

2023 Year End Report: Bracebridge Lagoon Lane WWTP



Environmental Compliance Approval: # 3237-BDGQDG

Engineering and Public Works Department

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Introduction

The Bracebridge Clean Water Plant (CWP), which services the Town of Bracebridge, is owned and operated by the District Municipality of Muskoka. The plant is located at 1000 Lagoon Lane and was commissioned in 2011. It services a population of approximately 8,600 people.

The treatment facility consists of 60 acres of facultative lagoons and a membrane bioreactor (MBR) treatment plant. The first two lagoons were constructed in 1959. They were 23 acres in size. By 1976, additional capacity was required to meet the needs of the town. At that time, an additional 37 acres of lagoon were constructed, bringing the total to 60 acres.

In 1983, an extended aeration treatment plant was commissioned to provide additional capacity for the growing population and in 2011, that plant was decommissioned, and a new membrane bioreactor (MBR) plant was constructed within the same 60 acres.

In February of 2022, the construction and commissioning of a new wastewater receiving facility, referred to as the 'Headworks' was completed. All sanitary wastewater from the Town's collection system is received at this facility, where it is screened via 3mm step screens. The material removed with the step screens is washed to remove many organics and compressed to remove excess water which is then discharged into the endless bag system. The mostly dried, bagged material is disposed of into an onsite refuse bin. The screened wastewater flows through the grit vortex separating heavier inorganic material to settle out, be collected and pumped as a slurry to the grith classifiers and hydro-cyclones. The mostly dried grits are discharging the endless bag system and disposed of in the onsite refuse bin. The refuse bin is emptied, and material is hauled off site weekly by local solid waste contractor. The raw sewage with solids removed, are then pumped to the MBR plant for secondary treatment. Aluminum is used as the coagulant and disinfection by ultra-violet lights. The only other chemical added to the wastewater treatment process is soda ash, for alkalinity. The final effluent is discharged into the Muskoka River by way of a diffused outfall.

The MBR plant operates under the MECP Environmental Compliance Approval (ECA Sewage) # 3237-BDGQDG, issued July 2019. Under the terms of the ECA, the plant is permitted to treat an average daily flow of 8,000m³/day, with a peak flow rating of 18,000m³/day. Effluent limit criteria are as follows:

Table 1 Effluent Limit Criteria

Effluent Parameter	Concentration
CBOD	10 mg/L
Total Suspended Solids	10 mg/L
Total Phosphorous	0.4 mg/L
Total Ammonia Nitrogen Summer (May 15 to September 30)	5.0 mg/L
Total Ammonia Nitrogen Winter (October 01 to May 14)	10.0 mg/L
E. coli	80 counts/100 ml (Monthly geometric Mean Density)
pH	6.0 – 9.5 inclusive

MBRs rely upon membrane equipment for liquids/solids separation prior to discharge of the

effluent. The membrane equipment installed at the Lagoon Lane WWTP is an immersed system, i.e. a system that is designed for installation within membrane tanks, which utilizes hollow fiber membranes.

Waste sludge from the MBR process is sent to one of the three primary facultative lagoons.

General Information

A review of the District of Muskoka's infrastructure needs is conducted annually by the Director of Water and Sewer Services, Area Manager and Chief Operator, and recommendations for maintenance, rehabilitation and renewal programs are considered.

Efforts to eliminate the discharge of untreated or partially treated wastewater to receiving waters are being accomplished by a long-term financial commitment to correct excessive infiltration into the wastewater collection system by means of sewer main rehabilitation / replacement, manhole rehabilitation and pumping station rehabilitation programs.

The treatment facility is capable of effective operation during emergencies, maintenance shutdowns, and power failures. This is achieved through such measures as preventive maintenance of duty / standby units, the duplication of major treatment components, the provision of standby power sources and extensive use of the SCADA systems. All pumping stations and treatment control systems use SCADA (Supervisor control and Data Acquisition), in combination with Data Highway Plus, and programmable logic controllers.

All operators are qualified to operate the systems efficiently and effectively to achieve the highest level of treatment at all times. A commitment to provide Operator training and certification is being sustained.

Regulatory sampling is carried out to meet the requirements outlined in the ECA, and additional in-house operational sampling beyond these regulatory requirements is being performed on a routine basis. These efforts have resulted in an effective treatment process which ensures that effluent discharges consistently meet effluent objectives and are environmentally safe. All final effluent sample results for the MBR facilities met their effluent limits.

All data in this report is a compilation of test results received from SGS Canada and their accredited laboratory, Lakefield Research. All in-plant sampling, analysis and recording of results conforms, in order of precedence, to the following 3 standards: Ministry's Procedure F-10-1, "Procedures for Sampling and Analysis Requirements for Municipal and Private Sewage Treatment Works", Ministry's publication "Protocol for the Sampling and Analysis of Industrial/Municipal Wastewater" and the American Water Works Association/Water Environment Federation (AWWA/WEF) publication "Standard Methods for the Examination of Water and Wastewater".

Executive Summary

In all respects, test results of the treated effluent for the parameters of CBOD5, suspended solids, ammonia, total phosphorous, and E. Coli are in compliance with the limits outlined in the Certificate of Approval regarding monthly allowable concentrations and total effluent loading throughout the entire year.

Overall, the plant treatment processes performed satisfactorily and are deemed to be adequate. All sample test results of the final effluent were within levels outlined in the plant ECA (#3237-BDGQDG).

Quantity of Flow Summary

The plant has a daily average flow design capacity of 8,000 m³/day. The actual average daily flow for the year was 4426 m³/day, however, the 3-year average is 3960 m³/day, which represents 49.5% of the plant capacity. None of the individual system components exceeded the design flow rating.

Plant Operational Upsets or Process Failures

ECA exceedance notification #5032-CMZRH2 – on January 9, 2023, a low pH discharge event of approximately 50 m³ occurred. Operations observed and adjusted process to achieve ECA requirements.

Notification #1-41ZELM. Lagoon Cell#1 berm revetment. The berm that separates Cell#1 from an adjacent drainage ditch suffered a minor leak that was reported to the MECP in October 2023. Operations performed sampling and monitoring. A local engineering firm was retained, and a local contractor performed the necessary repairs. Repairs completed in November 2023.

Summary of Maintenance

There were no significant plant upgrades on major infrastructure in 2023.

All equipment information at this plant is entered into a computer database. From this information, a scheduled preventive maintenance program has been established. The maintenance program includes (and not limited to):

- Monthly testing of emergency testing (under load) of the standby generators.
- Annual servicing of emergency standby generators.
- Annual replacement of U.V. bulbs.
- Annual infrared inspection of Motor Control panels.
- Annual calibration of flow metering devices.
- Annual cleaning of all sewage pumping stations.
- Marine inspection of effluent outfall and diffuser completed in 2022. (5-year cycle)

Evaluation of the Need for Improvement Works

The treatment facility is operating at a plant capacity of 49.5% and is in compliance with specified effluent parameter criteria. In addition, there has been no significant treatment process upsets and plant bypasses. As a result, there is no need for improvements to the existing works.

Interpretation of Analytical Results

All sample results for Raw Sewage and Final Effluent are reported in this section. Other tables in this report include Chemical Usage, Biosolids Quality, and Biosolids Quantity.

Raw Sewage

The information reported in the Raw Sewage sample results summary table consists of test

results of analysis conducted on composite samples of the plant influent flow as required by the plant ECA. Samples are sent for analysis to Lakefield Research, as well as analysis conducted on site using Standard Methods or equivalent. Weekly analysis has been performed and reported as specified under the terms outline in the ECA.

Influent Analysis

Table 2 Influent Analysis

Influent Parameter	Minimum	4 Week Average Maximum	Annual Average	Average loading kg/day
BOD5 (mg/L)	94	280.0	221.58	463.13
Suspended Solids (mg/L)	115	643	327	703.69
Total Phosphorus (mg/L)	2.10	6.20	3.56	7.24
TKN (mg/L)	10.10	63.50	31.25	62.57
pH	7.30	7.69	7.50	N/A

Effluent Analysis

The information reported in the Final Effluent sample results summary tables 14-19 consist of test results of analysis conducted on final effluent composite samples. Bacteriological samples, however, consisted of grab samples. Weekly analysis has been performed and reported as specified under the terms outlined in the ECA.

Effluent Objective Analysis

The effluent objectives were met during all sample periods.

Final Effluent Analysis Summary

All final effluent samples tested for CBOD5, suspended solids, ammonia, E. Coli, and total phosphorous were below non-compliance limits outlined in the ECA.

Table 3 Final Effluent Analysis Summary

Parameter	Minimum	4 Week Average Maximum	Annual Average	Average Loading kg/day
COBD5 (mg/L)	2	2	2	4.28
Suspended Solids (mg/L)	2	2.5	2.11	4.52
Total Phosphorus (mg/L)	0.03	0.04	0.03	0.07
Ammonia (mg/L)	0.39	1.47	1.16	3.61
E. Coli (#/100 mL)	0	0.44	0.04	N/A
pH	6.50	7.65	7.04	N/A

Final Effluent Sampling Summary

Average daily flow comparisons by day of week ensure ECA requirements for scheduled sampling are taken at a time, and in a location characteristic of the quality and quantity of the sewage stream over the time period being monitored. Average daily flow rates by day of the week compare the flow to the average daily flow for the entire year. This data is used to determine if a particular day of the week is best to ensure samples are taken to meet the requirements of scheduled monitoring sections of the ECA's. Sampling plans are reviewed and updated yearly based on the previous yearly flow data. For 2023 the sample collection day was Tuesday's.

Biosolids Generation

The quality and volume of biosolids both generated and hauled from the facility for disposal is outlined in the table provided. Waste activated sludge is pumped from the Bracebridge CWP to the Lagoon Cell #3. The lagoon provides storage and stabilization for the waste activated sludge.

In 2023, stabilized biosolids in Lagoon Cell #3 were equalized between Cell#1 and Cell#2, work performed by Region of Huronia Environmental Services.

It is not anticipated that there will be a significant increase in the total volume of bio solids produced in 2024.

Co-Treatment Flow Summary

The treatment plant has the capability to co-treat additional wastes through the Septage Receiving Facility, which located on site at the Septage Lagoons. Septage and holding tank waste are hauled in by vacuum trucks, and dumped into the receiving cell, which is then blended into the plant influent flow. In addition, leachate from the district owned Rosewarne Landfill are transported to a site within the collection system, blended with wastewater within the system, and then received at the headworks of the MBR facility.

The plant ECA (Sewage) # 3237-BDGQDG, states that the average quantity of partially treated septage lagoon effluent shall not exceed an annual daily average of 180 m³. The highest monthly average for partially treated septage lagoon effluent was 166.1 m³ in the month of May 2023 with no problems observed by this volume.

In 2023, 7319 m³ of hauled septage was received at Lagoon Lane septage lagoon and an additional 38082 m³ of District Rosewarne Landfill leachate was hauled for disposal. There was transfer of wastewater from the treatment lagoons 1 through 4 to the MBR plant in the fall of 2023. All septage, leachate and wastewater disposed of into the Lagoon Lane site, was processed through the lagoon system and the supernatant from septage lagoon cell#3 was pumped to the MBR plant. Septage cell #3 transfers are summarized in the following table:

Table 4 Septage Cell 3 Transfer Summary

Month	Minimum Daily Flow (m3)	Maximum Daily Flow (m3)	Total Monthly Flow (m3)
January	45.28	149.33	3138.77
February	67.92	135.83	3173.66
March	0	194.46	4255.28
April	11.32	191.40	4545.57
May	22.64	311.87	5150.80
June	30.19	181.09	2214.03
July	67.92	201.86	3621.67
August	28.30	253.64	3582.06
September	46.09	106.45	2000.27.
October	0	138.19	1682.98
November	7.20	69.13	1051.77
December	24.97	69.12	1176.96

Summary of Complaints received throughout the reporting period.

Event report # 1-27MRNQ – this event report number was issued during the biosolids equalization from Cell#3 to Cell#1 & Cell#2 in the event any aesthetic concerns developed from the community. There were no concerns from the community during the duration of work.

Bracebridge Wastewater Collection Summary

New Sewer Services:

A total of 88 customers connected to existing sewer laterals in 2023.

New Sewer Mains:

No new sewer mains were installed in Bracebridge in 2023.

Sewer Main Replacements:

Approx 180 meters of sewer main was replaced in 2023.

Low Pressure Sewer Breaks:

There were no low-pressure sewer breaks in 2023.

Sewer Force Main Breaks:

There was one sewer force main break in 2023 repaired at a cost of approximately \$10,000.00

Sewer Force Main Replacement:

There were no Sewer Force Main replacements in 2023.

Main Line Sewer Blockage:

There were no main line sewer blockages in 2023.

Sewer Lateral Blockage:

There were 5 sewer lateral blockages in 2023.
at an average cost of \$6000.00 each to repair.

Low Pressure Sewer Blockages:

There were no low-pressure sewer blockages in 2023.

Frozen Sewer Force Mains:

There were no frozen sewers Mains in 2023.

Frozen Sewer Service Laterals:

No sewer service laterals froze in 2023.

Frozen Low Pressure Sewer Services:

No low-pressure sewer services froze in 2023.

Sewer Flushing/Video:

Approximately of 6000 m of sewer main was flushed and video inspected in 2023 at a cost of approx. \$18,000.00.

Sewer Locates:

District staff assisted by sub-contractors addressed 1283 locate requests in 2023.

Table 5 Effluent Flow Summary - 2023

Month	Plant Total Monthly (m ³)	Average Day Flow (m ³ /d)	Maximum Day Flow (m ³ /d)	Minimum Day Flow (m ³ /d)	Lagoons Monthly Flow (m ³)	Facility Total Monthly Flow (m ³)
January	147820	4768	7810	3525		147820
February	121407	4336	5664	19999		121407
March	138467	4467	6373	3126		138467
April	210043	7001	12283	2568		210043
May	159510	5145	7911	3879		159510
June	117186	3906	4955	2600		117186
July	148833	4801	7702	2603		148833
August	115443	3724	4278	3165		115443
September	102433	3414	4610	2787		102433
October	131719	4249	6598	2593		131719
November	96330	3211	3622	2613		96330
December	126472	4080	6078	3252		126472

Total Flow: 1615663 m³
 Average Day: 4426 m³
 Maximum Day: 12283 m³
 Minimum Day: 1999

Table 6 Influent Quarterly Analysis Summary – Weekly 24-Hour Composite Sample Part 1

Sample Date	Sample Identification Number	BOD5 mg/L	Alkalinity (Total as CaCO3) mg/L	pH	Total Phosphorus mg/L	Suspended Solids mg/L
Feb 7 2023	CA12093	442	180	7.53	6.5	735
May 9 2023	CA12481	147	173	7.18	3.05	287
Aug 8 2023	CA12290	181	195	7.75	3.38	180
Nov 17 2023	CA13625	200	216	6.90	3.01	266
Yearly Average		242.5	191	7.34	4.0	367
Maximum		442	216	7.75	6.50	735
Minimum		147	173	6.90	3.01	180

Table 7 Influent Quarterly Analysis Summary – Weekly 24-Hour Composite Sample Part 2

Sample Date	Sample Identification Number	Total Kjeldahl Nitrogen mg/L	Nitrate Nitrogen mg/L	Nitrite Nitrogen mg/L	Total Ammonia Nitrogen mg/L
Feb 7 2023	CA12093	42.8	0.06	0.03	17.3
May 9 2023	CA12481	18.3	0.06	0.03	13.5
Aug 8 2023	CA12290	26.1	0.06	0.03	22.9
Nov 17 2023	CA13625	31.0	0.06	0.05	24.4
Yearly Average		29.6	0.06	0.04	19.5
Maximum		42.8	0.06	0.05	24.4
Minimum		18.3	0.06	0.03	13.5

Table 8 Chemical Usage Summary: Alum

Month	Average Dosage mg/L	Total kg (wet)
January	53.2	17376.48
February	43.9	13827.40
March	52.5	15330.22
April	28.6	12622.24
May	31.5	10594.58
June	37.8	9415.96
July	50.4	15908.90
August	42.4	10619.40
September	47.4	10392.50
October	47.3	13208.98
November	44.9	9264.82
December	52.2	13962.30

Total Yearly Kilograms (wet): 152523.78 kg

Table 9 Chemical Usage Summary: Soda Ash

Month	Average Dosage mg/L	Total kg (dry)
January	0.0	0.0
February	0.0	0.0
March	1.9	100.00
April	2.8	500.00
May	3.9	550.00
June	2.5	550.00
July	3.2	550.00
August	2.8	550.00
September	2.9	550.00
October	3.1	550.00
November	2.85	550.00
December	3.0	550.00

Total Yearly Kilograms: 5000 kg

Table 10 Chemical Usage Summary: Sodium Hypochlorite

Month	Average Flowrate – Hypo Clean	Total kg (wet)
January	85ml/min	3977.02
February	85ml/min	7696.60
March	85ml/min	1072.78
April	85ml/min	843.42
May	85ml/min	5073.30
June	85ml/min	254.62
July	85ml/min	1081.35
August	85ml/min	996.52
September	85ml/min	1093.22
October	85ml/min	4043.99
November	85ml/min	3707.00
December	85ml/min	1464.76

Total Yearly Kilograms (wet): 31304.35 kg

Table 11 Chemical Usage Summary: Citric Acid

Month	Average Flowrate – Acid Clean	Total Litres
January	85ml/min	226
February	85ml/min	1645
March	85ml/min	291
April	85ml/min	134
May	85ml/min	1058
June	85ml/min	92
July	85ml/min	57
August	85ml/min	113
September	85ml/min	170
October	85ml/min	1230
November	85ml/min	1195
December	85ml/min	479

Total Yearly Litres: 6690 L

Table 12 Effluent Quarterly Analysis Summary – Weekly 24-Hour Composite Sample Part 1

Sample Date	Sample Identification Number	CBOD5 mg/L	pH	Total Phosphorus mg/L	Suspended Solids mg/L
Feb 7 2023	CA12093	2	8.30	0.03	2
May 9 2023	CA12481	2	7.67	0.03	2
Aug 8 2023	CA12290	2	7.40	0.03	2
Nov 17 2023	CA13625	2	7.67	0.03	2
Yearly Average		2	7.76	0.03	2
Maximum		2	8.30	0.03	2
Minimum		2	7.40	0.03	2

Table 13 Effluent Quarterly Analysis Summary – Weekly 24-Hour Composite Sample Part 2

Sample Date	Sample Identification Number	Total Kjeldahl Nitrogen mg/L	Nitrate Nitrogen mg/L	Nitrite Nitrogen mg/L	Total Ammonia Nitrogen mg/L
Feb 7 2023	CA12093	0.8	3.04	0.03	0.1
May 9 2023	CA12481	0.5	3.90	0.03	0.1
Aug 8 2023	CA12290	0.9	2.88	0.03	0.1
Nov 17 2023	CA13625	3.7	2.32	0.03	2.1
Yearly Average		1.8	3.0	0.03	0.6
Maximum		3.7	3.9	0.03	2.1
Minimum		0.5	2.32	0.03	0.1

Table 14 Effluent Loading and Concentration Summary: COBD5

Month	Average mg/L	Average kg/day	Maximum Daily kg/day
January	2.00	3.08	5.04
February	2.00	3.10	4.05
March	2.00	2.80	4.11
April	2.00	4.67	8.19
May	2.00	3.32	5.10
June	2.00	2.60	3.30
July	2.00	3.10	4.97
August	2.00	2.40	2.76
September	2.00	2.28	3.07
October	2.00	2.74	4.26
November	2.00	2.14	2.41
December	2.00	2.63	4.08
Average Monthly	2.00		
Effluent Objective	5.00		
Non-Compliance	10		

Table 15 Effluent Loading and Concentration Summary: Suspended Solids

Month	Average mg/L	Average kg/day	Maximum Daily kg/day
January	2.25	3.46	5.67
February	2.00	3.10	4.05
March	2.00	2.80	4.11
April	2.00	4.67	8.19
May	2.20	3.65	5.61
June	2.00	2.60	3.30
July	2.50	3.87	6.21
August	2.40	2.88	3.31
September	2.00	2.28	3.07
October	2.00	2.74	4.26
November	2.00	2.14	2.41
December	2.00	2.63	4.08
Average Monthly	2.11		
Effluent Objective	5.00		
Non-Compliance	10.00		

Table 16 Effluent Loading and Concentration Summary: Total Ammonia Nitrogen Summer

Month	Average mg/L	Average kg/day	Maximum Daily kg/day
May	0.76	1.17	2.30
June	0.91	1.16	1.40
July	0.39	0.62	1.01
August	1.71	1.96	2.39
September	1.02	1.38	1.02
October	0.33	0.51	0.99
Average Monthly	0.85		
Effluent Objective	2.00		
Non-Compliance	5.00		

Table 17 Effluent Loading and Concentration Summary: Total Ammonia Nitrogen Winter

Month	Average mg/L	Average kg/day	Maximum Daily kg/day
January	1.50	2.31	3.78
February	3.82	5.92	7.73
March	1.08	1.50	2.21
April	0.13	0.29	0.51
November	1.30	1.39	1.57
December	1.00	1.32	2.04
Average Monthly	1.47		
Effluent Objective	2.00		
Non-Compliance	10.00		

Table 18 Effluent Loading and Concentration Summary: Fecal Coliform

Month	Geomean (#/100mL)	Maximum Daily (#/100mL)
January	0.00	0.00
February	0.00	0.00
March	0.00	0.00
April	0.00	0.00
May	0.00	0.00
June	0.00	0.00
July	0.44	3.00
August	0.00	0.00
September	0.00	0.00
October	0.00	0.00
November	0.00	0.00
December	0.00	0.00
Average Monthly	0.04	
Effluent Objective	2.00	
Non-Compliance	80.00	

Table 19 Effluent Loading and Concentration Summary: Total Phosphorus

Month	Average mg/L	Average kg/day	Maximum Daily kg/day
January	0.03	0.05	0.076
February	0.03	0.05	0.061
March	0.03	0.04	0.062
April	0.03	0.07	0.123
May	0.03	0.05	0.077
June	0.03	0.04	0.055
July	0.03	0.05	0.075
August	0.03	0.04	0.041
September	0.03	0.03	0.046
October	0.04	0.06	0.089
November	0.03	0.03	0.036
December	0.03	0.04	0.06
Average Monthly	0.03		
Effluent Objective	0.30		
Non-Compliance	0.40		

Table 20 Liquid Sludge Production Summary

Month	Hauler	Shipped to: Location	Volume m ³
January	Pumped	Lagoon Cell #3	4288.6
February	Pumped	Lagoon Cell #3	2971.6
March	Pumped	Lagoon Cell #3	2552.4
April	Pumped	Lagoon Cell #3	1895.4
May	Pumped	Lagoon Cell #3	4531.2
June	Pumped	Lagoon Cell #3	3610.7
July	Pumped	Lagoon Cell #3	4669.6
August	Pumped	Lagoon Cell #3	4978.1
September	Pumped	Lagoon Cell #3	3418.4
October	Pumped	Lagoon Cell #3	3404.9
November	Pumped	Lagoon Cell #3	3575.7
December	Pumped	Lagoon Cell #3	3223.4

Yearly Total Volume m³: 43120 m³

Table 21 Sludge Quality Analysis

Parameter Sampled (mg/L)	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
Date	Feb 7 2023	May 9 2023	Aug 8 2023	Nov 14 2023
Nitrate	0.3	0.7	3	3
Mercury	0.005	0.001	0.002	0.003
Chromium	0.11	0.09	0.07	0.10
Cobalt	0.02	0.01	0.01	0.01
Copper	3.2	1.8	1.5	2.0
Lead	0.1	0.1	0.2	0.3
Molybdenum	0.06	0.05	0.05	0.05
Nickel	0.10	0.07	0.05	0.08
Selenium	0.1	0.1	0.1	0.1
Arsenic	0.1	0.1	0.1	0.1
Zinc	3	2	1	2
Cadmium	0.005	0.005	0.005	0.005
Ammonia+ Ammonium	10.5	6.0	5.8	7.6
Total Kjeldahl Nitrogen	570	469	314	480
Total Phosphorus	180	140	112	181
Total Solids	9600	7650	6100	7260
Volatile Solids	8140	5430	4930	6300
Nitrite	0.4	1.1	3	3
Potassium	53	39	36	50
Total Suspended Solids	8320	6500	5720	6720

Bracebridge Certification of Reports

I certify that the information in this document and all attachments are correct, accurate, and complete to the best of my knowledge.

Michael Curie
Director, Water and Wastewater Services

Darren Ronson,
Manager of Water and Wastewater Operations