

Magic Lake Estates

Water and Sewer Systems

2016 Annual Report

CRD | **Drinking Water**

Introduction

This report provides a summary of the Magic Lake Estates Water and Sewer Service for the year 2016. This report includes 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 1991 the service converted to the Capital Regional District (CRD). The Magic Lake Estates water service is made up of 1,205 parcels, of the 1,205 parcels, there are 1,020 single family equivalents (or approximately the same amount of customers) obtaining service from the water system.

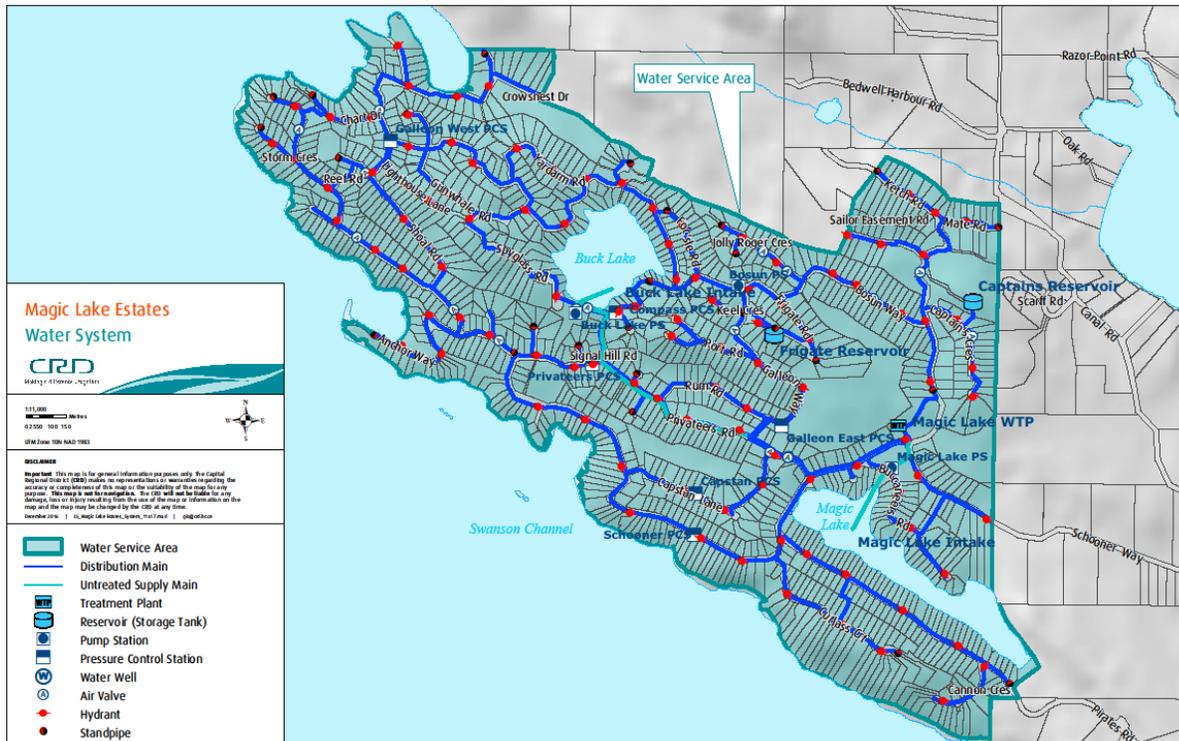


Figure 1: Map of Magic Lake Estates Water System

The Magic Lake Estates water system is primarily comprised of:

- Raw water is obtained from Buck Lake (primary source) and Magic Lake (secondary source), impounded, surface water bodies.
- 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 and potassium permanganate for algae control.
- Centralized water treatment plant consisting of a dual process including dissolved air flotation, filtration, ultraviolet light 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 kilometres of water mains).
- Other water system assets: 1,020 water service connections and meters, approximately 70 fire hydrants, 6 pressure reducing valve stations, 100 gate valves and standpipes.

Water Supply

Figure 2 and Figure 3 below, surface water supply monthly water levels are provided for both Buck Lake and Magic Lake respectively. It is important to note that normally Buck Lake provides 80% of the annual demand and Magic Lake provides 20%.

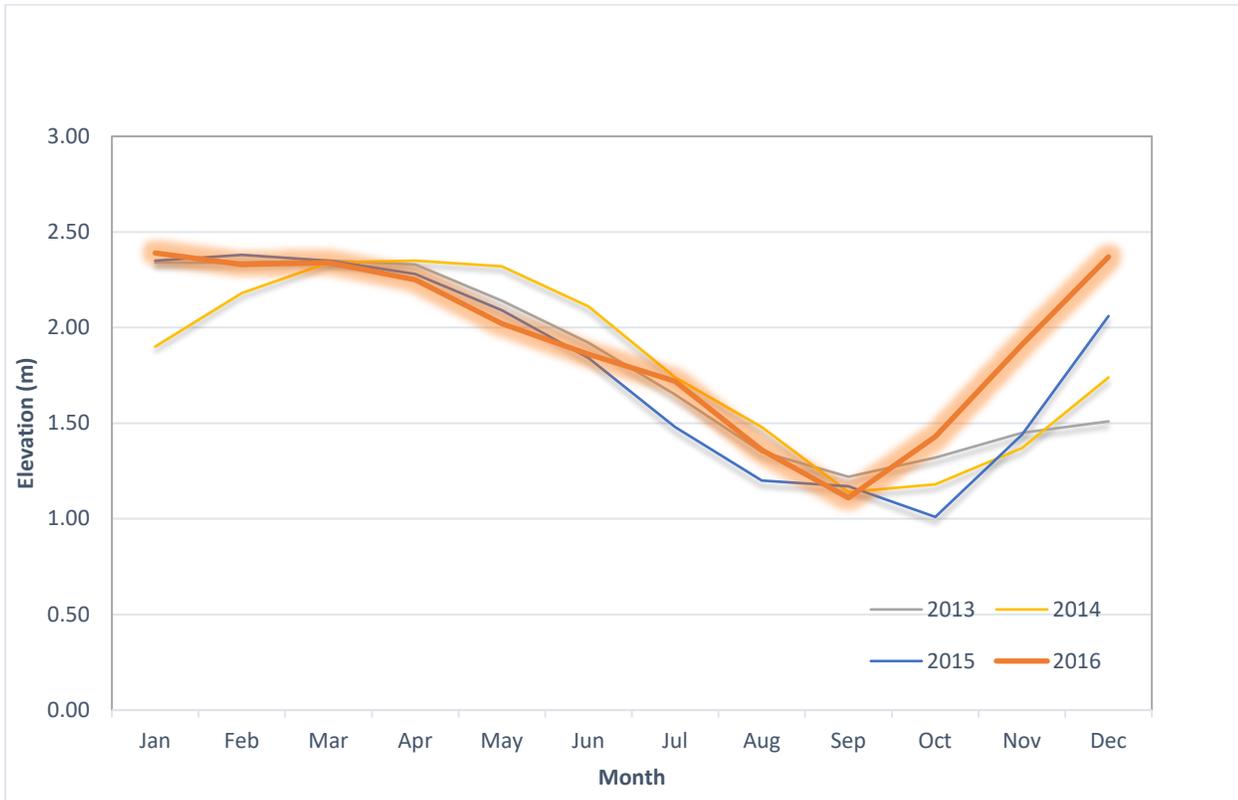


Figure 2: Magic Lake Estates Buck Lake Monthly Water Level



Figure 3: Magic Lake Estates Magic Lake Monthly Water Level

Water Production and Demand

Referring to Figure 4, 160,527 cubic meters of water was extracted (water production) from both Buck Lake and Magic Lake water sources in 2016; a 2% decrease from the previous year and a 13% decrease from the five year average. Water demand (customer water billing) for the service totaled 116,165 cubic meters of water; a 2% increase from the previous year and a 7% decrease from the five year average.

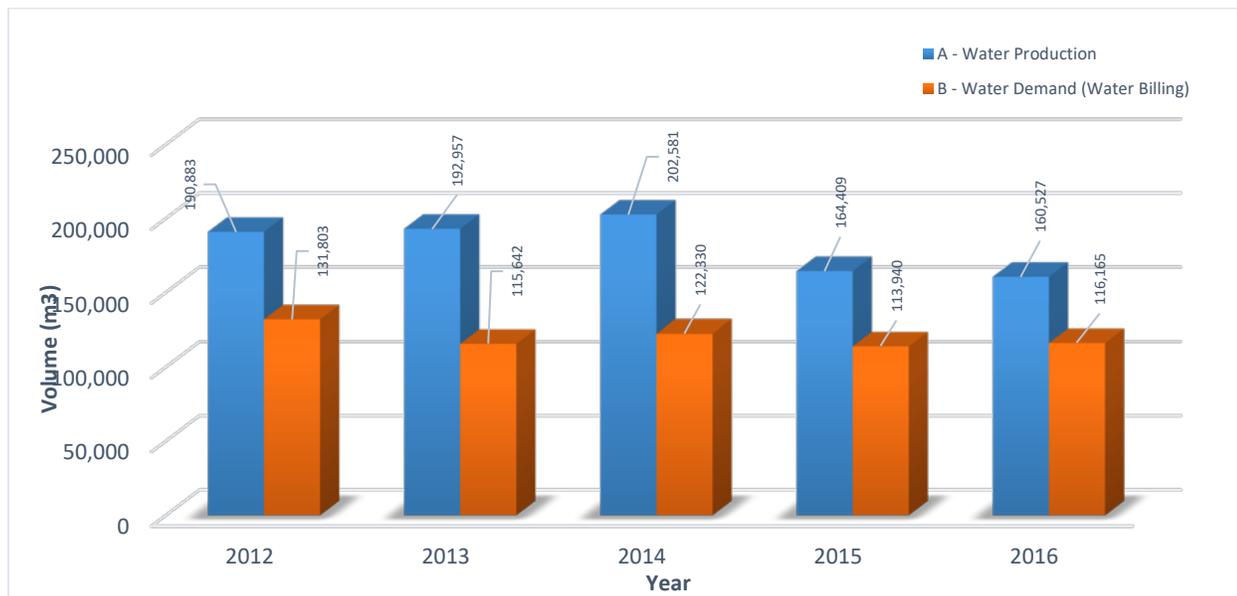


Figure 4: Magic Lake Estates Water System Annual Water Production and Demand.

The difference between annual water production and annual customer 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 2016 non-revenue water (44,362 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 25% which is considered to be on the high side for a water distribution system the size of Magic Lake Estates.

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 2016 was 80/20 Buck/Magic Lake unless water quality concerns or operational needs required a temporary adjustment. The CRD commissioned an additional potassium permanganate treatment system in January 2015 to address periodically elevated 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. Operating staff successfully addressed isolated and localized adverse water quality events due to aging and stagnant water through spot-flushing.

Overall Magic Lake Estates drinking water quality characteristics for 2016 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. Especially Magic Lake had a high total coliform bacteria concentration in the summer of 2016 (>2,000 CFU/100mL in June).
- *E. coli* bacteria concentrations were low in both lakes throughout the year.
- Raw water from both sources was medium hard (~67 mg/L CaCO₃).
- Buck Lake exhibited a raw water turbidity range from 0.45 to 10 nephelometric turbidity units (NTU) with an annual median of 0.68 NTU, and Magic Lake a range from 0.49 to 4.2 NTU with an annual median of 1.4 NTU. The higher turbidity values occurred typically during the winter months and during periods of increased algal activity.
- Buck Lake with an annual median total organic carbon (TOC) of 6.65 mg/L as well as Magic Lake with a median TOC of 8.27 mg/L are considered mesotrophic lakes (medium productive).
- Both lakes exhibited elevated iron and especially manganese concentrations which reached peaks of 617 mg/L (Fe) and 415 mg/L (Mn) during May in Magic Lake and 136 mg/L (Fe) and 372 mg/L (Mn) during February in Buck Lake.

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 well below the *Guidelines for Canadian Drinking Water Quality* (GCDWQ) limit of 1 (NTU);
- Total organic carbon (TOC median 4.30 mg/L) was lower than historical levels indicating that the DAF plant is more effective in removing TOC than the old plant; however, TOC concentrations of > 4mg/L are considered a strong precursor for disinfection by-product formation and potential limit exceedance.
- Disinfection by-products such as trihalomethanes (THM) and haloacetic acids (HAA) did not exceed the GCDWQ limit of 100 µg/L and 80 µg/L respectively. THM fluctuated between 62 and 93 µg/L. HAA were recorded at 20.2 µg/L.
- Metals were below maximum acceptable concentration (MAC) limits confirming the efficacy of the potassium permanganate treatment system in removing in particular iron and manganese.
- Both water sources were subject to occasional, naturally-occurring algal blooms that periodically affected taste and odour.

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/southern-gulf-islands-water-quality-reports/magic-lake-estates-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:

- February 2016 – Stainless Steel Pipework repairs. Assistance provided to a contractor for removal of pipework within the water treatment facility.
- March, 2016 – Ultra Violet Light (UV) disinfection system emergency repairs. As a result of the failure of one of the UV systems, corrective maintenance and programming was required to ensure alternate UV systems automatically start under all possible service conditions.
- April 2016 – Water treatment facility programming modifications. Programming review and modifications were required as a result of ongoing facility nuisance shutdown events and emergency call out events.

Water System Capital Project Updates

The Capital Projects that were in progress or completed in 2016 included:

1. Syphon at Magic Lake South Dam – the project was initiated and the existing syphon was assessed. Work continues to make the original syphon operational for emergency reservoir drawdown.
2. Signal Hill and Schooner PRV Upgrades – in 2016 the CRD engaged a safety consultant to identify options to address confined space safety. Through a value engineering exercise and preliminary discussions with the Ministry of Transportation Infrastructure, it is determined that above ground PRV stations are the most appropriate option. Work continues for detailed design and tendering.
3. Install Adjustable Intake Magic Lake – a concept was prepared and costs were estimated, this project has been deferred until 2021.
4. Magic Lake Dam Safety Upgrades – a staff gauge was installed at the Magic Lake south dam to monitor the lake elevation.
5. Buck Lake Building Alterations – the former Buck Lake water treatment building was altered to repurpose the building for material storage.
6. Safety Equipment – eyewash and drench hose equipment was installed at both raw water pump stations to aid the operators should the oxidation chemical come in contact with the operator.
7. Buck Lake East Dam Design – the dam remediation work was put on hold in order to reassess conceptual options and strategies.
8. Electrical Power for Storage Building – electrical service was extended to an ancillary storage building at the water treatment plant site.
9. Buck Lake Intake Line Assessment – the raw water intake line was suspected of being compromised, a pressure and vacuum testing exercise resulted in concluding that the condition of the intake pipe is satisfactory.
10. Magic Lake North Dam License Agreement – it was identified that the CRD did not have any formalized agreement with two land owners to occupy private property to facilitate access to the dam structure. Discussion to conclude rights for access with the two owners continue.
11. Public Engagement and Referendum – the future public information engagement and referendum related to funding of future water system improvements has been deferred until such time that the water system assessment is complete.

SEWER SYSTEM

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 sewer utility and in 1991 the service converted to the Capital Regional District (CRD). The sewer service is approximately 210 hectares in size and includes 714 parcels (in 2016) of which 623 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 1 Map of Magic Lake Estates Sewer System

Wastewater Flows

In 2016, sewage volumes of 17,571 m³ and 82,239 m³ were treated and discharged at Cannon and Schooner WWTP's respectively. These volumes equate to an average of 160 m³/connection. Sewage flows are trending upwards probably as a result of people spending more time in Magic Lake Estates (especially during the summer season) as well as inflow and infiltration that occurs during wet weather conditions. During the rainy season, inflow and infiltration water enters the sewer system through cracks and defects in the old pipes and manholes that were installed in the late 1960's.

Figure 2 shows Magic Lake Estate sewer flow trends over the last five years. The flows in 2016 were approximately 11% higher than 2015. As a result, the wastewater treatment plants have had difficulty processing peak flow conditions.

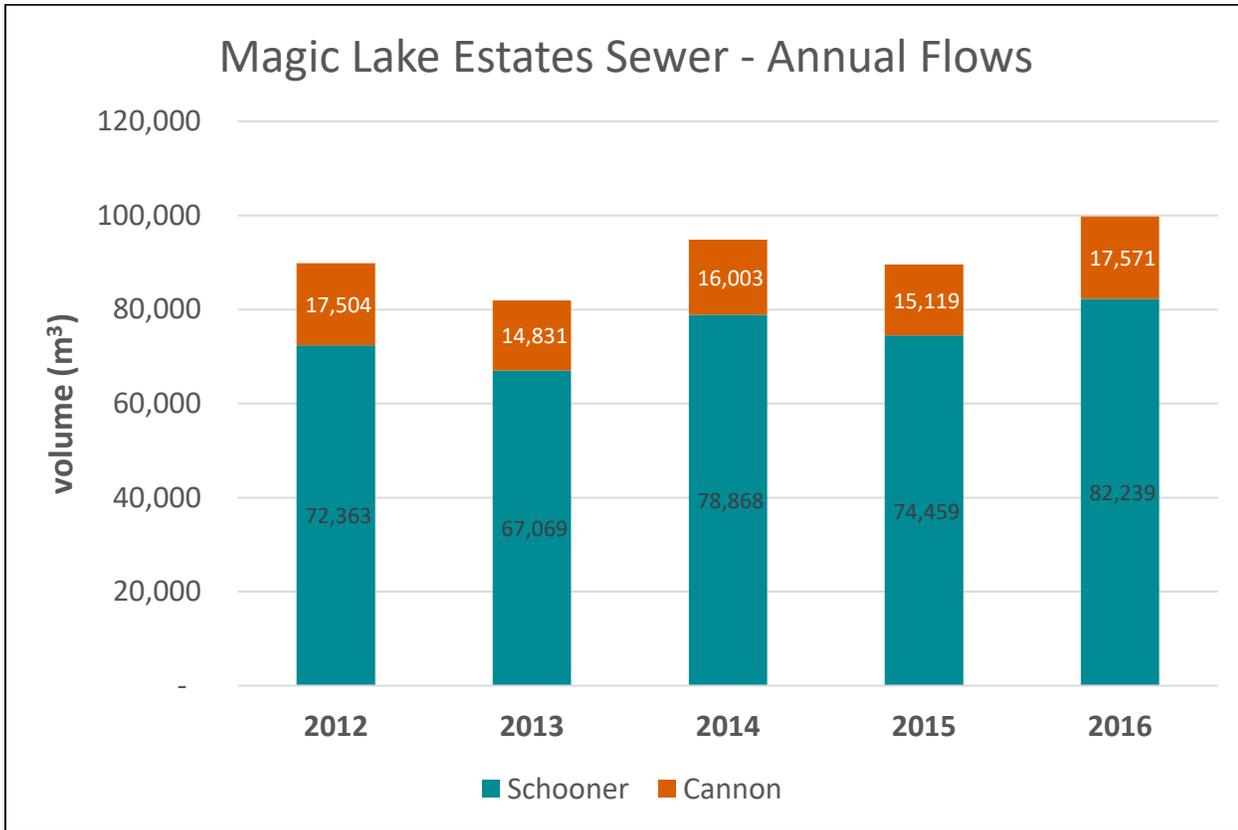


Figure 2 Magic Lake Estates Sewer Flow Trends 2012 - 2016

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 met all effluent quality requirements, with no exceedances of permitted limits observed (although effluent sampling did not take place during peak flow events). However, both plants exceeded their permitted daily flow allowances significantly in 2016. The exceedances all occurred during storm events when inflow and infiltration occurs and because neither plant has any equalization tanks to attenuate the peak flows. Figure 3 shows the number of exceedances at each plant along with the annual precipitation (which indicates there is a correlation between these two parameters). The Ministry of Environment has issued non-compliance warning letters for these two treatment facilities and is expecting upgrades to bring them back into compliance.

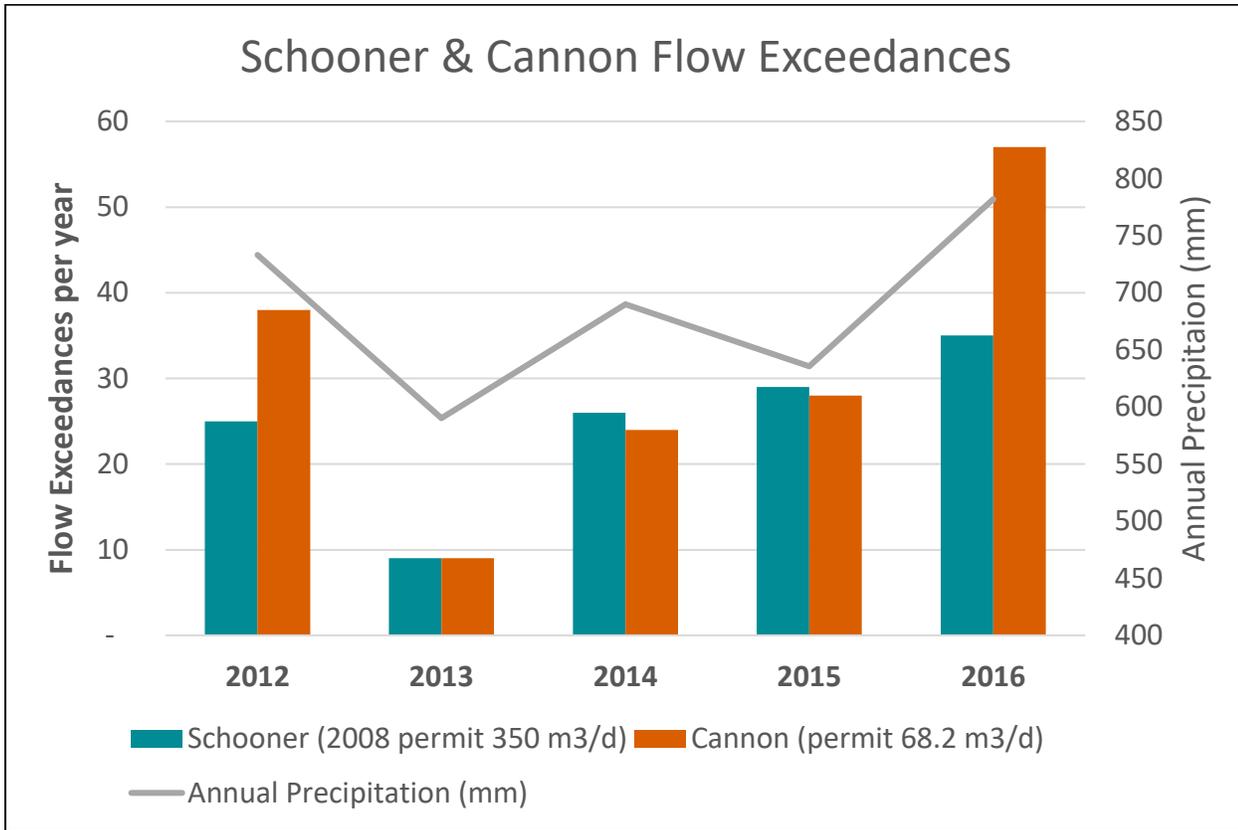


Figure 3 Schooner and Cannon WWTP Flow Exceedances

Receiving Water

In accordance with the provincial discharge permit, routine receiving water monitoring was conducted along the Schooner and Cannon outfalls in 2016. All stations had a geometric means less than provincial and federal guidelines for enterococci and fecal coliforms indicating that the waters around the outfall were safe for recreational activities. In addition, as a result of 3 consecutive days of plant flow volume exceedances in February, non-routine sampling events were conducted twice around the Cannon outfall and once around the Schooner outfall as required by the Ministry. A similar flow exceedance sampling event was triggered in October around the Cannon outfall. These samples were also all within the guidelines set to protect human primary contact for recreation. Sampling is not required again until 2020 unless there are continued plant exceedances or other unanticipated treatment issues.

Sewer Service Operational Highlights

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

- January 2016 – Drainage improvements around Chart Drive Septic Tank – Installation of ground water drainage piping system to divert ground water away from the underground concrete septic storage tank.
- March, 2016 – Manhole repairs – locate and raise a buried manhole adjacent to Chart Drive septic system.
- March 2016 – Galleon Way Pumping Station Electrical Repairs – Pump replacement and electrical equipment upgrade

- April 2016 – Cutlass Pumping Station Electrical Repairs – Troubleshooting and replacement of the pump electrical drives
- October 2016 – Cannon Wastewater Treatment Plant exceedances – As a result of more than three consecutive days of flow exceedances at Cannon, marine environmental monitoring sampling and testing activities were conducted.

Sewer Service Capital Project Updates

The Capital Projects that were in progress or completed in 2016 included:

1. Chart Drive Pump Station – the pump station was commissioned in November 2016; this project is complete.
2. Sewer Pipe Replacement (Buck Lake and Privateers Road) – closed circuit TV inspection of the pipe verified that it is in poor condition. Survey work and preliminary design work is complete. Detailed design will be completed in 2017 and the project will be tendered for construction during the dry weather season in 2018.
3. Inflow & Infiltration Assessment – Flow meters were installed to monitor 5 sub-catchment areas. The data is being evaluated. A contract to clean and inspect all the sewers and manholes has been awarded. After the inspection work is complete, a report will be prepared summarizing the pipe’s condition and priority repairs.
4. Schooner Tank Assessment – the aeration tank has been assessed and it requires some repairs, but it can continue to be used and incorporated into the overall wastewater treatment plant upgrade.

Substantial upgrades to the Schooner and Cannon treatment plants and collection system is required to eliminate all regulatory compliance violations. A referendum was held in 2015 to borrow \$6.1M to complete the necessary upgrades but it was not approved. Therefore, the proposed upgrades are being planned in a phased manner over a 5-year period. Phase 1 works (noted above) are progressing well and now the next phase to upgrade 6 pump stations and Schooner treatment plant is required. Public consultation is planned for the fall of 2017 and a new referendum is suggested for 2018.

Financial Report

Please refer to the attached *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 costs 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.

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CAPITAL REGIONAL DISTRICT

Magic Lake WATER Statement of Operations (Unaudited) For the Year Ended December 31, 2016

	2016	2015
Revenue		
Transfers from government	568,990	568,990
User Charges	287,196	253,555
Water Sales	14,744	17,027
Fees and Charges	499	1,138
Other revenue from own sources:		
Interest earnings	716	1,201
Other revenue	11,207	8,829
Total revenue	<u>883,352</u>	<u>850,740</u>
Expenses		
General government services	17,460	17,460
CRD Labour and Operating costs	336,985	316,630
Debt Servicing Costs	220,467	220,380
Other expenses	151,914	152,670
Total expenses	<u>726,826</u>	<u>707,140</u>
Net revenue (expenses)	156,526	143,600
Transfers to own funds:		
Capital Reserve Fund	141,526	209,696
Maintenance Reserve Fund	15,000	15,000
Annual surplus (deficit)	-	(81,096)
Accumulated surplus, beginning of year	-	81,096
Accumulated surplus, end of year	<u>\$ -</u>	<u>0</u>

CAPITAL REGIONAL DISTRICT

Magic Lake Estates WATER Statement of Reserve Balances (Unaudited) For the Year Ended December 31, 2016

	Capital Reserve	
	2016	2015
Beginning Balance	613,809	519,205
Transfer from Operating Budget	141,526	209,696
Transfers from completed capital projects	1,955	-
Interest Income	7,619	7,908
Transfer to Capital Projects	(251,000)	(123,000)
Ending Balance	<u>513,908</u>	<u>613,809</u>

	Operating Reserve	
	2016	2015
Beginning Balance	30,000	15,000
Transfer from/(to) Operating Budget	15,000	15,000
Ending Balance	<u>45,000</u>	<u>30,000</u>

CAPITAL REGIONAL DISTRICT

Magic Lake WATER (2) Statement of Operations (Unaudited) For the Year Ended December 31, 2016

	2016	2015
Revenue		
Transfers from government	160,287	169,319
User Charges		
Other revenue from own sources:		
Interest earnings	404	507
Other revenue	20,666	954
Total revenue	<u>181,357</u>	<u>170,780</u>
Expenses		
General government services	2,420	2,420
Debt Servicing Costs	153,634	171,921
Other expenses	396	386
Total expenses	<u>156,450</u>	<u>174,727</u>
Net revenue (expenses)	24,907	(3,947)
Transfers to own funds:		
Capital Reserve Fund		
Maintenance Reserve Fund		
Annual surplus (deficit)	24,907	(3,947)
Accumulated surplus, beginning of year	13,107	17,054
Accumulated surplus, end of year	<u>\$ 38,014</u>	<u>13,107</u>

CAPITAL REGIONAL DISTRICT

Magic Lake Sewer Statement of Operations (Unaudited) For the Year Ended December 31, 2016

	2016	2015
Revenue		
Transfers from government	334,920	281,370
User Charges	169,676	169,312
Other revenue from own sources:		
Interest earnings	351	742
Other revenue	1,012	471
Total revenue	<u>505,959</u>	<u>451,895</u>
Expenses		
General government services	15,758	15,230
Contract for Services	66,083	58,362
CRD Labour and Operating costs	289,611	226,565
Debt Servicing Costs	11,244	-
Other expenses	134,605	128,801
Total expenses	<u>517,301</u>	<u>428,958</u>
Net revenue (expenses)	(11,342)	22,937
Transfers to own funds:		
Capital Reserve Fund	14,208	46,225
Maintenance Reserve Fund	5,000	5,000
Annual surplus (deficit)	(30,550)	(28,288)
Accumulated surplus, beginning of year	30,550	58,838
Accumulated surplus, end of year	<u>\$ -</u>	<u>30,550</u>

CAPITAL REGIONAL DISTRICT

Magic Lake Estates SEWER Statement of Reserve Balances (Unaudited) For the Year Ended December 31, 2016

	Capital Reserve	
	2016	2015
Beginning Balance	83,829	178,372
Transfer from Operating Budget	14,208	46,225
Transfer from Equipment Replacement Fund	77,242	-
Interest Income	963	2,232
Transfer to Capital Projects	(115,000)	(143,000)
Ending Balance	<u>61,241</u>	<u>83,829</u>

	Operating Reserve	
	2016	2015
Beginning Balance	5,000	-
Transfer from/(to) Operating Budget	5,000	5,000
Ending Balance	<u>10,000</u>	<u>5,000</u>