

TABLE OF CONTENTS

	Page
1.0 INTRODUCTION	1
➤ Classification and Control Document Information.	
2.0 CONTACT INFORMATION	2
➤ Owner/Operator contact information	
3.0 WASTEWATER TREATMENT PLANT & TREATMENT PROCESS	3
4.0 COMPLIANCE WITH TERMS AND CONDITIONS OF CERTIFICATE OF APPROVAL	
4.1 PERFORMANCE	
4.1.1 Wastewater flows to the WPCP	4/5
4.1.2 Waste Stabilization Pond Effluent Quality	6
4.1.3. Waste Stabilization Pond Loading	7/8
4.1.3 Wetland Effluent Quality	8/9
4.2 MONITORING AND RECORDING	
➤ Table VII – Compliance to sampling frequency	10
➤ Table VIII – Waste Stabilization Pond – weekly lab results	11
➤ Table IX –Wetland Final Effluent – weekly lab results	12
4.3 OPERATION AND MAINTENANCE	
➤ Summary of Operations	13
➤ Summary of Maintenance	14
➤ Summary of Environmental or Operating Problems	15
4.4 REPORTING	16
5.0 CONCLUSION	16

APPENDICES

APPENDIX I - Brighton WPCP Monthly Performance Summary

1.0 INTRODUCTION

The Municipality of Brighton is pleased to present its Annual Performance Report for wastewater treatment for the operating period of January 1 to December 31, 2004.

Brighton's Water Pollution Control Plant services a population of approximately 5,000 consisting of 2,400 residential and 200 commercial accounts. The Ontario Environmental Training Consortium Certification Office (OETC) classifies the Water Pollution Control Plant as Wastewater Treatment Class 1 facility and Wastewater Collection Class 2 collection system.

The Brighton Wastewater Pollution Control Plant operates under Certificate of Approval number 3-0521-99-006 issued by the Ministry of Environment.

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

There was no sludge pumped to the drying beds during this reporting period and no material was utilized or removed from the composting site.

2.0 CONTACT INFORMATION

For information or questions regarding this report please contact:

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3.0 WASTEWATER TREATMENT PLANT DESCRIPTION & TREATMENT PROCESS

The sewage works in Brighton consists of:

- a 0.7 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) is a facultative lagoon where wastewater stabilization is carried out by a combination of aerobic, anaerobic and facultative bacteria.
- 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'ile Bay located off the northeast shore of Lake Ontario;
- a 2-cell drying bed to service the existing sewage treatment lagoons; sludge that accumulates in the lagoons may be periodically pumped to drying beds.

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. Approximately 35% of the sanitary sewage from the Brighton collection system flows by gravity to the aerated lagoon; the remainder of the flow (65%) was 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 that pumps wastewater through a forcemain to the aerated lagoon. A standby diesel generator is on-site at the pumping station to provide electricity to the pumps during power outage events.

Brighton's wastewater treatment system is a simple low-tech approach based on purifying the wastewater through biological activity in a lagoon-based system. Raw wastewater enters the aerated lagoon (lagoon #1) where it 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 then passes through a mixing chamber where Alum (Aluminum Sulfate) is added. Alum is a flocculent used in wastewater ponds to precipitate soluble phosphorus and aids in the settling of many other substances. The effluent then flows to the waste stabilization pond (lagoon #2) where the bound solids settle to the bottom and the organic portions 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 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 operators. Treatment performance from lagoon-based systems is susceptible to low temperature conditions and associated negative effects on biological treatment performance. Ammonia removal rates and microbial growth typically decrease with lower temperatures. The Certificate of Approval provides changes in concentration limits for Ammonia in the waste stabilization pond and constructed wetlands from October to April to provide allowances for cold temperatures that result in lower nitrification rates.

Monthly Municipal Utility Monitoring Program reports are forwarded to the Ministry of Environment. Analyses are taken in both the influent (raw sewage) and the effluent at the lagoon and wetlands to determine the amount of treatment achieved. The results must comply with MOE guidelines and Certificate of Approval effluent concentration limits.

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 2004 was 3,528 m³/day, which represents 77% of the average day design capacity of 4,600 m³/day. The maximum annual daily flow for 2004 occurred on September 9, 2004 where heavy precipitation contributed to a peak flow of 11,337 m³/day. Peak monthly flow of 149,474 m³ occurred in December due to precipitation combined with fluctuating temperatures contributing to increased runoff/infiltration during that month. Annual flow of sewage to the WPCP was 1,293,211 in 2004 with approximately 65% of the wastewater entered via the pumping station and 35% flowing by gravity from the remainder of the sanitary collection system.

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	99,348	3,205	4,683	70%
FEB	72,900	2,514	2,827	55%
MAR	139,521	4,500	7,827	98%
APR	137,429	4,581	6,130	100%
MAY	107,407	3,465	5,373	75%
JUN	91,458	3,049	4,950	66%
JUL	99,697	3,216	8,904	70%
AUG	113,708	3,668	10,866	80%
SEP	110,785	3,693	11,337	80%
OCT	80,535	2,598	2,815	56%
NOV	90,949	3,032	5,325	66%
DEC	149,474	4,822	7,024	105%
ANNUAL	1,293,211	3,528	11,337	77%

Volume of influent and effluent of wastewater to lagoon #2 measured 1,293,212 m³ with out-flows of 1,198,460 m³ respectively; this represents approximately 7% (94,752 m³) loss through evaporation and/or transpiration throughout the year. See Table II, Chart 1, Page 5.

Average per capita daily wastewater flow from Brighton WWTP was approximately 0.7 m³/capita in 2004, which includes domestic, industrial and commercial contributions as well as infiltration and inflow. (Based on a population of 5,000 and an average daily flow of 3,528 m³/day.)

The total flow of wastewater to the treatment plant in 2003 was 1,139,036 m³, flows in 2004 were approximately 12% higher due to increased precipitation throughout the year.

Table III- Annual Flows to the WPCP

Date	2004	2003	2002	2001
JAN	99,348	72,557	94,250	82,240
FEB	72,900	68,753	98,823	91,182
MAR	139,521	121,860	122,051	135,398
APR	137,429	120,487	124,897	107,771
MAY	107,407	125,924	141,812	84,351
JUN	91,458	100,143	100,415	79,140
JUL	99,697	74,838	87,723	65,486
AUG	113,708	71,274	73,113	63,175
SEP	110,785	68,544	64,857	63,126
OCT	80,535	81,242	62,360	74,976
NOV	90,949	109,618	76,973	73,319
DEC	149,474	123,796	75,444	92,549
ANNUAL	1,293,211	1,139,036	1,122,718	1,012,713

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 effluent from the waste stabilization pond:

Table IV – 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

Table V - Waste Stabilization Pond Effluent Parameters - Compliance to C of A 2.(b) loading See Page 7.

Waste Stabilization Pond Effluent Summary:

- The Ontario Ministry of Environment monitors effluent quality from the Brighton Wastewater Treatment Plant through the Municipal Utilities Monitoring Program (MUMPS) reports which are submitted monthly summarizing the laboratory results for Biological Oxygen Demand, Total Phosphorus, Suspended Solids, Total Kjeldahl Nitrogen, and Total Ammonia.
- The Biological Oxygen Demand is the amount of oxygen used by micro-organisms as they decompose organic matter in the effluent sample for five days. High BOD in effluent means a large quantity of oxygen was needed to break down the organic matter and identifies a large amount of organic matter in the effluent indicating inadequate treatment. The CBOD₅ average concentration from the waste stabilization pond effluent in 2004 was 4.3 mg/L; the CofA limit is 30.0 mg/L CBOD₅ based on the average concentration of all samples taken.
- Total Suspended Solids in effluent are composed of settleable solids and nonsettleable solids depending on the size, shape and weight of the solid particles; large sized particles tend to settle more rapidly and are largely removed in the waste stabilization pond.. Suspended Solids concentration limit from the waste stabilization pond effluent is 40.0 mg/L. The annual average of Total Suspended Solids was 10.7 from the waste stabilization pond.
- Total Phosphorus (TP) refers to the amount of phosphorus in a sample. Excess TP stimulates algae and weed growth that may cause fluctuations in dissolved oxygen in the receiving waters. Total Phosphorus limits for the waste stabilization pond is based on the monthly average concentration of the parameter; the CofA limit is 1.0 mg/L TP. Monthly average concentration of Total Phosphorus in 2004 ranged from 0.15-0.90 mg/L.
- Limits for Ammonia change from May to October at 14.0 mg/L and Nov.-Apr. at 17.0 mg/L. Non-compliance with respect to concentrations of (Ammonia + Ammonium) Nitrogen in the effluent is deemed to have occurred when the '*monthly average*' concentration of the parameter listed in Table IV is exceeded in any calendar month. Ammonia concentrations from May to October ranged from 5.98 – 12.95 mg/L; and from 5.43-15.75 mg/L in November to April.
- There were no exceedances as defined in the Certificate of Approval of any of the parameters with respect to concentration or total loading in the waste stabilization pond (lagoon #2).

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 VI – 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

Wetland Effluent Summary:

- The average concentration of CBOD₅ from the constructed wetland effluent in 2004 was 2.69 mg/L; the CofA objective is 15.0 mg/L CBOD₅ based on the average concentration of all samples taken.
- Suspended Solids concentration limit from the constructed wetland effluent is 15.0 mg/L. The annual average concentration of Total Suspended Solids was 7.74 mg/L from the constructed wetland based on the average concentration of all samples taken.
- Total Phosphorus limits for the constructed wetland is based on the monthly average concentration of the parameter; the CofA limit is 0.80 mg/L. Monthly average concentrations of Total Phosphorus in 2004 ranged from 0.07-0.55 mg/L.
- Limits for Ammonia change from May to October at 10.0 mg/L and Nov.-Apr. at 15.0 mg/L. Non-compliance with respect to concentrations of (Ammonia + Ammonium) Nitrogen in the effluent is deemed to have occurred when the *'monthly average'* concentration of the parameter listed in Table VI is exceeded in any calendar month. Ammonia concentrations from May to October ranged from 2.68 – 8.85 mg/L; and from 3.88 - 15.33 mg/L from November to April.
- There were no exceedances as defined in the Certificate of Approval of any of the parameters with respect to concentration from the constructed wetland effluent.
- Lack of sunlight, plant production, decreased temperatures and ice cover in winter months directly affects treatment capability of a natural treatment process by limiting dissolved oxygen concentrations which may contribute to elevated food to microorganism ratio (F:M) conditions. 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. *E. coli* are sampled once a month from the waste stabilization pond basis as per CofA. See **Tables VIII and IX 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 two occasions in the wetland. See Tables VIII & IX.

4.2 Monitoring and Recording

Certificate of Approval 4.(a) Annual calibration of flow measuring devices was performed on September 1, 2004.

Certificate of Approval 4.(b)(c)(d) – Tables VII, VIII and IX demonstrates compliance with frequency of sampling of raw sewage, waste stabilization pond effluent and wetland effluent.

Tables VIII and IX provide 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 wastewater cascades over weirs or from outfalls; this appears to occur on a seasonal basis.

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. Continuing education for operators is promoted by the municipality for wastewater treatment and collection as well as health, safety, and technical related courses.

Certificate of Approval 7.(c) Flows through the Brighton Wastewater Treatment lagoons and wetlands are continuous.

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

See Table X for – 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.

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

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

- 97.2% CBOD₅ removal
- 97.0% removal of Suspended Solids
- 95.3% removal of Phosphorus
- 70.8% removal of Nitrogen
- 60.6% removal of Ammonia.

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

- Additional sampling of the waste stabilization pond for total suspended solids was carried out in October during the dredging period of the biosolids removal project. The effluent maintained normal concentrations below 4 mg/L TSS during the dredging operation.

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

➤ **LAGOON BIOSOLIDS REMOVAL PROJECT SUMMARY**

- January 2004, Janice Patterson, CH2M Hill biosolids specialist, presented information to Brighton Council, staff and public regarding options for the removal of biosolids from Brighton's lagoon-based wastewater treatment system.
 - April/May 2004, Biosolids are sampled by CH2M Hill technicians to determine if quality meets the Guidelines for the Utilization of Biosolids and Other Wastes on Agricultural Lands, and for approval of the Ministry of Environment. Lab results reveal that biosolids from Lagoon #2 - Waste Stabilization Pond meets guidelines; however, copper concentrations in biosolids from Lagoon #1 exceeded guidelines.
 - CH2M Hill prepared tender for Biosolids Management Program based on land application of biosolids from lagoon #2. Biosolids from Lagoon #1 included options for dewatering and landfill disposal or agricultural land application at reduced rates upon MOE approval.
 - June 2004, Terratech Environmental, a division of American Water Services (AWS) is awarded Tender 2004-07.
 - On October 5, 2004, MOE issued Provisional Certificate of Approval for an Organic Soil Conditioning Site for Lots 2 & 3, Concession 9 (former Township of Brighton) Municipality of Brighton to receive biosolids removed from Lagoon #2 – Waste Stabilization Pond.
 - Equipment was deployed at the Wastewater Pollution Control Plant in October by Terratech and Trimax. A silt curtain was placed at the effluent of Lagoon #2 prior to commencing operations. Inclement weather conditions in October and November resulted in unfavourable conditions for spreading with limited land application on 6 days between October 14 to November 9, 2004. The project was suspended on November 9th for the season. Lagoon #2 effluent was monitored and sampled during operations; suspended solids analyses performed by Caduceon Laboratories were all below 4 mg/L verifying that the effluent quality was not affected during this time.
 - Approximately 1,540 cubic meters of biosolids were land applied from lagoon #2; it was estimated that a total of 11,414 m³ of sludge is to be removed from lagoon # 2 and 8,214 m³ from lagoon #1. Certificate of Approval for land application of lagoon #1 biosolids has not been issued to date by the MOE.
 - The biosolids removal project will resume in the spring of 2005.
- Catchbasin cleaning was contracted out in May to assist with prevention of mosquito larva and control of West Nile Virus. Debris from the catchbasin cleaning was transferred to the Brighton Landfill Site.
- On September 22, 2004, the wet well was pumped out/cleaned to remove sludge and debris accumulated at the base. Vacuum trucks transferred the wastewater to Lagoon #1 at the Brighton WPCP.

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

- There were two significant rain events in 2004 that contributed to peak flows to the WPCP:
 - (i) On August 1, 2004, 10,866 m³ of wastewater entered the Wastewater Pollution Control Plant from heavy rainfall that occurred from July 30-31, 2004. Accumulations of approximately 120mm of precipitation over the 2-day period were recorded in the area which caused flooding to local watercourses and some sewer back-ups at low points in the system.
 - (ii) On September 9, 2004, 11,336 m³ of wastewater entered the Wastewater Pollution Control Plant. Heavy rainfall from the remnants of Hurricane Frances caused flooding in several areas of Brighton with approximate accumulations of 100mm of rainfall recorded by midnight on September 9. This resulted in the wet well at the pumping station to experience some flooding and a vacuum pumper truck was brought in to assist with the infiltration of stormwater to the pumping station by transferring the wastewater from the wet well to the WPCP. There was some sewage back-ups at low points in the system on September 10. All watercourses were well above normal conditions for several days. The lagoons also experienced higher than normal operating levels over a 24-hour period.
 - (iii) Although there are no combined sanitary and storm sewers in Brighton, the collection system is susceptible to higher flows with heavy precipitation events. Investigation of potential incorrect sump pump connections in the community will commence in 2005 to ensure that the discharge from sump pumps are not connected to the sanitary sewer system.
- Muskrat damage to the constructed wetlands have reduced plant growth in the vegetated zones. Seasonal trapping is being conducted to control muskrat population.

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.

In 2002, Ontario Parks requested that the Municipality of Brighton extend municipal water and sanitary sewer services into Presqu'ile Park to service the park office, campgrounds and other buildings. Extensions to the system commenced in spring of 2003 which included a new sewage pumping station and approximately 3.6 km. of sanitary sewer force main along Presqu'ile Parkway. Equipment problems at the chlorine booster station in the water distribution system delayed water service start-up to the park which was resolved by October 2004. Water services to the park commenced on October 28, 2004, alterations for sewer service connections have not been completed to date.

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

Milltronics performed annual calibration of flow meters at the Brighton WPCP on September 1, 2004.

4.4 **Reporting – Non-Compliance**

Certificate of Approval 7.(b) There were no non-compliance issues in this reporting period.

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. Enhanced 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) is tested at Caduceon Environmental Labs (formerly ETRL), a certified lab, on a weekly basis as per Certificate of Approval. The effluent quality from the lagoon and wetland site to Presqu'île Bay has met and/or exceeded the contaminant limits and objectives set under the terms and conditions of the Certificate of Approval. Brighton is dedicated to achieving continuous improvement of its wastewater treatment system and being environmentally responsible to the quality of its receiving waters.

- Biosolids lab results:

Parameter	Date Tested		MOE Compost Guidelines	Agrl. Land Max. Limits	Agrl. Land Targets
	May 21, 2003	June 24, 2004			
Arsenic	1 mg/kg	2 mg/kg	10 mg/kg	170 mg/kg	35 mg/kg
Cadmium	1.0 mg/kg	<1 mg/kg	3 mg/kg	34 mg/kg	4 mg/kg
Chromium	108 mg/kg	168 mg/kg	50 mg/kg	2800 mg/kg	530 mg/kg
Cobalt	4 mg/kg	<1 mg/kg	25 mg/kg	340 mg/kg	77 mg/kg
Lead	<5 mg/kg	19 mg/kg	150 mg/kg	1100 mg/kg	220 mg/kg
Mercury	0.294 mg/kg	0.388 mg/kg	0.15 mg/kg	11 mg/kg	1.4 mg/kg
Molybdenum	1 mg/kg	<1 mg/kg	2 mg/kg	94 mg/kg	1.2 mg/kg
Nickel	22 mg/kg	40 mg/kg	60 mg/kg	420 mg/kg	80 mg/kg
Selenium	0.7 mg/kg	0.9 mg/kg	2 mg/kg	34 mg/kg	6 mg/kg
Zinc	113 mg/kg	237 mg/kg	500 mg/kg	4200 mg/kg	840 mg/kg
Copper	313 mg/kg	609 mg/kg	60 mg/kg	1700 mg/kg	380 mg/kg
pH	7.56				

Lagoon #2 – Facultative Lagoon

Parameter	Date Tested		MOE Compost Guidelines	Agrl. Land Max. Limits	Agrl. Land Targets
	May 21, 2003	June 24, 2004			
Arsenic	1 mg/kg	2 mg/kg	10 mg/kg	170 mg/kg	35 mg/kg
Cadmium	1.0 mg/kg	<1 mg/kg	3 mg/kg	34 mg/kg	4 mg/kg
Chromium	108 mg/kg	168 mg/kg	50 mg/kg	2800 mg/kg	530 mg/kg
Cobalt	4 mg/kg	<1 mg/kg	25 mg/kg	340 mg/kg	77 mg/kg
Lead	<5 mg/kg	19 mg/kg	150 mg/kg	1100 mg/kg	220 mg/kg
Mercury	0.294 mg/kg	0.388 mg/kg	0.15 mg/kg	11 mg/kg	1.4 mg/kg
Molybdenum	1 mg/kg	<1 mg/kg	2 mg/kg	94 mg/kg	1.2 mg/kg
Nickel	22 mg/kg	40 mg/kg	60 mg/kg	420 mg/kg	80 mg/kg
Selenium	0.7 mg/kg	0.9 mg/kg	2 mg/kg	34 mg/kg	6 mg/kg
Zinc	113 mg/kg	237 mg/kg	500 mg/kg	4200 mg/kg	840 mg/kg
Copper	313 mg/kg	609 mg/kg	60 mg/kg	1700 mg/kg	380 mg/kg
pH	7.56				