

Waste Management Plan

Inuvik Soil Treatment Facility
Gwich'in Land and Water Board
Water Licence G17L1-002



KBL ENVIRONMENTAL LTD.
Inuvik Soil Treatment Facility Waste Management Plan
V.2.2

February 9, 2021

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PLAN REVISIONS

The effective date for the Petroleum Hydrocarbon Contaminated Soil Treatment Facility Waste Management Plan is upon approval of the plan from the Gwich'in Land and Water Board. The plan will be reviewed annually, and revised whenever there is an operational change at the Facility, changes to contact personnel, or as otherwise required by the Gwich'in Land and Water Board.

Table 0-1: Plan Revisions Table

Date of Revision	Title, Section#, or Page# of Revised Sections	Summary of Changes
September 2017	Table 2.1	Addition of discharge flow rate and discharge volume
October 2017	Updated facility drawing Table 2.1 Update	Version 2.1, drawing update to include labels on water tanks, Table 2.1 updated wording for soil re-use.
February 2021	Version 2.2 Section 1 Section 4 Table 4-3 Section 5.	Update wording to include receipt of water (1, 4, 5) Update wording to in-situ water treatment (4,5) Update wording to include water and precipitate from in-situ water treatment (Table 4-3)

1.0 INTRODUCTION

The soil treatment facility (STF) is an engineered biotreatment facility able to receive hydrocarbon-contaminated soil, snow, and water originating from spills or contaminated sites. The contaminants in the material entering the STF are primarily diesel, heating oil, and gasoline. The STF is active mostly during the summer months when temperatures allow for soil treatment activities. During the winter months, hydrocarbon-contaminated snow and water may be received and stored in the engineered water retention pond, until thaw and subsequent treatment.

Company Name, Site Name, and Site Location:

KBL Environmental Ltd.

Inuvik Soil Treatment Facility

The soil treatment facility is located at the Inuvik Solid Waste Disposal Facility (SWDF) in the Town of Inuvik, along the south-western section of the SWDF.

Lot 65, Group 1355, Inuvik, NT

Coordinates: (N) 7582173.14; (E) 554308.00

Effective Date of the Plan:

This Waste Management Plan (WMP) and any subsequent revisions, will be effective for the duration of the lease of the facility by KBL Environmental Ltd. (KBL). The effective date for the Facility WMP is the date that a water licence is granted to the facility. The WMP will be reviewed annually and updated as required.

2.0 ENVIRONMENTAL POLICY

KBL's commitment to the protection of the environment is demonstrated in how we conduct our day-to-day business operations. The highest standards of care are to be taken by all employees to minimize the environmental impact of all operations. KBL's management team has the responsibility to take a leadership role and develop policies and procedures that minimize environmental effects. Employees have the responsibility to bring to the attention of their immediate supervisor, procedures and incidents which may impair the environment. Our policy is to:

- 1) Comply with all applicable regulations.
- 2) Consider the environmental effects of our operations.
- 3) Provide staff with all the necessary information, training, and equipment.
- 4) Develop processes, policies, and procedures that minimize the occurrence and consequences of environmental incidents.

Our corporate environmental goal is to minimize the environmental impact of our operations.

3.0 PURPOSE AND SCOPE OF THE PLAN

The purpose of this Plan is to identify waste streams and outline management methods for wastes generated at the Facility.

KBL will manage the STF operations responsibly and will comply with all licences, permits, and applicable territorial and federal laws and regulations related to waste management specific to Facility operation. The following table lists regulations and guidelines that will be applied and referenced for the Facility operations in Inuvik.

Table 3-2: Applicable Waste Management Regulations and Guidelines

Jurisdictional Authority	Regulation or Guideline
Government of the Northwest Territories (GNWT), Department of Environment and Natural Resources (ENR)	<i>Environmental Protection Act (2014)</i> <i>Guideline for the General Management of Hazardous Waste in the NWT (1998)</i> <i>Northwest Territories Waters Act (2016)</i> <i>Guideline for Contaminated Sites Remediation</i>
Mackenzie Valley Land and Water Board (MVLWB)	<i>Guideline for Developing a Waste Management Plan (2011)</i> <i>Guideline for the Design, Operation, Monitoring, Maintenance, and Closure of Petroleum Hydrocarbon-Contaminated Soil Treatment Facilities in the Northwest Territories (2020)</i>
Environment and Climate Change Canada (ECCC)	<i>Federal Guidelines for Landfarming Petroleum Hydrocarbon-Contaminated Soils (SAIC 2006)</i>
Transport Canada (TC)	<i>Transportation of Dangerous Goods Regulations (2016)</i>

Description of the project for which the proponent is seeking or currently holds a Land-use permit and/or Water Licence:

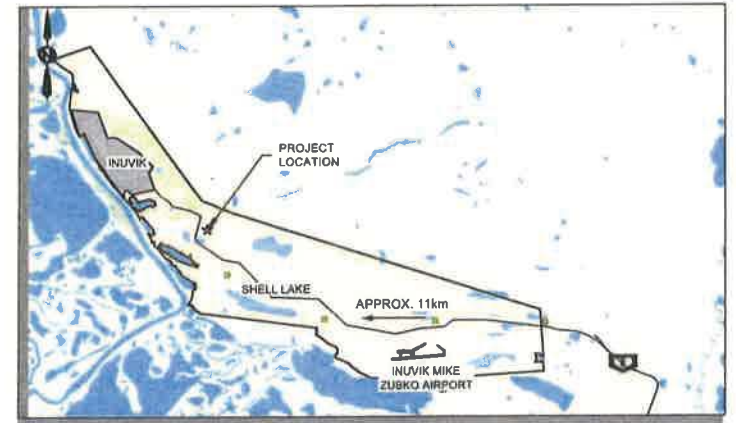
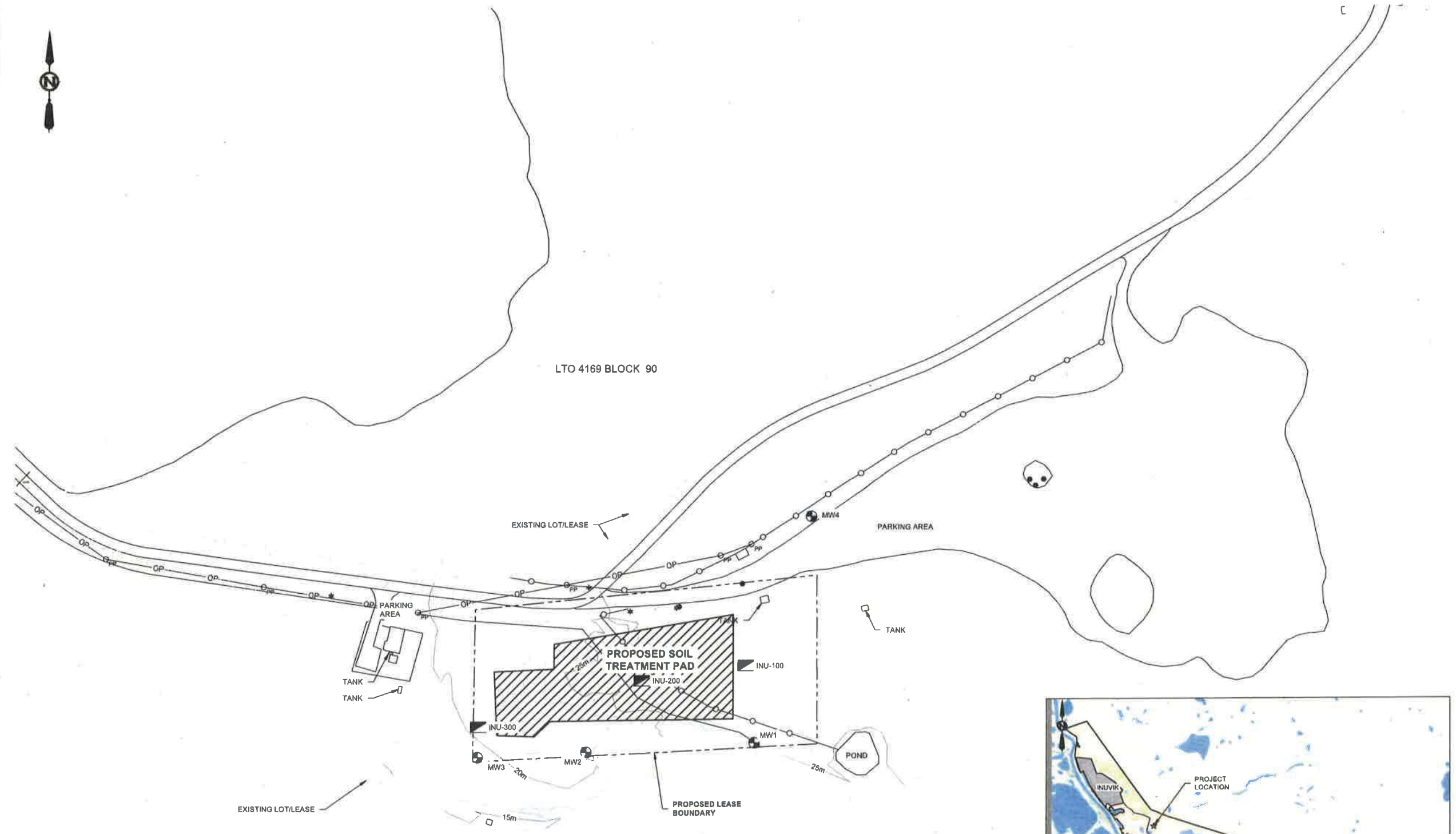
KBL and the Town of Inuvik have entered into an agreement for the lease of a 0.8 ha parcel of land located within the Inuvik SWDF. KBL will construct and operate a soil treatment facility that receives and treats soil and snow contaminated with petroleum hydrocarbons. The treated soil will be transferred to the Town of Inuvik for use as daily cover in its landfill. KBL is providing the expertise to manage the facility design, the Gwich'in Land and Water Board (GLWB) approval requirements, manage treatment operations and ensure facility compliance as specified in the Type B Licence issued by the Gwich'in Land and Water Board. Contracting services to construct as well as for the provision of heavy equipment to treat contaminated soil will be provided by an Inuvik contracting firm.

The soil treatment facility includes one engineered cell, for the receipt, storage, and treatment of petroleum hydrocarbon-contaminated soil, one engineered water retention pond; one small package treatment plant to treat petroleum hydrocarbon-contaminated water; two dedicated 63,000 L skid-mounted, portable above-ground storage tanks (AST) for water storage; and, one small shed for storage of supplies, documentation and health and safety equipment.

The permanent facility is intended to operate for five years commencing in summer 2017, after which it is anticipated that the Town of Inuvik will review its lease with KBL.

Proposed location for all waste management activities, on a map to scale with GPS coordinates.

Where applicable, show on a map the locations of historical waste management areas: see the following page.



PLAN 1:2000
OVERALL SITE

PLAN NTS
KEY



LEGEND	
28 m	TOPOGRAPHIC MAJOR CONTOUR CONTOUR INTERVAL = 5.0m
	TOPOGRAPHIC MINOR CONTOUR
	TREES
—○—○—	EXISTING FENCE
—OP—	EXISTING OVERHEAD POWER LINE
---	PROPOSED LEASE BOUNDARY
○ PP	EXISTING POWER POLE
*	EXISTING LIGHT
●	EXISTING TANK
● MW4	EXISTING MONITORING WELL
■ INU-100	EXISTING TEST PIT LOCATION
▨	PROPOSED WORK AREA

- NOTES:
1. DATUM: UTM NAD83 ZONE 8.
 2. CONTOURS PROVIDED BY KBL.
 3. BOLD LINES & TEXT REFERS TO NEW CONSTRUCTION.

0	2017SEP06	ISSUED FOR CONSTRUCTION	NAR	BJ	
No.	DATE	REVISION	BY	APP	
PROJECT No.	20173924-00				INITIALS
DRAWN BY	J HUBERT				
DESIGNED BY	S BARTSCH / B JARDINE				
SCALE	AS SHOWN				

PERMIT TO PRACTICE
ASSOCIATED ENGINEERING (B.C.) LTD.
Signature: *[Signature]*
Date: 11 Sept 2017
PERMIT NUMBER: P 554
The Association of Professional Engineers,
Geologists and Geophysicists of NWT/NU



CLIENT

KBL

PROJECT
INUVIK
SOIL TREATMENT FACILITY

TITLE	
OVERALL SITE PLAN / KEY PLAN	
DRAWING NUMBER	REV. NO.
3924-00-101	0

Description of site physical, surface, and subsurface characteristics, site water management (i.e., flow/drainage patterns), and geotechnical characteristics:

As noted above, the soil treatment facility is situated within an operating solid waste disposal facility that services the Town of Inuvik. The facility first began operating as a landfill in 1976.

Inuvik is situated within the Taiga Plains Ecozone. Inuvik is situated within the Mackenzie Delta Ecoregion. The ecoregion is marked by very cold winters and cool summers. The mean annual temperature is approximately -9.5°C. The mean summer temperature is 8.5°C and the mean winter temperature is -26.5°C. Mean annual precipitation ranges from 200 mm to less than 275 mm. The ecoregion is classified as having a high subarctic ecoclimate. The predominant vegetation consists of open, very stunted stands of black spruce and tamarack with secondary quantities of white spruce, and a ground cover of dwarf birch, willow, ericaceous shrubs, cottongrass, lichen, and moss. Poorly drained sites usually support tussocks of sedge, cottongrass, and sphagnum moss. Low shrub tundra, usually dwarf birch and willow, are also common. The delta is a complex area of peat-covered deltas and fluvial marine deposits. The present delta is remarkable for its multitude of lakes and channels. Wetlands extend over 50% of the ecoregion and are characteristically polygonal peat plateau bogs with ribbed fens. Regosolic Static and Gleysolic Static Cryosols with Organic Cryosols developed on level fluvioglacial, organic, and marine deposits are the dominant soils. Extensive discontinuous permafrost with low to medium ice content is prevalent throughout the ecoregion and is characterized by sparse ice wedges. Characteristic wildlife includes muskrat, beaver, mink, and waterfowl. Land uses are limited to trapping, hunting, recreation, and tourism. Major communities include Aklavik and Inuvik (Ecological Framework of Canada).

Bedrock in the Mackenzie Delta is sedimentary, comprised of Tertiary shale and sandstone. Preglacial, glacial, and post-glacial deposits overlie the bedrock. Depth to bedrock in the vicinity of Inuvik is approximately 50 metres (EBA 2011).

According to the Town of Inuvik SWDF O&M Manual, the majority of the footprint of the SWDF is within Inuvik's gravel quarry Lot 65, Group 1355 (CLSR 61339). To the northeast of the site is the steep slopes of Mount Baldy, and to the southwest is Airport Road and its surrounding industrial developments. Immediately to the north is the former Hospital Hill common fill quarry. According to the SWDF O&M Manual, geotechnical conditions in the area are mostly gathered from the historical quarrying activity in the Hospital Hill borrow pit. The entire district is underlain by deep permafrost, with occasional large ice lenses.

The SWDF is situated on a low, broad shoulder that extends southwesterly from near the base of Mt. Baldy. The Inuvik SWDF is on a low topographic crest which is beneficial for drainage control. The STF will be located near the southwestern limit of Lot 65.

KBL commissioned the excavation of three test pits within the boundary of the proposed STF which were advanced on October 28, 2016. Test pit depth ranged from 1.8 to 2.4 metres below ground surface (mbgs). Permafrost was not encountered in any of the test pits. A brown, organic top layer pebble and cobble extending to a depth of 0.2 mbgs was encountered in each test pit. Clay with scattered pebbles (some cobble in one of the test pits) was encountered to a depth ranging from 0.2 to 2.4 mbgs. The

deepest clay was encountered in the northeast section of the lease area. The clay observed during the test pitting investigation ranged from grey-brown to reddish-brown to dark brown. Garbage was encountered from 1.2 -1.8 mbgs in the test pit advanced in the southwest section of the lease area. Test pit locations and detailed observations are provided in a Memo by Dillon Consulting Ltd, dated October 28, 2016. The Memo is appended to KBL's Water Licence Application submission. Additional soil quality information will be collected through a drilling program scheduled for Spring 2017. Soil samples will be collected from boreholes that will be advanced along the lease area. The samples will be submitted for laboratory analysis for key parameters to confirm baseline soil quality for the project area.

Regionally, groundwater flow is inferred to be westerly towards the Mackenzie River.

4.0 WASTE TYPES

Materials received at the STF for treatment include petroleum hydrocarbon-contaminated soil, snow, and water. All materials are profiled before receipt to ensure that they meet the acceptance criteria (Please refer to Appendix B –Criteria, Sampling, and Handling located in the Operation and Maintenance Plan). The proposed criteria were determined using territorial and federal regulatory guidelines and are the operational criteria in use at two existing licenced soil treatment facilities operated by KBL in the Northwest Territories. Materials not meeting acceptance criteria will not be received into the facility and will remain the responsibility of the generator.

Petroleum hydrocarbon contaminated soil undergoes treatment via bioremediation. To support effective and efficient treatment, the soil is mechanically mixed and amendments such as water and surfactants may be added to modify pH, moisture content and enhance the bioavailability of contaminants. Once the bioremediation process has been given adequate time, the soil is sampled to confirm it meets the soil re-use criteria (Appendix B of the Operations and Maintenance Plan). Soil meeting re-use criteria is transferred to the Inuvik SWDF for re-use as backfill or daily cover at the Inuvik landfill. Potential end-users other than the Town of Inuvik will be reviewed by KBL in consultation with the GLWB on a case by case basis, for granting of approval per the terms of the STF Water Licence. Soil not meeting beneficial re-use criteria is hauled off-site for disposal at an approved facility for treatment or disposal.

Precipitation, snowmelt, and soil treatment pad leachate are managed through a combination of the retention pond, on-site above ground storage tanks (ASTs), in-situ treatment, and a portable water treatment plant (WTP) located on-site. Retention pond water may be used as a soil amendment on the soil treatment pad and/or for dust suppression purposes. The ASTs are used as temporary holding vessels to maintain freeboard in the retention pond, to allow for pond maintenance activities, or water storage until a water treatment event. The in-situ water treatment and the water treatment plant are designed to remove particulate matter, metals, and petroleum hydrocarbons. Once the water is treated, it is stored in an AST until analytical results confirm water quality. Where authorized under the STF Water Licence, treated water meeting discharge criteria may be used for dust suppression in the Town of Inuvik landfill operations or released to the environment at a designated location. Water not meeting discharge criteria is transferred off-site for disposal at an approved receiving facility.

In addition to contaminated soil, snow, and water, additional waste streams at the STF include spent

filter media generated through the operation of the water treatment plant, precipitated material generated from in-situ water treatment, as well as any spent spill response material that may be generated in the event of an accidental release of fuel and mechanical fluids during the operation of heavy equipment within the STF.

Wastes generated on-site is presented in Table 2. Potential environmental effects arising from waste management on-site are considered negligible: only treated water meeting the proposed discharge criteria (Appendix B of the Operations and Maintenance Plan) will be released to the environment per the facility's Water Licence.

Activities occurring at the STF are limited to those associated with the operation and maintenance of the soil treatment pad, water retention pond, and portable water treatment system. No vehicles are stored or maintained at the facility. The facility technician is on-site on an as-needed basis; any domestic waste brought to the site by the technician will be removed daily.

Table 4-3: Waste Streams, Source of Generation and Characteristics, Inuvik STF

Waste Stream	Source of Generation	Characteristics	Management Option	Volume
Treated Soil	Biotreatment	Bioremediated soil that meets licence criteria	Beneficial re-use as daily cover at the Inuvik landfill. Re-use as off-site fill upon approval by GLWB or Inspector	Est. Max. 6,000 m ³ /year
Petroleum hydrocarbon-contaminated soil	Biotreatment	Soil not successfully bioremediated	Transported off-site for final disposal at an approved landfill	Negligible
Water, untreated	Retention Pond	Precipitation, water, snowmelt, and/or soil treatment pad run-off	Re-use as a soil enhancement and to control dust emissions on soil pad	Max. 50m ³ /day total from June 1 - Spet 30
Water, treated	Water Treatment Effluent	Water, snowmelt, soil treatment effluent treated at WTP or in-situ, meets approved discharge criteria	Beneficial re-use as a dust suppressant at the Inuvik landfill, or discharged to the environment, per procedures & criteria outlined here, re-use as a soil enhancement and to control dust emissions on soil pad	Max. 50m ³ /event, not to exceed 300 L per min flow rate when discharged
Water, petroleum hydrocarbon-contaminated	Water Treatment Effluent	Water not successfully treated by WTP or in-situ	Transported off-site for treatment or disposal at an approved facility	Negligible
Precipitate generated from in-situ water treatment	Water Treatment Solids	Precipitate generated from in-situ treatment of water retention pond	Transported off-site for treatment or disposal at an approved facility	Negligible
Packaging materials	Amendments, materials, and equipment used at the facility	Inert materials, plastics, papers	Disposal at Inuvik landfill	Negligible

Spent filter media from WTP	Water Treatment operation	Spent bag filters, spent granular activated carbon	Transported off-site for treatment or disposal at an approved facility	Negligible
Spill response materials	Spill/accidental release from the facility or vehicles	Petroleum hydrocarbon-contaminated adsorptive materials	Transported off-site for treatment or disposal at an approved facility	Unknown
Petroleum hydrocarbon-contaminated soil, snow, or water	Spill or accidental release from facility or vehicles	Petroleum hydrocarbon-contaminated soil, snow, or water	Treatment through an on-site process (biotreatment/WTP) or transported off-site for treatment or disposal at an approved facility	Unknown

5.0 MANAGEMENT OF EACH WASTE TYPE

As a waste management company, KBL's core services center on the basic principles of waste management; source reduction, we apply the same principles of reuse, recycle, treatment, release, and disposal in how we operate our facilities. Accordingly, waste at the STF will be managed through:

- Soil biotreatment;
- Water treatment;
- On-site re-use;
- Off-site re-use;
- Effluent discharge; and
- Off-site disposal.

The environmental impacts associated with soil biotreatment, water treatment, and authorized effluent discharge, as described below, are anticipated to be negligible based on facility design, implementation of mitigation measures, and adherence to monitoring plans. Existing site conditions, mitigation measures, and soil and groundwater monitoring programs are presented in the "Predicted Environmental Impact of Undertaking and Proposed Mitigation Measures" which accompanied the application for the Class B Water Licence for the Inuvik Soil Treatment Facility.

Soil Treatment

The STF is designed to treat petroleum hydrocarbons. An engineered soil treatment pad is utilized to receive petroleum hydrocarbon-contaminated soil from off-site sources including residential, commercial, and industrial properties where a hydrocarbon spill or leak has occurred. Before acceptance of material at the STF, contaminated soil will be profiled; profiling will include laboratory analytical results of representative soil samples, and may also include a review of contaminant Safety Data Sheets (SDS) and transportation manifests towards determining suitability for treatment. Soil meeting acceptance criteria (Appendix B of the Operations and Maintenance Plan) will be deposited into a designated area within the engineered cell for biotreatment.

The design, operation, and maintenance of the soil treatment facility is described in the KBL Inuvik Soil Treatment Facility Operations and Maintenance Plan V.2.2 submitted with the facility water licence amendment application package.

Water Treatment

An engineered retention pond is utilized to contain soil treatment pad run-off and petroleum hydrocarbon-contaminated water, snow, and subsequent snow-melt. Before receipt on-site, snow and water will be profiled through contaminant SDS information where applicable, generator knowledge, transportation manifests, and/or laboratory analysis to determine suitability for treatment. Snow and water meeting the acceptance criteria (please refer to the Operation and Maintenance Plan) will be deposited into the retention pond. Snow will remain in the pond until it has melted. Retention pond water treatment events will occur as needed, based on pond holding capacity, and seasonal requirements (i.e. before freeze-up to ensure winter holding capacity). Retention pond water will undergo treatment in either the portable water treatment plant stored on-site (additional details on the WTP are presented below) or treated in-situ using a coagulant. Effluent generated at the soil treatment pad will also be directed to the engineered pond via a portable trash pump.

Water from the pond may be utilized for application within the soil treatment pad for the provision of moisture to the soil. Moisture is an integral part of promoting microbial activity responsible for the degradation of petroleum hydrocarbons. Water application for bioremediation is permissible provided the water is not hazardous as defined by the "Guideline for the General Management of Hazardous Waste in the NWT (1998)".

The design of the water retention pond is described in the KBL Inuvik Soil Treatment Facility Operations and Maintenance Plan V.2.2 submitted with the facility amendment application package.

Once seasonal conditions are suitable (snowmelt is occurring), water is pumped, using an inline pump or portable trash pump, from the collection point in the pond through the WTP or treated in-situ. Treated water is held in one of two dedicated 63,000 L skid-mounted, portable ASTs before use or discharge.

Water Treatment Plant

The portable WTP proposed for the STF is a package treatment plant consisting of a bag filter train with a granular activated carbon (GAC) vessel and an organoclay bed designed for removal of particulate matter and organic constituents such as petroleum hydrocarbons (WTP schematic is located in the facility Operation and Maintenance Plan). Filter cloth is affixed to the pump intake screen to minimize solids entering the treatment plant.

Under thaw conditions, contaminated water is pumped from the collection point in the engineered pond via an inline pump or a portable trash pump, through a series of inline bag filters (25 µm and 5 µm, respectively) to remove particulate matter. Filter bags have internal support to prevent bursting under high differential pressures that can build up during operation. Filtration occurs from the inside out, through the filter bag media. Following the filter bag train, effluent enters the bottom of the carbon vessels, containing approximately 227 kg (500 lbs) of each GAC and Organoclay MCM-830, or approved equivalent. Treatment occurs in an up-flow manner to promote contact between the effluent and the

media as this method tends to fluidize the bed, enhancing treatment success. Treated effluent leaves the system through an inline totalizing flow meter and is collected in the AST.

At times throughout operation, it will be necessary to flush and change the filter media. SDS for the filter media constituents will be located in a small storage shed on-site and be accessible to all workers.

Additional WTP details about the operation are provided in the KBL Inuvik Soil Treatment Facility, Operations and Maintenance Plan V.2.2, submitted as part of the facility amendment application package.

In-Situ Water Treatment

The water from the retention may also be treated in-situ using a coagulant. The type of coagulant would be dependent on the contaminants and be added directly to the water treatment pond. After the residence time is completed the metals will have precipitated out and the treated water would be stored in one of the ASTs and sampled for comparison against the EQC specified in the Water Licence. Sampling before, and after treatment will be required to determine treatment efficacy. The precipitated solids would be removed from the pond as required. The inspector will be provided with analytical water quality results before discharge as per the Water Licence.

KBL will provide in-situ water treatment for the retention pond water during the summer operating season as required. A final treatment event at the close of the summer season will be scheduled to provide maximum storage capacity in the retention pond through the winter and early spring.

Re-use and Disposal

Once the contaminant composition of the bioremediated soil is confirmed through laboratory analyses, the soil is classified as either meeting re-use criteria, requiring additional bioremediation, or requiring off-site disposal at a designated facility. It is planned that soil material meeting re-use criteria will be used as daily cover at the Inuvik landfill. Alternate end users will be reviewed by KBL in consultation with the GLWB on a case by case basis, for approval under the terms of the STF Water Licence.

Treated effluent meeting re-use criteria will be used in the biotreatment process to enhance bioremediation; treated effluent may also be used for dust suppression. Treated water meeting discharge criteria (Appendix B of the Operations and Maintenance Plan) may be used as a dust suppressant at the Inuvik landfill or released to the environment adjacent to the Facility. Please refer to the facility design drawings location in Appendix A of the Operation and Maintenance Plan for the discharge location. In an approved effluent discharge scenario, treated effluent will be batch discharged to the ground surface through a dedicated hose into the discharge location designed to control erosion. It is expected that discharge from the WTP will occur between July 1st and Sept 30th. Discharge volumes will not exceed 50 m³ per discharge event and the flow rate will not exceed 300 l per minute.

Material requiring disposal, including untreated water, soil not satisfying re-use criteria, spent filter media, and spent spill response materials will be disposed of at an appropriately licenced landfill or a Waste Processing Facility.

6.0 REFERENCES

Ecological Framework of Canada, <http://ecozones.ca/english/region/50.html>, accessed March 16, 2017.

Environmental Impact Statement for Construction of the Inuvik to Tuktoyaktuk Highway, NWT, EIRB File No. 02/10-05, May 2011, Kiggiak - EBA Consulting Ltd.

Operation and Maintenance Manual for Solid Waste Disposal Facilities, Town of Inuvik, NT, March 2006. Re-issued March 2012, Earth Tech Canada Inc.

Government of Northwest Territories (GNWT). 2003. Environmental Guidelines for Contaminated Site Remediation.

Government of the Northwest Territories (GNWT). 1998. Guideline for the General Management of Hazardous Waste in the NWT. Department of Environment and Natural Resources.

Canadian Council for the Ministers of the Environment (CCME). Canadian Environmental Quality Guidelines, Water Quality Guidelines, accessed March 17, 2017.