Defence Construction Canada

Water Use License Amendment and Renewal FOX-2, Longstaff Bluff Landfill Monitoring

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Note: As of 2017, mercury was removed from the soil and groundwater monitoring program at all DEW Line sites. PCBs were also removed from the groundwater monitoring program. All other aspects of the long-term landfill monitoring program remain the same.

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This Statement of Qualifications and Limitations is attached to and forms part of the Report.

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Appendix B removed to reduce file size.

1. Post Construction Monitoring Program

1.1 Introduction

The FOX-2 Longstaff Bluff DEW Line site is located on the southwestern coast of Baffin Island, near the tip of the Baird Peninsula. The exact location is 68° 53' 49" north latitude and 75° 09' 37" longitude. The station is located 15 km inland from the airstrip, on the southern end of a small peninsula jutting into Nauja Bay. The nearest community with charter aircraft and a full range of commercial and public services available is Hall Beach, 245 km to the west.

1.2 Background

FOX-2 was originally a main site within the original DEW Line system and was decommissioned in 1991. A Short Range Radar (SRR) station occupies a site approximately 300 m southeast of the former station area. NWS holds a reserve on this area, and an area at the Beach POL where SRR fuel tanks are located. The cleanup included the closure and remediation of five existing landfills. A new landfill for the disposal of non-hazardous wastes generated from demolition and collection of site debris was constructed. In addition, a DCC Tier II Disposal Facility was constructed for disposal of Tier II contaminated soil. The existing and new landfills, as shown on the overall site plan, Figure FOX-2.1, include:

- Airstrip West Landfill (not shown, completely excavated)
- Airstrip Landfill (not shown, completely excavated)
- Airstrip Camp Landfill Lobe A
- Hangar Non-Hazardous Waste Landfill (new)
- West Landfill Lobe E
- Tier II Disposal Facility (new)
- Upper Site Landfill Lobe A

The Department of National Defence (DND), in cooperation with Nunavut Tunngavik Incorporated (NTI), developed a landfill monitoring plan to address post closure monitoring requirements for the landfills at the DEW Line Sites (Appendix B). Defence Construction Canada (DCC) is managing the cleanup and monitoring programs on behalf of DND.

The objective of the landfill monitoring program is to collect sufficient information to assess the performance of the landfills from a geotechnical and environmental perspective. The landfill monitoring plan specifies the requirements for visual inspection, and chemical and thermal monitoring of landfills at the DEW Line sites under DND's jurisdiction.

Table 1 provides the landfill monitoring schedule for the FOX-2 site.

Table 1- MONITORING SCHEDULE – FOX-2 Longstff Bluff

No. of Years After Construction	Monitoring Event Number	Year
Prior to/During:	Baseline	2005, 2009-2011
1	1	2012
2	2	2013
3	3	2014
4	4	2015

5	5	2016
7	6	2018
10	7	2021
15	8	2026
25	9	2036

1.3 Program Components

The post-construction landfill monitoring program consists of four main components to measure the performance of the landfills, depending on the remediation plan for each landfill. These components are visual, soil, groundwater and thermal monitoring. Details on each of the monitoring components are provided below.

1.3.1 Visual Monitoring

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.

1.3.2 Soil Monitoring

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 upgradient and downgradient of each landfill. Upgradient samples are targeted to areas near the landfill, but not influenced by migration of contaminants through the landfill. Upgradient samples are meant to be representative of contaminant input conditions to the landfill and serve as the primary basis upon which to compare the downgradient contaminant concentrations.

Downgradient 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 from the landfill area. Although contaminants are primarily transported in water (surface and groundwater), they have a tendency to adsorb to soil particles the water is migrating through. Therefore the soil still retains information regarding the historical input of contaminants.

Analytical results of soil samples collected downgradient of landfills are compared to contaminant concentrations of samples collected upgradient of landfills. Downgradient 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 downgradient samples that are significantly higher than background or upgradient concentrations, particularly where there have been changes over time; provide evidence of contaminants having migrated to, 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.

Samples collected during baseline and subsequent landfill monitoring are 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, Analyses of Total Petroleum Hydrocarbons in soil.

The requirement for the analyses of baseline samples is to provide record information on the environmental status of the landfill should potential problems be identified during the monitoring program.

1.3.3 Groundwater Monitoring

During the construction phase, permanent groundwater monitoring wells are installed at all existing landfills classified as a moderate environmental risk (Class B landfills) and at new landfills built to support site remediation. At FOX-2, this includes the Non-Hazardous Waste Landfill (new), the Tier II Disposal Facility (new) and the Upper Site Landfill (existing). Groundwater monitoring wells were installed hydraulically upgradient and downgradient of the landfills. Surface and shallow depth soil samples are also collected adjacent to monitoring well locations. Analytical data from water samples collected from wells up and downgradient are reviewed in conjunction with soil analytical data to evaluate potential impacts associated with the landfill.

For baseline and for future monitoring events, the following physical measurements are recorded prior to the collections 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 inside:

- 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}.

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 modeling 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. Modeling also determines the length of time required for the landfill contents to freeze-back following the placement of additional surface fill. Geothermal modeling considers the following:

- 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).

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 freeze back 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.

1.4 Frequency

The landfill monitoring program consists of three phases, as described in detail below.

1.4.1 Phase I

Phase I involves monitoring of conditions to confirm that equilibrium is achieved. The frequency of monitoring events during Phase I is dependent on the closure or remediation design at specific landfills. The five-year term was selected on the basis that ground-temperature thermal regimes will require three to five years to reach equilibrium.

An evaluation of all Phase I data is carried out at the end of five years to confirm that thermal and chemical equilibrium is achieved, and that no stability issues are identified. The Phase I monitoring program may be extended, if required, to provide sufficient data to establish equilibrium conditions.

The first year of the Phase I post-construction monitoring is completed by the Environmental Sciences Group (ESG) of the Royal Military College of Canada, who are part of the DEW Line Clean Up Project Team. Subsequent landfill monitoring events are carried out by independent contractors, who successfully win the competitive tender.

1.4.2 Phase II

Phase II monitoring is the verification of equilibrium conditions established in Phase I. The monitoring frequency in Phase II is downgraded from Phase I and will be carried out according to the following schedule: year 7, 10, 15 and 25. Year 25 marks the end of Phase II monitoring.

1.4.3 Phase III

Phase III involves the monitoring for long-term issues such as liner integrity, permafrost stability and significant storm events. At the end of the Phase II program, 25 years after construction, a re-evaluation of the landfill monitoring program will be carried out prior to initiating any Phase III program. The scope of the Phase III monitoring program is not included here, but is anticipated to be based on a 10 year monitoring interval.

1.5 Review and Evaluation Process

An Environmental Working Group (EWG) was established to provide a technical report and to support the DLCU Steering Committee. This working group is comprised of qualified engineering and environmental scientists with expertise in environmental remediation and clean up in northern climates. The EWG has four designated representatives, two from each of the Owner (DND) and the Inuit (through the NTI), respectively.

During the monitoring program, the EWG reviews the results of the monitoring program in accordance with the methodology as described previously. The results of the review and any recommendations regarding changes to the monitoring plan and/or remediation requirements are reported to the DND/NTI Steering Committee.

The requirement for further monitoring after 25 years is evaluated. Monitoring may be terminated if the performance of the landfill was satisfactory over the period of monitoring from an environmental, geotechnical and thermal perspective, as appropriate. The assessment of satisfactory performance is carried out jointly by the NTI and DND.

2. Detailed Landfill Monitoring Requirements

Site figures documenting the monitoring locations at each landfill are provided in Appendix A. Table 2 provides a summary of the general landfill monitoring requirements at the DND DEW Line sites following construction.

Table 2 - General Landfill Monitoring Requirements

Landfill Classification	Visual Inspection	Groundwater Sampling	Soil Sampling	Thermal Monitoring
Existing Landfills, High Potential Environmental Risk (Class A)	Not required, as landfill to be 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	√	√	√	√

A summary of these requirements, as related to the specific landfills at FOX-2, is provided in Table 3. The rationale for the monitoring requirements is provided in the landfill-specific sections.

Table 3 – FOX-2 Landfill Monitoring Requirements

Landfill Designation	Visual Inspection	Groundwater Sampling	Soil Sampling	Thermal Monitoring
Tier II Disposal Facility	√	√	√	√
Non-Hazardous Waste Landfill	√		√	
Upper Site Landfill	√	√	√	√
Airstrip Camp Landfill Lobe A	√		√	
West Landfill Lobe E	√		√	

2.1 Non-Hazardous Waste Landfill

The Non-hazardous Waste Landfill is located in the airstrip area west of Borrow Area #4 and was constructed for the disposal of non-hazardous wastes and debris generated and collected during site clean-up.

The design of this landfill includes perimeter berms, and the placement of a cover of compacted granular fill over the landfilled material. Four groundwater monitoring wells were installed at the landfill perimeter.

The long term monitoring plan consists of visual inspection, and the periodic collection of soil and groundwater samples. Approximate locations for the collection of soil and groundwater samples are identified in Figure FOX-2.3.

2.2 Upper Site Landfill Lobe A

The Upper Site Landfill is 200 m east of the warehouse. It was the main disposal area for station operations, beginning in the 1950s. The size and approximate depth of the lobe is 4040 m2 and up to 2.0 m deep. There were several areas of Tier I and Tier II contamination on the landfill surface, as well as downgradient noted during the site investigation. Localized TPH impacts were also present. Surface contamination was generally associated with

debris, but some of the contamination along the toe may be due to landfill leachate. Four groundwater monitoring wells were installed at the landfill perimeter, and four thermistors were installed within the landfill.

Based on the evaluation of the landfill as a potential source of contamination, this landfill was classified as a moderate potential environmental risk. Remediation included excavation of surface hazardous soils and leachate containment.

The long term monitoring plan consists of visual monitoring, the collection of soil and groundwater samples, and monitoring of subsurface ground temperatures of the landfill. Approximate locations for the collection of soil and groundwater samples, and thermistor installation locations are identified on Figure FOX-2.5.

2.3 Tier II Soil Disposal Facility

The Tier II Disposal Facility was constructed approximately 100 m east of the main station area. The landfill cell was constructed with the placement of low-permeability, saturated, compacted berms, 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. Four groundwater monitoring wells were installed at the landfill perimeter, and four thermistors were installed within the landfill.

The long term monitoring plan consists of visual monitoring, the collection of soil and groundwater samples, and monitoring of subsurface ground temperatures of the landfill. Approximate locations for the collection of soil and groundwater samples, and thermistor installation locations are identified on Figure FOX-2.4.

2.4 West Landfill Lobe E

The West Landfill is located 0.9 km south of the beach POL area and 1.4 km west of the station area within an old borrow area. A road extends from the main station access road into the landfill/borrow area. Lobe E has an area of 1,780 m2, with an estimated depth of 1.5 m. Very little surface debris was noted at the landfill; a crushed barrel was present and there was one area (approximately 2 x 3 m) near the south end that had scattered wood fragments, Plexiglas pieces and miscellaneous small metal debris.

The West Landfill is located in one of the primary geochemical “hot spots” on the site. The subsurface water migration through the shear zone, with subsequent surface discharge, results in precipitation of oxides with co-precipitation of other metals because of a rapid change in redox conditions. The strong iron oxide precipitates, with associated higher levels of other metals, gives the appearance that the landfill is leaching. Applying the site-specific criteria, lobe E was found to have one area downgradient where zinc and nickel values were at or slightly above the criteria. Howver, the levels were marginally higher than surrounding sample concentrations, and concentrations of other metals were also relatively consistent, providing strong evidence that the observed concentrations were natural. This area has there not been considered as contaminated.
This landfill was evaluated as a low potential environmental risk. Remediation included removal of surface debris and regrading.

The long term monitoring plan consists of visual inspection, and the periodic collection of soil samples. Approximate locations for the collection of soil samples are identified in Figure FOX-2.3.

2.5 Airstrip Camp Landfill Lobe A

The Airstrip Camp Landfill is located 380 m northeast of the hangar, and is accessed via the same trail leading to the Airstrip Landfill. The landfill was not identified during previous investigations but the area was identified for geophysical survey in a review of historical air photos. The landfill sits within the footprint of the former construction

camp and at various times during camp takedown, earthmoving, material storage, and trenching activities were all observed here.

The long term monitoring plan consists of visual monitoring, and the periodic collection of soil samples. Approximate locations for the collection of soil and groundwater samples are identified on Figure FOX-2.2.

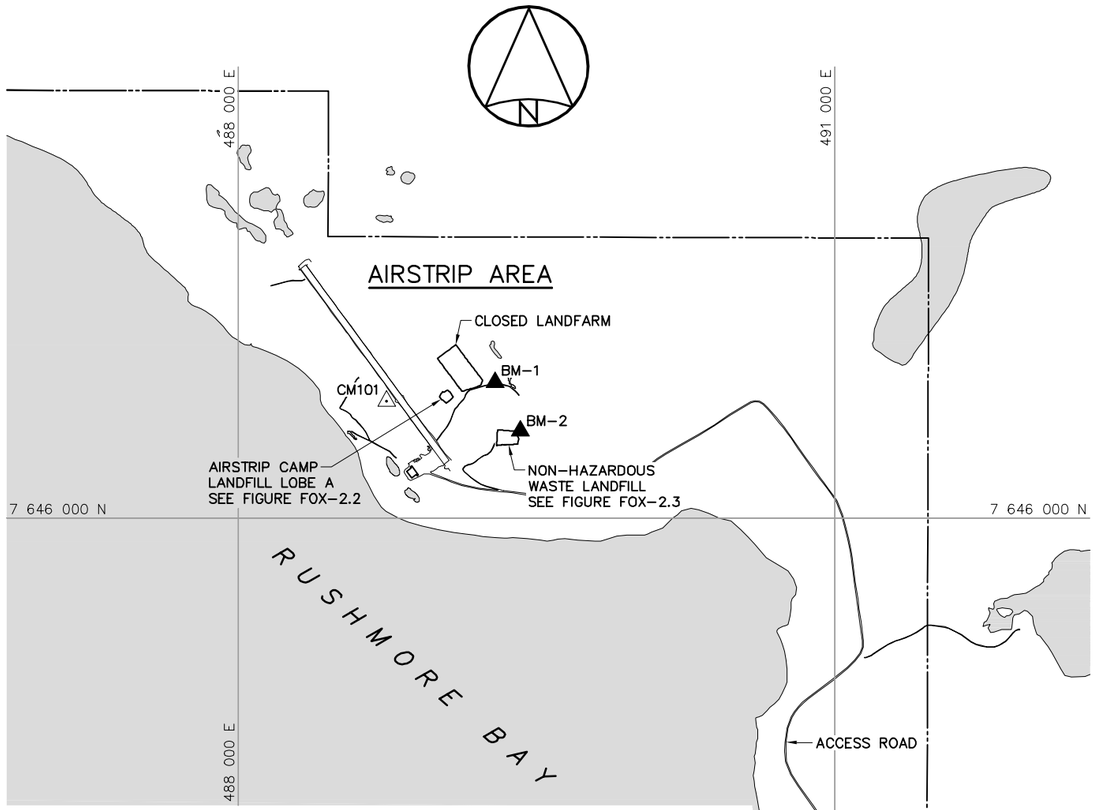
Table 4: Summary Of Landfill Monitoring Installations/ Sampling Locations
FOX-2 Longstaff Bluff

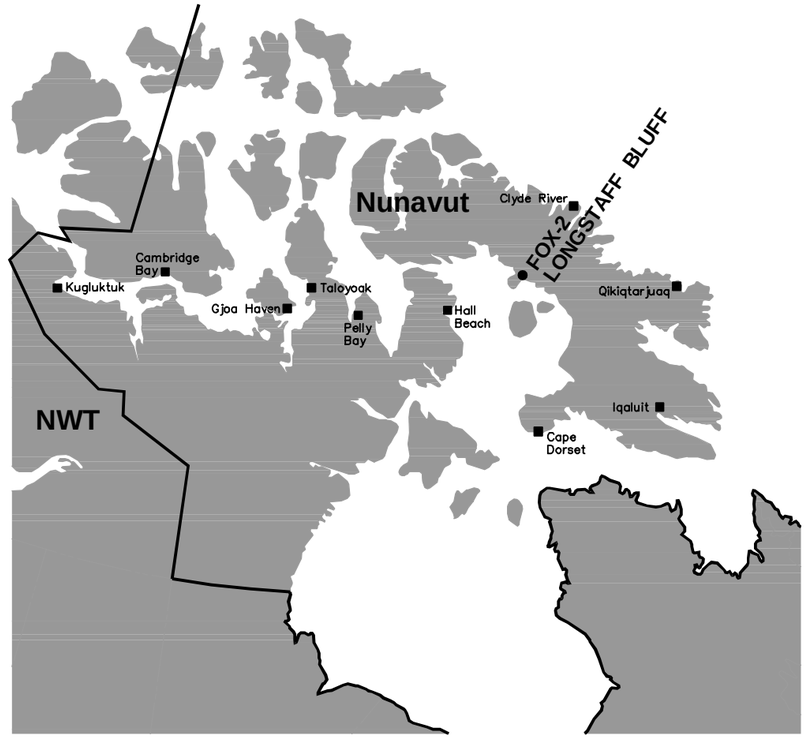
	Coordinates		Elevation
Landfill Designation/Monitoring Locations	North (m)	East (m)	(masl)
Airstrip Camp Landfill Lobe A			
Soil Sample 1	TBD	TBD	-
Soil Sample 2	TBD	TBD	-
Soil Sample 3	TBD	TBD	-
Soil Sample 4	TBD	TBD	-
Non-Hazardous Waste Landfill			
MW-05 (soil and groundwater)	7646429.4	489418.7	30.2
MW-06 (soil and groundwater)	7646358.3	489299.2	22.5
MW-07 (soil and groundwater)	7646398.3	489288.6	23.4
MW-08 (soil and groundwater)	7646440.0	489295.8	24.4
West Landfill			
Soil Sample 5	TBD	TBD	-
Soil Sample 6	TBD	TBD	-
Soil Sample 7	TBD	TBD	-
Soil Sample 8	TBD	TBD	-
Soil Sample 9	TBD	TBD	-
Tier II Disposal Facility			
MW-09 (soil and groundwater)	7643176.6	494276.9	156.9
MW-10 (soil and groundwater)	7643288.8	494341.7	149.7
MW-11 (soil and groundwater)	7643300.1	494284.2	148.9
MW-12 (soil and groundwater)	7643300.9	494232.0	149.2
VT-1 (temperature)	TBD	TBD	-
VT-2 (temperature)	TBD	TBD	-
VT-3 (temperature)	TBD	TBD	-
VT-4 (temperature)	TBD	TBD	-

Table 4: Summary Of Landfill Monitoring Installations/ Sampling Locations
FOX-2 Longstaff Bluff

	Coordinates		Elevation
Landfill Designation/Monitoring Locations	North (m)	East (m)	(masl)
Upper Site Landfill			
VT-5 (temperature)	TBD	TBD	-
VT-6 (temperature)	TBD	TBD	-
VT-7 (temperature)	TBD	TBD	-
VT-8 (temperature)	TBD	TBD	-
MW-13 (soil and groundwater)	7643177.6	494363.1	156.4
MW-14 (soil and groundwater)	7643301.7	494476.8	148.8
MW-15 (soil and groundwater)	7643264.2	494530.5	148.5
MW-16 (soil and groundwater)	7643213.3	494543.5	147.8

Note 1. Monitoring well coordinates as provided by the cleanup contractor (survey). Coordinates referenced to UTM Zone 14N, NAD83.





LOCATION OF LONGSTAFF BLUFF WITHIN NUNAVUT TERRITORY
SCALE: NTS

GENERAL NOTES:

1. ALL COORDINATES ARE REFERENCED TO NAD83 (CSRS), UTM ZONE 18N. ALL ELEVATIONS REFER TO GEODETIC DATUM.
2. ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE.

LEGEND:

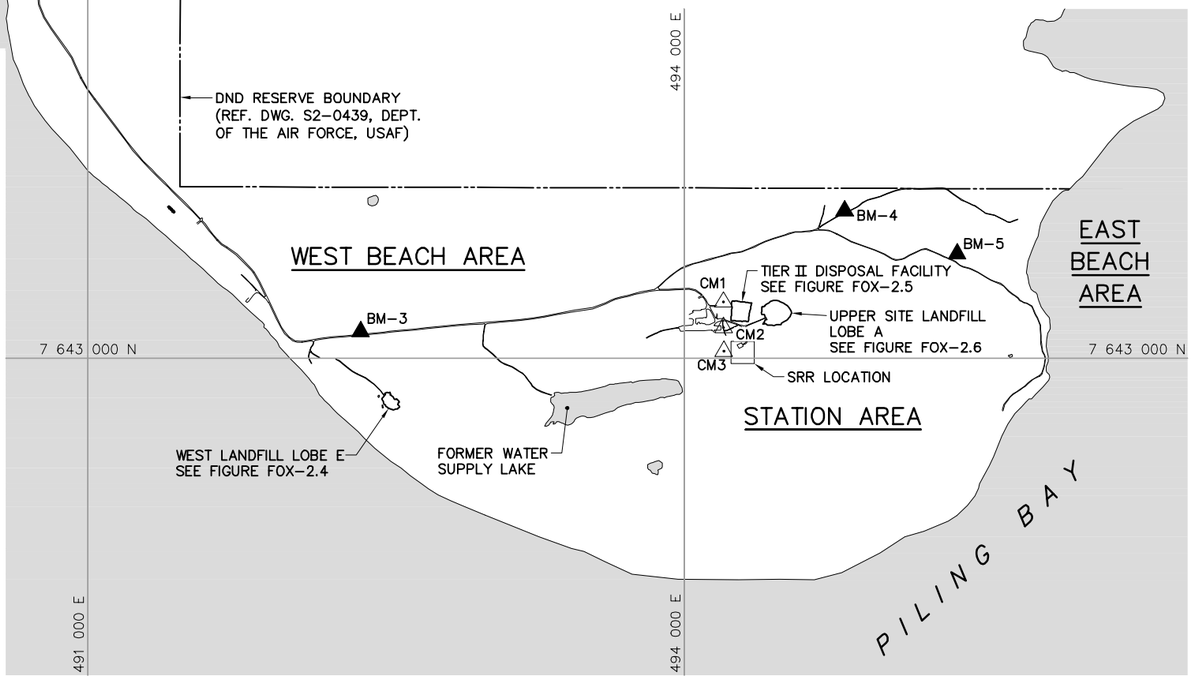
- △CM1 — SURVEY CONTROL MONUMENT (4)
- ▲BM–1 — PERMANENT BENCHMARK LOCATION (5)
- ——·—— — APPROXIMATE LOCATION OF PROPERTY BOUNDARY
- BODY OF WATER

SURVEY CONTROL MONUMENTS				
NO.	UTM COORDINATES		ELEV.	DESCRIPTION
	NORTHING	EASTING		
CM1	7 643 282.694	494 194.669	150.604	FOX–2 BASELINE STA. 0+00
CM2	7 643 154.373	494 195.664	155.980	FOX–2 BASELINE STA. N/A
CM3	7 643 035.836	494 196.504	158.975	FOX–2 BASELINE STA. N/A
CM101	7 646 589.787	488 746.333	12.088	FOX–2 BASELINE STA. 12+00

NOTE: BASELINE STATIONS SHOWN ARE IN IMPERIAL UNITS.

PERMANENT BENCHMARK (AS–BUILT)				
NO.	UTM COORDINATES		ELEV.	DESCRIPTION
	NORTHING	EASTING		
BM–1	7 646 684.430	489 291.060	29.490	25mm DIA. STEEL PIPE
BM–2	7 646 440.000	489 417.870	29.760	25mm DIA. STEEL PIPE
BM–3	7 643 133.590	492 370.950	37.280	25mm DIA. STEEL PIPE
BM–4	7 643 740.820	494 804.820	80.570	25mm DIA. STEEL PIPE
BM–5	7 643 525.070	495 369.930	43.210	25mm DIA. STEEL PIPE

NOTE: COORDINATES AND ELEVATIONS INDICATED ARE TOP OF BENCHMARK PIPE.



RECORD DRAWING
NOT FOR CONSTRUCTION

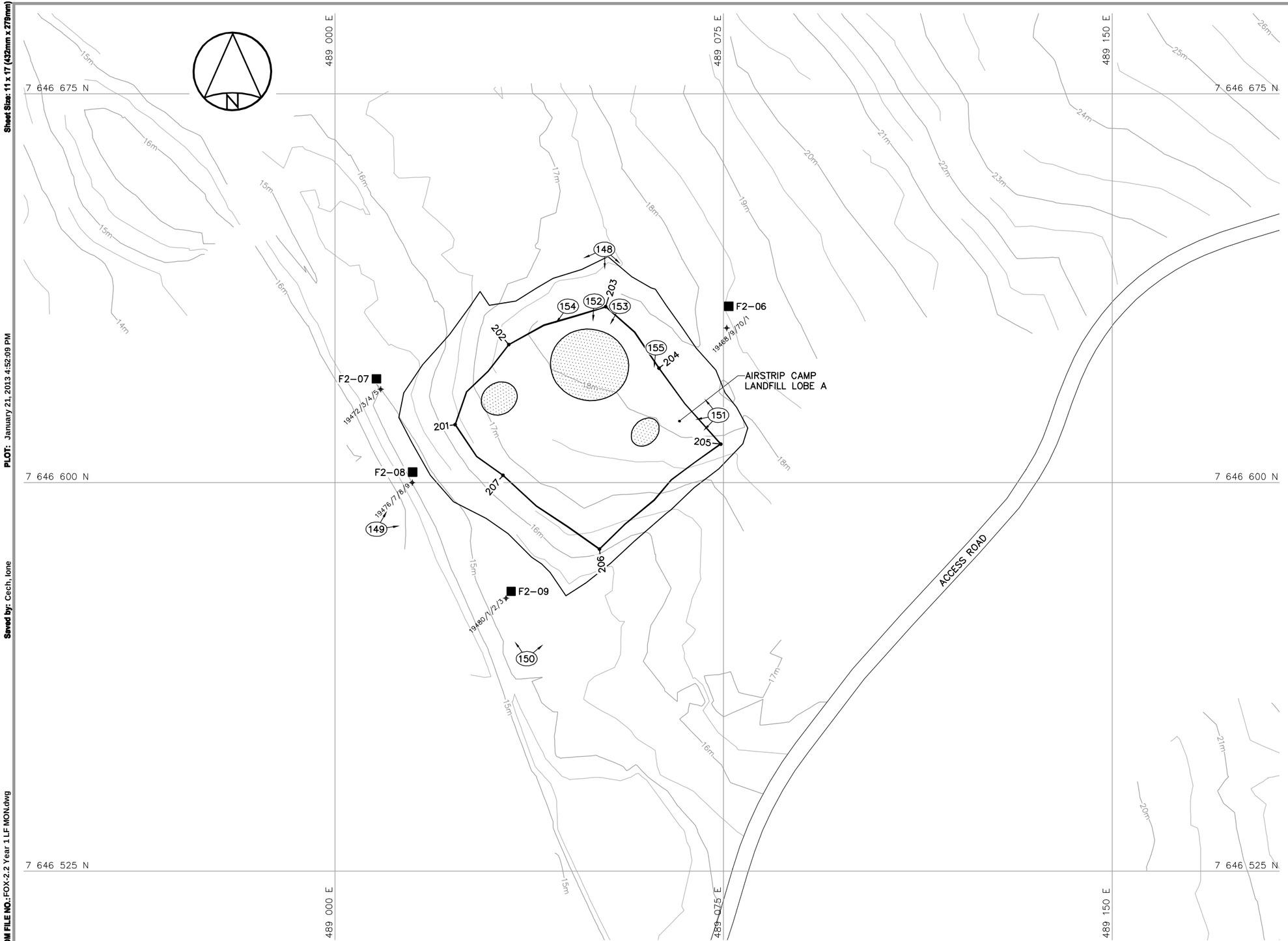
0 300 600 m SCALE 1:30000

DEW LINE CLEAN UP
LANDFILL MONITORING PLAN

FOX-2 LONGSTAFF BLUFF

LOCATION PLAN
FIGURE FOX-2.1

AECOM



GENERAL NOTES:

1. ALL COORDINATES ARE REFERENCED TO NAD83 (CSRS), UTM ZONE 18N. ALL ELEVATIONS REFER TO GEODETIC DATUM.
2. ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE.

LEGEND:

- 201 — COORDINATE POINT
- ■ — MONITORING SOIL SAMPLE LOCATION (4)
- MONITORING SITE FEATURE
- 148 — APPROX. PHOTOGRAPHIC VIEWPOINT
- 19468 — 2012 SOIL SAMPLE TAG LOCATION

AIRSTRIP CAMP LANDFILL (LOBE A) REGRADED (AS-BUILT)			
NO.	UTM COORDINATES		ELEV.
	NORTHING	EASTING	
201	7 646 611.2	489 023.2	16.4
202	7 646 626.6	489 033.5	17.8
203	7 646 633.9	489 052.3	18.2
204	7 646 622.1	489 062.5	18.3
205	7 646 607.4	489 074.5	17.9
206	7 646 587.2	489 051.1	16.1
207	7 646 601.4	489 032.4	16.7

RECORD DRAWING
NOT FOR CONSTRUCTION

0 7.5 15 m SCALE 1:750

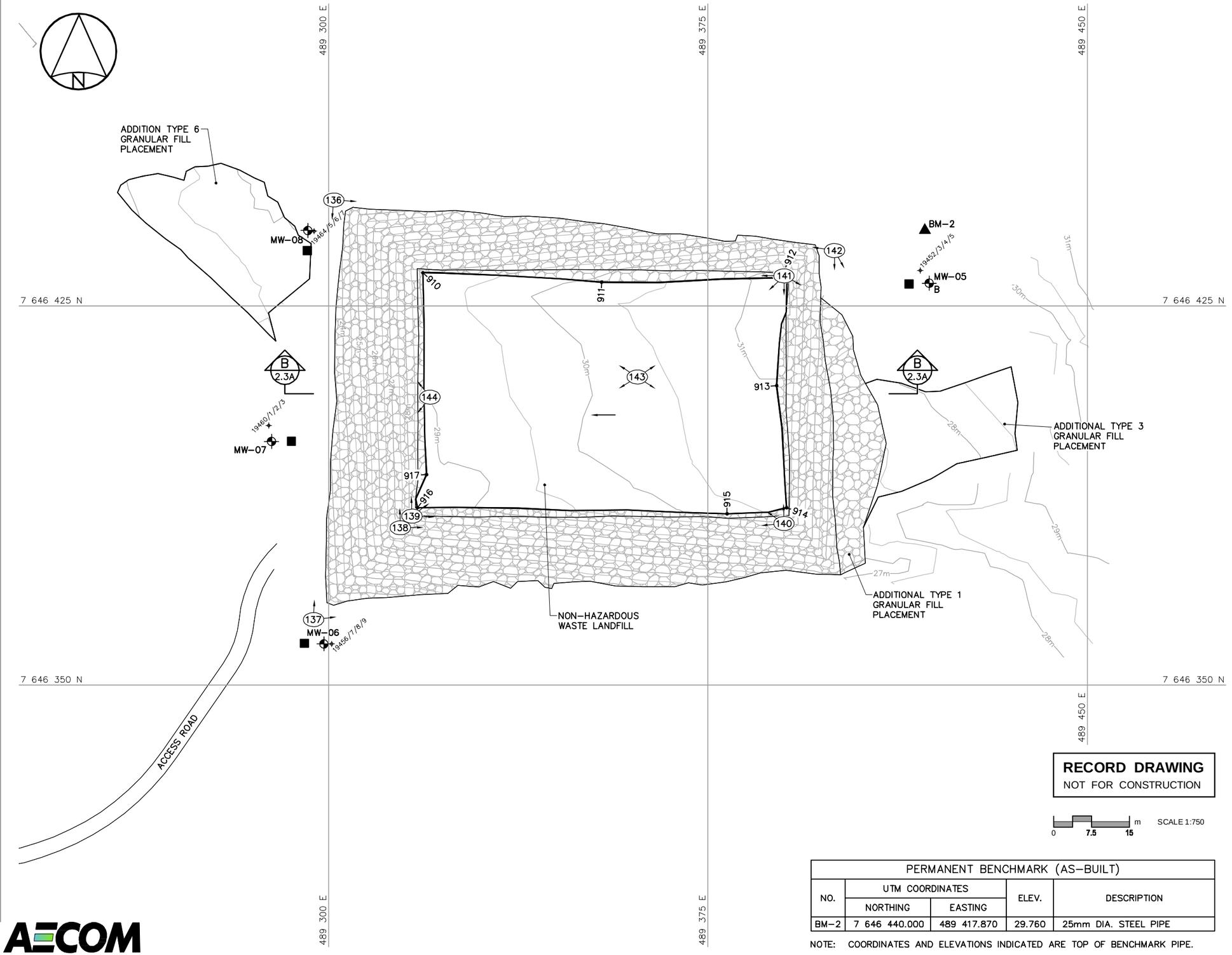
DEW LINE CLEAN UP
LANDFILL MONITORING PLAN

FOX-2 LONGSTAFF BLUFF

AIRSTRIP CAMP LANDFILL LOBE A

FIGURE FOX-2.2

AECOM



GENERAL NOTES:

1. ALL COORDINATES ARE REFERENCED TO NAD83 (CSRS), UTM ZONE 18N. ALL ELEVATIONS REFER TO GEODETIC DATUM.
2. ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE.

LEGEND:

BM-2	APPROXIMATE PERMANENT BENCHMARK LOCATION (1)
910	COORDINATE POINT
	MONITORING WELL LOCATION (3)
B	BACKGROUND MONITORING WELL LOCATION (1)
	MONITORING SOIL SAMPLE LOCATION (4)
136	APPROX. PHOTOGRAPHIC VIEWPOINT
19452	2012 SOIL SAMPLE TAG LOCATION

NON-HAZARDOUS WASTE LANDFILL FINAL GRADING (AS-BUILT)

NO.	UTM COORDINATES		ELEV.
	NORTHING	EASTING	
910	7 646 431.6	489 318.6	29.2
911	7 646 429.7	489 354.0	30.1
912	7 646 430.6	489 389.4	31.3
913	7 646 409.3	489 388.6	31.0
914	7 646 385.1	489 390.5	30.6
915	7 646 383.9	489 378.8	30.3
916	7 646 385.1	489 317.5	28.6
917	7 646 391.7	489 319.3	28.9

NOTE:
COORDINATE POINTS AND ELEVATIONS PROVIDED ARE TO THE FINAL GRADE OF ORGANIC MATERIAL ON THE PLATEAU AND PRIOR TO THE PLACEMENT OF TYPE 1 GRANULAR FILL ON SIDE SLOPES.

NON-HAZARDOUS WASTE LANDFILL MONITORING WELLS (AS-BUILT)

NO.	UTM COORDINATES		ELEV.
	NORTHING	EASTING	
MW-05	7 646 429.6	489 418.7	29.6
MW-06	7 646 358.2	489 299.1	21.9
MW-07	7 646 398.2	489 288.7	22.9
MW-08	7 646 440.0	489 295.9	23.9

RECORD DRAWING
NOT FOR CONSTRUCTION

0 7.5 15 m SCALE 1:750

PERMANENT BENCHMARK (AS-BUILT)

NO.	UTM COORDINATES		ELEV.	DESCRIPTION
	NORTHING	EASTING		
BM-2	7 646 440.000	489 417.870	29.760	25mm DIA. STEEL PIPE

NOTE: COORDINATES AND ELEVATIONS INDICATED ARE TOP OF BENCHMARK PIPE.

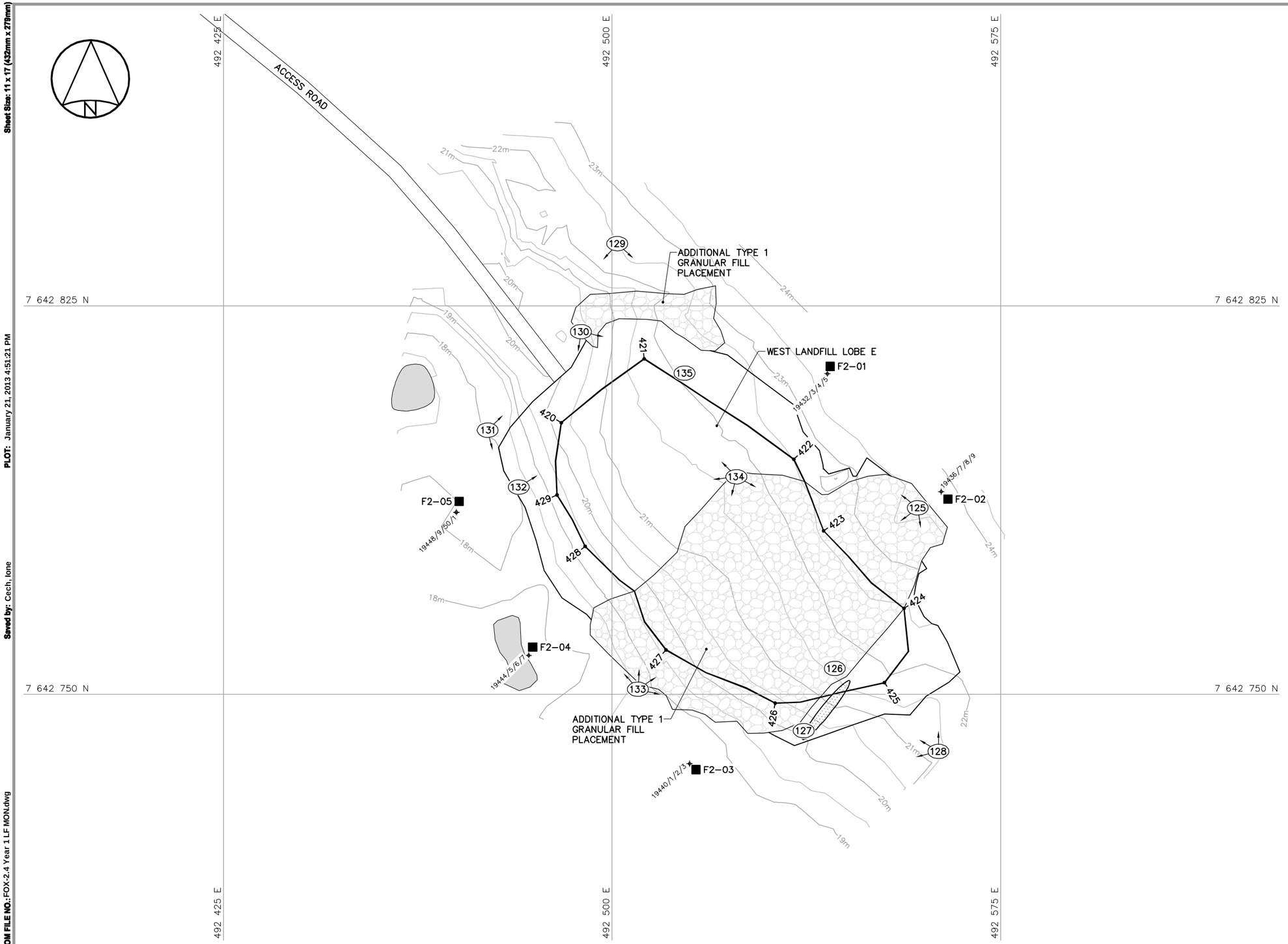
AECOM

DEW LINE CLEAN UP
LANDFILL MONITORING PLAN

FOX-2 LONGSTAFF BLUFF

NON-HAZARDOUS WASTE LANDFILL

FIGURE FOX-2.3



GENERAL NOTES:

1. ALL COORDINATES ARE REFERENCED TO NAD83 (CSRS), UTM ZONE 18N. ALL ELEVATIONS REFER TO GEODETIC DATUM.
2. ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE.

LEGEND:

- 420 — COORDINATE POINT
- MONITORING SOIL SAMPLE LOCATION (5)
- MONITORING SITE FEATURE
- 125 — APPROX. PHOTOGRAPHIC VIEWPOINT
- 19432 — 2012 SOIL SAMPLE TAG LOCATION
- BODY OF WATER

WEST LANDFILL (LOBE E) REGRADED (AS-BUILT)

NO.	UTM COORDINATES		ELEV.
	NORTHING	EASTING	
420	7 642 802.4	492 490.2	20.4
421	7 642 814.8	492 506.2	21.9
422	7 642 795.4	492 535.1	22.5
423	7 642 781.5	492 540.8	22.6
424	7 642 766.6	492 556.3	22.5
425	7 642 752.3	492 552.6	21.9
426	7 642 748.3	492 531.5	20.4
427	7 642 758.6	492 510.4	19.7
428	7 642 778.6	492 494.8	19.4
429	7 642 788.5	492 489.4	19.3

RECORD DRAWING
NOT FOR CONSTRUCTION

0 7.5 15 m SCALE 1:750

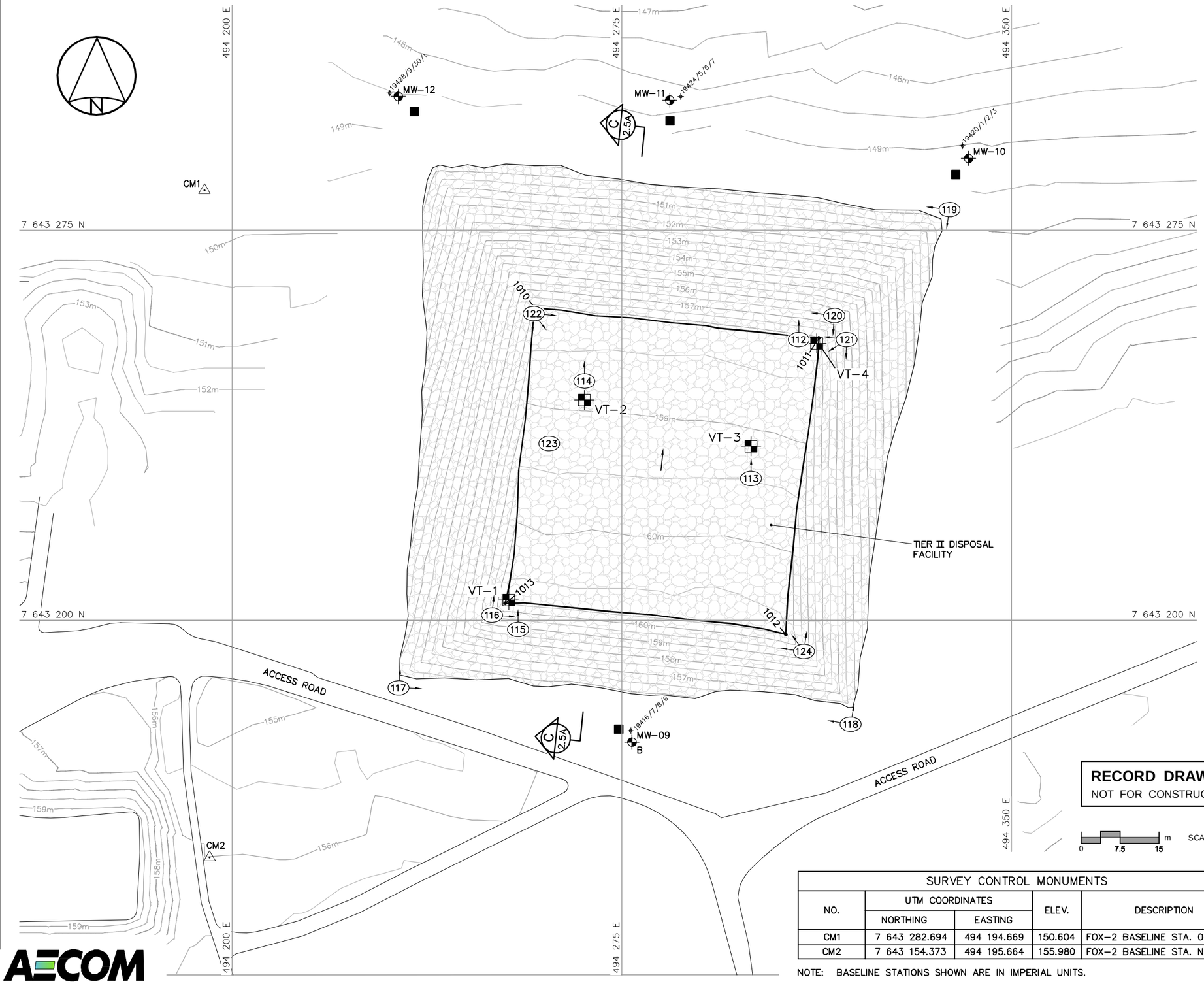
DEW LINE CLEAN UP
LANDFILL MONITORING PLAN

FOX-2 LONGSTAFF BLUFF

WEST LANDFILL LOBE E

FIGURE FOX-2.4

AECOM



GENERAL NOTES:

1. ALL COORDINATES ARE REFERENCED TO NAD83 (CSRS), UTM ZONE 18N. ALL ELEVATIONS REFER TO GEODETIC DATUM.
2. ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE.

LEGEND:

- CM1 — SURVEY CONTROL MONUMENT (2)
- 1010 — COORDINATE POINT
- MONITORING WELL LOCATION (3)
- B — BACKGROUND MONITORING WELL LOCATION (1)
- GROUND TEMPERATURE CABLE LOCATION (4)
- MONITORING SOIL SAMPLE LOCATION (4)
- 112 — APPROX. PHOTOGRAPHIC VIEWPOINT
- 19420 — 2012 SOIL SAMPLE TAG LOCATION

TIER II DISPOSAL FACILITY FINAL GRADING (AS-BUILT)			
NO.	UTM COORDINATES		ELEV.
	NORTHING	EASTING	
1010	7 643 260.1	494 258.2	158.1
1011	7 643 254.3	494 312.9	158.0
1012	7 643 197.3	494 306.5	160.5
1013	7 643 203.3	494 252.5	160.5

TIER II DISPOSAL FACILITY MONITORING WELLS (AS-BUILT)			
NO.	UTM COORDINATES		ELEV.
	NORTHING	EASTING	
MW-09	7 643 176.6	494 276.9	156.4
MW-10	7 643 288.9	494 341.7	149.1
MW-11	7 643 300.1	494 284.2	148.1
MW-12	7 643 300.8	494 232.0	148.6

TIER II DISPOSAL FACILITY GROUND TEMPERATURE CABLES (AS-BUILT)			
NO.	UTM COORDINATES		ELEV.
	NORTHING	EASTING	
VT-1	7 643 203.9	494 253.2	160.7
VT-2	7 643 242.4	494 267.8	158.8
VT-3	7 643 233.5	494 299.8	159.1
VT-4	7 643 253.3	494 312.5	158.2

RECORD DRAWING
NOT FOR CONSTRUCTION

0 7.5 15 m SCALE 1:750

SURVEY CONTROL MONUMENTS				
NO.	UTM COORDINATES		ELEV.	DESCRIPTION
	NORTHING	EASTING		
CM1	7 643 282.694	494 194.669	150.604	FOX-2 BASELINE STA. 0+00
CM2	7 643 154.373	494 195.664	155.980	FOX-2 BASELINE STA. N/A

NOTE: BASELINE STATIONS SHOWN ARE IN IMPERIAL UNITS.

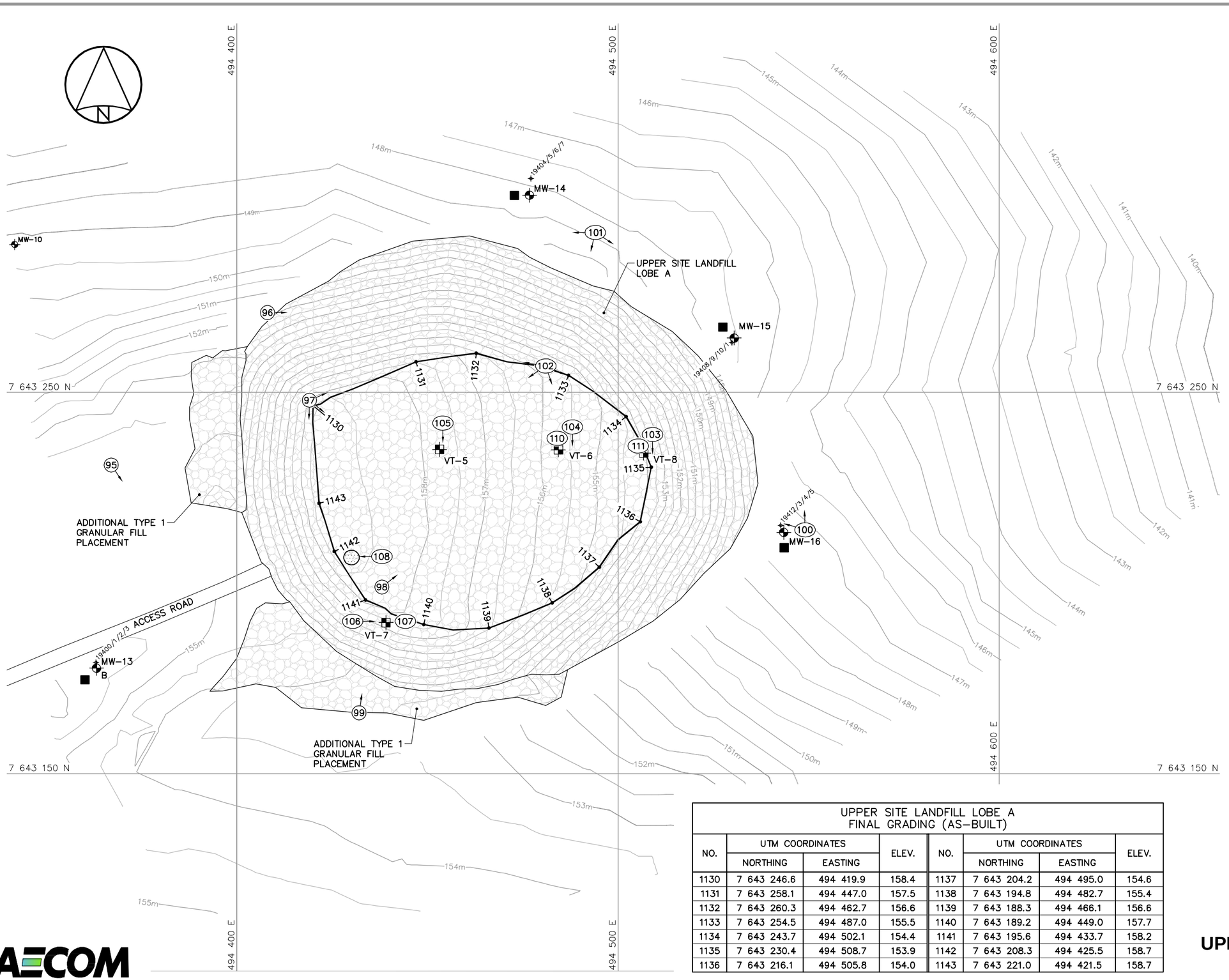
AECOM

DEW LINE CLEAN UP
LANDFILL MONITORING PLAN

FOX-2 LONGSTAFF BLUFF

TIER II DISPOSAL FACILITY

FIGURE FOX-2.5



GENERAL NOTES:

1. ALL COORDINATES ARE REFERENCED TO NAD83 (CSRS), UTM ZONE 18N. ALL ELEVATIONS REFER TO GEODETIC DATUM.
2. ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE.

LEGEND:

- 1130 — COORDINATE POINT
- MONITORING WELL LOCATION (3)
- B — BACKGROUND MONITORING WELL LOCATION (1)
- GROUND TEMPERATURE CABLE LOCATION (4)
- MONITORING SOIL SAMPLE LOCATION (4)
- MONITORING SITE FEATURE
- 100 — APPROX. PHOTOGRAPHIC VIEWPOINT
- 19400 — 2012 SOIL SAMPLE TAG LOCATION

UPPER SITE LANDFILL LOBE A
MONITORING WELLS (AS-BUILT)

NO.	UTM COORDINATES		ELEV.
	NORTHING	EASTING	
MW-13	7 643 177.7	494 363.1	155.7
MW-14	7 643 301.8	494 476.7	148.2
MW-15	7 643 264.3	494 530.4	147.7
MW-16	7 643 213.3	494 543.4	147.1

UPPER SITE LANDFILL LOBE A
GROUND TEMPERATURE CABLES (AS-BUILT)

NO.	UTM COORDINATES		ELEV.
	NORTHING	EASTING	
VT-5	7 643 235.1	494 453.1	157.7
VT-6	7 643 235.0	494 484.3	155.6
VT-7	7 643 189.6	494 439.1	157.1
VT-8	7 643 234.1	494 506.7	153.9

UPPER SITE LANDFILL LOBE A
FINAL GRADING (AS-BUILT)

NO.	UTM COORDINATES		ELEV.	NO.	UTM COORDINATES		ELEV.
	NORTHING	EASTING			NORTHING	EASTING	
1130	7 643 246.6	494 419.9	158.4	1137	7 643 204.2	494 495.0	154.6
1131	7 643 258.1	494 447.0	157.5	1138	7 643 194.8	494 482.7	155.4
1132	7 643 260.3	494 462.7	156.6	1139	7 643 188.3	494 466.1	156.6
1133	7 643 254.5	494 487.0	155.5	1140	7 643 189.2	494 449.0	157.7
1134	7 643 243.7	494 502.1	154.4	1141	7 643 195.6	494 433.7	158.2
1135	7 643 230.4	494 508.7	153.9	1142	7 643 208.3	494 425.5	158.7
1136	7 643 216.1	494 505.8	154.0	1143	7 643 221.0	494 421.5	158.7

RECORD DRAWING
NOT FOR CONSTRUCTION

0 10 20 m SCALE 1:1000

DEW LINE CLEAN UP
LANDFILL MONITORING PLAN

FOX-2 LONGSTAFF BLUFF

UPPER SITE LANDFILL LOBE A

FIGURE FOX-2.6

AECOM