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Nunalingni Kavamatkunillu Pivikhaqautikkut
Department of Community and Government Services
Ministère des Services communautaires et gouvernementaux

Phyllis Beaulieu
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Nunavut Water Board
P.O. Box 119
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Nov.13, 2007.

Sub: Pre-hearing Meeting/Teleconference for the Hamlet of Cape Dorset Type B Water License Amendment Application

Dear Ms. Phyllis,

The GN is submitting on behalf of the applicant a response to the items raised in your letter dated October 10, 2007, file reference No.3BM-CAP0207. We have tabulated our responses to specifically address the issues raised in your letter. Each item from your letter and the appended memo to you letter from BGC is addressed in the table below and the attachments. The attachments include the following;

- The record drawings of the construction
- The O&M Manual for the operation of the lagoon
- AMEC report on Seepage and stability analysis.

The table identifies the items that are addressed by the attachments. Otherwise the table itself provides the response to the issues.

Table 1- Cape Dorset Sewage Lagoon
Items from the October 10, 2007 letter from the NWB.

Item	Description	Response
1	Seepage	No seepage occurs through the frozen core or non-damaged liner. However, a seepage analysis is under way for the scenario with a damaged liner (hole in the liner). The hole is positioned near the active layer base. Results of the analysis will be provided to NWB on November 15, 2007.
2	As-built	Record Drawings of the construction based on information provided by the contractor, observations by Dillon and construction records provided by AMEC are attached.
3	Operation and Maintenance	O&M Manual submission is attached.
4	Ownership of the Lagoon	The Hamlet of Cape Dorset is the facility owner and operator.

Item	Description	Response
5	Geothermal Assessment	A geothermal assessment completed as described by BGC can not be completed without several years of thermister data. The O&M Manual describes the proposed procedure to complete this assessment as part of the lagoon monitoring and first geotechnical safety review. This review will be carried out 3 years after commissioning. See also response to 15 and 16.
6	Stability Assessment	Results of the analysis will be provided to NWB on November 15, 2007.
7	Identification of Geotechnical Engineer of Record	The term "Geotechnical Engineer of Record" is defined in a number of documents, and these definitions vary from document to document. Guidelines such as the Dam Safety Guidelines carry such a definition. However in our communication with the DSA, these guidelines have not been applied to a sewage lagoon in Canada. Therefore the use of that definition from that guideline is not applicable to this situation. The design process was completed through the retention of AMEC for geotechnical site investigation and reporting. The construction drawings were completed by Dillon with input from AMEC. On site observation was completed by both Dillon and AMEC are various times.
8	Discharge Criteria	The discharge criteria set in other communities in Nunavut have used the NWT Water Board "Blue Book". It is also understood that the new Municipal Waste Water Effluent Canada Wide Strategy will come into effect shortly. It is expected that the Criteria based on the MWWE will be TSS 45 mg/l BOD 45 mg/l. Disinfection will be completed on a risk assessment basis. The design of the lagoon is based on achieving the 45/45 value at the discharge of the lagoon pipe.
9	Sludge Management	Sludge volume will be monitored as part of O&M. The sludge will stay in the lagoon for the first 20 years. Fifteen (15) years after commissioning a sludge facility will be planned to address sludge accumulation once it's a concern. See section 3.4.5 of the O&M manual as well for information on monitoring.

Item	Description	Response
10	Use of current treatments system as a contingency measure	One cell will remain as contingency measure. Cell #1 of the old lagoon system. See section 3.4.3 of the O&M manual as well.
11	Abandonment and Reclamation	It is understood that the current licence will be extended for 2 years for the existing facilities. Decommissioning of the old system will occur after 1 year of the operation of the new system. As soon as the new lagoon is under operation, then the old one will no longer be used, except as noted for emergency contingency response. GN will develop an A&R plan over the next two years. (Within the terms of the extended licence) to cover the remediation and rehabilitation of the existing system.
12	Monitoring	The monitoring program is outlined in the O&M manual. See sections 3.4.4, 3.4.5 and 3.4.6 of the manual for details.
13	Confirmation of who is the geotechnical engineer of record for the design and construction of the sewage lagoon	See response to question 7.
14	As-built construction drawings, including design criteria, inspection records during construction, materials used, quality assurance protocols and quality control documentation	See attached record. Inspection records during cut-off trench construction are provided in AMEC's report "Cut-off Trench excavation. Sewage lagoon Berms Construction Monitoring, cape Dorset, NU."

Item	Description	Response
15	Installation of thermistors to monitor freeze-back of foundation and confirm geothermal modeling predictions. Details to include location, depth, bead locations (depths), method of monitoring (data logger or manual reading), frequency of readings, who will carry out the readings. Thermistors should go below the depth of zero annual temperature change in at least one of the locations that is representative of general site conditions so that the regional geothermal gradient can be determined. Geotechnical logs of the holes drilled for each thermistor should be provided	Based on Dam Safety Guidelines and AMEC's recommendations, monitoring boreholes should be advanced to confirm freeze-back of berm body and foundation. The monitoring program also allows for determination of temperature regime in the berm during operation. One or two monitoring boreholes can be drilled around the site (away from the berm) to confirm initial permafrost temperature used for the geothermal modeling. No need is required in determination of the regional geothermal gradient or initial ground temperatures. It is a known fact that the geothermal gradient for typical permafrost conditions is in a range 0.01 °C/m to 0.02 °C/m. However, if the geothermal gradient is even as high as 0.06 °C/m, it will result in insignificant impact to estimated berm temperature regime because influence of extremely cold climate is considerably greater than influence of the high geothermal gradient. Similarly, changing the initial ground temperature will alter the freeze-back estimates only for initial year after construction. Subsequence years will show very little difference from that already modeled.
16	Calibration of the geothermal analysis to the thermistor temperature measurements and site data.	Monitoring of permafrost temperature around the site does not allow for calibration of the geothermal model used for prediction of the berm temperature regime. Such monitoring would help in calibration of boundary conditions for undisturbed surface conditions (natural snow cover and undisturbed vegetation). The boundary conditions over the berm and impoundment area will differ considerably from boundary conditions of the undisturbed surface and for this reason cannot be calibrated with the use of temperature data obtained around the site. However, temperature data obtained from the monitoring boreholes along the berm can be used for calibration of boundary conditions over the berm area.
17	Confirm that the lagoon water temperatures used in the geothermal analysis are conservative with respect to operational water temperatures	This is confirmed.
18	O&M manual to include thermistor monitoring protocol and lagoon operation (annual discharge) required to maintain a frozen geothermal regime in the base of the lagoon. Changes in operations with respect to operating pond levels should trigger a review of the need to reassess geothermal model to check that frozen conditions are maintained	See O&M Manual section 3.4.6 and 3.4.7
19	Confirm rate of drawdown of lagoon during annual discharge	Draw down will occur over a 2 week period.

Item	Description	Response
20	Check stability of upstream slope under rapid drawdown conditions based on maximum potential drawdown rate. Stability analysis should assess stability of the thin unfrozen zone of the upstream shell predicted from the geothermal analysis as well as conservatively assuming that the entire shell upstream of the liner is thawed, with a failure zone that incorporates the GCL liner as a potential low strength element within the slope	See response to item 6.
21	Conduct a seepage analysis for the case assuming there are undetected defects/holes in the liner, with seepage taking place through the active zone in the downstream shell. Assess potential for this seepage to affect slope stability and integrity of frozen conditions in the berm and foundation	See response to item 1.
22	What was the protocol/criteria used in the field to establish the base of the cut-off trench?	The base of the trench should be at least 2 m below the existing ground surface and located in frozen ice poor soil or frozen competent bedrock (see longitudinal trench profiles in design drawings
23	For the areas where rock was encountered, what was the condition of the rock at the base of the core trench? (i.e. tight, fractured with open fractures, ice filled fractures, etc.).	Based on field notes of AMEC field engineer, the granite bedrock was weathered down to 100 mm with oxidization stains. Below the weathered zone the granite was medium crystalline with some individual crystals larger than the groundmass, competent, with occasional closed fractures, and with no visible ice. It is considered by field observation that these fractures were likely induced by blasting
24	Was any stripping done of the foundation under the upstream and downstream shells	The stripping was done within the drainage outfall section (see drawing "lagoon Berm Sections and Details")
25	Provide an as-built longitudinal section of the cutoff trench showing original ground surface, depth of any stripping and final depth of cutoff trench, top of rock and top of permafrost. Add any other information from previous investigations (air track holes)	See record drawings.
26	Were any seepage tests done in the base of the trench	No
27	Was any leakage testing done at the completion of the berm	No
28	Confirmation of material type used to backfill the cutoff trench	See record drawings
29	Provide operational protocols with respect to the potential for freezing of the discharge pipe	See O&M Manual section 3.4.2

Item	Description	Response
30	Ditch liner detail provided by applicant does not prevent seepage from entering the lagoon since it does not go below the active zone. Seepage inflow was noted at site through the recently completed berm.	The berm and cut-off trench were, as mentioned in the BGC memo, recently completed and for this reason were in an unfrozen state. Thus, the reported seepage, noted in the 2007 fall, was likely through the still unfrozen active layer and the unfrozen cut-off trench beneath the berm. This will be monitored. If the ditch seepage is present at an unacceptable rate, remediation action will be undertaken. Of note is the constructed containment is approximately 4,000 m^3 greater than the design requirements. Also in the first years of operation, the lagoon has 38,000 m^3 of spare hydraulic capacity because the hydraulic retention is designed for a 20 year life. Should there be seepage through the ditch in the first several years of operation it will not aversely impact the operation of the lagoon.

Please review this information, and should there be any outstanding issues, please contact the undersigned immediately.

Thanks.

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