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REPORT ON

2000 HYDROGEOLOGICAL INVESTIGATION AND GROUNDWATER MONITORING PROGRAM WARD 3 LANDFILL SITE TOWNSHIP OF ALFRED AND PLANTAGENET ONTARIO

Submitted to:

Corporation of the Township of Alfred and Plantagenet
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EXECUTIVE SUMMARY

This report presents the results of the 2000 hydrogeological investigation and groundwater monitoring program conducted by Golder Associates Ltd. (Golder) at the Ward 3 landfill site in the Township of Alfred and Plantagenet (Township). This hydrogeological investigation was completed in order to satisfy the requirements of Action Item 2 listed in the MOE Compliance Inspection Report (January 21, 2000) for the site. An assessment of site compliance under the MOE Reasonable Use Guideline B-7 is presented along with a summary of proposed future site activities, including items to address Action Items 1 and 3, is also provided in this report.

The field investigation activities included the drilling of seven boreholes, installation of 13 groundwater monitoring wells, sampling of all newly installed monitoring wells, in-situ hydraulic conductivity testing and test pitting to help delineate the current waste footprint at the site.

The geological conditions encountered in all boreholes were similar in that they all encountered a layer of fine to very fine sand, trace to some silt which was underlain by silty clay. Water table conditions were encountered within the sand unit at all borehole locations. Based on the groundwater elevations measured in the fall at the groundwater monitoring locations, the direction of horizontal groundwater flow at the site is interpreted to be in a southeasterly to southerly direction.

Exceedances of the Reasonable Use Performance Objectives (RUPO) as per MOE Guideline B-7 were reported for groundwater monitoring locations BH00-2B, BH00-3B, BH00-4A and BH00-4B, (located in close proximity to the waste) and at BH00-5A, BH00-6A and BH00-6B located downgradient of the waste.

Based on the data available for monitors at boreholes BH00-5 and BH00-6 and the distance of about 600 m to the south property boundary, it is concluded that the site is in compliance with MOE Guideline B-7 with respect to the south property boundary.

At this point, it is not possible to determine whether the site is in compliance with MOE Guideline B-7 along the west and east property boundaries. To evaluate site compliance at these locations, three additional borehole locations (with multi-level monitors) are proposed as shown on Figure 3.

It is recommended that a supplemental hydrogeological investigation be completed which would include the installation of additional groundwater monitoring wells to evaluate groundwater quality along the west and east property boundaries to conclusively establish the state of compliance with respect to MOE Guideline B-7.

An annual groundwater monitoring program should be established for the site. The objectives of the annual groundwater monitoring program are to continue monitoring of background groundwater quality; groundwater quality immediately adjacent to the fill area; groundwater quality within the area impacted or potentially impacted by landfill leachate (i.e., downgradient from the site); and to monitor seasonal groundwater flow directions across the site.

Surface water was not observed at the time of the 2000 summer and fall monitoring events, however surface water may occasionally occur at the site. An assessment of surface water quality at the site, if present, should be carried out in conjunction with the proposed 2001 groundwater monitoring program.

The area of the waste footprint is preliminary estimated to be about 2.7 hectares which is approximately 8 percent greater than the licensed waste footprint area of 2.51 hectares.

The preliminary estimate of on-site waste plus cover material ranges from 34,700 to 47,300m^3. The approved capacity of the site is 45,682m^3. Therefore, the site may have up to 11,000m^3 of capacity remaining, or could be at, or slightly above the licensed capacity.

In addition to the supplemental hydrogeological investigation during 2001, the Township should initiate the necessary activities to address Action Items 1 and 3 as discussed in Section 1.0 of this report. These items include preparation of an operation and development plan (or closure plan) focussed on utilizing the remaining approved site capacity as well as amending the C of A to recognize the area method of operation. As part of site operations planning, a review of the remaining site capacity and waste generation projections for the site service area would be completed to determine whether it is more appropriate to prepare an operation and development plan or a closure plan.

TABLE OF CONTENTS

TABLE OF CONTENTS - continued

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

1.0 INTRODUCTION

This report presents the results of the 2000 hydrogeological investigation and groundwater monitoring program conducted by Golder Associates Ltd. (Golder) at the Ward 3 landfill site in the Township of Alfred and Plantagenet (Township). This project was carried out as per the proposed work plan and cost estimate submitted to the Township on February 11, 2000. Authorization to proceed with the project was received via facsimile correspondence on April 28, 2000.

The Ward 3 landfill site (formerly known as the Carriere landfill site) is located on Part of west ½ of Lot 35, Concession 3 in the Township of Alfred and Plantagenet, Ontario. The landfill site is located southwest of Carriere Road about four kilometres northwest of the Village of Alfred, 70 kilometres east of Ottawa (Figure 1). The original Certificate of Approval (C of A) for the site was issued in 1977 and was later re-issued in 1981. A copy of the 1981 C of A is provided in Appendix A.

The permitted landfill area comprises 2.5 hectares within a total property area of ~~37.4~~ 21.7 hectares. The boundary of the landfill site and the limits of the waste fill are shown on Figure 2.

We understand that the Township purchased the site in 1999. The Ontario Ministry of Environment (MOE) conducted a site inspection on October 20, 1999 and issued a Compliance Inspection Report to the Township on January 21, 2000. Golder was retained by the Township to address Action Items 1, 2 and 3 as identified by the MOE in Section 4 of their Compliance Inspection Report which is attached as Appendix B. Action Items 1, 2 and 3 are summarized below:

1. Municipality is to amend the existing Certificate of Approval to incorporate the currently used area method of fill as opposed to the approved trench method;

2. The municipality is to retain the services of a competent consultant to conduct a complete hydrogeologic assessment of the site; and

3. The municipality is to retain the services of a competent consultant to complete the required Operation and Development Plan for the site.

This hydrogeological investigation was completed in order to satisfy the requirements of Action Item 2 listed above. This report discusses the results of the 2000 hydrogeological investigation and groundwater monitoring program and presents an assessment of site compliance under the MOE Reasonable Use Guideline B-7 (MOE, 1994). A summary of proposed future site activities, including those to address Action Items 1 and 3, is also provided in this report.

2.0 PROCEDURES

2.1 Summer Borehole Drilling and Monitoring Well Installation

The objectives of the summer borehole drilling and monitoring well installation program were to characterise the geological conditions, groundwater flow system and groundwater quality in close proximity to the waste disposal area and background (natural) conditions at the site.

The summer program was conducted between July 20 and 24, 2000, during which time a total of four boreholes (identified as BH00-1, BH00-2, BH00-3 and BH00-4) were drilled using a CME-55 track mounted hollow stem auger/rotary drill rig supplied and operated by Marathon Drilling Co. Ltd. of Gloucester, Ontario.

All boreholes were drilled using 200 millimetre diameter hollow stem augers. The boreholes were advanced to depths ranging from 6.7 to 9.9 metres below ground surface and all boreholes were terminated within the overburden. Soil samples were collected at regular intervals using a 50 millimetre diameter split spoon sampler in conjunction with performing the standard penetration test. The soil samples recovered from the boreholes were visually described in the field and returned to the Golder laboratory in Ottawa for further examination. A member of Golder's technical staff monitored the borehole drilling and monitoring well installation activities. The borehole locations are shown on Figure 2.

All boreholes were completed with two monitoring well installations. The monitoring wells were installed to allow subsequent measurement of groundwater levels and to permit groundwater sampling and in-situ hydraulic testing. In terms of monitoring well designations, the suffixes 'A' and 'B' respectively refer to the 'deeper' and 'shallower' installation at a given borehole location.

The deeper monitoring wells consist of a 1.5 metre length of 50 millimetre diameter, schedule 40, #10 slot, PVC screen which extends to above ground surface by means of a 50-millimetre diameter, schedule 40, flush threaded, PVC casing. The shallower monitoring wells consist of a 1.5 metre length of 38 millimetre diameter, schedule 40, #10 slot, PVC screen which extends to above ground surface by means of a 38 millimetre diameter, schedule 40, flush threaded, PVC casing. Bentonite seals were placed at specific locations within the boreholes to isolate the screen intake intervals (and thus prevent the vertical migration of groundwater along the length of the boring) and to provide seals near ground surface. Silica sand or native backfill was placed around and above the screened intervals. Each monitoring well location was completed with an aboveground protective casing. Detailed information on each installation is provided on the borehole logs in Appendix C.

Upon completion of the borehole drilling and monitoring well installation program, Golder's technical staff surveyed the ground surface elevation at each borehole and the top of casing elevation at each monitoring well location. All elevations were surveyed relative to a temporary benchmark (TBM No. 1) established northwest of the fill area near the BH00-1 (see Figure 2).

2.2 Summer Monitoring Session

A member of Golder Associates' technical staff conducted the summer monitoring session between August 17 and 19, 2000. The monitoring session was scheduled to include a groundwater and surface water component, however, surface water bodies of significance (i.e., ponds, streams, creeks, ditches) were not evident at the time of the monitoring session. Therefore, surface water samples were not collected as part of the summer monitoring session.

The scheduled groundwater monitoring locations included monitoring wells BH00-1A, BH00-1B, BH00-2A, BH00-2B, BH00-3A, BH00-3B, BH00-4A and BH00-4B. The groundwater level at each monitoring location was measured prior to development of the monitors. Monitor development was conducted by removing at least three standing well volumes of groundwater using dedicated sampling equipment. Sampling of the groundwater was conducted immediately after monitor development.

Groundwater samples from each monitoring location were collected using dedicated sampling equipment consisting of a length of flexible low density polyethylene (LDPE) tubing and a Model D-25 foot valve manufactured by Waterra Pumps Ltd. of Toronto, Ontario.

Groundwater samples were collected in pre-cleaned, laboratory-supplied containers containing preservatives (where appropriate). Groundwater samples destined for laboratory metals analysis were filtered in the field. The temperature, pH and electrical conductivity of the groundwater samples were measured in the field at the time of sample collection. The field conductivity measurements were obtained using a Myron L Conductivity Meter Model EP that was calibrated in the field prior to use. All samples were placed in coolers with ice packs and hand delivered to a private analytical laboratory.

All laboratory chemical and physical analyses of groundwater samples were performed by Accutest Laboratories Ltd. (Accutest) of Nepean, Ontario. The Reports of Analyses from Accutest for the summer monitoring session are provided in Appendix D-I.

2.3 Fall Borehole Drilling, Monitoring Well Installation and Test Pitting

The fall borehole drilling and monitoring well installation program was designed based on data collected from the summer programs described above (subsections 2.1 and 2.2). The objectives of the fall program were to characterize the area hydrogeologically downgradient of the disposal area and to attempt to define the extent of landfill leachate impact on groundwater at the site.

The fall program was conducted on October 17 and 18, 2000, during which time a total of three boreholes (identified as BH00-5, BH00-6 and BH00-7) were drilled using a CME-55 track mounted hollow stem auger/rotary drill rig supplied and operated by Marathon Drilling Co. Ltd. of Gloucester, Ontario.

All boreholes were drilled using 200 millimetre diameter hollow stem augers. The boreholes were advanced to depths ranging from 4.6 to 5.2 metres below ground surface and all boreholes were terminated within the overburden. Soil samples were collected at regular intervals using a 50 millimetre diameter split spoon sampler in conjunction with performing the standard penetration test. The soil samples recovered from the boreholes during the drilling program were visually described in the field and returned to the Golder laboratory in Ottawa for further examination. The borehole drilling and monitoring well installation activities were monitored by a member of Golder's technical staff. The borehole locations are shown on Figure 2.

Two of the boreholes (BH00-5 and BH00-6) were completed with two monitoring well installations, whereas BH00-7 was completed with a single monitoring well. The monitoring wells were installed in the boreholes to allow subsequent measurement of groundwater levels and to permit groundwater sampling and in-situ hydraulic testing. In terms of monitoring well designations, the suffixes 'A' and 'B' respectively refer to the 'deeper' and 'shallower' installation at a given borehole location.

The deeper monitoring wells and the single monitoring well at borehole BH00-7 consist of a 1.5 metre length of 50 millimetre diameter, schedule 40, #10 slot, PVC screen which extends to above ground surface by means of a 50-millimetre diameter, schedule 40, flush threaded, PVC casing. The shallower monitoring wells consist of a 1.5 metre length of 38 millimetre diameter, schedule 40, #10 slot, PVC screen which extends to above ground surface by means of a 38 millimetre diameter, schedule 40, flush threaded, PVC casing. Bentonite seals were placed at specific locations within the boreholes to isolate the screen intake intervals (and thus prevent the vertical migration of groundwater along the length of the boring) and to provide seals near ground surface. Silica sand or native backfill was placed around and above the screened intervals. Each monitoring well location was completed with an aboveground protective casing. Detailed information on each installation is provided on the borehole logs in Appendix C.

A shallow test pitting program was also conducted in the fall to help delineate the current waste footprint at the site. The test pits were completed on October 18, 2000. A backhoe and operator were provided by the Township and the 24 test pits were excavated under the direction of a member of Golder's technical staff. Subsurface conditions were recorded in the field and test pit logs are presented in Appendix E.

Upon completion of the borehole drilling and monitoring well installation program, Stantec Consulting Group Ltd. (Stantec) field engineering staff surveyed the location (northing, easting) and ground surface elevation at each test pit and borehole and the top of casing elevation at each monitoring well location. All elevations were surveyed relative to a temporary benchmark (TBM No. 1) established northwest of the fill area near the BH00-1 (see Figure 2). The ground surface and top of casing elevations for the monitoring wells are provided in Section 4.1. Stantec also completed a base plan for the site which has been used to prepare Figures 2 and 3 in this report.

2.4 Fall Monitoring Session

A member of Golder Associates' technical staff conducted the summer monitoring session between November 27 and 29, 2000. The monitoring session was scheduled to include a groundwater and surface water component, however, surface water courses were not evident at the time of the site visit. Therefore, surface water samples were not collected as part of the summer monitoring session.

The scheduled groundwater monitoring locations included BH00-5A, BH00-5B, BH00-6A, BH00-6B and BH00-7. The groundwater level at all groundwater monitoring well locations was measured prior to development of the monitors scheduled for sampling. Monitor development was conducted by removing at least three standing well volumes of groundwater using dedicated sampling equipment. Sampling of the groundwater was conducted immediately after monitor development.

Groundwater samples from each monitoring location were collected using dedicated sampling equipment consisting of a length of flexible LDPE tubing and a Model D-25 foot valve manufactured by Waterra Pumps Ltd. of Toronto, Ontario.

Groundwater samples were collected in pre-cleaned, laboratory-supplied containers containing preservatives (where appropriate). Groundwater samples destined for laboratory metals analysis were filtered in the field. The temperature, pH and electrical conductivity of the groundwater samples were measured in the field at the time of sample collection. The field conductivity measurements were obtained using a Myron L Conductivity Meter Model EP that was calibrated in the field prior to use. All samples were placed in coolers with ice packs and hand delivered to

Accutest. The Reports of Analyses from Accutest for the summer monitoring session are provided in Appendix D-II.

In-situ hydraulic conductivity testing (rising head tests) of selected monitoring locations was conducted on November 29, 2000. The rising head tests were conducted by evacuating water in the well using the dedicated water sampling equipment and measuring the time for recovery of groundwater levels. The calculated hydraulic conductivity values are discussed in Section 4.2 and the testing data are presented in Appendix F.

3.0 GEOLOGICAL CONDITIONS

A log of the geological conditions encountered in each borehole drilled during the 2000 hydrogeological investigation together with details of the monitoring well installations are given on the Record of Borehole Sheets in Appendix C. It is noted that the boundaries between strata on the Record of Borehole Sheets have been inferred from observations during drilling and non-continuous sampling and, as such, their positions should be considered as transitional in nature rather than an exact plane of geologic change. Natural variations other than those encountered in the boreholes should also be expected to exist.

The geological conditions encountered in all boreholes (BH00-1 through BH00-7) were similar in that they all encountered a layer of fine to very fine sand, trace to some silt which was underlain by silty clay. The sand thickness varied from 2.4 metres (at BH00-3) to 4.2 metres (at BH00-2). Water table conditions were encountered within the sand unit at all borehole locations. The top of silty clay was encountered at depths ranging from 3.1 to 5.2 metres below ground surface. Bedrock was not encountered in any of the boreholes. A surficial layer of sand mixed with municipal waste was encountered at BH00-2, BH00-3 and BH00-4 and varied from 0.9 to 1.2 metres in thickness. A surficial layer of topsoil was encountered at BH00-5, BH00-6 and BH007 and varied from 0.2 to 0.3 metres in thickness. The topsoil was mixed with peat at BH00-6.

The test pit logs are presented in Appendix E. The test pits were excavated to depths ranging from 0.9 to 2.8 metres below ground surface and encountered the surficial layer of sand mixed with municipal waste and/or the underlying native sand. The purpose the shallow test pitting was to aid in delineating the waste footprint at the site, which is shown on Figure 2. Where present in the test pits, the depth to the bottom of the waste varied from 0.6 metres (TP00-18) to greater than 1.6 metres (TP00-4). The typical depth to the bottom of the waste was 1.0 to 1.5 metres below grade.

4.0 PHYSICAL HYDROGEOLOGY

4.1 Water Table Elevations and Hydraulic Gradients

The groundwater level data obtained from the summer and fall monitoring sessions are presented below:

Monitoring Location	Ground Surface Elevation (metres)	Top of Casing Elevation (metres)	Summer Monitoring Session August 17, 2000		Fall Monitoring Session November 27, 2000	
			Depth to Groundwater (metres below top of casing)	Groundwater Elevation (metres)	Depth to Groundwater (metres below top of casing)	Groundwater Elevation (metres)
BH00-1A	99.18	99.97	1.93	98.04	1.65	98.32
BH00-1B	99.18	100.00	1.24	98.76	0.83	99.17
BH00-2A	99.54	100.33	1.67	98.66	1.49	98.84
BH00-2B	99.54	100.38	1.72	98.66	1.54	98.84
BH00-3A	98.54	99.26	1.58	97.68	1.44	97.82
BH00-3B	98.54	99.31	1.34	97.97	1.24	98.07
BH00-4A	99.84	100.77	2.42	98.35	2.35	98.42
BH00-4B	99.84	100.79	2.43	98.36	2.37	98.42
BH00-5A	97.73	98.67	-	-	0.83	97.84
BH00-5B	97.73	98.73	-	-	0.91	97.82
BH00-6A	97.97	98.78	-	-	0.86	97.92
BH00-6B	97.97	98.71	-	-	0.76	97.95
BH00-7	98.80	99.76	-	-	1.12	98.64

Notes: All elevations are referred to a local datum (TBM No. 1 as shown on Figure 2)

The groundwater elevation data presented above indicates that groundwater flow in the sand unit is primarily horizontal. Downward vertical gradients were measured between monitors in the upper sand and underlying silty clay (at BH00-1 and BH00-3) indicating that there is a potential for a component of groundwater flow that moves downward through the silty clay. Due to the difference in hydraulic conductivity (discussed in section 4.2), the rate of downward groundwater flow through the silty clay is considered negligible (in terms of volume and velocity) when compared to horizontal groundwater flow in the overlying sand unit.

The groundwater elevation data from all monitoring wells from the fall monitoring session were used to create piezometric surface elevation contours, which are presented on Figure 3. The contours indicate that horizontal groundwater flow in the sand unit is in a southeasterly to southerly direction. During the fall monitoring session, horizontal hydraulic gradients varied from 0.002 in the south to 0.003 beneath the northern part of the site.

4.2 Horizontal Hydraulic Conductivity

A summary of hydraulic conductivity estimates derived from in-situ testing of the monitoring wells conducted during the hydrogeological field investigation is provided below.

Location	Screened Interval		Soil Type	Hydraulic Conductivity (cm/s)
	mbgs	Elevation*		
BH00-1A	7.5 to 9.0	91.7 to 90.2	Silty clay	3.3×10^{-8}
BH00-1B	0.9 to 2.4	98.3 to 96.8	Fine sand, trace to some silt	7.8×10^{-4}
BH00-3A	4.5 to 6.0	94.0 to 92.5	Silty clay	2.6×10^{-6}
BH00-3B	1.7 to 3.2	96.8 to 95.3	Fine to very fine sand, trace to some silt	2.4×10^{-4}
BH00-5A	2.5 to 4.0	95.3 to 93.8	Fine sand, some silt	3.3×10^{-4}
BH00-5B	0.7 to 2.1	97.0 to 95.6	Fine sand, some silt	2.4×10^{-4}
BH00-6A	2.2 to 3.6	95.7 to 94.3	Fine sand, some silt	3.6×10^{-4}
BH00-6B	0.8 to 2.0	97.2 to 96.0	Fine sand, some silt	2.4×10^{-4}
BH00-7	1.2 to 2.7	97.6 to 96.1	Fine sand, some silt	5.1×10^{-4}

Notes:

mbgs – metres below ground surface

* - elevation referenced to the temporary benchmark (TBM No. 1) shown on Figures 2 and 3.

The horizontal hydraulic conductivity of the sand unit (fine to very fine sand, trace to some silt) ranged from 2.4×10^{-4} centimetres per second (cm/s) to 8.1×10^{-4} cm/s based on rising head tests conducted at seven locations. The horizontal hydraulic conductivity of the silty clay ranged from 3.3×10^{-8} cm/s to 2.6×10^{-6} cm/s based on rising head tests conducted at two locations.

4.3 Groundwater Flow Velocity

The average linear groundwater velocity, $\bar{v}$, is calculated using the equation:

$$\bar{v} = \frac{Ki}{n}$$

where: $\bar{v}$ = average linear groundwater velocity in units of length per time

n = dimensionless formation porosity

K = horizontal hydraulic conductivity in units of length per time

i = dimensionless horizontal hydraulic gradient in direction of $\bar{v}$

For unconsolidated deposits such as sand, typical porosity values can range from 25 to 50 percent (Freeze and Cherry, 1979). An average porosity of 30 percent for the granular overburden deposits is assumed for the determination of average linear groundwater velocities in the vicinity of the landfill site.

Using the range in hydraulic conductivity values for the sand unit (2.4×10^{-4} cm/s to 8.1×10^{-4} cm/s) and the range of horizontal gradients presented above (0.002 to 0.003), the average linear horizontal groundwater velocity within the sand unit below the landfill is approximately 0.5 to 2.5 metres per year towards the south/southeast.

The estimated range in hydraulic conductivity values for the silty clay is at least two orders of magnitude lower than the estimated values for the overlying sand. As such, the horizontal groundwater velocity in the silty clay is expected to be less than 1 centimetre per year.

5.0 GROUNDWATER CHEMISTRY

5.1 General Physical and Inorganic Chemical Analyses

The groundwater quality in the vicinity of the site was assessed by collecting a groundwater sample from each monitoring well with subsequent physical and chemical analyses. The chemical and physical analyses data obtained as a result of the 2000 groundwater monitoring programs along with the relevant Ontario Drinking Water Standards (MOE, 2000) are provided in Appendix G.

Discussions relating to compliance with the Ontario Drinking Water Standards (ODWS) relate specifically to non-health related objectives (i.e., aesthetic parameters) and health related standards for which a Maximum Acceptable Concentration (MAC) or Interim Maximum Acceptable Concentration (IMAC) have been established.

5.2 Background Groundwater Quality

Based on the physical hydrogeology, monitoring wells BH00-1A and BH00-1B are hydraulically upgradient from the landfill site and thus should not be impacted by landfill leachate. The shallow monitor (BH00-1B) is screened in the sand unit whereas the deeper monitor (BH00-1A) is screened in the underlying silty clay. Table 1 is provided to show the reported parameter concentrations for background groundwater quality in the sand and clay at the site.

Dissolved organic carbon (DOC), iron and manganese exceed the ODWS in background monitoring wells BH00-1A and BH00-1B. As such, concentrations of DOC, iron and manganese above the ODWS downgradient of the landfill site do not necessarily indicate leachate impact; comparison of *Leachate Indicator Parameter* concentrations with background concentrations are more meaningful with respect to assessing the degree of leachate impact on groundwater quality.

5.3 Leachate Indicator Parameters

Leachate Indicator Parameters are parameters which are useful in determining the presence/absence of landfill leachate impact on water resources; assessing the degree of leachate impact on water resources; and, are useful in determining the extent of leachate impact near a landfill site.

Based on a review of the groundwater chemistry data available to date (one round at each monitoring location), monitor BH00-3B appears have the greatest leachate effects as exhibited by elevated concentrations of chloride, hardness, sulphate, TDS, iron and strontium. As such, preliminary *Leachate Indicator Parameters* for the Ward 3 landfill have been selected using the 2000 groundwater monitoring results from monitoring well BH00-3B. The six parameters

considered to be groundwater *Leachate Indicator Parameters* at the site are: chloride, hardness, sulphate, TDS, iron and strontium.

5.4 Groundwater Quality

The parameters with reported levels exceeding their respective ODWS; a comparison of groundwater quality to background conditions; and, an interpretation of the geochemical data with respect to the degree of landfill leachate impact from the existing landfill site are summarized in Table 2 for each of the monitoring wells sampled in 2000.

Monitoring well impact interpretations included in Table 2 are summarized as follows:

- Monitoring wells BH00-1A and BH00-1B are located upgradient of the landfill and are considered representative of background groundwater quality;
- Monitoring well BH00-7 is located northeast (cross-gradient) of the landfill and is not impacted by landfill leachate;
- The greatest leachate impacts were noted in BH00-3B located at the south edge of the landfill. Groundwater in BH00-3A (screened in the silty clay) may be slightly impacted by leachate;
- Minor leachate impacts noted at BH00-2A, BH00-2B, BH00-4A and BH00-4B located in close proximity to the waste;
- Monitoring well BH00-6B is located 100 metres downgradient (south) of the landfill and is impacted by leachate, whereas BH00-6A may be slightly impacted;
- Monitoring wells BH00-5A and BH00-5B are located 100 metres downgradient (south) of the landfill and are not impacted by landfill leachate.

6.0 GROUNDWATER COMPLIANCE ASSESSMENT

MOE Guideline B-7 (MOE, 1994), *Incorporation of the Reasonable Use Concept into MOE Groundwater Management*, addresses the levels of off-site leachate impact on groundwater considered acceptable by the MOE and defines the level of impact on groundwater beyond which some form of mitigation measure(s) would be warranted.

Under MOE Guideline B-7, a change in the quality of groundwater on adjacent properties will only be acceptable if the quality is not degraded in excess of fifty percent of the difference between background concentrations and established water quality criteria for aesthetic related parameters, and twenty-five percent of the difference between background conditions and established water quality criteria for health related parameters. If the background concentration of a particular parameter exceeds a given water quality criteria, the quality of the groundwater should not be degraded further.

For the purpose of this site evaluation, the groundwater quality reported for the monitors BH00-1A (clay) and BH00-1B (sand) are considered representative of background groundwater quality in the vicinity of the landfill site. As well, the standards described in the ODWS are used to represent the established water quality criteria. The parameters selected for the compliance assessment include those within the schedule of analysis for the site that relate specifically to non-health related objectives (i.e., aesthetic parameters) and health related parameters for which a MAC or IMAC have been established as specified within the OWDS. The relative mobility of parameters was also considered in the selection of appropriate parameters. As such, the parameters that are significant to this discussion are barium, boron, chloride, DOC, iron, sodium, sulphate and TDS. Each of these eight parameters together with their respective ODWS concentrations, the maximum background concentrations from monitoring wells BH00-1B, and the calculated Reasonable Use Performance Objectives (RUPO) are provided below.

Parameter	ODWS (mg/L)	Maximum Background Concentration (mg/L)	Reasonable Use Performance Objectives (mg/L)
Barium	1 (MAC)	0.05	0.29
Boron	5 (IMAC)	0.01	1.26
Chloride	250 (AO)	2	126
DOC	5 (AO)	20.1	20.1
Iron	0.3 (AO)	0.92	0.92
Sodium	200 (AO)	31	116
Sulphate	500 (AO)	39	270
TDS	500 (AO)	300	400

Notes:
AO = Aesthetic Objective
MAC = Maximum Acceptable Concentration (Health Related Objective)
IMAC = Interim Maximum Acceptable Concentration (Health Related Objective)

In the absence of monitoring wells located on the property boundaries of the site, all monitoring wells screened in the sand unit around the perimeter of the waste (BH00-2A, BH00-2B, BH00-3B, BH00-4A, BH00-4B and BH00-7) and downgradient (BH00-5A, BH00-5B, BH00-6A and BH00-6B) were assessed for compliance with MOE Guideline B-7. A summary of parameters exceeding the RUPO at groundwater monitors at the site is presented in Table 3.

A review of the Table 3 along with data presented in Table 2 and discussed in Section 5.0 indicates that RUPO exceedances are present at monitoring locations BH00-2A, BH00-2B, BH00-3B, BH00-4A and BH00-4B, (located in close proximity to the waste) and at BH00-5A, BH00-6A and BH00-6B located downgradient of the waste. All of the monitoring wells listed above are interpreted to be impacted to varying degrees by landfill leachate with the exception of BH00-5A (refer to Table 2). The reported concentration of iron (0.93 mg/L) is essentially the same as the calculated RUPO of 0.92 mg/L.

Based on the groundwater quality data available for monitors at boreholes BH00-5 and BH00-6 and the distance of about 600 metres to the south property boundary, it is concluded that the site is in compliance with MOE Guideline B-7 with respect to the south property boundary.

At this point, it is not possible to determine whether the site is in compliance with MOE Guideline B-7 along the west and east property boundaries. To evaluate site compliance at these locations, three additional borehole locations (with multi-level monitors) are proposed as shown on Figure 3.

7.0 SURFACE WATER QUALITY

Surface water of any significance (i.e., ponds, streams, creeks, ditches) was not observed at the site during the summer and fall monitoring events. As a result, surface water samples were not collected from the site in 2000.

8.0 PRELIMINARY OPERATIONS REVIEW

Based on the test pit information and observations during the site work, the approximate limit of the waste footprint is shown on Figure 2. The area of the waste footprint is preliminary estimated to be about 2.7 hectares which is approximately 8 percent greater than the licensed waste footprint area of 2.51 hectares as noted on page 2 of the Compliance Inspection Report (refer to Appendix B). A detailed calculation of the waste footprint would be included in the Operation and Development Plan/Closure Plan for the site.

Based on a typical depth to the bottom of the waste of 1 to 1.5 metres (refer to Section 3.0), the estimated volume of on-site buried waste plus cover material is 25,100 to 37,700 m^3. A preliminary estimate of the volume of above grade waste placed using the area method is 9,600m^3. The approved capacity of the site is 45,682 m^3 as noted on page 2 of the Compliance Inspection Report. Therefore, the site may have up to 11,000 m^3 of capacity remaining, or could be at, or slightly above the licensed capacity. A more detailed assessment of site capacity would be included in the Operation and Development Plan/Closure Plan for the site.

9.0 SUMMARY

The following points provide a summary and discussion of the results of the 2000 hydrogeological investigation and monitoring program at the Ward 3 landfill site.

- The objectives of the 2000 hydrogeological investigation were to characterise the geological conditions, groundwater flow system and groundwater quality in close proximity to the waste disposal area and immediately downgradient and also to characterize the background (natural) conditions in the area of the site.

- The 2000 hydrogeological investigation included summer and fall borehole drilling, monitoring well installation and groundwater quality monitoring events.

- Surface water of any significance (i.e., ponds, streams, creeks, ditches) was not observed at the site during the summer and fall monitoring events. As a result, surface water samples were not collected from the site in 2000.

- The geological conditions encountered in all boreholes were similar in that they all encountered a layer of fine to very fine sand, trace to some silt which was underlain by silty clay. Water table conditions were encountered within the sand unit at all borehole locations.

- Based on the groundwater elevations measured in the fall at the groundwater monitoring locations, the direction of horizontal groundwater flow at the site is interpreted to be in a southeasterly to southerly direction.

- Monitoring wells BH00-1A and BH00-1B are located upgradient of the landfill and are considered representative of background groundwater quality;

- Monitoring well BH00-7 is located northeast (cross-gradient) of the landfill and is not impacted by landfill leachate;

- The greatest leachate impacts were noted in BH00-3B located at the south edge of the landfill. Groundwater in BH00-3A (screened in the silty clay) may be slightly impacted by leachate;

- Minor leachate impacts noted at BH00-2A, BH00-2B, BH00-4A and BH00-4B located in close proximity to the waste;

- Monitoring well BH00-6B is located 100 metres downgradient (south) of the landfill and is impacted by leachate, whereas BH00-6A may be slightly impacted;

- Monitoring wells BH00-5A and BH00-5B are located 100 metres downgradient (south) of the landfill and are not impacted by landfill leachate;

- RUPO exceedances are present at monitoring locations BH00-2B, BH00-3B, BH00-4A and BH00-4B, (located in close proximity to the waste) and at BH00-5A, BH00-6A and BH00-6B located downgradient of the waste;

- Based on the groundwater data available for monitors at boreholes BH00-5 and BH00-6 and the distance of about 600 m to the south property boundary, it is concluded that the site is in compliance with MOE Guideline B-7 with respect to the south property boundary.

- At this point, it is not possible to determine whether the site is in compliance with MOE Guideline B-7 along the west and east property boundaries. To evaluate site compliance at these locations, three additional borehole locations (with multi-level monitors) are proposed as shown on Figure 3;

- The area of the waste footprint is preliminary estimated to be about 2.7 hectares which is approximately 8 percent greater than the licensed waste footprint area of 2.51 hectares.

- The preliminary estimate of on-site waste plus cover material ranges from 34,700 to 47,300m^3. The approved capacity of the site is 45,682m^3. Therefore, the site may have up to 11,000m^3 of capacity remaining, or could be at, or slightly above the licensed capacity.

10.0 PROPOSED FUTURE SITE ACTIVITES

This investigation was completed to assess the hydrogeological conditions in the area of the Ward 3 landfill site and to respond to Action Item 2 discussed in section 1.0 of this report. Groundwater quality data indicates that certain monitoring locations in the immediate vicinity of the waste and downgradient have been impacted by landfill leachate. Concentrations of select parameters in groundwater at some monitoring locations are greater than the RUPO as per MOE Guideline B-7. The groundwater quality at points of compliance along the west and east property boundaries is unknown. As such, it is not possible to currently determine whether the site is in compliance with MOE Guideline B-7 along the west and east property boundaries. It is recommended that a supplemental hydrogeological investigation be completed which would include the installation of additional groundwater monitoring wells to evaluate groundwater quality along the property boundary to conclusively establish the state of compliance with respect to MOE Guideline B-7. Proposed borehole locations are shown on Figure 3.

An annual groundwater monitoring program should be established for the site. The objectives of the annual groundwater monitoring program are to continue monitoring of background groundwater quality; groundwater quality immediately adjacent to the fill area; groundwater quality within the area impacted or potentially impacted by landfill leachate (i.e., downgradient from the site); and to monitor seasonal groundwater flow directions across the site. The proposed groundwater monitoring program for 2001 is summarised in Table 4.

Surface water was not observed at the time of the 2000 summer and fall monitoring events, however surface water may occasionally occur in the low-lying areas at the Ward 3 site. An assessment of surface water quality at the site, if present, should be carried out in conjunction with the proposed 2001 groundwater monitoring program.

In addition to the supplemental hydrogeological investigation during 2001, the Township should initiate the necessary activities to address Action Items 1 and 3 as discussed in Section 1.0 of this report. These items include preparation of an operation and development plan (or closure plan) focussed on utilizing the remaining approved site capacity as well as amending the C of A to recognize the area method of operation. As part of site operations planning, a review of the remaining site capacity and waste generation projections for the site service area would be completed to determine whether it is more appropriate to prepare an operation and development plan or a closure plan.

Further, upon completion of the items discussed above, a conceptual mitigation plan to address potential site non-compliance under MOE Guideline B-7 and Ontario Regulation 347 could be developed (if required). The mitigation plan might involve the establishment of an adequate on-site buffer zone around the waste footprint and/or an appropriate leachate attenuation zone (if required).

11.0 LIMITATIONS AND USE OF REPORT

This report was prepared for the exclusive use of the Township of Alfred and Plantagenet. The report, which specifically includes all tables, figures and appendices, is based on data and information collected by Golder and is based solely on the conditions of the properties at the time of the work, supplemented by historical information and data obtained by Golder as described in this report.

The assessment of environmental conditions and possible hazards at this site has been made using the results of physical measurements and chemical analyses of liquids from a number of locations. The site conditions between sampling locations have been inferred based on conditions observed at borehole and monitoring well locations. Subsurface conditions may vary from these sampled locations.

The services performed, as described in this report, were conducted in a manner consistent with that level of care and skill normally exercised by other members of the engineering and science professions currently practising under similar conditions, subject to the time limits and financial and physical constraints applicable to the services.

Any use which a third party makes of this report, or any reliance on, or decisions to be made based on it, are the responsibilities of such third parties. Golder accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

The findings of this report are valid only as of the date of this report. If new information is discovered in future work, including excavations, borings, or other studies, Golder should be requested to re-evaluate the conclusions of this report, and to provide amendments as required. The groundwater monitors installed during the course of this investigation by Golder have been left in place. These groundwater monitors are the property of the Township and not Golder.

GOLDER ASSOCIATES LTD.
Environmental Division

G.B. Murray, P.Eng.
Environmental Engineer

K.A. Marentette, M.Sc.
Senior Hydrogeologist /Associate

GBM:KAM:gbm:dc:cr
o:\efile\00\001-2749\report\rpt-001.doc

REFERENCES

Freeze, R.A. and J.A. Cherry, 1979. Groundwater: Prentice-Hall Inc., Englewood Cliff, New Jersey, 604 p.

Ministry of the Environment, 1994. Guideline B-7: Incorporation of the Reasonable Use Concept into MOE Groundwater Management,: MOE Program Development Branch: Ontario Ministry of the Environment, April 1994, 8 p.

Ministry of the Environment, 2000. Ontario Drinking Water Standards, Ontario Ministry of the Environment.

TABLE 1
BACKGROUND GROUNDWATER QUALITY
WARD 3 LANDFILL SITE, TOWNSHIP OF ALFRED AND PLANTAGENET

Parameter	OWDS (mg/L)	Background Concentration in Sand [1] (mg/L)	Background Concentration in Clay [2] (mg/L)
Alkalinity		166	156
Aluminum		1.18	3.78
Ammonia (as N)		0.49	1.40
Barium	1	0.05	0.04
Berillium		<0.002	<0.002
Boron	5	0.01	0.09
Cadmium	0.005	<0.005	<0.005
Calcium		34	32
Chloride	250	2.0	5.0
Chromium	0.05	<0.01	<0.01
Cobalt		<0.01	<0.01
COD		58	68
Electrical Conductivity		400	420
Copper	1	<0.01	0.01
DOC	5	**20.1**	**13.1**
Hardness (as $CaCO_3$)		118	121
Iron	0.3	**0.92**	**3.46**
Lead	0.01	<0.001	<0.001
Magnesium		8	10
Manganese	0.05	**0.11**	**0.14**
Molybdenum		<0.01	<0.01
Nickel		<0.01	<0.01
Nitrate (as N)	10	<0.10	<0.10
pH		7.1	7.4
Phenols		<0.001	<0.001
Phosphorus (total)		0.06	0.21
Potassium		7	7
Silicon		4.22	7.79
Silver		<0.01	<0.01
Sodium	200	31	59
Strontium		0.144	0.171
Sulphate	500	39	99
Sulphur		12	31
TDS	500	300	380
Thallium		<0.2	<0.2
Tin		<0.01	<0.01
Titanium		0.06	0.17
TKN		0.69	1.40
Vanadium		<0.01	<0.01
Zinc	5	<0.01	0.01

NOTES:

(1) Reported concentrations from monitor BH00-1B.
(2) Reported concentrations from monitor BH00-1A.

TABLE 2
SUMMARY OF 2000 GROUNDWATER QUALITY
WARD 3 LANDFILL SITE, TOWNSHIP OF ALFRED AND PLANTAGENET

Monitoring Well	Parameters Exceeding ODWS in 2000	Leachate Indicator Parameters [1] Greater than Two Times Background Values in 2000	Trends	Hydrogeological Interpretation
BH00-1A	DOC, Iron, Manganese	None	• Only one round of groundwater sampling completed thus far at this location.	• Upgradient of waste and screened in silty clay • Background groundwater quality monitor
BH00-1B	DOC, Iron, Manganese	None	• Only one round of groundwater sampling completed thus far at this location.	• Upgradient of waste and screened in sand • background groundwater quality monitor
BH00-2A	DOC, Iron, Manganese	Chloride, Hardness, Strontium	• Only one round of groundwater sampling completed thus far at this location.	• located within the limits of waste disposal on west side of the site and screened in silty clay. • groundwater may be slightly impacted by landfill leachate
BH00-2B	DOC, Iron, Manganese, TDS	Chloride, Iron	• Only one round of groundwater sampling completed thus far at this location.	• located within the limits of waste disposal on west side of the site and screened in sand. • groundwater may be slightly impacted by landfill leachate
BH00-3A	DOC, Iron, Manganese, TDS	Sulphate, TDS	• Only one round of groundwater sampling completed thus far at this location	• located within the limits of waste disposal on south side of the site and screened in silty clay. • groundwater may be slightly impacted by landfill leachate
BH00-3B	DOC, Iron, Manganese, Sulphate, TDS	Chloride, Hardness, Iron, Strontium, Sulphate, TDS	• Only one round of groundwater sampling completed thus far at this location	• located within the limits of waste disposal on south side of the site and screened in sand. • groundwater impacted by landfill leachate
BH00-4A	DOC, Iron, Manganese	Chloride, Hardness, Iron, Strontium	• Only one round of groundwater sampling completed thus far at this location	• located within the limits of waste disposal on east side of the site and screened in sand. • groundwater impacted by landfill leachate
BH00-4B	DOC, Iron, Manganese, TDS	Chloride, Hardness, Iron. Stontium, Sulphate, TDS	• Only one round of groundwater sampling completed thus far at this location	• located within the limits of waste disposal on east side of the site and screened in sand. • groundwater impacted by landfill leachate
BH00-5A	Iron, Manganese	None	• Only one round of groundwater sampling completed thus far at this location	• located downgradient of waste to the south and screened in sand • groundwater not impacted by landfill leachate
BH00-5B	None	None	• Only one round of groundwater sampling completed thus far at this location	• located downgradient of waste to the south and screened in sand • groundwater not impacted by landfill leachate

TABLE 2 (continued)
SUMMARY OF 2000 GROUNDWATER QAULITY
WARD 3 LANDFILL SITE, TOWNSHIP OF ALFRED AND PLANTAGENET

Monitoring Well	Parameters Exceeding ODWS in 2000	Leachate Indicator Parameters [1] Greater than Two Times Background Values in 2000	Trends	Hydrogeological Interpretation
BH00-6A	DOC, Iron, Manganese	Chloride, Iron	• Only one round of groundwater sampling completed thus far at this location	• located downgradient of waste to the south and screened in sand • groundwater may be slightly impacted by landfill leachate based on elevated chloride concentration • elevated iron, manganese and DOC may be related to presence of peat in area of the borehole
BH00-6B	DOC, Iron, Manganese, TDS	Chloride, Hardness, Iron, Stontium, Sulphate, TDS	• Only one round of groundwater sampling completed thus far at this location	• located downgradient of waste to the south and screened in sand • groundwater impacted by landfill leachate
BH00-7	Iron, Manganese	None	• Only one round of groundwater sampling completed thus far at this location	• located northwest of waste and screened in sand • groundwater not impacted by landfill leachate

Notes:
1. Leachate indicator parameters are selected from a list of parameters which are characterized by elevated concentrations in monitor BH00-3B in comparison to background conditions at BH00-1A and BH00-1B. The leachate indicator parameters are: Chloride, Hardness, Iron, Strontium, Sulphate and TDS.

TABLE 3
SUMMARY OF PARAMETERS EXCEEDING REASONABLE USE PERFORMANCE OBJECTIVES
AT GROUNDWATER MONITORS SCREENED IN THE SAND UNIT
WARD 3 LANDFILL SITE, TOWNSHIP OF ALFRED AND PLANTAGENET

Monitoring Location	Monitoring Session			
	Summer		Fall	
	Parameter	Concentration (mg/L)	Parameter	Concentration (mg/L)
BH00-2A	Iron	2.58		
	TDS	496		
BH00-2B	DOC	140	-	-
	Iron	24.3	-	-
	TDS	528	-	-
BH00-3B	Iron	10.0	-	-
	Sulphate	865	-	-
	TDS	1872	-	-
BH00-4A	Iron	12.1	-	-
	TDS	460	-	-
BH00-4B	Barium	0.35	-	-
	DOC	28	-	-
	Iron	20.8	-	-
	TDS	736	-	-
BH00-5A	-	-	Iron	0.93
BH00-6A	-	-	Iron	2.25
BH00-6B	-	-	DOC	71.7
	-	-	Iron	6.75
	-	-	TDS	720

TABLE 4
PROPOSED 2001 MONITORING PROGRAM
WARD 3 LANDFILL SITE, TOWNSHIP OF ALFRED AND PLANTAGENET

1.0 MONITORING SESSIONS

1.1 Water Level and Quality Monitoring

Spring (April/May)
Fall (September/October)

2.0 SAMPLING LOCATIONS

2.1 Groundwater

BH00-1A, BH00-1B, BH00-2A, BH00-2B, BH00-3A, BH00-3B, BH00-4A, BH00-4B, BH00-5A, BH00-5B, BH00-6A, BH00-6B and BH00-7.

2.2 Surface Water

Locations to be determined in the field at the time of groundwater sampling.

3.0 FIELD MEASURED PARAMETERS

Groundwater levels in all monitors

temperature, electrical conductivity, pH, dissolved oxygen (surface water only)

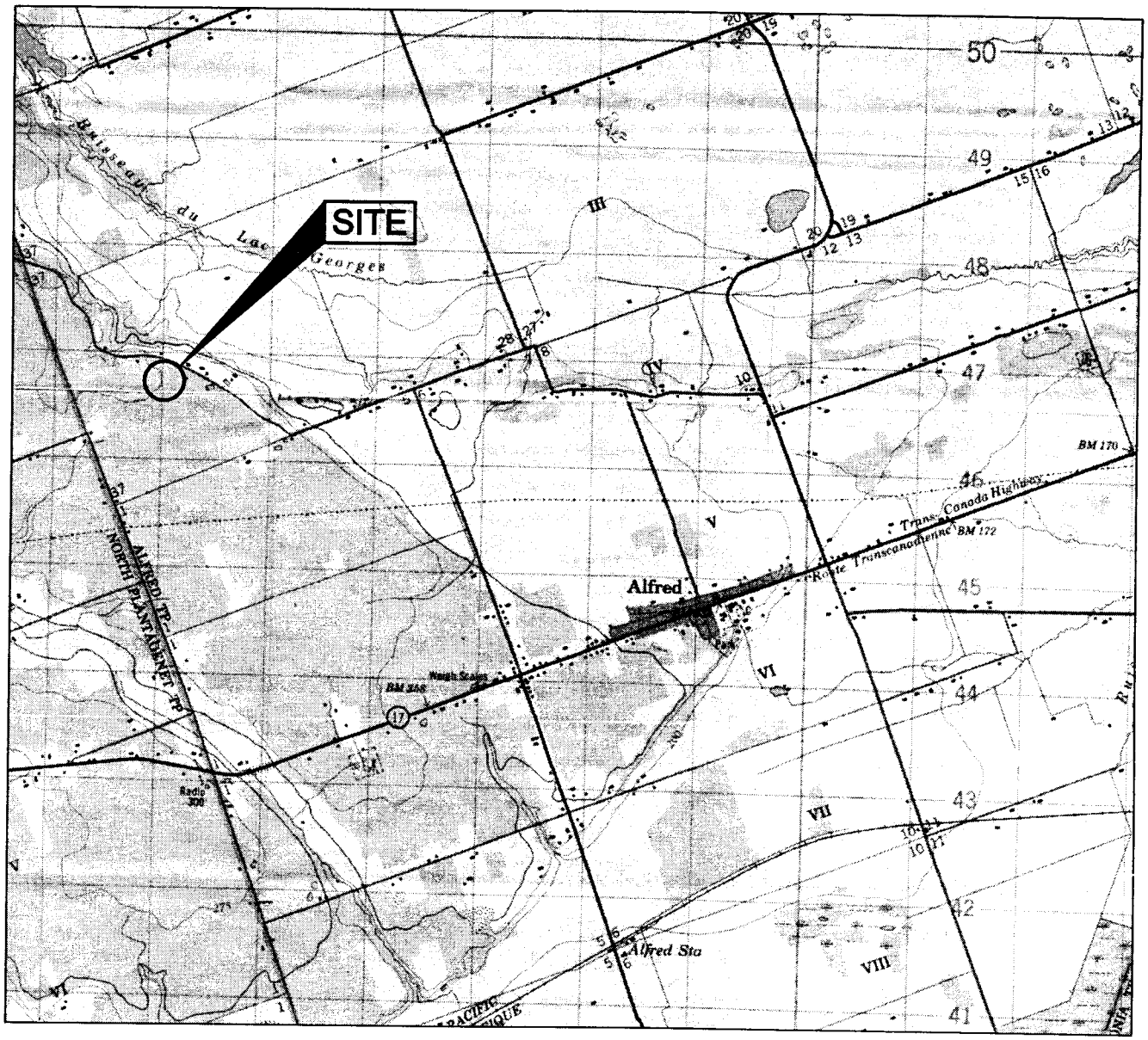
4.0 LABORATORY MEASURED PARAMETERS

Groundwater: alkalinity, aluminum, ammonia, barium, beryllium, boron, cadmium, calcium, chloride, chromium, cobalt, COD, copper, DOC, hardness (calculated from laboratory calcium and magnesium analyses), iron, lead, magnesium, manganese, molybdenum, nickel, nitrate, nitrite, phenols, phosphorus, potassium, silicon, silver, sodium, strontium, sulphate, sulphur, TDS, thallium, tin, titanium, TKN, vanadium, zinc.

NOTE: All laboratory analyses on water samples should be performed by a private analytical laboratory and the method detection limits (MDLs) for the specific analyses should be commensurate with the standards established in the MOE Ontario Drinking Water Standards (groundwater) or Provincial Water Quality Objectives (surface water).

KEY PLAN

FIGURE 1



SCALE 1 : 50,000

SPECIAL NOTE
THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT

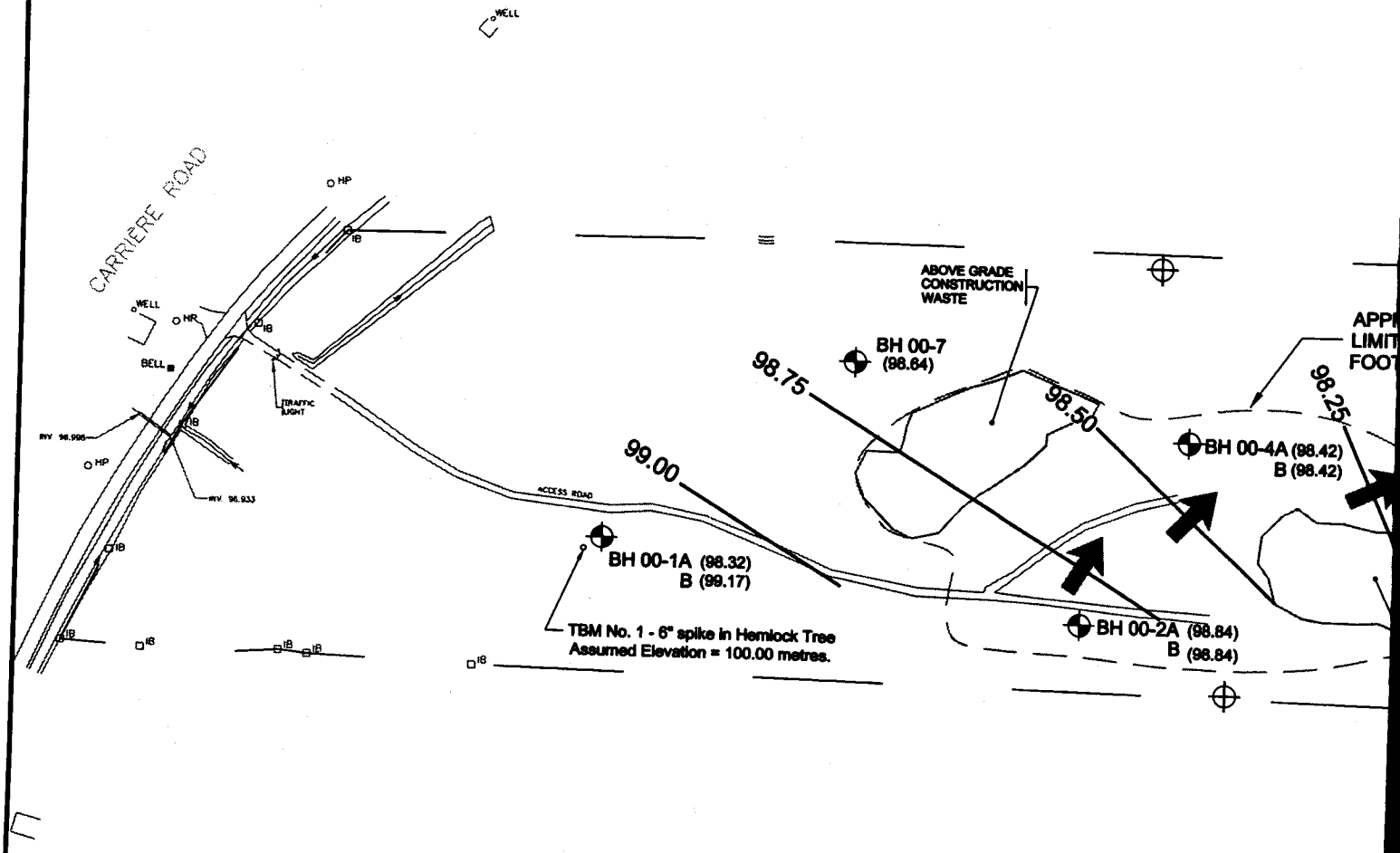
Date: FEB. 6, 2001

Project: 001-2749

Golder Associates

Drawn: K.T.

Chkd: GGM

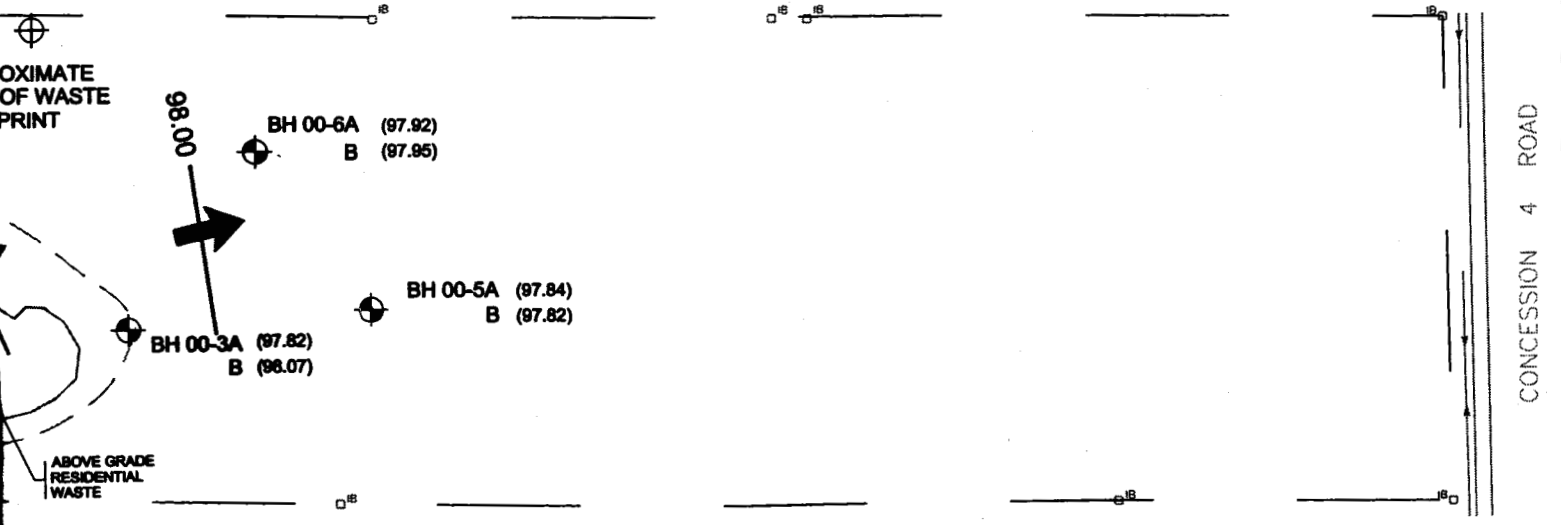

WELL
CARRIERE ROAD
HP
HB
WELL
HP
BELL
TRAFFIC LIGHT
RIV. 96.996
HP
RIV. 96.933
ACCESS ROAD
ABOVE GRADE CONSTRUCTION WASTE
BH 00-7 (98.64)
98.75
98.50
98.25
99.00
BH 00-4A (98.42)
B (98.42)
BH 00-1A (98.32)
B (99.17)
TBM No. 1 - 6" spike in Hemlock Tree
Assumed Elevation = 100.00 metres.
BH 00-2A (98.84)
B (98.84)

GROUNDWATER ELEVATIONS AND FLOW DIRECTION

FIGURE 3

LEGEND

- BOREHOLE LOCATION IN PLAN
- (97.92) GROUNDWATER ELEVATION, metres (MEASURED ON NOV. 27, 2000)
- —98.00— INFERRED GROUNDWATER ELEVATION CONTOUR, metres
- INTERPRETED DIRECTION OF GROUNDWATER FLOW IN SAND UNIT
- PROPOSED BOREHOLE LOCATION IN PLAN



REFERENCE:

BASE PLAN SUPPLIED BY : STANTEC CONSULTING LTD.

SCALE in metres

20 0 20 40 60 80

SCALE 1 : 3000

SPECIAL NOTE
THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT

Date: FEB. 22, 2001

Project: 001-2749

Golder Associates

Drawn: K.T.

Chkd: GBM

APPENDIX A

MOE CERTIFICATE OF APPROVAL (1981)

Ontario Ministry of the Environment

* 470904

PROVISIONAL CERTIFICATE OF APPROVAL
WASTE DISPOSAL SITE

Under The Environmental Protection Act, 1971 and the regulations and subject to the limitations thereof, this Provisional Certificate of Approval is issued to:

Arthur N. Carriere,
R.R. #1,
Alfred, Ontario.

for the use and operation of a 2.51 hectare landfilling site within a total site area of 37.4 hectares.

all in accordance with the following plans and specifications:
as per Schedule "A" (see attached)

Located: Part of West 1/2 of Lot 35, Concession 3,
Township of Alfred,
County of Prescott

which includes the use of the site only for the disposal of the following categories of waste (NOTE: Use of the site for additional categories of wastes requires a new application and amendments to the Provisional Certificate of Approval) 65% commercial, 30% domestic and 5% non-hazardous solid industrial waste.

and subject to the following conditions:

1. No waste shall be disposed of at the site until this Certificate including the reasons for this condition has been registered by the applicant as an instrument in the appropriate Land Registry Office against title to the site and a duplicate registered copy thereof has been returned by the applicant to the Director.

Registered ON TITLE as Instrument 48131

2. Wastes are to be deposited in an orderly manner in the fill area, compacted and adequately covered by 15 cm (6") of cover material once a month between April 15 and November 15, or as directed by the Director of the Southeastern Region of the Ministry of the Environment.

3. Burning of domestic waste is prohibited at the site.

THIS IS A TRUE COPY OF THE ORIGINAL CERTIFICATE MAILED ON 23.7.81

Dated this 14th day of July, 19 81.

(Signed)

Director, Section 39,
The Environmental Protection Act, 1971

Janv 6, 1977.

Mr G.J. McKenna, P.Eng.,
District Officer,
Municipal and Private Abatement,
4 Montréal Road,
Second Floor,
Cornwall, Ontario.

Subject: Operational Plan of Mr Arthur N. Carrière's Proposed Dump Site in the Township of Alfred.

Dear Sir:

Mr Arthur N. Carrière, if his dump site is approved intends to operate in the following manner:

according to Mr. Carriere topped using the trench had in approx 1980 next as method of landfill

1. The trenches will be dug to a maximum depth of 6 = 1.82 m feet, starting at the northeast end of the dump site, excavating the trench parallel to the east property line and progressing gradually with the other trenches toward the west side of the dump with all trenches being parallel to one another.

2. Compaction of the garbage and coverage with 6 inches of fill material will be done at least once a month and more frequently if required.

3. The access gate to the dump will be locked when the dump is not being used and signs will be erected near the gate. The signs erected will indicate the following:
   a) No trespassing.
   b) Hours for dump opening (as per Village requirements)
   c) Materials accepted in the dump site.

4. A buffer zone of 150 feet will be observed from all neighboring properties. This 150 feet buffer zone will include 50 feet of screening from adjacent properties.

5. The garbage will be compacted and covered using a D-6 dozer. The gravel road to the dump site is private and will be maintained by Mr Carrière.

Yours truly,

André Desjardins

André E. Desjardins, P.ENG.

c.c. Mr Carrière.

614 THERIAULT STREET, HAWKESBURY, ONTARIO, K6A 1Z3 – TEL.: (613) 632-4271

SCHEDULE "A"

Provisional Certificate of Approval No. A 470904

1. Application and Supporting Information forms for the Waste Disposal Site dated November 24, 1976.

2. Document entitled "Description of Proposed Waste Disposal Site".

3. Aerial photography showing the proposed site and surrounding area.

4. Plan dated November 26, 1976 showing the proposed waste disposal site and adjacent property owners.

5. "Operative Plan of Mr. Arthur Carrier's Proposed Dump Site in the Township of Alfred" dated January 6, 1977 prepared by Andre F. Desjardins, P. Eng., Consulting Engineer.

Ontario

MINISTRY OF THE ENVIRONMENT

NOTICE

TO: Arthur N. Carriere,
R.R. #1,
Alfred, Ontario.

You are hereby notified that Provisional Certificate of Approval No. A 470904 has been issued to you subject to the conditions outlined therein.

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

1. A reason for the condition requiring registration of the Certificate is that Section 46 of The Environmental Protection Act, 1971 prohibits any use being made of the lands after they cease to be used for waste disposal purposes within a period of twenty-five years from the year in which such land ceased to be used unless the approval of the Minister for the proposed use has been given. The purpose of this prohibition is to protect future occupants of the site and the environment from any hazards which might occur as a result of waste being disposed of on the site. This prohibition and potential hazard should be drawn to the attention of future owners and occupants by the Certificate being registered on title.

2. The reason for the imposition of condition 2 is to ensure that the development of this landfilling site will be in an orderly and systematic manner and the landfilling operations will be in accordance with the provisions of The Environmental Protection Act, 1971 and Regulation 824 pursuant to that Act and the use and operation of the site without such a conditon may create a nuisance.

3. A reason for condition 3 is to ensure the health and safety of any person and the operations of the site without such a condition may create a nuisance.

You may by written notice served upon me and the Environmental Appeal Board within 15 days after receipt of this Notice, require a hearing by the Board.

This Notice should be served upon:

The Secretary
Environmental Appeal Board
1 St. Clair Avenue West
5th Floor
Toronto, Ontario
M4V 1K7

AND

The Director
Section 39, E.P.A.
Ministry of the Environment
133 Dalton Street, Box 820,
Kingston, Ontario
K7L 4X6

Dated at Toronto this 14th day of July, 1981.

Ontario Environment anagement Branch

FOR NISTRY USE ONLY

File A —

SUPPORTING INFORMATION TO AN APPLICATION FOR APPROVAL OF A LANDFILL DISPOSAL SITE

APPLICANT TO COMPLETE ITEMS 1-4 INCLUSIVE

1. Site Details

APPLICANT

Arthur N. Carrière

SITE LOCATION

Pt W½ Lot 35 Concession 3

Alfred Township - Prescott County

TOTAL AREA OF SITE 92.5 65 ACRES	TOTAL AREA TO BE UTILIZED FOR WASTE DISPOSAL 6.2 ACRES
ANTICIPATED LIFETIME ____ YEARS	DISTANCE TO NEAREST WATERCOURSE N/A FT.
DISTANCE TO NEAREST POTABLE WELL WATER SUPPLY 900 FT.	DEPTH OF WELL NOTED AT LEFT 16 FT.
DISTANCE TO DWELLING 900 FT.	DISTANCE TO PUBLIC ROAD MEASURED FROM WORKING AREA 1,200 FT.
DISTANCE TO CEMETERY 14,000 FT.	DEPTH FROM ORIGINAL SURFACE TO BOTTOM OF WASTE 6 FT.

DEPTH FROM ORIGINAL SURFACE TO TOP OF FILL - FT.

GROUND CONDITIONS ENCOUNTERED MEASURED FROM ORIGINAL SURFACE

Fine Sand FROM 0' TO 9'

FROM ____ TO ____

FROM ____ TO ____

FROM ____ TO ____

DEPTH TO WATERTABLE BELOW SURFACE None at 9 FT.	ON(DATE) August 23 1976

GENERAL DESCRIPTION OF SITE (LOCATION, TOPOGRAPHY, ETC.)

1200 feet south of Forced Road across W½ Lot 35 Concession 3 on topographically high area.

PROPOSED USE OF LAND AFTER SITE FULLY UTILIZED

2. Wastes to be disposed of

DOMESTIC 95

COMMERCIAL

INDUSTRIAL WASTE

HAULED LIQUID INDUSTRIAL WASTE

DESCRIBE

ORIGIN (OTHER)

FOR REGIONAL OFFICE USE

Authorities consulted:	OBJECTION	COMMENTS
HEALTH UNIT	☐	☐
A.M.B.	☐	☐
MUNICIPALITY	☐	☐
CONSERVATION AUTHORITY	☐	☐
SANITARY ENGINEERING	☐	☐
INDUSTRIAL WASTES	☐	☐
WATER QUANTITY	☐	☐
OTHER ____	☐	☐
____	☐	☐

Inspection Record Forms attached Yes ☐ No ☐

Number of Forms ____

Regional Engineer's Report attached ☐

	REQUIRED	AVAILABL
Ground Water monitoring	Yes ☐ No ☐	Yes ☐ Nc
Surface Water monitoring	Yes ☐ No ☐	Yes ☐ Nc

3. Quantities

TOTAL TONS PER DAY	TOTAL GALLONS PER DAY
1	Nil

ESTIMATED ☒ OR MEASURED ☐

SITE OPENED 5 DAYS FROM 9 AM TO 4 PM

POPULATION SERVED ~~1,000~~ 1350

NAMES OF MUNICIPALITIES SERVED

Village of Alfred

OFFICIAL PLAN ☐ N/A ZONING BY-LAW ☐ N/A

SITE LAND ZONED	ADJACENT LAND ZONED
Agricultural	Agricultural

EQUIPMENT OWNED ☑ RENTED ☑

Ontario Environment Management Branch

FOR MINISTRY USE ONLY

File A —

APPLICATION FOR A CERTIFICATE OF APPROVAL FOR A WASTE DISPOSAL SITE

IMPORTANT NOTE: This form must be submitted through the office of the Regional Waste Management Engineer **See back of form for instructions for completing this form.**

1. Owner (Applicant) — Under the Environmental Protection Act and the Regulations, this application is made by:—

Arthur N. Carrière (Name)
RR 1
Alfred, Ontario. (Address)
Box 38

2. Type of disposal site — For the ~~Renewal~~ Issue of a Certificate of Approval for a

Landfilling Dump

3. Site location — Located

Pt W½ Lot 35 Concession
Alfred Township
Prescott County.

IF APPLICATION IS FOR REISSUE, COMPLETE SECTIONS 4 AND 5 (A OR B)

4. Previous Certificate details — ~~Certificate~~ / Provisional Certificate of Approval:— for this site was issued on:—

No. N/A
19

5. Changes.

(A) The following changes in use, operation or ownership (have occurred since the date of the original application) OR (are proposed)

N/A

(B)

6. Operator

APPENDIX B

MOE COMPLIANCE INSPECTION REPORT
(January 21, 2000)

Ministry of the Environment

113 Amelia Street
Cornwall ON K6H 3P1
Telephone: (613) 933-7402
Fax: (613) 933-6402

Ministère de l'Environnement

113 rue Amelia
Cornwall ON K6H 3P1
Téléphone: (613)933-7402
Télécopieur: (613)933-6402

Ontario

January 21, 2000

Diane Thauvette, Clerk-Treasurer
Corporation of the Township of
Alfred and Plantagenet
205 Old Highway 17
P.O. Box 350
Plantagenet, ON K0B 1L0

Dear Madam:

Re: Compliance Inspection Report - Carrière Waste Disposal Site

The above-noted facility was inspected on October 20, 1999, by Gerry Murphy, Senior Environmental Officer, for this office.

Enclosed is a copy of the inspection report. Your attention is directed to the sections of the report titled "Action(s) Required" .

I ask that you provide this office with a detailed abatement schedule for addressing the operational concerns outlined in the inspection report. Please send me this schedule by February 25, 2000.

If you have any questions or comments, please contact Gerry Murphy at this office at extension 232.

Yours truly,

R.J. Robertson
Area Supervisor

GM:sp
Enclosure

S:\GROUPS\WORDPRO\2000\Inspections\WASTE\CARRIERE

COMPLIANCE INSPECTION REPORT

CARRIÈRE
Waste Disposal Site

SOLID NON-HAZARDOUS WASTE DISPOSAL SITE

REPORT PREPARED BY THE CORNWALL OFFICE OF THE MINISTRY OF THE ENVIRONMENT, EASTERN REGION

Inspected by: Gerry Murphy
Inspection: October 20, 1999

TABLE OF CONTENTS

APPENDICES

Ontario

MINISTRY OF THE ENVIRONMENT

SOLID NON-HAZARDOUS WASTE DISPOSAL SITE INSPECTION REPORT

COMPANY/MUNICIPALITY: Old Township of Alfred, presently the amalgamated Township of Alfred & Plantagenet. Note: This site serves the Village of Alfred only.

SITE ADDRESS: Part of West ½ of Lot 35, Concession 3

CONTACT NAME: Sylvio Simard **TITLE:** Deputy Clerk

CONTACT TELEPHONE: 613-673-4797 **FAX:** 613-673-4812

SITE LOCATION: The site is located approximately 4.5 km northwest of the Village of Alfred and on the south side of Carrière Road.

SITE NAME: The site is still referred to as the Carrière site, but as of September 29,1999, the site is now owned and operated by the municipality and registered on title as Instrument No. 102864.

INSPECTION DATE: October 20, 1999

DATE OF LAST INSPECTION: December 15, 1994

1.0 CERTIFICATES OF APPROVAL

- CofA #A470904 - issued August 11,1977, expiry date August 15, 1982 (Appendix "A") Condition: For the use, operation and establishment of a landfilling site all in accordance with Schedule "A" attached.

- CofA #A470904 - dated July 14, 1981, with no expiry date (Appendix "B"), for the use and operation of a 2.51 Ha landfilling site within a total site area of 37.4 Ha, all in accordance with the following plans and specifications as per Schedule "A" attached.

  Conditions:

  1) No waste shall be disposed of at the site until this Certificate, including the reasons for this condition, has been registered by the applicant as an instrument in the appropriate Land Registry Office against title to the site and a duplicate registered copy thereof has been returned by the applicant to the Director. NOTE: The Certificate has been registered on title as Instrument No. 48131.

2) Wastes are to be deposited in an orderly manner in the fill area, compacted and adequately covered by 15 cm (6") of cover material once a month between April 15th and November 15th or as directed by the Director MOE.
3) Burning of domestic waste is prohibited at the site.

Is there a record of financial assurance on the MOE file?

- No record of financial assurance on the MOE files, with no requirement documented on the CofA.

What is the approved total area of the site ?

- The present approved total area of the site is 37.4 hectares.
  Note: When the site was purchased by the municipality (September 1999), they acquired 21.2 Ha of the approved 37.4 Ha from the original owner, Mr. Arthur Carrière. A copy of the assessment map (Appendix "C") is enclosed, which shows the presently approved 37.4 Ha area and the newly purchased area.

What is the approved landfilling area (footprint) of the site ?

- The approved footprint of the site is 2.51 Ha.

Does the site have an approved capacity ?

- The site does not have a documented approved capacity, but based on presently approved trench method of fill, the total site capacity is 45,682 m^3 of waste.
  Capacity calculation: Area of footprint, multiplied by approved depth of waste in trench
  (2.51 Ha =25,100 m^2) X (6 feet = 1.82 metres) = 45,682 m^3

  Note: Since this approval was issued in 1977 for trench method of fill, Mr. A. Carrière converted over to the area method of fill in approximately 1980.

2.0 INSPECTION OBSERVATIONS

Has the footprint been flagged and/or is clearly identifiable ?

- During the current compliance inspection, the footprint was not flagged, or clearly identifiable. Municipal representatives mentioned that this would be done within the new year.

Are wastes being deposited outside of the footprint ?

- At the time of the compliance inspection there was no evidence of wastes being deposited outside the footprint.

Is access to the site controlled ?

- Access to the site is regulated under Section 11 (2) of Regulation 347. Currently, the entrance to the site is controlled by a locked chain. No evidence of fencing around the perimeter of the approved site.

  Note: There is no need for site supervision, since waste pick-up and disposal is done by the municipality, with the site not being open to the public of the Village of Alfred.

Are wastes being adequately covered ?

- The waste was compacted and covered approximately 3 times a year when owned and operated by the previous owner of the site. This practice contravened Section 2 of the 1981 C of A that stipulates the waste be compacted and covered with 15 cm of cover material once a month between April 15th and November 15th. The current owner (Alfred and Plantagenet Township) ensures the site is covered as per instructions on the C of A. Cover material is imported to the site from a local sand pit. Windblown litter did not appear to be a concern at the time of the compliance inspection.

Is there evidence of burning ?

- The C of A stipulates burning of domestic waste is prohibited at the site. There was no evidence of open burning at the time of the compliance inspection.

Is there any obvious evidence of groundwater/surface water impact ?

- At the time of the compliance inspection, there was no obvious evidence of groundwater or surface water impacts, but to this date, no hydrogeological investigation has been performed to verify or deny an impact.

If a leachate control system is required for this site, is it operational ?

- It is currently impossible to determine if a leachate control system is required, since a full hydrogeological investigation has yet to be completed.

If a methane gas control system is required for this site, is it operational ?

- Currently impossible to determine if a methane gas control system is required, since a hydrogeological investigation has yet to be completed.

Is there evidence that wastes other than solid non-hazardous wastes are being deposited at the site?

- No evidence of waste other than solid non-hazardous wastes are being deposited at the site.

3.0 REVIEW OF OUTSTANDING ISSUES

- No complaints have been received by this Ministry pertaining to the operation of the site since the last Compliance Inspection report of 1994.

- A site inspection was completed in April 1998, by ministry staff, to assess the operating authority`s compliance with the site's Certificate of Approval. The Cornwall Area Office then forwarded a letter on August 21, 1998, to the attention of Diane Thauvette (Clerk-Treasurer, Alfred and Plantagenet Township) outlining recommendations pertaining to waste management practices (Appendix "D"). The Township then forwarded a response on September 21, 1998, outlining their remedial plan to comply with the ministry`s recommendations (Appendix "E").

4.0 SUMMARY OF INSPECTION FINDINGS (HEALTH/ENVIRONMENTAL IMPACT)

- Was there any indication of a known or anticipated human health impact during the inspection and/or review of relevant material, related to this Ministry's mandate ?

  Yes No ☒

- Was there any indication of a known or anticipated environmental impact during the inspection and/or review of relevant material ?

  Yes No ☒

- Was there any indication of a known or suspected violation of a legal requirement during the inspection and/or review of relevant material which could cause a human health impact or environmental impairment ?

  Yes ☒ No

  Specifics: The site is being operated using the area method of fill, but the CofA was issued to incorporate the trench method of fill.

- Was there any indication of a potential for environmental impairment during the inspection and/or the review of relevant material ?

  Yes ☒ No

  Specifics: The natural topography of the land surrounding and including the footprint would indicate a relatively high groundwater table and if so, there may be leachate concerns generated from wastes buried within the water table.

4.1 ACTION(S) REQUIRED

- The Municipality is to:

1) amend the existing C of A to incorporate the currently used area method of fill as opposed to the approved trench method;
2) retain the services of a competent consultant to conduct a complete hydrogeological assessment of the site;
3) retain the services of a competent consultant to complete the required Operation and Development Plan for the site;
4) develop a municipal plan, i.e. by-law, to deal with the disposal of waste appliances at the site that contain refrigerants. Enclosed (Appendix "F") is a copy of Ontario Regulation 189/94 entitled "Refrigerants". As was suggested, there appears to be two preferred ways to go with regard to an approved method of emptying these appliances of refrigerant. One would be to have the owner of the waste appliance retain the services of an Ozone Depletion Prevention (ODP) card member to come to the location where the appliance is stored and properly remove the refrigerant and then tag the appliance which would indicate the appliance as refrigerant free. The tagged appliance could then be disposed of at the local approved waste disposal site and stored with other white goods (stoves, etc.). The second method would involve the municipality accepting these refrigerant appliances, storing them in a separate secure area of the site and hiring an ODP card member to come to the waste disposal site to empty these units;
5) dispose of tires through a recycling company;
6) install an up-to-date sign at the entrance to the site that will denote the owner of the site, operator of the site, who is authorized to use the site, types of waste accepted, emergency telephone number, and any applicable local by-laws.

5.0 ACTION(S) REQUIRED

- The municipality is aware of the above inspection findings and is currently developing a strategy to deal with these situations. The municipality is to report, in writing, to the MOE Cornwall Area Office by February 25, 2000, of their intention as to the timing of these issues.

OCCURRENCE REPORT #: 9940002533 - to amend C of A.

PREPARED BY:

ENVIRONMENTAL OFFICER: Gerry Murphy
(Print)

(Signature)

Kingston/Cornwall Area Office
(District/Area Office)

January 21/2000
(Date)

REVIEWED BY:

DISTRICT SUPERVISOR: R.J. Robertson
(Print)

(Signature)

Jan 21/00
(Date)

REPORT MAILED OUT ON: 21.I.00
(Date)

NOTE: "This inspection does not in any way suggest that there is or has been compliance with applicable legislation and regulations as they apply or may apply to this facility. It is, and remains, the responsibility of the owner and/or the operating authority to ensure compliance with all applicable legislative and regulatory requirements."

APPENDIX "A"

CERTIFICATE OF APPROVAL

issued August 11, 1977

Ontario
Ministry of the Environment

Provisional Certificate No.
A 470904

PROVISIONAL CERTIFICATE OF APPROVAL
FOR A
WASTE DISPOSAL SITE

MINISTRY OF THE ENVIRONMENT
CORNWALL

Under The Environmental Protection Act, 1971 and the regulations and subject to the limitations thereof, this Provisional Certificate of Approval is issued to:

Arthur N. Carriere
R. R. # 1
Alfred, Ontario

For the use, operation and establishment of a landfilling site all in accordance with Schedule "A".

Located on Part of W½ Lot 35, Concession 3
Alfred Township
Prescott County

THIS IS A TRUE COPY OF THE ORIGINAL CERTIFICATE MAILED

ON AUG 12 1977

P. L.
(Signed)

This Provisional Certificate expires on the 15th day of August, 19 82

Dated this 11th day of August, 19 77

D. P. Caplice
DIRECTOR, SECTION 3 (a) E.P.A.

201

SCHEDULE "A"

Provisional Certificate of Approval No. A 470904

1. Application and Supporting Information forms for the Waste Disposal Site dated November 24, 1976.

2. Document entitled "Description of Proposed Waste Disposal Site".

3. Aerial photography showing the proposed site and surrounding area.

4. Plan dated November 26, 1976 showing the proposed waste disposal site and adjacent property owners.

5. "Operative Plan of Mr. Arthur Carrier's Proposed Dump Site in the Township of Alfred" dated January 6, 1977 prepared by Andre F. Desjardins, P. Eng., Consulting Engineer.

APPENDIX "B"

CERTIFICATE OF APPROVAL

issued July 14, 1981

of the Environment
Ontario

470904

PROVISIONAL CERTIFICATE OF APPROVAL
WASTE DISPOSAL SITE

Under The Environmental Protection Act, 1971 and the regulations and subject to the limitations thereof, this Provisional Certificate of Approval is issued to:

Arthur N. Carriere,
R.R. #1,
Alfred, Ontario.

for the use and operation of a 2.51 hectare landfilling site within a total site area of 37.4 hectares.

all in accordance with the following plans and specifications:
as per Schedule "A" (see attached)

Located: Part of West 1/2 of Lot 35, Concession 3,
Township of Alfred,
County of Prescott

which includes the use of the site only for the disposal of the following categories of waste (NOTE: Use of the site for additional categories of wastes requires a new application and amendments to the Provisional Certificate of Approval) 65% commercial, 30% domestic and 5% non-hazardous solid industrial waste.

and subject to the following conditions:

1. No waste shall be disposed of at the site until this Certificate including the reasons for this condition has been registered by the applicant as an instrument in the appropriate Land Registry Office against title to the site and a duplicate registered copy thereof has been returned by the applicant to the Director.

Registered ON TITLE as Instrument 48131

2. Wastes are to be deposited in an orderly manner in the fill area, compacted and adequately covered by 15 cm (6") of cover material once a month between April 15 and November 15, or as directed by the Director of the Southeastern Region of the Ministry of the Environment.

3. Burning of domestic waste is prohibited at the site.

THIS IS A TRUE COPY OF THE ORIGINAL CERTIFICATE MAILED ON 23.7.81

Dated this 14th day of July, 19 81.

(Signed)

Director, Section 39,
The Environmental Protection Act, 1971

Jan 6, 1977.

Mr G.J. McKenna, P.Eng.,
District Officer,
Municipal and Private Abatement,
4 Montréal Road,
Second Floor,
Cornwall, Ontario.

Subject: Operational Plan of Mr Arthur N. Carrière's Proposed Dump Site in the Township of Alfred.

Dear Sir:

Mr Arthur N. Carrière, if his dump site is approved intends to operate in the following manner:

according to Mr. Carriere stopped using the trench had in approx 1980 next we method of landfill

1. The trenches will be dug to a maximum depth of 6 = 1.82 m feet, starting at the northeast end of the dump site, excavating the trench parallel to the east property line and progressing gradually with the other trenches toward the west side of the dump with all trenches being parallel to one another.

2. Compaction of the garbage and coverage with 6 inches of fill material will be done at least once a month and more frequently if required.

3. The access gate to the dump will be locked when the dump is not being used and signs will be erected near the gate. The signs erected will indicate the following:
   a) No trespassing.
   b) Hours for dump opening (as per Village requirements)
   c) Materials accepted in the dump site.

4. A buffer zone of 150 feet will be observed from all neighboring properties. This 150 feet buffer zone will include 50 feet of screening from adjacent properties.

5. The garbage will be compacted and covered using a D-6 dozer. The gravel road to the dump site is private and will be maintained by Mr Carrière.

Yours truly,

André Desjardins

c.c. Mr Carrière.

André E. Desjardins, P.ENG.

614 THERIAULT STREET, HAWKESBURY, ONTARIO, K6A 1Z3 - TEL.: (613) 632-4271

SCHEDULE "A"

Provisional Certificate of Approval No. A 470904

1. Application and Supporting Information forms for the Waste Disposal Site dated November 24, 1976.

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5. "Operative Plan of Mr. Arthur Carrier's Proposed Dump Site in the Township of Alfred" dated January 6, 1977 prepared by Andre F. Desjardins, P. Eng., Consulting Engineer.

Ontario

MINISTRY OF THE ENVIRONMENT

NOTICE

TO: Arthur N. Carriere,
R.R. #1,
Alfred, Ontario.

You are hereby notified that Provisional Certificate of Approval No. A 470904 has been issued to you subject to the conditions outlined therein.

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

1. A reason for the condition requiring registration of the Certificate is that Section 46 of The Environmental Protection Act, 1971 prohibits any use being made of the lands after they cease to be used for waste disposal purposes within a period of twenty-five years from the year in which such land ceased to be used unless the approval of the Minister for the proposed use has been given. The purpose of this prohibition is to protect future occupants of the site and the environment from any hazards which might occur as a result of waste being disposed of on the site. This prohibition and potential hazard should be drawn to the attention of future owners and occupants by the Certificate being registered on title.

2. The reason for the imposition of condition 2 is to ensure that the development of this landfilling site will be in an orderly and systematic manner and the landfilling operations will be in accordance with the provisions of The Environmental Protection Act, 1971 and Regulation 824 pursuant to that Act and the use and operation of the site without such a conditon may create a nuisance.

3. A reason for condition 3 is to ensure the health and safety of any person and the operations of the site without such a condition may create a nuisance.

You may by written notice served upon me and the Environmental Appeal Board within 15 days after receipt of this Notice, require a hearing by the Board.

This Notice should be served upon:

The Secretary
Environmental Appeal Board
1 St. Clair Avenue West
5th Floor
Toronto, Ontario
M4V 1K7

AND

The Director
Section 39, E.P.A.
Ministry of the Environment
133 Dalton Street, Box 820,
Kingston, Ontario
K7L 4X6

Dated at Toronto this 14th day of July, 1981.

Ministry of the Environment — Waste Management Branch — Ontario

FOR MINISTRY USE ONLY

File A —

SUPPORTING INFORMATION TO AN APPLICATION FOR APPROVAL OF A LANDFILL DISPOSAL SITE

APPLICANT TO COMPLETE ITEMS 1-4 INCLUSIVE

1. Site Details

APPLICANT: Arthur N. Carrière

SITE LOCATION: Pt W½ Lot 35 Concession 3

Alfred Township - Prescott County

TOTAL AREA OF SITE 92.5 65 ACRES	TOTAL AREA TO BE UTILIZED FOR WASTE DISPOSAL 6.2 ACRES
ANTICIPATED LIFETIME ____ YEARS	DISTANCE TO NEAREST WATERCOURSE N/A FT.
DISTANCE TO NEAREST POTABLE WELL WATER SUPPLY 900 FT.	DEPTH OF WELL NOTED AT LEFT 16 FT.
DISTANCE TO DWELLING 900 FT.	DISTANCE TO PUBLIC ROAD MEASURED FROM WORKING AREA 1,200 FT.
DISTANCE TO CEMETERY 14,000 FT.	DEPTH FROM ORIGINAL SURFACE TO BOTTOM, OF WASTE 6 FT.
DEPTH FROM ORIGINAL SURFACE TO TOP OF FILL - FT.	

GROUND CONDITIONS ENCOUNTERED MEASURED FROM ORIGINAL SURFACE

Fine Sand FROM 0' TO 9'

FROM ____ TO ____

FROM ____ TO ____

FROM ____ TO ____

DEPTH TO WATERTABLE BELOW SURFACE None at 9 FT.	ON(DATE) August 23 1976

GENERAL DESCRIPTION OF SITE (LOCATION, TOPOGRAPHY, ETC.)

1200 feet south of Forced Road across W½ Lot 35 Concession 3 on topographically high area.

PROPOSED USE OF LAND AFTER SITE FULLY UTILIZED

2. Wastes to be disposed of

DOMESTIC 95

COMMERCIAL

INDUSTRIAL WASTE

HAULED LIQUID INDUSTRIAL WASTE

*DESCRIBE

ORIGIN (OTHER

FOR REGIONAL OFFICE USE

Authorities consulted:	Objection	Recommend
HEALTH UNIT	☐	☐
A.M.B.	☐	☐
MUNICIPALITY	☐	☐
CONSERVATION AUTHORITY	☐	☐
SANITARY ENGINEERING	☐	☐
INDUSTRIAL WASTES	☐	☐
WATER QUANTITY	☐	☐
OTHER ____	☐	☐
____	☐	☐

Inspection Record Forms attached Yes ☐ No ☐

Number of Forms ____

Regional Engineer's Report attached ☐

	REQUIRED	AVAILABLE
Ground Water monitoring	Yes ☐ No ☐	Yes ☐ No
Surface Water monitoring	Yes ☐ No ☐	Yes ☐ No

3. Quantities

TOTAL TONS PER DAY	TOTAL GALLONS PER DAY
1	Nil

ESTIMATED ☒ OR MEASURED ☐

SITE OPENED 5 DAYS FROM 9 AM TO 4 PM

POPULATION SERVED ~~1,000~~ 1350

NAMES OF MUNICIPALITIES SERVED

Village of Alfred

OFFICIAL PLAN ☐ N/A ZONING BY-LAW ☐ N/A

SITE LAND ZONED	ADJACENT LAND ZONED
Agricultural	Agricultural

EQUIPMENT OWNED ☐ RENTED ☐

Ontario Ministry of the Environment — Waste Management Branch

FOR MINISTRY USE ONLY

File A —

APPLICATION FOR A CERTIFICATE OF APPROVAL FOR A WASTE DISPOSAL SITE

IMPORTANT NOTE: This form must be submitted through the office of the Regional Waste Management Engineer **See back of form for instructions for completing this form.**

1. Owner (Applicant) — Under the Environmental Protection Act and the Regulations, this application is made by:—

Arthur N. Carrière (Name)
RR 1
Alfred, Ontario. (Address)
Box 38

2. Type of disposal site — For the ~~Renewal~~ Issue of a Certificate of Approval for a

Landfilling Dump

3. Site location — Located

Pt W½ Lot 35 Concession
Alfred Township
Prescott County.

IF APPLICATION IS FOR REISSUE, COMPLETE SECTIONS 4 AND 5 (A OR B)

4. Previous Certificate details — Certificate / Provisional Certificate for this site was issued on:— of Approval:— No. N/A 19

5. Changes.

(A) The following changes in use, operation or ownership (have occurred since the date of the original application) OR (are proposed)

N/A

(B)

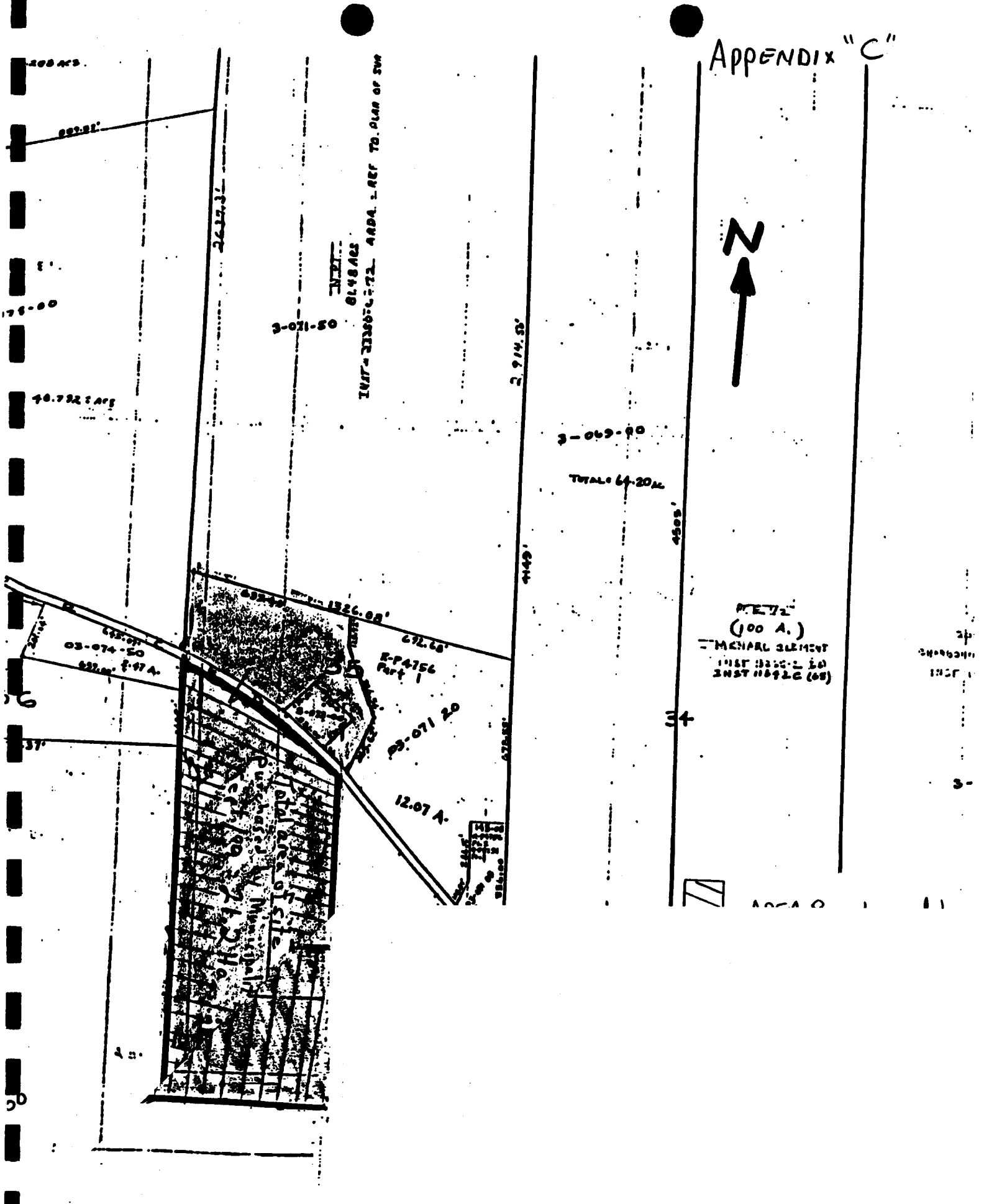
6. Operator

APPENDIX "C"

ASSESSMENT MAP

extracted from Official Plan 46R-6149

APPENDIX "C"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3-069-00
TOTAL = 64.20 AC.
03-074-50
E-P 4756 Part 1
03-071-20
12.07 A.
1326.88'
692.28'
2714.5'
4449'
4505'
34
P.E. 1/2
(100 A.)
MINERAL SEGMENT

APPENDIX "D"

LETTER TO THE MUNICIPALITY RE: MOE ASSESSMENT OF OPERATING AUTHORITY'S COMPLIANCE WITH CERTIFICATE OF APPROVAL

dated August 21, 1998

Ontario

Ministry of the Environment

113 Amelia Street, 2nd Floor
Cornwall, Ontario
K6H 3P1

(613) 933-7402 Fax: (613) 933-6402

(F)

Appendix "D"

August 21, 1998

Ms. Diane Thauvette
Clerk/Treasurer
Township of Alfred & Plantagenet
205 Old Route 17
P.O. Box 350
Plantagenet, Ontario K0B 1L0

Re: Township of Alfred - Carriere Waste disposal Site
Certificate of Approval Number A470904

The above-noted site was inspected in April 1998, and your attention is directed to the recommendations listed below.

The purpose of the inspection is to assess the operating authority's compliance with the site's Certificate of Approval issued by the Ministry of Environment for the use and operation of the waste disposal site. Operational procedures utilized at the site are also graded against the Ministry's policies and guidelines with a goal to achieving consistency in waste management practises.

1 **The frequency of covering waste is inadequate. Several months of waste was present on the day of the inspection. Final grading on 3 to 1 or 4 to 1 sideslopes should be done on closed portions of the site. Final cover and seeding or sodding is required for slope stability.**

2. **A litter control program should be implemented to minimize problems along the site boundaries and on adjacent lands.**

3. **The municipality should form a committee, or expand the mandate of any current waste management committee, to perform regular self assessments of compliance with the C of A and Operations plan, deal with complaints, review tenders/contracts, and to advise Council on all waste management issues and disposal options on the short and long term bases.**

4. **The entrance sign should provide an emergency telephone number and should include specific information on fines for illegal dumping at the gate and on the site.**

5. **Status reports regarding reserve capacity, waste volumes, complaints, monitoring results, etc, should be prepared for submission to the Cornwall District Office of the M.O.E. on a regular basis.**

6. **To comply with Regulation 189/94, the Municipality must choose one of the following options:**

- **Refuse all untagged refrigerant equipment (including refrigerators, freezers, air conditioners, etc)**

- **Accept only refrigerant equipment that is clearly tagged by "*a technician who possesses an Ozone Depletion Prevention (ODP) card*"**

- **Amend the Operation & Development Plan and obtain a minor modification to the C of A from MOE to establish an on-site "secure" storage area for refrigerant equipment that will be re-used or will be drained and tagged by a technician who possesses an ODP card.**

- **Establish a "Stationary refrigerant waste disposal sites" in accordance with necessary approvals (Section 27) or exemptions (Section 32) prescribed by Ont. Reg. 347, EPA.**

Please prepare a response to these concerns and submit it by September 30, 1998. In your submission, please give details and assign target dates for which you estimate each task will be completed.

If you have any questions or comments concerning the matter or wish an extension to the submission date, please contact Jeff Columbus at this office (933-7402).

Yours truly,

R. J. Robertson, P.Eng.
Area Supervisor
Abatement Section
Cornwall Area Office

LLB/lm
Enclosures

S:\GROUPS\WORDPRO\Ron Robertson (Rjr)\Letters\Thauvette2.wpd

APPENDIX "E"

LETTER OF RESPONSE FROM THE MUNICIPALITY TO AUGUST 21, 1998 LETTER OF MOE ASSESSMENT

dated September 21, 1998

Ministry of the Environment

113 Amelia Street
Cornwall ON K6H 3P1
Telephone: (613) 933-7402
Fax: (613) 933-6402

Ministère de l'Environnement

113 rue Amelia
Cornwall ON K6H 3P1
Téléphone: (613)933-7402
Télécopieur: (613)933-6402

Ontario

February 10, 2000

Diane Thauvette, Clerk-Treasurer
Corporation of the Township of
Alfred and Plantagenet
205 Old Highway 17
P.O. Box 350
Plantagenet, ON K0B 1L0

Dear Madam:

Re: Compliance Inspection Report - Carrière Waste Disposal Site

By letter dated January 21, 2000, we forwarded to you a copy of the Compliance Inspection Report for the Carrière Waste Disposal Site.

We have since noticed that the wrong Appendix "E" was inserted in this report. Would you kindly replace the Appendix "E" that is currently in the report with the Appendix "E" which you will find attached hereto.

Thank you very much for your cooperation in this matter.

Yours truly,

Gerry Murphy
Sr. Environmental Officer

GM:sp
Enclosure

S:\GROUPS\WORDPRO\2000\Inspections\WASTE\Carriere.ltr.wpd

CORPORATION DU CANTON D' ALFRED ET PLANTAGENET
THE TOWNSHIP OF

C.P. / P.O. Box 350
205 Old Highway 17 / 205 vieille route 17
Plantagenet, Ontario
K0B 1L0

TÉL: (613) 673-4797
FAX: (613) 673-4812

File: 257-02

September 21st, 1998

Appendix "E"

Mr. R. J. Robertson, P. Eng., Area Supervisor
Ministry of the Environment
113 Amelia Street
Cornwall, Ontario
K6H 3P1

Dear Sir:

Re: Township of Alfred and Plantagenet – (Former Village of Alfred) Carrière Waste Disposal Site - Certificate of Approval Number A 470904

Your report of August 21st, 1998, listing some recommendations concerning the above mentioned site was brought to the attention of the public works committee on September 2nd, 1998.

The following is submitted in reply to the different recommendations brought forward:

1. "The frequency of covering waste is inadequate."
Effective September 9th, waste covering will be carried out monthly during the period from April 15th, to November 15th. Final grading and seeding will be done before October 15th.

2. "A litter control program should be implemented..."
Site will be inspected monthly to start a litter control program and then appropriate action will be carried out as required.

3. "The municipality should form a committee..."
A public works committee has recently been formed for our municipality and anything dealing with waste collection as well as the management of the waste disposal sites is reported to this committee by the public works superintendent who sits on that committee.

4. "The entrance sign should provide..."
All entrance signs of the different waste disposal sites will be redone as soon as the set fines are received from the Attorney General. The emergency telephone numbers will also be corrected at the same time.

.../2

5. "Status reports regarding reserve capacity..."
Because of the recent restructuration of our municipality, council was not aware of the lack of reports for this site. As such a study was not budgeted, it is hereby requested that we postpone these reports for next year.

6. "To comply with regulation 189/94..."
There are presently no refrigerant equipment at this site and it is our intention to refuse all untagged refrigerant equipment at this particular site that is not opened to the public.

Hoping that the above answers your concerns, I remain.

Sincerely yours,

Sylvio Simard, Deputy Clerk

SS\ll

CORPORATION DU CANTON D' ALFRED ET DE PLANTAGENET
OF THE TOWNSHIP OF

C.P. / P.O. Box 350
205 Old Highway 17 / 205 vieille route 17
Plantagenet, Ontario
K0B 1L0

TÉL: (613) 673-4797
FAX: (613) 673-4812

933-6402

File: 257-02

September 21st, 1998

Appendix "G"

Mr. R. J. Robertson, P. Eng., Area Supervisor
Ministry of the Environment
113 Amelia Street
Cornwall, Ontario
K6H 3P1

Dear Sir:

Re: Township of Alfred and Plantagenet - Ward 1 (former Alfred Township) Waste Disposal Site - Certificate of Approval Number A470903

Your report of August 21st, 1998, listing some recommendations concerning the above mentioned site was brought to the attention of the public works committee on September 2nd, 1998.

The following is submitted in reply to the different recommendations brought forward:

1. "The frequency of covering waste is inadequate".
Effective September 28th, waste will be covered monthly during the period of April 15th to November 15th. The required final cover and seeding will be done by October 15th, 1998.

2. "A buffer strip should be established..."
A buffer strip of 5 meters is being established between the disposal area and surrounding brush to minimise fire hazard and facilitate covering waste along the site boundaries.

3. "The municipality should form a committee..."
A public works committee has recently been formed for our new municipality and anything dealing with waste collection as well as the management of the waste disposal sites is reported to this committee by the public works superintendent who sits on that committee.

4. "The entrance sign should provide..."
All entrance signs of the different waste disposal sites will be redone as soon as the set fines are received from the Attorney General. The emergency telephone numbers will also be corrected at the same time.

.../2

5. "Status reports regarding reserve capacity..."
A report regarding reserve capacity, waste volumes, complaints, monitoring results prepared by McNeely Engineering Consultants Ltd. was sent to you in May 1997. Hydrogeological studies are being done by Golder Associates and will be sent to you when available.

6. "To comply with Regulation 189/94..."
Attached please find a copy of our waste collection By-law that deals with this matter as well as a copy of our 1998 Fall Clean-Up Bulk Waste Collection flyer that indicates what to do in case of items containing CFC.

In the hope that the above answers your concerns, I remain.

Sincerely yours

Sylvio Simard, Deputy Clerk

SS\ll

encl.

APPENDIX C

RECORD OF BOREHOLE SHEETS (2000)

LIST OF ABBREVIATIONS

The abbreviations commonly employed on Records of Boreholes, on figures and in the text of the report are as follows:

I. SAMPLE TYPE

AS	Auger sample
BS	Block sample
CS	Chunk sample
DO	Drive open
DS	Denison type sample
FS	Foil sample
RC	Rock core
SC	Soil core
ST	Slotted tube
TO	Thin-walled, open
TP	Thin-walled, piston
WS	Wash sample

II. PENETRATION RESISTANCE

Standard Penetration Resistance (SPT), N:
The number of blows by a 63.5 kg. (140 lb.) hammer dropped 760 mm (30 in.) required to drive a 50 mm (2 in.) drive open sampler for a distance of 300 mm (12 in.).

Dynamic Penetration Resistance; N_d:
The number of blows by a 63.5 kg (140 lb.) hammer dropped 760 mm (30 in.) to drive uncased a 50 mm (2 in.) diameter, 60° cone attached to "A" size drill rods for a distance of 300 mm (12 in.).

PH: Sampler advanced by hydraulic pressure
PM: Sampler advanced by manual pressure
WH: Sampler advanced by static weight of hammer
WR: Sampler advanced by weight of sampler and rod

Piezo-Cone Penetration Test (CPT):
An electronic cone penetrometer with a 60° conical tip and a projected end area of 10 cm^2 pushed through ground at a penetration rate of 2 cm/s. Measurements of tip resistance (Q_t), porewater pressure (PWP) and friction along a sleeve are recorded electronically at 25 mm penetration intervals.

III. SOIL DESCRIPTION

(a) Cohesionless Soils

Density Index (Relative Density)	N Blows/300 mm or Blows/ft.
Very loose	0 to 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very dense	over 50

(b) Cohesive Soils

Consistency	c_u, s_u kPa	c_u, s_u psf
Very soft	0 to 12	0 to 250
Soft	12 to 25	250 to 500
Firm	25 to 50	500 to 1,000
Stiff	50 to 100	1,000 to 2,000
Very stiff	100 to 200	2,000 to 4,000
Hard	over 200	over 4,000

IV. SOIL TESTS

w	water content
w_p	plastic limit
w_l	liquid limit
C	consolidation (oedometer) test
CHEM	chemical analysis (refer to text)
CID	consolidated isotropically drained triaxial test[1]
CIU	consolidated isotropically undrained triaxial test with porewater pressure measurement[1]
D_R	relative density (specific gravity, G_S)
DS	direct shear test
M	sieve analysis for particle size
MH	combined sieve and hydrometer (H) analysis
MPC	Modified Proctor compaction test
SPC	Standard Proctor compaction test
OC	organic content test
SO_4	concentration of water-soluble sulphates
UC	unconfined compression test
UU	unconsolidated undrained triaxial test
V	field vane test (LV-laboratory vane test)
γ	unit weight

Note:
1. Tests which are anisotropically consolidated prior to shear are shown as CAD, CAU.

LIST OF SYMBOLS

Unless otherwise stated, the symbols employed in the report are as follows:

I. GENERAL

π = 3.1416
ln x, natural logarithm of x
$\log_{10}$ x or log x, logarithm of x to base 10
g acceleration due to gravity
t time
F factor of safety
V volume
W weight

II. STRESS AND STRAIN

γ shear strain
Δ change in, e.g. in stress: $\Delta \sigma$
ε linear strain
ε_v volumetric strain
η coefficient of viscosity
ν Poisson's ratio
σ total stress
σ' effective stress ($\sigma' = \sigma - u$)
σ'_{vo} initial effective overburden stress
$\sigma_1, \sigma_2, \sigma_3$ principal stresses (major, intermediate, minor)
σ_{oct} mean stress or octahedral stress $= (\sigma_1 + \sigma_2 + \sigma_3)/3$
τ shear stress
u porewater pressure
E modulus of deformation
G shear modulus of deformation
K bulk modulus of compressibility

III. SOIL PROPERTIES

(a) Index Properties

$\rho(\gamma)$ bulk density (bulk unit weight*)
$\rho_d(\gamma_d)$ dry density (dry unit weight)
$\rho_w(\gamma_w)$ density (unit weight) of water
$\rho_s(\gamma_s)$ density (unit weight) of solid particles
γ' unit weight of submerged soil ($\gamma' = \gamma - \gamma_w$)
D_R relative density (specific gravity)of solid particles ($D_R = \rho_s / \rho_w$) (formerly G_s)
e void ratio
n porosity
S degree of saturation

* Density symbol is ρ. Unit weight symbol is γ where $\gamma = \rho g$ (i.e. mass density x acceleration due to gravity)

(a) Index Properties (con't.)

w water content
w_l liquid limit
w_p plastic limit
I_P plasticity Index = $(w_l - w_p)$
w_S shrinkage limit
I_L liquidity index = $(w - w_p) / I_p$
I_C consistency index = $(w_l - w) / I_p$
e_{max} void ratio in loosest state
e_{min} void ratio in densest state
I_D density index = $(e_{max} - e) / (e_{max} - e_{min})$ (formerly relative density)

(c) Hydraulic Properties

h hydraulic head or potential
q rate of flow
v velocity of flow
i hydraulic gradient
k hydraulic conductivity (coefficient of permeability)
j seepage force per unit volume

(d) Consolidation (one-dimensional)

C_c compression index (normally consolidated range)
C_r recompression index (overconsolidated range)
C_S swelling index
C_α coefficient of secondary consolidation
m_v coefficient of volume change
c_v coefficient of consolidation
T_v time factor (vertical direction)
U degree of consolidation
σ'_p pre-consolidation pressure
OCR Overconsolidation ratio $= \sigma'_p / \sigma'_{vo}$

(e) Shear Strength

τ_p, τ_r peak and residual shear strength
ϕ' effective angle of internal friction
δ angle of interface friction
μ coefficient of friction = tan δ
c' effective cohesion
c_u, s_u undrained shear strength ($\phi = 0$ analysis)
p mean total stress $(\sigma_1 + \sigma_3)/2$
p' mean effective stress $(\sigma'_1 + \sigma'_3)/2$
q $(\sigma_1 - \sigma_3)/2$ or $(\sigma'_1 - \sigma'_3)/2$
q_u compressive strength $(\sigma_1 - \sigma_3)$
S_t sensitivity

Notes: 1. $\tau = c' + \sigma' \tan \phi'$
2. Shear strength = (Compressive strength)/2

PROJECT: 001-2749

LOCATION:

SAMPLER HAMMER, 64kg; DROP, 760mm

RECORD OF BOREHOLE: 00-1

BORING DATE: 20/07/2000

SHEET 1 OF 1

DATUM: Local

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ●, rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp W Wl; 10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		GROUND SURFACE		99.18							
	Power Auger 200mm DIAM. (Hollow Stem)	Loose, brown to green brown, fine SAND, trace to some silt, occasional clay silt layer		0.00	1	50 DO	-				Monitor B on Nov. 27/00; Concrete Casing; Granular Filter; Bentonite Seal; Monitor A on Nov. 27/00
1											
2					2	50 DO	7				38mm PVC # 10 Slot Screen B; Granular Filter
				97.05							
		Loose to compact, grey stratified fine SAND, trace to some silt		2.13	3	50 DO	9				
3					4	50 DO	10				
				95.37							
4		Firm to soft, grey to grey and red brown with depth SILTY CLAY		3.81	5	50 DO	1				Native Backfill
5					6	50 DO	PM				
					7	50 DO	PM				
6					8	50 DO	PM				
7											Bentonite Seal; Granular Filter
8					9	50 DO	PM				50mm PVC # 10 Slot Screen A
9											
					10	50 DO	PM				Top of pipe Elev. 99.97m (A), 100m (B)
				89.33							
10		END OF BOREHOLE		9.85							

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: P.A.H.

CHECKED: GBM

BOREHOLE 001-2749.GPJ GLDR_CAN.GDT 2/13/01

PROJECT: 001-2749

RECORD OF BOREHOLE: 00-2

SHEET 1 OF 1

LOCATION:

BORING DATE: 21/07/2000

DATUM: Local

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (20 40 60 80) nat V. + Q - ● rem V. ⊕ U - ○	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT Wp W Wl (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		GROUND SURFACE		99.54							
	Power Auger 200mm DIAM. (Hollow Stem)	Brown, fine sand with some municipal waste, plastics and organics (FILL)		0.00	1	50 DO	-				Protective Casing in Concrete Monitor A & B ▽ on Nov. 27/00 Sand Backfill
1				98.47							Bentonite Seal
		Compact, grey-brown to grey at depth, stratified, very fine SAND, some silt		1.07	2	50 DO	13				
2											38mm PVC # 10 Slot Screen B Granular Filter
					3	50 DO	16				
3											
					4	50 DO	13				Bentonite Seal
4											
					5	50 DO	16				50mm PVC # 10 Slot Screen A Granular Filter
5					6	50 DO	18				
				94.30							
		Very soft, grey and red to brown SILTY CLAY		5.24	7	50 DO	WR				
6											Bentonite Seal
					8	50 DO	WR				
				92.83							
7		END OF BOREHOLE		6.71							Top of pipe Elev. 100.33m (A), 100.38m (B)
8											
9											
10											

BOREHOLE 001-2749.GPJ GLDR_CAN.GDT 2/13/01

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: P.A.H.

CHECKED: GEM

PROJECT: 001-2749

RECORD OF BOREHOLE: 00-3

SHEET 1 OF 1

LOCATION:

BORING DATE: 24/07/2000

DATUM: Local

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp W Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		GROUND SURFACE		98.54							
	Power Auger 200mm DIAM. (Hollow Stem)	Brown sand with municipal waste (FILL)		0.00							Concrete Casing Monitor B on Nov. 27/00 Native Backfill ▽ Monitor A on Nov. 27/00 ▽
				97.63							
1		Compact, brown to grey, stratified fine to very fine SAND, trace to some silt		0.91	1	50 DO	-				Bentonite Seal
					2	50 DO	10				Granular Filter & Native Backfill
2											
					3	50 DO	11				38mm PVC # 10 Slot Screen B
3											
				95.19	4	50 DO	8				
		Soft to firm, grey SILTY CLAY		3.35							
4					5	50 DO	WH				Bentonite Seal
											Granular Filter
5					6	50 DO	PM				
											50mm PVC # 10 Slot Screen A
6					7	50 DO	PM				
											Bentonite Seal
				91.83	8	50 DO	PM				
		END OF BOREHOLE		6.71							
7											Top of pipe Elev. 99.26m (A), 99.31m (B)
8											
9											
10											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: P.A.H.

CHECKED: GBM

BOREHOLE 001-2749.GPJ GLDR_CAN.GDT 2/13/01

PROJECT: 001-2749

RECORD OF BOREHOLE: 00-4

SHEET 1 OF 1

LOCATION:

BORING DATE: 24/07/2000

DATUM: Local

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		GROUND SURFACE		99.84							
	Power Auger 200mm DIAM. (Hollow Stem)	Municipal waste in sand matrix (FILL)		0.00							Protective Casing in Concrete
1											Granular Filter
				98.62							Bentonite Seal
		Compact to loose, grey, fine SAND, trace to some silt		1.22							Granular Filter Monitor A & B on Nov. 27/00 ▽
2					1	50 DO	10				
					2	50 DO	9				38mm PVC # 10 Slot Screen B Granular Filter
3					3	50 DO	7				Bentonite Seal
4					4	50 DO	12				
											50mm PVC # 10 Slot Screen A Granular Filter
5				94.72	5	50 DO	13				
		Soft, grey SILTY CLAY		5.12							
6					6	50 DO	-				Bentonite Seal
					7	50 DO	PM				
				93.13							
		END OF BOREHOLE		6.71							
7											Top of pipe Elev. 100.77m (A), 100.79m (B)
8											
9											
10											

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: P.A.H.

CHECKED: GBM

BOREHOLE 001-2749.GPJ GLDR_CAN.GDT 2/23/01

PROJECT: 001-2749

RECORD OF BOREHOLE: 00-5

SHEET 1 OF 1

LOCATION:

BORING DATE: 17/10/2000

DATUM: Local

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp W Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		GROUND SURFACE		97.73							
	Power Auger 200mm DIAM. (Hollow Stem)	TOPSOIL		0.00 / 97.49							
1		Loose, grey-brown to grey, fine SAND, silty to some silt		0.24	1	50 DO	8				Monitor A & B on Nov. 27/00; Concrete Casing; Bentonite Seal
2					2	50 DO	8				38mm PVC # 10 Slot Screen B; Granular Filter; Bentonite Seal
3					3	50 DO	9				
					4	50 DO	8				Granular Filter; 50mm PVC # 10 Slot Screen A
		Grey, SILTY CLAY		94.22 / 3.51							
4					5	50 DO	PM				
5					6	50 DO	PM				Clay Bottom
		END OF BOREHOLE		92.55 / 5.18							
6											Top of pipe Elev. 98.67m (A), 98.73m (B)
7											
8											
9											
10											

BOREHOLE 001-2749.GPJ GLDR_CAN.GDT 2/13/01

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: P.A.H.

CHECKED: G.L.M.

PROJECT: 001-2749

RECORD OF BOREHOLE: 00-6

SHEET 1 OF 1

LOCATION:

BORING DATE: 18/10/2000

DATUM: Local

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger 200mm DIAM. (Hollow Stem)	GROUND SURFACE		97.97							
		PEAT/ TOPSOIL		0.00							Monitor A & B on Nov. 27/00
				97.67							Concrete Casing
		Loose, grey-brown to grey, fine SAND, some silt		0.30							Bentonite Seal
1					1	50 DO	–				
											38mm PVC # 10 Slot Screen B
2					2	50 DO	9				
											Granular Filter
											Bentonite Seal
					3	50 DO	8				
3											Granular Filter 50mm PVC # 10 Slot Screen A
				94.62							
		Firm to soft grey, SILTY CLAY		3.35	4	50 DO	3				
4											
					5	50 DO	PM				Clay Bottom
				93.40							
		END OF BOREHOLE		4.57							
5											
6											Top of pipe Elev. 98.78m (A), 98.71m (B)
7											
8											
9											
10											

BOREHOLE 001-2749.GPJ GLDR CAN.GDT 2/13/01

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: P.A.H.

CHECKED: GBM

PROJECT: 001-2749

LOCATION:

SAMPLER HAMMER, 64kg; DROP, 760mm

RECORD OF BOREHOLE: 00-7

BORING DATE: 17/10/2000

SHEET 1 OF 1

DATUM: Local

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp — W — Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		GROUND SURFACE		98.80							
		TOPSOIL		0.00							
	Power Auger 200mm DIAM. (Hollow Stem)	Loose, grey-brown to grey, fine SAND, some silt		98.50 / 0.30	1	50 DO	13				on Nov. 27/00 ▽ Concrete Casing; Bentonite Seal; Granular Filter
1											
2					2	50 DO	7				50mm PVC # 10 Slot Screen
3					3	50 DO	10				
		Grey, SILTY CLAY		95.66 / 3.14	4	50 DO	2				
4					5	50 DO	PM				Clay Bottom
		END OF BOREHOLE		94.23 / 4.57							
5											
6											Top of pipe Elev. 99.76m
7											
8											
9											
10											

BOREHOLE 001-2749.GPJ GLDR_CAN.GDT 2/13/01

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: P.A.H.

CHECKED: GGM

APPENDIX D

REPORTS OF ANALYSIS, ACCUTEST LABORATORIES LTD. (2000)

APPENDIX D-I

SUMMER MONITORING SESSION

ACCUTEST LABORATORIES LTD.

REPORT OF ANALYSIS

Client: Golder Associates Ltd.

ATT: Mr. Gordon Murray

Report Number: 2009321
Date: 2000-10-12
Date Submitted: 2000-08-21
Date Collected: 2000-08-19
Project:

P.O. Number:
Matrix: Ground water

PARAMETER	UNITS	MDL	84203 S-1 BH00-3B	84204 S-2 BH00-3A	84205 S-3 BH00-4B	84206 S-4 BH00-4A	84207 S-5 BH00-2B
Alkalinity as CaCO3	mg/L	5	438	122	551	397	349
COD	mg/L	4	50	28	90	35	375
Ag	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Al	mg/L	0.05	0.41	1.14	0.56	0.43	1.05
B	mg/L	0.01	0.12	0.03	0.11	0.09	<0.01
Ba	mg/L	0.01	0.16	0.08	0.35	0.18	0.20
Be	mg/L	0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Ca	mg/L	1	369	48	127	92	70
Cd	mg/L	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Cl	mg/L	1	73	8	20	13	7
Co	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cr	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cu	mg/L	0.01	0.01	<0.01	0.01	<0.01	<0.01
DOC	mg/L	0.4	14.3	5.8	28.0	8.4	140
Fe	mg/L	0.01	10.0	1.02	20.8	12.1	24.3
Hardness as CaCO3	mg/L	1	1310	190	441	321	233
Pb	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Mg	mg/L	1	93	17	30	22	14
Mn	mg/L	0.01	1.81	0.07	1.42	0.37	2.09
Mo	mg/L	0.01	<0.01	0.02	0.01	<0.01	<0.01
Ni	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
N-NH3	mg/L	0.02	0.66	0.73	5.47	0.97	15.5
N-NO3	mg/L	0.10	<0.10	6.94	<0.10	<0.10	<0.10
Phenols	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
K	mg/L	1	6	6	19	7	13
Si	mg/L	0.01	11.2	5.51	10.3	14.9	5.83
Na	mg/L	2	43	149	66	30	39
Sr	mg/L	0.005	0.683	0.318	0.885	0.427	0.276
S	mg/L	1	239	120	25	10	13
SO4	mg/L	1	865	365	79	26	41

MDL = Method Detection Limit INC = Incomplete

Comment:

This is a correction certificate and supercedes all previous copies of this report. Total P has been corrected due to the samples having been shaken prior to the first analysis.

APPROVAL: _____

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

ACCUTEST LABORATORIES LTD.

REPORT OF ANALYSIS

Client: Golder Associates Ltd.

ATT: Mr. Gordon Murray

Report Number: 2009321
Date: 2000-10-12
Date Submitted: 2000-08-21
Date Collected: 2000-08-19
Project:

P.O. Number:
Matrix: Ground water

PARAMETER	UNITS	MDL	84203 S-1 BH00-3B	84204 S-2 BH00-3A	84205 S-3 BH00-4B	84206 S-4 BH00-4A	84207 S-5 BH00-2B
Tl	mg/L	0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Sn	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Ti	mg/L	0.01	0.02	0.05	0.04	0.02	0.03
TDS	mg/L	2	1872	768	736	460	528
Total Kjeldahl Nitrogen	mg/L	0.05	1.49	0.82	5.93	1.28	15.5
Total P	mg/L	0.01	0.10	0.41	0.03	0.02	0.40
V	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	0.01
Zn	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01

MDL = Method Detection Limit INC = Incomplete
Comment:

APPROVAL: _____

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

ACCUTEST LABORATORIES LTD.

REPORT OF ANALYSIS

Client: Golder Associates Ltd.

ATT: Mr. Gordon Murray

Report Number: 2009321
Date: 2000-10-12
Date Submitted: 2000-08-21
Date Collected: 2000-08-19
Project:

P.O. Number:
Matrix: Ground water

PARAMETER	UNITS	MDL	84208 S-6 BH00-2A	84209 S-7 BH00-1B	84210 S-8 BH00-1A		
Alkalinity as CaCO3	mg/L	5	408	166	156		
COD	mg/L	4	33	58	68		
Ag	mg/L	0.01	<0.01	<0.01	<0.01		
Al	mg/L	0.05	1.58	1.18	3.78		
B	mg/L	0.01	0.02	0.01	0.09		
Ba	mg/L	0.01	0.14	0.05	0.04		
Be	mg/L	0.002	<0.002	<0.002	<0.002		
Ca	mg/L	1	86	34	32		
Cd	mg/L	0.005	<0.005	<0.005	<0.005		
Cl	mg/L	1	10	2	5		
Co	mg/L	0.01	<0.01	<0.01	<0.01		
Cr	mg/L	0.01	<0.01	<0.01	<0.01		
Cu	mg/L	0.01	<0.01	<0.01	0.01		
DOC	mg/L	0.4	9.3	20.1	13.1		
Fe	mg/L	0.01	2.58	0.92	3.46		
Hardness as CaCO3	mg/L	1	351	118	121		
Pb	mg/L	0.001	<0.001	<0.001	<0.001		
Mg	mg/L	1	33	8	10		
Mn	mg/L	0.01	0.46	0.11	0.14		
Mo	mg/L	0.01	<0.01	<0.01	<0.01		
Ni	mg/L	0.01	<0.01	<0.01	<0.01		
N-NH3	mg/L	0.02	0.49	0.49	1.40		
N-NO3	mg/L	0.10	<0.10	<0.10	<0.10		
Phenols	mg/L	0.001	<0.001	<0.001	<0.001		
K	mg/L	1	5	7	7		
Si	mg/L	0.01	10.3	4.22	7.79		
Na	mg/L	2	25	31	59		
Sr	mg/L	0.005	0.405	0.144	0.171		
S	mg/L	1	10	12	31		
SO4	mg/L	1	30	39	99		

MDL = Method Detection Limit INC = Incomplete

Comment:

APPROVAL: _____

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

ACCUTEST LABORATORIES LTD.

REPORT OF ANALYSIS

Client: Golder Associates Ltd.

ATT: Mr. Gordon Murray

Report Number: 2014106
Date: 2000-12-14
Date Submitted: 2000-11-29
Date Collected: 2000-11-29
Project: 001-2749

P.O. Number:
Matrix: Water

PARAMETER	UNITS	MDL	103253 S-1 BH00-5B	103254 S-2 BH00-5A	103255 S-3 BH00-6B	103256 S-4 BH00-6A	103257 S-5 BH00-7
Sn	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Ti	mg/L	0.01	0.02	0.04	<0.01	<0.01	0.02
TDS	mg/L	2	136	112	720	300	124
Total Kjeldahl Nitrogen	mg/L	0.05	0.23	0.23	1.23	0.60	0.19
Total P	mg/L	0.01	2.75	3.48	3.76	15.4	3.53
V	mg/L	0.001	0.003	0.002	0.006	0.003	0.002
Zn	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01

MDL = Method Detection Limit INC = Incomplete
Comment:

APPROVAL:

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

ACCUTEST LABORATORIES LTD.

REPORT OF ANALYSIS

Client: Golder Associates Ltd.

ATT: Mr. Gordon Murray

Report Number: 2009321
Date: 2000-10-12
Date Submitted: 2000-08-21
Date Collected: 2000-08-19
Project:

P.O. Number:
Matrix: Ground water

PARAMETER	UNITS	MDL	84208 S-6 BH00-2A	84209 S-7 BH00-1B	84210 S-8 BH00-1A		
Alkalinity as CaCO3	mg/L	5	408	166	156		
COD	mg/L	4	33	58	68		
Ag	mg/L	0.01	<0.01	<0.01	<0.01		
Al	mg/L	0.05	1.58	1.18	3.78		
B	mg/L	0.01	0.02	0.01	0.09		
Ba	mg/L	0.01	0.14	0.05	0.04		
Be	mg/L	0.002	<0.002	<0.002	<0.002		
Ca	mg/L	1	86	34	32		
Cd	mg/L	0.005	<0.005	<0.005	<0.005		
Cl	mg/L	1	10	2	5		
Co	mg/L	0.01	<0.01	<0.01	<0.01		
Cr	mg/L	0.01	<0.01	<0.01	<0.01		
Cu	mg/L	0.01	<0.01	<0.01	0.01		
DOC	mg/L	0.4	9.3	20.1	13.1		
Fe	mg/L	0.01	2.58	0.92	3.46		
Hardness as CaCO3	mg/L	1	351	118	121		
Pb	mg/L	0.001	<0.001	<0.001	<0.001		
Mg	mg/L	1	33	8	10		
Mn	mg/L	0.01	0.46	0.11	0.14		
Mo	mg/L	0.01	<0.01	<0.01	<0.01		
Ni	mg/L	0.01	<0.01	<0.01	<0.01		
N-NH3	mg/L	0.02	0.49	0.49	1.40		
N-NO3	mg/L	0.10	<0.10	<0.10	<0.10		
Phenols	mg/L	0.001	<0.001	<0.001	<0.001		
K	mg/L	1	5	7	7		
Si	mg/L	0.01	10.3	4.22	7.79		
Na	mg/L	2	25	31	59		
Sr	mg/L	0.005	0.405	0.144	0.171		
S	mg/L	1	10	12	31		
SO4	mg/L	1	30	39	99		

MDL = Method Detection Limit INC = Incomplete

Comment:

APPROVAL: _____

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

ACCUTEST LABORATORIES LTD.

REPORT OF ANALYSIS

Client: Golder Associates Ltd.

ATT: Mr. Gordon Murray

Report Number: 2009321
Date: 2000-10-12
Date Submitted: 2000-08-21
Date Collected: 2000-08-19
Project:

P.O. Number:
Matrix: Ground water

PARAMETER	UNITS	MDL	84208 S-6 BH00-2A	84209 S-7 BH00-1B	84210 S-8 BH00-1A		
Tl	mg/L	0.2	<0.2	<0.2	<0.2		
Sn	mg/L	0.01	<0.01	<0.01	<0.01		
Ti	mg/L	0.01	0.07	0.06	0.17		
TDS	mg/L	2	496	300	380		
Total Kjeldahl Nitrogen	mg/L	0.05	0.80	0.69	1.40		
Total P	mg/L	0.01	<0.01	0.06	0.21		
V	mg/L	0.01	<0.01	<0.01	<0.01		
Zn	mg/L	0.01	0.09	<0.01	0.01		

MDL = Method Detection Limit INC = Incomplete
Comment:

APPROVAL: _____

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

APPENDIX D-II

FALL MONITORING SESSION

ACCUTEST LABORATORIES LTD.

REPORT OF ANALYSIS

Client: Golder Associates Ltd.

ATT: Mr. Gordon Murray

Report Number: 2014106
Date: 2000-12-14
Date Submitted: 2000-11-29
Date Collected: 2000-11-29
Project: 001-2749

P.O. Number:
Matrix: Water

PARAMETER	UNITS	MDL	103258 S-6 BH00-7 Duplicate				
Alkalinity as CaCO3	mg/L	5	97				
COD	mg/L	4	11				
Ag	mg/L	0.0001	<0.0001				
Al	mg/L	0.05	0.48				
B	mg/L	0.01	<0.01				
Ba	mg/L	0.01	0.03				
Be	mg/L	0.002	<0.002				
Ca	mg/L	2	26				
Cd	mg/L	0.0001	<0.0001				
Cl	mg/L	1	1				
Co	mg/L	0.0002	0.0005				
Cr	mg/L	0.01	<0.01				
Cu	mg/L	0.001	0.002				
DOC	mg/L	0.3	4.5				
Fe	mg/L	0.01	0.81				
Hardness as CaCO3	mg/L	1	98				
Pb	mg/L	0.001	<0.001				
Mg	mg/L	1	8				
Mn	mg/L	0.01	0.08				
Mo	mg/L	0.01	<0.01				
Ni	mg/L	0.01	<0.01				
N-NH3	mg/L	0.02	0.13				
N-NO3	mg/L	0.10	<0.10				
Phenols	mg/L	0.001	0.002				
K	mg/L	1	3				
Si	mg/L	0.01	8.57				
Na	mg/L	2	3				
Sr	mg/L	0.003	0.074				
SO4	mg/L	1	9				
Tl	mg/L	0.001	<0.001				

MDL = Method Detection Limit INC = Incomplete

Comment:

APPROVAL:

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

ACCUTEST LABORATORIES LTD.

REPORT OF ANALYSIS

Client: Golder Associates Ltd.

ATT: Mr. Gordon Murray

Report Number: 2014106
Date: 2000-12-14
Date Submitted: 2000-11-29
Date Collected: 2000-11-29
Project: 001-2749

P.O. Number:
Matrix: Water

PARAMETER	UNITS	MDL	103258 S-6 Batch 7 Duplicate				
Sn	mg/L	0.01	<0.01				
Ti	mg/L	0.01	0.03				
TDS	mg/L	2	108				
Total Kjeldahl Nitrogen	mg/L	0.05	0.19				
Total P	mg/L	0.01	5.58				
V	mg/L	0.001	0.003				
Zn	mg/L	0.01	<0.01				

MDL = Method Detection Limit INC = Incomplete
Comment:

APPROVAL:

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

APPENDIX E

RECORD OF TEST PITS (2000)

RECORD OF TEST PITS

Test Pit Number	Depth (metres)	Description
TP 00-1	0.0 - 1.0	Red-brown to grey-brown fine SAND, trace to some silt No municipal waste Dry at 1.0 m Surface elevation at 99.83 metres
TP 00-2	0.0 - 0.4 0.4 - 0.9	Sand FILL Fine SAND No municipal waste Dry at 0.9 m Surface elevation at 99.58 metres
TP 00-3	0.0 - 1.85 1.85 - 2.2	Municipal waste and construction debris Grey fine SAND, some silt Water seepage had waste odour. Note: Quick test dig beside TP 00-3 at 6 m from property line revealed no municipal waste - only native sands Surface elevation 99.57 metres.
TP 00-4	0.0 - 0.6$\pm$ 0.6$\pm$ - 1.6	Sand FILL Municipal waste (appears that waste was placed in "trenches") Water at 1.3 m Surface elevation at 99.47 metres
TP 00-5	0.0 - 0.5$\pm$ 0.5$\pm$ - 1.5	Sand FILL Municipal waste No water seepage Surface elevation at 99.76 metres
TP 00-6	0.0 - 0.8 0.8 - 0.9 0.9 - 1.5	Municipal waste and sand mix Topsoil/organics Red-brown, silty fine SAND Dry Surface elevation at 99.78 metres
TP 00-7	0.0 - 0.2$\pm$ 0.2$\pm$ - 1.2	Sand FILL Municipal waste Water at 0.9 m Surface elevation at 99.44 metres

RECORD OF TEST PITS (continued)

Test Pit Number	Depth (metres)	Description
TP 00-8	0.0 - 0.3±	Sand FILL
	0.3± - 1.3	Municipal waste
		Water at 1.3 m
		Surface elevation at 99.73 metres
TP 00-9	0.0 - 0.2±	Sand FILL
	0.3± - 1.3	Municipal waste and cinder/ash
		Dry
		Surface elevation at 100.02 metres
TP 00-10	0.0 - 0.3±	Sand FILL
	0.3± - 1.6	Municipal waste
	1.6 - 1.8	Grey SAND
		Water at 1.5 m
		Surface elevation at 99.66 metres
TP 00-11	0.0 - 0.3±	Sand FILL
	0.3± - 1.0	Sand mixed with municipal waste
	1.0 - 1.5	red-brown to grey-brown fine SAND, some silty to silty
		Water at 1.5 m
		Surface elevation at 99.80 metres
TP 00-12	0.0 - 0.3±	Sand and topsoil
	0.3± - 1.5	Municipal waste
		No municipal waste at scheduled test pit site (i.e. native soils)
		10 m from property line.
		"Trench" of municipal waste approximately 13 metres from property line.
		Log at 13 m from property line or 3 m east of stake for TP 00-12.
		Surface elevation at 99.52 metres.
		Water at 1.3 m
TP 00-13	0.0 - 0.3	Sand, some gravel, asphalt pieces
	0.3 - 1.3	Sand FILL
	1.3 - 1.4	TOPSOIL
	1.4 - 1.6	Red-brown to grey-brown fine SAND, some silt
		Surface elevation at 100.10 metres

RECORD OF TEST PITS (continued)

Test Pit Number	Depth (metres)	Description
TP 00-14	0.0 - 0.4±	Sand FILL
	0.4± - 1.5	Municipal waste
	1.5 - 1.7	Grey, fine SAND, some silt
		Water at 1.5 m
		Surface elevation at 99.80 metres
TP 00-15	0.0 - 0.3±	Sand FILL
	0.3± - 1.5	Municipal waste
		Ponded water at 1.4 m
		Surface elevation at 99.52 metres
TP 00-16	0.0 - 0.2±	Sand FILL
	0.2± - 1.3	Municipal waste
	1.3 - 1.5	Grey, silty fine SAND
		Water at 1.1 m
		Surface elevation at 99.25 metres
TP 00-17	0.0 - 0.5±	Sand FILL
	0.5± - 1.8	Municipal waste
	1.8 - 2.1	Grey, fine SAND, some silt
		Water at 1.4 m
		Surface elevation at 99.29 metres
TP 00-17A		At property line and 3 m inside property line.
		No municipal waste
		Fine SAND to 1.2 m
TP 00-18	0.0 - 0.6	Sand and municipal waste
	0.6 - 1.2	Fine SAND
		Dry
		Surface elevation at 100.01
TP 00-19	0.0 - 0.5±	Sand FILL
	0.5± - 1.5	Municipal waste
		Ponded water at 1.4 metres
		TP was 4 metres long and municipal waste only found at east end (trench type landfill)

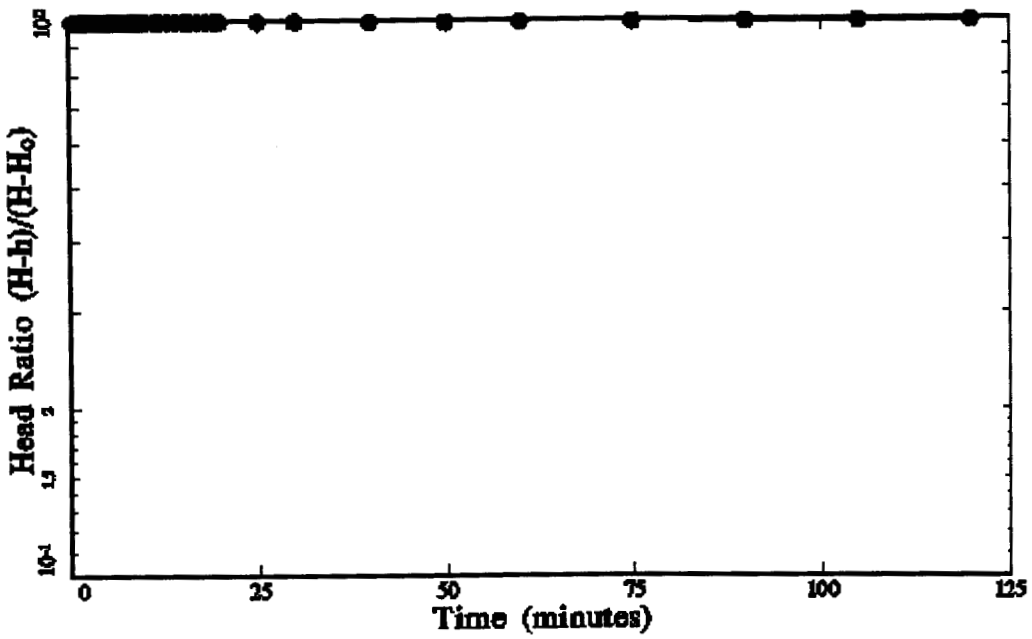
RECORD OF TEST PITS (continued)

Test Pit Number	Depth (metres)	Description
TP 00-20	0.0 - 0.3	Sand FILL
	0.3 - 1.0	Sand with organics and construction debris (woods, brick, metal insulation, plastic)
	1.0 - 1.15	TOPSOIL
	1.15 - 1.6	Silty SAND
		Water at 1.5 m
		Surface elevation at 99.52 metres
TP 00-21	0.0 - 0.3±	Sand and gravel with asphaltic concrete pieces
	0.3± - 1.5	Municipal waste
	1.5 - 2.8	Red to brown to grey browm silty fine SAND
		Water at 2.4 metres
		Surface elevation at 100.27 metres
TP 00-22	0.0 - 0.2±	Sand FILL
	0.2± - 1.3	Municipal waste
	1.3 - 1.5	TOPSOIL
	1.5 - 1.8	Grey brown fine SAND
		Dry at 1.8 metres
		Surface elevation at 99.47 metres
TP 00-23	0.0 - 0.2±	Sand with some municipal waste
	0.2± - 1.5	Municipal waste
	1.5 - 1.8	Grey silty fine SAND
		Water at 1.2 metres
		Test pit found municipal waste starting at 5 to 6 metres from property line. "Trench" of waste.
		Surface elevation at 98.91 metres
TP 00-24	0.0 - 1.2	Grey brown fine SAND, some silt
		No municipal waste
		Dry
		5 metres from toe of refuse pile
		Surface elevation at 98.52 metres

APPENDIX F

IN-SITU HYDRAULIC CONDUCTIVITY DATA (2000)

BH001-A



Hydraulic Conductivity, K = 3.3E-08 cm/sec
Basic Time Lag, T_o = 2.9E+04 minutes

Project Number : 001-2749
Date Tested : Nov.29/00

Type of Test : Rising Head
Reference : Hvorslev (1951)

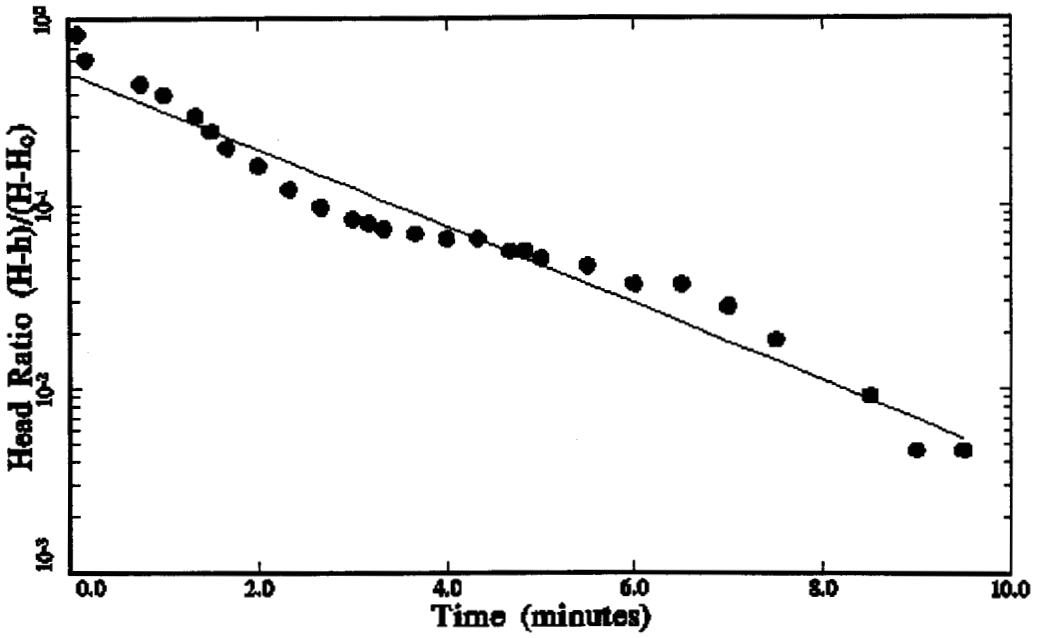
NEW = bh001-a.rpt
TITLE = BH001-A
PROJECT= 001-2749
TESTED = Nov.29/00

TIMES = pt.#,	time,	head
1	0.33000	9.02000
2	0.58000	9.02000
3	1.00000	9.02000
4	1.50000	9.01000
5	1.83000	9.01000
6	2.00000	9.00000
7	2.50000	9.00000
8	3.00000	9.00000
9	3.50000	9.00000
10	4.00000	9.00000
11	4.50000	9.00000
12	5.00000	9.00000
13	5.50000	9.00000
14	6.00000	9.00000
15	6.50000	9.00000
16	7.00000	9.00000
17	7.50000	8.99000
18	8.00000	8.99000
19	8.50000	8.99000
20	9.00000	8.99000
21	9.50000	8.99000
22	10.00000	8.99000
23	11.00000	8.99000
24	12.00000	8.99000
25	13.00000	8.99000
26	14.00000	8.99000
27	15.00000	8.99000
28	16.00000	8.99000
29	17.00000	8.99000
30	18.00000	8.99000
31	19.00000	8.99000
32	20.00000	8.99000
33	25.00000	8.99000
34	30.00000	8.99000
35	40.00000	8.98000
36	50.00000	8.98000
37	60.00000	8.98000
38	75.00000	8.98000
39	90.00000	8.98000
40	105.00000	8.98000
41	120.00000	8.98000

TEST = 1 2 : Rising Head - Hvorslev (1951)
WIND = 0 100

BHRAD = 10.16000 - Radius of borehole (cm)
WELLR = 2.54000 - Radius of well (cm)
LSCRN = 152.00000 - Length of well screen (cm)
STATH = 1.66000 - Depth of static water level (m)
INITH = 9.03000 - Depth of initial water level (m)
K = 3.2643E-08 - Hydraulic conductivity (cm/sec)
To = 29315 - Basic Time (min)

BH001-B



Hydraulic Conductivity, K = 7.8E-04 cm/sec
Basic Time Lag, T_o = 0.69 minutes

Project Number : 001-2749
Date Tested : Nov.29/00

Type of Test : Rising Head
Reference : Hvorslev (1951)

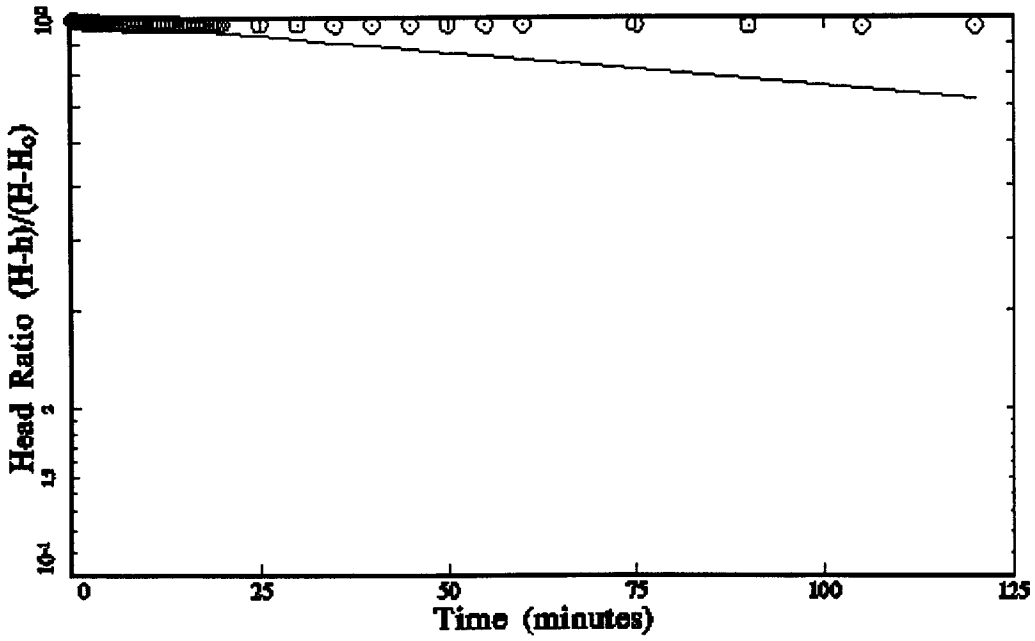
NEW = bh001-b.rpt
TITLE = BH001-B
PROJECT= 001-2749
TESTED = Nov.29/00
TIMES =

pt.#,	time,	head
1	0.08000	2.75000
2	0.17000	2.27000
3	0.75000	1.92000
4	1.00000	1.80000
5	1.33000	1.60000
6	1.50000	1.49000
7	1.67000	1.39000
8	2.00000	1.30000
9	2.33000	1.21000
10	2.67000	1.16000
11	3.00000	1.13000
12	3.17000	1.12000
13	3.33000	1.11000
14	3.67000	1.10000
15	4.00000	1.09000
16	4.33000	1.09000
17	4.67000	1.07000
18	4.83000	1.07000
19	5.00000	1.06000
20	5.50000	1.05000
21	6.00000	1.03000
22	6.50000	1.03000
23	7.00000	1.01000
24	7.50000	0.99000
25	8.50000	0.97000
26	9.00000	0.96000
27	9.50000	0.96000
28	10.00000	0.95000
29	10.50000	0.95000
30	11.00000	0.95000

TEST = 1 2 : Rising Head - Hvorslev (1951)
WIND = 0 100

BHRAD = 10.16000 - Radius of borehole (cm)
WELLR = 1.90000 - Radius of well (cm)
LSCRN = 152.00000 - Length of well screen (cm)
STATH = 0.95000 - Depth of static water level (m)
INITH = 3.12000 - Depth of initial water level (m)
K = 7.7658E-04 - Hydraulic conductivity (cm/sec)
To = 0.6895 - Basic Time (min)

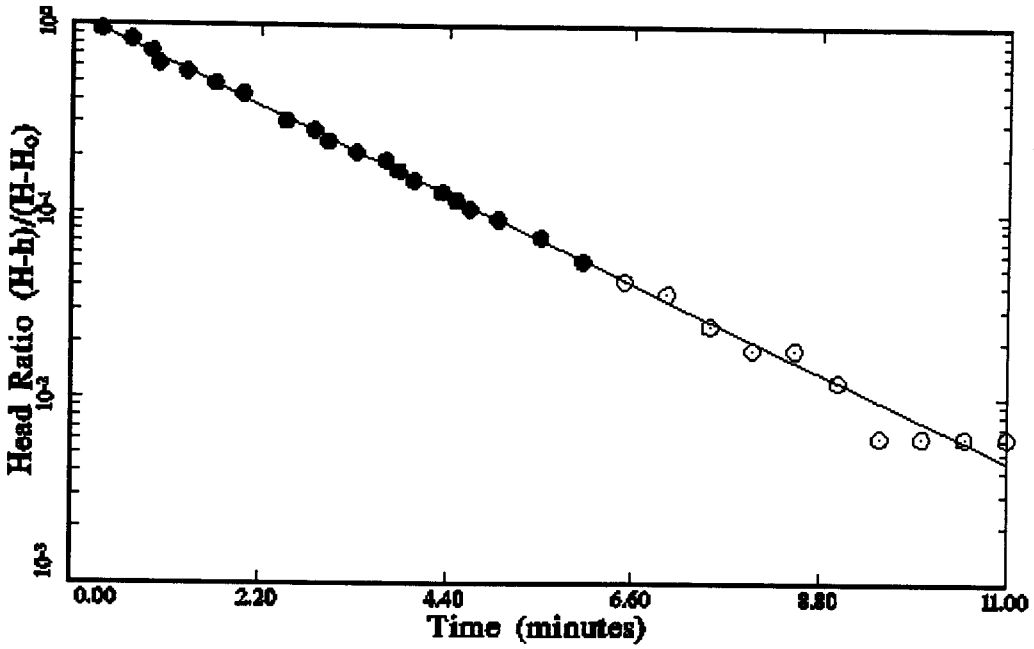
BH003-A



Hydraulic Conductivity, K = 2.6E-06 cm/sec
Basic Time Lag, T_o = 360 minutes

Project Number : 001-2749
Date Tested : Nov.29/00
Type of Test : Rising Head
Reference : Hvorslev (1951)

BH003-B



Hydraulic Conductivity, K = 2.4E-04 cm/sec
Basic Time Lag, T_o = 2.2 minutes

Project Number : 001-2745
Date Tested : Nov.29/00
Type of Test : Rising Head
Reference : Hvorslev (1951)

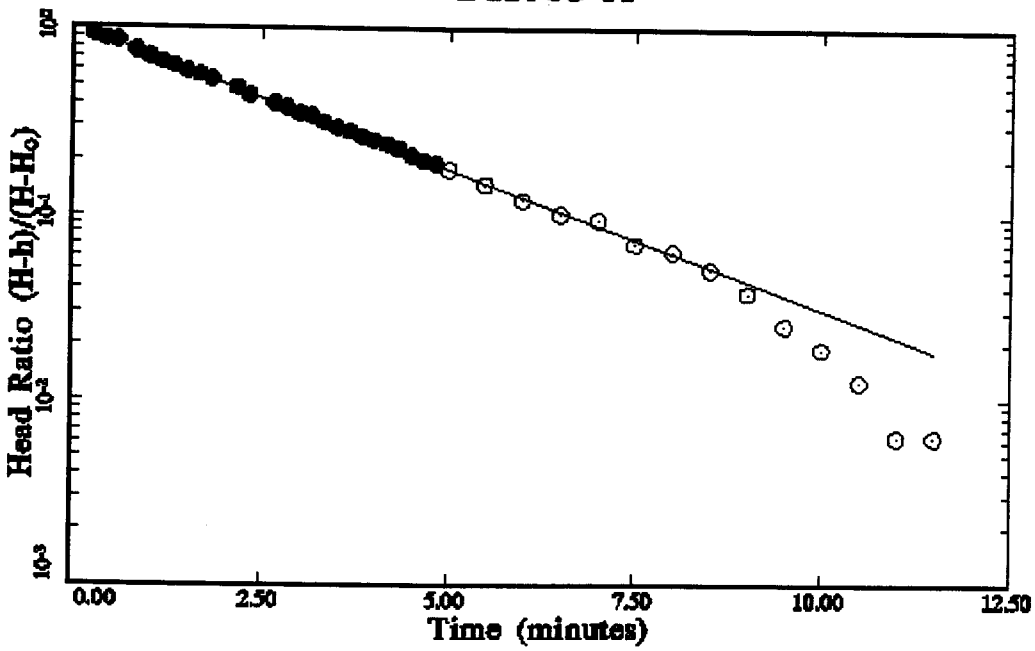
NEW = bh003-b.rpt
TITLE = BH003-B
PROJECT= 001-2749
TESTED = Nov.29/00

TIMES = pt.#,	time,	head
1	0.33000	2.80000
2	0.67000	2.62000
3	0.92000	2.45000
4	1.00000	2.28000
5	1.33000	2.18000
6	1.67000	2.06000
7	2.00000	1.96000
8	2.50000	1.76000
9	2.83000	1.71000
10	3.00000	1.65000
11	3.33000	1.60000
12	3.67000	1.57000
13	3.83000	1.53000
14	4.00000	1.50000
15	4.33000	1.47000
16	4.50000	1.45000
17	4.67000	1.43000
18	5.00000	1.41000
19	5.50000	1.38000
20	6.00000	1.35000
21	6.50000	1.33000
22	7.00000	1.32000
23	7.50000	1.30000
24	8.00000	1.29000
25	8.50000	1.29000
26	9.00000	1.28000
27	9.50000	1.27000
28	10.00000	1.27000
29	10.50000	1.27000
30	11.00000	1.27000
31	11.50000	1.26000
32	12.00000	1.26000
33	12.50000	1.26000
34	13.00000	1.26000
35	13.50000	1.26000
36	14.00000	1.26000

TEST = 1 2 : Rising Head - Hvorslev (1951)
WIND = 0 20

BHRAD = 10.16000 - Radius of borehole (cm)
WELLR = 1.90000 - Radius of well (cm)
LSCRN = 152.00000 - Length of well screen (cm)
STATH = 1.26000 - Depth of static water level (m)
INITH = 2.90000 - Depth of initial water level (m)
K = 2.4377E-04 - Hydraulic conductivity (cm/sec)
To = 2.1965 - Basic Time (min)

BH005-A



Hydraulic Conductivity, K = 3.3E-04 cm/sec
Basic Time Lag, T_o = 2.9 minutes

Project Number : 001-2749
Date Tested : Nov.29/01
Type of Test : Rising Head
Reference : Hvorslev (1951)

Title: BH005-A

Project Number: 001-2749
Date Tested: Nov.29/01
Type of Test: Rising Head
Analysis Method: Hvorslev (1951)

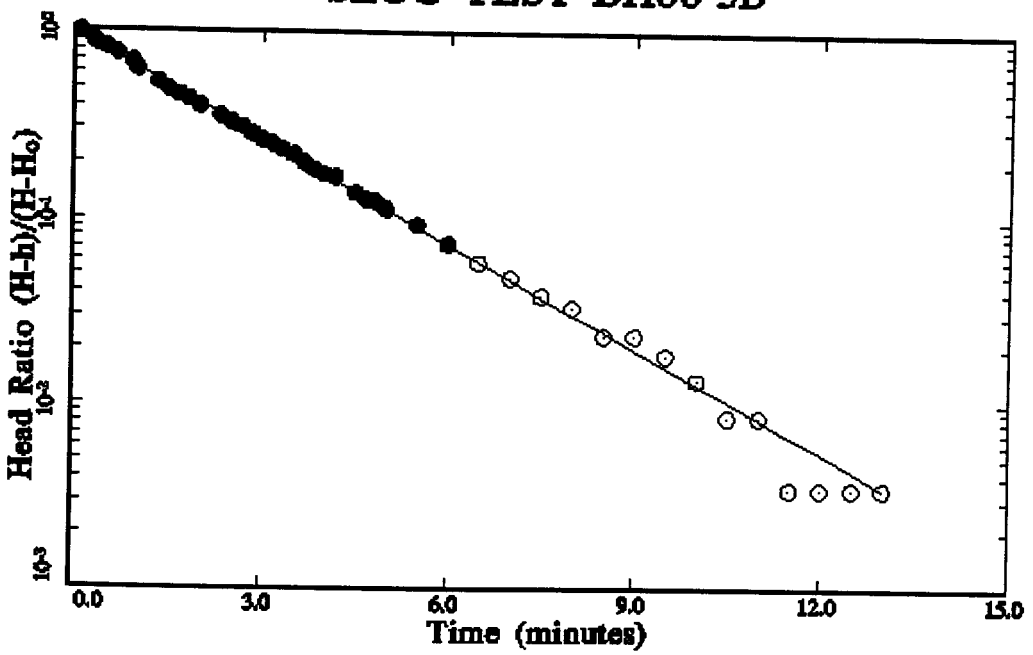
Water Level vs. Time Records

Reading Number	Time (min)	Water Level (m)
1	0.250	2.360
2	0.420	2.270
3	0.580	2.250
4	0.830	2.100
5	1.000	2.010
6	1.170	1.940
7	1.330	1.890
8	1.500	1.830
9	1.670	1.790
10	1.830	1.740
11	2.170	1.650
12	2.330	1.590
13	2.670	1.520
14	2.830	1.490
15	3.000	1.450
16	3.170	1.430
17	3.330	1.390
18	3.500	1.360
19	3.670	1.340
20	3.830	1.310
21	4.000	1.290
22	4.170	1.270
23	4.330	1.250
24	4.500	1.220
25	4.670	1.200
26	4.830	1.190
27	5.000	1.170
28	5.500	1.120
29	6.000	1.080
30	6.500	1.050
31	7.000	1.040
32	7.500	1.000
33	8.000	0.990
34	8.500	0.970
35	9.000	0.950
36	9.500	0.930
37	10.000	0.920
38	10.500	0.910
39	11.000	0.900
40	11.500	0.900
41	12.000	0.890

Radius of Borehole = 10.16 cm
Radius of Well = 2.54 cm
Length of Well Screen = 152.00 cm
Static Water Level = 0.89 m
Initial Water Level = 2.48 m

Hydraulic conductivity, K = 3.3E-04 cm/sec
Basic time lag, To = 2.9 minutes

SLUG TEST BH00-5B



Hydraulic Conductivity, K = 2.4E-04 cm/sec
Basic Time Lag, T_o = 2.2 minutes

Project Number : 001-2749
Date Tested : NOV. 29/00
Type of Test : Rising Head
Reference : Hvorslev (1951)

Title: SLUG TEST BH00-5B

Project Number: 001-2749
Date Tested: NOV. 29/00
Type of Test: Rising Head
Analysis Method: Hvorslev (1951)

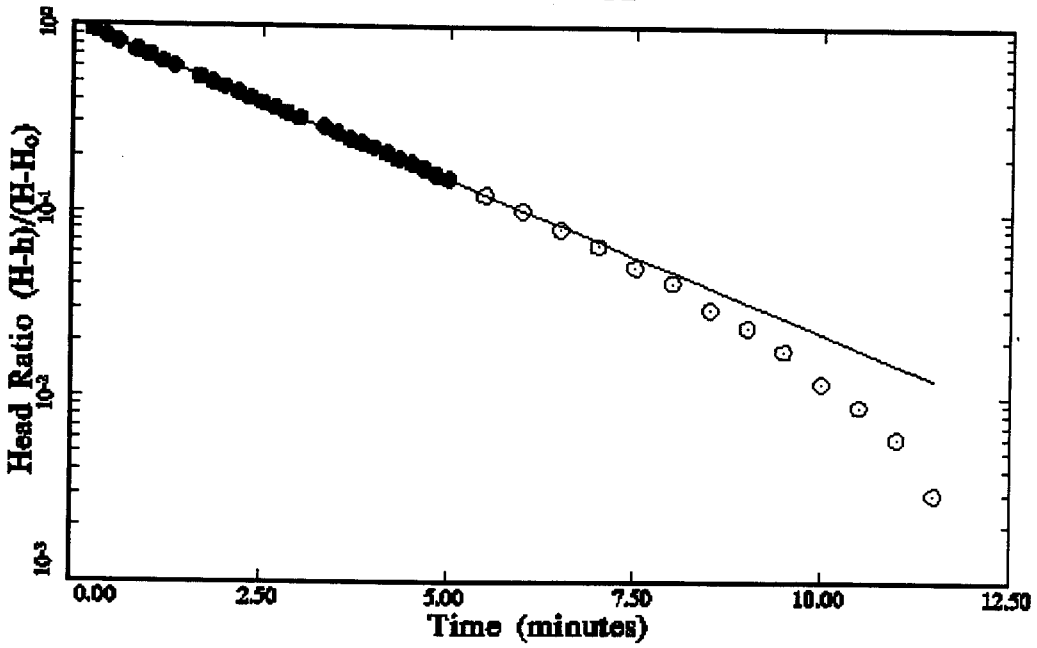
Water Level vs. Time Records

Reading Number	Time (min)	Water Level (m)
1	0.080	2.930
2	0.250	2.780
3	0.330	2.650
4	0.500	2.570
5	0.670	2.450
6	0.920	2.300
7	1.000	2.180
8	1.330	2.000
9	1.500	1.910
10	1.670	1.850
11	1.830	1.800
12	2.000	1.730
13	2.330	1.640
14	2.500	1.590
15	2.670	1.550
16	2.830	1.500
17	3.000	1.460
18	3.170	1.430
19	3.330	1.400
20	3.500	1.370
21	3.670	1.330
22	3.830	1.300
23	4.000	1.280
24	4.170	1.270
25	4.500	1.210
26	4.670	1.190
27	4.830	1.180
28	5.000	1.160
29	5.500	1.120
30	6.000	1.080
31	6.500	1.050
32	7.000	1.030
33	7.500	1.010
34	8.000	1.000
35	8.500	0.980
36	9.000	0.980
37	9.500	0.970
38	10.000	0.960
39	10.500	0.950
40	11.000	0.950
41	11.500	0.940
42	12.000	0.940
43	12.500	0.940
44	13.000	0.940
45	13.500	0.930

Radius of Borehole = 10.16 cm
Radius of Well = 1.90 cm
Length of Well Screen = 152.00 cm
Static Water Level = 0.93 m
Initial Water Level = 2.95 m

Hydraulic conductivity, K = 2.4E-04 cm/sec
Basic time lag, To = 2.2 minutes

BH006-A



Hydraulic Conductivity, K = 3.6E-04 cm/sec
Basic Time Lag, T_o = 2.6 minutes

Project Number : 001-2749
Date Tested : Nov 29/00
Type of Test : Rising Head
Reference : Hvorslev (1951)

Title: BH006-A

Project Number: 001-2749
Date Tested: Nov 29/00
Type of Test: Rising Head
Analysis Method: Hvorslev (1951)

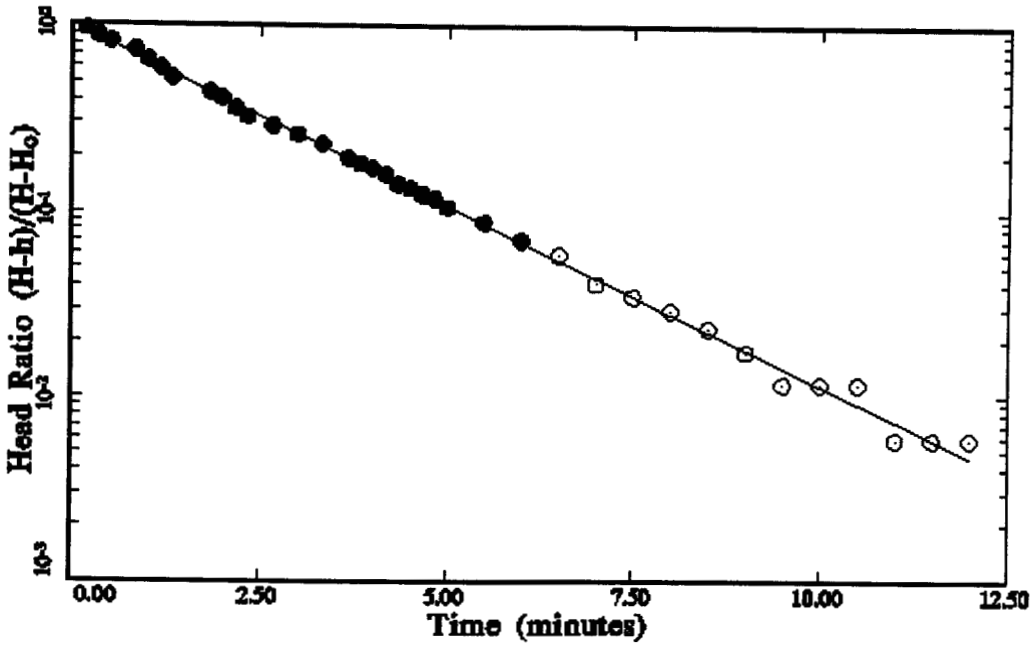
Water Level vs. Time Records

Reading Number	Time (min)	Water Level (m)
1	0.250	4.020
2	0.420	3.810
3	0.580	3.610
4	0.830	3.350
5	1.000	3.210
6	1.170	3.040
7	1.330	2.920
8	1.670	2.660
9	1.830	2.560
10	2.000	2.460
11	2.170	2.360
12	2.330	2.270
13	2.500	2.180
14	2.670	2.110
15	2.830	2.030
16	3.000	1.970
17	3.330	1.860
18	3.500	1.790
19	3.670	1.730
20	3.830	1.680
21	4.000	1.640
22	4.170	1.590
23	4.330	1.540
24	4.500	1.510
25	4.670	1.470
26	4.830	1.430
27	5.000	1.400
28	5.500	1.310
29	6.000	1.240
30	6.500	1.170
31	7.000	1.120
32	7.500	1.070
33	8.000	1.040
34	8.500	1.000
35	9.000	0.980
36	9.500	0.960
37	10.000	0.940
38	10.500	0.930
39	11.000	0.920
40	11.500	0.910
41	12.000	0.900
42	12.500	0.900

Radius of Borehole = 10.16 cm
Radius of Well = 2.54 cm
Length of Well Screen = 152.00 cm
Static Water Level = 0.90 m
Initial Water Level = 4.24 m

Hydraulic conductivity, K = 3.6E-04 cm/sec
Basic time lag, To = 2.6 minutes

BH006-B



Hydraulic Conductivity, K = 2.4E-04 cm/sec
Basic Time Lag, T_o = 2.2 minutes

Project Number : BH-3749
Date Tested : Nov.29/01
Type of Test : Rising Head
Reference : Hvorslev (1951)

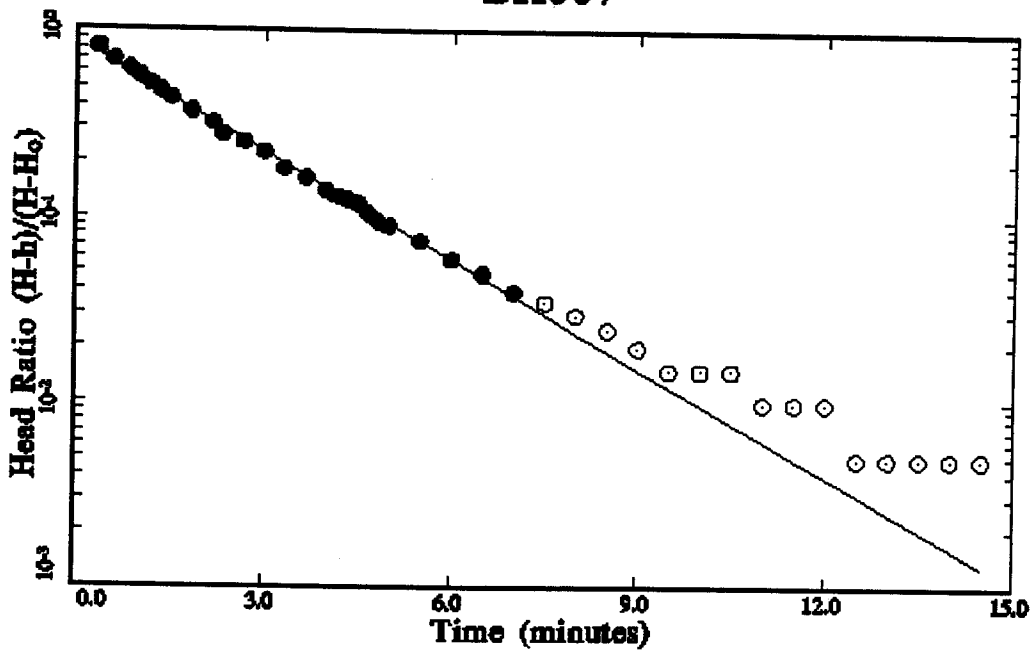
NEW = o:\efile\00\001-2749\gaats\bh006-b.rpt
TITLE = BH006-B
PROJECT= 001-2749
TESTED = Nov.29/01

TIMES = pt.#,	time,	head
1	0.17000	2.40000
2	0.33000	2.27000
3	0.50000	2.17000
4	0.83000	2.03000
5	1.00000	1.88000
6	1.17000	1.78000
7	1.33000	1.66000
8	1.83000	1.52000
9	2.00000	1.46000
10	2.17000	1.38000
11	2.33000	1.32000
12	2.67000	1.26000
13	3.00000	1.21000
14	3.33000	1.16000
15	3.67000	1.10000
16	3.83000	1.08000
17	4.00000	1.06000
18	4.17000	1.04000
19	4.33000	1.01000
20	4.50000	1.00000
21	4.67000	0.98000
22	4.83000	0.97000
23	5.00000	0.95000
24	5.50000	0.92000
25	6.00000	0.89000
26	6.50000	0.87000
27	7.00000	0.84000
28	7.50000	0.83000
29	8.00000	0.82000
30	8.50000	0.81000
31	9.00000	0.80000
32	9.50000	0.79000
33	10.00000	0.79000
34	10.50000	0.79000
35	11.00000	0.78000
36	11.50000	0.78000
37	12.00000	0.78000
38	12.50000	0.77000
39	13.00000	0.77000
40	13.50000	0.77000
41	14.00000	0.77000
42	14.50000	0.77000
43	15.00000	0.77000

TEST = 1 2 : Rising Head - Hvorslev (1951)
WIND = 0 25

BHRAD = 10.16000 - Radius of borehole (cm)
WELLR = 1.90000 - Radius of well (cm)
LSCRN = 152.00000 - Length of well screen (cm)
STATH = 0.77000 - Depth of static water level (m)
INITH = 2.48000 - Depth of initial water level (m)
K = 2.4177E-04 - Hydraulic conductivity (cm/sec)
To = 2.2147 - Basic Time (min)

BH007



Hydraulic Conductivity, K = 5.1E-04 cm/sec
Basic Time Lag, T_o = 1.9 minutes

Project Number : 001-2745
Date Tested : Nov.29/00

Type of Test : Rising Head
Reference : Hvorslev (1951)

NEW = bh007.rpt
TITLE = BH007
PROJECT= 001-2749
TESTED = Nov.29/00

TIMES = pt.#,	time,	head
1	0.33000	2.79000
2	0.58000	2.56000
3	0.83000	2.42000
4	1.00000	2.30000
5	1.17000	2.20000
6	1.33000	2.11000
7	1.50000	2.04000
8	1.83000	1.91000
9	2.17000	1.81000
10	2.33000	1.72000
11	2.67000	1.67000
12	3.00000	1.61000
13	3.33000	1.53000
14	3.67000	1.49000
15	4.00000	1.44000
16	4.17000	1.42000
17	4.33000	1.41000
18	4.50000	1.40000
19	4.67000	1.37000
20	4.83000	1.35000
21	5.00000	1.34000
22	5.50000	1.31000
23	6.00000	1.28000
24	6.50000	1.26000
25	7.00000	1.24000
26	7.50000	1.23000
27	8.00000	1.22000
28	8.50000	1.21000
29	9.00000	1.20000
30	9.50000	1.19000
31	10.00000	1.19000
32	10.50000	1.19000
33	11.00000	1.18000
34	11.50000	1.18000
35	12.00000	1.18000
36	12.50000	1.17000
37	13.00000	1.17000
38	13.50000	1.17000
39	14.00000	1.17000
40	14.50000	1.17000
41	15.00000	1.16000
42	15.50000	1.16000
43	16.00000	1.16000
44	16.50000	1.16000
45	17.00000	1.16000
46	17.50000	1.16000

TEST = 1 2 : Rising Head - Hvorslev (1951)
WIND = 0 25

BHRAD = 10.16000 - Radius of borehole (cm)
WELLR = 2.54000 - Radius of well (cm)
LSCRN = 152.00000 - Length of well screen (cm)
STATH = 1.16000 - Depth of static water level (m)
INITH = 3.19000 - Depth of initial water level (m)
K = 5.1050E-04 - Hydraulic conductivity (cm/sec)
To = 1.8745 - Basic Time (min)

APPENDIX G

HISTORICAL GROUNDWATER CHEMICAL DATA

Golder Associates

CARRIERE (WARD 3) - REPORT OF MONITORING RESULTS

Sample Source: **1-A**

Date Sampled: 19-Aug-2000

Parameter	ODWS/O	
Alkalinity (CaCO3)	30-500	156
Aluminum	0.1	3.780
Ammonia (as N)		1.40
Barium	1	0.040
Beryllium		<0.002
Boron	5	0.090
Cadmium	0.005	<0.00500
Calcium		32.0
Chloride	250	5.0
Chromium	0.05	<0.010
Cobalt		<0.0100
COD		68
Conductivity (uS/cm)		420
Copper	1	0.0100
DOC	5	13.1
Hardness (CaCO3)	80-100	121
Iron	0.3	3.46
Lead	0.01	<0.0010
Magnesium		10.00
Manganese	0.05	0.140
Molybdenum		<0.010
Nickel		<0.010
Nitrate (as N)	10	<0.10
pH (pH units)	6.5-8.5	7.4
Phenols		<0.001
Phosphorus (total)		0.21
Potassium		7.0
Silicon		7.79
Silver		<0.0100
Sodium	200	59.0
Strontium		0.171
Sulphate	500	99.0
Sulphur		31
TDS	500	380
Temperature (C)	15	8.0
Thallium		<0.20000
Tin		<0.010
Titanium		0.170
TKN		1.40
Vanadium		<0.0100
Zinc	5	0.010

All values reported in mg/L unless otherwise noted.

Golder Associates

CARRIERE (WARD 3) - REPORT OF MONITORING RESULTS

Sample Source: **1-B**

Date Sampled: 19-Aug-2000

Parameter	ODWS/O	
Alkalinity (CaCO3)	30-500	166
Aluminum	0.1	1.180
Ammonia (as N)		0.49
Barium	1	0.050
Beryllium		<0.002
Boron	5	0.010
Cadmium	0.005	<0.00500
Calcium		34.0
Chloride	250	2.0
Chromium	0.05	<0.010
Cobalt		<0.0100
COD		58
Conductivity (uS/cm)		400
Copper	1	<0.0100
DOC	5	20.1
Hardness (CaCO3)	80-100	118
Iron	0.3	0.92
Lead	0.01	<0.0010
Magnesium		8.00
Manganese	0.05	0.110
Molybdenum		<0.010
Nickel		<0.010
Nitrate (as N)	10	<0.10
pH (pH units)	6.5-8.5	7.1
Phenols		<0.001
Phosphorus (total)		0.06
Potassium		7.0
Silicon		4.22
Silver		<0.0100
Sodium	200	31.0
Strontium		0.144
Sulphate	500	39.0
Sulphur		12
TDS	500	300
Temperature (C)	15	9.0
Thallium		<0.20000
Tin		<0.010
Titanium		0.060
TKN		0.69
Vanadium		<0.0100
Zinc	5	<0.010

All values reported in mg/L unless otherwise noted.

Golder Associates

CARRIERE (WARD 3) - REPORT OF MONITORING RESULTS

Sample Source: **2-A**

Date Sampled: 19-Aug-2000

Parameter	ODWS/O	
Alkalinity (CaCO3)	30-500	408
Aluminum	0.1	1.580
Ammonia (as N)		0.49
Barium	1	0.140
Beryllium		<0.002
Boron	5	0.020
Cadmium	0.005	<0.00500
Calcium		86.0
Chloride	250	10.0
Chromium	0.05	<0.010
Cobalt		<0.0100
COD		33
Conductivity (uS/cm)		500
Copper	1	<0.0100
DOC	5	9.3
Hardness (CaCO3)	80-100	351
Iron	0.3	2.58
Lead	0.01	<0.0010
Magnesium		33.00
Manganese	0.05	0.460
Molybdenum		<0.010
Nickel		<0.010
Nitrate (as N)	10	<0.10
pH (pH units)	6.5-8.5	7.5
Phenols		<0.001
Phosphorus (total)		<0.01
Potassium		5.0
Silicon		10.30
Silver		<0.0100
Sodium	200	25.0
Strontium		0.405
Sulphate	500	30.0
Sulphur		10
TDS	500	496
Temperature (C)	15	7.0
Thallium		<0.20000
Tin		<0.010
Titanium		0.070
TKN		0.80
Vanadium		<0.0100
Zinc	5	0.090

All values reported in mg/L unless otherwise noted.

Golder Associates

CARRIERE (WARD 3) - REPORT OF MONITORING RESULTS

Sample Source: **2-B**

Sheet: 1

Date Sampled: 19-Aug-2000

Parameter	ODWS/O	
Alkalinity (CaCO3)	30-500	349
Aluminum	0.1	1.050
Ammonia (as N)		15.50
Barium	1	0.200
Beryllium		<0.002
Boron	5	<0.010
Cadmium	0.005	<0.00500
Calcium		70.0
Chloride	250	7.0
Chromium	0.05	<0.010
Cobalt		<0.0100
COD		375
Conductivity (uS/cm)		600
Copper	1	<0.0100
DOC	5	140.0
Hardness (CaCO3)	80-100	233
Iron	0.3	24.30
Lead	0.01	<0.0010
Magnesium		14.00
Manganese	0.05	2.090
Molybdenum		<0.010
Nickel		<0.010
Nitrate (as N)	10	<0.10
pH (pH units)	6.5-8.5	7.2
Phenols		<0.001
Phosphorus (total)		0.40
Potassium		13.0
Silicon		5.83
Silver		<0.0100
Sodium	200	39.0
Strontium		0.276
Sulphate	500	41.0
Sulphur		13
TDS	500	528
Temperature (C)	15	9.0
Thallium		<0.20000
Tin		<0.010
Titanium		0.030
TKN		15.50
Vanadium		0.0100
Zinc	5	<0.010

All values reported in mg/L unless otherwise noted.

Golder Associates

CARRIERE (WARD 3) - REPORT OF MONITORING RESULTS

Sample Source: **3-A**

Date Sampled: 19-Aug-2000

Parameter	ODWS/O	
Alkalinity (CaCO3)	30-500	122
Aluminum	0.1	1.140
Ammonia (as N)		0.73
Barium	1	0.080
Beryllium		<0.002
Boron	5	0.030
Cadmium	0.005	<0.00500
Calcium		48.0
Chloride	250	8.0
Chromium	0.05	<0.010
Cobalt		<0.0100
COD		28
Conductivity (uS/cm)		800
Copper	1	<0.0100
DOC	5	5.8
Hardness (CaCO3)	80-100	190
Iron	0.3	1.02
Lead	0.01	<0.0010
Magnesium		17.00
Manganese	0.05	0.070
Molybdenum		0.020
Nickel		<0.010
Nitrate (as N)	10	6.94
pH (pH units)	6.5-8.5	7.2
Phenols		<0.001
Phosphorus (total)		0.41
Potassium		6.0
Silicon		5.51
Silver		<0.0100
Sodium	200	149.0
Strontium		0.318
Sulphate	500	365.0
Sulphur		120
TDS	500	768
Temperature (C)	15	8.0
Thallium		<0.20000
Tin		<0.010
Titanium		0.050
TKN		0.82
Vanadium		<0.0100
Zinc	5	<0.010

All values reported in mg/L unless otherwise noted.

Golder Associates

CARRIERE (WARD 3) - REPORT OF MONITORING RESULTS

Sample Source: **3-B**

Date Sampled: 19-Aug-2000

Parameter	ODWS/O	
Alkalinity (CaCO3)	30-500	438
Aluminum	0.1	0.410
Ammonia (as N)		0.66
Barium	1	0.160
Beryllium		<0.002
Boron	5	0.120
Cadmium	0.005	<0.00500
Calcium		369.0
Chloride	250	73.0
Chromium	0.05	<0.010
Cobalt		<0.0100
COD		50
Conductivity (uS/cm)		1600
Copper	1	0.0100
DOC	5	14.3
Hardness (CaCO3)	80-100	1310
Iron	0.3	10.00
Lead	0.01	<0.0010
Magnesium		93.00
Manganese	0.05	1.810
Molybdenum		<0.010
Nickel		<0.010
Nitrate (as N)	10	<0.10
pH (pH units)	6.5-8.5	7.0
Phenols		<0.001
Phosphorus (total)		0.10
Potassium		6.0
Silicon		11.20
Silver		<0.0100
Sodium	200	43.0
Strontium		0.683
Sulphate	500	865.0
Sulphur		239
TDS	500	1872
Temperature (C)	15	9.0
Thallium		<0.20000
Tin		<0.010
Titanium		0.020
TKN		1.49
Vanadium		<0.0100
Zinc	5	<0.010

All values reported in mg/L unless otherwise noted.

Golder Associates

CARRIERE (WARD 3) - REPORT OF MONITORING RESULTS

Sample Source: **4-A**

Sheet: 1

Date Sampled: 19-Aug-2000

Parameter	ODWS/O	
Alkalinity (CaCO3)	30-500	397
Aluminum	0.1	0.430
Ammonia (as N)		0.97
Barium	1	0.180
Beryllium		<0.002
Boron	5	0.090
Cadmium	0.005	<0.00500
Calcium		92.0
Chloride	250	13.0
Chromium	0.05	<0.010
Cobalt		<0.0100
COD		35
Conductivity (uS/cm)		600
Copper	1	<0.0100
DOC	5	8.4
Hardness (CaCO3)	80-100	321
Iron	0.3	12.10
Lead	0.01	<0.0010
Magnesium		22.00
Manganese	0.05	0.370
Molybdenum		<0.010
Nickel		<0.010
Nitrate (as N)	10	<0.10
pH (pH units)	6.5-8.5	7.4
Phenols		<0.001
Phosphorus (total)		0.02
Potassium		7.0
Silicon		14.90
Silver		<0.0100
Sodium	200	30.0
Strontium		0.427
Sulphate	500	26.0
Sulphur		10
TDS	500	460
Temperature (C)	15	8.0
Thallium		<0.20000
Tin		<0.010
Titanium		0.020
TKN		1.28
Vanadium		<0.0100
Zinc	5	<0.010

All values reported in mg/L unless otherwise noted.

Golder Associates

CARRIERE (WARD 3) - REPORT OF MONITORING RESULTS

Sample Source: **4-B**

Sheet: 1

Date Sampled: 19-Aug-2000

Parameter	ODWS/O	
Alkalinity (CaCO3)	30-500	397
Aluminum	0.1	0.560
Ammonia (as N)		5.47
Barium	1	0.350
Beryllium		<0.002
Boron	5	0.110
Cadmium	0.005	<0.00500
Calcium		127.0
Chloride	250	20.0
Chromium	0.05	<0.010
Cobalt		<0.0100
COD		90
Conductivity (uS/cm)		800
Copper	1	0.0100
DOC	5	28.0
Hardness (CaCO3)	80-100	441
Iron	0.3	20.80
Lead	0.01	<0.0010
Magnesium		30.00
Manganese	0.05	1.420
Molybdenum		0.010
Nickel		<0.010
Nitrate (as N)	10	<0.10
pH (pH units)	6.5-8.5	7.1
Phenols		<0.001
Phosphorus (total)		0.03
Potassium		19.0
Silicon		10.30
Silver		<0.0100
Sodium	200	66.0
Strontium		0.885
Sulphate	500	79.0
Sulphur		25
TDS	500	736
Temperature (C)	15	10.0
Thallium		<0.20000
Tin		<0.010
Titanium		0.040
TKN		5.93
Vanadium		<0.0100
Zinc	5	<0.010

All values reported in mg/L unless otherwise noted.

Golder Associates

CARRIERE (WARD 3) - REPORT OF MONITORING RESULTS

Sample Source: **5-A**

Date Sampled: 29-Nov-2000

Parameter	ODWS/O	
Alkalinity (CaCO3)	30-500	98
Aluminum	0.1	0.730
Ammonia (as N)		0.22
Barium	1	0.030
Beryllium		<0.002
Boron	5	<0.010
Cadmium	0.005	<0.00010
Calcium		19.0
Chloride	250	1.0
Chromium	0.05	<0.010
Cobalt		0.0007
COD		<4
Conductivity (uS/cm)		160
Copper	1	0.0020
DOC	5	2.0
Hardness (CaCO3)	80-100	85
Iron	0.3	0.93
Lead	0.01	<0.0010
Magnesium		9.00
Manganese	0.05	0.060
Molybdenum		<0.010
Nickel		<0.010
Nitrate (as N)	10	<0.10
pH (pH units)	6.5-8.5	8.2
Phenols		<0.001
Phosphorus (total)		3.48
Potassium		4.0
Silicon		8.26
Silver		<0.0001
Sodium	200	11.0
Strontium		0.080
Sulphate	500	8.0
TDS	500	112
Temperature (C)	15	7.0
Thallium		<0.00100
Tin		<0.010
Titanium		0.040
TKN		0.23
Vanadium		0.0020
Zinc	5	<0.010

All values reported in mg/L unless otherwise noted.

Golder Associates

CARRIERE (WARD 3) - REPORT OF MONITORING RESULTS

Sample Source: **5-B**

Date Sampled: 29-Nov-2000

Parameter	ODWS/O	
Alkalinity (CaCO3)	30-500	119
Aluminum	0.1	0.290
Ammonia (as N)		0.15
Barium	1	0.040
Beryllium		<0.002
Boron	5	<0.010
Cadmium	0.005	<0.00010
Calcium		27.0
Chloride	250	1.0
Chromium	0.05	<0.010
Cobalt		0.0006
COD		8
Conductivity (uS/cm)		190
Copper	1	0.0080
DOC	5	3.2
Hardness (CaCO3)	80-100	109
Iron	0.3	0.30
Lead	0.01	<0.0010
Magnesium		10.00
Manganese	0.05	0.050
Molybdenum		<0.010
Nickel		<0.010
Nitrate (as N)	10	<0.10
pH (pH units)	6.5-8.5	7.4
Phenols		<0.001
Phosphorus (total)		2.75
Potassium		3.0
Silicon		8.02
Silver		<0.0001
Sodium	200	6.0
Strontium		0.082
Sulphate	500	8.0
TDS	500	136
Temperature (C)	15	7.0
Thallium		<0.00100
Tin		<0.010
Titanium		0.020
TKN		0.23
Vanadium		0.0030
Zinc	5	<0.010

All values reported in mg/L unless otherwise noted.

Golder Associates

CARRIERE (WARD 3) - REPORT OF MONITORING RESULTS

Sample Source: **6-A**

Date Sampled: 29-Nov-2000

Parameter	ODWS/O	
Alkalinity (CaCO3)	30-500	245
Aluminum	0.1	0.170
Ammonia (as N)		0.36
Barium	1	0.110
Beryllium		<0.002
Boron	5	0.010
Cadmium	0.005	<0.00010
Calcium		54.0
Chloride	250	4.0
Chromium	0.05	<0.010
Cobalt		0.0003
COD		35
Conductivity (uS/cm)		320
Copper	1	0.0020
DOC	5	14.9
Hardness (CaCO3)	80-100	213
Iron	0.3	2.25
Lead	0.01	<0.0010
Magnesium		19.00
Manganese	0.05	0.340
Molybdenum		<0.010
Nickel		<0.010
Nitrate (as N)	10	<0.10
pH (pH units)	6.5-8.5	7.6
Phenols		0.003
Phosphorus (total)		15.40
Potassium		5.0
Silicon		13.40
Silver		<0.0001
Sodium	200	17.0
Strontium		0.203
Sulphate	500	12.0
TDS	500	300
Temperature (C)	15	8.0
Thallium		<0.00100
Tin		<0.010
Titanium		<0.010
TKN		0.60
Vanadium		0.0030
Zinc	5	<0.010

All values reported in mg/L unless otherwise noted.

Golder Associates

CARRIERE (WARD 3) - REPORT OF MONITORING RESULTS

Sample Source: **6-B**

Date Sampled: 29-Nov-2000

Parameter	ODWS/O	
Alkalinity (CaCO3)	30-500	359
Aluminum	0.1	0.230
Ammonia (as N)		0.16
Barium	1	0.160
Beryllium		<0.002
Boron	5	0.030
Cadmium	0.005	<0.00010
Calcium		144.0
Chloride	250	23.0
Chromium	0.05	<0.010
Cobalt		0.0015
COD		141
Conductivity (uS/cm)		850
Copper	1	0.0030
DOC	5	71.7
Hardness (CaCO3)	80-100	512
Iron	0.3	6.75
Lead	0.01	<0.0010
Magnesium		37.00
Manganese	0.05	1.350
Molybdenum		<0.010
Nickel		<0.010
Nitrate (as N)	10	<0.10
pH (pH units)	6.5-8.5	6.8
Phenols		0.006
Phosphorus (total)		3.76
Potassium		4.0
Silicon		10.60
Silver		<0.0001
Sodium	200	29.0
Strontium		0.302
Sulphate	500	199.0
TDS	500	720
Temperature (C)	15	5.0
Thallium		<0.00100
Tin		<0.010
Titanium		<0.010
TKN		1.23
Vanadium		0.0060
Zinc	5	<0.010

All values reported in mg/L unless otherwise noted.

Golder Associates

CARRIERE (WARD 3) - REPORT OF MONITORING RESULTS

Sample Source: 7

Sheet: 1

Date Sampled: 29-Nov-2000

Parameter	ODWS/O	
Alkalinity (CaCO3)	30-500	97
Aluminum	0.1	0.460
Ammonia (as N)		0.14
Barium	1	0.030
Beryllium		<0.002
Boron	5	<0.010
Cadmium	0.005	<0.00010
Calcium		25.0
Chloride	250	3.0
Chromium	0.05	<0.010
Cobalt		0.0005
COD		14
Conductivity (uS/cm)		140
Copper	1	0.0020
DOC	5	4.6
Hardness (CaCO3)	80-100	100
Iron	0.3	0.81
Lead	0.01	<0.0010
Magnesium		9.00
Manganese	0.05	0.080
Molybdenum		<0.010
Nickel		<0.010
Nitrate (as N)	10	0.11
pH (pH units)	6.5-8.5	7.7
Phenols		0.002
Phosphorus (total)		3.53
Potassium		3.0
Silicon		8.48
Silver		<0.0001
Sodium	200	4.0
Strontium		0.073
Sulphate	500	7.0
TDS	500	124
Temperature (C)	15	7.0
Thallium		<0.00100
Tin		<0.010
Titanium		0.020
TKN		0.19
Vanadium		0.0020
Zinc	5	<0.010

All values reported in mg/L unless otherwise noted.