

1.0 INTRODUCTION

The Municipality of Brighton is pleased to present its Annual Performance Report for sewage treatment works for the operating period of January 1 to December 31, 2002.

Brighton’s Water Pollution Control Plant services a population of approximately 4,700 residents consisting of 2,300 residential and 200 commercial accounts. The Ontario Environmental Training Consortium (OETC) classifies the Water Pollution Control Plant as Class I Wastewater Treatment and Class II Wastewater Collection facility.

The Brighton Wastewater Pollution Control Plant operates under Certificate of Approval number 3-0521-99-006 issued by the Ministry of Environment. The composting program has not been initiated to date, therefore reporting for this program is not applicable at this time.



CONTROL DOCUMENT INFORMATION

Type of Control Document	Number	Issue Date	Effluent Monitoring Requirements (Yes/No)	Effluent Reporting Requirements (Yes/No)
C of A Sewage Works	3-0521-99-006	7/09/99	YES	YES
C of A Sludge Drying Beds	3-0381-96-006	8/01/96	N/A	N/A
C of A Composting Site	A710120	2/05/97	N/A	N/A

- Sludge pumped and transferred from the Waste Stabilization Pond to the Drying Beds at total of four times during the reporting period.
- Composted sludge mixed with leaves and woodchips not utilized during this reporting period.

2.0 CONTACT INFORMATION

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3.0 WASTEWATER TREATMENT PLANT DESCRIPTION & TREATMENT PROCESS

The sewage works in Brighton consists of:

- a 0.68 hectare aerated lagoon (lagoon #1) with two mechanical surface aerators. The effluent from the aeration lagoon passes through a chemical mixing chamber where alum is added before entering the waste stabilization pond;
- a 5.44 hectare waste stabilization pond (lagoon #2), and;
- a constructed wetland having a surface area of 6.2 hectare, located south of the existing waste stabilization pond consisting of Wetland Cell #1 (north cell) and Wetland Cell #2 (south cell) with alternating deep zones and vegetative terraces. The effluent from the constructed wetlands is continuous and discharges to a natural wetland that borders Presqu'île Bay located off the northeast shore of Lake Ontario.

The hydraulic capacity of the sewage works has been re-rated at 4,600 m³/day since the constructed wetlands were incorporated to the treatment system in the summer of 2000. A portion of raw sewage from the Brighton collection system flows by gravity to the aerated lagoon. The remainder of the sanitary system flow is collected at the Harbour Street Sewage Pumping Station where it is pumped through a forcemain to the WPCP. The pumping station is equipped with three dry well raw sewage pumps and a standby diesel generator that pumps the flow through a forcemain to the sewage treatment area.

Brighton's wastewater treatment system is a simple low-tech approach based on working with natural processes and energies. The raw wastewater enters the aerated lagoon where the sewage is mixed and oxygenated. The added oxygen allows aerobic microorganisms to reduce organic matter and nutrients in the wastewater and reduce odour potential. The effluent from the aerated lagoon (lagoon #1) then passes through a mixing chamber where alum is added. The alum acts as a binding agent that aids in settling out phosphorus and suspended solids from the wastewater. The sewage then flows to the waste stabilization pond (lagoon #2) where the bound solids settle to the bottom and are decomposed through microbial action. Dissolved materials such as nitrogen and phosphorous are used by green algae in the pond for cell growth. The effluent from the waste stabilization pond then enters the constructed wetland for final polishing, where the water is further filtered and cleansed.

The natural processes occurring in the lagoons and wetland system produce a good quality effluent that is monitored regularly by municipal staff. Lab results show some variability due to seasonal affects occurring in a natural treatment process such as temperature, plant growth, death and decay. Naturally, increased performance is exhibited during warmer months when nutrients are absorbed from the growth of vegetation and bacteria are most active. Wastewater effluent from the wastewater pollution control plant (WPCP) are tested at Caduceon Environmental Labs (formerly ETRL), a certified lab, on a weekly basis as per Certificate of Approval.

4.0 COMPLIANCE WITH TERMS AND CONDITIONS OF CERTIFICATE OF APPROVAL

4.1 Performance

4.1.1 *Wastewater Flow to the WPCP*

Certificate of Approval 2.(a) The Owner shall ensure that the flow of sewage into the sewage treatment works does not exceed the average daily flow of 4,600 m³/day for a period of any twelve (12) consecutive calendar months.

The average daily flow for 2002 was 3,092 m³/day, which represents 67% of the average day design capacity of 4,600 m³/day. The maximum annual daily flow for 2002 occurred on May 14 where heavy rainfall contributed to peak flow of 10,314- m³/day as well as a peak monthly flow of 141,812 m³. In 2001, the maximum monthly flow of 135,398 m³ occurred in March, with a peak flow of 7,449 m³/day on March 24, 2001 mainly due to heavy snow accumulations and spring thaw.

The total flow of wastewater to the treatment plant in 2002 was 1,122,718 m³, approximately 10% higher than the total flow for 2001 of 1,012,713 m³.

Table I – Monthly Sewage In-flow to Treatment Plant

Date	Total Flow m ³	Avg. Flow m ³ /Day	Max. Day Flow m ³	% (Avg.Day/Design Capacity)
JAN	94,250	3,038	3,430	66%
FEB	98,823	3,529	5,470	77%
MAR	122,051	3,937	6,178	86%
APR	124,897	4,163	6,062	91%
MAY	141,812	4,575	10,314	99%
JUN	100,415	3,347	4,617	73%
JUL	87,723	2,830	4,026	62%
AUG	73,113	2,358	2,770	51%
SEP	64,857	2,162	2,593	47%
OCT	62,360	2,079	2,534	45%
NOV	76,973	2,566	3,246	56%
DEC	75,444	2,515	2,809	55%
ANNUAL	1,122,718	3,092	10,314	67%

There were no incidences of diversion of flow from the sewage works as defined in the *Certificate of Approval Condition No. 3* during the period of this report.

4.1.2 Waste Stabilization Pond Effluent Quality

Certificate of Approval 2.(b) The owner shall design, construct and/or operate the sewage treatment works such that the concentrations of the materials named below as effluent parameters are not exceeded in the effluents from the waste stabilization pond:

Table II – C of A Waste Stabilization Pond Effluent Parameters

Effluent Parameters	Concentration in Effluent	Loading in Effluent
CBOD ₅	30.0 mg/L	138.0 kg./day
Suspended Solids	40.0 mg/L	184.0 kg./day
Ammonia & Ammonium Nitrogen (May 1 to Oct. 30) ¹	14.0 mg/L¹	64.4 kg./day¹
(Nov. 1 to Apr. 30) ²	17.0 mg/L ²	78.2 kg./day ²
Total Phosphorus	1.0 mg/L	4.6 kg./day

Note: *Limits for Ammonia change from May to Oct (shaded area Table III) and Nov. to Apr.*

-Noncompliance with respect to concentrations of CBOD₅ and Suspended Solids in the effluent is deemed to have occurred when the average concentration of all samples taken exceeds the corresponding concentration in Table II.

-Non-compliance with respect to concentrations of (Ammonia + Ammonium) Nitrogen and Total Phosphorus in the effluent is deemed to have occurred when the 'monthly average' concentration of the parameter listed in Table II is exceeded in any calendar month.

-Noncompliance levels for average monthly concentrations of Ammonia in July and October were over 14 mg/L..

-Appendix II demonstrates graphical data for these parameters.

-Table III demonstrates the concentration and loadings of CBOD₅, Suspended Solids, Ammonia and Total Phosphorus in the Waste Stabilization Pond Effluent.

-See Appendix II Waste Stabilization Pond Loadings

Table III - Waste Stabilization Pond Effluent - Compliance to C of A 2.(b)

	CBOD ₅		Suspended Solids		Ammonia		Total Phosphorus	
	Conc.	Loading	Conc.	Loading	Conc.	Loading	Conc.	Loading
	mg/L	kg/day	mg/L	kg/day	Mg/L	Kg/day	mg/L	kg/day
JAN	7.80	23.70	25.80	78.38	13.82	41.99	0.59	1.79
FEB	7.80	27.53	25.80	91.05	13.18	46.51	0.61	2.15
MAR	8.10	31.89	27.00	106.30	9.29	36.57	0.56	2.20
APR	11.64	48.46	41.00	170.68	6.92	28.72	0.65	2.71
MAY	3.10	14.18	7.00	32.03	8.66	39.62	0.40	1.83
JUN	3.70	12.38	2.50	8.37	13.25	44.35	0.28	0.94
JUL	7.44	21.06	5.80	16.41	15.66	44.32	0.26	0.74
AUG	3.65	8.61	4.00	9.43	8.10	19.10	0.16	0.38
SEP	3.20	6.92	5.50	11.89	8.47	18.31	0.19	0.41
OCT	7.40	15.38	4.80	9.98	15.40	32.02	0.23	0.48
NOV	4.90	12.57	4.25	10.91	14.95	38.36	0.21	0.54
DEC	3.52	8.85	7.20	18.11	16.92	42.55	0.57	1.43
AVG	6.02	18.61	13.39	41.39				

Waste Stabilization Pond Effluent Summary:

- Annual average concentration of 6.02 mg/L CBOD₅ was below C of A limit of 30 mg/L.
- Annual average loading of 18.61 kg/day CBOD₅ was below C of A limit of 138.0 kg/day.
- Annual average concentration of 13.39 mg/L Suspended Solids was below C of A limit of 40 mg/L.
- Annual average Suspended Solids loading of 41.39 kg/day was below C of A limit of 184 kg/day.
- Monthly average concentrations for Ammonia from May to October were below C of A limit of 14.0 mg/L in May, June, August and September;
- **Noncompliance for monthly average concentrations of Ammonia occurred in July at 15.66-mg/L and in October at 15.4 mg/L, over the C of A limit of 14.0 mg/L.**
- Monthly average loadings for Ammonia from May to October were all below C of A limit of 64.4 kg/day.
- Monthly average concentrations for Ammonia from November to April were all below C of A limit of 17.0 mg/L.
- Monthly average loadings for Ammonia from November to April were all below C of A limit of 78.2 kg/day.
- Monthly average concentrations for Total Phosphorus were all below C of A limit of 1.0 mg/L.
- Monthly average loadings for Total Phosphorus were all below C of A limit of 4.6 kg/day.

Average monthly ammonia concentrations reached above the C of A Limit of 14.0 mg/L during the months of July and October. Noncompliance was reported to the Ministry of Environment. The operating depth of the wetland and lagoon were increased in August to enhance retention and treatment time. These changes demonstrated lowered concentrations of ammonia by August.

From November to April, the C of A limit is 17.0 mg/L for Ammonia. In October, ammonia levels rose above C of A limits in the Waste Stabilization Pond; however final effluent from the wetland remained below C of A objectives. Sampling at the receiving body, Presqu'île Bay, were taken in October which revealed Ammonia levels <0.5 mg/L. (see lab results Table VIII)

Although the Certificate of Approval stipulates lower concentrations for ammonia to be met from May to October, in fact, the lagoon/wetland system has enhanced ammonia reduction commencing as early as March and has demonstrated optimum performance from April to September.

Remaining parameters listed in Table III were in compliance with C of A concentration and loading limits.

4.1.3 Wetland Effluent Quality

Certificate of Approval 5.(a) the Owner shall use best effort to operate the sewage treatment works with the objective that the concentrations of the materials named below as effluent parameters are not exceeded in the effluent from constructed wetland:

Table IV – C of A Constructed Wetland Effluent Objectives

Constructed Wetland Effluent Parameter	Concentration
CBOD ₅	15.0 mg/L
Suspended Solids	15.0 mg/L
Ammonia + Ammonium Nitrogen (May 1 to October 30) ¹	10.0 mg/L ¹
(November 1 to April 30) ²	15.0 mg/L ²
Total Phosphorus	0.80 mg/L

Note: Limits for Ammonia change from May to Oct (shaded area Table V) and Nov. to Apr.

Table V Constructed Wetland Effluent Concentrations - Compliance to C of A 5.(a)

	CBOD ₅ mg/L	Suspended Solids mg/L	Ammonia mg/L	Total Phosphorus mg/L
JAN	3.80	8.40	13.24	0.25
FEB	3.50	7.00	12.40	0.23
MAR	3.10	5.00	8.43	0.12
APR	4.48	4.00	6.57	0.18
MAY	2.00	2.00	8.09	0.31
JUN	3.50	3.25	12.40	0.34
JUL	3.76	6.20	13.82	0.31
AUG	2.20	7.50	8.17	0.23
SEP	5.70	3.67	4.21	0.16
OCT	4.76	4.80	9.22	0.48
NOV	4.00	7.50	12.75	0.15
DEC	3.76	6.80	15.36	0.53
AVG	3.71	5.51	12.03	0.25

Note Objectives for Ammonia in June and July over 10 mg/L. and over 15 mg/L in December.

Results for wetland parameters are objectives only and will assist in establishing limits once the 5-year monitoring timeframe is complete. Ammonia concentrations in June, July, and December were above objective concentration limits. Operating depths in the wetland cells were measured manually on May 30th, and gradually increased from an average of 8-12 inches to 22 inches to enhance retention and treatment time. By August the wetland effluent Ammonia concentration dropped to 8.17 mg/L, below C of A objectives. Staff will monitor operating levels more closely to achieve optimal treatment time in the wetland cells.

In December, cold temperatures caused the wetland cells to freeze over, operating levels were dropped in early January 2003 to create an air gap to assist oxygen transfer and allow space for gases to be released.

Lack of sunlight, plant production and decreased temperatures in winter months directly affects the amount of algae in the lagoons. Algae and plants consume nitrogen and phosphorus in the wastewater; lack of this activity in winter months limits the reduction of Ammonia and Phosphorus in the final effluent.

Certificate of Approval (5.)(b) stipulates that the geometric mean density of *E. Coli* should not exceed 200 organisms per 100 ml. for any calendar month. See **Tables VII and VIII representing the weekly lab results of the Waste Stabilization Pond and Wetland Effluent including monthly *E. Coli* results.** *E. Coli* levels were above 200 organisms per 100 ml on four occasions in the lagoon and wetland. The lagoons and wetland are home to many birds, amphibians and mammals including nesting swans, ducks, geese, as well as frogs, snakes, and snapping turtles. Migrating birds in fall gather in the wetlands for extended periods which may contribute to elevated concentrations of *E.Coli* in the effluent; elevated *E.Coli* results were also observed in the fall of 2001.

4.2 **Monitoring and Recording**

Certificate of Approval 4.(a) Annual calibration of flow measuring devices was performed on September 26, 2002. A copy of the report was sent to the Ministry of Environment District Office and is on file at the Brighton WPCP plant and Public Works office.

Certificate of Approval 4.(b)(c)(d) – Table VI demonstrates compliance with frequency of sampling of raw sewage, waste stabilization pond effluent and wetland effluent. Extra sampling occurred in the wetland on July 16, 2002 when investigating odour complaints.

Tables VII and VIII provide lab weekly lab results of samples collected.

4.3 **Operation and Maintenance**

Certificate of Approval (5.)(c) stipulates that the Owner shall endeavour to operate the sewage treatment works such that the effluent will not contain any oil or other substance in amounts sufficient to create a visible film or sheen on the surface of the receiving waters and shall be essentially free of any floating material.

Occasional foaming was present where the wastewater is agitated such as at the bottom of outfalls or weirs; this appears to be a natural reaction which occurs annually from time to time.

Certificate of Approval 6.(a) refers to proper maintenance of related equipment and appurtenances to operate sewage works, including funding for operator training.

An Operations and Maintenance Manual is in place at the Sewage Works. Operators have been involved in safety, wastewater treatment and collection training. Continuing education is promoted and supported by the municipality for wastewater treatment and collection as well as other related courses.

4.4 **Reporting**

Certificate of Approval 7.(b) In August and November, 2002 reports of non-compliance were made to the Ministry of Environment District Office regarding exceedance of Ammonia concentration in the Waste Stabilization Pond in July and October. C of A limit of 14.0 mg/L were slightly exceeded in both instances. Also, Ammonia concentrations in June and July at the wetland were above C of A objective of 10 mg/L and slightly over 15.0 mg/L in December.

Ammonia concentrations in 2001/2002 revealed lower levels commencing in March and running through to September. Lower C of A limits for ammonia in the waste stabilization pond and wetlands are reduced between May to October; however, in both October 2001 and 2002, ammonia concentrations tend to increase significantly. Should this cycle continue, the Ministry of Environment may note that the timeframe in the C of A of May to October and November to April in reaching ammonia levels limits are attainable during the periods of April to September and October to March when reassessing the sewage works and evaluating a new Certificate of Approval.

Appendix I Brighton WPCP Performance Summary details results and adequacy of the sewage treatment performance demonstrating removal and percent efficiency from raw sewage concentrations through to final effluent for CBOD₅, Suspended Solids, Total Phosphorus, TKN and Ammonia.

Certificate of Approval 7.(c) There was no reportable occurrence of bypasses from the Brighton WPCP. Flows through the WPCP are continuous.

Certificate of Approval 7.(d)(i) Summary of all monitoring data including an overview of the sewage treatment program.

Tables VII and VIII include weekly lab results. *Appendix I* – Sewage Treatment Plant Performance - demonstrates efficiency of each stage of the Brighton WPCP treatment system.

Certificate of Approval 7.(d)(ii) Interpretation of all monitoring and analytical data and comparison to the final effluent quality and quantity.

Appendix I demonstrates the success of Brighton's WPCP natural treatment process, which includes:

- 94.5% CBOD₅ removal
- 96.3% removal of Suspended Solids
- 93.4% removal of Phosphorus
- 57.7% removal of Nitrogen
- 57.6% removal of Ammonia.

Appendix II demonstrates charts representing concentrations from the waste stabilization pond effluent and final wetland effluent for CBOD₅, Suspended Solids, Ammonia and Total Phosphorus.

Certificate of Approval 7.(d)(iii) Summary of any final effluent quality assurance or control measures undertaken during the reporting period.

Final effluent quality was tested in October in the receiving body, Presqu'ile Bay, to analyze and monitor receiving water quality. Results indicate that the effluent from the constructed wetland, which flows through the natural wetland and Presqu'ile Bay have no detrimental effect on the receiving water. See Lab Results for Presqu'ile Bay Table VIII.

Certificate of Approval 7.(d)(iv) Summary of maintenance carried out on major structure, equipment, apparatus, mechanism forming part of the works.

Sludge from the waste stabilization pond was pumped to the sludge drying beds a total of four times during the warmer months. Dried sludge was transferred to the on-site compost pile and mixed with leaves and wood chips.

Inspection and repairs to the back-up generator at the Harbour Street Pumping Station in November included pressure checks and repairs to cooling system.

A bioaugmentation program was implemented in April to October utilizing Microbe Aid, a freeze dried bacteria with enzyme implant. This product was utilized to enhance the decomposition process and decrease suspended solids, CBOD₅, and sludge volume in the Waste Stabilization Pond. Enhanced reduction in CBOD₅ from 82.1% in 2001 to 91.1% removal in 2002, and reduction in Suspended Solids from 77.2% removal in 2001 to 90.9% in 2002 from the waste stabilization pond effluent.

Certificate of Approval 7.(d)(v) Summary of any environmental or operating problems encountered and mitigative measures taken.

In January 2002, a check valve malfunctioned on pump No. 3 at the Harbour St. Pumping Station causing some flooding in the dry well. A hauler was called in to transfer the sewage from the dry well to lagoon #1, the pump was shut down and locked out for repair, and a new sump pump was installed. There was no spill to the environment. Mitigation measures included new isolation and check valves being installed as well as a magnetic flow meter in the discharge header in order to accurately track station flows. The work was performed in June during low flow times.

An odour complaint was received in April emitting from the constructed wetland site. Wayne Pearson, operator in charge, evaluated and confirmed odours emitting from stagnant pools in the reed bed along the north cell. John Pries, wetland consultant from CH2M Hill, visited the site in May and assisted staff in measuring depth of the wetland cells and advised that activities contributed to the odour problem included peak flows in May to the sewage treatment works and operating levels not providing sufficient hydraulic retention time for the contaminant load. Extra sampling to investigate wetland performance in July revealed little difference between north and south cells. Staff gradually increased operating levels and will monitor more closely to ensure levels provide sufficient treatment and retention time.

John Pries, the wetland consultant, visited the site on May 30th and September 11, to investigate odour concerns and performance overview.

Certificate of Approval 7.(d)(vi) Summary of alterations, extensions or replacements in the process or operation of the works which are considered for implementation over the next reporting period.

Baffle curtains were installed in the Waste Stabilization Pond in September to prevent short-circuiting and enhance contact time in the waste stabilization pond. The Municipality is investigating methods to enhance ammonia reduction and improve performance in the lagoon.

Certificate of Approval 7.(d)(iv) Summary of calibration and maintenance procedures conducted on all monitoring equipment.

Milltronics performed annual calibration of flow meters including in-flow, lagoon outflow, and wetland final outflow on September 26, 2002; a copy of the report was submitted to the MOE district office.

5.0 CONCLUSION

The Brighton Water Pollution Control Plant has been successful in treating the wastewater utilizing the lagoons and wetlands through natural treatment processes. The final quality of the effluent may be influenced by a majority of environmental factors such as climate or wildlife. These factors must be considered when analyzing the data and performance of the effluent quality. The wetlands were incorporated into the treatment system in the summer of 2000, at which time, a 5-year study period was allowed to investigate efficiency and create working limits for the final effluent at the wetland.

The final effluent discharged from the wetland site to Presqu'ile Bay has met and/or exceeded the majority of water contaminant objectives set under the terms and conditions of the Certificate of Approval. The Municipality of Brighton is presently investigating alternatives to enhance ammonia reduction and address the removal of sludge from the Waste Stabilization Pond. Brighton is dedicated to achieve continuous improvement of its wastewater treatment to meet limits set by the Ministry of Environment.

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