ANNUAL WATER LICENCE REPORT

NORMAN WELLS AIRPORT AIRSIDE
LAND TREATMENT UNIT
WATER LICENCE S17L8-003

Submitted to:

Sahtu Land and Water Board
Box 1
Fort Good Hope, NT XOE OHO

Prepared by:

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Project Number: 170518

March 2018

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1. INTRODUCTION

BluMetric Environmental Inc. (BluMetric™) was retained by Public Services and Procurement Canada (PSPC) on behalf of Transport Canada (TC) to prepare this Annual Water Licence Report for the operations of the Airside Land Treatment Unit (LTU) including soil treatment, and soil and groundwater sampling activities within the LTU on the Norman Wells Airport property, in Norman Wells, Northwest Territories. The project area is located entirely on land administered by Transport Canada. This report is a requirement of the Type B Water Licence S17L8-003 obtained from the Sahtu Land and Water Board (SLWB) on December 5, 2017. The Water Licence S17L8-003 expires December 4, 2022. This report includes all work performed in relation to this project for the calendar year 2017.

BluMetric has supported the maintenance and sampling work that occurred at the facility in 2017 and provided contractor supervision for local contractor HRN Contracting who provides heavy equipment and operators to conduct work at the site. The work at the LTU was completed on behalf of Transport Canada, the permittee and licencee.

2. REPORTING REQUIREMENTS

Table 1 presents the associated management plans submitted (or to be submitted) as part of the requirements of Water Licence S17L8-003.

Table 1: Reporting Requirements

Report	Date submitted
Engagement Plan	November 8, 2017
Waste Management Plan	November 7, 2017
Operations and Maintenance Manual	Submission 2018
Spill Contingency Plan	November 6, 2017
Closure and Reclamation Plan	Submission 2018
Water Quality Monitoring Program	Submission 2018

There was no Surveillance Network Program in place for 2017 as the three (3) existing groundwater monitoring wells were damaged by frost jacking and could not be used to collect representative groundwater samples. A plan was put in place to replace the three (3) monitoring wells in 2018.

3. BACKGROUND

The Norman Wells Airport LTU was constructed in 2004 by Winnipeg Environmental Remediation Inc to contain petroleum hydrocarbon (PHCs) impacted soils from several affected areas at the airport (Arcadis 2017).

The LTU was designed to hold approximately 2500m^3 of PHC contaminated soil (Arcadis 2017). Dimensions of the facility are approximately 100 m by 50 m with a 0.5 m berm surrounding the LTU. This area was compacted and lined with a synthetic geomembrane to prevent contaminants from leaching into the surrounding environment. No other specifics on the construction of the landfarm are available, including design drawings.

The LTU is currently estimated to contain approximately 4,230 cubic metres (m^3) of soil. The soil is formed into three windrows, totaling approximately 2,950 m^3, and the remainder of the LTU has a covering of soil that is approximately 0.3 m thick that has been maintained to protect the integrity of the LTU liner. This volume of soil is estimated to be approximately 1,280 m^3.

4. FACILITY DESIGN

The LTU was designed to hold approximately 2500 cubic meters (m^3) of PHC contaminated soil (Arcadis 2017). Dimensions of the facility are approximately 100m by 50m with a 0.5 m berm surrounding the LTU. This area was compacted and lined with a synthetic geomembrane to prevent contaminants from leaching into the surrounding environment. A low area is located in the southeast corner of the LTU and is currently where runoff collects. There are no pumps or leachate collection systems installed as part of this facility. No other specifics on the construction of the landfarm are available (including design drawings).

Three (3) monitoring wells were previously installed around the facility (one upgradient and two downgradient) to monitor possible groundwater impacts associated with the LTU. Following BluMetric's visit in July, these wells were found to be damaged and could not be used for groundwater sampling.

5. SUMMARY OF 2017 FIELD ACTIVITIES

The first field investigations were completed by BluMetric personnel at the Norman Wells Airport lands Airside LTU between July 6 and 9, 2017. A soil sampling program was conducted for the purpose of determining whether PFAS impacted soil was present and to evaluate the initial representative PHC concentrations within the LTU. Information gathered during the site investigations was also used to assess any potential for impacts to groundwater quality around the Site resulting from known deficiencies in the liner beneath the LTU, and to develop recommendations regarding new groundwater monitoring well locations.

The first maintenance event took place from September 5 to 8, 2017. The soil was piled into windrows to increase surface area and maximize aeration. Fertilizer was added to all the windrows and the soil within the LTU was tilled with an excavator. All the windrows were flipped with the excavator to aid in the aeration of the soil, thus providing oxygen for the micro-organisms, as well as to distribute nutrients and moisture in the soil to further aid biodegradation. Efforts were made to till the entire soil profile in each cell. While in the process of piling soil into windrows, standing water from the east side of the LTU (located at the bottom of the berm) was drained towards the south end depression. The level of water on the south end of the LTU became critically high. The drainage of the water from the east side was stopped by limiting further drainage to this area through the placement of soil within the LTU. Further maintenance work ensured that no further water drained to this area. The ponding of water is considered to be a good indication that the liner is generally intact and limiting the migration of water from within the LTU to beyond the liner. The first maintenance event also included liner repairs of areas of known damage that were observed during sampling. Soil was removed from these areas using hand shovels and the damage was repaired by applying liner patches using liner adhesive.

Soil sampling and a second maintenance event at the LTU occurred from September 28 to 30, 2017, and from October 1 to 4, 2017, respectively. The soil sampling program was conducted for the purpose of evaluating the progress of the remediation of the PHC-contaminated soils within the LTU since the first maintenance event. As a precautionary measure, the water quality of the ponded water on the eastern and southern edges of the LTU was characterized through sampling on September 28, 2017 and this is discussed further in Section 6.2 Surface Water Quality. During the second maintenance event, soil within the LTU was tilled with an excavator. Fertilizer was added to each windrow prior to the beginning of tilling. All windrows were flipped twice to aid in the aeration of the soil. A residual amount of soil of approximately 0.3 m thick was maintained above the liner throughout the LTU to avoid tearing the liner with the excavator. The second maintenance event (October 1 to 4, 2017) was also conducted in unison with further liner repairs to any observed liner damage. Additional efforts were made to locate historically reported tears using all data available, but without success. Minor tears were made by the

excavator in the process of locating the historical tearsbut these were repaired immediately using the previously described approach.

6. SITE SAMPLING, RESULTS AND OBSERVATIONS

6.1 SOIL

The soil within the LTU was sampled twice in 2017: between July 6 and 9, 2017 and between September 28 and 30, 2017. No soil was removed from the LTU in 2017.

6.2 SURFACE WATER

6.2.1 Criteria

Surface water sampling was conducted of the standing water present within the eastern and southern portions of the LTU. The CCME Water Quality Guidelines for the Protection of Aquatic Life were identified as the applicable criteria as well as the discharge criteria specified in the SLWB Water Licence S17L8-003. These criteria were compared to the analytical results from the September 2017 water sampling.

6.2.2 Laboratory Results

On September 28, 2017, BluMetric collected three surface water samples from the standing water on the eastern and southern edges of the LTU. One surface water sample was collected from the standing water on the eastern side of the LTU, and one surface water sample and one duplicate sample were collected from the southern side of the LTU. The three surface water samples were submitted for laboratory analysis for PHCs and benzene, toluene, ethylbenzene and xylenes (BTEX).

The laboratory results indicate that none of the PHC or BTEX parameters were detected at a concentration above the laboratory's method detection limit. Therefore, based on these results there are no exceedances of the CCME Canadian Water Quality Guidelines for Freshwater Aquatic Life or the SLWB Water Licence Discharge Criteria for PHCs and BTEX.

Analytical results for surface water quality have been presented in Appendix A – Table 1.

6.2.3 Discharge

No surface water was requested nor required to be removed from the LTU in 2017. This work is anticipated in Spring 2018.

6.3 SITE INSPECTIONS

Three (3) site inspections were conducted of the Norman Wells Airside LTU in 2017. These were conducted in conjunction with sampling and maintenance work at the site. Photographs from these inspections have been included in Appendix B.

Site Inspection – July 6 to 9, 2017
Upon arrival the BluMetric Site Investigation Leader walked the perimeter and interior of the LTU, noting general site observations and photographing the area. The condition of the liner was noted and details regarding maintenance and deteriorating fringe conditions were recorded and photographed. The existing groundwater monitoring wells were inspected and consideration was given to the location of replacement wells as the existing monitoring network was deemed inoperative. Site features were also surveyed by the BluMetric Field Geomatics Specialist using a Hemisphere RTK-GPS with a base rover set up. Collected survey locations included the perimeter of the LTU, the PHC sampling grid, individual test pit locations, visible tears in the geomembrane liner, existing monitoring well locations, and additional site features for spatial referencing.

Site Inspection – September 28 to 30, 2017
BluMetric personnel inspected the LTU upon arrival and monitored site conditions during the sampling and maintenance work for any new indications of deficiencies in the LTU's construction (liner tears). Liner repairs were conducted as issues were identified. Levels of standing water within the LTU were also monitored to ensure that no discharges would occur. Photographs were taken of site conditions and reported to PSPC/TC.

Site Inspection – October 1 to 4, 2017
BluMetric personnel inspected the LTU upon arrival and monitored site conditions during the maintenance work for any new indications of deficiencies in the LTU's construction (liner tears). This site visit included attempts to locate historical liner deficiencies and repairs. Liner repairs were conducted on any punctures to the liner that occurred or were encountered. Levels of standing water within the LTU were also monitored to ensure that no discharges would occur. Photographs were taken of site conditions and reported to PSPC/TC.

7. WASTE DISPOSAL

No significant waste was generated as part of the 2017 operations of the site. Waste consisted of packaging materials (i.e. fertilizer bags, sampling supply packaging) used to conduct the sampling and maintenance work at the site as well as personal food waste from on-site personnel. All packaging and personal waste was transported off-site and directed to the Norman Wells Municipal Landfill for disposal.

8. UPDATES OR REVISIONS TO WATER LICENCE PLANS

The Water Licence required the following submissions as a condition of the issuance of the licence:

- a revised Engagement Plan within 60 days of issuance of the WL;
- a revised Waste Management Plan within 60 days of issuance of the WL;
- a Water Quality Monitoring Program within 90 days of issuance of the WL;
- an Operations and Maintenance Manual within 60 days of issuance of the WL;
- a revised Spill Contingency Plan within 60 days of issuance of the WL;
- a Closure and Reclamation Plan within 90 days of issuance of the WL.

These submissions were due to the Water Board between January and March 2018 and therefore, these updates will be included in the 2018 Water Licence Report.

9. SURVEILLANCE NETWORK PROGRAM REPORT

No Surveillance Network Program (SNP) Report has been included as part of the 2017 Annual Report as the groundwater monitoring wells at the site were unable to be sampled due to damage caused by the historical frost-jacking of the wells. The 2018 work will include the decommissioning and replacement of these groundwater monitoring wells and two rounds of groundwater sampling to ensure that the SNP is operational for 2018. The first groundwater sampling event will occur in the spring or early summer after the snow melts and the ground thaws.

10. REQUIREMENTS FOR 2018

According to Water Licence S17L8-003, the following items will take place during the 2018 calendar:

- Drill three (3) new monitoring wells for the Surveillance Network Program to replace the three existing ones according to the conditions of the Type A Land Use Permit S17X-004;
- Post the necessary signs to identify the Landfarm and the stations of the Surveillance Network Program;
- The Licensee will submit to the Board for approval:
    - a revised Engagement Plan within 60 days of issuance of the WL;
    - a revised Waste Management Plan within 60 days of issuance of the WL;
    - a Water Quality Monitoring Program within 90 days of issuance of the WL;
    - an Operations and Maintenance Manual within 60 days of issuance of the WL;
    - a revised Spill Contingency Plan within 60 days of issuance of the WL;
    - a Closure and Reclamation Plan within 90 days of issuance of the WL.

The Norman Wells Airside LTU will be operated according to the above described plans to ensure that operations are in accordance with Water Licence S17L8-003.

11. SAMPLING AND ANALYSIS PLAN 2018

11.1 SOIL

Soil within the LTU will be sampled every 2-4 months to evaluate the progress of the remediation of the PHC-contaminated soils after each maintenance event until results show concentrations below the applicable criteria for decommissioning. As for previous sampling events, samples will be analyzed for F1 to F4 PHCs and BTEX. The sampling methodology will include discrete sampling for volatiles (F1 and BTEX) and composite sampling for all other analytes. A total of twenty (20) soil samples and (2) duplicates will be collected to characterize the soil quality within the LTU. This sampling density meets the requirements of the SLWB Water Licence.

In preparation for decommissioning, samples for the first 2018 sampling event will also be analyzed for the more extensive list of parameters in the Treated Soil Criteria identified as part of the SLWB Water License: Metals, soil pH, PHCs, BTEX, polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs) and phenols.

In addition, three soil samples will be analyzed for Phosphate, Nitrate and Potassium to provide landfarm performance data to guide the LTU operations in 2018. Samples will also be analyzed for grain-size analysis to confirm soil characteristics.

11.2 GROUNDWATER

As described in Section 8, groundwater sampling will occur as part of the SNP in 2018. Two (2) rounds of sampling are planned, which will occur in the spring following the thaw and again in the fall prior to freeze up. These samples will be analyzed for all parameters specified within the SNP as part of the Water Licence.

11.3 SURFACE WATER

Preliminary surface water quality samples collected in 2017 indicated that the water quality of the ponded water within the LTU is suitable for discharge. It is anticipated that a request for discharge of this surface water will be made in Spring 2018 to reduce the level of standing water within the LTU.

12. CLOSURE

The conclusions presented in this report represent our professional opinion and are based upon the work described in this report and any limiting conditions in the terms of reference, scope of work, or conditions noted herein. The findings presented in this report are based on conditions observed at the specified dates and locations, and on the analysis of samples for the specified parameters. Unless otherwise stated, the findings cannot be extended to previous or future site conditions, portions of the site that were not investigated directly, or types of analysis not performed.

BluMetric Environmental Inc. makes no warranty as to the accuracy or completeness of the information provided by others, or of conclusions and recommendations predicated on the accuracy of that information. Nothing in this report is intended to constitute or provide a legal opinion. BluMetric Environmental Inc. makes no representation as to compliance with environmental laws, rules, regulations, or policies established by regulatory agencies.

This report has been prepared for the Sahtu Land and Water Board on behalf of Public Services and Procurement Canada and Transport Canada. Any use a third party makes of this report, any reliance on the report, or decisions based upon the report, are the responsibility of those third parties unless authorization is received from BluMetric Environmental Inc. in writing. BluMetric Environmental Inc. accepts no responsibility for any loss or damages suffered by any unauthorized third party as a result of decisions made or actions taken based on this report.

Respectfully submitted,
BluMetric Environmental Inc.

Alexandra Duchesne, M.Env.
Intermediate Environmental Scientist

Andrea Jenney, P. Eng.
Senior Project Engineer

13. REFERENCES

Arcadis Canada Inc. April 2017. Airside Land Treatment Unit Assessment and Remedial Options Assessment.

Canadian Council of Ministers of the Environment (CCME), 2016, Guidance Manual for Environmental Site Characterization in Support of Environmental and Human Health Risk Assessment – Volume 1 Guidance Manual.

Government of Canada, 2006. Federal Guidelines for Landfarming Petroleum Hydrocarbon Contaminated Soils.

Government of the Northwest Territories, 2003. Environmental Guideline for Contaminated Site Remediation.

Appendix A:
Surface Water Chemistry Results
2017

Sample ID	CCME[1] Guidelines	SLWB Discharge Criteria[2]	UNITS	RDL	South 1	South 2	East
Date Collected					28-Sep-17	28-Sep-17	28-Sep-17
Lab ID					L2000336-1	L2000336-2	L2000336-3
BTEX & F1 Hydrocarbons							
Benzene	0.37	0.37	mg/L	0.0005	ND	ND	ND
Toluene	0.002	0.002	mg/L	0.0005	ND	ND	ND
Ethylbenzene	0.09	0.09	mg/L	0.0005	ND	ND	ND
o-Xylene	NV	NV	mg/L	0.0005	ND	ND	ND
p+m-Xylene	NV	NV	mg/L	0.0005	ND	ND	ND
Total Xylenes	NV	3.9	mg/L	0.00071	ND	ND	ND
F1 (C6-C10)	NV	0.81	mg/L	0.10	ND	ND	ND
F1 (C6-C10) - BTEX	NV	0.81	mg/L	0.10	ND	ND	ND
F2-F4 Hydrocarbons							
F2 (C10-C16 Hydrocarbons)	NV	1.3	mg/L	0.10	ND	ND	ND
F3 (C16-C34 Hydrocarbons)	NV	NV	mg/L	0.25	ND	ND	ND
F4 (C34-C50 Hydrocarbons)	NV	NV	mg/L	0.25	ND	ND	ND

Legend:

350 Exceeds the applicable criteria

(1) CCME Water Quality Guidelines for the Protection of Aquatic Life

(2) Sahtu Land and Water Board Water Licence S17L8-003 Wastewater Discharge Criteria

mg/L - Milligrams per litre

RDL - Reportable Detection Limit

ND - Not Detected

NV - No Value

NA - Not Analyzed

Appendix B:
Site Photos 2017

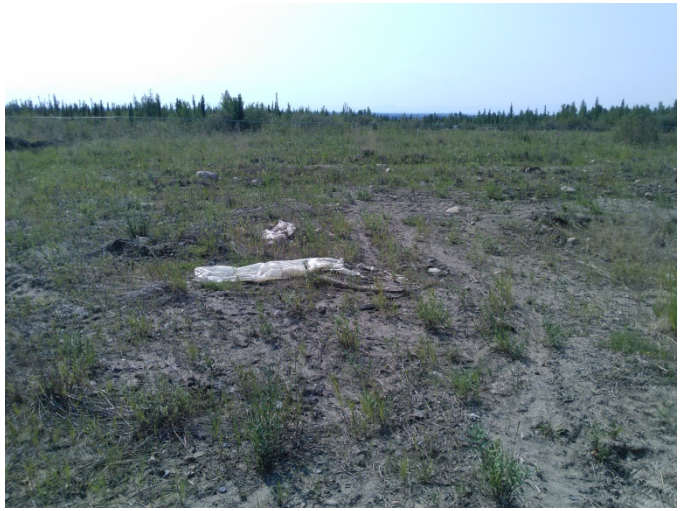

Photo 1: Land Treatment Unit (LTU), looking south. July 2017

Photo 2: LTU looking north – July 2017

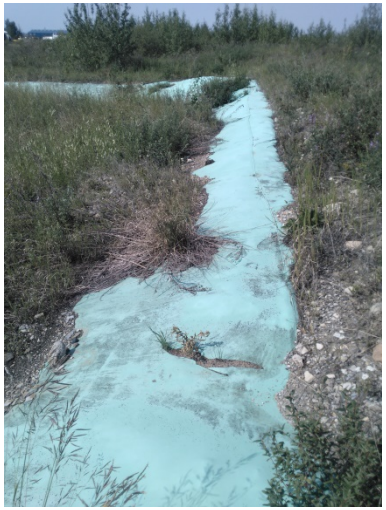

Photo 3: Northern edge of the LTU, looking south – July 2017

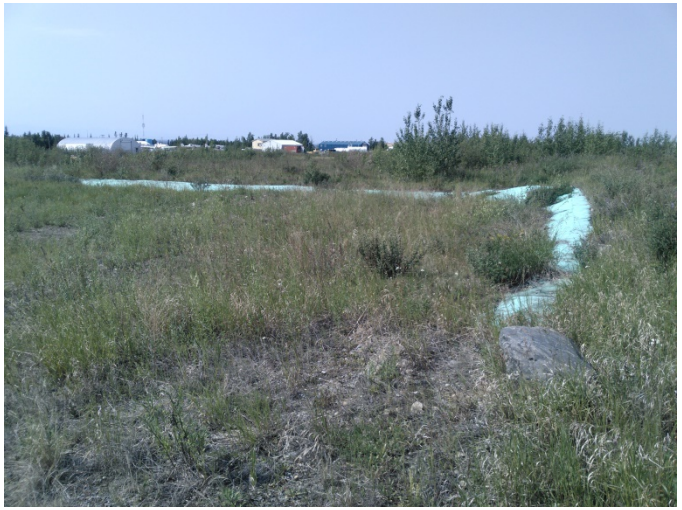

Photo 4: North west corner of LTU, looking south – July 2017

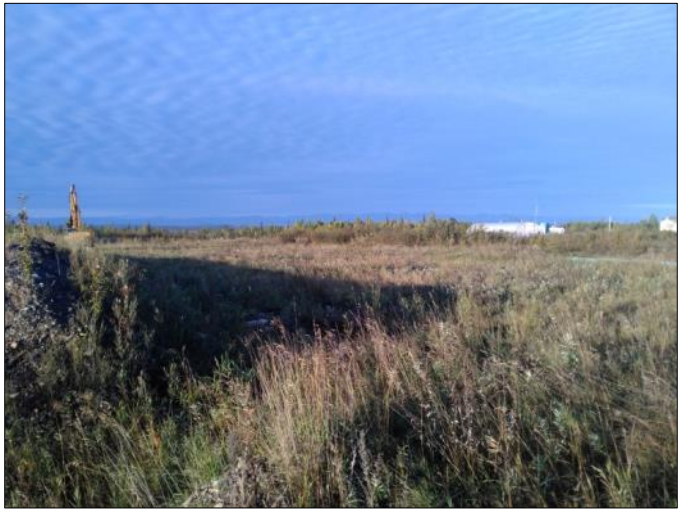

Photo 5: LTU prior to windrows – September 2017

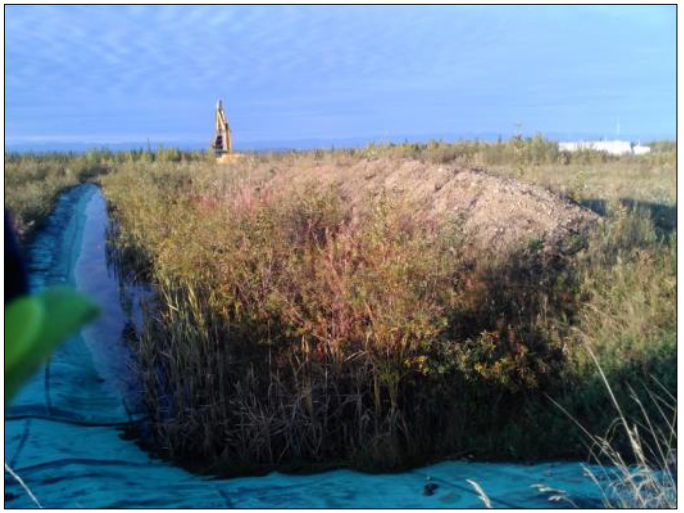

Photo 6: View from berm looking south – September 2017

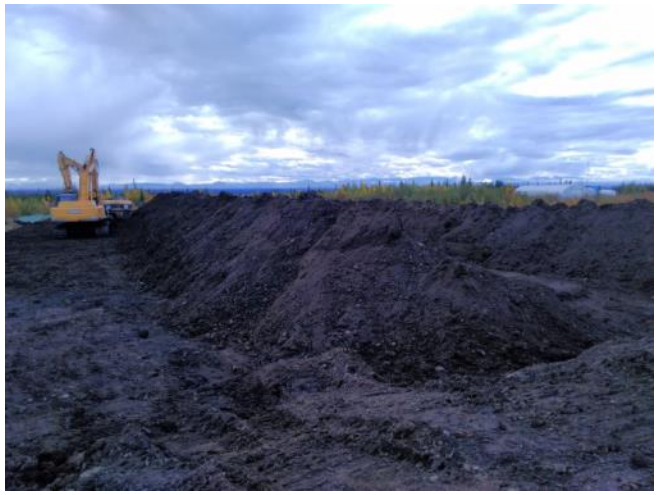

Photo 7: All windrows flipped – September 2017

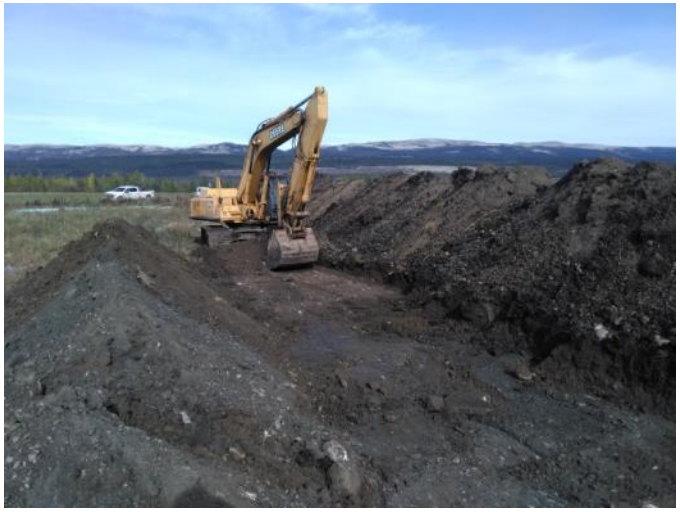

Photo 8:Work being done on the second windrow – September 2017

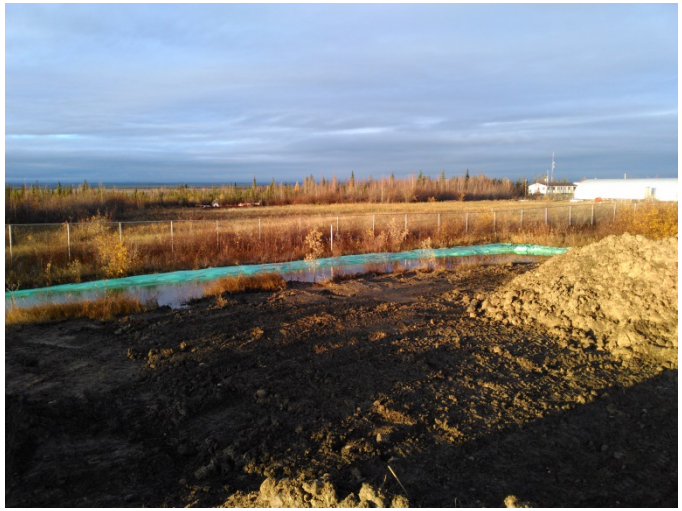

Photo 9: Accumulated water along the south side of LTU, October 2017

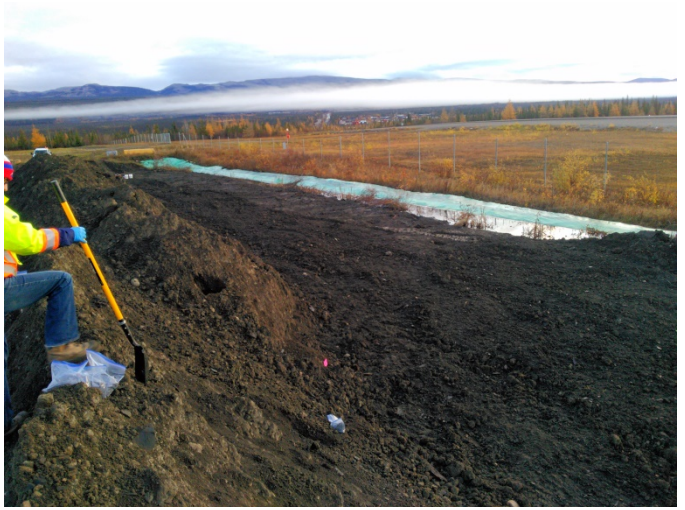

Photo 10: Soil sampling along the east side of LTU, October 2017

Photo 11: All three windrows flipped for the second time, October 2017

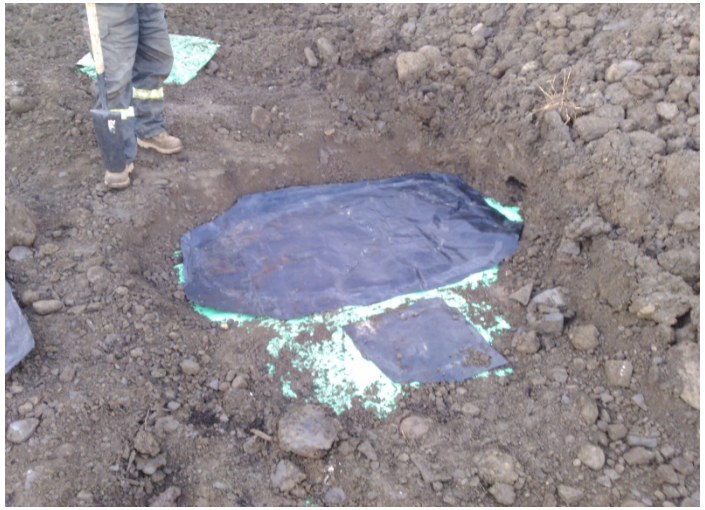

Photo 12: Completed liner repair, October 2017