FIRE TRAINING AREA AND LAND TREATMENT UNIT
REMEDIAL WORK
NORMAN WELLS AIRPORT
NORMAN WELLS, NORTHWEST TERRITORIES
PROJECT No.: 7040
SOLICITATION No.: E0213-03C012/A

Submitted to:

Transport Canada
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Submitted by:

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WERI Project No.: 1001-046-03

May 2004

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Client:

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EXECUTIVE SUMMARY

Winnipeg Environmental Remediations Inc. (WERInc), also referred to as the Contractor, was retained by Transport Canada (TC), also referred to as the Client, to conduct remedial activities at Norman Wells Airport, Norman Wells, Northwest Territories. Remedial activities in Norman Wells were conducted in September 2003 in accordance with the terms of the specifications provided by the Client. Activities conducted by the Contractor are reported under this cover and included the commissioning of a treatment cell to contain petroleum hydrocarbon contaminated soil and the excavation of petroleum hydrocarbon contaminated soil from the former Fire Training Area (FTA) at Norman Wells Airport.

A Land Treatment Unit (LTU) was commissioned adjacent to the former FTA site to contain approximately 1500 m^3 of petroleum hydrocarbon contaminated soil with a treatment depth of 0.5 m. The base of the LTU was excavated below grade and a perimeter berm was established around the LTU to prevent contaminant runoff. The base and berm of the LTU were compacted and a synthetic geomembrane liner was placed over the base and berm to prevent contaminants from leaching into the subsoil. The treatment cell was designed to contain the petroleum hydrocarbon contaminated soil excavated from the former FTA site.

The Contractor excavated approximately 1500 m^3 of petroleum hydrocarbon contaminated soil. The contaminated area was partially located within the established footprint of the LTU, which necessitated the stockpiling of the excavated material in a designated area. The stockpiled material was subsequently transferred within the treatment area of the LTU after the treatment cell was fully commissioned.

Field screening and confirmatory soil sampling were conducted during the excavation. The lateral and vertical extent of the excavation was terminated when field screening results were <100 parts per million (ppm). Once the lateral and vertical extent of the excavation was established, confirmatory soil samples were obtained from the sidewalls and base of the excavated area to be tested for petroleum hydrocarbons by an accredited laboratory, in accordance with the regulations and guidelines of the Government of the Northwest Territories (GNWT) and the Canadian Council of Ministers of the Environment (CCME). Unfortunately, the confirmatory soil samples were lost in transit and, therefore, the laboratory analyses could not be conducted.

The contaminated soil was transported via tandem trucks to the LTU, where it will undergo sufficient treatment to meet or exceed the remediation criteria of GNWT and CCME. Soil placed within the LTU was graded to a depth of approximately 0.45-0.5m to facilitate tilling and enhance the volatilization of hydrocarbon vapours. The excavations were backfilled with clean clay and gravel mixture and compacted.

The treatment of the soil contained in the LTU should be conducted during the 2004 field season, which will include regular tilling of the impacted soil and confirmatory soil sampling at the end of the field season to evaluate the rate of contaminant degradation. Confirmatory water sampling should also be conducted periodically, using the monitoring wells installed up-gradient and down-gradient from the treatment cell, to monitor site conditions. The treatment period may require more than one field season before compliance with the applicable regulatory criteria can be achieved.

Furthermore, since the confirmatory soil samples were lost in transit, it is also recommended that a test pitting program is conducted along the perimeter of the excavated area to obtain

confirmatory soil samples that are representative of the lateral extent of the excavation. A test pit should also be advanced below the backfilled area to obtain a soil sample that is representative of the vertical extent of the excavation. The test pitting program would be conducted after the treatment of the contaminated soil is completed and the LTU is scheduled for decommissioning.

1.0 INTRODUCTION

1.1 Terms of Reference

Winnipeg Environmental Remediations Inc. (WERInc), also referred to as the Contractor, was retained by Transport Canada (TC), also referred to as the Client, to conduct remedial activities at Norman Wells Airport, Norman Wells, Northwest Territories. Remedial activities, including the commissioning of the Land Treatment Unit (LTU) and the excavation of petroleum hydrocarbon contaminated soil, were conducted from September 6-11, 2003. All activities were coordinated with and approved by the Client.

1.2 Objectives

A Phase II Environmental Site Assessment (ESA) conducted previously at Norman Wells Airport identified subsurface soil contamination at the former Fire Training Area (FTA). The ESA identified the presence of petroleum hydrocarbon contaminated soil at the FTA site that required remediation. A Remedial Action Plan (RAP) was developed by TC based upon the findings and recommendations of the ESA, which included the removal and ex-situ treatment of the contaminated soil in an LTU.

The remedial activities conducted by the Contractor at Norman Wells Airport addressed environmental issues that were identified in the RAP. The remedial work was completed on behalf of the Client as part of TC's objective to bring Norman Wells Airport in compliance with current environmental legislation and/or regulations of the Government of the Northwest Territories (GNWT) and the Canadian Council of Ministers of the Environment (CCME).

1.3 Scope of Work

Remedial activities conducted at Norman Wells Airport included:

1. commissioning an LTU adjacent to the former FTA site that is capable of containing 1500 m^3 of petroleum hydrocarbon contaminated soil;
2. excavation of approximately 1500 m^3 of petroleum hydrocarbon contaminated soil from the former FTA site;
3. confirmatory soil sampling;
4. site restoration; and
5. the preparation of a closure report detailing site activities and the results of the sampling program.

1.4 Methodology

Soil sampling was conducted using guidelines and criteria outlined in publications from the GNWT and CCME.

2.0 SITE CONDITIONS

2.1 Site Locations and Description

The LTU was commissioned on airport property at a location approved by the regional airport manager and the TC Project Manager. The selection of the location was based upon several criteria including site accessibility, proximity to the work site, airport regulations/activities, local

soil and groundwater conditions, and disturbance to native vegetation and wildlife. Using these criteria, it was determined that the best available site was located adjacent to the FTA site. The treatment area of the LTU had dimensions of approximately 100 x 30 m. An impermeable synthetic geomembrane liner was placed on the base and berms of the LTU to prevent contaminants from leaching into the subsoil.

3.0 PROJECT DETAILS

All work was undertaken according to the directions of TC and in accordance with territorial and federal environmental regulations. The TC Project Manager was updated regularly on remediation efforts and all work was inspected for final approval. This section will detail the remedial work that was undertaken by the Contractor.

Remedial activities conducted at Norman Wells Airport included the following:

1. The Contractor commissioned an LTU for the ex-situ treatment of petroleum hydrocarbon contaminated soil at Norman Wells Airport (Figures 1 and 2, Appendix A). The treatment area of the LTU was excavated below grade. Material removed during this process was used to establish the perimeter berm that surrounded the cell, which reached a height of 1 m above grade and had a width of 1.5 m. Once excavated, the base of the LTU was graded to obtain a 5% slope down gradient and a 1% slope towards the centre of the cell. A 5 m sump area was established down-gradient to collect excess water from storm events and snow runoff during the spring.

   The base and berms of the LTU were compacted to a rate equivalent or better than the surrounding native soil and a synthetic geomembrane liner was placed over the treatment area and berm to prevent contaminants from leaching into the subsoil during the treatment period (Photo 1, Appendix B). The geomembrane selected for this project was the 30 mil Arctic Liner® supplied by Layfield Geosynthetics of Canada. The Arctic Liner® is designed to withstand the harshness of a northern climate and it is also resistant to deterioration from exposure to chemicals such as hydrocarbons. The Arctic Liner® is designed for prolonged use and is suitable for multi-year remediation projects.

   The geomembrane was anchored to the berms and inspected for breaches before the placement of contaminated soil in the treatment area. Two (2) above-grade mount monitoring wells were commissioned down gradient and one (1) monitoring well was commissioned up gradient from the cell to monitor subsurface conditions during the treatment period.

2. The Contractor excavated approximately 1500 m^3 of petroleum hydrocarbon contaminated soil from the former FTA site (Photo 2, Appendix B). The location of the excavation and its dimensions are shown in Figure 3 (Appendix A). The vertical extent of the excavation ranged from approximately 2.5-3 m below ground surface.

   The contaminated area was located within the footprint of the LTU, which delayed the commissioning of the LTU. Therefore, the excavated material was stockpiled in an area adjacent to the LTU and transferred into the treatment area upon completion of the excavation, where it was spread in a uniform layer of approximately 0.5 m depth (Photo 3, Appendix B). Ramps were established over the berm of the LTU to provide access to heavy equipment required to spread the contaminated soil within the treatment area.

An appropriate material to be used as protective fill over the liner (such as sand) could not be found locally and, therefore, the contaminated soil had to be placed directly upon the liner. However, a minimum base of 0.3 m thickness was established in the treatment area to permit the travel of heavy equipment, in order to protect the liner from the movement of heavy equipment.

3. Field screening and confirmatory soil sampling were conducted during the excavation. The soil sampling program is discussed in Section 4.

4. Site restoration activities conducted at the former FTA site included backfilling of the excavated area and compaction of backfill material. The backfill material consisted of clean clay and gravel mixture and it was placed in lifts of 150 mm to achieve sufficient compaction (*i.e.* equivalent or better than surrounding soil conditions). The site was graded for positive drainage upon completion of backfilling, where required. The commissioning of the LTU was completed upon completion of the backfilling.

4.0 FIELD INVESTIGATION AND SAMPLE ANALYSES

4.1 Soil Sampling Program

Soil Testing

Field screening was conducted by the Contractor during the excavation, using a photo ionization detector (PID), and subjected to an ambient temperature headspace (ATH) vapour test. Briefly, the procedures used for the ATH vapour testing were as follows:

- In order to prevent or reduce the likelihood of cross-contamination new sanitary gloves were worn for each sampling event.
- Soil samples were collected from the walls and base of the excavation at regular intervals.
- Soil samples were placed within plastic bags and sealed to retain the vapours.
- The vapour emanating from the soil samples were allowed to accumulate in the headspace of the bag at an ambient temperature for approximately fifteen minutes.
- The hydrocarbon vapour concentration was measured in the headspace of the bag by placing the probe of the PID into the bag.

Field screening results of the soil samples obtained from the sidewalls and base of the excavated area are shown in Figure 3 (Appendix A). The highest recorded field screening result during the excavation was >9000 ppm. The excavation at the FTA site was advanced until field screening results from the sidewalls and base were <100 ppm.

Analytical Analyses of Soil Samples

Confirmatory soil samples were obtained from the north, south, west and east sidewalls and the base of the excavation. All confirmatory samples collected from the excavations were scheduled for transportation to Enviro-Test Laboratories in Winnipeg, Manitoba, a Canadian Association for Environmental Analytical Laboratories (CAEAL) and Standards Council of Canada (SCC) accredited laboratory, to be tested for petroleum hydrocarbons. However, the samples were lost in transit and the confirmatory analyses could not be conducted.

4.2 Water Sampling Program

Water was not encountered during the excavation at the FTA site and, therefore, a groundwater sampling program was not conducted.

5.0 DISCUSSION AND CONCLUSIONS

The contaminated soil excavated from the former FTA site was placed in the lined treatment area of the LTU commissioned adjacent to the former FTA. The contaminated soil was spread in a uniform layer to facilitate future LTU management activities. Since the contaminated area was partially located within the footprint of the LTU, the excavated soil was stockpiled in a designated area adjacent to the treatment area. The transportation of the contaminated soil into the treatment area was conducted upon completion of the excavation and subsequent backfilling, and after the treatment cell was fully commissioned.

Field screening was conducted during the excavation to direct the removal of the contaminated soil. When the lateral and vertical extent of the excavation was established, soil samples obtained from the sidewalls and base of the excavated area had ATH vapour results that were <100 ppm. However, the confirmatory soil samples obtained from the sidewalls and base of the excavated area were not tested by an analytical laboratory, since the samples were lost in transit. Nonetheless, based upon the low field screening results and the visual and olfactory investigation conducted by the field technicians upon completion of the excavation, it was concluded that the excavation was sufficiently advanced laterally and vertically to meet the requirements of the GNWT and CCME criteria for the remediation of industrial sites.

Site restoration activities conducted at the sites included backfilling of the excavation with clean fill. The backfill material consisted primarily of clay and gravel mixture. The backfill material was compacted in lifts of 150 mm and graded to match the surrounding topography.

6.0 RECOMMENDATIONS

The following recommendations address environmental issues that remain outstanding at the former FTA site:

I. Treatment of the contaminated soil placed in the LTU should continue during the 2004 field season. The soil should be turned over four (4) times at five-to-six week intervals from mid-May to mid-September. Tilling events would be conducted during hot days, if possible, to increase the rate of volatilization. The treatment layer could be windrowed with a bulldozer or tilled using a heavy duty disker or other suitable tilling implement.

II. Confirmatory soil sampling should be conducted in the LTU at the end of the 2004 field season. The sampling would be conducted immediately following the final tilling event. Representative samples from the treatment area should be submitted to an accredited laboratory to be tested for petroleum hydrocarbons according to GNWT and CCME regulations. Removal of the soil from the LTU would be recommended if confirmatory sampling results were favourable (*i.e.* below remediation criteria). Otherwise, treatment would continue during subsequent field seasons until results are below the applicable soil remediation criteria of GNWT and CCME.

III. Sampling of the water collected in the monitoring wells at the LTU should be sampled at the end of the field season to monitor site conditions. Confirmatory water samples should be analyzed for BTEX, total petroleum hydrocarbons (TPH) and lead.

IV. Water that could collect in the sump area should be pumped out if the amount of water becomes significant (typically more than half full), since an excess amount of water could breach the berm. This water could be pumped back into the treatment area if the soil is not saturated or it can be discharged out of the LTU if results of confirmatory sampling of the water in the sump are favourable. If the water in the sump is contaminated and the soil in the treatment area is already saturated, an oil/water separator could be used to treat the water on site and discharged directly to the surrounding environment.

V. Confirmatory soil samples were obtained from the sidewalls and base of the excavated area but they were not tested by an analytical laboratory since they were lost in transit. Even though low field screening results identified minimal petroleum hydrocarbon impact, it is recommended that a test pitting program is conducted when the LTU is scheduled to be decommissioned to obtain confirmatory soil samples. Four (4) test pits should be located near the lateral extent of the excavated area; an additional test pit should also be located below the backfilled area. The test pits located adjacent to the lateral extent of the backfilled area should be advanced to a depth of approximately 2 m below ground surface; conversely, the test pit located below the backfilled area should be advanced to a depth of approximately 4 m below ground surface. A confirmatory soil sample should be obtained from each test pit at the corresponding depth. Assuming that the site has not been impacted by spill events occurring after the completion of the remedial work, the soil samples obtained from the test pits will be representative of the sidewall and base samples.

7.0 CLOSURE

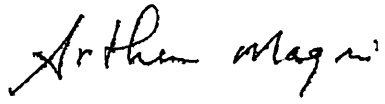
The conclusions and recommendations presented in this report were based on the scope of work outlined for the purpose of the remedial work at the site(s) and any changes or modifications to the scope of work that were approved by the Client. This report was prepared in accordance with acceptable environmental site investigation/remediation principles and practices. However, as with any environmental site assessment the intent was to identify and address environmental concerns and does not necessarily eliminate potential environmental concerns.

The conclusions presented herein represent the best judgement of the assessor based on certain environmental standards and on the site conditions observed during the site work and were intended for the Client. Any use which a third party makes of this report or any reliance or decision to be made based upon it is the responsibility of such third parties. WERInc does not accept responsibility for damages suffered by any third party as a result of the decisions made or actions taken based upon this report.

Test results are representative of specific sample locations. These locations have been selected based upon site conditions and other investigations. The observations made as part of the remedial work does not apply to areas that could not be observed. In addition, other materials or compounds not investigated or addressed or beyond the scope of work could be present at the site(s). If other chemical parameters are identified as an environmental concern,

WERInc must be notified to assess whether modification to any part of this report should be conducted.

Prepared by:



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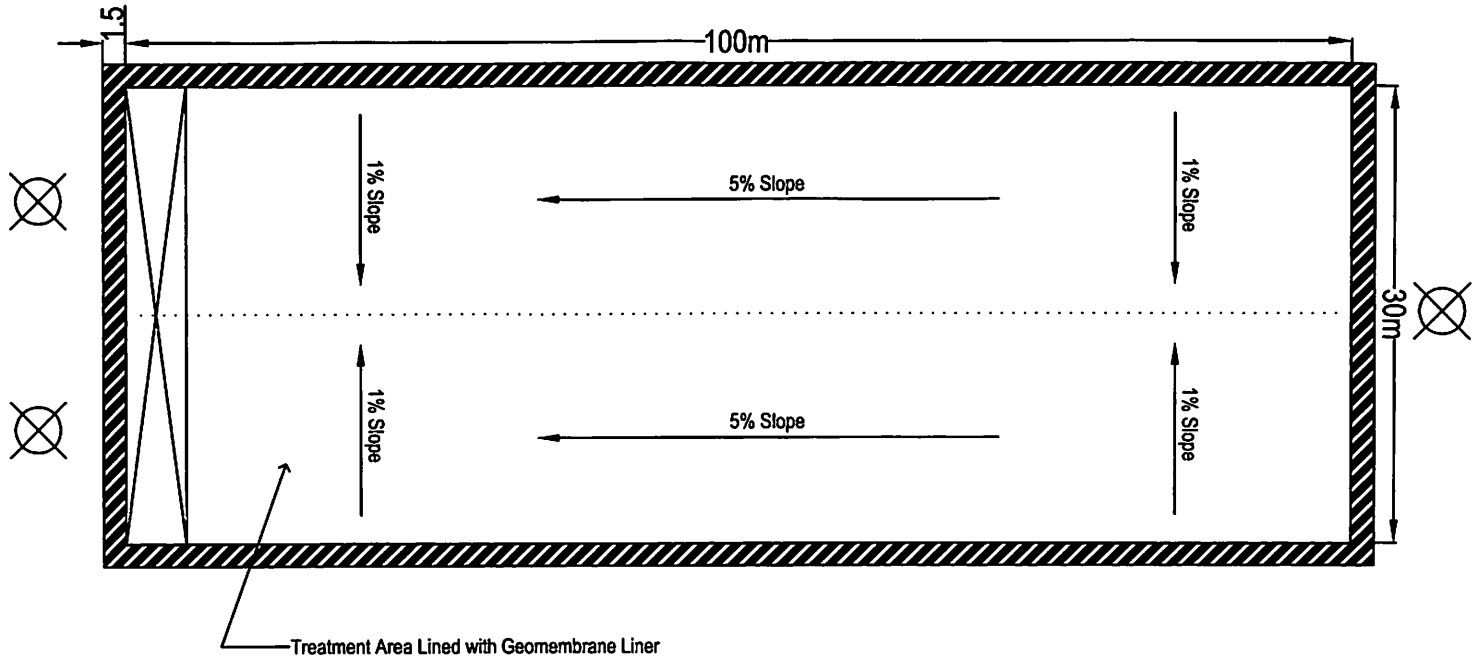
Reviewed by:

Dennis Antony, B.Sc., R.R.D.
Senior Project Manager
WERInc

APPENDIX A

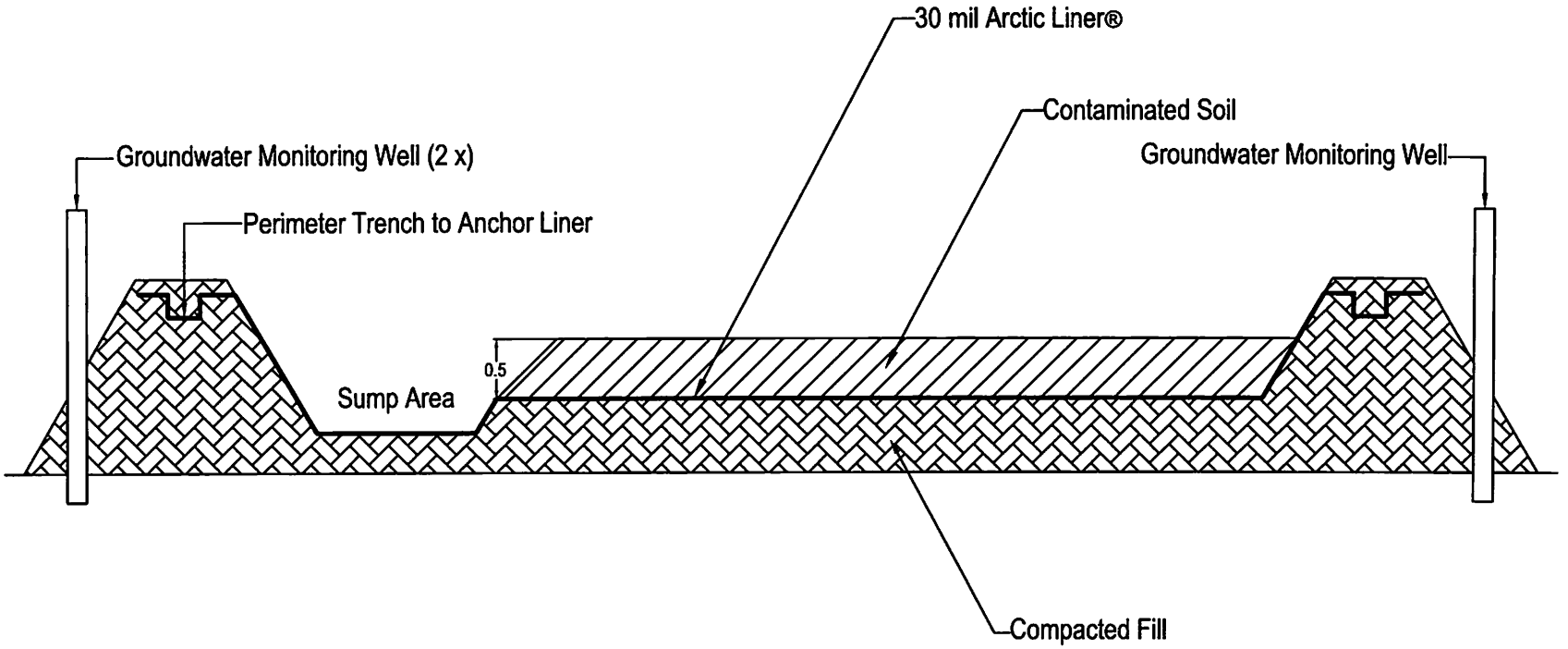
FIGURES



LEGEND

- Monitoring Wells
- Berm Surrounding Cell
- Sump Area (5 m)

WERI	Client: Transport Canada		Remedial Work FTA and Land Treatment Unit Norman Wells Airport, Norman Wells, NT Plan View of LTU	
Drawn By: AM	Scale: NTS	Units: Metres	Date: May 2004	Figure No.: 1



WERI	Client: Transport Canada		Remedial Work FTA and Land Treatment Unit Norman Wells Airport, Norman Wells, NT Cross-Section of LTU	
Drawn By: AM	Scale: NTS	Units: Metres	Date: May 2004	Figure No.: 2

NOTES

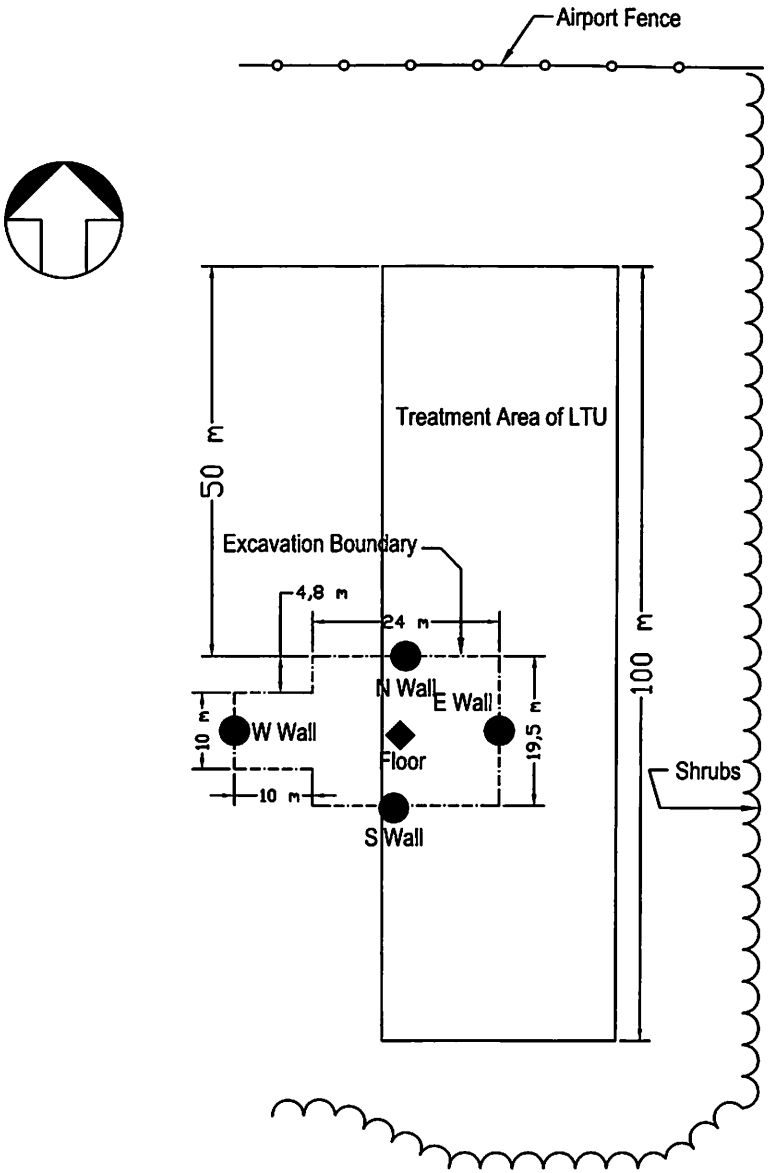
GPS Coordinates and Field Screening Results of Soil Samples:
W Wall: GPS coords. not available; 70 ppm (2.5 m below ground surface)
E Wall: N65°16"30' W126°46"47.25'; 40 ppm (1.5 m below ground surface)
S Wall: N65°16"29.9' W126°46"47.25'; 40 ppm (2 m below ground surface)
N Wall: N65°16"30.4' W126°46"47.4'; 40 ppm (1.5 m below ground surface)
Floor: N65°16"30.2' W126°46"47.65'; 30 ppm (3m below ground surface)

GPS Coordinates of LTU Treatment Area:
NW Corner: N65°16"31.5' W126°46"45.8'
NE Corner: N65°16"31.5' W126°46"42'
SE Corner: N65°16"28.5' W126°46"46.5
SW Corner: N65°16"28.8' W126°46"48.5

LEGEND

- ◆ Location of Wall Samples
- ● Location of Base Samples

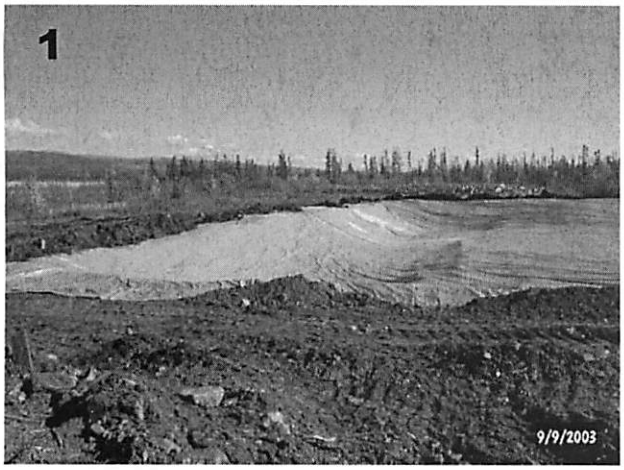
bgs = below ground surface



WERI	Client: Transport Canada		Remedial Work FTA and Land Treatment Unit Norman Wells Airport, Norman Wells, NT Site Plan FTA Excavation	
Drawn By: AM	Scale: NTS	Units: As Shown	Date: May 2004	Figure No.: 3

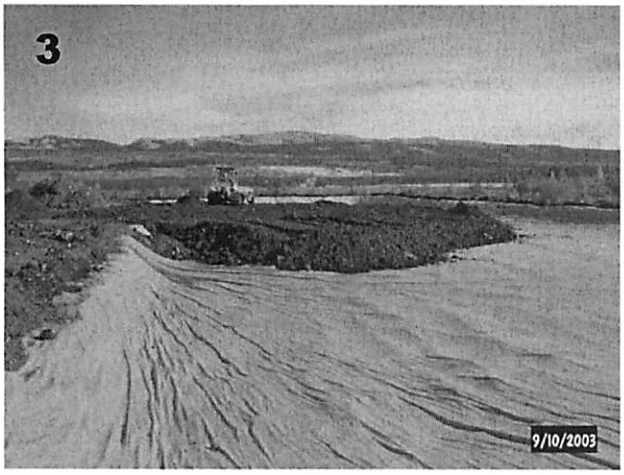
APPENDIX B

PHOTOGRAPHS



Geomembrane liner covers the base and perimeter berm of the LTU

Excavation at FTA site



Spreading contaminated soil in the LTU