FRANZ ENVIRONMENTAL INC.

◆ CONSULTING ◆ ENGINEERING ◆ TECHNOLOGIES ◆

Long Term Monitoring, 2011
FOX-C, Ekalugad Fjord, Nunavut

FINAL REPORT

Prepared for:

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EXECUTIVE SUMMARY

Franz Environmental Inc. (FRANZ) was retained by Aboriginal Affairs and Northern Development Canada – Nunavut Regional Office (AANDC) to conduct long-term monitoring activities at the former Distant Early Warning (DEW) Line site FOX-C. This project was completed under AANDC standing offer number 01-11-6001/5, call-up number 01, file number 1632-11/01-11-6001/5.

The FOX-C Ekalugad Fjord site is located on the Northeastern coast of Baffin Island, Nunavut, on the southern shore of Ekalugad Fjord. FOX-C was an intermediate DEW Line Site at which a remediation project was conducted between 2005 and 2008. After demolition, remediation consisted of disposal of non-hazardous waste and contaminated soils in on-site facilities.

Monitoring efforts were conducted on July 27, 2011 while based out of the nearest community, Qikiqtarjuaq, approximately 240 km to the Southeast. The landfill monitoring program consisted of a visual inspection of the Non-Hazardous Waste Landfill (NHWL). The five monitoring wells on site could not be sampled as they were frozen. In addition, the natural environment was monitored and physical evidence and anecdotal evidence and information suggest that wildlife and local hunters continue to frequent this site.

Overall, physical observations suggest that the NHWL is in good condition and performing as designed to contain the enclosed waste. One area of potential settlement was noted on the top of the landfill, running north to south; this area was noted during the 2009 monitoring event and appears to have lessened in magnitude since the previous observations. Minor (<0.2 m in depth) erosion channels were observed on the northeast and southwest sides of the landfill, these erosion channels were also noted in the 2009 monitoring event. While the length and depth of these channels have increased slightly, they are not currently negatively impacting the integrity of the landfill. A noticeable depression of approximately 390 m^2 was observed adjacent to the northwest berm between monitoring well MW-North and the beach access road. The depression was observed to be damp and is likely to contain ponded water during rainfall events or spring melt. Four small (< 0.02 m^3) potholes were observed along the sides of the landfill. Some upwelling of bentonite was observed between well stickups and casings.

Unfortunately, due to weather related time restriction the Lake, Beach, Mid- and Upper Station Areas could not be observed in 2011.

This executive summary should be read in conjunction with the main report and is subject to the same limitations described in Section 7.0.

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1.0 INTRODUCTION

Franz Environmental Inc. (FRANZ) was retained by Aboriginal Affairs and Northern Development Canada – Nunavut Regional Office (AANDC) to conduct long-term monitoring activities at the former DEW Line site FOX-C. This project was completed under AANDC standing offer number 01-11-6001/5, call-up number 01; file number 1632-11/01-11-6001/5.

This report describes the monitoring activities completed for AANDC at FOX-C and was prepared in accordance with the FRANZ Proposal No. P-3756, dated June 30, 2011, the Call-up Details, dated July 11, 2011 and the Project Initiating Meeting Minutes, dated July 19, 2011.

Throughout this report the AANDC DEW Line site FOX-C will be referred to as "the Site".

1.1 Project Objectives

The objective of the 2011 long-term monitoring was to complete the second monitoring event in the planned 25 year monitoring program at the FOX-C site as described in the FOX-C Ekalugad Fjord Long-Term Monitoring Plan. This included visual observations, chemical analyses (where warranted and possible) and interviews with members of the nearby community knowledgeable of local activities at the site to determine the condition of the natural environment and whether the site infrastructure is performing as designed.

1.2 Scope of Work

Consistent with previous years monitoring activity, the scope of work undertaken at the site in 2011 was as described in the 2008 Long-Term Monitoring Plan was as follows:

1. Visual Monitoring of the NHWL, including
   - Visually checking the physical integrity of the NHWL and looking for evidence of settlement, erosion, frost action, animal burrows, vegetation, staining, vegetation stress, seepage points, exposed debris, and the condition of wells;
   - Taking photographs to document the condition of the NHWL and substantiate the recorded observations.
2. Active Layer Water Monitoring, including
   - The collection of samples from the 5 monitoring wells installed around the NHWL. These samples were to be analysed and the results compared to those from background samples.
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. Natural Environment Monitoring, including

- The collection of direct and indirect evidence of wildlife presence and activity;
- Making observations regarding the re-vegetation of disturbed areas.

5. Preparation of a 2011 monitoring program report.

The following tasks were assessed as necessary to fulfill the scope:

a) Review of the FOX-C LTM Plan, previous LTM reports for FOX-C, and the AMSRP;
b) Preparation of a health and safety plan;
c) Preparation of a sampling plan for soil and groundwater;
d) Collection of water level data and observation of monitoring well condition at the site;
e) Visual inspection, measurement and photo documentation of the site;
f) Interviewing local residents and officials to understand land use and wildlife trends; and
g) Reporting.

2.0 BACKGROUND INFORMATION

2.1 Site Description

According to AANDC's FOX-C Ekalugad Fjord Long-Term Monitoring (LTM) plan, the Intermediate Distant Early Warning (DEW) Line Site was constructed in 1957 and subsequently abandoned in 1963. The site is located on the northeast coast of Baffin Island, a mountainous area characterized by deep fjords and glaciers. The site is comprised of three areas: the Upper Station, Mid Station, and Lower Station. The Lower Station is subsequently divided into three areas: the Lake Area, the Beach Area, and the Landfill Area, now occupied by the non-hazardous waste landfill.

The Upper Station is so-called because of its location, at 770 m above mean sea level. Before remediation was completed in 2008, the main site facilities were located in this area and included a module train, warehouse, garage, a former Quonset building, Inuit house, bulk fuel storage tanks, a radar tower as well as other site debris.

The Mid Station is located at the base of the summit approximately 500 m east of the Upper Station. A glacier located across from the Mid Station feeds a river that flows alongside the access road to an unnamed lake. Before remediation, the Mid Station area contained a dump area, barrel storage pad, four former Quonset buildings and numerous barrel and debris areas. A site access road travels east from the Upper Station, through the Mid Station to a junction in the Lake Area. The road is approximately 5.9 kilometres long.

At the Lower Station near the Lake Area the site access road from the Upper Station splits into two parts. One section heads southwest to the Lake Area and is approximately 1.1 kilometres long. A river flows out of this lake and empties into the ocean at the Beach Area. The other section of the road heads north to the Beach Area and is approximately 2.2 kilometres long. Before remediation, there were two petroleum, oil and lubricants (POL) storage tanks at the beach area, barrel caches and abandoned construction equipment. The landing area at the beach was used to land equipment and supplies including bulk fuel transfers to the POL storage tanks. The remediation construction camp was located near this Beach Area.

A non-hazardous waste landfill (NHWL) was constructed at the site in 2006–2007 and closed in 2008. It was designed to contain non-hazardous materials only. It was constructed on natural ground surface with the organic matter stripped and consists of four perimeter berms constructed of granular material. The non-hazardous waste was placed in the landfill in layers consisting of 0.5 m lifts of waste covered by 0.15 m of granular fill. The waste layers were compacted and a final cover consisting of a minimum of 1.0 m of granular fill was used to cap the landfill. The NHWL contains the following:

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

The site is not regularly inhabited; in addition, wells at the site would tend to freeze due to the presence of permafrost, therefore groundwater is not considered to be used for water supply purposes. The area is known to be used by hunters and fishermen. Interviews with residents of the nearby community of Qikiqtarjuaq indicate that hunting does still take place in the area; several local Qikiqtarjuaq residents are known have cabins in the area.

2.2 Previous Monitoring Programs

The 2011 monitoring program was the second of a proposed eight that are scheduled over a 25 year period. To become familiar with the site, FRANZ reviewed the following reports pertaining to DEW Lines sites:

- Long Term Monitoring, 2009, FOX-C, Ekalugad Fjord, Nunavut;
- FOX-C Ekalugad Fjord Long-Term Monitoring Plan, March 23, 2008, Indian and Northern Affairs Canada; and
- Abandoned Military Site Remediation Protocol, December 2008, Indian and Northern Affairs Canada, Contaminated Sites Program.

3.0 INVESTIGATIVE METHODOLOGY

The monitoring program was carried out at the FOX-C DEW Line site on July 27, 2011 by Ryan Fletcher and Catherine LeBlanc under the supervision of AANDC representative Charlotte Lamontagne. During the field investigations, weather conditions were cloudy and 4 to 5 degrees Celsius with a low cloud ceiling. The program consisted of the following:

- Completing a Health & Safety kick-off meeting;
- Visually observing and photographically documenting the physical integrity of the landfill;
- Collection of ground water samples from existing wells (if possible);
- Collection of soil samples (if necessary, as per the LTM plan); and
- Gathering information through first hand observation as well as through knowledgeable persons regarding local wildlife and human activity.

The field investigation procedures are described below.

3.1 Health & Safety Plan

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

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

3.2 Visual Inspections

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

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

3.3 Wildlife Survey

FRANZ made observations of the natural environment at the time of the site visit and recorded these observations in field notes. Observations included direct sightings of wildlife, other evidence of wildlife (e.g., droppings, tracks, feathers/fur), wildlife activities (migrating, nesting, etc.), numerical estimates of wildlife, and vegetation observations. Where possible, observations by FRANZ have been compared to previously recorded observations.

As part of the investigation, a FRANZ representative interviewed several members of the Nattivak Hunters and Trappers Association in Qikiqtarjuaq, as well as other community members knowledgeable about surrounding areas. Land uses by humans and wildlife, as well as changes in use over previous years by each, were discussed and pertinent information is documented in this report.

3.4 Groundwater Sampling

Upon arrival at the FOX-C site, the FRANZ field assessors made an attempt to measure water levels at each of the wells. Using a water level tape, the field assessors found that none of the monitoring wells contained groundwater; all of the water in the wells was frozen. The level of the frozen water and the casing heights of each well were recorded, but no water samples could be obtained. General well conditions were also recorded, and the wells were re-locked using keyed-alike padlocks.

3.5 Soil Sampling

Because there were no indications of seepage or staining as part of the visual inspection, no soil samples were collected during the monitoring activities, as per the 2008 Long-term Monitoring Plan for the site.

4.0 NON-HAZARDOUS WASTE LANDFILL (NHWL)

4.1 Area Summary

The NHWL is located in the Lower Site Landfill Area, between the Beach and Lake Areas of the FOX-C DEW Line site. The monitoring of the landfill included visual observations to assess its physical integrity, including evidence for erosion, ponding, frost action, settlement and lateral movement. Groundwater and soil samples were to be collected at locations up- and downgradient of the NHWL. Due to completely frozen wells groundwater samples could not be taken and as there were no apparent signs of facility malfunction, soil samples were deemed unnecessary by both the FRANZ and AANDC personnel on site. The visual inspection report, including supporting photos and figure, is presented in Section 4.3.

4.2 Photographic Record

The photographic record of the NHWL has been completed as per the Terms of Reference (Photographs 1 to 79, attached CD-ROM). Those portions of the record referenced in the body of this document are included in Appendix B. The complete photographic record, of full-resolution photographs, is provided in the attached CD-ROM.

4.3 Visual Inspection Report

Monitoring consisted, in part, of visual observations of the NHWL to assess its physical integrity, by collecting evidence of erosion, ponding, frost action, settlement and lateral movement. A plan view of the NHWL indicating photographic viewpoints, observed salient features, and locations of ground water monitoring wells is presented in Figure A-1, Appendix A. The visual monitoring checklist provided in the FOX-C LTM plan has been completed and is included in Table 4-3 of this report. Table 4-1 and Table 4-2 present the preliminary visual inspection results for 2011 monitoring of the NHWL at FOX-C.

Table 4-1: Preliminary Visual Inspection Report Non-Hazardous Waste Landfill

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

Table 4-2: Preliminary Visual Inspection Report Non-Hazardous Waste Landfill - Definitions

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

Settlement

A linear area of settlement was noted running from north to south on the entire top of the landfill (Figure A-1; Appendix A), in the central area along the apex of the NHWL. The landfill slopes upwards slightly from the east to a high point in the centre, after which it slopes downwards gently to the west. Immediately to the west of the high point, a slight depression across the width of the NHWL is present. This settlement is likely an artifact of the techniques used to build the NHWL and may not be a settlement issue as was noted in the 2009 report. Based on the photographic evidence from 2009, the extent of the depression has not changed significantly since previously noted and if anything has decreased in importance.

Additionally, an area of noticeable depression was observed directly north of the NHWL (Feature H, Figure A-1; Appendix A and Photographs 10, 62 to 65, CD-ROM). This 389 m^2 depression was damp during the site visit and appears likely to contain ponded water at times of high rainfall and spring melt. The depression does not currently appear to impact the structure of the landfill.

Several potholes were noted ranging in volume from 0.006 m^3 to 0.016 m^3 (Feature B, I, R, and T, Figure A-1; Appendix A and Photographs 52, 66, 77, and 79, Attached CD-ROM). These features are likely a result of erosion and not settlement as most of the potholes contained one or more large cobbles at the downgradient extent. The presence of large cobbles embedded in the landfill berm's cause eddy currents to form in the run-off water and therefore mechanically erode away some of the fine soil particles. This action is contributing to the pothole development.

Erosion

Minor erosion channels were observed running down the berms of the landfill on the northeast, and southwest sides (Feature A, E, F, G, K, M, N, O, and P, Figure A-1; Appendix A and see Tale 4-3 for photograph references); and to a lesser extent the northwest, south sides. Additional erosion channels were observed at the toe of the landfill on the northeast side (Feature C and D, Figure A-1; Appendix A and Photographs 53 to 58; CD-ROM) running down towards MW-East B, as well as on the northwest toe (Feature J, Figure A-1; Appendix A and Photographs 18, 19, 67 and 68; CD-ROM) and southwest side (Features Q and S, Figure A-1; Appendix A and Photographs 76 to 78; CD-ROM). The maximum depth of the erosion channels noted was less than 0.2 m and on average less than 0.1 m.

Some larger particles (cobbles) are exposed at the top of the berms on the southwest and south sides of the NHWL. These features appear to be a result of water washing the finer grained soils away down the slope of the berms.

Several potholes (see settlement above) were noted along the berms of the NHWL. These features may be a result of water run-off and erosion based on the presence of cobbles which appear to be collecting run-off water and causing loss of finer grained material.

Frost Action

Some upwelling of bentonite inside well stickups was observed (Photo 80, Attached CD-ROM). This may be evidence of frost action at the site; however, limited movement of the well casing inside the stickups was observed.

Some minor cracking was observed surrounding the landfill on the native soils suggesting some minor frost action outside of the landfill extents. No evidence of any frost action on the landfill or the landfill berms was observed.

Evidence of Burrowing Animals

No evidence of burrowing animals was observed in the area of the NHWL.

Re-establishment of Vegetation

Based on the regional setting of this landfill reestablishment of vegetation is likely to take a significant amount of time. No growth was observed on the top or sides of the landfill.

Staining

No staining was observed in the area of the NHWL.

Seepage Points

One potential seepage point was observed to the northeast of the NHWL. This feature was identified as feature D and did not contain any evidence of staining or product seepage from the landfill. This feature appeared to be caused only by melt water that may be day-lighting at this point. Feature D may also be a result of erosion and not seepage; however, was worthy of noting under this observation heading to track progress in future monitoring assessments.

Exposed Debris

No exposed debris was observed in the area of the NHWL.

Discussion

All physical observations suggest that the NHWL is performing as designed and is containing the enclosed waste. Groundwater samples were not taken due to the frozen state of all the monitoring wells. Soil samples were not collected given the lack of evidence (e.g. staining) of any anomalies. The facility appears in satisfactory condition.

Table 4-3 below summarizes the results of the visual inspection.

Table 4-3: FOX-C – Ekalugad Fjord – Visual Monitoring Checklist

Checklist Item	Feature Letter	Relative Location	Length (m)	Width (m)	Depth (m)	Extent	Description (Change)	Additional Comments	Photo Reference
Erosion	A	20m northwest of the NHWLs southeast corner	10	0.2	0.02	<1%	Minor erosion channel	Measurements of worst case	51
Settlement	B	40 m northwest of the NHWLs southeast corner	0.25	0.3	0.1	<1%	Small pothole, may be result of erosion and not settlement	Measurements of worst case	52
Erosion	C	Northeast of NHWL running down and to the southeast of MW-East B	72	3	0.1	<1%	Minor erosion channel developing starting at the southeast corner of the NHWL, running north towards MW-East B.	Measurements of width are worst case and measurements of depth are average	53-57
Erosion/seepage	D	6 m northeast of the toe of NHWL at edge of access road	16	0.6	0.2	<1%	Channel carved into the edge of the road. May be caused by either erosion or potential seepage point.	Measurements of worst case. No staining or evidence of landfill seepage was observed.	58
Erosion	E	Center of northeast berm	13	0.3	0.02	<1%	Minor erosion channel	Measurements of worst case	59
Erosion	F	20 m southeast of northeast corner of NHWL	12	0.35	0.02	<1%	Minor erosion channel	Measurements of worst case	50 and 60
Erosion	G	8 m southeast of northeast corner of NHWL	13	0.2	0.01	<1%	Minor erosion channel	Measurements of worst case	61
Settlement/Erosion	H	North corner of the NHWL, just beyond the berm	389 m^2			<1%	Area of settlement and erosion. Appears to contain ponded water during rain and melt events	Does not affect the landfill integrity at this point	62-65
Settlement/Erosion	I	46 m southwest of the northeast corner of the NHWL	0.3	0.2	0.1	<1%	Small pothole, may be result of erosion and not settlement		66
Erosion	J	At toe of northwest corner of the NHWL	45	2	0.1	<1%	Erosion channel at the base of the NHWL	Does not affect the landfill integrity at this point	67 and 68
Erosion	K	2 m north of MW-northwest	12	0.3	0.1	<1%	Erosion channel	Measurements of worst case	69 and 70
Erosion	L	14 m southeast of northwest corner of NHWL	15.8 m^2			<1%	Exposed cobbles at top of berm		71
Erosion	M	14 m southeast of northwest corner of NHWL	18	0.05	0.05	<1%	Two minor erosion channels stemming from feature L	Measurements of worst case	72
			10	0.05	0.05	<1%			
Erosion	N	18 m southeast of northwest corner of NHWL	10	0.05	0.05	<1%	Three grouped minor erosion channel	Measurements of worst case	73 and 44
		20 m southeast of northwest corner of NHWL	11	0.1	0.05	<1%			
		21 m southeast of northwest corner of NHWL	22	0.25	0.1	<1%			

Checklist Item	Feature Letter	Relative Location	Length (m)	Width (m)	Depth (m)	Extent	Description (Change)	Additional Comments	Photo Reference
Erosion	O	11 m northwest of southwest corner of NHWL	10	0.05	0.03	<1%	Four grouped minor erosion channels	Measurements of worst case. Measurement of location to center of erosion channel grouping	74 and 46
			11	0.25	0.05	<1%			
			18	0.5	0.05	<1%			
			12	0.15	0.05	<1%			
Erosion	P	5 m northwest of southwest corner of NHWL	14	0.35	0.05	<1%	Minor erosion channel	Measurements of worst case	75
Erosion	Q	19 m east of southwest corner of NHWL	22.1 m^2			<1%	Exposed cobbles at top of berm		76
			7	0.05	0.02	<1%	Western minor erosion channel stemming from exposed cobbles	Measurements of worst case	
			8	0.05	0.01	<1%	Eastern minor erosion channel stemming from exposed cobbles	Measurements of worst case	
Settlement/Erosion	R	30 m east of southwest corner of NHWL	0.3	0.35	0.15	<1%	Small pothole, may be result of erosion and not settlement		77
Erosion	S	35 m east of southwest corner of NHWL	30.2 m^2			<1%	Exposed cobbles at top of berm		78
Settlement/Erosion	T	50 m east of southwest corner of NHWL	0.2	0.2	0.1	<1%	Small depression area, pothole		79

5.0 SURROUNDING AREAS

Due to time constraint caused by rapidly deteriorating weather conditions (fog and cloud cover), in addition to general difficulty in accessing the site, it was decided by both FRANZ personnel and the on-site AANDC representative that the outlying areas on site would not be observed during the 2011 monitoring event. This omission should be noted and redoubled efforts to monitor these areas should be undertaken in future monitoring events.

Lake Area

To the southwest of the NHWL (Lower Site Landfill Area) lies the Lake Area, in which are found Borrow Areas 5 and 6 as well as the in-situ treatment area. This area was not observed during the 2011 field program due to time and weather constraints.

Beach Area

To the north of the NHWL lies the Beach Area, containing Borrow Area 4, the former camp and the decommissioned sewage lagoon. This area was not observed during the 2011 field program due to time and weather constraints.

Mid- and Upper Station Areas

The Upper Station Area is located on the nearest peak to the east of the NHWL, at over 700 masl. The Mid Station Area is slightly to east of this, roughly 100 m lower than the Upper Station. This area was not observed during the 2011 field program due to time and weather constraints.

Access Road

The recently constructed and decommissioned road, used to access the Upper Station area from the Beach area, was not observed during the 2011 field program due to time and weather constraints.

6.0 NATURAL ENVIRONMENT

Information regarding the natural environment was gathered directly, through observation, and indirectly, through consultation with knowledgeable local persons in order to better understand the presence and temporal change of wildlife. The FOX-C Long-Term Monitoring Plan recommends monitoring the following parameters:

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

Wildlife and Human Activity

According to Harry Alookie from the Qikiqtarjuaq Hunters and Trappers Association the area around FOX-C is used during the winter and summer for harvesting narwhal, char, caribou, and goose. Hunting for Polar Bear occurs during October to March and can occur in the area around FOX-C. Wolves are rare and it has been around eight years since the last sighting. Beluga whales are also rare in the FOX-C area. There has been an increase in Killer Whale sightings in the past couple of years with pods numbering 100 to 150 whales observed.

During the site visit, the FRANZ field assessors observed evidence (e.g. scat, tracks or visual observation) that Canada geese, polar bears and ducks are present on the site.

Re-establishment of Vegetation

Based on the regional setting of this site, reestablishment of vegetation is likely to take a significant amount of time. No growth was observed on any of the regraded areas.

7.0 LIMITATIONS

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

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

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

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

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

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

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

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

8.0 REFERENCES

Franz Environmental Inc., March 27, 2009. *Long Term Monitoring, 2009 FOX-C, Ekalugad Fjord, Nunavut.*

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

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

UMA Engineering Ltd. April, 2009. FOX-C Intermediate DEW Line Site, Ekalugad Fjord, Site Restoration.

9.0 CLOSURE

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

Yours truly,

Franz Environmental Inc.

Ryan Fletcher, C.Tech., EP
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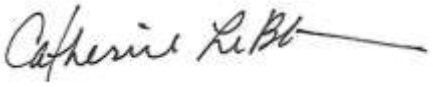

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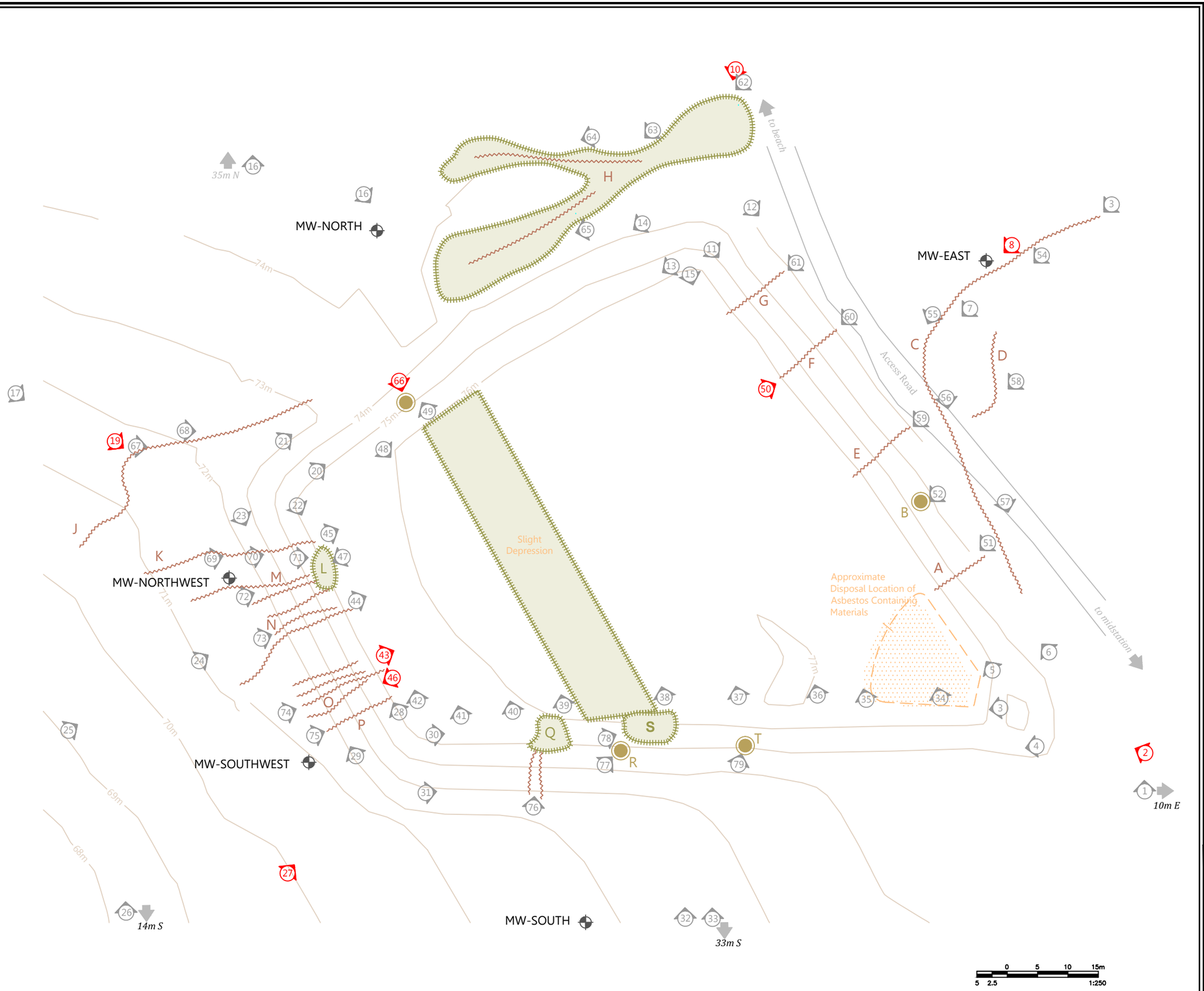
APPENDIX A

Figures



Legend

- MW — Monitoring Well Locations
- 25 — Picture Viewpoint Number
- 8 — Viewpoint Photograph Included in Appendix B
- A — Settlement or Depression
- Pothole
- Erosion
- A — Feature Reference Letter

Note:
Picture numbers refer to photograph names as they appear on the attached cd-rom.

Title: Non-Hazardous Waste Landfill

FRANZ ENVIRONMENTAL INC.
CONSULTING ENGINEERING TECHNOLOGIES

Project: FOX-C Ekalugad Fiord 1697-1101

Date: January 2012

Client: Aboriginal Affairs and Northern Development Canada

Scale as shown

Figure A-1

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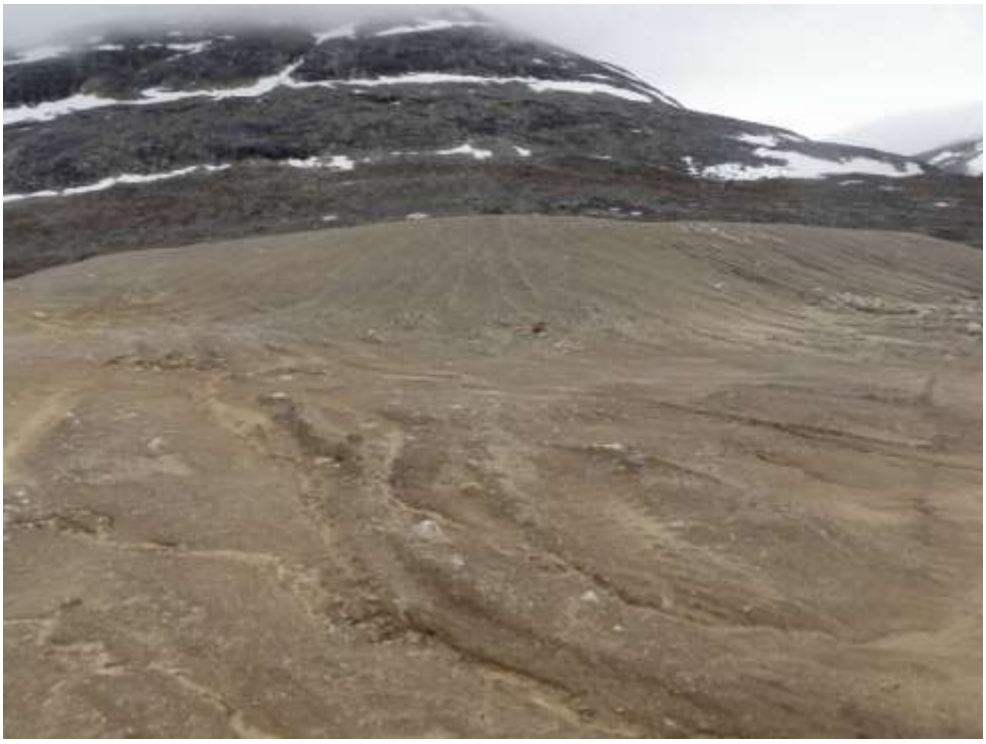
APPENDIX B

Site Photographs

East corner of the NHWL. Viewpoint 2 (Figure A-1; Appendix A). Photograph reference 2 (CD-ROM). Direction photo taken: NW

North corner of the NHWL. Note the damp depression area. Viewpoint 10 (Figure A-1; Appendix A). Photograph reference 10 (CD-ROM). Direction photo taken: SW



West corner of the NHWL. Note the erosion channel at the toe of the NHWL. Viewpoint 19 (Figure A-1; Appendix A). Photograph reference 19 (CD-ROM). Direction photo taken: SE

South corner of the NHWL. Viewpoint 27 (Figure A-1; Appendix A). Photograph reference 27 (CD-ROM). Direction photo taken: NW

Southwest edge of the landfill. Monitoring well MW-Southeast is at the toe of NHWL. Note the erosion channels. Viewpoint 46 (Figure A-1; Appendix A). Photograph reference 10 (CD-ROM). Direction photo taken: SW

Top of the landfill. Viewpoint 43 (Figure A-1; Appendix A). Photograph reference 43 (CD-ROM). Direction photo taken: NW

Erosion Channel of the northeast toe of NHWL. Viewpoint 8 (Figure A-1; Appendix A). Photograph reference 8. Direction photo taken: NW

Northeast side of NHWL. Note the erosion channels. Viewpoint 50 (Figure A-1; Appendix A). Photograph reference 50 (CD-ROM). Direction photo taken: NE

Pothole along northwest side of the NHWL. Viewpoint 66. Photograph reference 66 (CD-ROM). Direction photo taken: S

Inside casing of MW-South. Note the bentonite uprising. Viewpoint N/A. Photograph reference 80 (CD-ROM). Direction photo taken: N/A

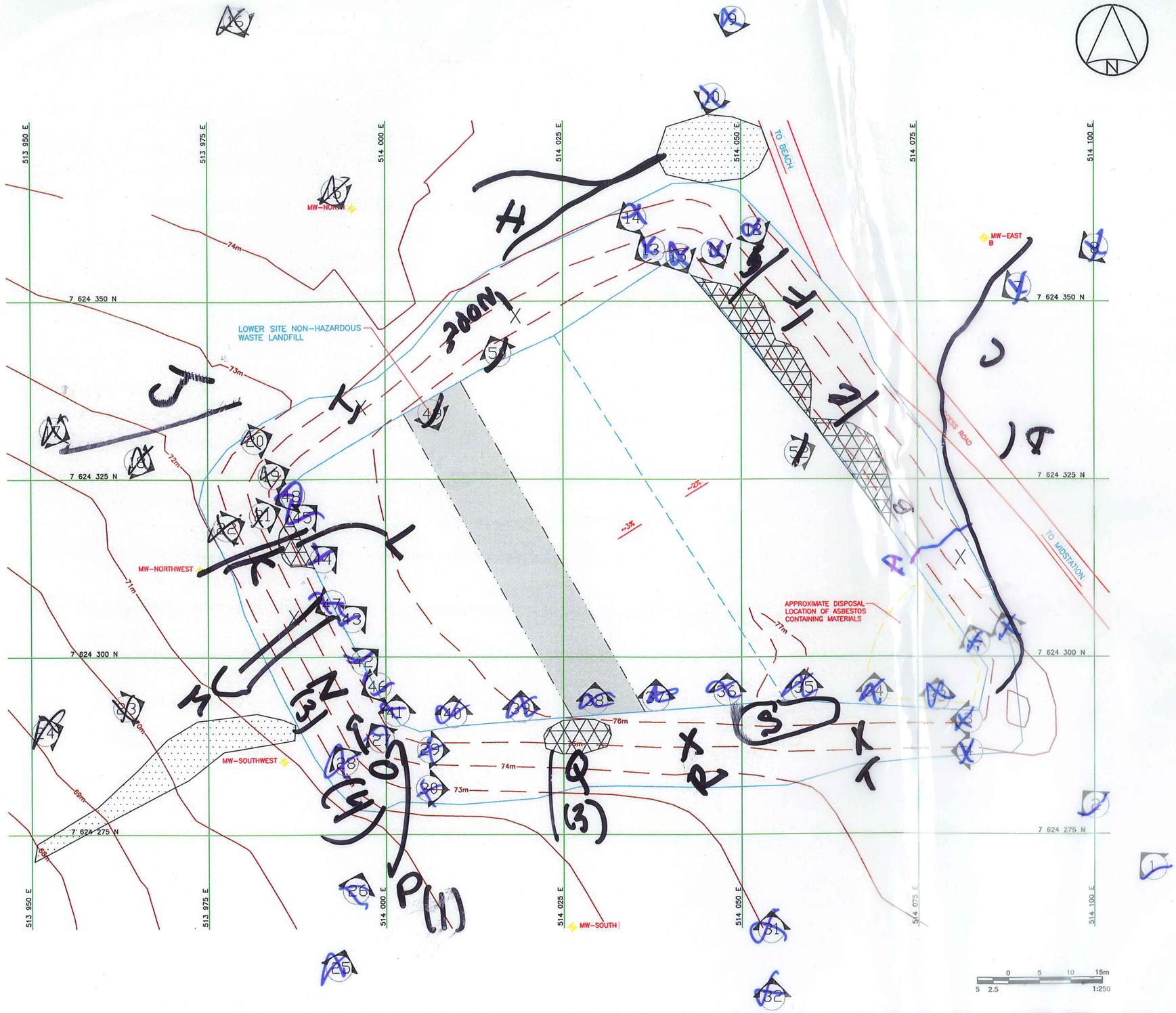
Polar Bear Track. Size 10 boot print as reference. Viewpoint N/A. Photograph reference 81 (CD-ROM). Direction photo taken: N/A

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

Viewpoint #	Picture #	Viewpoint #	Picture #	Viewpoint #	Picture #
1	1	28	28	55	55
2	**2**	29	29	56	56
3	3	30	30	57	57
4	4	31	31	58	58
5	5	32	32	59	59
6	6	33	33	60	60
7	7	34	34	61	61
8	**8**	35	35	62	62
9	9	36	36	63	63
10	**10**	37	37	64	64
11	11	38	38	65	65
12	12	39	39	**66**	**66**
13	13	40	40	67	67
14	14	41	41	68	68
15	15	42	42	69	69
16	16	**43**	**43**	70	70
17	17	44	44	71	71
18	18	45	45	72	72
19	**19**	**46**	**46**	73	73
20	20	47	47	74	74
21	21	48	48	75	75
22	22	49	49	76	76
23	23	**50**	**50**	77	77
24	24	51	51	78	78
25	25	52	52	79	79
26	26	53	53	**N/A**	**80**
27	**27**	54	54	**N/A**	**81**

APPENDIX C

Field Notes



LEGEND

- PICTURE NUMBER VIEWPOINT
- EXPOSED RIPRAP
- SETTLEMENT
- AREA OF DEPRESSION
- X POTHOLE

Viewpoint #	Picture #	Viewpoint #.	Picture #
1	P8270412	28	P8270440
2	P8270413	29	P8270441
3	P8270414	30	P8270442
4	P8270415	31	P8270443
5	P8270416	32	P8270444
6	P8270417	33	P8270445
7	P8270418	34	P8270446
8	P8270419	35	P8270447
9	P8270420	36	P8270448
10	P8270421	37	P8270449
11	P8270422	38	P8270450
12	P8270423	39	P8270451
13	P8270424	40	P8270452
14	P8270425	41	P8270453
15	P8270427	42	P8270454
16	P8270428	43	P8270455
17	P8270429	44	P8270456
18	P8270430	45	P8270457
19	P8270431	46	P8270458
20	P8270432	47	P8270459
21	P8270433	48	P8270460
22	P8270434	49	P8270461
23	P8270435	50	P8270462
24	P8270436	51	P8270463
25	P8270437	52	P8270464
26	P8270438	53	P8270465
27	P8270439		

NOTE:
PICTURE NUMBERS REFER TO PHOTOGRAPH NAMES AS THEY APPEAR ON THE ATTACHED CD-ROM.

Title: NON-HAZARDOUS WASTE LANDFILL

FRANZ ENVIRONMENTAL INC.
CONSULTING ♦ ENGINEERING ♦ TECHNOLOGIES

Project: FOX-C EKALUGAD FIORD 1697-0902

Date: NOVEMBER 2009

Client: INDIAN AND NORTHERN AFFAIRS CANADA

SCALE AS SHOWN

FIGURE A-1

FOX-D/C July 28/11

Interview with Harry Alookie 13:45

3 Community Concern
-> Tanker Area -> Beach Tanks
-> Buried Barrels
-> Ice dumping

-> Whaling station & blubber
~~bar~~ barrels - Historical significance

-> graves 1800's -> very important
significance old whaler's graves
DSC_0714 (picture) - station
DSC_0780 (graves)

=> new graves -> reunion ~6 yrs
ago & people who used to
live there. -> leaching concern

Hunting -> 2 general areas
Winter

Kivitoo -> each weekend Hunters
Fox-C -> 6 to 8 Caribou in
general area

LEVEL

SUMMER

Kivalliq → each weekend
Houses in area Hunting
- Seals
- Small game, goose's
goose eggs
Fish Lakes as well
(Land locked - Chars)

FOX-C
→ 6 to 8 - Further north
on mainland (winter?
summer)
→ 20 in July for 1 week
for camping
↳ Narwhale
→ Char
- Charbo
- Goose
-

→ Polar Bear opens in
Oct to March
↳ 230 to be harvested

-Wolves are rare
-Last 8 years have been
sightings
wolverines
Foxes are around
Used for parka trimmings.

-Birds migrate North @ this
- Ducks (eider) time of year
- Murs
- Arctic tern
↳ harvested for
elders

Beluga are rare
or further north this time of year in town
around Fox-C

Bowhead
↳ no tag this year
It full of harbour
this time year.
↳ more now

Killer whales
- 100 - 150 /pod
- in Oct - Nov
- ↑ in sightings

- Hunting mostly on shoreline

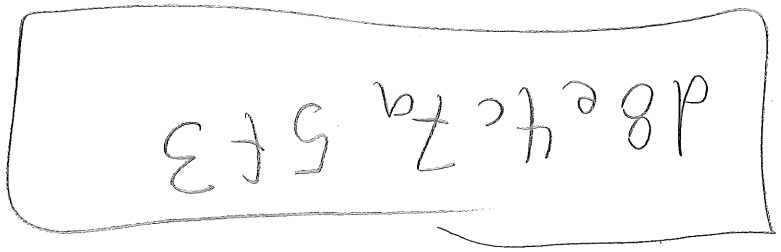
- Elders live mostly on hunting
  - only takes what they need

Monitoring Well Sampling Record

Site Name:	FOXC		
Date of Sampling Event:	July 27/11	Time:	16:06
Names of Samplers:	CL/CC		
Landfill Name:			
Monitoring Well ID:	MW-Northwest		
Sample Number:			
Condition of Well:			
Measured Data			
Well pipe height above ground (cm)=	46		
Diameter of well (cm)=	5		
Depth of well installation (cm)= (from ground surface)	350		
Length screened section (cm)=	200		
Depth to top of screen (cm)= (from ground surface)	50		
Depth to water surface (cm)= (from top of pipe)	53.5	Measurement method: (meter, tape, etc)	
Static water level (cm)= (below ground surface)			
Measured well refusal depth (cm)= (i.e. depth to frozen ground)		Evidence of sludge or siltation:	
Thickness of water column (cm)=			
Static volume of water in well (mL)=			
Free product thickness (mm)=		Measurement method: (meter, paste, etc)	
Purging: (Y/N)		Purging/Sampling Equipment:	
Volume Purged Water=			
Decontamination required: (Y/N)			
Number washes:			
Number rinses:			
Final pH=			
Final Conductivity (uS/cm)=			
Final Temperature (degC)=			

FROZEN.

Lock had to be broken - replaced



Monitoring Well Sampling Record

Site Name:	FOX-C		
Date of Sampling Event:	July 27/11	Time:	15:40
Names of Samplers:	CL & CEL		
Landfill Name:	HW-Southwest		
Monitoring Well ID:			
Sample Number:			
Condition of Well:			
Measured Data			
Well pipe height above ground (cm)=	47 1/2		
Diameter of well (cm)=	5		
Depth of well installation (cm)= (from ground surface)	350		
Length screened section (cm)=	200		
Depth to top of screen (cm)= (from ground surface)	50		
Depth to water surface (cm)= (from top of pipe)	56	Measurement method: (meter, tape, etc)	
Static water level (cm)= (below ground surface)			
Measured well refusal depth (cm)= (i.e. depth to frozen ground)		Evidence of sludge or siltation:	
Thickness of water column (cm)=			
Static volume of water in well (mL)=			
Free product thickness (mm)=		Measurement method: (meter, paste, etc)	
Purging: (Y/N)		Purging/Sampling Equipment:	
Volume Purged Water=			
Decontamination required: (Y/N)			
Number washes:			
Number rinses:			
Final pH=			
Final Conductivity (uS/cm)=			
Final Temperature (degC)=			

FROZEN

-Replaced lock.

Monitoring Well Sampling Record

Site Name:	FOX C		
Date of Sampling Event:	July 27/11	Time:	15:30
Names of Samplers:	CL & CH		
Landfill Name:	NW-South		
Monitoring Well ID:			
Sample Number:	N/A		
Condition of Well:	GOOD		
Measured Data			
Well pipe height above ground (cm)=	55		
Diameter of well (cm)=	5		
Depth of well installation (cm)= (from ground surface)	350		
Length screened section (cm)=	200		
Depth to top of screen (cm)= (from ground surface)	50		
Depth to water surface (cm)= (from top of pipe)	58	Measurement method: (meter, tape, etc)	meter
Static water level (cm)= (below ground surface)	FROZEN		
Measured well refusal depth (cm)= (i.e. depth to frozen ground)	58	Evidence of sludge or siltation:	
Thickness of water column (cm)=			
Static volume of water in well (mL)=			
Free product thickness (mm)=		Measurement method: (meter, paste, etc)	
Purging: (Y/N)	N	Purging/Sampling Equipment:	
Volume Purged Water=			
Decontamination required: (Y/N)			
Number washes:			
Number rinses:			
Final pH=			
Final Conductivity (uS/cm)=			
Final Temperature (degC)=			

Monitoring Well Sampling Record

Site Name:	FDK-C		
Date of Sampling Event:	1/4/27	Time:	15:53
Names of Samplers:	CL/CEL		
Landfill Name:			
Monitoring Well ID:	MW-EAST		
Sample Number:			
Condition of Well:	Damp @ bottom of well (casing), erosion @ bottom		
Measured Data			
Well pipe height above ground (cm)=	69.5		
Diameter of well (cm)=	5		
Depth of well installation (cm)= (from ground surface)	350		
Length screened section (cm)=	200		
Depth to top of screen (cm)= (from ground surface)	50		
Depth to water surface (cm)= (from top of pipe)	660	Measurement method: (meter, tape, etc)	
Static water level (cm)= (below ground surface)			
Measured well refusal depth (cm)= (i.e. depth to frozen ground)		Evidence of sludge or siltation:	
Thickness of water column (cm)=			
Static volume of water in well (mL)=			
Free product thickness (mm)=		Measurement method: (meter, paste, etc)	
Purging: (Y/N)		Purging/Sampling Equipment:	
Volume Purged Water=			
Decontamination required: (Y/N)			
Number washes:			
Number rinses:			
Final pH=			
Final Conductivity (uS/cm)=			
Final Temperature (degC)=			

FROZEN

Hinge broken

Monitoring Well Sampling Record

Site Name:	Fox C		
Date of Sampling Event:	July 27/11	Time:	1545
Names of Samplers:	J		
Landfill Name:			
Monitoring Well ID:	MW-NORTH		
Sample Number:			
Condition of Well:	GOOD		
Measured Data			
Well pipe height above ground (cm)=	58		
Diameter of well (cm)=	5		
Depth of well installation (cm)= (from ground surface)	350		
Length screened section (cm)=	200		
Depth to top of screen (cm)= (from ground surface)	50		
Depth to water surface (cm)= (from top of pipe)	415	Measurement method: (meter, tape, etc)	
Static water level (cm)= (below ground surface)			
Measured well refusal depth (cm)= (i.e. depth to frozen ground)		Evidence of sludge or siltation:	
Thickness of water column (cm)=			
Static volume of water in well (mL)=			
Free product thickness (mm)=		Measurement method: (meter, paste, etc)	
Purging: (Y/N)		Purging/Sampling Equipment:	
Volume Purged Water=			
Decontamination required: (Y/N)			
Number washes:			
Number rinses:			
Final pH=			
Final Conductivity (uS/cm)=			
Final Temperature (degC)=			

FROZEN