Long-Term Monitoring, 2011
CAM-F, Sarcpa Lake, Nunavut

FINAL REPORT

Prepared for:

Aboriginal Affairs and Northern Development Canada
Nunavut Regional Office
P.O. Box 2200
Iqaluit, Nunavut
X0A 0H0

Prepared by:

Franz Environmental Inc.
329 Churchill Avenue, Suite 200
Ottawa, Ontario
K1Z 5B8
Tel. (613) 721-0555
Fax: (613) 721-0029

Project No. 1697-1101
January11th , 2010

EXECUTIVE SUMMARY

Franz Environmental Inc. (FRANZ) was retained by Aboriginal Affairs and Northern Development Canada (AANDC) to conduct the fourth year of long-term monitoring activities at the former CAM-F Distant Early Warning (DEW) Line site at Sarcpa Lake, Nunavut as prescribed by INAC's CAM-F Sarcpa Lake Long-Term Monitoring Plan. This project was completed under AANDC standing offer number 01-11-6001/5, call-up number 01; file number 1632-11/01-011-6001/5.

The CAM-F Sarcpa Lake site is located on the Melville Peninsula in the Baffin Region of Nunavut, 110 km southwest of Igloolik and 85 km west of Hall Beach. CAM-F was an Intermediate DEW line site constructed in 1957 and operated until 1963. The site was used as a scientific research station between 1977 and 1988.

An environmental remediation project was conducted at the site between 2005 and 2008. Activities included the demolition and disposal of buildings, structures and other debris, as well as the cleanup of hazardous materials. A secure soil disposal facility (SSDF) and non-hazardous waste landfill (NHWL) were constructed during remediation to contain some of the demolished materials and excavated soils. These structures remain present at the site.

FRANZ conducted the field activities for the fourth year of the CAM-F long-term monitoring program on August 27 and 28, 2011, while based in the nearby community of Hall Beach.

Physical observations from the 2011 field activities, it appears that the two landfills, SSDF and NHWL, are performing as designed and are containing the enclosed waste. At no time during the present monitoring year has the active layer reached depths equal to or greater than the depth of the liner and the waste contained within.

Based on climate data collected at the Hall Beach airport weather station, 2011 was on average a cooler year than 2010, however temperatures recorded in the SSDF seem to indicate that the landfill was cooler in 2010 than in 2011. It is possible climate data from coastal Hall Beach is not as representative of local climate conditions for CAM-F as is presently assumed. The Hall Beach climate data remains the most representative climate data record available for the site. Thermal monitoring data suggest that the temperature below ground surface within the SSDF may have increased since the low established in 2009. Due to the natural variability over the short term of climactic data such as temperature, FRANZ is not able to draw any conclusions with respect to the significance of a perceived trend in the observed year to year temperature variability of the SSDF. Thermal monitoring data indicate that the waste contained within the SSDF remained frozen year-round in 2010-2011.

In addition to physical and temperature observations, FRANZ collected soil and groundwater samples to assess the performance of the SSDF. No groundwater samples could be collected at the NHWL as the wells were dry. Analytical results for soil samples collected in the vicinity of the SSDF satisfy guidelines for contaminants of potential concern at the site. Concentrations of contaminants of concern in groundwater samples are below the acceptable maximum when compared with historical results with exception of total copper, lead, and nickel for MW06-6. The increase in the concentration of the three metals may have been due to the high concentration of total suspended solids in the sample.

As a result of the physical and thermal observations and analytical results of the 2011 field program it appears that its facilities continue to operate as designed and that the site poses no imminent threat to the natural environment. Based on field observations, FRANZ recommends that:

1. Should signs of seepage persist or new signs of landfill deterioration appear near any of the seepage points noted in 2011, collection of a soil sample from one of the seepage points on the SSDF should be added to the monitoring program.

This executive summary should be read in conjunction with the main report and is subject to the same limitations described in Section 9.0.

TABLE OF CONTENTS

LIST OF FIGURES (Appendix A)

LIST OF TABLES

LIST OF APPENDICES

1.0 INTRODUCTION

Franz Environmental Inc. (FRANZ) was retained by Aboriginal Affairs and Northern Development Canada – Nunavut Regional Office (AANDC), formerly Indian and Northern Affairs Canada (INAC), to complete year four of the CAM-F DEW Line long-term monitoring plan. This project was completed under AANDC standing offer number 01-11-6001/5, call-up number 01; file number 1632-11/01-011-6001/5.

This report describes the monitoring activities completed in 2011 at the former DEW Line station, Sarcpa Lake, Nunavut. It was prepared in accordance with the FRANZ Proposal No. P-3756, dated June 30, 2011, the Call-up Details, dated July 11, 2011, the Project Initiating Meeting Minutes, dated July 19, 2011, the Project Initiating Meeting #2 Minutes, dated August 8, 2011 and Addendum to the Proposal, dated July 5, 2011.

Throughout this report the former DEW Line site, CAM-F, at Sarcpa Lake, Nunavut, will be referenced as “the site”.

1.1 Project Objectives

The objective of the 2011 long-term monitoring was to complete the fourth monitoring event the performance of the SSDF and NHWL to ensure that they are performing as intended. This included visual observations, chemical analyses (where warranted and possible) and interviews with members of the nearby community knowledgeable of local activities at the site to determine the condition of the natural environment and whether the site infrastructure is performing as designed.

1.2 Scope of Work

Consistent with previous years monitoring activity, the scope of work undertaken at the site in 2011 was as described in the 2007 CAM-F Sarcpa Lake Long-Term Monitoring (LTM) plan ((INAC, 2007) was as follows:

1. Visual Monitoring of the Non-Hazardous Waste Landfill (NHWL) and Secure Soil Disposal Facility (SSDF), including:
    - Checking the physical integrity of the SSDF and NHWL and observing any evidence of erosion, ponding, frost action, settlement and lateral movement and completing a Visual Monitoring Checklist.
    - Taking photographs to document the condition of the SSDF and NHWL, and substantiate the recorded observations.

2. Active Layer Water Monitoring of the SSDF, including:
    - Collection of samples from the two monitoring wells installed downgradient of the SSDF and the one well installed upgradient.
    - Examination and analysis of the samples for colour, odour, hardness, pH, conductivity, temperature, total and dissolved metals (arsenic, cadmium, chromium, cobalt, copper, lead, nickel, and zinc), polychlorinated biphenyls (PCBs), total petroleum hydrocarbons (TPH), major ions, total dissolved solids (TDS) and total suspended solids (TSS).
3. Soil Monitoring in the area around the SSDF, including:
    - The collection of soil samples from the toe of the SSDF in the vicinity of the monitoring wells.
    - Analysis of the soil samples for metals (arsenic, cadmium, chromium, cobalt, copper, lead, nickel, and zinc), PCBs and TPH.
4. Thermal Monitoring of the SSDF, including:
    - Collection of data from automatic data loggers attached to 4 thermistor strings with beads at selected intervals to provide ground temperature profiles at various locations within the SSDF.
5. Natural Environment Monitoring
6. Preparation of a report documenting the 2011 monitoring program.

In addition the work outlined in the Long-Term Monitoring Plan, additional items were added to the scope of work in the Addendum to the Proposal, dated July 5, 2011 and were as follows:

1. Monitor water levels in three wells around the non-hazardous waste landfill at CAM-F;
2. Collect one water sample from each well and one duplicate sample;
3. Analyze data and report conclusions associated with the three wells around the landfill as part of the CAM-F report.

To fulfill the scope of work as described above, FRANZ along with AANDC, devised a work plan that included the following tasks:

a) Preparation of a health and safety plan;
b) Preparation of a sampling plan for soil and groundwater;
c) Excavation of test pits;
d) Collection of soil samples for chemical analysis;
e) Obtaining groundwater samples from wells for chemical analysis;

f) Inspection of thermistor installations and collection of data logger information;
g) Interpretation of analytical data;
h) Visual inspection, measurement and photo documentation of the site;
i) Interviewing local residents and officials to understand land use and wildlife trends; and
j) Reporting.

The work plan for the 2011 field work was based mainly on the following documents: CAM-F Sarcpa Lake Long-Term Monitoring Plan (INAC, 2007), the 2008, 2009, and 2010 monitoring program reports (UMA, 2008 and FRANZ, 2009, 2010), the UMA/AECOM borehole logs and well installation records and the Biogénie thermistor installation records.

1.3 Report Format

The long-term monitoring report presented herein is structured as follows:

Chapter 1 – Introduction: Provides general background information and outlines the scope and objectives of this study.

Chapter 2 – Background Information: Describes the history, the regional and physical setting and the general characteristics of the site.

Chapter 3 – Regulatory Guidelines: Presents the evaluation guidelines used for the assessment of chemical impacts and provides context for the use of certain environmental quality guidelines to assess impacts and screen chemicals of concern.

Chapter 4 – Investigative Methodology: Presents the methodology, level of effort and details of the field investigations.

Chapters 5 – Summary of SSDF Conditions: Describes the physical characteristics and the chemical impacts, and distributions with respect to applicable regulatory guidelines of the SSDF.

Chapters 6 – Summary of NHWL Conditions: Describes the physical characteristics of the NHWL.

Chapter 7 – Surrounding Areas and Natural Environment: Describes the physical conditions of the remainder of the study area, including flora and fauna.

Chapter 8 – Conclusions and Recommendations: Presents main findings and conclusions as well as recommendations for the next site visit.

2.0 BACKGROUND INFORMATION

2.1 Site Description

CAM-F Sarcpa Lake, Nunavut was an Intermediate Distant Early Warning (DEW) Line site, constructed in 1957 and later abandoned in 1963. It was converted into a scientific research station in 1977 under the Science Institute of the Northwest Territories and Canada, Department of Indian Affairs and Northern Development, and operated seasonally until 1988. A remediation project was conducted at the site between 2005 and 2008. The remediation involved the demolition and disposal of buildings, structures and other debris, as well as the cleanup of hazardous materials. Contaminated soil was excavated and either shipped off site or placed in a secure soil disposal facility on site.

The CAM-F site consists of two main parts - the station area and the former construction camp area at Sarcpa Lake. Before remediation was completed in 2008, site facilities consisted of an airstrip, small module train, warehouse, garage, a Quonset hut, an Inuit house, two former landfill areas, and petroleum, oil and lubricants (POL) storage facilities. Before the remediation was completed, the site contained approximately 10,000 barrels of unknown contents, a radar tower that had been dismantled, other site debris and contaminated soil. There were also some miscellaneous waste and chemical residues remaining from the research facility. The beach area at Sarcpa Lake included a former construction camp that consisted primarily of scattered barrels of unknown contents (in and around the lake), abandoned construction equipment, and a small machine shop and generator pad.

A Secure Soil Disposal Facility (SSDF) and Non-hazardous Waste Landfill (NHWL) were constructed during remediation from July 2006 to September 2007 (Figures A-2 and A-3, Appendix A, respectively).

The SSDF was designed to contain non-hazardous contaminated soils. The design was based on the characteristics of the contaminants in the soil and the local geothermal and permafrost properties. The design uses permafrost as the primary containment barrier with both the contents and perimeter berms remaining in a frozen state. It was assumed that the SSDF would reach a frozen state within 3-4 years of construction, and ground temperature data loggers were installed at each of the four corners of the facility to monitor the freeze back of the contents and berms. The thickness of the cover material was calculated to prevent the thaw of the contaminated soil even after 10 consecutive 1-in-100 warm years. In response to Arctic climate change studies, the initial design was modified in 2007 and an additional metre of cover was added, increasing the total cover material from 2.3 to 3.3 metres. The SSDF contains the following:

- Tier II contaminated soil (as defined by the DEW Line Cleanup Criteria, presented in INAC's Abandoned Military Site Remediation Protocol, AMSRP.); and
- Petroleum hydrocarbon (PHC) contaminated soils (benzene, toluene, ethylbenzene and xylenes (BTEX), PHC fractions F1 and F2).

The NHWL was designed to contain non-hazardous materials only. It was constructed on the natural ground surface with the organic matter stripped and consists of four perimeter berms constructed of granular material. The non-hazardous waste was placed in the landfill in layers consisting of 0.5 m lifts of waste covered by 0.15 m of granular fill. The waste layers were compacted and a final cover consisting of a minimum of 3.3 m of granular fill was used to cap the landfill. The NHWL contains the following:

- Tier I contaminated soil (i.e., soil with lead content between 200 and 500 parts per million (ppm) and PCB content between 1 and 5 ppm)
- Petroleum hydrocarbon fractions F3 and F4 contaminated soil
- Non-hazardous demolition debris, such as timbers, plywood, and sheet metal
- Non-hazardous site debris, such as scrap metal and wood
- Non-hazardous debris/soil excavated from landfills
- Creosote timbers
- Double-bagged asbestos

The site is not regularly inhabited; in addition, wells at the site would tend to freeze due to the presence of permafrost, therefore groundwater is not considered to be used for water supply purposes. The area is known to be used by hunters and fishermen, who often make use of the cabin that was restored during the remedial activity.

2.2 Previous Monitoring Programs

Prior to the field program, FRANZ reviewed the following reports pertaining to the CAM-F DEW Line site, which include previous site investigations and remedial activities:

- CAM-F Sarcpa Lake Long-Term Monitoring Plan, January 23, 2007, Indian and Northern Affairs Canada.
- CAM-F Borehole Logs, UMA/AECOM, July 24, 2006.
- CAM-F SSDF Monitoring Well Installations, February 17, 2005, UMA Engineering Ltd.
- Long Term Monitoring 2008, CAM-F DEW Line Site, NU, January 8, 2009, UMA Engineering Ltd.
- Long Term Monitoring 2009, CAM-F Sarcpa Lake, Nunavut, November 27, 2009, Franz Environmental Inc.
- Long Term Monitoring 2010, CAM-F Sarcpa Lake, Nunavut, December 10, 2010, Franz Environmental Inc.

- Abandoned Military Site Remediation Protocol, March 2009, Indian and Northern Affairs Canada, Contaminated Sites Program.

2.3 CAM-F Long-Term Monitoring Plan

The 2011 monitoring program was the fourth of a proposed 10 that are scheduled over a 25 year period. Information from the 2008, 2009, and 2010 investigations were incorporated into this year's sampling plan. Data collected in 2008, 2009, and 2010 were combined with the latest data, as well as that from pre-landfill construction in 2006 and 2007, and analyzed.

As part of the investigation, information was gathered though a member of the Hall Beach Hunters and Trappers Association. Land use by both humans and wildlife were discussed.

Monitoring procedures adopted by AANDC for this site are based on those defined in the INAC Abandoned Military Site Remediation Protocol.

3.0 REGULATORY AND OTHER GUIDELINES

3.1 Guideline Review

Where guidelines were developed, criteria presented in the CAM-F Sarcpa Lake Long-Term Monitoring Plan (INAC, 2007) were used to compare both soil and groundwater analytical results. Federal and select provincial guidelines were applied where site-specific criteria were absent and/or were less strict the federal and provincial standards.

Soil analytical results were compared to the Canadian Council of Ministers of the Environment (CCME) Canadian Environmental Quality Guidelines, specifically the *Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health* (CSQGs) and the *Canada-Wide Standards for Petroleum Hydrocarbons in Soil* (CWS-PHC). These guidelines are applied to most federal contaminated sites. The guidelines are numerical limits intended to maintain, improve or protect environmental quality and human health at contaminated sites. They are derived using toxicological data and aesthetic considerations.

The CSQGs (CCME, 1999) are a subsection of the Canadian Environmental Quality Guidelines. The CSQGs are derived to approximate a no- to low- effect level (or threshold level) based only on scientific data, including toxicology, fate, and behaviour. The CSQGs are based on direct contact, ingestion, and inhalation toxicity data, and were developed to protect receptors exposed indirectly to contaminants of concern. Fact sheets are provided for 32 compounds. The benzene, toluene, ethylbenzene and xylenes fact sheets were used to obtain regulatory criteria for this report.

The CWS-PHC (CCME, 2008a) present criteria for petroleum hydrocarbons in soil. These numerical standards are based on the assessment and consistent management of risks posed to humans, plants, animals and environmental processes under four common land uses (agricultural, residential/parkland, commercial and industrial). Under Tier 1 of the CWS, specific numerical levels are presented for the four land uses, two soil textures (coarse and fine) and the four defined petroleum hydrocarbon fractions (F1 (nC_6-nC_{10}); F2 (nC_{10}-nC_{16}); F3 (nC_{16}-nC_{34}) and F4 (nC_{34}+)).

The CWS-PHC also include the option to generate Tier 2 levels where site-specific information indicates that site conditions exist that modify human or ecological exposure to PHC contamination. Such conditions may alter risks significantly relative to the generic conditions that were used to derive Tier 1 levels. A third tier in the CWS-PHC involves developing site-specific cleanup levels and management options using general and site-specific information in conducting a risk assessment.

The CAM-F former DEW Line site is a federal site, and is therefore exempt from territorial regulation; however, future disposition of the site may make it subject to territorial environmental guidelines. Because the Nunavut environmental guidelines are based on the work of the CCME, the federal and territorial guidelines often coincide.

The governing guideline for soil at contaminated sites in Nunavut is the *Environmental Guideline for Contaminated Site Remediation* (EGCSR), published by the Government of Nunavut in March, 2009. The criteria for Petroleum Hydrocarbons (PHC) in soil are found in Section 2.4, and are adapted from the CCME's CWS-PHC. The criteria for other compounds in soil are found in Table A-4 of Appendix 4 of the EGCSR, and are obtained from the CSQGs, published in the *Canadian Environmental Quality Guidelines* (CCME, 1999, updated 2007). The criteria are numerical limits intended to maintain, improve or protect environmental quality and human health at contaminated sites. Because the EGCSR is based on federal standards and has been updated recently, FRANZ does not expect that there are any discrepancies between the federal standards applied to the site and the Nunavut guidelines.

3.2 Groundwater

There are no groundwater guidelines provided in the CAM-F LTM plan. In the absence of site-specific guidelines, the AMSRP guidance on post-construction monitoring indicates that "comparison to background and baseline values is recommended." The AMSRP provides the following table for the assessment of analytical data in groundwater.

Table 3-1: Groundwater Assessment

Geochemical Assessment	Acceptable	Marginal	Significant	Unacceptable
Groundwater concentrations within average ± three standard deviations or within analytical variability	Performing as expected			
Increasing trend in contaminant data over 2 or more successive monitoring events (variation in excess of average ± three standard deviations or analytical variability)		Low risk of failure		
Groundwater concentrations in excess of three times average baseline concentrations in more than one monitoring event			Moderate risk of failure	
Where applicable, surface water concentrations in excess of surface water quality guidelines for the protection of aquatic life				Failure

Geochemical Assessment	Acceptable	Marginal	Significant	Unacceptable
Required Actions	Monitor as per schedule	Increase monitoring frequency. Monitor surface water quality, if applicable, in downgradient water bodies within 300 m.	Assess causes of increasing contaminant concentrations. Evaluate whether remediation is required.	Assess cause of contaminant concentrations. Develop remedial plan. Implement remedial plan.

This table is reproduced from AMSRP Chapter 11, Table 4.2

FRANZ has used historical data presented in previous reports to obtain the mean and standard deviation of monitoring conducted from 2006 to 2010 for comparison with results from the 2011 field program. This data is collected in Tables B-8 and B-9 for groundwater and B-10 for soil, presented in Appendix B.

FRANZ obtained acceptable values for groundwater results from these tables (calculated as mean plus or minus three standard deviations). Maximum acceptable values from these ranges are presented in groundwater analytical tables in Appendix B.

For some parameters, specifically BTEX, sufficient data to support calculations of mean and standard deviation were not available. This is primarily due to the high frequency of not detected (nd) results for BTEX compounds in collected samples.

3.3 Soil

The soil standards or guidelines adopted for this evaluation are as follows:

- CAM-F Sarcpa Lake Long-Term Monitoring Plan (INAC, 2007) – Table 2, DEW Line Cleanup Criteria Tier II Contaminant Criteria for metals and PCBs.
- *Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health* (CCME, 1999, with updates) for residential/parkland use, including fact sheets for benzene, toluene, ethylbenzene, and xylenes. Non-potable groundwater is stipulated and coarse grain material is assumed based on a 2009 grain-size analysis, field observation (generally sandy material) as well as for conservative reasons – being that coarse grain criteria are more stringent than those applied to fine grain.
- *Canada-Wide Standards for Petroleum Hydrocarbons in Soil* (CCME, 2008a) - Tier 1 residential/parkland use, coarse-grained soil, non-potable groundwater.

As a preliminary and conservative determination of protection of human health and the environment at the site, Tier 1 levels of the CWS are applied to all analytical results where site specific values are not specified. The appropriate levels are presented with the laboratory analytical data in tables. The rationale for the selection of the appropriate criteria is discussed below.

BTEX Compounds

For the BTEX compounds specifically, the CSQGs were used to determine the appropriate pathway-specific guidelines. For benzene, for example, the 2004 update was used, with the following assumptions:

- Residential/Parkland land use
- Coarse-grained soils
- 10^{-5} acceptable incremental risk
- With applicable guidelines the most conservative of:
  - Soil dermal contact guideline
  - Soil ingestion guideline
  - Eco soil contact

The groundwater check (drinking water) pathway was excluded, as groundwater in the area of Sarcpa Lake is not used as a source of potable water. With its exclusion, the most conservative guideline for benzene applicable at the site is related to the protection of the pathway for the inhalation of indoor air (slab on grade), at 0.095 mg/kg; however, there are no buildings near either the NHWL or the SSDF (the hunting shelter is sufficiently far from both that it is not likely to be affected by vapour intrusion). The most conservative remaining guideline is therefore the ecological soil contact guideline, at 31 mg/kg. A similar process was used to determine the most conservative applicable guideline value for toluene, ethylbenzene and xylenes.

Petroleum Hydrocarbons

For petroleum hydrocarbons, the CWS-PHC was used to determine the appropriate pathway-specific guidelines. Pathway-specific guidelines can be found in the CWS-PHC Technical Supplement (CCME, 2008c).

4.0 INVESTIGATIVE METHODOLOGY

The monitoring program was carried out at the CAM-F DEW Line site on August 27 and 28, 2011. During the field investigations, weather conditions were sunny with temperatures around 8°C. The monitoring program included the following tasks:

- Completing a Health & Safety Kick-off Meeting;
- Visually observing and photographically documenting the physical integrity of the landfill and the reporting on the observable conditions over the rest of the site;
- Natural environment monitoring and gathering information from knowledgeable persons regarding local wildlife and human activity;
- Collecting landfill temperature data from previously installed thermistor strings;
- Sampling of groundwater and soil from designated locations at the site;
- Measuring headspace vapour concentrations in the soil samples and various physical parameters in the water samples; and
- Submission of soil and groundwater samples, including duplicates, for applicable laboratory analysis.

The field investigation procedures are described below.

4.1 Health & Safety Plan

Before commencing with site activities, a site-specific health and safety plan (HASP) was developed. The HASP identified and provided mitigative actions for potential physical and chemical hazards associated with the monitoring work. The HASP also contained a listing of emergency contact numbers and provided protocols to follow in the event of an emergency.

A copy of the HASP was presented to AANDC for review and approval before site activities began. This plan was distributed and discussed with all personnel involved in the investigative program prior to conducting any work on-site. A copy of the HASP has been retained on file at FRANZ and at the AANDC Nunavut Regional Office.

4.2 Visual Inspections

The physical integrity of the SSDF, NHWL, and surrounding areas were assessed using systematic visual observations and empirical measurements to record evidence of erosion, ponding, frost action, settlement and lateral movement of the landfills. A visual monitoring checklist, presented in the CAM-F LTM plan, was completed for each landfill. A photographic record was completed to document the condition of the structures and substantiate the visual observations. A portion of this photographic record appears in Appendix B; and is presented in its entirety on the accompanying CD ROM.

The 2011 visual inspection was conducted with the aid of a Trimble Pro XRT GPS unit to locate features of note and to collect GIS information to be used in report preparation. A detailed data dictionary (Trimble file) was created prior to the site visit to capture all required information as outlined in the long-term monitoring plan. An SSF file and the data dictionary (trimble file) are included in the appended CD ROM to be used in future site investigations.

4.3 Wildlife Survey

FRANZ recorded observations of the natural environment made during the site visit including direct sightings of wildlife, other evidence of wildlife (e.g., droppings, tracks, feathers/fur), wildlife activities (migrating, nesting, etc.), numerical estimates of wildlife, and vegetation observations.

As part of the investigation, information was gathered from the wildlife monitor, Lily Arnaqguaq, a member of the Hall Beach Hunters and Trappers Association. Land use by both humans and wildlife were discussed. For added continuity, it is recommended that the same wildlife monitor be employed during future monitoring events at the site, if possible.

A discussion of the recorded observations and information obtained is presented in Section 7.0 of this report.

4.4 Thermistor Monitoring

A thermistor string was installed at each of the four corners of the SSDF in September 2007. Each string consists of 11 or 12 temperature sensing thermocouple beads connected to a Lakewood Systems UltraLogger data logger, programmed to continually record values twice daily at 0h00 and 12h00.

At the time of inspection all thermistor strings appeared to be functioning well. Thermistor data for the period from September 2010 to August 2011 were downloaded from each logger, using a laptop and portable power supply, and inspected on site to ensure completeness. Data logger battery voltages were noted and a visual inspection of the housing equipment was performed. Desiccant cartridges were replaced on all four thermistor, as recommended in the previous monitoring report (FRANZ, 2010). Each logger was then restarted to begin collecting temperature information anew.

The SSDF ground temperature record, containing continuous information since September 2007 was updated. A discussion, along with plots of temperature versus depth and time, is presented in section 5.4. The annual maintenance report, which also contains a basic description of the data logger systems, can be found in Table B-11, Appendix B. Raw data is provided on the attached CD-ROM.

4.5 Groundwater and Soil Sampling

The groundwater and soil sampling methodology conformed to guidance provided in the following documents:

- CCME EPC-NCS62E *Guidance Manual on Sampling, Analysis, and Data Management for Contaminated Sites - Volume I: Main Report*, Dec 93 (CCME catalogue - http://www.ccme.ca/assets/pdf/pn_1101_e.pdf);
- CCME EPC-NCS66E *Guidance Manual on Sampling, Analysis, and Data Management for Contaminated Sites - Volume II: Analytical Method Summaries*, Dec 93 (CCME catalogue - http://www.ccme.ca/assets/pdf/pn_1103_e.pdf);
- INAC *CAM-F Sarcpa Lake Long-Term Monitoring Plan* (INAC, 2009); and
- INAC *Abandoned Military Site Remediation Protocol*, Contaminated Sites Program (INAC, 2009).

4.5.1 Groundwater Sampling

Groundwater was sampled at three predetermined locations: one upgradient (MW06-04) and two downgradient (MW06-05 and MW06-06) of the SSDF; MW06-06 had poor recharge rate and was sampled over two days. Samples could not be collected from the NHWL as MW0602 and MW0603 were dry and MW0601 only had 22 cm of water and very limited recharge; the recharge rate of MW06-06 at the SSDF was very limited. A Geopump brand persistaltic pump was used to purge the designated monitoring wells. Wells were purged of three well volumes except where poor recharge rates made it necessary to sample sooner. A Horiba U-22 water quality meter was calibrated and used to measure in-situ field parameters including temperature, conductivity, dissolved oxygen, turbidity, pH and oxidation-reduction potential. Sampling took place when these parameters stabilized. Water samples submitted for total metals analyses were not field-filtered but were filtered for dissolved metals. A summary of the status of the monitoring wells is found in Table 5-3, Section 5.3.

Sampling locations were selected as described in *CAM-F Sarcpa Lake Long-Term Monitoring Plan* and were the same as those sampled during the previous years' monitoring events.

A summary of the samples that were collected and submitted for laboratory analysis during the groundwater sampling activities is provided in Table 4-1 below. Groundwater sample logs and notes are included in Appendix C.

Table 4-1: Summary of groundwater sample collection near the SSDF.

SSDF Area	Sample	Analytical Parameters
Upgradient	MW06-04	- total and dissolved metals - PCBs - petroleum hydrocarbon fractions F1-F4 and BTEX - inorganics (major ions, TDS, TSS, colour, pH, conductivity)
	AH-1*	
Downgradient	MW06-05	
	MW06-06	

Note: * indicates a blind field duplicate of the sample listed directly above.

All samples were stored immediately in laboratory prepared sample bottles (for future laboratory analysis). Water samples for laboratory analysis were stored in laboratory supplied coolers equipped with ice from the time of collection until delivery to the laboratory.

Additional details on the groundwater sampling are presented in the groundwater sample records provided in Appendix C.

4.5.2 Test Pitting and Soil Sampling

Soil sampling was completed by manual test pitting. Three test pits, identified as TP11-1, TP11-2 and TP11-3 were manually advanced in the vicinity of the SSDF at the locations specified in the long-term monitoring plan. Samples were collected within a two to four metre radius of the monitoring wells. Background samples located at the benchmarks to the east and west of the SSDF were not sampled this year in accordance with the long-term monitoring plan. All locations were the same as those sampled during the previous years' monitoring events.

Test pitting was performed using a shovel, decontaminated with Alconox between sample collections. Composite soil samples were collected from the side wall of each test pit at two discrete intervals: 0 – 15 cm and 40 to 50 cm below ground surface. The soil sample interval was specified by further identifying samples as (0-15) or (40-50). Soil samples were collected from each test pit and placed into laboratory prepared jars for potential chemical analyses. Discrete soil samples and blind duplicates were collected as grab samples using disposable nitrile gloves for each sample. Fresh, sterile gloves were used at each sample location. Soil stratigraphy was logged and photos taken before backfilling the test pits with excavated soil.

A total of six soil samples were collected and submitted for laboratory analysis for petroleum hydrocarbons (PHCs) fractions F1-F4 and benzene, toluene, ethylbenzene and xylenes (BTEX) as well as metals and polychlorinated biphenyls (PCBs). Two field duplicate samples (DUP-T and DUP-B) were also submitted for analysis for QA/QC purposes. Professional judgment and visual observations were used to select the samples submitted for laboratory analysis. Samples submitted for laboratory analysis were stored in laboratory supplied coolers equipped with ice from the time of collection until delivery to the laboratory.

A summary of the samples that were collected and submitted for laboratory analysis during the test pitting activities is provided in Table 4-2 below.

Table 4-2: Summary of soil sample collection near the SSDF.

SSDF Area	Sample	Depth (mbgs)
Upgradient	TP11-1T	0 – 0.15
	TP11-1B	0.4 – 0.5
Downgradient	TP11-2T	0 – 0.15
	TP11-2B	0.4 – 0.5
	TP11-3T	0 – 0.15
	DUP T*	0 – 0.15
	TP11-3B	0.4 – 0.5
	DUP B*	0.4 – 0.5

Note: * indicates a blind field duplicate of the sample listed above.
mbgs = metres below ground surface.

Test pit locations for the SSDF area are indicated on Figure A-2, Appendix A and additional details on the soil samples collected are presented in the test pit logs provided in Appendix C. No test pits were excavated as part of the NHWL monitoring program.

4.6 Quality Assurance and Quality Control

Field personnel employed FRANZ's Quality Assurance/Quality Control (QA/QC) protocols, including appropriate techniques for soil sampling, sample storage, shipping and handling, as well as collection of duplicates.

4.6.1 Field

Soil samples collected for potential laboratory analysis were placed in polyethylene bags and laboratory prepared 60 mL and 125 mL glass jars fitted with screw-tight Teflon-lined lids. Groundwater samples were collected from monitoring wells and placed in a variety of appropriately sized and prepared laboratory vessels. Sample numbers were clearly marked on the containers. The soil jars and water bottles were filled to capacity with minimum headspace and stored in coolers with cold packs to moderate temperature fluctuations during transport to the laboratory. To prevent cross contamination, samples were collected with fresh nitrile gloves. Where soil samples were impossible to obtain by hand, a stainless steel trowel or shovel was used and decontaminated between samples.

As a quality control measure, two soil and one groundwater blind field duplicate samples were collected and analyzed for PHC fractions F1-F4, BTEX, metals and PCBs. The water samples were also analyzed for additional parameters, such as major ions, colour, pH, conductivity, total dissolved solids, etc.

The samples were transported to the project laboratory accompanied by a Chain of Custody form. Copies of the Chain of Custody forms are provided in Appendix D.

Analytical results from these samples were compared with the analytical results from previous annual monitoring events.

4.6.2 Laboratory

To assess the reliability of the laboratory data, duplicate samples were taken for approximately every five samples collected by FRANZ. Two blind field duplicates were collected in the soil sampling program, and one blind field duplicate was collected in the groundwater sampling program.

For soil duplicates, FRANZ personnel generated the duplicate samples by alternately placing approximately 50 percent of the sample volume into the primary sample container and then placing the same amount into the duplicate container. For water sample duplicates the field staff placed aliquots of approximately 50 percent of the container volume into each container until both containers were filled.

Analytical data quality was assessed by submission of the following:

- Soil samples TP11-3T (primary) and DUP-T (soil duplicate), and TP11-3B (primary) and DUP-B (soil duplicate) were analyzed for petroleum hydrocarbons (PHC), polychlorinated biphenyls (PCBs) and metals.
- Groundwater sample MW06-04 (primary) and AH-1 (water duplicate) was analyzed PHC, PCBs, metals, conductivity, pH, colour and temperature.

Sampling procedures and laboratory analytical precision are evaluated by calculating the relative percent difference (RPD) for a sample and duplicate pair according the following equation:

$$RPD = | X_1 – X_2 | / X_{avg} \times 100$$

where: X_1 and X_2 are the duplicate concentrations and X_{avg} is the mean of these two values. The duplicate results were evaluated using criteria developed by Zeiner (1994), which draws from several data validation guidelines developed by the United States Environmental Protection Agency (USEPA). According to these criteria, the RPD for duplicate samples should be less than 20% for aqueous samples, and less than 40% for solid samples. RPDs can only be calculated when the compound is detected in both the original and the duplicate sample at a concentration five times above the reportable detection limit (or method detection limit - MDL). Alternative criteria are used to evaluate duplicate pairs where one or both of the results are less than five times the MDL, or where one or both of the results is less than the MDL (i.e. nd or 'not-detected'). The alternative criteria used for the evaluation of the data, adapted from Zeiner (1994), are presented in Table 4-3 below. When both concentrations are less than the MDL, no calculation/evaluation criterion is required.

Table 4-3: Criteria for the Evaluation of Blind and Duplicate Sample Results

Scenario	**Result A**	**Result B**	**Criteria for Acceptance**	
			Aqueous (water)	**Soil (Soil)**
A	nd	nd	Acceptable precision; no evaluation required	
B	nd	positive	result B – 0.5 x MDL < MDL	result B – 0.5 x MDL < 2 x MDL
C	positive and > 5 x MDL	positive and > 5 x MDL	RPD < 20%	RPD < 40%
D	positive and < or = 5 x MDL	positive	|result B – result A| < MDL[1]	|result B – result A| < 2 x MDL[1]

Source: Zeiner, S.T., Realistic Criteria for the Evaluation of Field Duplicate Sample Results, Proceedings of Superfund XV, November 29-December 1, 1994, Sheraton Washington Hotel, Washington, D.C. – modified to use Method Detection Limit (MDL) or Reportable Detection Limit (RDL) in lieu of the Quantitation Limit (QL), the Instrument Detection Limit (IDL) and/or Laboratory Reporting Limit (LRL).

Notes:

nd – not detected

RPD – relative percent difference, |result A - result B| / |(result A + result B)/2|

1. When result reported was less than half the quantitation limit, half the limit was used in the equation.

The precision is considered acceptable when the evaluation criteria are met or when both results are below the MDL. When the evaluation criteria are not satisfied, the following apply:

- nd vs. positive – unacceptable precision: the positive result is considered an estimate and the nd result is considered inconclusive.
- Positive vs. positive – unacceptable precision: the results are considered an estimate.

Refer to Appendix E for a discussion on QA/QC results.

4.7 Laboratory Analytical Program

Soil and groundwater samples were sent to Maxxam Analytics in Ottawa, Ontario for chemical analyses of the target compounds previously identified. Maxxam is certified by the Canadian Association for Laboratory Accreditation, Inc. (CALA) and has an internal QA/QC protocol. The laboratory QA/QC documentation is provided with the analytical report and was reviewed by FRANZ as part of the QA/QC protocol. The laboratory certificates of analysis and chain of custody forms are presented in Appendix D.

5.0 SUMMARY OF SSDF CONDITIONS

5.1 Area Summary

The SSDF is located at north of the east end of the airstrip of the CAM-F site. The monitoring of the SSDF landfill included visual observations to assess its physical integrity, including evidence for erosion, ponding, frost action, settlement and lateral movement. Groundwater and soil samples were also collected at locations up- and downgradient of the SSDF.

The SSDF soil and groundwater sample locations and photographic viewpoints are shown on Figure A-2, Appendix A. The visual inspection report, including supporting photos and drawing, is presented in Sections 5.2 and 5.3 below.

5.2 Photographic Record

The photographic record of the SSDF has been completed as per the Statement of Work (Photographs 1 to 84; attached CD-ROM). Copies of the photographs that are referenced in the body of this document are provided in Appendix F, where photograph captions provide the landfill viewpoint number (as seen on Figure A-2; Appendix A) where applicable. The complete photographic record, including full-resolution photographs, is contained in the attached CD-ROM.

5.3 Visual Inspection Report

Monitoring consisted, in part, of visual observations of the SSDF to assess its physical integrity, by collecting evidence of erosion, ponding, frost action, settlement and lateral movement. A plan view of the SSDF indicating photographic viewpoints, observed salient features, and locations of ground water monitoring wells is presented in Figure A-2; Appendix A. The visual inspection of the SSDF and surrounding area was conducted on August 27, 2011. The visual monitoring checklist was completed using the format requested by AANDC and is presented as Table 5-3 of this report. Field notes relating to the visual inspection are included in Appendix G. Table 5-1 and Table 5-2 present the preliminary visual inspection results for 2011 monitoring of the NHWL at CAM-F.

Table 5-1: Preliminary Visual Inspection Report SSDF Landfill

Feature	Presence (Y/N)	Severity Rating	Extent
Settlement	Y	Acceptable	Occasional
Erosion	Y	Acceptable	Occasional
Frost Action	Y	Acceptable	Isolated
Animal Borrows	N	Not Observed	None
Vegetation	Y	Acceptable	Isolated
Staining	N	Not Observed	None
Vegetation Stress	N	Not Observed	None
Seepage / Ponded Water	Y	Acceptable	Occasional
Debris Exposure	N	Not Observed	None

Feature	Presence (Y/N)	Severity Rating	Extent
Monitoring Well Condition	Y	Good condition - Acceptable	
Overall Landfill Performance	**Acceptable**		

Table 5-2: Preliminary Visual Inspection Report SSDF - Definitions

Performance / Severity Rating	Description
Acceptable	Noted features are of little consequence. The landfill is performing as designed. Minor deviations in environmental or physical performance may be observed, such as isolated areas of erosion, settlement.
Marginal	Physical/environmental performance appears to be deteriorating with time. Observations may include an increase in size or number of features of note, such as differential settlement, erosion or cracking. No significant impact on landfill stability to date, but potential for failure is assessed as low or moderate.
Significant	Significant or potentially significant changes affecting landfill stability, such as significant changes in slope geometry, significant erosion or differential settlement; scarp development. The potential for failure is assessed as imminent.
Unacceptable	Stability of landfill is compromised to the extent that ability to contain waste materials is compromised. Examples may include: • Debris exposed in erosion channels or areas of differential settlement. • Liner exposed. • Slope failure.
Extent	**Description**
Isolated	Singular feature
Occasional	Features of note occurring at irregular intervals/locations
Numerous	Many features of note, impacted less than 50% of the surface area of the landfill
Extensive	Impacting greater than 50% of the surface area of the landfill

Based on the minimal erosion, settlement, frost action, burrowing, staining and seepage observed, the performance of the SSDF, with respect to containment, was rated as satisfactory. The evidence observed suggests the structure is performing as designed.

<u>Settlement</u>

The minor settlement that was observed over most of the southern half of the SSDF in 2009 was not evident during the 2011 site inspection visit, suggesting that the complete top of the SSDF has settled more evenly as was also observed in 2010. The depth of settling over the area appears small; it has taken place to approximately the same depth as in 2008, 2009, and 2010.

Settlement depressions A and B (Figure A-2; Appendix A) were observed to the north and northeast of the landfill extents, with no significant change from previous monitoring events.

These features do not pose any risk to the landfills integrity. Minor settlement cracking was observed along the landfill's perimeter, generally located approximately 4 m up the face of the berm from the toe (see features C, D, F, K, M, O, and T; Figure A-2; Appendix A). Although the additional observed settlement cracking is minor, it does indicate that the toe of the landfill has settled slightly from the previous site visit in 2010.

Erosion

The small preferred-drainage channels observed in previous years at the toe on the southwest side of the SSDF are still apparent (see features I, J, N, and Q; Figure A-2; Appendix A). Based on a comparison with photo documentation from 2008, 2009, and 2010, there does not appear to be an appreciable increase in the size of these channels.

Rip rap has been exposed in a small, localized area, where fine-grained fill has been washed out on some of the structure's slopes and top, although no significant change from previous years is apparent. A few new, small, scattered potholes have formed in one area on the eastern side of the SSDF. Potholes elsewhere over the structure were observed in 2008, 2009, and 2010 and it would appear that the top and sides of the SSDF have not noticeably worsened in this respect. The large section of exposed rip rap along the southern edge roughly coincides with the area where Type 1 Granular Fill was used to construct the SSDF; the presumably smaller diameter, Type 2 Granular Fill was used to cover the remainder of the SSDF surface. It is unlikely, therefore, that this exposed rip rap is due to erosion.

The erosion observed in 2011 has not increased significantly since the 2010 landfill inspection.

Frost Action

No evidence of heaving or cracking was observed on the top or on the berms of the SSDF. Additionally, no frost action was observed at any of the thermistor housing units or at the surface (0-10 cm depth) or subsurface (40-50 cm depth) near the monitoring wells.

Evidence of Burrowing Animals

Indications of burrowing animals were not observed on or around the SSDF.

Vegetation

Vegetative re-growth was observed mainly in one location (see feature S; Figure A-2; Appendix A) on the southeast corner of the SSDF berm; however, other indications of vegetative re-growth were also observed in lesser concentrations along the entire band of the SSDF landfill at the approximate level of the seepage points V, P, L, and H (Figure A-2; Appendix A). It is believed that these passive seepage points may actually help to aid in the re-vegetation process.

Staining

No staining on or around the SSDF was observed.

Seepage Points

As in previous years, no ponding was observed on top of the landfill.

Active Seepage

Five active seepage points (see features I, J, N, Q, and R; Figure A-2; Appendix A) were observed along the southern toe of the landfill. Three of the active seepage points (I, J, and N; Figure A-2; Appendix A) exhibited active flowing water during the 2011 site visit. Two of the seepage points (I and Q; Figure A-2; Appendix A) terminated at standing ponded water. In comparison to previous site visits, the volume of seepage water appears to have increased; however, the 2011 site visit occurred after several days of persistent rain and fog in the region which may be directly linked to the apparent increase in seepage volumes observed. A close relationship between active seepage and recent precipitation events is further supported by the apparent absence of seepage points observed in 2009, a year in which there had been no rainfall recorded in the days before the site visit.

Feature R contained heavily saturated soil, but did not exhibit the free flowing nature of the other observed seepage points during the 2011 site visit.

These active seepage features directly correlate with the observations of erosion noted above. These features should be monitored closely, as they may present a pathway for landfill contents should the seepages worsen in subsequent years. Consideration could be given to collecting a soil sample in one of these locations should the seepage persist.

Passive Seepage

Four passive seepage points (see features H, L, P, and V; Figure A-2; Appendix A) were identified along the southeastern, southern and western sides of the SSDF. The passive seepage points were very moist but not fully saturated. No rivulets or erosion channels had yet formed, however. Lesser bands of seemingly moist soil connected these seepage features laterally around the majority of the landfill.

These passive seepage points were roughly half way up the SSDF sides, and are at or below the depth of permafrost within the landfill (as established from temperature data in section 5.4). It is believed that these passive seepage features are a result of the freeze thaw cycle at the landfill. Consideration could be given to collecting a soil sample in one of these locations should the seepage persist.

Debris

Other than the same small wooden bench on top of the landfill surface observed in previous site inspections, exposed debris was not observed.

Discussion

Based on the minimal erosion, settlement, frost action, burrowing, staining and seepage observed, the performance of the SSDF, with respect to containment, was rated as satisfactory. The evidence observed suggests the structure is performing as designed.

It is estimated that some of the passive seepage points may be below the depth of permafrost (as established from temperature data in section 5.4) and the depth to the contaminated soil (3.3 m below landfill top). It is not expected, however, that this is a sign of failure. The landfill sides with southern exposure are likely to absorb more incoming solar radiation than the top of the landfill, and can thus be expected to have a slightly deeper active layer than the landfill top. A greater apparent depth of thawing on the sides is not unexpected and the observed seepage may be originating from moisture in the active layer on top of the landfill, seeping downward, wetting the berm faces at lower elevations. Temperature data from the four corners of the SSDF suggest that even at these relatively outer portions of the landfill, the contaminated soil lies within a zone that remains frozen throughout the year (see Section 5.4).

The moist to saturated seepage points on the sides of the SSDF and the active seepage points along the base of the landfill, however, should be carefully observed for evidence of increasing seepage and erosion during future site inspections. The amount of precipitation in the Sarcpa Lake area during the week preceding the 2012 monitoring visit should be noted to further substantiate the mechanism of observed seepage. The visual inspection report, including supporting photos and drawing, is presented in Table 5-3 below.

Table 5-3: CAM-F Sarcpa Lake – SSDF Visual Inspection

Checklist Item	Feature Letter	Relative Location	Length (m)	Width (m)	Depth (m)	Extent	Description (Change)	Additional Comments	Photo Reference
Settlement	A	Near the road, 12 m east of northeast of MW604	20 m^2		0.02	<1%	Ponded water		54
Settlement	B	Near the road, 14 m north of the SSDF northwest corner	28 m^2		0.1	<1%	Large Depression		55
Settlement	C	Along toe of the landfill, at the northwest corner of the SSDF	12	0.005	0.01	<1%	Minor cracking and a slightly low lying area		56-57
Settlement	D	Along the northwest side of the landfill, 12 m south of the northwest corner of the SSDF	16	0.005	0.01	<1%	Minor settlement cracks		58-59
Settlement	E	Along the side of the landfill , near toe of the SSDF along the west side, 31 m south of the northwest corner	16 m^2		0.12	<1%	Minor settlement and cracking, Pothole		60-62
Settlement	F	Along the side of the landfill , near toe of the SSDF along the west side, 33 m north of the southwest corner	25	0.005	0.025	<1%	Minor settlement cracks		63
Settlement	G	Along the side of the landfill , near toe of the SSDF along the west side, 35 m north of the southwest corner	0.03 m^3			<1%	Two small settlement features - potholes		64-65
Seepage	H	Along the side of the landfill in the southwest corner of the SSDF	16 m^2		N/A	<1%	Dark, saturated soil, not actively running		66
Seepage	I	Toe of the landfill in the southwest corner of the SSDF	13.4 m^2		0.25	<1%	Seepage area. Two drainage courses, actively seeping with ponded water	North ponded area	67-68
			41 m^2		0.25	<1%		South ponded area	
			7	1	0.15	<1%		North channel	
			8.8	1	0.2	<1%		South channel	
Seepage	J	14 m southeast from the southwest corner of the SSDF near the toe	7.3	0.5	0.15	<1%	Active Seepage		69
Settlement	K	9 m east from the southwest corner of the SSDF along side of landfill	13.6	0.005	0.01	<1%	Cracking		70 -71
Seepage	L	15 m east from the southwest corner of the SSDF along side of landfill	19.7 m^2		N/A	<1%	Dark saturated soil – long linear feature		17
Settlement	M	37 m east from the southwest corner of the SSDF along side of landfill	16.5	0.01	0.05	<1%	Very minor settlement cracking		72
Seepage	N	28 m east from the southwest corner of the SSDF near the toe	9.6	0.05	N/A	<1%	Seepage face and associated drainage	Seepage Face	73 -74
			40	0.4	0.3	<1%		Drainage channel	
Settlement	O	24 m west from the southeast corner of the SSDF along side of landfill	12.5	0.005	0.01	<1%	Minor settlement cracking		74 and 46
Seepage	P	20 m west from the southeast corner of the SSDF along side of landfill	42.9 m^2		N/A	<1%	Dark saturated soil		26

<table>
<tr><th>Checklist Item</th><th>Feature Letter</th><th>Relative Location</th><th>Length (m)</th><th>Width (m)</th><th>Depth (m)</th><th>Extent</th><th>Description (Change)</th><th>Additional Comments</th><th>Photo Reference</th></tr>
<tr><td rowspan="4">Seepage</td><td rowspan="4">Q</td><td rowspan="4">11 m west from the southeast corner of the SSDF at the toe of the landfill</td><td>12</td><td>0.05</td><td>N/A</td><td><1%</td><td rowspan="4">Seepage face, associated drainage and ponded water</td><td>Seepage Face</td><td rowspan="4">76-77</td></tr>
<tr><td>0.25</td><td>0.45</td><td>0.25</td><td><1%</td><td>West channel</td></tr>
<tr><td>0.15</td><td>0.4</td><td>0.15</td><td><1%</td><td>East channel</td></tr>
<tr><td colspan="2">42 m^2</td><td>0.2</td><td><1%</td><td>Ponded water</td></tr>
<tr><td rowspan="2">Seepage</td><td rowspan="2">R</td><td rowspan="2">Southeast corner of the SSDF at toe</td><td>11.1</td><td>0.1</td><td>N/A</td><td><1%</td><td rowspan="2">Seepage face and saturated soil area with ponded water</td><td>Seepage face</td><td rowspan="2">23</td></tr>
<tr><td colspan="2">32 m^2</td><td>N/A</td><td><1%</td><td>Saturated soil area</td></tr>
<tr><td>Vegetation</td><td>S</td><td>Southeast corner of the SSDF along the side slope</td><td colspan="3">N/A</td><td><1%</td><td>Area of vegetation</td><td>Beginning of re-vegetation</td><td>79</td></tr>
<tr><td rowspan="2">Settlement</td><td rowspan="2">T</td><td rowspan="2">40 m north from the southeast corner of the SSDF along the side slope</td><td>7.8</td><td>0.01</td><td>0.01</td><td rowspan="2"><1%</td><td rowspan="2">Settlement cracks</td><td>South crack</td><td>80</td></tr>
<tr><td>8.9</td><td>0.01</td><td>0.01</td><td>North crack</td><td></td></tr>
<tr><td>Settlement</td><td>U</td><td>28 m south from the northeast corner of the SSDF along the side slope</td><td colspan="2">10.1 m^2</td><td>0.2</td><td><1%</td><td>Settlement/depressions</td><td></td><td>81</td></tr>
<tr><td>Seepage</td><td>V</td><td>18 m south from the northeast corner of the SSDF along the side slope</td><td colspan="2">29 m2</td><td>N/A</td><td><1%</td><td>Dark saturated soil with very sparse vegetation</td><td></td><td>36 and 38</td></tr>
</table>

Note: Measurements for relative location were taken from the landfill corner at the toe to the center of the feature of note.

5.4 Thermal Monitoring Data

As described in the initial annual monitoring report (UMA, 2008), two thermistor strings (01-VT and 02-VT) are installed from the SSDF surface to the top of the key trench, while two strings (03-VT and 04-VT) are installed from 1.5 m below the surface to the middle of the key trench. To compensate for predictions made in the most recent (at the time of installation) global warming study, an additional one metre (1 m) of fill was placed on top of the landfill in 2007, raising the elevation of the thermistors accordingly. Despite the raised elevation of each of the thermistor strings from the original design, their current depths seem to provide sufficient information to evaluate the essential thermal conditions within the facility.

A complete memory transfer was successfully performed on each thermistor data logger. The position of the 0ºC isotherm was calculated at each location from ground temperatures collected on August 24, 2011 and compared to the position as determined from the previous years' data (Table 5-4). The maximum depth of the active layer – depth to the 0 ºC isotherm, or permafrost – was also interpolated from the deepest points during the year at which temperatures straddled the freezing point. A sample plot of depth versus temperature (at each thermistor bead for string 01-VT) for a day at the end of each month over the previous year is presented in Figure A-4, Appendix A, while the temperature variation at depth over the life of the landfill for thermistor 01-VT is shown on Figure A-5, Appendix A.

Table 5-4: Depths to active layer in the SSDF (m). All values interpolated.

Thermistor	01-VT	02-VT	03-VT	04-VT
Aug 24, 2008	1.7	2.2	2.4	2.0
Aug 24, 2009	1.8	2.2	2.3	2.2
Aug 24, 2010	1.7	2.2	2.3	2.2
Aug 24, 2011	1.8	2.1	2.3	2.2
Max between Sept 19, 2007 and Aug 24, 2008 (date established (YYYY-MM-DD))	Permafrost not yet established.		6.8 (2007-09-19)	6.0 (2007-09-19)
Max between Aug 25, 2008 and Aug 24, 2009 (date established (YYYY-MM-DD))	1.8 (2009-08-22)	2.3 (2008-09-07)	2.5 (2008-09-07)	2.2 (2009-08-24)
Max between Aug 25, 2009 and Aug 24, 2010 (date established (YYYY-MM-DD))	1.8 (2009-09- 5 to 7)	2.2 (2009-09-07)	2.4 (2009-09- 6 to 11)	2.2 (2009-09-03)
Max between Aug 25, 2010 and Aug 24, 2011 (date established (YYYY-MM-DD))	1.8 (2010-09-08)	2.3 (2010-09-08)	2.4 (2010-09-10)	2.3 (2010-09-10)

From the data in Table 5-4, it would appear that the active layer has been relatively stable over the past year.

The average temperature recorded at Hall Beach was cooler in 2010-2011 than in 2009-2010; however the average temperature of the thermistors at 3.3 m below ground surface (bgs) increased compared to the previous year. Although the SSDF was found to be slightly warmer in 2011 than in 2009 and 2010, the contents of the landfill at the liner depth and below did remain frozen throughout the year (Table 5-5).

Table 5-5: Average annual temperatures at various locations for the period from August 25 to August 24 (ºC).

Year		**2007-2008**	**2008-2009**	**2009-2010**	**2010-2011**
Hall Beach		-13.3	-12.8	-10.8	-11.6
SSDF surface (bead 1 of 01-VT & 02-VT)		N/A	-11.1	-9.3	-9.2
Average temperature at 3.3 m below SSDF surface.	**01-VT**	N/A	-8.7	-8.1	-7.0
	02-VT	N/A	-8.0	-7.4	-6.6
	03-VT*	N/A	-8.7	-7.8	-7.1
	04-VT*	N/A	-10.0	-8.7	-7.9
Maximum temperature at 3.3 m below SSDF surface.	**01-VT**	N/A	-1.4	-1.7	-1.7
	02-VT	N/A	-0.9	-1.4	-1.3
	03-VT*	N/A	-1.0	-1.4	-1.3
	04-VT*	N/A	-1.5	-1.6	-1.4

*interpolated values.

While conditions were slightly cooler from August 25, 2010 to August 24, 2011, the average surface temperature at the SSDF was 0.1°C warmer than the previous year. The annual maximum temperature at 3.3 m bgs was unchanged from the previous year at 01-VT, it increased by 0.1°C in thermistors 02-VT and 03-VT and increased by 0.2°C in 04-VT. Note that the dates over which the annual temperatures were averaged, as selected in Figure A-6; Appendix A, were selected to allow comparison of the maximum of three years worth of data, the first reliable data being logged around October 1, 2007. The average temperature at 3.3 m bgs has increased since the low established in 2009, despite the lower average annual temperature from August 25, 2010 to August 24, 2011 (see Figure A-6; Appendix A). Factors other than surface air temperature may affect landfill thermal regime, including snow and cloud cover, data for which is difficult to collect. Additionally, Environment Canada records have incomplete climate data for the nearby weather station at Hall Beach.

Additional details can be found in the thermistor annual maintenance monitoring report (Table B-11, Appendix B). Field notes relating to the thermistor inspection are included in Appendix G. A verification of the data collected by the thermistors was performed by comparing the logged temperature versus the recorded resistance. Results indicate that all temperature sensing beads of the four thermistor strings are functioning well. Details of the tests can be seen in Table B-12, Appendix B.

Additional thermistor inspection details, concerning field monitoring issues, field verification options and data cable pin-out, are included in Appendix H.

5.5 Analytical Results – Groundwater Samples

As described in section 4.5.1, a total of four groundwater samples (three samples plus one blind duplicate) were submitted to Maxxam Analytics in Ottawa, Ontario for analyses of petroleum hydrocarbons (PHCs), metals, PCBs and inorganic parameters. Analytical results are discussed below. As suggested in AMSRP Chapter 11 "Post-Construction Monitoring," FRANZ compared analytical results to the mean of previous data. The AMSRP indicates that where groundwater concentrations are within the range of the average ± three standard deviations, the landfill is performing acceptably. Historical averages and standard deviations for groundwater are presented in Table B-8 and B-9.

PHCs

Analytical results and maximum acceptable concentrations (based on historical results) for PHCs in groundwater are shown in Table B-1; Appendix B. Concentrations for all parameters were below laboratory reportable detection limits and thus fall below the maximum acceptable concentrations. While historical data does not permit the meaningful calculation of mean and standard deviations for BTEX compounds, none of these compounds exceeded detection limits.

Metals

Analytical results and the maximum acceptable concentrations (based on historical results) for dissolved and total metals in groundwater are shown in Table B-2; Appendix B. The groundwater sample collected from MW06-06 had total copper (54 µg/L), total nickel (130 µg/L), and total lead (6.6 µg/L) concentrations above the maximum acceptable concentrations derived from the mean data as per the AMSRP of 52 µg/L, 33 µg/L, and 2 µg/L respectively.

For additional context and purposes of comparison, the concentrations of total copper, nickel, and lead were compared to the Ontario Ministry of the Environment (MOE) *Soil, Ground Water and Sediment Standards for the use under Park XV.1 of the Environmental Protection Act (April 2011)* Table 3: Full Depth Generic Site Conditions Standards in a Non-Potable Ground Water Condition. Concentrations of total copper, nickel, and lead in groundwater from MW06-06 were well below the MOE standards of 87 µg/L for copper, 490 µg/L for nickel, and 25 µg/L for lead. None of the other parameters in the samples collected in 2011 were above the mean of previous samples plus three standard deviations.

Groundwater sampling conditions were not ideal at MW06-06 as there was a limited amount of water in the well and it had limited recharge (refer to monitoring well sampling records in Appendix C). The sample at MW06-06 was collected over two days and the well was pumped dry several times. This could have lead to the relatively high concentration of total suspended solids (TSS) in the sample collected at MW06-06. The TSS of the sample was approximately three times higher than in previous years, and at least five times higher than in samples collected from other two wells in 2011 (refer to Table B-4; Appendix B). The suspended solids in the unfiltered total metals sample may contribute to increased total copper, nickel, and lead concentrations. The groundwater sample collected from MW06-05, also downgradient of the SSDF and adjacent to MW06-06, did not contain elevated concentrations of total copper, nickel, or lead. MW06-05 had better recharge and did not require sampling over a two day period; in addition the sample from this well had the lowest amount of TSS measured in 2011.

PCBs

Laboratory analytical results and the maximum acceptable concentration (based on historical results) for PCBs are shown in Table B-3; Appendix B. As shown in the table, concentrations were below the RDLs and thus satisfy the standards applied to the site.

Inorganics

Laboratory analytical results and selected provincial standards and federal guidelines for inorganics are shown in Table B-4; Appendix B. Concentrations were within maximum acceptable concentrations where values were available.

The following changes in groundwater chemistry were observed:

- New historical maxima for total copper (46 µg/L to 54 µg/L), total nickel (38.8 µg/L to 130 µg/L) and total lead (1 µg/L to 7 µg/L).
- A new acceptable range for total lead was established from not calculated to 0 < 2.
- Increase of over three times the previous concentrations of total copper, nickel, and lead.

Laboratory certificates of analyses for the 2011 groundwater samples are provided in Appendix D.

5.6 Analytical Results – Soil Samples

As described in section 4.5.2, a total of eight soil samples (six samples plus two blind duplicates) were submitted to Maxxam Analytics in Ottawa, Ontario for analyses of PHCs, metals and PCBs. Obtained analytical results are discussed below.

PHCs

Laboratory analytical results and selected provincial standards and federal guidelines for PHCs are shown in Table B-5; Appendix B. As shown in the table, concentrations satisfied the selected standards and guidelines applied to the site.

Metals

Laboratory analytical results and selected federal and site specific criteria for metals are shown in Table B-6; Appendix B. As shown in the table, concentrations satisfied the guideline criteria applied to the site.

PCBs

Laboratory analytical results and selected federal guidelines for PCBs are shown in Table B-7; Appendix B. Neither provincial nor site-specific guidelines exist for PCBs and federal guidelines provide a criterion for total PCBs only. As shown in the table, concentrations satisfied the guideline criterion applied to the site.

There was no significant soil chemistry change since previous monitoring events (refer to Table B-10).

Laboratory certificates of analyses for the 2011 soil samples are provided in Appendix D.

6.0 SUMMARY OF NHWL CONDITIONS

6.1 Area Summary

The NHWL is located to the northwest of the SSDL. The monitoring of the SSDF landfill included visual observations to assess its physical integrity, including evidence for erosion, ponding, frost action, settlement and lateral movement. No groundwater samples could be collected from the wells at the NHWL as MW0602 and MW0603 were dry and MW0601 only had 22 cm of water and very limited recharge. The LTM plan did not include the collection of soil samples at the NHWL unless warranted by observations made during the visual inspection.

A plan view of the NHWL indicating photographic viewpoints can be seen in Figure A-3, Appendix A. The visual inspection report, including supporting photos and drawing, is presented in sections 6.2 and 6.3 below.

6.2 Photographic Record

The photographic record of the NHWL was completed as per the Statement of Work. Copies of the photographs that are referenced in the body of this document are provided in Appendix F, where photograph captions provide the landfill viewpoint number (as seen on Figure A-3, Appendix A) where applicable. The complete photographic record, including full-resolution photographs, is contained in the attached CD-ROM.

6.3 Visual Inspection Report

The visual inspection of the NHWL and surrounding area was conducted on August 28, 2011. The visual monitoring checklist was completed using the format requested by AANDC and is presented as Table 6-3 of this report. Field notes relating to the visual inspection are included in Appendix G. Table 6-1 and Table 6-2 present the preliminary visual inspection results for 2011 monitoring of the NHWL at CAM-F.

Table 6-1: Preliminary Visual Inspection Report NWHL

Feature	**Presence (Y/N)**	**Severity Rating**	**Extent**
Settlement	Y	Acceptable	Occasional
Erosion	Y	Acceptable	Isolated
Frost Action	N	Not Observed	None
Animal Borrows	N	Not Observed	None
Vegetation	N	Not Observed	None
Staining	N	Not Observed	None
Vegetation Stress	N	Not Observed	None
Seepage / Ponded Water	N	Not Observed	None
Debris Exposure	N	Not Observed	None
Monitoring Well Condition	Y	Good condition - Acceptable	
Overall Landfill Performance	**Acceptable**		

Table 6-2: Preliminary Visual Inspection Report NHWL - Definitions

Performance / Severity Rating	Description
Acceptable	Noted features are of little consequence. The landfill is performing as designed. Minor deviations in environmental or physical performance may be observed, such as isolated areas of erosion, settlement.
Marginal	Physical/environmental performance appears to be deteriorating with time. Observations may include an increase in size or number of features of note, such as differential settlement, erosion or cracking. No significant impact on landfill stability to date, but potential for failure is assessed as low or moderate.
Significant	Significant or potentially significant changes affecting landfill stability, such as significant changes in slope geometry, significant erosion or differential settlement; scarp development. The potential for failure is assessed as imminent.
Unacceptable	Stability of landfill is compromised to the extent that ability to contain waste materials is compromised. Examples may include: • Debris exposed in erosion channels or areas of differential settlement. • Liner exposed. • Slope failure.
Extent	**Description**
Isolated	Singular feature
Occasional	Features of note occurring at irregular intervals/locations
Numerous	Many features of note, impacted less than 50% of the surface area of the landfill
Extensive	Impacting greater than 50% of the surface area of the landfill

Settlement

Settlement on the landfill top (see features A and B) is similar to that described in 2009 and 2010 (two small locations on the northwest sector; refer to Figure A-3, Appendix A). There is no obvious cause to this settlement. There is no evidence of significant water infiltration and no ponding was observed at or around the NHWL.

The same settlement areas (see features C and D) were also observed beyond the toe of the NHWL between the NW corner and the SW side (see Figure A-3, Appendix A) where maximum depth of settlement of 0.3 to 0.4 m is reached.

Erosion

Evidence of erosion is similar to that observed in 2009 and 2010: there exists minor erosion on the side slopes of the NHWL, likely due to down-slope washing of fine-grained fill between cobbles and boulders. The small preferred drainage channels that were observed on the top and the southeast corner of the NHWL in 2009 and 2010 were not observed in 2011 and have likely been filled in with fines. The southeast corner toe remains unaffected. The minor erosion on top is not significant, revealing only a thin layer of larger grade stone. There is no apparent downgradient erosion.

Frost Action

No evidence of heaving or cracking was observed on the top or sides of the NHWL. Other than a slight sorting of granular fill on certain areas of landfill slope faces, there were no apparent signs of frost action.

Evidence of Burrowing Animals

Indications of burrowing animals were not observed.

Staining

Indications of staining on or around the NHWL were not observed on or around the NHWL.

Seepage Points

Small rills or erosion channels observed on the side slopes in 2009 were interpreted as evidence that seepage had occurred on all side slopes of the NHWL; no indication of rills or erosion channels associated with seepage were observed during the 2011 site visit. As proposed above, evidence of apparent seepage may be closely linked to timing of precipitation events over the short term. No ponding within the vicinity of the NHWL was evident. Conditions seem relatively unchanged since the 2008, 2009, and 2010 inspection.

Debris

No debris within the vicinity of the NHWL was observed.

Discussion

Based on the very minimal erosion, settlement, frost action, burrowing, staining and seepage observed, the performance of the NHWL, with respect to containment, was again rated as satisfactory. The visual inspection report, including supporting photos and drawing, is presented in the following Table 6-3.

Table 6-3: CAM-F Sarcpa Lake – NHWL Landfill Visual Inspection

Checklist Item	Feature Letter	Relative Location	Length (m)	Width (m)	Depth (m)	Extent	Description (Change)	Additional Comments	Photo Reference
Settlement	A	Top of NHWL, 24.6 m east from the northwest top ledge	12.9 m^2		0.02	<1%	Small depression		47-48
Settlement	B	Top of NHWL, 15.4 m east from the northwest top ledge	32.3 m^2		0.1	<1%	Large Depression		49
Settlement	C	3.3 m west of the west corner of the NHWL	6.6 m^2		0.02	<1%	Slight low area		50
Settlement	D	10.8 m southwest of the south corner of the NHWL	16.3 m^2		0.25	<1%	Settlement		51

7.0 SURROUNDING AREAS AND NATURAL ENVIRONMENT

The rest of the CAM-F DEW Line site was also inspected, including the borrow sources and re-graded areas. With the exception of the cabin area between the NHWL and SSDF which is in constant use, the site was found to be clean and in good order. Re-grading of the borrow areas to the west of the NHWL was noted to be of lesser quality than at other re-graded areas.

Long-Term Monitoring plans for other, similarly managed AANDC sites recommend monitoring the following parameters to better understand the presence and temporal changes to wildlife and the natural environment:

- Wildlife sightings
- Other evidence of recent presence of wildlife (e.g. droppings, tracks)
- Wildlife activity (e.g. nesting, migration)
- Qualitative assessment of relative numbers versus previous years
- Revegetation of disturbed areas versus previous years

Information regarding these parameters were either gathered directly, through personal observation while on site or indirectly, through our wildlife monitor, a member of the Hunters and Trappers Association, Iqaluit, who consulted knowledgeable local persons in the nearby community of Igloolik.

<u>Wildlife and Human Activity</u>

From information from a member of the Hunter and Trappers Organization in Hall Beach, Lily Arnaqguaq, the site is used for hunting and fishing. During the monitoring, the following signs of wildlife were observed on site between late morning and late afternoon on August 27 and 28, 2011:

- Snow geese flew over (multiple occasions).
- Snow geese tracks and scat all over site.
- Caribou tracks near the SSDF.
- Sandpipers (several) near the SSDF.
- Small sparrow-like birds near the NHWL

Human activity was summarized as follows:

- Sarcpa Lake is apparently used for fishing.
- Cabin is well used. The entrance was very dirty, being covered with several uncleaned caribou pelts. Pelts and remains, such as bones, were also strewn across the area outside the cabin.

- Several empty barrels were observed outside the cabin. Several barrels with small amounts of gasoline were also noted. Most of these barrels have accumulated since the last long-term monitoring site visit.

It seems clear that the site is used frequently by both local hunters and a variety of wildlife.

Re-establishment of Vegetation

Major site remedial work, comprised of excavation and construction activities, was completed in the summer of 2007, approximately three years prior to the site monitoring visit. Little evidence of revegetation was observed in August 2011. Given the regional setting of the CAM-F DEW Line site and growth observed at other, similar sites in the Nunavut region, it is reasonable to assume that it will take some time for native vegetation to become re-established at the site.

A couple of lone pieces of vegetation were taking root, however, at feature S on the southeast corner of the SSDF.

8.0 CONCLUSIONS AND RECOMMENDATIONS

All physical observations suggest that there has been little significant change over the last three years at the CAM-F Distant Early Warning (DEW) Line site and that both the secure soil disposal facility (SSDF) and the non-hazardous waste (NHWL) landfill are performing as designed and are containing the enclosed waste.

FRANZ conducted the field activities for the fourth year of the CAM-F long-term monitoring program on August 27 and 28, 2011, while based in the nearby community of Hall Beach.

Physical observations from the 2011 field activities suggest that there has been little significant change over the last four years at the CAM-F DEW Line site and that both the SSDF and the NHWL are performing as designed and are containing the enclosed waste. Temperature data indicated that the temperature below ground surface increased since the low established in 2009 and from data collected in 2010. The maximum depth of the active layer remains less than the depth to contaminated material.

In addition to physical and temperature observations, FRANZ collected soil and groundwater samples to assess the performance of the SSDF. Analytical results for soil samples collected in the vicinity of the SSDF satisfy guidelines for contaminants of potential concern at the site. The concentrations of contaminants of concern, total copper, nickel and lead, in groundwater samples were above the acceptable maximum when compared with historical results. An increase in chemical concentration from one sampling event to the next is worth noting but there are no other signs of landfill instability. The sampling event in 2012 will assist in determining if there is a trend towards an increase in the concentration of chemicals of concern in groundwater or if it was an isolated incident due to the high total suspended solid concentration of the sample. The concentration of copper, nickel, and lead in the soil remained consistent when compared with previous year's concentrations.

As a result of the physical and thermal observations and analytical results of the 2011 field program, FRANZ believes that the site is little changed from the last monitoring event, in September 2010, that its facilities continue to operate as designed and that the site poses no imminent threat to the natural environment. Based on field observations, FRANZ recommends that the following be added to the statement of work for long term monitoring at the site in 2012:

1. Should signs of seepage persist or new signs of landfill deterioration appear near any of the seepage points noted in 2011, collection of a soil sample from one of the seepage points on the SSDF should be added to the monitoring program.

9.0 LIMITATIONS

This report has been prepared exclusively for Aboriginal Affairs and Northern Development Canada. Any other person or entity may not rely upon the report without the express written consent from Aboriginal Affairs and Northern Development Canada.

Any use, which a third party makes of this report, or any reliance on decisions made based on it, is the responsibility of such third parties. Franz Environmental Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

Some of the information presented in this report was provided through existing documents and interviews. Although attempts were made, whenever possible, to obtain a minimum of two confirmatory sources of information, Franz Environmental Inc., in certain instances, has been required to assume that the information provided is accurate.

The conclusions presented represent the best judgment of the assessors based on current environmental standards and on the site conditions observed on August 27 and 28, 2011. Due to the nature of the investigation and the limited data available, the assessors cannot warrant against undiscovered environmental liabilities.

Should additional information become available, Franz Environmental Inc. requests that this information be brought to our attention so that we may re-assess the conclusions presented herein.

There is no warranty, expressed or implied that the work reported herein has uncovered all potential environmental liabilities, nor does the report preclude the possibility of contamination outside of the areas of investigation. The findings of this report were developed in a manner consistent with a level of care and skill normally exercised by members of the environmental science and engineering profession currently practicing under similar conditions in the area.

A potential remains for the presence of unknown, unidentified, or unforeseen surface and sub-surface contamination. Any evidence of such potential site contamination would require appropriate surface and sub-surface exploration and testing.

If new information is developed in future work (which may include excavations, borings, or other studies), Franz Environmental Inc. should be requested to re-evaluate the conclusions of this report, and to provide amendments as required.

10.0 REFERENCES

Canadian Council of Ministers of the Environment. 2007. *Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health.*

Canadian Council of Ministers of the Environment. 2008a. *Canada-Wide Standards for Petroleum Hydrocarbons in Soil.*

Canadian Council of Ministers of the Environment. 2008b. *Canada-Wide Standard for Petroleum Hydrocarbons (PHC) in Soil: Scientific Rationale Supporting Technical Document.*

Canadian Council of Ministers of the Environment. 2008c. *Canada-Wide Standard for Petroleum Hydrocarbons (PHC) in Soil: User Guidance.*

FIGQG, May 2010. *Guidance Document on Federal Interim Groundwater Quality Guidelines for Federal Contaminated Sites.*

Franz Environmental Inc. December 10, 2010. Long Term Monitoring 2010, CAM-F Sarcpa Lake, Nunavut.

Franz Environmental Inc. November 27, 2009. Long Term Monitoring 2009, CAM-F Sarcpa Lake, Nunavut.

Indian and Northern Affairs Canada. January 23, 2007. *CAM-F Sarcpa Lake Long-Term Monitoring Plan*.

Indian and Northern Affairs Canada, March 23, 2008. *FOX-C Ekaluguad Fjord Long-Term Monitoring Plan*

Indian and Northern Affairs Canada. December 2008. *Abandoned Military Site Remediation Protocol*, Contaminated Sites Program.

UMA Engineering Ltd. February 17, 2005. *CAM-F SSDF Monitoring Well Installations*.

UMA Engineering Ltd. January 8, 2009. *Long Term Monitoring 2008*, CAM-F Dew Line Site, Nu.

Zeiner, S.*T., Realistic Criteria for the Evaluation of Field Duplicate Sample Results,* Proceedings of Superfund XV, November 29-December 1, 1994, Sheraton Washington Hotel, Washington, D.C.

11.0 CLOSURE

We trust that this information satisfies your present requirements. Should you have any questions or require additional information, please do not hesitate to contact the undersigned.

Yours truly,

Franz Environmental Inc.

Ryan Fletcher, C.Tech., EP
Field Assessor

Catherine LeBlanc, B.Eng.
Field Assessor

Kevin McKenna, B.Sc.
Project Manager

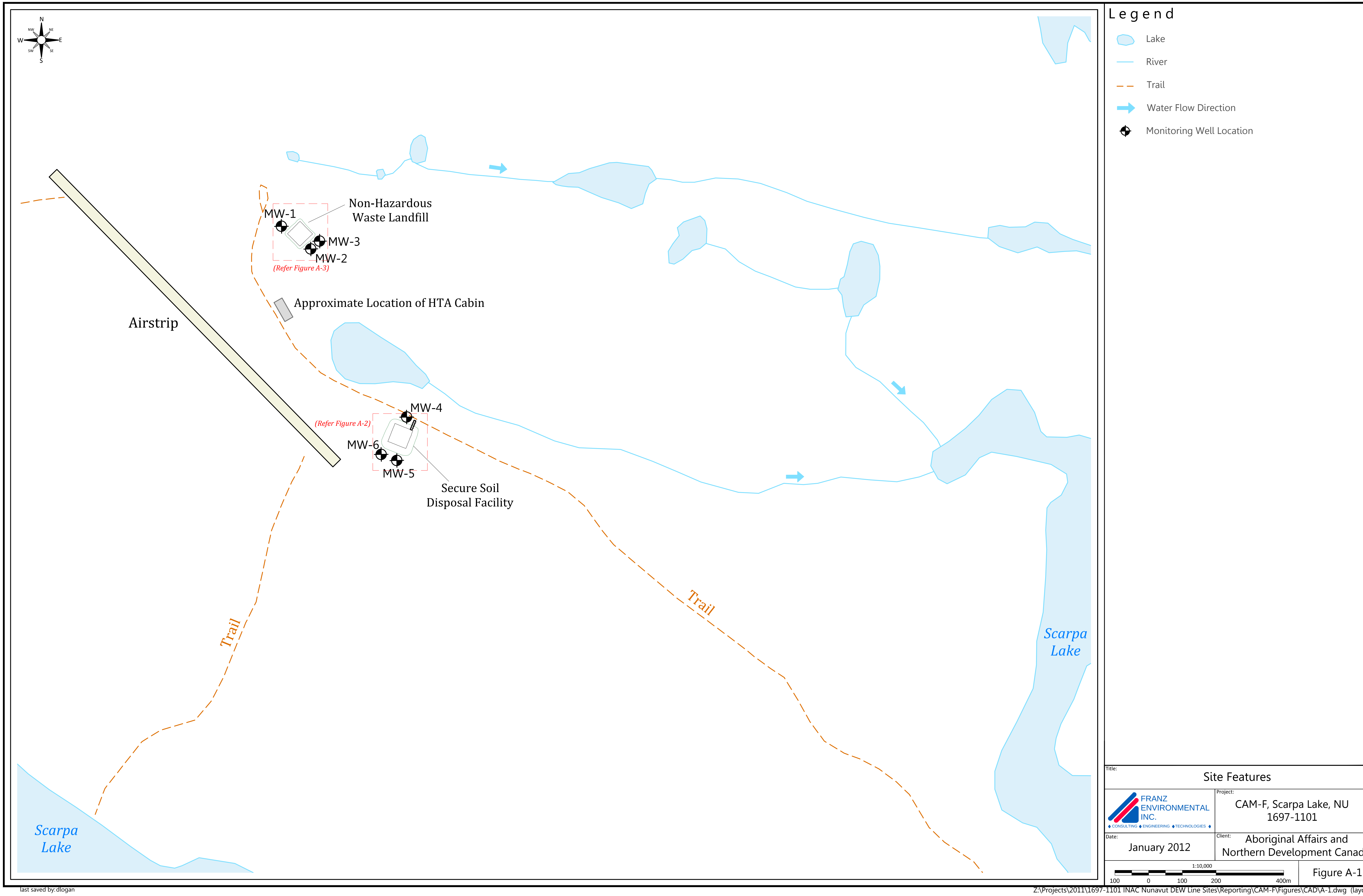
Steve Livingstone, M.Sc., P.Geol
Principal/Senior Reviewer

Distribution: Addressee (2 paper, 1 electronic)
FRANZ (1 electronic)

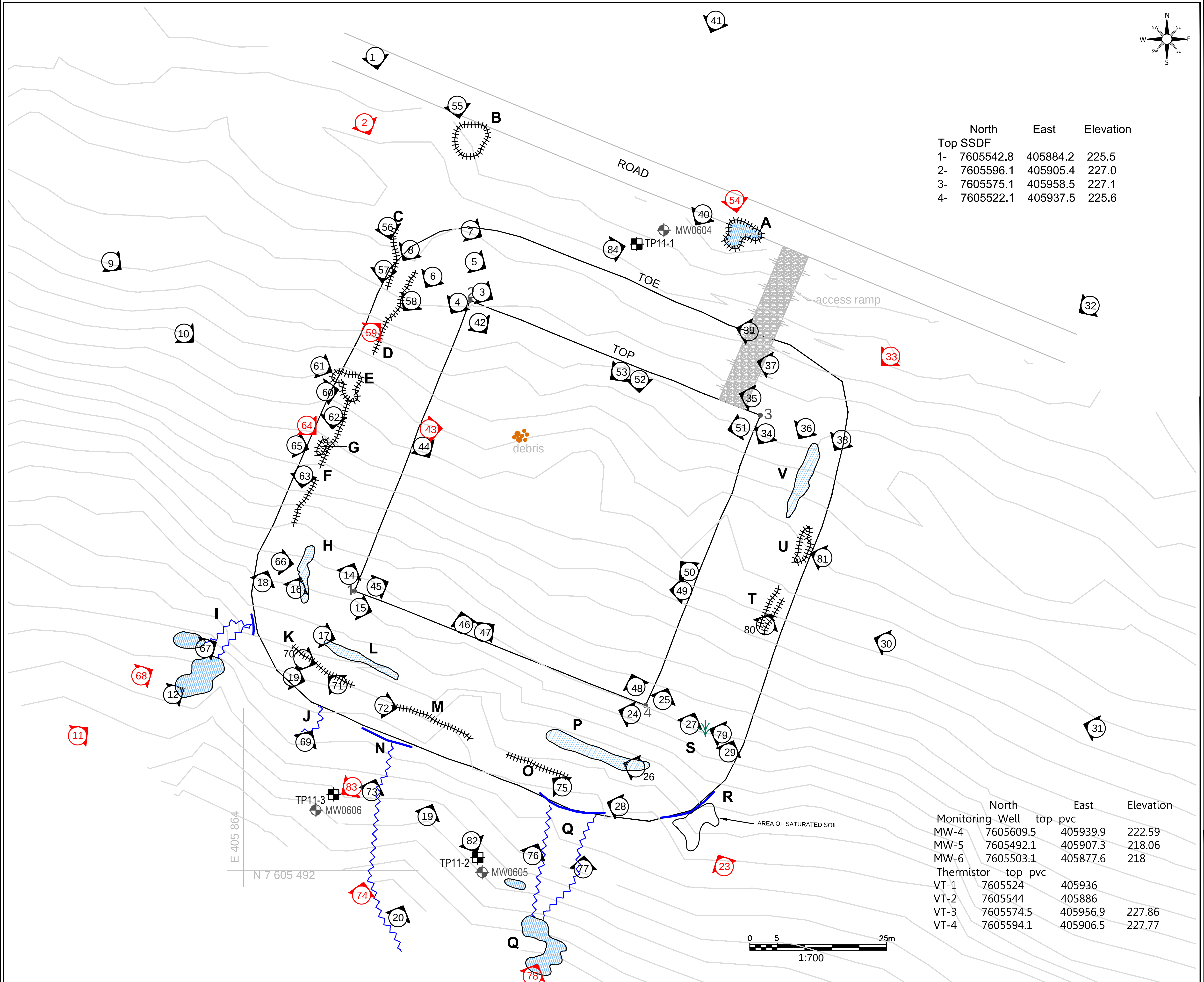
Z:\Projects\2011\1697-1101 INAC Nunavut DEW Line Sites\Reporting\CAM-F\Text\FINAL\Final Report CAM-F.docx

APPENDIX A

Figures



N
S
E
W
NW
NE
SW
SE
Legend
Lake
River
Trail
Water Flow Direction
Monitoring Well Location
Non-Hazardous
Waste Landfill
MW-1
MW-3
MW-2
(Refer Figure A-3)
Approximate Location of HTA Cabin
Airstrip
MW-4
(Refer Figure A-2)
MW-6
MW-5
Secure Soil
Disposal Facility
Trail
Trail
Scarpa
Lake
Scarpa
Lake
Title:
Site Features
FRANZ
ENVIRONMENTAL
INC.
Project:
CAM-F, Scarpa Lake, NU
1697-1101
Date:
January 2012
Client:
Aboriginal Affairs and
Northern Development Canada
1:10,000
100
0
100
200
400m
Figure A-1
last saved by:dlogan
Z:\Projects\2011\1697-1101 INAC Nunavut DEW Line Sites\Reporting\CAM-F\Figures\CAD\A-1.dwg (layout)



Top SSDF	North	East	Elevation
1-	7605542.8	405884.2	225.5
2-	7605596.1	405905.4	227.0
3-	7605575.1	405958.5	227.1
4-	7605522.1	405937.5	225.6

Monitoring Well top pvc	North	East	Elevation
MW-4	7605609.5	405939.9	222.59
MW-5	7605492.1	405907.3	218.06
MW-6	7605503.1	405877.6	218
Thermistor top pvc			
VT-1	7605524	405936	
VT-2	7605544	405886	
VT-3	7605574.5	405956.9	227.86
VT-4	7605594.1	405906.5	227.77

Legend

- MW Monitoring Well Locations
- TP Test Pit Locations
- Picture Viewpoint Number
- Viewpoint Photograph Included in Appendix F
- Ponded Surface Water
- Erosion Channel (blue = active)
- Cracking
- Area of Depression/Settlment
- Active Seepage Points
- Passive Seepage Points
- Vegetation Cover

Note:
Picture numbers refer to photograph names as they appear in Table F-2: Appendix F

Title: Secure Soil Disposal Facility

FRANZ ENVIRONMENTAL INC.
♦ CONSULTING ♦ ENGINEERING ♦ TECHNOLOGIES ♦

Project: CAM-F Sarcpa Lake, NU
1697-1101

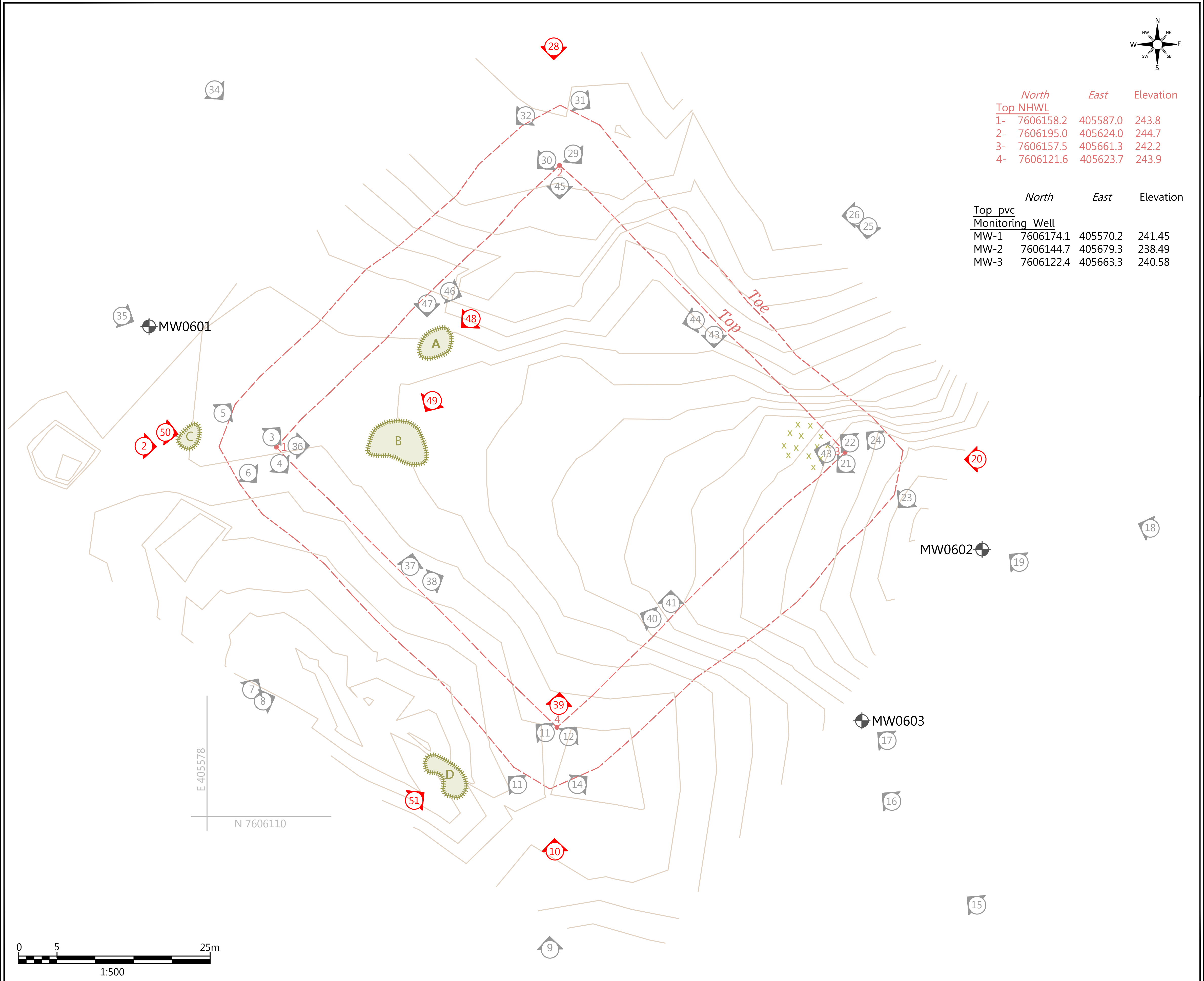
Date: January 2012

Client: Aboriginal Affairs and Northern Development Canada

Scale: Scale as shown

Figure A-2

last saved by: dlogan



Top NHWL	North	East	Elevation
1-	7606158.2	405587.0	243.8
2-	7606195.0	405624.0	244.7
3-	7606157.5	405661.3	242.2
4-	7606121.6	405623.7	243.9

Top pvc Monitoring Well	North	East	Elevation
MW-1	7606174.1	405570.2	241.45
MW-2	7606144.7	405679.3	238.49
MW-3	7606122.4	405663.3	240.58

Legend

- MW Monitoring Well Locations
- 25 Picture Viewpoint Number
- A Settlement
- Poor Grading
- 25 Viewpoint Photograph Included in Appendix F

Note:
Picture numbers refer to photograph names as they appear in Table F-2: Appendix F

Title: Non-Hazardous Waste Landfill

FRANZ ENVIRONMENTAL INC.
♦ CONSULTING ♦ ENGINEERING ♦ TECHNOLOGIES ♦

Project: CAM-F Sarcpa Lake, NU
1697-1101

Date: January 2012

Client: Aboriginal Affairs and Northern Development Canada

Scale as shown

Figure A-3

last saved by: dlogan

Z:\Projects\2011\1697-1101 INAC Nunavut DEW Line Sites\Reporting\CAM-F\Figures\CAD\1697-1101_CAM-F_NHWL_latest.dwg (layout)

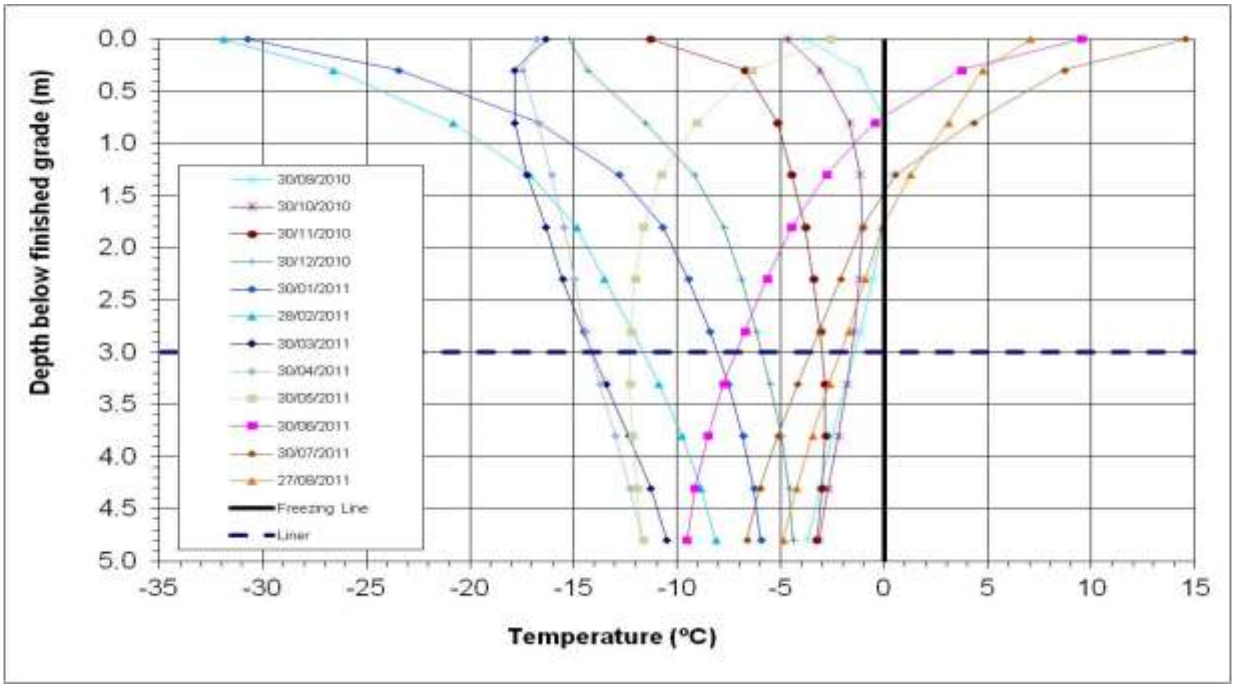


Figure A-4: Example of thermal monitoring data at the Secure Soil Disposal Facility on the 30th of each month for the period September 2010-August 2011 at thermistor VT01.

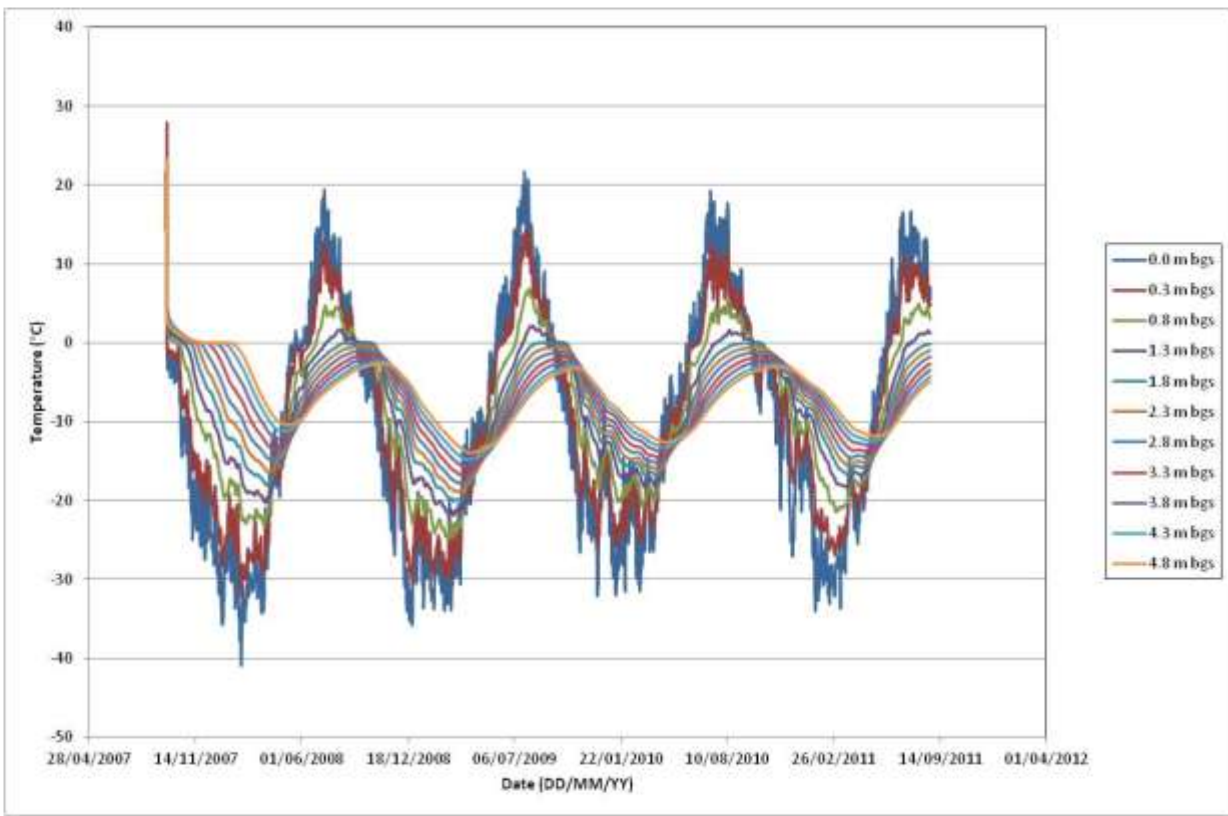
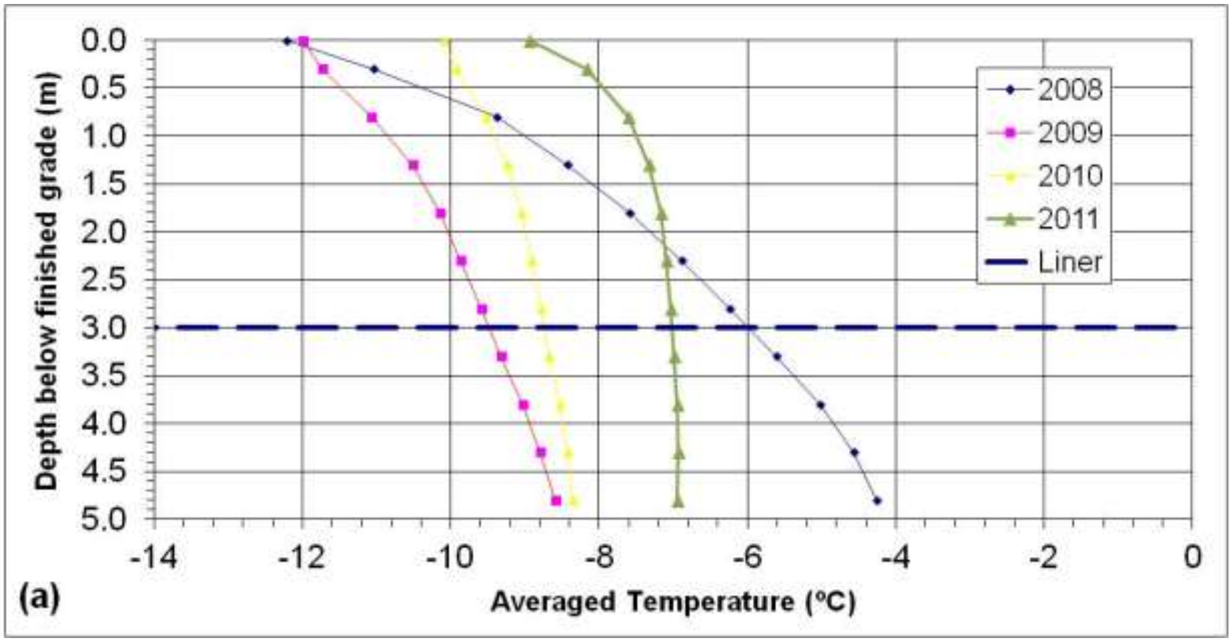


Figure A-5: Example of thermal monitoring data at the Secure Soil Disposal Facility (September 2010-August 2011) for Thermistor VT01



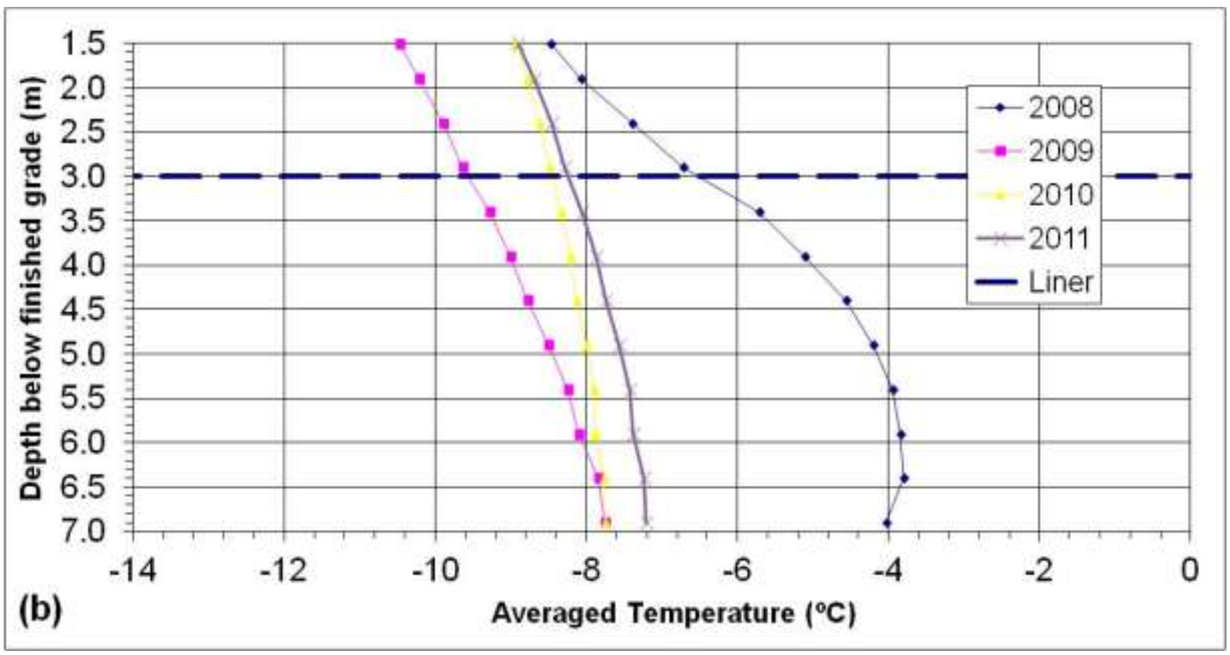


Figure A-6: Vertical profile of temperature (averaged over the annual periods of October 1 to August 26) with increasing depth below the top of the Secure Soil Disposal Facility for thermistor data (a) VT01 and (b) VT03.

APPENDIX B

Tables

Table B-1
Ground Water Chemical Concentrations - PHCs

PARAMETER	**Upper Limit of Acceptability[1]**	**RDL**	**MW06-4**	**AH-1**	**Duplicate Evaluation**			**MW06-5**	**MW06-6**
Sample ID									
Date			27/08/2011	27/08/2011	Scenario*	RPD (%)	Acceptable	27/08/2011	27/08/2011
BTEX & F1 Hydrocarbons (ug/L)									
Benzene	Not Available	0.2	<0.2	<0.2	A	---	Y	<0.2	<0.2
Toluene	Not Available	0.2	<0.2	<0.2	A	---	Y	<0.2	<0.2
Ethylbenzene	Not Available	0.2	<0.2	<0.2	A	---	Y	<0.2	<0.2
o-Xylene	Not Available	0.2	<0.2	<0.2	A	---	Y	<0.2	<0.2
p+m-Xylene	Not Available	0.4	<0.4	<0.4	A	---	Y	<0.4	<0.4
Total Xylenes	Not Available	0.4	<0.4	<0.4	A	---	Y	<0.4	<0.4
F1 (C6-C10)	195	25	<25	<25	A	---	Y	<25	<25
F1 (C6-C10) - BTEX	195	25	<25	<25	A	---	Y	<25	<25
F2-F4 Hydrocarbons (ug/L)									
F2 (C10-C16 Hydrocarbons)	186	100	<100	<100	A	---	Y	<100	<100
F3 (C16-C34 Hydrocarbons)	186	100	<100	<100	A	---	Y	<100	<100
F4 (C34-C50 Hydrocarbons)	186	100	<100	<100	A	---	Y	<100	<100
Reached Baseline at C50	Not Applicable		Yes	Yes	NC	NC	NC	Yes	Yes

Notes:

1 = Upper Limit of Acceptability is determined as described in Report Section 3.2. Upper limits of acceptability are calculated from Table B-8, using mean of previous sampling rounds +3 standard deviations. Previous results for BTEX are insufficient to provide upper limits.

* = See Quality Assurance and Quality Control section for scenario rationale.

NC = No Criteria

RDL= Reportable Detection Limit

20 = Guideline selected for CAM-F DEW Line landfills.

20 = Exceeds selected guideline.

Table B-2
Ground Water Chemical Concentrations - Metals

PARAMETER / Sample ID / Date	Upper Limit of Acceptability[1]	Lowest RDL	MW06-4	AH-1	Duplicate Evaluation			MW06-5	MW06-6
Date			27/08/2011	27/08/2011	Scenario*	RPD (%)	Acceptable	27/08/2011	27/08/2011
Metals (ug/L)									
Dissolved Arsenic (As)	NC	1	<1	<1	A	---	Y	<1	<1
Total Arsenic (As)	3	1	<1	<1	A	---	Y	<1	1
Dissolved Cadmium (Cd)	1	0.1	<0.1	<0.1	A	---	Y	0.3	<0.1
Total Cadmium (Cd)	1	0.1	<0.1	<0.1	A	---	Y	<0.1	<0.1
Dissolved Cobalt (Co)	3	0.5	2.1	1.9	D	---	Y	<0.5	0.6
Total Cobalt (Co)	7	0.5	2.1	2.4	D	---	Y	<0.5	4.0
Dissolved Chromium (Cr)	NC	5	<5	<5	A	---	Y	<5	<5
Total Chromium (Cr)	95	5	<5	<5	A	---	Y	<5	34
Dissolved Copper (Cu)	17	1	<1	<1	A	---	Y	9	3
Total Copper (Cu)	52	1	4	4	D	---	Y	8	54
Dissolved Nickel (Ni)	60	1	15	14	C	7	Y	4	10
Total Nickel (Ni)	33	1	16	17	C	6	Y	5	130
Dissolved Lead (Pb)	7646	0.5	<0.5	<0.5	A	---	Y	<0.5	<0.5
Total Lead (Pb)	2	0.5	<0.5	<0.5	A	---	Y	<0.5	6.6
Dissolved Zinc (Zn)	5641	5	<5	<5	A	---	Y	64	52
Total Zinc (Zn)	5782	5	7	8	D	---	Y	48	670

Notes:

1 = Upper LImit of Acceptability is determined as described in Report Section 3.2. Upper limits of acceptability are calculated from Table B-9, using mean of previous sampling rounds +3 standard deviations.

* = See Quality Assurance and Quality Control section for scenario rationale.

α = Total value assumed same as dissolved value.

β = Dissolved value assumed same total value.

γ = Value a function of water hardness.

NC = No Criteria

RDL= Reportable Detection Limit

20 = Exceeds selected guideline.

Table B-3
Ground Water Chemical Concentrations - PCBs

PARAMETER	Upper Limit of Acceptability[1]	RDL	MW06-4	AH-1	Duplicate Evaluation			MW06-5	MW06-6
Sample ID									
Date			27/08/2011	27/08/2011	Scenario*	RPD (%)	Acceptable	27/08/2011	27/08/2011
PCBs (ug/L)									
Aroclor 1016	NC	0.05	<0.05	<0.05	A	---	Y	<0.05	<0.05
Aroclor 1221	NC	0.05	<0.05	<0.05	A	---	Y	<0.05	<0.05
Aroclor 1232	NC	0.05	<0.05	<0.05	A	---	Y	<0.05	<0.05
Aroclor 1242	NC	0.05	<0.05	<0.05	A	---	Y	<0.05	<0.05
Aroclor 1248	NC	0.05	<0.05	<0.05	A	---	Y	<0.05	<0.05
Aroclor 1254	NC	0.05	<0.05	<0.05	A	---	Y	<0.05	<0.05
Aroclor 1260	NC	0.05	<0.05	<0.05	A	---	Y	<0.05	<0.05
Aroclor 1262	NC	0.05	<0.05	<0.05	A	---	Y	<0.05	<0.05
Aroclor 1268	NC	0.05	<0.05	<0.05	A	---	Y	<0.05	<0.05
Total PCB	NC	0.05	<0.05	<0.05	A	---	Y	<0.05	<0.05

Notes:

1 = Upper LImit of Acceptability is determined as described in Report Section 3.2. Upper limits of acceptability are calculated from Table B-8, using mean of previous sampling rounds +3 standard deviations. There have been no historical detections of PCB components, indicating that results within sampling variance are acceptable.

* = See Quality Assurance and Quality Control section for scenario rationale.

NC = No Criteria

RDL= Reportable Detection Limit

20 = Exceeds selected guideline.

Table B-4
Ground Water Chemical Concentrations - Inorganics

PARAMETER		Groundwater Criteria	Lowest RDL	MW06-4	AH-1	Duplicate Evaluation			MW06-5	MW06-6
Sample ID		Upper Limit of Acceptability[1]								
Date				27/08/2011	27/08/2011	Scenario*	RPD (%)	Acceptable	27/08/2011	27/08/2011
Inorganics	**Units**									
Colour	TCU	110	2	3	4	D	---	Y	4	3
Conductivity	umho/cm	4442	1	4020	3963	C	1	Y	1500	1440
Total Dissolved Solids	mg/L	NC	10	3000	2940	C	2	Y	1080	1120
Fluoride (F-)	mg/L	NC	0.1	0.5	0.5	D	---	Y	3	0.7
Orthophosphate (P)	mg/L	NC	0.01	<0.01	<0.01	A	---	Y	<0.01	<0.01
pH	pH	7.61 - 8.36	NC	7.86	7.97	C	1	Y	7.95	8.19
Total Suspended Solids	mg/L	NC	1	4	5	D	---	N	2	27
Dissolved Sulphate (SO4)	mg/L	NC	10	2400	2400	C	0	Y	590	550
Dissolved Chloride (Cl)	mg/L	NC	1	110	110	C	0	Y	49	26
Nitrite (N)	mg/L	NC	0.01	<0.01	<0.01	A	---	Y	<0.01	<0.01
Nitrate (N)	mg/L	NC	0.1	<0.1	<0.1	A	---	Y	0.3	<0.1
Nitrate + Nitrite	mg/L	NC	0.1	<0.1	<0.1	A	---	Y	0.3	<0.1

Notes:

1 = Upper LImit of Acceptability is determined as described in Report Section 3.2. Upper limits of acceptability are calculated from Table B-8, using mean of previous sampling rounds +3 standard deviations.

* = See Quality Assurance and Quality Control section for scenario rationale.

NC = No Criteria

RDL= Reportable Detection Limit

20 = Exceeds selected guideline.

Table B-5
Soil Chemical Concentrations - PHCs

PARAMETER	**Federal**		**RDL**														
Sample ID				**TP11-1T**	**TP11-1B**	**TP11-2T**	**TP11-2B**	**TP11-3T**	**DUP T**	Duplicate Evaluation			**TP11-3B**	**DUP B**	Duplicate Evaluation		
Date	**CCME [1] Residential/ Parkland**	**CWS for PHC in Soil (<1.5m)[2]**		27/08/2011	27/08/2011	27/08/2011	27/08/2011	27/08/2011	27/08/2011	Scenario*	RPD (%)	Acceptable	27/08/2011	27/08/2011	Scenario*	RPD (%)	Acceptable
Depth (m)				0 - 0.15	0.4 - 0.5	0 - 0.15	0.4 - 0.5	0 - 0.15	0 - 0.15				0.4 - 0.5	0.4 - 0.5			
BTEX & F1 Hydrocarbons (ug/g)																	
Benzene	**31**	NC	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	A	---	Y	<0.02	<0.02	A	---	Y
Toluene	**75**	NC	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	A	---	Y	<0.02	<0.02	A	---	Y
Ethylbenzene	**55**	NC	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	A	---	Y	<0.02	<0.02	A	---	Y
o-Xylene	NC	NC	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	A	---	Y	<0.02	<0.02	A	---	Y
p+m-Xylene	NC	NC	0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	A	---	Y	<0.04	<0.04	A	---	Y
Total Xylenes	**95**	NC	0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	A	---	Y	<0.04	<0.04	A	---	Y
F1 (C6-C10)	NC	NC	10	<10	<10	<10	<10	<10	<10	A	---	Y	<10	<10	A	---	Y
F1 (C6-C10) - BTEX	NC	**30** (210)	10	<10	<10	<10	<10	<10	<10	A	---	Y	<10	<10	A	---	Y
F2-F4 Hydrocarbons (ug/g)																	
F2 (C10-C16 Hydrocarbons)	NC	**150** (150)	10	<10	<10	<10	<10	<10	<10	A	---	Y	<10	<10	A	---	Y
F3 (C16-C34 Hydrocarbons)	NC	**300** (300)	10	21	20	<10	<10	22	26	D	---	Y	14	<10	A	---	Y
F4 (C34-C50 Hydrocarbons)	NC	**2800** (2800)	10	<10	10	<10	<10	<10	<10	A	---	Y	<10	<10	A	---	Y
Reached Baseline at C50	N/A	N/A	N/A	Yes	Yes	Yes	Yes	Yes	Yes	NC	NC	NC	Yes	Yes	NC	NC	NC

Notes:

1 = CCME (2007), Canadian Soil Quality Guidelines, Update 7.0, Table 2. Canadian Soil Quality Guidelines, Residential / Parkland Use, coarse-grained soils.

2 = CCME (2008) Canadian-Wide Standards for Petroleum Hydrocarbons in Soil - Table 1, Tier 1 levels for PHCs, Residential / Parkland Use in coarse-grained surface soils. (Brackets) Protection of Eco Soil Contact from Table 1 - Technical Supplement.

*= See Quality Assurance and Quality Control section for scenario rationale.

N/A = Not applicable

NC = No Criteria

RDL= Reportable Detection Limit

20 = Guideline selected for CAM-F DEW Line landfills.

20 = Exceeds selected guideline.

Table B-6
Soil Chemical Concentrations - Metals

PARAMETER	**Federal**																	
Sample ID	**CCME[1] Residential/ Parkland**	**CCME[2] Human Health Ingestion (H) / Eco Soil Contact (E)**	**INAC DEW Line Cleanup Criteria, Tier II**	**RDL**	**TP11-1T**	**TP11-1B**	**TP11-2T**	**TP11-2B**	**TP11-3T**	**DUP T**	**Duplicate Evaluation**			**TP11-3B**	**DUP B**	**Duplicate Evaluation**		
Date					27/08/2011	27/08/2011	27/08/2011	27/08/2011	27/08/2011	27/08/2011	Scenario*	RPD (%)	Acceptable	27/08/2011	27/08/2011	Scenario*	RPD (%)	Acceptable
Depth (m)					0 - 0.15	0.4 - 0.5	0 - 0.15	0.4 - 0.5	0 - 0.15	0 - 0.15				0.4 - 0.5	0.4 - 0.5			
Metals (ug/g)																		
Arsenic (As)	**12**	12H 17E	30	1	1	1	1	1	<1	<1	A	---	Y	<1	<1	B	---	Y
Cadmium (Cd)	10	NC	**5**	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	A	---	Y	<0.1	<0.1	A	---	Y
Cobalt (Co)	50	NC	**50**	0.1	7.0	6.9	6.9	8.3	6.3	6.0	C	5	Y	7.2	6.8	C	20	Y
Chromium (Cr)	**64**	220H 64E	250	1	29	32	30	33	26	23	C	12	Y	32	29	C	13	Y
Copper (Cu)	**63**	1100H 63E	100	0.5	20	18	19	22	20	18	C	11	Y	20	19	C	15	Y
Nickel (Ni)	**50**	50E	100	0.5	19	20	20	24	17	16	C	6	Y	19	20	C	18	Y
Lead (Pb)	**140**	140H 300E	500	1	8	6	7	7	7	6	C	15	Y	7	7	C	0	Y
Zinc (Zn)	**200**	200E	500	5	46	44	45	47	45	42	C	7	Y	45	44	C	7	Y
Mercury (Hg)	6.6	6.6H 12E	**2**	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	A	---	Y	<0.05	<0.05	A	---	Y
Physical Properties																		
Moisture (%)	NC	NC	NC	0.2	8.0	12	7.9	7.8	17	24	C	34	Y	7.8	13	C	50	N

Notes:

1 = CCME (2007), Canadian Soil Quality Guidelines, Update 7.0, Table 1. Canadian Soil Quality Guidelines, Residential / Parkland Use, coarse-grained soils.

2 = CCME (2007), Canadian Soil Quality Guidelines, Update 7.0, Table 2. Human health soil ingestion and Eco Soil Contact.

* = See Quality Assurance and Quality Control section for scenario rationale.

** = CCME (2007), Canadian Soil Quality Guidelines, Update 7.0, Table 2. Interim remediation criteria for soil that have not yet been replaced by canadian soil quality guidelines.

N/A = Not applicable

NC = No Criteria

RDL= Reportable Detection Limit

20 = Guideline selected for CAM-F DEW Line landfills.

20 = Exceeds selected guideline.

Table B-7
Soil Chemical Concentrations - PCBs

PARAMETER	Federal	INAC DEW Line Cleanup Criteria, Tier II	RDL														
Sample ID	**CCME[1] Residential/ Parkland**			**TP11-1T**	**TP11-1B**	**TP11-2T**	**TP11-2B**	**TP11-3T**	**DUP T**	**Duplicate Evaluation**			**TP11-3B**	**DUP B**	**Duplicate Evaluation**		
Date				27/08/2011	27/08/2011	27/08/2011	27/08/2011	27/08/2011	27/08/2011	Scenario*	RPD (%)	Acceptable	27/08/2011	27/08/2011	Scenario*	RPD (%)	Acceptable
Depth (m)				0 - 0.15	0.4 - 0.5	0 - 0.15	0.4 - 0.5	0 - 0.15	0 - 0.15				0.4 - 0.5	0.4 - 0.5			
Polychlorinated Biphenyls (ug/g)																	
Aroclor 1262	NC	NC	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	A	---	Y	<0.01	<0.01	A	---	Y
Aroclor 1016	NC	NC	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	A	---	Y	<0.01	<0.01	A	---	Y
Aroclor 1221	NC	NC	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	A	---	Y	<0.01	<0.01	A	---	Y
Aroclor 1232	NC	NC	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	A	---	Y	<0.01	<0.01	A	---	Y
Aroclor 1242	NC	NC	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	A	---	Y	<0.01	<0.01	A	---	Y
Aroclor 1248	NC	NC	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	A	---	Y	<0.01	<0.01	A	---	Y
Aroclor 1254	NC	NC	0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	A	---	Y	<0.01	<0.01	A	---	Y
Aroclor 1260	NC	NC	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	A	---	Y	<0.01	<0.01	A	---	Y
Aroclor 1268	NC	NC	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	A	---	Y	<0.01	<0.01	A	---	Y
Total PCB	**1.3**	50	0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	A	---	Y	<0.01	<0.01	A	---	Y

Notes:
1 = CCME (2007), Canadian Soil Quality Guidelines, Update 7.0, Table 1
*= See Quality Assurance and Quality Control section for scenario rationale.
NC = No Criteria
RDL= Reportable Detection Limit
20 = Exceeds selected guideline.

Table B-8
Ground water chemical concentrations – 2006 to 2010 (PHCs)

Sample #	Location	Date	PCBs [ug/L]	TPH Identity								Conductivity [μmho/cm]	pH	Colour
				Benzene	Toluene	Ethyl-benzene	Total Xylene	F1 [ug/L]	F2 [ug/L]	F3 [ug/L]	F4 [ug/L]			
Upgradient Groundwater Samples														
MW06-04	MW06-04	2006	<0.05									3110	7.9	
MW06-04	MW06-04	2008	<0.01					<100	<100	<100	<100	630	8.2	>70
MW0604-1	MW06-04	2009	<0.05	<0.2	<0.2	<0.2	<0.4	<100	<100	<100	<100	3740	7.8	4
MW1004	MW06-04	2010	<0.05	<0.2	<0.2	<0.2	<0.4	<100	<100	<100	<100	1980	8.0	4
DUP-1	MW06-04	2010	<0.05	<0.2	<0.2	<0.2	<0.4	<100	<100	<100	<100	1950	8.0	3
MW06-04	MW06-04	2011	<0.05	<0.2	<0.2	<0.2	<0.4	<25	<100	<100	<100	4020	7.86	3
AH-1	MW06-04	2011	<0.05	<0.2	<0.2	<0.2	<0.4	<25	<100	<100	<100	3930	7.97	4
DowngradientGroundwaterSamples														
MW06-05	MW06-05	2006	<0.05									847	7.8	
MW06-05	MW06-05	2007	<0.10					<25000	<100	<100	<100			
MW06-05	MW06-05	2008	<0.01					<100	<100	<100	<100	1010	8.1	60
MW06-07	MW06-05	2008	<0.01					<100	<100	<100	<100	1000	8.1	60
MW0605-1	MW06-05	2009	<0.05	<0.2	<0.2	<0.2	<0.4	<100	<100	<100	<100	1520	7.8	3
MW1005	MW06-05	2010	<0.05	<0.2	<0.2	<0.2	<0.4	<100	<100	<100	<100	1650	8.0	2
MW06-05	MW06-05	2011	<0.05	<0.2	<02	<0.2	<0.4	<25	<100	<100	<100	1500	7.95	4
MW06-06	MW06-06	2006	<0.05									2260	8.1	
MW06-06	MW06-06	2007	<0.10					<25000	<100	<100	<100			
MW06-06	MW06-06	2008	<0.01					200	200	200	200	1060	8.0	>70
MW0606-1	MW06-06	2009	<0.05	<0.2	<0.2	<0.2	<0.4	<100	<100	<100	<100	1530	8.1	3
DUP-01	MW06-06	2009	<0.05	<0.2	<0.2	<0.2	<0.4	<100	<100	<100	<100	1650	7.9	5
MW1006	MW06-06	2010	<0.05	<0.2	<0.2	<0.2	<0.4	<100	<100	<100	<100	1510	8.0	< 2
MW06-06	MW06-06	2011	<0.05	<0.2	<0.2	<0.2	<0.4	<25	<100	<100	<100	1440	8.19	3
Statistics														
N Value			21	12	12	12	12	18	18	18	18	19	19.0	16
N Value [2006-2010 only]			17	8	8	8	8	14	14	14	14	15	15	12
Average			<0.1	<0.2	<2	<0.2	<0.4	88	106	106	106	1912	8.0	19
Average [2006-2010 only]			<0.1	<0.2	<0.2	<0.2	<0.4	108	110	110	110	1669	8	34
Minimum			<0.01	<0.2	<0.2	<0.2	<0.4	25	100	100	100	630	7.8	2
Maximum			<0.1	<0.2	<2	<0.2	<0.4	25000	200	200	200	4020	8.2	70
Standard Deviation (s)* [2006-2010 only]			NC	NC	NC	NC	NC	29	27	27	27	843	0	31
Acceptable Range (Average +/- 3s) [2006-2010 only]			NC	NC	NC	NC	NC	22 < 195	25 < 186	25 < 186	25 < 186	0 < 4442	7.61 < 8.36	0 < 110

Sample duplicates underlined (primary sample listed above duplicate)

Detection limits are converted to results to calculate average and standard deviation

*Note that very high detection limits (25,000) for F1 are excluded from average and standard deviation calculations as outliers

Zero is substituted for negative values where average minus 3s is less than zero

NC: Not calculated. Where there are no values other than "non-detect," no standard deviation is calculated. The acceptable range for these samples should be close to the detection limit.

Table B-9
Ground water chemical concentrations – 2006 to 2010 (Metals)

Sample #	Location	Date	Diss. As [ug/l]	As [ug/l]	Diss. Cd [ug/l]	Cd [ug/l]	Diss. Co [ug/l]	Co [ug/l]	Diss. Cr [ug/l]	Cr [ug/l]	Diss. Cu [ug/l]	Cu [ug/l]	Diss. Ni [ug/l]	Ni [ug/l]	Diss. Pb [ug/l]	Pb [ug/l]	Zn [ug/l]	Diss. Zn [ug/l]	Diss. Hg [ug/l]	Hg [ug/l]
Upgradient Groundwater Samples																				
MW06-04	MW06-04	2006	<1		<0.1		1		<5		2			4		<0.5		<5		
MW06-04	MW06-04	2008	<1	1	<0.025	0.163	1	3	<1	19	8	32	40	<3	3710	<1	234	50	<0.025	<0.025
MW0604-1	MW06-04	2009	<1	<1	<0.1	<0.1	2.1	2.5	<5	<5	1	7	8	9	1.1	<0.5	60	24		<0.1
MW1004	MW06-04	2010	<1	<0.5	<0.1	<0.05	0.8	0.77	<5	<2.5	6	5.9	4	4.4	<0.5	<0.25	10	9.9		
<u>DUP-1</u>	MW06-04	2010	<1	<0.5	<0.1	<0.05	0.6	0.82	<5	<2.5	7	6.3	4	4.7	<0.5	<0.25	9	10.1		
MW06-04	MW06-04	2011	<1	<1	<0.1	<0.1	2.1	2.1	<5	<5	<1	4	15	16	<0.5	<0.5	<5	7		
<u>AH-1</u>	MW06-04	2011	<1	<1	<0.1	<0.1	1.9	2.4	<5	<5	<1	4	14	17	<0.5	<0.5	<5	8		
DowngradientGroundwaterSamples																				
MW06-05	MW06-05	2006	1		0.1		1.7		<5		8			15		<0.5		47		
MW06-05	MW06-05	2007		<1		<1		2		6		6	9		1		30			
MW06-05	MW06-05	2008	<1	2	<0.025	0.261	2	3	<1	11	12	12	20	6	807	<1	43	347	<0.025	<0.025
<u>MW06-07</u>	MW06-05	2008	<1	2	<0.025	0.307	2	2	<1	16	10	16	20	6	1100	<1	63	40	<0.025	<0.025
<u>MW0605-1</u>	MW06-05	2009	<1	<1	<0.1	<0.1	1.2	1.5	<5	<5	6	9	18	9	<0.5	<0.5	9	18		<0.1
MW1005	MW06-05	2010	<1	0.5	0.1	0.11	0.7	1.02	<5	<2.5	7	7.2	7	7	<0.5	0.37	73	63.5		
MW06-05	MW06-05	2011	<1	<1	0.3	<0.1	<0.5	<0.5	<5	<5	9	8	4	5	<0.5	<0.5	64	48		
MW06-06	MW06-06	2006	<1		<0.1		<0.5		<5		4			3		<0.5		9		
MW06-06	MW06-06	2007		<1		<1		2		25		13	22		1		170			
MW06-06	MW06-06	2008	<1	2	<0.025	0.453	1	6	<1	97	13	46	30	8	7390	<1	6210	6650	<0.025	<0.025
MW0606-1	MW06-06	2009	<1	1	<0.1	0.1	0.5	2.3	<5	21	3	21	20	5	3.3	<0.5	330	120		<0.1
<u>DUP-01</u>	MW06-06	2009	<1	<1	<0.1	<0.1	0.6	2.3	<5	11	5	12	13	6	2.5	<0.5	170	170		<0.1
MW1006	MW06-06	2010	<1	<0.5	0.7	0.09	0.7	0.9	6	<2.5	8	7.8	49	38.8	<0.5	0.37	70	96.9		
MW06-06	MW06-06	2011	<1	1	<0.1	<0.1	0.6	4	<5	34	3	54	10	130	<0.5	6.6	52	670		
Statistics																				
N Value			19	18	19	18	19	18	19	18	19	18	18	19	18	19	18	19	4	8
N Value [2006-2010 only]			15	14	15	14	15	14	15	14	15	14	14	15	14	15	14	15	4	8
Average			1	1	0.126	0.238	1.1	2	4	15	6	15	17	16	723	1	423	442	<0.025	<0.1
Average [2006-2010 only]			1	1	0.073	0.358	1.2	2.7	4	22	7	17	20	7	1302	1	732	680	<0.025	<0.1
Minimum			1	1	0.025	0.050	0.5	0.5	1	3	1	4	4	3	0.5	0.3	5	5	<0.025	<0.025
Maximum			1	2	0.700	1.000	2.1	6	6	97	13	54	49	130	7390	7	6210	6650	<0.025	<0.1
Standard Deviation (s)* [2006-2010 only]			NC	0.549725	0.164	0.326	0.6	1.34	NC	24	3	12	13	9	2115	0.3	1636	1701	NC	NC
Acceptable Range (Average +/- 3s) [2006-2010 only]			NC	0 < 3	0 < 1	0 < 1	0 < 3	0 < 7	NC	0 < 95	0 < 17	0 < 52	0 < 60	0 < 33	0 < 7646	0 < 2	0 < 5641	0 < 5782	NC	NC

<u>Sample duplicates underlined (primary sample listed above duplicate)</u>
Detection limits are converted to results to calculate average and standard deviation except where there are no detections - in this case "NC" is substituted
Zero is substituted for negative values where average minus 3s is less than zero
NC: Not calculated. Where there are no values other than "non-detect," no standard deviation is calculated. The acceptable range for these samples should be close to the detection limit.

Table B-10
Soil chemical concentrations – 2006 to 2011 (PCBs, PHCs, and Inorganics)

Sample #	Location	Date	Depth (cm)	As [ug/g]	Cd [ug/g]	Co [ug/g]	Cr [ug/g]	Cu [ug/g]	Ni [ug/g]	Pb [ug/g]	Zn [ug/g]	Hg [ug/g]	PCBs [ug/g]	TPH Identity [ug/g]			
														F1	F2	F3	F4
Upgradient Groundwater Samples																	
MW06-04	MW06-04	2006		1	<0.3	7.4	30	20	20	6	42	<0.05	<0.01	<10	<10	11	<10
952	MW06-04	2007	0	<0.7	<0.9	4	17	10	12	<10	28		<0.1	<10	<20	<20	<20
953	MW06-04	2007	30	<0.7	<0.9	4	18	12	13	<10	29		<0.1	<10	<20	<20	<20
MW06-04	MW06-04	2008	0	0.8	0.5	6.4	29	16	19	9	39	<0.5	<0.005	<10	<10	<10	<10
MW06-04	MW06-04	2008	30	0.7	<0.5	6	27	16	17	13	38	<0.5	<0.005	<10	<10	<10	<10
TP0904-1	MW06-04	2009	0 to 10	<1	<0.1	5.6	21	15	15	7	35	<0.05	0.05	10	10	10	10
TP0904-2	MW06-04	2009	40 to 50	<1	<0.1	8.1	31	19	20	7	43	<0.05	<0.01	<10	<10	21	<10
TP10-1 (0-15)	MW06-04	2010	0 to 10	1	0.1	6	23	19	15	12	51	<0.05	0.09	<10	<10	69	<10
TP10-1 (40-50)	MW06-04	2010	40 to 50	1	<0.1	6.3	23	19	16	13	48	<0.05	0.04	<10	<10	<10	<10
TP11-1T	MW06-04	2011	0 to 10	1	<0.1	7.0	29	20	19	8	46		0.01	<10	<10	21	<10
TP11-1B	MW06-04	2011	40 to 50	1	<0.1	6.9	32	18	20	6	44		<0.01	<10	<10	20	10
TP-BM1-01	BM1	2009	0 to 10	<1	<0.1	6.8	26	20	19	7	46	<0.05	<0.01	<10	<10	25	<10
TP-BM1-02	BM1	2009	40 to 50	<1	<0.1	7.6	33	19	22	7	41	<0.05	<0.01	<10	<10	<10	<10
TP-BM2-01	BM2	2009	0 to 10	<1	<0.1	6.9	26	16	17	6	38	<0.05	<0.01	<10	<10	<10	<10
TP-BM2-02	BM2	2009	40 to 50	<1	<0.1	7.4	31	20	20	7	43	<0.05	<0.01	<10	<10	<10	<10
Downgradient Groundwater Samples																	
MW06-05	MW06-05	2006		1	<0.3	7.6	28	23	20	7	41	<0.05	<0.01	<10	<10	<10	<10
949	MW06-05	2007	0	<0.7	<0.9	4	19	12	13	<10	33		<0.1	<10	<20	<20	<20
950	MW06-05	2007	30	<0.7	<0.9	4	17	11	12	<10	29		<0.1	<10	<20	<20	<20
951	MW06-05	2007	30	<0.7	<0.9	4	18	13	13	<10	31		<0.1	<10	<20	<20	<20
MW06-05	MW06-05	2008	0	0.6	<0.5	6	26	14	16	9	41	<0.5	<0.005	<10	<10	61	22
MW06-07	MW06-05	2008	0	0.6	<0.5	5.5	25	15	16	8	37	<0.5	<0.005	<10	<10	18	<10
MW06-05	MW06-05	2008	30	0.6	<0.5	5.2	24	17	14	8	36	<0.5	<0.005	<10	<10	72	61
MW06-07	MW06-05	2008	30	0.5	<0.5	5.2	24	15	15	8	34	<0.5	<0.005	<10	<10	58	42
TP0905-1	MW06-05	2009	0 to 10	<1	<0.1	6.8	27	19	19	8	44	<0.05	<0.01	<10	<10	13	<10
TP0905-2	MW06-05	2009	40 to 50	<1	<0.1	7.3	29	19	19	7	40	<0.05	<0.01	<10	<10	<10	<10
DUP-02	MW06-05	2009	40 to 50	<1	<0.1	7.2	28	19	19	7	40	<0.05	<0.01	<10	<10	<10	<10
TP10-2 (0-15)	MW06-05	2010	0 to 10	1	<0.1	6.9	27	20	19	7	47	<0.05	<0.01	<10	<10	<10	<10
TP10-2 (40-50)	MW06-05	2010	40 to 50	1	<0.1	7	28	21	19	7	45	<0.05	<0.01	<10	<10	<10	<10
DUP-1	MW06-05	2010	40 to 50	1	<0.1	7.3	28	21	20	7	46	<0.05	<0.01	<10	<10	<10	<10
TP11-2T	MW06-05	2011	0 to 15	1	<0.1	6.9	30	19	20	7	45		<0.01	<10	<10	<10	<10
TP11-2B	MW06-05	2011	40 to 50	1	<0.1	8.3	33	22	24	7	47		<0.01	<10	<10	<10	<10
MW06-06	MW06-06	2006		1	<0.3	8	30	18	20	6	42	<0.05	<0.01	<10	<10	<10	<10
947	MW06-06	2007	0	<0.7	<0.9	4	17	9	11	<10	29		<0.1	<10	<20	<20	<20
948	MW06-06	2007	30	<0.7	<0.9	5	19	14	14	<10	33		<0.1	<10	<20	<20	<20
MW06-06	MW06-06	2008	0	0.8	<0.5	6.8	30	17	20	10	42	<0.5	<0.005	<10	<10	<10	<10
MW06-06	MW06-06	2008	30	0.8	0.5	6.4	29	26	19	9	38	<0.5	<0.005	<10	<10	<10	<10
TP0906-01	MW06-06	2009	0 to 10	<1	<0.1	6.7	25	35	18	6	40	<0.05	<0.01	<10	<10	<10	<10
DUP-01	MW06-06	2009	0 to 10	<1	<0.1	6.7	27	17	18	7	40	<0.05	<0.01	<10	<10	<10	<10
TP0906-02	MW06-06	2009	40 to 50	<1	<0.1	7.3	28	19	19	7	40	<0.05	<0.01	<10	<10	<10	<10
TP10-3 (0-15)	MW06-06	2010	0 to 10	1	<0.1	6.7	26	19	18	7	43	<0.05	<0.01	<10	<10	18	<10
DUP-2	MW06-06	2010	0 to 10	1	<0.1	6.6	27	21	18	8	46	<0.05	<0.01	<10	<10	12	<10
TP10-3 (40-50)	MW06-06	2010	40 to 50	1	<0.1	6.8	28	21	20	7	44	<0.05	<0.01	<10	<10	14	<10
TP11-3T	MW06-06	2011	40 to 50	<1	<0.1	6.3	26	20	17	7	45		<0.01	<10	<10	22	<10
DUP T	MW06-06	2011	0 to 10	<1	<0.1	6.0	23	18	16	6	42		<0.01	<10	<10	26	<10
TP11-3B	MW06-06	2011	0 to 10	<1	<0.1	7.2	32	20	19	7	45		<0.01	<10	<10	<10	<10
DUP B	MW06-06	2011	40 to 50	<1	<0.1	6.8	29	19	20	7	44		<0.01	<10	<10	<10	<10
Statistics																	
	N Value			46	46	46	46	46	46	46	46	31	46	46	46	46	46
	Average			0.9	0.3	6.4	26	18	18	8	40	<0.5	0	10	12	19	14
	Minimum			0.5	0.1	4.0	17	9	11	6	28	<0.05	0.005	10	10	10	10
	Maximum			1.0	0.9	8.3	33	35	24	13	51	<0.5	0.1	10	20	72	61

Sample duplicates underlined (primary sample listed above duplicate)

Table B-11: Thermistor Annual Maintenance Report

Contractor name: Franz Environmental Inc.	**Inspection date:** August 27, 2011
Prepared by: Ryan Fletcher & Catherine LeBlanc	

Thermistor Information

Thermistor Number	**CAMF 01-VT**	**CAMF 02-VT**	**CAMF 03-VT**	**CAMF 04-VT**
Install date	2007-09-21	2010-09-07	2007-09-16	2007-09-17
Location	CAM-F (SSDF)	CAM-F (SSDF)	CAM-F (SSDF)	CAM-F (SSDF)
Inclination	Vertical	Vertical	Vertical	Vertical
Cable length (m)	7.8	7.8	8.4	8.4
Cable length (m) above ground	3	3	1.5	1.5
No. of beads	11	11	12	12
Bead type	44007	44007	44007	44007
Coordinates (m)	N:7605524 E: 405936	N:7605544 E: 405886	N:7605574.5 E: 405956.9	N:7605594.1 E: 405906.5
Serial no.	07060039	09010147	05070006	05070020
Logger model	Lakewood Systems Ultralogger			

Thermistor inspection

Thermistor Number	**CAMF 01-VT**	**CAMF 02-VT**	**CAMF 03-VT**	**CAMF 04-VT**
Casing	Good condition	Good condition	Good condition	Good condition
Cover	Good condition	Good condition	Good condition	Good condition
Data logger	Good condition	Good condition	Good condition	Good condition
Cable	Good condition	Good condition	Good condition	Good condition
Beads	Operational	Operational	Operational	Operational
Battery installation date	2010-09-08	2010-09-07	2010-09-07	2010-09-07
Main battery (V)				
On Aug 27/11	11.34	11.34	11.34	11.34
Aux battery (V)				
On Aug 27/11	13.50	13.14	13.75	13.63

Observations and proposed maintenance

- Based on the previous monitoring report, the desiccant cartridges were replaced as they had turned slightly pink. It is recommended that spare desiccant cartridges be brought to the site each year to use as needed.
- Batteries were replaced in data loggers in 2010 and should not need replacing until 2013. Given that no scheduled monitoring event is scheduled for 2013, it should be acceptable to replace the batteries in four years, at the following monitoring event in 2014, given the acceptable voltages measured on the 3 year old batteries swapped out this year as well as Lakewood Systems' suggested battery life of 3 to 5 years.
- A note on battery voltages: The battery voltage levels are particularly meaningful when rechargeable batteries are used. With lithium batteries, as is the case at CAM-F, the discharge curve is extremely flat until total failure, when voltage levels drop off abruptly. Because voltage readings are not a good predictor of failure, lithium batteries should be replaced based on their date stickers.

Table B-12: Manual Thermistor Readings

Analog Channel		Thermistor R (Ohms)	Temperature (ºC)		
			Manual	Logged	Difference
VT01	1	11884	6.3549	7.0443	0.7
	2	12714	4.9908	4.7274	0.3
	3	14038	3.0098	3.0744	0.1
	4	15370	1.2181	1.2587	0.0
	5	16412	-0.0660	-0.1002	0.0
	6	17196	-0.9734	-0.9243	0.0
	7	17921	-1.7721	-1.7381	0.0
	8	18718	-2.6094	-2.6561	0.0
	9	19529	-3.4214	-3.0245	0.4
	10	20350	-4.2059	-3.8077	0.4
	11	21000	-4.8022	-4.4445	0.4
		maximum	--	--	***0.7***
VT02	1	11598	6.8500	7.2645	0.4
	2	12334	5.6025	5.0118	0.6
	3	13369	3.9832	3.9687	0.0
	4	14333	2.5970	2.5589	0.0
	5	15527	1.0185	0.9464	0.1
	6	16681	-0.3827	-0.4354	0.1
	7	17413	-1.2163	-1.328	0.1
	8	18303	-2.1785	-2.3148	0.1
	9	19100	-2.9967	-3.1234	0.1
	10	19833	-3.7161	-3.8759	0.2
	11	20510	-4.3546	-4.5714	0.2
		maximum	--	--	***0.6***
VT03	1	14800	1.9626	2.1128	0.2
	2	15578	0.9541	0.9212	0.0
	3	16409	-0.0625	-0.3134	0.3
	4	17128	-0.8965	-1.2717	0.4
	5	18124	-1.9893	-2.4957	0.5
	6	18926	-2.8214	-3.4153	0.6
	7	19720	-3.6072	-4.2756	0.7
	8	20370	-4.2245	-4.9905	0.8
	9	21060	-4.8562	-5.5994	0.7
	10	21740	-5.4565	-6.2135	0.8
	11	22200	-5.8509	-6.6096	0.8
	12	22800	-6.3517	-7.0464	0.7
		maximum	--	--	***0.8***

Analog Channel		Thermistor R (Ohms)	Temperature (ºC)		
			Manual	Logged	Difference
VT04	1	15089	1.5812	1.8519	0.3
	2	15882	0.5753	0.5831	0.0
	3	16662	-0.3605	-0.532	0.2
	4	17339	-1.1339	-1.4099	0.3
	5	18270	-2.1438	-2.5629	0.4
	6	19139	-3.0357	-3.5459	0.5
	7	19934	-3.8129	-4.4234	0.6
	8	20810	-4.6301	-5.2463	0.6
	9	21590	-5.3259	-5.9381	0.6
	10	22350	-5.9775	-6.5715	0.6
	11	23490	-6.9097	-7.5304	0.6
	12	23160	-6.6451	-7.1122	0.5
		maximum	--	--	***0.6***

APPENDIX C

Test Pit Logs and Monitoring Well Sampling Records and Notes

Date: 27-Aug-11		**Test Pit: TP11-1**			
Logged by: CEL					
Method: Hand Excavation					
Location: CAM-F			Type	Analysis & Depth of Sample (m)	COMMENTS
Issue	Depth (m)	Description			
Near MW06-04	0 - 0.5	Brown, wet sand, coarse, cobbles, some gravel.	GR	PHCs, Metals, PCBs (0-0.15) PHCs, Metals, PCBs (0.4 - 0.5)	

Date: 27-Aug-11		**Test Pit: TP11-2**			
Logged by: CEL					
Method: Hand Excavation					
Location: CAM-F			Type	Analysis & Depth of Sample (m)	COMMENTS
Issue	Depth (m)	Description			
Near MW06-05	0 - 0.5	0-0.15 Dark and light brown sand, moist, coarse, some gravel Dark band at 0.15 0.16-0.5 Brown, wet sand, coarse, cobbles with some gravel	GR	PHCs, Metals, PCBs (0-0.15) PHCs, Metals, PCBs (0.4 - 0.5)	Dup T - 0-0.15 Dup B - 0.4-0.5

Date: 27-Aug-11		**Test Pit: TP11-3**			
Logged by: CEL					
Method: Hand Excavation					
Location: CAM-F			Type	Analysis & Depth of Sample (m)	COMMENTS
Issue	Depth (m)	Description			
Near MW06-06	0 - 0.5	0-0.15 Light grey brown sand, coarse, some gravel, wet Dark band at 0.15 0.16-0.5 Light grey brown sand, coarse, some gravel, wet	GR	PHCs, Metals, PCBs (0-0.15) PHCs, Metals, PCBs (0.4 - 0.5)	Duplicate D1 collected here

Groundwater Sampling

Project: 1697-1101

Franz Personnel: CEL & MD
Weather: Overcast/5°c

Sampling of Monitoring Wells

Name of Area: SSDF			Sector:
Date of Sampling:	Day: 27	Month: 08	Year: 2011
Monitoring Well ID:	MW06-04		
Coordinates of Well	Easting:		Northing:
	GPS unit:		WP #:
Type of Well:	**Stick Up**	Drive Point	
Condition of Well:	**Good**	Broken Casing	Bailer stuck in well
	Waterra tubing stuck in well		Missing Cap
Volume Purged (L):	2 L		
Sampling Equipment:	Geopump brand persistaltic pump and Horiba U-22 water quality meter		

Measured Data

Well Depth (m):	1.69	
Water Depth (m):	0.57	
Stick Up (m):	0.27	

Field Chemistry

Name and # unit:	Readings *	
pH:	1	6.06
	2	6.25
	3	6.37
	4	6.47
	5	6.55
	6	6.63
	7	6.68
	8	6.73
	9	6.77
	10	6.81
	11	6.84
Temperature (◦C):	1	3.25
	2	3.03
	3	2.80
	4	2.75
	5	2.74
	6	2.70
	7	2.81
	8	2.79
	9	2.72
	10	2.68
	11	2.65
Conductivity (mS/cm):	1	4.45
	2	4.44
	3	4.44
	4	4.43
	5	4.43
	6	4.43
	7	4.44
	8	4.44
	9	4.45
	10	4.46
	11	4.46
DO:	1	4.38
	2	3.14
	3	2.30
	4	1.75
	5	1.65
	6	1.44
	7	1.20
	8	1.01
	9	0.77
	10	0.59
	11	0.41
ORP:	1	12
	2	-6
	3	-18
	4	-28
	5	-31
	6	-37
	7	-43
	8	-53
	9	-63
	10	-74
	11	-86
Turbidity:	1	118.0
	2	77.8
	3	50.6
	4	51.3
	5	45.9
	6	43.3
	7	36.6
	8	36.8
	9	32.6
	10	30.9
	11	32.1

Sample Analysis	Y/N	# of Bottles	Duplicate Information
PHC	Y	13	AH-1
PCB Total	Y		AH-1
Total Metals	Y		AH-1
Dissolved Metals	Y		AH-1
General	Y		AH-1
Other			

Comments/ Notes:

(*) Field Chemistry Readings should be taken every 30 seconds until parameters stabilize

Groundwater Sampling

Project:	1697-1101	Franz Personnel:	CEL & MD
		Weather:	Overcast/5°c

Sampling of Monitoring Wells

Name of Area: SSDF			Sector:
Date of Sampling:	Day: 27	Month: 08	Year: 2011
Monitoring Well ID:	MW06-05		
Coordinates of Well	Easting:		Northing:
	GPS unit:		WP #:
Type of Well:	**Stick Up**	Drive Point	
Condition of Well:	**Good**	Broken Casing	Bailer stuck in well
	Waterra tubing stuck in well		Missing Cap
Volume Purged (L):	1.5 L		
Sampling Equipment:	Geopump brand persistaltic pump and Horiba U-22 water quality meter		

Measured Data

Well Depth (m):	2.09
Water Depth (m):	1.04
Stick Up (m):	0.68

Field Chemistry

Name and # unit:	#	Readings *
pH:	1	7.76
	2	7.69
	3	7.66
	4	7.65
	5	7.65
	6	
	7	
	8	
	9	
	10	
	11	
Temperature (◦C):	1	3.36
	2	3.68
	3	3.93
	4	4.03
	5	4.06
	6	
	7	
	8	
	9	
	10	
	11	
Conductivity (mS/cm):	1	2.09
	2	1.96
	3	1.77
	4	7.72
	5	1.69
	6	
	7	
	8	
	9	
	10	
	11	
DO:	1	9.66
	2	9.53
	3	10.26
	4	10.61
	5	10.77
	6	
	7	
	8	
	9	
	10	
	11	
ORP:	1	174
	2	173
	3	174
	4	176
	5	177
	6	
	7	
	8	
	9	
	10	
	11	
Turbidity:	1	10.0
	2	9.2
	3	8.5
	4	7.1
	5	7.1
	6	
	7	
	8	
	9	
	10	
	11	

Sample Analysis	Y/N	# of Bottles	Duplicate Information
PHC	Y	13	
PCB Total	Y		
Total Metals	Y		
Dissolved Metals	Y		
General	Y		
Other			

Comments/ Notes:

(*) Field Chemistry Readings should be taken every 30 seconds until parameters stabilize

Groundwater Sampling

Project: 1697-1101

Franz Personnel: CEL & MD
Weather: Overcast/5°c

Sampling of Monitoring Wells

Name of Area: SSDF			Sector:
Date of Sampling:	Day: 27 & 28	Month: 08	Year: 2011
Monitoring Well ID:	MW06-06		
Coordinates of Well	Easting:		Northing:
	GPS unit:		WP #:
Type of Well:	**Stick Up**	Drive Point	
Condition of Well:	**Good**	Broken Casing	Bailer stuck in well
	Waterra tubing stuck in well		Missing Cap
Volume Purged (L):	1 L		
Sampling Equipment:	Geopump brand persistaltic pump and Horiba U-22 water quality meter		

Measured Data

Well Depth (m):	1.95
Water Depth (m):	1.56
Stick Up (m):	0.75

Field Chemistry

Name and # unit:	Readings *	
pH:	1	8.07
	2	8.16
	3	8.11
	4	
	5	
	6	
	7	
	8	
	9	
	10	
	11	
Temperature (◦C):	1	3.76
	2	3.50
	3	3.69
	4	
	5	
	6	
	7	
	8	
	9	
	10	
	11	
Conductivity (mS/cm):	1	1.67
	2	1.66
	3	1.69
	4	
	5	
	6	
	7	
	8	
	9	
	10	
	11	
DO:	1	5.60
	2	5.27
	3	5.93
	4	
	5	
	6	
	7	
	8	
	9	
	10	
	11	
ORP:	1	171
	2	172
	3	170
	4	
	5	
	6	
	7	
	8	
	9	
	10	
	11	
Turbidity:	1	29.8
	2	23.3
	3	26.3
	4	
	5	
	6	
	7	
	8	
	9	
	10	
	11	

Sample Analysis	Y/N	# of Bottles	Duplicate Information
PHC	Y	11	
PCB Total	Y		
Total Metals	Y		
Dissolved Metals	Y		
General	Y		
Other			

Comments/ Notes:
Could not fill two F1/BTEX vials due to limited water.
Pumped dry
Sampling occurred over two days due to limited recharge

(*) Field Chemistry Readings should be taken every 30 seconds until parameters stabilize

APPENDIX D

Laboratory Reports and Chain of Custody Forms

Maxxam

Maxxam Analytics International Corporation o/a Maxxam Analytics
6740 Campobello Road, Mississauga, Ontario Canada L5N 2L8 Tel:(905) 817-5700 Toll-free:800-653-6266 Fax:(905) 817-5779 www.maxxam.ca

CHAIN OF CUSTODY RECORD

Page 1 of 1

INVOICE INFORMATION:		REPORT INFORMATION (if differs from invoice):		PROJECT INFORMATION:	
Company Name:	#10988 Franz Environmental Inc	Company Name:		Quotation #:	B14919
Contact Name:	Invoices, Lillian & Catherine	Contact Name:	Catherine LeBlanc	P.O. #:	
Address:	329 Churchill Ave N Suite 200	Address:		Project #:	1697-1101
	Ottawa ON K1Z 5B8			Project Name:	
Phone:	(613)721-0555 Fax: (613)721-0029	Phone:	Fax:	Site #:	
Email:	cleblanc@franzenvironmental.com; lellis@franzenvi	Email:	cleblanc@franzenvironmental.com	Sampled By:	

Laboratory Use Only:

MAXXAM JOB #:	BOTTLE ORDER #:
	275432
CHAIN OF CUSTODY #:	PROJECT MANAGER:
C#275432-01-01	JULIE CLEMENT

Regulation 153 (2011)

- [ ] Table 1 - [ ] Res/Park - [ ] Medium/Fine
- [ ] Table 2 - [ ] Ind/Comm - [ ] Coarse
- [ ] Table 3 - [ ] Agri/Other
- [ ] Table ___ - [ ] For RSC

Other Regulations

- [ ] CCME - [ ] Sanitary Sewer Bylaw
- [ ] Reg. 558 - [ ] Storm Sewer Bylaw
- [ ] MISA Municipality ______
- [ ] PWQO
- [ ] Other ______

SPECIAL INSTRUCTIONS

See Quote for metals

Include Criteria on Certificate of Analysis (Y/N)? ___

Note: For MOE regulated drinking water samples - please use the Drinking Water Chain of Custody Form

SAMPLES MUST BE KEPT COOL (< 10ºC) FROM TIME OF SAMPLING UNTIL DELIVERY TO MAXXAM

TURNAROUND TIME (TAT) REQUIRED:

PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS

Regular (Standard) TAT: [x]
(will be applied if Rush TAT is not specified):
Standard TAT = 5-7 Working days for most tests.
Please note: Standard TAT for certain tests such as BOD and Dioxins/Furans are > 5 days - contact your Project Manager for details.

Job Specific Rush TAT (if applies to entire submission) [ ]
Date Required: ______ Time Required: ______
Rush Confirmation Number: ______ *(call lab for #)*

ANALYSIS REQUESTED (Please be specific):

	Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	Regulated Drinking Water ? (Y / N)	Metals Field Filtered ? (Y / N)	Anions/pH/Conductivity/Color	Dissolved Metals by ICPMS	Mercury (low level)	PHC F1-F4 & BTEX in water	Polychlorinated Biphenyl in Water	Total Metals Analysis by ICPMS	TSS & TDS				# of Bottles	Comments
1		MW06-4	Aug27	PM	W		Y	X	X	X	X	X	X	X				13	
2		MW06-5	Aug27	↓			Y	X	X	X	X	X	X	X				13	
3		MW06-6	Aug27				Y	X	X	X	X	X	X	X				13	Limited Sample.
4		~~MW06-6~~	~~Aug28~~	~~AM~~			~~Y~~												~~Limited Sample.~~
5		AH-1	Aug27	PM	W		Y	X	X	X	X	X	X	X				13	
6																			
7																			
8																			
9																			
10																			

30-Aug-11 11:01
JULIE CLEMENT
B1D2341
M_D OTT-001

REC'D IN OTTAWA

*RELINQUISHED BY: (Signature/Print)	Date: (YY/MM/DD)	Time:	RECEIVED BY: (Signature/Print)	Date: (YY/MM/DD)	Time:	# Jars Used and Not Submitted
Catherine LeBlanc	11/08/27	8:00	Shaun colbert	2011/08/30	9:15	

Laboratory Use Only

Time Sensitive	Temperature (°C) on Receipt	Custody Seal	Yes	No
	4/6/6	Present	✓	
		Intact	✓	

1/2/5 7/8/9
on ice

White: Maxxam Yellow: Client

* IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORD. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

Maxxam Analytics International Corporation o/a Maxxam Analytics

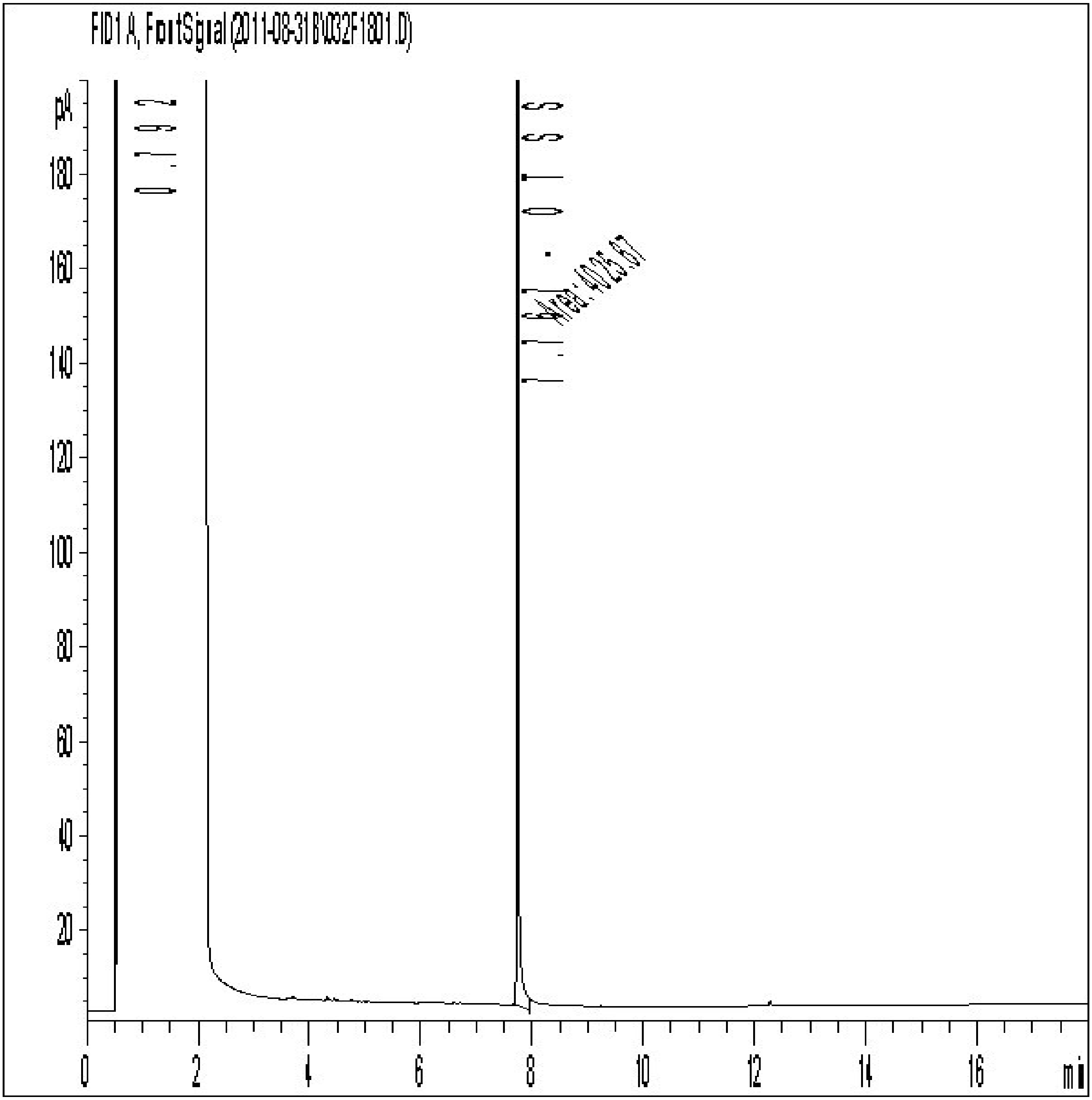
Success Through Science®

Report Date: 2011/09/07
Maxxam Job #: B1D2341
Maxxam Sample: KS2329

Franz Environmental Inc
Client Project #: 1697-1101

Client ID: MW06-4

Petroleum Hydrocarbons F2-F4 in Water Chromatogram



Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

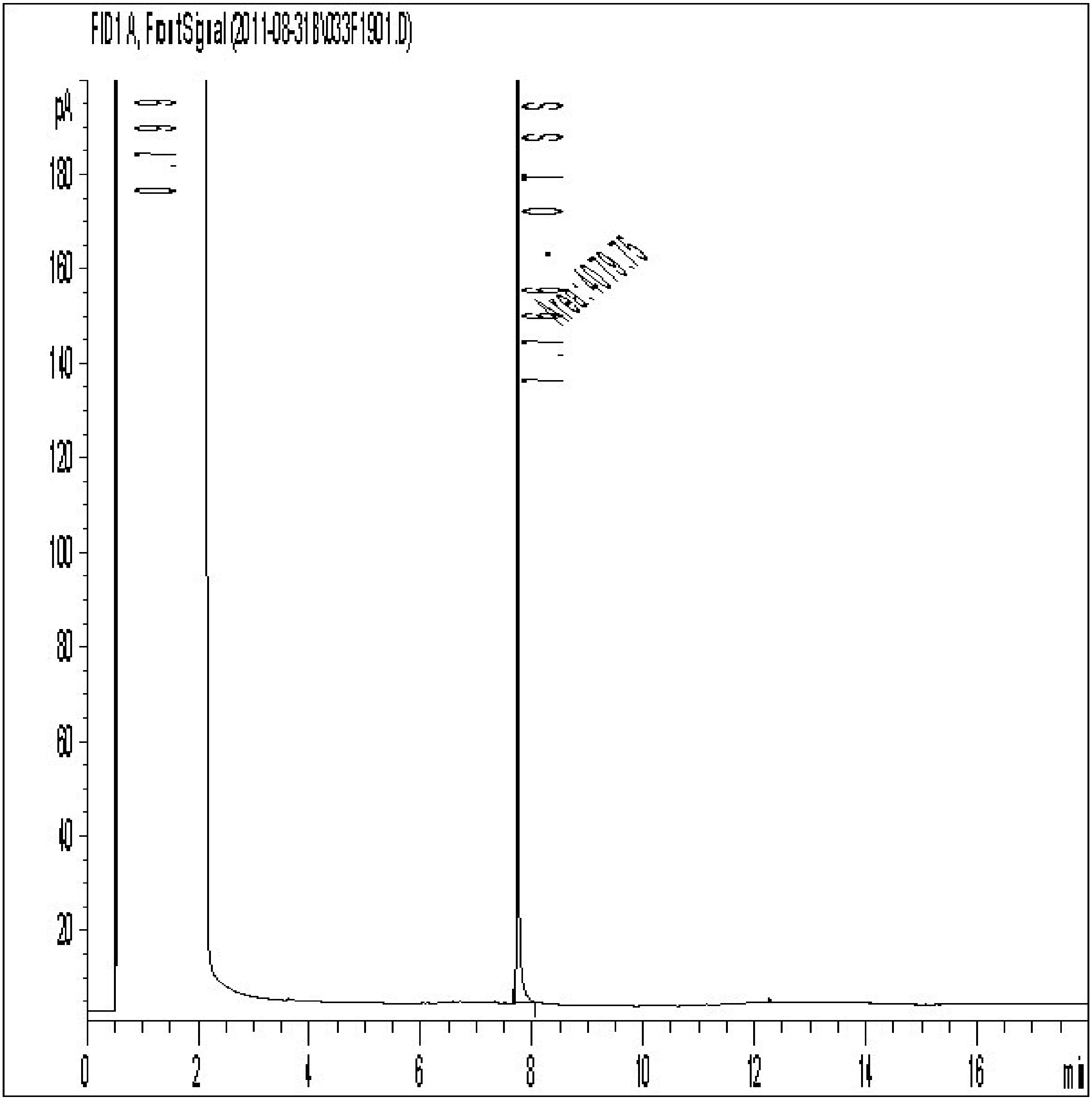
Success Through Science®

Franz Environmental Inc
Client Project #: 1697-1101

Client ID: MW06-5

Report Date: 2011/09/07
Maxxam Job #: B1D2341
Maxxam Sample: KS2330

Petroleum Hydrocarbons F2-F4 in Water Chromatogram



Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

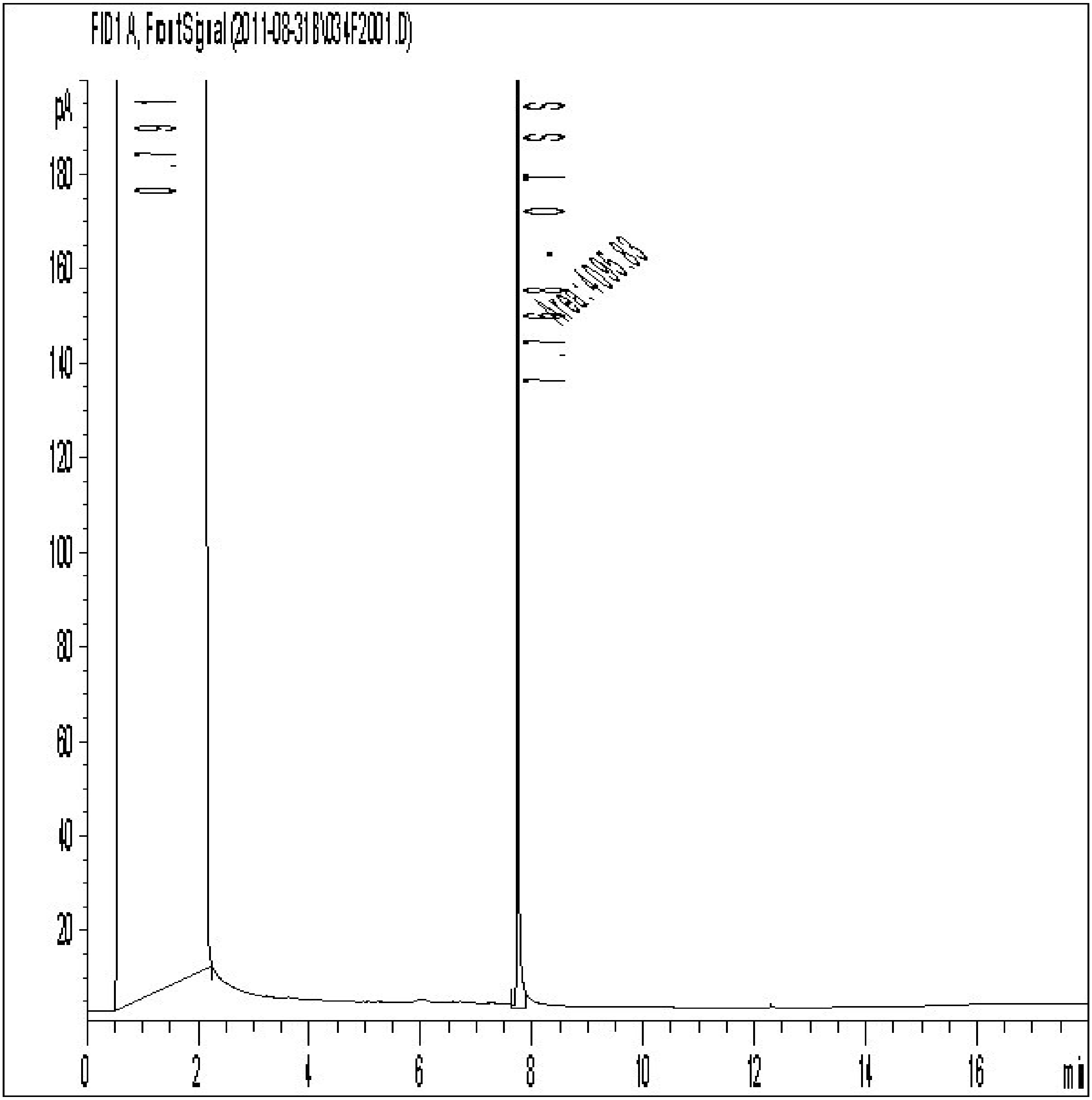
Success Through Science®

Franz Environmental Inc
Client Project #: 1697-1101

Report Date: 2011/09/07
Maxxam Job #: B1D2341
Maxxam Sample: KS2331

Client ID: MW06-6

Petroleum Hydrocarbons F2-F4 in Water Chromatogram



Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

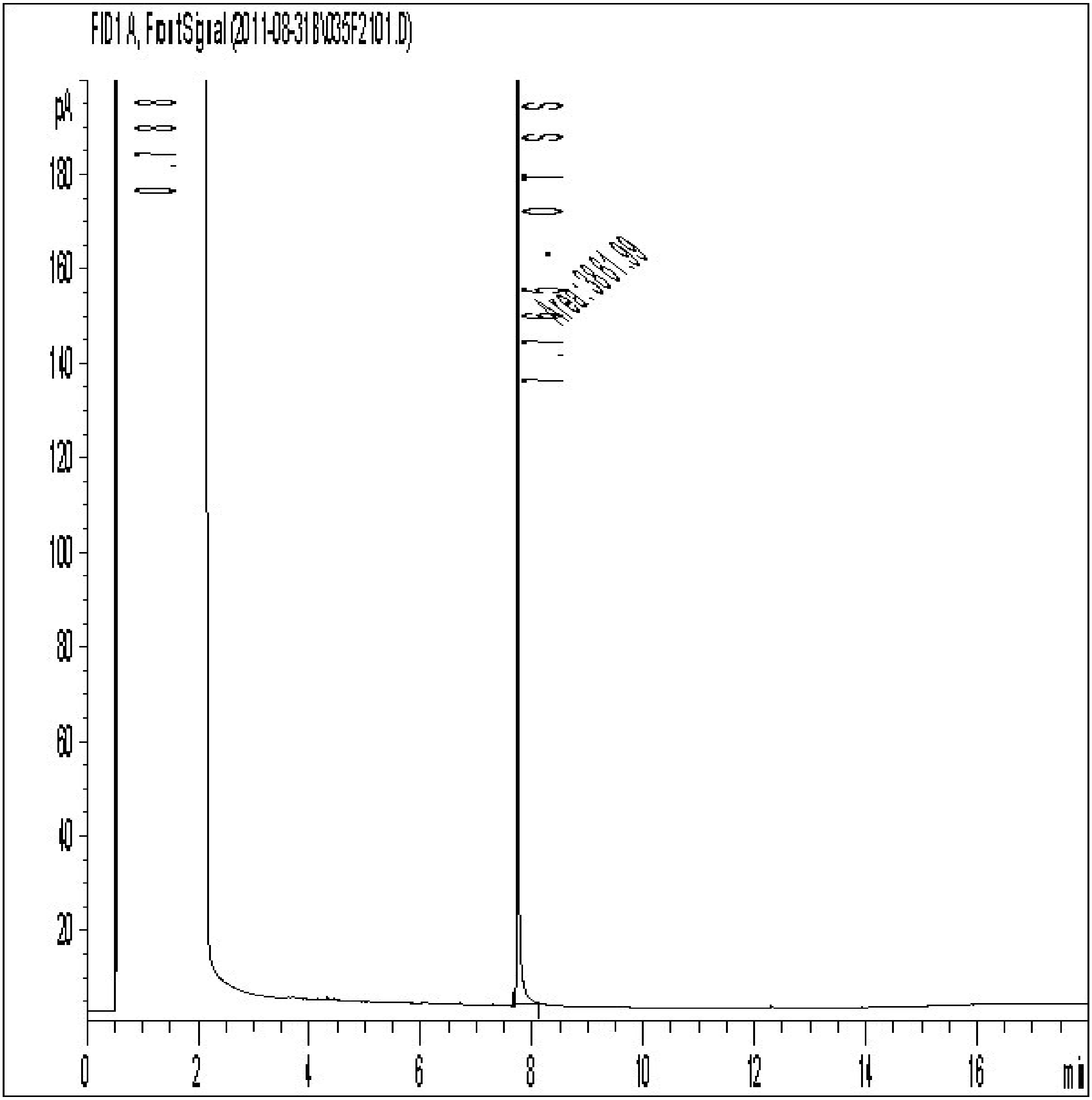
Success Through Science®

Report Date: 2011/09/07
Maxxam Job #: B1D2341
Maxxam Sample: KS2332

Franz Environmental Inc
Client Project #: 1697-1101

Client ID: AH-1

Petroleum Hydrocarbons F2-F4 in Water Chromatogram



Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam

Your Project #: 1697-1101
Your C.O.C. #: 27543201, 275432-01-01

Attention: Catherine LeBlanc
Franz Environmental Inc
329 Churchill Ave N
Suite 200
Ottawa, ON
K1Z 5B8

Report Date: 2011/09/07

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B1D2341
Received: 2011/08/30, 11:01

Sample Matrix: Water
Samples Received: 4

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Method Reference
Chloride by Automated Colourimetry (1)	4	N/A	2011/09/06	CAM SOP-00463	SM 4500 Cl E
Colour (1)	4	N/A	2011/09/02	CAM SOP-00412	APHA 2120
Conductivity (1)	4	N/A	2011/09/04	CAM SOP-00448	SM 2510
Petroleum Hydro. CCME F1 & BTEX in Water	3	N/A	2011/09/01	OTT SOP-00002	CCME CWS
Petroleum Hydro. CCME F1 & BTEX in Water	1	N/A	2011/09/02	OTT SOP-00002	CCME CWS
Petroleum Hydrocarbons F2-F4 in Water	4	2011/08/30	2011/08/31	OTT SOP-00001	CCME Hydrocarbons
Fluoride (1)	4	2011/09/02	2011/09/04	CAM SOP-00448	APHA 4500FC
Mercury (low level) (1)	4	2011/09/01	2011/09/01	CAM SOP-00453	EPA 7470
Dissolved Metals by ICPMS (1)	1	N/A	2011/09/01	CAM SOP-00447	EPA 6020
Dissolved Metals by ICPMS (1)	3	N/A	2011/09/06	CAM SOP-00447	EPA 6020
Total Metals Analysis by ICPMS (1)	4	N/A	2011/09/06	CAM SOP-00447	EPA 6020
Nitrate (NO3) and Nitrite (NO2) in Water (1, 2)	4	N/A	2011/09/02	CAM SOP-00440	SM 4500 NO3I/NO2B
Polychlorinated Biphenyl in Water (1)	4	2011/09/01	2011/09/02	CAM SOP-00309	SW846 8082
pH (1)	4	N/A	2011/09/04	CAM SOP-00448	SM 4500H
Orthophosphate (1)	4	N/A	2011/09/06	CAM SOP-00461	SM 4500 P-F
Sulphate by Automated Colourimetry (1)	4	N/A	2011/09/06	CAM SOP-00464	EPA 375.4
Total Dissolved Solids (1)	4	N/A	2011/09/02	CAM SOP-00428	APHA 2540C
Low Level Total Suspended Solids (1)	4	N/A	2011/09/01	CAM SOP-00428	SM 2540D

Remarks:

Maxxam Analytics has performed all analytical testing herein in accordance with ISO 17025 and the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act. All methodologies comply with this document and are validated for use in the laboratory. The methods and techniques employed in this analysis conform to the performance criteria (detection limits, accuracy and precision) as outlined in the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act.

The CWS PHC methods employed by Maxxam conform to all prescribed elements of the reference method and performance based elements have been validated. All modifications have been validated and proven equivalent following the 'Alberta Environment Draft Addenda to the CWS-PHC, Appendix 6, Validation of Alternate Methods'. Documentation is available upon request. Maxxam has made the following improvements to the CWS-PHC reference benchmark method: (i) Headspace for F1; and, (ii) Mechanical extraction for F2-F4. Note: F4G cannot be added to the C6 to C50 hydrocarbons. The extraction date for samples field preserved with methanol for F1 and Volatile Organic Compounds is considered to be the date sampled.

Maxxam Analytics is accredited by SCC (Lab ID 97) for all specific parameters as required by Ontario Regulation 153/04. Maxxam Analytics is limited in liability to the actual cost of analysis unless otherwise agreed in writing. There is no other warranty expressed or implied. Samples will be retained at Maxxam Analytics for three weeks from receipt of data or as per contract.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
* Results relate only to the items tested.

Maxxam Analytics International Corporation o/a Maxxam Analytics 32 Colonnade Rd, Unit #1000, Nepean, ON K2E 7J6 Phone: 613 274-0573 Fax: 613 274-0574 Website: www.maxxamanalytics.com

(1) This test was performed by Maxxam Analytics Mississauga
(2) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

JULIE CLEMENT, Ottawa Customer Service
Email: JClement@maxxam.ca
Phone# (613) 274-3549

==
Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Total cover pages: 1

Maxxam Job #: B1D2341
Report Date: 2011/09/07

Franz Environmental Inc
Client Project #: 1697-1101

Sampler Initials: CL

RESULTS OF ANALYSES OF WATER

Maxxam ID		KS2329			KS2330	KS2331		KS2332		
Sampling Date		2011/08/27			2011/08/27	2011/08/27		2011/08/27		
	Units	**MW06-4**	**RDL**	**QC Batch**	**MW06-5**	**MW06-6**	**RDL**	**AH-1**	**RDL**	**QC Batch**
Inorganics										
Colour	TCU	3	2	2602465	4	3	2	4	2	2602465
Conductivity	umho/cm	4020	1	2603927	1500	1440	1	3930	1	2603927
Total Dissolved Solids	mg/L	3000	10	2601612	1080	1120	10	2940	10	2601612
Fluoride (F-)	mg/L	0.5	0.1	2603928	0.3	0.7	0.1	0.5	0.1	2603928
Orthophosphate (P)	mg/L	<0.01	0.01	2602453	<0.01	<0.01	0.01	<0.01	0.01	2602453
pH	pH	7.86		2603929	7.95	8.19		7.97		2603929
Total Suspended Solids	mg/L	4	1	2601319	2	27	1	5	1	2601318
Dissolved Sulphate (SO4)	mg/L	2400	10	2602454	590	550	5	2400	10	2602454
Dissolved Chloride (Cl)	mg/L	110	1	2602452	49	26	1	110	1	2602452
Nitrite (N)	mg/L	<0.01	0.01	2602443	<0.01	<0.01	0.01	<0.01	0.01	2602443
Nitrate (N)	mg/L	<0.1	0.1	2602443	0.3	<0.1	0.1	<0.1	0.1	2602443
Nitrate + Nitrite	mg/L	<0.1	0.1	2602443	0.3	<0.1	0.1	<0.1	0.1	2602443

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam Analytics International Corporation o/a Maxxam Analytics 32 Colonnade Rd, Unit #1000, Nepean, ON K2E 7J6 Phone: 613 274-0573 Fax: 613 274-0574 Website: www.maxxamanalytics.com

Maxxam Job #: B1D2341
Report Date: 2011/09/07

Franz Environmental Inc
Client Project #: 1697-1101

Sampler Initials: CL

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Maxxam ID		KS2329	KS2330		KS2331		KS2332		
Sampling Date		2011/08/27	2011/08/27		2011/08/27		2011/08/27		
	Units	**MW06-4**	**MW06-5**	**QC Batch**	**MW06-6**	**QC Batch**	**AH-1**	**RDL**	**QC Batch**
Metals									
Mercury (Hg)	ug/L	<0.01	<0.01	2601322	0.01	2601322	<0.01	0.01	2601322
Dissolved Aluminum (Al)	ug/L	12	12	2605513	11	2603934	6	5	2601450
Total Aluminum (Al)	ug/L	230	15	2606043	6800	2606043	700	5	2606043
Dissolved Antimony (Sb)	ug/L	<0.5	<0.5	2605513	<0.5	2603934	<0.5	0.5	2601450
Total Antimony (Sb)	ug/L	<0.5	<0.5	2604619	<0.5	2604619	<0.5	0.5	2604619
Dissolved Arsenic (As)	ug/L	<1	<1	2605513	<1	2603934	<1	1	2601450
Total Arsenic (As)	ug/L	<1	<1	2604619	1	2604619	<1	1	2604619
Dissolved Barium (Ba)	ug/L	13	47	2605513	19	2603934	13	2	2601450
Total Barium (Ba)	ug/L	15	49	2604619	51	2604619	19	2	2604619
Dissolved Beryllium (Be)	ug/L	<0.5	<0.5	2605513	<0.5	2603934	<0.5	0.5	2601450
Total Beryllium (Be)	ug/L	<0.5	<0.5	2604619	<0.5	2604619	<0.5	0.5	2604619
Dissolved Boron (B)	ug/L	110	<10	2605513	54	2603934	110	10	2601450
Total Boron (B)	ug/L	110	<10	2604619	56	2604619	110	10	2604619
Dissolved Cadmium (Cd)	ug/L	<0.1	0.3	2605513	<0.1	2603934	<0.1	0.1	2601450
Total Cadmium (Cd)	ug/L	<0.1	<0.1	2604619	<0.1	2604619	<0.1	0.1	2604619
Dissolved Chromium (Cr)	ug/L	<5	<5	2605513	<5	2603934	<5	5	2601450
Total Chromium (Cr)	ug/L	<5	<5	2604619	34	2604619	<5	5	2604619
Dissolved Copper (Cu)	ug/L	<1	9	2605513	3	2603934	<1	1	2601450
Total Copper (Cu)	ug/L	4	8	2604619	54	2604619	4	1	2604619
Dissolved Iron (Fe)	ug/L	940	<100	2605513	<100	2603934	810	100	2601450
Total Iron (Fe)	ug/L	1100	<100	2604619	8500	2604619	1900	100	2604619
Dissolved Lead (Pb)	ug/L	<0.5	<0.5	2605513	<0.5	2603934	<0.5	0.5	2601450
Total Lead (Pb)	ug/L	<0.5	<0.5	2604619	6.6	2604619	0.7	0.5	2604619
Dissolved Molybdenum (Mo)	ug/L	6.3	1.1	2605513	14	2603934	5.8	0.5	2601450
Total Molybdenum (Mo)	ug/L	6.8	1.5	2604619	13	2604619	6.4	0.5	2604619
Dissolved Nickel (Ni)	ug/L	15	4	2605513	10	2603934	14	1	2601450
Total Nickel (Ni)	ug/L	16(1)	5	2604619	130	2604619	17(1)	1	2604619
Dissolved Selenium (Se)	ug/L	<2	<2	2605513	2	2603934	<2	2	2601450
Total Selenium (Se)	ug/L	4	<2	2604619	3	2604619	5	2	2604619
Dissolved Silver (Ag)	ug/L	<0.1	<0.1	2605513	<0.1	2603934	<0.1	0.1	2601450
Total Silver (Ag)	ug/L	<0.1	<0.1	2604619	0.3	2604619	<0.1	0.1	2604619
Dissolved Thallium (Tl)	ug/L	<0.05	<0.05	2605513	<0.05	2603934	<0.05	0.05	2601450
Total Thallium (Tl)	ug/L	<0.05	<0.05	2604619	0.10	2604619	<0.05	0.05	2604619
Dissolved Titanium (Ti)	ug/L	<5	<5	2605513	<5	2603934	<5	5	2601450

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
(1) - ICPMS(003) analysis:Detection Limit was raised due to matrix interferences.

Maxxam Analytics International Corporation o/a Maxxam Analytics 32 Colonnade Rd, Unit #1000, Nepean, ON K2E 7J6 Phone: 613 274-0573 Fax: 613 274-0574 Website: www.maxxamanalytics.com

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Maxxam ID		KS2329	KS2330		KS2331		KS2332		
Sampling Date		2011/08/27	2011/08/27		2011/08/27		2011/08/27		
	Units	**MW06-4**	**MW06-5**	**QC Batch**	**MW06-6**	**QC Batch**	**AH-1**	**RDL**	**QC Batch**
Total Titanium (Ti)	ug/L	24	<5	2604619	400	2604619	62	5	2604619
Dissolved Uranium (U)	ug/L	420	53	2605513	230	2603934	420	0.1	2601450
Total Uranium (U)	ug/L	460	66	2604619	260	2604619	460	0.1	2604619
Dissolved Zinc (Zn)	ug/L	<5	64	2605513	52	2603934	<5	5	2601450
Total Zinc (Zn)	ug/L	7	48	2604619	670	2604619	8	5	2604619

POLYCHLORINATED BIPHENYLS BY GC-ECD (WATER)

Maxxam ID		KS2329	KS2330	KS2331	KS2332		
Sampling Date		2011/08/27	2011/08/27	2011/08/27	2011/08/27		
	Units	**MW06-4**	**MW06-5**	**MW06-6**	**AH-1**	**RDL**	**QC Batch**
PCBs							
Aroclor 1016	ug/L	<0.05	<0.05	<0.05	<0.05	0.05	2601902
Aroclor 1221	ug/L	<0.05	<0.05	<0.05	<0.05	0.05	2601902
Aroclor 1232	ug/L	<0.05	<0.05	<0.05	<0.05	0.05	2601902
Aroclor 1242	ug/L	<0.05	<0.05	<0.05	<0.05	0.05	2601902
Aroclor 1248	ug/L	<0.05	<0.05	<0.05	<0.05	0.05	2601902
Aroclor 1254	ug/L	<0.05	<0.05	<0.05	<0.05	0.05	2601902
Aroclor 1260	ug/L	<0.05	<0.05	<0.05	<0.05	0.05	2601902
Aroclor 1262	ug/L	<0.05	<0.05	<0.05	<0.05	0.05	2601902
Aroclor 1268	ug/L	<0.05	<0.05	<0.05	<0.05	0.05	2601902
Total PCB	ug/L	<0.05	<0.05	<0.05	<0.05	0.05	2601902
Surrogate Recovery (%)							
2,4,5,6-Tetrachloro-m-xylene	%	58	58	66	59		2601902
Decachlorobiphenyl	%	104	97	95	88		2601902

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam Analytics International Corporation o/a Maxxam Analytics 32 Colonnade Rd, Unit #1000, Nepean, ON K2E 7J6 Phone: 613 274-0573 Fax: 613 274-0574 Website: www.maxxamanalytics.com

Maxxam Job #: B1D2341
Report Date: 2011/09/07

Franz Environmental Inc
Client Project #: 1697-1101

Sampler Initials: CL

O'REG 153 PETROLEUM HYDROCARBONS (WATER)

Maxxam ID		KS2329	KS2330	KS2331	KS2332		
Sampling Date		2011/08/27	2011/08/27	2011/08/27	2011/08/27		
	Units	**MW06-4**	**MW06-5**	**MW06-6**	**AH-1**	**RDL**	**QC Batch**
BTEX & F1 Hydrocarbons							
Benzene	ug/L	<0.20	<0.20	<0.20	<0.20	0.20	2601711
Toluene	ug/L	<0.20	<0.20	<0.20	<0.20	0.20	2601711
Ethylbenzene	ug/L	<0.20	<0.20	<0.20	<0.20	0.20	2601711
o-Xylene	ug/L	<0.20	<0.20	<0.20	<0.20	0.20	2601711
p+m-Xylene	ug/L	<0.40	<0.40	<0.40	<0.40	0.40	2601711
Total Xylenes	ug/L	<0.40	<0.40	<0.40	<0.40	0.40	2601711
F1 (C6-C10)	ug/L	<25	<25	<25	<25	25	2601711
F1 (C6-C10) - BTEX	ug/L	<25	<25	<25	<25	25	2601711
F2-F4 Hydrocarbons							
F2 (C10-C16 Hydrocarbons)	ug/L	<100	<100	<100	<100	100	2599257
F3 (C16-C34 Hydrocarbons)	ug/L	<100	<100	<100	<100	100	2599257
F4 (C34-C50 Hydrocarbons)	ug/L	<100	<100	<100	<100	100	2599257
Reached Baseline at C50	ug/L	YES	YES	YES	YES		2599257
Surrogate Recovery (%)							
1,4-Difluorobenzene	%	103	101	100	97		2601711
4-Bromofluorobenzene	%	100	93	102	94		2601711
D10-Ethylbenzene	%	98	85	91	102		2601711
D4-1,2-Dichloroethane	%	90	91	91	99		2601711
o-Terphenyl	%	105	107	107	101		2599257

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam Analytics International Corporation o/a Maxxam Analytics 32 Colonnade Rd, Unit #1000, Nepean, ON K2E 7J6 Phone: 613 274-0573 Fax: 613 274-0574 Website: www.maxxamanalytics.com

Maxxam Job #: B1D2341
Report Date: 2011/09/07

Franz Environmental Inc
Client Project #: 1697-1101

Sampler Initials: CL

Test Summary

Maxxam ID	KS2329	**Collected**	2011/08/27
Sample ID	MW06-4	**Shipped**	
Matrix	Water	**Received**	2011/08/30

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Chloride by Automated Colourimetry	AC	2602452	N/A	2011/09/06	DEONARINE RAMNARINE
Colour	SPEC	2602465	N/A	2011/09/02	CHRISTINE PHAM
Conductivity	COND	2603927	N/A	2011/09/04	YOGESH PATEL
Petroleum Hydro. CCME F1 & BTEX in Wat	HSGC/MSFD	2601711	N/A	2011/09/01	STEVE ROBERTS
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	2599257	2011/08/30	2011/08/31	LYNDSEY HART
Fluoride	F	2603928	2011/09/02	2011/09/04	YOGESH PATEL
Mercury (low level)	CVAA	2601322	2011/09/01	2011/09/01	LAWRENCE CHEUNG
Dissolved Metals by ICPMS	ICP/MS	2605513	N/A	2011/09/06	KEVIN COMERFORD
Total Metals Analysis by ICPMS	ICP/MS	2606043	N/A	2011/09/07	HUA REN
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	2602443	N/A	2011/09/02	CHRIS LI
Polychlorinated Biphenyl in Water	GC/ECD	2601902	2011/09/01	2011/09/02	LI PENG
pH	PH	2603929	N/A	2011/09/04	YOGESH PATEL
Orthophosphate	AC	2602453	N/A	2011/09/06	DEONARINE RAMNARINE
Sulphate by Automated Colourimetry	AC	2602454	N/A	2011/09/06	DEONARINE RAMNARINE
Total Dissolved Solids	SLDS	2601612	N/A	2011/09/02	TEJPRATAP MISHRA
Low Level Total Suspended Solids	SLDS	2601319	N/A	2011/09/01	SUBHASHCHANDRA PATEL

Maxxam ID	KS2330	**Collected**	2011/08/27
Sample ID	MW06-5	**Shipped**	
Matrix	Water	**Received**	2011/08/30

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Chloride by Automated Colourimetry	AC	2602452	N/A	2011/09/06	DEONARINE RAMNARINE
Colour	SPEC	2602465	N/A	2011/09/02	CHRISTINE PHAM
Conductivity	COND	2603927	N/A	2011/09/04	YOGESH PATEL
Petroleum Hydro. CCME F1 & BTEX in Wat	HSGC/MSFD	2601711	N/A	2011/09/01	STEVE ROBERTS
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	2599257	2011/08/30	2011/08/31	LYNDSEY HART
Fluoride	F	2603928	2011/09/02	2011/09/04	YOGESH PATEL
Mercury (low level)	CVAA	2601322	2011/09/01	2011/09/01	LAWRENCE CHEUNG
Dissolved Metals by ICPMS	ICP/MS	2605513	N/A	2011/09/06	KEVIN COMERFORD
Total Metals Analysis by ICPMS	ICP/MS	2606043	N/A	2011/09/07	HUA REN
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	2602443	N/A	2011/09/02	CHRIS LI
Polychlorinated Biphenyl in Water	GC/ECD	2601902	2011/09/01	2011/09/02	LI PENG

Maxxam Analytics International Corporation o/a Maxxam Analytics 32 Colonnade Rd, Unit #1000, Nepean, ON K2E 7J6 Phone: 613 274-0573 Fax: 613 274-0574 Website: www.maxxamanalytics.com

Test Summary

pH	PH	2603929	N/A	2011/09/04	YOGESH PATEL
Orthophosphate	AC	2602453	N/A	2011/09/06	DEONARINE RAMNARINE
Sulphate by Automated Colourimetry	AC	2602454	N/A	2011/09/06	DEONARINE RAMNARINE
Total Dissolved Solids	SLDS	2601612	N/A	2011/09/02	TEJPRATAP MISHRA
Low Level Total Suspended Solids	SLDS	2601318	N/A	2011/09/01	SUBHASHCHANDRA PATEL

Maxxam ID KS2330 Dup　**Collected** 2011/08/27
Sample ID MW06-5　**Shipped**
Matrix Water　**Received** 2011/08/30

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Polychlorinated Biphenyl in Water	GC/ECD	2601902	2011/09/01	2011/09/02	LI PENG

Maxxam ID KS2331　**Collected** 2011/08/27
Sample ID MW06-6　**Shipped**
Matrix Water　**Received** 2011/08/30

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Chloride by Automated Colourimetry	AC	2602452	N/A	2011/09/06	DEONARINE RAMNARINE
Colour	SPEC	2602465	N/A	2011/09/02	CHRISTINE PHAM
Conductivity	COND	2603927	N/A	2011/09/04	YOGESH PATEL
Petroleum Hydro. CCME F1 & BTEX in Wat	HSGC/MSFD	2601711	N/A	2011/09/01	STEVE ROBERTS
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	2599257	2011/08/30	2011/08/31	LYNDSEY HART
Fluoride	F	2603928	2011/09/02	2011/09/04	YOGESH PATEL
Mercury (low level)	CVAA	2601322	2011/09/01	2011/09/01	LAWRENCE CHEUNG
Dissolved Metals by ICPMS	ICP/MS	2603934	N/A	2011/09/06	HUA REN
Total Metals Analysis by ICPMS	ICP/MS	2606043	N/A	2011/09/07	HUA REN
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	2602443	N/A	2011/09/02	CHRIS LI
Polychlorinated Biphenyl in Water	GC/ECD	2601902	2011/09/01	2011/09/02	LI PENG
pH	PH	2603929	N/A	2011/09/04	YOGESH PATEL
Orthophosphate	AC	2602453	N/A	2011/09/06	DEONARINE RAMNARINE
Sulphate by Automated Colourimetry	AC	2602454	N/A	2011/09/06	DEONARINE RAMNARINE
Total Dissolved Solids	SLDS	2601612	N/A	2011/09/02	TEJPRATAP MISHRA
Low Level Total Suspended Solids	SLDS	2601318	N/A	2011/09/01	SUBHASHCHANDRA PATEL

Maxxam Analytics International Corporation o/a Maxxam Analytics 32 Colonnade Rd, Unit #1000, Nepean, ON K2E 7J6 Phone: 613 274-0573 Fax: 613 274-0574 Website: www.maxxamanalytics.com

Maxxam Job #: B1D2341
Report Date: 2011/09/07

Franz Environmental Inc
Client Project #: 1697-1101

Sampler Initials: CL

Test Summary

Maxxam ID	KS2332	**Collected**	2011/08/27
Sample ID	AH-1	**Shipped**	
Matrix	Water	**Received**	2011/08/30

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Chloride by Automated Colourimetry	AC	2602452	N/A	2011/09/06	DEONARINE RAMNARINE
Colour	SPEC	2602465	N/A	2011/09/02	CHRISTINE PHAM
Conductivity	COND	2603927	N/A	2011/09/04	YOGESH PATEL
Petroleum Hydro. CCME F1 & BTEX in Wat	HSGC/MSFD	2601711	N/A	2011/09/02	STEVE ROBERTS
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	2599257	2011/08/30	2011/08/31	LYNDSEY HART
Fluoride	F	2603928	2011/09/02	2011/09/04	YOGESH PATEL
Mercury (low level)	CVAA	2601322	2011/09/01	2011/09/01	LAWRENCE CHEUNG
Dissolved Metals by ICPMS	ICP/MS	2601450	N/A	2011/09/01	GRACE BU
Total Metals Analysis by ICPMS	ICP/MS	2606043	N/A	2011/09/07	HUA REN
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	2602443	N/A	2011/09/02	CHRIS LI
Polychlorinated Biphenyl in Water	GC/ECD	2601902	2011/09/01	2011/09/02	LI PENG
pH	PH	2603929	N/A	2011/09/04	YOGESH PATEL
Orthophosphate	AC	2602453	N/A	2011/09/06	DEONARINE RAMNARINE
Sulphate by Automated Colourimetry	AC	2602454	N/A	2011/09/06	DEONARINE RAMNARINE
Total Dissolved Solids	SLDS	2601612	N/A	2011/09/02	TEJPRATAP MISHRA
Low Level Total Suspended Solids	SLDS	2601318	N/A	2011/09/01	SUBHASHCHANDRA PATEL

Maxxam ID	KS2332 Dup	**Collected**	2011/08/27
Sample ID	AH-1	**Shipped**	
Matrix	Water	**Received**	2011/08/30

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Total Dissolved Solids	SLDS	2601612	N/A	2011/09/02	TEJPRATAP MISHRA

Maxxam Analytics International Corporation o/a Maxxam Analytics 32 Colonnade Rd, Unit #1000, Nepean, ON K2E 7J6 Phone: 613 274-0573 Fax: 613 274-0574 Website: www.maxxamanalytics.com

Package 1	5.3°C
Package 2	2.7°C
Package 3	8.0°C

Each temperature is the average of up to three cooler temperatures taken at receipt

GENERAL COMMENTS

Cooler custody seal was present and intact.

Sample KS2330-01: Results for dissolved zinc are greater than total zinc. The results have been confirmed by re-analysis.

Maxxam Analytics International Corporation o/a Maxxam Analytics 32 Colonnade Rd, Unit #1000, Nepean, ON K2E 7J6 Phone: 613 274-0573 Fax: 613 274-0574 Website: www.maxxamanalytics.com

Maxxam

Maxxam Job #: B1D2341
Report Date: 2011/09/07

Franz Environmental Inc
Client Project #: 1697-1101

Sampler Initials: CL

QUALITY ASSURANCE REPORT

			Matrix Spike		Spiked Blank		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	Units	Value (%)	QC Limits	% Recovery	QC Limits
2599257	o-Terphenyl	2011/08/31	107	30 - 130	103	30 - 130	100	%				
2599257	F2 (C10-C16 Hydrocarbons)	2011/08/31	101	60 - 130	88	60 - 130	<100	ug/L	120(1)	50		
2599257	F3 (C16-C34 Hydrocarbons)	2011/08/31	101	60 - 130	88	60 - 130	<100	ug/L	116(1)	50		
2599257	F4 (C34-C50 Hydrocarbons)	2011/08/31	101	60 - 130	88	60 - 130	<100	ug/L	NC	50		
2601318	Total Suspended Solids	2011/09/01					<1	mg/L	NC	25	100	85 - 115
2601319	Total Suspended Solids	2011/09/01					<1	mg/L	NC	25	99	85 - 115
2601322	Mercury (Hg)	2011/09/01	117	80 - 120	104	80 - 120	<0.01	ug/L	NC	25		
2601450	Dissolved Aluminum (Al)	2011/09/01	99	80 - 120	99	90 - 110	<5	ug/L	NC	20		
2601450	Dissolved Antimony (Sb)	2011/09/01	105	80 - 120	99	90 - 110	<0.5	ug/L	11.9	20		
2601450	Dissolved Arsenic (As)	2011/09/01	100	80 - 120	98	90 - 110	<1	ug/L	NC	20		
2601450	Dissolved Barium (Ba)	2011/09/01	99	80 - 120	101	90 - 110	<2	ug/L	0.1	20		
2601450	Dissolved Beryllium (Be)	2011/09/01	102	80 - 120	100	90 - 110	<0.5	ug/L	NC	20		
2601450	Dissolved Boron (B)	2011/09/01	NC	80 - 120	99	90 - 110	<10	ug/L	4.2	20		
2601450	Dissolved Cadmium (Cd)	2011/09/01	102	80 - 120	102	90 - 110	<0.1	ug/L	NC	20		
2601450	Dissolved Chromium (Cr)	2011/09/01	103	80 - 120	101	90 - 110	<5	ug/L	NC	20		
2601450	Dissolved Copper (Cu)	2011/09/01	96	80 - 120	100	90 - 110	<1	ug/L	NC	20		
2601450	Dissolved Iron (Fe)	2011/09/01	96	80 - 120	95	90 - 110	<100	ug/L	NC	20		
2601450	Dissolved Lead (Pb)	2011/09/01	93	80 - 120	96	90 - 110	<0.5	ug/L	NC	20		
2601450	Dissolved Molybdenum (Mo)	2011/09/01	107	80 - 120	102	90 - 110	<0.5	ug/L	2.1	20		
2601450	Dissolved Nickel (Ni)	2011/09/01	99	80 - 120	100	90 - 110	<1	ug/L	NC	20		
2601450	Dissolved Selenium (Se)	2011/09/01	103	80 - 120	100	90 - 110	<2	ug/L	NC	20		
2601450	Dissolved Silver (Ag)	2011/09/01	84	80 - 120	97	90 - 110	<0.1	ug/L	NC	20		
2601450	Dissolved Thallium (Tl)	2011/09/01	97	80 - 120	100	90 - 110	<0.05	ug/L	NC	20		
2601450	Dissolved Titanium (Ti)	2011/09/01	105	80 - 120	100	90 - 110	<5	ug/L	NC	20		
2601450	Dissolved Uranium (U)	2011/09/01	104	80 - 120	103	90 - 110	<0.1	ug/L	NC	20		
2601450	Dissolved Zinc (Zn)	2011/09/01	97	80 - 120	101	90 - 110	<5	ug/L	NC	20		
2601612	Total Dissolved Solids	2011/09/02					<10	mg/L	0.6	25	98	90 - 110
2601711	1,4-Difluorobenzene	2011/09/01	100	70 - 130	97	70 - 130	104	%				
2601711	4-Bromofluorobenzene	2011/09/01	106	70 - 130	119	70 - 130	95	%				
2601711	D10-Ethylbenzene	2011/09/01	109	70 - 130	77	70 - 130	84	%				
2601711	D4-1,2-Dichloroethane	2011/09/01	97	70 - 130	90	70 - 130	93	%				
2601711	Benzene	2011/09/02	90	70 - 130	78	70 - 130	<0.20	ug/L	NC	40		
2601711	Toluene	2011/09/02	100	70 - 130	96	70 - 130	<0.20	ug/L	NC	40		
2601711	Ethylbenzene	2011/09/02	101	70 - 130	89	70 - 130	<0.20	ug/L	NC	40		
2601711	o-Xylene	2011/09/02	102	70 - 130	97	70 - 130	<0.20	ug/L	NC	40		
2601711	p+m-Xylene	2011/09/02	95	70 - 130	87	70 - 130	<0.40	ug/L	NC	40		
2601711	F1 (C6-C10)	2011/09/02	100	70 - 130	98	70 - 130	<25	ug/L	NC	40		
2601711	Total Xylenes	2011/09/02					<0.40	ug/L	NC	40		
2601711	F1 (C6-C10) - BTEX	2011/09/02					<25	ug/L	NC	40		
2601902	2,4,5,6-Tetrachloro-m-xylene	2011/09/02	59	30 - 130	64	30 - 130	64	%				

Maxxam Analytics International Corporation o/a Maxxam Analytics 32 Colonnade Rd, Unit #1000, Nepean, ON K2E 7J6 Phone: 613 274-0573 Fax: 613 274-0574 Website: www.maxxamanalytics.com

Maxxam Job #: B1D2341
Report Date: 2011/09/07

Franz Environmental Inc
Client Project #: 1697-1101

Sampler Initials: CL

QUALITY ASSURANCE REPORT

			Matrix Spike		Spiked Blank		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	Units	Value (%)	QC Limits	% Recovery	QC Limits
2601902	Decachlorobiphenyl	2011/09/02	100	30 - 130	98	30 - 130	95	%				
2601902	Aroclor 1260	2011/09/02	102	30 - 130	90	30 - 130	<0.05	ug/L	NC	40		
2601902	Total PCB	2011/09/02	102	30 - 130	90	30 - 130	<0.05	ug/L	NC	40		
2601902	Aroclor 1016	2011/09/02					<0.05	ug/L	NC	40		
2601902	Aroclor 1221	2011/09/02					<0.05	ug/L	NC	40		
2601902	Aroclor 1232	2011/09/02					<0.05	ug/L	NC	40		
2601902	Aroclor 1242	2011/09/02					<0.05	ug/L	NC	40		
2601902	Aroclor 1248	2011/09/02					<0.05	ug/L	NC	40		
2601902	Aroclor 1254	2011/09/02					<0.05	ug/L	NC	40		
2601902	Aroclor 1262	2011/09/02					<0.05	ug/L	NC	40		
2601902	Aroclor 1268	2011/09/02					<0.05	ug/L	NC	40		
2602443	Nitrite (N)	2011/09/02	105	80 - 120	104	85 - 115	<0.01	mg/L	NC	25		
2602443	Nitrate (N)	2011/09/02	108	80 - 120	103	85 - 115	<0.1	mg/L	NC	25		
2602452	Dissolved Chloride (Cl)	2011/09/06	NC	75 - 125	105	80 - 120	<1	mg/L	0.2	20		
2602453	Orthophosphate (P)	2011/09/06	98	75 - 125	102	80 - 120	<0.01	mg/L	NC	25		
2602454	Dissolved Sulphate (SO4)	2011/09/06	NC	75 - 125	101	80 - 120	<1	mg/L	0.5	25		
2602465	Colour	2011/09/02			99	85 - 115	<2	TCU	NC	25		
2603927	Conductivity	2011/09/04					<1	umho/cm	0.1	25	103	85 - 115
2603928	Fluoride (F-)	2011/09/04	100	80 - 120	103	85 - 115	<0.1	mg/L	NC	25		
2603934	Dissolved Aluminum (Al)	2011/09/06	101	80 - 120	97	80 - 120	<5	ug/L				
2603934	Dissolved Antimony (Sb)	2011/09/06	105	80 - 120	98	80 - 120	<0.5	ug/L				
2603934	Dissolved Arsenic (As)	2011/09/06	99	80 - 120	95	80 - 120	<1	ug/L				
2603934	Dissolved Barium (Ba)	2011/09/06	NC	80 - 120	95	80 - 120	<2	ug/L				
2603934	Dissolved Beryllium (Be)	2011/09/06	102	80 - 120	94	80 - 120	<0.5	ug/L				
2603934	Dissolved Boron (B)	2011/09/06	100	80 - 120	92	80 - 120	<10	ug/L				
2603934	Dissolved Cadmium (Cd)	2011/09/06	103	80 - 120	97	80 - 120	<0.1	ug/L				
2603934	Dissolved Chromium (Cr)	2011/09/06	98	80 - 120	94	80 - 120	<5	ug/L				
2603934	Dissolved Copper (Cu)	2011/09/06	94	80 - 120	94	80 - 120	<1	ug/L				
2603934	Dissolved Iron (Fe)	2011/09/06	96	80 - 120	93	80 - 120	<100	ug/L				
2603934	Dissolved Lead (Pb)	2011/09/06	97	80 - 120	96	80 - 120	<0.5	ug/L	NC	20		
2603934	Dissolved Molybdenum (Mo)	2011/09/06	106	80 - 120	97	80 - 120	<0.5	ug/L				
2603934	Dissolved Nickel (Ni)	2011/09/06	95	80 - 120	93	80 - 120	<1	ug/L				
2603934	Dissolved Selenium (Se)	2011/09/06	99	80 - 120	98	80 - 120	<2	ug/L				
2603934	Dissolved Silver (Ag)	2011/09/06	100	80 - 120	95	80 - 120	<0.1	ug/L				
2603934	Dissolved Thallium (Tl)	2011/09/06	97	80 - 120	97	80 - 120	<0.05	ug/L				
2603934	Dissolved Titanium (Ti)	2011/09/06	98	80 - 120	93	80 - 120	<5	ug/L				
2603934	Dissolved Uranium (U)	2011/09/06	104	80 - 120	99	80 - 120	<0.1	ug/L				
2603934	Dissolved Zinc (Zn)	2011/09/06	100	80 - 120	97	80 - 120	<5	ug/L				
2604619	Total Antimony (Sb)	2011/09/06	102	80 - 120	105	85 - 115	<0.5	ug/L	NC	20		
2604619	Total Arsenic (As)	2011/09/06	95	80 - 120	98	85 - 115	<1	ug/L	NC	20		

Success Through Science®

Maxxam Job #: B1D2341
Report Date: 2011/09/07

Franz Environmental Inc
Client Project #: 1697-1101

Sampler Initials: CL

QUALITY ASSURANCE REPORT

			Matrix Spike		Spiked Blank		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	Units	Value (%)	QC Limits	% Recovery	QC Limits
2604619	Total Barium (Ba)	2011/09/06	94	80 - 120	99	85 - 115	<2	ug/L	6.8	20		
2604619	Total Beryllium (Be)	2011/09/06	94	80 - 120	98	85 - 115	<0.5	ug/L	NC	20		
2604619	Total Boron (B)	2011/09/06	94	80 - 120	97	85 - 115	<10	ug/L	6.3	20		
2604619	Total Cadmium (Cd)	2011/09/06	99	80 - 120	105	85 - 116	<0.1	ug/L	NC	20		
2604619	Total Chromium (Cr)	2011/09/06	89	80 - 120	95	85 - 115	<5	ug/L	NC	20		
2604619	Total Copper (Cu)	2011/09/06	91	80 - 120	98	85 - 115	1, RDL=1	ug/L	NC	20		
2604619	Total Iron (Fe)	2011/09/06	93	80 - 120	97	85 - 115	<100	ug/L	8.8	20		
2604619	Total Lead (Pb)	2011/09/06	95	80 - 120	100	85 - 115	<0.5	ug/L	NC	20		
2604619	Total Molybdenum (Mo)	2011/09/06	100	80 - 120	105	85 - 115	<0.5	ug/L	4.5	20		
2604619	Total Nickel (Ni)	2011/09/06	90	80 - 120	95	85 - 115	<1	ug/L	NC	20		
2604619	Total Selenium (Se)	2011/09/06	96	80 - 120	102	85 - 115	<2	ug/L	NC	20		
2604619	Total Silver (Ag)	2011/09/06	92	80 - 120	98	85 - 115	<0.1	ug/L	NC	20		
2604619	Total Thallium (Tl)	2011/09/06	95	80 - 120	99	85 - 115	<0.05	ug/L	NC	20		
2604619	Total Titanium (Ti)	2011/09/06	92	80 - 120	96	85 - 115	<5	ug/L	NC	20		
2604619	Total Uranium (U)	2011/09/06	100	80 - 120	102	85 - 115	<0.1	ug/L	5.3	20		
2604619	Total Zinc (Zn)	2011/09/06	95	80 - 120	102	85 - 115	<5	ug/L	NC	20		
2605513	Dissolved Aluminum (Al)	2011/09/02	103	80 - 120	94	80 - 120	<5	ug/L	NC	20		
2605513	Dissolved Antimony (Sb)	2011/09/02	111	80 - 120	99	80 - 120	<0.5	ug/L	NC	20		
2605513	Dissolved Arsenic (As)	2011/09/02	103	80 - 120	96	80 - 120	<1	ug/L	1.3	20		
2605513	Dissolved Barium (Ba)	2011/09/02	97	80 - 120	97	80 - 120	<2	ug/L	4.7	20		
2605513	Dissolved Beryllium (Be)	2011/09/02	100	80 - 120	93	80 - 120	<0.5	ug/L	NC	20		
2605513	Dissolved Boron (B)	2011/09/02	99	80 - 120	94	80 - 120	13, RDL=10	ug/L	4.8	20		
2605513	Dissolved Cadmium (Cd)	2011/09/02	110	80 - 120	99	80 - 120	<0.1	ug/L	NC	20		
2605513	Dissolved Chromium (Cr)	2011/09/02	111	80 - 120	94	80 - 120	<5	ug/L	NC	20		
2605513	Dissolved Copper (Cu)	2011/09/02	109	80 - 120	93	80 - 120	<1	ug/L	NC	20		
2605513	Dissolved Iron (Fe)	2011/09/02	111	80 - 120	97	80 - 120	<100	ug/L	3.8	20		
2605513	Dissolved Lead (Pb)	2011/09/02	98	80 - 120	96	80 - 120	<0.5	ug/L	NC	20		
2605513	Dissolved Molybdenum (Mo)	2011/09/02	111	80 - 120	100	80 - 120	<0.5	ug/L	NC	20		
2605513	Dissolved Nickel (Ni)	2011/09/02	108	80 - 120	92	80 - 120	<1	ug/L	NC	20		
2605513	Dissolved Selenium (Se)	2011/09/02	104	80 - 120	95	80 - 120	<2	ug/L	NC	20		
2605513	Dissolved Silver (Ag)	2011/09/02	54 (1, 2)	80 - 120	94	80 - 120	<0.1	ug/L	NC	20		
2605513	Dissolved Thallium (Tl)	2011/09/02	98	80 - 120	96	80 - 120	<0.05	ug/L	NC	20		
2605513	Dissolved Titanium (Ti)	2011/09/02	114	80 - 120	96	80 - 120	<5	ug/L	NC	20		
2605513	Dissolved Uranium (U)	2011/09/02	104	80 - 120	100	80 - 120	<0.1	ug/L	NC	20		

Maxxam Analytics International Corporation o/a Maxxam Analytics 32 Colonnade Rd, Unit #1000, Nepean, ON K2E 7J6 Phone: 613 274-0573 Fax: 613 274-0574 Website: www.maxxamanalytics.com

Maxxam

Success Through Science®

Maxxam Job #: B1D2341
Report Date: 2011/09/07

Franz Environmental Inc
Client Project #: 1697-1101

Sampler Initials: CL

QUALITY ASSURANCE REPORT

			Matrix Spike		Spiked Blank		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	Units	Value (%)	QC Limits	% Recovery	QC Limits
2605513	Dissolved Zinc (Zn)	2011/09/02	111	80 - 120	95	80 - 120	<5	ug/L	NC	20		
2606043	Total Aluminum (Al)	2011/09/07	79 (1)	80 - 120	96	85 - 115	<5	ug/L	NC	20		

N/A = Not Applicable
RDL = Reportable Detection Limit
RPD = Relative Percent Difference
Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.
Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.
QC Standard: A blank matrix to which a known amount of the analyte has been added. Used to evaluate analyte recovery.
Spiked Blank: A blank matrix to which a known amount of the analyte has been added. Used to evaluate analyte recovery.
Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.
Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.
NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was not sufficiently significant to permit a reliable recovery calculation.
NC (RPD): The RPD was not calculated. The level of analyte detected in the parent sample and its duplicate was not sufficiently significant to permit a reliable calculation.
(1) - Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.
(2) - The recovery was below the lower control limit. This may represent a low bias in some results for flagged analytes.

Maxxam Analytics International Corporation o/a Maxxam Analytics 32 Colonnade Rd, Unit #1000, Nepean, ON K2E 7J6 Phone: 613 274-0573 Fax: 613 274-0574 Website: www.maxxamanalytics.com

Validation Signature Page

Maxxam Job #: B1D2341

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

CRISTINA CARRIERE, Scientific Services

PAUL RUBINATO, Analyst, Maxxam Analytics

ALINA SEGAL, Manager Main Lab - Organics

STEVE ROBERTS, Lab Supervisor, Ottawa

===

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam

Maxxam Analytics International Corporation o/a Maxxam Analytics
6740 Campobello Road, Mississauga, Ontario Canada L5N 2L8 Tel:(905) 817-5700 Toll-free:800-653-6266 Fax:(905) 817-5779 www.maxxam.ca

CHAIN OF CUSTODY RECORD

Page 1 of 1

INVOICE INFORMATION:		REPORT INFORMATION (if differs from invoice):		PROJECT INFORMATION:		Laboratory Use Only:	
Company Name:	#10988 Franz Environmental Inc	Company Name:		Quotation #:	B14919	MAXXAM JOB #:	BOTTLE ORDER #:
Contact Name:	Invoices, Lillian & Catherine	Contact Name:	Catherine LeBlanc	P.O. #:			275432
Address:	329 Churchill Ave N Suite 200	Address:		Project #:	1697-1101	CHAIN OF CUSTODY #:	PROJECT MANAGER:
	Ottawa ON K1Z 5B8			Project Name:		C#275432-02-01	JULIE CLEMENT
Phone:	(613)721-0555 Fax: (613)721-0029	Phone:	Fax:	Site #:			
Email:	cleblanc@franzenvironmental.com; lellis@franzenvi	Email:	cleblanc@franzenvironmental.com	Sampled By:			

Regulation 153 (2011)
☐ Table 1 ☐ Res/Park ☐ Medium/Fine
☐ Table 2 ☐ Ind/Comm ☐ Coarse
☐ Table 3 ☐ Agri/Other
☐ Table ___ ☐ For RSC

Other Regulations
☐ CCME ☐ Sanitary Sewer Bylaw
☐ Reg. 558 ☐ Storm Sewer Bylaw
☐ MISA Municipality ___
☐ PWQO
☐ Other ___

SPECIAL INSTRUCTIONS: See Quote for metals.

Include Criteria on Certificate of Analysis (Y/N)? ___

Note: For MOE regulated drinking water samples - please use the Drinking Water Chain of Custody Form

SAMPLES MUST BE KEPT COOL (< 10ºC) FROM TIME OF SAMPLING UNTIL DELIVERY TO MAXXAM

ANALYSIS REQUESTED (Please be specific):

	Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	Regulated Drinking Water ? (Y / N)	Metals Field Filtered ? (Y / N)	Anions/pH/Conductivity/Color	Dissolved Metals by ICPMS	Mercury (low level)	PHC F1-F4 & BTEX in water	Polychlorinated Biphenyl in Water	Total Metals Analysis by ICPMS	TSS & TDS	Metals (see Quote)	PCB	F1/BTEX, F2-F4	# of Bottles	Comments
1		TP11-1T	Aug 27	PM	Soil										X	X	X	4	
2		TP11-2T	↓	↓	↓										X	X	X	4	
3		TP11-3T	↓	↓	↓										X	X	X	4	30-Aug-11 09:15
4		Dup T	Aug 27	PM	↓										X	X	X	4	JULIE CLEMENT
5		TP11-~~T~~1B	↓	↓	↓										X	X	X	4	B1D2331
6		TP11-2B	↓	↓	↓										X	X	X	4	M_D OTT-001
7		TP11-3B	↓	↓	↓										X	X	X	4	
8		DUP B	↓	↓	↓										X	X	X	4	REC'D IN OTTAWA
9																			
10																			

TURNAROUND TIME (TAT) REQUIRED:

PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS

Regular (Standard) TAT: ☑
(will be applied if Rush TAT is not specified):
Standard TAT = 5-7 Working days for most tests.
Please note: Standard TAT for certain tests such as BOD and Dioxins/Furans are > 5 days - contact your Project Manager for details.

Job Specific Rush TAT (if applies to entire submission)
Date Required: ___ Time Required: ___ ☐
Rush Confirmation Number: ___ (call lab for #)

RELINQUISHED BY: (Signature/Print)	Date: (YY/MM/DD)	Time:	RECEIVED BY: (Signature/Print)	Date: (YY/MM/DD)	Time:	# Jars Used and Not Submitted	Laboratory Use Only		
Catherine LeBlanc / Catherine LeBlanc	11/08/29	8:00	Shaun Colbert / Shaun Colbert	2011/08/30	9:15 am		Time Sensitive	Temperature (ºC) on Receipt: 4/6/6	Custody Seal Yes ✓ No; Present ✓; Intact ✓

1/2/5 7/8/9
on ice

* IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORD. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

White: Maxxam Yellow: Client

Maxxam Analytics International Corporation o/a Maxxam Analytics

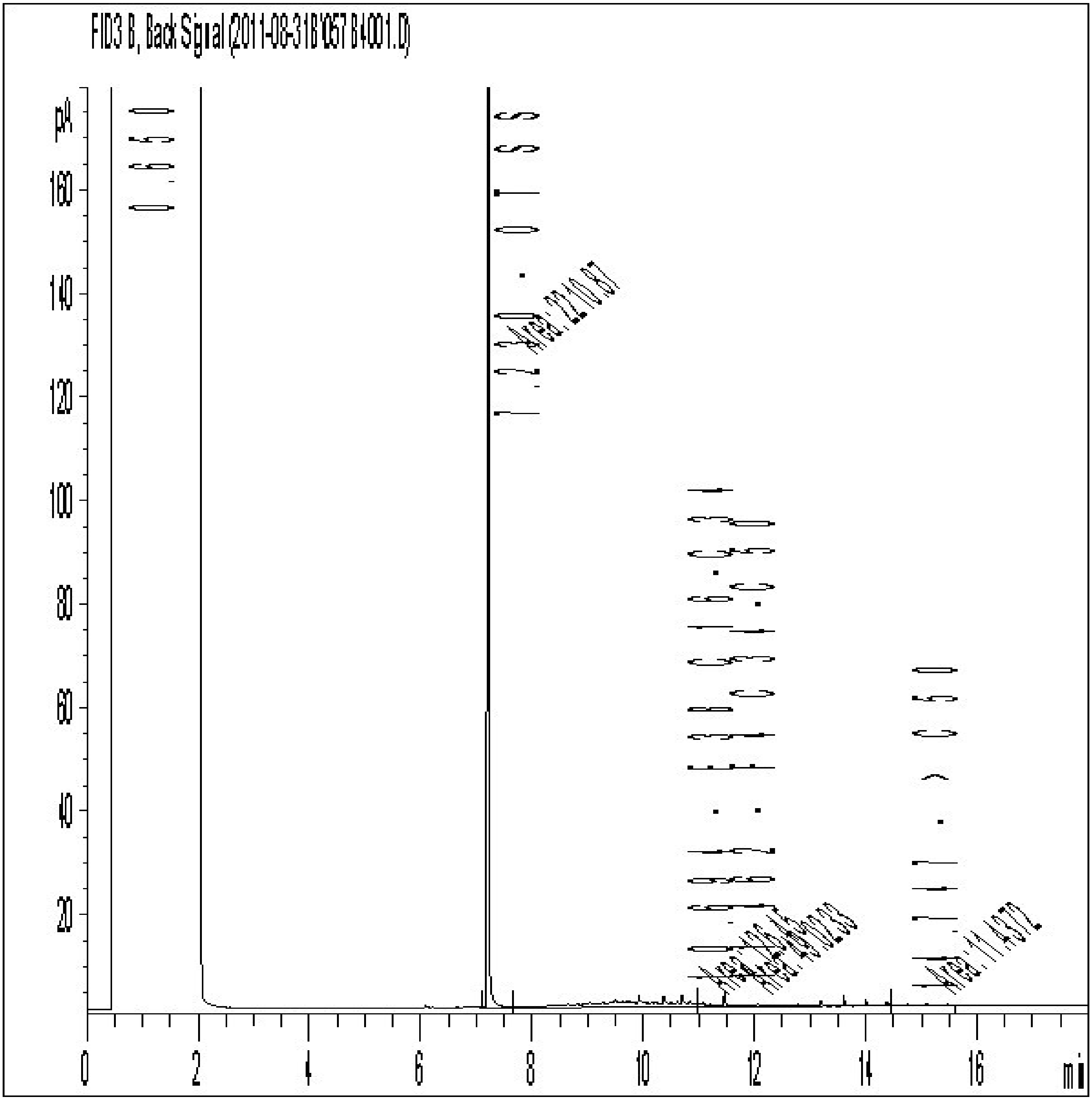
Success Through Science®

Report Date: 2011/09/06
Maxxam Job #: B1D2331
Maxxam Sample: KS2276

Franz Environmental Inc
Client Project #: 1697-1101

Client ID: TP11-1T

Petroleum Hydrocarbons F2-F4 in Soil Chromatogram



Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

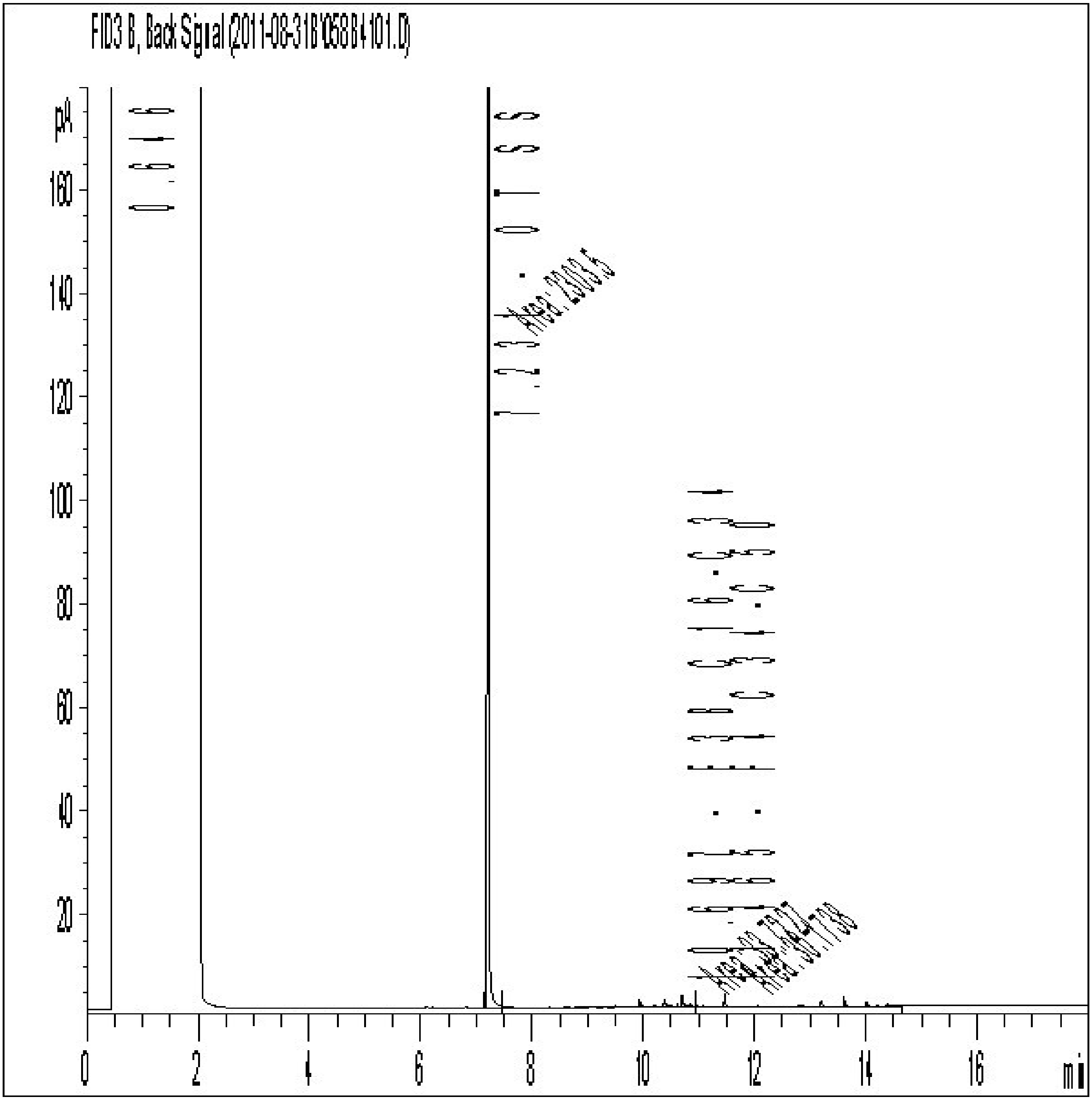
Success Through Science®

Report Date: 2011/09/06
Maxxam Job #: B1D2331
Maxxam Sample: KS2277

Franz Environmental Inc
Client Project #: 1697-1101

Client ID: TP11-2T

Petroleum Hydrocarbons F2-F4 in Soil Chromatogram



Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

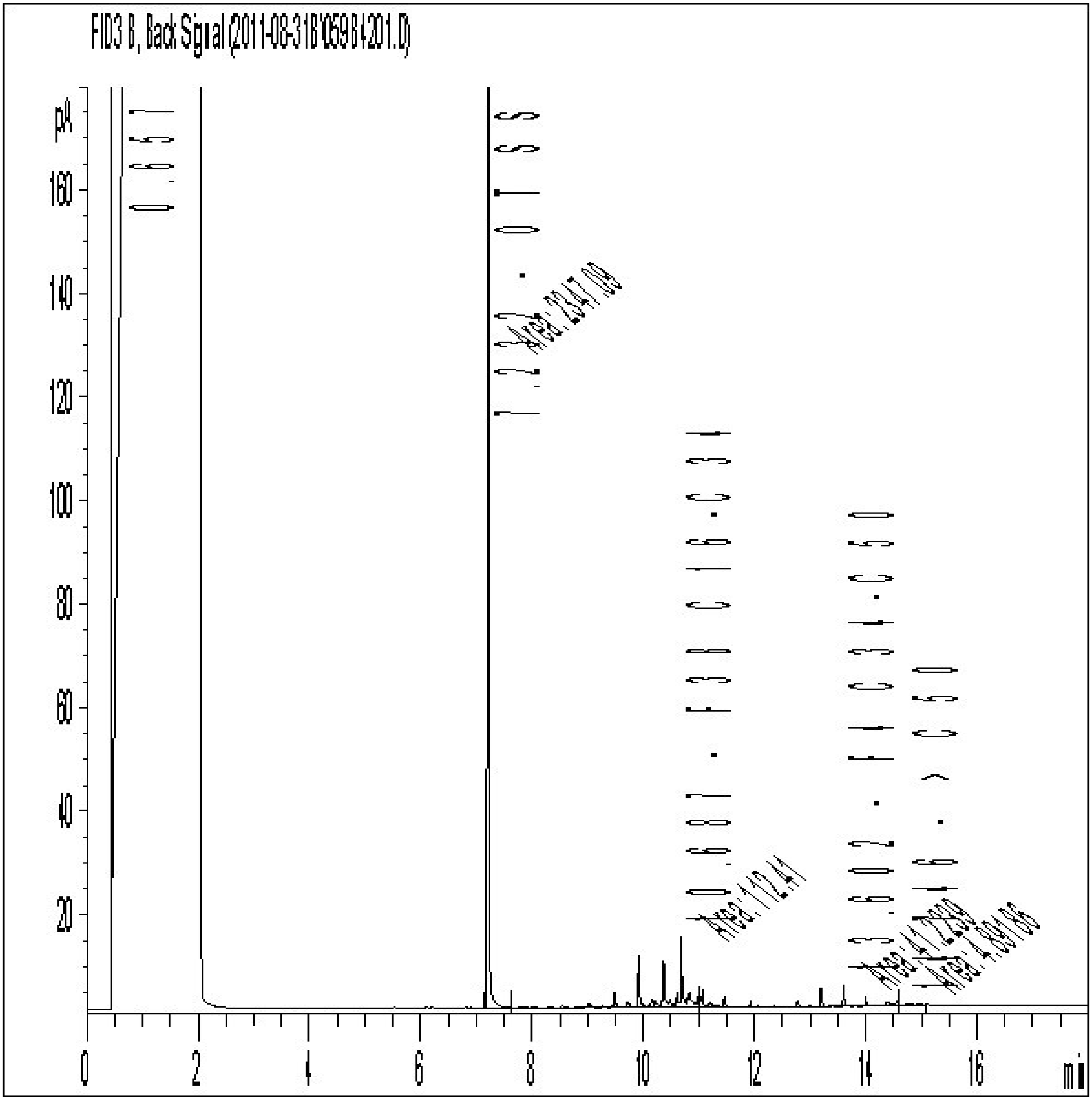
Success Through Science®

Franz Environmental Inc
Client Project #: 1697-1101

Report Date: 2011/09/06
Maxxam Job #: B1D2331
Maxxam Sample: KS2278

Client ID: TP11-3T

Petroleum Hydrocarbons F2-F4 in Soil Chromatogram



Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam

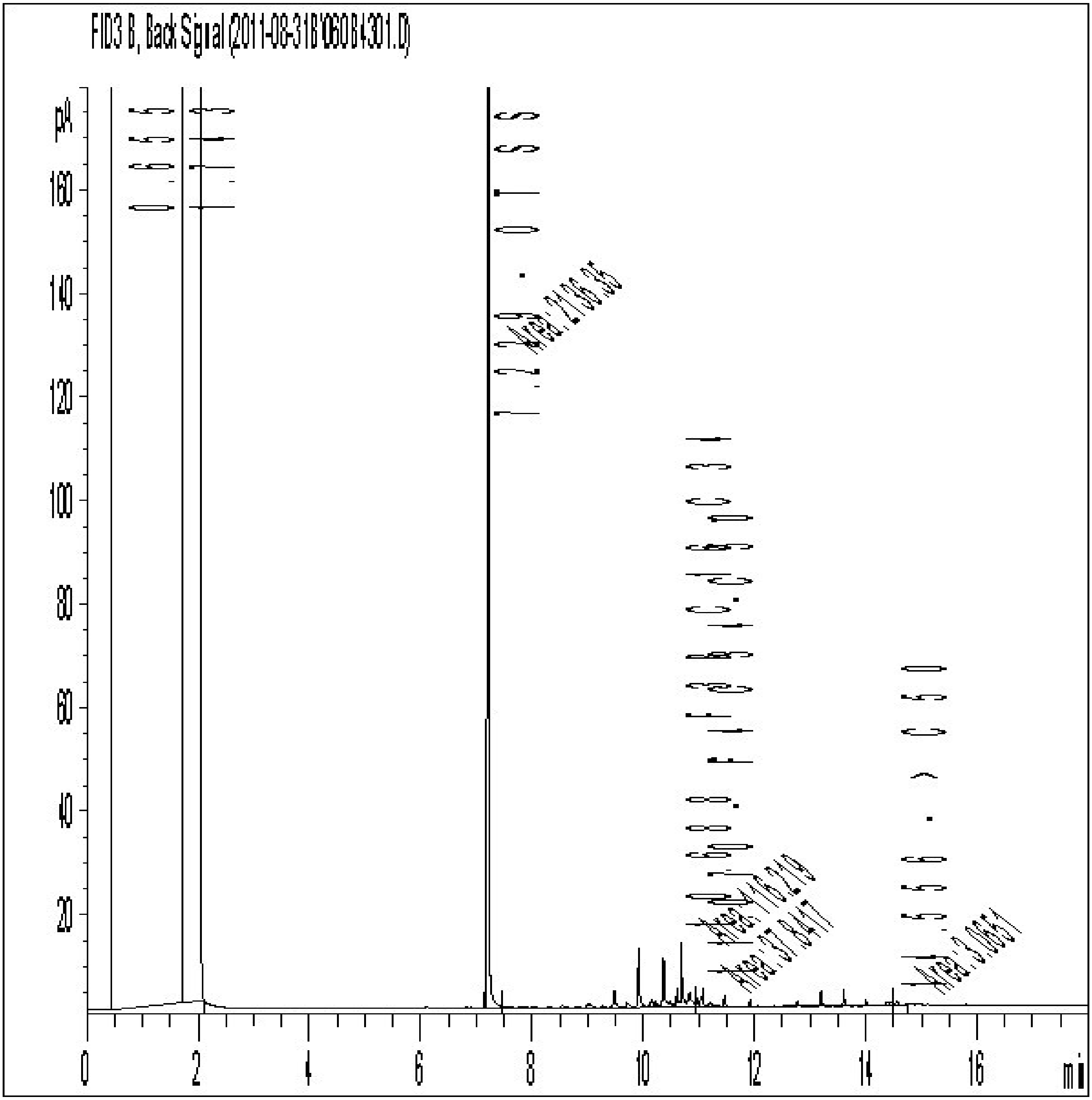
Success Through Science®

Report Date: 2011/09/06
Maxxam Job #: B1D2331
Maxxam Sample: KS2279

Franz Environmental Inc
Client Project #: 1697-1101

Client ID: DUP T

Petroleum Hydrocarbons F2-F4 in Soil Chromatogram



Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

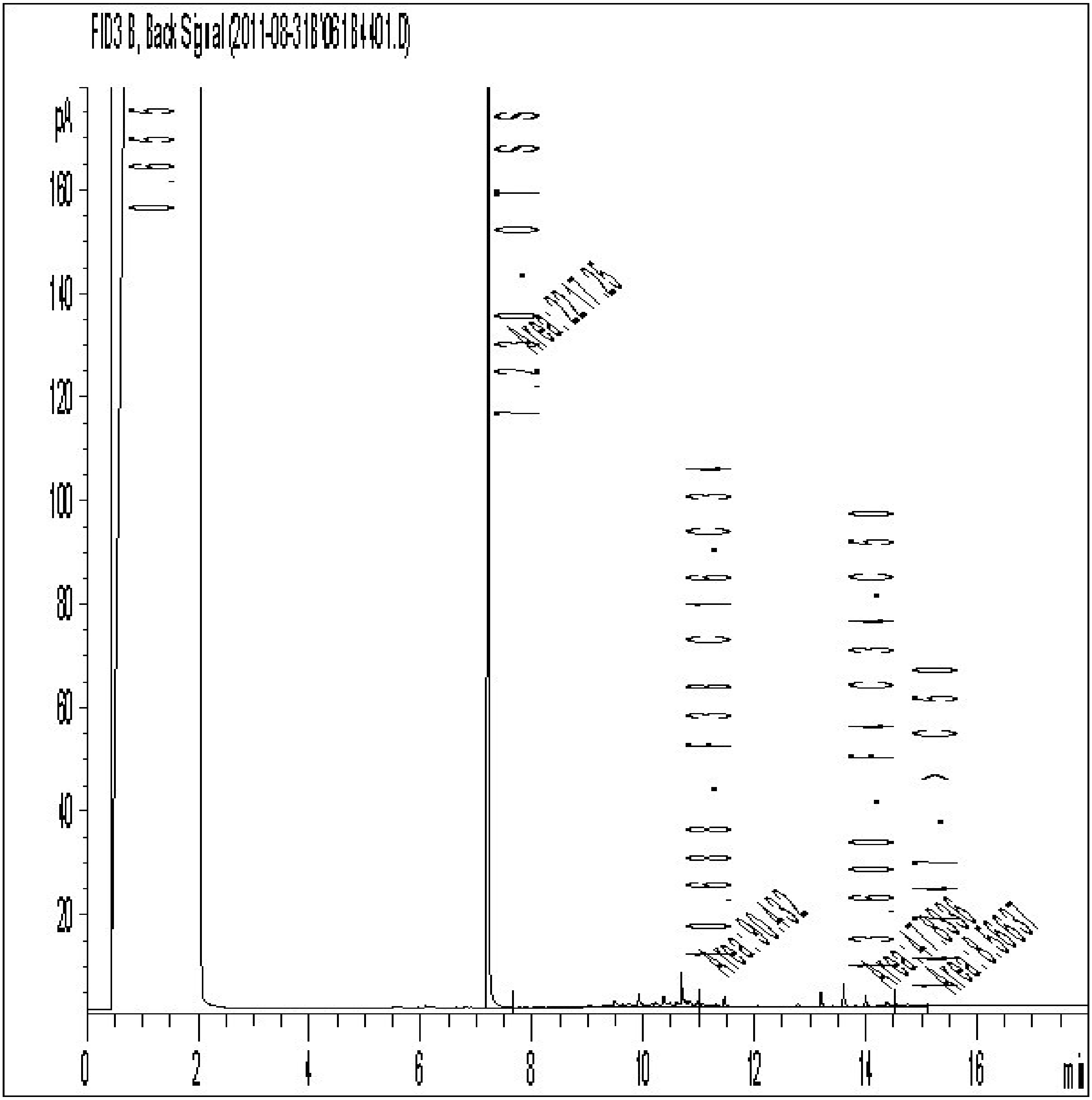
Success Through Science®

Franz Environmental Inc
Client Project #: 1697-1101

Report Date: 2011/09/06
Maxxam Job #: B1D2331
Maxxam Sample: KS2280

Client ID: TP11-1B

Petroleum Hydrocarbons F2-F4 in Soil Chromatogram



Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam

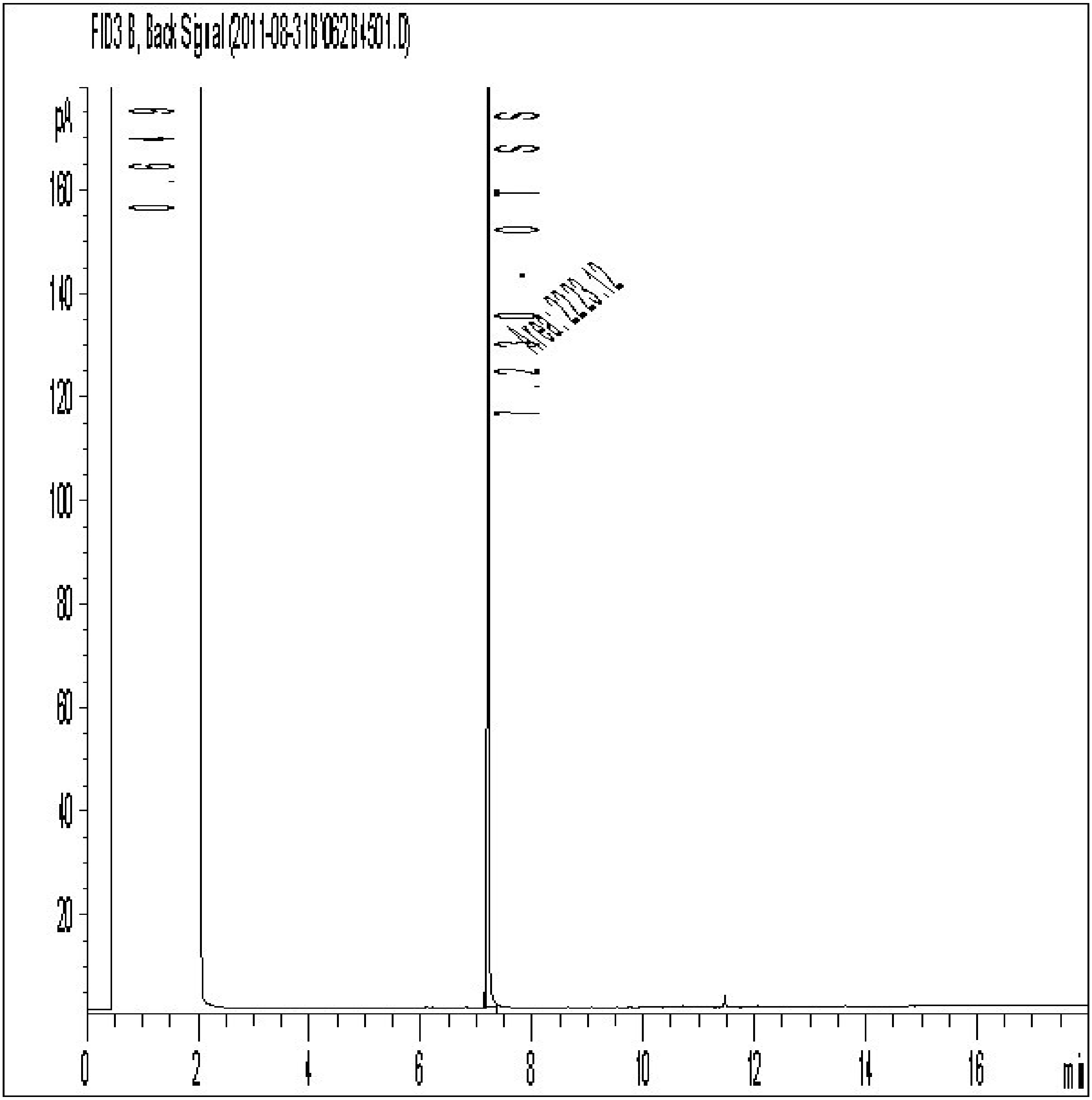
Success Through Science®

Franz Environmental Inc
Client Project #: 1697-1101

Report Date: 2011/09/06
Maxxam Job #: B1D2331
Maxxam Sample: KS2281

Client ID: TP11-2B

Petroleum Hydrocarbons F2-F4 in Soil Chromatogram



Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

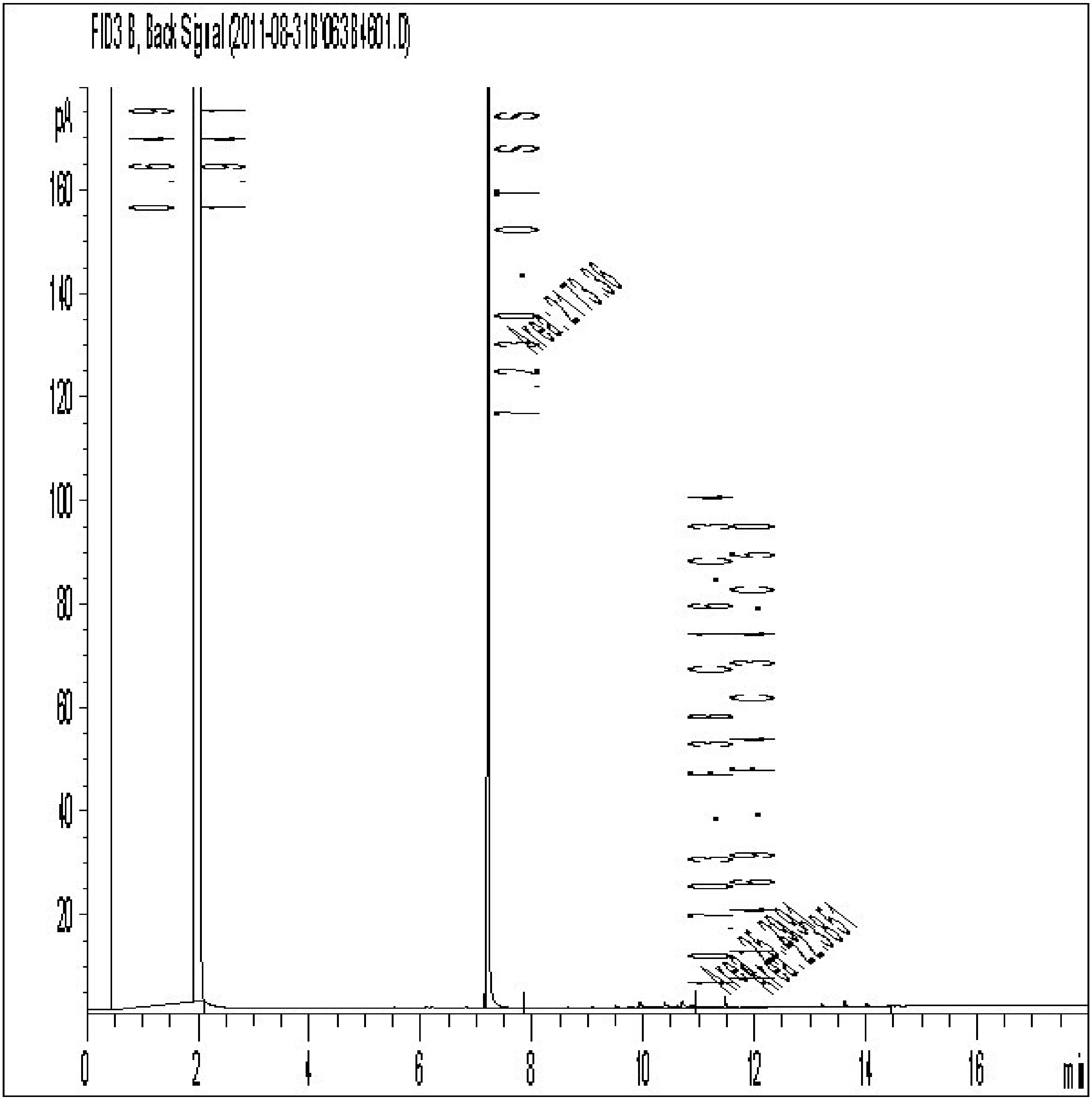
Success Through Science®

Franz Environmental Inc
Client Project #: 1697-1101

Report Date: 2011/09/06
Maxxam Job #: B1D2331
Maxxam Sample: KS2282

Client ID: TP11-3B

Petroleum Hydrocarbons F2-F4 in Soil Chromatogram



Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

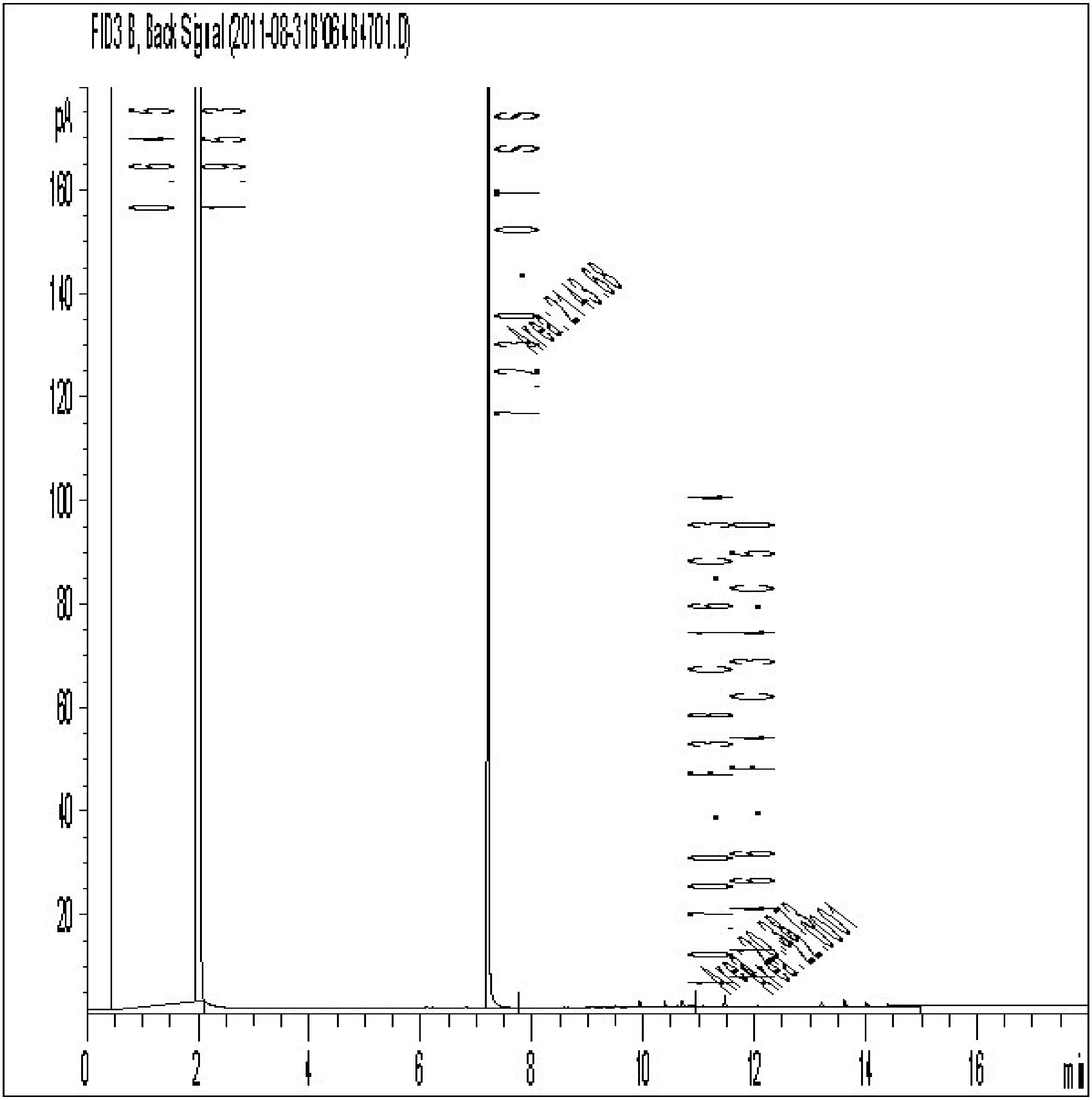
Success Through Science®

Report Date: 2011/09/06
Maxxam Job #: B1D2331
Maxxam Sample: KS2283

Franz Environmental Inc
Client Project #: 1697-1101

Client ID: DUP B

Petroleum Hydrocarbons F2-F4 in Soil Chromatogram



Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam

Success Through Science®

Your Project #: 1697-1101
Your C.O.C. #: 27543202, 275432-02-01

Attention: Catherine LeBlanc
Franz Environmental Inc
329 Churchill Ave N
Suite 200
Ottawa, ON
K1Z 5B8

Report Date: 2011/09/06

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B1D2331
Received: 2011/08/30, 09:15

Sample Matrix: Soil
Samples Received: 8

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Method Reference
Petroleum Hydro. CCME F1 & BTEX in Soil	3	2011/08/31	2011/08/31	OTT SOP-00002	CCME CWS
Petroleum Hydro. CCME F1 & BTEX in Soil	5	2011/08/31	2011/09/01	OTT SOP-00002	CCME CWS
Petroleum Hydrocarbons F2-F4 in Soil	8	2011/08/30	2011/09/01	OTT SOP-00001	CCME CWS
Acid Extr. Metals (aqua regia) by ICPMS (1)	8	2011/09/01	2011/09/02	CAM SOP-00447	EPA 6020
MOISTURE	8	N/A	2011/09/01	CAM SOP-00445	MOE HANDBOOK(1983)
Polychlorinated Biphenyl in Soil (1)	8	2011/09/01	2011/09/02	CAM SOP-00309	SW846 8082

Remarks:

Maxxam Analytics has performed all analytical testing herein in accordance with ISO 17025 and the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act. All methodologies comply with this document and are validated for use in the laboratory. The methods and techniques employed in this analysis conform to the performance criteria (detection limits, accuracy and precision) as outlined in the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act.

The CWS PHC methods employed by Maxxam conform to all prescribed elements of the reference method and performance based elements have been validated. All modifications have been validated and proven equivalent following the 'Alberta Environment Draft Addenda to the CWS-PHC, Appendix 6, Validation of Alternate Methods'. Documentation is available upon request. Maxxam has made the following improvements to the CWS-PHC reference benchmark method: (i) Headspace for F1; and, (ii) Mechanical extraction for F2-F4. Note: F4G cannot be added to the C6 to C50 hydrocarbons. The extraction date for samples field preserved with methanol for F1 and Volatile Organic Compounds is considered to be the date sampled.

Maxxam Analytics is accredited by SCC (Lab ID 97) for all specific parameters as required by Ontario Regulation 153/04. Maxxam Analytics is limited in liability to the actual cost of analysis unless otherwise agreed in writing. There is no other warranty expressed or implied. Samples will be retained at Maxxam Analytics for three weeks from receipt of data or as per contract.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
* Results relate only to the items tested.

(1) This test was performed by Maxxam Analytics Mississauga

../2

Maxxam Analytics International Corporation o/a Maxxam Analytics 32 Colonnade Rd, Unit #1000, Nepean, ON K2E 7J6 Phone: 613 274-0573 Fax: 613 274-0574 Website: www.maxxamanalytics.com

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

JULIE CLEMENT, Ottawa Customer Service
Email: JClement@maxxam.ca
Phone# (613) 274-3549

==
Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Total cover pages: 2

Maxxam Job #: B1D2331
Report Date: 2011/09/06

Franz Environmental Inc
Client Project #: 1697-1101

O'REG 153 PETROLEUM HYDROCARBONS (SOIL)

Maxxam ID		KS2276	KS2277	KS2278	KS2279	KS2280	KS2281	KS2282	KS2283		
Sampling Date		2011/08/27	2011/08/27	2011/08/27	2011/08/27	2011/08/27	2011/08/27	2011/08/27	2011/08/27		
	Units	**TP11-1T**	**TP11-2T**	**TP11-3T**	**DUP T**	**TP11-1B**	**TP11-2B**	**TP11-3B**	**DUP B**	**RDL**	**QC Batch**
Inorganics											
Moisture	%	8.0	7.9	17	24	12	7.8	7.8	13	0.2	2598846
BTEX & F1 Hydrocarbons											
Benzene	ug/g	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.02	2599953
Toluene	ug/g	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.02	2599953
Ethylbenzene	ug/g	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.02	2599953
o-Xylene	ug/g	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.02	2599953
p+m-Xylene	ug/g	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	0.04	2599953
Total Xylenes	ug/g	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	0.04	2599953
F1 (C6-C10)	ug/g	<10	<10	<10	<10	<10	<10	<10	<10	10	2599953
F1 (C6-C10) - BTEX	ug/g	<10	<10	<10	<10	<10	<10	<10	<10	10	2599953
F2-F4 Hydrocarbons											
F2 (C10-C16 Hydrocarbons)	ug/g	<10	<10	<10	<10	<10	<10	<10	<10	10	2598849
F3 (C16-C34 Hydrocarbons)	ug/g	21	<10	22	26	20	<10	<10	<10	10	2598849
F4 (C34-C50 Hydrocarbons)	ug/g	<10	<10	<10	<10	10	<10	<10	<10	10	2598849
Reached Baseline at C50	ug/g	YES	YES	YES	YES	YES	YES	YES	YES		2598849
Surrogate Recovery (%)											
1,4-Difluorobenzene	%	105	101	97	102	103	100	98	102		2599953
4-Bromofluorobenzene	%	90	78	84	75	79	76	84	75		2599953
D10-Ethylbenzene	%	96	98	90	83	85	96	99	101		2599953
D4-1,2-Dichloroethane	%	106	102	100	99	105	103	96	105		2599953
o-Terphenyl	%	98	102	104	95	98	99	96	95		2598849

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam Analytics International Corporation o/a Maxxam Analytics 32 Colonnade Rd, Unit #1000, Nepean, ON K2E 7J6 Phone: 613 274-0573 Fax: 613 274-0574 Website: www.maxxamanalytics.com

Maxxam Job #: B1D2331
Report Date: 2011/09/06

Franz Environmental Inc
Client Project #: 1697-1101

ELEMENTS BY ATOMIC SPECTROSCOPY (SOIL)

Maxxam ID		KS2276	KS2277	KS2278	KS2279	KS2280	KS2281	KS2282	KS2283		
Sampling Date		2011/08/27	2011/08/27	2011/08/27	2011/08/27	2011/08/27	2011/08/27	2011/08/27	2011/08/27		
	Units	**TP11-1T**	**TP11-2T**	**TP11-3T**	**DUP T**	**TP11-1B**	**TP11-2B**	**TP11-3B**	**DUP B**	**RDL**	**QC Batch**
Metals											
Acid Extractable Arsenic (As)	ug/g	1	1	<1	<1	1	1	<1	1	1	2601917
Acid Extractable Cadmium (Cd)	ug/g	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	2601917
Acid Extractable Chromium (Cr)	ug/g	29	30	26	23	32	33	32	29	1	2601917
Acid Extractable Cobalt (Co)	ug/g	7.0	6.9	6.3	6.0	6.9	8.3	7.2	6.8	0.1	2601917
Acid Extractable Copper (Cu)	ug/g	20	19	20	18	18	22	20	19	0.5	2601917
Acid Extractable Lead (Pb)	ug/g	8	7	7	6	6	7	7	7	1	2601917
Acid Extractable Nickel (Ni)	ug/g	19	20	17	16	20	24	19	20	0.5	2601917
Acid Extractable Zinc (Zn)	ug/g	46	45	45	42	44	47	45	44	5	2601917

POLYCHLORINATED BIPHENYLS BY GC-ECD (SOIL)

Maxxam ID		KS2276	KS2277	KS2278	KS2279	KS2280	KS2281	KS2282	KS2283		
Sampling Date		2011/08/27	2011/08/27	2011/08/27	2011/08/27	2011/08/27	2011/08/27	2011/08/27	2011/08/27		
	Units	**TP11-1T**	**TP11-2T**	**TP11-3T**	**DUP T**	**TP11-1B**	**TP11-2B**	**TP11-3B**	**DUP B**	**RDL**	**QC Batch**
PCBs											
Aroclor 1016	ug/g	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	2601326
Aroclor 1221	ug/g	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	2601326
Aroclor 1232	ug/g	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	2601326
Aroclor 1242	ug/g	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	2601326
Aroclor 1248	ug/g	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	2601326
Aroclor 1254	ug/g	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	2601326
Aroclor 1260	ug/g	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	2601326
Aroclor 1262	ug/g	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	2601326
Aroclor 1268	ug/g	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	2601326
Total PCB	ug/g	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	2601326
Surrogate Recovery (%)											
2,4,5,6-Tetrachloro-m-xylene	%	91	79	111	106	94	98	88	95		2601326
Decachlorobiphenyl	%	109	110	126	119	114	129	108	112		2601326

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam Analytics International Corporation o/a Maxxam Analytics 32 Colonnade Rd, Unit #1000, Nepean, ON K2E 7J6 Phone: 613 274-0573 Fax: 613 274-0574 Website: www.maxxamanalytics.com

Maxxam Job #: B1D2331
Report Date: 2011/09/06

Franz Environmental Inc
Client Project #: 1697-1101

Test Summary

Maxxam ID	KS2276	**Collected**	2011/08/27
Sample ID	TP11-1T	**Shipped**	
Matrix	Soil	**Received**	2011/08/30

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Petroleum Hydro. CCME F1 & BTEX in Soil	HSGC/MSFD	2599953	2011/08/31	2011/08/31	STEVE ROBERTS
Petroleum Hydrocarbons F2-F4 in Soil	GC/FID	2598849	2011/08/30	2011/09/01	LYNDSEY HART
Acid Extr. Metals (aqua regia) by ICPMS	ICP/MS	2601917	2011/09/01	2011/09/02	VIVIANA CANZONIERI
MOISTURE	BAL	2598846	N/A	2011/09/01	LYNDSEY HART
Polychlorinated Biphenyl in Soil	GC/ECD	2601326	2011/09/01	2011/09/02	JOY ZHANG

Maxxam ID	KS2276 Dup	**Collected**	2011/08/27
Sample ID	TP11-1T	**Shipped**	
Matrix	Soil	**Received**	2011/08/30

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Petroleum Hydro. CCME F1 & BTEX in Soil	HSGC/MSFD	2599953	2011/08/31	2011/08/31	STEVE ROBERTS

Maxxam ID	KS2277	**Collected**	2011/08/27
Sample ID	TP11-2T	**Shipped**	
Matrix	Soil	**Received**	2011/08/30

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Petroleum Hydro. CCME F1 & BTEX in Soil	HSGC/MSFD	2599953	2011/08/31	2011/08/31	STEVE ROBERTS
Petroleum Hydrocarbons F2-F4 in Soil	GC/FID	2598849	2011/08/30	2011/09/01	LYNDSEY HART
Acid Extr. Metals (aqua regia) by ICPMS	ICP/MS	2601917	2011/09/01	2011/09/02	VIVIANA CANZONIERI
MOISTURE	BAL	2598846	N/A	2011/09/01	LYNDSEY HART
Polychlorinated Biphenyl in Soil	GC/ECD	2601326	2011/09/01	2011/09/02	JOY ZHANG

Maxxam Analytics International Corporation o/a Maxxam Analytics 32 Colonnade Rd, Unit #1000, Nepean, ON K2E 7J6 Phone: 613 274-0573 Fax: 613 274-0574 Website: www.maxxamanalytics.com

Maxxam Job #: B1D2331
Report Date: 2011/09/06

Franz Environmental Inc
Client Project #: 1697-1101

Test Summary

Maxxam ID KS2278 **Collected** 2011/08/27
Sample ID TP11-3T **Shipped**
Matrix Soil **Received** 2011/08/30

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Petroleum Hydro. CCME F1 & BTEX in Soil	HSGC/MSFD	2599953	2011/08/31	2011/08/31	STEVE ROBERTS
Petroleum Hydrocarbons F2-F4 in Soil	GC/FID	2598849	2011/08/30	2011/09/01	LYNDSEY HART
Acid Extr. Metals (aqua regia) by ICPMS	ICP/MS	2601917	2011/09/01	2011/09/02	VIVIANA CANZONIERI
MOISTURE	BAL	2598846	N/A	2011/09/01	LYNDSEY HART
Polychlorinated Biphenyl in Soil	GC/ECD	2601326	2011/09/01	2011/09/02	JOY ZHANG

Maxxam ID KS2279 **Collected** 2011/08/27
Sample ID DUP T **Shipped**
Matrix Soil **Received** 2011/08/30

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Petroleum Hydro. CCME F1 & BTEX in Soil	HSGC/MSFD	2599953	2011/08/31	2011/09/01	STEVE ROBERTS
Petroleum Hydrocarbons F2-F4 in Soil	GC/FID	2598849	2011/08/30	2011/09/01	LYNDSEY HART
Acid Extr. Metals (aqua regia) by ICPMS	ICP/MS	2601917	2011/09/01	2011/09/02	VIVIANA CANZONIERI
MOISTURE	BAL	2598846	N/A	2011/09/01	LYNDSEY HART
Polychlorinated Biphenyl in Soil	GC/ECD	2601326	2011/09/01	2011/09/02	JOY ZHANG

Maxxam ID KS2280 **Collected** 2011/08/27
Sample ID TP11-1B **Shipped**
Matrix Soil **Received** 2011/08/30

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Petroleum Hydro. CCME F1 & BTEX in Soil	HSGC/MSFD	2599953	2011/08/31	2011/09/01	STEVE ROBERTS
Petroleum Hydrocarbons F2-F4 in Soil	GC/FID	2598849	2011/08/30	2011/09/01	LYNDSEY HART
Acid Extr. Metals (aqua regia) by ICPMS	ICP/MS	2601917	2011/09/01	2011/09/02	VIVIANA CANZONIERI
MOISTURE	BAL	2598846	N/A	2011/09/01	LYNDSEY HART
Polychlorinated Biphenyl in Soil	GC/ECD	2601326	2011/09/01	2011/09/02	JOY ZHANG

Maxxam Analytics International Corporation o/a Maxxam Analytics 32 Colonnade Rd, Unit #1000, Nepean, ON K2E 7J6 Phone: 613 274-0573 Fax: 613 274-0574 Website: www.maxxamanalytics.com

Maxxam Job #: B1D2331
Report Date: 2011/09/06

Franz Environmental Inc
Client Project #: 1697-1101

Test Summary

Maxxam ID KS2281 **Collected** 2011/08/27
Sample ID TP11-2B **Shipped**
Matrix Soil **Received** 2011/08/30

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Petroleum Hydro. CCME F1 & BTEX in Soil	HSGC/MSFD	2599953	2011/08/31	2011/09/01	STEVE ROBERTS
Petroleum Hydrocarbons F2-F4 in Soil	GC/FID	2598849	2011/08/30	2011/09/01	LYNDSEY HART
Acid Extr. Metals (aqua regia) by ICPMS	ICP/MS	2601917	2011/09/01	2011/09/02	VIVIANA CANZONIERI
MOISTURE	BAL	2598846	N/A	2011/09/01	LYNDSEY HART
Polychlorinated Biphenyl in Soil	GC/ECD	2601326	2011/09/01	2011/09/02	JOY ZHANG

Maxxam ID KS2282 **Collected** 2011/08/27
Sample ID TP11-3B **Shipped**
Matrix Soil **Received** 2011/08/30

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Petroleum Hydro. CCME F1 & BTEX in Soil	HSGC/MSFD	2599953	2011/08/31	2011/09/01	STEVE ROBERTS
Petroleum Hydrocarbons F2-F4 in Soil	GC/FID	2598849	2011/08/30	2011/09/01	LYNDSEY HART
Acid Extr. Metals (aqua regia) by ICPMS	ICP/MS	2601917	2011/09/01	2011/09/02	VIVIANA CANZONIERI
MOISTURE	BAL	2598846	N/A	2011/09/01	LYNDSEY HART
Polychlorinated Biphenyl in Soil	GC/ECD	2601326	2011/09/01	2011/09/02	JOY ZHANG

Maxxam ID KS2283 **Collected** 2011/08/27
Sample ID DUP B **Shipped**
Matrix Soil **Received** 2011/08/30

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Petroleum Hydro. CCME F1 & BTEX in Soil	HSGC/MSFD	2599953	2011/08/31	2011/09/01	STEVE ROBERTS
Petroleum Hydrocarbons F2-F4 in Soil	GC/FID	2598849	2011/08/30	2011/09/01	LYNDSEY HART
Acid Extr. Metals (aqua regia) by ICPMS	ICP/MS	2601917	2011/09/01	2011/09/02	VIVIANA CANZONIERI
MOISTURE	BAL	2598846	N/A	2011/09/01	LYNDSEY HART
Polychlorinated Biphenyl in Soil	GC/ECD	2601326	2011/09/01	2011/09/02	JOY ZHANG

Maxxam Analytics International Corporation o/a Maxxam Analytics 32 Colonnade Rd, Unit #1000, Nepean, ON K2E 7J6 Phone: 613 274-0573 Fax: 613 274-0574 Website: www.maxxamanalytics.com

Package 1	5.3°C
Package 2	2.7°C
Package 3	8.0°C

Each temperature is the average of up to three cooler temperatures taken at receipt

GENERAL COMMENTS

Cooler custody seal was present and intact.

O'REG 153 PETROLEUM HYDROCARBONS (SOIL)

Petroleum Hydrocarbons F2-F4 in Soil: Matrix Spiked recovery was not calculated due to high concentration of target compounds in the parent sample.

Maxxam Analytics International Corporation o/a Maxxam Analytics 32 Colonnade Rd, Unit #1000, Nepean, ON K2E 7J6 Phone: 613 274-0573 Fax: 613 274-0574 Website: www.maxxamanalytics.com

Maxxam Job #: B1D2331
Report Date: 2011/09/06

Franz Environmental Inc
Client Project #: 1697-1101

QUALITY ASSURANCE REPORT

			Matrix Spike		Spiked Blank		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	Units	Value (%)	QC Limits	% Recovery	QC Limits
2598846	Moisture	2011/09/01							0.9	50		
2598849	o-Terphenyl	2011/08/31	98	30 - 130	92	30 - 130	97	%				
2598849	F2 (C10-C16 Hydrocarbons)	2011/08/31	NC	60 - 130	93	60 - 130	<10	ug/g	11.9	50		
2598849	F3 (C16-C34 Hydrocarbons)	2011/08/31	NC	60 - 130	93	60 - 130	<10	ug/g	14.6	50		
2598849	F4 (C34-C50 Hydrocarbons)	2011/08/31	NC	60 - 130	93	60 - 130	<10	ug/g	34.5	50		
2599953	1,4-Difluorobenzene	2011/08/31	102	60 - 140	118	60 - 140	97	%				
2599953	4-Bromofluorobenzene	2011/08/31	105	60 - 140	107	60 - 140	72	%				
2599953	D10-Ethylbenzene	2011/08/31	97	30 - 130	97	30 - 130	121	%				
2599953	D4-1,2-Dichloroethane	2011/08/31	100	60 - 140	111	60 - 140	97	%				
2599953	Benzene	2011/08/31	93	60 - 140	112	60 - 140	<0.02	ug/g	NC	50		
2599953	Toluene	2011/08/31	97	60 - 140	117	60 - 140	<0.02	ug/g	NC	50		
2599953	Ethylbenzene	2011/08/31	98	60 - 140	97	60 - 140	<0.02	ug/g	NC	50		
2599953	o-Xylene	2011/08/31	96	60 - 140	99	60 - 140	<0.02	ug/g	NC	50		
2599953	p+m-Xylene	2011/08/31	95	60 - 140	96	60 - 140	<0.04	ug/g	NC	50		
2599953	F1 (C6-C10)	2011/08/31	113	60 - 140	107	60 - 140	<10	ug/g	NC	50		
2599953	Total Xylenes	2011/08/31					<0.04	ug/g	NC	50		
2599953	F1 (C6-C10) - BTEX	2011/08/31					<10	ug/g	NC	50		
2601326	2,4,5,6-Tetrachloro-m-xylene	2011/09/01	84	30 - 130	100	30 - 130	98	%				
2601326	Decachlorobiphenyl	2011/09/01	90	30 - 130	113	30 - 130	105	%				
2601326	Aroclor 1260	2011/09/01	99	30 - 130	121	30 - 130	<0.01	ug/g	NC	50		
2601326	Total PCB	2011/09/01	99	30 - 130	121	30 - 130	<0.01	ug/g	12.8	50		
2601326	Aroclor 1016	2011/09/01					<0.01	ug/g				
2601326	Aroclor 1221	2011/09/01					<0.01	ug/g				
2601326	Aroclor 1232	2011/09/01					<0.01	ug/g				
2601326	Aroclor 1242	2011/09/01					<0.01	ug/g	NC	50		
2601326	Aroclor 1248	2011/09/01					<0.01	ug/g	NC	50		
2601326	Aroclor 1254	2011/09/01					<0.01	ug/g	NC	50		
2601326	Aroclor 1262	2011/09/01					<0.01	ug/g				
2601326	Aroclor 1268	2011/09/01					<0.01	ug/g				
2601917	Acid Extractable Arsenic (As)	2011/09/02	93	75 - 125			<1	ug/g	NC	30	95	75 - 125
2601917	Acid Extractable Cadmium (Cd)	2011/09/02	97	75 - 125			<0.1	ug/g	NC	30	92	75 - 125
2601917	Acid Extractable Chromium (Cr)	2011/09/02	101	75 - 125			<1	ug/g	NC	30	102	75 - 125
2601917	Acid Extractable Cobalt (Co)	2011/09/02	95	75 - 125			<0.1	ug/g	0.2	30	97	75 - 125
2601917	Acid Extractable Copper (Cu)	2011/09/02	93	75 - 125			<0.5	ug/g	37.7(1)	30	99	75 - 125
2601917	Acid Extractable Lead (Pb)	2011/09/02	96	75 - 125			<1	ug/g	NC	30	94	75 - 125

Maxxam Analytics International Corporation o/a Maxxam Analytics 32 Colonnade Rd, Unit #1000, Nepean, ON K2E 7J6 Phone: 613 274-0573 Fax: 613 274-0574 Website: www.maxxamanalytics.com

Maxxam Job #: B1D2331
Report Date: 2011/09/06

Franz Environmental Inc
Client Project #: 1697-1101

QUALITY ASSURANCE REPORT

			Matrix Spike		Spiked Blank		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	Units	Value (%)	QC Limits	% Recovery	QC Limits
2601917	Acid Extractable Nickel (Ni)	2011/09/02	96	75 - 125			<0.5	ug/g	4.8	30	101	75 - 125
2601917	Acid Extractable Zinc (Zn)	2011/09/02	100	75 - 125			<5	ug/g	NC	30	105	75 - 125

N/A = Not Applicable
RPD = Relative Percent Difference
Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.
Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.
QC Standard: A blank matrix to which a known amount of the analyte has been added. Used to evaluate analyte recovery.
Spiked Blank: A blank matrix to which a known amount of the analyte has been added. Used to evaluate analyte recovery.
Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.
Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.
NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was not sufficiently significant to permit a reliable recovery calculation.
NC (RPD): The RPD was not calculated. The level of analyte detected in the parent sample and its duplicate was not sufficiently significant to permit a reliable calculation.
(1) - Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.

Maxxam Analytics International Corporation o/a Maxxam Analytics 32 Colonnade Rd, Unit #1000, Nepean, ON K2E 7J6 Phone: 613 274-0573 Fax: 613 274-0574 Website: www.maxxamanalytics.com

Validation Signature Page

Maxxam Job #: B1D2331

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

CHARLES ANCKER, B.Sc., M.Sc., C.Chem, Senior Analyst

Cristina Carriere

CRISTINA CARRIERE, Scientific Services

Paul

PAUL RUBINATO, Analyst, Maxxam Analytics

ALINA SEGAL, Manager Main Lab - Organics

Maxxam Analytics International Corporation o/a Maxxam Analytics 32 Colonnade Rd, Unit #1000, Nepean, ON K2E 7J6 Phone: 613 274-0573 Fax: 613 274-0574 Website: www.maxxamanalytics.com

Validation Signature Page

Maxxam Job #: B1D2331

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

STEVE ROBERTS, Lab Supervisor, Ottawa

===
Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Analytics International Corporation o/a Maxxam Analytics 32 Colonnade Rd, Unit #1000, Nepean, ON K2E 7J6 Phone: 613 274-0573 Fax: 613 274-0574 Website: www.maxxamanalytics.com

APPENDIX E

QA/QC Discussion

In order to obtain the required minimum of 20% duplicate samples, as stipulated in Long-Term Monitoring Plan, two duplicate soil samples (one top and one bottom) and one duplicate groundwater sample were collected at the site in 2011. Analytical results for submitted samples and their duplicate pairs were compared to provide an indication of the precision of both the field sampling and laboratory analyzing methods. Results are presented along with chemical data in Appendix B, while the methodology is discussed in section 4.6.

All groundwater and soil samples analyzed for PHCs, metals, PCBs and inorganics fell within limits of QA/QC acceptability with the exception of the groundwater sample MW06-04 and AH-1 for Total Suspended Solids (TSS). The samples exceeded the acceptable range for “Case D” samples as outlined in Table 4-3. The difference between the two concentrations, however, was exactly equal to the RDL, which is the margin of error on such a reading.

The internal laboratory quality control for analyses meets acceptability criteria. Therefore based on both laboratory and field QA/QC results, the data is reliable for its intended use. Laboratory QA/QC results are included in the laboratory certificates of analyses provided in Appendix D.

APPENDIX F

Site Photographs

Northwest corner of the SSDF. Viewpoint 2 (Figure A-2; Appendix A). Photograph reference P8270099 (CD-ROM).
Direction photo taken: SE

Southwest corner of the SSDF. Viewpoint 11 (Figure A-2; Appendix A). Photograph reference P8270108 (CD-ROM).
Direction photo taken: NE

Southeast corner of the SSDF. Viewpoint 23 (Figure A-2; Appendix A). Photograph reference P8270120 (CD-ROM). Direction photo taken: NW

Northeast corner of the SSDF. Viewpoint 33 (Figure A-2; Appendix A). Photograph reference P8270130 (CD-ROM). Direction photo taken: SW

Top of the SSDF. Viewpoint 43 (Figure A-2; Appendix A). Photograph reference P8270140 (CD-ROM). Direction photo taken: E

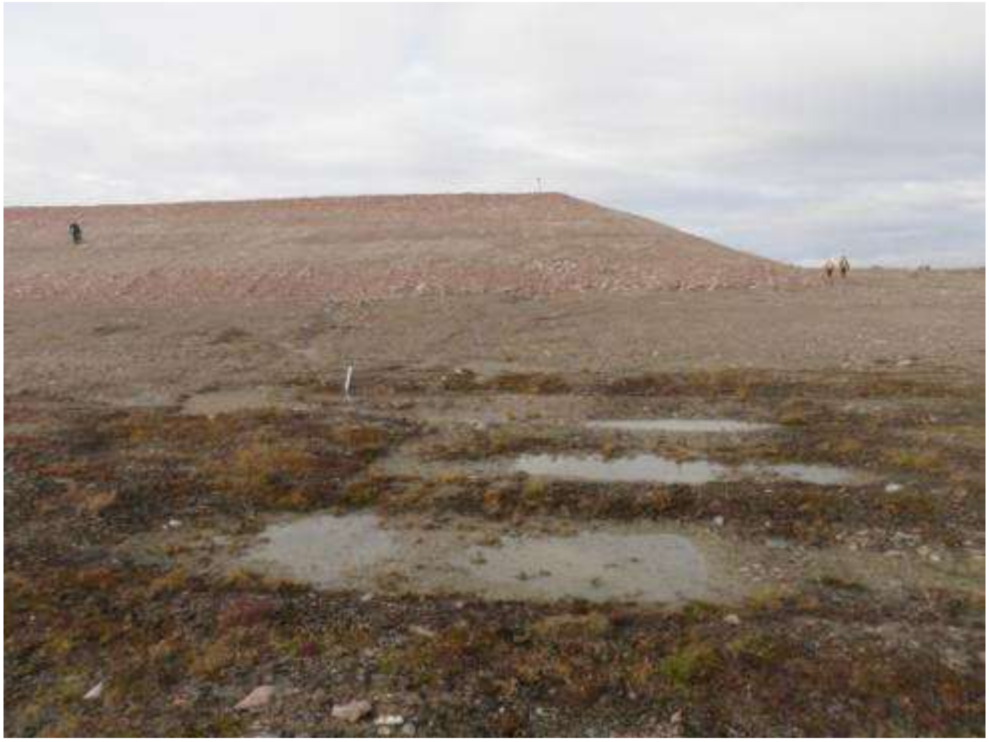
Ponded water near airstrip. Viewpoint 54 (Figure A-2; Appendix A). Photograph reference P8270151 (CD-ROM). Direction photo taken: S

Cracking on west slope of SSDF. Viewpoint 59 (Figure A-2; Appendix A). Photograph reference P8270156 (CD-ROM). Direction photo taken: E

Pothole on west slope of SSDF. Viewpoint 64 (Figure A-2; Appendix A). Photograph reference P8270161 (CD-ROM). Direction photo taken: E

Ponding from active seepage at the southwest corner. Viewpoint 68 (Figure A-2; Appendix A). Photograph reference P8270165 (CD-ROM). Direction photo taken: NE

Active erosion from active seepage along the south toe of the SSDF. Viewpoint 74 (Figure A-2; Appendix A). Photograph reference P8270171 (CD-ROM). Direction photo taken: N



Ponded water from the active seep near the southeast corner of the SSDF. Viewpoint 78 (Figure A-2; Appendix A). Photograph reference P8270175 (CD-ROM). Direction photo taken: SE

Soil sampling near MW0606. Viewpoint 83 (Figure A-2; Appendix A). Photograph reference P8270180 (CD-ROM). Direction photo taken: SE

Table F-1. Picture viewpoint numbers of the SSDF (as depicted in Figure A-2, Appendix A) cross-referenced with picture numbers on attached CD-ROM.

Viewpoint	Picture	Viewpoint	Picture	Viewpoint	Picture
1	P8270098	31	P8270128	61	P8270158
2	**P8270099**	32	P8270129	62	P8270159
3	P8270100	**33**	**P8270130**	63	P8270160
4	P8270101	34	P8270131	**64**	**P8270161**
5	P8270102	35	P8270132	65	P8270162
6	P8270103	36	P8270133	66	P8270163
7	P8270104	37	P8270134	67	P8270164
8	P8270105	38	P8270135	**68**	**P8270165**
9	P8270106	39	P8270136	69	P8270166
10	P8270107	40	P8270137	70	P8270167
11	**P8270108**	41	P8270138	71	P8270168
12	P8270109	42	P8270139	72	P8270169
13	P8270110	**43**	**P8270140**	73	P8270170
14	P8270111	44	P8270141	**74**	**P8270171**
15	P8270112	45	P8270142	75	P8270172
16	P8270113	46	P8270143	76	P8270173
17	P8270114	47	P8270144	77	P8270174
18	P8270115	48	P8270145	**78**	**P8270175**
19	P8270116	49	P8270146	79	P8270176
20	P8270117	50	P8270147	80	P8270177
21	P8270118	51	P8270148	81	P8270178
22	P8270119	52	P8270149	82	P8270179
23	**P8270120**	53	P8270150	**83**	**P8270180**
24	P8270121	**54**	**P8270151**	84	P8270181
25	P8270122	55	P8270152		
26	P8270123	56	P8270153		
27	P8270124	57	P8270154		
28	P8270125	58	P8270155		
29	P8270126	**59**	**P8270156**		
30	P8270127	60	P8270157		

Note:
Numbers in **bold** appear in Appendix B.

West corner of the NHWL. Viewpoint 2 (Figure A-3; Appendix A). Photograph reference P8280002 (CD-ROM). Direction photo taken: E

South corner of the NHWL. Viewpoint 10 (Figure A-3; Appendix A). Photograph reference P8280010 (CD-ROM). Direction photo taken: N

East corner of the NHWL. Viewpoint 20 (Figure A-3; Appendix A). Photograph reference P8280020 (CD-ROM). Direction photo taken: W

West corner of the NHWL. Viewpoint 28 (Figure A-3; Appendix A). Photograph reference P8280028 (CD-ROM). Direction photo taken: S

Top of the NHWL from west corner. Viewpoint 39 (Figure A-3; Appendix A). Photograph reference P8280039 (CD-ROM). Direction photo taken: N

Feature A – small depression on top of the NHWL. Viewpoint 48 (Figure A-3; Appendix A). Photograph reference P8280048 (CD-ROM). Direction photo taken: SW

Feature B – large depression on top of the NHWL. Viewpoint 49 (Figure A-3; Appendix A). Photograph reference P8280049 (CD-ROM). Direction photo taken: S

Feature C –Slight low area near the west corner of the NHWL. Viewpoint 50 (Figure A-3; Appendix A). Photograph reference P8280050 (CD-ROM). Direction photo taken: W

Feature D –Settlement near the south corner of the NWHL. Viewpoint 51 (Figure A-3; Appendix A). Photograph reference P8280051 (CD-ROM). Direction photo taken: W

Table F-2. Picture viewpoint numbers of the NHWL (as depicted in Figure A-2, Appendix A) cross-referenced with picture numbers on Attached CD-ROM.

Viewpoint	Picture	Viewpoint	Picture	Viewpoint	Picture
1	P8280001	21	P8280021	41	P8280041
2	**P8280002**	22	P8280022	42	P8280042
3	P8280003	23	P8280023	43	P8280043
4	P8280004	24	P8280024	44	P8280044
5	P8280005	25	P8280025	45	P8280045
6	P8280006	26	P8280026	46	P8280046
7	P8280007	27	P8280027	47	P8280047
8	P8280008	**28**	**P8280028**	**48**	**P8280048**
9	P8280009	29	P8280029	**49**	**P8280049**
10	**P8280010**	30	P8280030	**50**	**P8280050**
11	P8280011	31	P8280031	**51**	**P8280051**
12	P8280012	32	P8280032		
13	P8280013	33	P8280033		
14	P8280014	34	P8280034		
15	P8280015	35	P8280035		
16	P8280016	36	P8280036		
17	P8280017	37	P8280037		
18	P8280018	38	P8280038		
19	P8280019	**39**	**P8280039**		
20	**P8280020**	40	P8280040		

Note:
Numbers in **bold** appear in Appendix B.

APPENDIX G

Field Notes

Monitoring Well Sampling Record

Site Name:	CAMF		
Date of Sampling Event:	Aug 28	Time:	
Names of Samplers:	CL / MD		
Landfill Name:	NHWL		
Monitoring Well ID:	MW06-01		
Sample Number:			
Condition of Well:			
Measured Data			
Well pipe height above ground (cm)=	0.4		
Diameter of well (cm)=			
Depth of well installation (cm)= (from ground surface)			
Length screened section (cm)=			
Depth to top of screen (cm)= (from ground surface)			
Depth to water surface (cm)= (from top of pipe)	2.22	Measurement method: (meter, tape, etc)	
Static water level (cm)= (below ground surface)			
Measured well refusal depth (cm)= (i.e. depth to frozen ground)	2.40	Evidence of sludge or siltation:	
Thickness of water column (cm)=			
Static volume of water in well (mL)=			
Free product thickness (mm)=		Measurement method: (meter, paste, etc)	
Purging: (Y/N)		Purging/Sampling Equipment:	
Volume Purged Water=			
Decontamination required: (Y/N)			
Number washes:			
Number rinses:			
Final pH=			
Final Conductivity (uS/cm)=			
Final Temperature (degC)=			

No Recharge
purged ~ 0.25 L.

Field parameters could not be collected because it was purged dry.

Monitoring Well Sampling Record

Site Name:	Com F		
Date of Sampling Event:	Aug. 28	Time:	
Names of Samplers:	C.E.L MD		
Landfill Name:	MW 2		
Monitoring Well ID:			
Sample Number:			
Condition of Well:	No cap		
Measured Data			
Well pipe height above ground (cm)=	7.5 cm		
Diameter of well (cm)=			
Depth of well installation (cm)= (from ground surface)			
Length screened section (cm)=			
Depth to top of screen (cm)= (from ground surface)			
Depth to water surface (cm)= (from top of pipe)	NO WATER	Measurement method: (meter, tape, etc)	
Static water level (cm)= (below ground surface)			
Measured well refusal depth (cm)= (i.e. depth to frozen ground)	2.25 cm	Evidence of sludge or siltation:	
Thickness of water column (cm)=			
Static volume of water in well (mL)=			
Free product thickness (mm)=		Measurement method: (meter, paste, etc)	
Purging: (Y/N)		Purging/Sampling Equipment:	
Volume Purged Water=			
Decontamination required: (Y/N)			
Number washes:			
Number rinses:			
Final pH=			
Final Conductivity (uS/cm)=			
Final Temperature (degC)=			

Monitoring Well Sampling Record

Site Name:	CAM F		
Date of Sampling Event:	AUG 27	Time:	
Names of Samplers:	OR / MD		
Landfill Name:	SSDF		
Monitoring Well ID:	MW06-04		
Sample Number:			
Condition of Well:			
Measured Data			
Well pipe height above ground (cm)=	0.27		
Diameter of well (cm)=			
Depth of well installation (cm)= (from ground surface)			
Length screened section (cm)=			
Depth to top of screen (cm)= (from ground surface)			
Depth to water surface (cm)= (from top of pipe)	0.57	Measurement method: (meter, tape, etc)	
Static water level (cm)= (below ground surface)			
Measured well refusal depth (cm)= (i.e. depth to frozen ground)	1.69 ~~0.7~~	Evidence of sludge or siltation:	
Thickness of water column (cm)=			
Static volume of water in well (mL)=			
Free product thickness (mm)=		Measurement method: (meter, paste, etc)	
Purging: (Y/N)		Purging/Sampling Equipment:	
Volume Purged Water=			
Decontamination required: (Y/N)			
Number washes:			
Number rinses:			
Final pH=			
Final Conductivity (uS/cm)=			
Final Temperature (degC)=			

Monitoring Well Sampling Record

Site Name:	Cam-F		
Date of Sampling Event:	Aug. 27	Time:	
Names of Samplers:	MD · CEL		
Landfill Name:	MW-5		
Monitoring Well ID:			
Sample Number:			
Condition of Well:	Good		
Measured Data			
Well pipe height above ground (cm)=	68 cm		
Diameter of well (cm)=			
Depth of well installation (cm)= (from ground surface)			
Length screened section (cm)=			
Depth to top of screen (cm)= (from ground surface)			
Depth to water surface (cm)= (from top of pipe)	1.04 cm	Measurement method: (meter, tape, etc)	
Static water level (cm)= (below ground surface)			
Measured well refusal depth (cm)= (i.e. depth to frozen ground)	2.09 cm	Evidence of sludge or siltation:	
Thickness of water column (cm)=			
Static volume of water in well (mL)=			
Free product thickness (mm)=		Measurement method: (meter, paste, etc)	
Purging: (Y/N)		Purging/Sampling Equipment:	
Volume Purged Water=			
Decontamination required: (Y/N)			
Number washes:			
Number rinses:			
Final pH=			
Final Conductivity (uS/cm)=			
Final Temperature (degC)=			

Monitoring Well Sampling Record

Site Name:	Cam-F		
Date of Sampling Event:	Aug 28	Time:	
Names of Samplers:	CEL MP		
Landfill Name:			
Monitoring Well ID:	MW06-3		
Sample Number:			
Condition of Well:	FAIR - casing outside loose, sticky lid		
	duct tape in well		
Measured Data			
Well pipe height above ground (cm)=			
Diameter of well (cm)=			
Depth of well installation (cm)= (from ground surface)	0.63		
Length screened section (cm)=			
Depth to top of screen (cm)= (from ground surface)			
Depth to water surface (cm)= (from top of pipe)	NO WATER	Measurement method: (meter, tape, etc)	
Static water level (cm)= (below ground surface)			
Measured well refusal depth (cm)= (i.e. depth to frozen ground)	2.93	Evidence of sludge or siltation:	
Thickness of water column (cm)=			
Static volume of water in well (mL)=			
Free product thickness (mm)=		Measurement method: (meter, paste, etc)	
Purging: (Y/N)		Purging/Sampling Equipment:	
Volume Purged Water=			
Decontamination required: (Y/N)			
Number washes:			
Number rinses:			
Final pH=			
Final Conductivity (uS/cm)=			
Final Temperature (degC)=			

Monitoring Well Sampling Record

Site Name:	Cam-F		
Date of Sampling Event:	Aug 27	Time:	
Names of Samplers:	CEL - MD		
Landfill Name:	MW-6		
Monitoring Well ID:			
Sample Number:			
Condition of Well:	Good		
Measured Data			
Well pipe height above ground (cm)=	75 cm		
Diameter of well (cm)=			
Depth of well installation (cm)= (from ground surface)			
Length screened section (cm)=			
Depth to top of screen (cm)= (from ground surface)			
Depth to water surface (cm)= (from top of pipe)	1.56 cm	Measurement method: (meter, tape, etc)	
Static water level (cm)= (below ground surface)			
Measured well refusal depth (cm)= (i.e. depth to frozen ground)	1.95 cm	Evidence of sludge or siltation:	
Thickness of water column (cm)=			
Static volume of water in well (mL)=			
Free product thickness (mm)=		Measurement method: (meter, paste, etc)	
Purging: (Y/N)		Purging/Sampling Equipment:	
Volume Purged Water=			
Decontamination required: (Y/N)			
Number washes:			
Number rinses:			
Final pH=			
Final Conductivity (uS/cm)=			
Final Temperature (degC)=			

CAM F 15:15

FRANZ on site' CEL, CL & MD

Horiba Cal

pH	Con	Tur	DO	temp	orp
4.14	4.59	0	10.9	16.57	307
4.04	4.71	6	10.24	15.08	301

MW06-04 +DUP (AH-1)

Depth to water 0.57 d=5 cm

Depth to bottom 1.69 27 cm

↳ shelc up height

T	pH	Con	Tur	DO	temp	orp
15:34	6.06	4.45	118.0	4.38	3.25	12
15:36	6.25	4.44	77.8	3.14	3.03	-6
15:38	6.37	4.44	50.6	2.30	2.80	-18
15:40	6.47	4.43	51.3	1.75	2.75	-28
15:42	6.55	4.43	45.9	1.65	2.74	-31
15:44	6.63	4.43	43.3	1.44	2.70	-37
15:46	6.68	4.44	36.6	1.20	2.81	-43
15:48	6.73	4.44	36.8	1.01	2.79	-53
15:50	6.77	4.45	32.6	0.77	2.72	-63
15:52	6.81	4.46	30.9	0.59	2.68	-74
15:54	6.84	4.46	32.1	0.41	2.65	-86

LEVEL

MW06-6 17:08

	pH	con	Tur	DO	Temp	ORP
17:09	8.07	1.07	29.8	5.60	3.76	171
17:11	8.14	1.66	23.3	5.27	3.50	172
17:13	8.11	1.69	26.3	5.93	3.69	170

Pumped dry 2 / L

MW06-5

	pH	Con	Tur	Do	Temp	ORP
17:23	7.76	2.09	10.0	9.66	3.36	174
17:25	7.69	1.96	9.2	9.33	3.68	173
17:27	7.66	1.77	8.5	10.26	3.93	174
17:29	7.65	1.72	7.1	10.41	4.03	176
17:31	7.65	1.69	7.1	10.77	4.06	177

TP11-2

0-0.5 wet, sandy, light grey/brown coarse, some gravel

Band of ~~blu~~ dark brown @ 15cm

0-0.15 Sampled PHC, PCB, metals 3 jars + 1 bag

0.16 to 0.5 PHC, PCB, metals 3 jars + 1 bag

TP11-3 + DUP 1

- last page of NOTES!

LEVEL

1697-1101 CAM-F Aug 27/11

Thermistor Readings (manual)

VT-3	Kohms	VT-4	VT-2	VT-~~#1~~ 1
1	14.732	14.941	11.598	11.884
2	15.644	15.894	12.334	12.714
3	16.622	16.806	13.369	14.038
4	17.483	17.599	14.333	15.370
5	18.612	18.650	15.527	16.412
6	19.512	19.618	16.681	17.196
7	20.41	20.50	17.413	17.921
8	21.11	21.41	18.303	18.718
9	21.83	22.22	19.100	19.529
10	22.50	22.97	19.833	20.35
11	22.93	24.02	20.51	21.00
12	23.48	23.52	—	—
13	—	—	—	—
14	—	—	—	—
15	—	—	—	—
16	—	—	—	—

1697-1101 CAM-F Aug 27/11

VT-4

Memory = 39% full

Battery main = 11.34 V

Aux = 13.63 V

date = 27/08/11

Time = 10:56:45 pm

Site_004_CAMF-04VT_Aug_27

All programing is correct

→ Datalogger re-set

– set time to current time

CAM-F

1697-1101 Aug 27/11

VT3 - CAMF-03VT site:3

Memory = 39% full

Battery main = 11.34V
Aux = 13.75V

Date = 8/27/11

Time = 10:04:45 pm

set clock to correct time

Programed correctly

CAM-F

1697-1101 Aug 27/11

VT2 - CAMF-02VT site:2

Memory = 39% full

Battery Main 11.34V
Aux 13.14V

Date 8/28/11

Time 12:02:12 AM

re-set time to current

Programed correctly

LEVEL

1697-1101 CAM-F Aug 27/11

VT1 → site_001_CAMF_01VT_Aug28_2011

Memory - 39%

Battery Main - 11.34 V
Aux - 13.50 V

Clock: 12:05:07 am
Date: 8/28/11

- re-set clock to current time

- re-set logger

Aug 28/11 CAM F 1697-1101

9:30 Franz on site
Overcast, light rain, 4°C

MW06: no lock, no well cap

Depth to water 2.22
Depth to bottom 2.40
D = 50 mm
Stick up depth = 40cm

	pH	Cond	Turb	DO	temp	orp
9:52	8.28	0.729	empty well			

purged 0.25 L.

LEVEL

TP11-3 + DUP T + DUP B
0-0.5
0-0.15 dark brown & light brown sand, moist, coarse, sand with some gravel

@ 0.15 band of ~~drat~~ dark brown

0.16 to 0.5 Same as TP11 2

0 - 0.15 PHC, PCB, metals
DUP - PHC, PCB metals
0.15 - 0.5 PHC, PCB, metals
DUP - PHC, PCB, metals

TP11 -1
0-0.5 brown, wet sand, coarse, cobbles, some gravel
PHC, Metals, PCB,
TOP + Bottom.

Interview with Lily

- Area still used for hunting no change
- esp hunting building
- Geese
- Caribou
- Both seasons
- Fishing nearby lake.

LEVEL

APPENDIX H

Thermistor Details

From monitoring experience at AANDC DEW Line and abandoned mine sites, Franz Environmental Inc. suggests the following steps be considered to collect better-quality temperature data with increased efficiency from the thermistor data loggers installed to monitor landfill freezeback.

1. Before the long-term monitoring field program commences, the following information should be confirmed if not recorded in the thermistor installation report: bead type, bead depths, bead offset or calibration data, appropriate temperature conversion file (e.g. 16temp.sff for bead type 44007 if using Lakewood Systems hardware and Prolog software). Without this baseline data, field temperature readings will not be interpretable.

2. A list of provisions and checks for thermistor maintenance should be provided, particularly given that most sites are visited only once per year. The list will increase the chances of rectifying or preventing problems with thermistors in the field, minimizing the chances of leaving malfunctioning loggers in the field to collect a year of bad data – or to collect no data at all. The list of provisions and checks should include (but not be limited to) the following items:
    a. A spare data logger. Consultants should be prepared to change data loggers on site if field observations indicate that the logger in place is not functioning. The logger replaced at 02VT (at the CAM-F SSDF in 2010) and sent to Lakewood Systems for repair is now available to AANDC.
    b. A spare set of data logger batteries. Consultants should be prepared to change data logger batteries (a 9V and a 12V lithium) if voltages are low or data logger not functioning (see also note 5 below). One set of batteries, left over from the 2011 CAM-F monitoring program, is available to AANDC.
    c. Consideration for shipment of dangerous goods. Lithium batteries are considered a dangerous good and therefore require special packaging and additional time to be transported to sites.
    d. Desiccant cartridges. Bring spare desiccant cartridges to all sites with thermistors, and open all data logger units to verify if cartridges require replacement (based on colour). Also look for evidence of moisture within the thermistor housing unit and on cable pins, as moisture can cause serious logger malfunction.
    e. Manual data verification. Temperature data should be verified manually in the field each year, for each thermistor string, which means bringing data logger software (with appropriate resistance-temperature conversion file obtained from the manufacturer) and a manual temperature conversion file (.xls), also obtained from the manufacturer. If there is a significant difference (i.e., > 0.2 C, perhaps giving small leeway to top bead and possible rapid temperature change over short time periods), the spare logger should be swapped in and again values compared. An

effort should be made, however, to attempt to minimize the time between manual and logged temperature readings. If issues persist, the beads themselves may not be in good condition (though there is no immediate field option to fix this problem).

f. Manual verification equipment. A switchbox (to isolate and probe individual analog data channels on data loggers) and accurate ohmmeter is required to perform a manual verification of thermistor data loggers and temperature sensing beads. In the event that these are unavailable, manual verification is still possible, if slightly more difficult and less precise. Small alligator clips and a diagram of the data logger cable pin-out (attached later in this appendix) will be required to replace the switchbox (note pin “M” is common). In the absence of a Lakewood-provided, or other sensitive ohmmeter, a low quality multimeter can be used if calibrated, either before or immediately after field measurements. The internal resistors of the Lakewood Systems data loggers may be used for this purpose (contact Lakewood or see attached sheet later in this appendix for some common resistances found in the RX-16 data logger).

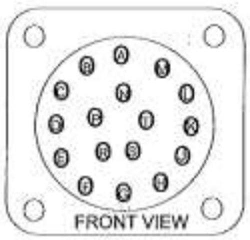
g. Adjust data logger clocks. If consistent termperature comparisons are to be made year to year, time should be verified and corrected to the appropriate local time as some data logger clocks appear to drift significantly over the period of a single year.

3. Whether future installations of thermistor strings include surface (air) temperature beads or not, weather data from the nearest weather stations should be considered in analyses. Although temperature data is likely to be the most reliable and useful, snowfall and wind speed data, landfill aggregate type and moisture content could also be shown to impact landfill freezeback.

4. Reports and data from other permafrost sites with landfill thermistors would be extremely useful in helping to analyse landfill temperature trends.

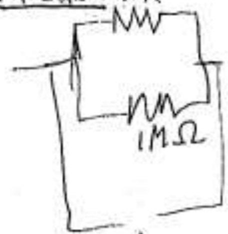
5. A note on battery voltages: The battery voltage levels are particularly meaningful when rechargeable batteries are used. With lithium batteries, as is the case at CAM-F, the discharge curve is extremely flat until total failure, when voltage levels drop off abruptly. Because voltage readings are not a good predictor of failure, lithium batteries should generally be replaced based on their date stickers.

RX-16 CONNECTOR PINOUT AND WIRING



PIN#	ALG#	COLOR
PIN A	ALG 1	Black
PIN B	ALG 2	Purple
PIN C	ALG 3	White
PIN D	ALG 4	Grey
PIN E	ALG 5	Red
PIN F	ALG 6	Brown
PIN G	ALG 7	White/Green
PIN H	ALG 8	Blue
PIN J	ALG 9	Green
PIN K	ALG 10	Yellow
PIN L	ALG 11	White/Blue
PIN N	ALG 12	Orange
PIN P	ALG 13	White/Yellow
PIN R	ALG 14	White/Black
PIN S	ALG 15	White/Brown (Bat V)
PIN T	ALG 16	P1 Green
PIN M	REF	Black (18 Gauge)

Data logger (thermistor) - verification



- open logger
- red module across top
- analog 1 (A1) + GND
  ↳ meas Ω across : should be 9998 Ω ± few ohms
  (record val)

↳ calibrate V-meter afterwards
(from ___ to ___)

- jumper A1 & A2 & should get ~5K ± few ohms (for that Ω range)

pin-out for thermistor string : maybe labelled inside box

(*) leads : L

A-T : pins 1-16   A-H = 1-8   N = 12
J = 9   P-T = 13-16
K-L = 10-11
* Pin "M" is common
* no pin "I", "O",