The Collection of Landfill Monitoring Data at the PIN-3 Lady Franklin Point – 2006 FINAL Report

Prepared for
Defence Construction Canada

Submitted by
Gartner Lee Limited

December 2006

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8 Defence Construction Canada
1 Gartner Lee Limited
1 Kitnuna Corporation

December 19, 2006

Mr. Thuc Nyugen
Defence Construction Canada
Constitution Square, Suite 1720
350 Albert Street
Ottawa, ON K1A 0K3

Dear Mr. Nyugen:

Re: GLL 60-725 – FINAL Report for the 2006 Collection of Landfill Monitoring Data at the PIN-3 Dew Line Site, Lady Franklin Point, Nunavut

We are pleased to submit eight hard copies of the 2006 Final Report on the Collection of Landfill Monitoring Data at the PIN-3 Dew Line Site at Lady Franklin Point, Nunavut. This report documents the data collected from our site visit to the PIN-3 Site on August 14th, 15th, 16th, 17th, and 18th, 2006. In addition to the hard copy reports, we have also attached three digital data discs to the report which contains:

- All numeric data files including analytical results, thermistor data and associated graphs submitted in MS Excel 97-2000;
- All text files submitted in MS Word 97-2000;
- All drawings submitted in AutoCAD Version 2000;
- All photographic records of the geotechnical inspection submitted in digital format and in hardcopy in the location specific report as well;
- All photographic records of the soil samples collected at each location. These have been provided as an attachment to the main report and include an index of the photo numbers and the locations;
- All photographic records of the condition of the thermistor casings along with maintenance report forms;
- All photographic records of the condition of the monitoring wells. These have been provided as attachments to the main report and include an index of the photo numbers and the locations; and
- All field notes have been attached to each specific landfill investigation report.

From the visual analysis, there does not appear to be any significant erosion or cover issues for the landfills.

Soil samples were collected at two depths from each of the eight test pits. Sample results are located within each site report. DCC should compare the laboratory results to their internal DEW Line Site Guidelines to confirm whether the analytical results are in compliance.

Six of the eight wells sampled contained sufficient water for analysis. A full suite of groundwater samples were collected from all wells at the Main Landfill and only wells MW-11 and MW-12 were sampled at the Tier II Disposal Facility. Sample results are located within each site report. DCC should compare the laboratory results to their internal DEW Line Site Guidelines to confirm whether the analytical results are in compliance.

All of the thermistors were downloaded successfully. The batteries were also replaced, and data loggers reset in accordance with the instructions provided by other consultants representing DCC.

Scheduling of the field program for mid August appears to have been successful in improving the potential for recovering groundwater samples, compared to the previous year.

If you have any questions or comments concerning this report, please do not hesitate to call me.

Yours very truly,
KITNUNA CORPORATION AND GARTNER LEE LTD

Dennis Lu, B.Sc.
Environmental Scientist
AHK / Attach.

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1. Introduction

The Department of National Defence (DND) in co-operation with Nunavut Tunngavik Incorporated (NTI) has developed a Landfill Monitoring Plan to address post closure monitoring requirements for the landfills at the DEW Line sites. Defence Construction Canada (DCC) is managing the clean-up monitoring programs on behalf of DND. Kitnuna Corporation and Gartner Lee Limited in a joint venture were awarded the contract for the purposes of providing services for the collection of landfill monitoring data at the PIN-3 Lady Franklin Point Site in the Nunavut Settlement Area for 2006. This report will provide the procedures and the results for interpretation on the monitoring completed in 2006.

2. Background

The PIN-3 Lady Franklin Point DEW Line Site is located on the Southwestern side of Victoria Island at 68^{o} 28' North and 113 ^{o} 13' West in Nunavut Territory. PIN-3 is located approximately 325 km west of Cambridge Bay and 115 km northeast of Kugluktuk.

PIN-3 was converted to a Long Range Radar (LRR) site in the early 1990's. Remediation of the components not required for operation of the LRR commenced in 2002 and was completed in 2004. As part of the cleanup, five landfills were decommissioned, a non-hazardous landfill was constructed for demolition debris, and a soil disposal facility for the containment of contaminated soil was constructed. A total of 6 landfills exist at the PIN-3 site today:

1) Main Landfill
2) NWS Landfill
3) South Landfill – East and West
4) North Landfill
5) Non-Hazardous Waste Landfill
6) DCC Tier II Soil Disposal Facility

The locations of the various landfills are shown on Figure 1. Access to the landfills was gained through on-site roads. The baseline monitoring of the landfills commenced in 2005. Monitoring is to occur every year until 2008. After 2008, monitoring frequency at this site will decrease.

Figure 1. Dew Line Clean Up Monitoring Plan

2.1 Project Objectives

The objective of the landfill monitoring program is to collect sufficient information to assess the performance of the landfill from a geotechnical and environmental perspective. The Landfill Monitoring Plan specified the requirements for the visual inspection as well as the chemical and thermal monitoring of the landfills. The long term monitoring plan consists of visual monitoring for signs of settlement, collection of soil and groundwater samples to evaluate the effectiveness of the leachate containment system, and monitoring of the sub-surface ground temperatures along the toe of and in the main body of the landfill.

2.2 2006 Monitoring Event

On August 15, 16, 17, 18 2006 the field data collection event was conducted at the PIN-3 DEW Line site. The monitoring event consisted of visual inspections, soil sampling, groundwater sampling, and thermal monitoring of the landfills at designated locations.

At each of the landfill locations mentioned above, a field inspection was conducted to observe whether there were any visual signs of impact (such as seepage or stressed vegetation caused by the landfill) and for physical stability. Photographic records of the landfill were taken to show the condition of the landfill and any area of concern that was observed. The observations and the photographic record for each of the landfills is discussed individually in the Site reports presented in Appendices A through F.

Soil sampling was conducted at all of the designated landfills for 2006. Groundwater sampling was conducted at the Main Landfill and the DCC Tier II Soil Disposal Facility. Generally, soil samples were collected at depths of 0.10 m and approximately 0.40 - 0.50 m, although there were some variations in sample depths dependent on the ground conditions. The soil samples were analyzed for Polychlorinated Biphenyls (PCBs), total petroleum hydrocarbons (TPHs) as defined, and inorganic elements. PCBs were analysed for Total Aroclors, TPH is defined by the Canadian Council of Ministers of the Environment (CCME) Canada Wide Standards (CWS) Fraction 1 to Fraction 3 and the inorganic elements were analysed for total metals using low level detection limits.

The analytical results for each sampled landfill are discussed individually in the Site reports presented in Appendices A through F.

Where possible, groundwater elevations were measured at each observation well for the landfills designated to be monitored in 2006. The monitoring conditions and field measurements were documented and collected at each monitoring well. The field measurements included the following: presence and thickness of free product (if applicable), depth to bottom of well, stick up height and visual

condition of the observation well. Groundwater samples were collected from the 2006 designated observation wells that had sufficient water volumes to obtain samples. The water samples were obtained utilizing a peristaltic pump for low flow extraction. Disposable tubing was used in every well. The samples were analyzed for PCBs, TPHs, and inorganic elements.

The field methods for collecting the groundwater samples followed the QA/QC protocols and sampling requirements as requested in the Terms of Reference. The monitoring wells were purged at a rate equivalent or less than 100 ml/min with a peristaltic pump. Field chemistry measurements were taken at monitoring wells that were sampled. Further discussion regarding the field measurements, the field chemistry and the analytical results are discussed in the Site reports presented in Appendices A and F. The well development records and well condition records are appended to the relevant sections in Appendices A and F.

Thermal Monitoring was conducted at the Main Landfill and the DCC Tier II Soil Disposal Facility in 2006. The data was downloaded from the system using the Lakewoods Systems Ltd. software. The information downloaded is further discussed in the individual Site Reports presented in Appendices A and F.

3. Landfill Monitoring

As requested by DCC, Gartner Lee has presented the landfill monitoring reports as individual reports under the cover of this main report. The Landfill Monitoring Reports for each locality are presented in the appendices of this main report as follows:

Appendix A Main Landfill;
Appendix B NWS Landfill;
Appendix C South Landfill – East and West;
Appendix D North Landfill;
Appendix E Non-Hazardous Waste Landfill; and
Appendix F Tier II Soil Disposal Facility.

All information collected that is relevant to these individual areas is presented in these sections or as attachments at the end of the sections.

4. Quality Assurance/Quality Control

For the soil and groundwater samples collected, a blind duplicate was collected approximately every tenth sample collected. Tables used for the calculation of RSDs are located in Appendix H.

A total of six (6) blind duplicate soil samples and three (3) blind duplicate groundwater samples were collected for submission. 10% of all samples were submitted to each ALS Environmental and Maxxam Analytical for analysis and an additional 10% of samples were submitted to the Environmental Services Group for archival purposes. No blank groundwater sample was collected in the 2006 sampling event. The soil and water samples submitted and the corresponding sample locations are documented in Table 1.

Table 1. Blind Duplicates

Sample Identification	Duplicate of Sample	Sample Location	Depth (m)	Matrix (soil/water)	Landfill	Laboratory
TP-17	TP-3	MW-6	0.1	soil	Main Landfill	ALS
TP-18	TP-4	MW-6	0.5	soil	Main Landfill	ALS
TP-19	TP-13	MW-11	0.1	soil	Tier II	Maxxam
TP-20	TP-14	MW-11	0.5	soil	Tier II	Maxxam
TP-21	TP-13	MW-11	0.1	soil	Tier II	ESG
TP-22	TP-14	MW-11	0.5	soil	Tier II	ESG
MW-6	MW-5	MW-11	-	water	Tier II	ALS
MW-7	MW-5	MW-11	-	water	Tier II	Maxxam
MW-8	MW-5	MW-11	-	water	Tier II	ESG

Soil samples TP-17 and TP-18 were submitted to ALS Environmental in Vancouver for analysis, samples TP-19 and TP-20 were submitted to Maxxam PSC Analytical Services in Vancouver for analysis to verify the validity of the analysis results. Samples TP-21 and TP22 were submitted to the Environmental Services Group for archiving.

A total of 4 duplicate pairs of soil were submitted for analysis. Each sample was analysed for 14 parameters yielding a total of 56 sets of numbers to be calculated for relative standard deviation (RSD). Of the fifty six (56) RSDs calculated, thirty five (35) sets returned a value of "n/a" due to one or both concentrations being below the detection limit. Eleven (11) sets returned an acceptable RSD of below 20% for inorganics and 30%for organics and ten (10) sets returned unacceptable RSDs.

Duplicate pair TP3 and TP17 returned values exceeding the RSD target for Chromium and Copper. Chromium returned a RSD of 22%. Due to the low concentrations of Chromium, a higher variance is likely. The method detection limit (MDL) for Chromium is 2.0 mg/kg; as both samples are within three times the MDL, a higher RSD is expected. Copper returned a RSD of 41%, soil in the top 15 cm of the test pit ranged from peat and fine sandy silt in a plant root matrix near surface to fine sand below. A slight change in matrix within the same sample depth may be enough to affect the concentration.

Duplicate pair TP-4 and TP-18 returned a value exceeding the RSD target for CCME CWS Fraction 2 (C10-C16). Due to the low concentrations of CCME CWS Fraction 2, a higher variance is likely. The method detection limit (MDL) for F2 is 5.0 mg/kg; as both samples are within three times the MDL, a higher RSD is expected.

Duplicate pair TP-13 and TP-19 returned values exceeding the RSD target for Arsenic, Chromium, Copper, Lead and Zinc with values of 29%, 22%, 21%, 64% and 48% respectively. Soil in the top 15 cm of the test pit ranged from peat and fine sandy silt in plant root matrix near surface to a medium grained sand below. A slight change in matrix within the same sample depth may be enough to affect the concentration. Chromium and Lead concentrations were also within three times the MDL which could lead to higher variance.

Duplicate pair TP-14 and TP-20 returned values exceeding the RSD target for Arsenic and Chromium. Arsenic returned an RSD of 28%, grain size in the bottom portion of the test pit ranged from medium sand to cobble size material. A slight change in matrix within the same sample depth may be enough to affect the concentration. Chromium returned a RSD of 31%. Due to the low concentrations of Chromium, a higher variance is likely. The method detection limit (MDL) for Chromium is 2.0 mg/kg; as both samples are within three times the MDL, a higher RSD is expected.

Three blind duplicates were taken at groundwater sample location MW-11 (sample MW-5). Sample MW-6 was submitted to ALS Environmental, MW-7 was submitted to Maxxam PSC Analytical Services and MW-8 was submitted to the ESG for archiving. Each sample was analysed for 11 parameters yielding a total of 22 sets of numbers to be calculated for RSD. Of the twenty two (22) RSDs calculated, twenty one returned a value of "n/a" due to one or both concentrations being below the detection limit and one (1) RSD returned a value above the acceptable RSD goal of 20% for inorganics and 30% for organics.

Duplicate pair MW-5 and MW-6 returned a value exceeding the target for Zinc. Due to the low concentrations of Zinc, a higher variance is likely. The method detection limit (MDL) for Zinc is 0.025 mg/kg; as both samples are within three times the MDL, a higher RSD is expected.

Although RSDs exceed limits, concentrations were near detection limits and results are considered suitable for the intent of the monitoring program.

5. Conclusions

From the visual analysis during the site visit, there does not appear to be any significant erosion or cover issues that require immediate attention or that would be expected to lead to degraded cover performance in the near term. The effectiveness of a visual inspection relies in large part on the ability to detect relative changes in the surface contours and elevations. The existing relatively rough final grade of several of the landfill covers (Tier II in particular) does not lend itself to effective visual inspection as the pre-existing construction irregularities mask all but large and obvious changes.

No as-built survey records are available for the PIN-3 landfills.

Soil samples were collected at the designated locations in 2006. Two samples were collected at the each location. Minor concentrations of detectable hydrocarbons were noted in two test pits at the Main Landfill and three test pits at the DCC Tier II Disposal Facility. Inspections of the chromatograms reveal that the minor hydrocarbon concentrations are likely caused by naturally occurring organics in the peat found on site. The chromatograms and field observations agree with the correlation of naturally occurring organics in the peat layer.

In 2006, groundwater samples were collected from 6 of the 8 monitoring wells at the site. The mid-August timing of the sampling appears to have occurred during maximum thaw. There does not appear to be any significant issues with groundwater quality issues.

6. Limitations

This report has been prepared as an assessment of the environmental condition of the subject site located at Lady Franklin Point, Nunavut. The monitoring and investigation programs as described in this report, were conducted in a manner consistent with that level of care and skill normally exercised by other members of the engineering and science professions currently practising under similar conditions, subject to the time limits and financial and physical constraints applicable to the services.

The assessment of environmental conditions and possible hazards at this Site has been made using the results of chemical analysis of soil/sediment and groundwater from a limited number of locations. The Site conditions between sampling locations have been inferred based on conditions observed at sampling locations. Subsurface conditions may vary from those encountered at the sample locations.

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

The content of this report is based on information collected during our investigation, our present understanding of the Site conditions, and our professional judgement in light of such information at the time of this report. This report provides a professional opinion and therefore no warranty is either expressed, implied, or made as to the conclusions, advice and recommendations offered in this report. This report does not provide a legal opinion regarding compliance with applicable laws. With respect to regulatory compliance issues, it should be noted that regulatory statutes and the interpretation of regulatory statutes are subject to change.

The findings and conclusions of this report are valid only as of the date of this report. If new information is discovered in future work, including excavations, borings, or other studies, GLL should be requested to re-evaluate the conclusions of this report, and to provide amendments as required.

If you should have any questions regarding this report, please contact the undersigned at your convenience.

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Appendices

Appendix A

Landfill Monitoring Report – Main Landfill

Appendix B

Landfill Monitoring Report - NWS Landfill

Appendix C

Landfill Monitoring Report - South Landfill – East and West

Appendix D

Landfill Monitoring Report - North Landfill

Appendix E

Landfill Monitoring Report – Non-Hazardous Waste Landfill

Appendix F

Landfill Monitoring - Tier II Soil Disposal Facility

Appendix G

Laboratory Reports

Appendix H

QA/QC