

TOWNSHIP OF HURON-KINLOSS
2010 LUCKNOW SEWAGE WORKS
PERFORMANCE REPORT

February 2011

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File No. 02033

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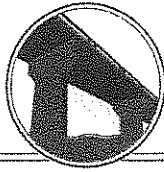
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**TOWNSHIP OF HURON-KINLOSS
2010 LUCKNOW SEWAGE WORKS
PERFORMANCE REPORT**

1.0 INTRODUCTION

The sewage treatment works for Lucknow are located in Part Lots 53, 54 and 55, Conc. 1 in the Former Township of Kinloss, northeast of Lucknow. The location of the community and the sewage works are shown in Figure 1.1.

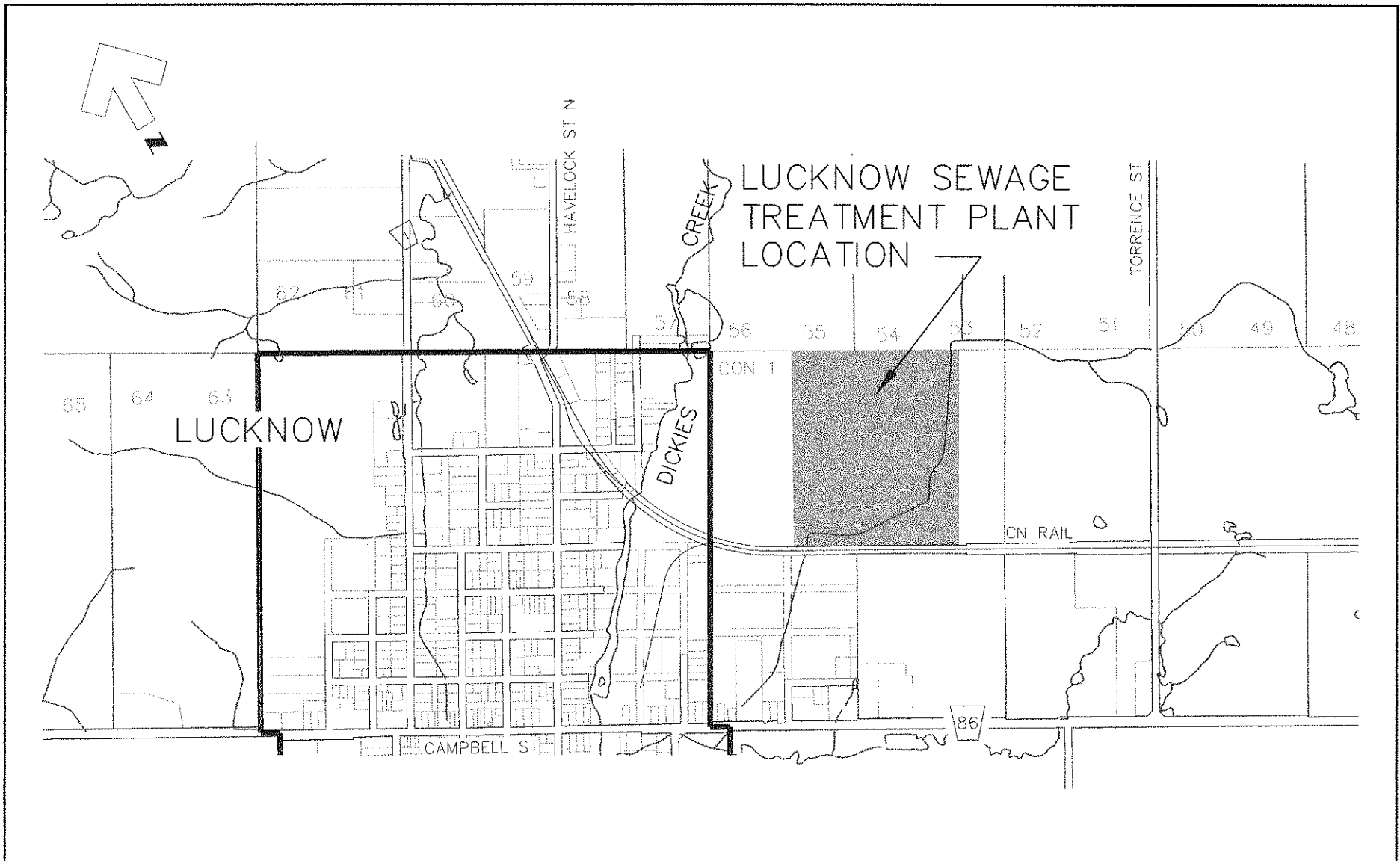
The sewage treatment system was originally constructed under Ministry of the Environment Certificate of Approval (C. of A.) No. 3-1390-88-896, dated January 24, 1989. The sewage treatment works is now operated under C. of A. No. 1180-5QCNEW, dated October 16, 2003.

The works consist of three (3) aerated lagoons, with each cell having approximately 10,700 m³ in volume at an operating depth of approximately 4.0 m. An effluent storage lagoon, having a total operating volume of 67,500 m³ with a liquid depth of 3.0 m, has been provided for winter storage or emergency effluent storage. For final disposal, the effluent from the treatment works is directed to six (6) rapid infiltration basins (RIB's) which allow infiltration of the treated effluent into the groundwater regime.

In 2010, the treatment system was operated as follows:

Raw sewage from the main sewage pumping station was pumped to Aerated Cell No. 1, which in turn fed Aerated Cell No. 2 and then Aerated Cell No. 3, in series. The treated effluent from Cell No. 3 was placed continuously on the RIB's throughout 2010, with the exception of some days in late-April to late-May when flow to the RIB's was cut off in order to fill Aeration Cell No. 3, which was at a low level because it had been drained to facilitate repairs to the cell discharge works.

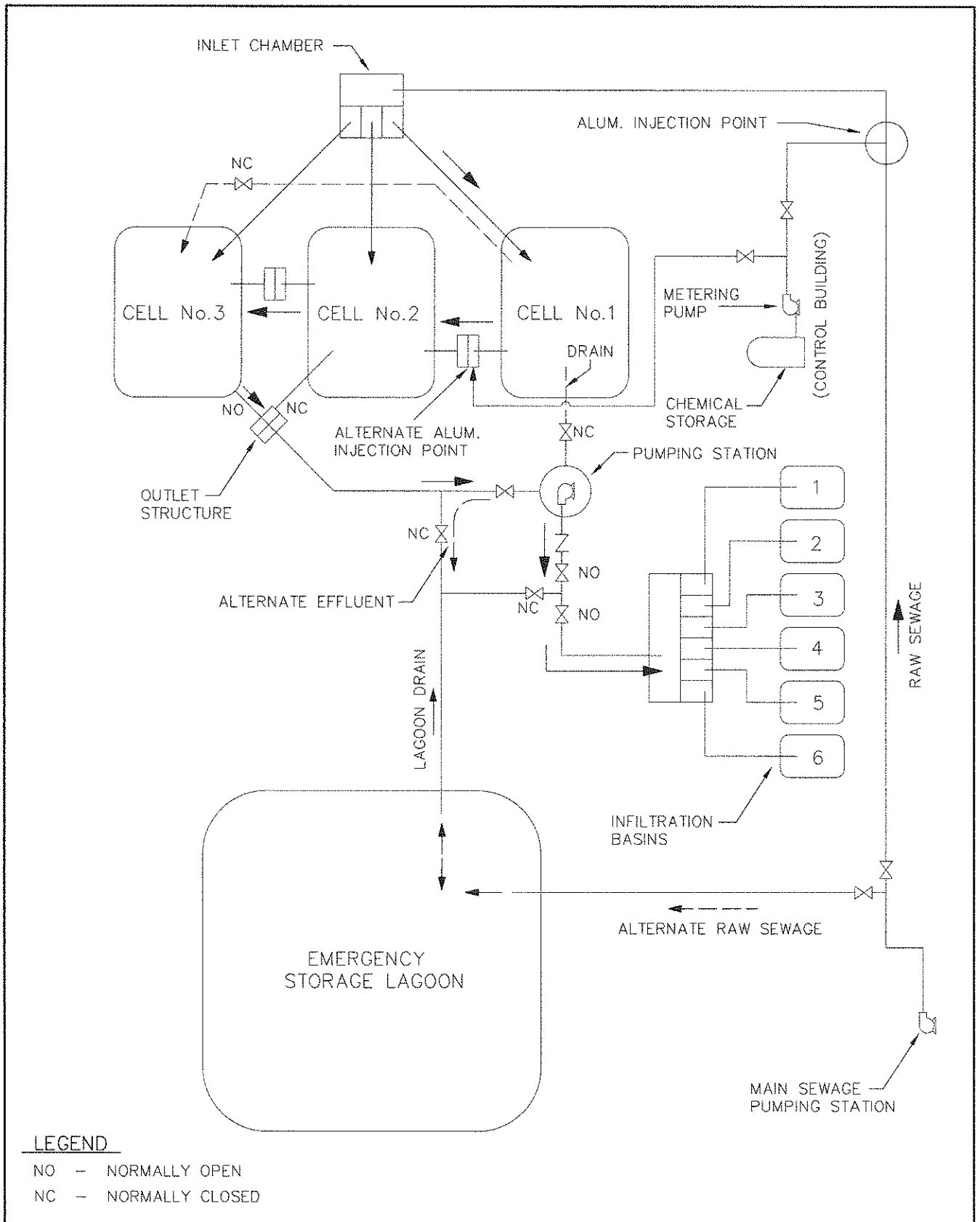
A schematic (Ref. 1) of the treatment and discharge system is shown as Figure 1.2. The sewage treatment works are operated by Veolia Water Canada.



Municipality of
Huron-Kinloss
Location of Treatment Plant
Lucknow Sewage Works
2010 Performance Report

DATE
January 2011
SCALE
1 : 15000

PROJECT No.
02033
FIGURE No.
1.1



LEGEND

- NO - NORMALLY OPEN
- NC - NORMALLY CLOSED



**Municipality of
Huron-Kinloss**
Process Schematic
Lucknow Sewage Works
2010 Performance Report

DATE
January 2011

PROJECT No.
02033

SCALE
Not to Scale

FIGURE No.
1.2

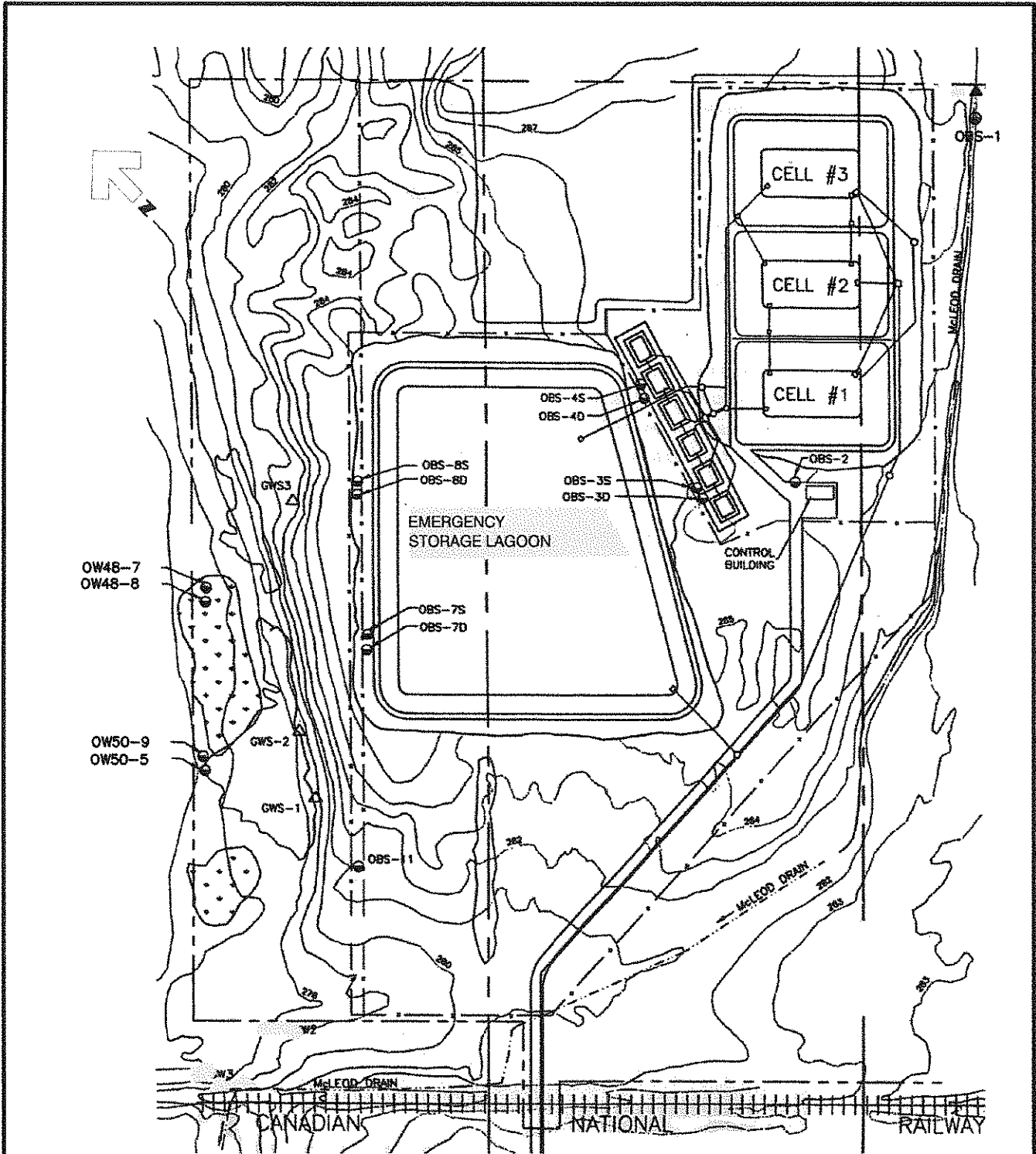
The purpose of this report is to summarize the operating and monitoring data collected, as required by the C. of A., for the 2010 operating year. In addition, the report is to identify the treatment being provided to the sewage and to provide comments with respect to compliance with the C. of A.

Figure 1.3 shows the sewage works site, monitoring wells and sampling points.

The site generally slopes from the north-central part of the property south-westerly, and also to the north and east. There is a low-lying area, which is reportedly a kettle depression, near the west site boundary.

According to the report entitled "Sanitary Sewage Works, Rapid Infiltration Basin Monitoring, 1992-1993" (Ref. 1), the *"Northeast, southeast and southwest quadrants of the site are drained by the McLeod Drain. The drain enters the site at the northeast corner, traverses the southeast quadrant and exits near the southwest corner of the site. In general, depending on the location within the site and on seasonal groundwater fluctuations, the McLeod Drain recharges the groundwater (in the northeast quadrant) and groundwater discharges to the remainder of the Drain."*

The hydrogeologic aspects of the site were determined by Morrison Beatty Ltd. during the Class Environmental Assessment and final design processes. In general, the groundwater, in the surficial gravel and sand, flows from northeast to southwest. According to original studies, the groundwater flows underneath the kettle depression located near the west site limit. In addition, a potential for groundwater discharge into this low-lying kettle area was identified.



LEGEND

- OBS-73 OBSERVATION WELL No. 7 - SHALLOW (S) OR DEEP (D)
- △ GWS-1 GROUNDWATER SEEP SAMPLING STATION



BMROSS
engineering better communities

Municipality of
Huron-Kinloss
Site Plan and Observation Well Locations
Lucknow Sewage Works
2010 Performance Report

DATE
January 2011
SCALE
1 : 3000

PROJECT No.
02033
FIGURE No.
1.3

2.0 RAW SEWAGE

2.1 2010 Flows

The 2010 monthly flows are shown graphically in Figure 2.1. Flow data was obtained from the utility monitoring system records maintained by Veolia, the operator of the works. The flows are recorded from a magnetic flow meter located in the sewage pumping station on Mill Street. All of the flow from the Village is pumped to the sewage treatment facility via this pumping station.

Table 2.1 is a summary of the 2010 monthly flows as reported by Veolia. The annual average daily flow during 2010 was 564 m³/day. This is approximately 75% of the rated capacity of 750 m³/day stated in the C. of A. During the years 2006 through 2009, the average annual daily flow ranged from 543 to 662 m³/day, with a four year average of 610 m³/day. The 2010 average daily flow is approximately 7 to 8% lower than the average daily flow during the previous four years.

As noted in both Figure 2.1 and Table 2.1, there is some seasonal variation in average monthly flows. The lowest average daily flow by month was 492 m³/day in February, and the highest average daily flow by month was 660 m³/day in July.

Comparing the monthly average day flows during 2010 to the monthly average flows during the 2006 to 2010 period, it is observed that monthly variations in 2010 are uncharacteristic of typical years at the works, as the highest average day flows usually occur during spring months and lowest average day flows often occur during summer months. Average daily flow rates in the months of June through September were greater in 2010 than the five year running average for those months. In 1997, it was concluded from peak flows (maximum daily flows) that there might be areas of direct inflow to the sanitary sewer system.

In 2010, maximum daily flows in June and July were greater than the largest maximum daily flows for the same months during the 2006 to 2009 period. During all other months in 2010, the maximum daily flows were less than the previous four years maximum flows. The maximum day flow during 2010 was 1,534 m³/day, which occurred in June. This maximum day flow is significantly lower than the single day maximum flows recorded during the 2006 to 2009 period, which ranged from 2,576 to 3,934 m³/day.

Figure 2.1
2010 Daily Influent Flows

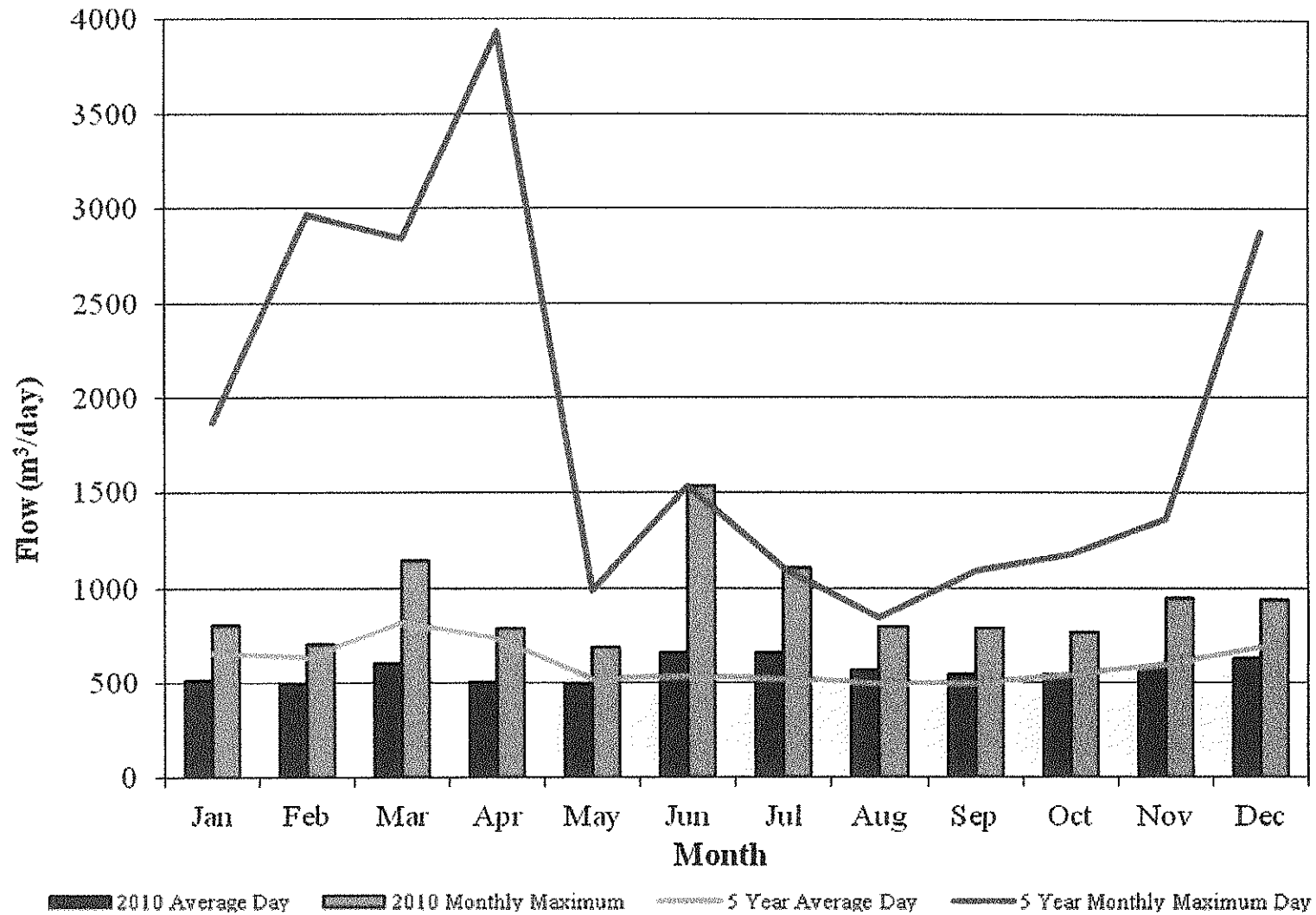


Table 2.1
Summary of 2010 Monthly Flows

Month	Total Flow m ³	Average Day m ³	Maximum Day m ³
January	15,866	512	804
February	13,779	492	706
March	18,553	598	1,142
April	15,020	501	790
May	15,354	495	690
June	19,651	655	1,534
July	20,460	660	1,104
August	17,450	563	798
September	16,147	538	790
October	16,640	537	764
November	17,689	590	949
December	19,324	623	940
Total	190,067	---	---
Average	---	564	---
Maximum	---	---	1,534

2.2 2010 Raw Sewage Sample Results and Discussion

a) CBOD₅

Results of raw sewage analysis for CBOD₅ concentration, completed in 2010, are shown in Table 2.2. Using the annual average daily concentration of 143.6 mg/L and the annual average daily flow of 564 m³/day, the average loading was calculated to be 81.0 kg/day. With an assumed serviced population of 1,162 persons (2006 census), the average per capita loading of CBOD₅ in 2010 is approximately 70 grams/capita/day. This is slightly less than a typical organic sewage loading rate of 75 grams/capita/day for CBOD₅ (Ref. 2). In 2009 the CBOD₅ loading was 79 grams/capita/day.

b) Suspended Solids

Results of raw sewage analysis for suspended solids concentration, completed in 2010, are shown in Table 2.2. Using the annual average daily concentration of 128.3 mg/L and the annual average daily flow of 564 m³/day, the average loading was calculated to be 72.3 kg/day. With an assumed serviced population of 1,162 persons (2006 census), the average per capita loading of suspended solids in 2010 is approximately 62 grams/capita/day. This is approximately 31% less than a typical suspended solids loading rate for domestic sewage of approximately 90 grams/capita/day (Ref.2). In 2009, the suspended solids loading was 70 grams/capita/day.

Table 2.2
Summary of 2010 Raw Sewage Strengths

Month	Average Day m ³ /d	CBOD		Suspended Solids		TKN		Total Phosphorus	
		mg/L	kg/d	mg/L	kg/d	mg/L	kg/d	mg/L	kg/d
January	512	190.5	97.5	140.0	71.7	21.0	10.8	2.79	1.43
February	492	176.0	86.6	140.0	68.9	22.5	11.1	3.04	1.50
March	598	181.5	108.6	121.0	72.4	18.3	11.0	2.16	1.29
April	501	191.5	95.9	143.5	71.8	20.3	10.1	2.59	1.30
May	495	112.5	55.7	133.5	66.1	20.5	10.1	2.30	1.14
June	655	115.0	75.3	120.0	78.6	16.0	10.5	2.24	1.47
July	660	74.5	49.2	98.0	64.7	12.5	8.3	1.38	0.91
August	563	97.0	54.6	118.5	66.7	17.9	10.1	2.06	1.16
September	538	131.0	70.5	134.0	72.1	17.0	9.2	1.98	1.06
October	537	148.5	79.7	145.0	77.8	17.9	9.6	2.01	1.08
November	590	147.0	86.7	110.0	64.9	16.1	9.5	2.00	1.18
December	623	158.7	98.9	136.7	85.2	19.0	11.8	2.34	1.46
Average	564	143.6	81.0	128.3	72.3	18.2	10.3	2.24	1.26

c) Total Kjeldahl Nitrogen

Results of raw sewage analysis for total Kjeldahl nitrogen (TKN) concentration, completed in 2010, are shown in Table 2.2. Average values for TKN concentration and loading are 18.2 mg/L and 10.3 kg/day, respectively. These values are a slightly less than the previous year values of 19.3 mg/L and 11.2 kg/day. The values are less than typical for domestic wastewater (Ref. 3).

d) Total Phosphorus

Results of raw sewage analysis for total phosphorus concentration, completed in 2010, are shown in Table 2.2. Average values for phosphorus concentration and loading are 2.24 mg/L and 1.26 kg/day. These values are slightly less than the previous year values of 2.64 mg/L and 1.53 kg/day. The values are less than typical for domestic wastewater (Ref. 3).

e) Comment

In summary, concentrations and loadings of tested raw sewage parameters are lower in all cases, compared to recent years. Concentrations and per capita loadings of each parameter are lower than typical values, based on comparisons to reference literature.

3.0 INFILTRATION FACILITY INFLUENT MONITORING

3.1 General

The C. of A. states that the facultative aerated lagoon system should be designed, constructed and operated such that the average monthly concentrations in the discharge into the rapid infiltration basins comply with the values listed in Table 3.1.

Table 3.1
Rapid Infiltration Basin C. of A. Criteria

Parameter	Average Monthly Concentrations (Design Objectives)
CBOD ₅	≤ 20 mg/L
Suspended Solids	≤ 20 mg/L
Total Phosphorus	≤ 1 mg/L

The sample date and results of the analyses of the effluent from Cell No. 3 are shown in Table 3.2. The samples were grab samples from the effluent of the last aerated cell (Cell No. 3) prior to discharge onto the RIB's.

Table 3.2: Summary of 2010 Infiltration Basin Influent Sample Results

Date (2010)	CBOD (mg/L)	Suspended Solids (mg/L)	Ammonia & Ammonium (mg/L)	TKN (mg/L)	Nitrite (NO ₂) (mg/L)	Nitrate (NO ₃) (mg/L)	Total Phosphorus (mg/L)	Dissolved Phosphorus (mg/L)	pH (units)	Chloride (mg/L)
January 13	7	9	14.1	14.2	0.12	3.94	0.46	0.32	7.19	170
January 27	11	12	16.0	18.1	0.07	2.12	0.57	0.37	7.45	160
January Average	9.0	10.5	15.1	16.2	0.10	3.03	0.52	0.35	7.32	165
February 10	6	7	17.3	18.6	0.06	1.69	0.50	0.51	7.46	180
February 24	8	5	19.2	20.8	0.06	0.90	0.56	0.50	7.63	180
February Average	7.0	6.0	18.3	19.7	0.06	1.30	0.53	0.51	7.55	180
March 10	6	5	19.8	21.0	<0.06	0.72	0.53	0.57	7.74	190
March 24	11	12	16.2	17.5	0.12	0.87	0.42	0.39	7.91	150
March Average	8.5	8.5	18.0	19.3	<0.09	0.80	0.48	0.48	7.83	170
April 07	17	14	13.6	15.1	0.28	1.06	0.28	0.18	7.97	170
April 21	11	10	10.5	11.4	0.38	1.28	0.17	0.12	8.12	160
April Average	14.0	12.0	12.1	13.3	0.33	1.17	0.23	0.15	8.05	165
May 05	6	4	9.6	12.0	0.22	0.45	0.23	0.19	7.74	160
May 19	10	27	6.8	7.8	0.58	1.22	0.15	0.07	9.13	170
May Average	8.0	15.5	8.2	9.9	0.40	0.84	0.19	0.13	8.44	165
June 02	8	11	13.0	14.6	0.14	<0.05	0.40	0.24	7.51	160
June 16	58	13	5.4	6.7	3.42	6.22	0.28	0.12	6.98	160
June 30	5	8	2.0	4.2	2.25	7.29	0.27	0.13	7.00	160
June Average	23.7	10.7	6.8	8.5	1.94	<4.52	0.32	0.16	7.16	160
July 14	5	7	2.8	3.8	0.63	2.76	0.17	0.15	7.09	140
July 28	5	10	1.1	2.6	0.33	4.62	0.17	0.10	7.16	150
July Average	5.0	8.5	2.0	3.2	0.48	3.69	0.17	0.13	7.13	145
August 11	3	5	1.5	2.1	0.38	1.83	0.15	0.11	7.28	150
August 25	6	10	1.3	2.3	0.29	0.99	0.21	0.16	7.45	150
August Average	4.5	7.5	1.4	2.2	0.34	1.41	0.18	0.14	7.37	150
September 08	5	11	1.2	2.0	0.08	0.74	0.18	0.10	7.48	150
September 22	5	12	1.0	2.0	0.17	1.71	0.16	0.15	7.50	140
September Average	5.0	11.5	1.1	2.0	0.13	1.23	0.17	0.13	7.49	145
October 06	8	10	<0.1	<0.5	<0.06	4.87	0.16	0.13	7.26	150
October 20	4	13	<0.1	<0.5	0.06	6.43	0.15	0.09	7.28	150
October Average	6.0	11.5	<0.1	<0.5	<0.06	5.65	0.16	0.11	7.27	150
November 03	<4	11	0.3	2.9	0.31	8.01	0.18	0.11	7.67	150
November 17	<4	10	2.0	3.0	0.51	7.69	0.20	0.17	7.64	140
November Average	<4.0	10.5	1.2	3.0	0.41	7.85	0.19	0.14	7.66	145
December 01	6	10	3.8	7.0	0.54	6.94	0.34	0.20	7.77	130
December 20	7	7	8.1	9.4	0.28	4.33	0.41	0.38	7.52	130
December 28	5	6	9.7	11.4	0.23	3.44	0.48	0.37	7.39	140
December Average	6.0	7.7	7.2	9.3	0.35	4.90	0.41	0.32	7.56	133
ANNUAL AVERAGE	<8.4	10.0	<7.6	<8.9	<0.40	<3.00	0.29	0.23	7.57	156

3.2 2010 Sample Results and Discussion

a) CBOD₅

The 2010 annual average effluent CBOD₅ for Cell No. 3 was less than 8.4 mg/L, which complies with the monthly concentration Design Objective of 20 mg/L. One monthly average slightly exceeded the Design Objective; the June average was 23.7 mg/L, generally the result of an uncharacteristically high result of 58 mg/L on June 16.

b) Suspended Solids

The 2010 annual average effluent suspended solids for Cell No. 3 was 10.0 mg/L, which complies with the Design Objective of 20 mg/L. No monthly averages exceeded the Design Objective. One single sample result exceeded the Design Objective; the May 19 result was 27 mg/L.

c) Ammonia, TKN, Nitrite and Nitrate

There are no aeration cell effluent performance requirements set out in the C. of A. for any nitrogen compounds.

d) Phosphorus

The 2010 annual average effluent total phosphorus for Cell No. 3 was 0.29 mg/L, which complies with the Design Objective of 1.0 mg/L. No monthly averages or individual samples exceeded the Design Objective.

e) pH & Chlorides

The C. of A. requires that pH remain within the range of 6.0 to 9.0 inclusive. In 2010, pH levels for all but one sample remained within this range, with an annual average level of 7.57. The May 19 value was 9.13, slightly above the upper limit of the allowable range. There are no aeration cell effluent performance requirements set out in the C. of A. for chlorides.

4.0 GROUNDWATER DISCHARGE

4.1 Mid-Site Groundwater Seepage

Groundwater discharge was sampled at least once per month, at groundwater monitoring locations Nos. OBS-3S and OBS-4S as stipulated by the C. of A. OBS-3S is located immediately west of Rapid Infiltration Basin No. 5. OBS-4S is located immediately west of Rapid Infiltration Basin No. 2. The sampling dates and results of the sample analyses are contained in Tables 4.1 and 4.2.

No limit or objective criteria are provided in the C. of A. with regards to Mid-Site Groundwater quality.

Table 4.1: Summary of 2010 Groundwater Sample (OBS-3S) Results

DATE (2010)	CBOD (mg/L)	Suspended Solids (mg/L)	Ammonia & Ammonium (mg/L)	TKN (mg/L)	Nitrite (NO₂) (mg/L)	Nitrate (NO₃) (mg/L)	Total Phosphorus (mg/L)	Dissolved Phosphorus (mg/L)	pH	E. Coli (cfu/100mL)
January 13	<2.0	3.0	2.4	3.7	<0.06	14.80	0.31	0.17		106
February 10	<2.0	4.0	12.1	13.0	<0.06	2.20	0.28	0.24	7.57	52
March 10	5.0	3.0	15.6	17.2	<0.06	3.60	0.48	0.40	7.49	44
April 07	4.0	3.0	11.3	12.4	<0.06	1.23	0.49	0.34	7.25	40
May 05	3.0	10.0	11.0	11.8	<0.06	0.52	0.71	0.29	7.41	152
June 02	<4.0	11.0	11.0	12.2	<0.06	5.71	0.88	0.25	7.24	34
July 14	<2.0	5.0	<0.1	1.4	0.17	3.95	0.53	0.23	7.13	<2
September 08	<2.0	<2.0	<0.1	<0.5	<0.06	1.35	0.37	0.27	7.23	<2
October 06	<2.0	2.0	<0.1	<0.5	<0.06	1.16	0.33	0.28	7.34	<2
November 03	<2.0	7.0	<0.1	<0.5	<0.06	4.83	0.27	0.22	7.48	14
December 01	<2.0	<2.0	1.0	4.0	<0.06	9.87	0.21	0.18	7.43	50

Table 4.2: Summary of 2010 Groundwater Sample (OBS-4S) Results

DATE (2010)	CBOD (mg/L)	Suspended Solids (mg/L)	Ammonia & Ammonium (mg/L)	TKN (mg/L)	Nitrite (NO₂) (mg/L)	Nitrate (NO₃) (mg/L)	Total Phosphorus (mg/L)	Dissolved Phosphorus (mg/L)	pH	E. Coli (cfu/100mL)
January 13	3.0	5.0	<0.1	2.3	<0.06	12.70	0.18	0.16		150
February 10	<4.0	3.0	11.5	11.7	<0.06	4.29	0.24	0.20	7.41	10
March 10	<4.0	2.0	16.1	17.6	<0.06	1.27	0.36	0.35	7.45	10
April 07	4.0	7.0	11.3	12.5	<0.06	1.50	0.38	0.32	7.26	56
May 05	<4.0	17.0	13.9	15.2	<0.06	0.17	1.20	0.48	7.38	144
June 02	<2.0	6.0	5.0	6.5	<0.06	9.65	0.33	0.25	7.13	82
July 14	8.0	5.0	0.8	1.7	0.34	2.54	0.64	0.21	7.16	<2
August 11	<2.0	4.0	0.1	<0.5	<0.06	1.15	0.38	0.24	7.31	<2
September 08	<2.0	4.0	<0.1	0.5	<0.06	1.79	0.29	0.26	7.40	12
October 06	<2.0	<2.0	<0.1	<0.5	<0.06	4.09	0.33	0.22	7.43	<2
November 03	<2.0	<3.0	<0.1	1.9	<0.06	8.56	0.23	0.22	7.43	2
December 01	2.0	<2.0	0.1	1.6	<0.06	13.80	0.21	0.19	7.40	10

4.2 Final Groundwater Seepage

During operations in 2010, groundwater discharge was sampled at least twice per month at Sampling Point No. GWS-3. The sampling station is located approximately 50 m east of the westerly property boundary and 50 m west of the Emergency Storage Lagoon at an approximate elevation of 281.5 m ASL. The performance parameters for this sampling point, as indicated in the C. of A., are listed in Table 4.3. The sampling dates and results of the sample analyses, including individual samples and monthly averages, are contained in Table 4.4.

Table 4.3
C. of A. Criteria for Final Groundwater Seepage (GWS-3)

Parameter	Non-Compliance Limits Average Monthly Concentrations
Total Ammonia	2.5 mg/L
Unionized Ammonia	0.1 mg/L
CBOD ₅	5.0 mg/L
Suspended Solids	5.0 mg/L
Total Phosphorus	0.1 mg/L
<i>Escherichia coli</i>	100 organisms/ 100 ml (Mean Geometric Density)

Table 4.4: Summary of 2010 Final Groundwater Seepage (GWS-3) Results

Date (2010)	CBOD (mg/L)	Suspended Solids (mg/L)	Ammonia & Ammonium (mg/L)	TKN (mg/L)	Nitrite (NO ₂) (mg/L)	Nitrate (NO ₃) (mg/L)	Total Phosphorus (mg/L)	Dissolved Phosphorus (mg/L)	pH	Chloride (mg/L)	Temp. (°C)	Unionized Ammonia (mg/L)	E.Coli ¹ (cfu/100mL)
January 13	<2.0	<2.0	2.6	2.7	0.09	3.18	<0.03	<0.03	6.71	120	6.0	0.0018	<2
January 27	<2.0	<2.0	2.3	2.8	0.09	4.18	<0.03	0.05	6.99	100	7.5	0.0034	<2
January Average	<2.0	<2.0	2.5	2.8	0.09	3.68	<0.03	<0.04	6.9	110	6.8	0.0026	<2
February 10	<2.0	<2.0	2.1	2.1	0.12	6.06	<0.03	<0.03	7.42	110	7.0	0.0081	<2
February 24	<2.0	<2.0	1.7	1.9	0.12	7.23	<0.03	<0.03	7.42	120	7.0	0.0065	<2
February Average	<2.0	<2.0	1.9	2.0	0.12	6.65	<0.03	<0.03	7.4	115	7.0	0.0073	<2
March 10	<4.0	<2.0	1.6	1.7	0.12	7.47	<0.03	<0.03	7.37	130	7.0	0.0055	<2
March 24	<2.0	<2.0	1.2	1.2	0.09	7.70	0.03	<0.03	7.11	110	10.0	0.0029	<2
March Average	<3.0	<2.0	1.4	1.5	0.11	7.59	<0.03	<0.03	7.2	120	8.5	0.0042	<2
April 07	<2.0	<2.0	1.0	1.8	0.14	7.46	<0.03	<0.03	7.10	120	10.0	0.0023	<2
April 21	<2.0	<3.0	0.8	1.0	0.14	7.25	<0.03	<0.03	7.21	120	10.0	0.0024	<2
April Average	<2.0	<2.5	0.9	1.4	0.14	7.36	<0.03	<0.03	7.2	120	10.0	0.0024	<2
May 05	<2.0	<2.0	0.6	1.0	0.12	6.48	<0.03	<0.03	7.29	120	12.0	0.0025	<2
May 19	<2.0	<2.0	0.3	<0.5	<0.06	6.62	<0.03	<0.03	7.37	130	11.0	0.0014	<2
May Average	<2.0	<2.0	0.5	<0.8	<0.09	6.55	<0.03	<0.03	7.3	125	11.5	0.0020	<2
June 02	<2.0	<2.0	0.2	<0.5	<0.06	6.14	<0.03	<0.03	7.25	130	13.8	0.0009	<2
June 16	<2.0	<2.0	0.2	<0.5	<0.06	4.65	0.03	0.03	6.96	140	13.7	0.0004	8
June 30	<2.0	<2.0	0.3	0.5	<0.06	3.58	<0.03	<0.03	6.92	140	12.0	0.0005	
June Average	<2.0	<2.0	0.2	<0.5	<0.06	4.79	<0.03	<0.03	7.0	137	13.2	0.0006	<5
July 14	<2.0	<2.0	<0.1	0.7	<0.06	5.10	<0.03	<0.03	7.03	120	12.0	<0.0002	<2
July 28	3.0	<2.0	<0.1	0.5	0.06	4.53	<0.03	<0.03	7.05	130	12.0	<0.0002	<2
July Average	<2.5	<2.0	<0.1	0.6	<0.06	4.82	<0.03	<0.03	7.0	125	12.0	<0.0002	<2
August 11	<4.0	<2.0	<0.1	0.6	0.08	3.98	<0.03	<0.03	7.20	130	12.0	<0.0003	<2
August 25	<2.0	<2.0	<0.1	<0.5	0.13	3.10	<0.03	<0.03	7.39	130	12.0	<0.0005	<2
August Average	<3.0	<2.0	<0.1	<0.6	0.11	3.54	<0.03	<0.03	7.3	130	12.0	<0.0004	<2

Table 4.4: Summary of 2010 Final Groundwater Seepage (GWS-3) Results (Continued)

Date (2010)	CBOD (mg/L)	Suspended Solids (mg/L)	Ammonia & Ammonium (mg/L)	TKN (mg/L)	Nitrite (NO ₂) (mg/L)	Nitrate (NO ₃) (mg/L)	Total Phosphorus (mg/L)	Dissolved Phosphorus (mg/L)	pH	Chloride (mg/L)	Temp. (°C)	Unionized Ammonia (mg/L)	E.Coli ¹ (cfu/100mL)
September 08	<2.0	<2.0	0.1	<0.5	0.12	2.81	<0.03	<0.03	7.30	130	13.0	0.0005	<2
September 22	<2.0	<2.0	0.3	0.5	0.12	2.48	0.04	0.04	7.19	130	12.0	0.0010	<2
September Average	<2.0	<2.0	0.2	<0.5	0.12	2.65	<0.04	<0.04	7.2	130	12.5	0.0007	<2
October 06	<2.0	<2.0	0.7	<0.5	0.12	2.19	<0.03	<0.03	7.11	130	11.0	0.0018	<2
October 20	<2.0	<2.0	1.2	1.2	0.10	1.61	<0.03	<0.02	7.17	130	10.0	0.0033	<2
October Average	<2.0	<2.0	1.0	<0.9	0.11	1.90	<0.03	<0.03	7.1	130	10.5	0.0025	<2
November 03	<2.0	<2.0	1.9	2.0	0.10	1.06	<0.03	<0.02	7.20	120	10.0	0.0056	<2
November 17	<2.0	<2.0	1.6	1.5	0.13	0.88	<0.03	0.04	7.25	110	9.0	0.0049	<2
November Average	<2.0	<2.0	1.8	1.8	0.12	0.97	<0.03	<0.03	7.2	115	9.5	0.0052	<2
December 01	<2.0	<2.0	1.6	1.9	0.09	1.28	<0.03	<0.02	7.01	110	10.0	0.0030	<2
December 20	<2.0	<2.0	0.8	1.1	0.12	1.63	<0.03	<0.03	7.29	110	10.0	0.0029	<2
December 28	10.0	<2.0	0.8	1.0	0.16	1.66	0.04	<0.03	7.25	110	10.0	0.0026	<2
December Average	<4.7	<2.0	1.1	1.3	0.12	1.52	<0.03	<0.03	7.2	110	10.0	0.0028	<2
ANNUAL AVERAGE	<2.4	<2.0	<0.9	<1.2	<0.10	4.33	<0.03	<0.03	7.18	122	10.3	<0.0026	<3

Notes: 1. Typically, monthly geomean is calculated for E.Coli. Where one or more sample results are reported as "0", the average is calculated rather than the geomean.

4.3 2010 Final Groundwater Seepage Sample Results and Discussion

a) CBOD₅

The greatest average CBOD₅ concentration in 2010 was less than 4.7 mg/L, which occurred in December. Average concentrations in each month were below the C. of A. limit of 5.0 mg/L. The maximum single sample CBOD₅ concentration was 10.0 mg/L on December 28; no other single samples during 2010 were greater than 4.0 mg/L.

b) Suspended Solids

The greatest average suspended solids concentration in 2010 was less than 2.5 mg/L, which occurred in the month of April. Average concentrations in each month were below the C. of A. limit of 5.0 mg/L. The maximum single sample suspended solids concentration was less than 3.0 mg/L.

c) Total Ammonia, TKN, Nitrite, Nitrate, and Unionized Ammonia

The maximum allowable monthly average concentration for total ammonia is listed in the C. of A. as 2.5 mg/L. The greatest average monthly concentration in 2010 was 2.5 mg/L in January and is at the maximum allowable concentration. The maximum single sample concentration was 2.6 mg/L on January 13.

The C. of A. performance criteria sets limits on unionized ammonia. Un-ionized ammonia was calculated from measured values of total ammonia, pH and temperature. The limit for non-compliance is 0.10 mg/L as an average monthly concentration. The greatest average concentration during 2010 was 0.0073 mg/L in February. The greatest single sample concentration was 0.0081 mg/L, also occurring in February. Average concentrations in all months were below the C. of A. limit.

In 2010, the annual average for TKN was less than 1.2 mg/L, for Nitrite the annual average was less than 0.10 mg/L, and for Nitrate the annual average was 4.33 mg/L. The 2010 average concentrations of TKN and Nitrite are similar to the previous two years, while the Nitrate concentration is slightly elevated.

d) Total Phosphorus

The maximum allowable monthly average concentration for total phosphorus is listed in the C. of A. as 0.1 mg/L. The greatest average monthly concentration in 2010 was less than 0.04 mg/L in September. The greatest single sample concentration was 0.04 mg/L in September and December.

e) E. Coli

The performance section of the C. of A. states that the non-compliance criterion for the concentration of E. Coli (yearly geometric mean) is 100 organisms/100 ml. The annual geometric mean for E. Coli in 2010 is less than 3 CFU/100 ml. This is well within the non-compliance criteria. The greatest individual result was 8 cfu/100mL.

f) pH & Chlorides

Sampling for pH and chlorides is required by the C. of A., but there are no compliance criteria.

The chloride concentration at the groundwater seepage sampling point averaged 122 mg/L for the year, compared to 156 mg/L in the Cell No. 3 effluent. The lower groundwater seepage value is probably a result of dilution of effluent by groundwater. Chloride is not treated in the sewage plant or attenuated by groundwater flow, other than by dilution. A chloride value of 122 mg/L indicates that treated sewage is reaching the sampling location, because background chlorides are less than 10 mg/L (refer to Table 5.1). The 2009 annual average chloride concentration at the groundwater seepage sampling point was 113 mg/L.

g) Discussion

In general, for most parameters, the quality of the groundwater seepage is excellent and consistent with previous years of operation.

4.4 Surface Water

The C. of A. does not require surface water quality testing. As such, no testing was carried out in 2010. From 1993 to 2003 there was virtually no difference between water quality upgradient and downgradient of the site; therefore it was concluded that site operations have no effect on surface water, and surface water sampling was eliminated from the monitoring program.

5.0 GROUNDWATER QUALITY

5.1 Background Groundwater Chemistry

Observation Well OBS-1 was historically used to monitor background groundwater chemistry because it is outside the influence of the sewage works. Table 5.1 summarizes the average background water quality from 1998 to 2003.

In the "2003 Lucknow Sewage Works Performance Report" it was concluded that no identifiable groundwater contamination was leaving the property as a result of the Lucknow Sewage Works. As ground water sampling is not required by the C. of A., no samples have been taken at Well OBS-1 since 2003.

**Table 5.1
 Historical Background Chemistry**

Parameter (mg/L, unless noted)	Average Background Chemistry (OBS -1)
Alkalinity (as CaCO ₃)	303
pH (units)	8.00
Conductivity (mmhos/cm)	618
TKN (as N)	1.2
Total Phosphorus	0.038
Ammonia + Ammonium (as N)	0.2
Organic Nitrogen	1.0
Nitrite (as N)	0.06
Nitrate (as N)	3.1
Chloride	8
Dissolved Organic Carbon	1.1
Hardness (as CaCO ₃)	355
Calcium	97
Sodium	4.2

6.0 CERTIFICATE OF APPROVAL COMPLIANCE REQUIREMENTS

6.1 Aerated Lagoon Effluent Quality

Under the performance section of the C. of A., it is stated: *"The facultative aerated lagoon should be designed, constructed and operated such that the following average monthly concentrations in the discharge into the rapid infiltration facility are achieved."* Table 6.1 provides a total count of the monthly concentration exceedances during 2010.

**Table 6.1
 Aerated Lagoon Effluent Quality Exceedances**

Parameter	Average Monthly Concentrations (Design Objectives)	Exceedances
CBOD ₅	≤ 20 mg/L	1
Suspended Solids	≤ 20 mg/L	0
Total Phosphorus	≤ 1 mg/L	0

Historically, the design objectives have occasionally been exceeded. In 2010, the CBOD₅ objective was exceeded during one month.

6.2 Groundwater Seepage

The performance section of the C. of A. requires that the works: *“be designed, constructed and operated such that the following average monthly concentrations in the groundwater seepage into the swale leading to the McLeod Drain, or in the swale discharge itself, are not exceeded.”* Table 6.2 provides a total count of the monthly concentration exceedances during 2010.

The intent of sampling at GWS-3 is to create a “trigger” that will warn of possible future problems.

**Table 6.2
 Groundwater Seepage (GWS-3) Effluent Quality C. of A. Exceedances**

Parameter	Average Monthly Concentrations (Trigger Criteria)	Exceedances
Total Ammonia	2.5 mg/L	0
Unionized Ammonia	0.1 mg/L	0
CBOD ₅	5 mg/L	0
Suspended Solids	5 mg/L	0
Total Phosphorus	0.1 mg/L	0
<i>Escherichia coli</i>	100 organisms / 100 ml (Mean Geometric Density)	0

6.3 Comments on Sampling

Sampling frequencies and analysis generally followed the requirements of the C. of A. (Appendix A).

7.0 EFFECTIVENESS OF TREATMENT PROCESS

Table No. 7.1 is a summary of the overall effectiveness of the treatment of raw sewage from its entry to the works through to the groundwater seep which discharges to the depression west of the emergency lagoon.

**Table 7.1:
 Overall Sewage Renovation Based on Annual Averages**

Parameter (mg/L unless noted)	Raw Sewage	Cell 3 Effluent	Design Objective	Groundwater Seepage	Non-Compliance Criteria	% Reduction Plant	% Reduction Groundwater	% Reduction Overall
CBOD	143.6	<8.4	20.0	<2.4	5.0	>94.2%	>4.2%	>98.3%
Suspended Solids	128.3	10.0	20.0	<2.0	5.0	92.2%	>6.2%	>98.4%
TKN	18.23	<8.9	--	<1.2	--	>51.2%	>42.2%	>93.4%
Total Phosphorus	2.24	0.29	1.00	<0.03	0.10	86.9%	>11.6%	>98.7%
E. Coli (CFU/100mL)	--	--	--	<3	100	--	--	--
Nitrite	--	<0.40	--	<0.10	--	--	--	--
Nitrate	--	<3.00	--	4.33	--	--	--	--
Un-ionized Ammonia	--	--	--	<0.0026	0.10	--	--	--
Chloride	--	156.1	--	122.2	--	--	--	--

In general terms, the works are providing excellent treatment of the sewage, and there is anticipated to be little, if any, impact downgradient from the works.

8.0 OPERATIONS

8.1 General

Condition 9 (5) of the C. of A. requires the owner to report on various operational activities at the sewage treatment and pumping facilities.

8.2 Operating Problems

The operator reported that a slow discharge from the RIBs was observed in September and October 2010. The operator addressed this issue by replacing the sand filter media in the RIBs during November.

8.3 Maintenance Equipment

Routine maintenance occurred as required. The following activities were specifically carried out during 2010:

- Cell Nos. 2 and 3 were drained in order to allow access to repair the Cell No. 3 discharge structure.
- The valve between Cell Nos. 2 and 3 was repaired.
- Sand media in the RIBs was replaced.
- One of the transfer pumps to the RIBs was replaced.

8.4 Effluent Quality Assurance

All monitoring and sampling for quality assurance took place as required by the C. of A.

8.5 Calibration of Effluent Monitoring Equipment

This facility has no effluent monitoring equipment. Effluent volumes are assumed to be equal to influent volumes, and all effluent sampling is by grab sample.

8.6 Sludge Volumes

Sludge accumulates in the bottom of the aerated cells. No sludge was removed from the lagoons in 2010. The operator observed the sludge depth in Cell Nos. 2 and 3 to be 450 to 600 mm in 2010. Sludge was last removed in 2004.

8.7 Complaints

No complaints were reported.

8.8 Bypasses

No bypass of the treatment facilities took place in 2010.

9.0 CONCLUSIONS AND RECOMMENDATIONS

The following are the conclusions and recommendations resulting from the analysis of operating and monitoring data for the Lucknow Sewage Works during 2010:

1. The annual average sewage flow was 564 m³/day in 2010, as determined by the flow measuring instrumentation in the Mill Street Sewage Pumping Station. Given that the approved flow to the works is 750 m³/day, the works operated at 75% of the design capacity. The 2010 average daily flow is 7 to 8% lower than the average flow during the previous four years.


Historically, maximum day flows will typically be greatest during spring months and be lowest during the summer months. During 2010, the maximum day trend was uncharacteristic, with the maximum day flow of 1,534 m³/day occurring in June. In 2001 it was suggested that the high maximum daily flows experienced may be from roof drains, sump pumps, etc. Historical maximum day flows for each month provide some indication that direct inflow from storm water is occurring at times. Action should continue to be taken to identify and remove any illegal connections that exist.

2. Raw sewage concentrations and loadings for CBOD₅ and suspended solids decreased slightly from 2009 to 2010. On a per capita basis, loading for CBOD₅ is slightly less than typical values for domestic wastewater, while loading for suspended solids is approximately 31% less than typical values. Concentrations and loadings for TKN and total phosphorous decreased slightly from 2009 to 2010, and remain below typical values for domestic wastewater
3. Groundwater quality, as measured at GWS-3, generally remained excellent throughout 2010. There were no exceedances of the C. of A. average monthly concentration limits for any parameter.
4. It is concluded that the works provided excellent treatment of sewage in 2010 and, in our opinion, generally exceeded typical tertiary treatment standards.

All of which is respectfully submitted.

B. M. ROSS AND ASSOCIATES LIMITED



Per 
S. D. Burns, P. Eng.

Per 
Andrew J. Garland, B.A.Sc.

References

1. "Sanitary Sewage Works, Rapid Infiltration Basin Monitoring, 1994" dated May 29, 1995 by B. M. Ross and Associates Limited.
2. "Guidelines for the Design of Water Treatment Works" dated April 1982 by the Project Co-ordination Branch, Design & Equipment Section, Ministry of the Environment, Ontario.
3. Metcalf and Eddy (2003). Wastewater Engineering: Treatment and Reuse (4th ed.). New York: McGraw-Hill.

APPENDIX 'A'

CERTIFICATE OF APPROVAL



Ontario

Ministry of the Environment
Ministère de l'Environnement

AMENDED CERTIFICATE OF APPROVAL
MUNICIPAL AND PRIVATE SEWAGE WORKS
NUMBER 1180-5QCNEW

The Corporation of the Township of Huron-Kinloss
PO Box 130
Ripley, Ontario
N0G 2R0

Site Location: Lucknow Sewage Treatment Facility
Lot 53, 54, 55, Concession 1
Huron-Kinloss Township, County of Bruce

You have applied in accordance with Section 53 of the Ontario Water Resources Act for approval of:

A sanitary sewage collection, treatment and disposal system serving and located in the Village of Lucknow (Geo Reference: NAD 83 within Zone 17, UTM 459,863 m Easting and 4,867,846 m Northing) with wastewater treatment facilities rated at a capacity of 750 m³/d *Average Daily Flow*. The overall wastewater collection, treatment and disposal system comprises of the following *Works*:

WASTEWATER COLLECTION WORKS

Sanitary sewers and associated appurtenances running along Napier Street, William Street, Ludgard Street, Gough Street, Rose Street, Hamilton Street, Wheeler Street, Hays Street, Welsley Street, Campbell Street, Willoughby Street, Stauffer Street, Havelock Street, North Delhi Street, Inglis Street, Outram Street, Victoria Street, Alberta Street, Ross Street, Palmerston Street, Clyde Street, Canning Street, South Delhi Street, Bob Street, Elgin Street, and Walter Street.

WASTEWATER PUMPING FACILITY

A sanitary wastewater pumping station located on Mill Site No. 3 at the South end of the Southern extension of Inglis Street and consisting of the following:

- a 4.70 m x 2.10 m x 10.83 m deep concrete wet well designed to handle a *Peak Flow Rate* of 32.5 L/s, equipped with three (3) centrifugal pumps of the following capacities:
 - One (1) pump to handle *Average Daily Flow* rated at 8.68 L/s at a TDH of 44.6 m; and
 - Two (2) pumps (one duty one standby) to handle *Peak Flow Rates*, each rated at 32.5 L/s at a TDH of 44.6 m.
- approximately 2,600 m of 200 mm diameter forcemain located along Inglis Street, Willoughby

Street, Bob Street, Campbell Street and Highway No. 86, Kinloss Township Street and Access Road to treatment plant site.

WASTEWATER TREATMENT SYSTEM

A wastewater treatment facility comprising of the following:

- a three (3)-cell aerated facultative lagoon system, with each cell having bottom dimensions of 53.7 m x 21.0 m, top-of-berm dimensions of 83.0 m x 55.3 m and total depth of 4.9 m (including 0.9 m freeboard), providing a total volume of approximately 32,000 m³ and including the following:
 - five (5) single-speed mechanical surface aerators out of which two (2) aerators are in Cell No. 1, two (2) in Cell No.2 and one (1) in Cell No.3; and
 - inlet, transfer and outlet structures and pipings.
- a chemical phosphorus removal system consisting of the following:
 - one (1) 27.0 m³ volume alum storage tank;
 - two (2) metering pumps (one duty one standby) each rated at 30 L/hr; and
 - two (2) feed lines, one discharging into the aerated facultative lagoon inlet structure and the other into the transfer structure between Cells Nos. 1 and 2 of the lagoons.
- an emergency facultative aerated lagoon bypass forcemain discharging raw sewage into the emergency lagoon;
- one (1) aerated facultative lagoon effluent pumping station equipped with the following:
 - two (2) pumps (one duty one standby), each rated at 11.6 L/s; and
 - a forcemain discharging into the emergency lagoon or in to the distribution chamber upstream of the rapid infiltration basins.
- one (1) emergency lagoon, having a total depth of 3.6 m (including 0.6 m freeboard) and a total operating volume of 67,500 m³;

WASTEWATER DISPOSAL FACILITY

A wastewater disposal facility consisting of the following:

- a rapid infiltration facility to dispose of the final effluent at a maximum total daily flow rate of 1,000 m³/d and consisting of the following:
 - six (6) infiltration basins, each having bottom dimensions of 10.0 m x 7.0 m, top-of-berm dimensions of 16.0 m x 13.0 m, and total depth of 1.0 m; and
 - associated distribution structures, piping and appurtenances.

- an effluent groundwater interceptor system, as a contingency system to be constructed when necessary, located along the Southern part of the Western boundary of the treatment facility and comprising of the following
 - approximately 300 m of interceptor sewer, including manholes; and
 - one (1) submersible pump rated at 10 L/s at a TDH of 5 m, installed in one of the manholes.

all in accordance with the Application for Approval of Municipal and Private Sewage Works dated April 30, 2003 and received on May 5, 2003 along with 2002 Lucknow Sewage Works Performance Report prepared by B. M. Ross and Associates Limited, Goderich, Ontario.

For the purpose of this Certificate of Approval and the terms and conditions specified below, the following definitions apply:

"Act" means the Ontario Water Resources Act, R.S.O. 1990, Chapter 0.40, as amended;

"Average Daily Flow" means the cumulative total sewage flow to the sewage works during a calendar year divided by the number of days during which sewage was flowing to the sewage works that year;

"CBOD," means five day carbonaceous (nitrification inhibited) biochemical oxygen demand measured in an unfiltered sample;

"Certificate" means this entire certificate of approval document, issued in accordance with Section 53 of the Act, and includes any schedules;

"Daily Concentration" means the concentration of a contaminant in the effluent discharged over any single day, as measured by a composite or grab sample, whichever is required;

"Director" means any Ministry employee appointed by the Minister pursuant to section 5 of the Act;

"District Manager" means the District Manager of the Owen Sound District Office of the Ministry;

"E. Coli" refers to the thermally tolerant forms of Escherichia that can survive at 44.5 degrees Celsius;

"Geometric Mean Density" is the nth root of the product of multiplication of the results of n number of samples over the period specified;

"Ministry" means the Ontario Ministry of the Environment;

"Monthly Average Concentration" means the arithmetic mean of all Daily Concentrations of a contaminant in the effluent sampled or measured, or both, during a calendar month;

"Owner" means the Township of Huron-Kinloss and includes its successors and assignees;

"*Peak Flow Rate*" means the maximum rate of sewage flow for which the plant or process unit was designed;

"*Previous Works*" means those portions of the sewage works previously constructed and approved under a certificate of approval;

"*Rated Capacity*" means the *Average Daily Flow* for which the *Works* are approved to handle;

"*Regional Director*" means the Regional Director of the Southwestern Region of the Ministry; and

"*Works*" means the sewage works described in the *Owner's* application, this *Certificate* and in the supporting documentation referred to herein, to the extent approved by this *Certificate* and includes the *Previous Works*.

You are hereby notified that this approval is issued to you subject to the terms and conditions outlined below:

TERMS AND CONDITIONS

1. GENERAL PROVISIONS

- (1) The *Owner* shall ensure that any person authorized to carry out work on or operate any aspect of the *Works* is notified of this *Certificate* and the conditions herein and shall take all reasonable measures to ensure any such person complies with the same.
- (2) Except as otherwise provided by these Conditions, the *Owner* shall design, build, install, operate and maintain the *Works* in accordance with the description given in this *Certificate*, the application for approval of the works and the submitted supporting documents and plans and specifications as listed in this *Certificate*.
- (3) Where there is a conflict between a provision of any submitted document referred to in this *Certificate* and the Conditions of this *Certificate*, the Conditions in this *Certificate* shall take precedence, and where there is a conflict between the listed submitted documents, the document bearing the most recent date shall prevail.
- (4) Where there is a conflict between the listed submitted documents, and the application, the application shall take precedence unless it is clear that the purpose of the document was to amend the application.
- (5) The requirements of this *Certificate* are severable. If any requirement of this *Certificate*, or the application of any requirement of this *Certificate* to any circumstance, is held invalid or unenforceable, the application of such requirement to other circumstances and the remainder of this certificate shall not be affected thereby. (applicable terms and conditions pasted in or entered by Reviewer)

2. CHANGE OF OWNER

- (1) The *Owner* shall notify the *District Manager* and the *Director*, in writing, of any of the following changes within 30 days of the change occurring:
 - (a) change of *Owner*;
 - (b) change of address of the *Owner*;
 - (c) change of partners where the *Owner* is or at any time becomes a partnership, and a copy of the most recent declaration filed under the Business Names Act, R.S.O. 1990, c.B17 shall be included in the notification to the *District Manager*;
 - (d) change of name of the corporation where the *Owner* is or at any time becomes a corporation, and a copy of the most current information filed under the Corporations Informations Act, R.S.O. 1990, c. C39 shall be included in the notification to the *District Manager*;
- (2) In the event of any change in ownership of the *Works*, other than a change to a successor municipality, the *Owner* shall notify in writing the succeeding owner of the existence of this *Certificate*, and a copy of such notice shall be forwarded to the *District Manager* and the *Director*.

3. CONSTRUCTED WORKS

Within one year of the date of issuance of this *Certificate*, a set of as-built drawings showing the *Works* "as constructed" shall be prepared, if not already prepared. These drawings shall be kept up to date through revisions undertaken from time to time and a copy shall be retained at the *Works* for the operational life of the *Works*.

4. BY-PASSES

- (1) Any *By-pass* of raw sewage in to the emergency lagoon is prohibited, except where:
 - (a) it is necessary to avoid loss of life, personal injury, danger to public health or severe property damage;
 - (b) it is necessary to take all the three aerated lagoon cells out of service simultaneously in an exceptional situation;
 - (c) the *District Manager* agrees that it is necessary for the purpose of carrying out essential maintenance and the *District Manager* has given prior written acknowledgment of the *By-pass*; or

- (d) the *Regional Director* has given prior written acknowledgment of the *By-pass*.
- (2) The *Owner* shall collect at least one (1) grab sample of the *By-pass* and have it analyzed for the parameters outlined in Condition 6 using the protocols in Condition 9.
- (3) The *Owner* shall maintain a logbook of all *By-pass* events which shall include, at a minimum, the time, location, duration, quantity of *By-pass*, the authority for *By-pass* pursuant to subsection (1), and the reasons for the occurrence.
- (4) Following any *by-pass* or discharge of raw wastewater in to the emergency lagoon, the lagoon shall not be used for effluent storage until it has been cleaned up in a manner acceptable to the District Officer.

5. EFFLUENT OBJECTIVES

- (1) The *Owner* shall use best efforts to design and operate the *Works* with the objective that the concentrations of the materials named below as effluent parameters are not exceeded in the effluent from the facultative aerated lagoon system.

Table 1 - Lagoon Effluent Objectives	
Effluent Parameter	Monthly Average Concentration (milligrams per litre)
<i>CBOD₅</i>	20
Suspended Solids	20
Total Phosphorus	1.0

- (2) The *Owner* shall use best efforts to:
 - (a) maintain the pH of the effluent from the *Works* within the range of 6.0 to 9.0, inclusive, at all times;
 - (b) operate the works within the *Rated Capacity* of the *Works*;
 - (c) ensure that the effluent from the *Works* is essentially free of floating and settleable solids and does not contain oil or any other substance in amounts sufficient to create a visible film or sheen or foam or discolouration on the receiving waters.
- (3) The *Owner* shall include in all reports submitted in accordance with Condition 8, a summary of the efforts made and results achieved under this Condition.

6. EFFLUENT LIMITS

- (1) The *Owner* shall operate and maintain the *Works* such that the concentrations of the materials named below as effluent parameters are not exceeded in the seepage of the groundwater at the groundwater monitoring well No. GWS-3.

Table 2 - Effluent Limits (Sampling point at GWS-3)	
Effluent Parameter	Monthly Average Concentration (milligrams per litre unless otherwise indicated)
<i>CBOD₅</i>	5.0
Suspended Solids	5.0
Total Phosphorus	0.1
Total Ammonia	2.5
Unionized Ammonia	0.1
<i>E-Coli</i>	100 organisms/100 mL (<i>Mean Geometric Density</i>)

- (2) For the purposes of determining compliance with and enforcing subsection (1) the *Monthly Average Concentration* of a parameter named in Column 1 of Table 2 in subsection (1) shall not exceed the corresponding maximum concentration set out in Column 2 of Table 2 in subsection (1).
- (3) Subsection (2) shall apply upon the issuance of this *Certificate*.
- (4) Only those monitoring results collected during the corresponding time period shall be used in calculating the *Monthly Average Concentration* for this *Certificate*.
- (5) In case of an exceedance for two consecutive months of any of the parameters listed in Column 1 of Table 2 in subsection (1), the Owner shall undertake an assessment of the performance of the entire system and, within ninety (90) days of the exceedance, submit a report to the District Office of the Ministry assessing the potential impacts of the exceedance on the environment and remedial actions recommended for preventing future exceedance.

7. OPERATION AND MAINTENANCE

- (1) The *Owner* shall exercise due diligence in ensuring that, at all times, the *Works* and the related equipment and appurtenances used to achieve compliance with this *Certificate* are properly operated and maintained. Proper operation and maintenance shall include effective performance, adequate funding, adequate operator staffing and training, including training in all procedures and other requirements of this *Certificate* and the *Act* and regulations, process controls and alarms and the use of process chemicals and other substances used in the *Works*.
- (2) The *Owner* shall prepare, if not already prepared, an operations manual within six (6) months of the issuance of this *Certificate*, that includes, but not necessarily limited to, the following information:

- (a) operating procedures for routine operation of the *Works*;
 - (b) inspection programs, including frequency of inspection, for the *Works* and the methods or tests employed to detect when maintenance is necessary;
 - (c) repair and maintenance programs, including the frequency of repair and maintenance for the *Works*;
 - (d) procedures for the inspection and calibration of monitoring equipment;
 - (e) a spill prevention control and countermeasures plan, consisting of contingency plans and procedures for dealing with equipment breakdowns, potential spills and any other abnormal situations, including notification of the *District Manager*; and
 - (f) procedures for receiving, responding and recording public complaints, including recording any follow-up actions taken.
- (3) The *Owner* shall maintain the operations manual current and retain a copy at the location of the *Works* for the operational life of the *Works*. Upon request, the *Owner* shall make the manual available to *Ministry* staff.
- (4) The *Owner* shall provide for the overall operation of the *Works* with an operator who holds a licence that is applicable to that type of facility and that is of the same class as or higher than the class of the facility in accordance with Ontario Regulation 435/93.

8. EFFLUENT MONITORING AND RECORDING

The *Owner* shall, during the operation of the *Works*, carry out the following monitoring program:

- (1) All samples and measurements taken for the purposes of this *Certificate* are to be taken at a time and in a location characteristic of the quality and quantity of the effluent stream over the time period being monitored.
- (2) For the purposes of this condition, the following definitions apply:
 - (a) Bi-weekly means once every two weeks; and
 - (b) Monthly means once every month.
- (3) Samples shall be collected at the sampling points, at the frequency specified, by means of the specified sample type and analyzed for each parameter listed in Tables 3, 4, 5 and 6 and all results recorded:

Table 3 - Raw Wastewater Monitoring (Sampling point at the inlet of the lagoon system)		
Parameters	Sample Type	Frequency
<i>CBOD₅</i>	Grab	Bi-weekly
Suspended Solids	Grab	Bi-weekly
Total Phosphorus	Grab	Bi-weekly
Total Kjeldahl Nitrogen	Grab	Bi-weekly

Table 4 - Infiltration Facility Influent Monitoring (Sampling point at the inlet of the infiltration facility)		
Parameters	Sample Type	Frequency
<i>CBOD₅</i>	Grab	Bi-weekly
Suspended Solids	Grab	Bi-weekly
Total Phosphorus	Grab	Bi-weekly
Soluble Phosphorus	Grab	Bi-weekly
Total Kjeldahl Nitrogen	Grab	Bi-weekly
Total Ammonia Nitrogen	Grab	Bi-weekly
Nitrate Nitrogen	Grab	Bi-weekly
pH	Grab	Monthly
Chlorides	Grab	Monthly
<i>E-Coli</i>	Grab	Monthly

Table 5 - Mid-site Groundwater Seepage Monitoring (Sampling point at the groundwater monitoring wells Nos. OBS-3S and OBS-4S)		
Parameters	Sample Type	Frequency
<i>CBOD₅</i>	Grab	Monthly
Suspended Solids	Grab	Monthly
Total Phosphorus	Grab	Monthly
Soluble Phosphorus	Grab	Monthly
Total Ammonia Nitrogen	Grab	Monthly
Nitrate Nitrogen	Grab	Monthly
pH	Grab	Monthly
Temperature	Grab	Monthly
<i>E-Coli</i>	Grab	Monthly

Table 6 - Final Groundwater Seepage Monitoring (Sampling point at the groundwater monitoring location No. GWS-3)		
Parameters	Sample Type	Frequency
CBOD ₅	Grab	Bi-weekly
Suspended Solids	Grab	Bi-weekly
Total Phosphorus	Grab	Bi-weekly
Soluble Phosphorus	Grab	Bi-weekly
Total Kjeldahl Nitrogen	Grab	Bi-weekly
Total Ammonia Nitrogen	Grab	Bi-weekly
Nitrate Nitrogen	Grab	Bi-weekly
pH	Grab	Bi-weekly
Temperature	Grab	Bi-weekly
Chlorides	Grab	Bi-weekly
<i>E-Coli</i>	Grab	Monthly

(Note: definition of grab sample is included in document (4)(b) below so no additional definitions are needed)

- (4) The methods and protocols for sampling, analysis and recording shall conform, in order of precedence, to the methods and protocols specified in the following:
- (a) the Ministry's Procedure F-10-1, "Procedures for Sampling and Analysis Requirements for Municipal and Private Sewage Treatment Works (Liquid Waste Streams Only), as amended from time to time by more recently published editions;
 - (b) the Ministry's publication "Protocol for the Sampling and Analysis of Industrial/Municipal Wastewater" (January 1999), ISBN 0-7778-1880-9, as amended from time to time by more recently published editions;
 - (c) the publication "Standard Methods for the Examination of Water and Wastewater" (20th edition), as amended from time to time by more recently published editions;
 - (d) for any parameters not mentioned in the documents referenced in (a), (b) and (c), the written approval of the *District Manager* shall be obtained prior to sampling.
- (5) The temperature and pH of the effluent from the *Works* shall be determined in the field at the time of sampling for Total Ammonia Nitrogen. The concentration of unionized ammonia shall be calculated using the total ammonia concentration, pH and temperature using the methodology stipulated in "Ontario's Provincial Water Quality Objectives" dated July 1994, as amended, for ammonia (unionized).

- (6) The measurement frequencies specified in subsection (2) in respect to any parameter are minimum requirements which may, after (6/12/24) months of monitoring in accordance with this Condition, be modified by the *District Manager* in writing from time to time.
- (7) The *Owner* shall install and maintain (a) continuous flow measuring device(s), to measure the flowrate in to the lagoon system with an accuracy to within plus or minus 15 per cent (+/- 15%) of the actual flowrate for the entire design range of the flow measuring device, and record the flowrate at a daily frequency.
- (8) The *Owner* shall retain for a minimum of three (3) years from the date of their creation, all records and information related to or resulting from the monitoring activities required by this *Certificate*.

9. REPORTING

- (1) Ten (10) days prior to the date of a planned *By-pass* being conducted pursuant to Condition 4 and as soon as possible for an unplanned *By-pass*, the *Owner* shall notify the *District Manager* (in writing) of the pending start date, in addition to an assessment of the potential adverse effects on the environment and the duration of the *By-pass*.
- (2) The *Owner* shall report to the *District Manager* or designate, any exceedance of any parameter specified in Condition 6 orally, as soon as reasonably possible, and in writing within ten (10) days or after all the laboratory results have been received and tabulated, whichever is earlier.
- (3) In addition to the obligations under Part X of the Environmental Protection Act, the *Owner* shall, within 10 working days of the occurrence of any reportable spill as defined in Ontario Regulation 675/98, bypass or loss of any product, by-product, intermediate product, oil, solvent, waste material or any other polluting substance into the environment, submit a full written report of the occurrence to the *District Manager* describing the cause and discovery of the spill or loss, clean-up and recovery measures taken, preventative measures to be taken and schedule of implementation.
- (4) The *Owner* shall, upon request, make all manuals, plans, records, data, procedures and supporting documentation available to *Ministry* staff.
- (5) The *Owner* shall prepare and submit to the *District Manager*, a performance report, on an annual basis, within ninety (90) days following the end of the existing period being reported upon. The reports shall contain, but shall not be limited to, the following information:
 - (a) a summary and interpretation of all monitoring data and a comparison to the effluent limits outlined in Condition 6, including an overview of the success and

adequacy of the *Works*;

- (b) a description of any operating problems encountered and corrective actions taken;
- (c) a summary of all maintenance carried out on any major structure, equipment, apparatus, mechanism or thing forming part of the *Works*;
- (d) a summary of any effluent quality assurance or control measures undertaken in the reporting period;
- (e) a summary of the calibration and maintenance carried out on all effluent monitoring equipment; and
- (f) a description of efforts made and results achieved in meeting the Effluent Objectives of Condition 5.
- (g) a tabulation of the volume of sludge generated in the reporting period, an outline of anticipated volumes to be generated in the next reporting period and a summary of the sludge handling technique(s);
- (h) a summary of any complaints received during the reporting period and any steps taken to address the complaints;
- (i) a summary of all *By-pass*, spill or abnormal discharge events; and
- (j) any other information the *District Manager* requires from time to time.

10. REVOCATION OF EXISTING APPROVALS

- (1) The descriptions of the approved works and conditions of approval in this Certificate apply in place of all the existing descriptions and conditions in the Certificates of Approval under the Ontario Water Resources Act for sewage works which are part of the works approved by this Certificate.
- (2) Notwithstanding Condition 10(1) above, the original applications for approval, including design calculations, engineering drawings, and reports prepared in support of the existing Certificate(s) of Approval whose descriptions of the approved works and conditions are now replaced pursuant to Condition 10(1) above, shall form part of this Certificate.
- (3) Where an existing Certificate of Approval referred to in Condition 10(1) above applies to works in addition to the works approved by this certificate, it shall continue to apply to those additional works.

The reasons for the imposition of these terms and conditions are as follows:

1. Condition 1 is imposed to ensure that the *Works* are built and operated in the manner in which they were described for review and upon which approval was granted. This condition is also included to emphasize the precedence of Conditions in the *Certificate* and the practice that the Approval is based on the most current document, if several conflicting documents are submitted for review. The condition also advises the Owners their responsibility to notify any person they authorized to carry out work pursuant to this *Certificate* the existence of this *Certificate*.
2. Condition 2 is included to ensure that the *Ministry* records are kept accurate and current with respect to the approved works and to ensure that subsequent owners of the *Works* are made aware of the *Certificate* and continue to operate the *Works* in compliance with it.
3. Condition 3 is included to ensure that the record drawings of the *Works* "as constructed" are maintained for future references.
4. Condition 4 is included to indicate that by-passes of untreated sewage to the emergency lagoon is prohibited, save in certain limited circumstances where the failure to *By-pass* could result in greater injury to the public interest than the *By-pass* itself where a *By-pass* will not violate the approved effluent requirements, or where the *By-pass* can be limited or otherwise mitigated by handling it in accordance with an approved contingency plan. The notification and documentation requirements allow the *Ministry* to take action in an informed manner and will ensure the *Owner* is aware of the extent and frequency of *By-pass* events.
5. Condition 5 is imposed to establish non-enforceable effluent quality objectives which the *Owner* is obligated to use best efforts to strive towards on an ongoing basis. These objectives are to be used as a mechanism to trigger corrective action proactively and voluntarily before environmental impairment occurs and before the compliance limits of Condition 6 are exceeded.
6. Condition 6 is imposed to ensure that the effluent discharged from the *Works* to the groundwater meets the *Ministry's* effluent quality requirements thus minimizing environmental impact on the groundwater.
7. Condition 7 is included to require that the *Works* be properly operated, maintained, funded, staffed and equipped such that the environment is protected and deterioration, loss, injury or damage to any person or property is prevented. As well, the inclusion of a comprehensive operations manual governing all significant areas of operation, maintenance and repair is prepared, implemented and kept up-to-date by the owner and made available to the *Ministry*. Such a manual is an integral part of the operation of the *Works*. Its compilation and use should assist the *Owner* in staff training, in proper plant operation and in identifying and planning for contingencies during possible abnormal conditions. The manual will also act as a benchmark for *Ministry* staff when reviewing the *Owner's* operation of the work.

8. Condition 8 is included to enable the *Owner* to evaluate and demonstrate the performance of the *Works*, on a continual basis, so that the *Works* are properly operated and maintained at a level which is consistent with the design objectives and effluent limits specified in the *Certificate* and that the *Works* does not cause any impairment to the receiving groundwater.
9. Condition 9 is included to provide a performance record for future references, to ensure that the *Ministry* is made aware of problems as they arise, and to provide a compliance record for all the terms and conditions outlined in this *Certificate*, so that the *Ministry* can work with the *Owner* in resolving any problems in a timely manner.
10. Condition 10 is included to stipulate that this *Certificate* replaces all previous approvals for the works being the subject of this *Certificate*, and that the existing approvals remain in force for the purpose of any works which are not subject to this *Certificate*.

This Certificate of Approval revokes and replaces Certificate(s) of Approval No. 3-1390-88-896 issued on January 24, 1989

In accordance with Section 100 of the Ontario Water Resources Act, R.S.O. 1990, Chapter 0.40, as amended, you may by written notice served upon me and the Environmental Review Tribunal within 15 days after receipt of this Notice, require a hearing by the Tribunal. Section 101 of the Ontario Water Resources Act, R.S.O. 1990, Chapter 0.40, provides that the Notice requiring the hearing shall state:

1. The portions of the approval or each term or condition in the approval in respect of which the hearing is required, and;
2. The grounds on which you intend to rely at the hearing in relation to each portion appealed.

The Notice should also include:

3. The name of the appellant;
4. The address of the appellant;
5. The Certificate of Approval number;
6. The date of the Certificate of Approval;
7. The name of the Director;
8. The municipality within which the works are located;

And the Notice should be signed and dated by the appellant.

This Notice must be served upon:

The Secretary*
Environmental Review Tribunal
2300 Yonge St., 12th Floor
P.O. Box 2382
Toronto, Ontario
M4P 1E4

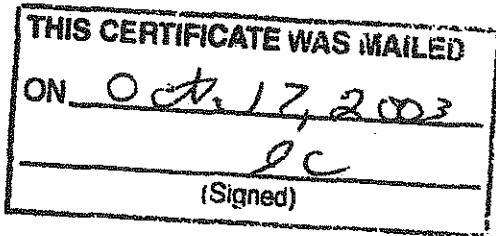
AND

The Director
Section 53, Ontario Water Resources Act
Ministry of the Environment
2 St. Clair Avenue West, Floor 12A
Toronto, Ontario
M4V 1L5

* Further information on the Environmental Review Tribunal's requirements for an appeal can be obtained directly from the Tribunal at: Tel: (416) 314-4600, Fax: (416) 314-4506 or www.ert.gov.on.ca

The above noted sewage works are approved under Section 53 of the Ontario Water Resources Act.

DATED AT TORONTO this 16th day of October, 2003



A handwritten signature in black ink, appearing to be "Mohamed Dhalla".

Mohamed Dhalla, P.Eng.
Director
Section 53, Ontario Water Resources Act

ZB/

c: District Manager, MOE Owen Sound
Steve Burns, P.Eng., B.M. Ross and Associates Limited ✓

RECEIVED

OCT 22 2003

B.M. ROSS & ASSOC. LTD.

APPENDIX 'B'

TERMS OF REFERENCE

Village of Lucknow

**ANNUAL SEWAGE WORKS PERFORMANCE REPORT
TERMS OF REFERENCE**

As a condition of the approval of its sewage works in 1989, the Village of Lucknow is required to provide an annual "Performance Report" to be submitted to the Ministry of Environment within the first 90 days of each calendar year. This "Performance Report" is to cover the twelve (12) months of operations and monitoring in the preceding calendar year for the sewage works.

The following are the Terms of Reference for the preparation and submission of the above noted annual "Performance Report". All sampling, analyses and water level recordings are to be undertaken by the Operating Authority and will be supplied within forty-five (45) days of the end of the operating year:

1. All influent, raw sewage flow data, including daily, average monthly and total flows, shall be summarized and presented in an orderly fashion in a report.
2. All influent, raw sewage chemical and physical data, including BOD₅; suspended solids; total phosphorus and TKN shall be summarized and presented in an orderly fashion in the report.
3. All sample results of the effluent of the last aerated cell prior to discharge to the rapid infiltration basins (RIB's) shall be summarized and presented in an orderly fashion. The following parameters should be included in the summary; BOD₅; suspended solids; total ammonia nitrogen; TKN; nitrite; nitrate; total phosphorus; soluble phosphorus; pH; chlorides; and conductivity. (Note: If the operating authority has not analyzed for the required parameters, the author of the annual "Performance Report" cannot be held responsible, but should note that all required parameters were not tested.)

4. All groundwater and/or surface water sample results from sampling locations specified for groundwater and surface water monitoring shall be summarized and presented in a logical and orderly fashion in the report. The parameters to be analyzed are the same as those specified in Number 3 (above), except temperature shall also be provided.
5. All groundwater level data collected for the year shall be summarized and presented in an orderly fashion.
6. A plan showing the "works" and the groundwater and surface water sampling and recording points shall be provided.
7. Groundwater piezometric surface contours shall be shown for each sampling period. A plan showing the "mounding" of the groundwater level shall be produced.
8. There shall be a section of the report which addresses each of the following items:
 - i) Introduction to report.
 - ii) Purpose of the report.
 - iii) General description of the site, including topography, geology and hydrogeology.
 - iv) An overview (plan) of the works.
 - v) Provincial groundwater and surface water objectives as they apply to these works.
 - vi) Background groundwater chemistry.
 - vii) Certificate of Approval compliance requirements for the lagoon effluent and groundwater/surface water compliance requirements for the groundwater and McLeod Drain.

- 9. The report shall contain a discussion on the physical and chemical changes to the raw sewage from the influent works through to the seepage/water quality in the groundwater or the McLeod Drain, as shown by the analytical results.**

- 10. The report should contain a section describing the subsurface hydrogeological conditions and effects created by the introduction of the treated effluent to the groundwater regime. Included should be a discussion on mounding, further treatment of the sewage effluent and phosphorus attenuation.**

- 11. The report shall contain an Executive Summary at the beginning of the report.**

- 12. The report shall contain conclusions and recommendations with respect to the operations of the works and also make recommendations with respect the effectiveness of the system and provide recommendations with respect to future monitoring programs.**

- 13. Ten (10) copies of the "Performance Report" shall be provided to the Village of Lucknow for distribution.**

