

## COUNCIL REPORT

M&C No.	2019-187
Report Date	July 24, 2019
Meeting Date	July 29, 2019
Service Area	Saint John Water

His Worship Mayor Don Darling and Members of Common Council

**SUBJECT: Saint John Water – 2018 Annual Water Report**

### **OPEN OR CLOSED SESSION**

This matter is to be discussed in open session of Common Council.

### **AUTHORIZATION**

Primary Author	Commissioner/Dept. Head	City Manager
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### **RECOMMENDATION**

It is recommended that Common Council receive and file this report summarizing the Saint John Water 2018 Annual Water Report.

### **EXECUTIVE SUMMARY**

Municipalities in New Brunswick operate public drinking water systems under conditions set out in certificates of *Approval to Operate* drinking water treatment and distribution facilities. Developed by the Department of the Environment and Local Government (DELG), in collaboration with the Department of Health, these formal approvals set out standards for water treatment facilities, distribution systems and operators that strive to assure safe drinking water.

The City of Saint John (as the *Approval Holder*) provides drinking water services to the public under authority of *Approval to Operate W-1510: Drinking Water Treatment and Distribution Facilities*. This *Approval to Operate* was issued by the New Brunswick Minister of the Environment effective September 07, 2017, and expires September 06, 2022.

The certificate of *Approval to Operate* is a regulatory tool designed around the multi-barrier philosophy. All municipal water systems in New Brunswick are required to abide by the various conditions set out in *Approvals to Operate* drinking water treatment and distribution facilities. The standards set through the various conditions strive to ensure safe and reliable drinking water for all users. Saint John Water fully endorses the philosophy behind the need for strict regulation of systems supplying such a vital public service.

## ***ANNUAL REPORT***

Condition 25 (Approval W-1510) of the certificate requires submission of an Annual Report to the Department of the Environment and Local Government. The report provides pertinent technical and operating information to the Regulator on the City's water systems including:

- Monitoring results (daily/weekly/monthly data such as free chlorine residual, turbidity, pH, temperature, iron, manganese, etc.)
- Monthly water production
- Operational highlights (significant incidents and system improvements, changes, or additions);
- Alarm log - major alarms
- Summary of backflow prevention and cross-connection activities;
- Summary of flushing activities;
- Operator information (training, certifications, and staffing changes);
- Public relations (notifications & public education)
- List of major new extensions and/or renewals complete with analytical results (microbiological, organic & inorganic)

## ***PREVIOUS RESOLUTION***

October 2, 2017; ***2018 Water & Sewerage Utility Fund Capital Budget.***  
(M&C No. 2017-247)

October 30<sup>th</sup>, 2017; ***2018 Water & Sewerage Utility Operating Budget.***  
(M&C No. 2017-273)

## ***STRATEGIC ALIGNMENT***

This report aligns with Council's priority for Sustainable City Services and Municipal Infrastructure.

## **BACKGROUND**

### **Protective Barriers**

People must have water to live; good health depends on consuming adequate quantities of safe, clean drinking water. That water must be delivered, at the best cost possible, to Saint John homes, institutions and businesses in a state that is clear, colourless, odourless and free of disease-causing micro-organisms (pathogens) or harmful chemicals.

The Drinking Water Service is a public service that provides drinking water to the community and is vital to the economic vitality of the region. This service includes the supply of water, treatment, testing, transmission and distribution, administration of the service, and billing and collections.

Saint John Water manages its drinking water service based on the Multi-Barrier Approach from the water source to the user's tap. Drinking water quality must be assured through a series of protective barriers, for instance:

- Source (watershed and wellfield) Protection;
- Drinking Water Treatment;
- Operations and Maintenance (including staff training, development and staff levels);
- Monitoring and Alarms (Sampling Plan, SCADA system, and record keeping);
- Distribution System (residual chlorine maintenance, total coliform sampling, E. coli sampling, water quality flushing, storage reservoirs, backflow prevention and cross connection control); and
- Emergency Response

### **ANALYSIS**

The Saint John Water – 2018 Annual Water Report, with all its attachments, consists of hundreds of pages of facts and data. Rather than table the full voluminous document with Common Council, a summarized version with selected sections is provided. A full copy of the report with all appendices is on file with the Common Clerk and available on the City of Saint John webpage Tuesday July 30, 2019.

Saint John Water is responsible for the delivery of water and wastewater services on behalf of the City of Saint John. In accordance with Condition 25 of the *Approval to Operate*, the annual water report is intended to provide the (DELG) with pertinent information relating to operation of the municipal water system.

## **Analytical Results**

The City of Saint John obtains its drinking water from primarily one watershed, and two wellfields, Loch Lomond (east), the South Bay Wellfield (west) and the Harbourview Wellfield. The quality of water in the lakes that make up the watershed is important to the final quality of treated potable water. To that end, Saint John Water analyzed raw water sources in the eastern water system from ten locations and in the western water system from four locations. Saint John Water also analyzes the raw water at each of the five production wells (3 West and 2 Harbourview). With the new West Well system, there are also monitoring wells surrounding the wellfield which form part of the overall monitoring of the raw water. This raw water sampling is in addition to the water quality Sampling Plan approved by the DELG.

The approved Water Sampling Plan from the DELG required that samples be collected weekly at thirty five locations across the three water distribution systems and microbiologically analyzed. Twenty of the sites are required to be analyzed semi-annually for inorganic parameters and quarterly for organic parameters.

In addition to the testing noted above, numerous other water parameters are tested routinely to monitor system safety and drinking water quality.

## **Water Production: Spruce Lake and South Bay Wellfield Combined**

Annual water production (raw from Spruce Lake and potable from the South Bay Wellfield) during 2018 for the Spruce Lake / South Bay Wellfield system was approximately 41.9 billion litres, an increase of 4.2 billion litres over 2017 annual Spruce Lake water production, which was 37.7 billion litres. A comparison of water production for previous four years can be seen in Table 1 below.

**Table 1: 2018 Annual Water Production (raw and treated)  
Spruce Lake & South Bay Wellfield**

Year	Production (billion Liters)	Increase/Decrease from Previous Year (billions of Liters)
2018	41.9	+4.2
2017	37.7	-4.6
2016	42.3	8.1
2015	34.2	-3.5
2014	37.7	-1.9

In 2018, Loch Lomond water flowed from the East water system crossing Reversing Falls Bridge to the West system via a 900 mm transmission main from January to October. When East water is flowing across the bridge, it only supplies Industrial Customers (Irving Pulp and Paper and Irving Tissue). The water distribution system configuration physically prevents East treated water from mixing with west potable water due to a physical air gap which was installed between the 2 systems as part of the Safe Clean Drinking Water Project (SCDWP). Water flow across the bridge stopped on October 2, 2018 when the requirement for having the 900mm pipe in service to accommodate the SCDWP work ceased. During the period, the 900 mm transmission main was in service, Industrial Customers on the West side were supplied with water for process based on the operating split of approximately one-sixth of their water from East and five-sixths from the West raw water system. It is important to note that the West system supplies only raw untreated water to these Industrial Customers. Irving Pulp and Paper will be supplied raw water from the West Industrial System going forward.

In 2018, peak monthly production was 4.65 billion litres occurring in the month of July. This is 0.90 billion litres higher than the peak in 2017 as can be seen in the Table 2 below. Table 2 compares the previous four year's peak production and the month in which it occurred.

**Table 2 : Peak Monthly Production (raw and treated)  
Spruce Lake/South Bay Wellfield**

Year	Peak Monthly Production (billion Liters)	Increase/Decrease from Previous Year (billions of Liters)	Peak Month
2018	4.65	+0.90	Jul
2017	3.75	-0.52	Aug
2016	4.27	-0.03	Sep
2015	4.30	-0.42	Jul
2014	4.72	+0.84	Aug

### **2018 South Bay Wellfield Treated Water Production**

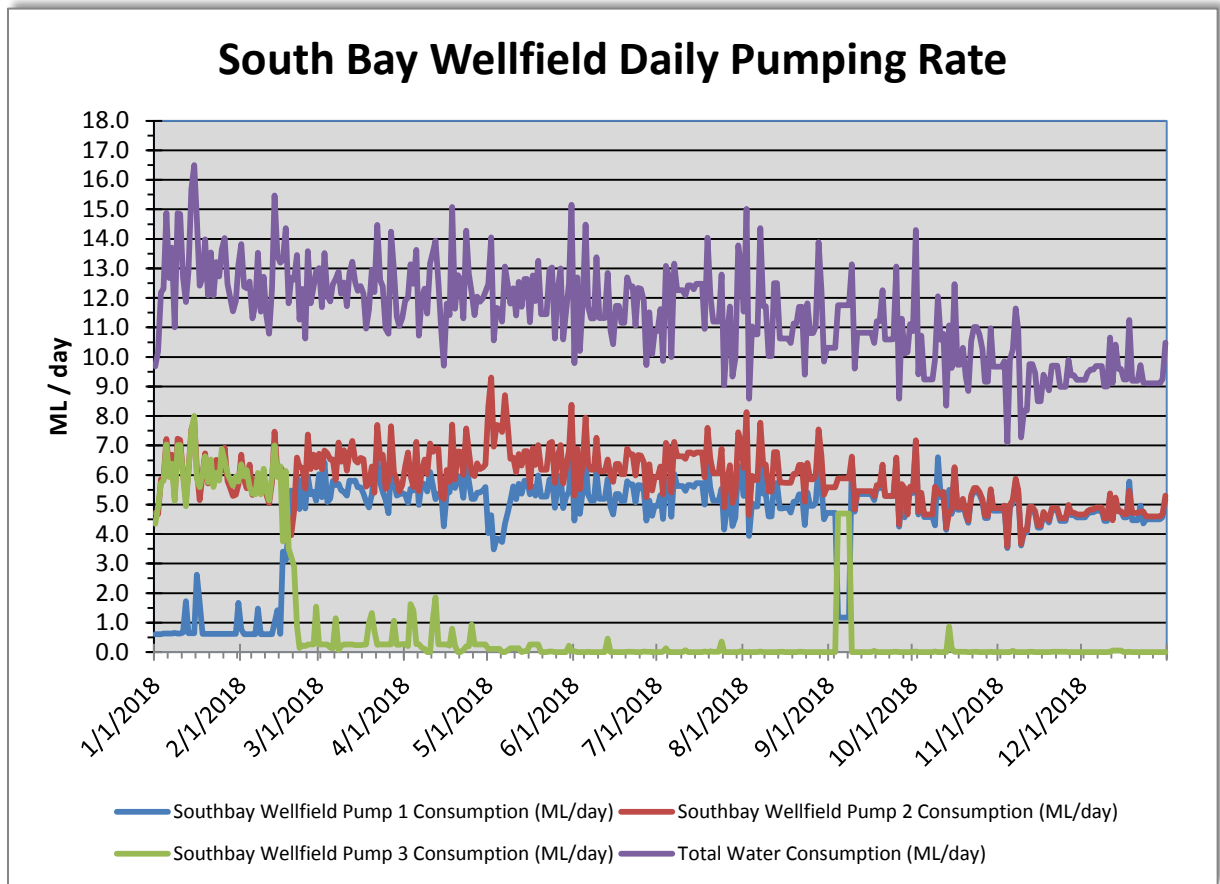
Annual ground water withdrawn from the South Bay aquifer in 2018 was about 4.2 billion litres. 2018 was the first full year water was pumped from the aquifer and delivered to Customers after chlorination and orthophosphate addition at the Spruce Lake Treatment Facility. Table 3 below breaks down the annual ground water withdrawn from the South Bay Aquifer by month including the peak volumes per month.

**Table 3 : South Bay Wellfield – 2018 Water Production**

Month	Peak Daily Production (Mega Litres)	Average Daily Production (Mega Litres)	Monthly Production (Mega Litres)
January	16.5	13.0	402.2
February	15.5	12.6	351.7
March	14.5	12.3	381.8
April	15.1	12.3	368.9
May	15.2	12.2	377.2
June	14.5	11.6	347.9
July	14.0	11.8	366.0
August	15.0	11.3	349.4
September	13.1	11.0	329.2
October	14.3	10.2	317.3
November	11.6	9.3	279.2
December	11.3	9.5	294.0
<b>TOTAL</b>			<b>4,164.9</b>
<b>AVERAGE</b>		<b>11.4</b>	

Condition 2 in Approval to Operate W-1510 states a maximum annual average pumping rate for the combined three production wells of 12.5 ML/day. It further states that the 12.5 ML/day operational pumping rate for the South Bay Wellfield is to be averaged over a running annual basis (i.e. a maximum of 4562.5ML pumped over 365 days).

As can be seen in Table 3, a maximum of 4164.9 ML was pumped from the aquifer in 2018. This represents 91.3% of the maximum allowable water pumped from the aquifer or 397.6 ML lower than the maximum allowable as per the Approval to Operate. Furthermore, the daily average pumping rate over the entire year is 11.4 ML/day which is lower than the 12.5 ML/day permitted within the Approval to Operate; therefore Saint John Water is compliant with condition 2 of the Approval to Operate. The Figure 1, below illustrates the daily pumping rates for the three production wells along with the total of all three pumps (purple line).



**Figure 1: 2018 South Bay Wellfield Daily Pumping Rates**

As can be seen in Figure 1, the water demands on the west side were highest in January 2018 decreasing constantly over the entire year ending with the lowest water demands at the end of 2018. This pattern of water usage or water demands by Customer has not been experienced in previous years by Saint John Water. Water demands can be expected to peak in summer months during higher water usage periods.

Approval to Operate W-1510 also requires the monitoring and recording of water levels in each of the three production wells (Condition 27). Condition 27 further states that each well is not to fall below +1m above mean sea level (amsl) more than 100 days/year with a maximum of 20 consecutive days. Table 4, below shows the water elevation for each production well on a quarterly basis since the production wells were commissioned in September 2017.

**Table 4: South Bay Wellfield  
2017/2018 Quarterly Production Well Water Elevation<sup>1</sup>**

Well ID	Monitoring Period	Water Level Elevation at Start of the Monitoring Period (m asl)	Water Level Elevation at End of the Monitoring Period (m asl)	Approximate Change in Water Level Elevation (m)	
				Quarterly	Total <sup>2,3</sup>
Well #1	Q1 (Oct –Dec 2017)	4.6	2	2.6	2.6
	Q2 (Jan – Mar 2018)	2	0.6	1.4	4
	Q3 (Apr – Jun 2018)	0.6	0.2	0.4	4.4
	Q4 (Jul – Sep 2018)	0.2	-0.8	1	5.4
	Q5 (Oct – Dec 2018)	-0.8	-1.2	0.4	5.8
Well #2	Q1 (Oct –Dec 2017)	4.7	2	2.7	2.7
	Q2 (Jan – Mar 2018)	2	0.5	1.5	4.2
	Q3 (Apr – Jun 2018)	0.5	0.1	0.4	4.6
	Q4 (Jul – Sep 2018)	0.1	-0.7	0.8	5.4
	Q5 (Oct – Dec 2018)	-0.7	-1.1	0.4	5.8
Well #3	Q1 (Oct –Dec 2017)	4.7	2	2.7	2.7
	Q2 (Jan – Mar 2018)	2	0.6	1.4	4.1
	Q3 (Apr – Jun 2018)	0.6	0.2	0.4	4.5
	Q4 (Jul – Sep 2018)	0.2	-0.7	0.9	5.4
	Q5 (Oct – Dec 2018)	-0.7	-0.8	0.1	5.5

Notes:

1. Data supplied by BGC Engineering based on Saint John Water's SCADA data
2. Total change in water elevation to the water level elevation observed at each location (August 21, 2017 before the start of the wellfield operation (September 14, 2017).
3. Total change at the end or Q4 is the annual change.

As shown in Table 4, the water level in each of the three production wells begins to stabilize below the +1m amsl towards the end of 2018. As a result, Saint John Water is out of compliance with respect to Condition 27 of the Approval to Operate the Drinking Water System. Saint John Water has been diligently working with industry experts along with the Department of Environment and Local Government and Department of Health to find a solution to this issue and restore the water levels in the aquifer above the +1 amsl.

### **Musquash Water System Supplemental Supply to Spruce Lake Watershed**

When the water level in Spruce Lake drops to approximately 60 metres, Saint John Water turns on the Musquash Pump Station and transfers water from the East Musquash watershed to Menzies Lake. This inter-basin transfer is necessary to provide for the industrial demand and to assure adequate lake levels in Spruce Lake in times of low precipitation. A total volume of 16.007 billion litres was transferred during a total of 111 days of pumping in 2018. For comparison purposes, the previous four year's inter-basin transfers are shown in Table 5 below.



**Table 5: Musquash – Menzies Lake Interbasin Transfer**

Year	Volume Transferred (billions of Litres)	# of Operating Days
2018	16.007	111
2017	16.615	111
2016	23.726	182
2015	10.548	87
2014	7.197	57

### ***Water Production: Loch Lomond System***

During 2018, annual water production for the Loch Lomond system (raw and treated) was 27.5 billion litres, a decrease of 5.8 billion litres over 2017 Loch Lomond water production, which was 33.3 billion litres. This decrease can be contributed to the decrease flow across the Reversing Falls Bridge via the 900mm transmission main compared to 2017 along with the rehabilitation of various water transmission and distribution pipes associated with the Safe, Clean drinking Water project. For comparison purposes the Table 6, shows the total annual water production (raw and treated) for the previous four years.

**Table 6: 2018 Annual Water Production (raw and treated) – Loch Lomond System**

Year	Production (billion Litres)	Increase/Decrease from Previous Year (billions of Litres)
2018	27.5	-5.8
2017	33.3	+1.6
2016	31.7	-4.7
2015	36.4	+4.4
2014	32.0	+0.2

### ***2018 Loch Lomond System Monthly Water Production***

Annual treated water production for 2018 for the Loch Lomond system was approximately 24.5 billion litres, a decrease of 5.4 billion litres from 2017 water production, which was 29.9 billion litres. In 2018, peak daily production was 137.5 ML an increase from 2017 which was 135.1 ML. Table 7 presents the Peak Daily Production and the Monthly treated water production.

**Table 7: Loch Lomond System 2018 Treated Water Production**

Month	Peak Daily Production (Mega Litres)	Monthly Production (Mega Litres)
January	100.6	2,404.5
February	97.5	2,192.5
March	102.4	2,320.8
April	136.0	2,263.9
May	97.6	2,261.5
June	119.2	2,559.7
July	137.5	3,112.4
August	126.1	2,450.8
September	54.9	1,401.0
October	43.5	1,143.1
November	46.0	1,134.7
December	44.1	1,243.7
<b>TOTAL</b>		<b>24,488.5</b>

### **CHEMICAL CONSUMPTION**

During 2018, a total of 99.6 tonnes of gaseous chlorine were purchased for the Loch Lomond System. This is a dramatic drop in consumption from previous years due to the commissioning and start-up of the new Loch Lomond Drinking Water Treatment Facility (LLDWTF). As part of the Safe, Clean drinking Water project, the start-up of the new treatment plant occurred on August 30, 2018. As a result of this start-up Saint John Water stopped the addition of Chlorine gas at Latimer Lake on September 21, 2018 after a planned transition to the new plant.

A total of 52.9 tonnes of sodium hypochlorite was purchased for the South Bay Wellfield. The drop in chlorine usage for the West system compared to previous years is mainly due to the conversion from surface water to ground water in September 2017, which has a much lower organic content than the surface water supply and thus has much less chlorine demand.

**Table 8: Chemical Consumptions by Year**

Year	Loch Lomond System - gaseous Chlorine (tonnes)	Spruce Lake System - Sodium Hypochlorite (tonnes)
2018	99.6	52.9
2017	129.4	133.9
2016	119.8	167.6
2015	171.5	175.2
2014	144.2	186.7
2013	158.3	210.6

## ***OPERATIONAL HIGHLIGHTS***

Saint John Water manages its drinking water service based on the Multi-Barrier Approach from the water source to the user's tap. Drinking water quality must be assured through a series of protective barriers. Source water (watershed and wellfield) protection is the first barrier. To aid in this, both Spruce Lake and Loch Lomond watersheds are protected under the Province of New Brunswick's Watershed Protection Area Designation Order. This order places various restrictions on the types of activities allowed on either the watercourse or surrounding land. In general, it is much less expensive to prevent negative impacts to watersheds than site remediation after an incident has occurred.

Many of the lands in the watersheds are forested, and this brings risks such as forest fire, disease, and insect infestation. When forests are not managed properly or are not maintained in a state of good health, it puts the drinking water supply at risk. In 2018, like previous years, we received various public concerns from home owners around the Loch Lomond watershed related to misuse and illegal dumping on city owned property. Operational staff increased surveillance in these areas and in some cases erected signs and barriers in the affected areas in an attempt to curtail these activities. Staff also removed several truckloads of garbage from these sites.

### ***Operational Highlight – Water Treatment***

2018 marked a significant achievement for Saint John Water, the City of Saint John and the citizens it serves. For many decades, the City operated a Water Treatment Facility at Latimer Lake which consisted of coarse screening followed by chlorination. This rudimentary process provided drinking water to Customers east of the Reversing Falls for many years. With the completion of the new Loch Lomond Drinking Water Treatment Facility in late August 2018, the City is now delivering high quality drinking water to its customers using a modern day state-of-the-art Water Treatment Facility. This treatment facility, along with several kilometres of transmission/distribution pipe, was part of the Safe Clean Drinking Water Project.

### ***Operational Highlight – Water Distribution***

In 2018, Saint John Water Staff responded to 44 water main breaks, 4 more than 2017. The mains ranged in size from 50mm to 400 mm in diameter.

Also in 2018, Saint John Water did not experience any large transmission main failures. This was a direct result of the new installations as well as the rehabilitated portions of the transmission main system that was completed on the Safe Clean Drinking Water Project.

### Operational Highlight – Orthophosphate Introduction

In 2018, Saint John Water began introducing an orthophosphate solution to both the East and West water systems. Orthophosphates are commonly used in the water treatment industry to combat pipe corrosion by stabilizing the internal pipe scale. The orthophosphate solution is a NSF 61 certified product which means it has been approved to be used in potable water systems. It should be noted that the introduction of orthophosphate was approved by both the Department of Health (DOH) and the Department of Environment and Local Government (NBDELG) prior to implementation.

A temporary orthophosphate dosing system was added to the West system to potentially assist in stabilizing existing scale formation on private copper plumbing. The dosing system was commissioned in March 2018.



**Figure : Temporary Orthophosphate Dosing System - Spruce Lake WTP**

Orthophosphate addition in the East system started in June 2018 as a means to slowly transition the water quality in the east system to water that will eventually be produced from the new Loch Lomond Drinking Water Treatment Facility. The temporary dosing of orthophosphate solution at Latimer Lake Water Treatment Facility ceased in early September shortly after the LLDWTF came on-line. The addition of orthophosphate at the new LLDWTF was always contemplated under the Safe, Clean Drinking Water Project.

For comparison purposes, Table 9 below illustrates orthophosphate consumption for the past year for both the East and West systems. Also included in the table is the mass of dry Orthophosphate product the City purchased for the new LLDWTF.

**Table 9: Orthophosphate Consumption**

Year	Loch Lomond System - Liquid Orthophosphate (Litres)	South Bay System – Liquid Orthophosphate (Litres)	Loch Lomond Drinking Water Treatment Facility (kg)
2018	8,000	7,000	14,515

### Operational Highlight – Sodium Hydroxide Introduction

In 2018, Saint John Water began introducing a 50% sodium hydroxide solution to the East water systems. Sodium Hydroxide is commonly used in the water treatment industry to adjust the pH of finished water. It is a NSF 61 certified product which means it has been approved to be used in potable water systems. It should be noted that the introduction of sodium hydroxide was approved by both the DOH and NBDELG prior to implementation.

pH adjustment in the East system started in April 2018 as a means to slowly transition the water pH in the east system to water that will eventually be produced from the new Loch Lomond Drinking Water Treatment Facility. The temporary dosing of sodium hydroxide solution at Latimer Lake Water Treatment Facility ceased in early September shortly after the LLDWTF came on-line. Table 10 below shows the amount of Sodium Hydroxide consumed with the temporary dosing system at Latimer Lake. pH adjustment at the new LLDWTF was always contemplated under the Safe, Clean drinking Water Project.

**Table 10: Sodium Hydroxide Consumption**

Year	Loch Lomond System - Sodium Hydroxide (kg)
2018	106,877

### **Operator Training & Certification**

Saint John Water continues to make advances in the operation and maintenance of our water and wastewater systems and the pivotal role they play in providing for the protection of public health and the delivery of a vital service. The City of Saint John continues to work with the New Brunswick Community College – Saint John in developing training programs for its water and wastewater operators. The training has been attended by City of Saint John staff, numerous other municipalities from New Brunswick and by private companies. A detailed training and certification summary is included in the annual report.

### ***SERVICE AND FINANCIAL OUTCOMES***

Staff will be forwarding the *Saint John Water 2018 Annual Water Report* to the DELG and the Department of Health on behalf of the City of Saint John (*Approval Holder*). An electronic version of the full 2018 Annual Report is available on the City of Saint John Web site.

### ***INPUT FROM OTHER SERVICE AREAS AND STAKEHOLDERS***

N/A

### ***ATTACHMENTS***

N/A