AEROBIC LANDFILL
AND LEACHATE MANAGEMENT SYSTEM
SETTLER'S PARK
Markham, Ontario

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Project No. 272-061
February, 2006

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Attachment 1

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1.0 INTRODUCTION AND OVERVIEW

1.1 Environmental Aspects

In the 1960's, land reclamation by waste disposal was a common practice. Little was known about long-term environmental impacts at the time and very few steps were taken to protect water resources or neighbouring properties. During that period, the Settler's Park property was the site of an aggregate extraction operation. Once the sand was mined to the water table, the owner proceeded to reclaim the land by landfilling.

The lack of attention to environment concerns during the landfilling period now hampers Markham's ability to implement effective mitigation measures. For example, the lack of a buffer zone around much of the site increases the risk of off-site methane migration and constrains the operation of gas control systems. Large depressions on the site maximizes leachate production, while the lack of a liner and a limited attenuation zone increase impacts to the natural environment.

1.2 Long Term Liability

The organic waste in landfills typically takes over 100 years to fully decompose. As a result, landfill owners are required to commit funds for long term care and monitoring of most landfills. The Settler's Park landfill is an example of the type of landfill that requires long-term care. The two primary risks are offsite migration of methane gas and discharge of leachate constituents into German Mills Creek.

It has been over 30 years since the Settler's Park landfill closed, however samples of raw waste collected during drilling operations indicate that the decomposition process is proceeding very slowly. Based on the observed sluggish rate of docomposition, the current methane and leachate impacts are expected to last for many more decades. In reality, Markham will be liable for environmental protection until the landfill decomposes to harmless material.

1.3 Aerobic Landfill Mitigation

A series of site investigations over the past 5 years have focussed on options to accelerate the decomposition process. Aerobic landfill technology has emerged as the most cost-effective solution. Pilot-scale tests were conducted to develop design parameters for a full-scale aerobic landfill. World-wide experience with aerobic landfills have shown that they accelerate the rate of waste decomposition, eliminate methane production, and significantly lower the long-term financial burden and liability.

Conversion of a landfill to aerobic condition requires the injection of air into the waste material. This process eliminates the anaerobic microbes, which produce methane, and supports aerobic microbes. The latter bacteria consume the oxygen in the injected air and convert the waste to carbon dioxide, water and stable soil.

The aerobic process is exothermic, which produces large quantities of thermal energy in the form of heat. Temperatures of up to 70°C can be achieved under optimum aerobic conditions.

The addition of moisture to the landfill enhances the aerobic process and accelerates the rate of decomposition. At Settler's Park, the injection of groundwater from the leachate plume would mitigate adverse impacts in German Mills Creek at the same time as speed up the waste stabilization process.

In addition to eliminating the liability of off-site methane migration, aerobic landfills achieve major reductions in greenhouse gas emissions. This is due to the fact that conventional landfills emit enormous quantities of methane to the atmosphere and methane has 21 times the impact of an equal volume of carbon dioxide.

1.4 A Leadership Role for Markham

In spite of the fact that aerobic landfill technology has been implemented around the world, only three are known to have been implemented in Canada. Toronto operates an aerobic landfill at the Donlands site, and two partial aerobic sites have been developed in British Columbia. In each case, the aerobic conditions were established to eliminate the risk of methane migration into buildings.

At the 25 year-old Donlands aerobic landfill, an unexpected community asset has been establishment of a thick, mixed forest on the site. (Trees never mature on normal landfills due to the lack of oxygen in the root zone). The Donlands site is the only one of six landfills constructed in ravines along the Don river to be transformed into the natural, wooded landscape of the valley lands.

Another major asset of aerobic landfills is the thermal energy that is produced and stored within the site. Current technology, similar to geothermal energy systems, can be utilized to recover the stored thermal energy for space heating in buildings. This "free" source of energy may make it feasible to construct year-round park facilities such as greenhouses or an interpretive centre. These facilities could focus on the sensitive ecology in the area and also showcase the aerobic technology.

An aerobic landfill at Settler's Park will provide Markham with a leadership role in demonstrating an innovative, sustainable landfill technology. For the vast number of small and medium municipal landfills in Canada, aerobic technology offers a reliable and cost-effective method of achieving a major reduction in greenhouse gas emissions, producing thermal energy and accelerating landfill stabilization. The technology provides an opportunity to convert an environmental liability into a significant community asset.

This report describes the current impacts of the Settler's Park landfill and presents a conceptual design for a full-scale aerobic landfill. The design includes collection and recirculation of the leachate which is currently discharging into German Mills Creek via the groundwater regime. When implemented, the aerobic landfill will fully mitigate the methane and leachate impacts, reduce greenhouse gas emissions and produce thermal energy.

2.0 SETTLER'S PARK HISTORY

Settler's Park is a 38 ha parcel of passive parkland with about 230 m of frontage on John St. at German Mills Creek as shown on Figure 1. The boundary of the waste landfill, which also defines the limits if the original sand pit, is outlined on Figure 1. The creek flows through the eastern portion of the park and the western portion is bordered by over 25 residential homes, all located within 15 m of the edge of the landfill.

The German Mills Creek valley lands have been filled with inert clean materials. The former meandering creek bed was also filled, and a new channel constructed in the native sand deposit along the eastern edge of the valley. We assume that the stream channel realignment project and the floodplain fill operations were carried out in accordance with TRCA regulations, however, we have not located any documentation on the design and authorization of these works.

The landfill operations were carried out by the former owner of the site, James Sabiston Ltd. (Sabiston). At the time that the waste disposal operations started, there were no government requirements to install a liner beneath the landfill. Unlined landfills allow leachate (from infiltrating precipitation) to percolate downward to the groundwater regime. Easterly movement of the groundwater will then slowly transport the leachate plume toward German Mills Creek.

After completion of the landfilling operations in 1975, ownership of the property was transferred to the Town of Markham. Several years later, the MOE became concerned about potential impacts of the landfill on the abutting residential properties. Studies in the early 1980's confirmed that odourous gases were being emitted from settlement cracks around the landfill perimeter. Also, drilling programs confirmed that methane was migrating onto the adjacent properties via unsaturated sandy deposits that are buried beneath a surface layer of clayey soil.

The landfill gas concerns led to the MOE issuing a Control Order to Sabiston, to install a gas collection system along the north and west boundaries of the site. The system was installed in

1983. Under an agreement with Sabiston, Markham took over responsibility to operate, monitor and maintain the gas collection system in 1984. In acquiring the Settler's Park property, Markham became liable for potential impacts of the landfill to both the public and the natural environment.

The original landfill gas system included a header pipe which connected 22 gas recovery wells to a positive displacement air blower in a fan house in the northeast corner of the landfill. A flare was installed on the exhaust stack to burn the methane and other flammable gases; however, it has not been working for the past several years due to the lack of gases that can be collected for burning. The layout of the existing gas recovery wells is shown on Figure 2. Four infiltration basins that have been created by irregular settlement of the landfill waste are also shown on Figure 2.

Four natural depressions have been created by irregular settlement of the landfill waste. These depressions contain the site runoff and function as infiltration basins with all runoff being re

Over the years, the gas collection system has been prone to periodic breakdown and failure. Examples of the system failure includes:

- plugging of the gas recovery well screens;
- blockages of the header pipes due to settlement of the landfill;
- failure of header flow-control valves;
- air leakage into the header system due to settlement failures;
- failure of the landfill gas flaring system;
- system shut-down after power outages, and
- failure of a propane back-up system for gas flaring.

The physical failures in the gas collection piping and control systems have been caused by the lack of perimeter buffer strip of firm ground. Mos of the gas recovery wells and the header piping are constructed in unstable waste materials, which causes blockages and ruptures in the piping.

3.0 HYDROGEOLOGIC SETTING

3.1 Geology

Two distinctively different geological deposits are found in the vicinity of the settler's Park site: a surficial deposit of glacial till and partially buried deposits of sand and gravel. The till is about 3 to 5 m thick around the landfill site. It ranges from clayey to sandy silt in composition and contains isolated lenses of sand.

In the German Mills Creek valley, the till has been eroded away, exposing the sand and gravel deposit at the surface. The aggregate extraction operations started in the valley lands and proceeded westward. The till cap was removed to permit extraction of the underlying sand and gravel down to the water table.

3.2 Groundwater

The water table is located below the base of Settler's Park landfill in the underlying deposits. The water table slopes gently toward German Mills Creek and defines the surface of the Upper Aquifer in the area. The predicted water table contours are plotted on Figure 1. Virtually all groundwater that migrates beneath the landfill site in the Upper Aquifer discharges into German Mills Creek.

Inspection of the west bank of the creek revealed evidence of groundwater discharge along much of the reach between SS1 and SS2 (refer to Figure 1). At two piezometer locations, PZ2 and PZ3, the seepage occurs a few centimetres above the stream level, however, most seepages occur near the low-water level in the stream.

The stream bottom and bank sediments in some groundwater seepage areas are discoloured by iron staining. Probing at seepage areas with significant iron staining revealed coarse sand and gravel deposits just below stream level. The staining is an iron oxide precipitate which is deposited on the sediments when dissolved iron in the groundwater is exposed to oxygen.

Field studies were carried out in June, 2005 to determine if there were significant areas of groundwater upwelling in the stream. The studies included temperature profiling by spot measurements along the stream and by continuous, datalogger monitoring, to assess diurnal thermal patterns. The spot measurements of temperature at the top and bottom of the stream did not detect any evidence of cooler groundwater discharge. The stream temperature cooled from 22°C at John Street to 19°C south of the landfill over a three hour period (see results on Figure 1). The temperature data loggers showed that the "apparent cooling" observed in the spot readings was due to a drop in atmospheric temperature, rather than groundwater discharge.

The temperature profiling demonstrated that the large mass of the streamflow masks the relatively small volume of groundwater discharge. Subsequent thermal monitoring of shallow groundwater (in piezometers PZ2 and PZ3 at the edge of the stream) showed it was significantly warmer than typical 10°C groundwater. For example, the June, 2005 groundwater temperatures in PZ2 and PZ3 were 13°C and 16°C, respectively. The difference in temperature reflected shading (PZ2) versus direct sunlight (PZ3) conditions. The thermal impact of fluctuating air temperature on the shallow groundwater temperature indicates that the discharge rate is small.

Based on the general groundwater flow patterns at Settler's Park, the total groundwater flux emptying into the stream within the site is estimated to be in the range of 1 to 2 L/s. The thermal profiling indicates that the groundwater discharge to German Mills Creek is uniformly distributed along the streambed, but the discharge rate is too small to affect the stream temperature.

4.0 LANDFILL IMPACTS

4.1 Landfill Gas

Positive pressure in the Settler's Park landfill forces the methane to migrate laterally beneath the abutting residential homes. Methane is combustible at concentrations of 5 to 15% by volume in air. The MOE's Certificate of Approval for the gas control system states that it is required to *"prevent migration of landfill gas onto adjacent properties thus eliminating the risk of fire or explosion in the houses".*

Over the past 20 years, Markham has operated the gas recovery wells to protect the abutting residences. The absence of a buffer zone around the site however, has been a major constraint to the viability and operation of the gas control system. On-going and unpredicted settlement of the header pipes require reactive mitigation, when system failures occur. Proactive mitigation has not been possible because of the lack of stable ground conditions around the site perimeter.

In addition to the potential impacts to the neighbouring properties, large quantities of methane also vent through the landfill cap directly into the atmosphere. Methane is a harmful greenhouse gas and the landfill is believed to be the largest single source of greenhouse gas emissions in Markham.

4.2 Landfill Leachate

As noted previously, the lack of a liner beneath the landfill results in leachate percolation downward into the groundwater regime. The leachate plume, is then transported easterly in the aquifer flow system to German Mills Creek.

Observation wells and piezometers, installed between the landfill and the stream, have been sampled to evaluate the attenuation capacity of the site. The water quality results for both the wells and the stream are summarized in Tables 1, 2 and 3 in Appendix B.

The capacity of the site to attenuate the leachate plume by dilution can be assessed, examining the chloride distribution. Chloride is a non-reactive parameter that is only attenuated by dilution. The chloride concentrations between the landfill and the stream are as follows:

OW 2-18 (landfill) = over 2000 mg/L
OW 6-6 (streambank) = 344 to 527 mg/L

The results indicate that significant attenuation occurs on the property, however the groundwater flow paths are too short to achieve complete cleanup of the leachate plume.

The leachate plume constituents that pose the greatest risk to quality in the sediments of the stream appear to be ammonia and several trace metals. Ammonia for example, averages about 8 mg/L at the streambank (OW 6-6) and was 1.4 mg/L in the stream sediments (piezometers P2 and P3) in June, 2005. The latter measurement resulted in an unionized ammonia of 0.06 to 0.1 mg/L, which exceeds the Provincial Water Quality Objective (PWQO) of 0.02 mg/L. Greater exceedances of unionized ammonia may occur during the summer months, since it is temperature dependent.

Iron in the two streambed piezometers falls between 10 and 20 mg/L, (in June 2005 samples) which is well over the PWQO of 0.3 mg/L. Other PWQO exceedances in the piezometers included zinc, lead, copper, chromium and cobalt.

The water quality in German Mills Creek was monitored in 2002, 2003 and 2004 (refer to Table 2, Appendix B). The samples are collected upstream (SS1) and downstream (SS2) of the landfill. In addition, samples were collected in the vicinity of a groundwater seepage area (SS3) in 2003 and 2004. All samples were collected during the August to September low-flow period, when flow was measured in the range of 200-300 L/s (refer to Table 5, Appendix B).

Comparison of the upstream and downstream water samples indicates that the overall landfill leachate plume does not cause a significant impact to the streamflow in German Mills Creek. This is largely due to the fact that the low flow in the stream is several hundred times greater than the groundwater flux beneath the landfill. The leachate impacts appear to be limited manly to the small flux of groundwater which discharges through the bottom sediments and into the stream.

The main leachate indicators which increase in concentration between the upstream and downstream stations include: chloride, calcium, iron, manganese, zinc and ammonia. The increase in concentrations, however, are generally only a few percent.

4.3 Remedial Action

A remedial action plan is required to address both the leachate impact in German Mills creek and the failing gas control system. The following section describes a plan to eliminate methane production by aerobic technology and recirculate the leachate to protect the stream.

5.0 REMEDIAL ACTION PLAN

5.1 Aerobic Landfill Design

5.1.1 Aerobic Pilot Test

A pilot aerobic landfill test was carried out in a specially-designed test well (TW2) in July and August, 2004. The test was run at an air injection rate of 45 L/s for a 9 day period. Indicators of aerobic landfill conditions such as a decrease in methane generation, increase in oxygen levels and production of thermal energy (heat) were monitored in a network of gas probes. Figure 3 shows the extent of the aerobic zone and the thermal plume around the pilot test well.

The calorific reactions associated with aerobic decomposition around the air injection well created a large sphere of thermal (heat) energy. The landfill temperature outside the stainless-steel well screen increased from 16°C to 26°C during the 9 day test period. The decay in temperature around the test well was monitored continuously until early 2005. The graphs of atmospheric temperature and landfill temperature are shown on Figure 3. The results show that the thermal energy was retained in the landfill at the test well, with a very gradual decay to 21°C.

Methane in the landfill around the well screen in the test well decreased from 34% (by volume) to less than 5% and remained low for 11 days after completion of the air injection test. The overall results of the pilot test demonstrated that it is feasible to reduce methane to non-hazardous levels by utilizing aerobic landfill technology.

5.1.2 Aerobic Landfill Design

When oxygen is injected into a landfill, the biodegradation process is transformed from anaerobic to aerobic metabolism. The result is a gradual decrease in methane production and the production of thermal (heat) energy. Once established, the aerobic process achieves much more rapid stabilization of the waste than an anaerobic process. This shortens the time required to manage and monitor environmental impacts, and reduces the financial burden of the site. The process also virtually eliminates the malodorous gases associated with anaerobic landfills.

Implementation of aerobic landfill technology requires the installation of a network of air injection wells. Atmosphere air is injected into the waste via the nests of wells by means of positive displacement air blowers. The air is distributed to the injection wells through a system of header pipes that are buried just below the ground surface.

The layout of the air injection system is shown in Figures 4, 5 and 6. A total of 22 injection wells are planned, with an additional 10 contingency wells to be installed only if conditions require them. The contingency wells may be needed if the waste permeability is lower than expected.

The design of the injection wells is shown on Figure A-1, Appendix A. A nest of two steel wells is proposed at each well site. This design will optimize the distribution of air in both the deep and the shallow portions of the landfill. The design specifications for the air injection well nests are outlined in Table A-1, Appendix A.

Temperature and gas monitoring probes are required throughout the landfill to monitor the system performance. The monitoring network is also shown on Figure 4. Automated monitoring, using remote temperature loggers, is required to ensure optimum conditions are maintained for aerobic decomposition. The design of a nested monitoring well system is shown on Figure A-2 and the specifications are outlined in Table A-2.

5.1.3 Leachate Management Plan

An effective way to add moisture to the aerobic landfill is by recirculation of the leachate that is discharging into German Mills Creek. The most cost-effective method of intercepting the leachate is by means of shallow wells installed along the west bank of German Mills Creek. The water table is within 4 m of the ground surface in this area. The wells would be connected to a common header and suction pump.

The pumping rate would be adjusted to limit the drawdown to the stream level. This groundwater pumping system would capture the leachate plume without causing a reversal of groundwater flow beneath the stream.

The design of a typical leachate collection well is shown on Figure A-3 and the specifications are outlined on Table A-3. A monitoring tube is required in the annulus of each collection well in order to monitor the drawdown. A sample port on each well allows sampling of the groundwater, in order to assess the distribution and strength of the leachate plume. The layout of the leachate collector wells is shown on Figure 4.

The leachate will be distributed across the surface of the landfill via shallow infiltration trenches. The design of the infiltration system is shown on Figure A-4 and the specifications outlined in Table A-4. The layout of the infiltration trenches are shown on Figure A-4.

The leachate management system will only operate during the frost-free period. This eliminates the need for deep burial of the piping, and operation of the system under freezing conditions.

6.0 PROJECT COST ESTIMATES

The estimated cost to develop the aerobic landfill and install a leachate management system is summarized below:

1. Aerobic Landfill

–	22 air injection wells, controls and fittings, piping, monitoring wells and an air injection blower (installed in existing pump house)	$379,700
–	engineering fees	68,000
	Sub-Total	**$447,700**

2. Leachate Management System

–	10 leachate collection wells, pumping station, piping, infiltration trenches and monitoring wells	$205,000
–	engineering fees	40,000
	Sub-Total	**$245,000**
	Total	**$624,700**
	Contingency (10%)	**62,500**
	Total Project Estimate	**$687,200**

3. Annual Monitoring

– Allowance for annual monitoring and reporting of the air injection and leachate management systems:

2007	**$ 37,000**
2008	**$ 18,500**

7.0 CONCLUSIONS AND RECOMMENDATIONS

Field investigation and monitoring programs at the Settler's Park landfill indicate that slow anaerobic decomposition of the waste will continue to produce methane and leachate for many decades.

Anaerobic decomposition of the Settler's Park landfill releases large quantities of methane, (a greenhouse gas), to the atmosphere and produces leachate which migrates via the groundwater regime to German Mills Creek.

Potential adverse impacts caused by the Settler's Park landfill include: a) subsurface migration of methane beneath the abutting residences, and b) discharge of leachate constituents into the bottom sediments in German Mills Creek.

Pilot testing of the aerobic technology has demonstrated that it is feasible to develop a full-scale aerobic landfill at Settler's Park. The aerobic landfill will eliminate the liabilities associated with the production of methane gas and release of greenhouse gases, and accelerate the decomposition process.

Mitigation of the adverse leachate impacts in German Mills Creek can be accomplished by installing shallow leachate collection wells and recirculating the contaminated groundwater back into the landfill. Landfill infiltration trenches can be used to add moisture to the landfill, which will further enhance the aerobic decomposition process.

In summary, implementation of an aerobic landfill at the Settler's Park landfill is an innovative approach to reducing the life-cycle costs of managing the landfill impacts. An added benefit of aerobic landfills in the large quantity of thermal energy that is produced. This energy can be easily recovered for space heating in on-site buildings.

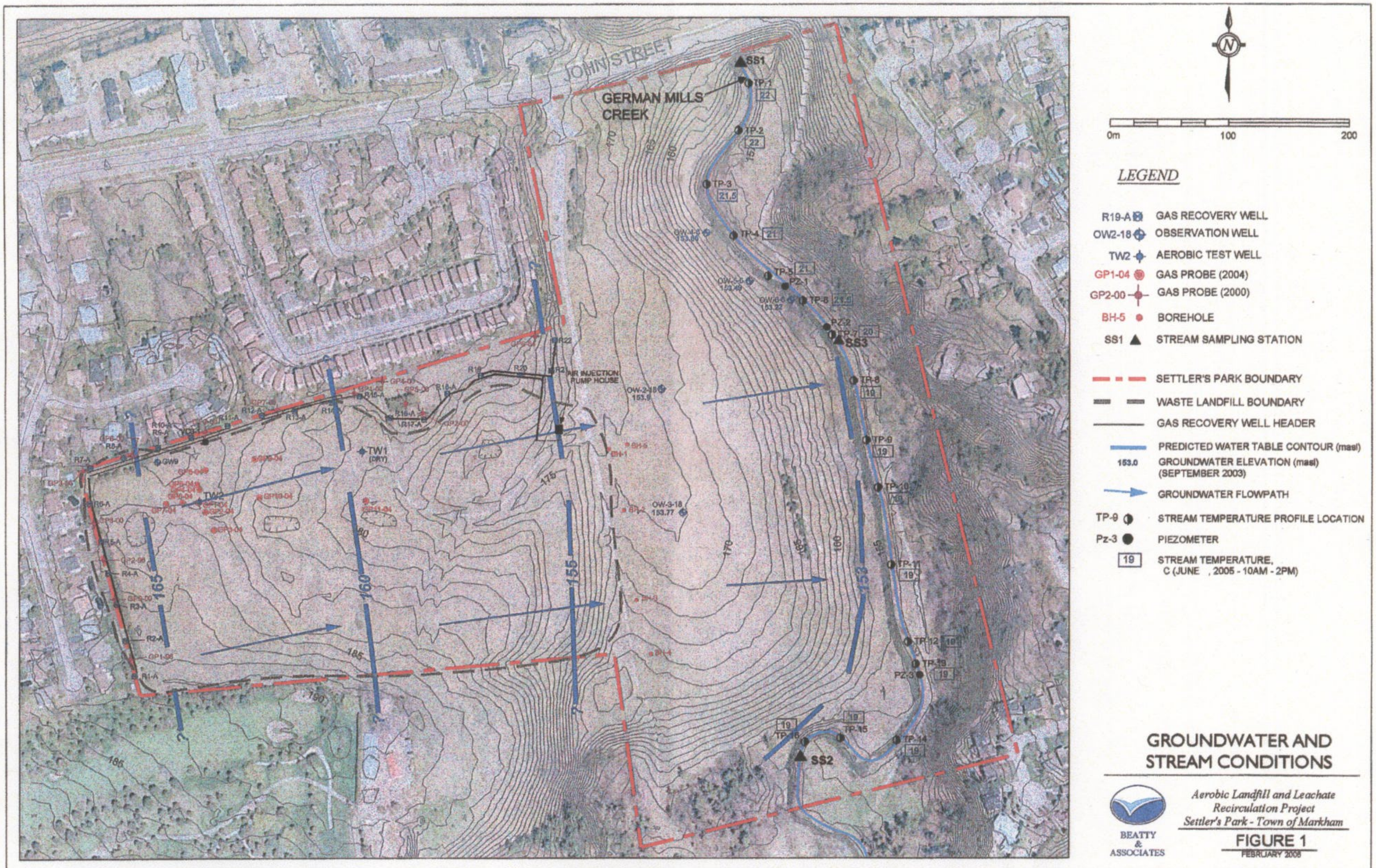
Conversion of the site to an aerobic landfill will transform the site from an environmental liability to a significant community asset. It provides Markham with an opportunity to showcase a sustainable landfill technology to municipalities across the country and beyond.

A conceptual aerobic landfill and leachate management system has been developed in this report. We recommend that Markham implement the systems as presented in the report.

Yours very truly,
Beatty & Associates Limited

Brian Beatty, P. Eng.,
President

FIGURES


JOHN STREET
GERMAN MILLS CREEK
AIR INJECTION PUMP HOUSE
0m
100
200
LEGEND
R19-A GAS RECOVERY WELL
OW2-18 OBSERVATION WELL
TW2 AEROBIC TEST WELL
GP1-04 GAS PROBE (2004)
GP2-00 GAS PROBE (2000)
BH-5 BOREHOLE
SS1 STREAM SAMPLING STATION
SETTLER'S PARK BOUNDARY
WASTE LANDFILL BOUNDARY
GAS RECOVERY WELL HEADER
PREDICTED WATER TABLE CONTOUR (masl)
153.0 GROUNDWATER ELEVATION (masl) (SEPTEMBER 2003)
GROUNDWATER FLOWPATH
TP-9 STREAM TEMPERATURE PROFILE LOCATION
Pz-3 PIEZOMETER
19 STREAM TEMPERATURE, C (JUNE , 2005 - 10AM - 2PM)
GROUNDWATER AND STREAM CONDITIONS
BEATTY & ASSOCIATES
Aerobic Landfill and Leachate Recirculation Project
Settler's Park - Town of Markham
FIGURE 1
FEBRUARY 2006

EXISTING GAS CONTROL SYSTEM AND AEROBIC LANDFILL PILOT TEST

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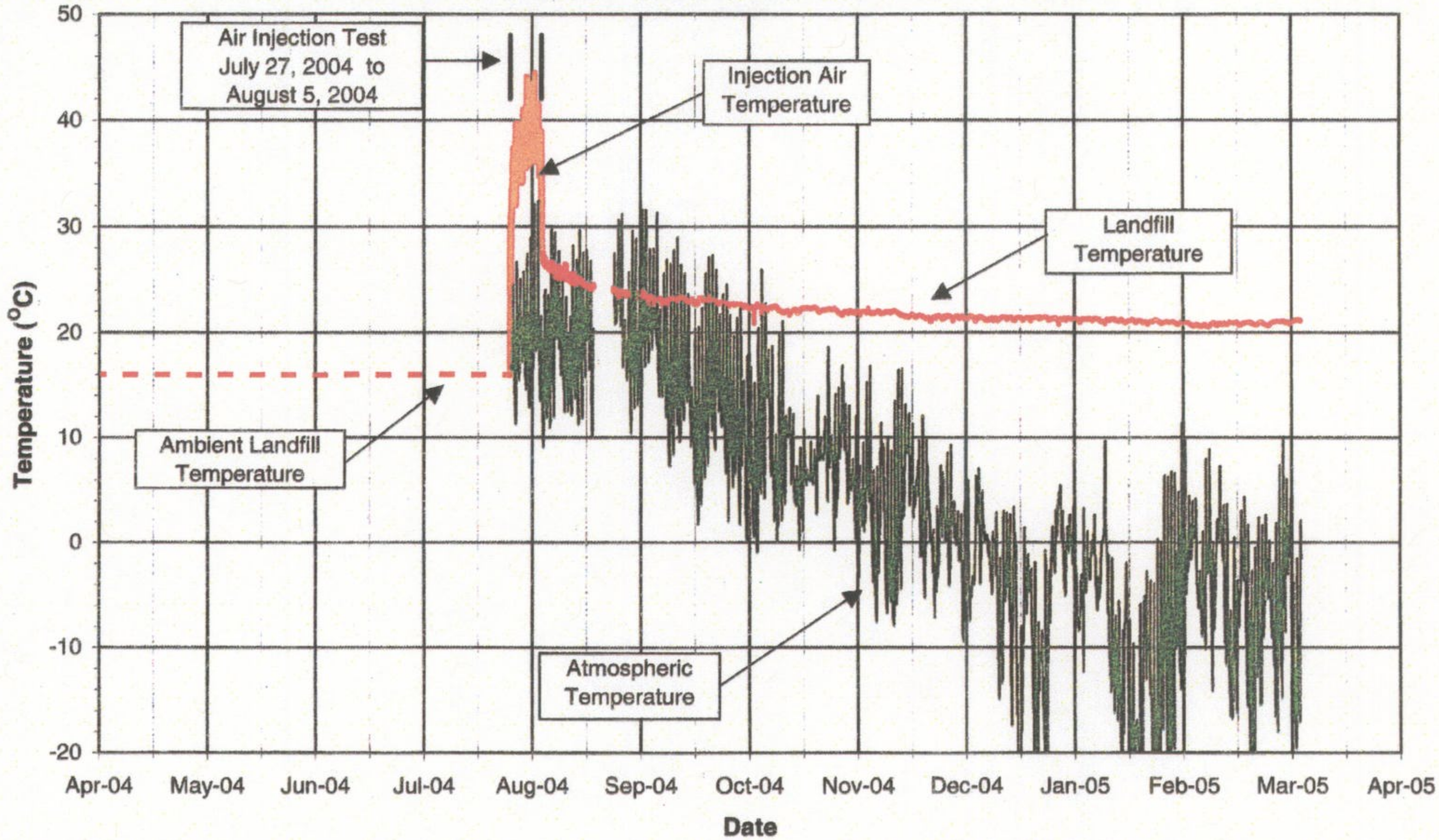
Aerobic Landfill and Leachate Recirculation Project
Settler's Park - Town of Markham

FIGURE 2
FEBRUARY 2006

Aerobic Landfill and Leachate Recirculation Project

9-Day Aerobic Pumping Test



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Landfill Temperature Monitoring

Settler's Park - Town of Markham

Figure 3

0m 50 100

LEGEND

- SETTLER'S PARK BOUNDARY
- APPROXIMATE WASTE LANDFILL BOUNDARY
- A A' CROSS-SECTION LOCATION KEY

EXISTING GAS COLLECTION SYSTEM

- GAS RECOVERY WELL HEADER
- R13-A GAS RECOVERY WELL
- TW2 AEROBIC TEST WELL

AEROBIC LANDFILL SYSTEM

- AIR INJECTION WELL NEST
- CONTINGENCY AIR INJECTION WELL NEST
- AIR INJECTION MANIFOLD
- LEACHATE RECIRCULATION FORCEMAIN
- LEACHATE INFILTRATION MANIFOLD
- MONITORING WELL NEST (LEACHATE / AIR)

LEACHATE CONTROL SYSTEM

- LEACHATE COLLECTION WELL
- LEACHATE COLLECTION MANIFOLD

AIR INJECTION AND LEACHATE INFILTRATION SYSTEM

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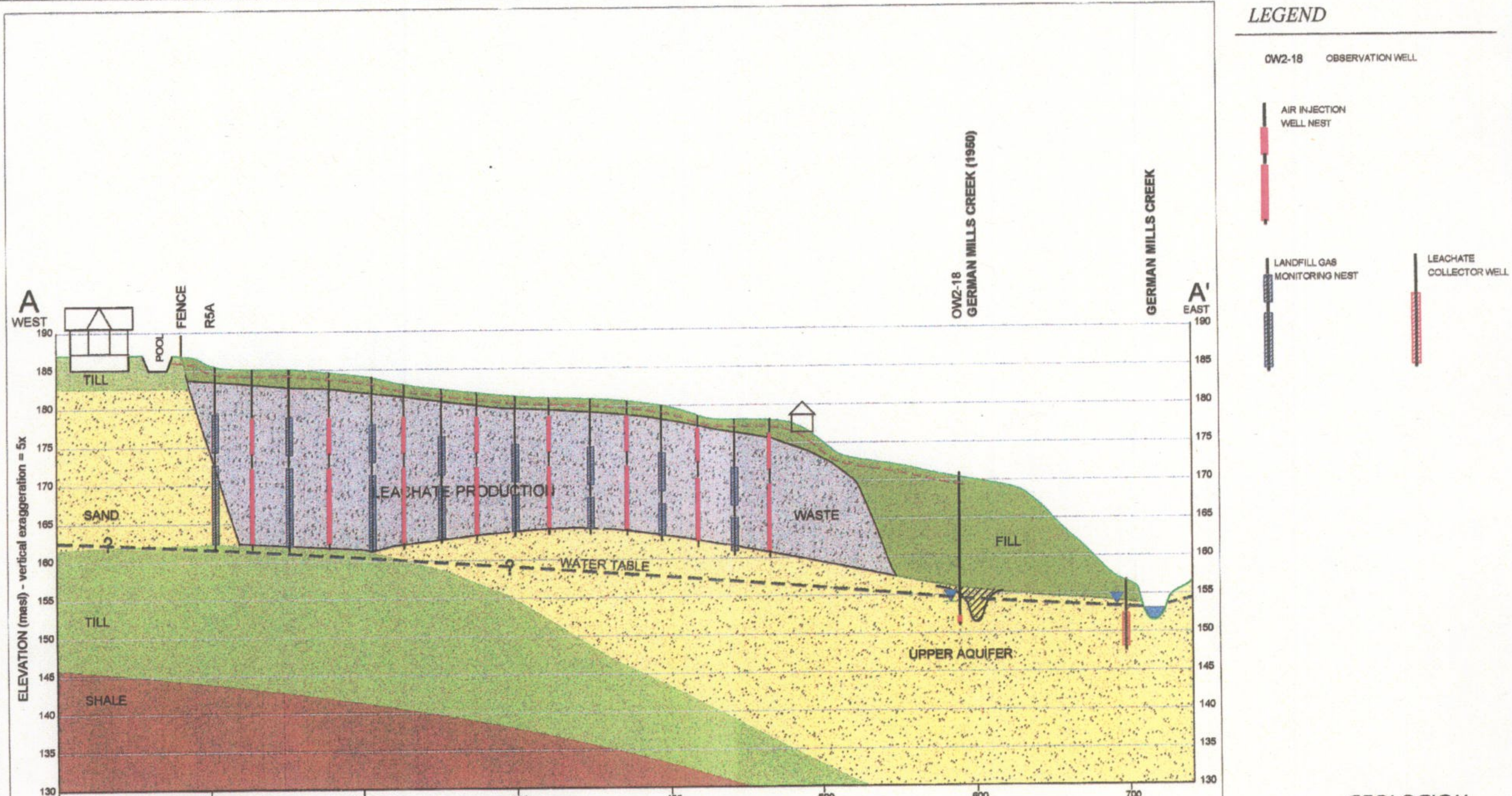
Aerobic Landfill and Leachate Recirculation Project
Settler's Park - Town of Markham

FIGURE 4
FEBRUARY 2006

272-051 SETTLER'S PARK\2006\BASE.DWG



GEOLOGICAL CROSS-SECTION A-A'

Aerobic Landfill and Leachate Recirculation Project
Settler's Park - Town of Markham

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FIGURE 5

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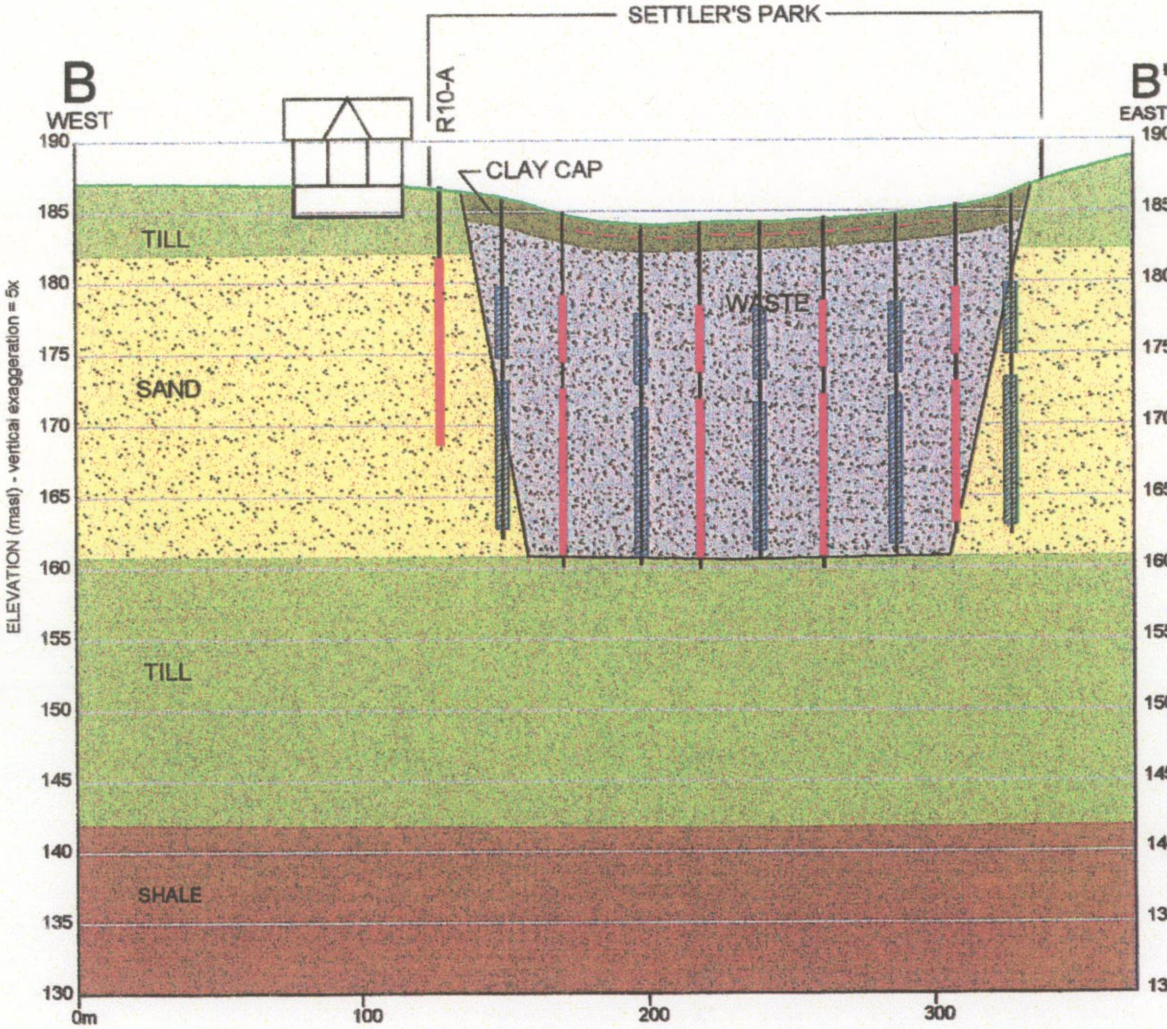

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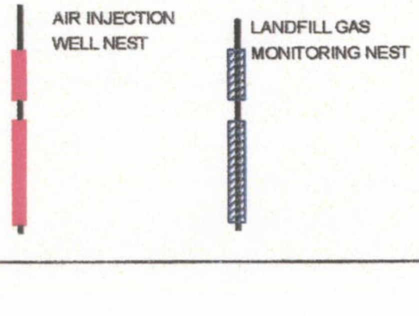

GEOLOGICAL CROSS-SECTION B-B'

Aerobic Landfill and Leachate Recirculation Project
Settler's Park - Town of Markham

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FIGURE 6

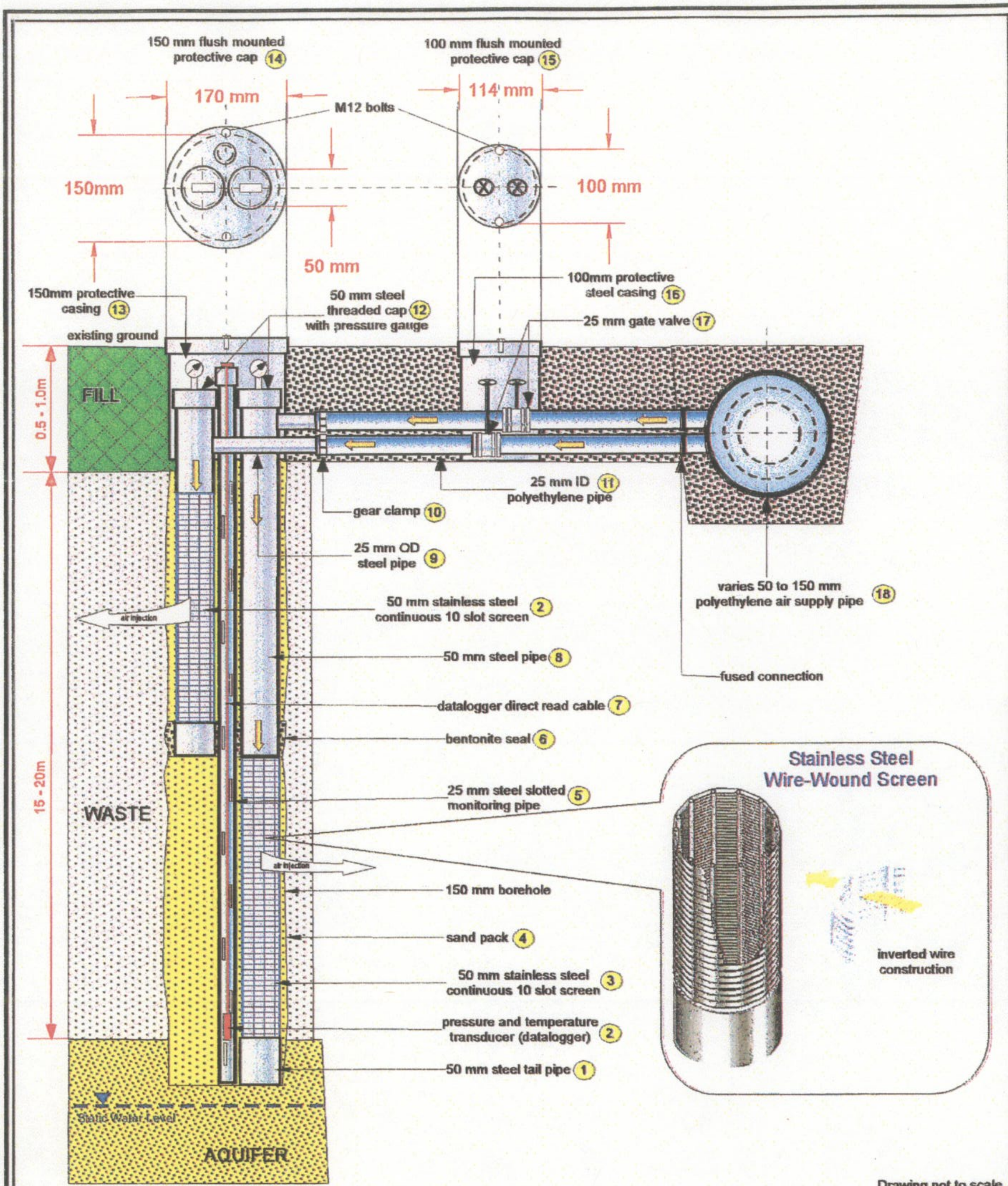
FEBRUARY 2006

272-031 SETTLER'S PARK/2006/XS-B.DWG

APPENDIX A

Aerobic Landfill and Leachate Recirculation Project

- Design Details -



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Air Injection Well Nest
Aerobic Landfill Project

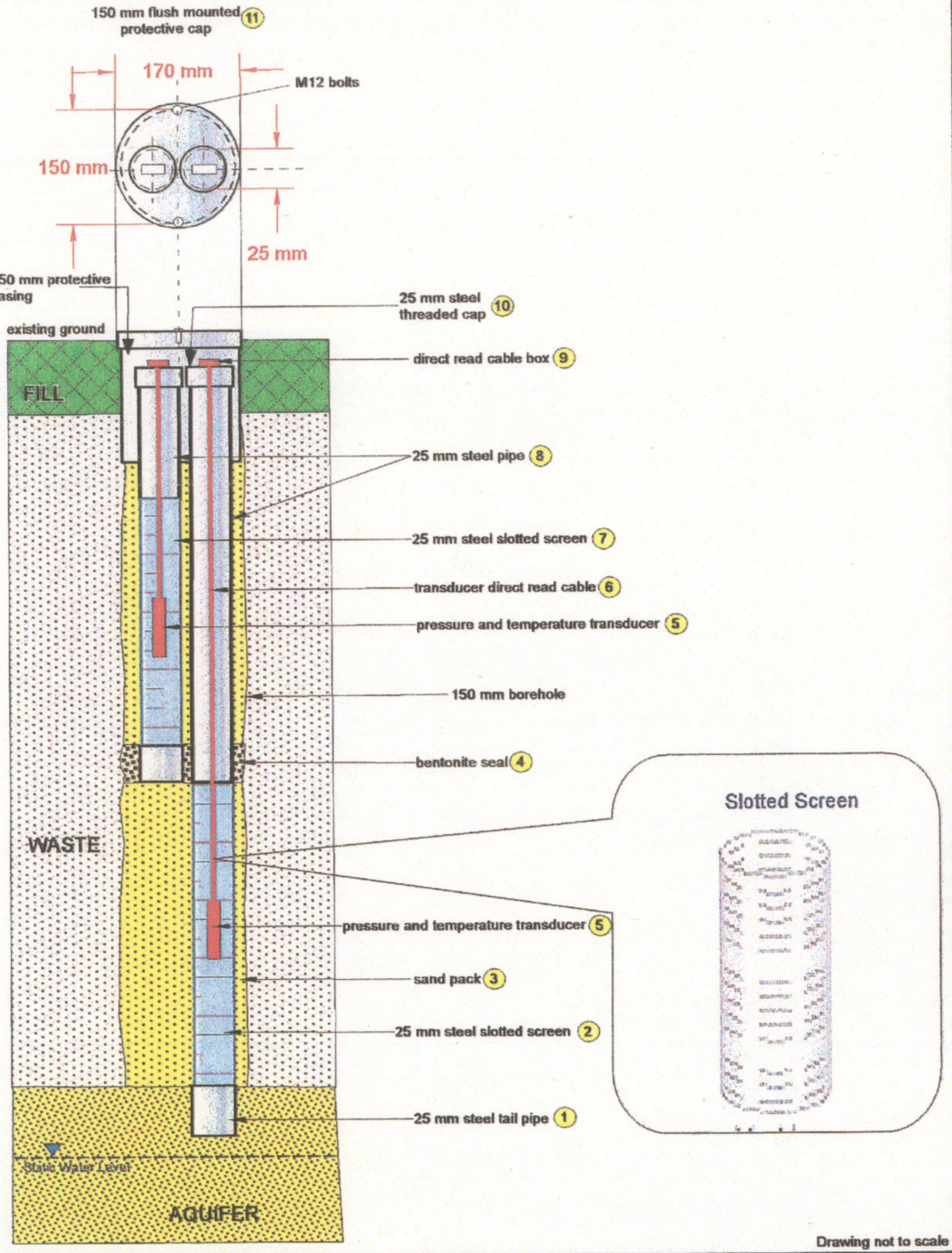
Settler's Park - MARKHAM

Figure A-1

TABLE A-1

AIR INJECTION WELL NEST
DESIGN DETAILS
(refer to Figure A-1)

No.	Description
1.	50mm flush NPT thread steel pipe, closed at the bottom
2.	Pressure and temperature transducer (Solinst or similar datalogger)
3.	50mm flush NPT thread stainless steel, continuous wire-wound screen, 10 slot (slot size chosen after grain size analysis were performed)
4.	Industrial sand no.1 grain size
5.	25mm flush NPT thread slotted steel monitoring pipe
6.	3/8 hole plug hydrated after set in place
7.	Transducer (datalogger) direct read cable
8..	50mm flush NPT thread steel plain pipe
9.	25mm OD steel pipe, 90°welded on 50mm pipe
10.	Stainless steel gear clamp
11.	25mm polyethylene pipe, series 100/SDR
12.	50mm steel NPT thread well cap with pressure gauge (0-40 PSI pressure range)
13.	150mm steel protective casing, sealed in place
14.	150mm galvanized water tight cap
15.	100mm galvanized water tight cap
16.	100mm steel protective casing, sealed in place
17.	25mm gate valve, flange mounted
18.	50 to 150mm polyethylene air supply pipe, series 100/SDR 17.0



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Monitoring Well Nest
Aerobic Landfill Project

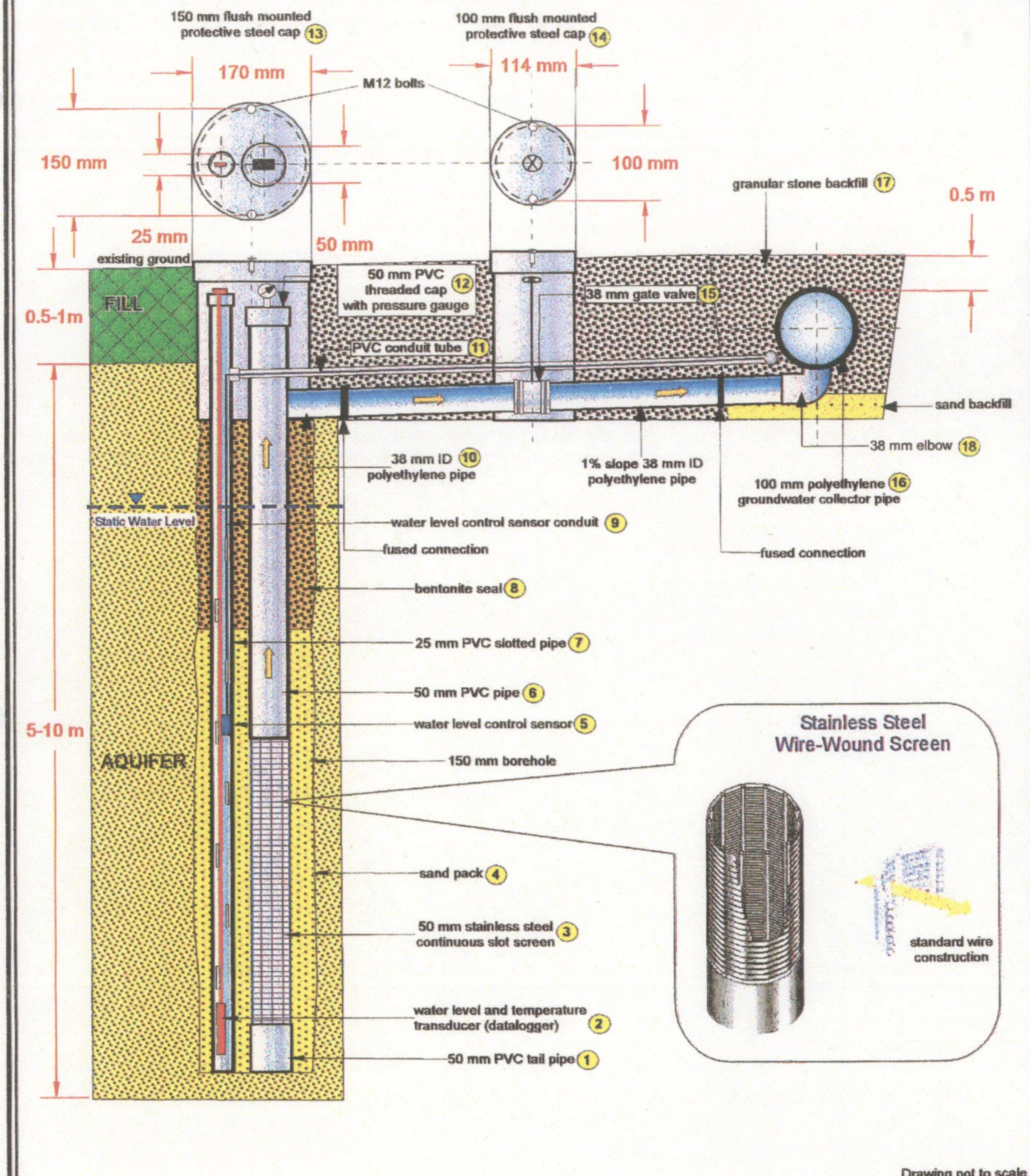
Settler's Park - MARKHAM

Figure A-2

TABLE A-2

MONITORING WELL NEST
Design Details
(refer to Figure A-2)

No.	Description
1.	25mm flush NPT thread steel pipe, closed at the bottom
2.	25mm flush NPT thread slotted steel, screen
3.	Industrial sand no.1 grain size
4.	3/8 hole plug hydrated after set in place
5.	"Solinst" or similar pressure and temperature transducer
6.	transducers direct read cable
7.	25mm flush NPT thread slotted steel screen
8.	25mm flush NPT thread steel plain pipe
9.	PS direct read cable connection box
10.	25mm steel NPT thread well cap
11.	150mm galvanized water tight cap
12.	150 mm steel protective casing, sealed in place



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Leachate Collection Well
Leachate Recirculation Project

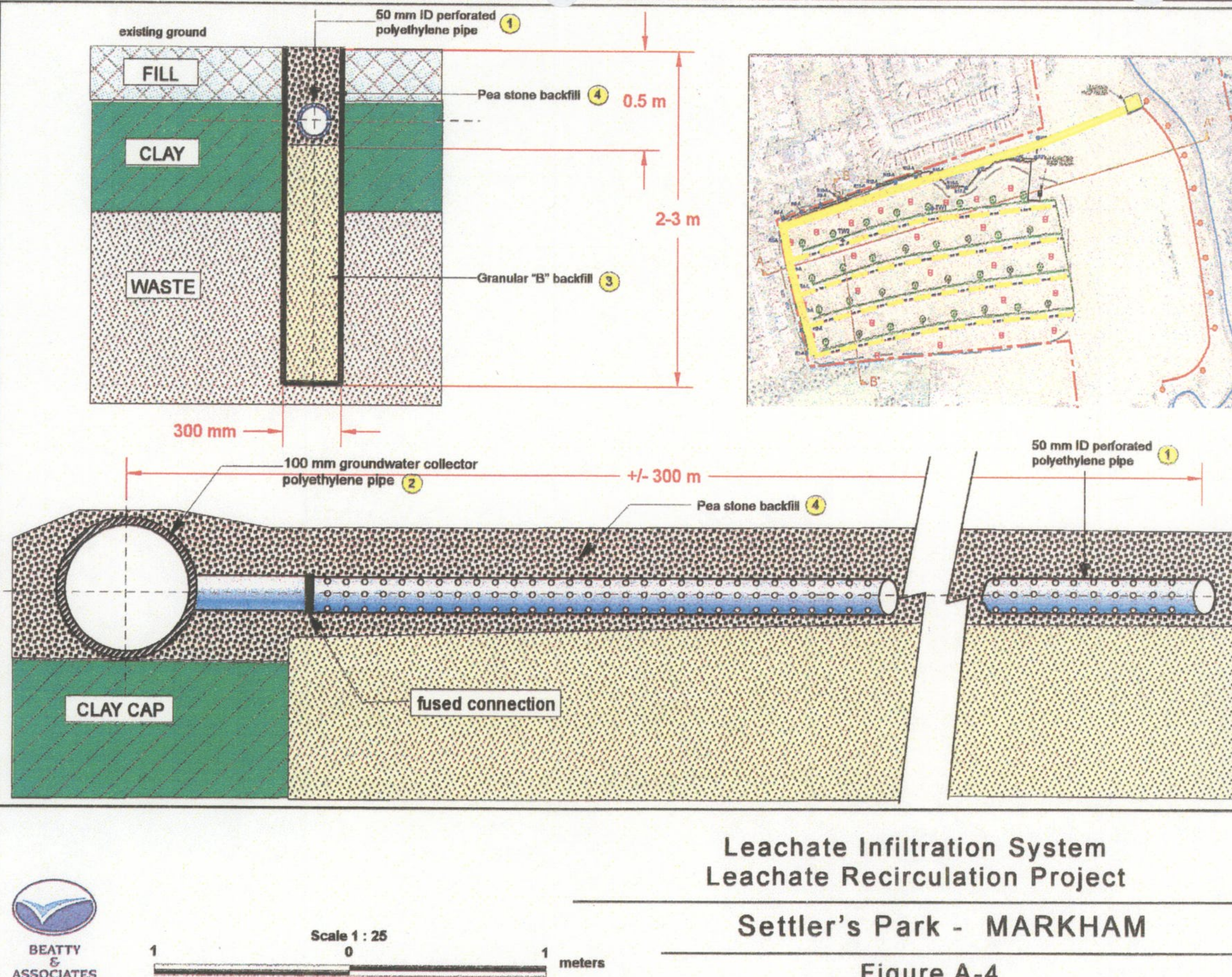
Settler's Park - MARKHAM

Figure A-3

TABLE A-3

LEACHATE COLLECTION WELL DESIGN DETAILS (refer to Figure A-3)

No.	Description
1.	50mm flush threaded PVC tail pipe, closed at the bottom
2.	Solinst or similar water level and temperature transducer
3.	50mm flush NPT thread stainless steel, wire-wound screen, standard wire construction (slot size determined from grain size analysis)
4.	Industrial sand no1 grain size
5.	Automatic water level sensor
6.	50mm flush threaded PVC plain pipe
7.	25mm ID PVC slotted pipe
8.	3/8 hole plug
9.	electrical conduit for water level control sensor
10.	38mm polyethylene pipe, fused in place
11.	12mm PVC conduit tube
12.	50mm PVC threaded well cap with pressure gauge attached (0- 40 PSI pressure range)
13.	150mm galvanized water tight cap
14.	100mm galvanized water tight cap
15.	38mm gate valve, flange mounted
16.	100mm polyethylene groundwater collector pipe
17.	granular stone backfill
18.	90° long radius 38mm polyethylene elbow



BEATTY & ASSOCIATES

Leachate Infiltration System
Leachate Recirculation Project

Settler's Park - MARKHAM

Figure A-4

TABLE A-4

Leachate Infiltration System Design Details (refer to Figure A-4)

No.	Description
1.	50mm ID perforated polyethylene pipe series 100SDR/ 7.5
2.	100mm ID plain polyethylene pipe series 100SDR/ 7.5
3.	Granular stone type B backfill
4.	Pea stones backfill

APPENDIX B

Groundwater and German Mills Creek Monitoring

Table 1

Settlers Park, Markham

Aerobic Landfill and Leachate Recirculation System

Groundwater Quality

Parameter	Unit	ODWS [1]	OW 2-18		OW 3-18		OW 5-6		OW 6-6		
			22-Sep-03	6-Aug-04	22-Sep-03	6-Aug-04	22-Sep-03	6-Aug-04	22-Sep-03	6-Aug-04	17-Jun-05
Metals											
Silver (Ag)	mg/L	NA	<0.0001	<0.0006	<0.0001	<0.0006	<0.0001	<0.0006	<0.0001	<0.0006	0.0018
Aluminum (Al)	mg/L	0.1	0.009	0.055	<0.005	0.029	<0.005	0.012	<0.005	0.069	2.81
Arsenic (As)	mg/L	0.25	0.097	0.012	0.004	0.0087	<0.002	0.0049	0.002	0.0039	0.024
Boron (B)	mg/L	5	0.211	0.76	0.201	0.31	0.072	0.1	0.263	0.33	0.28
Barium (Ba)	mg/L	1	0.355	0.84	0.331	0.39	0.081	0.1	0.227	0.41	0.644
Beryllium (Be)	mg/L	NA	<0.001	<0.0014	<0.001	<0.0014	<0.001	<0.0014	<0.001	<0.0014	0.0008
Bismuth (Bi)	mg/L	NA	<0.001	<0.0022	<0.001	<0.0022	<0.001	<0.0022	<0.001	<0.0022	<0.001
Calcium (Ca)	mg/L	NA	123	170	456	490	102	110	154	180	965
Cadmium (Cd)	mg/L	0.005	<0.0001	<0.001	<0.0001	<0.001	<0.0001	<0.001	<0.0001	<0.001	0.0009
Cobalt (Co)	mg/L	NA	0.0004	0.001	0.0015	<0.001	0.0005	<0.001	0.0011	<0.001	0.0155
Chromium (Cr)	mg/L	0.05	<0.05	0.0025	<0.005	<0.0016	<0.005	<0.0016	<0.005	<0.0016	0.013
Copper (Cu)	mg/L	1	<0.0005	<0.003	<0.0005	<0.003	0.0006	<0.003	<0.0005	<0.003	0.027
Iron (Fe)	mg/L	0.3	0.74	7.1	3.93	29	<0.03	17	8.57	39	50.4
Potassium (K)	mg/L	NA	11.3	31	6.6	5.4	3.3	4	8.9	10	10.8
Magnesium (Mg)	mg/L	NA	47.4	95	106	120	17.0	19	32.5	36	77.9
Manganese (Mn)	mg/L	0.05	0.313	0.29	4.84	4.9	0.251	0.3	0.419	0.46	2.02
Molybdenum (Mo)	mg/L	NA	0.061	0.03	0.016	0.0061	0.003	0.0022	0.014	0.0045	0.002
Sodium (Na)	mg/L	200	1210	4000	150	250	50.2	68	282	300	320
Nickel (Ni)	mg/L	NA	0.003	0.005	0.003	<0.001	0.001	<0.001	0.003	<0.001	0.023
Phosphorus (P)	mg/L	NA	<0.05	0.07	<0.05	0.07	<0.05	0.43	<0.05	0.67	2.0
Lead (Pb)	mg/L	0.01	0.001	0.0038	<0.0005	<0.0022	<0.0005	<0.0022	<0.0005	<0.0022	0.0596
Antimony (Sb)	mg/L	NA	0.0742	0.14	0.0015	0.002	<0.0005	<0.001	0.0006	<0.001	<0.001
Selenium (Se)	mg/L	0.01	<0.002	<0.0016	<0.002	<0.0016	<0.002	<0.0016	<0.002	<0.0016	<0.002
Silicon (Si)	mg/L	NA	12.7	11	8.73	11	5.34	6.3	8.63	10	16.7
Tin (Sn)	mg/L	NA	0.003	0.0076	<0.001	<0.0008	<0.001	<0.0008	<0.001	0.013	<0.001
Strontium (Sr)	mg/L	NA	0.719	1.5	1.77	2	0.351	0.41	0.905	1.0	2.33
Titanium (Ti)	mg/L	NA	<0.005	0.015	<0.005	0.002	<0.005	<0.002	<0.005	0.003	0.021
Vanadium (V)	mg/L	NA	<0.005	<0.001	<0.005	<0.001	<0.0005	<0.001	<0.0005	0.002	0.026
Zinc (Zn)	mg/L	5	<0.005	0.095	<0.005	0.009	<0.005	0.15	<0.005	0.25	0.124
Ions											
Fluoride (F^-)	mg/L	1.5	-	<0.1	-	<0.1	0.2	0.2	0.8	0.7	0.3
Chloride (Cl^-)	mg/L	250	2020	6290	898	1060	71.2	104	468	527	344
Bromide (Br^-)	mg/L	NA	-	<0.35	-	<0.35	<0.5	0.76	<0.5	<0.35	<0.35
Sulphate (SO_4^{-2})	mg/L	500	14.8	5.5	221	234	9.0	<0.5	4.2	4.1	24.1
Carbonate (CO_3)	mg/L	NA	1		1		1		1		<1
Bicarbonate (HCO_3^-)	mg/L	NA	836		576		427		721		766
Hardness	mg CaCO3/L	80-100	504.7		1575		325.1		520.1		257
Alkalinity	mg CaCO3/L	NA	688	<1	474	559	352	727	593	639	628
Nutrients											
Nitrite (NO_2^-) -N	mg/L	1	<1	<0.1	<1	<0.1	0.2	<0.1	<0.2	<0.1	<0.1
Nitrate (NO_3^-) -N	mg/L	10	<0.2	<0.1	<0.2	<0.1	<0.2	0.4	<0.2	<0.1	<0.1
Ammonia (NH_3) -N	mg/L	NA	8.8	41.5	0.63	1.02	0.94	1.02	8.00	8.8	7.21
Phosphate (PO_4^{-3})	mg/L	NA	<1	<0.3	<1	<0.3	<1	<0.3	<1	<0.3	<0.3
General Chemistry											
pH	pH units	6.5-8.5	7.83	7.9	7.23	7.37	7.78	7.77	7.50	7.49	7.53
Dissolved Organic Carbon (DOC)	mg/L	5	57.7	35.8	24.8	13.9	4.5	2.9	7.4	6.2	11.2
Colour	TCU	5	242	30	32	<5	11	<5	38	<5	17.0
Specific Conductivity	umhos/cm	NA	6669	17100	3129	4440	826	1620	2178	2570	2150
Turbidity	NTU	1	30	130000	49	21000	-	1930	-	3730	822
Total Dissolved Solids (TDS)	mg/L	500	3852	7600	2123	3120	464	639	1307	1340	1190
Biological Oxygen Demand (BOD_5)	mg/L	NA	130	-	6.6	8	15.4	20	24.0	22	-
Chemical Oxygen Demand (COD)	mg/L	NA	170	373	80	484	20	18	70	54	83
Total Organic Carbon (TOC)	mg/L	NA	59.2	70.6	25.6	14.7	6.7	3.8	15.5	7.7	11.6

Notes:

[1] ODWS = Ontario Drinking Water Standards, MOE, January 2001

[2] PWQO = Provincial Water Quality Objectives, MOEE, February 1999, Appendix A, Table 2 Table of PWQO's and Interim PWQO's,

[2-1] Interim PWQO's are set for emergency purposes based on the best information readily available

[2-2] PWQO for Beryllium listed is based on sample Hardness being >75mg/L

[2-3] PWQO for Cadmium listed is based on sample Hardness being >100mg/L

[2-4] Interim PWQO for Lead listed is based on sample Hardness being > 80mg/L

[2-5] Alkalinity should not be decreased by more than 25% of the natural concentration

[2-6] Suspended matter should not be added to surface water in concentrations that will change the natural Secchi disc reading by more than

NA = Parameter is not listed in the applicable guideline

Table 2

Settlers Park, Markham

Aerobic Landfill and Leachate Recirculation System

German Mills Creek - Water Quality

Parameter	Units	PWQO [2]	SS1 25-Sep-02	SS1 18-Sep-03	SS1 6-Aug-04	SS2 25-Sep-02	SS2 18-Sep-03	SS2 6-Aug-04	SS3 18-Sep-03	SS3 6-Aug-04
Metals										
Silver (Ag)	mg/L	0.0001	<0.0001	<0.0001	<0.0006	<0.0001	<0.0001	<0.0006	<0.0001	<0.0006
Aluminium (Al)	mg/L	0.075 [2-1]	0.116	0.069	0.15	0.109	0.086	0.11	0.062	0.15
Arsenic (As)	mg/L	0.005 [2-1]	<0.002	<0.002	<0.0014	<0.002	<0.002	<0.0014	<0.002	<0.0014
Boron (B)	mg/L	0.2 [2-1]	0.061	0.038	0.038	0.047	0.037	0.037	0.037	0.035
Barium (Ba)	mg/L	NA	0.062	0.068	0.051	0.063	0.066	0.055	0.068	0.052
Berylium (Be)	mg/L	1.1 [2-2]	<0.001	<0.001	<0.0014	<0.001	<0.001	<0.0014	<0.001	<0.0014
Bismuth (Bi)	mg/L	NA	<0.001	<0.001	<0.0022	<0.001	<0.001	<0.0022	<0.001	<0.0022
Calcium (Ca)	mg/L	NA	92.7	98.3	73	95.5	93.1	81	93.8	74
Cadmium (Cd)	mg/L	0.0005 [2-3]	<0.0001	<0.0001	<0.001	<0.0001	<0.0001	<0.001	<0.0001	<0.001
Cobalt (Co)	mg/L	0.0009	0.0002	<0.0001	<0.001	0.0002	0.0001	<0.001	<0.0001	<0.001
Chromium (Cr)	mg/L	0.001	<0.005	<0.005	<0.0016	<0.005	<0.005	<0.0016	<0.005	<0.0016
Copper (Cu)	mg/L	0.005	0.0028	0.0033	0.004	0.0027	0.0049	0.004	0.0034	0.004
Iron (Fe)	mg/L	0.3	0.21	0.17	0.42	0.4	0.45	0.55	0.32	0.45
Potassium (K)	mg/L	NA	3.5	3.0	2.4	3.3	2.9	2.4	2.9	2.3
Magnesium (Mg)	mg/L	NA	16.4	16.8	13	16.9	16.3	14	16.3	13
Manganese (Mn)	mg/L	NA	0.019	0.018	0.018	0.033	0.033	0.029	0.030	0.025
Molybdenum (Mo)	mg/L	0.04	0.001	0.001	<0.0014	0.001	0.001	<0.0014	0.001	<0.0014
Sodium (Na)	mg/L	NA	49.5	65.0	66	48.5	59.6	65	62.9	65
Nickel (Ni)	mg/L	0.025	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001
Phosphorus (P)	mg/L	0.01-0.03 [2-1]	<0.05	0.08	0.11	0.06	0.10	0.13	0.06	<0.04
Lead (Pb)	mg/L	0.005 [2-4]	<0.0005	<0.0005	<0.0022	<0.0005	<0.0005	<0.0022	<0.0005	<0.0022
Antimony (Sb)	mg/L	0.02 [2-1]	0.0005	<0.0005	<0.001	<0.0005	<0.0005	<0.001	<0.0005	<0.001
Selenium (Se)	mg/L	0.1	<0.002	<0.002	<0.0016	<0.002	<0.002	<0.0016	<0.002	<0.0016
Silicon (Si)	mg/L	NA	4.24	4.25	2.7	4.8	4.19	3.1	4.14	2.9
Tin (Sn)	mg/L	NA	<0.001	<0.001	<0.0008	<0.001	<0.001	<0.0008	<0.001	<0.0008
Strontium (Sr)	mg/L	NA	0.305	0.322	0.29	0.307	0.311	0.3	0.326	0.28
Titanium (Ti)	mg/L	NA	<0.005	<0.005	0.006	<0.005	<0.005	0.005	<0.005	0.005
Vanadium (V)	mg/L	0.006 [2-1]	0.0007	0.0010	<0.001	0.0006	0.0009	<0.001	0.0008	<0.001
Zinc (Zn)	mg/L	0.02 [2-1]	0.011	0.015	0.029	0.013	0.007	0.039	0.010	0.039
Ions										
Fluoride (F^-)	mg/L	NA	0.2	0.2	0.4	0.2	0.2	0.3	0.2	0.3
Chloride (Cl^-)	mg/L	NA	105	127	126	101	121	126	129	126
Bromide (Br^-)	mg/L	NA	<0.5	<0.5	<0.35	<0.5	<0.5	<0.35	<0.5	<0.35
Sulphate (SO_4)	mg/L	NA	66.2	58.8	43.8	62.1	58.0	43.3	60.0	42.3
Carbonate (CO_3^{-2})	mg/L	NA	1	1		1	1		1	
Bicarbonate (HCO_3^-)	mg/L	NA	258	254		267	262		262	
Hardness	mg $CaCO_3$/L	NA	299.2	314.7		308.2	299.9		301.4	
Cation Sum	eq/L	NA	-	9.19		-	8.66		8.84	
Anion Sum	eq/L	NA	-	9.00		-	8.96		9.23	
Alkalinity	mg $CaCO_3$/L	2-5	213	210	165	221	217	191	217	176
Nutrients										
Nitrite (NO_2^-)	mg/L	NA	<0.2	<0.2	<0.1	<0.2	<0.2	<0.1	<0.2	<0.1
Nitrate (NO_3^-)	mg/L	NA	0.7	0.4	0.6	0.6	0.4	0.5	0.5	0.5
Ammonia (NH_3)	mg/L	NA	0.03	<0.03	<0.05	0.07	<0.03	<0.05	<0.03	<0.05
Ammonia (NH_3) (un-ionized)	mg/L	0.02 (un-ionized)	0.001 [2-7]	<0.001 [2-7]	<0.001 [2-7]	0.003 [2-7]	<0.001 [2-7]	<0.001 [2-7]	<0.001 [2-7]	<0.001 [2-7]
Phosphate (PO_4)	mg/L	NA	<1	<1	<0.3	<1	<1	<0.3	<1	<0.3
General Chemistry										
pH	pH units	6.5-8.5	8.32	8.44	8.21	8.23	8.37	8.22	8.19	8.23
Dissolved Organic Carbon (DOC)	mg/L	NA	3.3	3.9	3.1	2.7	3.9	2.9	3.6	2.9
Colour	TCU	NA	-	32	<5	-	34	<5	42	<5
Specific Conductivity	umhos/cm	NA	820	866	833	814	850	874	878	846
Turbidity	NTU	2-6	-	3.8	6.3	-	4.1	5.9	5.9	10.9
Total Dissolved Solids (TDS)	mg/L	NA	462	495	472	460	481	499	495	500
Biological Oxygen Demand (BOD_5)	mg/L	NA	-	<0.5	<4	-	0.8	<4	0.6	<4
Chemical Oxygen Demand (COD)	mg/L	NA	-	16	12.0	-	15	8	14	11
Total Organic Carbon (TOC)	mg/L	NA	-	4.7	4.1	-	4.8	3.1	4.8	3.9

Notes:

[2] PWQO = Provincial Water Quality Objectives, MOEE, February 1999, Appendix A, Table 2 Table of PWQO's and Interim PWQO's,

[2-1] Interim PWQO's are set for emergency purposes based on the best information readily available

[2-2] PWQO for Beryllium listed is based on sample Hardness being >75mg/L

[2-3] PWQO for Cadmium listed is based on sample Hardness being >100mg/L

[2-4] Interim PWQO for Lead listed is based on sample Hardness being > 80mg/L

[2-5] Alkalinity should not be decreased by more than 25% of the natural concentration

[2-6] Suspended matter should not be added to surface water in concentrations that will change the natural Secchi disc reading by more than 10%

[2-7] Un-ionized Ammonia calculated by multiplying reported value of Ammonia by the factor, determined by water temperature and pH, in table "Percent NH_3 in aqueous ammonia solutions for 0-30°C and pH 6-10", Provincial Water Quality Objectives, MOEE, February 1999, Appendix A, pg. 10. Stream Temperature on September 25, 2002 was 20°C, pH values are reported on page 2 of this table.

NA = Parameter is not listed in the applicable guideline

Table 3

Settlers Park, Markham

Aerobic Landfill and Leachate Recirculation System

Stream Bed Groundwater Quality

Parameter	Unit	ODWS [1]	PWQO [2]	P2 17-Jun-05	P3 17-Jun-05
Metals					
Dissolved Silver (Ag)	mg/L	NA	0.0001	<0.0005	<0.0005
Dissolved Aluminum (Al)	mg/L	0.1	0.075 [2-1]	3.8	2.45
Dissolved Arsenic (As)	mg/L	0.25	0.005 [2-1]	0.003	0.006
Dissolved Boron (B)	mg/L	5	0.2 [2-1]	0.15	0.06
Dissolved Barium (Ba)	mg/L	1	NA	0.213	0.248
Dissolved Beryllium (Be)	mg/L	NA	1.1 [2-2]	<0.0005	<0.0005
Dissolved Bismuth (Bi)	mg/L	NA	NA	<0.001	<0.001
Dissolved Calcium (Ca)	mg/L	NA	NA	188	177
Dissolved Cadmium (Cd)	mg/L	0.005	0.0005 [2-3]	0.0004	0.0006
Dissolved Cobalt (Co)	mg/L	NA	0.0009	0.0054	0.0039
Dissolved Chromium (Cr)	mg/L	0.05	0.001	<0.005	0.006
Dissolved Copper (Cu)	mg/L	1	0.005	0.023	0.007
Dissolved Iron (Fe)	mg/L	0.3	0.3	18.1	11.7
Dissolved Potassium (K)	mg/L	NA	NA	7	2.2
Dissolved Magnesium (Mg)	mg/L	NA	NA	31.1	23.5
Dissolved Manganese (Mn)	mg/L	0.05	NA	0.494	0.313
Dissolved Molybdenum (Mo)	mg/L	NA	0.04	0.001	<0.001
Dissolved Sodium (Na)	mg/L	200	NA	100	27.1
Dissolved Nickel (Ni)	mg/L	NA	0.025	0.009	0.009
Dissolved Phosphorus (P)	mg/L	NA	0.01-0.03 [2-1]	0.7	0.7
Dissolved Lead (Pb)	mg/L	0.01	0.005 [2-4]	0.0143	0.0246
Dissolved Antimony (Sb)	mg/L	NA	0.02 [2-1]	<0.001	<0.001
Dissolved Selenium (Se)	mg/L	0.01	0.1	<0.002	<0.002
Dissolved Silicon (Si)	mg/L	NA	NA	12.1	11.2
Dissolved Tin (Sn)	mg/L	NA	NA	<0.001	<0.001
Dissolved Strontium (Sr)	mg/L	NA	NA	0.518	0.441
Dissolved Titanium (Ti)	mg/L	NA	NA	0.029	0.042
Dissolved Vanadium (V)	mg/L	NA	0.006 [2-1]	0.017	0.011
Dissolved Zinc (Zn)	mg/L	5	0.02 [2-1]	0.068	0.305
Ions					
Fluoride (F-)	mg/L	1.5	NA	0.2	<0.1
Chloride (Cl)	mg/L	250	NA	131	39.8
Bromide (Br-)	mg/L	NA	NA	0.39	<0.35
Sulphate (SO4)	mg/L	500	NA	16.9	1.5
Carbonate (CO3)	mg/L	NA	NA	<1	<1
Anion Sum	me/L			12.6	7.52
Cation Sum	me/L			15.2	12
Bicarbonate (HCO3)	mg/L	NA	NA	523	388
Hardness (CaCO3)	mg/L	80-100	NA	522	512
Total Alkalinity (Total as CaCO3)	mg/L	NA	[2-5]	428	318
Nutrients					
Nitrite (N)	mg/L	1	NA	<0.1	<0.1
Nitrate (N)	mg/L	10	NA	<0.1	<0.1
Total Ammonia-N	mg/L	NA	0.02 (un-ionized)	1.44	0.65
Total Unionized Ammonia	mg/L			0.1	0.06
Phosphate-P	mg/L	NA	NA	<0.3	<0.3
General Chemistry					
pH	pH	6.5-8.5	6.5-8.5	8.06	8.16
Dissolved Organic Carbon	mg/L	5	NA	8.8	3.6
Colour	TCU	5	NA	15	9
Conductivity	umho/cm	NA	NA	1190	682
Turbidity	NTU	1	[2-6]	2150	131
Total Dissolved Solids	mg/L	500	NA	573	334
Biological Oxygen Demand (BOD5)	mg/L	NA	NA	-	-
Total Chemical Oxygen Demand (COD)	mg/L	NA	NA	100	98
Total Organic Carbon (TOC)	mg/L	NA	NA	20.6	7.8

Notes:

[1] ODWS = Ontario Drinking Water Standards, MOE, January 2001

[2] PWQO = Provincial Water Quality Objectives, MOEE, February 1999, Appendix A, Table 2 Table of PWQO's and Interim PWQO's.

[2-1] Interim PWQO's are set for emergency purposes based on the best information readily available

[2-2] PWQO for Beryllium listed is based on sample Hardness being >75mg/L

[2-3] PWQO for Cadmium listed is based on sample Hardness being >100mg/L

[2-4] Interim PWQO for Lead listed is based on sample Hardness being > 80mg/L

[2-5] Alkalinity should not be decreased by more than 25% of the natural concentration

[2-6] Suspended matter should not be added to surface water in concentrations that will change the natural Secchi disc reading by more than

NA = Parameter is not listed in the applicable guideline

Table 4

Settler's Park, Markham

Aerobic Landfill and Leachate Recirculation System

Groundwater Levels

Well No. *	Ground Elevation (masl) **	Measuring Point Elevation (masl) **	Depth of Well (masl) **	Water Levels (masl)						
				21-Jul-03	30-Jul-03	7-Aug-03	18-Sep-03	21-Jan-04	6-Aug-04	17-Jun-05
OW 1-16	181.5	182.12	165.4	-	-	<165.4	<165.4	<165.4	<165.4	-
OW 2-18	171.2	171.92	153.26	157.71	153.99	153.99	153.90	154.13	154.02	-
OW 3-18	170.5	171.23	152.47	152.82	153.26	153.54	153.77	153.80	153.83	-
OW 4-6	157.6	158.24	151.95	-	153.67	153.72	153.66	153.74	153.76	-
OW 5-6	157.3	157.92	151.59	-	153.49	153.51	153.49	153.54	153.57	-
OW 6-6	156.8	157.38	150.84	-	153.21	153.22	153.22	153.23	153.26	153.33

Note:

Elevations are estimated from topographic map

* Second number is the well depth in metres

** masl = meters above sea level

Elevations are assumed from topographic map

Table 5

Settler's Park, Markham

Aerobic Landfill and Leachate Recirculation System

Germain Mills Creek

Streamflow Measurements

Location	Streamflow (L/s)	
	25-Sep-02	6-Aug-04
SS1	240	250
SS2	250	255
SS3	-	265