

Biofarm Cell Construction and Remediation of Re-Supply Area, Taloyoak, Nunavut

February 26, 2003

Report

**Biofarm Cell Construction and
Remediation of Re-Supply Area,
Taloyoak, Nunavut**

Government of Nunavut
Public Works & Services
Petroleum Products Division

02-0456

Submitted by:

Dillon Consulting Limited

(In reply, please refer to)

Our File: 02-0456

February 26, 2003

Government of Nunavut
Public Works & Services
Petroleum Products Division
P.O. Box 590
Rankin Inlet, Nunavut X0C 0G0

Attention: Mr. Baljinger Brar
Project Officer

**Biofarm Cell Construction and Remediation of Re-Supply Area
Bulk Fuel Storage Facility, Taloyoak, Nunavut**

Dear Mr. Brar:

Dillon Consulting Limited is pleased to provide you with four report copies of the above-mentioned report, for work completed in Taloyoak, Nunavut.

We trust that this report meets your requirements and look forward to your comments upon review of this document. If you have any questions, please contact the undersigned at your convenience.

Yours truly,

Dillon Consulting Limited

Douglas D. Bell, M. Sc., P. Geo.
*Regional Practice Leader
Contaminated Sites Management
North/West Region*

DDB:kse

Attachment

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1 INTRODUCTION

1.1 Background

Dillon Consulting Limited (Dillon) was retained by the Government of Nunavut (GN), Public Works & Services (PWS), Petroleum Products Division (PPD), to conduct a remedial excavation of the Bulk Fuel Storage Facility re-supply connection, in Taloyoak, Nunavut.

The contaminated material was previously characterized during the Phase I/II and III Environmental Site Assessments (ESAs) of the Bulk Fuel Storage Facility conducted by Dillon in 1999 and 2000, respectively. Dillon reported hydrocarbon concentrations in excess of the soil guidelines used by the Department of Sustainable Development (DSD), GN, for the purpose of assessing hydrocarbon based contamination at all PPD facilities across Nunavut. The Total Petroleum Hydrocarbon (TPH) concentrations of samples taken from the excavated material were as high as 3,400 ppm. BTEX compounds (Benzene, Toluene, Ethylbenzene and Xylenes) were not identified in the samples. The volume of hydrocarbon contaminated soil at the re-supply connection was estimated to be approximately 780 m³. The total volume of hydrocarbon contaminated soil (re-supply connection and the tank farm) was estimated at approximately 1700 m³.

1.2 Objectives and Scope of Work

The objectives of this project were as follows:

- Construct a lined biofarm containment cell;
- Excavate impacted soil from the re-supply connection and transport to the biofarm;
- Construct fence around the biofarm cell;
- Collect confirmatory samples at the limits of the excavation;
- Backfill and compact the excavation to near pre-construction grades; and,
- Install four (4) monitoring wells near the existing storage tank area.

Kitnuna Construction Limited (Kitnuna) was retained by PPD to carry out the above listed objectives. Kitnuna mobilized to the site on September 16, 2002 and Dillon arrived on-site September 19, 2002.

Dillon's scope of work included the following:

- Contract administration;
- On-site inspection and final inspection of biofarm cell construction;
- Conduct field screening of hydrocarbon vapour emission;
- Collection of confirmatory sampling;
- Prepare construction/remediation report and drawings; and,
- Prepare O & M Manual.

2 BIOFARM CELL

2.1 Construction and Inspection

The biofarm cell was designed to accept hydrocarbon contaminated soil excavated from the re-supply connection area. The biofarm cell is located near the local landfill, Lot 1000, LTO 1608. The biofarm was to be surrounded by a gated 1.9 m zinc-galvanized chain link fence in order to accommodate equipment necessary for tillage activities. However, as per direction from the client representative, the fence was not erected during the September 2002 work program.

The biofarm cell is approximately 1.8 m in height and 33 m by 33 m in length and width. The cell is constructed of recompacted native fill, and is covered with an impermeable membrane which is keyed into the top of the berm on all four sides. The impermeable membrane consists of a 300 mm Arctic Liner® that is underlain and overlain by a 10oz/yard Non-Woven Geotextile, and covered by 50 mm fine granular material.

The slopes of the berm are 2.5:1 on the inside slope and 2:1 on the outside slope. A 1.1 m deep (3.5 m square) retention basin is located in the western corner of the cell, and filled with fine granular material. A 100 mm HDPE perforated leachate collection pipe is located at the bottom of the retention basin, connects to a solid pipe on the sloped face and runs to the top of the berm. The leachate collection pipe can be used to control moisture content by removing leachate or water from the retention basin and spraying it back onto the contaminated soil (See drawing T1 and T2 for design specifications, and landfarm plan and sections views).

Construction of the biofarm cell was completed on September 24, 2002 and filled with contaminated soil between September 24 and 26, 2002. The construction and final inspections were conducted by Jason Andrews, E.I.T. of Dillon.

2.2 Operations and Maintenance Manual

An O&M Manual for the biofarm cell has been developed as part of this work program. The O&M Manual is a stand-alone document, separate from this report. The objective of the manual is to present procedures necessary for the aerobic treatment of soils contaminated with fuel of a diesel/heating oil variety.

3 REMEDIATION AND CONFIRMATION

3.1 Excavation

Based on the analytical results of the Phase III ESA (Dillon, 2000), approximately 780 m³ of hydrocarbon impacted soil was characterized as contaminated with hydrocarbons. Two separate areas of contamination were identified at the re-supply connection, as indicated on drawing T1.

The first excavation of contaminated material began at the northeast end of the site and proceeded southwest to the area in front of the re-supply pipeline. The contaminated material was excavated down to permafrost (approximately 1 m below surface) and was not excavated within 45E of any structural footings.

The second excavation began northeast of the bay doors of the on-site garage and proceeded in both a south and west direction. The excavation stopped approximately 1.2 m below ground surface, in a layer of grey clay that did not appear to be contaminated. The excavation was not advanced beyond 45E of any structural footings.

The material excavated was largely sand and silty clay with some pebbles and cobbles. Some dark staining and varying strengths of hydrocarbon odour were observed. A total of approximately 750 m³ of contaminated material was excavated, placed into the biofarm cell and levelled.

3.2 Confirmation of Remediation

3.2.1 Methodology

Total Hydrocarbon Vapour Concentration (THVC) readings were conducted on-site the help delineate the extent of hydrocarbon contaminated soil. As the excavation progressed from known areas of contamination, soil samples were collected and placed into re-sealable plastic bags and allowed to warm for approximately 10 minutes. The bagged samples were then screened for volatile organic vapours using a Gastech® Tracetehtor - Model 1238 (Gastech) combustible gas detector operated in methane elimination mode.

Prior to arriving in Taloyoak, the Gastech was calibrated using hexane at two points: 400 parts per million by volume (ppm) and 40 per cent of the lower explosive limit (LEL). Volatile hydrocarbon vapours were measured using a fixed-volume headspace technique, in which the bagged soil sample was punctured and the headspace petroleum hydrocarbon vapour levels measured. The highest headspace vapour level observed for each sample was recorded in ppm or % LEL, as appropriate (For reference, headspace vapour levels recorded in % LEL can be converted to ppm by multiplying by 100).

The excavation was continued until a low THVC reading was achieved and/or no visual or olfactory evidence of impact could be noted. At this point soil samples were collected from the excavation wall and placed into laboratory prepared 125 ml glass jars with a Teflon lined lid. The jarred samples were placed on ice in a cooler pending possible laboratory analysis. Select soil samples were submitted to EnviroTest Laboratories, Edmonton, Alberta (EnviroTest) for analysis based on screening results and visual/olfactory observations.

Samples were comprised entirely of soil from distinct layers, and were not composed of soil different locations. Samples were not taken either on the bottom of the excavation where permafrost was present or on walls adjacent to footings as further excavation in these areas was not practical or safe. Samples were collected by hand with single-use nitrile gloves used for sampling quality assurance. Soil samples were analyzed for TPH and BTEX compounds, which were identified as the Contaminants of Concern (COC) in previous investigations.

3.2.2 Analytical Results

As summarized in Table 1, the September 19, 2002 analytical results of the confirmatory soil samples show that fifteen (15) of sixteen (16) samples were below applicable guideline criteria. One sample (TAR-11) had a TPH concentration in excess of the recommended criteria.

Table 1: Laboratory Soil Analysis and THVC Results

BTEX and Total Petroleum Hydrocarbons, Results in mg/kg (ppm)							
Sample ID	Benzene	Toluene	Ethyl-benzene	Total Xylenes	TPH (C ₅ -C ₃₀)		THVC (ppm)
					C ₅ -C ₁₀	C ₁₁ -C ₃₀	
TAR-1	<0.01	<0.01	<0.01	<0.01	<0.5	<5	20
TAR-2	<0.01	<0.01	<0.01	<0.01	<0.5	<5	25
TAR-3	<0.01	<0.01	<0.01	<0.01	<0.5	<5	75
TAR-4	<0.01	<0.01	<0.01	0.01	0.8	29	90
TAR-5	0.02	0.01	0.05	0.11	2.2	370	130
TAR-6	<0.01	<0.01	<0.01	<0.01	<0.5	21	110
TAR-7	<0.01	<0.01	<0.01	0.08	5.8	290	130
TAR-8	<0.01	<0.01	0.16	0.54	22	2200	100
TAR-9	<0.01	<0.01	0.04	0.09	4.3	150	40
TAR-10	<0.01	<0.01	0.15	0.24	7.5	9	60
TAR-11	<0.01	0.04	0.44	2.1	61	3600	240
TAR-12	<0.01	<0.01	0.25	0.68	22	380	200
TAR-13	<0.01	<0.01	0.10	0.39	12	170	70
TAR-14	<0.01	<0.01	0.24	0.74	21	870	140
TAR-15	<0.01	<0.01	0.22	0.73	23	850	170
TAR-16	<0.01	<0.01	0.16	0.42	16	130	150
Assessment Criteria	5⁽¹⁾	0.8⁽¹⁾	20⁽¹⁾	17⁽¹⁾	Total TPH = 2500⁽¹⁾		N.C.

Notes:

N.C.: No Assessment criteria available.

BOLD: Indicates result exceeds applicable criteria

(1) GNWT – Department of Resource, Wildlife and Economic Development, Industrial Land Use Guideline.

3.2.3 Discussion

Based on the analytical results and on-site observations, it is concluded that 5 - 10 m³ of contaminated material was not excavated and exists in the vicinity of sample TAR-11. This material remains on-site as a result of analytical results being received after the site work had been completed.

3.3 Site Restoration

After confirmatory samples were obtained, backfilling was commenced using clean, native material. The fill material was compacted and graded to match existing elevations.

3.4 Monitoring Well Installation

Four (4) monitoring wells were to be installed on-site in the vicinity of the tank farm. However, as per direction from the client representative, the well installations were deferred until 2003.

4 OVERALL SUMMARY AND CONCLUSIONS

This report documents the inspection of the biofarm cell construction and the remediation of hydrocarbon-contaminated soil at the re-supply connection. The contaminated soil was excavated from two (2) areas at the re-supply connection and relocated to a geomembrane lined containment berm where it is to be aerated until remediated. Approximately 750 m³ of contaminated soil was relocated to the berm. The following table summarizes the processes, actions and results of this project.

Table 2: Summary of Actions

Process	Action/Results
Construction	Constructed biofarm cell that was lined with geotextile and geomembrane. The biofarm cell was inspected and determined to have been constructed to required specifications. The fence was not erected around the cell as part of the September 2002 work plan; the fencing material was moved to be stored at the tank farm facility. (See appended drawings for dimensions and specifications).
Remediation	Excavated hydrocarbon contaminated soil from two areas at re-supply connection and transported material into the biofarm cell. Approximately 750 m ³ of material was placed in the biofarm.
Confirmation of Remediation	Sixteen (16) excavation limit samples collected and analyzed for TPH and BTEX compounds. Fifteen (15) samples below applicable guidelines. One (1) sample (TAR-11) exceeded applicable guideline criteria for TPH. Approximately 5 to 10 m ³ of contaminated material remains on site.
Backfilling	Remedial excavation was backfilled using locally available non-contaminated material (sandy gravel), and graded to original elevation.
Monitoring Well Installation	Monitoring wells were not installed at the tank farm as part of the September 2002 work plan.

Based on the field observations and analytical results of confirmatory soil samples, it is concluded that the majority of the contaminated soil exceeding applicable guidelines was successfully removed for disposal within the biofarm cell. It is estimated that approximately 5 to 10 m³ of contaminated soil remain at the re-supply connection.

It is Dillon's recommendation that the remaining hydrocarbon contaminated soil at the re-supply connection be excavated and transported to the biofarm cell. The location of the remaining contaminated soil at TAR-11 is indicated on drawing T1.

An O&M Manual has been created for the biofarm cell and has been included under separate cover. The objective of the manual is to present procedures necessary for the aerobic treatment of soils contaminated with fuel of a diesel/heating oil variety.

5 CLOSURE

This report was prepared exclusively for the purposes, project, and site location outlined in the report. The report is based on information provided to, or obtained by, Dillon as indicated in the report and applies solely to site conditions and the regulatory and planning frameworks existing at the time of the site investigation. Although a reasonable investigation was conducted by Dillon, Dillon's investigation was by no means exhaustive and cannot be construed as a certification of the absence of any contaminants from the site. Rather, Dillon's report represents a reasonable review of available information within an established work scope and schedule.

This report was prepared by Dillon for the sole benefit of our client, Petroleum Products Division, Public Works & Services, Government of Nunavut, and is not to be relied upon by any third parties without Dillon's express written consent. The material in this report reflects Dillon's best judgement in light of the information available to it at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions made based on it, are the responsibilities of such third parties. Dillon accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

Respectfully submitted,

Dillon Consulting Limited

Douglas D. Bell, M.Sc., P.Geo.
Regional Practice Leader
Site Contaminant Management
North/West Region

APPENDIX A

SITE PHOTOGRAPHS



Photo 1: Berm under construction looking southeast



Photo 2: Berm construction complete and ready for liner.


 DILLON CONSULTING October 2002	SITE PHOTOGRAPHS		PROJECT NO. 02-0456
	Taloyoak Bulk Fuel Re-Supply Area Remediation		PHOTO NO. 1, 2



Photo 3: Installation of geomembrane on geotextile.



Photo 4: Installation of geotextile on top of geomembrane.


 October 2002	SITE PHOTOGRAPHS	PROJECT NO. 02-0456
	Taloyoak Bulk Fuel Re-Supply Area Remediation	PHOTO NO. 3, 4



Photo 5: Excavation of contaminated material near fuel pipeline.



Photo 6: Excavation of contaminated material in front of garage.


 October 2002	SITE PHOTOGRAPHS	PROJECT NO. 02-0456
	Taloyoak Bulk Fuel Re-Supply Area Remediation	PHOTO NO. 5, 6



Photo 7: Eastern side of site after backfilling and grading looking East



Photo 8: Western side of site after backfilling and grading looking West



 DILLON CONSULTING October 2002	SITE PHOTOGRAPHS	PROJECT NO. 02-0456
	Taloyoak Bulk Fuel Re-Supply Area Remediation	PHOTO NO. 7, 8



Photo 9: Western side of site after backfilling and grading looking East



Photo 10: Completed berm looking southwest from road.

 DILLON CONSULTING October 2002	SITE PHOTOGRAPHS		PROJECT NO. 02-0456
	Taloyoak Bulk Fuel Re-Supply Area Remediation		PHOTO NO. 9, 10

APPENDIX B

LABORATORY CERTIFICATES

02-0456

MATERIALS TESTING

ETL EnviroTest

A DIVISION OF ETL CHEMSPEC ANALYTICAL LIMITED

RECEIVED

OCT 22 2002

DILLON CONSULTING LIMITED
CALGARY, ALBERTA

CHEMICAL ANALYSIS REPORT

DILLON CONSULTING LTD

DATE: 18-OCT-02 Revision: 1

ATTN: JASON ANDREWS

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CALGARY AB T2P 3P4

Lab Work Order #: L82068

Sampled By: JEA

Date Received: 27-SEP-02

Project P.O. #: N/A

Project Reference: 02-0456

Comments:

APPROVED BY: 

TONY CIARLA

Project Manager

THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE WRITTEN AUTHORITY OF THE LABORATORY.
ALL SAMPLES WILL BE DISPOSED OF AFTER 30 DAYS FOLLOWING ANALYSIS. PLEASE CONTACT THE LAB IF YOU
REQUIRE ADDITIONAL SAMPLE STORAGE TIME.

LABORATORY ACCREDITATIONS:

- STANDARDS COUNCIL OF CANADA IN COOPERATION WITH THE CANADIAN ASSOCIATION FOR ENVIRONMENTAL ANALYTICAL LABORATORIES (CAEAL)
- FOR SPECIFIC TESTS AS REGISTERED BY THE COUNCIL (EDMONTON, CALGARY, GRANDE PRAIRIE, SASKATOON, WINNIPEG, THUNDER BAY, WATERLOO)
- AMERICAN INDUSTRIAL HYGIENE ASSOCIATION (AIHA) IN THE INDUSTRIAL HYGIENE PROGRAM (EDMONTON, WINNIPEG)
- STANDARDS COUNCIL OF CANADA IN COOPERATION WITH THE CANADIAN FOOD INSPECTION AGENCY (CFIA) FOR FERTILIZER AND FEED TESTING (SASKATOON) AND FOR MICROBIOLOGICAL TESTING IN FOOD (WINNIPEG)

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Canada Fax:
1-800-286-7319

www.envirotest.com

Sample Details/Parameters	Result	Qualifier	D.L.	Units	Extracted	Analyzed	By	Batch
L82068-1 TAR-1 Sample Date: 24-SEP-02 Matrix: SOIL BTEX, TVH and TEH								
TEH (C11-C30)	<5		5	mg/kg	30-SEP-02	02-OCT-02	RRF	R95369
BTEX and TVH (C5-C10)								
Benzene	<0.01		0.01	mg/kg	30-SEP-02	02-OCT-02	RLB	R95587
Toluene	<0.01		0.01	mg/kg	30-SEP-02	02-OCT-02	RLB	R95587
Ethylbenzene	<0.01		0.01	mg/kg	30-SEP-02	02-OCT-02	RLB	R95587
Xylenes	<0.01		0.01	mg/kg	30-SEP-02	02-OCT-02	RLB	R95587
Total Volatiles (C5-C10)	<0.5		0.5	mg/kg	30-SEP-02	02-OCT-02	RLB	R95587
% Moisture	9.9		0.1	%	30-SEP-02	02-OCT-02	DJB	R95192
L82068-3 TAR-2 Sample Date: 24-SEP-02 Matrix: SOIL BTEX, TVH and TEH								
TEH (C11-C30)	<5		5	mg/kg	30-SEP-02	02-OCT-02	RRF	R95369
BTEX and TVH (C5-C10)								
Benzene	<0.01		0.01	mg/kg	30-SEP-02	02-OCT-02	RLB	R95587
Toluene	<0.01		0.01	mg/kg	30-SEP-02	02-OCT-02	RLB	R95587
Ethylbenzene	<0.01		0.01	mg/kg	30-SEP-02	02-OCT-02	RLB	R95587
Xylenes	<0.01		0.01	mg/kg	30-SEP-02	02-OCT-02	RLB	R95587
Total Volatiles (C5-C10)	<0.5		0.5	mg/kg	30-SEP-02	02-OCT-02	RLB	R95587
% Moisture	6.9		0.1	%	30-SEP-02	02-OCT-02	DJB	R95192
L82068-5 TAR-3 Sample Date: 24-SEP-02 Matrix: SOIL BTEX, TVH and TEH								
TEH (C11-C30)	<5		5	mg/kg	30-SEP-02	02-OCT-02	RRF	R95369
BTEX and TVH (C5-C10)								
Benzene	<0.01		0.01	mg/kg	30-SEP-02	02-OCT-02	RLB	R95587
Toluene	<0.01		0.01	mg/kg	30-SEP-02	02-OCT-02	RLB	R95587
Ethylbenzene	<0.01		0.01	mg/kg	30-SEP-02	02-OCT-02	RLB	R95587
Xylenes	<0.01		0.01	mg/kg	30-SEP-02	02-OCT-02	RLB	R95587
Total Volatiles (C5-C10)	<0.5		0.5	mg/kg	30-SEP-02	02-OCT-02	RLB	R95587
% Moisture	7.6		0.1	%	30-SEP-02	02-OCT-02	DJB	R95192
L82068-7 TAR-4 Sample Date: 24-SEP-02 Matrix: SOIL BTEX, TVH and TEH								
TEH (C11-C30)	29		5	mg/kg	30-SEP-02	02-OCT-02	RRF	R95369
BTEX and TVH (C5-C10)								
Benzene	<0.01		0.01	mg/kg	30-SEP-02	02-OCT-02	RLB	R95587
Toluene	<0.01		0.01	mg/kg	30-SEP-02	02-OCT-02	RLB	R95587
Ethylbenzene	<0.01		0.01	mg/kg	30-SEP-02	02-OCT-02	RLB	R95587
Xylenes	0.01		0.01	mg/kg	30-SEP-02	02-OCT-02	RLB	R95587
Total Volatiles (C5-C10)	0.8		0.5	mg/kg	30-SEP-02	02-OCT-02	RLB	R95587
% Moisture	7.8		0.1	%	30-SEP-02	02-OCT-02	DJB	R95192

ENVIRO-TEST CHEMICAL ANALYSIS REPORT

Sample Details/Parameters	Result	Qualifier	D.L.	Units	Extracted	Analyzed	By	Batch
L82068-9 TAR-5 Sample Date: 24-SEP-02 Matrix: SOIL BTEX, TVH and TEH TEH (C11-C30) BTEX and TVH (C5-C10) Benzene Toluene Ethylbenzene Xylenes Total Volatiles (C5-C10) % Moisture	370 0.02 0.01 0.05 0.11 2.2 6.1		5 0.01 0.01 0.01 0.01 0.5 0.1	mg/kg mg/kg mg/kg mg/kg mg/kg %	03-OCT-02 30-SEP-02 30-SEP-02 30-SEP-02 30-SEP-02 30-SEP-02 30-SEP-02	04-OCT-02 02-OCT-02 02-OCT-02 02-OCT-02 02-OCT-02 02-OCT-02 02-OCT-02	RRF RLB RLB RLB RLB RLB DJB	R95812 R95587 R95587 R95587 R95587 R95587 R95192
L82068-11 TAR-6 Sample Date: 25-SEP-02 Matrix: SOIL BTEX, TVH and TEH TEH (C11-C30) BTEX and TVH (C5-C10) Benzene Toluene Ethylbenzene Xylenes Total Volatiles (C5-C10) % Moisture	21 <0.01 <0.01 <0.01 <0.01 <0.5 4.8		5 0.01 0.01 0.01 0.01 0.5 0.1	mg/kg mg/kg mg/kg mg/kg mg/kg %	30-SEP-02 30-SEP-02 30-SEP-02 30-SEP-02 30-SEP-02 30-SEP-02 30-SEP-02	02-OCT-02 02-OCT-02 02-OCT-02 02-OCT-02 02-OCT-02 02-OCT-02 02-OCT-02	RRF RLB RLB RLB RLB RLB DJB	R95369 R95587 R95587 R95587 R95587 R95587 R95192
L82068-13 TAR-7 Sample Date: 25-SEP-02 Matrix: SOIL BTEX, TVH and TEH TEH (C11-C30) BTEX and TVH (C5-C10) Benzene Toluene Ethylbenzene Xylenes Total Volatiles (C5-C10) % Moisture	290 <0.01 <0.01 <0.01 0.08 5.8 7.4		5 0.01 0.01 0.01 0.01 0.5 0.1	mg/kg mg/kg mg/kg mg/kg mg/kg %	30-SEP-02 30-SEP-02 30-SEP-02 30-SEP-02 30-SEP-02 30-SEP-02 30-SEP-02	02-OCT-02 02-OCT-02 02-OCT-02 02-OCT-02 02-OCT-02 02-OCT-02 02-OCT-02	RRF RLB RLB RLB RLB RLB DJB	R95369 R95587 R95587 R95587 R95587 R95587 R95192
L82068-15 TAR-8 Sample Date: 25-SEP-02 Matrix: SOIL BTEX, TVH and TEH TEH (C11-C30) BTEX and TVH (C5-C10) Benzene Toluene Ethylbenzene Xylenes Total Volatiles (C5-C10) % Moisture	2200 <0.01 <0.01 0.16 0.54 22 8.0		5 0.01 0.01 0.01 0.01 0.5 0.1	mg/kg mg/kg mg/kg mg/kg mg/kg %	30-SEP-02 30-SEP-02 30-SEP-02 30-SEP-02 30-SEP-02 30-SEP-02 30-SEP-02	02-OCT-02 02-OCT-02 02-OCT-02 02-OCT-02 02-OCT-02 02-OCT-02 02-OCT-02	RRF RLB RLB RLB RLB RLB DJB	R95369 R95587 R95587 R95587 R95587 R95587 R95192

Sample Details/Parameters	Result	Qualifier	D.L.	Units	Extracted	Analyzed	By	Batch
L82068-17 TAR-9 Sample Date: 25-SEP-02 Matrix: SOIL BTEX, TVH and TEH								
TEH (C11-C30)	150		5	mg/kg	30-SEP-02	02-OCT-02	RRF	R95369
BTEX and TVH (C5-C10)								
Benzene	<0.01		0.01	mg/kg	30-SEP-02	02-OCT-02	RLB	R95587
Toluene	<0.01		0.01	mg/kg	30-SEP-02	02-OCT-02	RLB	R95587
Ethylbenzene	0.04		0.01	mg/kg	30-SEP-02	02-OCT-02	RLB	R95587
Xylenes	0.09		0.01	mg/kg	30-SEP-02	02-OCT-02	RLB	R95587
Total Volatiles (C5-C10)	4.3		0.5	mg/kg	30-SEP-02	02-OCT-02	RLB	R95587
% Moisture	7.2		0.1	%	30-SEP-02	02-OCT-02	DJB	R95192
L82068-19 TAR-10 Sample Date: 25-SEP-02 Matrix: SOIL BTEX, TVH and TEH								
TEH (C11-C30)	9		5	mg/kg	03-OCT-02	04-OCT-02	RRF	R95812
BTEX and TVH (C5-C10)								
Benzene	<0.01		0.01	mg/kg	30-SEP-02	02-OCT-02	RLB	R95587
Toluene	<0.01		0.01	mg/kg	30-SEP-02	02-OCT-02	RLB	R95587
Ethylbenzene	0.15		0.01	mg/kg	30-SEP-02	02-OCT-02	RLB	R95587
Xylenes	0.24		0.01	mg/kg	30-SEP-02	02-OCT-02	RLB	R95587
Total Volatiles (C5-C10)	7.5		0.5	mg/kg	30-SEP-02	02-OCT-02	RLB	R95587
% Moisture	10		0.1	%	30-SEP-02	02-OCT-02	DJB	R95192
L82068-21 TAR-11 Sample Date: 25-SEP-02 Matrix: SOIL BTEX, TVH and TEH								
TEH (C11-C30)	3600		5	mg/kg	30-SEP-02	02-OCT-02	RRF	R95369
BTEX and TVH (C5-C10)								
Benzene	<0.01		0.01	mg/kg	30-SEP-02	02-OCT-02	RLB	R95587
Toluene	0.04		0.01	mg/kg	30-SEP-02	02-OCT-02	RLB	R95587
Ethylbenzene	0.44		0.01	mg/kg	30-SEP-02	02-OCT-02	RLB	R95587
Xylenes	2.1		0.01	mg/kg	30-SEP-02	02-OCT-02	RLB	R95587
Total Volatiles (C5-C10)	61		0.5	mg/kg	30-SEP-02	02-OCT-02	RLB	R95587
% Moisture	7.3		0.1	%	30-SEP-02	02-OCT-02	DJB	R95192
L82068-23 TAR-12 Sample Date: 25-SEP-02 Matrix: SOIL BTEX, TVH and TEH								
TEH (C11-C30)	380		5	mg/kg	30-SEP-02	02-OCT-02	RRF	R95369
BTEX and TVH (C5-C10)								
Benzene	<0.01		0.01	mg/kg	30-SEP-02	02-OCT-02	RLB	R95587
Toluene	<0.01		0.01	mg/kg	30-SEP-02	02-OCT-02	RLB	R95587
Ethylbenzene	0.25		0.01	mg/kg	30-SEP-02	02-OCT-02	RLB	R95587
Xylenes	0.68		0.01	mg/kg	30-SEP-02	02-OCT-02	RLB	R95587
Total Volatiles (C5-C10)	22		0.5	mg/kg	30-SEP-02	02-OCT-02	RLB	R95587
% Moisture	8.0		0.1	%	30-SEP-02	02-OCT-02	DJB	R95192

ENVIRO-TEST CHEMICAL ANALYSIS REPORT

Sample Details/Parameters		Result	Qualifier	D.L.	Units	Extracted	Analyzed	By	Batch
L82068-25	TAR-13								
Sample Date: 25-SEP-02									
Matrix: SOIL									
BTEX, TVH and TEH									
TEH (C11-C30)		170		5	mg/kg	30-SEP-02	02-OCT-02	RRF	R95369
BTEX and TVH (C5-C10)									
Benzene		<0.01		0.01	mg/kg	30-SEP-02	02-OCT-02	RLB	R95587
Toluene		<0.01		0.01	mg/kg	30-SEP-02	02-OCT-02	RLB	R95587
Ethylbenzene		0.10		0.01	mg/kg	30-SEP-02	02-OCT-02	RLB	R95587
Xylenes		0.39		0.01	mg/kg	30-SEP-02	02-OCT-02	RLB	R95587
Total Volatiles (C5-C10)		12		0.5	mg/kg	30-SEP-02	02-OCT-02	RLB	R95587
% Moisture		9.3		0.1	%	30-SEP-02	02-OCT-02	DJB	R95192
L82068-27	TAR-14								
Sample Date: 25-SEP-02									
Matrix: SOIL									
BTEX, TVH and TEH									
TEH (C11-C30)		870		5	mg/kg	30-SEP-02	02-OCT-02	RRF	R95369
BTEX and TVH (C5-C10)									
Benzene		<0.01		0.01	mg/kg	30-SEP-02	02-OCT-02	RLB	R95587
Toluene		<0.01		0.01	mg/kg	30-SEP-02	02-OCT-02	RLB	R95587
Ethylbenzene		0.24		0.01	mg/kg	30-SEP-02	02-OCT-02	RLB	R95587
Xylenes		0.74		0.01	mg/kg	30-SEP-02	02-OCT-02	RLB	R95587
Total Volatiles (C5-C10)		21		0.5	mg/kg	30-SEP-02	02-OCT-02	RLB	R95587
% Moisture		7.6		0.1	%	30-SEP-02	02-OCT-02	DJB	R95192
L82068-29	TAR-15								
Sample Date: 25-SEP-02									
Matrix: SOIL									
BTEX, TVH and TEH									
TEH (C11-C30)		850		5	mg/kg	30-SEP-02	02-OCT-02	RRF	R95369
BTEX and TVH (C5-C10)									
Benzene		<0.01		0.01	mg/kg	30-SEP-02	02-OCT-02	RLB	R95587
Toluene		<0.01		0.01	mg/kg	30-SEP-02	02-OCT-02	RLB	R95587
Ethylbenzene		0.22		0.01	mg/kg	30-SEP-02	02-OCT-02	RLB	R95587
Xylenes		0.73		0.01	mg/kg	30-SEP-02	02-OCT-02	RLB	R95587
Total Volatiles (C5-C10)		23		0.5	mg/kg	30-SEP-02	02-OCT-02	RLB	R95587
% Moisture		6.8		0.1	%	30-SEP-02	02-OCT-02	DJB	R95192
L82068-31	TAR-16								
Sample Date: 26-SEP-02									
Matrix: SOIL									
BTEX, TVH and TEH									
TEH (C11-C30)		130		5	mg/kg	30-SEP-02	02-OCT-02	RRF	R95369
BTEX and TVH (C5-C10)									
Benzene		<0.01		0.01	mg/kg	30-SEP-02	02-OCT-02	RLB	R95587
Toluene		<0.01		0.01	mg/kg	30-SEP-02	02-OCT-02	RLB	R95587
Ethylbenzene		0.16		0.01	mg/kg	30-SEP-02	02-OCT-02	RLB	R95587
Xylenes		0.42		0.01	mg/kg	30-SEP-02	02-OCT-02	RLB	R95587
Total Volatiles (C5-C10)		16		0.5	mg/kg	30-SEP-02	02-OCT-02	RLB	R95587
% Moisture		11		0.1	%	30-SEP-02	02-OCT-02	DJB	R95192
Refer to Referenced Information for Qualifiers (if any) and Methodology.									

Reference Information

Methods Listed (if applicable):

ETL Test Code	Matrix	Test Description	Preparation Method Reference**	Analytical Method Reference**
BTX,TVH-CL	Soil	BTEX and TVH (C5-C10)	EPA 5030B/5035	EPA 5021/8015&8240-Headspace GC/FID/MSD
PREP-MOISTURE-CL	Soil	% Moisture		Oven dry 105C-Gravimetric
TEH-CL	Soil	TEH (C11-C30)	EPA 3550B	EPA 3550/8000-GC-FID

** Analytical Methods employed follow in-house standard operations procedures, which are generally based on US-EPA, ASTM, NIOSH and/or APHA methods.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location	Laboratory Definition Code	Laboratory Location
CL	Enviro-Test Laboratories - Calgary, Alberta, Canada		

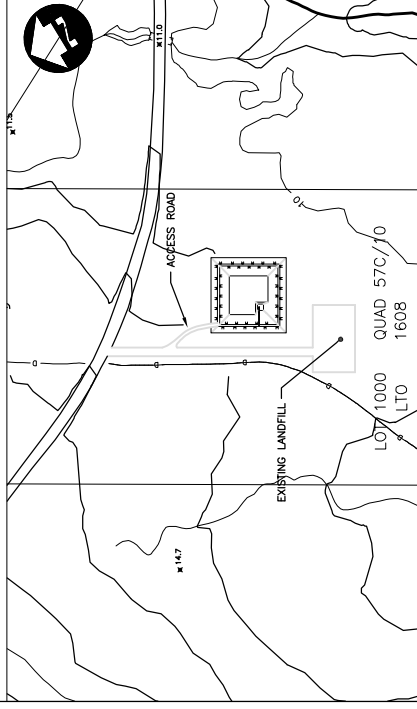
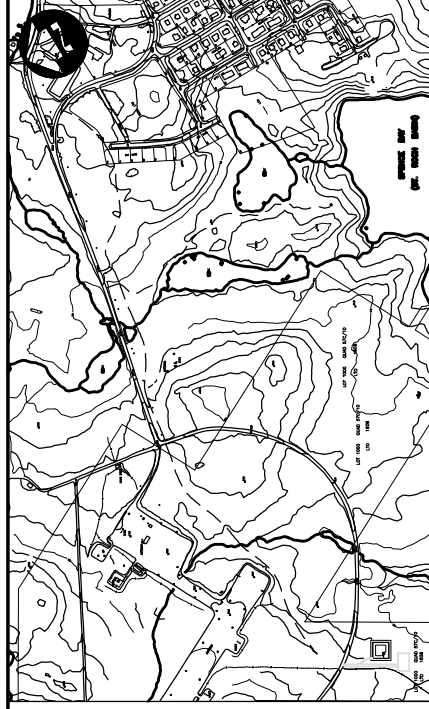
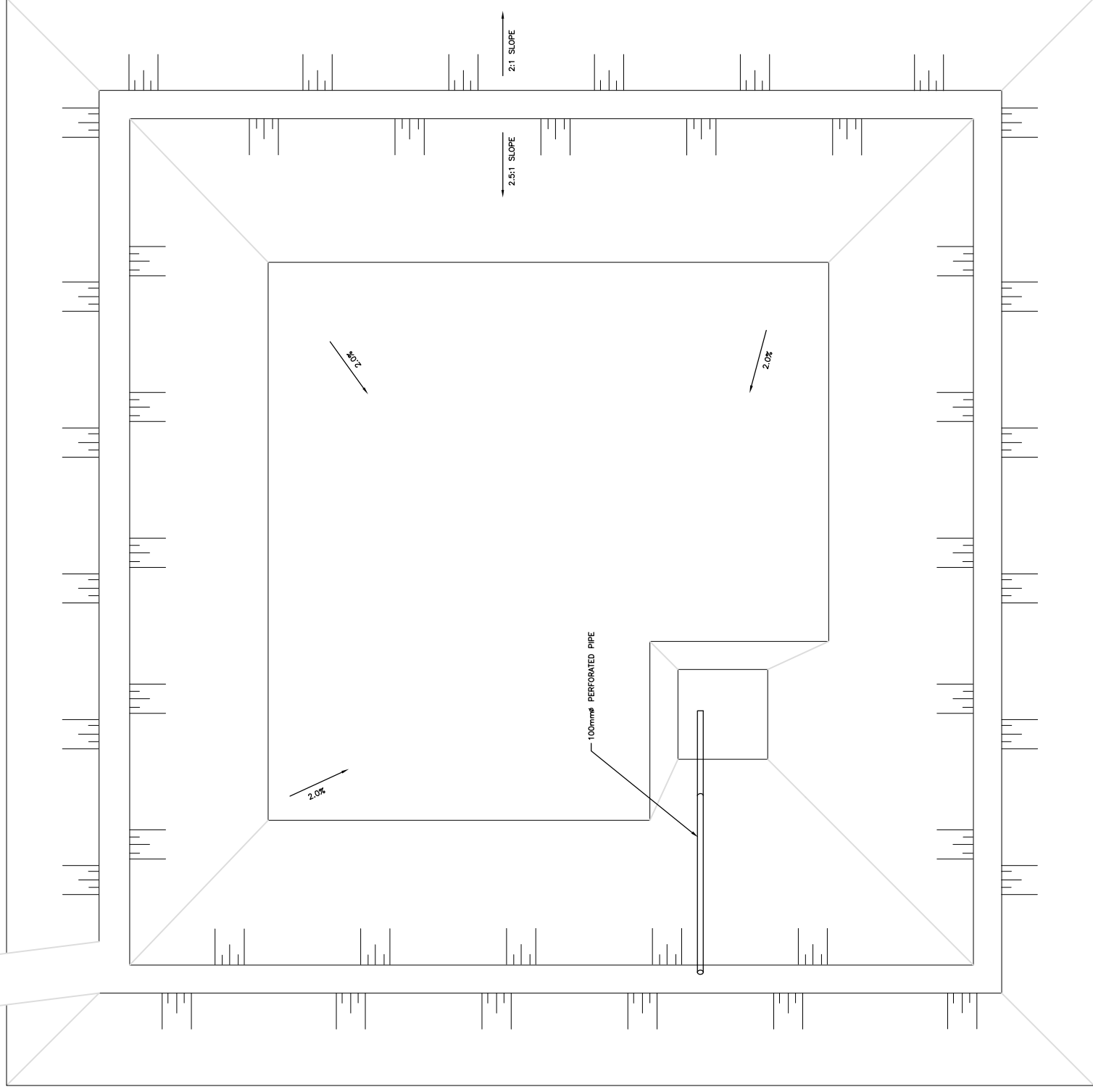
Test results reported relate only to the samples as received by the laboratory.

Although test results are generated under strict QA/QC protocols, any unsigned test reports, faxes, or emails are considered preliminary.

Enviro-Test Laboratories has an extensive QA/QC program where all analytical data reported is analyzed using approved referenced procedures followed by checks and reviews by senior managers and quality assurance personnel. However, since the results are obtained from chemical measurements and thus cannot be guaranteed, Enviro-Test Laboratories assumes no liability for the use or interpretation of the results.

APPENDIX C

DRAWINGS



This record drawing has been prepared based in part upon information furnished by others. Dillon Consulting Limited cannot assure the accuracy of others' information and thus is not responsible for the accuracy of this record drawing or for any error or omission that may have been incorporated into it as a result. Those relying on this drawing are advised to obtain independent verification of its accuracy before applying it for any purpose.

LAND FARM PLAN

$$\frac{1}{100}$$

EXCAVATION DETAIL - RESUPPLY AREA

1:400

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DATE</div>										<div>RECORD DRAWING</div> <div>APPROVED BY _____ DATE 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