

Magic Lake Estates Water and Sewer System

2021 Annual Report

CRD | Drinking Water and Wastewater

Introduction

This report provides a summary of the Magic Lake Estates (MLE) Water and Sewer Service for 2021 and provides a description of the water and sewer services including: summary of the water supply, demand and production, drinking water quality, wastewater treatment flows, effluent quality, operations highlights, capital project updates and financial report.

WATER SYSTEM

Water Service Description

The community of Magic Lake Estates is primarily a rural residential development with some community properties located on Pender Island in the Southern Gulf Islands Electoral Area which was originally serviced by a private water utility and in 1981 the service converted to the Capital Regional District (CRD). The Magic Lake Estates water service is made up of 1,202 parcels, of which there are 1,043 single family equivalents (or approximately the same amount of customers) obtaining service from the water system.

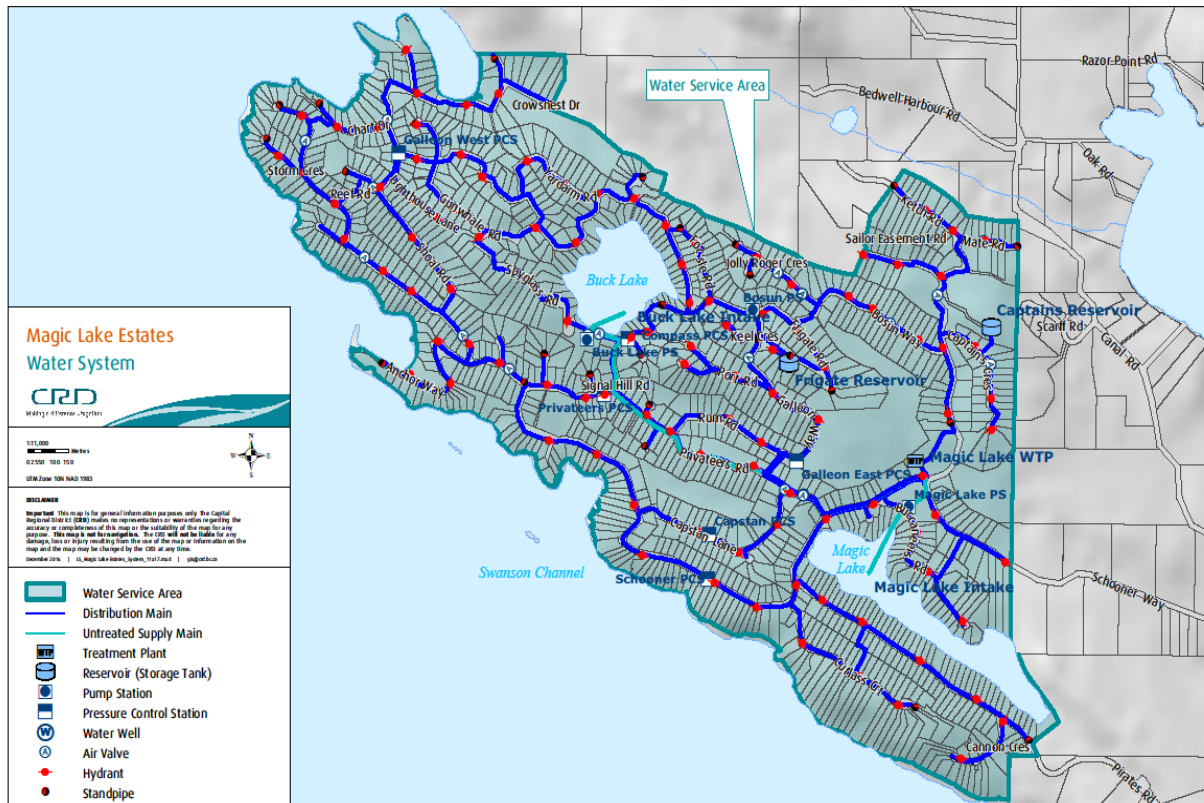


Figure 1: Map of Magic Lake Estates Water System

The Magic Lake Estates water system is primarily comprised of:

- Two raw water sources; Buck Lake (primary source) and Magic Lake (secondary source).
- Four earthen dam structures (two at Buck Lake and two at Magic Lake).
- Two raw water pump stations, one each related to the raw water supplies, with pretreatment oxidation equipment to treat and control dissolved manganese and iron in the raw water source.
- Centralized water treatment plant consisting of a dual process including dissolved air flotation (DAF), filtration, ultraviolet light disinfection and chlorine disinfection.
- One booster pump station / pressure reducing station (Bosun).
- Two steel storage tanks, Frigate and Captains (volumes; Frigate 750 cubic meters or 200,000 USg and Captains 341 cubic meters or 90,000 USg).
- Supervisory Control and Data Acquisition (SCADA) system.
- Distribution system and supply pipe network (in excess of 27 kilometers of water mains).
- Other water system assets: 1,043 water service connections and meters, approximately 70 fire hydrants, 6 pressure reducing valve stations, 100 gate valves and standpipes.

Water Supply

Surface water supply monthly water levels are provided in Figures 2 and 3 for Buck Lake and Magic Lake respectively. It is important to note that under normal operating conditions, Buck Lake provides 80% and Magic Lake provides 20% of the annual raw water demand for the service. However, due to an algae event in Magic Lake, Buck Lake provided 100% of the raw water supply from approximately August to December of 2021.

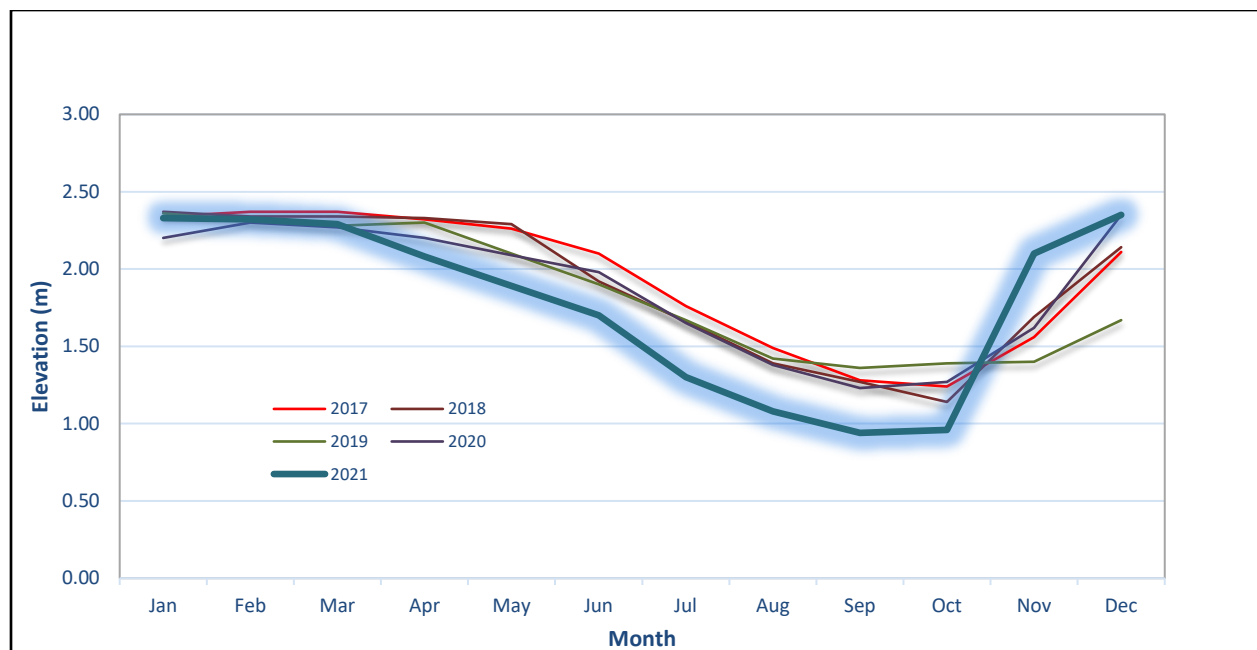


Figure 2: Buck Lake Monthly Water Level

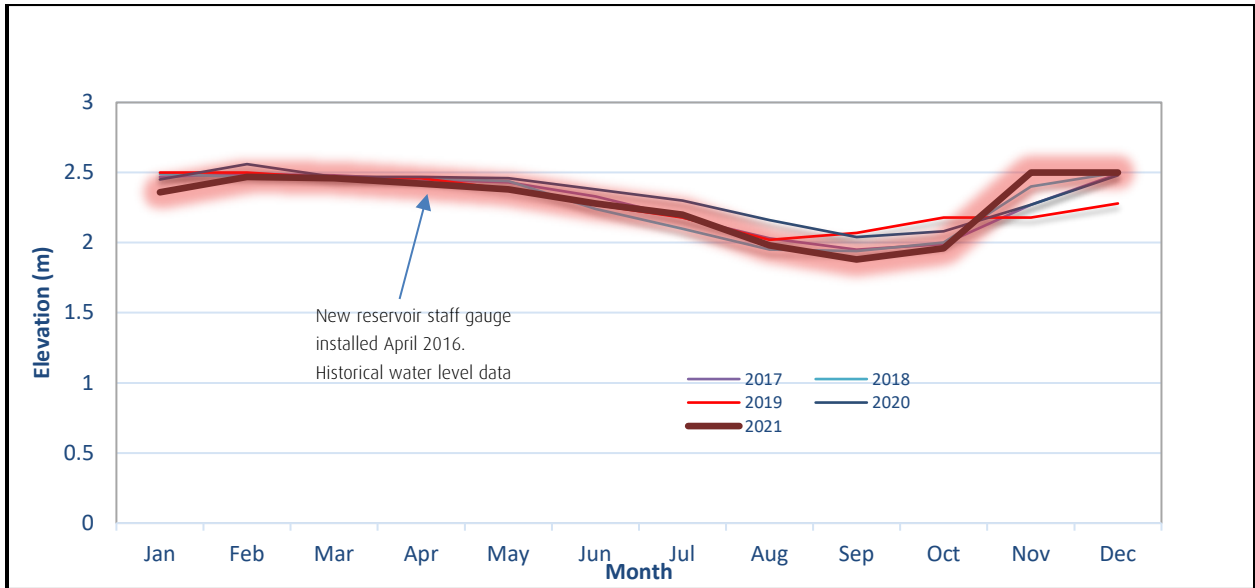


Figure 3: Magic Lake Monthly Water Level

Water Production and Demand

Referring to Figure 4, 203,909 cubic meters of water was extracted (water production) from both Buck Lake and Magic Lake water sources in 2021; a 5% increase from the previous year and an 18% increase in the five year average. Water demand (customer water billing) for the service totaled 124,811 cubic meters of water; a 6% increase from the previous year and a 20% increase from the rolling five year average.

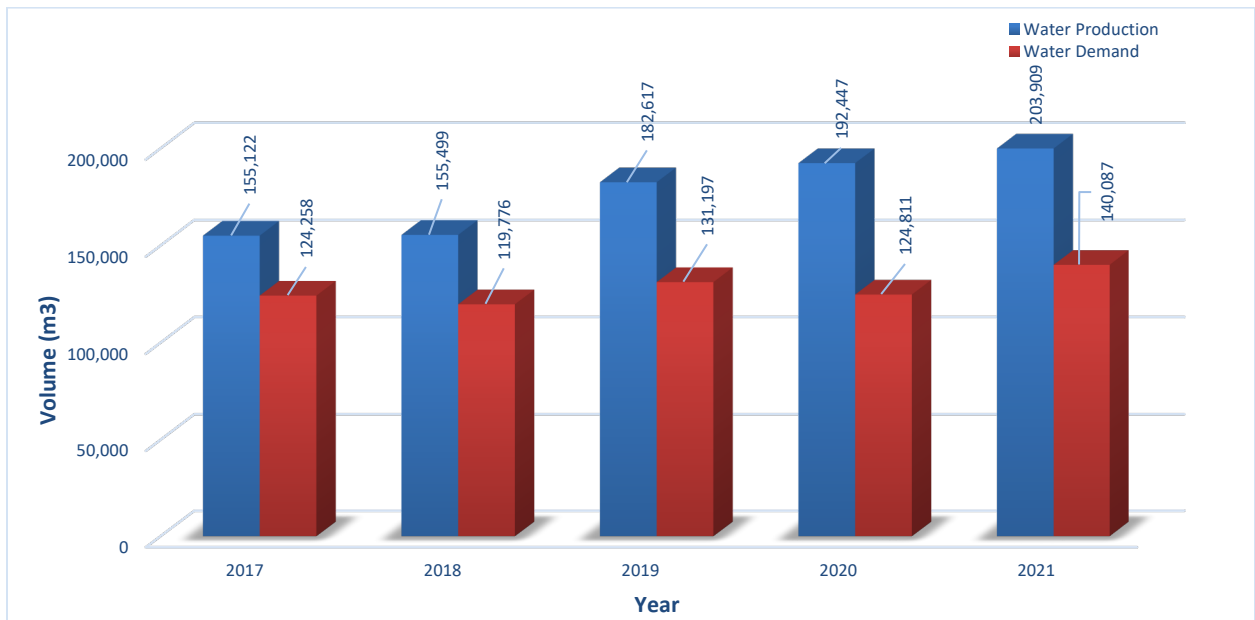


Figure 4: Magic Lake Estates Water System Annual Water Production and Demand

The difference between annual water production and annual customer water demand is referred to as non-revenue water and can include water system leaks, water system maintenance and operational use (e.g. water main flushing, filter system backwashing), potential unauthorized use and fire-fighting use.

The 2021 non-revenue water (63,822 cubic meters) represents about 31% of the total water production for the service area. However, approximately 5,000 cubic meters of the non-revenue water can be attributed to operational use. Therefore, the non-revenue water associated with system losses is approximately 29% which although is a slight decrease from the previous year, is considered to be high for a water distribution system the size of Magic Lake Estates. Further investigation and analysis can be carried out which could include a water audit in order to determine what corrective actions can be taken to reduce water loss.

Figure 5 below illustrates the monthly water production for Magic Lake Estates for the past five years. The monthly water production trends are typical for smaller water systems such as Magic Lake Estates. In review of water production for 2021, the monthly trend for June and July is higher than the previous years and is primarily the result of higher water demands due to the environmental heat dome that occurred during this period.

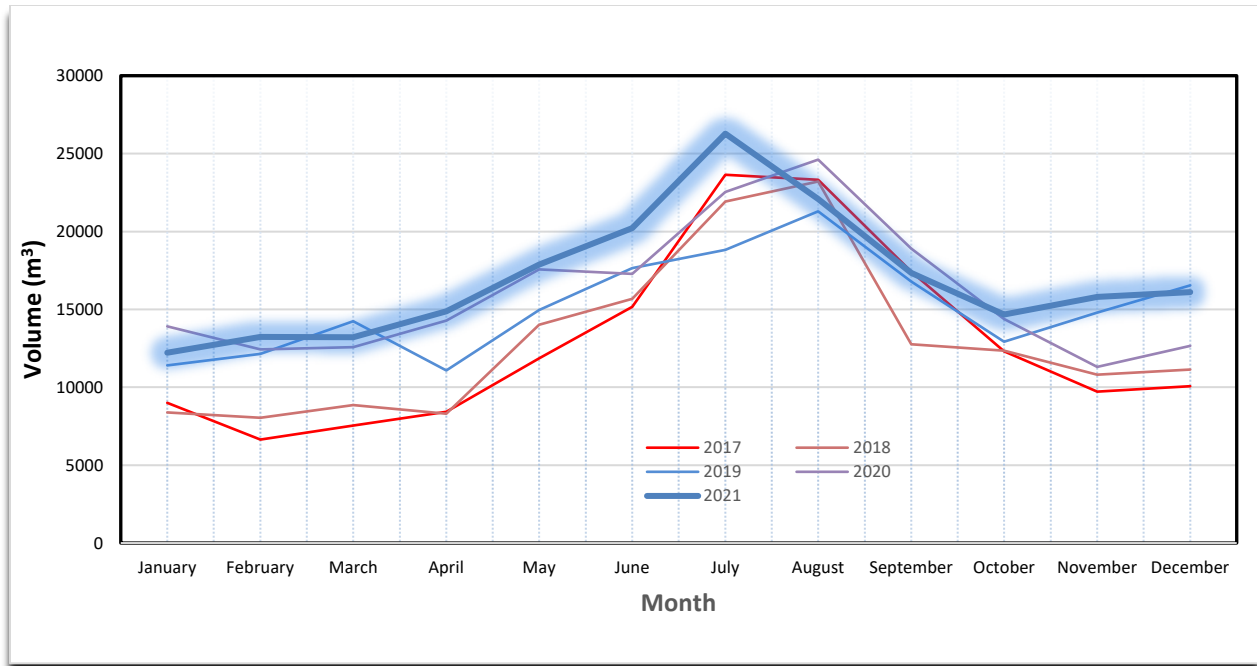


Figure 5: Magic Lake Estates Water System Monthly Water Production.

Drinking Water Quality

Two intake lines from Buck Lake and Magic Lake provide blended source water to the DAF treatment plant. The typical intake blending ratio in 2021 was 80/20 Buck/Magic lakes unless water quality concerns or operational needs required a temporary adjustment. Due to a cyanobacteria bloom in Magic Lake, the source water supply came from Buck Lake only from August 20 until October 25, 2021. While Buck Lake also experienced higher algal activity during the summer, there was no algal bloom and no major risk to water quality from this source. Iron and manganese concentrations in Magic Lake were high throughout all seasons. Buck Lake only experienced high manganese concentrations in the fall. The treatment plant includes an additional potassium permanganate treatment system that was continuously operated in 2021 to address periodically elevated iron and manganese levels in the raw water.

The drinking water supplied to the service area was safe for consumption at all times except for a short period (July 28 to 31) during which a boil water advisory (BWA) was issued to 25 homes within the service area. This BWA was necessary due to a water contamination risk after a contractor struck and damaged a water main.

The existing multi-barrier treatment system was able to deal with several algal as well as high iron and manganese events in both source lakes throughout the year. The treatment system was also able to reduce the total organic carbon (TOC) concentration by >50%, however, the high organic loading of the raw water still resulted in a high organic carbon concentration in the treated drinking water which can have taste and odour implications and can lead to high disinfection by-product concentrations. As in previous years, operations staff successfully mitigated localized adverse water quality events due to aging and stagnant water through spot-flushing.

Overall Magic Lake Estates drinking water quality characteristics for 2021 are summarized below.

Raw Water:

- Both lake sources exhibited low concentrations of total coliform bacteria throughout the winter months but higher concentration during the summer period. In Magic Lake, the total coliform bacteria concentrations rose to about 6,000 CFU/100mL in late summer. This was higher than in previous years and maybe a results from the extreme heat wave in early summer. Buck Lake only saw an increase to 460 CFU/100mL summer which was similar than in previous years.
- *E. coli* bacteria concentrations were generally low in both lakes throughout the year. During the summer months the concentrations were slightly higher than during the rest of the year. This is a typical pattern for lakes.
- Raw water from both sources was medium hard (54.8 – 62.5 mg/L CaCO₃).
- Buck Lake exhibited a raw water turbidity range from 0.45 to 2.3 nephelometric turbidity units (NTU) with an annual median of 0.7 NTU, and Magic Lake a range from 0.95 to 4.6 NTU with an annual median of 1.40 NTU. The higher turbidity occurred typically during the periods of increased algal activity in late summer and fall. The turbidity in both lakes was generally consistent with historical turbidity trends.
- Buck Lake, with an annual median total organic carbon (TOC) of 6.5 mg/L, and Magic Lake, with a median TOC of 8.5 mg/L, are considered mesotrophic lakes (medium productive).
- Both lakes exhibited seasonally elevated iron and manganese concentrations which reached peaks of 349 µg/L (Fe) and 289 µg/L (Mn) in Magic Lake in November, and 62.5 µg/L (Fe) and 163 µg/L (Mn) in Buck Lake also in November. These metal concentrations were unusually high for these lakes and likely a consequence of the extreme rainfall and runoff event on November 14/15, 2021. While these metal concentrations may be high throughout all seasons in Magic Lake, these episodes are more limited to the fall in Buck Lake.

Treated Water:

- Treated water was bacteriologically safe to drink with no confirmed positive of either *E. coli* or total coliform bacteria in the treated water. One sample from the distribution system in December tested positive for total coliform bacteria. Resampling did not confirm an actual drinking water contamination.
- Treated water turbidity (cloudiness) was typically well below the Guidelines for Canadian Drinking Water Quality (GCDWQ) limit of 1 NTU with the exception of very few isolated samples exceeding this limit on few occasions, mostly associated with operational activities such as flushing or pipe repairs.

- Total organic carbon (TOC median 3.7 mg/L) was in line with results in previous years. A 57% reduction of TOC indicates a satisfactory performance of the DAF plant. TOC concentrations of > 4 mg/L are considered a strong precursor for disinfection by-product formation and potential guidelines exceedance.
- Metals were below maximum acceptable concentration (MAC) and also mostly below the aesthetic objective (AO) limits, confirming the efficacy of the potassium permanganate treatment system in removing in particular iron and manganese.
- Disinfection by-products such as trihalomethanes (THM) were in compliance with the annual average requirement in the GCDWQ, but some individual samples did exceed the GCDWQ limit of 100 µg/L. TTHM concentrations fluctuated between 46 and 120 µg/L for an annual average of 77 µg/L. Haloacetic acids (HAA) tested always below the MAC of 80 µg/L in 2021.
- Periods with algal blooms or high algal activity in the source lakes affected occasionally the taste and odour of the drinking water.
- The water temperature exceeded the GCDWQ aesthetic limit of 15°C between May and October.
- The newly established GCDWQ MAC for aluminum was at no time in 2021 exceeded.

Table 1 and 2 below provide a summary of the 2021 raw and treated water test results.

Water Quality data collected from this drinking water system can be reviewed on the CRD website:

<https://www.crd.bc.ca/about/data/drinking-water-quality-reports>

Water System Operational Highlights

The following is a summary of the major operational issues that were addressed by CRD Integrated Water Services staff:

- Emergency storm event responses in early 2021.
- Water treatment plant air saturator vessel corrective maintenance.
- Water system leak repairs:
 - 2708 Privateers Road
 - 37140 Galleon Way
 - 2640 Shoal Road
 - 47303 Schooner Way
 - Galleon Way near Port Road
 - 2604 Dory Way
 - Lighthouse Lane
 - 2711 Privateers Road
 - 2767/2769 Schooner Way
 - 2666 Schooner Way
- Emergency response to cold weather event beginning December 28 that resulted in freezing of pipes at various locations within the water distribution system.

Water System Capital Project Updates

The Capital Projects that were in progress or completed in 2021 included:

1. Design and Construction Buck lake and Magic Lake Adjustable Intakes – A consultant was retained and a design report drafted in 2021, with procurement for the intake floats to happen in 2022.

2. Safety Improvements – Two safety items were addressed. A culvert installation on Schooner Way to address safety concerns for staff to pull off the road to perform water sampling activities; and the purchase and installation of fuel storage and containment to address safety concerns.
3. Buck Lake Dam Repairs – Phase 1 – Work has started on the performance analysis and additional inspections. The minor dam repairs are in planning phase.
4. Magic Lake Estates Water Treatment Plant (WTP) SCADA Hot Standby – Procurement started for replacement of the SCADA server. Configuration and deployment to occur in 2022.
5. Buck lake Lighting Replacement – Project to commence in 2022 by CRD Operations.

SEWER SYSTEM

Service Description

The community of Magic Lake Estates is primarily a rural residential development located on Pender Island in the Southern Gulf Islands Electoral Area which was originally serviced by a private sewer utility and in 1981 the service converted to the CRD. The sewer service is approximately 210 hectares in size and includes 714 parcels of which 642 are serviced. Some of the sewer infrastructure includes: 16km of sewer pipe, 316 manholes, seven pump stations, and two treatment plants each with an outfall into Swanson Channel.

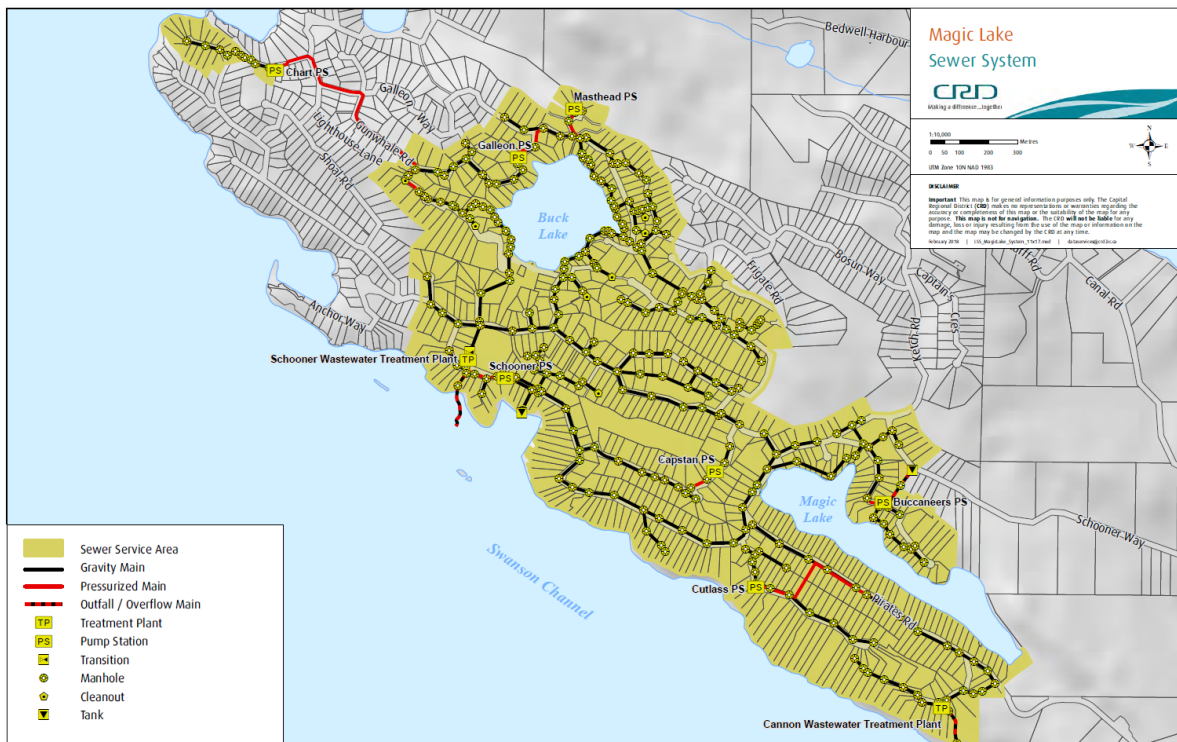


Figure 5: Map of Magic Lake Estates Sewer System

Wastewater Flows

The total monthly and 6-year total annual flows are shown in Figures 6 and 7 below. The graphs indicate that the 2021 wastewater flows were about 12% higher than 2020 and about 19% higher than the 5-year average. The monthly flows show some seasonal variation in the summer due to peak tourist times (i.e. August is about 11% higher than June), but the more significant variation occurs in the winter due to inflow and infiltration (where November had 3.5 times the flow as July).

The Municipal Wastewater Regulation (MWR) contains requirements for the treatment, reuse and discharge of municipal wastewater effluent. The regulation includes a requirement that sewer flows reaching treatment plants should not exceed 2.0 times “average dry weather flow” during storm events with less than a 5-year return period. Based on the measured flow rates, the Magic Lake Estates sewer system does not meet that requirement.

The peak winter flows have also resulted in a number of total daily flow exceedances at each treatment plant as shown in Figure 8 below.

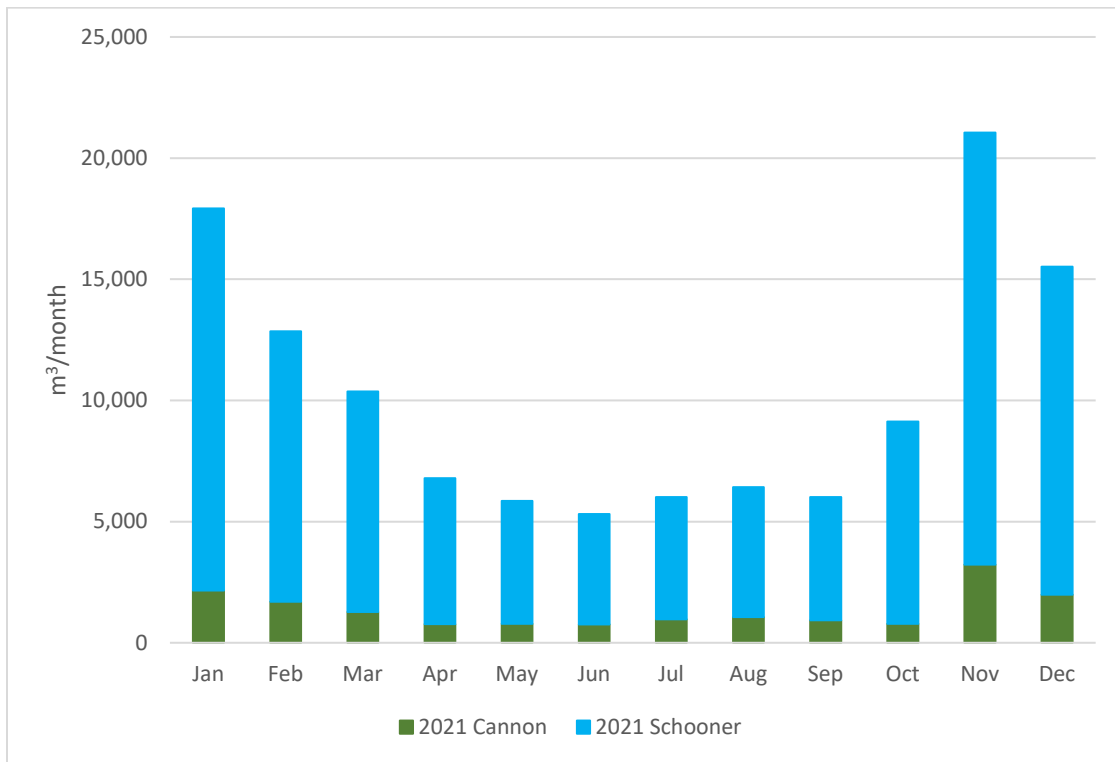


Figure 6: Total Monthly Flows (m³/month)

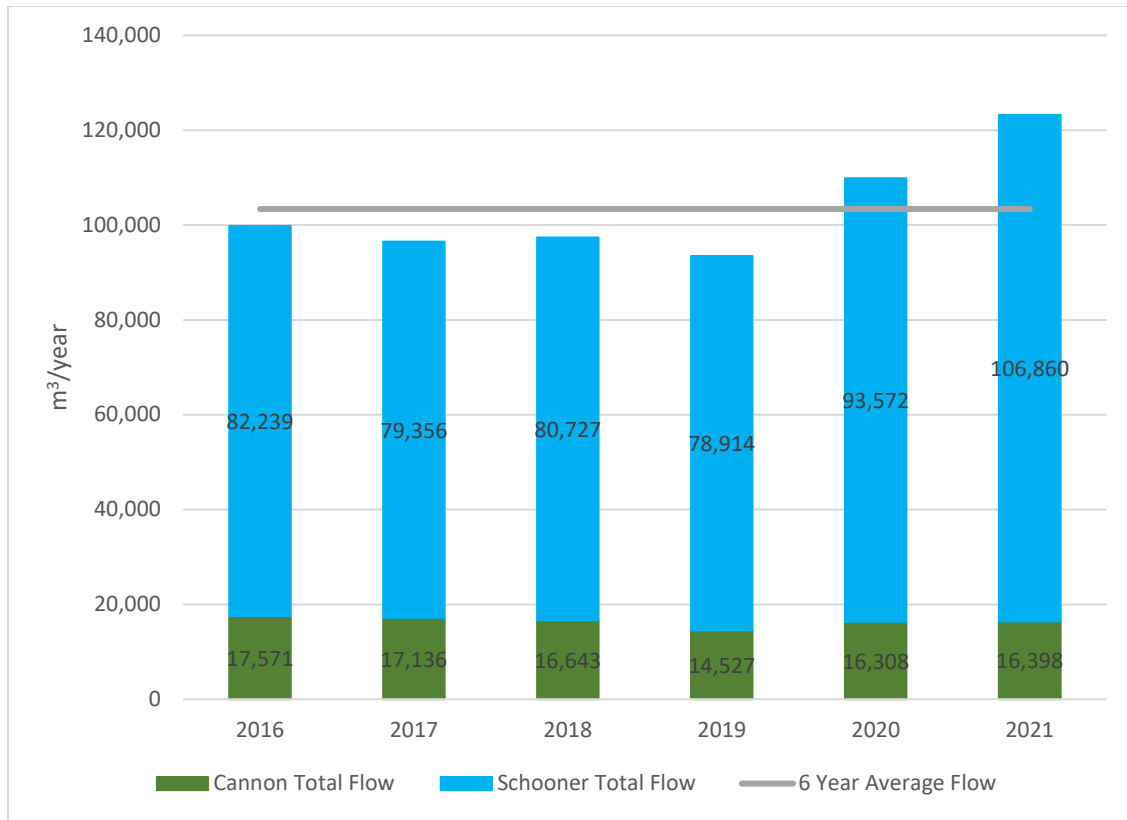


Figure 7: Total Wastewater Flows (m³/year)

Treated Effluent – Regulatory Compliance

Flow and effluent quality are assessed for compliance with the federal regulatory limits (Schooner only) and provincial discharge permits (both Schooner and Cannon) on a daily and monthly basis, respectively. Treated wastewater from Cannon was in compliance throughout 2021. There were nine presumed or documented compliance exceedances at Schooner during 2021, consisting of six fecal coliform exceedances and three Total Suspended Solids (TSS) exceedances. These exceedances were associated with heavy rain events or power outages when the treatment system was unable to function as designed. Both plants exceeded their permitted daily flow allowances in 2021 on multiple occasions. The exceedances all occurred during storm events when inflow and infiltration occurs and because neither plant has equalization tanks to attenuate the peak flows. Figure 8 shows the number of exceedances at each plant along with the annual precipitation. In 2021 there was 1.7 times the number of flow exceedances than 2020, with 19 at Schooner and 54 at Cannon (totaling 73 in 2021 versus 43 in 2020). The BC Ministry of Environment and Climate Change Strategy has issued non-compliance warning letters for these two treatment facilities and is expecting upgrades to bring them back into compliance.

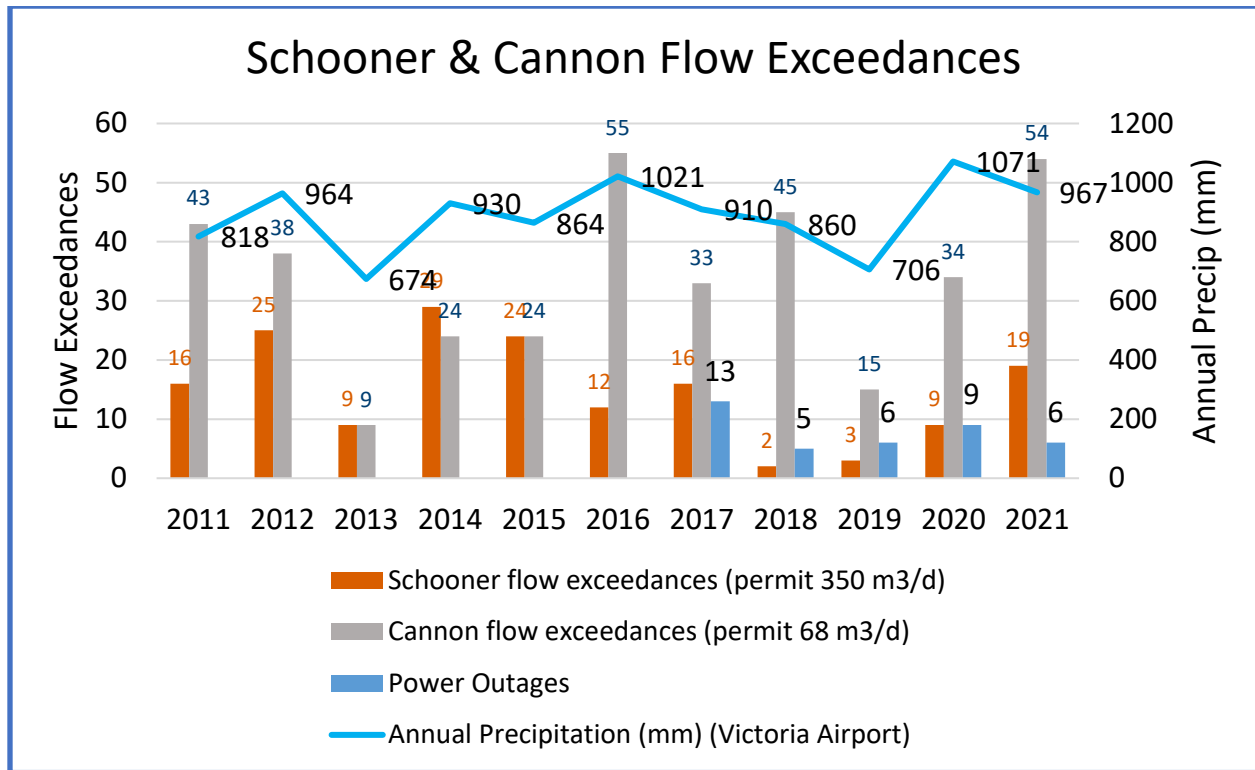


Figure 8: Schooner and Cannon Wastewater Treatment Plant (WWTP) Flow Exceedances

Receiving Water

Routine receiving water monitoring was last required for both Magic Lake Estates Wastewater Treatment Plants in 2020, and will be next required in 2024 unless there are planned bypasses, plant failures/overflows, or wet weather overflows that exceed three days duration in the winter or one day duration in the summer. Bypass or overflow sampling is only required once per season for events that are similar in nature as long as the first seasonal sampling confirms results were within guidelines set to protect human primary contact for recreation.

Overflow sampling was required twice in 2021 around both the Cannon and Schooner outfalls, following plant overflows each lasting longer than three days in January and November. All results were well below human health guidelines.

Sewer Service Operational Highlights

The following is a summary of the major operational issues that were addressed by CRD Integrated Water Services staff:

- Emergency storm event responses in early 2021
- Cutlass Court Pump Station control float replacements
- Cannon Wastewater Treatment Plant scum pump replacement
- Schooner Wastewater Treatment Plant:
 - Air blower #2 replacement
 - HMI replacement
 - RAS pump replacement
 - VFD replacement
- Chart Drive Pump Station site ground well pump replacement

- Emergency storm event response November 14/15 that resulted in significant overflows at various sites
- Emergency response due to cold weather event December 28 causing freezing of infrastructure various sites

Sewer Service Capital Project Updates

The Capital Projects that were in progress in 2021 included:

1. Wastewater Infrastructure Renewal – Sewer Replacement.

After public consultation a referendum was held on November 23, 2019 to borrow up to \$6 million to complete Phase 1 upgrades. The referendum was successful and a design consultant (Stantec) was retained to complete the design of about 3km of sewer pipe replacement. The design was tendered in December 2020 and closed in February 2021. A contract was awarded and construction commenced in May and was substantially completed by December 2021. The next phase of sewer replacement work will occur after the pump station and treatment plant work has commenced so that the remaining funds from the \$6 million loan are known prior to making further commitments.

2. Wastewater Infrastructure Renewal – Pump Station and Treatment Plant Upgrades.

In 2020, the CRD submitted a grant application to the “Investing in Canada Infrastructure Program” for \$5.65 million of additional funding to complete the following work:

- Renew Buccaneer, Galleon, Schooner, Capstan, Cutlass and Masthead Pump Stations;
- Replace Cannon WWTP with a new pump station; and
- Upgrade Schooner WWTP.

The grant was approved in late summer 2021. A Request for Proposals was issued in the fall and McElhanney Ltd. was retained to complete the design of the upgrades. It is anticipated that the design will be tendered in the third quarter of 2022 and construction will commence in 2023.

Refer to the website <https://www.crd.bc.ca/project/capital-projects/magic-lake-estates-wastewater-system-infrastructure-replacement-project-infrastructure-replacement-project> for more information.

Financial Report

Please refer to the attached 2021 Statement of Operations and Reserve Balances.

Revenue includes parcel taxes (Transfers from Government), fixed user fees (User Charges), interest on savings (Interest earnings), a transfer from the maintenance reserve account, and miscellaneous revenue such as late payment charges (Other revenue).

Expenses include all costs of providing the service. General Government Services include budget preparation, financial management, utility billing and risk management services. CRD Labour and Operating Costs include CRD staff time as well as the cost of equipment, tools and vehicles. Debt servicing costs are interest and principal payments on long term debt. Other Expenses include all other costs to administer and operate the water and sewer systems, including insurance, supplies, water testing and electricity.

The difference between Revenue and Expenses is reported as Net revenue (expenses). Any transfers to or from capital or reserve accounts for the service (Transfers to Own Funds) are

deducted from this amount and added to any surplus or deficit carry forward from the prior year, yielding an Accumulated Surplus (or deficit) that is carried forward to the following year. As of December 31, 2021, the accumulated deficit in Magic Lake Sewer-Debt Only (\$6 million) was \$7,772. In alignment with Local Government Act Section 374 (11), if actual expenditures exceed actual revenues, any deficiency must be included in the next years' financial plan. The financial plan approved by CRD Board on March 16, 2022 incorporated this deficit.

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Attachment: 2021 [Statement of Operations and Reserve Balances](#)

For questions related to this Annual Report please email IWSAdministration@crd.bc.ca

Table 1

Table 1: 2021 Summary of Raw Water Test Results, Magic Lake Estates Water System									
PARAMETER		2021 ANALYTICAL RESULTS				CANADIAN GUIDELINES	2011 - 2020 RESULTS		
Parameter Name	Units of Measure	Annual Median	Samples Analyzed	Range Minimum Maximum		≤ = Less than or equal to	Median	Samples Analyzed	Range Minimum-Maximum
(ND means Not Detected by analytical method used)									
Physical/Biological Parameters									
Buck Lake									
Carbon, Total Organic	mg/L	6.5	11	5.8	7.6		6.63	68	5.60 - 9.84
Colour, True	TCU	11.0	17	7.0	27.0	≤ 15 AO	13.2	100	7.8 - 28.0
Hardness as CaCO ₃	mg/L	62.5	4	60.9	65.3	No Guideline Required	65.8	35	32.6 - 91.9
pH	pH units		Not tested in 2021			7.0 - 10.5 AO	7.7	32	6.9 - 8.8
Turbidity	NTU	0.7	17	0.45	2.3		1.14	168	0.36 - 10.0
Magic Lake									
Carbon, Total Organic	mg/L	8.5	11	7.6	11.0		8.61	64	6.76 - 11.0
Colour, True	TCU	27.0	17	18.0	44.0	≤ 15 AO	22.0	46	6.0 - 50.0
Hardness as CaCO ₃	mg/L	54.8	4	51.4	64.8	No Guideline Required	60.2	33	30.9 - 96.0
pH	pH units		Not tested in 2021			7.0 - 10.5 AO	7.5	26	6.9 - 8.1
Turbidity	NTU	1.4	17	0.95	4.6		1.4	147	0.19 - 24.5
Non-Metallic Inorganic Chemicals									
Buck Lake									
Silicon	mg/L as Si	5.1	4	4.52	5.96		5.11	35	4.6 - 11.9
Magic Lake									
Silicon	mg/L as Si	1.88	4	1.62	2.33		1.17	33	ND - 5.76
Metals									
Buck Lake									
Aluminum	ug/L as Al	18.4	4	3.2	64.4	2900 MAC / 100 OG	10.5	35	ND - 194
Antimony	ug/L as Sb	ND	4	ND	ND	6 MAC	ND	35	0.04 - 0.58
Arsenic	ug/L as As	0.38	4	0.34	0.45	10 MAC	0.42	35	0.31 - 1.25
Barium	ug/L as Ba	9.85	4	7.5	11.6	1000 MAC	10.7	34	7.8 - 21.9
Beryllium	ug/L as Be	ND	4	ND	ND		ND	35	ND
Bismuth	ug/L as Bi	ND	4	ND	ND		ND	27	ND - 0.07
Boron	ug/L as B	ND	4	ND	ND	5000 MAC	ND	35	ND - 656
Cadmium	ug/L as Cd	ND	4	ND	ND	5 MAC	ND	35	ND
Calcium	mg/L as Ca	17.2	4	16.9	17.7	No Guideline Required	18.1	35	6.58 - 21.4
Chromium	ug/L as Cr	ND	4	ND	ND	50 MAC	ND	35	ND
Cobalt	ug/L as Co	ND	4	ND	ND		0.35	35	ND - 0.20
Copper	ug/L as Cu	0.65	4	0.59	0.75	2000 MAC / ≤ 1000 AO	1.48	35	0.36 - 37.3
Iron	ug/L as Fe	62.5	4	14.9	263.0	≤ 300 AO	62.0	35	12.0 - 507.0
Lead	ug/L as Pb	ND	4	ND	ND	5 MAC	ND	35	ND - 3.70
Lithium	ug/L as Li	ND	4	ND	ND		ND	13	ND - 0.88
Magnesium	mg/L as Mg	4.7	4	4.5	5.2	No Guideline Required	4.99	35	3.92 - 9.34
Manganese	ug/L as Mn	30.7	4	15.7	163.0	120 MAC / ≤ 20 AO	34.0	35	10.0 - 506
Molybdenum	ug/L as Mo	ND	4	ND	ND		ND	35	0.01 - 28.0
Nickel	ug/L as Ni	ND	4	ND	ND		ND	35	ND
Potassium	mg/L as K	1.18	4	1.14	1.25		1.17	35	0.51 - 5.28
Selenium	ug/L as Se	ND	4	ND	ND	50 MAC	ND	35	0.1 - 0.74
Silver	ug/L as Ag	ND	4	ND	ND	No Guideline Required	ND	35	ND
Sodium	mg/L as Na	10.5	4	10.2	11.4	≤ 200 AO	11.0	35	8.75 - 23.2
Strontium	ug/L as Sr	118.5	4	111.0	123.0	7000 MAC	117	35	81.0 - 134
Sulphur	mg/L as S	ND	4	ND	ND		ND	27	ND - 4.10
Tin	ug/L as Sn	ND	4	ND	ND		ND	35	ND
Titanium	ug/L as Ti	ND	4	ND	ND		ND	35	ND
Thallium	ug/L as Tl	ND	4	ND	ND		ND	27	ND
Uranium	ug/L as U	ND	4	ND	ND	20 MAC	ND	27	ND - 0.01
Vanadium	ug/L as V	ND	4	ND	ND		ND	35	ND - 0.28
Zinc	ug/L as Zn	ND	4	ND	ND	≤ 5000 AO	ND	35	ND - 205
Zirconium	ug/L as Zr	ND	4	ND	ND		ND	27	ND
Magic Lake									
Aluminum	ug/L as Al	28.0	4	4.9	131.0	2900 MAC / 100 OG	31.4	33	ND - 713
Antimony	ug/L as Sb	ND	4	ND	ND	6 MAC	ND	33	ND
Arsenic	ug/L as As	0.50	4	0.35	0.82	10 MAC	ND	33	ND - 2.75
Barium	ug/L as Ba	15.1	4	12.6	18.2	1000 MAC	15.1	33	ND - 84.9
Beryllium	ug/L as Be	ND	4	ND	ND		ND	33	ND
Bismuth	ug/L as Bi	ND	4	ND	ND		ND	25	ND
Boron	ug/L as B	ND	4	ND	ND	5000 MAC	ND	33	ND
Cadmium	ug/L as Cd	ND	4	ND	ND	5 MAC	ND	33	ND - 0.01
Calcium	mg/L as Ca	14.2	4	12.7	16.2	No Guideline Required	15.2	33	5.01 - 19.8
Chromium	ug/L as Cr	ND	4	ND	ND	50 MAC	ND	33	ND
Cobalt	ug/L as Co	ND	4	ND	ND		ND	33	ND
Copper	ug/L as Cu	1.49	4	0.5	1.64	2000 MAC / ≤ 1000 AO	1.64	33	0.43 - 57.0
Iron	ug/L as Fe	276.5	4	155.0	349.0	≤ 300 AO	208	33	50.0 - 4260
Lead	ug/L as Pb	ND	4	ND	ND	5 MAC	ND	33	ND - 1.42
Lithium	ug/L as Li	ND	4	ND	ND		ND	16	ND
Magnesium	mg/L as Mg	4.83	4	4.55	5.89	No Guideline Required	5.58	33	4.46 - 11.5
Manganese	ug/L as Mn	86.7	4	8.7	289.0	120 MAC / ≤ 20 AO	47.0	33	2.80 - 5000
Molybdenum	ug/L as Mo	ND	4	ND	ND		ND	33	ND - 27.0
Nickel	ug/L as Ni	ND	4	ND	ND		ND	33	ND
Potassium	mg/L as K	1.17	4	0.94	1.24		1.09	33	0.17 - 10.8
Selenium	ug/L as Se	ND	4	ND	ND	50 MAC	ND	33	ND
Silver	ug/L as Ag	ND	4	ND	ND	No Guideline Required	ND	33	ND
Sodium	mg/L as Na	10.7	4	10.6	12.0	≤ 200 AO	11.2	33	9.02 - 39.6
Strontium	ug/L as Sr	96.3	4	86.0	121.0	7000 MAC	109.0	33	75.0 - 158
Sulphur	mg/L as S	ND	4	ND	ND		ND	25	ND - 3.70
Tin	ug/L as Sn	ND	4	ND	ND		ND	33	ND
Titanium	ug/L as Ti	ND	4	ND	ND		ND	33	ND - 22.0
Thallium	ug/L as Tl	ND	4	ND	ND		ND	25	ND
Uranium	ug/L as U	ND	4	ND	ND	20 MAC	ND	25	ND - 0.19
Vanadium	ug/L as V	ND	4	ND	ND		ND	33	ND
Zinc	ug/L as Zn	ND	4	ND	ND	≤ 5000 AO	ND	33	ND - 215
Zirconium	ug/L as Zr	ND	4	ND	0.22		ND	25	ND
Microbial Parameters									
Indicator Bacteria (Buck Lake)									
Coliform, Total	CFU/100 mL	40	17	3	460		66	193	ND - 10 400
<i>E. coli</i>	CFU/100 mL	ND	17	ND	4		ND	193	ND - 200
Hetero. Plate Count, 7 day	CFU/1 mL		Not tested in 2021				1345	64	330 - 5800
Indicator Bacteria (Magic Lake)									
Coliform, Total	CFU/100 mL	780	17	189	6000		ND	144	ND - 8 400
<i>E. coli</i>	CFU/100 mL	ND	17	ND	18		2	151	ND - 115
Hetero. Plate Count, 7 day	CFU/1 mL		Not tested in 2021				2600	59	370 - 20000
Parasites (Buck Lake)									
<i>Cryptosporidium</i> , Total oocysts	oocysts/100 L	ND	2	ND	ND	Zero detection desirable	ND	17	ND - 1.45
<i>Giardia</i> , Total cysts	cysts/100 L	ND	2	ND	ND	Zero detection desirable	ND	17	ND
Parasites (Magic Lake)									
<i>Cryptosporidium</i> , Total oocysts	oocysts/100 L	ND	2	ND	ND	Zero detection desirable	ND	16	ND - 5.30
<i>Giardia</i> , Total cysts	cysts/100 L	ND	2	ND	ND	Zero detection desirable	ND	16	ND

Table 2

Table 2: 2021 Summary of Treated Water Test Results, Magic Lake Estates Water System									
PARAMETER		2021 ANALYTICAL RESULTS				CANADIAN GUIDELINES	2011 - 2020 RESULTS		
Parameter Name	Units of Measure	Annual Median	Samples Analyzed	Range Min. Max.		≤ = Less than or equal to	Median	Samples Analyzed	Range Min.-Max.
ND means Not Detected by analytical method used									
Physical Parameters									
Carbon, Total Organic	mg/L as C	3.7	19	3.1	5.1		4.0	123	ND - 43.5
Colour, True	TCU	ND	119	ND	3.0	15 AO	ND	506	ND - 5.0
Hardness as CaCO3	mg/L	61.2	12	58.1	65.2		65.3	73	58.8 - 72.1
pH	No units		Not tested in 2021			7.0-10.5 AO	7.16	29	6.89 - 7.7
Turbidity	NTU	ND	125	ND	4.4	1 MAC and ≤ 5 AO	0.17	992	0.11 - 3.9
Water Temperature	Degrees C	11.8	260	3.9	23.1	≤ 15 C°C	11.5	6043	4.5 - 24.0
Microbial Parameters									
Indicator Bacteria									
Coliform, Total	CFU/100 mL	ND	207	ND	1	0 MAC	ND	1476	ND - 45
<i>E. coli</i>	CFU/100 mL	ND	207	ND	ND	0 MAC	ND	1478	ND - 2
Hetero. Plate Count, 7 day	CFU/1 mL	340	6	ND	1300	No Guideline Required	ND	162	ND - 140
Disinfectants									
Disinfectants									
Chlorine, Free Residual	mg/L as Cl2	0.47	262	0.02	1.74	No Guideline Required	0.31	6767	0.0 - 3.40
Chlorine, Total Residual	mg/L as Cl ₂	0.68	205	0.13	1.96	No Guideline Required	0.66	6636	0.01 - 3.8
Disinfection By-Products									
Trihalomethanes (THMs)									
Bromodichloromethane	ug/L	17.5	8	12.0	24.0		17.0	53	11.2- 29.4
Bromoform	ug/L	ND	8	ND	ND		ND	53	ND
Chloroform	ug/L	52.0	8	32.0	87.0		49.0	49	ND - 6.39
Chlorodibromomethane	ug/L	3.6	8	2.2	4.0		3.1	52	18.8 - 100
Total Trihalomethanes	ug/L	73.0	8	46.0	120.0	100 MAC	69.8	53	25.9 - 125
Haloacetic Acids (HAAs)									
HAA5	ug/L	38.5	8	32.0	46.0	80 MAC	19.7	4	21.4 - 15.2
Metals									
Aluminum	ug/L as Al	26.2	12	14.0	92.4	2900 MAC / 100 OG	25.7	73	11.7 - 186.0
Antimony	ug/L as Sb	ND	12	ND	ND	6 MAC	ND	73	ND - 0.03
Arsenic	ug/L as As	0.2	12	0.15	0.36	10 MAC	0.22	73	0.14 - 0.32
Barium	ug/L as Ba	7.6	12	6.8	8.8	1000 MAC	7.90	73	6.0 - 10.7
Beryllium	ug/L as Be	ND	12	ND	ND		ND	73	ND
Bismuth	ug/L as Bi	ND	12	ND	ND		ND	73	ND
Boron	ug/L as B	ND	12	ND	ND	5000 MAC	ND	73	ND
Cadmium	ug/L as Cd	ND	12	ND	ND	5 MAC	ND	73	ND
Calcium	mg/L as Ca	16.9	12	15.8	17.5	No Guideline Required	17.7	73	16.0 - 19.8
Chromium	ug/L as Cr	ND	12	ND	ND	50 MAC	ND	73	ND
Cobalt	ug/L as Co	ND	12	ND	ND		ND	73	ND - 0.02
Copper	ug/L as Cu	12.0	12	0.35	23.3	2000 MAC / ≤ 1000 AO	9.29	73	0.25 - 19.8
Iron	ug/L as Fe	ND	12	ND	19.1	≤ 300 AO	8.7	73	2.4 - 34.5
Lead	ug/L as Pb	0.68	12	ND	1.67	5 MAC	0.41	73	ND - 1.66
Lithium	ug/L as Li	ND	12	ND	ND		ND	30	ND - 0.85
Magnesium	mg/L as Mg	4.67	12	4.31	5.53	No Guideline Required	5.1	73	4.44 - 5.70
Manganese	ug/L as Mn	3.65	12	ND	33.8	120 MAC / ≤ 20 AO	3.9	73	ND - 190.0
Molybdenum	ug/L as Mo	ND	12	ND	ND		ND	73	ND - 0.05
Nickel	ug/L as Ni	ND	12	ND	ND		ND	73	0.31 - 2.80
Potassium	mg/L as K	1.35	12	1.28	1.58		1.37	73	1.17 - 1.63
Selenium	ug/L as Se	ND	12	ND	ND	50 MAC	ND	73	ND - 0.11
Silicon	ug/L as Si	4105	12	2790	5140		4070	73	4.13 - 5080
Silver	ug/L as Ag	ND	12	ND	ND	No Guideline Required	ND	73	ND
Sodium	mg/L as Na	12.8	12	11.6	14.7	≤ 200 AO	13.9	73	12.0 - 14.9
Strontium	ug/L as Sr	115	12	105	125	7000 MAC	119	73	102 - 133
Sulphur	mg/L as S	ND	12	ND	ND		ND	73	ND - 4.50
Tin	ug/L as Sn	ND	12	ND	ND		ND	73	ND
Titanium	ug/L as Ti	ND	12	ND	ND		ND	73	ND
Thallium	ug/L as Tl	ND	12	ND	ND		ND	73	ND
Uranium	ug/L as U	ND	12	ND	ND	20 MAC	ND	73	ND
Vanadium	ug/L as V	ND	12	ND	ND		ND	73	ND
Zinc	ug/L as Zn	5.9	12	ND	27.2	≤ 5000 AO	ND	73	2.02 - 39.7
Zirconium	ug/L as Zr	ND	12	ND	ND		ND	72	ND