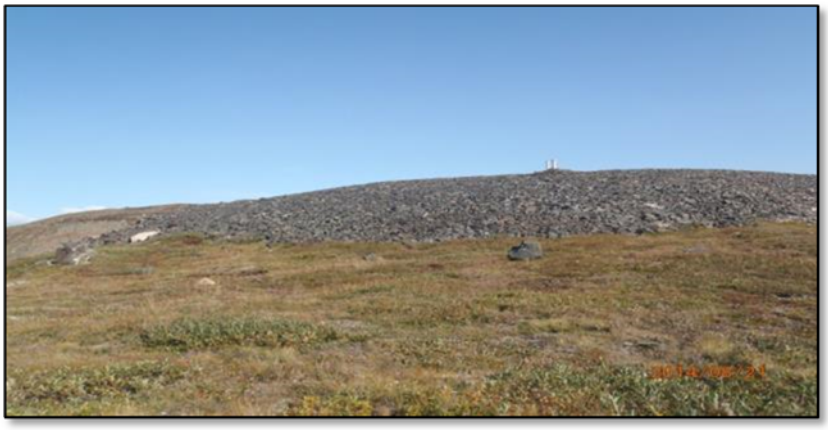
FRANZ ENVIRONMENTAL INC.
CONSULTING ENGINEERING TECHNOLOGIES
AN ARCADIS COMPANY

Long Term Monitoring, 2014

SWMF Landfill, Roberts Bay, Nunavut



FINAL REPORT

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EXECUTIVE SUMMARY

ARCADIS Franz Canada Inc. (FRANZ) was retained by Aboriginal and Northern Affairs Canada (AANDC) to conduct the third long-term monitoring site visit to the remediated abandoned silver mine site ("the site") at Roberts Bay, Nunavut, as prescribed by AANDC's Roberts Bay and Ida Bay Long-Term Monitoring Plan. This project was completed under AANDC standing offer number 4600000861, order number 4500319928, dated July 17, 2014.

The site is located on crown land approximately 115 km southwest of the hamlet of Cambridge Bay, south of Melville Sound on the north coast of mainland Nunavut, and approximately 1 km north of Roberts Lake. Access to the site is by rotary wing aircraft, fixed wing aircraft equipped with floats or by barge. The Roberts Bay site was an active silver mine in the early 1970s and was again the subject of exploration in the 1980s and 1990s. Remedial activity was conducted between 2008 and 2010, and consisted of disposal of non-hazardous waste and contaminated soils in an on-site facility, the Solid Waste Management Facility landfill (SWMF). The first year of monitoring activities were completed in 2010.

The site visit to complete the third long term monitoring event was conducted on August 20 and 21, 2014 while based out of the nearby hamlet of Cambridge Bay. The monitoring program included the following tasks: completing a health and safety plan; visually observing and photographically documenting the physical integrity of the landfill; natural environment monitoring; collecting landfill temperature data from previously installed thermistor strings; and collecting four surface water samples, plus one duplicate, and submitting for applicable laboratory analysis.

Data was retrieved from thermistor string B and appeared to be a complete set in the field. However, during data processing it was observed that the data is corrupt and recorded faulty temperatures. The set of data for string B was sent to Lakewood Systems Inc. for review; however, they were not able to retrieve any additional data. It is recommended that the datalogger installed at String B be replaced during the third monitoring round of long term monitoring at Roberts Bay.

Thermal monitoring data indicates that the temperature below ground surface at the SWMF has decreased each year since the previous site visit, and that permafrost was established within the waste at the SWMF in 2010. Although there is inadequate data to determine the maximum depth of the active layer at thermistor string B over the past two years, thermal monitoring data from thermistor strings A and C indicate that the maximum depth of the active layer has remained less than the depth to the waste material contained within the SWMF. Therefore, the waste material has remained entirely frozen for that period.

The chemical data obtained through the investigation were compared to historic site data as well as established guidelines. Site-specific guidelines were used preferentially, although federal guidelines from the Canadian Council of Ministers of the Environment (CCME) were used where necessary. For parameters not covered by CCME guidelines, provincial authorities were consulted.

Based on chemical and ground temperature data analysis as well as visual and photographic investigations, FRANZ determined that the site and its SWMF continue to operate as designed, and the site poses no present threat to 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 8.0.

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1.0 INTRODUCTION

ARCADIS Franz Canada Inc. (FRANZ) was retained by Aboriginal Affairs and Northern Development Canada (AANDC) to complete the third monitoring event (Year 5) of the Roberts Bay mine long-term monitoring plan. This project was completed under AANDC standing offer number 4600000861, order number 4500319928, dated July 17, 2014.

This report describes the monitoring activities completed in 2014 at the former Roberts Bay silver mine, located on crown land approximately 115 km southwest of the Hamlet of Cambridge Bay, south of Melville Sound in the central Kitikmeot Region of Nunavut (Figure A-1, Appendix A). It was prepared in accordance with the AANDC Request for Proposal (RFP) dated May 29, 2014, FRANZ Proposal No. 5173b, dated June 23, 2014 and the Project Initiation Meeting held on August 15, 2014.

Throughout this report the abandoned silver mine site at Roberts Bay, Nunavut, will be referred to as "the site."

1.1 Project Objectives

The overall objective of the Roberts Bay mine long-term monitoring plan is to determine whether the Solid Waste Management Facility (SWMF) landfill constructed at the site is performing as designed and continues to contain the waste placed within it during the remediation. To achieve this overall objective, visual observation, interviews with members of the nearby community knowledgeable of local activities, surface water samples and thermal monitoring were conducted at the site.

1.2 Scope of Work

The scope of long term monitoring work as described in the Roberts Bay and Ida Bay Long-Term Monitoring Plan (INAC, 2009) was as follows:

1. Visual monitoring of the SWMF, including:
    - Checking the physical integrity of the SWMF 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 SWMF and substantiate the recorded observations.
2. Monitoring of surface water in the vicinity of the SWMF, including:
    - Collection of samples from the designated upgradient and downgradient surface water sampling points.
    - Examination and analyses of the samples for colour, odour, hardness, pH, conductivity, temperature, total and dissolved metals, polychlorinated biphenyls

(PCBs), petroleum hydrocarbon (PHCs), major ions, total dissolved solids (TDS) and total suspended solids (TSS).

3. Soil Monitoring (as required):
    - Soil sampling was to be limited to locations where seepage or staining was identified as part of the visual inspection.
4. Thermal monitoring of the SWMF, including:
    - Collection of data from automatic dataloggers attached to each of the three thermistor strings installed at the SWMF.
    - Analysis of the thermal data to provide ground temperature profiles at various locations within the SWMF.
    - Servicing the dataloggers, as required.
5. Natural environment monitoring:
    - Documentation of observations and evidence of humans and wildlife activity present at the site.
    - Making observations regarding the re-vegetation of disturbed areas.
    - 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 2014 monitoring program.

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

a) Preparation of a health and safety plan;
b) Preparation of a sampling plan for surface water;
c) Obtaining surface water samples for chemical analysis;
d) Inspection of thermistor installations and collection of datalogger information;
e) Interpretation of analytical data;
f) Visual inspection and photo documentation of the site;
g) Observing and investigating land use and wildlife trends; and
h) Reporting.

1.3 Report Format

The long-term monitoring report 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 and the regional and physical setting of the site and its general characteristics.

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.

Sections 5 – Summary of SWMF Conditions: Describes the physical characteristics and the chemical impacts and distribution above applicable regulatory guidelines of the SWMF.

Section 6 – Surrounding Areas and Natural Environment: Describes the physical conditions of the remainder of the study area, including flora and fauna.

Section 7 – Conclusions and Recommendations: Presents main findings and conclusions as well as recommendations for the next site visit.

Section 8 – Limitations

Section 9 – References

Section 10 – Closure

2.0 BACKGROUND INFORMATION

2.1 Site Description

Roberts Bay and nearby Ida Bay are two abandoned silver mines located approximately 115 kilometres southwest of Cambridge Bay on the north coast of mainland Nunavut in the central Kitikmeot region of the territory. The Roberts Bay site is located approximately 1 km north of Roberts Lake while the Ida Bay mine site is located adjacent to Melville Sound about 6 km north of the Roberts Bay site.

These two sites were explored between 1965 and 1972 and operated from 1972 to 1975, after which, they were abandoned. Further explorations continued throughout the 1980s and 1990s. Evidence of recent mineral exploration (abandoned drilling equipment and empty drums) was observed near the dock at Roberts Lake during the 2012 monitoring visit, however during the 2014 site visit all equipment and the dock had been removed.

A remediation project was conducted at the sites between 2008 and 2010. The remediation involved the demolition and disposal of buildings, structures and other debris, as well as the cleanup of hazardous materials. Contaminated soil was excavated and either shipped off site or placed in the SWMF landfill constructed at the Roberts Bay site. All impacted materials were removed from Ida Bay and placed in the SWMF landfill at Roberts Bay as well; therefore no remediation infrastructure requiring monitoring was constructed there. Site visits to Ida Bay are thus not a part of the Roberts Bay long term monitoring program.

The Roberts Bay mine site had been in a state of abandonment for nearly 30 years when remediation activities commenced in 2008. Residual mine-related infrastructure present at the site prior to remediation included a tailings pond, waste rock piles, abandoned equipment and buildings, non-hazardous wastes and debris (e.g. scrap metal, wood, mill equipment, appliances and burlap bags), hazardous wastes (e.g. petroleum products, batteries, propane tanks, assay lab reagents and some unknown chemicals) and petroleum and metals impacted soil.

The site also contained two mine openings (one adit and one vertical shaft) and a capped vent raise. The fully-flooded adit was surrounded by a chain-link security fence which had deteriorated over time. The vertical shaft was located on the side of a basaltic ridge. The shaft was open with partially caved-in walls. Stability problems surrounding the collar and the vent raise had been addressed with a concrete cap. The two former mine openings and vent raise were fully sealed and re-graded during the remediation; they are no longer visible from the surface. A geochemical assessment conducted on the waste rock and the tailings at the site suggested that these materials are non-acid generating.

Constructed during remediation in the summer of 2009, the SWMF is a non-hazardous waste landfill built over the former tailings pond, as seen on Figures A-1 and A-2, Appendix A (also refer

to Photos 1 to 3, Appendix E). Monitoring procedures adopted by AANDC for this site are similar to those defined in the AANDC Abandoned Military Site Remediation Protocol, AMSRP, with some modifications as applicable to mine sites.

The SWMF was designed to contain non-hazardous contaminated soils and debris, and to encapsulate and stabilize tailings water remaining at the site. The SWMF was constructed over the former tailings pond, covered by a woven geotextile and then covered with 2 m of compacted waste rock which had been assessed as non-metal leaching and non-acid generating. The waste was placed in lifts and sequentially covered with granular fill. On the basis of survey work, a total of 109 m^3 of debris and 742 m^3 of debris and waste rock intermediate cover were placed into the SWMF.

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 projected that the SWMF would reach a frozen state within a few years of construction. To monitor the freeze back of the contents and berms, three ground temperature sensor strings (thermistors) and dataloggers were installed along a transect of the facility. The thickness of the cover material was calculated to exceed the maximum depth of active layer thawing using modeled climate data; this is to ensure impacted materials within the SWMF remain frozen throughout the year.

2.2 Previous Monitoring Programs

Prior to the field program, FRANZ reviewed the following reports pertaining to the Roberts Bay abandoned mine site, some of which include previous site investigations and remedial activities:

- Franz Environmental Inc., January 2013, 2012 Monitoring Program SWMF Landfill, Roberts Bay, Nunavut.
- Franz Environmental Inc., November 19, 2010, 2010 Monitoring Program SWMF Landfill, Roberts Bay, Nunavut.
- Indian and Northern Affairs Canada. February 9, 2009. Roberts Bay and Ida Bay Long-Term Monitoring Plan.
- Nunavut Water Board (NWB)'s Water License, August 8, 2008. License No. 1BR-ROB0813 issued to Indian and Northern Affairs Canada.
- SENES Consultants Limited, February, 2010. 2009 Inter-Seasonal Report for Roberts Bay and Ida Bay Mine Sites Site Remediation Program, Nunavut.
- AMEC Earth & Environmental for Public Works and Government Services Canada, January 2007, Roberts Bay and Ida Bay Abandoned Mine Sites Remediation Plan.
- Indian and Northern Affairs Canada, Contaminated Sites Program, March 2009, Abandoned Military Site Remediation Protocol.

The 2014 monitoring program was the third of eight scheduled over a 25 year period for the Site. Information from previous investigations was incorporated into this year's sampling plan. Data collected in subsequent years will be combined with the complete data set, as well as that from pre-landfill construction in 2008 and 2009, and analyzed.

As part of the investigation, information regarding land use by both humans and wildlife was gathered though interviews with members of the Ekaluktutiak Hunters and Trappers Association in the nearby community of Cambridge Bay.

3.0 REGULATORY GUIDELINES

3.1 Guideline Review

Where guidelines were developed, criteria presented in the Nunavut Water Board (NWB)'s Water Licence (NWB, 2008) were used to compare surface water analytical results. These criteria were developed during a human health and ecological risk assessment which determined site-specific remedial objectives prior to remediation of the site.

The Roberts Bay abandoned mine site is a federal site, and is therefore exempt from territorial regulation; however, the possibility of future disposition of the site may make it subject to territorial environmental guidelines. Because the Nunavut environmental guidelines are based on the work of the CCME, the federal and territorial guidelines often coincide.

The governing guideline for soil at contaminated sites in Nunavut is the *Environmental Guideline for Contaminated Site Remediation* (EGCSR), published by the Government of Nunavut in March, 2009. The criteria for Petroleum Hydrocarbons (PHC) in soil are found in Section 2.4, and are adapted from the CCME's CWS-PHC. The criteria for other compounds in soil are found in Table A-4 of Appendix 4 of the EGCSR, and are obtained from the CSQGs, published in the *Canadian Environmental Quality Guidelines* (CCME, 1999, updated 2011). The criteria are numerical limits intended to maintain, improve or protect environmental quality and human health at contaminated sites.

3.2 Surface Water

There are no surface water guidelines provided in the Roberts Bay long term monitoring plan. In the absence of site-specific guidelines, the AMSRP guidance on post-construction landfill monitoring indicates that "comparison to background and baseline values is recommended." The AMSRP provides the following table (Table 3-1) for the assessment of analytical data in groundwater; a similar approach has been used for the assessment of surface water analytical data.

Table 3-1: Groundwater Chemical Assessment Approach

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		

Geochemical Assessment	Acceptable	Marginal	Significant	Unacceptable
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 a previous report to obtain mean and standard deviation of analytical results from monitoring activities conducted in 2010 and 2012 in order to establish statistical upper limits of acceptability. These limits are calculated as mean plus three standard deviations, and are used for comparison with analytical results from the 2014 field program. The calculated upper limit of acceptability values are included in surface water analytical tables presented in Appendix B. This is a very limited data set and therefore standard deviations for some parameters are quite high; additional data will help to create more realistic limits.

For some parameters, sufficient data to calculate mean and standard deviation were not available. This is primarily due to the high frequency of results reported to be below the laboratory reportable detection limit (RDL).

In these instances, and for purposes of comparison with the calculated upper limits of acceptability, the following CCME guidelines are included in this report:

- *Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life (FWAL) Update 7.0* (CCME, 2007), Summary Table.

Canadian water quality guidelines are intended to provide protection of freshwater and marine life from anthropogenic stressors such as chemical inputs or changes to physical conditions

At the site, neither surface water nor groundwater is used for drinking water or agricultural uses. The landfill is greater than one kilometre from the nearest water body, Roberts Lake. Where upper limits of acceptability were not calculated, the CCME Freshwater Aquatic Life (FWAL) water quality guidelines were applied to the surface waters at the site.

4.0 INVESTIGATIVE METHODOLOGY

The site visit to Roberts Bay was carried out on August 20 and 21, 2014. During the field investigation, weather conditions were mostly cloudy with temperatures ranging from approximately 5°C to 10°C. The monitoring program included the following tasks:

- Completing a Health and Safety Plan;
- Visually observing and photographically documenting the physical integrity of the landfill and the reporting on the observable conditions over the rest of the site;
- Natural environment monitoring and gathering information from knowledgeable persons regarding local wildlife and human activity;
- Collecting landfill temperature data from previously installed thermistor strings;
- Measuring various physical parameters in the water samples; and
- Submission of surface water 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 work required to complete the site monitoring program. Emergency provisions such as extra food and shelter were included given the site's remoteness. A wildlife monitor with a valid firearm license was also hired and present on site for the duration of the site visit. The HASP 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 their review and approval before activities at the site began. Prior to conducting any work at the site, the HASP was distributed and discussed with all personnel involved in the monitoring program. A copy of the HASP has been retained on file with FRANZ.

4.2 Visual Inspections

The SWMF and immediate surrounding area were visually inspected to assess the landfill's physical integrity, including evidence for erosion, ponding, frost action, settlement and lateral movement. Using the format provided in the Roberts Bay and Ida Bay Long Term Monitoring Plan (INAC, 2009), a visual monitoring checklist was completed for the landfill (refer to Section 5.3). Photographs were taken from the viewpoints indicated on Figures A-1 and A-2, Appendix A.

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, and feathers/fur); wildlife activities (migrating, nesting, etc.); numerical estimates of wildlife; and vegetation.

As part of the investigation, information regarding land use by both humans and wildlife at the site was gathered though the wildlife monitor, Mr. Darcy Evetaligak, a member of the Ekaluktutiak Hunters and Trappers Organization. Additional information was gathered from other persons from the nearby community of Cambridge Bay knowledgeable of the site and surrounding area.

A discussion of the recorded observations and information obtained is presented in Section 6.0 of this report.

4.4 Thermal Monitoring

Three thermistor strings were installed along a transect of the SWMF in the late summer of 2009. Thermistor installation records with details concerning the number of beads and bead depths were not available to FRANZ staff. Based on the data collected in August, 2010, FRANZ concluded that the number of beads at Thermistors A, B and C is 9, 11 and 9, respectively. Assumptions regarding bead depth are discussed in detail in Section 5.4. Each thermistor string is connected to a Lakewood Systems UltraLogger datalogger that is programmed to record values twice daily – at 0h00 and 12h00 – on a continual basis.

At the time of the 2014 site visit, all thermistor strings were observed to be functioning well. However, during data processing out of the field FRANZ determined that the data from sting B is corrupt and recorded faulty temperatures on multiple strings and seemingly random timeframes (i.e., no noticeable pattern). The data set for string B was sent to Lakewood Systems Inc. for review. Unfortunately, Lakewood Systems Inc. was not able to retrieve any additional data for String B. Email correspondence is attached in Appendix H.

During the site visit, the resistance at each bead was measured manually at each thermistor string. This data was converted to temperature values which were compared to the 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. All manually collected data had close agreement with the data collected by the dataloggers. The manual resistance check data is presented in Table G-2, Appendix G.

Thermistor data for the period from August 2012 to August 2014 were downloaded from all three dataloggers 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. Batteries and desiccant cartridges

were replaced in each of the dataloggers during the 2014 site visit. Thermistor inspection records are presented in Table G-1, Appendix G.

The SWMF ground temperature record was compiled and trends were highlighted. A discussion, along with plots of temperature versus depth and time, is presented in Section 5.4. The annual maintenance report, which also contains a basic description of the datalogger systems, can be found in Table G-1, Appendix G. Raw data is provided in the attached CD-ROM.

4.5 Surface Water Sampling

The surface water 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 Roberts Bay and Ida Bay Long-Term Monitoring Plan (INAC, 2009); and
- INAC Abandoned Military Site Remediation Protocol, Contaminated Sites Program (INAC, 2009).

Surface water was sampled at four predetermined locations: three in proximity to the SWMF and one distant, background reading collected from Roberts Lake. In accordance with the established protocol at similar sites managed by AANDC, water samples submitted for metals analyses were not field-filtered.

It appeared that site conditions were similar to those observed during the 2012 site visit. No surface water was present at monitoring point ROB-7, therefore no sample was collected. Samples were successfully collected from previously established surface water monitoring points ROB-6, ROB-8 and ROB-10. The sample at ROB-8 was collected in duplicate, and a background sample was collected from Roberts Lake (surface water monitoring point ROB-9). A summary of the samples that were collected and submitted for laboratory analysis during the surface water sampling activities is provided in Table 4-1, below. Additional information is provided in the surface water sampling field notes included in Appendix C.

Table 4-1: Summary of surface water sample collection near the SWMF

SWMF Area	Sample	Description	Analytical Parameters
Downgradient	ROB-6	Surface water to southeast of landfill that may at times flow South to Roberts Lake	- total and dissolved metals - PCBs - petroleum hydrocarbon fractions F1-F4 and BTEX - inorganics (major ions, TDS, TSS, colour, pH, conductivity)
	ROB-8	Northeast of landfill (to detect possible leachate and runoff)	
	DUP-1*		
	ROB-10	Southeast of landfill (to detect possible leachate and runoff)	
Background	ROB-9	Roberts Lake (for background and control)	

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

All samples were stored immediately in laboratory prepared sample bottles. As soon as was possible, samples were placed on ice and remained chilled until delivery to the laboratory.

4.5.1 Test Pitting and Soil Sampling

If required, soil sampling was to be completed by manual test pitting. Baseline soil data was collected in during the 2010 site visit. Subsequent soil samples are only to be collected should physical or other chemical evidence of landfill deterioration be observed. No such evidence was observed during the 2014 site visit, therefore no test pits were advanced and no soil samples were collected.

4.6 Quality Assurance and Quality Control

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

4.6.1 Field

Surface water samples were collected and placed in a variety of 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 to moderate temperature fluctuations during transport from site. Once available, ice was added to the coolers to keep the samples chilled until they were delivered to the laboratory.

As a quality control measure, a surface water blind field duplicate sample was collected and analyzed for PHC fractions F1-F4, BTEX, inorganic parameters, total and dissolved metals, and

PCBs. Additional quality assurance field and travel blanks were also submitted to the laboratory for analysis of the parameters listed above.

FRANZ personnel collected the duplicate samples by alternately placing approximately 10 percent of the sample volume into the primary sample container and then placing the same amount into the duplicate container. The field staff continued placing aliquots of the same volume into each container until both containers were filled.

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

4.6.2 Laboratory

To assess the reliability of the laboratory data, duplicate samples were taken for at least every five samples collected by FRANZ. One blind field duplicate was collected in the surface water sampling program.

Analytical data quality was assessed by submission of the following:

- Surface water samples ROB-8 2014 (primary) and DUP-1 2014 (corresponding water duplicate), were analyzed for CCME PHCs F1-F4/BTEX, PCBs, and total metals., and major ions, hardness, conductivity, pH, TDS, TSS and colour were also analysed and duplication was compared.

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 the table 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)
A	nd	nd	Acceptable precision; no evaluation required
B	nd	positive	result B – 0.5 x MDL < MDL
C	positive and > 5 x MDL	Positive and > 5 x MDL	RPD < 20%
D	positive and < or = 5 x MDL	positive	|result B – result A| < 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 Section 5.6 for a discussion on QA/QC results.

4.7 Laboratory Analytical Program

Surface water samples were sent to Maxxam Analytics in Yellowknife, NWT and ultimately on to Edmonton, Alberta 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 results and chain of custody forms are presented in Appendix D.

5.0 SUMMARY OF SWMF CONDITIONS

5.1 Area Summary

The SWMF, composed of both a dry and a wet cell, is located to the west of the two former adits, and is built on the same location as the former mine tailings pond. Monitoring of the SWMF consisted in part of a visual inspection to assess its physical integrity by collecting evidence of erosion, ponding, frost action, settlement and lateral movement. Surface water samples were also collected at locations downgradient of the SWMF and a background surface water sample was collected from Roberts Lake.

The SWMF surface water sample locations and photographic viewpoints can be seen on Figure A-1 and on Figure A-2 in Appendix A. The visual inspection report, including supporting photos and figures, is presented in Section 5.3 below.

5.2 Photographic Record

The photographic record of the SWMF was completed as per Terms of Reference for the monitoring program. It is presented in Appendix E, where photograph captions provide the landfill viewpoint numbers (as seen on Figure A-2, Appendix A). Full resolution digital copies of the photographs are contained in the attached CD-ROM.

5.3 Visual Inspection Report

The visual inspection of the SWMF and surrounding area was conducted on August 21, 2014. The visual monitoring checklist was completed using the format provided in the *Roberts Bay and Ida Bay Long-Term Monitoring Plan* (INAC, 2009) and is presented as Table 5-1 of this report. Field notes relating to the visual inspection are included in Appendix F.

Settlement

Four areas of possible settlement were identified on the top of the SWMF during the 2010 site visit (refer to Figure A-2, Appendix A). One area of exception, the northernmost area of possible settlement, was not observed in the 2012 site visit. These three isolated areas were reported to be small (less than a few square metres) and shallow (less than 30 cm). There was no evidence of water infiltration reported and no ponding was observed on top of the landfill. After visual observations and comparison to the 2012 photographs, these areas of settlement remain unchanged in 2014.

Though these areas were identified, they were not observed to be of a large enough magnitude to be confirmed as settling. These areas appear to be a result of mechanical processes and may simply represent minor variation in the final grading and compaction of the surface of the landfill.

Similar to 2012, no ponded water was observed in the immediate vicinity of the SWMF during the 2014 site visit. Surface water was present to the northeast and southeast (sampling points ROB-6, ROB-8 and ROB-10) of the landfill (refer to Figure A-2, Appendix A).

Erosion

No evidence of erosion or preferred drainage channels was observed during the 2014 site visit.

Frost Action

Similar to observations made in 2010 and 2012, no evidence of heaving or cracking was observed on the top or berms of the SWMF, and no frost action was observed at any of the thermistor housing units during the 2014 site visit.

Evidence of Burrowing Animals

No animal burrows were observed on the SWMF during the 2014 site visit. As in the previous Site visit, indications of burrowing animals (ground squirrels (siq siqs) were prevalent throughout the undisturbed areas of the Site, specifically along the banks of the trail to Roberts Lake.

Staining

No evidence of staining was observed on or near the SWMF during the 2014 site visit.

Seepage Points

There was no evidence of seepage from the SWMF observed during the 2014 site visit.

Debris

No exposed debris was observed at the SWMF during the 2014 site visit. Abandoned exploration drilling equipment (drill rods, empty fuel drums, pallets, hydraulic hose, etc.) was observed near the shore of Roberts Lake during the 2012 site visit. A functional floating dock was also present at the beaching area of Roberts Lake at that time. During the 2014 site visit, the drilling equipment and dock were no longer present.

Discussion

Based on the minimal to non-existent erosion, settlement, frost action, burrowing, staining and seepage observed, the performance of the SWMF, with respect to containment, was rated as satisfactory. The evidence observed suggests the structure is performing as designed. The visual inspection report is presented in Table 5-1 below.

Table 5-1: Roberts Bay Abandoned Mine – Landfill Visual Inspection

Date:	August 21,2014
Landfill:	Solid Waste Management Facility Landfill (SWMF)

1. Erosion	**Answer**
a) Is erosion occurring on the surface or berms of the landfill?	No
i) Are there preferred drainage channels?	No
ii) Is there sloughing of material?	No
b) What is the extent of the erosion? *(percentage of surface area)*	–
i) Is it localized or continuous?	–
c) Where is the erosion occurring? N/A	
d) Explanation: N/A.	

2. Settlement	**Answer**
a) Is there differential settlement occurring on the surface?	No
i) Are there low areas or depressions?	Yes
ii) Are voids forming?	No
b) What is the extent of the settlement? *(percentage of surface area)*	< 1%
i) Is it localized or continuous?	Localized
ii) How deep is it?	< 0.3 m
c) Where is the settlement occurring? Three very small areas identified at surface of SWMF (refer to viewpoint numbers 27 to 32 on Figure A-2, Appendix A). Minor settlement areas remain unchanged since 2012. No new areas identified during the 2014 site visit.	
d) Explanation: No obvious cause, but appears to be a result of mechanical processes (i.e. grading and compaction of landfill surface during construction).	

3. Frost Action	**Answer**
a) Is there frost action/damage to the landfill?	No
i) Is there exposed debris due to uplift?	No
ii) Is there tension cracking along the berms?	No
iii) Is there sorting of granular fill?	No
b) What is the extent of the frost action? *(percentage of surface area)*	–
i) Is it localized or continuous?	–
c) Where is the heaving/cracking occurring? No frost action observed on any surface of the SWMF.	
d) Explanation: No apparent signs of frost action on any surface of the SWMF.	

4. Monitoring Instruments
a) What is the condition of the monitoring wells and thermistor strings? There are no monitoring wells present at this site. Thermistor housing units were in good condition. All locks (Guard, 40 mm universal-key padlocks, No. 834 (key number 102) were in good condition and did not need to be replaced. Thermistor batteries and desiccants were replaced in each datalogger. It was determined that the three sets of thermistor beads were operating correctly, however the datalogger was not recording data for beads 6, 7, and 8. After downloading all data available, the datalogger was reset and all sensors were turned on to recorded temperature data for all beads.
5. Others
Animal Burrows: No animal burrows were observed in or on the SWMF. **Vegetation**: No vegetation growth was observed on the SWMF. Due to elevation, drainage, regional climate, and the type of material (large angular cobble) used to cap the SWMF, the establishment of vegetation is not anticipated. No significant re-growth was observed in any of the worked areas of the site. **Staining**: No staining was observed at the SWMF. **Vegetation stress**: None observed. **Seepage points**: None observed. **Exposed debris**: No debris was exposed from the SWMF.
6. Sketch
See Figure A-2, Appendix A
7. General Comments
The physical condition of the SWMF remains unchanged from that observed in 2012. It is considered acceptable and appears to be performing as designed.

5.4 Thermal Monitoring Data

As generally described in the site remediation report (SENES, 2010), three thermistor strings (A, B and C) were installed in the SWMF. Thermistor string installation records were not available; however, site remediation specifications (INAC Project No. 416829) recommended that temperature sensing beads be placed at 500 mm intervals from thermistor bore bottoms to the landfill surface. Based on the elevations of the thermistor borehole bottoms, casing tops and the landfill surface provided by the SWMF construction drawings, it was assumed that thermistor beads were placed from the borehole bottom to the top at the recommended 500 mm spacing. The top bead appears to coincide with the landfill surface in the case of thermistor string A. Thermistor string B has the top bead positioned above the ground surface, while string C has the top two beads positioned above the ground surface. These conclusions are drawn based on

observation of the thermistor string cables within the housings, and are supported by the magnitude of diurnal temperature fluctuations observed at the upper beads. Larger diurnal temperature fluctuations are apparent when the bead is positioned above the ground surface and is measuring air temperature. The inferred bead depths are presented in Table G-2, Appendix G.

FRANZ performed a complete memory on the dataloggers installed at all three strings. A manual verification of the data downloaded from the dataloggers was performed in the field using a sensitive resistance meter available from the datalogger manufacturer. Results indicate that all temperature sensing beads of the three thermistor strings were performing well.

Data was retrieved from the datalogger installed at string B and appeared to be a complete set in the field. However, during data processing back in the office FRANZ observed that the data is corrupt and recorded faulty temperatures. The set of data for string B has been sent to Lakewood Systems Inc. for review. This data or lack thereof will be discussed further in the final report.

All thermistor beads positioned below the ground surface were found to yield temperatures within the standard ± 0.2 ºC margin of error when compared to field resistance readings, with the exception of bead 2 and bead 3 on string A (discrepancy of 0.3 ºC and 0.5 ºC), bead 1 on string B (discrepancy of 1.1 ºC) and bead 1 on string C (discrepancy of 1.0 ºC). The discrepancies noted in string A are very close to the acceptable margin of error; the data from these beads are considered useable and was retained. A larger margin of error between manually and automatically recorded temperatures is considered acceptable for beads positioned above or near the ground surface, as is the case for bead 1 of string B and bead 1 of string C. The larger margin of error is attributable to fluctuation in atmospheric temperature over the duration of the test period. Additional details of the manual verification test are presented in Table G-2, Appendix G.

The position of the 0°C isotherm was calculated at each location from ground temperatures recorded by the dataloggers on the day of the site visit (Table 5-2-2). Plots of depth versus temperature (at each thermistor bead) for each year and temperature versus time over the previous two years are presented on Figure G-1 through Figure G-6, Appendix G.

Table 5-2: Summary of SWMF Active Layer Thickness

	Thermistor String		
	A	**B**	**C**
Depth to 0º isotherm (m) on Aug 7, 2012	1.38	1.79**	1.71
Depth to 0º isotherm (m) on Aug 7, 2013	1.73	N/A*	1.59
Depth to 0º isotherm (m) on Aug 7, 2014	1.49	N/A*	1.00
Maximum depth to permafrost 2009	Permafrost trend not yet established		
Maximum depth to permafrost 2010 (m) (Jan 1 to Dec 31)	2.95	N/A*	2.31

	Thermistor String		
	A	**B**	**C**
Maximum depth to permafrost 2011 (m) (Jan 1 to Dec 31)	2.53	N/A*	2.07
Maximum depth to permafrost 2012 (m) (Jan 1 to Dec 31)	2.09	N/A*	2.00
Maximum depth to permafrost 2013 (m) (Jan 1 to Dec 31)	1.86	1.80**	1.86
Maximum depth to permafrost 2014	Permafrost trend not yet established		

*insufficient data to calculate a depth

**Interpolated from manually recorded temperature data

Because of the faulty data at thermistor string B, only half of the temperature sensing bead data is useful information at this time. Unfortunately, not enough information was available to calculate a reasonable value for maximum depth of the active layer at this location. At the locations of thermistor string A and C thermal monitoring indicates that, as expected, the active layer has progressively decreased in thickness over the past two years.

In general, it can be concluded that the SWMF is getting colder, and the waste contained within the SWMF, reported to be at a depth of ≥ 3 mbgs has remained frozen year round since the fall of 2010.

Thermistor details can be found in the annual maintenance monitoring report (Table G-1, Appendix G). Field notes relating to the thermistor inspection are included in Appendix F.

5.5 Analytical Results – Surface Water Samples

As described in Section 4.5.1, a total of five surface water samples (four samples plus one blind duplicate) were submitted to Maxxam Analytics in Edmonton, Alberta for analyses of PHCs, metals, PCBs and inorganic parameters. Obtained analytical results are discussed below.

PHCs

Laboratory analytical results and the selected federal guidelines—the CCME guidelines for the protection of freshwater aquatic life (FWAL)—for PHCs are presented in Table B-1, Appendix B. As shown in the table, concentrations of all PHC parameters, with exception of toluene, were below laboratory reportable detection limits (RDLs). Concentrations of toluene were reported in two samples (DUP-1 2014 and ROB-10 2014) just above the reportable detection limits, however well below guideline therefore satisfy the guidelines applied to the site. No upper limits of acceptability were calculated for PHCs in surface water.

Metals

Laboratory analytical results, selected federal (CCME FWAL) and calculated site-specific upper limits of acceptability for dissolved and total metals are presented in Table B-2, Appendix B. Site-specific upper limits of acceptability were calculated for total and dissolved metals parameters as detailed above in Section 3.2. None of the surface water samples submitted for metals analysis exceeded the calculated upper limits of acceptability for any of the parameters analyzed.

In addition, three exceedances were observed in comparing analytical results to the CCME FWAL guidelines: concentrations of total and dissolved copper in ROB-06 2014, ROB-9 2014 and ROB-10 2014 (total only), ranging from concentrations of 0.0023 mg/L to 0.0059 mg/L, marginally exceeding the CCME FWAL guideline of 0.002 mg/L. All other parameters reported concentrations below reportable detection limits of below CCME FWAL guidelines. Copper was previously been detected above guidelines in surface water at ROB-06 and ROB-09 during the 2012 site visit. These exceedances are noted for reference only. The calculated upper limit of acceptability remains the standard to which the 2014 monitoring results are compared to determine acceptability.

PCBs

Laboratory analytical results for PCBs are shown in Table B-3, Appendix B. A CCME guideline was not available for PCBs in surface water, nor was a site-specific upper limit of acceptability able to be calculated for PCBs, this due to the fact that all analytical results were reported below laboratory detection limits. Results are thus acceptable and indicative of no risk associated with PCBs at the site.

Inorganic Parameters

Laboratory analytical results for inorganic parameters are presented in Table B-4, Appendix B. CCME FWAL guidelines exist for some of the parameters under this heading; these are noted in Table B-4 for reference purposes. Using the methodology detailed in Section 3.3, site-specific upper limits of acceptability were successfully calculated for all of the parameters under this heading. These site-specific limits are used to determine the acceptability of the 2014 surface water monitoring analytical results. As indicated in the Table B-4, results for one parameter in sample ROB-10 2014 (dissolved nitrate) exceeded their respective calculated upper limits of acceptability and CCME FWAL guideline. It was noted that the result for dissolved nitrate in sample ROB-10 2014 was 19 mg/L, which is less than four times the calculated upper limit. Concentration of dissolved chloride and dissolved fluoride were reported for ROB-8 2014 and it's duplicate above their respective CCME FWAL guidelines, however below the upper limits of acceptability. Colour and pH for the ROB-8 2014 was also reported above the upper limits of

acceptability. The magnitudes of these exceedances are not considered to be significant or indicative of deterioration of the SWMF integrity.

Laboratory certificates of analyses for the 2014 surface water samples are provided in Appendix D.

5.6 QA/QC Discussion

In order to obtain the required minimum of 20% duplicate samples, as stipulated in Long Term Monitoring Plan, one duplicate surface water sample was collected during the 2014 monitoring activities. Analytical results for submitted samples and their duplicate pairs were compared to provide an indication of the precision of both the field sampling and laboratory analyzing methods. Results are presented along with chemical data in Tables B-1 through B-4, Appendix B.

Duplicate evaluations of surface water samples for PHCs, dissolved metals, PCBs and inorganic parameters all fell within limits of acceptability. Total suspended solids did not meet the duplicate evaluations criteria. 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.

6.0 SURROUNDING AREAS AND NATURAL ENVIRONMENT

The surrounding areas of the SWMF at Roberts Bay, including the borrow areas, locations of former adits and re-graded areas were also inspected during the 2014 site visit. The area surrounding the SWMF was found to be clean and in good order, with no significant change observed.

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
- Re-vegetation of disturbed areas versus previous years

Information regarding these parameters was either gathered directly, through personal observation while on site or indirectly, through the wildlife monitor, a member of the Ekaluktutiak Hunters and Trappers Association in the nearest community of Cambridge Bay, NU.

Wildlife and Human Activity

During the 2014 site visit, the following signs of wildlife were observed on site:

- Many ground squirrels (sik sik's) were observed at the site;
- A number of lemmings were observed, as well as ptarmigans;
- Several smaller birds were observed overhead and in the dense willow growth directly south west of the SWMF that included king eiders and common eiders;
- Loons and arctic swans were observed overhead; and
- Wolf and grizzly bear tracks were observed along the shore of Roberts Lake;
- Many snow geese and Canada goose were observed flying overhead and droppings were ubiquitous at the site.

After discussion with the wildlife monitor, it was reported that the site has been used for hunting and fishing in the past. Caribou, muskox, rabbits, foxes, seals, whales and arctic hare are hunted in the area. Arctic char and trout are also fished. The wildlife monitor also reported that the number of animals seen this year during hunting trips has gone down, especially for caribou.

Evidence of fish survey equipment and weirs that had been installed into a nearby creek flowing into Roberts Lake was present. It was reported in 2012 that a floating dock was present in Roberts Lake at the pathway leading to the SWMF and abandoned exploration drilling equipment adjacent to the dock, however, this has since been removed.

Re-establishment of Vegetation

Major site remedial work, which comprised excavation and construction activities, was completed in the summer of 2009. Little to no sign of re-vegetation was observed during the 2014 site visit. Given the regional setting of the Roberts Bay SWMF landfill and growth observed at other, similar sites in the Nunavut region, it is reasonable to assume that it will take some time for native vegetation to become re-established at the site. Due to the type of material used to cap the landfill (large angular cobble), re-vegetation of the surface of the SWMF it is considered to be very minimal within the time-frame of the long-term monitoring program at the site.

7.0 CONCLUSIONS AND RECOMMENDATIONS

FRANZ conducted the field activities for the second site visit of the Roberts Bay long term monitoring program on August 20 and 21, 2014, while based in the nearby community of Cambridge Bay.

Visual and physical observations from the 2014 field activities suggest that there has been little significant change at the site since the previous site visit in 2012. The SWMF is performing as designed and continues to contain the enclosed waste. Thermal monitoring data indicates that the temperature below ground surface at the SWMF has decreased each year since the previous site visit, and that permafrost was established within the waste at the SWMF in 2010. Although there is inadequate data to determine the maximum depth of the active layer at thermistor string B over the past two years, thermal monitoring data from thermistor strings A and C indicate that the maximum depth of the active layer has remained less than the depth to the waste material contained within the SWMF from August 2010 to August 2014.

Data was retrieved from the datalogger installed at string B and appeared to be a complete set in the field. However, during data processing it was observed that the data is corrupt and recorded faulty temperatures. The set of data for string B was sent to Lakewood Systems Inc. for review. After careful review and troubleshooting, Lakewood Systems Inc. was not able to retrieve any additional data from the datalogger. It is recommended that the datalogger installed at String B be replaced during the third monitoring round of long term monitoring at Roberts Bay.

In addition to physical and temperature observations, FRANZ collected surface water samples to assess the performance of the SWMF. With the exception of one parameter in sample ROB-10 2014 (dissolved nitrate), and pH and colour in sample ROB-8 2014 above the calculated upper limits of acceptability, all chemical parameters were measured at concentrations either below the laboratory RDL or below the calculated upper limits of acceptability. The reported exceedances noted above were minimal and are not considered indicative of any deterioration in the integrity of the SWMF.

As a result of the physical and thermal observations and analytical results of the 2014 field program, FRANZ believes that the site is little changed from the last monitoring event, in August 2012, that the SWMF continues to operate as designed, and that the site poses no present threat to human health or the natural environment.

8.0 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 ARCADIS Franz Canada 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. ARCADIS Franz Canada 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, ARCADIS Franz Canada 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 20 and 21, 2014. 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, ARCADIS Franz Canada 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), ARCADIS Franz Canada Inc. should be requested to re-evaluate the conclusions of this report, and to provide amendments as required.

9.0 REFERENCES

AMEC Earth & Environmental, January 2007. *Roberts Bay and Ida Bay Abandoned Mine Sites Remediation Plan.*

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

Canadian Council of Ministers of the Environment, 2007. *Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life (FWAL) Update 7.0*

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

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

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

Franz Environmental Inc., 2010. *Monitoring Program Solid Waste management Facility Landfill Roberts Bay, Nunavut, Final Report.*

Franz Environmental Inc., 2012. *Monitoring Program Solid Waste management Facility Landfill Roberts Bay, Nunavut, Final Report.*

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

Indian and Northern Affairs Canada. February 9, 2009. *Roberts Bay and Ida Bay Long-Term Monitoring Plan*.

Indian and Northern Affairs Canada, Specification, Project No. 416829, Roberts Bay/Ida Bay, Section 31 70 02 Site Remediation.

Ministry of the Environment, Ontario, 1994. *Water Management - Policies, Guidelines, Provincial Water Quality Objectives.*

Nunavut Water Board (NWB)'s Water Licence, August 8, 2008. License No. 1BR-ROB0813 issued to Indian and Northern Affairs Canada.

SENES Consultants Limited. February, 2010. *2009 Inter-Seasonal Report for Roberts Bay and Ida Bay Mine Sites Site Remediation Program, Nunavut*.

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.

10.0 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,

ARCADIS Franz Canada Inc.

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

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APPENDIX A

Figures

N

ROB-8

ROB-8

ROB-10

ROB-7

ROB-10

ROB-6

ROB-6

70m

Trail from Robert's Lake
Dock to the SWMF Landfill

34

ABANDONED EXPLORATION
DRILLING EQUIPMENT
(REMOVED)

35

36

SMALL
FLOATING
DOCK (REMOVED)

ROB-9

ROBERT'S
LAKE

LEGEND

- Pond/Surfacewater
- Solid Waste Management Facility Landfill
- Trail
- Surface water Sample Location (FRANZ, 2012 & 2014)
- Surface water Sample Location (FRANZ, 2010)
- Picture Viewpoint Number

Note: surface water sampled in the same location in 2012 and in 2014

Title: **SITE PLAN**

FRANZ ENVIRONMENTAL INC.
♦ CONSULTING ♦ ENGINEERING ♦ TECHNOLOGIES ♦

Project: **LONG TERM MONITORING PROGRAM, SWMF LANDFIL, ROBERTS BAY, NUNAVUT**

Date: October 2010

Updated: December 2014

Client: **ABORIGINAL AFFAIRS AND NORTHERN DEVELOPMENT CANADA**

SCALE: 1:3250

FIGURE A-1

TO BE PRINTED IN COLOUR ON 8.5"X11" PAPER ONLY - DO NOT SCALE

updated on:2-Dec-14 by rfletcher

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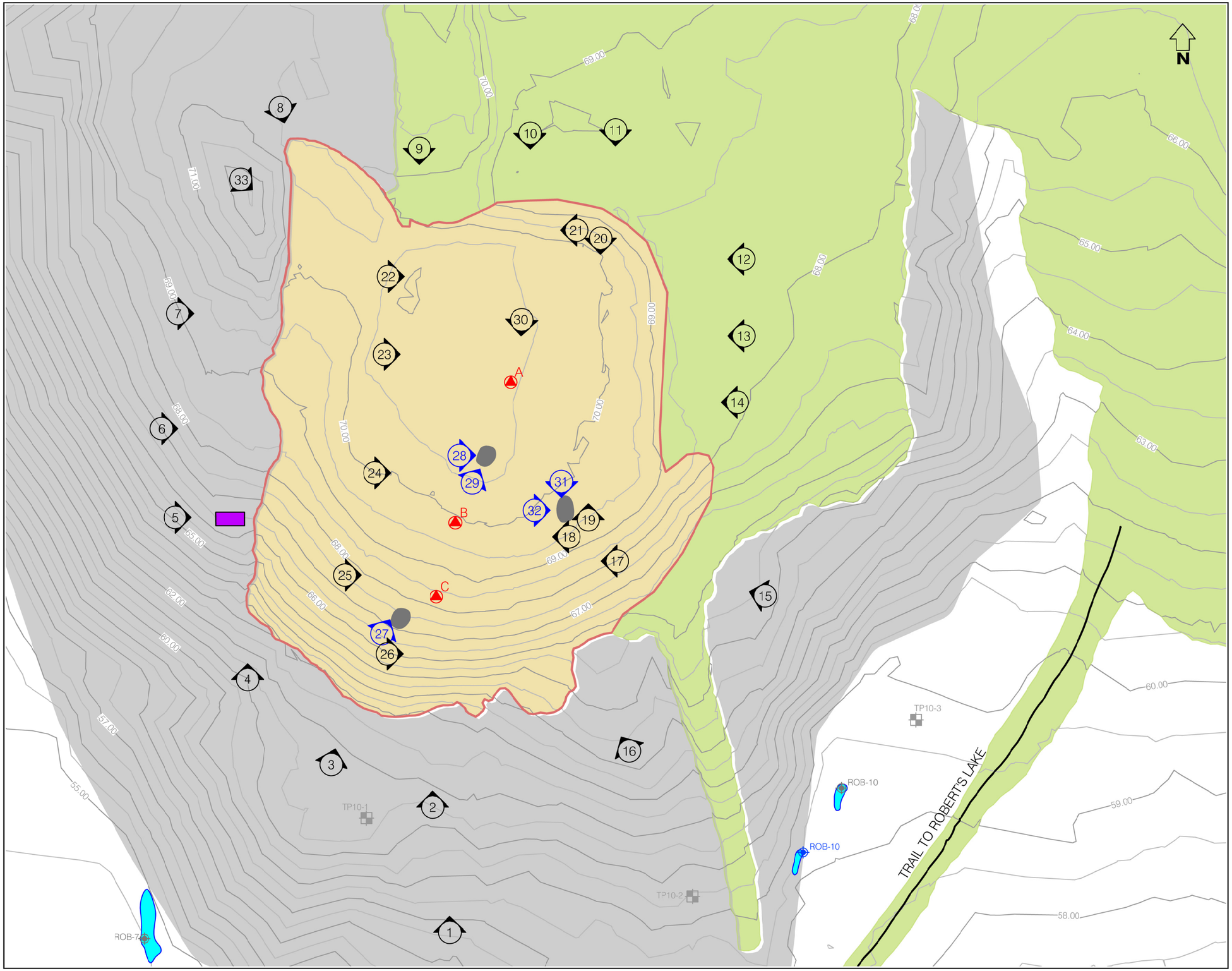

LEGEND

- 68.00 - Ground surface Contour
- Outcrop
- Waste Rock Area
- Pond/Surface water
- Blast Hole (2 m deep) - not visible (covered with rocks)
- Solid Waste Management Facility Landfill
- Possible Settlement Area
- 1 - Picture Viewpoint Number
- 27 - Picture Viewpoint Number (Settlement Area)
- Thermistor
- Surfacewater Sample Location (FRANZ, 2012 & 2014)
- Soil Sample Location (FRANZ, 2010)

REFERENCE:

1. PUBLIC WORKS AND GOVERNMENT SERVICES CANADA, PROJECT N° : 416829, SHEET 2 of 2
2. FIGURE BASED ON AMEC LAND SURVEYS LIMITED DRAWINGS: ROBERTS BAY AND IDA BAY MINE SITE REMEDIATION, SHEETS 1-4, SEPTEMBER 2005

NOTE:

1. SEE ATTACHED CD-ROM FOR VIEWPOINT PICTURES
2. SURFACE WATER SAMPLED IN THE SAME LOCATIONS IN 2012 AND 2014.

Scale 1:500

10 7.5 5.0 2.5 0 metres 10 20

Title: **SOLID WASTE MANAGEMENT FACILITY LANDFILL**

Project: **LONG TERM MONITORING PROGRAM, SWMF LANDFIL, ROBERTS BAY, NUNAVUT**

Client: **ABORIGINAL AFFAIRS AND NORTHERN DEVELOPMENT CANADA**

FRANZ ENVIRONMENTAL INC.
♦ CONSULTING ♦ ENGINEERING ♦ TECHNOLOGIES ♦

Date: October 2010
Updated: December 2014

FIGURE A-2

1967-1001/xxx/MZ/Roberts_Bay_MineSite.dwg

APPENDIX B

Analytical Results Tables

Table B-1
Surface Water Chemical Concentrations - PHCs

PARAMETER / Sample ID / Date	Units	Guidelines		RDL	ROB-6 2014	ROB-8 2014	DUP-1 2014	Duplicate Evaluation		ROB-10 2014	ROB-09 2014
		CCME FWAL[1]	Upper Limit of Acceptability[2]					RPD (%)	Acceptable		
					21/08/2014	21/08/2014	21/08/2014			21/08/2014	21/08/2014
BTEX & F1 Hydrocarbons											
Benzene	ug/L	370	Not Available	0.4	<0.40	<0.40	<0.40	---	Y	<0.40	<0.40
Toluene	ug/L	2	Not Available	0.4	<0.40	<0.40	0.44	---	Y	0.41	<0.40
Ethylbenzene	ug/L	90	Not Available	0.4	<0.40	<0.40	<0.40	---	Y	<0.40	<0.40
o-Xylene	ug/L	NC	Not Available	0.4	<0.40	<0.40	<0.40	---	Y	<0.40	<0.40
p+m-Xylene	ug/L	NC	Not Available	0.8	<0.80	<0.80	<0.80	---	Y	<0.80	<0.80
Total Xylenes	ug/L	NC	Not Available	0.8	<0.80	<0.80	<0.80	---	Y	<0.80	<0.80
F1 (C6-C10)	ug/L	NC	Not Available	100	<100	<100	<100	---	Y	<100	<100
F1 (C6-C10) - BTEX	ug/L	NC	Not Available	100	<100	<100	<100	---	Y	<100	<100
F2-F4 Hydrocarbons											
F2 (C10-C16 Hydrocarbons)	mg/L	NC	Not Available	0.1	<0.10	<0.10	<0.10	---	Y	<0.10	<0.10
F3 (C16-C34 Hydrocarbons)	mg/L	NC	Not Available	0.2	<0.20	<0.20	<0.20	---	Y	<0.20	<0.20
F4 (C34-C50 Hydrocarbons)	mg/L	NC	Not Available	0.2	<0.20	<0.20	<0.20	---	Y	<0.20	<0.20
Reached Baseline at C50	mg/L	NC	Not Available	N/A	Yes	Yes	Yes	NC	NC	Yes	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 calculated 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-2
Surface Water Chemical Concentrations - Metals

PARAMETER		Guidelines			Lowest RDL	ROB-6 2014		ROB-8 2014		DUP-1 2014		Duplicate Evaluation**		ROB-10 2014		ROB-9 2014	
Sample ID		CCME FWAL[1]	Upper Limit of Acceptability[2]									RPD (%)	Acceptable				
Date						21/08/2014		21/08/2014		21/08/2014				21/08/2014		21/08/2014	
Metals	**Units**	Total	Dissolved	Total		Dissolved	Total	Dissolved	Total	Dissolved	Total			Dissolved	Total	Dissolved	Total
Cadmium (Cd)	ug/L	0.00009	0.065	0.15	0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	---	Y	<0.020	<0.020	<0.020	<0.020
Arsenic (As)	mg/L	0.005	0.017	0.08	0.00020	0.00036	0.00046	0.0023	0.0026	0.0021	0.0023	12	Y	0.00083	0.0012	0.00023	0.00035
Chromium (Cr)	mg/L	NC	NC	0.004	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	---	Y	<0.0010	<0.0010	<0.0010	<0.0010
Cobalt (Co)	mg/L	NC	NC	0.008	0.00030	<0.00030	<0.00030	0.00032	0.00036	0.00033	0.00036	---	Y	<0.00030	<0.00030	<0.00030	<0.00030
Copper (Cu)	mg/L	0.002˘	0.006	0.028	0.00020	**0.0045**	**0.0049**	0.00072 (1)	0.00040	0.00040	0.00063	---	Y	**0.0057**	**0.0059**	0.0019	**0.0023**
Lead (Pb)	mg/L	0.001˘	0.001	0.022	0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	---	Y	<0.00020	<0.00020	<0.00020	<0.00020
Nickel (Ni)	mg/L	0.025˘	0.008	0.016	0.00050	0.00051	0.00061	0.00079 (1)	0.00071	0.00066	0.00070	---	Y	<0.00050	<0.00050	0.00053 (1)	<0.00050
Zinc (Zn)	mg/L	0.03	0.012	0.034	0.0030	0.0034 (1)	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	---	Y	<0.0030	<0.0030	<0.0030	<0.0030

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 calculated using mean of previous sampling rounds +3 standard deviations.

3 = The CCME guideline for chromium is the Cr(VI) guideline as it is the more stringent of the available chromium guidelines for the protection of freshwater aquatic life

˘ = Used average water hardness to calculate CCME guideline

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

** = Total metal values used for the Duplicate Evaluation

NC = No Criteria

- Not Analyzed

RDL= Reportable Detection Limit

20 = Exceeds CCME FWAL guideline.

20 = Detection limit exceeds selected guideline

Table B-3
Surface Water Chemical Concentrations - PCBs

PARAMETER	Guidelines		RDL	ROB-6 2014	ROB-8 2014	DUP-1 2014	Duplicate Evaluation		ROB-10 2014	ROB-9 2014
Sample ID	CCME FWAL[1]	Upper Limit of Acceptability[2]					RPD (%)	Acceptable		
Date				21/08/2014	21/08/2014	21/08/2014			21/08/2014	21/08/2014
PCBs (mg/L)										
Aroclor 1016	NC	Not Available	0.000050	<0.000050	<0.000050	<0.000050	---	Y	<0.000050	<0.000050
Aroclor 1221	NC	Not Available	0.000050	<0.000050	<0.000050	<0.000050	---	Y	<0.000050	<0.000050
Aroclor 1232	NC	Not Available	0.000050	<0.000050	<0.000050	<0.000050	---	Y	<0.000050	<0.000050
Aroclor 1242	NC	Not Available	0.000050	<0.000050	<0.000050	<0.000050	---	Y	<0.000050	<0.000050
Aroclor 1248	NC	Not Available	0.000050	<0.000050	<0.000050	<0.000050	---	Y	<0.000050	<0.000050
Aroclor 1254	NC	Not Available	0.000050	<0.000050	<0.000050	<0.000050	---	Y	<0.000050	<0.000050
Aroclor 1260	NC	Not Available	0.000050	<0.000050	<0.000050	<0.000050	---	Y	<0.000050	<0.000050
Aroclor 1262	NC	Not Available	0.000050	<0.000050	<0.000050	<0.000050	---	Y	<0.000050	<0.000050
Aroclor 1268	NC	Not Available	0.000050	<0.000050	<0.000050	<0.000050	---	Y	<0.000050	<0.000050
Total PCB	NC	Not Available	0.000050	<0.000050	<0.000050	<0.000050	---	Y	<0.000050	<0.000050

Notes:

CCME (2007) Canadian Environmental Quality Guidelines Summary Table.

1 = Canadian Water Quality Guidelines for the protection of Freshwater Aquatic Life (FWAL).

Upper Limit of Acceptability is determined as described in Report Section 3.2. Upper

2 = limits of acceptability are calculated 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-4
Surface Water Chemical Concentrations - Inorganic Parameters

PARAMETER		Guidelines		Lowest RDL	ROB-6 2014	ROB-8 2014	DUP-1 2014	Duplicate Evaluation		ROB-10 2014	ROB-9 2014
Sample ID		CCME FWAL[1]	Upper Limit of Acceptability[2]					RPD (%)	Acceptable		
Date					21/08/2014	21/08/2014	21/08/2014			21/08/2014	21/08/2014
Inorganics	**Units**										
Calculated Parameters											
Dissolved Nitrate (NO3)	mg/L	13	4.8	0.044	3.6	<0.044	<0.044	---	Y	**19**	<0.044
Nitrate plus Nitrite (N)	mg/L	NC	NC	0.010	0.81	<0.010	<0.010	---	Y	4.3	<0.010
Dissolved Nitrite (NO2)	mg/L	0.06	NC	0.033	<0.033	<0.033	<0.033	---	Y	<0.033	<0.033
Misc. Inorganics											
Conductivity	uS/cm	NC	5287	1.0	720	5200	5200	0	Y	790	260
pH	pH	6.5-9.0	7.0 < 8.0	N/A	7.92	8.03	8.04	NC	NC	7.88	7.43
Total Dissolved Solids	mg/L	NC	4584	10	420	2900	2900	0	Y	420	120
Total Suspended Solids	mg/L	NC	552	1.0	5.3	15	8.0	61	N	1.3	4.0
Anions											
Dissolved Fluoride (F)	mg/L	0.12	0.16	0.050	0.053	**0.15**	**0.15**	---	Y	<0.050	<0.050
Dissolved Sulphate (SO4)	mg/L	NC	366	1.0	98	160	170	6	Y	150	4.8
Dissolved Chloride (Cl)	mg/L	120	1304	1.0	76	**1500**	**1500**	0	Y	61	61
Nutrients											
Orthophosphate (P)	mg/L	NC	0.007	0.0030	<0.0030	0.0030	<0.0030	---	Y	<0.0030	<0.0030
Dissolved Nitrite (N)	mg/L	13	NC	0.010	<0.010	<0.010	<0.010	---	Y	<0.010	<0.010
Dissolved Nitrate (N)	mg/L	13	5.0	0.010	0.81	<0.010	<0.010	---	Y	4.3	<0.010
Physical Properties											
True Colour	PtCo units	NC	76	2.0	43	80	82	2	Y	15	16

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 calculated using mean of previous sampling rounds +3 standard deviations; significant figures of results are factored in the calculation.

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

NC = No Criteria

RDL= Reportable Detection Limit

20 = Exceeds Upper Limit of Acceptability

APPENDIX C

Surface Water Sampling Notes

1697-1401 Roberts Bay DEW LINES Aug 21/14

8:30 - left Cambridge Bay for Roberts Bay
9:00 - arrived Roberts Bay

- on site Franz (J. Dittburner + K. Krug)
  Air Tindi (M. Murphy & Vandun)
  Beaumont (D Davey)
- went through health + Safety.
- hiked up to landfill.

- surveyed area for surface water
  - found ROB-8 + ROB-10
- Kim will sample surface water
- Julio will do DGPS work (geotech assessment + photo ~~as~~ log work)

ROB-10 2014

- taken in same location as previous years (SE of landfill in small ponded water)

- started sampling at 10:45
  finished sampling at 11:20

1697-1401 DEW Lines Roberts Bay Aug 21/14

2.8°C | 10.98 DO mg/L
0.921 mS/cm | 6.82 pH
535 µS/cm | 129.1 ORP
83.2 DO%

- samples clear - some algae / vegetation in first few from bottom
- total bottles 12

ROB-8 2014 & DUP-1 2014

- sampled at same location as 2012
- confirmed with DGPS
- NE of landfill, large ponded area 6" to 1 ft deep - small critters in water, clear, no odours.

YSI Readings:

8.48°C | 18.27 DO mg/L
5.386 mS/cm | 7.79 pH
~~5.386~~ 3710 µS/cm | 90.0 ORP
160.1 DO%

- sample is clear, some algae likely no sheen, no odours.
- sampled 12 bottles for each - DUP + sample.

Rite in the Rain

1697-1401 DEW Lines Aug 21/14

ROB-7 2014 – sampling location is dry – no sample collected.
– no other sample locations around west side of landfill.

ROB-6 2014 – surface water location
– same location as 2012
– small ponded water down gradient to ROB-10 – south east of landfill
– clear, no algea, no sheen or odours.
* sampled 11 bottles – limited sample for PAHs

YSI Readings.

9.28°C	16.01 DO mg/L
0.804 ms/cm²	6.93 pH
562 µS/cm	122.7 ORP
140.8 DO %	

→ All samples collected with peristaltic pump and YSI 556

1697-1401 DEW Lines Aug 21/14

ROB-9 2014

– same location as previous years on Roberts Lake at end of path (South of landfill)
– background sample

YSI Readings

9.55°C	14.16 DO mg/L
0.275 mS/cm²	6.74 pH
194 µS/cm	127.6 ORP
124.3 DO %	

– Sampled 12 bottles total
– sample clear, no odours or sheen, no algea.

Natural Environment Monitoring.

What saw: wolf, grizzly tracks, sik sik, lemming, ptarmigan, Canada Geese, Common Iders, King Iders, Loons, Swans, Snow buntings.

What is around here too: caribou, muskox, rabbits, Arctic Hare, seals, Char, Trout, whales, foxes

Rite in the Rain

APPENDIX D

Laboratory Certificates of Analyses and

Chain of Custody Forms

Maxxam

Success Through Science®

Your Project #: ROBERTS BAY/1697-1401 DEW LINE
Your C.O.C. #: 445769-01-01

Attention: JULIE DITTBURNER
FRANZ ENVIRONMENTAL INC.
329 CHURCHILL AVE NORTH
SUITE 2000
OTTAWA, ON
CANADA K1Z 5B8

Report Date: 2014/09/02
Report #: R1634076
Version: 1

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B474869
Received: 2014/08/22, 9:15

Sample Matrix: Water
Samples Received: 5

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
BTEX/F1 in Water by HS GC/MS	5	N/A	2014/08/28	AB SOP-00039	CCME CWS/EPA 5260C m
Cadmium - low level CCME - Dissolved	5	N/A	2014/09/01	AB SOP-00043	EPA 200.8 R5.4 m
Cadmium - low level CCME (Total)	5	2014/08/26	2014/09/01	AB SOP-00014 / AB SOP-00043	EPA 200.8 R5.4m
Chloride by Automated Colourimetry	5	N/A	2014/08/29	AB SOP-00020	SM 22 4500-Cl G m
True Colour	5	N/A	2014/08/27	EENVSOP-00065	SM 22 2120 C m
Conductivity @25C	5	N/A	2014/08/28	AB SOP-00005	SM 22 2510 B m
Fluoride	5	N/A	2014/08/28	AB SOP-00005	SM 22 4500-F C m
CCME Hydrocarbons (F2-F4 in water)	5	2014/08/27	2014/08/28	AB SOP-00037 / AB SOP-00040	CCME PHC-CWS
Elements by ICP - Dissolved	5	N/A	2014/08/28	AB SOP-00042	EPA 200.7 CFR 2012 m
Elements by ICP - Total	5	2014/08/31	2014/08/31	AB SOP-00014 / AB SOP-00042	EPA 200.7 CFR 2012 m
Elements by ICPMS - Dissolved	5	N/A	2014/08/31	AB SOP-00043	EPA 200.8 R5.4 m
Elements by ICPMS - Total	5	2014/08/31	2014/08/31	AB SOP-00014 / AB SOP-00043	EPA 200.8 R5.4 m
Nitrate and Nitrite	5	N/A	2014/08/30	AB SOP-00023	Auto Calc
Nitrate + Nitrite-N (calculated)	5	N/A	2014/08/30	AB SOP-00023	SM 4110-B
Nitrogen, (Nitrite, Nitrate) by IC	5	N/A	2014/08/27	AB SOP-00023	SM 22 4110 B m
Polychlorinated Biphenyls (1)	5	2014/08/27	2014/08/30	CAL SOP-00149	EPA 3510C, EPA 8082A
pH @25C	5	N/A	2014/08/28	AB SOP-00005	SM 22 4500-H B m
Orthophosphate by Konelab	5	N/A	2014/08/27	AB SOP-00025	SM 22 4500-P A,B,F m
Sulphate by Automated Colourimetry	5	N/A	2014/08/29	AB SOP-00018	SM 22 4500-SO4 E m
Total Dissolved Solids (Filt. Residue)	5	2014/08/27	2014/08/27	AB SOP-00065	SM 22 2540 C m
Total Suspended Solids (NFR)	5	2014/08/27	2014/08/27	AB SOP-00061	SM 22 2540 D m

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

(1) This test was performed by Maxxam Calgary Environmental

Your Project #: ROBERTS BAY/1697-1401 DEW LINE
Your C.O.C. #: 445769-01-01

Attention: JULIE DITTBURNER
FRANZ ENVIRONMENTAL INC.
329 CHURCHILL AVE NORTH
SUITE 2000
OTTAWA, ON
CANADA K1Z 5B8

Report Date: 2014/09/02
Report #: R1634076
Version: 1

CERTIFICATE OF ANALYSIS

Encryption Key

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

Sherlyne Sim, B.Eng, Project Manager
Email: SSim@maxxam.ca
Phone# (780) 577-7113

==========

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 #: B474869
Report Date: 2014/09/02

FRANZ ENVIRONMENTAL INC.
Client Project #: ROBERTS BAY/1697-1401 DEW LINE

Sampler Initials: JD , KK

AT1 BTEX AND F1-F4 IN WATER (WATER)

Maxxam ID		KL1807	KL1808	KL1809	KL1810	KL1811		
Sampling Date		2014/08/21	2014/08/21	2014/08/21	2014/08/21	2014/08/21		
COC Number		445769-01-01	445769-01-01	445769-01-01	445769-01-01	445769-01-01		
	UNITS	**R0B-6 2014**	**R0B-8 2014**	**R0B-9 2014**	**R0B-10 2014**	**DUP-1 2014**	**RDL**	**QC Batch**
Ext. Pet. Hydrocarbon								
F2 (C10-C16 Hydrocarbons)	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	7616052
F3 (C16-C34 Hydrocarbons)	mg/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	7616052
F4 (C34-C50 Hydrocarbons)	mg/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	7616052
Reached Baseline at C50	mg/L	Yes	Yes	Yes	Yes	Yes	N/A	7616052
Volatiles								
Benzene	ug/L	<0.40	<0.40	<0.40	<0.40	<0.40	0.40	7616051
Toluene	ug/L	<0.40	<0.40	<0.40	0.41	0.44	0.40	7616051
Ethylbenzene	ug/L	<0.40	<0.40	<0.40	<0.40	<0.40	0.40	7616051
m & p-Xylene	ug/L	<0.80	<0.80	<0.80	<0.80	<0.80	0.80	7616051
o-Xylene	ug/L	<0.40	<0.40	<0.40	<0.40	<0.40	0.40	7616051
Xylenes (Total)	ug/L	<0.80	<0.80	<0.80	<0.80	<0.80	0.80	7616051
F1 (C6-C10) - BTEX	ug/L	<100	<100	<100	<100	<100	100	7616051
(C6-C10)	ug/L	<100	<100	<100	<100	<100	100	7616051
Surrogate Recovery (%)								
1,4-Difluorobenzene (sur.)	%	101	98	98	98	98	N/A	7616051
4-Bromofluorobenzene (sur.)	%	100	100	99	100	98	N/A	7616051
D4-1,2-Dichloroethane (sur.)	%	101	103	100	103	103	N/A	7616051
O-TERPHENYL (sur.)	%	104	108	104	115	104	N/A	7616052

N/A = Not Applicable
RDL = Reportable Detection Limit

Maxxam Job #: B474869
Report Date: 2014/09/02

FRANZ ENVIRONMENTAL INC.
Client Project #: ROBERTS BAY/1697-1401 DEW LINE

Sampler Initials: JD , KK

REGULATED METALS (CCME/AT1) - DISSOLVED

Maxxam ID		KL1807			KL1808			KL1809		
Sampling Date		2014/08/21			2014/08/21			2014/08/21		
COC Number		445769-01-01			445769-01-01			445769-01-01		
	UNITS	**R0B-6 2014**	**RDL**	**QC Batch**	**R0B-8 2014**	**RDL**	**QC Batch**	**R0B-9 2014**	**RDL**	**QC Batch**
Low Level Elements										
Dissolved Cadmium (Cd)	ug/L	<0.020	0.020	7614764	<0.020	0.020	7615813	<0.020	0.020	7615813
Elements										
Dissolved Aluminum (Al)	mg/L	0.016	0.0030	7621619	0.0069	0.0030	7621619	0.014	0.0030	7621619
Dissolved Antimony (Sb)	mg/L	<0.00060	0.00060	7621619	<0.00060	0.00060	7621619	<0.00060	0.00060	7621619
Dissolved Arsenic (As)	mg/L	0.00036	0.00020	7621619	0.0023	0.00020	7621619	0.00023	0.00020	7621619
Dissolved Barium (Ba)	mg/L	0.049	0.010	7618491	0.044	0.010	7618491	<0.010	0.010	7618812
Dissolved Beryllium (Be)	mg/L	<0.0010	0.0010	7621619	<0.0010	0.0010	7621619	<0.0010	0.0010	7621619
Dissolved Boron (B)	mg/L	0.034	0.020	7618491	0.044	0.020	7618491	0.026	0.020	7618812
Dissolved Calcium (Ca)	mg/L	72	0.30	7618491	140	0.30	7618491	6.1	0.30	7618812
Dissolved Chromium (Cr)	mg/L	<0.0010	0.0010	7621619	<0.0010	0.0010	7621619	<0.0010	0.0010	7621619
Dissolved Cobalt (Co)	mg/L	<0.00030	0.00030	7621619	0.00032	0.00030	7621619	<0.00030	0.00030	7621619
Dissolved Copper (Cu)	mg/L	0.0045	0.00020	7621619	0.00072 (1)	0.00020	7621619	0.0019	0.00020	7621619
Dissolved Iron (Fe)	mg/L	<0.060	0.060	7618491	0.13	0.060	7618491	<0.060	0.060	7618812
Dissolved Lead (Pb)	mg/L	<0.00020	0.00020	7621619	<0.00020	0.00020	7621619	<0.00020	0.00020	7621619
Dissolved Lithium (Li)	mg/L	<0.020	0.020	7618491	<0.020	0.020	7618491	<0.020	0.020	7618812
Dissolved Magnesium (Mg)	mg/L	27	0.20	7618491	110	0.20	7618491	6.1	0.20	7618812
Dissolved Manganese (Mn)	mg/L	<0.0040	0.0040	7618491	0.20	0.0040	7618491	<0.0040	0.0040	7618812
Dissolved Molybdenum (Mo)	mg/L	0.00069	0.00020	7621619	0.00072	0.00020	7621619	0.00020	0.00020	7621619
Dissolved Nickel (Ni)	mg/L	0.00051	0.00050	7621619	0.00079 (1)	0.00050	7621619	0.00053 (1)	0.00050	7621619
Dissolved Phosphorus (P)	mg/L	<0.10	0.10	7618491	<0.10	0.10	7618491	<0.10	0.10	7618812
Dissolved Potassium (K)	mg/L	2.8	0.30	7618491	9.8	0.30	7618491	2.0	0.30	7618812
Dissolved Selenium (Se)	mg/L	<0.00020	0.00020	7621619	<0.00020	0.00020	7621619	<0.00020	0.00020	7621619
Dissolved Silicon (Si)	mg/L	2.7	0.10	7618491	0.39	0.10	7618491	0.30	0.10	7618812
Dissolved Silver (Ag)	mg/L	<0.00010	0.00010	7621619	<0.00010	0.00010	7621619	<0.00010	0.00010	7621619
Dissolved Sodium (Na)	mg/L	34	0.50	7618491	750 (2)	5.0	7618491	33	0.50	7618812
Dissolved Strontium (Sr)	mg/L	0.14	0.020	7618491	0.70	0.020	7618491	0.037	0.020	7618812
Dissolved Sulphur (S)	mg/L	30	0.20	7618491	50	0.20	7618491	1.7	0.20	7618812
Dissolved Thallium (Tl)	mg/L	<0.00020	0.00020	7621619	<0.00020	0.00020	7621619	<0.00020	0.00020	7621619
Dissolved Tin (Sn)	mg/L	<0.0010	0.0010	7621619	<0.0010	0.0010	7621619	<0.0010	0.0010	7621619
Dissolved Titanium (Ti)	mg/L	<0.0010	0.0010	7621619	<0.0010	0.0010	7621619	<0.0010	0.0010	7621619
Dissolved Uranium (U)	mg/L	0.0020	0.00010	7621619	0.0011	0.00010	7621619	<0.00010	0.00010	7621619
Dissolved Vanadium (V)	mg/L	<0.0010	0.0010	7621619	<0.0010	0.0010	7621619	<0.0010	0.0010	7621619

RDL = Reportable Detection Limit
(1) Dissolved greater than total. Results are within limits of uncertainty(MU).
(2) Detection limits raised due to dilution to bring analyte within the calibrated range.

Maxxam Job #: B474869
Report Date: 2014/09/02

FRANZ ENVIRONMENTAL INC.
Client Project #: ROBERTS BAY/1697-1401 DEW LINE

Sampler Initials: JD , KK

REGULATED METALS (CCME/AT1) - DISSOLVED

Maxxam ID		KL1807			KL1808			KL1809		
Sampling Date		2014/08/21			2014/08/21			2014/08/21		
COC Number		445769-01-01			445769-01-01			445769-01-01		
	UNITS	**R0B-6 2014**	**RDL**	**QC Batch**	**R0B-8 2014**	**RDL**	**QC Batch**	**R0B-9 2014**	**RDL**	**QC Batch**
Dissolved Zinc (Zn)	mg/L	0.0034 (1)	0.0030	7621619	<0.0030	0.0030	7621619	<0.0030	0.0030	7621619

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

Maxxam Job #: B474869
Report Date: 2014/09/02

FRANZ ENVIRONMENTAL INC.
Client Project #: ROBERTS BAY/1697-1401 DEW LINE

Sampler Initials: JD , KK

REGULATED METALS (CCME/AT1) - DISSOLVED

Maxxam ID		KL1810		KL1811		
Sampling Date		2014/08/21		2014/08/21		
COC Number		445769-01-01		445769-01-01		
	UNITS	**R0B-10 2014**	**RDL**	**DUP-1 2014**	**RDL**	**QC Batch**
Low Level Elements						
Dissolved Cadmium (Cd)	ug/L	<0.020	0.020	<0.020	0.020	7615813
Elements						
Dissolved Aluminum (Al)	mg/L	0.0064	0.0030	0.0050	0.0030	7621619
Dissolved Antimony (Sb)	mg/L	0.0015	0.00060	<0.00060	0.00060	7621619
Dissolved Arsenic (As)	mg/L	0.00083	0.00020	0.0021	0.00020	7621619
Dissolved Barium (Ba)	mg/L	0.037	0.010	0.045	0.010	7618812
Dissolved Beryllium (Be)	mg/L	<0.0010	0.0010	<0.0010	0.0010	7621619
Dissolved Boron (B)	mg/L	0.045	0.020	0.039	0.020	7618812
Dissolved Calcium (Ca)	mg/L	77	0.30	140	0.30	7618812
Dissolved Chromium (Cr)	mg/L	<0.0010	0.0010	<0.0010	0.0010	7621619
Dissolved Cobalt (Co)	mg/L	<0.00030	0.00030	0.00033	0.00030	7621619
Dissolved Copper (Cu)	mg/L	0.0057	0.00020	0.00040	0.00020	7621619
Dissolved Iron (Fe)	mg/L	<0.060	0.060	0.13	0.060	7618812
Dissolved Lead (Pb)	mg/L	<0.00020	0.00020	<0.00020	0.00020	7621619
Dissolved Lithium (Li)	mg/L	<0.020	0.020	<0.020	0.020	7618812
Dissolved Magnesium (Mg)	mg/L	26	0.20	120	0.20	7618812
Dissolved Manganese (Mn)	mg/L	<0.0040	0.0040	0.19	0.0040	7618812
Dissolved Molybdenum (Mo)	mg/L	0.0017	0.00020	0.00080	0.00020	7621619
Dissolved Nickel (Ni)	mg/L	<0.00050	0.00050	0.00066	0.00050	7621619
Dissolved Phosphorus (P)	mg/L	<0.10	0.10	<0.10	0.10	7618812
Dissolved Potassium (K)	mg/L	4.0	0.30	10	0.30	7618812
Dissolved Selenium (Se)	mg/L	0.00038	0.00020	<0.00020	0.00020	7621619
Dissolved Silicon (Si)	mg/L	2.2	0.10	0.39	0.10	7618812
Dissolved Silver (Ag)	mg/L	<0.00010	0.00010	<0.00010	0.00010	7621619
Dissolved Sodium (Na)	mg/L	51	0.50	740 (1)	5.0	7618812
Dissolved Strontium (Sr)	mg/L	0.15	0.020	0.72	0.020	7618812
Dissolved Sulphur (S)	mg/L	45	0.20	50	0.20	7618812
Dissolved Thallium (Tl)	mg/L	<0.00020	0.00020	<0.00020	0.00020	7621619
Dissolved Tin (Sn)	mg/L	<0.0010	0.0010	<0.0010	0.0010	7621619
Dissolved Titanium (Ti)	mg/L	<0.0010	0.0010	<0.0010	0.0010	7621619
Dissolved Uranium (U)	mg/L	0.0030	0.00010	0.0010	0.00010	7621619
Dissolved Vanadium (V)	mg/L	<0.0010	0.0010	<0.0010	0.0010	7621619

RDL = Reportable Detection Limit
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.

Maxxam Job #: B474869
Report Date: 2014/09/02

FRANZ ENVIRONMENTAL INC.
Client Project #: ROBERTS BAY/1697-1401 DEW LINE

Sampler Initials: JD , KK

REGULATED METALS (CCME/AT1) - DISSOLVED

Maxxam ID		KL1810		KL1811		
Sampling Date		2014/08/21		2014/08/21		
COC Number		445769-01-01		445769-01-01		
	UNITS	**R0B-10 2014**	**RDL**	**DUP-1 2014**	**RDL**	**QC Batch**
Dissolved Zinc (Zn)	mg/L	<0.0030	0.0030	<0.0030	0.0030	7621619

RDL = Reportable Detection Limit

Maxxam Job #: B474869
Report Date: 2014/09/02

FRANZ ENVIRONMENTAL INC.
Client Project #: ROBERTS BAY/1697-1401 DEW LINE

Sampler Initials: JD , KK

REGULATED METALS (CCME/AT1) - TOTAL

Maxxam ID		KL1807		KL1808		KL1809	KL1810		
Sampling Date		2014/08/21		2014/08/21		2014/08/21	2014/08/21		
COC Number		445769-01-01		445769-01-01		445769-01-01	445769-01-01		
	UNITS	**R0B-6 2014**	**RDL**	**R0B-8 2014**	**RDL**	**R0B-9 2014**	**R0B-10 2014**	**RDL**	**QC Batch**
Low Level Elements									
Total Cadmium (Cd)	ug/L	<0.020	0.020	<0.020	0.020	<0.020	<0.020	0.020	7614765
Elements									
Total Aluminum (Al)	mg/L	0.024	0.0030	0.013	0.0030	0.077	0.0094	0.0030	7621571
Total Antimony (Sb)	mg/L	<0.00060	0.00060	<0.00060	0.00060	<0.00060	0.0016	0.00060	7621571
Total Arsenic (As)	mg/L	0.00046	0.00020	0.0026	0.00020	0.00035	0.0012	0.00020	7621571
Total Barium (Ba)	mg/L	0.051	0.010	0.045	0.010	<0.010	0.037	0.010	7621574
Total Beryllium (Be)	mg/L	<0.0010	0.0010	<0.0010	0.0010	<0.0010	<0.0010	0.0010	7621571
Total Boron (B)	mg/L	0.038	0.020	0.045	0.020	0.023	0.051	0.020	7621574
Total Calcium (Ca)	mg/L	71	0.30	140	0.30	5.8	75	0.30	7621574
Total Chromium (Cr)	mg/L	<0.0010	0.0010	<0.0010	0.0010	<0.0010	<0.0010	0.0010	7621571
Total Cobalt (Co)	mg/L	<0.00030	0.00030	0.00036	0.00030	<0.00030	<0.00030	0.00030	7621571
Total Copper (Cu)	mg/L	0.0049	0.00020	0.00040	0.00020	0.0023	0.0059	0.00020	7621571
Total Iron (Fe)	mg/L	0.14	0.060	0.15	0.060	0.17	<0.060	0.060	7621574
Total Lead (Pb)	mg/L	<0.00020	0.00020	<0.00020	0.00020	<0.00020	<0.00020	0.00020	7621571
Total Lithium (Li)	mg/L	<0.020	0.020	<0.020	0.020	<0.020	<0.020	0.020	7621574
Total Magnesium (Mg)	mg/L	29	0.20	120	0.20	6.5	27	0.20	7621574
Total Manganese (Mn)	mg/L	0.0050	0.0040	0.20	0.0040	0.011	<0.0040	0.0040	7621574
Total Molybdenum (Mo)	mg/L	0.00070	0.00020	0.00079	0.00020	0.00024	0.0017	0.00020	7621571
Total Nickel (Ni)	mg/L	0.00061	0.00050	0.00071	0.00050	<0.00050	<0.00050	0.00050	7621571
Total Phosphorus (P)	mg/L	<0.10	0.10	<0.10	0.10	<0.10	<0.10	0.10	7621574
Total Potassium (K)	mg/L	3.1	0.30	11	0.30	2.2	4.3	0.30	7621574
Total Selenium (Se)	mg/L	<0.00020	0.00020	<0.00020	0.00020	<0.00020	0.00041	0.00020	7621571
Total Silicon (Si)	mg/L	2.9	0.10	0.43	0.10	0.48	2.3	0.10	7621574
Total Silver (Ag)	mg/L	<0.00010	0.00010	<0.00010	0.00010	<0.00010	<0.00010	0.00010	7621571
Total Sodium (Na)	mg/L	35	0.50	770 (1)	5.0	34	52	0.50	7621574
Total Strontium (Sr)	mg/L	0.15	0.020	0.71	0.020	0.038	0.15	0.020	7621574
Total Sulphur (S)	mg/L	31	0.20	52	0.20	1.6	46	0.20	7621574
Total Thallium (Tl)	mg/L	<0.00020	0.00020	<0.00020	0.00020	<0.00020	<0.00020	0.00020	7621571
Total Tin (Sn)	mg/L	<0.0010	0.0010	<0.0010	0.0010	<0.0010	<0.0010	0.0010	7621571
Total Titanium (Ti)	mg/L	<0.0010	0.0010	<0.0010	0.0010	0.0024	<0.0010	0.0010	7621571
Total Uranium (U)	mg/L	0.0022	0.00010	0.0012	0.00010	<0.00010	0.0031	0.00010	7621571
Total Vanadium (V)	mg/L	<0.0010	0.0010	<0.0010	0.0010	0.0016	0.0015	0.0010	7621571

RDL = Reportable Detection Limit
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.

Maxxam Job #: B474869
Report Date: 2014/09/02

FRANZ ENVIRONMENTAL INC.
Client Project #: ROBERTS BAY/1697-1401 DEW LINE

Sampler Initials: JD , KK

REGULATED METALS (CCME/AT1) - TOTAL

Maxxam ID		KL1807		KL1808		KL1809	KL1810		
Sampling Date		2014/08/21		2014/08/21		2014/08/21	2014/08/21		
COC Number		445769-01-01		445769-01-01		445769-01-01	445769-01-01		
	UNITS	**R0B-6 2014**	**RDL**	**R0B-8 2014**	**RDL**	**R0B-9 2014**	**R0B-10 2014**	**RDL**	**QC Batch**
Total Zinc (Zn)	mg/L	<0.0030	0.0030	<0.0030	0.0030	<0.0030	<0.0030	0.0030	7621571

RDL = Reportable Detection Limit

Maxxam Job #: B474869
Report Date: 2014/09/02

FRANZ ENVIRONMENTAL INC.
Client Project #: ROBERTS BAY/1697-1401 DEW LINE

Sampler Initials: JD , KK

REGULATED METALS (CCME/AT1) - TOTAL

Maxxam ID		KL1811		
Sampling Date		2014/08/21		
COC Number		445769-01-01		
	UNITS	**DUP-1 2014**	**RDL**	**QC Batch**
Low Level Elements				
Total Cadmium (Cd)	ug/L	<0.020	0.020	7615814
Elements				
Total Aluminum (Al)	mg/L	0.013	0.0030	7621571
Total Antimony (Sb)	mg/L	<0.00060	0.00060	7621571
Total Arsenic (As)	mg/L	0.0023	0.00020	7621571
Total Barium (Ba)	mg/L	0.045	0.010	7621574
Total Beryllium (Be)	mg/L	<0.0010	0.0010	7621571
Total Boron (B)	mg/L	0.044	0.020	7621574
Total Calcium (Ca)	mg/L	140	0.30	7621574
Total Chromium (Cr)	mg/L	<0.0010	0.0010	7621571
Total Cobalt (Co)	mg/L	0.00036	0.00030	7621571
Total Copper (Cu)	mg/L	0.00063	0.00020	7621571
Total Iron (Fe)	mg/L	0.14	0.060	7621574
Total Lead (Pb)	mg/L	<0.00020	0.00020	7621571
Total Lithium (Li)	mg/L	<0.020	0.020	7621574
Total Magnesium (Mg)	mg/L	120	0.20	7621574
Total Manganese (Mn)	mg/L	0.20	0.0040	7621574
Total Molybdenum (Mo)	mg/L	0.00084	0.00020	7621571
Total Nickel (Ni)	mg/L	0.00070	0.00050	7621571
Total Phosphorus (P)	mg/L	<0.10	0.10	7621574
Total Potassium (K)	mg/L	11	0.30	7621574
Total Selenium (Se)	mg/L	<0.00020	0.00020	7621571
Total Silicon (Si)	mg/L	0.43	0.10	7621574
Total Silver (Ag)	mg/L	<0.00010	0.00010	7621571
Total Sodium (Na)	mg/L	780 (1)	5.0	7621574
Total Strontium (Sr)	mg/L	0.70	0.020	7621574
Total Sulphur (S)	mg/L	52	0.20	7621574
Total Thallium (Tl)	mg/L	<0.00020	0.00020	7621571
Total Tin (Sn)	mg/L	<0.0010	0.0010	7621571
Total Titanium (Ti)	mg/L	<0.0010	0.0010	7621571
Total Uranium (U)	mg/L	0.0011	0.00010	7621571
Total Vanadium (V)	mg/L	<0.0010	0.0010	7621571

RDL = Reportable Detection Limit
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.

Maxxam Job #: B474869
Report Date: 2014/09/02

FRANZ ENVIRONMENTAL INC.
Client Project #: ROBERTS BAY/1697-1401 DEW LINE

Sampler Initials: JD , KK

REGULATED METALS (CCME/AT1) - TOTAL

Maxxam ID		KL1811		
Sampling Date		2014/08/21		
COC Number		445769-01-01		
	UNITS	**DUP-1 2014**	**RDL**	**QC Batch**
Total Zinc (Zn)	mg/L	<0.0030	0.0030	7621571

RDL = Reportable Detection Limit

Maxxam Job #: B474869
Report Date: 2014/09/02

FRANZ ENVIRONMENTAL INC.
Client Project #: ROBERTS BAY/1697-1401 DEW LINE

Sampler Initials: JD , KK

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		KL1807		KL1808		KL1809		KL1810		
Sampling Date		2014/08/21		2014/08/21		2014/08/21		2014/08/21		
COC Number		445769-01-01		445769-01-01		445769-01-01		445769-01-01		
	UNITS	**R0B-6 2014**	**RDL**	**R0B-8 2014**	**RDL**	**R0B-9 2014**	**QC Batch**	**R0B-10 2014**	**RDL**	**QC Batch**
Calculated Parameters										
Dissolved Nitrate (NO3)	mg/L	3.6	0.044	<0.044	0.044	<0.044	7615803	19	0.044	7615803
Nitrate plus Nitrite (N)	mg/L	0.81	0.010	<0.010	0.010	<0.010	7615804	4.3	0.010	7615804
Dissolved Nitrite (NO2)	mg/L	<0.033	0.033	<0.033	0.033	<0.033	7615803	<0.033	0.033	7615803
Misc. Inorganics										
Conductivity	uS/cm	720	1.0	5200	1.0	260	7617750	790	1.0	7617750
pH	pH	7.92	N/A	8.03	N/A	7.43	7617753	7.88	N/A	7617753
Total Dissolved Solids	mg/L	420	10	2900	10	120	7616064	420	10	7616064
Total Suspended Solids	mg/L	5.3	1.0	15	1.0	4.0	7615952	1.3	1.0	7615952
Anions										
Dissolved Fluoride (F)	mg/L	0.053	0.050	0.15	0.050	<0.050	7617755	<0.050	0.050	7617755
Dissolved Sulphate (SO4)	mg/L	98	1.0	160	1.0	4.8	7616517	150	1.0	7617643
Dissolved Chloride (Cl)	mg/L	76	1.0	1500 (1)	10	61	7616503	61	1.0	7617609
Nutrients										
Orthophosphate (P)	mg/L	<0.0030	0.0030	0.0030	0.0030	<0.0030	7616111	<0.0030	0.0030	7616111
Dissolved Nitrite (N)	mg/L	<0.010	0.010	<0.010	0.010	<0.010	7616801	<0.010	0.010	7616801
Dissolved Nitrate (N)	mg/L	0.81	0.010	<0.010	0.010	<0.010	7616801	4.3	0.010	7616801
Physical Properties										
True Colour	PtCo units	43	2.0	80	2.0	16	7617011	15	2.0	7617011

RDL = Reportable Detection Limit
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.

Maxxam Job #: B474869
Report Date: 2014/09/02

FRANZ ENVIRONMENTAL INC.
Client Project #: ROBERTS BAY/1697-1401 DEW LINE

Sampler Initials: JD , KK

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		KL1811		
Sampling Date		2014/08/21		
COC Number		445769-01-01		
	UNITS	**DUP-1 2014**	**RDL**	**QC Batch**
Calculated Parameters				
Dissolved Nitrate (NO3)	mg/L	<0.044	0.044	7615803
Nitrate plus Nitrite (N)	mg/L	<0.010	0.010	7615804
Dissolved Nitrite (NO2)	mg/L	<0.033	0.033	7615803
Misc. Inorganics				
Conductivity	uS/cm	5200	1.0	7617750
pH	pH	8.04	N/A	7617753
Total Dissolved Solids	mg/L	2900	10	7616064
Total Suspended Solids	mg/L	8.0	1.0	7615952
Anions				
Dissolved Fluoride (F)	mg/L	0.15	0.050	7617755
Dissolved Sulphate (SO4)	mg/L	170	1.0	7617643
Dissolved Chloride (Cl)	mg/L	1500 (1)	10	7617609
Nutrients				
Orthophosphate (P)	mg/L	<0.0030	0.0030	7616111
Dissolved Nitrite (N)	mg/L	<0.010	0.010	7616801
Dissolved Nitrate (N)	mg/L	<0.010	0.010	7616801
Physical Properties				
True Colour	PtCo units	82	2.0	7617011

RDL = Reportable Detection Limit
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.

Maxxam Job #: B474869
Report Date: 2014/09/02

FRANZ ENVIRONMENTAL INC.
Client Project #: ROBERTS BAY/1697-1401 DEW LINE

Sampler Initials: JD , KK

POLYCHLORINATED BIPHENYLS BY GC-ECD (WATER)

Maxxam ID		KL1807	KL1808	KL1809	KL1810	KL1811		
Sampling Date		2014/08/21	2014/08/21	2014/08/21	2014/08/21	2014/08/21		
COC Number		445769-01-01	445769-01-01	445769-01-01	445769-01-01	445769-01-01		
	UNITS	**R0B-6 2014**	**R0B-8 2014**	**R0B-9 2014**	**R0B-10 2014**	**DUP-1 2014**	**RDL**	**QC Batch**
Polychlorinated Biphenyls								
Aroclor 1016	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000050	7616071
Aroclor 1221	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000050	7616071
Aroclor 1232	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000050	7616071
Aroclor 1242	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000050	7616071
Aroclor 1248	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000050	7616071
Aroclor 1254	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000050	7616071
Aroclor 1260	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000050	7616071
Aroclor 1262	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000050	7616071
Aroclor 1268	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000050	7616071
Total Aroclors	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000050	7616071
Surrogate Recovery (%)								
NONACHLOROBIPHENYL (sur.)	%	67	69	70	65	68	N/A	7616071

N/A = Not Applicable
RDL = Reportable Detection Limit

Maxxam Job #: B474869
Report Date: 2014/09/02

FRANZ ENVIRONMENTAL INC.
Client Project #: ROBERTS BAY/1697-1401 DEW LINE

Sampler Initials: JD , KK

Package 1	8.3°C
Package 2	10.0°C

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

General Comments

Results relate only to the items tested.

FRANZ ENVIRONMENTAL INC.
Attention: JULIE DITTBURNER
Client Project #: ROBERTS BAY/1697-1401 DEW LINE
P.O. #:
Site Location:

Quality Assurance Report

Maxxam Job Number: EYKB474869

QA/QC Batch Num	Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	UNITS	QC Limits
7615952	RPT	Matrix Spike	Total Suspended Solids	2014/08/27		103	%	80 - 120
		Spiked Blank	Total Suspended Solids	2014/08/27		101	%	80 - 120
		Method Blank	Total Suspended Solids	2014/08/27	<1.0		mg/L	
		RPD	Total Suspended Solids	2014/08/27	NC		%	20
7616051	PS7	Matrix Spike	1,4-Difluorobenzene (sur.)	2014/08/28		96	%	70 - 130
			4-Bromofluorobenzene (sur.)	2014/08/28		100	%	70 - 130
			D4-1,2-Dichloroethane (sur.)	2014/08/28		103	%	70 - 130
			Benzene	2014/08/28		81	%	70 - 130
			Toluene	2014/08/28		81	%	70 - 130
			Ethylbenzene	2014/08/28		84	%	70 - 130
			m & p-Xylene	2014/08/28		83	%	70 - 130
			o-Xylene	2014/08/28		85	%	70 - 130
			(C6-C10)	2014/08/28		87	%	70 - 130
		Spiked Blank	1,4-Difluorobenzene (sur.)	2014/08/29		105	%	70 - 130
			4-Bromofluorobenzene (sur.)	2014/08/29		81	%	70 - 130
			D4-1,2-Dichloroethane (sur.)	2014/08/29		110	%	70 - 130
			Benzene	2014/08/29		87	%	70 - 130
			Toluene	2014/08/29		98	%	70 - 130
			Ethylbenzene	2014/08/29		84	%	70 - 130
			m & p-Xylene	2014/08/29		88	%	70 - 130
			o-Xylene	2014/08/29		86	%	70 - 130
			(C6-C10)	2014/08/29		102	%	70 - 130
		Method Blank	1,4-Difluorobenzene (sur.)	2014/08/29		109	%	70 - 130
			4-Bromofluorobenzene (sur.)	2014/08/29		85	%	70 - 130
			D4-1,2-Dichloroethane (sur.)	2014/08/29		115	%	70 - 130
			Benzene	2014/08/29	<0.40		ug/L	
			Toluene	2014/08/29	<0.40		ug/L	
			Ethylbenzene	2014/08/29	<0.40		ug/L	
			m & p-Xylene	2014/08/29	<0.80		ug/L	
			o-Xylene	2014/08/29	<0.40		ug/L	
			Xylenes (Total)	2014/08/29	<0.80		ug/L	
			F1 (C6-C10) - BTEX	2014/08/29	<100		ug/L	
			(C6-C10)	2014/08/29	<100		ug/L	
		RPD	Benzene	2014/08/29	NC		%	40
			Toluene	2014/08/29	NC		%	40
			Ethylbenzene	2014/08/29	NC		%	40
			m & p-Xylene	2014/08/29	NC		%	40
			o-Xylene	2014/08/29	NC		%	40
			Xylenes (Total)	2014/08/29	NC		%	40
			F1 (C6-C10) - BTEX	2014/08/29	NC		%	40
			(C6-C10)	2014/08/29	NC		%	40
7616052	KK5	Matrix Spike						
		[KL1808-08]	O-TERPHENYL (sur.)	2014/08/28		98	%	50 - 130
			F2 (C10-C16 Hydrocarbons)	2014/08/28		101	%	50 - 130
			F3 (C16-C34 Hydrocarbons)	2014/08/28		101	%	50 - 130
			F4 (C34-C50 Hydrocarbons)	2014/08/28		91	%	50 - 130
		Spiked Blank	O-TERPHENYL (sur.)	2014/08/28		101	%	50 - 130
			F2 (C10-C16 Hydrocarbons)	2014/08/28		111	%	70 - 130
			F3 (C16-C34 Hydrocarbons)	2014/08/28		107	%	70 - 130
			F4 (C34-C50 Hydrocarbons)	2014/08/28		97	%	70 - 130
		Method Blank	O-TERPHENYL (sur.)	2014/08/28		103	%	50 - 130
			F2 (C10-C16 Hydrocarbons)	2014/08/28	<0.10		mg/L	
			F3 (C16-C34 Hydrocarbons)	2014/08/28	<0.20		mg/L	
			F4 (C34-C50 Hydrocarbons)	2014/08/28	<0.20		mg/L	
		RPD [KL1807-07]	F2 (C10-C16 Hydrocarbons)	2014/08/28	NC		%	40

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7616052	KK5	RPD [KL1807-07]	F3 (C16-C34 Hydrocarbons)	2014/08/28	NC		%	40
			F4 (C34-C50 Hydrocarbons)	2014/08/28	NC		%	40
7616064	GM4	Matrix Spike	Total Dissolved Solids	2014/08/27		NC	%	80 - 120
		Spiked Blank	Total Dissolved Solids	2014/08/27		98	%	80 - 120
		Method Blank	Total Dissolved Solids	2014/08/27	<10		mg/L	
		RPD	Total Dissolved Solids	2014/08/27	7.3		%	20
7616071	LZ3	Matrix Spike	NONACHLOROBIPHENYL (sur.)	2014/08/30		48	%	30 - 130
			Aroclor 1260	2014/08/30		58	%	30 - 130
		Spiked Blank	NONACHLOROBIPHENYL (sur.)	2014/08/30		56	%	30 - 130
			Aroclor 1260	2014/08/30		76	%	30 - 130
		Method Blank	NONACHLOROBIPHENYL (sur.)	2014/08/30		55	%	30 - 130
			Aroclor 1016	2014/08/30	<0.000050		mg/L	
			Aroclor 1221	2014/08/30	<0.000050		mg/L	
			Aroclor 1232	2014/08/30	<0.000050		mg/L	
			Aroclor 1242	2014/08/30	<0.000050		mg/L	
			Aroclor 1248	2014/08/30	<0.000050		mg/L	
			Aroclor 1254	2014/08/30	<0.000050		mg/L	
			Aroclor 1260	2014/08/30	<0.000050		mg/L	
			Aroclor 1262	2014/08/30	<0.000050		mg/L	
			Aroclor 1268	2014/08/30	<0.000050		mg/L	
			Total Aroclors	2014/08/30	<0.000050		mg/L	
7616111	AL2	Matrix Spike	Orthophosphate (P)	2014/08/27		106	%	80 - 120
		Spiked Blank	Orthophosphate (P)	2014/08/27		104	%	80 - 120
		Method Blank	Orthophosphate (P)	2014/08/27	<0.0030		mg/L	
		RPD	Orthophosphate (P)	2014/08/27	NC		%	20
7616503	ARD	Matrix Spike	Dissolved Chloride (Cl)	2014/08/29		97	%	80 - 120
		Spiked Blank	Dissolved Chloride (Cl)	2014/08/29		103	%	80 - 120
		Method Blank	Dissolved Chloride (Cl)	2014/08/29	<1.0		mg/L	
		RPD	Dissolved Chloride (Cl)	2014/08/29	0.1		%	20
7616517	ARD	Matrix Spike	Dissolved Sulphate (SO4)	2014/08/29		NC	%	80 - 120
		Spiked Blank	Dissolved Sulphate (SO4)	2014/08/29		106	%	80 - 120
		Method Blank	Dissolved Sulphate (SO4)	2014/08/29	<1.0		mg/L	
		RPD	Dissolved Sulphate (SO4)	2014/08/29	0.7		%	20
7616801	MPH	Matrix Spike	Dissolved Nitrite (N)	2014/08/27		101	%	80 - 120
			Dissolved Nitrate (N)	2014/08/27		99	%	80 - 120
		Spiked Blank	Dissolved Nitrite (N)	2014/08/27		101	%	80 - 120
			Dissolved Nitrate (N)	2014/08/27		105	%	80 - 120
		Method Blank	Dissolved Nitrite (N)	2014/08/27	<0.010		mg/L	
			Dissolved Nitrate (N)	2014/08/27	<0.010		mg/L	
		RPD	Dissolved Nitrite (N)	2014/08/27	NC		%	20
			Dissolved Nitrate (N)	2014/08/27	0.3		%	20
7617011	MRD	Spiked Blank	True Colour	2014/08/27		99	%	80 - 120
		Method Blank	True Colour	2014/08/27	<2.0		PtCo units	
		RPD [KL1811-01]	True Colour	2014/08/27	2.4		%	20
7617609	ARD	Matrix Spike	Dissolved Chloride (Cl)	2014/08/29		NC	%	80 - 120
		Spiked Blank	Dissolved Chloride (Cl)	2014/08/29		103	%	80 - 120
		Method Blank	Dissolved Chloride (Cl)	2014/08/29	<1.0		mg/L	
		RPD	Dissolved Chloride (Cl)	2014/08/29	1.4		%	20
7617643	ARD	Matrix Spike	Dissolved Sulphate (SO4)	2014/08/29		NC	%	80 - 120
		Spiked Blank	Dissolved Sulphate (SO4)	2014/08/29		106	%	80 - 120
		Method Blank	Dissolved Sulphate (SO4)	2014/08/29	<1.0		mg/L	
		RPD	Dissolved Sulphate (SO4)	2014/08/29	1.0		%	20
7617750	MA4	Spiked Blank	Conductivity	2014/08/28		102	%	90 - 110
		Method Blank	Conductivity	2014/08/28	<1.0		uS/cm	
		RPD	Conductivity	2014/08/28	0.4		%	20

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7617753	MA4	Spiked Blank	pH	2014/08/28		100	%	97 - 103
		RPD	pH	2014/08/28	0.1		%	N/A
7617755	MA4	Matrix Spike	Dissolved Fluoride (F)	2014/08/28		98	%	80 - 120
		Spiked Blank	Dissolved Fluoride (F)	2014/08/28		97	%	80 - 120
		Method Blank	Dissolved Fluoride (F)	2014/08/28	<0.050		mg/L	
		RPD	Dissolved Fluoride (F)	2014/08/28	NC		%	20
7618491	SDH	Matrix Spike	Dissolved Barium (Ba)	2014/08/28		94	%	80 - 120
			Dissolved Boron (B)	2014/08/28		97	%	80 - 120
			Dissolved Calcium (Ca)	2014/08/28		96	%	80 - 120
			Dissolved Iron (Fe)	2014/08/28		95	%	80 - 120
			Dissolved Lithium (Li)	2014/08/28		85	%	80 - 120
			Dissolved Magnesium (Mg)	2014/08/28		93	%	80 - 120
			Dissolved Manganese (Mn)	2014/08/28		98	%	80 - 120
			Dissolved Phosphorus (P)	2014/08/28		93	%	80 - 120
			Dissolved Potassium (K)	2014/08/28		92	%	80 - 120
			Dissolved Silicon (Si)	2014/08/28		NC	%	80 - 120
			Dissolved Sodium (Na)	2014/08/28		NC	%	80 - 120
			Dissolved Strontium (Sr)	2014/08/28		92	%	80 - 120
		Spiked Blank	Dissolved Barium (Ba)	2014/08/28		94	%	80 - 120
			Dissolved Boron (B)	2014/08/28		96	%	80 - 120
			Dissolved Calcium (Ca)	2014/08/28		96	%	80 - 120
			Dissolved Iron (Fe)	2014/08/28		93	%	80 - 120
			Dissolved Lithium (Li)	2014/08/28		88	%	80 - 120
			Dissolved Magnesium (Mg)	2014/08/28		95	%	80 - 120
			Dissolved Manganese (Mn)	2014/08/28		96	%	80 - 120
			Dissolved Phosphorus (P)	2014/08/28		90	%	80 - 120
			Dissolved Potassium (K)	2014/08/28		94	%	80 - 120
			Dissolved Silicon (Si)	2014/08/28		96	%	80 - 120
			Dissolved Sodium (Na)	2014/08/28		96	%	80 - 120
			Dissolved Strontium (Sr)	2014/08/28		92	%	80 - 120
			Dissolved Sulphur (S)	2014/08/28		96	%	80 - 120
		Method Blank	Dissolved Barium (Ba)	2014/08/28	<0.010		mg/L	
			Dissolved Boron (B)	2014/08/28	<0.020		mg/L	
			Dissolved Calcium (Ca)	2014/08/28	<0.30		mg/L	
			Dissolved Iron (Fe)	2014/08/28	<0.060		mg/L	
			Dissolved Lithium (Li)	2014/08/28	<0.020		mg/L	
			Dissolved Magnesium (Mg)	2014/08/28	<0.20		mg/L	
			Dissolved Manganese (Mn)	2014/08/28	<0.0040		mg/L	
			Dissolved Phosphorus (P)	2014/08/28	<0.10		mg/L	
			Dissolved Potassium (K)	2014/08/28	<0.30		mg/L	
			Dissolved Silicon (Si)	2014/08/28	<0.10		mg/L	
			Dissolved Sodium (Na)	2014/08/28	<0.50		mg/L	
			Dissolved Strontium (Sr)	2014/08/28	<0.020		mg/L	
			Dissolved Sulphur (S)	2014/08/28	<0.20		mg/L	
		RPD	Dissolved Barium (Ba)	2014/08/28	NC		%	20
			Dissolved Boron (B)	2014/08/28	0.7		%	20
			Dissolved Calcium (Ca)	2014/08/28	0.3		%	20
			Dissolved Iron (Fe)	2014/08/28	2.0		%	20
			Dissolved Lithium (Li)	2014/08/28	NC		%	20
			Dissolved Magnesium (Mg)	2014/08/28	0.5		%	20
			Dissolved Manganese (Mn)	2014/08/28	0.2		%	20
			Dissolved Phosphorus (P)	2014/08/28	NC		%	20
			Dissolved Potassium (K)	2014/08/28	0.2		%	20
			Dissolved Silicon (Si)	2014/08/28	0.1		%	20
			Dissolved Sodium (Na)	2014/08/28	0.4		%	20

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7618491	SDH	RPD	Dissolved Strontium (Sr)	2014/08/28	0.3		%	20
			Dissolved Sulphur (S)	2014/08/28	0.4		%	20
7618812	SDH	Matrix Spike	Dissolved Barium (Ba)	2014/08/28		93	%	80 - 120
			Dissolved Boron (B)	2014/08/28		95	%	80 - 120
			Dissolved Calcium (Ca)	2014/08/28		NC	%	80 - 120
			Dissolved Iron (Fe)	2014/08/28		84	%	80 - 120
			Dissolved Lithium (Li)	2014/08/28		90	%	80 - 120
			Dissolved Magnesium (Mg)	2014/08/28		NC	%	80 - 120
			Dissolved Manganese (Mn)	2014/08/28		92	%	80 - 120
			Dissolved Phosphorus (P)	2014/08/28		95	%	80 - 120
			Dissolved Potassium (K)	2014/08/28		94	%	80 - 120
			Dissolved Silicon (Si)	2014/08/28		91	%	80 - 120
			Dissolved Sodium (Na)	2014/08/28		NC	%	80 - 120
			Dissolved Strontium (Sr)	2014/08/28		NC	%	80 - 120
		Spiked Blank	Dissolved Barium (Ba)	2014/08/28		96	%	80 - 120
			Dissolved Boron (B)	2014/08/28		99	%	80 - 120
			Dissolved Calcium (Ca)	2014/08/28		97	%	80 - 120
			Dissolved Iron (Fe)	2014/08/28		95	%	80 - 120
			Dissolved Lithium (Li)	2014/08/28		90	%	80 - 120
			Dissolved Magnesium (Mg)	2014/08/28		98	%	80 - 120
			Dissolved Manganese (Mn)	2014/08/28		98	%	80 - 120
			Dissolved Phosphorus (P)	2014/08/28		93	%	80 - 120
			Dissolved Potassium (K)	2014/08/28		97	%	80 - 120
			Dissolved Silicon (Si)	2014/08/28		98	%	80 - 120
			Dissolved Sodium (Na)	2014/08/28		99	%	80 - 120
			Dissolved Strontium (Sr)	2014/08/28		94	%	80 - 120
			Dissolved Sulphur (S)	2014/08/28		98	%	80 - 120
		Method Blank	Dissolved Barium (Ba)	2014/08/28	<0.010		mg/L	
			Dissolved Boron (B)	2014/08/28	<0.020		mg/L	
			Dissolved Calcium (Ca)	2014/08/28	<0.30		mg/L	
			Dissolved Iron (Fe)	2014/08/28	<0.060		mg/L	
			Dissolved Lithium (Li)	2014/08/28	<0.020		mg/L	
			Dissolved Magnesium (Mg)	2014/08/28	<0.20		mg/L	
			Dissolved Manganese (Mn)	2014/08/28	<0.0040		mg/L	
			Dissolved Phosphorus (P)	2014/08/28	<0.10		mg/L	
			Dissolved Potassium (K)	2014/08/28	<0.30		mg/L	
			Dissolved Silicon (Si)	2014/08/28	<0.10		mg/L	
			Dissolved Sodium (Na)	2014/08/28	<0.50		mg/L	
			Dissolved Strontium (Sr)	2014/08/28	<0.020		mg/L	
			Dissolved Sulphur (S)	2014/08/28	<0.20		mg/L	
		RPD	Dissolved Barium (Ba)	2014/08/28	1.6		%	20
			Dissolved Boron (B)	2014/08/28	0.8		%	20
			Dissolved Calcium (Ca)	2014/08/28	0.9		%	20
			Dissolved Iron (Fe)	2014/08/28	NC		%	20
			Dissolved Lithium (Li)	2014/08/28	2.5		%	20
			Dissolved Magnesium (Mg)	2014/08/28	0.5		%	20
			Dissolved Manganese (Mn)	2014/08/28	0.9		%	20
			Dissolved Phosphorus (P)	2014/08/28	NC		%	20
			Dissolved Potassium (K)	2014/08/28	2.3		%	20
			Dissolved Silicon (Si)	2014/08/28	0.5		%	20
			Dissolved Sodium (Na)	2014/08/28	2.2		%	20
			Dissolved Strontium (Sr)	2014/08/28	0.2		%	20
			Dissolved Sulphur (S)	2014/08/28	0.5		%	20
7621571	SF3	Matrix Spike [KL1808-03]	Total Aluminum (Al)	2014/08/31		94	%	80 - 120

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7621571	SF3	Matrix Spike						
		[KL1808-03]	Total Antimony (Sb)	2014/08/31		107	%	80 - 120
			Total Arsenic (As)	2014/08/31		99	%	80 - 120
			Total Beryllium (Be)	2014/08/31		104	%	80 - 120
			Total Chromium (Cr)	2014/08/31		96	%	80 - 120
			Total Cobalt (Co)	2014/08/31		93	%	80 - 120
			Total Copper (Cu)	2014/08/31		93	%	80 - 120
			Total Lead (Pb)	2014/08/31		91	%	80 - 120
			Total Molybdenum (Mo)	2014/08/31		111	%	80 - 120
			Total Nickel (Ni)	2014/08/31		93	%	80 - 120
			Total Selenium (Se)	2014/08/31		98	%	80 - 120
			Total Silver (Ag)	2014/08/31		98	%	80 - 120
			Total Thallium (Tl)	2014/08/31		92	%	80 - 120
			Total Tin (Sn)	2014/08/31		109	%	80 - 120
			Total Titanium (Ti)	2014/08/31		104	%	80 - 120
			Total Uranium (U)	2014/08/31		98	%	80 - 120
			Total Vanadium (V)	2014/08/31		104	%	80 - 120
			Total Zinc (Zn)	2014/08/31		97	%	80 - 120
		Spiked Blank	Total Aluminum (Al)	2014/08/31		102	%	80 - 120
			Total Antimony (Sb)	2014/08/31		101	%	80 - 120
			Total Arsenic (As)	2014/08/31		98	%	80 - 120
			Total Beryllium (Be)	2014/08/31		103	%	80 - 120
			Total Chromium (Cr)	2014/08/31		97	%	80 - 120
			Total Cobalt (Co)	2014/08/31		96	%	80 - 120
			Total Copper (Cu)	2014/08/31		96	%	80 - 120
			Total Lead (Pb)	2014/08/31		103	%	80 - 120
			Total Molybdenum (Mo)	2014/08/31		104	%	80 - 120
			Total Nickel (Ni)	2014/08/31		98	%	80 - 120
			Total Selenium (Se)	2014/08/31		99	%	80 - 120
			Total Silver (Ag)	2014/08/31		100	%	80 - 120
			Total Thallium (Tl)	2014/08/31		102	%	80 - 120
			Total Tin (Sn)	2014/08/31		104	%	80 - 120
			Total Titanium (Ti)	2014/08/31		100	%	80 - 120
			Total Uranium (U)	2014/08/31		100	%	80 - 120
			Total Vanadium (V)	2014/08/31		102	%	80 - 120
			Total Zinc (Zn)	2014/08/31		99	%	80 - 120
		Method Blank	Total Aluminum (Al)	2014/08/31	<0.0030		mg/L	
			Total Antimony (Sb)	2014/08/31	<0.00060		mg/L	
			Total Arsenic (As)	2014/08/31	<0.00020		mg/L	
			Total Beryllium (Be)	2014/08/31	<0.0010		mg/L	
			Total Chromium (Cr)	2014/08/31	<0.0010		mg/L	
			Total Cobalt (Co)	2014/08/31	<0.00030		mg/L	
			Total Copper (Cu)	2014/08/31	<0.00020		mg/L	
			Total Lead (Pb)	2014/08/31	<0.00020		mg/L	
			Total Molybdenum (Mo)	2014/08/31	<0.00020		mg/L	
			Total Nickel (Ni)	2014/08/31	<0.00050		mg/L	
			Total Selenium (Se)	2014/08/31	<0.00020		mg/L	
			Total Silver (Ag)	2014/08/31	<0.00010		mg/L	
			Total Thallium (Tl)	2014/08/31	<0.00020		mg/L	
			Total Tin (Sn)	2014/08/31	<0.0010		mg/L	
			Total Titanium (Ti)	2014/08/31	<0.0010		mg/L	
			Total Uranium (U)	2014/08/31	<0.00010		mg/L	
			Total Vanadium (V)	2014/08/31	<0.0010		mg/L	
			Total Zinc (Zn)	2014/08/31	<0.0030		mg/L	
		RPD [KL1808-03]	Total Aluminum (Al)	2014/08/31	NC		%	20

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Maxxam Job Number: EYKB474869

QA/QC Batch Num	Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	UNITS	QC Limits
7621571	SF3	RPD [KL1808-03]	Total Antimony (Sb)	2014/08/31	NC		%	20
			Total Arsenic (As)	2014/08/31	7.6		%	20
			Total Beryllium (Be)	2014/08/31	NC		%	20
			Total Chromium (Cr)	2014/08/31	NC		%	20
			Total Cobalt (Co)	2014/08/31	NC		%	20
			Total Copper (Cu)	2014/08/31	NC		%	20
			Total Lead (Pb)	2014/08/31	NC		%	20
			Total Molybdenum (Mo)	2014/08/31	NC		%	20
			Total Nickel (Ni)	2014/08/31	NC		%	20
			Total Selenium (Se)	2014/08/31	NC		%	20
			Total Silver (Ag)	2014/08/31	NC		%	20
			Total Thallium (Tl)	2014/08/31	NC		%	20
			Total Tin (Sn)	2014/08/31	NC		%	20
			Total Titanium (Ti)	2014/08/31	NC		%	20
			Total Uranium (U)	2014/08/31	6.9		%	20
			Total Vanadium (V)	2014/08/31	NC		%	20
			Total Zinc (Zn)	2014/08/31	NC		%	20
7621574	LT4	Matrix Spike	Total Barium (Ba)	2014/08/31		100	%	80 - 120
			Total Boron (B)	2014/08/31		101	%	80 - 120
			Total Calcium (Ca)	2014/08/31		96	%	80 - 120
			Total Iron (Fe)	2014/08/31		NC	%	80 - 120
			Total Lithium (Li)	2014/08/31		102	%	80 - 120
			Total Magnesium (Mg)	2014/08/31		104	%	80 - 120
			Total Manganese (Mn)	2014/08/31		98	%	80 - 120
			Total Phosphorus (P)	2014/08/31		98	%	80 - 120
			Total Potassium (K)	2014/08/31		104	%	80 - 120
			Total Silicon (Si)	2014/08/31		101	%	80 - 120
			Total Sodium (Na)	2014/08/31		104	%	80 - 120
			Total Strontium (Sr)	2014/08/31		99	%	80 - 120
		Spiked Blank	Total Barium (Ba)	2014/08/31		98	%	80 - 120
			Total Boron (B)	2014/08/31		99	%	80 - 120
			Total Calcium (Ca)	2014/08/31		95	%	80 - 120
			Total Iron (Fe)	2014/08/31		99	%	80 - 120
			Total Lithium (Li)	2014/08/31		99	%	80 - 120
			Total Magnesium (Mg)	2014/08/31		102	%	80 - 120
			Total Manganese (Mn)	2014/08/31		98	%	80 - 120
			Total Phosphorus (P)	2014/08/31		96	%	80 - 120
			Total Potassium (K)	2014/08/31		102	%	80 - 120
			Total Silicon (Si)	2014/08/31		100	%	80 - 120
			Total Sodium (Na)	2014/08/31		102	%	80 - 120
			Total Strontium (Sr)	2014/08/31		97	%	80 - 120
			Total Sulphur (S)	2014/08/31		102	%	80 - 120
		Method Blank	Total Barium (Ba)	2014/08/31	<0.010		mg/L	
			Total Boron (B)	2014/08/31	<0.020		mg/L	
			Total Calcium (Ca)	2014/08/31	<0.30		mg/L	
			Total Iron (Fe)	2014/08/31	<0.060		mg/L	
			Total Lithium (Li)	2014/08/31	<0.020		mg/L	
			Total Magnesium (Mg)	2014/08/31	<0.20		mg/L	
			Total Manganese (Mn)	2014/08/31	<0.0040		mg/L	
			Total Phosphorus (P)	2014/08/31	<0.10		mg/L	
			Total Potassium (K)	2014/08/31	<0.30		mg/L	
			Total Silicon (Si)	2014/08/31	<0.10		mg/L	
			Total Sodium (Na)	2014/08/31	<0.50		mg/L	
			Total Strontium (Sr)	2014/08/31	<0.020		mg/L	
			Total Sulphur (S)	2014/08/31	<0.20		mg/L	

FRANZ ENVIRONMENTAL INC.
Attention: JULIE DITTBURNER
Client Project #: ROBERTS BAY/1697-1401 DEW LINE
P.O. #:
Site Location:

Quality Assurance Report (Continued)

Maxxam Job Number: EYKB474869

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	UNITS	QC Limits
7621574 LT4	RPD	Total Barium (Ba)	2014/08/31	NC		%	20
		Total Boron (B)	2014/08/31	NC		%	20
		Total Calcium (Ca)	2014/08/31	1.2		%	20
		Total Iron (Fe)	2014/08/31	1.5		%	20
		Total Lithium (Li)	2014/08/31	NC		%	20
		Total Magnesium (Mg)	2014/08/31	1.5		%	20
		Total Manganese (Mn)	2014/08/31	0.3		%	20
		Total Phosphorus (P)	2014/08/31	NC		%	20
		Total Potassium (K)	2014/08/31	NC		%	20
		Total Silicon (Si)	2014/08/31	0.7		%	20
		Total Sodium (Na)	2014/08/31	NC		%	20
		Total Strontium (Sr)	2014/08/31	NC		%	20
		Total Sulphur (S)	2014/08/31	NC		%	20
7621619 SF3	Matrix Spike						
	[KL1807-04]	Dissolved Aluminum (Al)	2014/08/31		102	%	80 - 120
		Dissolved Antimony (Sb)	2014/08/31		96	%	80 - 120
		Dissolved Arsenic (As)	2014/08/31		99	%	80 - 120
		Dissolved Beryllium (Be)	2014/08/31		106	%	80 - 120
		Dissolved Chromium (Cr)	2014/08/31		98	%	80 - 120
		Dissolved Cobalt (Co)	2014/08/31		96	%	80 - 120
		Dissolved Copper (Cu)	2014/08/31		99	%	80 - 120
		Dissolved Lead (Pb)	2014/08/31		97	%	80 - 120
		Dissolved Molybdenum (Mo)	2014/08/31		108	%	80 - 120
		Dissolved Nickel (Ni)	2014/08/31		100	%	80 - 120
		Dissolved Selenium (Se)	2014/08/31		102	%	80 - 120
		Dissolved Silver (Ag)	2014/08/31		93	%	80 - 120
		Dissolved Thallium (Tl)	2014/08/31		98	%	80 - 120
		Dissolved Tin (Sn)	2014/08/31		106	%	80 - 120
		Dissolved Titanium (Ti)	2014/08/31		110	%	80 - 120
		Dissolved Uranium (U)	2014/08/31		100	%	80 - 120
		Dissolved Vanadium (V)	2014/08/31		106	%	80 - 120
		Dissolved Zinc (Zn)	2014/08/31		98	%	80 - 120
	Spiked Blank	Dissolved Aluminum (Al)	2014/08/31		100	%	80 - 120
		Dissolved Antimony (Sb)	2014/08/31		92	%	80 - 120
		Dissolved Arsenic (As)	2014/08/31		99	%	80 - 120
		Dissolved Beryllium (Be)	2014/08/31		101	%	80 - 120
		Dissolved Chromium (Cr)	2014/08/31		99	%	80 - 120
		Dissolved Cobalt (Co)	2014/08/31		96	%	80 - 120
		Dissolved Copper (Cu)	2014/08/31		100	%	80 - 120
		Dissolved Lead (Pb)	2014/08/31		101	%	80 - 120
		Dissolved Molybdenum (Mo)	2014/08/31		104	%	80 - 120
		Dissolved Nickel (Ni)	2014/08/31		99	%	80 - 120
		Dissolved Selenium (Se)	2014/08/31		101	%	80 - 120
		Dissolved Silver (Ag)	2014/08/31		93	%	80 - 120
		Dissolved Thallium (Tl)	2014/08/31		100	%	80 - 120
		Dissolved Tin (Sn)	2014/08/31		103	%	80 - 120
		Dissolved Titanium (Ti)	2014/08/31		102	%	80 - 120
		Dissolved Uranium (U)	2014/08/31		99	%	80 - 120
		Dissolved Vanadium (V)	2014/08/31		102	%	80 - 120
		Dissolved Zinc (Zn)	2014/08/31		98	%	80 - 120
	Method Blank	Dissolved Aluminum (Al)	2014/08/31	<0.0030		mg/L	
		Dissolved Antimony (Sb)	2014/08/31	<0.00060		mg/L	
		Dissolved Arsenic (As)	2014/08/31	<0.00020		mg/L	
		Dissolved Beryllium (Be)	2014/08/31	<0.0010		mg/L	
		Dissolved Chromium (Cr)	2014/08/31	<0.0010		mg/L	

FRANZ ENVIRONMENTAL INC.
Attention: JULIE DITTBURNER
Client Project #: ROBERTS BAY/1697-1401 DEW LINE
P.O. #:
Site Location:

Quality Assurance Report (Continued)

Maxxam Job Number: EYKB474869

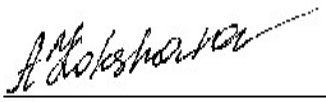
QA/QC Batch Num	Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	UNITS	QC Limits
7621619	SF3	Method Blank	Dissolved Cobalt (Co)	2014/08/31	<0.00030		mg/L	
			Dissolved Copper (Cu)	2014/08/31	<0.00020		mg/L	
			Dissolved Lead (Pb)	2014/08/31	<0.00020		mg/L	
			Dissolved Molybdenum (Mo)	2014/08/31	<0.00020		mg/L	
			Dissolved Nickel (Ni)	2014/08/31	<0.00050		mg/L	
			Dissolved Selenium (Se)	2014/08/31	<0.00020		mg/L	
			Dissolved Silver (Ag)	2014/08/31	<0.00010		mg/L	
			Dissolved Thallium (Tl)	2014/08/31	<0.00020		mg/L	
			Dissolved Tin (Sn)	2014/08/31	<0.0010		mg/L	
			Dissolved Titanium (Ti)	2014/08/31	<0.0010		mg/L	
			Dissolved Uranium (U)	2014/08/31	<0.00010		mg/L	
			Dissolved Vanadium (V)	2014/08/31	<0.0010		mg/L	
			Dissolved Zinc (Zn)	2014/08/31	<0.0030		mg/L	
		RPD [KL1807-04]	Dissolved Aluminum (Al)	2014/08/31	3.6		%	20
			Dissolved Antimony (Sb)	2014/08/31	NC		%	20
			Dissolved Arsenic (As)	2014/08/31	NC		%	20
			Dissolved Beryllium (Be)	2014/08/31	NC		%	20
			Dissolved Chromium (Cr)	2014/08/31	NC		%	20
			Dissolved Cobalt (Co)	2014/08/31	NC		%	20
			Dissolved Copper (Cu)	2014/08/31	1.3		%	20
			Dissolved Lead (Pb)	2014/08/31	NC		%	20
			Dissolved Molybdenum (Mo)	2014/08/31	NC		%	20
			Dissolved Nickel (Ni)	2014/08/31	NC		%	20
			Dissolved Selenium (Se)	2014/08/31	NC		%	20
			Dissolved Silver (Ag)	2014/08/31	NC		%	20
			Dissolved Thallium (Tl)	2014/08/31	NC		%	20
			Dissolved Tin (Sn)	2014/08/31	NC		%	20
			Dissolved Titanium (Ti)	2014/08/31	NC		%	20
			Dissolved Uranium (U)	2014/08/31	0.6		%	20
			Dissolved Vanadium (V)	2014/08/31	NC		%	20
			Dissolved Zinc (Zn)	2014/08/31	NC		%	20

N/A = Not Applicable
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 sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.
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 too small to permit a reliable recovery calculation (matrix spike concentration was less than 2x that of the native sample concentration).
NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (one or both samples < 5x RDL).

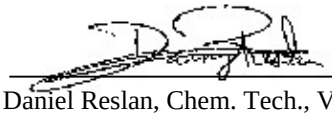
Validation Signature Page

Maxxam Job #: B474869

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

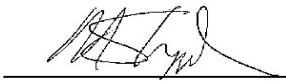


Anna Koksharova, M.Sc., Senior Analyst



Daniel Reslan, Chem. Tech., Volatiles Supervisor

Dina Tleugabulova, Ph.D., Scientific Specialist, Inorganics Department



Michael Sheppard, Organics Supervisor

==========

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

Maxxam Analytics International Corporation o/a Maxxam Analytics
9331 - 48th Street, Edmonton, Alberta Canada T6B 2R4 Tel:(780) 577-7100 Toll-Free:800-563-6266 Fax:(780) 450-4187 www.maxxam.ca

08/1201(2) JM

Chain Of Custody Record

Page 1 of 1

INVOICE INFORMATION:		Report Information		Project Information		Laboratory Use Only	
Company Name	#3269 FRANZ ENVIRONMENTAL INC.	Company Name	#27236 FRANZ ENVIRONMENTAL INC.	Quotation #		Maxxam Job #	Bottle Order #:
Contact Name	JULIE DITTBURNER	Contact Name	JULIE DITTBURNER	P.O. #		B474869 NFA/JRC	445769
Address	329 Churchill Ave North Suite 2000 Ottawa ON K1Z5B8	Address	329 Churchill Ave North Suite 2000 Ottawa ON K1Z5B8	Project #	1697-1401 DEW Lines	Chain Of Custody Record	Project Manager
Phone	(613) 794-7447 Fax: (613) 721-0029	Phone	(613) 794-7447 Fax:	Project Name	Roberts Bay	C#445769-01-01	Sherlyne Sim
Email	jdittburner@franzenvironmental.com	Email	jdittburner@franzenvironmental.com	Site #			
				Sampled By	JD & KK		

Regulatory Criteria: CCME

Special Instructions:

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

Samples must be kept cool (< 10ºC) from time of sampling until delivery to maxxam

Turnaround Time (TAT) Required

Please provide advance notice for rush projects

Regular (Standard) TAT (will be applied if Rush TAT is not specified) X

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)	Regulated Metals (CCME/AT1) - Dissolved	Regulated Metals (CCME/AT1) - Total	AT1 BTEX and F1-F4 in Water	Polychlorinated Biphenyls	Total Suspended Solids (NFR)/Total Dissolved Solids	Nitrogen, (Nitrite, Nitrate) by IC	PH, Chloride, PO4, SO4, EC, Colour, F	AT1 BTEX and F1-F4 in Soil	Regulated Metals (CCME/AT1) - Soils	Polychlorinated Biphenyls in Soils	# of Bottles	Comments
1		ROB-6 2014	Aug 21 2014	PM	SW	N	Y	X	X	X	X	X	X	X				11	limited sample for PAHs - only 1 bottle
2		ROB-8 2014						X	X	X	X	X	X	X				12	
3		ROB-9 2014						X	X	X	X	X	X	X				12	
4		ROB-10 2014						X	X	X	X	X	X	X				12	
5		DUP-1 2014	↓	↓	↓	↓	↓	X	X	X	X	X	X	X				12	
6																			RECEIVED IN YELLOWKNIFE By: Michelle Goulet 09:15 2014-08-22
7																			
8																			Temp: 8 8 9 10 10 9
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	Lab Use Only: Time Sensitive	Temperature (ºC) on Receipt	Custody Seal Intact on Cooler?
J. Dittburner / J. Dittburner	14/08/21	3:45pm	Shaun Bale	2014/08/23	1037			3,5,7 0,5,5 Ice Present in all	X Yes No

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

White: Maxxam Yellow: Client

Maxxam

Success Through Science®

FRANZ ENVIRONMENTAL INC.

Report Date: 2014/09/02
Client Project #: ROBERTS BAY/1697-1401 DEW LINE

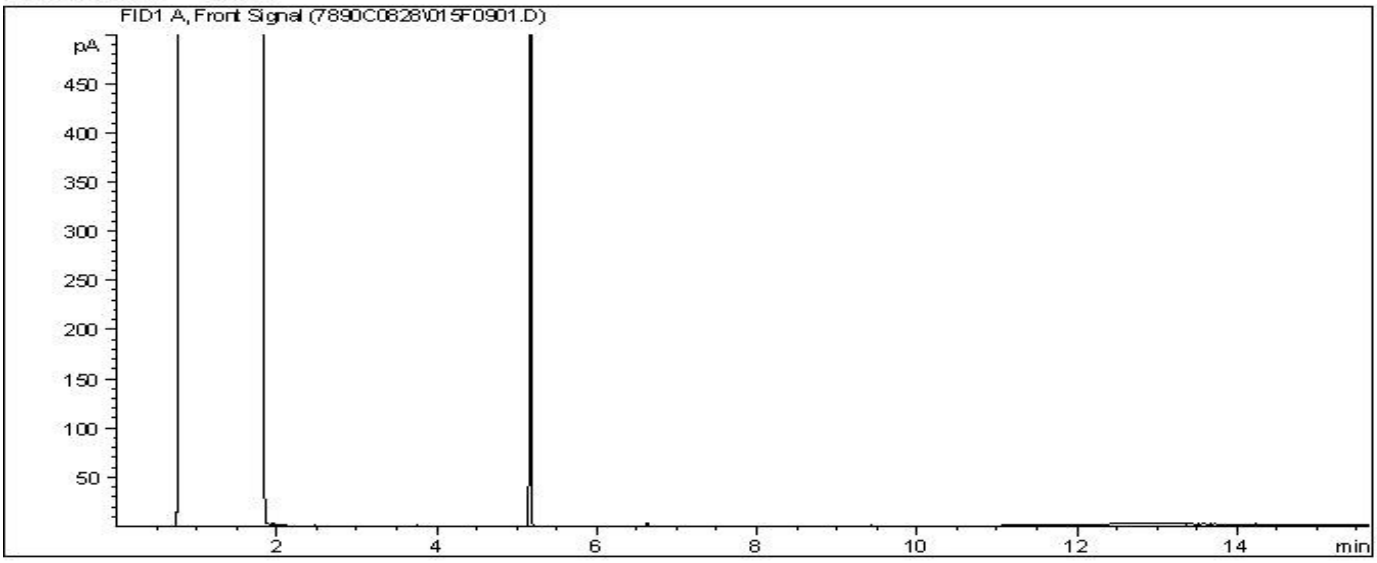
Maxxam Job #: B474869

Maxxam Sample: KL1807

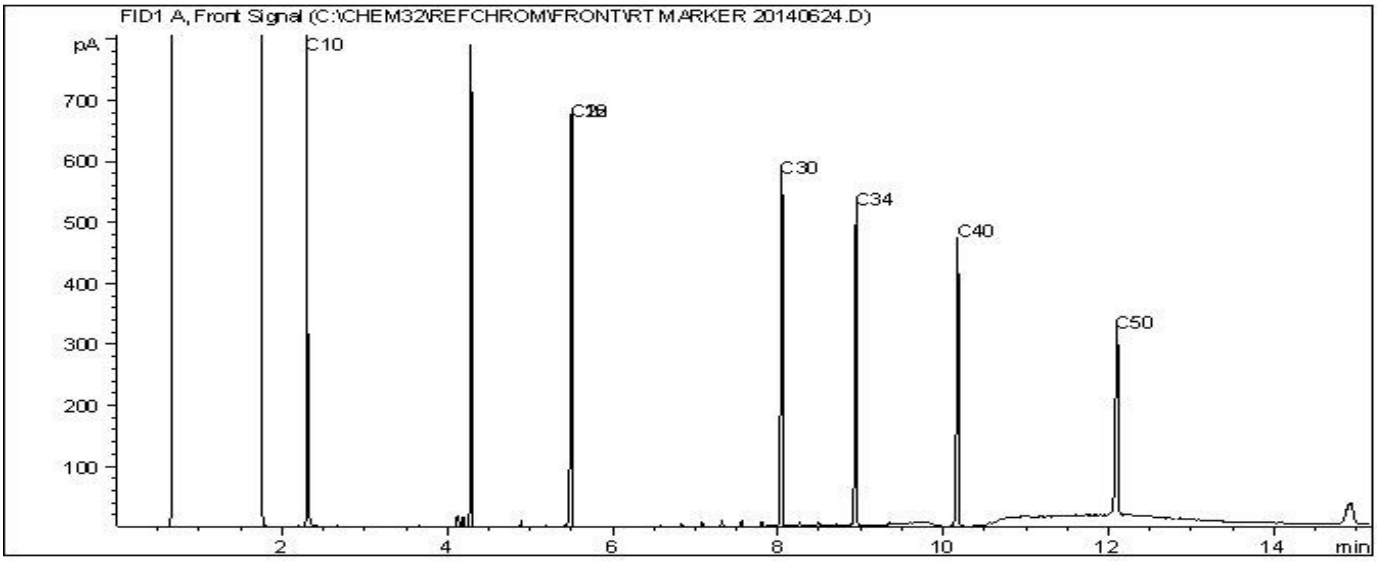
Client ID: R0B-6 2014

CCME Hydrocarbons (F2-F4 in water) Chromatogram

Instrument: 7890C



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

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

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FRANZ ENVIRONMENTAL INC.

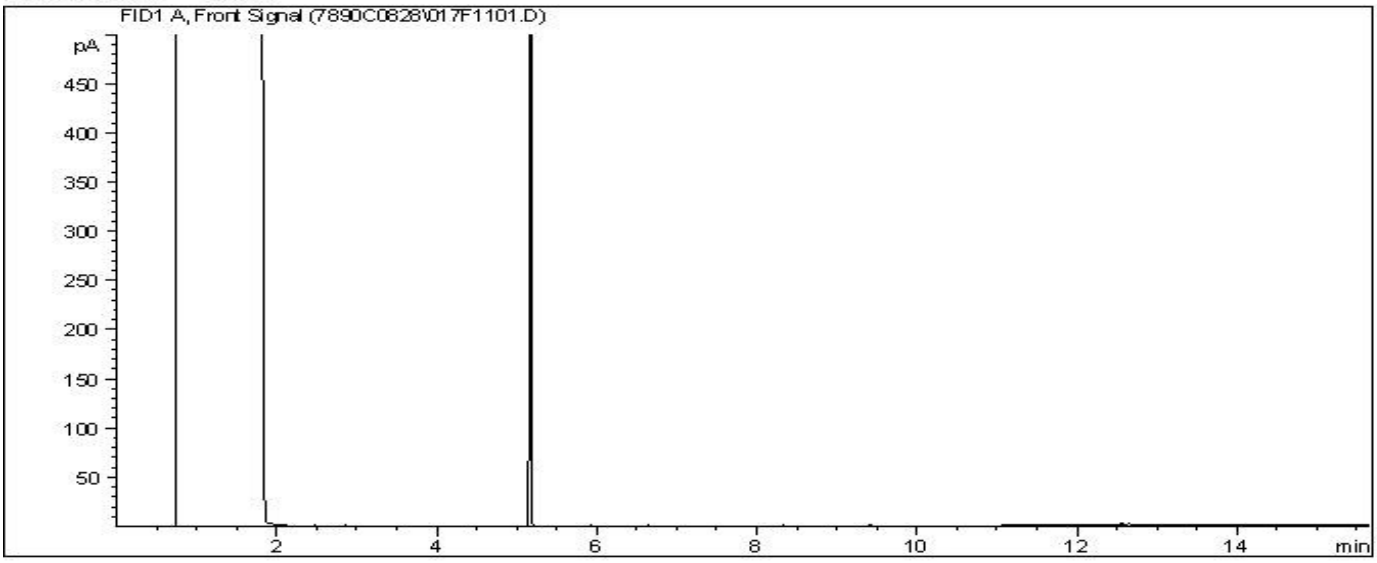
Report Date: 2014/09/02
Client Project #: ROBERTS BAY/1697-1401 DEW LINE

Maxxam Job #: B474869
Maxxam Sample: KL1808

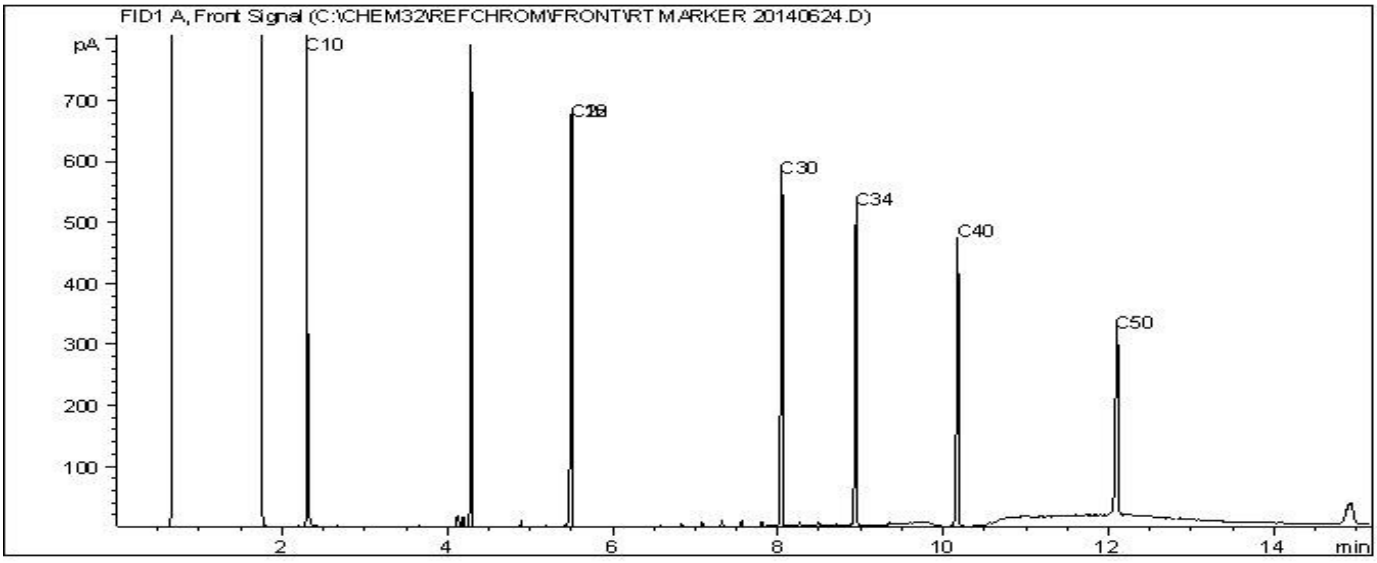
Client ID: R0B-8 2014

CCME Hydrocarbons (F2-F4 in water) Chromatogram

Instrument: 7890C



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12		Diesel:	C8 - C22	
Varsol:	C8 - C12		Lubricating Oils:	C20 - C40	
Kerosene:	C7 - C16		Crude Oils:	C3 - C60+	

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

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FRANZ ENVIRONMENTAL INC.

Report Date: 2014/09/02
Client Project #: ROBERTS BAY/1697-1401 DEW LINE

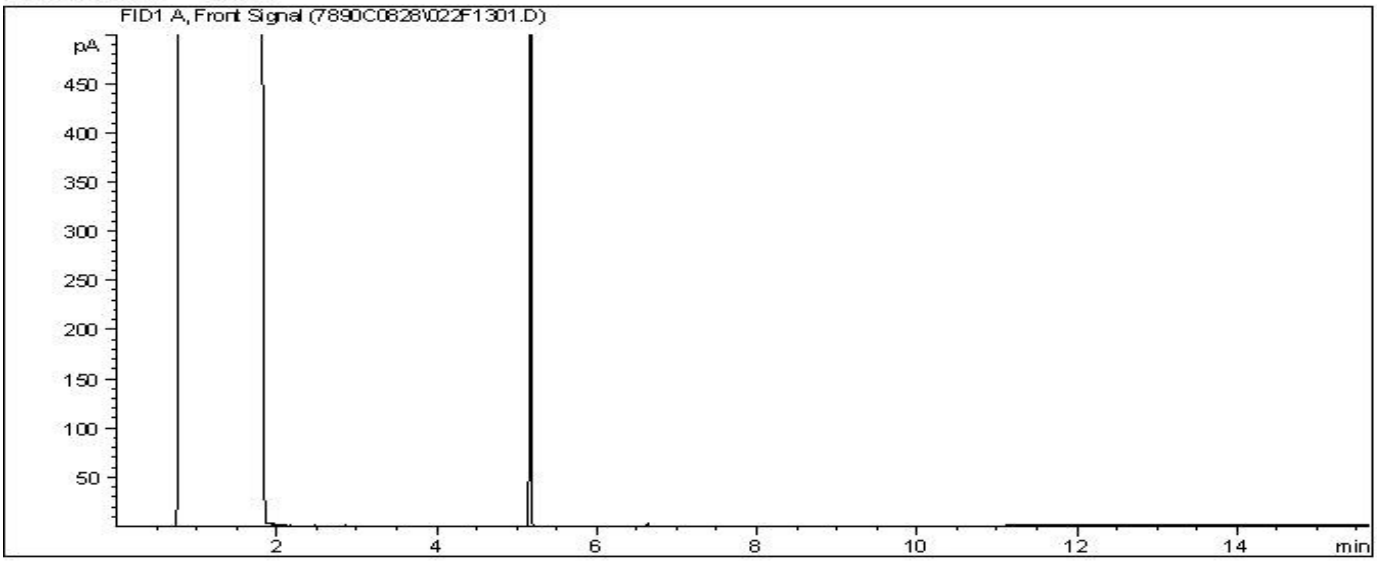
Maxxam Job #: B474869

Maxxam Sample: KL1809

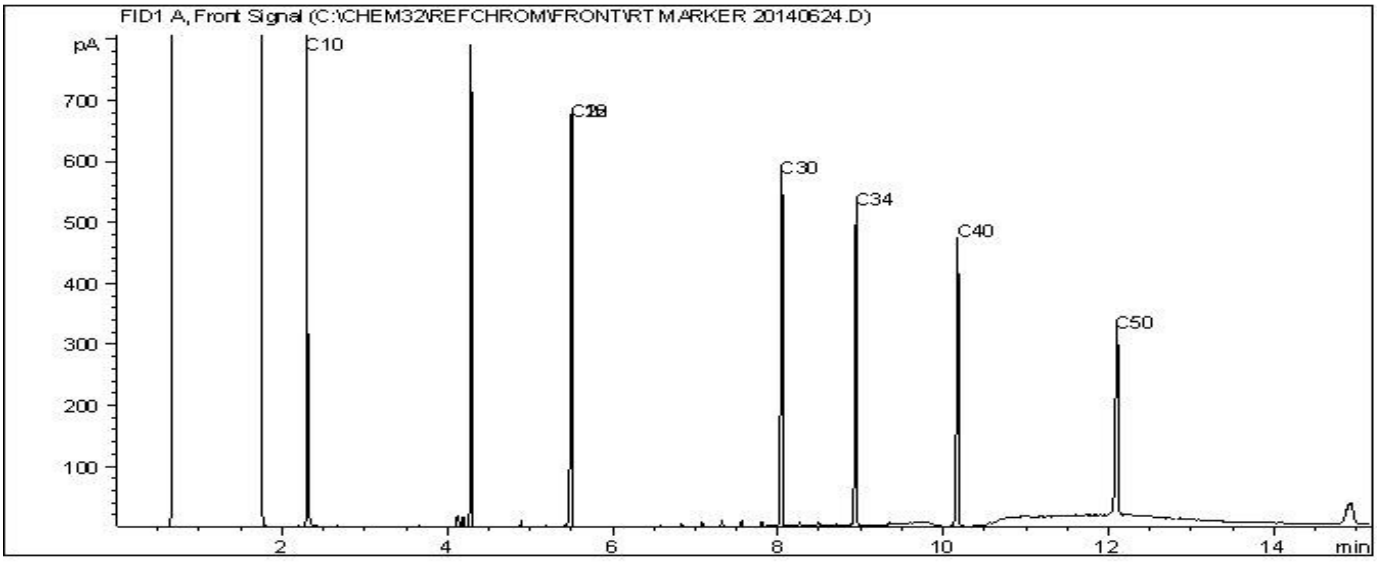
Client ID: R0B-9 2014

CCME Hydrocarbons (F2-F4 in water) Chromatogram

Instrument: 7890C



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12		Diesel:	C8 - C22	
Varsol:	C8 - C12		Lubricating Oils:	C20 - C40	
Kerosene:	C7 - C16		Crude Oils:	C3 - C60+	

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

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FRANZ ENVIRONMENTAL INC.

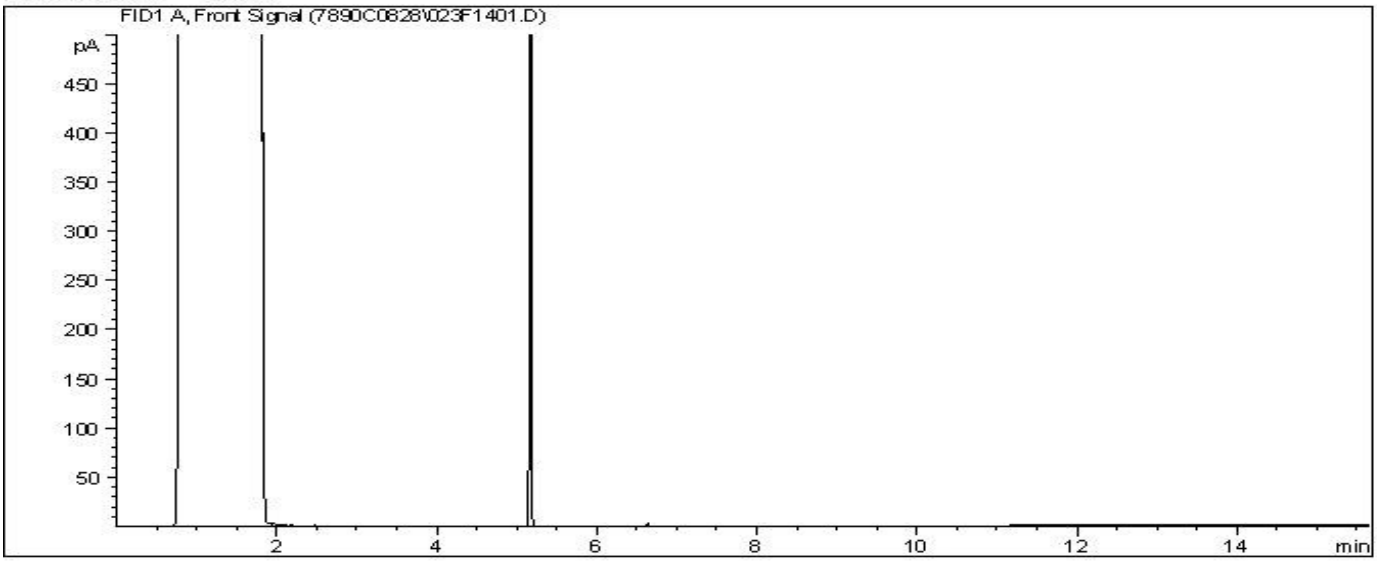
Report Date: 2014/09/02
Client Project #: ROBERTS BAY/1697-1401 DEW LINE

Maxxam Job #: B474869
Maxxam Sample: KL1810

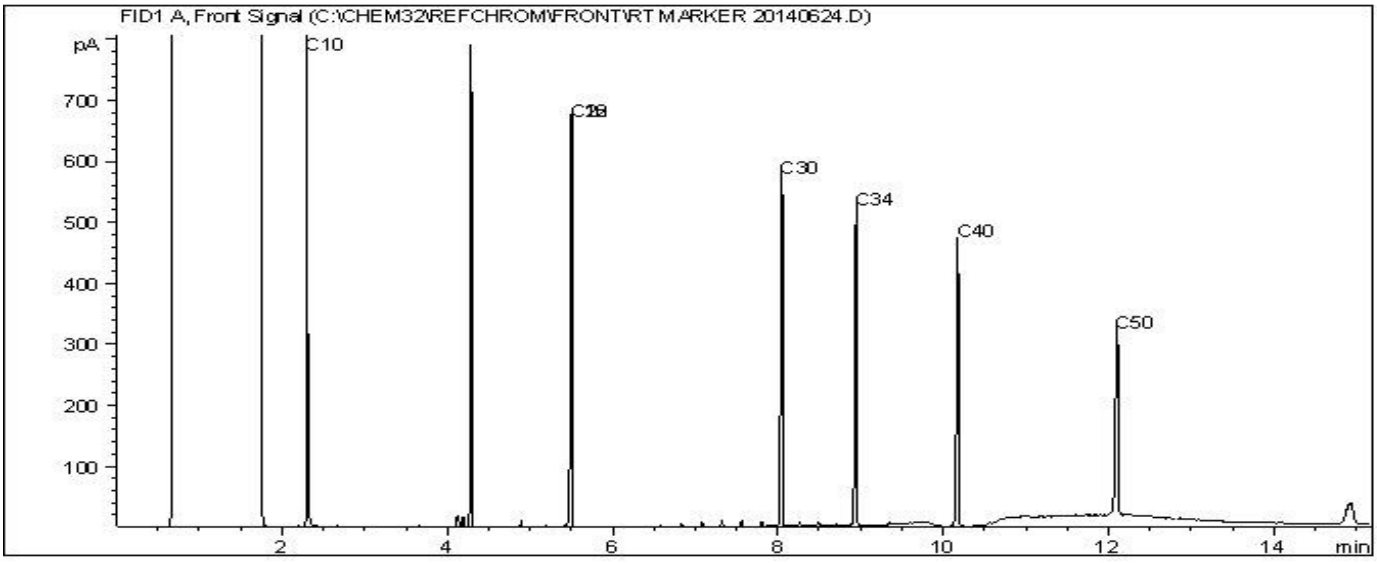
Client ID: R0B-10 2014

CCME Hydrocarbons (F2-F4 in water) Chromatogram

Instrument: 7890C



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12		Diesel:	C8 - C22	
Varsol:	C8 - C12		Lubricating Oils:	C20 - C40	
Kerosene:	C7 - C16		Crude Oils:	C3 - C60+	

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

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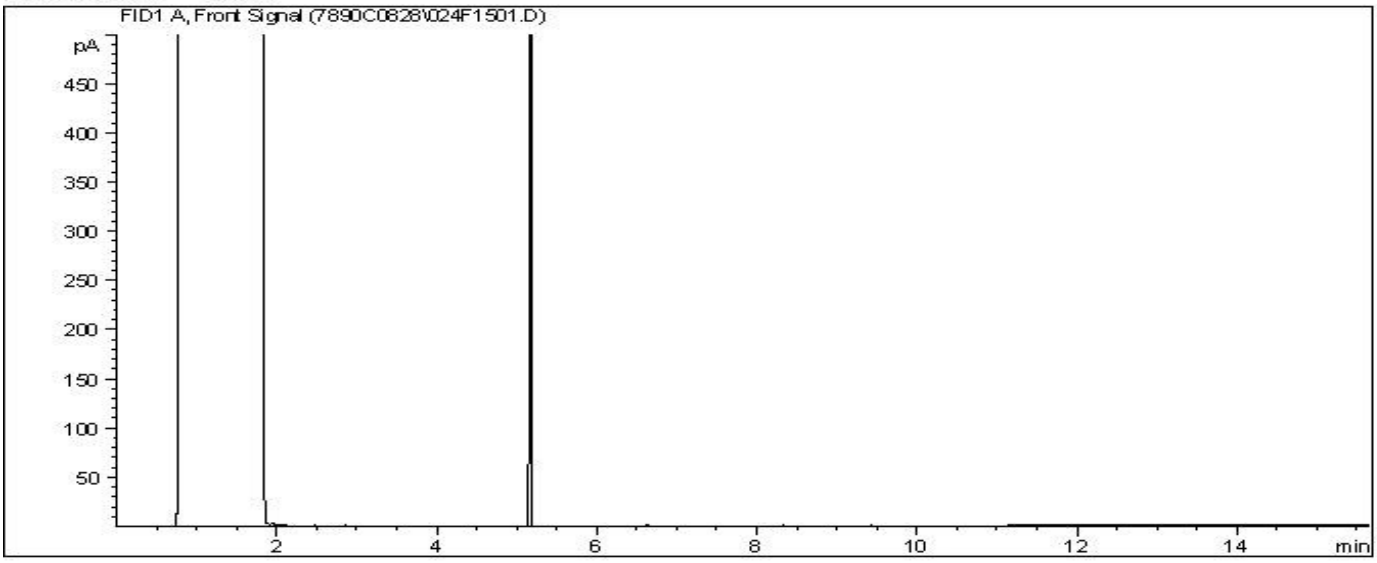
FRANZ ENVIRONMENTAL INC.

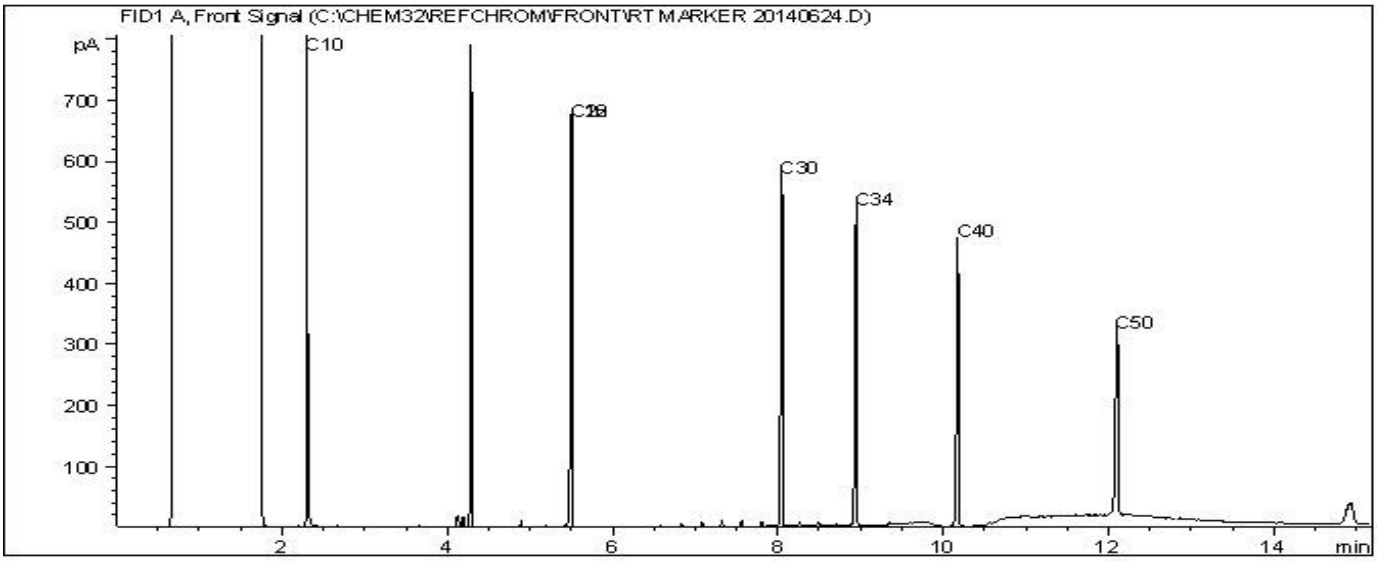
Report Date: 2014/09/02
Client Project #: ROBERTS BAY/1697-1401 DEW LINE
Maxxam Job #: B474869
Maxxam Sample: KL1811
Client ID: DUP-1 2014

CCME Hydrocarbons (F2-F4 in water) Chromatogram

Instrument: 7890C



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12		Diesel:	C8 - C22	
Varsol:	C8 - C12		Lubricating Oils:	C20 - C40	
Kerosene:	C7 - C16		Crude Oils:	C3 - C60+	

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

APPENDIX E

Site Photo Log

South side of Solid Waste Management Facility Landfill (SWMFL). Viewpoint 1 (Figure A-2; Appendix A). Photograph reference P821001. Direction photo taken: N

South side of SWMFL. Viewpoint 2 (Figure A-2; Appendix A). Photograph reference P8210002. Direction photo taken: N

South side of SWMFL. Viewpoint 3 (Figure A-2; Appendix A). Photograph reference P8210003.
Direction photo taken: N

West edge of SWMFL. Viewpoint 4 (Figure A-2; Appendix A). Photograph reference P8210004.
Direction photo taken: N

West side of SWMFL. Viewpoint 5 (Figure A-2; Appendix A). Photograph reference P8210005.
Direction photo taken: E

West side of SWMFL. Viewpoint 6 (Figure A-2; Appendix A). Photograph reference P8210006.
Direction photo taken: E

West side of SWMFL. Viewpoint 7 (Figure A-2; Appendix A). Photograph reference P8210007.
Direction photo taken: E

Northwest corner of SWMFL. Viewpoint 8 (Figure A-2; Appendix A). Photograph reference P8210008.
Direction photo taken: E

North side of SWMFL. Viewpoint 9 (Figure A-2; Appendix A). Photograph reference P8210009.
Direction photo taken: S

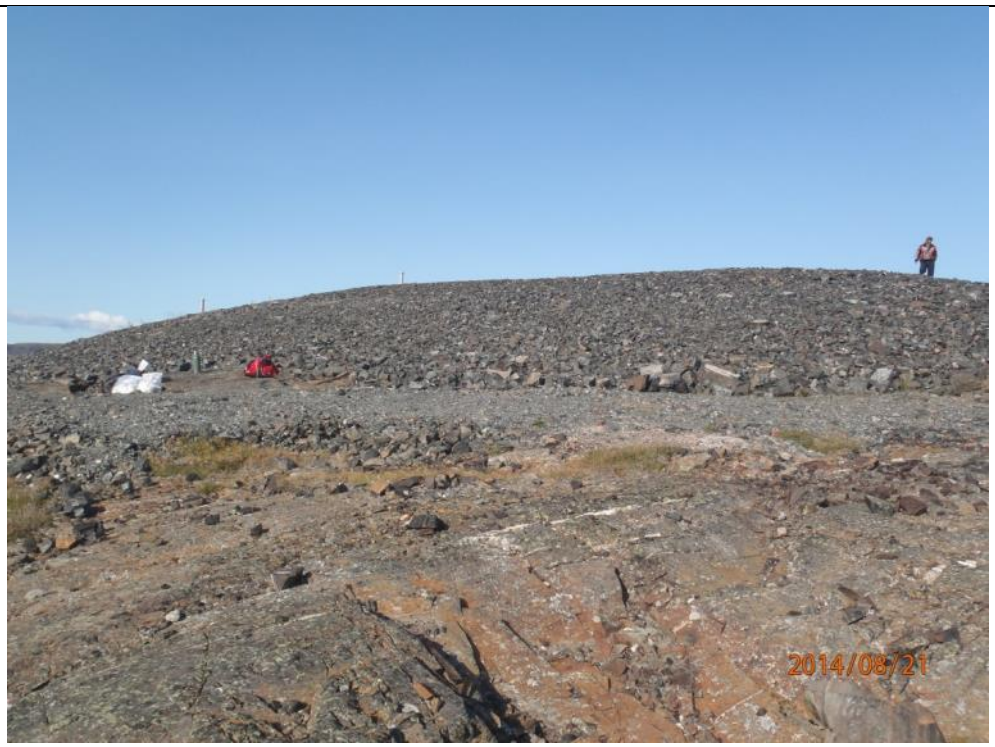
North side of SWMFL. Viewpoint 10 (Figure A-2; Appendix A). Photograph reference P8210010.
Direction photo taken: S

North side of SWMFL. Viewpoint 11 (Figure A-2; Appendix A). Photograph reference P8210011.
Direction photo taken: S

East side of SWMFL. Viewpoint 12 (Figure A-2; Appendix A). Photograph reference P8210012.
Direction photo taken: W

East side of SWMFL. Viewpoint 13 (Figure A-2; Appendix A). Photograph reference P8210013.
Direction photo taken: W

East side of SWMFL. Viewpoint 14 (Figure A-2; Appendix A). Photograph reference P8210014.
Direction photo taken: W



East side of SWMFL. Viewpoint 15 (Figure A-2; Appendix A). Photograph reference P8210015.
Direction photo taken: W

Southeast corner of SWMFL. Viewpoint 16 (Figure A-2; Appendix A). Photograph reference P8210016.
Direction photo taken: NW

Top of the SWMFL from the Southeast corner. Viewpoint 17 (Figure A-2; Appendix A). Photograph reference P8210017. Direction photo taken: W

Top of the SWMFL from the Southeast corner. Viewpoint 18 (Figure A-2; Appendix A). Photograph reference P8210018. Direction photo taken: W

Top of the SWMFL from the Southeast corner. Viewpoint 19 (Figure A-2; Appendix A). Photograph reference P8210019. Direction photo taken: N

Top of the SWMFL from the Northeast corner. Viewpoint 20 (Figure A-2; Appendix A). Photograph reference P8210020. Direction photo taken: S

Top of the SWMFL from the Northeast corner. Viewpoint 21 (Figure A-2; Appendix A). Photograph reference P8210021. Direction photo taken: W

Top of the SWMFL from the Northwest corner. Viewpoint 22 (Figure A-2; Appendix A). Photograph reference P8210022. Direction photo taken: E

Top of the SWMFL from the Northwest side. Viewpoint 23 (Figure A-2; Appendix A). Photograph reference P8210023. Direction photo taken: E

Top of the SWMFL from the Southwest corner. Viewpoint 26 (Figure A-2; Appendix A). Photograph reference P8210026. Direction photo taken: E

Top of the SWMFL from the Southwest corner. Viewpoint 27 (Figure A-2; Appendix A). Photograph reference P8210027. Direction photo taken: NE

Top of the SWMFL from the center. Viewpoint 28 (Figure A-2; Appendix A). Photograph reference P8210028. Direction photo taken: E

Top of the SWMFL from the center. Viewpoint 29 (Figure A-2; Appendix A). Photograph reference P8210029. Direction photo taken: NE

View of surface water sample location ROB-8. Photograph reference P8210035. Direction photo taken: SE

View of surface water sample location ROB-6. Photograph reference P8210034. Direction photo taken: S

View of the lake and surface water sample location ROB-9. Photograph reference P8210065.
Direction photo taken: SW

APPENDIX F

Field Notes

CONTENTS

PAGE	REFERENCE	DATE

1097-1401 DEW Lines

Aug. 2014

7:15 Franz (J. Dittbrenner / K. Krug) met at Air Tindi float base to meet Charter.

9:00: left YK for Cambridge Bay

11:50: arrived in Cambridge Bay - met Darcy (Bear Monitor) at float base.

- Air Tindi refuelled plane

12:30: left CB for Robert's Bay

1:15: arrived at Robert's Bay - no float dock - all has been removed. - had to find best location to dock.

1:30 - had to hike up to landfill - ~30 min (1km hike)

- going to do data logger download first today.

At String A

Site Number: 1

Description: String A

Sample Rate: 1/2 hr.

Rite in the Rain

1697-1401 Robert's Bay. DEW Lines Aug ~~July~~ 20/14

Memory Percent Full : 81 %
Date when Full : Jan 23/2015
Battery Main (9V) 11.34 V
Aux (12V) : 13.50 V
~~Battery Installation~~

Manual Thermister Readings

Analog Channel	Thermister R (Ohms)
1	11.737
2	13.012
3	13.726
4	15.947
5	17.003
6	17.889
7	18.981
8	19.945
9	20.98

- when we downloaded from data logger data - beads 6, 7, 8 did not download anything - appears was not collecting data since installed last.

1697-1401 DEW Lines Aug ~~July~~ 20/14

- reconfigured data logger.
- turned Analog 6, 7, 8 on (at least thinks so)
- read current - 0% ~~memory~~ memory Full, date when full : 1/3/17
  9V : 11.34 V
  12V : 18.63 V
  sample rate: 12 hrs
- hooked data logger back up and put back in casing. - changed batteries & dessicant.

At String B @ 4:00 pm

site # : 001
Description: ROB VT-B
Sample Rate: 12 hrs
memory % full: 81 %
Date when full: 23/01/2015
Battery main (9V): 11.34
Aux Batt (12V): 13.50
date: Aug 20/2014
data logger time: 3:24 pm - actual time 4:14 pm

Rite in the Rain

1697-1401 Dew Lines Aug 20/14

↳ manual Thermistor Readings.

Analog Channel	Thermistor R (k Ohms)
1	9.869
2	10.713
3	12.852
4	13.849
5	15.284
6	16.580
7	17.491
8	18.30
9	19.29
10	20.14
11	20.88

- down loaded data - again beads 6, 7, 8 didn't record anything from the start - looks like data logger wasn't set properly.
- saved xcel, raw + csv file formats of data
- reconfigured data logger
- turned on bead 6, 7, 8

→

read current configuration
Site: 001 memory: 0% Full
ROB VT-B date when full:
12 hr readings. 1/3/17
main 9V: 11.34
Aux 12V: 13.50
date: Aug 20/14
time: 4:29 pm:

- changed batteries + desiccants.

AA String C @ 4:45

Site #: 3
Description: String C
Sample Rate: 12 hr
memory % full: 81%
Date when full: 23/01/2015
Battery Main (9V): 11.34 V
Aux (12V): 13.14 V
date: Aug 20/2014
time: 3:56 pm - actual time: 4:46 pm

→

Rite in the Rain

1697-1401 DEW Lines Aug 20/14

Manual Thermistor Readings:

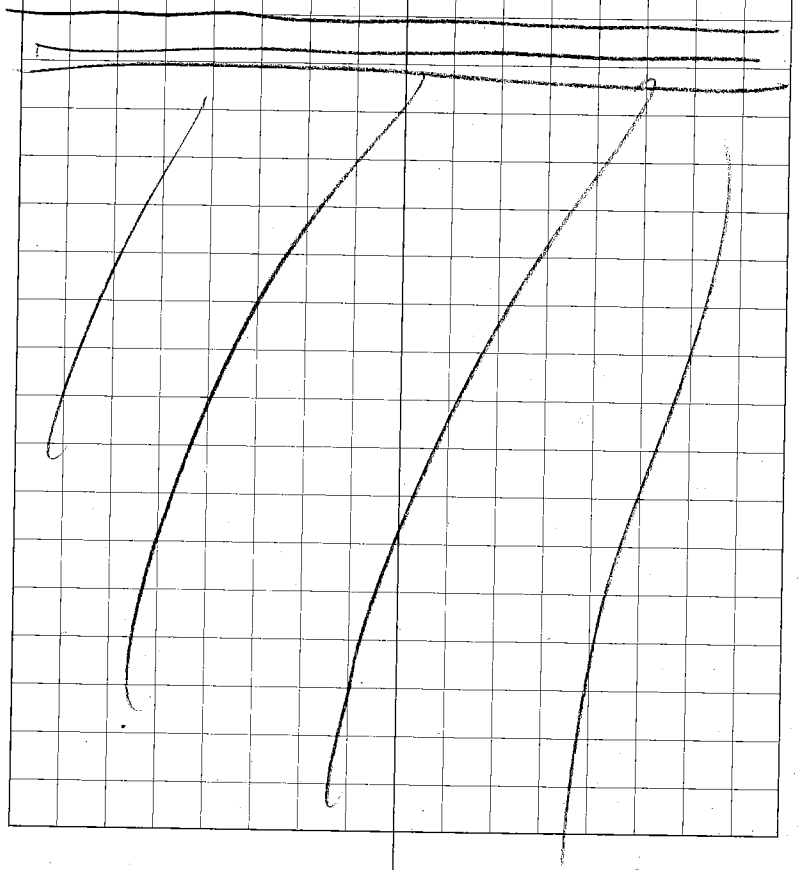
Analog Channel	Thermistor R (KOhms)
1	9.894
2	10.599
3	12.862
4	13.796
5	15.122
6	16.514
7	17.338
8	18.117
9	19.028

- same thing with beads by 7 & 8 - no data even recorded.
- ~~no~~ sensors not enabled? - like others

- saved files in excel, raw & csv file format
- reconfigured the data logger
- after configuration
  - site 3 - string C
  - logging 12 hrs.
  - percent full: 0%
  - date when full: 1/3/17
- main (9V): 11:34
  Aux (12V): 13.14 date: Aug 20/2014
  time: 4:21

1697-1401 DEW Lines Aug 20/14

- replaced batteries & dessicants.
- hiked back down to the plane.
5:50: back to CB. ✓
6:20: arrived in C.B



Rite in the Rain

Robert's Bay

Date:	August 9,2012
Landfill:	Solid Waste Management Facility Landfill (SWMF)

1. Erosion	Answer
a) Is erosion occurring on the surface or berms of the landfill?	No
i) Are there preferred drainage channels?	No
ii) Is there sloughing of material?	No
b) What is the extent of the erosion? ***(percentage of surface area)***	–
i) Is it localized or continuous?	–
c) Where is the erosion occurring? N/A	
d) Explanation: N/A.	

No erosion

2. Settlement	Answer
a) Is there differential settlement occurring on the surface?	No
i) Are there low areas or depressions?	Yes
ii) Are voids forming?	No
b) What is the extent of the settlement? ***(percentage of surface area)***	< 1%
i) Is it localized or continuous?	Localized
ii) How deep is it?	< 0.3 m
c) Where is the settlement occurring? Very small areas at a few locations on the landfill top (refer to viewpoint numbers 27 to 32 on Figure A-2, Appendix A). - settlement areas appear to have remained unchanged since 2012. - No new settlement areas observed.	
d) Explanation: No obvious cause. Settlement areas are small enough that it is possible that they are simply artefacts of the construction process. - appears to be result of construction grading - 100% mechanical - just wasn't packed flat.	

3. Frost Action	Answer
a) Is there frost action/damage to the landfill?	No
i) Is there exposed debris due to uplift?	No
ii) Is there tension cracking along the berms?	No
iii) Is there sorting of granular fill?	No
b) What is the extent of the frost action? ***(percentage of surface area)***	–
i) Is it localized or continuous?	–
c) Where is the heaving/cracking occurring? None visible on the any surface of the SWMF. None observed	
d) Explanation: No apparent signs of frost action on any surface of the SWMF. none observed	

No frost action observed.

4. Monitoring Instruments

a) What is the condition of the monitoring wells and thermistor strings? No monitoring wells present at this Site. - good condition - locks could all open (did not replace any)

Thermistor housing units were in good condition. It was determined that the three sets of thermistor beads were operating correctly, but that one of the dataloggers (on string-B) was malfunctioning. This datalogger was replaced with a spare datalogger provided by AANDC. Each thermistor casing was locked with Guard, 40 mm universal-key padlocks, No. 834 (key number 102). Thermistor batteries will require replacement during the next Site visit, scheduled for summer of 2014. - changed batteries & desiccants in early - all functioning - appears not set properly (beads 6, 7, 8 did not record anything from 1st set date in data logger)

5. Others

Animal Burrows: no animal burrows were observed in or on the SWMF. none observed

Vegetation: no vegetation was observed on the SWMF. Due to elevation, drainage, regional climate, and the type of material (large angular cobble) used to cap the SWMF, the establishment of vegetation is not anticipated. No significant re-growth was observed in any of the worked areas of the Site. no vegetation observed

Staining: no staining was observed at the SWMF. no staining

Vegetation stress: none observed. none

Seepage points: none observed. none observed

Exposed debris: no debris was exposed from the SWMF. no exposed debris

6. Sketch

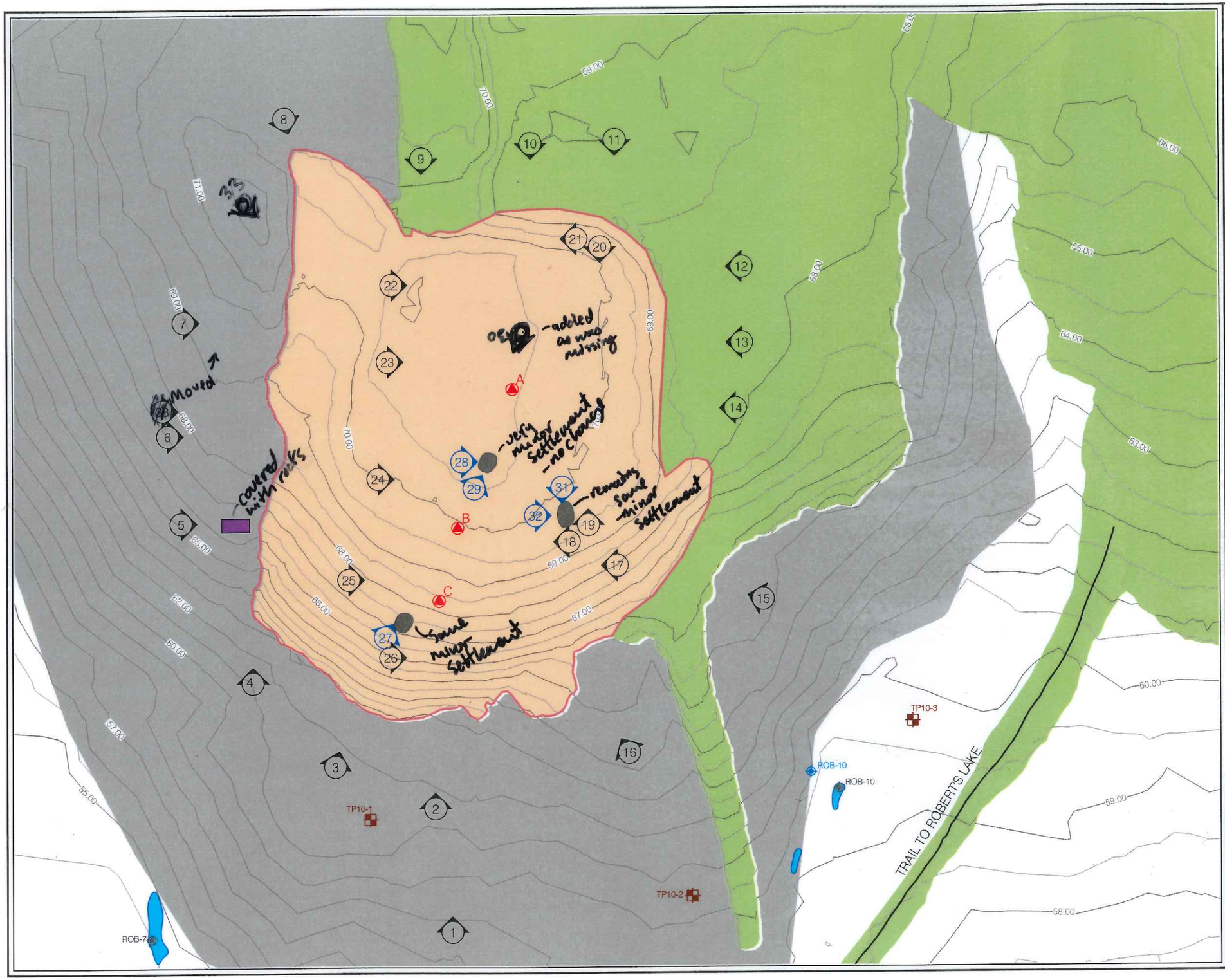
See Figure A-2, Appendix A - see figure

7. General Comments

The physical condition of the SWMF is acceptable and appears to be performing as designed.

yes - same as 2012

beads when we put down loading



N

LEGEND

- 68.00 - Ground surface Contour
- Outcrop
- Waste Rock Area
- Pond/Surface water
- Blast Hole (2 m deep)
- Solid Waste Management Facility Landfill
- Trail
- Possible Settlement Area
- 1 - Picture Viewpoint Number
- 27 - Picture Viewpoint Number (Settlement Area)
- Thermistor
- Surfacewater Sample Location (FRANZ, 2012)
- Surfacewater Sample Location (FRANZ, 2010)
- Soil Sample Location (FRANZ, 2010)

REFERENCE:

1. PUBLIC WORKS AND GOVERNMENT SERVICES CANADA, PROJECT N° : 416829, SHEET 2 of 2
2. FIGURE BASED ON AMEC LAND SURVEYS LIMITED DRAWINGS: ROBERTS BAY AND IDA BAY MINE SITE REMEDIATION, SHEETS 1-4, SEPTEMBER 2005

NOTE:

1. SEE ATTACHED CD-ROM FOR VIEWPOINT PICTURES

Scale 1:500

10 7.5 5.0 2.5 0 metres 10 20

Title: SOLID WASTE MANAGEMENT FACILITY LANDFILL

Project: LONG TERM MONITORING PROGRAM, SWMF LANDFIL, ROBERTS BAY, NUNAVUT

Client: ABORIGINAL AFFAIRS AND NORTHERN DEVELOPMENT CANADA

FRANZ ENVIRONMENTAL INC.
♦ CONSULTING ♦ ENGINEERING ♦ TECHNOLOGIES ♦

Date: October 2010

Updated: January 2013

FIGURE A-2

1967-1001/xxx/MZ/Roberts_Bay_MineSite.dwg

APPENDIX G

Thermistor Data

Table G-1: Thermistor Annual Maintenance Report

Contractor name: ARCADIS Franz Canada Inc.	**Inspection date:** 2014-08-20
Prepared by: Julie Dittburner	

Thermistor Information

Thermistor Number	**String-A site 1**	**String-B site 2**	**String-C site 3**
Install date	2009	2009	2009
Location	Roberts Bay (SWMF)	Roberts Bay (SWMF)	Roberts Bay (SWMF)
Inclination	Vertical	Vertical	Vertical
Cable length (m)	N/A	N/A	N/A
Cable length (m) above ground	2.5	3.3	3.1
No. of beads*	9	11	9
Bead type	44007	44007	44007
Coordinates (m)	N:7563819 E: 435359	N:7563800 E: 435351	N:7563790 E: 435349
Elevation: casing top (masl)	71.80	71.29	69.53
Elevation: bottom bore (masl)	66.67	65.76	65.11
Serial no.	07060503	05070003	07060500
Logger model	Lakewood Systems Ultralogger (RX-16, Revision JC)		

*determined indirectly from thermistor logger data.

Thermistor inspection

Thermistor Number	**String-A site 1**	**String-B site 2**	**String-C site 3**
Casing	Good condition	Good condition	Good condition
Cover	Good condition	Good condition	Good condition
Datalogger	Good condition	Good Condition	Good condition
Cable	Good condition	Good condition	Good condition
Beads	Operational	Operational	Operational
Memory Used	81%	81%	81%
Battery installation date	Aug 20, 2014	Aug 20, 2014	Aug 20, 2014
Battery change date (recommended)	2017	2017	2017
Main battery (V)	11.34	11.34	11.34
Aux battery (V)	13.63	13.50	13.14

Observations and proposed maintenance

- All locks were functional on all three thermistor casings: Guard, 40 mm universal-key padlocks, No. 834 (key number 102).

- Batteries were replaced in dataloggers at all strings.

- A Lakewood resistance meter and switchbox were employed to compare manual (taken directly from thermistor beads) and logged readings. It was determined that all of the beads were functioning correctly.

Table G-2: Manual Thermistor Readings and Inferred Bead Elevations

Analog Channel		Elevation (masl)*	Depth (mbgs)*	Thermistor R (Ohms)	Temperature (ºC)		
					Manual	Logged	Difference
String-A	1	70.5	0	11737	6.3857	6.2474	0.1
	2	70.17	0.33	13012	4.3850	4.108	0.3
	3	69.67	0.83	13726	3.3293	2.8615	0.5
	4	69.17	1.33	15947	0.3817	0.4492	0.1
	5	68.67	1.83	17003	-0.9164	-0.8365	0.1
	6	68.17	2.33	17889	-1.9552	-1.9403	0.0
	7	67.67	2.83	18981	-3.0155	-2.9812	0.0
	8	67.17	3.33	19945	-3.9267	-3.9792	0.1
	9	66.67	3.83	20980	-4.9039	-4.919	0.0
	maximum				--	--	***0.5***
String-B	1	70.76	-0.5	9869	10.0291	11.1082	1.1
	2	70.26	0	10713	8.3154	8.1693	0.1
	3	69.76	0.14	12852	4.6318	4.6652	0.0
	4	69.26	0.64	13849	3.1462	3.2061	0.1
	5	68.76	1.14	15284	1.1918	1.2529	0.1
	6	68.26	1.64	16580	-0.4030	-0.3453	0.1
	7	67.76	2.14	17491	-1.4395	-1.4237	0.0
	8	67.26	2.64	18300	-2.3121	-2.3019	0.0
	9	66.76	3.14	19290	-3.4719	-3.4456	0.0
	10	66.26	3.64	20140	-4.1559	-4.1702	0.0
	11	65.76	4.14	20880	-4.8410	-4.8829	0.0
	maximum				--	--	***1.1***

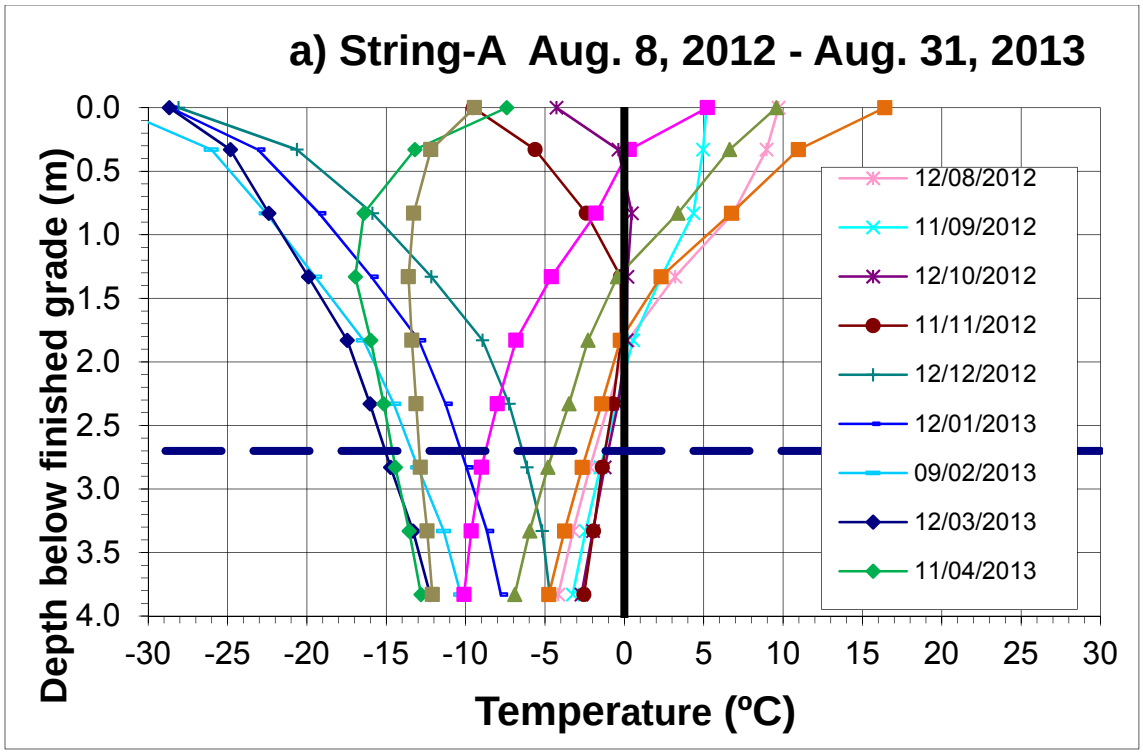
Analog Channel		Elevation (masl)*	Depth (mbgs)*	Thermistor R (Ohms)	Temperature (ºC)		
					Manual	Logged	Difference
String-C	1	68.61	-0.5	9894	9.9890	11.0389	1.0
	2	68.61	-0.41	10599	8.5393	8.4345	0.1
	3	68.11	0.09	12862	4.5948	4.609	0.0
	4	67.61	0.59	13796	3.1996	3.2531	0.1
	5	67.11	1.09	15122	1.4015	1.4138	0.0
	6	66.61	1.59	16514	-0.3863	-0.3606	0.0
	7	66.11	2.09	17338	-1.2943	-1.244	0.1
	8	65.61	2.59	18117	-2.1096	-2.1539	0.0
	9	65.11	3.09	19028	-3.0753	-3.0715	0.0
	maximum				--	--	***1.0***

Temperature difference attributable to greater variability in air temp measured by surface beads and time difference between logging time and manual resistance reading.

Established elevation of borehole bottom (from as-built drawings).

Established elevation of landfill surface (from as-built drawings).

*Inferred elevation and depth based on design recommendations of 500 mm bead spacing from borehole bottom.



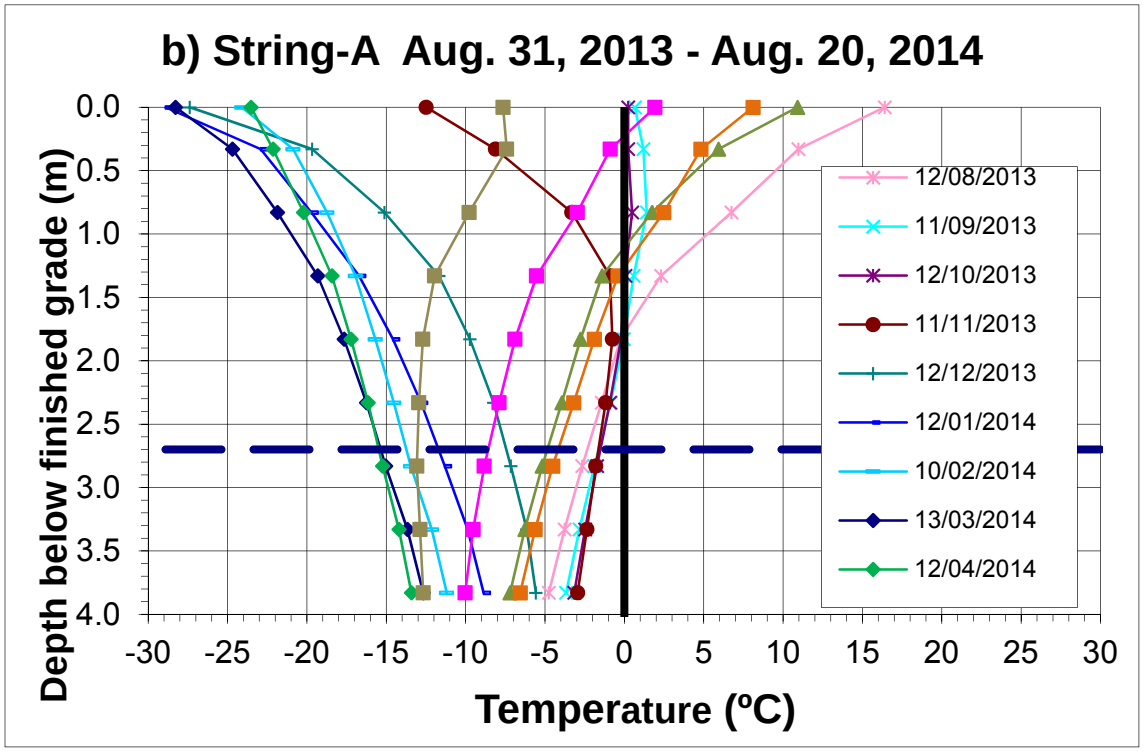


Figure G- 1: Monthly ground temperature profiles at thermistor string A: a) 2012-2013, b) 2013-2014

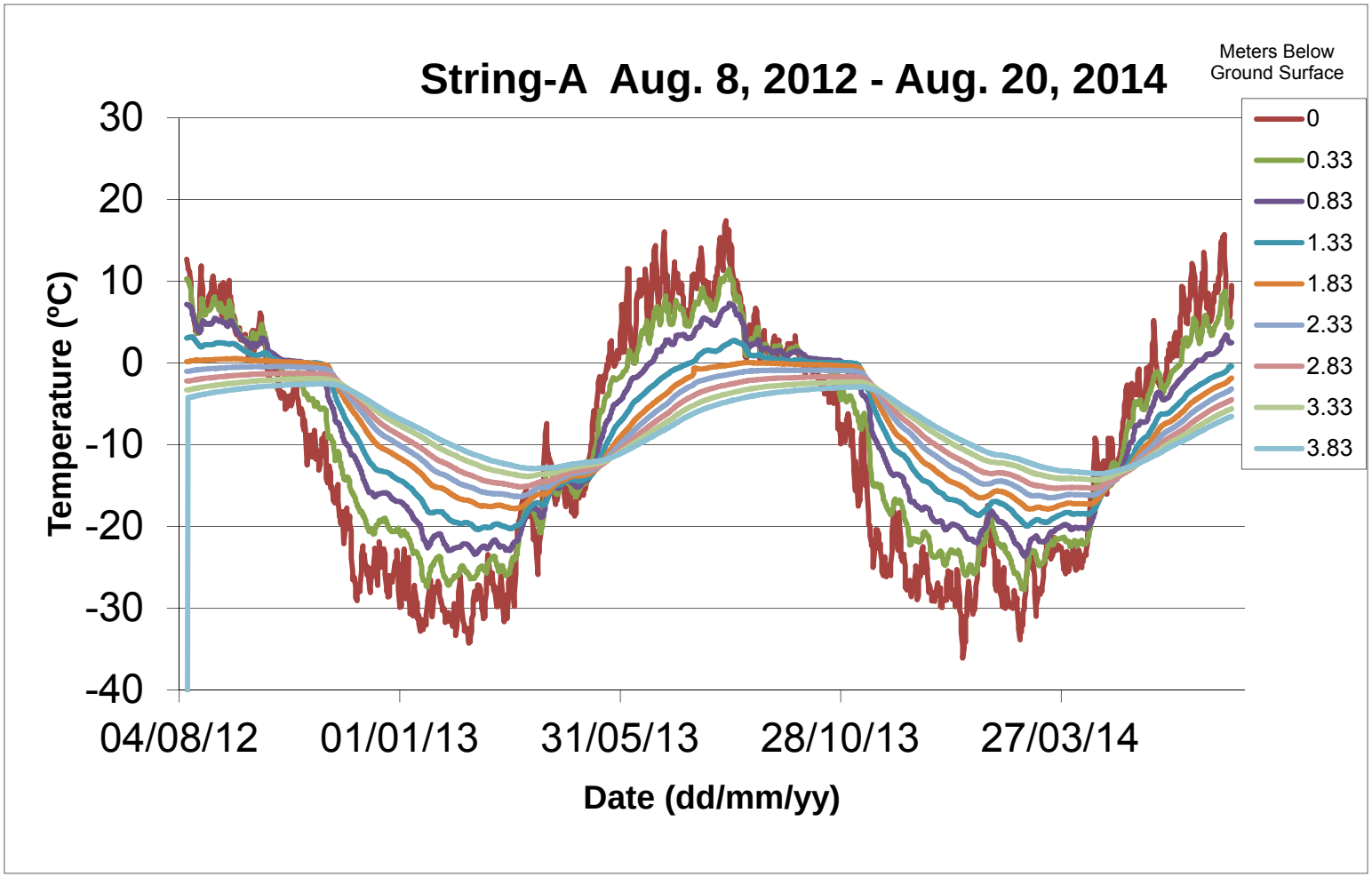


Figure G- 2: Temperature vs. time at thermistor string A: (August 2012-August 2014)

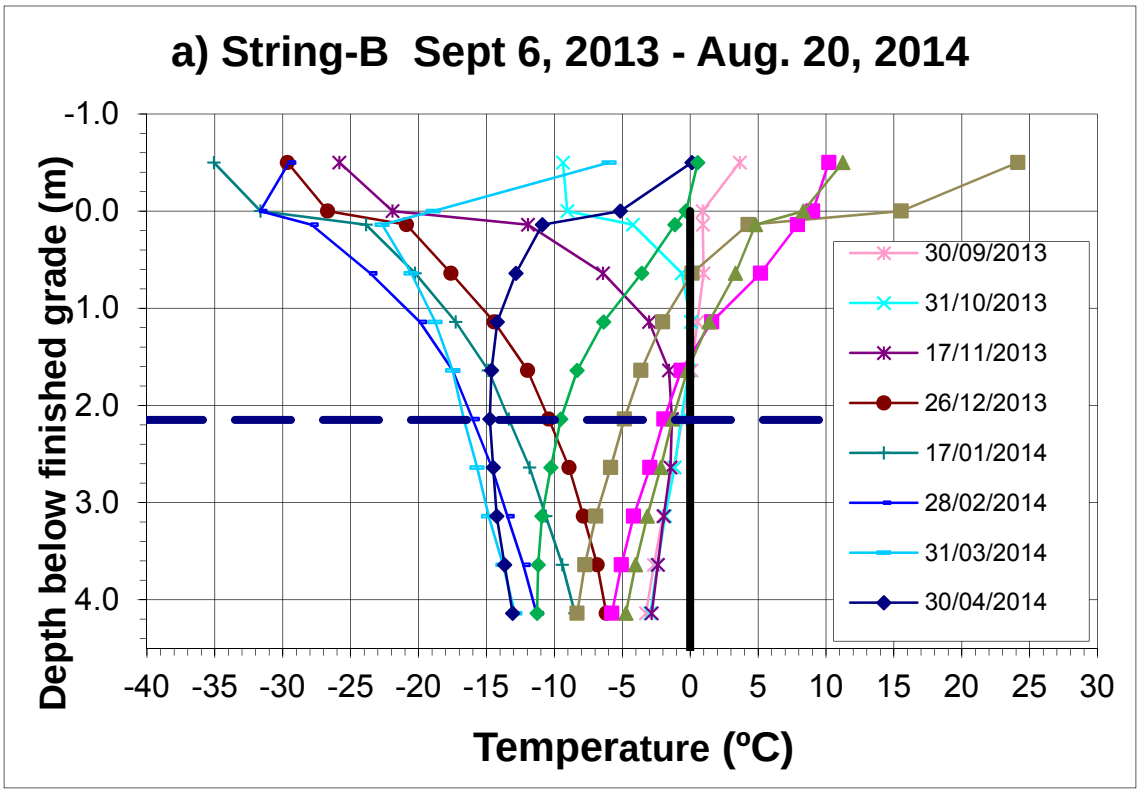


Figure H- 3: Monthly ground temperature profiles at thermistor string B: a) 2013-2014

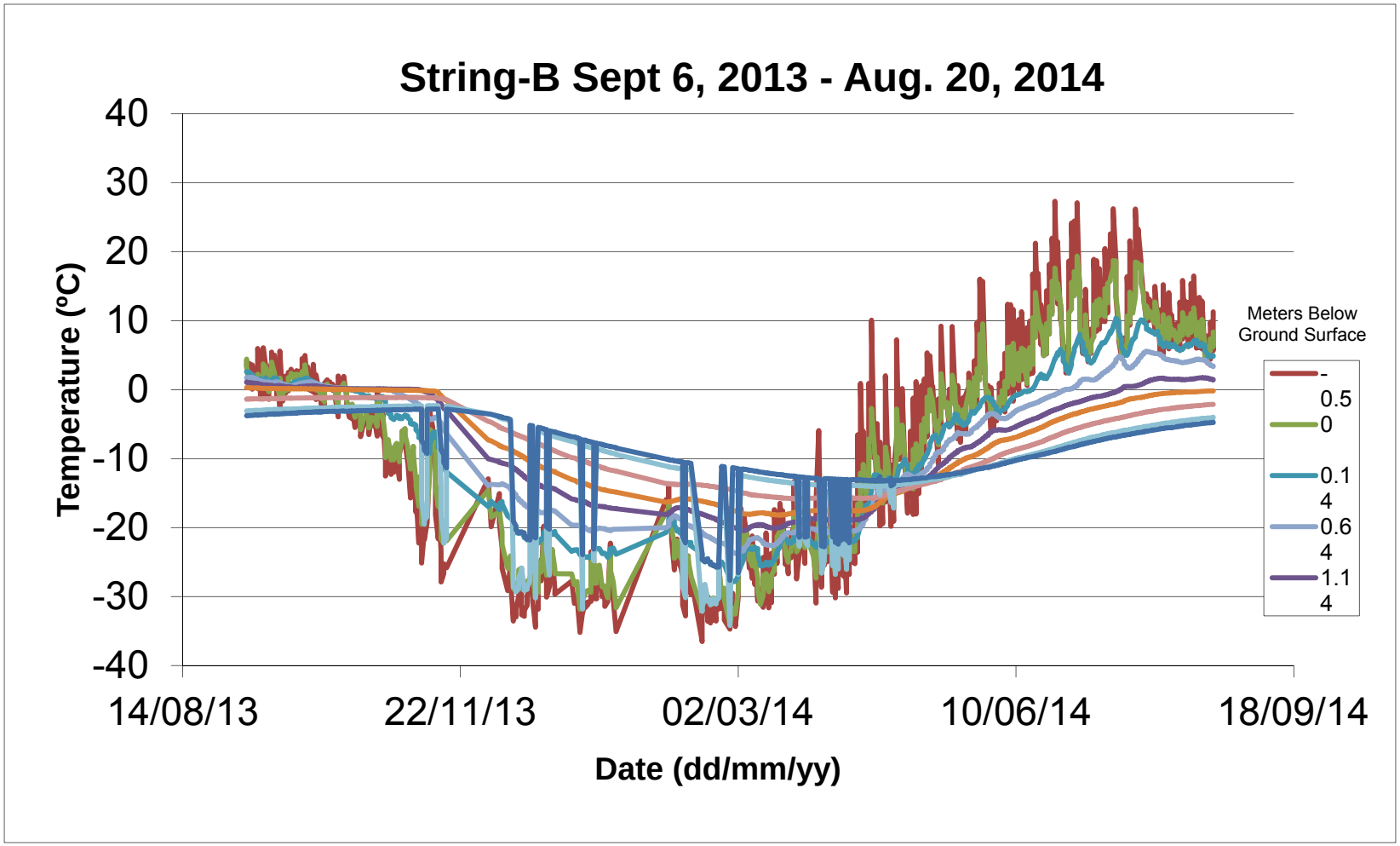
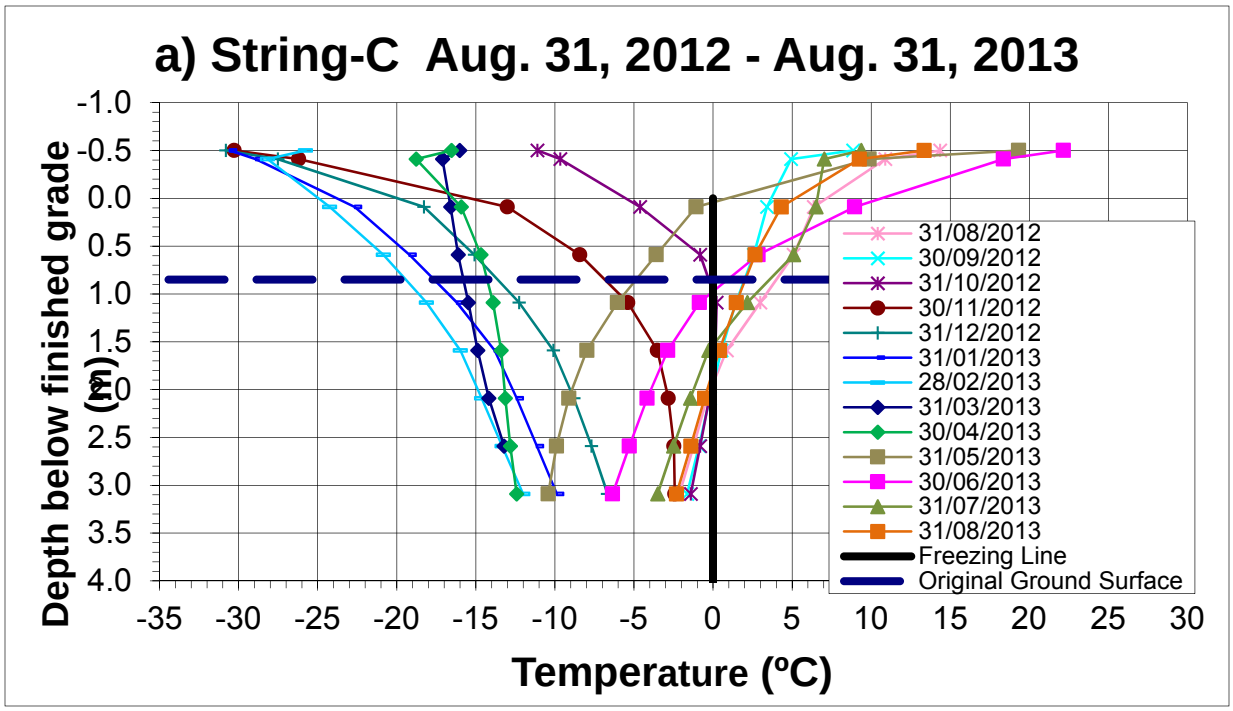


Figure G- 4: Temperature vs. Time at Thermistor String B (2013-2014)



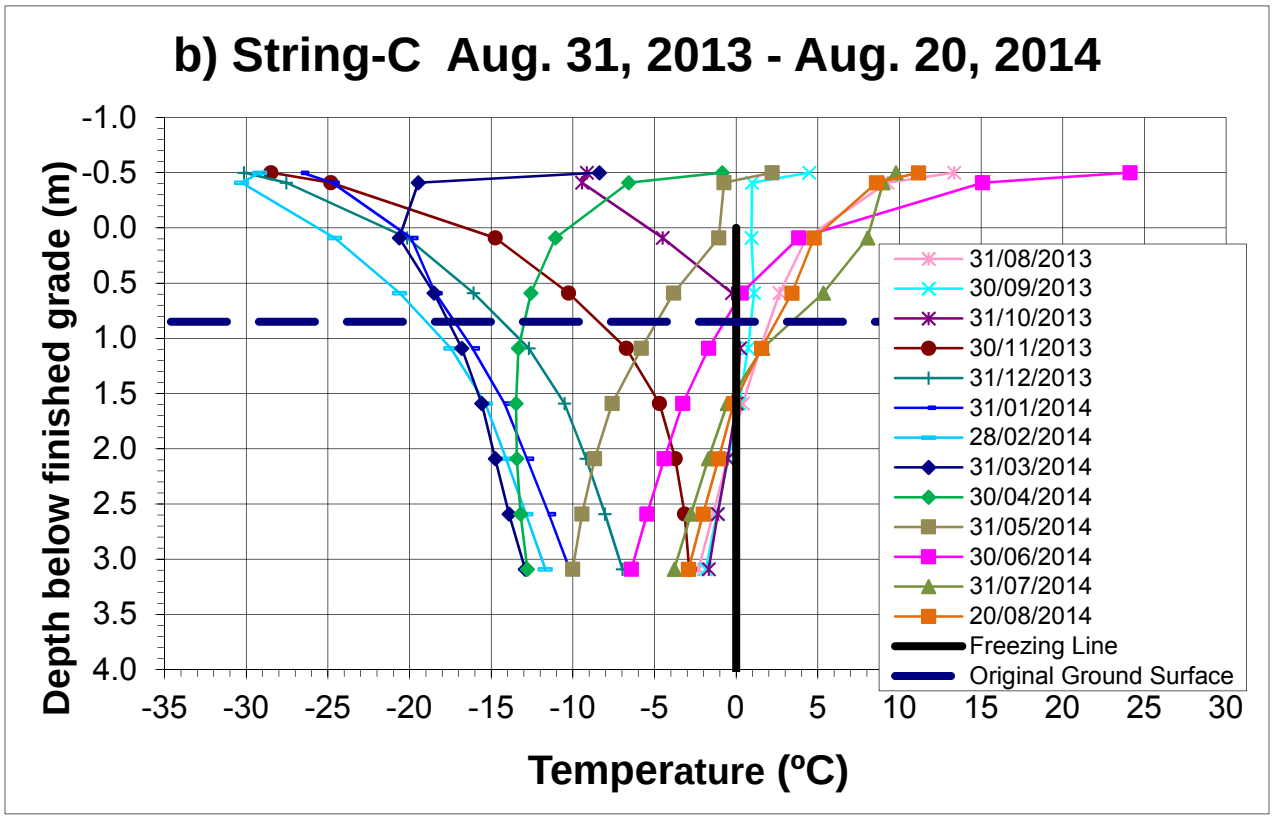


Figure G- 5: Monthly Ground Temperature Profiles at Thermistor String C: a) 2012-2013 b) 2013-2014

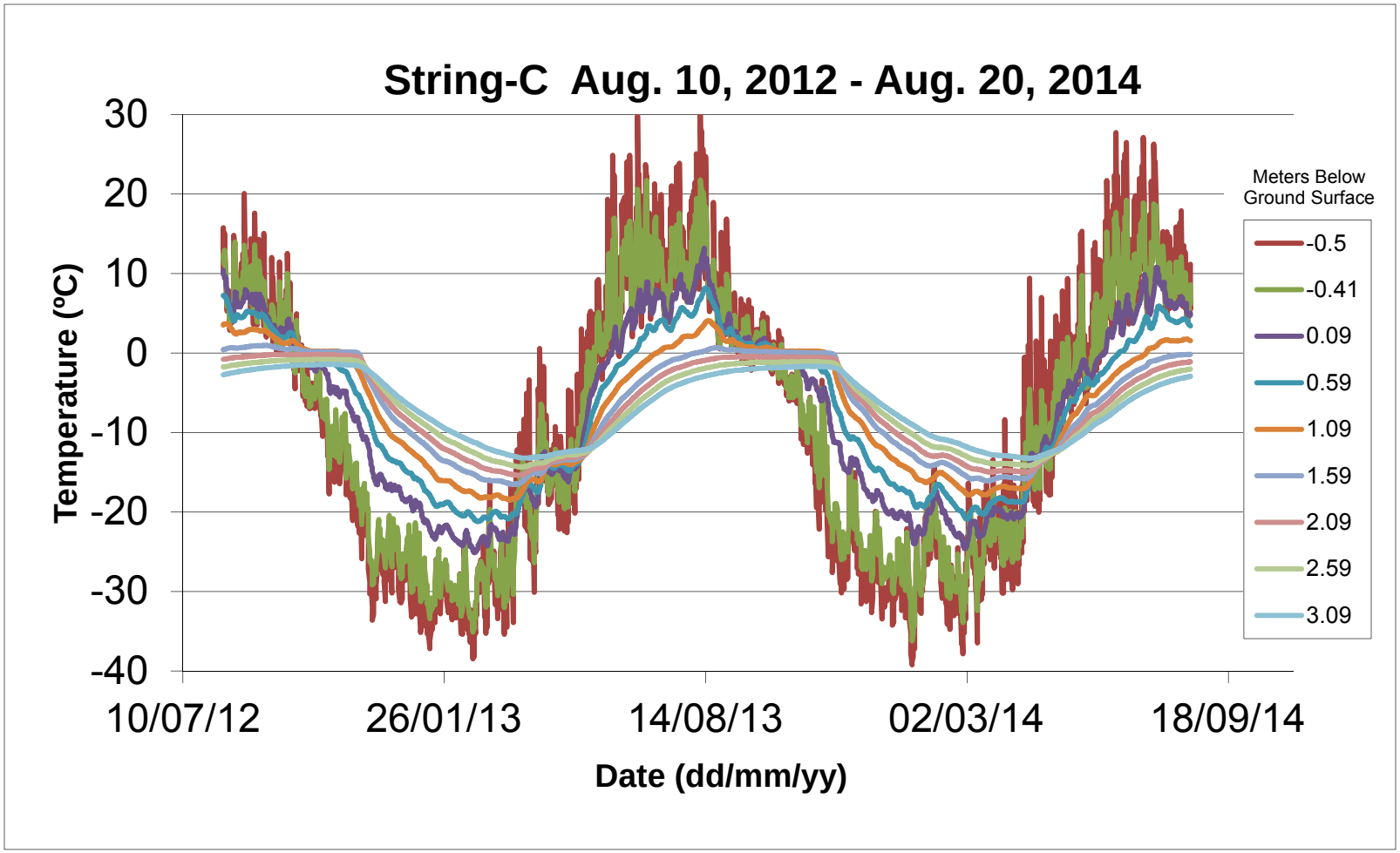


Figure G- 6: Temperature vs. Time at Thermistor String C (August 2012-August 2014)

APPENDIX H

Datalogger Email Correspondence

Dittburner, Julie (FRANZ)

From: Henderson, Andrew (FRANZ)
Sent: March-05-15 9:05 AM
To: Fletcher, Ryan (FRANZ)
Cc: Dittburner, Julie (FRANZ)
Subject: FW: FW: Quote for refurb - reply - dh - data processing?
Attachments: ForFranz2014March3.zip

Ryan,

Can you have a look at this and see if it's any different than what we got out of it?

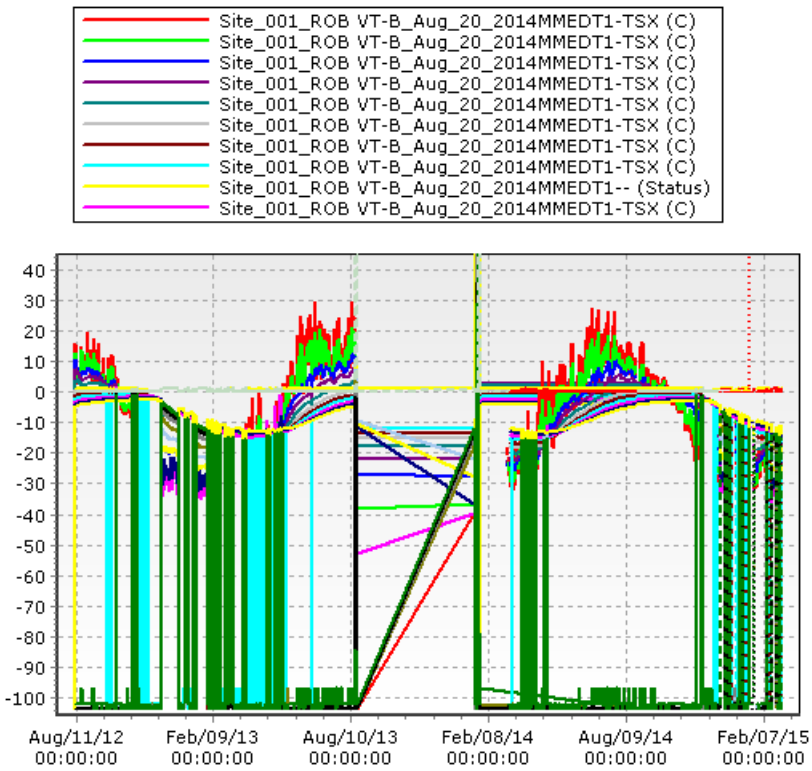
ANDREW HENDERSON, B.A.SC., P.ENG. | Franz Environmental
329 Churchill Ave North, Ottawa, Ontario K1Z 5B8 | Ph: 613-721-0555 | Fax: 613-721-0029 | www.franzenvironmental.com
Now operating as ARCADIS Franz Canada Inc.

From: James Hlibka [mailto:james@lakewood.com]
Sent: March-04-15 7:14 PM
To: Henderson, Andrew (FRANZ)
Cc: Don Hlibka
Subject: Re: FW: Quote for refurb - reply - dh - data processing?

Hi Andrew,

I was able to pull 7 chunks of data out of the complete memory transfer that Don gave me. When I look at all the data it looks like this:

. ROB VT-B and 1 ROB VT-B and 1 ROB VT-B and 1 ROB VT-B



The year values for all of the files could be wrong and I can changes those if you need. It is also possible that the clock could have frozen at various points causing problems with the dates and times. I have attached files for the 7 chunks I was able to extract. Does the attached data make sense to you?

Thanks,
James

--
ph.: (780) 462-9110 x 222
fax: (780) 450-3867
web: lakewood.com

On 3/3/2015 10:51 AM, Don Hlibka wrote:

> Hi James,
>
> Could you parse out what may be reasonable data out of this file for Andrew.
>
> Please check my notes below.
> (I told him below that it would be about 1 hour of work).
>
> Thanks.
>
> ***Regards Don Hlibka***
>
> ***Bus.ph. 780-462-9110 ext. 221***
> ***Bus.fax 780-450-3867***
> ***Cell ph. 780-699-6189 (off while driving)***
>
> ***e-mail don@lakewood.com***
> *home page* http://www.lakewood.com/

From: Henderson, Andrew (FRANZ) [mailto:ahenderson@franzenvironmental.com]
Sent: Tuesday, March 03, 2015 6:50 AM
To: Don Hlibka
Cc: 'James Hlibka'
Subject: RE: Quote for refurb - reply - dh - data processing?

Yes please!

ANDREW HENDERSON, B.A.SC., P.ENG. | Franz Environmental
329 Churchill Ave North, Ottawa, Ontario K1Z 5B8 | Ph: 613-721-0555 | Fax: 613-721-0029 | www.franzenvironmental.com
Now operating as ARCADIS Franz Canada Inc.

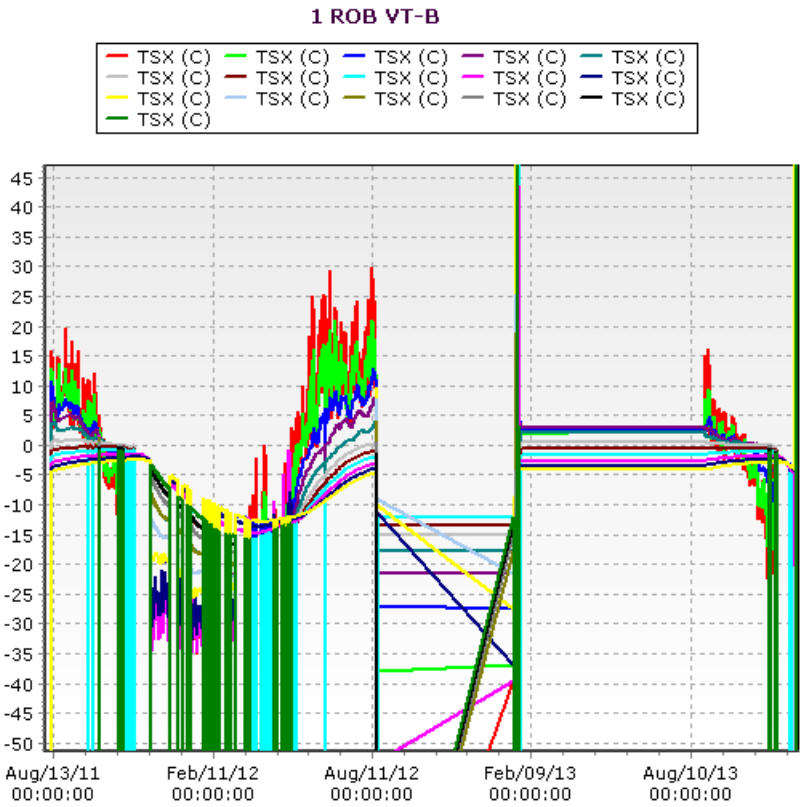
From: Don Hlibka [mailto:don@lakewood.com]
Sent: March-02-15 6:25 PM
To: Henderson, Andrew (FRANZ)
Cc: 'James Hlibka'
Subject: RE: Quote for refurb - reply - dh - data processing?

Hi Andrew,

In quickly looking at the profile of the data, it seems that there whis would be the areas of some reasonable data.

Do you want James to extract data from these regions?

It's probably around an hour of work.



Regards Don Hlibka

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From: Henderson, Andrew (FRANZ) [mailto:ahenderson@franzenvironmental.com]
Sent: Monday, March 02, 2015 2:23 PM
To: Don Hlibka
Cc: boris@lakewood.com; Dittburner, Julie (FRANZ)
Subject: RE: Quote for refurb - reply

Hi Don, [Our email is acting up this afternoon – apologies if this is the third time you receive this!]

Sent the email to the client and we'll see if she approves it.

One more thing – would you mind having a look at the attached file as well from a datalogger we had to leave in the field. There is some wonky data in there and I wonder if you've ever seen anything like it before. Lots of jumping around and huge negative numbers that likely don't reflect reality.

We are happy to pay for all your work looking at these files too, by the way, and thanks!

Andrew