Clean Harbors Canada, Inc.
Lambton Facility
4090 Telfer Road, R.R. #1
Corunna, Ontario
N0N 1G0

2007 Annual Landfill Report

Executive Summary

1.0 INTRODUCTION

1.1 Background and Scope

Clean Harbors Canada, Inc. operates a hazardous waste management complex on a 121.4-hectare parcel of land in St. Clair Township, Lambton County, called the Lambton Facility. The location of the Lambton Facility and major site features are shown in **Figure 1** and **Figure 2**, respectively. The Lambton Facility encompasses an analytical laboratory, a transportation depot, a high temperature incinerator, associated pretreatment processes, as well as a secure landfill.

The landfill is operated in accordance with Provisional Certificate of Approval No. **A031806** dated September 5, 1997.

A copy of the provisional certificate is provided in **Appendix A**.

1.2 Site Inspection, Monitoring and Reporting Requirements

Condition 15 of the Provisional Certificate of Approval requires that the following information for the landfill and landfill pretreatment system be provided on, or before November 30 of each year.

a) The results of the interpretive analysis of all monitoring programs, as defined in conditions 9 and 10 (specifically, monitoring programs for groundwater, cap integrity, surface water, air quality and bio-monitoring);

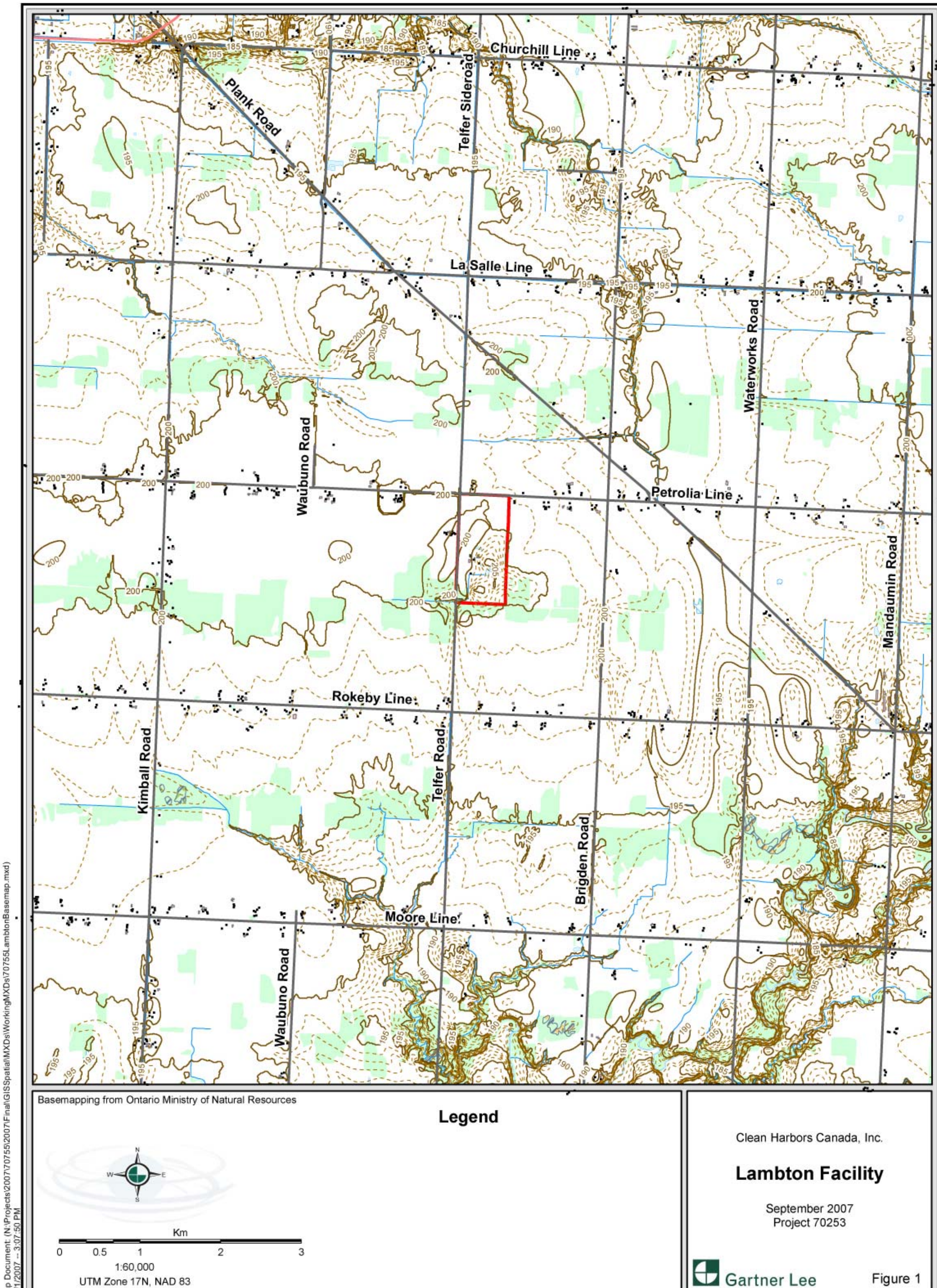
b) A summary of waste received for landfill and pretreatment at the site, including the quantities, types and origin;

c) A list of all rejected waste shipments, together with the reasons for rejection;

d) A report on the progress of landfill activities, including total capacity used and the remaining site life, berm development, extent and location of any gravel or sand lenses excavated and the location of any old wells discovered and plugged; and

e) A summary and discussion of past analytical data, based on previous annual reports and showing trends in data and potential future concerns.

This annual report, which covers the period from **September 1, 2006 to August 31, 2007**, presents the requested information.


Churchill Line
Plank Road
Telfer Sideroad
La Salle Line
Waterworks Road
Waubuno Road
Petrolia Line
Mandaumin Road
Rokeby Line
Kimball Road
Telfer Road
Brigden Road
Moore Line
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UTM Zone 17N, NAD 83
Clean Harbors Canada, Inc.
Lambton Facility
September 2007
Project 70253
Gartner Lee
Figure 1
Map Document: (N:\Projects\2007\70755\2007\Final\GISSpatial\MXDs\WorkingMXDs\70755LambtonBasemap.mxd)
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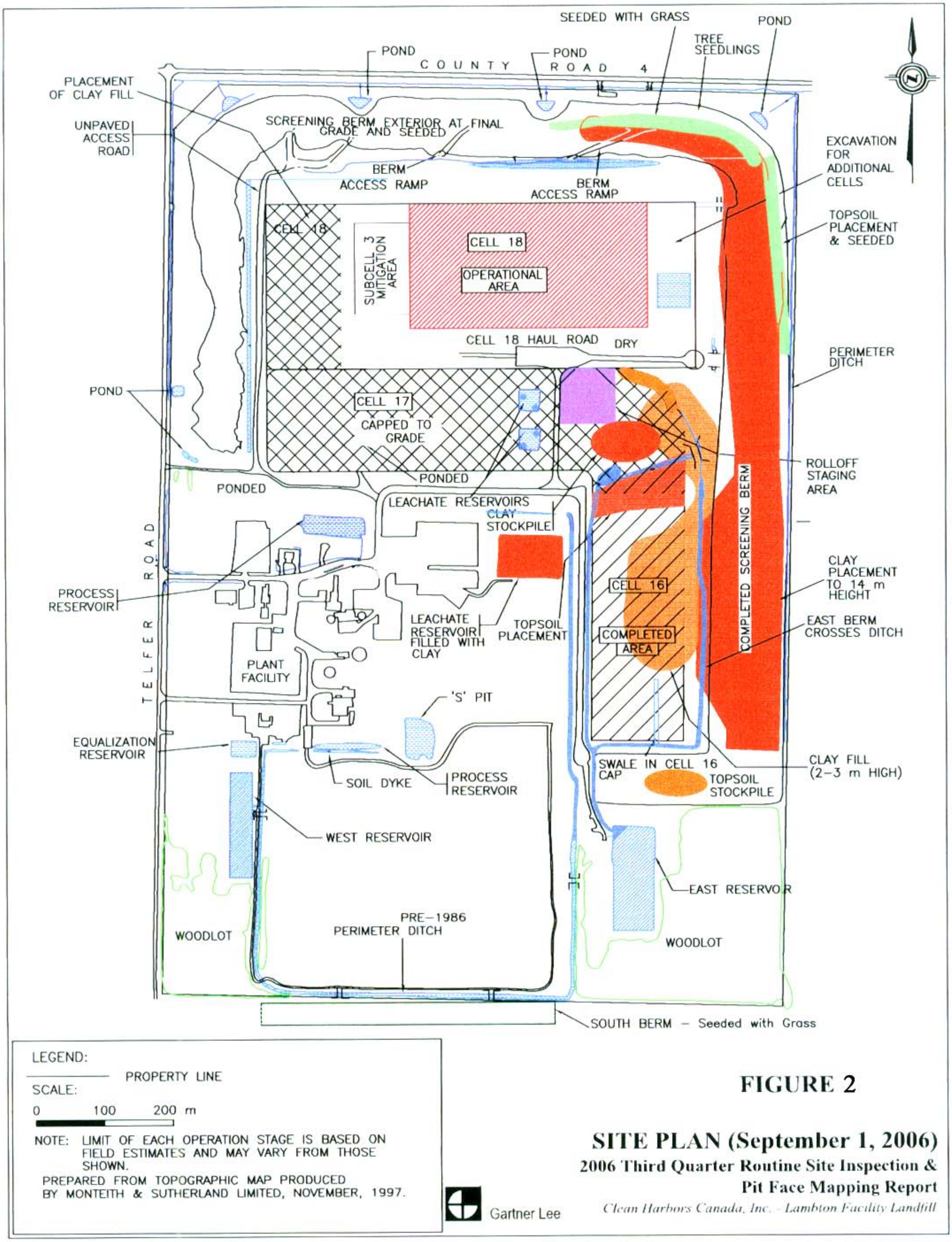


FIGURE 2

SITE PLAN (September 1, 2006)

2006 Third Quarter Routine Site Inspection & Pit Face Mapping Report

Clean Harbors Canada, Inc. – Lambton Facility Landfill

1.3 Report Organization

This report is subdivided into two parts:

- The Executive Summary outlines the various site monitoring activities, as set out in the Provisional Certificate of Approval (C of A)
- The Appendices contain supporting information reports and technical data submitted by consultants responsible for the various environmental monitoring programs conducted at the Lambton Facility.

Following is a brief description of the contents:

EXECUTIVE SUMMARY	
Section 1: Introduction	Provides background of on-site operations and monitoring activities
Section 2: Monitoring Facility Operations	Overview of site operations and description of the waste received
Section 3: Site Inspection Activities	Summary of site inspection reports, landfill cap compaction, geotechnical inspection and monitoring, and Sub-cell 3 mitigation works
Section 4: Environmental Monitoring	Summary of groundwater, surface water, air quality and biological monitoring activities
Section 5: Recommendations	Summary of recommendations contained within each of the technical reports
APPENDICES	
Appendix A: Provisional Certificates of Approval	Provisional Certificate of Approval No. A031806, September 4, 1997, as amended November 16, 1998
Appendix B: 2006 Annual Landfill Report Correspondence	Ontario Ministry of the Environment review comments concerning Clean Harbors 2006 Annual Landfill Report and the company's response
Appendix C: Waste Material Codes & Descriptions	Description of material codes applied by Clean Harbors Canada, Inc. to characterize waste streams
Appendix D: Waste Load Rejection Summary	List of rejected waste loads and basis for rejection
Appendix E: Summary of Quarterly Site Inspection Reports	Summary of quarterly site inspection results undertaken by Gartner Lee Limited
Appendix F: Landfill Construction Activities Summary Report	Summary of landfill construction activities carried out in Cell 18 and the results of laboratory analyses of the clay material used for cap construction. Provided by Inspec-Sol Inc.
Appendix G: Geotechnical Borehole Decommissioning Report	Summary of inclinometer decommissioning activities conducted by Inspec-Sol Inc.
Appendix H: Sub-Cell 3 Mitigation Structure Report	Summary description of design and construction activities carried out to mitigate seeps in sub-cell 3. Prepared by Inspec-Sol Inc.

Appendix I: Groundwater Monitoring Report	Technical reports detailing geology/hydrogeology, the groundwater monitoring network, the monitoring well sampling protocols, chemical analysis results, sub-cell 3 mitigation performance monitoring results, and the landfill cap integrity assessment associated with the landfill's performance. Prepared by Gartner Lee Limited
Appendix J: Surface Water Quality Data	Chemistry data, POLLUTECH Enviroquatics Ltd. toxicity test results for treated surface water discharge and the benthic study of the equalization pond prepared by Gartner Lee Limited
Appendix K: Air Quality Monitoring Report	Technical report prepared by ORTECH Canada Ltd.
Appendix L: Bio-Monitoring Report	Technical report prepared by Cordner Science Ltd..

1.4 Ministry of the Environment Review of 2006 Annual Landfill Report

It has been the historic practice for the Ministry of the Environment (MOE) to provide comments on the facility's annual landfill reports. The comments typically relate to requests for clarification and, on occasion, reflect a difference in opinion on data interpretation. With respect to issues pertaining to environmental monitoring, Clean Harbors Canada, Inc. confers closely with its independent consultants in reviewing the Ministry comments and providing a written response. The responses can take the form of modifications to reporting procedures, in order to ensure the clarity of future documentation, and direct correspondence, providing further detailed explanations to the MOE. If received, the Ministry's comments about the 2006 Annual Landfill Report are contained in **Appendix B**.

2. FACILITY OPERATIONS

2.1 General

The secure landfill occupies a total fill area of approximately 56 hectares including the pre-1985 fill area, Cell 16, completed in 1992, and Cell 17 completed in early 1998. The two cells encompass an area of 14.3 hectares. Current fill operations involve Cell 18, which is 13.1 hectares in size. The portion of the landfill area not directly used for landfilling contains drainage ditches, surface water reservoirs, access roads and stockpiles of clay and topsoil. Undeveloped buffer land and berms separate the landfill operation from surrounding properties. Major features of the site are shown in **Figure 2**.

The landfill design is based on a progressive trench and fill techniques, which uses conventional excavation and earth moving equipment. The trench for cells 16 and 17 is 18.3 m (60 ft.) deep and approximately 150 m wide. The associated landfilling operation involved the placement of 12.2 m of waste in the trench, capping it with a 6-m thick layer of native, unweathered clay till to an elevation comparable with the original ground surface.

The Cell 18 design was modified in late 1997. From 1997 to September 1999, operations involved the excavation of a primary cell to elevation 182 mASL and a series of trenches, which extended an additional 6 m below the base of the primary cell. The trenches were excavated as required and backfilled after careful inspection by the resident geotechnical engineer. Since 1997, the compacted portion of the cap (i.e., the diffusion barrier) has been reduced in thickness to about 5 m. The overall thickness of the cap, which includes un-compacted clay till over the finished, compacted portion, might exceed 8 m ± locally.

From September 1999, sub-cells 4, 5, 6 and 7 were excavated no deeper than elevation 180 m and a 1-m compacted clay liner was placed in the bottom. Waste was placed on top of the compacted clay liner. For sub-cell 8 and thereafter, trenches were excavated to a base grade of about 182 mASL, with no placement of a compacted clay liner.

Over the subject period September 1, 2006 to August 31, 2007, waste was placed in Sub-cells 4, 5, 6, 7, 8 and 9 above the 195 m level, as per the approval of the air space recovery plan.

2.1.1 Air Space Recovery Plan

Clean Harbors Canada, Inc. submitted a revised Design and Operations Report for the landfill to the Ontario Ministry of the Environment (MOE) for its approval. The plan involved using available, already-permitted capacity that runs adjacent to current Cell-18 within the boundaries of the existing landfill. The area of land to be excavated is currently the site of the plant's temporary offloading receiving cell, container storage area and an internal access road, all of which will be relocated. The plan also included placement of wastes, approximately four metres, across the top of Cell-18 from sub-cell 4 to sub-cell 12 which was partially completed during this reporting period. The revised Design and Operations Plan was approved by the MOE on June 17, 2004.

2.2 Waste Quantities and Landfill Capacity

2.2.1 Waste Quantities

Conditions 4 and 5 of the Provisional Certificate of Approval identify the waste streams that are acceptable for landfill at the Lambton Facility. The landfill pretreatment system referenced in the provisional certificate was not used during this reporting period. Waste currently received at the facility is either placed in the secure chemical landfill, or incinerated. A description of the material classification codes used by the facility to describe landfill-destined wastes is provided in **Appendix C**. The new waste classification codes reflect the implementation of a computer business platform and the waste codes reflect their use in this system as a description of the wastes to be received.

As per Condition 8, daily records are maintained at the facility, identifying the quantities and types of wastes received, origin of the waste, results of analyses performed and the location of placement in the cell. Associated information (i.e. description of the quantities of waste received and their origin), and an estimate of the remaining capacity in Cell 18 are summarized on an annual basis per Condition 15 (b).

In the period from September 1, 2006 through to August 31, 2007, Clean Harbors Lambton Facility received 160,389 tonnes of solid waste (106,926 cu. m). This number was calculated using an average density of 1.5 kg/litre. A summary of the waste types and quantities received at the facility is provided in Table 1. Total volumes by origin were:

Total Waste Receipts by Source

Source	Volume Received	% Total Volume
Ontario	70,895	44%
Other Provinces	20,669	13%
United States	68,825	43%
Total	**160,389**	**100 %**

2.2.2 Landfill Capacity

The permitted capacity for Cell 18 is 1.9 million cubic metres. With the approval of the landfill airspace recovery plan in 2003, the total practical capacity is also approximately 1.9 million cu. m.

The total volume of landfill space consumed up to August 31, 2007 was 1,454,515 cu. m (76.5%). The remaining permitted space available for landfill as of August 31, 2007 is approximately 445,485 cu. m. (23.5%). Based on the projected rate of landfill activity, Cell 18 will reach capacity in January 2012.

Table 1. Waste Quantity* by Waste Types, September 1, 2006 to August 31, 2007

Clean Harbors Waste Codes	Material Type	Generator Location			Total
		Ontario	Other Provinces	United States	
CA1	Solids contaminated with cyanides	1,614	0	4	1,618
CANL	Spent pot liner	0	745	10,798	11,543
CBP	Non Hazardous	2,189	54	343	2,586
CCRK	Incinerable solids	0	0	358	358
CCRL	Organic solids	28,880	13,923	34,850	49,868
CCS	Inorganic solids	23,128	5,792	5,387	62,092
CCSF	Electroplating waste	163	0	3,645	3,808
CCSM	Inorganic Debris	51	0	499	550
CHG	Solids contaminated with mercury	0	96	0	96
CNIA	Asbestos	6	0	0	6
CNO	Non RCRA Solids	2,624	0	15	2,639
D92L	Pesticides	559	59	12,926	13,544
LBD1	Alkaline batteries	85	0	0	85
	Incinerator Ash	11,596	0	0	0
	TOTAL	**70,895**	**20,669**	**68,825**	**160,389**
	Percent of Total	**44%**	**13%**	**43%**	**100%**

All values expressed in tonnes. Descriptions of the Clean Harbors material codes for the waste categories are provided in Appendix C. The volumes reported in the table are generated from analysis of the waste manifests for solid wastes received at the Lambton Facility's secure, chemical solid waste landfill.

2.3 Waste Load Rejection Summary

Clean Harbors Canada, Inc. is required under Condition 15 (c) of the Provisional Certificate of Approval to provide the MOE with a list of all rejected waste loads (i.e. vehicle shipments) together with the reasons for rejection.

During the reporting period covered by this report, **198** individual loads of waste were rejected by the Lambton Facility for failing to meet the site's acceptance criteria. A summary of all waste loads rejected and related reasoning is presented in **Appendix D**.

A total of 38 loads were rejected because they failed the facility's acceptance criteria for total volatile hydrocarbons (VHC) greater than two percent total volatile organic compounds by weight;.

Loads rejected due to failure of the site's gas evolution test were reduced from 111 in 2006 to 30 for this reporting year. Investigation revealed the cause for these failures to be inappropriate analytical protocols and testing methods used by the waste generator during pre-analysis.

28 loads were rejected for failure of the landfill flashpoint test. A further 15 loads failed to meet the facility's test for reactive cyanides and 13 loads were rejected for failure of the acceptance standard for resistance to penetration (15 PSI).

Other key reasons shipments were refused included: the material failed the test for releasable sulfides; the material contained free liquids; and the materials were deemed to be too dusty or odorous for acceptable handling.

3. SITE INSPECTION ACTIVITIES

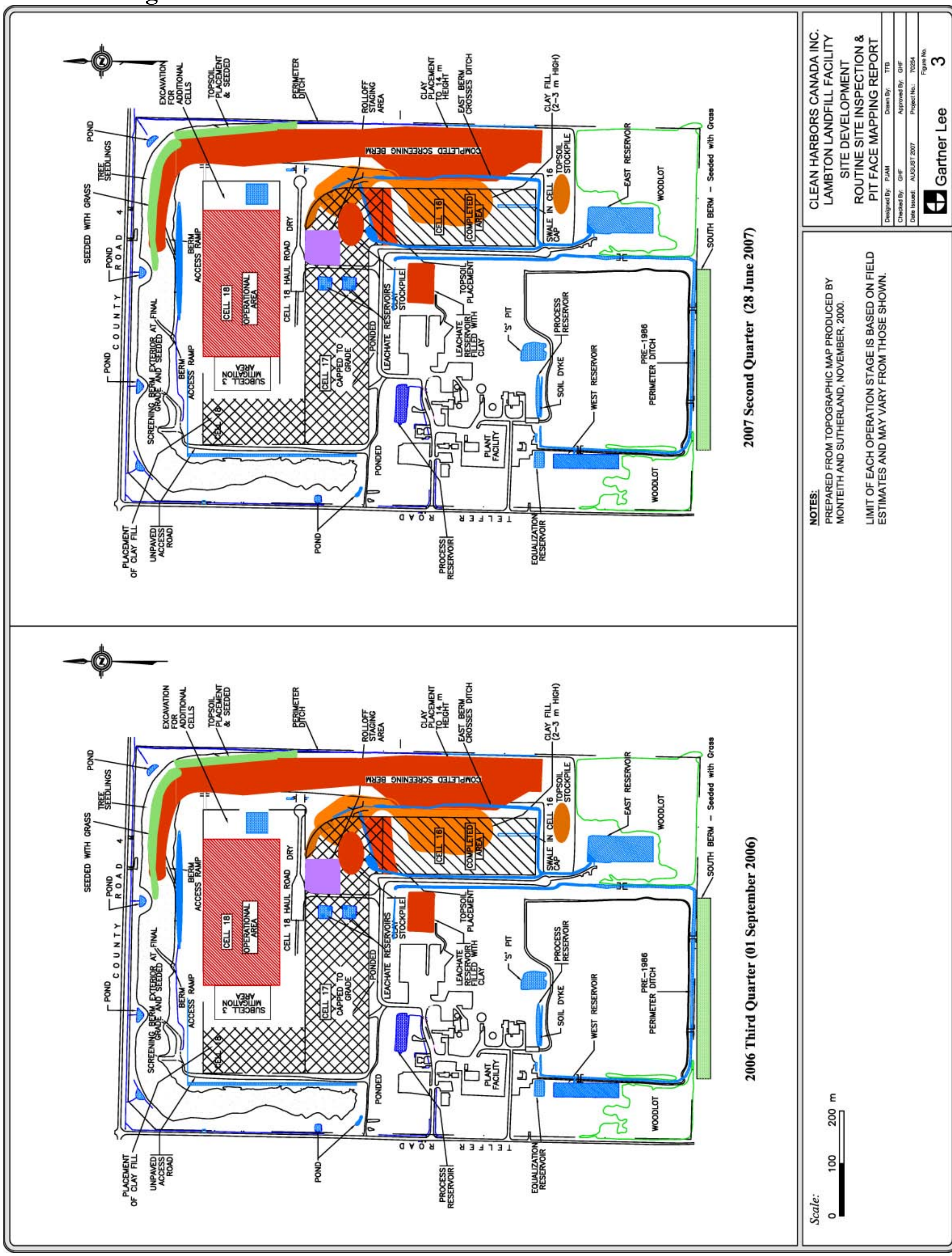
Quarterly Site Inspections

Per Condition 15 (d) of the Provisional Certificate of Approval, Clean Harbors Canada, Inc. provides a yearly summary of the progress of landfilling including berm development, the extent and location of any gravel/sand lenses excavated and the locations of any old wells discovered and plugged. This summary is compiled from the results of site inspections conducted on a quarterly basis. The inspection program, as designed, provides independent confirmation that the site is being developed in accordance with the provisions set forth in the Design and Operations Report.

Gartner Lee Limited was retained in 2006 and 2007 to undertake the site inspections. The inspections were conducted on the following dates:

Third Quarter 2006 – September 1, 2006
Fourth Quarter 2006 – December 13, 2006
First Quarter 2007 – March 20, 2007
Second Quarter 2007 - June 28, 2007

The site inspections consisted of a visual assessment of the landfill operations including the waste fill area, the excavated cell area, the landfill cap, berm construction and the surface water management system. The pit-face mapping component of the inspection involved the examination of the side slopes and the base of the excavated cell to identify the occurrence and distribution of any granular lenses and man-made discontinuities, such as boreholes, wells and tile drains. The site inspection and pit-face mapping events are documented in interim reports included in Appendix E. The progress of site development during this period, based on site conditions on September 1, 2006 and June 28, 2007 is shown in **Figure 3**.



3.1 Cell 18 Excavation

3.1.1 Excavation Development

As per the amended CofA (September, 2004), the sub-cells were excavated to a general base grade of 185 mASL (about 15 m below ground surface). Trenches are excavated from this base plateau as needed, to a base grade of 181 mASL or to about 18.3 m below ground surface. As part of the approved air space recovery plan, additional capacity was excavated along the north boundary of sub-cells 4 through 8.

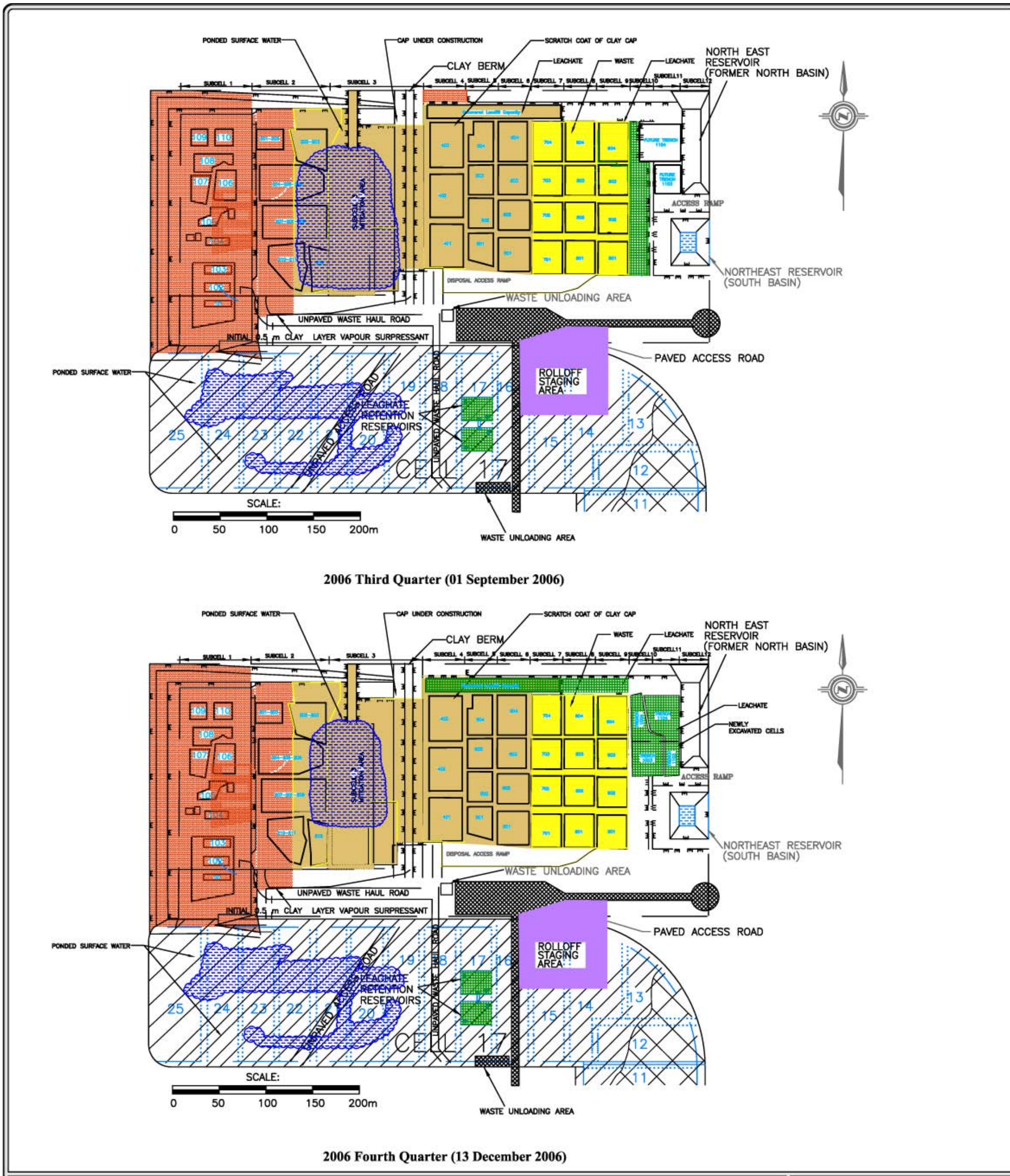
The sub-cell numbering sequence has been altered starting with Sub-cell 4. Sub-cell 1 (75 m wide), Sub-cell 2 (85 m wide) and Sub-cell 3 (100 m wide) each contain a series of trench rows. The remaining sub-cells, starting with Sub-cell 4, contain only one north-south trending row of trenches. This produces a smaller sub-cell having a width of between 35 m and 45 m.

3.1.1.2 Landfill Cell Advancement

Figures 4 and 5 presents the progress of excavation advancement within Cell 18 for each inspection date. A detailed description of excavation progress is presented in the site inspection reports contained in **Appendix E**.

During the 2006/2007 monitoring period, excavation of Trenches 1003 and 1004 (Sub-cell 10) as well as Trenches 1103 and 1104 (Sub-cell 11) were completed. In addition, the southern basin of the North Eastern Storm Water Reservoir was removed in preparation for the future excavation of Trenches 1101 and 1102 (Sub-cell 11).

Figure 4. Site Development (Third and Fourth Quarter 2006)



LEGEND:

13 SUBCELL DESIGNATION

313 SUBCELL TRENCH 313

NOTES:

PREPARED FROM TOPOGRAPHIC MAP PRODUCED BY MONTEITH AND SUTHERLAND, NOVEMBER, 2000.

LIMIT OF EACH OPERATION STAGE IS BASED ON FIELD ESTIMATES AND MAY VARY FROM THOSE SHOWN

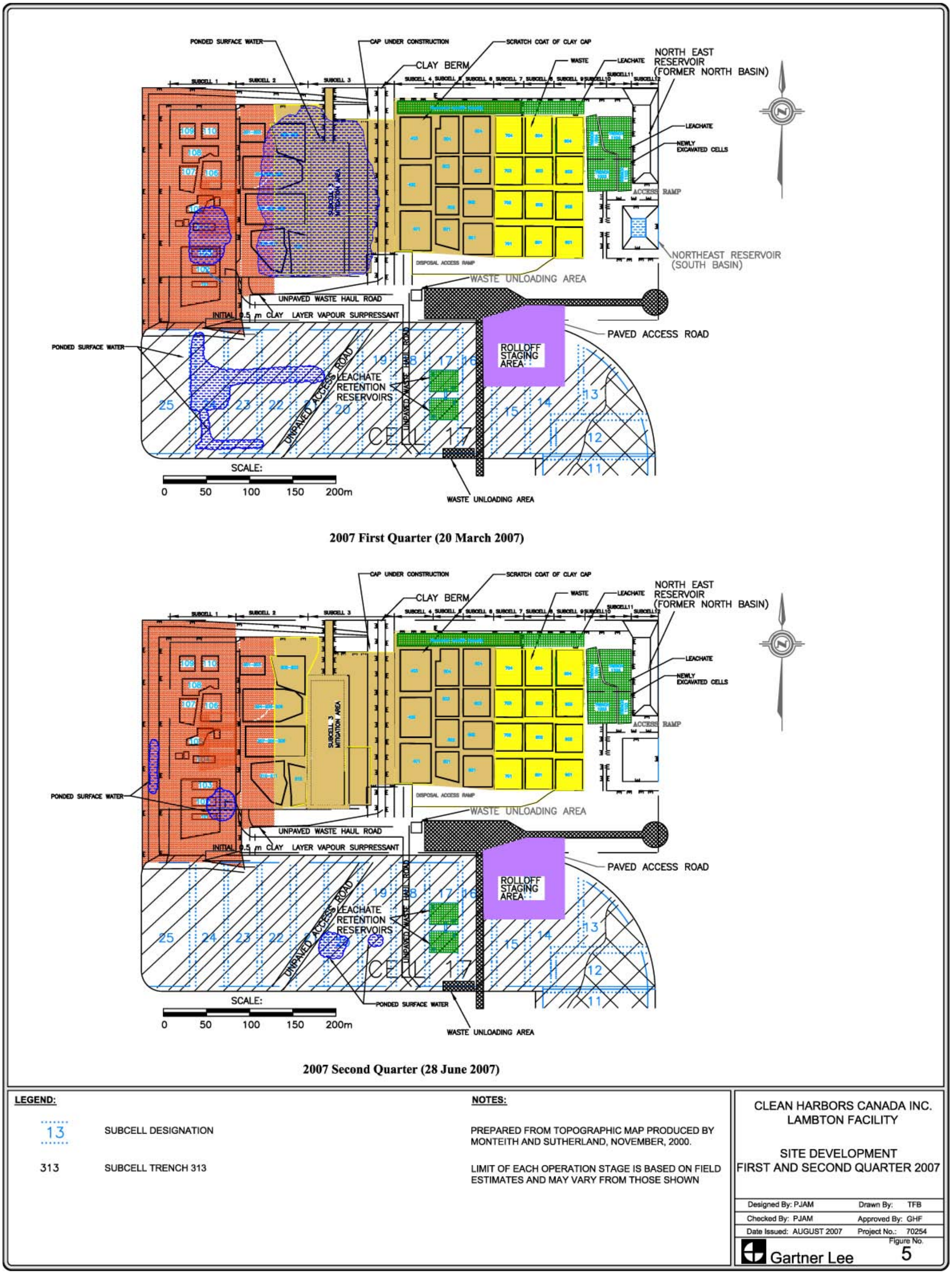
CLEAN HARBORS CANADA INC.
LAMBTON FACILITY

SITE DEVELOPMENT
THIRD AND FOURTH QUARTER 2006

Designed By: PJAM	Drawn By: TFB
Checked By: PJAM	Approved By: GHF
Date Issued: AUGUST 2007	Project No.: 70254

Gartner Lee — Figure No. 4

Figure 5. Site Development (First and Second Quarter 2007)



3.1.1.3 Sidewall Stability

The quarterly inspections reports provide general observations regarding sidewall stability. The Cell 18 sidewalls have a slope angle of 45° or 1 vertical to 1 horizontal with a 10 m wide bench cut into the slope at a depth of about 4.5 m from surface. Rilling and general weathering associated with previous precipitation events were observed across the slope face when exposed to the elements for a period of time.

Detailed assessment of slope stability and base heave is conducted on an as-needed basis by a geotechnical consultant (Inspec-Sol Inc) in 2006/2007. The geotechnical reports are on file with Clean Harbors Canada, Inc. at the Lambton Facility.

3.1.2 Pit Face Mapping

Pit face mapping documents the progress of the excavation and is conducted to identify manmade features such as abandoned wells, boreholes and drainage tiles; and geologic discontinuities such as sand lenses. Geophysical surveys are performed in the path of the excavation on an as-needed basis, to locate metallic well casings (i.e., abandoned petroleum wells or water supply wells) and other anomalous conditions such as brine seeps. No geophysical surveys were conducted during the 2006/2007 monitoring period.

No boreholes or wells were observed on the benches or the landfill base that could be accessed for inspection other than those installed by the geotechnical consultant. Only a minor volume of material was excavated during the 2006/2007 monitoring period, requiring only a limited inspection of the excavation.

3.1.3 Active Waste Fill Area

The waste is to a large part comprised of contaminated soil-like materials, ash, plastic, steel drums, wood and cardboard. Waste is transported to the working face via ramps cut across the south sidewall of the Cell 18 excavation at Sub-cell 4. From the west end of the Cell 18 haul road, some of the bulk waste is off-loaded into a concrete-lined pit where an excavator subsequently transferred the waste into all-terrain trucks. Dusty and other prepackaged waste is transferred in roll-off containers and hauled by all-terrain tractor directly to the working face along access roads to the ramps at Sub-cell 4. A bulldozer spreads and compacts the waste once off-loaded at the working face.

Leachate control measures included the use of a portable pump with hose to pump accumulated leachate from sumps within the sub-cells to the leachate reservoirs.

Figures 4 and 5 presents the progress of waste fill placement within Cell 18 for each of the four inspection dates. A detailed description of waste fill progress is presented in the individual site inspection reports within **Appendix E**.

During the 2006/2007 monitoring period, waste was primarily placed within Sub-cells 7 through Sub-cell 11 (specifically portions of Trench 1104).

3.1.4 Landfill Cap

Per Condition 14 of the Provisional Certificate of Approval, the landfill cap is to be constructed in accordance with Section 4.4 of the Design & Operations Report and the quality of cap construction is to be monitored as described in the Design & Operations Report.

As part of its site inspection activities, Gartner Lee Limited records visual observations of the progression of landfill cap construction during each quarterly site inspection. Inspec-Sol Inc. conducts the quality control associated with cap construction.

3.1.5 Cell 17 Cap Construction

Cell 17 Cap Construction (specifically Sub-cells 21 through to Sub-cell 25) was completed during late 2002 through the placement of topsoil and seeding of this area. No additional construction activities occurred with respect to the construction of the Cell 17 cap during the 2006/2007 monitoring period.

3.1.6 Cell 18 Cap Construction

A portion of the landfill cap was constructed on the south side of Subcell 1, 2 and 3 from September 25 to October 6, 2006. This narrow strip of cap along the southern section of these Subcells brings the cap in this area to the cap completion elevation of 200 m amsl. The cap was constructed with primarily grey clay from the Trench 1103/1104 excavations, and a section of mixed brown/grey clay over the Subcell 3 Mitigation Structure. Inspec-Sol prepared the construction drawings for the cap work. The clay cap was compacted to achieve a hydraulic conductivity of 1×10^{-7} cm/s or less. Inspec-Sol monitored the construction of the cap, and provided quality control and compaction testing services during cap construction. Approximately 13,050 m^3 of clay was placed during the partial cap construction. The field inspection reports, photographs, and compaction test results are included in **Appendix F**.

The compaction test results, field inspection reports, and laboratory testing were summarized in a separate report following completion of the construction activities. The report is entitled "2006 Construction Activities Summary Report, Cell 18, Lambton Facility" and was submitted to Clean Harbors in June 2007. This report is included as Appendix F.

The June 2006 Inspec-Sol study on the use of mixed gray and brown clay for future cap construction was submitted by Clean Harbors Canada, Inc. to the Ministry of Environment, and has been endorsed by their technical reviewers. The Design and Operations Report was amended to change the material type allowed in cap construction, from strictly gray clay to allowing a mixture of brown and gray clay.

3.1.7 Berm Development

Soil excavated from Cell 18 has previously been used to extend the east perimeter berm westward across closed Cell 16. In general, the geometry of the perimeter berms surrounding cells 16, 17, and 18 appears to be unchanged since September 1, 2006. In addition, a temporary interior separation berm was constructed between Sub-cells 10 and 11 during the third quarter of 2006 in order to contain leachate within Sub-cell 10 during the excavation of Sub-cell 11.

3.1.8 Surface Water Management System

The surface water management system consists of perimeter and internal drainage ditches that direct surface runoff to three retention reservoirs located in the east, west and northeast portions of the site. Flow from the retention reservoirs is directed through a water treatment facility. Following treatment, the water is discharged to an equalization reservoir and released to the drainage ditch along Telfer Road, on an as needed basis. Leachate from the sub-cells is pumped to two leachate retention ponds located on the cap of Cell 17. Retained leachate is pumped to the incinerator.

Inspection of the perimeter ditches and retention reservoirs established that their sideslopes were stable with only minor evidence of erosion.

The Equalization Basin provides for the adequate retention of the treated storm water. The exposed, concrete-lined sideslopes appear to be stable, although cracks and spalling of the concrete were observed.

Detailed observations of the surface water management system are presented in the site inspections contained in Appendix E.

3.2 Geotechnical Monitoring and Inspection – INSPEC-SOL

Geotechnical monitoring and inspection is carried out on at least a weekly basis for the Cell 18 area. The geotechnical monitoring and inspection is performed by Inspec-Sol Inc. Quarterly summary reports are prepared for the geotechnical monitoring and inspection activities and these reports are on file with Clean Harbors Canada, Inc. The following paragraphs summarize the activities conducted.

The following routine monitoring tasks were carried out over the reporting period of September 1, 2006 to August 31, 2007:

- Weekly visual inspections of Cell 18, which entailed, at a minimum, visual inspection of the top of the slopes, base of the excavation, side slopes, stormwater and leachate ponds and other items deemed appropriate by the Geotechnical Engineer;
- Quarterly inspection by the Geotechnical Engineer of Cell 18 and screening berm slope stability issues, as well as a visual assessment of any geotechnical issues noted for Cell 16 and Cell 17; and
- Monthly monitoring and interpretation of the existing geotechnical instrumentation around the perimeter of Cell 18, including slope indicators, heave gauges, survey pins, and pneumatic piezometers.

Over the subject period September 1, 2006 to August 31, 2007, the following construction activities were completed in Cell 18:

- Waste placement in Subcells 5, 6,7, 8 and 9 above the 195 m level;
- Construction of a portion of the landfill cap over Sub-cells 1, 2 and 3 using a mixture of gray and brown clay (September 26 to October 6, 2006);
- Transition berm and cap key construction along the north side of Sub-cells 4 to 8 (August 10 to September 22, 2006);

- Decommissioning of the northeast stormwater pond in Sub-cell 12 (as part of the excavation of Trenches 1103 and 1104);
- Excavation of Trenches 1103 and 1104 in Sub-cell 11 (July 12 to September 19, 2006);
- Excavation of Trenches 1003 and 1004 in Sub-cell 10 (October 16 to November 9, 2006);
- Excavation of Trenches 1001 and 1002 in Sub-cell 10 (February 16 to April 16, 2007);
- Placement of cover material over Sub-cells to 4 to 9 (Spring of 2007): and
- Construction of new access ramp in the south corner of Sub-cell 12 for waste placement (June 2007).

Inspec-Sol was present during the above construction activities and performed increased monitoring in addition to the routine monitoring noted above. The results of the monitoring and instrumentation data are summarized in the quarterly reports.

No obvious slope stability issues were observed during the weekly inspections of Cell 18. The side slopes of Cell 18 have been exposed for a long period, and as such show signs of weathering and erosional gullies and rills.

The Geotechnical Engineer was on site at a minimum of once per quarter to conduct the visual inspections. The inspection involves an inspection of Cell 18 construction activities and side slopes in addition to the perimeter screening berm.

The compaction test results, field inspection reports, and laboratory testing for the 2006 Construction Activities were summarized in a separate report following completion of the construction activities. The report is entitled "2006 Construction Activities Summary Report, Cell 18, Lambton Facility" and was submitted to Clean Harbors in June 2007. This report is included as **Appendix F**.

3.2.1 Decommissioning/Abandonment of Geotechnical Instrumentation and New Instrumentation

During the reporting period of September 1, 2006 to August 31, 2007, six geotechnical instrumentation locations were abandoned. These instruments consisted of inclinometers and piezometers installed in boreholes. The decommissioning consisted of over-drilling the instrument casing and sealing the borehole with benseal grout, in accordance with Ontario Regulation 903, and Appendix V (Well Decommissioning Program) of the Clean Harbors Design and Operations Report.

One new nested piezometer (Piezometer 0768) was installed in August 2007, to the east central side of Subcell 12. The remaining geotechnical instrumentation was maintained to facilitate on-going monitoring programs. Further details of the decommissioned instruments and new instrumentation are summarized in **Appendix G.**

3.2.2 Subcell 3 Mitigation Structure Backfill

Construction of the Clay backfill as part of Sub-cell 3 mitigation structure backfill was completed in August 2003. As-recorded drawings were provided to Clean Harbors Canada, Inc. in November 2003, and these drawings were subsequently forwarded to the Ministry of Environment.

The surface of the clay backfill at Sub-cell 3 was covered in July 2005 with an interim clay cap approximately 1.0 to 1.5 m thick., therefore inspection of the surface of the mitigation structure can not be carried out. Prior to being covered, the surface of the mitigation structure was inspected as part of the weekly inspections for any signs of cracking, settlements, erosion and/or water pondage. The clay backfill surface was found to be intact and no significant signs of cracking, settlement, erosion or water pondage were noted. Prior to construction of the interim clay cap, the surface of the mitigation structure was prepared by scarifying and hydrating, to ensure proper bonding of the newly placed clay to the existing mitigation structure.

The compaction test results, field inspection reports, and laboratory testing were summarized in a separate report following completion of the construction activities. The report is entitled "Interim Cap Construction Summary Report, Subcells 2 and 3, Cell 18" and was submitted to Clean Harbors Canada, Inc. in June 2006, and subsequently to the MOE for their review. See **Appendix F**.

4. ENVIRONMENTAL MONITORING

4.1 Groundwater Monitoring Program

The annual groundwater monitoring program is undertaken at the Lambton Facility in accordance with Condition 9 of the Provisional Certificate of Approval No. A031806 dated September 5, 1997 and amended on June 17, 2004. In addition to the core compliance program, monitoring is undertaken along the south berm as a requirement of Provincial Officer Order No. P548009 (dated February 20, 2002).

The goal of the monitoring program is to provide for the early detection of changes in groundwater quality at the site. To address this goal, monitoring wells have been installed along the perimeter of the Facility property in the two hydraulically active, water-bearing zones, which are the primary pathways along which contaminants could travel. These are referred to as the Active Aquitard and the Interface Aquifer. The Active Aquitard is the near surface weathered portion of the clay-silt overburden that is present at the site. Weathering including summer desiccation and winter frost action has fractured the clay materials to a depth on the order of 3 m to 4 m. Groundwater movement through the fractures is potentially rapid in comparison with movement through unfractured overburden materials.

The Interface Aquifer is located at the contact of the overburden and bedrock, and is characterized by a thin, discontinuous layer of granular material overlying fractured bedrock. This aquifer has been capable of satisfying residential water requirements albeit the yield and quality has been problematic. Prior to the extension of municipal water service into the St. Clair Township of (former Moore Township), this thin zone formed the regional aquifer and was extensively used as a source of water supply by area residents. The aquifer is still used as a source of water supply by some residents who are either located on a side road that is not serviced or have chosen not to connect with the municipal service. A few residents also use shallow wells completed in the Active Aquitard as a source of non-potable supply.

Two compliance monitoring events are completed in late spring (May or June) and fall (October or November) of each year. The program, as designed and approved by the Ministry of the Environment (MOE), requires that Clean Harbors Canada, Inc. collect samples and analyze parameters that are: a) present in the waste at elevated concentrations; and, b) relatively mobile (i.e., not readily attenuated). Parameters, which have a low mobility through the overburden including heavy metals and organic compounds, are analyzed but at a reduced frequency. Samples are analyzed by an independent laboratory to detection limits below the applicable Ontario Drinking Water Standards (ODWS). Water level measurements are obtained during each sampling event.

The water level measurements and chemical analysis results are added to the existing database of information and used to produce updated groundwater elevation plans and 'concentration vs. time plots'. Statistical analysis of the chemical data is performed on the data in order to distinguish between long-term trends and short-term spurious data referred to as "spikes" and data that is anomalous such as analytical artifacts.

The 2006/2007 Annual Groundwater Monitoring Report produced by Gartner Lee Limited is appended (Appendix I)

4.1.1 2006/2007 Monitoring Program

The 2006/2007 semi-annual groundwater monitoring program involved:

- the measurement of groundwater levels in the monitoring wells installed in the hydraulically active geologic units below and adjacent to the Lambton Facility property; and,

- two sampling events conducted in November 2006 and May 2007, during which the existing monitoring wells are sampled.

The November 2006 (Fall 2006) and May 2007 (Spring 2007) samples were analyzed for major and minor ions. Samples collected during the May 2007 event were also analyzed for metals and volatile organic compounds.

The samples collected from wells installed along the south berm were analyzed for chloride and sodium, only.

4.1.2 Compliance Monitoring Well Network

The compliance monitoring well network consists of:

- 23 'shallow' wells [note: 19 of these wells are employed to monitor shallow groundwater flow through the weathered/fractured zone of the overburden (referred to as the Active Aquitard), and the remaining 4 shallow wells are used to assess the effects of berm construction on groundwater levels and water quality both within and below the berm]; and,
- 24 deep wells employed to monitor the primary water-bearing zone (note: 23 of the deep wells are installed at the overburden/bedrock contact referred to as the Interface Aquifer and one deep well is installed in the underlying Shale Aquitard).

The majority of the monitoring wells installed on-site are located at the Facility's point of compliance, namely, along the boundary of the site. Other monitoring wells have been installed internal to the site and are used for the early detection of changing conditions in groundwater flow and chemistry.

Three well nests (TW35-94, TW36-94, TW37-94) have been installed at locations off-property. Each well nest includes a shallow and deep well installed in the two monitored zones (Active Aquitard and Interface Aquifer). The monitoring data for these wells are used to flag any regional changes in ambient groundwater flow and water quality that may impact on the interpretation of conditions on the property.

As part of the process of implementing the prescribed monitoring program presented in the Design and Operations (D&O) Report, the MOE requested that a number of older wells continue to be sampled until such time as all new wells are commissioned. These older wells have been replaced by newer installations and represent redundant monitoring points. Monitoring of these redundant wells was initiated in 1997 and included shallow wells OW11-86-III(S), OW12-83-IV(S), TW21-94-II(S) and TW15-94, and deep wells OW11-86-I(D) and OW12-83-I(D). The replacement wells have been commissioned and Clean Harbors Canada, Inc. submitted a letter to the MOE in 2004 describing the program results and requesting permission to decommission these older wells. The MOE has not yet responded to this request.

4.1.3 Sub-cell 3 Mitigation Performance Monitoring

Two clay barriers containing internal layers of gravel, referred to as Hydraulic Control Layers (HCLs), have been installed in Sub-cell 3 to mitigate venting of gas/water, which occurred in 1999. A monitoring program was subsequently established to evaluate the effectiveness of these mitigation structures. The program involves water level monitoring and groundwater sampling at two extraction/monitoring wells (EW1a-01 and EW2a-01) screened against the HCLs installed in each of the mitigation structures and two deep wells installed in the Interface Aquifer (PW1-N and PW2-S).

The two extraction/monitoring wells were installed in November 2001 and are employed to control the water levels in the HCLs. EW1a-01 was installed in the northern HCL that blankets former Seep B and EW2a-01 was installed in the southern HCL, which blankets former Seep A and Seep C.

4.1.4 Cap Integrity Testing

Cap integrity testing has been conducted since the early 1990s to verify that any upward movement of chemicals from the waste through the cap was by the process of diffusion. The program involved coring through the cap and sectioning the core, with each of the sections submitted for chloride analysis. The results were compared with theoretical curves generated by diffusion models. The results basically demonstrated that any movement upward through the cap would be by diffusion and it was recommended that the program either be discontinued or the frequency be reduced.

4.1.5 Purge Wells

Clean Harbors Canada, Inc. agreed to install purge wells on site as a contingency measure for use in the future, if required. The program is described in the facility's Landfill D&O Report and Provisional Certificate of Approval (C of A). The purge wells were installed in August and December 2003.

4.1.6 South Berm Performance Monitoring

The South Berm was constructed in 2001 to accommodate soils excavated to enlarge two retention reservoirs. It was postulated at that time, based on water table mounding below the existing Northern berm, that a mound would develop below the South Berm. This mounding would act as a barrier to shallow groundwater flow. The MOE requested that monitoring wells be installed along the South Berm to assess the development of the water table mounding. In total, three overburden wells were installed along the top of the south berm and three overburden wells were installed along the north toe of the south berm.

Monitoring involves the measurement of water levels (to calculate the hydraulic gradient) and the collection of water samples for analysis of chloride and sodium (indicators of leachate movement from the landfill).

4.2 Monitoring Results

4.2.1. Groundwater Levels

The movement of groundwater beneath the Lambton Facility is described as follows:

Active Aquitard

Shallow groundwater flow through the Active Aquitard is from topographic highs, such as the perimeter berms, to topographic lows such as drainage ditches and excavations. The observed hydraulic head distribution in 2006/2007 is consistent with that reported in previous years. The south berm monitoring program has established that a groundwater mound has developed below the south berm.

Inactive Aquitard

Flow in the Inactive Aquitard, as inferred from calculated vertical hydraulic gradients, is downward from the Active Aquitard to the Interface Aquifer.

Interface Aquifer

The water levels in the Interface Aquifer have been affected by aquifer depressurization pumping that occurred between April 2001 and August 2004 in support of Sub-cell 3 mitigation. Following the discontinuation of pumping in August 2004, the groundwater levels have shown substantial recovery to pre-pumping conditions observed in 1999.

4.2.2. Groundwater Quality Data

4.2.2.1 Active Aquitard

Inorganic Groundwater Chemistry

The shallow groundwater below the site is more mineralized than that represented by the three shallow wells located off-site. The chemistry of the shallow groundwater, even in the least disturbed areas of the site (shallow wells located south of the site), is characterized by slightly elevated sodium concentrations compared to the chemistry of the off-site wells. It can be concluded that the shallow groundwater quality on the Lambton Facility property exhibits the accumulated effects of site development (i.e., waste placement and temporary storage, use of de-icing salts on roadways, calcium chloride for dust suppression and effects of earth moving activities, berm construction etc.).

Of the wells that show statistically significant increasing trends, TW22-94S (chloride), TW32-94-IV (chloride and sodium), TW40-99S (sulphate), TW42-99S (sulphate), TW45-99S (chloride), TW46-99S (potassium) and TW53-03S (sulphate and sodium) exceed their typical range.

The groundwater in the vicinity of TW22-94S could be affected by road salt usage on Telfer Road or possibly from the discharge of deep groundwater from the adjacent artesian well (TW22-94D).

Wells TW32-94-IV, TW40-99S, TW46-99S and TW53-03S installed in and adjacent to the northern perimeter berm exhibit chemistry, which is more mineralized (i.e., higher alkalinity, chloride, sodium, potassium and sulphate), than wells, which are removed from the berm. Several of these monitoring wells also exceed the Guideline B-7 values for alkalinity, sulphate, sodium, fluoride, or boron in one or more groundwater samples. The berm is constructed using native clay excavated from the landfill cells prior to waste placement. This material, at depth, has a higher chloride and sodium concentration than the surface material and contains pyrite. Weathering of minerals in the clay following its placement appears to be contributing to the higher concentrations. This phenomenon was first observed in 1994/1995 and no new information is available to refute this conclusion.

Shallow monitoring well TW15-94, located adjacent to the pre-1986 landfill and well OW11-86III(S) located adjacent to the service entrance to the site, are affected by site operations. Specifically, TW15-94 is affected by leachate movement from the pre-1986 landfill and OW11-86III(S) is affected by storm runoff from the roadway as well as the storage of road de-icing material storage in the wells immediate vicinity. These internal wells are not part of the prescribed monitoring well network. A number of additional shallow wells were installed in 1999 to the south and have been incorporated into the compliance monitoring program. The two wells [TW15-94 and OW11-86III(S)] could be removed from the monitoring program (see Recommendations Section 5.1).

Organic Groundwater Chemistry

No VOCs were detected above the MDLs in the Active Aquitard wells. The next biennial sampling event and analysis for VOCs is scheduled for Spring 2009.

4.2.2.2 Interface Aquifer

Inorganic Groundwater Chemistry

For the most part, the 2006/2007 chemistry in the Interface Aquifer remained stable or showed a decrease in parameter concentrations. Only OW12-83-I(D) (chloride and sodium), TW48-99D (chloride and sodium) and TW22-99D (chloride and sulphate) currently exceed the off-site UCLs these indicator parameters.

All three wells are screened against low permeability materials. For the most part TW22-99D and TW48-99D show stable or decreasing trends in indicator parameters. It is suspected that recharge to these two wells consists primarily of deeper bedrock groundwater given the low hydraulic conductivities at these locations and that little to no Basal Till (Interface Aquifer material) was encountered during the drilling of these two wells.

For OW12-83-I(D), chloride and sulphate concentrations appear to have stabilized since the discontinuation of Sub-cell 3 depressurization pumping in late 2004. It is likely that ‘fresher’ groundwater at this location was drawn away from the well through the highly permeable zone that surrounds this well during the active pumping of the sub-cell. Subsequently, discontinuation of pumping has allowed deeper bedrock groundwater to recharge this portion of the site.

Interface Aquifer wells TW47-00D (chloride and sodium) currently exceeds the UCLs for chloride and sodium. A statistically significant increasing trend for these parameters is evident at TW47-00D however, concentrations of these parameters remain within their typical range of the Interface Aquifer. It is suspected that the chemistry of TW47-00D is trending towards natural conditions of the Interface Aquifer. The current UCLs for TW47-00D were established based on the first eight samples collected from this well which were collected during the depressurization pumping of Sub-cell 3. As such these samples are expected to be more representative of a mixture of natural water at this location and fresher water being pulled towards Sub-cell 3 due to depressurization pumping. As such, the derived UCLs may be artificially low.

Other wells showing statistically significant increasing trends in one or more indicator parameters are either within or slightly below their typical range and are below both off-site and well-specific UCLs.

In addition, statistically significant increasing trend in sulphate was observed at PW1-N. PW2-S showed an increasing trend in chloride and potassium, however only the trend in chloride exceeds the historical maximum value for this well. It is suspected that these trends are related to the discontinuation of depressurization pumping activities. The chemistry for these two wells is expected to stabilize over time.

Alkalinity, chloride, sodium and fluoride were detected in a number of the Interface Aquifer wells at concentrations that exceed both the ODWS and the derived Guideline B-7 values. Boron concentrations exceed their respective Guideline B-7 value at TW48-00D. These parameters are naturally occurring constituents in the shale groundwater. TW48-00D is located in a low permeability zone that appears to be influenced by an upwelling of shale bedrock groundwater.

Organic Groundwater Chemistry

Benzene was detected at OW11-86-I(D) above the derived Guideline B-7 value, but below the ODWS criteria. Historically, benzene has been sporadically detected in several of the Interface Aquifer wells at the site [including OW11-86-I(D)]. The source of the benzene is not known, however, petroleum hydrocarbons are extracted in Lambton County in the general area of the site and it is possible that the benzene is naturally occurring.

Trichloroethylene (TCE) and cis-1,2-dichloroethane (c-1,2-DCA - a degradation product of TCE) were detected in well TW22-99D. The detected concentrations were below both the ODWS value and the derived Guideline B-7 value for TCE and cis-1,2-DCA respectively. Given the location of this well, low conductivity of the bedrock in this portion of the site, the upward gradient exhibited by TW22-99D, the mineralized (reducing) geochemical characteristic of the groundwater at this location and the non-detection of TCE in any other Interface Aquifer wells in the vicinity of TW22-99D, the source of the TCE is not considered to be landfill related. Additional review and investigation is required to assess this possibility.

The next biennial sampling event and analysis for VOCs is scheduled for Spring 2009.

4.2.3 Sub-cell 3 Mitigation Performance Monitoring

Performance monitoring results for the HCL and Interface Aquifer wells adjacent to Sub-cell 3 indicate that an inward/upward hydraulic gradient towards Sub-cell 3 was maintained during the 2006/2007 monitoring period; no precipitates were observed in the bottom of the two extraction wells; and, the chemistry within the HCL is consistent with Interface Aquifer water which has been in contact with the rock used in the construction of the HCL. There were no changes in water quality that would indicate a breach of the compacted clay barrier has occurred. It is concluded that the mitigation structure is performing as designed.

4.2.4 South Berm Performance Monitoring

A groundwater mound has developed below the south berm and groundwater flow beneath the berm is northward. Based on these data, the design of the south berm provides a barrier to shallow groundwater/leachate movement form the pre-1986 landfill cells.

4.3 Surface Water Monitoring

Condition 9 (a) iii) of the Provisional Certificate of Approval requires Clean Harbors Canada, Inc. to undertake water monitoring in accordance with the program in Section 6.3, Surface Water Monitoring, of the Final Design & Operations Report (Clean Harbors Canada, Inc., June 2003).

The surface water management system directs all storm water via a series of ditches and reservoirs to a water treatment plant located within the main processing area of the Lambton Facility. Once treated, the surface water (referred to as treated effluent) is discharged to an equalization pond. Before discharge is permitted, this equalization pond is analyzed and verified to meet the discharge criteria identified in condition 10(d) of the Provisional Certificate of Approval. When the conditions are satisfied the equalization pond is discharged to a ditch along Telfer Road. During discharge the treated surface water is monitored daily for continual acceptance against the discharge criteria. Samples are collected and analyzed for specifically, pH, total phenols, solvent extractables, total suspended solids and toxicity (Microtox).

On a semi-annual basis, samples of the treated surface water are analyzed for a more comprehensive list of parameters and undergo acute toxicity testing; also, chronic testing is conducted on an annual basis. The samples are taken on three (3) consecutive high discharge days, typically in the spring and fall. The samples undergo biological testing, exposing the species to varying concentrations for prescribed periods. The test results provide a semi-quantitative assessment of the acute and annual chronic toxicity of the treated surface water.

4.3.1 Surface Water Quality

The surface water runoff collected in the east and west retention ponds along with the water treatment plant are sampled and analyzed on a daily basis when being discharged for selected indicator parameters.

The treated surface water discharged to the municipal drainage system from the equalization pond is also sampled and analyzed on a daily basis for selected indicator parameters and on a semi-annual basis for a comprehensive list of chemical parameters. Samples are also collected for biological testing (see section 4.3.2 and 4.3.3). The surface water quality data results are provided in **Appendix J-1**.

Daily effluent analyses were performed on samples collected from the equalization pond discharge over 206 discharge days between August 18, 2006 and May 27, 2007. The daily analyses were performed at the Clean Harbors on-site laboratory. The results show no exceedances of the control limits for pH, phenols, chemical oxygen demand (COD), solvent extractables (Oil & Grease), and total suspended solids (TSS).

Results for inorganic chloride, sulphate, conductivity and Microtox also included (no control limit). Microtox results showed no toxicity for each discharge day.

Lambton Scientific conducted the analysis of the samples collected for the semi-annual surface water sampling events. The analyses conducted included total cyanide, pH, dissolved organic carbon (DOC), phosphorus, conductivity, total Kjeldahl nitrogen (TKN), ammonia, nitrate, nitrite and metals. Test results are found in **Appendix J-2**.

4.3.2 Toxicity Testing

The samples of the treated surface water from the equalization pond are collected on three consecutive high discharge days twice per year and submitted for toxicity testing. A sample was also taken for annual chronic testing. In addition, a program involving the annual surveying of benthic invertebrates of the reservoir was also carried out.

Surface water samples collected on November 1, 2 and 3, 2006 and April 25, 26 and 27, 2007 were submitted to Pollutech EnviroQuatics Limited for the following semi-annual set of tests:

Acute Testing

- A 96-hour test of acute lethality of the sample to juvenile rainbow trout;
- A 48-hour test of acute lethality of the sample to neonates (<24 hr old) of the water flea (*Daphnia magna*);
- A surface water sample was collected on April 25, 2007 for the following annual test.

Chronic Testing

- A 7-day test of sub lethal toxicity of the sample to Fathead minnows and neonates (< 24 hr old) *Ceriodaphnia dubia*. The test was run concurrently with the test of the acute lethality and involved examination of the test organisms for loss of mobility, which is a subtler indicator of toxicity than death.

The tests were conducted according to accepted procedures and all indicators confirmed that the tests maintained acceptable and good levels of quality control. Specific observations of test integrity are:

a) For the Acute testing; No mortality or immobility of any test organism was observed in controls, confirming that the organisms were healthy and that the test conditions themselves did not stress the organisms or influence the results. For the Chronic testing; No mortality of any test organism was observed and only a slight effect in the growth was observed.

b) Simultaneous tests run in reference toxicants produced results that were within the historic range for the Pollutech lab, confirming that the tests of the equalization pond samples were not influenced by changes in the sensitivity of the test organisms or in variations in laboratory procedure from previous tests;

c) Test conditions (pH, dissolved oxygen and temperature) were well within the acceptable range and are not likely to have imposed any stress on the test organisms or influenced the results.

4.3.3 Benthic Study of Equalization Pond

The Spring Equalization Basin Monitoring Event was conducted on May 17, 2007. Monitoring involved profiling of the oxygen concentration with depth in the pond and the characterization of the benthic community. A second oxygen profile was collected under warm weather conditions on August 31, 2006 in response to MOE recommendations.

The ponds benthic community is represented primarily by Chironomidae, with a few Oligochate (midge larve). Gastropods (snails) are also present, however, only shells were recovered, indicating that these organisms may not survive in the basin. Apart from the snails, the organisms identified are adapted to soft sediment due to their burrowing life strategies. In terms of dominance, chironomids are the most abundant and make up greater than 50% of the subpopulation represented by this family. Organisms belonging to chironomidae are generally tolerant of low dissolved oxygen, organic-rich water common to disturbed environments. Anoxic conditions were present in both May and August 2007. Under these conditions in water, sediment bound pollutants could potentially be re-dissolved in the water column and impact the discharge from the basin.

In May 2007, no fish were caught using traditional angling methods, however, the presence of several fish feeding on the surface of the water were observed. In August 2007, >100 sunfish were observed along the shore of the Basin.

The complete benthic study of the equalization basin is presented in **Appendix J-4**.

4.4 Air Quality Monitoring

ORTECH Environmental (ORTECH) was retained by Clean Harbors Environmental Services (Clean Harbors) to conduct the annual ambient air quality monitoring (AAQM) program at their Lambton Facility (Facility) located at 4090 Telfer Road, Corunna, Ontario.

Clean Harbors is required to conduct certain fenceline ambient air measurements at its Corunna Facility on an annual basis, according to specific monitoring requirements and a plan accepted by the MOE, as a condition of the operational Certificate of Approval for the facility. As specified, a total of five pairs of simultaneous upwind/downwind speciated VOC measurements were done, by sampling for ½-hour periods on selected summer days with appropriate weather forecasts, during June to September 2007. Similarly, 24-hour upwind/downwind samples were collected on the same occasions for subsequent analysis of TSP and selected elemental constituents, speciated carbonyls and airborne mercury, along with acquisition of localized meteorological data. The overall approach and measurement methodologies were generally consistent with previous monitoring at the plant. The measured levels were then compared with applicable air quality limits to which the various facility emission sources might contribute. In an effort to potentially detect maximum contributions, the downwind monitoring is conducted at appropriate selected locations along the facility property line that is closest to the landfill area. Previous downwind monitoring has been done on the elevated berm within the facility boundaries.

For a large part of all measurement intervals, the meteorological conditions, on selected monitoring days, were suitable to the survey objectives and conducive to acquire near maximum downwind levels of the target substances at the fenceline. Downwind concentrations for many of the measured VOC species were higher than upwind concentrations on most occasions. Both TSP and many of the elemental particulate components were also higher at the downwind site during each measurement interval which were indicative of facility contributions to the fenceline concentrations. Of the speciated carbonyl measurements, low levels of formaldehyde and acetaldehyde were detectable on some occasions. Low levels of particulate mercury were found in most of the samples whereas mercury vapour was non-detectable within the sensitivity of the method.

Apart from one specific substance (i.e., naphthalene), and one TSP result, all measured levels of the various vapour and particulate constituents were below the accepted regulatory air quality concentration limits (i.e., ½-hour POI standards or guidelines and/or 24-hour AAQC, as applicable), which are available for many of the target substances. In most instances, the highest measured concentrations of the multiple speciated compounds being determined often represented only a small fraction of the accepted limits. The maximum downwind TSP concentration exceeded the AAQC by a small margin during one of the measurement periods and was at the associated AAQC on another occasion. The target elemental constituent levels were found to be less than 10% of their specific AAQC values, except for iron that was a higher fraction of the metallic iron AAQC. This comparison is considered to be conservative since the portion of metallic iron in the analyzed particulate matter, as opposed to other iron compounds was likely to be minor. Downwind concentrations of naphthalene were elevated and exceeded the ½-hour POI odour based guideline in four of five sample sets. However, most of the other measured VOC species were usually a small fraction of their respective standards (i.e., typically less than 10%). While there were measurable facility contributions for a large variety of airborne substances at the plant fenceline due to facility activities, there were no exceedances of any of the standards in O reg. 419. Only two components (TSP and naphthalene) exceeded their respective AAQC or guidelines. In the case of the TSP exceedance, the facility contributed only approximately one-half to the exceedance concentration at the downwind site when considering the upwind sample concentration.

4.5 Bio-monitoring Program

The Biomonitoring Program is one of the Lambton Facility's ongoing monitoring programs, which are required by its Certificate of Approval. The Biomonitoring Program provides an indication of trends, through time, in the concentration of analytes within the vicinity of the Lambton Facility. The program uses a network of test sites located up to two kilometres from the facility boundaries. In 2006, 14 test sites were monitored. The fixed-plot design ensures that monitoring can be conducted at the same test sites over a number of years. Each fall, samples from up to four environmental media (soil, ditch sediment, natural grass vegetation and agricultural crops) from each of the test sites are collected and submitted to the analytical laboratory to determine the concentration of selected inorganic and organic analytes or chemicals. The field, analytical and reporting phases of the Biomonitoring Program proceeded as planned during the 2006 field year.

Weather data were not available for the months of August through December, 2006 from Environment Canada. The months of April and June were drier than normal and the months of January, February, March, May and July were wetter than normal in 2006. January to July of 2006 were the same or warmer than normal.

Characterization of the soil indicated that the biomonitoring sites represented the soil types most commonly found in the area surrounding the Lambton Facility. The findings for plant available nutrients, organic matter content, cation exchange capacity, pH and clay content of the soil and ditch sediment were within expected values for southern Ontario and there were no observable spatial trends. The type of soil is significant in that the fate of chemical species deposited on soils is highly dependent on the characteristics of the soil. The bioavailability of a chemical for uptake by plant roots, as well as the mobility of a chemical in the water phase of the soil are closely tied to the affinity of the chemical for the soil solid phase. The soil solid phase is related to the clay and organic matter contents as well as the cation exchange capacity of the soil. Monitoring the accumulation of chemical species in soils and plants that are similar to those found in the area to which one wishes to extrapolate provides confidence that the results represent the neighbouring properties. This is particularly true for this Biomonitoring Program since the soil and crop types are very similar throughout the local area around the Lambton Facility.

The impacts of changes in method detection limits (MDLs) continued to cause concern that concentration exceedances and/or trends identified during the reporting phase represented actual shifts in the concentrations of these analytes in the environment, rather than changes in analytical sensitivity.

Updated site specific and site wide control chart data for the inorganic analytes from 1991 to 2005 were used during data analysis. When control charts are updated, the upper limit (called UL06) or threshold against which exceedances are identified frequently changes. The magnitude and direction of the change depends on the variability in the data and, in some cases, the variability in the MDLs that were used to calculate the control chart upper and lower limits.

Inorganic Analytes: Annual and Long-term Site Specific Findings

In 2006, the concentrations of 17 analytes exceeded their respective upper control limits (UL06) within various environmental media across 12 monitoring sites. Site wide exceedances occurred for two analytes. Based on a review of program data, individual or site wide findings did not appear to be problematic relative to the 2006 field year with the following exceptions: ongoing elevated concentrations of silicon in various media, which are confounded with the change in analytical testing facility; strontium in natural grass and aluminum in natural grass.

Concentration trend lines using linear regression statistics were updated on a site-specific basis for inorganic analytes. The purpose was to identify trends in the concentrations of analytes (i.e. downward, upward, no change) over time. Change in the environment over time is inevitable and may be influenced by many local, regional and global factors. Upward trends, as with downward trends, are expected and confirm the dynamic nature of environmental change. However, due to the presence of the Lambton Facility within the local area, upward trends may warrant further investigation.

Trend lines were developed for 1197 combinations of analyte x matrix x site x sampling depth (soil and sediment only). Twenty-two (22) trend lines (6 downward; 16 upward; $p<0.003$) indicating actual environmental change in analyte concentrations were identified. Six (6) trend lines had a negative or downward slope, which indicated decreases in the concentrations of these analytes (aluminum, barium, boron, iron, potassium) over time (1991 to 2006). Sixteen (16) of these trend lines had a positive or upward slope, which indicated increases in the concentrations of these analytes (calcium, chloride, chromium, magnesium, manganese, phosphorus, potassium, sodium, sulphur, zinc, zirconium) over time (1991 to 2006). Downward trend lines were all associated with natural grass. Upward trend lines were associated with natural grass (4/16), soil (7/16)) and ditch sediment (5/16). Nine of 14 sites (E1, E2, E5, N2, S1, S2, S3, S4, W2) had at least one trend line ($p<0.003$) associated with the site. There were 4/22 trend lines associated with site N2 (2 natural grass, 2 sediment). There were 3/22 trend lines associated with sites E1, E2, E5 and S4, respectively. Sampling depth was approximately 15 cm for all soil and sediment trend lines except potassium in soil at site S3 on the facility grounds where sampling depth was approximately 5 cm. There were no observations ($p<0.003$) for crops as represented by soybeans in the sampling program. (Not enough data on a site specific basis were available for meaningful analyses of other crops (field corn, winter wheat, sugar beets) in the program.)

For the purposes of the Biomonitoring Program, analytes of particular interest met two criteria. They showed an upward trend in concentration within a matrix at a site and they were listed as Group 2 analytes in this project. Based on these criteria, the presence of zinc in the sediment obtained from the drainage ditch at site N2 may warrant further review.

Organic Analytes: Annual Findings

In 2006, six organochlorinated pesticides (OCPs) (p,p'-DDD, p,p'-DDE, p,p'-DDT, dieldrin, endosulfan II and endosulfan sulfate) were detected at very low concentrations in three media (natural grass, soil, ditch sediment). OCPs were not detected in any of the crops (soybean, sugar beet, winter wheat) that were sampled in 2006. PCB and PCP were not detected in any media during the 2006 field year. None of the soil samples contained a concentration of dioxins or furans (PCDD/DF) greater than the Ontario Typical Range (OTR_{98}) for dioxins/furans in Rural Parkland class 1 soil (based on 2,3,7,8-TCDD Toxic Equivalents (TEQ)), which is 0.0048 ng/g. Criteria, against which the values for natural grass and agricultural crops (soybean, sugar beet, winter wheat) could be compared, were not available.

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5. RECOMMENDATIONS

5.1 Site Inspections

The following recommendations are provided based on the quarterly site inspections performed during the 2006/2007 monitoring period:

a) As per the requirements of Section 4.5.2 of the site's Design and Operations Report (as amended in June 2003), a geophysical survey of Sub-cells 11 and 12 should be completed to identify any sand or gravel occurrences, brine seeps, or abandoned oil/gas wells within the footprint of this area, before any waste is placed within the Sub-cells;

b) Sideslope failures are an inherent concern with deep excavations such as Cell 18 and thus Clean Harbors Canada, Inc. should continue routine inspection of the sidewalls of the excavation.

Leachate was observed to have overflowed into the "clean water" sump and trenches located in Sub-cell 10. Future surface water within this area should be treated as leachate until the impacted soils have been excavated from Sub-cells 10 and 11.

5.2 Environmental Monitoring

5.2.1 Monitoring Well Network

All shallow and deep wells have been developed and have been commissioned for inclusion in the annual monitoring program. It is therefore recommended that consideration be given to decommissioning of those shallow wells [TW15-94, OW11-86-III(S) and OW12-86-III(S)] and deep wells [OW11-86-I(D) and OW12-83-I(D)] that are redundant to the monitoring program. These wells have been monitored at the MOE's request, with the understanding that the wells could be decommissioned once the new wells provide data representative of the geologic units in which they have been installed.

Any revisions to the compliance-monitoring program should be reviewed with the MOE prior to their implementation.

5.2.2. Sub-cell 3 Monitoring Well Network

The riser casing for monitoring wells EW1a-01 and EW2a-01 should be extended as the clay cap in Sub-cell 3 is brought to final grade to allow for continued monitoring of these wells. This would involve adding lengths of riser casing to the existing riser pipes for these wells. Monitoring of the Interface Aquifer at the north end of Sub-cell 3 is currently achieved via PW1-N. As such, it is recommended that redundant well TW1-99 be decommissioned to allow for the completion of the clay cap.

Upon completion of the clay cap and achieving final grade in Sub-cell 3, the additional HCL monitoring wells (total of four) should be installed and instrumented with monitoring devices.

5.2.3 Groundwater Chemical Analyses

The current monitoring activities associated with the groundwater chemical analysis should be continued.

In addition, it is recommended that:

a) Given that the historical chemistry of TW47-00D is likely representative of a mixture of natural groundwater at this location being flushed with fresher water, pulled towards Sub-cell 3 by means of the depressurization pumping, it is expected that the currently derived well specific UCLs for this well are artificially low. The trends in chemistry at this location should be monitored and once stable, the UCLs should be recalculated based on the first eight stable samples.

b) TW45-99D is very slow to recover after purging. As such, a sample has not been collected from this well for the past four sampling events. It is recommended that purging procedures be modified for TW45-99D to allow for the collection of a groundwater sample during the next sampling event.

c) Wells TW32-94-IV, TW40-99S, TW46-99S and TW53-03S installed in and adjacent to the northern perimeter berm exhibit chemistry, which is more mineralized (i.e., higher alkalinity, chloride, sodium, potassium and sulphate), than wells, which are removed from the berm. Several of these monitoring wells also exceed the Guideline B-7 values for alkalinity, sulphate, sodium, fluoride, or boron in one or more groundwater samples. The berm is constructed using native clay excavated from the landfill cells prior to waste placement. This material, at depth, has a higher chloride and sodium concentration than the surface material and contains pyrite. Weathering of minerals in the clay following its placement appears to be contributing to the higher concentrations. This phenomenon was first observed in 1994/1995 and no new information is available to refute this conclusion. It is recommended that an investigation be conducted to assess the significance of the weathering of berm materials on the local surface water system, including the roadside ditches.

d) TCE and c-1,2-DCA were detected at TW22-99D at values well below both the ODWS and the derived Guideline B-7 values. It is recommended that this well be resampled for VOCs during the 2007/2008 monitoring period to confirm the presence of these volatiles and to monitor any possible emerging trends in concentration. A possible source of the TCE is deep well disposal activities that were conducted on site in the 1970s. Additional review and investigation is warranted to assess this possibility.

5.2.4 South Berm Performance Monitoring

The south berm, as designed, appears to be acting as a barrier to shallow groundwater/leachate movement from the pre-1986 landfill cells. A meeting between Clean Harbors Canada and the MOE was held on September 2, 2004 to discuss this program. Clean Harbors Canada, Inc. has been awaiting the MOE's decision with respect to discontinuation of this monitoring program since that time.

5.2.5 Cap Integrity Testing

Given the MOE's response to Clean Harbors request to modify the requirements of the Cap Integrity Testing Program, as outlined in the memorandum from the MOE to Clean Harbors (July 22, 2005), the following recommendations should be considered with respect to this program:

a) As outlined in the MOE's memorandum, cap integrity testing of the Cell 16 Cap should next be completed during the 2012 Monitoring Period.

b) Given the nature of the waste in Cell 18 (lower in chloride than waste contained in Cell 16), it is unlikely that a significant diffusion profile will develop in the near future. Therefore, it is recommended that the results of Cap Integrity Testing of the Cell 16 Cap in 2012 be used to determine if and when a significant diffusion profile would be expected to occur in Cell 18. The change in profile in the cap of Cell 16 between 2000 and 2012 will be extrapolated to Cell 18 and used to determine if and when a significant diffusion profile would be expected to occur.

5.2.6 Benthic Study of Equalization Pond

Seasonal variations in the dissolved oxygen content of the pond water may create a potential for anoxic conditions to exist particularly during warm summer months. This in turn, introduces the possibility of sediment-bound pollutants being released in the pond discharge. It is recommended that the scope of data collection and interpretation continue as outlined in the benthic study report (**Appendix J-4**).

5.2.7 Air Monitoring Program

The Clean Harbors fenceline monitoring survey, during summer 2007, was based upon the overall approach and measurement methods used in the previous years' program. The 2003 monitoring was understood to incorporate modifications to the approach used in earlier surveys based upon specific MOE requests. Should this monitoring be required in future years, the following suggestions are provided with intent to optimize the data in meeting the overall requirements:

- Preparation of a fenceline monitoring plan for submission to MOE, which includes specific requirements and potential modifications, with provision to obtain MOE approval and/or acceptance prior to commencement of future monitoring,
- Since speciated VOC monitoring is perceptively important, further consideration should be given to optimize the target compound list. For example, it is relevant to confirm that the target substances being monitored represent known and/or suspected facility releases, as opposed to extraneous compounds in which facility contributions are highly unlikely,
- Similarly, speciated particulate monitoring is considered to be relevant, whereas inclusion of certain elements which have been historically non-detectable, unlikely to be present and/or non-applicable to the high-volume measurement technique should be re-examined (e.g., volatile constituents),

- Unless mercury has been previously detected with confidence in earlier measurements, it is suggested to either delete this requirement and/or revise the measurement methodology to better quantify its occurrence,
- It is suggested to delete the monitoring requirement for carbonyls with the assumption that previous measurements have indicated either non-detectable or very low levels, it is recommended to apply greater focus to naphthalene measurements and possibly verifying the performance of the measurement technique (e.g., intercomparison of available techniques). For example, ascertainment of existing concentrations is particularly relevant especially in view of associated naphthalene control strategy efforts.

5.2.8 Bio-Monitoring Program

A review of the field, analytical and statistical data indicated that follow up should occur as follows:

Analytes:

1. For those analytes where the long-term trend in concentration in a matrix is upward ($p<0.003$), relevant literature should be reviewed as an initial step toward further investigation of the findings especially since the literature was last reviewed in approximately 1997. The finding for zinc, a Group 2 analyte, should be given highest priority.
2. The finding for Group 2 analyte aluminum in 2006 may warrant further investigation to determine the potential cause(s) of the elevated concentration.
3. The findings for strontium in 2006 may warrant further investigation to determine the potential cause(s) of the elevated concentrations.
4. The findings for silicon in 2006 and previous years warrant further investigation to determine the potential cause(s) of the elevated concentrations. It was recommended in the 2005 Annual Report that "specific laboratory accuracy be evaluated by submitting blind samples of a specific standard reference material containing a known amount of silicon, along with the other samples to be collected in 2006/07".

Data Analysis and Reporting:

5. As the size and complexity of the database continues to increase, it is essential that the reporting phase include enough time to carefully review the basis for the findings from the initial statistical analyses. In several instances in 2006, the reason(s) for the findings were explained when the raw data and/or information were reviewed.
6. Monitoring of changes in the MDLs during the program should continue and impacts on the findings should be reported where applicable.
7. When assessing the findings for the Biomonitoring Program the greatest weight should be given to comparisons within and amongst sites monitored in the program versus comparisons with the Ontario ULN and OTR values, which represent aging databases.
8. When control chart data are updated every three years, impacts on the upper limits, which are used to determine annual exceedances, should be discussed i.e. which upper limits were raised, lowered or not changed and why.
9. Site wide trend lines and a review of the long term findings for organic analytes should be conducted for the 2008 Annual Report. This would complete the three year cycle used to update control chart data and review long term findings related to the Biomonitoring Program.
10. The Annual Report for the Biomonitoring Program should include a section that lists conclusions/recommendations from previous reports and the status of follow up actions.

11. The Annual Report should include a section that discusses recurring findings to ensure that this information is brought forward and updated annually so that previous discussions are compiled and either confirmed or revised based on new findings.
12. Assessment of the impact of soil mixing (whether due to tillage or movement of sediment) on the concentrations of analytes in soil or sediment should continue to be part of the Biomonitoring Program. It is recommended that the updated control chart data (1991-2005) and especially the UL06, be revised to represent depth categories, as was done for the control chart data and the UL03 (1991-2002).
13. In future, trend lines should be developed for sub sets of data at lower MDLs where the size of the sub sets of data has increased to $n \geq 6$.
14. As recommended previously, weather information indicating the actual conditions experienced in the vicinity of the Lambton Facility could be provided by an automated, on-site weather station.

Given the location of the biomonitoring sites within a local, regional and global scale, the sites could have been exposed to a number of potential sources of inorganic and organic chemicals or analytes. The concentrations of the identified chemicals were generally within expected levels with exceptions /qualifications as discussed above. The range of results (some of which warranted further investigation) suggests that the Biomonitoring Program is effectively fulfilling its purpose and meeting its specific objectives. The program continues as originally conceived. Development and interpretation of the data should continue.