UMA | AECOM

DEW Line Clean-up Project

FOX-5 Broughton Island

Baseline Landfill Monitoring

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1.1 Introduction

The FOX-5 Broughton Island DEW Line site is located on the southeastern edge of Broughton Island. Broughton Island is a small island off the east coast of the Cumberland Peninsula of Baffin Island. The FOX-5 site is located at 67° 33' north latitude and 63° 49' west longitude. The site is located approximately 9 km east of the community of Qikiqtarjuaq (formerly Broughton Island) and sits on a high point about 2 km inland of Davis Strait. The main site is approximately 550 m above sea level and is accessed by an all-season road; however, the road has not been maintained since the completion of the site clean-up. The former airstrip for the site operations is located by the coast, adjacent to the community, and there is commercial airline access to the community. A maintained helipad is present at the upper site in the vicinity of the North Warning System (NWS) Short Range Radar Site (SRR).

FOX-5 was originally an auxiliary station within the original DEW Line system that was decommissioned in 1991. A remotely operated NWS SRR Station has been constructed in its vicinity. The environmental clean-up and demolition of facilities not required for the operation of the SRR site commenced in 2001 and was completed during the summer of 2006. The clean-up included the closure and remediation of two existing landfills as well as the construction of two landfills for the disposal of non-hazardous wastes generated from demolition, and collection of site debris, one of which was also constructed to contain Tier II soils in a separate cell. These landfills, as shown on the overall site plan, Figure FOX-5.1, include:

- Airstrip Landfill: completely excavated, therefore no monitoring is required (not shown);
- Station Non-Hazardous Waste Landfill (new);
- Main Landfill; and
- Middle Site Tier II Soil Disposal Facility/Non-Hazardous Waste Landfill (new).

Assessment of the FOX-5 site was carried out in 1990, 1998, 2000, and 2001. The engineering component of the assessment was completed by UMA Engineering Ltd. (UMA) and the environmental component by the Environmental Sciences Group (ESG). Input on traditional land use was provided by Nunavut Tunngavik Incorporated (NTI). Design requirements for landfill closure were based upon the geophysical and geotechnical investigations performed by UMA and EBA Engineering Consultants Ltd. (EBA), and the environmental data provided by ESG.

In accordance with the NTI-DND Cooperation Agreement, landfill monitoring will be carried out following clean-up of the site. The monitoring schedule for the FOX-5 Broughton Island site is provided in Table 1.1. Shaded rows indicate the monitoring events conducted internally by the DEW Line Clean-up project team.

This report has been prepared as a summary of the baseline monitoring carried out at FOX-5 Broughton Island. Soil and groundwater sampling was done by ESG, with analytical work performed by the Analytical Services Unit at Queen's University and the Royal Military College laboratories in Kingston, Ontario. The final construction inspection of the landfills was carried out by EBA and UMA.

The following sections provide an overview of the site biophysical environment and traditional land use activities, site background conditions, the general monitoring program, and provide the basis for evaluation of monitoring results.

Table 1.1: Monitoring Schedule - FOX-5 Broughton Island

No. of Years After Construction	Monitoring Event Number	Year
Prior to and during	Baseline	1998, 2000, 2001, 2004, 2005 & 2006
1	1	2007
2	2	2008
3	3	2009
4	4	2010
5	5	2011

1.2 Background

1.2.1 Geology and Background Geochemical Conditions

The terrain at FOX-5 consists of marine sediments at the coastal regions, with glacial till deposits in broad U-shaped valleys found in the island interior and boulder covered uplands near the station. The boulder covered uplands are partly bound by sheer cliff walls along the west coast. There are prominent periglacial and frost features shown by extensive patterned ground within the valley, till sheets and frost, shattered bedrock. Slopes of the site are variable ranging from very steep where bedrock is at or near the surface to gentle and subdued where terrain is comprised of glacial till.

The surface materials make up five categories including: till, felsenmeer/bedrock or weathered bedrock, fluvial, colluvial, and raised marine. Weathered bedrock, till and raised marine deposits make up the largest part of the landscape. Boulders from the underlying bedrock cover the uplands area around the station. Silty sand matrix is found between the boulders. The boulders are generally 0.3 to 1.0 m in size, but some are larger than 2.0 m.

Drainage flows radially downslope from the station area, parallel to the slope of the steep terrain and standing water is present in many areas of the valley. In the station vicinity, drainage commonly occurs in rills below the boulder surface cover. The Main Landfill is located within a saddle shaped depression that is drained by several small streams that, historically, converged into a single drainage course at the downslope toe of the landfill.

Background soil samples were collected during early site investigations in locations removed from site activities within the appropriate terrain units (i.e. the same terrain units where site activity was present) to establish background geochemical conditions in areas investigated at the site. Sample results are presented in Table 1.2. No occurrences of naturally elevated inorganic element concentrations were identified.

1.2.2 Biophysical Environment

At the FOX-5 Upper Site, vegetation is sparser than what is generally found in the overall area. Any areas that have been disturbed within the Station Area are almost totally void of vegetation. Where boulder cover is present, vegetation mostly consists of lichens and mosses, with approximately 5% vegetative cover. Where there is an absence of boulders and less severe climate (i.e. in valleys or the middle and lower sites) vegetation is more abundant, up to 15%.

Annual precipitation is in the order of 287.7 mm, with approximately 37.7 mm as rain and 250.0 mm as snow. May to June and September to November are the wettest times of the year. Prevailing winds are from the northwest and average 8.9 km/hr annually. Climate normal from 1971-2000 for the site, collected from an Environment Canada weather station located at the station, are provided in Table 1.3.

Broughton Island is located within an area of polar bear denning and wintering areas, and polar bear occurrences in the coastal areas are common. Barren-ground caribou of the South-Baffin herd are found in this region of Baffin Island, though observances of caribou on the island are rare. Other terrestrial fauna that may be present in the area include foxes, hare, and lemmings.

The eastern coast of Baffin Island is an important migratory route for seals and whales. Beluga whales are found throughout the arctic and subarctic regions. Out of five separate beluga populations, one is in the Cumberland Sound region, south of Broughton Island. From July to late August belugas frequent coastal areas and they overwinter along the edge of the pack ice in the Davis Strait and along west Greenland. Bowhead whales occur in the Davis Strait, Baffin Bay, and Cumberland Sound regions. The World Wildlife Fund has identified Isabella Bay, approximately 200 km north of the site, as a major summering area for most of the endangered eastern Arctic population of bowhead whales. Narwhal are found primarily in the eastern Arctic and during the summer periods they migrate north to Lancaster Sound and Baffin Bay. The killer whale can be found in the Davis Strait and Lancaster Sound in the late summer. Walrus are found from northern Labrador to Ellesmere Island and are thought to overwinter along the edge of the fast ice and in the pack ice off southeastern Baffin Island. The ringed seal, harbour seal, bearded seal, harp seal and hooded seal are all found in the eastern Arctic. The Davis Strait is one of three main whelping areas for hooded seals.

While no raptors were reported or observed during the site visit, snowy owls, peregrine falcons, gyrfalcon, and rough legged hawk are known to occur in this area.

The largest colony of northern fulmar is located 50 km south of the station at Cape Searle. There are more colonies to the north and the south of the site. Other species of seabirds that occur in Baffin Bay in the summer include the black-legged kittiwake, thick-billed mure and black guillemot. Four species of gull are found on Baffin Island including: glaucous gull, Thayer's gull, rare ivory gull and Sabine's gull.

Large populations of Arctic char occur in the area and are a significant food source for domestic and commercial use. A commercial clams fishery is also operated out of the Qikiqtarjuaq community.

1.2.3 Traditional Land Use

The community of Qikiqtarjuaq is located approximately 6 km by road from the Middle Site Area and 12 km by road from the Station Area. Because of the community proximity, the potential for human exposure to site impacts is considered relatively high; although, the duration of contact is considered low.

Hunting of terrestrial species is minimal at the site, but hunting of aquatic mammals and fishing is common.

A heritage site, possibly late Thule in affiliation was identified on the west side of Broughton Island southeast of the summit station. At this location three tent rings, three caches, three shelters, a grave marker, a hearth and possibly two sets of kayak rests were found. No archaeological features were identified in proximity to the station operations.

Table 1.2: FOX-5 Broughton Island - Summary of Site Background Soil Analytical Data

Sample #	Date	Copper [mg/kg]	Nickel [mg/kg]	Cobalt [mg/kg]	Cadmium [mg/kg]	Lead [mg/kg]	Zinc [mg/kg]	Chromium [mg/kg]	Arsenic [mg/kg]	Mercury [mg/kg]	PCBs [mg/kg]	TPH [mg/kg]
F5-016	1990		7.0		<1	12		20	1.5	<0.05	<0.01	<5
F5-048	1990		13.0		<1	<10		33	4.9	<0.05	<0.01	<5
G1008	1990	22.0	<5.0	<5.0	<1.0	<10	37	<20	1.0	<0.5		
G1009	1990	6.2	<5.0	<5.0	<1.0	<10	47	<20	1.6	<0.5		
G1028	1990	<3.0	<5.0	<5.0	<1.0	<10	34	22	1.2	<0.5		
G1029	1990	16.6	8.9	9.8	<1.0	<10	71	28	1.5	<0.5		
G1030	1990	5.9	<5.0	<5.0	<1.0	<10	42	<20	1.4	<0.5		
N Value		5	7	5	7	7	5	7	7	7	2	2
Average		12.7	5.6	4.0	<1.0	6.0	46.2	25.8	1.9		<0.01	<5
Standard Deviation		8.0	4.2	3.3		2.6	14.7	5.9	1.4			
Minimum		5.9	2.5	2.5		5.0	34.0	20.0	1.0	<0.05		
Maximum		22.0	13.0	9.8		12.0	71.0	33.0	4.9	<0.5		
95% Confidence Limit		7.0	3.1	2.9		2.0	12.9	4.4	1.0			

Table 1.3: Climate Normals for the FOX-5 Broughton Island Site

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Precipitation													
Mean Rainfall	0.0	0.0	0.0	0.0	0.4	3.4	16.3	15.9	2.9	0.3	0.0	0.0	39.2
Mean Snowfall	6.8	6.8	5.7	16	31.4	15.2	10.5	10.2	30	45.8	37.1	7.3	223
Precipitation (mm)	6.8	6.8	5.7	16	31.8	18.6	26.8	26.1	32.9	46.1	37.1	7.3	262
#. days w/ rain ≥0.2 mm	0.0	0.0	0.0	0.0	0.05	0.95	5.5	5.6	0.84	0.21	0.0	0.0	13.2
#. days w/ snow ≥0.2 mm	4	3.5	3.2	6.2	9.1	4.9	2.9	3.5	8.6	13.6	9.5	4.3	73.3
Temperature													
Mean Daily Max.	-21.9	-22.8	-20.2	-13.8	-5.3	2.4	7.3	5.9	-0.4	-5.9	-13.2	-19.4	-8.9
Mean Daily Min.	-27.7	-28.8	-26.7	-20.8	-11.4	-3.1	1.4	0.4	-4.5	-10.4	-18.3	-25.1	-14.6
Daily Mean	-24.8	-25.8	-23.5	-17.3	-8.4	-0.4	4.4	3.1	-2.5	-8.1	-15.8	-22.3	-11.8
Extreme Max.	3.9	1.1	4	7.8	11.1	17.8	18.3	18.9	14.4	10.6	7.5	5	
Extreme Min.	-41.7	-42.8	-40.7	-34.3	-26.1	-12.2	-8.9	-7.8	-13.9	-24.4	-33.3	-39.2	
Degree Days													
Above 18°C*	0	0	0	0	0	0	0	0	0	0	0	0	0
Below 18°C*	1301.9	1219.3	1295.9	1048.6	813.4	567.2	422.6	463	612.5	808.5	998.4	1231.2	10782
Above 5°C*	0	0	0	0	0	4.5	38.5	24.1	2.2	0	0	0	69
Below 0°C*	743.9	711.2	737.9	508.7	257.2	60.3	6.3	11.2	91.4	251.1	458.4	673.2	4511
Month-end Snow Cover (cm)	79	78	74	71	58	13	3	2	20	56	86	83	

*climate normals were obtained from 1961-1990 for Broughton Island from Environment Canada

1.3 Landfill Monitoring Program

The general components of the landfill monitoring program at FOX-5 include:

- Visual inspection;
- Surface and shallow depth soil sampling and analysis;
- Groundwater sampling and analysis;
- Ground temperature monitoring; and
- Pore pressure monitoring.

The requirements for landfill monitoring, as laid out in Environmental Provisions of the NTI-DND Agreement, are summarized in Table 1.4. Detailed landfill monitoring requirements are described in the Landfill Monitoring Plan - Part B - Nunavut Settlement Region.

Table 1.4: General Landfill Monitoring Requirements

Landfill Classification	Visual Inspection	Groundwater Sampling	Soil Sampling	Thermal Monitoring	Pore Pressure Monitoring*
Existing Landfills, High Potential Environmental Risk (Class A)	no monitoring as landfill is excavated				
Existing Landfills, Moderate Potential Environmental Risk (Class B)	√	√	√	√	√*
Existing Landfill, Low Potential Environmental Risk (Class C)	√		√		
New Landfill, Non-Hazardous Waste Landfill	√	√	√		
New Landfill, DCC Tier II Disposal Facility	√	√	√	√	

*Note: Pore pressure monitoring is only required over the short term at select landfills located on slopes where slope stability is a concern until landfill freezeback is demonstrated through thermal monitoring.

A summary of monitoring requirements, as related to the specific landfills at FOX-5, is provided in Table 1.5. The rationale for the monitoring requirements is provided in the landfill-specific sections.

Table 1.5: FOX-5 Broughton Island Landfill Monitoring Requirements

Landfill Classification	Visual Inspection	Groundwater Sampling	Soil Sampling	Thermal Monitoring	Pore Pressure Monitoring*
Station Area Non-Hazardous Waste Landfill	√	√	√		
Main Landfill	√		√	√	√
Middle Site Tier II Disposal Facility/Non-Hazardous Waste Landfill	√	√	√		

1.3.1 Visual Inspection

The physical condition of each landfill is inspected in accordance with the Visual Inspection Checklist provided in the Environmental Provisions of the NTI-DND Agreement. Documented observations include evidence of settlement, ponding, frost action, erosion, and lateral movement, as well as sloughing of berms, and thermal contraction cracks. Documentation of observations is supported using hand drawn sketches, as applicable. Photographic Records are provided to document the general condition of the landfill and to substantiate all recorded observations.

Each feature observed in the visual inspection checklist is given a severity reading, based on the extent to which it is observed, and its impact on landfill performance, with an overall landfill performance rating provided encompassing the impact of all features observed. The classification criteria for this evaluation are outlined in the landfill monitoring contract Terms of Reference (TOR).

1.3.2 Soil Sampling

Background (naturally occurring) conditions refer to native soil geochemistry and represent soil quality from an area not impacted by site activities. Soil sampling to establish general site background conditions was conducted in 1990. Results are reported in Table 1.2 above.

Baseline conditions refer to existing soil chemistry at the landfill area prior to and during remediation. The baseline landfill monitoring program consists of two phases: samples collected as part of the landfill assessment program which determined whether the landfill posed a potential environmental risk, and samples collected during the construction/closure of the landfill. The results of subsequent landfill monitoring events are compared to baseline and background values to evaluate any potential changes in environmental conditions.

As part of the baseline sampling program, soil samples are collected in areas up-gradient and down-gradient of each landfill. Up-gradient samples are targeted to areas near the landfill, and especially to those locations influenced by migration of up-gradient contaminants through the landfill. Up-gradient samples are meant to be representative of contaminant input conditions to the landfill and serve as the primary basis upon which to compare the down-gradient contaminant concentrations.

Down-gradient soil samples are collected at surface/shallow depths from designated areas at the toe of each landfill and from areas of preferential drainage. These soil samples are collected and analyzed to document whether there has been migration of contaminants, either historically or recent, from the landfill area. Although contaminants are primarily transported in water (surface and groundwater), they have a tendency to sorb to soil particles the water is migrating through. The soil, thus, retains information regarding the historical input of contaminants.

Analytical results of soil samples collected down-gradient of landfills are compared to contaminant concentrations of samples collected up-gradient of landfills. Down-gradient samples are also compared to overall site background contaminant levels because they help in establishing a more broad level of contaminant concentrations that can be found at the site, particularly where different soil or rock types are present. Contaminant concentrations in down-gradient samples that are significantly higher than background or up-gradient concentrations, particularly where there have been changes over time; provide evidence of contaminants having migrated to and, possibly beyond, the soil sampling location. These data, in conjunction with other site-specific information, were used in the assessment of the environmental status of the landfill and the determination of an appropriate remediation solution.

Soil sampling locations are indicated on the site-specific landfill drawings included in the annexes to this report. Samples collected during baseline and subsequent landfill monitoring is analyzed for the following parameters:

- Inorganic elements: arsenic, cadmium, chromium, cobalt, copper, lead, nickel, and zinc.
- Mercury.
- PCBs (polychlorinated biphenyls - total Aroclor).
- TPH (Total Petroleum Hydrocarbons) - as represented by the sum of F1 (nC_6 to nC_{10}), F2 (nC_{10} to nC_{16}.), and F3 (nC_{16} to nC_{34}.), as defined by the CCME Tier I Method - Rev. 5, Analysis of Total Petroleum Hydrocarbons in soil.

The Method Detection Limit (MDL) for each parameter is specified in Table 1.8.

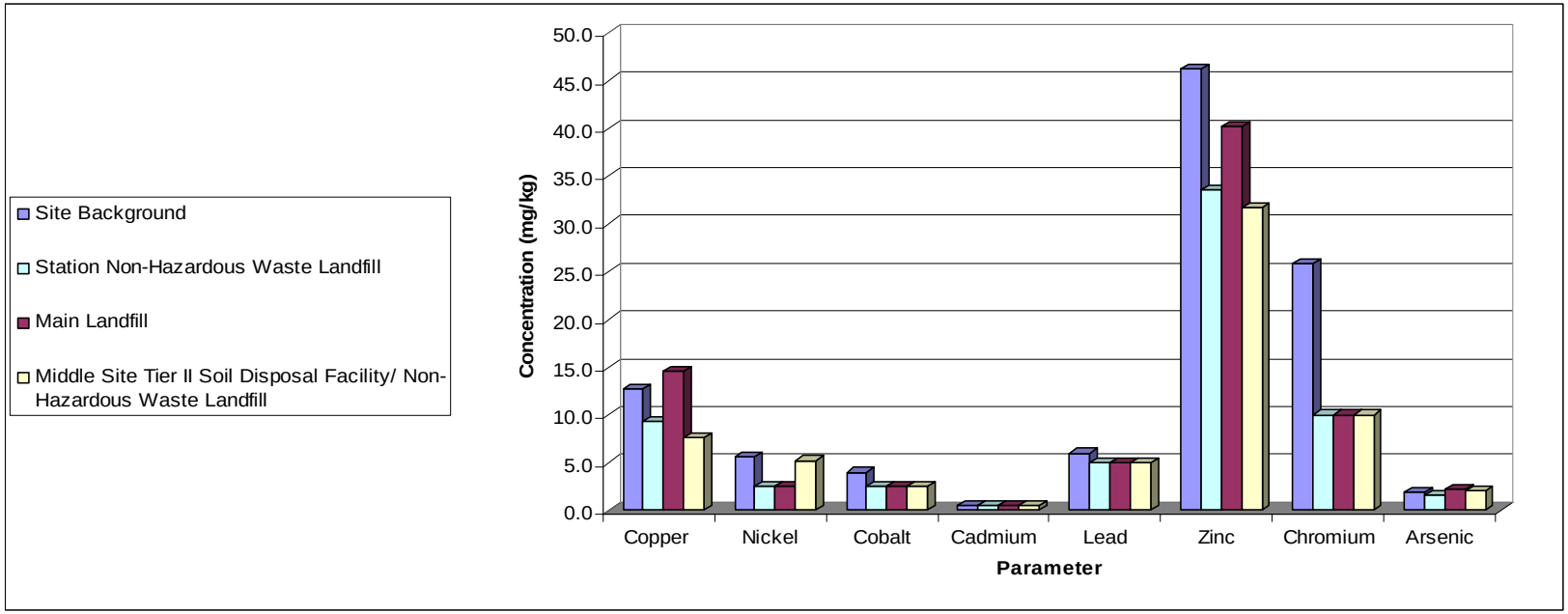
The requirement for the analysis of baseline samples is to provide record information on the environmental status of the landfill should potential problems is identified during the monitoring program. Analytical results are presented under the discussion for each landfill.

To provide a basis for evaluation with subsequent monitoring analytical results, simple statistical analyses were carried out to determine the arithmetic mean, standard deviation, and 95% confidence interval for each inorganic parameter analyzed. In general, for samples in which the concentration was less than the Method Detection Limit (MDL), one-half of the MDL was used in the statistical analyses. However, in cases where the majority of the analytical results fell below the MDL, the arithmetic mean is represented as less than the MDL. It should be noted that MDLs for analyses completed under previous years' landfill assessment programs may not be the same as those specified Table 1.8, particularly for PCBs. In cases where the contaminant was not detected, the chemical baseline is typically represented as a range over the different MDLs. Summaries of the arithmetic mean of the concentration of inorganic elements in soil are presented in Table 1.6. Additional statistical data is presented under the discussion for each landfill.

Table 1.6: FOX-5 Broughton Island - Summary of Arithmetic Mean - Soil Baseline Data

Area	Arithmetic Mean (in mg/kg)								Range
	Copper	Nickel	Cobalt	Cadmium	Lead	Zinc	Chromium	Arsenic	PCBs
Site Background	12.7	5.6	4.0	<1.0	6.0	46.2	25.8	1.9	<0.01
Station Non-Hazardous Waste Landfill	9.3	<5.0	<5.0	<1.0	<10	33.6	<20	1.8	<0.0030 to 0.041
Main Landfill	14.6	<5.0	<5.0	<1.0	<10	40.2	<20	2.2	<0.0030 to <0.1
Middle Site Tier II Soil Disposal Facility/Non-Hazardous Waste Landfill	7.6	5.2	<5.0	<1.0	<10	31.7	<20	2.1	<0.0030 to <0.1

Figure 1.1: FOX-5 Broughton Island - Summary of Arithmetic Mean - Soil Baseline Data



1.3.3 Groundwater Sampling

During the construction phase, groundwater monitoring wells are installed at all existing landfills classified as a moderate environmental risk (Class B landfills) and new landfills. At FOX-5, the Main Landfill was classified as Class B. Two new landfills were built during the construction phase: the Middle Site Tier II Soil Disposal Facility/Non-Hazardous Waste Landfill and the Station Non-Hazardous Waste Landfill to accommodate non-hazardous demolition waste and site debris. Groundwater monitoring wells were installed hydraulically up-gradient and down-gradient of the landfills as indicated in Table 1.5 and Table 1.9. Surface and shallow depth soil samples are also collected adjacent to monitoring well locations. Analytical data from water samples collected from wells up and down-gradient are reviewed in conjunction with soil analytical data to evaluate potential impacts associated with the landfill. Baseline groundwater data exists only from the site clean-up period; no samples were collected in the relevant areas during the site investigation. A summary of mean baseline concentrations of contaminants in groundwater is provided in Table 1.7.

For baseline and for future monitoring events, the following physical measurements are recorded prior to collection of groundwater samples from a monitoring well:

- Water elevation.
- Total water depth.
- Height of well stick-up.
- Depth to bottom of well.
- Presence of hydrocarbons.
- Hydrocarbon thickness (if appropriate).

Prior to sampling, monitoring wells are purged until groundwater parameters such as pH, temperature and conductivity stabilize. In the event of low recharge volumes, standing water may be sampled and specifically documented. Water samples are not filtered.

Following withdrawal of a water sample, other physical measurements recorded include:

- Colour, odour.
- pH; conductivity, and temperature.

Groundwater samples are analyzed for the following parameters:

- Inorganic elements (total concentrations): arsenic, cadmium, chromium, cobalt, copper, lead, nickel and zinc.
- Mercury.
- PCBs (polychlorinated biphenyls - total Aroclor).
- TPH (Total Petroleum Hydrocarbons) - C_6 to C_{32}.

Minimum Method Detection Limits are specified in Table 1.8. A summary of the landfill monitoring installations/sampling locations is provided in Table 1.9.

Table 1.7: FOX-5 Broughton Island - Summary of Arithmetic Mean - Groundwater Baseline Data

Area	Arithmetic Mean (in mg/L)							
	Copper	Nickel	Cobalt	Cadmium	Lead	Zinc	Chromium	Arsenic
Station Area Non-Hazardous Waste Landfill	0.036	0.075	0.010	<0.0010	<0.010	0.097	0.116	0.002
Main Landfill	0.062	0.053	0.015	<0.0010	<0.010	0.129	0.119	<0.0030
Middle Site Tier II Soil Disposal Facility/Non-Hazardous Waste Landfill	0.012	0.043	<0.0030	<0.0010	<0.010	0.063	0.084	<0.0030

Figure 1.2: FOX-5 Broughton Island - Summary of Arithmetic Mean - Groundwater Baseline Data

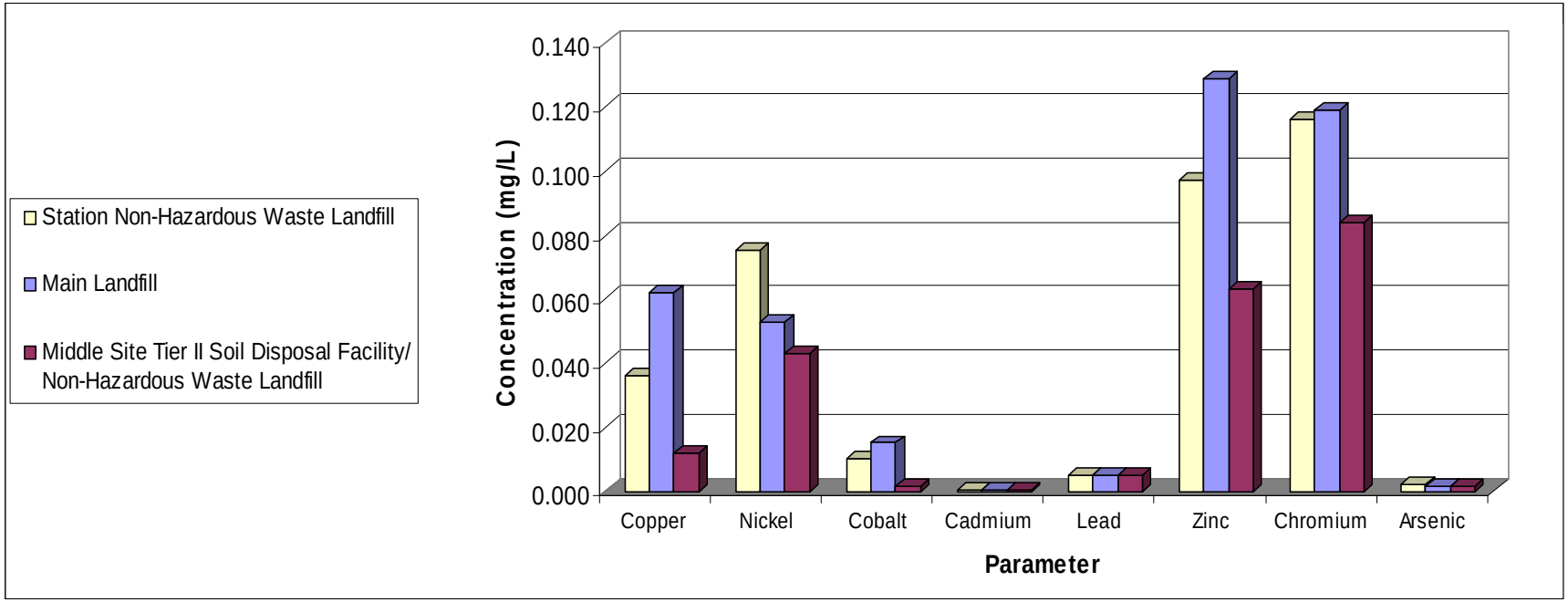


Table 1.8: Detection Limits for Analytical Requirements

Parameter	Soil Samples Minimum Analytical Detection Limit (mg/kg = ppm)	Water Samples Minimum Analytical Detection Limit (mg/L = ppm)
Copper	<3.0	<0.005
Nickel	<5.0	<0.010
Cobalt	<5.0	<0.005
Cadmium	<1.0	<0.001
Lead	<10	<0.01
Zinc	<15	<0.005
Chromium (total)	<20	<0.005
Arsenic	<0.2	<0.05
Mercury	<0.1	<0.001
PCBs	<0.05	<0.003
TPH	<40	<1

1.3.4 Thermal Monitoring

For Class B landfills and Tier II Soil Disposal Facilities where a component of the design includes the placement of sufficient fill to promote aggradation of permafrost through the landfill contents, geothermal modelling is conducted to determine the maximum depth of active layer at the landfill, and the amount of fill required on the landfill surface to ensure that the active layer does not penetrate into the landfill contents following freeze-back. Modelling also determines the length of time required for the landfill contents to freeze-back following the placement of additional surface fill. Geothermal modelling considers soil type, soil thermal properties, presence or absence of insulating cover (vegetation or snow drift), measured ground temperatures at the site or at nearby sites, measured air temperature and climatic data, an estimated 1 in 100 warm year air temperature, an estimated ten consecutive years of 1 in 100 warm years, and an estimate of the effect of global warming (based on estimates of temperature change reported by the Panel on Energy Research and Development for Environment Canada - PERD - in 1998).

At the FOX-5 Main Landfill, a typical active layer depth based on mean climatic data was 1.9 m. The predicted active layer depth for a 1 in 100 warm year was 2.3 m, and for ten consecutive 1 in 100 warm years was 2.8 m. The predicted active layer depth for the landfill after 100 years of global warming (using the best estimate approximation method as opposed to more conservative estimate) was 2.5 m. The initial active layer depth used for design at FOX-5 Main Landfill was the resultant active layer depth from modelling 10 consecutive 1 in 100 warm years - a depth of 2.8 m. However, during construction, it was decided to substitute the full Type 2 granular fill cover (well graded sand and gravel) with a combination of Type 2 overlain by Type 1 granular fill cover. Type 1 surficial cover, consisting of coarse-grained rip-rap type material, was felt warranted to protect against surface erosion. However, because Type 1 material is less insulating than Type 2, changes were required to the overlying fill thickness to ensure freezeback conditions. Accordingly, the design fill thickness was increased by 0.5 m, with a final design active layer thickness of 3.3 m. Based on the results of geothermal modelling, it is expected to take one year for the landfill contents to freeze back with this depth of cover fill.

At the FOX-5 Middle Site area, a typical active layer depth based on ten years of mean climatic data was 1.6 m. The predicted active layer depth for a 1 in 100 warm year was 2.0 m and for ten consecutive 1 in 100 warm years was 2.2 m. The predicted active layer depth for the landfill after 100 years of global warming (using the best estimate approximation method) was 2.0 m. The active layer depth used for design at FOX-5 Middle Site Tier II Soil Disposal Facility is the resultant active layer depth from modelling 10 consecutive 1 in 100 warm years - a depth of 2.2 m. It is expected to take one year for the landfill contents to freeze back with this depth of cover fill.

During landfill construction, vertical thermistors were installed within the landfill to record ground temperatures. Measured ground temperatures will be compared to the active layer depth and freeze-back time modelled during design. It is anticipated that all landfills where freezeback is an integral part of the design will reach thermal equilibrium within approximately five years following closure. If thermal equilibrium is not achieved within five years, it may be necessary to increase the term of the thermal monitoring.

1.3.5 Pore Pressure Monitoring

For specific landfills provided with a leachate containment system, measurement of pore pressures was identified as a short term monitoring requirement. The geotechnical design, specifically slope stability and corresponding factors of safety, were based on assumption of pore pressures over the period of time required for the landfill to freeze-back. In these landfills, pore pressure piezometers were installed at select locations beneath the synthetic liner. Pore pressure readings will be collected until the thermal monitoring indicates that freeze-back of the landfill has occurred.

At the FOX-5 site, four vibrating wire piezometers were installed at the Main Landfill at the same location as vertical thermistors.

1.4 Scope of Report

The following sections of the report are organized according to landfill designation. For each landfill included in the monitoring program, the following information is provided:

- A brief description of the landfill.
- Qualitative assessment of the potential environmental risk associated with the specific landfill.
- Summary of the remediation design.
- Baseline conditions (as applicable).

Table 1.9: Summary of Landfill Monitoring Installations/Sampling Locations FOX-5 Broughton Island

Landfill Designation/Monitoring Locations	Coordinates[1]		Elevation
	North (m)	East (m)	(masl)
Station Non-Hazardous Waste Landfill			
MW-15 (soil and groundwater)	5180.119	5132.816	571.5
MW-16 (soil and groundwater)	5175.227	5041.688	570.6
MW-17 (soil and groundwater)	5252.856	5028.479	567.0
MW-18 (soil and groundwater)	5284.745	5061.284	565.8
MW-19 (soil and groundwater)	5265.135	5101.161	567.3

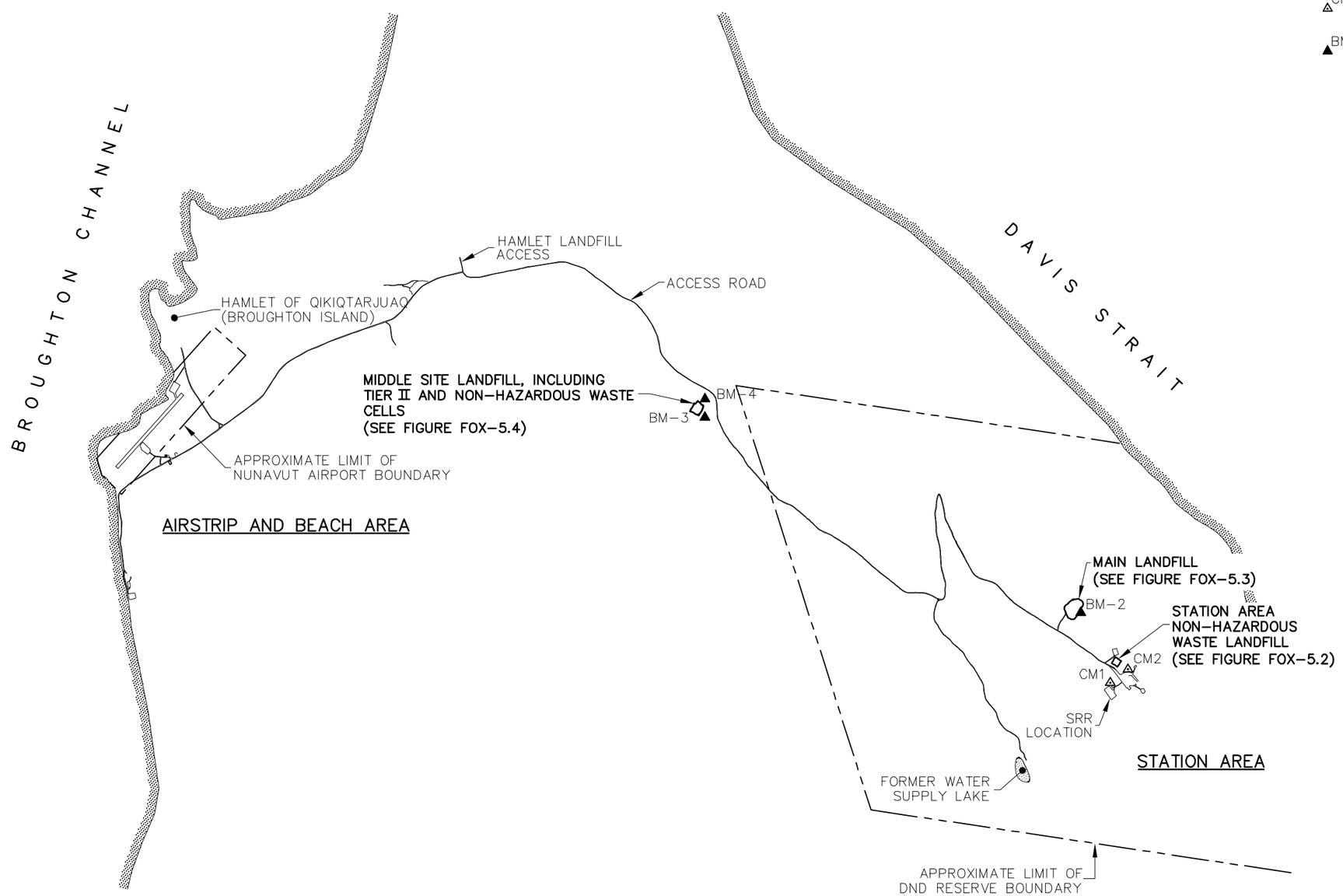
Landfill Designation/Monitoring Locations	Coordinates[1]		Elevation (masl)
	North (m)	East (m)	
Main Landfill			
MW-10 (soil and groundwater)	5660.5	4514.2	511.2
MW-11 (soil and groundwater)	5904.4	4665.5	484.4
MW-12 (soil and groundwater)	5891.5	4700.2	479.8
MW-13 (soil and groundwater)	5858.1	4719.3	480.6
MW-14 (soil and groundwater)	5801.6	4700.7	493.4
VT-1/P (temperature and pore pressure)	5871.2	4671.1	485.5
VT-2/P (temperature and pore pressure)	5864.2	4658.5	491.0
VT-3/P (temperature and pore pressure)	5855.8	4681.5	486.3
VT-4/P (temperature and pore pressure)	5848.4	4669.3	491.3
VT-5 (temperature)	5832.7	4644.6	496.2
VT-6 (temperature)	5811.8	4557.9	501.4
VT-7 (temperature)	5751.2	4602.7	505.6
VT-8 (temperature)	5722.2	4615.8	505.8
Middle Site Tier II Soil Disposal Facility/Non-Hazardous Waste Landfill			
MW-5 (soil and groundwater)	9760.6	15584.6	313.2
MW-6 (soil and groundwater)	9736.9	15446.6	305.9
MW-7 (soil and groundwater)	9808.2	15438.1	303.1
MW-8 (soil and groundwater)	9877.3	15490.4	303.5
MW-9 (soil and groundwater)	9878.4	15541.2	306.7
VT-9 (temperature)	9748.5	15527.3	313.4
VT-10 (temperature)	9773.1	15544.8	314.0
VT-11 (temperature)	9779.4	15507.9	311.4
VT-12 (temperature)	9811.9	15484.6	310.3

Note 1: Coordinates referenced to local grid system. Upper and Middle Sites on separate grid systems. Monitoring well and thermistor coordinates as provided by the clean-up contractor.

LEGEND:

CM2 — SURVEY CONTROL MONUMENT

BM−2 — PERMANENT BENCHMARK LOCATION



SCALE 1:50000

0 500 1000 1500 m

RECORD DRAWING
NOT FOR CONSTRUCTION

MIDDLE SITE SURVEY BENCHMARKS				
NO.	COORDINATES		ELEV.	DESCRIPTION
	NORTHING	EASTING		
BM−3	9 700.063	15 599.940	314.770	25mm DIA. STEEL PIPE
BM−4	9 900.067	15 600.081	309.963	25mm DIA. STEEL PIPE

STATION AREA SURVEY BENCHMARKS				
NO.	COORDINATES		ELEV.	DESCRIPTION
	NORTHING	EASTING		
CM1	5 000.000	5 000.000	581.561	FOX−5 BASELINE STA. 5+81.69
CM2	5 145.012	5 191.951	574.530	FOX−5 BASELINE STA. −2+07.90
BM−2	5 749.976	4 692.327	502.600	25mm DIA. STEEL PIPE

UMA | AECOM

DEW LINE CLEAN UP
LANDFILL MONITORING PLAN

FOX-5 BROUGHTON ISLAND

OVERALL SITE PLAN

FIGURE FOX-5.1

DGN NAME: F5-RD01.DWG CLC – 08/01/28

2.0 Station Area Non-Hazardous Waste Landfill

A new landfill was constructed at the Broughton Island site east of the station area for the disposal of non-hazardous materials generated from the demolition of facilities not required for the operation of the SRR, for site debris collected during clean-up and for Tier I contaminated soil. The location of this landfill encompasses the former sewage outfall, and is located within the vicinity of an area of hydrocarbon contamination originating at the garage area.

Several areas of contaminated soil were identified up-gradient of this landfill during the site investigation. A large Type B (fuel oil) hydrocarbon plume was present, extending north from the vicinity of the garage pad into the footprint for the new landfill construction. This plume intercepted the south corner of the landfill. In the area of the former dormitory building on the pad to the south-southwest, Tier I lead and PCBs, and Tier II Pb were present. While all of the above-noted contaminated soil areas were excavated during clean-up, it is expected that residual contaminant levels may be observed in the up-gradient vicinity of this landfill. It should also be noted that the original investigation analyses commonly only tested for copper, lead, and zinc, as these are the primary contaminants observed in these areas that exceed criteria, however, there is also the possibility for elevated levels (although not above criteria) of other metals in this vicinity as a result of historical operations.

In summary, because of its location immediately down-gradient from the former station area of the FOX-5 site, there is a higher than usual potential for contaminants to be identified at this landfill during landfill monitoring. As such, the location of elevated impacts, and the change in concentrations over time, will be particularly important to document for monitoring of landfill performance. It is expected that overall contaminant levels will decline over time.

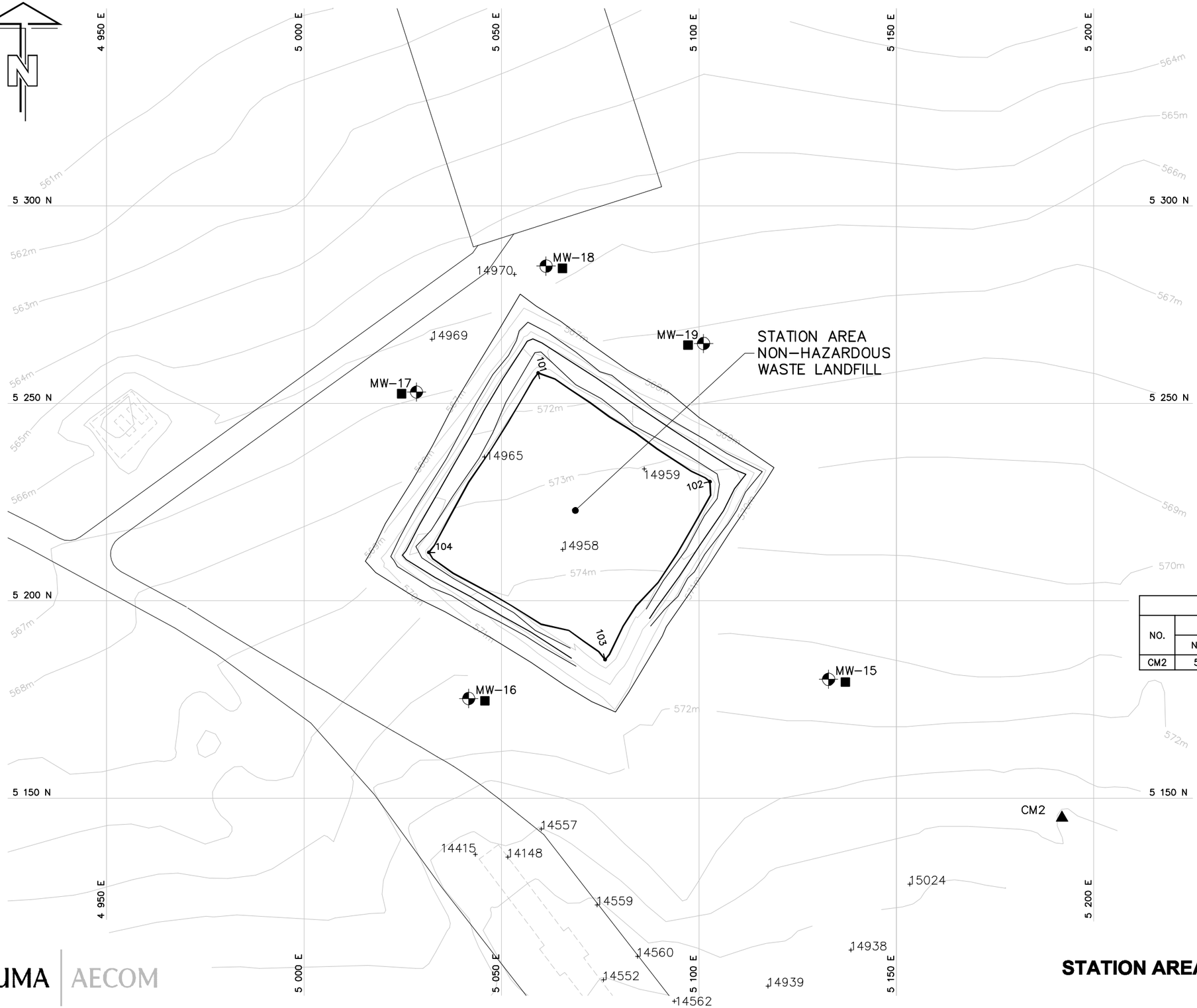
The long term monitoring plan consists of visual monitoring, and the periodic collection of soil and groundwater samples. Approximate locations for the collection of soil samples are identified on Figure FOX-5.2 below.

2.1 Baseline Data

Sample locations for baseline soil samples are shown in Figure FOX-5.2. A summary of the baseline soil analytical data is provided in Table 2.1. Baseline data is comprised of landfill assessment data for soil samples collected up- and down-gradient of the landfill during the site investigation, and data from soil samples collected at the permanent monitoring locations during site clean-up.

Soil baseline concentrations of inorganic elements at the Station Non-Hazardous Waste Landfill are consistent site background levels. Low-level PCBs (up to 0.041 mg/kg) were detected at monitoring locations both up and down-gradient of the landfill in 2004, 2005 and 2006. Low-level TPH (F2 and F3 fractions was detected at almost all monitoring locations over the same years, but concentrations were noticeably higher in up-gradient samples (up to 2060 mg/kg), which is consistent with the location of contaminated soil impacts identified during site investigations.

A summary of baseline groundwater data is provided in Table 2.2. Baseline data was collected from permanent monitoring locations in 2004, 2005 and 2006. While there is no background groundwater data with which to compare, all the groundwater samples (at the Main Landfill, the Middle Site Tier II Soil Disposal Facility and the Station Non-Hazardous Waste Landfill) have approximately the same concentrations and there are no extremely high concentrations of any of the inorganic elements. No PCBs and TPH were detected.



LEGEND:

- TBM4 — TEMPORARY BENCHMARK
- BM-1 — PERMANENT BENCHMARK
- 101 — COORDINATE POINT
- ■ — MONITORING SOIL SAMPLE LOCATION
- ⊕ ■ — MONITORING WELL LOCATION
- 14170 — BASELINE SOIL SAMPLE LOCATION

COORDINATE POINTS (AS BUILT) NON-HAZARDOUS WASTE LANDFILL			
NO.	NORTHING	EASTING	ELEV.
101	5 257.7	5 059.3	571.4
102	5 230.2	5 102.8	573.5
103	5 185.1	5 076.2	574.6
104	5 212.3	5 031.6	573.5

COORDINATE POINTS (AS BUILT) MONITORING WELLS			
NO.	NORTHING	EASTING	ELEV.
MW-15	5 180.1	5 132.8	571.50
MW-16	5 175.2	5 041.7	570.63
MW-17	5 252.9	5 028.5	567.00
MW-18	5 284.7	5 061.3	565.82
MW-19	5 265.1	5 101.2	567.33

SURVEY CONTROL MONUMENTS				
NO.	COORDINATES		ELEV.	DESCRIPTION
	NORTHING	EASTING		
CM2	5 145.012	5 191.951	574.530	FOX-5 BASELINE STA. -2+07.90

SCALE 1:1000 — 0 10 20 30 m

RECORD DRAWING
NOT FOR CONSTRUCTION

DEW LINE CLEAN UP
LANDFILL MONITORING PLAN

FOX-5 BROUGHTON ISLAND

STATION AREA NON-HAZARDOUS WASTE LANDFILL

FIGURE FOX-5.2

UMA | AECOM

DOS NAME: F5-RD02.DWG CLC - 08/01/28

Table 2.1: Station Non-Hazardous Waste Landfill – Baseline Soil Data (mg/kg)

Sample #	Location	Date	Depth (cm)	Cu	Ni	Co	Cd	Pb	Zn	Cr	As	Hg	PCBs	TPH	TPH Identity		
															F1	F2	F3
Up-gradient Soil Samples																	
14148		1998	0	12				34	100				<0.5				
14159		1998	0										<0.5				
14415		1998	0										<0.5				
15292	14415	1998	30										<0.5				
14552		1998	0					110					0.6				
14557		1998	0										<0.5				
14559		1998	0										<0.5				
14560		1998	0					<10					<0.5				
14561		1998	0					<10					0.6				
14562		1998	0					10					<0.5				
14938		1998	0	6.7				11	35				<0.5				
14939		1998	0										<0.5				
15024		1998	30											<40			
15025	15024	1998	45											<40			
28666	MW 16	2005	30	9.3	5.2	<5.0	<1.0	<10	37	<20	1.2		0.0095	1402	52	1100	250
20266	MW 15	2006	0	16	11	7.4	<1.0	<10	39	23	1.7	<0.10	<0.0030	<10	< 10	< 4.0	< 9.0
20268	MW 15	2006	30	15	10	7.7	<1.0	<10	36	22	1.5	<0.10	<0.010	<10	< 10	< 4.0	< 9.0
20270	MW 16	2006	0	8.9	<5.0	<5.0	<1.0	<10	35	<20	1.7	<0.10	<0.0030	1634	24	1500	110
20272	MW 16	2006	30	7.3	<5.0	<5.0	<1.0	<10	32	<20	1.7	<0.10	0.0080	2060	40	1900	120
Down-gradient Soil Samples																	
14958		1998	0	5.1				<10	28								
14959		1998	0	5.5				<10	29								
14965		1998	0	17.0				<10	29								
14969		1998	0	11.0				<10	34								
14970		1998	0	4.4				12									
14971		1998	0	3.6				17									
5928	MW 17	2004	0	6.8	<5.0	<5.0	<1.0	<10	31	<20	2.1	<0.10	<0.0030	<10	<10	<4.0	<9.0
5930	MW 17	2004	30	7.6	<5.0	<5.0	<1.0	<10	32	<20	1.6	<0.10	<0.0030	12	<10	<4.0	12
28668	MW 17	2005	0	11	5.1	<5.0	<1.0	17	39	<20	1.8		0.011	68	<10	<4.0	68

Sample #	Location	Date	Depth (cm)	Cu	Ni	Co	Cd	Pb	Zn	Cr	As	Hg	PCBs	TPH	TPH Identity		
															F1	F2	F3
28670	MW 17	2005	30	7.1	<5.0	<5.0	<1.0	<10	28	<20	1.4		<0.0030	<10	<10	<4.0	<9.0
28672	MW 18	2005	0	7.1	<5.0	<5.0	<1.0	<10	28	<20	1.3		<0.0030	20	<10	<4.0	20
28674	MW 18	2005	30	7.1	<5.0	<5.0	<1.0	<10	29	<20	<1.0		<0.0030	24	<10	13	11
28676	MW 19	2005	0	8.2	5.3	<5.0	<1.0	<10	36	<20	1.5		<0.0030	43	<10	10	33
20274	MW 17	2006	0	7.3	<5.0	<5.0	<1.0	<10	27	<20	1.7	<0.10	<0.0030	9.6	< 10	< 4.0	9.6
20276	MW 17	2006	30	7.6	<5.0	<5.0	<1.0	<10	28	<20	1.8	<0.10	<0.0030	<10	< 10	< 4.0	< 9.0
20278	MW 18	2006	0	6.4	<5.0	<5.0	<1.0	<10	28	<20	1.9	<0.10	<0.0030	18	< 10	< 4.0	18
20280	MW 18	2006	30	5.3	<5.0	<5.0	<1.0	<10	27	<20	1.7	<0.10	<0.0030	25.8	< 10	6.8	19
20282	MW 19	2006	0	8.7	<5.0	<5.0	<1.0	<10	30	<20	3.1	<0.10	<0.0030	34	< 10	34	<9.0
20284	MW 19	2006	30	9.1	5.7	5.3	<1.0	<10	33	<20	3.3	<0.10	<0.0030	<10	< 10	< 4.0	< 9.0
	N Value			28	24	24	19	28	29	25	19	12	25	20			
	Average			8.4	<5.0	<5.0	<1.0	<10	31.7	<20	1.6	<0.10	<0.0030	270			
	Standard Deviation			3.4					3.9		0.7			626			
	Minimum			3.6	<5.0	<5.0		<10	27.0	<20	0.5		<0.0030	0.5			
	Maximum			17.0	11.0	7.7		17.0	39.0	23.0	3.3		0.6	2060			
	95% Confidence Limit			1.3					1.4		0.3			274			

Table 2.2: Station Non-Hazardous Waste Landfill – Baseline Groundwater Data (in mg/L)

Sample #	Location	Date	Cu	Ni	Co	Cd	Pb	Zn	Cr	As	Hg	PCBs	TPH	TPH Identity		
														F1	F2	F3
Up-gradient Groundwater Samples																
5915	MW 15	2004	0.067	0.088	0.030	<0.0010	<0.010	0.14	0.14	0.0030	<0.00040	<0.000020	<1.0	<0.050	<0.50	<1.0
5916	MW16	2004	0.047	0.12	0.012	<0.0010	<0.010	0.13	0.084	<0.0030	<0.00040	<0.000020	<1.0	<0.050	<0.50	<1.0
28606	MW 15	2005	0.01	0.10	<0.0030	<0.0010	<0.010	0.021	0.020	<0.0030	<0.00040	<0.000020	<1.0	<0.050	<0.50	<1.0
28607	MW 16	2005	0.02	0.014	0.0056	<0.0010	<0.010	0.062	0.025	<0.0030	<0.00040	<0.000020	<1.0	<0.050	<0.50	<1.0
20235	MW 15	2006	0.047	0.14	0.017	<0.0010	<0.010	0.14	0.32	<0.0030	<0.00040	<0.000020	<1.0	<0.050	<0.50	<1.0
20236	MW 16	2006	0.041	0.089	0.015	<0.0010	0.013	0.23	0.17	0.0040	<0.00040	<0.000020	<1.0	<0.050	<0.50	<1.0
Down-gradient Groundwater Samples																
5917	MW 17	2004	0.026	0.044	0.0030	<0.0010	<0.010	0.029	0.045	<0.0030	<0.00040	<0.000020	<1.0	<0.050	<0.50	<1.0
28677	MW 18	2005	0.05	0.044	<0.0030	<0.0010	<0.010	0.078	0.10	<0.0030	<0.00040	<0.000020	<1.0	<0.050	<0.50	<1.0
20237	MW 17	2006	0.019	0.069	<0.0030	<0.0010	<0.010	0.017	0.13	<0.0030	<0.00040	<0.000020	<1.0	0.14	<0.50	<1.0
20238	MW 18	2006	0.015	0.045	<0.0030	<0.0010	<0.010	0.019	0.085	<0.0030	<0.00040	<0.000020	<1.0	<0.050	<0.50	<1.0
20239	MW 19	2006	0.052	0.069	0.025	<0.0010	0.013	0.20	0.16	0.0070	<0.00040	<0.000020	<1.0	<0.050	<0.50	<1.0
N Value			11	11	11	11	11	11	11	11	11	11	11			
Average			0.036	0.075	0.010	<0.0010	<0.010	0.097	0.116	<0.0030	<0.00040	<0.000020	<1.0			
Standard Deviation			0.019	0.038	0.010			0.075	0.084							
Minimum			0.011	0.014	<0.0030			0.017	0.020	<0.0030						
Maximum			0.067	0.144	0.030		0.013	0.229	0.317	0.007						
95% Confidence Limit			0.011	0.022	0.006			0.045	0.050							

3.0 Main Landfill

The Main Landfill is located approximately 1 km northwest of the Station Area, in a broad valley. The landfill was estimated to encompass an area of over 10,000 m^2 with a toe extending approximately 3.5 m above existing grade. The depth of the landfill was estimated to be on average 1.5 to 2 m. Contaminant migration was detected at the landfill prior to remediation.

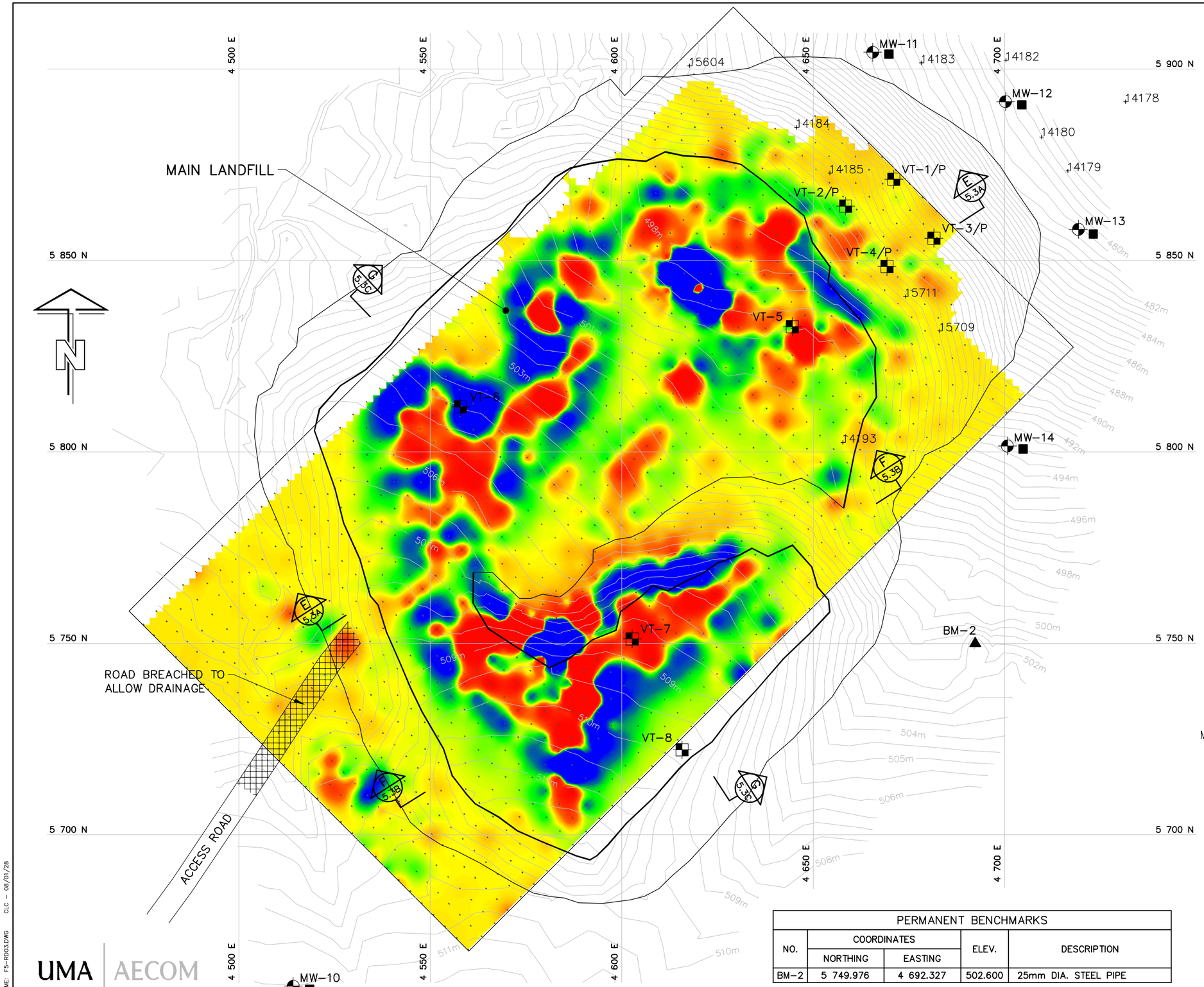
Based on existing information regarding this landfill as a source of contamination, its potential migration pathways and receptors, the Main Landfill was classified as moderate potential environmental risk. The remediation consisted of a leachate containment system. Existing drainage channels passing through the landfill were backfilled, and drainage was-routed around the landfill. Leachate containment design included the excavation of a trench to saturated and/or frozen ground beyond the landfill perimeter, and the placement of a synthetic liner system anchored into the trench and extended over the full landfill surface. Saturated, compacted, well-graded silty sand and gravel (Type 4 granular) was placed within the trench overlying the liner system. Finally, a sufficient cover of granular fill was placed over the surface and key trench to promote the aggradation of permafrost into the landfill contents. For erosion protection from surface drainage, the top cover section was comprised of Type 1 (rip rap) granular. Five groundwater monitoring wells were installed at the landfill perimeter, and eight thermistors were installed within the landfill footprint to monitor freeze back conditions. Four of the down-gradient thermistor installations were also equipped with pore pressure piezometers to monitor pore pressure in the down-gradient landfill area for slope stability.

The long term monitoring plan consists of visual monitoring, the periodic collection of soil and groundwater samples and thermal monitoring, with recording of pore pressure data until it is demonstrated that freezeback conditions have been achieved. Approximate locations for the collection of soil and groundwater samples, and for collection of ground temperature and pore pressure measurements, are identified on Figure FOX-5.3. Cross-sections showing the leachate containment design and surface cover thickness are provided in Figures FOX-5.3a, b, and c.

3.1 Baseline Data

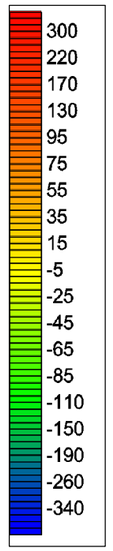
Locations for baseline soil samples are shown in Figure FOX-5.3. A summary of baseline soil analytical data is provided in Table 3.1. Baseline data is comprised of landfill assessment data for soil samples collected up- and down-gradient of the landfill during 1998, 2004, 2005, and 2006. Soil baseline average concentrations of inorganic elements at the Main Landfill were found to be slightly higher than background levels for copper, cobalt and lead; other inorganic element concentrations were consistent with background. Low-level PCBs were detected down-gradient of the landfill in 2005 and 2006: concentrations ranged from non-detectable to 0.26 mg/kg. No PCBs had been detected at the landfill during 1998 because of the higher detection limit used for analyses (0.1 mg/kg). High-levels of hydrocarbons were detected up-gradient of the landfill in 1998. Low-level hydrocarbons were detected down-gradient of the landfill in 1998, 2005 and 2006. The TPH detection limit of 40 mg/kg used during the first year of the site investigation was lowered to 10 mg/kg in the later years of study, when the analytical method was changed to the CCME CWS method. It should be noted that it has been typical to identify higher concentrations of hydrocarbons during monitoring when the analytical method has switched from the TPH method used for site investigations to the CCME method used for monitoring.

A summary of baseline groundwater data is provided in Table 3.2. Baseline data was collected from permanent monitoring locations in 2004, 2005 and 2006. While there is no background groundwater data with which to compare, all the groundwater samples collected from the three site landfills have similar analyte levels and there are no extremely high concentrations of any of the inorganic elements. No PCBs and TPH were detected.



LEGEND:

- TBM4 — TEMPORARY BENCHMARK
- BM–1 — PERMANENT BENCHMARK
- 101 — COORDINATE POINT
- ■ — MONITORING SOIL SAMPLE LOCATION
- ⊕ — MONITORING WELL LOCATION
- ⊞ — VERTICAL THERMISTOR LOCATION
- 14179 — BASELINE SOIL SAMPLE LOCATION



MAGNETIC GRADIENT (gammas/m)

COORDINATE POINTS (AS–BUILT) VERTICAL THERMISTORS		
NO.	NORTHING	EASTING
VT–1	5 871.2	4 671.1
VT–2	5 864.2	4 658.5
VT–3	5 855.8	4 681.5
VT–4	5 848.4	4 669.3
VT–5	5 832.7	4 644.6
VT–6	5 811.8	4 557.9
VT–7	5 751.2	4 602.7
VT–8	5 722.2	4 615.8

COORDINATE POINTS (AS BUILT) MONITORING WELLS			
NO.	NORTHING	EASTING	ELEV.
MW–10	5 660.5	4 514.2	511.18
MW–11	5 904.4	4 665.5	484.41
MW–12	5 891.5	4 700.2	479.79
MW–13	5 858.1	4 719.3	480.55
MW–14	5 801.6	4 700.7	493.43

SCALE 1:1000

0 10 20 30 m

RECORD DRAWING
NOT FOR CONSTRUCTION

PERMANENT BENCHMARKS				
NO.	COORDINATES		ELEV.	DESCRIPTION
	NORTHING	EASTING		
BM–2	5 749.976	4 692.327	502.600	25mm DIA. STEEL PIPE

UMA | AECOM

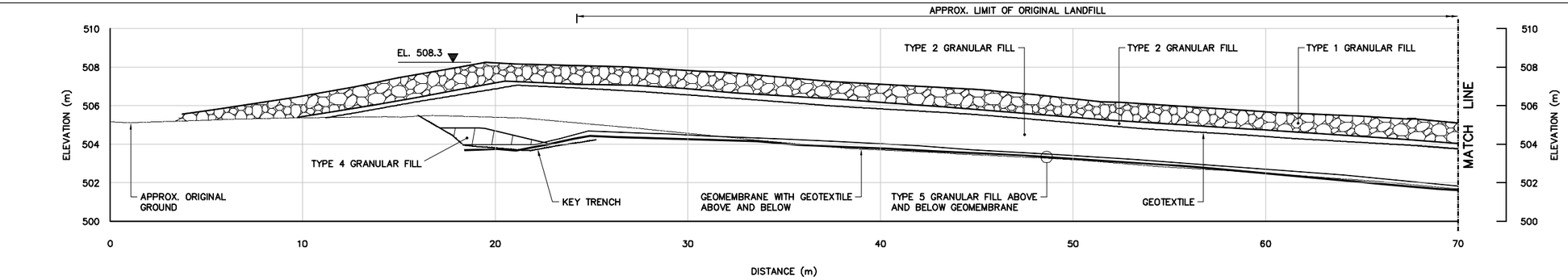
DEW LINE CLEAN UP
LANDFILL MONITORING PLAN

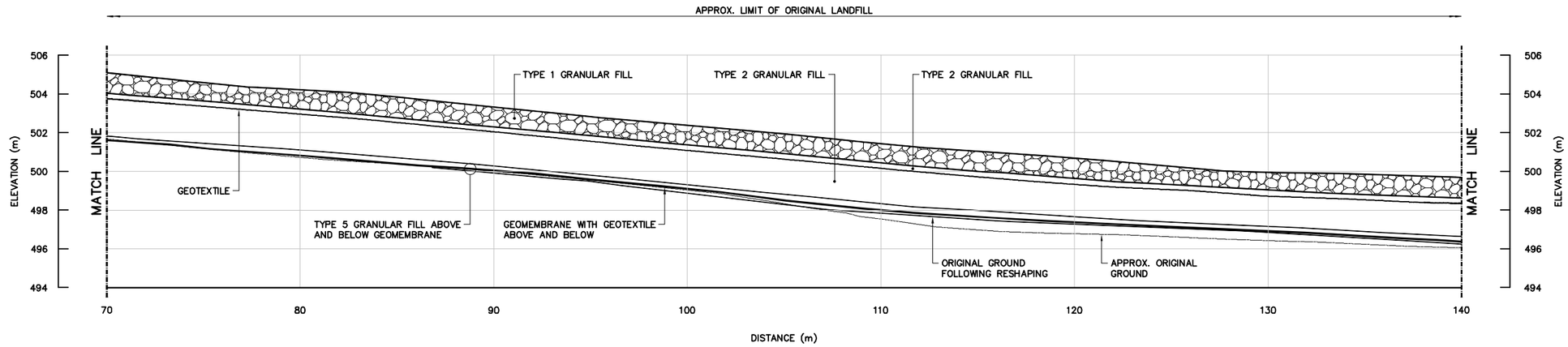
FOX-5 BROUGHTON ISLAND

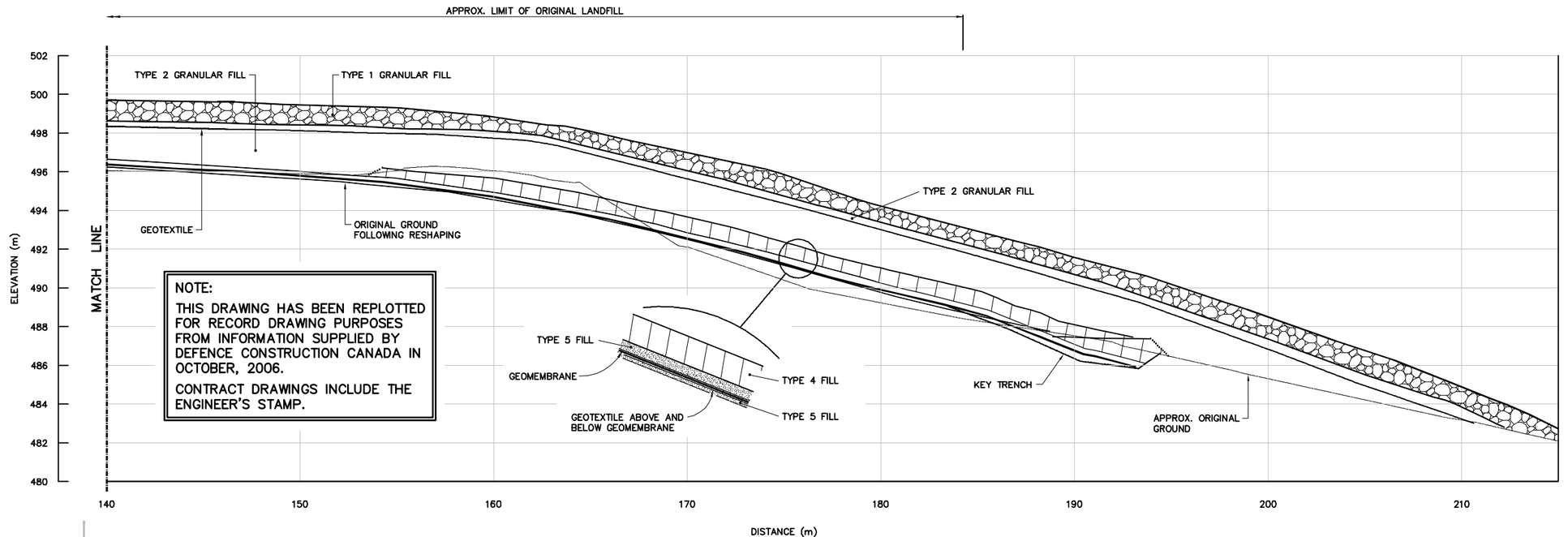
MAIN LANDFILL

FIGURE FOX-5.3

DOS NAME: F5-RD03.DWG CLC – 08/01/28







General Notes:

1. ALL ELEVATIONS ARE REFERENCED TO MEAN SEA LEVEL.
2. ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE.
3. KEY TRENCH EXTENDS BELOW ORIGINAL GROUND TO SATURATED GROUND (DEPTH VARIES).

Legend:

——— GENERATED BASED ON PROVIDED SURVEY INFORMATION

····· BASED ON DESIGN, NOT SURVEYED

SCALE 1:250 0 2.5 5 m

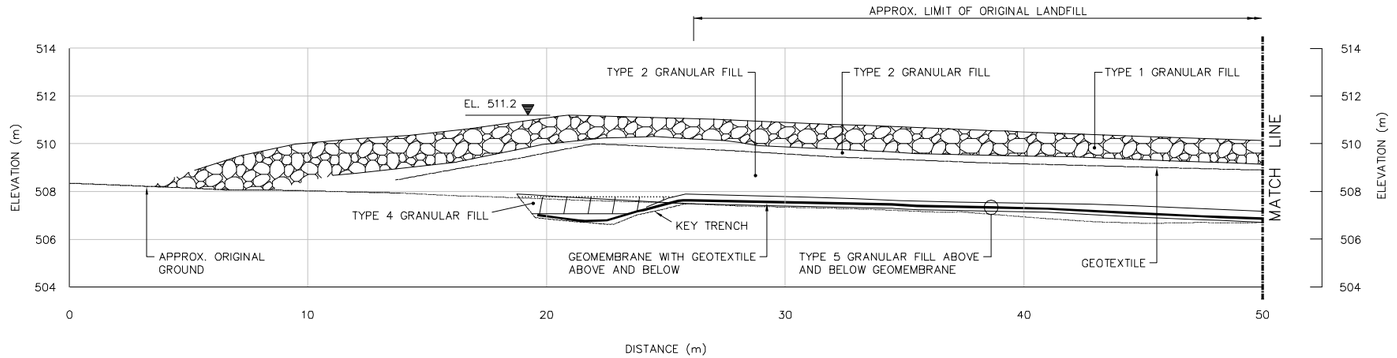
UMA | AECOM

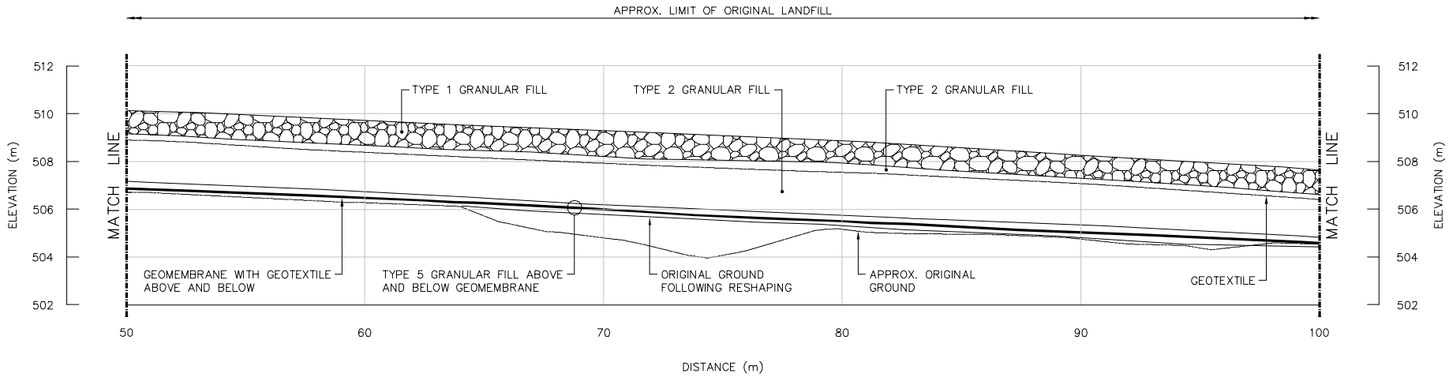
SECTION E 5.3

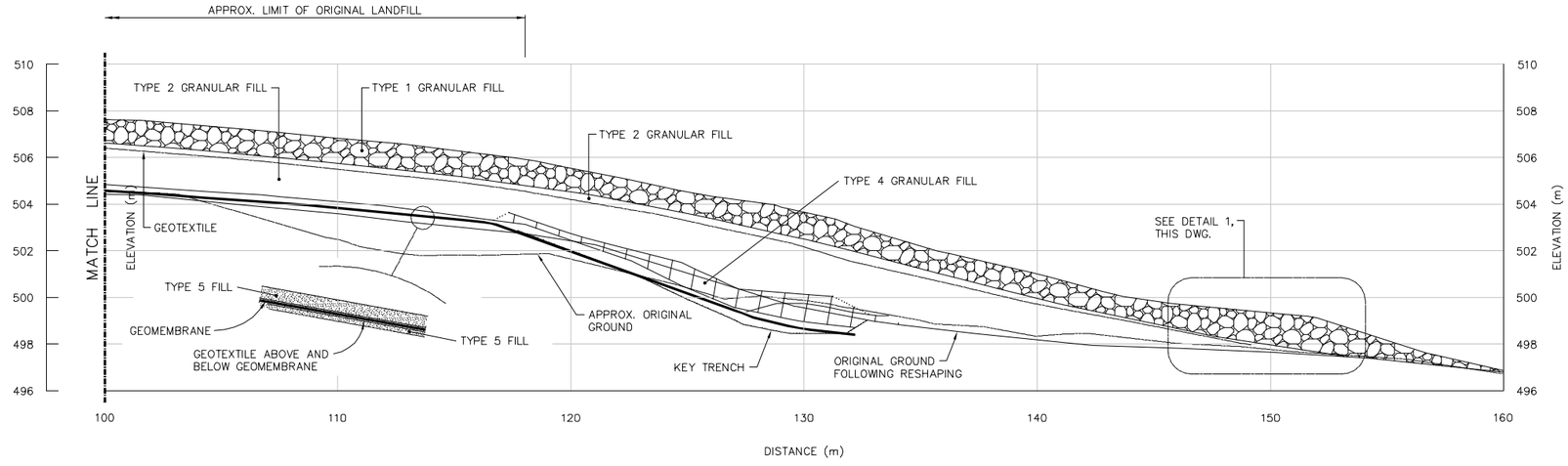
DEW LINE CLEAN UP
LANDFILL MONITORING PLAN

FOX-5 BROUGHTON ISLAND
MAIN LANDFILL
CROSS-SECTION
FIGURE FOX-5.3A

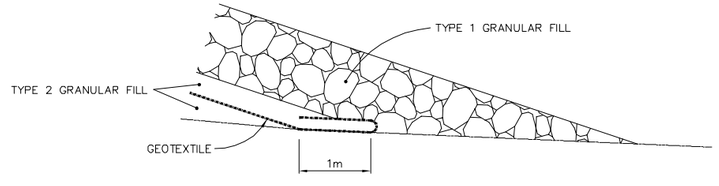
DGN NAME: F5-RDG3A.DWG CLC – 08/01/28







SECTION F 5.3



DETAIL 1 5.3
N.T.S.

NOTE:

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CONTRACT DRAWINGS INCLUDE THE ENGINEER'S STAMP.

General Notes:

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3. KEY TRENCH EXTENDS BELOW ORIGINAL GROUND TO SATURATED GROUND (DEPTH VARIES).

Legend:

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····· BASED ON DESIGN, NOT SURVEYED

SCALE 1:250

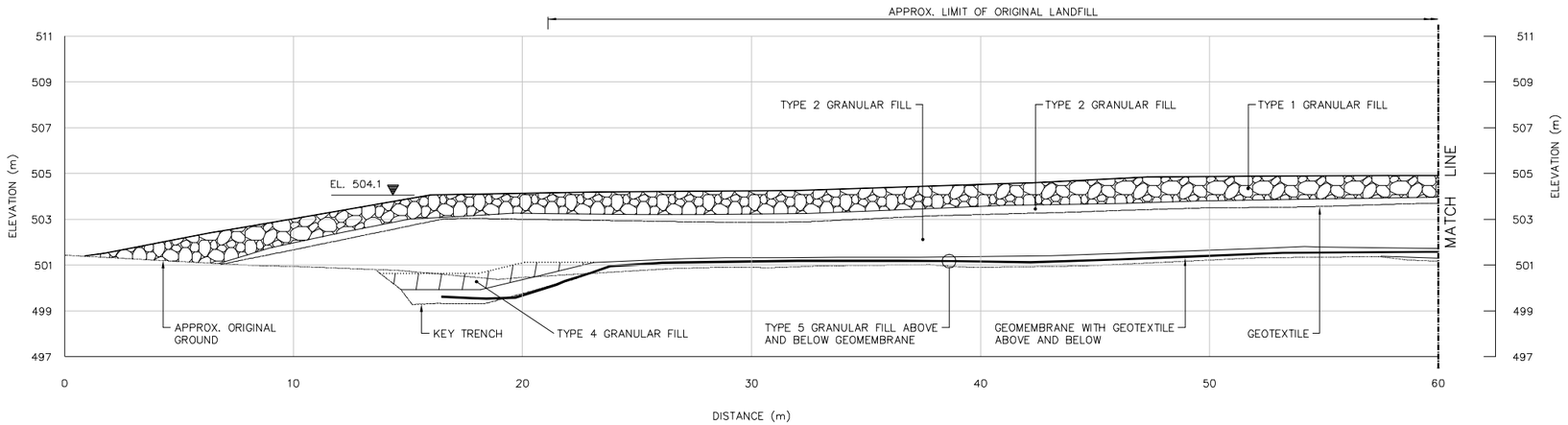
0 2.5 5 m

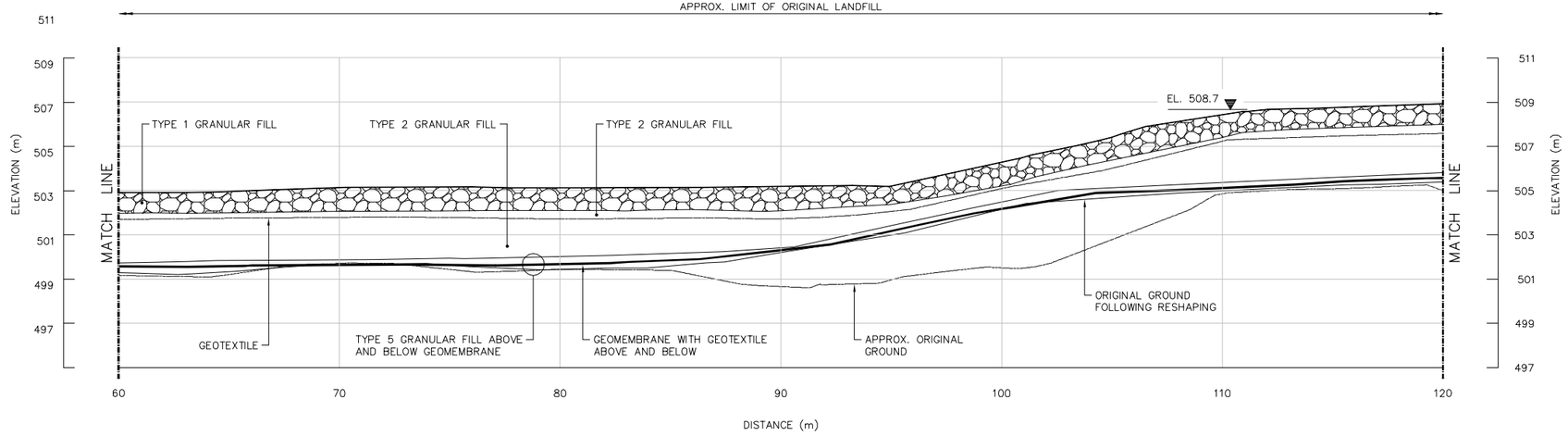
UMA | AECOM

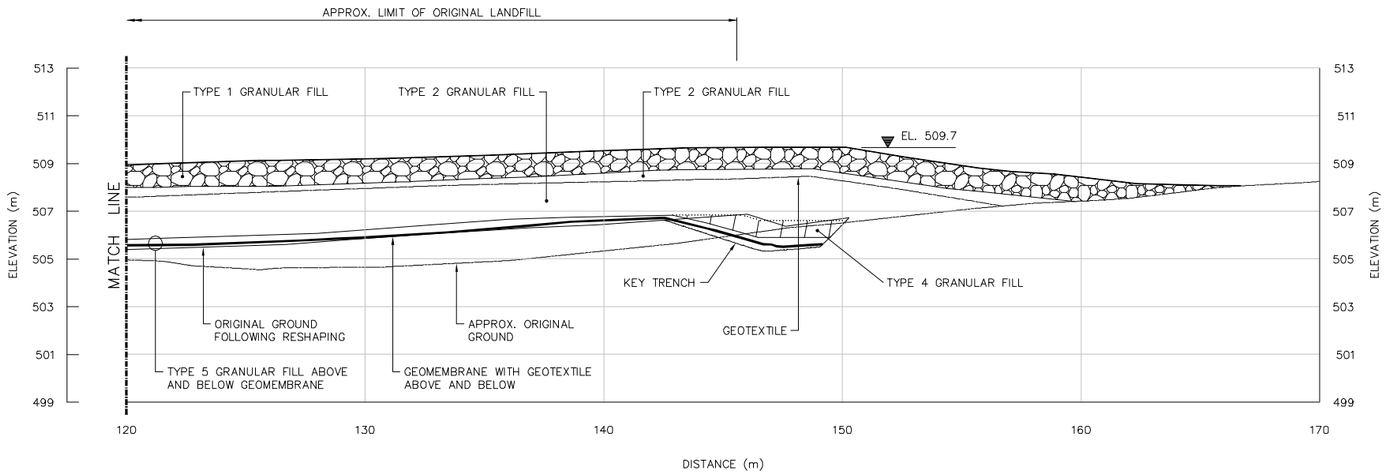
DEW LINE CLEAN UP
LANDFILL MONITORING PLAN

FOX-5 BROUGHTON ISLAND
MAIN LANDFILL
CROSS-SECTION
FIGURE FOX-5.3B

DOS NAME: F5-R03B.DWG CLC – 08/01/28







SECTION G 5.3

General Notes:

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2. ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE.
3. KEY TRENCH EXTENDS BELOW ORIGINAL GROUND TO SATURATED GROUND (DEPTH VARIES).

Legend:

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CONTRACT DRAWINGS INCLUDE THE ENGINEER'S STAMP.

SCALE 1:250 0 2.5 5 m

UMA | AECOM

DEW LINE CLEAN UP
LANDFILL MONITORING PLAN

FOX-5 BROUGHTON ISLAND
MAIN LANDFILL
CROSS-SECTION
FIGURE FOX-5.3C

DOS NAME: F5-RO03C.DWG CLC – 08/01/28

Table 3.1: Main Landfill - Baseline Soil Data (in mg/kg)

Sample #	Location	Date	Depth (cm)	Cu	Ni	Co	Cd	Pb	Zn	Cr	As	Hg	PCBs	TPH	TPH Identity		
															F1	F2	F3
Up-gradient Soil Samples																	
5932	MW 10	2004	0	8.1	<5.0	<5.0	<1.0	<10	31	<20	2.2	<0.10	<0.0030	41	<10	<4.0	41
5934	MW 10	2004	30	6.5	<5.0	<5.0	<1.0	<10	24	<20	1.9	<0.10	<0.0030	<10	<10	7	<9.0
28629	MW 10	2005	0	6.5	<5.0	<5.0	<1.0	<10	25	<20	2.4		<0.0030	<10	<10	<4.0	9
28632	MW 10	2005	40	6.1	5.5	<5.0	<1.0	<10	23	<20	1.5		<0.0030	<10	<10	<4.0	<9.0
20262	MW 10	2006	0	7.5	5.2	5.2	<1.0	<10	34	<20	5.8	<0.10	<0.0030	10.3	< 10	< 4.0	10.3
20264	MW 10	2006	30	7.7	<5.0	<5.0	<1.0	<10	29	<20	2.5	<0.10	<0.0030	<10	< 10	< 4.0	< 9.0
Down-gradient Soil Samples																	
14178		1998	0	7.9	<5.0	<5.0	<1.0	12	25	<20	0.9		<0.1	<40			
14179		1998	0	3.9	<5.0	<5.0	<1.0	<10	20	<20	0.5		<0.1	<40			
14180		1998	0	23.0	7.5	<5.0	<1.0	18	51	20	0.8		<0.1	<40			
14181		1998	0	8.8	9.8	<5.0	<1.0	21	44	<20	0.9		<0.1	<40			
14182		1998	0	20.0	<5.0	<5.0	<1.0	19	38	<20	0.6		0.1				
14183		1998	0	5.6	5.1	<5.0	<1.0	19	45	<20	0.6		0.1	670	100% lube oil		
14184		1998	0	13.0	5.4	<5.0	<1.0	18	54	<20	1.1		<0.1				
14185		1998	0	10.0	<5.0	<5.0	1	15	180	<20	0.9		0.1	<40			
14193		1998	0	9.4	5.3	<5.0	<1.0	<10	36	<20	1.0		<0.1	<40			
15709		1998	0	4.6	<5.0	<5.0	<1.0	11	27	<20	1.0		<0.1				
15710	15709	1998	70	5.1	<5.0	<5.0	<1.0	<10	33	<20	1.2		<0.1				
15711		1998	0	11.0	5.3	<5.0	<1.0	10	48	<20	1.3		<0.1				
15712	15711	1998	70	6.8	<5.0	<5.0	<1.0	<10	48	<20	1.0		<0.1				
28633	MW 11	2005	0	7.1	<5.0	<5.0	<1.0	19	33	<20	4.0		0.007	25	<10	<4.0	25
28635	MW 11	2005	40	6.4	6.2	<5.0	<1.0	11	24	<20	3.3		<0.0030	<10	<10	<4.0	<9.0
28637	MW 12	2005	0	9.0	5.1	<5.0	<1.0	25	50	<20	4.1		0.26	740	<10	<4.0	740

Sample #	Location	Date	Depth (cm)	Cu	Ni	Co	Cd	Pb	Zn	Cr	As	Hg	PCBs	TPH	TPH Identity		
															F1	F2	F3
28639	MW 12	2005	40	6.6	<5.0	<5.0	<1.0	<10	36	<20	1.9		0.0061	21	<10	4	17
28641	MW 13	2005	0	5.9	<5.0	<5.0	<1.0	<10	28	<20	2.0		0.0053	17	<10	<4.0	17
28643	MW 13	2005	40	5.4	<5.0	<5.0	<1.0	<10	24	<20	1.4		0.003	16	<10	<4.0	16
28645	MW 14	2005	0	9.1	7.2	5	<1.0	<10	40	<20	2.9		<0.0030	29	<10	<4.0	29
28647	MW 14	2005	40	6.9	<5.0	<5.0	<1.0	12	29	<20	2.9		<0.0030	20	<10	7	13
20246	MW 11	2006	30	6.9	<5.0	<5.0	<1.0	<10	17	<20	3.2	<0.10	<0.0030	<10	< 10	< 4.0	< 9.0
20248	MW 11	2006	0	9.3	7.6	<5.0	<1.0	<10	29	<20	3.8	<0.10	<0.0030	13	< 10	< 4.0	13
20250	MW 12	2006	0	15.0	11.0	<5.0	<1.0	22	63	<20	5.5	<0.10	0.2	73	< 10	< 4.0	73
20252	MW 12	2006	30	8	<5.0	<5.0	<1.0	<10	43	<20	2.7	<0.10	0.0084	<10	< 10	< 4.0	< 9.0
20254	MW 13	2006	0	8.5	<5.0	<5.0	<1.0	<10	28	<20	3.7	<0.10	0.00236	<10	< 10	6.5	< 9.0
20256	MW 13	2006	30	6.7	<5.0	<5.0	<1.0	<10	27	<20	2.9	<0.10	0.0031	<10	< 10	< 4.0	< 9.0
20258	MW 14	2006	0	7.3	<5.0	<5.0	<1.0	<10	29	<20	2.3	<0.10	<0.0030	10	< 10	< 4.0	10
20260	MW 14	2006	30	6.7	<5.0	<5.0	<1.0	<10	32	<20	3.9	<0.10	<0.0030	<10	< 10	< 4.0	< 9.0
	N Value			35	35	35	35	35	35	35	35	12	35	29			
	Average			8.5	<5.0	<5.0	<1.0	<10	38.5	<20	2.2	<0.10	<0.0030	<10			
	Standard Deviation			3.9					26.8		1.4						
	Minimum			3.9					17.0		0.5						
	Maximum			23.0	11.0	5.2	1.0	25.0	180.0		5.8		0.26	740.0			
	95% Confidence Limit			1.3					8.9		0.5						

Table 3.2: Main Landfill - Baseline Groundwater Data (in mg/L)

Sample #	Location	Date	Cu	Ni	Co	Cd	Pb	Zn	Cr	As	Hg	PCBs	TPH	TPH Identity		
														F1	F2	F3
Up-gradient Groundwater Samples																
5918	MW 10	2004	0.093	0.059	0.048	<0.0010	0.03	0.30	0.140	0.009	<0.40	<0.020	<1.0	<0.050	<0.50	<1.0
28600/01	MW 10	2005	<0.0050	<0.0050	<0.0030	<0.0010	<0.010	0.02	0.011	<0.0030	<0.00040	<0.000020	<1.0	<0.050	<0.50	<1.0
Down-gradient Groundwater Samples																
28602	MW 11	2005	0.032	0.027	0.008	<0.0010	<0.010	0.06	0.072	<0.0030	<0.00040	<0.000020	<1.0	<0.050	<0.50	<1.0
28603	MW 12	2005	0.027	0.027	0.011	<0.0010	<0.010	0.07	0.077	0.005	<0.00040	<0.000020	<1.0	<0.050	<0.50	<1.0
28604	MW 13	2005	0.220	0.110	0.031	<0.0010	0.03	0.38	0.310	0.011	<0.00040	<0.000020	<1.0	<0.050	<0.50	<1.0
28605	MW 14	2005	0.130	0.086	0.041	<0.0010	0.03	0.32	0.250	0.007	<0.00040	<0.000020	<1.0	<0.050	<0.50	<1.0
20240/41	BMW 10	2006	0.010	0.035	<0.0030	<0.0010	<0.010	0.03	0.067	<0.0030	<0.00040	<0.000020	<1.0	<0.050	<0.50	<1.0
20242	MW 11	2006	0.009	0.025	<0.0030	<0.0010	<0.010	0.01	0.047	<0.0030	<0.00040	<0.000020	<1.0	<0.050	<0.50	<1.0
20243	MW 13	2006	0.064	0.079	0.004	<0.0010	<0.010	0.06	0.152	<0.0030	<0.00040	<0.000020	<1.0	<0.050	<0.50	<1.0
20244	MW 14	2006	0.028	0.032	0.003	<0.0010	<0.010	0.04	0.067	<0.0030	<0.00040	<0.000020	<1.0	<0.050	<0.50	<1.0
N Value			10	10	10	10	10	10	10	10	10	10	10			
Average			0.062	0.053	0.015	<0.0010	<0.010	0.129	0.119	<0.0030	<0.00040	<0.00002	<1.0			
Standard Deviation			0.069	0.032	0.018			0.143	0.095							
Minimum			0.003	0.025	0.002			0.013	0.011							
Maximum			0.220	0.110	0.048			0.380	0.310							
95% Confidence Limit			0.043	0.020	0.011			0.089	0.059							

4.0 Middle Site Non-Hazardous Waste Landfill/Tier II Soil Disposal Facility

The Middle Site Tier II Soil Disposal Facility/Non-Hazardous Waste Landfill is located between the main station area and the community of Qikiqtarjuaq. The Disposal Facility area is at the top of a pass about 30 m south of the station road on the west side of a saddle between two higher areas. Drainage from the area tends to flow to the west, with an average grade of 6%. This new landfill was constructed for the disposal of Tier II soil and non-hazardous waste. Before construction, the area had no visual or olfactory indication of contamination and no debris was noted in the area. The area consisted of undisturbed ground with soils consisting of sand with sorted gravel, cobble, and boulder strands. The terrain becomes more bouldery to the north and south of the landfill. The vegetation consists of mosses and a small amount of grasses.

The landfill was constructed with two separate cells, based on differing containment requirements. The Non-Hazardous Waste cell was constructed of compacted perimeter berms, with the placement of a cover of compacted granular fill over the landfilled material. The Tier II cell was constructed with the placement of low-permeability, saturated, compacted berms keyed into frozen/saturated ground, the installation of a liner system over the berms and along the landfill base, and the placement of a surface liner system over the landfill contents with the placement of overlying sufficient granular fill to promote freezeback of landfill contents. Five groundwater monitoring wells were installed at the landfill perimeter, and four thermistors were installed in the Tier II Facility cell.

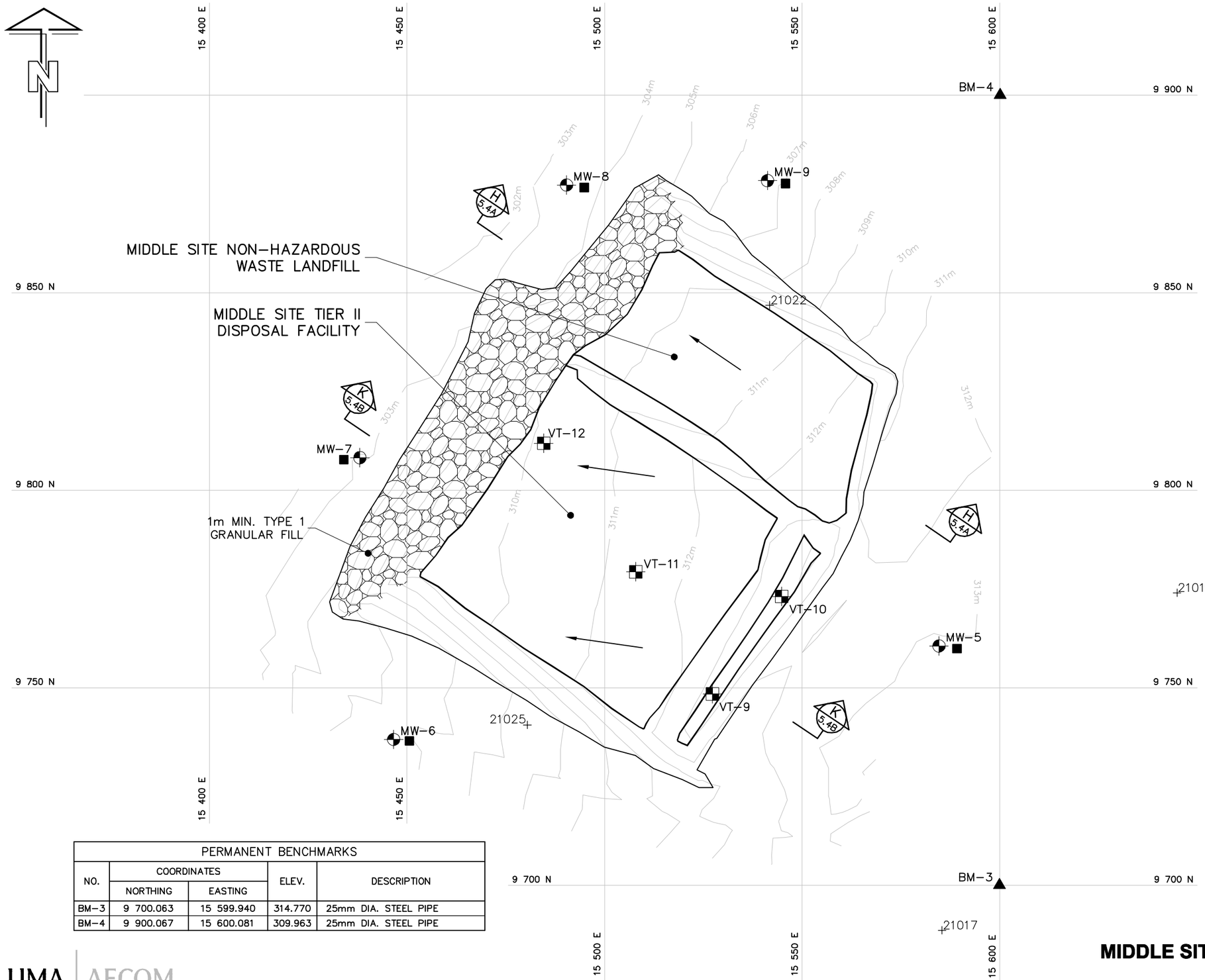
The long term monitoring plan consists of visual monitoring, collection of soil and groundwater samples and thermal monitoring. Approximate locations for the collection of soil and groundwater samples and thermal data are identified on Figure FOX-5.4.

4.1 Baseline Data

Sample locations for baseline soil samples are shown in Figure FOX-5.4. A summary of the baseline soil analytical data is provided in Table 4.1. Baseline data is comprised of soil samples collected from the existing footprint of the landfill prior to construction, as well as soil and groundwater samples collected during construction.

Soil baseline concentrations of inorganic elements at the Middle Site Facility are consistent with or lower than site background levels. No PCBs have been detected at the landfill. In 2004, 2005, and 2006 low-level hydrocarbons, primarily F1 and F3 fractions, were detected at locations both up-gradient and down-gradient of landfill lobes. The maximum concentration of TPH observed was 28 mg/kg.

A summary of baseline groundwater data is provided in Table 4.2. Baseline data was collected from permanent monitoring locations in 2004, 2005 and 2006. While there is no background groundwater data with which to compare, all the groundwater samples from each of the three site landfills have approximately the same concentrations and there are no extremely high concentrations of any of the inorganic elements. No PCBs and TPH were detected.



LEGEND:

- TBM4 — TEMPORARY BENCHMARK
- BM-1 — PERMANENT BENCHMARK
- 101 — COORDINATE POINT
- MONITORING SOIL SAMPLE LOCATION
- MONITORING WELL LOCATION
- VERTICAL THERMISTOR LOCATION
- 21022 — BASELINE SOIL SAMPLE LOCATION

COORDINATE POINTS (AS-BUILT)
VERTICAL THERMISTORS

NO.	NORTHING	EASTING
VT-9	9 748.5	15 527.3
VT-10	9 773.1	15 544.8
VT-11	9 779.4	15 507.9
VT-12	9 811.9	15 484.6

COORDINATE POINTS (AS BUILT)
MONITORING WELLS

NO.	NORTHING	EASTING	ELEV.
MW-5	9 760.6	15 584.6	313.23
MW-6	9 736.9	15 446.6	305.89
MW-7	9 808.2	15 438.1	303.13
MW-8	9 877.3	15 490.4	303.48
MW-9	9 878.4	15 541.2	306.69

SCALE 1:1000 — 0 10 20 30 m

RECORD DRAWING
NOT FOR CONSTRUCTION

PERMANENT BENCHMARKS

NO.	COORDINATES		ELEV.	DESCRIPTION
	NORTHING	EASTING		
BM-3	9 700.063	15 599.940	314.770	25mm DIA. STEEL PIPE
BM-4	9 900.067	15 600.081	309.963	25mm DIA. STEEL PIPE

UMA | AECOM

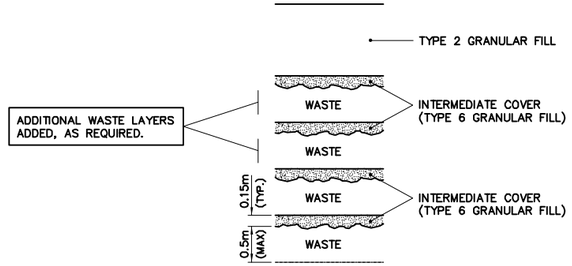
DWG NAME: F5-RD04.DWG CLC - 08/01/28

DEW LINE CLEAN UP
LANDFILL MONITORING PLAN

FOX-5 BROUGHTON ISLAND

MIDDLE SITE NON-HAZARDOUS WASTE LANDFILL AND TIER II DISPOSAL FACILITY

FIGURE FOX-5.4



WASTE PLACEMENT DETAIL

N.T.S.

NOTE:

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CONTRACT DRAWINGS INCLUDE THE ENGINEER'S STAMP.

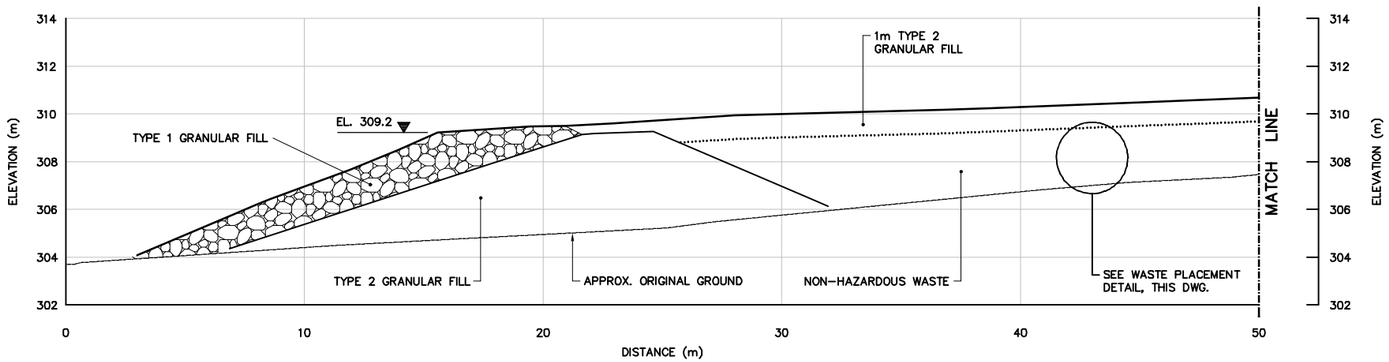
General Notes:

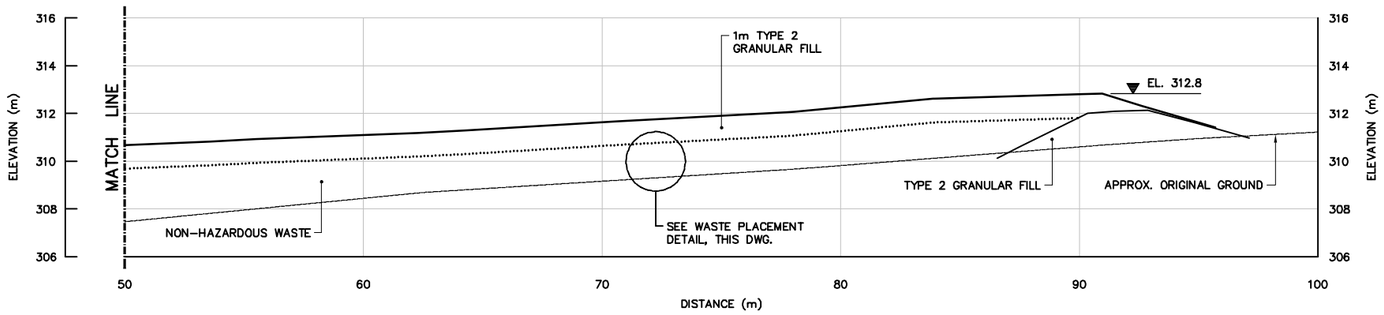
1. ALL ELEVATIONS ARE REFERENCED TO MEAN SEA LEVEL.
2. ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE.
3. KEY TRENCH EXTENDS BELOW ORIGINAL GROUND TO SATURATED GROUND (DEPTH VARIES).

Legend:

——— GENERATED BASED ON PROVIDED SURVEY INFORMATION

····· BASED ON DESIGN, NOT SURVEYED





SECTION H 5.4

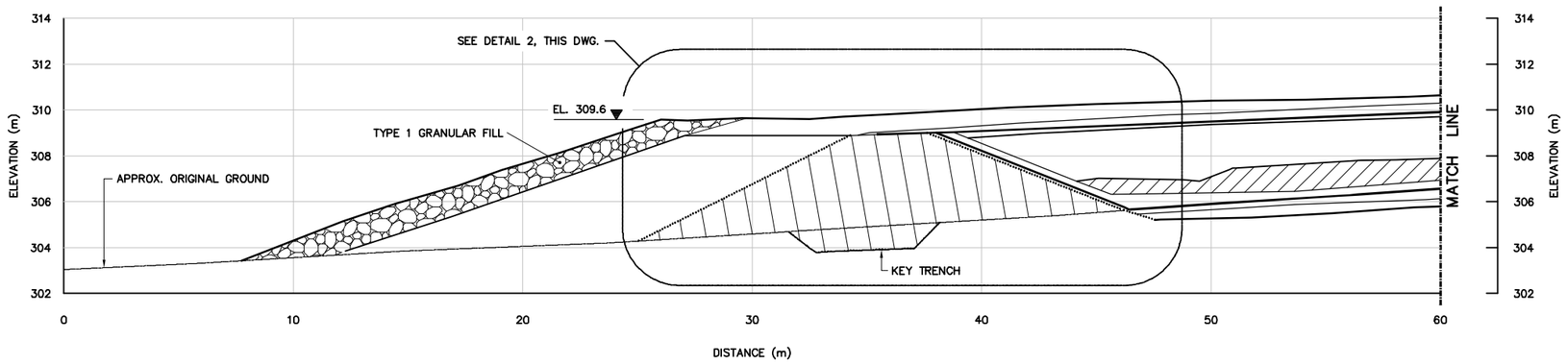
SCALE 1:250 0 2.5 5 m

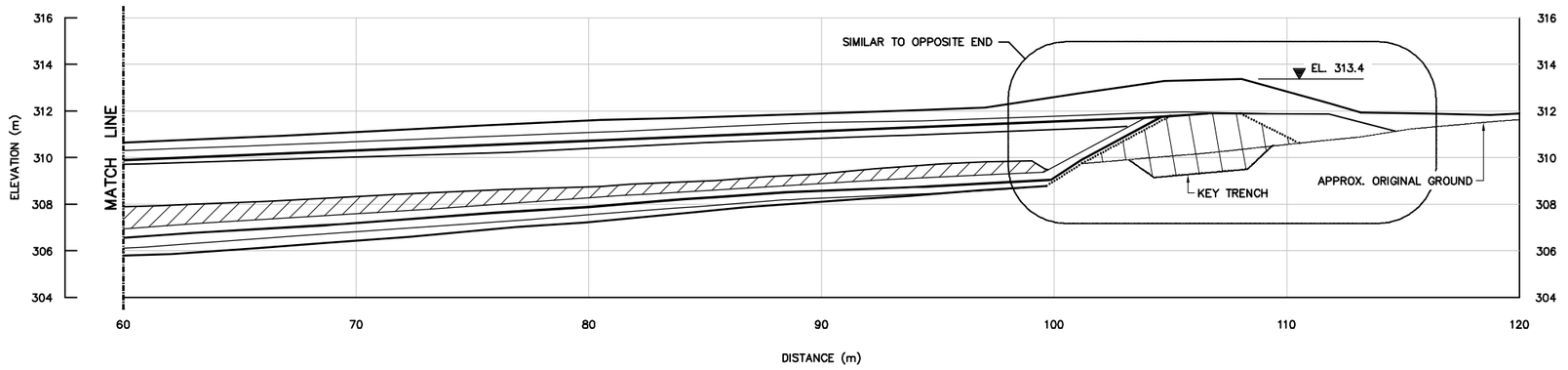
DEW LINE CLEAN UP
LANDFILL MONITORING PLAN

FOX-5 BROUGHTON ISLAND
MIDDLE SITE NON-HAZARDOUS WASTE LANDFILL
CROSS-SECTION
FIGURE FOX-5.4A

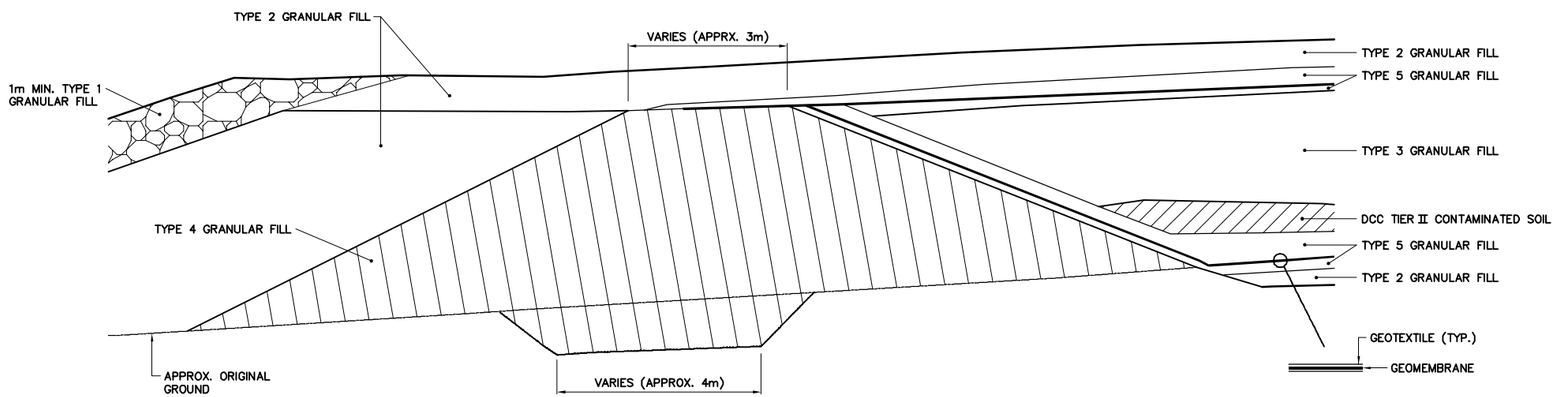
UMA | AECOM

DGS NAME: F5-R004A.DWG CLC — 08/01/28





SECTION K 5.4



DETAIL 2 N.T.S.

General Notes:

1. ALL ELEVATIONS ARE REFERENCED TO MEAN SEA LEVEL.
2. ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE.
3. KEY TRENCH EXTENDS BELOW ORIGINAL GROUND TO SATURATED GROUND (DEPTH VARIES).

Legend:

——— GENERATED BASED ON PROVIDED SURVEY INFORMATION

····· BASED ON DESIGN, NOT SURVEYED

NOTE:

THIS DRAWING HAS BEEN REPLOTTED FOR RECORD DRAWING PURPOSES FROM INFORMATION SUPPLIED BY DEFENCE CONSTRUCTION CANADA IN OCTOBER, 2006.

CONTRACT DRAWINGS INCLUDE THE ENGINEER'S STAMP.

SCALE 1:250 m (0, 2.5, 5)

UMA | AECOM

DEW LINE CLEAN UP
LANDFILL MONITORING PLAN

FOX-5 BROUGHTON ISLAND
TIER II DISPOSAL FACILITY
CROSS-SECTION
FIGURE FOX-5.4B

DOS NAME: F5-RD04B.DWG CLC - 08/01/28

Table 4.1: Middle Site Non-Hazardous Waste Landfill/Tier II Soil Disposal Facility– Baseline Soil Data

Sample #	Location	Date	Depth (cm)	Cu	Ni	Co	Cd	Pb	Zn	Cr	As	Hg	PCBs	TPH	TPH Identity		
															F1	F2	F3
Up-gradient Soil Samples																	
21019		2002	0	4.3	<5.0	<5.0	<1.0	<10	22	<20	<1.0		<0.1				
21020	21019	2002	140	6.8	5.1	<5.0	<1.0	<10	32	<20	1.9		<0.1				
21021	21019	2002	140	6.9	5.3	<5.0	<1.0	<10	33	<20	1.6		<0.1				
5950/51	MW 5	2004	0	9.6	8.3	7.5	<1.0	<10	46	<20	2.3	<0.10	<0.0030	<10	<10	<4.0	<9.0
5952	MW 5	2004	30	6.6	6.3	5	<1.0	<10	30	<20	1.6	<0.10	<0.0030	11	11	<4.0	<9.0
28610	MW 5	2005	0	9.2	<5.0	<5.0	<1.0	<10	18	<20	2.6		<0.0030	10	<10	<4.0	10
28612	MW 5	2005	40	5.6	<5.0	<5.0	<1.0	<10	19	<20	1.5		<0.0030	<10	<10	<4.0	<9.0
20286	MW 5	2006	0	6.2	<5.0	<5.0	<1.0	<10	23	<20	1.9	<0.10	<0.0030	21	< 10	< 4.0	21
20288	MW 5	2006	30	6.2	<5.0	<5.0	<1.0	<10	24	<20	3.1	<0.10	<0.0030	28	< 10	< 4.0	28
Down-gradient Soil Samples																	
21017		2002	0	6.6	<5.0	<5.0	<1.0	<10	32	<20	1.6		<0.1				
21018	21017	2002	130	8.6	6.5	5.7	<1.0	<10	41	<20	1.9		<0.1				
21022		2002	0	6.9	6.6	<5.0	<1.0	<10	31	<20	2.5		<0.1				
21023	21022	2002	60														
21024	21022	2002	140	6.0	<5.0	<5.0	<1.0	<10	29	<20	1.7		<0.1				
21025		2002	0	8.8	5.9	5.7	<1.0	<10	38	<20	1.5		<0.1				
21026	21025	2002	120	7.2	6.1	5.3	<1.0	<10	38	<20	1.6		<0.1				
5954	MW 6	2004	0	6.1	6.1	<5.0	<1.0	<10	28	<20	1.4	<0.10	<0.0030	23	<10	<4.0	23
5956	MW 6	2004	30	7.1	6.0	5.5	<1.0	<10	33	<20	1.8	<0.10	<0.0030	<10	<10	<4.0	<9.0
5958	MW 7	2004	0	9.5	7.7	5.6	<1.0	<10	43	<20	1.8	<0.10	<0.0030	12	<10	<4.0	12
5960/61	MW 7	2004	30	9.2	8.0	6	<1.0	<10	44	<20	1.6	<0.10	<0.0030	11	11	<4.0	<9.0
5962	MW 8	2004	0	7.3	6.6	6.1	<1.0	<10	36	<20	2.1	<0.10	<0.0030	16	<10	<4.0	16
5964	MW 8	2004	30	6.8	<5.0	<5.0	<1.0	<10	27	<20	2.0	<0.10	<0.0030	20	10	<4.0	10
5966	MW 9	2004	0	6.6	5.0	<5.0	<1.0	<10	27	<20	1.4	<0.10	<0.0030	10	10	<4.0	<9.0
5968	MW 9	2004	30	6.1	5.0	<5.0	<1.0	<10	27	<20	2.1	<0.10	<0.0030	<10	<10	<4.0	<9.0

Sample #	Location	Date	Depth (cm)	Cu	Ni	Co	Cd	Pb	Zn	Cr	As	Hg	PCBs	TPH	TPH Identity		
															F1	F2	F3
28614	MW 6	2005	0	7.0	5.3	<5.0	<1.0	<10	28	<20	1.9		<0.0030	26	<10	<4.0	26
28616	MW 6	2005	40	8.2	6.4	5.3	<1.0	<10	33	<20	2.1		<0.0030	<10	<10	<4.0	<9.0
28618	MW 7	2005	0	8.4	6.2	<5.0	<1.0	<10	32	<20	1.9		<0.0030	20	<10	<4.0	20
28620	MW 7	2005	40	9.3	7.0	5.7	<1.0	<10	42	<20	1.9		<0.0030	13	<10	<4.0	13
28622	MW 8	2005	0	8.3	5.9	5.1	<1.0	<10	31	<20	2.5		<0.0030	14	<10	<4.0	14
28624	MW 8	2005	40	7.6	6.6	5.1	<1.0	<10	31	<20	2.3		<0.0030	<10	<10	<4.0	<9.0
28626	MW 9	2005	0	7.6	5.6	<5.0	<1.0	<10	30	<20	2.2		<0.0030	13	<10	<4.0	13
28628	MW 9	2005	40	6.9	5.9	<5.0	<1.0	<10	29	<20	1.9		<0.0030	<10	<10	<4.0	<9.0
20290/91	MW 6	2006	0	7.7	5.2	<5.0	<1.0	<10	31	<20	2.0	<0.10	<0.0030	20	< 10	< 4.0	20
20292	MW 6	2006	30	7.3	5.2	<5.0	<1.0	<10	29	<20	2.5	<0.10	<0.0030	<10	< 10	< 4.0	< 9.0
20294	MW 7	2006	0	11.0	7.4	5.8	<1.0	<10	44	<20	2.9	<0.10	<0.0030	<10	< 10	< 4.0	< 9.0
20296	MW 7	2006	30	9.1	6.3	5.1	<1.0	<10	39	<20	1.8	<0.10	<0.0030	<10	< 10	< 4.0	< 9.0
20298	MW 8	2006	0	8.4	5.3	<5.0	<1.0	<10	29	<20	3.2	<0.10	<0.0030	16	< 10	< 4.0	16
20300/01	MW 8	2006	30	9.4	<5.0	<5.0	<1.0	<10	31	<20	3.5	<0.10	<0.0030	<10	< 10	< 4.0	<9.0
20302	MW 9	2006	0	7.3	<5.0	<5.0	<1.0	<10	27	<20	2.8	<0.10	<0.0030	15	< 10	< 4.0	15
20304	MW 9	2006	30	7.8	5.5	<5.0	<1.0	<10	29	<20	2.5	<0.10	<0.0030	10	< 10	< 4.0	10
	N Value			39	39	39	39	39	39	39	39	20	39	30			
	Average			7.6	5.2	<5.0	<1.0	<10	31.7	<20	2.0	<0.10	<0.0030	16.3			
	Standard Deviation			1.4	1.8				6.7		0.6			5.6			
	Minimum			4.3	<5.0	<5.0			18.0		<1.0			10.0			
	Maximum			11.0	8.3	7.5			46.0		3.5		<0.1	28.0			
	95% Confidence Limit			0.4	0.6				2.1		0.2			2.0			

Table 4.2: Middle Site Non-Hazardous Waste Landfill/Tier II Soil Disposal Facility – Baseline Groundwater Data

Sample #	Location	Date	Cu	Ni	Co	Cd	Pb	Zn	Cr	As	Hg	PCBs	TPH	TPH Identity		
														F1	F2	F3
Up-gradient Groundwater Samples																
5919	MW 5	2004										<0.020	<1.0	<0.050	<0.50	<1.0
28595	MW 5	2005	<0.0050	0.0062	<0.0030	<0.0010	<0.010	0.01	0.014	<0.0030	<0.00040	<0.000020	<1.0	<0.050	<0.50	<1.0
20229	MW 5	2006	0.0293	0.1573	0.0033	<0.0010	<0.010	0.1681	0.304	<0.0030	<0.00040	<0.000020	<1.0	<0.050	<0.50	<1.0
Down-gradient Groundwater Samples																
5946	MW 6	2004										<0.020	<1.0	<0.050	<0.50	<1.0
5947	MW 7	2004										<0.020	<1.0	<0.050	<0.50	<1.0
5948	MW 8	2004										<0.020	<1.0	<0.050	<0.50	<1.0
5949	MW 9	2004										<0.020	<1.0	<0.050	<0.50	<1.0
28596	MW 6	2005	0.0074	0.0087	<0.0030	<0.0010	<0.010	<0.010	0.02	<0.0030	<0.00040	<0.000020	<1.0	<0.050	<0.50	<1.0
28597	MW 7	2005	0.008	0.013	<0.0030	<0.0010	<0.010	0.01	0.02	<0.0030	<0.00040	<0.000020	<1.0	<0.050	<0.50	<1.0
28598	MW 8	2005	<0.0050	0.0095	<0.0030	<0.0010	<0.010	0.087	0.016	<0.0030	<0.00040	<0.000020	<1.0	<0.050	<0.50	<1.0
28599	MW 9	2005	0.0083	0.011	<0.0030	<0.0010	<0.010	<0.010	0.026	<0.0030	<0.00040	<0.000020	<1.0	<0.050	<0.50	<1.0
20230/31	MW 6	2006	0.0125	0.068	<0.0030	<0.0010	<0.010	<0.010	0.1346	<0.0030	<0.00040	<0.000020	<1.0	<0.050	<0.50	<1.0
20232	MW 7	2006	0.0158	0.029	<0.0030	<0.0010	<0.010	0.0231	0.0501	<0.0030	<0.00040	<0.000020	<1.0	<0.050	<0.50	<1.0
20233	MW 8	2006	0.0221	0.061	<0.0030	<0.0010	<0.010	0.2992	0.1191	<0.0030	<0.00040	<0.000020	<1.0	<0.050	<0.50	<1.0
20234	MW 9	2006	0.013	0.068	<0.0030	<0.0010	<0.010	0.02	0.132	<0.0030	<0.00040	<0.000020	<1.0	<0.050	<0.50	<1.0
N Value			10	10	10	10	10	10	10	10	10	15	15			
Average			0.012	0.043	<0.0030	<0.0010	<0.010	0.063	0.084	<0.0030	<0.00040	<0.000020	<1.0			
Standard Deviation			0.008	0.048				0.098	0.092							
Minimum			<0.0050	0.006				<0.010	0.014							
Maximum			0.029	0.157				0.299	0.304							
95% Confidence Limit			0.005	0.030				0.061	0.057							

Appendix A
FOX-5 Broughton Island Year 1 Monitoring Data

FOX-5 Broughton Island - 2007 Landfill Monitoring

In August 2007, a visual inspection of each landfill and downloading of ground temperature and pore pressure data, where required, was carried out by EBA Engineering Consultants Ltd. (EBA). Soil and groundwater samples were collected where applicable by the Environmental Sciences Group (ESG). Samples were analyzed at Queen's University and Royal Military College laboratories, in Kingston, Ontario.

The following table documents the specific monitoring requirements for 2007 (year 1 of monitoring) at each landfill.

Landfill Classification	Visual Inspection	Groundwater Sampling	Soil Sampling	Thermal Monitoring	Pore Pressure Monitoring*
Station Area Non-Hazardous Waste Landfill	√	√	√		
Main Landfill	√		√	√	√
Middle Site Tier II Disposal Facility/Non-Hazardous Waste Landfill	√	√	√		

This appendix serves as a compilation of the EBA geotechnical report (EBA 2008) and the ESG environmental report (ESG 2007) to document the results of landfill monitoring from year 1. The data is organized by landfill in separate annexes. The following information is provided in each annex:

- Visual inspection checklist;
- Visual inspection drawing mark-up;
- A selection of visual inspection photos (all photos will be provided electronically);
- Thermal monitoring summary (where applicable);
- Pore pressure monitoring summary (where applicable);
- Plots of ground temperatures with depth at each thermistor installation (where applicable);
- Summary of 2007 soil analytical data;
- Evaluation of 2007 soil analytical data, as compared to baseline conditions;
- Summary of 2007 groundwater analytical data; and
- Monitoring well development/sampling reports (where applicable).

Summary of Significant Observations

With the exception of thermal and pore pressure data, no interpretation or recommendations have been provided in this appendix; these shall be provided by the Environmental Working Group - Nunavut Tunngavik Incorporated (EWG-NTI). Meeting minutes from the review shall be appended to this report.

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Annex: Station Non-Hazardous Waste Landfill- Year 1 Data

Figures:

- FOX-5.2: Station Non-Hazardous Waste Landfill

Tables:

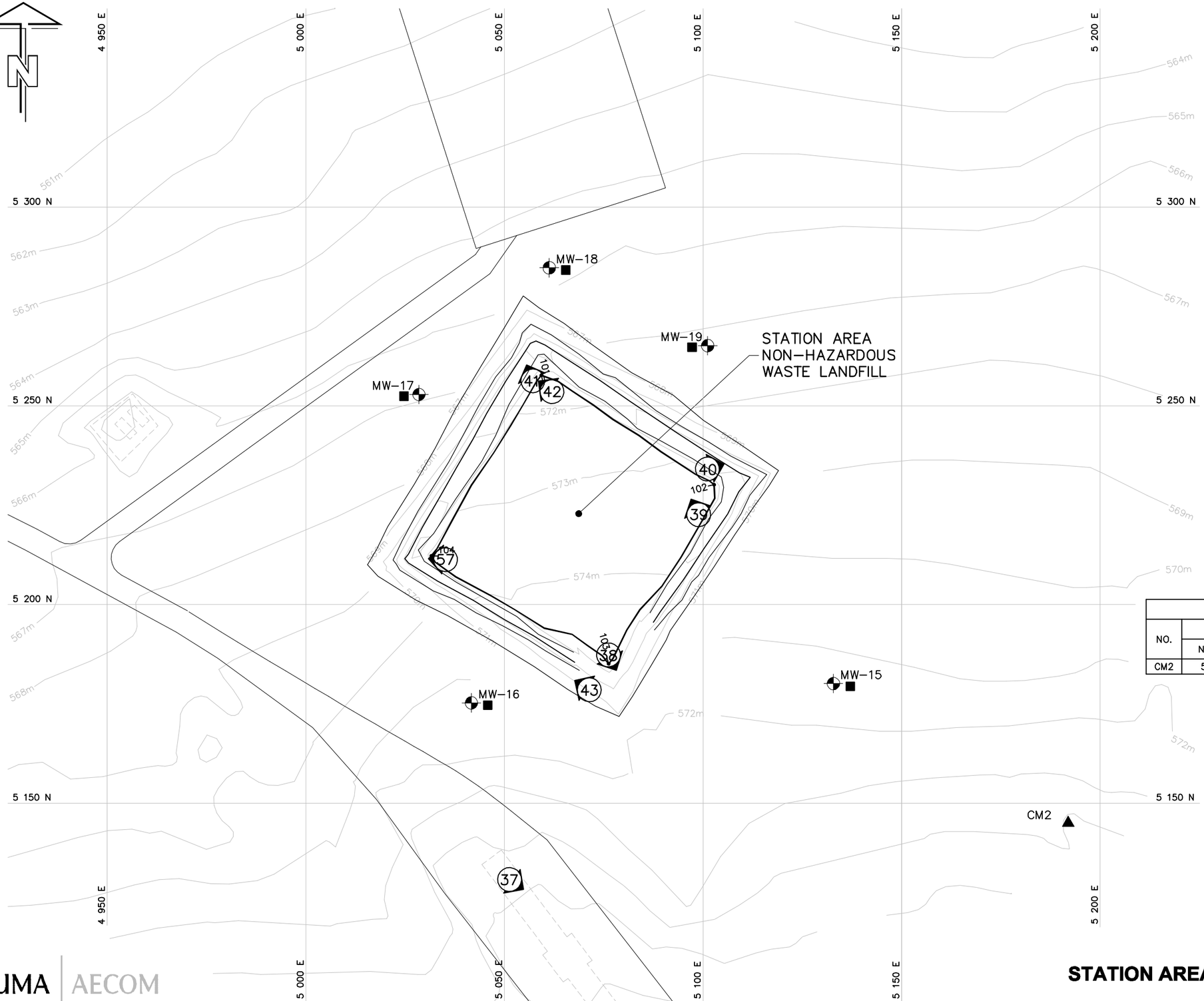
- Landfill Visual Inspection - FOX-5 Broughton Island Station Area Non-Hazardous Waste Landfill
- Station Non-Hazardous Waste Landfill - Year 1 (2007) Soil Data
- Station Non-Hazardous Waste Landfill - Evaluation of Year 1 Soil Analytical Data
- Station Non-Hazardous Waste Landfill - Year 1 (2007) Groundwater Data

Photographic Records:

- Photos A1 through A3

Well Sampling Records:

- Well MW 15
- Well MW 16
- Well MW 17
- Well MW 18
- Well MW 19



LEGEND:

- TBM4 — TEMPORARY BENCHMARK
- BM–1 — PERMANENT BENCHMARK
- 101 — COORDINATE POINT
- MONITORING SOIL SAMPLE LOCATION
- MONITORING WELL LOCATION
- 39 — PHOTOGRAPHIC VIEWPOINT

COORDINATE POINTS (AS BUILT)
NON–HAZARDOUS WASTE LANDFILL

NO.	NORTHING	EASTING	ELEV.
101	5 257.7	5 059.3	571.4
102	5 230.2	5 102.8	573.5
103	5 185.1	5 076.2	574.6
104	5 212.3	5 031.6	573.5

COORDINATE POINTS (AS BUILT)
MONITORING WELLS

NO.	NORTHING	EASTING	ELEV.
MW–15	5 180.1	5 132.8	571.50
MW–16	5 175.2	5 041.7	570.63
MW–17	5 252.9	5 028.5	567.00
MW–18	5 284.7	5 061.3	565.82
MW–19	5 265.1	5 101.2	567.33

SURVEY CONTROL MONUMENTS

NO.	COORDINATES		ELEV.	DESCRIPTION
	NORTHING	EASTING		
CM2	5 145.012	5 191.951	574.530	FOX–5 BASELINE STA. –2+07.90

SCALE 1:1000 — 0 10 20 30 m

RECORD DRAWING
NOT FOR CONSTRUCTION

UMA | AECOM

DWG NAME: F5–RD02.DWG CLC – 07/12/13

DEW LINE CLEAN UP
LANDFILL MONITORING PLAN

FOX-5 BROUGHTON ISLAND

STATION AREA NON-HAZARDOUS WASTE LANDFILL

FIGURE FOX-5.2

LANDFILL VISUAL INSPECTION

Site Name: FOX-5, Broughton Island
Landfill: **Station Area Non-Hazardous Waste Landfill**
Designation:
Date Inspected: August 19 to August 21, 2007
Inspected by: Ed Grozic, P.Eng.
EBA Engineering Consultants Ltd.

Signature: 

TABLE B1: STATION AREA NON-HAZARDOUS WASTE LANDFILL

Checklist Item	Present (Yes/No)	Location	Length	Width	Depth	Extent	Description	Photographic Records	Severity Rating	Additional Comments
Settlement	No	N/A	N/A	N/A	N/A	None	N/A	N/A	Not observed	N/A
Erosion	No	N/A	N/A	N/A	N/A	None	N/A	N/A	Not observed	N/A
Frost Action	No	N/A	N/A	N/A	N/A	None	N/A	N/A	Not observed	N/A
Animal Burrows	No	N/A	N/A	N/A	N/A	None	N/A	N/A	Not observed	N/A
Vegetation	No	N/A	N/A	N/A	N/A	None	N/A	N/A	Not observed	N/A
Staining	No	N/A	N/A	N/A	N/A	None	N/A	N/A	Not observed	N/A
Vegetation Stress	No	N/A	N/A	N/A	N/A	None	N/A	N/A	Not observed	N/A
Seepage Points	No	N/A	N/A	N/A	N/A	None	N/A	N/A	Not observed	N/A
Debris Exposed	No	N/A	N/A	N/A	N/A	None	N/A	N/A	Not observed	N/A
Presence/Condition of Monitoring Instruments	No	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Not observed	N/A
Other Features of Note	No									
Overall Landfill Performance:	**Acceptable**									

Station Non-Hazardous Waste Landfill - Year 1 (2007) Soil Data (in mg/kg)

Sample #	Location	Date	Depth (cm)	Cu	Ni	Co	Cd	Pb	Zn	Cr	As	Hg	PCBs	TPH	TPH Identity		
															F1	F2	F3
Station Non-Hazardous Waste Landfill - Baseline Concentrations				**8.4+/- 1.4**	**<5.0**	**<5.0**	**<1.0**	**<10**	**31.7 +/- 1.4**	**<20**	**1.6 +/- 0.3**	**<0.10**	**<0.0030**	**270 +/- 274**			
Station Non-Hazardous Waste Landfill - Max Concentrations				**17**	**11**	**7.7**		**17**	**39**	**23**	**3.3**		**0.6**	**2060**			
Up-gradient Soil Samples																	
24776	MW 15	2007	10	12	9.0	6.5	<1.0	<10	32	<20	1.5	<0.10	<0.0030	<10	<10	4.4	<9.0
24778	MW 15	2007	40	11	8.2	5.9	<1.0	<10	31	<20	1.1	<0.10	<0.0030	<10	<10	4.5	<9.0
24770	MW 16	2007	10	9.2	<5.0	<5.0	<1.0	<10	40	<20	1.4	<0.10	<0.0030	16	<10	6.0	10
24772	MW 16	2007	40	64	<5.0	<5.0	<1.0	<10	44	<20	<1.0	<0.10	<0.0030	443	<10	53	390
Down-gradient Soil Samples																	
24790/91	MW 17	2007	10	5	<5.0	<5.0	<1.0	<10	25	<20	<1.0	<0.10	<0.0030	<10	<10	5.6	<9.0
24792	MW 17	2007	40	<3.0	<5.0	<5.0	<1.0	<10	18	<20	1.2	<0.10	<0.0030	<10	<10	5.3	<9.0
24786	MW 18	2007	10	4.6	<5.0	5.0	<1.0	<10	31	<20	1.9	<0.10	<0.0030	19.2	<10	5.2	14
24788	MW 18	2007	40	6	<5.0	5.1	<1.0	14	34	<20	1.8	<0.10	<0.0030	322	<10	52	270
24780	MW 19	2007	10	4	<5.0	<5.0	<1.0	<10	19	<20	1.4	<0.10	<0.0030	<40	<10	5.5	<9.0
24782	MW 19	2007	40	5	<5.0	<5.0	<1.0	<10	25	<20	2.4	<0.10	<0.0030	<40	<10	< 4.0	<9.0

Station Landfill - EVALUATION OF YEAR 1 SOIL ANALYTICAL DATA

Parameter	N value Baseline	Arithmetic Mean +/- 95% Confidence Limit Baseline	Maximum Baseline [mg/kg]	2007	Comments
Copper	27	8.4+/- 1.4	17	Concentrations within 95% confidence interval, with three exceptions.	Up-gradient surface and depth samples at MW 15 had concentrations of 12 & 11 mg/kg, respectively (below baseline maximum). Up-gradient depth sample at MW 16 had a concentration of 64 mg/kg (above baseline max).
Nickel	21	<5.0	11	Concentrations consistent with baseline mean (non-detect), with 2 exceptions	Up-gradient surface and depth samples at MW 15 had concentrations of 9.0 & 5.9 mg/kg, respectively (below baseline maximum).
Cobalt	21	<5.0	7.7	Concentrations consistent with baseline mean (non-detect) for six of ten samples.	Up-gradient surface and depth samples at MW 15 had concentrations of 6.5 & 5.9 mg/kg, respectively. Down-gradient samples (surface and depth) at MW 18 were also slightly above baseline, with concentrations of 5.0 & 5.1 mg/kg respectively. All below baseline max.
Cadmium	21	<1.0		Concentrations consistent with baseline mean (non-detect).	
Lead	27	<10	17	Concentrations consistent with baseline mean (non-detect), with 1 exception.	Down-gradient depth sample at MW 18 had a concentration of 14 mg/kg (below baseline max).
Zinc	25	31.7+/- 1.4	39	Concentrations consistent with baseline mean (non-detect), with 2 exceptions.	Up-gradient surface and depth samples at MW 16 had a concentration of 40 & 41 mg/kg respectively (below baseline max).
Chromium	21	<20	23	Concentrations consistent with baseline mean (non-detect).	
Arsenic	21	1.6+/- 0.3	3.3	Concentrations within 95% confidence interval, with one exception.	Depth sample at MW 19 had a concentration of 2.4 mg/kg (below baseline max).
Mercury	12	<0.10		Concentrations consistent with baseline mean (non-detect).	
PCBs	25	<0.0030	0.6	Results all non-detect.	

Station Landfill - EVALUATION OF YEAR 1 SOIL ANALYTICAL DATA

Parameter	N value Baseline	Arithmetic Mean +/- 95% Confidence Limit Baseline	Maximum Baseline [mg/kg]	2007	Comments
TPH	25	270+/- 274	2060	Concentrations within 95% confidence interval.	Up-gradient samples at MW 16 had elevated levels of TPH (up to 443 mg/kg at depth), and down-gradient samples at MW 18 had elevated concentrations (up to 322 mg/kg at depth). Concentrations have decreased at MW 16 but increased at MW 18, down-gradient.

Station Non-Hazardous Waste Landfill - Year 1 (2007) Groundwater Data (in mg/L)

Sample #	Location	Date	Cu	Ni	Co	Cd	Pb	Zn	Cr	As	Hg	PCBs	TPH	TPH Identity		
														F1	F2	F3
Up-gradient Groundwater Samples																
24779	MW 15	2007	0.024	0.16	0.0066	<0.0010	<0.010	0.052	0.33	<0.0030	< 0.00040	< 0.000020	<1.0	< 0.050	< 0.50	< 1.0
24774	MW 16	2007	0.031	0.060	0.0089	<0.0010	<0.010	0.12	0.11	<0.0030	< 0.00040	< 0.000020	<1.0	< 0.050	< 0.50	< 1.0
Down-gradient Groundwater Samples																
24794	MW 17	2007	0.011	0.038	<0.0030	<0.0010	<0.010	0.021	0.073	<0.0030	< 0.00040	< 0.000020	<1.0	< 0.050	< 0.50	< 1.0
24789	MW 18	2007	0.058	0.16	0.0030	<0.0010	<0.010	0.12	0.32	<0.0030	< 0.00040	< 0.000020	<1.0	< 0.050	< 0.50	< 1.0
24784	MW 19	2007	0.032	0.052	0.013	<0.0010	<0.010	0.10	0.11	<0.0030	< 0.00040	< 0.000020	<1.0	< 0.050	< 0.50	< 1.0

Photo 18 (Image 42 SNHWLF)
Station Non-hazardous Waste Landfill - Panoramic from south corner.

Photo 19 (Image 37 SNHWLF)
Station Non-hazardous Waste Landfill - View from DEW Line clean up monument.

Photo 20 (Image 39 SNHWLF)
Station Non-hazardous Waste Landfill - East facing slope looking southwest.

Monitoring Well Sampling Log - BMW #15 2007

Site Name:	FOX-5
Date of Sampling Event:	18-Aug-07
Names of Samplers:	Matthew Mackay
	Dana Kelly
	Sam Soja
Monitoring Well ID:	BMW #15
Facility:	Station Non-Hazardous LF

Water Sample Measured Data

Condition of Well:	Well Ok, Casing Intact, DEW Line Lock cut and replaced, Bentonite has expanded half way up the inside of the casing		
Procedure/Equipment:	Measuring Tape	Procedure/Equipment:	Interface Meter
Well height above ground (m)=	0.35	Depth to water surface (m)=	0.76
Diameter of well (m)=	0.05	Static water level* (m)=	0.76
Depth of installation* (m)=	4.55	Depth to bottom (m)=	1.77
Length screened section (m)=	1.0	Free product thickness (mm)=	None
Depth to top of screen* (m)=	0.52		

Calculations		**Notes**	
Depth of water (m)=	1.01	Evidence of sludge etc:	None
Well volume of water (L)=	2.0	Evidence of freezing/siltation: (compare to installation record)	Ice at bottom
Length screen collecting water (m)=	1.01		

Purging Information

Equipment:	Waterra Tubing with ball

Date & Time	Volume Removed (L)	Temperature (^{o}C)	pH	Conductivity (uS/cm)	Turbidity (NTU)	Description of water
11:00	2.5	2	12.28	3	79.9	Water is very turbid and brown in color

Water Sampling		**Soil Sampling**	
Date and time collected:	18/08/2007 11:20	Date and time collected:	15/08/2007 14:15
Sample Number - Water:	07-24779	Sample Number - Soil:	07-24775/76 - 10 cm
			07-24777/78 -30 cm
Sample containers:	1 L HDPE	Sample containers:	Whirlpaks
	1 L Teflon		125 mL Jars
	250 mL Amber Glass		
Procedure/Equipment:	Waterra Tubing with ball valve	Procedure/Equipment:	Shovel, Plastic scoop
Water description:	Water is still slightly	Soil description:	Brown wet silt with sand and some gravel/rocks
Filtration: (Y/N)	N		
Acidification: (Y/N)	N		
Sampling Equipment Decontamination: (Y/N)	Y	Sampling Equipment Decontamination: (Y/N)	N
Number washes:	1	Number washes:	n/a
Number rinses:	1	Number rinses:	n/a

n/a=not applicable

*From ground surface. Unless this is stated, all measurements are assumed to be from the top of the casing.

Monitoring Well Sampling Log - BMW #16 2007

Site Name:	FOX-5
Date of Sampling Event:	18-Aug-07
Names of Samplers:	Matthew Mackay
	Dana Kelly
	Sam Soja
Monitoring Well ID:	BMW # 16
Facility:	Station Non-Hazardous LF

Water Sample Measured Data

Condition of Well:	Well Ok, Casing Intact, DEW Line Lock cut and replaced		
Procedure/Equipment:	Measuring Tape	Procedure/Equipment:	Interface Meter
Well height above ground (m)=	0.45	Depth to water surface (m)=	0.33
Diameter of well (m)=	0.05	Static water level* (m)=	0.33
Depth of installation* (m)=	4.46	Depth to bottom (m)=	1.44
Length screened section (m)=	1.0	Free product thickness (mm)=	None
Depth to top of screen* (m)=	0.46		

Calculations		Notes	
Depth of water (m)=	1.11	Evidence of sludge etc:	None
Well volume of water (L)=	2.2	Evidence of freezing/siltation: (compare to installation record)	Ice at bottom
Length screen collecting water (m)=	0.98		

Purging Information

Equipment: Waterra Tubing with ball

Date & Time	Volume Removed (L)	Temperature (^{o}C)	pH	Conductivity (uS/cm)	Turbidity (NTU)	Description of water
12:00	2.5	2.2	11	10	72.4	Slightly brown in color, cloudy

Water Sampling		Soil Sampling	
Date and time collected:	18/08/2007 12:00	Date and time collected:	15/08/2007 13:30
Sample Number - Water:	07-24774	Sample Number - Soil:	07-24770/71 -10 cm
			07-24772/73 -30 cm
Sample containers:	1 L HDPE	Sample containers:	Whirlpaks
	1 L Teflon		125 mL Jars
	250 mL Amber Glass		
Procedure/Equipment:	Waterra Tubing with ball valve	Procedure/Equipment:	Shovel, Plastic scoop
Water description:	Water clear	Soil description:	Brown wet silt with sand and some gravel/rocks
Filtration: (Y/N)	N		
Acidification: (Y/N)	N		
Sampling Equipment Decontamination: (Y/N)	Y	Sampling Equipment Decontamination: (Y/N)	N
Number washes:	1	Number washes:	n/a
Number rinses:	1	Number rinses:	n/a

n/a=not applicable

*From ground surface. Unless this is stated, all measurements are assumed to be from the top of the casing.

Monitoring Well Sampling Log - MW #17 2007

Site Name:	FOX-5
Date of Sampling Event:	18-Aug-07
Names of Samplers:	Matthew Mackay
	Dana Kelly
	Sam Soja
Monitoring Well ID:	MW # 17
Facility:	Station Non-Hazardous LF

Water Sample Measured Data

Condition of Well:	Well Ok, Casing Intact, DEW Line Lock cut and replaced		
Procedure/Equipment:	Measuring Tape	Procedure/Equipment:	Interface Meter
Well height above ground (m)=	0.29	Depth to water surface (m)=	1.04
Diameter of well (m)=	0.05	Static water level* (m)=	1.04
Depth of installation* (m)=	4.46	Depth to bottom (m)=	1.37
Length screened section (m)=	2.0	Free product thickness (mm)=	None
Depth to top of screen* (m)=	0.60		

Calculations		Notes	
Depth of water (m)=	0.33	Evidence of sludge etc:	None
Well volume of water (L)=	0.6	Evidence of freezing/siltation: (compare to installation record)	Ice at bottom
Length screen collecting water (m)=	0.33		

Purging Information

Equipment: Waterra Tubing with ball

Date & Time	Volume Removed (L)	Temperature (^{o}C)	pH	Conductivity (uS/cm)	Turbidity (NTU)	Description of water
14:30	0.9	1.8	12.64	5	66.4	Water is clear

Water Sampling		Soil Sampling	
Date and time collected:	18/08/2007 14:30	Date and time collected:	15/08/2007 17:00
Sample Number - Water:	07-24794	Sample Number - Soil:	07-24790/91 -10 cm
			07-24792/93 -30 cm
Sample containers:	1 L HDPE	Sample containers:	Whirlpaks
	1 L Teflon		125 mL Jars
	250 mL Amber Glass		
Procedure/Equipment:	Waterra Tubing with ball valve	Procedure/Equipment:	Shovel, Plastic scoop
Water description:	Clear	Soil description:	Brown wet silt with sand and some gravel/rocks
Filtration: (Y/N)	N		
Acidification: (Y/N)	N		
Sampling Equipment Decontamination: (Y/N)	Y	Sampling Equipment Decontamination: (Y/N)	N
Number washes:	1	Number washes:	n/a
Number rinses:	1	Number rinses:	n/a

n/a=not applicable

*From ground surface. Unless this is stated, all measurements are assumed to be from the top of the casing.

Monitoring Well Sampling Log - MW #18 2007

Site Name:	FOX-5
Date of Sampling Event:	18-Aug-07
Names of Samplers:	Matthew Mackay
	Dana Kelly
	Sam Soja
Monitoring Well ID:	MW # 18
Facility:	Station Non-Hazardous LF

Water Sample Measured Data

Condition of Well:	Well Ok, Casing Intact, DEW Line Lock cut and replaced		
Procedure/Equipment:	Measuring Tape	Procedure/Equipment:	Interface Meter
Well height above ground (m)=	0.35	Depth to water surface (m)=	0.49
Diameter of well (m)=	0.05	Static water level* (m)=	0.49
Depth of installation* (m)=	4.6	Depth to bottom (m)=	0.60
Length screened section (m)=	3.0	Free product thickness (mm)=	None
Depth to top of screen* (m)=	0.60		

Calculations		**Notes**	
Depth of water (m)=	0.11	Evidence of sludge etc:	None
Well volume of water (L)=	0.2	Evidence of freezing/siltation: (compare to installation record)	Ice at bottom
Length screen collecting water (m)=	0		

Purging Information

Equipment: Waterra Tubing with ball

Date & Time	Volume Removed (L)	Temperature (^{o}C)	pH	Conductivity (uS/cm)	Turbidity (NTU)	Description of water
15:20	0.25	2.4	12.29	4	24	Water is clear

Water Sampling		**Soil Sampling**	
Date and time collected:	18/08/2007 15:20	Date and time collected:	15/08/2007 16:30
Sample Number - Water:	07-24789	Sample Number - Soil:	07-24785/86 -10 cm
			07-24787/88 -30 cm
Sample containers:	1 L HDPE	Sample containers:	Whirlpaks
	1 L Teflon		125 mL Jars
	250 mL Amber Glass		
Procedure/Equipment:	Waterra Tubing with ball valve	Procedure/Equipment:	Shovel, Plastic scoop
Water description:	Clear	Soil description:	Brown wet silt with sand and some gravel/rocks
Filtration: (Y/N)	N		
Acidification: (Y/N)	N		
Sampling Equipment Decontamination: (Y/N)	Y	Sampling Equipment Decontamination: (Y/N)	N
Number washes:	1	Number washes:	n/a
Number rinses:	1	Number rinses:	n/a

n/a=not applicable

*From ground surface. Unless this is stated, all measurements are assumed to be from the top of the casing.

Monitoring Well Sampling Log - MW #19 2007

Site Name:	FOX-5
Date of Sampling Event:	18-Aug-07
Names of Samplers:	Matthew Mackay
	Dana Kelly
	Sam Soja
Monitoring Well ID:	MW # 19
Facility:	Station Non-Hazardous LF

Water Sample Measured Data			
Condition of Well:	Well Ok, Casing Intact, DEW Line Lock cut and replaced		
Procedure/Equipment:	Measuring Tape	Procedure/Equipment:	Interface Meter
Well height above ground (m)=	0.38	Depth to water surface (m)=	0.90
Diameter of well (m)=	0.05	Static water level* (m)=	0.90
Depth of installation* (m)=	4.6	Depth to bottom (m)=	1.37
Length screened section (m)=	3.0	Free product thickness (mm)=	None
Depth to top of screen* (m)=	0.60		

Calculations		**Notes**	
Depth of water (m)=	0.47	Evidence of sludge etc:	None
Well volume of water (L)=	0.9	Evidence of freezing/siltation: (compare to installation record)	Ice at bottom
Length screen collecting water (m)=	0.47		

Purging Information

Equipment: Waterra Tubing with ball valve

Date & Time	Volume Removed (L)	Temperature (^{o}C)	pH	Conductivity (uS/cm)	Turbidity (NTU)	Description of water
16:10	1	2.2	11.32	3	93	Water is slightly turbid and brown in color

Water Sampling		**Soil Sampling**	
Date and time collected:	18/08/2007 16:10	Date and time collected:	15/08/2007 15:00
Sample Number - Water:	07-24784	Sample Number - Soil:	07-24780/81 -10 cm
			07-24782/83 -30 cm
Sample containers:	1 L HDPE	Sample containers:	Whirlpaks
	1 L Teflon		125 mL Jars
	250 mL Amber Glass		
Procedure/Equipment:	Waterra Tubing with ball valve	Procedure/Equipment:	Shovel, Plastic scoop
Water description:	Water is muddy brown	Soil description:	Brown wet silt with sand and some gravel/rocks
Filtration: (Y/N)	N		
Acidification: (Y/N)	N		
Sampling Equipment Decontamination: (Y/N)	Y	Sampling Equipment Decontamination: (Y/N)	N
Number washes:	1	Number washes:	n/a
Number rinses:	1	Number rinses:	n/a

n/a=not applicable

*From ground surface. Unless this is stated, all measurements are assumed to be from the top of the casing.

Annex: Main Landfill - Year 1 Data

Figure:

- FOX-5.3: Main Landfill
- Ground Temperature Profile Main Landfill Facility Vertical GTC VT-1/P
- Ground Temperature Profile Main Landfill Facility Vertical GTC VT-2/P
- Ground Temperature Profile Main Landfill Facility Vertical GTC VT-3/P
- Ground Temperature Profile Main Landfill Facility Vertical GTC VT-4/P
- Ground Temperature Profile Main Landfill Facility Vertical GTC VT-5
- Ground Temperature Profile Main Landfill Facility Vertical GTC VT-6
- Ground Temperature Profile Main Landfill Facility Vertical GTC VT-7
- Ground Temperature Profile Main Landfill Facility Vertical GTC VT-8

Tables:

- Landfill Visual Inspection - FOX-5 Broughton Island Upper Site Main Landfill
- Main Landfill-North - Year 1 (2007) Soil Data
- Main Landfill-North - Evaluation of Year 1 Soil Analytical Data
- Main Landfill - Year 1 (2007) Groundwater Data

Photographic Records:

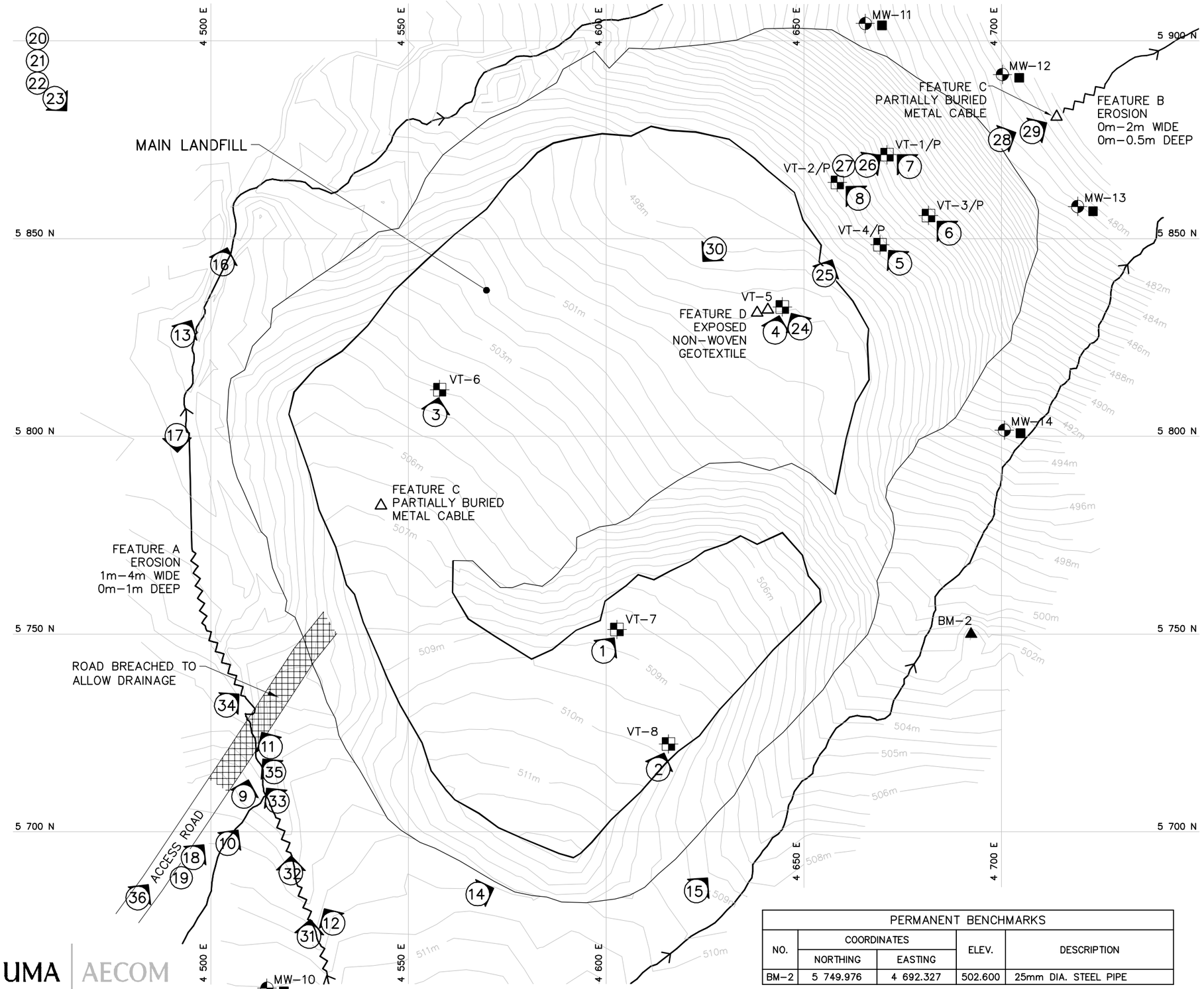
- Photos A1 and A-2
- Photos A3 and A4
- Photos A5 and A6
- Photos A7 and A8
- Photos A9 and A10
- Photos A11 and A12
- Photos A13 and A14
- Photos A15 and A16
- Photo A17

Well Sampling Records:

- Well MW 10
- Well MW 11
- Well MW 12
- Well MW 13

Thermistor Annual Maintenance Reports:

- VT-1/P
- VT-2/P
- VT-3/P
- VT-4/P
- VT-5
- VT-6
- VT-7
- VT-8



LEGEND:

- TBM4 — TEMPORARY BENCHMARK
- BM-1 — PERMANENT BENCHMARK
- 101 — COORDINATE POINT
- MONITORING SOIL SAMPLE LOCATION
- MONITORING WELL LOCATION
- VERTICAL THERMISTOR LOCATION
- 4 — PHOTOGRAPHIC VIEWPOINT
- EROSION (NTS)
- OTHER FEATURE/DEBRIS (NTS)
- SURFACE DRAINAGE

COORDINATE POINTS (AS-BUILT) VERTICAL THERMISTORS		
NO.	NORTHING	EASTING
VT-1	5 871.2	4 671.1
VT-2	5 864.2	4 658.5
VT-3	5 855.8	4 681.5
VT-4	5 848.4	4 669.3
VT-5	5 832.7	4 644.6
VT-6	5 811.8	4 557.9
VT-7	5 751.2	4 602.7
VT-8	5 722.2	4 615.8

COORDINATE POINTS (AS BUILT) MONITORING WELLS			
NO.	NORTHING	EASTING	ELEV.
MW-10	5 660.5	4 514.2	511.18
MW-11	5 904.4	4 665.5	484.41
MW-12	5 891.5	4 700.2	479.79
MW-13	5 858.1	4 719.3	480.55
MW-14	5 801.6	4 700.7	493.43

SCALE 1:1000 — 0 10 20 30 m

RECORD DRAWING
NOT FOR CONSTRUCTION

PERMANENT BENCHMARKS				
NO.	COORDINATES		ELEV.	DESCRIPTION
	NORTHING	EASTING		
BM-2	5 749.976	4 692.327	502.600	25mm DIA. STEEL PIPE

UMA | AECOM

DWG NAME: F5-R003.DWG CLC - 07/12/13

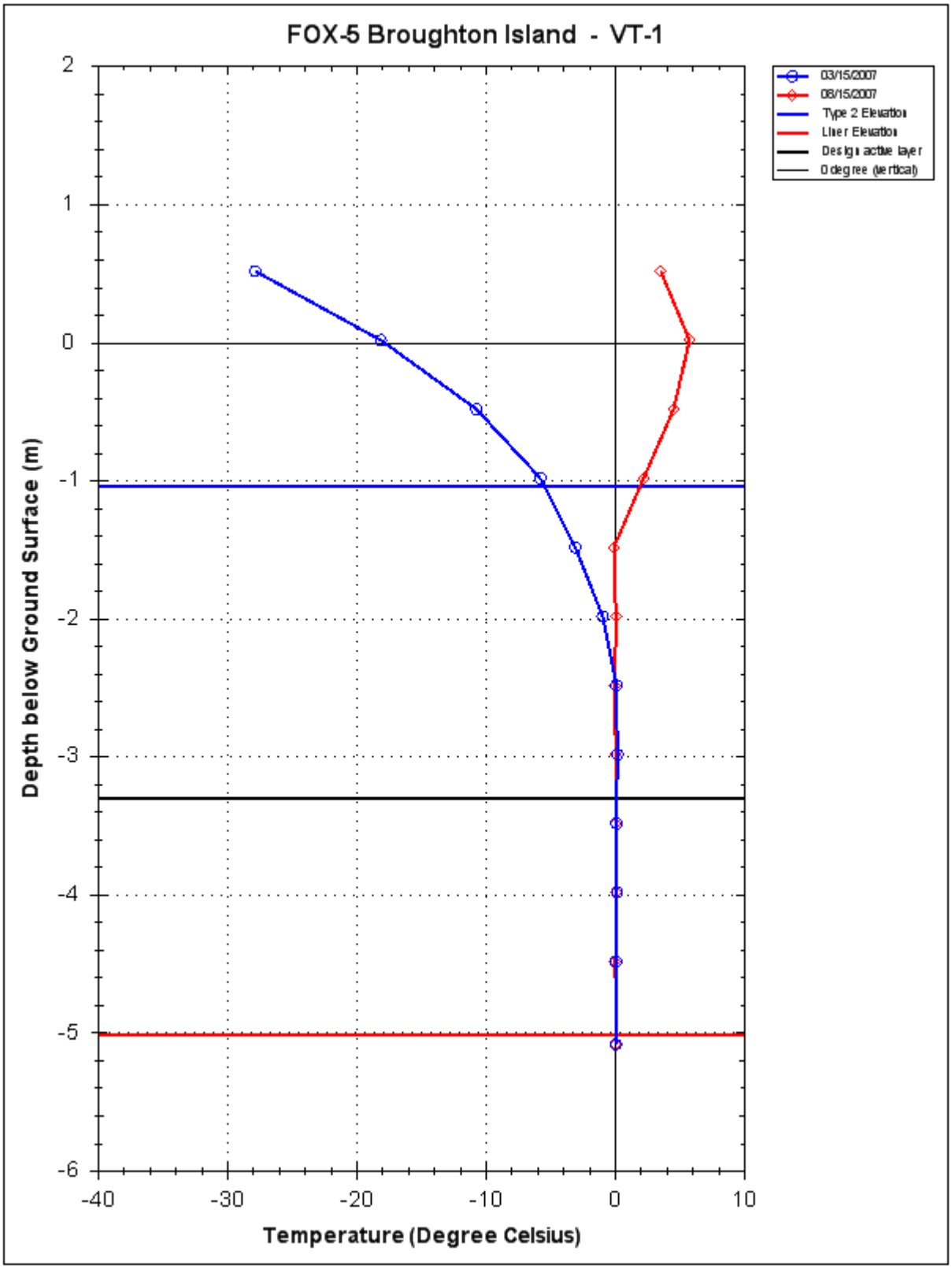
DEW LINE CLEAN UP
LANDFILL MONITORING PLAN

FOX-5 BROUGHTON ISLAND

MAIN LANDFILL

FIGURE FOX-5.3

THERMAL MONITORING ANNUAL DATA ANALYSIS



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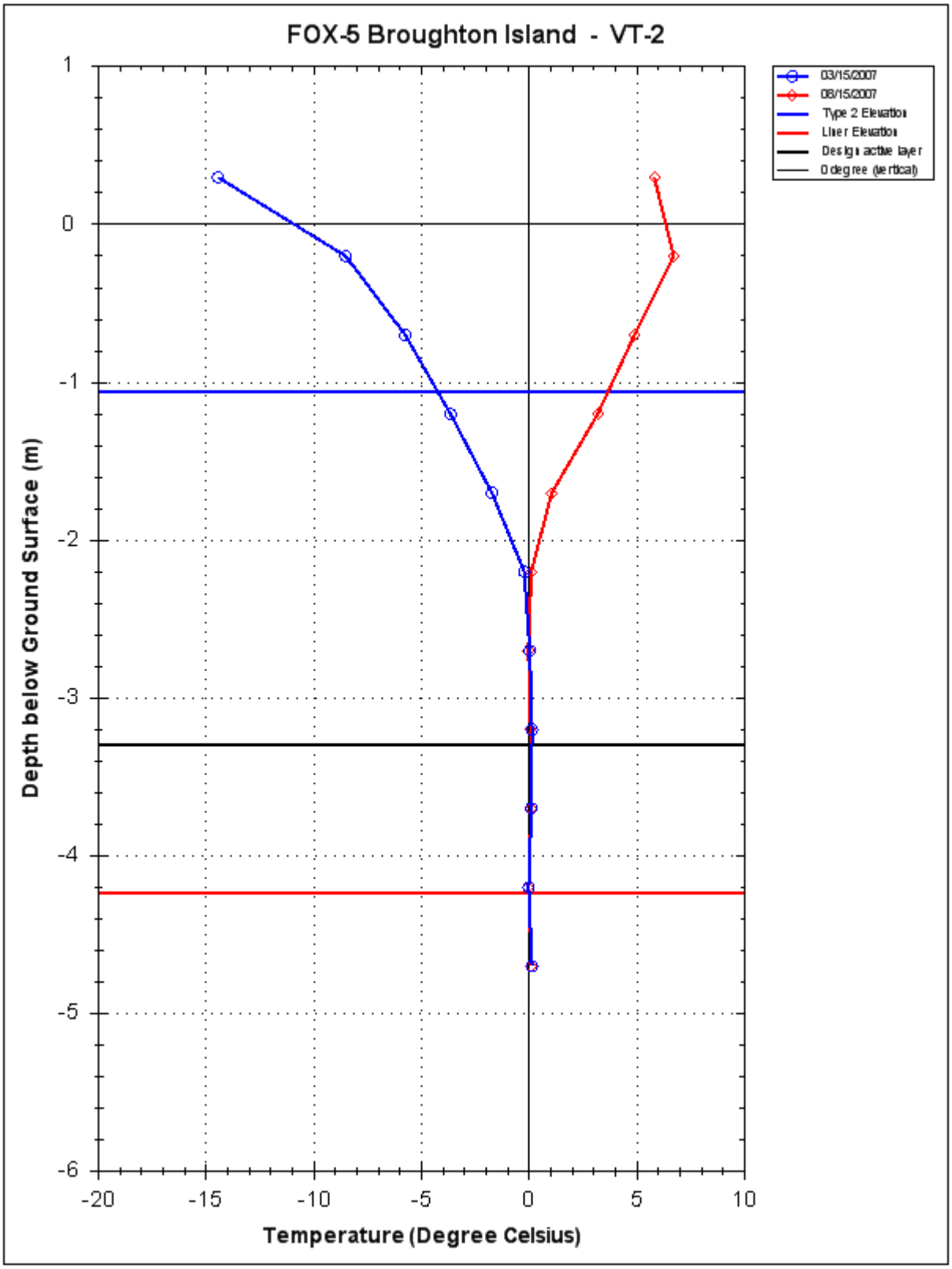

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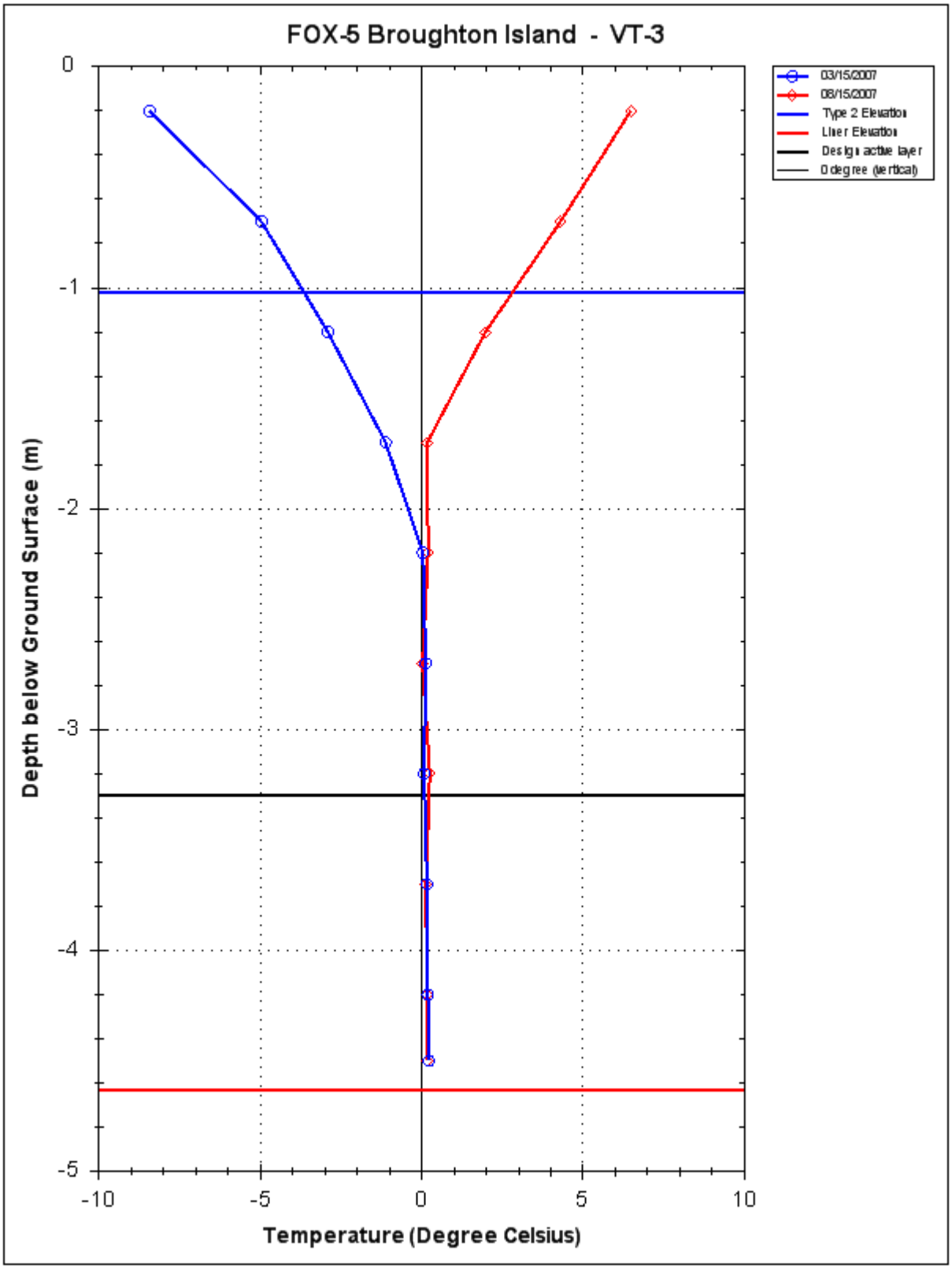

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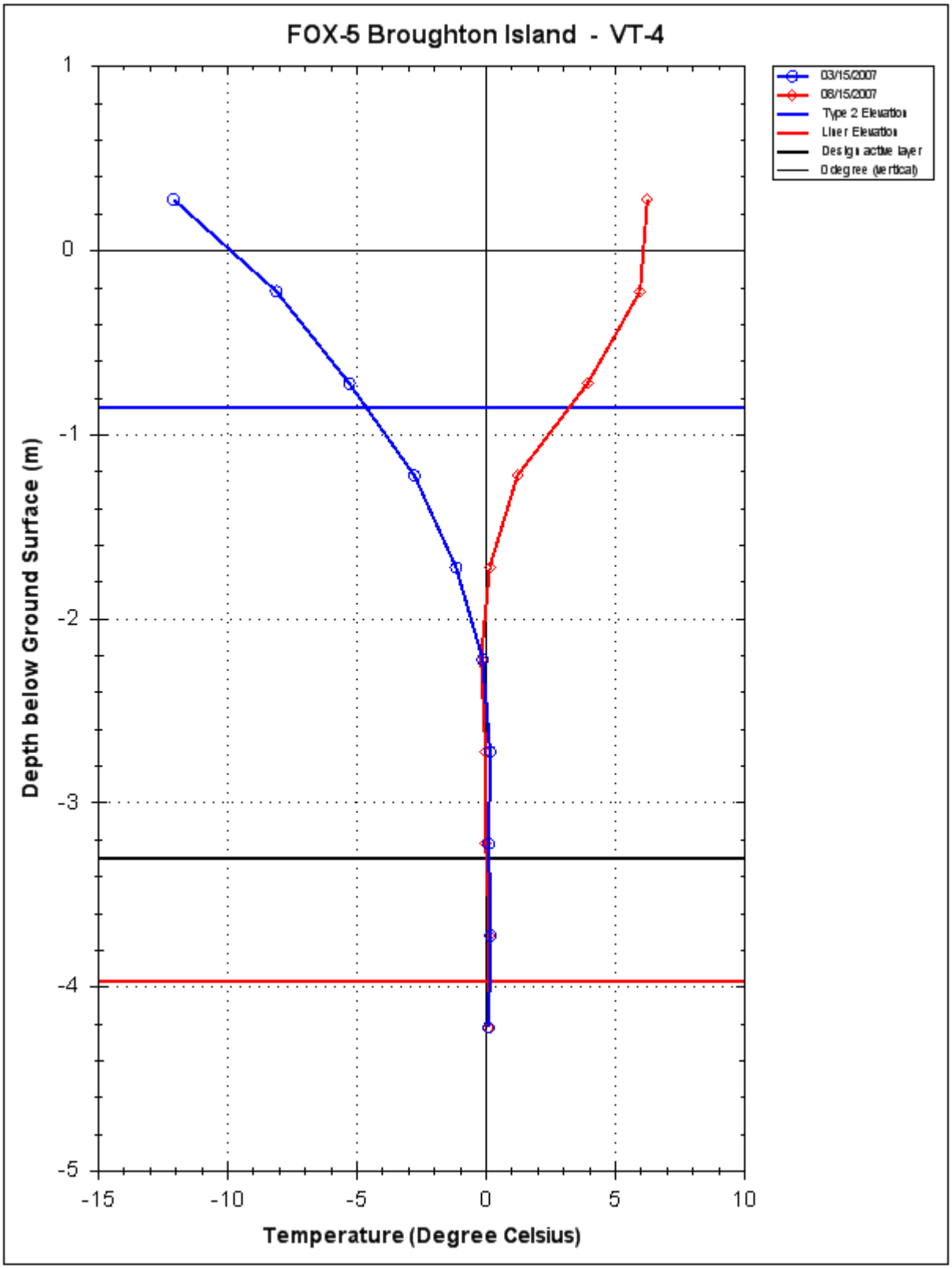

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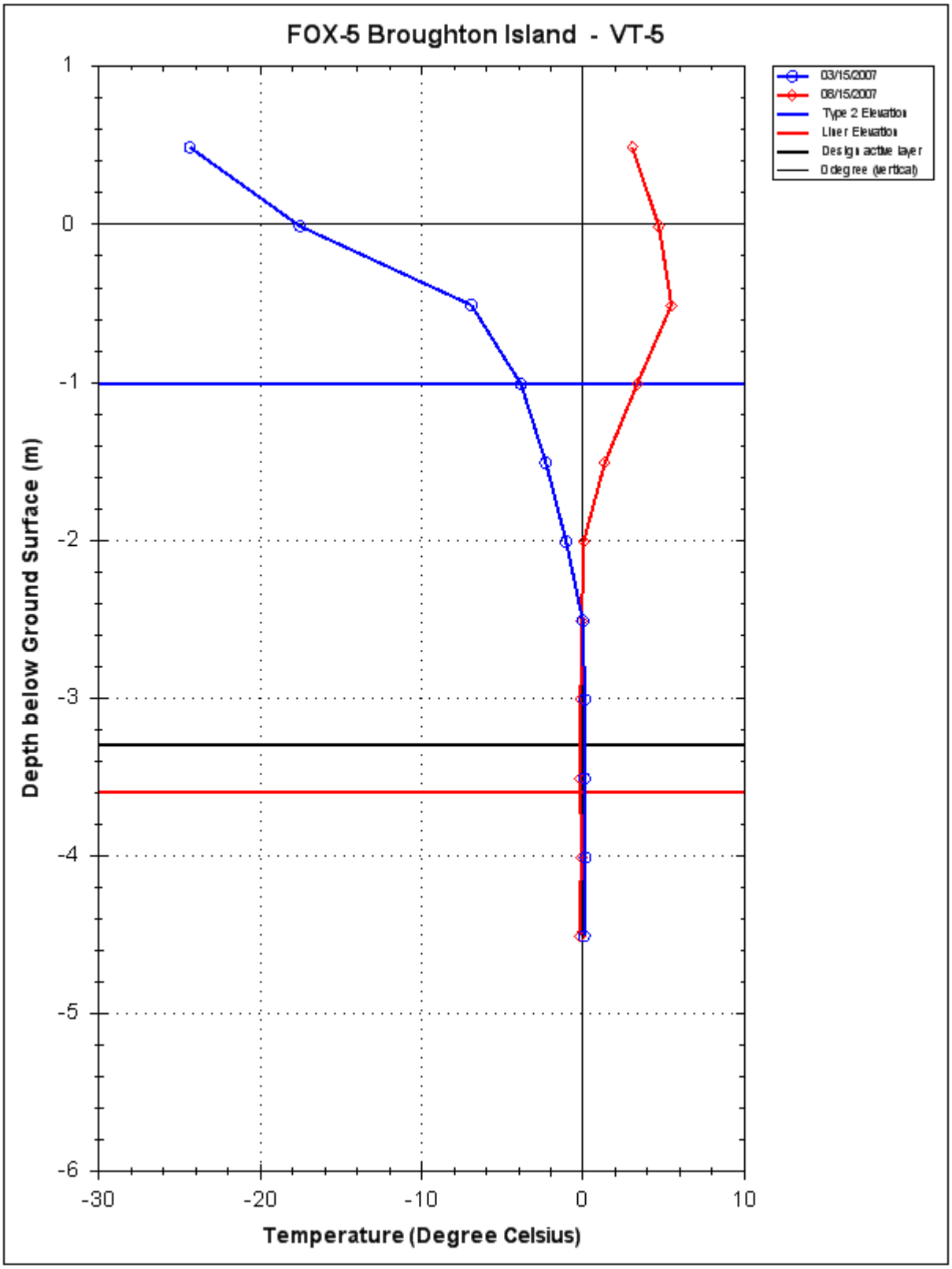

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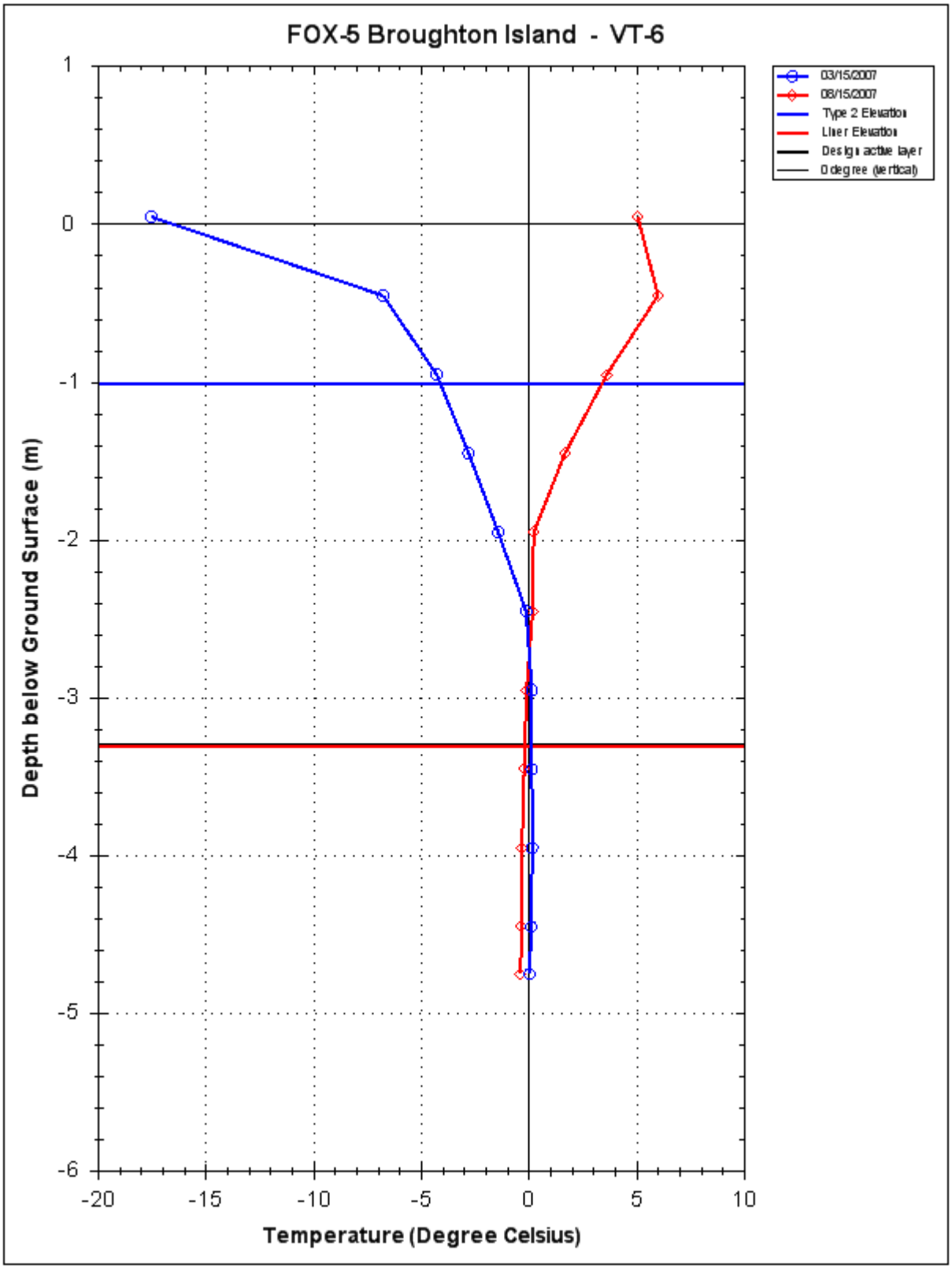

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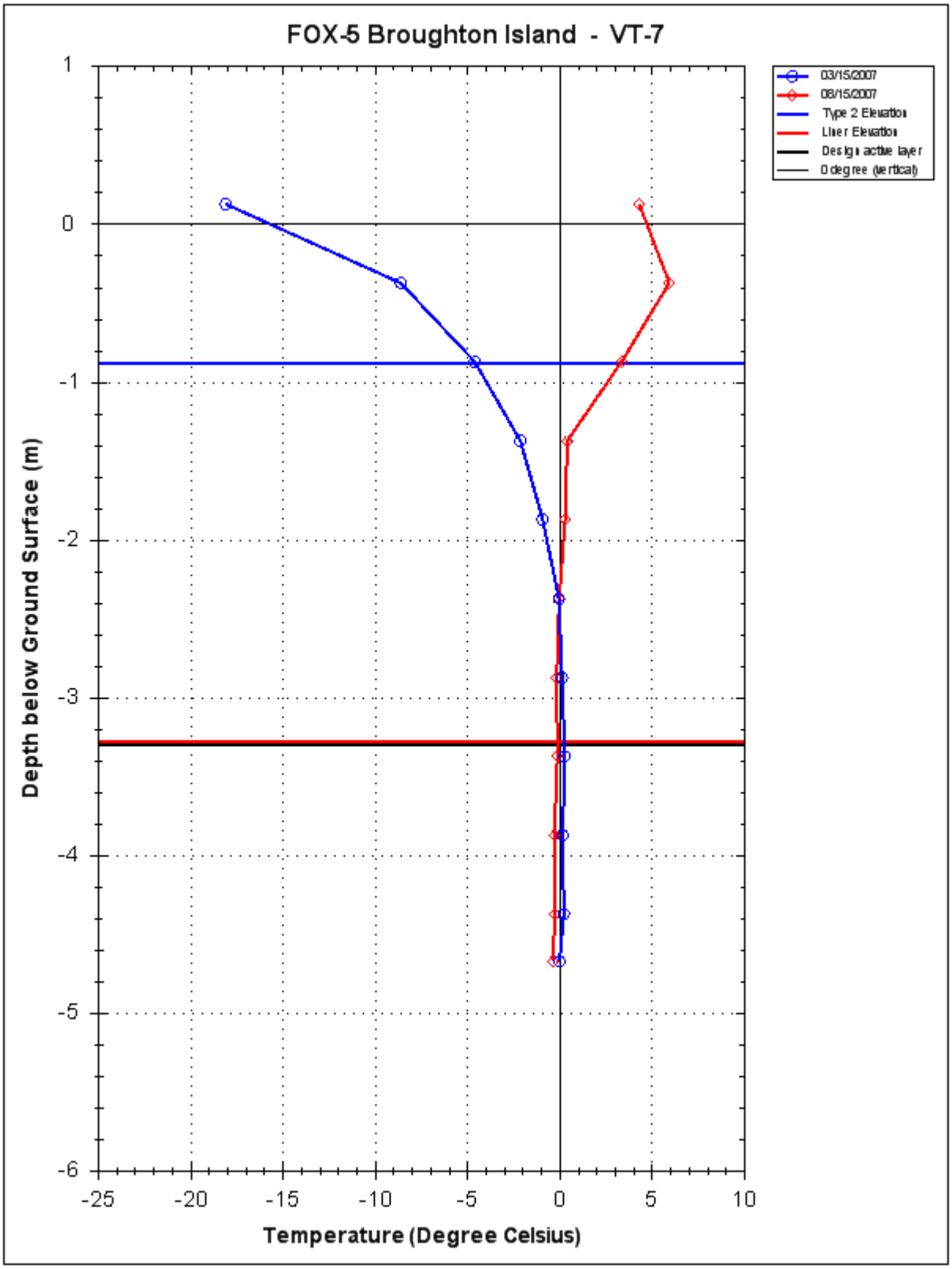

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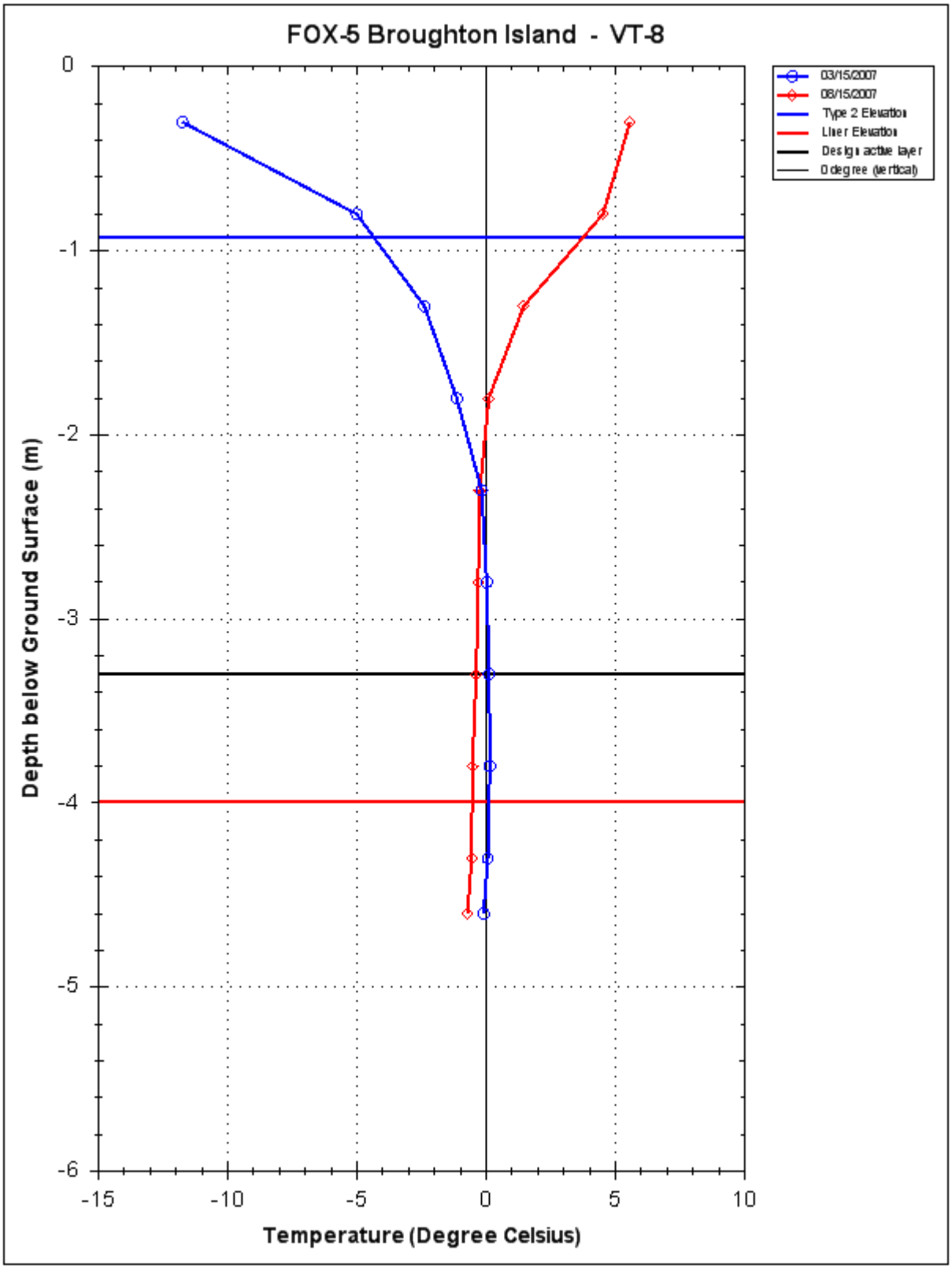


LANDFILL VISUAL INSPECTION

Site Name: FOX-5, Broughton Island
Landfill: **Upper Site Main Landfill**
Designation:
Date Inspected: August 19, 2007 to August 21, 2007
Inspected by: Ed Grozic, P.Eng., EBA Engineering Consultants Ltd.
Signature:

TABLE A1: MAIN LANDFILL

Checklist Item	Present (Yes/No)	Location	Length	Width	Depth	Extent	Description	Photographic Records (Images Provided on Data CD)	Severity Rating	Additional Comments
Settlement	No	N/A	N/A	N/A	N/A	None	N/A	N/A	Not observed	N/A
Erosion	Yes	Feature A See Figure FOX-5.A1 (southwest and northwest side of landfill)	~ 100 m	1 to 4 m	0 to 1 m	Isolated	Surface runoff erosion channel	Photo 3 (Image 31) Photos 4 (Image 32) Photo 5 (Image 33) Photo 6 (Image 13) Additional CD Images – Image 9 to 11, Image 16 to 19, Image 31 to 36	Acceptable	Surface runoff has eroded a channel in sandy soil along the southwest side of the landfill and deposited material along the northwest side of the landfill. The erosion is not in direct contact with the landfill. Further erosion could occur along the up gradient section of the channel, where the soils are particularly sandy, until the channel naturally stabilizes. The observed surface runoff pattern is consistent with planned remedial measures to direct flow around the landfill.
Erosion	Yes	Feature B See Figure FOX-5.A1 (northeast side, down slope of landfill)	20 m	0 to 2 m	0 to 0.5 m	Isolated	Surface runoff erosion channel	Photo 7 (Image 28) Photo 8 (Image 29)	Acceptable	Surface runoff has eroded a small channel down slope of the landfill. Runoff originates from slopes to the southeast of the landfill and the erosion appears to have occurred during spring breakup. The erosion should naturally stabilize given the cobbly and bouldery terrain down slope of the landfill. The observed surface runoff pattern is consistent with planned remedial measures to direct flow around the landfill.
Frost Action	No	N/A	N/A	N/A	N/A	None	N/A	N/A	Not observed	N/A
Animal Burrows	No	N/A	N/A	N/A	N/A	None	N/A	N/A	Not observed	N/A
Vegetation	No	N/A	N/A	N/A	N/A	None	N/A	N/A	Not observed	N/A
Staining	No	N/A	N/A	N/A	N/A	None	N/A	N/A	Not observed	N/A
Vegetation Stress	No	N/A	N/A	N/A	N/A	None	N/A	N/A	Not observed	N/A
Seepage Points	No	N/A	N/A	N/A	N/A	None	N/A	N/A	Not observed	N/A
Debris Exposed	Yes	Feature C See Figure FOX-5.A1 two locations	N/A	N/A	N/A	Isolated	Metal cable surface debris	Photo 8 (Image 29)	Acceptable	Rusted metal cable surface debris was identified at two locations. The cables are partially buried.
Presence/Condition of Monitoring Instruments	Yes	See Figure FOX-5.A1 VT-1, to VT-8	N/A	N/A	N/A	N/A	Inclined protective surface casings	Photos 9 to 17 (Images 1 to 8) Additional CD Images Image 24 to 27	Marginal	Protective surface casings at VT-1 to VT4 are leaning down gradient. VT-4 is inclined the greatest (about 20º from vertical) and VT-1 is inclined the least (about 10º from vertical). The casings stickup 1.25 m to 1.55 m above ground, indicating that the embedment depth is 0.75 m to 0.45 m. Successfully downloaded ground temperature data from loggers.
Other Features of Note Exposed Non-woven Geotextile	Yes	Feature D See Figure FOX-5.A1	N/A	N/A	N/A	Isolated	Exposed geotextile	Photo 17 (Image 24)	Acceptable	Non-woven geotextile fabric exposed next to VT-5.
Overall Landfill Performance:	**Acceptable**									

Main Landfill - Year 1 (2007) Soil Data (in mg/kg)

Sample #	Location	Date	Depth (cm)	Cu	Ni	Co	Cd	Pb	Zn	Cr	As	Hg	PCBs	TPH	TPH Identity		
															F1	F2	F3
Main Landfill- Baseline Concentrations				**8.5+/-1.3**	**<5.0**	**<5.0**	**<1.0**	**<10**	**38.5+/-8.9**	**<20**	**2.2+/-0.5**	**<0.10**	**<0.0030**	**<10**			
Main Landfill - Maximum Concentrations				**23**	**11**	**5.2**	**1**	**25**	**180**		**5.8**		**0.26**	**740**			
Up-gradient Soil Samples																	
24746	MW 10	2007	10	4.9	<5.0	<5.0	<1.0	<10	32	<20	<1.0	<0.10	<0.0030	15	<10	4.0	11
24748	MW 10	2007	40	4.4	<5.0	<5.0	<1.0	<10	31	<20	<1.0	<0.10	<0.0030	16	<10	4.5	11
Down-gradient Soil Samples																	
24750/51	MW 11	2007	10	6.6	5.8	5.5	<1.0	12	32	<20	3.4	<0.10	<0.0030	<10	<10	6.0	<9.0
24752	MW 11	2007	40	4.7	<5.0	<5.0	<1.0	<10	20	<20	2.9	<0.10	<0.0030	27	<10	8.1	19
24756	MW 12	2007	10	3.9	<5.0	<5.0	<1.0	<10	29	<20	1.6	<0.10	<0.0030	40	<10	5.2	35
24758	MW 12	2007	40	3.6	<5.0	<5.0	<1.0	<10	26	<20	1.1	<0.10	<0.0030	23	<10	6.3	17
24760/61	MW 13	2007	10	<3.0	<5.0	<5.0	<1.0	<10	21	<20	<1.0	<0.10	0.0052	40	<10	6.8	33
24762	MW 13	2007	40	3.0	<5.0	<5.0	<1.0	<10	21	<20	<1.0	<0.10	<0.0030	16	<10	5.7	10
24766	MW 14	2007	10	<3.0	<5.0	<5.0	<1.0	<10	19	<20	1.3	<0.10	<0.0030	13	<10	4.1	9.2
24768	MW 14	2007	40	3.8	<5.0	<5.0	<1.0	<10	27	<20	1.5	<0.10	<0.0030	<10	<10	6.7	<9.0

Main Landfill - EVALUATION OF YEAR 1 SOIL ANALYTICAL DATA

Parameter	N value Baseline	Arithmetic Mean +/- 95% Confidence Limit Baseline	Maximum Baseline [mg/kg]	2007	Comments
Copper	35	8.5+/-1.3	23	All results are within the 95% confidence limit.	
Nickel	35	<5.0	11	Concentrations consistent with baseline mean (non-detect), with one exception.	The shallow sample at MW 11 had a concentration of 5.8 mg/kg (below baseline max).
Cobalt	35	<5.0	5.2	Concentrations consistent with baseline mean (non-detect), with one exception.	Shallow sample at MW 11 had a concentration of 5.5 mg/kg (slightly above baseline max).
Cadmium	35	<1.0	1	Concentrations consistent with baseline mean (non-detect).	
Lead	35	<10	25	Concentrations consistent with baseline mean (non-detect), with one exception.	Shallow sample at MW 11 had a concentration of 12 mg/kg (below baseline max).
Zinc	35	38.5+/-8.9	180	All results are within the 95% confidence limit.	
Chromium	35	<20		Concentrations consistent with baseline mean (non-detect).	
Arsenic	35	2.2+/-0.5	5.8	Concentrations within 95% confidence interval, with two exceptions.	Shallow and depth samples at MW 11 had concentrations of 3.4 & 2.9 mg/kg respectively (below baseline max).
Mercury	12	<0.10		Concentrations consistent with baseline mean (non-detect).	
PCBs	35	<0.0030	0.26	Concentrations consistent with baseline mean (non-detect), with one exception.	Surface sample at MW 13 had a concentration of 0.0052 mg/kg (below baseline max).

Main Landfill - EVALUATION OF YEAR 1 SOIL ANALYTICAL DATA

Parameter	N value Baseline	Arithmetic Mean +/- 95% Confidence Limit Baseline	Maximum Baseline [mg/kg]	2007	Comments
TPH	29	<10	740	Concentrations consistent with baseline mean (non-detect) for 2 of ten results, but all below baseline max.	Shallow and depth samples at MW 10, 12 & 13 had concentrations of 15, 16, 40, 23, 40 & 16 mg/kg respectively. MW 11 depth sample had a concentration of 27 mg/kg and shallow sample at MW 14 had a concentration of 13 mg/kg.

Main Landfill - Year 1 (2007) Groundwater Data (in mg/L)

Sample #	Location	Date	Cu	Ni	Co	Cd	Pb	Zn	Cr	As	Hg	PCBs	TPH	TPH Identity		
														F1	F2	F3
Up-gradient Groundwater Samples																
24749/97	MW 10	2007	0.014	0.067	0.0040	<0.0010	<0.010	0.026	0.13	<0.0030	< 0.00040	< 0.000020	<1.0	< 0.050	< 0.50	< 1.0
Down-gradient Groundwater Samples																
24754	MW 11	2007	0.012	0.081	<0.0030	<0.0010	<0.010	0.012	0.16	<0.0030	< 0.00040	< 0.000020	< 1.0	< 0.050	< 0.50	< 1.0
24759	MW 12	2007	Well was dry at time of sampling													
24764	MW 13	2007	0.069	0.053	0.0039	<0.0010	<0.010	0.23	0.087	<0.0030	< 0.00040	< 0.000020	< 1.0	< 0.050	< 0.50	< 1.0
24769	MW 14	2007	0.021	0.049	<0.0030	<0.0010	<0.010	0.089	0.088	<0.0030	< 0.00040	< 0.000020	< 1.0	< 0.050	< 0.50	< 1.0

Photo 1 (Image 23 USMLF)
Main Landfill - Panoramic view looking southeast.

Photo 2 (Image 18 USMLF)
Main Landfill - Panoramic view looking southeast.

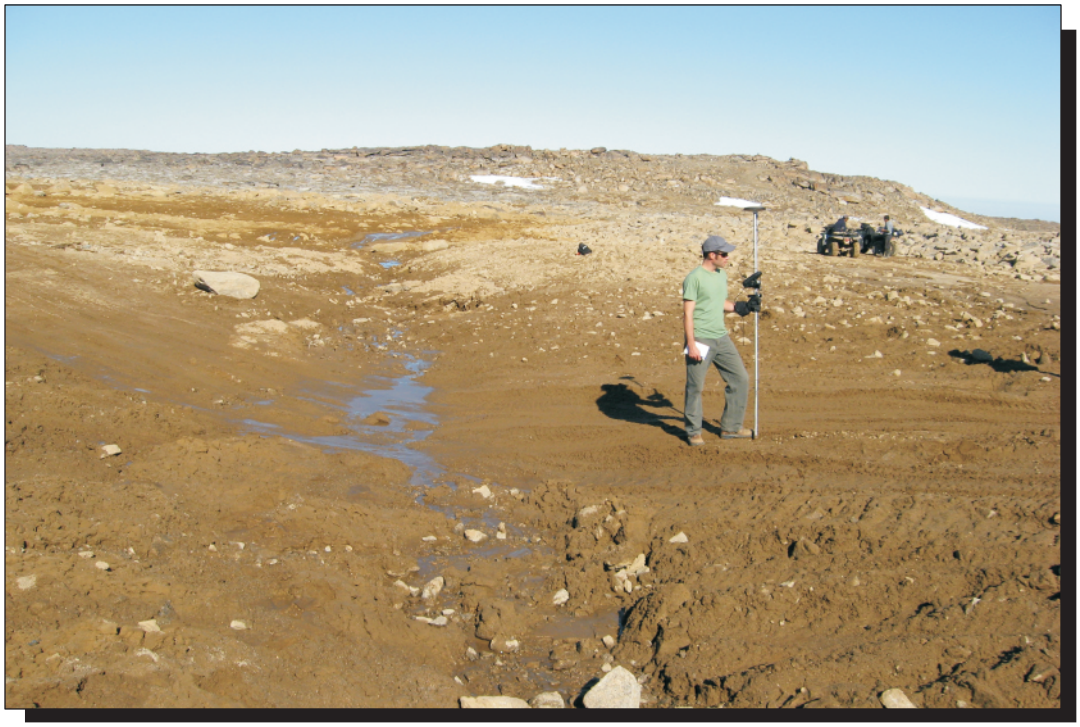


Photo 3 (Image 31 USMLF)
Main Landfill - Looking northwest along erosion channel.

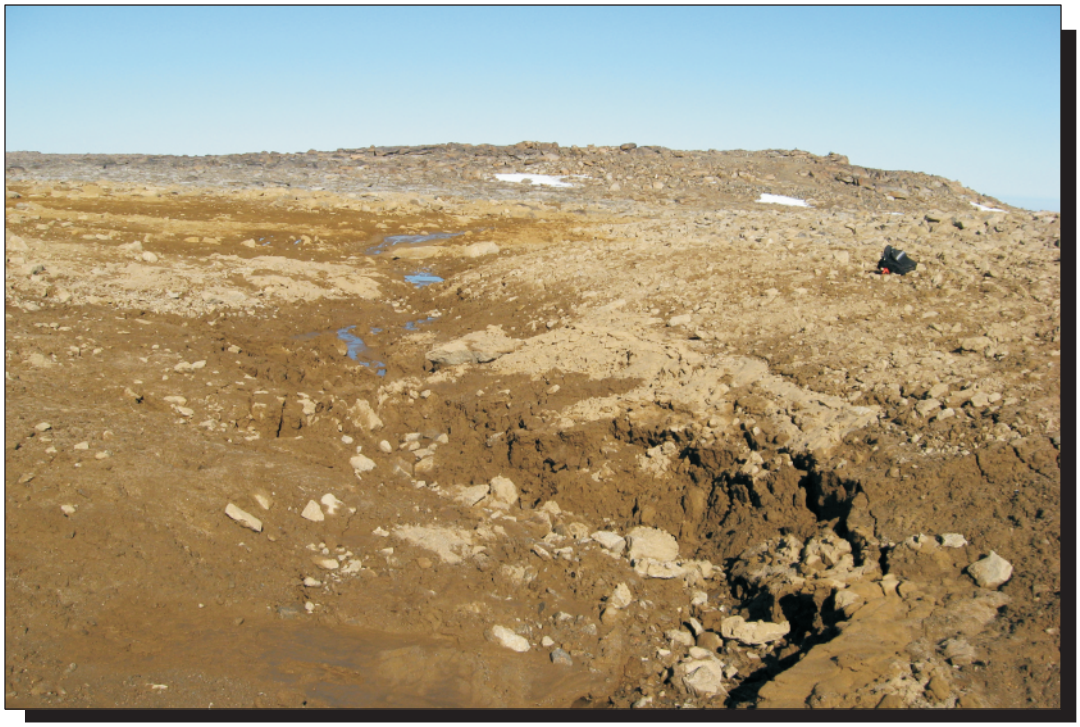


Photo 4 (Image 32 USMLF)
Main Landfill - Erosion channel looking northwest.

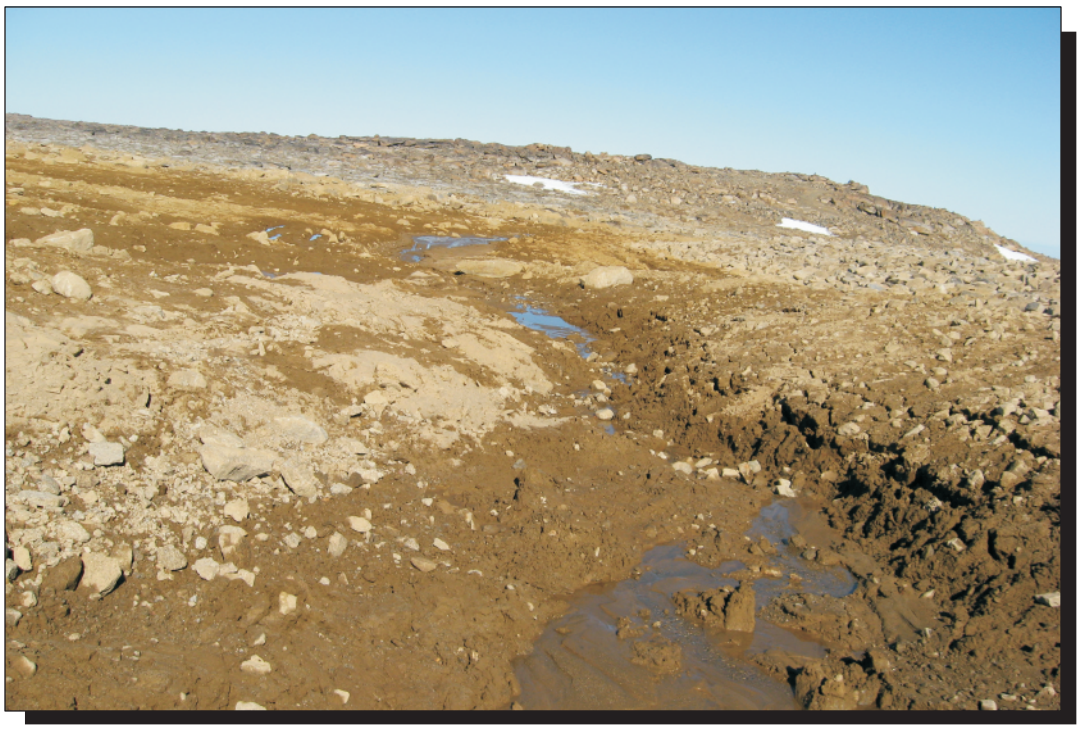


Photo 5 (Image 33 USMLF)
Main Landfill - Erosion channel looking northwest.

Photo 6 (Image 13 USMLF)
Main Landfill - Northwest side of landfill looking northeast.

Photo 7 (Image 28 USMLF)
Main Landfill - Looking northeast from VT-3 at erosional feature downslope of landfill.

Photo 8 (Image 29 USMLF)
Main Landfill - Partially exposed metal cable and erosional feature downslope of landfill.

Photo 9 (Image 07 USMLF)
VT-1 looking northwest

Photo 10 (Image 08 USMLF)
VT-2 looking northwest

Photo 11 (Image 06 USMLF)
Main Landfill - VT-3 looking northwest.

Photo 12 (Image 05 USMLF)
Main Landfill - VT-4 looking northwest.

Photo 13 (Image 04 USMLF)
Main Landfill - VT-5 looking northwest.

Photo 14 (Image 03 USMLF)
Main Landfill - VT-6 looking northwest.

Photo 15 (Image 01 USMLF)
Main Landfill - VT-7 looking northwest.

Photo 16 (Image 02 USMLF)
Main Landfill - VT-8 looking northwest.

Photo 17 (Image 24 USMLF)
Main Landfill - Non-woven geotextile exposed next to VT-5.

Monitoring Well Sampling Log - BMW# 10 2007

Site Name:	FOX-5
Date of Sampling Event:	19-Aug-07
Names of Samplers:	Matthew Mackay
	Dana Kelly
	Sam Soja
Monitoring Well ID:	BMW #10
Facility:	Upper site Main Landfill

Water Sample Measured Data

Condition of Well:	Well Ok, Casing Intact, DEW Line Lock cut and replaced		
Procedure/Equipment:	Measuring Tape	Procedure/Equipment:	Interface Meter
Well height above ground (m)=	0.27	Depth to water surface (m)=	0.38
Diameter of well (m)=	0.05	Static water level* (m)=	0.38
Depth of installation* (m)=	4.5	Depth to bottom (m)=	2.00
Length screened section (m)=	1.0	Free product thickness (mm)=	None
Depth to top of screen* (m)=	0.56		

Calculations		Notes	
Depth of water (m)=	1.62	Evidence of sludge etc:	None
Well volume of water (L)=	3.2	Evidence of freezing/siltation: (compare to installation record)	Ice at bottom
Length screen collecting water (m)=	1.44		

Purging Information

Equipment:	Waterra Tubing with ball valve

Date & Time	Volume Removed (L)	Temperature (^{o}C)	pH	Conductivity (uS/cm)	Turbidity (NTU)	Description of water
14:00	3.75	3.2	9.64	2	29.3	Water almost clear, but some turbidity noted

Water Sampling		Soil Sampling	
Date and time collected:	19/08/2007 14:20	Date and time collected:	16/08/2007 10:00
Sample Number - Water:	07-24749	Sample Number - Soil:	07-24745/46 -10 cm
			07-24747/48 -30 cm
Sample containers:	1 L HDPE	Sample containers:	Whirlpaks
	1 L Teflon		125 mL Jars
	250 mL Amber Glass		
Procedure/Equipment:	Waterra Tubing with ball valve	Procedure/Equipment:	Shovel, Plastic scoop
Water description:	clear	Soil description:	Soil is moist fine brown sand
Filtration: (Y/N)	N		
Acidification: (Y/N)	N		
Sampling Equipment Decontamination: (Y/N)	Y	Sampling Equipment Decontamination: (Y/N)	N
Number washes:	1	Number washes:	n/a
Number rinses:	1	Number rinses:	n/a

n/a=not applicable

*From ground surface. Unless this is stated, all measurements are assumed to be from the top of the casing.

Monitoring Well Sampling Log - MW# 11 2007

Site Name:	FOX-5
Date of Sampling Event:	19-Aug-07
Names of Samplers:	Matthew Mackay
	Dana Kelly
	Sam Soja
Monitoring Well ID:	MW # 11
Facility:	Upper site Main Landfill

Water Sample Measured Data

Condition of Well:	Well Ok, Casing Intact, DEW Line Lock cut and replaced		
Procedure/Equipment:	Measuring Tape	Procedure/Equipment:	Interface Meter
Well height above ground (m)=	0.84	Depth to water surface (m)=	1.17
Diameter of well (m)=	0.05	Static water level* (m)=	1.17
Depth of installation* (m)=	4.7	Depth to bottom (m)=	1.69
Length screened section (m)=	3.0	Free product thickness (mm)=	None
Depth to top of screen* (m)=	0.60		

Calculations		**Notes**	
Depth of water (m)=	0.52	Evidence of sludge etc:	None
Well volume of water (L)=	1.0	Evidence of freezing/siltation: (compare to installation record)	Ice at bottom
Length screen collecting water (m)=	0.52		

Purging Information

Equipment:	Waterra Tubing with ball valve

Date & Time	Volume Removed (L)	Temperature (^{o}C)	pH	Conductivity (uS/cm)	Turbidity (NTU)	Description of water
15:00	1.5	2.8	10.66	3	40.9	Water slightly turbid

Water Sampling		**Soil Sampling**	
Date and time collected:	19/08/2007 15:20	Date and time collected:	16/08/2007 10:40
Sample Number - Water:	07-24754	Sample Number - Soil:	07-24750/51 -10 cm
			07-24752/53 -30 cm
Sample containers:	1 L HDPE	Sample containers:	Whirlpaks
	1 L Teflon		125 mL Jars
	250 mL Amber Glass		
Procedure/Equipment:	Waterra Tubing with ball	Procedure/Equipment:	Shovel, Plastic scoop
Water description:	Some suspended material, slightly turbid	Soil description:	Soil is moist fine brown sand
Filtration: (Y/N)	N		
Acidification: (Y/N)	N		
Sampling Equipment Decontamination: (Y/N)	Y	Sampling Equipment Decontamination: (Y/N)	N
Number washes:	1	Number washes:	n/a
Number rinses:	1	Number rinses:	n/a

n/a=not applicable

*From ground surface. Unless this is stated, all measurements are assumed to be from the top of the casing.

Monitoring Well Sampling Log - MW #12 2007

Site Name:	FOX-5
Date of Sampling Event:	19-Aug-07
Names of Samplers:	Matthew Mackay
	Dana Kelly
	Sam Soja
Monitoring Well ID:	MW # 12
Facility:	Upper site Main Landfill

Water Sample Measured Data			
Condition of Well:	Well Ok, Casing Intact, DEW Line Lock cut and replaced, Well Dry		
Procedure/Equipment:	Measuring Tape	Procedure/Equipment:	Interface Meter
Well height above ground (m)=	0.33	Depth to water surface (m)=	Well Dry
Diameter of well (m)=	0.05	Static water level* (m)=	Well Dry
Depth of installation* (m)=	4.6	Depth to bottom (m)=	1.32
Length screened section (m)=	3.0	Free product thickness (mm)=	None
Depth to top of screen* (m)=	0.60		

Calculations		**Notes**	
Depth of water (m)=	n/a	Evidence of sludge etc:	None
Well volume of water (L)=	n/a	Evidence of freezing/siltation: (compare to installation record)	Ice at bottom
Length screen collecting water (m)=	n/a		

Purging Information

Equipment:	Waterra Tubing with ball

Date & Time	Volume Removed (L)	Temperature (^{o}C)	pH	Conductivity (uS/cm)	Turbidity (NTU)	Description of water
Well Dry						

Water Sampling		**Soil Sampling**	
Date and time collected:	19/08/2007 15:40	Date and time collected:	16/08/2007 11:00
Sample Number - Water:	07-24759	Sample Number - Soil:	07-24755/56 -10 cm
			07-24757/58 -30 cm
Sample containers:	n/a	Sample containers:	Whirlpaks
	n/a		125 mL Jars
	n/a		
Procedure/Equipment:	n/a	Procedure/Equipment:	Shovel, Plastic scoop
Water description:	No water in well, frozen	Soil description:	Soil is moist fine brown sand
Filtration: (Y/N)	n/a		
Acidification: (Y/N)	n/a		
Sampling Equipment Decontamination: (Y/N)	n/a	Sampling Equipment Decontamination: (Y/N)	N
Number washes:	n/a	Number washes:	n/a
Number rinses:	n/a	Number rinses:	n/a

n/a=not applicable

*From ground surface. Unless this is stated, all measurements are assumed to be from the top of the casing.

Monitoring Well Sampling Log - MW# 13 2007

Site Name:	FOX-5
Date of Sampling Event:	19-Aug-07
Names of Samplers:	Matthew Mackay
	Dana Kelly
	Sam Soja
Monitoring Well ID:	MW # 13
Facility:	Upper site Main Landfill

Water Sample Measured Data

Condition of Well:	Well Ok, Casing Intact, DEW Line Lock cut and replaced		
Procedure/Equipment:	Measuring Tape	Procedure/Equipment:	Interface Meter
Well height above ground (m)=	0.40	Depth to water surface (m)=	0.83
Diameter of well (m)=	0.05	Static water level* (m)=	0.83
Depth of installation* (m)=	4.6	Depth to bottom (m)=	1.25
Length screened section (m)=	3.0	Free product thickness (mm)=	None
Depth to top of screen* (m)=	0.60		

Calculations		Notes	
Depth of water (m)=	0.42	Evidence of sludge etc:	None
Well volume of water (L)=	0.8	Evidence of freezing/siltation: (compare to installation record)	Ice at bottom
Length screen collecting water (m)=	0.42		

Purging Information

Equipment:	Waterra Tubing with ball valve

Date & Time	Volume Removed (L)	Temperature (^{o}C)	pH	Conductivity (uS/cm)	Turbidity (NTU)	Description of water
16:20	1	4.1	10.91	2	63	cloudy

Water Sampling		Soil Sampling	
Date and time collected:	19/08/2007 16:20	Date and time collected:	16/08/2007 11:10
Sample Number - Water:	07-24764	Sample Number - Soil:	07-24760/61 -10 cm
			07-24762/63 -30 cm
Sample containers:	1 L HDPE	Sample containers:	Whirlpaks
	1 L Teflon		125 mL Jars
	250 mL Amber Glass		
Procedure/Equipment:	Waterra Tubing with ball valve	Procedure/Equipment:	Shovel, Plastic scoop
Water description:	Cloudy	Soil description:	Soil is moist fine brown sand
Filtration: (Y/N)	N		
Acidification: (Y/N)	N		
Sampling Equipment Decontamination: (Y/N)	Y	Sampling Equipment Decontamination: (Y/N)	N
Number washes:	1	Number washes:	n/a
Number rinses:	1	Number rinses:	n/a

n/a=not applicable

*From ground surface. Unless this is stated, all measurements are assumed to be from the top of the casing.

Monitoring Well Sampling Log - MW #14 2007

Site Name:	FOX-5
Date of Sampling Event:	19-Aug-07
Names of Samplers:	Matthew Mackay
	Dana Kelly
	Sam Soja
Monitoring Well ID:	MW # 14
Facility:	Upper site Main Landfill

Water Sample Measured Data

Condition of Well:	Well Ok, Casing Intact,		
Procedure/Equipment:	Measuring Tape	Procedure/Equipment:	Interface Meter
Well height above ground (m)=	0.49	Depth to water surface (m)=	0.67
Diameter of well (m)=	0.05	Static water level* (m)=	0.67
Depth of installation* (m)=	4.6	Depth to bottom (m)=	1.39
Length screened section (m)=	3.0	Free product thickness (mm)=	None
Depth to top of screen* (m)=	0.60		

Calculations		Notes	
Depth of water (m)=	0.72	Evidence of sludge etc:	None
Well volume of water (L)=	1.4	Evidence of freezing/siltation: (compare to installation record)	Ice at bottom
Length screen collecting water (m)=	0.72		

Purging Information

Equipment: Waterra Tubing with ball valve

Date & Time	Volume Removed (L)	Temperature (^{o}C)	pH	Conductivity (uS/cm)	Turbidity (NTU)	Description of water
17:00	1.75	2.6	11.06	2	46.9	Water is slightly turbid

Water Sampling		Soil Sampling	
Date and time collected:	19/08/2007 17:20	Date and time collected:	16/08/2007 11:35
Sample Number - Water:	07-24769	Sample Number - Soil:	07-24765/66 -10 cm
			07-24767/68 -30 cm
Sample containers:	1 L HDPE	Sample containers:	Whirlpaks
	1 L Teflon		125 mL Jars
	250 mL Amber Glass		
Procedure/Equipment:	Waterra Tubing with ball valve	Procedure/Equipment:	Shovel, Plastic scoop
Water description:	Cloudy	Soil description:	Soil is moist fine brown sand
Filtration: (Y/N)	N		
Acidification: (Y/N)	N		
Sampling Equipment Decontamination: (Y/N)	Y	Sampling Equipment Decontamination: (Y/N)	N
Number washes:	1	Number washes:	n/a
Number rinses:	1	Number rinses:	n/a

n/a=not applicable

*From ground surface. Unless this is stated, all measurements are assumed to be from the top of the casing.

Thermal Monitoring

Thermistor Annual Maintenance Report

Contractor Name:	**EBA**	Inspection Date:	**8/20/2007**
Prepared By:	**Ed Grozic**		

Thermistor Information

Site Name:	**FOX-5 Broughton**	Thermistor Location:	**Upper Site Main Landfill**
Thermistor Number:	**VT-1**	Inclination:	**Vertical**

Install Date:	**7/18/2006**	First Date Event:	**9/14/2006**	Last Date Event:	**8/21/2007**
Coordinates and Elevation:	N **5871**	E **4671**	Elev **490**		
Total Cable Length (m):	**8.6**	Lead Length to 1st Bead (m):	**3.52**	Number of Beads:	**12**
Datalogger Serial #:	**0202064**	Cable Serial #:	**1695**		

Thermistor Inspection

	Good	Need Maintenance
Casing	**Yes**	**No**
Cover	**Yes**	**No**
Data Logger	**Yes**	**No**
Cable	**Yes**	**No**
Beads	**Yes**	**No**
Battery Installation Date	**9/1/2006**	
Battery Levels	Main **11.34**	Aux **13.87**

Manual Ground Temperature Reading

Bead	Ohms	Degree C
1	12740	4.9264
2	14090	2.9050
3	14430	2.4302
4	15240	1.3478
5	16190	0.1579
6	16350	-0.0348
7	16390	-0.0826
8	16350	-0.0348

Bead	Ohms	Degree C
9	16330	-0.0108
10	16300	0.0252
11	16330	-0.0108
12	16360	-0.0467

Observation and Proposed Maintenance

The protective surface casing is inclined down slope about 8 degrees (visual approximation). Visually, VT-4 is inclined the greatest and VT-1 is inclined the least. The housings stickup above ground about 1.25 m to 1.55 m, indicating that their embedment depth is between 0.75 m to 0.45 m (design embedment = 0.6 m). Initially, it was unclear why the housings were inclined, but upon later review of the construction field notes it was determined that housings were installed perpendicular to the landfill slope due to limitations with the drilling equipment during installation.

Vibrating Wire Piezometer was not read because of frozen ground conditions.

Thermal Monitoring

Thermistor Annual Maintenance Report

Contractor Name:	**EBA**	Inspection Date:	**8/20/2007**
Prepared By:	**Ed Grozic**		

Thermistor Information

Site Name:	**FOX-5 Broughton**	Thermistor Location:	**Upper Site Main Landfill**
Thermistor Number:	**VT-2**	Inclination:	**Vertical**

Install Date:	**8/18/2006**	First Date Event:	**9/14/2006**	Last Date Event:	**8/21/2007**
Coordinates and Elevation:	N **5864**	E **4658**	Elev **494**		
Total Cable Length (m):	**8.6**	Lead Length to 1st Bead (m):	**3.3**	Number of Beads:	**11**
Datalogger Serial #:	**02020228**	Cable Serial #:	**1696**		

Thermistor Inspection

	Good	Need Maintenance
Casing	**Yes**	**No**
Cover	**Yes**	**No**
Data Logger	**Yes**	**No**
Cable	**Yes**	**No**
Beads	**Yes**	**No**
Battery Installation Date	**9/1/2006**	
Battery Levels	Main **11.34**	Aux **13.75**

Manual Ground Temperature Reading

Bead	Ohms	Degree C
1	13530	3.7159
2	13630	3.5684
3	14060	2.9475
4	14650	2.1296
5	15640	0.8369
6	16300	0.0252
7	16370	-0.0587
8	16340	-0.0228

Bead	Ohms	Degree C
9	16300	0.0252
10	16370	-0.0587
11	16300	0.0252

Observation and Proposed Maintenance

The protective surface casing is inclined down slope about 8 degrees (visual approximation). Visually, VT-4 is inclined the greatest and VT-1 is inclined the least. The housings stickup above ground about 1.25 m to 1.55 m, indicating that their embedment depth is between 0.75 m to 0.45 m (design embedment = 0.6 m). Initially, it was unclear why the housings were inclined, but upon later review of the construction field notes it was determined that housings were installed perpendicular to the landfill slope due to limitations with the drilling equipment during installation.

Vibrating Wire Piezometer was not read because of frozen ground conditions.

Thermal Monitoring

Thermistor Annual Maintenance Report

Contractor Name:	**EBA**	Inspection Date:	**8/20/2007**
Prepared By:	**Ed Grozic**		

Thermistor Information

Site Name:	**FOX-5 Broughton**	Thermistor Location:	**Upper Site Main Landfill**
Thermistor Number:	**VT-3**	Inclination:	**Vertical**

Install Date:	**8/18/2006**	First Date Event:	**9/14/2006**	Last Date Event:	**8/21/2007**
Coordinates and Elevation:	N **5856**	E **4682**	Elev **491**		
Total Cable Length (m):	**9.8**	Lead Length to 1st Bead (m):	**5.3**	Number of Beads:	**15**
Datalogger Serial #:	**02020255**	Cable Serial #:	**1697**		

Thermistor Inspection

	Good	Need Maintenance
Casing	**Yes**	**No**
Cover	**Yes**	**No**
Data Logger	**Yes**	**No**
Cable	**Yes**	**No**
Beads	**Yes**	**No**
Battery Installation Date	**9/1/2006**	
Battery Levels	Main **11.34**	Aux **13.75**

Manual Ground Temperature Reading

Bead	Ohms	Degree C
1	12640	5.0856
2	12670	5.0377
3	12500	5.3109
4	12030	6.0887
5	13070	4.4108
6	13920	3.1473
7	14320	2.5824
8	15190	1.4128

Bead	Ohms	Degree C
9	16150	0.2064
10	16340	-0.0228
11	16360	-0.0467
12	16300	0.0252
13	16290	0.0372
14	16270	0.0613
15	16290	0.0372

Observation and Proposed Maintenance

The protective surface casing is inclined down slope about 12 degrees (visual approximation). Visually, VT-4 is inclined the greatest and VT-1 is inclined the least. The housings stickup above ground about 1.25 m to 1.55 m, indicating that their embedment depth is between 0.75 m to 0.45 m (design embedment = 0.6 m). Initially, it was unclear why the housings were inclined, but upon later review of the construction field notes it was determined that housings were installed perpendicular to the landfill slope due to limitations with the drilling equipment during installation.

Vibrating Wire Piezometer was not read because of frozen ground conditions.

Thermal Monitoring

Thermistor Annual Maintenance Report

Contractor Name:	**EBA**	Inspection Date:	**8/20/2007**
Prepared By:	**Ed Grozic**		

Thermistor Information

Site Name:	**FOX-5 Broughton**	Thermistor Location:	**Upper Site Main Landfill**
Thermistor Number:	**VT-4**	Inclination:	**Vertical**

Install Date:	**8/16/2006**	First Date Event:	**9/14/2006**	Last Date Event:	**8/21/2007**
Coordinates and Elevation:	N **5848**	E **4669**	Elev **494**		
Total Cable Length (m):	**9**	Lead Length to 1st Bead (m):	**4.78**	Number of Beads:	**13**
Datalogger Serial #:	**02020265**	Cable Serial #:	**1698**		

Thermistor Inspection

	Good	Need Maintenance
Casing	**Yes**	**No**
Cover	**Yes**	**No**
Data Logger	**Yes**	**No**
Cable	**Yes**	**No**
Beads	**Yes**	**No**
Battery Installation Date	**9/1/2006**	
Battery Levels	Main **11.34**	Aux **13.75**

Manual Ground Temperature Reading

Bead	Ohms	Degree C
1	13450	3.8348
2	13930	3.1330
3	14010	3.0186
4	13880	3.2048
5	13780	3.3493
6	14440	2.4164
7	15570	0.9253
8	16320	0.0012

Bead	Ohms	Degree C
9	16490	-0.2016
10	16420	-0.1184
11	16390	-0.0826
12	16350	-0.0348
13	16320	0.0012

Observation and Proposed Maintenance

The protective surface casing is inclined down slope about 17 degrees (visual approximation). Visually, VT-4 is inclined the greatest and VT-1 is inclined the least. The housings stickup above ground about 1.25 m to 1.55 m, indicating that their embedment depth is between 0.75 m to 0.45 m (design embedment = 0.6 m). Initially, it was unclear why the housings were inclined, but upon later review of the construction field notes it was determined that housings were installed perpendicular to the landfill slope due to limitations with the drilling equipment during installation.

Vibrating Wire Piezometer was not read because of frozen ground conditions.

Thermal Monitoring

Thermistor Annual Maintenance Report

Contractor Name:	**EBA**	Inspection Date:	**8/20/2007**
Prepared By:	**Ed Grozic**		

Thermistor Information

Site Name:	**FOX-5 Broughton**	Thermistor Location:	**Upper Site Main Landfill**
Thermistor Number:	**VT-5**	Inclination:	**Vertical**

Install Date:	**8/16/2006**	First Date Event:	**9/14/2006**	Last Date Event:	**8/21/2007**
Coordinates and Elevation:	N **5833**	E **4645**	Elev **499**		
Total Cable Length (m):	**8**	Lead Length to 1st Bead (m):	**3.49**	Number of Beads:	**11**
Datalogger Serial #:	**02020252**	Cable Serial #:	**1699**		

Thermistor Inspection

	Good	Need Maintenance
Casing	**Yes**	**No**
Cover	**Yes**	**No**
Data Logger	**Yes**	**No**
Cable	**Yes**	**No**
Beads	**Yes**	**No**
Battery Installation Date	**9/1/2006**	
Battery Levels	Main **11.34**	Aux **13.75**

Manual Ground Temperature Reading

Bead	Ohms	Degree C
1	13.53	252.7481
2	14240	2.6940
3	13880	3.2048
4	14530	2.2929
5	15350	1.2059
6	16290	0.0372
7	16430	-0.1303
8	16480	-0.1898

Bead	Ohms	Degree C
9	16500	-0.2135
10	16530	-0.2490
11	16580	-0.3081

Observation and Proposed Maintenance

Thermal Monitoring

Thermistor Annual Maintenance Report

Contractor Name:	**EBA**	Inspection Date:	**8/20/2007**
Prepared By:	**Ed Grozic**		

Thermistor Information

Site Name:	**FOX-5 Broughton**	Thermistor Location:	**Upper Site Main Landfill**
Thermistor Number:	**VT-6**	Inclination:	**Vertical**

Install Date:	**8/17/2006**	First Date Event:	**9/14/2006**	Last Date Event:	**8/21/2007**
Coordinates and Elevation:	N **5812**	E **4558**	Elev **505**		
Total Cable Length (m):	**7.8**	Lead Length to 1st Bead (m):	**3.05**	Number of Beads:	**11**
Datalogger Serial #:	**02020256**	Cable Serial #:	**1700**		

Thermistor Inspection

	Good	Need Maintenance
Casing	**Yes**	**No**
Cover	**Yes**	**No**
Data Logger	**Yes**	**No**
Cable	**Yes**	**No**
Beads	**Yes**	**No**
Battery Installation Date	**9/1/2006**	
Battery Levels	Main **11.34**	Aux **13.50**

Manual Ground Temperature Reading

Bead	Ohms	Degree C
1	13630	3.5684
2	13690	3.4804
3	14450	2.4026
4	15220	1.3738
5	16060	0.3161
6	16280	0.0493
7	16460	-0.1660
8	16580	-0.3081

Bead	Ohms	Degree C
9	16640	-0.3787
10	16610	-0.3434
11	16720	-0.4723

Observation and Proposed Maintenance

Thermal Monitoring

Thermistor Annual Maintenance Report

Contractor Name:	**EBA**	Inspection Date:	**8/20/2007**
Prepared By:	**Ed Grozic**		

Thermistor Information

Site Name:	**FOX-5 Broughton**	Thermistor Location:	**Upper Site Main Landfill**
Thermistor Number:	**VT-7**	Inclination:	**Vertical**

Install Date:	**8/16/2006**	First Date Event:	**9/14/2006**	Last Date Event:	**8/21/2007**
Coordinates and Elevation:	N **5751**	E **4603**	Elev **509**		
Total Cable Length (m):	**7.8**	Lead Length to 1st Bead (m):	**3.13**	Number of Beads:	**11**
Datalogger Serial #:	**02020257**	Cable Serial #:	**1701**		

Thermistor Inspection

	Good	Need Maintenance
Casing	**Yes**	**No**
Cover	**Yes**	**No**
Data Logger	**Yes**	**No**
Cable	**Yes**	**No**
Beads	**Yes**	**No**
Battery Installation Date	**9/1/2006**	
Battery Levels	Main **11.34**	Aux **13.02**

Manual Ground Temperature Reading

Bead	Ohms	Degree C
1	14360	2.5269
2	14010	3.0186
3	14810	1.9141
4	16020	0.3650
5	16370	-0.0587
6	16470	-0.1779
7	16540	-0.2608
8	16590	-0.3198

Bead	Ohms	Degree C
9	16650	-0.3904
10	16730	-0.4840
11	16780	-0.5423

Observation and Proposed Maintenance

Thermal Monitoring

Thermistor Annual Maintenance Report

Contractor Name:	**EBA**	Inspection Date:	**8/20/2007**
Prepared By:	**Ed Grozic**		

Thermistor Information

Site Name:	**FOX-5 Broughton**	Thermistor Location:	**Upper Site Main Landfill**
Thermistor Number:	**VT-8**	Inclination:	**Vertical**

Install Date:	**8/16/2006**	First Date Event:	**9/14/2006**	Last Date Event:	**8/21/2007**
Coordinates and Elevation:	N **5722**	E **4616**	Elev **510**		
Total Cable Length (m):	**7.3**	Lead Length to 1st Bead (m):	**2.7**	Number of Beads:	**10**
Datalogger Serial #:	**02020259**	Cable Serial #:	**1702**		

Thermistor Inspection

	Good	Need Maintenance
Casing	**Yes**	**No**
Cover	**Yes**	**No**
Data Logger	**Yes**	**No**
Cable	**Yes**	**No**
Beads	**Yes**	**No**
Battery Installation Date	**9/1/2006**	
Battery Levels	Main **11.34**	Aux **13.38**

Manual Ground Temperature Reading

Bead	Ohms	Degree C
1	14110	2.8767
2	14370	2.5131
3	15480	1.0395
4	16280	0.0493
5	16530	-0.2490
6	16680	-0.4256
7	16720	-0.4723
8	16850	-0.6235

Bead	Ohms	Degree C
9	16940	-0.7274
10	17030	-0.8307

Observation and Proposed Maintenance

Annex: Middle Site Non-Hazardous Waste Landfill/Tier II Soil Disposal Facility - Year 1 Data

Figure:

- FOX-5.4: Middle Site Non-Hazardous Waste Landfill/Tier II Soil Disposal Facility
- Ground Temperature Profile Main Landfill Facility Vertical GTC VT-9
- Ground Temperature Profile Main Landfill Facility Vertical GTC VT-10
- Ground Temperature Profile Main Landfill Facility Vertical GTC VT-11
- Ground Temperature Profile Main Landfill Facility Vertical GTC VT-12

Tables:

- Landfill Visual Inspection - FOX-5 Broughton Island Middle Site Tier II Soil Disposal Facility/Non-Hazardous Waste Landfill
- Middle Site Non-Hazardous Waste Landfill/Tier II Soil Disposal Facility - Year 1 (2007) Soil Data
- Middle Site Non-Hazardous Waste Landfill/Tier II Soil Disposal Facility - Evaluation of Year 1 Soil Analytical Data
- Middle Site Non-Hazardous Waste Landfill/Tier II Soil Disposal Facility - Year 1 (2007) Groundwater Data

Photographic Records:

- Photos C21 through C23
- Photos C24 and C25
- Photos C26 and C27
- Photos C28 and C29
- Photos C30

Well Sampling Records:

- Well MW 5
- Well MW 6
- Well MW 7
- Well MW 8
- Well MW 9

Thermistor Annual Maintenance Reports:

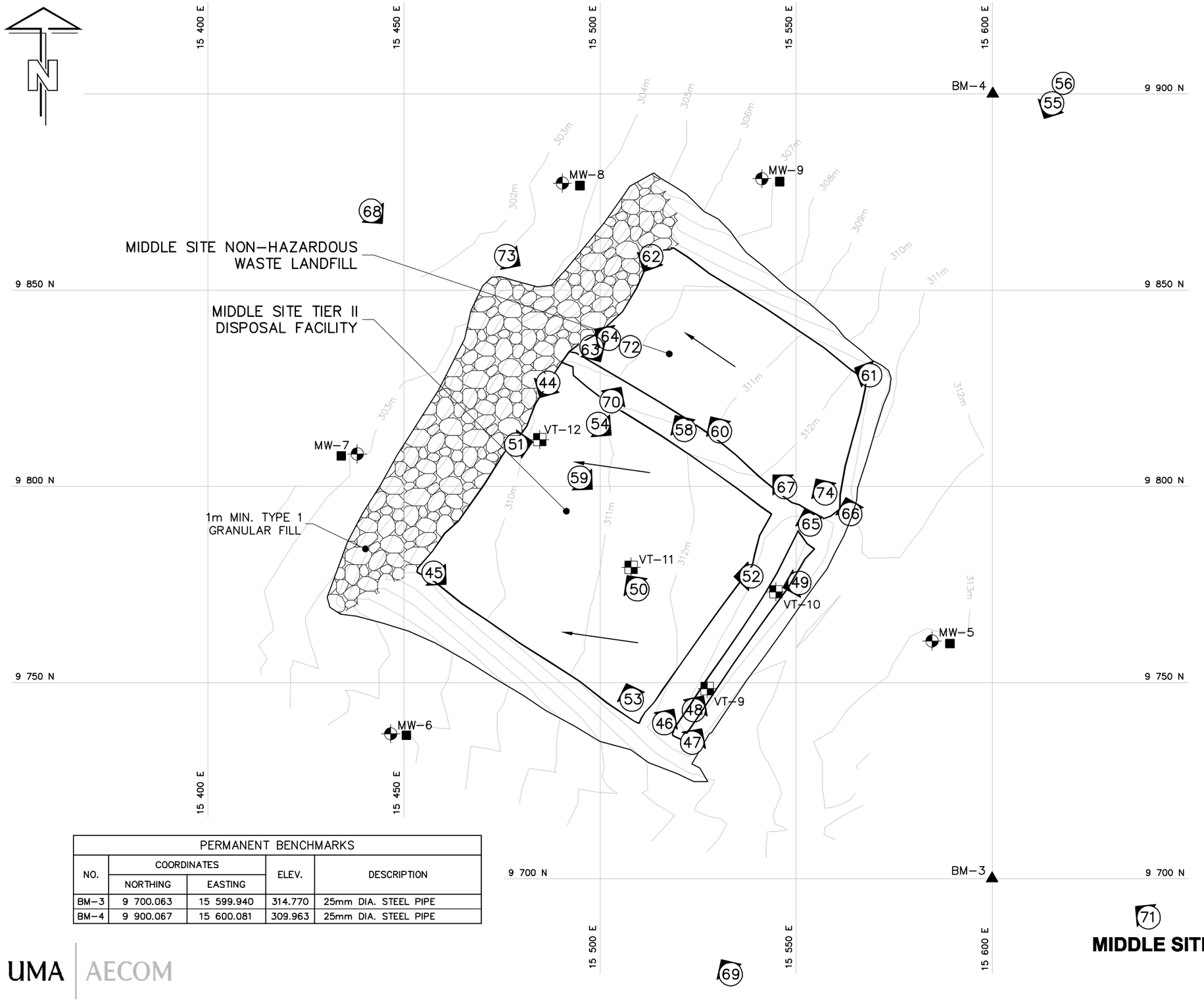
- VT-9
- VT-10
- VT-11
- VT-12

Middle Site Tier II Soil Disposal Facility - Evaluation of Ground Temperature

Ground temperature profiles for vertical thermistors VT-9 to VT-12 are attached, showing ground temperatures curves since August, 2007. The table shows the depth of active layer as defined by the 0°C isotherm for August 20, 2007.

Summary of Tier II Soil Disposal Facility Thermal Results				
	VT-9	**VT-10**	**VT-11**	**VT-12**
Depth (m) of 0°C Isotherm (Aug 20/07)	1.3	1.8	1.5	1.3

The inferred active layer depths noted above are less than the thickness of the 2.2 m granular cover over the Tier II soil; the landfill contents are remaining frozen. The measured active layers are within the range of the thermal calculations (EBA 2007).



LEGEND:

- TBM4 — TEMPORARY BENCHMARK
- BM-1 — PERMANENT BENCHMARK
- 101 — COORDINATE POINT
- MONITORING SOIL SAMPLE LOCATION
- MONITORING WELL LOCATION
- VERTICAL THERMISTOR LOCATION
- 63 — PHOTOGRAPHIC VIEWPOINT

COORDINATE POINTS (AS-BUILT)
VERTICAL THERMISTORS

NO.	NORTHING	EASTING
VT-9	9 748.5	15 527.3
VT-10	9 773.1	15 544.8
VT-11	9 779.4	15 507.9
VT-12	9 811.9	15 484.6

COORDINATE POINTS (AS BUILT)
MONITORING WELLS

NO.	NORTHING	EASTING	ELEV.
MW-5	9 760.6	15 584.6	313.23
MW-6	9 736.9	15 446.6	305.89
MW-7	9 808.2	15 438.1	303.13
MW-8	9 877.3	15 490.4	303.48
MW-9	9 878.4	15 541.2	306.69

SCALE 1:1000 — 0 10 20 30 m

RECORD DRAWING
NOT FOR CONSTRUCTION

PERMANENT BENCHMARKS

NO.	COORDINATES		ELEV.	DESCRIPTION
	NORTHING	EASTING		
BM-3	9 700.063	15 599.940	314.770	25mm DIA. STEEL PIPE
BM-4	9 900.067	15 600.081	309.963	25mm DIA. STEEL PIPE

UMA | AECOM

DWG NAME: F5-RD04.DWG CLC – 07/12/13

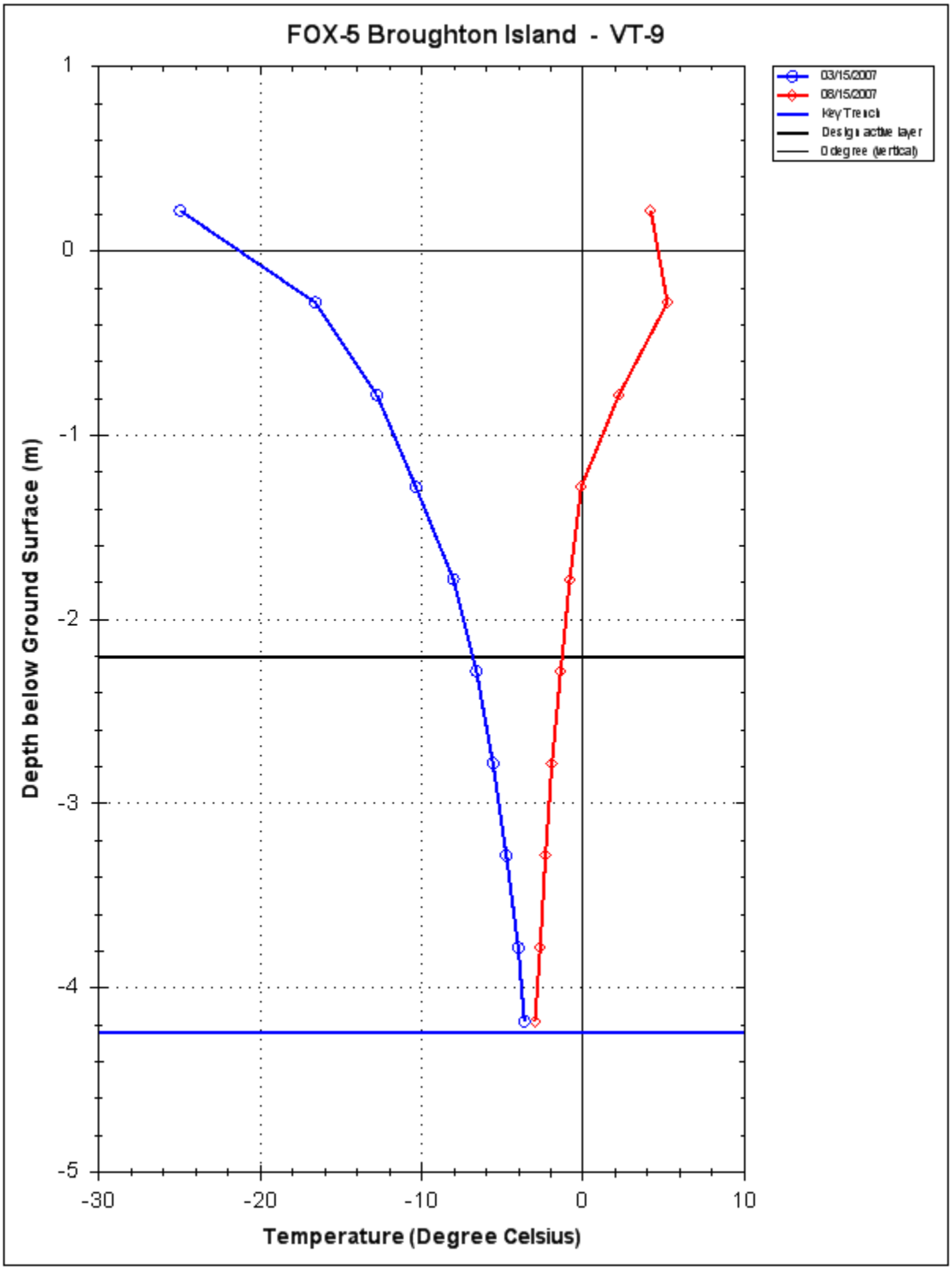
DEW LINE CLEAN UP
LANDFILL MONITORING PLAN

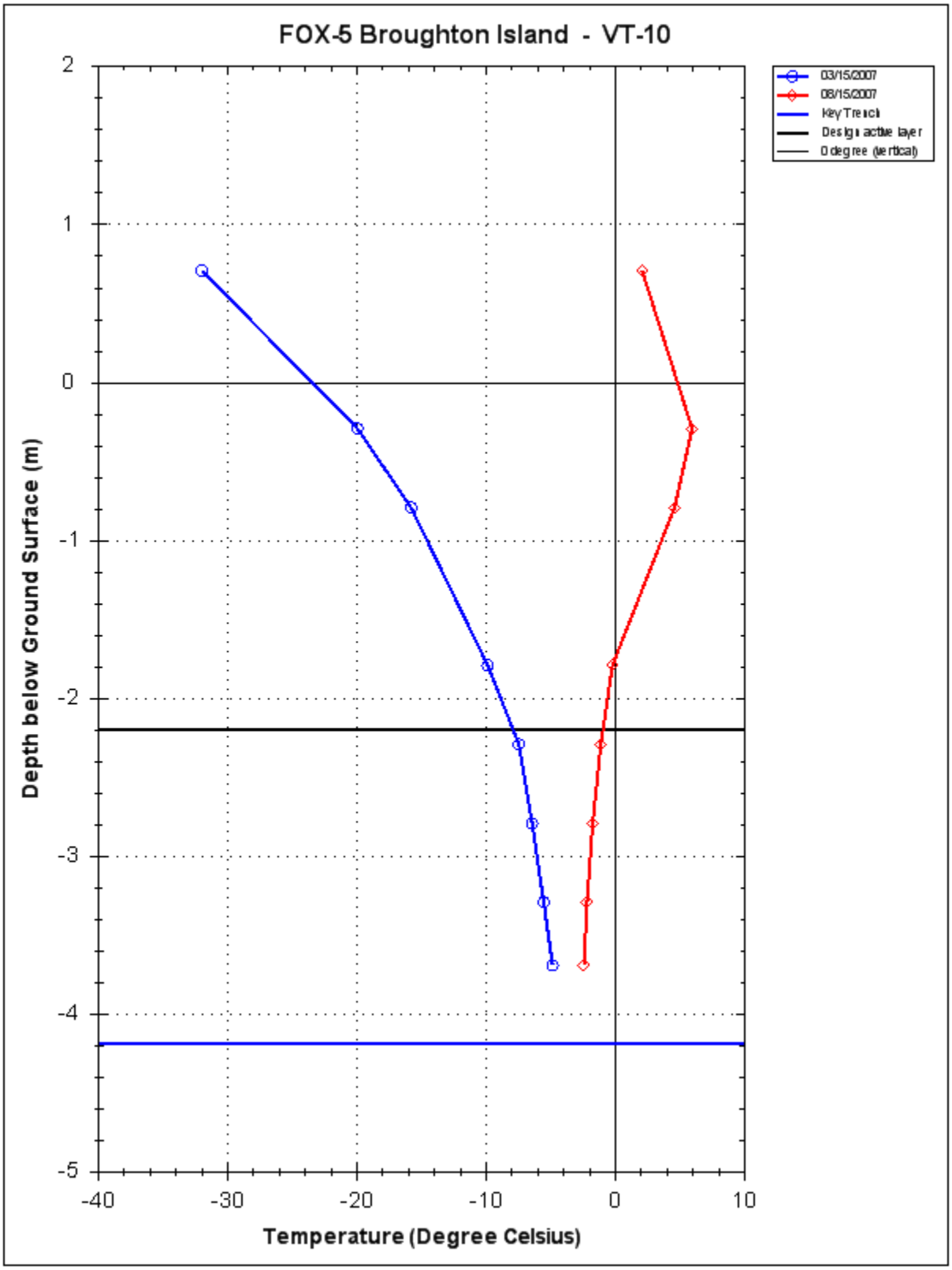
FOX-5 BROUGHTON ISLAND

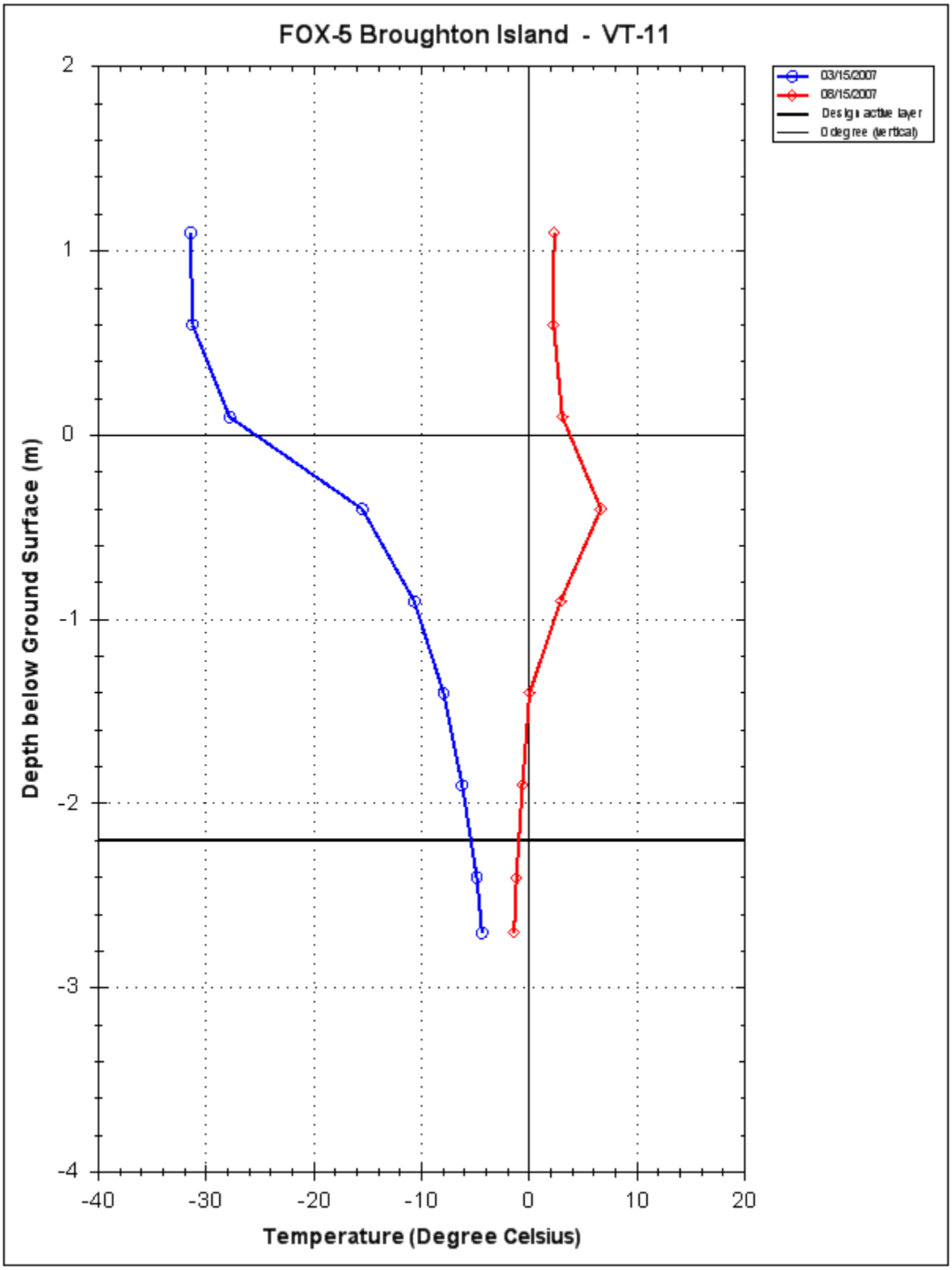
MIDDLE SITE NON-HAZARDOUS WASTE LANDFILL AND TIER II DISPOSAL FACILITY

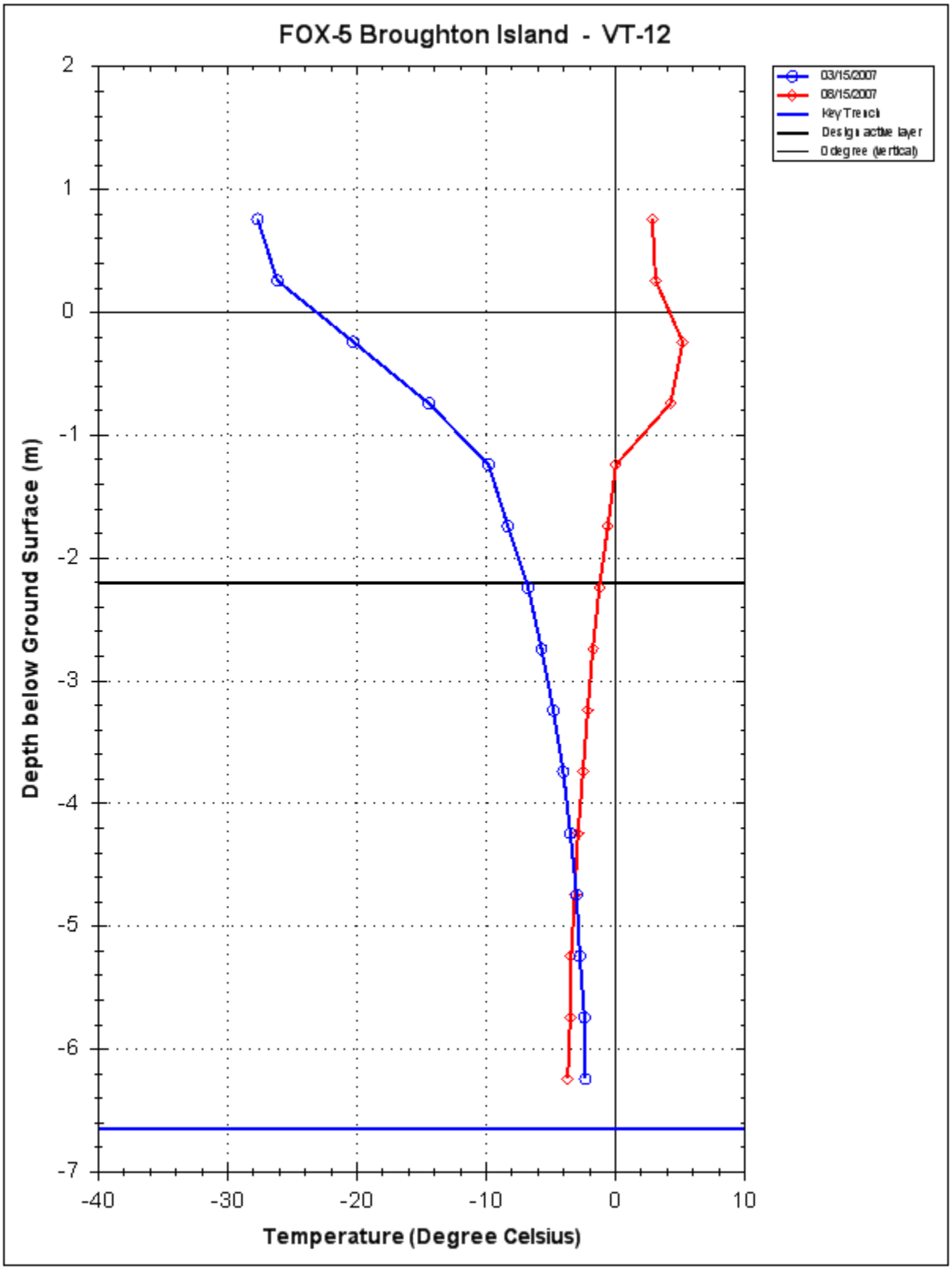
FIGURE FOX-5.4

THERMAL MONITORING ANNUAL DATA ANALYSIS




FOX-5 Broughton Island - VT-10
03/15/2007
08/15/2007
Key Trench
Design active layer
0 degree (vertical)
Depth below Ground Surface (m)
2
1
0
-1
-2
-3
-4
-5
-40
-30
-20
-10
0
10
Temperature (Degree Celsius)


FOX-5 Broughton Island - VT-11
03/15/2007
08/15/2007
Design active layer
0 degree (vertical)
Depth below Ground Surface (m)
2
1
0
-1
-2
-3
-4
-40
-30
-20
-10
0
10
20
Temperature (Degree Celsius)


FOX-5 Broughton Island - VT-12
03/15/2007
08/15/2007
Key Trench
Design active layer
0 degree (vertical)
Depth below Ground Surface (m)
2
1
0
-1
-2
-3
-4
-5
-6
-7
-40
-30
-20
-10
0
10
Temperature (Degree Celsius)

LANDFILL VISUAL INSPECTION

Site Name: FOX-5, Broughton Island
Landfill: **Middle Site Tier II Soil Disposal Facility/Non-Hazardous Waste Landfill**
Designation:
Date Inspected: August 19 to August 21, 2007
Inspected by: Ed Grozic, P.Eng.
EBA Engineering Consultants Ltd.
Signature:

TABLE C1: MIDDLE SITE TIER II SOIL DISPOSAL FACILITY & NON-HAZARDOUS WASTE LANDFILL

Checklist Item	Present Yes/No	Location	Length	Width	Depth	Extent	Description	Photographic Records (Images Provided on Data CD)	Severity Rating	Additional Comments
Settlement	Yes	Feature E See Figure FOX-5.C1	~5 m	~ 2 m	< 3 cm	Isolated	Subtle depression	Photo 23 (Image 60) Photo 24 (Image 58) Additional CD Images Image 67 and 70	Acceptable	Subtle depression on surface of NHW Landfill. Water appears to have temporarily ponded in the area. Area slopes/grades slightly to the northwest. There is potential for additional settlement and water ponding to occur as the landfill contents settle over time.
Erosion	Yes	Feature F See Figure FOX-5.C1	~ 18 m	< 0.5	~ 0.1 m	Isolated	Minor erosion	Photo 25 (Image 72) Additional CD Images Image 64 and 73	Acceptable	Minor erosion along northwest slope of landfill due to channeling of surface runoff. Cobbles and boulders are present on the slope and provide natural armoring.
Frost Action	No	N/A	N/A	N/A	N/A	None	N/A	N/A	N/A	N/A
Animal Burrows	No	N/A	N/A	N/A	N/A	None	N/A	N/A	N/A	N/A
Vegetation	No	N/A	N/A	N/A	N/A	None	N/A	N/A	N/A	N/A
Staining	Yes	Feature G See Figure FOX-5.C1	~ 30 m	~ 20 m	N/A	Isolated	Subtle discoloration	Images 65 and 74 on CD	Acceptable	Naturally patchy and mottled reddish discoloration on surface of landfill at northeast part of NHW Landfill
Vegetation Stress	No	N/A	N/A	N/A	N/A	None	N/A	N/A	N/A	N/A
Seepage Points	No	N/A	N/A	N/A	N/A	None	N/A	N/A	N/A	N/A
Debris Exposed	No	N/A	N/A	N/A	N/A	None	N/A	N/A	N/A	N/A
Presence/Condition of Monitoring Instruments	Yes	See Figure FOX-5.C1 VT-9 to VT-12	N/A	N/A	N/A	N/A	N/A	Photos 26 to 29 (Images 46 to 51)	Acceptable	Successfully downloaded ground temperature data from loggers.
Other Features of Note	No	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Overall Landfill Performance:	**Acceptable**									

Middle Site Non-Hazardous Waste Landfill/Tier II Disposal Facility - Year 1 (2007) Soil Data (in mg/kg)

Sample #	Location	Date	Depth (cm)	Cu	Ni	Co	Cd	Pb	Zn	Cr	As	Hg	PCBs	TPH	TPH Identity		
															F1	F2	F3
Middle Site Facility - Baseline Concentrations				**7.6+/-0.4**	**5.2+/-0.6**	**<5.0**	**<1.0**	**<10**	**31.7+/-2.1**	**<20**	**2.0+/-0.2**	**<0.10**	**<0.0030**	**16+/-2**			
Middle Site Facility - Maximum Concentrations				**11**	**8.3**	**7.5**			**46**		**3.5**		**<0.1**	**28**			
Up-gradient Soil Samples																	
24720/21	MW 5	2007	10	5.5	<5.0	<5.0	<1.0	<10	30	<20	1.2	<0.10	<0.0030	121	<10	11	110
24722	MW 5	2007	40	6.4	6.2	6.2	<1.0	<10	37	<20	<1.0	<0.10	<0.0030	31	<10	5.3	26
Down-gradient Soil Samples																	
24726	MW 6	2007	10	5.1	5.3	5.0	<1.0	<10	29	<20	<1.0	<0.10	<0.0030	38	<10	4.2	34
24728	MW 6	2007	40	5.7	5.4	5.3	<1.0	<10	32	<20	<1.0	<0.10	<0.0030	29	<10	< 4.0	29
24730/31	MW 7	2007	10	6.4	6.0	5.0	<1.0	<10	35	<20	<1.0	<0.10	<0.0030	67	<10	4.1	63
24732	MW 7	2007	40	6.9	6.5	5.8	<1.0	<10	42	<20	<1.0	<0.10	<0.0030	39	<10	8.7	30
24736	MW 8	2007	10	4.9	<5.0	<5.0	<1.0	<10	28	<20	1.2	<0.10	<0.0030	53	<10	6.3	47
24738	MW 8	2007	40	4.5	<5.0	<5.0	<1.0	<10	27	<20	<1.0	<0.10	<0.0030	43	<10	6.0	37
24740/41	MW 9	2007	10	5.2	5.2	<5.0	<1.0	<10	31	<20	<1.0	<0.10	<0.0030	29	<10	7.3	22
24742	MW 9	2007	40	4.6	<5.0	<5.0	<1.0	<10	28	<20	1.1	<0.10	<0.0030	18	<10	6.2	12

Middle Site Non-Hazardous Waste Landfill/Tier II Disposal Facility - EVALUATION OF YEAR 1 SOIL ANALYTICAL DATA

Parameter	N value Baseline	Arithmetic Mean +/- 95% Confidence Limit Baseline	Maximum Baseline [mg/kg]	2007	Comments
Copper	39	7.6+/-0.4	11	All measured results within the 95% confidence limit.	
Nickel	39	5.2+/-0.6	8.3	Measured results within the 95% confidence limit for seven of ten results.	Up-gradient depth sample at MW 5 had a concentration of 6.2 mg/kg (below baseline max). Shallow and depth samples for MW 7 had concentrations of 6.0 & 6.5 mg/kg respectively (below baseline max).
Cobalt	39	<5.0	7.5	Concentrations consistent with baseline mean (non-detect) for five of ten results.	Up-gradient depth sample at MW 5 (6.2 mg/kg) and depth and shallow samples for MW 6 & 7 (5.3, 5.0, 5.8, 5.0 respectively) were slightly elevated above the baseline mean. All were below baseline max.
Cadmium	39	<1.0		Concentrations consistent with baseline mean (non-detect).	
Lead	39	<10		Concentrations consistent with baseline mean (non-detect).	
Zinc	39	31.7+/-2.1	46	Measured results within the 95% confidence limit for seven of ten results.	Up-gradient depth sample at MW 5 had a concentration of 37 mg/kg (below baseline max). Shallow and depth samples for MW 7 had concentrations of 35 & 42 mg/kg respectively (below baseline max).
Chromium	39	<20		Concentrations consistent with baseline mean (non-detect).	
Arsenic	39	2.0+/-0.2	3.5	All measured results within the 95% confidence limit.	
Mercury	20	<0.10		Concentrations consistent with baseline mean (non-detect).	
PCBs	39	<0.0030	<0.1	All results non-detect.	
TPH	39	16+/-2	28	All measured results above the 95% confidence limit with one exception.	Shallow and depth samples for all wells except MW 9 have slightly elevated levels of F2 and F3 hydrocarbons. Concentrations ranged from 18 to 121 mg/kg, with the highest concentration at the up-gradient location.

Middle Site Non-Hazardous Waste Landfill/Tier II Disposal Facility - Year 1 (2007) Groundwater Data (in mg/L)

Sample #	Location	Date	Cu	Ni	Co	Cd	Pb	Zn	Cr	As	Hg	PCBs	TPH	TPH Identity		
														F1	F2	F3
Up-gradient Groundwater Samples																
24724	MW 5	2007	0.012	0.044	<0.0030	<0.0010	<0.010	0.086	0.089	<0.0030	<0.00040	<0.000020	<1.0	<0.050	<0.50	<1.0
Down-gradient Groundwater Samples																
24729	MW 6	2007	0.018	0.10	<0.0030	<0.0010	<0.010	0.039	0.21	<0.0030	<0.00040	<0.000020	<1.0	<0.050	<0.50	<1.0
24734	MW 7	2007	0.017	0.076	0.0040	<0.0010	<0.010	0.032	0.14	<0.0030	<0.00040	<0.000020	<1.0	<0.050	<0.50	<1.0
24739	MW 8	2007	0.015	0.062	<0.0030	<0.0010	<0.010	0.18	0.12	<0.0030	<0.00040	<0.000020	<1.0	<0.050	<0.50	<1.0
24744	MW 9	2007	0.029	0.10	<0.0030	<0.0010	<0.010	0.042	0.20	<0.0030	<0.00040	<0.000020	<1.0	<0.050	<0.50	<1.0

Photo 21 (Image 53 MSTII)
Tier II Facility - Panoramic from south corner.

Photo 22 (Image 56 MSTII)
Middle Site Non-hazardous Waste Landfill - View from road looking southwest.

Photo 23 (Image 60 MSTII)
Middle Site Tier II/NHW Landfill looking northwest along adjoining berm.

Photo 24 (Image 58 MSTII)
Middle Site Non-hazardous Waste Landfill - Subtle depression and wet area on surface of landfill.

Photo 25 (Image 72 MSNHWLF)
Middle Site Non-hazardous Waste Landfill - Minor erosion and migration of fine-grained sediment on northwest facing slope.

Photo 26 (Image 48 MSTII)
Tier II Facility - VT-9 looking northeast.

Photo 27 (Image 49 MSTII)
Tier II Facility - VT-10 looking east.

Photo 28 (Image 50 MSTII)
Tier II Facility - VT-11 looking south.

Photo 29 (Image 51 MSTII)
VT-12 looking northeast.

Photo 30 (Image 74 MSNHWLF)
Middle Site Non-Hazardous Waste Landfill - Panoramic view of surface of landfill looking northwest.
Note natural reddish discoloration of landfill surface.

Monitoring Well Sampling Log - BMW #5 2007

`	FOX-5		
Date of Sampling Event:	19-Aug-07		
Names of Samplers:	Matthew Mackay		
	Dana Kelly		
	Sam Soja		
Monitoring Well ID:	BMW #5		
Facility:	Middle Site Tier II/NHWLF		
Water Sample Measured Data			
Condition of Well:	Well Ok, Casing Intact, DEW Line Lock Intact		
Procedure/Equipment:	Measuring Tape	Procedure/Equipment:	Interface Meter
Well height above ground (m)=	0.47	Depth to water surface (m)=	0.72
Diameter of well (m)=	0.05	Static water level* (m)=	0.72
Depth of installation* (m)=	4.6	Depth to bottom (m)=	1.59
Length screened section (m)=	3.0	Free product thickness (mm)=	None
Depth to top of screen* (m)=	0.60		
Calculations		**Notes**	
Depth of water (m)=	0.87	Evidence of sludge etc:	None
Well volume of water (L)=	1.7	Evidence of freezing/siltation: (compare to installation record)	Ice at bottom
Length screen collecting water (m)=	0.87		

Purging Information

Equipment: Waterra Tubing with ball valve

Date & Time	Volume Removed (L)	Temperature (^{o}C)	pH	Conductivity (uS/cm)	Turbidity (NTU)	Description of water
9:00	2.0 L	3.9	11.5	4	137	Water is cloudy and slightly turbid

Water Sampling		**Soil Sampling**	
Date and time collected:	19/08/2007 9:20	Date and time collected:	15/08/2007 9:30
Sample Number - Water:	07-24724	Sample Number - Soil:	07-24720/21 -10 cm
			07-24722/23 -30 cm
Sample containers:	1 L HDPE	Sample containers:	Whirlpaks
	1 L Teflon		125 mL Jars
	250 mL Amber Glass		
Procedure/Equipment:	Waterra Tubing with ball valve	Procedure/Equipment:	Shovel, Plastic scoop
Water description:	Water is cloudy and slightly turbid	Soil description:	Organics to 10 cm, brown silt and sand, 10% gravel and rock
Filtration: (Y/N)	N		
Acidification: (Y/N)	N		
Sampling Equipment Decontamination: (Y/N)	Y	Sampling Equipment Decontamination: (Y/N)	N
Number washes:	1	Number washes:	n/a
Number rinses:	1	Number rinses:	n/a

n/a=not applicable

*From ground surface. Unless this is stated, all measurements are assumed to be from the top of the casing.

Monitoring Well Sampling Log - MW# 6 2007

`	FOX-5		
Date of Sampling Event:	19-Aug-07		
Names of Samplers:	Matthew Mackay		
	Dana Kelly		
	Sam Soja		
Monitoring Well ID:	MW # 6		
Facility:	Middle Site Tier II/NHWLF		
Water Sample Measured Data			
Condition of Well:	There is water in the casing almost to the top of the well, Casing Intact, DEW Line Lock Intact		
Procedure/Equipment:	Measuring Tape	Procedure/Equipment:	Interface Meter
Well height above ground (m)=	0.47	Depth to water surface (m)=	0.62
Diameter of well (m)=	0.05	Static water level* (m)=	0.62
Depth of installation* (m)=	4.7	Depth to bottom (m)=	1.65
Length screened section (m)=	3.0	Free product thickness (mm)=	None
Depth to top of screen* (m)=	0.50		
Calculations		**Notes**	
Depth of water (m)=	1.03	Evidence of sludge etc:	None
Well volume of water (L)=	2.0	Evidence of freezing/siltation: (compare to installation record)	Ice at bottom
Length screen collecting water (m)=	1.03		

Purging Information

Equipment: Waterra Tubing with ball valve

Date & Time	Volume Removed (L)	Temperature (^{o}C)	pH	Conductivity (uS/cm)	Turbidity (NTU)	Description of water
10:00	2.75	4.4	11.52	3	41.3	Water is slightly turbid and translucent

Water Sampling		**Soil Sampling**	
Date and time collected:	19/08/2007 10:20	Date and time collected:	15/08/2007 10:15
Sample Number - Water:	07-24729	Sample Number - Soil:	07-24725/26 -10 cm
			07-24727/28 - 30cm
Sample containers:	1 L HDPE	Sample containers:	Whirlpaks
	1 L Teflon		125 mL Jars
	250 mL Amber Glass		
Procedure/Equipment:	Waterra Tubing with ball valve	Procedure/Equipment:	Shovel, Plastic scoop
Water description:	Water is clear	Soil description:	Organics to 10 cm, brown silt and sand, some gravel and rock
Filtration: (Y/N)	N		
Acidification: (Y/N)	N		
Sampling Equipment Decontamination: (Y/N)	Y	Sampling Equipment Decontamination: (Y/N)	N
Number washes:	1	Number washes:	n/a
Number rinses:	1	Number rinses:	n/a

n/a=not applicable

*From ground surface. Unless this is stated, all measurements are assumed to be from the top of the casing.

Monitoring Well Sampling Log - MW# 7 2007

`	FOX-5		
Date of Sampling Event:	19-Aug-07		
Names of Samplers:	Matthew Mackay		
	Dana Kelly		
	Sam Soja		
Monitoring Well ID:	MW # 7		
Facility:	Middle Site Tier II/NHWLF		
Water Sample Measured Data			
Condition of Well:	There is water in the casing almost to the top of the well, Casing Intact, DEW Line Lock Intact		
Procedure/Equipment:	Measuring Tape	Procedure/Equipment:	Interface Meter
Well height above ground (m)=	0.42	Depth to water surface (m)=	0.98
Diameter of well (m)=	0.05	Static water level* (m)=	0.98
Depth of installation* (m)=	4.6	Depth to bottom (m)=	1.64
Length screened section (m)=	3.0	Free product thickness (mm)=	None
Depth to top of screen* (m)=	0.40		
Calculations		**Notes**	
Depth of water (m)=	0.66	Evidence of sludge etc:	None
Well volume of water (L)=	1.3	Evidence of freezing/siltation: (compare to installation record)	Ice at bottom
Length screen collecting water (m)=	0.66		

Purging Information

Equipment: Waterra Tubing with ball valve

Date & Time	Volume Removed (L)	Temperature (^{o}C)	pH	Conductivity (uS/cm)	Turbidity (NTU)	Description of water
11:00	1.5	5.4	11.11	3	43	Water is translucent

Water Sampling		**Soil Sampling**	
Date and time collected:	19/08/2007 11:20	Date and time collected:	15/08/2007 11:00
Sample Number - Water:	07-24734	Sample Number - Soil:	07-24730/31 -10 cm
			07-24732/33 -30 cm
Sample containers:	1 L HDPE	Sample containers:	Whirlpaks
	1 L Teflon		125 mL Jars
	250 mL Amber Glass		
Procedure/Equipment:	Waterra Tubing with ball valve	Procedure/Equipment:	Shovel, Plastic scoop
Water description:	Water is clear	Soil description:	Organics to 10 cm, brown silt and sand, some gravel and rock
Filtration: (Y/N)	N		
Acidification: (Y/N)	N		
Sampling Equipment Decontamination: (Y/N)	Y	Sampling Equipment Decontamination: (Y/N)	N
Number washes:	1	Number washes:	n/a
Number rinses:	1	Number rinses:	n/a

n/a=not applicable

*From ground surface. Unless this is stated, all measurements are assumed to be from the top of the casing.

Monitoring Well Sampling Log - MW# 8 2007

`	FOX-5		
Date of Sampling Event:	19-Aug-07		
Names of Samplers:	Matthew Mackay		
	Dana Kelly		
	Sam Soja		
Monitoring Well ID:	MW # 8		
Facility:	Middle Site Tier II/NHWLF		
Water Sample Measured Data			
Condition of Well:	Well OK, Casing Intact, DEW Line Lock Intact		
Procedure/Equipment:	Measuring Tape	Procedure/Equipment:	Interface Meter
Well height above ground (m)=	0.49	Depth to water surface (m)=	0.80
Diameter of well (m)=	0.05	Static water level* (m)=	0.80
Depth of installation* (m)=	4.7	Depth to bottom (m)=	1.46
Length screened section (m)=	3.0	Free product thickness (mm)=	None
Depth to top of screen* (m)=	0.45		
Calculations		**Notes**	
Depth of water (m)=	0.66	Evidence of sludge etc:	None
Well volume of water (L)=	1.3	Evidence of freezing/siltation: (compare to installation record)	Ice at bottom
Length screen collecting water (m)=	0.66		

Purging Information

Equipment: Waterra Tubing with ball valve

Date & Time	Volume Removed (L)	Temperature (^{o}C)	pH	Conductivity (uS/cm)	Turbidity (NTU)	Description of water
12:00	1.75	5	10.9	5	22.8	Minimal sediment floating in the water

Water Sampling		**Soil Sampling**	
Date and time collected:	19/08/2007 12:20	Date and time collected:	15/08/2007 11:45
Sample Number - Water:	07-24739	Sample Number - Soil:	07-24735/36 -10 cm
			07-24737/38 -30 cm
Sample containers:	1 L HDPE	Sample containers:	Whirlpaks
	1 L Teflon		125 mL Jars
	250 mL Amber Glass		
Procedure/Equipment:	Waterra Tubing with ball valve	Procedure/Equipment:	Shovel, Plastic scoop
Water description:	Water is clear	Soil description:	Organics to 10 cm, brown silt and sand, some gravel and rock
Filtration: (Y/N)	N		
Acidification: (Y/N)	N		
Sampling Equipment Decontamination: (Y/N)	Y	Sampling Equipment Decontamination: (Y/N)	N
Number washes:	1	Number washes:	n/a
Number rinses:	1	Number rinses:	n/a

n/a=not applicable

*From ground surface. Unless this is stated, all measurements are assumed to be from the top of the casing.

Monitoring Well Sampling Log - MW #9 2007

`	FOX-5		
Date of Sampling Event:	19-Aug-07		
Names of Samplers:	Matthew Mackay		
	Dana Kelly		
	Sam Soja		
Monitoring Well ID:	MW # 9		
Facility:	Middle Site Tier II/NHWLF		
Water Sample Measured Data			
Condition of Well:	There is water in the casing, Casing Intact, DEW Line Lock Intact		
Procedure/Equipment:	Measuring Tape	Procedure/Equipment:	Interface Meter
Well height above ground (m)=	0.49	Depth to water surface (m)=	1.10
Diameter of well (m)=	0.05	Static water level* (m)=	1.10
Depth of installation* (m)=	4.60	Depth to bottom (m)=	1.47
Length screened section (m)=	3.00	Free product thickness (mm)=	None
Depth to top of screen* (m)=	0.50		
Calculations		**Notes**	
Depth of water (m)=	0.37	Evidence of sludge etc:	None
Well volume of water (L)=	0.7	Evidence of freezing/siltation: (compare to installation record)	Ice at bottom
Length screen collecting water (m)=	0.37		

Purging Information

Equipment: Waterra Tubing with ball valve

Date & Time	Volume Removed (L)	Temperature (^{o}C)	pH	Conductivity (uS/cm)	Turbidity (NTU)	Description of water
13:00	1	4.7	10.8	2	57.1	Cloudy

Water Sampling		**Soil Sampling**	
Date and time collected:	19/08/2007 13:30	Date and time collected:	15/08/2007 12:20
Sample Number - Water:	07-24744	Sample Number - Soil:	07-24740/41 -10 cm
			07-24742/43 -30 cm
Sample containers:	1 L HDPE	Sample containers:	Whirlpaks
	1 L Teflon		125 mL Jars
	250 mL Amber Glass		
Procedure/Equipment:	Waterra Tubing with ball valve	Procedure/Equipment:	Shovel, Plastic scoop
Water description:	Water still cloudy	Soil description:	Organics to 10 cm, brown silt and sand, some gravel and rock
Filtration: (Y/N)	N		
Acidification: (Y/N)	N		
Sampling Equipment Decontamination: (Y/N)	Y	Sampling Equipment Decontamination: (Y/N)	N
Number washes:	1	Number washes:	n/a
Number rinses:	1	Number rinses:	n/a

n/a=not applicable

*From ground surface. Unless this is stated, all measurements are assumed to be from the top of the casing.

Thermal Monitoring

Thermistor Annual Maintenance Report

Contractor Name:	**EBA**	Inspection Date:	**8/20/2007**
Prepared By:	**Ed Grozic**		

Thermistor Information

Site Name:	**FOX-5 Broughton**	Thermistor Location:	**Middle Site Tier II Soil Disposal Facility**
Thermistor Number:	**VT-9**	Inclination:	**Vertical**

Install Date:	**9/1/2006**	First Date Event:	**9/14/2006**	Last Date Event:	**8/19/2007**		
Coordinates and Elevation:	N	**9749**	E	**15528**	Elev	**313**	
Total Cable Length (m):	**7.4**	Lead Length to 1st Bead (m):	**3.22**	Number of Beads:	**10**		
Datalogger Serial #:	**02020261**	Cable Serial #:	**1703**				

Thermistor Inspection

	Good	Need Maintenance	
Casing	**Yes**	**No**	
Cover	**Yes**	**No**	
Data Logger	**Yes**	**No**	
Cable	**Yes**	**No**	
Beads	**Yes**	**No**	
Battery Installation Date		**9/1/2006**	
Battery Levels	Main	**11.34**	Aux **13.38**

Manual Ground Temperature Reading

Bead	Ohms	Degree C
1	11030	7.8637
2	14040	2.9759
3	15000	1.6617
4	16350	-0.0348
5	16980	-0.7734
6	17490	-1.3491
7	17950	-1.8525
8	18350	-2.2786

Bead	Ohms	Degree C
9	18690	-2.6326
10	18970	-2.9188

Observation and Proposed Maintenance

Thermal Monitoring

Thermistor Annual Maintenance Report

Contractor Name:	**EBA**	Inspection Date:	**8/20/2007**
Prepared By:	**Ed Grozic**		

Thermistor Information

Site Name:	**FOX-5 Broughton**	Thermistor Location:	**Middle Site Tier II Soil Disposal Facility**
Thermistor Number:	**VT-10**	Inclination:	**Vertical**

Install Date:	**9/1/2006**	First Date Event:	**9/14/2006**	Last Date Event:	**8/19/2007**
Coordinates and Elevation:	N **9773**	E **15545**	Elev **314**		
Total Cable Length (m):	**7.4**	Lead Length to 1st Bead (m):	**3.71**	Number of Beads:	**10**
Datalogger Serial #:	**02020230**	Cable Serial #:	**1704**		

Thermistor Inspection

	Good	Need Maintenance
Casing	**Yes**	**No**
Cover	**Yes**	**No**
Data Logger	**Yes**	**No**
Cable	**Yes**	**No**
Beads	**Yes**	**No**
Battery Installation Date	**9/1/2006**	
Battery Levels	Main **11.34**	Aux **13.50**

Manual Ground Temperature Reading

Bead	Ohms	Degree C
1	9700	10.5278
2	12870	4.7215
3	13360	3.9696
4	14140	2.8344
5	15290	1.2832
6	16440	-0.1422
7	17240	-1.0693
8	17770	-1.6573

Bead	Ohms	Degree C
9	18230	-2.1518
10	18520	-2.4565

Observation and Proposed Maintenance

Thermal Monitoring

Thermistor Annual Maintenance Report

Contractor Name:	**EBA**	Inspection Date:	**8/20/2007**
Prepared By:	**Ed Grozic**		

Thermistor Information

Site Name:	**FOX-5 Broughton**	Thermistor Location:	**Middle Site Tier II Soil Disposal Facility**
Thermistor Number:	**VT-11**	Inclination:	**Vertical**

Install Date:	**9/1/2006**	First Date Event:	**9/14/2006**	Last Date Event:	**8/19/2007**
Coordinates and Elevation:	N **9779**	E **15508**	Elev **311**		
Total Cable Length (m):	**6.8**	Lead Length to 1st Bead (m):	**4.1**	Number of Beads:	**9**
Datalogger Serial #:	**02020120**	Cable Serial #:	**1705**		

Thermistor Inspection

	Good	Need Maintenance
Casing	**Yes**	**No**
Cover	**Yes**	**No**
Data Logger	**Yes**	**No**
Cable	**Yes**	**No**
Beads	**Yes**	**No**
Battery Installation Date	**9/1/2006**	
Battery Levels	Main **11.34**	Aux **13.48**

Manual Ground Temperature Reading

Bead	Ohms	Degree C
1	9100	11.8680
2	8700	12.8181
3	8680	12.8668
4	13560	3.6715
5	14950	1.7278
6	16340	-0.0228
7	18890	-2.8375
8	17350	-1.1930

Bead	Ohms	Degree C
9	17530	-1.3935

Observation and Proposed Maintenance

Thermal Monitoring

Thermistor Annual Maintenance Report

Contractor Name:	**EBA**	Inspection Date:	**8/20/2007**
Prepared By:	**Ed Grozic**		

Thermistor Information

Site Name:	**FOX-5 Broughton**	Thermistor Location:	**Middle Site Tier II Soil Disposal Facility**
Thermistor Number:	**VT-12**	Inclination:	**Vertical**

Install Date:	**9/1/2006**	First Date Event:	**9/14/2006**	Last Date Event:	**8/19/2007**
Coordinates and Elevation:	N **9812**	E **15485**	Elev **310**		
Total Cable Length (m):	**10**	Lead Length to 1st Bead (m):	**3.76**	Number of Beads:	**15**
Datalogger Serial #:	**02020270**	Cable Serial #:	**1706**		

Thermistor Inspection

	Good	Need Maintenance
Casing	**Yes**	**No**
Cover	**Yes**	**No**
Data Logger	**Yes**	**No**
Cable	**Yes**	**No**
Beads	**Yes**	**No**
Battery Installation Date	**8/1/2006**	
Battery Levels	Main **11.34**	Aux **13.02**

Manual Ground Temperature Reading

Bead	Ohms	Degree C
1	9040	12.0074
2	9940	10.0177
3	12790	4.8473
4	14380	2.4992
5	16300	0.0252
6	16820	-0.5887
7	17370	-1.2154
8	17810	-1.7008

Bead	Ohms	Degree C
9	18180	-2.0988
10	18550	-2.4877
11	18900	-2.8477
12	19150	-3.1003
13	19410	-3.3591
14	19540	-3.4871
15	19690	-3.6335

Observation and Proposed Maintenance