

Waste Management Plan

Cambridge Bay Soil and Water Treatment Facility

Kitikmeot Environmental Ltd.



WASTE MANAGEMENT PLAN

FINAL

Cambridge Bay Soil and Water Treatment Facility
V.2.2
4300CBSTF

March 2022

TABLE OF CONTENTS

| | |
|---|----|
| Executive Summary..... | 1 |
| 1.0 Introduction | 2 |
| 2.0 Environmental Policy | 3 |
| 3.0 Project Objectives and Scope of Work..... | 3 |
| 3.1. Project Description | 4 |
| 3.2. Rationale..... | 4 |
| 4.0 Environmental Setting | 4 |
| 5.0 Waste Types..... | 5 |
| 6.0 Waste Management..... | 6 |
| 6.1. Soil Treatment | 7 |
| 6.2. Utility Locates..... | 8 |
| 6.3. Reuse and Disposal | 9 |
| 7.0 Documentation and Reporting..... | 9 |
| 8.0 Training..... | 10 |
| 9.0 References..... | 10 |

LIST OF TABLES

| | |
|---|---|
| Table 1: Relevant Waste Management Regulations and Guidelines..... | 3 |
| Table 2: Waste Streams, Source of Generation and Characteristics, Cambridge Bay SWTF..... | 5 |

APPENDICES

| | |
|------------|---|
| Appendix A | Soil Acceptance and Reuse Criteria |
| Appendix B | General Location of Soil and Water Treatment Facility |
| Appendix C | Facility Design Drawing |

EXECUTIVE SUMMARY

This Plan outlines what Kitikmeot Environmental Ltd. will do with any waste generated on site. Wastes include contaminated soil and water that can't be treated on site, as well as those that can be; each of these are disposed of differently. Waste also includes materials that need to be disposed of if there is a spill on site that needs to be cleaned up. Soil that is successfully treated on site is used either for fill or to cover garbage at the landfill. Water that is successfully treated on site can be used to increase moisture at the soil treatment facility or can be released to ground surface. Any soil or water that cannot be successfully treated is hauled to and disposed of at an authorized location.

REVISION HISTORY

| DATE | DOCUMENT VERSION | SUMMARY OF CHANGES MADE | AUTHOR | APPROVER |
|---------------|------------------|---|--------|----------|
| June 2016 | Ver. 1 | Initial Draft | JF | |
| January 2017 | Ver. 1 | Initial Final Issue | JF | |
| December 2022 | Ver.2.1 | Ownership Change, Contacts & Date Updates | KHF | |

Notice to Reader

This document and its content are protected by Canadian copyright law. Except as otherwise provided for under Canadian copyright law, this website and its content may not be copied, published, distributed, downloaded or otherwise stored in a retrieval system, transmitted or converted, in any form or by any means, electronic or otherwise, without the prior written permission of the copyright owner.

For further information, please contact:

Kitikmeot Environmental Ltd.
regulatory@kblenv.com
780.452.7779

1.0 INTRODUCTION

Kitikmeot Environmental Ltd. (KEL) operates a soil and water treatment facility (the Facility) located adjacent to the Hamlet of Cambridge Bay sewage lagoon.

Coordinates for the Facility are:

69° 07' 40.52" N 105° 02' 35.29"W

The site is accessible by road, from an access road off Natic Street.

Facility operations and maintenance contacts:

Corporate Office:

Kitikmeot Environmental Ltd.
30 Mitik Street
Cambridge Bay, NU
XOB 0C0

Operator Contacts:

Dino Forlin
Director of Business Development
Kitikmeot Environmental Ltd.
dforlin@ginig.com
867.983.2200

Primary Contact

Katie Oliver
Environmental Consulting Manager
KBL Environmental Ltd.
koliver@kblenv.com
780.452.7779
780.893.3305 (cell)

Secondary Contact

The effective date for this Waste Management Plan (the Plan) is January 1, 2023. The Plan will be effective for the duration of the lease and the life of the facility, a period of five (5) years, after which it will be reviewed for renewal.

2.0 ENVIRONMENTAL POLICY

Our commitment to the protection of the environment needs to be 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. The company 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 those procedures and incidents which may impair the environment. Our policy is to:

- 1) Comply with all applicable government 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 PROJECT OBJECTIVES AND SCOPE OF WORK

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

KBL will manage the program operations responsibly and will comply with all licenses, 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 Yellowknife.

Table 1. Relevant Waste Management Regulations and Guidelines

| Jurisdictional Authority | Regulation or Guideline |
|--|--|
| Government of Nunavut (GN), Department of Environment (DoE) | <i>Environmental Guideline for the General Management of Hazardous Waste (2010)</i> |
| Government of Nunavut (GN), Department of Environment (DoE) | <i>Environmental Guideline for Site Remediation (2002)</i> |
| Government of Nunavut (GN), Department of Environment (DoE) | <i>Environmental Guideline for Contaminated Site Remediation (2003)</i> |
| Environment Canada (EC) | <i>Federal Guidelines for Landfarming Petroleum Hydrocarbon Contaminated Soils (SAIC 2006)</i> |
| Environment and Climate Change Canada (ECCC) | <i>The Fisheries Act R.S.C., 1985, c. F-14 (1985)</i> |
| Transport Canada (TC) | <i>Transportation of Dangerous Goods Regulations (2012)</i> |

3.1. Project Description

The purpose of this project is to operate a permanent SWTF in Cambridge Bay, NU. The site of the facility is located at 69°07'40.52" N 105°02'35.29"W. The permanent facility includes an engineered cell to receive petroleum hydrocarbon-contaminated snow and water. Water is treated on site by a package treatment plant. Treated water is stored in a tank until it is confirmed that the water meets discharge criteria, after which it is reused on site or released to the surrounding environment. Following bioremediation, treated soil meeting license criteria will beneficially be reused off site. Soil and water not meeting discharge/reuse criteria is transported off site for disposal at a suitable facility. The facility also includes an area of the treatment pad designated for storage of hazardous wastes awaiting transportation to authorized facilities.

The Facility includes: one engineered cell consisting of three sub-cells: one cell 50 m x 40 m, for receipt, storage and treatment of petroleum hydrocarbon-contaminated soil; one cell designed for storage of up to 170 m³ of petroleum hydrocarbon-contaminated snow and water; one cell 19 m x 14 m designed for storage of hazardous waste awaiting shipment; one small package treatment plant to treat petroleum hydrocarbon-contaminated water; one or two above ground storage tank(s) (AST) for treated water storage; one small shed for storage of supplies, documentation and health and safety equipment.

3.2. Rationale

Operation of the proposed Facility will provide industry with a continued, local treatment option for petroleum hydrocarbon-impacted waste. In addition, having a local service provision may provide a reduced cost structure to generators which in turn may promote liability management as opposed to alternative management techniques such as long term monitoring or natural attenuation. Further, on-site treatment of soil and water allows for a significant reduction in the amount of site-specific infrastructure that may otherwise be required to manage these waste streams at source (i.e. at exploration and mine sites). In addition, production of soil suitable for beneficial reuse is desirable in an area where soil is naturally scarce.

4.0 ENVIRONMENTAL SETTING

Cambridge Bay, including the Facility, is situated within the Northern Arctic ecozone (NAE 2008). In this ecoregion, the landscape predominantly consists of low rolling plains covered with soil and rock debris left by glaciers. Many coastlines are characterized by wide flat plains with perennially frozen ground (permafrost). Mean annual temperatures range from -30 to -35°C in winter and from 5°C to 10°C in summer. Mean annual precipitation is 100-200 mm, with snow potentially falling during any month. Much of the region is devoid of plants, with the exception of some coastal lowlands and nutrient rich sheltered valleys. Muskox, Caribou, Arctic Fox and Polar Bear are the three dominant large mammals in the area, with the Collared Lemming being the only small mammal. Birds including Snowy Owl, Snow Geese, Canada Geese, and Horned Larks are also common to the region (NAE 2008).

5.0 WASTE TYPES

Materials received at the site for treatment will include petroleum hydrocarbon-contaminated soil, water, and snow. All materials are profiled prior to receipt to ensure that they meet acceptance criteria (Appendix A). 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 bioavailability of contaminants. Once the bioremediation process has been given adequate time, soil is sampled to confirm it meets discharge/beneficial reuse criteria (as presented in Appendix A). Soil meeting reuse criteria is hauled off site for local beneficial reuse, such as backfill or alternative daily cover at the Cambridge Bay Landfill. Soil not meeting beneficial reuse criteria is hauled off site for disposal at an appropriate facility such as a Class II landfill. Similarly, water, snowmelt and biotreatment pad leachate are all collected and treated through a package water treatment plant on site. The treatment plant is designed to remove particulate matter and petroleum hydrocarbons. Treated water is stored in an AST on site where it is sampled to confirm it meets discharge criteria. Water meeting discharge criteria is then used as a soil amendment on the biotreatment pad, for dust suppression or released to the environment at a designated location. Water not meeting discharge criteria is hauled off site for disposal at an approved receiving facility.

Additional waste streams include spent filter media arising from WTP operation, and contaminated soil, snow and water as well as spent spill response material that may arise from an accidental spill. Potential environmental effects arising from waste management on site are considered negligible: only treated water meeting discharge criteria is released to the environment.

Activities on site are limited to those associated with operation and maintenance of the biotreatment pad and water treatment facility. No vehicles or additional equipment are stored or maintained on site, nor is there an office or full time personnel on site. As such, no wastes associated with these activities are expected to be generated.

A portion of the bermed and lined soil treatment pad is used for the storage of hazardous waste containers (drums, bags etc.) that are awaiting transportation to authorized facilities. These types of waste could include fuels, oils, solvents and glycols which require consolidation, containerization and temporary storage onsite while awaiting shipment to authorized facilities.

Table 2. Waste Streams, Source of Generation and Characteristics, Cambridge Bay SWTF

| Waste Stream | Source of Generation | Characteristics | Management Option | Volume |
|---|----------------------|-------------------------------------|--|----------------------------------|
| Treated soil | Biotreatment | Bioremediated soil | Beneficial reuse off-site as fill or alternative daily cover at the Cambridge Bay landfill | Up to 3,000 m ³ /year |
| Petroleum hydrocarbon-contaminated soil | Biotreatment | Soil not successfully bioremediated | Transported off site for final disposal at an approved Class II Landfill | Negligible |

| | | | | |
|---|---|--|--|---|
| Treated water | WTP effluent | Water, snow melt and/or biotreatment pad effluent treated at WTP, meets discharge criteria | Beneficial reuse as a dust suppressant, application to biotreatment pad as a soil amendment, or discharge to the environment | Up to 10 m ³ /day between June 1 and Sept 30 |
| Petroleum hydrocarbon-contaminated water | WTP effluent | Water not successfully treated at WTP | Transported off site for final disposal at an approved Class II Landfill | Negligible |
| Spent filter media from WTP | WTP operation | Spent bag filters, spent granular activated carbon | Transported off site for final disposal at an approved Class II Landfill | Negligible |
| Spent spill response materials | Spill or accidental release from facility or vehicles | Petroleum hydrocarbon-contaminated adsorptive materials | Transported off site for final disposal at an approved Class II Landfill | Unknown |
| Petroleum hydrocarbon-contaminated soil, water and snow | Spill or accidental release from facility or vehicles | Petroleum hydrocarbon-contaminated soil, water or snow | Treatment through on-site process (biotreatment/WTP) or transported off site for final disposal at an approved Class II Landfill | Unknown |
| Hazardous Wastes | Commercial or industrial | Fuels, Oils, Glycols | Temporary Storage in cell while awaiting shipment | Unknown |

6.0 WASTE MANAGEMENT

As a waste management company, KEL incorporates the basic principles of waste management into daily operations, which includes source reduction, reuse, recycling, treatment, release, and disposal.

Accordingly, waste is managed on site by:

- Soil biotreatment;
- Water treatment;
- Off-site reuse;
- Effluent discharge; and
- Off-site disposal.

Environmental impacts associated with soil biotreatment, water treatment and effluent discharge, as described below, are anticipated to be negligible based on facility design, implementation of mitigation measures, and adherence to monitoring plans. Baseline studies, mitigation measures and monitoring plans

are presented in the *Cambridge Bay Soil and Water Treatment Facility Environmental Protection Plan* (KEL 2022).

6.1. Soil Treatment

An engineered biotreatment 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. Prior to receipt on site, contaminated soil is profiled which may include sampling and analysis and/or review of contaminant Materials Safety Data Sheets (MSDS) information and suitable movement documents to determine suitability for treatment. Soil meeting acceptance criteria (Appendix A1) is deposited into the soil treatment pad. The biotreatment pad has been constructed as per engineered drawings shown in Appendix (C).

The facility has been designed to receive up to 3,000 m³ (a drawing of the Facility Plan and Section is provided in Appendix B). The cell is 50 m by 40 m, surrounded by a soil berm approximately 1.5 m tall with 2:1 side slopes measured from existing grade. The base of the cell is graded to a 1.0% slope on the longaxis, away from the entrance ramps to control and direct interior drainage towards the water storage cell.

At least 0.2 m of soil fill <8mm in diameter, debris, and organics (protective fill) covers the base of the cell and the sides of the berm to protect the overlaying geomembrane against punctures. A Solmax 460ST 60 mm single textured high density polyethylene (HDPE) liner (or equivalent) covers the cell floor, overlaps the crest of each berm, and is anchored into the side of the perimeter berms. A 16 oz non-woven geotextile overlays the geomembrane as a precaution against punctures, and is anchored into the perimeter berms. Approximately 500 mm of fill free from debris and organics overlays the geotextile on the base of the cell, for torsion protection from turning vehicles. At least 300 mm of fill overlays the interior side slopes of the berms.

While it is not expected to be frequent, there may be times throughout operation wherein it may be necessary to add amendments to the soil to promote effective and efficient breakdown of hydrocarbon constituents. Typical amendments include fertilizer to stimulate natural microflora activity, water to adjust moisture content and lime to modify pH. In more extreme circumstances, other soil conditioners such as surfactants (Ivey-sol or equivalent), can be added to liberate hydrocarbon from soil particle adsorption to promote bioavailability. Similarly, an oxidant (RegenOx or equivalent) may be used to promote oxidation. In the event that any of these are required, MSDS is located in a small storage shed or storage container on site and be accessible to all workers, and the *Cambridge Bay Soil and Water Treatment Facility Spill Contingency Plan* (KEL 2022) is updated to include an appropriate spill response plan for the soil amendment. Any amendments is procured for immediate use; no long term storage on site is expected. Over the short term, amendments is stored with appropriate containment in the locked shed on site or off-site at the KEL Office.

Further details pertaining to biotreatment facility operation can be found in the *Cambridge Bay Soil and Water Treatment Facility Operations and Maintenance Plan* (KEL 2022).

6.2. Utility Locates

An engineered pond is utilized to accept STF leachate and petroleum hydrocarbon-contaminated water and snow from off-site sources including residential, commercial and industrial properties where a petroleum hydrocarbon spill or leak has occurred. Prior to receipt on site, snow and water is profiled which may include sampling and analysis and/or review of contaminant MSDS information and suitable movement documents to determine suitability for treatment. Water and snow is deposited into an engineered cell and will remain in the cell until snow has melted, at which time the meltwater is directed to an adjacent on-site WTP. Effluent generated at the biotreatment pad will also be directed to the engineered pond via portable trash pump.

Engineered Pond

The pond has been designed to contain up to 170 m³ of water at any one time maintaining a free board of at least 0.3 m. The cell can accommodate snow piled to the height of the top of the berm (0.9 m) to limit the risk of overtopping during spring melt. The cell is designed to be 14 m by 19 m, surrounded by a soil berm approximately 0.8 m tall with 3:1 side slopes measured from existing grade with 0.3 m of freeboard.

At least 0.2 m of soil fill free from material greater than 8 mm in diameter, debris, and organics (protective fill) covers the base of the pond and the sides of the berm to protect the overlaying geomembrane against punctures. The base of the pond area is graded and proof rolled with a smooth drum roller. A GSE NW8 non-woven geomembrane, or approved equivalent, will cover the pond floor overlapping the crest of each berm and is anchored into the side of the perimeter berms. A Layfield Enviro Liner 6140, or approved equivalent, overlays the geomembrane as a precaution against punctures and is anchored into the perimeter berms.

While in operation during the winter months, the pond may be covered to prevent increased treatable water volume due to precipitation.

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 water treatment plant. Treated water is held in an adequately sized single wall AST prior to discharge.

Water Treatment Plant

The water treatment at the Facility is a package treatment plant consisting of a bag filter train and a granular activated carbon (GAC) bed designed for removal of particulate matter and organic constituents such as petroleum hydrocarbons.

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 vessel, containing approximately 227 kg (500 lbs) of GAC, 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 is necessary to flush and change the filter media. MSDS for the filter media constituents located in a small storage shed or storage container on site and be accessible to all workers.

6.3. Reuse and Disposal

Once bioremediated soil has been analyzed, it is classified as either meeting reuse criteria, or requiring off-site disposal at a designated facility. It is planned that the majority of the soil material meeting reuse criteria is used either as fill or as alternative daily cover at the Cambridge Bay Landfill.

Treated effluent water meeting discharge criteria (detailed in the Water Licence and in Table A4) is either beneficially reused or discharged to the environment. Treated effluent is batch discharged to the ground surface through a dedicated hose wherein the water will flow overland to natural drainage. Depending on conditions on the biotreatment pad, treated effluent can be applied to the soil lifts to aid in bioremediation and promote dust suppression. Remaining treated effluent is released to the environment adjacent to the Facility. It is expected that discharge from the WTP will occur between July 1 and Sept 30. Discharge volumes will not exceed 10 m³/day; given reuse options, typical discharge volumes are expected to be much less.

Depending on conditions on the biotreatment pad, treated effluent not meeting discharge criteria can be applied to the soil lifts to aid in bioremediation and promote dust suppression. Material requiring disposal, including untreated water, soil that could not be treated, spent filter media, and spent spill response materials is disposed of at approved waste facility locations.

7.0 DOCUMENTATION AND REPORTING

Waste management reporting is in accordance with requirements set forth in the license and with record keeping and reporting requirements of the Government of Nunavut and KEL's internal Policies and Procedures. The focus of waste management reporting is to ensure that the generation, handling and final disposition of materials is accounted for. The following information for each waste stream collected, stored and reported is as follows:

- Movement documents (Federal Manifests or Bill of Ladings);
- Volume and/or weight;
- Disposal summaries; and

- Applicable analytical and/or profile information.

8.0 TRAINING

Personnel managing waste are certified in Workplace Hazardous Material Information System (WHMIS) and Transportation of Dangerous Goods (TDG). Any waste shipment requiring a Federal Movement Document (FMD) will need to have the FMD filled out by an individual holding a valid certificate in TDG. Personnel responsible for operation and maintenance of the WTP will receive training from manufacturer prior to operation.

9.0 REFERENCES

Anderson, John et al. *Northern Arctic Ecozone (NAE) Ecological Framework of Canada* (2008). April 8, 2016 <ecozones.ca>

Transportation of Dangerous Goods Regulations. SOR/2012-245

Canadian Council for the Ministers of the Environment (CCME). 2014. Canadian Environmental Quality Guidelines, Water Quality Guidelines for the Protection of Aquatic Life. Accessed on Jan 31, 2014.

Government of Nunavut (GN). 2003. Environmental Guidelines for Contaminated Site Remediation.

Government of Nunavut (GN). 2002. Environmental Guidelines for Site Remediation.

Kitikmeot Environmental Ltd. (KEL). 2022. Cambridge Bay Soil and Water Treatment Facility Environmental Protection Plan.

Kitikmeot Environmental Ltd. (KEL). 2022. Cambridge Bay Soil and Water Treatment Facility Spill Contingency Plan.

Kitikmeot Environmental Ltd. (KEL). 2022. Cambridge Bay Soil and Water Treatment Facility Operation and Maintenance Plan.

Science Applications International Corporation (SAIC). 2006. Federal Guidelines for Landfarming Petroleum Hydrocarbon Contaminated Soils. Presented to Contaminated Sites Division and Emergencies Engineering Technologies Office (EETO), Environmental Technology Centre, Environment Canada.

APPENDIX A

Soil Acceptance and Reuse Criteria

Table A1. Acceptance and Re-Use criteria for Petroleum Hydrocarbons to be met prior to industrial use of treated contaminated soils

| PHC Reuse Criteria | ADC Fine-Grained Soil (mg/kg) | ADC Coarse-Grained Soil (mg/kg) | Facility Acceptance Criteria (mg/kg) |
|--------------------|-------------------------------|---------------------------------|--------------------------------------|
| Benzene | 5 | 5 | N/A |
| Toluene | 0.8 | 0.8 | N/A |
| Ethylbenzene | 20 | 20 | N/A |
| Xylenes | 20 | 20 | N/A |
| PHC (F1) | 320 | 320 | 12500 |
| PHC (F2) | 260 | 260 | 10000 |
| PHC (F3) | 2500 | 1700 | 5000 |
| PHC (F4) | 6600 | 3300 | 7500 |

* If testing for particle size is not completed to determine if the soil is Coarse or Fine – grained, soil must be treated to achieve the Coarse-grained soil criteria

Sources:

1: CCME's Canada-Wide Standards for Petroleum Hydrocarbons in Soil

2: Government of Nunavut's Environmental Guidelines for the Management of Contaminated Sites. Eco Soil Contact.



Table A2. Acceptance and Re-Use criteria for Metals to be met prior to industrial use of treated contaminated soils

| Parameter | Units | CCME Industrial Guidelines for Metals in Soil (mg/kg) | Facility Acceptance Criteria (mg/kg) |
|-------------------------------|-------|---|--------------------------------------|
| Antimony | mg/kg | 40 | 40 |
| Arsenic | mg/kg | 12 | 12 |
| Barium | mg/kg | 2000 | 2000 |
| Beryllium | mg/kg | 8 | 8 |
| Boron | mg/kg | N/A | N/A |
| Cadmium | mg/kg | 22 | 22 |
| Chromium (total) | mg/kg | 87 | 87 |
| Chromium, hexavalent (Cr(VI)) | mg/kg | 1.4 | 1.4 |
| Cobalt | mg/kg | 300 | 300 |
| Copper | mg/kg | 91 | 91 |
| Lead | mg/kg | 600 | 600 |
| Mercury | mg/kg | 50 | 50 |
| Molybdenum | mg/kg | 40 | 40 |
| Nickel | mg/kg | 89 | 89 |
| Selenium | mg/kg | 2.9 | 2.9 |
| Silver | mg/kg | 40 | 40 |
| Thallium | mg/kg | 1 | 1 |
| Tin | mg/kg | 300 | 300 |
| Uranium | mg/kg | 300 | 300 |
| Vanadium | mg/kg | 130 | 130 |
| Zinc | mg/kg | 360 | 360 |

Sources:

1: CCME's Canada-Wide Standards for Petroleum Hydrocarbons in Soil



2: Government of Nunavut's Environmental Guidelines for the Management of Contaminated Sites.



Table A3: Discharge Criteria for Water as per Government of Nunavut (Department of Environment)

| Parameter | Maximum Concentration of any grab sample (mg/L) |
|---------------------------------------|---|
| Total Extractable Hydrocarbons (TEH)* | 15 and no visible sheen |
| Total Lead | 0.05 ¹ |
| Benzene | 0.37 ² |
| Toluene | 0.002 ³ |
| Ethylbenzene | 0.09 ³ |

Sources:

- 1: B.C. Reg. 168/94: Petroleum Storage and Distribution Facilities Storm Water Regulation
- 2: GN Department of Environment Environmental Guideline for Industrial Waste Discharges
- 3: CCME Water Quality Guidelines for the Protection of Aquatic Life

Table A4. Treated Water Discharge Guidelines

| Parameters | Units | Site-Specific Guidelines |
|----------------------------|-------|--------------------------|
| Benzene | mg/L | 0.37 |
| Toluene | mg/L | 0.002 |
| Ethylbenzene | mg/L | 0.09 |
| Xylenes | mg/L | 0.03 |
| F1 (C6-C10) | mg/L | 0.15 |
| F2 (C10-C16) | mg/L | 0.11 |
| F3 (C16-C34) | mg/L | - |
| F4 (C34-C50) | mg/L | - |
| Aluminum (Al) | mg/L | 0.005-0.1 ^a |
| Arsenic (As) | mg/L | 0.005 |
| Beryllium (Be) | mg/L | - |
| Boron (B) | mg/L | 1.5 |
| Cadmium (Cd) | mg/L | 0.00009 |
| Chromium, Hexavalent (Cr6) | mg/L | 0.001 |
| Chromium, Trivalent (Cr3) | mg/L | 0.0089 |



Table A4. Treated Water Discharge Guidelines

| Parameters | Units | Site-Specific Guidelines |
|---------------------|-------|--------------------------|
| Cobalt (Co) | mg/L | 0.0025 |
| Copper (Cu) | mg/L | 0.002-0.004 ^b |
| Iron (Fe) | mg/L | 0.3 |
| Lead (Pb) | mg/L | 0.001-0.007 ^b |
| Manganese (Mn) | mg/L | - |
| Mercury (Hg), Total | mg/L | 0.000026 |
| Molybdenum (Mo) | mg/L | 0.073 |
| Nickel (Ni) | mg/L | 0.025-0.15 ^b |
| Phosphorus (P) | mg/L | Calculation |
| Selenium (Se) | mg/L | 0.001 |
| Silver (Ag) | mg/L | 0.00025 |
| Strontium (Sr) | mg/L | - |
| Vanadium (V) | mg/L | - |
| Zinc (Zn) | mg/L | 0.03 |

- Parameters without guidelines indicated by "-"

a pH-dependent parameter

b hardness-dependent parameter

- Canadian Environmental Quality Guidelines, Water Quality Guidelines for the Protection of Freshwater Aquatic Life (CCME CWQGs; CCME, 1999)

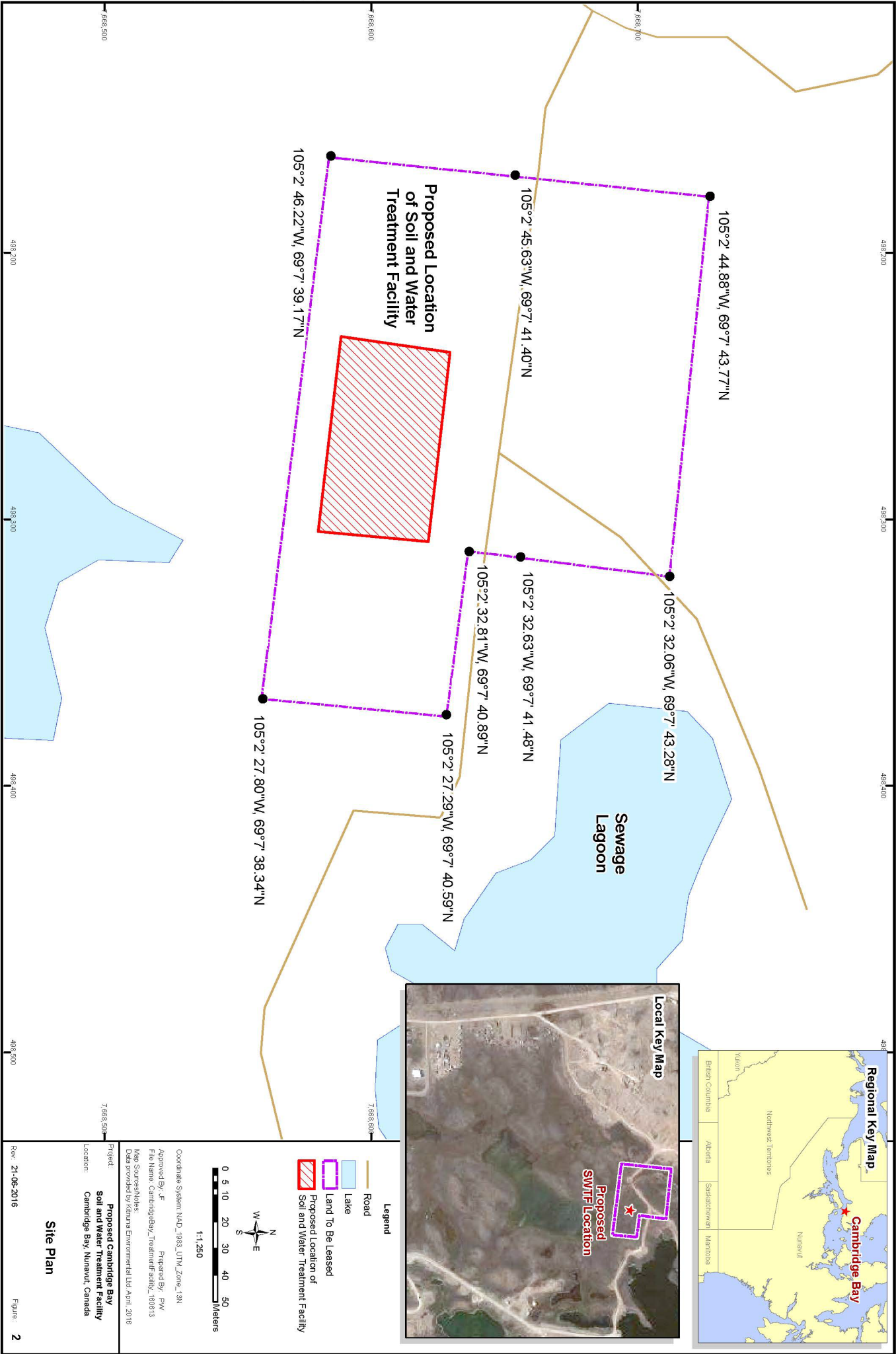
Where no guideline exists, parameter will be analyzed for ongoing trend analysis



APPENDIX B

General Location of Soil and Water Treatment Facility

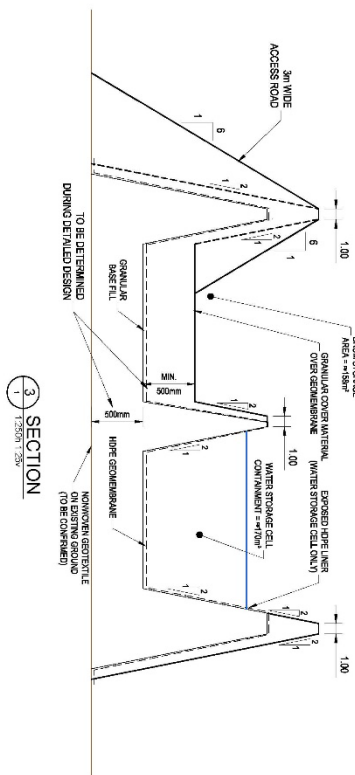
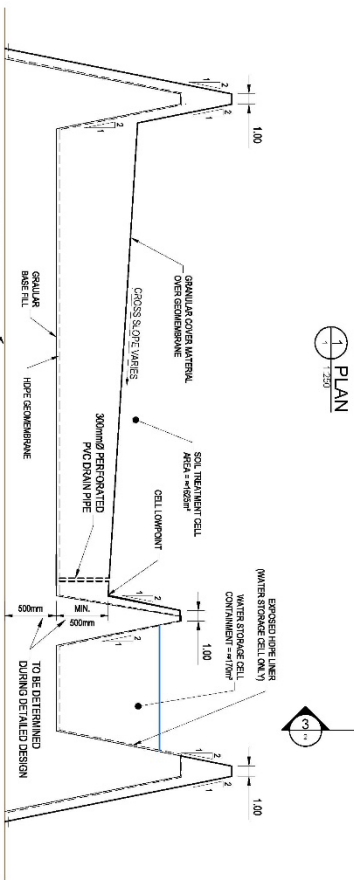
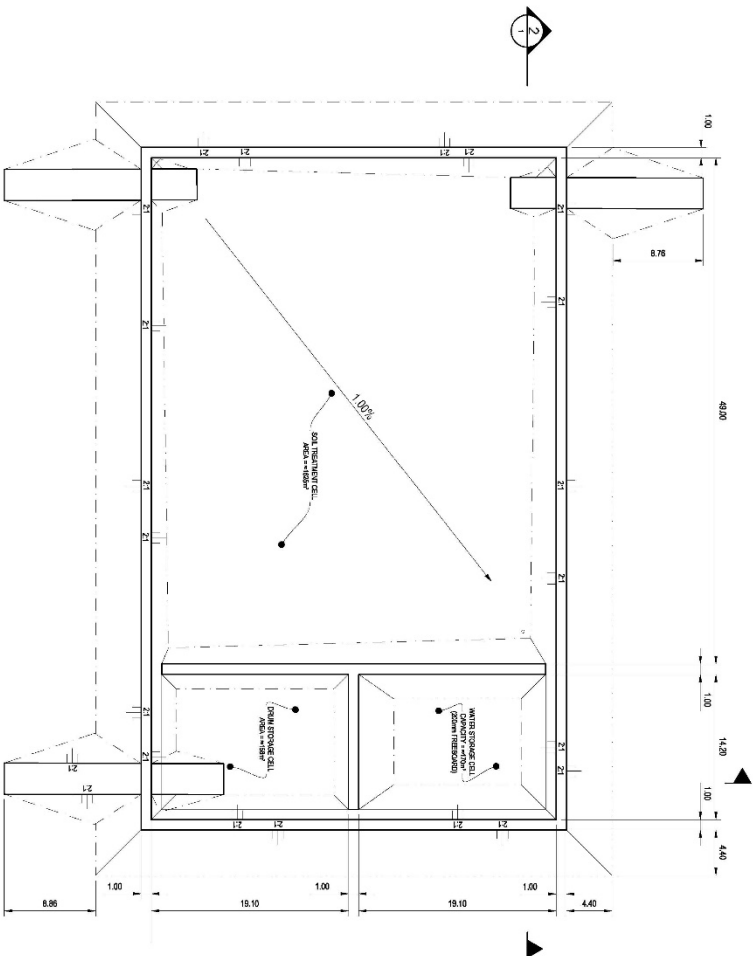




APPENDIX C

Facility Design Drawing





NOTES:

1. FIGURE IS IN SUPPORT OF KIEL'S APPLICATION FOR A DEVELOPMENT PLAN FOR A SOIL TREATMENT FACILITY IN CAMBRIDGE, BAY, N.I.
2. FIGURES PRESENT GENERAL LAYOUTS AND CONCEPTUAL DESIGNS. FINAL DESIGN AND CONSTRUCTION WILL DEPEND ON FIELD CONDITIONS AND LOCALLY AVAILABLE CONSTRUCTION MATERIALS.
3. SCALES AND DIMENSIONS ARE APPROXIMATE.
4. EXISTING GRADE IS ASSUMED TO BE FLAT AND LEVEL. ACTUAL CONFIGURATION WILL MAKE USE OF ADJUNCTIVE NATURAL SLOPE ORIENTATIONS.
5. BERM HEIGHT MAY BE INCREASED TO ACCOMMODATE FIELD CONDITIONS.
6. GEOMERATIVE INSULATION QUALITY CONTROL AND QUALITY ASSURANCE SHALL BE CONDUCTED THROUGHOUT INSULATION ASSURING TO MINIMIZE UNDESIRABLE PENETRATIONS.
7. BERMS AND BASE SHALL BE COMPACTED TO BERT STANDARD PROPOSED DENSITY IN LOTS OF UP TO 300 MILLIMETERS.
8. PRACTICAL INSULATION LAYER AND GRADING FILLS TO BE PLACED PRIOR TO PLACEMENT OF GEOTEXTILE AND GEOMERATIVE.
9. BERM SLOPES TO BE DETERMINED DURING DETAILED DESIGN.
10. MINIMUM DEPTH OF BASE FILL ABOVE EXISTING GROUND TO BE DETERMINED DURING DETAILED DESIGN.

SECTION 2
1:2500 1:250

NOT FOR CONSTRUCTION



| NO. | DESCRIPTION | DATE |
|-----|--------------------------|------------|
| 01 | ISSUED FOR CLIENT REVIEW | 18/04/2018 |
| 02 | | |
| 03 | | |
| 04 | | |
| 05 | | |
| 06 | | |
| 07 | | |
| 08 | | |
| 09 | | |
| 10 | | |
| 11 | | |
| 12 | | |
| 13 | | |
| 14 | | |
| 15 | | |
| 16 | | |
| 17 | | |
| 18 | | |
| 19 | | |
| 20 | | |
| 21 | | |
| 22 | | |
| 23 | | |
| 24 | | |
| 25 | | |
| 26 | | |
| 27 | | |
| 28 | | |
| 29 | | |
| 30 | | |
| 31 | | |
| 32 | | |
| 33 | | |
| 34 | | |
| 35 | | |
| 36 | | |
| 37 | | |
| 38 | | |
| 39 | | |
| 40 | | |
| 41 | | |
| 42 | | |
| 43 | | |
| 44 | | |
| 45 | | |
| 46 | | |
| 47 | | |
| 48 | | |
| 49 | | |
| 50 | | |
| 51 | | |
| 52 | | |
| 53 | | |
| 54 | | |
| 55 | | |
| 56 | | |
| 57 | | |
| 58 | | |
| 59 | | |
| 60 | | |
| 61 | | |
| 62 | | |
| 63 | | |
| 64 | | |
| 65 | | |
| 66 | | |
| 67 | | |
| 68 | | |
| 69 | | |
| 70 | | |
| 71 | | |
| 72 | | |
| 73 | | |
| 74 | | |
| 75 | | |
| 76 | | |
| 77 | | |
| 78 | | |
| 79 | | |
| 80 | | |
| 81 | | |
| 82 | | |
| 83 | | |
| 84 | | |
| 85 | | |
| 86 | | |
| 87 | | |
| 88 | | |
| 89 | | |
| 90 | | |
| 91 | | |
| 92 | | |
| 93 | | |
| 94 | | |
| 95 | | |
| 96 | | |
| 97 | | |
| 98 | | |
| 99 | | |
| 100 | | |

REDUCED

KIEL SOIL TREATMENT FACILITY - CONCEPTUAL DESIGN
CAMBRIDGE BAY, NUNAVUT

SITE PLAN AND SECTION

1

15,220,1000

Conditions of Use
KIEL'S provides and/or services on a non-exclusive basis. KIEL'S shall not be responsible for any loss or damage to any property or person, or for any liability, arising from the use of the information provided by KIEL'S. KIEL'S shall not be responsible for any loss or damage to any property or person, or for any liability, arising from the use of the information provided by KIEL'S. KIEL'S shall not be responsible for any loss or damage to any property or person, or for any liability, arising from the use of the information provided by KIEL'S.