WATER RUN-OFF TREATMENT AND DISCHARGE AT THE CITY OF IQALUIT SOLID WASTE FACILITY

FINAL VERSION

October 26, 2015

O/Ref.: QE15-107-4

WATER RUN-OFF TREATMENT AND DISCHARGE AT THE CITY OF IQALUIT SOLID WASTE FACILITY

Approved and Prepared by:

Greg Johnson, Eng., M.Sc.A.
Project Director – Northern Projects

Qikiqtaaluk environmental
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1. OBJECTIVE

- Treat up to 10,000,000 litres of water so that it can be discharged

2. FIGURES

- Figure 1 : Site Plan
- Figure 2 : Treatment Flow Chart

3. DISCHARGE CRITERIA

The discharge criteria presented below is still under review and will be finalised with Environment Canada prior to its application. The criteria below were suggested by Environment Canada after discussion during the proposal period. The treated water is going to be discharged in to Koojessee Inlet, which is a marine environment.

Parameter	Treatment Target
Ammonia	< 3 mg/L NH_3-N
BOD	25 mg/L or levels which are non-acutely toxic
Total Suspended Solids	15 mg/L
pH	Env Canada 6-7 NWB 6.5 – 9
Arsenic	12.5 µg/L
Cadmium	0.12 µg/L
Chromium	< 100 µg/L
Copper	4.8 µg/L
Mercury	1.6 µg/L
Nickel	74 µg/L
Zinc	120 µg/L
Dioxins and Furans	39 ppq TEQ
Oil & Grease	5 mg/L

Toxicity testing will also be performed according the Environment Canada's Biological Test Method: Reference Method for Determining Acute Lethality of Effluents to Rainbow Trout to further confirm that the treated water poses no risk to the environment.

4. PRINCIPAL STEPS

1. Initial treatment of the water for metals and total suspended solids;
2. Transfer of the water treated in step one into the bioreactor;
3. Biological treatment in the bioreactor to lower the biological oxygen demand and the ammonia nitrogen levels;
4. Final polishing of the water by filtration to remove particles and organic contaminants; and,
5. Discharge of treated water, once approvals have been given.

5. INITIAL TREATMENT OF THE WATER FOR METALS AND TOTAL SUSPENDED SOLIDS

This treatment will be done by adding a lime slurry to the water to raise the pH above 8 which will cause the metals in solution to precipitate out of the water. This will be achieved by pumping water from one end of the pond and rejecting it into a point the farthest from the pumping location. A lime slurry will be added to the water at the intake of the pumps so that the pumps mix the contaminated water and the lime slurry, helping to keep the lime in suspension. The pump has a flow rate of 200 litres per minute with a two inch outlet. The two inch hose will be attached to a six inch diameter hose that is a minimum of 50 feet long. This will give the required reaction time between the lime and the water to cause the pH to raise to 8 before it is discharged back into the holding pond. A flocculating agent will also be added to the water which will encourage the solids suspended in the water to accumulate into larger particles and settle in the bottom of the treatment pond.

The dosage rates of the lime a flocculating agents need to be adjusted based on the concentrations of the metals and total suspended solids in the water. The treatment period will also very depending on the volume of the water and the level of contaminants to be removed. The following table presents the anticipated dosage rates and treatment times for each of the holding ponds:

Parameter		Leachate Containment Pond	Retention Pond	Drafting Pond
Lime Addition Rate	mg/L	400	200	160
Polymer 1 Addition Rate	mg/L	4	4	4
Polymer 2 Addition Rate	mg/L	4	4	4
Treatment Period	Days	4	6	1

Treatment will start in the Retention Pond, which will be treated in a closed loop until the desired pH and water clarity is achieved. Once this water is treated, it will be pumped into the Bioreactor. Once the Retention Pond is emptied, the water from the Drafting Pond and the Leachate Containment Pond will be pumped into the Retention Pond and the lime and the polymer will be added during this process. The water will continue to be treated in a closed loop until the desired pH and clarity is achieved. This water will be pumped into the bioreactor once it is started to be emptied.

6. TRANSFER OF WATER

Once the water in each of the ponds has been treated to meet the requirements of the first step the water will be transferred into the bioreactor. Authorisation is required from AANDC to transfer water from a holding pond into the bioreactor.

7. BIOLOGICAL TREATMENT TO LOWER THE BIOLOGICAL OXYGEN DEMAND AND THE AMMONIA NITROGEN

The water in the bioreactor will be treated for Biological Oxygen Demand (BOD) and ammonia nitrogen through a biological treatment that will use naturally occurring bacteria in the water to lower the levels of BOD and ammonia nitrogen. This will be accomplished by oxygenating the water by using an air compressor which will pump compressed air into the bottom of the bioreactor through aeration tubing that will be spaced at a distance of every 4 feet. The water will also be heated using a boiler and heat exchanger to raise the temperature of the water over 15 degrees Celsius to provide ideal conditions for biological activity.

It is estimated that one month will be required to lower the levels of biological oxygen demand and ammonia nitrogen in the water to meet discharge criteria. At the end of the bioreactor a silt curtain will be installed and the solids will be flocculated out of the water. The silt curtain is necessary to prevent the solids from the treatment process from accumulating over the aeration hoses. The solids from this process are mostly dead organic matter from the treatment process. The accumulated solids will be disposed of in the City of Iqaluit's Landfill.

Following one month of treatment, water will start to be pumped from the bioreactor through the filtration system. As the water is pumped out an equal amount of water will be pumped into the bioreactor. The flow rate will be set so that the water will remain in the bioreactor for a minimum of one month.

8. FINAL POLISHING

The final polishing of the water will be done by pumping the water, at a flow rate of 200 litres per minute, through GAF filters with a pore size of 25 microns to remove as much of the solids as possible from the water. The water will then be pumped through an Ultrasportion filter.

Ultrasorption is a patented technology developed by QE's partner Sanexen Environmental Services Inc. primarily to remove dioxins and furans from water, however, it also works extremely well to remove emulsified organic contaminants. The process developed uses the difference in affinity that contaminants have between water and an agent integrated into a filter matrix. The agent in question is integrated to a solid medium that presents an excellent surface contact with water and introduces a strong sharing of the contaminants and the aqueous phase towards the media. The agent selected reduces the affinity of contaminants to water by increasing the surface tension of the water and permits to intercept and hold the contaminants. The efficiency of extraction is a function of the intrinsic hydrophobicity of the contaminants. The Ultrasorption filter will remove any emulsified organic contaminants

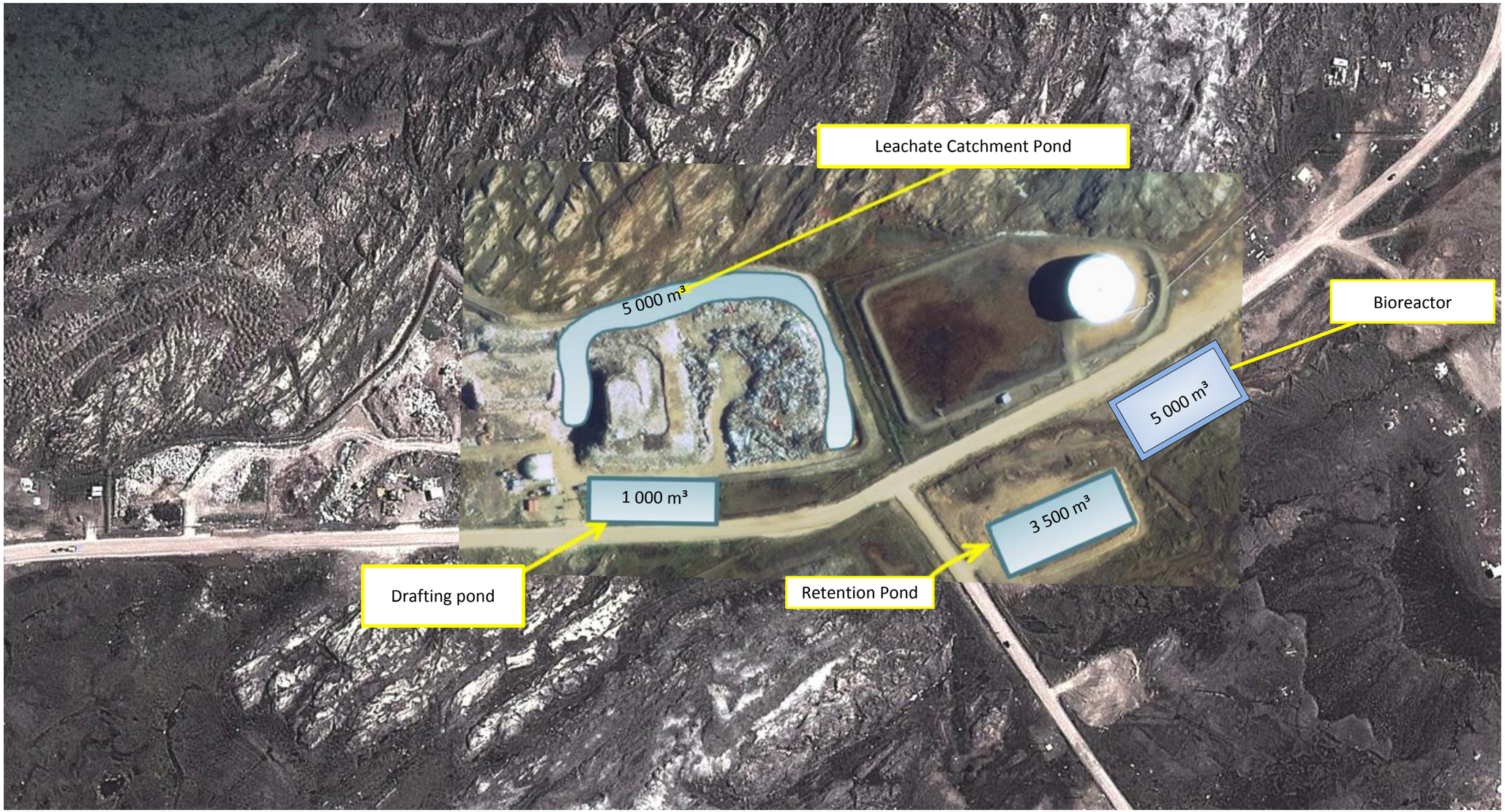
Following the Ultrasorption filter the water will be pumped into an activated carbon filter to remove any remaining organic contamination. A final pH adjustment will be done to ensure that the discharge criteria is met.

9. DISCHARGE

Once the biological treatment is completed, and the water is pumped through the filters, the water will then be pumped into 4 holding basins. As each basin is filled a sample will be collected and sent to the laboratories to show the efficiency of the treatment process and that the water respects the discharge criteria. Once 4 continuous samples have shown that the water meets the discharge criteria, the water from the treatment system will be pumped continuously to the discharge location with a sample collected once per week to show that the treatment process is still respecting the discharge criteria. Should samples show that the water does not meet the discharge criteria, then the process will be stopped and the approval process will have to be restarted until the water once again meets the discharge criteria.

APPENDIX A

FIGURES



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CONFIDENTIAL

Title: **Figure 1 Site Plan**		
Project: **CITY OF IQALUIT SOLID WASTE FACILITY Iqaluit, Nunavut**		
Scale: As shown	Conception date: 2015-10-23	Revision date: 2015-10-23
Drawn by: J.-F. Larose	Verified by: G. Jonhson	Approved by: S. Laberge
Project n°: QE15-107-4	Drawing n°: QE15-107-4-01.vsd	Layout: A

Presented to: Iqaluit

Presented by: Qikiqtaaluk environmental

3:Leachate Catchment pond

Landfill

1:Drafting pond

pH

2:Retention pond

Solids to landfill

4:Bioreactor

Aeration area

Settling area

To Bay

pH

Legend

- Ajustment of the pH
- Coagulant injection
- Nutrient injection
- Air compressor
- Transfer pump
- Sludge pump
- Solids
- Air injection
- Curtain
- TSS removal
- Ultrasorption filter
- Granular activated Carbon filter
- Heat exchanger
- Boiler

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Title: **Figure 2 TREATMENT FLOW CHART**		
Project: **CITY OF IQALUIT SOLID WASTE FACILITY Iqaluit, Nunavut**		
Scale: None	Conception date: 2015-10-23	Revision date: 2015-10-23
Drawn by: J.-F. Larose	Verified by: G. Jonhson	Approved by: S. Laberge
Project n°: QE15-107-4	Drawing n°: QE15-107-4-02.vsd	Layout: A

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Presented by: Qikiqtaaluk environmental