

Magic Lake Estates Water and Sewer Systems

2019 Annual Report

CRD | Drinking Water and Wastewater

Introduction

This report provides a summary of the Magic Lake Estates Water and Sewer Service for 2019 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 1,205 parcels, of which there are 1,034 single family equivalents (or approximately the same amount of customers) obtaining service from the water system.

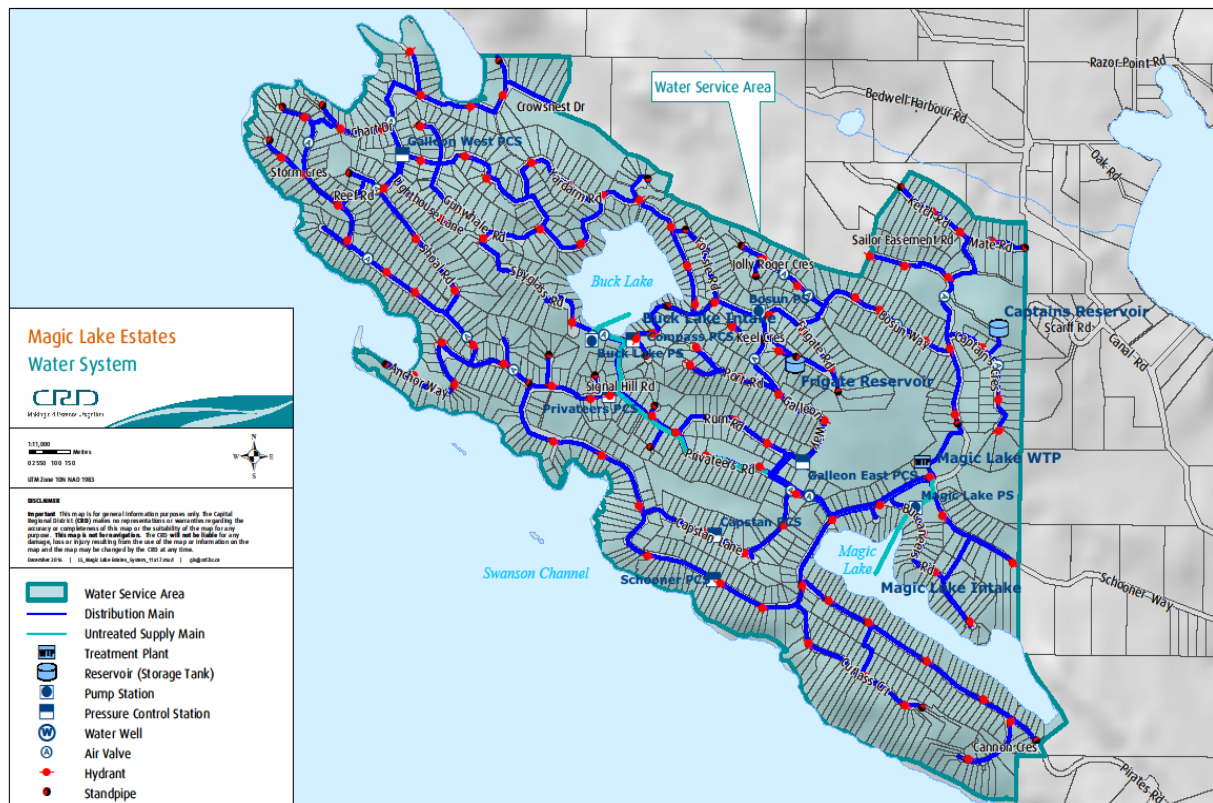


Figure 1: Map of Magic Lake Estates Water System

The Magic Lake Estates water system is primarily comprised of:

- Two (2) 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, 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 metres or 200,000 USg and Captains 341 cubic metres 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: 1,035 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.

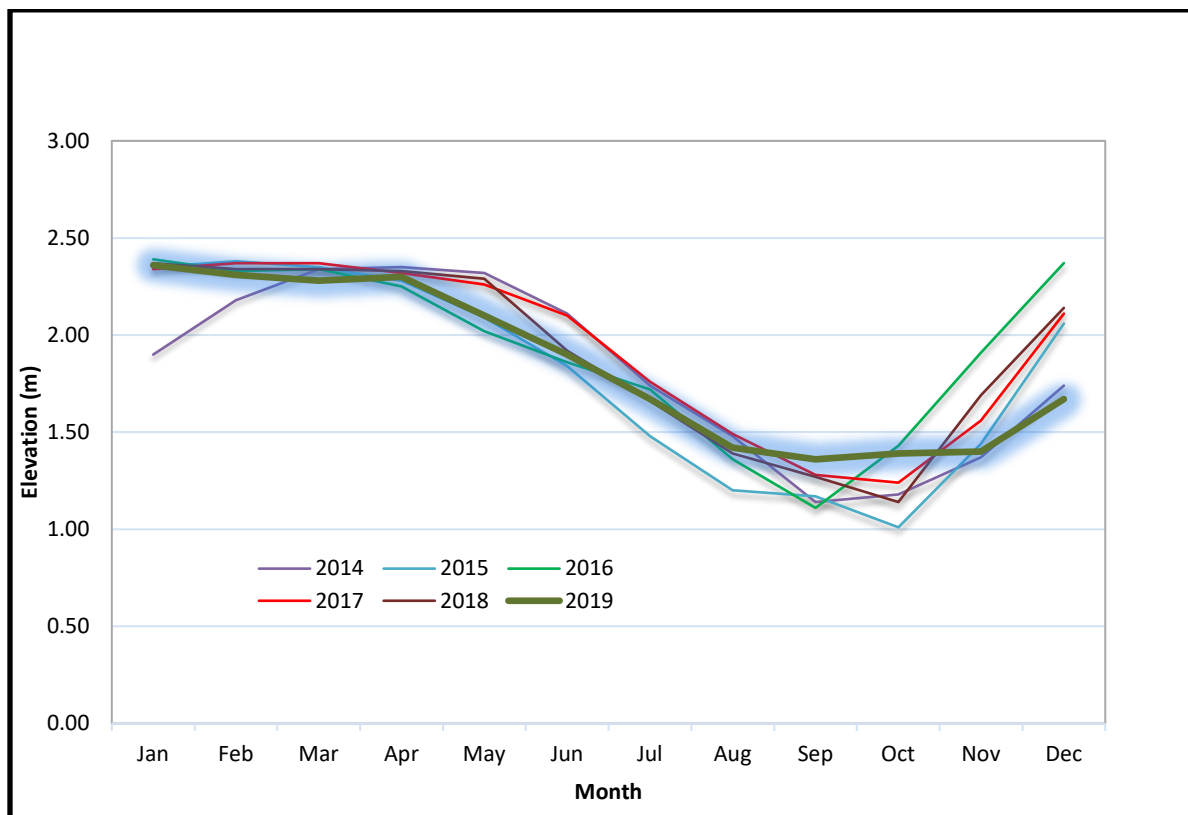


Figure 2: Buck Lake Monthly Water Level

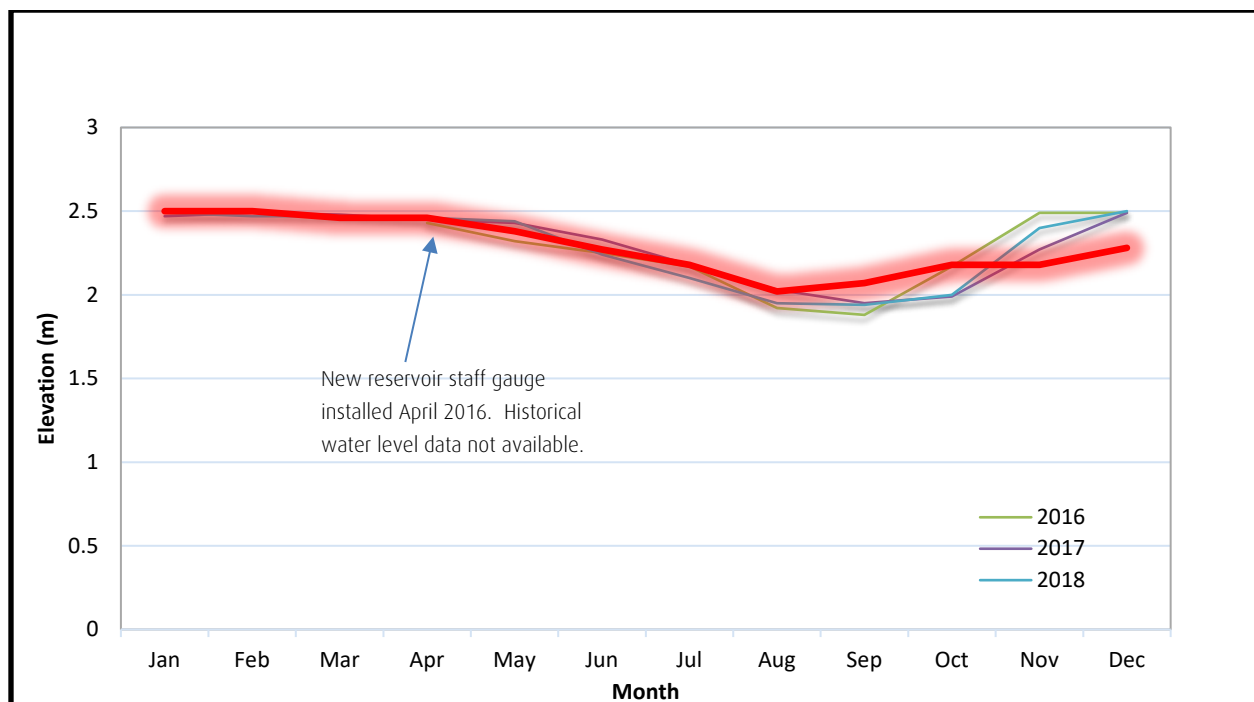


Figure 3: Magic Lake Monthly Water Level

Water Production and Demand

Referring to Figure 4, 182,617 cubic meters of water was extracted (water production) from both Buck Lake and Magic Lake water sources in 2019; a 17% increase from the previous year and a 9% increase in the five year average. Water demand (customer water billing) for the service totaled 131,197 cubic meters of water; a 10% increase from the previous year and a 10% increase from the rolling five year average. The higher water demand can partially be attributed to seven water service connections added to the water system in 2019. Additionally during 2019, several properties were notified by the CRD of having higher than normal consumption after quarterly meter readings were performed. Some property owners identified significant leaks on their service lines that required repairs. Approximately 10,000 cubic meters of water can be attributed to the higher water demand as a result of these leaks.

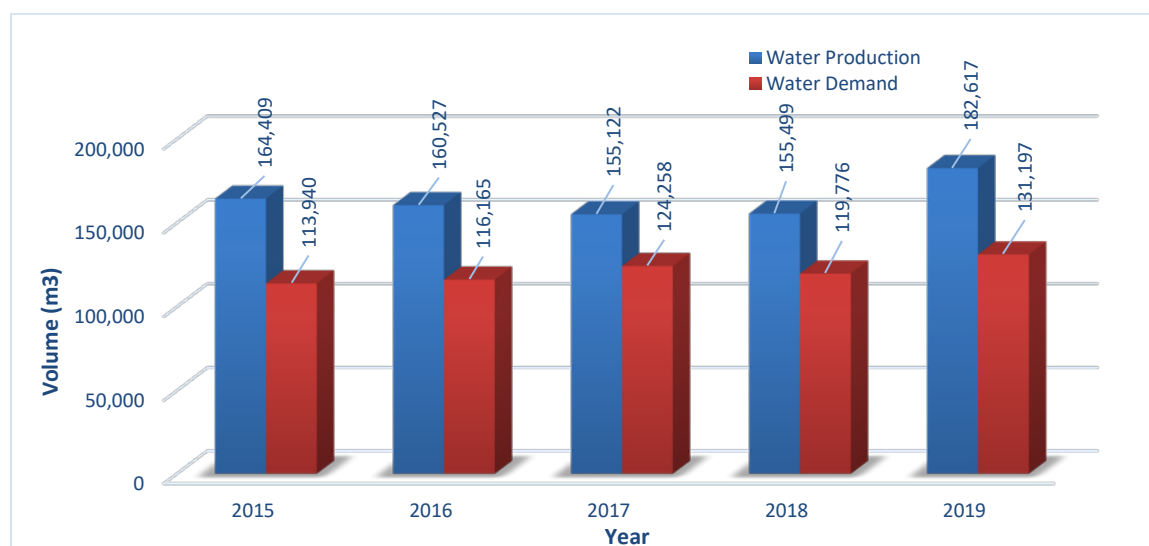


Figure 4: Magic Lake Estates Water System Annual Water Production and Demand.

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 2019 non-revenue water (51,420 cubic meters) represents about 28% 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 26% which is an increase from the previous year and considered to be high for a water distribution system the size of Magic Lake Estates. To address this, a water loss control program should be implemented for the service.

Figure 5 below illustrates the monthly water production for 2019 along with the historical water production information. The monthly water production trends are typical for smaller water systems such as Magic Lake Estates. In review of monthly water production, November and December of 2019 is considerably higher than historically and is the result of a significant number of leaks that went undetected on private property.

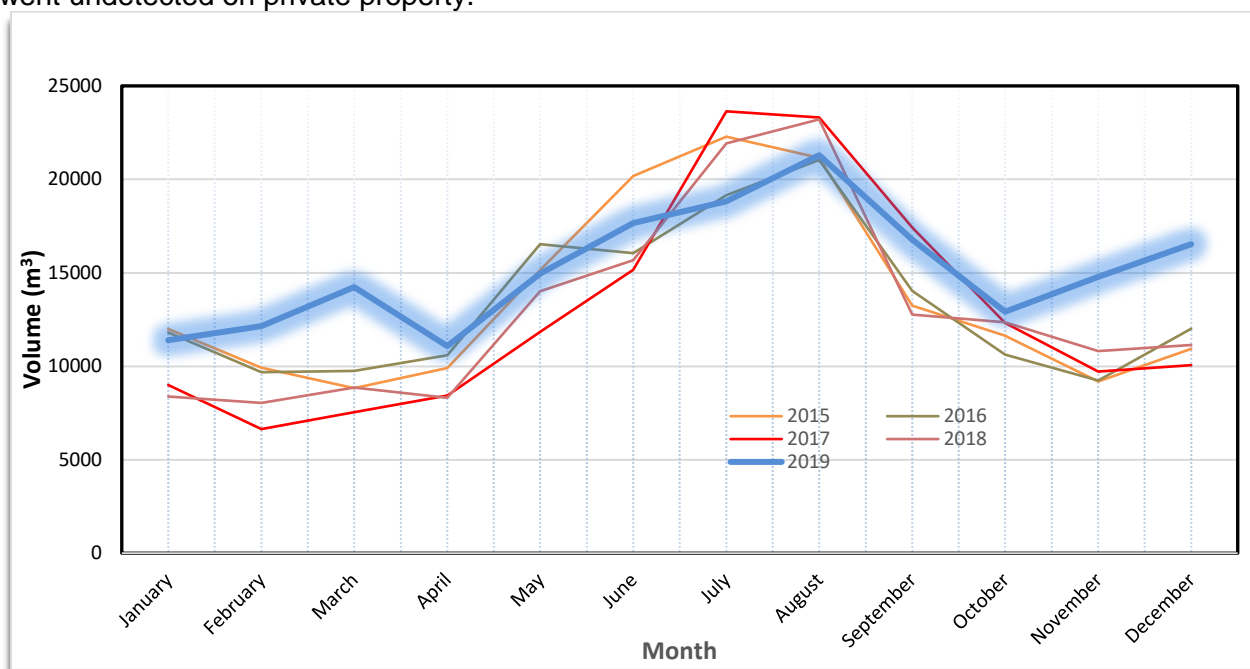


Figure 5: Magic Lake Estates Water System Monthly Water Production.

Drinking Water Quality

Two intake lines from Buck Lake and Magic Lake provide blended source water to the Dissolved Air Flotation (DAF) treatment plant. The typical intake blending ratio in 2019 was 80/20 Buck/Magic lakes unless water quality concerns or operational needs required a temporary adjustment. The treatment plant includes an additional potassium permanganate treatment system that was continuously operated in 2019 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. 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 2019 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 both lakes, the total coliform bacteria concentrations rose to about 4,000 CFU/100mL in late summer.
- *E. coli* bacteria concentrations were generally low in both lakes throughout the year. During the summer months the concentration 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 (60 - 65 mg/L CaCO₃).
- Buck Lake exhibited a raw water turbidity range from 0.36 to 2.4 nephelometric turbidity units (NTU) with an annual median of 0.9 NTU, and Magic Lake a range from 0.65 to 2.7 NTU with an annual median of 1.70 NTU. The higher turbidity occurred typically during the periods of increased algal activity in late summer and fall. While Buck Lake was consistent with historical turbidity trends, Magic Lake exhibited in general a lower turbidity than in previous years.
- Buck Lake, with an annual median total organic carbon (TOC) of 6.4 mg/L, and Magic Lake, with a median TOC of 8.65 mg/L, are considered mesotrophic lakes (medium productive).
- Both lakes exhibited seasonal elevated iron and manganese concentrations which reached peaks of 237 µg/L (Fe) and 411 µg/L (Mn) in Magic Lake in March, and 266 µg/L (Fe) and 226 µg/L (Mn) in Buck Lake in November. Early spring and fall are the two common periods for high concentrations of these metals in both lakes.

Treated Water:

- Treated water was bacteriologically safe to drink with no confirmed positive of either *E. coli* or total coliforms in the treated water.
- 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 (two samples at 1.3 and 1.8 NTU in June).
- Total organic carbon (TOC median 3.5 mg/L) was lower than in previous years indicating that the DAF plant's performance improved further. 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) limits confirming the efficacy of the potassium permanganate treatment system in removing in particular iron and manganese. On February 21 and May 14 the aesthetic objective (AO) for manganese concentrations was exceeded but the concentrations were well below the AO for the rest of the year.
- Disinfection by-products such as trihalomethanes (THM) did not exceed the GCDWQ limit of 100 µg/L. THM concentrations fluctuated between 57 and 79 µg/L which is a further improvement from last year and a direct result of the improved TOC removal rate by the DAF plant. Treated water samples were not tested for haloacetic acids (HAA) in 2018 due to a solid history of very low results (20.2 µg/L in 2016 compared to the MAC of 80 µg/L) in this water system.

- Both water sources were subject to occasional, naturally occurring algal blooms that periodically affected taste and odour.
- The water temperature exceeded the GCDWQ aesthetic limit of 15°C between June and September.
- The treated water pH was 7.2 and therefore within the GCDWQ recommended range of 7.0 – 10.5.

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:

- Magic Lake Water Treatment Plant air saturator repairs.
- Captains Reservoir communications equipment repairs.
- Magic Lake Water Treatment Plant dissolved air flotation train 1 programming revisions.
- SCADA (Supervisory Control and Data Acquisition) computer server failure and replacement.
- Water main leak repair near 3729 Bosun Way.
- Water main leak repair near 3748 Privateers.
- Magic Lake Treatment Plant polymer chemical feed pump troubleshooting and repairs.

Water System Capital Project Updates

The Capital Projects that were in progress or completed in 2019 included:

1. Siphon at Magic Lake South Dam - Planning was completed for a removable siphon with PVC pipe that can be relocated if required, testing to occur in 2020 with project close out and revised standard operating procedures and dam emergency plan.
2. Signal Hill, Schooner and Capstans PRV Upgrades – Construction of the three pressure control stations was completed in July 2019 and within budget.
3. ISOPAC Storage and Handling – Equipment procured and delivered to the water treatment plant for safe handling. A new standard operating procedure is available to address the safety concern of lifting full ISOPAC barrels. The project was completed within budget.
4. Buck Lake Dam Safety Review – A consultant has been retained and will deliver a report in 2020.

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 630 are serviced. Some of the sewer infrastructure includes: 16km of sewer pipe, 316 manholes, 6 pump stations, and two treatment plants each with an outfall into Swanson Channel.

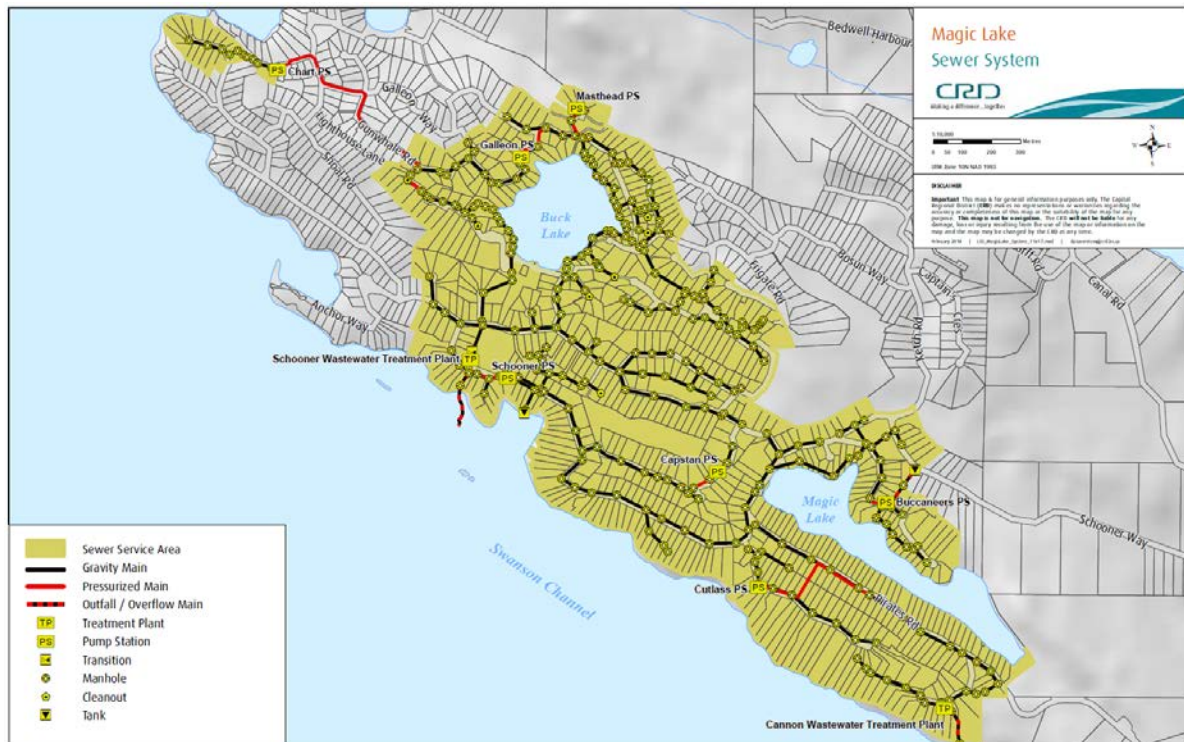


Figure 5: Map of Magic Lake Estates Sewer System

Wastewater Flows

The monthly flows and the total annual flow over the past 5 years are shown in Figures 6 and 7 below. The graphs indicate that the 2019 wastewater flows were about 4% lower than 2018 and about 2% lower 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 8% higher than June or September), but the more significant variation occurs in the winter due to inflow and infiltration (where January has almost 3 times the flow as June).

The Municipal Sewage Regulation (MSR) 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 exceedances at each treatment plant as shown in Figure 8 below.

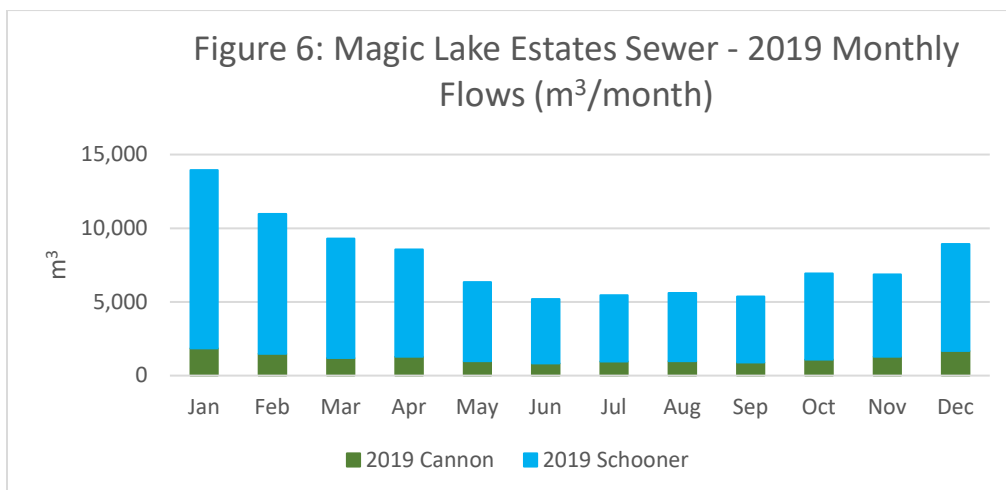


Figure 6: 2019 Monthly Flows

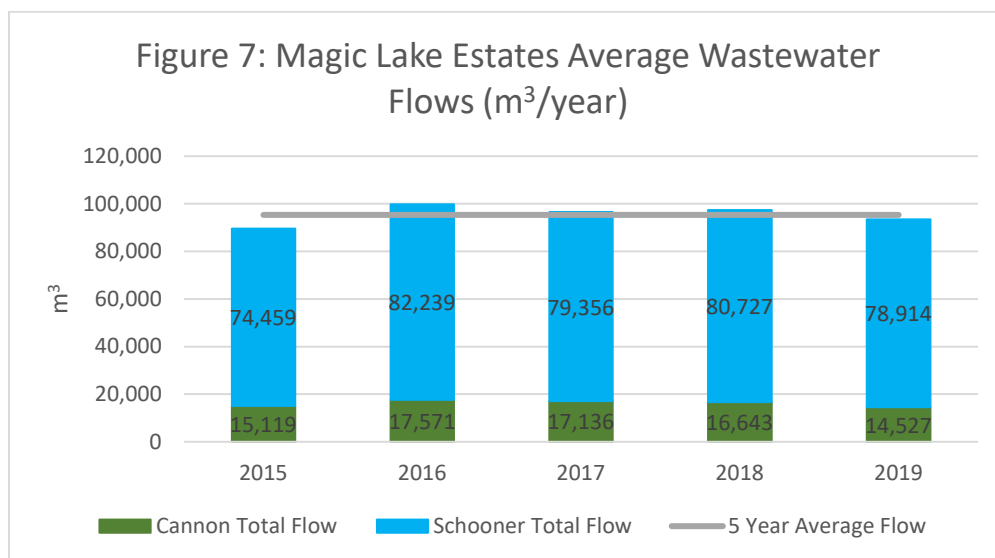


Figure 7: Average Wastewater flows

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 the Cannon Crescent WWTP exceeded effluent quality regulations for TSS on 4% of the sampling days in 2019. All other sampling days at both treatment plants met all effluent quality requirements, with no further exceedances of permitted limits observed (although effluent sampling did not necessarily take place during peak flow events). However, both plants exceeded their permitted daily flow allowances in 2019 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. There were fewer exceedances in 2019 than 2018, with 15 at Cannon and 31 at Schooner, totaling 46 in 2019 versus 97 in 2018. 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.

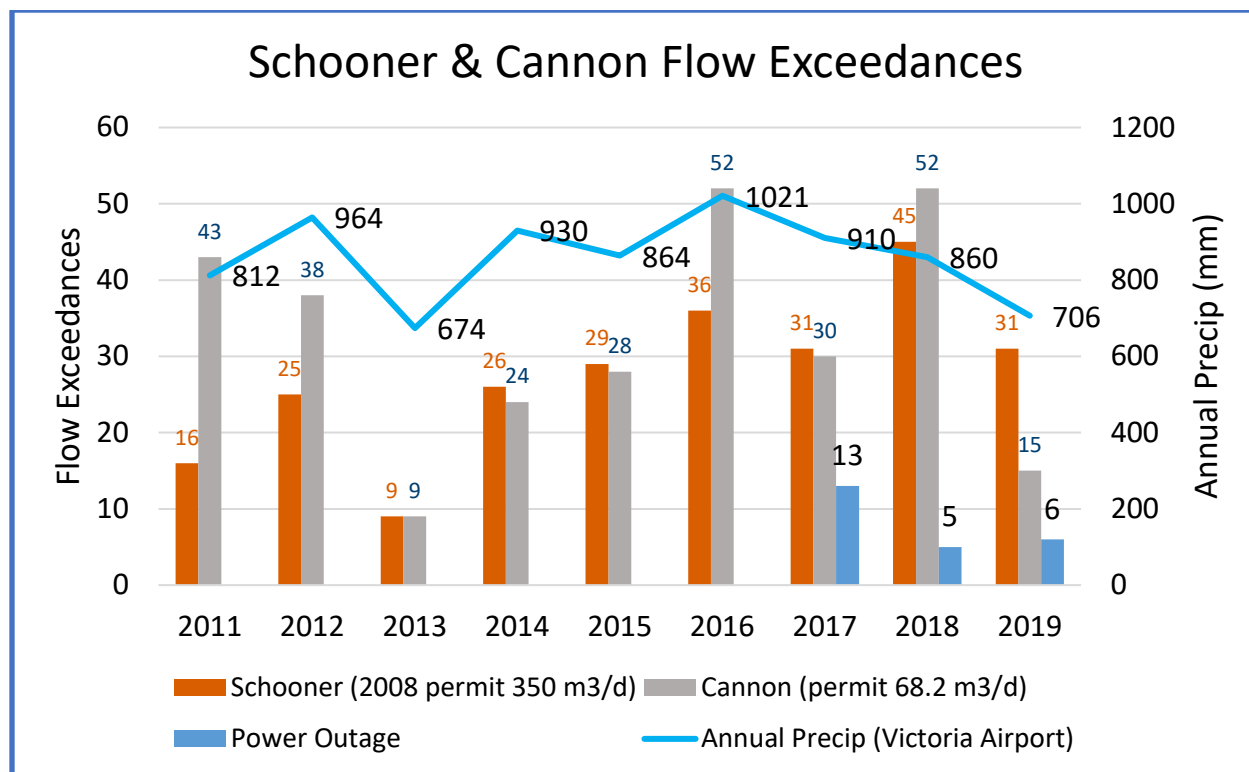


Figure 8: Schooner and Cannon WWTP Flow Exceedances

Receiving Water

Routine receiving water monitoring was not required at either of the Magic Lake Estates WWTPs in 2019. This monitoring is only required every 4 years unless there are planned bypasses, plant failures/overflows, or wet weather overflows that exceed 3 days duration in the winter or 1 day duration in the summer. The routine sampling last took place in 2016 and is next required in 2020. 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.

No emergency or overflow sampling was required at either of the Magic Lake Estates WWTPs in 2019, as sampling was conducted for each season of overflows in December 2018 and January 2020.

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 electronic variable frequency drive replacement.
- Schooner Wastewater Pump Station float switch control system replacement.
- Schooner Wastewater Treatment Plant scum pump replacement.

Sewer Service Capital Project Updates

The Capital Projects that were in progress in 2019 included:

1. Wastewater Infrastructure Renewal – Public Consultation – Substantial upgrades to the Schooner and Cannon treatment plants and collection system are required to eliminate all regulatory compliance violations. Three options of various phasing of upgrades were presented to the community at an April 27, 2019 Open House which included a tour of the

Schooner WWTP. Feedback from the public was received until June 2, 2019 and 133 response forms were received. A summary of the responses are documented in the Public Feedback Summary Report (see www.crd.bc.ca/magiclake-sewer). This proceeded to a Referendum held on November 23, 2019 to borrow up to \$6,000,000 to complete Phase 1 upgrades. The referendum was successful and staff have commenced with a RFP to retain a design consultant.

2. In fall of 2019, staff also prepared a grant application to the "Investing in Canada Infrastructure Program" for \$5.65M of additional funding that would enable most all of the work identified in Phase 1, 2 and 3 to be completed. The Province has indicated that the results of the grant application could be announced in early 2021.

Financial Report

Please refer to the attached 2019 Financial Summary Statement of Operations. *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 includes all costs of providing the service. *General Government Services* includes budget preparation, financial management, utility billing and risk management services. *CRD Labour and Operating Costs* includes 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* includes all other costs to administer and operate the water system, 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 are then 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.

Submitted by:	Matt McCrank, M.Sc., P.Eng., Senior Manager, Wastewater Infrastructure Operations
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Attachment: 2019 Financial Summary Statement of Operations

CAPITAL REGIONAL DISTRICT

MAGIC LAKE ESTATE WATER
Statement of Operations (Unaudited)
For the Year Ended December 31, 2019

	2019	2018
Revenue		
Transfers from government	568,990	568,989
User Charges	312,521	299,955
Water Sales	24,397	17,693
Leases	8,100	8,100
Fees and Charges	977	2,182
Other revenue from own sources:		
Interest earnings	1,634	2,634
Other revenue	1,169	2,647
Transfer from Operating Reserve	3,000	-
Total Revenue	920,788	902,200
Expenses		
General government services	20,709	17,910
CRD Labour and Operating costs	432,789	293,670
Debt Servicing Costs	220,379	220,317
Other expenses	156,070	159,766
Total Expenses	829,948	691,663
Net revenue (expenses)	90,841	210,537
Transfers to own funds:		
Capital Reserve Fund	80,841	195,537
Operating Reserve Fund	10,000	15,000
Annual surplus (deficit)	-	-
Accumulated surplus, beginning of year	-	-
Accumulated surplus, end of year	-	-

CAPITAL REGIONAL DISTRICT

MAGIC LAKE ESTATE WATER Statement of Reserve Balances (Unaudited) For the Year Ended December 31, 2019

	Capital Reserve	
	2019	2018
Beginning Balance	676,988	672,346
Transfer from Operating Budget	80,841	195,537
Transfers from completed capital projects	43,807	-
Interest Income	17,906	12,055
Transfer to Capital Projects	(65,000)	(202,950)
Ending Balance	754,542	676,988

	Operating Reserve	
	2019	2018
Beginning Balance	96,595	79,488
Transfer from Operating Budget	10,000	15,000
Transfer to Operating Budget	(3,000)	-
Interest Income	2,886	2,107
Ending Balance	106,481	96,595

CAPITAL REGIONAL DISTRICT

MAGIC LAKE ESTATE SEWER Statement of Operations (Unaudited) For the Year Ended December 31, 2019

	2019	2018
Revenue		
Transfers from government	526,770	508,320
User Charges	240,887	188,801
Other revenue from own sources:		
Interest earnings	1,220	1,636
Other revenue	1,696	1,571
Transfer from Operating Reserve	10,000	-
Total Revenue	780,574	700,327
Expenses		
General government services	19,189	17,870
Contract for Services	92,516	87,821
CRD Labour and Operating costs	289,385	259,807
Debt Servicing Costs	174,430	120,791
Other expenses	161,174	156,271
Total Expenses	736,693	642,561
Net revenue (expenses)	43,881	57,766
Transfers to own funds:		
Capital Reserve Fund	30,621	42,366
Operating Reserve Fund	13,260	15,400
Annual surplus (deficit)	-	-
Accumulated surplus, beginning of year	-	-
Accumulated surplus, end of year	\$ -	-

CAPITAL REGIONAL DISTRICT

MAGIC LAKE ESTATE SEWER Statement of Reserve Balances (Unaudited) For the Year Ended December 31, 2019

	Capital Reserve	
	2019	2018
Beginning Balance	172,061	126,680
Transfer from Operating Budget	30,621	42,366
Transfers from completed capital projects	-	92,558
Interest Income	4,405	3,015
Transfer to Capital Projects	(70,000)	(92,558)
Ending Balance	137,087	172,061

	Operating Reserve	
	2019	2018
Beginning Balance	26,515	10,664
Transfer from Operating Budget	13,260	15,400
Transfer to Operating Budget	(10,000)	-
Interest Income	968	451
Ending Balance	30,744	26,515