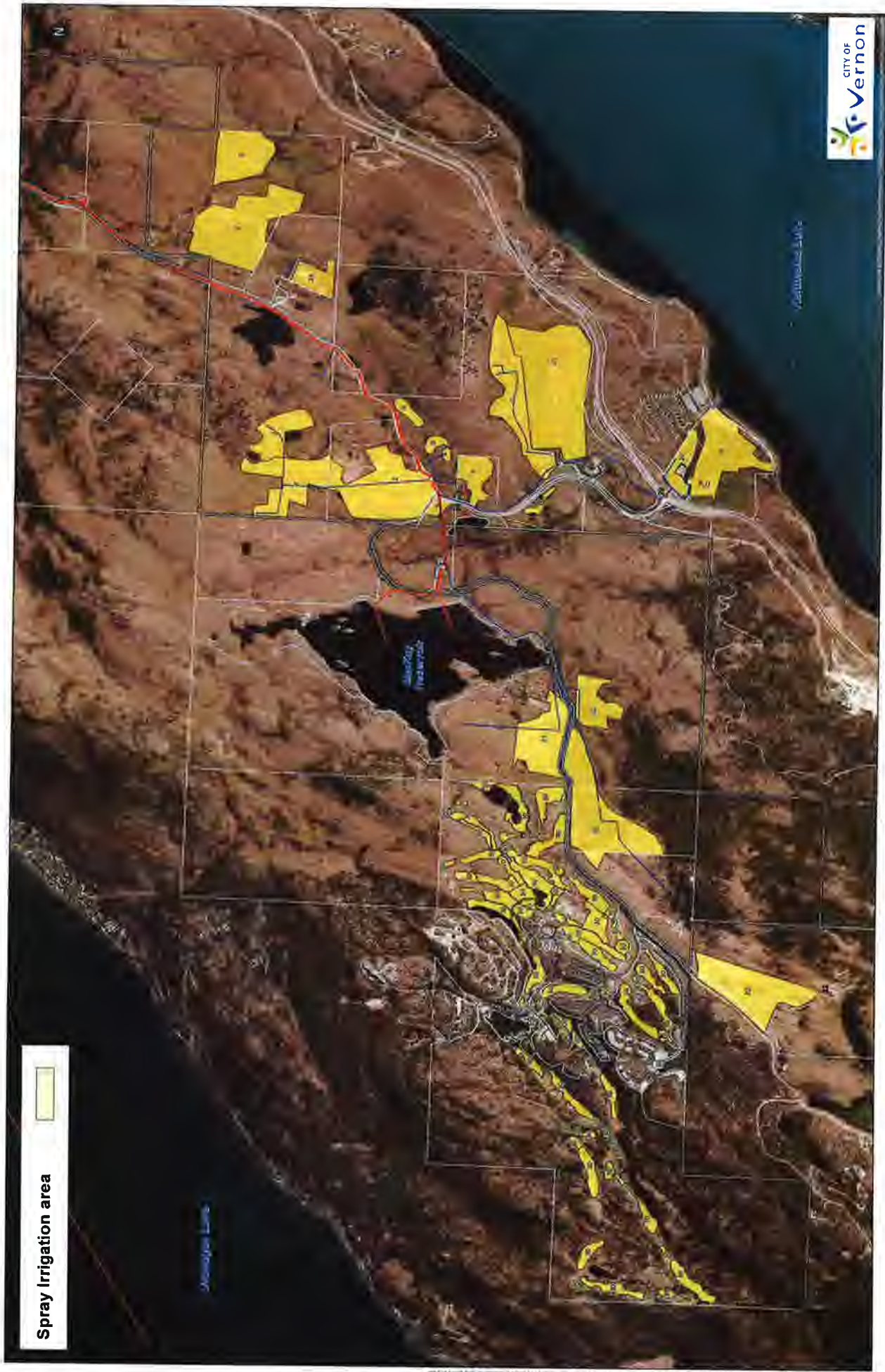
Use of the outfall remains an important method to restore imbalance of the spray irrigation system in years where supply exceeds demand.

# Appendix I

## *Spray Irrigation Areas*



Spray Irrigation area



## Appendix J

### *Irrigation Water Quality Results*

*Caro Analytical Services*



## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
MacKay Reservoir Effluent (ME 12215) - EMS

**WORK ORDER REPORTED** 0051382  
2020-05-25 15:44

Analyte	Result	RL	Units	Analyzed	Qualifier
<b>MacKay Reservoir Effluent to Irr. (CV4) - Reclaimed (E228539) (0051382-01)   Matrix: Fresh Water  </b>					F2, FILT, PRES
<b>Sampled: 2020-05-14 13:15</b>					
<b>Anions</b>					
Chloride	94.4	0.10	mg/L	2020-05-16	
Fluoride	0.24	0.10	mg/L	2020-05-17	
Nitrate (as N)	0.588	0.010	mg/L	2020-05-17	
Nitrite (as N)	< 0.010	0.010	mg/L	2020-05-17	
Phosphate (as P)	0.632	0.0050	mg/L	2020-05-17	
Sulfate	82.8	1.0	mg/L	2020-05-16	
<b>Calculated Parameters</b>					
Hardness, Total (as CaCO <sub>3</sub> )	203	0.500	mg/L	N/A	
Nitrate+Nitrite (as N)	0.588	0.0100	mg/L	N/A	
Nitrogen, Total	2.31	0.100	mg/L	N/A	
Nitrogen, Organic	1.02	0.100	mg/L	N/A	
<b>Dissolved Metals</b>					
Lithium, dissolved	0.00829	0.00010	mg/L	2020-05-22	
Aluminum, dissolved	< 0.0050	0.0050	mg/L	2020-05-22	
Antimony, dissolved	0.00022	0.00020	mg/L	2020-05-22	
Arsenic, dissolved	0.00076	0.00050	mg/L	2020-05-22	
Barium, dissolved	0.0307	0.0050	mg/L	2020-05-22	
Beryllium, dissolved	< 0.00010	0.00010	mg/L	2020-05-22	
Bismuth, dissolved	< 0.00010	0.00010	mg/L	2020-05-22	
Boron, dissolved	0.104	0.0050	mg/L	2020-05-22	
Cadmium, dissolved	0.000930	0.000010	mg/L	2020-05-22	
Calcium, dissolved	48.5	0.20	mg/L	2020-05-22	
Chromium, dissolved	< 0.00050	0.00050	mg/L	2020-05-22	
Cobalt, dissolved	0.00032	0.00010	mg/L	2020-05-22	
Copper, dissolved	0.00157	0.00040	mg/L	2020-05-25	
Iron, dissolved	0.017	0.010	mg/L	2020-05-22	
Lead, dissolved	< 0.00020	0.00020	mg/L	2020-05-22	
Magnesium, dissolved	20.0	0.010	mg/L	2020-05-22	
Manganese, dissolved	0.0934	0.00020	mg/L	2020-05-22	
Mercury, dissolved	0.000026	0.000010	mg/L	2020-05-21	
Molybdenum, dissolved	0.00419	0.00010	mg/L	2020-05-22	
Nickel, dissolved	0.00180	0.00040	mg/L	2020-05-22	
Phosphorus, dissolved	0.781	0.050	mg/L	2020-05-22	
Potassium, dissolved	19.8	0.10	mg/L	2020-05-25	
Selenium, dissolved	< 0.00050	0.00050	mg/L	2020-05-22	
Silicon, dissolved	3.7	1.0	mg/L	2020-05-22	
Silver, dissolved	< 0.000050	0.000050	mg/L	2020-05-22	
Sodium, dissolved	97.9	0.10	mg/L	2020-05-25	
Strontium, dissolved	0.565	0.0010	mg/L	2020-05-22	
Sulfur, dissolved	32.6	3.0	mg/L	2020-05-25	

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
MacKay Reservoir Effluent (ME 12215) - EMS

**WORK ORDER REPORTED** 0051382  
2020-05-25 15:44

Analyte	Result	RL	Units	Analyzed	Qualifier
<b>MacKay Reservoir Effluent to Irr. (CV4) - Reclaimed (E228539) (0051382-01)   Matrix: Fresh Water  </b>					F2, FILT, PRES
<b>Sampled: 2020-05-14 13:15, Continued</b>					
<b>Dissolved Metals, Continued</b>					
Tellurium, dissolved	< 0.00050	0.00050	mg/L	2020-05-22	
Thallium, dissolved	< 0.000020	0.000020	mg/L	2020-05-22	
Thorium, dissolved	< 0.00010	0.00010	mg/L	2020-05-22	
Tin, dissolved	< 0.00020	0.00020	mg/L	2020-05-22	
Titanium, dissolved	< 0.0050	0.0050	mg/L	2020-05-22	
Tungsten, dissolved	< 0.0010	0.0010	mg/L	2020-05-22	
Uranium, dissolved	<b>0.00196</b>	0.000020	mg/L	2020-05-22	
Vanadium, dissolved	<b>0.0010</b>	0.0010	mg/L	2020-05-22	
Zinc, dissolved	<b>0.0327</b>	0.0040	mg/L	2020-05-22	
Zirconium, dissolved	< 0.00010	0.00010	mg/L	2020-05-22	
<b>General Parameters</b>					
Ammonia, Total (as N)	<b>0.699</b>	0.050	mg/L	2020-05-21	
BOD, 5-day	< 6.7	2.0	mg/L	2020-05-21	
Nitrogen, Total Kjeldahl	<b>1.72</b>	0.050	mg/L	2020-05-24	
pH	<b>8.16</b>	0.10	pH units	2020-05-20	HT2
Phosphorus, Total (as P)	<b>0.908</b>	0.0020	mg/L	2020-05-21	
Phosphorus, Total Dissolved	<b>0.840</b>	0.0020	mg/L	2020-05-21	
Solids, Total Suspended	< 2.0	2.0	mg/L	2020-05-22	HT1
<b>Microbiological Parameters</b>					
Coliforms, Total	<b>3.1</b>	1.0	MPN/100 mL	2020-05-15	
Coliforms, Fecal	< 1.0	1.0	MPN/100 mL	2020-05-15	
<b>Total Metals</b>					
Sodium, total	<b>98.7</b>	0.10	mg/L	2020-05-21	

### Sample Qualifiers:

F2	The sample was not field-preserved with HNO3 and was therefore preserved in the laboratory and held for at least 16 hours prior to analysis for total metals.
FILT	The sample has been filtered for TDP in the laboratory. Results may not reflect conditions at the time of sampling.
HT1	The sample was prepared and/or analyzed past the recommended holding time.
HT2	The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.
PRES	Sample has been preserved for TDP in the laboratory and the holding time has been extended.

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
MacKay Reservoir Effluent (ME 12215) - EMS

**WORK ORDER REPORTED** 0061962  
2020-06-25 14:13

Analyte	Result	RL	Units	Analyzed	Qualifier
<b>MacKay Reservoir Effluent to Irr. (CV4) - Reclaimed (E228539) (0061962-01)   Matrix: Fresh Water  </b> <b>Sampled: 2020-06-17 14:30</b>					F2, FILT, PRES
<b>Anions</b>					
Chloride	95.6	0.10	mg/L	2020-06-21	
Fluoride	0.26	0.10	mg/L	2020-06-21	
Nitrate (as N)	0.533	0.010	mg/L	2020-06-21	HT1
Nitrite (as N)	< 0.010	0.010	mg/L	2020-06-21	HT1
Phosphate (as P)	0.632	0.0050	mg/L	2020-06-21	HT1
Sulfate	82.4	1.0	mg/L	2020-06-21	
<b>Calculated Parameters</b>					
Hardness, Total (as CaCO <sub>3</sub> )	220	0.500	mg/L	N/A	
Nitrate+Nitrite (as N)	0.533	0.0100	mg/L	N/A	
Nitrogen, Total	2.23	0.0500	mg/L	N/A	
Nitrogen, Organic	0.878	0.0500	mg/L	N/A	
<b>Dissolved Metals</b>					
Lithium, dissolved	0.00981	0.00010	mg/L	2020-06-25	
Aluminum, dissolved	0.0079	0.0050	mg/L	2020-06-25	
Antimony, dissolved	0.00033	0.00020	mg/L	2020-06-25	
Arsenic, dissolved	0.00157	0.00050	mg/L	2020-06-25	
Barium, dissolved	0.0286	0.0050	mg/L	2020-06-25	
Beryllium, dissolved	< 0.00010	0.00010	mg/L	2020-06-25	
Bismuth, dissolved	< 0.00010	0.00010	mg/L	2020-06-25	
Boron, dissolved	0.166	0.0500	mg/L	2020-06-25	
Cadmium, dissolved	0.000025	0.000010	mg/L	2020-06-25	
Calcium, dissolved	52.5	0.20	mg/L	2020-06-25	
Chromium, dissolved	< 0.00050	0.00050	mg/L	2020-06-25	
Cobalt, dissolved	0.00032	0.00010	mg/L	2020-06-25	
Copper, dissolved	0.0112	0.00040	mg/L	2020-06-25	
Iron, dissolved	0.038	0.010	mg/L	2020-06-25	
Lead, dissolved	< 0.00020	0.00020	mg/L	2020-06-25	
Magnesium, dissolved	21.5	0.010	mg/L	2020-06-25	
Manganese, dissolved	0.188	0.00020	mg/L	2020-06-25	
Mercury, dissolved	< 0.000010	0.000010	mg/L	2020-06-23	
Molybdenum, dissolved	0.00351	0.00010	mg/L	2020-06-25	
Nickel, dissolved	0.00199	0.00040	mg/L	2020-06-25	
Phosphorus, dissolved	1.02	0.050	mg/L	2020-06-25	
Potassium, dissolved	18.5	0.10	mg/L	2020-06-25	
Selenium, dissolved	< 0.00050	0.00050	mg/L	2020-06-25	
Silicon, dissolved	3.2	1.0	mg/L	2020-06-25	
Silver, dissolved	< 0.000050	0.000050	mg/L	2020-06-25	
Sodium, dissolved	94.9	0.10	mg/L	2020-06-25	
Strontium, dissolved	0.556	0.0010	mg/L	2020-06-25	
Sulfur, dissolved	32.0	3.0	mg/L	2020-06-25	
Tellurium, dissolved	< 0.00050	0.00050	mg/L	2020-06-25	

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
MacKay Reservoir Effluent (ME 12215) - EMS

**WORK ORDER REPORTED** 0061962  
2020-06-25 14:13

Analyte	Result	RL	Units	Analyzed	Qualifier
<b>MacKay Reservoir Effluent to Irr. (CV4) - Reclaimed (E228539) (0061962-01)   Matrix: Fresh Water  </b>					F2, FILT, PRES
<b>Sampled: 2020-06-17 14:30, Continued</b>					
<b>Dissolved Metals, Continued</b>					
Thallium, dissolved	< 0.000020	0.000020	mg/L	2020-06-25	
Thorium, dissolved	< 0.00010	0.00010	mg/L	2020-06-25	
Tin, dissolved	< 0.00020	0.00020	mg/L	2020-06-25	
Titanium, dissolved	< 0.0050	0.0050	mg/L	2020-06-25	
Tungsten, dissolved	< 0.0010	0.0010	mg/L	2020-06-25	
Uranium, dissolved	<b>0.00182</b>	0.000020	mg/L	2020-06-25	
Vanadium, dissolved	< 0.0010	0.0010	mg/L	2020-06-25	
Zinc, dissolved	<b>0.0366</b>	0.0040	mg/L	2020-06-25	
Zirconium, dissolved	<b>0.00012</b>	0.00010	mg/L	2020-06-25	
<b>General Parameters</b>					
Ammonia, Total (as N)	<b>0.823</b>	0.050	mg/L	2020-06-23	
BOD, 5-day	< 6.0	2.0	mg/L	2020-06-24	
Nitrogen, Total Kjeldahl	<b>1.70</b>	0.050	mg/L	2020-06-24	
pH	<b>7.66</b>	0.10	pH units	2020-06-22	HT2
Phosphorus, Total (as P)	<b>1.04</b>	0.0020	mg/L	2020-06-22	
Phosphorus, Total Dissolved	<b>1.00</b>	0.0020	mg/L	2020-06-22	
Solids, Total Suspended	< 2.0	2.0	mg/L	2020-06-22	
<b>Microbiological Parameters</b>					
Coliforms, Total	<b>1.0</b>	1.0	MPN/100 mL	2020-06-18	
Coliforms, Fecal	<b>1.0</b>	1.0	MPN/100 mL	2020-06-18	
<b>Total Metals</b>					
Sodium, total	<b>89.1</b>	0.10	mg/L	2020-06-24	

### Sample Qualifiers:

F2	The sample was not field-preserved with HNO3 and was therefore preserved in the laboratory and held for at least 16 hours prior to analysis for total metals.
FILT	The sample has been filtered for DP in the laboratory. Results may not reflect conditions at the time of sampling.
HT1	The sample was prepared and/or analyzed past the recommended holding time.
HT2	The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.
PRES	Sample has been preserved for DP in the laboratory and the holding time has been extended.

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
MacKay Reservoir Effluent (ME 12215) - EMS

**WORK ORDER REPORTED** 0071446  
2020-07-22 16:06

Analyte	Result	RL	Units	Analyzed	Qualifier
<b>MacKay Reservoir Effluent to Irr. (CV4) - Reclaimed (E228539) (0071446-01)   Matrix: Fresh Water  </b>					F2, FILT, PRES
<b>Sampled: 2020-07-14 13:00</b>					
<b>Anions</b>					
Chloride	91.5	0.10	mg/L	2020-07-17	
Fluoride	0.21	0.10	mg/L	2020-07-17	
Nitrate (as N)	0.635	0.010	mg/L	2020-07-17	
Nitrite (as N)	< 0.010	0.010	mg/L	2020-07-17	
Phosphate (as P)	0.702	0.0050	mg/L	2020-07-17	
Sulfate	82.7	1.0	mg/L	2020-07-17	
<b>Calculated Parameters</b>					
Hardness, Total (as CaCO3)	208	0.500	mg/L	N/A	
Nitrate+Nitrite (as N)	0.635	0.0100	mg/L	N/A	
Nitrogen, Total	2.52	0.100	mg/L	N/A	
Nitrogen, Organic	0.935	0.100	mg/L	N/A	
<b>Dissolved Metals</b>					
Lithium, dissolved	0.00804	0.00010	mg/L	2020-07-22	
Aluminum, dissolved	0.0063	0.0050	mg/L	2020-07-22	
Antimony, dissolved	0.00022	0.00020	mg/L	2020-07-22	
Arsenic, dissolved	0.00089	0.00050	mg/L	2020-07-22	
Barium, dissolved	0.0273	0.0050	mg/L	2020-07-22	
Beryllium, dissolved	< 0.00010	0.00010	mg/L	2020-07-22	
Bismuth, dissolved	< 0.00010	0.00010	mg/L	2020-07-22	
Boron, dissolved	0.149	0.0500	mg/L	2020-07-22	
Cadmium, dissolved	0.000024	0.000010	mg/L	2020-07-22	
Calcium, dissolved	51.6	0.20	mg/L	2020-07-22	
Chromium, dissolved	< 0.00050	0.00050	mg/L	2020-07-22	
Cobalt, dissolved	0.00031	0.00010	mg/L	2020-07-22	
Copper, dissolved	0.00328	0.00040	mg/L	2020-07-22	
Iron, dissolved	0.028	0.010	mg/L	2020-07-22	
Lead, dissolved	< 0.00020	0.00020	mg/L	2020-07-22	
Magnesium, dissolved	19.1	0.010	mg/L	2020-07-22	
Manganese, dissolved	0.154	0.00020	mg/L	2020-07-22	
Mercury, dissolved	0.000022	0.000010	mg/L	2020-07-21	
Molybdenum, dissolved	0.00310	0.00010	mg/L	2020-07-22	
Nickel, dissolved	0.00161	0.00040	mg/L	2020-07-22	
Phosphorus, dissolved	1.01	0.050	mg/L	2020-07-22	
Potassium, dissolved	18.7	0.10	mg/L	2020-07-22	
Selenium, dissolved	< 0.00050	0.00050	mg/L	2020-07-22	
Silicon, dissolved	3.4	1.0	mg/L	2020-07-22	
Silver, dissolved	< 0.000050	0.000050	mg/L	2020-07-22	
Sodium, dissolved	82.7	0.10	mg/L	2020-07-22	
Strontium, dissolved	0.520	0.0010	mg/L	2020-07-22	
Sulfur, dissolved	29.8	3.0	mg/L	2020-07-22	
Tellurium, dissolved	< 0.00050	0.00050	mg/L	2020-07-22	

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
MacKay Reservoir Effluent (ME 12215) - EMS

**WORK ORDER REPORTED** 0071446  
2020-07-22 16:06

Analyte	Result	RL	Units	Analyzed	Qualifier
<b>MacKay Reservoir Effluent to Irr. (CV4) - Reclaimed (E228539) (0071446-01)   Matrix: Fresh Water  </b>					F2, FILT, PRES
<b>Sampled: 2020-07-14 13:00, Continued</b>					
<b>Dissolved Metals, Continued</b>					
Thallium, dissolved	< 0.000020	0.000020	mg/L	2020-07-22	
Thorium, dissolved	< 0.00010	0.00010	mg/L	2020-07-22	
Tin, dissolved	< 0.00020	0.00020	mg/L	2020-07-22	
Titanium, dissolved	< 0.0050	0.0050	mg/L	2020-07-22	
Tungsten, dissolved	< 0.0010	0.0010	mg/L	2020-07-22	
Uranium, dissolved	0.00169	0.000020	mg/L	2020-07-22	
Vanadium, dissolved	< 0.0010	0.0010	mg/L	2020-07-22	
Zinc, dissolved	0.0295	0.0040	mg/L	2020-07-22	
Zirconium, dissolved	< 0.00010	0.00010	mg/L	2020-07-22	
<b>General Parameters</b>					
Ammonia, Total (as N)	0.945	0.050	mg/L	2020-07-17	
BOD, 5-day	< 9.4	2.0	mg/L	2020-07-21	
Nitrogen, Total Kjeldahl	1.88	0.050	mg/L	2020-07-20	
pH	8.03	0.10	pH units	2020-07-17	HT2
Phosphorus, Total (as P)	1.09	0.0050	mg/L	2020-07-19	
Phosphorus, Total Dissolved	1.04	0.0050	mg/L	2020-07-19	
Solids, Total Suspended	2.2	2.0	mg/L	2020-07-20	
<b>Microbiological Parameters</b>					
Coliforms, Total	< 1	1	MPN/100 mL	2020-07-15	
Coliforms, Fecal	< 1	1	MPN/100 mL	2020-07-15	
<b>Total Metals</b>					
Sodium, total	91.1	0.10	mg/L	2020-07-21	

### Sample Qualifiers:

F2	The sample was not field-preserved with HNO3 and was therefore preserved in the laboratory and held for at least 16 hours prior to analysis for total metals.
FILT	The sample has been filtered for TDP in the laboratory. Results may not reflect conditions at the time of sampling.
HT2	The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.
PRES	Sample has been preserved for TDP in the laboratory and the holding time has been extended.

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
MacKay Reservoir Effluent (ME 12215) - EMS

**WORK ORDER REPORTED** 0083110  
2020-09-03 12:20

Analyte	Result	RL	Units	Analyzed	Qualifier
---------	--------	----	-------	----------	-----------

**MacKay Reservoir Effluent to Irr. (CV4) - Reclaimed (E228539) (0083110-01) | Matrix: Fresh Water |**  
**Sampled: 2020-08-31 10:15**

**Microbiological Parameters**

Coliforms, Total	< 1	1	MPN/100 mL	2020-09-01	
Coliforms, Fecal	< 1	1	MPN/100 mL	2020-09-01	

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
MacKay Reservoir Effluent (ME 12215) - EMS

**WORK ORDER REPORTED** 0080479  
2020-08-12 16:14

Analyte	Result	RL	Units	Analyzed	Qualifier
<b>MacKay Reservoir Effluent to Irr. (CV4) - Reclaimed (E228539) (0080479-01)   Matrix: Fresh Water  </b>					
<b>Sampled: 2020-08-04 13:30</b>					
<b>Anions</b>					
Chloride	89.8	0.10	mg/L	2020-08-07	
Fluoride	0.20	0.10	mg/L	2020-08-07	
Nitrate (as N)	0.676	0.010	mg/L	2020-08-07	
Nitrite (as N)	0.016	0.010	mg/L	2020-08-07	
Phosphate (as P)	0.681	0.0050	mg/L	2020-08-07	
Sulfate	79.8	1.0	mg/L	2020-08-07	
<b>Calculated Parameters</b>					
Hardness, Total (as CaCO <sub>3</sub> )	204	0.500	mg/L	N/A	
Nitrate+Nitrite (as N)	0.692	0.0100	mg/L	N/A	
Nitrogen, Total	2.74	0.100	mg/L	N/A	
Nitrogen, Organic	1.09	0.100	mg/L	N/A	
<b>Dissolved Metals</b>					
Lithium, dissolved	0.00937	0.00010	mg/L	2020-08-11	
Aluminum, dissolved	0.0072	0.0050	mg/L	2020-08-11	
Antimony, dissolved	0.00027	0.00020	mg/L	2020-08-11	
Arsenic, dissolved	0.00083	0.00050	mg/L	2020-08-11	
Barium, dissolved	0.0283	0.0050	mg/L	2020-08-11	
Beryllium, dissolved	< 0.00010	0.00010	mg/L	2020-08-11	
Bismuth, dissolved	< 0.00010	0.00010	mg/L	2020-08-11	
Boron, dissolved	0.144	0.0500	mg/L	2020-08-11	
Cadmium, dissolved	0.000030	0.000010	mg/L	2020-08-11	
Calcium, dissolved	48.4	0.20	mg/L	2020-08-11	
Chromium, dissolved	< 0.00050	0.00050	mg/L	2020-08-11	
Cobalt, dissolved	0.00029	0.00010	mg/L	2020-08-11	
Copper, dissolved	0.00369	0.00040	mg/L	2020-08-11	
Iron, dissolved	0.020	0.010	mg/L	2020-08-11	
Lead, dissolved	< 0.00020	0.00020	mg/L	2020-08-11	
Magnesium, dissolved	20.1	0.010	mg/L	2020-08-11	
Manganese, dissolved	0.125	0.00020	mg/L	2020-08-11	
Mercury, dissolved	< 0.000010	0.000010	mg/L	2020-08-11	
Molybdenum, dissolved	0.00363	0.00010	mg/L	2020-08-11	
Nickel, dissolved	0.00219	0.00040	mg/L	2020-08-11	
Phosphorus, dissolved	1.08	0.050	mg/L	2020-08-11	
Potassium, dissolved	17.7	0.10	mg/L	2020-08-11	
Selenium, dissolved	< 0.00050	0.00050	mg/L	2020-08-11	
Silicon, dissolved	3.8	1.0	mg/L	2020-08-11	
Silver, dissolved	< 0.000050	0.000050	mg/L	2020-08-11	
Sodium, dissolved	86.9	0.10	mg/L	2020-08-11	
Strontium, dissolved	0.540	0.0010	mg/L	2020-08-11	
Sulfur, dissolved	29.1	3.0	mg/L	2020-08-11	
Tellurium, dissolved	< 0.00050	0.00050	mg/L	2020-08-11	

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
MacKay Reservoir Effluent (ME 12215) - EMS

**WORK ORDER REPORTED** 0091835  
2020-10-01 18:11

Analyte	Result	RL	Units	Analyzed	Qualifier
<b>MacKay Reservoir Effluent to Irr. (CV4) - Reclaimed (E228539) (Duplicate) (0091835-02)   Matrix: Fresh Water   Sampled: 2020-09-16 13:00, Continued</b>					F2, FILT, PRES
<b>General Parameters, Continued</b>					
pH	8.04	0.10	pH units	2020-09-19	HT2
Phosphorus, Total (as P)	1.10	0.0050	mg/L	2020-09-20	
Phosphorus, Total Dissolved	1.06	0.0050	mg/L	2020-09-20	
Solids, Total Suspended	< 2.0	2.0	mg/L	2020-09-23	
<b>Microbiological Parameters</b>					
Coliforms, Total	< 1	1	MPN/100 mL	2020-09-17	
Coliforms, Fecal	< 1	1	MPN/100 mL	2020-09-17	
<b>Total Metals</b>					
Sodium, total	91.7	0.10	mg/L	2020-09-30	

### Sample Qualifiers:

F2	The sample was not field-preserved with HNO3 and was therefore preserved in the laboratory and held for at least 16 hours prior to analysis for total metals.
FILT	The sample has been filtered for TDP in the laboratory. Results may not reflect conditions at the time of sampling.
HT2	The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.
PRES	Sample has been preserved for TDP in the laboratory and the holding time has been extended.

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
MacKay Reservoir Effluent (ME 12215) - EMS

**WORK ORDER REPORTED** 0091835  
2020-10-01 18:11

Analyte	Result	RL	Units	Analyzed	Qualifier
<b>MacKay Reservoir Effluent to Irr. (CV4) - Reclaimed (E228539) (Duplicate) (0091835-02)   Matrix: Fresh Water   Sampled: 2020-09-16 13:00, Continued</b>					F2, FILT, PRES

### *Dissolved Metals, Continued*

Lithium, dissolved	0.00885	0.00010	mg/L	2020-09-23	
Aluminum, dissolved	0.0116	0.0050	mg/L	2020-09-23	
Antimony, dissolved	0.00026	0.00020	mg/L	2020-09-23	
Arsenic, dissolved	0.00084	0.00050	mg/L	2020-09-23	
Barium, dissolved	0.0288	0.0050	mg/L	2020-09-23	
Beryllium, dissolved	< 0.00010	0.00010	mg/L	2020-09-23	
Bismuth, dissolved	< 0.00010	0.00010	mg/L	2020-09-23	
Boron, dissolved	0.145	0.0500	mg/L	2020-09-23	
Cadmium, dissolved	0.000021	0.000010	mg/L	2020-09-23	
Calcium, dissolved	50.5	0.20	mg/L	2020-09-23	
Chromium, dissolved	< 0.00050	0.00050	mg/L	2020-09-23	
Cobalt, dissolved	0.00033	0.00010	mg/L	2020-09-23	
Copper, dissolved	0.00392	0.00040	mg/L	2020-09-23	
Iron, dissolved	0.034	0.010	mg/L	2020-09-23	
Lead, dissolved	0.00022	0.00020	mg/L	2020-09-23	
Magnesium, dissolved	20.3	0.010	mg/L	2020-09-23	
Manganese, dissolved	0.172	0.00020	mg/L	2020-09-23	
Mercury, dissolved	0.000011	0.000010	mg/L	2020-09-22	
Molybdenum, dissolved	0.00386	0.00010	mg/L	2020-09-23	
Nickel, dissolved	0.00187	0.00040	mg/L	2020-09-23	
Phosphorus, dissolved	1.12	0.050	mg/L	2020-09-23	
Potassium, dissolved	17.9	0.10	mg/L	2020-09-23	
Selenium, dissolved	< 0.00050	0.00050	mg/L	2020-09-23	
Silicon, dissolved	3.7	1.0	mg/L	2020-09-23	
Silver, dissolved	< 0.000050	0.000050	mg/L	2020-09-23	
Sodium, dissolved	88.6	0.10	mg/L	2020-09-23	
Strontium, dissolved	0.507	0.0010	mg/L	2020-09-23	
Sulfur, dissolved	29.9	3.0	mg/L	2020-09-23	
Tellurium, dissolved	< 0.00050	0.00050	mg/L	2020-09-23	
Thallium, dissolved	< 0.000020	0.000020	mg/L	2020-09-23	
Thorium, dissolved	< 0.00010	0.00010	mg/L	2020-09-23	
Tin, dissolved	< 0.00020	0.00020	mg/L	2020-09-23	
Titanium, dissolved	< 0.0050	0.0050	mg/L	2020-09-23	
Tungsten, dissolved	< 0.0010	0.0010	mg/L	2020-09-23	
Uranium, dissolved	0.00159	0.000020	mg/L	2020-09-23	
Vanadium, dissolved	< 0.0010	0.0010	mg/L	2020-09-23	
Zinc, dissolved	0.0322	0.0040	mg/L	2020-09-23	
Zirconium, dissolved	0.00011	0.00010	mg/L	2020-09-23	

### *General Parameters*

Ammonia, Total (as N)	1.08	0.050	mg/L	2020-09-18	
BOD, 5-day	< 6.0	2.0	mg/L	2020-09-23	
Nitrogen, Total Kjeldahl	2.14	0.050	mg/L	2020-09-22	

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
MacKay Reservoir Effluent (ME 12215) - EMS

**WORK ORDER REPORTED** 0091835  
2020-10-01 18:11

Analyte	Result	RL	Units	Analyzed	Qualifier
<b>MacKay Reservoir Effluent to Irr. (CV4) - Reclaimed (E228539) (0091835-01)   Matrix: Fresh Water  </b>					<b>F2, FILT, PRES</b>
<b>Sampled: 2020-09-16 13:00</b>					
<b>Anions</b>					
Chloride	87.5	0.10	mg/L	2020-09-18	
Fluoride	0.24	0.10	mg/L	2020-09-18	
Nitrate (as N)	0.240	0.010	mg/L	2020-09-18	
Nitrite (as N)	0.128	0.010	mg/L	2020-09-18	
Phosphate (as P)	0.745	0.0050	mg/L	2020-09-18	
Sulfate	79.1	1.0	mg/L	2020-09-18	
<b>Calculated Parameters</b>					
Hardness, Total (as CaCO <sub>3</sub> )	211	0.500	mg/L	N/A	
Nitrate+Nitrite (as N)	0.368	0.0100	mg/L	N/A	
Nitrogen, Total	2.42	0.0500	mg/L	N/A	
Nitrogen, Organic	0.967	0.0500	mg/L	N/A	
<b>Dissolved Metals</b>					
Lithium, dissolved	0.00914	0.00010	mg/L	2020-09-23	
Aluminum, dissolved	0.0145	0.0050	mg/L	2020-09-23	
Antimony, dissolved	0.00024	0.00020	mg/L	2020-09-23	
Arsenic, dissolved	0.00097	0.00050	mg/L	2020-09-23	
Barium, dissolved	0.0299	0.0050	mg/L	2020-09-23	
Beryllium, dissolved	< 0.00010	0.00010	mg/L	2020-09-23	
Bismuth, dissolved	0.00011	0.00010	mg/L	2020-09-23	
Boron, dissolved	0.148	0.0500	mg/L	2020-09-23	
Cadmium, dissolved	0.000035	0.000010	mg/L	2020-09-23	
Calcium, dissolved	51.0	0.20	mg/L	2020-09-23	
Chromium, dissolved	< 0.00050	0.00050	mg/L	2020-09-23	
Cobalt, dissolved	0.00032	0.00010	mg/L	2020-09-23	
Copper, dissolved	0.00461	0.00040	mg/L	2020-09-23	
Iron, dissolved	0.041	0.010	mg/L	2020-09-23	
Lead, dissolved	0.00042	0.00020	mg/L	2020-09-23	
Magnesium, dissolved	20.2	0.010	mg/L	2020-09-23	
Manganese, dissolved	0.169	0.00020	mg/L	2020-09-23	
Mercury, dissolved	< 0.000010	0.000010	mg/L	2020-09-22	
Molybdenum, dissolved	0.00386	0.00010	mg/L	2020-09-23	
Nickel, dissolved	0.00203	0.00040	mg/L	2020-09-23	
Phosphorus, dissolved	1.08	0.050	mg/L	2020-09-23	
Potassium, dissolved	18.0	0.10	mg/L	2020-09-23	
→ Selenium, dissolved	< 0.00050	0.00050	mg/L	2020-09-23	
Silicon, dissolved	3.8	1.0	mg/L	2020-09-23	
Silver, dissolved	< 0.000050	0.000050	mg/L	2020-09-23	
Sodium, dissolved	87.2	0.10	mg/L	2020-09-23	
Strontium, dissolved	0.521	0.0010	mg/L	2020-09-23	
Sulfur, dissolved	29.9	3.0	mg/L	2020-09-23	
Tellurium, dissolved	< 0.00050	0.00050	mg/L	2020-09-23	

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
MacKay Reservoir Effluent (ME 12215) - EMS

**WORK ORDER REPORTED** 0091835  
2020-10-01 18:11

Analyte	Result	RL	Units	Analyzed	Qualifier
<b>MacKay Reservoir Effluent to Irr. (CV4) - Reclaimed (E228539) (0091835-01)   Matrix: Fresh Water  </b>					F2, FILT, PRES
<b>Sampled: 2020-09-16 13:00, Continued</b>					
<b>Dissolved Metals, Continued</b>					
Thallium, dissolved	< 0.000020	0.000020	mg/L	2020-09-23	
Thorium, dissolved	< 0.00010	0.00010	mg/L	2020-09-23	
Tin, dissolved	< 0.00020	0.00020	mg/L	2020-09-23	
Titanium, dissolved	< 0.0050	0.0050	mg/L	2020-09-23	
Tungsten, dissolved	< 0.0010	0.0010	mg/L	2020-09-23	
Uranium, dissolved	0.00161	0.000020	mg/L	2020-09-23	
Vanadium, dissolved	0.0029	0.0010	mg/L	2020-09-23	
Zinc, dissolved	0.0372	0.0040	mg/L	2020-09-23	
Zirconium, dissolved	0.00014	0.00010	mg/L	2020-09-23	
<b>General Parameters</b>					
Ammonia, Total (as N)	1.09	0.050	mg/L	2020-09-18	
BOD, 5-day	< 6.0	2.0	mg/L	2020-09-23	
Nitrogen, Total Kjeldahl	2.05	0.050	mg/L	2020-09-22	
pH	8.03	0.10	pH units	2020-09-19	HT2
Phosphorus, Total (as P)	1.13	0.0050	mg/L	2020-09-20	
Phosphorus, Total Dissolved	1.09	0.0050	mg/L	2020-09-20	
Solids, Total Suspended	< 2.0	2.0	mg/L	2020-09-23	
<b>Microbiological Parameters</b>					
Coliforms, Total	< 1	1	MPN/100 mL	2020-09-17	
Coliforms, Fecal	< 1	1	MPN/100 mL	2020-09-17	
<b>Total Metals</b>					
Sodium, total	90.9	0.10	mg/L	2020-09-30	
<b>MacKay Reservoir Effluent to Irr. (CV4) - Reclaimed (E228539) (Duplicate) (0091835-02)   Matrix: Fresh Water  </b>					F2, FILT, PRES
<b>Sampled: 2020-09-16 13:00</b>					
<b>Anions</b>					
Chloride	84.2	0.10	mg/L	2020-09-18	
Fluoride	0.25	0.10	mg/L	2020-09-18	
Nitrate (as N)	0.236	0.010	mg/L	2020-09-18	
Nitrite (as N)	0.129	0.010	mg/L	2020-09-18	
Phosphate (as P)	0.749	0.0050	mg/L	2020-09-18	
Sulfate	76.3	1.0	mg/L	2020-09-18	
<b>Calculated Parameters</b>					
Hardness, Total (as CaCO3)	210	0.500	mg/L	N/A	
Nitrate+Nitrite (as N)	0.365	0.0100	mg/L	N/A	
Nitrogen, Total	2.50	0.0500	mg/L	N/A	
Nitrogen, Organic	1.06	0.0500	mg/L	N/A	
<b>Dissolved Metals</b>					

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
MacKay Reservoir Effluent (ME 12215) - EMS

**WORK ORDER REPORTED** 0109268  
2020-10-09 16:28

Analyte	Result	RL	Units	Analyzed	Qualifier
<b>MacKay Reservoir Effluent to Irr. (CV4) - Reclaimed (E228539) (0109268-01)   Matrix: Fresh Water  </b>					FILT,
<b>Sampled: 2020-10-01 09:00, Continued</b>					PRES
<b>Dissolved Metals, Continued</b>					
Thallium, dissolved	< 0.000020	0.000020	mg/L	2020-10-07	
Thorium, dissolved	< 0.00010	0.00010	mg/L	2020-10-07	
Tin, dissolved	< 0.00020	0.00020	mg/L	2020-10-07	
Titanium, dissolved	< 0.0050	0.0050	mg/L	2020-10-07	
Tungsten, dissolved	< 0.0010	0.0010	mg/L	2020-10-07	
Uranium, dissolved	<b>0.00167</b>	0.000020	mg/L	2020-10-07	
Vanadium, dissolved	< 0.0010	0.0010	mg/L	2020-10-07	
Zinc, dissolved	<b>0.0323</b>	0.0040	mg/L	2020-10-07	
Zirconium, dissolved	<b>0.00012</b>	0.00010	mg/L	2020-10-07	
<b>General Parameters</b>					
Ammonia, Total (as N)	<b>1.10</b>	0.050	mg/L	2020-10-06	
BOD, 5-day	< 7.0	2.0	mg/L	2020-10-07	
Nitrogen, Total Kjeldahl	<b>2.01</b>	0.050	mg/L	2020-10-06	
pH	<b>7.95</b>	0.10	pH units	2020-10-06	HT2
Phosphorus, Total (as P)	<b>1.13</b>	0.0050	mg/L	2020-10-07	
Phosphorus, Total Dissolved	<b>1.10</b>	0.0050	mg/L	2020-10-07	
Solids, Total Suspended	< 2.0	2.0	mg/L	2020-10-06	
<b>Microbiological Parameters</b>					
Coliforms, Total	< 1	1	MPN/100 mL	2020-10-02	
Coliforms, Fecal	< 1	1	MPN/100 mL	2020-10-02	
<b>Total Metals</b>					
Sodium, total	<b>94.8</b>	0.10	mg/L	2020-10-09	

### Sample Qualifiers:

FILT The sample has been filtered for DP in the laboratory. Results may not reflect conditions at the time of sampling.

HT2 The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.

PRES Sample has been preserved for Diss Met, DP in the laboratory and the holding time has been extended.

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
MacKay Reservoir Effluent (ME 12215) - EMS

**WORK ORDER REPORTED** 0109268  
2020-10-09 16:28

Analyte	Result	RL	Units	Analyzed	Qualifier
<b>MacKay Reservoir Effluent to Irr. (CV4) - Reclaimed (E228539) (0109268-01)   Matrix: Fresh Water  </b>					FILT, PRES
<b>Sampled: 2020-10-01 09:00</b>					
<b>Anions</b>					
Chloride	90.6	0.10	mg/L	2020-10-03	
Fluoride	0.25	0.10	mg/L	2020-10-03	
Nitrate (as N)	0.231	0.010	mg/L	2020-10-03	
Nitrite (as N)	0.133	0.010	mg/L	2020-10-03	
Phosphate (as P)	0.682	0.0050	mg/L	2020-10-03	
Sulfate	80.5	1.0	mg/L	2020-10-03	
<b>Calculated Parameters</b>					
Hardness, Total (as CaCO <sub>3</sub> )	225	0.500	mg/L	N/A	
Nitrate+Nitrite (as N)	0.364	0.0100	mg/L	N/A	
Nitrogen, Total	2.37	0.0500	mg/L	N/A	
Nitrogen, Organic	0.911	0.0500	mg/L	N/A	
<b>Dissolved Metals</b>					
Lithium, dissolved	0.00941	0.00010	mg/L	2020-10-07	
Aluminum, dissolved	0.0105	0.0050	mg/L	2020-10-07	
Antimony, dissolved	0.00024	0.00020	mg/L	2020-10-07	
Arsenic, dissolved	0.00088	0.00050	mg/L	2020-10-07	
Barium, dissolved	0.0331	0.0050	mg/L	2020-10-07	
Beryllium, dissolved	< 0.00010	0.00010	mg/L	2020-10-07	
Bismuth, dissolved	< 0.00010	0.00010	mg/L	2020-10-07	
Boron, dissolved	0.174	0.0500	mg/L	2020-10-07	
Cadmium, dissolved	< 0.000010	0.000010	mg/L	2020-10-07	
Calcium, dissolved	52.9	0.20	mg/L	2020-10-07	
Chromium, dissolved	< 0.00050	0.00050	mg/L	2020-10-07	
Cobalt, dissolved	0.00034	0.00010	mg/L	2020-10-07	
Copper, dissolved	0.00467	0.00040	mg/L	2020-10-07	
Iron, dissolved	0.027	0.010	mg/L	2020-10-07	
Lead, dissolved	< 0.00020	0.00020	mg/L	2020-10-07	
Magnesium, dissolved	22.5	0.010	mg/L	2020-10-07	
Manganese, dissolved	0.224	0.00020	mg/L	2020-10-07	
Mercury, dissolved	< 0.000010	0.000010	mg/L	2020-10-04	
Molybdenum, dissolved	0.00331	0.00010	mg/L	2020-10-07	
Nickel, dissolved	0.00220	0.00040	mg/L	2020-10-07	
Phosphorus, dissolved	1.18	0.050	mg/L	2020-10-07	
Potassium, dissolved	19.3	0.10	mg/L	2020-10-07	
Selenium, dissolved	< 0.00050	0.00050	mg/L	2020-10-07	
Silicon, dissolved	4.2	1.0	mg/L	2020-10-07	
Silver, dissolved	< 0.000050	0.000050	mg/L	2020-10-07	
Sodium, dissolved	93.1	0.10	mg/L	2020-10-07	
Strontium, dissolved	0.562	0.0010	mg/L	2020-10-07	
Sulfur, dissolved	30.8	3.0	mg/L	2020-10-07	
Tellurium, dissolved	< 0.00050	0.00050	mg/L	2020-10-07	

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0051287  
2020-05-26 11:29

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
<b>VWRC Final Treated Effluent - 24hr Comp. - E228121 (0051287-01)   Matrix: Fresh Water   Sampled: 2020-05-13 00:00 To 2020-05-14 00:00</b>						FILT, PRES
<b>Anions</b>						
Chloride	81.5	± 4.5	0.10	mg/L	2020-05-16	
Nitrate (as N)	2.99	± 0.19	0.010	mg/L	2020-05-16	
Nitrite (as N)	0.396	± 0.041	0.010	mg/L	2020-05-16	
Phosphate (as P)	0.0200	± 0.0042	0.0050	mg/L	2020-05-16	
<b>Calculated Parameters</b>						
Nitrate+Nitrite (as N)	3.38		0.0100	mg/L	N/A	
Nitrogen, Total	4.98		0.100	mg/L	N/A	
Nitrogen, Organic	1.52		0.100	mg/L	N/A	
<b>General Parameters</b>						
Alkalinity, Total (as CaCO <sub>3</sub> )	118	± 7	1.0	mg/L	2020-05-19	
Alkalinity, Phenolphthalein (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-05-19	
Alkalinity, Bicarbonate (as CaCO <sub>3</sub> )	118		1.0	mg/L	2020-05-19	
Alkalinity, Carbonate (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-05-19	
Alkalinity, Hydroxide (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-05-19	
Ammonia, Total (as N)	0.070	± 0.021	0.050	mg/L	2020-05-20	
BOD, 5-day	7.9	± 1.9	2.0	mg/L	2020-05-20	
BOD, 5-day Carbonaceous	7.3	± 1.7	2.0	mg/L	2020-05-21	
Conductivity (EC)	619	± 15	2.0	µS/cm	2020-05-19	
Nitrogen, Total Kjeldahl	1.59	± 0.22	0.050	mg/L	2020-05-22	
pH	7.64	± 0.02	0.10	pH units	2020-05-19	HT2
Phosphorus, Total (as P)	0.194	± 0.022	0.0020	mg/L	2020-05-20	
Phosphorus, Total Dissolved	0.0877	± 0.0104	0.0020	mg/L	2020-05-20	
Solids, Total Suspended	4.0	± 1.6	2.0	mg/L	2020-05-20	
<b>Total Metals</b>						
Sodium, total	65.8	± 12.0	0.10	mg/L	2020-05-21	



## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0051287  
2020-05-26 11:29

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
VWRC Treated Effluent (FTE) Grab - E228121 (0051287-02)   Matrix: Fresh Water   Sampled: 2020-05-14 09:15						
<b>Microbiological Parameters</b>						
Coliforms, Total	22.6		1.0	MPN/100 mL	2020-05-14	
Coliforms, Fecal	1.0		1.0	MPN/100 mL	2020-05-14	

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0061964  
2020-06-26 11:45

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
<b>VWRC Final Treated Effluent - 24hr Comp. - E228121 (0061964-03)   Matrix: Fresh Water   Sampled: 2020-06-17 00:00 To 2020-06-18 00:00</b>						FILT, PRES
<b>Anions</b>						
Chloride	75.9	± 4.2	0.10	mg/L	2020-06-21	
Nitrate (as N)	3.00	± 0.19	0.010	mg/L	2020-06-21	
Nitrite (as N)	0.105	± 0.011	0.010	mg/L	2020-06-21	
Phosphate (as P)	0.0069	± 0.0027	0.0050	mg/L	2020-06-21	
<b>Calculated Parameters</b>						
Nitrate+Nitrite (as N)	3.10		0.0100	mg/L	N/A	
Nitrogen, Total	4.83		0.0500	mg/L	N/A	
Nitrogen, Organic	1.51		0.0500	mg/L	N/A	
<b>General Parameters</b>						
Alkalinity, Total (as CaCO <sub>3</sub> )	185	± 10	1.0	mg/L	2020-06-23	
Alkalinity, Phenolphthalein (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-06-23	
Alkalinity, Bicarbonate (as CaCO <sub>3</sub> )	185		1.0	mg/L	2020-06-23	
Alkalinity, Carbonate (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-06-23	
Alkalinity, Hydroxide (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-06-23	
Ammonia, Total (as N)	0.221	± 0.028	0.050	mg/L	2020-06-23	
BOD, 5-day	3.0	± 1.2	2.0	mg/L	2020-06-24	
BOD, 5-day Carbonaceous	4.6	± 1.4	2.0	mg/L	2020-06-24	
Conductivity (EC)	808	± 20	2.0	µS/cm	2020-06-23	
Nitrogen, Total Kjeldahl	1.73	± 0.22	0.050	mg/L	2020-06-24	
pH	8.03	± 0.02	0.10	pH units	2020-06-23	HT2
Phosphorus, Total (as P)	0.144	± 0.016	0.0020	mg/L	2020-06-23	
Phosphorus, Total Dissolved	0.0578	± 0.0069	0.0020	mg/L	2020-06-23	
Solids, Total Suspended	2.6	± 0.9	2.0	mg/L	2020-06-22	
<b>Total Metals</b>						
Sodium, total	73.6	± 13.4	0.10	mg/L	2020-06-24	



## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0061964  
2020-06-26 11:45

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
<b>VWRC Treated Effluent (FTE) Grab - E228121 (1) (0061964-04)   Matrix: Fresh Water   Sampled: 2020-06-17 13:30</b>						
<b>Microbiological Parameters</b>						
Coliforms, Total	1.0		1.0	MPN/100 mL	2020-06-18	
Coliforms, Fecal	< 1.0		1.0	MPN/100 mL	2020-06-18	

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0070864  
2020-07-16 13:19

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
<b>VWRC Final Treated Effluent - 24hr Comp. - E228121 (0070864-02)   Matrix: Fresh Water   Sampled: 2020-07-08 00:00 To 2020-07-09 00:00</b>						FILT, PRES
<b>Anions</b>						
Chloride	75.3	± 4.2	0.10	mg/L	2020-07-12	
Nitrate (as N)	3.05	± 0.19	0.010	mg/L	2020-07-12	
Nitrite (as N)	0.111	± 0.012	0.010	mg/L	2020-07-12	
Phosphate (as P)	< 0.0050		0.0050	mg/L	2020-07-12	
<b>Calculated Parameters</b>						
Nitrate+Nitrite (as N)	3.16		0.0100	mg/L	N/A	
Nitrogen, Total	4.54		0.0500	mg/L	N/A	
Nitrogen, Organic	1.37		0.0500	mg/L	N/A	
<b>General Parameters</b>						
Alkalinity, Total (as CaCO <sub>3</sub> )	205	± 11	1.0	mg/L	2020-07-11	
Alkalinity, Phenolphthalein (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-07-11	
Alkalinity, Bicarbonate (as CaCO <sub>3</sub> )	205		1.0	mg/L	2020-07-11	
Alkalinity, Carbonate (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-07-11	
Alkalinity, Hydroxide (as CaCO <sub>3</sub> )	< 1.0		1.0	mg/L	2020-07-11	
Ammonia, Total (as N)	< 0.050		0.050	mg/L	2020-07-13	
BOD, 5-day	2.6	± 1.3	2.0	mg/L	2020-07-15	
BOD, 5-day Carbonaceous	2.5	± 1.4	2.0	mg/L	2020-07-15	
Conductivity (EC)	829	± 20	2.0	µS/cm	2020-07-11	
Nitrogen, Total Kjeldahl	1.37	± 0.17	0.050	mg/L	2020-07-16	
pH	8.03	± 0.02	0.10	pH units	2020-07-11	HT2
Phosphorus, Total (as P)	0.107	± 0.012	0.0020	mg/L	2020-07-14	
Phosphorus, Total Dissolved	0.0763	± 0.0091	0.0020	mg/L	2020-07-14	
Solids, Total Suspended	2.4	± 0.9	2.0	mg/L	2020-07-15	
<b>Total Metals</b>						
Sodium, total	87.1	± 15.9	0.10	mg/L	2020-07-15	



## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO#** 0070864  
**REPORTED** 2020-07-16 13:19

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
<b>VWRC Treated Effluent (FTE) Grab - E228121 (0070864-03)   Matrix: Fresh Water   Sampled: 2020-07-09 08:30</b>						
<b>Microbiological Parameters</b>						
Coliforms, Total	2		1	MPN/100 mL	2020-07-10	
Coliforms, Fecal	< 1		1	MPN/100 mL	2020-07-10	

### Sample Qualifiers:

FILT The sample has been filtered for DP in the laboratory. Results may not reflect conditions at the time of sampling.

HT1 The sample was prepared and/or analyzed past the recommended holding time.

HT2 The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.

PRES Sample has been preserved for DP in the laboratory and the holding time has been extended.

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0080496  
2020-08-12 13:06

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
<b>VRWC Treated Effluent to Direct Irrigation FFE E229578 (0080496-01)   Matrix: Water   Sampled: 2020-08-04 14:30</b>						
<b>General Parameters</b>						
BOD, 5-day	1.1	± 1.1	2.0	mg/L	2020-08-12	
pH	7.00	± 0.02	0.10	pH units	2020-08-05	ST2, EST, HT
Solids, Total Suspended	< 2.0		2.0	mg/L	2020-08-09	
Turbidity	0.58	± 0.07	0.10	NTU	2020-08-07	

### Sample Qualifiers:

CST2 analyzed with a pH strip due to low sample volume remaining  
 EST This is an estimated value.  
 HT2 The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.



## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0083109  
2020-09-03 12:33

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
<b>VRWC Treated Effluent to Direct Irrigation FFE E229578 (0083109-01)   Matrix: Water   Sampled: 2020-08-31 09:00</b>						
<i>Microbiological Parameters</i>						
Coliforms, Total	< 1		1	MPN/100 mL	2020-09-01	
Coliforms, Fecal	< 1		1	MPN/100 mL	2020-09-01	

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Final Treated Effluent (ME12215) - EMS

**CARO WO# REPORTED** 0092647  
2020-09-30 12:33

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
<b>VRWC Treated Effluent to Direct Irrigation FFE E229578 (0092647-01)   Matrix: Water   Sampled: 2020-09-24 08:00</b>						
<b>General Parameters</b>						
BOD, 5-day	4.0	± 1.3	2.0	mg/L	2020-09-30	
pH	7.66	± 0.02	0.10	pH units	2020-09-29	HT2
Solids, Total Suspended	2.0	± 0.9	2.0	mg/L	2020-09-28	
Turbidity	0.88	± 0.07	0.10	NTU	2020-09-25	
<b>Microbiological Parameters</b>						
Coliforms, Total	16		1	MPN/100 mL	2020-09-25	
Coliforms, Fecal	< 1		1	MPN/100 mL	2020-09-25	

### Sample Qualifiers:

HT2 The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.

## Appendix K

### *Bailey Springs Water Quality Results*

*Caro Analytical Services*

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Bailey Springs (ME12215) - EMS

**WORK ORDER REPORTED** 0011352  
2020-01-29 16:25

Analyte	Result	RL	Units	Analyzed	Qualifier
<b>Bailey Springs (0500578) (0011352-01)   Matrix: Fresh Water   Sampled: 2020-01-21 13:00</b>					FILT, PRES
<b>Anions</b>					
Chloride	148	0.10	mg/L	2020-01-24	
Nitrate (as N)	0.313	0.010	mg/L	2020-01-24	
Nitrite (as N)	< 0.010	0.010	mg/L	2020-01-24	
Phosphate (as P)	0.0646	0.0050	mg/L	2020-01-24	
Sulfate	109	1.0	mg/L	2020-01-24	
<b>Calculated Parameters</b>					
Nitrate+Nitrite (as N)	0.313	0.0100	mg/L	N/A	
Nitrogen, Total	0.859	0.0500	mg/L	N/A	
Nitrogen, Organic	0.517	0.0500	mg/L	N/A	
<b>General Parameters</b>					
Ammonia, Total (as N)	0.029	0.020	mg/L	2020-01-23	
Conductivity (EC)	1260	2.0	µS/cm	2020-01-23	
Nitrogen, Total Kjeldahl	0.546	0.050	mg/L	2020-01-23	
pH	8.36	0.10	pH units	2020-01-23	HT2
Phosphorus, Total (as P)	0.130	0.0020	mg/L	2020-01-23	
Phosphorus, Total Dissolved	0.123	0.0020	mg/L	2020-01-23	
<b>Microbiological Parameters</b>					
Coliforms, Total	285	1.0	MPN/100 mL	2020-01-22	
Coliforms, Fecal	1.0	1.0	MPN/100 mL	2020-01-22	
<b>Total Metals</b>					
Sodium, total	125	0.10	mg/L	2020-01-29	

### Sample Qualifiers:

FILT The sample has been filtered for TDP in the laboratory. Results may not reflect conditions at the time of sampling.

HT2 The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.

PRES Sample has been preserved for TDP in the laboratory and the holding time has been extended.

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Bailey Springs (ME12215) - EMS

**WORK ORDER REPORTED** 0021196  
2020-02-24 10:28

Analyte	Result	RL	Units	Analyzed	Qualifier
<b>Bailey Springs (0500578) (0021196-01)   Matrix: Surface Water   Sampled: 2020-02-14 13:30</b>					FILT, PRES
<b>Anions</b>					
Chloride	152	0.10	mg/L	2020-02-15	
Nitrate (as N)	1.08	0.010	mg/L	2020-02-15	
Nitrite (as N)	< 0.010	0.010	mg/L	2020-02-15	
Phosphate (as P)	0.0900	0.0050	mg/L	2020-02-15	
Sulfate	108	1.0	mg/L	2020-02-15	
<b>Calculated Parameters</b>					
Nitrate+Nitrite (as N)	1.08	0.0100	mg/L	N/A	
Nitrogen, Total	1.70	0.0500	mg/L	N/A	
Nitrogen, Organic	0.620	0.0500	mg/L	N/A	
<b>General Parameters</b>					
Ammonia, Total (as N)	< 0.020	0.020	mg/L	2020-02-19	
Conductivity (EC)	1280	2.0	µS/cm	2020-02-15	
Nitrogen, Total Kjeldahl	0.620	0.050	mg/L	2020-02-19	
pH	8.31	0.10	pH units	2020-02-15	HT2
Phosphorus, Total (as P)	0.146	0.0020	mg/L	2020-02-19	
Phosphorus, Total Dissolved	0.135	0.0020	mg/L	2020-02-19	
<b>Microbiological Parameters</b>					
Coliforms, Total	278	1.0	MPN/100 mL	2020-02-14	
Coliforms, Fecal	4.1	1.0	MPN/100 mL	2020-02-14	
<b>Total Metals</b>					
Sodium, total	123	0.10	mg/L	2020-02-23	

### Sample Qualifiers:

FILT The sample has been filtered for DP in the laboratory. Results may not reflect conditions at the time of sampling.  
HT2 The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.  
PRES Sample has been preserved for DP in the laboratory and the holding time has been extended.



## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Bailey Springs (ME12215) - EMS

**WORK ORDER REPORTED** 0031099  
2020-03-19 12:06

Analyte	Result	RL	Units	Analyzed	Qualifier
Bailey Springs (0500578) (0031099-01)   Matrix: Fresh Water   Sampled: 2020-03-11 14:00					FILT, PRES
<b>Anions</b>					
Chloride	132	0.10	mg/L	2020-03-12	
Nitrate (as N)	1.18	0.010	mg/L	2020-03-12	
Nitrite (as N)	< 0.010	0.010	mg/L	2020-03-12	
Phosphate (as P)	0.0625	0.0050	mg/L	2020-03-12	
Sulfate	101	1.0	mg/L	2020-03-12	
<b>Calculated Parameters</b>					
Nitrate+Nitrite (as N)	1.18	0.0100	mg/L	N/A	
Nitrogen, Total	1.77	0.0500	mg/L	N/A	
Nitrogen, Organic	0.592	0.0500	mg/L	N/A	
<b>General Parameters</b>					
Ammonia, Total (as N)	< 0.020	0.020	mg/L	2020-03-13	
Conductivity (EC)	1220	2.0	µS/cm	2020-03-14	
Nitrogen, Total Kjeldahl	0.592	0.050	mg/L	2020-03-14	
pH	8.33	0.10	pH units	2020-03-14	HT2
Phosphorus, Total (as P)	0.135	0.0020	mg/L	2020-03-16	
Phosphorus, Total Dissolved	0.113	0.0020	mg/L	2020-03-16	
<b>Microbiological Parameters</b>					
Coliforms, Total	287	1.0	MPN/100 mL	2020-03-12	
Coliforms, Fecal	287	1.0	MPN/100 mL	2020-03-12	
<b>Total Metals</b>					
Sodium, total	117	0.10	mg/L	2020-03-19	

### Sample Qualifiers:

FILT The sample has been filtered for DP in the laboratory. Results may not reflect conditions at the time of sampling.  
 HT2 The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.  
 PRES Sample has been preserved for DP in the laboratory and the holding time has been extended.

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Bailey Springs (ME12215) - EMS

**WORK ORDER REPORTED** 0041342  
2020-04-24 11:52

Analyte	Result	RL	Units	Analyzed	Qualifier
<b>Bailey Springs (0500578) (0041342-01)   Matrix: Fresh Water   Sampled: 2020-04-16 14:00</b>					FILT, PRES
<b>Anions</b>					
Chloride	107	0.10	mg/L	2020-04-19	
Nitrate (as N)	0.542	0.010	mg/L	2020-04-19	
Nitrite (as N)	< 0.010	0.010	mg/L	2020-04-19	
Phosphate (as P)	0.0452	0.0050	mg/L	2020-04-19	
Sulfate	85.9	1.0	mg/L	2020-04-19	
<b>Calculated Parameters</b>					
Nitrate+Nitrite (as N)	0.542	0.0100	mg/L	N/A	
Nitrogen, Total	1.11	0.0500	mg/L	N/A	
Nitrogen, Organic	0.564	0.0500	mg/L	N/A	
<b>General Parameters</b>					
Ammonia, Total (as N)	< 0.050	0.050	mg/L	2020-04-21	
Conductivity (EC)	1060	2.0	µS/cm	2020-04-22	
Nitrogen, Total Kjeldahl	0.564	0.050	mg/L	2020-04-22	
pH	8.39	0.10	pH units	2020-04-22	HT2
Phosphorus, Total (as P)	0.124	0.0020	mg/L	2020-04-23	
Phosphorus, Total Dissolved	0.107	0.0020	mg/L	2020-04-23	
<b>Microbiological Parameters</b>					
Coliforms, Total	387	1.0	MPN/100 mL	2020-04-17	
Coliforms, Fecal	1.0	1.0	MPN/100 mL	2020-04-17	
<b>Total Metals</b>					
Sodium, total	110	0.10	mg/L	2020-04-24	

### Sample Qualifiers:

FILT The sample has been filtered for TDP in the laboratory. Results may not reflect conditions at the time of sampling

HT2 The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.

PRES Sample has been preserved for TDP in the laboratory and the holding time has been extended.

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Bailey Springs (ME12215) - EMS

**WORK ORDER REPORTED** 0051381  
2020-05-25 14:25

Analyte	Result	RL	Units	Analyzed	Qualifier
<b>Bailey Springs (0500578) (0051381-01)   Matrix: Fresh Water   Sampled: 2020-05-14 13:30</b>					FILT, PRES
<b>Anions</b>					
Chloride	110	0.10	mg/L	2020-05-16	
Nitrate (as N)	0.346	0.010	mg/L	2020-05-16	
Nitrite (as N)	< 0.010	0.010	mg/L	2020-05-16	
Phosphate (as P)	0.0535	0.0050	mg/L	2020-05-16	
Sulfate	83.5	1.0	mg/L	2020-05-16	
<b>Calculated Parameters</b>					
Nitrate+Nitrite (as N)	0.346	0.0100	mg/L	N/A	
Nitrogen, Total	1.04	0.0500	mg/L	N/A	
Nitrogen, Organic	0.691	0.0500	mg/L	N/A	
<b>General Parameters</b>					
Ammonia, Total (as N)	< 0.050	0.050	mg/L	2020-05-22	
Conductivity (EC)	1060	2.0	µS/cm	2020-05-20	
Nitrogen, Total Kjeldahl	0.691	0.050	mg/L	2020-05-24	
pH	8.49	0.10	pH units	2020-05-20	HT2
Phosphorus, Total (as P)	0.123	0.0020	mg/L	2020-05-21	
Phosphorus, Total Dissolved	0.0954	0.0020	mg/L	2020-05-21	
<b>Microbiological Parameters</b>					
Coliforms, Total	1730	1.0	MPN/100 mL	2020-05-15	
Coliforms, Fecal	6.2	1.0	MPN/100 mL	2020-05-15	
<b>Total Metals</b>					
Sodium, total	108	0.10	mg/L	2020-05-21	

### Sample Qualifiers:

FILT The sample has been filtered for TDP in the laboratory. Results may not reflect conditions at the time of sampling.

HT2 The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.

PRES Sample has been preserved for TDP in the laboratory and the holding time has been extended.

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Bailey Springs (ME12215) - EMS

**WORK ORDER REPORTED** 0061961  
2020-06-25 11:29

Analyte	Result	RL	Units	Analyzed	Qualifier
<b>Bailey Springs (0500578) (0061961-01)   Matrix: Fresh Water   Sampled: 2020-06-17 14:25</b>					FILT, PRES
<b>Anions</b>					
Chloride	122	0.10	mg/L	2020-06-21	
Nitrate (as N)	0.146	0.010	mg/L	2020-06-21	HT1
Nitrite (as N)	< 0.010	0.010	mg/L	2020-06-21	HT1
Phosphate (as P)	0.0299	0.0050	mg/L	2020-06-21	HT1
Sulfate	97.5	1.0	mg/L	2020-06-21	
<b>Calculated Parameters</b>					
Nitrate+Nitrite (as N)	0.146	0.0100	mg/L	N/A	
Nitrogen, Total	0.918	0.0500	mg/L	N/A	
Nitrogen, Organic	0.689	0.0500	mg/L	N/A	
<b>General Parameters</b>					
Ammonia, Total (as N)	0.083	0.050	mg/L	2020-06-23	
Conductivity (EC)	1040	2.0	µS/cm	2020-06-22	
Nitrogen, Total Kjeldahl	0.772	0.050	mg/L	2020-06-24	
pH	7.98	0.10	pH units	2020-06-22	HT2
Phosphorus, Total (as P)	0.183	0.0020	mg/L	2020-06-22	
Phosphorus, Total Dissolved	0.124	0.0020	mg/L	2020-06-22	
<b>Microbiological Parameters</b>					
Coliforms, Total	6130	1.0	MPN/100 mL	2020-06-18	
Coliforms, Fecal	53.9	1.0	MPN/100 mL	2020-06-18	
<b>Total Metals</b>					
Sodium, total	112	0.10	mg/L	2020-06-24	

### Sample Qualifiers:

FILT The sample has been filtered for DP in the laboratory. Results may not reflect conditions at the time of sampling.  
 HT1 The sample was prepared and/or analyzed past the recommended holding time.  
 HT2 The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.  
 PRES Sample has been preserved for DP in the laboratory and the holding time has been extended.

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Bailey Springs (ME12215) - EMS

**WORK ORDER REPORTED** 0071435  
2020-07-22 15:59

Analyte	Result	RL	Units	Analyzed	Qualifier
<b>Bailey Springs (0500578) (0071435-01)   Matrix: Fresh Water   Sampled: 2020-07-14 13:30</b>					FILT, PRES
<b>Anions</b>					
Chloride	114	0.10	mg/L	2020-07-16	
Nitrate (as N)	0.048	0.010	mg/L	2020-07-16	
Nitrite (as N)	< 0.010	0.010	mg/L	2020-07-16	
Phosphate (as P)	0.0679	0.0050	mg/L	2020-07-16	
<b>Calculated Parameters</b>					
Nitrate+Nitrite (as N)	0.0475	0.0100	mg/L	N/A	
Nitrogen, Total	0.734	0.0500	mg/L	N/A	
Nitrogen, Organic	0.520	0.0500	mg/L	N/A	
<b>General Parameters</b>					
Ammonia, Total (as N)	0.166	0.050	mg/L	2020-07-16	
Conductivity (EC)	1080	2.0	µS/cm	2020-07-17	
Nitrogen, Total Kjeldahl	0.686	0.050	mg/L	2020-07-21	
pH	8.50	0.10	pH units	2020-07-17	HT2
Phosphorus, Total (as P)	0.163	0.0050	mg/L	2020-07-17	
Phosphorus, Total Dissolved	0.129	0.0050	mg/L	2020-07-17	
<b>Microbiological Parameters</b>					
Coliforms, Total	> 2420	1	MPN/100 mL	2020-07-15	
Coliforms, Fecal	687	1	MPN/100 mL	2020-07-15	
<b>Total Metals</b>					
Sodium, total	113	0.10	mg/L	2020-07-21	

### Sample Qualifiers:

FILT The sample has been filtered for TDP in the laboratory. Results may not reflect conditions at the time of sampling.  
HT2 The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.  
PRES Sample has been preserved for NH3, TKN, TDP and TP in the laboratory and the holding time has been extended.

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Bailey Springs (ME12215) - EMS

**WORK ORDER REPORTED** 0080478  
2020-08-12 12:13

Analyte	Result	RL	Units	Analyzed	Qualifier
<b>Bailey Springs (0500578) (0080478-01)   Matrix: Fresh Water   Sampled: 2020-08-04 13:45</b>					
<b>Anions</b>					
Chloride	117	0.10	mg/L	2020-08-07	
Nitrate (as N)	0.031	0.010	mg/L	2020-08-07	
Nitrite (as N)	< 0.010	0.010	mg/L	2020-08-07	
Phosphate (as P)	0.0418	0.0050	mg/L	2020-08-07	
<b>Calculated Parameters</b>					
Nitrate+Nitrite (as N)	0.0307	0.0100	mg/L	N/A	
Nitrogen, Total	0.884	0.0500	mg/L	N/A	
Nitrogen, Organic	0.853	0.0500	mg/L	N/A	
<b>General Parameters</b>					
Ammonia, Total (as N)	< 0.050	0.050	mg/L	2020-08-07	
Conductivity (EC)	1180	2.0	µS/cm	2020-08-08	
Nitrogen, Total Kjeldahl	0.853	0.050	mg/L	2020-08-10	
pH	8.52	0.10	pH units	2020-08-08	HT2
Phosphorus, Total (as P)	0.175	0.0050	mg/L	2020-08-10	
Phosphorus, Total Dissolved	0.145	0.0050	mg/L	2020-08-10	
<b>Total Metals</b>					
Sodium, total	122	0.10	mg/L	2020-08-11	

**Sample Qualifiers:**

HT2 The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Bailey Springs (ME12215) - EMS

**WORK ORDER REPORTED** 0083111  
2020-09-03 12:21

Analyte	Result	RL	Units	Analyzed	Qualifier
---------	--------	----	-------	----------	-----------

**Bailey Springs (0500578) (0083111-01) | Matrix: Fresh Water | Sampled: 2020-08-31 10:30**

**Microbiological Parameters**

Coliforms, Total	9210	1	MPN/100 mL	2020-09-01	
Coliforms, Fecal	349	1	MPN/100 mL	2020-09-01	

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Bailey Springs (ME12215) - EMS

**WORK ORDER REPORTED** 0091831  
2020-09-24 15:10

Analyte	Result	RL	Units	Analyzed	Qualifier
<b>Bailey Springs (0500578) (0091831-01)   Matrix: Fresh Water   Sampled: 2020-09-16 13:30</b>					FILT, PRES
<b>Anions</b>					
Chloride	116	0.10	mg/L	2020-09-18	
Nitrate (as N)	0.062	0.010	mg/L	2020-09-18	
Nitrite (as N)	< 0.010	0.010	mg/L	2020-09-18	
Phosphate (as P)	0.0627	0.0050	mg/L	2020-09-18	
<b>Calculated Parameters</b>					
Nitrate+Nitrite (as N)	0.0624	0.0100	mg/L	N/A	
Nitrogen, Total	0.977	0.0500	mg/L	N/A	
Nitrogen, Organic	0.852	0.0500	mg/L	N/A	
<b>General Parameters</b>					
Ammonia, Total (as N)	0.063	0.050	mg/L	2020-09-18	
Conductivity (EC)	1210	2.0	µS/cm	2020-09-19	
Nitrogen, Total Kjeldahl	0.915	0.050	mg/L	2020-09-22	
pH	8.46	0.10	pH units	2020-09-19	HT2
Phosphorus, Total (as P)	0.229	0.0050	mg/L	2020-09-20	
Phosphorus, Total Dissolved	0.170	0.0050	mg/L	2020-09-20	
<b>Microbiological Parameters</b>					
Coliforms, Total	9210	1	MPN/100 mL	2020-09-17	
Coliforms, Fecal	488	1	MPN/100 mL	2020-09-17	
<b>Total Metals</b>					
Sodium, total	124	0.10	mg/L	2020-09-24	

### Sample Qualifiers:

FILT The sample has been filtered for TDP in the laboratory. Results may not reflect conditions at the time of sampling.

HT2 The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.

PRES Sample has been preserved for TDP in the laboratory and the holding time has been extended.

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Bailey Springs (ME12215) - EMS

**WORK ORDER REPORTED** 0109440  
2020-10-13 10:55

Analyte	Result	RL	Units	Analyzed	Qualifier
<b>Bailey Springs (0500578) (0109440-01)   Matrix: Fresh Water   Sampled: 2020-10-02 09:00</b>					FILT, PRES
<b>Anions</b>					
Chloride	114	0.10	mg/L	2020-10-04	
Nitrate (as N)	0.133	0.010	mg/L	2020-10-04	
Nitrite (as N)	< 0.010	0.010	mg/L	2020-10-04	
Phosphate (as P)	0.0456	0.0050	mg/L	2020-10-04	
<b>Calculated Parameters</b>					
Nitrate+Nitrite (as N)	0.133	0.0100	mg/L	N/A	
Nitrogen, Total	1.09	0.0500	mg/L	N/A	
Nitrogen, Organic	0.897	0.0500	mg/L	N/A	
<b>General Parameters</b>					
Ammonia, Total (as N)	0.058	0.050	mg/L	2020-10-07	
Conductivity (EC)	1110	2.0	µS/cm	2020-10-07	
Nitrogen, Total Kjeldahl	0.955	0.050	mg/L	2020-10-08	
pH	8.44	0.10	pH units	2020-10-07	HT2
Phosphorus, Total (as P)	0.280	0.0050	mg/L	2020-10-08	
Phosphorus, Total Dissolved	0.219	0.0050	mg/L	2020-10-08	
<b>Microbiological Parameters</b>					
Coliforms, Total	7910	1	MPN/100 mL	2020-10-02	
Coliforms, Fecal	276	1	MPN/100 mL	2020-10-02	
<b>Total Metals</b>					
Sodium, total	119	0.10	mg/L	2020-10-11	

### Sample Qualifiers:

FILT The sample has been filtered for TDP in the laboratory. Results may not reflect conditions at the time of sampling.

HT2 The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.

PRES Sample has been preserved for TDP in the laboratory and the holding time has been extended.

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Bailey Springs (ME12215) - EMS

**WORK ORDER REPORTED** 20K0826  
2020-11-16 16:20

Analyte	Result	RL	Units	Analyzed	Qualifier
<b>Bailey Springs (0500578) (20K0826-01)   Matrix: Fresh Water   Sampled: 2020-11-06 09:00</b>					FILT, PRES
<b>Anions</b>					
Chloride	133	0.10	mg/L	2020-11-10	
Nitrate (as N)	0.156	0.010	mg/L	2020-11-10	HT1
Nitrite (as N)	< 0.010	0.010	mg/L	2020-11-10	HT1
Phosphate (as P)	0.0442	0.0050	mg/L	2020-11-10	HT1
<b>Calculated Parameters</b>					
Nitrate+Nitrite (as N)	0.156	0.0100	mg/L	N/A	
Nitrogen, Total	0.788	0.0500	mg/L	N/A	
Nitrogen, Organic	0.570	0.0500	mg/L	N/A	
<b>General Parameters</b>					
Ammonia, Total (as N)	0.062	0.050	mg/L	2020-11-10	
Conductivity (EC)	1060	2.0	µS/cm	2020-11-11	
Nitrogen, Total Kjeldahl	0.632	0.050	mg/L	2020-11-13	
pH	8.41	0.10	pH units	2020-11-11	HT2
Phosphorus, Total (as P)	0.180	0.0050	mg/L	2020-11-13	
Phosphorus, Total Dissolved	0.151	0.0050	mg/L	2020-11-13	
<b>Microbiological Parameters</b>					
Coliforms, Total	548	1	MPN/100 mL	2020-11-06	
Coliforms, Fecal	13	1	MPN/100 mL	2020-11-06	
<b>Total Metals</b>					
Sodium, total	133	0.10	mg/L	2020-11-13	

### Sample Qualifiers:

FILT	The sample has been filtered for DP in the laboratory. Results may not reflect conditions at the time of sampling.
HT1	The sample was prepared and/or analyzed past the recommended holding time.
HT2	The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.
PRES	Sample has been preserved for DP in the laboratory and the holding time has been extended.

## TEST RESULTS

**REPORTED TO PROJECT** Vernon Water Reclamation, City of  
Bailey Springs (ME12215) - EMS

**WORK ORDER REPORTED** 20L0455  
2020-12-09 16:32

Analyte	Result	RL	Units	Analyzed	Qualifier
<b>Bailey Springs (0500578) (20L0455-01)   Matrix: Fresh Water   Sampled: 2020-12-02 15:00</b>					FILT, PRES
<b>Anions</b>					
Chloride	121	0.10	mg/L	2020-12-05	
Nitrate (as N)	0.273	0.010	mg/L	2020-12-05	
Nitrite (as N)	< 0.010	0.010	mg/L	2020-12-05	
Phosphate (as P)	0.0627	0.0050	mg/L	2020-12-05	
<b>Calculated Parameters</b>					
Nitrate+Nitrite (as N)	0.273	0.0100	mg/L	N/A	
Nitrogen, Total	0.936	0.0500	mg/L	N/A	
Nitrogen, Organic	0.663	0.0500	mg/L	N/A	
<b>General Parameters</b>					
Ammonia, Total (as N)	< 0.050	0.050	mg/L	2020-12-04	
Conductivity (EC)	1020	2.0	µS/cm	2020-12-09	
Nitrogen, Total Kjeldahl	0.663	0.050	mg/L	2020-12-08	
pH	8.33	0.10	pH units	2020-12-09	HT2
Phosphorus, Total (as P)	0.151	0.0050	mg/L	2020-12-07	
Phosphorus, Total Dissolved	0.149	0.0050	mg/L	2020-12-07	
<b>Microbiological Parameters</b>					
Coliforms, Total	804	1	MPN/100 mL	2020-12-03	
Coliforms, Fecal	10	1	MPN/100 mL	2020-12-03	
<b>Total Metals</b>					
Sodium, total	126	0.10	mg/L	2020-12-06	

### Sample Qualifiers:

FILT The sample has been filtered for TDP in the laboratory. Results may not reflect conditions at the time of sampling.

HT2 The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.

PRES Sample has been preserved for TDP in the laboratory and the holding time has been extended.

# Appendix L

## *Groundwater Monitoring Program*

*Associated Environmental*

## REPORT

---

### City of Vernon

### Reclaimed Water Irrigation 2020 Groundwater Monitoring Program



MARCH 2021

#### **CONFIDENTIALITY AND © COPYRIGHT**

This document is for the sole use of the addressee and Associated Environmental Consultants Inc. The document contains proprietary and confidential information that shall not be reproduced in any manner or disclosed to or discussed with any other parties without the express written permission of Associated Environmental Consultants Inc. Information in this document is to be considered the intellectual property of Associated Environmental Consultants Inc. in accordance with Canadian copyright law.

This report was prepared by Associated Environmental Consultants Inc. for the account of City of Vernon. The material in it reflects Associated Environmental Consultants Inc.'s best judgement, in the light of the information available to it, at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Associated Environmental Consultants Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

# TABLE OF CONTENTS

SECTION	PAGE NO.
Table of Contents	i
List of Tables	ii
List of Figures	iii
1 Introduction	1-1
1.1 Background	1-1
1.2 Objective and Scope	1-1
1.3 Study Area	1-1
2 Conceptual Model of Groundwater Flow	2-1
2.1 Lithology	2-1
2.2 Groundwater Levels	2-3
2.3 Water Chemistry	2-5
3 Groundwater Quality	3-1
3.1 Methods	3-1
3.2 Results and Discussion	3-5
4 Bailey Springs Water Quality	4-1
4.1 Methods	4-1
4.2 Results and Discussion	4-1
5 Summary	5-1
5.1 Conceptual Model of Groundwater Flow	5-1
5.2 Groundwater Quality	5-1
5.3 Bailey Springs	5-3
6 Recommendations	6-1
Closure	
References	
Appendix A - Cross Sections and Well Logs	
Appendix B - Tri-linear Diagrams	
Appendix C - Tabulated 2020 Water Quality Data	
Appendix D - Time Series Plots	
Appendix E - Laboratory Reports	

## LIST OF TABLES

	PAGE NO.
Table 2-1 Aquifers in the Study Area	2-2
Table 3-1 2020 Groundwater Monitoring Network and Well Details	3-1
Table 3-2 Exceedances of the Applicable Guidelines or Standards in Groundwater in 2020	3-5
Table 3-3 Average and 2020 Nitrogen Concentrations in Clay Valve #4	3-9
Table 4-1 Exceedances of BC Aquatic Life and/or Recreation Guidelines in Baily Springs in 2020	4-2

## LIST OF FIGURES

	PAGE NO
Figure 1-1 Study Area and Monitoring Network	1-3
Figure 2-1 Groundwater Levels at MW-2 and DMW-2 (October 2017-January 2021)	2-4

# 1 INTRODUCTION

## 1.1 Background

The City of Vernon (the City) treats municipal wastewater to an advanced (tertiary) level at the Vernon Water Reclamation Centre (VWRC). The treated wastewater is stored in the MacKay Reservoir, and meets the criteria of "reclaimed water" under the BC *Municipal Wastewater Regulation* (MWR) because it meets the MWR standards for use in irrigation (BC Reg. 87/2012). The reclaimed water is used to irrigate approximately 1,500 ha of agricultural land on the south side of the city. The irrigation program is authorized by the BC Ministry of Environment and Climate Change Strategy (ENV) through Operational Certificate (OC) ME 12215 (MOE 2008). Under the OC, groundwater monitoring is to be completed each year and an annual report submitted to ENV.

In 2010, the City retained Summit Environmental Consultants Inc. (now Associated Environmental Consultants Inc. [Associated]) to implement a groundwater monitoring program to assess potential impacts on groundwater from its reclaimed water irrigation operations. Since then, Associated has conducted the annual groundwater monitoring program on behalf of the City. This report presents the results of the 2020 monitoring program. For more details on the historical program, see previous annual reports (Summit 2010, 2012, 2013, 2015a; Associated 2016, 2017, 2018, 2019, 2020).

## 1.2 Objective and Scope

Section 8.6 of the OC requires that a groundwater monitoring program be conducted by a Qualified Professional to "establish if irrigation with reclaimed water is impacting groundwater" (MOE 2008). The objective of the 2020 monitoring program is to monitor for potential effects on groundwater from irrigation operations. To meet this objective, Associated conducted the following scope of work:

1. Conducted the annual groundwater sampling program from a network of monitoring and domestic wells;
2. Compared the water quality data to applicable guidelines and historical data;
3. Provided a summary of the conceptual model of groundwater flow completed by Associated in previous years;
4. Reviewed groundwater level data collected from dataloggers installed in two monitoring wells (DMW-3 and MW-2) to better understand groundwater fluctuations;
5. Developed tri-linear diagrams to assess groundwater types and better understand the age and/or origin of the groundwater; and
6. Prepared an annual report that summarizes the results of the 2020 monitoring program.

In addition, Associated compared water quality data for Bailey Springs<sup>1</sup> (provided by the City) to applicable guidelines and historical data, and included the results in this report.

## 1.3 Study Area

The City's reclaimed water irrigation distribution system is located on lands between Kalamalka and Okanagan Lakes as indicated by the orange areas in Figure 1-1. The study area includes lands within and south of the city limits to just beyond the MacKay Reservoir, including Townships 9, 10, 13 and 14.

---

<sup>1</sup> In addition to conducting a groundwater monitoring program, the City is required to collect samples from a stream referred to as Bailey Springs (EMS 500578) under Section 8.9 of the OC (MOE 2008). Bailey Springs is a surface watercourse that originates south of the MacKay Reservoir and discharges to Kalamalka Lake.

The study area includes a northeast to southwest-trending ridge (hereafter referred to as the Commonage Ridge; Figure 1-1), where Commonage Road bisects the top of the ridge that descends to Okanagan Lake (northwest) and Kalamalka Lake (southeast). Several gullies, which have ephemeral water draining towards Okanagan Lake, are located on the bench lands to the west and east of Commonage Road.

Reclaimed wastewater is applied to five major areas: The Rise Golf Course, Vernon Golf and Country Club, Predator Ridge Golf Resort, individual private properties in the Commonage area, and the City-managed area on the hillside northwest of Commonage Road (Figure 1-1). The current groundwater monitoring program focuses on the reclaimed water that is applied to the City-managed area on the hillside northwest of Commonage Road. Agricultural and horticultural land use in the irrigation area managed by the City includes forage production, livestock grazing, irrigated pasture, and forest tree seedling nursery production. The OC states that the "general philosophy of the operation of the reclaimed water irrigation system shall be for beneficial reuse of reclaimed water" (OC Section 11.5.1). The City has control over irrigation rates in the City-managed area. For all other areas, the City manages irrigation use through Bylaw 4899 (City of Vernon 2005) and by providing all lessees with a copy of Appendix A of the OC each year (as required) to remind them of their requirements regarding irrigation rates, aerosol drift, buffers, prevention of surface runoff, and other factors. Over the past few years, the City has been working with lessees to improve water use practices and reduce instances of over-irrigation that could cause saturated soils or surface runoff.



## 2 CONCEPTUAL MODEL OF GROUNDWATER FLOW

Associated (2019) completed an in-depth review of available information to create a conceptual model of groundwater flow. The majority of the review focused on the study area north of the Commonage Ridge as this is where the larger aquifers are located and where the more complex groundwater flow patterns likely occur. The following sections provide a summary of that review, augmented by additional data collected in 2019 and 2020. Further details on the full review completed in 2018 are provided in Associated (2019).

### 2.1 Lithology

Associated (2019) reviewed numerous borehole lithology data from publicly available data and from monitoring wells drilled by Associated for other City projects in the area. The lithology observed in the boreholes is consistent with the lithology described by Nasmith (1963) and Fulton et al. (1965). The study area north of the Commonage Ridge comprises undivided glacial deposits (i.e., sand, gravel, clay, and till) along the hillside and predominantly fluvial/alluvial deposits in the valley bottom, which is commonly called Priest Valley.

ENV most recently updated the aquifer mapping for the North Okanagan in 2019; these updates are based on extensive work completed by Hassan et al. (2019). There are now four aquifers mapped in the study area (ENV 2021) (Table 2-1).

**Table 2-1**  
**Aquifers in the Study Area**

	<b>Aquifer 346</b>	<b>Aquifer 347</b>	<b>Aquifer 1227</b>	<b>Aquifer 471</b>
Aquifer name	South Vernon Unconfined Aquifer	South Vernon Confined Aquifer	Okanagan Landing Deep Confined Aquifer	No name given
Productivity	Moderate	High	High	Low
Vulnerability	Moderate	Low	Low	Moderate
Lithology	Likely alluvium or stream terrace deposits (Unit A).	Sands and gravels from alluvium or stream terrace deposits (Unit C).	Sand and gravel dominated, but can be silty (Unit C). Contact with bedrock.	Fractured crystalline bedrock. Granite and Alkali Feldspar.
Groundwater recharge	Assumed to be from precipitation, leakage from creeks/alluvial fans, and mountain block recharge.	Predominantly from leakage through overlying confining unit from Aquifer 346. Also mountain block recharge and leakage from sediments along the valley margins.	Predominantly expected to derive from mountain block recharge via seepage from fractures and faults below the valley.	Likely occurs from direct infiltration of precipitation at bedrock outcrops, slow leakage, and/or from surface water features.
Size (km <sup>2</sup> )	14.7	6.8	3.75	127.6
Number of registered wells correlated to the aquifer	105	113	6	113
Median well depth (m)	13.7	38.1	112.8	85.34
Number of registered flowing artesian wells	17 (16% of wells)	47 (42% of wells)	2 (33% of wells)	1 (<1% of wells)

Source: ENV 2021

Cross sections generated by Associated (2019) are provided in Appendix A<sup>2</sup>. Figure A-1 shows the locations of the cross sections. Cross Section A-A' (Figure A-2) has been updated from Associated (2019) given the information provided by Hassan et al. (2019) and shows the distinction between the South Vernon Confined (Aquifer 347), the South Vernon Unconfined (Aquifer 347), and the Okanagan Landing Deep Confined (Aquifer 1227).

<sup>2</sup> The accuracy of cross sections relies on the lithology information from publicly available well logs and the accuracy of elevation data available. Data from monitoring wells installed for the Hesperia Landfill groundwater monitoring program (MW17-1, MW17-5, MW17-6, MW2018-1, MW2018-2, MW2018-3) have been surveyed to geodetic datum (+/- 1 cm) (Associated 2019). The ground elevations for other wells used were determined based on elevation data available from the City and have an accuracy of +/- 1 m (COV 2016). Borehole logs used to develop the cross sections are provided in Associated (2019).

Cross Sections B-B' and C-C' (Figures A-3 and A-4, respectively) show that the lithology on the hillside is complex and that lithology units are not laterally extensive east-west.

## 2.2 Groundwater Levels

On October 25, 2017, Associated installed pressure transducer dataloggers in monitoring wells MW-2 (WTN 58804) and DMW-3 (WTN 58803), both of which are included in the long-term monitoring groundwater monitoring program (Section 3), to measure and record groundwater levels every 6 hours. Approximately once every three months since that time, the City has retrieved data from the loggers and recorded a manual groundwater level reading. Data are available between October 25, 2017 and January 8, 2021 (Figure 2-1).

Monitoring well DMW-3 is located south of Bench Row Road but north of the Commonage Ridge (Figure 1-1). It is the only well in the monitoring program that is not within the area that is irrigated with reclaimed water. The monitoring well was installed in May 1989, and the well log indicates 1.83 m of red, sandy clay overlying fractured bedrock. The borehole was drilled to 5.79 m below ground (m bg) and the monitoring well was screened between 2.74 and 5.79 m bg (across the fractured bedrock).

The well is situated near an ephemeral drainage that drains north. Groundwater levels in the well are typically at approximately 2.5 m below top of casing (m btoc) throughout the year, except in spring (March-May) when groundwater levels rise to approximately 0.74 to 0.88 m btoc. During the period of record, groundwater levels rise rapidly in March during freshet (e.g., groundwater levels rose by as much as 0.76 m in a period of 24 hours (March 17, 2018)). Fieldwork completed at the well (e.g., water sampling) suggests that the surface seal of the wellhead is competent and that the increased water level is due to an increase in water level of the aquifer, not just an increase of water level in the well.

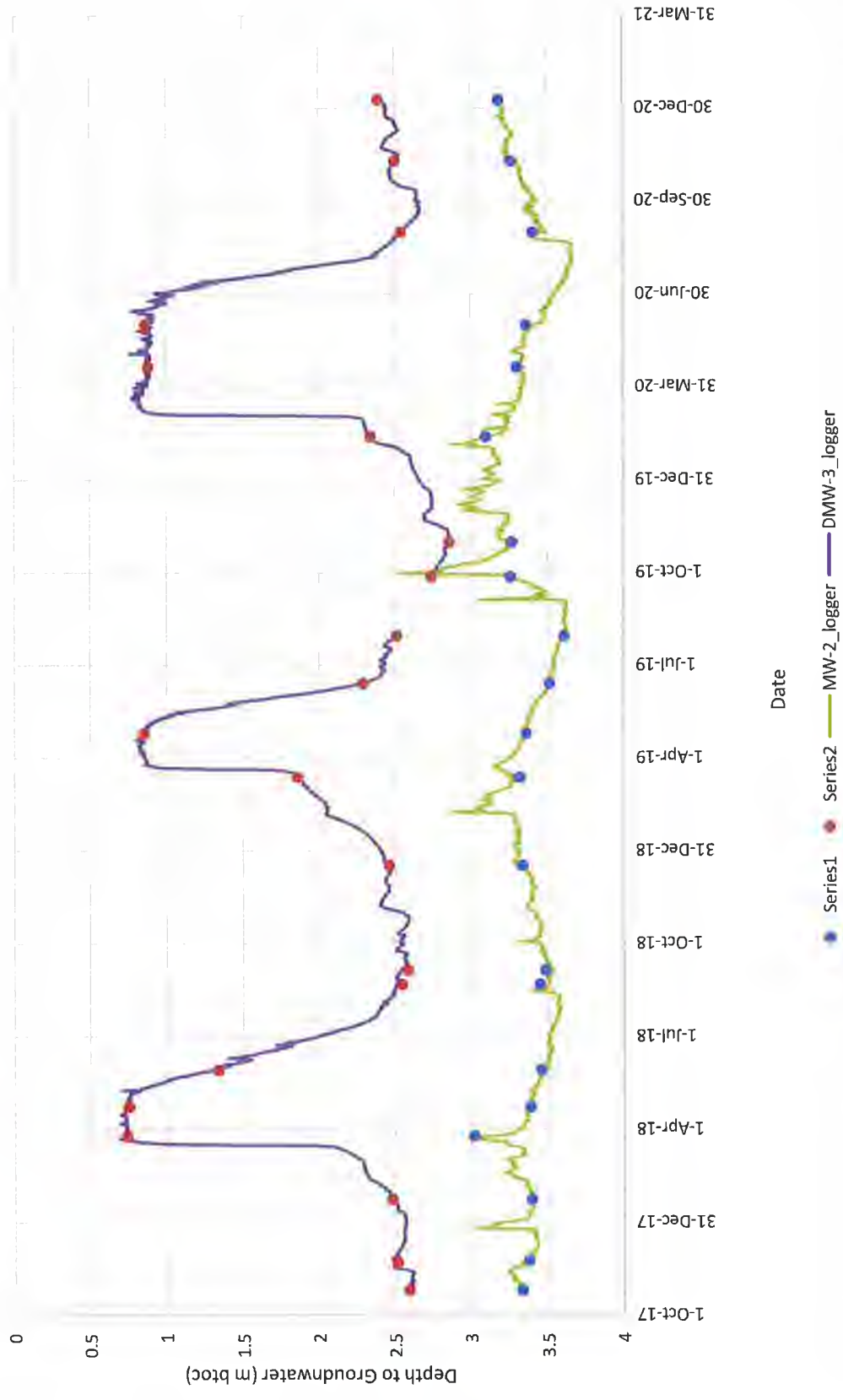
Monitoring well MW-2 is located approximately 35 m south of Okanagan Avenue in the eastern portion of the study area within the reclaimed water irrigated area (Figure 1-1). It is at a higher elevation than some of the other wells in the valley bottom, and the groundwater level in this well is comparable to the perceived potentiometric level in the flowing artesian wells located at lower elevations.<sup>3</sup> The well log indicates that the well is partially screened across a semi-confined layer of coarse gravel from 12.8 to 14.3 m bg (likely Aquifer 347). The static groundwater level is between 2.6 and 3.6 m btoc throughout the period of record. The response to freshet in this well is less noticeable, which is expected due to the overlying confining layers inhibiting direct recharge of the aquifer. Recharge to this aquifer likely comes from the highlands to the south. Because coarse gravel aquifers typically have large storativity values<sup>4</sup>, changes in water levels, which would indicate recharge and discharge of water from the aquifer, are less noticeable.

A 'sawtooth' pattern observed in MW-2 on Figure 2-1 indicates that the well is being influenced by a neighbouring pumping well. The minimal drawdown/recovery observed here suggests that the pumping well is a great distance away, and/or the aquifer has a high transmissivity<sup>5</sup>.

<sup>3</sup> The potentiometric level is the imaginary level to which water in a confined aquifer would rise if it were completely pierced with a well. When the potentiometric level is above ground, a flowing artesian well results. We do not have confirmed data on the potentiometric levels of the flowing artesian wells on Okanagan Avenue, but 1-2 m above ground lines up with the groundwater elevation at MW-2.

<sup>4</sup> Storativity is a measure of an aquifer's ability to store water.

<sup>5</sup> Transmissivity is a measure of an aquifer's ability to transmit water.



**Figure 2-1**  
Groundwater Levels at MW-2 and DMW-2 (October 2017-January 2021)

## 2.3 Water Chemistry

Associated used the 2020 groundwater chemistry data collected during the field program (described in detail in Section 3) to create tri-linear diagrams (i.e., Piper and Stiff Diagrams). These diagrams provide six major ions or combinations of ions plotted onto one diagram to assist with assessment of the types of groundwater in the study area (Hounslow 1995). Groundwater flowing in an aquifer during the natural cycle is influenced by residence time and interaction with the host rock or material along the flow path, and can be generally classified as more freshly recharged (i.e., low mineralization) or having a longer residence time (i.e., higher mineralization).

The 2020 tri-linear diagrams (Appendix B) align with the findings of the 2018 and 2019 monitoring programs (Associated 2019, 2020). The predominant finding from Associated (2019) was that water quality is variable spatially, both horizontally through the area and vertically within different aquifers.

The findings are summarized as follows:

1. The Piper Diagram for 2020 (Figure B-1; Appendix B) indicates that the wells north of the Commonage Ridge typically plot as Calcium-Bicarbonate, Calcium-Magnesium, and Calcium-Sulphate water types, which suggests younger to moderate residence times. DMW-4 and DMW-5 are both located south of the Commonage Ridge. The groundwater type is mainly a Calcium-Sulphate water, but over time DMW-4 has changed to a Bicarbonate-Sodium water (Figure B-2; Appendix B). Both DMW-4 and DMW-5 have shown changes in water chemistry over time, including removal of chloride, sulphate, and calcium and an increase in alkalinity.
2. The Stiff Diagrams for 2020 (Figure B-3; Appendix B) indicate that there are five different chemistry signatures:
  - MW11-02 is at the western extent of the study area and has higher concentrations for all ions.
  - WTN 24991 and MW-5 are located centrally along Okanagan Avenue and are flowing artesian. These wells show younger, more recently recharged groundwater. MW-5 has higher magnesium and sulphate and lesser calcium and alkalinity than WTN 24991.
  - DMW-1, MW-2, WTN 39421, and DMW18-1 are located at the eastern end of the study area and all, except for DMW-1, are installed to relatively similar depths. MW-2, although similar to the others, has slightly different source(s) influencing its chemistry and may be isolated from the other wells.
  - DMW-3 is the upgradient well and, based on the datalogger, it is closely tied to surface water. It contains high concentrations of ions and is therefore potentially influenced by other upgradient activities (e.g., road salt, animal pasture).
  - DMW-4 and DMW-5 are located south of the Commonage Ridge and are unique from the others based on higher sodium/potassium and alkalinity.
3. The chemistry in MW-2 has changed over time (Figure B-4; Appendix B). Between 2012 and 2020, sodium, potassium, chloride, and alkalinity have decreased while calcium, magnesium, and sulphate have remained relatively stable.
4. Some of the deeper, flowing artesian wells (WTN 24991 and MW-5) exhibit water that is typical of freshly recharged (i.e., younger) groundwater. This is counter-intuitive since deeper aquifers typically host older groundwater. A potential cause of this groundwater is due to a pathway of higher transmissivity (e.g., fracture or fault within the bedrock). This freshly recharged water is not likely from the reclaimed water irrigation, since these wells do not exhibit high concentrations of nitrate-N and chloride. WTN 39421 is a flowing artesian well located on Okanagan Avenue with higher equivalents of sulphate and calcium, suggesting a different aquifer from WTN 24991 and MW-5.

5. Typical parameters associated with reclaimed water (i.e., nitrate-N, chloride, and conductivity) are not necessarily always higher in downgradient wells. The highest concentrations are found in WTN 39421, DMW-1, and DMW-6. MW-2, MW-5, and WTN 24991 are located between these wells and have relatively lower concentrations than their neighbouring wells; indicating the spatial variability in water chemistry.
6. The datalogger information collected from DMW-3 suggests that the well is very closely tied to surface water and therefore is not representative of groundwater in deeper aquifers. This suggests surficial sources of anthropogenic inputs. Additionally, DMW-3 is installed across fractured bedrock, creating a different chemical signature than the downgradient wells that are installed in unconsolidated sediments (as evidenced by the Stiff Diagram [Figure B-3; Appendix B]). The findings imply that in order for upgradient monitoring wells to be useful as part of the reclaimed water irrigation monitoring, they would need to be installed at the bedrock contact, or very deep in the hillside (over 50 m), to intersect similar aquifers in the receiving environment.
7. Although there is no confirmed lithological log for DMW-1, it is much shallower than WTN 39421 and is likely installed across a different aquifer. Based on the available lithological data for the study area, DMW-1 and WTN 39421 are likely separated by a 30–40 m thick unit of clay (Appendix A, Figure A-2). Both wells have similar water quality and similar signatures that are apparent in the Stiff Diagrams (Figure B-3; Appendix B); WTN 39421 has less chloride and alkalinity but higher sulphate values. They have similar concentrations of nitrate-N, dissolved selenium, and conductivity values. The similar groundwater signature and chemistry may be due to similar material hosting the aquifers (i.e., although these two wells are separated by a thick clay unit, the geological depositional environment could have been similar for the aquifers).
8. Monitoring well MW11-02 has concentrations of certain parameters that are an order of magnitude higher than all other wells, which suggests some additional influence(s) when compared to the other monitoring wells.

Section 3 provides further discussion on water quality, including comparison to applicable guidelines.

### 3 GROUNDWATER QUALITY

#### 3.1 Methods

##### 3.1.1 Monitoring Network

Groundwater sampling occurred on September 29, 2020, prior to the end of the irrigation season. This timing aligns with previous sampling programs (Summit 2015b, Associated 2018, 2019, 2020). The groundwater monitoring network consists of monitoring wells and domestic water supply wells, as listed in Table 3-1 and shown on Figure 1-1. Table 3-1 also provides a summary of the depth to water and depth to bottom of each well in the monitoring program, and indicates whether a well log is available. All available well logs are provided in Appendix A.

**Table 3-1**  
**2020 Groundwater Monitoring Network and Well Details**

Location ID	Well Type	Well Log Available?	Depth to Water	Well Depth
MW-2	Monitoring well	Yes (WTN 58804)	3.35 mbtoc <sup>A</sup>	14.3 m <sup>B</sup>
MW-5	Flowing artesian well	No	Flowing artesian	49.8 mbtoc <sup>A</sup>
MW11-02	Monitoring well	Yes	32.57 mbtoc <sup>A</sup>	34.6 mbtoc
DMW-1	Private domestic well (dug well)	Possibly WTN 8414 <sup>C</sup>	0.45 mbtoc <sup>A</sup>	2.4 m <sup>B</sup>
DMW-3	Monitoring well	Yes (WTN 58803)	2.64 mbtoc <sup>A</sup>	6.3 mbtoc <sup>A</sup>
DMW-4	Private domestic well	No	0.6 mbtoc <sup>D</sup>	Estimated to be 4 m <sup>E</sup>
DMW-5	Private domestic well	No	Flowing artesian	Unknown
WTN 39421	Water supply well	Yes (WTN 39421)	Flowing artesian	45 m <sup>B</sup>
WTN 24991	Water supply well	Yes (WTN 24991)	Flowing artesian	113 m <sup>B</sup>
DMW18-1	Private domestic well	Yes (WTN 1950)	6 m <sup>B</sup>	8.5 m <sup>B</sup>

Notes: mbtoc = metre below top of casing; mbg = metre below ground surface; m = metre, taken from registered well log; therefore, unknown if measurement is below top of casing or ground.

<sup>A</sup> Based on field measurements (September 29, 2020).

<sup>B</sup> Based on information in the registered well log.

<sup>C</sup> Assumed WTN based on well location and field measured depth to bottom, but not confirmed.

<sup>D</sup> Depth to water measured in September 2018. Could not access the wellhead in 2019/2020.

<sup>E</sup> Well depth is based on anecdotal information from the property owner. No well log is available and the well head cannot be accessed.

This monitoring network is the same one used in 2019 (Associated 2020). Well DMW18-1 is tested quarterly as part of the City's Hesperia Landfill Monitoring Program (Associated 2021), but data are included in this report for interpretation as it is a potential domestic receptor in the study area.

##### 3.1.2 Sampling Methodology and Parameters Tested

Groundwater samples were collected following standard BC methods (MOE 2013a). Prior to sampling, monitoring wells were purged to remove at least three times the well volume, until dry or until field parameters stabilized, using a submersible pump, peristaltic pump, or foot-valve inertial pumping system, depending on well depth. Field parameters (i.e., temperature, conductivity, pH, dissolved oxygen, oxidation-reduction potential, and turbidity) were measured

with field meters during purging. Domestic wells were generally purged using existing pumps until field parameters stabilized. DMW-1, which is a dug well that cannot be purged, was sampled directly using a bailer.

Groundwater samples were collected as grab samples in laboratory-supplied bottles, filtered and preserved in the field (where necessary), and shipped via chain of custody protocol to CARO Analytical Services (an accredited laboratory) in Kelowna BC for analysis of the following parameters<sup>6</sup>:

- alkalinity, bromide, chloride, fluoride, sodium, sulphate, total dissolved solids (TDS), and hardness (total as CaCO<sub>3</sub>);
- ammonia-N, nitrate-N, nitrite-N, total Kjeldahl nitrogen (TKN), organic nitrogen, and total nitrogen;
- orthophosphate, dissolved phosphorus, and total phosphorus; and
- dissolved metals.

### 3.1.3 Comparison to Guidelines

Given the objective of the groundwater monitoring program (i.e., to establish if irrigating with reclaimed water is impacting groundwater), the groundwater quality results are assessed relative to water quality guidelines. To protect nearby receptors (i.e., domestic wells used for drinking water and irrigation purposes, and groundwater discharging to surface waterbodies), the 2020 groundwater quality results were compared to the following water quality guidelines:

- Guidelines for Canadian Drinking Water Quality (Health Canada DW) (Health Canada 2019);
- British Columbia Source Drinking Water Quality Guidelines (BC DW) (ENV 2020a);
- BC Approved and Working Water<sup>7</sup> Quality Guidelines for aquatic life (BC AL; acute guidelines only), irrigation water (BC IW), and livestock water (BC LW) (ENV 2019a, 2020b); and
- BC *Contaminated Sites Regulation* (CSR) Schedule 3.2, Generic Numerical Water Standards for Drinking Water (DW), Irrigation (IW), Livestock (LW), and Freshwater Aquatic Life (AW) (BC Reg. 253/16).

The Health Canada DW and BC DW guideline levels are designated as either a maximum acceptable concentration (MAC) or an aesthetic objective (AO) (Health Canada 2019, ENV 2020a). The MAC guidelines are health-risk-based and determined based on the known health effects associated with the substance. The AO guidelines apply to those variables that adversely affect taste or intended, typical water uses (e.g., staining of laundry) but do not pose a health hazard. For interpretation purposes, whichever guideline (Health Canada or BC) is more stringent was used and referred to as the DW guideline.

After sampling, the results from domestic supply wells were compared with the Health Canada DW and BC DW guidelines. Associated provided the well owners with a summary of any exceedances and the original laboratory report, as a courtesy for participating in the study and to notify residents of any drinking water guideline exceedances.

Exceeding a BC water quality guideline does not imply there are unacceptable risks, but rather the potential for adverse effects may be increased and additional investigation may be required (ENV 2019a).

---

<sup>6</sup> DMW18-1, which is sampled quarterly as part of a different monitoring program (Associated 2020), was tested for the same parameters listed here with the exception of bromide, fluoride, organic nitrogen, total nitrogen, dissolved phosphorus and orthophosphate.

<sup>7</sup> Some of the BC water quality guidelines are considered "working," but for purposes of discussion in this report, they are given equal weight as approved guidelines.

### 3.1.4 Comparison to Background, Reclaimed Water Quality, and Historical Data

Water quality data and guideline exceedances are assessed and interpreted by comparing to available background water quality, reclaimed water quality, and historical data.

#### Background Groundwater Quality

Obtaining background water quality for the area is difficult because the irrigation area is extensive. Of the wells included in the standard monitoring program (Table 3-1), only monitoring well DMW-3 is located upgradient of the reclaimed water irrigation area. However, as described in Section 2, DMW-3 likely does not represent background water quality for most wells because it is closely tied to surface water and is installed across fractured bedrock, which is anticipated to have a different chemistry signature than the downgradient wells (which are generally installed in unconsolidated sand and gravel material). A review of the lithology in the area indicates that any additional monitoring wells intended as representative upgradient samples would also likely need to be installed across fractured bedrock (similar to DMW-3) because the unconsolidated sediments are very thin on the upper valley walls and are typically not water-bearing.

Since our ability to compare the downgradient water quality to DMW-3 is limited, Associated reviewed the north side of the valley, where reclaimed water is not used, to determine whether further information on background water quality could be obtained in 2018. A preliminary review suggested that the subsurface stratigraphy may be similar on the north side of the valley, where irrigation water is not applied (with the exception of The Rise Golf Course) (Associated 2019). Although this is not a standard approach for determining background, if it were possible to obtain samples from a variety of depths and locations, this information could provide some indication of the range of constituents in a similar geological area that is not irrigated with reclaimed water.

Based on a review of the BC Water Resource Atlas in 2018, more than 20 mapped wells were identified for potential testing; however, most of the wells no longer existed or Associated could not gain access (Associated 2019). Many of these wells may have been established as private domestic wells when the area was not supplied by the public water system and may have become inactive once the public water supply was installed. Five background wells were identified and tested in 2018. The results, which were reported in Associated (2019), did not provide a wide range of potential background levels given their depths and locations, but provided some base information.

Therefore, the majority of our background concentration information comes from the regional background concentrations developed by ENV.

#### Reclaimed Water Quality

In addition to the wells listed in Table 3-1, water quality data collected for the program also include Clay Valve #4, which is at the distribution point after Mackay Reservoir (i.e., samples reflect quality of the reclaimed water prior to irrigation). This location is sampled monthly by City staff during the irrigation season, as required by the OC (MOE 2008).

In 2020, City staff collected samples at Clay Valve #4 monthly between May and October, and submitted the samples to CARO Analytical Services for analysis of the following parameters:

- biochemical oxygen demand;
- pH, total suspended solids, chloride, sodium, sulphate, and fluoride (June through October only);
- nitrogen (ammonia-N, nitrate-N, nitrite-N, TKN, organic nitrogen, and total nitrogen);
- phosphorus (orthophosphate, dissolved phosphorus, total phosphorus);

- total coliforms and fecal coliforms; and
- dissolved metals (including hardness).

The Clay Valve #4 analytical list includes the parameters required under Section 8.3.4 of the OC, plus fluoride, chloride, sodium, sulphate, and dissolved metals. These were added to make the list more consistent with groundwater analyses, to aid with interpretation.

Each year, the City provides Associated with the water quality results from this location for inclusion in the water quality database.

### Historical Water Quality Data

For most of the groundwater sampling locations, the dataset begins in 2011 when the groundwater monitoring program was initiated. The exceptions are DMW18-1 (first tested in 2018) and DMW-3 and MW-2 (part of a previous monitoring program conducted by ENV between 1979 and 1995). The prior program collected data for DMW-3 from 1989 to 1995 and for MW-2 from 1979 to 1995.

### 3.1.5 Quality Assurance and Quality Control

The quality assurance / quality control (QA/QC) measures applied as part of the sampling program included calibrating instruments prior to sampling, wearing nitrile gloves, and using either dedicated well equipment or thoroughly decontaminating and rinsing equipment between wells. In addition, a blind duplicate sample was collected. Collection and analysis of duplicate samples provides information on the combined (field and analytical) precision of the sampling and the analytical program. The individual analytical results for each analyte in each sample of the duplicate pair were compared, and the relative percent difference (RPD) value was calculated for each analyte pair as follows:

$$RPD = \left( \frac{a-b}{\left( \frac{a+b}{2} \right)} \right) \times 100$$

where *a* and *b* are duplicate pair values in identical units. An RPD value of 20% or less is generally considered acceptable, whereas an RPD value greater than 20% may indicate a problem with either sampling or analysis (MOE 2013a). This limit may vary depending on the analysis involved and the concentration of the analyte. The RPD value also tends to increase as the result approaches the detection limit. Therefore, use of this threshold is restricted to duplicate pair values that are greater than five times their detection limit (MOE 2013a).

In addition to the collection of duplicate samples, a trip blank sample was collected<sup>8</sup>. Trip blanks are deionized water in sealed containers that are provided by the laboratory. These are taken into the field and remain in sample coolers during sampling; they are not opened. Laboratory analytic results are then compared to the analytical results expected for deionized water.

<sup>8</sup> A field blank sample (i.e., deionized water and a separate bottle set to fill in the field) was also requested by the laboratory, but was not provided and deionized water could not be obtained in time for the field sampling event.

## 3.2 Results and Discussion

### 3.2.1 Guideline Exceedances

Table 3-2 identifies the parameters that exceeded the applicable drinking water, aquatic life, irrigation water, and/or livestock water guidelines and/or standards in the 2020 groundwater samples. All 2020 results, tabulated and compared with all applicable guidelines, are included in Appendix C. The original laboratory reports for 2020 are provided in Appendix E.

**Table 3-2**  
**Exceedances of the Applicable Guidelines or Standards in Groundwater in 2020**

	DMW-1	DMW-3	DMW-4	DMW-5	MW-2	MW11-02	MW-5	WTN 24991	WTN 39421	DMW18-1
Conductivity (field-measured)	X	X	X	X	X	X			X	X
Temperature (field-measured)				X						
Chloride			X	X		X				
Fluoride				X						
Sulphate						X				
Total dissolved solids	X	X	X	X	X	X			X	X
Nitrate-N						X				
Phosphorus (total)	X		X	X	X	X		X		
Phosphorus (dissolved)	X		X	X	X	X		X		
Chromium (dissolved)	X					X			X	X
Cobalt (dissolved)						X				
Lithium (dissolved)	X	X	X	X		X				X
Manganese (dissolved)		X		X	X		X	X		
Molybdenum (dissolved)			X	X	X			X		X
Selenium (dissolved)	X					X			X	X
Sodium (dissolved)				X						
Uranium (dissolved)	X			X	X	X				X

Notes: X indicates an exceedance of the applicable guidelines and/or standards, differentiated as follows:

X = exceedance of the applicable drinking water guidelines (Health Canada DW, BC DW, and/or CSR DW).

X = exceedance of the applicable irrigation and/or livestock water guidelines (BC IW, BC LW, CSR IW, and/or CSR LW).

■ = exceedance of the applicable aquatic life guidelines (BC AL acute and CSR AW).

Although dissolved oxygen was below the BC AL in groundwater, it is not included as an exceedance in the above table as dissolved oxygen in groundwater is not representative of dissolved oxygen in surface water.

The DW MAC exceedances are considered to represent the highest concern because much of the study area is not serviced by public water supply, and domestic wells are used for consumption purposes. Exceedances of a DW MAC in 2020 included:

- Cobalt (MW11-02);
- Manganese (DMW-3 and DMW-5);
- Lithium (DMW-1, DMW-3, DMW-4, DMW-5, MW11-02, and DMW18-1);
- Nitrate-N (MW11-02);
- Selenium (DMW-1, MW11-02, WTN 39421, and DMW18-1); and
- Uranium (DMW-1, DMW-5, and MW11-02).

These parameters are discussed further in Section 3.2.2.

### 3.2.2 Comparison to Background, Reclaimed Water Quality, and Historical Data

The following sections provide a brief interpretation and historical comparisons for parameters that exceeded guidelines in groundwater 2020 (Table 3-2). Plots showing temporal changes in concentrations for these parameters are included in Appendix D. Historical data can be found in Associated (2018). As described in Section 3.1.4, Clay Valve #4 is the distribution point after Mackay Reservoir (i.e., samples collected at Clay Valve #4 reflect quality of the reclaimed water prior to irrigation). Results from Clay Valve #4 in 2020 are provided in Appendix C.

#### 3.2.2.1 Routine Parameters

##### Conductivity

There are no DW, AW, or LW guidelines for conductivity. The BC IW guideline for conductivity varies based on crop type (ENV 2020b). The guideline is <700  $\mu\text{S}/\text{cm}$  for low tolerance crops, <1,200  $\mu\text{S}/\text{cm}$  for slightly tolerant crops, <2,200  $\mu\text{S}/\text{cm}$  for moderately tolerant crops, <3,600  $\mu\text{S}/\text{cm}$  for tolerant crops, and <5,000  $\mu\text{S}/\text{cm}$  for very tolerant crops.<sup>9</sup>

In 2020, conductivity exceeded the BC IW guideline for low tolerance crops in all wells except MW-5 and WTN 24991 (Figure D-1). Conductivity also exceeded the BC IW guideline for slightly tolerant crops in DMW-5 and MW11-02. All conductivity results met the guidelines for moderately tolerant, tolerant, and very tolerant crops. Between 2011 and 2019, conductivity levels in DMW-1 and DMW-5 had been increasing, but in 2020 they decreased to levels similar to those first measured in 2011. All wells, except WTN 39421, experienced a reduction in conductivity in 2020. Conductivity was not measured in Clay Valve #4 in 2019 (and is not required, according to the OC).

##### Chloride

Chloride is a conservative ion, meaning that once it is dissolved in water it tends to stay in solution. As a result, chloride that enters groundwater may reach downgradient surface water (MOE 2003). Examples of anthropogenic sources of chloride to the environment include the application of road salt, industrial activities, municipal wastewater, leachate from refuse disposal sites, and fertilizers (MOE 2003). There are no health-based drinking water guidelines for chloride; however, concentrations above 250 mg/L may cause corrosion in drinking water systems and/or may

<sup>9</sup> Low tolerance crops include strawberry, raspberry, bean, and carrot; slightly tolerant crops include all other fruits and berries, corn, sweet corn, onion, parsnip, radish, pea, pumpkin, lettuce, pepper, muskmelon, sweet potato, potato, celery, cabbage kohlrabi, cauliflower, cowpea, broadbean, flax, sunflower, and clover; moderately tolerant crops include spinach, cantaloupe, cucumber, tomato, squash, Brussel sprout, broccoli, turnip, brome, alfalfa, big trefoil, beardless, wildrye, vetch timothy, and crested wheatgrass (ENV 2020b).

produce an undesirable taste (Health Canada 1987). The DW AO and CSR DW for chloride is 250 mg/L. The BC and CSR IW are 100 mg/L and the BC LW and AW are 600 mg/L. The CSR AW standard is 1500 mg/L.

In 2020, chloride concentrations (Figure D-2) met the DW AO in all wells except DMW-5 (256 mg/L). The chloride concentrations in DMW-4 and MW11-02 exceeded the BC IW guideline of 100 mg/L but not the DW AO. Chloride concentrations in DMW-5 generally increased between 2011 (i.e., the first sample event, when guidelines were met) and 2016, but have remained relatively consistent since that time. Chloride has increased in DMW-1 since monitoring began, but remains below guidelines. Chloride concentrations in DMW-3, DMW-4, MW-2, and DMW18-1 have decreased since monitoring began and have generally stabilized over the past three years, whereas chloride concentrations have remained relatively consistent in MW-5, MW11-02, WTN 24991, and WTN 39421 throughout.

DMW-5 is located in a cattle pasture (i.e., near sources of manure and urea) and close to a major roadway (i.e., a source of road salt), which could contribute to the increase in chloride. The well depth is unknown because the well log is not available, but the well is flowing artesian. Chloride in Clay Valve #4, which was tested in 2003, 2015, 2016, 2017, 2018, 2019, and 2020, has remained relatively consistent and ranged from 75.9 to 175 mg/L, with an average of 94.5 mg/L. Given that concentrations are lower in the reclaimed water than in DMW-5, and given that an increasing trend is not visually apparent in the other wells in the reclaimed water irrigation area, there are likely other sources of the elevated chloride in DMW-5.

### Fluoride

Fluoride is naturally occurring in Canada and can reach the water supply through the degradation and erosion of fluoride-containing rocks (Health Canada 2010). The DW MAC, CSR DW, and BC LW are 1.5 mg/L, the CSR IW and CSR LW are 1.0 mg/L, the BC IW is 2.0 mg/L, and the BC AL is calculated based on the water hardness.

Fluoride in DMW-5 (1.28 mg/L) exceeded the CSR IW and CSR LW. The guidelines for fluoride were not exceeded by any other well, and the concentration in the remaining wells ranged from <0.10 mg/L to 0.52 mg/L. The trend in fluoride has been stable in all wells, with the exception of DMW-3 (upgradient of irrigation) and DMW-5, where concentrations generally increased between 2016 and 2019, but both decreased in 2020 (Figure D-3). Concentrations in DMW-4 also increased between 2016 and 2018, but have decreased since then. All three of these wells are located on the south side of the Commonage Ridge, near MacKay Reservoir. Fluoride testing in Clay Valve #4 was previously not required as per the OC, but testing began in 2020 to support our understanding of potential impacts on groundwater, and concentrations ranged from 0.20 to 0.26 mg/L. The one year of data collected from Clay Valve #4 suggests the fluoride concentrations were not elevated above 0.26 mg/L in the reclaimed water. The higher concentration in DMW-5 (1.28 mg/L) is likely not a result of the reclaimed water, but continued monitoring of Clay Valve #4 is warranted to assess for yearly fluctuations to confirm.

### Sodium

Sodium compounds are widely present in nature and can be present in treated municipal wastewater due to human consumption of table salt. The DW AO and CSR DW are 200 mg/L. There are no IW, LW, or AL guidelines for sodium.

In 2020, sodium concentrations met the DW AO and CSR DW in all wells except DMW-5 (221 mg/L). The pattern of sodium concentrations in DMW-5 is similar to that of chloride (i.e., increasing from 2011-2016) in the same well (Figure D-4); although similar to chloride, it appears that concentrations may have stabilized since 2016.

Similar to chloride, sodium has decreased since 2014 in DMW-4 and MW-2. It has also decreased slightly in DMW18-1 since it was first tested in 2018. In other wells, it has remained relatively consistent.

Sodium in Clay Valve #4 in 2020 ranged from 89.1 to 98.7 mg/L (total) and 82.7 to 97.9 mg/L (dissolved), and the concentrations in background well DMW-3 are mid-range compared to the concentrations in the other wells.

### **Sulphate**

Sulphate enters the water cycle through weathering of parent rocks, atmospheric deposition, and discharges from anthropogenic sources, such as mining operations, agricultural runoff, and municipal wastewater (MOE 2013b). The DW AO and CSR DW are 500 mg/L. The BC LW and CSR LW are 1000 mg/L. The BC AL is calculated based on the water hardness; in this case, the guideline is 429 mg/L. There is no IW guideline.

In 2020, sulphate concentrations met the guidelines in all wells except MW11-02 (Figure D-5), which had a concentration of 661 mg/L and exceeded the DW AO, CSR DW, and BC AL. Historically, sulphate concentrations in MW11-02 have been approximately double the concentrations detected in other monitoring wells in the network, and there is no apparent upward trend in MW11-02; rather, it has fluctuated between 500 and 800 mg/L since 2011. Of all sites, WTN 24991 and Clay Valve #4 generally continue to have the lowest sulphate concentrations, ranging from 76.3 to 82.8 mg/L in Clay Valve #4 in 2020. The lower concentrations of sulphate in Clay Valve #4 suggest that the concentrations in MW11-02 are unrelated to reclaimed water irrigation operations, and are likely naturally occurring or caused by other anthropogenic sources. Sulphate concentrations in the other wells have remained relatively consistent since 2011, with the exceptions of DMW-3 and DMW-4 where they have decreased.

### **Total Dissolved Solids**

TDS was added to the monitoring program in 2019 to aid with the development of tri-linear diagrams to better classify the water types in the study area (Section 2.3). The DW AO and BC IW are 500 mg/L, and the BC LW is 1000 mg/L. In 2020, TDS in all wells except flowing artesian wells MW-5 and WTN 24991 exceeded the DW AO and BC IW guidelines. In DMW-5 and MW11-02, TDS also exceeded the BC LW guideline. A time series plot was not generated for TDS, as there are only two years of data.

#### **3.2.2.2 Nitrogen**

The different forms of nitrogen that make up the total nitrogen pool in soils and water are organic nitrogen, nitrate, nitrite, ammonia, and ammonium. A portion of the organic nitrogen in soils and shallow groundwater is converted by microbes to ammonia and ammonium through the process of mineralization. Ammonium is converted to nitrite ( $\text{NO}_2$ ) and then nitrate ( $\text{NO}_3$ ) through the process of microbial nitrification. Because of these processes, nitrogen in groundwater is typically found primarily as nitrate. Of the nitrogen forms, ammonia is most toxic to aquatic life, whereas nitrate is of higher concern for human health (i.e., drinking water). In addition, nitrate is an anion (negatively-charged particle) and tends not to bind with clay and organic matter, both of which are also mostly negatively charged. Therefore, it can travel readily through groundwater.

#### **Clay Valve #4**

Because inorganic nitrogen converts readily between forms, it is important to assess all forms of nitrogen in reclaimed water, including total nitrogen. The City is not specifically required to treat for nitrogen under the OC (i.e., no maximum acceptable level is specified), nor are limits set for nitrogen in reclaimed water under the MWR. However, in 2005, the treatment system at the VWRC was upgraded to include Biological Nutrient Removal (BNR), which reduces both the nitrogen and phosphorus content of wastewater.

Table 3-3 lists the average concentrations of key nitrogen parameters in Clay Valve #4 before BNR (pre-2006) and after BNR (i.e., 2006 – 2020), and the range of concentrations in 2020. The most stringent applicable guidelines are provided in Table 3-3 for context, but it is important to note that these guidelines apply to the receiving environment (i.e., groundwater and surface water) and not Clay Valve #4. However, they show that levels of ammonia-N, nitrate-N, and nitrite-N generally have remained low since the BNR system was brought online.

**Table 3-3**  
**Average and 2020 Nitrogen Concentrations in Clay Valve #4**

Nitrogen Form	Average Concentration before BNR <sup>1</sup> (mg/L)	Average Concentration after BNR <sup>2</sup> (mg/L)	Range of Concentrations in 2020 (mg/L)	Guideline for Comparison Purposes Only
Ammonia-N	9.8	0.517	0.699 – 1.100	DW – none AL – 0.688 to 18.5 mg/L <sup>3</sup>
Nitrate-N	2.0	1.15	0.231 – 0.676	DW – 10 mg/L AL – 32.8 mg/L
Nitrite-N	0.17	0.036	0.128 – 0.133	DW – 1 mg/L AL – 0.06 to 0.60 mg/L <sup>4</sup>
Total Nitrogen	13.9	2.87	2.23 - 2.74	None

Notes: BNR = Biological Nutrient Removal

<sup>1</sup> Average based on all available pre-2006 data, which include two samples from 1979 and samples from 1996 to 2005.

<sup>2</sup> Average calculated based on data from 2006 to 2020.

<sup>3</sup> Guideline varies based on the water pH and temperature; BC AL acute maximum guideline range is shown.

<sup>4</sup> Guideline varies based on the chloride concentration; BC AL acute maximum guideline range is shown.

### Nitrogen (in Groundwater)

In 2020, ammonia-N, nitrite-N, and nitrate-N in groundwater met all applicable guidelines, except for nitrate-N in MW11-02. Nitrite-N was detected only in MW11-02, but the concentration was below the guideline maximums. Ammonia-N was detected only in MW-2, MW-5, and WTN 24991, but concentrations remained below the BC AL acute guideline and CSR AW, both of which are calculated based on the sample pH and temperature. There are no DW, IW, or LW guidelines for ammonia-N.

As described above, nitrogen in groundwater is most readily found as nitrate. Nitrate occurs in groundwater at low levels naturally, but can be present as the result of anthropogenic sources. The local baseline concentration of nitrate is difficult to determine due to the long history of development and agriculture in the area; however, natural processes typically result in nitrate concentrations of less than 1 mg/L in groundwater in BC, and concentrations above 3 mg/L usually suggest anthropogenic effects (MOE 2007).<sup>10</sup> Key anthropogenic sources of nitrate include agricultural

<sup>10</sup> This finding is supported by a compilation of 11,660 results for nitrate-N across the Cordillera region (including most of BC, part of Alberta, and part of the Yukon and Northwest Territories), which had a median nitrate-N concentration of 0.05 mg/L. In addition, over 98% of the samples had a nitrate-N concentration of less than 10 mg/L (Rivera 2014). Generally, nitrate-N values greater than 3 mg/L are considered to indicate contribution from human activities (Rivera 2014).

activities (e.g., cattle manure, fertilizers) and human wastewater (e.g., from municipal treatment systems and private septic systems) (Health Canada 2013).

The applicable guidelines/standards for nitrate-N range from 10 mg/L (DW MAC and CSR DW) to 400 mg/L (CSR AW). In 2020, nitrate-N concentrations in all wells (Figure D-6) met the guidelines/standards except MW11-02, which had a concentration of 10.1 mg/L in September. As this represented an increase relative to the 2019 concentration of 8.98 mg/L, Associated sampled the well again in December, and the nitrate-N concentration was 8.84 mg/L (below guidelines, but still considered elevated). As reported previously, nitrate-N concentrations in MW11-02 had exceeded the DW MAC relatively consistently since monitoring began. The concentration of nitrate-N in this well has consistently decreased since early 2012, when the measured concentration was approximately 20 mg/L. In 2019, concentrations had decreased to a level that meets the DW guideline (i.e., 8.98 mg/L). As noted, the nitrate-N concentration in September 2020 was again slightly above the DW MAC.

The elevated nitrate-N in MW11-02 is not likely related to the use of reclaimed water, given that it is notably higher than at any other monitoring location and higher than the nitrate-N in Clay Valve #4 (which ranged from 0.231 to 0.676 mg/L in 2020; Table 3-3). The well is downgradient from the PRT commercial tree nursery, and elevated nitrate-N concentrations may be an indication of the use of nitrogen-based fertilizers in the nursery's operations. The general decrease in concentrations since 2011 is a positive sign. We understand from conversations with PRT that they have expanded in recent years and therefore require more liquid fertilizer, and are aware of the elevated nitrate concentrations (O. Bonnefoy, personal communication, 2021). As part of water and nutrient management, PRT has been making improvements to their irrigation management plan. Improvements include source control (i.e., testing the water before adding nitrogen fertilizer) and adding a 245 m long ditch downslope of their operations, which is intended to capture runoff (O. Bonnefoy, personal communication, 2021). The ditch has been planted with willows in an effort to extract water and nutrients from the runoff before it infiltrates below the rooting zone. Continued monitoring of MW11-02 over the next few years will help to assess the effectiveness of the irrigation management plan.

Nitrate-N concentrations in all other wells in 2020 met guidelines, but similar to previous years, some wells had concentrations that are likely not naturally occurring (i.e., above 3 mg/L): DMW-1 (3.15 mg/L) and DMW-5 (4.92 mg/L). Nitrate-N in DMW-1 has fluctuated from 2.29 mg/L (in 2012) to 3.15 mg/L (in 2020). Concentrations have increased slightly since monitoring began in 2011, but have not exceeded guidelines. Nitrate-N in DMW-5 has historically met guidelines but increased steadily from <1 mg/L in 2011 to >6 mg/L in 2017, as reported in Associated (2019), then decreased in 2018 and 2019, followed by an increase in 2020. As mentioned previously, this well is located in a cattle pasture (i.e., known sources of manure and urea). Nitrate-N in DMW18-1 exceeded DW MAC in 2018 (11.9 mg/L in June 2018 only) (Associated 2019), but concentrations have decreased consistently since that time and met the applicable guidelines in 2019 and 2020.

As noted, the nitrate-N concentrations in MW11-02, DMW-1, and DMW-5 (i.e., > 3 mg/L) are not considered representative of natural conditions. The spatial variability of these exceedances across the study area suggests there are localized sources contributing to above-background levels. Testing of additional domestic wells on the other side of the valley (i.e., where reclaimed water is not used) in 2018 found one well with a nitrate-N concentration of 21 mg/L (Associated 2019), which also suggests localized sources. DMW-3, which is outside the area of reclaimed water use, typically has lower levels of nitrate (ranged from 0.156 mg/L to 1.01 mg/L), but this well is also located upgradient of the agricultural land along the valley walls.

As described above, total nitrogen concentrations in the reclaimed water entering the irrigation system at Clay Valve #4 have decreased since BNR was brought online, and recent total nitrogen levels (2.23 - 2.74 mg/L in 2020) are much lower than the nitrate-N levels in MW11-02 and DMW-5. However, nitrogen flux (movement) through groundwater can vary depending on crop cover, soil texture and organic matter content, and geology and infiltration rate. In some cases, nitrate that infiltrates below the rooting zone can remain in a groundwater system for a long time. Although the reclaimed water may be contributing somewhat to the detected nitrate levels, the majority of the nitrate in these wells is likely the result of land use activities (i.e., horticulture, livestock, local residential septic fields, or lawn care products).

### 3.2.2.3 Phosphorus

The MWR does not set standards for phosphorus for reclaimed water. There is no Health Canada DW or CSR DW for phosphorus, but the BC DW AO is 0.01 mg/L for total phosphorus. According to ENV (2020a) and the supporting documentation for this AO, the guideline for phosphorus applies to lakes that are used as a source of drinking water, to reduce the risk of algal blooms in surface water (MOE 2001a). No guidelines are recommended for streams used for drinking water, and no discussion on groundwater is included (MOE 2001a). Therefore, BC DW AO is not inferred to apply to groundwater (where algal blooms are not a concern). There are also no LW (BC or CSR), IW (BC or CSR), or CSR AW standards for total or dissolved phosphorus.

The BC AL guideline for phosphorus is 0.015 mg/L (total and dissolved phosphorus). The guideline documents do not specifically state that they apply only to surface water, but phosphorus is generally a concern for surface waterbodies. The BC AL is the only guideline applied to phosphorus in groundwater for this report, for comparative purposes. However, this is considered a conservative approach. As a comparison, at ground dispersal sites (septic fields), inorganic phosphorus (orthophosphate) readily adsorbs onto soil particle surfaces, reducing the likelihood of transport in groundwater.

In 2020, total and dissolved phosphorus concentrations (Figures D-7 and D-8) exceeded the BC AL of 0.015 mg/L in DMW-1, DMW-4, DMW-5, MW-2, MW11-02, and WTN 24991. Similar to previous years, the highest concentrations of total phosphorus and dissolved phosphorus were in DMW-4 at 0.400 mg/L and 0.398 mg/L, respectively. Historically, the highest concentrations of dissolved phosphorus have been in DMW-4, but concentrations have remained relatively consistent over the 2011-2020 monitoring period. With the exception MW11-02, which has shown notable fluctuations in total phosphorus only, concentrations of both total phosphorus and dissolved phosphorus have remained relatively steady in all wells.

Total phosphorus in the reclaimed water at Clay Valve #4 in 2020 ranged from 0.908 to 1.13 mg/L, and dissolved phosphorus ranged from 0.84 to 1.1 mg/L, similar to previous years.

### 3.2.2.4 Metals

Exceedances of the guidelines for metals have occurred since groundwater testing began in 2011. Metals are not typically contaminants of concern in most municipal wastewaters, and the MWR sets no specific standards for metals in treated effluent. There are two possible mechanisms by which irrigation with treated effluent could influence metal concentrations in groundwater:

1. Metals can be added to groundwater if they are present at elevated levels in the irrigation water. To assess this condition, the City has been testing metals periodically in Clay Valve #4 samples since 2016.
2. Metals that are naturally present in the soil can be mobilized by the infiltration of irrigation water, and over time may result in elevated concentrations in groundwater. Note, however, that the average pH of the irrigation water (at Clay Valve #4) has been typically near-neutral, and heavy metal mobilization generally

tends to be more significant when the pH of the water is lower (more acidic) than the observed range (USGS 2016). Some metals such as selenium will mobilize more readily when the pH is higher (more alkaline) (WHO 2003).

Exceedances of dissolved metals guidelines are common in BC, and many metals are naturally occurring. Obtaining representative upgradient samples to assess the range of background levels is difficult, as described in Section 2.

In 2020, dissolved metals that exceeded the applicable guidelines included chromium, cobalt, lithium, manganese, molybdenum, selenium, and uranium. All of these are attributed, at least in part, to background concentrations, as discussed below.

- **Dissolved chromium** (Figure D-9) met the DW and LW guidelines and standards (both 0.05 mg/L) in all wells in 2020. The concentration in DMW-1 (0.00610 mg/L) exceeded the BC IW and CSR IW (0.0049 and 0.005 mg/L) and the BC AL (0.001 mg/L), and the concentrations in MW11-02 (0.00187 mg/L), WTN 39421 (0.00210 mg/L), and DMW18-1 (0.00159 to 0.00202 mg/L in 2020) exceeded the BC AL only, but none exceeded the CSR AW standard of 0.01 mg/L.<sup>11</sup> These results are consistent with findings from previous monitoring programs. Historically, the highest chromium concentration has been detected in DMW-1, where concentrations have fluctuated around 0.006 mg/L. In the other wells, concentrations have remained below 0.003 mg/L. Chromium concentrations in groundwater depend on bedrock-groundwater interactions and the AL and IW guideline for chromium is low; therefore, it is relatively common to find naturally occurring concentrations in groundwater near the guideline. Also, chromium in Clay Valve #4 has been consistently below the detection limit of 0.0005 mg/L since it was first tested in 2016.
- **Dissolved cobalt** (Figure D-10) exceeded the BC DW MAC (0.001 mg/L) in MW11-02 (0.00293 mg/L) in 2020. The BC DW MAC is a new guideline for cobalt, as of the 2020 guideline update (ENV 2020a).<sup>12</sup> Health Canada does not specify a DW MAC for cobalt. The CSR DW is also 0.001 mg/L, but ENV has set a interim background groundwater concentration of 0.02 mg/L for cobalt at all sites in BC; therefore, the concentration at MW11-02 is not considered to exceed the CSR DW. The cobalt concentration at MW11-02 was below the CSR IW and BC IW (0.050 mg/L), the CSR LW and BC LW (1.0 mg/L), the BC acute AL (0.110 mg/L), and the CSR AW (0.040 mg/L). Similar to other parameters, cobalt has historically been elevated in MW11-02 with respect to the other wells, and concentrations have decreased since 2011. All other wells remained below the applicable guidelines and standards, and cobalt in Clay Valve #4 in 2020 ranged from 0.00029 to 0.00034 mg/L in 2020.
- **Dissolved manganese** (Figure D-11) exceeded the DW MAC (0.12 mg/L), DW AO (0.02 mg/L), and IW (BC and CSR; 0.200 mg/L) in DMW-5. The concentration in DMW-3 exceeded the DW MAC and AO, but not the BC or CSR IW. Concentrations in MW-2, MW-5 and WTN 24991 exceeded the DW AO guideline, but not the DW MAC or IW guidelines, and none of the wells exceeded the CSR DW (1.5 mg/L). The exceedances may reflect natural conditions, as such exceedances are common for groundwater throughout the BC Interior. Although concentrations of manganese in DMW-5 have fluctuated, they have consistently been above guidelines since testing began in 2011. Since testing of manganese began in Clay Valve #4 in 2016, dissolved manganese has ranged from 0.0114 to 0.224 mg/L.

<sup>11</sup> There are separate guidelines for Cr(III) and Cr(VI). Because speciated chromium was not tested as part of the program, the most stringent value (Cr(III)) was used for comparison purposes.

<sup>12</sup> According to ENV (2020a), the new BC guideline for cobalt is a health-based guideline, based on the 2019 United States Environmental Protection Agency Regional Screening Levels for tapwater.

- Dissolved molybdenum** (Figure D-12) exceeded the CSR IW<sup>13</sup> (0.01 mg/L) but not the BC IW (0.05 mg/L) or any of the LW, DW, or AL guidelines in DMW18-1, DMW-4, DMW-5, MW-2, and WTN 24991 in 2020. Dissolved molybdenum appears to be trending upward over the past two years at DMW18-1 and possibly WTN 24991, in contrast to the other wells where it has remained more stable. Dissolved molybdenum has been lowest in MW-5 and Clay Valve #4 (0.0031 to 0.0053 mg/L, over the period of record).
- Dissolved lithium** (Figure D-13) exceeded the CSR DW (0.008 mg/L) in DMW-1, DMW-3, DMW-4, DMW-5, DMW18-1, and MW11-02. Neither Health Canada nor the BC DW specify a limit for lithium in drinking water; however, the CSR DW limit is 0.008 mg/L. No wells exceeded IW, LW, or AL guidelines, which range from 0.75 mg/L to 5.0 mg/L. Lithium concentrations in all wells have remained relatively consistent over time, with the exception of DMW-5 in which lithium increased between 2011 and 2015. Since 2016, it has remained relatively stable at approximately 0.06 mg/L. In Clay Valve #4, dissolved lithium has ranged from 0.00804 to 0.0135 mg/L. In 2019, ENV (2019c) released Technical Bulletin 3, which provides regional background concentrations of arsenic, lithium, selenium, uranium, and vanadium for four regions in BC. For the Thompson-Okanagan Region<sup>14</sup>, the background concentration for lithium is 0.096 mg/L (compared to the CSR DW of 0.008 mg/L). **Concentrations of dissolved lithium in all wells in 2020 remained below the Thompson-Okanagan Regional background concentration (ENV 2019c).** This finding, and the presence of lithium above guidelines in four of five wells tested on the north side of the valley in 2018, suggests that dissolved lithium concentrations are likely naturally occurring (Associated 2019).
- Dissolved selenium** (Figure D-14) exceeded the BC DW MAC, CSR DW, and BC IW (0.01 mg/L) and the BC AL (0.002 mg/L) in four wells: DMW-1, DMW18-1, MW11-02, and WTN 39421. DMW-1 and WTN 39421 also exceeded the CSR IW and AW of 0.02 mg/L and the CSR LW of 0.03 mg/L. All concentrations were below Health Canada's DW MAC of 0.05 mg/L; however, the BC DW MAC of 0.01 mg/L is the recommended drinking guideline for BC (MOH 2017). Concentrations of dissolved selenium in DMW18-1 have decreased since the well was added to the program in 2018, and MW11-02 has decreased over the same time period. Concentrations have also decreased in DMW-3, which is outside the reclaimed water use area, and MW-2, which is within the reclaimed water use area. In other wells, selenium has remained relatively stable.  
 For the Thompson-Okanagan Region,<sup>14</sup> the background concentration for selenium is 0.107 mg/L (compared to the CSR DW of 0.010 mg/L). **Concentrations of dissolved selenium in all wells in 2020 remained below the Thompson-Okanagan Regional background concentration (ENV 2019c).** The highest concentration in 2020 was in DMW-1, at 0.0376 mg/L. Additionally, selenium concentrations in Clay Valve #4 have remained below guidelines with concentrations ranging from <0.00050 mg/L to 0.00077 mg/L since 2011, and at lower concentrations than in the groundwater samples. This suggests selenium is likely naturally occurring in the Vernon area.
- Dissolved uranium** (Figure D-15) exceeded the DW MAC and CSR DW (0.02 mg/L), IW (BC and CSR; 0.010 mg/L), and BC AL (0.0085 mg/L) in DMW-1, DMW-5, and MW11-02 in 2020. Concentrations in DMW18-1 exceeded the IW (BC and CSR) and BC AL, but not the DW MAC, and concentrations in MW-2 exceeded only the BC AL. Concentrations have been generally consistent since 2011 except in DMW-1 and DMW-5, where they have increased (0.0134 to 0.0223 mg/L in DMW-1 and 0.0203 to 0.0304 mg/L in DMW-5). Conversely, in MW-2 and DMW18-1, uranium has decreased. Uranium in MW11-02 has fluctuated from below the MAC of 0.02 mg/L to as high as 0.0669 mg/L; MW-2 has had similar fluctuations as MW11-02 but of smaller magnitudes. In other wells, uranium has remained relatively stable.

<sup>13</sup> The CSR molybdenum standard is 0.010 – 0.030 mg/L, which varies with crop, soil drainage, and molybdenum-copper ratio, and refers to a note to 'consult a director for further advice' (B.C. Reg. 253/16).

<sup>14</sup> The Thompson-Okanagan Region encompasses the general area between Kamloops and Kelowna. Provincial mapping (iMap BC) shows the area in which these background concentrations apply, and includes part of the reclaimed water use area.

The uranium exceedances may be the result of localized groundwater reacting with the parent rock material in the soil, causing dissolution of uranium. For the Thompson-Okanagan Region, the background concentration for dissolved uranium is 0.084 mg/L (compared to the CSR DW of 0.020 mg/L). **Concentrations of dissolved uranium in all wells in 2020 remained below the Thompson-Okanagan Regional background concentration (ENV 2019c).** Additionally, uranium concentrations in Clay Valve #4 have remained below guidelines ranging from 0.00159 mg/L to 0.00306 mg/L (since 2011) and at lower concentrations than in the groundwater samples.

### 3.2.3 Quality Assurance and Quality Control

RPD values were calculated from duplicate sample set collected at MW-2.<sup>15</sup> Once values less than five times their respective detection limit were removed, the average RPD value was 3% and all RPD values met the 20% threshold.

The results from the trip blank sample was consistent with the results expected for deionized water. All parameters were non-detect, with the exception of total sodium (0.02 mg/L) and total tin (0.00006 mg/L). Both these detected results are within 5x their respective detection limits.

Further information about the laboratory's QA/QC is provided in the laboratory reports (Appendix E).

---

<sup>15</sup> Duplicate samples collected directly by the City from Bailey Springs and Clay Valve #4 are assessed by the City, and not included in this report.

## 4 BAILEY SPRINGS WATER QUALITY

### 4.1 Methods

#### 4.1.1 Sampling Location, Frequency, and Methodology

Section 8.9 of the OC requires monthly sampling of Bailey Springs. In 2020, samples from Bailey Springs were collected monthly by City staff, and submitted to CARO Analytical Services for analysis of the following parameters:

- pH, conductivity, chloride, and sodium;
- nitrogen (ammonia-N, nitrate-N, nitrite-N, TKN, organic nitrogen, and total nitrogen);
- phosphorus (orthophosphate, dissolved phosphorus, total phosphorus);
- total coliforms and fecal coliforms; and
- sulphate (January through June).

The analytical list includes the parameters required under Section 8.9 of the OC, plus sulphate, which the City tests periodically to more closely align with the groundwater analytical program. Testing of dissolved metals was discontinued in 2020, based on the recommendations of Associated (2020). Metals are not required by the OC, and based on the results of the previous monitoring programs, there does not appear to be an effect on metals in Bailey Springs from the reclaimed water program (Associated 2020).

Each year, the City provides Associated with the water quality results from Bailey Springs for inclusion in the water quality database, and Associated compares the data to applicable guidelines and historical data (Section 4.1.2).

#### 4.1.2 Comparison to Guidelines and Historical Data

To assess potential risk to aquatic life receptors, results from Bailey Springs were compared with the BC AL (ENV 2019a, 2020b). CSR AW standards were not applied to surface water, as they are designed for groundwater that flows to surface water. For this reason, in many cases, the CSR AW standards apply a dilution factor and are therefore less stringent than the BC AL. The BC AL guideline represents the levels of constituents that are considered protective for aquatic life (e.g., in a stream).

For some parameters, the BC AL guideline includes two maximum levels: chronic (or long-term average) and acute (or short-term maximum). Compliance with chronic guidelines is typically assessed by calculating the average concentration over a specified period (e.g., 5 samples in 30 days). The chronic guidelines are more stringent than the acute guidelines because they are designed to protect aquatic life from ongoing exposure. The individual measured concentrations in Bailey Springs were assessed against both the chronic and acute AL guidelines for screening purposes.

Results from Bailey Springs were also compared with the BC Recreational Water Quality Guidelines (BC REC; ENV 2019b), as the outflow to Kalamalka Lake is located next to a commercial campground, beach area, and boat launch (Figure 1-1).

### 4.2 Results and Discussion

#### 4.2.1 Aquatic Life Guideline Exceedances

Table 4-1 lists the parameters that exceeded the BC AL and/or BC REC guidelines in the 2020 surface water samples from Bailey Springs. All results, tabulated and compared with guidelines, are included in Appendix C.

**Table 4-1**  
**Exceedances of BC Aquatic Life and/or Recreation Guidelines in Bailey Springs in 2020**

Parameter	Bailey Springs
Chloride	X
Phosphorus (dissolved)	X
Phosphorus (total)	X

Notes: X indicates an exceedance of the applicable guidelines, differentiated as follows:

X = exceedance of the applicable recreation guidelines (BC REC)

■ = exceedance of the applicable aquatic life guidelines (BC AL acute and/or chronic)

#### 4.2.2 Comparison to Historical Data

Bailey Springs has been tested since 1976; therefore, there is a significant historical dataset. The following sections provide a brief interpretation and historical comparisons for parameters that exceeded guidelines in Bailey Springs in 2020 and/or are considered key parameters of interest for reclaimed water. Plots showing temporal changes in concentrations for these parameters are included in Appendix D. Historical data are found in Associated (2018).

##### 4.2.2.1 Chloride

In 2020, chloride concentrations at Bailey Springs met the BC acute AL guideline of 600 mg/L, and concentrations met the BC chronic AL guideline of 150 mg/L during all months except February (152 mg/L). There are no BC REC guidelines for chloride. Historically, chloride concentrations at Bailey Springs increased from 1980 (<50 mg/L) to 2013 (239 mg/L) (Figure D-16). However, since 2013, concentrations have decreased (Figure D-17) and in 2020, concentrations ranged from 107 mg/L (in April) to 152 mg/L (in February). Historically, chloride concentrations have typically exceeded the BC chronic AL during at least one month each year.

The sample point for Bailey Springs is downstream of where the creek crosses Highway 97 and is within an agricultural area. Seasonal trends in chloride at Bailey Springs in recent years have shown that lower concentrations are typically found during summer when irrigation rates are at their highest levels. In 2020, that trend continued, with the highest chloride concentrations occurring in November, January, February, and March, which corresponds with the timing for the use of road salt.

As a comparison, chloride in the irrigation water at Clay Valve #4, which was tested in 2003, 2015, 2016, 2017, 2018, 2019, and 2020, has remained relatively consistent and ranged from 75.9 to 175 mg/L, with an average of 94.5 mg/L. Concentrations appear to have remained consistent since testing began in 2015, but there are no pre-2015 data for comparison, as the OC does not require the City to test for chloride at Clay Valve #4.

##### 4.2.2.2 Nitrogen

In 2020, nitrite-N was not detected in Bailey Springs.

Nitrate-N was detected in all samples and ranged from 0.031 mg/L (in August) to 1.18 mg/L (in March), but all concentrations remained below the BC chronic and acute AL of 3.0 and 32.8 mg/L, respectively, and the BC REC guideline of 10 mg/L. The highest concentrations in 2020 were in February, March, and April 2020. Nitrate-N concentrations have been relatively consistent in Bailey Springs over time (Figure D-18).

Ammonia-N in Bailey Springs was not detected in February, March, April, May, August, or December. It was detected in the other six months, and ranged from 0.029 mg/L (in January) to 0.166 mg/L (in July). The BC AL chronic and acute guidelines for ammonia-N vary based on the water pH and temperature. Temperature data were not available, but based on the maximum pH of 8.52 in 2020 (i.e., most conservative approach), the most stringent BC AL chronic and acute guidelines are 0.261 mg/L and 1.91 mg/L; therefore, all 2020 results met guidelines. There are no BC REC guidelines for ammonia-N. Similar to nitrate, concentrations of ammonia-N have remained relatively stable over the period of record, although concentrations have increased slightly since 2017 (Figure D-19).

#### 4.2.2.3 Phosphorus

Phosphorus is not toxic to aquatic life in the concentrations found in municipal effluent; however, when compared to other macronutrients required by aquatic plants, phosphorus is the least abundant and commonly the first nutrient to limit biological productivity (e.g. algal growth). It is a concern primarily for lakes, where an increase in phosphorus inputs can lead to increased algal growth that can sometimes lead to reduced DO levels in water to levels that are harmful to aquatic life. There are no BC AL or REC guidelines for phosphorus in streams because there are other factors (e.g., flow velocity, light, temperature, and invertebrate grazing pressure) that affect algal growth.

Bailey Springs flows into Kalamalka Lake, and therefore the concern is whether the spring is contributing phosphorus-elevated water to the lake. The BC AL for total and dissolved phosphorus applies to lakes, and the guideline states that it is not possible to specify a single acceptable phosphorus concentration to protect aquatic life, but suggests a range of 0.005 to 0.015 mg/L (ENV 2019a). Furthermore, ENV has proposed a Water Quality Objective (WQO) for total phosphorus in Kalamalka Lake of 0.008 mg/L (MOE 2001b). The BC REC guideline for total and dissolved phosphorus in lakes is 0.01 mg/L.

In 2020, total and dissolved phosphorus in Bailey Springs exceeded the Kalamalka Lake WQO, BC AL, and BC REC during all months of the year. Total phosphorus ranged from 0.123 mg/L (in May) to 0.280 mg/L (in October), and dissolved phosphorus ranged from 0.095 mg/L (in May) to 0.219 mg/L (in October). Total and dissolved phosphorus in Bailey Springs increased between 1976 and 2001; since that time, concentrations have been more stable (Figure D-20 and D-21).

Prior to 2006, when the treatment process was improved to include BNR, the average concentration of total (Figure D-22) and dissolved (Figure D-23) phosphorus in the irrigation water at Clay Valve #4 was 3.66 and 3.26 mg/L, respectively. Since 2006, total and dissolved phosphorus concentrations have averaged 1.41 and 1.23 mg/L, respectively. In 2020, total phosphorus in Clay Valve #4 ranged from 0.908 to 1.13 mg/L, and dissolved phosphorus ranged from 0.840 to 1.10 mg/L. These levels are similar to 2019.

The increasing trend noted in total and dissolved phosphorus in Bailey Springs from 1976 to the early 2000s may be related to reclaimed water use, as concentrations in Clay Valve #4 water were historically higher, but the improved treatment processes since 2006 may have contributed to the phosphorus concentrations in Bailey Springs levelling off over the past 10 years. However, it is difficult to ascertain the source of the phosphorus in Bailey Springs in more recent years, as it is in the reclaimed water use area and downstream of MacKay Reservoir, but also within an agricultural area, where cattle are present and farmers may use phosphorus fertilizers.

#### 4.2.2.4 Coliform Bacteria

Coliform bacteria are not tested in the groundwater wells because they are not considered a likely indicator of irrigation with reclaimed water. When present in the irrigation water, they are generally removed via subsurface

filtration before reaching the groundwater table. When coliforms are found in groundwater, they are more likely related to a local source (e.g., a leaking septic system or influence from surface water), or they may have been introduced from the soil bacteria during drilling.

Fecal coliforms and total coliforms are tested by the City at Bailey Springs and Clay Valve #4, as per the requirements in the OC. There is no BC AL guideline for fecal coliforms or total coliforms, unless the water is used for growing and harvesting shellfish (ENV 2019a). There is also no BC REC guideline for fecal or total coliforms. The BC REC guideline for *E. coli* is a maximum of  $\leq 400$  CFU/100 mL and a geometric mean (based on a minimum of 5 samples) of  $\leq 200$  CFU/100 mL. Testing of *E. coli* at Bailey Springs is not required under the OC.<sup>16</sup>

In 2020, fecal coliforms in Bailey Springs ranged from 1 CFU/100 mL (in January and April) to 687 CFU/100 mL (in July) (Figure D-24). Total coliforms ranged from 278 CFU/100 mL (in February) to 9,210 CFU/100 mL (in August and September). If it was assumed that all the fecal coliforms present are *E. coli*, concentrations in July (687 CFU/100 mL) and September (488 CFU/100 mL) would have exceeded the BC REC guideline, but the geometric mean for the year (33 CFU/100 mL) met the guidelines. Coliforms are commonly found in surface water, especially where agriculture activity and cattle are present, as at Bailey Springs.

In 2020, fecal coliforms were non-detectable ( $< 1$  CFU/100 mL) in all Clay Valve #4 irrigation water samples except June (1 CFU/100 mL). Total coliforms were non-detect in all samples except May (3.1 CFU/100 mL) and June (1 CFU/100 mL). The OC requires disinfection such that fecal coliforms are  $< 2.2$  CFU/100 mL for irrigation water in unrestricted public access areas (MOE 2008). These limits were met in 2020.

Given that the water from Clay Valve #4 is disinfected prior to use and that coliform counts were not detected or very low, the fecal coliforms in Bailey Springs are not attributed to the use of reclaimed water.

---

<sup>16</sup> Historically, guidelines were based on fecal coliforms, which were considered an indicator of disease risk from pathogenic bacteria; more recently, guidelines have shifted to specify *E. coli* (MOE 2001c).

## 5 SUMMARY

On behalf of the City of Vernon, Associated completed the 2020 Groundwater Monitoring Program for the City's reclaimed water irrigation operations to meet Section 8.6 of OC 12215. The monitoring program in 2020 followed the program completed in previous years, and consisted of groundwater sampling once in 2020 (late September) from a network of monitoring wells and domestic wells, comparing the results to applicable water quality guidelines and historical data, and preparing the annual monitoring report (this document).

Under Section 8.9 of the OC, the City is also required to collect monthly samples from a surface watercourse (Bailey Springs). Data from those samples, which were collected directly by the City, were provided to Associated for inclusion in the 2020 Groundwater Monitoring Program report. Data from Clay Valve #4, which represent the quality of the water prior to irrigation, were also provided to Associated to aid in interpretation.

### 5.1 Conceptual Model of Groundwater Flow

The conceptual model of groundwater flow in the study area can be divided into two parts: flow south of the Commonage Ridge, and flow north of the Commonage Ridge. Groundwater flow south of this hydraulic divide is towards the south and is predominantly constrained to shallow surficial sediments and fractured bedrock. Groundwater eventually discharges to Kalamalka Lake. Flow north of the Commonage Ridge is more complex. Groundwater recharge occurs around Bench Row Road, as evidenced by the large influx of water at DMW-3 during freshet. Groundwater then flows towards the north where it enters a deeper flow regime. Groundwater then recharges the unconfined and confined valley aquifers before finally discharging to Vernon Creek and/or Okanagan Lake. Flow on the hillside is complicated by lithological units that are not laterally extensive, and perched aquifers can exist on top of some units with lower permeability.

The water chemistry of the downgradient wells further suggests variable flow paths; all of the wells along Okanagan Avenue show variable concentrations of constituents and variable water types. Data are inconsistent and, in some cases, counter-intuitive. For example, deeper wells indicate younger groundwater, which suggests a shorter residence time in the aquifer, so it is possible that there is a pathway of high transmissivity (high porosity) at deeper depths. If the younger water was associated with reclaimed water irrigation, we would expect to see higher concentrations of nitrate-N and chloride. However, these constituents are lowest in some of these wells. The tri-linear diagrams (Appendix B) show several water types in the study area, which indicates that aquifers and lithological units are not connected throughout the study area.

### 5.2 Groundwater Quality

The complex hydrogeological setting makes it difficult to assess background water quality. Upgradient monitoring wells would need to be installed in the bedrock (like DMW-3; the only current upgradient well), which can show different chemistry than wells installed in unconsolidated aquifers because the unconsolidated sediments are very thin in the areas upgradient of the irrigation areas, and might not have sufficient water for sampling. However, even though background wells are difficult to install outside of the irrigation area and in the unconsolidated deposits, there are several ways in which the results can be interpreted. Given the available water quality data, the monitoring program is likely sufficient to identify potential widespread impacts on groundwater.

#### Notable Exceedances

Potential groundwater receptors include downgradient domestic wells and aquatic life in surface waterbodies to which groundwater may discharge. To address potential risks to these receptors, groundwater results were compared with

drinking water, aquatic life, irrigation, and livestock guidelines. Of highest concern are parameters that exceeded a human health-based (MAC) drinking water guideline in groundwater:

- Cobalt (MW11-02);
- Manganese (DMW-3 and DMW-5);
- Lithium (DMW-1, DMW-3, DMW-4, DMW-5, MW11-02, and DMW18-1);
- Nitrate (MW11-02);
- Selenium (DMW-1, MW11-02, WTN 39421, and DMW18-1); and
- Uranium (DMW-1, DMW-5, and MW11-02).

**Although it is difficult to assess background groundwater quality, it is unlikely that these exceedances are related to reclaimed water use.** Cobalt, lithium, selenium, and uranium concentrations were all below regional background concentrations established for the Thompson-Okanagan Region, which suggests that these parameters are naturally occurring in the Vernon area. Furthermore, the concentrations are lower in Clay Valve #4 (reclaimed water) than in the groundwater samples. Although regional background concentrations have not been established for manganese, manganese is a common occurrence in BC, and also unlikely related to reclaimed water use from a municipal wastewater facility.

Nitrate-N at MW11-02 (10.1 mg/L) exceeded the DW MAC of 10 mg/L during the September sampling event. The well was resampled in December 2020 and the nitrate-N concentration (8.84 mg/L) met guidelines. The elevated nitrate-N in MW11-02 is not likely related to the use of reclaimed water, given that it is notably higher than at any other monitoring location and higher than the nitrate-N in the water entering the irrigation system at Clay Valve #4. The well is downgradient from the PRT commercial tree nursery, and elevated nitrate-N concentrations may be an indication of the use of nitrogen-based fertilizers in the nursery's operations. The nitrate-N concentrations in MW11-02 have generally decreased since 2011 but remain at around 8 to 10 mg/L. PRT is managing nitrogen releases from their operation through a combination of source control and a natural system to removal nitrate from runoff, consisting of a ditch planted with willow that intercepts runoff (O. Bonnefoy, personal communication, 2021). However, challenges evidently remain and monitoring of MW11-02 will continue to assess effectiveness.

Nitrate-N did not exceed in any other wells in 2020, but consistent with previous years, concentrations in some wells are more than what is likely to occur naturally (i.e., > 3 mg/L), particularly in DMW-1 and DMW-5. A minor component of the elevated concentrations may be due to the City irrigation program; however, the spatial variability of these above-background nitrate-N levels across the study area indicates that other localized sources are likely more important.

### **Notable Changes in Groundwater Quality**

In 2020, chloride, fluoride, sodium, and nitrate-N in DMW-5 generally remained consistent with the 2019 data, suggesting that they may be stabilizing. DMW-5 is located in a cattle pasture and downgradient of Highway 97. There is no available well log and the well depth is unknown, but the well is flowing artesian. However, given the number of potential sources and lack of well information, the specific causes of exceedances in this well are unclear.

Other notable differences from previous years are as follows:

- Nitrate in DMW18-1 has decreased since it was above guidelines in 2018, and did not exceed guidelines in 2020.
- Chloride has increased in DMW-1 since monitoring began, but remains within guidelines, whereas chloride has decreased in DMW-3, DMW-4, MW-2, and DMW18-1.

- Fluoride has increased in DMW-3 and DMW-5.
- Selenium has generally decreased in MW-2 since 2011 and in DMW18-1 since 2018 (when it was added to the program). It has also decreased in DMW-3, which is outside the reclaimed water use area.
- Uranium had previously been flagged as increasing in DMW-1 and DMW-5, but recent data suggest it may be stabilizing. Uranium concentrations have decreased in MW-2 and DMW18-1.

### 5.3 Bailey Springs

Similar to previous years, chloride marginally exceeded the more stringent BC chronic AL in February but remained below the acute guidelines and the chronic guidelines during all other months. Chloride concentrations are typically higher in winter months.

Fecal coliforms are tested in Bailey Springs monthly, as per the OC, but the updated ENV guidelines are for *E. coli*. If all of the fecal coliforms present are assumed to be *E. coli*, then the BC REC maximum guideline of 400 CFU/100 mL was exceeded in July and September. However, it is unlikely these are related to reclaimed water use. Coliforms are commonly found in surface water, especially where agriculture activity and cattle are present, as at Bailey Springs, and the reclaimed water is disinfected prior to use.

Similar to previous years, dissolved and total phosphorus in Bailey Springs (which discharges to Kalamalka Lake approximately 450 m below the sampling point) consistently exceeded the WQO for Kalamalka Lake during all months. Total and dissolved phosphorus in Bailey Springs increased between 1976 and 2001; since that time, concentrations have been more stable. The improved treatment processes since 2005, which resulted in a reduction in total and dissolved phosphorus, may have contributed to the phosphorus concentrations levelling off over the past 10 years. However, it is difficult to ascertain the source(s) of the phosphorus in Bailey Springs, as it is in the reclaimed water use area and downstream of MacKay Reservoir, but also within an agricultural area, where cattle are present.

## 6 RECOMMENDATIONS

Associated recommends the City continue the monitoring program in 2021 to remain compliant with Sections 8.6 and 8.9 of the OC, with the following additions:

- Continue to test Clay Valve #4 for chloride, sodium, sulphate, fluoride, and dissolved metals monthly during the irrigation season, in addition to the parameters required by the OC. The data will be used to compare to guideline exceedances in groundwater results. Include conductivity and total dissolved solids (TDS) to the analyte list so that the water type can be compared to the monitoring wells via tri-linear diagrams.
- Test Bailey Springs for the same parameters tested in 2020, but include field temperature at the time of sampling. Temperature is needed so that the aquatic life guideline for ammonia (which is calculated based on the sample pH and temperature) can be properly calculated.

City of Vernon

## CLOSURE


This report was prepared for the City of Vernon to document the results of the 2020 Groundwater Monitoring Program for the City's Reclaimed Water Use Program.

The services provided by Associated Environmental Consultants Inc. in the preparation of this report were conducted in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions. No other warranty expressed or implied is made.

Respectfully submitted,  
Associated Environmental Consultants Inc.



2021-MAR-11  
Mike Weldon, P. Geo.  
Project Hydrogeologist



Nicole Penner, P. Ag.  
Environmental Scientist



Marta Green, P. Geo.  
Senior Hydrogeologist



## REFERENCES

Associated Environmental Consultants Inc. (Associated). 2016. Spray Irrigation Groundwater Monitoring 2015 Program. Prepared for the City of Vernon. February 2016.

Associated Environmental Consultants Inc. (Associated). 2017. Spray Irrigation Groundwater Monitoring 2016 Program. Prepared for the City of Vernon. January 2017.

Associated Environmental Consultants Inc. (Associated). 2018. Spray Irrigation Groundwater Monitoring 2017 Program. Prepared for the City of Vernon. March 2018.

Associated Environmental Consultants Inc. (Associated). 2019. Reclaimed Water Irrigation 2018 Groundwater Monitoring Program. Prepared for the City of Vernon. March 2019.

Associated Environmental Consultants Inc. (Associated). 2020. Reclaimed Water Irrigation 2019 Groundwater Monitoring Program. Prepared for the City of Vernon. March 2020.

Associated Environmental Consultants Inc. (Associated). 2021. Hesperia Landfill 2020 Groundwater and Surface Water Monitoring Program. Prepared for the City of Vernon. February 2020.

Bonnefoy, O. Nursery Manager. PRT. 2021. Personal Communication (Telephone call) with Melanie Piorecky of Associated. January 13, 2021.

British Columbia Ministry of Environment (MOE). 2001a. Water Quality Criteria for Nutrients and Algae, Overview Report. Water Management Branch. Last updated August 7, 2001. Available at: <https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/wqgs-wqos/approved-wqgs/nutrients-or.pdf>

British Columbia Ministry of Environment (MOE). 2001b. Phosphorus in the Okanagan Valley Lakes Sources, Water Quality Objectives and Control Possibilities. Water Quality. Water Management Branch. Last updated September 18, 2001. Available at: <http://www.env.gov.bc.ca/wat/wq/objectives/okphosphorus/okphosphorus.html>

British Columbia Ministry of Environment (MOE). 2001c. Water Quality Criteria for Microbiological Indicators. Overview Report. Updated August 7, 2011. Available at: <https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/water-quality-guidelines/approved-wqgs/microindicators-or.pdf>

British Columbia Ministry of Environment (MOE). 2003. Ambient Water Quality Guidelines for Chloride Overview Report. Prepared pursuant to subsection 2(3) of the Environmental Management Act. Available at: <https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/water-quality-guidelines/approved-wqgs/chloride-or.pdf>

British Columbia Ministry of Environment (MOE). 2007. Nitrate in Groundwater. Fact Sheets - Groundwater Quality  
Available at: [http://www.env.gov.bc.ca/wsd/plan\\_protect\\_sustain/groundwater/library/ground\\_fact\\_sheets/pdfs/no3\(020715\)\\_fin2.pdf](http://www.env.gov.bc.ca/wsd/plan_protect_sustain/groundwater/library/ground_fact_sheets/pdfs/no3(020715)_fin2.pdf)

British Columbia Ministry of Environment (MOE). 2008. Operational Certificate ME 12215. Issued to the Corporation of the City of Vernon. Date issued: October 31, 1997. Date amended: January 14, 2008.

British Columbia Ministry of Environment (MOE). 2013a. British Columbia Field Sampling Manual for Continuous Monitoring and the Collection of Air, Air-Emission, Water, Wastewater, Soil, Sediment, and Biological Samples. 2013 Edition. Available at: <https://www2.gov.bc.ca/gov/content/environment/research-monitoring-reporting/monitoring/laboratory-standards-quality-assurance/bc-field-sampling-manual>

British Columbia Ministry of Environment (MOE). 2013b. Ambient Water Quality Guidelines for Sulphate. Technical Appendix. Water Protection & Sustainability Branch. Environmental Sustainability and Strategic Policy Division. Available at: [https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/water-quality-guidelines/approved-wqgs/sulphate/bc\\_moe\\_wqg\\_sulphate.pdf](https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/water-quality-guidelines/approved-wqgs/sulphate/bc_moe_wqg_sulphate.pdf)

British Columbia Ministry of Environment and Climate Change Strategy (ENV). 2019a. British Columbia Approved Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture Summary Report. Ministry of Environment and Climate Change Strategy, Water Protection and Sustainability Branch. August 2019. Available at: [https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/water-quality-guidelines/approved-wqgs/wqg\\_summary\\_aquaticlife\\_wildlife\\_agri.pdf](https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/water-quality-guidelines/approved-wqgs/wqg_summary_aquaticlife_wildlife_agri.pdf)

British Columbia Ministry of Environment and Climate Change Strategy (ENV). 2019b. Recreational Water Quality Guidelines, Guideline Summary. Ministry of Environment & Climate Change Strategy, Water Protection and Sustainability Branch. Available at: [https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/water-quality-guidelines/approved-wqgs/drinking-water-and-recreation/recreational\\_water\\_quality\\_guidelines\\_bcenv.pdf](https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/water-quality-guidelines/approved-wqgs/drinking-water-and-recreation/recreational_water_quality_guidelines_bcenv.pdf)

British Columbia Ministry of Environment and Climate Change Strategy (ENV). 2019c. Technical Bulletin for Contaminated Sites. Regional Background Concentrations for Select Inorganic Substances in Groundwater. Updated July 31, 2019. Available at: [https://www2.gov.bc.ca/assets/gov/environment/air-land-water/site-remediation/docs/bulletins/tb-3/july\\_2019\\_-\\_regional\\_background\\_concentrations\\_for\\_select\\_inorganic\\_substances\\_in\\_groundwater.pdf](https://www2.gov.bc.ca/assets/gov/environment/air-land-water/site-remediation/docs/bulletins/tb-3/july_2019_-_regional_background_concentrations_for_select_inorganic_substances_in_groundwater.pdf)

British Columbia Ministry of Environment and Climate Change Strategy (ENV). 2020a. Source Drinking Water Quality Guidelines. Water Quality Guideline Series. Water Protection and Sustainability Branch. Available at: [https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/water-quality-guidelines/approved-wqgs/drinking-water-and-recreation/source\\_drinking\\_water\\_quality\\_guidelines\\_bcenv.pdf](https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/water-quality-guidelines/approved-wqgs/drinking-water-and-recreation/source_drinking_water_quality_guidelines_bcenv.pdf)

British Columbia Ministry of Environment and Climate Change Strategy (ENV). 2020b. British Columbia Working Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture (July 2020). Water Quality Guideline Series. Water Protection and Sustainability Branch. Available at:

[https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/water-quality-guidelines/bc\\_env\\_working\\_water\\_quality\\_guidelines.pdf](https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/water-quality-guidelines/bc_env_working_water_quality_guidelines.pdf)

British Columbia Ministry of Environment and Climate Change Strategy (ENV). 2021. BC Water Resource Atlas. Available at: <http://maps.gov.bc.ca/ess/hm/wrbc/>. Accessed Jan 28 2021.

British Columbia Ministry of Health (MOH). 2017. Drinking Water Officers' Guide Part A Legislative Requirements. Last updated August 2017. Available at: [https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/how-drinking-water-is-protected-in-bc/part\\_a.pdf](https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/how-drinking-water-is-protected-in-bc/part_a.pdf)

City of Vernon (COV). 2005. Irrigation Water Supply Bylaw #4899. Available at: <https://www.vernon.ca/government-services/bylaws/irrigation-water-supply-bylaw-4899>

City of Vernon (COV). 2016. Open Data Catalogue. Contour Data. 1m Elevation Contours. Last Update April 2016. <https://www.vernon.ca/government-services/maps-gis/open-data-deep>.

*Contaminated Sites Regulation*. B.C. Reg. 253/16. Victoria, BC.

Fulton, R.J., A.A. Berti, and G.W. Smith. 1965. Surficial Geology Vernon. Map 1392A.

Hassan, S., M. Stewart, and R. Allard. 2019. North Okanagan Aquifer Mapping and Geologic Modelling Phase III: Okanagan Valley Aquifer Update. Water Science Series, WSS2019-03. Prov. B.C., Victoria B.C.

Health Canada. 1987. Guidelines for Canadian Drinking Water Quality: Guideline Technical Document - Chloride. Available at: <https://www.canada.ca/en/health-canada/services/publications/healthy-living/guidelines-canadian-drinking-water-quality-guideline-technical-document-chloride.html>

Health Canada. 2010. Guidelines for Canadian Drinking Water Quality: Guideline Technical Document - Fluoride. Available at: <https://www.canada.ca/en/health-canada/services/publications/healthy-living/guidelines-canadian-drinking-water-quality-guideline-technical-document-fluoride.html>

Health Canada. 2013. Guidelines for Canadian Drinking Water Quality: Guideline Technical Document - Nitrate and Nitrite. Prepared by the Federal-Provincial-Territorial Committee on Drinking Water of the Federal-Provincial-Territorial Committee on Health and the Environment. Available at: <https://www.canada.ca/en/health-canada/services/publications/healthy-living/guidelines-canadian-drinking-water-quality-guideline-technical-document-nitrate-nitrite.html>

Health Canada. 2019. Guidelines for Canadian Drinking Water Quality - Summary Table. Prepared by the Federal-Provincial-Territorial Committee on Drinking Water of the Federal-Provincial-Territorial Committee on Health and the Environment. Updated June 2019. Available at: <https://www.canada.ca/en/health-canada/services/environmental-workplace-health/reports-publications/water-quality/guidelines-canadian-drinking-water-quality-summary-table.html>

Hounslow, A.W. 1995. *Water Quality Data, Analysis and Interpretation*. CRC Press LLC. ISBN 0-87371-676-0.

Nasmith, H. 1962. Late glacial history and surficial deposits of the Okanagan valley, British Columbia. British Columbia Department of Mines and Petroleum Resources, Bulletin No. 46. Available at:

<http://www.empr.gov.bc.ca/Mining/Geoscience/PublicationsCatalogue/BulletinInformation/BulletinsAfter1940/Documents/Bull46.pdf>

Rivera, A. 2014. Canada's Groundwater Resources. Markham, Ontario. Fitzhenry & Whiteside. Ltd.

Summit Environmental Consultants Inc. (Summit). 2010. Groundwater Monitoring Program Design, City of Vernon Spray Irrigation System Report, City Spray Irrigation Areas, Vernon, BC. Project No. 2010-8911.010. Report prepared for Mr. Andrew Marr, Manager, Vernon Water Reclamation Centre.

Summit Environmental Consultants Inc. (Summit). 2012. 2012 Annual Report - Groundwater Monitoring Program Spray Irrigation System. Prepared for the City of Vernon.

Summit Environmental Consultants Inc. (Summit). 2013. 2013 Annual Report - Groundwater Monitoring Program Spray Irrigation System. Prepared for the City of Vernon.

Summit Environmental Consultants Inc. (Summit). 2015a. Annual Report - City of Vernon Spray Irrigation 2014 Groundwater Monitoring Program. Prepared for the City of Vernon. January 30, 2015.

Summit Environmental Consultants Inc. (Summit). 2015b. Sampling Frequency Assessment for the City of Vernon Spray Irrigation Monitoring Program (Operational Certificate ME 12215). Prepared for the City of Vernon. January 30, 2015.

United States Geological Survey (USGS). 2016. pH - Water properties. Available at:  
<https://water.usgs.gov/edu/ph.html>

World Health Organization (WHO). 2003. Selenium in Drinking-water. Background document for development of WHO Guidelines for Drinking-water Quality. WHO/SDE/WSH/03.04/13

## APPENDIX A - CROSS SECTIONS AND WELL LOGS



**FIGURE A-1: CROSS-SECTIONS & LITHOLOGICAL INFORMATION USED FOR INTERPRETATION**  
 City of Vernon  
 City of Vernon Groundwater Monitoring Program

PROJECT NO : 2019-8456  
 DATE: February 2020  
 DRAWN BY: Bdu

1227	Aquifers
346	346
347	347
471	471

- Cross-section lines
- Commonage Ridge
- Fault (Approximate)
- Monitoring Well - Closed
- Fielding Prairie Borehole
- Hesperia Monitoring Well
- Other Well
- Domestic Monitoring Well - Active
- Domestic Monitoring Well - Closed
- Monitoring Well - Active



Associated  
Environmental

PROJECT NO.:

2019-8456

DATE:

February 2020

DRAWN BY:

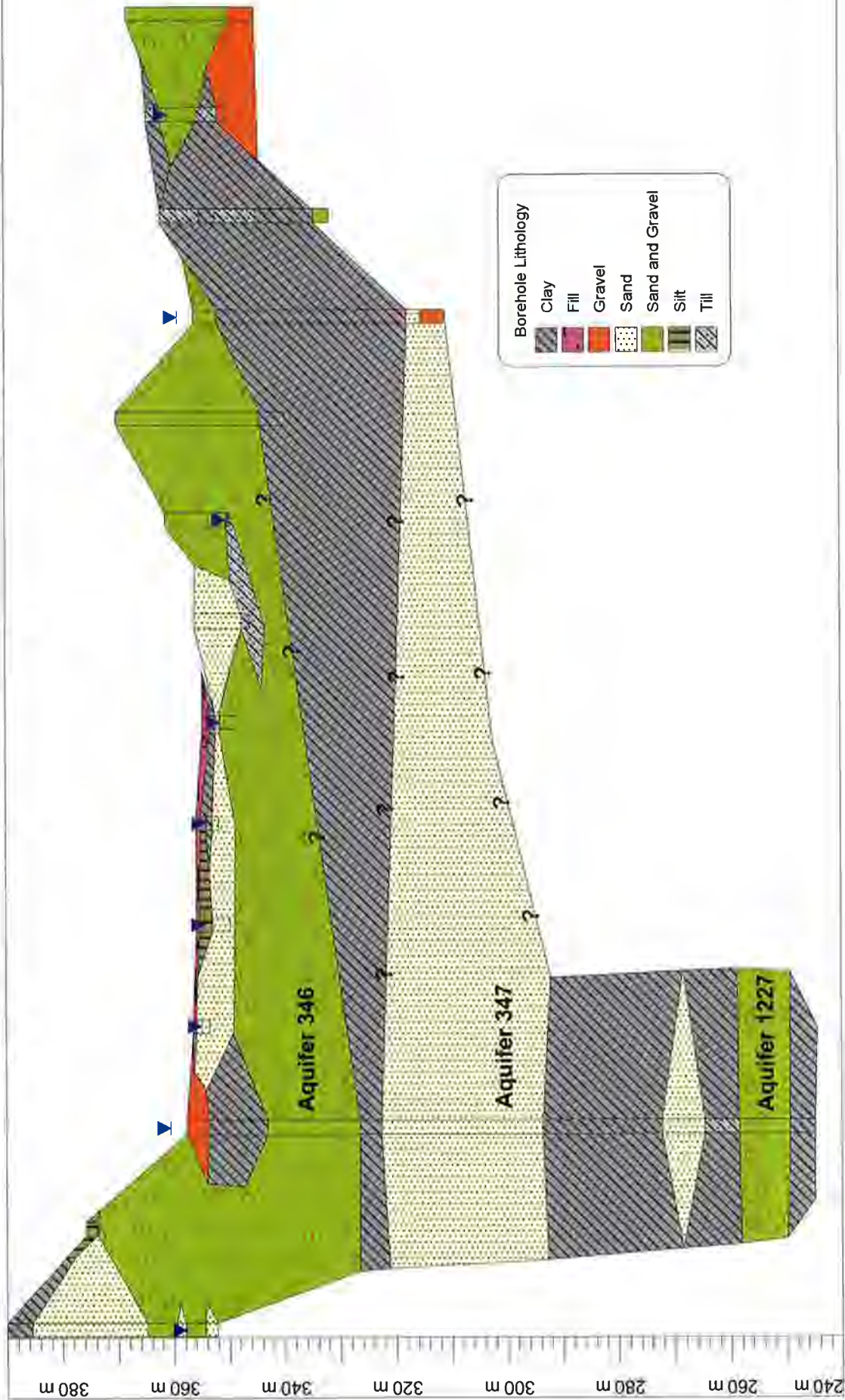
MW

FIGURE A-2: CROSS SECTION A-A'

City of Vernon

2019 Spray Irrigation Monitoring

MW11-02 -545.9 m- MW11-01 -890.1 m- WTN 24991 416.2 m 5660 BH201 -78.4 m- BH2 (2014) -32.3 m- BH3 (2014) -57.5 m- BH4 (2014) 76.3 m WTN 1953 (DMW18-1) 86.8 m MW17-1 116.1 m WTN 17878 (DMW17-7) 191.0 m WTN 39421 178.6 m WTN 27357 (DMW17-WTN 58504 (MW-2) WTN 22488 (DMW-5) 221.4 m 796.2 m





Associated  
Environmental

PROJECT NO: 2019-8456.000

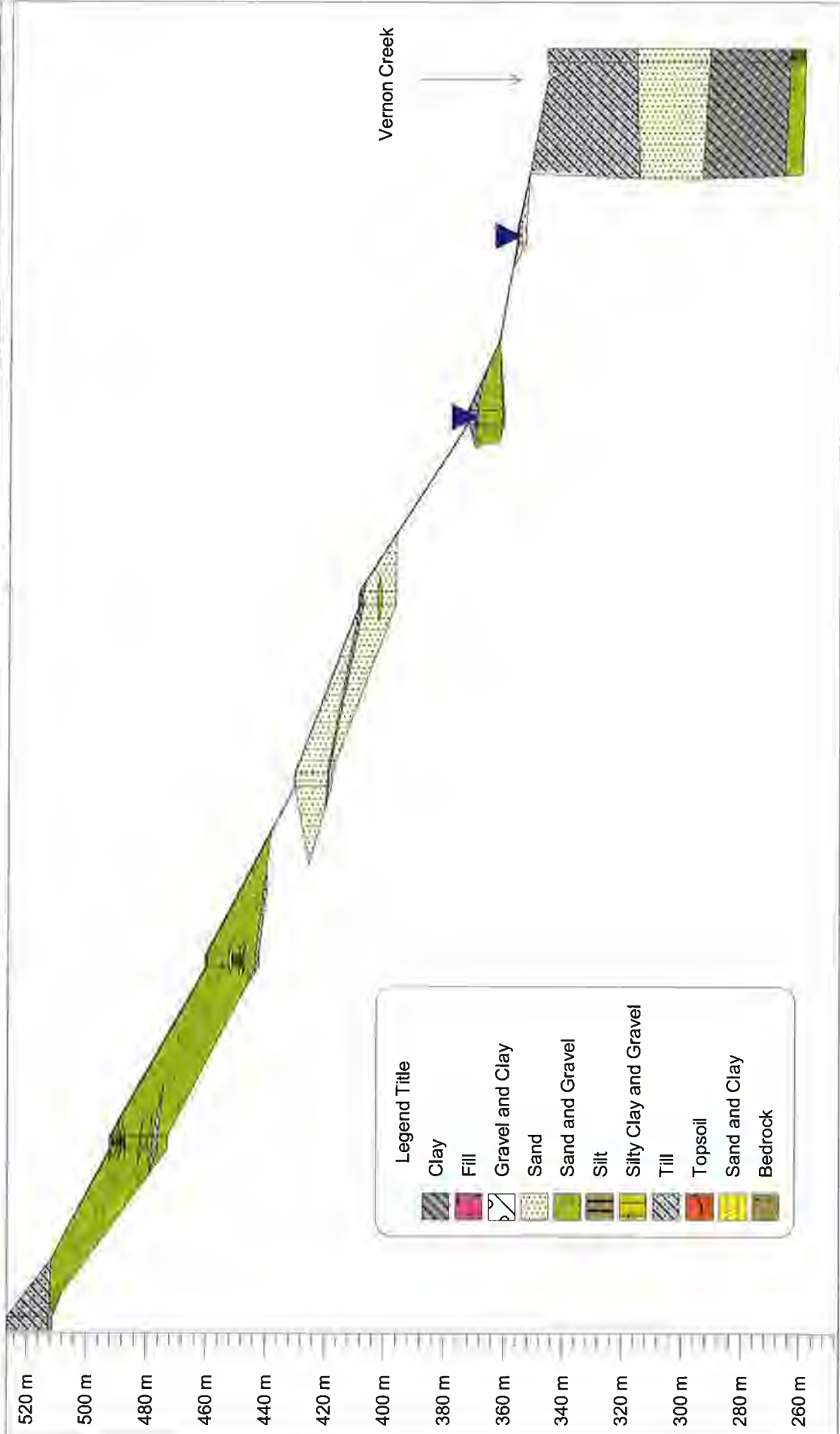
DATE: January 2019

DRAWN BY: MW

FIGURE A-3: CROSS SECTION B-B'

City of Vernon

2019 Groundwater Monitoring Program - Reclaimed Water Use





Associated  
Environmental

PROJECT NO.: 2019-8456.000

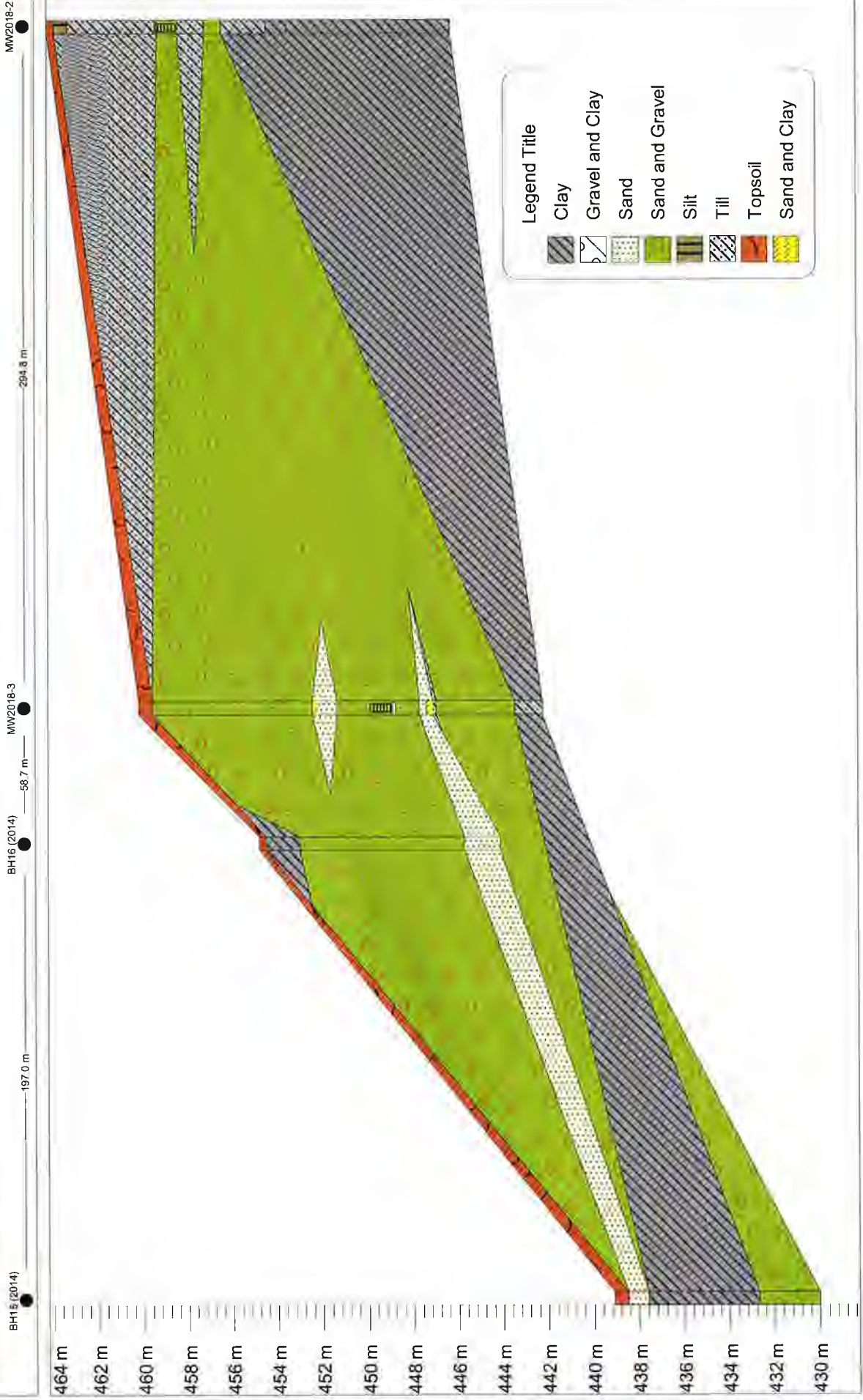
DATE: February 2019

DRAWN BY: MW

FIGURE A-4: CROSS SECTION C-C'

City of Vernon

2019 Groundwater Monitoring Program - Reclaimed Water Use



Project No: 2010-8911.010

Test Hole / Borehole I.D.: BH11-05

Client: City of Vernon

Well I.D.: MW11-02

Location: Okanagan Landing, Vernon, BC

Location on site: Below PRT site

Logged by/ Checked by: CDH

Northing/ Easting: 0

Elevation: 0

SUBSURFACE PROFILE			SAMPLE			WELL	
Depth	Symbol	Description	Type	I.D.	flag for analysis	Well Details	Well Completion
-5 m		Ground Surface				Monument stick-up casing protector	
0		<b>SILTY CLAY</b> Dk. brown silty clay  -some f-m gravel @ 7'					Bentonite Seal 0.3-1.5m
15		<b>SAND</b> Brown v.f.-m sand, tr.-some lt. brown silt					Cuttings (clayey) 1.5-9.1m
25		<b>SAND</b> Brown- lt. brown+ tan f-c sand, tr. moist, tr. v.f. gravel  -siltier section @ 30'				-slightly more silty 30-32'	Bentonite Seal 9.1-9.8m
35		<b>SAND</b> Lt. brown v.f-m sand, tr. silt, tr. v.c. sand, sl. moist					
45		<b>SAND</b> Lt. brown v.f-m sand, tr. v.c. sand, tr. silt, dry.  -some f. gravel, well rounded, dry.				- f. gravel 52-55'	Bentonite Seal 15.2-15.8m
55		<b>SAND</b> Tan-brown f-m sand, tr. c sand, tr. silt, sl. moist  -dry, less silt					
65							


**Test Hole / Borehole I.D.: BH11-05**

**Well I.D.: MW11-02**

**Location on site:** Below PRT site

**Northing/ Easting: 0**

**Elevation: 0**

SUBSURFACE PROFILE			SAMPLE			WELL	
Depth	Symbol	Description	Type	I.D.	flag for analysis	Well Details	Well Completion
75		<b>SAND</b> Brown-lt. brown v.f-m sand, some silt, moist  - some-tr. f-gravel, dry				- moist silt, not wet 68'  - granule - v.f. gravel 71-73'	 Bentonite Seal 21.3-21.9m  Bentonite Seal 27.1-28.3m  Silica Sand 28.3-34.6m  Screen Interval 31.5-34.6m
85		<b>SAND</b> Lt. brown -brown v.f-m sand, tr.-some f. gravel				- f-c sand + f gravel 83-84'	
95	29	<b>SAND + GRAVEL</b> Lt. brown f-c sand + f. gravel, coated gravels				- moist, coated sands and gravels 98-100'	
105		<b>SAND</b> Lt. brown f-v.c. sand, some f. gravel					
115		<b>SAND + GRAVEL</b> Brown f-v.c. sand + f. gravel  - some gravel moist -wet					
		<b>SILTY SAND</b> Blue-brown silty f-c sand, loss of water in return					
125	39	End of Borehole				Drilled using ODEX 4" casing with NWJ rods, 10' lengths. Rental 175-400 compressor pushing under 400 cfm.	
135							

DMW18-1



## Report 1 - Detailed Well Record

Well Tag Number: 1950	Construction Date: 1940-01-01 00:00:00
Owner: L FUHR	Driller: Unknown
Address:	Well Identification Plate Number:
Area: VERNON	Plate Attached By:
	Where Plate Attached:
WELL LOCATION:	PRODUCTION DATA AT TIME OF DRILLING:
OSOYOOS (ODYD) Land District	Well Yield: 0 (Driller's Estimate)
District Lot: Plan: Lot:	Development Method:
Township: Section: Range:	Pump Test Info Flag: N
Indian Reserve: Meridian: Block:	Artesian Flow:
Quarter:	Artesian Pressure (ft):
Island:	Static Level: 20 feet
BCCGS Number (NAD 83): 082L024144 Well: 45	WATER QUALITY:
Class of Well:	Character:
Subclass of Well:	Colour:
Orientation of Well:	Odour:
Status of Well: New	Well Disinfected: N
Licence General Status: UNLICENSED	EMO ID:
Well Use: Private Domestic	Water Chemistry Info Flag:
Observation Well Number:	Field Chemistry Info Flag:
Observation Well Status:	Site Info (SEAM):
Construction Method: Dug	Water Utility:
Diameter: 0.0 inches	Water Supply System Name:
Casing drive shoe:	Water Supply System Well Name:

Well Depth: 28 feet			
Elevation: 0 feet (ASL)	SURFACE SEAL:		
Final Casing Stick Up: inches	Flag: N		
Well Cap Type:	Material:		
Bedrock Depth: feet	Method:		
Lithology Info Flag: N	Depth (ft):		
File Info Flag: N	Thickness (in):		
Sieve Info Flag: N	WELL CLOSURE INFORMATION:		
Screen Info Flag: N	Reason For Closure:		
Site Info Details:	Method of Closure:		
Other Info Flag:	Closure Sealant Material:		
Other Info Details:	Closure Backfill Material:		
	Details of Closure:		
Screen from	to feet	Type	Slot Size
Casing from	to feet	Diameter	Material
			Drive Shoe
GENERAL REMARKS:			
LITHOLOGY INFORMATION:			
From	to	28	
0	Ft.		SANDY CLAY
From	to	0	
28	Ft.		HARDPAN, WATER ON TOP OF HARDPAN

- [Return to Main](#)
- [Return to Search Options](#)
- [Return to Search Criteria](#)

### Information Disclaimer

The Province disclaims all responsibility for the accuracy of information provided. Information provided should not be used as a basis for making financial or any other commitments.

DMW-1



## Report 1 - Detailed Well Record

Well Tag Number: 8414	Construction Date: 1950-01-01 00:00:00
Owner: W E DOUGLAS	Driller: Unknown
Address:	Well Identification Plate Number:
Area:	Plate Attached By:
	Where Plate Attached:
WELL LOCATION:	PRODUCTION DATA AT TIME OF DRILLING:
OSOYOOS (ODYD) Land District	Well Yield: 0 (Driller's Estimate)
District Lot: Plan: Lot:	Development Method:
Township: Section: Range:	Pump Test Info Flag:
Indian Reserve: Meridian: Block:	Artesian Flow:
Quarter:	Artesian Pressure (ft):
Island:	Static Level: 3 feet
BGS Number (NAD 83): 082L024144 Well: 5	WATER QUALITY:
Class of Well:	Character:
Subclass of Well:	Colour:
Orientation of Well:	Odour:
Status of Well: New	Well Disinfected: N
Licence General Status: UNLICENSED	EMS ID:
Well Use: Private Domestic	Water Chemistry Info Flag:
Observation Well Number:	Field Chemistry Info Flag:
Observation Well Status:	Site Info (SEAM):
Construction Method: Dug	Water Utility:
Diameter: 0.0 inches	Water Supply System Name:
Casing drive shoe:	Water Supply System Well Name:

Well Depth: 8 feet			
Elevation: 0 feet (ASL)	SURFACE SEAL:		
Final Casing Stick Up: inches	Flag:		
Well Cap Type:	Material:		
Bedrock Depth: feet	Method:		
Lithology Info Flag:	Depth (ft):		
File Info Flag:	Thickness (in):		
Sieve Info Flag:			
Screen Info Flag:	WELL CLOSURE INFORMATION:		
	Reason For Closure:		
Site Info Details:	Method of Closure:		
Other Info Flag:	Closure Sealant Material:		
Other Info Details:	Closure Backfill Material:		
	Details of Closure:		
Screen from	to feet	Type	Slot Size
Casing from	to feet	Diameter	Material Drive Shoe
GENERAL REMARKS:			
LITHOLOGY INFORMATION:			
From 0 to 0 Ft. NO LOG- SOIL, CLAY & ROCK			

- [Return to Main](#)
- [Return to Search Options](#)
- [Return to Search Criteria](#)

### Information Disclaimer

The Province disclaims all responsibility for the accuracy of information provided. Information provided should not be used as a basis for making financial or any other commitments.



DMW-3

**Report 1 - Detailed Well Record**

Well Tag Number: 58803	Construction Date: 1989-05-12 00:00:00.0			
Owner: CITY OF VERNON	Driller: Dan Gare Drilling			
Address: BENCH ROW RD	Well Identification Plate Number:			
	Plate Attached By:			
	Where Plate Attached:			
Area: VERNON	PRODUCTION DATA AT TIME OF DRILLING:			
WELL LOCATION:	Well Yield: 0 (Driller's Estimate)			
OSOYOOS (ODYD) Land District	Development Method:			
District Lot: Plan: Lot:	Pump Test Info Flag:			
Township: 9 Section: 20 Range:	Artesian Flow:			
Indian Reserve: Meridian: Block:	Artesian Pressure (ft):			
Quarter: SW	Static Level: 10 feet			
Island:	WATER QUALITY:			
BCGS Number (NAD 27): 082L024142 Well: 12	Character:			
	Colour:			
Class of Well:	Odour:			
Subclass of Well:	Well Disinfected: N			
Orientation of Well:	EMS ID:			
Status of Well: New	Water Chemistry Info Flag:			
Well Use: Private Domestic	Field Chemistry Info Flag:			
Observation Well Number:	Site Info (SEAM):			
Observation Well Status:				
Construction Method: Drilled	Water Utility:			
Diameter: 6.0 inches	Water Supply System Name:			
Casing drive shoe:	Water Supply System Well Name:			
Well Depth: 19 feet				
Elevation: 0 feet (ASL)	SURFACE SEAL:			
Final Casing Stick Up: inches	Flag:			
Well Cap Type:	Material:			
Bedrock Depth: 6 feet	Method:			
Lithology Info Flag:	Depth (ft):			
File Info Flag:	Thickness (in):			
Sieve Info Flag:				
Screen Info Flag:	WELL CLOSURE INFORMATION:			
	Reason For Closure:			
Site Info Details:	Method of Closure:			
Other Info Flag:	Closure Sealant Material:			
Other Info Details:	Closure Backfill Material:			
	Details of Closure:			
Screen from	to feet	Type	Slot Size	
Casing from	to feet	Diameter	Material	Drive Shoe
GENERAL REMARKS:				
MONITOR WELL				
LITHOLOGY INFORMATION:				
From	0 to	6 Ft.	SANDY CLAY, RED	
From	6 to	10 Ft.	BROKEN BEDROCK	
From	10 to	19 Ft.	FRACTURED BEDROCK	

- [Return to Main](#)
- [Return to Search Options](#)
- [Return to Search Criteria](#)

**Information Disclaimer**

The Province disclaims all responsibility for the accuracy of information provided. Information provided should not be used as a basis for making financial or any other commitments.



DMW-6

## Report 1 - Detailed Well Record

Well Tag Number: 22488	Construction Date: 1969-06-18 00:00:00
Owner: PAUL WARWICK	Driller: Pacific Water Wells
Address: OK AVENUE	Well Identification Plate Number:
Area: VERNON	Photo Attached By:
	Where Plate Attached:
WELL LOCATION:	PRODUCTION DATA AT TIME OF DRILLING:
OSOYOOS (ODYD) Land District	Well Yield: 30 (Driller's Estimate) Gallons per Minute (U.S./Imperial)
District Lot: Plan: B3911 Lot:	Development Method:
Township: 9 Section: 28 Range:	Pump Test Info Flag:
Indian Reserve: Meridian: Block:	Artesian Flow:
Quarter: NW	Artesian Pressure (ft):
Island:	Flow Level: 32 feet
BCGN Number (NAD 83): 082L024322 Well: 38	WATER QUALITY:
Class of Well:	Chlorine:
Subclass of Well:	Colour:
Classification of Well:	Conductivity:
Status of Well: New	Well Disinfected: N
License General Status: UNLICENSED	PM ID:
Well Use: Unknown Well Use	Water Chemistry Info Flag:
Observation Well Number:	Field Chemistry Info Flag:
Observation Well Status:	Site Info (SEAM):
Construction Method: Drilled	Water Utility:
Diameter: 6.0 inches	Water Supply System Name:
Casing drive shoe:	Water Supply System Well Name:
Well Depth: 76 feet	
Elevation: 0 feet (ASL)	SURFACE SEAL:
Final Casing Stick Up: inches	Flag:
Well Cap Type:	Material:
Annular Depth: feet	Method:
Lithology Info Flag:	Depth (ft):
File Info Flag:	Thickness (in):
Gravel Info Flag:	
Screen Info Flag:	WELL CLOSURE INFORMATION:
Site Info Details:	Reason For Closure:
Other Info Flag:	Method of Closure:
Other Info Details:	Closure Sealant Material:
	Closure Backfill Material:

Details of Closure				
Screen from	to feet	Type	Slot Size	
Casing from	to feet	Diameter	Material	Drive Shoe
GENERAL REMARKS:				
LITHOLOGY INFORMATION:				
From	0 to	60 Ft.	SANDY GRAVEL	
From	60 to	76 Ft.	GRAVEL WATER-BEARING	

- [Return to Main](#)

- [Return to Search Options](#)

- [Return to Search Criteria](#)

**Information Disclaimer**

The Province disclaims all responsibility for the accuracy of information provided. Information provided should not be used as a basis for making financial or any other commitments.



MW-2

## Report 1 - Detailed Well Record

Well Tag Number: 58804	Construction Date: 1989-05-12 00:00:00
Owner: CITY OF VERNON	Driller: Dan Gare Drilling
Address: OKANAGAN AVE	Well Identification Plate Number:
Area: VERNON	Plate Attached By:
	Where Plate Attached:
WELL LOCATION:	PRODUCTION DATA AT TIME OF DRILLING:
OSOYCOOS (ODYD) Land District	Well Yield: 0 (Driller's Estimate)
District Lot: 64 Plan: 2591 Lot: B	Development Method:
Township: 9 Section: Range:	Pump Test Info Flag:
Indian Reserve: Meridian: Block:	Artesian Flow:
Quarter:	Artesian Pressure (ft):
Island:	Static Level: 39 feet
BCGS Number (NAD 83): 082L024144 Well: 48	WATER QUALITY:
Class of Well:	Character:
Subclass of Well:	Colour:
Orientation of Well:	Odour:
Status of Well: New	Well Disinfected: N
Licence General Status: UNLICENSED	EMS ID:
Well Use: Private Domestic	Water Chemistry Info Flag:
Observation Well Number:	Field Chemistry Info Flag:
Observation Well Status:	Site Info (SEAM):
Construction Method: Drilled	Water Utility:
Diameter: 6.0 inches	Water Supply System Name:
Casing drive shoe:	Water Supply System Well Name:
Well Depth: 47 feet	
Elevation: 0 feet (ASL)	SURFACE SEAL:

Final Casing Stick Up: inches	Flag:
Well Cap Type:	Material:
Bedrock Depth: feet	Method:
Lithology Info Flag:	Depth (ft):
File Info Flag:	Thickness (in):
Sieve Info Flag:	
Screen Info Flag:	WELL CLOSURE INFORMATION:
	Reason For Closure:
Site Info Details:	Method of Closure:
Other Info Flag:	Closure Sealant Material:
Other Info Details:	Closure Backfill Material:
	Details of Closure:
Screen from to feet Type	Slot Size
Casing from to feet Diameter	Material Drive Shoe
GENERAL REMARKS:	
LITHOLOGY INFORMATION:	
From 0 to 8 Ft. CLAY & ROCKS	
From 8 to 30 Ft. SAND & GRAVEL, RED	
From 30 to 42 Ft. CLAY & ROCKS	
From 42 to 47 Ft. COARSE GRAVEL	

- [Return to Main](#)
- [Return to Search Options](#)
- [Return to Search Criteria](#)

### Information Disclaimer

The Province disclaims all responsibility for the accuracy of information provided. Information provided should not be used as a basis for making financial or any other commitments.



## Report 1 - Detailed Well Record

Well Tag Number: 39421	Construction Date: 1978-03-28 00:00:00
Owner: CROWN VILLA MHP - CAROL BOLDSTONE	Driller: Okanagan Rotary Well Drilling
Address: 6080 OKANAGAN AVE	Well Identification Plate Number: 10073
Area: VERNON	Plate Attached By: MIKE KAPINIAK
	Where Plate Attached: WELL CASING
WELL LOCATION:	PRODUCTION DATA AT TIME OF DRILLING:
ODYD (ODYD) Land District	Well Yield: 80 (Driller's Estimate) Gallons per Minute (U.S./Imperial)
District Lot: 62 Plan: 4685 Lot: 1	Development Method:
Township: Section: Range:	Pump Test Info Flag: N
Indian Reserve: Meridian: Block:	Artesian Flow: 3 Gallons per Minute (U.S./Imperial)
Quarter:	Artesian Pressure (ft):
Island:	Static Level:
BCGE Number (NAD 83): 082L024144 Well:	WATER QUALITY:
Class of Well: Water supply	Character:
Subclass of Well: Domestic	Colour:
Contamination of Well:	Odour:
Status of Well: New	Well Disinfected: N
License General Status: UNLICENSED	PHS ID: E262160
Well Use: Water Supply System	Water Chemistry Info Flag: N
Observation Well Number:	Field Chemistry Info Flag:
Observation Well Status:	Site Info (SEAM): N
Construction Method: Drilled	Water Utility: N
Diameter: inches	Water Supply System Name: CROWN VILLA MHP WATER SYSTEM
Casing drive shoe	Water Supply System Well Name:
Well Depth: 148 feet	
Completion: 1171.3 feet (ASL)	SURFACE SEAL:
Final Casing Stick Up: inches	Flag: N
Well Cap Type:	Material:
Backsack Depth: feet	Method:
Lithology Info Flag: Y	Depth (ft):
File Info Flag: N	Thickness (in):
Sieve Info Flag: N	Inner from To: feet
Screen Info Flag: N	
Site Info Details:	WELL CLOSURE INFORMATION:
Other Info Flag:	Reason For Closure:
	Method of Closure:

Other Info Details:		Closure Sealant Material:		
		Closure Backfill Material:		
		Details of Closure:		
Screen from	to feet	Type	Slot Size	
Casing from	to feet	Diameter	Material	Drive Shoe
0	16	null	null	null
GENERAL REMARKS:				
LITHOLOGY INFORMATION:				
From	0 to	14 Ft	SAND & GRAVEL (DRY)	0 nothing entered
From	14 to	23 Ft	BROWN CLAY	
From	23 to	60 Ft	HARD GRAYISH BLUE CLAY	
From	60 to	100 Ft	SOFT LIGHT GRAY CLAY	
From	100 to	126 Ft	VERY HARD STIFF DARK GRAY CLAY	
From	126 to	134 Ft	FINE SAND	
From	134 to	148 Ft	CLEAN GRAVEL (WATER)	0 nothing entered

- [Return to Main](#)
- [Return to Search Options](#)
- [Return to Search Criteria](#)

#### Information Disclaimer

The Province disclaims all responsibility for the accuracy of information provided. Information provided should not be used as a basis for making financial or any other commitments.



## Report 1 - Detailed Well Record

Well Tag Number: 24991	Construction Date: 1971-06-24 00:00:00
Owner: CLAIRMONT UTILITIES	Driller: Pacific Water Wells
Address:	Well Identification Plate Number: 10033
Area: OKANAGAN LANDING	Plate Attached By:
	Where Plate Attached:
WELL LOCATION	PRODUCTION DATA AT TIME OF DRILLING
OKOYODI (ODYD) Land District	Well Yield: 30 (Driller's Estimate) U.S. Gallons per Minute
District Lot: 62 & 63 Plan: Lot	Development Method:
Township: Section: Range:	Pump Test Info Flag: Y
Indian Reserve: Meridian: Block	Artesian Flow:
Quarter:	Artesian Pressure (ft):
Island:	Static Level: 8 feet
UCC Number (NAD 83): 082L024143 Well: 44	WATER QUALITY:
Class of Well: Water supply	Character:
Subclass of Well: Domestic	Colour:
Orientation of Well	Odour:
Status of Well: New	Well Disinfected: N
License General Status: UNLICENSED	WQE ID: E262182
Well Use: Water Supply System	Water Chemistry Info Flag: Y
Observation Well Number:	Field Chemistry Info Flag:
Observation Well Status:	Site Info (SEAM): N
Construction Method: Drilled	Water Utility: Y
Diameter: 8 inches	Water Supply System Name: CLAREMONT UTILITIES
Casing drive shoe:	Water Supply System Well Name: WELL NO. 2
Well Depth: 370 feet	
Elevation: 1177.8 feet (ASL)	SURFACE SEAL:
Final Casing Stick Up: inches	Flag: N
Well Cap Type	Material:
Bedrock Depth: feet	Method:
Lithology Info Flag: Y	Depth (ft):
File Info Flag: N	Thickness (in):
Sieve Info Flag: N	

Screen Info Flag: Y		WELL CLOSURE INFORMATION:		
Site Info Details:		Reason For Closure:		
Other Info Flag:		Method of Closure:		
Other Info Details:		Closure Sealant Material:		
		Closure Backfill Material:		
		Details of Closure:		
Screen from	to feet	Type	Slot Size	
334	null		20	
null	null		30	
null	null		50	
null	355		80	
Casing from	to feet	Diameter	Material	Drive Shoe
0	210	10	null	null
210	335	8	null	null
GENERAL REMARKS:				
DRAWDOWN AT 1.6 X 108 TO THE 4TH. SPECIFIC CAPACITY = 2.54 USGM				
LITHOLOGY INFORMATION:				
From	0 to	13 Ft	COBBLES, GRAVEL	
From	13 to	48 Ft	CLAY	
From	48 to	102 Ft	TIGHT GRAVEL, WATER-BEARING	
From	102 to	115 Ft	CLAY	
From	115 to	210 Ft	SAND, FINE SILTY	
From	210 to	280 Ft	CLAY	
From	280 to	305 Ft	SILTY SAND	
From	305 to	325 Ft	STONEY CLAY	
From	325 to	355 Ft	SAND GRAVEL	
From	355 to	370 Ft	CLAY, BACKFILLED TO 355'	

- [Return to Main](#)
- [Return to Search Options](#)
- [Return to Search Criteria](#)

#### Information Disclaimer

The Province disclaims all responsibility for the accuracy of information provided. Information provided should not be used as a basis for making financial or any other commitments.

## APPENDIX B - TRI-LINEAR DIAGRAMS

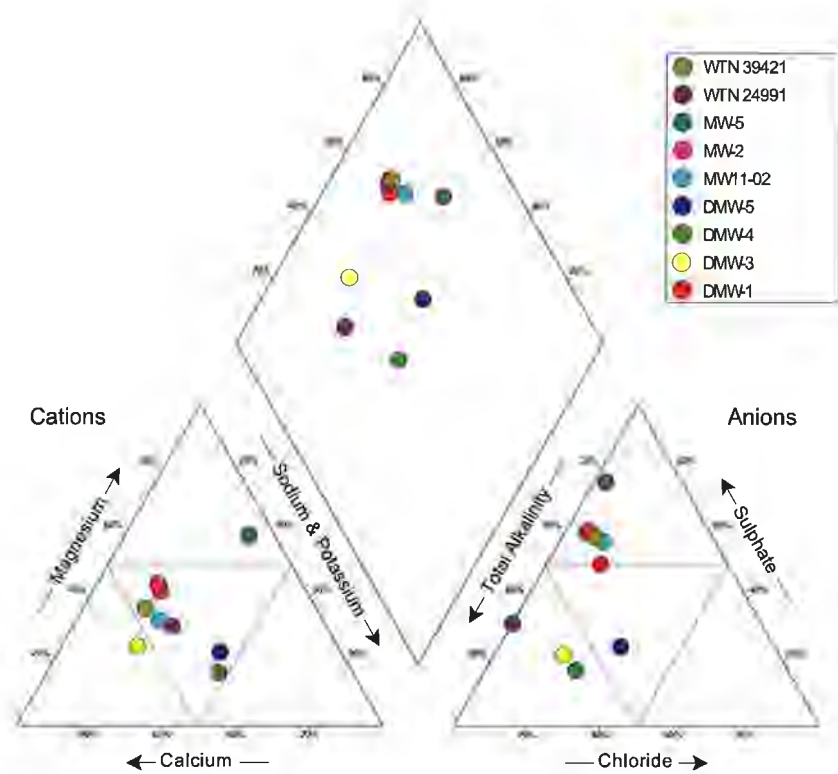


Figure B-1 Piper Plot (2020 Data)

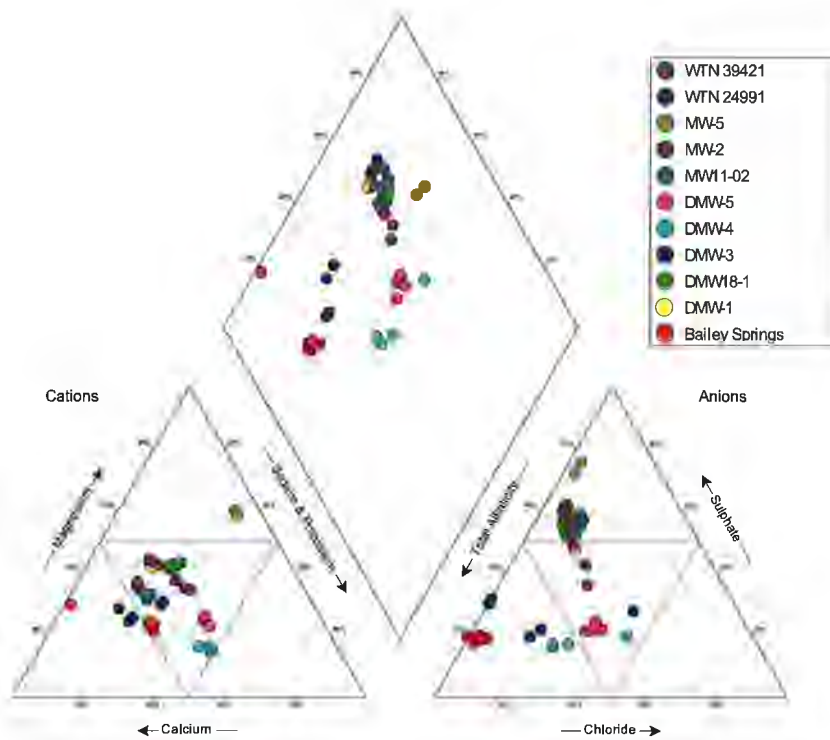


Figure B-2 Piper Plot (All Data)

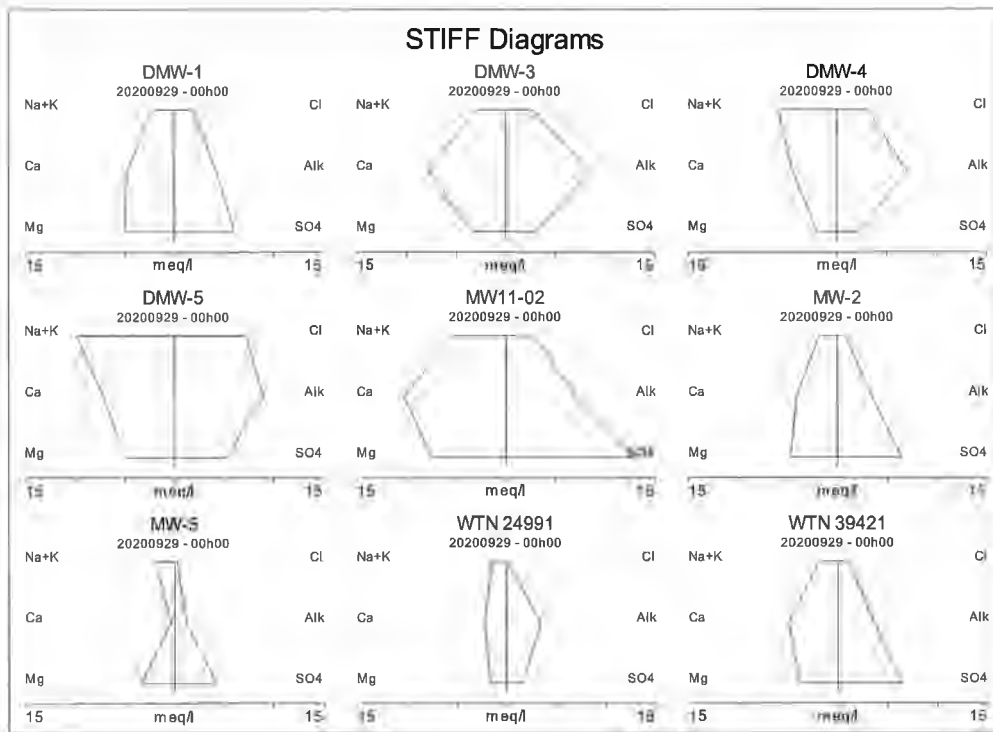


Figure B-3 Stiff Diagrams (2020 Data)

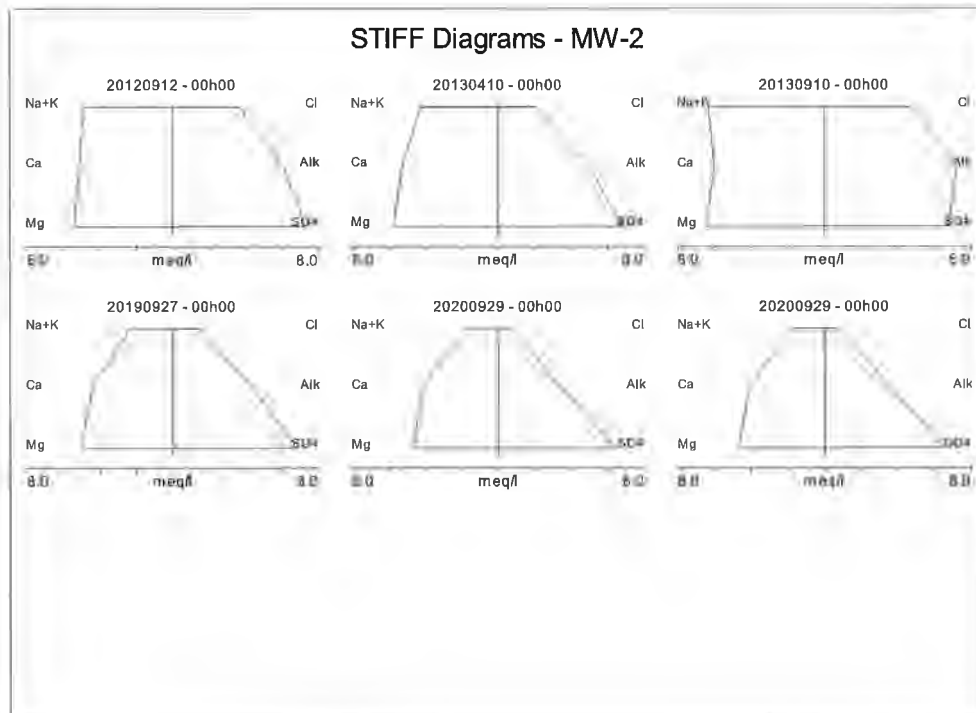


Figure B-4 Stiff Diagrams for MW-2 (2012, 2013, 2019, and 2020)

## APPENDIX C - TABULATED 2020 WATER QUALITY DATA

**Table C-1: 2020 Groundwater Quality Results**  
**City of Vernon Reclaimed Water Irrigation Groundwater Monitoring Program**

**Legend for Table C-1:**

<	Less than reported detection limit
GCDWQ MAC	Guidelines for Canadian Drinking Water Quality - Maximum Acceptable Concentrations
GCDWQ AO	Guidelines for Canadian Drinking Water Quality - Aesthetic Objectives
BC SDWQG MAC	BC Source Drinking Water Quality Guidelines - Maximum Acceptable Concentrations
BC SDWQG AO	BC Source Drinking Water Quality Guidelines - Aesthetic Objectives
CSR DW	BC CSR Generic Numerical Water Standards for Drinking Water
BCAWQG I	BC Approved Water Quality Guidelines for Irrigation
BCWWQG I	BC Working Water Quality Guidelines for Irrigation
CSR IW	BC CSR Generic Numerical Water Standards for Irrigation
BCAWQG L	BC Approved Water Quality Guidelines for Livestock
BCWWQG L	BC Working Water Quality Guidelines for Livestock
CSR LW	BC CSR Generic Numerical Water Standards for Livestock
BCAWQG AL (ST)	BC Approved Water Quality Guidelines for Freshwater Aquatic Life (short-term acute)
BCWWQG AL	BC Working Water Quality Guidelines for Freshwater Aquatic Life
CSR AW	BC CSR Generic Numerical Water Standards for Freshwater Aquatic Life
Calc	Calculated guideline or standard. The guideline or standard is dependent on the value of one or more other analytes, and is calculated from a formula or table.
N	Narrative type of guideline or standard, or Result Note.
NG	No Guideline
NT	Not Tested or Measured
<b>GCDWQ MAC</b>	Highlighted value exceeds the GCDWQ MAC
<b>GCDWQ AO</b>	Highlighted value exceeds the GCDWQ AO
<b>BC SDWQG MAC</b>	Highlighted value exceeds the BC SDWQG MAC
<b>BC SDWQG AO</b>	Highlighted value exceeds the BC SDWQG AO
<b>CSR DW</b>	Highlighted value exceeds the CSR DW
<u>BCAWQG I</u>	Highlighted value exceeds the BCAWQG I
<u>BCWWQG I</u>	Highlighted value exceeds the BCWWQG I
<u>CSR IW</u>	Highlighted value exceeds the CSR IW
BCAWQG L	Highlighted value exceeds the BCAWQG L
BCWWQG L	Highlighted value exceeds the BCWWQG L
CSR LW	Highlighted value exceeds the CSR LW
BCAWQG AL (ST)	Highlighted value exceeds the BCAWQG AL (ST)
BCWWQG AL	Highlighted value exceeds the BCWWQG AL
CSR AW	Highlighted value exceeds the CSR AW

Table C-1: 2023 Groundwater Quality Results  
City of Vernon Reclaimed Water Irrigation Groundwater Monitoring Program

Analyte	Unit	Guideline										Sampling Location					Data Sampled					Lab Sample ID					Sample Type																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
		GCDWQ MAC	GCDWQ AO	BC SDWQG MAC	BC SDWQG AO	CSR DW	BCAWQGL	BCWQGL	CSR LW	BCAWQGL (ST)	BCWQGL AL	CSR AW	DMW-1 29-Sep-20 0109234-02 Normal	DMW1B-1 11-Jun-20 0051349-10 Normal	DMW1B-1 08-Sep-20 0091074-01 Normal	DMW1B-1 10-Dec-20 2013444-05 Normal	DMW-3 29-Sep-20 0109234-07 Normal	DMW-4 29-Sep-20 0109234-04 Normal	DMW-5 29-Sep-20 0109234-05 Normal																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
Field Results																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													

Table C-1: 2020 Groundwater Quality Results  
City of Vernon Reclaimed Water Irrigation Groundwater Monitoring Program

Analyte	Unit	Guideline														Sampling Location						
		GCDWQ MAC	GCDWQ AO	BC SDWQ MAC	BC SDWQ AO	IC SDWQ AO	CSR DW	BCAWQ <sub>L</sub>	BCWWQ <sub>L</sub>	CSR LW	BCAWQ <sub>L</sub> (ST)	BCWWQ <sub>L</sub> AL	CSR LW	BCAWQ <sub>L</sub> AL	CSR LW	DMW-1 29-Sep-20 0109234-02 Normal	DMW18-1 08-Sep-20 0061349-10 Normal	DMW18-1 11-Jun-20 0091074-01 Normal	DMW18-1 10-Dec-20 201.1344-05 Normal	DMW-3 28-Sep-20 0109234-07 Normal	DMW-4 28-Sep-20 0109234-04 Normal	DMW-5 28-Sep-20 0109234-05 Normal
Mercury (dissolved)	mg/L	0.001	NG	0.001	NG	0.001	0.0020 <sup>1.20</sup>	NG	0.002	0.00020 <sup>2.22</sup>	NG	0.00025	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Molybdenum (dissolved)	mg/L	NG	NG	0.088	NG	0.250	0.005 <sup>0.11</sup>	NG	0.050	2 <sup>2.23</sup>	NG	10.000	0.00855	0.0115	0.0133	0.0136	0.00791	0.0140	0.0143	0.00791	0.0140	0.0123
Nickel (dissolved)	mg/L	NG	NG	0.08	NG	0.060	0.004 <sup>0.11</sup>	NG	1.000	NG	Calc <sup>13.5</sup>	Calc <sup>14.1</sup>	0.00114	0.00078	0.00051	<0.00040	0.00162	0.00193	0.00051	0.00162	0.00193	0.00362
Selenium (dissolved)	mg/L	0.05	NG	0.01	NG	0.010	0.010 <sup>0.12</sup>	NG	0.030	0.002 <sup>0.18</sup>	NG	0.020	0.00114	0.00078	0.00051	<0.00040	0.00162	0.00193	0.00051	0.00162	0.00193	0.00362
Silver (dissolved, as S)	mg/L	NG	NG	NG	NG	0.0020	0.0020 <sup>0.11</sup>	NG	NG	Calc <sup>11.5</sup>	NG	NG	0.00050	0.00050	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Sodium (dissolved)	mg/L	NG	200	NG	NG	200	200 <sup>0.11</sup>	NG	NG	Calc <sup>11.5</sup>	NG	49.2	58.4	58.4	74.0	65.8	65.7	127	231	127	231	221
Bromine (dissolved)	mg/L	7.0 <sup>1.9</sup>	NG	7.0	NG	2.500	2.500 <sup>0.11</sup>	NG	NG	NG	NG	1.14	0.842	0.841	0.841	0.972	1.22	0.852	2.31	0.852	2.31	2.31
Sulphur (dissolved)	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	98.6	98.6	108	144	118	53.8	35.0	88.1	35.0	88.1	88.1
Tellurium (dissolved)	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Thallium (dissolved)	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	0.0008 <sup>0.11</sup>	0.003	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Thoron (dissolved)	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Tin (dissolved)	mg/L	NG	NG	NG	NG	2.500	2.500 <sup>0.11</sup>	NG	NG	NG	NG	NG	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Titanium (dissolved)	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	1.000	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Tungsten (dissolved)	mg/L	NG	NG	NG	NG	0.003	0.003 <sup>0.11</sup>	NG	0.020	0.010	0.0085	0.085	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Vanadium (dissolved)	mg/L	0.02	NG	0.02	NG	0.020	0.020 <sup>0.11</sup>	NG	0.100	0.100	0.0085	0.085	0.0020	<0.0010	0.0021	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Zinc (concentrated)	mg/L	3.0	5.0	3.0	5.0	3.000 <sup>0.11</sup>	3.000 <sup>0.11</sup>	NG	1.000 <sup>0.11</sup>	1.000 <sup>0.11</sup>	2.000	2.000	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Zinc (dissolved)	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Zinc (dissolved)	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Zinc (dissolved)	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010



Table C-1: 2020 Groundwater Quality Results  
City of Vernon Reclaimed Water Irrigation Groundwater Monitoring Program

Analyte	Unit	Guidelines											Sampling Location				Sample Type			
		GCDWQ MAC	GCDWQ AO	BE SDWQ MAC	BE SDWQ AO	CSR DW	BCAWQGL	BCAWQGL	CSR LW	BCAWQGL (ST)	BCWQGL AL	CSR AW	Date Sampled	MW-2 0109234-08 Normal	MW-2 0109234-09 Duplicate	MW11-02 29-Sep-20 0109234-11 Normal	MW11-02 10-Dec-20 20L1347-01 Normal	MW-5 29-Sep-20 0109234-10 Normal	WTN 24991 29-Sep-20 0109234-01 Normal	WTN 39421 29-Sep-20 0109234-03 Normal
<b>Field Results</b>																				
Conductivity	µS/cm	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG								
Depth to Water	m	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG								
Dissolved oxygen	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG								
Oxidation reduction potential	mV	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG								
pH		NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG								
Temperature	°C	7.0 - 10.5 <sup>1,2</sup>	15	NG	NG	NG	NG	NG	NG	NG	NG	NG								
Turbidity	NTU	1 <sup>1</sup>	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG								
<b>Lab Results</b>																				
<b>General</b>																				
Alkalinity (bicarbonate as CaCO <sub>3</sub> )	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG								
Alkalinity (carbonate as CaCO <sub>3</sub> )	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG								
Alkalinity (hydroxide as CaCO <sub>3</sub> )	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG								
Alkalinity (phenolphthalein as CaCO <sub>3</sub> )	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG								
Alkalinity (total as CaCO <sub>3</sub> )	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG								
Bromide	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG								
Chloride	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG								
Fluoride	mg/L	1.5	NG	1.5	NG	250 <sup>3,4</sup>	250 <sup>3,4</sup>	250 <sup>3,4</sup>	1,000 <sup>3,4</sup>	800 <sup>3,4</sup>	800 <sup>3,4</sup>	1,000 <sup>3,4</sup>								
Hardness: Total (dissolved as CaCO <sub>3</sub> )	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG								
Sulfate	mg/L	500 <sup>1,2</sup>	500 <sup>1,2</sup>	500 <sup>1,2</sup>	500 <sup>1,2</sup>	500 <sup>1,2</sup>	500 <sup>1,2</sup>	500 <sup>1,2</sup>	500 <sup>1,2</sup>	500 <sup>1,2</sup>	500 <sup>1,2</sup>	500 <sup>1,2</sup>								
Total dissolved solids	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG								
<b>Nutrients</b>																				
Ammonia (total as N)	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG								
Nitrate (as N)	mg/L	10 <sup>1,2</sup>	10 <sup>1,2</sup>	10 <sup>1,2</sup>	10 <sup>1,2</sup>	10 <sup>1,2</sup>	10 <sup>1,2</sup>	10 <sup>1,2</sup>	10 <sup>1,2</sup>	10 <sup>1,2</sup>	10 <sup>1,2</sup>	10 <sup>1,2</sup>								
Nitrate + Nitrite (as N)	mg/L	10 <sup>1,2</sup>	10 <sup>1,2</sup>	10 <sup>1,2</sup>	10 <sup>1,2</sup>	10 <sup>1,2</sup>	10 <sup>1,2</sup>	10 <sup>1,2</sup>	10 <sup>1,2</sup>	10 <sup>1,2</sup>	10 <sup>1,2</sup>	10 <sup>1,2</sup>								
Nitrite (as N)	mg/L	1.0	NG	1.0	NG	1.0	1.0	1.0	1.0	1.0	1.0	1.0								
Total nitrogen	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG								
Total organic nitrogen	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG								
Orthophosphate (dissolved, as P)	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG								
Phosphorus (total, APHA 4500-P)	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG								
Phosphorus (dissolved, APHA 4500-P)	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG								
Potassium (dissolved)	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG								
<b>Dissolved Metals</b>																				
Aluminum (dissolved)	mg/L	NG	NG	NG	NG	9,500 <sup>3,4</sup>	9,500 <sup>3,4</sup>	9,500 <sup>3,4</sup>	9,500 <sup>3,4</sup>	9,500 <sup>3,4</sup>	9,500 <sup>3,4</sup>	9,500 <sup>3,4</sup>								
Arsenic (dissolved)	mg/L	0.006	NG	0.006	NG	0.006	0.006	0.006	0.006	0.006	0.006	0.006								
Barium (dissolved)	mg/L	2.0 <sup>3,4</sup>	NG	2.0 <sup>3,4</sup>	NG	1,000	1,000	1,000	1,000	1,000	1,000	1,000								
Beryllium (dissolved)	mg/L	NG	NG	NG	NG	0.008	0.008	0.008	0.008	0.008	0.008	0.008								
Bismuth (dissolved)	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG								
Boron (dissolved)	mg/L	5	NG	5	NG	5,000	5,000	5,000	5,000	5,000	5,000	5,000								
Cadmium (dissolved)	mg/L	0.007 <sup>3,4</sup>	NG	0.005	NG	0.005	0.005	0.005	0.005	0.005	0.005	0.005								
Calcium (dissolved)	mg/L	0.05	NG	0.05	NG	0.05	0.05	0.05	0.05	0.05	0.05	0.05								
Chromium (dissolved)	mg/L	0.05	NG	0.05	NG	0.05	0.05	0.05	0.05	0.05	0.05	0.05								
Cobalt (dissolved)	mg/L	0.01	NG	0.01	NG	0.01	0.01	0.01	0.01	0.01	0.01	0.01								
Copper (dissolved)	mg/L	2.0 <sup>3,4</sup>	NG	2.0 <sup>3,4</sup>	NG	1,500 <sup>3,4</sup>	1,500 <sup>3,4</sup>	1,500 <sup>3,4</sup>	1,500 <sup>3,4</sup>	1,500 <sup>3,4</sup>	1,500 <sup>3,4</sup>	1,500 <sup>3,4</sup>								
Iron (dissolved)	mg/L	0.05 <sup>3,4</sup>	NG	0.05	NG	0.05	0.05	0.05	0.05	0.05	0.05	0.05								
Lithium (dissolved)	mg/L	0.005 <sup>3,4</sup>	NG	0.005	NG	0.005	0.005	0.005	0.005	0.005	0.005	0.005								
Magnesium (dissolved)	mg/L	0.02 <sup>3,4</sup>	NG	0.02	NG	0.02	0.02	0.02	0.02	0.02	0.02	0.02								
Manganese (dissolved)	mg/L	0.12 <sup>3,4</sup>	NG	0.12	NG	0.12	0.12	0.12	0.12	0.12	0.12	0.12								

Table C-1: 2020 Groundwater Quality Results  
City of Vernon Reclaimed Water Irrigation Groundwater Monitoring Program

Analyte	Unit	Guideline												Sampling Location				Date Sampled				Lab Sample ID				Sample Type																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
														BCAWQ		CSR LW		BCAWQ AL		BOWQ		CSR AW		MW-2		MW-2		MW11-02		MW11-02		MW-5		WTN 24891		WTN 39421																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
		BCDWQ MAC	BCDWQ AO	BC DW	BCAWQG	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR AW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ	CSR LW	BCAWQ AL	BOWQ



**Table C-1: 2020 Groundwater Quality Results**  
**City of Vernon Reclaimed Water Irrigation Groundwater Monitoring Program**  
**Guideline Notes**

<b>1. Notes for Guidelines for Canadian Drinking Water Quality - Maximum Acceptable Concentrations (GCDWQ MAC)</b>
<b>Note 1.1 for Turbidity:</b>
Waterworks systems that use a surface water source or a groundwater source under the direct influence of surface water should filter the source water to meet health-based turbidity limits, as defined for specific treatment technologies. Where possible, filtration systems should be designed and operated to reduce turbidity levels as low as possible, with a treated water turbidity target of less than 0.1 NTU at all times. Where this is not achievable, the treated water turbidity levels from individual filters should meet the requirements described in GCDWQ. For systems that use groundwater that is not under the direct influence of surface water, which are considered less vulnerable to faecal contamination, turbidity should generally be below 1.0 NTU. For effective operation of the distribution system, it is good practice to ensure that water entering the distribution system has turbidity levels below 1.0 NTU.
<b>Note 1.2 for Nitrate + Nitrite (as N):</b>
The MAC for Nitrate (as N) is 10 mg/L
<b>Note 1.3 for Arsenic (dissolved):</b>
Every effort should be made to maintain arsenic levels in drinking water as low as reasonably achievable.
<b>Note 1.4 for Barium (dissolved):</b>
Update January 24, 2020. The MAC was revised from 1.0 mg/L to 2.0 mg/L.
<b>Note 1.5 for Cadmium (dissolved):</b>
A maximum acceptable concentration (MAC) of 0.007 mg/L (7 µg/L) is established for total cadmium in drinking water, based on a sample of water taken at the tap. (Update July 14, 2020)
<b>Note 1.6 for Copper (dissolved):</b>
A maximum acceptable concentration (MAC) of 2 mg/L is established for total copper in drinking water, based on a sample of water taken at the tap. Guidelines for Canadian Drinking Water Quality - Guideline Technical Document on Copper, June 2019.
<b>Note 1.7 for Lead (dissolved):</b>
The maximum acceptable concentration (MAC) for total lead in drinking water is 0.005 mg/L (5 µg/L), based on a sample of water taken at the tap and using the appropriate protocol for the type of building being sampled. Every effort should be made to maintain lead levels in drinking water as low as reasonably achievable (or ALARA). (GCDWQ: Guideline Technical Document; March, 2019)
<b>Note 1.8 for Manganese (dissolved):</b>
Guidelines for Canadian Drinking Water Quality - Guideline Technical Document on manganese, May 2019.
<b>Note 1.9 for Strontium (dissolved):</b>
Guidelines for Canadian Drinking Water Quality - Guideline Technical Document on strontium, May 2019.
<b>2. Notes for Guidelines for Canadian Drinking Water Quality - Aesthetic Objectives (GCDWQ AO)</b>
<b>Note 2.1 for pH:</b>
The operational guideline for pH is a range of 7.0 to 10.5 in finished drinking water.
<b>Note 2.2 for Sulphate:</b>
There may be a laxative effect in some individuals when sulphate levels exceed 500 mg/L. Health authorities should be notified of drinking water sources containing above 500 mg/L.
<b>Note 2.3 for Aluminum (dissolved):</b>
This is an operational guidance value, designed to apply only to drinking water treatment plants using aluminum-based coagulants. The operational guidance value of 0.1 mg/L applies to conventional treatment plants, and 0.2 mg/L applies to other types of treatment systems.
<b>Note 2.4 for Copper (dissolved):</b>
Guidelines for Canadian Drinking Water Quality - Guideline Technical Document on Copper, June 2019.
<b>Note 2.5 for Manganese (dissolved):</b>
Guidelines for Canadian Drinking Water Quality - Guideline Technical Document on manganese, May 2019.
<b>3. Notes for BC Source Drinking Water Quality Guidelines - Maximum Acceptable Concentrations (2020 and updates) (BC SDWQG MAC)</b>
<b>General Notes:</b>
The source drinking water quality guidelines presented in this document apply to the ambient water before it is treated and distributed for domestic use. The guidelines apply to drinking water sources from surface water and groundwater.
<b>Note 3.1 for Turbidity:</b>
For raw drinking water without treatment for particulates the guideline is: ≤ 1 NTU of turbidity. For raw drinking water with treatment for particulates the guideline is: Natural background turbidity is ≤ 50 NTU: Change from background should not exceed 5 NTU. Natural background turbidity is > 50 NTU: Change from background should not exceed 10% of the background turbidity.

**Table C-1: 2020 Groundwater Quality Results**  
**City of Vernon Reclaimed Water Irrigation Groundwater Monitoring Program**  
**Guideline Notes**

<b>Note 3.2 for Copper (dissolved):</b>
Includes short-term and long-term exposure.
<b>4. Notes for BC Source Drinking Water Quality Guidelines - Aesthetic Objectives (2020 and updates) (BC SDWQG AO)</b>
<b>General Notes:</b>
The source drinking water quality guidelines presented in this document apply to the ambient water before it is treated and distributed for domestic use. The guidelines apply to drinking water sources from surface water and groundwater.
<b>Note 4.1 for Phosphorus (total, APHA 4500-P):</b>
The AO for lakes is 0.01 mg/L. For lakes with residence time > 6 months, measure total P during spring overturn. For lakes with residence time < 6 months, measure mean epilimnetic total P during the growing season (ENV 1985).
<b>Note 4.2 for Phosphorus (dissolved, APHA 4500-P):</b>
The AO for lakes is 0.01 mg/L. For lakes with residence time > 6 months, measure total P during spring overturn. For lakes with residence time < 6 months, measure mean epilimnetic total P during the growing season (ENV 1985).
<b>5. Notes for BC CSR Generic Numerical Water Standards for Drinking Water (CSR DW)</b>
<b>General Notes:</b>
BC Contaminated Sites Regulation, Generic Numerical Water Standards, Schedule 3.2; includes amendments up to B.C. Reg. 13/2019, January 24, 2019. Drinking water standards are for unfiltered samples obtained at the point of consumption. Heavy metals, metalloids and inorganic ions are expressed as total substance concentrations unless otherwise indicated.
<b>Note 5.1 for Chloride:</b>
Standard to protect against taste and odour concerns.
<b>Note 5.2 for Sulphate:</b>
Standard to protect against taste and odour concerns.
<b>Note 5.3 for Nitrate (as N):</b>
Where nitrate and nitrite are present, total nitrate plus nitrite-nitrogen should not exceed this value.
<b>Note 5.4 for Nitrate + Nitrite (as N):</b>
Where nitrate and nitrite are present, total nitrate plus nitrite-nitrogen should not exceed this value.
<b>Note 5.5 for Aluminum (dissolved):</b>
Standard is specific to protection of human health. Standard is derived with TRV protective of adults. Standard may not adequately protect other age groups. Standard may not address aesthetic (organoleptic) concerns related to drinking water quality. Water treatment may be required.
<b>Note 5.6 for Chromium (dissolved):</b>
Analytical results for chromium (all species) in water may be used to demonstrate compliance with the standards. Where the standards cannot be met based on analytical results for chromium (all species), chromium speciation may be necessary. Standard is 50 µg/L for chromium, hexavalent. Standard is 6000 µg/L for chromium, trivalent. The standard of 50 µg/L was used to identify exceedances for dissolved chromium in order to demonstrate compliance with the standards.
<b>Note 5.7 for Cobalt (dissolved):</b>
The standard in Schedule 3.2 is 1 µg/L. However the BC Ministry of Environment and Climate Change Strategy has set an interim background groundwater concentration estimate of 20 ug/L for Cobalt at sites in the Province. Therefore a standard of 20 ug/L has been used for this criteria set.
<b>Note 5.8 for Copper (dissolved):</b>
Standard is specific to protection of human health. Standard is derived with TRV protective of adults. Standard may not adequately protect other age groups. Standard may not address aesthetic (organoleptic) concerns related to drinking water quality. Water treatment may be required.
<b>Note 5.9 for Iron (dissolved):</b>
Standard applies to a site used for an industrial or commercial purpose or activity set out in Schedule 2 as (a) item A6, A7, A8 or A11 (b) item C1, C2, C3, C4 or C6, (c) item D2, D3, D5, or D6 (d) item E4, or (e) item H14. Standard applies to a site used for an industrial or commercial purpose or activity set out in Schedule 2 as item H11 or H20, but only if the site was used for the purpose or activity in conjunction with or as a result of the site also being used for at least one of the purposes or activities set out above. Standard is specific to protection of human health. Standard is derived with TRV protective of adults. Standard may not adequately protect other age groups. Standard may not address aesthetic (organoleptic) concerns related to drinking water quality. Water treatment may be required.

**Table C-1: 2020 Groundwater Quality Results**  
**City of Vernon Reclaimed Water Irrigation Groundwater Monitoring Program**  
**Guideline Notes**

<b>Note 5.10 for Manganese (dissolved):</b>
Standard applies to a site used for an industrial or commercial purpose or activity set out in Schedule 2 as (a) item B1 (b) item C1, C3 or C4 (c) item D2, D3, D5, or D6 (d) item E4, or (e) item H3 or H14. Standard applies to a site used for an industrial or commercial purpose or activity set out in Schedule 2 as item H11 or H20, but only if the site was used for the purpose or activity in conjunction with or as a result of the site also being used for at least one of the purposes or activities set out above. Standard is specific to protection of human health. Standard is derived with TRV protective of adults. Standard may not adequately protect other age groups. Standard may not address aesthetic (organoleptic) concerns related to drinking water quality. Water treatment may be required.
<b>Note 5.11 for Sodium (dissolved):</b>
Standard is specific to protection of human health. Standard is derived with TRV protective of adults. Standard may not adequately protect other age groups.
<b>Note 5.12 for Zinc (dissolved):</b>
Standard is specific to protection of human health. Standard is derived with TRV protective of adults. Standard may not adequately protect other age groups.
<b>6. Notes for BC Approved Water Quality Guidelines for irrigation (BCAWQG I)</b>
<b>General Notes:</b>
The Water Quality Guidelines (Criteria) Reports by BC Ministry of Environment were used as references for the guidelines. (Internet address: <a href="http://www.env.gov.bc.ca/wat/wq/wq_guidelines.html">http://www.env.gov.bc.ca/wat/wq/wq_guidelines.html</a> ). Overview Reports (BC MOE) were used as the references for the guidelines unless the note for specific analyte indicates that the Technical Appendix (BC MOE) was used.
<b>Note 6.1 for pH:</b>
Update August 2019 Summary Report.
<b>Note 6.2 for Temperature:</b>
The recommended guideline for temperature is + or - 1 degree Celsius change from natural ambient background.
<b>Note 6.3 for Turbidity:</b>
Induced turbidity should not exceed 10 NTU when background turbidity is less than or equal to 50 NTU, nor should induced turbidity be more than 20 % of background when background is greater than 50 NTU.
<b>Note 6.4 for Fluoride:</b>
Total fluoride in irrigation water should not exceed 1.0 mg/L as a 30-day average or a maximum of 2.0 mg/L.
<b>Note 6.5 for Aluminum (dissolved):</b>
The guideline maximum for total aluminum is 5 mg/L. A separate guideline for dissolved aluminum is not provided.
<b>Note 6.6 for Arsenic (dissolved):</b>
The interim guideline for total arsenic is 100 µg/L.
<b>Note 6.7 for Boron (dissolved):</b>
The guideline for total boron depends on the crop, and varies from 0.5 mg/L to 6 mg/L. The most stringent guideline maximum of 0.5 mg/L, for very sensitive and sensitive crops, was used to identify exceedances for this report.
<b>Note 6.8 for Copper (dissolved):</b>
The guideline maximum for total copper is 200 µg/L.
<b>Note 6.9 for Lead (dissolved):</b>
For neutral and alkaline fine-textured soils the total lead concentration in irrigation water should not exceed 400 µg/L at any time. The concentration of total lead in irrigation water for use on all other soils should not exceed 200 µg/L at any time. / The most stringent guideline maximum was used in this report.
<b>Note 6.10 for Mercury (dissolved):</b>
The guideline maximum for total mercury is 2.0 µg/L.
<b>Note 6.11 for Molybdenum (dissolved):</b>
The guideline maximum for total molybdenum for irrigation of forage crops is 0.05 mg/L. There is no guideline maximum for total molybdenum for irrigation of non-forage crops.
<b>Note 6.12 for Selenium (dissolved):</b>
The guideline for total selenium is 10 µg/L mean. The mean concentrations in the water column are based on at least 5 weekly samples taken over a 30-day period.

**Table C-1: 2020 Groundwater Quality Results**  
**City of Vernon Reclaimed Water Irrigation Groundwater Monitoring Program**  
**Guideline Notes**

<b>Note 6.13 for Zinc (dissolved):</b>
The guideline maximum for total zinc for irrigation is as follows: - Soil pH less than 6: 1000 µg/L. - Soil pH equal to or greater than 6, and less than 7: 2000 µg/L. - Soil pH greater than or equal to 7: 5000 µg/L. / The most stringent guideline maximum was used in this report.
<b>7. Notes for BC Working Water Quality Guidelines for Irrigation (2020) (BCWWQG I)</b>
<b>General Notes:</b>
Reference: B.C. Working Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture (2020). WWQG values are long-term (i.e. average) concentrations unless identified as a short-term maximum in the "Notes" for a specific analyte. Long-term WWQGs represent average substance concentrations calculated from 5 samples in 30 days. WWQG are given for total substance concentrations unless otherwise noted.
<b>Note 7.1 for Conductivity:</b>
The guideline varies from 700 to 5000 µS/cm depending on the type of crop. The most stringent guideline has been used for this report.
<b>Note 7.2 for Total dissolved solids:</b>
The guideline varies from 500 to 3500 mg/L depending on the type of crop. The most stringent guideline has been used for this report.
<b>Note 7.3 for Cadmium (dissolved):</b>
This is a Short-term maximum guideline.
<b>Note 7.4 for Chromium (dissolved):</b>
The guideline for Cr(VI) is 8 µg/L (total). The guideline for Cr(III) is 4.9 µg/L (total). The guideline of 4.9 µg/L for Cr(III) was used, in this report, to identify exceedances for dissolved chromium, and total chromium as a means for determining the potential for exceeding the Cr(VI) and/or Cr(III) guidelines.
<b>Note 7.5 for Cobalt (dissolved):</b>
Continuous or intermittent use on all soils.
<b>Note 7.6 for Lithium (dissolved):</b>
The guideline is 2.5 mg/L for non-citrus crops (May not be protective of barley and other cereal crops; 1.0 mg/L suggested for cereal crops). The guideline is 0.75 mg/L for citrus crops. / The most stringent guideline was used in this report.
<b>8. Notes for BC CSR Generic Numerical Water Standards for Irrigation (CSR IW)</b>
<b>General Notes:</b>
BC Contaminated Sites Regulation, Generic Numerical Water Standards, Schedule 3.2; includes amendments up to B.C. Reg. 13/2019, January 24, 2019. Standards for all organic substances are for total substance concentrations. Any water sample to be analyzed for organic substances should not be filtered. Standards for surface water samples to be analyzed for heavy metals, metalloids and inorganic ions are total substance concentrations. In addition, it is recommended that surface water samples being analyzed for heavy metals, metalloids and inorganic ions should also be analyzed for dissolved substance concentrations. Standards for groundwater samples for heavy metals, metalloids and inorganic ions are for dissolved substance concentrations. In addition, it is recommended that groundwater samples being analyzed for heavy metals, metalloids and inorganic ions should also be analyzed for total substance concentrations. Standards apply to irrigation of all soil types, unless otherwise indicated. There are several different standards for site-specific factors for some analytes. The most stringent standards were used for this criteria set.
<b>Note 8.1 for Chloride:</b>
Standard to protect all types of crops.
<b>Note 8.2 for Boron (dissolved):</b>
Standard varies depending on crop. This standard is for blackberry crop.
<b>Note 8.3 for Chromium (dissolved):</b>
Analytical results for chromium (all species) in water may be used to demonstrate compliance with the standards. Where the standards cannot be met based on analytical results for chromium (all species), chromium speciation may be necessary. Standard is 8 µg/L for chromium, hexavalent. Standard is 5 µg/L for chromium, trivalent. The standard of 5 µg/L was used to identify exceedances for dissolved chromium in order to demonstrate compliance with the standards.

**Table C-1: 2020 Groundwater Quality Results**  
**City of Vernon Reclaimed Water Irrigation Groundwater Monitoring Program**  
**Guideline Notes**

<b>Note 8.4 for Iron (dissolved):</b>
Standard applies to a site used for an industrial or commercial purpose or activity set out in Schedule 2 as (a) item A6, A7, A8 or A11 (b) item C1, C2, C3, C4 or C6, (c) item D2, D3, D5, or D6 (d) item E4, or (e) item H14. Standard applies to a site used for an industrial or commercial purpose or activity set out in Schedule 2 as item H11 or H20, but only if the site was used for the purpose or activity in conjunction with or as a result of the site also being used for at least one of the purposes or activities set out above.
<b>Note 8.5 for Lithium (dissolved):</b>
Standard to protect all types of crops.
<b>Note 8.6 for Manganese (dissolved):</b>
Standard applies to a site used for an industrial or commercial purpose or activity set out in Schedule 2 as (a) item B1 (b) item C1, C3 or C4 (c) item D2, D3, D5, or D6 (d) item E4, or (e) item H3 or H14. Standard applies to a site used for an industrial or commercial purpose or activity set out in Schedule 2 as item H11 or H20, but only if the site was used for the purpose or activity in conjunction with or as a result of the site also being used for at least one of the purposes or activities set out above.
<b>Note 8.7 for Molybdenum (dissolved):</b>
Standard varies with crop, soil drainage and Mo:Cu ratio. Standard is 10 – 30 µg/L. Consult a director for further advice. The most stringent standard of 10 µg/L has been used.
<b>Note 8.8 for Selenium (dissolved):</b>
Standard varies with type of application; continuous or intermittent. This standard is for continuous applications on crops
<b>Note 8.9 for Zinc (dissolved):</b>
The standard varies (from 1000 to 5000 µg/L) with soil pH. This standard (which is the most stringent) is for soil pH less than 6.0
<b>9. Notes for BC Approved Water Quality Guidelines for livestock (BCAWQG L)</b>
<b>General Notes:</b>
The Water Quality Guidelines (Criteria) Reports by BC Ministry of Environment were used as references for the guidelines. (Internet address: <a href="http://www.env.gov.bc.ca/wat/wq/wq_guidelines.html">http://www.env.gov.bc.ca/wat/wq/wq_guidelines.html</a> ). Overview Reports (BC MOE) were used as the references for the guidelines unless the note for specific analyte indicates that the Technical Appendix (BC MOE) was used.
<b>Note 9.1 for pH:</b>
Update August 2019 Summary Report.
<b>Note 9.2 for Temperature:</b>
The recommended guideline for temperature is + or - 1 degree Celsius change from natural ambient background.
<b>Note 9.3 for Turbidity:</b>
Induced turbidity should not exceed 5 NTU when background turbidity is less than or equal to 50 NTU, nor should induced turbidity be more than 10 % of background when background is greater than 50 NTU.
<b>Note 9.4 for Chloride:</b>
The water quality guideline for chloride for livestock watering is 600 mg/L.
<b>Note 9.5 for Fluoride:</b>
The total fluoride recommendation for dairy cows, breeding stock and other long-lived animals is 1.0 mg/L as a 30-day mean and 1.5 mg/L as a maximum. Total fluoride should not exceed 2.0 mg/L as a 30-day mean or 4.0 mg/L maximum in the drinking water of all other types of livestock, unless fluoride is provided in the diet by bone meal or mineral additives, in which case 1.0 mg/L as a 30-day mean and 2.0 mg/L maximum is recommended. / The most stringent guideline maximum was used in this report.
<b>Note 9.6 for Nitrate (as N):</b>
Overview Report Update, September 2009.
<b>Note 9.7 for Nitrate + Nitrite (as N):</b>
The guideline maximum for nitrate as nitrogen is 100 mg/l. Where nitrate and nitrite are present, the total nitrate+nitrite nitrogen should not exceed this value. Overview Report Update, September 2009.
<b>Note 9.8 for Nitrite (as N):</b>
Overview Report Update, September 2009.

**Table C-1: 2020 Groundwater Quality Results**  
**City of Vernon Reclaimed Water Irrigation Groundwater Monitoring Program**  
**Guideline Notes**

<b>Note 9.9 for Aluminum (dissolved):</b>
The guideline maximum for total aluminum is 5 mg/L. A separate guideline for dissolved aluminum is not provided.
<b>Note 9.10 for Arsenic (dissolved):</b>
The interim guideline for total arsenic is 25 µg/L.
<b>Note 9.11 for Boron (dissolved):</b>
The guideline maximum for total boron is 5 mg/L.
<b>Note 9.12 for Copper (dissolved):</b>
The guideline maximum for total copper is 300 µg/L.
<b>Note 9.13 for Lead (dissolved):</b>
The guideline maximum for total lead is 100 µg/L.
<b>Note 9.14 for Mercury (dissolved):</b>
The guideline maximum for total mercury is 3.0 µg/L.
<b>Note 9.15 for Molybdenum (dissolved):</b>
If livestock are consuming forages not irrigated, or if no molybdenum containing fertilizers are applied to grow feed consumed by livestock, then the guideline maximum for total molybdenum is 0.08 mg/L. For all other cases, the guideline maximum for total molybdenum is 0.05 mg/L. / The most stringent guideline maximum was used in this report.
<b>Note 9.16 for Selenium (dissolved):</b>
The guideline for total selenium is 30.0 µg/L mean. The mean concentrations in the water column are based on at least 5 weekly samples taken over a 30-day period.
<b>Note 9.17 for Zinc (dissolved):</b>
The guideline maximum for total zinc is 2000 µg/L.
<b>10. Notes for BC Working Water Quality Guidelines for Livestock (2020) (BCWWQG L)</b>
<b>General Notes:</b>
Reference: B.C. Working Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture (2020). WWQG values are long-term (i.e. average) concentrations unless identified as a short-term maximum in the "Notes" for a specific analyte. Long-term WWQGs represent average substance concentrations calculated from 5 samples in 30 days. WWQG are given for total substance concentrations unless otherwise noted.
<b>Note 10.1 for Sulphate:</b>
The guideline is for dissolved sulphate.
<b>Note 10.2 for Total dissolved solids:</b>
The guideline is 1,000-3,000 mg/L, and is species dependent. Maximum of 1000 mg/L is relatively low level of salinity; excellent for all classes of livestock. TDS between 1000 and 3000 mg/L is satisfactory for all classes of livestock and poultry, but some loss in productivity should be anticipated; may cause temporary and mild diarrhoea in livestock not accustomed to them or watery droppings in poultry. / The most stringent guideline was used in this report.
<b>Note 10.3 for Cadmium (dissolved):</b>
This is a Short-term maximum guideline.
<b>Note 10.4 for Chromium (dissolved):</b>
The guideline for Cr(VI) is 50 µg/L (total). The guideline for Cr(III) is 50 µg/L (total). The guideline of 50 µg/L for Cr(VI), and for Cr(III) was used, in this report, to identify exceedances for dissolved chromium, and total chromium as a means for determining the potential for exceeding the Cr(VI) and/or Cr(III) guidelines.
<b>11. Notes for BC CSR Generic Numerical Water Standards for Livestock (CSR LW)</b>
<b>General Notes:</b>
BC Contaminated Sites Regulation, Generic Numerical Water Standards, Schedule 3.2; includes amendments up to B.C. Reg. 13/2019, January 24, 2019. Standards for all organic substances are for total substance concentrations. Any water sample to be analyzed for organic substances should not be filtered. Standards for surface water samples to be analyzed for heavy metals, metalloids and inorganic ions are total substance concentrations. In addition, it is recommended that surface water samples being analyzed for heavy metals, metalloids and inorganic ions should also be analyzed for dissolved substance concentrations. Standards for groundwater samples for heavy metals, metalloids and inorganic ions are for dissolved substance concentrations. In addition, it is recommended that groundwater samples being analyzed for heavy metals, metalloids and inorganic ions should also be analyzed for total substance concentrations.

**Table C-1: 2020 Groundwater Quality Results**  
**City of Vernon Reclaimed Water Irrigation Groundwater Monitoring Program**  
**Guideline Notes**

<b>Note 11.1 for Fluoride:</b>
Standard varies with type of livestock. Consult a director for further advice.
<b>Note 11.2 for Nitrate (as N):</b>
Where nitrate and nitrite are present, total nitrate plus nitrite-nitrogen should not exceed this value.
<b>Note 11.3 for Nitrate + Nitrite (as N):</b>
Where nitrate and nitrite are present, total nitrate plus nitrite-nitrogen should not exceed this value.
<b>Note 11.4 for Chromium (dissolved):</b>
Analytical results for chromium (all species) in water may be used to demonstrate compliance with the standards. Where the standards cannot be met based on analytical results for chromium (all species), chromium speciation may be necessary. Standard is 50 µg/L for chromium, hexavalent. Standard is 50 µg/L for chromium, trivalent. The standard of 50 µg/L was used to identify exceedances for dissolved chromium in order to demonstrate compliance with the standards.
<b>12. Notes for BC Approved Water Quality Guidelines for freshwater aquatic life (Short-term acute) (BCAWQG AL (ST))</b>
<b>General Notes:</b>
For some parameters, there are two water quality guidelines: the short-term acute guideline (i.e. maximum), and the long-term chronic guideline (i.e. average). The short-term acute guideline was used in this criteria set for parameters that have both guideline values.
<b>Note 12.1 for Dissolved oxygen:</b>
The instantaneous minimum guideline for dissolved oxygen is 5 mg/L for all life stages other than buried embryo/alevin. The instantaneous minimum guideline for dissolved oxygen in the water column is 9 mg/L for buried embryo/alevin. The instantaneous minimum guideline for dissolved oxygen in interstitial water is 6 mg/L for buried embryo/alevin. The 30-day mean guideline (minimum) for dissolved oxygen is 8 mg/L for all life stages other than buried embryo/alevin. The 30-day mean guideline (minimum) for dissolved oxygen in the water column is 11 mg/L for buried embryo/alevin. The 30-day mean guideline (minimum) for dissolved oxygen in interstitial water is 8 mg/L for buried embryo/alevin.
<b>Note 12.2 for pH:</b>
pH less than 6.5: No statistically significant decrease in pH from background. pH from 6.5 to 9.0: Unrestricted change permitted within this range. pH over 9.0: No statistically significant increase in pH from background. See BC MOE Overview Report for additional details.
<b>Note 12.3 for Temperature:</b>
The maximum daily temperature of 19 degrees Celsius is for streams with unknown fish distribution. See BC MOE Overview Report for additional details for streams with unknown fish distribution, and specific guidelines for streams with known fish distribution, and guideline for lakes and impoundments.
<b>Note 12.4 for Turbidity:</b>
When background is less than or equal to 8 NTU: - Maximum Induced Turbidity of 8 NTU in 24 hours. - For sediment inputs that last between 24 hours and 30 days (daily sampling preferred) the mean turbidity should not exceed background by more than 2 NTU. Maximum Induced Turbidity of 5 NTU when background is between 8 and 50 NTU. Maximum Induced Turbidity of 10% when background is greater than 50 NTU.
<b>Note 12.5 for Chloride:</b>
To protect freshwater aquatic life from acute and lethal effects, the maximum concentration of chloride (mg/L as NaCl) at any time should not exceed 600 mg/L. To protect freshwater aquatic life from chronic effects, the average (arithmetic mean computed from five weekly samples collected over a 30-day period) concentration of chloride (mg/L as NaCl) should not exceed 150 mg/L.
<b>Note 12.6 for Fluoride:</b>
Correction by BC MOE Sept. 2011: The criteria for Fluoride (total) in mg/L is 0.4 as a maximum where the water hardness (as CaCO <sub>3</sub> ) is less than or equal to 10 mg/L. Otherwise use the equation: LC50 fluoride = -51.73 + 92.57 log <sub>10</sub> (Hardness) and multiply by 0.01. Hardness is as CaCO <sub>3</sub> in units mg/L.
<b>Note 12.7 for Sulphate:</b>
The approved 30-day average (minimum of 5 evenly-spaced samples collected in 30 days) water quality guidelines to protect aquatic life in BC for sulphate are: 128 mg/L at hardness of 0 to 30 mg/L as CaCO <sub>3</sub> 218 mg/L at hardness of 31 to 75 mg/L as CaCO <sub>3</sub> 309 mg/L at hardness of 76 to 180mg/L as CaCO <sub>3</sub> 429 mg/L at hardness 181 to 250 mg/L as CaCO <sub>3</sub> Need to determine guideline based on site water for hardness greater than 250 mg/L as CaCO <sub>3</sub> . For screening purposes in this report, exceedance were flagged for sulphate greater than 429 mg/L at hardness greater than 250 mg/L as CaCO <sub>3</sub> .

**Table C-1: 2020 Groundwater Quality Results**  
**City of Vernon Reclaimed Water Irrigation Groundwater Monitoring Program**  
**Guideline Notes**

<b>Note 12.8 for Ammonia (total, as N):</b>
The maximum guideline for ammonia varies as a function of pH and temperature. See Table 3 in Overview Report Update September 2009. The 30-day average guideline for ammonia varies as a function of pH and temperature. See Table 4 in Overview Report Update September 2009. / The lab pH and field temperature results were used for determining the maximum ammonia for this report. If a lab pH result was not available then the field pH result was used.
<b>Note 12.9 for Nitrate (as N):</b>
The guideline maximum for nitrate (as N) is 32.8 mg/l. The 30-day average guideline for nitrate (as N) is 3.0 mg /L. The 30-day average (chronic) concentration is based on 5 weekly samples collected within a 30-day period. Where nitrate and nitrite are present, the total nitrate+nitrite nitrogen should not exceed these values.
<b>Note 12.10 for Nitrate + Nitrite (as N):</b>
The guideline maximum for nitrate (as N) is 32.8 mg/l. The 30-day average guideline for nitrate (as N) is 3.0 mg /L. The 30-day average (chronic) concentration is based on 5 weekly samples collected within a 30-day period. Where nitrate and nitrite are present, the total nitrate+nitrite nitrogen should not exceed these values.
<b>Note 12.11 for Nitrite (as N):</b>
The guideline maximum for nitrite as N is: 0.06 mg/L if chloride less than 2 mg/L 0.12 mg/L if chloride is 2 to 4 mg/L 0.18 mg/L if chloride is 4 to 6 mg/L 0.24 mg/L if chloride is 6 to 8 mg/L 0.30 mg/L if chloride is 8 to 10 mg/L 0.60 mg/L if chloride is greater than 10 mg/L. The guideline 30-day average for nitrite as N is: 0.02 mg/L if chloride less than 2 mg/L 0.04 mg/L if chloride is 2 to 4 mg/L 0.06 mg/L if chloride is 4 to 6 mg/L 0.08 mg/L if chloride is 6 to 8 mg/L 0.10 mg/L if chloride is 8 to 10 mg/L 0.20 mg/L if chloride is greater than 10 mg/L.
<b>Note 12.12 for Phosphorus (total, APHA 4500-P):</b>
Streams: None proposed for streams. Lakes: It is not possible to specify a single phosphorous concentration to achieve protection of aquatic life in lakes. A range of total phosphorous concentrations (5-15 µg/L) is suggested as the criterion which can be used as the basis for site specific water quality objectives. (Table 3 and Overview Rept) A maximum of 15 µg/L (0.015 mg/L) was used in this report for screening purposes.
<b>Note 12.13 for Phosphorus (dissolved, APHA 4500-P):</b>
Streams: None proposed for streams. Lakes: It is not possible to specify a single phosphorous concentration to achieve protection of aquatic life in lakes. A range of total phosphorous concentrations (5-15 µg/L) is suggested as the criterion which can be used as the basis for site specific water quality objectives. (Table 3 and Overview Rept) A maximum of 15 µg/L (0.015 mg/L) was used in this report for screening purposes.
<b>Note 12.14 for Aluminum (dissolved):</b>
The maximum concentration of dissolved aluminum at any time should not exceed: 1. 0.10 mg/L when the pH is greater than or equal to 6.5 2. The value (in mg/L) determined by the following relationship if pH less than 6.5 Dissolved Aluminum = $e^{(1.209 - 2.426 (pH) + 0.286 (pH)^2)}$ The 30-day average concentration of dissolved aluminum (based on a minimum of 5 approximately weekly samples) should not exceed: 1. 0.05 mg/L when the median pH over 30 days is greater than or equal to 6.5 2. the value determined by the following relationship at median pH less than 6.5 Dissolved Aluminum = $e^{(1.6 - 3.327 (\text{median pH}) + 0.402 (\text{median pH})^2)}$
<b>Note 12.15 for Arsenic (dissolved):</b>
The recommended guideline is for total arsenic.
<b>Note 12.16 for Boron (dissolved):</b>
The recommended guideline is for total boron.

**Table C-1: 2020 Groundwater Quality Results**  
**City of Vernon Reclaimed Water Irrigation Groundwater Monitoring Program**  
**Guideline Notes**

<b>Note 12.17 for Cadmium (dissolved):</b>
<p>The guideline for cadmium is determined on a site-specific basis according to the local water hardness. The guideline for cadmium (dissolved) in µg/L is determined by the following equations for short term exposure:</p> <ol style="list-style-type: none"> <li>1. If hardness (as CaCO<sub>3</sub>) is less than 7 mg/L then maximum is 0.0380 µg/L</li> <li>2. If hardness (as CaCO<sub>3</sub>) is from 7 to 45 mg/L then maximum is based on equation:  <math display="block">e \text{ to the power of } \{1.03[\ln(\text{hardness})] - 5.274\}</math></li> <li>3. If hardness (as CaCO<sub>3</sub>) is greater than 455 mg/L then maximum is 2.8 µg/L.</li> </ol> <p>When water hardness is greater than the upper bound (i.e., highest water hardness tested), a site-specific assessment may be required.</p>
<b>Note 12.18 for Cobalt (dissolved):</b>
<p>The interim maximum concentration for total cobalt is 110 µg/L to protect aquatic life in the freshwater environment from acute effects of cobalt.</p> <p>The interim 30-day average concentration for total cobalt (based on five weekly samples) is 4 µg/L to protect aquatic life from chronic effects of cobalt.</p>
<b>Note 12.19 for Copper (dissolved):</b>
<p>The guideline is for dissolved copper and is dependent on the specific chemistry of the water body and can only be calculated using the British Columbia Biotic Ligand Model (BC BLM) software. (Update August 2019)</p>
<b>Note 12.20 for Lead (dissolved):</b>
<p>The maximum guideline for total lead in water, at a water hardness less than or equal to 8 mg/L as CaCO<sub>3</sub> is set at 3.0 µg/L. When water hardness exceeds 8.0 mg/L CaCO<sub>3</sub> the maximum guideline for lead at any time is given by the following equation:  <math display="block">\text{Maximum Criteria (µg/L)} = \exp(1.273 \ln(\text{hardness})) - 1.460</math></p> <p>The 30-day average guideline for total lead in water, when water hardness exceeds 8 mg/L as CaCO<sub>3</sub>, is as follows:  <math display="block">\text{30-Day Average (µg/L)} \text{ is less than or equal to } 3.31 + \exp(1.273 \ln(\text{mean hardness})) - 4.704</math></p> <p>For hardness less than or equal to 8.0 mg/L there is no 30-day average guideline; hence the maximum concentration of 3.0 µg/L is used.</p>
<b>Note 12.21 for Manganese (dissolved):</b>
<p>The maximum concentration of total manganese in mg/L at any time should not exceed the value as determined by the following relationship:  <math display="block">0.01102 \text{ hardness} + 0.54</math>         where water hardness is reported as mg/L of CaCO<sub>3</sub>.</p> <p>The 30-day mean concentration of total manganese in mg/L should be less than or equal to the value as determined by the following relationship:  <math display="block">0.0044 \text{ hardness} + 0.605</math>         where water hardness is reported as mg/L of CaCO<sub>3</sub>.</p>
<b>Note 12.22 for Mercury (dissolved):</b>
<p>The average concentration of total mercury in water as measured over a 30-day period (based on five weekly samples) should not exceed 0.02 µg/L when the methyl mercury (MeHg) constitutes less than or equal to 0.5% of the total mercury concentration. When the proportion of MeHg is greater than 0.5%, the guideline should be adjusted as indicated in the Table 1 and Table 4 of the BC MOE Overview Report - First Update, February 2001.</p> <p>There is no guideline maximum for total mercury in water, for freshwater aquatic life.</p>
<b>Note 12.23 for Molybdenum (dissolved):</b>
<p>The maximum concentration for total molybdenum is 2 mg/L.</p> <p>The 30-day average concentration for total molybdenum (based on at least five weekly samples in a period of 30 days) is less than or equal to 1 mg/L.</p>
<b>Note 12.24 for Selenium (dissolved):</b>
<p>The 30-day average water quality guideline for protection of aquatic life is 2 µg/L determined as the mean concentration of 5 evenly spaced samples collected over 30 days, and measured as total selenium.</p> <p>The 30-day average alert concentration for the protection of aquatic life in sensitive ecosystems is 1 µg/L determined as the mean concentration of 5 evenly spaced samples collected over 30 days, and measured as total selenium.</p>
<b>Note 12.25 for Silver (dissolved):</b>
<p>The guideline maximum for total silver is:</p> <p>0.1 µg/L maximum if hardness less than or equal to 100 mg/L</p> <p>3.0 µg/L maximum if hardness greater than 100 mg/L.</p> <p>The guideline 30-day average for total silver is:</p> <p>0.05 µg/L as 30-day mean if hardness less than or equal to 100 mg/L</p> <p>1.5 µg/L as 30-day mean if hardness greater than 100 mg/L.</p>

**Table C-1: 2020 Groundwater Quality Results**  
**City of Vernon Reclaimed Water Irrigation Groundwater Monitoring Program**  
**Guideline Notes**

<b>Note 12.26 for Zinc (dissolved):</b>
<p>The Short-term Maximum concentration of total zinc (µg/L) at any time should not exceed 33 µg/L when water hardness is less than or equal to 90 mg/L as CaCO<sub>3</sub>.</p> <p>When water hardness exceeds 90 mg/L CaCO<sub>3</sub>, the Short-term Maximum guideline in µg/L for total zinc is the value determined by the following relationship:</p> $33 + 0.75 * (\text{hardness} - 90)$ <p>where water hardness is reported as mg/L of CaCO<sub>3</sub>.</p> <p>Short-term maximum WQG formula applies to water hardness between 90 – 500 mg/L CaCO<sub>3</sub>.</p> <p>The Long-term Average concentration of total zinc (µg/L) at any time should not exceed 7.5 µg/L when water hardness is less than or equal to 90 mg/L as CaCO<sub>3</sub>.</p> <p>When water hardness exceeds 90 mg/L CaCO<sub>3</sub>, the Long-term Average guideline in µg/L for total zinc is the value determined by the following relationship:</p> $7.5 + 0.75 * (\text{hardness} - 90)$ <p>where water hardness is reported as mg/L of CaCO<sub>3</sub>.</p> <p>Long-term average WQG formula applies to water hardness between 90 – 330 mg/L CaCO<sub>3</sub>.</p>
<b>13. Notes for BC Working Water Quality Guidelines for Freshwater Aquatic Life (2020) (BCWWQG AL)</b>
<b>General Notes:</b>
<p>Reference: B.C. Working Water Quality Guidelines: Aquatic Life, Wildlife &amp; Agriculture (2020). WWQG values are long-term (i.e. average) concentrations unless identified as a short-term maximum in the "Notes" for a specific analyte. Long-term WWQGs represent average substance concentrations calculated from 5 samples in 30 days. WWQG are given for total substance concentrations unless otherwise noted.</p>
<b>Note 13.1 for Alkalinity (phenolphthalein, as CaCO<sub>3</sub>):</b>
<p>The guideline for alkalinity (total as CaCO<sub>3</sub>) is as follows:</p> <ul style="list-style-type: none"> <li>- Less than 10 mg/L, highly sensitive to acid inputs</li> <li>- 10 to 20 mg/L, moderately sensitive to acid inputs</li> <li>- Greater than 20 mg/L, low sensitivity to acid inputs.</li> </ul> <p>Sensitivity to acid inputs can be determined by the concentration of dissolved calcium: &lt; 4 mg/L is highly sensitive to acid inputs; 4 to 8 mg/L is moderately sensitive; and &gt; 8 mg/L is low sensitivity.</p>
<b>Note 13.2 for Alkalinity (total, as CaCO<sub>3</sub>):</b>
<p>The guideline for alkalinity (total as CaCO<sub>3</sub>) is as follows:</p> <ul style="list-style-type: none"> <li>- Less than 10 mg/L, highly sensitive to acid inputs</li> <li>- 10 to 20 mg/L, moderately sensitive to acid inputs</li> <li>- Greater than 20 mg/L, low sensitivity to acid inputs.</li> </ul> <p>Sensitivity to acid inputs can be determined by the concentration of dissolved calcium: &lt; 4 mg/L is highly sensitive to acid inputs; 4 to 8 mg/L is moderately sensitive; and &gt; 8 mg/L is low sensitivity.</p>
<b>Note 13.3 for Antimony (dissolved):</b>
The guideline is for antimony (III).
<b>Note 13.4 for Calcium (dissolved):</b>
<p>The guideline for dissolved calcium in mg/L is as follows:</p> <ul style="list-style-type: none"> <li>- Less than 4, highly sensitive to acid inputs</li> <li>- 4 to 8, moderately sensitive</li> <li>- Greater than 8, low sensitivity.</li> </ul>
<b>Note 13.5 for Chromium (dissolved):</b>
<p>The guideline for Cr(VI) is 1 µg/L (total). The guideline for Cr(III) is 8.9 µg/L (total). The guideline of 1 µg/L for Cr(VI) was used, in this report, to identify exceedances for dissolved chromium, and total chromium as a means for determining the potential for exceeding the Cr(VI) and/or Cr(III) guidelines.</p>
<b>Note 13.6 for Nickel (dissolved):</b>
<p>The guideline for nickel in µg/L is determined as follows:</p> <p>When the water hardness is 0 to ≤ 60 mg/L, the maximum is 25 µg/L</p> <p>At hardness &gt; 60 to ≤ 180 mg/L the maximum is calculated using the equation:</p> $e \text{ raised to the power of } \{0.76[\ln(\text{hardness})] + 1.06\}$ <p>At hardness &gt; 180 mg/L, the maximum is 150 µg/L</p> <p>Where water hardness is reported as mg/L CaCO<sub>3</sub>.</p> <p>If the water hardness is unknown, the maximum is 25 µg/L.</p>
<b>Note 13.7 for Thallium (dissolved):</b>
30-day average, site-specific objective for the lower Columbia River, BC

**Table C-1: 2020 Groundwater Quality Results**  
**City of Vernon Reclaimed Water Irrigation Groundwater Monitoring Program**  
**Guideline Notes**

<b>14. Notes for BC CSR Generic Numerical Water Standards for Freshwater Aquatic Life (CSR AW)</b>
<b>General Notes:</b>
<p>BC Contaminated Sites Regulation, Generic Numerical Water Standards, Schedule 3.2; includes amendments up to B.C. Reg. 13/2019, January 24, 2019.</p> <p>Aquatic life standards assume minimum 1:10 dilution available, and are to protect freshwater life.</p> <p>Standards for all organic substances are for total substance concentrations. Any water sample to be analyzed for organic substances should not be filtered.</p> <p>Standards for surface water samples to be analyzed for heavy metals, metalloids and inorganic ions are total substance concentrations. In addition, it is recommended that surface water samples being analyzed for heavy metals, metalloids and inorganic ions should also be analyzed for dissolved substance concentrations.</p> <p>Standards for groundwater samples for heavy metals, metalloids and inorganic ions are for dissolved substance concentrations. In addition, it is recommended that groundwater samples being analyzed for heavy metals, metalloids and inorganic ions should also be analyzed for total substance concentrations.</p>
<b>Note 14.1 for Fluoride:</b>
<p>The standard for fluoride is:</p> <p>2000 µg/L @ H &lt; 50</p> <p>3000 µg/L @ H ≥ 50</p> <p>Where H means water hardness in mg/L as CaCO<sub>3</sub>.</p>
<b>Note 14.2 for Sulphate:</b>
<p>The standard for sulfate is:</p> <p>1280 mg/L @ H ≤ 30</p> <p>2180 mg/L @ H 31 - 75</p> <p>3090 mg/L @ H 76 - 180</p> <p>4290 mg/L @ H &gt; 180</p> <p>Where H means water hardness in mg/L as CaCO<sub>3</sub>.</p>
<b>Note 14.3 for Ammonia (total, as N):</b>
<p>Standard varies with pH and temperature. 10 degrees C is assumed. Consult a director for further advice.</p> <p>The standard for ammonia, total (as N) is:</p> <p>1,310 µg/L @ pH ≥ to 8.5</p> <p>3,700 µg/L @ pH 8.0 - &lt; 8.5</p> <p>11,300 µg/L @ pH 7.5 - &lt; 8.0</p> <p>18,500 µg/L @ pH 7.0 - &lt; 7.5</p> <p>18,400 µg/L @ pH &lt; 7.0</p>
<b>Note 14.4 for Nitrate (as N):</b>
Standard may not protect all amphibians. Consult director for further advice.
<b>Note 14.5 for Nitrate + Nitrite (as N):</b>
Standard may not protect all amphibians. Consult director for further advice.
<b>Note 14.6 for Nitrite (as N):</b>
<p>Standard varies with chloride concentration. Consult a director for further advice.</p> <p>The standard for nitrite (as N) is:</p> <p>200 µg/L (Cl &lt; 2 mg/L)</p> <p>400 µg/L (Cl 2 - &lt; 4 mg/L)</p> <p>600 µg/L (Cl 4 - &lt; 6 mg/L)</p> <p>800 µg/L (Cl 6 - &lt; 8 mg/L)</p> <p>1,000 µg/L (Cl 8 - &lt; 10 mg/L)</p> <p>2,000 µg/L (Cl ≥ 10 mg/L)</p>
<b>Note 14.7 for Cadmium (dissolved):</b>
<p>The standard for cadmium is as follows:</p> <p>0.5 µg/L @ H &lt; 30</p> <p>1.5 µg/L @ H 30 - &lt; 90</p> <p>2.5 µg/L @ H 90 - &lt; 150</p> <p>3.5 µg/L @ H 150 - &lt; 210</p> <p>4 µg/L @ H ≥ 210</p> <p>Where H means water hardness in mg/L as CaCO<sub>3</sub>.</p>
<b>Note 14.8 for Chromium (dissolved):</b>
<p>Analytical results for chromium (all species) in water may be used to demonstrate compliance with the standards. Where the standards cannot be met based on analytical results for chromium (all species), chromium speciation may be necessary.</p> <p>Standard is 10 µg/L for chromium, hexavalent. Standard is 90 µg/L for chromium, trivalent. The standard of 10 µg/L was used to identify exceedances for dissolved chromium in order to demonstrate compliance with the standards.</p>
<b>Note 14.9 for Copper (dissolved):</b>

**Table C-1: 2020 Groundwater Quality Results**  
**City of Vernon Reclaimed Water Irrigation Groundwater Monitoring Program**  
**Guideline Notes**

The standard for copper is as follows:

20 µg/L @ H < 50  
 30 µg/L @ H 50 - < 75  
 40 µg/L @ H 75 - < 100  
 50 µg/L @ H 100 - < 125  
 60 µg/L @ H 125 - < 150  
 70 µg/L @ H 150 - < 175  
 80 µg/L @ H 175 - < 200  
 90 µg/L @ H ≥ 200

Where H means water hardness in mg/L as CaCO<sub>3</sub>.

**Note 14.10 for Lead (dissolved):**

The standard for lead is as follows:

40 µg/L @ H < 50  
 50 µg/L @ H 50 - < 100  
 60 µg/L @ H 100 - < 200  
 110 µg/L @ H 200 - < 300  
 160 µg/L @ H ≥ 300

Where H means water hardness in mg/L as CaCO<sub>3</sub>.

**Note 14.11 for Nickel (dissolved):**

The standard for nickel is as follows:

250 µg/L @ H < 60  
 650 µg/L @ H 60 - < 120  
 1,100 µg/L @ H 120 - < 180  
 1,500 µg/L @ H ≥ 180

Where H means water hardness in mg/L as CaCO<sub>3</sub>.

**Note 14.12 for Silver (dissolved):**

The standard for silver is:

0.5 µg/L @ H ≤ 100  
 15 µg/L @ H > 100

Where H means water hardness in mg/L as CaCO<sub>3</sub>.

**Note 14.13 for Zinc (dissolved):**

The standard for zinc is as follows:

75 µg/L @ H < 90  
 150 µg/L @ H = 90 - < 100  
 900 µg/L @ H = 100 - < 200  
 1,650 µg/L @ H = 200 - < 300  
 2,400 µg/L @ H = 300 - < 400  
 3,150 µg/L @ H = 400 - < 500

If H ≥ 500 then use following formula:

Standard (µg/L) =  $10 \times [7.5 + \{(0.75)(H - 90)\}]$

Where H means water hardness in mg/L as CaCO<sub>3</sub>.

There are special ministry approval and data reporting requirements for water hardness values ≥ 500 mg/L as CaCO<sub>3</sub>.

Reference is Schedule 3.2 and Protocol 10.

**Table C-2: 2020 Bailey Springs Results**  
**City of Vernon Reclaimed Water Irrigation Groundwater Monitoring Program**

**Legend for Table C-2:**

<	Less than reported detection limit
BCAWQG AL (ST)	BC Approved Water Quality Guidelines for Freshwater Aquatic Life (short-term acute)
BCAWQG AL (LT)	BC Approved Water Quality Guidelines for Freshwater Aquatic Life (long-term chronic)
BCWWQG AL	BC Working Water Quality Guidelines for Freshwater Aquatic Life
BC RWQG	BC Recreational Water Quality Guidelines
Calc	Calculated guideline or standard. The guideline or standard is dependent on the value of one or more other analytes, and is calculated from a formula or table.
N	Narrative type of guideline or standard, or Result Note.
NG	No Guideline
NT	Not Tested or Measured
BCAWQG AL (ST)	Highlighted value exceeds the BCAWQG AL (ST)
BCAWQG AL (LT)	Highlighted value exceeds the BCAWQG AL (LT)
BCWWQG AL	Highlighted value exceeds the BCWWQG AL
<b>BC RWQG</b>	Highlighted value exceeds the BC RWQG

Table C-2: 2020 Bailey Springs Results  
City of Vernon Reclaimed Water Irrigation Groundwater Monitoring Program

Analyte	Unit	Sampling Location									
		Date Sampled									
		Sample Type									
		Guideline									
		BCAQWQAL (ST)	BCAQWQAL (LT)	BCAQWQAL	BCAQWQAL	BCAQWQAL	BCAQWQAL	BCAQWQAL	BCAQWQAL	BCAQWQAL	BCAQWQAL
<b>Lab Results</b>											
<b>General</b>											
Chloride	mg/L	600 <sup>1.1</sup>	150 <sup>1.1</sup>	NG	NG	NG	NG	NG	NG	NG	NG
Conductivity	µS/cm	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
pH		N <sup>1.2</sup>	N <sup>1.2</sup>	NG	NG	NG	NG	NG	NG	NG	NG
Sulfate (total)	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
Sulfate	mg/L	Calc <sup>1.3</sup>	Calc <sup>1.3</sup>	NG	NG	NG	NG	NG	NG	NG	NG
<b>Nutrients</b>											
Ammonia (total, as N)	mg/L	Calc <sup>1.4</sup>	Calc <sup>1.4</sup>	NG	NG	NG	NG	NG	NG	NG	NG
Nitrate (as N)	mg/L	32.8 <sup>1.5</sup>	3.0 <sup>2.5</sup>	NG	NG	NG	NG	NG	NG	NG	NG
Nitrite (as N)	mg/L	Calc <sup>1.6</sup>	Calc <sup>1.6</sup>	NG	NG	NG	NG	NG	NG	NG	NG
Total nitrogen	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
Total Kjeldahl nitrogen	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
Total organic nitrogen	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
Orthophosphate (dissolved, as P)	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
Phosphorus (total, APHA 4500-P)	mg/L	0.015 <sup>1.7</sup>	N <sup>1.7</sup>	NG	NG	NG	NG	NG	NG	NG	NG
Phosphorus (dissolved, APHA 4500-P)	mg/L	0.015 <sup>1.8</sup>	N <sup>1.8</sup>	NG	NG	NG	NG	NG	NG	NG	NG
<b>Microbiological</b>											
Fecal coliforms (counts)	CFU/100 mL	N <sup>1.9</sup>	N <sup>1.9</sup>	NG	NG	NG	NG	NG	NG	NG	NG
Total coliforms (counts)	CFU/100 mL	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG



**Table C-2: 2020 Bailey Springs Results**  
**City of Vernon Reclaimed Water Irrigation Groundwater Monitoring Program**  
**Guideline Notes**

<b>1. Notes for BC Approved Water Quality Guidelines for freshwater aquatic life (Short-term acute) (BCAQG AL (ST))</b>
<b>General Notes:</b>
For some parameters, there are two water quality guidelines: the short-term acute guideline (i.e. maximum), and the long-term chronic guideline (i.e. average). The short-term acute guideline was used in this criteria set for parameters that have both guideline values.
<b>Note 1.1 for Chloride:</b>
To protect freshwater aquatic life from acute and lethal effects, the maximum concentration of chloride (mg/L as NaCl) at any time should not exceed 600 mg/L. To protect freshwater aquatic life from chronic effects, the average (arithmetic mean computed from five weekly samples collected over a 30-day period) concentration of chloride (mg/L as NaCl) should not exceed 150 mg/L.
<b>Note 1.2 for pH:</b>
pH less than 6.5: No statistically significant decrease in pH from background. pH from 6.5 to 9.0: Unrestricted change permitted within this range. pH over 9.0: No statistically significant increase in pH from background. See BC MOE Overview Report for additional details.
<b>Note 1.3 for Sulphate:</b>
The approved 30-day average (minimum of 5 evenly-spaced samples collected in 30 days) water quality guidelines to protect aquatic life in BC for sulphate are: 128 mg/L at hardness of 0 to 30 mg/L as CaCO <sub>3</sub> 218 mg/L at hardness of 31 to 75 mg/L as CaCO <sub>3</sub> 309 mg/L at hardness of 76 to 180 mg/L as CaCO <sub>3</sub> 429 mg/L at hardness 181 to 250 mg/L as CaCO <sub>3</sub> Need to determine guideline based on site water for hardness greater than 250 mg/L as CaCO <sub>3</sub> . For screening purposes in this report, exceedance were flagged for sulphate greater than 429 mg/L at hardness greater than 250 mg/L as CaCO <sub>3</sub> .
<b>Note 1.4 for Ammonia (total, as N):</b>
The maximum guideline for ammonia varies as a function of pH and temperature. See Table 3 in Overview Report Update September 2009. The 30-day average guideline for ammonia varies as a function of pH and temperature. See Table 4 in Overview Report Update September 2009. / The lab pH and field temperature results were used for determining the maximum ammonia for this report. If a lab pH result was not available then the field pH result was used.
<b>Note 1.5 for Nitrate (as N):</b>
The guideline maximum for nitrate (as N) is 32.8 mg/L. The 30-day average guideline for nitrate (as N) is 3.0 mg /L. The 30-day average (chronic) concentration is based on 5 weekly samples collected within a 30-day period. Where nitrate and nitrite are present, the total nitrate+nitrite nitrogen should not exceed these values.
<b>Note 1.6 for Nitrite (as N):</b>
The guideline maximum for nitrite as N is: 0.06 mg/L if chloride less than 2 mg/L 0.12 mg/L if chloride is 2 to 4 mg/L 0.18 mg/L if chloride is 4 to 6 mg/L 0.24 mg/L if chloride is 6 to 8 mg/L 0.30 mg/L if chloride is 8 to 10 mg/L 0.60 mg/L if chloride is greater than 10 mg/L. The guideline 30-day average for nitrite as N is: 0.02 mg/L if chloride less than 2 mg/L 0.04 mg/L if chloride is 2 to 4 mg/L 0.06 mg/L if chloride is 4 to 6 mg/L 0.08 mg/L if chloride is 6 to 8 mg/L 0.10 mg/L if chloride is 8 to 10 mg/L 0.20 mg/L if chloride is greater than 10 mg/L.
<b>Note 1.7 for Phosphorus (total, APHA 4500-P):</b>
Streams: None proposed for streams. Lakes: It is not possible to specify a single phosphorous concentration to achieve protection of aquatic life in lakes. A range of total phosphorous concentrations (5-15 µg/L) is suggested as the criterion which can be used as the basis for site specific water quality objectives. (Table 3 and Overview Rept) A maximum of 15 µg/L (0.015 mg/L) was used in this report for screening purposes.

**Table C-2: 2020 Bailey Springs Results**  
**City of Vernon Reclaimed Water Irrigation Groundwater Monitoring Program**  
**Guideline Notes**

**Note 1.8 for Phosphorus (dissolved, APHA 4500-P):**

Streams: None proposed for streams.

Lakes: It is not possible to specify a single phosphorous concentration to achieve protection of aquatic life in lakes. A range of total phosphorous concentrations (5-15 µg/L) is suggested as the criterion which can be used as the basis for site specific water quality objectives. (Table 3 and Overview Rept)

A maximum of 15 µg/L (0.015 mg/L) was used in this report for screening purposes.

**Note 1.9 for Fecal coliforms (counts):**

The guideline for fecal coliforms is as follows: "The fecal coliform density in fresh and marine waters used for the growing and harvesting of shellfish for human consumption should not exceed a median MPN of 14/100 mL over 30 days, and at least 90% of the samples in a 30-day period should not exceed 43/100 mL."

**2. Notes for BC Approved Water Quality Guidelines for freshwater aquatic life (Long-term chronic) (BCAWQG AL (LT))**

**General Notes:**

For some parameters, there are two water quality guidelines: the short-term acute guideline (i.e. maximum), and the long-term chronic guideline (i.e. average). The long-term chronic guideline was used in this criteria set for parameters that have both guideline values.

**Note 2.1 for Chloride:**

To protect freshwater aquatic life from acute and lethal effects, the maximum concentration of chloride (mg/L as NaCl) at any time should not exceed 600 mg/L.

To protect freshwater aquatic life from chronic effects, the average (arithmetic mean computed from five weekly samples collected over a 30-day period) concentration of chloride (mg/L as NaCl) should not exceed 150 mg/L.

**Note 2.2 for pH:**

pH less than 6.5: No statistically significant decrease in pH from background.

pH from 6.5 to 9.0: Unrestricted change permitted within this range.

pH over 9.0: No statistically significant increase in pH from background.

See BC MOE Overview Report for additional details.

**Note 2.3 for Sulphate:**

The approved 30-day average (minimum of 5 evenly-spaced samples collected in 30 days) water quality guidelines to protect aquatic life in BC for sulphate are:

128 mg/L at hardness of 0 to 30 mg/L as CaCO<sub>3</sub>

218 mg/L at hardness of 31 to 75 mg/L as CaCO<sub>3</sub>

309 mg/L at hardness of 76 to 180mg/L as CaCO<sub>3</sub>

429 mg/L at hardness 181 to 250 mg/L as CaCO<sub>3</sub>

Need to determine guideline based on site water for hardness greater than 250 mg/L as CaCO<sub>3</sub>.

For screening purposes in this report, exceedance were flagged for sulphate greater than 429 mg/L at hardness greater than 250 mg/L as CaCO<sub>3</sub>.

**Note 2.4 for Ammonia (total, as N):**

The maximum guideline for ammonia varies as a function of pH and temperature. See Table 3 in Overview Report Update September 2009.

The 30-day average guideline for ammonia varies as a function of pH and temperature. See Table 4 in Overview Report Update September 2009. / The lab pH and field temperature results were used for determining the maximum ammonia concentration for this report. If a lab pH result was not available then the field pH result was used.

**Note 2.5 for Nitrate (as N):**

The guideline maximum for nitrate (as N) is 32.8 mg/l.

The 30-day average guideline for nitrate (as N) is 3.0 mg /L. The 30-day average (chronic) concentration is based on 5 weekly samples collected within a 30-day period.

Where nitrate and nitrite are present, the total nitrate+nitrite nitrogen should not exceed these values.

**Table C-2: 2020 Bailey Springs Results**  
**City of Vernon Reclaimed Water Irrigation Groundwater Monitoring Program**  
**Guideline Notes**

<b>Note 2.6 for Nitrite (as N):</b>
<p>The guideline maximum for nitrite as N is:</p> <p>0.06 mg/L if chloride less than 2 mg/L</p> <p>0.12 mg/L if chloride is 2 to 4 mg/L</p> <p>0.18 mg/L if chloride is 4 to 6 mg/L</p> <p>0.24 mg/L if chloride is 6 to 8 mg/L</p> <p>0.30 mg/L if chloride is 8 to 10 mg/L</p> <p>0.60 mg/L if chloride is greater than 10 mg/L.</p> <p>The guideline 30-day average for nitrite as N is:</p> <p>0.02 mg/L if chloride less than 2 mg/L</p> <p>0.04 mg/L if chloride is 2 to 4 mg/L</p> <p>0.06 mg/L if chloride is 4 to 6 mg/L</p> <p>0.08 mg/L if chloride is 6 to 8 mg/L</p> <p>0.10 mg/L if chloride is 8 to 10 mg/L</p> <p>0.20 mg/L if chloride is greater than 10 mg/L.</p>
<b>Note 2.7 for Phosphorus (total, APHA 4500-P):</b>
<p>Streams: None proposed for streams.</p> <p>Lakes: It is not possible to specify a single phosphorous concentration to achieve protection of aquatic life in lakes. A range of total phosphorous concentrations (5-15 µg/L) is suggested as the criterion which can be used as the basis for site specific water quality objectives.</p>
<b>Note 2.8 for Phosphorus (dissolved, APHA 4500-P):</b>
<p>Streams: None proposed for streams.</p> <p>Lakes: It is not possible to specify a single phosphorous concentration to achieve protection of aquatic life in lakes. A range of total phosphorous concentrations (5-15 µg/L) is suggested as the criterion which can be used as the basis for site specific water quality objectives.</p>
<b>Note 2.9 for Fecal coliforms (counts):</b>
<p>The guideline for fecal coliforms is as follows: "The fecal coliform density in fresh and marine waters used for the growing and harvesting of shellfish for human consumption should not exceed a median MPN of 14/100 mL over 30 days, and at least 90% of the samples in a 30-day period should not exceed 43/100 mL."</p>
<b>3. Notes for BC Recreational Water Quality Guidelines (2019) (BC RWQG)</b>
<b>General Notes:</b>
<p>The guidelines are for primary contact recreational uses. Primary contact is defined as activities, such as swimming (this includes bathing/wading for the purposes of this document), windsurfing and waterskiing, as well as secondary contact activities, such as canoeing or fishing, in natural waters through intentional or incidental immersion.</p>
<b>Note 3.1 for Phosphorus (total, APHA 4500-P):</b>
<p>The guideline for lakes is 0.01 mg/L.</p>
<b>Note 3.2 for Phosphorus (dissolved, APHA 4500-P):</b>
<p>The guideline for lakes is 0.01 mg/L.</p>

**Table C-3: 2020 Clay Valve #4 Results**  
**City of Vernon Reclaimed Water Irrigation Groundwater Monitoring Program**

Sampling Location		Clay Valve #4	Clay Valve #4	Clay Valve #4	Clay Valve #4	Clay Valve #4	Clay Valve #4	Clay Valve #4
Date Sampled		14-May-20	17-Jun-20	14-Jul-20	04-Aug-20	16-Sep-20	16-Sep-20	01-Oct-20
Sample Type		Normal	Normal	Normal	Normal	Normal	Duplicate	Normal
Analyte	Unit							
Lab Results								
General								
Biochemical oxygen demand	mg/L	<6.7	<6.0	<9.4	<6.8	<6.0	<6.0	<7.0
Chloride	mg/L	94.4	95.6	91.5	89.8	87.5	84.2	90.6
Fluoride	mg/L		0.26	0.21	0.2	0.24	0.25	0.25
Hardness, Total (dissolved as CaCO3)	mg/L	203	220	208	204	211	210	225
pH		8.16	7.66	8.03	8.18	8.03	8.04	7.95
Sulphate	mg/L	82.8	82.4	82.7	79.8	79.1	76.3	80.5
Sodium (total)	mg/L	98.7	89.1	91.1	92.8	90.9	91.7	94.8
Total suspended solids	mg/L	<2.0	<2.0	2.2	<2.0	<2.0	<2.0	<2.0
Nutrients								
Ammonia (total, as N)	mg/L	0.699	0.823	0.945	0.952	1.09	1.08	1.1
Nitrate (as N)	mg/L	0.588	0.533	0.635	0.676	0.24	0.236	0.231
Nitrite (as N)	mg/L	<0.010	<0.010	<0.010	<0.010	0.128	0.129	0.133
Total nitrogen	mg/L	2.31	2.23	2.52	2.74	2.42	2.5	2.37
Total kjeldahl nitrogen	mg/L	1.72	1.7	1.88	2.04	2.05	2.14	2.01
Total organic nitrogen	mg/L	1.02	0.878	0.935	1.09	0.967	1.06	0.911
Orthophosphate (dissolved, as P)	mg/L	0.632	0.632	0.702	0.681	0.745	0.749	0.682
Phosphorus (dissolved, by ICPMS/ICPOES)	mg/L	0.781	1.02	1.01	1.08	1.08	1.12	1.18
Phosphorus (total, APHA 4500-P)	mg/L	0.908	1.04	1.09	1.12	1.13	1.1	1.13
Phosphorus (dissolved, APHA 4500-P)	mg/L	0.84	1	1.04	1.1	1.09	1.06	1.1
Potassium (dissolved)	mg/L	19.8	18.5	18.7	17.7	18	17.9	19.3
Microbiological								
Fecal coliforms (counts)	CFU/100 mL	<1.0	1	<1	<1	<1	<1	<0
Total coliforms (counts)	CFU/100 mL	3.1	1	<1	<1	<1	<1	<1.0
Dissolved Metals								
Aluminum (dissolved)	mg/L	<0.0050	0.0079	0.0063	0.0072	0.0145	0.0116	0.0105
Antimony (dissolved)	mg/L	0.00022	0.00033	0.00022	0.00027	0.00024	0.00026	0.00024
Arsenic (dissolved)	mg/L	0.00076	0.00157	0.00089	0.00083	0.00097	0.00084	0.00088
Barium (dissolved)	mg/L	0.0307	0.0286	0.0273	0.0283	0.0299	0.0288	0.0331
Beryllium (dissolved)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth (dissolved)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	0.00011	<0.00010	<0.00010
Boron (dissolved)	mg/L	0.104	0.166	0.149	0.144	0.148	0.145	0.174
Cadmium (dissolved)	mg/L	0.00093	0.000025	0.000024	0.00003	0.000035	0.000021	<0.00010
Calcium (dissolved)	mg/L	48.5	52.5	51.6	48.4	51	50.5	52.9
Chromium (dissolved)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt (dissolved)	mg/L	0.00032	0.00032	0.00031	0.00029	0.00032	0.00033	0.00034
Copper (dissolved)	mg/L	0.00157	0.0112	0.00328	0.00369	0.00461	0.00392	0.00467
Iron (dissolved)	mg/L	0.017	0.038	0.028	0.02	0.041	0.0343	0.027
Lead (dissolved)	mg/L	<0.00020	<0.00020	<0.00020	<0.00020	0.00042	0.00022	<0.00020
Lithium (dissolved)	mg/L	0.00829	0.00981	0.00804	0.00937	0.00914	0.00885	0.00941
Magnesium (dissolved)	mg/L	20	21.5	19.1	20.1	20.2	20.3	22.5
Manganese (dissolved)	mg/L	0.0934	0.188	0.154	0.125	0.169	0.172	0.224
Mercury (dissolved)	mg/L	<0.000010	<0.000010	0.000022	<0.000010	<0.000010	0.000011	<0.00010
Molybdenum (dissolved)	mg/L	0.00419	0.00351	0.0031	0.00363	0.00386	0.00386	0.00331
Nickel (dissolved)	mg/L	0.0018	0.00199	0.00616	0.00219	0.00203	0.00187	0.0022
Selenium (dissolved)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Silicon (dissolved, as Si)	mg/L	3.7	3.2	3.4	3.8	3.8	3.7	4.2
Silver (dissolved)	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050

**Table C-3: 2020 Clay Valve #4 Results**  
**City of Vernon Reclaimed Water Irrigation Groundwater Monitoring Program**

Sampling Location		Clay Valve #4	Clay Valve #4	Clay Valve #4	Clay Valve #4	Clay Valve #4	Clay Valve #4	Clay Valve #4
Date Sampled		14-May-20	17-Jun-20	14-Jul-20	04-Aug-20	16-Sep-20	16-Sep-20	01-Oct-20
Sample Type		Normal	Normal	Normal	Normal	Normal	Duplicate	Normal
Analyte	Unit							
Sodium (dissolved)	mg/L	97.9	94.9	82.7	86.9	87.2	88.6	93.1
Strontium (dissolved)	mg/L	0.565	0.556	0.52	0.54	0.521	0.507	0.562
Sulphur (dissolved)	mg/L	32.6	32	29.8	29.1	29.9	29.9	30.8
Tellurium (dissolved)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Thallium (dissolved)	mg/L	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
Thorium (dissolved)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Tin (dissolved)	mg/L	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Titanium (dissolved)	mg/L	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Tungsten (dissolved)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Uranium (dissolved)	mg/L	0.00196	0.00182	0.00169	0.0019	0.00161	0.00159	0.00167
Vanadium (dissolved)	mg/L	0.001	0.001	<0.0010	<0.0010	0.0029	<0.0010	<0.0010
Zinc (dissolved)	mg/L	<0.00010	0.0366	0.0295	0.0331	0.0372	0.0322	0.0323
Zirconium (dissolved)	mg/L	0.0001	0.00012	<0.00010	<0.00010	0.00014	0.00011	0.00012



## APPENDIX D - TIME SERIES PLOTS

**List of Acronyms:**

GCDWQ MAC	Guidelines for Canadian Drinking Water Quality - Maximum Acceptable Concentrations
GCDWQ AO	Guidelines for Canadian Drinking Water Quality - Aesthetic Objectives
BC SDWQG MAC	BC Source Drinking Water Quality Guidelines - Maximum Acceptable Concentrations
BC SDWQG AO	BC Source Drinking Water Quality Guidelines - Aesthetic Objectives
CSR DW	BC CSR Generic Numerical Water Standards for Drinking Water
BCAWQG I	BC Approved Water Quality Guidelines for Irrigation
BCWWQG I	BC Working Water Quality Guidelines for Irrigation
CSR IW	BC CSR Generic Numerical Water Standards for Irrigation
BCAWQG L	BC Approved Water Quality Guidelines for Livestock
BCWWQG L	BC Working Water Quality Guidelines for Livestock
CSR LW	BC CSR Generic Numerical Water Standards for Livestock
BCAWQG AL (ST)	BC Approved Water Quality Guidelines for Freshwater Aquatic Life (short-term; acute)
BCAWQG AL (LT)	BC Approved Water Quality Guidelines for Freshwater Aquatic Life (long-term; chronic - Bailey Springs only)
BCWWQG AL	BC Working Water Quality Guidelines for Freshwater Aquatic Life
CSR AW	BC CSR Generic Numerical Water Standards for Freshwater Aquatic Life
BC RWQG	BC Recreational Water Quality Guidelines
Calc	Calculated guideline: the guideline is dependent on the value of one or more other analytes, and is calculated from a formula or table. Therefore, it is not shown on the plot. Refer to guideline notes in Appendix C for further details.
N	Narrative type of guideline; therefore, it is not shown on the plot. Refer to guideline notes in Appendix C for further details.

Note: On all plots, results that were below detection are plotted at one-half the detection limit and circled to indicate it is an inferred data point. Guidelines are only shown on the figures if there is an applicable guideline for that parameter.



Figure D-1: Plot of field-measured conductivity in groundwater (all data since 2011)<sup>1</sup>

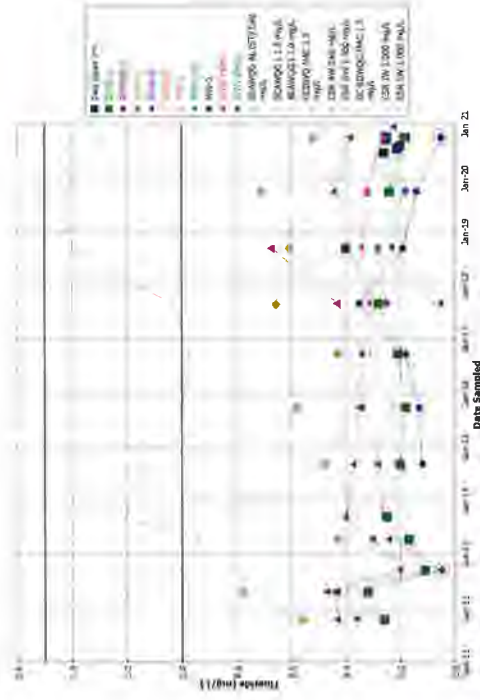


Figure D-3: Plot of fluoride in groundwater and Clay Valve #4 (all data since 2011)

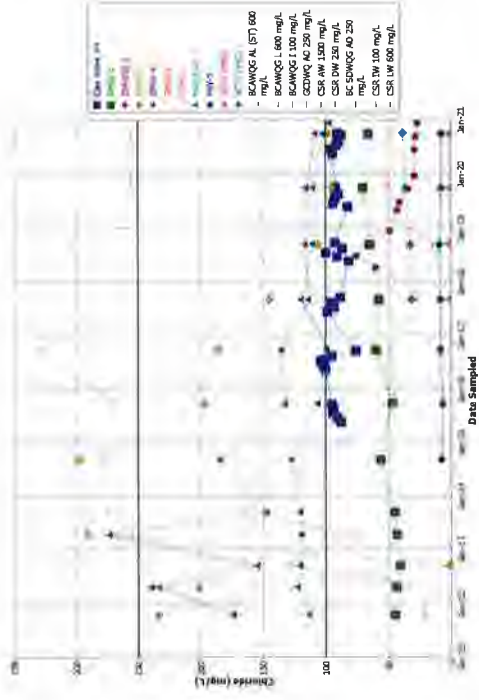


Figure D-2: Plot of chloride in groundwater and Clay Valve #4 (all data since 2011)

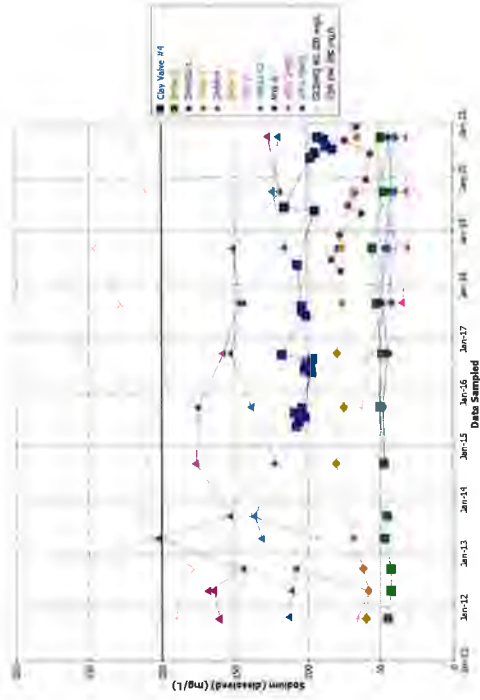


Figure D-4: Plot of dissolved sodium in groundwater and Clay Valve #4 (all data since 2011)

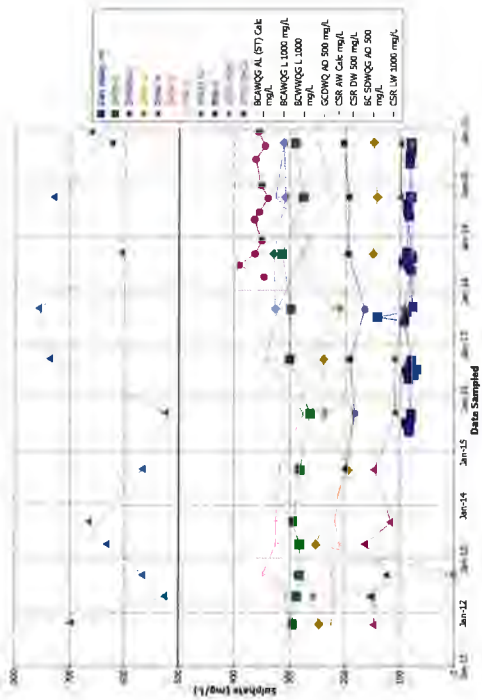
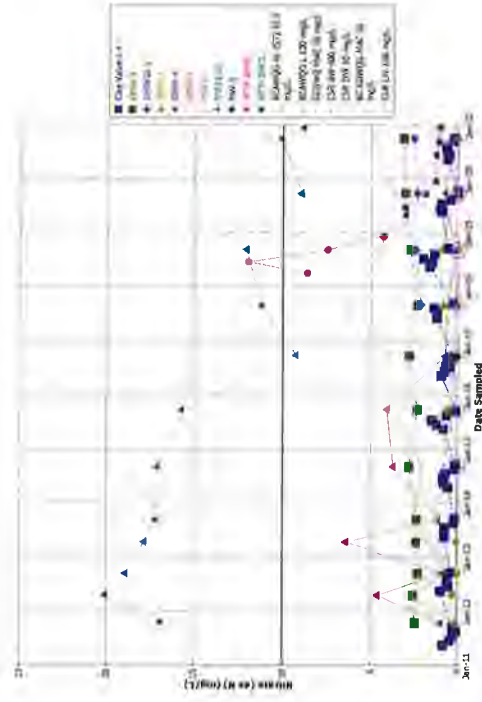


Figure D-5: Plot of sulphate in groundwater and Clay Valve #4 (all data since 2011)



**Figure D-6: Plot of nitrate-N in groundwater and Clay Valve #4 (all data since 2011)**

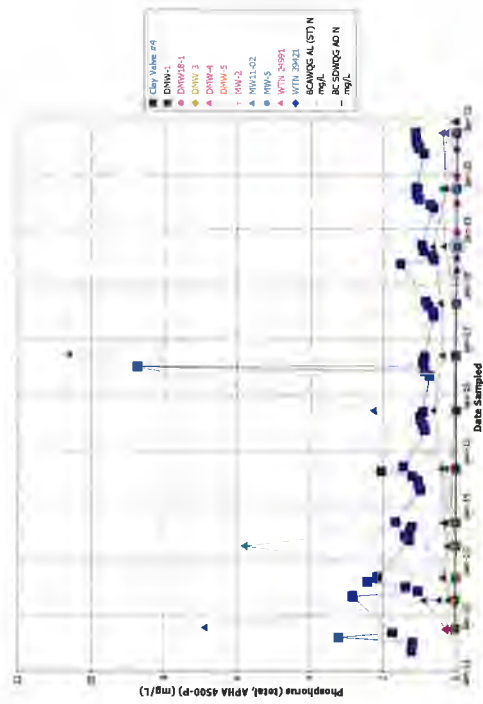


Figure D-7: Plot of total phosphorus in groundwater and Clay Valve #4 (all data since 2011)

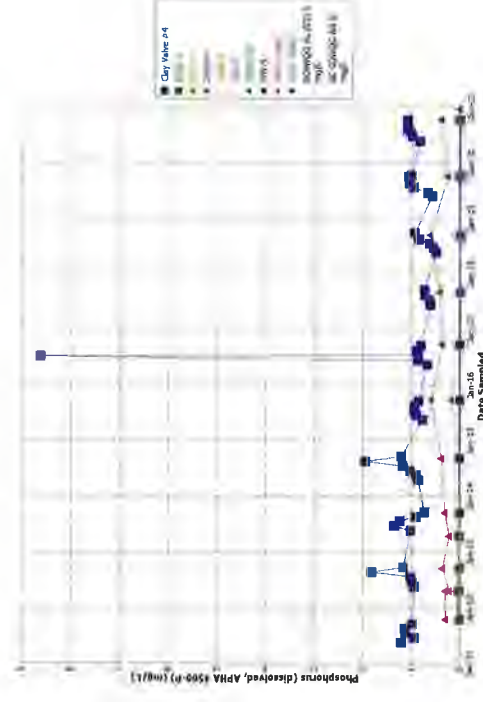


Figure D-8: Plot of dissolved phosphorus in groundwater and Clay Valve #4 (all data since 2011)

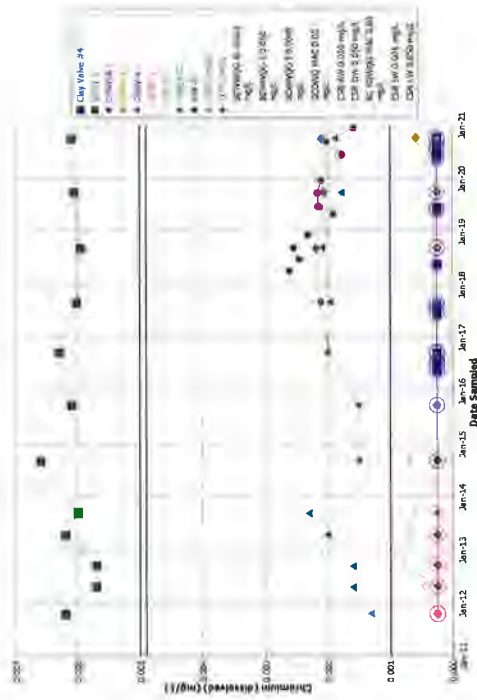


Figure D-9: Plot of dissolved chromium in groundwater and Clay Valve #4 (all data since 2011)

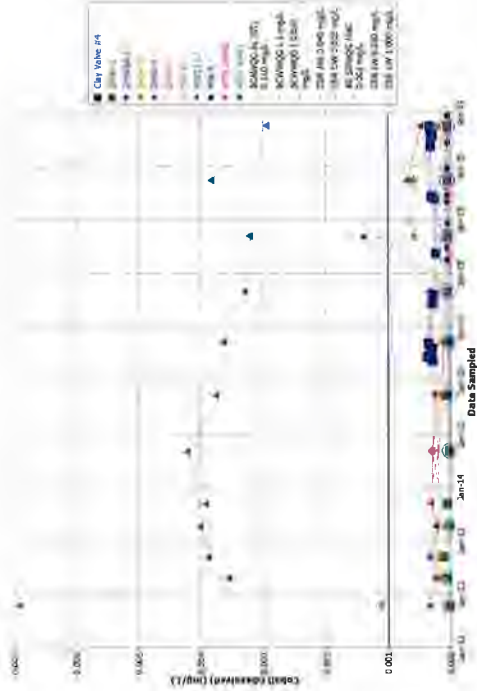


Figure D-10: Plot of dissolved cobalt in groundwater and Clay Valve #4 (all data since 2011)

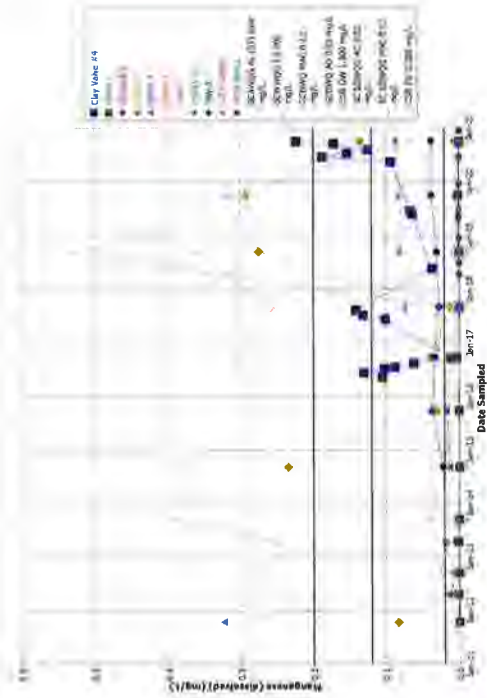


Figure D-11: Plot of dissolved manganese in groundwater and Clay Valve #4 (all data since 2011)

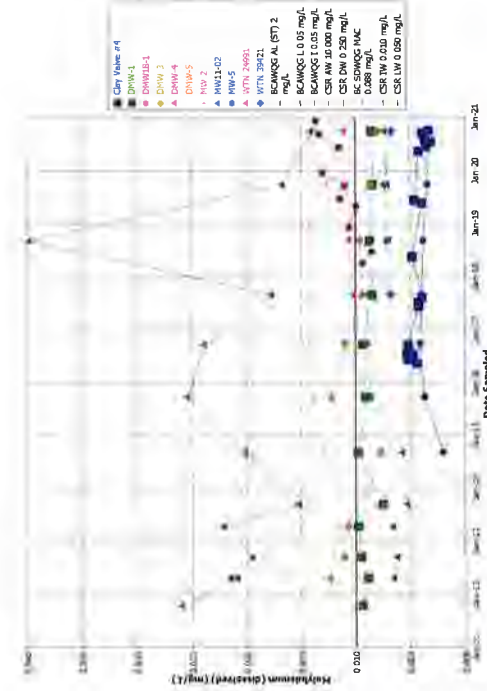


Figure D-12: Plot of dissolved molybdenum in groundwater and Clay Valve #4 (all data since 2011)

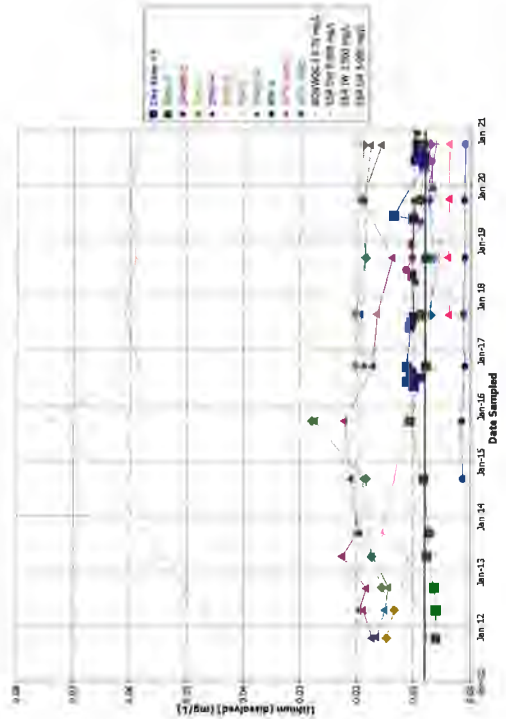


Figure D-13: Plot of dissolved lithium in groundwater and Clay Valve #4 (all data since 2011)

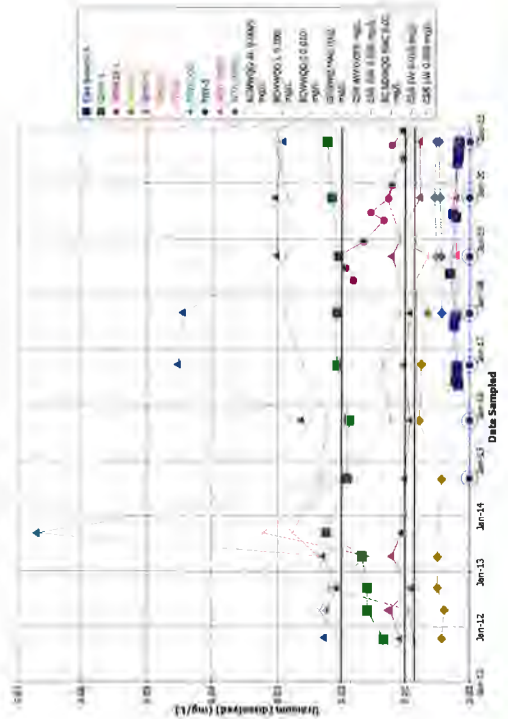


Figure D-15: Plot of dissolved uranium in groundwater and Clay Valve #4 (all data since 2011)

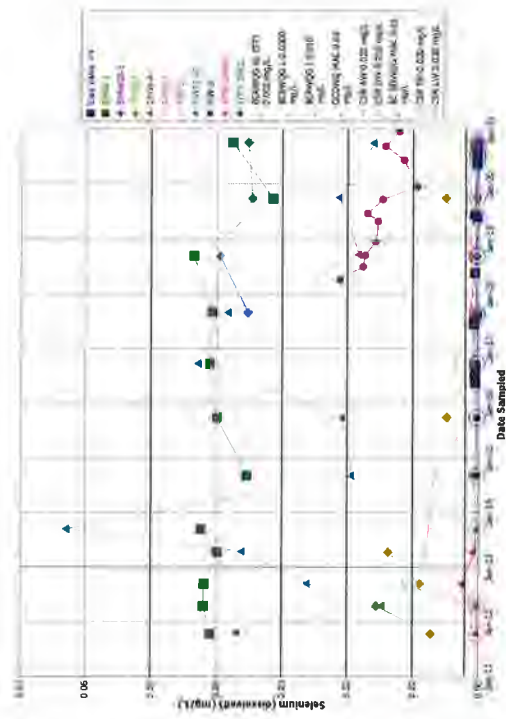


Figure D-14: Plot of dissolved selenium in groundwater and Clay Valve #4 (all data since 2011)

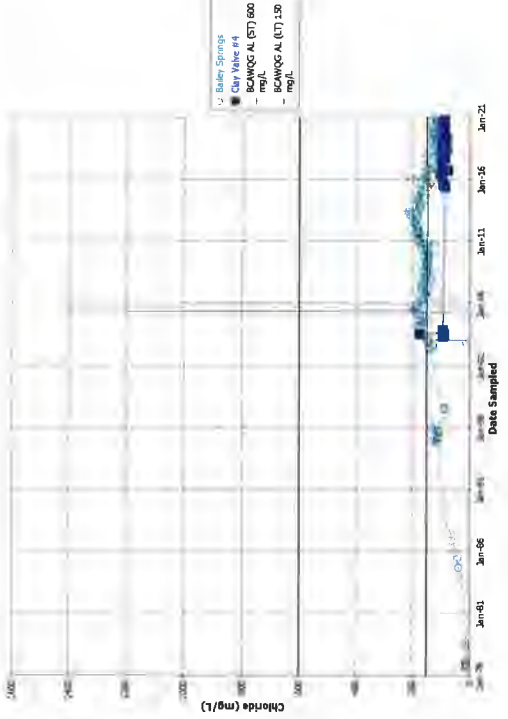


Figure D-16: Plot of chloride in Bailey Springs and Clay Valve #4 (all data)

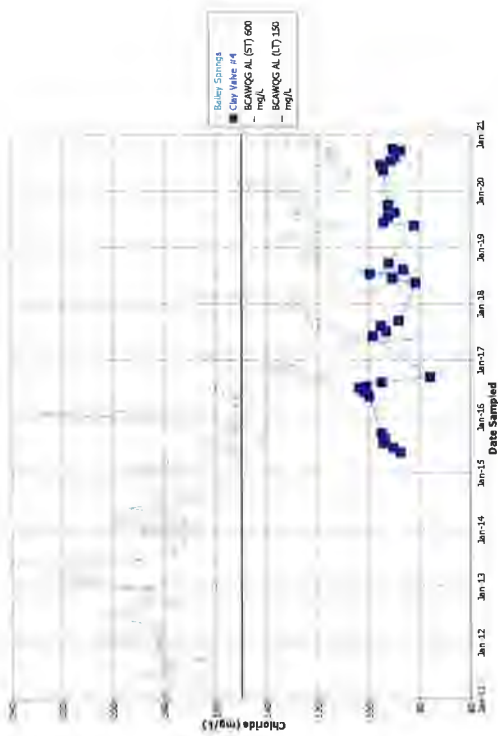


Figure D-17: Plot of chloride in Bailey Springs and Clay Valve #4 (data since 2011)

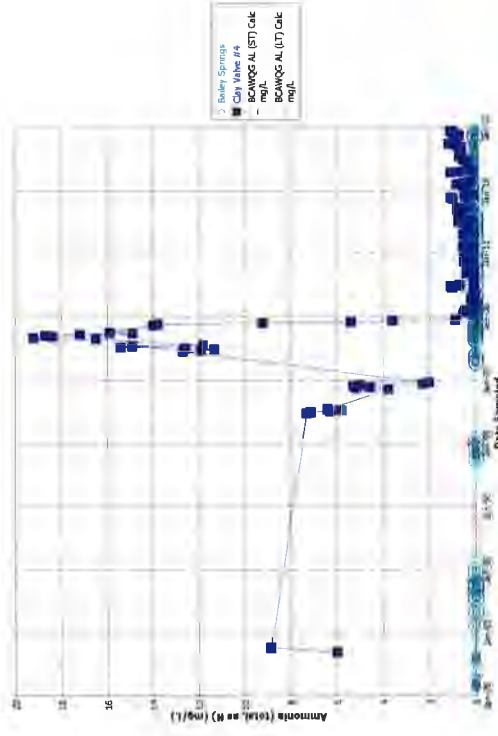


Figure D-19: Plot of ammonia-N in Bailey Springs and Clay Valve #4 (all data)

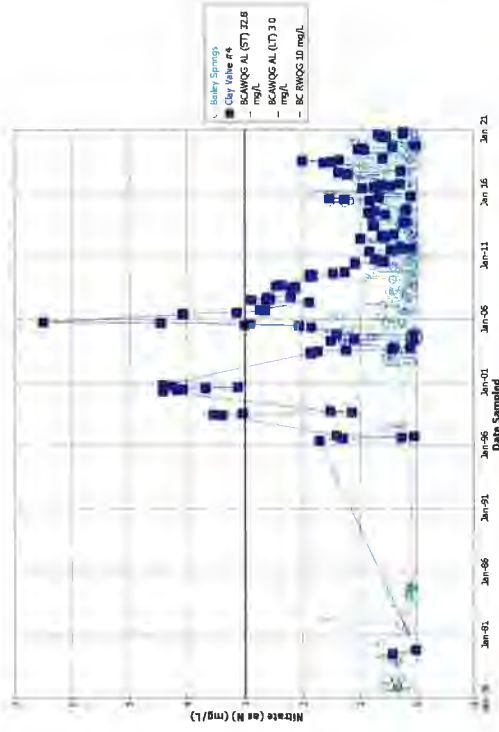


Figure D-18: Plot of nitrate-N in Bailey Springs and Clay Valve #4 (all data)

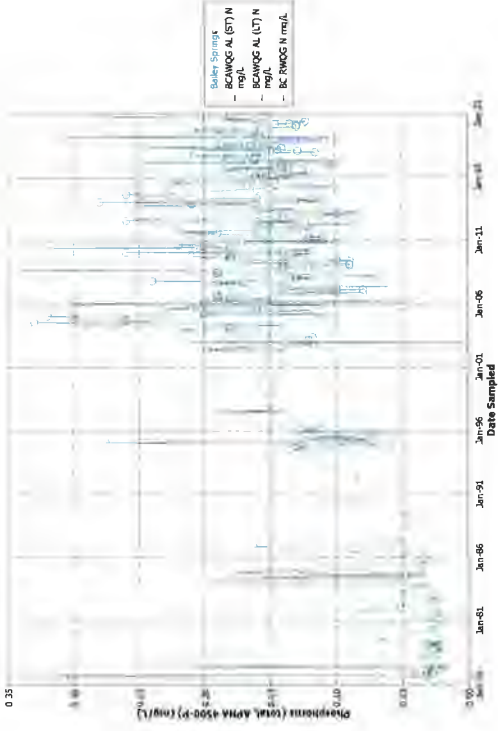


Figure D-20: Plot of total phosphorus in Bailey Springs (all data)

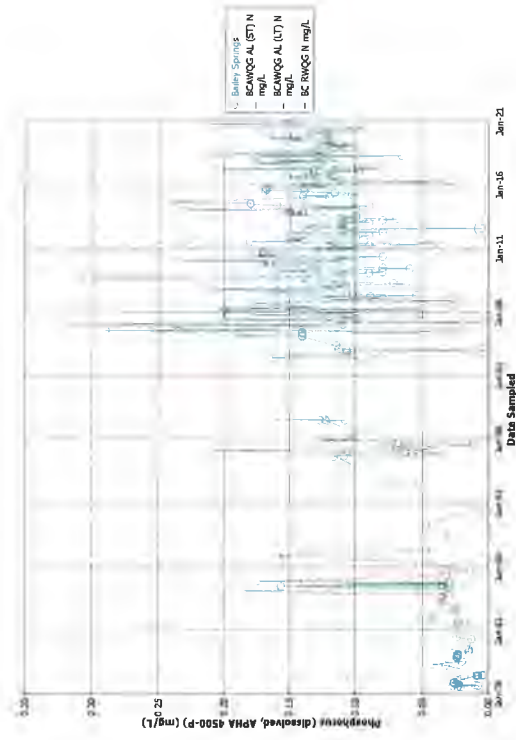


Figure D-21: Plot of dissolved phosphorus in Bailey Springs (all data)

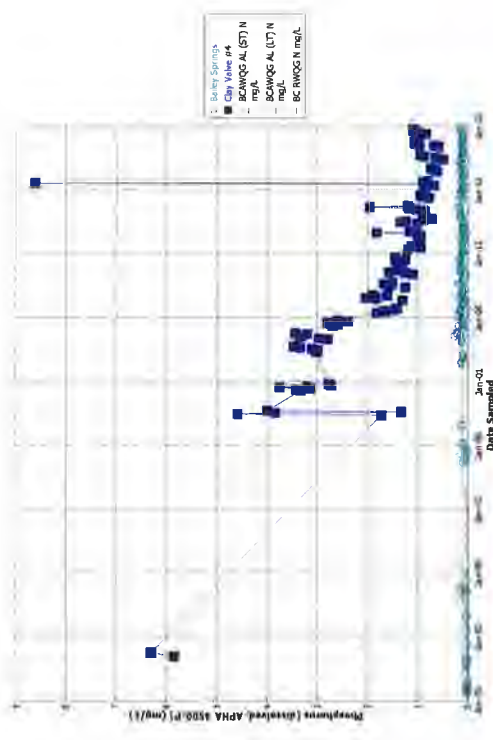


Figure D-23: Plot of dissolved phosphorus in Bailey Springs and Clay Valve #4 (all data)

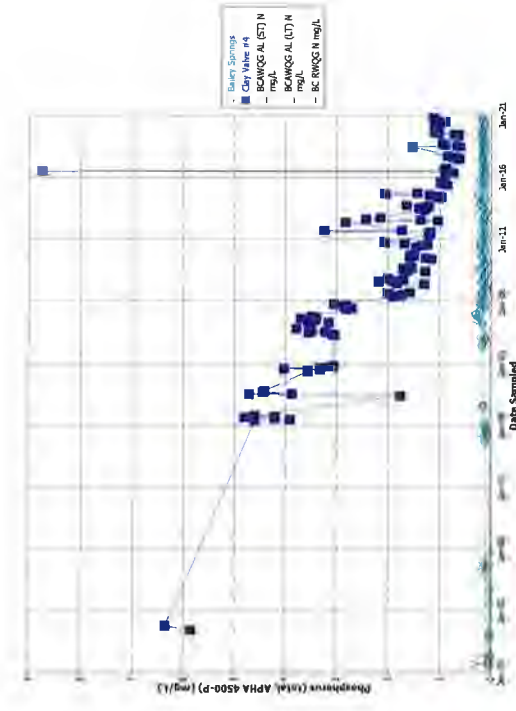


Figure D-22: Plot of total phosphorus in Bailey Springs and Clay Valve #4 (all data)

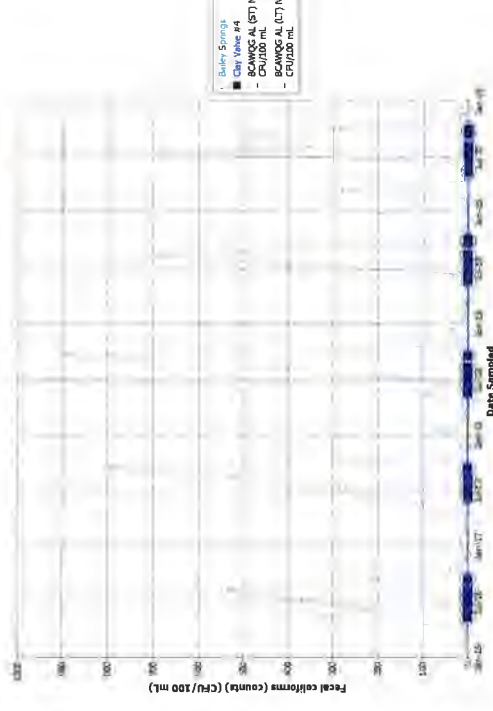


Figure D-24: Plot of fecal coliforms in Bailey Springs and Clay Valve #4 (data since 2016)²

² On Figure D-24, only data since 2016 is shown because the analytical method changed (MPN to CFU). Furthermore, a value of 8,700 CFU/100 mL was reported in Bailey Springs in August 2018 but is not shown on the above figure so as to not obscure trends from more recent (e.g. 2020) data

## APPENDIX E - LABORATORY REPORTS

## CERTIFICATE OF ANALYSIS

<b>REPORTED TO</b>	Associated Environmental Consultants Inc. (Vernon) #200 - 2800 29th Street Vernon, BC V1T 9P9	<b>WORK ORDER</b>	0109234
<b>ATTENTION</b>	Nicole Penner	<b>RECEIVED / TEMP</b>	2020-09-30 13:45 / 6°C
<b>PO NUMBER</b>		<b>REPORTED</b>	2021-03-04 16:58
<b>PROJECT</b>	City of Vernon	<b>COC NUMBER</b>	No Number
<b>PROJECT INFO</b>	2020-8704.000.000		

### Introduction:

CARO Analytical Services is a testing laboratory full of smart, engaged scientists driven to make the world a safer and healthier place. Through our clients' projects we become an essential element for a better world. We employ methods conducted in accordance with recognized professional standards using accepted testing methodologies and quality control efforts. CARO is accredited by the Canadian Association for Laboratories Accreditation (CALA) to ISO/IEC 17025:2017 for specific tests listed in the scope of accreditation approved by CALA.

#### *Big Picture Sidekicks*



You know that the sample you collected after snowshoeing to site, digging 5 meters, and racing to get it on a plane so you can submit it to the lab for time sensitive results needed to make important and expensive decisions (whew) is VERY important. We know that too.

#### *We've Got Chemistry*



It's simple. We figure the more you enjoy working with our fun and engaged team members; the more likely you are to give us continued opportunities to support you.

#### *Ahead of the Curve*



Through research, regulation knowledge, and instrumentation, we are your analytical centre for the technical knowledge you need, BEFORE you need it, so you can stay up to date and in the know.

### Work Order Comments:

*If you have any questions or concerns, please contact me at [acrump2@caro.ca](mailto:acrump2@caro.ca)*

### Authorized By:

Alana Crump temp  
Team Lead, Client Service

1-888-311-8846 | [www.caro.ca](http://www.caro.ca)

#110 4011 Viking Way Richmond, BC V6V 2K9 | #102 3677 Highway 97N Kelowna, BC V1X 5C3 | 17225 109 Avenue Edmonton, AB T5S 1H7 |  
#108 4475 Wayburne Drive Burnaby, BC V5G 4X4



## TEST RESULTS

**REPORTED TO PROJECT** Associated Environmental Consultants Inc. (Vernon)  
City of Vernon

**WORK ORDER REPORTED** 0109234  
2021-03-04 16:58

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
<b>WTN 24991 (0109234-01)   Matrix: Water   Sampled: 2020-09-29 08:15</b>						
<b>Anions</b>						
Bromide	< 0.10	N/A	0.10	mg/L	2020-10-03	
Chloride	<b>1.44</b>	AO ≤ 250	0.10	mg/L	2020-10-03	
Fluoride	<b>0.26</b>	MAC = 1.5	0.10	mg/L	2020-10-03	
Nitrate+Nitrite (as N)	< 0.0050	N/A	0.0050	mg/L	2020-10-23	
Nitrite (as N)	< 0.0050	MAC = 1	0.0050	mg/L	2020-10-23	
Phosphate (as P)	< 0.0050	N/A	0.0050	mg/L	2020-10-03	HT1
Sulfate	<b>77.7</b>	AO ≤ 500	1.0	mg/L	2020-10-03	
<b>Calculated Parameters</b>						
Hardness, Total (as CaCO <sub>3</sub> )	<b>194</b>	N/A	0.500	mg/L	N/A	
Nitrate (as N)	< 0.0100	MAC = 10	0.0100	mg/L	N/A	
Nitrogen, Organic	<b>0.0860</b>	N/A	0.0500	mg/L	N/A	
<b>Dissolved Metals</b>						
Lithium, dissolved	<b>0.00368</b>	N/A	0.00010	mg/L	2020-10-07	
Aluminum, dissolved	<b>0.0080</b>	N/A	0.0050	mg/L	2020-10-07	
Antimony, dissolved	< 0.00020	N/A	0.00020	mg/L	2020-10-07	
Arsenic, dissolved	<b>0.00116</b>	N/A	0.00050	mg/L	2020-10-07	
Barium, dissolved	<b>0.0184</b>	N/A	0.0050	mg/L	2020-10-07	
Beryllium, dissolved	< 0.00010	N/A	0.00010	mg/L	2020-10-07	
Bismuth, dissolved	< 0.00010	N/A	0.00010	mg/L	2020-10-07	
Boron, dissolved	< 0.0500	N/A	0.0500	mg/L	2020-10-07	
Cadmium, dissolved	< 0.000010	N/A	0.000010	mg/L	2020-10-07	
Calcium, dissolved	<b>44.6</b>	N/A	0.20	mg/L	2020-10-07	
Chromium, dissolved	< 0.00050	N/A	0.00050	mg/L	2020-10-07	
Cobalt, dissolved	< 0.00010	N/A	0.00010	mg/L	2020-10-07	
Copper, dissolved	< 0.00040	N/A	0.00040	mg/L	2020-10-07	
Iron, dissolved	<b>0.204</b>	N/A	0.010	mg/L	2020-10-07	
Lead, dissolved	< 0.00020	N/A	0.00020	mg/L	2020-10-07	
Magnesium, dissolved	<b>19.9</b>	N/A	0.010	mg/L	2020-10-07	
Manganese, dissolved	<b>0.0865</b>	N/A	0.00020	mg/L	2020-10-07	
Mercury, dissolved	< 0.000010	N/A	0.000010	mg/L	2020-10-03	
Molybdenum, dissolved	<b>0.0111</b>	N/A	0.00010	mg/L	2020-10-07	
Nickel, dissolved	< 0.00040	N/A	0.00040	mg/L	2020-10-07	
Phosphorus, dissolved	< 0.050	N/A	0.050	mg/L	2020-10-07	
Potassium, dissolved	<b>3.60</b>	N/A	0.10	mg/L	2020-10-07	
Selenium, dissolved	< 0.00050	N/A	0.00050	mg/L	2020-10-07	
Silicon, dissolved	<b>10.3</b>	N/A	1.0	mg/L	2020-10-07	
Silver, dissolved	< 0.000050	N/A	0.000050	mg/L	2020-10-07	
Sodium, dissolved	<b>32.1</b>	N/A	0.10	mg/L	2020-10-07	
Strontium, dissolved	<b>0.468</b>	N/A	0.0010	mg/L	2020-10-07	
Sulfur, dissolved	<b>29.2</b>	N/A	3.0	mg/L	2020-10-07	
Tellurium, dissolved	< 0.00050	N/A	0.00050	mg/L	2020-10-07	
Thallium, dissolved	< 0.000020	N/A	0.000020	mg/L	2020-10-07	

## TEST RESULTS

**REPORTED TO PROJECT** Associated Environmental Consultants Inc. (Vernon)  
City of Vernon

**WORK ORDER REPORTED** 0109234  
2021-03-04 16:58

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
---------	--------	-----------	----	-------	----------	-----------

**WTN 24991 (0109234-01) | Matrix: Water | Sampled: 2020-09-29 08:15, Continued**

### Dissolved Metals, Continued

Thorium, dissolved	< 0.00010	N/A	0.00010	mg/L	2020-10-07	
Tin, dissolved	< 0.00020	N/A	0.00020	mg/L	2020-10-07	
Titanium, dissolved	< 0.0050	N/A	0.0050	mg/L	2020-10-07	
Tungsten, dissolved	< 0.0010	N/A	0.0010	mg/L	2020-10-07	
Uranium, dissolved	<b>0.00197</b>	N/A	0.000020	mg/L	2020-10-07	
Vanadium, dissolved	< 0.0010	N/A	0.0010	mg/L	2020-10-07	
Zinc, dissolved	< 0.0040	N/A	0.0040	mg/L	2020-10-07	
Zirconium, dissolved	< 0.00010	N/A	0.00010	mg/L	2020-10-07	

### General Parameters

Alkalinity, Total (as CaCO <sub>3</sub> )	<b>174</b>	N/A	1.0	mg/L	2020-10-05	
Alkalinity, Phenolphthalein (as CaCO <sub>3</sub> )	< 1.0	N/A	1.0	mg/L	2020-10-05	
Alkalinity, Bicarbonate (as CaCO <sub>3</sub> )	<b>174</b>	N/A	1.0	mg/L	2020-10-05	
Alkalinity, Carbonate (as CaCO <sub>3</sub> )	< 1.0	N/A	1.0	mg/L	2020-10-05	
Alkalinity, Hydroxide (as CaCO <sub>3</sub> )	< 1.0	N/A	1.0	mg/L	2020-10-05	
Ammonia, Total (as N)	<b>0.122</b>	None Required	0.050	mg/L	2020-10-06	
Nitrogen, Total Kjeldahl	<b>0.208</b>	N/A	0.050	mg/L	2020-10-05	
Phosphorus, Total (as P)	<b>0.0164</b>	N/A	0.0050	mg/L	2020-10-07	
Phosphorus, Total Dissolved	<b>0.0163</b>	N/A	0.0050	mg/L	2020-10-07	
Solids, Total Dissolved	<b>310</b>	AO ≤ 500	15	mg/L	2020-10-05	

**DMW-1 (0109234-02) | Matrix: Water | Sampled: 2020-09-29 09:30**

### Anions

Bromide	< 0.10	N/A	0.10	mg/L	2020-10-03	
Chloride	<b>66.2</b>	AO ≤ 250	0.10	mg/L	2020-10-03	
Fluoride	<b>0.18</b>	MAC = 1.5	0.10	mg/L	2020-10-03	
Nitrate+Nitrite (as N)	<b>3.15</b>	N/A	0.0050	mg/L	2020-10-23	
Nitrite (as N)	< 0.0050	MAC = 1	0.0050	mg/L	2020-10-23	
Phosphate (as P)	< 0.0050	N/A	0.0050	mg/L	2020-10-03	HT1
Sulfate	<b>292</b>	AO ≤ 500	1.0	mg/L	2020-10-03	

### Calculated Parameters

Hardness, Total (as CaCO <sub>3</sub> )	<b>491</b>	N/A	0.500	mg/L	N/A	
Nitrate (as N)	<b>3.15</b>	MAC = 10	0.0550	mg/L	N/A	
Nitrogen, Organic	<b>0.169</b>	N/A	0.0500	mg/L	N/A	

### Dissolved Metals

Lithium, dissolved	<b>0.00843</b>	N/A	0.00010	mg/L	2020-10-07	
Aluminum, dissolved	< 0.0050	N/A	0.0050	mg/L	2020-10-07	
Antimony, dissolved	< 0.00020	N/A	0.00020	mg/L	2020-10-07	
Arsenic, dissolved	<b>0.00086</b>	N/A	0.00050	mg/L	2020-10-07	
Barium, dissolved	<b>0.0386</b>	N/A	0.0050	mg/L	2020-10-07	
Beryllium, dissolved	< 0.00010	N/A	0.00010	mg/L	2020-10-07	



## TEST RESULTS

**REPORTED TO PROJECT** Associated Environmental Consultants Inc. (Vernon)  
City of Vernon

**WORK ORDER REPORTED** 0109234  
2021-03-04 16:58

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
---------	--------	-----------	----	-------	----------	-----------

### DMW-1 (0109234-02) | Matrix: Water | Sampled: 2020-09-29 09:30, Continued

#### Dissolved Metals, Continued

Bismuth, dissolved	< 0.00010	N/A	0.00010	mg/L	2020-10-07	
Boron, dissolved	< 0.0500	N/A	0.0500	mg/L	2020-10-07	
Cadmium, dissolved	<b>0.000024</b>	N/A	0.000010	mg/L	2020-10-07	
Calcium, dissolved	<b>95.6</b>	N/A	0.20	mg/L	2020-10-07	
Chromium, dissolved	<b>0.00610</b>	N/A	0.00050	mg/L	2020-10-07	
Cobalt, dissolved	< 0.00010	N/A	0.00010	mg/L	2020-10-07	
Copper, dissolved	< 0.00040	N/A	0.00040	mg/L	2020-10-07	
Iron, dissolved	< 0.010	N/A	0.010	mg/L	2020-10-07	
Lead, dissolved	< 0.00020	N/A	0.00020	mg/L	2020-10-07	
Magnesium, dissolved	<b>61.1</b>	N/A	0.010	mg/L	2020-10-07	
Manganese, dissolved	< 0.00020	N/A	0.00020	mg/L	2020-10-07	
Mercury, dissolved	< 0.000010	N/A	0.000010	mg/L	2020-10-03	
Molybdenum, dissolved	<b>0.00855</b>	N/A	0.00010	mg/L	2020-10-07	
Nickel, dissolved	<b>0.00114</b>	N/A	0.00040	mg/L	2020-10-07	
Phosphorus, dissolved	< 0.050	N/A	0.050	mg/L	2020-10-07	
Potassium, dissolved	<b>6.42</b>	N/A	0.10	mg/L	2020-10-07	
Selenium, dissolved	<b>0.0376</b>	N/A	0.00050	mg/L	2020-10-07	
Silicon, dissolved	<b>10.7</b>	N/A	1.0	mg/L	2020-10-07	
Silver, dissolved	< 0.000050	N/A	0.000050	mg/L	2020-10-07	
Sodium, dissolved	<b>49.2</b>	N/A	0.10	mg/L	2020-10-07	
Strontium, dissolved	<b>1.14</b>	N/A	0.0010	mg/L	2020-10-07	
Sulfur, dissolved	<b>98.6</b>	N/A	3.0	mg/L	2020-10-07	
Tellurium, dissolved	< 0.00050	N/A	0.00050	mg/L	2020-10-07	
Thallium, dissolved	< 0.000020	N/A	0.000020	mg/L	2020-10-07	
Thorium, dissolved	< 0.00010	N/A	0.00010	mg/L	2020-10-07	
Tin, dissolved	< 0.00020	N/A	0.00020	mg/L	2020-10-07	
Titanium, dissolved	< 0.0050	N/A	0.0050	mg/L	2020-10-07	
Tungsten, dissolved	< 0.0010	N/A	0.0010	mg/L	2020-10-07	
Uranium, dissolved	<b>0.0223</b>	N/A	0.000020	mg/L	2020-10-07	
Vanadium, dissolved	<b>0.0020</b>	N/A	0.0010	mg/L	2020-10-07	
Zinc, dissolved	< 0.0040	N/A	0.0040	mg/L	2020-10-07	
Zirconium, dissolved	< 0.00010	N/A	0.00010	mg/L	2020-10-07	

#### General Parameters

Alkalinity, Total (as CaCO <sub>3</sub> )	<b>211</b>	N/A	1.0	mg/L	2020-10-05	
Alkalinity, Phenolphthalein (as CaCO <sub>3</sub> )	< 1.0	N/A	1.0	mg/L	2020-10-05	
Alkalinity, Bicarbonate (as CaCO <sub>3</sub> )	<b>211</b>	N/A	1.0	mg/L	2020-10-05	
Alkalinity, Carbonate (as CaCO <sub>3</sub> )	< 1.0	N/A	1.0	mg/L	2020-10-05	
Alkalinity, Hydroxide (as CaCO <sub>3</sub> )	< 1.0	N/A	1.0	mg/L	2020-10-05	
Ammonia, Total (as N)	< 0.050	None Required	0.050	mg/L	2020-10-06	
Nitrogen, Total Kjeldahl	<b>0.169</b>	N/A	0.050	mg/L	2020-10-05	
Phosphorus, Total (as P)	<b>0.0166</b>	N/A	0.0050	mg/L	2020-10-07	
Phosphorus, Total Dissolved	<b>0.0161</b>	N/A	0.0050	mg/L	2020-10-07	

## TEST RESULTS

**REPORTED TO PROJECT** Associated Environmental Consultants Inc. (Vernon)  
City of Vernon

**WORK ORDER REPORTED** 0109234  
2021-03-04 16:58

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
---------	--------	-----------	----	-------	----------	-----------

### DMW-1 (0109234-02) | Matrix: Water | Sampled: 2020-09-29 09:30, Continued

#### General Parameters, Continued

Solids, Total Dissolved	773	AO ≤ 500	15	mg/L	2020-10-05	
-------------------------	-----	----------	----	------	------------	--

### WTN 39421 (0109234-03) | Matrix: Water | Sampled: 2020-09-29 10:00

#### Anions

Bromide	< 0.10	N/A	0.10	mg/L	2020-10-03	
Chloride	38.3	AO ≤ 250	0.10	mg/L	2020-10-03	
Fluoride	0.19	MAC = 1.5	0.10	mg/L	2020-10-03	
Nitrate+Nitrite (as N)	2.56	N/A	0.0050	mg/L	2020-10-23	
Nitrite (as N)	< 0.0050	MAC = 1	0.0050	mg/L	2020-10-23	
Phosphate (as P)	< 0.0050	N/A	0.0050	mg/L	2020-10-03	HT1
Sulfate	312	AO ≤ 500	1.0	mg/L	2020-10-04	

#### Calculated Parameters

Hardness, Total (as CaCO <sub>3</sub> )	440	N/A	0.500	mg/L	N/A	
Nitrate (as N)	2.56	MAC = 10	0.0550	mg/L	N/A	
Nitrogen, Organic	0.153	N/A	0.0500	mg/L	N/A	

#### Dissolved Metals

Lithium, dissolved	0.00704	N/A	0.00010	mg/L	2020-10-07	
Aluminum, dissolved	< 0.0050	N/A	0.0050	mg/L	2020-10-07	
Antimony, dissolved	< 0.00020	N/A	0.00020	mg/L	2020-10-07	
Arsenic, dissolved	0.00073	N/A	0.00050	mg/L	2020-10-07	
Barium, dissolved	0.0460	N/A	0.0050	mg/L	2020-10-07	
Beryllium, dissolved	< 0.00010	N/A	0.00010	mg/L	2020-10-07	
Bismuth, dissolved	< 0.00010	N/A	0.00010	mg/L	2020-10-07	
Boron, dissolved	< 0.0500	N/A	0.0500	mg/L	2020-10-07	
Cadmium, dissolved	< 0.000010	N/A	0.000010	mg/L	2020-10-07	
Calcium, dissolved	98.8	N/A	0.20	mg/L	2020-10-07	
Chromium, dissolved	0.00210	N/A	0.00050	mg/L	2020-10-07	
Cobalt, dissolved	< 0.00010	N/A	0.00010	mg/L	2020-10-07	
Copper, dissolved	< 0.00040	N/A	0.00040	mg/L	2020-10-07	
Iron, dissolved	0.032	N/A	0.010	mg/L	2020-10-07	
Lead, dissolved	< 0.00020	N/A	0.00020	mg/L	2020-10-07	
Magnesium, dissolved	46.8	N/A	0.010	mg/L	2020-10-07	
Manganese, dissolved	0.00221	N/A	0.00020	mg/L	2020-10-07	
Mercury, dissolved	< 0.000010	N/A	0.000010	mg/L	2020-10-03	
Molybdenum, dissolved	0.00673	N/A	0.00010	mg/L	2020-10-07	
Nickel, dissolved	0.00101	N/A	0.00040	mg/L	2020-10-07	
Phosphorus, dissolved	< 0.050	N/A	0.050	mg/L	2020-10-07	
Potassium, dissolved	6.36	N/A	0.10	mg/L	2020-10-07	
Selenium, dissolved	0.0353	N/A	0.00050	mg/L	2020-10-07	
Silicon, dissolved	11.9	N/A	1.0	mg/L	2020-10-07	

## TEST RESULTS

**REPORTED TO PROJECT** Associated Environmental Consultants Inc. (Vernon)  
City of Vernon

**WORK ORDER REPORTED** 0109234  
2021-03-04 16:58

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
---------	--------	-----------	----	-------	----------	-----------

**WTN 39421 (0109234-03) | Matrix: Water | Sampled: 2020-09-29 10:00, Continued**

### Dissolved Metals, Continued

Silver, dissolved	< 0.000050	N/A	0.000050	mg/L	2020-10-07	
Sodium, dissolved	<b>39.6</b>	N/A	0.10	mg/L	2020-10-07	
Strontium, dissolved	<b>1.08</b>	N/A	0.0010	mg/L	2020-10-07	
Sulfur, dissolved	<b>101</b>	N/A	3.0	mg/L	2020-10-07	
Tellurium, dissolved	< 0.00050	N/A	0.00050	mg/L	2020-10-07	
Thallium, dissolved	< 0.000020	N/A	0.000020	mg/L	2020-10-07	
Thorium, dissolved	< 0.00010	N/A	0.00010	mg/L	2020-10-07	
Tin, dissolved	< 0.00020	N/A	0.00020	mg/L	2020-10-07	
Titanium, dissolved	< 0.0050	N/A	0.0050	mg/L	2020-10-07	
Tungsten, dissolved	< 0.0010	N/A	0.0010	mg/L	2020-10-07	
Uranium, dissolved	<b>0.00475</b>	N/A	0.000020	mg/L	2020-10-07	
Vanadium, dissolved	<b>0.0049</b>	N/A	0.0010	mg/L	2020-10-07	
Zinc, dissolved	<b>0.0186</b>	N/A	0.0040	mg/L	2020-10-07	
Zirconium, dissolved	< 0.00010	N/A	0.00010	mg/L	2020-10-07	

### General Parameters

Alkalinity, Total (as CaCO <sub>3</sub> )	<b>178</b>	N/A	1.0	mg/L	2020-10-05	
Alkalinity, Phenolphthalein (as CaCO <sub>3</sub> )	< 1.0	N/A	1.0	mg/L	2020-10-05	
Alkalinity, Bicarbonate (as CaCO <sub>3</sub> )	<b>178</b>	N/A	1.0	mg/L	2020-10-05	
Alkalinity, Carbonate (as CaCO <sub>3</sub> )	< 1.0	N/A	1.0	mg/L	2020-10-05	
Alkalinity, Hydroxide (as CaCO <sub>3</sub> )	< 1.0	N/A	1.0	mg/L	2020-10-05	
Ammonia, Total (as N)	< 0.050	None Required	0.050	mg/L	2020-10-06	
Nitrogen, Total Kjeldahl	<b>0.153</b>	N/A	0.050	mg/L	2020-10-05	
Phosphorus, Total (as P)	<b>0.0120</b>	N/A	0.0050	mg/L	2020-10-07	
Phosphorus, Total Dissolved	<b>0.0106</b>	N/A	0.0050	mg/L	2020-10-07	
Solids, Total Dissolved	<b>723</b>	AO ≤ 500	15	mg/L	2020-10-05	

**DMW-4 (0109234-04) | Matrix: Water | Sampled: 2020-09-29 10:40**

### Anions

Bromide	< 0.10	N/A	0.10	mg/L	2020-10-03	
Chloride	<b>108</b>	AO ≤ 250	0.10	mg/L	2020-10-03	
Fluoride	<b>0.38</b>	MAC = 1.5	0.10	mg/L	2020-10-03	
Nitrate+Nitrite (as N)	<b>0.381</b>	N/A	0.0050	mg/L	2020-10-23	
Nitrite (as N)	< 0.0050	MAC = 1	0.0050	mg/L	2020-10-23	
Phosphate (as P)	<b>0.212</b>	N/A	0.0050	mg/L	2020-10-03	HT1
Sulfate	<b>98.2</b>	AO ≤ 500	1.0	mg/L	2020-10-03	

### Calculated Parameters

Hardness, Total (as CaCO <sub>3</sub> )	<b>324</b>	N/A	0.500	mg/L	N/A	
Nitrate (as N)	<b>0.381</b>	MAC = 10	0.0100	mg/L	N/A	
Nitrogen, Organic	<b>0.636</b>	N/A	0.0500	mg/L	N/A	

### Dissolved Metals



## TEST RESULTS

**REPORTED TO PROJECT** Associated Environmental Consultants Inc. (Vernon)  
City of Vernon

**WORK ORDER REPORTED** 0109234  
2021-03-04 16:58

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
---------	--------	-----------	----	-------	----------	-----------

### DMW-4 (0109234-04) | Matrix: Water | Sampled: 2020-09-29 10:40, Continued

#### Dissolved Metals, Continued

Lithium, dissolved	0.0157	N/A	0.00010	mg/L	2020-10-07	
Aluminum, dissolved	< 0.0050	N/A	0.0050	mg/L	2020-10-07	
Antimony, dissolved	< 0.00020	N/A	0.00020	mg/L	2020-10-07	
Arsenic, dissolved	0.00314	N/A	0.00050	mg/L	2020-10-07	
Barium, dissolved	0.0296	N/A	0.0050	mg/L	2020-10-07	
Beryllium, dissolved	< 0.00010	N/A	0.00010	mg/L	2020-10-07	
Bismuth, dissolved	< 0.00010	N/A	0.00010	mg/L	2020-10-07	
Boron, dissolved	0.225	N/A	0.0500	mg/L	2020-10-07	
Cadmium, dissolved	0.000248	N/A	0.000010	mg/L	2020-10-07	
Calcium, dissolved	89.6	N/A	0.20	mg/L	2020-10-07	
Chromium, dissolved	< 0.00050	N/A	0.00050	mg/L	2020-10-07	
Cobalt, dissolved	0.00047	N/A	0.00010	mg/L	2020-10-07	
Copper, dissolved	0.0133	N/A	0.00040	mg/L	2020-10-07	
Iron, dissolved	< 0.010	N/A	0.010	mg/L	2020-10-07	
Lead, dissolved	< 0.00020	N/A	0.00020	mg/L	2020-10-07	
Magnesium, dissolved	24.2	N/A	0.010	mg/L	2020-10-07	
Manganese, dissolved	< 0.00020	N/A	0.00020	mg/L	2020-10-07	
Mercury, dissolved	< 0.000010	N/A	0.000010	mg/L	2020-10-03	
Molybdenum, dissolved	0.0140	N/A	0.00010	mg/L	2020-10-07	
Nickel, dissolved	0.00193	N/A	0.00040	mg/L	2020-10-07	
Phosphorus, dissolved	0.421	N/A	0.050	mg/L	2020-10-07	
Potassium, dissolved	14.9	N/A	0.10	mg/L	2020-10-07	
Selenium, dissolved	< 0.00050	N/A	0.00050	mg/L	2020-10-07	
Silicon, dissolved	10.5	N/A	1.0	mg/L	2020-10-07	
Silver, dissolved	< 0.000050	N/A	0.000050	mg/L	2020-10-07	
Sodium, dissolved	127	N/A	0.10	mg/L	2020-10-07	
Strontium, dissolved	0.852	N/A	0.0010	mg/L	2020-10-07	
Sulfur, dissolved	35.0	N/A	3.0	mg/L	2020-10-07	
Tellurium, dissolved	< 0.00050	N/A	0.00050	mg/L	2020-10-07	
Thallium, dissolved	< 0.000020	N/A	0.000020	mg/L	2020-10-07	
Thorium, dissolved	< 0.00010	N/A	0.00010	mg/L	2020-10-07	
Tin, dissolved	< 0.00020	N/A	0.00020	mg/L	2020-10-07	
Titanium, dissolved	< 0.0050	N/A	0.0050	mg/L	2020-10-07	
Tungsten, dissolved	< 0.0010	N/A	0.0010	mg/L	2020-10-07	
Uranium, dissolved	0.00762	N/A	0.000020	mg/L	2020-10-07	
Vanadium, dissolved	0.0022	N/A	0.0010	mg/L	2020-10-07	
Zinc, dissolved	0.0091	N/A	0.0040	mg/L	2020-10-07	
Zirconium, dissolved	0.00017	N/A	0.00010	mg/L	2020-10-07	

#### General Parameters

Alkalinity, Total (as CaCO <sub>3</sub> )	351	N/A	1.0	mg/L	2020-10-05	
Alkalinity, Phenolphthalein (as CaCO <sub>3</sub> )	< 1.0	N/A	1.0	mg/L	2020-10-05	
Alkalinity, Bicarbonate (as CaCO <sub>3</sub> )	351	N/A	1.0	mg/L	2020-10-05	

## TEST RESULTS

**REPORTED TO PROJECT** Associated Environmental Consultants Inc. (Vernon)  
City of Vernon

**WORK ORDER REPORTED** 0109234  
2021-03-04 16:58

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
<b>DMW-4 (0109234-04)   Matrix: Water   Sampled: 2020-09-29 10:40, Continued</b>						
<b>General Parameters, Continued</b>						
Alkalinity, Carbonate (as CaCO <sub>3</sub> )	< 1.0	N/A	1.0	mg/L	2020-10-05	
Alkalinity, Hydroxide (as CaCO <sub>3</sub> )	< 1.0	N/A	1.0	mg/L	2020-10-05	
Ammonia, Total (as N)	< 0.050	None Required	0.050	mg/L	2020-10-06	
Nitrogen, Total Kjeldahl	<b>0.636</b>	N/A	0.050	mg/L	2020-10-05	
Phosphorus, Total (as P)	<b>0.400</b>	N/A	0.0050	mg/L	2020-10-07	
Phosphorus, Total Dissolved	<b>0.398</b>	N/A	0.0050	mg/L	2020-10-07	
Solids, Total Dissolved	<b>703</b>	AO ≤ 500	15	mg/L	2020-10-05	

### DMW-5 (0109234-05) | Matrix: Water | Sampled: 2020-09-29 11:00

#### Anions

Bromide	< 0.10	N/A	0.10	mg/L	2020-10-03	
Chloride	<b>256</b>	AO ≤ 250	0.10	mg/L	2020-10-03	
Fluoride	<b>1.28</b>	MAC = 1.5	0.10	mg/L	2020-10-03	
Nitrate+Nitrite (as N)	<b>4.92</b>	N/A	0.0050	mg/L	2020-10-23	
Nitrite (as N)	< 0.0050	MAC = 1	0.0050	mg/L	2020-10-23	
Phosphate (as P)	< 0.0050	N/A	0.0050	mg/L	2020-10-03	HT1
Sulfate	<b>249</b>	AO ≤ 500	1.0	mg/L	2020-10-03	

#### Calculated Parameters

Hardness, Total (as CaCO <sub>3</sub> )	<b>610</b>	N/A	0.500	mg/L	N/A
Nitrate (as N)	<b>4.92</b>	MAC = 10	0.130	mg/L	N/A
Nitrogen, Organic	<b>0.528</b>	N/A	0.0500	mg/L	N/A

#### Dissolved Metals

Lithium, dissolved	<b>0.0588</b>	N/A	0.00010	mg/L	2020-10-07
Aluminum, dissolved	< 0.0050	N/A	0.0050	mg/L	2020-10-07
Antimony, dissolved	< 0.00020	N/A	0.00020	mg/L	2020-10-07
Arsenic, dissolved	< 0.00050	N/A	0.00050	mg/L	2020-10-07
Barium, dissolved	<b>0.0848</b>	N/A	0.0050	mg/L	2020-10-07
Beryllium, dissolved	< 0.00010	N/A	0.00010	mg/L	2020-10-07
Bismuth, dissolved	< 0.00010	N/A	0.00010	mg/L	2020-10-07
Boron, dissolved	<b>0.117</b>	N/A	0.0500	mg/L	2020-10-07
Cadmium, dissolved	<b>0.000015</b>	N/A	0.000010	mg/L	2020-10-07
Calcium, dissolved	<b>144</b>	N/A	0.20	mg/L	2020-10-07
Chromium, dissolved	< 0.00050	N/A	0.00050	mg/L	2020-10-07
Cobalt, dissolved	<b>0.00020</b>	N/A	0.00010	mg/L	2020-10-07
Copper, dissolved	<b>0.00147</b>	N/A	0.00040	mg/L	2020-10-07
Iron, dissolved	< 0.010	N/A	0.010	mg/L	2020-10-07
Lead, dissolved	< 0.00020	N/A	0.00020	mg/L	2020-10-07
Magnesium, dissolved	<b>60.4</b>	N/A	0.010	mg/L	2020-10-07
Manganese, dissolved	<b>0.329</b>	N/A	0.00020	mg/L	2020-10-07
Mercury, dissolved	< 0.000010	N/A	0.000010	mg/L	2020-10-03

## TEST RESULTS

**REPORTED TO PROJECT** Associated Environmental Consultants Inc. (Vernon)  
City of Vernon

**WORK ORDER REPORTED** 0109234  
2021-03-04 16:58

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
---------	--------	-----------	----	-------	----------	-----------

**DMW-5 (0109234-05) | Matrix: Water | Sampled: 2020-09-29 11:00, Continued**

### Dissolved Metals, Continued

Molybdenum, dissolved	0.0174	N/A	0.00010	mg/L	2020-10-07	
Nickel, dissolved	0.00352	N/A	0.00040	mg/L	2020-10-07	
Phosphorus, dissolved	< 0.050	N/A	0.050	mg/L	2020-10-07	
Potassium, dissolved	11.3	N/A	0.10	mg/L	2020-10-07	
Selenium, dissolved	0.00065	N/A	0.00050	mg/L	2020-10-07	
Silicon, dissolved	14.5	N/A	1.0	mg/L	2020-10-07	
Silver, dissolved	< 0.000050	N/A	0.000050	mg/L	2020-10-07	
Sodium, dissolved	221	N/A	0.10	mg/L	2020-10-07	
Strontium, dissolved	2.31	N/A	0.0010	mg/L	2020-10-07	
Sulfur, dissolved	88.1	N/A	3.0	mg/L	2020-10-07	
Tellurium, dissolved	< 0.00050	N/A	0.00050	mg/L	2020-10-07	
Thallium, dissolved	< 0.000020	N/A	0.000020	mg/L	2020-10-07	
Thorium, dissolved	< 0.00010	N/A	0.00010	mg/L	2020-10-07	
Tin, dissolved	< 0.00020	N/A	0.00020	mg/L	2020-10-07	
Titanium, dissolved	< 0.0050	N/A	0.0050	mg/L	2020-10-07	
Tungsten, dissolved	< 0.0010	N/A	0.0010	mg/L	2020-10-07	
Uranium, dissolved	0.0304	N/A	0.000020	mg/L	2020-10-07	
Vanadium, dissolved	< 0.0010	N/A	0.0010	mg/L	2020-10-07	
Zinc, dissolved	< 0.0040	N/A	0.0040	mg/L	2020-10-07	
Zirconium, dissolved	< 0.00010	N/A	0.00010	mg/L	2020-10-07	

### General Parameters

Alkalinity, Total (as CaCO <sub>3</sub> )	448	N/A	1.0	mg/L	2020-10-05	
Alkalinity, Phenolphthalein (as CaCO <sub>3</sub> )	< 1.0	N/A	1.0	mg/L	2020-10-05	
Alkalinity, Bicarbonate (as CaCO <sub>3</sub> )	448	N/A	1.0	mg/L	2020-10-05	
Alkalinity, Carbonate (as CaCO <sub>3</sub> )	< 1.0	N/A	1.0	mg/L	2020-10-05	
Alkalinity, Hydroxide (as CaCO <sub>3</sub> )	< 1.0	N/A	1.0	mg/L	2020-10-05	
Ammonia, Total (as N)	< 0.050	None Required	0.050	mg/L	2020-10-06	
Nitrogen, Total Kjeldahl	0.528	N/A	0.050	mg/L	2020-10-05	
Phosphorus, Total (as P)	0.0235	N/A	0.0050	mg/L	2020-10-07	
Phosphorus, Total Dissolved	0.0237	N/A	0.0050	mg/L	2020-10-07	
Solids, Total Dissolved	1350	AO ≤ 500	15	mg/L	2020-10-05	

**DMW-3 (0109234-07) | Matrix: Water | Sampled: 2020-09-29 15:00**

### Anions

Bromide	< 0.10	N/A	0.10	mg/L	2020-10-03	
Chloride	98.3	AO ≤ 250	0.10	mg/L	2020-10-03	
Fluoride	0.52	MAC = 1.5	0.10	mg/L	2020-10-03	
Nitrate+Nitrite (as N)	0.308	N/A	0.0050	mg/L	2020-10-23	
Nitrite (as N)	< 0.0050	MAC = 1	0.0050	mg/L	2020-10-23	
Phosphate (as P)	< 0.0050	N/A	0.0050	mg/L	2020-10-03	HT1
Sulfate	149	AO ≤ 500	1.0	mg/L	2020-10-03	

## TEST RESULTS

**REPORTED TO PROJECT** Associated Environmental Consultants Inc. (Vernon)  
City of Vernon

**WORK ORDER REPORTED** 0109234  
2021-03-04 16:58

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
<b>DMW-3 (0109234-07)   Matrix: Water   Sampled: 2020-09-29 15:00, Continued</b>						
<b>Calculated Parameters</b>						
Hardness, Total (as CaCO <sub>3</sub> )	565	N/A	0.500	mg/L	N/A	
Nitrate (as N)	0.308	MAC = 10	0.0100	mg/L	N/A	
Nitrogen, Organic	0.442	N/A	0.0500	mg/L	N/A	
<b>Dissolved Metals</b>						
Lithium, dissolved	0.0189	N/A	0.00010	mg/L	2020-10-07	
Aluminum, dissolved	< 0.0050	N/A	0.0050	mg/L	2020-10-07	
Antimony, dissolved	< 0.00020	N/A	0.00020	mg/L	2020-10-07	
Arsenic, dissolved	0.00083	N/A	0.00050	mg/L	2020-10-07	
Barium, dissolved	0.0296	N/A	0.0050	mg/L	2020-10-07	
Beryllium, dissolved	< 0.00010	N/A	0.00010	mg/L	2020-10-07	
Bismuth, dissolved	< 0.00010	N/A	0.00010	mg/L	2020-10-07	
Boron, dissolved	< 0.0500	N/A	0.0500	mg/L	2020-10-07	
Cadmium, dissolved	0.000038	N/A	0.000010	mg/L	2020-10-07	
Calcium, dissolved	156	N/A	0.20	mg/L	2020-10-07	
Chromium, dissolved	0.00059	N/A	0.00050	mg/L	2020-10-07	
Cobalt, dissolved	0.00023	N/A	0.00010	mg/L	2020-10-07	
Copper, dissolved	0.00367	N/A	0.00040	mg/L	2020-10-07	
Iron, dissolved	0.122	N/A	0.010	mg/L	2020-10-07	
Lead, dissolved	< 0.00020	N/A	0.00020	mg/L	2020-10-07	
Magnesium, dissolved	42.7	N/A	0.010	mg/L	2020-10-07	
Manganese, dissolved	0.136	N/A	0.00020	mg/L	2020-10-07	
Mercury, dissolved	< 0.000010	N/A	0.000010	mg/L	2020-10-03	
Molybdenum, dissolved	0.00791	N/A	0.00010	mg/L	2020-10-07	
Nickel, dissolved	0.00162	N/A	0.00040	mg/L	2020-10-07	
Phosphorus, dissolved	< 0.050	N/A	0.050	mg/L	2020-10-07	
Potassium, dissolved	8.41	N/A	0.10	mg/L	2020-10-07	
Selenium, dissolved	0.00077	N/A	0.00050	mg/L	2020-10-07	
Silicon, dissolved	14.6	N/A	1.0	mg/L	2020-10-07	
Silver, dissolved	< 0.000050	N/A	0.000050	mg/L	2020-10-07	
Sodium, dissolved	65.7	N/A	0.10	mg/L	2020-10-07	
Strontium, dissolved	1.22	N/A	0.0010	mg/L	2020-10-07	
Sulfur, dissolved	53.8	N/A	3.0	mg/L	2020-10-07	
Tellurium, dissolved	< 0.00050	N/A	0.00050	mg/L	2020-10-07	
Thallium, dissolved	< 0.000020	N/A	0.000020	mg/L	2020-10-07	
Thorium, dissolved	< 0.00010	N/A	0.00010	mg/L	2020-10-07	
Tin, dissolved	< 0.00020	N/A	0.00020	mg/L	2020-10-07	
Titanium, dissolved	< 0.0050	N/A	0.0050	mg/L	2020-10-07	
Tungsten, dissolved	< 0.0010	N/A	0.0010	mg/L	2020-10-07	
Uranium, dissolved	0.00516	N/A	0.000020	mg/L	2020-10-07	
Vanadium, dissolved	< 0.0010	N/A	0.0010	mg/L	2020-10-07	
Zinc, dissolved	0.0748	N/A	0.0040	mg/L	2020-10-07	
Zirconium, dissolved	< 0.00010	N/A	0.00010	mg/L	2020-10-07	

## TEST RESULTS

**REPORTED TO PROJECT** Associated Environmental Consultants Inc. (Vernon)  
City of Vernon

**WORK ORDER REPORTED** 0109234  
2021-03-04 16:58

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
---------	--------	-----------	----	-------	----------	-----------

### DMW-3 (0109234-07) | Matrix: Water | Sampled: 2020-09-29 15:00, Continued

#### General Parameters

Alkalinity, Total (as CaCO <sub>3</sub> )	419	N/A	1.0	mg/L	2020-10-05	
Alkalinity, Phenolphthalein (as CaCO <sub>3</sub> )	< 1.0	N/A	1.0	mg/L	2020-10-05	
Alkalinity, Bicarbonate (as CaCO <sub>3</sub> )	419	N/A	1.0	mg/L	2020-10-05	
Alkalinity, Carbonate (as CaCO <sub>3</sub> )	< 1.0	N/A	1.0	mg/L	2020-10-05	
Alkalinity, Hydroxide (as CaCO <sub>3</sub> )	< 1.0	N/A	1.0	mg/L	2020-10-05	
Ammonia, Total (as N)	< 0.050	None Required	0.050	mg/L	2020-10-06	
Nitrogen, Total Kjeldahl	0.442	N/A	0.050	mg/L	2020-10-05	
Phosphorus, Total (as P)	0.0059	N/A	0.0050	mg/L	2020-10-07	
Phosphorus, Total Dissolved	0.0057	N/A	0.0050	mg/L	2020-10-07	
Solids, Total Dissolved	869	AO ≤ 500	15	mg/L	2020-10-05	

### MW-2 (0109234-08) | Matrix: Water | Sampled: 2020-09-29 15:45

#### Anions

Bromide	< 0.10	N/A	0.10	mg/L	2020-10-03	
Chloride	25.7	AO ≤ 250	0.10	mg/L	2020-10-03	
Fluoride	0.25	MAC = 1.5	0.10	mg/L	2020-10-03	
Nitrate+Nitrite (as N)	0.0658	N/A	0.0050	mg/L	2020-10-23	
Nitrite (as N)	< 0.0050	MAC = 1	0.0050	mg/L	2020-10-23	
Phosphate (as P)	< 0.0050	N/A	0.0050	mg/L	2020-10-03	HT1
Sulfate	306	AO ≤ 500	1.0	mg/L	2020-10-03	

#### Calculated Parameters

Hardness, Total (as CaCO <sub>3</sub> )	445	N/A	0.500	mg/L	N/A	
Nitrate (as N)	0.0658	MAC = 10	0.0100	mg/L	N/A	
Nitrogen, Organic	0.169	N/A	0.0500	mg/L	N/A	

#### Dissolved Metals

Lithium, dissolved	0.00600	N/A	0.00010	mg/L	2020-10-07	
Aluminum, dissolved	< 0.0050	N/A	0.0050	mg/L	2020-10-07	
Antimony, dissolved	< 0.00020	N/A	0.00020	mg/L	2020-10-07	
Arsenic, dissolved	0.00100	N/A	0.00050	mg/L	2020-10-07	
Barium, dissolved	0.0400	N/A	0.0050	mg/L	2020-10-07	
Beryllium, dissolved	< 0.00010	N/A	0.00010	mg/L	2020-10-07	
Bismuth, dissolved	< 0.00010	N/A	0.00010	mg/L	2020-10-07	
Boron, dissolved	< 0.0500	N/A	0.0500	mg/L	2020-10-07	
Cadmium, dissolved	0.000039	N/A	0.000010	mg/L	2020-10-07	
Calcium, dissolved	83.8	N/A	0.20	mg/L	2020-10-07	
Chromium, dissolved	< 0.00050	N/A	0.00050	mg/L	2020-10-07	
Cobalt, dissolved	0.00019	N/A	0.00010	mg/L	2020-10-07	
Copper, dissolved	< 0.00040	N/A	0.00040	mg/L	2020-10-07	
Iron, dissolved	0.015	N/A	0.010	mg/L	2020-10-07	
Lead, dissolved	< 0.00020	N/A	0.00020	mg/L	2020-10-07	

## TEST RESULTS

**REPORTED TO PROJECT** Associated Environmental Consultants Inc. (Vernon)  
City of Vernon

**WORK ORDER REPORTED** 0109234  
2021-03-04 16:58

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
---------	--------	-----------	----	-------	----------	-----------

### MW-2 (0109234-08) | Matrix: Water | Sampled: 2020-09-29 15:45, Continued

#### Dissolved Metals, Continued

Magnesium, dissolved	57.3	N/A	0.010	mg/L	2020-10-07	
Manganese, dissolved	0.0685	N/A	0.00020	mg/L	2020-10-07	
Mercury, dissolved	< 0.000010	N/A	0.000010	mg/L	2020-10-04	
Molybdenum, dissolved	0.0145	N/A	0.00010	mg/L	2020-10-07	
Nickel, dissolved	0.00129	N/A	0.00040	mg/L	2020-10-07	
Phosphorus, dissolved	< 0.050	N/A	0.050	mg/L	2020-10-07	
Potassium, dissolved	5.96	N/A	0.10	mg/L	2020-10-07	
Selenium, dissolved	< 0.00050	N/A	0.00050	mg/L	2020-10-07	
Silicon, dissolved	9.2	N/A	1.0	mg/L	2020-10-07	
Silver, dissolved	< 0.000050	N/A	0.000050	mg/L	2020-10-07	
Sodium, dissolved	38.9	N/A	0.10	mg/L	2020-10-07	
Strontium, dissolved	0.949	N/A	0.0010	mg/L	2020-10-07	
Sulfur, dissolved	108	N/A	3.0	mg/L	2020-10-07	
Tellurium, dissolved	< 0.00050	N/A	0.00050	mg/L	2020-10-07	
Thallium, dissolved	< 0.000020	N/A	0.000020	mg/L	2020-10-07	
Thorium, dissolved	< 0.00010	N/A	0.00010	mg/L	2020-10-07	
Tin, dissolved	< 0.00020	N/A	0.00020	mg/L	2020-10-07	
Titanium, dissolved	< 0.0050	N/A	0.0050	mg/L	2020-10-07	
Tungsten, dissolved	< 0.0010	N/A	0.0010	mg/L	2020-10-07	
Uranium, dissolved	0.00982	N/A	0.000020	mg/L	2020-10-07	
Vanadium, dissolved	< 0.0010	N/A	0.0010	mg/L	2020-10-07	
Zinc, dissolved	0.140	N/A	0.0040	mg/L	2020-10-07	
Zirconium, dissolved	< 0.00010	N/A	0.00010	mg/L	2020-10-07	

#### General Parameters

Alkalinity, Total (as CaCO <sub>3</sub> )	172	N/A	1.0	mg/L	2020-10-05	
Alkalinity, Phenolphthalein (as CaCO <sub>3</sub> )	< 1.0	N/A	1.0	mg/L	2020-10-05	
Alkalinity, Bicarbonate (as CaCO <sub>3</sub> )	172	N/A	1.0	mg/L	2020-10-05	
Alkalinity, Carbonate (as CaCO <sub>3</sub> )	< 1.0	N/A	1.0	mg/L	2020-10-05	
Alkalinity, Hydroxide (as CaCO <sub>3</sub> )	< 1.0	N/A	1.0	mg/L	2020-10-05	
Ammonia, Total (as N)	< 0.050	None Required	0.050	mg/L	2020-10-06	
Nitrogen, Total Kjeldahl	0.169	N/A	0.050	mg/L	2020-10-05	
Phosphorus, Total (as P)	0.149	N/A	0.0050	mg/L	2020-10-07	
Phosphorus, Total Dissolved	0.0355	N/A	0.0050	mg/L	2020-10-07	
Solids, Total Dissolved	662	AO ≤ 500	15	mg/L	2020-10-05	

### MW-0 (0109234-09) | Matrix: Water | Sampled: 2020-09-29 15:50

#### Anions

Bromide	< 0.10	N/A	0.10	mg/L	2020-10-03	
Chloride	25.4	AO ≤ 250	0.10	mg/L	2020-10-03	
Fluoride	0.26	MAC = 1.5	0.10	mg/L	2020-10-03	
Nitrate+Nitrite (as N)	0.0640	N/A	0.0050	mg/L	2020-10-23	

## TEST RESULTS

**REPORTED TO PROJECT** Associated Environmental Consultants Inc. (Vernon)  
City of Vernon

**WORK ORDER REPORTED** 0109234  
2021-03-04 16:58

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
<b>MW-0 (0109234-09)   Matrix: Water   Sampled: 2020-09-29 15:50, Continued</b>						
<b>Anions, Continued</b>						
Nitrite (as N)	< 0.0050	MAC = 1	0.0050	mg/L	2020-10-23	
Phosphate (as P)	< 0.0050	N/A	0.0050	mg/L	2020-10-03	HT1
Sulfate	<b>312</b>	AO ≤ 500	1.0	mg/L	2020-10-03	
<b>Calculated Parameters</b>						
Hardness, Total (as CaCO <sub>3</sub> )	<b>441</b>	N/A	0.500	mg/L	N/A	
Nitrate (as N)	<b>0.0640</b>	MAC = 10	0.0100	mg/L	N/A	
Nitrogen, Organic	<b>0.142</b>	N/A	0.0500	mg/L	N/A	
<b>Dissolved Metals</b>						
Lithium, dissolved	<b>0.00600</b>	N/A	0.00010	mg/L	2020-10-07	
Aluminum, dissolved	< 0.0050	N/A	0.0050	mg/L	2020-10-07	
Antimony, dissolved	< 0.00020	N/A	0.00020	mg/L	2020-10-07	
Arsenic, dissolved	<b>0.00087</b>	N/A	0.00050	mg/L	2020-10-07	
Barium, dissolved	<b>0.0381</b>	N/A	0.0050	mg/L	2020-10-07	
Beryllium, dissolved	< 0.00010	N/A	0.00010	mg/L	2020-10-07	
Bismuth, dissolved	< 0.00010	N/A	0.00010	mg/L	2020-10-07	
Boron, dissolved	< 0.0500	N/A	0.0500	mg/L	2020-10-07	
Cadmium, dissolved	<b>0.000037</b>	N/A	0.000010	mg/L	2020-10-07	
Calcium, dissolved	<b>82.7</b>	N/A	0.20	mg/L	2020-10-07	
Chromium, dissolved	< 0.00050	N/A	0.00050	mg/L	2020-10-07	
Cobalt, dissolved	<b>0.00015</b>	N/A	0.00010	mg/L	2020-10-07	
Copper, dissolved	< 0.00040	N/A	0.00040	mg/L	2020-10-07	
Iron, dissolved	<b>0.013</b>	N/A	0.010	mg/L	2020-10-07	
Lead, dissolved	< 0.00020	N/A	0.00020	mg/L	2020-10-07	
Magnesium, dissolved	<b>56.8</b>	N/A	0.010	mg/L	2020-10-07	
Manganese, dissolved	<b>0.0617</b>	N/A	0.00020	mg/L	2020-10-07	
Mercury, dissolved	< 0.000010	N/A	0.000010	mg/L	2020-10-04	
Molybdenum, dissolved	<b>0.0136</b>	N/A	0.00010	mg/L	2020-10-07	
Nickel, dissolved	<b>0.00115</b>	N/A	0.00040	mg/L	2020-10-07	
Phosphorus, dissolved	< 0.050	N/A	0.050	mg/L	2020-10-07	
Potassium, dissolved	<b>5.88</b>	N/A	0.10	mg/L	2020-10-07	
Selenium, dissolved	<b>0.00069</b>	N/A	0.00050	mg/L	2020-10-07	
Silicon, dissolved	<b>9.3</b>	N/A	1.0	mg/L	2020-10-07	
Silver, dissolved	< 0.000050	N/A	0.000050	mg/L	2020-10-07	
Sodium, dissolved	<b>38.6</b>	N/A	0.10	mg/L	2020-10-07	
Strontium, dissolved	<b>0.910</b>	N/A	0.0010	mg/L	2020-10-07	
Sulfur, dissolved	<b>108</b>	N/A	3.0	mg/L	2020-10-07	
Tellurium, dissolved	< 0.00050	N/A	0.00050	mg/L	2020-10-07	
Thallium, dissolved	< 0.000020	N/A	0.000020	mg/L	2020-10-07	
Thorium, dissolved	< 0.00010	N/A	0.00010	mg/L	2020-10-07	
Tin, dissolved	< 0.00020	N/A	0.00020	mg/L	2020-10-07	
Titanium, dissolved	< 0.0050	N/A	0.0050	mg/L	2020-10-07	
Tungsten, dissolved	< 0.0010	N/A	0.0010	mg/L	2020-10-07	

## TEST RESULTS

**REPORTED TO PROJECT** Associated Environmental Consultants Inc. (Vernon)  
City of Vernon

**WORK ORDER REPORTED** 0109234  
2021-03-04 16:58

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
---------	--------	-----------	----	-------	----------	-----------

### MW-0 (0109234-09) | Matrix: Water | Sampled: 2020-09-29 15:50, Continued

#### Dissolved Metals, Continued

Uranium, dissolved	0.00953	N/A	0.000020	mg/L	2020-10-07	
Vanadium, dissolved	< 0.0010	N/A	0.0010	mg/L	2020-10-07	
Zinc, dissolved	0.138	N/A	0.0040	mg/L	2020-10-07	
Zirconium, dissolved	< 0.00010	N/A	0.00010	mg/L	2020-10-07	

#### General Parameters

Alkalinity, Total (as CaCO <sub>3</sub> )	183	N/A	1.0	mg/L	2020-10-05	
Alkalinity, Phenolphthalein (as CaCO <sub>3</sub> )	< 1.0	N/A	1.0	mg/L	2020-10-05	
Alkalinity, Bicarbonate (as CaCO <sub>3</sub> )	183	N/A	1.0	mg/L	2020-10-05	
Alkalinity, Carbonate (as CaCO <sub>3</sub> )	< 1.0	N/A	1.0	mg/L	2020-10-05	
Alkalinity, Hydroxide (as CaCO <sub>3</sub> )	< 1.0	N/A	1.0	mg/L	2020-10-05	
Ammonia, Total (as N)	0.080	None Required	0.050	mg/L	2020-10-06	
Nitrogen, Total Kjeldahl	0.222	N/A	0.050	mg/L	2020-10-05	
Phosphorus, Total (as P)	0.156	N/A	0.0050	mg/L	2020-10-07	
Phosphorus, Total Dissolved	0.0353	N/A	0.0050	mg/L	2020-10-07	
Solids, Total Dissolved	684	AO ≤ 500	15	mg/L	2020-10-05	

### MW-5 (0109234-10) | Matrix: Water | Sampled: 2020-09-29 16:40

#### Anions

Bromide	< 0.10	N/A	0.10	mg/L	2020-10-03	
Chloride	7.64	AO ≤ 250	0.10	mg/L	2020-10-03	
Fluoride	< 0.10	MAC = 1.5	0.10	mg/L	2020-10-03	
Nitrate+Nitrite (as N)	0.0211	N/A	0.0050	mg/L	2020-10-23	
Nitrite (as N)	< 0.0050	MAC = 1	0.0050	mg/L	2020-10-23	
Phosphate (as P)	< 0.0050	N/A	0.0050	mg/L	2020-10-03	HT1
Sulfate	204	AO ≤ 500	1.0	mg/L	2020-10-03	

#### Calculated Parameters

Hardness, Total (as CaCO <sub>3</sub> )	188	N/A	0.500	mg/L	N/A
Nitrate (as N)	0.0211	MAC = 10	0.0100	mg/L	N/A
Nitrogen, Organic	< 0.0500	N/A	0.0500	mg/L	N/A

#### Dissolved Metals

Lithium, dissolved	0.00101	N/A	0.00010	mg/L	2020-10-07
Aluminum, dissolved	< 0.0050	N/A	0.0050	mg/L	2020-10-07
Antimony, dissolved	< 0.00020	N/A	0.00020	mg/L	2020-10-07
Arsenic, dissolved	< 0.00050	N/A	0.00050	mg/L	2020-10-07
Barium, dissolved	< 0.0050	N/A	0.0050	mg/L	2020-10-07
Beryllium, dissolved	< 0.00010	N/A	0.00010	mg/L	2020-10-07
Bismuth, dissolved	< 0.00010	N/A	0.00010	mg/L	2020-10-07
Boron, dissolved	< 0.0500	N/A	0.0500	mg/L	2020-10-07
Cadmium, dissolved	< 0.000010	N/A	0.000010	mg/L	2020-10-07
Calcium, dissolved	7.79	N/A	0.20	mg/L	2020-10-07



## TEST RESULTS

**REPORTED TO PROJECT** Associated Environmental Consultants Inc. (Vernon)  
City of Vernon

**WORK ORDER REPORTED** 0109234  
2021-03-04 16:58

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
<b>MW-5 (0109234-10)   Matrix: Water   Sampled: 2020-09-29 16:40, Continued</b>						
<i><b>Dissolved Metals, Continued</b></i>						
Chromium, dissolved	< 0.00050	N/A	0.00050	mg/L	2020-10-07	
Cobalt, dissolved	< 0.00010	N/A	0.00010	mg/L	2020-10-07	
Copper, dissolved	< 0.00040	N/A	0.00040	mg/L	2020-10-07	
Iron, dissolved	<b>0.012</b>	N/A	0.010	mg/L	2020-10-07	
Lead, dissolved	< 0.00020	N/A	0.00020	mg/L	2020-10-07	
Magnesium, dissolved	<b>40.9</b>	N/A	0.010	mg/L	2020-10-07	
Manganese, dissolved	<b>0.0381</b>	N/A	0.00020	mg/L	2020-10-07	
Mercury, dissolved	< 0.000010	N/A	0.000010	mg/L	2020-10-04	
Molybdenum, dissolved	<b>0.00326</b>	N/A	0.00010	mg/L	2020-10-07	
Nickel, dissolved	< 0.00040	N/A	0.00040	mg/L	2020-10-07	
Phosphorus, dissolved	< 0.050	N/A	0.050	mg/L	2020-10-07	
Potassium, dissolved	<b>3.12</b>	N/A	0.10	mg/L	2020-10-07	
Selenium, dissolved	< 0.00050	N/A	0.00050	mg/L	2020-10-07	
Silicon, dissolved	< 1.0	N/A	1.0	mg/L	2020-10-07	
Silver, dissolved	< 0.000050	N/A	0.000050	mg/L	2020-10-07	
Sodium, dissolved	<b>43.7</b>	N/A	0.10	mg/L	2020-10-07	
Strontium, dissolved	<b>0.0460</b>	N/A	0.0010	mg/L	2020-10-07	
Sulfur, dissolved	<b>71.3</b>	N/A	3.0	mg/L	2020-10-07	
Tellurium, dissolved	< 0.00050	N/A	0.00050	mg/L	2020-10-07	
Thallium, dissolved	< 0.000020	N/A	0.000020	mg/L	2020-10-07	
Thorium, dissolved	< 0.00010	N/A	0.00010	mg/L	2020-10-07	
Tin, dissolved	< 0.00020	N/A	0.00020	mg/L	2020-10-07	
Titanium, dissolved	< 0.0050	N/A	0.0050	mg/L	2020-10-07	
Tungsten, dissolved	< 0.0010	N/A	0.0010	mg/L	2020-10-07	
Uranium, dissolved	< 0.000020	N/A	0.000020	mg/L	2020-10-07	
Vanadium, dissolved	< 0.0010	N/A	0.0010	mg/L	2020-10-07	
Zinc, dissolved	< 0.0040	N/A	0.0040	mg/L	2020-10-07	
Zirconium, dissolved	< 0.00010	N/A	0.00010	mg/L	2020-10-07	
<i><b>General Parameters</b></i>						
Alkalinity, Total (as CaCO <sub>3</sub> )	<b>57.7</b>	N/A	1.0	mg/L	2020-10-05	
Alkalinity, Phenolphthalein (as CaCO <sub>3</sub> )	<b>4.4</b>	N/A	1.0	mg/L	2020-10-05	
Alkalinity, Bicarbonate (as CaCO <sub>3</sub> )	<b>49.0</b>	N/A	1.0	mg/L	2020-10-05	
Alkalinity, Carbonate (as CaCO <sub>3</sub> )	<b>8.8</b>	N/A	1.0	mg/L	2020-10-05	
Alkalinity, Hydroxide (as CaCO <sub>3</sub> )	< 1.0	N/A	1.0	mg/L	2020-10-05	
Ammonia, Total (as N)	<b>0.469</b>	None Required	0.050	mg/L	2020-10-06	
Nitrogen, Total Kjeldahl	<b>0.478</b>	N/A	0.050	mg/L	2020-10-05	
Phosphorus, Total (as P)	<b>0.0075</b>	N/A	0.0050	mg/L	2020-10-07	
Phosphorus, Total Dissolved	< 0.0050	N/A	0.0050	mg/L	2020-10-07	
Solids, Total Dissolved	<b>358</b>	AO ≤ 500	15	mg/L	2020-10-05	

**MW11-02 (0109234-11) | Matrix: Water | Sampled: 2020-09-29 09:00**

## TEST RESULTS

**REPORTED TO PROJECT** Associated Environmental Consultants Inc. (Vernon)  
City of Vernon

**WORK ORDER REPORTED** 0109234  
2021-03-04 16:58

Analyte	Result	Guideline	RL Units	Analyzed	Qualifier
<b>MW11-02 (0109234-11)   Matrix: Water   Sampled: 2020-09-29 09:00, Continued</b>					
<b>Anions</b>					
Bromide	< 0.10	N/A	0.10 mg/L	2020-10-03	
Chloride	102	AO ≤ 250	0.10 mg/L	2020-10-03	
Fluoride	0.24	MAC = 1.5	0.10 mg/L	2020-10-03	
Nitrate+Nitrite (as N)	10.1	N/A	0.0050 mg/L	2020-10-23	
Nitrite (as N)	0.0102	MAC = 1	0.0050 mg/L	2020-10-23	
Phosphate (as P)	< 0.0050	N/A	0.0050 mg/L	2020-10-03	HT1
Sulfate	622	AO ≤ 500	1.0 mg/L	2020-10-03	
<b>Calculated Parameters</b>					
Hardness, Total (as CaCO <sub>3</sub> )	893	N/A	0.500 mg/L	N/A	
Nitrate (as N)	10.1	MAC = 10	0.130 mg/L	N/A	
Nitrogen, Organic	0.758	N/A	0.0500 mg/L	N/A	
<b>Dissolved Metals</b>					
Lithium, dissolved	0.0176	N/A	0.00010 mg/L	2020-10-07	
Aluminum, dissolved	< 0.0050	N/A	0.0050 mg/L	2020-10-07	
Antimony, dissolved	< 0.00020	N/A	0.00020 mg/L	2020-10-07	
Arsenic, dissolved	0.00081	N/A	0.00050 mg/L	2020-10-07	
Barium, dissolved	0.0278	N/A	0.0050 mg/L	2020-10-07	
Beryllium, dissolved	< 0.00010	N/A	0.00010 mg/L	2020-10-07	
Bismuth, dissolved	< 0.00010	N/A	0.00010 mg/L	2020-10-07	
Boron, dissolved	0.159	N/A	0.0500 mg/L	2020-10-07	
Cadmium, dissolved	0.000080	N/A	0.000010 mg/L	2020-10-07	
Calcium, dissolved	206	N/A	0.20 mg/L	2020-10-07	
Chromium, dissolved	0.00187	N/A	0.00050 mg/L	2020-10-07	
Cobalt, dissolved	0.00293	N/A	0.00010 mg/L	2020-10-07	
Copper, dissolved	0.00226	N/A	0.00040 mg/L	2020-10-07	
Iron, dissolved	0.020	N/A	0.010 mg/L	2020-10-07	
Lead, dissolved	< 0.00020	N/A	0.00020 mg/L	2020-10-07	
Magnesium, dissolved	91.6	N/A	0.010 mg/L	2020-10-07	
Manganese, dissolved	0.00550	N/A	0.00020 mg/L	2020-10-07	
Mercury, dissolved	< 0.000010	N/A	0.000010 mg/L	2020-10-04	
Molybdenum, dissolved	0.00733	N/A	0.00010 mg/L	2020-10-07	
Nickel, dissolved	0.0151	N/A	0.00040 mg/L	2020-10-07	
Phosphorus, dissolved	0.059	N/A	0.050 mg/L	2020-10-07	
Potassium, dissolved	9.13	N/A	0.10 mg/L	2020-10-07	
Selenium, dissolved	0.0160	N/A	0.00050 mg/L	2020-10-07	
Silicon, dissolved	13.4	N/A	1.0 mg/L	2020-10-07	
Silver, dissolved	< 0.000050	N/A	0.000050 mg/L	2020-10-07	
Sodium, dissolved	120	N/A	0.10 mg/L	2020-10-07	
Strontium, dissolved	1.38	N/A	0.0010 mg/L	2020-10-07	
Sulfur, dissolved	213	N/A	3.0 mg/L	2020-10-07	
Tellurium, dissolved	< 0.00050	N/A	0.00050 mg/L	2020-10-07	
Thallium, dissolved	< 0.000020	N/A	0.000020 mg/L	2020-10-07	

## TEST RESULTS

**REPORTED TO PROJECT** Associated Environmental Consultants Inc. (Vernon)  
City of Vernon

**WORK ORDER REPORTED** 0109234  
2021-03-04 16:58

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
---------	--------	-----------	----	-------	----------	-----------

### MW11-02 (0109234-11) | Matrix: Water | Sampled: 2020-09-29 09:00, Continued

#### Dissolved Metals, Continued

Thorium, dissolved	< 0.00010	N/A	0.00010	mg/L	2020-10-07	
Tin, dissolved	< 0.00020	N/A	0.00020	mg/L	2020-10-07	
Titanium, dissolved	< 0.0050	N/A	0.0050	mg/L	2020-10-07	
Tungsten, dissolved	< 0.0010	N/A	0.0010	mg/L	2020-10-07	
Uranium, dissolved	0.0291	N/A	0.000020	mg/L	2020-10-07	
Vanadium, dissolved	0.0011	N/A	0.0010	mg/L	2020-10-07	
Zinc, dissolved	< 0.0040	N/A	0.0040	mg/L	2020-10-07	
Zirconium, dissolved	< 0.00010	N/A	0.00010	mg/L	2020-10-07	

#### General Parameters

Alkalinity, Total (as CaCO <sub>3</sub> )	346	N/A	1.0	mg/L	2020-10-05	
Alkalinity, Phenolphthalein (as CaCO <sub>3</sub> )	< 1.0	N/A	1.0	mg/L	2020-10-05	
Alkalinity, Bicarbonate (as CaCO <sub>3</sub> )	346	N/A	1.0	mg/L	2020-10-05	
Alkalinity, Carbonate (as CaCO <sub>3</sub> )	< 1.0	N/A	1.0	mg/L	2020-10-05	
Alkalinity, Hydroxide (as CaCO <sub>3</sub> )	< 1.0	N/A	1.0	mg/L	2020-10-05	
Ammonia, Total (as N)	< 0.050	None Required	0.050	mg/L	2020-10-06	
Nitrogen, Total Kjeldahl	0.758	N/A	0.050	mg/L	2020-10-05	
Phosphorus, Total (as P)	0.292	N/A	0.0050	mg/L	2020-10-07	
Phosphorus, Total Dissolved	0.0468	N/A	0.0050	mg/L	2020-10-07	
Solids, Total Dissolved	1550	AO ≤ 500	15	mg/L	2020-10-05	

### Trip Blank (0109234-12) | Matrix: Water | Sampled: 2020-09-29

#### Anions

Bromide	< 0.10	N/A	0.10	mg/L	2020-10-03	
Chloride	< 0.10	AO ≤ 250	0.10	mg/L	2020-10-03	
Fluoride	< 0.10	MAC = 1.5	0.10	mg/L	2020-10-03	
Nitrate+Nitrite (as N)	< 0.0050	N/A	0.0050	mg/L	2020-10-23	
Nitrite (as N)	< 0.0050	MAC = 1	0.0050	mg/L	2020-10-23	
Phosphate (as P)	< 0.0050	N/A	0.0050	mg/L	2020-10-03	HT1
Sulfate	< 1.0	AO ≤ 500	1.0	mg/L	2020-10-03	

#### Calculated Parameters

Hardness, Total (as CaCO <sub>3</sub> )	< 0.500	None Required	0.500	mg/L	N/A	
Nitrate (as N)	< 0.0100	MAC = 10	0.0100	mg/L	N/A	
Nitrogen, Organic	< 0.0500	N/A	0.0500	mg/L	N/A	

#### General Parameters

Alkalinity, Total (as CaCO <sub>3</sub> )	< 1.0	N/A	1.0	mg/L	2020-10-05	
Alkalinity, Phenolphthalein (as CaCO <sub>3</sub> )	< 1.0	N/A	1.0	mg/L	2020-10-05	
Alkalinity, Bicarbonate (as CaCO <sub>3</sub> )	< 1.0	N/A	1.0	mg/L	2020-10-05	
Alkalinity, Carbonate (as CaCO <sub>3</sub> )	< 1.0	N/A	1.0	mg/L	2020-10-05	
Alkalinity, Hydroxide (as CaCO <sub>3</sub> )	< 1.0	N/A	1.0	mg/L	2020-10-05	
Ammonia, Total (as N)	< 0.050	None Required	0.050	mg/L	2020-10-06	

## TEST RESULTS

**REPORTED TO PROJECT** Associated Environmental Consultants Inc. (Vernon)  
City of Vernon

**WORK ORDER REPORTED** 0109234  
2021-03-04 16:58

Analyte	Result	Guideline	RL Units	Analyzed	Qualifier
<b>Trip Blank (0109234-12)   Matrix: Water   Sampled: 2020-09-29, Continued</b>					
<b>General Parameters, Continued</b>					
Nitrogen, Total Kjeldahl	< 0.050	N/A	0.050 mg/L	2020-10-05	
Phosphorus, Total Dissolved	< 0.0050	N/A	0.0050 mg/L	2020-10-07	
Solids, Total Dissolved	< 15	AO ≤ 500	15 mg/L	2020-10-05	
<b>Total Metals</b>					
Aluminum, total	< 0.0050	OG < 0.1	0.0050 mg/L	2020-10-08	
Antimony, total	< 0.00020	MAC = 0.006	0.00020 mg/L	2020-10-08	
Arsenic, total	< 0.00050	MAC = 0.01	0.00050 mg/L	2020-10-08	
Barium, total	< 0.0050	MAC = 2	0.0050 mg/L	2020-10-08	
Beryllium, total	< 0.00010	N/A	0.00010 mg/L	2020-10-08	
Bismuth, total	< 0.00010	N/A	0.00010 mg/L	2020-10-08	
Boron, total	< 0.0100	MAC = 5	0.0500 mg/L	2020-10-08	
Cadmium, total	< 0.000010	MAC = 0.005	0.000010 mg/L	2020-10-08	
Calcium, total	< 0.20	None Required	0.20 mg/L	2020-10-08	
Chromium, total	< 0.00050	MAC = 0.05	0.00050 mg/L	2020-10-08	
Cobalt, total	< 0.00005	N/A	0.00010 mg/L	2020-10-08	
Copper, total	< 0.00040	MAC = 2	0.00040 mg/L	2020-10-08	
Iron, total	< 0.010	AO ≤ 0.3	0.010 mg/L	2020-10-08	
Lead, total	< 0.00020	MAC = 0.005	0.00020 mg/L	2020-10-08	
Lithium, total	< 0.00010	N/A	0.00010 mg/L	2020-10-08	
Magnesium, total	< 0.010	None Required	0.010 mg/L	2020-10-08	
Manganese, total	< 0.00020	MAC = 0.12	0.00020 mg/L	2020-10-08	
Mercury, total	< 0.000010	MAC = 0.001	0.000010 mg/L	2020-10-03	
Molybdenum, total	< 0.00010	N/A	0.00010 mg/L	2020-10-08	
Nickel, total	< 0.00040	N/A	0.00040 mg/L	2020-10-08	
Phosphorus, total	< 0.050	N/A	0.050 mg/L	2020-10-08	
Potassium, total	< 0.02	N/A	0.10 mg/L	2020-10-08	
Selenium, total	< 0.00050	MAC = 0.05	0.00050 mg/L	2020-10-08	
Silicon, total	< 0.5	N/A	1.0 mg/L	2020-10-08	
Silver, total	< 0.000050	None Required	0.000050 mg/L	2020-10-08	
Sodium, total	<b>0.02</b>	AO ≤ 200	0.10 mg/L	2020-10-08	
Strontium, total	< 0.0010	7	0.0010 mg/L	2020-10-08	
Sulfur, total	< 0.6	N/A	3.0 mg/L	2020-10-08	
Tellurium, total	< 0.00050	N/A	0.00050 mg/L	2020-10-08	
Thallium, total	< 0.000020	N/A	0.000020 mg/L	2020-10-08	
Thorium, total	< 0.00002	N/A	0.00010 mg/L	2020-10-08	
Tin, total	<b>0.00006</b>	N/A	0.00020 mg/L	2020-10-08	
Titanium, total	< 0.0050	N/A	0.0050 mg/L	2020-10-08	
Tungsten, total	< 0.0002	N/A	0.0010 mg/L	2020-10-08	
Uranium, total	< 0.000020	MAC = 0.02	0.000020 mg/L	2020-10-08	
Vanadium, total	< 0.0010	N/A	0.0010 mg/L	2020-10-08	
Zinc, total	< 0.0040	AO ≤ 5	0.0040 mg/L	2020-10-08	
Zirconium, total	< 0.00010	N/A	0.00010 mg/L	2020-10-08	



## TEST RESULTS

**REPORTED TO** Associated Environmental Consultants Inc. (Vernon)  
**PROJECT** City of Vernon

**WORK ORDER** 0109234  
**REPORTED** 2021-03-04 16:58

**Sample Qualifiers:**

HT1 The sample was prepared and/or analyzed past the recommended holding time.

## APPENDIX 1: SUPPORTING INFORMATION

**REPORTED TO PROJECT** Associated Environmental Consultants Inc. (Vernon)  
City of Vernon

**WORK ORDER REPORTED** 0109234  
2021-03-04 16:58

Analysis Description	Method Ref.	Technique	Accredited	Location
Alkalinity in Water	SM 2320 B* (2017)	Titration with H <sub>2</sub> SO <sub>4</sub>	✓	Kelowna
Ammonia, Total in Water	SM 4500-NH <sub>3</sub> G* (2017)	Automated Colorimetry (Phenate)	✓	Kelowna
Anions in Water	SM 4110 B (2017)	Ion Chromatography	✓	Kelowna
Dissolved Metals in Water	EPA 200.8 / EPA 6020B	0.45 µm Filtration / Inductively Coupled Plasma-Mass Spectrometry (ICP-MS)	✓	Richmond
Hardness in Water	SM 2340 B (2017)	Calculation: 2.497 [diss Ca] + 4.118 [diss Mg]	✓	N/A
Mercury, dissolved in Water	EPA 245.7*	BrCl <sub>2</sub> Oxidation / Cold Vapor Atomic Fluorescence Spectrometry (CVAFS)	✓	Richmond
Mercury, total in Water	EPA 245.7*	BrCl <sub>2</sub> Oxidation / Cold Vapor Atomic Fluorescence Spectrometry (CVAFS)	✓	Richmond
Nitrate+Nitrite in Water	SM 4500-NO <sub>3</sub> - F (2017)	Automated Colorimetry (Cadmium Reduction)	✓	Kelowna
Nitrite in Water	SM 4500-NO <sub>3</sub> - F (2017)	Automated Colorimetry (Cadmium Reduction)	✓	Kelowna
Nitrogen, Total Kjeldahl in Water	SM 4500-Norg D* (2017)	Block Digestion and Flow Injection Analysis	✓	Kelowna
Phosphorus, Total Dissolved in Water	SM 4500-P B.5* (2011) / SM 4500-P F (2017)	Persulfate Digestion / Automated Colorimetry (Ascorbic Acid)	✓	Kelowna
Phosphorus, Total in Water	SM 4500-P B.5* (2011) / SM 4500-P F (2017)	Persulfate Digestion / Automated Colorimetry (Ascorbic Acid)	✓	Kelowna
Solids, Total Dissolved in Water	SM 2540 C* (2017)	Gravimetry (Dried at 103-105C)	✓	Kelowna
Total Metals in Water	EPA 200.2 / EPA 6020B	HNO <sub>3</sub> +HCl Hot Block Digestion / Inductively Coupled Plasma-Mass Spectrometry (ICP-MS)	✓	Richmond

*Note: An asterisk in the Method Reference indicates that the CARO method has been modified from the reference method*

### Glossary of Terms:

RL	Reporting Limit (default)
<	Less than the specified Reporting Limit (RL) - the actual RL may be higher than the default RL due to various factors
AO	Aesthetic Objective
MAC	Maximum Acceptable Concentration (health based)
mg/L	Milligrams per litre
OG	Operational Guideline (treated water)
EPA	United States Environmental Protection Agency Test Methods
SM	Standard Methods for the Examination of Water and Wastewater, American Public Health Association

### Guidelines Referenced in this Report:

Guidelines for Canadian Drinking Water Quality (Health Canada, June 2019)

**Note: In some cases, the values displayed on the report represent the lowest guideline and are to be verified by the end user**



## APPENDIX 1: SUPPORTING INFORMATION

**REPORTED TO** Associated Environmental Consultants Inc. (Vernon)  
**PROJECT** City of Vernon

**WORK ORDER** 0109234  
**REPORTED** 2021-03-04 16:58

### General Comments:

The results in this report apply to the samples analyzed in accordance with the Chain of Custody document. This analytical report must be reproduced in its entirety. CARO is not responsible for any loss or damage resulting directly or indirectly from error or omission in the conduct of testing. Liability is limited to the cost of analysis. Samples will be disposed of 30 days after the test report has been issued or once samples expire, whichever comes first. Longer hold is possible if agreed to in writing.

Results in **Bold** indicate values that are above CARO's method reporting limits. Any results that are above regulatory limits are highlighted **red**. Please note that results will only be highlighted red if the regulatory limits are included on the CARO report. Any Bold and/or highlighted results do not take into account method uncertainty. If you would like method uncertainty or regulatory limits to be included on your report, please contact your Account Manager: [acrump2@caro.ca](mailto:acrump2@caro.ca)

*Please note any regulatory guidelines applied to this report are added as a convenience to the client, at their request, to help provide some initial context to analytical results obtained. Although CARO makes every effort to ensure accuracy of the associated regulatory guideline(s) applied, the guidelines applied cannot be assumed to be correct due to a variety of factors and as such CARO Analytical Services assumes no liability or responsibility for the use of those guidelines to make any decisions. The original source of the regulation should be verified and a review of the guideline(s) should be validated as correct in order to make any decisions arising from the comparison of the analytical data obtained to the relevant regulatory guideline for one's particular circumstances. Further, CARO Analytical Services assumes no liability*

## APPENDIX 2: QUALITY CONTROL RESULTS

**REPORTED TO PROJECT** Associated Environmental Consultants Inc. (Vernon)  
City of Vernon

**WORK ORDER REPORTED** 0109234  
2021-03-04 16:58

The following section displays the quality control (QC) data that is associated with your sample data. Groups of samples are prepared in "batches" and analyzed in conjunction with QC samples that ensure your data is of the highest quality. Common QC types include:

- **Method Blank (Blk):** A blank sample that undergoes sample processing identical to that carried out for the test samples. Method blank results are used to assess contamination from the laboratory environment and reagents.
- **Duplicate (Dup):** An additional or second portion of a randomly selected sample in the analytical run carried through the entire analytical process. Duplicates provide a measure of the analytical method's precision (reproducibility).
- **Blank Spike (BS):** A sample of known concentration which undergoes processing identical to that carried out for test samples, also referred to as a laboratory control sample (LCS). Blank spikes provide a measure of the analytical method's accuracy.
- **Matrix Spike (MS):** A second aliquot of sample is fortified with with a known concentration of target analytes and carried through the entire analytical process. Matrix spikes evaluate potential matrix effects that may affect the analyte recovery.
- **Reference Material (SRM):** A homogenous material of similar matrix to the samples, certified for the parameter(s) listed. Reference Materials ensure that the analytical process is adequate to achieve acceptable recoveries of the parameter(s) tested.

Each QC type is analyzed at a 5-10% frequency, i.e. one blank/duplicate/spike for every 10-20 samples. For all types of QC, the specified recovery (% Rec) and relative percent difference (RPD) limits are derived from long-term method performance averages and/or prescribed by the reference method.

Analyte	Result	RL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
<b>Anions, Batch B0J0118</b>									
<b>Blank (B0J0118-BLK1)</b>			Prepared: 2020-10-02, Analyzed: 2020-10-02						
Bromide	< 0.10	0.10 mg/L							
Chloride	< 0.10	0.10 mg/L							
Fluoride	< 0.10	0.10 mg/L							
Nitrate (as N)	< 0.010	0.010 mg/L							
Nitrite (as N)	< 0.010	0.010 mg/L							
Phosphate (as P)	< 0.0050	0.0050 mg/L							
Sulfate	< 1.0	1.0 mg/L							
<b>Blank (B0J0118-BLK2)</b>			Prepared: 2020-10-03, Analyzed: 2020-10-03						
Bromide	< 0.10	0.10 mg/L							
Chloride	< 0.10	0.10 mg/L							
Fluoride	< 0.10	0.10 mg/L							
Nitrate (as N)	< 0.010	0.010 mg/L							
Nitrite (as N)	< 0.010	0.010 mg/L							
Phosphate (as P)	< 0.0050	0.0050 mg/L							
Sulfate	< 1.0	1.0 mg/L							
<b>Blank (B0J0118-BLK3)</b>			Prepared: 2020-10-03, Analyzed: 2020-10-03						
Bromide	< 0.10	0.10 mg/L							
Chloride	< 0.10	0.10 mg/L							
Fluoride	< 0.10	0.10 mg/L							
Nitrate (as N)	< 0.010	0.010 mg/L							
Nitrite (as N)	< 0.010	0.010 mg/L							
Phosphate (as P)	< 0.0050	0.0050 mg/L							
Sulfate	< 1.0	1.0 mg/L							
<b>LCS (B0J0118-BS1)</b>			Prepared: 2020-10-02, Analyzed: 2020-10-02						
Bromide	4.03	0.10 mg/L	4.00		101	85-115			
Chloride	16.1	0.10 mg/L	16.0		100	90-110			
Fluoride	4.09	0.10 mg/L	4.00		102	88-108			
Nitrate (as N)	4.08	0.010 mg/L	4.00		102	90-110			
Nitrite (as N)	2.01	0.010 mg/L	2.00		100	85-115			
Phosphate (as P)	0.983	0.0050 mg/L	1.00		98	80-120			
Sulfate	16.2	1.0 mg/L	16.0		101	90-110			
<b>LCS (B0J0118-BS2)</b>			Prepared: 2020-10-03, Analyzed: 2020-10-03						
Bromide	4.01	0.10 mg/L	4.00		100	85-115			

## APPENDIX 2: QUALITY CONTROL RESULTS

**REPORTED TO PROJECT** Associated Environmental Consultants Inc. (Vernon)  
City of Vernon

**WORK ORDER REPORTED** 0109234  
2021-03-04 16:58

Analyte	Result	RL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
---------	--------	----------	-------------	---------------	-------	-----------	-------	-----------	-----------

### Anions, Batch B0J0118, Continued

#### LCS (B0J0118-BS2), Continued

Prepared: 2020-10-03, Analyzed: 2020-10-03

Chloride	16.0	0.10 mg/L	16.0		100	90-110			
Fluoride	4.03	0.10 mg/L	4.00		101	88-108			
Nitrate (as N)	4.08	0.010 mg/L	4.00		102	90-110			
Nitrite (as N)	2.01	0.010 mg/L	2.00		100	85-115			
Phosphate (as P)	0.952	0.0050 mg/L	1.00		95	80-120			
Sulfate	16.1	1.0 mg/L	16.0		100	90-110			

#### LCS (B0J0118-BS3)

Prepared: 2020-10-03, Analyzed: 2020-10-03

Bromide	3.96	0.10 mg/L	4.00		99	85-115			
Chloride	16.2	0.10 mg/L	16.0		101	90-110			
Fluoride	4.09	0.10 mg/L	4.00		102	88-108			
Nitrate (as N)	4.10	0.010 mg/L	4.00		103	90-110			
Nitrite (as N)	2.00	0.010 mg/L	2.00		100	85-115			
Phosphate (as P)	1.04	0.0050 mg/L	1.00		104	80-120			
Sulfate	15.9	1.0 mg/L	16.0		100	90-110			

### Anions, Batch B0J2155

#### Blank (B0J2155-BLK1)

Prepared: 2020-10-23, Analyzed: 2020-10-23

Nitrate+Nitrite (as N)	< 0.0050	0.0050 mg/L							
------------------------	----------	-------------	--	--	--	--	--	--	--

#### LCS (B0J2155-BS1)

Prepared: 2020-10-23, Analyzed: 2020-10-23

Nitrate+Nitrite (as N)	0.515	0.0050 mg/L	0.500		103	91-108			
------------------------	-------	-------------	-------	--	-----	--------	--	--	--

#### Duplicate (B0J2155-DUP1)

Source: 0109234-03

Prepared: 2020-10-23, Analyzed: 2020-10-23

Nitrate+Nitrite (as N)	2.61	0.0050 mg/L	2.56		2	10			
------------------------	------	-------------	------	--	---	----	--	--	--

#### Matrix Spike (B0J2155-MS1)

Source: 0109234-03

Prepared: 2020-10-23, Analyzed: 2020-10-23

Nitrate+Nitrite (as N)	3.90	0.0500 mg/L	1.25	2.56	107	80-120			
------------------------	------	-------------	------	------	-----	--------	--	--	--

### Anions, Batch B0J2159

#### Blank (B0J2159-BLK1)

Prepared: 2020-10-23, Analyzed: 2020-10-23

Nitrite (as N)	< 0.0050	0.0050 mg/L							
----------------	----------	-------------	--	--	--	--	--	--	--

#### LCS (B0J2159-BS1)

Prepared: 2020-10-23, Analyzed: 2020-10-23

Nitrite (as N)	0.524	0.0050 mg/L	0.500		105	90-110			
----------------	-------	-------------	-------	--	-----	--------	--	--	--

#### Duplicate (B0J2159-DUP1)

Source: 0109234-03

Prepared: 2020-10-23, Analyzed: 2020-10-23

Nitrite (as N)	< 0.0050	0.0050 mg/L	< 0.0050				20		
----------------	----------	-------------	----------	--	--	--	----	--	--

#### Matrix Spike (B0J2159-MS1)

Source: 0109234-03

Prepared: 2020-10-23, Analyzed: 2020-10-23

Nitrite (as N)	0.139	0.0050 mg/L	0.125	< 0.0050	111	75-120			
----------------	-------	-------------	-------	----------	-----	--------	--	--	--

### Dissolved Metals, Batch B0J0259

#### Blank (B0J0259-BLK1)

Prepared: 2020-10-02, Analyzed: 2020-10-03

Mercury, dissolved	< 0.000010	0.000010 mg/L							
--------------------	------------	---------------	--	--	--	--	--	--	--

#### Blank (B0J0259-BLK2)

Prepared: 2020-10-02, Analyzed: 2020-10-03

Mercury, dissolved	< 0.000010	0.000010 mg/L							
--------------------	------------	---------------	--	--	--	--	--	--	--

#### Reference (B0J0259-SRM1)

Prepared: 2020-10-02, Analyzed: 2020-10-03

Mercury, dissolved	0.00671	0.000010 mg/L	0.00581		115	70-130			
--------------------	---------	---------------	---------	--	-----	--------	--	--	--

## APPENDIX 2: QUALITY CONTROL RESULTS

**REPORTED TO PROJECT** Associated Environmental Consultants Inc. (Vernon)  
City of Vernon

**WORK ORDER REPORTED** 0109234  
2021-03-04 16:58

Analyte	Result	RL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
---------	--------	----------	-------------	---------------	-------	-----------	-------	-----------	-----------

### *Dissolved Metals, Batch B0J0259, Continued*

**Reference (B0J0259-SRM2)** Prepared: 2020-10-02, Analyzed: 2020-10-03

Mercury, dissolved	0.00617	0.000010 mg/L	0.00581	106	70-130
--------------------	---------	---------------	---------	-----	--------

### *Dissolved Metals, Batch B0J0315*

**Blank (B0J0315-BLK1)** Prepared: 2020-10-03, Analyzed: 2020-10-04

Mercury, dissolved	< 0.000010	0.000010 mg/L
--------------------	------------	---------------

**Blank (B0J0315-BLK2)** Prepared: 2020-10-03, Analyzed: 2020-10-04

Mercury, dissolved	< 0.000010	0.000010 mg/L
--------------------	------------	---------------

**Reference (B0J0315-SRM1)** Prepared: 2020-10-03, Analyzed: 2020-10-04

Mercury, dissolved	0.00574	0.000010 mg/L	0.00581	99	70-130
--------------------	---------	---------------	---------	----	--------

**Reference (B0J0315-SRM2)** Prepared: 2020-10-03, Analyzed: 2020-10-04

Mercury, dissolved	0.00575	0.000010 mg/L	0.00581	99	70-130
--------------------	---------	---------------	---------	----	--------

### *Dissolved Metals, Batch B0J0524*

**Blank (B0J0524-BLK1)** Prepared: 2020-10-07, Analyzed: 2020-10-07

Lithium, dissolved	< 0.00010	0.00010 mg/L
Aluminum, dissolved	< 0.0050	0.0050 mg/L
Antimony, dissolved	< 0.00020	0.00020 mg/L
Arsenic, dissolved	< 0.00050	0.00050 mg/L
Barium, dissolved	< 0.0050	0.0050 mg/L
Beryllium, dissolved	< 0.00010	0.00010 mg/L
Bismuth, dissolved	< 0.00010	0.00010 mg/L
Boron, dissolved	< 0.0500	0.0500 mg/L
Cadmium, dissolved	< 0.000010	0.000010 mg/L
Calcium, dissolved	< 0.20	0.20 mg/L
Chromium, dissolved	< 0.00050	0.00050 mg/L
Cobalt, dissolved	< 0.00010	0.00010 mg/L
Copper, dissolved	< 0.00040	0.00040 mg/L
Iron, dissolved	< 0.010	0.010 mg/L
Lead, dissolved	< 0.00020	0.00020 mg/L
Magnesium, dissolved	< 0.010	0.010 mg/L
Manganese, dissolved	< 0.00020	0.00020 mg/L
Molybdenum, dissolved	< 0.00010	0.00010 mg/L
Nickel, dissolved	< 0.00040	0.00040 mg/L
Phosphorus, dissolved	< 0.050	0.050 mg/L
Potassium, dissolved	< 0.10	0.10 mg/L
Selenium, dissolved	< 0.00050	0.00050 mg/L
Silicon, dissolved	< 1.0	1.0 mg/L
Silver, dissolved	< 0.000050	0.000050 mg/L
Sodium, dissolved	< 0.10	0.10 mg/L
Strontium, dissolved	< 0.0010	0.0010 mg/L
Sulfur, dissolved	< 3.0	3.0 mg/L
Tellurium, dissolved	< 0.00050	0.00050 mg/L
Thallium, dissolved	< 0.000020	0.000020 mg/L
Thorium, dissolved	< 0.00010	0.00010 mg/L
Tin, dissolved	< 0.00020	0.00020 mg/L
Titanium, dissolved	< 0.0050	0.0050 mg/L
Tungsten, dissolved	< 0.0010	0.0010 mg/L
Uranium, dissolved	< 0.000020	0.000020 mg/L
Vanadium, dissolved	< 0.0010	0.0010 mg/L
Zinc, dissolved	< 0.0040	0.0040 mg/L
Zirconium, dissolved	< 0.00010	0.00010 mg/L

## APPENDIX 2: QUALITY CONTROL RESULTS

**REPORTED TO PROJECT** Associated Environmental Consultants Inc. (Vernon)  
City of Vernon

**WORK ORDER REPORTED** 0109234  
2021-03-04 16:58

Analyte	Result	RL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
---------	--------	----------	-------------	---------------	-------	-----------	-------	-----------	-----------

### Dissolved Metals, Batch B0J0524, Continued

LCS (B0J0524-BS1)			Prepared: 2020-10-07, Analyzed: 2020-10-07						
Lithium, dissolved	0.0202	0.00010 mg/L	0.0200		101	80-120			
Aluminum, dissolved	0.0229	0.0050 mg/L	0.0199		115	80-120			
Antimony, dissolved	0.0201	0.00020 mg/L	0.0200		101	80-120			
Arsenic, dissolved	0.0199	0.00050 mg/L	0.0200		99	80-120			
Barium, dissolved	0.0205	0.0050 mg/L	0.0198		104	80-120			
Beryllium, dissolved	0.0227	0.00010 mg/L	0.0198		115	80-120			
Bismuth, dissolved	0.0214	0.00010 mg/L	0.0200		107	80-120			
Boron, dissolved	< 0.0500	0.0500 mg/L	0.0200		113	80-120			
Cadmium, dissolved	0.0203	0.000010 mg/L	0.0199		102	80-120			
Calcium, dissolved	2.19	0.20 mg/L	2.02		108	80-120			
Chromium, dissolved	0.0210	0.00050 mg/L	0.0198		106	80-120			
Cobalt, dissolved	0.0201	0.00010 mg/L	0.0199		101	80-120			
Copper, dissolved	0.0210	0.00040 mg/L	0.0200		105	80-120			
Iron, dissolved	2.05	0.010 mg/L	2.02		101	80-120			
Lead, dissolved	0.0209	0.00020 mg/L	0.0199		105	80-120			
Magnesium, dissolved	2.10	0.010 mg/L	2.02		104	80-120			
Manganese, dissolved	0.0198	0.00020 mg/L	0.0199		100	80-120			
Molybdenum, dissolved	0.0193	0.00010 mg/L	0.0200		97	80-120			
Nickel, dissolved	0.0204	0.00040 mg/L	0.0200		102	80-120			
Phosphorus, dissolved	2.05	0.050 mg/L	2.00		103	80-120			
Potassium, dissolved	2.03	0.10 mg/L	2.02		101	80-120			
Selenium, dissolved	0.0239	0.00050 mg/L	0.0200		119	80-120			
Silicon, dissolved	2.3	1.0 mg/L	2.00		117	80-120			
Silver, dissolved	0.0200	0.000050 mg/L	0.0200		100	80-120			
Sodium, dissolved	2.16	0.10 mg/L	2.02		107	80-120			
Strontium, dissolved	0.0200	0.0010 mg/L	0.0200		100	80-120			
Sulfur, dissolved	5.3	3.0 mg/L	5.00		106	80-120			
Tellurium, dissolved	0.0204	0.00050 mg/L	0.0200		102	80-120			
Thallium, dissolved	0.0204	0.000020 mg/L	0.0199		103	80-120			
Thorium, dissolved	0.0200	0.00010 mg/L	0.0200		100	80-120			
Tin, dissolved	0.0219	0.00020 mg/L	0.0200		109	80-120			
Titanium, dissolved	0.0208	0.0050 mg/L	0.0200		104	80-120			
Tungsten, dissolved	0.0212	0.0010 mg/L	0.0200		106	80-120			
Uranium, dissolved	0.0209	0.000020 mg/L	0.0200		104	80-120			
Vanadium, dissolved	0.0213	0.0010 mg/L	0.0200		106	80-120			
Zinc, dissolved	0.0227	0.0040 mg/L	0.0200		114	80-120			
Zirconium, dissolved	0.0194	0.00010 mg/L	0.0200		97	80-120			

Duplicate (B0J0524-DUP1)			Source: 0109234-01		Prepared: 2020-10-07, Analyzed: 2020-10-07				
Lithium, dissolved	0.00375	0.00010 mg/L		0.00368		2	20		
Aluminum, dissolved	< 0.0050	0.0050 mg/L		0.0080			20		
Antimony, dissolved	< 0.00020	0.00020 mg/L		< 0.00020			20		
Arsenic, dissolved	0.00123	0.00050 mg/L		0.00116			20		
Barium, dissolved	0.0193	0.0050 mg/L		0.0184			20		
Beryllium, dissolved	< 0.00010	0.00010 mg/L		< 0.00010			20		
Bismuth, dissolved	< 0.00010	0.00010 mg/L		< 0.00010			20		
Boron, dissolved	< 0.0500	0.0500 mg/L		< 0.0500			20		
Cadmium, dissolved	< 0.000010	0.000010 mg/L		< 0.000010			20		
Calcium, dissolved	45.9	0.20 mg/L		44.6		3	20		
Chromium, dissolved	< 0.00050	0.00050 mg/L		< 0.00050			20		
Cobalt, dissolved	< 0.00010	0.00010 mg/L		< 0.00010			20		
Copper, dissolved	0.00113	0.00040 mg/L		< 0.00040			20		
Iron, dissolved	0.208	0.010 mg/L		0.204		2	20		
Lead, dissolved	< 0.00020	0.00020 mg/L		< 0.00020			20		
Magnesium, dissolved	20.3	0.010 mg/L		19.9		2	20		
Manganese, dissolved	0.0880	0.00020 mg/L		0.0865		2	20		

## APPENDIX 2: QUALITY CONTROL RESULTS

**REPORTED TO PROJECT** Associated Environmental Consultants Inc. (Vernon)  
City of Vernon

**WORK ORDER REPORTED** 0109234  
2021-03-04 16:58

Analyte	Result	RL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
<b>Dissolved Metals, Batch B0J0524, Continued</b>									
<b>Duplicate (B0J0524-DUP1), Continued</b>		<b>Source: 0109234-01</b>		<b>Prepared: 2020-10-07, Analyzed: 2020-10-07</b>					
Molybdenum, dissolved	0.0109	0.00010 mg/L		0.0111			2	20	
Nickel, dissolved	< 0.00040	0.00040 mg/L		< 0.00040				20	
Phosphorus, dissolved	< 0.050	0.050 mg/L		< 0.050				20	
Potassium, dissolved	3.56	0.10 mg/L		3.60			1	20	
Selenium, dissolved	< 0.00050	0.00050 mg/L		< 0.00050				20	
Silicon, dissolved	11.3	1.0 mg/L		10.3			9	20	
Silver, dissolved	< 0.000050	0.000050 mg/L		< 0.000050				20	
Sodium, dissolved	32.5	0.10 mg/L		32.1			1	20	
Strontium, dissolved	0.476	0.0010 mg/L		0.468			2	20	
Sulfur, dissolved	27.7	3.0 mg/L		29.2			5	20	
Tellurium, dissolved	< 0.00050	0.00050 mg/L		< 0.00050				20	
Thallium, dissolved	< 0.000020	0.000020 mg/L		< 0.000020				20	
Thorium, dissolved	< 0.00010	0.00010 mg/L		< 0.00010				20	
Tin, dissolved	0.00021	0.00020 mg/L		< 0.00020				20	
Titanium, dissolved	< 0.0050	0.0050 mg/L		< 0.0050				20	
Tungsten, dissolved	< 0.0010	0.0010 mg/L		< 0.0010				20	
Uranium, dissolved	0.00200	0.000020 mg/L		0.00197			2	20	
Vanadium, dissolved	< 0.0010	0.0010 mg/L		< 0.0010				20	
Zinc, dissolved	< 0.0040	0.0040 mg/L		< 0.0040				20	
Zirconium, dissolved	< 0.00010	0.00010 mg/L		< 0.00010				20	

### Reference (B0J0524-SRM1)

Prepared: 2020-10-07, Analyzed: 2020-10-07

Lithium, dissolved	0.104	0.00010 mg/L	0.100	104	70-130
Aluminum, dissolved	0.250	0.0050 mg/L	0.235	106	70-130
Antimony, dissolved	0.0462	0.00020 mg/L	0.0431	107	70-130
Arsenic, dissolved	0.428	0.00050 mg/L	0.423	101	70-130
Barium, dissolved	3.07	0.0050 mg/L	3.30	93	70-130
Beryllium, dissolved	0.246	0.00010 mg/L	0.209	118	70-130
Boron, dissolved	1.84	0.0500 mg/L	1.65	111	70-130
Cadmium, dissolved	0.226	0.000010 mg/L	0.221	102	70-130
Calcium, dissolved	8.01	0.20 mg/L	7.72	104	70-130
Chromium, dissolved	0.435	0.00050 mg/L	0.434	100	70-130
Cobalt, dissolved	0.128	0.00010 mg/L	0.124	103	70-130
Copper, dissolved	0.847	0.00040 mg/L	0.815	104	70-130
Iron, dissolved	1.27	0.010 mg/L	1.27	100	70-130
Lead, dissolved	0.110	0.00020 mg/L	0.110	100	70-130
Magnesium, dissolved	6.83	0.010 mg/L	6.59	104	70-130
Manganese, dissolved	0.348	0.00020 mg/L	0.342	102	70-130
Molybdenum, dissolved	0.403	0.00010 mg/L	0.404	100	70-130
Nickel, dissolved	0.866	0.00040 mg/L	0.835	104	70-130
Phosphorus, dissolved	0.525	0.050 mg/L	0.499	105	70-130
Potassium, dissolved	2.91	0.10 mg/L	2.88	101	70-130
Selenium, dissolved	0.0321	0.00050 mg/L	0.0324	99	70-130
Sodium, dissolved	18.2	0.10 mg/L	18.0	101	70-130
Strontium, dissolved	0.924	0.0010 mg/L	0.935	99	70-130
Thallium, dissolved	0.0381	0.000020 mg/L	0.0385	99	70-130
Uranium, dissolved	0.251	0.000020 mg/L	0.258	97	70-130
Vanadium, dissolved	0.871	0.0010 mg/L	0.873	100	70-130
Zinc, dissolved	0.861	0.0040 mg/L	0.848	102	70-130

### General Parameters, Batch B0J0248

#### Blank (B0J0248-BLK1)

Prepared: 2020-10-06, Analyzed: 2020-10-06

Ammonia, Total (as N)	< 0.050	0.050 mg/L
-----------------------	---------	------------

## APPENDIX 2: QUALITY CONTROL RESULTS

**REPORTED TO PROJECT** Associated Environmental Consultants Inc. (Vernon)  
City of Vernon

**WORK ORDER REPORTED** 0109234  
2021-03-04 16:58

Analyte	Result	RL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
<b>General Parameters, Batch B0J0248, Continued</b>									
<b>Blank (B0J0248-BLK2)</b>									Prepared: 2020-10-06, Analyzed: 2020-10-06
Ammonia, Total (as N)	< 0.050	0.050 mg/L							
<b>Blank (B0J0248-BLK3)</b>									Prepared: 2020-10-06, Analyzed: 2020-10-06
Ammonia, Total (as N)	< 0.050	0.050 mg/L							
<b>Blank (B0J0248-BLK4)</b>									Prepared: 2020-10-06, Analyzed: 2020-10-06
Ammonia, Total (as N)	< 0.050	0.050 mg/L							
<b>LCS (B0J0248-BS1)</b>									Prepared: 2020-10-06, Analyzed: 2020-10-06
Ammonia, Total (as N)	1.00	0.050 mg/L	1.00		100	90-115			
<b>LCS (B0J0248-BS2)</b>									Prepared: 2020-10-06, Analyzed: 2020-10-06
Ammonia, Total (as N)	1.00	0.050 mg/L	1.00		100	90-115			
<b>LCS (B0J0248-BS3)</b>									Prepared: 2020-10-06, Analyzed: 2020-10-06
Ammonia, Total (as N)	0.997	0.050 mg/L	1.00		100	90-115			
<b>LCS (B0J0248-BS4)</b>									Prepared: 2020-10-06, Analyzed: 2020-10-06
Ammonia, Total (as N)	0.986	0.050 mg/L	1.00		99	90-115			
<b>Duplicate (B0J0248-DUP3)</b>									Source: 0109234-11 Prepared: 2020-10-06, Analyzed: 2020-10-06
Ammonia, Total (as N)	< 0.050	0.050 mg/L		< 0.050				15	
<b>Matrix Spike (B0J0248-MS3)</b>									Source: 0109234-11 Prepared: 2020-10-06, Analyzed: 2020-10-06
Ammonia, Total (as N)	0.301	0.050 mg/L	0.250	< 0.050	105	75-125			

### General Parameters, Batch B0J0346

<b>Blank (B0J0346-BLK1)</b>									Prepared: 2020-10-05, Analyzed: 2020-10-05
Solids, Total Dissolved	< 15	15 mg/L							
<b>LCS (B0J0346-BS1)</b>									Prepared: 2020-10-05, Analyzed: 2020-10-05
Solids, Total Dissolved	239	15 mg/L	240		100	85-115			
<b>Duplicate (B0J0346-DUP1)</b>									Source: 0109234-11 Prepared: 2020-10-05, Analyzed: 2020-10-05
Solids, Total Dissolved	1530	15 mg/L		1550			2	15	

### General Parameters, Batch B0J0349

<b>Blank (B0J0349-BLK1)</b>									Prepared: 2020-10-04, Analyzed: 2020-10-05
Nitrogen, Total Kjeldahl	< 0.050	0.050 mg/L							
<b>Blank (B0J0349-BLK2)</b>									Prepared: 2020-10-04, Analyzed: 2020-10-05
Nitrogen, Total Kjeldahl	< 0.050	0.050 mg/L							
<b>LCS (B0J0349-BS1)</b>									Prepared: 2020-10-04, Analyzed: 2020-10-05
Nitrogen, Total Kjeldahl	1.05	0.050 mg/L	1.00		105	85-115			
<b>LCS (B0J0349-BS2)</b>									Prepared: 2020-10-04, Analyzed: 2020-10-05
Nitrogen, Total Kjeldahl	1.05	0.050 mg/L	1.00		105	85-115			

### General Parameters, Batch B0J0427

<b>Blank (B0J0427-BLK1)</b>									Prepared: 2020-10-05, Analyzed: 2020-10-05
Alkalinity, Total (as CaCO <sub>3</sub> )	< 1.0	1.0 mg/L							
Alkalinity, Phenolphthalein (as CaCO <sub>3</sub> )	< 1.0	1.0 mg/L							

## APPENDIX 2: QUALITY CONTROL RESULTS

**REPORTED TO PROJECT** Associated Environmental Consultants Inc. (Vernon)  
City of Vernon

**WORK ORDER REPORTED** 0109234  
2021-03-04 16:58

Analyte	Result	RL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
---------	--------	----------	-------------	---------------	-------	-----------	-------	-----------	-----------

### General Parameters, Batch B0J0427, Continued

#### Blank (B0J0427-BLK1), Continued

Prepared: 2020-10-05, Analyzed: 2020-10-05

Alkalinity, Bicarbonate (as CaCO <sub>3</sub> )	< 1.0	1.0 mg/L							
Alkalinity, Carbonate (as CaCO <sub>3</sub> )	< 1.0	1.0 mg/L							
Alkalinity, Hydroxide (as CaCO <sub>3</sub> )	< 1.0	1.0 mg/L							

#### Blank (B0J0427-BLK2)

Prepared: 2020-10-05, Analyzed: 2020-10-05

Alkalinity, Total (as CaCO <sub>3</sub> )	< 1.0	1.0 mg/L							
Alkalinity, Phenolphthalein (as CaCO <sub>3</sub> )	< 1.0	1.0 mg/L							
Alkalinity, Bicarbonate (as CaCO <sub>3</sub> )	< 1.0	1.0 mg/L							
Alkalinity, Carbonate (as CaCO <sub>3</sub> )	< 1.0	1.0 mg/L							
Alkalinity, Hydroxide (as CaCO <sub>3</sub> )	< 1.0	1.0 mg/L							

#### LCS (B0J0427-BS1)

Prepared: 2020-10-05, Analyzed: 2020-10-05

Alkalinity, Total (as CaCO <sub>3</sub> )	96.6	1.0 mg/L	100		97	80-120			
---	------	----------	-----	--	----	--------	--	--	--

#### LCS (B0J0427-BS2)

Prepared: 2020-10-05, Analyzed: 2020-10-05

Alkalinity, Total (as CaCO <sub>3</sub> )	96.8	1.0 mg/L	100		97	80-120			
---	------	----------	-----	--	----	--------	--	--	--

### General Parameters, Batch B0J0585

#### Blank (B0J0585-BLK1)

Prepared: 2020-10-07, Analyzed: 2020-10-07

Phosphorus, Total (as P)	< 0.0050	0.0050 mg/L							
--------------------------	----------	-------------	--	--	--	--	--	--	--

#### Blank (B0J0585-BLK2)

Prepared: 2020-10-07, Analyzed: 2020-10-07

Phosphorus, Total (as P)	< 0.0050	0.0050 mg/L							
Phosphorus, Total Dissolved	< 0.0050	0.0050 mg/L							

#### Blank (B0J0585-BLK3)

Prepared: 2020-10-07, Analyzed: 2020-10-07

Phosphorus, Total (as P)	< 0.0050	0.0050 mg/L							
Phosphorus, Total Dissolved	< 0.0050	0.0050 mg/L							

#### LCS (B0J0585-BS1)

Prepared: 2020-10-07, Analyzed: 2020-10-07

Phosphorus, Total (as P)	0.101	0.0050 mg/L	0.100		101	85-115			
--------------------------	-------	-------------	-------	--	-----	--------	--	--	--

#### LCS (B0J0585-BS2)

Prepared: 2020-10-07, Analyzed: 2020-10-07

Phosphorus, Total (as P)	0.101	0.0050 mg/L	0.100		101	85-115			
Phosphorus, Total Dissolved	0.101	0.0050 mg/L	0.100		101	85-115			

#### LCS (B0J0585-BS3)

Prepared: 2020-10-07, Analyzed: 2020-10-07

Phosphorus, Total (as P)	0.102	0.0050 mg/L	0.100		102	85-115			
Phosphorus, Total Dissolved	0.101	0.0050 mg/L	0.100		101	85-115			

#### Duplicate (B0J0585-DUP2)

Source: 0109234-08

Prepared: 2020-10-07, Analyzed: 2020-10-07

Phosphorus, Total (as P)	0.149	0.0050 mg/L		0.149			< 1	15	
Phosphorus, Total Dissolved	0.0364	0.0050 mg/L		0.0355			3	15	

#### Matrix Spike (B0J0585-MS2)

Source: 0109234-08

Prepared: 2020-10-07, Analyzed: 2020-10-07

Phosphorus, Total (as P)	0.252	0.0050 mg/L	0.102	0.149	101	70-125			
Phosphorus, Total Dissolved	0.139	0.0050 mg/L	0.102	0.0355	102	70-125			

### Total Metals, Batch B0J0260

#### Blank (B0J0260-BLK1)

Prepared: 2020-10-02, Analyzed: 2020-10-03

Mercury, total	< 0.000010	0.000010 mg/L							
----------------	------------	---------------	--	--	--	--	--	--	--

#### Blank (B0J0260-BLK2)

Prepared: 2020-10-02, Analyzed: 2020-10-03

Mercury, total	< 0.000010	0.000010 mg/L							
----------------	------------	---------------	--	--	--	--	--	--	--

## APPENDIX 2: QUALITY CONTROL RESULTS

**REPORTED TO PROJECT** Associated Environmental Consultants Inc. (Vernon)  
City of Vernon

**WORK ORDER REPORTED** 0109234  
2021-03-04 16:58

Analyte	Result	RL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
---------	--------	----------	-------------	---------------	-------	-----------	-------	-----------	-----------

### Total Metals, Batch B0J0260, Continued

#### Reference (B0J0260-SRM1)

Prepared: 2020-10-02, Analyzed: 2020-10-03

Mercury, total	0.00693	0.000010 mg/L	0.00581	119	70-130
----------------	---------	---------------	---------	-----	--------

#### Reference (B0J0260-SRM2)

Prepared: 2020-10-02, Analyzed: 2020-10-03

Mercury, total	0.00635	0.000010 mg/L	0.00581	109	70-130
----------------	---------	---------------	---------	-----	--------

### Total Metals, Batch B0J0421

#### Blank (B0J0421-BLK1)

Prepared: 2020-10-05, Analyzed: 2020-10-06

Aluminum, total	< 0.0050	0.0050 mg/L
Antimony, total	< 0.00020	0.00020 mg/L
Arsenic, total	< 0.00050	0.00050 mg/L
Barium, total	< 0.0050	0.0050 mg/L
Beryllium, total	< 0.00010	0.00010 mg/L
Bismuth, total	< 0.00010	0.00010 mg/L
Boron, total	< 0.0500	0.0500 mg/L
Cadmium, total	< 0.000010	0.000010 mg/L
Calcium, total	< 0.20	0.20 mg/L
Chromium, total	< 0.00050	0.00050 mg/L
Cobalt, total	< 0.00010	0.00010 mg/L
Copper, total	< 0.00040	0.00040 mg/L
Iron, total	< 0.010	0.010 mg/L
Lead, total	< 0.00020	0.00020 mg/L
Lithium, total	< 0.00010	0.00010 mg/L
Magnesium, total	< 0.010	0.010 mg/L
Manganese, total	< 0.00020	0.00020 mg/L
Molybdenum, total	< 0.00010	0.00010 mg/L
Nickel, total	< 0.00040	0.00040 mg/L
Phosphorus, total	< 0.050	0.050 mg/L
Potassium, total	< 0.10	0.10 mg/L
Selenium, total	< 0.00050	0.00050 mg/L
Silicon, total	< 1.0	1.0 mg/L
Silver, total	< 0.000050	0.000050 mg/L
Sodium, total	< 0.10	0.10 mg/L
Strontium, total	< 0.0010	0.0010 mg/L
Sulfur, total	< 3.0	3.0 mg/L
Tellurium, total	< 0.00050	0.00050 mg/L
Thallium, total	< 0.000020	0.000020 mg/L
Thorium, total	< 0.00010	0.00010 mg/L
Tin, total	< 0.00020	0.00020 mg/L
Titanium, total	< 0.0050	0.0050 mg/L
Tungsten, total	< 0.0010	0.0010 mg/L
Uranium, total	< 0.000020	0.000020 mg/L
Vanadium, total	< 0.0010	0.0010 mg/L
Zinc, total	< 0.0040	0.0040 mg/L
Zirconium, total	< 0.00010	0.00010 mg/L

#### LCS (B0J0421-BS1)

Prepared: 2020-10-05, Analyzed: 2020-10-06

Aluminum, total	0.0236	0.0050 mg/L	0.0199	118	80-120
Antimony, total	0.0206	0.00020 mg/L	0.0200	103	80-120
Arsenic, total	0.0210	0.00050 mg/L	0.0200	105	80-120
Barium, total	0.0207	0.0050 mg/L	0.0198	105	80-120
Beryllium, total	0.0220	0.00010 mg/L	0.0198	111	80-120
Bismuth, total	0.0208	0.00010 mg/L	0.0200	104	80-120
Boron, total	< 0.0500	0.0500 mg/L	0.0200	104	80-120
Cadmium, total	0.0202	0.000010 mg/L	0.0199	101	80-120
Calcium, total	2.21	0.20 mg/L	2.02	109	80-120



## APPENDIX 2: QUALITY CONTROL RESULTS

**REPORTED TO PROJECT** Associated Environmental Consultants Inc. (Vernon)  
City of Vernon

**WORK ORDER REPORTED** 0109234  
2021-03-04 16:58

Analyte	Result	RL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
<b>Total Metals, Batch B0J0421, Continued</b>									
<b>LCS (B0J0421-BS1), Continued</b>					Prepared: 2020-10-05, Analyzed: 2020-10-06				
Chromium, total	0.0198	0.00050 mg/L	0.0198		100	80-120			
Cobalt, total	0.0203	0.00010 mg/L	0.0199		102	80-120			
Copper, total	0.0213	0.00040 mg/L	0.0200		107	80-120			
Iron, total	2.02	0.010 mg/L	2.02		100	80-120			
Lead, total	0.0203	0.00020 mg/L	0.0199		102	80-120			
Lithium, total	0.0216	0.00010 mg/L	0.0200		108	80-120			
Magnesium, total	2.31	0.010 mg/L	2.02		114	80-120			
Manganese, total	0.0211	0.00020 mg/L	0.0199		106	80-120			
Molybdenum, total	0.0198	0.00010 mg/L	0.0200		99	80-120			
Nickel, total	0.0209	0.00040 mg/L	0.0200		105	80-120			
Phosphorus, total	2.19	0.050 mg/L	2.00		109	80-120			
Potassium, total	2.10	0.10 mg/L	2.02		104	80-120			
Selenium, total	0.0212	0.00050 mg/L	0.0200		106	80-120			
Silicon, total	2.4	1.0 mg/L	2.00		118	80-120			
Silver, total	0.0200	0.000050 mg/L	0.0200		100	80-120			
Sodium, total	2.27	0.10 mg/L	2.02		113	80-120			
Strontium, total	0.0205	0.0010 mg/L	0.0200		102	80-120			
Sulfur, total	5.1	3.0 mg/L	5.00		102	80-120			
Tellurium, total	0.0192	0.00050 mg/L	0.0200		96	80-120			
Thallium, total	0.0199	0.000020 mg/L	0.0199		100	80-120			
Thorium, total	0.0199	0.00010 mg/L	0.0200		99	80-120			
Tin, total	0.0200	0.00020 mg/L	0.0200		100	80-120			
Titanium, total	0.0199	0.0050 mg/L	0.0200		99	80-120			
Tungsten, total	0.0207	0.0010 mg/L	0.0200		103	80-120			
Uranium, total	0.0203	0.000020 mg/L	0.0200		101	80-120			
Vanadium, total	0.0232	0.0010 mg/L	0.0200		116	80-120			
Zinc, total	0.0222	0.0040 mg/L	0.0200		111	80-120			
Zirconium, total	0.0199	0.00010 mg/L	0.0200		100	80-120			
<b>Reference (B0J0421-SRM1)</b>					Prepared: 2020-10-05, Analyzed: 2020-10-06				
Aluminum, total	0.321	0.0050 mg/L	0.299		107	70-130			
Antimony, total	0.0515	0.00020 mg/L	0.0517		100	70-130			
Arsenic, total	0.127	0.00050 mg/L	0.119		107	70-130			
Barium, total	0.796	0.0050 mg/L	0.801		99	70-130			
Beryllium, total	0.0627	0.00010 mg/L	0.0501		125	70-130			
Boron, total	4.65	0.0500 mg/L	4.11		113	70-130			
Cadmium, total	0.0509	0.000010 mg/L	0.0503		101	70-130			
Calcium, total	12.3	0.20 mg/L	10.7		115	70-130			
Chromium, total	0.251	0.00050 mg/L	0.250		100	70-130			
Cobalt, total	0.0394	0.00010 mg/L	0.0384		102	70-130			
Copper, total	0.505	0.00040 mg/L	0.487		104	70-130			
Iron, total	0.514	0.010 mg/L	0.504		102	70-130			
Lead, total	0.305	0.00020 mg/L	0.278		110	70-130			
Lithium, total	0.486	0.00010 mg/L	0.398		122	70-130			
Magnesium, total	4.18	0.010 mg/L	3.59		116	70-130			
Manganese, total	0.112	0.00020 mg/L	0.111		101	70-130			
Molybdenum, total	0.195	0.00010 mg/L	0.196		99	70-130			
Nickel, total	0.257	0.00040 mg/L	0.248		104	70-130			
Phosphorus, total	0.253	0.050 mg/L	0.213		119	70-130			
Potassium, total	6.36	0.10 mg/L	5.89		108	70-130			
Selenium, total	0.133	0.00050 mg/L	0.120		111	70-130			
Sodium, total	9.78	0.10 mg/L	8.71		112	70-130			
Strontium, total	0.394	0.0010 mg/L	0.393		100	70-130			
Thallium, total	0.0891	0.000020 mg/L	0.0787		113	70-130			
Uranium, total	0.0396	0.000020 mg/L	0.0344		115	70-130			
Vanadium, total	0.392	0.0010 mg/L	0.391		100	70-130			



## APPENDIX 2: QUALITY CONTROL RESULTS

**REPORTED TO PROJECT** Associated Environmental Consultants Inc. (Vernon)  
City of Vernon

**WORK ORDER REPORTED** 0109234  
2021-03-04 16:58

Analyte	Result	RL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
---------	--------	----------	-------------	---------------	-------	-----------	-------	-----------	-----------

*Total Metals, Batch B0J0421, Continued*

**Reference (B0J0421-SRM1), Continued**

Prepared: 2020-10-05, Analyzed: 2020-10-06

Zinc, total	2.56	0.0040 mg/L	2.50		102	70-130			
-------------	------	-------------	------	--	-----	--------	--	--	--

## CERTIFICATE OF ANALYSIS

**REPORTED TO** Associated Environmental Consultants Inc. (Vernon)  
#200 - 2800 29th Street  
Vernon, BC V1T 9P9

**ATTENTION** Nicole Penner

**PO NUMBER**

**PROJECT** City of Vernon  
**PROJECT INFO** 2020-8704.000.000

**WORK ORDER** 20L1347

**RECEIVED / TEMP** 2020-12-11 09:40 / 5°C  
**REPORTED** 2020-12-22 15:28

**COC NUMBER** No Number

### Introduction:

CARO Analytical Services is a testing laboratory full of smart, engaged scientists driven to make the world a safer and healthier place. Through our clients' projects we become an essential element for a better world. We employ methods conducted in accordance with recognized professional standards using accepted testing methodologies and quality control efforts. CARO is accredited by the Canadian Association for Laboratories Accreditation (CALA) to ISO/IEC 17025:2017 for specific tests listed in the scope of accreditation approved by CALA.

#### Big Picture Sidekicks



You know that the sample you collected after snowshoeing to site, digging 5 meters, and racing to get it on a plane so you can submit it to the lab for time sensitive results needed to make important and expensive decisions (whew) is VERY important. We know that too.

#### We've Got Chemistry



It's simple. We figure the more you enjoy working with our fun and engaged team members; the more likely you are to give us continued opportunities to support you.

#### Ahead of the Curve



Through research, regulation knowledge, and instrumentation, we are your analytical centre for the technical knowledge you need, BEFORE you need it, so you can stay up to date and in the know.

*If you have any questions or concerns, please contact me at [acrump@caro.ca](mailto:acrump@caro.ca)*

#### Authorized By:

Alana Crump  
Team Lead, Client Service

1-888-311-8846 | [www.caro.ca](http://www.caro.ca)

#110 4011 Viking Way Richmond, BC V6V 2K9 | #102 3677 Highway 97N Kelowna, BC V1X 5C3 | 17225 109 Avenue Edmonton, AB T5S 1H7

## TEST RESULTS

**REPORTED TO PROJECT** Associated Environmental Consultants Inc. (Vernon)  
City of Vernon

**WORK ORDER REPORTED** 20L1347  
2020-12-22 15:28

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
<b>MW11-02 (20L1347-01)   Matrix: Water   Sampled: 2020-12-10 17:00</b>						
<b>Anions</b>						
Bromide	< 0.10	N/A	0.10	mg/L	2020-12-12	
Chloride	96.8	AO ≤ 250	0.10	mg/L	2020-12-12	
Fluoride	0.22	MAC = 1.5	0.10	mg/L	2020-12-12	
Nitrate (as N)	8.84	MAC = 10	0.010	mg/L	2020-12-12	
Nitrite (as N)	< 0.010	MAC = 1	0.010	mg/L	2020-12-12	
Phosphate (as P)	< 0.0050	N/A	0.0050	mg/L	2020-12-12	
Sulfate	661	AO ≤ 500	1.0	mg/L	2020-12-12	
<b>Calculated Parameters</b>						
Nitrate+Nitrite (as N)	8.84	N/A	0.0100	mg/L	N/A	
Nitrogen, Total	9.23	N/A	0.0500	mg/L	N/A	
Nitrogen, Organic	0.330	N/A	0.0500	mg/L	N/A	
<b>General Parameters</b>						
Alkalinity, Total (as CaCO <sub>3</sub> )	383	N/A	1.0	mg/L	2020-12-17	
Alkalinity, Phenolphthalein (as CaCO <sub>3</sub> )	< 1.0	N/A	1.0	mg/L	2020-12-17	
Alkalinity, Bicarbonate (as CaCO <sub>3</sub> )	383	N/A	1.0	mg/L	2020-12-17	
Alkalinity, Carbonate (as CaCO <sub>3</sub> )	< 1.0	N/A	1.0	mg/L	2020-12-17	
Alkalinity, Hydroxide (as CaCO <sub>3</sub> )	< 1.0	N/A	1.0	mg/L	2020-12-17	
Ammonia, Total (as N)	0.064	None Required	0.050	mg/L	2020-12-14	
Nitrogen, Total Kjeldahl	0.394	N/A	0.050	mg/L	2020-12-17	
Phosphorus, Total (as P)	0.0622	N/A	0.0050	mg/L	2020-12-17	
Phosphorus, Total Dissolved	0.0234	N/A	0.0050	mg/L	2020-12-17	
Solids, Total Dissolved	1540	AO ≤ 500	15	mg/L	2020-11-16	HT1

### Sample Qualifiers:

HT1 The sample was prepared and/or analyzed past the recommended holding time.



## APPENDIX 1: SUPPORTING INFORMATION

**REPORTED TO PROJECT** Associated Environmental Consultants Inc. (Vernon)  
City of Vernon

**WORK ORDER REPORTED** 20L1347  
2020-12-22 15:28

Analysis Description	Method Ref.	Technique	Accredited	Location
Alkalinity in Water	SM 2320 B* (2017)	Titration with H <sub>2</sub> SO <sub>4</sub>	✓	Kelowna
Ammonia, Total in Water	SM 4500-NH <sub>3</sub> G* (2017)	Automated Colorimetry (Phenate)	✓	Kelowna
Anions in Water	SM 4110 B (2017)	Ion Chromatography	✓	Kelowna
Nitrogen, Total Kjeldahl in Water	SM 4500-Norg D* (2017)	Block Digestion and Flow Injection Analysis	✓	Kelowna
Phosphorus, Total Dissolved in Water	SM 4500-P B.5* (2011) / SM 4500-P F (2017)	Persulfate Digestion / Automated Colorimetry (Ascorbic Acid)	✓	Kelowna
Phosphorus, Total in Water	SM 4500-P B.5* (2011) / SM 4500-P F (2017)	Persulfate Digestion / Automated Colorimetry (Ascorbic Acid)	✓	Kelowna
Solids, Total Dissolved in Water	SM 2540 C* (2017)	Gravimetry (Dried at 103-105C)	✓	Kelowna

*Note: An asterisk in the Method Reference indicates that the CARO method has been modified from the reference method*

### Glossary of Terms:

RL	Reporting Limit (default)
<	Less than the specified Reporting Limit (RL) - the actual RL may be higher than the default RL due to various factors
AO	Aesthetic Objective
MAC	Maximum Acceptable Concentration (health based)
mg/L	Milligrams per litre
SM	Standard Methods for the Examination of Water and Wastewater, American Public Health Association

### Guidelines Referenced in this Report:

Guidelines for Canadian Drinking Water Quality (Health Canada, June 2019)

**Note: In some cases, the values displayed on the report represent the lowest guideline and are to be verified by the end user**

### General Comments:

The results in this report apply to the samples analyzed in accordance with the Chain of Custody document. This analytical report must be reproduced in its entirety. CARO is not responsible for any loss or damage resulting directly or indirectly from error or omission in the conduct of testing. Liability is limited to the cost of analysis. Samples will be disposed of 30 days after the test report has been issued or once samples expire, whichever comes first. Longer hold is possible if agreed to in writing.

Results in **Bold** indicate values that are above CARO's method reporting limits. Any results that are above regulatory limits are highlighted **red**. Please note that results will only be highlighted red if the regulatory limits are included on the CARO report. Any Bold and/or highlighted results do not take into account method uncertainty. If you would like method uncertainty or regulatory limits to be included on your report, please contact your Account Manager: [acrump@caro.ca](mailto:acrump@caro.ca)

*Please note any regulatory guidelines applied to this report are added as a convenience to the client, at their request, to help provide some initial context to analytical results obtained. Although CARO makes every effort to ensure accuracy of the associated regulatory guideline(s) applied, the guidelines applied cannot be assumed to be correct due to a variety of factors and as such CARO Analytical Services assumes no liability or responsibility for the use of those guidelines to make any decisions. The original source of the regulation should be verified and a review of the guideline(s) should be validated as correct in order to make any decisions arising from the comparison of the analytical data obtained to the relevant regulatory guideline for one's particular circumstances. Further, CARO Analytical Services assumes no liability or responsibility for any loss attributed from the use of these guidelines in any way.*

## APPENDIX 2: QUALITY CONTROL RESULTS

**REPORTED TO PROJECT** Associated Environmental Consultants Inc. (Vernon)  
City of Vernon

**WORK ORDER REPORTED** 20L1347  
2020-12-22 15:28

The following section displays the quality control (QC) data that is associated with your sample data. Groups of samples are prepared in "batches" and analyzed in conjunction with QC samples that ensure your data is of the highest quality. Common QC types include:

- **Method Blank (Blk):** A blank sample that undergoes sample processing identical to that carried out for the test samples. Method blank results are used to assess contamination from the laboratory environment and reagents.
- **Duplicate (Dup):** An additional or second portion of a randomly selected sample in the analytical run carried through the entire analytical process. Duplicates provide a measure of the analytical method's precision (reproducibility).
- **Blank Spike (BS):** A sample of known concentration which undergoes processing identical to that carried out for test samples, also referred to as a laboratory control sample (LCS). Blank spikes provide a measure of the analytical method's accuracy.
- **Matrix Spike (MS):** A second aliquot of sample is fortified with with a known concentration of target analytes and carried through the entire analytical process. Matrix spikes evaluate potential matrix effects that may affect the analyte recovery.
- **Reference Material (SRM):** A homogenous material of similar matrix to the samples, certified for the parameter(s) listed. Reference Materials ensure that the analytical process is adequate to achieve acceptable recoveries of the parameter(s) tested.

Each QC type is analyzed at a 5-10% frequency, i.e. one blank/duplicate/spike for every 10-20 samples. For all types of QC, the specified recovery (% Rec) and relative percent difference (RPD) limits are derived from long-term method performance averages and/or prescribed by the reference method.

Analyte	Result	RL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
<b>Anions, Batch B0L1016</b>									
<b>Blank (B0L1016-BLK1)</b>			Prepared: 2020-12-11, Analyzed: 2020-12-11						
Bromide	< 0.10	0.10 mg/L							
Chloride	< 0.10	0.10 mg/L							
Fluoride	< 0.10	0.10 mg/L							
Nitrate (as N)	< 0.010	0.010 mg/L							
Nitrite (as N)	< 0.010	0.010 mg/L							
Phosphate (as P)	< 0.0050	0.0050 mg/L							
Sulfate	< 1.0	1.0 mg/L							
<b>Blank (B0L1016-BLK2)</b>			Prepared: 2020-12-11, Analyzed: 2020-12-11						
Bromide	< 0.10	0.10 mg/L							
Chloride	< 0.10	0.10 mg/L							
Fluoride	< 0.10	0.10 mg/L							
Nitrate (as N)	< 0.010	0.010 mg/L							
Nitrite (as N)	< 0.010	0.010 mg/L							
Phosphate (as P)	< 0.0050	0.0050 mg/L							
Sulfate	< 1.0	1.0 mg/L							
<b>LCS (B0L1016-BS1)</b>			Prepared: 2020-12-11, Analyzed: 2020-12-11						
Bromide	4.14	0.10 mg/L	4.00		104	85-115			
Chloride	16.1	0.10 mg/L	16.0		101	90-110			
Fluoride	3.96	0.10 mg/L	4.00		99	88-108			
Nitrate (as N)	3.94	0.010 mg/L	4.00		98	90-110			
Nitrite (as N)	1.82	0.010 mg/L	2.00		91	85-115			
Phosphate (as P)	1.08	0.0050 mg/L	1.00		108	80-120			
Sulfate	15.9	1.0 mg/L	16.0		99	90-110			
<b>LCS (B0L1016-BS2)</b>			Prepared: 2020-12-11, Analyzed: 2020-12-11						
Bromide	3.91	0.10 mg/L	4.00		98	85-115			
Chloride	15.7	0.10 mg/L	16.0		98	90-110			
Fluoride	3.99	0.10 mg/L	4.00		100	88-108			
Nitrate (as N)	4.09	0.010 mg/L	4.00		102	90-110			
Nitrite (as N)	1.84	0.010 mg/L	2.00		92	85-115			
Phosphate (as P)	1.10	0.0050 mg/L	1.00		110	80-120			
Sulfate	15.9	1.0 mg/L	16.0		100	90-110			

**General Parameters, Batch B0L1249**

## APPENDIX 2: QUALITY CONTROL RESULTS

**REPORTED TO PROJECT** Associated Environmental Consultants Inc. (Vernon)  
City of Vernon

**WORK ORDER REPORTED** 20L1347  
2020-12-22 15:28

Analyte	Result	RL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
<b>General Parameters, Batch B0L1249, Continued</b>									
<b>Blank (B0L1249-BLK1)</b>			Prepared: 2020-12-14, Analyzed: 2020-12-14						
Ammonia, Total (as N)	< 0.050	0.050 mg/L							
<b>Blank (B0L1249-BLK2)</b>			Prepared: 2020-12-14, Analyzed: 2020-12-14						
Ammonia, Total (as N)	< 0.050	0.050 mg/L							
<b>Blank (B0L1249-BLK3)</b>			Prepared: 2020-12-14, Analyzed: 2020-12-14						
Ammonia, Total (as N)	< 0.050	0.050 mg/L							
<b>LCS (B0L1249-BS1)</b>			Prepared: 2020-12-14, Analyzed: 2020-12-14						
Ammonia, Total (as N)	0.961	0.050 mg/L	1.00		96	90-115			
<b>LCS (B0L1249-BS2)</b>			Prepared: 2020-12-14, Analyzed: 2020-12-14						
Ammonia, Total (as N)	0.965	0.050 mg/L	1.00		96	90-115			
<b>LCS (B0L1249-BS3)</b>			Prepared: 2020-12-14, Analyzed: 2020-12-14						
Ammonia, Total (as N)	0.962	0.050 mg/L	1.00		96	90-115			
<b>General Parameters, Batch B0L1463</b>									
<b>Blank (B0L1463-BLK1)</b>			Prepared: 2020-11-16, Analyzed: 2020-11-16						
Solids, Total Dissolved	< 15	15 mg/L							
<b>LCS (B0L1463-BS1)</b>			Prepared: 2020-11-16, Analyzed: 2020-11-16						
Solids, Total Dissolved	239	15 mg/L	240		100	85-115			
<b>Duplicate (B0L1463-DUP1)</b>			<b>Source: 20L1347-01</b> Prepared: 2020-11-16, Analyzed: 2020-11-16						
Solids, Total Dissolved	1630	15 mg/L		1540			6	15	
<b>General Parameters, Batch B0L1509</b>									
<b>Blank (B0L1509-BLK1)</b>			Prepared: 2020-12-16, Analyzed: 2020-12-17						
Nitrogen, Total Kjeldahl	< 0.050	0.050 mg/L							
<b>Blank (B0L1509-BLK2)</b>			Prepared: 2020-12-16, Analyzed: 2020-12-17						
Nitrogen, Total Kjeldahl	< 0.050	0.050 mg/L							
<b>LCS (B0L1509-BS1)</b>			Prepared: 2020-12-16, Analyzed: 2020-12-17						
Nitrogen, Total Kjeldahl	1.02	0.050 mg/L	1.00		102	85-115			
<b>LCS (B0L1509-BS2)</b>			Prepared: 2020-12-16, Analyzed: 2020-12-17						
Nitrogen, Total Kjeldahl	1.02	0.050 mg/L	1.00		102	85-115			
<b>General Parameters, Batch B0L1546</b>									
<b>Blank (B0L1546-BLK1)</b>			Prepared: 2020-12-16, Analyzed: 2020-12-17						
Phosphorus, Total (as P)	< 0.0050	0.0050 mg/L							
<b>Blank (B0L1546-BLK2)</b>			Prepared: 2020-12-16, Analyzed: 2020-12-17						
Phosphorus, Total (as P)	< 0.0050	0.0050 mg/L							
<b>Blank (B0L1546-BLK3)</b>			Prepared: 2020-12-16, Analyzed: 2020-12-17						
Phosphorus, Total Dissolved	< 0.0050	0.0050 mg/L							
<b>LCS (B0L1546-BS1)</b>			Prepared: 2020-12-16, Analyzed: 2020-12-17						
Phosphorus, Total (as P)	0.110	0.0050 mg/L	0.100		110	85-115			

## APPENDIX 2: QUALITY CONTROL RESULTS

**REPORTED TO PROJECT** Associated Environmental Consultants Inc. (Vernon)  
City of Vernon

**WORK ORDER REPORTED** 20L1347  
2020-12-22 15:28

Analyte	Result	RL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
---------	--------	----------	-------------	---------------	-------	-----------	-------	-----------	-----------

### General Parameters, Batch B0L1546, Continued

<b>LCS (B0L1546-BS2)</b>				Prepared: 2020-12-16, Analyzed: 2020-12-17					
Phosphorus, Total (as P)	0.110	0.0050 mg/L	0.100		110	85-115			
<b>LCS (B0L1546-BS3)</b>				Prepared: 2020-12-16, Analyzed: 2020-12-17					
Phosphorus, Total Dissolved	0.110	0.0050 mg/L	0.100		110	85-115			

### General Parameters, Batch B0L1667

<b>Blank (B0L1667-BLK1)</b>				Prepared: 2020-12-17, Analyzed: 2020-12-17					
Alkalinity, Total (as CaCO <sub>3</sub> )	< 1.0	1.0 mg/L							
Alkalinity, Phenolphthalein (as CaCO <sub>3</sub> )	< 1.0	1.0 mg/L							
Alkalinity, Bicarbonate (as CaCO <sub>3</sub> )	< 1.0	1.0 mg/L							
Alkalinity, Carbonate (as CaCO <sub>3</sub> )	< 1.0	1.0 mg/L							
Alkalinity, Hydroxide (as CaCO <sub>3</sub> )	< 1.0	1.0 mg/L							
<b>Blank (B0L1667-BLK2)</b>				Prepared: 2020-12-17, Analyzed: 2020-12-17					
Alkalinity, Total (as CaCO <sub>3</sub> )	< 1.0	1.0 mg/L							
Alkalinity, Phenolphthalein (as CaCO <sub>3</sub> )	< 1.0	1.0 mg/L							
Alkalinity, Bicarbonate (as CaCO <sub>3</sub> )	< 1.0	1.0 mg/L							
Alkalinity, Carbonate (as CaCO <sub>3</sub> )	< 1.0	1.0 mg/L							
Alkalinity, Hydroxide (as CaCO <sub>3</sub> )	< 1.0	1.0 mg/L							
<b>Blank (B0L1667-BLK3)</b>				Prepared: 2020-12-17, Analyzed: 2020-12-17					
Alkalinity, Total (as CaCO <sub>3</sub> )	< 1.0	1.0 mg/L							
Alkalinity, Phenolphthalein (as CaCO <sub>3</sub> )	< 1.0	1.0 mg/L							
Alkalinity, Bicarbonate (as CaCO <sub>3</sub> )	< 1.0	1.0 mg/L							
Alkalinity, Carbonate (as CaCO <sub>3</sub> )	< 1.0	1.0 mg/L							
Alkalinity, Hydroxide (as CaCO <sub>3</sub> )	< 1.0	1.0 mg/L							
<b>LCS (B0L1667-BS1)</b>				Prepared: 2020-12-17, Analyzed: 2020-12-17					
Alkalinity, Total (as CaCO <sub>3</sub> )	102	1.0 mg/L	100		102	80-120			
<b>LCS (B0L1667-BS2)</b>				Prepared: 2020-12-17, Analyzed: 2020-12-17					
Alkalinity, Total (as CaCO <sub>3</sub> )	102	1.0 mg/L	100		102	80-120			
<b>LCS (B0L1667-BS3)</b>				Prepared: 2020-12-17, Analyzed: 2020-12-17					
Alkalinity, Total (as CaCO <sub>3</sub> )	102	1.0 mg/L	100		102	80-120			

## Appendix M

### *Sanitary Use Bylaw*



**THE CORPORATION OF THE CITY OF VERNON**

# **SANITARY USE BYLAW #4863**

Consolidated for convenience

PAGE 2

BYLAW NUMBER 4863

**THE CORPORATION OF THE CITY OF VERNON**

**BYLAW NUMBER 4863**

<b>BYLAW No.</b>	<b>ADOPTION</b>	<b>AMENDMENT</b>
5100	September 10, 2007	Section 4.01 be deleted in its entirety.
		▪
		▪

BYLAW NUMBER 4863

THE CORPORATION OF THE CITY OF VERNON

BYLAW NUMBER 4863

A bylaw to regulate discharges  
into the Sanitary Sewer System

---

WHEREAS pursuant to Section 8 of the Community Charter and amendments thereto, Council may, by bylaw, provide for the establishment of a system of sanitary sewer works and regulate the use of the sanitary sewer works of the City;

AND WHEREAS there are compounds in waste that in various concentrations are detrimental to the operation of the sanitary sewer works whose discharge must be regulated.

NOW THEREFORE BE IT RESOLVED that the Council of The Corporation of the City of Vernon, in open meeting assembled, enact as follows:

1.00 CITATION

- 1.01 This bylaw may be cited as the "City of Vernon Sanitary Sewer Use Bylaw Number 4863, 2005".

2.00 SCOPE

- 2.01 This bylaw regulates the use of the sanitary sewer system within the City of Vernon.
- 2.02 The provisions of this bylaw apply to all direct and indirect discharges to any part of the City of Vernon sanitary sewer system.
- 2.03 This bylaw regulates the quantity and quality of wastes that may be discharged to the City of Vernon sanitary sewer system and the degree of pre-treatment required.
- 2.04 All applicable fees associated with this bylaw are charged in accordance with the City's current Fees and Charges Bylaw, and all subsequent amendments.
- 2.05 Nothing in this bylaw relieves any person or organization from complying with any provision of any Federal or Provincial legislation or any other bylaw of the City of Vernon.

3.00 DEFINITIONS

- 3.01 In this bylaw, the following words and terms shall have the meanings hereinafter assigned to them:

PAGE 4  
BYLAW NUMBER 4863

"Adverse Effect" means impairment of or damage to the environment, human health or safety.

"Biosolids" means solids derived from primary, secondary, or advanced treatment of domestic wastewater which have been treated through one or more controlled processes that reduce pathogens, reduce volatile solids or chemically stabilize.

"B.O.D." or "Biochemical Oxygen Demand" means the quantity of oxygen utilized in the biochemical oxidation of organic matter under standard laboratory conditions in five (5) days at 20°C, expressed in milligrams per liter as determined by the appropriate procedure in "Standard Methods".

"BTEX" means the total of benzene, toluene, ethyl benzene, and xylene.

"Building Sanitary Sewer" means all pipes, conduits, drains and other equipment and facilities owned and maintained by the Owner for the purpose of collecting and transporting waste to the City of Vernon sanitary sewer.

"City" means the Corporation of the City of Vernon, in the Province of British Columbia.

"C.O.D." or "Chemical Oxygen Demand" means the measure of the oxygen consuming capacity of organic and inorganic matter present in wastewater as determined by the appropriate procedure described in "Standard Methods".

"Cooling Water" means untreated water originating from uses such as air conditioning, cooling or refrigeration where the only pollutant added to the water is heat.

"Compatible Pollutant" means B.O.D., S.S., pH and fecal coliform bacteria and such additional pollutants as are now, or may be in the future, specified and controlled in the City of Vernon Operational Certificate as issued by the Ministry of Water, Land and Air Protection, for its wastewater treatment works where said works have been designed and used to reduce or remove such pollutants.

"Composite Sample" means a sample which is composed of equal portions of a specified number of Grab Samples collected at the same sampling point at specified time intervals during a specified sampling period.

"Contaminant" means any substance, whether gaseous, liquid or solids, whether dissolved or suspended that:

- a. injures, or is capable of injuring, the health or safety of a person;
- b. injures, or is capable of injuring, property or any life form;
- c. interferes, or is capable of interfering, with the operation of a Sewer or Sewage Facility;
- d. causes, or is capable of causing, material physical discomfort to a person;

PAGE 5  
BYLAW NUMBER 4863

e damages, or is capable of damaging, the environment.

"Domestic Wastewater" means wastewater that is composed of liquid and water carried wastes associated with the use of water for drinking, cooking, cleaning, washing, hygiene, sanitation or other domestic purposes.

"Effluent" means the liquid outflow of any facility designed to treat or convey wastewater.

"Garbage" means solid wastes from domestic and commercial preparation, cooking and dispensing of food, and from handling, storage and sale of food as well as any other refuse not normally associated with typical domestic wastewater.

"Grab Sample" means an aliquot of a sampled stream or discharge collected at one particular place and time.

"High Strength Wastes" means wastewater having;

- a. B.O.D. in excess of 500 mg/l as analyzed in a twenty-four-hour composite sample, 1000 mg/l as analyzed in a two-hour composite sample, or 2000 mg/l as analyzed in a grab sample or;
- b. C.O.D. in excess of 750 mg/l as analyzed in a twenty-four-hour composite sample, 1500 mg/l as analyzed in a two-hour composite sample, or 3000 mg/l as analyzed in a grab sample or;
- c. Suspended Solids (S.S.) in excess of 500 mg/l as analyzed in a twenty-four-hour composite sample, 1000 mg/l as analyzed in a two-hour composite sample, or 2000 mg/l as analyzed in a grab sample.

"Holding Tank" means a device or structure designed for the temporary storage of wastewater.

"Incompatible Pollutant" means any pollutant that is not a compatible pollutant as defined in this section.

"Industrial Wastewater" means wastewater that is composed of liquid and water carried wastes associated with processes employed in industrial manufacturing, trade, or commercial and business establishments, as distinct from domestic wastewater.

"mg/l" or "mg/litre" means milligrams per liter

"Non Polluted Water" means water that does not contain any compatible pollutants or contaminants such as rainwater, groundwater, swimming pool water or any other non sewage wastewater.

"Oil and Grease" means organic substance including, but not limited to, hydrocarbons, esters, fats, oils, waxes and high molecular weight carboxylic acids.

PAGE 6  
BYLAW NUMBER 4863

"Owner" shall have the same meaning as assigned to it under the Community Charter

"pH" means the logarithm of the reciprocal of the concentration of hydrogen ions in a solution.

"Pesticide" means an organism or material that is represented, sold, used or intended to be used to prevent, destroy, repel or mitigate a pest and includes a plant growth regulator, plant defoliator or plant desiccant and a control product, other than a device that is a control product under the Pest Control Products Act (Canada).

"Plumbing Fixture" means a receptacle, appliance, apparatus or device that discharges wastewater to the sanitary sewer.

"Pool" means any man made structure with a water depth exceeding 450 mm

"Premises" means any residential, commercial or industrial structure that has a building sanitary sewer connected to the City of Vernon Sanitary Sewer System.

"Pretreatment" means application of physical, chemical and/or biological processes to reduce the amount of pollutants in, or alter the nature of the pollutant properties in a wastewater prior to discharging such wastewater to the sanitary sewer.

"Sanitary Sewer" means a Sewer which carries Domestic or Industrial Wastewater but is not intended to carry stormwater, cooling water, groundwater, or unpolluted water.

"Sanitary Sewer System" means all pipes, conduits, drains and other equipment and facilities owned or otherwise under the control of the City for collecting, pumping and transporting wastewater including all such pipes, conduits, drains and other equipment and facilities which connect to those owned or otherwise under the control of the City.

"Septic Tank" means a device or structure in which the solids contained in wastewater are decomposed by anaerobic bacteria and the effluent is disposed of to an infiltration field.

"Sewage Facility" means any works owned by or under the control or jurisdiction of the City that collects, transports, stores, treats, utilizes or discharges wastewater.

"Sewer Connection" means the sanitary sewer or storm sewer connecting pipe from the property line to the sewer.

"Significant User" means any User of the City's Sanitary Sewer whose flow exceeds 125 m<sup>3</sup> per day (27,500 imperial gallons per day) or whose discharge to the sanitary sewer system typically has a strength of 500 mg/l S.S. or 500 mg/l B.O.D.

"Special Waste" means special waste as defined in the *Environmental Management Act* of British Columbia.

"Special Waste Regulation" means the Hazardous Waste Regulation pursuant to the *Environmental Management Act* of British Columbia.

PAGE 7  
BYLAW NUMBER 4863

"Standard Methods" means the latest edition of Standard Methods for the Examination of Water and Wastewater as published by the American Public Health Association, American Waterworks Association and the Water Environment Federation.

"S.S." means the solids matter, expressed in mg/l, in a liquid as determined according to Standard Methods.

"Stormwater" means water originating from rainwater, snowmelt or groundwater, including roof drain water.

"Twenty-Four-Hour Composite Sample" means a composite sample consisting of equal portions of 24 grab samples collected at 1 hour intervals.

"Two-Hour Composite Sample" means a composite sample consisting of equal portions of 8 grab samples collected at 15 minute intervals.

"Trucked Waste" means any waste that is collected and transported off site by means of a tank truck and discharged to the sanitary sewer system and includes septic tank waste (septage), holding tank waste and portable toilet waste.

"Unpolluted Water" is water not containing any pollutants limited or prohibited by the water quality standards in effect, or water whose discharge will not cause any violation of receiving water quality standards as established in Federal or Provincial legislation.

"User" means any person who discharges, causes or permits the discharge of wastewater into the City's Sanitary Sewer system.

"Waste" or "Wastes" means any substance, whether gaseous, liquid or solid, that is discharged or discarded, directly or indirectly to a sanitary sewer or wastewater treatment facility.

"Wastewater" means domestic wastewater or industrial wastewater.

"Wastewater Treatment System" means all facilities and equipment owned or otherwise under the control of the City of Vernon to treat domestic and industrial wastewater such that following treatment the effluent is suitable for reuse by the City's reclaimed water irrigation program or for discharge to Okanagan Lake via the deep lake outfall.

4.00 CONNECTION TO THE SANITARY SEWER

4.01 Every sanitary sewer connection shall be installed in accordance with the standards contained in the City's current Subdivision and Development Servicing Bylaw, and all subsequent amendments, and shall be installed prior to the installation of the building sanitary sewer.

4.02 The owner or occupier of any premises upon which a new commercial or industrial facility will be operated and where, on average, it is projected that more than 300m<sup>3</sup> of

PAGE 8  
BYLAW NUMBER 4863

non domestic wastewater will be discharged to the sanitary sewer system in any 30 day period, must obtain a Sewer Use Permit from the City of Vernon by completing a Sewer Use Permit Application prior to connection to the sanitary sewer system.

- 4.03 The owner or occupier of any premises upon which an existing commercial or industrial facility is operated and where, on average, more than 300m<sup>3</sup> of non domestic wastewater is discharged to the sanitary sewer system in a 30 day period, must obtain a Sewer Use Permit from the City of Vernon by completing a Sewer Use Permit Application prior to any alteration or expansion of the facility.
- 4.04 Grease and oil interceptors shall be installed for all food preparation facilities sufficient to prevent the discharge of grease and oil to the sanitary sewer system.
- 4.05 Grease, oil and sand interceptors shall be installed at all vehicle repair and maintenance establishments sufficient to prevent the discharge of grease, oil and sand to the sanitary sewer system.
- 4.06 All interceptors shall be installed upstream of the sanitary sewer system service connection and shall be located so as to be readily accessible for inspection and maintenance.
- 4.07 The owner or occupier of any premises upon which an interceptor is installed shall maintain the interceptor in a serviceable condition at all times.
- 4.08 The City of Vernon may, at its sole discretion, request that the owner or occupier of any premises upon which a grease, oil or sand interceptor is installed to provide records of maintenance of the interceptor.
- 4.09 The control manhole shall be installed and maintained by the owner or occupier of the premises and shall be accessible to the City of Vernon at all times to inspect and sample material entering the sanitary sewer system.
- 4.010 The control manhole and flowmeter specification must be approved by the City of Vernon prior to connection to the sanitary sewer system.

5.00 MONITORING OF DISCHARGE TO THE SANITARY SEWER SYSTEM

- 5.01 Should it be determined through sampling and analysis that the discharge to the sanitary sewer system from a premises is in violation of this bylaw, the City of Vernon may direct the owner or occupier of the premises to take steps to comply with the bylaw and may require the owner or occupier to install monitoring equipment as necessary to demonstrate compliance with this bylaw.
- 5.02 All test, measurements, analysis and examinations of wastewater required to demonstrate compliance with this bylaw shall be at the cost of the owner or occupier of the premises where a discharge occurs.

PAGE 9  
BYLAW NUMBER 4863

6.00 PENALTIES

Any person who violates any provision of this bylaw will be deemed to have committed an offence and shall be liable upon summary conviction to the following penalties:

- a. a minimum fine of \$500.00;
- b. a maximum fine of \$10,000;
- c. in the case of a continuing offense, for each day that the offense continues, either or both of:
  - 1. a minimum fine under paragraph a.
  - 2. a maximum fine under paragraph b;
- d. in a prosecution of an offense against a municipal bylaw, the justice or court may impose all or part of the penalties applicable in relation to the offense, together with the costs of prosecution.

7.00 WASTE DISCHARGE

7.01 Prohibited Wastes

Except as otherwise provided in this bylaw, no person shall release or discharge, or permit the releasing or discharge into the sanitary sewer system of any Prohibited Waste as described in Schedule A.

7.02 Restricted Wastes

Except as otherwise provided in this bylaw, no person shall release or discharge, or permit the releasing or discharge into the sanitary sewer system of any Restricted Waste as described in Schedule B.

7.03 High Strength Wastes

The City may accept High Strength Wastes as defined in this bylaw into the sanitary sewer system at its sole discretion where the wastewater is not such that it can damage the sanitary sewer system or the wastewater treatment system. The City will impose a sewer service surcharge on High Strength Wastes as contained in the City's current Fees and Charges Bylaw, and all subsequent amendments.

7.04 Trucked Waste

All provisions in this bylaw apply to all trucked waste discharged to the sanitary sewer, with the exception of the limits for B.O.D. and S.S. contained in Schedule B, Section 1 and Section 3.

The City of Vernon will accept Trucked Waste from haulers holding a valid City of Vernon business license into the sanitary sewer system at the designated discharge location(s) and during the times designated by the City of Vernon. The location and times may vary at the discretion of the City of Vernon. The City of Vernon reserves the

PAGE 10  
BYLAW NUMBER 4863

right, at its sole discretion, to refuse to accept any load of trucked waste that it considers to be of questionable origin or quality.

The discharge of trucked waste to the sanitary sewer system at any location(s) other than those authorized by the City of Vernon are strictly prohibited and are subject to the penalties contained in this bylaw.

A properly completed load manifest for every load of trucked waste discharged to the City of Vernon sanitary sewer must be provided to the City of Vernon or its designated representative by the trucked waste hauler prior to discharge to the sanitary sewer. Failure to provide a properly completed load manifest will result in the refusal to accept the load of trucked waste.

Only trucked waste originating in the Regional District of the North Okanagan will be accepted.

Waste from commercial oil and grease separators and commercial car wash catch basins will not be accepted into the sanitary sewer.

In addition to the penalties described in this bylaw, the City of Vernon may, at its sole discretion, suspend or revoke access to the designated discharge location should a trucked waste hauler be found in violation of any of the provisions of this bylaw.

7.05 Non Polluted Water

No person shall release or discharge, or permit the releasing or discharge into the sanitary sewer system any non polluted water.

7.06 Pretreatment Requirements

Where wastewater discharged into the sanitary sewer collection system is found to have been deleterious to the sanitary sewer collection system or wastewater treatment plant, the City of Vernon may, by notice in writing to the owner or occupier of any premises:

- a. Refuse to allow any additional wastes to be discharged to the sanitary sewer system.
- b. Require the owner or occupier of any premises to construct, operate and maintain wastewater pre-treatment facilities to ensure compliance with this bylaw.
- c. Require the owner or occupier of any premises to construct, operate and maintain facilities to control the rate of discharge to the sanitary sewer system.
- d. Require the owner or occupier to pay additional charges to cover the added cost of treating the wastes discharged to the sanitary sewer system as contained in the City's current Fees and Charges Bylaw, and all subsequent amendments.

8.00 TEMPORARY DISCHARGE TO THE SANITARY SEWER

PAGE 11  
BYLAW NUMBER 4863

- 8.01 Any person who wishes to discharge wastewater to the sanitary sewer system on a temporary basis, must obtain a Temporary Sewer Use Permit from the City of Vernon by completing a Sewer Use Permit Application prior to any discharge to the sanitary sewer.
- 8.02 Charges for temporary discharges to the sanitary sewer system are as described in the City's current Fees and Charges Bylaw, and all subsequent amendments.

READ A FIRST TIME this 27 day of June, 2005.

READ A SECOND TIME this 27 day of June, 2005.

READ A THIRD TIME this 27 day of June, 2005.

ADOPTED this 11 day of July, 2005.

---

Mayor:

---

City Clerk:

**PROHIBITED WASTE**

The following are designated as Prohibited Waste:

1. Any material which causes or will cause an adverse effect.
2. Any stormwater or unpolluted water.
3. Any flammable or explosive material.
4. Any pesticides, insecticides, herbicides, or fungicides save and except chemicals contained in stormwater emanating from trees or vegetation treated in accordance with the Pesticide Control Act.
5. Any material capable of obstructing wastewater flow or interfering with the operation of any part of the sewage collection or treatment system. These materials include, but are not limited to, ashes, cinders, sand, mud, straw, grass clippings, insoluble shavings, metal, glass, rags, feathers, tar, asphalt, creosote, plastics, wood, animal paunch contents, offal, blood, bones, meat trimmings and waste, fish or fowl head, shrimp, crab or clam shells, fish scales, entrails, lard, mushrooms, tallow, baking dough, chemical residues, cannery or wine waste, bulk solids, hair and fleshings, spent grain and hops, whole or ground food or beverage containers, garbage, paint residues, cat box litter, slurries of concrete, cement, lime or mortar.
6. Any material, other than domestic wastewater, which by itself or in combination with another substance is capable of creating odours related to but not limited to hydrogen sulfide, carbon disulfide, other reduced sulfur compounds, amines or ammonia outside or in and around the wastewater collection system.
7. Any noxious or malodorous material which by itself or in combination with another material is capable of creating a public nuisance or hazard to life or may be prevent entry into a sewer or pump station for its maintenance or repair.
8. Any material with corrosive properties which by itself or in combination with another material may cause damage to any part of the sewage collection or wastewater treatment system.
9. Any infectious material which by itself or in combination with another material may create a contaminant in any part of the sewage collection or wastewater treatment system.
10. Grit removed from commercial or industrial premises including but not limited to grit removed from car washing establishments, automobile garages, restaurant sumps or interceptors.
11. Any material classified as a Special Waste.

PAGE 2  
SCHEDULE "A"

12. Any material that may cause biosolids from the Water Reclamation Plant to fail to meet the criteria outlined in the British Columbia Organic Matter Recycling Regulation for any end use that the city may choose to undertake at any given time.

**RESTRICTED WASTE**

The following are designated as Restricted Waste:

1. Any wastewater having a B.O.D. in excess of 500 mg/l as analyzed in a twenty-four-hour composite sample, 1000 mg/l as analyzed in a two-hour composite sample, or 2000 mg/l as analyzed in a grab sample.
2. Any wastewater having a C.O.D. in excess of 750 mg/l as analyzed in a twenty-four-hour composite sample, 1500 mg/l as analyzed in a two-hour composite sample, or 3000 mg/l as analyzed in a grab sample.
3. Any wastewater having a S.S. in excess of 500 mg/l as analyzed in a twenty-four-hour composite sample, 1000 mg/l as analyzed in a two-hour composite sample, or 2000 mg/l as analyzed in a grab sample.
4. Any wastewater which contains oil and grease in a concentration that is in excess of 100 mg/l as analyzed in a twenty-four-hour composite sample, 200 mg/l as analyzed in a two-hour composite sample, or 400 mg/l as analyzed in a grab sample.
5. Any wastewater which contains oil and grease derived from a petroleum source in a concentration that is in excess of 15 mg/l as analyzed in a twenty-four-hour composite sample, 30 mg/l as analyzed in a two-hour composite sample, or 60 mg/l as analyzed in a grab sample.
6. Any material which may solidify or become viscous at temperatures above 0°C.
7. Any wastewater having a temperature greater than 65° C.
8. Any wastewater having a pH lower than 5.0 or higher than 11.0 as determined by a grab sample, or less than 5.5 or higher than 10.5 as determined by a two-hour composite sample.
9. Any wastes from the preparation, cooking and dispensing of food that has not been properly comminuted to 12mm or less in any dimension. Such waste must be shredded to such a degree that all particles will be freely carried under the flow conditions prevailing in the sanitary sewer collection system.
10. Any wastewater containing a hazardous, toxic or poisonous substance in sufficient quantity to injure or interfere with any sanitary sewer system or wastewater treatment system which could constitute a hazard to humans or animals, or create a hazard in areas receiving treated effluent from the wastewater treatment plant.
11. Any wastewater containing dyes or colouring material which pass through the sanitary sewer or wastewater treatment system and discolour any part of the sanitary sewer, wastewater treatment system or the treated effluent from wastewater treatment plant.

PAGE 2  
SCHEDULE "B"

12. Any wastewater containing substances in concentrations that are not amenable to treatment or reduction in the wastewater treatment process being employed by the City at any given time or that cannot be treated to such a degree during the normal wastewater treatment process to meet the requirements of the City of Vernon's Ministry of Water, Land and air Protection Operational Certificate or any other applicable provincial or federal legislation that may be in effect.
13. Any wastewater with a concentration, in a combined or uncombined form, in excess of the levels set out below:

Substance	Expressed As	Concentration in mg/l		
		A	B	C
Aluminum	Al	50	100	200
Arsenic	As	1	2	4
Boron	B	50	100	200
Cadmium	Cd	0.2	0.4	0.8
Chromium	Cr	4	8	16
Cobalt	Co	5	10	20
Copper	Cu	2	4	8
Cyanide	Cn	1	2	4
Iron	Fe	10	20	40
Lead	Pb	1	2	4
Manganese	Mn	5	10	20
Mercury	Hg	0.05	0.1	0.2
Molybdenum	Mo	1	2	4
Nickel	Ni	2	4	8
Phenols		1	2	4
Phosphorus	P	12.5	25	50
Silver	Ag	1	2	4
Sulphate	SO <sub>4</sub>	1500	3000	6000
Sulphide	S	1	2	4
Tin	Sn	5	10	20
Zinc	Zn	3	6	12
A:		24 hour composite sample		
B:		2 hour composite sample		
C:		Grab sample		

PAGE 3  
SCHEDULE "B"

14. Any wastewater which contains additional water added solely for the purpose of diluting waste which would otherwise exceed the applicable maximum concentrations.

## Appendix N

### *VWRC Process Schematic*

The diagram illustrates the initial stages of wastewater treatment. It begins with an 'INFLUENT SEWER' at the top. The flow proceeds through a 'FINE SCREEN' and a 'BAR SCREEN' into a large rectangular tank. From this tank, the effluent goes to a 'SCREENINGS DEWATERING PRESS' on the left, which has a 'TO DISPOSAL' line. The main flow continues to two 'GRIT TANKS' (circular). Below the grit tanks are 'PARSHALL FLUMES' (two rectangular structures). The flow then passes through 'PRIMARY INFLUENT PUMPS' (a row of four pumps) before entering the 'AERATION TANKS' (a large rectangular tank at the bottom). A 'RETURN' line is shown at the bottom right, indicating a recirculation path.



2002