

Northwest Territories Power Corporation

Inuvialuit Water Board License Number: N3L8-1838
Aklavik, Northwest Territories



2021 Annual Report

Submitted To: Inuvialuit Water Board
License Number: N3L8-1838
Version Number: V.1.0

January 11, 2022

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1.0 INTRODUCTION

1.1. Project Information

Corporate Office

Northwest Territories Power Corporation
4 Capital Drive
Hay River, NT

Project Location

Former NTPC Power Plant Site
68° 13' 6.24" North and 135° 0' 21.24" West
Aklavik, NT

The Inuvialuit Water Board (IWB) granted the Northwest Territories Power Corporation a Water License (N3L8-1838) for the Remediation and Reclamation of the former Aklavik Power Plant Site in Aklavik, NWT on August 15, 2016 and expiring on December 31, 2019. In recognition of the requirement for additional biotreatment of contaminated soil at the site beyond the expiry date of the license, the IWB renewed the water license for an additional three years with an effective date of January 1, 2020 and expiry date of December 31, 2022.

1.2. Purpose

This document fulfills the annual reporting requirements under Part B (1) and Annex 1, Part 1 of Water Licence N3L8-1838.

2.0 LICENCE PART B: GENERAL CONDITIONS – ANNUAL REPORT

Item 1. a) The monthly and annual quantities in cubic meters (m³) of treated water discharged into the municipal drainage ditch

No treated water was discharged into the municipal drainage ditch at the Site in 2021.

Item 1. b) The monthly and annual quantities in cubic meters (m³) of treated contaminated soil at the biotreatment facility

Approximately 920 m³ of hydrocarbon impacted soil has been undergoing bioaugmentation treatment in the biotreatment cell. Approximately 1,980 m³ of impacted soil remains onsite, outside the biotreatment cell.

Item 1. c) A Summary report which includes all data and information generated under the “Surveillance Network Program (SNP)”

SNP 1838-01: Not Applicable as no water was treated for discharge at the Site.

Item 1. d) A list and description including location and volumes of all unauthorized discharges and spills, and summaries of all associated remediation activities and follow up actions taken

No unauthorized discharges and spills occurred at the Site in 2021.

Item 1. e) A description of any spill and operational training carried out

No spill or operational training was carried out at the Site in 2021 other than standard tool box and job hazard assessments completed prior to the start of work.

Item 1. f) The results of any monitoring program undertaken (eg. Temperature, moisture of biotreatment cell)

A monitoring program of the soil was not completed in 2021.

Item 1. g) A summary of remediation, reclamation and closure activities completed

The following remediation, reclamation and closure activities were completed at the Site in 2021:

- Completion of a Records Review and Gap Analysis to review historical records for the site and identify any gaps in understanding
- Submission of an updated Remediation Action Plan to the Government of Northwest Territories Department of Environmental and Natural Resources (GNWT-ENR) for approval.
- Delineation of hydrocarbon contaminated soils in the southeastern portion of the Site.
- Pumping of untreated water from the biotreatment cell into totes for future disposal.
- Tarping of the biotreatment cell to prevent additional water run-off at the site.
- Obtaining characterization samples of the soil for off-site disposal of the Inuvik Soil Treatment Facility.
- Completion of an Environmental Impact Screening for the Environmental Impact Screening Committee ("EISC") in the Inuvialuit Settlement Region of the Northwest Territories and the North Slope Region of the Yukon.

Please refer to Appendix A – 2021 Remediation Progress Report for a full description of the remediation activities completed.

Item 1. h) A report complete with Summary, conclusion and recommendation. The report will include analytical data and a description of any work anticipated for the next year.

Please refer to Appendix A – 2021 Remediation Progress Report.

A horizontal banner with a green background featuring a pattern of overlapping, stylized leaf shapes in various shades of green.

APPENDIX A

2021 Annual Remediation Progress Report

2021 Remediation Progress Report

Former NTPC Power Plant, Aklavik, NT
Northwest Territories Power Corporation



2021 Remediation Progress Report

DRAFT

Northwest Territories Power Corporation
Former NTPC Power Plant, Aklavik, NT
Version 1.0
21-051NT

January 11, 2021

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EXECUTIVE SUMMARY

Northwest Territories Power Corporation (NTPC) retained KBL Environmental Ltd (KBL) to complete remediation of impacted soils located at the former NTPC power plant site in Aklavik, NT, hereinafter referred to as the 'Site'. The contract was awarded in January 2021. Existing contamination at the site, at the end of 2020, included approximately 920 m³ of hydrocarbon impacted soil and 40,000L of untreated water inside a biotreatment cell. The biocell was built in 2017 to carry out bioaugmented treatment of excavated contaminated soils. The treatment process was unsuccessful in meeting the required cleanup standards, and the soil and water were left staged in the cell pending further action. Approximately 1,980 m³ of unexcavated impacted soil has also been delineated across the remainder of the site. In addition, 70 bags of excavated soil, from the removal of a dock in 2015, along with 8 totes of impacted water have been stored on site for future management.

The purpose of this report is to summarize the remedial activities completed in 2021 and those planned for 2022 in accordance with Part B (1 g and h) and Annex 1, Part 1 of Water Licence N3L8-1838.

The scope of work and corresponding work completed for the 2021 field season included:

1. Completion of a Records Review and Gap Analysis (RRGA) to review historical records for the site and identify any gaps in understanding.
 - Based on the results of the RRGA and requirements of the Environmental Impact Screening Committee, soil sampling of the southeastern portion of the Site, to fully delineate contaminated soil in the area and an Environmental Impact Screening were added to the 2021 scope of work. (2021 scope of work items 5 and 6 below).
2. Submission of an updated Remediation Action Plan to the Government of Northwest Territories Department of Environmental and Natural Resources for approval.
 - Completed on May 28, 2021.
3. Pumping of 92 m³ untreated water (total 100m³) from the biotreatment cell into totes for future disposal and tarping of the biotreatment cell to prevent additional water run-off at the site.
 - Completed on July 21, 2021.
4. Obtaining characterization samples of the soil for off-site disposal of the Inuvik Soil Treatment Facility.
 - All six soil samples indicate that contaminated soils at the site meet criteria for off-site disposal at KBL's Inuvik Soil Treatment Facility.
5. Delineation of hydrocarbon contaminated soils in the southeastern, northern, and western portions of the Site.
 - Test pitting was completed in the southeastern portion of the Site near TP13 on June 29, 2021. All samples were confirmed to be below the applied GNWT Tier 1 commercial use

guidelines for coarse-grained soils.

- Test pitting was also attempted in the northern portion of the Site near TP3 and TP15. The area surrounding TP3 could not be sampled as it is located on the northern property boundary, outside the property boundary fence in a ditch that was filled with water at the time of the site visit. The area surrounding TP15 could not be sampled as soil bags were stored on top of the desired sampling location. KBL attempted to move the bags, however they began to rip open and created a potential for contaminated soil spill onto the surface of the site. KBL recommends this work be completed in conjunction with scheduled remediation activities in 2022.
6. Completion of an Environmental Impact Screening for the Environmental Impact Screening Committee in the Inuvialuit Settlement Region of the Northwest Territories and the North Slope Region of the Yukon.
 - Mitigation of adverse effects has been introduced at the Project design stage, and adverse effects will be avoided to the greatest extent practical. No residual effects were predicted for any of the value components evaluated as part of the project.

In 2022, NTPC plans to remediate the site through the following activities:

1. Removal of 920 m³ stockpiled soil for disposal at KBL's Inuvik Soil Treatment Facility;
2. Decommissioning of the onsite Soil Treatment Facility and removal of the property fence, concrete pad, and concrete dock for disposal in the municipal landfill;
3. Removal of 100m³ untreated water currently stored onsite in totes for disposal at KBL's Inuvik Soil Treatment Facility;
4. Excavating approximately 1,980 m³ of unexcavated soil to a depth of approximately 2.0 m;
5. Collecting confirmatory samples of the excavated area(s) for field screening and subsequent third-party laboratory analysis;
6. Off-site disposal of all impacted soil to the Inuvik Soil Treatment Facility (STF);
7. Backfilling site to grade with clean fill; and
8. Final remediation reporting to ENR and IWB.

Previous environmental site assessments at the Site delineated the impacted soil at the site and were used to calculate the estimated amount of soil requiring remedial excavations in addition to the permafrost depth at 2m. If the field- screening measurement and/or visual/olfactory indicators suggests a sample location will exceed applicable guideline, additional soil may be removed from the horizontal extents and sampled at additional locations for full delineation, prior to collecting a confirmatory sample. As per direction from ENR, excavations will cease at 2m bgs in order to protect the permafrost. In the event impacted soils remain present at the permafrost interface (2m bgs), NTPC will communicate with the ENR representative for further guidance.

1.0 INTRODUCTION

Northwest Territories Power Corporation (NTPC) retained KBL Environmental Ltd (KBL) to complete remediation of impacted soils located at the former NTPC power plant site in Aklavik, NT, hereinafter referred to as the 'Site'. The contract was awarded in January 2021. Existing contamination at the site, at the end of 2020, included approximately 920 m³ of hydrocarbon impacted soil and 40,000L of untreated water inside a biotreatment cell. The biocell was built in 2017 to carry out bioaugmented treatment of excavated contaminated soils. The treatment process was unsuccessful in meeting the required cleanup standards, and the soil and water were left staged in the cell pending further action. Approximately 1,980 m³ of unexcavated impacted soil has also been delineated across the remainder of the site. In addition, 70 bags of excavated soil, from the removal of a dock in 2015, along with 8 totes of impacted water have been stored on site for future management.

The purpose of this report is to summarize the remedial activities completed in 2021 and those planned for 2022 in accordance with Part B (1 g and h) and Annex 1, Part 1 of Water Licence N3L8-1838.

The scope of work for the 2021 field season included:

1. Completion of a Records Review and Gap Analysis to review historical records for the site and identify any gaps in understanding.
2. Submission of an updated Remediation Action Plan to the Government of Northwest Territories Department of Environmental and Natural Resources (GNWT-ENR) for approval.
3. Pumping of untreated water from the biotreatment cell into totes for future disposal and tarping of the biotreatment cell to prevent additional water run-off at the site.
4. Obtaining characterization samples of the soil for off-site disposal of the Inuvik Soil Treatment Facility.

Based on the results of the records review and permitting requirements for planned 2022 scope of work items, the following scope of work items were added to the 2021 field season:

5. Delineation of hydrocarbon contaminated soils in the southeastern, northern, and western portions of the Site.
6. Completion of an Environmental Impact Screening for the Environmental Impact Screening Committee ("EISC") in the Inuvialuit Settlement Region of the Northwest Territories and the North Slope Region of the Yukon.

2.0 BACKGROUND

The Site is a former power station situated in the hamlet of Aklavik, located on the Peel Channel of the

west side of the Mackenzie River Delta (Appendix A, Figure 1), approximately 100 km south of the Beaufort Sea and 55 km west of Inuvik. The Site legal description is Lots 58, 58A, and 58B, LTO 33, Plan CLSR 40355.

The Site historically had a power plant that used Bunker C to generate electricity. In the mid-1970s, a new powerhouse was constructed to support a switch to fuel oil (diesel). In addition to the powerhouse, former infrastructure included an aboveground diesel storage tank (AST) and an office. Remaining infrastructure included a concrete dock used to support the original generator, a smaller concrete pad, and a chain-link fence around the perimeter.

A July 1997 Phase II ESA (EBA 1998) included digging 16 test pits; analytical results suggested that most of the soil impacts were south of the former AST. This observation was based on the highest total petroleum hydrocarbon (TPH) concentrations at the south property line, including 96,000 mg/kg at a depth of 0.6 m bgs from a test pit south of the former AST, and 39,000 mg/kg at a depth of 0.3 m bgs from a test pit located between the former AST and the concrete dock.

A groundwater assessment in 2002 (Golder 2002) included digging five test pits to a depth between 1.8 and 2.2 m bgs and installing five groundwater monitoring wells (Golder 2002). The well farthest to the north had no detectable Petroleum Hydrocarbons (PHCs), while other wells on the Site had benzene, toluene, ethylbenzene, and PHC fraction 2 (F2; C>10-C16) concentrations higher than applicable Canadian Council of Ministers of the Environment guidelines.

A Phase III ESA in June and July 2003 included soil sampling from an additional 22 test pits and 8 manual boreholes offsite in the cemetery, plus groundwater sampling of the 5 wells (Biogenie 2004). The assessment concluded that an estimated 2,720 m³ of hydrocarbon-impacted soils was present on NTPC's property at an average depth of 1.8 m bgs. Limited data suggested that site soils were also impacted with polycyclic aromatic hydrocarbons higher than the Environmental Guidelines for Contaminated Site Remediation (Northwest Territories 2003) for residential/parkland land use.

August 2015, Matrix used hand augers to collect soil samples to a depth of 1 m. Concentrations of hydrocarbons and metals exceeded Environmental Guidelines for Contaminated Site Remediation (Northwest Territories 2003). Impacts in the south portion of the Site were consistent with the historical location of the Bunker C generator and included PHC fraction 3 (F3; C>16-C34; 280 to 42,300 mg/kg), fraction 4 (F4; C>34; 7,710 to 25,800 mg/kg), and metals (copper, nickel, and zinc) consistent with historical fuel spillage and engine wear. Impacts in the north section of the Site (where the 1970s powerhouse was built) were characterized by elevated levels of PHC F2 (1,660 to 22,700 mg/kg) indicative of diesel. Arsenic levels exceeded guidelines at multiple locations; this is attributable to imported gravel from a nearby quarry and is not considered a contaminant of concern.

In July 2017, a 17 m x 28 m biotreatment cell was constructed at the former plant site in Aklavik, NT. Approximately 920 m³ of hydrocarbon impacted soil has been undergoing bioaugmentation treatment in the biotreatment cell. Surface water runoff that collects in the biotreatment cell has also been treated annually through an onsite treatment system. Due to issues with the holding tank approximately 40,000 L of untreated water remains in the biocell. Approximately 1,980 m³ (based on the Phase III ESA conducted in 2003) of impacted soil remains onsite outside the biotreatment cell. Soil analysis from the

biotreatment cell indicates a reduction in hydrocarbon concentrations, however the estimated time to reduce hydrocarbon concentrations to Industrial Criteria is beyond 10 years.

Removal of a concrete dock located onsite was attempted in 2015. Local equipment was unable to break up the concrete dock for removal. Soil surrounding the concrete dock was excavated and placed in soil bags, along with 8 totes of impacted water. The concrete dock, 70 bags of soil and 8 totes of impacted water remain onsite.

Table 2.0 Historical Reports Reviewed by KBL

Year	Author	Report Title	Summary of Findings
1998	EBA Engineering Consultants Ltd.	Phase II ESA	The 1997 assessment has shown that diesel fuel contamination is present on site in the soil at five locations – one being near the powerhouse, and the others being near and down slope of the diesel fuel storage tank. Slightly elevated lead levels were also detected in the groundwater of Test pit 11 near the powerhouse. However, leaded gasoline was reportedly not used on site, and the presence of lead may be a naturally occurring characteristic of the Aklavik site groundwater.
2004	Biogenie	Phase III ESA	Delineation and confirmation of the 1998 findings. An estimated 2,720m ³ of hydrocarbon-impacted soil identified at the site at an average depth of 1.8 m. Groundwater monitoring indicated natural attenuation of hydrocarbon levels was occurring. Impacted areas were not anticipated to migrate beyond their current location.
2005	Biogenie	Site Remediation – Anglican Cemetery	Remedial excavation of 23.2 m ³ hydrocarbon-impacted soil at the south adjoining property completed. Soil was placed in bags and stored at NTPC's site. Contaminated soil remained under the fence on the project boundary.
2008	Biogenie	Final Remediation, Aklavik NTPC Power Plant	Construction of a biotreatment cell and remedial excavation of 80m ³ hydrocarbon-impacted soil at the northeast adjoining property completed. Soil in bags from 2005 and current report excavations placed into biotreatment cell.
2009	Biogenie	Final Remediation – Progress Report	Soil on treatment pad was treated by aeration then covered with a tarp. Two soil samples were obtained to monitor remediation progress.
2009	Biogenie	Concrete Analysis Report	The concrete slab on-site was analyzed for disposal. Analysis confirmed the concrete could be disposed as non-hazardous waste at the municipal landfill.
2017	Matrix Solutions Inc.	Remediation Summary Report	Approximately one third of the impacted soils on the site were excavated and a biotreatment cell was constructed to contain the soils and surface water runoff. One treatment campaign was completed on the soils. Following treatment and approval from the Inuvialuit Water Board 33.1 m ³ of treated water was discharged to the drainage ditch along the north edge of the site.

2018	Matrix Solutions Inc.	Remediation Summary Progress Report	Monitoring of soil remediation progress completed. Following treatment and approval from the Inuvialuit Water Board 59.8 m ³ of treated water was discharged to the drainage ditch along the north edge of the site. Estimated remaining time to remediate soils on biotreatment cell was 2 to 4 years.
2019	Matrix Solutions Inc.	Remediation Summary Progress Report	Monitoring of soil remediation progress completed. Estimated remaining time to remediate soils on biotreatment cell was 7 to 15 years. Water on the biotreatment cell was treated and pumped into a holding tank on-site. Due to a tear in a seam of the discharge holding tank, approximately 26 m ³ of treated water released onsite and reported as a spill to the Inuvialuit Water Board.

A full listing of historical references is provided in Section 11.0 References.

3.0 SITE SETTING

The Site is a former power station situated in the hamlet of Aklavik, located on the Peel Channel of the west side of the Mackenzie River Delta (Appendix A, Figure 2), approximately 100 km south of the Beaufort Sea and 55 km west of Inuvik. The Site legal description is Lots 58, 58A, and 58B, LTO 33, Plan CLSR 40355.

There are residential and commercial structures located within 20m of the Site.

3.1. Terrain and Topography

The site topography is flat, sloping gently to the southeast. The Peel Channel bends around the south side of Aklavik. The distance between the channel shores to the east and the south of the site is approximately 250 m. A layer of gravel and clay fill covers most of the site, underlain by the original topsoil and clayey silt; the depth to permafrost is approximately 1.2 to 2.1 m below ground surface (bgs) (Matrix, 2017). The elevation of the site is approximately 7.0 m.

3.2. Climate

Aklavik is located in the Mackenzie Delta ecoregion which is part of the Taiga Plains ecozone (Ecological Stratification Working Group [ESWG] 1995). It has a subarctic climate, typical of Canada's Arctic, with mild summers and cold winters lasting most of the year. The average temperature for the year is -8.2°C, the warmest month is typically July with average temperatures of 13.8°C and the coldest month is typically January with average temperatures of -26.3°C. The mean annual precipitation ranges from 100 to 200 millimetres (mm).

3.3. Geology and Surficial Geology

As the site is located within the Mackenzie River Delta, it is overlain by Quaternary deltaic deposits, described by Norris (1975) as "fluvatile silt, sand and gravel, in part with cover of organic deposits; undivided."

A layer of gravel and clay fill covers most of the site, underlain by the original topsoil and clayey silt; the depth to permafrost is approximately 1.2 to 2.1 m below ground surface (bgs).

3.4. Hydrology

The hydrology of the Mackenzie Delta is complex, highly dynamic, and consists of a network of streams, lakes, and wetlands almost 80 km wide (Imperial Oil 2004). The majority of water in the Delta originates from the Mackenzie River. At least some of the water in the site area likely originates from the Peel River, since the Peel River also has distributaries into the Delta. The Peel Channel is the largest main channel near the site, located about 3.2 km to the east-southeast at its closest point to the site, at the big bend in the channel south of Bickish Avenue. Peak runoff commonly occurs at the end of May or early June. Flooding occurs in the spring as a result of high spring flows and ice jams on the main channels.

The majority of the waterbodies in the area tend to be shallow (maximum depths of 2.2 m) with soft organic bottom substrates. Water quality information in the area is limited; however, water quality is influenced by the flood frequency from the larger delta channels (Imperial Oil 2004) and by runoff from the Richardson Mountains.

4.0 REGULATORY FRAMEWORK

In the Northwest Territories, the process to manage (identify, assess, remediate) contaminated sites is described in the Environmental Guideline for Contaminated Site Remediation (NWT CSR) (GNWT, 2003). The guideline presents remediation criteria for the protection of human and ecological health, in the context of four generic land use types. A three-tiered approach outlines the application of the remediation criteria or further development of site-specific remediation objectives.

The current land use of the site is industrial, and the Site is located in a commercial and residential area of Aklavik, Northwest Territories. The nearest water body is Peel Channel, located 230m from the power station. Soil encountered during the sampling was a silty sand, which corresponded to a coarse material for regulatory purposes. Based on site location, site zoning, neighboring land uses and site soil conditions, the NWT CSR Tier 1 Criteria, commercial land use, coarse-grained criteria were applied for management of the site.

5.0 PLANNED METHODOLOGY

This section summarizes the methods used to carry out and complete the scope of work.

5.1. Records Review and Gap Analysis (RRGA)

A records review was conducted by KBL of the historical records listed in Section 2.0 to ensure both the site history, and currently available data was thoroughly understood. The review encompassed a review of aerial photographs; interviewing of knowledgeable persons; review of spill databases; consultation on site history; and an evaluation of the information's accuracy, reliability and sufficiency. This review provided the basis for the Remediation Action Plan and subsequent field work.

5.2. Remediation Action Plan

A remediation Action Plan ("RAP") was developed using information from the RRGA and recommended

scope of work with the goal of removing all contaminated soils and restoring the site to prior grade. The purpose of the RAP was to summarize assessment activities to date, and to provide a detailed plan for review and approval by the ENR. The RAP outlined the scope of the remediation, remediation methods, contingency plans, sampling methodologies, Quality Assurance/Quality Control (QA/QC), and mitigation controls for Site Receptors.

5.3. Health and Safety

KBL and contractors had valid safety certificate for Workplace Hazardous Material Information System, Transportation of Dangerous Goods, and Standard First Aid (at least one of every three on-site workers). Level II Ground Disturbance training was required for all personnel directly involved in ground disturbance activities.

A pre-job safety meeting and hazard assessment were conducted prior to starting work activities. Fire-retardant reflective coveralls, hardhats, steel-toed boots, and safety glasses were worn by all on-site personnel.

5.4. Surface Water Collection and Storage

Prior remediation efforts at the Site included treatment of water runoff from the biotreatment cell, storage in the on-site AST, and discharge of the water upon approval from the IWB. Due to a tear in a seam of the discharge holding tank, a spill of treated water occurred in 2019. To prevent future spills from the tank and due to concerns with possible lead exceedances in the water after treatment, the water was not treated in 2021. KBL subcontracted Northwind Industries Ltd. to pump water in the biotreatment cell into 1m³ totes for future disposal off-site in 2022. The soil on the biotreatment cell was tarped to prevent additional water runoff from accumulating in 2021 and at the end of the field season, no water run-off was located on the cell.

5.5. General Soil Sampling Methods

KBL personnel logged the soils according to a modified version of the Unified Soil Classification System (ASTM, 2017). Soil descriptions included a description of the soil stratigraphy, measured vapor concentrations, and comments regarding any unusual staining and/or debris. Soil vapor field screening was conducted using an RKL Eagle II photoionization detector (PID) calibrated to a 100 parts per million (ppm) methane standard.

Soil samples were collected by excavator and by hand in the test pits, with clean new nitrile gloves for each sample. A 125-mL aliquot was placed in a jar with zero headspace for analysis of F2-F4 hydrocarbon fractions. In addition, a 5-gram portions were obtained using Terracore® sampling equipment provided by the laboratory, and field preserved in glass vials containing 10 mL methanol for F1 hydrocarbon fraction and BTEX analyses. An undisturbed portion of soil was collected in a plastic soil bag for field headspace. An approximately equal amount of soil was collected in each bag, and the samples were heated an approximately equal amount before field testing to promote volatilization and detection of representative PHCs in the soil.

Samples were selected for laboratory analyses based on elevated hydrocarbon vapor headspace readings

and/or visual evidence of impacts. Soil samples were kept cool in coolers packed with ice, for analysis and shipped to a Canadian Association for Laboratory Accreditation Inc. (CALA) and Standards Council of Canada (SCC) accredited laboratory, under completed laboratory chain of custody forms.

Soil sample naming/labeling methodology is summarized below:

- 21TP## - soil samples collection.

5.6. Sampling Quality Assurance / Quality Control

KBL personnel implemented the following methods/tasks as a part of the quality assurance and quality control (QA/QC) program for sampling:

- Used clean and calibrated sampling equipment.
- Used disposable nitrile gloves while handling samples.
- Used laboratory-supplied sample containers.
- Completed chain of custody forms in the field and delivered the samples directly to the laboratory.

Blind Field Duplicates

A field duplicate (or blind duplicate) sample is a second sample collected from the same location as an original yet stored in separate laboratory containers. The sample is given a different identifier to prevent the laboratory from being aware of its similar origin as the primary sample.

From the test pitting program, three duplicates were submitted for laboratory analysis:

- 21DUP01 0.4m (Duplicate of 21TP01 0.3m)
- 21DUP01 0.9m (Duplicate of 21TP01 0.8m)
- 21DUP01 1.3m (Duplicate of 21TP01 1.2m)

Relative Percent Difference

The relative percent difference (RPD) is calculated for the results of the sample and its duplicate. The RPD is used to evaluate the representativeness of the sample. The RPD for two data points is equal to the difference divided by the mean multiplied by 100%, as displayed in the equation below.

$$RPD\% = \left| \frac{(C1 - C2)}{\left[\frac{C1 + C2}{2} \right]} \right| \times 100\%$$

For duplicate samples where one or both results were within five times the laboratory method detection limit (MDL), RPDs were not calculated as the differences would be primarily influenced by measurement error.

For soil samples, RPDs of 40% or less are generally acceptable (Zeiner 1994). Where soil sample RPD exceeds 40% the sample concentrations should be considered estimates.

6.0 2021 WORK COMPLETED AND RESULTS

6.1. Records Review and Gap Analysis

A records review was conducted by KBL of the historical records listed in Section 2.0 to ensure both the site history, and currently available data is thoroughly understood. Gaps in understanding between the records review, available data and ideal site information was presented to NTPC on February 22, 2021 (Appendix B).

Results of Records Review and Gap Analysis

The following findings were identified during the RRGAs:

- Inconsistencies were identified in historical soil regulatory framework with guideline criteria being compared to both industrial and commercial land use criteria. In addition, fine grained soil criteria had been used when coarse-grained soil had been identified at site.
 - Based on discussions with ENR, the site location, site zoning, neighboring land uses and site soil conditions, the NWT CSR Tier 1 Criteria, commercial land use, coarse-grained criteria were applied for management of the site.
 - Confirmation sampling was recommended in the northern portion of the site near historical test pit TP3 and on the western portion of the Site near historical test pits TP15 for comparison to the applicable remediation criteria.
- Inconsistencies were identified in historical surface water regulatory framework applications with Groundwater for aquatic life and Protection of potable groundwater criteria being incorrectly excluded based on the distance to the Peel River, which is reported as a source of drinking water for the community.
 - Based on the decision to dispose of water off-site, no additional work is required.
- Composite sampling and gaps in horizontal delineation were identified for soil samples obtained from the southeastern portion of the Site near TP13.
 - Soil sampling was recommended for the southeastern and northern portions of the Site to fully delineate contaminated soil in the area.
- Vertical delineation of the contaminated soil was not completed due to the presence of the permafrost active layer.
 - ENR has advised NTPC and KBL to remediate soils to the active permafrost layer, obtain confirmatory soil samples, and if contamination remains present a meeting with ENR will occur to discuss next steps.

In addition to the findings of the RRGAs, NTPC was advised by the EISC in the Inuvialuit Settlement

Region of the Northwest Territories and the North Slope Region of the Yukon that an Environmental Impact Screening of the Site will be required prior to start of remediation excavation activities.

Based on the results of the RRGAs and requirements of the EISC, soil sampling of the southeastern portion of the Site to fully delineate contaminated soil in the area and an Environmental Impact Screening were added to the 2021 scope of work.

6.2. Delineation of Soil in Southeast, North, and Western Portions of Site

Based upon the information provided in the RRGAs, test pitting was completed in the southeastern portion of the Site near TP13 on June 29, 2021. The test pit program consisted of four test pits using an excavator with samples obtained from 0.3m, 0.8m, and 1.2m bgs. A total of 12 soil samples were obtained and sent to a third party laboratory for analysis of contaminants of concern (BTEX and F1-F4). Excavator refusal was encountered at 1.3m bgs, likely due to the permafrost. (Appendix A, Figure 5).

Test pitting was also attempted in the northern portion of the Site near TP3 and TP15. The area surrounding TP3 could not be sampled as it is located on the northern property boundary, outside the property boundary fence in a ditch that was filled with water at the time of the site visit. The area surrounding TP15 could not be sampled as soil bags were stored on top of the desired sampling location. KBL attempted to move the bags, however they began to rip open and created a potential for contaminated soil spill onto the surface of the site.

Results of Delineation of Soil in Southeast, North, and Western Portions of Site

All twelve test pits were confirmed to be below the applied GNWT Tier 1 commercial use guidelines for coarse-grained soils. Tabulated laboratory results are presented in Appendix D, Table 1 and the Certificate of Analysis (COA) is presented in Appendix E.

6.3. Remediation Action Plan

A RAP was developed and submitted to ENR on May 28, 2021. A copy of the RAP is included in Appendix C.

6.4. Surface Water Collection and Storage

On July 21, 2021, 92m³ of water was pumped from the biotreatment cell into 1m³ totes for future disposal off-site in 2022. At the end of the 2021 field season, 100m³ of untreated water (8m³ from 2020 and 92m³ from 2021) was stored in totes for future disposal off-site.

6.5. Soil Characterization for Off-site Disposal

On October 24, 2021, six soil characterization samples were obtained from the site for approval of off-site disposal at KBL's Inuvik Soil Treatment Facility. Soil samples were analyzed for total petroleum hydrocarbons, metals, and pH.

Results of Soil Characterization for Off-site Disposal

All six soil samples indicate that contaminated soils at the site meet criteria for off-site disposal at KBL's

Inuvik Soil Treatment Facility.

6.6. Environmental Impact Screening

NTPC submitted a Project Summary Questionnaire (PSQ) to the EISC on April 15, 2021. The EISC Prescreening Sub-committee reviewed the PSQ and determined on June 8, 2021, that this project will be subject to an Environmental Impact Screening and a Project Description (PD) needs to be submitted (EISC File 04-21-02). A PD was developed by KBL on behalf of NTPC in response to this requirement and submitted to the EISC on November 23, 2021.

The EISC reviewed the PD submission and requested additional information, including a revised PD, from NTPC on December 3, 2021. A revised PD was submitted to EISC on December 13, 2021, and a final review by EISC was outstanding as of the end of 2021.

Results of Environmental Impact Screening

The likely environmental effects that are anticipated to occur as a result of the Project were considered for all physical works and activities during the Project's life cycle. Effects were identified and assessed, taking into consideration applicable mitigation and impact management measures, along with standard policies and practices. Applicable mitigation measures have been identified to avoid or minimize any likely adverse environmental effects. Under the Canadian Environmental Assessment Act (1992), mitigation is defined as the measures for the elimination, reduction or control of adverse environmental effects of a project. Mitigation of adverse effects has been introduced at the Project design stage, and adverse effects will be avoided to the greatest extent practical. No residual effects were predicted for any of the value components evaluated as part of the project. A summary of the value components evaluated, potential effects identified, and proposed mitigation efforts are included in Table 6.1 below.

Table 6.1: Summary of Potential Impacts, Proposed Mitigation, Predicted Residual Effect and Predicted Significance

Valued Component	Potential Impacts	Proposed Mitigation	Predicted Residual Effect	Predicted Significance
Permafrost	Permafrost Melt	Work to be completed in winter months. No excavating beneath identified permafrost location	No residual effects as permafrost not exposed to above freezing temperatures.	N/A*
Soil Quality	Spills/contamination	Implement Spill Contingency Plan; keep spill response equipment on hand and, use pads/drip trays during refueling	No residual effects predicted	N/A*
Water Quality	Contaminate spills into or nearby water bodies	Implement Spill Contingency Plan; keep spill response equipment	No residual effects predicted	N/A*

		on hand and, use pads/drip trays during refueling		
Dust emission	Localized emissions of dust in dry conditions	Work to be completed in winter months	No residual effects predicted	N/A*
Noise	Short term noise impacts	Limit time window during excavation activities	No residual effects predicted	N/A*
Greenhouse Gases	Greenhouse gas emissions	Limit idling; ensure vehicle maintenance; backhauls; local treatment; and choosing the lowest emissions option.	No residual effects predicted	N/A*
Local employment	Loss of employment	Hire locals that can completely and effectively complete the work	No residual effects predicted	N/A*
Community wellbeing	Off-site migration constituents of concern.	Remedial excavation	No residual effects predicted	N/A*
Temperature	Shorter winter road season	Monitoring of winter road conditions and starting work as soon as practical	No residual effects predicted	N/A*
Precipitation	Rain creating additional impacted water	Covering soil pile with tarp and remedial excavations	No residual effects predicted	N/A*

*N/A – as no residual effect is predicted, no significance rating is applied.

7.0 2022 WORK PLANNED

In 2022, NTPC plans to remediate the site through the following activities:

- Removal of 920 m³ stockpiled soil for disposal at KBL's Inuvik Soil Treatment Facility;
- Decommissioning of the on-site Soil Treatment Facility and removal of the property fence, concrete pad, and concrete dock for disposal in the municipal landfill;
- Removal of 100m³ untreated water currently stored onsite in totes for disposal at KBL's Inuvik Soil Treatment Facility;
- Excavating approximately 1980 m³ of unexcavated soil to a depth of approximately 2.0 m;
- Collecting confirmatory samples of the excavated area(s) for field screening and subsequent third-party laboratory analysis;
- Off-site disposal of all impacted soil to the Inuvik Soil Treatment Facility (STF);
- Backfilling site to grade with clean fill; and
- Final remediation reporting to ENR and IWB.

As outlined in Section 2.0, previous environmental site assessments at the Site delineated the impacted soil at the site and were used to calculate the estimated amount of soil requiring remedial excavations in addition to the permafrost depth at 2m. If the field- screening measurement and/or visual/olfactory

indicators suggests a sample location will exceed applicable guideline, additional soil may be removed from the horizontal extents and sampled at additional locations for full delineation, prior to collecting a confirmatory sample. As per direction from ENR, excavations will cease at 2m bgs in order to protect the permafrost. In the event impacted soils remain present at the permafrost interface (2m bgs), NTPC will communicate with the ENR representative for further guidance. The proposed excavation limits and soil pile outline are presented in Appendix A, Figure 4.

7.1. Planned Methodology

Stockpiled and contaminated soil identified in the RAP will be excavated and transported to KBL's Soil Treatment Facility in Inuvik. Stored totes of untreated water will also be transported to KBL's Soil Treatment Facility in Inuvik. Waste Manifests will be completed, and copies included in the final remediation report. The soil will be weighed at the scale in Inuvik on the way to the KBL Soil Treatment Facility and the actual amount of soil removed recorded in tonnes. KBL Assumes 1.8 tonnes per m³ will be excavated.

Delineation of contaminated soils using a handheld photoionization detector will be completed and once it is believed that excavation extents have been achieved, confirmatory samples will be collected from walls and bases of remedial excavations to be analyzed for the contaminants of concern. All sample locations will be recorded for future reference. Soil samples will be collected in accordance with KBL's Standard Operating Procedures (SOP) for Soil Sampling during Remedial Excavations and Soil Treatment Operations. As samples are collected, headspace vapour samples will be analyzed in the field using an RKI Eagle 2 (or similar) and using PetroFLAG tests to determine the likelihood that the sample will meet applicable guidelines. If it is suspected that a sample location will exceed the guideline based on the headspace vapour reading, additional soil may be removed prior to collecting a confirmatory sample. Samples will be packed in laboratory supplied containers and kept cool and will be transported on a chain of custody to either the laboratory depot or a third-party cargo operator for transportation to the laboratory. KBL Will forward the soil sampling results in batches to confirm remediation as excavation progresses.

Field observations will be collected on KBL's standardized field sample collection form. Analytical parameters and QA/QC procedures for the water and sediment samples will be detailed in the Sampling Plan. Samples will be handled while wearing disposable nitrile gloves and changed between each sample collection. Samples will be sealed inside laboratory provided resealable bags and transported inside coolers containing icepacks. Samples analyzed for methyl-mercury content will be kept frozen. Field measurements, sampling information and observations will be recorded on site.

Daily field forms shall be used to document site activities and to facilitate integration of the results into the final report. The entries shall include, but not be limited to:

- Detailed description, time and location of tasks completed;
- Names of all on site personnel including sub-contractors;
- Times of personnel arrival/departure;
- Safety Meetings and Environment, Health and Safety incidents;

- Initialization and conclusion times of component sampling efforts;
- Summary of sample collections, handling and storage, including sampling GPS locations;
- Results of field measurements;
- Baseline and offset field plans for test locations;
- Limitations encountered during the site visit;
- Wildlife observations;
- Signs of recent human habitation or use;
- Budget updates; and
- Weather conditions, visitors and third-party enquiries.

Digital photographs of the sampling locations shall be taken during the field investigation to document sampling activities and the conditions on-site. Photographs will be labeled, date stamped, oriented, logged, location-referenced and included in the final report. Photographs will document:

- Sample locations;
- Equipment;
- Hazardous waste materials;
- Non-hazardous waste materials;
- Actual and potential physical hazards;
- Stressed vegetation; and
- Neighbouring land use.

Site Closure

As per Part G of the water license, a Final Remediation Report will be completed to outline all site activities and sampling results and submitted to ENR and the IWB for review. All sample results and methodologies will be reported and an evaluation of sample results against applicable guidelines and criteria will be included. Delineation of exceedances if any, identification of the source of the exceedances as applicable, and recommendations for further action such as remediation requirements for commercial and residential development as per the Guidelines, if any will be included. Data tables will include the evaluation of sampling results against applicable guidelines and include results from sampling activities. Figures will indicate the locations of all sampling locations and numerical sample results for parameters which exceed guidelines at each sample location compared to applicable guidelines. Photographs and laboratory reports will also be included in the report. The Final Remediation Report will be reviewed and signed by the KBL Senior Technical Lead who is a NAPEG registered professional.

Sampling data will be compared to Government of the Northwest Territories (GNWT) standard "Environmental Guideline for Contaminated Site Remediation" (2003) commercial land use, coarse-grained criteria and the GNWT representative. Once approval is received from the GNWT, the area will be backfilled with clean fill dirt and a rework of the existing clean earthen materials within the property limits, supplemented with clean granular fill materials, will be completed.

7.2. 2022 Remediation Schedule

The currently planned schedule of activities to achieve remediation on the Site is shown below.

Phase	Description	Scheduled Completion
Mobilization	Equipment Mobilization	January 31, 2022
Soil Remediation	Excavate Biocell (980 m ³)	February 1 – 18, 2022
Soil Remediation	Decommission Biocell	February 21, 2022
Soil Remediation	Excavate Impacted Soil (1,920 m ³)	February 8-25, 2022
Soil Remediation	Demo Concrete loading pad	February 25 - 28, 2022
Soil Remediation	Load, Transport and Disposal of soil at Inuvik STF	February 25 – March 15, 2022
Soil Remediation	Submit soil sampling results for backfill approval	February 25, 2022
Soil Remediation	Backfill on trucking return from Inuvik STF	February 25 – March 17, 2022
Mobilization	Equipment Demobilization	March 18, 2022

8.0 CONCLUSION & RECOMMENDATIONS

Based on the project objectives and scope of work for the 2021 Remediation program, KBL makes the following summary and conclusions:

- A Remediation Action Plan has been prepared and submitted to ENR for approval.
 - KBL recommends remediation activities in 2022 be completed in alignment with the RAP.
- An Environmental Impact Screening was completed for EISC and predicted that planned 2022 remediation activities will have no residual effects for any of the value components evaluated as part of the project and recommended mitigation measures.
 - KBL recommends mitigation measures proposed in the Environmental Impact Screening be implemented during remediation activities planned for 2022.
- Untreated water remains on site in 100 – one cubic meter totes.
 - Water is approved for disposal at KBL's Inuvik Soil Treatment Facility.
- Approximately 920 m³ of hydrocarbon impacted soil remains on site in a biotreatment cell, 70 bags on the western portion of the site, and 1,980 m³ of unexcavated hydrocarbon impacted soil remains on site.
 - KBL recommends remedial excavation of the hydrocarbon impacted soil.
- All six soil characterization samples obtained indicate that contaminated soils at the site meet criteria for off-site disposal at KBL's Inuvik Soil Treatment Facility.

- Soil is approved for disposal at KBL's Inuvik Soil Treatment Facility.
- Test pitting completed in the southeastern portion of the Site near TP13 on June 29, 2021 indicated all samples were confirmed to be below the applied GNWT Tier 1 commercial use guidelines for coarse-grained soils.
 - Based on the laboratory results, no further action is required in the southeastern portion of the Site near TP13.
- Test pitting was also attempted in the northern portion of the Site near TP3 and TP15. The area surrounding TP3 could not be sampled as it is located on the northern property boundary, outside the property boundary fence in a ditch that was filled with water at the time of the site visit. The area surrounding TP15 could not be sampled as soil bags were stored on top of the desired sampling location. KBL attempted to move the bags, however they began to rip open and created a potential for contaminated soil spill onto the surface of the site.
 - KBL recommends this work be completed in conjunction with scheduled remediation activities in 2022.

In 2022, KBL on behalf of NTPC is proposing to cleanup all remaining hydrocarbon impacted soil (920 m³ inside bio cell and 1980 m³ outside bio cell) to the applicable criteria, remove and dispose of hydrocarbon impacted soil and untreated water to KBL's Soil Treatment Facility in Inuvik, and decommission the biotreatment cell. Once remedial excavations and confirmatory sampling are complete, the site will be backfilled with clean soil. A final remediation report will be prepared for submission to the ENR and IWB once 2022 remediation activities are complete.

9.0 NOTICE TO READERS/CLOSURE

This report has been prepared and the work referred to in this report has been undertaken by KBL for the exclusive use of Northwest Territories Power Corporation who has been party to the development of the scope of work and understands its limitations. The methodology, conclusions and recommendations in this report are based solely upon the scope of work and subject to the time and budgetary considerations derived in the documents which constitute the proposal and/or contract pursuant to which this report was issued.

The conclusions and recommendations in this report have been developed in a manner consistent with the level of skill normally exercised by professionals currently practicing under similar conditions in the area and reflect KBL's best judgement based on information available at the time of preparation of this report. No other warranties, either expressed or implied are made as to the professional services included in this report.

The conclusions contained in this report are valid only as of the date of this report and may be based, in part, upon information provided by others. If any of the information is inaccurate, new information is discovered, the conditions of the Site or intended use of the Site change, or applicable standards are

amended, modifications to this report may be necessary. KBL cannot be responsible for the use of this report or portions thereof unless KBL is requested to review and, if necessary, update the report. The results of the work herein should in no way be construed as a warranty that the subject Site is free from any and all contamination.

Any lithology descriptions, notes, or drawings have been made with the intent of providing general information on the subsurface conditions of the Site. This information should not be used as geotechnical data for any purpose unless specifically addressed. If referenced, groundwater, vapour or other subsurface conditions refer only to those observed at the location and time of observation noted. This report must be read in whole, as sections taken out of context may be misleading. KBL cannot be responsible for the use of portions of the report without reference to the entire report. If discrepancies occur between the preliminary (draft) and final versions, it is the final version that takes precedence. Nothing in this report is intended to constitute or provide a legal opinion.

The contents of this report are confidential and proprietary. Other than by Public Works and Government Services Canada, copying or distribution of this report or use of or reliance on the information contained herein in whole or in part, is not permitted without the express consent of the NTPC. Any use, reliance on, or decision made by a third party based on this report is the sole responsibility of such third party. KBL accepts no liability or responsibility for any damages that may be suffered or incurred by any third party as a result of the use of, reliance on, or any decision made based on this report.

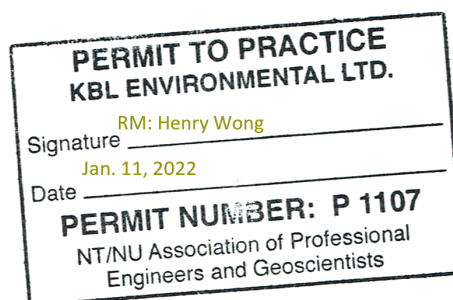
Prepared and Submitted by

Reviewed by:



Katie Oliver, CET, PMP
Project Director

Henry Wong, P.Eng.
Senior Review



10.0 REFERENCES

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PHOTOS

SITE PHOTOS



Photo 1: Untreated water in biotreatment cell prior to pumping into totes. June 29, 2021



Photo 2: Untreated water stored in totes on site. May 27, 2021



Photo 3: Hydrocarbon impacted soils on biotreatment cell. June 29, 2021



Photo 4: Test Pit TP03. June 29, 2021



Photo 5: Torn soil bag after attempting to relocate for test pitting activities on western portion of the Site. June 29, 2021



Photo 6: Location of proposed test pitting on northern portion of Site. June 29, 2021.



Photo 7: Excavator encountering refusal at 1.3m bgs. June 29, 2021



Photo 8: Soil bags stored on northwestern portion of the Site. June 29, 2021.

A decorative header banner with a green background featuring a pattern of overlapping, stylized leaf shapes in various shades of green.

APPENDIX A

Figures



Date: Aug 23, 2021



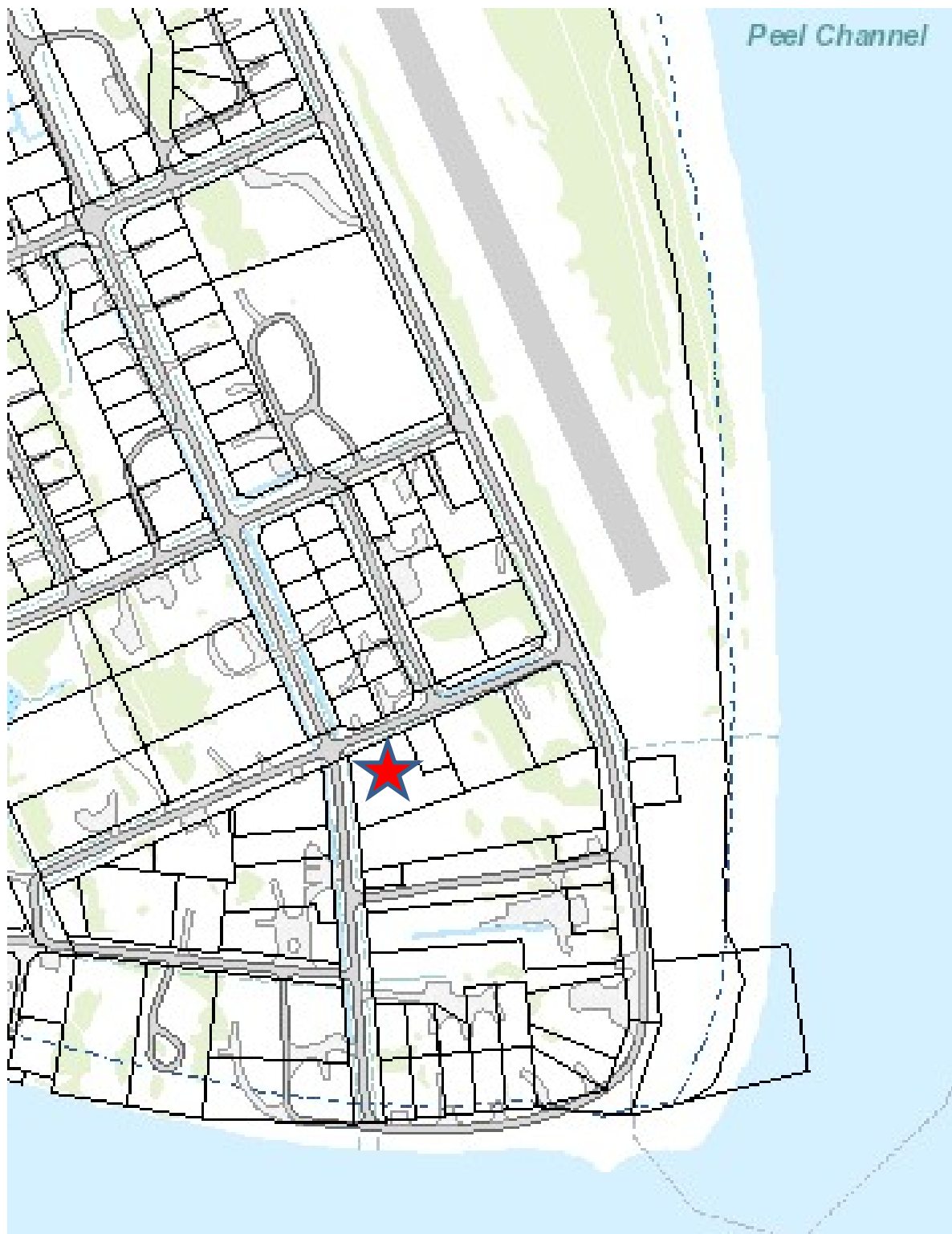
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SITE LOCATION MAP NTPC Aklavik Remediation

Figure #:

1



KBL



SITE LOCATION
NTPC Aklavik Remediation

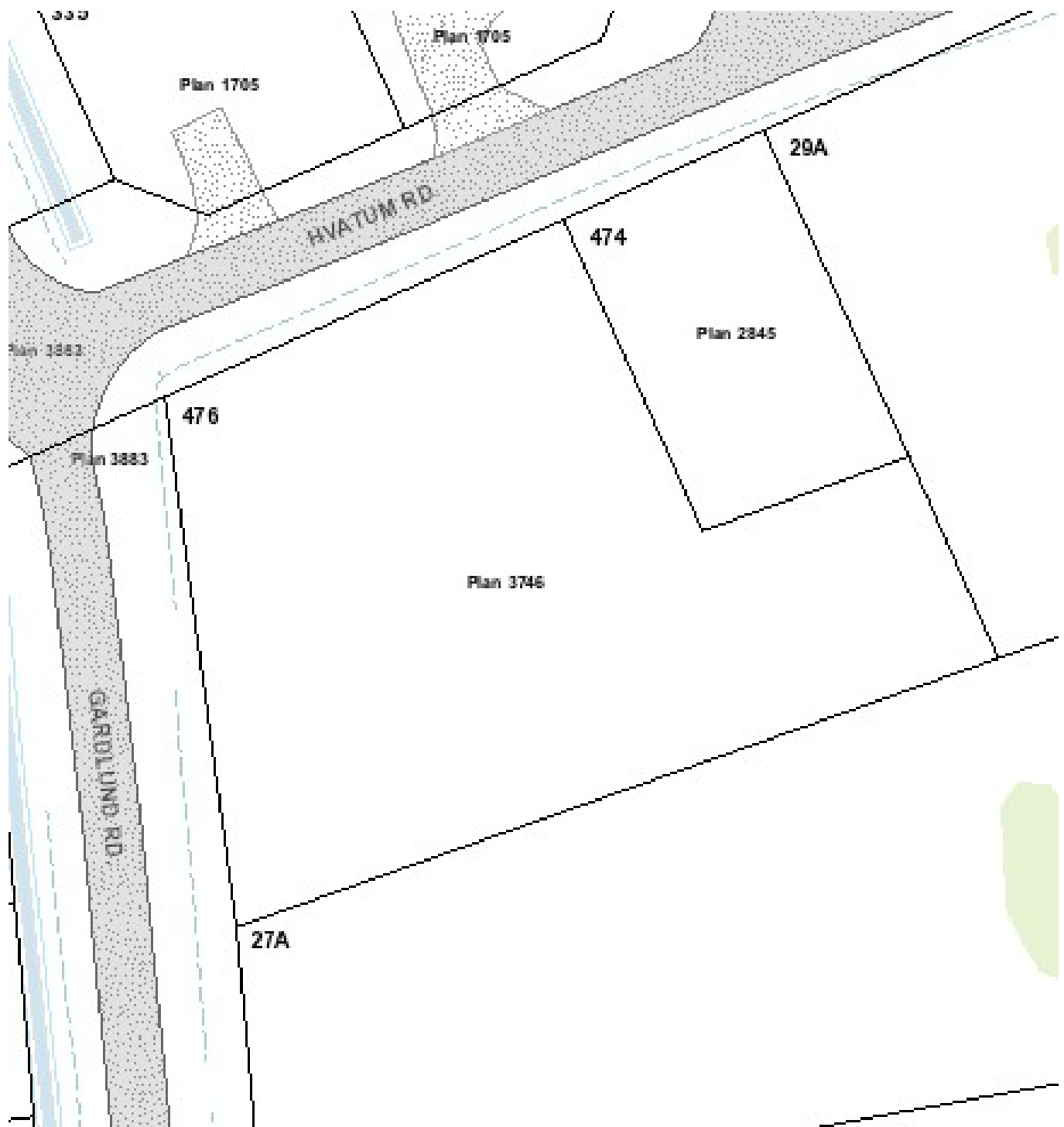


SITE

Date: Aug 23, 2021

Figure #:

2



Date: Aug 23, 2021



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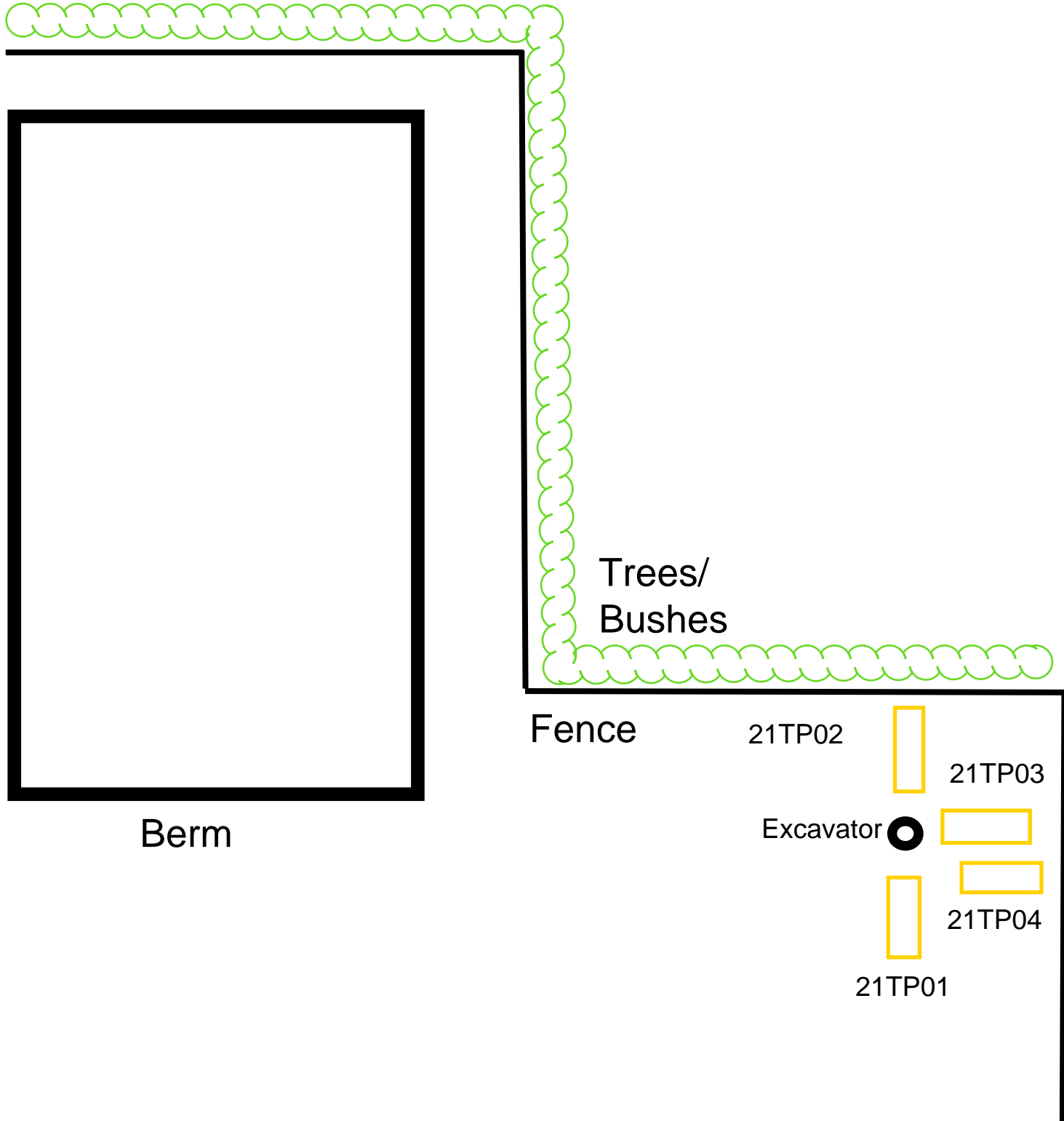


SITE PLAN
NTPC Aklavik Remediation

Figure #:

3







APPENDIX B

Technical Memo - Gap Analysis

February 22, 2021

TECHNICAL MEMO

Attention: Travis Perkins
Environmental Analyst/PM, NTPC

Joshua Clark
HSE Policy Coordinator

From: David Vanderkley, Senior Project Manager Environmental, KBL

21-051NT Aklavik NTPC Remediation

MPC5232 - Aklavik Soil Remediation Project – Data Gap Analysis Summary

During the project kick-off meeting with NTPC, held on January 22, 2021, KBL reported there were data gaps in the RFP after reviewing historical reports for the Site. NTPC requested KBL document the data gaps and submit the information to NTPC.

The site is a former power station situated in the hamlet of Aklavik, located on the Peel Channel of the west side of the Mackenzie River Delta (Figure 1), approximately 100 km south of the Beaufort Sea and 55 km west of Inuvik. The site legal description is Lots 58, 58A, and 58B, LTO 33, Plan CLSR 40355.

A site plan is provided on Figure 2. The current land use is industrial. Surrounding land uses are residential to the north and commercial to the west. There is public land located south of the site (Anglican Church cemetery). Areas to the east are undeveloped.

The site topography is flat, sloping gently to the southeast. Peel Channel bends around the south side of Aklavik. The distance between the channel shores to the east and the south of the site is approximately 250 m. A layer of gravel and clay fill covers most of the site, underlain by the original topsoil and clayey silt; the depth to permafrost is approximately 1.2 to 2.1 m below ground surface (bgs).

The site historically had a power plant that used Bunker C to generate electricity. In the mid-1970s a new powerhouse was constructed to support a switch to fuel oil (diesel). In addition to the powerhouse, former infrastructure included an aboveground diesel storage tank (AST) and an office. Remaining infrastructure includes a concrete dock used to support the original generator, a smaller concrete pad, and a chain-link fence around the perimeter.

The following is a summary of the investigation work to date:

- A July 1997 Phase II ESA (EBA 1998) included digging 16 test pits; analytical results suggested that most of the soil impacts were south of the former AST. This observation was based on the highest total petroleum hydrocarbon (TPH) concentrations at the south property

line, including 96,000 ppm at a depth of 0.6 m bgs from a test pit south of the former AST, and 39,000 ppm at a depth of 0.3 m bgs from a test pit located between the former AST and the concrete dock.

- A groundwater assessment in 2002 (Golder 2002) included digging five test pits to a depth between 1.8 and 2.2 m bgs and installing five groundwater monitoring wells (Golder 2002). The well farthest to the north had no detectable PHCs, while other wells on the site had benzene, toluene, ethylbenzene, and PHC fraction 2 (F2; C>10-C16) concentrations higher than applicable Canadian Council of Ministers of the Environment (CCME) guidelines.
- A Phase III ESA in June and July 2003 included soil sampling from an additional 22 test pits and eight manual boreholes offsite in the cemetery, plus groundwater sampling of the five wells (Biogenie 2004). The assessment concluded that an estimated 2,720 m³ of hydrocarbon-impacted soils was present on NTPC's property at an average depth of 1.8 m bgs. Limited data suggested that site soils were also impacted with polycyclic aromatic hydrocarbons higher than the Environmental Guidelines for Contaminated Site Remediation (Northwest Territories 2003) for residential/parkland land use.
- In August 2015, Matrix used hand augers to collect soil samples to a depth of 1 m. Concentrations of hydrocarbons and metals exceeded Environmental Guidelines for Contaminated Site Remediation (Northwest Territories 2003). Impacts in the south portion of the site were consistent with the historical location of the Bunker C generator and included PHC fraction 3 (F3; C>16-C34; 280 to 42,300 mg/kg), fraction 4 (F4; C>34; 7,710 to 25,800 mg/kg) and metals (copper, nickel, and zinc) consistent with historical fuel spillage and engine wear. Impacts in the north section of the site (where the 1970s powerhouse was built) were characterized by elevated levels of PHC F2 (1,660 to 22,700 mg/kg) indicative of diesel. Arsenic levels exceeded guidelines at multiple locations; this is attributable to imported gravel from a nearby quarry and is not considered a contaminant of concern.

The following is a GAP Analysis Summary from the investigations:

Land Use

- The 1997 Phase 2 ESA indicated that the analytical results were compared to Commercial Land Use
- The July 2003 Phase 3 ESA identified the land use for Site was Industrial and the adjacent cemetery was Residential.
- Soil texture was determined to be fine-grained at depth beneath gravel

Water use:

- Groundwater for aquatic life - incorrectly excluded (10 m reference for surface water body is for Tier II application - CCME CWS PHC -User Guide "*As a general rule, water wells and surface water bodies within 500 m of the PHC contamination should be identified*").
- Protection of potable groundwater excluded, but a distance to the Peel River is missing (KBL measured ~220 m per Google map).
- It is reported in Aklavik Safe Water Report (2003) indicating report drinking water from Peel River, which would be assumed to be in contact with the groundwater of the Site.

Missing:

- description of site size

Inconsistencies:

- Composite samples were used in PII and PIII ESAs which is not an industry standard. Samples that were not discrete should be considered suspect.
- RFP indicating clean-up to industrial, but surrounding land use is residential and/or commercial. The neighbouring land use is usually applied to 30 m for F1 and F2 vapour intrusion pathway and can only be exempted through a Tier 2 process. KBL to confirm if that is appropriate based on surrounding areas.
- Soil Texture - the dominant soil type was described as fine-grained in PIII, but the coarse grain soil from surface to a depth >1.0 m being the dominate soil type for governing horizontal and vertical migration for the receptors of this site (CCME CWS PHC -User Guide "*As noted elsewhere, decisions on soil texture must be made to identify most likely risk with respect to the pathway of concern.*"). KBL to review if coarse grain is more appropriate since the overlying fill layer can impact eco soil contact and vapour migration.
- Exposure pathway - CCME Management criteria was selected, but GNWT CSR has no Management Limit pathway rather a >1.5m depth subsoil standards. KBL to review if CCME Management criteria can be applied.

Delineation Inconsistencies:

Phase II

The following are samples that appear not to be identified in the impacted zone. Delineation prior to remedial activities maybe required.

- TP-5 marked as exceeds regulated TPH criteria - however, not in current Impacted zone
- TP-9 Petro Flag Data exceedance - however, not in current Impacted zone
- TP-13 marked as exceeds regulated TPH criteria - however, not in current Impacted zone

- TP-14 Petro Flag Data exceedance - however, not in current Impacted zone

Phase III

In reviewing applicable criteria, if residential criteria are applied:

- TP15 marked as meeting reg. criteria - however, would exceed if residential criteria applies
- TP3 marked as meeting reg. criteria - however, would exceed if residential criteria applies
- Contaminant Assessment of MS2 to MS5 indicated that contamination present 5m south of property line; however, not shown in RFP Site plan
- It was noted that groundwater impacts were not anticipated to migrate off-site based on the date of the spill and the type of soil onsite. There is no data to confirm this.

Permafrost Delineation:

- Area #2 main area – listed as contaminant zone to depth of 2m @ permafrost – however, it should be noted that most of the samples exceed GNWT Sub-soil criteria at permafrost depth.
- Need confirmation on how to address impacted soil in potential frozen permafrost active layer. A meeting with GWNT ENR maybe required for sign off of remediation prior to start of program.

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A horizontal banner with a green background featuring a pattern of overlapping leaf shapes in various shades of green.

APPENDIX C

Remediation Action Plan

April 5, 2021

Dear Travis Perkins, Environmental Analyst/PM, NTPC and Joshua Clark, HSE Policy Coordinator

REFERENCE: MPC5232 - Remedial Action Plan for Aklavik Soil Remediation Project

1.0 INTRODUCTION

Northwest Territories Power Corporation (NTPC) retained KBL Environmental Ltd (KBL) to prepare a remedial action plan (RAP) for the above-noted site, hereinafter referred to as the 'Site'. The following RAP will be provided by NTPC to the Government of Northwest Territories Environmental and Natural Resources (GNWT ENR) for regulatory review and approval prior to initiating remediation activities.

The purpose of this RAP is to summarize assessment activities to date, and to provide a detailed plan for review and approval by the ENR. KBL will conduct this work in accordance with conditions laid out in the contract between KBL and NTPC.

2.0 BACKGROUND

The Site is a former power station situated in the hamlet of Aklavik, located on the Peel Channel of the west side of the Mackenzie River Delta (Figure 1), approximately 100 km south of the Beaufort Sea and 55 km west of Inuvik. The Site legal description is Lots 58, 58A, and 58B, LTO 33, Plan CLSR 40355.

The Site historically had a power plant that used Bunker C to generate electricity. In the mid-1970s, a new powerhouse was constructed to support a switch to fuel oil (diesel). In addition to the powerhouse, former infrastructure included an aboveground diesel storage tank (AST) and an office. Remaining infrastructure included a concrete dock used to support the original generator, a smaller concrete pad, and a chain-link fence around the perimeter.

A July 1997 Phase II ESA (EBA 1998) included digging 16 test pits; analytical results suggested that most of the soil impacts were south of the former AST. This observation was based on the highest total petroleum hydrocarbon (TPH) concentrations at the south property line, including 96,000 mg/kg at a depth of 0.6 m bgs from a test pit south of the former AST, and 39,000 mg/kg at a depth of 0.3 m bgs from a test pit located between the former AST and the concrete dock.

A groundwater assessment in 2002 (Golder 2002) included digging five test pits to a depth between 1.8 and 2.2 m bgs and installing five groundwater monitoring wells (Golder 2002). The well farthest to the north had no detectable Petroleum Hydrocarbons (PHCs), while other wells on the Site had benzene, toluene, ethylbenzene, and PHC fraction 2 (F2; C>10-C16) concentrations higher than applicable Canadian Council of Ministers of the Environment guidelines.

A Phase III ESA in June and July 2003 included soil sampling from an additional 22 test pits and 8 manual

boreholes offsite in the cemetery, plus groundwater sampling of the 5 wells (Biogenie 2004). The assessment concluded that an estimated 2,720 m³ of hydrocarbon-impacted soils was present on NTPC's property at an average depth of 1.8 m bgs. Limited data suggested that site soils were also impacted with polycyclic aromatic hydrocarbons higher than the Environmental Guidelines for Contaminated Site Remediation (Northwest Territories 2003) for residential/parkland land use.

August 2015, Matrix used hand augers to collect soil samples to a depth of 1 m. Concentrations of hydrocarbons and metals exceeded Environmental Guidelines for Contaminated Site Remediation (Northwest Territories 2003). Impacts in the south portion of the Site were consistent with the historical location of the Bunker C generator and included PHC fraction 3 (F3; C>16-C34; 280 to 42,300 mg/kg), fraction 4 (F4; C>34; 7,710 to 25,800 mg/kg), and metals (copper, nickel, and zinc) consistent with historical fuel spillage and engine wear. Impacts in the north section of the Site (where the 1970s powerhouse was built) were characterized by elevated levels of PHC F2 (1,660 to 22,700 mg/kg) indicative of diesel. Arsenic levels exceeded guidelines at multiple locations; this is attributable to imported gravel from a nearby quarry and is not considered a contaminant of concern.

In July 2017, a 17 m x 28 m biotreatment cell was constructed at the former plant site in Aklavik, NT. Approximately 920 m³ of hydrocarbon impacted soil has been undergoing bioaugmentation treatment in the biotreatment cell. Surface water runoff that collects in the biotreatment cell has also been treated annually through an onsite treatment system. Due to issues with the holding tank approximately 40,000 L of untreated water remains in the biocell. Approximately 1,980 m³ (based on the Phase III ESA conducted in 2003) of impacted soil remains onsite outside the biotreatment cell. Soil analysis from the biotreatment cell indicates a reduction in hydrocarbon concentrations, however the estimated time to reduce hydrocarbon concentrations to Industrial Criteria is beyond 10 years.

Removal of a concrete dock located onsite was attempted in 2015. Local equipment was unable to break up the concrete dock for removal. Soil surrounding the concrete dock was excavated and placed in soil bags, along with 8 totes of impacted water. The concrete dock, 70 bags of soil and 8 totes of impacted water remain onsite.

3.0 SCOPE OF REMEDIATION

3.1. Contaminants of Concern

Based on impacts identified through historical work completed onsite, the contaminants of concern were determined to be the following:

- Toluene, ethylbenzene, and xylenes.
- PHC fractions F1, F2 and F3.

3.2. Remediation Objectives

The main objective of a remediation is to remove PHC impacted soil at the Site in exceedance of 2003 Northwest Territories Environmental Guideline for Contaminated Site Remediation (NWT CSR, 2003) commercial land use, coarse-grained criteria in order to obtain regulatory closure of the Site:

- 1) Preparation of a detailed Remediation Action Plan, as per the Government of the Northwest Territories Environment and Natural Resources (GNWT ENR) Environmental Guideline for Contaminated Site Remediation;
- 2) Obtain required permits for start of work;
- 3) Removal and disposal of the property fence, concrete pad and concrete dock;
- 4) Removal and disposal of 8 plastic totes containing impacted water;
- 5) Remediation of all remaining hydrocarbon impacted soil (920 m³ excavated soil inside biocell and 70 Bags of excavated soil and 1,980 m³ unexcavated soil outside biocell) to below Commercial Criteria, while ensuring the protection of subsurface permafrost as per direction from GNWT ENR;
- 6) Confirmatory sampling of the remediated areas to confirm compliance with established criteria and obtain closure of the Site;
- 7) Annual reporting;
- 8) Attendance at community consultations as required.
- 9) Management of the biotreatment cell including annual reporting requirements and decommissioning;
- 10) Delineating potential impacted soils in the vicinity of historic test pits (July 2003) TP3 and TP13;
- 11) Treatment and disposal and/or decant of 40,000L of untreated water at the biocell; and,
- 12) Returning the Site to pre-remediation grade and conditions. Remediation of all remaining hydrocarbon impacted soil (920 m³ inside biocell and 1,980 m³ outside biocell) to below Commercial Criteria at the former power plant site in Aklavik, NT.

3.3. Method of Remediation

Soil remediation at the former power plant in Aklavik, NT. Soils are impacted by petroleum hydrocarbons (PHCs) from spills/leaks from heating oil tanks/piping. The volume of soil to be removed is estimated to be 920 m³ of stockpiled soil, and 1980 m³ of unexcavated soil to a depth of approximately 2.0m. Confirmatory samples will be compared to the commercial land use for coarse-grain surface soil criteria.

As soil samples are collected, subsamples will be placed in resealable plastic bags for headspace vapour measurements by an RKI Eagle 2 (or similar) organic vapour analyzer (OVA). An additional subsample will be collected, and field screened for relative PHC concentrations with PetroFlag. If the field- screening measurement and/or visual/olfactory indicators suggests a sample location will exceed applicable guideline, additional soil may be sampled at additional depths for full delineation, prior to collecting a confirmatory sample. Samples will be packed in laboratory supplied containers and kept cool and will be transported on a chain of custody to either the laboratory depot or a third-party cargo operator for transportation to AGAT Laboratories.

Soil samples along the sidewalls of the excavation will be collected at approximately 5 m horizontal intervals and at approximately 0.75 m intervals on the vertical. Soil samples on the base of the excavation will be collected at approximately 25 m² intervals. The extents of the excavation may be larger than what is depicted on the Figure 2.

A total of 51 confirmatory samples, which includes 5 duplicates, will be submitted for analysis of BTEX, F1-F4. An additional 5 samples will be collected and submitted for analysis of BTEX, F1-F4, Total Metals, Mercury, pH, Particle Size by Sieve for Inuvik Soil Treatment Facility acceptance. Confirmatory samples will be selected based on field screening and field observations. One confirmatory sample for every approximately 10 linear metres from the walls, and one sample for approximately 100 m² from the base. Duplicates will be at 1 sample for every 10 confirmatory samples submitted for analysis.

Any soils excavated and placed in stockpiles will be placed on sheet plastic as not to cross impact soils. If a stockpile of suspect clean is created, a stockpile soil sample will be collected and soil vapour screened and screened with PetroFLAG. If field screening indicated potentially impacted a stockpile soil sample will be submitted for BTEX, F1-F4 analysis.

Remedial work will include excavation and off-site disposal of all impacted soil, and impacted water to the Inuvik Soil Treatment Facility (STF). Soils will be frozen, therefore sealed end-dump trucks will not be required, but a roll over cover on the truck units will be implemented to prevent any materials escaping from the top of the unit. Water will be stored in 1 m³ totes and will also be frozen. The totes will be transported to the Inuvik STF by flatbed truck.

KBL shall provide documentation for confirming the volumes of soils removed from the Site.

The Site shall be restored to requirements outlined in RFP which include backfilling the Site to grade with clean fill. Imported clean fill will have 3 samples submitted for laboratory analysis to confirm clean.

3.4. Contingency Plans for Additional Contamination Discovery

If additional contaminants are discovered during the remedial excavation program activities, KBL will notify NTPC verbally immediately and followed up with written communication. KBL will make recommendation to NTPC for further assessment, monitoring, and potential remedial work to determine the extent of impact.

If impacts are still present at the permafrost interface, KBL will discuss with NTPC and GNWT ENR on how to proceed.

3.5. Sampling Design and Quality Assurance/Quality Control

Soil sampling activities will be conducted by the following methods also in accordance with industry accepted practices and KBL standard operating procedures (SOPs):

- With the assistance of a hydraulic excavator, collect discrete soil samples from the excavation walls and the excavation bases (one sample per 10 m x 10 m intervals). Laboratory analysis will be selected based on field screening results, and will target samples with the most likely potential for containing impacts.
- Log and field screen soil samples.
- Submit the soil samples to an accredited and client approval laboratory for analyses.

KBL personnel will implement the following methods/tasks as part of the quality assurance and quality control (QA/QC) program for sampling:

- Use clean and calibrated sampling equipment.
- Use disposable nitrile gloves while handling samples.
- Use laboratory-supplied sample containers.
- Collect one field duplicate soil per approximately ten laboratory-analyzed samples, and submit the samples for laboratory analysis.
- Complete chain of custody forms in the field, and deliver the samples in sealed coolers to the courier for transportation to the laboratory.

3.6. Mitigation Controls for Site Receptors

Based on the potential for adverse effects to adjacent receptors, KBL has determined the following actions as mitigation strategies:

- Human exposure – fencing to restrict access to the public.
- Surface water - surface water does not currently exist on-site, but if encountered proper mitigation to keep water on-site will be implemented.
- Animals– animals will be restricted to the immediate excavation by constructed fencing and having an egress ramp from the excavation.

3.7. Timeline

The schedule may be revised if warranted upon agreement between NTPC and KBL. KBL acknowledges that certain aspects of the project schedule may be dictated by weather and site conditions and thus endeavours to be able to supply personnel on a flexible scheduling basis to ensure that work at the Site is completed during times of maximum thaw or with greatest opportunity for project success. The schedule accounts for winter road access to the Site from January through April each year.

Phase	Description	Scheduled Completion
Pre-Remediation Reports	Health and Safety Plan and Environmental Protection Plan	February 28, 2021
Pre-Remediation Reports	Remediation Action Plan Draft/Final	May14, 2021
Delineation	Test pit delineate area TP5 and TP13	June 21, 2021 or February 2022
Mobilization	Mobilize water totes to Aklavik	June 14, 2021
Soil Pile	Cover soil pile with black plastic sheeting	June 21, 2021
Water Treatment	Biocell Water Decant	June 21, 2021
Annual Report	2021 Annual STF Report	December 15, 2021
Annual Report	2021 Remediation Progress Report	December 15, 2021
Mobilization	Equipment Mobilization	January 31, 2022
Soil Remediation	Excavate Biocell (980 m ³)	February 1 – 18, 2022
Soil Remediation	Decommission Biocell	February 21, 2022
Soil Remediation	Excavate Impacted Soil (1,920 m ³)	February 8-25, 2022
Soil Remediation	Demo Concrete loading pad	February 25 - 28, 2022
Soil Remediation	Load, Transport and Disposal of soil at Inuvik STF	February 25 – March 15, 2022
Soil Remediation	Submit soil sampling results for backfill approval	February 25, 2022
Soil Remediation	Backfill on trucking return from Inuvik STF	February 25 – March 17, 2022
Mobilization	Equipment Demobilization	March 18, 2022
Annual Report	2022 Annual STF Decommissioning Report	March 31, 2022
Annual Report	Final Remediation Report	March 31, 2022

4.0 POST REMEDIATION

4.1. Site Stability

Backfilling activities will be conducted to ensure adequate compaction, which may include over filling the excavation to minimize any depressions due to settling.

5.0 CLOSURE

We trust that this meets your present requirements. Should you have any questions or comments, please contact the undersigned at your convenience.

Sincerely,

Prepared by:

Name: David Vanderkley

Title: Senior Environmental Project Manager

Date: May 12, 2021

Reviewed by:

Name: Henry Wong, P.Eng.

Title: Senior Engineer

Date: May 12, 2021

Attachments:

Appendix A Figures

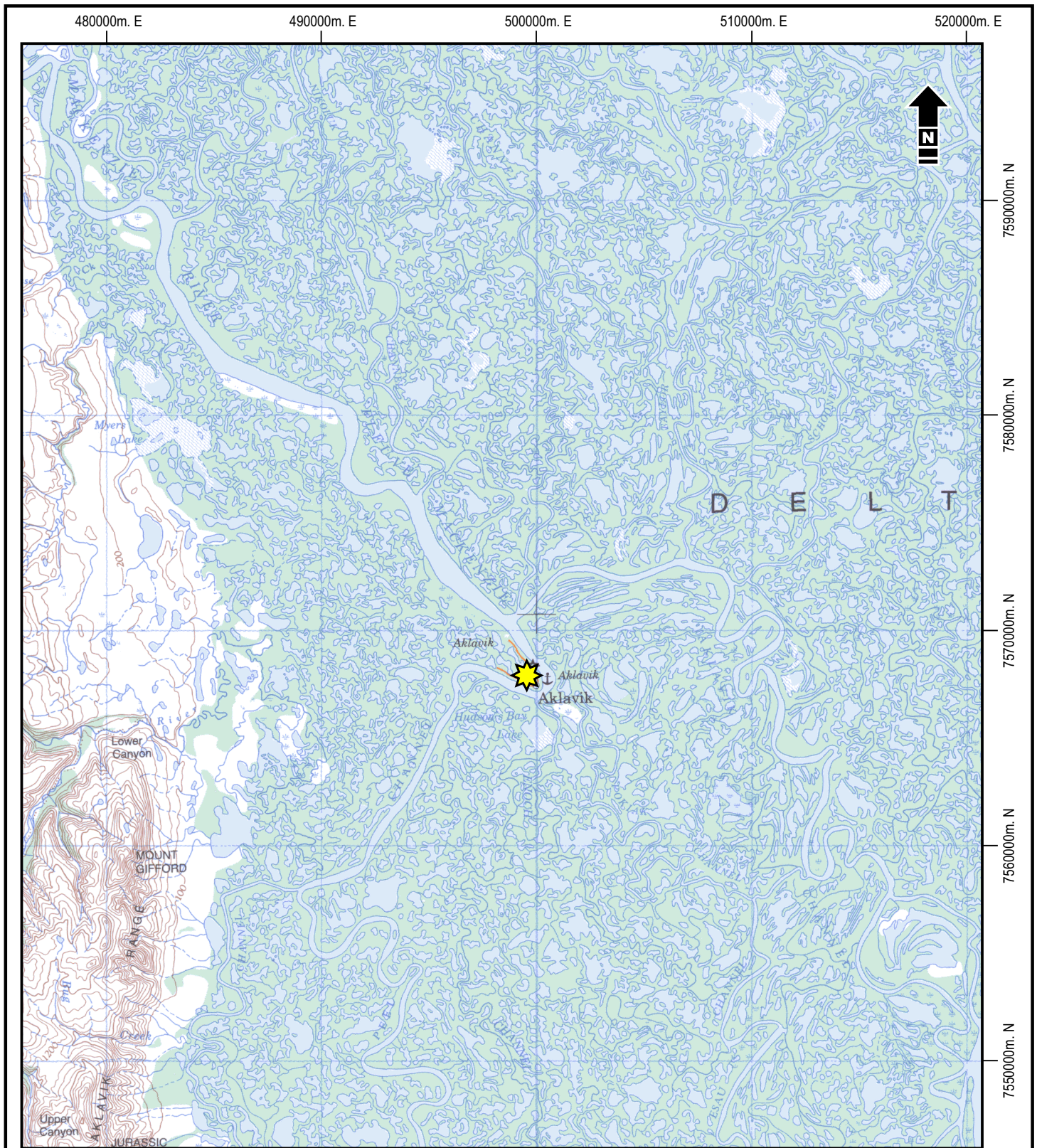
Figure 1 Site Location

Figure 2 Site Plan

Figure 3 Soil Analytical Results

Appendix A

Figures



Site Location

Northwest Territories Power Corporation
Lot 58, 58A and 58B, LTO 33, Plan CLSR 40355, Aklavik, NT

Site Location Map

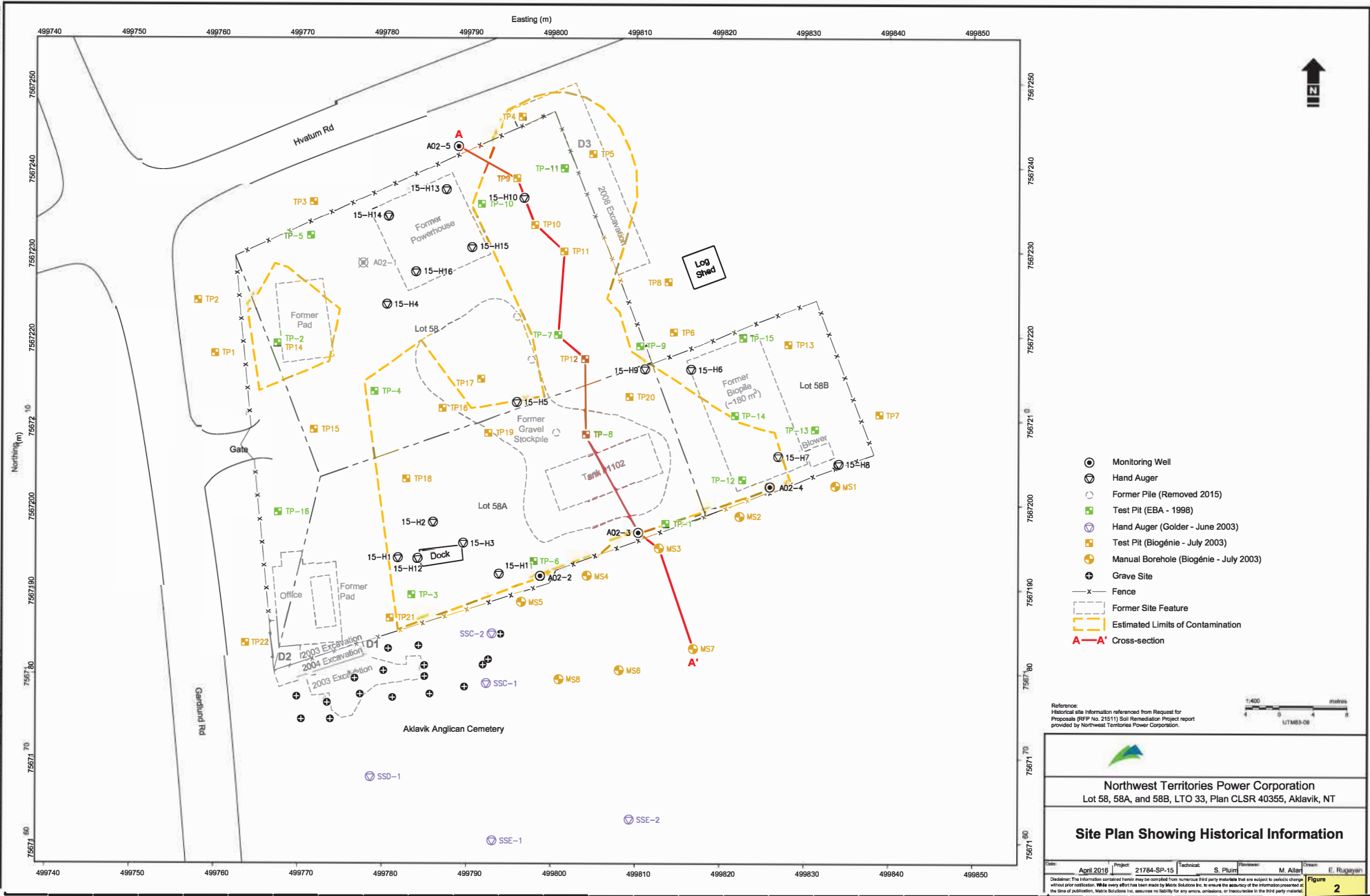
Date: April 2016	Project: 21784-LP-16	Technical: D. Felske	Reviewer: M. Allan	Drawn: J. Kern
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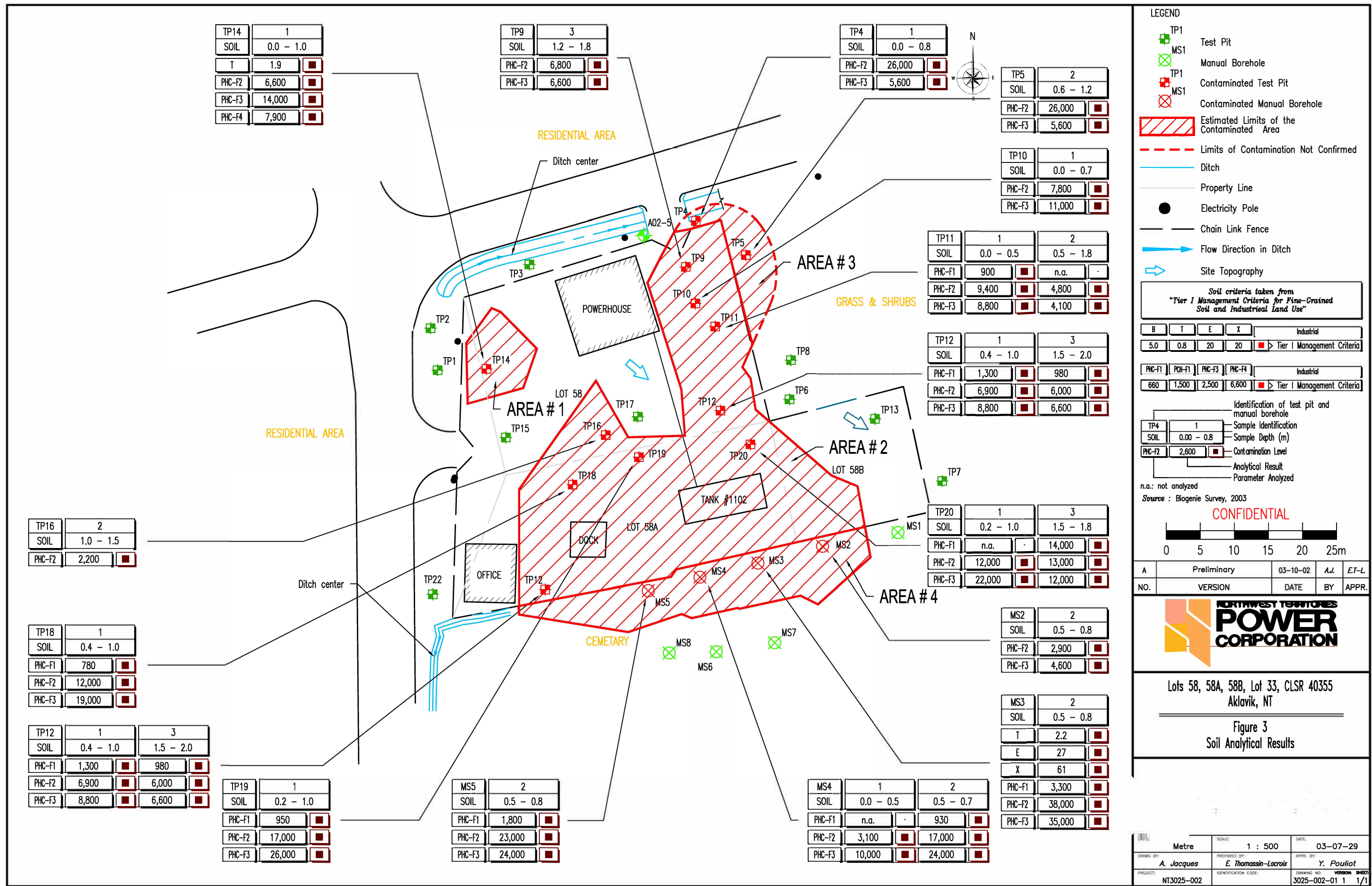
Disclaimer: The information contained herein may be compiled from numerous third party materials that are subject to periodic change without prior notification. While every effort has been made by Matrix Solutions Inc. to ensure the accuracy of the information presented at the time of publication, Matrix Solutions Inc. assumes no liability for any errors, omissions, or inaccuracies in the third party material.

Figure 1

Reference: 107 B (Aklavik), Edition 1.1, UTM Zone 08, NAD83
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1:250,000 metres
2,500 0 2,500 5,000





APPENDIX D

Tabulated Results

Table 1
Client: NTPC
Project: Aklavik Remediation NTPC
KBL File #: 21-051NT

		PHCs					BTEX				Inorganics
		F1	F1 minus BTEX	F2	F3	F4	Benzene	Toluene	Ethylbenzene	Xylene Total	Moisture
		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	%
NWT Course-Grained Commercial Standard			310	760	1,700	3,300	5	0.8	20	17	
Laboratory Detection Limit (mg/kg)		10	10	20	20	20	0.0050	0.050	0.010	0.10	-
Date	Field ID										
06-29-2021	21TP01 0.3M	<10	<10	23	314	63	0.0153	0.061	0.028	0.15	9.63
06-29-2021	21DUP01 0.4M	<10	<10	<20	245	71	0.0077	0.054	0.037	0.25	17.7
Quality Assurance RPD Calculation		-	-	-	25%	12%	-	-	-	-	59%
06-29-2021	21TP01 0.8M	<10	<10	<20	35	<20	<0.0050	<0.050	<0.010	<0.10	25.4
06-29-2021	21DUP01 0.9M	<10	<10	<20	47	<20	<0.0050	<0.050	<0.010	<0.10	24.5
Quality Assurance RPD Calculation		-	-	-	-	-	-	-	-	-	4%
06-29-2021	21TP01 1.2M	<10	<10	<20	31	<20	<0.0050	<0.050	<0.010	<0.10	22.2
06-29-2021	21DUP01 1.3M	13	11	<20	25	<20	<0.0050	0.38	0.184	1.19	24.2
Quality Assurance RPD Calculation		-	-	-	-	-	-	-	-	-	9%
06-29-2021	21TP02 0.4M	<10	<10	<20	146	38	0.0090	0.052	0.023	0.15	20.6
06-29-2021	21DUP01 0.4M	<10	<10	<20	245	71	0.0077	0.054	0.037	0.25	17.7
06-29-2021	21TP02 0.9M	<10	<10	<20	102	29	<0.0050	<0.050	<0.010	<0.10	25.4
06-29-2021	21DUP01 0.9M	<10	<10	<20	47	<20	<0.0050	<0.050	<0.010	<0.10	24.5
06-29-2021	21TP02 1.3M	<10	<10	<20	22	<20	<0.0050	<0.050	<0.010	<0.10	22.2
06-29-2021	21DUP01 1.3M	13	11	<20	25	<20	<0.0050	0.380	0.184	1.19	24.2
06-29-2021	21TP03 0.4M	<10	<10	27	344	96	0.0114	0.062	0.048	0.25	9.83
06-29-2021	21TP03 0.9M	<10	<10	<20	141	70	<0.0050	<0.050	<0.010	<0.10	40.3
06-29-2021	T21TP03 1.2M	<10	<10	<20	31	<20	<0.0050	<0.050	<0.010	<0.10	25.5
06-29-2021	21TP04 0.3M	<10	<10	<20	165	37	0.0163	0.069	0.028	0.17	9.11
06-29-2021	21TP04 0.8M	<10	<10	<20	52	<20	<0.0050	<0.050	<0.010	<0.10	24.8
06-29-2021	21TP04 1.2M	<10	<10	<20	46	<20	<0.0050	<0.050	<0.010	<0.10	26.3

Legend
mg/kg milligrams per kilogram
Dup blind field duplicate sample
RPD relative percent difference (-- indicates incalculable as below or within five times the detection limits)

Applicable Guidelines

- GNWT Environmental Guideline for Contaminated Site Remediation (2003); most stringent values for commercial land use, coarse soils, surface

Notes

- Analytical data reported by ALS Analytical (Work Order #: L2609104)

Table 2
Client: NTPC
Project: Aklavik Remediation NTPC
KBL File #: 21-051NT

						Inorganics		Total Metals																		
					Total Petroleum Hydrocarbons (calculated)																					
		F2	F3	F4		pH	Moisture	Antimony (Sb)	Arsenic (As)	Barium (Ba)	Beryllium (Be)	Cadmium (Cd)	Chromium (Cr)	Cobalt (Co)	Copper (Cu)	Lead (Pb)	Molybdenum (Mo)	Nickel (Ni)	Selenium (Se)	Silver (Ag)	Thallium (Tl)	Tin (Sn)	Uranium (U)	Vanadium (V)	Zinc (Zn)	Mercury (Hg)
Inuvik STF Acceptance Limit		-	-	-	30,000	8	-	40	123	2000	8	22	87	300	91	600	40	89	2.9	40	1	300	300	130	360	50
Date	Field ID																									
10-24-2021	21BH01	1310	5190	335	6835	7.72	18.1	0.64	12.8	381	0.43	0.61	15	8.55	25	11.4	1.54	26.9	0.78	0.15	0.135	<2.0	0.709	35.2	111	0.101
10-24-2021	21BH02	975	4870	312	6157	7.94	17.8	0.62	12.9	414	0.46	0.519	15.8	8.92	22.3	12.2	1.61	28.1	0.8	0.15	0.14	<2.0	0.75	37.2	103	0.132
10-24-2021	21BH03	1000	4810	382	6192	7.96	17.7	0.62	13.8	421	0.45	0.488	14.2	8.57	20.6	11.5	2.02	27	0.76	0.14	0.136	<2.0	0.725	36.5	97.2	0.102
10-24-2021	21BH04	1270	4120	231	5621	7.94	19.8	0.67	14.4	494	0.5	0.596	17.6	9.91	24.5	13.7	1.71	31.7	0.85	0.17	0.159	<2.0	0.886	40.9	114	0.11
10-24-2021	21BH05	768	3390	244	4402	7.99	20.9	0.62	13.1	427	0.46	0.502	15.7	8.68	22.6	12.2	1.61	28	0.84	0.15	0.143	<2.0	0.783	36.2	99.8	0.0959
10-24-2021	21BH06	1170	4180	357	5707	7.93	20.7	0.72	15.2	502	0.51	0.627	17.5	10.1	25.9	14.2	1.9	32.3	0.93	0.17	0.164	<2.0	0.845	42.2	118	0.11

Legend
mg/kg milligrams per kilogram
Dup blind field duplicate sample
RPD relative percent difference (-- indicates incalculable as below or within five times the detection limits)

Applicable Guidelines

- Inuvik STF Water License Permit Acceptance Limit

Notes

- Analytical data reported by ALS Analytical (Work Order #: L2656073)

A horizontal banner with a green background featuring a pattern of overlapping leaf shapes in various shades of green.

APPENDIX E

Certificate of Analysis



KBL Environmental Ltd.
ATTN: David Vanderkley
3601, 75 Avenue
Leduc ab T9E 0Z5

Date Received: 02-JUL-21
Report Date: 09-JUL-21 16:47 (MT)
Version: FINAL

Client Phone: 780-893-3305

Certificate of Analysis

Lab Work Order #: L2609104

Project P.O. #: MM005

Job Reference: 21-051NT

C of C Numbers:

Legal Site Desc:

Oliver Gregg
Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ADDRESS: 314 Old Airport Road, Unit 116, Yellowknife, NT X1A 3T3 Canada | Phone: +1 867 873 5593 |
ALS CANADA LTD Part of the ALS Group An ALS Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2609104-1 21TP01 0.3M Sampled By: CLIENT on 29-JUN-21 @ 08:45 Matrix: SOIL CCME BTEX, F1 TO F4 BTEX and F1 Benzene Toluene Ethylbenzene Xylenes m+p-Xylene o-Xylene Surrogate: 1,4-Difluorobenzene (SS) Surrogate: 4-Bromofluorobenzene (SS) Surrogate: 3,4-Dichlorotoluene (SS) CCME Total Extractable Hydrocarbons Surrogate: 2-Bromobenzotrifluoride Chrom. to baseline at nC50 Prep/Analysis Dates CCME Total Hydrocarbons F1 (C6-C10) F1-BTEX F2 (C10-C16) F3 (C16-C34) F4 (C34-C50) Total Hydrocarbons (C6-C50) Miscellaneous Parameters % Moisture	0.0153 0.061 0.028 0.15 0.094 0.056 108.0 121.5 78.6 88.3 YES 10 10 23 314 63 400 9.63		0.0050 0.050 0.010 0.10 0.050 0.050 70-130 70-130 70-130 70-130 10 10 20 20 20 20 0.25	mg/kg mg/kg mg/kg mg/kg mg/kg mg/kg % % % % mg/kg mg/kg mg/kg mg/kg mg/kg mg/kg %	29-JUN-21 29-JUN-21 29-JUN-21 29-JUN-21 29-JUN-21 29-JUN-21 29-JUN-21 29-JUN-21 29-JUN-21 07-JUL-21 07-JUL-21 07-JUL-21 05-JUL-21	08-JUL-21 08-JUL-21 08-JUL-21 08-JUL-21 08-JUL-21 08-JUL-21 08-JUL-21 08-JUL-21 08-JUL-21 07-JUL-21 07-JUL-21 07-JUL-21 09-JUL-21	R5508763 R5508763 R5508763 R5508763 R5508763 R5508763 R5508763 R5508763 R5508763 R5514166 R5514166 R5514166 R5511919
L2609104-2 21TP01 0.8M Sampled By: CLIENT on 29-JUN-21 @ 08:55 Matrix: SOIL CCME BTEX, F1 TO F4 BTEX and F1 Benzene Toluene Ethylbenzene Xylenes m+p-Xylene o-Xylene Surrogate: 1,4-Difluorobenzene (SS) Surrogate: 4-Bromofluorobenzene (SS) Surrogate: 3,4-Dichlorotoluene (SS) CCME Total Extractable Hydrocarbons Surrogate: 2-Bromobenzotrifluoride Chrom. to baseline at nC50 Prep/Analysis Dates CCME Total Hydrocarbons F1 (C6-C10) F1-BTEX F2 (C10-C16) F3 (C16-C34) F4 (C34-C50) Total Hydrocarbons (C6-C50) Miscellaneous Parameters % Moisture	<0.0050 <0.050 <0.010 <0.10 <0.050 <0.050 99.6 104.1 87.7 89.7 YES 10 10 20 35 20 35 25.4		0.0050 0.050 0.010 0.10 0.050 0.050 70-130 70-130 70-130 70-130 10 10 20 20 20 20 0.25	mg/kg mg/kg mg/kg mg/kg mg/kg mg/kg % % % % mg/kg mg/kg mg/kg mg/kg mg/kg mg/kg %	29-JUN-21 29-JUN-21 29-JUN-21 29-JUN-21 29-JUN-21 29-JUN-21 29-JUN-21 29-JUN-21 29-JUN-21 07-JUL-21 07-JUL-21 07-JUL-21 05-JUL-21	08-JUL-21 08-JUL-21 08-JUL-21 08-JUL-21 08-JUL-21 08-JUL-21 08-JUL-21 08-JUL-21 08-JUL-21 07-JUL-21 07-JUL-21 07-JUL-21 09-JUL-21	R5508763 R5508763 R5508763 R5508763 R5508763 R5508763 R5508763 R5508763 R5508763 R5514166 R5514166 R5514166 R5511919

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters		Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2609104-5	21TP02 0.9M							
Sampled By:	CLIENT on 29-JUN-21 @ 09:35							
Matrix:	SOIL							
CCME BTEX, F1 TO F4								
BTEX and F1								
Benzene		<0.0050		0.0050	mg/kg	29-JUN-21	08-JUL-21	R5508763
Toluene		<0.050		0.050	mg/kg	29-JUN-21	08-JUL-21	R5508763
Ethylbenzene		<0.010		0.010	mg/kg	29-JUN-21	08-JUL-21	R5508763
Xylenes		<0.10		0.10	mg/kg	29-JUN-21	08-JUL-21	R5508763
m+p-Xylene		<0.050		0.050	mg/kg	29-JUN-21	08-JUL-21	R5508763
o-Xylene		<0.050		0.050	mg/kg	29-JUN-21	08-JUL-21	R5508763
Surrogate: 1,4-Difluorobenzene (SS)		115.1		70-130	%	29-JUN-21	08-JUL-21	R5508763
Surrogate: 4-Bromofluorobenzene (SS)		113.4		70-130	%	29-JUN-21	08-JUL-21	R5508763
Surrogate: 3,4-Dichlorotoluene (SS)		95.6		70-130	%	29-JUN-21	08-JUL-21	R5508763
CCME Total Extractable Hydrocarbons								
Surrogate: 2-Bromobenzotrifluoride		88.7		70-130	%	07-JUL-21	07-JUL-21	R5513359
Chrom. to baseline at nC50		YES				07-JUL-21	07-JUL-21	R5513359
Prep/Analysis Dates						07-JUL-21	07-JUL-21	R5513359
CCME Total Hydrocarbons								
F1 (C6-C10)		<10		10	mg/kg		09-JUL-21	
F1-BTEX		<10		10	mg/kg		09-JUL-21	
F2 (C10-C16)		<20		20	mg/kg		09-JUL-21	
F3 (C16-C34)		102		20	mg/kg		09-JUL-21	
F4 (C34-C50)		29		20	mg/kg		09-JUL-21	
Total Hydrocarbons (C6-C50)		131		20	mg/kg		09-JUL-21	
Miscellaneous Parameters								
% Moisture		25.4		0.25	%		05-JUL-21	R5511919
L2609104-6	21TP02 1.3M							
Sampled By:	CLIENT on 29-JUN-21 @ 09:55							
Matrix:	SOIL							
CCME BTEX, F1 TO F4								
BTEX and F1								
Benzene		<0.0050		0.0050	mg/kg	29-JUN-21	08-JUL-21	R5508763
Toluene		<0.050		0.050	mg/kg	29-JUN-21	08-JUL-21	R5508763
Ethylbenzene		<0.010		0.010	mg/kg	29-JUN-21	08-JUL-21	R5508763
Xylenes		<0.10		0.10	mg/kg	29-JUN-21	08-JUL-21	R5508763
m+p-Xylene		<0.050		0.050	mg/kg	29-JUN-21	08-JUL-21	R5508763
o-Xylene		<0.050		0.050	mg/kg	29-JUN-21	08-JUL-21	R5508763
Surrogate: 1,4-Difluorobenzene (SS)		98.3		70-130	%	29-JUN-21	08-JUL-21	R5508763
Surrogate: 4-Bromofluorobenzene (SS)		96.0		70-130	%	29-JUN-21	08-JUL-21	R5508763
Surrogate: 3,4-Dichlorotoluene (SS)		85.8		70-130	%	29-JUN-21	08-JUL-21	R5508763
CCME Total Extractable Hydrocarbons								
Surrogate: 2-Bromobenzotrifluoride		89.3		70-130	%	07-JUL-21	07-JUL-21	R5513359
Chrom. to baseline at nC50		YES				07-JUL-21	07-JUL-21	R5513359
Prep/Analysis Dates						07-JUL-21	07-JUL-21	R5513359
CCME Total Hydrocarbons								
F1 (C6-C10)		<10		10	mg/kg		09-JUL-21	
F1-BTEX		<10		10	mg/kg		09-JUL-21	
F2 (C10-C16)		<20		20	mg/kg		09-JUL-21	
F3 (C16-C34)		22		20	mg/kg		09-JUL-21	
F4 (C34-C50)		<20		20	mg/kg		09-JUL-21	
Total Hydrocarbons (C6-C50)		22		20	mg/kg		09-JUL-21	
Miscellaneous Parameters								
% Moisture		22.2		0.25	%		05-JUL-21	R5511919

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2609104-7 21TP03 0.4M Sampled By: CLIENT on 29-JUN-21 @ 10:05 Matrix: SOIL CCME BTEX, F1 TO F4 BTEX and F1 Benzene 0.0114 0.0050 mg/kg 29-JUN-21 08-JUL-21 R5508763 Toluene 0.062 0.050 mg/kg 29-JUN-21 08-JUL-21 R5508763 Ethylbenzene 0.048 0.010 mg/kg 29-JUN-21 08-JUL-21 R5508763 Xylenes 0.25 0.10 mg/kg 29-JUN-21 08-JUL-21 R5508763 m+p-Xylene 0.175 0.050 mg/kg 29-JUN-21 08-JUL-21 R5508763 o-Xylene 0.078 0.050 mg/kg 29-JUN-21 08-JUL-21 R5508763 Surrogate: 1,4-Difluorobenzene (SS) 92.9 70-130 % 29-JUN-21 08-JUL-21 R5508763 Surrogate: 4-Bromofluorobenzene (SS) 116.6 70-130 % 29-JUN-21 08-JUL-21 R5508763 Surrogate: 3,4-Dichlorotoluene (SS) 103.2 70-130 % 29-JUN-21 08-JUL-21 R5508763 CCME Total Extractable Hydrocarbons Surrogate: 2-Bromobenzotrifluoride 88.3 70-130 % 07-JUL-21 07-JUL-21 R5513359 Chrom. to baseline at nC50 YES 07-JUL-21 07-JUL-21 R5513359 Prep/Analysis Dates 07-JUL-21 07-JUL-21 R5513359 CCME Total Hydrocarbons F1 (C6-C10) <10 10 mg/kg 09-JUL-21 F1-BTEX <10 10 mg/kg 09-JUL-21 F2 (C10-C16) 27 20 mg/kg 09-JUL-21 F3 (C16-C34) 344 20 mg/kg 09-JUL-21 F4 (C34-C50) 96 20 mg/kg 09-JUL-21 Total Hydrocarbons (C6-C50) 467 20 mg/kg 09-JUL-21 Miscellaneous Parameters % Moisture 9.83 0.25 % 05-JUL-21 R5511919							
L2609104-8 21TP03 0.9M Sampled By: CLIENT on 29-JUN-21 @ 10:15 Matrix: SOIL CCME BTEX, F1 TO F4 BTEX and F1 Benzene <0.0050 0.0050 mg/kg 29-JUN-21 08-JUL-21 R5508763 Toluene <0.050 0.050 mg/kg 29-JUN-21 08-JUL-21 R5508763 Ethylbenzene <0.010 0.010 mg/kg 29-JUN-21 08-JUL-21 R5508763 Xylenes <0.10 0.10 mg/kg 29-JUN-21 08-JUL-21 R5508763 m+p-Xylene <0.050 0.050 mg/kg 29-JUN-21 08-JUL-21 R5508763 o-Xylene <0.050 0.050 mg/kg 29-JUN-21 08-JUL-21 R5508763 Surrogate: 1,4-Difluorobenzene (SS) 80.4 70-130 % 29-JUN-21 08-JUL-21 R5508763 Surrogate: 4-Bromofluorobenzene (SS) 81.7 70-130 % 29-JUN-21 08-JUL-21 R5508763 Surrogate: 3,4-Dichlorotoluene (SS) 75.4 70-130 % 29-JUN-21 08-JUL-21 R5508763 CCME Total Extractable Hydrocarbons Surrogate: 2-Bromobenzotrifluoride 91.5 70-130 % 07-JUL-21 07-JUL-21 R5513359 Chrom. to baseline at nC50 YES 07-JUL-21 07-JUL-21 R5513359 Prep/Analysis Dates 07-JUL-21 07-JUL-21 R5513359 CCME Total Hydrocarbons F1 (C6-C10) <10 10 mg/kg 09-JUL-21 F1-BTEX <10 10 mg/kg 09-JUL-21 F2 (C10-C16) <20 20 mg/kg 09-JUL-21 F3 (C16-C34) 141 20 mg/kg 09-JUL-21 F4 (C34-C50) 70 20 mg/kg 09-JUL-21 Total Hydrocarbons (C6-C50) 211 20 mg/kg 09-JUL-21 Miscellaneous Parameters % Moisture 40.3 0.25 % 05-JUL-21 R5511919							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2609104-9 T21TP03 1.2M Sampled By: CLIENT on 29-JUN-21 @ 10:35 Matrix: SOIL CCME BTEX, F1 TO F4 BTEX and F1 Benzene							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2609104-13 21DUP01 0.4M Sampled By: CLIENT on 29-JUN-21 @ 11:25 Matrix: SOIL CCME BTEX, F1 TO F4 BTEX and F1 Benzene 0.0077 0.0050 mg/kg 29-JUN-21 08-JUL-21 R5508763 Toluene 0.054 0.050 mg/kg 29-JUN-21 08-JUL-21 R5508763 Ethylbenzene 0.037 0.010 mg/kg 29-JUN-21 08-JUL-21 R5508763 Xylenes 0.25 0.10 mg/kg 29-JUN-21 08-JUL-21 R5508763 m+p-Xylene 0.143 0.050 mg/kg 29-JUN-21 08-JUL-21 R5508763 o-Xylene 0.105 0.050 mg/kg 29-JUN-21 08-JUL-21 R5508763 Surrogate: 1,4-Difluorobenzene (SS) 109.6 70-130 % 29-JUN-21 08-JUL-21 R5508763 Surrogate: 4-Bromofluorobenzene (SS) 104.3 70-130 % 29-JUN-21 08-JUL-21 R5508763 Surrogate: 3,4-Dichlorotoluene (SS) 88.9 70-130 % 29-JUN-21 08-JUL-21 R5508763 CCME Total Extractable Hydrocarbons Surrogate: 2-Bromobenzotrifluoride 87.6 70-130 % 07-JUL-21 07-JUL-21 R5513359 Chrom. to baseline at nC50 YES 07-JUL-21 07-JUL-21 R5513359 Prep/Analysis Dates 07-JUL-21 07-JUL-21 R5513359 CCME Total Hydrocarbons F1 (C6-C10) <10 10 mg/kg 09-JUL-21 F1-BTEX <10 10 mg/kg 09-JUL-21 F2 (C10-C16) <20 20 mg/kg 09-JUL-21 F3 (C16-C34) 245 20 mg/kg 09-JUL-21 F4 (C34-C50) 71 20 mg/kg 09-JUL-21 Total Hydrocarbons (C6-C50) 316 20 mg/kg 09-JUL-21 Miscellaneous Parameters % Moisture 17.7 0.25 % 05-JUL-21 R5512398							
L2609104-14 21DUP01 0.9M Sampled By: CLIENT on 29-JUN-21 @ 11:35 Matrix: SOIL CCME BTEX, F1 TO F4 BTEX and F1 Benzene <0.0050 0.0050 mg/kg 29-JUN-21 08-JUL-21 R5508763 Toluene <0.050 0.050 mg/kg 29-JUN-21 08-JUL-21 R5508763 Ethylbenzene <0.010 0.010 mg/kg 29-JUN-21 08-JUL-21 R5508763 Xylenes <0.10 0.10 mg/kg 29-JUN-21 08-JUL-21 R5508763 m+p-Xylene <0.050 0.050 mg/kg 29-JUN-21 08-JUL-21 R5508763 o-Xylene <0.050 0.050 mg/kg 29-JUN-21 08-JUL-21 R5508763 Surrogate: 1,4-Difluorobenzene (SS) 94.6 70-130 % 29-JUN-21 08-JUL-21 R5508763 Surrogate: 4-Bromofluorobenzene (SS) 98.4 70-130 % 29-JUN-21 08-JUL-21 R5508763 Surrogate: 3,4-Dichlorotoluene (SS) 79.5 70-130 % 29-JUN-21 08-JUL-21 R5508763 CCME Total Extractable Hydrocarbons Surrogate: 2-Bromobenzotrifluoride 87.9 70-130 % 07-JUL-21 07-JUL-21 R5513359 Chrom. to baseline at nC50 YES 07-JUL-21 07-JUL-21 R5513359 Prep/Analysis Dates 07-JUL-21 07-JUL-21 R5513359 CCME Total Hydrocarbons F1 (C6-C10) <10 10 mg/kg 09-JUL-21 F1-BTEX <10 10 mg/kg 09-JUL-21 F2 (C10-C16) <20 20 mg/kg 09-JUL-21 F3 (C16-C34) 47 20 mg/kg 09-JUL-21 F4 (C34-C50) <20 20 mg/kg 09-JUL-21 Total Hydrocarbons (C6-C50) 47 20 mg/kg 09-JUL-21 Miscellaneous Parameters % Moisture 24.5 0.25 % 05-JUL-21 R5512398							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
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BTXS,F1-MEOH-ED	Soil	BTEX and F1	EPA 8260C/5021A and CWS PHC Tier 1
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This analysis involves the extraction of a subsample of the sediment/soil with methanol added in the field at the time of subsampling. The soil methanol extract is added to water and reagents, then heated in a sealed vial to equilibrium. The headspace from the vial is transferred into a gas chromatograph. BTX Target compound concentrations are measured using mass spectrometry detection. The instrumental portion of F1 analysis is carried out in accordance with the Canada Wide Standard for Petroleum Hydrocarbons in Soil - Tier 1 Method (2001).

ETL-TVH,TEH-CCME-ED	Soil	CCME Total Hydrocarbons	CCME CWS-PHC, Pub #1310, Dec 2001
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Analytical methods used for analysis of CCME Petroleum Hydrocarbons have been validated and comply with the Reference Method for the CWS PHC.

Hydrocarbon results are expressed on a dry weight basis.

In cases where results for both F4 and F4G are reported, the greater of the two results must be used in any application of the CWS PHC guidelines and the gravimetric heavy hydrocarbons cannot be added to the C6 to C50 hydrocarbons.

In samples where BTEX and F1 were analyzed, F1-BTEX represents a value where the sum of Benzene, Toluene, Ethylbenzene and total Xylenes has been subtracted from F1.

In samples where PAHs, F2 and F3 were analyzed, F2-Naphth represents the result where Naphthalene has been subtracted from F2. F3-PAH represents a result where the sum of Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Dibenzo(a,h)anthracene, Fluoranthene, Indeno(1,2,3-cd)pyrene, Phenanthrene, and Pyrene has been subtracted from F3.

Unless otherwise qualified, the following quality control criteria have been met for the F1 hydrocarbon range:

1. All extraction and analysis holding times were met.
2. Instrument performance showing response factors for C6 and C10 within 30% of the response factor for toluene.
3. Linearity of gasoline response within 15% throughout the calibration range.

Unless otherwise qualified, the following quality control criteria have been met for the F2-F4 hydrocarbon ranges:

1. All extraction and analysis holding times were met.
2. Instrument performance showing C10, C16 and C34 response factors within 10% of their average.
3. Instrument performance showing the C50 response factor within 30% of the average of the C10, C16 and C34 response factors.
4. Linearity of diesel or motor oil response within 15% throughout the calibration range.

F2-4-TMB-ED	Soil	CCME Total Extractable Hydrocarbons	CCME CWS-PHC, Pub #1310, Dec 2001
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This analysis is carried out in accordance with the "Reference Method for the Canada-Wide Standard for Petroleum Hydrocarbons in Soil - Tier 1 Method, Canadian Council of Ministers of the Environment" For C10 to C50 hydrocarbons (F2, F3, F4) and gravimetric heavy hydrocarbons (F4G-sg), a subsample of the sediment/soil is extracted with 1:1 hexane:acetone using a rotary extractor. The extract undergoes a silica-gel clean-up to remove polar compounds. F2, F3 & F4 are analyzed by on-column GC/FID, and F4G-sg is analyzed gravimetrically.

Notes:

1. F2 (C10-C16): Sum of all hydrocarbons that elute between nC10 and nC16.
2. F3 (C16-C34): Sum of all hydrocarbons that elute between nC16 and nC34.
3. F4 (C34-C50): Sum of all hydrocarbons that elute between nC34 and nC50.
4. F4G: Gravimetric Heavy Hydrocarbons
5. F4G-sg: Gravimetric Heavy Hydrocarbons (F4G) after silica gel treatment.
6. Where F4 (C34-C50) and F4G-sg results are reported for a sample, the larger of the reported values is used for comparison against the relevant CCME standard for F4.
7. The gravimetric heavy hydrocarbon results (F4G-sg), cannot be added to the C6 to C50 hydrocarbon results.
8. This method is validated for use.
9. Data from analysis of quality control samples is available upon request.
10. Reported results are expressed as milligrams per dry kilogram.

PREP-MOISTURE-ED	Soil	% Moisture	CCME PHC in Soil - Tier 1 (mod)
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The weighed portion of soil is placed in a 105°C oven to dry to a constant weight; the drying time will vary based on the moisture content of the soil. The dried soil weight is then used to calculate % moisture.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

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
ED	ALS ENVIRONMENTAL - EDMONTON, ALBERTA, CANADA

Chain of Custody Numbers:

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
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GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg ww - milligrams per kilogram based on wet weight of sample
mg/kg lw - milligrams per kilogram based on lipid-adjusted weight
mg/L - unit of concentration based on volume, parts per million.

< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Workorder: L2609104

Report Date: 09-JUL-21

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Client: KBL Environmental Ltd.

3601, 75 Avenue

Leduc ab T9E 0Z5

Contact: David Vanderkley

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
BTXS,F1-MEOH-ED Soil								
Batch	R5508763							
WG3569267-2	LCS							
Benzene			113.9		%		70-130	08-JUL-21
Toluene			105.9		%		70-130	08-JUL-21
Ethylbenzene			90.1		%		70-130	08-JUL-21
m+p-Xylene			104.9		%		70-130	08-JUL-21
o-Xylene			103.0		%		70-130	08-JUL-21
WG3569267-1	MB							
Benzene			<0.0050		mg/kg		0.005	08-JUL-21
Toluene			<0.050		mg/kg		0.05	08-JUL-21
Ethylbenzene			<0.010		mg/kg		0.01	08-JUL-21
m+p-Xylene			<0.050		mg/kg		0.05	08-JUL-21
o-Xylene			<0.050		mg/kg		0.05	08-JUL-21
Surrogate: 1,4-Difluorobenzene (SS)			102.2		%		70-130	08-JUL-21
Surrogate: 4-Bromofluorobenzene (SS)			93.7		%		70-130	08-JUL-21
Surrogate: 3,4-Dichlorotoluene (SS)			104.6		%		70-130	08-JUL-21
F2-4-TMB-ED Soil								
Batch	R5513359							
WG3569961-4	DUP	L2609104-15						
F2 (C10-C16)		<20	<20	RPD-NA	mg/kg	N/A	40	07-JUL-21
F3 (C16-C34)		25	21		mg/kg	19	40	07-JUL-21
F4 (C34-C50)		<20	<20	RPD-NA	mg/kg	N/A	40	07-JUL-21
WG3569961-3	IRM	ALS PHC RM3						
F2 (C10-C16)			95.4		%		70-130	07-JUL-21
F3 (C16-C34)			95.7		%		70-130	07-JUL-21
F4 (C34-C50)			91.7		%		70-130	07-JUL-21
WG3569961-2	LCS	DIESEL/MOTOR OIL						
F2 (C10-C16)			112.5		%		70-130	07-JUL-21
F3 (C16-C34)			116.6		%		70-130	07-JUL-21
F4 (C34-C50)			117.9		%		70-130	07-JUL-21
WG3569961-1	MB							
F2 (C10-C16)			<20		mg/kg		20	07-JUL-21
F3 (C16-C34)			<20		mg/kg		20	07-JUL-21
F4 (C34-C50)			<20		mg/kg		20	07-JUL-21
Surrogate: 2-Bromobenzotrifluoride			93.4		%		70-130	07-JUL-21

Quality Control Report

Workorder: L2609104

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Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
F2-4-TMB-ED		Soil						
Batch	R5514166							
WG3570621-3	IRM	ALS PHC RM3						
F2 (C10-C16)			93.4		%		70-130	07-JUL-21
F3 (C16-C34)			93.2		%		70-130	07-JUL-21
F4 (C34-C50)			89.9		%		70-130	07-JUL-21
WG3570621-2	LCS	DIESEL/MOTOR OIL						
F2 (C10-C16)			104.8		%		70-130	07-JUL-21
F3 (C16-C34)			111.6		%		70-130	07-JUL-21
F4 (C34-C50)			114.2		%		70-130	07-JUL-21
WG3570621-1	MB							
F2 (C10-C16)			<20		mg/kg		20	07-JUL-21
F3 (C16-C34)			<20		mg/kg		20	07-JUL-21
F4 (C34-C50)			<20		mg/kg		20	07-JUL-21
Surrogate: 2-Bromobenzotrifluoride			91.0		%		70-130	07-JUL-21
PREP-MOISTURE-ED		Soil						
Batch	R5511919							
WG3568994-3	DUP	L2609104-9						
% Moisture		25.5	25.4		%	0.3	20	05-JUL-21
WG3568994-2	LCS							
% Moisture			99.7		%		90-110	05-JUL-21
WG3568994-1	MB							
% Moisture			<0.25		%		0.25	05-JUL-21
Batch	R5512398							
WG3569105-2	LCS							
% Moisture			100.3		%		90-110	05-JUL-21
WG3569105-1	MB							
% Moisture			<0.25		%		0.25	05-JUL-21

Quality Control Report

Workorder: L2609104

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Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.



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1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form

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1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.



KBL Environmental Ltd.
ATTN: David Vanderkley
3601, 75 Avenue
Leduc ab T9E 0Z5

Date Received: 26-OCT-21
Report Date: 16-NOV-21 13:03 (MT)
Version: FINAL REV. 2

Client Phone: 780-893-3305

Certificate of Analysis

Lab Work Order #: L2656073

Project P.O. #: MM025

Job Reference: 21-051NT

C of C Numbers:

Legal Site Desc:

Comments: ADDITIONAL 08-NOV-21 11:31



Oliver Gregg
Account Manager

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ADDRESS: 314 Old Airport Road, Unit 116, Yellowknife, NT X1A 3T3 Canada | Phone: +1 867 873 5593 |
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* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters		Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2656073-2	21BH02							
Sampled By:	CLIENT on 24-OCT-21							
Matrix:	SOIL							
Metals in Soil by CRC ICPMS								
Silver (Ag)		0.15		0.10	mg/kg	04-NOV-21	04-NOV-21	R5636172
Thallium (Tl)		0.140		0.050	mg/kg	04-NOV-21	04-NOV-21	R5636172
Tin (Sn)		<2.0		2.0	mg/kg	04-NOV-21	04-NOV-21	R5636172
Uranium (U)		0.750		0.050	mg/kg	04-NOV-21	04-NOV-21	R5636172
Vanadium (V)		37.2		0.20	mg/kg	04-NOV-21	04-NOV-21	R5636172
Zinc (Zn)		103		2.0	mg/kg	04-NOV-21	04-NOV-21	R5636172
Miscellaneous Parameters								
% Moisture		17.8		0.25	%		29-OCT-21	R5633079
pH (1:2 soil:water)		7.94		0.10	pH		04-NOV-21	R5636189
CCME Total Extractable Hydrocarbons								
Surrogate: 2-Bromobenzotrifluoride		91.7		70-130	%	31-OCT-21	31-OCT-21	R5633421
Chrom. to baseline at nC50		YES				31-OCT-21	31-OCT-21	R5633421
Prep/Analysis Dates						31-OCT-21	31-OCT-21	R5633421
CCME Total Hydrocarbons								
F2 (C10-C16)		975		20	mg/kg		31-OCT-21	
F3 (C16-C34)		4870		20	mg/kg		31-OCT-21	
F4 (C34-C50)		312		20	mg/kg		31-OCT-21	
L2656073-3	21BH03							
Sampled By:	CLIENT on 24-OCT-21							
Matrix:	SOIL							
Metals in Soil by ICPMS (CCME)								
Mercury in Soil by CVAAS								
Mercury (Hg)		0.102		0.0050	mg/kg	04-NOV-21	04-NOV-21	R5636119
Metals in Soil by CRC ICPMS								
Antimony (Sb)		0.62		0.10	mg/kg	04-NOV-21	04-NOV-21	R5636172
Arsenic (As)		13.8		0.10	mg/kg	04-NOV-21	04-NOV-21	R5636172
Barium (Ba)		421		0.50	mg/kg	04-NOV-21	04-NOV-21	R5636172
Beryllium (Be)		0.45		0.10	mg/kg	04-NOV-21	04-NOV-21	R5636172
Cadmium (Cd)		0.488		0.020	mg/kg	04-NOV-21	04-NOV-21	R5636172
Chromium (Cr)		14.2		0.50	mg/kg	04-NOV-21	04-NOV-21	R5636172
Cobalt (Co)		8.57		0.10	mg/kg	04-NOV-21	04-NOV-21	R5636172
Copper (Cu)		20.6		0.50	mg/kg	04-NOV-21	04-NOV-21	R5636172
Lead (Pb)		11.5		0.50	mg/kg	04-NOV-21	04-NOV-21	R5636172
Molybdenum (Mo)		2.02		0.10	mg/kg	04-NOV-21	04-NOV-21	R5636172
Nickel (Ni)		27.0		0.50	mg/kg	04-NOV-21	04-NOV-21	R5636172
Selenium (Se)		0.76		0.20	mg/kg	04-NOV-21	04-NOV-21	R5636172
Silver (Ag)		0.14		0.10	mg/kg	04-NOV-21	04-NOV-21	R5636172
Thallium (Tl)		0.136		0.050	mg/kg	04-NOV-21	04-NOV-21	R5636172
Tin (Sn)		<2.0		2.0	mg/kg	04-NOV-21	04-NOV-21	R5636172
Uranium (U)		0.725		0.050	mg/kg	04-NOV-21	04-NOV-21	R5636172
Vanadium (V)		36.5		0.20	mg/kg	04-NOV-21	04-NOV-21	R5636172
Zinc (Zn)		97.2		2.0	mg/kg	04-NOV-21	04-NOV-21	R5636172
Miscellaneous Parameters								
% Moisture		17.7		0.25	%		29-OCT-21	R5633079
pH (1:2 soil:water)		7.96		0.10	pH		04-NOV-21	R5636189
CCME Total Extractable Hydrocarbons								
Surrogate: 2-Bromobenzotrifluoride		90.0		70-130	%	31-OCT-21	31-OCT-21	R5633421
Chrom. to baseline at nC50		YES				31-OCT-21	31-OCT-21	R5633421
Prep/Analysis Dates						31-OCT-21	31-OCT-21	R5633421
CCME Total Hydrocarbons								
F2 (C10-C16)		1000		20	mg/kg		31-OCT-21	

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2656073-3 21BH03 Sampled By: CLIENT on 24-OCT-21 Matrix: SOIL CCME Total Hydrocarbons F3 (C16-C34) F4 (C34-C50)	 4810 382		 20 20	 mg/kg mg/kg		 31-OCT-21 31-OCT-21	
L2656073-4 21BH04 Sampled By: CLIENT on 24-OCT-21 Matrix: SOIL Metals in Soil by ICPMS (CCME) Mercury in Soil by CVAAS Mercury (Hg) Metals in Soil by CRC ICPMS Antimony (Sb) Arsenic (As) Barium (Ba) Beryllium (Be) Cadmium (Cd) Chromium (Cr) Cobalt (Co) Copper (Cu) Lead (Pb) Molybdenum (Mo) Nickel (Ni) Selenium (Se) Silver (Ag) Thallium (Tl) Tin (Sn) Uranium (U) Vanadium (V) Zinc (Zn) Miscellaneous Parameters % Moisture pH (1:2 soil:water) CCME Total Extractable Hydrocarbons Surrogate: 2-Bromobenzotrifluoride Chrom. to baseline at nC50 Prep/Analysis Dates CCME Total Hydrocarbons F2 (C10-C16) F3 (C16-C34) F4 (C34-C50)	 0.110 0.67 14.4 494 0.50 0.596 17.6 9.91 24.5 13.7 1.71 31.7 0.85 0.17 0.159 <2.0 0.886 40.9 114 19.8 7.94 93.1 YES 1270 4120 231		 0.0050 0.10 0.10 0.50 0.10 0.020 0.50 0.10 0.50 0.50 0.10 0.50 0.10 0.20 0.10 0.050 2.0 0.050 0.20 2.0 0.25 0.10 70-130 20 20 20	 mg/kg mg/kg % pH % mg/kg mg/kg mg/kg	 04-NOV-21 04-NOV-21 29-OCT-21 04-NOV-21 31-OCT-21 31-OCT-21 31-OCT-21 31-OCT-21 31-OCT-21 31-OCT-21	 04-NOV-21 04-NOV-21 04-NOV-21 04-NOV-21 04-NOV-21 04-NOV-21 04-NOV-21 04-NOV-21 04-NOV-21 04-NOV-21 04-NOV-21 04-NOV-21 04-NOV-21 04-NOV-21 04-NOV-21 04-NOV-21 04-NOV-21 04-NOV-21 04-NOV-21 04-NOV-21 04-NOV-21 04-NOV-21 04-NOV-21 04-NOV-21 04-NOV-21 04-NOV-21	 R5636119 R5636172 R5636172 R5636172 R5636172 R5636172 R5636172 R5636172 R5636172 R5636172 R5636172 R5636172 R5636172 R5636172 R5636172 R5636172 R5636172 R5636172 R5636172 R5636172 R5633079 R5636189 R5633421 R5633421 R5633421 31-OCT-21 31-OCT-21 31-OCT-21
L2656073-5 21BH05 Sampled By: CLIENT on 24-OCT-21 Matrix: SOIL Metals in Soil by ICPMS (CCME) Mercury in Soil by CVAAS Mercury (Hg) Metals in Soil by CRC ICPMS Antimony (Sb) Arsenic (As) Barium (Ba) Beryllium (Be) Cadmium (Cd) Chromium (Cr)	 0.0959 0.62 13.1 427 0.46 0.502 15.7		 0.0050 0.10 0.10 0.50 0.10 0.020 0.50	 mg/kg mg/kg mg/kg mg/kg mg/kg mg/kg mg/kg mg/kg mg/kg	 04-NOV-21 04-NOV-21 04-NOV-21 04-NOV-21 04-NOV-21 04-NOV-21 04-NOV-21 04-NOV-21 04-NOV-21	 04-NOV-21 04-NOV-21 04-NOV-21 04-NOV-21 04-NOV-21 04-NOV-21 04-NOV-21 04-NOV-21 04-NOV-21	 R5636119 R5636172 R5636172 R5636172 R5636172 R5636172 R5636172 R5636172

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2656073-5 21BH05 Sampled By: CLIENT on 24-OCT-21 Matrix: SOIL Metals in Soil by CRC ICPMS Cobalt (Co) 8.68 0.10 mg/kg 04-NOV-21 04-NOV-21 R5636172 Copper (Cu) 22.6 0.50 mg/kg 04-NOV-21 04-NOV-21 R5636172 Lead (Pb) 12.2 0.50 mg/kg 04-NOV-21 04-NOV-21 R5636172 Molybdenum (Mo) 1.61 0.10 mg/kg 04-NOV-21 04-NOV-21 R5636172 Nickel (Ni) 28.0 0.50 mg/kg 04-NOV-21 04-NOV-21 R5636172 Selenium (Se) 0.84 0.20 mg/kg 04-NOV-21 04-NOV-21 R5636172 Silver (Ag) 0.15 0.10 mg/kg 04-NOV-21 04-NOV-21 R5636172 Thallium (Tl) 0.143 0.050 mg/kg 04-NOV-21 04-NOV-21 R5636172 Tin (Sn) <2.0 2.0 mg/kg 04-NOV-21 04-NOV-21 R5636172 Uranium (U) 0.783 0.050 mg/kg 04-NOV-21 04-NOV-21 R5636172 Vanadium (V) 36.2 0.20 mg/kg 04-NOV-21 04-NOV-21 R5636172 Zinc (Zn) 99.8 2.0 mg/kg 04-NOV-21 04-NOV-21 R5636172 Miscellaneous Parameters % Moisture 20.9 0.25 % 29-OCT-21 R5633079 pH (1:2 soil:water) 7.99 0.10 pH 04-NOV-21 R5636189 CCME Total Extractable Hydrocarbons Surrogate: 2-Bromobenzotrifluoride 90.1 70-130 % 31-OCT-21 31-OCT-21 R5633421 Chrom. to baseline at nC50 YES 31-OCT-21 31-OCT-21 R5633421 Prep/Analysis Dates 31-OCT-21 31-OCT-21 R5633421 CCME Total Hydrocarbons F2 (C10-C16) 768 20 mg/kg 31-OCT-21 F3 (C16-C34) 3390 20 mg/kg 31-OCT-21 F4 (C34-C50) 244 20 mg/kg 31-OCT-21							
L2656073-6 21BH06 Sampled By: CLIENT on 24-OCT-21 Matrix: SOIL Metals in Soil by ICPMS (CCME) Mercury in Soil by CVAAS Mercury (Hg) 0.110 0.0050 mg/kg 04-NOV-21 04-NOV-21 R5636119 Metals in Soil by CRC ICPMS Antimony (Sb) 0.72 0.10 mg/kg 04-NOV-21 04-NOV-21 R5636172 Arsenic (As) 15.2 0.10 mg/kg 04-NOV-21 04-NOV-21 R5636172 Barium (Ba) 502 0.50 mg/kg 04-NOV-21 04-NOV-21 R5636172 Beryllium (Be) 0.51 0.10 mg/kg 04-NOV-21 04-NOV-21 R5636172 Cadmium (Cd) 0.627 0.020 mg/kg 04-NOV-21 04-NOV-21 R5636172 Chromium (Cr) 17.5 0.50 mg/kg 04-NOV-21 04-NOV-21 R5636172 Cobalt (Co) 10.1 0.10 mg/kg 04-NOV-21 04-NOV-21 R5636172 Copper (Cu) 25.9 0.50 mg/kg 04-NOV-21 04-NOV-21 R5636172 Lead (Pb) 14.2 0.50 mg/kg 04-NOV-21 04-NOV-21 R5636172 Molybdenum (Mo) 1.90 0.10 mg/kg 04-NOV-21 04-NOV-21 R5636172 Nickel (Ni) 32.3 0.50 mg/kg 04-NOV-21 04-NOV-21 R5636172 Selenium (Se) 0.93 0.20 mg/kg 04-NOV-21 04-NOV-21 R5636172 Silver (Ag) 0.17 0.10 mg/kg 04-NOV-21 04-NOV-21 R5636172 Thallium (Tl) 0.164 0.050 mg/kg 04-NOV-21 04-NOV-21 R5636172 Tin (Sn) <2.0 2.0 mg/kg 04-NOV-21 04-NOV-21 R5636172 Uranium (U) 0.845 0.050 mg/kg 04-NOV-21 04-NOV-21 R5636172 Vanadium (V) 42.2 0.20 mg/kg 04-NOV-21 04-NOV-21 R5636172 Zinc (Zn) 118 2.0 mg/kg 04-NOV-21 04-NOV-21 R5636172 Miscellaneous Parameters % Moisture 20.7 0.25 % 29-OCT-21 R5633079 pH (1:2 soil:water) 7.93 0.10 pH 04-NOV-21 R5636189							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2656073-6 21BH06 Sampled By: CLIENT on 24-OCT-21 Matrix: SOIL CCME Total Extractable Hydrocarbons Surrogate: 2-Bromobenzotrifluoride Chrom. to baseline at nC50 Prep/Analysis Dates CCME Total Hydrocarbons F2 (C10-C16) F3 (C16-C34) F4 (C34-C50)	 86.6 YES 1170 4180 357		 70-130 20 20 20	 % mg/kg mg/kg mg/kg	 31-OCT-21 31-OCT-21 31-OCT-21	31-OCT-21 31-OCT-21 31-OCT-21 31-OCT-21 31-OCT-21 31-OCT-21	R5633421 R5633421 R5633421
L2656073-7 COMPOSITE Sampled By: CLIENT on 24-OCT-21 Matrix: SOIL % Particles > 75um (Coarse/Fine) % >75um General Texture Class	 35.1 Fine		 1.0	 %		12-NOV-21 12-NOV-21	R5646121 R5646121

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
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ETL-TVH,TEH-CCME-ED	Soil	CCME Total Hydrocarbons	CCME CWS-PHC, Pub #1310, Dec 2001
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Analytical methods used for analysis of CCME Petroleum Hydrocarbons have been validated and comply with the Reference Method for the CWS PHC.

Hydrocarbon results are expressed on a dry weight basis.

In cases where results for both F4 and F4G are reported, the greater of the two results must be used in any application of the CWS PHC guidelines and the gravimetric heavy hydrocarbons cannot be added to the C6 to C50 hydrocarbons.

In samples where BTEX and F1 were analyzed, F1-BTEX represents a value where the sum of Benzene, Toluene, Ethylbenzene and total Xylenes has been subtracted from F1.

In samples where PAHs, F2 and F3 were analyzed, F2-Naphth represents the result where Naphthalene has been subtracted from F2. F3-PAH represents a result where the sum of Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Dibenzo(a,h)anthracene, Fluoranthene, Indeno(1,2,3-cd)pyrene, Phenanthrene, and Pyrene has been subtracted from F3.

Unless otherwise qualified, the following quality control criteria have been met for the F1 hydrocarbon range:

1. All extraction and analysis holding times were met.
2. Instrument performance showing response factors for C6 and C10 within 30% of the response factor for toluene.
3. Linearity of gasoline response within 15% throughout the calibration range.

Unless otherwise qualified, the following quality control criteria have been met for the F2-F4 hydrocarbon ranges:

1. All extraction and analysis holding times were met.
2. Instrument performance showing C10, C16 and C34 response factors within 10% of their average.
3. Instrument performance showing the C50 response factor within 30% of the average of the C10, C16 and C34 response factors.
4. Linearity of diesel or motor oil response within 15% throughout the calibration range.

F2-4-TMB-ED	Soil	CCME Total Extractable Hydrocarbons	CCME Tier 1
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This analysis is carried out in accordance with the "Reference Method for the Canada-Wide Standard for Petroleum Hydrocarbons in Soil - Tier 1 Method, Canadian Council of Ministers of the Environment" For C10 to C50 hydrocarbons (F2, F3, F4) and gravimetric heavy hydrocarbons (F4G-sg), a subsample of the sediment/soil is extracted with 1:1 hexane:acetone using a rotary extractor. The extract undergoes a silica-gel clean-up to remove polar compounds. F2, F3 & F4 are analyzed by on-column GC/FID, and F4G-sg is analyzed gravimetrically.

Notes:

1. F2 (C10-C16): Sum of all hydrocarbons that elute between nC10 and nC16.
2. F3 (C16-C34): Sum of all hydrocarbons that elute between nC16 and nC34.
3. F4 (C34-C50): Sum of all hydrocarbons that elute between nC34 and nC50.
4. F4G: Gravimetric Heavy Hydrocarbons
5. F4G-sg: Gravimetric Heavy Hydrocarbons (F4G) after silica gel treatment.
6. Where F4 (C34-C50) and F4G-sg results are reported for a sample, the larger of the reported values is used for comparison against the relevant CCME standard for F4.
7. The gravimetric heavy hydrocarbon results (F4G-sg), cannot be added to the C6 to C50 hydrocarbon results.
8. This method is validated for use.
9. Data from analysis of quality control samples is available upon request.
10. Reported results are expressed as milligrams per dry kilogram.

HG-200.2-CVAA-ED	Soil	Mercury in Soil by CVAAS	EPA 200.2/1631E (Mod)
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Soil samples are digested with nitric and hydrochloric acids, followed by analysis by CVAAS.

MET-200.2-CCMS-ED	Soil	Metals in Soil by CRC ICPMS	EPA 200.2/6020A (mod)
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Soil/sediment is dried, disaggregated, and sieved (2 mm). Strong Acid Leachable Metals in the <2mm fraction are solubilized by heated digestion with nitric and hydrochloric acids. Instrumental analysis is by Collision / Reaction Cell ICPMS.

Limitations: This method is intended to liberate environmentally available metals. Silicate minerals are not solubilized. Some metals may be only partially recovered (matrix dependent), including Al, Ba, Be, Cr, S, Sr, Ti, Tl, V, W, and Zr. Elemental Sulfur may be poorly recovered by this method. Volatile forms of sulfur (e.g. sulfide, H₂S) may be excluded if lost during sampling, storage, or digestion.

PH-1:2-ED	Soil	pH 1:2 H ₂ O Extract	CSSS 16.2 - PH OF 1:2 WATER EXTRACT
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Soil and de-ionized water (by volume) are mixed in a defined ratio. The slurry is allowed to stand, shaken, and then allowed to stand again prior to taking measurements. After equilibration, the pH of the liquid portion of the extract is measured by a pH meter. Field Measurement is recommended where accurate pH measurements are required, due to the 15 minute recommended hold time.

PREP-MOISTURE-ED	Soil	% Moisture	CCME PHC in Soil - Tier 1 (mod)
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The weighed portion of soil is placed in a 105°C oven to dry to a constant weight; the drying time will vary based on the moisture content of the soil. The dried soil weight is then used to calculate % moisture.

PSA-75UM-SIEVE-ED	Soil	% Particles > 75um (Coarse/Fine)	ASTM D422-63-SIEVE
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An air-dried sample is reduced to < 2 mm size and mixed with a dispersing agent (Calgon solution). The sample is washed through a 200 mesh (75

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
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µm) sieve. The retained weight of sample is used to determine % sand fraction.
Reference: ASTM D422-63

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

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
ED	ALS ENVIRONMENTAL - EDMONTON, ALBERTA, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

mg/kg - milligrams per kilogram based on dry weight of sample

mg/kg ww - milligrams per kilogram based on wet weight of sample

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight

mg/L - unit of concentration based on volume, parts per million.

< - Less than.

D.L. - The reporting limit.

N/A - Result not available. Refer to qualifier code and definition for explanation.

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

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Workorder: L2656073

Report Date: 16-NOV-21

Page 1 of 5

Client: KBL Environmental Ltd.

3601, 75 Avenue

Leduc ab T9E 0Z5

Contact: David Vanderkley

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
F2-4-TMB-ED		Soil						
Batch	R5633421							
WG3648797-4	DUP	L2656073-1						
F2 (C10-C16)		1310	1370		mg/kg	4.7	40	31-OCT-21
F3 (C16-C34)		5190	4990		mg/kg	4.0	40	31-OCT-21
F4 (C34-C50)		335	289		mg/kg	15	40	31-OCT-21
WG3648797-3	IRM	ALS PHC RM3						
F2 (C10-C16)			90.5		%		70-130	31-OCT-21
F3 (C16-C34)			90.8		%		70-130	31-OCT-21
F4 (C34-C50)			86.5		%		70-130	31-OCT-21
WG3648797-2	LCS	DIESEL/MOTOR OIL						
F2 (C10-C16)			108.0		%		70-130	31-OCT-21
F3 (C16-C34)			102.5		%		70-130	31-OCT-21
F4 (C34-C50)			102.9		%		70-130	31-OCT-21
WG3648797-1	MB							
F2 (C10-C16)			<20		mg/kg		20	31-OCT-21
F3 (C16-C34)			<20		mg/kg		20	31-OCT-21
F4 (C34-C50)			<20		mg/kg		20	31-OCT-21
Surrogate: 2-Bromobenzotrifluoride			93.9		%		70-130	31-OCT-21
HG-200.2-CVAA-ED		Soil						
Batch	R5636119							
WG3652321-3	CRM	SCP_SS-2_SOIL						
Mercury (Hg)			98.6		%		70-130	04-NOV-21
WG3652321-4	DUP	L2656073-1						
Mercury (Hg)		0.101	0.0954		mg/kg	6.1	40	04-NOV-21
WG3652321-2	LCS							
Mercury (Hg)			89.0		%		80-120	04-NOV-21
WG3652321-1	MB							
Mercury (Hg)			<0.0050		mg/kg		0.005	04-NOV-21
MET-200.2-CCMS-ED		Soil						
Batch	R5636172							
WG3652321-3	CRM	SCP_SS-2_SOIL						
Antimony (Sb)			98.2		%		70-130	04-NOV-21
Arsenic (As)			94.6		%		70-130	04-NOV-21
Barium (Ba)			96.7		%		70-130	04-NOV-21
Beryllium (Be)			92.8		%		70-130	04-NOV-21
Cadmium (Cd)			90.6		%		70-130	04-NOV-21
Chromium (Cr)			91.3		%		70-130	04-NOV-21
Cobalt (Co)			97.3		%		70-130	04-NOV-21

Quality Control Report

Workorder: L2656073

Report Date: 16-NOV-21

Page 2 of 5

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-ED		Soil						
Batch	R5636172							
WG3652321-3	CRM	SCP_SS-2_SOIL						
Copper (Cu)			98.0		%		70-130	04-NOV-21
Lead (Pb)			92.4		%		70-130	04-NOV-21
Molybdenum (Mo)			93.2		%		70-130	04-NOV-21
Nickel (Ni)			97.8		%		70-130	04-NOV-21
Selenium (Se)			0.18		mg/kg		0-0.34	04-NOV-21
Silver (Ag)			133.9	MES	%		70-130	04-NOV-21
Thallium (Tl)			0.080		mg/kg		0.029-0.129	04-NOV-21
Tin (Sn)			92.0		%		70-130	04-NOV-21
Uranium (U)			86.6		%		70-130	04-NOV-21
Vanadium (V)			94.7		%		70-130	04-NOV-21
Zinc (Zn)			89.2		%		70-130	04-NOV-21
WG3652321-4	DUP	L2656073-1						
Antimony (Sb)		0.64	0.59		mg/kg	7.9	30	04-NOV-21
Arsenic (As)		12.8	12.3		mg/kg	3.6	30	04-NOV-21
Barium (Ba)		381	361		mg/kg	5.5	40	04-NOV-21
Beryllium (Be)		0.43	0.40		mg/kg	7.0	30	04-NOV-21
Cadmium (Cd)		0.610	0.475		mg/kg	25	30	04-NOV-21
Chromium (Cr)		15.0	14.0		mg/kg	6.9	30	04-NOV-21
Cobalt (Co)		8.55	8.44		mg/kg	1.2	30	04-NOV-21
Copper (Cu)		25.0	25.5		mg/kg	1.9	30	04-NOV-21
Lead (Pb)		11.4	11.8		mg/kg	3.3	40	04-NOV-21
Molybdenum (Mo)		1.54	1.54		mg/kg	0.1	40	04-NOV-21
Nickel (Ni)		26.9	27.0		mg/kg	0.2	30	04-NOV-21
Selenium (Se)		0.78	0.70		mg/kg	10	30	04-NOV-21
Silver (Ag)		0.15	0.14		mg/kg	3.4	40	04-NOV-21
Thallium (Tl)		0.135	0.135		mg/kg	0.3	30	04-NOV-21
Tin (Sn)		<2.0	<2.0	RPD-NA	mg/kg	N/A	40	04-NOV-21
Uranium (U)		0.709	0.798		mg/kg	12	30	04-NOV-21
Vanadium (V)		35.2	33.4		mg/kg	5.4	30	04-NOV-21
Zinc (Zn)		111	112		mg/kg	0.7	30	04-NOV-21
WG3652321-2	LCS							
Antimony (Sb)			98.2		%		80-120	04-NOV-21
Arsenic (As)			102.3		%		80-120	04-NOV-21
Barium (Ba)			100.4		%		80-120	04-NOV-21
Beryllium (Be)			97.9		%		80-120	04-NOV-21

Quality Control Report

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Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-ED		Soil						
Batch R5636172								
WG3652321-2 LCS								
Cadmium (Cd)			101.4		%		80-120	04-NOV-21
Chromium (Cr)			97.3		%		80-120	04-NOV-21
Cobalt (Co)			100.7		%		80-120	04-NOV-21
Copper (Cu)			100.6		%		80-120	04-NOV-21
Lead (Pb)			93.5		%		80-120	04-NOV-21
Molybdenum (Mo)			97.8		%		80-120	04-NOV-21
Nickel (Ni)			99.4		%		80-120	04-NOV-21
Selenium (Se)			102.5		%		80-120	04-NOV-21
Silver (Ag)			98.4		%		80-120	04-NOV-21
Thallium (Tl)			91.3		%		80-120	04-NOV-21
Tin (Sn)			96.4		%		80-120	04-NOV-21
Uranium (U)			93.9		%		80-120	04-NOV-21
Vanadium (V)			100.4		%		80-120	04-NOV-21
Zinc (Zn)			92.6		%		80-120	04-NOV-21
WG3652321-1 MB								
Antimony (Sb)			<0.10		mg/kg		0.1	04-NOV-21
Arsenic (As)			<0.10		mg/kg		0.1	04-NOV-21
Barium (Ba)			<0.50		mg/kg		0.5	04-NOV-21
Beryllium (Be)			<0.10		mg/kg		0.1	04-NOV-21
Cadmium (Cd)			<0.020		mg/kg		0.02	04-NOV-21
Chromium (Cr)			<0.50		mg/kg		0.5	04-NOV-21
Cobalt (Co)			<0.10		mg/kg		0.1	04-NOV-21
Copper (Cu)			<0.50		mg/kg		0.5	04-NOV-21
Lead (Pb)			<0.50		mg/kg		0.5	04-NOV-21
Molybdenum (Mo)			<0.10		mg/kg		0.1	04-NOV-21
Nickel (Ni)			<0.50		mg/kg		0.5	04-NOV-21
Selenium (Se)			<0.20		mg/kg		0.2	04-NOV-21
Silver (Ag)			<0.10		mg/kg		0.1	04-NOV-21
Thallium (Tl)			<0.050		mg/kg		0.05	04-NOV-21
Tin (Sn)			<2.0		mg/kg		2	04-NOV-21
Uranium (U)			<0.050		mg/kg		0.05	04-NOV-21
Vanadium (V)			<0.20		mg/kg		0.2	04-NOV-21
Zinc (Zn)			<2.0		mg/kg		2	04-NOV-21

PH-1:2-ED

Soil

Quality Control Report

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Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PH-1:2-ED								
Soil								
Batch	R5636189							
WG3652602-2	DUP	L2656073-3						
pH (1:2 soil:water)		7.96	7.94	J	pH	0.02	0.3	04-NOV-21
WG3652602-1	IRM	ALS SAL 2019						
pH (1:2 soil:water)			7.79		pH		7.55-8.15	04-NOV-21
WG3652602-3	LCS	PH-6						
pH (1:2 soil:water)			6.01		pH		5.8-6.2	04-NOV-21
PREP-MOISTURE-ED								
Soil								
Batch	R5633079							
WG3648801-3	DUP	L2656073-1						
% Moisture		18.1	18.5		%	1.7	20	29-OCT-21
WG3648801-2	LCS							
% Moisture			101.8		%		90-110	29-OCT-21
WG3648801-1	MB							
% Moisture			<0.25		%		0.25	29-OCT-21
PSA-75UM-SIEVE-ED								
Soil								
Batch	R5646121							
WG3657382-2	IRM	ALS SAL 2019						
% >75um			34.6		%		29.1-39.1	12-NOV-21
WG3657382-1	MB							
% >75um			<1.0		%		1	12-NOV-21

Quality Control Report

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Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
J	Duplicate results and limits are expressed in terms of absolute difference.
MES	Data Quality Objective was marginally exceeded (by < 10% absolute) for < 10% of analytes in a Multi-Element Scan / Multi-Parameter Scan (considered acceptable as per OMOE & CCME).
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

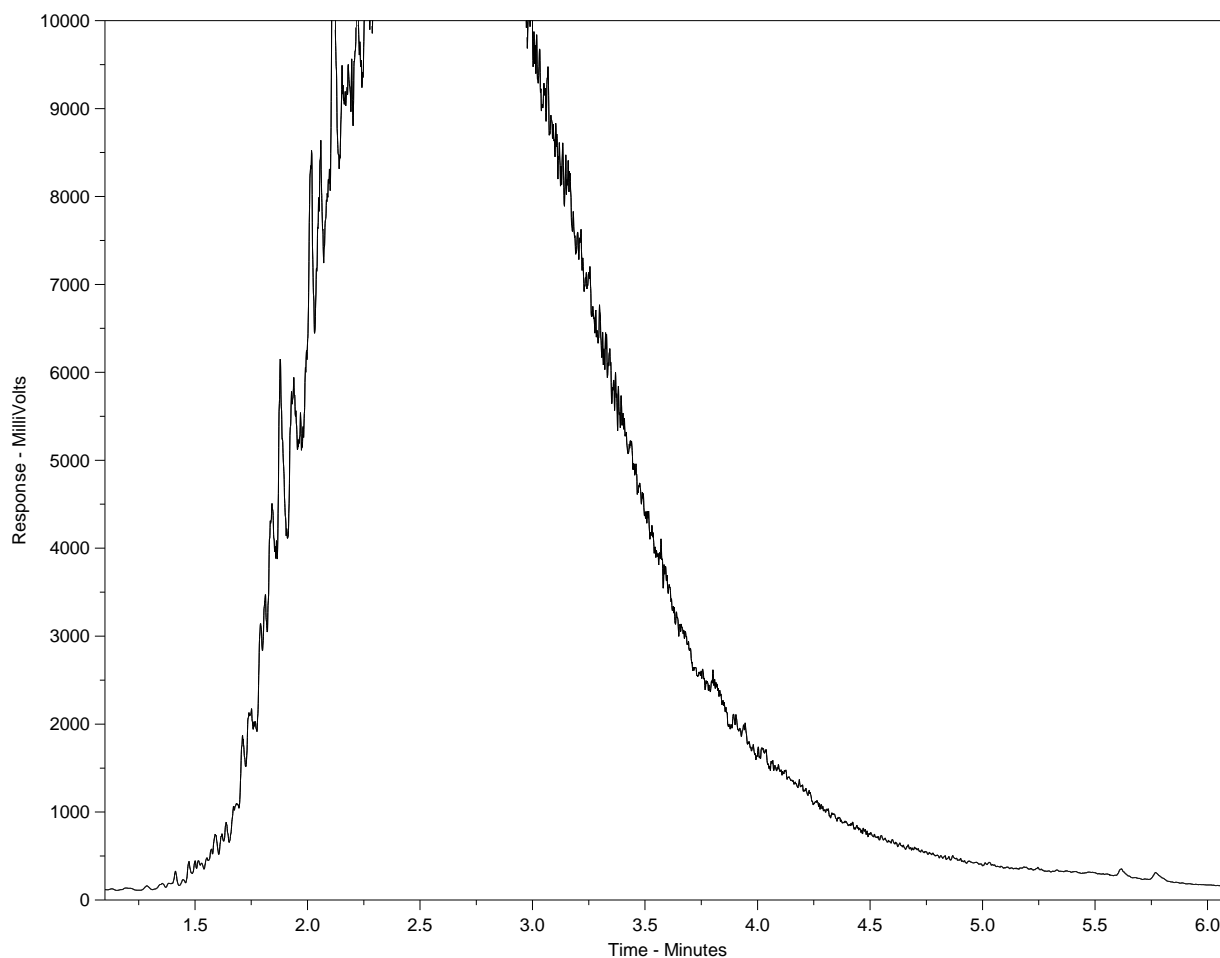
The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

Hydrocarbon Distribution Report



ALS Sample ID: L2656073-1
Client ID: 21BH01



F2		F3		F4		>F4
nC10	nC16		nC34		nC50	
174°C	287°C		481°C		575°C	
346°F	549°F		898°F		1067°F	
Gasoline		Motor Oils/ Lube Oils/ Grease				
Diesel/ Jet Fuels						

The Canada Wide Standard Hydrocarbon Distribution Report is intended to assist you in characterizing hydrocarbon products that may be present in your sample. The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products as well as a number of specified n-alkane hydrocarbon marker compounds. Comparison of this report with those of reference standards may also assist in characterizing hydrocarbons present in the sample.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

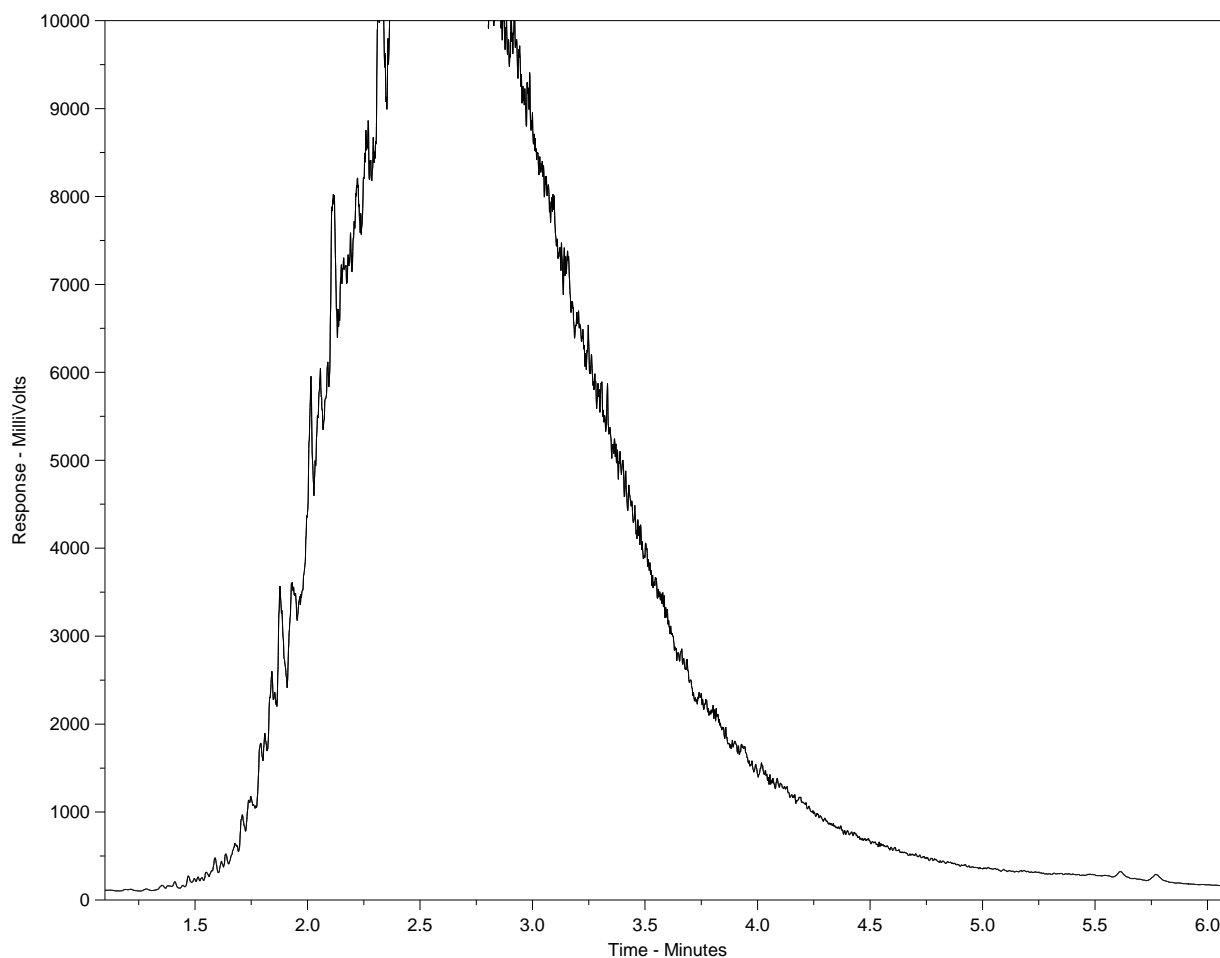
Note:

This chromatogram was produced with a high temperature GC method that is specific to the Canada-Wide Standard method. Note that retention times and distribution profiles from reports produced using different GC programs will differ.

Hydrocarbon Distribution Report



ALS Sample ID: L2656073-2
Client ID: 21BH02



F2		F3		F4		>F4
nC10	nC16		nC34		nC50	
174°C	287°C		481°C		575°C	
346°F	549°F		898°F		1067°F	
Gasoline		Motor Oils/ Lube Oils/ Grease				
Diesel/ Jet Fuels						

The Canada Wide Standard Hydrocarbon Distribution Report is intended to assist you in characterizing hydrocarbon products that may be present in your sample. The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products as well as a number of specified n-alkane hydrocarbon marker compounds. Comparison of this report with those of reference standards may also assist in characterizing hydrocarbons present in the sample.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

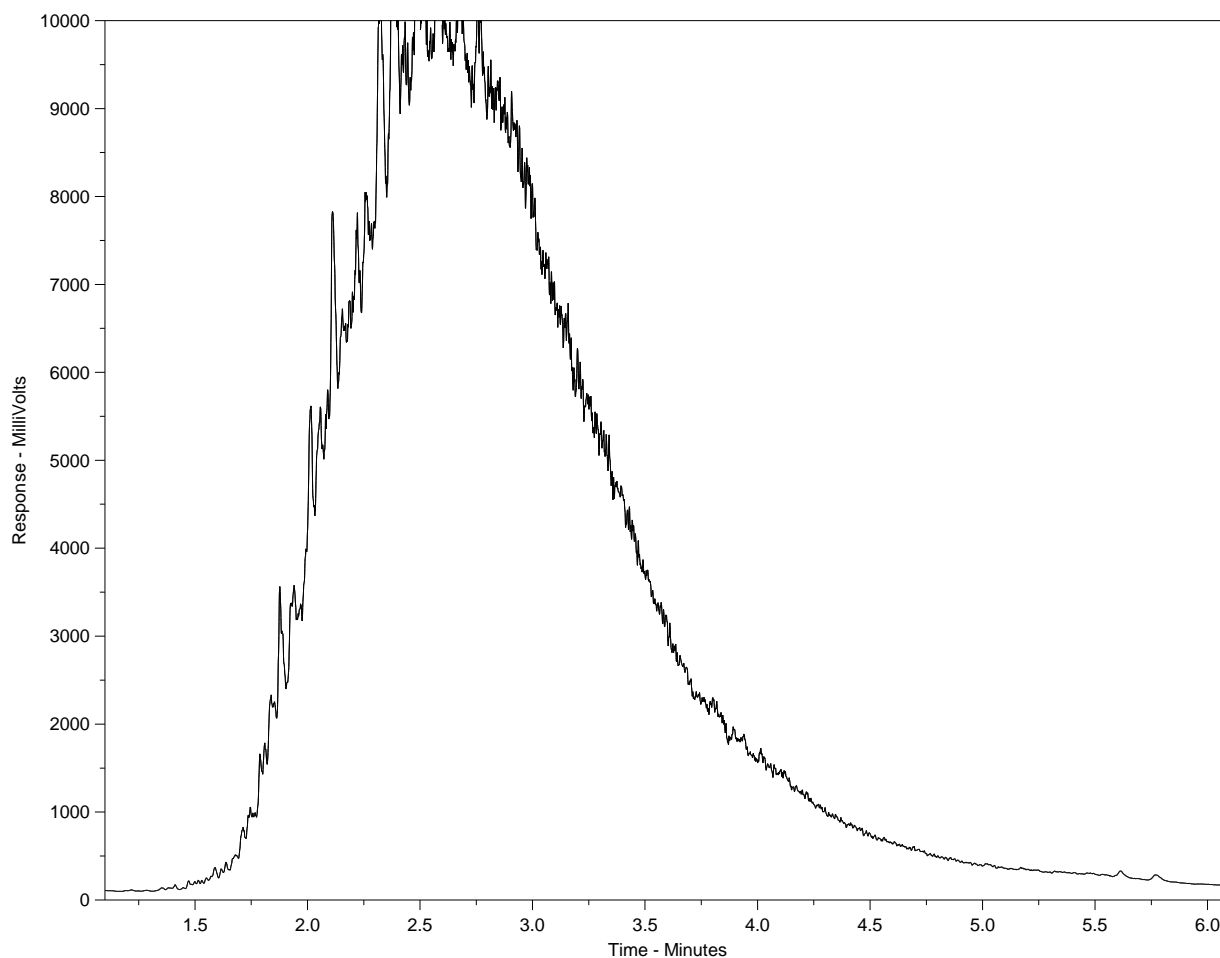
Note:

This chromatogram was produced with a high temperature GC method that is specific to the Canada-Wide Standard method. Note that retention times and distribution profiles from reports produced using different GC programs will differ.

Hydrocarbon Distribution Report



ALS Sample ID: L2656073-3
Client ID: 21BH03



F2		F3		F4		>F4
nC10	nC16		nC34		nC50	
174°C	287°C		481°C		575°C	
346°F	549°F		898°F		1067°F	
Gasoline		Motor Oils/ Lube Oils/ Grease				
Diesel/ Jet Fuels						

The Canada Wide Standard Hydrocarbon Distribution Report is intended to assist you in characterizing hydrocarbon products that may be present in your sample. The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products as well as a number of specified n-alkane hydrocarbon marker compounds. Comparison of this report with those of reference standards may also assist in characterizing hydrocarbons present in the sample.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

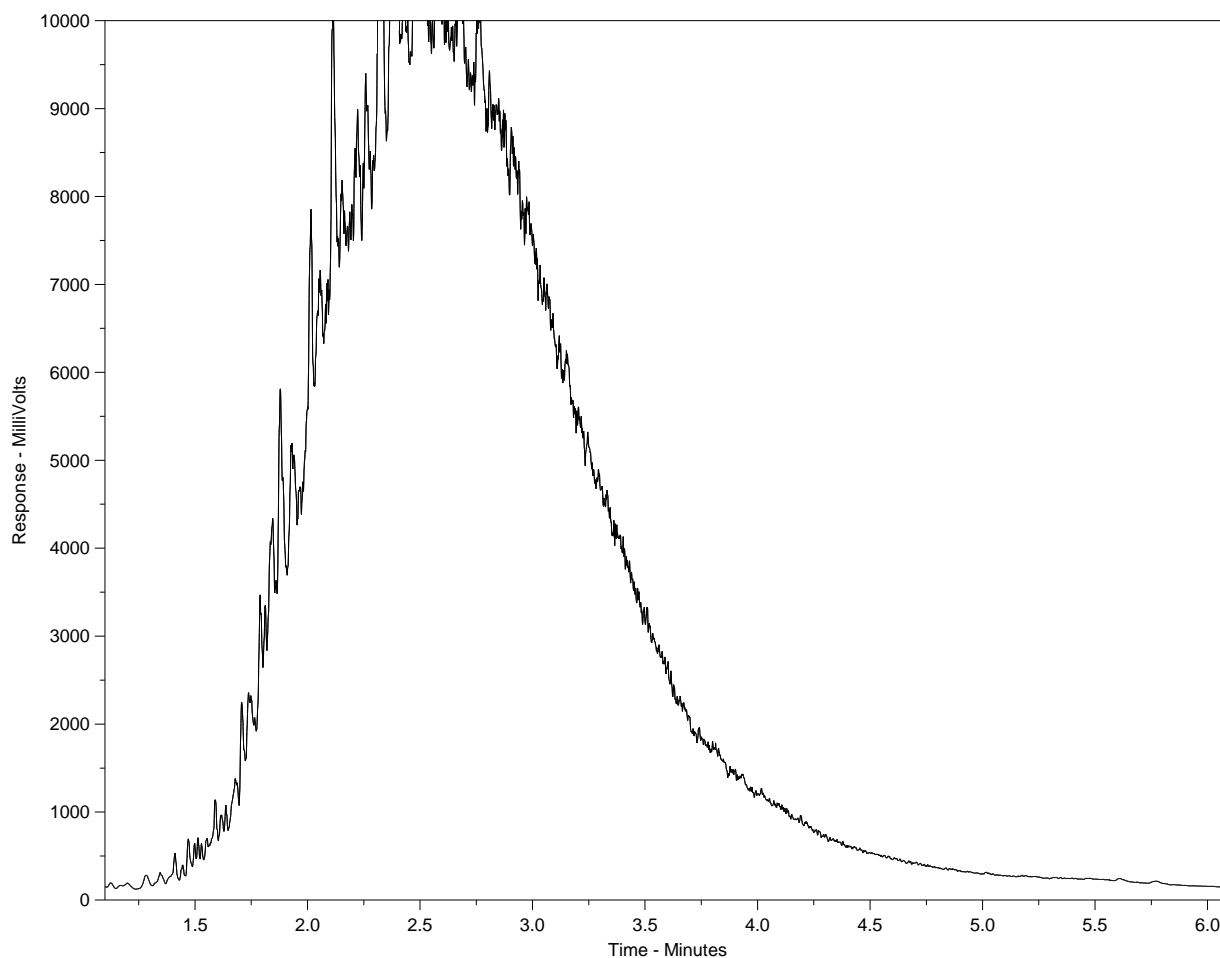
Note:

This chromatogram was produced with a high temperature GC method that is specific to the Canada-Wide Standard method. Note that retention times and distribution profiles from reports produced using different GC programs will differ.

Hydrocarbon Distribution Report



ALS Sample ID: L2656073-4
Client ID: 21BH04



F2		F3		F4	>F4
nC10	nC16		nC34	nC50	
174°C	287°C		481°C	575°C	
346°F	549°F		898°F	1067°F	
Gasoline		Motor Oils/ Lube Oils/ Grease			
Diesel/ Jet Fuels					

The Canada Wide Standard Hydrocarbon Distribution Report is intended to assist you in characterizing hydrocarbon products that may be present in your sample. The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products as well as a number of specified n-alkane hydrocarbon marker compounds. Comparison of this report with those of reference standards may also assist in characterizing hydrocarbons present in the sample.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

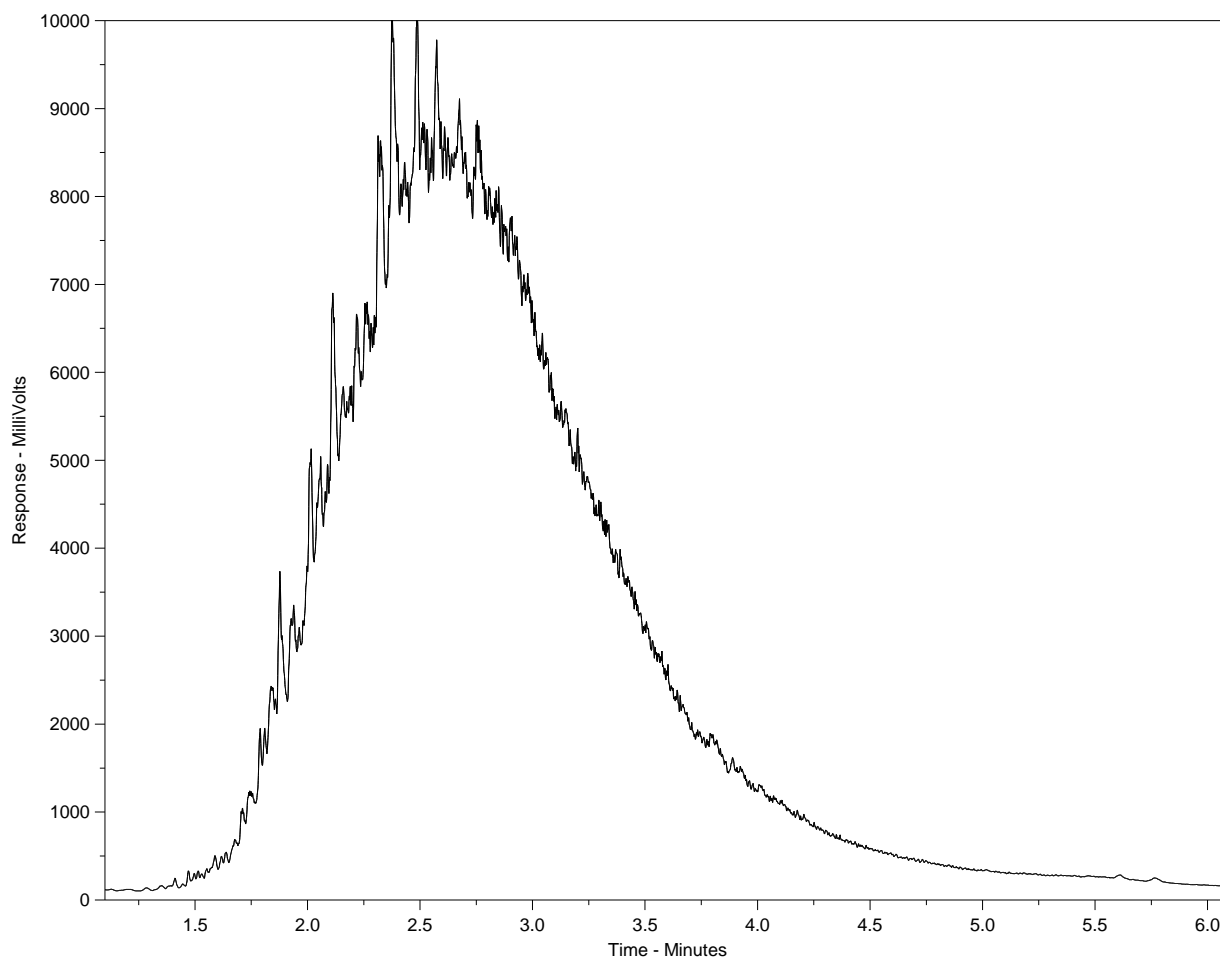
Note:

This chromatogram was produced with a high temperature GC method that is specific to the Canada-Wide Standard method. Note that retention times and distribution profiles from reports produced using different GC programs will differ.

Hydrocarbon Distribution Report



ALS Sample ID: L2656073-5
Client ID: 21BH05



F2		F3		F4		>F4
nC10	nC16		nC34		nC50	
174°C	287°C		481°C		575°C	
346°F	549°F		898°F		1067°F	
Gasoline		Motor Oils/ Lube Oils/ Grease				
Diesel/ Jet Fuels						

The Canada Wide Standard Hydrocarbon Distribution Report is intended to assist you in characterizing hydrocarbon products that may be present in your sample. The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products as well as a number of specified n-alkane hydrocarbon marker compounds. Comparison of this report with those of reference standards may also assist in characterizing hydrocarbons present in the sample.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

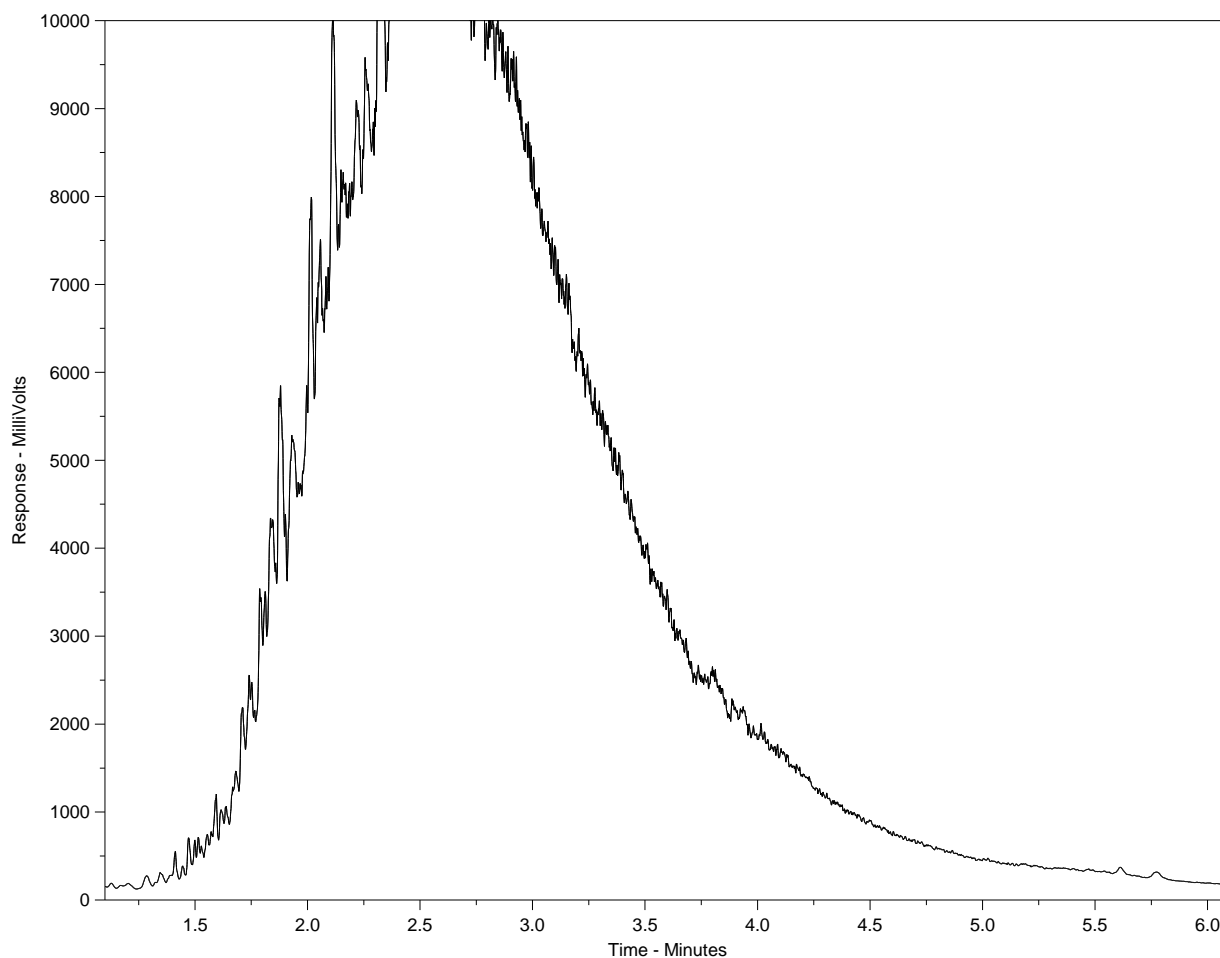
Note:

This chromatogram was produced with a high temperature GC method that is specific to the Canada-Wide Standard method. Note that retention times and distribution profiles from reports produced using different GC programs will differ.

Hydrocarbon Distribution Report



ALS Sample ID: L2656073-6
Client ID: 21BH06



F2		F3		F4		>F4
nC10	nC16		nC34		nC50	
174°C	287°C		481°C		575°C	
346°F	549°F		898°F		1067°F	
Gasoline		Motor Oils/ Lube Oils/ Grease				
Diesel/ Jet Fuels						

The Canada Wide Standard Hydrocarbon Distribution Report is intended to assist you in characterizing hydrocarbon products that may be present in your sample. The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products as well as a number of specified n-alkane hydrocarbon marker compounds. Comparison of this report with those of reference standards may also assist in characterizing hydrocarbons present in the sample.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note:

This chromatogram was produced with a high temperature GC method that is specific to the Canada-Wide Standard method. Note that retention times and distribution profiles from reports produced using different GC programs will differ.



L2656073-COFC



L2656073-COFC

AUG 2023 EDITION