Report to:

DEPARTMENT OF COMMUNITY &
GOVERNMENT SERVICES
GOVERNMENT OF NUNAVUT

Operations and Maintenance Manual
Kugaaruk Landfarm Facility
NWB Licence No. 8BR-KRK0609

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Report to:

DEPARTMENT OF COMMUNITY & GOVERNMENT
SERVICES GOVERNMENT OF NUNAVUT

OPERATIONS AND MAINTENANCE MANUAL
KUGAARUK LANDFARM FACILITY
NWB LICENCE NO. 8BR-KRK0609

FEBRUARY 2010

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1.0 INTRODUCTION

An Operations and Maintenance (O&M) Manual is required to fulfill the conditions associated with the Nunavut Water Board (NWB) Licence No. 8BR-KRK0609 issued to the Government of Nunavut's Community and Government Services Department on May 25, 2005. The Licence was issued for the purposes of water use and waste disposal activities associated with the Kugaaruk Landfarm Facility. Unless otherwise noted, the work activities described in this document will be undertaken by a firm engaged by the Nunavut Department of Community and Government Services (the Contractor). The Contractor will be primarily responsible for ensuring compliance with the documented procedures and for ensuring that appropriate health and safety precautions are being observed. A qualified engineering consulting firm (the Consultant) will also be engaged by the Government of Nunavut to conduct and/or oversee sampling and site assessment activities and prepare any required documentation in compliance with the requirements of the regulators.

1.1 LANDFARM TREATMENT FACILITY

The need for a site to treat contaminated soil in Kugaaruk was identified by the Government of Nunavut when plans were developed for the relocation of a fuel oil tank and gasoline tank in the Hamlet. The Department of Community and Government Services arranged for the construction of the landfarm in 2004 to accept and treat petroleum contaminated soil which was to be excavated after the existing storage tanks were removed. The landfarm consists of a cell to hold the soil to be treated and a water retention cell to contain water which has been in contact with the contaminated soil. The berms for the two adjoining cells were constructed of local soil and gravel. Both cells are equipped with a synthetic liner that runs across the base of the cell and up the interior side of the berms. Culverts placed through the interior berm between the two cells allow excess water from the soil cell to flow into the water retention area. The landfarm is located approximately 1.5 km southeast of the community.

In July 2007, approximately 2200 m^3 of hydrocarbon impacted soil was excavated from the former tank site and placed in the treatment cell of the landfarm. The contamination was determined to be primarily in the diesel fuel range of petroleum hydrocarbons. The soil is turned periodically to enhance aeration and natural biodegradation of the hydrocarbon contaminants. Once completion of treatment has been confirmed through laboratory analyses and any required regulatory authorizations are received, the soil will be removed from the landfarm and transported to an approved location. The Nunavut Department of Community and Government Services (CGS) is proposing to leave the landfarm berms and liners in place for possible future use.

An interim closure plan has been developed in conformance with the Guidelines for Abandonment and Restoration Planning for Mines in the Northwest Territories (September, 1990) as required by Nunavut Water Board Licence No. 8BR-KRK0609. Once the soil remediation process is completed, the closure procedure will be implemented subject to the approval of the Nunavut water Board.

2.0 ROUTINE OPERATING PROCEDURES

2.1 SOIL TURNING

Approximately 2200 m^3 of hydrocarbon impacted soil have been placed within the treatment cell of the landfarm. The soil is turned periodically to enhance aeration and natural biodegradation of the hydrocarbon contaminants.

2.1.1 INITIAL SITE INSPECTION

Prior to commencing any site work, the Contractor will conduct an inspection of all berms and other physical features associated with the landfarm. Any physical damage related to settlement or loss of cover material will be noted. Minor repairs will be conducted as required. Any major structural failure must be reported to the Consultant and CGS and a plan for corrective action will be developed.

2.1.2 EQUIPMENT REQUIREMENTS

The use of rubber tired equipment is preferred for working within the soil treatment cell. The equipment should be capable of excavating at least the top 0.6 m of soil in the treatment cell, and should be capable of handling small rocks and gravel. If a rubber tired excavator with suitable capacity is not available, tracked equipment may be used provided that a minimum 30 cm depth of soil and granular cover material is maintained between the tracks and the upper geotextile liner. An excavator with a reach of at least 10 m and a bucket capacity of at least 1.0 m^3 should be used to minimize the movement of equipment within the cell. Any equipment used within the landfarm must be checked for fluid leaks, and any leaks must be repaired prior to commencing site work.

2.1.3 OPERATING TRAINING

The personnel responsible for operating machinery must be experienced operators familiar with the equipment to be used. Prior to commencing site work, the Contractor will provide a briefing for the operator on procedures to be followed to minimize potential damage to the physical features of the landfarm and to ensure that the required operation is conducted safely and effectively in accordance with this document and the terms of the Nunavut Water Board Licence.

2.1.4 PREPARATION FOR SOIL TURNING

An impermeable geomembrane liner is installed at the base of the treatment cell. It is covered by 15 cm of sand, followed by a layer of geotextile and another 15 cm protective sand layer. Prior to commencing soil turning operations, the Contractor will dig a number of test pits by hand throughout the soil pile to confirm the depth to the upper geotextile liner.

2.1.5 SOIL TURNING METHOD AND FREQUENCY

The soil is to be turned within the landfarm soil treatment cell twice per year; immediately after spring-thaw (June/July), and again in late summer (August). The soil should be turned to a depth of 0.6 m during each event. There is approximately 0.9 m (3 ft.) of soil within the treatment cell. The soil should be excavated to a depth of 0.6 m (2 ft.) to ensure the excavator bucket stays at least 0.3 m above the upper liner cover. A spotter should be employed to direct the operator during soil turning activities to ensure that the excavator reaches the required depth without causing damage to the liner. During excavation, each bucket load should be re-deposited in a manner which brings the bottom material to the surface and breaks up any consolidated material.

During turning activities, any soil that has accumulated in the immediate vicinity of the interior berm should be removed, and soil pile should be restored to at least a 3:1 slope along the side closest to the interior berm, in order to minimize erosion into the culverts. Additionally, soils should be kept approximately 1 m from the interior berm, to allow for proper drainage. A drainage channel should be maintained around the entire perimeter of the soil pile in order to allow impounded water to flow to the retention cell.

The Contractor should maintain a supply of geotextile material consistent with the material used for the upper liner in the soil cell. In the event of major tear to the upper liner during soil turning operations, the Contractor will expose the area, secure a piece of new geotextile over the tear with a minimum one metre overlap and then replace granular cover material over the repaired area.

2.2 REMOVAL OF SNOW ACCUMULATION

Excavation equipment will be used to remove snow accumulation within the soil treatment cell near the end of the winter season. A sufficient buffer layer of snow should be maintained to ensure that the landfarm liners are not damaged and that the impacted soil is not inadvertently removed. In practical terms, snow removal would only involve drifted snow along the interior of the berms.

2.3 RETENTION CELL WATER SAMPLING

Prior to retention cell treatment and/or discharge, a surface water sample will be collected for analysis of benzene, toluene, ethylbenzene and xylene (BTEX) and Petroleum Hydrocarbon (PHC) Fractions F1 to F4 concentrations. The sample will be obtained from the centre of the south berm of the landfarm retention cell, approximately 0.5 m from the edge of the water and will be taken as soon as possible after the ice cover has melted off the retention cell. Upon collection, the water sample will be immediately transferred to appropriate laboratory supplied bottles, preserved as necessary and stored in an ice-chilled cooler prior to submission to an accredited laboratory. Sample collection and handling will be conducted in accordance with the *Quality Assurance and Quality Control Plan for the Kugaaruk Landfarm Facility* (Wardrop, February 2010). A site plan is attached illustrating the sample collection location.

Wardrop has trained two local individuals in Kugaaruk to undertake this work. Ideally, the retention cell water sampling will be conducted by these individuals within the specified timeframe to ensure adequate shipping time for the water treatment system, should it be required. If these individuals are unavailable to complete this work, Wardrop will make alternate arrangements for sample collection.

2.4 RETENTION CELL WATER TREATMENT

If the analysis of the water in the retention cell exceeds applicable water quality guidelines, treatment of the water will be conducted prior to discharging. An activated carbon treatment process will be used to reduce hydrocarbon levels in the water retention pond discharge. A portable treatment system comprising six – 55-gallon Disposorb units manufactured by Calgon Carbon Corporation (or equivalent) will be used to reduce contaminant concentrations to below guideline limits. Two units will be connected in series, with three pairs of units operating in parallel. The pump flow rate will need to be adjusted to Calgon's specifications to mitigate the potential for breakthrough. A silt filter will be placed in the line supplying water to the carbon filter.

To ensure that the water is effectively treated, the discharge from the carbon treatment system will be directed back into the retention cell on the opposite side of where the water was withdrawn. The theoretical carbon contact time required to achieve the required contaminant removal in the entire volume of water in the retention cell will be calculated. Two samples of the treated water will be obtained by the Consultant for laboratory analysis after the required treatment time has elapsed. One sample will be taken from the same sample location as the pretreatment sample and the other will be taken close to the northeast corner of the retention cell. Once confirmatory analytical results are received and confirm that all parameters are below the appropriate guidelines, cell water will be discharged as per the method described in Section 2.5.

2.5 RETENTION CELL WATER DISCHARGE

Discharge from the water retention cell will be achieved with the use of a gasoline fuelled pump with a flow rate capacity of 100 to 150 gallons per minute. The pump will be set up immediately adjacent to the landfarm, with a short hose or pipe running into the retention cell. The hose will be fitted with a floating basket intake to prevent any unnecessary disturbance of the granular material on the base of the cell. Water should be discharged to the constructed splash pad by hose or temporary pipe laid on the ground during the activities. Water discharge is to occur only during daylight hours while the operation is monitored. The quantity of water removed is to be recorded and provided to the Consultant. Any refueling of the pump should be completed in accordance with the *Spill Contingency Plan, Kugaaruk Soil Landfarm* (Wardrop, February 2010).

2.6 SOIL REMOVAL AND DISPOSAL

When soil samples obtained at the end of the treatment season confirm that soil within the treatment cell has been successfully remediated below the applicable guidelines, soil will be removed from the landfarm upon receiving all required regulatory approvals.

Appropriately sized excavation equipment will be used to excavate the soil pile and place the material into trucks for removal from the site. Caution will be exercised to ensure that the cell liner is not damaged during the excavation. An employee will be assigned to monitor the soil removal visually and direct the excavator to ensure that all treated soil and the uppermost portion of the underlying layer of granular material are removed. Clean granular fill will be brought in and spread as necessary to replace any excavated cover material. The soil will be transported to the Kugaaruk waste disposal ground, to be used as landfill cover material.

Upon completion of the soil removal, the cell will be inspected and any areas where the impermeable liner is exposed will be covered after a visual examination for damage to the liner. Areas where a breach of the liner may have occurred will be marked for subsequent investigation and repair by a qualified contractor. The surface profile within the cell will be established to minimize water ponding within the cell, and to ensure that any impounded water flows toward the drains leading to the retention cell. The Consultant will be on site to monitor the soil removal activities and to conduct a follow-up inspection of the landfarm.

3.0 ROUTINE SOIL AND GROUNDWATER SAMPLING PROCEDURES

3.1 LANDFARM TREATMENT CELL SOIL SAMPLING

The soil within the treatment cell is to be sampled annually as indicated in the Nunavut Water Board License Application. Annual soil sampling will be completed in late August by the Consultant, and requires the preparation of six composite samples from at least 24 discrete sampling points. The soil samples will be submitted to an accredited laboratory for BTEX, PHC Fraction F1 to F4 analysis.

A total of six composite samples (LF1, LF2, LF3, LF4, LF5 and LF6), will be collected from the Landfarm soil treatment cell, to confirm the soil quality for the volume of material. To ensure that samples are representative of the material, the Landfarm is to be divided into six longitudinal segments by dividing the northwest exterior berm into six equal lengths, and then extending a perpendicular line to the opposite side of the cell. For segment lengths of 50 m or less, four discrete samples are to be collected from equidistant points along the centre line of the segment. For segments over 50 m in length, an additional discrete sample is to be taken for every 10 m or less. Samples will be collected from approximately 0.3 m below grade with appropriate hand tools. Standard field methods for decontamination of sampling equipment will be employed by the Consultant. Refer to the Site Plan, attached, for further detail.

3.2 GROUNDWATER MONITORING WELLS

The Landfarm Soil Treatment Facility has five groundwater monitoring wells (MW1, MW2, MW3, MW4, and MW5) installed along the south and west exterior berm of the retention cell. The wells are constructed with 0.3 m of solid 25-mm diameter PVC casing, followed by No. 10 factory slot well screen. Protective flush-mount steel casings were installed at grade to protect wells.

An additional groundwater monitoring well will be installed in summer 2010 upslope of the landfarm, in order to establish baseline conditions for the local study areas.

All groundwater well monitoring and sampling activities are will be conducted by Wardrop, in accordance with the, *Quality Assurance and Quality Control Plan for the Kugaaruk Landfarm Facility, February, 2010.* Refer to the attached site plan in Appendix A for monitoring well locations.

3.2.1 SITE MONITORING

Site monitoring will occur annually for the duration of the soil treatment activities during the late August site visit. Site monitoring will also be conducted for a two year period following the removal of soil from the treatment cell to ensure there are no residual impacts associated with the Landfarm Treatment Facility. Site monitoring will comprise the measurement of the depth to static groundwater level using a dual phase electronic water level indicator; measurement of headspace vapour concentrations in the well using a portable combustible gas monitor; inspection for the presence of Light Nonaqueous Phase Liquids (LNAPL), as well as any observation of the physical characteristics of the groundwater during purging. Wells are to be purged of three well casing volumes or until dry prior to groundwater sample collection.

3.2.2 GROUNDWATER MONITORING WELL SAMPLING

Following the recharge of the monitoring wells during the late August annual site visit, discrete water samples will be collected by the Consultant from all onsite monitoring wells using clear dedicated disposable polyethylene bailers, to limit the loss of volatiles during sample collection. Samples will be collected for analysis of BTEX, PHC Fractions F1 to F4, Polychlorinated Biphenyls (PCB), Polycyclic Aromatic Hydrocarbons (PAH), and dissolved metals. The water samples will be immediately transferred to appropriate laboratory supplied bottles, preserved as necessary and stored in an ice-chilled cooler prior to submission to an accredited laboratory.

4.0 REFERENCES

Department of Indian and Northern Affairs Canada, Water Resources Division, and the Northwest Territories Water Board. July 1996. *Quality Assurance (QA) and Quality Control (QC) Guidelines For Use By Class "B" Licensees in Collecting Representative Water Samples In The Field and For Submission of a QA/QC Plan.*

Wardrop Engineering Inc. May 1, 2006 Letter to Mr. Murdoch, Nunavut Water Board. *Proposed Soil Landfarm, Hamlet of Kugaaruk, Your File NWB4KRK.*

Wardrop Engineering Inc. June 5, 2006 Letter to Mr. Murdoch, Nunavut Water Board. *Proposed Landfarm – Kugaaruk.*

Wardrop Engineering Inc. July 19, 2007 Letter to Mr. Navjit Sidhu, Government of Nunavut, Community and Government Services Division. *Kugaaruk Landfarm – Start-up Procedures.*

Wardrop Engineering Inc. September 15, 2009 Letter to Ms. Beaulieu, Nunavut Water Board. *NWB Water Licence No. 8BR-KRK0609 – Request for Renewal*

Wardrop Engineering Inc. January 2010. *Quality Assurance and Quality Control Plan, Kugaaruk Soil Landfarm Facility, NWB Licence No. 8BR-KRK0609.*

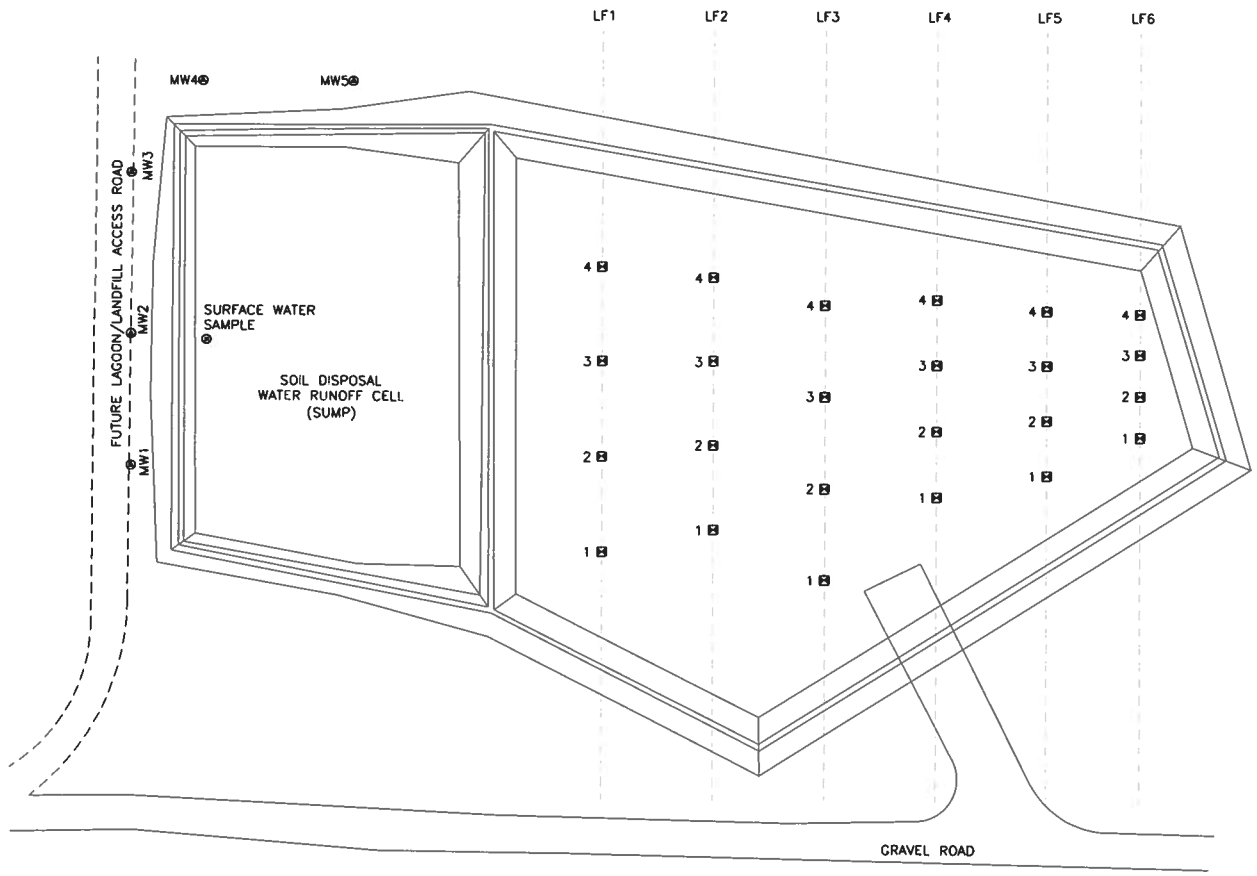
Wardrop Engineering Inc. January 2010. *Interim Abandonment and Reclamation Plan, Kugaaruk Soil Landfarm.*

Wardrop Engineering Inc. February 2010. *Spill Contingency Plan, Kugaaruk Soil Landfarm.*

APPENDIX A

SITE PLAN: SAMPLING LOCATIONS

X:\A-G\GOVERNMENT OF NUNAVUT\02228808.05 – LAND FARM WATER LICENSE COMPLIANCE ASSISTANCE\CAD\ENV\0222880805-SKT-V0001-A2.DWG 09.12.22 10:03 AM PRECOURT, SYLVIO



PRELIMINARY DRAWING

NOT TO BE USED FOR CONSTRUCTION

LEGEND
- SOIL SAMPLE LOCATION
- SOIL SAMPLING LINE
- MONITORING WELL
- SURFACE WATER SAMPLE

REFERENCE DRAWINGS: 0222880801-SKT-V0004-A4

0 10 20 30 40 50 m
SCALE 1:800 (APPROXIMATE)

NO.	DATE	DESCRIPTION	ISSUED BY
REVISIONS/ISSUE			

WARDROP A TETRA TECH COMPANY
PEOPLE, PASSION, PERFORMANCE. TRUSTED GLOBALLY

AUTHORIZED BY:
DATE: 09.11.30
CLIENT DRAWING NO.

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DRAWING DESCRIPTION
FIGURE 1: SITE PLAN SHOWING 2009 LANDFARM SAMPLING LOCATIONS KUGAARUK, NUNAVUT

DESIGNED BY:	SP	DRAWN BY:	SP	DRAWING NO.	REV.
REVIEWED BY:	SZ	SCALE:	1:800	0222880805-SKT-V0001	A2

AL (11" x 8.5")