FRANZ ENVIRONMENTAL INC.

◆ CONSULTING ◆ ENGINEERING ◆ TECHNOLOGIES ◆

Long Term Monitoring, 2012
CAM-F, Sarcpa Lake, Nunavut

FINAL REPORT

Prepared for:

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EXECUTIVE SUMMARY

Franz Environmental Inc. (FRANZ) was retained by Aboriginal Affairs and Northern Development Canada (AANDC) to conduct the fifth year of long-term monitoring activities at the former CAM-F Distant Early Warning (DEW) Line site at Sarcpa Lake, Nunavut (the Site) as prescribed by the CAM-F Sarcpa Lake Long Term Monitoring Plan. This project was completed under AANDC standing offer number 01-11-6001/5, call-up number 02; 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 and a hunting/emergency shelter cabin remain present at the Site.

FRANZ conducted the field activities for the fifth year of the CAM-F long-term monitoring program on August 5th and 6th, 2012, while based in the nearby community of Hall Beach.

Based on physical observations from the 2012 field activities, the most representative climate data record available for the site, it appears that the two landfills, the SSDF and NHWL, are performing as designed and continue to contain 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, 2012 was on average a cooler year than 2011. Temperatures recorded in the SSDF indicate that the landfill was cooler in 2012 than in 2011. Thermal monitoring data suggest that the temperature below ground surface within the SSDF has decreased in 2011-2012, and is comparable to the low established in 2009. Thermal monitoring data indicate that the waste contained within the SSDF remained frozen year-round in 2011-2012.

In addition to physical and temperature observations, FRANZ collected groundwater samples to assess the performance of the SSDF and NHWL. For the first time ever since the long term

monitoring program was established at CAM-F, groundwater samples were collected from all of the wells present at the Site, including those surrounding the NHWL. In previous years, none of the wells at the NHWL were sampled as they were dry. Concentrations of contaminants of concern in groundwater samples were below the upper limit of acceptability when compared with aggregate historical results with exception of total and dissolved cobalt in MW06-1 and dissolved copper in MW06-3. Neither MW06-1 nor MW06-3 had been sampled in previous years.

As per AANDC instruction, no soil samples were collected at the soil monitoring points sampled in previous years. Soil samples were only to be collected during the 2012 monitoring event if evidence of breech in landfill integrity was observed or suspected (e.g., staining, or erosion).

Physical and thermal observations of the landfills and results of the groundwater chemical analysis conducted during the 2012 field program indicate that the containment facilities at CAM-F continue to operate as designed and that the Site continues to pose no threat to human health or the natural environment.

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

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1.0 INTRODUCTION

Franz Environmental Inc. (FRANZ) was retained by Aboriginal Affairs and Northern Development Canada – Nunavut Regional Office (AANDC) to complete year five 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 02; file number 1632-11/01-011-6001/5.

This report describes the monitoring activities completed in 2012 at the former DEW Line station, Sarcpa Lake, Nunavut. It was prepared in accordance with the FRANZ Proposal No. P-4178, dated June 7, 2012, the Call-up details, dated June 18, 2012 and the July 12, 2012 Project Initiating Meeting,

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 2012 long-term monitoring program was to complete the fifth monitoring event to assess the performance of the Secure Soil Disposal Facility (SSDF) and Non-Hazardous Waste Landfill (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 2012 was as described in the 2007 CAM-F Sarcpa Lake Long-Term Monitoring (LTM) plan (INAC, 2007):

1. Visual monitoring of the NHWL and 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 (groundwater) monitoring of the SSDF and NHWL, including:
    - Collection of samples from the two monitoring wells installed downgradient of both the SSDF and NHWL and the one well installed upgradient of each.
    - 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), petroleum hydrocarbons (PHCs), major ions, total dissolved solids (TDS) and total suspended solids (TSS).

3. Soil Monitoring in the area around the SSDF and NHWL, including:
    - The collection of soil samples from the toe of the SSDF and NHWL in the vicinity of the monitoring wells, if required.
    - Analysis of the soil samples for metals (arsenic, cadmium, chromium, cobalt, copper, lead, nickel, and zinc), PCBs and PHCs.
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.
    - Servicing the dataloggers, as required.
5. Natural environment monitoring:
    - Documentation of observations of wildlife and evidence of wildlife present at the site.
    - Interview with member(s) of the local Hunters and Trappers Organization or other persons knowledgeable of the Site; collection of anecdotal information.
6. Preparation of a report documenting the 2012 monitoring program.

To fulfil 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) Collection of 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 2012 field work was based mainly on the following documents: CAM-F Sarcpa Lake Long-Term Monitoring Plan (INAC, 2007); the 2008-2011 monitoring program reports (UMA, 2008 and FRANZ, 2009, 2010, 2011); 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:

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

Section 2 – *Background Information:* Describes the history, the regional and physical setting and the general characteristics of the Site.

Section 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.

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

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

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

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

Section 8 – *Conclusions and Recommendations:* Presents main findings and conclusions as well as recommendations for the next visit to the Site.

Section 9 – *Limitations*

Section 10 – *References*

Section 11 – *Closure*

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 abandoned in 1963. It was converted into a scientific research station in 1977 by the Science Institute of the Northwest Territories and the Department of Indian Affairs and Northern Development, and operated seasonally until 1988.

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; the Site contained approximately 10,000 barrels of unknown contents, a radar tower that had been dismantled, other debris and contaminated soil. There were also small volumes of miscellaneous waste and chemical residues remaining from the research facility. The beach area at Sarcpa Lake included a former construction camp, remnants of which 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 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. 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

- Soils impacted with benzene, toluene, ethylbenzene and xylenes (BTEX) and 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);
- Soils impacted with PHC fractions F3 and F4;
- Non-hazardous demolition debris, such as timbers, plywood, and sheet metal;
- Non-hazardous debris, such as scrap metal and wood;
- Non-hazardous debris/soil excavated from landfills;
- Creosote timbers; and
- Double-bagged asbestos

The Site is not regularly inhabited, and groundwater is not considered to be used for water supply purposes. Surface water was historically used for drinking water supply. The area is known to be frequently used by hunters and fishermen, who 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.
- Long Term Monitoring 2011, CAM-F Sarcpa Lake, Nunavut, January 11, 2012, Franz Environmental Inc.

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

The 2012 monitoring program was the fifth of ten that are scheduled over a 25 year period. Information from the 2008, 2009, 2010 and 2011 investigations were incorporated into this year's sampling plan. Data collected in 2008-2011 were combined with the latest data, as well as that from pre-landfill construction in 2006 and 2007, and collectively analyzed.

As part of the investigation, information was gathered through 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.

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
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 2011 for comparison with results from the 2012

field program. This data is compiled in Table B-5 and Table B-6 for groundwater and 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, PCBs and PHCs, 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, PCBs and PHC 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.

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 directly and 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 are expected to 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 PHCs in soil are found in Section 2.4, and are adapted from the 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.

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 fact sheet 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, at 0.030 mg/kg, 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 (SQG_E) for surface soils, 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 5 and 6, 2012. Weather conditions on August 5th were not optimal; air temperature was approximately 9ºC with a sustained moderate breeze and intermittent, at times heavy rain. Weather improved on the second day of the monitoring program, conditions were partly sunny with a light breeze and a high temperature of approximately 12ºC. The monitoring program included the following tasks:

- Completing a health and safety kick-off meeting;
- Visually observing and photographically documenting the physical integrity of the landfills 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 at the SSDF;
- Sampling of groundwater from designated locations at the Site (Note that for the 2012 monitoring program, soil samples were only to be collected if evidence of leaching/seeping and staining was observed);
- Measuring various physical parameters in the water samples; and
- Submission of groundwater samples, including duplicates, for applicable laboratory analysis.

The field investigation procedures are described below.

4.1 Health and 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 C; and is presented in its entirety on the accompanying CD ROM.

The 2012 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 was created prior to the Site visit to capture all required information as outlined in the long-term monitoring plan. The GPS data file (file extension .ssf) and the data dictionary file (file extension .ddf) 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, David Irqittuk, a member of the Hall Beach Hunters and Trappers Association. Land use by both humans and wildlife were discussed.

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 were functioning well. At each thermistor string the resistances at each bead were measured manually; this data was converted to temperature values which were compared to the last values logged by the dataloggers. The manual resistance check confirms the functionality of each bead, and the comparison with the logged data confirms that the analog data channels of the datalogger are operating correctly. As expected, the beads and loggers were performing well and the manually collected data had close agreement with the data collected by the dataloggers. Manual resistance check data is presented in Table H-2 in Appendix H.

Upon completion of the manual resistance check, the four dataloggers were removed from their installations and transported to the hotel in Hall Beach where they were downloaded and

serviced. Thermistor data for the period from August 28, 2011 to August 5, 2012 were downloaded from each logger, using a laptop with Lakewood Systems' Prolog (v.1.198) software. Datasets from each datalogger were inspected to ensure completeness and data validity prior to resetting the datalogger units. Datalogger battery voltages, memory usage, and programming were noted and a visual inspection of the housing equipment was performed. Thermistor inspection records are presented in Table H-1, Appendix H. Auxiliary batteries (ULB-5) and desiccant cartridges were replaced in each datalogger prior to reinstallation at the thermistor locations. After reinstallation each logger was restarted to begin collecting temperature information and communication between each datalogger and thermistor string was confirmed before sealing the housings.

The SSDF ground temperature record, containing continuous information since September 2007 was updated. A discussion, along with plots of temperature versus depth and time, are presented in section 5.4 and in Appendix H. 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 the SSDF at three predetermined locations: one upgradient (MW06-04) and two downgradient (MW06-05 and MW06-06) of the landfill. Recharge was adequate for the samples to be collected over a single day, likely owing to the wet conditions. Groundwater was also sampled at the NHWL at three predetermined locations: one upgradient (MW06-01) and two downgradient (MW06-02 and MW06-03). This was the first year of the long term monitoring program that groundwater samples were successfully collected from the NHWL.

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-52 water quality meter was calibrated and used to measure in-situ

field parameters including temperature, conductivity, dissolved oxygen, pH and oxidation-reduction potential. Sampling took place when these parameters stabilized. Water samples submitted for total metals analyses were not field-filtered. Water samples submitted for dissolved metals were filtered in the field.

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 D.

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

Landfill Area		Sample	Analytical Parameters
NHWL	Upgradient	MW1	- total and dissolved metals - PCBs - petroleum hydrocarbon fractions F1-F4 and BTEX - inorganics (major ions, TDS, TSS, colour, pH, conductivity)
	Downgradient	MW2	
		MW3	
SSDF	Upgradient	MW4	
	Downgradient	MW5	
		DUP1*	
		MW6	

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.

4.5.2 Test Pitting and Soil Sampling

Soil monitoring point sampling was discontinued in favor of soil sample collection based on physical evidence and observation. No evidence of landfill leaching or staining was observed during the 2012 monitoring event. As a result, no soil samples were collected.

4.6 Quality Assurance and Quality Control

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

4.6.1 Field

Groundwater samples were collected from monitoring wells and placed in appropriately sized and prepared laboratory vessels. Sample numbers were clearly marked on the containers. The 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.

As a quality control measure, one groundwater blind field duplicate sample was 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 E.

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. One blind field duplicate was collected in the groundwater sampling program.

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:

- Groundwater sample MW5 (primary) and DUP-1 (water duplicate) were analyzed for PHCs, BTEX, PCBs, total and dissolved 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 4-2 below. When both concentrations are less than the MDL, no calculation/evaluation criterion is required.

Table 4-2: 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 F for a discussion on QA/QC results.

4.7 Laboratory Analytical Program

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 E.

5.0 SUMMARY OF SSDF CONDITIONS

5.1 Area Summary

The SSDF is located east of the airstrip at 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 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 97; attached CD-ROM). Copies of the photographs that are referenced in the body of this document are provided in Appendix C. Photograph viewpoint numbers (as seen on Figure A-2; Appendix A) shown in red are included in Appendix C. The complete photographic record, including full-resolution photographs, is provided 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 5, 2012. 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 2012 monitoring of the SSDF 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	N	Not Observed	None
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
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.

Settlement

The minor settlement that was observed over most of the southern half of the SSDF in 2009 was less evident in 2010 and not evident during the 2011 Site inspection, suggesting that the entire top of the SSDF has settled evenly. The depth of settling over the area is minimal (< 10 cm). No new settlement areas were identified during the 2012 monitoring event.

Settlement depression features A and B were observed to the north and northeast of the landfill extents, with no significant change from previous monitoring events (see Picture Viewpoint Numbers (VP) 54 and 55 Figure A-2; Appendix A). Other settlement depressions depicted on Figure A-2, features E (VP 60-61), G (VP 65-66) and U (VP 87) were observed to be very minor and not significantly changed from the previous year. These settlement features do not pose any risk to the landfill integrity. The minor settlement cracking that was observed along the landfill's perimeter and 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) was not significantly changed, with the exception that the cracking observed in previous years was less evident in 2012.

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 (VP 73-75), J (VP 95-96), N (VP 79-80), and Q (VP 82-84); Figure A-2; Appendix A). Based on a comparison with photo documentation from 2008-2011, there does not appear to be an appreciable increase in the length or depth of these channels.

Angular cobble 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. Potholes observed in 2008, 2009, 2010 and 2011 were not significantly changed in 2012.

The erosion observed in 2012 has not increased significantly since the 2011 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 near the monitoring wells.

Evidence of Burrowing Animals

Indications of burrowing animals were not observed on or around the SSDF in 2012.

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. Additional indications of vegetative re-growth observed in 2011 were confirmed in 2012. New growth was observed on the top of the landfill and mid way up the south and east facing slopes of the landfill, the new growth is shown in Figure A-2; Appendix A, near previously identified features J, L, and T (VP 95-96, 94 and 97, and 92-93, respectively). It is believed that the previously identified passive seepage points may be contributing to the re-vegetation.

Staining

No staining on or around the SSDF was observed in 2012.

Ponded Water

As in previous years, no ponded water was observed on top of the landfill in 2012. A larger area of ponded water was observed around the perimeter of the SSDF (see feature W, Figure A-2, Appendix A), this ponding, is not significant and most likely represents puddles associated with the very wet conditions during the 2012 Site visit.

Seepage Points

Five seepage points (see features I, J, N, Q, and R; Figure A-2; Appendix A) were observed along the southern toe of the landfill in 2012. Two of the active seepage points (I and J; Figure A-2; Appendix A) exhibited active flowing water during the 2012 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 does not appear to have significantly changed. A direct relationship between active seepage and recent precipitation events was proposed in 2011. As in 2011, conditions were wet during the 2012 site visit and similar seepage was observed as in the previous year.

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.

Passive Seepage

Four passive seepage points (see features H, L, P, and V; Figure A-2; Appendix A) identified in 2011 were not observed during the 2012 site visit. This is most likely due to heavy precipitation on the day of the Site visit, resulting in saturation of all of the surface soils at the SSDF. The passive seepage points were thus indistinguishable from the saturated soil. No rivulets or erosion channels associated with these passive seepage points were observed.

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.

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, increased in size in 2012		54
Settlement	B	Near the road, 14 m north of the SSDF northwest corner	28 m^2		0.1	<1%	Large Depression; No significant change (NSC)		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; NSC 2012		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; less evident/NSC 2012		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; NSC 2012		60-61
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; NSC 2012		67
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; NSC 2012		70
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; not observed in 2012		71
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; NSC 2012	North ponded area	73-75
			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; not flowing in 2012		-
Settlement	K	9 m east from the southwest corner of the SSDF along side of landfill	13.6	0.005	0.01	<1%	Cracking; less evident in 2012		76-77
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; Not observed in 2012		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; not observed in 2012		78
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; NSC 2012	Seepage Face	79-80
			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; NSC 2012		81
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; not observed in 2012		26

Checklist Item	Feature Letter	Relative Location	Length (m)	Width (m)	Depth (m)	Extent	Description (Change)	Additional Comments	Photo Reference
Seepage	Q	11 m west from the southeast corner of the SSDF at the toe of the landfill	12	0.05	N/A	<1%	Seepage face, associated drainage and ponded water; NSC 2012	Seepage Face	82-84
			0.25	0.45	0.25	<1%		West channel	
			0.15	0.4	0.15	<1%		East channel	
			42 m^2		0.2	<1%		Ponded water	
Seepage	R	Southeast corner of the SSDF at toe	11.1	0.1	N/A	<1%	Seepage face and saturated soil area with ponded water; less evident in 2012	Seepage face	23
			32 m^2		N/A	<1%		Saturated soil area	
Vegetation	S	Southeast corner of the SSDF along the side slope	N/A			<1%	Area of vegetation; increased density of growth in 2012	Vegetation establishing on top of landfill and along eastern and southern slopes	85, 91-97,
Settlement	T	40 m north from the southeast corner of the SSDF along the side slope	7.8	0.01	0.01	<1%	Settlement cracks; less evident in 2012	South crack	86
			8.9	0.01	0.01			North crack	
Settlement	U	28 m south from the northeast corner of the SSDF along the side slope	10.1 m^2		0.2	<1%	Settlement/depressions; not observed in 2012		87
Seepage	V	18 m south from the northeast corner of the SSDF along the side slope	29 m^2		N/A	<1%	Dark saturated soil with very sparse vegetation; NSC 2012		36 and 38
Ponded Water	W	MW06-04	~55 m^2				Ponded/puddled water	Likely attributable to the heavy rains during the 2012 site visit	40, 90

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.

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 5, 2012 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. Regional climate and aggregate historical temperature data for the SSDF are plotted and presented Figures H-1 to H-6 in Appendix H. Temperature profile plots of (a) depth versus temperature and (b) temperature versus time for each thermistor string in 2011-2012 are presented in Figures H-7 to H-10, Appendix H.

Table 5-4: Maximum Depth to Permafrost 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
Aug 5, 2012	1.3	1.7	1.8	1.9
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)
Max between Aug 25, 2011 and Aug 5, 2012 (date established (YYYY-MM-DD))	1.3 (2011/10/14)	1.7 (2012/08/05)	2.3 (2011/08/29)	2.2 (2011-08-30)

From the data in Table 5-4, it would appear that the active layer did not thaw to as great of depth as in past years.

The average temperature recorded at Hall Beach was colder in 2011-2012 than the previous year; the average temperature of the thermistors at 3.3 meters below ground surface (mbgs) also showed a decrease compared to the previous year. The contents of the landfill at the liner depth and below remained 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	2011-2012**
Hall Beach		-13.3	-12.8	-10.8	-11.6	-12.1
SSDF surface (bead 1 of 01-VT & 02-VT)		N/A	-11.1	-9.3	-9.2	-9.1
Average temperature at 3.3 m below SSDF surface.	**01-VT**	N/A	-8.7	-8.1	-7.0	-9.4
	02-VT	N/A	-8.0	-7.4	-6.6	-8.7
	03-VT*	N/A	-8.7	-7.8	-7.1	-9.2
	04-VT*	N/A	-10.0	-8.7	-7.9	-9.0
Maximum temperature at 3.3 m below SSDF surface.	**01-VT**	N/A	-1.4	-1.7	-1.7	-1.8
	02-VT	N/A	-0.9	-1.4	-1.3	-1.5
	03-VT*	N/A	-1.0	-1.4	-1.3	-1.5
	04-VT*	N/A	-1.5	-1.6	-1.4	-1.5

*interpolated values **data to August 5, 2012

While average temperature was cooler in Hall Beach from August 25, 2011 to August 5, 2012 than in the previous year, the average surface temperature at the SSDF was 0.1°C warmer. Average temperatures at the liner depth were between 2.4ºC and 2.1ºC cooler than the previous year. The annual maximum temperature at 3.3 mbgs was 0.1ºC less at 01-VT and 04-VT, it decreased by 0.2°C in thermistors 02-VT and 03-VT.

Two short data gaps, Oct.10-28, 2011, and April 26 - May 13, 2012, were observed at 02-VT; the cause of these data gaps is not known. Discussion with the manufacturer indicated that such data gaps could be the result of depleted coin cell battery. Lakewood Systems Inc. recommends replacing coin cell batteries every 5 years. Coin cell battery replacement is not practical in the field, at worst it would need to be done by a trained individual at the accommodations in Hall Beach; at best it should be done by service staff at Lakewood Systems in Edmonton.

Memory capacity of each datalogger was 38% full. Once the dataloggers were reset, the Prolog software calculated approximately 867 days of memory capacity at a 12hr logging frequency. Datalogger memories will therefore be full on December 21, 2014. Memory capacity will not be an issue for data collection until the next round of monitoring as the next site visit scheduled for August 2014. However, the datalogger programming must be amended during the August 2014 site visit to ensure the dataloggers have the capacity to continue to record temperature data until the following site visit in August of 2017.

Additional details can be found in the thermistor annual maintenance monitoring report (Table H-1, Appendix H). 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 are presented in Table H-2, Appendix H. Additional thermistor inspection information concerning field monitoring issues and field verification options are included in Appendix H.

5.5 Analytical Results – Groundwater Samples

As described in section 4.5.1, a total of seven groundwater samples (six samples plus one blind field duplicate) were submitted to Maxxam Analytics in Ottawa, Ontario for analyses of 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-5 and B-6.

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 for dissolved and total metals in groundwater including the maximum acceptable concentrations (based on historical results) are shown in Table B-2; Appendix B. The groundwater sample collected from MW06-01 exhibited concentrations of total and dissolved cobalt (220 and 210 µg/L respectively) above the maximum acceptable concentrations of 6 µg/L (total) and 3 µg/L (dissolved) derived from the mean data as per the AMSRP. In addition, groundwater collected from MW06-03 exhibited a concentration of dissolved copper of 24 µg/L, slightly above the calculated upper limit of acceptability of 17 µg/L. Note that neither of the wells exhibiting exceedances of the upper limit of acceptability for metals had been previously sampled, the significance of these exceedances is therefore considered to be low.

For additional context and purposes of comparison, the concentration of cobalt was compared to available CCME guidelines. The CCME has defined guidelines for cobalt for the protection of agriculture. Two guidelines exist for cobalt: irrigation (50 µg/L) and livestock (1000 µg/L). Given

that this is the first year that data have been collected from MW06-01, this result does not signify any deterioration of the landfill integrity. The results for cobalt in MW06-01 do not exceed the CCME guideline for livestock watering and there is no suspected risk associated with the result. None of the other parameters in the samples collected in 2012 were above the mean of previous samples plus three standard deviations.

Inorganics

Laboratory analytical results and selected provincial standards and federal guidelines for inorganics are shown in Table B-3; Appendix B. Concentrations were within maximum acceptable concentrations where values were available.

PCBs

Laboratory analytical results for PCBs, and the maximum acceptable concentrations (based on historical results) are shown in Table B-4; Appendix B. As shown in the table, concentrations were below the RDLs and thus satisfy the standards applied to the Site.

Laboratory certificates of analyses for the 2012 groundwater samples are provided in Appendix E.

5.6 Analytical Results – Soil Samples

No staining or other cause to suspect breech of landfill integrity was observed, thus per AANDC instruction, no soil samples were collected at the Site during the 2012 monitoring event.

6.0 SUMMARY OF NHWL CONDITIONS

6.1 Area Summary

The NHWL is located to the northwest of the airstrip. Monitoring of the NHWL included visual observations to assess its physical integrity, including evidence for erosion, ponding, frost action, settlement and lateral movement. Groundwater samples were also collected at locations up- and downgradient of the NHWL.

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 C, where photograph captions provide the landfill viewpoint number (as seen in red 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 6, 2012. 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 2012 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 previous years (two small locations on the northwest sector; refer to Figure A-3, Appendix A). There is no obvious cause to this settlement, which is considered minor. 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. A new area of minor settlement located approximately 25 m north of the NHWL was documented as feature E (see Figure A-3, Appendix A).

Erosion

Evidence of erosion is similar to that observed in previous years: there exists minor erosion on the side slopes of the NHWL, likely due to down-slope washing of fine-grained fill between cobbles. There is no apparent downgradient erosion from the landfill.

Frost Action

No evidence of heaving or cracking was observed on the top or sides of the NHWL. There were no apparent signs of frost action observed in 2012.

Evidence of Burrowing Animals

Indications of burrowing animals were not observed.

Staining

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

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 or 2012 Site visits. 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 from previous inspections.

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		-
Settlement	E	25 m north of the north corner of the NHWL	20 m^2		0.25	<1%	Slight low area	Maximum depth	27

7.0 SURROUNDING AREAS AND NATURAL ENVIRONMENT

The area surrounding 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 frequent use, the Site was found to be clean and in good order. A small amount of scattered debris including fuel drums is present around the hunting cabin. 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 was either gathered directly, through personal observation while on Site or indirectly, through our wildlife monitor, a member of the Hall Beach Hunters and Trappers Association, who consulted knowledgeable local persons in the nearby community of Hall Beach.

Wildlife and Human Activity

From information from a member of the Hunter and Trappers Organization in Hall Beach, David Irqittuk, the Site is used for hunting and fishing. During the 2012 Site visit, the following signs of wildlife were observed:

- Snow geese flew over on multiple occasions; tracks and scat were evident throughout the Site.
- A raven was observed near the NHWL.
- Two pairs of plovers or sandpipers were observed near the NHWL on the second day.
- Caribou tracks were observed throughout the Site.
- Several sic sics were observed.
- A lone caribou estimated to be two or three years old was observed on the road within 200 m of the NHWL (see cover photograph).

Human activity was summarized as follows (based on direct observation and information provided by Mr. Irqittuk):

- Sarcpa Lake is apparently used for fishing.
- The hunting cabin is well used and tidy.
- Several empty barrels were observed outside the cabin. Several barrels with small amounts of gasoline were also noted. These barrels have accumulated since the completion of the remediation work in 2008.

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, five years prior to the 2012 Site monitoring visit. Evidence of revegetation was observed in August 2011 and had established further in 2012; however, 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 continue take many years for native vegetation to become fully re-established at the Site.

8.0 CONCLUSIONS AND RECOMMENDATIONS

FRANZ conducted the field activities for the fifth year of the CAM-F long-term monitoring program on August 5 and 6, 2012, while based in the nearby community of Hall Beach.

Physical observations from the 2012 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 decreased since last year and was comparable to the low established in 2009. The maximum depth of the active layer remains less than the depth to contaminated material.

In addition to physical and temperature observations, FRANZ collected groundwater samples to assess the performance of the SSDF and NHWL. Cobalt was measured in a single groundwater sample at a concentration above the acceptable maximum (i.e., compared with historical results throughout the Site). This comparison is not especially meaningful for this result as this was the first sample to be successfully collected from MW06-01 since the inception of the CAM-F long term monitoring program. While an increase in chemical concentration from one sampling event to the next is worth noting, there are no other signs of landfill instability.

Thermal monitoring infrastructure installed at the SSDF is performing well. During the next scheduled monitoring event both the main and auxiliary batteries should be changed in all of the dataloggers. While Lakewood Systems recommends replacing the internal coin cell battery every five years, based on experience with these dataloggers at other DEW Line site, it is not clear that this is absolutely necessary—In FRANZ's experience with these dataloggers at other DEW Line sites, data has been successfully downloaded from dataloggers which have been in the field for 10 years. Data gaps observed at Two fresh desiccant cartridges should also be installed in each datalogger unit. To avoid a data gap in the thermal monitoring due to insufficient memory storage for three years of 12hr data, the dataloggers will have to be reprogrammed during the 2014 monitoring event. Datalogger sampling frequency will have to be reduced (suggested to once per day at noon). Lakewood Systems is available for assistance with the re-programming.

As a result of the physical and thermal observations and analytical results of the 2012 field program, FRANZ believes that the Site is little changed from the last monitoring event, in August 2011, that its facilities continue to operate as designed, and that the Site poses no present threat to human health or the natural environment.

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 Franz Environmental Inc. and 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 5 and 6, 2012. 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

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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.

Kevin McKenna, HBSc.
Field Assessor / Project Manager

Andrew Henderson, B.A.Sc., P.Eng.
Environmental Engineer

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

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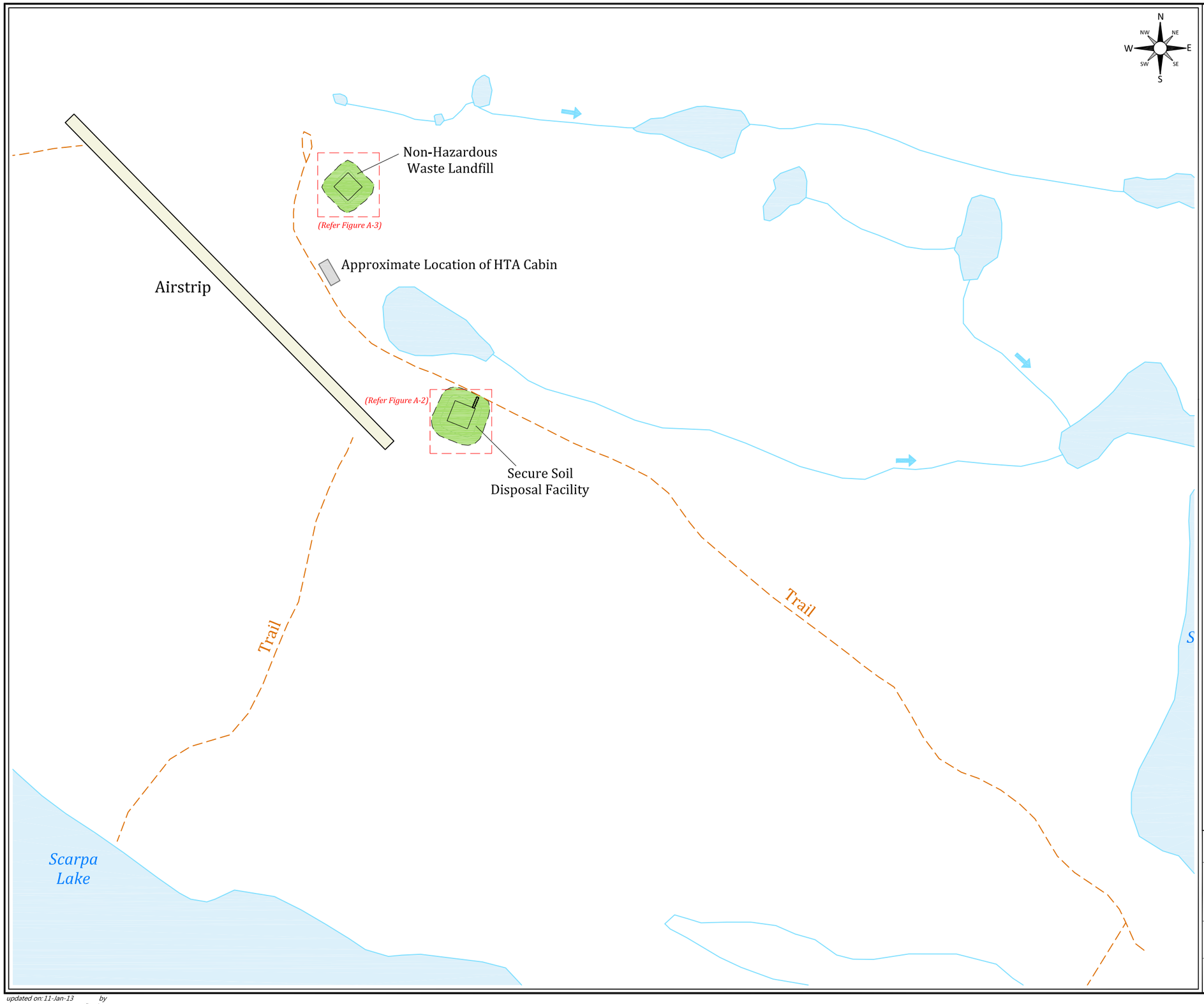
APPENDIX A

Figures



Legend

- Lake
- River
- Trail
- Water Flow Direction
- Monitoring Well Location

Title: Site Plan

FRANZ ENVIRONMENTAL INC.
♦ CONSULTING ♦ ENGINEERING ♦ TECHNOLOGIES ♦

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

Date: January 2013

Client: Aboriginal Affairs and Northern Development Canada

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Figure A-1

updated on:11-Jan-13 by rfletcher

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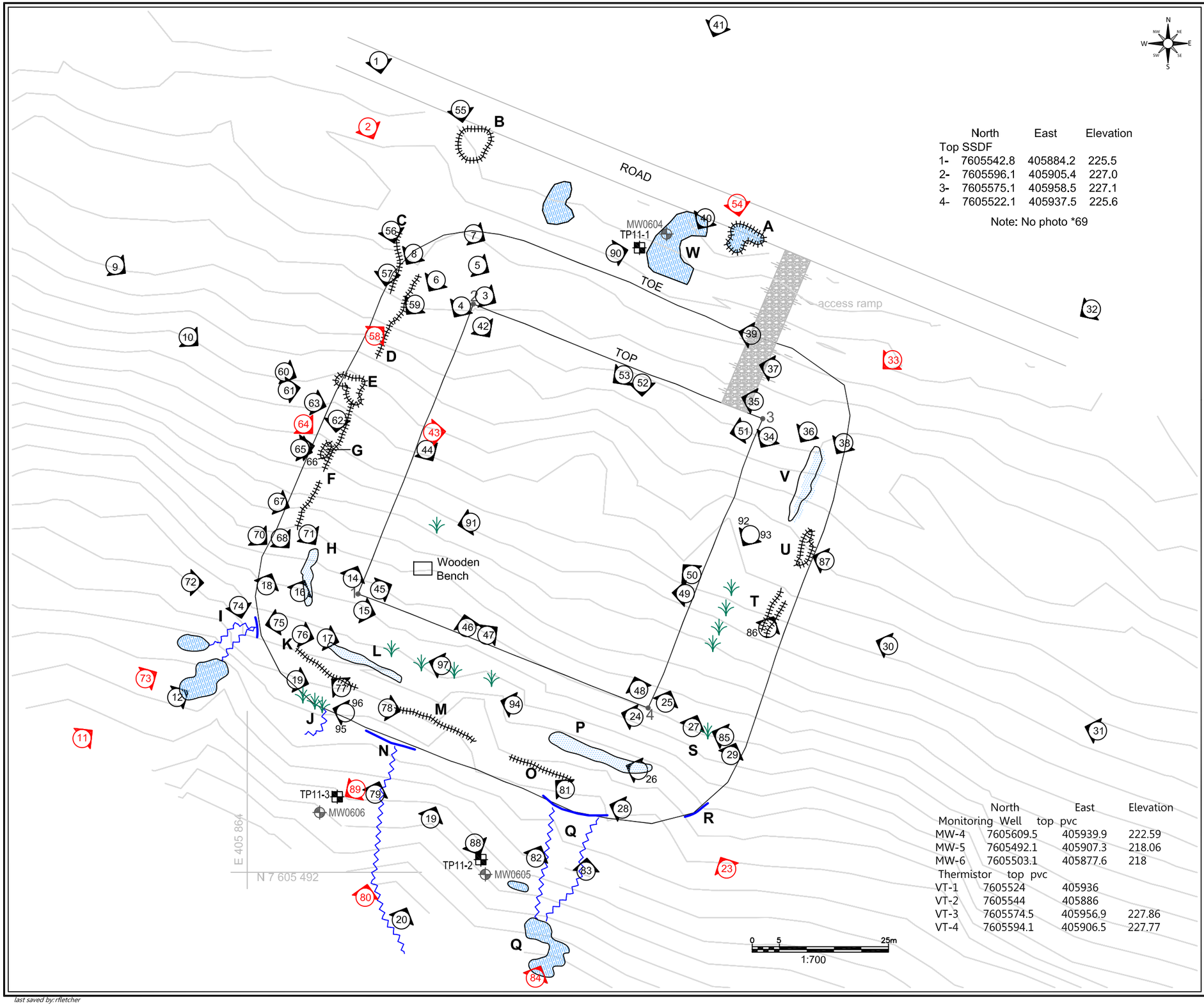


	North	East	Elevation
Top SSDF			
1-	7605542.8	405884.2	225.5
2-	7605596.1	405905.4	227.0
3-	7605575.1	405958.5	227.1
4-	7605522.1	405937.5	225.6

Note: No photo *69

	North	East	Elevation
Monitoring Well	top pvc		
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
- 25 — Picture Viewpoint Number
- 25 — Viewpoint Photograph Included in Appendix F
- Ponded Surface Water
- Erosion Channel (blue = active)
- Cracking
- Area of Depression/Settlement
- Active Seepage Points
- Passive Seepage Points (not observed in 2012)
- 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 1697-1201

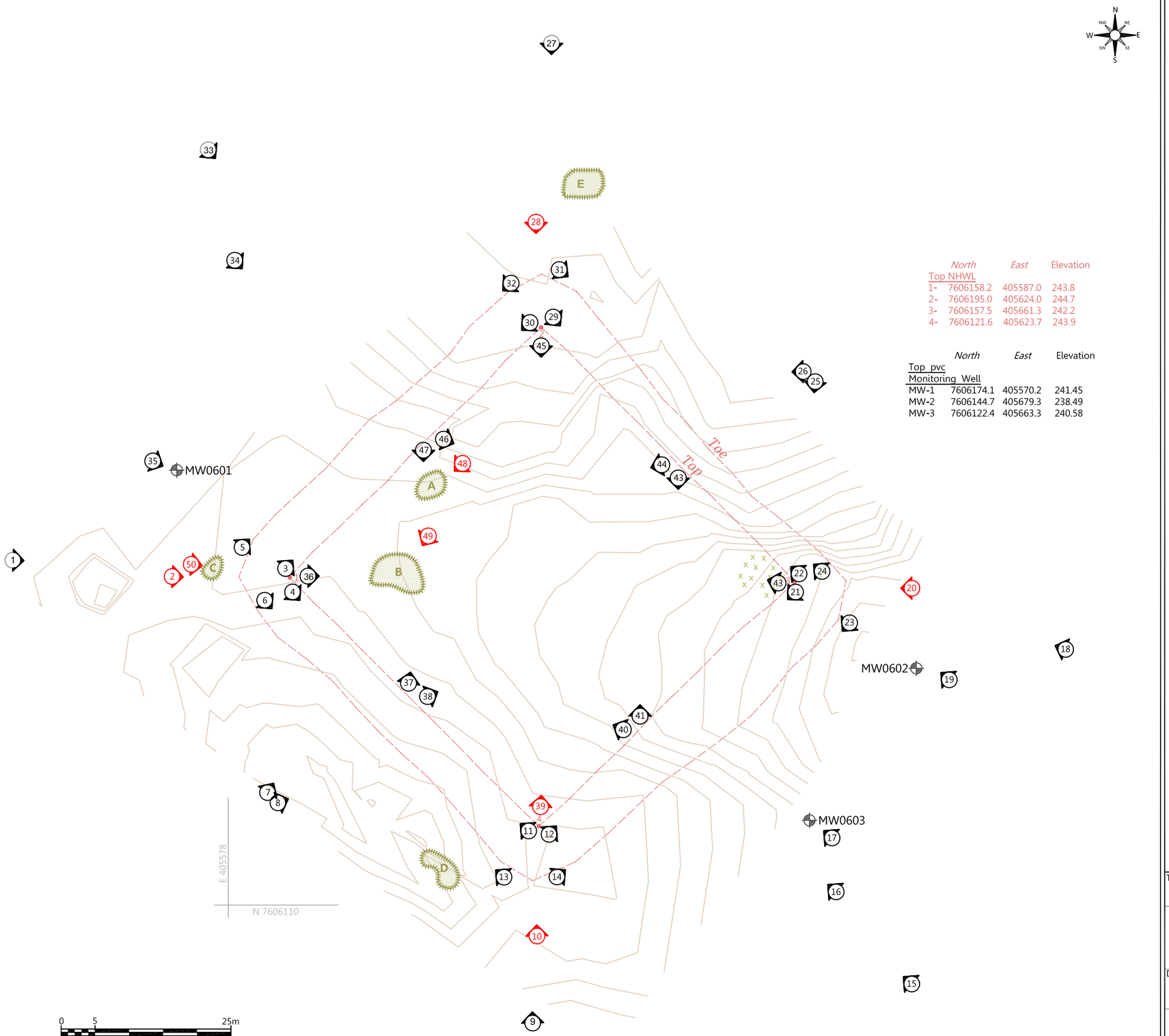
Date: January 2013

Client: Aboriginal Affairs and Northern Development Canada

Scale: Scale as shown

Figure A-2

last saved by:rfletcher



	North	East	Elevation
Top NHWL			
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

	North	East	Elevation
Top pvc Monitoring Well			
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 C

Title: Non-Hazardous Waste Landfill

FRANZ ENVIRONMENTAL INC.
♦ CONSULTING ♦ ENGINEERING ♦ TECHNOLOGIES ♦

Project: CAM-F Sarcpa Lake, NU 1697-1201

Date: January 2013

Client: Aboriginal Affairs and Northern Development Canada

Scale as shown

Figure A-3

last saved by: rfletcher

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APPENDIX B

Analytical Results Tables

Table B-1
Ground Water Chemical Concentrations 2012 - PHCs

PARAMETER	Guidelines		RDL	MW1	MW2	MW3	MW4	MW5	DUP-1	Duplicate Evaluation			MW6
Sample ID	CCME FWAL[1]	Upper Limit of Acceptability[2]								Scenario*	RPD (%)	Acceptable	
Date				8/6/2012	8/6/2012	8/6/2012	8/6/2012	8/6/2012	8/6/2012				8/6/2012
BTEX & F1 Hydrocarbons (ug/L)													
Benzene	370	Not Available	0.2	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	A	---	Y	<0.20
Toluene	2	Not Available	0.2	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	A	---	Y	<0.20
Ethylbenzene	90	Not Available	0.2	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	A	---	Y	<0.20
o-Xylene	NC	Not Available	0.2	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	A	---	Y	<0.20
p+m-Xylene	NC	Not Available	0.4	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	A	---	Y	<0.40
Total Xylenes	NC	Not Available	0.4	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	A	---	Y	<0.40
F1 (C6-C10)	NC	222	25	<25	<25	<25	<25	<25	<25	A	---	Y	<25
F1 (C6-C10) - BTEX	NC	222	25	<25	<25	<25	<25	<25	<25	A	---	Y	<25
F2-F4 Hydrocarbons													
F2 (C10-C16 Hydrocarbons)	NC	175	100	<100	<100	<100	<100	<100	<100	A	---	Y	<100
F3 (C16-C34 Hydrocarbons)	NC	175	100	<100	<100	<100	<100	<100	<100	A	---	Y	<100
F4 (C34-C50 Hydrocarbons)	NC	175	100	<100	<100	<100	<100	<100	<100	A	---	Y	<100
Reached Baseline at C50	NC	N/A	N/A	Yes	Yes	Yes	Yes	Yes	Yes	NC	NC	NC	Yes

Notes:

1 = CCME (2007) Canadian Environmental Quality Guidelines Summary Table. Canadian Water Quality Guidelines for the protection of Freshwater Aquatic Life (FWAL).

2 = Upper Limit of Acceptability is determined as described in Report Section 3.2. Upper limits of acceptability are clcaulated using mean of previous sampling rounds +3 standard deviations.

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

N/A = Not Applicable

NC = No Criteria

RDL= Reportable Detection Limit

20 = Exceeds selected guideline.

Table B-2
Ground Water Chemical Concentrations 2012 - Metals

PARAMETER / Sample ID / Date	Upper Limit of Acceptability[1]	Lowest RDL	MW1	MW2	MW3	MW4	MW5	DUP-1	Duplicate Evaluation			MW6
			8/6/2012	8/6/2012	8/6/2012	8/6/2012	8/6/2012	8/6/2012	Scenario*	RPD (%)	Acceptable	8/6/2012
Metals (ug/L)												
Dissolved Arsenic (As)	NC	0.2	0.33	<0.20	0.21	<0.20	0.32	0.3	D	---	Y	0.24
Total Arsenic (As)	3	0.2	0.34	0.23	0.61	0.24	0.37	0.37	D	---	Y	0.3
Dissolved Cadmium (Cd)	1	0.005	0.0078	0.012	0.016	0.027	0.049	0.044	C	11	Y	0.016
Total Cadmium (Cd)	1	0.005	0.0099	0.01	0.039	0.017	0.037	0.044	C	17	Y	0.011
Dissolved Cobalt (Co)	3	0.3	210	<0.30	0.57	0.75	0.74	0.8	D	---	Y	<0.30
Total Cobalt (Co)	6	0.3	220	<0.30	1.6	0.8	0.75	0.67	D	---	Y	0.39
Dissolved Chromium (Cr)	NC	1	<1.0	3.2	<1.0	<1.0	<1.0	<1.0	A	---	Y	<1.0
Total Chromium (Cr)	82	1	<1.0	3.5	3	<1.0	<1.0	<1.0	A	---	Y	<1.0
Dissolved Copper (Cu)	17	0.2	7	3.9	24	6.9	7.7	6.4	C	18	Y	5.6
Total Copper (Cu)	59	0.2	7.4	4	37	6.7	7.3	6.8	C	7	Y	6.3
Dissolved Nickel (Ni)	54	0.5	24	0.99	6.4	3.9	4.4	4.4	C	0	Y	6.3
Total Nickel (Ni)	102	0.5	25	1.2	12	3.9	4.2	4.3	C	2	Y	6.4
Dissolved Lead (Pb)	6398	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	A	---	Y	<0.2
Total Lead (Pb)	5	0.2	<0.2	<0.2	2.2	<0.2	<0.2	<0.2	A	---	Y	<0.2
Dissolved Zinc (Zn)	4764	3	270	140	43	33	35	29	C	19	Y	24
Total Zinc (Zn)	4978	3	300	170	160	34	32	32	C	0	Y	26

Notes:

1 = Upper LImit of Acceptability is determined as described in Report Section 3.2. Upper limits of acceptability are calculated from Table B-6, 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 2012 - Inorganics

PARAMETER		Guidelines		Lowest RDL	MW1	MW2	MW3	MW4	MW5	DUP-1	Duplicate Evaluation			MW6
Sample ID		CCME FWAL[1]	Upper Limit of Acceptability[2]								Scenario*	RPD (%)	Acceptable	
Date					8/6/2012	8/6/2012	8/6/2012	8/6/2012	8/6/2012	8/6/2012				8/6/2012
Inorganics	**Units**													
Colour	TCU	NC	118	2	<2	5	42	4	<2	4	B	---	Y	5
Conductivity	umho/cm	NC	5040	1.0	670	480	270	1400	1600	1600	C	0	Y	1200
Total Dissolved Solids	mg/L	NC	Not Available	10	398	284	222	1060	1330	1350	C	1	Y	900
Hardness ($CaCO_3$)	mg/L	NC	Not Available	0.5	240	230	130	600	880	880	C	0	Y	580
Fluoride (F-)	mg/L	0.12	Not Available	0.10	0.52	0.16	0.12	0.34	0.33	0.33	D	---	Y	0.39
Orthophosphate (P)	mg/L	NC	Not Available	0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	A	---	Y	<0.010
pH	pH	6.5-9.0	7.62-8.35	N/A	8.14	8.07	8.10	7.95	7.90	7.90	NC	NC	NC	7.89
Total Suspended Solids	mg/L	NC	Not Available	10	<10	<10	100	<10	<10	<10	A	---	Y	14
Dissolved Sulphate (SO4)	mg/L	NC	Not Available	5	88	35	<1	540	640	640	C	0	Y	380
Dissolved Chloride (Cl)	mg/L	120	Not Available	1	10	12	<1	28	47	47	C	0	Y	30
Nitrite (N)	mg/L	NC	Not Available	0.010	0.020	<0.010	<0.010	0.014	<0.010	<0.010	A	---	Y	<0.010
Nitrate (N)	mg/L	13	Not Available	0.10	10	7.2	<0.10	3.8	1.3	1.4	C	7	Y	2.8
Nitrate + Nitrite	mg/L	NC	Not Available	0.10	10	7.2	<0.10	3.9	1.3	1.4	C	7	Y	2.8

Notes:

1 = CCME (2007) Canadian Environmental Quality Guidelines Summary Table. Canadian Water Quality Guidelines for the protection of Freshwater Aquatic Life (FWAL).

2 = Upper Limit of Acceptability is determined as described in Report Section 3.2. Upper limits of acceptability are clcaulated using mean of previous sampling rounds +3 standard deviations.

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

NC = No Criteria

- Not Analyzed

RDL= Reportable Detection Limit

20 = Exceeds selected guideline.

Table B-4
Ground Water Chemical Concentrations 2012 - PCBs

PARAMETER	Guidelines		RDL	MW1	MW2	MW3	MW4	MW5	DUP-1	Duplicate Evaluation			MW6
Sample ID	CCME FWAL[1]	Upper Limit of Acceptability[2]								Scenario*	RPD (%)	Acceptable	
Date				8/6/2012	8/6/2012	8/6/2012	8/6/2012	8/6/2012	8/6/2012				8/6/2012
PCBs (ug/L)													
Aroclor 1016	NC	Not Available	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	A	---	Y	<0.05
Aroclor 1221	NC	Not Available	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	A	---	Y	<0.05
Aroclor 1232	NC	Not Available	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	A	---	Y	<0.05
Aroclor 1242	NC	Not Available	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	A	---	Y	<0.05
Aroclor 1248	NC	Not Available	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	A	---	Y	<0.05
Aroclor 1254	NC	Not Available	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	A	---	Y	<0.05
Aroclor 1260	NC	Not Available	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	A	---	Y	<0.05
Aroclor 1262	NC	Not Available	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	A	---	Y	<0.05
Aroclor 1268	NC	Not Available	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	A	---	Y	<0.05
Total PCB	NC	Not Available	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	A	---	Y	<0.05

Notes:

1 = CCME (2007) Canadian Environmental Quality Guidelines Summary Table. Canadian Water Quality Guidelines for the protection of Freshwater Aquatic Life (FWAL).

2 = Upper Limit of Acceptability is determined as described in Report Section 3.2. Upper limits of acceptability are clcaulated 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
Groundwater Concentrations – 2006 to 2011 (PHCs, PCBs, Inorganics)

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
MW1	MW06-01	2012	<0.05	<0.2	<0.2	<0.2	<0.4	<25	<100	<100	<100	670	8.14	<2
MW4	MW06-04	2012	<0.05	<0.2	<0.2	<0.2	<0.4	<25	<100	<100	<100	1400	7.95	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	8.10	60
MW0605-1	MW06-05	2009	<0.05	<0.2	<0.2	<0.2	<0.4	<100	<100	<100	<100	1520	7.80	3
MW1005	MW06-05	2010	<0.05	<0.2	<0.2	<0.2	<0.4	<100	<100	<100	<100	1650	8.00	2
MW06-05	MW06-05	2011	<0.05	<0.2	<02	<0.2	<0.4	<25	<100	<100	<100	1500	7.95	4
MW5	MW06-05	2012	<0.05	<0.2	<02	<0.2	<0.4	<25	<100	<100	<100	1600	7.90	<2
DUP-1	MW06-05	2012	<0.05	<0.2	<02	<0.2	<0.4	<25	<100	<100	<100	1600	7.90	4
MW06-06	MW06-06	2006	<0.05									2260	8.10	
MW06-06	MW06-06	2007	<0.10					<25000	<100	<100	<100			
MW06-06	MW06-06	2008	<0.01					200	200	200	200	1060	8.00	>70
MW0606-1	MW06-06	2009	<0.05	<0.2	<0.2	<0.2	<0.4	<100	<100	<100	<100	1530	8.10	3
DUP-01	MW06-06	2009	<0.05	<0.2	<0.2	<0.2	<0.4	<100	<100	<100	<100	1650	7.90	5
MW1006	MW06-06	2010	<0.05	<0.2	<0.2	<0.2	<0.4	<100	<100	<100	<100	1510	8.00	< 2
MW06-06	MW06-06	2011	<0.05	<0.2	<0.2	<0.2	<0.4	<25	<100	<100	<100	1440	8.19	3
MW6	MW06-06	2012	<0.05	<0.2	<0.2	<0.2	<0.4	<25	<100	<100	<100	1200	7.89	5
MW2	MW06-02	2012	<0.05	<0.2	<0.2	<0.2	<0.4	<25	<100	<100	<100	480	8.07	5
MW3	MW06-03	2012	<0.05	<0.2	<0.2	<0.2	<0.4	<25	<100	<100	<100	270	8.10	42
Statistics														
N Value			28	19	19	19	19	25	25	25	25	26	26	23
N Value [2006-2011 only]			21	12	12	12	12	18	18	18	18	19	19	16
Average			<0.1	<0.2	<2	<0.2	<0.4	88	105	105	105	1800	8.0	16
Average [2006-2011 only]			<0.1	<0.2	<2	<0.2	<0.4	88	106	106	106	1912	8.0	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)* [2006-2011 only]			NC	NC	NC	NC	NC	45	24	24	24	1042	0.12	28
Standard Deviation (s)*								45	25	25	25	1060	0.12	28
Acceptable Range (Average +/- 3s) [2006-2011 only]			NC	NC	NC	NC	NC	0 < 222	35 < 176	35 < 176	35 < 176	0 < 5040	7.62 < 8.35	0 < 118

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-6
Groundwater Concentrations – 2006 to 2011 (Metals)

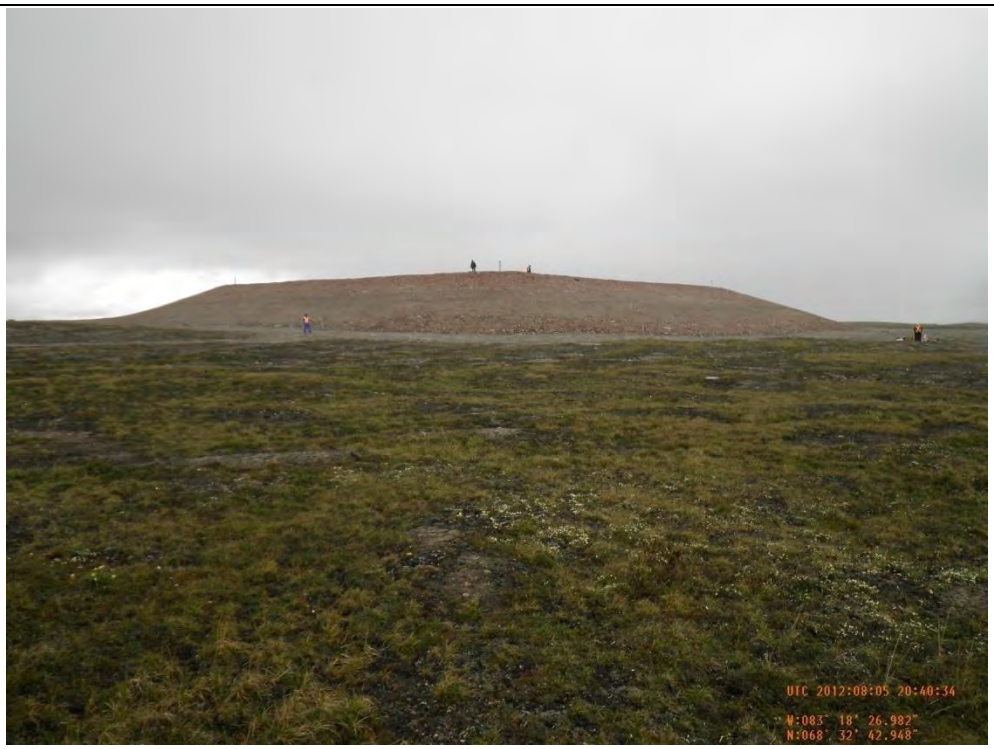
Sample #	Location	Date	Diss. As	As	Diss. Cd	Cd	Diss. Co	Co	Diss. Cr	Cr	Diss. Cu	Cu	Diss. Ni	Ni	Diss. Pb	Pb	Zn	Diss. Zn	Diss. Hg	Hg
			[ug/l]	[ug/l]	[ug/l]	[ug/l]	[ug/l]	[ug/l]	[ug/l]	[ug/l]	[ug/l]	[ug/l]	[ug/l]	[ug/l]	[ug/l]	[ug/l]	[ug/l]	[ug/l]	[ug/l]	[ug/l]
Upgradient Groundwater Samples																				
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		
DUP-1	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		
AH-1	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		
MW1	MW06-01	2012	0.33	0.34	0.0078	0.0099	210	220	<1.0	<1.0	7	7.4	24	25	<0.2	<0.2	270	300		
MW4	MW06-04	2012	<0.20	0.24	0.027	0.017	0.75	0.8	<1.0	<1.0	6.9	6.7	3.9	3.9	<0.2	<0.2	33	34		
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
MW06-07	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
MW0605-1	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		
MW5	MW06-05	2012	0.32	0.37	0.049	0.037	0.74	0.75	<1.0	<1.0	7.7	7.3	4.4	4.2	<0.2	<0.2	35	32		
DUP1	MW06-05	2012	0.3	0.37	0.044	0.044	0.8	0.67	<1.0	<1.0	6.4	6.8	4.4	4.3	<0.2	<0.2	29	32		
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
DUP-01	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		
MW6	MW06-06	2012	0.24	0.3	0.016	0.011	<0.30	0.39	<1.0	<1.0	5.6	6.3	6.3	6.4	<0.2	<0.2	24	26		
MW2	MW06-02	2012	<0.20	0.23	0.012	0.01	<0.30	<0.30	3.2	3.5	3.9	4	0.99	1.2	<0.2	<0.2	140	170		
MW3	MW06-03	2012	0.21	0.61	0.016	0.039	0.57	1.6	<1.0	3	24	37	6.4	12	<0.2	2.2	43	160		
Statistics																				
N Value			26	25	26	25	26	25	26	25	26	25	25	26	25	26	25	26	4	8
N Value [2006-2011 only]			19	18	19	18	19	18	19	18	19	18	18	19	18	19	18	19	4	8
Average			1	1	0.106	0.191	10	11	4	12	6	13	15	14	566	0.7	348	367	<0.025	<0.1
Average [2006-2011 only]			1	1	0.126	0.238	1.1	2.2	4	15	6	15	17	16	723	0.9	423	442	<0.025	<0.1
Minimum			0	0.24	0.008	0.010	0.30	0.39	1	1	1	4	4	3	0	0	5	5	<0.025	<0.025
Maximum			1	2	1	1	210	220	6	97	13	54	49	130	7390	6.6	6210	6650	<0.025	<0.1
Standard Deviation (s)* [2006-2011 only]			NC	0.48	0.15	0.30	0.62	1.3	NC	22	3.6	14	12	29	1891	1.4	1447	1512	NC	NC
Acceptable Range (Average +/- 3s) [2006-2011 only]			NC	0 < 3	0 < 1	0 < 1	0 < 3	0 < 6	NC	0 < 82	0 < 17	0 < 59	0 < 54	0 < 102	0 < 6398	0 < 5	0 < 4764	0 < 4978	NC	NC

Sample duplicates underlined (primary sample listed above duplicate)
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.

APPENDIX C

Site Photographs

Northwest corner of the SSDF. Viewpoint 2 (Figure A-2; Appendix A). Photograph reference RIMG0002 (CD-ROM). Direction photo taken: SE



Southwest corner of the SSDF. Viewpoint 11 (Figure A-2; Appendix A). Photograph reference RIMG0011 (CD-ROM). Direction photo taken: NE

Southeast corner of the SSDF. Viewpoint 23 (Figure A-2; Appendix A). Photograph reference RIMG0023 (CD-ROM).
Direction photo taken: NW

Northeast corner of the SSDF. Viewpoint 33 (Figure A-2; Appendix A). Photograph reference RIMG0033 (CD-ROM).
Direction photo taken: SW

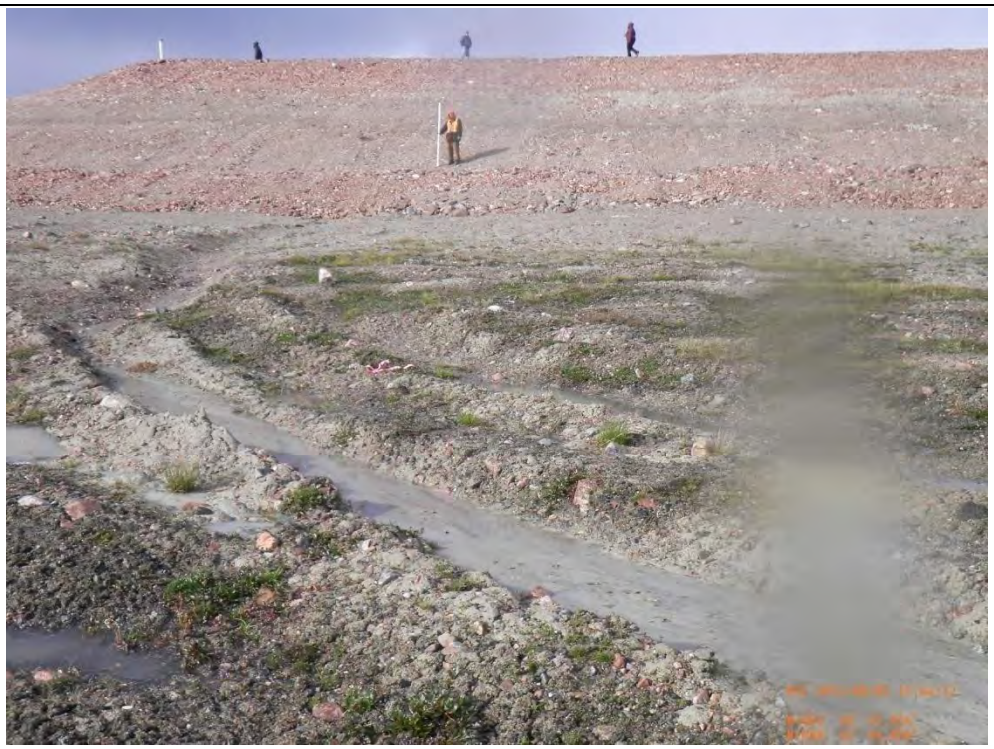
Top of the SSDF. Viewpoint 43 (Figure A-2; Appendix A). Photograph reference RIMG0043 (CD-ROM). Direction photo taken: E

Ponded water near airstrip. Viewpoint 54 (Figure A-2; Appendix A). Photograph reference RIMG0054 (CD-ROM). Direction photo taken: S

West slope of SSDF; location of feature D, fine cracks observed in 2011 were not present in 2012. Viewpoint 58 (Figure A-2; Appendix A). Photograph reference RIMG0058 (CD-ROM). Direction photo taken: N

Pothole on west slope of SSDF (foreground end of survey level). Viewpoint 66 (Figure A-2; Appendix A). Photograph reference RIMG0066 (CD-ROM). Direction photo taken: E

Ponding from active seepage at the southwest corner. Viewpoint 73 (Figure A-2; Appendix A). Photograph reference RIMG0073 (CD-ROM). Direction photo taken: NE



Active erosion from active seepage along the south toe of the SSDF. Viewpoint 80 (Figure A-2; Appendix A). Photograph reference RIMG0080 (CD-ROM). Direction photo taken: N

Ponded water from the active seep near the southeast corner of the SSDF. Viewpoint 84 (Figure A-2; Appendix A). Photograph reference RIMG0084 (CD-ROM). Direction photo taken: SE

Monitoring well MW0606 and former soil monitoring point location. Viewpoint 89 (Figure A-2; Appendix A). Photograph reference RIMG0089 (CD-ROM). Direction photo taken: SE

Table C-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	RIMG0001	34	RIMG0034	67	RIMG0067
2	**RIMG0002**	35	RIMG0035	68	RIMG0068
3	RIMG0003	36	RIMG0036	-	-
4	RIMG0004	37	RIMG0037	70	RIMG0070
5	RIMG0005	38	RIMG0038	71	RIMG0071
6	RIMG0006	39	RIMG0039	72	RIMG0072
7	RIMG0007	40	RIMG0040	**73**	**RIMG0073**
8	RIMG0008	41	RIMG0041	74	RIMG0074
9	RIMG0009	42	RIMG0042	75	RIMG0075
10	RIMG0010	**43**	**RIMG0043**	76	RIMG0076
11	**RIMG0011**	44	RIMG0044	77	RIMG0077
12	RIMG0012	45	RIMG0045	78	RIMG0078
13	RIMG0013	46	RIMG0046	79	RIMG0079
14	RIMG0014	47	RIMG0047	**80**	**RIMG0080**
15	RIMG0015	48	RIMG0048	81	RIMG0081
16	RIMG0016	49	RIMG0049	82	RIMG0082
17	RIMG0017	50	RIMG0050	83	RIMG0083
18	RIMG0018	51	RIMG0051	**84**	**RIMG0084**
19	RIMG0019	52	RIMG0052	85	RIMG0085
20	RIMG0020	53	RIMG0053	86	RIMG0086
21	RIMG0021	**54**	**RIMG0054**	87	RIMG0087
22	RIMG0022	55	RIMG0055	88	RIMG0088
23	**RIMG0023**	56	RIMG0056	**89**	**RIMG0089**
24	RIMG0024	57	RIMG0057	90	RIMG0090
25	RIMG0025	**58**	**RIMG0058**	91	RIMG0091
26	RIMG0026	59	RIMG0059	92	RIMG0092
27	RIMG0027	60	RIMG0060	93	RIMG0093
28	RIMG0028	61	RIMG0061	94	RIMG0094
29	RIMG0029	62	RIMG0062	95	RIMG0095
30	RIMG0030	63	RIMG0063	96	RIMG0096
31	RIMG0031	64	RIMG0064	97	RIMG0097
32	RIMG0032	65	RIMG0065	-	-
33	**RIMG0033**	**66**	**RIMG0066**	-	-

Note:
Images for numbers in **bold** appear in this Appendix.

West corner of the NHWL. Viewpoint 2 (Figure A-3; Appendix A). Photograph reference RIMG0002 (CD-ROM).
Direction photo taken: E

South corner of the NHWL. Viewpoint 10 (Figure A-3; Appendix A). Photograph reference RIMG0010 (CD-ROM).
Direction photo taken: N

East corner of the NHWL. Viewpoint 20 (Figure A-3; Appendix A). Photograph reference RIMG0020 (CD-ROM).
Direction photo taken: W

West corner of the NHWL. Viewpoint 28 (Figure A-3; Appendix A). Photograph reference RIMG0028 (CD-ROM).
Direction photo taken: S

Top of the NHWL from west corner. Viewpoint 39 (Figure A-3; Appendix A). Photograph reference RIMG0039 (CD-ROM). Direction photo taken: N

Feature A – small depression on top of the NHWL. Viewpoint 48 (Figure A-3; Appendix A). Photograph reference RIMG0048 (CD-ROM). Direction photo taken: SW

Feature B – large depression on top of the NHWL. Viewpoint 49 (Figure A-3; Appendix A). Photograph reference RIMG0049 (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 RIMG0050 (CD-ROM). Direction photo taken: W

Table C-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	RIMG0001	21	RIMG0020	41	RIMG0041
2	**RIMG0002**	22	RIMG0022	42	RIMG0042
3	RIMG0003	23	RIMG0023	43	RIMG0043
4	RIMG0004	24	RIMG0024	44	RIMG0044
5	RIMG0005	25	RIMG0025	45	RIMG0045
6	RIMG0006	26	RIMG0026	46	RIMG0046
7	RIMG0007	27	RIMG0027	47	RIMG0047
8	RIMG0008	**28**	**RIMG0028**	**48**	**RIMG0048**
9	RIMG0009	29	RIMG0029	**49**	**RIMG0049**
10	**RIMG0010**	30	RIMG0030	**50**	**RIMG0050**
11	RIMG0011	31	RIMG0031		
12	RIMG0012	32	RIMG0032		
13	RIMG0013	33	RIMG0033		
14	RIMG0014	34	RIMG0034		
15	RIMG0015	35	RIMG0035		
16	RIMG0016	36	RIMG0036		
17	RIMG0017	37	RIMG0037		
18	RIMG0018	38	RIMG0038		
19	RIMG0019	**39**	**RIMG0039**		
20	**RIMG0020**	40	RIMG0040		

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

APPENDIX D

Monitoring Well Sampling Records and Notes

Groundwater Sampling

Project: 1697-1201

Franz Personnel: D. Kiar
Weather: Partly Sunny /~10°C

Sampling of Monitoring Wells

Name of Area: SSDF			Sector:
Date of Sampling:	Day: 6th	Month: 08	Year: 2012
Monitoring Well ID:	**MW06-01**		
Coordinates of Well	Easting: 405570.2		Northing: 7606174.1
	GPS unit:		WP #:
Type of Well:	**Stick Up**		OVM (ppm): 0
Condition of Well:	**Good**		
Volume Purged (L):	> 2 L		
Sampling Equipment:	Geopump brand persistaltic pump and Horiba U-52 water quality meter		

Measured Data

Well Depth (mbgs):	1.77		**Sample Analysis**	**Y/N**	**# of Bottles**	**Duplicate Information**
Water Depth (mbgs):	1.367					
Stick Up (mags):	0.6					
Field Chemistry						
Name and # unit:	**Readings ***					
pH:	1	8.64	PHC	Y	11	
	2	8.48				
	3	8.58				
	4	8.61				
	5	8.54				
	6	8.46				
	7	8.39				
	8					
	9		PCB Total	Y		
	10					
	11					
Temperature (◦C):	1	11.33				
	2	10.69				
	3	10.13				
	4	9.75				
	5	9.61				
	6	9.60				
	7	9.65				
	8		Total Metals	Y		
	9					
	10					
	11					
Conductivity (mS/cm):	1	0.659				
	2	0.655				
	3	0.639				
	4	0.621				
	5	0.628				
	6	0.617				
	7	0.602	Dissolved Metals	Y		
	8					
	9					
	10					
	11					
DO:	1	9.37				
	2	8.16				
	3	7.92				
	4	7.53	General	Y		
	5	7.53				
	6	7.55				
	7	7.41				
	8					
	9					
	10					
	11					

Comments/ Notes:

Good recharge, likely due to wet conditions.

pumping at 100-150 ml/min

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

Groundwater Sampling

Project: 1697-1201

Franz Personnel: D. Kiar
Weather: Partly Sunny /~10°C

Sampling of Monitoring Wells

Name of Area: SSDF			Sector:
Date of Sampling:	Day: 6th	Month: 08	Year: 2012
Monitoring Well ID:	**MW06-02**		
Coordinates of Well	Easting: 405679.3		Northing: 7606144.7
	GPS unit:		WP #:
Type of Well:	**Stick Up**		OVM (ppm): 0
Condition of Well:	**Good**		
Volume Purged (L):	> 2 L		
Sampling Equipment:	Geopump brand persistaltic pump and Horiba U-52 water quality meter		

Measured Data

Well Depth (mbgs):	1.885		**Sample Analysis**	**Y/N**	**# of Bottles**	**Duplicate Information**
Water Depth (mbgs):	1.513					
Stick Up (mags):	0.7					
Field Chemistry						
Name and # unit:	**Readings ***					
pH:	1	7.80	PHC	Y	11	
	2	7.72				
	3	7.68				
	4	7.62				
	5	7.53				
	6					
	7					
	8					
	9		PCB Total	Y		
	10					
	11					
Temperature (◦C):	1	11.71				
	2	11.53				
	3	11.11				
	4	10.94				
	5	10.78				
	6					
	7					
	8		Total Metals	Y		
	9					
	10					
	11					
Conductivity (mS/cm):	1	0.419				
	2	0.422				
	3	0.420				
	4	0.424				
	5	0.416				
	6					
	7		Dissolved Metals	Y		
	8					
	9					
	10					
	11					
DO:	1	7.41				
	2	6.62				
	3	6.45				
	4	6.40	General	Y		
	5	6.24				
	6					
	7					
	8					
	9					
	10					
	11					

Comments/ Notes:

Good recharge, likely due to wet conditions.

pumping at 100-150 ml/min

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

Groundwater Sampling

Project: 1697-1201

Franz Personnel: D. Kiar
Weather: Partly Sunny /~10°C

Sampling of Monitoring Wells

Name of Area: SSDF			Sector:
Date of Sampling:	Day: 6th	Month: 08	Year: 2012
Monitoring Well ID:	**MW06-03**		
Coordinates of Well	Easting: 405663.3		Northing: 7606122.4
	GPS unit:		WP #:
Type of Well:	**Stick Up**		OVM (ppm): 0
Condition of Well:	**Good**		
Volume Purged (L):	> 3.5 L		
Sampling Equipment:	Geopump brand persistaltic pump and Horiba U-52 water quality meter		

Measured Data

Well Depth (mbgs):	2.445		**Sample Analysis**	**Y/N**	**# of Bottles**	**Duplicate Information**
Water Depth (mbgs):	1.53					
Stick Up (mags):	0.63					
Field Chemistry						
Name and # unit:	**Readings ***					
pH:	1	8.25	PHC	Y	11	
	2	8.09				
	3	7.88				
	4	7.84				
	5	7.82				
	6					
	7					
	8					
	9		PCB Total	Y		
	10					
	11					
Temperature (◦C):	1	10.98				
	2	11.01				
	3	6.85				
	4	7.61				
	5	6.09				
	6					
	7					
	8		Total Metals	Y		
	9					
	10					
	11					
Conductivity (mS/cm):	1	0.237				
	2	0.230				
	3	0.272				
	4	0.283				
	5	0.294				
	6					
	7		Dissolved Metals	Y		
	8					
	9					
	10					
	11					
DO:	1	10.11				
	2	7.52				
	3	9.14				
	4	9.19	General	Y		
	5	9.19				
	6					
	7					
	8					
	9					
	10					
	11					

Comments/ Notes:

Good recharge, likely due to wet conditions.

pumping at 100-150 ml/min

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

Groundwater Sampling

Project: 1697-1201

Franz Personnel: D. Kiar
Weather: Rain/~10°C

Sampling of Monitoring Wells

Name of Area: SSDF			Sector:
Date of Sampling:	Day: 5th	Month: 08	Year: 2012
Monitoring Well ID:	**MW06-04**		
Coordinates of Well	Easting: 405939.9		Northing: 7605609.5
	GPS unit:		WP #:
Type of Well:	**Stick Up**		OVM (ppm): 0
Condition of Well:	**Good**		
Volume Purged (L):	> 3.5 L		
Sampling Equipment:	Geopump brand persistaltic pump and Horiba U-52 water quality meter		

Measured Data

Well Depth (mbgs):	1.575		**Sample Analysis**	**Y/N**	**# of Bottles**	**Duplicate Information**
Water Depth (mbgs):	1.423					
Stick Up (mags):	0.52					
Field Chemistry						
Name and # unit:	**Readings ***					
pH:	1	7.51	PHC	Y	11	
	2	7.61				
	3	7.62				
	4	7.60				
	5	7.60				
	6	7.58				
	7					
	8					
	9		PCB Total	Y		
	10					
	11					
Temperature (◦C):	1	10.29				
	2	8.30				
	3	8.55				
	4	8.56				
	5	8.35				
	6	7.90				
	7					
	8		Total Metals	Y		
	9					
	10					
	11					
Conductivity (mS/cm):	1	1.45				
	2	1.43				
	3	1.43				
	4	1.42				
	5	1.41				
	6	1.41				
	7		Dissolved Metals	Y		
	8					
	9					
	10					
	11					
DO:	1	2.43				
	2	1.86				
	3	1.70				
	4	1.54	General	Y		
	5	1.41				
	6	1.36				
	7					
	8					
	9					
	10					
	11					

Comments/ Notes:

Good recharge, likely due to wet conditions.

pumping at 100-150 ml/min

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

Groundwater Sampling

Project: 1697-1201

Franz Personnel: D. Kiar
Weather: Rain/~10°C

Sampling of Monitoring Wells

Name of Area: SSDF			Sector:
Date of Sampling:	Day: 5th	Month: 08	Year: 2012
Monitoring Well ID:	**MW06-05**		
Coordinates of Well	Easting: 405907.3		Northing: 7605492.1
	GPS unit:		WP #:
Type of Well:	**Stick Up**		OVM (ppm): 0
Condition of Well:	**Good**		
Volume Purged (L):	> 4 L		
Sampling Equipment:	Geopump brand persistaltic pump and Horiba U-52 water quality meter		

Measured Data

Well Depth (mbgs):	1.765		**Sample Analysis**	**Y/N**	**# of Bottles**	**Duplicate Information**
Water Depth (mbgs):	1.535					
Stick Up (mags):	0.67					
Field Chemistry						
Name and # unit:	**Readings ***					
pH:	1	7.39	PHC	Y	22	DUP-1
	2	7.43				
	3	7.54				
	4	7.52				
	5	5.53				
	6					
	7					
	8					
	9		PCB Total	Y		DUP-1
	10					
	11					
Temperature (◦C):	1	3.79				
	2	3.99				
	3	4.04				
	4	4.11				
	5	4.15				
	6					
	7					
	8		Total Metals	Y		DUP-1
	9					
	10					
	11					
Conductivity (mS/cm):	1	2.02				
	2	2.00				
	3	1.89				
	4	1.78				
	5	1.77				
	6	1.74				
	7		Dissolved Metals	Y		DUP-1
	8					
	9					
	10					
	11					
DO:	1	6.38				
	2	6.72				
	3	6.93				
	4	6.92	General	Y		DUP-1
	5	6.93				
	6					
	7					
	8					
	9					
	10					
	11					

Comments/ Notes:

Good recharge, likely due to wet conditions.

pumping at 100-150 ml/min

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

Groundwater Sampling

Project: 1697-1201

Franz Personnel: D. Kiar
Weather: Rain/~10°C

Sampling of Monitoring Wells

Name of Area: SSDF			Sector:
Date of Sampling:	Day: 5th	Month: 08	Year: 2012
Monitoring Well ID:	**MW06-06**		
Coordinates of Well	Easting:405877.6		Northing:7605503.1
	GPS unit: N/A		WP #: N/A
Type of Well:	**Stick Up**		OVM (ppm): 0
Condition of Well:	**Good**		
Volume Purged (L):	>3 L		
Sampling Equipment:	Geopump brand persistaltic pump and Horiba U-52 water quality meter		

Measured Data

Well Depth (mbgs):	1.87		**Sample Analysis**	**Y/N**	**# of Bottles**	**Duplicate Information**
Water Depth (mbgs):	1.66					
Stick Up (mags):	0.72					
Field Chemistry						
Name and # unit:	**Readings ***					
pH:	1	7.64	PHC	Y	11	
	2	7.42				
	3	7.51				
	4	7.52				
	5	7.49				
	6	7.47				
	7	7.47				
	8	7.47				
	9		PCB Total	Y		
	10					
	11					
Temperature (◦C):	1	9.11				
	2	4.99				
	3	4.85				
	4	5.03				
	5	4.92				
	6	4.88				
	7	4.62				
	8	4.65	Total Metals	Y		
	9					
	10					
	11					
Conductivity (mS/cm):	1	1.36				
	2	1.61				
	3	1.50				
	4	1.40				
	5	1.26				
	6	1.21				
	7	1.19	Dissolved Metals	Y		
	8	1.18				
	9					
	10					
	11					
DO:	1	10.61				
	2	10.72				
	3	9.52				
	4	8.66	General	Y		
	5	7.86				
	6	7.50				
	7	6.94				
	8	6.46				
	9					
	10					
	11					

Comments/ Notes:

Good recharge, likely due to wet conditions.

pumping at 100-150 ml/min

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

APPENDIX E

Laboratory Certificates of Analysis and Chain of Custody Forms

Success Through Science®

Your Project #: 1697-1201 (F)
Site Location: CAM-F DEW LINE
Your C.O.C. #: 36564501, 365645-01-01

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

Report Date: 2012/08/16

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B2C1186
Received: 2012/08/10, 10:30

Sample Matrix: Water
Samples Received: 7

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Method Reference
Chloride by Automated Colourimetry (1)	7	N/A	2012/08/14	CAM SOP-00463	EPA 325.2
Colour (1)	6	N/A	2012/08/13	CAM SOP-00412	APHA 2120
Colour (1)	1	N/A	2012/08/14	CAM SOP-00412	APHA 2120
Conductivity (1)	7	N/A	2012/08/13	CAM SOP-00448	SM 2510
Petroleum Hydro. CCME F1 & BTEX in Water	7	N/A	2012/08/13	OTT SOP-00002	CCME CWS
Petroleum Hydrocarbons F2-F4 in Water	7	2012/08/13	2012/08/13	OTT SOP-00001	CCME Hydrocarbons
Fluoride (1)	7	2012/08/11	2012/08/13	CAM SOP-00448	APHA 4500FC
Nitrate (NO3) and Nitrite (NO2) in Water (1,2)	7	N/A	2012/08/15	CAM SOP-00440	SM 4500 NO3I/NO2B
Polychlorinated Biphenyl in Water (1)	4	2012/08/13	2012/08/13	CAM SOP-00309	SW846 8082
Polychlorinated Biphenyl in Water (1)	3	2012/08/13	2012/08/14	CAM SOP-00309	SW846 8082
pH (1)	7	N/A	2012/08/13	CAM SOP-00448	SM 4500H+ B
Orthophosphate (1)	7	N/A	2012/08/14	CAM SOP-00461	EPA 365.1
Sulphate by Automated Colourimetry (1)	7	N/A	2012/08/14	CAM SOP-00464	EPA 375.4
Total Dissolved Solids (1)	7	N/A	2012/08/14	CAM SOP-00428	APHA 2540C
Total Suspended Solids (1)	7	N/A	2012/08/13	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. Reporting results to two significant figures at the RDL is to permit statistical evaluation and is not intended to be an indication of analytical precision.

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) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.

../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

Maxxam Job #: B2C1186
Report Date: 2012/08/16

Franz Environmental Inc
Client Project #: 1697-1201 (F)
Site Location: CAM-F DEW LINE
Sampler Initials: DK

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 #: B2C1186
Report Date: 2012/08/16

Franz Environmental Inc
Client Project #: 1697-1201 (F)
Site Location: CAM-F DEW LINE
Sampler Initials: DK

RESULTS OF ANALYSES OF WATER

Maxxam ID		OL3461	OL3462		OL3463		OL3464		
Sampling Date		2012/08/06	2012/08/06		2012/08/06		2012/08/05		
	Units	**MW1**	**MW2**	**RDL**	**MW3**	**RDL**	**MW4**	**RDL**	**QC Batch**
Inorganics									
Colour	TCU	<2	5	2	42	10	4	2	2935917
Conductivity	umho/cm	670	480	1.0	270	1.0	1400	1.0	2935938
Total Dissolved Solids	mg/L	398	284	10	222	10	1060	10	2936131
Fluoride (F-)	mg/L	0.52	0.16	0.10	0.12	0.10	0.34	0.10	2935939
Orthophosphate (P)	mg/L	<0.010	<0.010	0.010	<0.010	0.010	<0.010	0.010	2936375
pH	pH	8.14	8.07		8.10		7.95		2935940
Total Suspended Solids	mg/L	<10	<10	10	100	10	<10	10	2935916
Dissolved Sulphate (SO4)	mg/L	88	35	1	<1	1	540	5	2936376
Dissolved Chloride (Cl)	mg/L	10	12	1	<1	1	28	1	2936373
Nitrite (N)	mg/L	0.020	<0.010	0.010	<0.010	0.010	0.014	0.010	2935927
Nitrate (N)	mg/L	10	7.2	1.0	<0.10	0.10	3.8	0.10	2935927
Nitrate + Nitrite	mg/L	10	7.2	1.0	<0.10	0.10	3.9	0.10	2935927

Maxxam ID		OL3465		OL3466			OL3467	OL3467		
Sampling Date		2012/08/05		2012/08/05						
	Units	**MW5**	**RDL**	**MW6**	**RDL**	**QC Batch**	**DUP-1**	**DUP-1 Lab-Dup**	**RDL**	**QC Batch**
Inorganics										
Colour	TCU	<2	2	5	2	2935917	4	4	2	2937305
Conductivity	umho/cm	1600	1.0	1200	1.0	2935938	1600		1.0	2935938
Total Dissolved Solids	mg/L	1330	10	900	10	2936131	1350		10	2936131
Fluoride (F-)	mg/L	0.33	0.10	0.39	0.10	2935939	0.33		0.10	2935939
Orthophosphate (P)	mg/L	<0.010	0.010	<0.010	0.010	2936375	<0.010	<0.010	0.010	2936375
pH	pH	7.90		7.89		2935940	7.90			2935940
Total Suspended Solids	mg/L	<10	10	14	10	2935916	<10		10	2935916
Dissolved Sulphate (SO4)	mg/L	640	5	380	2	2936376	640	650	5	2936376
Dissolved Chloride (Cl)	mg/L	47	1	30	1	2936373	47	47	1	2936373
Nitrite (N)	mg/L	<0.010	0.010	<0.010	0.010	2935927	<0.010		0.010	2935927
Nitrate (N)	mg/L	1.3	0.10	2.8	0.10	2935927	1.4		0.10	2935927
Nitrate + Nitrite	mg/L	1.3	0.10	2.8	0.10	2935927	1.4		0.10	2935927

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 #: B2C1186
Report Date: 2012/08/16

Franz Environmental Inc
Client Project #: 1697-1201 (F)
Site Location: CAM-F DEW LINE
Sampler Initials: DK

POLYCHLORINATED BIPHENYLS BY GC-ECD (WATER)

Maxxam ID		OL3461	OL3462	OL3463	OL3464	OL3465	OL3466	OL3467		
Sampling Date		2012/08/06	2012/08/06	2012/08/06	2012/08/05	2012/08/05	2012/08/05			
	Units	**MW1**	**MW2**	**MW3**	**MW4**	**MW5**	**MW6**	**DUP-1**	**RDL**	**QC Batch**
PCBs										
Aroclor 1016	ug/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	2936138
Aroclor 1221	ug/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	2936138
Aroclor 1232	ug/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	2936138
Aroclor 1242	ug/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	2936138
Aroclor 1248	ug/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	2936138
Aroclor 1254	ug/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	2936138
Aroclor 1260	ug/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	2936138
Aroclor 1262	ug/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	2936138
Aroclor 1268	ug/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	2936138
Total PCB	ug/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	2936138
Surrogate Recovery (%)										
Decachlorobiphenyl	%	93	90	89	91	99	97	101		2936138

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B2C1186
Report Date: 2012/08/16

Franz Environmental Inc
Client Project #: 1697-1201 (F)
Site Location: CAM-F DEW LINE
Sampler Initials: DK

O'REG 153 PETROLEUM HYDROCARBONS (WATER)

Maxxam ID		OL3461	OL3462	OL3463	OL3464	OL3465	OL3466	OL3467		
Sampling Date		2012/08/06	2012/08/06	2012/08/06	2012/08/05	2012/08/05	2012/08/05			
	Units	**MW1**	**MW2**	**MW3**	**MW4**	**MW5**	**MW6**	**DUP-1**	**RDL**	**QC Batch**
BTEX & F1 Hydrocarbons										
Benzene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	2936396
Toluene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	2936396
Ethylbenzene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	2936396
o-Xylene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	2936396
p+m-Xylene	ug/L	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	0.40	2936396
Total Xylenes	ug/L	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	0.40	2936396
F1 (C6-C10)	ug/L	<25	<25	<25	<25	<25	<25	<25	25	2936396
F1 (C6-C10) - BTEX	ug/L	<25	<25	<25	<25	<25	<25	<25	25	2936396
F2-F4 Hydrocarbons										
F2 (C10-C16 Hydrocarbons)	ug/L	<100	<100	<100	<100	<100	<100	<100	100	2936322
F3 (C16-C34 Hydrocarbons)	ug/L	<100	<100	<100	<100	<100	<100	<100	100	2936322
F4 (C34-C50 Hydrocarbons)	ug/L	<100	<100	<100	<100	<100	<100	<100	100	2936322
Reached Baseline at C50	ug/L	YES	YES	YES	YES	YES	YES	YES		2936322
Surrogate Recovery (%)										
1,4-Difluorobenzene	%	103	105	104	106	105	105	106		2936396
4-Bromofluorobenzene	%	101	100	101	103	104	101	102		2936396
D10-Ethylbenzene	%	107	107	107	101	104	106	110		2936396
D4-1,2-Dichloroethane	%	99	100	97	98	98	98	99		2936396
o-Terphenyl	%	77	76	76	75	74	77	79		2936322

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 #: B2C1186
Report Date: 2012/08/16

Franz Environmental Inc
Client Project #: 1697-1201 (F)
Site Location: CAM-F DEW LINE
Sampler Initials: DK

Test Summary

Maxxam ID OL3461 **Collected** 2012/08/06
Sample ID MW1 **Shipped**
Matrix Water **Received** 2012/08/10

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Chloride by Automated Colourimetry	AC	2936373	N/A	2012/08/14	Deonarine Ramnarine
Colour	SPEC	2935917	N/A	2012/08/13	Charles Opoku-Ware
Conductivity	COND	2935938	N/A	2012/08/13	Surinder Rai
Petroleum Hydro. CCME F1 & BTEX in Wat	HSGC/MSFD	2936396	N/A	2012/08/13	Steve Roberts
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	2936322	2012/08/13	2012/08/13	Lyndsey Hart
Fluoride	F	2935939	2012/08/11	2012/08/13	Surinder Rai
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	2935927	N/A	2012/08/15	Chris Li
Polychlorinated Biphenyl in Water	GC/ECD	2936138	2012/08/13	2012/08/13	Joy Zhang
pH	PH	2935940	N/A	2012/08/13	Surinder Rai
Orthophosphate	AC	2936375	N/A	2012/08/14	Birenkumar Patel
Sulphate by Automated Colourimetry	AC	2936376	N/A	2012/08/14	Deonarine Ramnarine
Total Dissolved Solids	SLDS	2936131	N/A	2012/08/14	Gurpreet Kaur
Total Suspended Solids	SLDS	2935916	N/A	2012/08/13	Bansari Ray

Maxxam ID OL3462 **Collected** 2012/08/06
Sample ID MW2 **Shipped**
Matrix Water **Received** 2012/08/10

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Chloride by Automated Colourimetry	AC	2936373	N/A	2012/08/14	Deonarine Ramnarine
Colour	SPEC	2935917	N/A	2012/08/13	Charles Opoku-Ware
Conductivity	COND	2935938	N/A	2012/08/13	Surinder Rai
Petroleum Hydro. CCME F1 & BTEX in Wat	HSGC/MSFD	2936396	N/A	2012/08/13	Steve Roberts
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	2936322	2012/08/13	2012/08/13	Lyndsey Hart
Fluoride	F	2935939	2012/08/11	2012/08/13	Surinder Rai
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	2935927	N/A	2012/08/15	Chris Li
Polychlorinated Biphenyl in Water	GC/ECD	2936138	2012/08/13	2012/08/13	Joy Zhang
pH	PH	2935940	N/A	2012/08/13	Surinder Rai
Orthophosphate	AC	2936375	N/A	2012/08/14	Birenkumar Patel
Sulphate by Automated Colourimetry	AC	2936376	N/A	2012/08/14	Deonarine Ramnarine
Total Dissolved Solids	SLDS	2936131	N/A	2012/08/14	Gurpreet Kaur
Total Suspended Solids	SLDS	2935916	N/A	2012/08/13	Bansari Ray

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Maxxam Job #: B2C1186
Report Date: 2012/08/16

Franz Environmental Inc
Client Project #: 1697-1201 (F)
Site Location: CAM-F DEW LINE
Sampler Initials: DK

Test Summary

Maxxam ID OL3463 **Collected** 2012/08/06
Sample ID MW3 **Shipped**
Matrix Water **Received** 2012/08/10

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Chloride by Automated Colourimetry	AC	2936373	N/A	2012/08/14	Deonarine Ramnarine
Colour	SPEC	2935917	N/A	2012/08/13	Charles Opoku-Ware
Conductivity	COND	2935938	N/A	2012/08/13	Surinder Rai
Petroleum Hydro. CCME F1 & BTEX in Wat	HSGC/MSFD	2936396	N/A	2012/08/13	Steve Roberts
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	2936322	2012/08/13	2012/08/13	Lyndsey Hart
Fluoride	F	2935939	2012/08/11	2012/08/13	Surinder Rai
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	2935927	N/A	2012/08/15	Chris Li
Polychlorinated Biphenyl in Water	GC/ECD	2936138	2012/08/13	2012/08/13	Joy Zhang
pH	PH	2935940	N/A	2012/08/13	Surinder Rai
Orthophosphate	AC	2936375	N/A	2012/08/14	Birenkumar Patel
Sulphate by Automated Colourimetry	AC	2936376	N/A	2012/08/14	Deonarine Ramnarine
Total Dissolved Solids	SLDS	2936131	N/A	2012/08/14	Gurpreet Kaur
Total Suspended Solids	SLDS	2935916	N/A	2012/08/13	Bansari Ray

Maxxam ID OL3464 **Collected** 2012/08/05
Sample ID MW4 **Shipped**
Matrix Water **Received** 2012/08/10

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Chloride by Automated Colourimetry	AC	2936373	N/A	2012/08/14	Deonarine Ramnarine
Colour	SPEC	2935917	N/A	2012/08/13	Charles Opoku-Ware
Conductivity	COND	2935938	N/A	2012/08/13	Surinder Rai
Petroleum Hydro. CCME F1 & BTEX in Wat	HSGC/MSFD	2936396	N/A	2012/08/13	Steve Roberts
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	2936322	2012/08/13	2012/08/13	Lyndsey Hart
Fluoride	F	2935939	2012/08/11	2012/08/13	Surinder Rai
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	2935927	N/A	2012/08/15	Chris Li
Polychlorinated Biphenyl in Water	GC/ECD	2936138	2012/08/13	2012/08/13	Joy Zhang
pH	PH	2935940	N/A	2012/08/13	Surinder Rai
Orthophosphate	AC	2936375	N/A	2012/08/14	Birenkumar Patel
Sulphate by Automated Colourimetry	AC	2936376	N/A	2012/08/14	Deonarine Ramnarine
Total Dissolved Solids	SLDS	2936131	N/A	2012/08/14	Gurpreet Kaur
Total Suspended Solids	SLDS	2935916	N/A	2012/08/13	Bansari Ray

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Franz Environmental Inc
Client Project #: 1697-1201 (F)
Site Location: CAM-F DEW LINE
Sampler Initials: DK

Test Summary

Maxxam ID OL3465 **Collected** 2012/08/05
Sample ID MW5 **Shipped**
Matrix Water **Received** 2012/08/10

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Chloride by Automated Colourimetry	AC	2936373	N/A	2012/08/14	Deonarine Ramnarine
Colour	SPEC	2935917	N/A	2012/08/13	Charles Opoku-Ware
Conductivity	COND	2935938	N/A	2012/08/13	Surinder Rai
Petroleum Hydro. CCME F1 & BTEX in Wat	HSGC/MSFD	2936396	N/A	2012/08/13	Steve Roberts
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	2936322	2012/08/13	2012/08/13	Lyndsey Hart
Fluoride	F	2935939	2012/08/11	2012/08/13	Surinder Rai
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	2935927	N/A	2012/08/15	Chris Li
Polychlorinated Biphenyl in Water	GC/ECD	2936138	2012/08/13	2012/08/14	Joy Zhang
pH	PH	2935940	N/A	2012/08/13	Surinder Rai
Orthophosphate	AC	2936375	N/A	2012/08/14	Birenkumar Patel
Sulphate by Automated Colourimetry	AC	2936376	N/A	2012/08/14	Deonarine Ramnarine
Total Dissolved Solids	SLDS	2936131	N/A	2012/08/14	Gurpreet Kaur
Total Suspended Solids	SLDS	2935916	N/A	2012/08/13	Bansari Ray

Maxxam ID OL3466 **Collected** 2012/08/05
Sample ID MW6 **Shipped**
Matrix Water **Received** 2012/08/10

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Chloride by Automated Colourimetry	AC	2936373	N/A	2012/08/14	Deonarine Ramnarine
Colour	SPEC	2935917	N/A	2012/08/13	Charles Opoku-Ware
Conductivity	COND	2935938	N/A	2012/08/13	Surinder Rai
Petroleum Hydro. CCME F1 & BTEX in Wat	HSGC/MSFD	2936396	N/A	2012/08/13	Steve Roberts
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	2936322	2012/08/13	2012/08/13	Lyndsey Hart
Fluoride	F	2935939	2012/08/11	2012/08/13	Surinder Rai
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	2935927	N/A	2012/08/15	Chris Li
Polychlorinated Biphenyl in Water	GC/ECD	2936138	2012/08/13	2012/08/14	Joy Zhang
pH	PH	2935940	N/A	2012/08/13	Surinder Rai
Orthophosphate	AC	2936375	N/A	2012/08/14	Birenkumar Patel
Sulphate by Automated Colourimetry	AC	2936376	N/A	2012/08/14	Deonarine Ramnarine
Total Dissolved Solids	SLDS	2936131	N/A	2012/08/14	Gurpreet Kaur
Total Suspended Solids	SLDS	2935916	N/A	2012/08/13	Bansari Ray

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Maxxam Job #: B2C1186
Report Date: 2012/08/16

Franz Environmental Inc
Client Project #: 1697-1201 (F)
Site Location: CAM-F DEW LINE
Sampler Initials: DK

Test Summary

Maxxam ID OL3467 **Collected**
Sample ID DUP-1 **Shipped**
Matrix Water **Received** 2012/08/10

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Chloride by Automated Colourimetry	AC	2936373	N/A	2012/08/14	Deonarine Ramnarine
Colour	SPEC	2937305	N/A	2012/08/14	Christine Pham
Conductivity	COND	2935938	N/A	2012/08/13	Surinder Rai
Petroleum Hydro. CCME F1 & BTEX in Wat	HSGC/MSFD	2936396	N/A	2012/08/13	Steve Roberts
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	2936322	2012/08/13	2012/08/13	Lyndsey Hart
Fluoride	F	2935939	2012/08/11	2012/08/13	Surinder Rai
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	2935927	N/A	2012/08/15	Chris Li
Polychlorinated Biphenyl in Water	GC/ECD	2936138	2012/08/13	2012/08/14	Joy Zhang
pH	PH	2935940	N/A	2012/08/13	Surinder Rai
Orthophosphate	AC	2936375	N/A	2012/08/14	Birenkumar Patel
Sulphate by Automated Colourimetry	AC	2936376	N/A	2012/08/14	Deonarine Ramnarine
Total Dissolved Solids	SLDS	2936131	N/A	2012/08/14	Gurpreet Kaur
Total Suspended Solids	SLDS	2935916	N/A	2012/08/13	Bansari Ray

Maxxam ID OL3467 Dup **Collected**
Sample ID DUP-1 **Shipped**
Matrix Water **Received** 2012/08/10

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Chloride by Automated Colourimetry	AC	2936373	N/A	2012/08/14	Deonarine Ramnarine
Colour	SPEC	2937305	N/A	2012/08/14	Christine Pham
Orthophosphate	AC	2936375	N/A	2012/08/14	Birenkumar Patel
Sulphate by Automated Colourimetry	AC	2936376	N/A	2012/08/14	Deonarine Ramnarine

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Maxxam Job #: B2C1186
Report Date: 2012/08/16

Franz Environmental Inc
Client Project #: 1697-1201 (F)
Site Location: CAM-F DEW LINE
Sampler Initials: DK

Package 1	4.3°C

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

GENERAL COMMENTS

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 #: B2C1186
Report Date: 2012/08/16

Franz Environmental Inc
Client Project #: 1697-1201 (F)
Site Location: CAM-F DEW LINE
Sampler Initials: DK

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
2935916	Total Suspended Solids	2012/08/13					<10	mg/L	NC	25	98	85 - 115
2935917	Colour	2012/08/13			99	85 - 115	<2	TCU	NC	25		
2935927	Nitrite (N)	2012/08/15	106	80 - 120	104	85 - 115	<0.010	mg/L	NC	25		
2935927	Nitrate (N)	2012/08/15	99	80 - 120	96	85 - 115	<0.10	mg/L	NC	25		
2935938	Conductivity	2012/08/13					<1.0	umho/cm	0.08	25	101	85 - 115
2935939	Fluoride (F-)	2012/08/13	100	80 - 120	98	80 - 120	<0.10	mg/L	NC	20		
2936131	Total Dissolved Solids	2012/08/14					<10	mg/L	8.4	25	101	90 - 110
2936138	Decachlorobiphenyl	2012/08/13	119	60 - 130	83	60 - 130	83	%				
2936138	Aroclor 1260	2012/08/13	91	60 - 130	76	60 - 130	<0.05	ug/L	NC	30		
2936138	Total PCB	2012/08/13	91	60 - 130	76	60 - 130	<0.05	ug/L	NC	40		
2936138	Aroclor 1016	2012/08/13					<0.05	ug/L	NC	40		
2936138	Aroclor 1221	2012/08/13					<0.05	ug/L	NC	40		
2936138	Aroclor 1232	2012/08/13					<0.05	ug/L	NC	40		
2936138	Aroclor 1242	2012/08/13					<0.05	ug/L	NC	30		
2936138	Aroclor 1248	2012/08/13					<0.05	ug/L	NC	30		
2936138	Aroclor 1254	2012/08/13					<0.05	ug/L	NC	30		
2936138	Aroclor 1262	2012/08/13					<0.05	ug/L	NC	40		
2936138	Aroclor 1268	2012/08/13					<0.05	ug/L	NC	40		
2936322	o-Terphenyl	2012/08/13	71	30 - 130	73	30 - 130	75	%				
2936322	F2 (C10-C16 Hydrocarbons)	2012/08/13	73	50 - 130	81	70 - 130	<100	ug/L	NC	50		
2936322	F3 (C16-C34 Hydrocarbons)	2012/08/13	73	50 - 130	81	70 - 130	<100	ug/L	NC	50		
2936322	F4 (C34-C50 Hydrocarbons)	2012/08/13	73	50 - 130	81	70 - 130	<100	ug/L	NC	50		
2936373	Dissolved Chloride (Cl)	2012/08/14	NC	80 - 120	103	80 - 120	<1	mg/L	0.9	20		
2936375	Orthophosphate (P)	2012/08/14	99	75 - 125	101	80 - 120	<0.010	mg/L	NC	25		
2936376	Dissolved Sulphate (SO4)	2012/08/14	42	75 - 125	97	80 - 120	<1	mg/L	0.5	20		
2936396	1,4-Difluorobenzene	2012/08/13	106	70 - 130	107	70 - 130	108	%				
2936396	4-Bromofluorobenzene	2012/08/13	101	70 - 130	102	70 - 130	103	%				
2936396	D10-Ethylbenzene	2012/08/13	106	70 - 130	113	70 - 130	105	%				
2936396	D4-1,2-Dichloroethane	2012/08/13	101	70 - 130	101	70 - 130	98	%				
2936396	Benzene	2012/08/13	89	70 - 130	88	70 - 130	<0.20	ug/L	NC	40		
2936396	Toluene	2012/08/13	86	70 - 130	84	70 - 130	<0.20	ug/L	NC	40		
2936396	Ethylbenzene	2012/08/13	90	70 - 130	93	70 - 130	<0.20	ug/L	NC	40		
2936396	o-Xylene	2012/08/13	93	70 - 130	93	70 - 130	<0.20	ug/L	NC	40		
2936396	p+m-Xylene	2012/08/13	83	70 - 130	84	70 - 130	<0.40	ug/L	NC	40		
2936396	F1 (C6-C10)	2012/08/13	90	70 - 130	98	70 - 130	<25	ug/L	NC	40		
2936396	Total Xylenes	2012/08/13					<0.40	ug/L	NC	40		

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Maxxam Job #: B2C1186
Report Date: 2012/08/16

Franz Environmental Inc
Client Project #: 1697-1201 (F)
Site Location: CAM-F DEW LINE
Sampler Initials: DK

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
2936396	F1 (C6-C10) - BTEX	2012/08/13					<25	ug/L	NC	40		
2937305	Colour	2012/08/14			100	85 - 115	<2	TCU	NC	25		

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.

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Validation Signature Page

Maxxam Job #: B2C1186

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, Scientific Services

Paul Rubinato, Analyst, Maxxam Analytics

==========

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.

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Your Project #: MB2C1186

Attention: SUB CONTRACTOR
MAXXAM ANALYTICS
CAMPOBELLO
6740 CAMPOBELLO ROAD
MISSISSAUGA, ON
CANADA L5N 2L8

Report Date: 2012/08/14

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B270930
Received: 2012/08/11, 10:10

Sample Matrix: Water
Samples Received: 7

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Cadmium - low level CCME - Dissolved	7	N/A	2012/08/14	AB SOP-00043	EPA 200.8
Cadmium - low level CCME (Total)	7	2012/08/11	2012/08/14	AB SOP-00043	EPA 200.8
Hardness	7	N/A	2012/08/14	AB WI-00065	SM 2340B
Elements by ICP - Dissolved	7	N/A	2012/08/12	AB SOP-00042	EPA 200.7
Elements by ICP - Total	7	2012/08/12	2012/08/12	AB SOP-00042	EPA 200.7
Elements by ICPMS - Dissolved	7	N/A	2012/08/14	AB SOP-00043	EPA 200.8
Elements by ICPMS - Total	7	2012/08/12	2012/08/14	AB SOP-00043	EPA 200.8

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

Encryption Key

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

Carmen Mackay, Project Manager Assistant
Email: CMacKay@maxxam.ca
Phone# (403) 291-3077

==========

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Total cover pages: 1

Maxxam Job #: B270930
Report Date: 2012/08/14

MAXXAM ANALYTICS
Client Project #: MB2C1186

REGULATED METALS (CCME/AT1) - DISSOLVED

Maxxam ID		EE1725	EE1726	EE1727	EE1728	EE1729		
Sampling Date		2012/08/06	2012/08/06	2012/08/06	2012/08/05	2012/08/05		
	UNITS	**MW1 (OL3461)**	**MW2 (OL3462)**	**MW3 (OL3463)**	**MW4 (OL3464)**	**MW5 (OL3465)**	**RDL**	**QC Batch**
Low Level Elements								
Dissolved Cadmium (Cd)	ug/L	0.0078	0.012	0.016	0.027	0.049	0.0050	6074962
Elements								
Dissolved Aluminum (Al)	mg/L	0.0043	0.0035	0.018	0.014	0.0070	0.0010	6075556
Dissolved Antimony (Sb)	mg/L	<0.00060	<0.00060	<0.00060	<0.00060	<0.00060	0.00060	6075556
Dissolved Arsenic (As)	mg/L	0.00033	<0.00020	0.00021	<0.00020	0.00032	0.00020	6075556
Dissolved Barium (Ba)	mg/L	0.026 (1)	0.035	0.031	<0.010	0.040 (1)	0.010	6075655
Dissolved Beryllium (Be)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	6075556
Dissolved Boron (B)	mg/L	<0.020	0.087 (1)	<0.020	0.032	0.023 (1)	0.020	6075655
Dissolved Calcium (Ca)	mg/L	60	69 (2)	37	120	180	0.30	6075655
Dissolved Chromium (Cr)	mg/L	<0.0010	0.0032	<0.0010	<0.0010	<0.0010	0.0010	6075556
Dissolved Cobalt (Co)	mg/L	0.21	<0.00030	0.00057	0.00075	0.00074	0.00030	6075556
Dissolved Copper (Cu)	mg/L	0.0070	0.0039	0.024	0.0069 (2)	0.0077 (2)	0.00020	6075556
Dissolved Iron (Fe)	mg/L	<0.060	<0.060	<0.060	<0.060	<0.060	0.060	6075655
Dissolved Lead (Pb)	mg/L	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	0.00020	6075556
Dissolved Lithium (Li)	mg/L	0.020 (1)	<0.020	<0.020	0.040	0.031	0.020	6075655
Dissolved Magnesium (Mg)	mg/L	21	13	9.1	75 (2)	100	0.20	6075655
Dissolved Manganese (Mn)	mg/L	0.077 (2)	<0.0040	0.0066	0.018	0.0057	0.0040	6075655
Dissolved Molybdenum (Mo)	mg/L	0.010	0.0012	0.00047	0.0092	0.0028 (2)	0.00020	6075556
Dissolved Nickel (Ni)	mg/L	0.024	0.00099	0.0064	0.0039	0.0044 (2)	0.00050	6075556
Dissolved Phosphorus (P)	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	6075655
Dissolved Potassium (K)	mg/L	6.9	3.9 (2)	4.4	6.9 (2)	6.8 (2)	0.30	6075655
Dissolved Selenium (Se)	mg/L	0.00033	<0.00020	<0.00020	0.00052	0.00049 (1)	0.00020	6075556
Dissolved Silicon (Si)	mg/L	1.9	2.2	2.2	2.4 (2)	3.0 (2)	0.10	6075655
Dissolved Silver (Ag)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	6075556
Dissolved Sodium (Na)	mg/L	40	8.0	5.4	69 (2)	31	0.50	6075655
Dissolved Strontium (Sr)	mg/L	0.092	0.064 (1)	0.062 (1)	0.30	0.34	0.020	6075655
Dissolved Sulphur (S)	mg/L	26	12 (2)	0.87	180 (2)	220	0.20	6075655
Dissolved Thallium (Tl)	mg/L	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	0.00020	6075556
Dissolved Tin (Sn)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	6075556
Dissolved Titanium (Ti)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	6075556
Dissolved Uranium (U)	mg/L	0.0050	0.0047	0.0015	0.072	0.15	0.00010	6075556
Dissolved Vanadium (V)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	6075556

RDL = Reportable Detection Limit
(1) Dissolved greater than total. Results are within limits of uncertainty(MU).
(2) Dissolved greater than total. Results within acceptable limits of precision.

Maxxam Job #: B270930
Report Date: 2012/08/14

MAXXAM ANALYTICS
Client Project #: MB2C1186

REGULATED METALS (CCME/AT1) - DISSOLVED

Maxxam ID		EE1725	EE1726	EE1727	EE1728	EE1729		
Sampling Date		2012/08/06	2012/08/06	2012/08/06	2012/08/05	2012/08/05		
	UNITS	**MW1 (OL3461)**	**MW2 (OL3462)**	**MW3 (OL3463)**	**MW4 (OL3464)**	**MW5 (OL3465)**	**RDL**	**QC Batch**
Dissolved Zinc (Zn)	mg/L	0.27	0.14	0.043	0.033	0.035 (1)	0.0030	6075556

RDL = Reportable Detection Limit
(1) Dissolved greater than total. Results within acceptable limits of precision.

Maxxam Job #: B270930
Report Date: 2012/08/14

MAXXAM ANALYTICS
Client Project #: MB2C1186

REGULATED METALS (CCME/AT1) - DISSOLVED

Maxxam ID		EE1730	EE1731		
Sampling Date		2012/08/05			
	UNITS	**MW6 (OL3466)**	**DUP-1 (OL3467)**	**RDL**	**QC Batch**
Low Level Elements					
Dissolved Cadmium (Cd)	ug/L	0.016	0.044	0.0050	6074962
Elements					
Dissolved Aluminum (Al)	mg/L	0.010	0.0056	0.0010	6075556
Dissolved Antimony (Sb)	mg/L	<0.00060	<0.00060	0.00060	6075556
Dissolved Arsenic (As)	mg/L	0.00024	0.00030	0.00020	6075556
Dissolved Barium (Ba)	mg/L	0.031	0.039	0.010	6075655
Dissolved Beryllium (Be)	mg/L	<0.0010	<0.0010	0.0010	6075556
Dissolved Boron (B)	mg/L	<0.020	0.023 (1)	0.020	6075655
Dissolved Calcium (Ca)	mg/L	120	180	0.30	6075655
Dissolved Chromium (Cr)	mg/L	<0.0010	<0.0010	0.0010	6075556
Dissolved Cobalt (Co)	mg/L	<0.00030	0.00080 (1)	0.00030	6075556
Dissolved Copper (Cu)	mg/L	0.0056	0.0064	0.00020	6075556
Dissolved Iron (Fe)	mg/L	<0.060	<0.060	0.060	6075655
Dissolved Lead (Pb)	mg/L	<0.00020	<0.00020	0.00020	6075556
Dissolved Lithium (Li)	mg/L	0.036	0.032	0.020	6075655
Dissolved Magnesium (Mg)	mg/L	68	100	0.20	6075655
Dissolved Manganese (Mn)	mg/L	0.017	0.0056	0.0040	6075655
Dissolved Molybdenum (Mo)	mg/L	0.0049	0.0026	0.00020	6075556
Dissolved Nickel (Ni)	mg/L	0.0063	0.0044 (2)	0.00050	6075556
Dissolved Phosphorus (P)	mg/L	<0.10	<0.10	0.10	6075655
Dissolved Potassium (K)	mg/L	8.5	6.7	0.30	6075655
Dissolved Selenium (Se)	mg/L	0.0013	0.00039	0.00020	6075556
Dissolved Silicon (Si)	mg/L	2.6	3.0	0.10	6075655
Dissolved Silver (Ag)	mg/L	<0.00010	<0.00010	0.00010	6075556
Dissolved Sodium (Na)	mg/L	25	31	0.50	6075655
Dissolved Strontium (Sr)	mg/L	0.22	0.34	0.020	6075655
Dissolved Sulphur (S)	mg/L	130	220	0.20	6075655
Dissolved Thallium (Tl)	mg/L	<0.00020	<0.00020	0.00020	6075556
Dissolved Tin (Sn)	mg/L	<0.0010	<0.0010	0.0010	6075556
Dissolved Titanium (Ti)	mg/L	<0.0010	<0.0010	0.0010	6075556
Dissolved Uranium (U)	mg/L	0.089	0.14	0.00010	6075556
Dissolved Vanadium (V)	mg/L	<0.0010	<0.0010	0.0010	6075556

RDL = Reportable Detection Limit
(1) Dissolved greater than total. Results are within limits of uncertainty(MU).
(2) Dissolved greater than total. Results within acceptable limits of precision.

Maxxam Job #: B270930
Report Date: 2012/08/14

MAXXAM ANALYTICS
Client Project #: MB2C1186

REGULATED METALS (CCME/AT1) - DISSOLVED

Maxxam ID		EE1730	EE1731		
Sampling Date		2012/08/05			
	UNITS	**MW6 (OL3466)**	**DUP-1 (OL3467)**	**RDL**	**QC Batch**
Dissolved Zinc (Zn)	mg/L	0.24	0.029	0.0030	6075556
RDL = Reportable Detection Limit					

Maxxam Job #: B270930
Report Date: 2012/08/14

MAXXAM ANALYTICS
Client Project #: MB2C1186

REGULATED METALS (CCME/AT1) - TOTAL

Maxxam ID		EE1725	EE1726	EE1727	EE1728	EE1729	EE1730		
Sampling Date		2012/08/06	2012/08/06	2012/08/06	2012/08/05	2012/08/05	2012/08/05		
	UNITS	**MW1 (OL3461)**	**MW2 (OL3462)**	**MW3 (OL3463)**	**MW4 (OL3464)**	**MW5 (OL3465)**	**MW6 (OL3466)**	**RDL**	**QC Batch**
Low Level Elements									
Total Cadmium (Cd)	ug/L	0.0099	0.010	0.039	0.017	0.037	0.011	0.0050	6074963
Elements									
Total Aluminum (Al)	mg/L	0.011	0.092	1.3	0.017	0.011	0.15	0.0010	6075555
Total Antimony (Sb)	mg/L	<0.00060	0.00066	<0.00060	<0.00060	<0.00060	<0.00060	0.00060	6075555
Total Arsenic (As)	mg/L	0.00034	0.00023	0.00061	0.00024	0.00037	0.00030	0.00020	6075555
Total Barium (Ba)	mg/L	0.025	0.035	0.043	<0.010	0.039	0.032	0.010	6075653
Total Beryllium (Be)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	6075555
Total Boron (B)	mg/L	<0.020	0.086	<0.020	0.034	0.022	0.021	0.020	6075653
Total Calcium (Ca)	mg/L	60	68	37	120	180	120	0.30	6075653
Total Chromium (Cr)	mg/L	<0.0010	0.0035	0.0030	<0.0010	<0.0010	<0.0010	0.0010	6075555
Total Cobalt (Co)	mg/L	0.22	<0.00030	0.0016	0.00080	0.00075	0.00039	0.00030	6075555
Total Copper (Cu)	mg/L	0.0074	0.0040	0.037	0.0067	0.0073	0.0063	0.00020	6075555
Total Iron (Fe)	mg/L	<0.060	0.072	1.2	<0.060	<0.060	0.17	0.060	6075653
Total Lead (Pb)	mg/L	<0.00020	<0.00020	0.0022	<0.00020	<0.00020	<0.00020	0.00020	6075555
Total Lithium (Li)	mg/L	<0.020	<0.020	<0.020	0.040	0.034	0.037	0.020	6075653
Total Magnesium (Mg)	mg/L	21	13	9.3	74	100	68	0.20	6075653
Total Manganese (Mn)	mg/L	0.076	<0.0040	0.023	0.018	0.0059	0.020	0.0040	6075653
Total Molybdenum (Mo)	mg/L	0.011	0.0013	0.00072	0.0095	0.0027	0.0052	0.00020	6075555
Total Nickel (Ni)	mg/L	0.025	0.0012	0.012	0.0039	0.0042	0.0064	0.00050	6075555
Total Phosphorus (P)	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	6075653
Total Potassium (K)	mg/L	7.0	3.8	4.8	6.7	6.7	8.6	0.30	6075653
Total Selenium (Se)	mg/L	0.00040	<0.00020	<0.00020	0.00053	0.00044	0.0014	0.00020	6075555
Total Silicon (Si)	mg/L	1.9	2.4	5.4	2.3	2.9	3.3	0.10	6075653
Total Silver (Ag)	mg/L	<0.00010	<0.00010	0.00065	<0.00010	<0.00010	0.00012	0.00010	6075555
Total Sodium (Na)	mg/L	41	8.0	7.8	68	31	25	0.50	6075653
Total Strontium (Sr)	mg/L	0.093	0.063	0.060	0.30	0.34	0.22	0.020	6075653
Total Sulphur (S)	mg/L	26	11	1.0	170	220	130	0.20	6075653
Total Thallium (Tl)	mg/L	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	0.00020	6075555
Total Tin (Sn)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	6075555
Total Titanium (Ti)	mg/L	<0.0010	0.0036	0.043	<0.0010	<0.0010	0.0081	0.0010	6075555
Total Uranium (U)	mg/L	0.0053	0.0050	0.0024	0.077	0.15	0.094	0.00010	6075555
Total Vanadium (V)	mg/L	<0.0010	<0.0010	0.0021	<0.0010	<0.0010	<0.0010	0.0010	6075555
Total Zinc (Zn)	mg/L	0.30	0.17	0.16	0.034	0.032	0.26	0.0030	6075555

RDL = Reportable Detection Limit

Maxxam Job #: B270930
Report Date: 2012/08/14

MAXXAM ANALYTICS
Client Project #: MB2C1186

REGULATED METALS (CCME/AT1) - TOTAL

Maxxam ID		EE1731		
Sampling Date				
	UNITS	**DUP-1 (OL3467)**	**RDL**	**QC Batch**
Low Level Elements				
Total Cadmium (Cd)	ug/L	0.044	0.0050	6074963
Elements				
Total Aluminum (Al)	mg/L	0.012	0.0010	6075555
Total Antimony (Sb)	mg/L	<0.00060	0.00060	6075555
Total Arsenic (As)	mg/L	0.00037	0.00020	6075555
Total Barium (Ba)	mg/L	0.040	0.010	6075653
Total Beryllium (Be)	mg/L	<0.0010	0.0010	6075555
Total Boron (B)	mg/L	0.021	0.020	6075653
Total Calcium (Ca)	mg/L	180	0.30	6075653
Total Chromium (Cr)	mg/L	<0.0010	0.0010	6075555
Total Cobalt (Co)	mg/L	0.00067	0.00030	6075555
Total Copper (Cu)	mg/L	0.0068	0.00020	6075555
Total Iron (Fe)	mg/L	<0.060	0.060	6075653
Total Lead (Pb)	mg/L	<0.00020	0.00020	6075555
Total Lithium (Li)	mg/L	0.033	0.020	6075653
Total Magnesium (Mg)	mg/L	100	0.20	6075653
Total Manganese (Mn)	mg/L	0.0060	0.0040	6075653
Total Molybdenum (Mo)	mg/L	0.0026	0.00020	6075555
Total Nickel (Ni)	mg/L	0.0043	0.00050	6075555
Total Phosphorus (P)	mg/L	<0.10	0.10	6075653
Total Potassium (K)	mg/L	6.9	0.30	6075653
Total Selenium (Se)	mg/L	0.00043	0.00020	6075555
Total Silicon (Si)	mg/L	3.0	0.10	6075653
Total Silver (Ag)	mg/L	<0.00010	0.00010	6075555
Total Sodium (Na)	mg/L	31	0.50	6075653
Total Strontium (Sr)	mg/L	0.35	0.020	6075653
Total Sulphur (S)	mg/L	220	0.20	6075653
Total Thallium (Tl)	mg/L	<0.00020	0.00020	6075555
Total Tin (Sn)	mg/L	<0.0010	0.0010	6075555
Total Titanium (Ti)	mg/L	<0.0010	0.0010	6075555
Total Uranium (U)	mg/L	0.15	0.00010	6075555
Total Vanadium (V)	mg/L	<0.0010	0.0010	6075555
Total Zinc (Zn)	mg/L	0.032	0.0030	6075555

RDL = Reportable Detection Limit

Maxxam Job #: B270930
Report Date: 2012/08/14

MAXXAM ANALYTICS
Client Project #: MB2C1186

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		EE1725	EE1726	EE1727	EE1728	EE1729	EE1730		
Sampling Date		2012/08/06	2012/08/06	2012/08/06	2012/08/05	2012/08/05	2012/08/05		
	UNITS	**MW1 (OL3461)**	**MW2 (OL3462)**	**MW3 (OL3463)**	**MW4 (OL3464)**	**MW5 (OL3465)**	**MW6 (OL3466)**	**RDL**	**QC Batch**
Calculated Parameters									
Hardness (CaCO3)	mg/L	240	230	130	600	880	580	0.50	6074965

RDL = Reportable Detection Limit

Maxxam ID		EE1731		
Sampling Date				
	UNITS	**DUP-1 (OL3467)**	**RDL**	**QC Batch**
Calculated Parameters				
Hardness (CaCO3)	mg/L	880	0.50	6074965

RDL = Reportable Detection Limit

Maxxam Job #: B270930
Report Date: 2012/08/14

MAXXAM ANALYTICS
Client Project #: MB2C1186

Package 1	7.0°C

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

General Comments

Results relate only to the items tested.

MAXXAM ANALYTICS
Attention: SUB CONTRACTOR
Client Project #: MB2C1186
P.O. #:
Site Location:

Quality Assurance Report

Maxxam Job Number: CB270930

QA/QC Batch Num	Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	UNITS	QC Limits
6075555	TDB	Matrix Spike	Total Aluminum (Al)	2012/08/14		NC	%	80 - 120
			Total Antimony (Sb)	2012/08/14		109	%	80 - 120
			Total Arsenic (As)	2012/08/14		102	%	80 - 120
			Total Beryllium (Be)	2012/08/14		104	%	80 - 120
			Total Chromium (Cr)	2012/08/14		96	%	80 - 120
			Total Cobalt (Co)	2012/08/14		99	%	80 - 120
			Total Copper (Cu)	2012/08/14		99	%	80 - 120
			Total Lead (Pb)	2012/08/14		99	%	80 - 120
			Total Molybdenum (Mo)	2012/08/14		102	%	80 - 120
			Total Nickel (Ni)	2012/08/14		99	%	80 - 120
			Total Selenium (Se)	2012/08/14		94	%	80 - 120
			Total Silver (Ag)	2012/08/14		103	%	80 - 120
			Total Thallium (Tl)	2012/08/14		94	%	80 - 120
			Total Tin (Sn)	2012/08/14		102	%	80 - 120
			Total Titanium (Ti)	2012/08/14		95	%	80 - 120
			Total Uranium (U)	2012/08/14		96	%	80 - 120
			Total Vanadium (V)	2012/08/14		100	%	80 - 120
			Total Zinc (Zn)	2012/08/14		99	%	80 - 120
		Spiked Blank	Total Aluminum (Al)	2012/08/14		101	%	80 - 120
			Total Antimony (Sb)	2012/08/14		110	%	80 - 120
			Total Arsenic (As)	2012/08/14		103	%	80 - 120
			Total Beryllium (Be)	2012/08/14		99	%	80 - 120
			Total Chromium (Cr)	2012/08/14		99	%	80 - 120
			Total Cobalt (Co)	2012/08/14		100	%	80 - 120
			Total Copper (Cu)	2012/08/14		101	%	80 - 120
			Total Lead (Pb)	2012/08/14		101	%	80 - 120
			Total Molybdenum (Mo)	2012/08/14		104	%	80 - 120
			Total Nickel (Ni)	2012/08/14		100	%	80 - 120
			Total Selenium (Se)	2012/08/14		95	%	80 - 120
			Total Silver (Ag)	2012/08/14		104	%	80 - 120
			Total Thallium (Tl)	2012/08/14		94	%	80 - 120
			Total Tin (Sn)	2012/08/14		111	%	80 - 120
			Total Titanium (Ti)	2012/08/14		96	%	80 - 120
			Total Uranium (U)	2012/08/14		97	%	80 - 120
			Total Vanadium (V)	2012/08/14		101	%	80 - 120
			Total Zinc (Zn)	2012/08/14		112	%	80 - 120
		Method Blank	Total Aluminum (Al)	2012/08/14	0.0014, RDL=0.0010		mg/L	
			Total Antimony (Sb)	2012/08/14	<0.00060		mg/L	
			Total Arsenic (As)	2012/08/14	<0.00020		mg/L	
			Total Beryllium (Be)	2012/08/14	<0.0010		mg/L	
			Total Chromium (Cr)	2012/08/14	<0.0010		mg/L	
			Total Cobalt (Co)	2012/08/14	<0.00030		mg/L	
			Total Copper (Cu)	2012/08/14	<0.00020		mg/L	
			Total Lead (Pb)	2012/08/14	<0.00020		mg/L	
			Total Molybdenum (Mo)	2012/08/14	<0.00020		mg/L	
			Total Nickel (Ni)	2012/08/14	<0.00050		mg/L	
			Total Selenium (Se)	2012/08/14	<0.00020		mg/L	
			Total Silver (Ag)	2012/08/14	<0.00010		mg/L	
			Total Thallium (Tl)	2012/08/14	<0.00020		mg/L	
			Total Tin (Sn)	2012/08/14	<0.0010		mg/L	
			Total Titanium (Ti)	2012/08/14	<0.0010		mg/L	
			Total Uranium (U)	2012/08/14	<0.00010		mg/L	
			Total Vanadium (V)	2012/08/14	<0.0010		mg/L	
			Total Zinc (Zn)	2012/08/14	<0.0030		mg/L	
		RPD	Total Aluminum (Al)	2012/08/14	3.4		%	20

MAXXAM ANALYTICS
Attention: SUB CONTRACTOR
Client Project #: MB2C1186
P.O. #:
Site Location:

Quality Assurance Report (Continued)

Maxxam Job Number: CB270930

QA/QC Batch Num	Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	UNITS	QC Limits
6075555	TDB	RPD	Total Antimony (Sb)	2012/08/14	NC		%	20
			Total Arsenic (As)	2012/08/14	NC		%	20
			Total Beryllium (Be)	2012/08/14	NC		%	20
			Total Chromium (Cr)	2012/08/14	NC		%	20
			Total Cobalt (Co)	2012/08/14	NC		%	20
			Total Copper (Cu)	2012/08/14	4.0		%	20
			Total Lead (Pb)	2012/08/14	NC		%	20
			Total Molybdenum (Mo)	2012/08/14	NC		%	20
			Total Nickel (Ni)	2012/08/14	NC		%	20
			Total Selenium (Se)	2012/08/14	NC		%	20
			Total Silver (Ag)	2012/08/14	NC		%	20
			Total Thallium (Tl)	2012/08/14	NC		%	20
			Total Tin (Sn)	2012/08/14	NC		%	20
			Total Titanium (Ti)	2012/08/14	NC		%	20
			Total Uranium (U)	2012/08/14	NC		%	20
			Total Vanadium (V)	2012/08/14	NC		%	20
			Total Zinc (Zn)	2012/08/14	NC		%	20
6075556	TDB	Matrix Spike	Dissolved Aluminum (Al)	2012/08/14		NC	%	80 - 120
			Dissolved Antimony (Sb)	2012/08/14		87	%	80 - 120
			Dissolved Arsenic (As)	2012/08/14		101	%	80 - 120
			Dissolved Beryllium (Be)	2012/08/14		100	%	80 - 120
			Dissolved Chromium (Cr)	2012/08/14		97	%	80 - 120
			Dissolved Cobalt (Co)	2012/08/14		97	%	80 - 120
			Dissolved Copper (Cu)	2012/08/14		98	%	80 - 120
			Dissolved Lead (Pb)	2012/08/14		95	%	80 - 120
			Dissolved Molybdenum (Mo)	2012/08/14		98	%	80 - 120
			Dissolved Nickel (Ni)	2012/08/14		98	%	80 - 120
			Dissolved Selenium (Se)	2012/08/14		96	%	80 - 120
			Dissolved Silver (Ag)	2012/08/14		103	%	80 - 120
			Dissolved Thallium (Tl)	2012/08/14		91	%	80 - 120
			Dissolved Tin (Sn)	2012/08/14		89	%	80 - 120
			Dissolved Titanium (Ti)	2012/08/14		98	%	80 - 120
			Dissolved Uranium (U)	2012/08/14		94	%	80 - 120
			Dissolved Vanadium (V)	2012/08/14		102	%	80 - 120
			Dissolved Zinc (Zn)	2012/08/14		101	%	80 - 120
		Spiked Blank	Dissolved Aluminum (Al)	2012/08/14		106	%	80 - 120
			Dissolved Antimony (Sb)	2012/08/14		97	%	80 - 120
			Dissolved Arsenic (As)	2012/08/14		102	%	80 - 120
			Dissolved Beryllium (Be)	2012/08/14		100	%	80 - 120
			Dissolved Chromium (Cr)	2012/08/14		100	%	80 - 120
			Dissolved Cobalt (Co)	2012/08/14		101	%	80 - 120
			Dissolved Copper (Cu)	2012/08/14		103	%	80 - 120
			Dissolved Lead (Pb)	2012/08/14		101	%	80 - 120
			Dissolved Molybdenum (Mo)	2012/08/14		100	%	80 - 120
			Dissolved Nickel (Ni)	2012/08/14		102	%	80 - 120
			Dissolved Selenium (Se)	2012/08/14		102	%	80 - 120
			Dissolved Silver (Ag)	2012/08/14		106	%	80 - 120
			Dissolved Thallium (Tl)	2012/08/14		97	%	80 - 120
			Dissolved Tin (Sn)	2012/08/14		102	%	80 - 120
			Dissolved Titanium (Ti)	2012/08/14		94	%	80 - 120
			Dissolved Uranium (U)	2012/08/14		97	%	80 - 120
			Dissolved Vanadium (V)	2012/08/14		102	%	80 - 120
			Dissolved Zinc (Zn)	2012/08/14		106	%	80 - 120
		Method Blank	Dissolved Aluminum (Al)	2012/08/14	<0.0010		mg/L	
			Dissolved Antimony (Sb)	2012/08/14	<0.00060		mg/L	

MAXXAM ANALYTICS
Attention: SUB CONTRACTOR
Client Project #: MB2C1186
P.O. #:
Site Location:

Quality Assurance Report (Continued)

Maxxam Job Number: CB270930

QA/QC Batch Num	Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	UNITS	QC Limits
6075556	TDB	Method Blank	Dissolved Arsenic (As)	2012/08/14	<0.00020		mg/L	
			Dissolved Beryllium (Be)	2012/08/14	<0.0010		mg/L	
			Dissolved Chromium (Cr)	2012/08/14	<0.0010		mg/L	
			Dissolved Cobalt (Co)	2012/08/14	<0.00030		mg/L	
			Dissolved Copper (Cu)	2012/08/14	<0.00020		mg/L	
			Dissolved Lead (Pb)	2012/08/14	<0.00020		mg/L	
			Dissolved Molybdenum (Mo)	2012/08/14	<0.00020		mg/L	
			Dissolved Nickel (Ni)	2012/08/14	<0.00050		mg/L	
			Dissolved Selenium (Se)	2012/08/14	<0.00020		mg/L	
			Dissolved Silver (Ag)	2012/08/14	<0.00010		mg/L	
			Dissolved Thallium (Tl)	2012/08/14	<0.00020		mg/L	
			Dissolved Tin (Sn)	2012/08/14	<0.0010		mg/L	
			Dissolved Titanium (Ti)	2012/08/14	<0.0010		mg/L	
			Dissolved Uranium (U)	2012/08/14	<0.00010		mg/L	
			Dissolved Vanadium (V)	2012/08/14	<0.0010		mg/L	
			Dissolved Zinc (Zn)	2012/08/14	<0.0030		mg/L	
		RPD	Dissolved Aluminum (Al)	2012/08/14	2.9		%	20
			Dissolved Antimony (Sb)	2012/08/14	NC		%	20
			Dissolved Arsenic (As)	2012/08/14	NC		%	20
			Dissolved Beryllium (Be)	2012/08/14	NC		%	20
			Dissolved Chromium (Cr)	2012/08/14	NC		%	20
			Dissolved Cobalt (Co)	2012/08/14	NC		%	20
			Dissolved Copper (Cu)	2012/08/14	2.7		%	20
			Dissolved Lead (Pb)	2012/08/14	NC		%	20
			Dissolved Molybdenum (Mo)	2012/08/14	NC		%	20
			Dissolved Nickel (Ni)	2012/08/14	NC		%	20
			Dissolved Selenium (Se)	2012/08/14	NC		%	20
			Dissolved Silver (Ag)	2012/08/14	NC		%	20
			Dissolved Thallium (Tl)	2012/08/14	NC		%	20
			Dissolved Tin (Sn)	2012/08/14	NC		%	20
			Dissolved Titanium (Ti)	2012/08/14	NC		%	20
			Dissolved Uranium (U)	2012/08/14	NC		%	20
			Dissolved Vanadium (V)	2012/08/14	NC		%	20
			Dissolved Zinc (Zn)	2012/08/14	NC		%	20
6075653	STI	Matrix Spike	Total Barium (Ba)	2012/08/12		94	%	80 - 120
			Total Boron (B)	2012/08/12		103	%	80 - 120
			Total Calcium (Ca)	2012/08/12		101	%	80 - 120
			Total Iron (Fe)	2012/08/12		93	%	80 - 120
			Total Lithium (Li)	2012/08/12		97	%	80 - 120
			Total Magnesium (Mg)	2012/08/12		97	%	80 - 120
			Total Manganese (Mn)	2012/08/12		97	%	80 - 120
			Total Phosphorus (P)	2012/08/12		99	%	80 - 120
			Total Potassium (K)	2012/08/12		98	%	80 - 120
			Total Silicon (Si)	2012/08/12		105	%	80 - 120
			Total Sodium (Na)	2012/08/12		94	%	80 - 120
			Total Strontium (Sr)	2012/08/12		97	%	80 - 120
		Spiked Blank	Total Barium (Ba)	2012/08/12		94	%	80 - 120
			Total Boron (B)	2012/08/12		102	%	80 - 120
			Total Calcium (Ca)	2012/08/12		100	%	80 - 120
			Total Iron (Fe)	2012/08/12		91	%	80 - 120
			Total Lithium (Li)	2012/08/12		97	%	80 - 120
			Total Magnesium (Mg)	2012/08/12		97	%	80 - 120
			Total Manganese (Mn)	2012/08/12		96	%	80 - 120
			Total Phosphorus (P)	2012/08/12		98	%	80 - 120
			Total Potassium (K)	2012/08/12		98	%	80 - 120

MAXXAM ANALYTICS
Attention: SUB CONTRACTOR
Client Project #: MB2C1186
P.O. #:
Site Location:

Quality Assurance Report (Continued)

Maxxam Job Number: CB270930

QA/QC Batch Num	Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	UNITS	QC Limits
6075653	STI	Spiked Blank	Total Silicon (Si)	2012/08/12		104	%	80 - 120
			Total Sodium (Na)	2012/08/12		94	%	80 - 120
			Total Strontium (Sr)	2012/08/12		96	%	80 - 120
		Method Blank	Total Barium (Ba)	2012/08/12	<0.010		mg/L	
			Total Boron (B)	2012/08/12	<0.020		mg/L	
			Total Calcium (Ca)	2012/08/12	<0.30		mg/L	
			Total Iron (Fe)	2012/08/12	<0.060		mg/L	
			Total Lithium (Li)	2012/08/12	<0.020		mg/L	
			Total Magnesium (Mg)	2012/08/12	<0.20		mg/L	
			Total Manganese (Mn)	2012/08/12	<0.0040		mg/L	
			Total Phosphorus (P)	2012/08/12	<0.10		mg/L	
			Total Potassium (K)	2012/08/12	<0.30		mg/L	
			Total Silicon (Si)	2012/08/12	<0.10		mg/L	
			Total Sodium (Na)	2012/08/12	<0.50		mg/L	
			Total Strontium (Sr)	2012/08/12	<0.020		mg/L	
			Total Sulphur (S)	2012/08/12	<0.20		mg/L	
		RPD	Total Barium (Ba)	2012/08/12	NC		%	20
			Total Boron (B)	2012/08/12	NC		%	20
			Total Calcium (Ca)	2012/08/12	NC		%	20
			Total Iron (Fe)	2012/08/12	NC		%	20
			Total Lithium (Li)	2012/08/12	NC		%	20
			Total Magnesium (Mg)	2012/08/12	NC		%	20
			Total Manganese (Mn)	2012/08/12	NC		%	20
			Total Phosphorus (P)	2012/08/12	NC		%	20
			Total Potassium (K)	2012/08/12	NC		%	20
			Total Silicon (Si)	2012/08/12	NC		%	20
			Total Sodium (Na)	2012/08/12	NC		%	20
			Total Strontium (Sr)	2012/08/12	NC		%	20
			Total Sulphur (S)	2012/08/12	NC		%	20
6075655	STI	Matrix Spike	Dissolved Barium (Ba)	2012/08/13		101	%	80 - 120
			Dissolved Boron (B)	2012/08/13		101	%	80 - 120
			Dissolved Calcium (Ca)	2012/08/13		105	%	80 - 120
			Dissolved Iron (Fe)	2012/08/13		99	%	80 - 120
			Dissolved Lithium (Li)	2012/08/13		102	%	80 - 120
			Dissolved Magnesium (Mg)	2012/08/13		102	%	80 - 120
			Dissolved Manganese (Mn)	2012/08/13		100	%	80 - 120
			Dissolved Phosphorus (P)	2012/08/13		102	%	80 - 120
			Dissolved Potassium (K)	2012/08/13		101	%	80 - 120
			Dissolved Silicon (Si)	2012/08/13		92	%	80 - 120
			Dissolved Sodium (Na)	2012/08/13		96	%	80 - 120
			Dissolved Strontium (Sr)	2012/08/13		101	%	80 - 120
		Spiked Blank	Dissolved Barium (Ba)	2012/08/12		96	%	80 - 120
			Dissolved Boron (B)	2012/08/12		96	%	80 - 120
			Dissolved Calcium (Ca)	2012/08/12		101	%	80 - 120
			Dissolved Iron (Fe)	2012/08/12		93	%	80 - 120
			Dissolved Lithium (Li)	2012/08/12		96	%	80 - 120
			Dissolved Magnesium (Mg)	2012/08/12		98	%	80 - 120
			Dissolved Manganese (Mn)	2012/08/12		97	%	80 - 120
			Dissolved Phosphorus (P)	2012/08/12		100	%	80 - 120
			Dissolved Potassium (K)	2012/08/12		98	%	80 - 120
			Dissolved Silicon (Si)	2012/08/12		92	%	80 - 120
			Dissolved Sodium (Na)	2012/08/12		91	%	80 - 120
			Dissolved Strontium (Sr)	2012/08/12		95	%	80 - 120
		Method Blank	Dissolved Barium (Ba)	2012/08/12	<0.010		mg/L	
			Dissolved Boron (B)	2012/08/12	<0.020		mg/L	

MAXXAM ANALYTICS
Attention: SUB CONTRACTOR
Client Project #: MB2C1186
P.O. #:
Site Location:

Quality Assurance Report (Continued)

Maxxam Job Number: CB270930

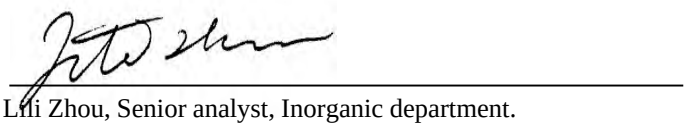
QA/QC Batch Num	Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	UNITS	QC Limits
6075655	STI	Method Blank	Dissolved Calcium (Ca)	2012/08/12	<0.30		mg/L	
			Dissolved Iron (Fe)	2012/08/12	<0.060		mg/L	
			Dissolved Lithium (Li)	2012/08/12	<0.020		mg/L	
			Dissolved Magnesium (Mg)	2012/08/12	<0.20		mg/L	
			Dissolved Manganese (Mn)	2012/08/12	<0.0040		mg/L	
			Dissolved Phosphorus (P)	2012/08/12	<0.10		mg/L	
			Dissolved Potassium (K)	2012/08/12	<0.30		mg/L	
			Dissolved Silicon (Si)	2012/08/12	<0.10		mg/L	
			Dissolved Sodium (Na)	2012/08/12	<0.50		mg/L	
			Dissolved Strontium (Sr)	2012/08/12	<0.020		mg/L	
			Dissolved Sulphur (S)	2012/08/12	<0.20		mg/L	
		RPD	Dissolved Barium (Ba)	2012/08/12	NC		%	20
			Dissolved Boron (B)	2012/08/12	NC		%	20
			Dissolved Calcium (Ca)	2012/08/12	0.3		%	20
			Dissolved Iron (Fe)	2012/08/12	2.3		%	20
			Dissolved Lithium (Li)	2012/08/12	NC		%	20
			Dissolved Magnesium (Mg)	2012/08/12	0.1		%	20
			Dissolved Manganese (Mn)	2012/08/12	NC		%	20
			Dissolved Phosphorus (P)	2012/08/12	NC		%	20
			Dissolved Potassium (K)	2012/08/12	NC		%	20
			Dissolved Silicon (Si)	2012/08/12	NC		%	20
			Dissolved Sodium (Na)	2012/08/12	NC		%	20
			Dissolved Strontium (Sr)	2012/08/12	NC		%	20
			Dissolved Sulphur (S)	2012/08/12	1.7		%	20

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.
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.
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.

Validation Signature Page

Maxxam Job #: B270930

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



Lili Zhou, Senior analyst, Inorganic department.

==========

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.

Your Project #: 1697-1201
Site Location: CAM-F CAM-D ROBERTS BAY DEW LINE
Your C.O.C. #: 36556401, 365564-01-02

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

Report Date: 2012/08/16

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B2C1257
Received: 2012/08/10, 10:30

Sample Matrix: Water
Samples Received: 2

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Method Reference
Petroleum Hydro. CCME F1 & BTEX in Water	2	N/A	2012/08/13	OTT SOP-00002	CCME CWS
Petroleum Hydrocarbons F2-F4 in Water	2	2012/08/13	2012/08/13	OTT SOP-00001	CCME Hydrocarbons
Polychlorinated Biphenyl in Water (1)	2	2012/08/13	2012/08/13	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. Reporting results to two significant figures at the RDL is to permit statistical evaluation and is not intended to be an indication of analytical precision.

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 Job #: B2C1257
Report Date: 2012/08/16

Franz Environmental Inc
Client Project #: 1697-1201
Site Location: CAM-F CAM-D ROBERTS BAY DEW LINE
Sampler Initials: DK

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 #: B2C1257
Report Date: 2012/08/16

Franz Environmental Inc
Client Project #: 1697-1201
Site Location: CAM-F CAM-D ROBERTS BAY DEW LINE
Sampler Initials: DK

POLYCHLORINATED BIPHENYLS BY GC-ECD (WATER)

Maxxam ID		OL3689	OL3690		
Sampling Date		2012/08/07	2012/07/25		
	Units	**FIELD BLANK**	**TRIP BLANK**	**RDL**	**QC Batch**
PCBs					
Aroclor 1016	ug/L	<0.05	<0.05	0.05	2936138
Aroclor 1221	ug/L	<0.05	<0.05	0.05	2936138
Aroclor 1232	ug/L	<0.05	<0.05	0.05	2936138
Aroclor 1242	ug/L	<0.05	<0.05	0.05	2936138
Aroclor 1248	ug/L	<0.05	<0.05	0.05	2936138
Aroclor 1254	ug/L	<0.05	<0.05	0.05	2936138
Aroclor 1260	ug/L	<0.05	<0.05	0.05	2936138
Aroclor 1262	ug/L	<0.05	<0.05	0.05	2936138
Aroclor 1268	ug/L	<0.05	<0.05	0.05	2936138
Total PCB	ug/L	<0.05	<0.05	0.05	2936138
Surrogate Recovery (%)					
Decachlorobiphenyl	%	88	93		2936138

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 #: B2C1257
Report Date: 2012/08/16

Franz Environmental Inc
Client Project #: 1697-1201
Site Location: CAM-F CAM-D ROBERTS BAY DEW LINE
Sampler Initials: DK

O'REG 153 PETROLEUM HYDROCARBONS (WATER)

Maxxam ID		OL3689	OL3690		
Sampling Date		2012/08/07	2012/07/17		
	Units	**FIELD BLANK**	**TRIP BLANK**	**RDL**	**QC Batch**
BTEX & F1 Hydrocarbons					
Benzene	ug/L	<0.20	<0.20	0.20	2936396
Toluene	ug/L	<0.20	<0.20	0.20	2936396
Ethylbenzene	ug/L	<0.20	<0.20	0.20	2936396
o-Xylene	ug/L	<0.20	<0.20	0.20	2936396
p+m-Xylene	ug/L	<0.40	<0.40	0.40	2936396
Total Xylenes	ug/L	<0.40	<0.40	0.40	2936396
F1 (C6-C10)	ug/L	<25	<25	25	2936396
F1 (C6-C10) - BTEX	ug/L	<25	<25	25	2936396
F2-F4 Hydrocarbons					
F2 (C10-C16 Hydrocarbons)	ug/L	<100	<100	100	2936322
F3 (C16-C34 Hydrocarbons)	ug/L	<100	<100	100	2936322
F4 (C34-C50 Hydrocarbons)	ug/L	<100	<100	100	2936322
Reached Baseline at C50	ug/L	YES	YES		2936322
Surrogate Recovery (%)					
1,4-Difluorobenzene	%	104	108		2936396
4-Bromofluorobenzene	%	103	107		2936396
D10-Ethylbenzene	%	103	97		2936396
D4-1,2-Dichloroethane	%	99	102		2936396
o-Terphenyl	%	76	75		2936322

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 #: B2C1257
Report Date: 2012/08/16

Franz Environmental Inc
Client Project #: 1697-1201
Site Location: CAM-F CAM-D ROBERTS BAY DEW LINE
Sampler Initials: DK

Test Summary

Maxxam ID OL3689 **Collected** 2012/08/07
Sample ID FIELD BLANK **Shipped**
Matrix Water **Received** 2012/08/10

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Petroleum Hydro. CCME F1 & BTEX in Wat	HSGC/MSFD	2936396	N/A	2012/08/13	Steve Roberts
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	2936322	2012/08/13	2012/08/13	Lyndsey Hart
Polychlorinated Biphenyl in Water	GC/ECD	2936138	2012/08/13	2012/08/13	Joy Zhang

Maxxam ID OL3690 **Collected** 2012/07/25
Sample ID TRIP BLANK **Shipped**
Matrix Water **Received** 2012/08/10

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Petroleum Hydro. CCME F1 & BTEX in Wat	HSGC/MSFD	2936396	N/A	2012/08/13	Steve Roberts
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	2936322	2012/08/13	2012/08/13	Lyndsey Hart
Polychlorinated Biphenyl in Water	GC/ECD	2936138	2012/08/13	2012/08/13	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 #: B2C1257
Report Date: 2012/08/16

Franz Environmental Inc
Client Project #: 1697-1201
Site Location: CAM-F CAM-D ROBERTS BAY DEW LINE
Sampler Initials: DK

Package 1	4.7°C

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

GENERAL COMMENTS

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 #: B2C1257
Report Date: 2012/08/16

Franz Environmental Inc
Client Project #: 1697-1201
Site Location: CAM-F CAM-D ROBERTS BAY DEW LINE
Sampler Initials: DK

QUALITY ASSURANCE REPORT

			Matrix Spike		Spiked Blank		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	Units	Value (%)	QC Limits
2936138	Decachlorobiphenyl	2012/08/13	119	60 - 130	83	60 - 130	83	%		
2936138	Aroclor 1260	2012/08/13	91	60 - 130	76	60 - 130	<0.05	ug/L	NC	30
2936138	Total PCB	2012/08/13	91	60 - 130	76	60 - 130	<0.05	ug/L	NC	40
2936138	Aroclor 1016	2012/08/13					<0.05	ug/L	NC	40
2936138	Aroclor 1221	2012/08/13					<0.05	ug/L	NC	40
2936138	Aroclor 1232	2012/08/13					<0.05	ug/L	NC	40
2936138	Aroclor 1242	2012/08/13					<0.05	ug/L	NC	30
2936138	Aroclor 1248	2012/08/13					<0.05	ug/L	NC	30
2936138	Aroclor 1254	2012/08/13					<0.05	ug/L	NC	30
2936138	Aroclor 1262	2012/08/13					<0.05	ug/L	NC	40
2936138	Aroclor 1268	2012/08/13					<0.05	ug/L	NC	40
2936322	o-Terphenyl	2012/08/13	71	30 - 130	73	30 - 130	75	%		
2936322	F2 (C10-C16 Hydrocarbons)	2012/08/13	73	50 - 130	81	70 - 130	<100	ug/L	NC	50
2936322	F3 (C16-C34 Hydrocarbons)	2012/08/13	73	50 - 130	81	70 - 130	<100	ug/L	NC	50
2936322	F4 (C34-C50 Hydrocarbons)	2012/08/13	73	50 - 130	81	70 - 130	<100	ug/L	NC	50
2936396	1,4-Difluorobenzene	2012/08/13	106	70 - 130	107	70 - 130	108	%		
2936396	4-Bromofluorobenzene	2012/08/13	101	70 - 130	102	70 - 130	103	%		
2936396	D10-Ethylbenzene	2012/08/13	106	70 - 130	113	70 - 130	105	%		
2936396	D4-1,2-Dichloroethane	2012/08/13	101	70 - 130	101	70 - 130	98	%		
2936396	Benzene	2012/08/13	89	70 - 130	88	70 - 130	<0.20	ug/L	NC	40
2936396	Toluene	2012/08/13	86	70 - 130	84	70 - 130	<0.20	ug/L	NC	40
2936396	Ethylbenzene	2012/08/13	90	70 - 130	93	70 - 130	<0.20	ug/L	NC	40
2936396	o-Xylene	2012/08/13	93	70 - 130	93	70 - 130	<0.20	ug/L	NC	40
2936396	p+m-Xylene	2012/08/13	83	70 - 130	84	70 - 130	<0.40	ug/L	NC	40
2936396	F1 (C6-C10)	2012/08/13	90	70 - 130	98	70 - 130	<25	ug/L	NC	40
2936396	Total Xylenes	2012/08/13					<0.40	ug/L	NC	40
2936396	F1 (C6-C10) - BTEX	2012/08/13					<25	ug/L	NC	40

N/A = Not Applicable
RPD = Relative Percent Difference
Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.
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 (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.

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 #: B2C1257

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

Paul Rubinato, Analyst, Maxxam Analytics

==========

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.

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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 #:	B23655	MAXXAM JOB #:	BOTTLE ORDER #: 365645
Contact Name:	Invoices, Lillian & Kevin	Contact Name:	Kevin McKenna	P.O. #:			
Address:	329 Churchill Ave N Suite 200	Address:		Project #:	1697-1201 (F)		
	Ottawa ON K1Z 5B8			Project Name:	CAM-F DEW Line	CHAIN OF CUSTODY #:	PROJECT MANAGER:
Phone:	(613)721-0555 Fax: (613)721-0029	Phone:	Fax:	Site #:		C#365645-01-01	Julie Clement
Email:	lellis@franzenvironmental.com, invoicesottawa@fra	Email:	kmckenna@franzenvironmental.com	Sampled By:	D.Kus / K.McKenna		

Regulation 153 (2011)

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

Other Regulations

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

SPECIAL INSTRUCTIONS

Samples contained in cooler -4 cooler -5 and cooler -6

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 (< 10°C) FROM TIME OF SAMPLING UNTIL DELIVERY TO MAXXAM

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.
[x]

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

	Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	Regulated Drinking Water ? (Y/N)	Metals Field Filtered ? (Y/N)	F1 & BTEX in water	F2-F4 in water	Polychlorinated Biphenyl in Water	CCME Metals (low Level), dissolved	CCME Metals (low Level), total	pH / Colour, conductivity, Hardness	Conductivity (Major Ions, Nos, NO2, NO3, PO4, SO4)	Hardness	Total Suspended Solids	Total Dissolved Solids	# of Bottles	Comments
1		MW1	12/08/06	PM	GW	N	Y	X	X	X	X	X	X	X		X	X	11	
2		MW2	12/08/06	PM	GW	N	Y	X	X	X	X	X	X	X		X	X	11	
3		MW3	12/08/06	PM	GW	N	Y	X	X	X	X	X	X	X		X	X	10	Limited sample (only single 500mL for PCBs)
4		MW4	12/08/05	PM	GW	N	Y	X	X	X	X	X	X	X		X	X	11	
5		MW5	12/08/05	PM	GW	N	Y	X	X	X	X	X	X	X		X	X	11	
6		MW6	12/08/05	PM	GW	N	Y	X	X	X	X	X	X	X		X	X	11	
7		Dup-1	/	/	GW	N	Y	X	X	X	X	X	X	X		X	X	11	
8																			
9																			
10																			

*RELINQUISHED BY: (Signature/Print)	Date: (YY/MM/DD)	Time:	RECEIVED BY: (Signature/Print)	Date: (YY/MM/DD)	Time:	# Jars Used and Not Submitted
K.McKenna / Kevin McKenna	12/08/08	8:20	Simon Nowaliwga	12/09/08	8:20	

Laboratory Use Only				
Time Sensitive	Temperature (°C) on Receipt	Custody Seal	Yes	No
		Present		
		Intact		

* 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

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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 #:	B23655	MAXXAM JOB #:	BOTTLE ORDER #: 365645
Contact Name:	Invoices, Lillian & Kevin	Contact Name:	Kevin McKenna	P.O. #:			
Address:	329 Churchill Ave N Suite 200	Address:		Project #:	1697-1201		
	Ottawa ON K1Z 5B8			Project Name:	CAM-F, CAM-D, Roberts Bay	CHAIN OF CUSTODY #: C#365645-02-02	PROJECT MANAGER: Julie Clement
Phone:	(613)721-0555 Fax: (613)721-0029	Phone:	Fax:	Site #:			
Email:	lellis@franzenvironmental.com, invoicesottawa@fra	Email:	kmckenna@franzenvironmental.com	Sampled By:	D.Kuc/K. McKenna		

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

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

SPECIAL INSTRUCTIONS: SAMPLES contained in cooler-1

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 (< 10°C) FROM TIME OF SAMPLING UNTIL DELIVERY TO MAXXAM

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 #)*

	Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	Regulated Drinking Water ? (Y/N)	Metals Field Filtered ? (Y/N)	Major Ions: NO2, NO3, Cl, PO4, SO4, F	F1/BTEX	F2-F4	PCB's	Dissolved Metals	Total Metals					# of Bottles	Comments
1		Field Blank	12/08/07	PM	H_2O		N	X	X	X	X	X	X					9	
2		TRIP BLANK	*See Note	/	H_2O		N	X	X	X	X	X	X					9	
3											Note:								
4											* TRIP BLANK DATES:								
5											F1/BTEX: 2012/07/17								
6											F2-F4: 2012/07/25								
7											PCBs: 2012/07/25								
8											Dissolved Metals: 2012/07/25								
9											Total Metals: 2012/07/25								
10																			

*RELINQUISHED BY: (Signature/Print)	Date: (YY/MM/DD)	Time:	RECEIVED BY: (Signature/Print)	Date: (YY/MM/DD)	Time:	# Jars Used and Not Submitted
Kevin McKenna / K McK	12/08/08	8:15	Simran Nirwal Maxxam S.N.	12/08/08	9:15	

Laboratory Use Only				
Time Sensitive	Temperature (°C) on Receipt	Custody Seal	Yes	No
		Present		
		Intact		

*** 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

APPENDIX F

QA/QC Discussion

In order to obtain the required minimum of 20% duplicate samples, as stipulated in Long-Term Monitoring Plan, one duplicate groundwater sample was collected at the site in 2012. Analytical results for submitted samples and the duplicate pair 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 samples analyzed for PHCs, metals, PCBs and inorganic parameters fell within limits of QA/QC acceptability.

Both field and travel blanks were submitted to the laboratory for analysis; no parameters were detected in these samples, supporting the validity of results for the other groundwater samples analyzed. Results for the QA/QC blanks are provided in Appendix E.

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 G

Field Notes

1697-1201 CAM-F Aug 3 2012

10:50pm: GFA Predicts Patchy clouds 2000-16,000 ft Lists Rain/Drizzle/Mist for Flight into Hall Beach.

- Weather office Predicts 4.4°C 90% Showers
- Weather Network Predicts Possible delay due to mixed Precip. in H.B.

→ Good Prob. for CAM-F

Site access Sat & Sun. Weak Low Pressure Syst moving @ 5 Kts. Vis. P6SM, Cleaning.

Aug 4 2012

Wheels up @ 9:15 AM

Weather 5°C in Iqaluit Mostly cloudy Flight time to Hall Beach est. 3 hrs.

Upon landing in Hall Beach:

1. Refuel Aircraft
2. Gasoline for Generator.
3. Drop Oversuit & sweater to Mall Akavak
4. Call Gjoa Haven Inns North to Inform Not staying there tonight
5. Call Gjoa Haven HTA William to inform (867) 360 6028
6. Hall Beach HTA for BM? (867) 928 8994

LEVEL

Proj # 1697-1201 CAM-F Aug 5 2012

Touch down HB @ 12:08 pm. Meet Book

Refuel & Take off @ 1:15 pm @ gate

Land CAM-F @ 2:05 pm @ 800

- Charlotte Lamontagne / Allison Dunn, AANDC
- Dave Kiar / Kevin McKenna, FRANZ
- Simon Noaluk, Nunatta David Irqittuk, HB. HTO

CAM-F - VT01 SN 07060039

Casing dented, locked

Resistance Test (Main 11.34V) Memory 38%

Aux 13.26V Batt lost before 13/08/M

Read	Measured Ω	
1	10.331	· Downloaded all data
2	12.488	& Communication Error
3	14.641	Change Com Port Setting
4	16.478	to wait for Synchronization
5	17.433	code & wait for end of
6	18.408	Packet marker → RAW
7	19.336	dwnld successful
8	20.37	· Complete Memory Transfer
9	21.39	Successful
10	22.37	· Backed up to external
11	23.16	memory
12	103.11	· Memory cleared

Changed Config to Stop when Memory full 12/21/14

Restarted Mem 0%

calced @ 867 days

CAM-F

1697-1201

VT02 Serial # 09100147 Aug 5 2012

Read #	Ω	Batts
1	15.786	Main: 11.34 (Best)
2	16.458	Aux: 12.41 (Good)*
3	17.764	Memory 38%
4	18.749	Clock 00:18
5	20.05	Date 08/06/12
6	21.21	Error on download
7	22.19	Δ Com Setting to 3 time
8	23.16	and 3 retries on error
9	23.97	checked wait for sync
10	24.68	checked wait for end of Packet
11	25.56	OK - download successful
12	25.13	Updated Programming to
13	1161 F	Stop Collecting data when memory full
		· Set datalogger Clock
		Date when full 12/21/14

* Changed Aux Batt New Expiry July 2017

LEVEL

CAM-F 1697-1201

VT03 SN 05070006 Aug 6 2012

Board #	Ω
1	15.708
2	16.738
3	17.725
4	18.78
5	20.16
6	21.25
7	22.29
8	23.07
9	23.87
10	24.54
11	24.93
12	25.41
13	120.48

Batteries: Memory
Main: 11.34 (Best) 38 %
Aux: 13.38 V (Best)
Clock 00:19
DATE 08/06/12
- Reset Clock to current time
- Changed Program to stop when memory full
- Had to set Direct communication as for other loggers to complete download - (getting errors)
- Restart datalogger. Full time calculated @ 12/21/14

CAM-F 1697+1201

VT04 SN

Ω

Aug 5 2012

1	
2	10.027
3	11.913
4	13.692
5	15.171
6	16.571
7	17.679
8	18.622
9	19.743
10	20.75
11	21.62
12	22.37
	121.85

Batts: Volts Memory
Main: 11.34 (Best) 38 %
Aux: 13.38 (Best)
Time: 1:25
Date: 08/06/12
- Set Clock to Current time
- Same Protocol to download
- Change Direct Communication Settings from default
- ✓ Wait for Sync
- ✓ Wait for end Packet

4PM

Change Prog. to Stop when Memory Full
Calculated Memory Full 12/21/14

Wheels up and out of CAMF day 1 @ 9PM
- then water down to 12AM

LEVEL

10°C Part. Cloud CAM-F Aug 6 2012

Depart Hall Beach 9:45 AM

- Charlotte Lamontagne / Allison Dunn, AANDC
- David Kiis / Kevin McKenna, Fronz
- Simon Nadluk, Nunatta Env.
- David Ingittuk, H.B. HTO

Land @ 10:15

Thermistor Datalogger Re-installation

Analog Channel	VT 03	VT 02	VT 01	VT 04
1	0.8279	10.2786	9.8577	0.7724
2	-0.4328	5.7104	5.1714	-0.4151
3	-1.5098	3.4343	2.3109	-1.5380
4	-2.6017	1.4524	-0.0977	-2.6017
5	-3.9326	-0.4328	1.2461	-3.893
6	-4.9719	-1.6816	-2.1652	-4.9719
7	-5.8789	-2.3949	-3.1416	-5.8304
8	-6.6286	-3.2081	-4.1755	-6.6532
9	-7.2687	-4.5926	-5.1396	-7.3953
10	-7.7683	-4.9320	-6.0217	-7.9015
11	-8.3253	-6.3950	-6.7403	-8.6424
12	-8.5131	—	—	-8.3561
13	—	—	—	—
Main	11.34 V	11.34 V	11.34 V	11.34
Aux	13.38 V	12.41	13.26 V	13.38
Casing	Locked	Locked	Locked	Locked

1697-1201 CAM-F Aug 6 2012

4:08 PM Departure to Hall Beach.

Wildlife Observed on site.

Birds
- Raven
- Piping Plover like movement black Ring around Neck
- Snow Geese Flying overhead
- Some Caribou N/years old
- Siksiks

Other signs of wildlife:
- Snow Geese lots of droppings
- Lots of Caribou tracks around SSDF & NHWL

Vegetation: SSDF - South and East berms slopes showed sparse veg. growth about 1/2 way up the berm

NHWL: No significant Veg. observed on LF. Some sparse Veg observed in wetted area surrounding LF especially on east side. Near MW installation.

NHWL Feature & settlement not observed.

LEVEL

Aug 5/2012
1697-1201 (F)

CAM-F Monitoring at SSDF Landfill

- Ground water monitoring and sampling of the 3 wells around SSDF LandFill (MW4, MW5, MW6)

- Low flow sampling Procedures:
- Heron Instruments interface Meter
- Peristaltic Pump
- Horriba Multi-parameter instrument

sample parameters:
PHC F2-F4
BTEX, PHC F1
PCBs
Total metals
Dissolved metals
Gen Chem / solids

Aug 5/2012 1697-1201 (F)

CAM-F Monitoring

SSDF Landfill

~~MW6~~ MW6

OVM : 0 ppm

stickup : 0.72 m

WL : 0.929 m below TOC

PL : —

BOW : 1.87

comments : well in good condition

no sediments at base.

started pumping at 3:30.

- pumping @ ~ 100-150 mL/min

Time	Temp	pH	cond	DO	salinity	WL
3:35	9.11	7.64	1.36	10.61	0.7	1.039
3:37	4.99	7.42	1.61	10.72	0.8	1.051
3:41	4.82	7.51	1.50	9.52	0.7	1.059
3:45	5.03	7.52	1.40	8.66	0.7	1.069
3:50	4.92	7.49	1.26	7.86	0.6	1.083
3:54	4.88	7.47	1.21	7.50	0.6	1.095
3:58	4.62	7.47	1.19	6.94	0.6	1.111
4:02	4.65	7.47	1.18	6.46	0.6	1.129

Parameters suf. stable at 4:03

Sampling well at 4:05

- PCBs (2x 500mL)
- PHCs F2-F4 (2x500mL)
- BTEX F1 (3x40 mL
- Total metals (1x 200mL
- Dissolved metals (1x 200mL
- Gen Chem (1x 500mL
- solids (1x 500mL)

(same parameters as MW6)

Aug 5/2012 1697-1201 (F)

CAM-F Monitoring

MW5 SSDF Landfill

OVM : 0 ppm

stickup : 0.67m

WL : 0.901

PL : n/a

BOW : 1.765

comments : Well in good condition

- No sediments at base

- started pumping @ ~ 5:00

- pumping @ ~ 100-200 mL/min

Time	Temp (°C)	DO	Cond	Salinity	WL	PH
~~5:03~~	~~3.91~~	~~7.36~~	~~2.02~~			
5:04	3.78	6.38	2.00	1.0	0.989	7.39
5:08	3.99	6.72	1.89	0.9	1.019	7.43
5:13	4.04	6.93	1.78	0.9	1.029	7.54
5:17	4.11	6.92	1.77	0.9	1.041	7.52
5:23	4.15	6.93	1.74	0.9	1.050	7.53

- parameters stabilised @ ~ 5:25

- sampled well at ~ 5:35

- collected Duplicate Sample

Dup - 1"

Rite in the Rain

1697-120 (F)
Aug 5/2012

LAM-F Monitoring
SSDF Landfill

MW4

dVM: 0 ppm
stickup: ~~0.368~~ ~~1.5~~ 0.52 m
WL: 0.368 mbtoc
PL: /
BOW: 1.575
Comments: well is in good condition
- No sediment at base of well
- started pumping @ ~ 7:15
- pumping @ ~ 150-200mL/min

Time	Temp	pH	Cond.	DO	~~Salinity~~	WL
7:18	10.29	7.51	1.45	2.43	0.7	0.609
7:22	8.30	7.61	1.43	1.86	0.7	0.765
7:28	8.55	7.62	1.43	1.70	0.7	0.849
7:32	8.56	7.60	1.42	1.54	0.70	0.882
7:36	8.35	7.60	1.41	1.41	0.70	0.929
7:40	7.90	7.58	1.41	1.36	0.70	0.971

- parameters sufficiently stabilised
sampled well @ ~ 7:45
(same parameters as MW6)

Rite in the Rain

Aug 6/2012
1697-1201 (f)

CAM-F monitoring
Non-Haz Landfill

MW 1

OVM: 0ppm (open to atmosphere)
stickup: 0.16 m
WL: 1.003m
PL: —
BOW: 1.770m
Comments: Well in good condition; No cap on well pipe (monument still covers well regardless)

MW 2

OVM: 0ppm (open to atmosphere)
stickup: 0.7m
WL: 1.072m
PL: —
BOW: 1.885m
Comments: Well in good condition; No cap on well pipe (monument still covers well regardless)

Aug 6/2012
1697-1201 (f)

CAM-F monitoring
Non-Haz Landfill

MW 3

OVM: 0 ppm
stickup: 0.63m
WL: 1.545m
PL: —
BOW: 2.445m
Comments: Well in good condition.

Sampling of wells in Next pages →

Aug 6/2012
1697-1201 (F)

CAM-F Monitoring
Non Haz Landfill

- GW Sampling

MW 1

- started pumping @ 11:48
- pumping @ ~ 150-200 mL/min

Time	Temp	pH	Cond	DO	Salinity	WL
11:50	11.33	8.64	0.659	9.37	0.3	1.145m
11:54	10.69	8.48	0.655	8.16	0.3	1.195m
11:58	10.13	8.58	0.639	7.92	0.3	1.235m
12:02	9.75	8.61	0.621	7.53	0.3	1.251m
12:06	9.61	8.54	0.628	7.53	0.3	1.246m
12:10	9.60	8.46	0.617	7.55	0.3	1.249m
12:14	9.65	8.39	0.602	7.41	0.3	1.259m

parameters sufficiently stabilised;
Sampled well @ 12:15
(same parameters as Aug 5 wells)

Aug 6/2012
1697-1201 (F)

CAM-F Monitoring
Non Haz Landfill

GW Sampling

MW 3

- started Pumping @ ~ 1:15
- pumping @ ~ 160-200 mL/min

Time	Temp	pH	Cond	DO	Salinity	WL
1:20	10.98	8.25	0.237	10.11	0.1	1.693
1:24	11.01	8.09	0.230	7.52	0.1	1.775
1:28	6.85	7.88	0.272	9.14	0.1	1.854
1:32	6.13	7.84	0.283	9.19	0.1	1.925
1:36	6.09	7.82	0.294	9.19	0.1	2.001

Parameters sufficiently stabilized.
Sample well at 1:38 pm.
(same parameters as Aug 5 wells)

Aug 6/2012
1697-1201 (f)

CAM-F Monitoring
Non Haz Landfill

GW Sampling

MW2

- started pumping @ 2:05
- pumping @ ~100-200 mL/min

Time	Temp	pH	Cond	DO	~~turb~~ salinity	WL
2:14	11.71	7.80	0.419	7.41	0.2	1.078
2:18	11.53	7.72	0.422	6.62	0.2	1.079
2:22	11.11	7.68	0.420	6.45	0.2	1.079
2:26	10.94	7.62	0.424	6.40	0.2	1.079
2:30	10.78	7.53	0.416	6.24	0.2	1.079

Parameters sufficiently stable
Sample well at 2:32pm

(same parameters as Aug 5 wells)

APPENDIX H

Thermistor Data

Table H-1: Thermistor Annual Maintenance Report

Contractor name: Franz Environmental Inc.	**Inspection date:** August 5-6, 2012
Prepared by: Kevin McKenna	

Thermistor Information

Thermistor Number	CAMF 01-VT	CAMF 02-VT	CAMF 03-VT	CAMF 04-VT
Install date	2007-09-21	2007-09-19	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 16 channel RX 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
Memory Used	38%	38%	38%	38%
Battery installation date	2012-08-06	2012-08-06	2012-08-06	2012-08-06
Main battery (V) On Aug 6/12	11.34	11.34	11.34	11.34
Aux battery (V) On Aug 6/12	13.26	12.41	13.26	13.38

Observations and proposed maintenance

- Two fresh desiccant cartridges should be installed in each datalogger at every site visit.
- Main and Auxiliary batteries in each datalogger need to be replaced during the next site visit (FY 2014-2015).
- Dataloggers also contain a small coin cell battery that is soldered to the main circuit board of the datalogger units. This battery provides data backup in the event of Main and Auxiliary battery failure. Data gaps were observed at 02-VT; this could be the result of depleted coin cell battery. Lakewood recommends replacing coin cell batteries every 5 years. Coin cell battery replacement is not practical in the field, at worst it would need to be done at the accommodations in Hall Beach, at best it should be done by Lakewood Systems in Edmonton.
- Prolog software calculated approximately 867 days of memory capacity, at the programmed 12hr logging frequency; therefore, datalogger memories will be full on December 21, 2014. Memory capacity will not be an issue for the next round of monitoring as the next site visit scheduled for August 2014. However, the datalogger programs must be amended to reduce the frequency of temperature recordings during the August 2014 site visit. Reduction from a 12 hr recording frequency to a 24 hr frequency is proposed to ensure the dataloggers continue to record temperature data until the following site visit in August of 2017.

Table H-2: Manual Thermistor Readings

Analog Channel		Thermistor R (Ohms)	Temperature (ºC)		
			Manual	Logged	Difference
VT01	1	10331	9.2218	10.0629	0.8
	2	12488	5.3521	5.1016	0.3
	3	14641	2.1761	2.2332	0.1
	4	16478	-0.1443	-0.1205	0.0
	5	17433	-1.2386	-1.2461	0.0
	6	18408	-2.2886	-2.2322	0.1
	7	19336	-3.2316	-3.2119	0.0
	8	20370	-4.2245	-4.2334	0.0
	9	21390	-5.1502	-5.1876	0.0
	10	22370	-5.9943	-6.0514	0.1
	11	23160	-6.6451	-6.7622	0.1
		maximum	--	--	***0.8***
VT02	1	10027	9.8398	10.5197	0.7
	2	11916	6.3004	5.6904	0.6
	3	13692	3.5066	3.4493	0.1
	4	15171	1.4745	1.3896	0.1
	5	16571	-0.2539	-0.3541	0.1
	6	17679	-1.5096	-1.5995	0.1
	7	18622	-2.5107	-2.625	0.1
	8	19743	-3.6294	-3.771	0.1
	9	20750	-4.5753	-4.7197	0.1
	10	21620	-5.3521	-5.5405	0.2
	11	22370	-5.9943	-6.2243	0.2
		maximum	--	--	***0.7***
VT03	1	15708	0.7911	0.8052	0.0
	2	16738	-0.4491	-0.3947	0.1
	3	17725	-1.5598	-1.5585	0.0
	4	18780	-2.6729	-2.6406	0.0
	5	20160	-4.0275	-4.0019	0.0
	6	21250	-5.0261	-5.0171	0.0
	7	22290	-5.9269	-5.9381	0.0
	8	23070	-6.5722	-6.6749	0.1
	9	23870	-7.2093	-7.31	0.1
	10	24540	-7.7247	-7.8571	0.1
	11	24930	-8.0175	-8.2358	0.2
	12	25410	-8.3710	-8.5777	0.2
		maximum	--	--	***0.2***
VT04	1	15786	0.6941	0.7598	0.1
	2	16458	-0.1206	-0.0445	0.1
	3	17764	-1.6022	-1.579	0.0
	4	18749	-2.6412	-2.6043	0.0
	5	20050	-3.9234	-3.8969	0.0
	6	21210	-4.9905	-4.9905	0.0
	7	22190	-5.8424	-5.8789	0.0
	8	23160	-6.6451	-6.7294	0.1
	9	23970	-7.2872	-7.4146	0.1
	10	24680	-7.8304	-7.9627	0.1
	11	25500	-8.4364	-8.6846	0.2
	12	25130	-8.1657	-8.3813	0.2
		maximum	--	--	***0.2***

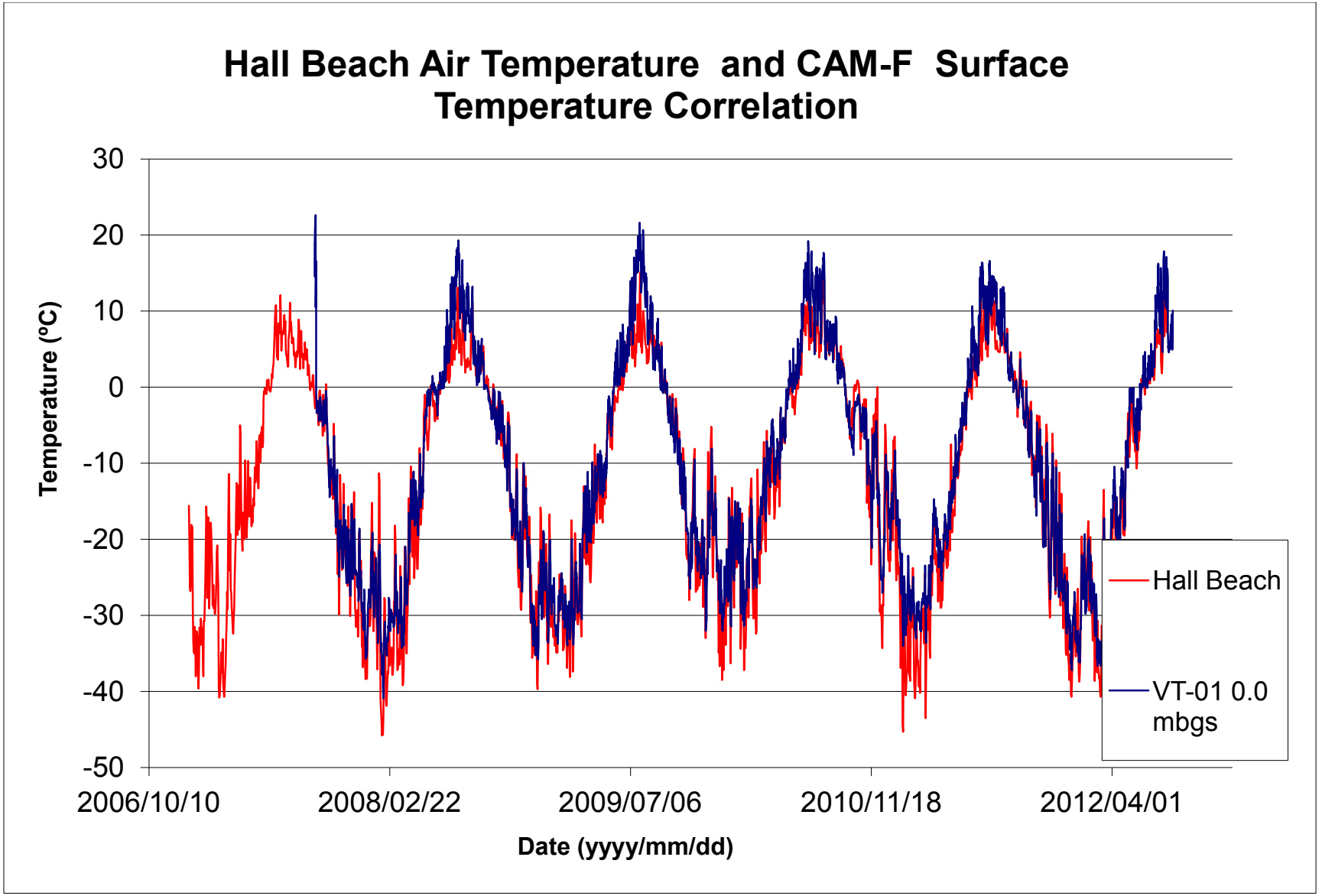


Figure H- 1: Hall Beach weather station daily air temperature data plotted with daily temperatures at the surface of the SSDF at VT-01.

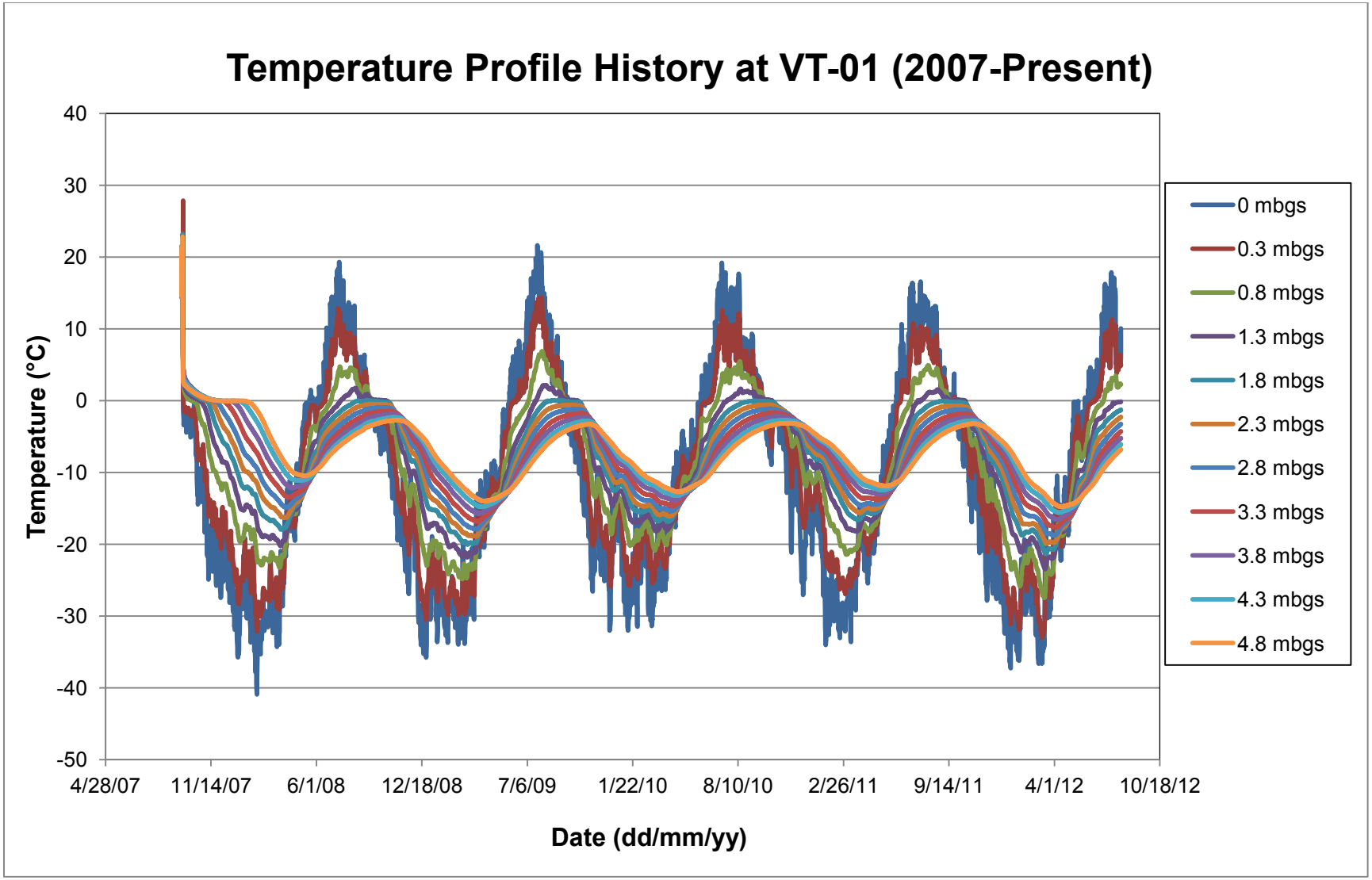


Figure H- 2: Full historical temperature record of thermistor VT-01 from installation to present.

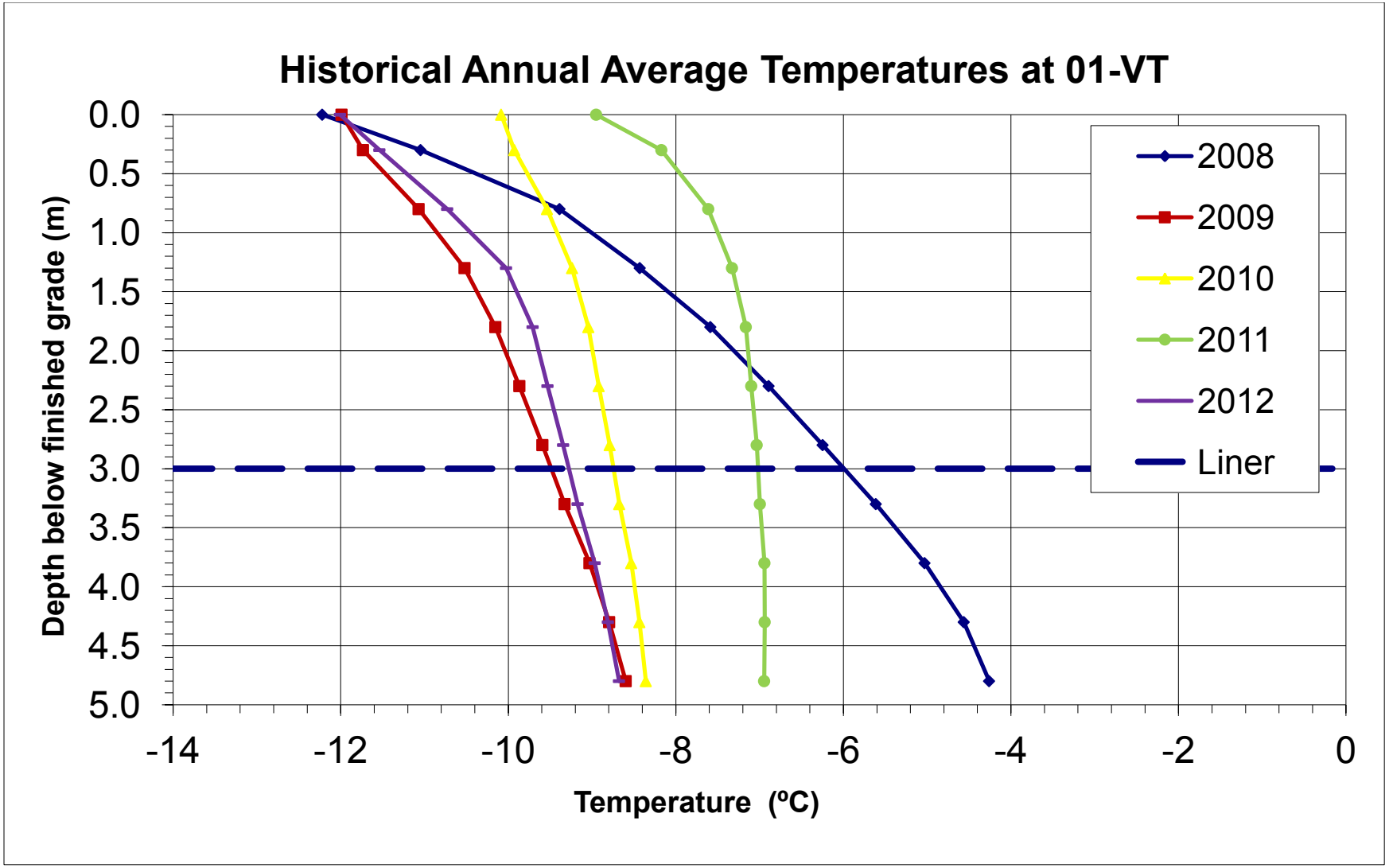


Figure H- 3: Historical Annual Average Temperatures for thermistor 01-VT.

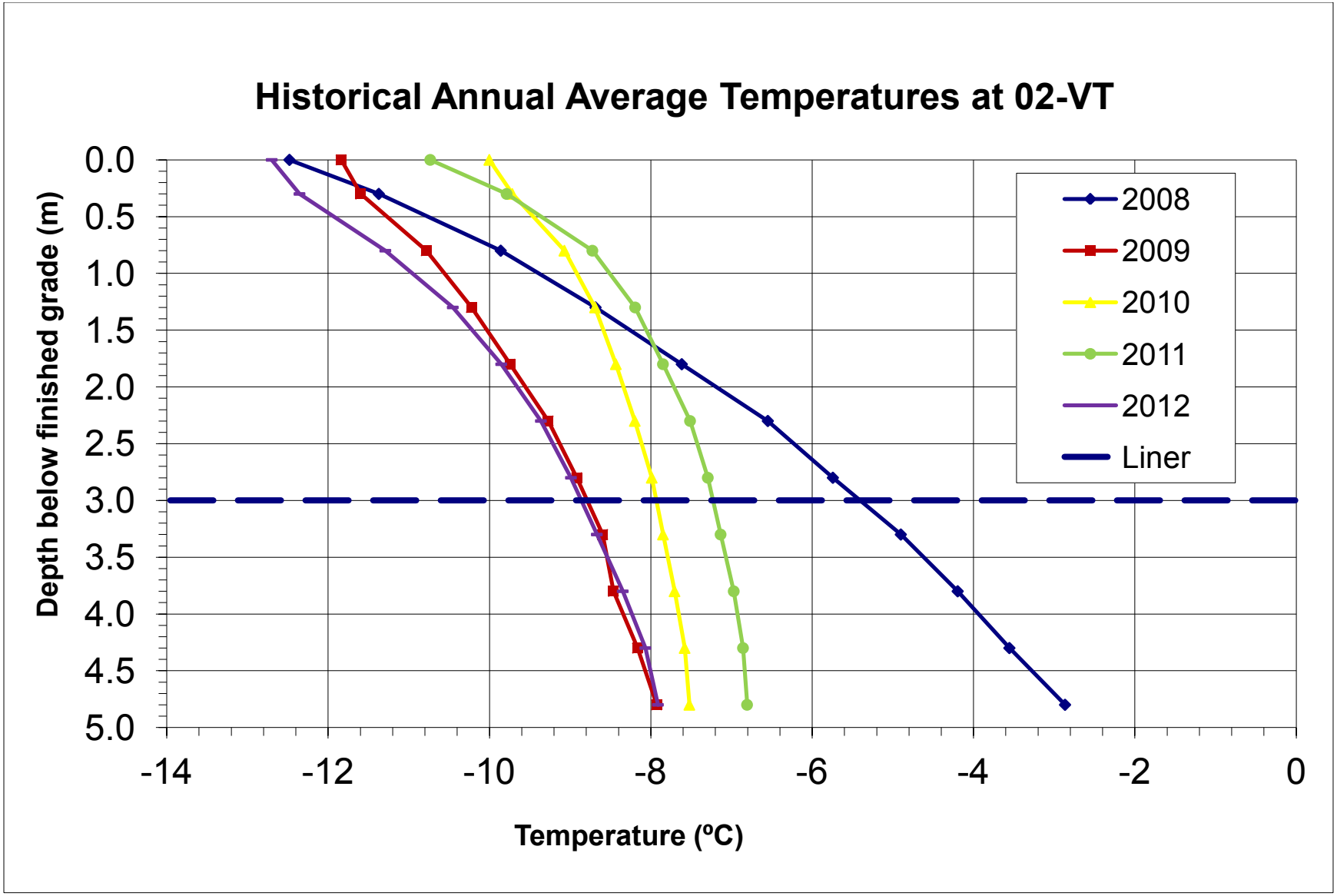


Figure H- 4: Historical Annual Average Temperatures at Thermistor Installation 02-VT

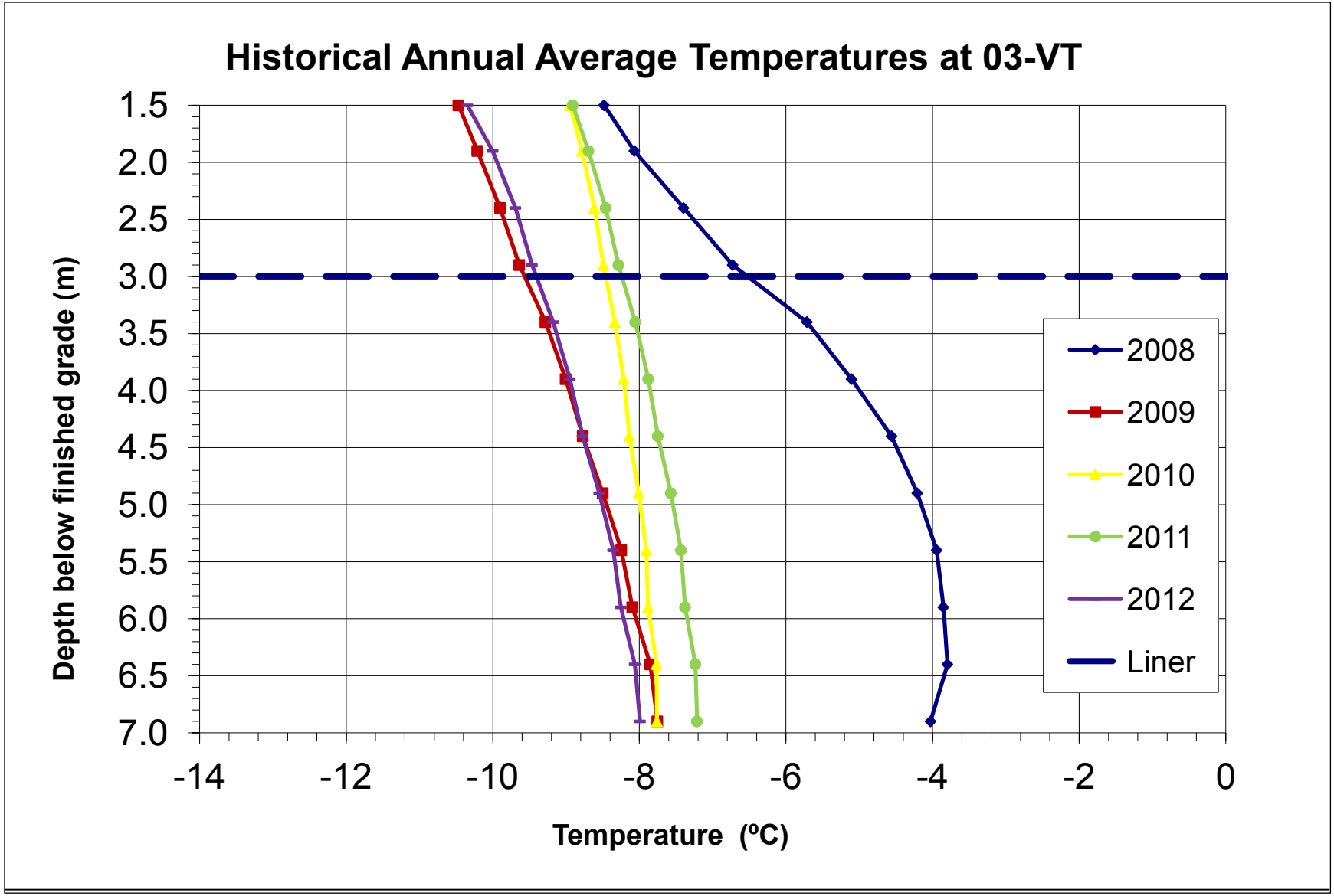


Figure H- 5: Historical Annual Average Temperatures at Thermistor Installation 03-VT

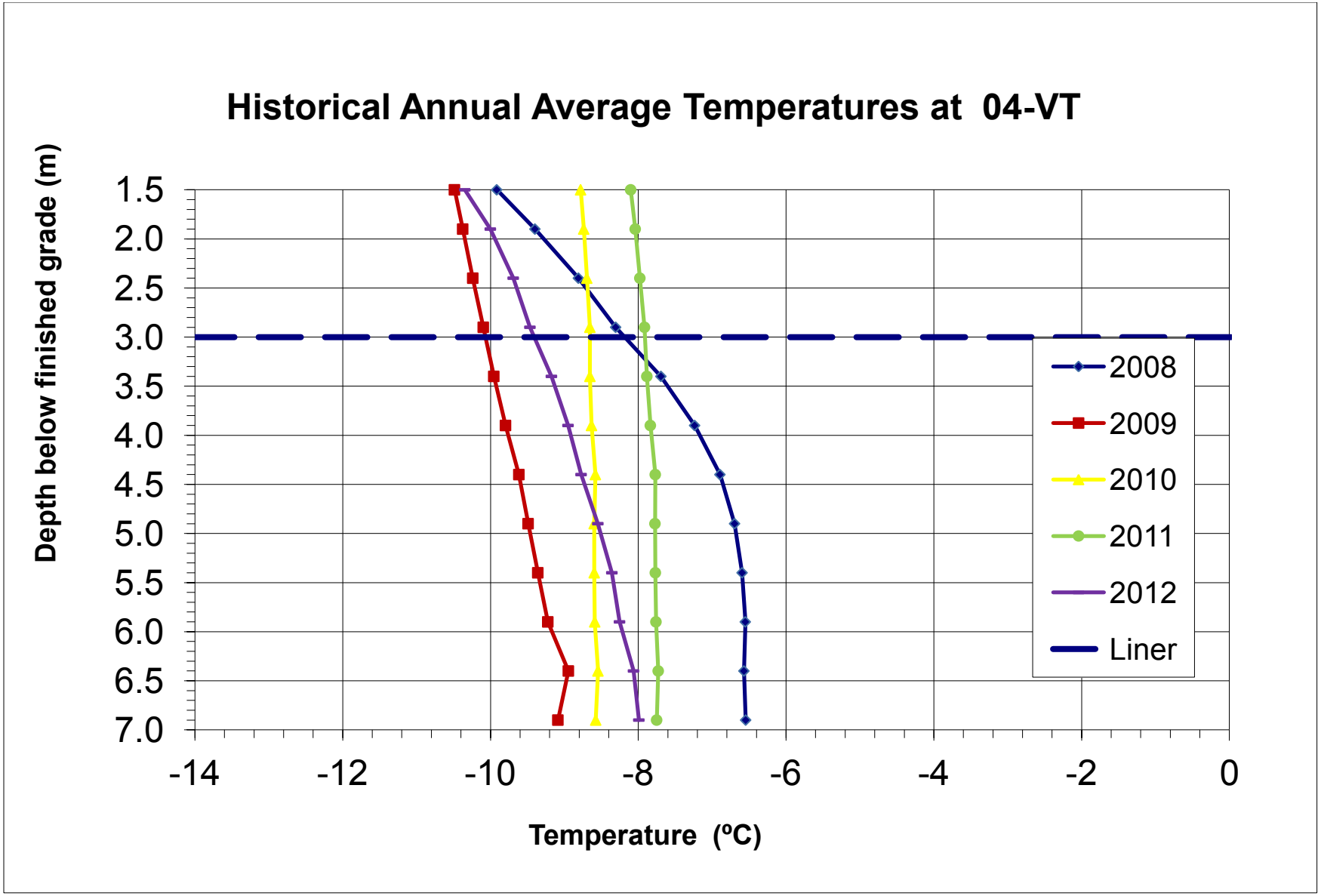
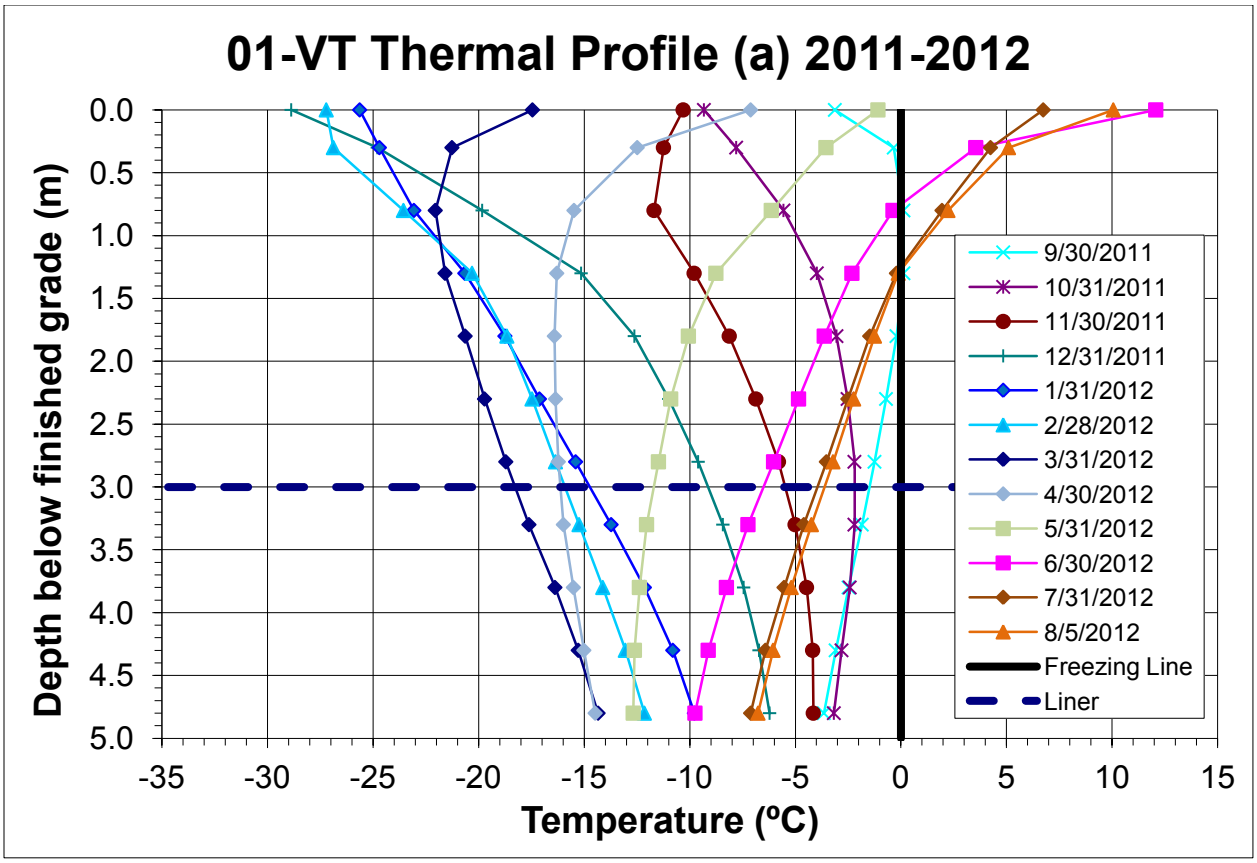


Figure H- 6: Historical Annual Average Temperatures at thermistor installation 04-VT



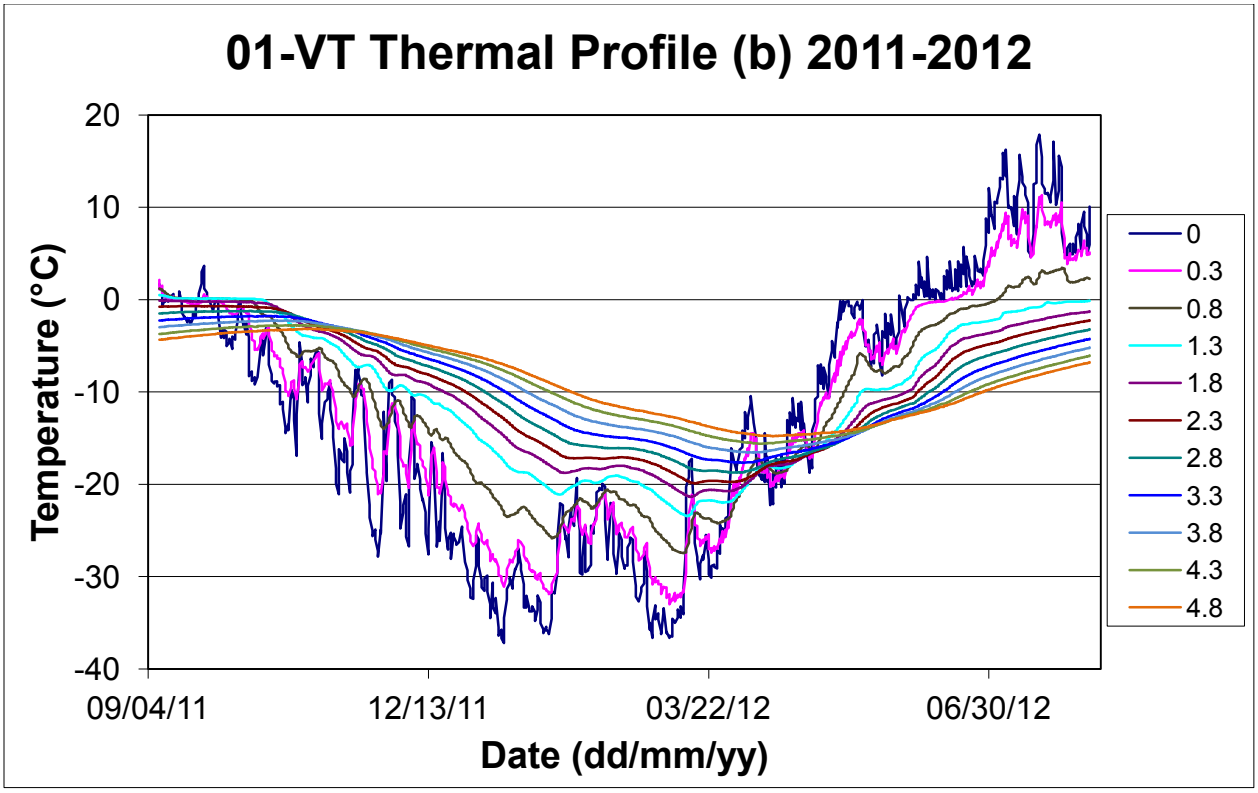
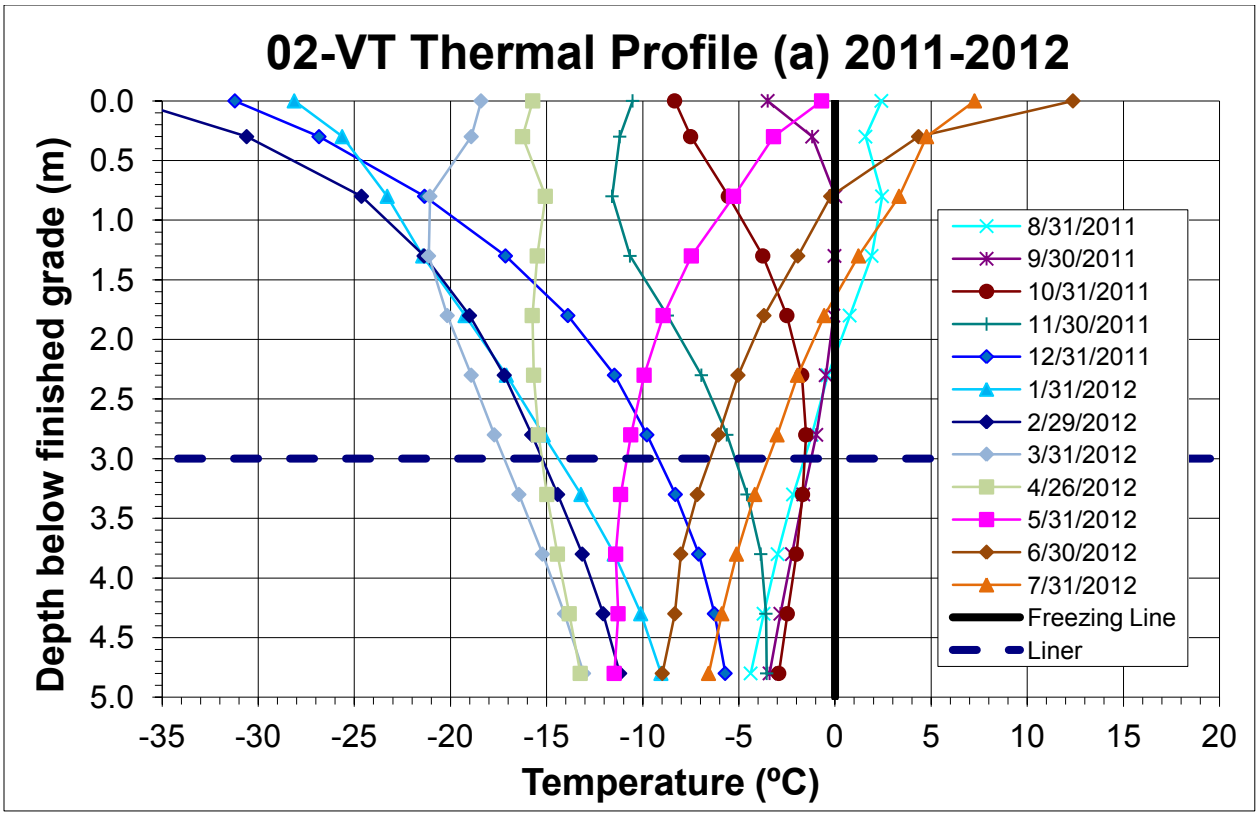


Figure H- 7: Thermal Profiles at 01-VT for 2011-2012: (a) monthly data (last day of the month) (b) full year record



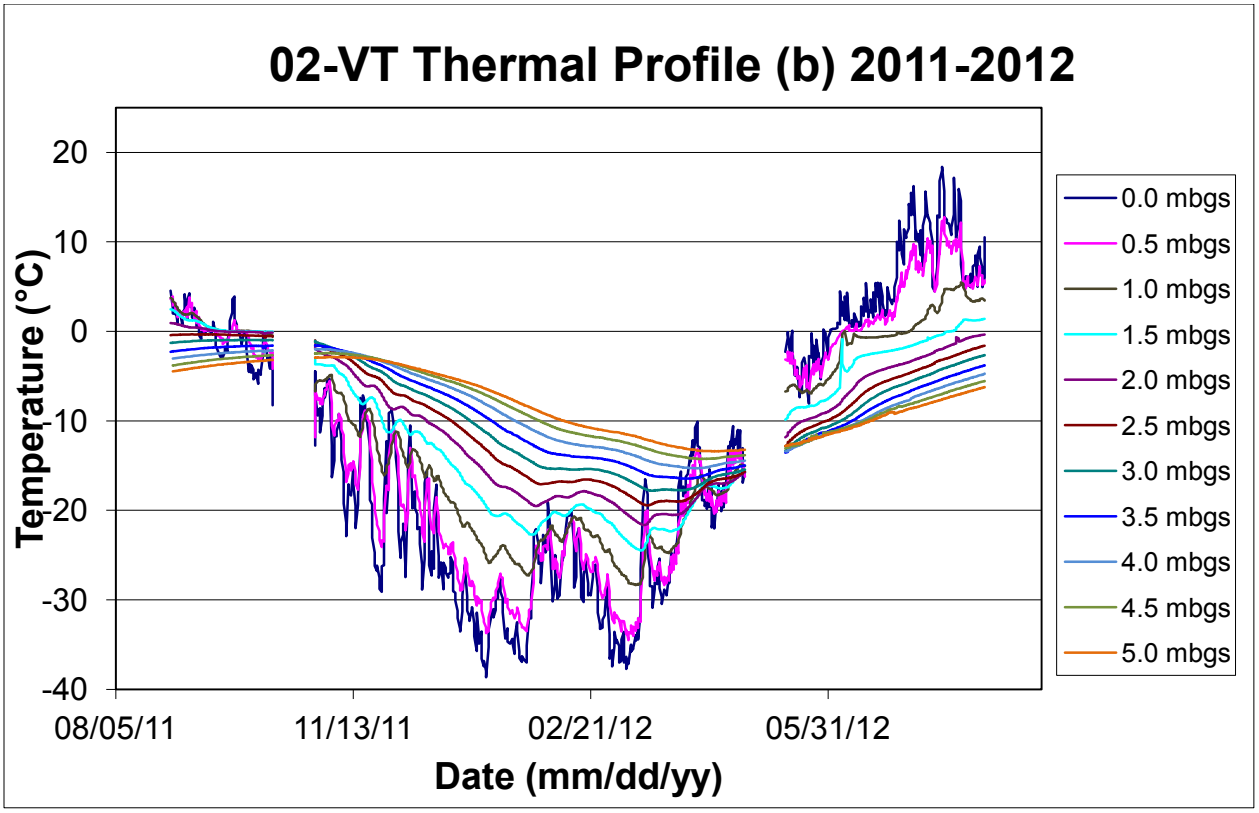
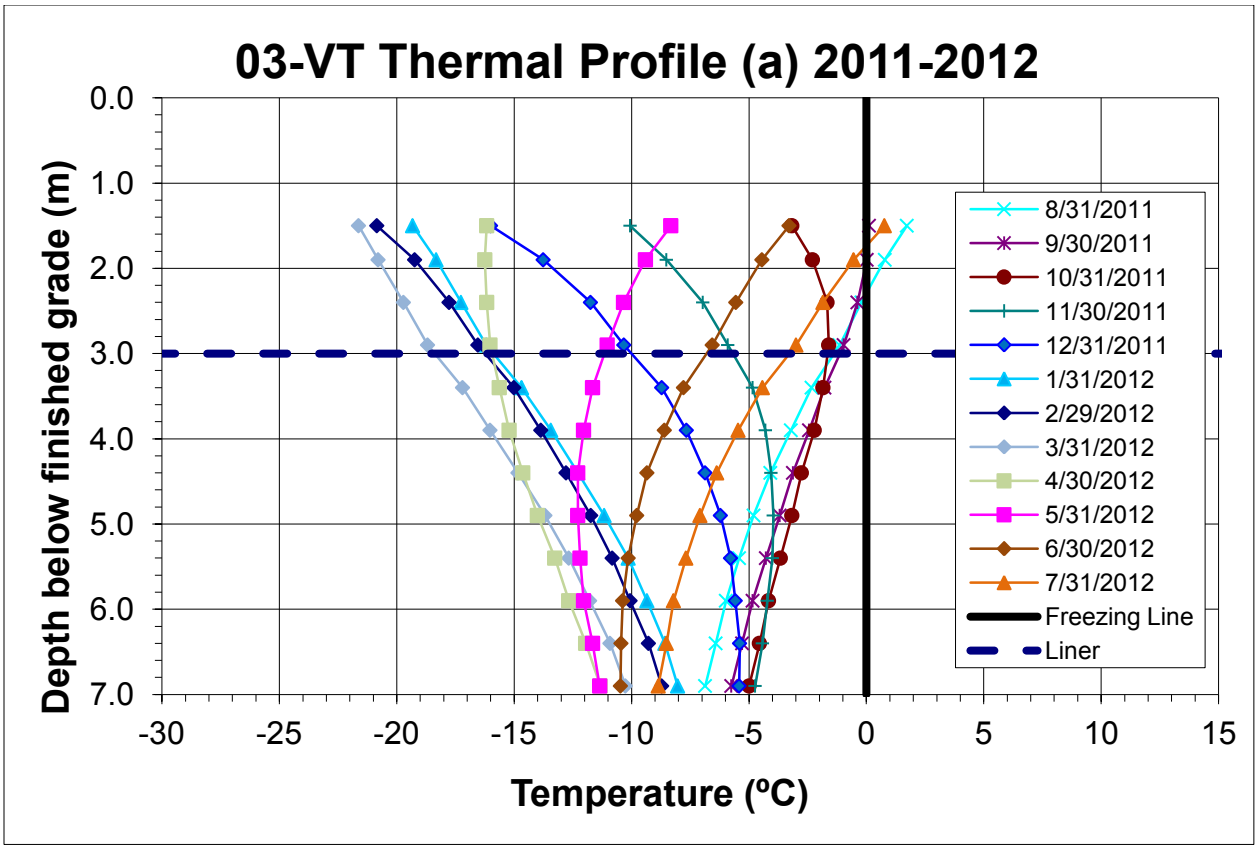


Figure H- 8: Profiles at 02-VT for 2011-2012: (a) monthly data (last day of the month) (b) full year record



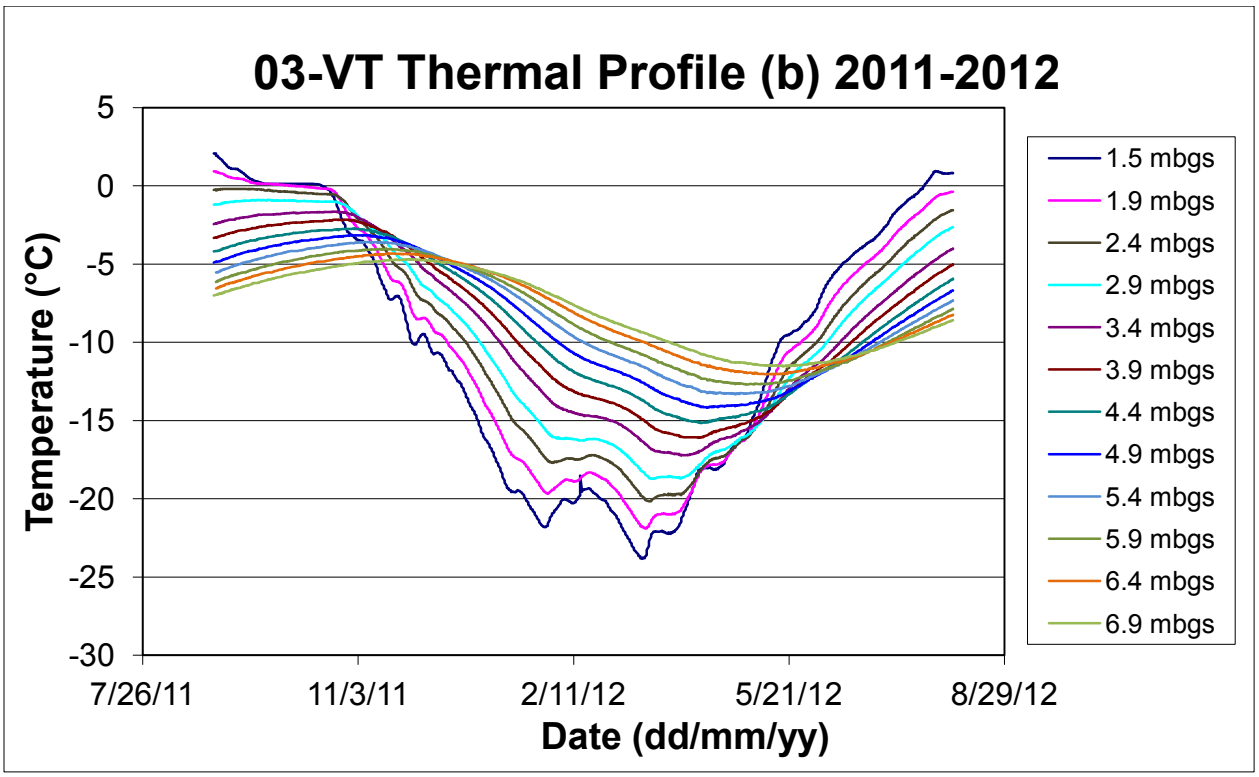
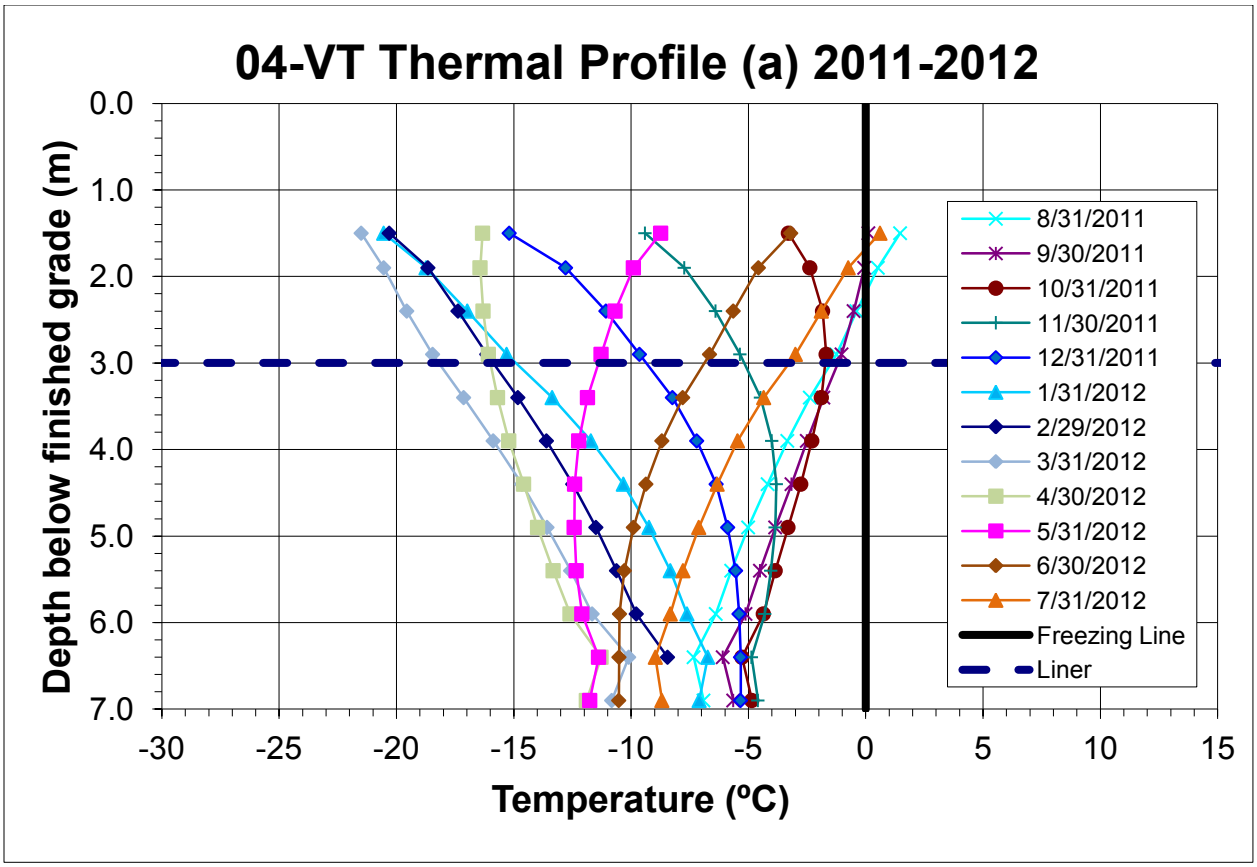


Figure H- 9: Profiles at 02-VT for 2011-2012: (a) monthly data (last day of the month) (b) full year record



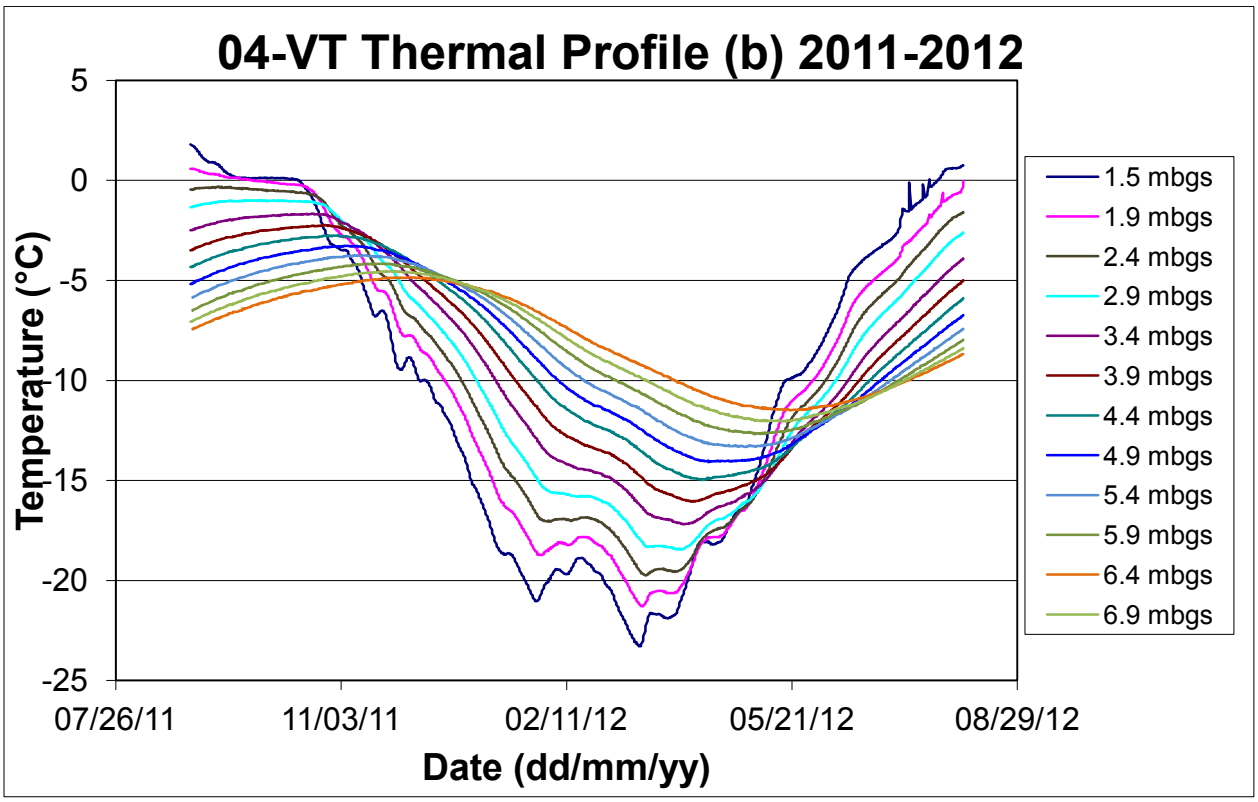


Figure H- 10: Profiles at 02-VT for 2011-2012: (a) monthly data (last day of the month) (b) full year record

ADDITIONAL THERMISTOR REFERENCE INFORMATION

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. A faulty datalogger was removed from CAM-F in 2011 and replaced with a spare logger provided by AANDC. This faulty logger was repaired and reinstalled at the Roberts Bay SWMF in 2012 to replace the malfunctioning datalogger at VT-B. The faulty logger removed from Roberts Bay was, in turn, sent to Lakewood Systems for repair is now available to AANDC for future use.
    b. A spare set of data logger batteries. Consultants should be prepared to change data logger batteries with lithium batteries supplied by Lakewood Systems (9V ULB-1 and 12V ULB-5) if voltages are low or data logger not functioning (see also note 5 below).
    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. Given the increasing length of time between monitoring events, it is recommended to use more than one fresh desiccant cartridge per datalogger.
    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, 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 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.