THE VILLAGE OF LIONS BAY

KELVIN GROVE

Wastewater Treatment Plant

2018 ANNUAL REPORT

JAN
2019

Naizam Jaffer
Public Works Manager

CONTENTS

Introduction

The upper and lower Kelvin Grove neighbourhoods in the Village of Lions Bay are serviced by a sanitary sewer network that culminates in a wastewater treatment plant (WWTP) that was constructed in 1981 on the waterfront of Howe Sound, at the Kelvin Grove Beach Park. A total of 94 residential lots are connected to the WWTP through a network of 2,173 meters of 200mm PVC sanitary sewer pipes, manholes, and property connections or service laterals. A map of this sanitary sewer system is shown in Appendix 1.

TREATMENT AND MICROBIOLOGY

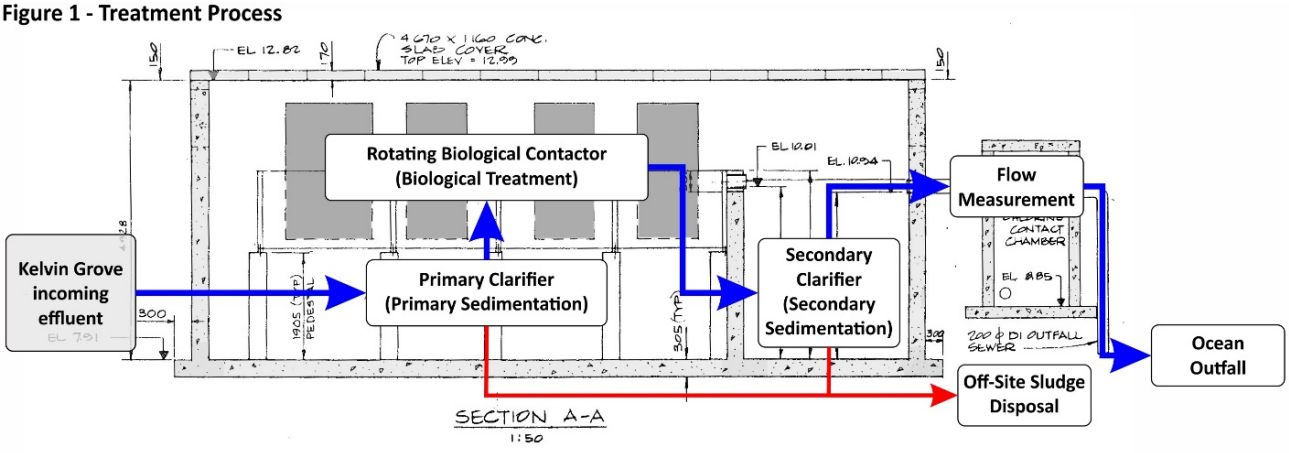
The Kelvin Grove WWTP is a fixed-film treatment process that consists of three distinct process phases:

- Primary Sedimentation;
- Biological Treatment; and
- Secondary Sedimentation.

Upon passing through each of these phases, the treated wastewater passes through a flow measurement device consisting of a weir and level transducer mounted within a metering chamber. Once through the flow meter, the wastewater is released into Howe Sound via an ocean outfall pipe 85 meters beyond the high tide mark and at a depth of 60 metres.

The treatment process is represented diagrammatically below:

Figure 1 - Treatment Process



The wastewater treatment process is dependent upon the presence and activity of the microorganisms within the wastewater and treatment plant. This microbial ecology is a complex combination of interrelationships among bacteria, protozoa, and metazoa with the organic contents of the wastewater. Microorganisms use this organic content as a carbon source for respiration, energy generation, and biomass production. Once the organic content of wastewater is depleted, microorganisms form floc and settle out of the wastewater stream as sludge.

PRIMARY SEDIMENTATION

Wastewater enters the primary clarifier or primary sedimentation tank where suspended solids are removed by gravity sedimentation under quiescent conditions. The settled solids form a sludge blanket at the bottom of the clarifier. The primary clarifier also provides for effective removal of grit, debris, and excessive fats, oils or grease (dubbed 'FOG') prior to the supernatant's entry into the biological treatment phase.

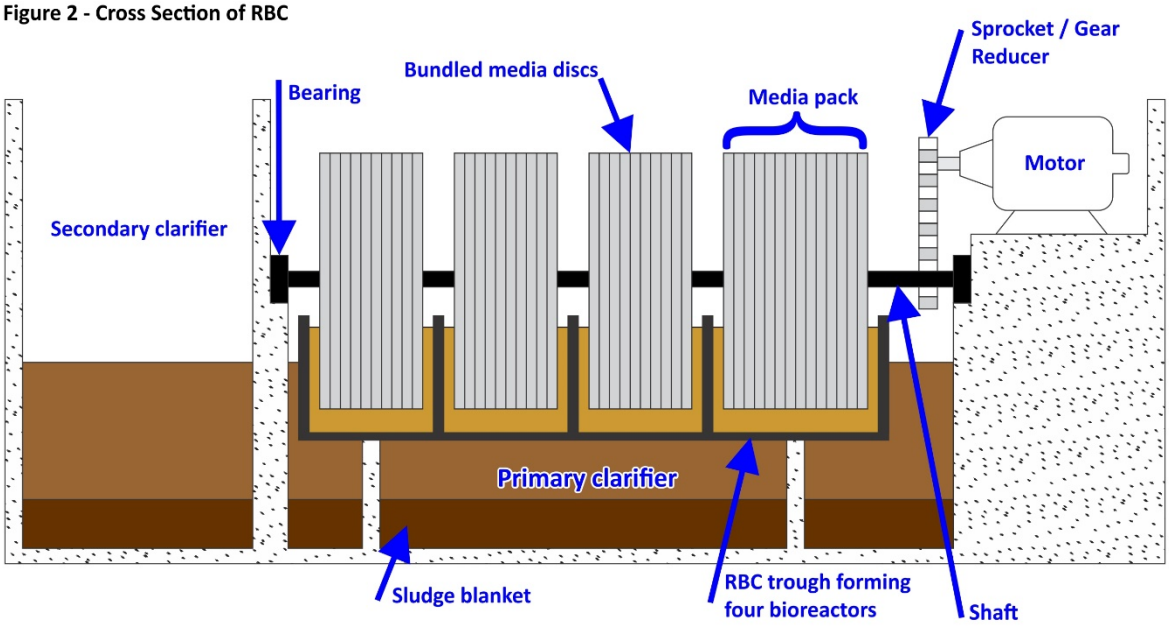
Continual input of raw wastewater into the primary clarifier and gravity settlement results in a thickening of the sludge blanket over time. Sludge blanket depth is a crucial component to the proper functioning of the treatment system, so much so that at excessive sludge blanket depths (greater than 30 cm) the sludge may turn septic, which depletes oxygen levels that ultimately inhibits healthy biomass growth which thereby decreases treatment efficiency.

BIOLOGICAL TREATMENT

From the primary clarifier, the supernatant with its colloidal and dissolved organic matter is further cleansed by biological treatment which is accomplished by a rotating biological contactor (RBC) treatment system. The RBC consists of multiple large diameter, closely spaced corrugated discs constructed of high-density polyethylene (HDPE). These disks are bundled together into what is termed a 'media pack' and are mounted in series along a horizontal shaft [Figure 2]. The Kelvin Grove WWTP utilizes the L400 ROTORdisks™ system, which has four media packs separated by baffles into a series of bioreactors, each referred to as a stage. An electric motor rotates the shaft and media packs at a rate of 1.5 to 1.6 revolutions per minute, alternately exposing the media packs to wastewater and air. Microfauna within the wastewater affix themselves to the discs creating a biofilm over the entire surface area of the media. The corrugations on the media disks are designed to give extra surface area per unit volume to each disc thereby increasing the biofilms ability to metabolize and treat the organic materials contained in the wastewater. This permits high degrees of treatment to be achieved for relatively short wastewater retention times.

Photo: Initial biofilm growth on RBC media.

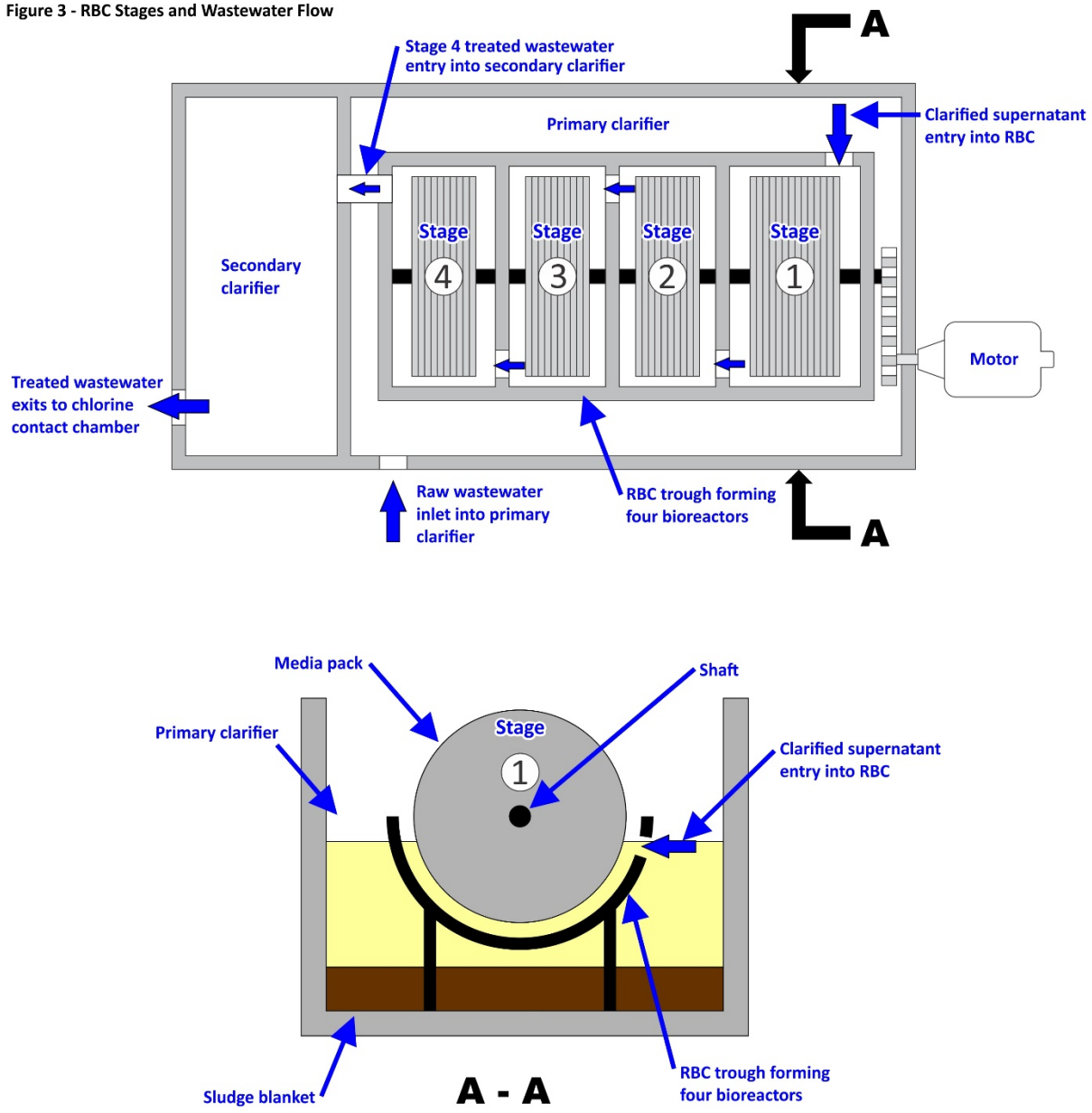
Figure 2 - Cross Section of RBC



From start to finish, the wastewater flows through the RBC's stages or bioreactors by simple displacement and gravity. As wastewater passes from stage to stage, it undergoes a progressively increasing degree of treatment by specific biological cultures in each stage, which are adapted to the changing wastewater.

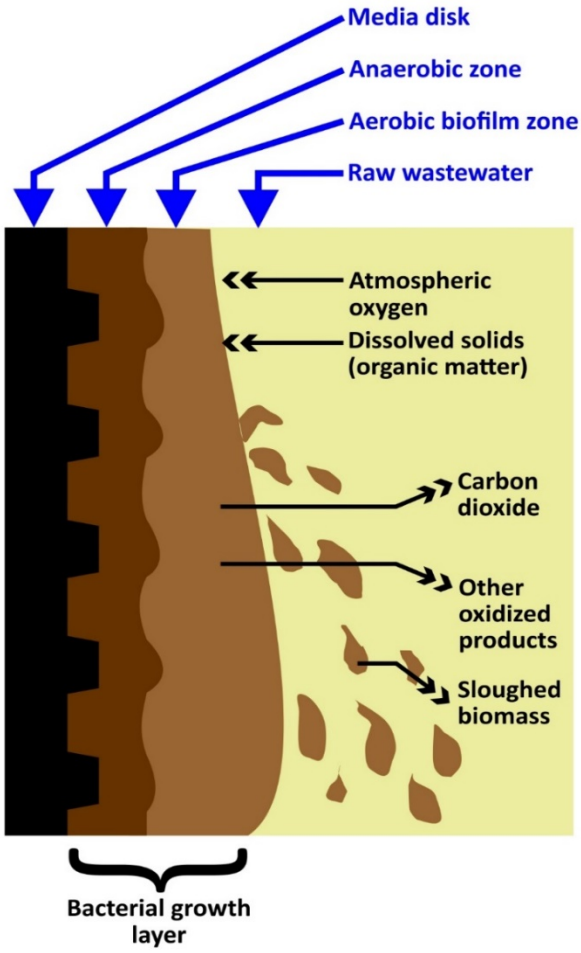
The supernatant enters the first bioreactor (Stage 1) at the point furthest away from the inlet to the plant [Figure 3]. This is the stage where the highest biological activity occurs and where biofilm accumulations are the greatest since the organic loading is highest. As the biofilm thickens, it develops into two layers: an active (aerobic) and an inactive (anaerobic) layer. By and large organics within the wastewater are transformed into biomass in the aerobic layer.

Figure 3 - RBC Stages and Wastewater Flow



Biofilm growth increases on the media disks until it reaches a tipping point with the continual drag caused by the media packs rotation generating shearing forces that causes excess biomass to slough off into the supernatant [Figure 4]. Rotation of the media also provides turbulence at the interface between biomass and wastewater so that dissolved oxygen and wastewater nutrients to the biomass through the mechanism of mixing and that of diffusion. This continual rotation also serves to keep the sloughed material in suspension through the progressive stages and into the secondary clarifier.

Figure 4 - Cross Section at RBC



Microfauna in the Initial stages are almost entirely constituted by species of ciliates and filamentous and nonfilamentous bacteria. As the wastewater passes through subsequent stages, it undergoes a progressively increasing degree of treatment by specific microfauna in each stage. The decreasing concentration of organic matter leads to the appearance of higher life forms including nitrifying bacteria, along with various types of protozoans, rotifers, and other predators.

In a well-functioning unit with the appropriate feed rate, nutrient loading, microfauna, and media rotation rates, the RBC will emit an earthy, humus-like ("musty") smell inside the unit. A substantial sour or "sewage" smell is indicative of suboptimal conditions.

SECONDARY SEDIMENTATION

Once through the fourth stage of the RBC, the treated wastewater enters the secondary clarifier. The large aggregates of biomass sloughed off the media packs retain their high density and settle rapidly in the secondary clarifier. At this point in the process the effluent is relatively clear and colourless and free of suspended matter. Sludge from the primary and secondary clarifiers is removed on an annual basis and transferred to the Iona Island wastewater treatment plant in Richmond where it undergoes further treatment.

KELVIN GROVE WWTP OPERATING PERMIT

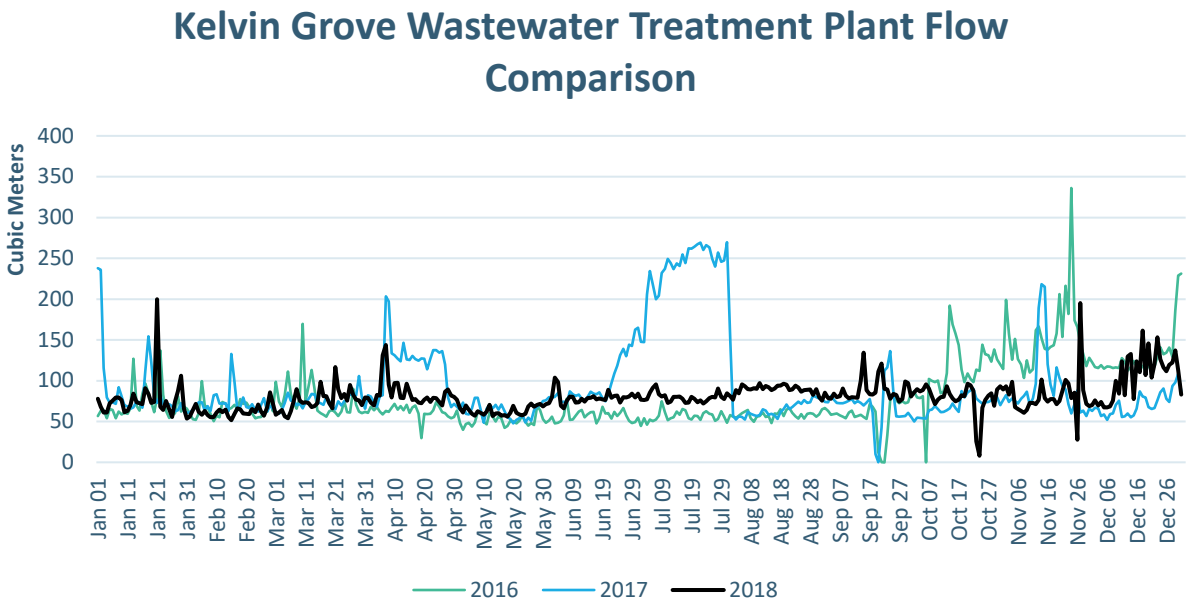
The authority to discharge wastewater into the waters of Howe Sound is governed by the provincial *Environmental Management Act*. The Kelvin Grove WWTP operates under permit number 5188 (the "Permit") which regulates the quantity and quality of the plant's discharge. The parameters stipulated in the Permit are as follows:

Parameter	Permit Value
Volume (m^3/day)	340
BOD_5 (mg/L)	45
TSS (mg/L)	60

Water Quality

Reporting requirements consist of quarterly sampling of treated wastewater for five-day biochemical oxygen demand (BOD_5) and total suspended solids (TSS) as well as the submission of an annual report to the Ministry of the Environment each January.

The following graph indicates daily wastewater discharge volumes for 2018 (black line) in comparison to the previous two years – at no time did the plant exceed the maximum discharge volume. Detailed daily flow tables for 2018 are contained in Appendix 2.



The following table indicates quarterly sampling results for five-day biological BOD_5 and TSS. Complete laboratory analysis records are contained in Appendix 3.

Date	BOD_5 (mg/L) Max 45	TSS (mg/L) Max 60
16-JAN-18	36.2	24.6
24-APR-18	26.6	33.1
25-JUL-18	8.9	12.6
18-OCT-18	3.8	10.6

As indicated by the table above, the sampling results were within permit compliance parameters for 2018. BOD_5 and TSS are governed by microbial activity and system efficiency. Temperature affects the operation of the treatment system and as indicated in the above table, colder temperatures in the late fall and early spring likely reduced biological activity thereby reducing their ability to reduce BOD_5 and TSS levels.

Maintenance

In accordance with the Permit, regular inspection and maintenance activities are conducted to keep the facility in good working order. Biweekly inspections are performed to check for vandalism, damage to the media disks, misalignment or excessive shaft deflection, motor torque loading (excessive heat), and for clogging of weirs or orifice areas. At the time of inspection, grease fittings and bearings are lubricated.

In December of 2018, routine inspections identified a defect in the mechanical components of the RBC. The main sprocket driving the shaft and media pack lost some teeth resulting in damage to the chain and gear reducer. While serious in nature, the defects have not impacted the rotation rate of the media packs and the overall functioning of the system. Replacement parts were ordered and are expected to arrive in early February 2019 after which staff will conduct the required repairs.

Annual Dewatering

Annual dewatering or removal of the sludge from the primary and secondary clarifiers is carried out in the fall of each year. This labour and resource intensive process involves the removal of the roof, pressure washing of clarifiers, and vacuuming out the sludge accumulations from the

bottom of the chambers. During this maintenance activity, a detailed inspection of the bearings, shaft, motor and media disc occurs with repairs or maintenance performed as needed.

Outfall Pipe Inspection

Quinquennial inspection of the WWTP wastewater outfall pipe is performed by certified divers or remotely operated vehicles. Video footage of the inspection is reviewed and analyzed with remedial measures budgeted and scheduled as required.

A video inspection was conducted early in the New Year with no significant deficiencies identified. The inspection report is attached as Appendix 4. Two minor issues were noted:

- The outfall pipe diffuser appeared to be covered in sediment, and
- The outfall signage is obscured by vegetation

Planned remediation:

- Staff will continue to monitor the metering chamber for backup thereby indicating obstruction of the outfall pipe, and
- a new outfall sign will be installed at a location more visible to boaters.

The next outfall dive is scheduled to take place during the 2023 calendar year.

Facility Classification and Operator Certification

The Kelvin Grove WWTP has been evaluated as a Small Wastewater System (Lagoon) by the Environmental Operators Certification Program Society (EOCP). One employee completed certification for the operation of the plant in 2018 and a second operator is expected to complete certification in 2019.

Appendix 1 – Sanitary Sewer System Diagram

Appendix 2 – Daily Flow Monitoring Logs

Date	Day Total (L)	Max. DF (L/sec.)	Max. DF Time (24 Hr.)	Min. DF (L/sec.)	Min. DF Time (24 Hr.)	Max. DF Temp. (°C)	Max. DFT Time (24 Hr.)	Min. DF Temp. (°C)	Min. DFT Time (24 Hr.)
1-Jan-18	78019.38	1.73	13:56	0.34	5:34	7	17:48	6	5:08
2-Jan-18	68223.05	1.79	20:10	0.33	4:31	7	21:06	6	6:16
3-Jan-18	61013.85	1.5	16:36	0.31	3:41	8	19:16	7	5:44
4-Jan-18	61082.79	1.48	9:13	0.28	3:36	8	23:42	7	5:22
5-Jan-18	72483.37	1.53	17:17	0.33	4:20	9	22:22	8	0:47
6-Jan-18	75508.94	1.94	16:43	0.42	3:53	9	17:51	8	3:59
7-Jan-18	79283.39	1.71	9:49	0.42	3:02	9	0:17	8	23:22
8-Jan-18	79595.46	1.67	8:31	0.46	2:12	9	22:29	8	3:41
9-Jan-18	76149.83	1.54	16:44	0.46	5:01	9	11:28	8	4:26
10-Jan-18	61265.4	1.23	21:44	0.18	10:50	9	12:39	8	10:50
11-Jan-18	62979.03	1.49	19:31	0.29	4:33	9	0:06	8	17:42
12-Jan-18	70574.51	1.64	16:48	0.35	3:39	8	0:04	8	5:40
13-Jan-18	84067.85	1.82	10:52	0.54	5:11	9	21:11	8	3:06
14-Jan-18	73408.37	1.67	19:13	0.36	4:55	9	21:49	8	6:43
15-Jan-18	72228.62	1.62	23:03	0.3	3:24	9	21:37	8	6:13
16-Jan-18	71066.6	1.67	20:43	0.4	5:00	9	20:00	9	3:12
17-Jan-18	90987.41	1.79	19:00	0.45	4:45	9	0:05	9	8:47
18-Jan-18	83646.07	1.63	19:09	0.57	3:47	9	0:04	9	10:28
19-Jan-18	72982.17	1.68	22:23	0.39	3:20	9	0:12	8	23:59
20-Jan-18	73995.98	1.51	10:54	0.39	4:16	9	0:51	8	23:51
21-Jan-18	199790.2	6.33	9:13	0.82	23:59	8	4:56	8	23:39
22-Jan-18	68058.76	1.39	8:17	0.46	3:48	8	11:54	8	5:14
23-Jan-18	64057.27	1.42	9:03	0.24	4:47	8	1:46	8	11:15
24-Jan-18	75064.27	1.88	21:51	0.4	3:21	8	19:17	8	1:45
25-Jan-18	64833.5	1.4	20:14	0.43	5:25	8	0:00	8	23:51
26-Jan-18	55721.61	1.45	9:30	0.32	3:34	8	18:36	7	8:21
27-Jan-18	74485.39	1.78	9:31	0.27	3:07	8	22:35	7	6:38
28-Jan-18	87051.96	1.98	19:56	0.32	5:24	8	23:32	7	6:16
29-Jan-18	106119.8	2.12	7:31	0.69	0:48	9	15:06	8	1:41
30-Jan-18	65566.36	2.15	21:43	0.31	13:19	8	0:00	8	23:59
1-Feb-18	53476.12	1.83	7:29	0.23	3:32	8	23:33	7	5:39
2-Feb-18	55762.44	1.42	8:12	0.2	3:24	8	21:56	7	3:20
3-Feb-18	64328.76	1.39	16:53	0.3	3:51	9	23:12	8	0:09
4-Feb-18	71671.37	1.5	8:38	0.36	5:16	9	22:56	9	7:35
5-Feb-18	61689.17	1.74	21:31	0.33	4:43	9	0:10	9	23:47
6-Feb-18	58197.9	1.24	9:22	0.26	3:51	9	20:30	9	5:56
7-Feb-18	62939.94	2.63	18:49	0.26	5:37	9	23:36	9	5:42

Date	Day Total (L)	Max. DF (L/sec.)	Max. DF Time (24 Hr.)	Min. DF (L/sec.)	Min. DF Time (24 Hr.)	Max. DF Temp. (°C)	Max. DFT Time (24 Hr.)	Min. DF Temp. (°C)	Min. DFT Time (24 Hr.)
8-Feb-18	58042.86	1.55	21:28	0.27	4:58	10	14:28	9	23:54
9-Feb-18	55087.26	1.4	7:13	0.24	4:55	9	0:03	8	23:53
10-Feb-18	55541.16	1.4	9:44	0.27	1:51	9	0:06	8	23:15
11-Feb-18	61175.86	1.54	9:45	0.25	4:00	8	16:27	7	8:06
12-Feb-18	64726.66	1.93	20:01	0.23	3:35	8	0:41	7	7:27
13-Feb-18	61537.7	1.58	20:12	0.33	4:18	7	16:34	7	5:50
14-Feb-18	64472.55	1.77	21:46	0.32	2:46	7	16:35	6	6:28
15-Feb-18	55665.48	1.28	21:42	0.25	3:37	7	21:47	7	5:57
16-Feb-18	51621.02	1.19	8:26	0.21	4:57	8	21:43	7	5:23
17-Feb-18	59378.4	1.78	18:06	0.23	3:05	8	18:56	7	22:46
18-Feb-18	66266.9	1.56	9:39	0.26	5:55	8	0:01	6	23:53
19-Feb-18	64968.76	1.62	21:05	0.22	3:23	6	0:00	5	5:29
20-Feb-18	60016.11	1.86	21:46	0.25	2:38	6	22:14	5	5:45
21-Feb-18	59645.22	1.59	19:33	0.23	2:46	6	0:11	5	4:04
22-Feb-18	59108.95	1.42	7:37	0.23	5:17	6	12:31	5	5:21
23-Feb-18	65190.66	1.37	21:37	0.2	5:43	6	0:18	5	5:28
24-Feb-18	61222.36	1.51	12:28	0.26	4:10	6	13:06	5	5:53
25-Feb-18	70794.85	2.09	10:19	0.21	2:18	7	15:43	6	0:27
26-Feb-18	62387.69	1.67	7:50	0.22	2:04	7	22:02	6	3:33
27-Feb-18	57219.42	1.63	19:17	0.2	2:18	7	19:32	6	5:02
28-Feb-18	67311.51	1.87	23:07	0.24	5:10	7	23:41	7	5:23
1-Mar-18	85862.54	1.84	2:00	0.48	23:51	8	15:57	7	6:26
2-Mar-18	58101.87	1.72	7:12	0.29	4:50	7	16:54	7	5:46
3-Mar-18	61138.85	1.89	10:05	0.27	2:36	8	15:30	7	5:03
4-Mar-18	64346.94	1.99	21:50	0.22	5:36	8	16:14	7	6:54
5-Mar-18	56259.81	1.42	7:14	0.21	2:31	8	19:50	7	6:02
6-Mar-18	53958.91	1.58	8:05	0.21	1:55	9	15:34	7	4:34
7-Mar-18	62453.48	1.74	7:34	0.24	5:16	8	23:15	7	6:40
8-Mar-18	75229.24	1.68	19:49	0.32	3:51	8	21:23	8	5:31
9-Mar-18	89550.27	1.7	18:56	0.66	12:33	9	16:14	8	9:41
10-Mar-18	75452.08	1.7	7:47	0.43	3:21	9	16:16	7	6:58
11-Mar-18	72932.42	1.86	19:21	0.35	3:46	9	17:39	8	4:09
12-Mar-18	73563.59	1.62	20:10	0.41	4:30	10	19:55	9	4:36
13-Mar-18	72946.11	1.72	21:51	0.43	23:59	10	15:13	10	23:50
14-Mar-18	67577.3	1.5	20:18	0.37	2:05	10	15:43	9	22:48
15-Mar-18	68987.2	1.82	6:49	0.32	1:42	10	17:52	9	9:04
16-Mar-18	72409.02	1.54	19:55	0.35	2:16	10	16:26	9	9:15
17-Mar-18	98636.14	2.08	7:07	0.46	2:02	10	16:35	9	9:03
18-Mar-18	81119.57	1.64	20:07	0.32	4:16	10	16:22	9	2:25

Date	Day Total (L)	Max. DF (L/sec.)	Max. DF Time (24 Hr.)	Min. DF (L/sec.)	Min. DF Time (24 Hr.)	Max. DF Temp. (°C)	Max. DFT Time (24 Hr.)	Min. DF Temp. (°C)	Min. DFT Time (24 Hr.)
19-Mar-18	80906.08	1.68	21:38	0.4	23:59	10	15:30	9	5:13
20-Mar-18	72337.11	1.5	6:39	0.34	3:07	10	16:19	10	21:43
21-Mar-18	66287.75	1.35	21:00	0.34	1:58	10	19:48	9	5:37
22-Mar-18	116781.8	2.07	10:16	0.51	0:22	10	0:22	9	23:50
23-Mar-18	89829.92	1.55	18:18	0.58	1:51	9	0:02	8	7:13
24-Mar-18	78836.79	1.66	8:48	0.56	23:47	9	15:01	8	5:43
25-Mar-18	83680.17	1.9	8:04	0.38	4:39	9	17:11	8	4:00
26-Mar-18	75622.35	1.43	22:31	0.38	1:15	9	19:34	9	4:46
27-Mar-18	94887.49	1.83	7:02	0.56	0:53	10	18:13	9	1:49
28-Mar-18	82713.35	2.17	21:25	0.55	3:22	10	15:13	9	9:52
29-Mar-18	76633	1.6	7:46	0.58	22:56	10	15:45	9	2:15
30-Mar-18	75753.54	1.93	8:22	0.39	1:31	10	17:49	9	3:56
31-Mar-18	70206.91	1.52	8:42	0.35	1:44	10	18:04	9	3:10
1-Apr-18	79317.79	1.45	10:32	0.35	3:07	10	14:03	9	17:42
2-Apr-18	78986.66	1.85	9:43	0.48	2:53	10	18:42	9	10:43
3-Apr-18	73315.89	1.58	18:43	0.36	1:47	10	22:12	9	0:03
4-Apr-18	69528.3	1.43	6:08	0.32	1:47	10	15:09	9	5:00
5-Apr-18	82404.38	1.93	16:53	0.39	2:07	10	23:55	9	4:37
6-Apr-18	81661.51	1.86	8:21	0.49	4:23	11	22:51	10	3:16
7-Apr-18	131344.3	2.94	9:54	0.46	1:56	11	0:05	10	3:37
8-Apr-18	143709.4	2.63	8:54	0.9	23:59	11	18:11	10	8:26
9-Apr-18	95099.13	1.87	8:58	0.5	23:59	11	16:42	10	6:38
10-Apr-18	79520.9	2.09	8:15	0.37	3:22	11	18:07	10	7:52
11-Apr-18	96994.39	2.39	21:51	0.39	3:18	11	0:00	10	23:38
12-Apr-18	97568.52	2.14	21:40	0.64	23:59	11	15:00	10	9:00
13-Apr-18	78901.95	1.73	6:38	0.46	2:07	10	0:51	9	17:56
14-Apr-18	78640.87	1.63	17:12	0.41	3:07	10	14:53	9	5:30
15-Apr-18	96228.94	2.35	21:35	0.48	2:19	11	15:51	10	5:09
16-Apr-18	86150.26	1.74	6:34	0.62	23:30	10	0:10	10	23:53
17-Apr-18	76458.7	1.81	20:05	0.43	1:53	11	15:06	10	10:54
18-Apr-18	77642.8	1.93	18:31	0.4	3:06	11	16:57	10	4:39
19-Apr-18	73231.21	1.65	18:24	0.36	2:40	11	18:22	10	7:53
20-Apr-18	72289.36	1.57	6:33	0.38	2:33	11	14:08	11	6:26
21-Apr-18	76723.74	1.85	8:15	0.4	2:28	11	14:44	10	5:25
22-Apr-18	79555.05	1.8	8:09	0.35	1:49	12	18:16	10	5:51
23-Apr-18	74103.32	1.87	20:17	0.38	3:55	13	18:54	11	8:26
24-Apr-18	79167.97	1.89	6:49	0.36	0:21	14	18:05	12	8:57
25-Apr-18	78844.39	1.74	17:21	0.47	23:41	14	19:53	12	8:11
26-Apr-18	73969.02	2.6	16:52	0.3	1:07	15	17:19	13	8:01

Date	Day Total (L)	Max. DF (L/sec.)	Max. DF Time (24 Hr.)	Min. DF (L/sec.)	Min. DF Time (24 Hr.)	Max. DF Temp. (°C)	Max. DFT Time (24 Hr.)	Min. DF Temp. (°C)	Min. DFT Time (24 Hr.)
27-Apr-18	69460.84	1.71	7:41	0.26	2:07	16	14:05	14	8:37
28-Apr-18	86575.3	1.82	17:56	0.35	4:27	15	0:10	13	23:58
29-Apr-18	89175.92	1.83	12:45	0.47	2:36	13	0:04	12	7:04
30-Apr-18	81905.1	2	20:14	0.39	1:18	13	17:17	12	5:27
1-May-18	80227.27	1.83	17:51	0.41	1:33	14	16:44	12	5:09
2-May-18	76837.21	1.77	20:45	0.37	3:15	15	19:15	13	7:50
3-May-18	66253.88	1.6	6:54	0.32	23:57	15	18:17	13	5:47
4-May-18	61059.23	1.44	7:21	0.18	1:59	15	0:45	14	23:57
5-May-18	69621.94	3.91	9:16	0.21	2:06	16	18:50	13	9:34
6-May-18	64595.47	2.15	9:28	0.2	3:59	17	20:29	15	8:24
7-May-18	59282.75	1.74	6:18	0.18	3:33	17	15:43	15	8:20
8-May-18	57279.51	1.54	6:24	0.2	2:58	17	19:05	15	8:17
9-May-18	62768.06	2.08	18:12	0.21	2:41	17	0:00	15	11:20
10-May-18	60680.27	1.64	6:14	0.22	4:24	16	15:44	15	6:57
11-May-18	58476	1.7	5:57	0.21	2:31	16	18:55	14	10:11
12-May-18	62006.5	1.65	9:33	0.21	1:15	17	18:25	15	8:28
13-May-18	70486.31	1.79	20:15	0.26	1:57	18	20:45	16	8:17
14-May-18	56571.76	1.49	6:29	0.19	4:00	19	21:25	17	10:37
15-May-18	59856.77	1.76	6:36	0.2	3:12	19	15:57	17	9:57
16-May-18	60432.31	1.46	18:47	0.27	1:40	18	0:05	17	23:53
17-May-18	57230.74	1.47	6:35	0.21	1:50	17	15:31	16	9:46
18-May-18	58020.58	1.6	21:23	0.21	2:04	16	17:07	16	6:41
19-May-18	55858.59	1.7	9:04	0.24	3:43	16	17:57	16	7:23
20-May-18	60802.11	1.54	12:01	0.22	2:42	17	18:25	16	5:29
21-May-18	69152.24	2.21	11:49	0.22	1:32	18	15:37	16	8:07
22-May-18	60617.53	1.71	6:29	0.3	1:34	18	20:19	16	10:09
23-May-18	58740.25	1.79	6:24	0.24	1:25	19	15:55	16	9:50
24-May-18	57593.33	1.51	21:45	0.22	1:26	19	15:42	17	9:10
25-May-18	59279.76	1.66	7:23	0.24	2:40	19	15:37	17	10:06
26-May-18	68378.65	1.68	9:17	0.32	1:17	18	17:44	16	8:53
27-May-18	71994.04	2.11	21:31	0.35	3:20	19	17:50	16	8:19
28-May-18	68166.4	1.53	21:39	0.3	3:19	19	15:21	17	7:37
29-May-18	70313.31	2.29	6:34	0.31	0:59	18	15:34	16	11:11
30-May-18	71669.24	1.79	6:37	0.29	2:02	18	15:40	16	10:14
31-May-18	68628.38	1.83	5:46	0.3	1:26	18	15:20	16	9:53
1-Jun-18	71259.97	1.62	20:45	0.3	3:42	17	0:01	16	23:55
2-Jun-18	72489.31	1.64	7:46	0.32	1:52	17	20:15	15	6:29
3-Jun-18	79951.42	1.98	18:30	0.34	4:49	17	0:01	16	23:51
4-Jun-18	103740.5	2.8	7:26	0.63	1:31	17	15:18	15	11:37

Date	Day Total (L)	Max. DF (L/sec.)	Max. DF Time (24 Hr.)	Min. DF (L/sec.)	Min. DF Time (24 Hr.)	Max. DF Temp. (°C)	Max. DFT Time (24 Hr.)	Min. DF Temp. (°C)	Min. DFT Time (24 Hr.)
5-Jun-18	98134.7	2.19	6:35	0.52	22:59	16	0:02	15	23:52
6-Jun-18	69392.2	1.72	6:57	0.3	1:29	17	20:22	15	5:11
7-Jun-18	65930.78	1.69	6:42	0.32	2:32	17	0:00	16	23:53
8-Jun-18	75212.54	2.08	21:43	0.33	3:07	16	0:00	15	23:56
9-Jun-18	80605.71	1.8	7:38	0.44	4:29	16	15:22	15	9:40
10-Jun-18	80253.48	1.65	9:47	0.36	3:15	17	15:18	15	10:45
11-Jun-18	73123.73	2.18	21:30	0.3	1:25	17	15:24	15	10:25
12-Jun-18	73533.69	1.8	18:56	0.37	1:20	16	0:00	15	5:10
13-Jun-18	77753.68	1.93	6:30	0.35	1:50	16	15:37	15	10:30
14-Jun-18	74193.91	1.98	6:20	0.36	1:47	16	15:27	15	4:31
15-Jun-18	78652.31	1.81	8:30	0.36	2:14	17	21:55	15	4:22
16-Jun-18	78880.2	2.94	9:26	0.41	4:02	18	22:03	16	8:08
17-Jun-18	81138.94	2.14	21:43	0.39	2:00	19	21:33	17	8:45
18-Jun-18	77041.5	1.72	8:10	0.33	2:52	21	20:52	18	7:09
19-Jun-18	78417.31	1.95	6:26	0.4	23:43	21	18:42	19	10:09
20-Jun-18	77085.18	2	21:41	0.32	2:31	21	18:02	19	8:18
21-Jun-18	76335.9	1.75	20:26	0.37	3:24	21	16:26	19	10:03
22-Jun-18	89055.56	1.84	6:27	0.52	0:39	20	0:00	18	23:23
23-Jun-18	78973.84	1.72	21:48	0.37	2:21	19	15:33	18	10:20
24-Jun-18	81392.03	1.86	21:14	0.28	3:17	19	0:00	17	23:49
25-Jun-18	81633.17	1.63	8:03	0.43	3:08	18	17:01	17	11:00
26-Jun-18	73122.21	1.56	21:45	0.36	2:12	19	15:32	17	10:25
27-Jun-18	79774.32	1.81	20:25	0.4	1:53	19	17:26	17	10:32
28-Jun-18	79307.92	1.8	18:10	0.38	2:34	19	0:00	17	11:50
29-Jun-18	80495.65	1.75	21:49	0.4	0:17	17	0:04	17	15:16
30-Jun-18	83997.58	1.9	12:23	0.41	3:05	17	19:14	17	5:48
1-Jul-18	79266.59	1.76	8:37	0.42	1:48	18	15:16	17	5:23
2-Jul-18	84077.48	1.81	21:51	0.39	3:05	18	17:09	17	10:31
3-Jul-18	76646.62	1.69	20:05	0.32	2:52	19	18:59	17	9:49
4-Jul-18	76251.56	1.74	20:23	0.36	1:40	20	21:14	17	9:11
5-Jul-18	77212.94	1.83	21:46	0.33	1:36	21	20:24	19	8:06
6-Jul-18	85464.35	1.78	20:53	0.36	2:33	21	15:15	19	23:53
7-Jul-18	91090.06	2.1	8:38	0.41	2:00	20	15:37	18	9:38
8-Jul-18	95416.06	2.23	8:25	0.38	3:25	20	20:03	18	9:54
9-Jul-18	83345.84	1.69	21:44	0.36	2:01	20	0:00	19	23:43
10-Jul-18	80602.67	1.58	8:14	0.41	3:55	19	0:04	18	23:52
11-Jul-18	82048.45	2.18	21:37	0.32	2:31	20	19:21	18	5:20
12-Jul-18	72657.37	1.6	6:35	0.36	4:03	21	18:17	19	8:49
13-Jul-18	74411.18	1.44	6:38	0.35	2:45	21	19:16	19	10:13

Date	Day Total (L)	Max. DF (L/sec.)	Max. DF Time (24 Hr.)	Min. DF (L/sec.)	Min. DF Time (24 Hr.)	Max. DF Temp. (°C)	Max. DFT Time (24 Hr.)	Min. DF Temp. (°C)	Min. DFT Time (24 Hr.)
14-Jul-18	80051.85	1.78	21:30	0.38	4:17	22	19:46	19	10:22
15-Jul-18	80321.82	1.72	11:35	0.38	3:42	22	18:20	20	9:56
16-Jul-18	80709.67	1.61	19:07	0.36	3:17	22	18:17	20	10:25
17-Jul-18	77869.15	2.04	21:33	0.35	3:20	22	18:55	20	9:48
18-Jul-18	72667.17	1.68	18:43	0.36	2:08	22	17:58	20	10:45
19-Jul-18	72989.94	1.76	21:02	0.34	3:12	21	0:03	20	23:58
20-Jul-18	80159.23	1.73	21:28	0.35	1:42	21	15:45	19	10:56
21-Jul-18	77693.63	2.15	9:05	0.39	4:23	20	18:46	19	10:35
22-Jul-18	73416.87	1.78	8:27	0.35	3:48	21	20:50	19	9:14
23-Jul-18	76078.04	1.79	18:53	0.34	3:56	22	18:58	20	8:53
24-Jul-18	71823.69	1.55	6:28	0.36	3:30	22	19:02	20	8:40
25-Jul-18	74834.25	1.7	21:31	0.34	1:15	23	17:48	21	10:02
26-Jul-18	78700.97	1.82	21:37	0.42	2:47	23	19:11	21	8:27
27-Jul-18	80305.21	1.84	8:31	0.39	1:00	23	15:51	21	9:25
28-Jul-18	79483.23	1.62	8:40	0.41	3:18	23	17:53	21	8:13
29-Jul-18	90546.55	1.87	21:23	0.5	3:12	23	19:13	21	8:19
30-Jul-18	80056.25	1.59	15:46	0.39	2:56	23	19:50	22	7:56
31-Jul-18	77427.26	1.75	19:23	0.41	2:30	23	15:38	22	8:38
1-Aug-18	84459.38	2.12	19:06	0.41	2:12	23	0:00	21	9:46
2-Aug-18	81000.86	1.58	8:43	0.41	3:24	21	0:02	20	9:29
3-Aug-18	76617.27	2.01	20:14	0.4	3:49	21	18:10	20	9:27
4-Aug-18	88646.52	1.97	21:29	0.39	2:04	21	19:23	19	10:18
5-Aug-18	84705.13	1.8	9:18	0.44	4:43	22	18:31	20	9:57
6-Aug-18	95614	3.49	9:27	0.45	0:54	22	16:42	21	9:58
7-Aug-18	93138.95	2.08	21:42	0.5	2:29	23	17:49	21	8:34
8-Aug-18	89515.67	1.87	17:45	0.49	3:08	23	18:12	21	9:23
9-Aug-18	89410.33	1.61	20:14	0.53	3:14	23	18:33	22	8:19
10-Aug-18	90783.28	1.89	7:22	0.54	3:12	23	19:26	22	8:13
11-Aug-18	89923.55	1.79	8:27	0.53	4:39	23	0:00	21	23:48
12-Aug-18	96915.96	2.33	9:11	0.56	4:39	21	0:00	20	23:58
13-Aug-18	89615.91	2.15	21:45	0.5	3:38	20	18:20	19	4:15
14-Aug-18	93486.62	1.88	21:22	0.55	0:55	21	19:32	20	9:04
15-Aug-18	92170.76	2.26	8:28	0.5	2:33	21	18:11	20	6:37
16-Aug-18	88424.7	1.8	21:26	0.5	3:51	21	15:58	20	10:26
17-Aug-18	90270.19	1.79	8:04	0.51	2:53	21	15:30	20	10:46
18-Aug-18	93907.76	1.75	9:00	0.59	3:51	20	19:09	19	7:31
19-Aug-18	93767.25	2.06	10:21	0.51	2:42	20	17:15	19	6:46
20-Aug-18	96242.4	1.78	20:19	0.51	2:47	21	21:04	19	9:53
21-Aug-18	95166.28	1.79	8:53	0.52	1:35	21	18:22	20	10:27

Date	Day Total (L)	Max. DF (L/sec.)	Max. DF Time (24 Hr.)	Min. DF (L/sec.)	Min. DF Time (24 Hr.)	Max. DF Temp. (°C)	Max. DFT Time (24 Hr.)	Min. DF Temp. (°C)	Min. DFT Time (24 Hr.)
22-Aug-18	88498.73	1.81	21:43	0.5	1:30	21	0:00	20	9:49
23-Aug-18	89452.24	1.66	17:10	0.49	4:04	20	0:00	19	23:52
24-Aug-18	93933.33	1.89	19:50	0.49	2:39	19	15:09	19	10:49
25-Aug-18	91696.74	2.73	9:06	0.5	2:49	19	0:32	18	23:51
26-Aug-18	86410.98	2.29	18:01	0.47	4:24	19	19:18	18	5:21
27-Aug-18	88473.26	1.97	20:22	0.44	4:05	19	19:19	18	10:21
28-Aug-18	88922.1	1.88	6:37	0.46	1:04	19	17:25	18	10:42
29-Aug-18	89097.26	1.76	18:35	0.5	3:44	19	14:59	19	2:28
30-Aug-18	82547.36	1.88	7:57	0.51	1:22	19	16:33	18	10:37
31-Aug-18	89691.36	1.88	7:30	0.54	3:55	19	17:28	19	10:48
1-Sep-18	79983.6	1.83	9:20	0.51	2:50	19	14:00	18	10:40
2-Sep-18	75677.25	1.61	9:17	0.37	2:14	19	18:19	18	10:45
3-Sep-18	85498.59	1.85	18:45	0.35	1:38	19	14:06	18	10:35
4-Sep-18	78863.98	1.64	19:02	0.37	3:37	19	18:01	18	10:07
5-Sep-18	77968.48	1.77	19:35	0.4	1:15	19	17:05	18	10:36
6-Sep-18	84191.97	1.85	7:02	0.39	3:57	20	17:40	18	8:06
7-Sep-18	79810.37	1.63	6:20	0.46	2:26	19	0:04	19	23:47
8-Sep-18	80985.2	2	8:57	0.44	1:41	19	13:35	18	23:53
9-Sep-18	90495.76	2	15:40	0.39	2:35	18	0:02	18	23:59
10-Sep-18	81828.68	1.63	16:49	0.39	1:45	18	0:03	17	4:27
11-Sep-18	78329.11	1.82	6:17	0.41	1:52	18	18:40	17	4:49
12-Sep-18	79679.89	1.76	18:40	0.4	2:22	17	18:31	17	4:28
13-Sep-18	79332.33	1.73	12:13	0.36	2:34	17	15:17	17	5:08
14-Sep-18	78871.75	1.82	9:16	0.44	3:14	17	18:34	17	4:58
15-Sep-18	99824.53	2.31	16:58	0.49	5:20	17	0:05	16	23:58
16-Sep-18	134389.6	2.93	8:09	0.68	23:47	17	0:02	16	23:51
17-Sep-18	88393.61	1.95	6:28	0.52	3:54	16	19:03	16	5:06
18-Sep-18	83323.63	1.97	19:02	0.43	2:11	16	19:12	15	5:57
19-Sep-18	82893.72	2.02	19:08	0.46	2:21	16	17:24	15	4:53
20-Sep-18	85402.04	1.69	9:03	0.48	2:30	16	0:06	16	23:54
21-Sep-18	111115.4	2.34	8:34	0.87	23:30	16	0:04	15	23:52
22-Sep-18	120870.7	2.93	7:59	0.73	1:29	16	15:03	15	4:56
23-Sep-18	90232.39	1.94	20:00	0.55	5:26	16	0:00	15	23:53
24-Sep-18	89427.63	2.24	21:37	0.46	2:25	16	20:34	15	5:15
25-Sep-18	77840.31	1.53	7:00	0.42	2:01	16	17:29	15	9:42
26-Sep-18	83791.49	2.53	17:13	0.44	3:58	16	17:24	15	5:21
27-Sep-18	82655.15	1.76	6:02	0.42	1:18	16	16:13	16	4:56
28-Sep-18	74499.37	2.16	7:29	0.38	1:54	17	17:45	16	9:06
29-Sep-18	77685.29	2.15	8:28	0.37	4:41	17	0:28	16	23:57

Date	Day Total (L)	Max. DF (L/sec.)	Max. DF Time (24 Hr.)	Min. DF (L/sec.)	Min. DF Time (24 Hr.)	Max. DF Temp. (°C)	Max. DFT Time (24 Hr.)	Min. DF Temp. (°C)	Min. DFT Time (24 Hr.)
30-Sep-18	99162.12	2.16	21:38	0.46	3:20	16	0:00	15	23:56
1-Oct-18	97008.38	2.38	6:14	0.59	23:59	15	0:01	15	5:46
2-Oct-18	80494.22	1.9	18:11	0.48	1:35	15	0:00	14	23:49
3-Oct-18	85659.27	1.88	21:50	0.42	2:18	14	0:00	13	23:56
4-Oct-18	89517.72	2.21	6:24	0.44	2:49	14	18:36	13	5:04
5-Oct-18	86902.76	1.62	7:34	0.5	3:43	14	18:44	13	5:06
6-Oct-18	88629.34	1.74	8:41	0.48	4:49	14	16:58	13	5:53
7-Oct-18	95498.8	3.81	11:35	0.39	3:29	14	14:35	14	6:43
8-Oct-18	90274.75	1.91	20:35	0.43	3:55	14	19:19	14	6:20
9-Oct-18	81202.78	1.92	21:45	0.4	0:31	15	22:14	14	4:49
10-Oct-18	71385.31	1.64	6:42	0.4	3:09	15	11:53	14	10:09
11-Oct-18	76713.48	2.06	6:45	0.39	3:43	15	0:11	14	9:19
12-Oct-18	79694.97	1.91	8:31	0.38	3:18	15	12:00	14	5:26
13-Oct-18	80249.75	2.17	20:24	0.38	3:04	15	15:03	14	10:32
14-Oct-18	93372.67	1.91	18:06	0.35	23:51	14	11:42	14	8:08
15-Oct-18	83679.6	1.7	6:09	0.37	1:14	14	21:50	14	9:03
16-Oct-18	78368.21	1.75	19:23	0.39	3:13	15	22:07	14	5:22
17-Oct-18	74718.69	1.82	6:42	0.37	3:54	15	16:46	14	2:13
18-Oct-18	76877.05	1.96	21:42	0.37	1:34	15	11:53	14	9:27
19-Oct-18	82083.52	1.83	20:52	0.44	3:53	15	12:01	14	9:50
20-Oct-18	80968.53	1.74	8:10	0.38	3:57	14	11:46	14	6:46
21-Oct-18	96386.86	2.15	10:20	0.53	3:16	14	11:51	14	5:26
22-Oct-18	94522.93	2.01	7:44	0.57	23:46	14	11:44	14	4:36
23-Oct-18	87727.37	1.67	20:18	0.37	1:12	14	19:01	13	11:20
24-Oct-18	25838.21	2.27	6:46	0.06	20:38	14	0:01	13	10:09
25-Oct-18	8055.21	0.12	12:16	0.07	1:57	13	0:19	13	23:52
26-Oct-18	67015.99	1.8	19:24	0.09	7:38	14	14:47	13	8:01
27-Oct-18	76344.99	1.88	8:33	0.41	4:19	13	17:24	13	6:54
28-Oct-18	82002.27	1.74	19:58	0.35	2:07	14	20:19	13	5:56
29-Oct-18	84386.86	1.7	7:20	0.45	23:59	13	0:06	13	23:52
30-Oct-18	69182.19	1.72	21:52	0.32	0:42	13	22:00	13	4:15
1-Nov-18	89422.83	1.81	21:26	0.35	0:40	14	23:43	13	1:57
2-Nov-18	93083.1	1.96	11:04	0.51	23:15	14	14:12	14	0:06
3-Nov-18	82945.63	1.91	15:41	0.29	2:14	14	0:34	13	22:53
4-Nov-18	98842.1	2.27	9:10	0.57	23:49	14	11:23	13	23:46
5-Nov-18	67644.9	1.66	21:49	0.29	4:26	13	11:16	13	23:48
6-Nov-18	65319.41	1.65	7:27	0.29	1:52	13	0:01	13	15:55
7-Nov-18	63078.76	1.44	8:48	0.32	4:38	13	0:02	12	23:58
8-Nov-18	60564.48	1.64	22:01	0.31	2:11	12	0:03	11	12:43

Date	Day Total (L)	Max. DF (L/sec.)	Max. DF Time (24 Hr.)	Min. DF (L/sec.)	Min. DF Time (24 Hr.)	Max. DF Temp. (°C)	Max. DFT Time (24 Hr.)	Min. DF Temp. (°C)	Min. DFT Time (24 Hr.)
9-Nov-18	64185.82	1.61	9:32	0.32	4:11	12	0:04	11	4:54
10-Nov-18	72611.76	1.49	10:12	0.35	6:01	12	11:34	11	6:20
11-Nov-18	72885.01	1.86	22:04	0.31	4:23	11	22:22	11	6:08
12-Nov-18	71091.06	1.51	10:09	0.32	3:51	12	21:03	11	6:35
13-Nov-18	76132.01	1.64	7:40	0.31	2:50	12	22:50	11	6:12
14-Nov-18	101232.9	1.95	6:48	0.77	3:35	12	18:54	11	10:13
15-Nov-18	78533.01	3.3	18:51	0.42	3:25	12	19:36	11	5:01
16-Nov-18	74366.27	1.58	9:50	0.47	2:46	12	11:32	11	23:11
17-Nov-18	77572.38	1.64	20:48	0.43	2:57	12	0:46	11	20:13
18-Nov-18	77535.97	1.59	11:50	0.42	3:56	11	0:08	10	7:46
19-Nov-18	71393.97	1.48	10:37	0.39	3:47	11	22:57	10	4:49
20-Nov-18	75315.88	1.65	21:39	0.42	3:41	11	22:16	10	2:43
21-Nov-18	87234.75	1.67	21:25	0.41	2:57	11	22:37	11	0:26
22-Nov-18	101113.7	1.79	16:49	0.72	12:43	11	8:38	11	15:54
23-Nov-18	96891.92	1.7	21:59	0.77	4:00	11	0:12	11	20:50
24-Nov-18	78501.53	1.67	9:30	0.48	5:19	11	0:00	10	6:47
25-Nov-18	85522.86	2	18:07	0.46	5:13	11	19:31	10	2:48
26-Nov-18	27516.84	2.07	7:31	0.48	1:56	11	8:15	10	1:59
27-Nov-18	195298	3.85	7:17	1.13	23:59	11	20:27	10	7:36
28-Nov-18	88645.28	1.77	7:39	0.7	23:59	11	0:03	10	21:18
29-Nov-18	71752.7	1.51	7:23	0.41	4:31	10	0:03	10	5:36
30-Nov-18	68841.07	1.6	7:17	0.41	3:44	10	0:03	10	3:42
1-Dec-18	70068.94	1.74	10:14	0.38	4:45	10	0:00	9	23:54
2-Dec-18	76109.23	1.83	22:59	0.36	5:05	10	11:46	9	8:12
3-Dec-18	69620.84	1.4	8:44	0.35	5:15	9	0:00	8	5:59
4-Dec-18	74107.51	1.6	20:33	0.3	2:50	9	0:07	8	6:34
5-Dec-18	67394.96	1.8	23:05	0.32	4:25	9	23:20	7	3:05
6-Dec-18	67175.99	1.52	8:33	0.32	3:33	8	0:01	7	4:49
7-Dec-18	68615.99	1.49	7:01	0.32	3:34	8	18:47	7	5:27
8-Dec-18	75427.32	1.65	10:11	0.33	3:55	9	23:38	8	1:45
9-Dec-18	99943.26	2.26	10:18	0.4	4:31	9	22:52	9	7:13
10-Dec-18	84336.99	1.95	23:21	0.59	3:28	10	23:25	9	1:27
11-Dec-18	123828.3	2.09	17:26	0.85	5:18	10	0:05	9	15:26
12-Dec-18	82024.61	1.82	7:53	0.54	4:50	9	0:03	9	20:21
13-Dec-18	129835.8	2.49	21:31	0.56	1:18	9	20:11	9	6:10
14-Dec-18	132774.1	2.58	3:30	0.99	23:59	9	17:39	9	22:27
15-Dec-18	77574.21	1.43	9:01	0.48	4:30	9	1:54	8	10:50
16-Dec-18	123916.6	2.5	17:53	0.45	2:42	10	23:52	9	0:33
17-Dec-18	110264.1	3.92	19:19	0.92	15:00	10	9:45	9	15:50

Date	Day Total (L)	Max. DF (L/sec.)	Max. DF Time (24 Hr.)	Min. DF (L/sec.)	Min. DF Time (24 Hr.)	Max. DF Temp. (°C)	Max. DFT Time (24 Hr.)	Min. DF Temp. (°C)	Min. DFT Time (24 Hr.)
18-Dec-18	161291.2	2.91	19:02	1.41	15:37	10	0:04	8	0:00
19-Dec-18	106712.5	1.99	0:01	0.83	23:10	9	0:23	9	6:34
20-Dec-18	145627.9	3.31	7:11	0.58	1:48	10	11:45	8	17:01
21-Dec-18	103643.2	1.88	8:01	0.73	23:46	9	0:01	8	22:39
22-Dec-18	120571.7	2.99	20:32	0.4	4:21	8	19:03	8	5:55
23-Dec-18	153202.6	2.86	10:19	1.23	2:05	9	23:07	8	10:28
24-Dec-18	126442.1	2.63	11:58	0.94	5:19	9	16:50	8	5:54
25-Dec-18	116256.5	2.39	10:22	0.75	4:53	8	0:24	8	6:35
26-Dec-18	111664.8	2.52	11:52	0.73	3:47	8	0:08	8	4:32
27-Dec-18	119493	2.58	12:18	0.8	5:10	8	0:25	7	12:52
28-Dec-18	122034.7	2.22	22:25	0.71	3:56	8	9:43	7	13:56
29-Dec-18	137278	2.72	11:30	0.93	4:37	9	20:04	7	2:26
30-Dec-18	112608.4	1.92	20:12	0.87	4:38	8	1:43	8	23:57
31-Dec-18	83148.27	1.8	11:00	0.66	23:04	8	0:01	7	18:39

Appendix 3 – Laboratory Analysis Records

Results Summary L2045427

Job Reference

Report To Naizam Jaffer, VILLAGE OF LIONS BAY

Date Received 16-Jan-2018 12:42

Report Date 25-Jan-2018 12:40

Report Version 1

Client Sample ID			SEWER TREATMENT PLANT
Date Sampled			16-Jan-2018
Time Sampled			12:10
ALS Sample ID			L2045427-1
Parameter	Lowest Detection Limit	Units	Water
Physical Tests (Water)			
Total Suspended Solids	3.0	mg/L	24.6
Aggregate Organics (Water)			
BOD	6.0	mg/L	36.2

Results Summary L2084148

Job Reference

Report To Naizam Jaffer, VILLAGE OF LIONS BAY

Date Received 24-Apr-2018 12:55

Report Date 4-May-2018 15:10

Report Version 1

Client Sample ID			SEWER TREATMENT PLANT
Date Sampled			24-Apr-2018
Time Sampled			12:00
ALS Sample ID			L2084148-1
Parameter	Lowest Detection Limit	Units	Water
Physical Tests (Water)			
Total Suspended Solids	3.0	mg/L	33.1
Aggregate Organics (Water)			
BOD	6.0	mg/L	26.6

Results Summary L2135676

Job Reference	
Report To	Naizam Jaffer, VILLAGE OF LIONS BAY
Date Received	25-Jul-2018 12:50
Report Date	7-Aug-2018 16:55
Report Version	1

Client Sample ID			SEWER TREATMENT PLANT
Date Sampled			25-Jul-2018
Time Sampled			12:00
ALS Sample ID			L2135676-1
Parameter	Lowest Detection Limit	Units	Water
Physical Tests (Water)			
Total Suspended Solids	3.0	mg/L	12.6
Aggregate Organics (Water)			
BOD	2.0	mg/L	8.9

Results Summary L2183334

Job Reference	
Report To	Naizam Jaffer, VILLAGE OF LIONS BAY
Date Received	18-Oct-2018 11:26
Report Date	23-Oct-2018 16:54
Report Version	1

Client Sample ID			SEWER TREATMENT PLANT
Date Sampled			18-Oct-2018
Time Sampled			10:30
ALS Sample ID			L2183334-1
Parameter	Lowest Detection Limit	Units	Water
Physical Tests (Water)			
Total Suspended Solids	3.0	mg/L	10.6
Aggregate Organics (Water)			
BOD	2.0	mg/L	3.8

Appendix 4 – Dive Inspection Report

CAN-DIVE CONSTRUCTION LTD.
Underwater Innovators Since 1966

CAN-DIVE CONSTRUCTION LTD.

LIONS BAY STP OUTFALL INSPECTION

JANUARY 15, 2019

TABLE OF CONTENTS

1 INTRODUCTION

Can-Dive Construction Ltd. has prepared the following report detailing the inspection of the Lions Bay STP Marine Outfall that was carried out on January 15, 2019.

2 SCOPE OF WORK

- Ensure the outfall is in good working condition.
- Examine the entire length of the pipes and diffusers for breaks, leaks or blockages
- Inspect and assess the condition of the outfall pipe anchoring
- List and provide a detailed description of deficiencies and provide recommendation

3 PERSONNEL

The following CAN-DIVE personnel were involved in the inspection of the outfalls:

- **Aron Kerwer**, *Diver/Diving Supervisor/ROV Operator*
- **Mark Kunyckyj**, *Diver/ROV Tender*
- **Kayle Houlihan**, *Diver*

4 RESULTS

LIONS BAY STP MARINE OUTFALL MP4 Video File: *Lions Bay STP Outfall Insp.mp4*

Figure 1 Foreshore and partially obstructed outfall signage

The Lions Bay STP Outfall point of daylight was easily found in approximately 33 fsw at high tide. The pipe is well protected by sand and rock looking inshore. An outfall sign was visible but partially obstructed by vegetation. Moving offshore, the pipe rests on the seabed with little to no cover. Pipe ballast is of the C-type, non-reinforced concrete strap-on weights. All weights were found in good condition with the metal banding only showing light surface corrosion. At a depth of approximately 200 fsw the outfall transitions from steep rock to level mud/silt bottom. At this point debris buildup was increasing on one side of the pipe - indication of strong bottom currents. Moving along towards the diffuser, the pipe becomes increasingly buried and difficult to follow. We believe the diffuser was found in approximately 277 fsw. However, the diffuser ports were not observed due to the amount of sediment cover on the pipe. Additionally, the outfall pipe was found to be much longer and deeper than specified.

Summary Deficiencies:

- Sedimentation of terminus
- Vegetation obstructing outfall signage

Recommendation:

- Monitor backflow of outfall discharge for potential obstruction
- Maintain a frequent inspection and monitoring program for outfall
- Clear vegetation obstruction outfall signage

5 LIONS BAY OUTFALL REFERENCE PHOTOS

Figure 2 Point of daylight approximately 33 fsw at high tide

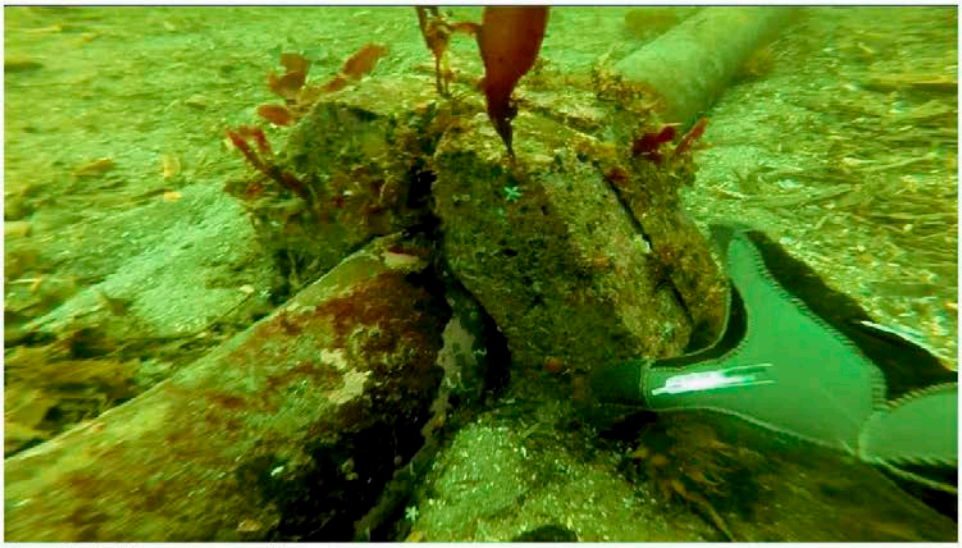


Figure 3 Typical C-type strap-on weight

Figure 4 Sedimentation on north side of pipe, indicating strong bottom currents

7 CONCLUSION

I trust this information will meet with your approval. Thank you for allowing Can-Dive the opportunity to assist you with this project. Should you have any questions, or require further information, please do not hesitate to contact myself.

Best Regards,

Aron Kerwer
CAN-DIVE CONSTRUCTION LTD.
778-837-7800