HYDROGEOLOGICAL ASSESSMENT

EMBRUN WELL HEAD MONITORING PROGRAM

2004 ANNUAL REPORT

Report prepared for the Township of Russell
Prepared by Sauriol Environmental Inc.
Dated: February 2005
Our File: P04-08B

SAURIOL
ENVIRONMENTAL Inc.

SAURIOL
ENVIRONNEMENT

GROUNDWATER IMPACT ASSESSMENT SPECIALIST
Helping society find solutions to environmental problems

SPÉCIALISTE DE L'ÉVALUATION D'IMPACT
SUR LES EAUX SOUTERRAINES
Contribuant à l'élaboration de solutions
aux problèmes environnementaux

February 28, 2005

Township of Russell
717 Notre Dame Street
Embrun, ON
K0A 1W1

Attention: Mr. Craig Cullen

Re: Hydrogeological Assessment
Embrun Well Head Monitoring Program
Annual Report 2004
Our file P04-08B

Dear Sir:

The following report contains the Hydrogeological Assessment of the Embrun Well Head Monitoring Program for the Year 2004.

The report includes a brief review of past studies, results from water level measurements and water samples taken in the summer and fall of 2004, including an analysis of the information.

Trusting that the above is satisfactory.

Yours Truly,
Sauriol Environmental Inc.

Jacques Sauriol M. Sc., P.Geo.
President

Circulation:
Township of Russell 4 copies
SEI file 1 copy

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2004 ANNUAL REPORT

1.0 INTRODUCTION

The following document presents a Hydrogeological Assessment of the Embrun Well Head Monitoring Program for the year of 2004. The program consisted of both sampling by the Township and bi-annual sampling by Sauriol Environmental Inc.

The Embrun well site is located on Part Lot A, Concession 4 in Township of Russell is operated under the Certificate of Approval # 7-0226-93-958. The monitoring program for 2004 consists of one production well, eight monitoring wells, and two residential wells. The photo on the cover page shows the site as flown over by the author on November 12, 2004.

1.1 Objectives

The primary objective of the year 2004 Hydrogeological Assessment of the Embrun Well Head Monitoring Program is to ensure the productivity and protection of the production well and of the aquifer. Specifically, this is done by providing an interpretation of the monitoring data collected in 2004, including a detailed review of aquifer hydraulics and an assessment of the transient and spatial changes to the well water quality.

1.2 Review of Past Surveys

The following subsection provides a brief review of the history and any environmental liabilities attached to the Embrun Wells, based on previous hydrogeological assessments (i.e. Robinson Consultants Inc. 2000 2001 & 2002 Annual Reports; SEI 2003). A map of the study site, showing the relation of the study site to the Village of Embrun, is provided in Figure 1. The site plan, showing the locations of the current production well, monitoring piezometers, and residential wells as of the time of this reporting, is illustrated in Figure 2. It also includes the approximate location of Robinson 2000 piezometers.

The Embrun production well is situated in an aquifer that consists of a buried glacio-fluvial deposit (buried esker core) made of granular materials and flanked by outwash sands and marine clays. The buried deposit is indicated in Figure 2 by the light grey shaded area. Groundwater velocities in previous reports were estimated to be 4m/yr; however more recent estimates indicated a range of groundwater velocities at about 20 m/yr in the outwash sands and in excess of 500 m/yr along the buried esker core (ref. SEI Dec 2004 Preliminary Hydrogeological Assessment; Screening of Landfill Operation Alternatives – Russell WDS).

The Russell WDS is located to the Northwest of the Embrun production well. The direction of groundwater flow from the landfill is to the East i.e. towards the aquifer. The Landfill is monitored by the Township and annual reports are produced to monitor the impact of the landfill groundwater (separate report). The landfill is noted to currently be impacting the groundwater in the localized area of the landfill.

The Dore pit is located to the South of the Embrun production well. The activities at the pit consist of sand and gravel extraction that requires the use of heavy equipment. Two 500 gal fuel tanks within a concrete spill containment area were located onsite to fuel the heavy equipment. The 2002 annual report noted some 50 gal drums of unknown contents and some derelict equipment. The ongoing activities and storage of fuel at this site remain of concern should there be an accident due to the proximity of the pit to the production well and the high groundwater flows in the aquifer.

Other environmental concerns for this site include a manure pit to the West of the production well and the application of road salt on Township Roads. The nearby manure pit is reported to be concrete lined to prevent leakage. Past estimates of the impacts of the road salts on the local groundwater showed low concentrations of Sodium, Chloride, and Calcium.

In nearby controlled piezometers, past reports compared measured concentrations to Ontario Drinking Water Standards (DWS) and some parameters such as Aluminium, Hardness, Manganese, Iron, TDS, and Sulphate were noted to exceed the DWS. The highest concentrations have tended to be at monitoring piezometers PZ13 and PZ16. No concentrations of petroleum hydrocarbons (BTEXs) were detected in the production well in 2002.

The 2003 annual report indicated that Iron and Manganese exceeded their aesthetic objectives of the DWS at selected stations. From the VOC scan, Ethylbenzene was detected in PZ16.

2.0 ACTIVITIES (2004)

A number of activities were undertaken in 2004 to address the hydrogeological items of concern for the Embrun Well Head Monitoring Program. SEI field staff measured static water levels and collected groundwater samples in the summer and fall at monitoring piezometers (PZ8, PZ13, PZ16, PZ18, PZ27, PZ28, PZ29, and PZ30) and two residential wells (Patenaude and Schoeni). Township staff collected samples from the primary production well. Subsections 2.1 – 2.3 provide a summary of monitoring activities undertaken in 2004 at the Embrun Wells.

2.1 Hydraulic Monitoring by SEI

SEI personnel measured static water levels at groundwater monitoring piezometers for both sampling runs in summer and fall 2004. The summer monitoring event took place on the July 6 and 7, 2004 and the fall monitoring event took place on the December 16, 2004. The water levels of the eight monitoring piezometers were measured. Water level measurements were not made at the residential wells. From the water level measurements and the known top of well elevations, groundwater table elevations were calculated for all stations (Table 1). Also included in Table 1 are water level measurements for spring and fall in 1998, 2000, 2001, 2002 and 2003. Station PZ-13 was not sampled in Dec 2004.

2.2 Groundwater Quality Monitoring by SEI

SEI staff conducted two groundwater monitoring events, in summer and fall of 2004 at the Embrun Well Site. Samples were collected from the eight monitoring piezometers (PZ8, PZ13, PZ16, PZ18, PZ27, PZ28, PZ29, and PZ30) and two residential wells (Schoeni and Patenaude). The Dore Pit was also sampled in 2004.

The monitoring piezometers were sampled after water level measurements were made. The stations were pumped with a portable submersible pump, and purged at about 19 litres per minute (5 gal/min) for 30 minutes. The samples were then collected in supplied bottles from Accutest Laboratories Ltd. All samples were subsequently submitted to Accutest Labs for analysis.

Samples were analyzed for pre-specified parameters, including Cl, TDS, Conductivity, Fe, Mn, Na, Ba and B, as outlined in the Terms of Reference. Selected stations located nearby the production well were also tested for BTEX as some parameters were detected in the past. The laboratory results from Accutest Labs are included in Appendix A, which also includes the field measurements presented in Table A-1. Figure 2 illustrates the approximated location of production well, monitoring piezometers, and residential wells that are located at the Embrun Well site.

2.3 Township Monitoring

Township personnel collected water samples from the Embrun production well throughout 2004. The data supplied by the Township is presented Appendix B. Monthly data was submitted for the parameters of Colour, pH, Temperature, Iron, Manganese, Turbidity, and Hydrogen Sulphide. The average monthly raw water flows for 2004 were also provided by the Township.

2.4 Faulty Stations

It was noted that stations PZ 29 and 30 along Catherine Road, are damaged (absence of the 2-inch diameter PVC pipe), have silted up, and may not yield representative formation sampling results. Station PZ29 is a shallower piezometer (6m) compared to PZ30 (11m), and both locations along the road right-of-way may partly explain the consistent more mineralized contents of PZ29. As part of the exhaustive hydrogeological investigation planned for 2005 at the nearby municipal waste disposal site, consideration should be given to the sounding of these two stations, and possibly abandonment and replacement farther on the edge of the road allowance.

3.0 INTERPRETATION

3.1 Hydraulic Monitoring by SEI

A summary of the Potentiometric Elevations (P.E.) calculated for all measured wells is provided in Table 1. Figure 3 presents the transient trends observed from water table elevation data for the monitored piezometers. Water levels in 2004 were similar to levels measured in the past. The seasonal groundwater recharge can be seen from the elevated water levels measured in the spring of each year when compared to levels measured in the fall. The measured seasonal water levels at each well have generally fluctuated over a range of 1.5 m over the last 6 years, and the measured potentiometric elevations fall between the elevations of 67.5 m and 71 m. There is no evidence of depletion of the aquifer.

The spatial distribution of groundwater levels measured in the summer of 2004 are presented in Figure 4. The conceptual model displays an estimate of possible gradients based on the data collected. The depressed potentiometric elevation of the water table is attributed to pumping activities at the production well and illustrates the capture zone as well as the converging flow field at Dore Lake, with a man made stream discharge outlet to Little Castor River.

3.2 Groundwater Quality of Production Well

The Annual Summary of Raw Water Flows for 2004 was compared to the same from 2003. Although there are two wells available, only PW-2 is in operation at the Embrun well head. The total amount of water used in 2004 decreased slightly from 903,180 to 902,880 m3, compared to 2003.

Groundwater quality was obtained from the Embrun production well in 2004 and is provided in Appendices A & B, with the monthly average water flows. The data was compared to the Drinking Water Standards (DWS; Reg 169/03). Raw water quality was shown to exceed DWS for TDS, Iron and Manganese. It is noted that these parameters have Aesthetic Objectives (AO) under DWS. For the raw water, both Iron and Manganese exceeded the DWS for every month with an average Fe of 2.61 mg/L and an average Mn of 0.396 mg/L. Iron and Manganese concentrations measured at the production well in 2004 are similar to past concentrations measured at the production well and nearby piezometers PZ16 and PZ18. Fe and Mn elevated concentrations are likely due to a solubility shift caused by oxygenated water recharging via the Dore pit.

Bacteriological surveys were completed weekly by the Municipality in 2004. These were tested for both total and fecal coliform (E.Coli.). No fecal coliform bacteria was detected in the raw well water. Only one event out of 52 surveys found samples with total coliform between 1 and 100 counts.

Treated water show Fe and Mn concentrations of 0.04 and 0.007 mg/L respectively, confirming the effectiveness of the treatment system at the plant. Treated well water was shown to exceed DWS for TDS (616 mg/L) and Hardness (478 mg/L). Elevated TDS and Hardness concentrations are likely due to proximity of the dewatering well and possible upconing from the underlying bedrock aquifer.

3.3 Groundwater Quality of the Well Head

3.3.1 Comparison to DWS

In 2004, several monitoring stations (PZ13, PZ16, PZ18, and PZ29) were found to exceed the Drinking Water Standards (DWS; Reg 169/03) for Iron and Manganese. It is noted that these parameters have only Aesthetic Objectives (AO) under DWS. The concentrations of other metals and inorganic parameters are either below the detection limit of the laboratory or well below the Maximum Acceptable Concentration (MAC) specified in the DWS, and are not of concern. Concentrations of Volatile Organic Compounds (VOC's) were detected in the summer of 2004 at PZ16. Elevated concentration of Ethylbenzene was reduced from 3.2 (2003) to 0.8 ug/L (2004), which is below the DWS of 2.4 ug/L. VOCs were not detected in the production well nor in the nearby Dore pit. Because of the location of PZ16 nearby a possible source of hydrocarbons (Dore Pit), VOCs should be monitored in the future.

The monitoring piezometers PZ28 and PZ29 appear to be slightly impacted by surface runoff. Contrary to 2003, there was no nitrate detected in these two stations during 2004.

3.3.2 Transient and Spatial Analysis

The concentrations of Barium, Boron, Iron, Manganese, Chloride, Total Dissolved Solids and Sodium are provided at the production well, PZ16 and PZ18 in the summer and fall from 2000 to 2004 (Tables 2A to 2C). The transient trends of selected parameter concentrations vs. time are presented in Figures 5A to 5C. These show that that measured parameters are constant with time.

The spatial distribution of concentrations of Chloride, TDS and Iron are expressed as conceptual models of concentration gradients in Figures 6A to 6C. Chloride concentrations vary spatially from 10 to 30 mg/L with a maximum concentration at the Marionville Road. TDS exhibits a similar distribution, with a range of 200 to 600 mg/L. Road salting is suspected as the likely cause for these elevated parameters. Iron shows a range of 0.1 to 2.3 mg/L with its spatial maximum near the production well. Manganese (not mapped) also exhibits a similar behaviour. This is likely caused by the presence of the nearby Dore Pit.

4.0 CONCLUSIONS

Overall the water quality measured at the site was good and the results of the samples do not suggest significant imminent threat to the production or quality of the water from the Embrun production well.

Water levels were measured in the summer and fall of 2004 at eight monitoring piezometers. Water levels of these piezometers were found to be similar to historical water level measurements and water levels at individual wells have fluctuated by about 1.5 m over the last six years. In the buried esker aquifer, shallow groundwater flow is southward in the North and northward in the South. This converging flow field, in addition to the "fan shape" of the deposit, contributes to the great production of the Embrun well head. The total amount of raw water consumed in 2004 was less than the amount used in 2003.

Eight monitoring piezometers and two residential wells were sampled in the summer and fall of 2004. The samples were analyzed for selected parameters specified in the Terms of Reference. There were no health related exceedences of the DWS noted in any of the samples of 2004. There were several exceedences of Aesthetic Objectives of DWS by the parameters of TDS, Iron and Manganese, near the well head.

A detected concentration of ethylbenzene (VOC) was noted at PZ16 in 2004. PZ16 is directly down-gradient of the Dore pit. Further sampling confirmed the absence of BTEX component in the production well water as well in the Dore Pit.

Transient analysis of groundwater quality indicates steady hydrogeochemistry at the well head. Elevated mineral contents (Cl and TDS) appear to peak at the Marionville Road.

It was noted that stations PZ 29 and 30 along Catherine Road, are damaged.

4.1 Recommendations

1. For future monitoring events, water level measurements should be made prior to any pumping activities in production well.
2. Continue the monitoring of ethylbenzene near PZ16. BTEX should be analyzed at PZ16, production well and Dore Lake water in 2005.
3. Obtain logs and integrate the Robinson's piezometers located to the north and west of the well head. Measure Spring (May) and Fall (October) depth to water level survey in PZ8, PZ13, PZ16, PZ 18, PZ27, PZ28, PZ29, PZ30, 00-1, 00-2, 00-3 and 00-4.
4. Listing of parameters for the analysis of the common groundwater quality indicator should include Chloride, Total Dissolved Solids, and Sodium (plus Ba, B, Fe and Mn).
5. Consideration should be given to the sounding and possibly abandonment and replacement farther on the edge of the road allowance.

TABLE 1: POTENTIOMETRIC ELEVATIONS EMBRUN WELL MONITORING PROGRAM												
Station	Top of Casing Elevation (m)	Potentiometric Elevation (m)										
		May-98	Nov-98	Jul-00	Dec-00	Jun-01	Oct-01	Jul-02	Nov-02	Jul-03	Oct-03	Jul-04	Dec-04
PZ-08	74.49	70.09	69.96	70.11	69.98	70.01	69.69	70.23	69.99	70.02	69.87	69.99	70.11
PZ-13	72.99	69.18	69.09	69.62	69.43	69.43	69.12	69.89	69.47	69.47	69.28	69.49	
PZ-16	72.34	69.10	68.80	69.22	68.71	68.67	68.19	68.94	68.53	68.49	68.22	68.44	68.62
PZ-18	72.27	69.01	68.67	69.00	68.35	68.41	67.74	68.45	68.31	68.06	67.69	67.93	68.12
PZ-27	71.63	70.48	69.97	70.53	69.93	70.12	69.52	70.18	69.68	69.75	69.19	69.80	69.71
PZ-28	71.72	70.33	69.61	70.55	69.58	69.78	69.09	70.21	69.25	69.48	68.95	69.47	69.61
PZ-29	72.45	70.35	70.08	70.74	70.31	70.28	69.91	70.80	69.99	70.11	69.72	70.09	70.60
PZ-30	71.795	69.68	69.72	70.10	69.93	69.63	69.64	70.16	69.60	69.41	69.34	69.47	70.30

Notes:

- May 1998 to November 2002 data Taken from Table 1, Embrun Aquifer Monitoring , 2002 Annual Report by Robinson Consultants Inc.

TABLE 2A: CONCENTRATIONS OF SELECTED PARAMETERS EMBRUN PRODUCTION WELL (2000 - 2004) EMBRUN WELL MONITORING PROGRAM

Parameter	ODWS	PRODUCTION WELL									
		Jul-00	Nov-00	Jun-01	Oct-01	Jun-02	Nov-02	Jul-03	Oct-03	Jul-04	Dec-04
Ba (mg/L)	1	0.12	0.1	0.14	0.09	0.12	0.09			0.09	0.08
B (mg/L)	5	0.02	0.02	0.01	0.03	<0.02	<0.05			0.04	0.03
Fe (mg/L)	0.3	**2.36**	**2.27**	**1.94**	**2.22**	**2.39**	**2.64**	**2.55**	**2.61**	**2.31**	**2.29**
Mn (mg/L)	0.05	**0.32**	**0.29**	**0.29**	**0.32**	**0.366**	**0.321**	**0.38**	**0.376**	**0.34**	**0.29**
Cl (mg/L)	250	13	14	15	14	15	19			16	16
TDS (mg/L)	500	**608**	**552**	500	**600**	**664**	**638**			**556**	**582**
Na (mg/L)	200	5	6	4	4	5				7	9

Notes:
- 2000 to 2002 data taken from Tables, Embrun Well Monitoring Program, 2002 Annual Report by Robinson Consultants Inc.
- Bold indicates that measured parameters exceeds Ontario Drinking Water Standard (ODWS)

TABLE 2B: CONCENTRATIONS OF SELECTED PARAMETERS EMBRUN WELL PZ-16 (2000 - 2004) EMBRUN WELL MONITORING PROGRAM

Parameter	ODWS	PZ-16									
		Jul-00	Nov-00	Jun-01	Oct-01	Jun-02	Nov-02	Jul-03	Oct-03	Jul-04	Dec-04
Ba (mg/L)	1	0.05	0.03	0.03	0.05	0.05	0.03	0.03	0.03	0.04	0.05
B (mg/L)	5	<0.01	0.02	0.01	0.03	<0.02	<0.05	<0.05	0.02	0.03	0.03
Fe (mg/L)	0.3	**12.8**	**4.62**	**3.08**	**4.56**	**8.02**	**3.54**	**3.26**	**2.84**	**2.16**	**1.4**
Mn (mg/L)	0.05	**0.74**	**0.44**	**0.46**	**0.37**	**0.724**	**0.437**	**0.406**	**0.351**	**0.35**	**0.27**
Cl (mg/L)	250	6	9	16	12	14	16			17	20
TDS (mg/L)	500	**1052**	**752**	**648**	**540**	**953**	**601**			415	422
Na (mg/L)	200	4	5	3	2	3				7	7

Notes:
- 2000 to 2002 data taken from Tables, Embrun Well Monitoring Program, 2002 Annual Report by Robinson Consultants Inc.
- Bold indicates that measured parameters exceeds Ontario Drinking Water Standard (ODWS)

TABLE 2C: CONCENTRATIONS OF SELECTED PARAMETERS EMBRUN WELL PZ-18 (2000 - 2004) EMBRUN WELL MONITORING PROGRAM

Parameter	ODWS	PZ-18									
		Jul-00	Nov-00	Jun-01	Oct-01	Jun-02	Nov-02	Jul-03	Oct-03	Jul-04	Dec-04
Ba (mg/L)	1	0.06	0.03	0.04	0.05	0.05	0.03	0.04	0.03	0.04	0.04
B (mg/L)	5	<0.01	0.02	<0.01	0.03	<0.02	<0.05	<0.05	0.01	0.04	0.02
Fe (mg/L)	0.3	**17.6**	**2.84**	**1.34**	**1.93**	**2.69**	**1.96**	**1.44**	**1.83**	**1.23**	**1.43**
Mn (mg/L)	0.05	**1.46**	**0.5**	**0.62**	**0.48**	**0.697**	**0.408**	**0.494**	**0.28**	**0.4**	**0.23**
Cl (mg/L)	250	3	3	3	5	2	7			6	5
TDS (mg/L)	500	**1196**	**736**	**616**	412	**721**	489			449	447
Na (mg/L)	200	4	6	4	2	3				5	6

Notes:
- 2000 to 2002 data taken from Tables, Embrun Well Monitoring Program, 2002 Annual Report by Robinson Consultants Inc.
- Bold indicates that measured parameters exceeds Ontario Drinking Water Standard (ODWS)

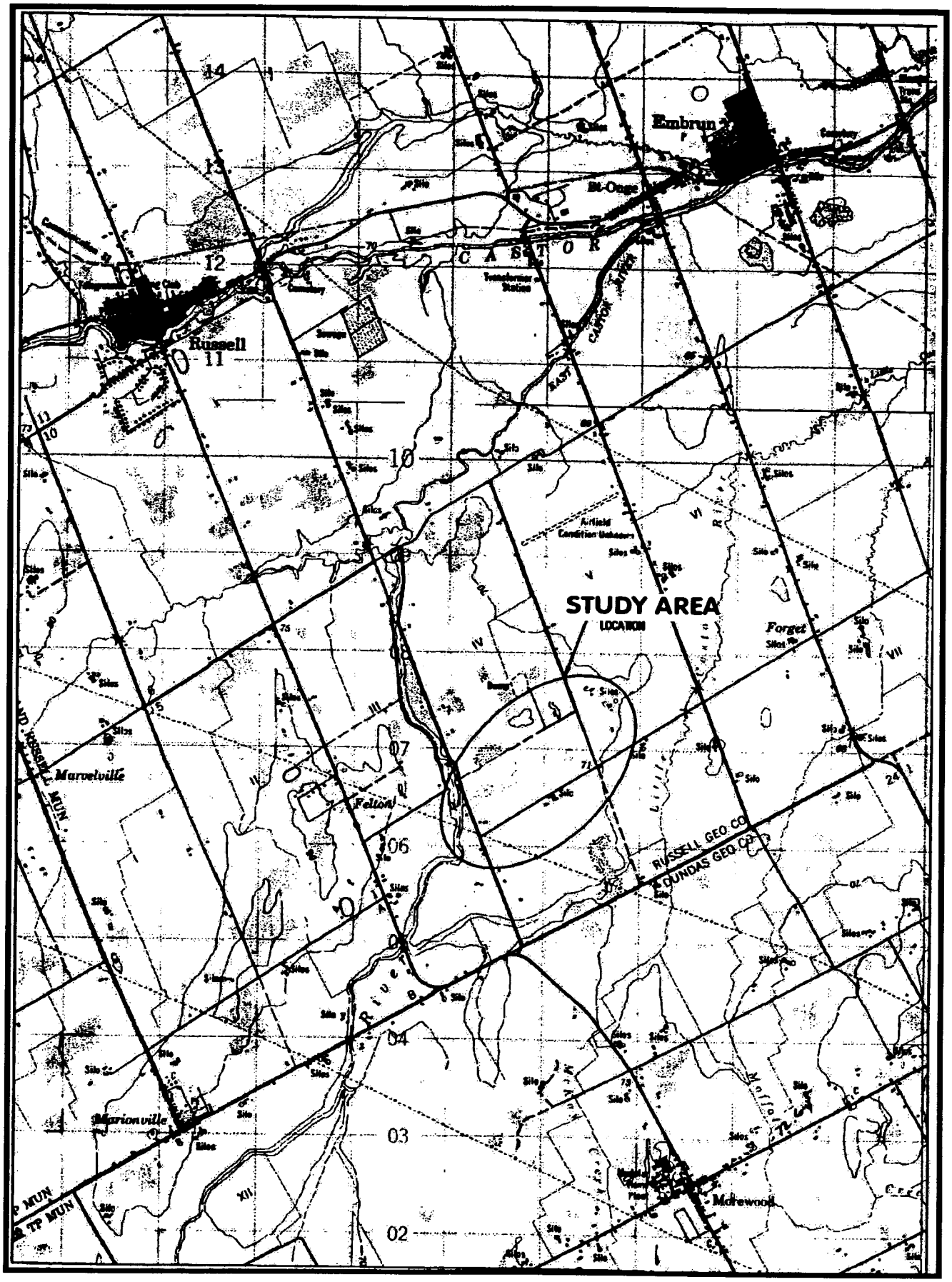


Figure 1

EMBRUN WATER SUPPLY STUDY SITE

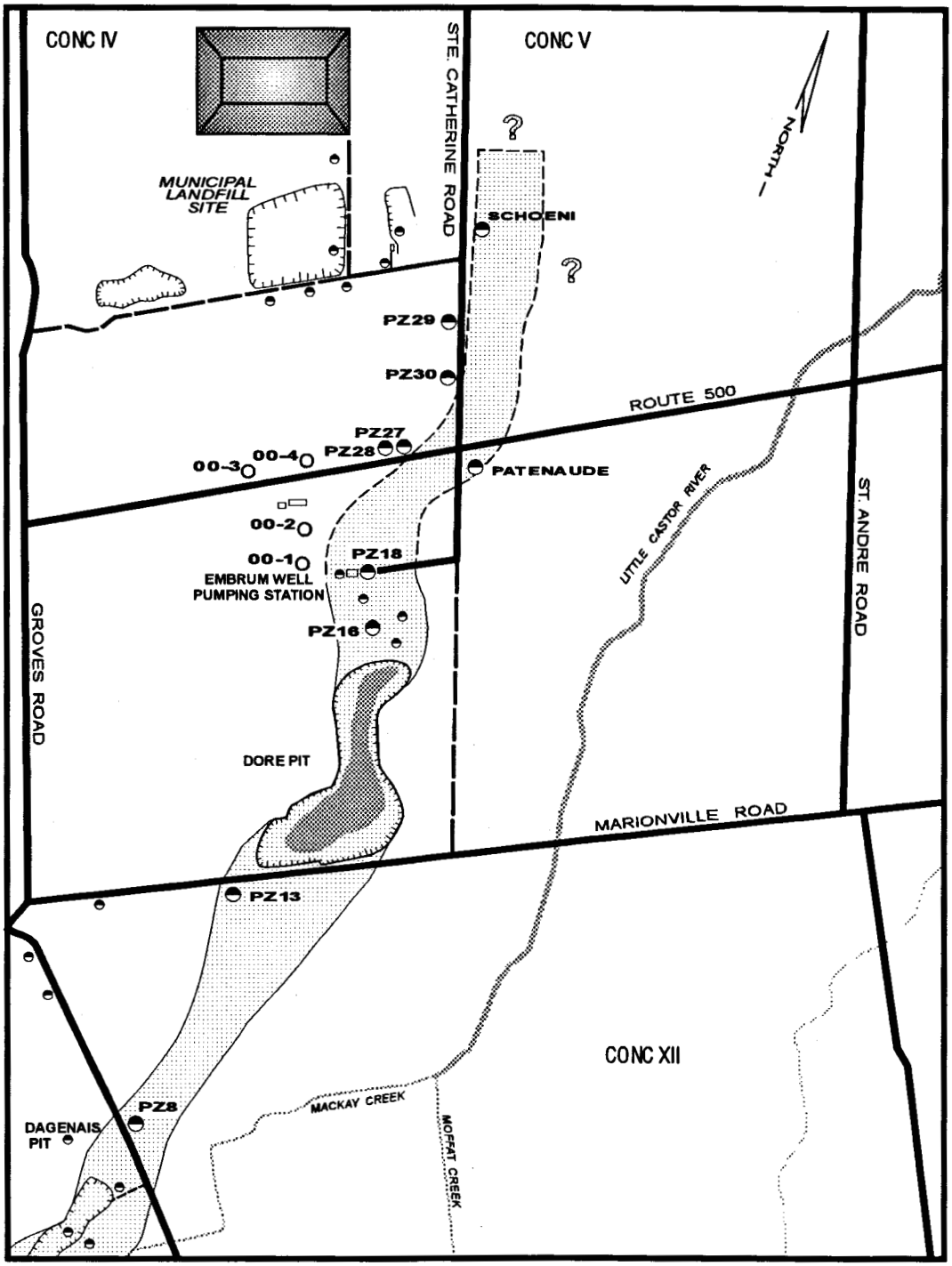
TOWNSHIP OF RUSSELL

SAURIOL ENVIRONMENTAL Inc.

MAP FILE: GEOPICSO 05-10- MAR 2005

DATE: FEBRUARY 2005 PROJECT No. POU-08b

EMBRUN WATER SUPPLY



Legend

- PZ28 MONITORED STATION
- STATION NOT MONITORED
- 00-4 ROBINSON STATIONS
- CORE OF ICE CONTACT DEPOSIT
  - Inferred / assumed

0 200 400m

Figure 2

SITE PLAN

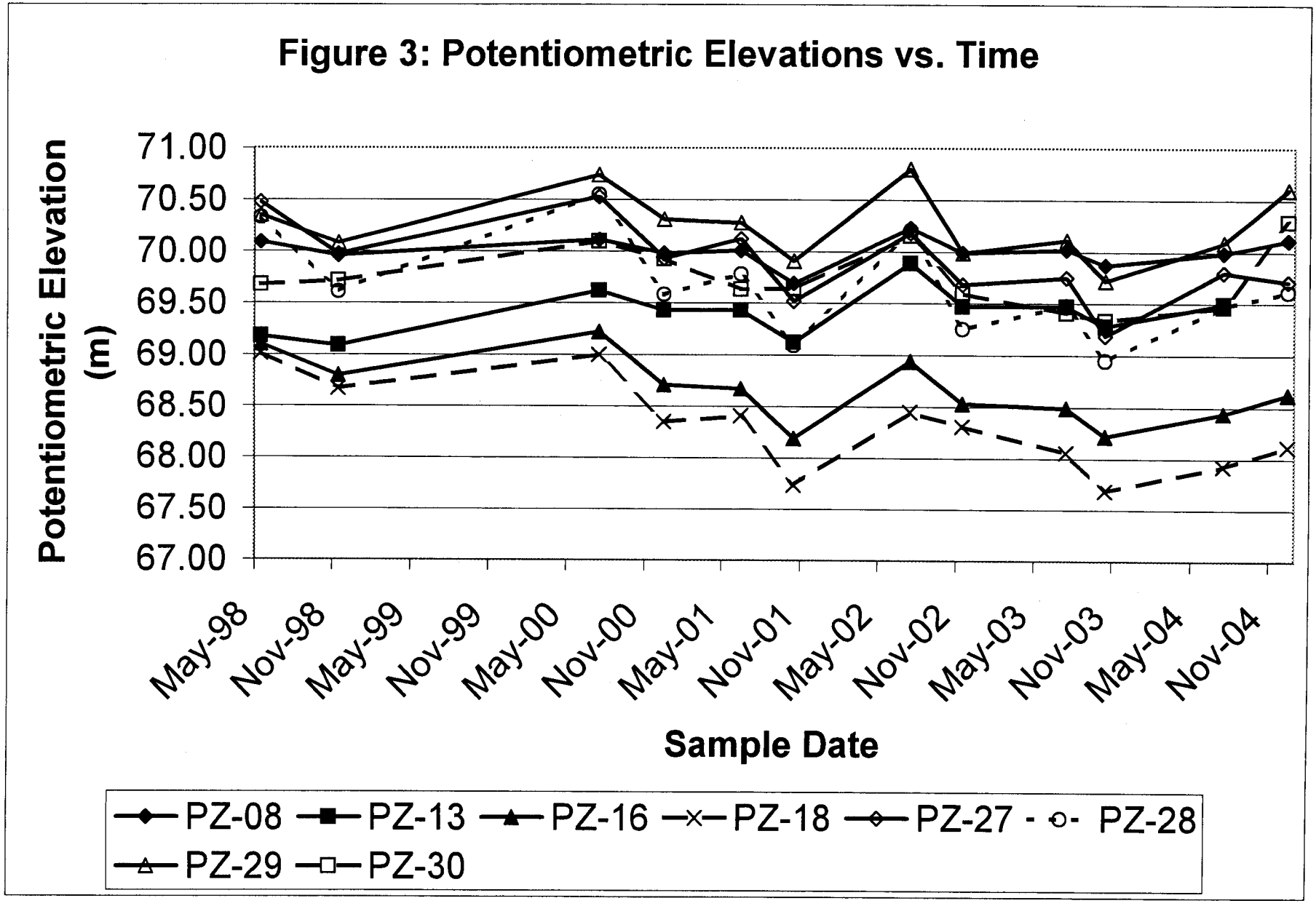
TOWNSHIP OF RUSSELL

SAURIOL ENVIRONMENTAL Inc.

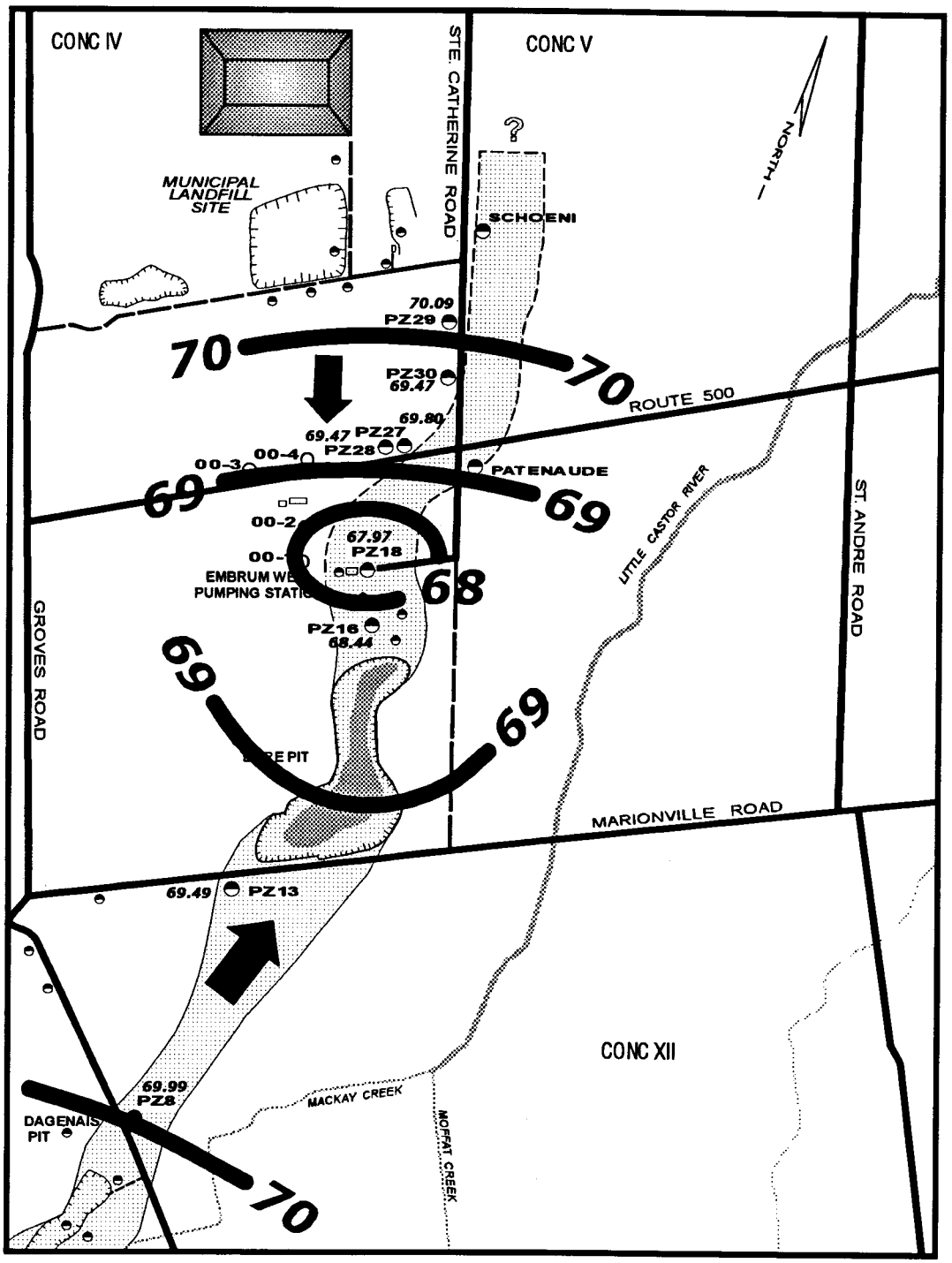
MAP FILE : GEOPICS G0510_EMBRUM - FEB 2005

DATE: Feb. 2005 PROJECT No. P04-08b

Figure 3: Potentiometric Elevations vs. Time



EMBRUN WATER SUPPLY



Legend

- PZ28 MONITORED STATION
- STATION NOT MONITORED
- 00-4 ROBINSON STATIONS
- CORE OF ICE CONTACT DEPOSIT (Inferred / assumed)
- GROUONDWATER FLOW DIRECTION

0 200 400m

Figure 4

POTENTIOMETRIC ELEVATIONS (masl) (July, 2004)

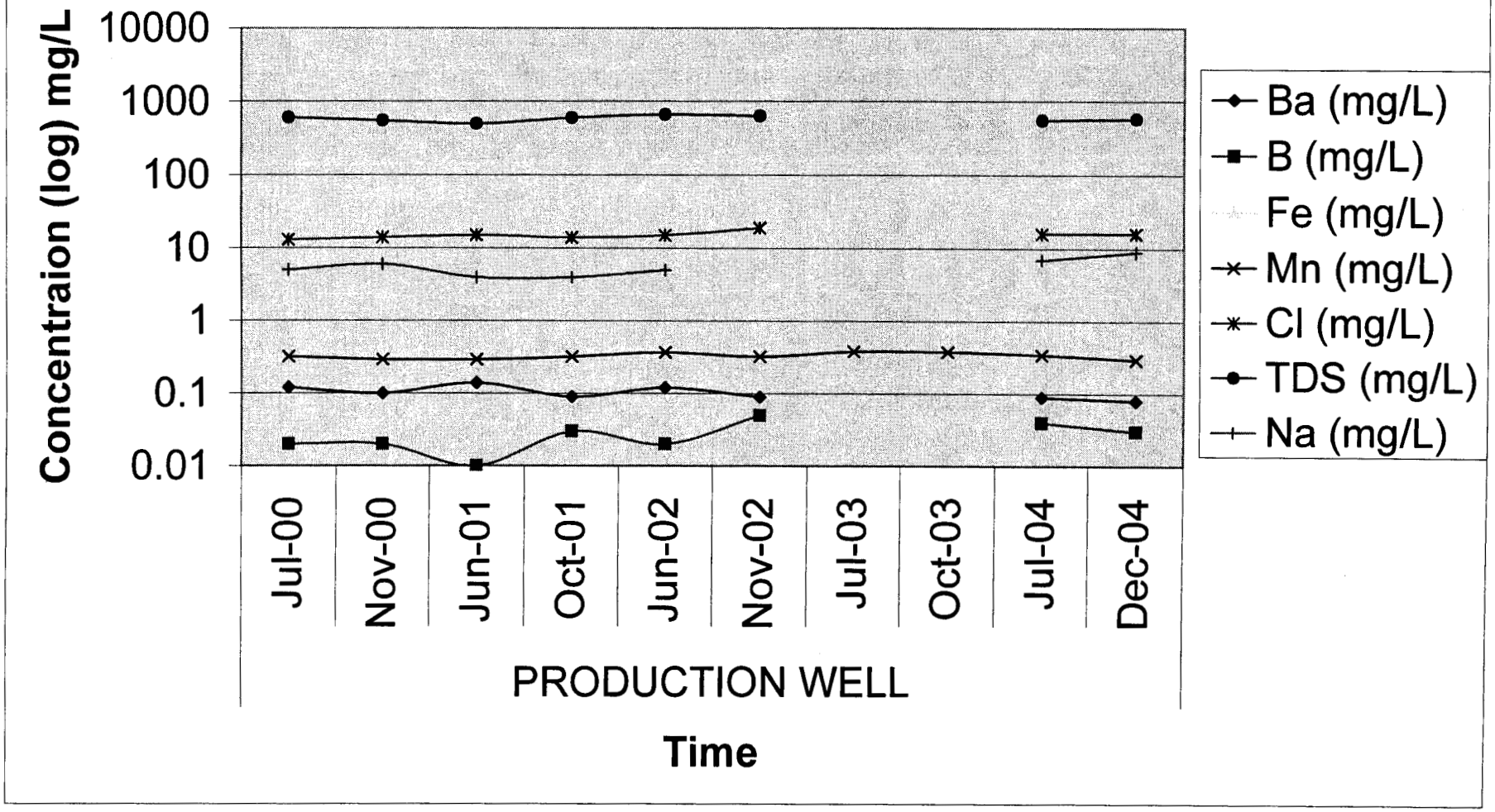
TOWNSHIP OF RUSSELL

SAURIOL ENVIRONMENTAL Inc.

MAP FILE : GEOPICS G0510_EMBRUM - FEB 2005

DATE: Feb. 2005 PROJECT No. P04-08b

Figure 5a: Production well concentrations vs time



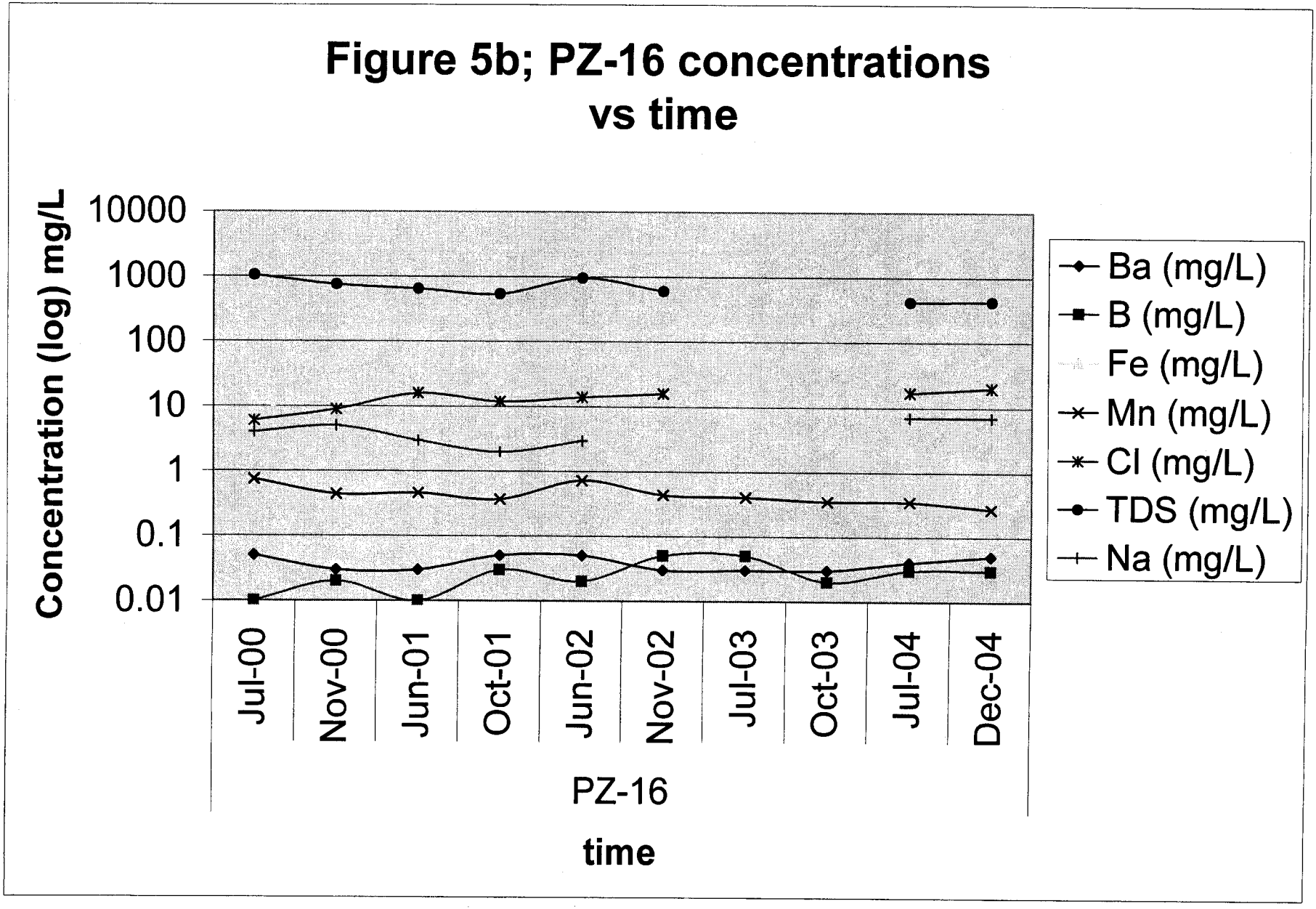
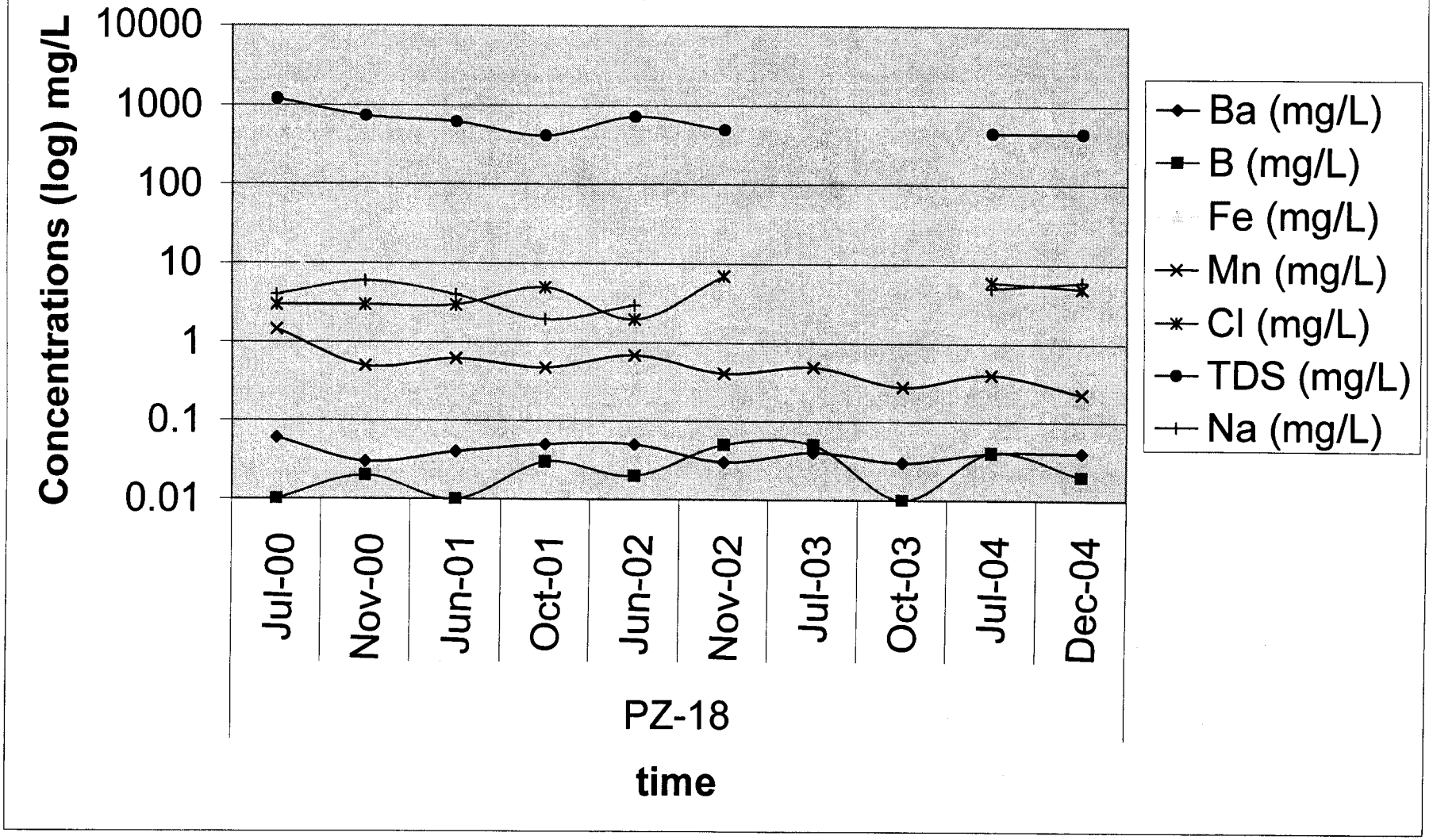
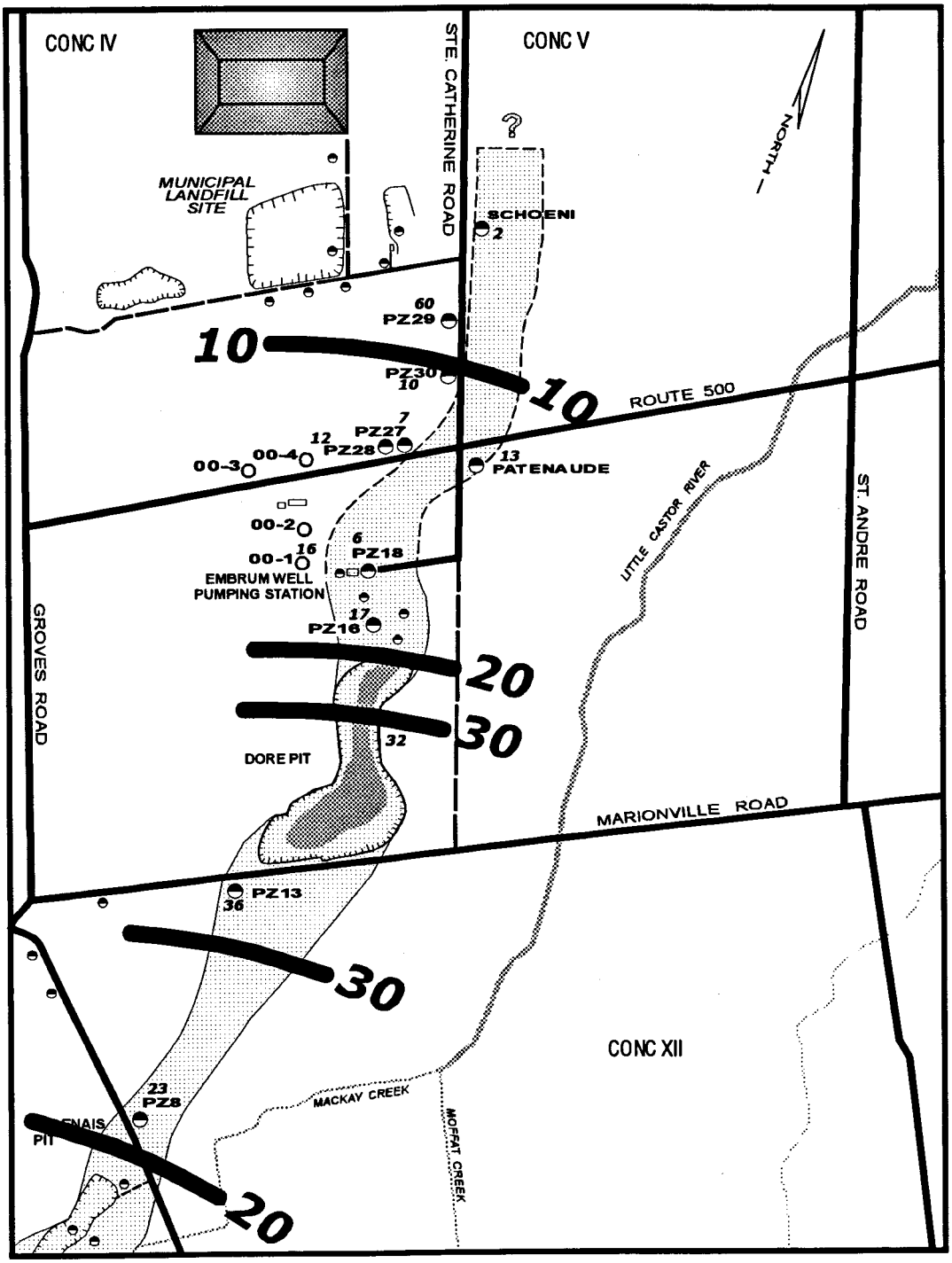


Figure 5b; PZ-16 concentrations vs time
Concentration (log) mg/L
10000
1000
100
10
1
0.1
0.01
Jul-00
Nov-00
Jun-01
Oct-01
Jun-02
Nov-02
Jul-03
Oct-03
Jul-04
Dec-04
PZ-16
time
Ba (mg/L)
B (mg/L)
Fe (mg/L)
Mn (mg/L)
Cl (mg/L)
TDS (mg/L)
Na (mg/L)

Figure 5c; PZ-18 Concentrations vs time



EMBRUN WATER SUPPLY



Legend

- PZ28 — MONITORED STATION
- STATION NOT MONITORED
- 00-4 — ROBINSON STATIONS
- CORE OF ICE CONTACT DEPOSIT
- Inferred / assumed
- 0 200 400m

Figure 6a

CHLORIDE (mg/L) (July, 2004)

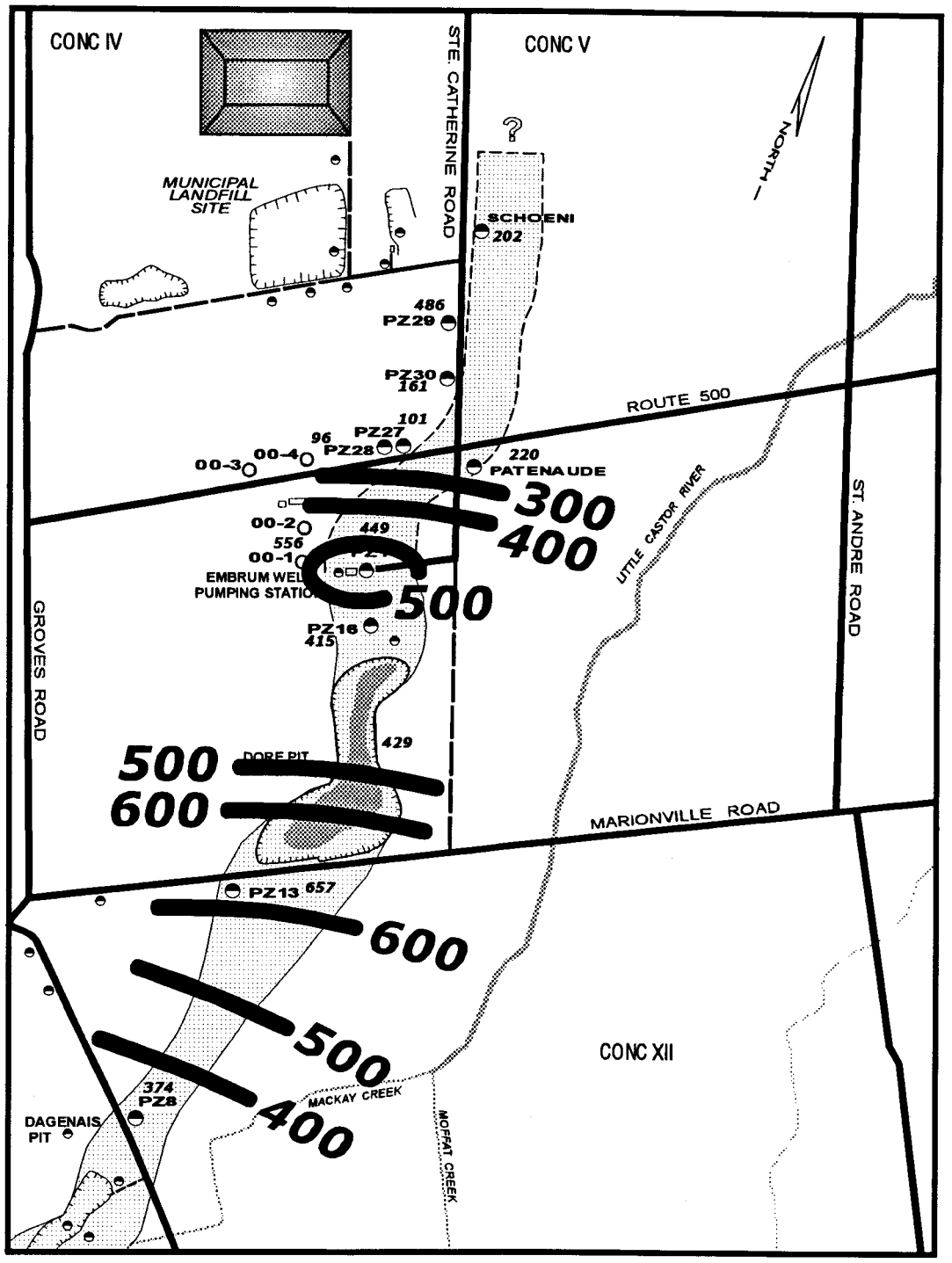
TOWNSHIP OF RUSSELL

SAURIOL ENVIRONMENTAL Inc.

MAP FILE : GEOPICS G0510_EMBRUM - FEB 2005

DATE: Feb. 2005 PROJECT No. P04-08b

EMBRUN WATER SUPPLY



Legend

- PZ28 MONITORED STATION
- STATION NOT MONITORED
- 00-4 ROBINSON STATIONS
- CORE OF ICE CONTACT DEPOSIT (Inferred / assumed)

0 200 400m

Figure 6b

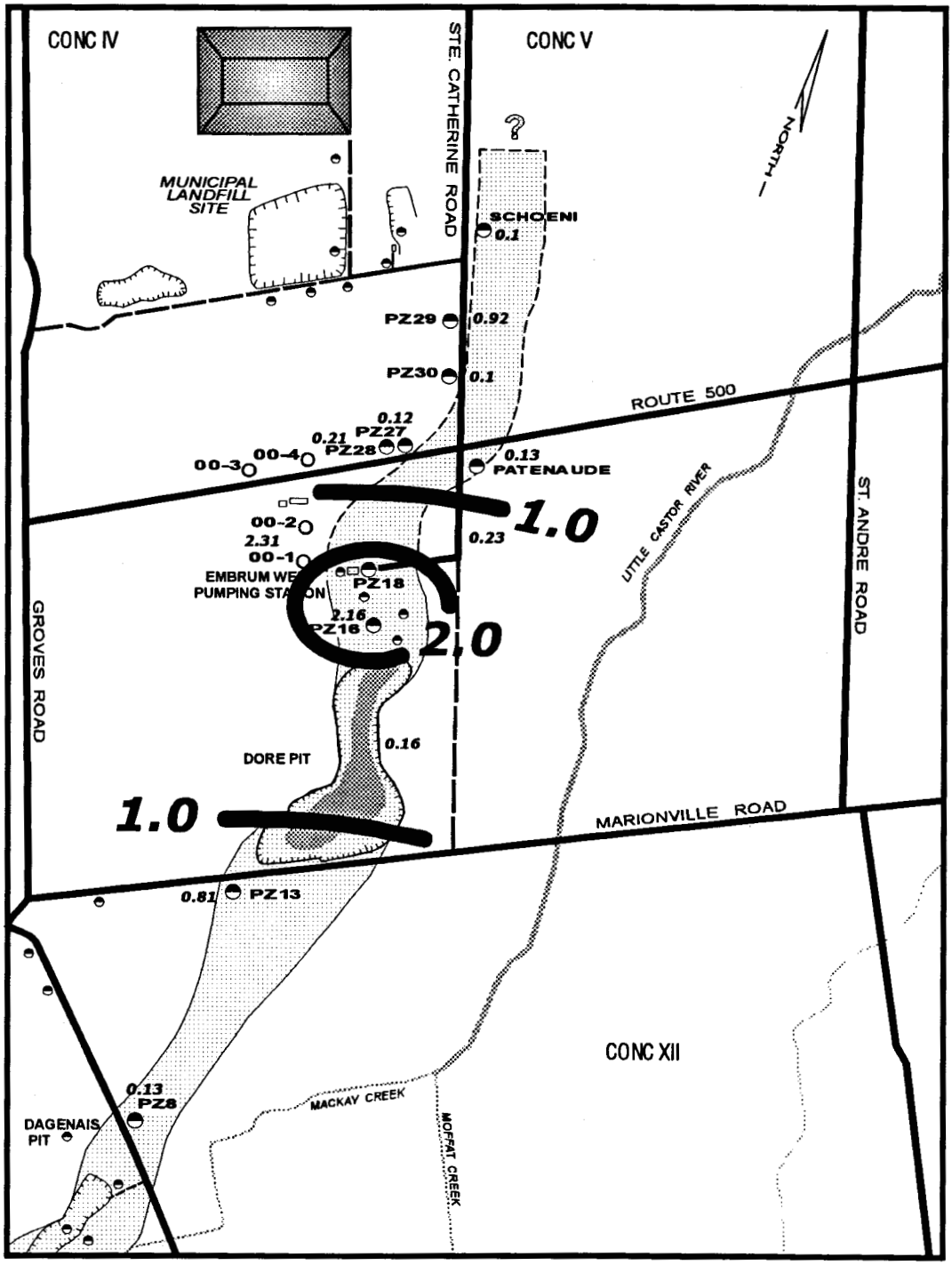
TDS (mg/L)
(July, 2004)
TOWNSHIP OF RUSSELL

SAURIOL ENVIRONMENTAL Inc.

MAP FILE: GEOPICS G0510_EMBRUM - FEB 2005

DATE: Feb. 2005 PROJECT No. P04-08b

EMBRUN WATER SUPPLY



Legend

PZ28 MONITORED STATION

STATION NOT MONITORED

00-4 ROBINSON STATIONS

CORE OF ICE CONTACT DEPOSIT

Inferred / assumed

0 200 400m

Figure 6c

IRON (mg/L) (July, 2004)

TOWNSHIP OF RUSSELL

SAURIOL ENVIRONMENTAL Inc.

MAP FILE : GEOPICS G0510_EMBRUM - FEB 2005

DATE: Feb. 2005 PROJECT No. P04-08b

APPENDIX A

LABORATORY RESULTS
EMBRUN WELL MONITORING PROGRAM

Table A-1 Field Measurements

Date:July 6-7 2004	stations											
Parameters	**PZ8**	**PZ13**	**PZ16**	**PZ18**	**PZ27**	**PZ28**	**PZ29**	**PZ30**	**Patenaude**	**Schoeni**	**Production well**	**Dore Lake**
Water Levels (m)	4.5	3.5	3.9	4.34	1.83	2.25	2.36	2.33			3.99	
Conductivity (uMhos/cm)	470	910	630	660	140	120	660	240		270	780	730
Temp ©	18.7	14.4	12.1	10.7	14.3	14.2	14.2	14		14.4	13	20.7
pH	7.6	7.3	7.5	7.6	9.1	9.3	7.4	6.6		8.5	7.5	8
Date:December 16 2004	**stations**											
Parameters	**PZ8**	**PZ13**	**PZ16**	**PZ18**	**PZ27**	**PZ28**	**PZ29**	**PZ30**	**Patenause**	**Schoeni**	**Production well**	**Dore Lake**
Water Levels (m)	4.38		3.72	4.15	1.92	2.11	1.85	1.5				
Conductivity (uMhos/cm)	575		625	650	160	150	600	380	330	270	800	675
Temp ©	8		10	9	8	8.5	8	8	9	9	11	1
pH	7.95		7.63	7.5	8.78	9.15	7.5	7.88	8.13	8.33	7.4	8.16

Notes:

Patenaude; property owned by son of previous owner

PZ16 well need new cap ; well full of cow hair

Client: **Township of Russell c/o Sauriol Environmental Inc.**
134 St. Paul St. P.O. Box 7181
Vanier, ON
K1L 8E3
Attention: **Mr. Jacques Sauriol**

Report Number: 2412786
Date: 2004-07-15
Date Submitted: 2004-07-07

Project: P04-08

P.O. Number:
Matrix: Water

	LAB ID:	329649	329650	329651	329652	329653	GUIDELINE		
	Sample Date:	2004-07-06	2004-07-06	2004-07-06	2004-07-06	2004-07-06			
	Sample ID:	P2-29	Schoeni	P2-30	P2-13	P2-27			
PARAMETER	UNITS	MDL					TYPE	LIMIT	UNITS
Chloride	mg/L	1	60	2	10	36	7			
Conductivity	uS/cm	5	747	311	248	1010	156			
N-NO3 (Nitrate)	mg/L	0.10	<0.10							
TDS (COND - CALC)	mg/L	5	486	202	161	657	101			
Sodium	mg/L	1	9	46	10	11	18			
Barium	mg/L	0.01	0.08	0.05	0.10	0.03	0.12			
Boron	mg/L	0.01	0.02	0.33	0.17	0.04	0.09			
Iron	mg/L	0.01	0.92	0.10	0.10	0.81	0.12			
Manganese	mg/L	0.01	0.09	<0.01	0.03	0.08	0.04			

MDL = Method Detection Limit INC = Incomplete AO = Aesthetic Objective OG = Operational Guideline MAC = Maximum Allowable Concentration IMAC = Interim Maximum Allowable Concentration
Comment:

APPROVAL:
Ewan McRobbie
Inorganic Lab Supervisor

ACCUTEST LABORATORIES LTD

REPORT OF ANALYSIS

Client: Township of Russell c/o Sauriol Environmental Inc.
134 St. Paul St. P.O. Box 7181
Vanier, ON
K1L 8E3
Attention: Mr. Jacques Sauriol

Report Number: 2412786
Date: 2004-07-15
Date Submitted: 2004-07-07

Project: P04-08

P.O. Number:
Matrix: Water

	LAB ID:	329654	329655				GUIDELINE		
	Sample Date:	2004-07-06	2004-07-06						
	Sample ID:	P2-28	P2-8						
PARAMETER	UNITS	MDL					TYPE	LIMIT	UNITS
Chloride	mg/L	1	12	23					
Conductivity	uS/cm	5	148	576					
N-NO3 (Nitrate)	mg/L	0.10	<0.10						
TDS (COND - CALC)	mg/L	5	96	374					
Sodium	mg/L	1	11	8					
Barium	mg/L	0.01	0.04	0.09					
Boron	mg/L	0.01	0.06	0.04					
Iron	mg/L	0.01	0.21	0.13					
Manganese	mg/L	0.01	0.06	0.05					

MDL = Method Detection Limit INC = Incomplete AO = Aesthetic Objective OG = Operational Guideline MAC = Maximum Allowable Concentration IMAC = Interim Maximum Allowable Concentration
Comment:

APPROVAL:
Ewan MacRobbie
Inorganic Lab Supervisor

Client: **Township of Russell c/o Sauriol Environmental Inc.**
134 St. Paul St. P.O. Box 7181
Vanier, ON
K1L 8E3
Attention: **Mr. Jacques Sauriol**

Report Number: 2412977
Date: 2004-07-19
Date Submitted: 2004-07-09

Project: P04-08

P.O. Number:
Matrix: Water

			LAB ID:	330086	330087	330088	330089		GUIDELINE		
			Sample Date:	2004-07-07	2004-07-07	2004-07-07	2004-07-07				
			Sample ID:	PZ-18	PZ-16	Production Well	Dore				
PARAMETER	**UNITS**	**MDL**							**TYPE**	**LIMIT**	**UNITS**
Chloride	mg/L	1		6	17	16	32				
Conductivity	uS/cm	5		690	639	855	660				
TDS (COND - CALC)	mg/L	5		449	415	556	429				
Sodium	mg/L	1		5	7	7	9				
Barium	mg/L	0.01		0.04	0.04	0.09	0.04				
Boron	mg/L	0.01		0.04	0.03	0.04	0.03				
Iron	mg/L	0.01		1.23	2.16	2.31	0.16				
Manganese	mg/L	0.01		0.40	0.35	0.34	0.02				

MDL = Method Detection Limit INC = Incomplete AO = Aesthetic Objective OG = Operational Guideline MAC = Maximum Allowable Concentration IMAC = Interim Maximum Allowable Concentration

Comment:

APPROVAL:

Peter Haulena
Analytical Services Manager

Client: **Township of Russell c/o Sauriol Environmental Inc.**
134 St. Paul St. P.O. Box 7181
Vanier, ON
K1L 8E3
Attention: **Mr. Jacques Sauriol**

Report Number: 2412977
Date: 2004-07-19
Date Submitted: 2004-07-09

Project: P04-08

P.O. Number:
Matrix: Water

	LAB ID:	330087	330088	330089			GUIDELINE		
	Sample Date:	2004-07-07	2004-07-07	2004-07-07					
	Sample ID:	PZ-16	Production Well	Dore					
PARAMETER	UNITS	MDL					TYPE	LIMIT	UNITS
BTEX									
Benzene	ug/L	0.5	<0.5	<0.5	<0.5				
Ethylbenzene	ug/L	0.5	0.8	<0.5	<0.5				
Toluene	ug/L	0.5	<0.5	<0.5	<0.5				
m/p-xylene	ug/L	1.0	<1.0	<1.0	<1.0				
o-xylene	ug/L	0.5	<0.5	<0.5	<0.5				
BTEX SURROGATES									
Toluene-d8	%		100	100	101				
Total Petroleum Hydrocarbons									
GRO (<C10)	mg/L	0.2	<0.2	<0.2	<0.2				
DRO (C10-C24)	mg/L	0.2	<0.2	<0.2	<0.2				
GRO + DRO	mg/L	0.2	<0.2	<0.2	<0.2				

MDL = Method Detection Limit INC = Incomplete AO = Aesthetic Objective OG = Operational Guideline MAC = Maximum Allowable Concentration IMAC = Interim Maximum Allowable Concentration

Comment:

APPROVAL:
Mina Nasirai
Organic Lab Supervisor

Client: **Sauriol Environmental Inc.**
134 St. Paul St. P.O. Box 7181
Vanier, ON
K1L 8E3
Attention: **Mr. Jacques Sauriol**

Report Number: 2424328
Date: 2004-12-23
Date Submitted: 2004-12-17

Project: P04-08

P.O. Number:
Matrix: Water

			LAB ID:	361601	361602				GUIDELINE		
			Sample Date:	2004-12-16	2004-12-16						
			Sample ID:	Production Well	Dore Pit						
PARAMETER	**UNITS**	**MDL**							**TYPE**	**LIMIT**	**UNITS**
Chloride	mg/L	1		16	34						
Conductivity	uS/cm	5		896	764						
TDS (COND - CALC)	mg/L	5		582	497						
Sodium	mg/L	2		9	11						
Barium	mg/L	0.01		0.08	0.04						
Boron	mg/L	0.01		0.03	0.02						
Iron	mg/L	0.01		2.29	0.17						
Manganese	mg/L	0.01		0.29	<0.01						

MDL = Method Detection Limit INC = Incomplete AO = Aesthetic Objective OG = Operational Guideline MAC = Maximum Allowable Concentration IMAC = Interim Maximum Allowable Concentration
Comment:

APPROVAL:
Ewan McRobbie
Inorganic Lab Supervisor

Client: **Sauriol Environmental Inc.**
134 St. Paul St. P.O. Box 7181
Vanier, ON
K1L 8E3
Attention: **Mr. Jacques Sauriol**

Report Number: 2424328
Date: 2004-12-23
Date Submitted: 2004-12-17

Project: P04-08

P.O. Number:
Matrix: Water

			LAB ID:	361601	361602				GUIDELINE		
			Sample Date:	2004-12-16	2004-12-16						
			Sample ID:	Production Well	Dore Pit						
PARAMETER	**UNITS**	**MDL**							**TYPE**	**LIMIT**	**UNITS**
BTEX											
Benzene	ug/L	0.5		<0.5	<0.5						
Ethylbenzene	ug/L	0.5		<0.5	<0.5						
Toluene	ug/L	0.5		<0.5	<0.5						
m/p-xylene	ug/L	1.0		<1.0	<1.0						
o-xylene	ug/L	0.5		<0.5	<0.5						
BTEX SURROGATES											
Toluene-d8	%			99	99						
Total Petroleum Hydrocarbons											
GRO (<C10)	mg/L	0.2		<0.2	<0.2						
DRO (C10-C24)	mg/L	0.2		<0.2	0.2						
GRO + DRO	mg/L	0.2		<0.2	0.2						

MDL = Method Detection Limit INC = Incomplete AO = Aesthetic Objective OG = Operational Guideline MAC = Maximum Allowable Concentration IMAC = Interim Maximum Allowable Concentration
Comment:

APPROVAL:
Mina Nasirai
Organic Lab Supervisor

Client: **Sauriol Environmental Inc.**
134 St. Paul St. P.O. Box 7181
Vanier, ON
K1L 8E3
Attention: **Mr. Jacques Sauriol**

Report Number: 2424327
Date: 2004-12-23
Date Submitted: 2004-12-17

Project: P04-08

P.O. Number:
Matrix: Water

			LAB ID:	361592	361593	361594	361595	361596	GUIDELINE		
			Sample Date:	2004-12-16	2004-12-16	2004-12-16	2004-12-16	2004-12-16			
			Sample ID:	PZ-29	PZ-30	Patenaude	PZ-18	PZ-16			
PARAMETER	UNITS	MDL							TYPE	LIMIT	UNITS
Chloride	mg/L	1		42	21	13	5	20			
Conductivity	uS/cm	5		684	368	338	688	649			
N-NO3 (Nitrate)	mg/L	0.10		<0.10							
TDS (COND - CALC)	mg/L	5		445	239	220	447	422			
Sodium	mg/L	2		9	9	7	6	7			
Barium	mg/L	0.01		0.08	0.10	0.14	0.04	0.05			
Boron	mg/L	0.01		0.02	0.12	0.11	0.02	0.03			
Iron	mg/L	0.01		0.04	0.11	0.13	1.43	1.40			
Manganese	mg/L	0.01		0.02	0.03	<0.01	0.23	0.27			

MDL = Method Detection Limit INC = Incomplete AO = Aesthetic Objective OG = Operational Guideline MAC = Maximum Allowable Concentration IMAC = Interim Maximum Allowable Concentration
Comment:

APPROVAL:
Ewan McRobbie
Inorganic Lab Supervisor

Client: **Sauriol Environmental Inc.**
134 St. Paul St. P.O. Box 7181
Vanier, ON
K1L 8E3
Attention: **Mr. Jacques Sauriol**

Report Number: 2424327
Date: 2004-12-23
Date Submitted: 2004-12-17

Project: P04-08

P.O. Number:
Matrix: Water

			361597	361598	361599	361600		GUIDELINE		
			2004-12-16	2004-12-16	2004-12-16	2004-12-16				
			Schoeni	PZ-27	PZ-28	PZ-8				
PARAMETER	**UNITS**	**MDL**						**TYPE**	**LIMIT**	**UNITS**
Chloride	mg/L	1	3	7	12	22				
Conductivity	uS/cm	5	264	161	144	589				
N-NO3 (Nitrate)	mg/L	0.10			<0.10					
TDS (COND - CALC)	mg/L	5	172	105	94	383				
Sodium	mg/L	2	20	21	11	8				
Barium	mg/L	0.01	0.09	0.11	0.03	0.08				
Boron	mg/L	0.01	0.18	0.07	0.03	0.02				
Iron	mg/L	0.01	0.10	0.01	<0.01	0.06				
Manganese	mg/L	0.01	<0.01	0.03	0.01	0.03				

MDL = Method Detection Limit INC = Incomplete AO = Aesthetic Objective OG = Operational Guideline MAC = Maximum Allowable Concentration IMAC = Interim Maximum Allowable Concentration
Comment:

APPROVAL:
Ewan McRobbie
Inorganic Lab Supervisor

APPENDIX B

TOWNSHIP MONITORING RESULTS
EMBRUN WELL MONITORING PROGRAM

ANNUAL SUMMARY - RAW WATER FLOWS

WATER WORKS NAME: EMBRUN WTP
YEAR: 2004
SERVICED POPULATION: 5145
DESIGN CAPACITY: 6000

MONTH	WELL #2		
	AVERAGE DAY (1000 m3)	MAXIMUM DAY (1000 m3)	MONTHLY TOTAL (1000 m3)
JAN	2.51	3.23	77.75
FEB	2.49	2.82	72.25
MAR	2.68	3.09	83.20
APR	2.59	3.44	77.81
MAY	2.92	3.75	90.62
JUN	3.01	3.51	90.41
JUL	2.67	3.56	82.78
AUG	2.70	3.19	83.78
SEP	2.66	3.38	79.91
OCT	2.41	3.38	74.64
NOV	2.69	2.88	80.73
DEC	2.39	3.04	9.00
TOTAL			902.88
AVERAGE	2.64		75.24
MAXIMUM		3.75	90.62

WELL #1 NOT IN OPERATION

Client: **Township of Russell**
717 Notre Dame
Embrun, ON
K0A 1W1
Attention: **Mr. Craig Cullen**

Report Number: 2310179
Date: 2003-07-14
Date Submitted: 2003-07-07

Project: Chemicals- Not Reportable Embrun
P.O. Number:
Matrix: Water

	LAB ID:	258931					GUIDELINE		
	Sample Date:	2003-07-07					MOE REG 170/03		
	Sample ID:	Embrun Clearwell (treated)							
PARAMETER	**UNITS**	**MDL**					**TYPE**	**LIMIT**	**UNITS**
Alkalinity as CaCO3	mg/L	5	193				OG	500	mg/L
Chloride	mg/L	1	21				AO	250	mg/L
Conductivity	uS/cm	5	948						
Dissolved Organic Carbon	mg/L	0.5	1.1				AO	5.0	mg/L
N-NH3 (Ammonia)	mg/L	0.02	<0.02						
N-NH3 (unionized)	mg/L	0.02	<0.02						
pH			7.73				AO	6.5-8.5	
Sulphate	mg/L	1	268				AO	500	mg/L
TDS (COND - CALC)	mg/L	5	616				AO	500	
Total Kjeldahl Nitrogen	mg/L	0.05	0.13						
Hardness as CaCO3	mg/L	1	478				OG	100	mg/L
Calcium	mg/L	1	150						
Magnesium	mg/L	1	25						
Copper	mg/L	0.001	0.004				AO	1.0	mg/L
Iron	mg/L	0.01	0.04				AO	0.30	mg/L
Manganese	mg/L	0.005	0.007				AO	0.05	mg/L
Aluminum	mg/L	0.01	<0.01				OG	0.10	mg/L
Zinc	mg/L	0.005	0.018				AO	5.0	mg/L

MDL = Method Detection Limit INC = Incomplete AO = Aesthetic Objective OG = Operational Guideline MAC = Maximum Allowable Concentration IMAC = Interim Maximum Allowable Concentration

Comment:

APPROVAL: _____
Peter Haulena
Analytical Services Manager

::

EMBRUN/MARIONVILLE WTP DAILY IN-HOUSE TESTING - 2004

RAW WATER		COLOUR	PH	TEMP	FE	MN	FL	TUR
JAN		3	7.2	9	2.65	0.403		0.24
FEB		3	7.2	9	2.67	0.411		0.22
MAR		3	7.2	9	2.70	0.405		0.24
APR		2	7.2	9	2.67	0.402		0.21
MAY		1	6.9	9	2.60	0.392		0.23
JUN		2	7.2	9	2.55	0.383		0.20
JUL		2	7.2	9	2.62	0.372		0.26
AUG		2	7.2	11	2.62	0.374		0.23
SEP		2	7.2	9	2.43	0.486		0.25
OCT		2	7.2	9	2.51	0.374		0.22
NOV		2	7.2	10	2.71	0.378		0.19
DEC		2	7.2	9	2.65	0.374		0.09
AVG		2	7.2	9	2.61	0.396		0.22

CLEAR WELL		COLOUR	PH	TEMP	FE	MN	FL	TUR MIN	TUR MAX	CL^2 TOTAL	CL^2 FREE MIN	CL^2 FREE MAX	PWW
JAN		0	7.2	9	0.03	0.017		0.04	0.16	0.67	0.34	0.69	2397
FEB		0	7.2	9	0.03	0.019		0.05	0.15	0.72	0.36	0.69	2520
MAR		1	7.2	9	0.04	0.020		0.04	0.15	0.65	0.39	0.59	2595
APR		0	7.2	9	0.05	0.018		0.05	0.18	0.64	0.25	0.57	2337
MAY		0	7.2	9	0.07	0.023		0.07	0.35	0.65	0.39	0.59	2595
JUN		0	7.2	9	0.06	0.032		0.06	0.25	0.65	0.31	0.90	2807
JUL		0	7.2	9	0.07	0.023		0.07	0.21	0.70	0.29	1.04	2896
AUG		0	7.2	9	0.06	0.020		0.06	0.18	0.65	0.30	0.68	2723
SEP		0	7.2	9	0.05	0.023		0.03	0.40	0.67	0.36	0.62	2661
OCT		0	7.2	9	0.04	0.017		0.02	0.13	0.71	0.36	0.67	2372
NOV		0	7.2	9	0.04	0.017		0.02	0.15	0.66	0.33	0.55	2587
DEC		0	7	9	0.03	0.017		0.03	0.12	0.63	0.31	0.54	2478
AVG		0	7.2	9	0.05	0.020		0.05	0.20	0.67	0.33	0.68	30,768

EMBRUN/MARIONVILLE WTP DAILY IN-HOUSE TESTING - 2004

EMBRUN DISTRIBUTION		COLOUR	PH	TEMP	FE	MN	FL	TUR MIN	TUR MAX	CL^2 TOTAL	CL^2 FREE MIN	CL^2 FREE MAX
JAN		0	7.2	6				0.06	0.16	0.65	0.32	0.59
FEB		1	7.2	6				0.05	0.12	0.77	0.46	0.74
MAR		0	7.2	7				0.05	0.12	0.71	0.39	0.70
APR		1	7.2	9				0.08	0.17	0.72	0.41	0.73
MAY		0	7.2	10				0.09	0.29	0.78	0.42	0.75
JUN		1	7.0	13				0.07	0.40	0.70	0.31	0.79
JUL		0	7.2	14				0.09	0.21	0.70	0.33	0.60
AUG		0	7.2	15				0.09	0.18	0.63	0.29	0.75
SEP		1	7.2	15				0.07	0.40	0.64	0.28	0.62
OCT		0	7.2	12				0.06	0.13	0.65	0.34	0.62
NOV		0	7.2	11				0.06	0.19	0.67	0.39	0.66
DEC		0	7.2	9				0.05	0.19	0.72	0.34	0.67
AVG		0	7.2	11				0.07	0.21	0.69	0.36	0.70

MARIONVILLE DISTRIBUTION		COLOUR	PH	TEMP	FE	MN	FL	TUR MIN	TUR MAX	CL^2 TOTAL	CL^2 FREE MIN	CL^2 FREE MAX
JAN		0	7.2	5				0.05	0.11	0.78	0.47	0.73
FEB		0	7.2	6				0.05	0.05	0.85	0.53	0.88
MAR		0	7.2	7				0.05	0.14	0.82	0.52	0.76
APR		1	7.2	9				0.08	0.15	0.79	0.49	0.69
MAY		0	7.2	11				0.08	0.40	0.82	0.48	0.78
JUN		0	7.0	13				0.07	0.19	0.75	0.44	0.70
JUL		0	7.2	14				0.05	0.18	0.72	0.40	0.87
AUG		0	7.2	15				0.04	0.04	0.75	0.43	0.72
SEP		0	7.2	14				0.06	0.30	0.65	0.33	0.58
OCT		1	7.2	12				0.06	0.16	0.76	0.43	0.70
NOV		1	7.2	11				0.05	0.19	0.76	0.40	0.74
DEC		0	7.2	8				0.05	0.15	0.79	0.45	0.72
AVG		0	7.2	11				0.06	0.17	0.77	0.45	0.74

ANNUAL SUMMARY - RAW WATER BACTERIOLOGICAL DATA

WATER WORKS NAME: EMBRUN
YEAR: 2004
SERVICED POPULATION: 5145
LABORATORIES WHICH PERFORMED ANALYSES: ACCUTEST LABORATORIES

MONTH	TOTAL COLIFORM				FECAL COLIFORM/ESCHERICHIA COLI		
	NO. OF SAMPLES COLLECTED	NO. OF SAMPLES 1-100 ORG./100ml	NO. OF SAMPLES 101-5000 ORG./100ml	NO. OF SAMPLES > 5000 ORG./100 ml	NO. OF SAMPLES 1-10 ORG./100ml	NO. OF SAMPLES 11-500 ORG./100ml	NO. OF SAMPLES >500 ORG./100 ml
JAN	4	0	0	0	0	0	0
FEB	4	0	0	0	0	0	0
MAR	5	0	0	0	0	0	0
APR	4	0	0	0	0	0	0
MAY	5	0	0	0	0	0	0
JUN	4	0	0	0	0	0	0
JUL	4	1	0	0	0	0	0
AUG	5	0	0	0	0	0	0
SEP	4	0	0	0	0	0	0
OCT	4	0	0	0	0	0	0
NOV	5	0	0	0	0	0	0
DEC	4	0	0	0	0	0	0
TOTAL	52	1	0	0	0	0	0

APPENDIX C

PROPOSED WORK PLAN (2005)
EMBRUN WELL MONITORING PROGRAM

YEAR 2005

Objectives:
Continued monitoring the hydraulics and water quality of aquifer with the Embrun Well Monitoring Program.

Hydraulics:

- Obtain logs and integrate the Robinson's piezometers located to the north and west of the well head
- Measure Spring (May) and Fall (October) depth to water level survey in PZ8, PZ13, PZ16, PZ 18, PZ27, PZ28, PZ29, PZ30, 00-1, 00-2, 00-3 and 00-4.
- Analyze spatial and transient water level trends

Water Quality:

- Collect water quality samples at PZ8, PZ13, PZ16, PZ 18, PZ27, PZ28, PZ29, PZ30, 00-1, 00-2, 00-3 and 00-4. both Patenaude and Schoeni residences in the spring and fall. Analyze for parameters of Cl, TDS, Ba, B, Fe, Mn and Na).
- Run BTEX + TPHs gas and diesel in PZ16 production well and Dore Lake water to firm up the concentration trend
- Analyze spatial and transient water quality trends.

Option:
Consideration should be given to the sounding and possibly abandonment and replacement of PZ 29 and 30, farther on the edge of the road allowance of Catherine Road.