

# Magic Lake Estates Water and Sewer System

2023 Annual Report

**CRD** | Drinking Water and Wastewater

## Introduction

This report provides a summary of the Magic Lake Estates (MLE) Water and Sewer Service for 2023 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 1,196 parcels, of which there are 1,059 single family equivalents (or approximately the same amount of customers) obtaining service from the water system.

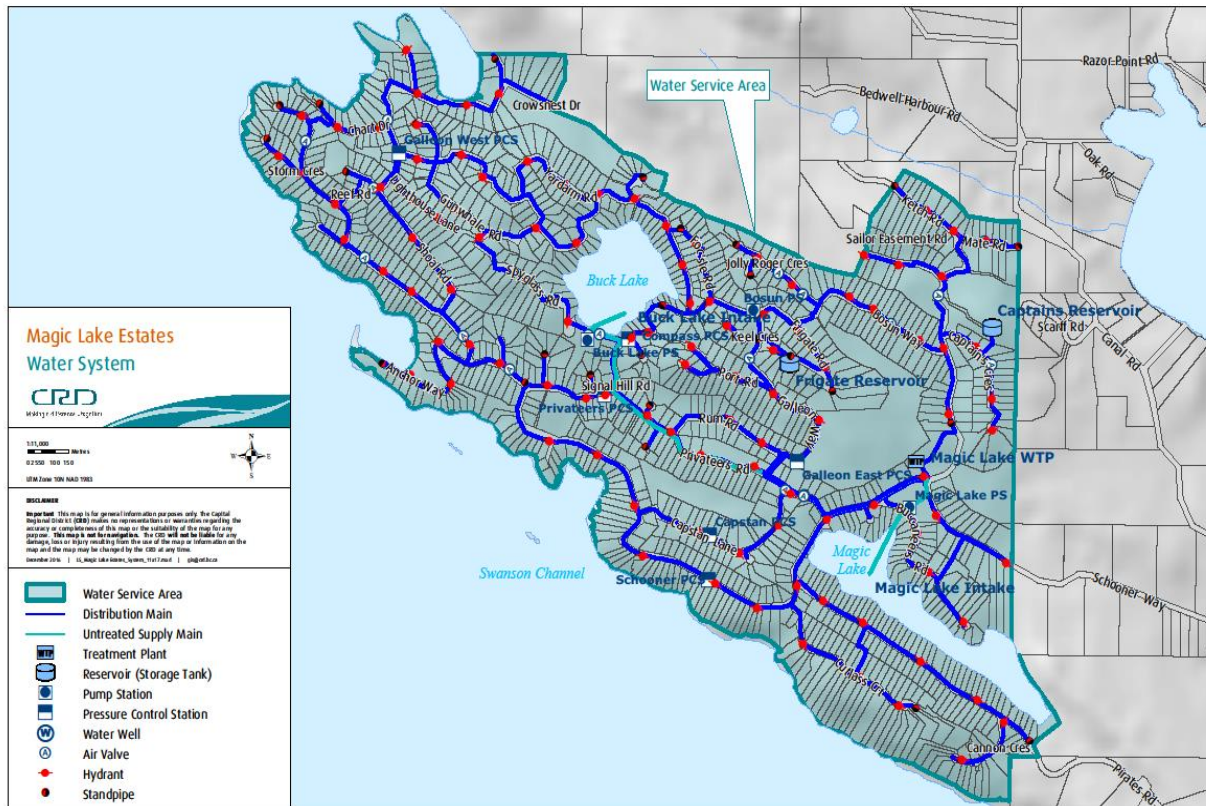


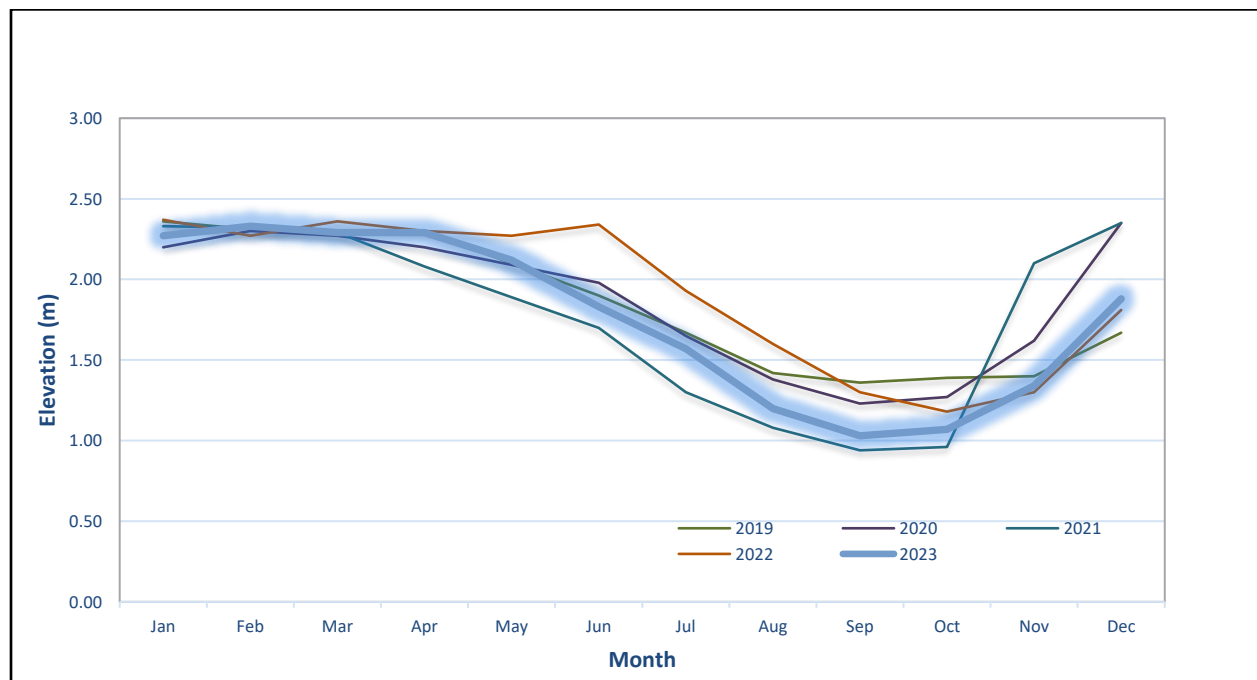
Figure 1: Map of Magic Lake Estates Water System

The Magic Lake Estates water system is primarily comprised of:

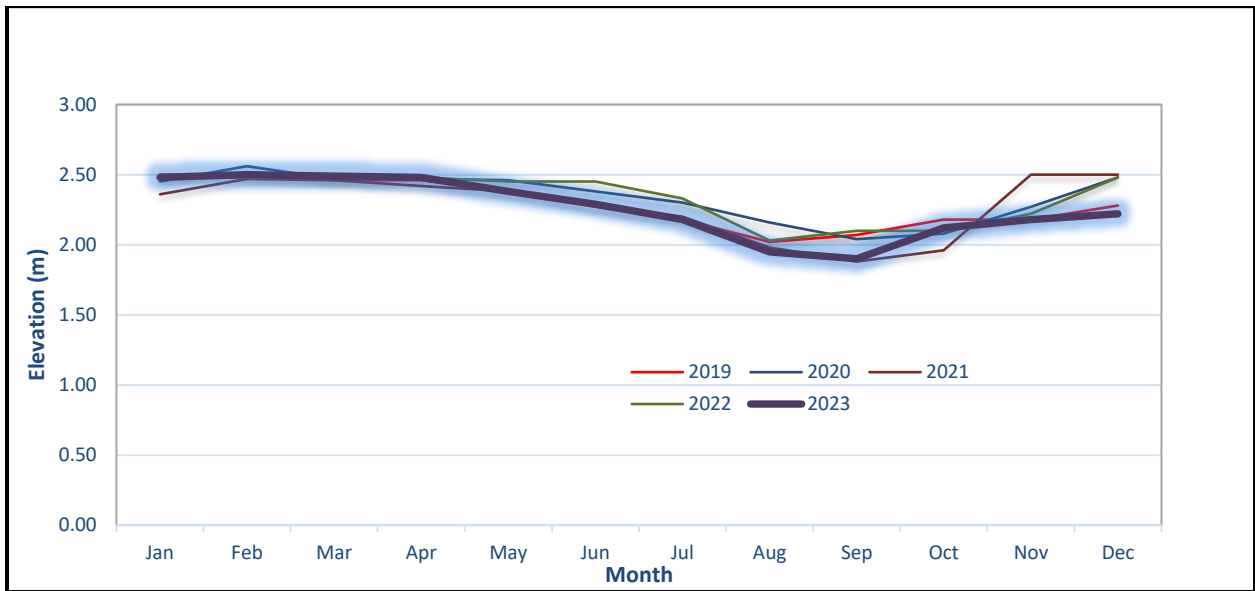
- Two raw water sources; Buck Lake (primary source) and Magic Lake (secondary source).
- Four earthen dam structures (two at Buck Lake and two at Magic Lake).
- Two raw water pump stations, one each related to the raw water supplies, with pretreatment oxidation equipment to treat and control dissolved 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: 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 for the month of August.



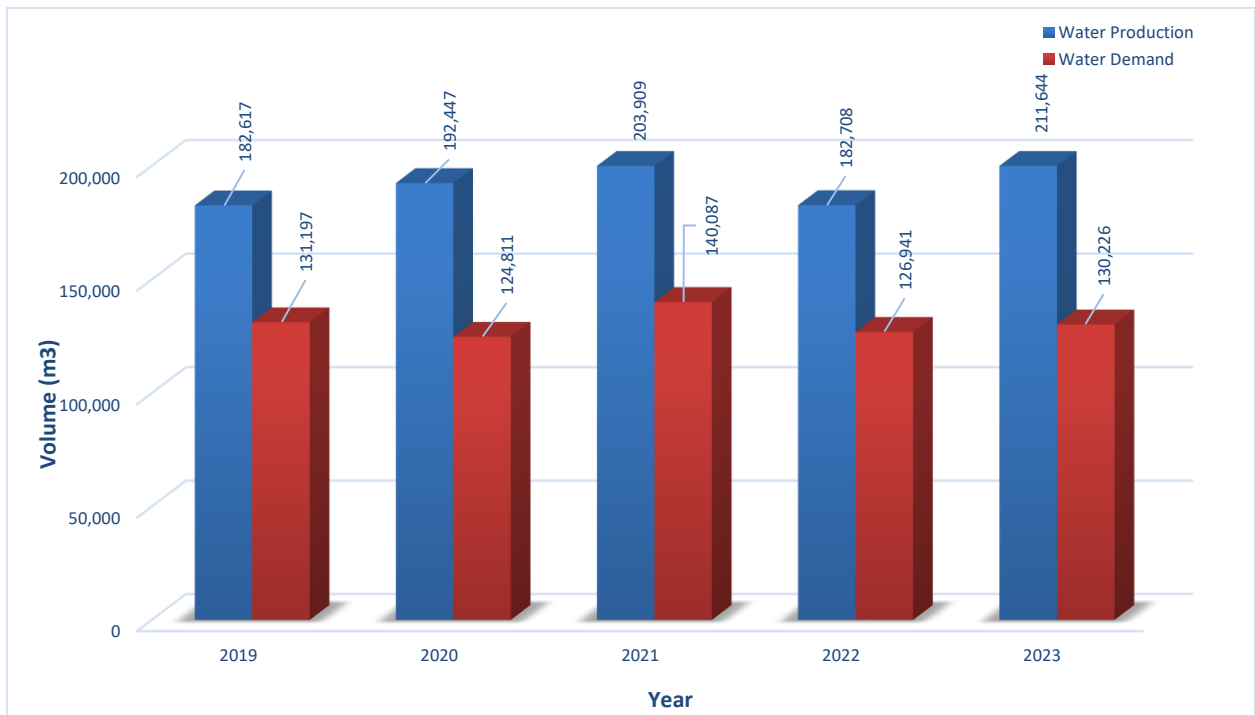
**Figure 2: Buck Lake Monthly Water Level**



**Figure 3: Magic Lake Monthly Water Level**

### Water Production and Demand

Referring to Figure 4, 211,644 cubic meters of water was extracted (water production) from both Buck Lake and Magic Lake water sources in 2023; a 16% increase from the previous year and an 15% increase in the rolling five-year average. Water demand (customer water billing) for the service totaled 130,226 cubic meters of water; a 3% increase from the previous year and a 1% increase from the rolling five-year average.

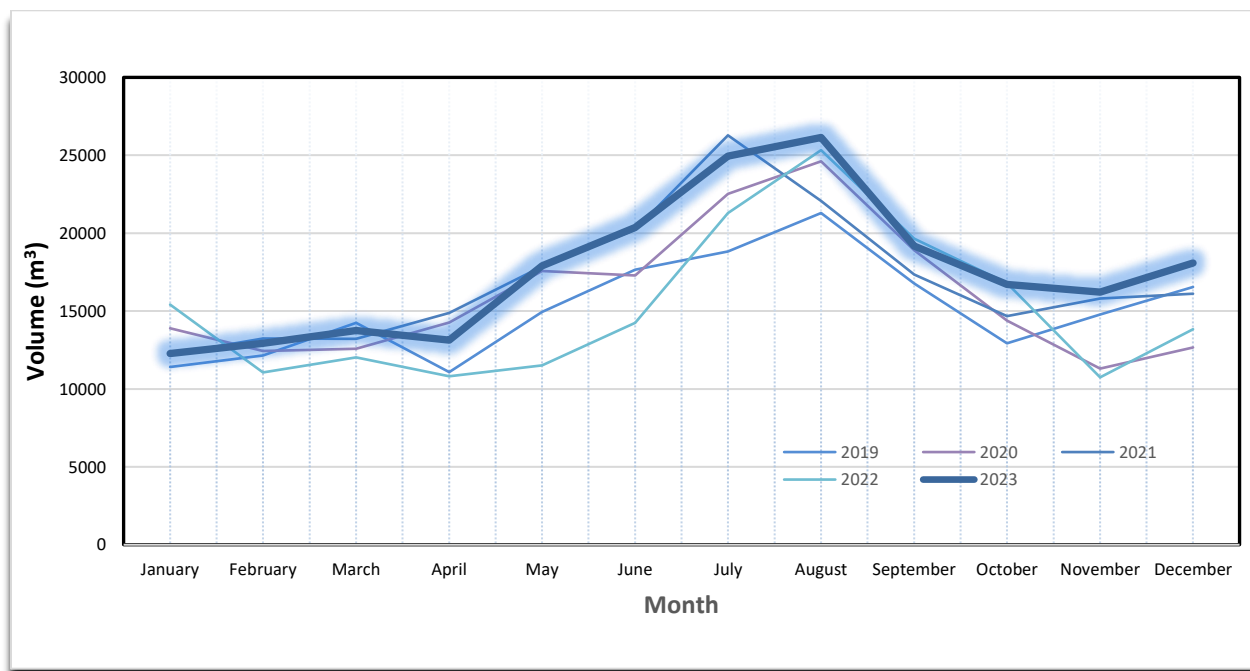


**Figure 4: Magic Lake Estates Water System Annual Water Production and Demand**

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 2023 non-revenue water (81,418 cubic meters) represents about 39% 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 36% which is an increase from the previous year is considered to be high for a water distribution system the size of Magic Lake Estates. Effort to determine the reason for the increase in non-revenue water including leak detection activities is required.

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 2023 (highlighted below), the monthly trend for August through December is higher than the previous years and is likely the result of water system leak or leaks developing in the system.



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

### Drinking Water Quality

Two intake lines from Buck Lake and Magic Lake provided blended source water to the DAF treatment plant. The typical intake blending ratio in 2023 was 80/20 Buck/Magic Lake. Magic Lake experienced a cyanobacteria bloom in May and June with the peak at the end of June. Fortunately, no cyanotoxins were detected in the source water throughout this algal event. Buck Lake did not experience a cyanobacteria bloom in 2023. The drinking water supplied to the service area was safe for consumption throughout the year.

The existing multi-barrier treatment system was able to deal with several algal events as well as high 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/odour/colour implications and can potentially lead to high disinfection by-product concentrations. Testing for total trihalomethanes in the treated water demonstrated levels in compliance with the GCDWQ. 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 2023 are summarized below.

#### Raw Water:

- Both lake sources exhibited low concentrations of total coliform bacteria throughout the winter months but higher concentration during the warm water period. In Magic Lake, the peak total coliform bacteria concentration was 3,300 CFU/100mL in mid-September. This was in line with previous summers. Buck Lake saw a total coliform spike of 410 CFU/100 mL at the end of June, which was much lower than last year.
- 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 (61 – 65 mg/L CaCO<sub>3</sub>).
- Buck Lake exhibited a raw water turbidity range from 0.4 to 2.1 nephelometric turbidity units (NTU) with an annual median of 0.65 NTU, and Magic Lake a range from 1.1 to 4.1 NTU with an annual median of 1.9 NTU. The higher turbidity occurred typically during the winter period, but also occasionally in summer periods with increased algal activity. The turbidity in both lakes was generally consistent with historical turbidity trends.
- Buck Lake, with an annual median total organic carbon (TOC) of 7.5 mg/L, and Magic Lake, with a median TOC of 9.9 mg/L, are considered mesotrophic lakes (medium productivity). TOC levels have been rising over the last few years, which could be an indication of increasing lake productivity.
- Buck Lake has higher colour results during the winter period. Magic Lake's water exceeds the aesthetic objective for water colour all year. This indicates elevated concentration of organics in the water.
- Both lakes exhibited seasonally elevated iron and manganese concentrations which reached peaks of 246 µg/L (Fe) in May and 53.6 µg/L (Mn) in May in Magic Lake, and 195 µg/L (Fe) in February and 206 µg/L (Mn) in November in Buck Lake. These metal concentrations were in line with long term trends.

#### Treated Water:

- Treated water was bacteriologically safe to drink with no E. coli bacteria found in the treated water. Only two samples from the distribution system recorded very low concentrations of total coliform bacteria (both in March). Immediate resamples from the same sampling stations 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 except for a very few isolated samples exceeding this limit, mostly associated with operational activities such as flushing or pipe repairs.
- Total organic carbon (TOC median 3.6 mg/L) was consistent with results in previous years. A 59% reduction of TOC compared with the source water TOC concentrations 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 consistently 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 total trihalomethanes (TTHM) were in compliance with the annual average requirement in the GCDWQ; no individual samples did exceed the GCDWQ limit of 100 µg/L. TTHM concentrations fluctuated between 52 and 87 µg/L for an annual average of 67 µg/L. Haloacetic acids (HAA) were not tested in 2023 but are typically low when TTHM are low.
- 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 September and mid-October.
- The newly established GCDWQ MAC for aluminum was at no time in 2023 exceeded.

The attached Table 1 and 2 provide a summary of the 2023 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:

- Water Treatment Plant:
  - Corrective maintenance filter rinse tank to recycle water pump 460 coupling replacement.
  - Corrective maintenance Train 2 DAF skimmer chain and sprockets replacements.
  - Replacement of failed chlorine analyzer equipment.
  - Replacement of failed clarification tank level transducer.
- Water system leak/break repairs:
  - Ketch Road – February 7
  - Gunwhale Road – July 25
  - Ketch Road – August 13
  - Intersection of Privateers and Doubloon (standpipe riser cracked) – July 31
- Captains Reservoir (Tank) Metal thickness assessment - April
- Emergency response due to extended freezing weather event. The exposed pipe to Captains Reservoir froze.

### **Water System Capital Project Updates**

The Capital Projects that were in progress or completed in 2023 included:

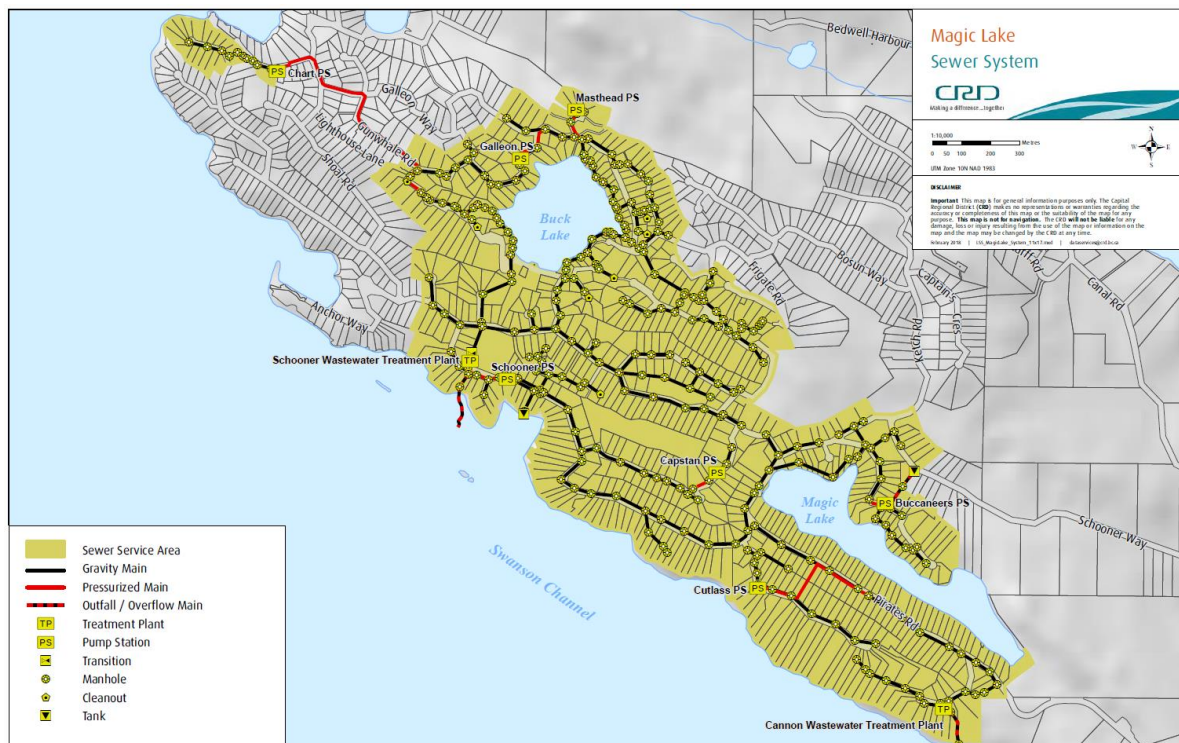
1. Buck Lake and Magic Lake Adjustable Intakes – A construction contract was in place and fabrication of the floating intake platforms was completed. Installation was pushed into 2024.
2. Buck Lake Dam Repairs – Phase 1 – Dam breach analysis finalized. Seepage weir project initiated.

3. Failed valve replacements – valves replaced.
4. EV Charging Station – completed.

## **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 709 parcels of which 642 are serviced. Some of the sewer infrastructure includes: 16 km of sewer pipe, 316 manholes, seven pump stations, and two treatment plants each with an outfall into Swanson Channel.



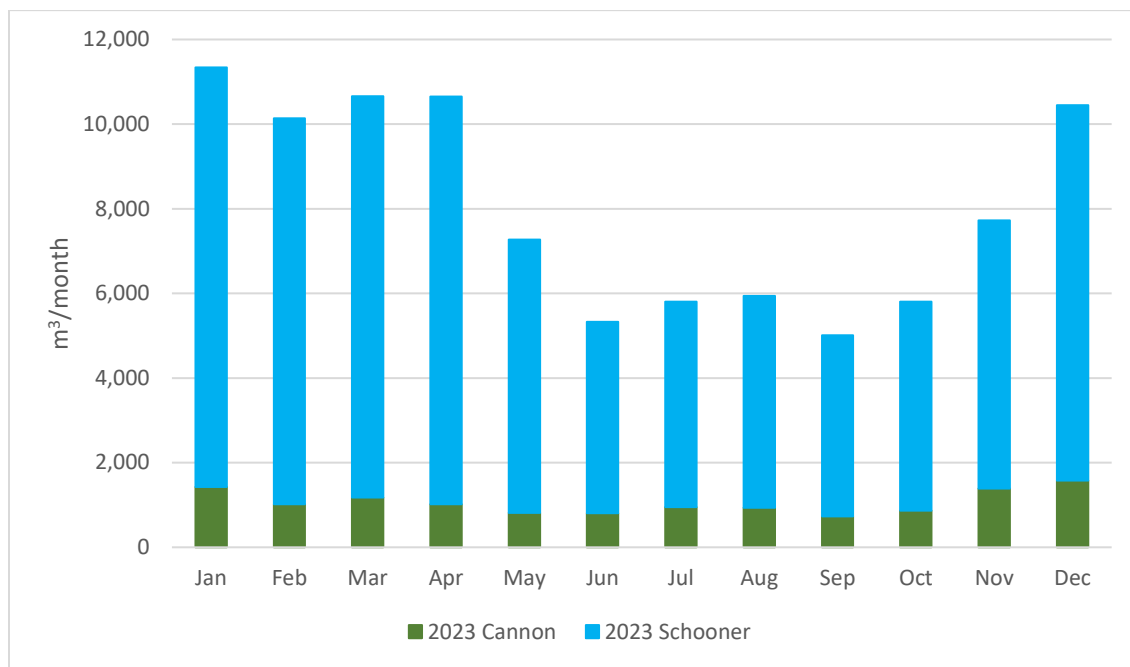
**Figure 5: Map of Magic Lake Estates Sewer System**

### **Wastewater Flows**

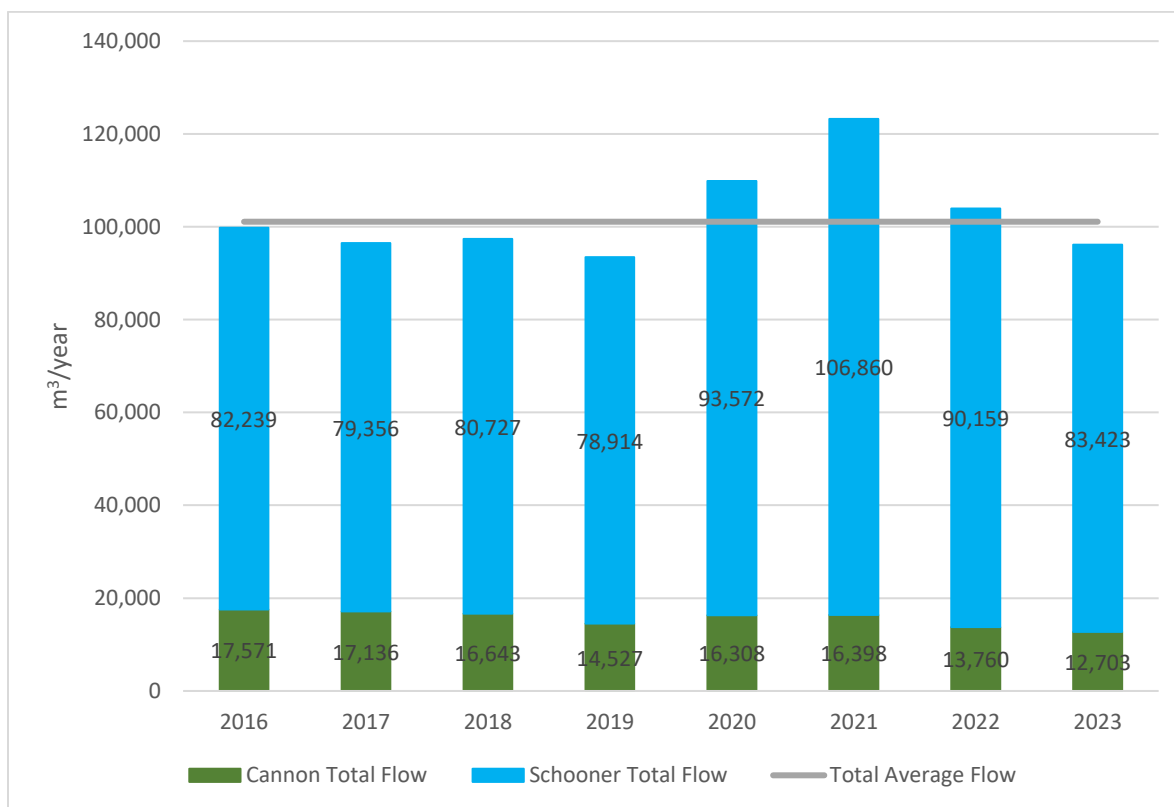
The total monthly and 8-year total annual flows are shown in Figures 6 and 7 below. The graphs indicate that the 2023 wastewater flows were about 7% lower than 2022 and about 5% lower than the 8-year average. The monthly flows show lowest flows in the summer months when there is less rain, but the more significant variation occurs in the winter due to inflow and infiltration (where January had 2 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)**



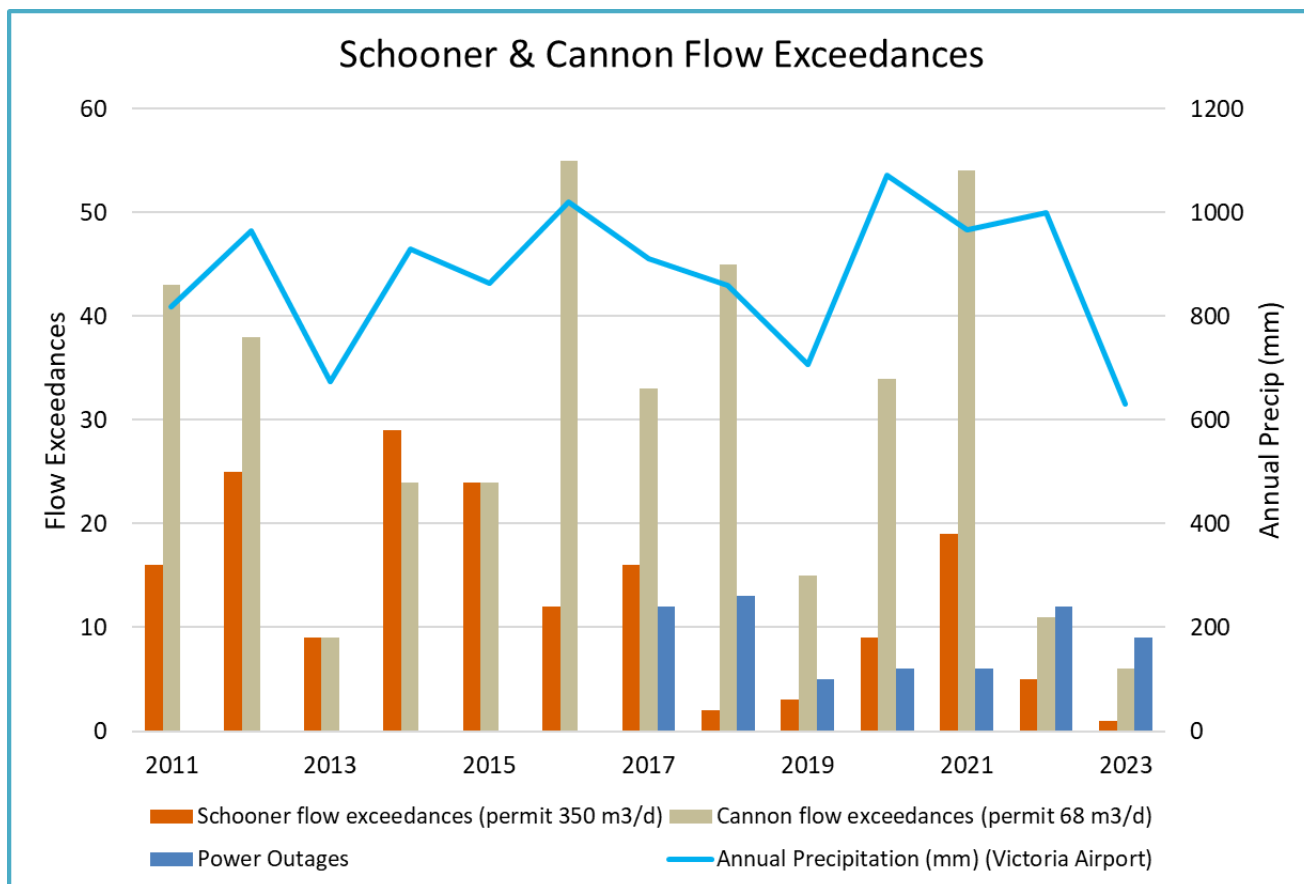
**Figure 7: Total Wastewater Flows (m³/year)**

### 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. In 2023, treated wastewater from Cannon met all regulatory limits for total suspended solids (TSS) and carbonaceous biochemical oxygen demand (CBOD), but had 6 flow exceedances.



At Schooner, there were 9 presumed or documented compliance exceedances due to power outages, as well as 2 sewer line breaks and 1 flow exceedance. Flow exceedances at both plants 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 2023 there were fewer flow exceedances than previous years, with 1 at Schooner and 6 at Cannon (totaling 7 in 2023 versus 16 in 2022, and 73 in 2021). This was primarily due to decreasing precipitation compared to previous years. The British Columbia 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.

There was no overflow/emergency receiving water sampling conducted in 2023.

### Sewer Service Operational Highlights

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

- Schooner Wastewater Treatment Plant

- Replacement of damaged valves due to freezing during January cold weather event; installation of additional freeze protection equipment
- Masthead Pump Station communications failure. The root cause of the failure was identified to be on the Telus infrastructure. Corrective maintenance was completed by Telus.
- Masthead Pump Station corrective maintenance that included troubleshooting and replacement of pumping control system equipment.
- Cutlass Court Pump Station corrective maintenance that included removing and de-ragging (removing obstructions) of the pumps.
- Buccaneers Pump Station corrective maintenance that included responding to a pump electrical overload condition. The pumps required removal for further troubleshooting and repairs.
- Operations assistance at the Schooner Wastewater Treatment Plant Capital Project upgrades on July 11 when the contractor inadvertently struck and damaged an active sewer pipe infrastructure resulting in a sewage spill.
- Emergency response to sewer blockage on Cannon Crescent. Sewer blockage determined to be on a service lateral connection.
- Chart Drive sewage pump station pump corrective maintenance that included the replacement of a failed pump.

### **Sewer Service Capital Project Updates**

After public consultation, a referendum was held on November 23, 2019 to borrow up to \$6 million to use along with a \$5.65 million “Investing in Canada Infrastructure” grant to complete some sewer replacement; and renewal of some pump stations and the Schooner WWTP.

The Capital Projects that were in progress or completed in 2023 included:

1. Wastewater Infrastructure Renewal – Sewer Replacement (Phase 1)

In 2021-2022 about 3km of sewer pipe and 35 manholes were replaced in various locations in the sewer service area.

2. Wastewater Infrastructure Renewal – Pump Station and Treatment Plant Upgrades (Phase 2 & 3)

In June of 2023, construction commenced on the following items:

- Renew Galleon, Schooner pump station with new mechanical and electrical equipment including new standby generators;
- Install a brand-new pump station at Cannon to pump to Schooner WWTP and decommission the old Cannon WWTP; and
- Complete several upgrades at Schooner WWTP including, new headworks, equalization tank, membrane bioreactor treatment processes, sludge holding tank, a new operations building with blowers, pumps, electrical room, and control room.

The project was about 50% complete at the end of 2023 and it is anticipated to be substantially complete by the end of summer of 2024.

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.

In the near future, upgrades will have to be made to Buccaneer, Capstan, Cutlass and Masthead Pump Stations and additional sewer pipe replacement. An asset management plan will be updated in 2024 to reflect the current status of all the wastewater infrastructure.

## Financial Report

Please refer to the attached 2023 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 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 funds for the service (Transfers to Own Funds) are deducted from this amount and are 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.

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Attachments: Table 1  
Table 2  
2023 Statement of Operations and Reserve Balances

For questions related to this Annual Report please email [IWSAdministration@crd.bc.ca](mailto:IWSAdministration@crd.bc.ca)

Table 1

Table 1: 2023 Summary of Raw Water Test Results, Magic Lake Estates Water System										
PARAMETER		2023 ANALYTICAL RESULTS				CANADIAN GUIDELINES	2013 - 2022 ANALYTICAL 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)										
<b>Physical/Biological Parameters</b>										
<b>Buck Lake</b>										
Carbon, Total Organic	mg/L	7.45	12	6.6	8.2		6.61	90	5.3	9.84
Colour, True	TCU	14	17	9	24	≤ 15 AO	12	132	7	29
Hardness as CaCO <sub>3</sub>	mg/L	65.15	4	62.3	71.6	No Guideline Required	64.85	40	50.4	91.9
pH	pH units	Not tested in 2023				7.0 - 10.5 AO	7.67	27	6.86	8.78
Turbidity	NTU	0.65	17	0.4	2.1		1	163	0.36	10
<b>Magic Lake</b>										
Carbon, Total Organic	mg/L	9.9	12	8.4	11		8.6	86	6.4	11
Colour, True	TCU	25	15	16	43	≤ 15 AO	24	125	6	50
Hardness as CaCO <sub>3</sub>	mg/L	60.85	4	56	67.7	No Guideline Required	59.7	37	48.7	96
pH	pH units	7.66	1	7.66	7.66	7.0 - 10.5 AO	7.4	21	6.9	8.13
Turbidity	NTU	1.9	15	1.1	4.1		1.52	148	0.19	24.5
<b>Non-Metallic Inorganic Chemicals</b>										
<b>Buck Lake</b>										
Silicon	mg/L as Si	5190	4	4980	5350		5125	40	4.6	11900
<b>Magic Lake</b>										
Silicon	mg/L as Si	1295	4	540	1630		1290	37	281	5760
<b>Metals</b>										
<b>Buck Lake</b>										
Aluminum	ug/L as Al	9.9	4	< 3	10.2	2900 MAC / 100 OG	< 10	40	< 3	95.6
Antimony	ug/L as Sb	< 0.5	4	< 0.5	< 0.5	6 MAC	< 0.5	40	0.041	< 0.5
Arsenic	ug/L as As	0.345	4	0.31	0.44	10 MAC	0.4	40	0.31	0.654
Barium	ug/L as Ba	9.85	4	8	12.1	1000 MAC	9.95	40	7.5	21.9
Beryllium	ug/L as Be	< 0.1	4	< 0.1	< 0.1		< 0.1	40	< 0.01	< 3
Bismuth	ug/L as Bi	< 1	4	< 1	< 1		< 1	36	0.074	< 1
Boron	ug/L as B	< 50	4	< 50	< 50	5000 MAC	< 50	40	< 50	262
Cadmium	ug/L as Cd	< 0.01	4	< 0.01	< 0.01	7 MAC	< 0.01	40	< 0.005	< 0.1
Calcium	mg/L as Ca	17.75	4	16.9	19.9	No Guideline Required	17.85	40	13.6	21.4
Chromium	ug/L as Cr	< 1	4	< 1	< 1	50 MAC	< 1	40	< 0.1	< 10
Cobalt	ug/L as Co	< 0.2	4	< 0.2	< 0.2		< 0.2	40	0.089	0.2
Copper	ug/L as Cu	0.525	4	0.41	0.57	2000 MAC / ≤ 1000 AO	1.07	40	0.35	37.3
Iron	ug/L as Fe	55.05	4	22.4	195	≤ 300 AO	68.9	40	14.2	507
Lead	ug/L as Pb	< 0.2	4	< 0.2	< 0.2	5 MAC	< 0.2	40	< 0.2	3.7
Lithium	ug/L as Li	< 2	4	< 2	< 2		< 2	22	< 2	< 2
Magnesium	mg/L as Mg	5.07	4	4.84	5.33	No Guideline Required	4.955	40	4	9.34
Manganese	ug/L as Mn	49.15	4	16.3	206	120 MAC / ≤ 20 AO	40.25	40	11	506
Molybdenum	ug/L as Mo	< 1	4	< 1	< 1		< 1	40	0.065	< 20
Nickel	ug/L as Ni	< 1	4	< 1	1.6		< 1	40	< 0.5	< 50
Potassium	mg/L as K	1.245	4	1.18	1.28		1.16	40	0.509	1.38
Selenium	ug/L as Se	< 0.1	4	< 0.1	< 0.1	50 MAC	< 0.1	40	0.047	< 0.5
Silver	ug/L as Ag	< 0.02	4	< 0.02	< 0.02	No Guideline Required	< 0.02	40	< 0.001	< 10
Sodium	mg/L as Na	11	4	10.3	12	≤ 200 AO	11	40	8.75	12.7
Strontium	ug/L as Sr	122	4	115	126	7000 MAC	117	40	81	134
Sulphur	mg/L as S	< 3	4	< 3	< 3		< 3	36	< 3	4.1
Tin	ug/L as Sn	< 5	4	< 5	< 5		< 5	40	< 0.2	< 20
Titanium	ug/L as Ti	< 5	4	< 5	< 5		< 5	40	< 0.5	< 10
Thallium	ug/L as Tl	< 0.01	4	< 0.01	< 0.01		< 0.01	36	< 0.002	< 0.05
Uranium	ug/L as U	< 0.1	4	< 0.1	< 0.1	20 MAC	< 0.1	36	0.012	< 0.1
Vanadium	ug/L as V	< 5	4	< 5	< 5		< 5	40	0.28	< 10
Zinc	ug/L as Zn	< 5	4	< 5	< 5	≤ 5000 AO	< 5	40	< 1	205
Zirconium	ug/L as Zr	< 0.1	4	< 0.1	< 0.1		< 0.1	36	< 0.1	< 0.5
<b>Magic Lake</b>										
Aluminum	ug/L as Al	15.85	4	3.6	34.6	2900 MAC / 100 OG	22.3	37	< 0.01	713
Antimony	ug/L as Sb	< 0.5	4	< 0.5	< 0.5	6 MAC	< 0.5	37	< 0.5	< 0.5
Arsenic	ug/L as As	0.47	4	0.39	0.7	10 MAC	< 0.5	37	0.35	2.75
Barium	ug/L as Ba	14.6	4	13.5	17.9	1000 MAC	15	37	< 9	84.9
Beryllium	ug/L as Be	< 0.1	4	< 0.1	< 0.1		< 0.1	37	< 0.1	< 3
Bismuth	ug/L as Bi	< 1	4	< 1	< 1		< 1	33	< 1	< 1
Boron	ug/L as B	< 50	4	< 50	< 50	5000 MAC	< 50	37	< 50	240
Cadmium	ug/L as Cd	< 0.01	4	< 0.01	< 0.01	7 MAC	< 0.01	37	< 0.01	0.01
Calcium	mg/L as Ca	15.4	4	13.9	17.3	No Guideline Required	15	37	12	19.8
Chromium	ug/L as Cr	1.1	4	< 1	8.6	50 MAC	< 1	37	< 1	< 10
Cobalt	ug/L as Co	< 0.2	4	< 0.2	< 0.2		< 0.2	37	< 0.2	< 20
Copper	ug/L as Cu	0.885	4	0.28	1.22	2000 MAC / ≤ 1000 AO	1.41	37	0.41	8.12
Iron	ug/L as Fe	178	4	89.8	246	≤ 300 AO	224	37	48.6	4260
Lead	ug/L as Pb	< 0.2	4	< 0.2	< 0.2	5 MAC	< 0.2	37	< 0.2	0.69
Lithium	ug/L as Li	< 2	4	< 2	< 2		< 2	24	< 2	< 2
Magnesium	mg/L as Mg	5.415	4	5.18	5.93	No Guideline Required	5.47	37	4.5	11.5
Manganese	ug/L as Mn	39.55	4	9.1	53.6	120 MAC / ≤ 20 AO	42.3	37	2.8	5000
Molybdenum	ug/L as Mo	1.1	4	< 1	8.3		< 1	37	< 1	< 20
Nickel	ug/L as Ni	3.05	4	< 1	36.5		< 1	37	< 1	< 50
Potassium	mg/L as K	1.435	4	1.17	1.53		1.12	37	0.17	1.62
Selenium	ug/L as Se	< 0.1	4	< 0.1	< 0.1	50 MAC	< 0.1	37	< 0.1	< 0.5
Silver	ug/L as Ag	< 0.02	4	< 0.02	< 0.02	No Guideline Required	< 0.02	37	< 0.02	< 10
Sodium	mg/L as Na	12	4	10.5	12.7	≤ 200 AO	11.2	37	9.02	15.4
Strontium	ug/L as Sr	104	4	102	134	7000 MAC	108	37	75	158
Sulphur	mg/L as S	< 3	4	< 3	< 3		< 3	33	< 3	3.7
Tin	ug/L as Sn	< 5	4	< 5	< 5		< 5	37	< 5	< 20
Titanium	ug/L as Ti	< 5	4	< 5	< 5		< 5	37	< 5	22
Thallium	ug/L as Tl	< 0.01	4	< 0.01	< 0.01		< 0.01	33	< 0.01	< 0.05
Uranium	ug/L as U	< 0.1	4	< 0.1	< 0.1	20 MAC	< 0.1	33	< 0.1	0.19
Vanadium	ug/L as V	< 5	4	< 5	< 5		< 5	37	< 5	< 10
Zinc	ug/L as Zn	< 5	4	< 5	< 5	≤ 5000 AO	< 5	37	< 1	215
Zirconium	ug/L as Zr	< 0.1	4	< 0.1	< 0.1		< 0.1	33	< 0.05	< 0.5
<b>Microbial Parameters</b>										
<b>Indicator Bacteria (Buck Lake)</b>										
Coliform, Total	CFU/100 mL	85	17	6	410	0 MAC	75	187	< 1	4700
<i>E. coli</i>	CFU/100 mL	< 1	17	< 1	3	0 MAC	3	187	< 1	200
Hetero. Plate Count, 7 day	CFU/1 mL	Not tested in 2023				No Guideline Required	1345	64	330	A 5800
<b>Indicator Bacteria (Magic Lake)</b>										
Coliform, Total	CFU/100 mL	320	15	25	3300	0 MAC	411	143	< 1	7600
<i>E. coli</i>	CFU/100 mL	< 1	15	< 1	16	0 MAC	< 2	151	< 1	115
Hetero. Plate Count, 7 day	CFU/1 mL	Not tested in 2023				No Guideline Required	2600	59	370	G 20000
<b>Parasites (Buck Lake)</b>										
<i>Cryptosporidium</i> , Total oocysts	oocysts/100 L	< 1	2	< 1	< 1	Zero detection desirable	< 1	14	< 1	1.45
<i>Giardia</i> , Total cysts	cysts/100 L	< 1	2	< 1	< 1	Zero detection desirable	< 1	14	< 1	< 1
<b>Parasites (Magic Lake)</b>										
<i>Cryptosporidium</i> , Total oocysts	oocysts/100 L	< 1	2	< 1	< 1	Zero detection desirable	< 1	15	< 1	5.3
<i>Giardia</i> , Total cysts	cysts/100 L	< 1	2	< 1	< 1	Zero detection desirable	< 1	15	< 1	< 1

**Table 2**

Table 2: 2023 Summary of Treated Water Test Results, Magic Lake Estates Water System										
PARAMETER		2023 ANALYTICAL RESULTS				CANADIAN GUIDELINES	2013 - 2022 ANALYTICAL RESULTS			
Parameter Name	Units of Measure	Annual Median	Samples Analyzed	Range Min. Max.		≤ = Less than or equal to	Median	Samples Analyzed	Range Minimum Maximum	
ND means Not Detected by analytical method used										
<b>Physical Parameters</b>										
Carbon, Total Organic	mg/L as C	3.6	20	3.4	4.4		#/NA	#/NA	#/NA	#/NA
Colour, True	TCU	< 2	52	< 2	11	15 AO	< 2	628	< 2	5
Hardness as CaCO3	mg/L	65.4	12	60	71.4		64.9	85	58.1	72.1
pH	No units	Not tested in 2023				7.0-10.5 AO	7.16	29	6.89	7.7
Turbidity	NTU	0.2	53	0.05	13	1 MAC and ≤ 5 AO	0.16	964	0.11	4.4
Water Temperature	Degrees C	11.1	319	5.6	24.7	≤ 15 C°C	8.6	5315	3.9	24
<b>Microbial Parameters</b>										
<b>Indicator Bacteria</b>										
Coliform, Total	CFU/100 mL	< 1	192	< 1	1	0 MAC	< 1	1458	< 1	45
<i>E. coli</i>	CFU/100 mL	< 1	192	< 1	< 1	0 MAC	< 1	1460	< 1	< 1
Hetero. Plate Count, 7 day	CFU/1 mL	50	8	< 10	610	No Guideline Required	< 10	168	< 10	6700
<b>Disinfectants</b>										
<b>Disinfectants</b>										
Chlorine, Free Residual	mg/L as Cl2	0.54	321	0	1.95	No Guideline Required	0.32	5342	0.02	4.9
Chlorine, Total Residual	mg/L as Cl2	0.71	211	0.11	2.2	No Guideline Required	0.66	5703	0.1	3.8
<b>Disinfection By-Products</b>										
<b>Trihalomethanes (THMs)</b>										
Bromodichloromethane	ug/L	17	8	12	21		18.5	57	11.2	24
Bromoform	ug/L	< 1	8	< 1	< 1		< 1	57	< 0.1	< 1
Chloroform	ug/L	45.5	8	37	62		54.5	57	18.8	100
Chlorodibromomethane	ug/L	3.05	8	2.4	3.7		3.25	56	< 0.1	4.9
Total Trihalomethanes	ug/L	66.5	8	52	87	100 MAC	#/NA	#/NA	#/NA	#/NA
<b>Haloacetic Acids (HAAs)</b>										
HAA5	ug/L	Not tested in 2023				80 MAC	33.5	12	< 0.1	46
<b>Metals</b>										
Aluminum	ug/L as Al	20.25	12	15	48.8	2900 MAC / 100 OG	25.7	85	11.7	186
Antimony	ug/L as Sb	< 0.5	12	< 0.5	< 0.5	6 MAC	< 0.5	85	0.033	< 0.5
Arsenic	ug/L as As	0.23	12	0.19	0.28	10 MAC	0.22	85	0.14	0.36
Barium	ug/L as Ba	8.6	12	8	10.2	1000 MAC	< 7.8	85	6	10.7
Beryllium	ug/L as Be	< 0.1	12	< 0.1	< 0.1		< 0.1	85	< 0.01	0.1
Bismuth	ug/L as Bi	< 1	12	< 1	< 1		< 1	85	< 0.005	1
Boron	ug/L as B	< 50	12	< 50	< 50	5000 MAC	< 50	85	< 50	52
Cadmium	ug/L as Cd	< 0.01	12	< 0.01	0.035	7 MAC	< 0.01	85	< 0.005	< 0.01
Calcium	mg/L as Ca	17.65	12	16	19.8	No Guideline Required	17.5	85	15.8	19.8
Chromium	ug/L as Cr	< 1	12	< 1	< 1	50 MAC	< 1	85	< 0.1	< 1
Cobalt	ug/L as Co	< 0.2	12	< 0.2	< 0.2		< 0.2	85	0.02	< 0.5
Copper	ug/L as Cu	9.975	12	0.23	24.3	2000 MAC / ≤ 1000 AO	9.75	85	0.25	23.3
Iron	ug/L as Fe	8.2	12	< 5	58.9	≤ 300 AO	8.3	85	2.4	34.5
Lead	ug/L as Pb	0.515	12	< 0.2	1.41	5 MAC	0.84	85	< 0.2	1.67
Lithium	ug/L as Li	< 2	12	< 2	< 2		< 5	42	0.85	< 5
Magnesium	mg/L as Mg	5.19	12	4.82	5.46	No Guideline Required	5.08	85	4.31	5.7
Manganese	ug/L as Mn	1.7	12	< 1	16.8	120 MAC / ≤ 20 AO	3.8	85	< 1	190
Molybdenum	ug/L as Mo	< 1	12	< 1	< 1		< 1	85	0.05	< 1
Nickel	ug/L as Ni	< 1	12	< 1	< 1		< 1	85	0.309	2.8
Potassium	mg/L as K	1.39	12	1.36	1.5		1.37	85	1.17	1.63
Selenium	ug/L as Se	< 0.1	12	< 0.1	< 0.1	50 MAC	< 0.1	85	< 0.04	0.11
Silicon	ug/L as Si	4075	12	3780	4300		4070	85	4.13	5140
Silver	ug/L as Ag	< 0.02	12	< 0.02	< 0.02	No Guideline Required	< 0.02	85	< 0.005	< 0.02
Sodium	mg/L as Na	14.25	12	12.9	15.3	≤ 200 AO	13.9	85	11.6	14.9
Strontium	ug/L as Sr	118.5	12	111	132	7000 MAC	119	85	102	133
Sulphur	mg/L as S	< 3	12	< 3	< 3		< 3	85	< 3	4.5
Tin	ug/L as Sn	< 5	12	< 5	< 5		< 5	85	< 0.2	< 5
Titanium	ug/L as Ti	< 5	12	< 5	< 5		< 5	85	< 0.5	< 5
Thallium	ug/L as Tl	< 0.01	12	< 0.01	< 0.01		< 0.01	85	< 0.002	< 0.05
Uranium	ug/L as U	< 0.1	12	< 0.1	< 0.1	20 MAC	< 0.1	85	< 0.002	< 0.1
Vanadium	ug/L as V	< 5	12	< 5	< 5		< 5	85	< 0.2	< 5
Zinc	ug/L as Zn	6.55	12	< 5	21.9	≤ 5000 AO	5.1	85	2.02	39.7
Zirconium	ug/L as Zr	< 0.1	12	< 0.1	< 0.1		< 0.1	84	< 0.1	< 0.5