Technical Information for Supplementary Information Guideline I3: Landfarm

Site Description

The landfarm will be located adjacent to the Hamlet of Cambridge Bay sewage lagoon, approximately 700 meters northeast of the community. The site is approximately 850 meters northwest of the Arctic Ocean as shown on Figure 1. The site was chosen by the Hamlet of Cambridge Bay to provide adequate separation from populated areas and to make use of existing transportation routes for the movement of trucks to and from the site. The site is accessed by a road that passes between the sewage lagoon and the quarry pit, which would not typically be used by the common public and thus doesn't create disturbance to any public areas.

It is understood by Kitnuna Environmental that the landfarm site will not cause any impact to traditional land use areas, and does not infringe on any commonly used traditional space.

Cambridge Bay is located within the zone of continuous permafrost. Bedrock consists of Cambrian to Ludlow Arctic Platfrom made up of dolostone, limestone and minor sandstone to shale (Harrison et al. 2013). The ground surface consists of a till layer of varying thickness. Groundwater flow in anticipated to be through the shallow till overburden. The elevation of the site is approximately 20 meters above sea level and the land slopes relatively consistently towards the bay. It is not anticipated that a risk of flood The site and surface water flow direction is shown on drawing Figure 2.

Facility Design

The soil and water treatment facility will consist of a 1625 m^2 soil treatment cell, a 158m^2 drum storage cell and a water storage cell capable of holding 170m^3 of water/snow. The soil cell and drum storage cell will be constructed to allow water to drain to the water storage cell. All of the cells will be surrounded by constructed berms and lined with a high density polyethylene (HDPE) liner that has the seams welded. The base and berms of the cells will be lined with a geotextile, be built upon granular base fill and have an HDPE impermeable liner.

The treatment cell will utilize natural slopes to facilitate runoff and collection of any water. Perforated drain pipes will allow for water to gravity drain and be stored in sumps which can be pumped into the water storage cell as needed.

Monitoring wells will be placed into the till overburden in at least 2 downgradient locations to allow water groundwater monitoring and sampling. Soil samples will be collected from the site prior to construction beginning to serve as a baseline for comparing results at the closure of the facility.

The average annual amount of precipitation in Cambridge Bay is 69mm of rain and 82 cm of snow. (The Weather Network 2016).

No onsite infrastructure is planned as a part of the soil and water treatment facility. Equipment onsite will consist of a mobile water treatment plant and water storage tanks as required. No fuel or chemicals will be stored on the site for active use purposes. Access to the facility will occur from an existing gravel road, and entrance to the cells will be via a designed approach ramp. Signage will be placed around the facility indicating that unauthorized entry is prohibited.

A conceptual design drawing can be found on Sheet No. 1. Once approval for construction is obtained, and the final location has been determined, design drawings that are stamped and signed by a registered professional in Nunavut.

Treatment Methods

Soil contaminated with petroleum hydrocarbons will be brought to the site from locations around the Hamlet of Cambridge Bay. Acceptance criteria is provided in *KEL's Operations and Maintenance Plan, Cambridge Bay Soil and Water Treatment Facility (KEL 2016)*. Soil will be stockpiled and given an identifier number to allow for sampling and to ensure that co-mingling does not occur. Treatment will occur by aeration using an excavator and if deemed necessary the addition of nutrient amendments. After treatment, samples will be collected and submitted to a certified laboratory for analysis. Samples will be compared to the criteria set forth in the Operations and Maintenance Plan to determine if it meets Industrial criteria. Soil that meets the criteria can be hauled offsite and used as additional daily cover and the Cambridge Bay Landfill. Soil that does not meet criteria will undergo further treatment.

Water/snow impacted with petroleum hydrocarbons will be brought to site and deposited into the water storage cell. Water will be treated using a package treatment plant that removes solids and organics using filters and activated carbon media, or similar. Treated water will be stored in an above ground storage tank and a sample will be collected and submitted for laboratory analysis to determine if the water meets the Government of Nunavut water discharge criteria as outlined in the Operations and Maintenance Plan. If water meets the discharge criteria, it will be discharged to surface in a manner that allows the water to follow natural drainage patterns to avoid any unnecessary erosion.

The hazardous waste storage area will be used to temporarily store waste drums that require re-containerization and shipment to certified disposal facilities. Care will be taken to ensure that no free product or waste sits open in the storage area. Any precipitation that contacts the waste storage area will be contained and drain to the water storage cell for treatment.

Operations and Maintenance

Acceptance of impacted material to the facility will be controlled by using criteria to determine if it is believed that treatment will be successful. All incoming material will require the necessary laboratory analysis confirming it meets acceptance criteria, along with a waste profile form. One representative sample of the material will be considered sufficient for use in determining acceptance. For acceptance soil will be analyzed for Benzene, Toluene, Ethylbenzene and Xylenes (BTEX) along with petroleum hydrocarbon fractions F1-F4. Total metals will also be analyzed to determine if they meet acceptance criteria as set forth in KELs Operation and Maintenance Plan (KEL 2016). In the case of an emergency, material may be accepted without laboratory analytical results.

Soil will be placed in the treatment cell in such a way that it will remain segregated and identifiable for the duration of its time in the cell. This will allow for easy tracking of the progress of the treatment of the soil by allowing representative samples to be collected on multiple events, if required. Soil will be piled to a maximum height of 3.0m and care will be taken to ensure that adequate space is maintained between the toe of the slope of each pile and the cell berms. Mechanical aeration will occur using an excavator bucket and/or allu bucket. If necessary, water from the storage cell will be sprayed on the soil

piles to increase moisture content to create more favorable conditions. Oversized material will be removed by either screening or manual separation.

The facility will be designed to allow water to drain away from the soil piles to the water storage cell. The natural slopes on the site will be used to determine the final placement of the facility on the provided property. Water that collects in the storage cell will be monitored to ensure that adequate freeboard is maintained. Water will be sampled and, as necessary, treated and re-sampled to ensure that it meets the Government of Nunavut Department of Environment discharge criteria. Discharge will occur to surface in a way that prevents erosion of sediments and allows the water to follow natural drainage slopes.

It is not anticipated that site volume will be an issue due to the location of the facility with the nearest neighbours being an active quarry and the sewage lagoon. Dust control is not expected to be required for the facility, but if necessary, water from the storage cell can be sprayed onto the soil piles to increase moisture content. Any operator that will be onsite will be explained the process and operational methods at the facility along with all safeguards to ensure that material from the facility does not breach to confines of the berms.

Soil at the facility will use Canadian Council of Ministers of the Environment (CCME) Canadian Environmental Quality Guidelines for Industrial land use as the criteria for determining if soil has been treated. The criteria for coarse grained soil will be used in all circumstances unless representative sampling shows that the soil is in fact fine grained. The parameters that will be compared to CCME Industrial will be Benzene, Toluene, Ethylbenzene and Xylenes (BTEX) along with petroleum hydrocarbon fractions F1-F4. Total metals will also be analyzed upon acceptance to the facility and as metals are not treatable, the acceptance criteria will also be used as the reuse criteria. Once it is determined that soil meets reuse criteria, it can be hauled to the landfill and used as additional daily cover. Any different final deposition of the soil will be discussed and confirmed on a case by case basis. Any soil that is untreatable will be containerized and shipped for disposal at an approved facility on an available sealift.

Water in the water storage cell will be sampled to determine if it meets discharge criteria as set forth by Government of Nunavut. If it does not meet discharge criteria it will be treated through a package treatment plant that will be mobilized to site. After treatment, the water will be sampled again and analyzed to determine if discharge criteria is achieved. Once the criteria is met, discharging will occur to surface in a way that allows for the water to follow natural drainage paths. The location of discharge will be monitored for erosion and if any is noted, the discharge volumes or locations will be evaluated and changed if necessary.

Surface and Groundwater Monitoring Programs

Once the final location for the facility on the property has been determined, groundwater and surface water monitoring locations will be chosen and baseline samples will be collected prior to operation of the facility. It is anticipated that due to the short summer season, groundwater may not be annually present each summer. Locations of sample points will be documented in a Groundwater and Surface Water Monitoring Program that is to be developed upon determination of placement of the facility on the property. It is proposed that samples will be analyzed for the following parameters:

- pH, Conductivity, Hardness
- Benzene, Toluene, Ethylbenzene, Xylenes (BTEX)
- Petroleum Hydrocarbons F1-F4
- Total Metals including mercury
- Total Extractable Hydrocarbons (TEH)

Quality assurance and quality control measures will be put in place during the groundwater and surface water sampling in the form of duplicate samples at a rate of 1 per 10 samples collected, along with the use of field and trip blanks. Laboratory QA/QC measures will also be included on analytical reports.

References

Harrison, J.C., Christie, R.L., Rainbird, R.H., and Ford, A. 2013. Geology, Tectonic assemblage map of the Cambridge Bay area, southeastern Victoria Island, Nunavut; Geological Survey of Canada. Canadian Geoscience Map 78 (preliminary), scale 1:500000

The Weather Network 2016, beta.theweathernetwork.com, Cambridge Bay, Nunavut

KEL 2016, Operations and Maintenance Plan, Cambridge Bay Soil and Water Treatment Facility