GROUNDWATER IMPACT ASSESSMENT

NON-STANDARD SEPTIC SYSTEM

ST-BERNARDIN SEWAGE WORKS PROJECT
TOWNSHIP OF CALEDONIA

Report prepared for Lascelles Engineering Ltd
Report prepared by Sauriol Environmental Inc
Our file No. 9516
Date: August 1995

SAURIOL
ENVIRONMENTAL Inc.
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CONTAMINANT HYDROGEOLOGY
ENVIRONMENTAL STUDIES
WATER SUPPLY HYDROGEOLOGY

HYDROGÉOLOGIE DES POLLUANTS
ETUDES D'IMPACT
HYDROGÉOLOGIE DE L'APPROVISIONNEMENT EN EAU

August 14 1995

Lascelles Engineering Ltd
870 St-James Street
Hawkesbury, Ontario K6A 2W8

Attn.: Mr. Gaetan Lascelles; President

Re: Groundwater Impact Assessment
Non-Standard Septic System
St-Bernardin Sewage Works Project
Township of Caledonia; Our File: 9516

Dear Gaetan

Further to the DS Lea letter (spring 1995) and your letter dated June 9 1995, we are pleased to present five copies of our report on the groundwater impact assessment for the St Bernardin revised Non-Standard Septic System.

Our work consisted in the simulation of the hydraulic mounding and the nitrate loading from a Class IV Septic System on the groundwater environment. The primary leaching bed and a spare area leaching bed are oriented perpendicular to the shallow groundwater flow direction. Both the primary and spare beds are located to the east of the calculated groundwater divide, to maximize the confinement of the flow in the Eastern direction. Because the primary bed is located downgradient of the spare bed, the assessment was completed on the spare bed (i.e. the closest to the groundwater divide). The revised model parameters were 25,500 litres of design effluent loading per day, of which 2,000 litres is sewer infiltration. An input concentration of 36.9 mg/litre nitrate was used as the source. Personal communication with the project engineer indicated a leaching bed loading area of more than 7,500 m2 (i.e. mantle excl.). The loading rate will be less than 3.4 litres per m2.

The computed hydraulic mound was estimated at 1.6 m above the seasonal high water level (i.e. 65.3 m geodetic). A particle tracking analysis indicates that the bulk of the flux will remain within the eastern drainage basin. Nitrate loading to the nearby Noname Creek is estimated to be in the order of 30 mg/L. The elevated organic matter in the low lying area and within the bottom of the creek (i.e. 0.22% foc) will undergo de-nitrification. No excessive nitrate loading to the creek is anticipated.

It is recommended that the top soil be removed below the bed area, and that the bottom elevation of the tiles be located at least 0.5 m above the calculated maximum hydraulic mound. Any existing buried agricultural drainage tiles need to be located and removed from the mound influence area of the leaching bed. The proponent will need to acquire the lands or at least the ground water rights of the contaminant attenuation zone. The land sale agreement (or at least a written confirmation of the intent of the present owner to sell his land or his rights) should be included with the submission to the Regulators.

Trusting that the contents of the report is to your satisfaction. We remain available to review its contents with you at your convenience.

Yours Very Truly
Sauriol Environmental Inc

Jacques Sauriol M.Sc.
President

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ST BERNARDIN SEWAGE WORK PROJECT
HYDROGEOLOGICAL IMPACT ASSESSMENT

1.0 OBJECTIVE:

The objective of the present work consists in the assessment of the groundwater impact of the proposed St Bernadin proposed Sewage Works. The simulation of the impact on the groundwater is made of two components, namely the impact due to the hydraulic mounding and the impact due the to the nitrate loading of the leaching bed .

1.1 PREVIOUS WORK AND TERRAIN ANALYSIS:

A terrain analysis of the property was completed by Lascelles Engineering Ltd in June 1995 (Appendix A). Other previous pertinent works include several hydrogeological report by Geo-analysis inc, specifically the February 1992 report. The reader is referred to these reports for detailed hydrostratigraphy of the property. It described a 0.5 - 1.0 metre thick fine to medium grained silty sand overlying 0.6 to 2.6 metres of fine sandy silt, over a thick sequence (30 metres) of marine clays over Paleozoic bedrock. Grain size analyses, hydraulic conductivity and percolation tests were completed. The shallow unconfined water table aquifer flows easterly towards a small creek (Noname Creek), tributary of Caledonia Creek (Figure 1). The seasonal high water table is estimated at 0.8 metres below the ground surface of the plateau.

1.2 THE SEPTIC SYSTEM CONCEPT:

The residences of Hamlet of St Bernardin are supplied with water by a combination of shallow dug wells, deep bedrock wells and cisterns, with sometimes two of the above on the same lot. Individual sub-standard septic systems are proposed to be replaced by a communal sewage works because of the restrictive existing lot size in the core of the Hamlet. The reader is referred to the engineering documents (i.e. Lascelles Engineering Ltd) for details on the proposed system.

Both a primary and a spare bed are proposed. The spare bed is located to the westernmost location, closest to the groundwater divide. The long axis of the leaching bed is located perpendicular to the shallow groundwater flow (ref. Lascelles Engineering Plan L85-1). The size of one bed is slightly in excess of 50 metres by 150 metres, equal to a surface area exceeding 7,500 square metres.

The design effluent was provided by Lascelles Engineering Ltd to be 25.5 cubic metres per day, of which 2 m3 are attributed to sewer infiltration. The design rate yields an effluent loading rate of approximately 3.4 litres per square metre of bed (refer to the Engineering report for details). Design input effluent concentration is calculated at 36.9 mg/L NO_3.

2.0 MODEL CONCEPTUALIZATION:

The modelling work has two activities, namely a flow solution and a transport solution. The modelling objective of the flow solution is "predictive" and was calibrated to measured heads and Creek base flow. The modelling objective of the transport solution is interpretative, since no site specific calibration target is available for this system.

A 2-D model was set to represent the stratigraphic units of the site. It consists of a 10 m thick layer with a bulk hydraulic conductivity of 9 EXP -4 cm/sec and a specific yield of 0.3. Initially a regional model was discretized and solved for flow for the St-Bernardin Hamlet Plateau. The flow solution was run with MODFLOW under steady state condition. A reasonable match of head distribution and creek base flow was achieved. A 6 percent infiltration recharge and a series of drain reaches were the initial inflow and outflow of water to the system. Subsequently a zoomed model was build as a subregion of the regional model. Located within the proposed leaching bed area, the spatial discretization provided a better resolution. A series of transient simulations were run for up to 2 years to ensure the stability of the pre-stressed conditions (Figure 2). Subsequently, the effect of the leaching hydraulic loading was added on to the system. The effect of the mounding of the bed was noted.

A transient 3D model was completed over the leaching bed area to refine the maximum elevation of the mound. A three layer model was built including sand over silt over clay stratigraphic units.

A particle tracking analysis (PATH3D) was also completed on the zoomed 2-D model for a transient 20 year period. This was completed to ascertain the advection (flow path) properties of the flow system.

Finally additional transient simulation runs were completed with the code MT3D to evaluate the nitrate concentrations to the edge of property and to outline the contaminant attenuation zone. A breakthrough curve was provided to assess the temporal migration behaviour of the nitrate plume.

2.1 MODEL INPUT PARAMETERS

MODFLOW, PATH3D and MT3D hydrogeological codes were used to simulate the impact of the new bed on the groundwater environment. The hydraulic mounding calculation was completed by using the design flow rate of 25.5 m3/day loaded over 7,500 m2 of the bed surface area, for the spare bed. The mounding impact is believed to be similar for the primary bed area. Mounding model design and assumptions are provided in Table 1. Nitrate loading model design and assumptions are provided in Table 2.

It was demonstrated in previous reports, that a thickness of more than 30 metres of marine clay was present in the area, and that this layer would isolate any underlying bedrock or basal gravel aquifers. It was also established that the receiving small water course located within the Eastern limit of the property is flowing towards the North.

2.2 RESULTS, HYDRAULIC MOUNDING:

The result of the hydraulic mounding is summarized in Table 3. Several one, two, ten and twenty-year-transient simulation runs were performed and indicated that quasi steady state head conditions were reached after two year of simulation. The maximum mounding for the proposed bed area, using 25.5 m3/day, was evaluated at 1.6 metres above the seasonally high water table, for both the 2-D and 3-D models (Figure 3). Because the seasonal high water table is located at approximately 0.8 metres below the ground surface near the primary leaching bed area (i.e. 63.7 m geodetic), the maximum mound will be higher than the ground surface (i.e. 64.5 m geodetic). The maximum rise of the water table will be 65.3 m geodetic. It is anticipated that the resulting hydraulic mound for the primary area is of similar magnitude (i.e. 1.6 metres above the seasonal high water table), but the foot print of the mound is displaced to the East of the primary bed. The horizontal spreading of the mound should be noted. This will have implication to the sizing of the mantle.

The advective assessment of the system is illustrated in Figure 4. It shows that the bulk of the flow is Eastward, with a minor component to the West. This westward flux is caused by the shift of the water divide due to the loading of the leaching bed. This will also have implication to the outline of the Contaminant Attenuation Zone.

2.3 RESULTS, NITRATE LOADING:

The results of the nitrate loading are summarized in Table 3. When using 25.5 m3/day @ 36.9 mg/L NO3-N for loading, the proposed bed generates approximately 30. mg/L nitrate at the creek, when using advective dispersion as the attenuation process (Figure 5). A breakthrough curve was generated at a fictitious observation well located near the Noname Creek. It shows that between 8 and 16 years will be required for the plume to reach the discharge point (Figure 6). It is anticipated that the primary area, being located closer to the Noname Creek, will yield approximately 40. mg/L nitrate NO3-N at the creek. Towards to west of the spare bed, the reasonable use criteria of 4.7 mg/L NO3 was reached at 145 metres from the centre of the primary bed. This 20 year transient simulation yielded a quasi steady state situation.

It should be noted that a strip of land between the beds and the Noname Creek is on private property. A Contaminated Attenuation Zone is therefore required, in order that the proponent controls the land (or its groundwater) impacted by the proposed septic system.

In addition to the advective dispersion processes, the nitrate plume will undergo some retardation within its flow path before its discharge to the surface water. Organic contents of the sand aquifer (Geo-analysis 1992) will enhance denitrification before the groundwater reaches the Noname Creek. In addition, the elevated organic matter in the Creek bottom (i.e. 0.22% foc) will undergo further denitrification before effluent discharges to the surface water. Previous conversations on other projects with Bruce Metcalfe of the MOEE in Kingston indicated that he was prepared to entertain the denitrification argument documented in the Muskoka experience (eg Robertson and Cherry 1990), where the organic contents of the stream bottom muck caused the drastic reduction of nitrate to the 2.5 mg/L NO3-N level.

2.4 SENSITIVITY ANALYSIS:

The control of numerical solutions is provided by the review of a series of error criterion. The grid size criteria Peclet Number varies between 3 and 5, and is indicative of a transport regime between advection dominated and dispersion dominated systems. Because there is no dominant process, the Hybrid Method of Characteristic (HMOC) numerical solution is hence appropriate as a scheme to solve the advection package. The Courant Number (Percel) controlling the transport step size, was set as 1, and is perceived acceptable given the selection of the HMOC scheme. The volumetric discrepancy of the flow solution was less than 0.0 percent. This water balance error criterion is considered acceptable. The volumetric discrepancy of the transport solution was 4. percent. This mass balance error criterion is also considered acceptable (Appendix B).

The simulated impact is sensitive to the hydraulic conductivity, recharge and the dispersivity values. The calibrated model does not represent a unique solution, but it is believed to best represent the known existing site conditions, because of the flux calibration target to the drain.

A sensitivity analysis was conducted while performing the model calibration. Selected model input parameters were varied and the effects were noted.

3.0 CONCLUSIONS AND RECOMMENDATIONS:

Our work consisted in the simulation of the hydraulic mounding and the nitrate loading from a Class IV Septic System on the groundwater environment. The primary leaching bed and a spare area leaching bed are oriented perpendicular to the shallow groundwater flow direction. Both the primary and spare beds are located to the east of the calculated groundwater divide, to maximize the confinement of the flow in the Eastern direction. Because the primary bed is located downgradient of the spare bed, the assessment was completed on the spare bed (i.e. the closest to the groundwater divide).

The revised model parameters were 25,500 litres of design effluent loading per day, of which 2,000 litres is sewer infiltration. An input concentration of 36.9 mg/litre nitrate was used as the source. Personal communication with the project engineer indicated a leaching bed loading area of more than 7,500 m2. The loading rate will be less than 3.4 litres per m2.

The computed hydraulic maximum mound was estimated at 1.6 m above the seasonal high water level. A particle tracking analysis indicates that the bulk of the flux will remain within the eastern drainage basin. Nitrate loading to the nearby Noname Creek is estimated to be in the order of 30 mg/L. The elevated organic matter in the low lying area and within the bottom of the creek will undergo de-nitrification. No excessive nitrate loading to the creek is anticipated.

It is recommended that

a) the layer of 0.1 to 0.3 metres thick top soil should be removed with light equipment in the area of the foot print of the leaching bed
b) the proposed leaching bed should be located perpendicular to the shallow groundwater flow
c) the leaching bed should be constructed as a raised tile bed; the bottom elevation of the tiles should be located at least 0.5 m above the seasonal maximum hydraulic mound of 1.6 m (i.e. 63.7 + 1.6 + 0.5 = 65.8 m geodetic)
d) an oversized mantle should be provided around the leaching bed, in order to contain the hydraulic mound
e) Any existing buried drainage tiles need to be located and removed from the mound influence area of the leaching bed.
f) The proponent will need to acquire the land (or at least the groundwater rights) for the strip of land between the back field and the Noname Creek. The land sale agreement (or at least a written confirmation of the intent of the present owner to sale his land or his rights) should be included with the submission.

TABLE 1 FLOW SOLUTION DESIGN & ASSUMPTIONS

Model MODFLOW (SSPA's MODF)

Q = 25.5 m3/day over 7,500 m2 of leaching bed

Effluent loading rate 3.4 L/m2

REGIONAL MODEL
50 rows @ 25 metres * 40 columns @ 25 metres = 1250m * 1000m

uniformly spaced grids

boundaries
no flow boundary for north and south
DRAIN (head dependant)
underlying clay surface = no flow boundary

One layer 10 m thick unconfined, constant hydraulic conductivity, isotropic in the horizontal plane; vertical anisotropy ratio of 0.1

Specific yield 0.3

precipitation recharge 6 % of annual Precipitation of 0.84 m/yr

model calibration steady state run

calibration targets
groundwater elevation of spring 1995 (Lascelles 1995)
Noname Creek measured flux for the concerned reach (104 m3/day)
For one contributing side of the Noname Creek = 52 m3/day
Drain water balance = 6300 m3/yr / 365 days / 5 reaches =
35 m3/day; hence similar order of magnitude.

ZOOMED MODEL

Grid	60 @ 9.1m * 60 @ 15.4 m
Model	MODFLOW
Transient analyses	1,2,10 an 20 years runs
Starting heads	as per boundaries of regional model
Sink sources	4 closest private wells; Q = -0.3 m3/day/well
	infiltration recharge
	Leaching bed loading recharge 3 wells @ 8.5 m3/day/well
	Drain M factor 1.5
	Conductance 0.5 - 0.6 m2/day/cell
	manual check 15.4 0.5 0..3 / 0.3 = 0.7 m2/day

3 layer model to refine maximum mound

PATH3D
No of particle 10 on top of cell
cells of 3 injection wells + few control wells upgradient of leaching bed

TABLE 2 TRANSPORT SOLUTION MODEL DESIGN & ASSUMPTIONS

Model MT3D

Q = 25.5 m3/day

NO3-N input 36.9 mg/L (23.5 M3/DAY * 40 MG/L / 25.5) to account for the dilution due to the sewer infiltration

NO3-N background 3.0 mg/L

same grid as MODFLOW's zoomed model

same boundary conditions as MODFLOW' zoomed model

Advection, dispersion and sink source packages

Longitudinal dispersivity 3.0 m
Th ratio 1.0m
Tv ratio 0.1m

Observation wells for breakthrough curve adjacent to drain

20 year runs used for nitrate loading solution

TABLE 3 SUMMARY OF RESULTS

Flow solution:	1.6 m above seasonal high water table 1.6 + 63.7 = 65.3 M geodetic reached near the end of year two Wide spread of mound
Particle tracking	bulk of advective flow to the East Some flow component to the West
Transport Solution	Low dispersive plume Eastward, reached Noname Creek in 8 to 16 years at maximum concentration of 30 mg/L NO3 A slower westward plume component of the plume reaches the Reasonable Use Criteria of 4.7 mg/L at ca. 145 m from the center of the primary bed

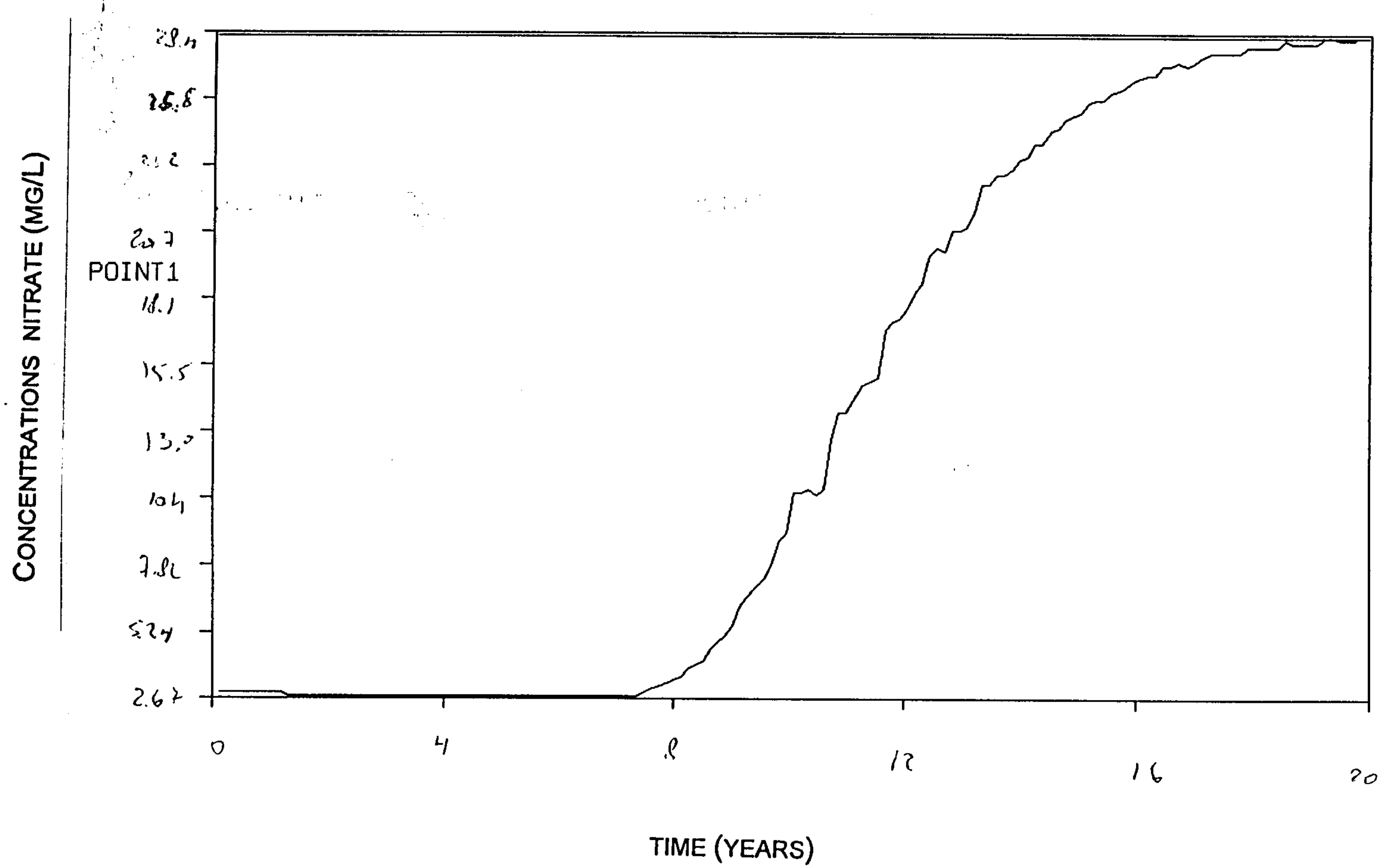

FIGURE 6 BREAKTHROUGH CURVE
NEAR NONAME CREEK

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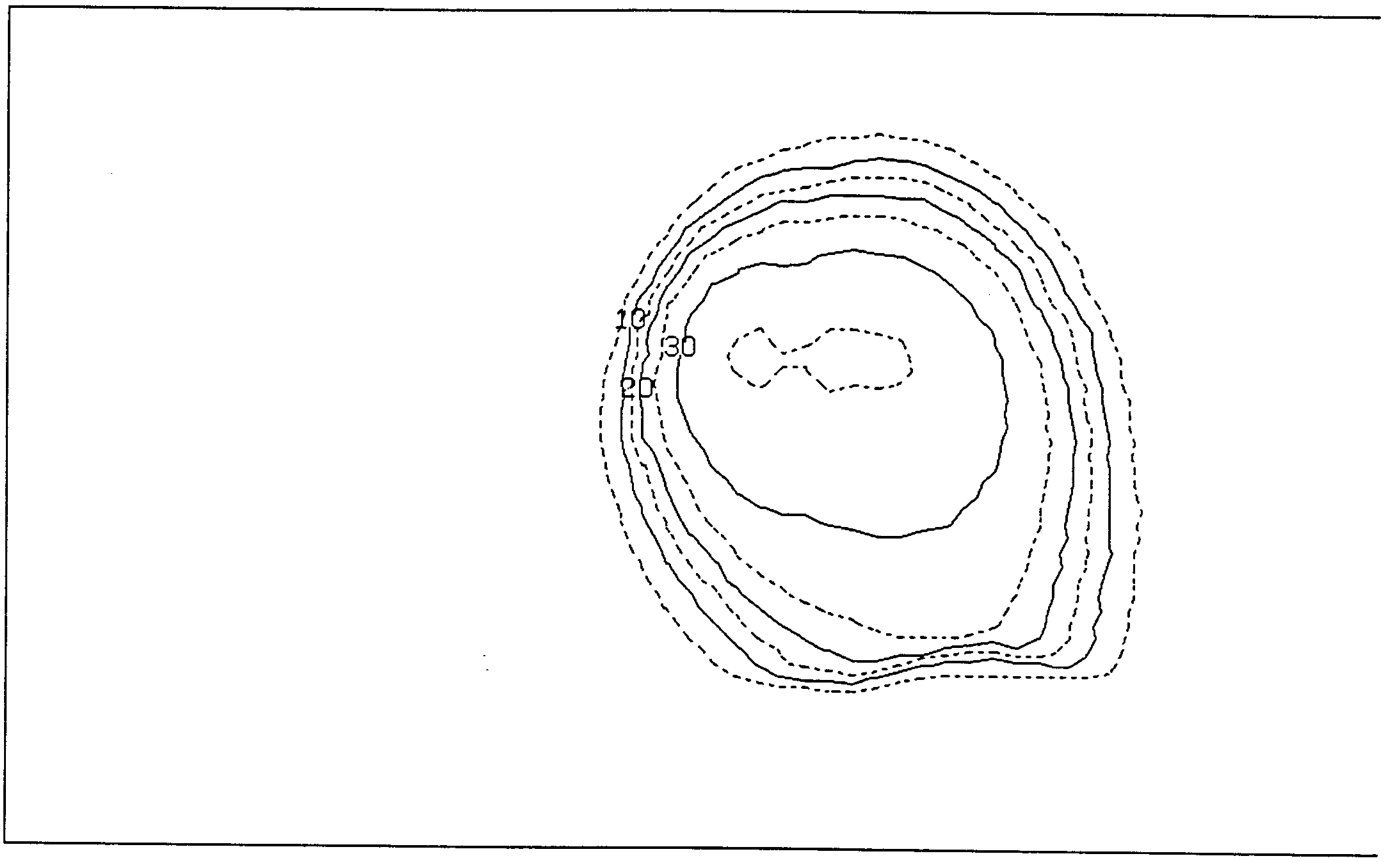

x[0.0: 923.8], y[0.0: 547.7], Layer: 1

FIGURE 5: TRANSPORT SOLUTION; NITRATE CONCENTRATION MG/L
ZOOMED MODEL; TRANSIENT 20 YEARS

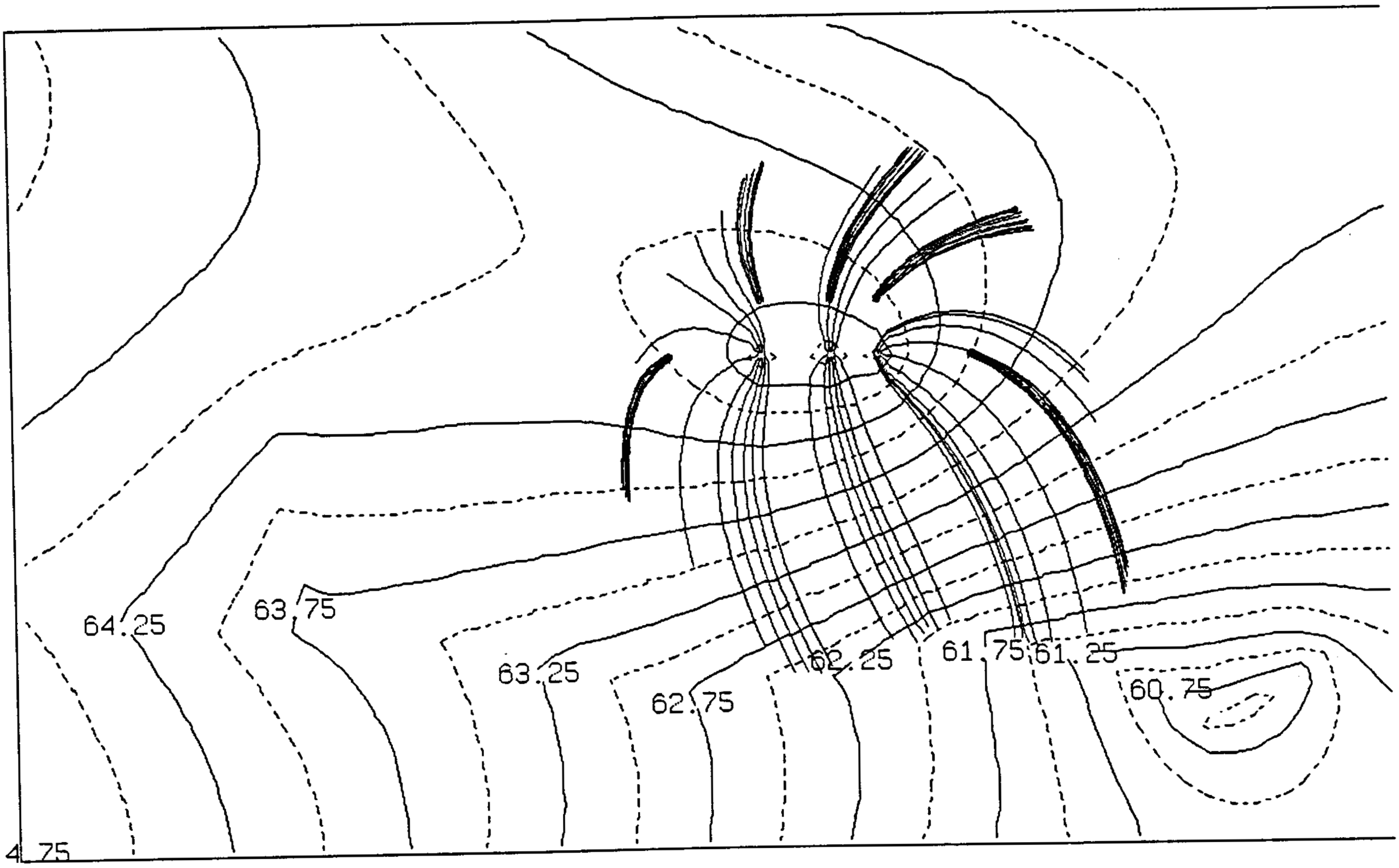

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FIGURE 4: PARTICLE TRACKING; LEACHING BED LOADING
ZOOMED MODEL; TRANSIENT 20 YEARS

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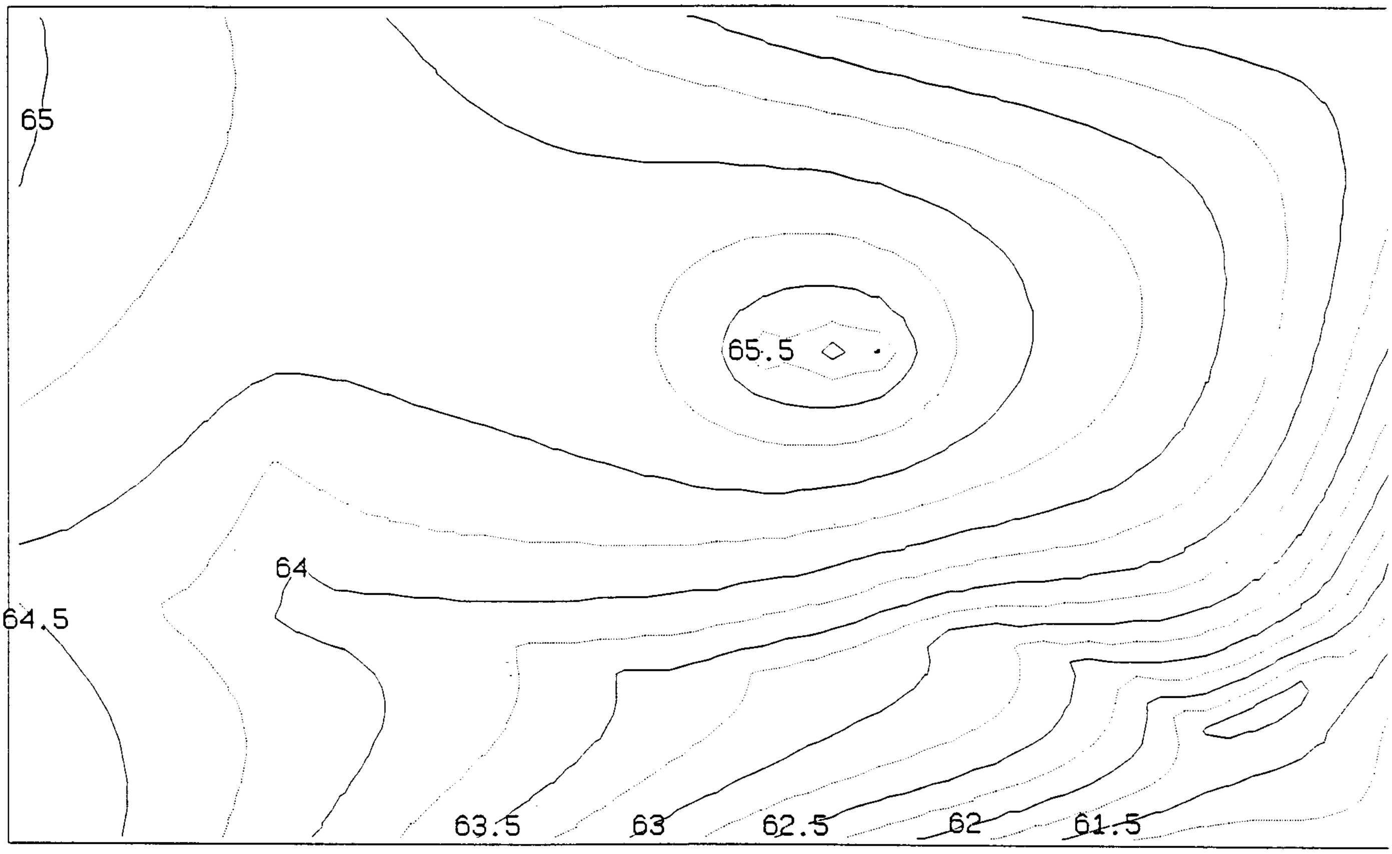

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FIGURE 3: HEAD DISTRIBUTION LEACHING BED LOADING
ZOOMED MODEL; TRANSIENT 20 YEARS

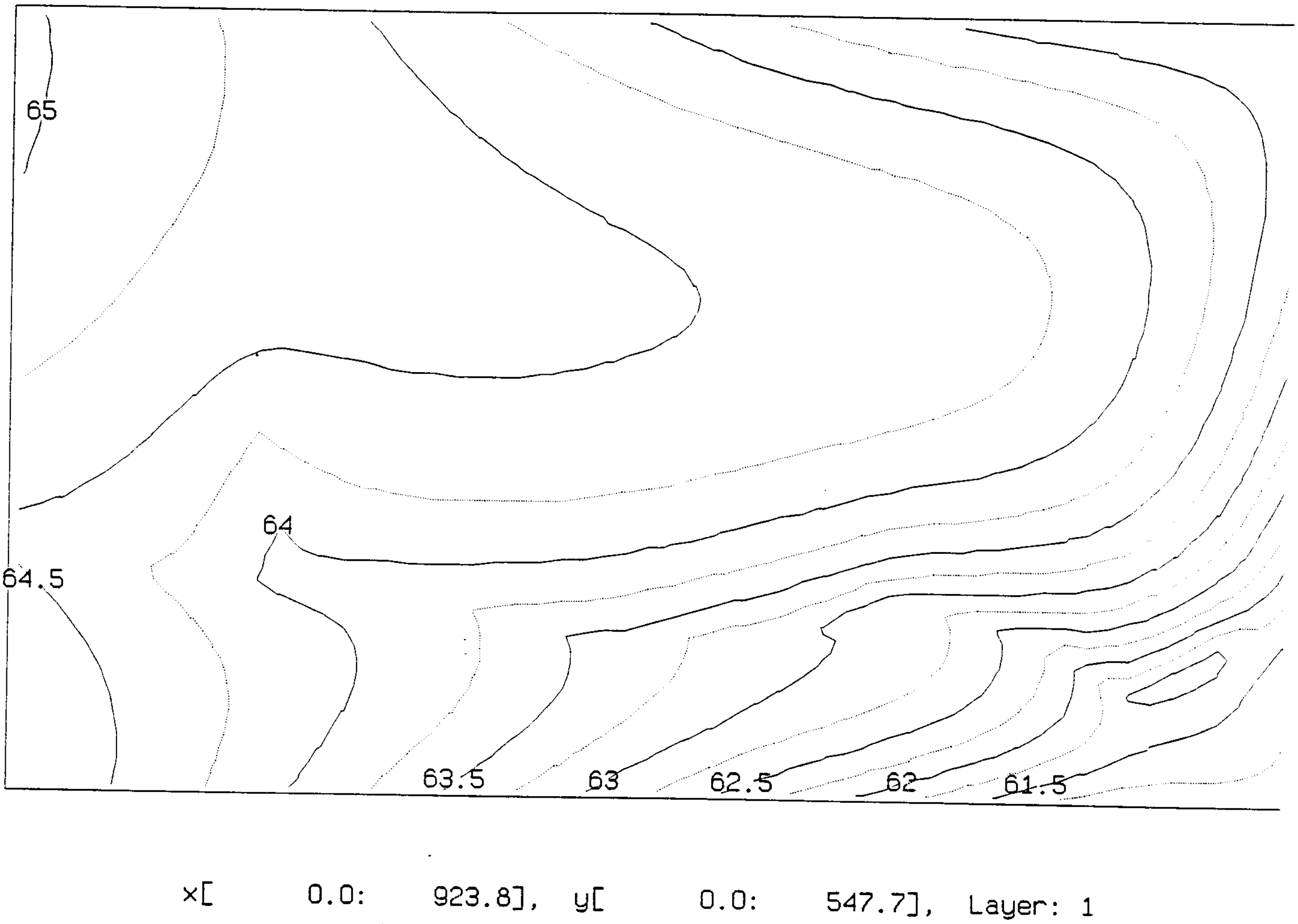

FIGURE 2: HEAD DISTRIBUTION PRE-STRESSED CONDITIONS
ZOOMED MODEL; TRANSIENT 1 YEAR

FIGURE 1: SITE PLAN

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APPENDIX A TERRAIN ANALYSIS

L'ingénierie
L·A·S·C·E·L·L·E·S
engineering limited
CONSULTING-ENGINEER INGENIEUR-CONSEIL
GAËTAN H. LASCELLES ING. P. ENG.

L89-103
July 24, 1995

Sauriol Environmental Inc.
282 Dupuis Street, Suite 400
Vanier ON K1L 7H9

Attention: Mr. Jacques Sauriol, M.Sc., President

Dear Jacques:

Re: **Proposed Communal Sewage Disposal System**
Hamlet of St-Bernardin
Township of Caledonia
Provincial Direct Grant Sewage Project No. 3-0630
Owner: Township of Caledonia

Please find enclosed the results of the terrain analysis performed by Lascelles Engineering Limited. The terrain analysis consisted of test pits, hydraulic conductivity tests, grain size analysis, terrain and ground water elevations and background nitrate levels of the unconfined aquifer. The terrain analysis was conducted on June 1, June 14 and 16, 1995.

The test pits were dug with a hand-auger to depths of 1.0 to 1.4 metres below ground level. The stratigraphy and soil colour, depth and ground water level observed in the test pits were recorded. The results of the test pit terrain analysis is described in Appendix 1. The test pit data performed by Desjardins/Lascelles Engineering Limited (November 1985) and Geo-analysis Inc. (December 1991) on adjacent land are also included in Appendix 1. From compilation of the test pit data, the soil at the proposed sewage disposal location consists of 0.02 to 0.40 metres of grey-brown to black fine sandy topsoil, 0.2 to 1.0 metres of fine to medium sand with some silt, 0.6 to 2.6 metres of fine sandy silt and fine grained grey clay. From waterwell records, the clay unit is believed to extend some 30 to 40 metres below the sandy silt layer.

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L89-103
(cont'd)

Hydraulic conductivity values for the silty sand and sandy silt stratigraphic units were obtained from Guelph permeameter testing. Two Guelph permeameter tests were performed in the silty sand unit yielding hydraulic conductivities of 3.24×10^{-3} cm/sec for test pit # 24 and 2.45×10^{-4} cm/sec for test pit # 23. A Guelph permeameter test performed in the sandy silt unit of Test Pit # 23 resulted in an hydraulic conductivity of 1.17×10^{-5} cm/sec. (Appendix 2). Geo-analysis Inc. (December 1991) conducted Guelph permeameter tests in the silty sand and sandy silt units in the vicinity of test pits 1 to 10, immediately to the north of the present testing locations and obtained values of hydraulic conductivities of 2.9×10^{-4} cm/sec for the silty sand unit and 1.3×10^{-5} cm/sec for the sandy silt unit.

Desjardins/Lascelles Engineering Limited (November 1985) conducted percolation tests in the silty sand and sandy silt units in the Hamlet of St-Bernardin. The silty sand unit has a percolation rate of 1 to 6 min./cm and the sandy silt unit has a percolation rate of 6 to 24 min/cm. Lascelles Engineering Limited completed dry sieve grain size analysis tests on soil samples from the silty sand and sandy silt units (Appendix 3). Geo-analysis Ltd. (December 1978) performed a well pumping test in the clay unit and determined the hydraulic conductivity of the upper 5 to 7 metres of the clay unit (fractured zone) to be 1×10^{-6} cm/sec. The underlying clay unit can be considered impermeable.

The terrain elevations for the studied area are shown on the enclosed plan L85-1 and listed in Appendix 1. The ground water is located at about 1.0 to 1.3 metres below ground level for June 1995, and appears to be at 0.6 to 1.5 metres below ground for December 1991 (Geo-analysis Inc.) in the area of test pits 1 to 10. The ground water gradient is 0.005 and the ground water flows east to an ephemeral creek. A groundwater divide exists to the west of the proposed sewage disposal location and is located near test pits 11 and 25. The terrain at the site is relatively flat with a slope of 0.001 to 0.005 towards the east. The fields may be tile drained with outlets to the creek. The ephemeral creek flows to the north at the eastern edge of the studied area. The creek is located at the bottom of a 4 metres deep ravine with side slope of about 1 in 10. The creek is about 0.3 to 0.5 metres wide and 0.1 metres deep with an average velocity of 0.04m/sec and a calculated flow of 0.0012 m^3/sec (104 m^3/day) for June 16, 1995.

The surficial soil surrounding the creek consists of a very thin layer of topsoil (0.02 metres) directly overlaying the clay. The flatter area near the creek appears wetter and is sustaining a lusher vegetation.

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Two ground water samples were tested by Accutest Laboratories for nitrate levels. The laboratory report in enclosed in Appendix 4. The nitrate concentrations vary from 2.8 to 4.3 mg/L for test pits 12 and 13 respectively. Nitrate analysis performed by Geo-analysis Inc. (December 1991) yielded values ranging from 0.6 to 9.0 mg/L in the area of test pits 1 to 10. The area of soil testing has been cultivated with corn crops for the past years. Nitrate addition is highly probable.

Trusting you will find this information and the enclosed appendices to your entire satisfaction, we remain,

Yours truly,

L'ingénierie
LASCELLES
engineering limited

per Manon Rodrigue
Manon C. Rodrigue, P.Eng.

encl.

cc: Joanne Bougie-Normand, Clerk-Treasurer, Township of Caledonia
Nitti Subramaniam, Ontario Clean Water Agency

Appendix 1

St-Bernardin Communal Sewage Disposal System **L89-103**
Test Pit Data

Boreholes (B.H.) number 1 to 7 performed by Desjardins/Lascelles Engineering Ltd on November 25 and 26, 1985.
Test pits (T.P.) number 1 to 10 performed by Geo-Analysis on December 6, 1991
Test pits (T.P.) number 11 to 25 performed by Lascelles Engineering Ltd on June 1 and June 14, 1995
Test pits locations are shown on Plan L85-1.

Test Pit Number	Elevation (metres)	Depth (metres)	Stratigraphic Description/ Colour	Ground Water Depth / Elevation (metres / metres)
B.H. # 1		1.50	fine sandy soil	1.40
B.H. # 2		1.30	fine sandy soil	1.25
B.H. # 3		1.30	fine sandy soil	1.25
B.H. # 4		1.45	fine sandy soil	1.40
B.H. # 5		1.50	fine sandy soil	> 1.50
B.H. # 6		1.52	fine sandy soil	1.47
B.H. # 7		1.00	fine sandy soil	0.90
T.P. # 1	64.45	4.50		1.30 (Dec. 6,1991) 63.15 0.70 (Dec.11,1991) 63.75
		0.00 - 0.30	fine sandy topsoil / grey-brown	
		0.30 - 1.70	medium silty sand / orange-brown	
		1.70 - 4.50	fine grained wet clay / grey	
T.P. # 2	64.37	2.20		1.195 (Dec. 6,1991) 63.175 0.85 (Dec. 11,1991) 63.52
		0.00 - 0.20	fine sandy topsoil / grey-brown	
		0.20 - 1.00	sandy silt / orange-brown	
		1.00 - 2.20	fine grained clay / grey	
T.P. # 3		4.50		
		0.00 - 0.40	silty sand / grey-brown	
		0.40 - 1.20	medium silty sand / orange-brown	
		1.20 - 2.90	sandy silt / orange-brown	
		2.90 - 4.50	fine grained clay / grey	

Appendix 1 (continued)

St-Bernardin Communal Sewage Disposal System **L89-103**
Test Pit Data

Test Pit Number	Elevation (metres)	Depth (metres)	Stratigraphic Description/ Colour	Ground Water Depth / Elevation (metres / metres)
T.P. # 4	64.39	3.20		1.22 (Dec. 6,1991) 63.17 0.70 (Dec. 11,1991) 63.69
		0.00 - 0.25	silty sand / grey-brown	
		0.25 - 0.35	medium silty sand / orange-brown	
		0.35 - 2.65	sandy silt / orange-brown	
		2.65 - 3.20	fine grained clay / grey	
T.P. # 5		3.50		
		0.00 - 0.40	fine sandy topsoil / grey-brown	
		0.40 - 0.60	medium silty sand / orange-brown	
		0.60 - 1.10	sandy silt / orange-brown	
		1.10 - 2.00	sandy clay / brown	
		2.00 - 3.50	fine grained clay / grey	
T.P. # 6		3.70		
		0.00 - 0.30	fine sandy topsoil / grey-brown	
		0.30 - 0.60	medium silty sand / orange-brown	
		0.60 - 1.20	sandy silt / orange-brown	
		1.20 - 2.40	sandy clay / brown	
T.P. # 7		3.60		
		0.00 - 0.30	fine sandy topsoil / grey-brown	
		0.30 - 0.60	medium silty sand	
		0.60 - 1.60	sandy silt / orange-brown	
		1.60 - 3.60	fine grained clay / grey	
T.P. # 8	64.57	4.30		1.715 (Dec. 6,1991) 62.855 0.53 (Dec. 11,1991) 64.04
		0.00 - 0.25	fine sandy topsoil / grey-brown	
		0.25 - 0.40	medium silty sand / orange-brown	
		0.40 - 2.00	sandy silt / orange-brown	
		2.00 - 4.30	fine grained clay / grey	
T.P. # 9	64.72	4.40		2.45 (Dec. 6,1991) 62.27 1.14 (Dec. 11,1991) 63.58
		0.00 - 0.20	fine sandy topsoil / grey-brown	
		0.20 - 0.40	medium silty sand / orange-brown	
		0.40 - 2.20	sandy silt / orange-brown	
		2.20 - 4.40	fine grained clay / grey	

Appendix 1 (continued)

St-Bernardin Communal Sewage Disposal System **L89-103**
Test Pit Data

Test Pit Number	Elevation (metres)	Depth (metres)	Stratigraphic Description/ Colour	Ground Water Depth / Elevation (metres / metres)
T.P. # 10			1.60	
		0.00 - 0.40	fine sandy topsoil / grey-brown	
		0.40 - 0.60	medium silty sand / orange-brown	
		0.60 - 1.25	sandy silt / orange-brown	
		1.25 - 1.60	fine grained clay / grey	
T.P. # 11		64.701	1.22	1.016 (June 1,1995) 63.685
		0.00 - 0.30	topsoil / black	
		0.30 - 1.22	fine sand mixed with clay / light brown	
T.P. # 12		64.611	1.22	1.092 (June 1,1995) 63.519
		0.00 - 0.28	topsoil / black	
		0.28 - 1.22	fine sand mixed with clay / light brown	
T.P. # 13		64.621	1.22	1.041 (June 1,1995) 63.580
		0.00 - 0.23	topsoil / black	
		0.23 - 1.22	fine sand mixed with clay / light brown	
T.P. # 14		64.591	1.22	1.067 (June 1,1995) 63.524
		0.00 - 0.25	topsoil / black	
		0.25 - 1.22	fine sand mixed with clay / light brown	
T.P. # 15		64.54	1.20	1.15 (June 16,1995) 63.39
		0.00 - 0.20	topsoil	
		0.20 - 0.60	sand	
		0.60 - 1.20	silt	
T.P. # 16		64.78	1.32	1.22 (June 16,1995) 63.56
		0.00 - 0.20	topsoil	
		0.20 - 0.60	sand	
		0.60 - 1.32	silt	
T.P. # 17		64.42	1.10	1.00 (June 16,1995) 63.42
		0.00 - 0.20	topsoil	
		0.20 - 0.50	sand	
		0.50 - 1.10	silt	
T.P. # 18		64.35	1.05	0.95 (June 16,1995) 63.40
		0.00 - 0.20	topsoil	
		0.20 - 0.50	sand	
		0.50 - 1.05	silt	

Appendix 1 (continued)

St-Bernardin Communal Sewage Disposal System **L89-103**
Test Pit Data

Test Pit Number	Elevation (metres)	Depth (metres)	Stratigraphic Description/ Colour	Ground Water Depth / Elevation (metres / metres)
T.P. # 19		62.38	0.80	> 0.80 (June 16,1995)
		0.00 - 0.02	topsoil	
		0.02 - 0.80	clay	
T.P. # 20		64.05	1.43	1.00 (June 16,1995) 63.05
		0.00 - 0.23	topsoil	
		0.23 - 0.43	sand	
		0.43 - 1.43	silt	
T.P. # 21		64.28	1.00	0.95 (June 16,1995) 63.33
		0.00 - 0.20	topsoil	
		0.20 - 0.40	sand	
		0.40 - 1.00	silt	
T.P. # 22		64.39	1.10	1.00 (June 16,1995) 63.39
		0.00 - 0.20	topsoil	
		0.20 - 0.45	sand	
		0.45 - 1.10	silt	
T.P. # 23		64.54	1.30	1.20 (June 16,1995) 63.34
		0.00 - 0.20	topsoil	
		0.20 - 0.60	sand	
		0.60 - 1.30	silt	
T.P. # 24		64.75	1.40	1.30 (June 16,1995) 63.45
		0.00 - 0.20	topsoil	
		0.20 - 0.60	sand	
		0.60 - 1.40	silt	
T.P. # 25		64.70	1.42	1.38 (June 16,1995) 63.31
		0.00 - 0.30	topsoil	
		0.30 - 0.70	sand	
		0.70 - 1.42	silt	

TEST HOLE # : T.P. #24

GP FIELD DATA SHEET

SECTION 2: STANDARDIZED PROCEDURE FOR PERMEAMETER READINGS AND CALCULATIONS

Date JUNE 14-95 Investigator Ghislain Lascelles / Manon Rodrigue / Jacques Gauriol

Material: SILTY SAND.

Reservoir Constants: (See label on Permeameter)

Depth of Well Hole 40 cm

Combined Reservoirs	X	34.96 cm²	☑ CHECK RESERVOIR USED
Inner Reservoir	Y	2.18 cm²	☐

Note: In standardized procedure the radius of the well hole is always 3.0 cm

1st Set of Readings with height of water in well (H_1) set at 5 cm

READING NUMBER	TIME	TIME INTERVAL (MIN)	WATER LEVEL IN RESERVOIR, (CM)	WATER LEVEL CHANGE, (CM)	RATE OF WATER LEVEL CHANGE, R_1, (CM/MIN)
1	12:07		9		
2	12:08	1	11.2	2.2	2.2
3	12:09	1	13.3	2.1	2.1
4	12:10	1	15.0	1.7	1.7
5	12:11	1	16.6	1.6	1.6
6	12:12	1	18.2	1.6	1.6
7	12:13	1	19.4	1.2	1.2
8	12:14	1	20.8	1.4	1.4
9	12:15	1	22.4	1.6	1.6
10	12:16	1	23.4	1.0	1.0
11	12:17	1	24.8	1.4	1.4
12	12:18	1	26.3	1.5	1.5
13	12:19	1	27.6	1.3	1.3
14	12:20	1	29.1	1.5	1.5
15	12:21	1	30.5	1.4	1.4
16	12:22	1	31.9	1.4	1.4
17	12:23	1	33.3	1.4	1.4

2nd Set of Readings with height of water in well (H_2) set at 10 cm

READING NUMBER	TIME	TIME INTERVAL (MIN)	WATER LEVEL IN RESERVOIR, (CM)	WATER LEVEL CHANGE, (CM)	RATE OF WATER LEVEL CHANGE, R_2, (CM/MIN)
1	12:23:30		38.2		
2	12:24	.5	40.0	1.8	3.6
3	12:24:30	.5	41.7	1.7	3.4
4	12:25	.5	43.2	1.5	3.0
5	12:25:30	.5	44.9	1.7	3.4
6	12:26	.5	46.6	1.7	3.4
7	12:26:30	.5	48.2	1.6	3.2
8	12:27	.5	49.7	1.5	3.0
9	12:27:30	.5	51.4	1.7	3.4
10	12:28	.5	53.0	1.6	3.2
11	12:28:30	.5	54.6	1.6	3.2
12	12:29	.5	56.4	1.8	3.6
13	12:29:30	.5	58.0	1.6	3.2
14	12:30	.5	59.6	1.6	3.2
15	12:30:30	.5	61.1	1.5	3.0
16	12:31		62.7	1.6	3.2

CALCULATIONS

$\bar{R}$, the steady state rate of flow, is achieved when R is the same in three consecutive time intervals.

For the 1st Set of Readings $\bar{R}_1$ = (1.4 [R_1])/60 = 0.023 cm/sec

For the 2nd Set of Readings $\bar{R}_2$ = (3.2 [R_2])/60 = 0.053 cm/sec

K_{fs} (FIELD SATURATED HYDRAULIC CONDUCTIVITY) = [(.0041)(34.96 [RESERVOIR CONSTANT])(0.053 [$\bar{R}_2$ - STEADY STATE RATE OF FLOW])] - [(.0054)(34.96 [RESERVOIR CONSTANT])(0.023 [$\bar{R}_1$ - STEADY STATE RATE OF FLOW])] = 3.24×10^{-3} cm/s

ϕ_m (MATRIC FLUX POTENTIAL) = [(.0572)(34.96 [RESERVOIR CONSTANT])(0.023 [$\bar{R}_1$ STEADY STATE RATE OF FLOW])] - [(.0237)(34.96 [RESERVOIR CONSTANT])(0.053 [$\bar{R}_2$ STEADY STATE RATE OF FLOW])] = 0.0025 cm²/

α (ALPHA PARAMETER) = (0.0032 [K_{fs}]) / (0.0025 [ϕ_m]) = 1.28 cm⁻¹

$\Delta\theta$ (DELTA THETA) = (______ [θ_{fs}, FIELD SATURATED WATER CONTENT OF SOIL, IN CM/CM]) - (______ [θ_i, AMBIENT WATER CONTENT OF SOIL, IN CM/CM]) = ______ cm³/cm³

ESTIMATED	☐	CHECK ONE
MEASURED	☐	

S (SORPTIVITY) = $\sqrt{2(\_\_\_\_ [\Delta\theta])(\_\_\_\_ [\phi_m])}$ = ______ cm sec$^{-1/2}$

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CONSULTING-ENGINEER INGENIEUR-CONSEIL
870 JAMES ST., HAWKESBURY, ONTARIO K6A 2W8

TEST HOLE : TP #23

GP FIELD DATA SHEET

SECTION 2: STANDARDIZED PROCEDURE FOR PERMEAMETER READINGS AND CALCULATIONS

Date JUNE 16-95 Investigator GHISLAIN LASCELLES

Material : SILTY SAND

Reservoir Constants: (See label on Permeameter)

Depth of Well Hole 34 cm

Combined Reservoirs X	34.96	cm²
Inner Reservoir Y		cm²

CHECK RESERVOIR USED: ☑ (Combined) ☐ (Inner)

Note: In standardized procedure the radius of the well hole is always 3.0 cm

1st Set of Readings with height of water in well (H_1) set at 5 cm

READING NUMBER	TIME	TIME INTERVAL (MIN)	WATER LEVEL IN RESERVOIR, (CM)	WATER LEVEL CHANGE, (CM)	RATE OF WATER LEVEL CHANGE, R_1, (CM/MIN)
1	9:32		22.8		
2	9:32:30	0.5	24.2	1.4	2.8
3	9:33	0.5	25.4	1.2	2.4
4	9:33:30	0.5	26.6	1.2	2.4
5	9:34	0.5	27.7	1.1	2.2
6	9:34:30	0.5	28.8	1.1	2.2
7	9:35	0.5	29.9	1.1	2.2
8	9:35:30	0.5	31.1	1.2	2.4
9	9:36	0.5	32.2	1.1	2.2
10	9:36:30	0.5	33.3	1.1	2.2
11	9:37	0.5	34.4	1.1	2.2

2nd Set of Readings with height of water in well (H_2) set at 10 cm

READING NUMBER	TIME	TIME INTERVAL (MIN)	WATER LEVEL IN RESERVOIR, (CM)	WATER LEVEL CHANGE, (CM)	RATE OF WATER LEVEL CHANGE, R_2, (CM/MIN)
	9:38:00	0.5	40.5		
	9:38:30	0.5	42.1	1.6	3.2
	9:39	0.5	43.7	1.6	3.2
	9:39:30	0.5	45.3	1.6	3.2
	9:40	0.5	46.8	1.5	3.0
	9:40:30	0.5	48.3	1.5	3.0
	9:41	0.5	49.8	1.5	3.0
	9:41:30	0.5	51.3	1.5	3.0

CALCULATIONS

$\bar{R}$, the steady state rate of flow, is achieved when R is the same in three consecutive time intervals.

For the 1st Set of Readings $\bar{R}_1$ = (2.2 (R_1))/60 = 0.0367 cm/sec

For the 2nd Set of Readings $\bar{R}_2$ = (3.0 (R_2))/60 = 0.05 cm/sec

K_{fs} (FIELD SATURATED HYDRAULIC CONDUCTIVITY) = [(.0041)(34.96 (RESERVOIR CONSTANT))(0.05 ($\bar{R}_2$ - STEADY STATE RATE OF FLOW))] - [(.0054)(34.96 (RESERVOIR CONSTANT))(0.0367 ($\bar{R}_1$ - STEADY STATE RATE OF FLOW))] = 2.45×10^{-4} cm/s

ϕ_m (MATRIC FLUX POTENTIAL) = [(.0572)(34.96 (RESERVOIR CONSTANT))(0.0367 ($\bar{R}_1$ STEADY STATE RATE OF FLOW))] - [(.0237)(34.96 (RESERVOIR CONSTANT))(0.05 ($\bar{R}_2$ STEADY STATE RATE OF FLOW))] = 3.19×10^{-2} cm²/

α (ALPHA PARAMETER) = (2.45×10^{-4} (K_{fs})) / (3.19×10^{-2} (ϕ_m)) = 7.68×10^{-3} cm⁻¹

$\Delta\theta$ (DELTA THETA) = (______ (θ_{fs}, FIELD SATURATED WATER CONTENT OF SOIL, IN CM³/CM³)) - (______ (θ_i, AMBIENT WATER CONTENT OF SOIL, IN CM³/CM³)) = ______ cm³/cm³

ESTIMATED	☐	CHECK ONE
MEASURED	☐	

S (SORPTIVITY) = $\sqrt{2(\_\_\_\_)(\_\_\_\_)}$ = ______ cm sec$^{-1/2}$

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TEST HOLE : TP # 23

GP FIELD DATA SHEET

SECTION 2: STANDARDIZED PROCEDURE FOR PERMEAMETER READINGS AND CALCULATIONS

Date JUNE 16-95 Investigator GHISLAIN LASCELLES

Material : SANDY SILT

Reservoir Constants: (See label on Permeamter)

Depth of Well Hole 84 cm

Combined Reservoirs	X	34.96	cm²
Inner Reservoir	Y		cm²

CHECK RESERVOIR USED: ☑ Combined Reservoirs ☐ Inner Reservoir

Note: In standardized procedure the radius of the well hole is always 3.0 cm

1st Set of Readings with height of water in well (H_1) set at 5 cm

READING NUMBER	TIME	TIME INTERVAL (MIN)	WATER LEVEL IN RESERVOIR, (CM)	WATER LEVEL CHANGE, (CM)	RATE OF WATER LEVEL CHANGE, R_1, (CM/MIN)
1	9:12		5.3		
2	9:13	1	5.7	0.4	0.4
3	9:14	1	6.2	0.5	0.5
4	9:15	1	6.6	0.4	0.4
5	9:16	1	7.0	0.4	0.4
6	9:17	1	7.3	0.3	0.3
7	9:18	1	7.6	0.3	0.3
8	9:19	1	8.0	0.4	0.4
9	9:20	1	8.3	0.3	0.3
10	9:21	1	8.6	0.3	0.3
11	9:22	1	8.9	0.3	0.3
12	9:23	1	9.2	0.3	0.3

2nd Set of Readings with height of water in well (H_2) set at 10 cm

READING NUMBER	TIME	TIME INTERVAL (MIN)	WATER LEVEL IN RESERVOIR, (CM)	WATER LEVEL CHANGE, (CM)	RATE OF WATER LEVEL CHANGE, R_2, (CM/MIN)
1	9:24	1	12.9		
2	9:25	1	13.3	0.4	0.4
3	9:26	1	13.8	0.5	0.5
4	9:27	1	14.2	0.4	0.4
5	9:28	1	14.6	0.4	0.4
6	9:29	1	15.0	0.4	0.4
7	9:30	1	15.4	0.4	0.4

CALCULATIONS

$\bar{R}$, the steady state rate of flow, is achieved when R is the same in three consecutive time intervals.

For the 1st Set of Readings $\bar{R}_1$ = (0.3 [R_1]) / 60 = 0.005 cm/sec

For the 2nd Set of Readings $\bar{R}_2$ = (0.4 [R_2]) / 60 = 0.0067 cm/sec

K_{fs} (FIELD SATURATED HYDRAULIC CONDUCTIVITY) = [(.0041)(34.96 [RESERVOIR CONSTANT])(0.0067 [$\bar{R}_2$ - STEADY STATE RATE OF FLOW])] - [(.0054)(34.96 [RESERVOIR CONSTANT])(0.005 [$\bar{R}_1$ - STEADY STATE RATE OF FLOW])] = 1.165×10^{-5} cm/s

ϕ_m (MATRIC FLUX POTENTIAL) = [(.0572)(34.96 [RESERVOIR CONSTANT])(0.005 [$\bar{R}_1$ STEADY STATE RATE OF FLOW])] - [(.0237)(34.96 [RESERVOIR CONSTANT])(0.0067 [$\bar{R}_2$ STEADY STATE RATE OF FLOW])] = 4.45×10^{-3} cm²/

α (ALPHA PARAMETER) = (1.165×10^{-5} [K_{fs}]) / (4.45×10^{-3} [ϕ_m]) = 2.62×10^{-3} cm⁻¹

$\Delta\theta$ (DELTA THETA) = (______ [θ_{fs}, FIELD SATURATED WATER CONTENT OF SOIL, IN CM³/CM³]) - (______ [θ_i, AMBIENT WATER CONTENT OF SOIL, IN CM³/CM³]) = ______ cm³/cm³

ESTIMATED	☐
MEASURED	☐

CHECK ONE

S (SORPTIVITY) = $\sqrt{2(\_\_\_\_ [\Delta\theta])(\_\_\_\_ [\phi_m])}$ = ______ cm sec$^{-1/2}$

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APPENDIX 3

SIEVE TEST ANALYSIS

DATE: 17/07/95 CONTRACT No.: L89-103

CLIENT: TOWNSHIP OF CALEDONIA TYPE OF MATERIAL: SILT & SAND

SAMPLE FROM: #29- FROM TEST PIT #23 BY: DL

WEIGHT OF CONTAINER: 0.59

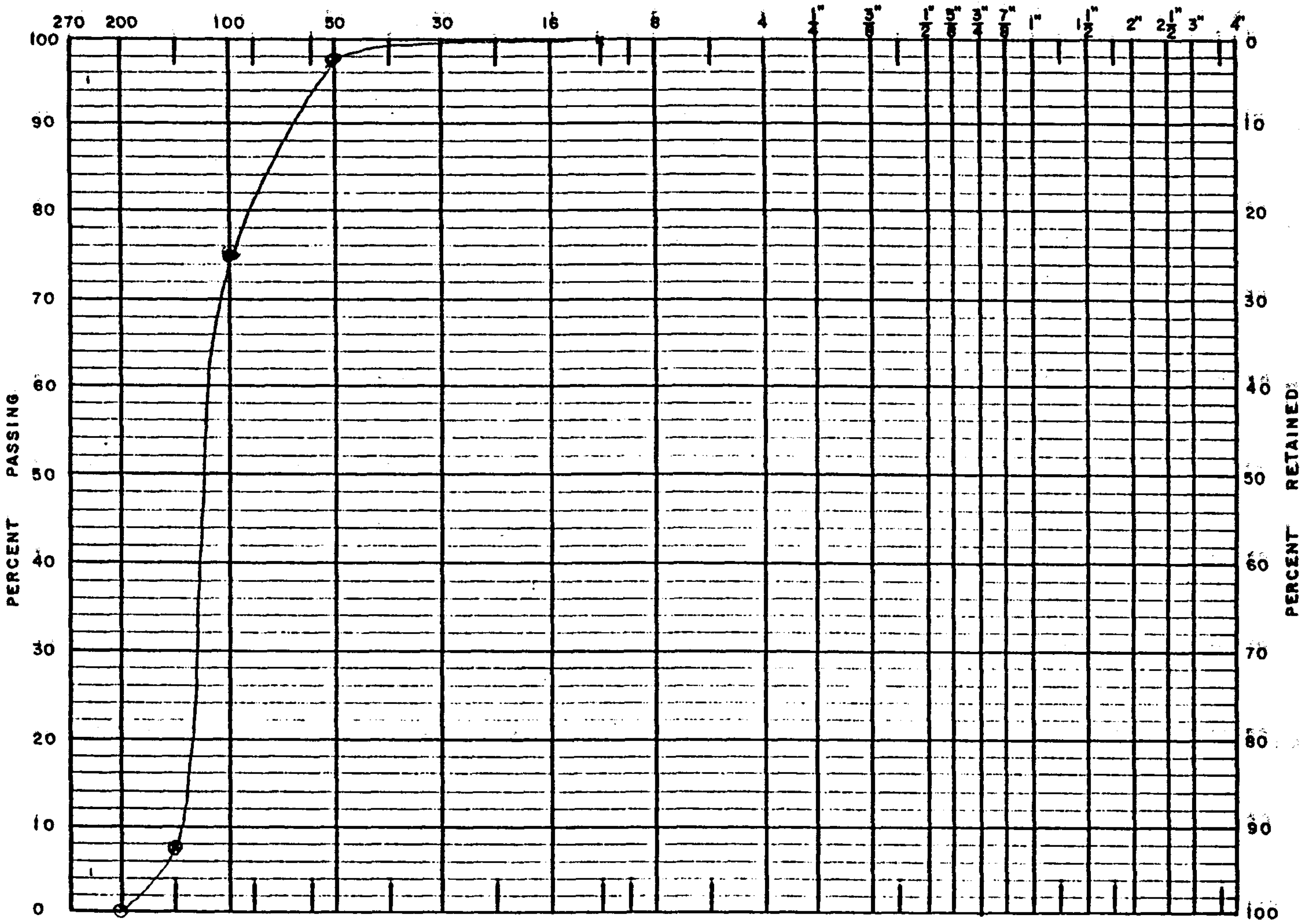
WEIGHT OF WET MATERIAL: 1.57 - 0.59 = 0.98

WEIGHT OF DRY MATERIAL: 1.50 - 0.59 = 0.91

SIEVE	ACCUMULATED WEIGHT RETAINED	ACCUMULATED % RETAINED
2 1/2"		
1"		
7/8"		
5/8"		
3/8"		
No. 4		
No. 14	0.59 - 0.59 = 0.00	0
No. 50	0.61 - 0.59 = 0.02	2.2
No. 100	0.82 - 0.59 = 0.23	25.3
No. 140	1.19 - 0.59 = 0.60	65.9
No. 200	1.43 - 0.59 = 0.84	92.3
PAN	1.50 - 0.59 = 0.91	100

COMMENTS:

GRADING CHART



JOB: L89-103 DATE: 17/07/95 BY: DC

SOURCE: TEST PIT #23

SAMPLE: #29-1

CLIENT: TOWNSHIP OF CALEDONIA

L'Ingénierie LASCELLES engineering limited
CONSULTANT ENGINEER INGENIEUR-CONSEIL

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S133

TEST No.: #29-2

SIEVE TEST ANALYSIS

DATE: 17/07/95 CONTRACT No.: L89-103

CLIENT: TOWNSHIP OF CALEDONIA TYPE OF MATERIAL: SAND & SILT

SAMPLE FROM: #29-2 FROM TEST PIT #23 BY: DC

WEIGHT OF CONTAINER: 0.59

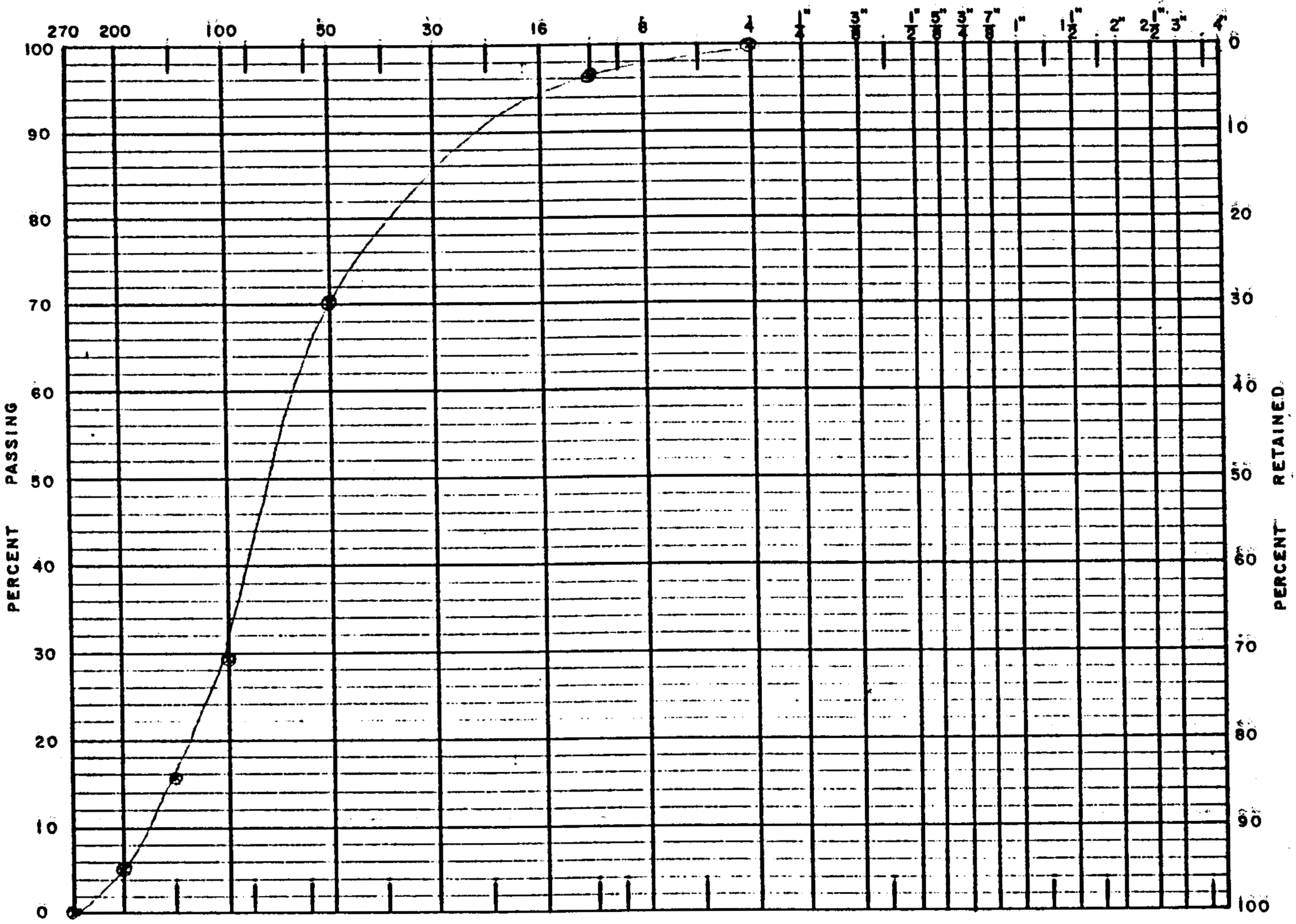
WEIGHT OF WET MATERIAL:

WEIGHT OF DRY MATERIAL: 1.16 - 0.59 = 0.57

SIEVE	ACCUMULATED WEIGHT RETAINED	ACCUMULATED % RETAINED
2 1/2"		
1"		
7/8"		
5/8"		
3/8"		
No. 4	0	
No. 14	0.61 - 0.59 = 0.02	3.5
No. 50	0.76 - 0.59 = 0.17	29.8
No. 100	0.99 - 0.59 = 0.40	70.2
No. 140	1.07 - 0.59 = 0.48	84.2
No. 200	1.13 - 0.59 = 0.54	94.7
PAN	1.16 - 0.59 = 0.57	100.

COMMENTS:

GRADING CHART



JOB: L89-103 DATE: 17/07/95 BY: DL

SOURCE: TEST PIT #23

SAMPLE: #29-2

CLIENT: TOWNSHIP OF CALEDONIA

L'Ingénierie LASCELLES engineering limited

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S133

APPENDIX 4

ACCUTEST LABORATORIES LTD.

REPORT OF ANALYSIS

Client: LASCELLES Engineering Ltd.

R. 9/06/95 D.L.

Report Number: A5-1397
Date: June 6, 1995
Date Submitted: June 2, 1995
Date Collected:
Project: Twp of Caledonia Communal System L89-103
Matrix: WATER

PARAMETER	UNITS	MDL	sample TP #2	sample TP #4	sample	sample	sample
N-NO3	mg/L	0.10	2.81	4.29			

MDL=Method Detection Limit ND=Not Detected

Comment:

ANALYST: ____________________

146 Colonnade Road Unit 8, Nepean, Ontario, K2E 7Y1 Tel:(613)727-5692 Fax:(613)727-5222

ACCUTEST LABORATORIES LTD.

REPORT OF ANALYSIS

Client: L'Ingenierie Lascelles

Report Number: A5-2334
Date: Aug. 15, 1995
Date Submitted: Aug. 8, 1995
Date Collected:
Project: St. Bernardin

Matrix: SOIL

PARAMETER	UNITS	MDL	sample	sample	sample	sample	sample
FOC	%	0.02	0.22				

MDL=Method Detection Limit ND=Not Detected

Comment:

ANALYST: ____________

146 Colonnade Road Unit 8, Nepean, Ontario, K2E 7Y1 Tel:(613)727-5692 Fax:(613)727-5222

APPENDIX B BUDGET ANALYSES

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 Þ  Project  Design  Options  Data  Run  Postprocess  Printer  List   17:12:34
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¤              CUMULATIVE VOLUMES      L**3
¤              ------------------                                             Ý
¤                                                                             Ý
¤                   IN:                                                       Ý
¤                   ---                                                       Ý
¤                     STORAGE =   0.13429E+06                                 Ý
¤               CONSTANT HEAD =    83350.                                     Ý
¤                       WELLS =   0.18615E+06                                 Ý
¤                      DRAINS =   0.00000                                     Ý
¤                    RECHARGE =   0.47644E+06                                 Ý
¤                    TOTAL IN =   0.88024E+06                                 Ý
¤                  OUT:                                                       Ý
¤                  ----                                                       Ý
¤                     STORAGE =    6841.4                                     Ý
¤               CONSTANT HEAD =   0.24426E+06                                 Ý
¤                       WELLS =    8760.0                                     Ý
¤                      DRAINS =   0.62037E+06                                 Ý
¤                    RECHARGE =   0.00000                                     Ý
¤                   TOTAL OUT =   0.88023E+06                                 Ý
¤                    IN - OUT =    7.7500                                     ±
¤          PERCENT DISCREPANCY =               0.00
àëÝÝÝÝÝÝÝÝ±ÝÝÝÝÝÝÝÝÝÝÝÝÝÝÝÝÝÝÝÝÝÝÝÝÝÝÝÝÝÝÝÝÝÝÝÝÝÝÝÝÝÝÝÝÝÝÝÝÝÝÝÝÝÝÝÝÝÝÝÝÝÝÝÝâî
 F1 Help  Alt-X Exit  F10 Menu                                        12242560
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 Þ Project  Design  Options  Data  Run  Postprocess  Printer  List   17:26:16
ë[±]ëëëëëëëëëëëëëëëëë D:\9516\MANON\JACQUES\SUBMODEL.M3D ëëëëëëëëëëëëëëëë3ë[]ë£

E MASS BUDGETS AT END OF TRANSPORT STEP   57, TIME STEP    3, STRESS PERIOD   Ý
------------------------------------------------------------------------------Ý
                                                                              Ý
                               IN                             OUT             Ý
                        ----------------               ----------------       Ý
CONSTANT CONCENTRATION:   0.0000000                     0.0000000             Ý
         CONSTANT HEAD:   0.0000000                    -703660.1              Ý
                 WELLS:   6701400.                     -21442.26              Ý
                DRAINS:   0.0000000                    -2109432.              Ý
              RECHARGE:   0.0000000                     0.0000000             Ý
 MASS STORAGE (SOLUTE):   2409800.                     -6684315.              Ý
------------------------------------------------------------------------      Ý
               [TOTAL]:   9111200.     UNDF            -9518848.     UNDF     Ý
                                                                              Ý
                           NET (IN - OUT):   -407648.0                        Ý
                    DISCREPANCY (PERCENT):   -4.376242                        Ý
                                                                              Ý
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 F1 Help  Alt-X Exit  F10 Menu                                        12833920
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