

June 2, 2006

Nunavut Water Board P.O. Box 119 Gjoa Haven, NU X0B 1J0 Tel: (867) 360-6338

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Attention: N

Mr. Joe Murdock Technical Advisor

Re: Cape Dorset Sewage Lagoon Water License Amendment

Dear Mr. Murdock:

In a letter dated May 8<sup>th</sup>, 2006, the Nunavut Water Board requested further information relating to the amendment application for water license **NWB3CAP0207**. Comments were provided by four interveners: Environment Canada, Indian and Northern Affairs Canada, Government of Nunavut – Department of Environment and a Public Citizen, which were received during the 30-day review period. These comments are addressed in this letter, with detailed responses provided in an orderly manner. Where questions/comments are not numbered, bullets are addressed in a sequential order, based on the Intervener's letter.

#### **Environment Canada**

Comments were received in a letter dated May 1, 2006, by Colette Spagnuolo, Environmental Assessment/Contaminated Sites Specialist.

#### Hydrology

• Diversion ditches have not been included around the lagoon, as the terrain is steep and rocky and constructing them would be difficult. The berm is intended to divert freshwater away from the lagoon.

The report states that the use of P Lake is for sewage treatment is not practical unless recharge water is directed away from the proposed lagoon. The lagoon has been designed such that water will flow from the lagoon, to P Lake, into the wetlands and then over the cliff. Recharge water in P Lake will not flow back into the lagoon.

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• The presence of a talik or fault beneath P Lake has not been confirmed; however, the lake is located in a zone of continuous permafrost. Any contaminant migration into the groundwater would be confined to the thawed depth. As groundwater flow typically follows surface topography, any groundwater in the area of P Lake is likely to flow directly to Telik Inlet. Movement through the ground would provide additional filtration of contaminants.

## Baseline Water Quality Sampling

• Additional baseline data will be collected from P Lake as soon as possible, to supplement the one sampling event conducted to date.

#### Quarry Operations

 A minimum undisturbed buffer zone of 100 m will be maintained between any proposed quarry operations and the normal high water mark of any water body.

## Treatment Efficiency

- In Heinke et al, short detention lagoons are defined as having 2 cells (for flows <400 m³/d) to 4 cells operated in two parallel series (for flows >400 m³/d), a minimum hydraulic detention time of 3 d/cell, a minimum depth of 3 m and sludge removed every 5 to 10 years. The principal treatment objective of short detention lagoons is to remove solids and associated BOD prior to passage into long detention lagoons. Long detention lagoons have a minimum of 2 cells, a summer treatment detention time of 60 days, a storage period of 365 days and a liquid depth of 1.5 to 2.0 m. Long detention lagoons can serve two functions: treatment and storage.
- The calculations shown in Table 6.2 are based on conservative estimates. For example, while  $K_{20}$  typically ranges from 0.25 to 0.50 days<sup>-1</sup>, a value of 0.1 was chosen. In addition, a maximum treatment time of 90 days was selected, and it was assumed that winter treatment would be negligible. Treatment could very likely extend beyond 90 days, and some winter treatment may occur. The values shown in Table 6.3 are based on actual information from Northern climates. Both sets of numbers are given, to provide a ranged of expected efficiencies. Lagoon processes are complex and hard to predict, however experience has shown that they are effective at treating domestic wastewater.
- The maximum retention time of 2.7 days was calculated based on a theoretical discharge time (14 days, as recommended by INAC) and an estimate of annual volume of sewage. It is recognized that there is considerable uncertainty in these numbers. In Table 6.2, a range of retention times was used to account for this uncertainty (i.e. approximately 2.7 ± 1 day).

• P Lake is intended to provide final treatment, before discharge to Telik Inlet. By having the wastewater flow from the lagoon, through a culvert into P Lake, mixing and aeration will occur. The wetlands located downstream of P Lake will also provide treatment, by nutrient uptake and filtration through their root system. Considerable aeration will occur as the wastewater flows over the cliff, towards Telik Inlet.

## Sampling Program

- The sampling program will be amended, as proposed by Environment Canada. Options for scaling it back will be reviewed following two years of operation, to allow time for any sediment resulting from construction to be flushed through the system.
- Based on the results of the fisheries survey conducted in 2005 (described in Final Design report), the absence of historical reports documenting fish present in P Lake and the present of impassable barriers that prevent fish movement between P Lake and other fish-bearing waters, it was concluded that P Lake is barren of fish. The wetland in question is located above the water fall, and downstream of P Lake. Since the wetland is hydraulically connected to P Lake, and has the same characteristics (impassable barriers to prevent fish movement), it is highly unlikely to contain fish.

#### General

- No fuel, chemicals, wastes of sediment will be deposited into any water body. This will be further outlined in the Operations and Maintenance manual, to be prepared for the site.
- Signs will be posted along the wetland and at P Lake, notifying residents that the area is a component of the sewage treatment system.
- An O&M manual will be developed for the new sewage lagoon. A detailed outline of the manual will be submitted to the NWB as part of the license application. The complete manual will be submitted following issuance of the license. A spill contingency plan will also be developed, but following issuance of the license. It will address both releases from the system as well as contingency plans in the event that weather/road conditions prevent sewage trucks from traveling to the lagoon.
  - O The existing system will be modified to include only a single cell, for use in emergencies, as described above. Record drawings of the modifications will be forwarded to Environment Canada when available.
- The existing 3-celled lagoon was repaired in 2004. The lagoon will be kept available for possible backup use if needed, for a trial period until it is certain that the new one is operational and functioning properly and access can be maintained all year. The old will then be decommissioned. An Abandonment and Restoration Plan will be submitted to the NWB prior to



decommissioning. It will include plans for disposal of the sludge contained within the lagoons.

- No oil, oil wastes or any other substance harmful to migratory birds will be deposited, or permitted to be deposited in any waters or any area frequented by migratory birds.
- The nests of any migratory birds will not be disturbed. Site activities will be scheduled as much as possible outside the migratory bird season (May 15 August 1). If active nests are encountered, the area will be avoided until nesting is complete.

# Indian and Northern Affairs Canada

Comments were received in a letter dated May 2, 2006, written by David Abernathy, Water Resources Coordinator.

- The reasons for selecting the lagoon over the mechanical treatment plant are as follows:
  - O Considering 20 years life cycle analysis, the P-Lake lagoon option has a lower life cycle cost compared to the Mechanical Treatment Plant option.
  - O The concern and unavailability of hiring and training qualified operators in the community.
  - O The Hamlet of Cape Dorset has identified a sewage Lagoon and wetlands system "P Lake" as their preferred sewage treatment option.
- It is noted that the statement "AMEC does not recommend the use of a liner on the base of the lagoon." (Section 5.2, Dillon Final Design report) is inaccurate. However, the AMEC report does not state that a liner is recommended. The report is included in the tender document, that was submitted to the Water Board. The thermal modeling completed by AMEC (see below) is completed assuming there is no liner on the lagoon base. Permafrost will agrade into the berms creating the impermeable barrier throughout the lagoon.
- The AMEC report states that over time, the unfrozen zone under the base of the lagoon will increase (based on thermal modelling). However, the permafrost will extend up into the berms over time, creating a permafrost boundary around the lagoon. If groundwater does become contaminated, it will be contained by the permafrost boundary.
- Diversion ditches have not been included around the lagoon, as the terrain is steep and rocky and constructing them would be difficult. The berm is intended to divert freshwater away from the lagoon.

The documentation available on the sludge generation in northern lagoons is entitled "Best Available Technology for Sewage Treatment in the North, Indian and Northern Affairs Canada, 2003". Page 55 of this report indicates that the sludge generation is expected to be between 0.08 to 0.14 m³ per year per person. Based on this, the annual sludge generation will be approximately between 120 m³ to 210 m³. The 20 year sludge generation is expected to be 4,000 m³. The lagoon area is approximately 40,000 m². Therefore, over the 20 year life, the sludge will accumulate to 0.1 m over the base of the lagoon.

The outlet pipe is set above this level, therefore the sludge does not need to be removed over the 20 year life of the project.

 Erosion-control measures will be used in the down-gradient areas of stockpiled rockfill and where quarrying activities are taking place. Nearby water bodies will be monitored to ensure no sedimentation takes place.

# Government of Nunavut - Department of Environment

Comments were received in a letter dated April 20, 2006, written by Mike Atkinson, Manager Environmental Assessment and Land Use.

# Spill Contingency Plan

• A spill contingency plan will be produced following issuance of the water license. As confirmed by the Nunavut Water Board, the spill contingency plan will be a condition of the license. The plan will facilitate response to spills which could occur during operation. It will also include a list of available spill response equipment and names of trained personnel.

The contractor is responsible for developing spill contingency procedures during construction. They are required to meet territorial regulations with respect to protection of the environment.

#### Disposal of Sewage Sludge

• The new sewage Lagoon has been designed for a 20 year life time. The lagoon is sized to include accommodation of the expected sludge accumulation, and it is unlikely that any removal will be needed until decommissioning. (See calculation provided on previous page.)



## Public Citizen - Claude Constantineau

Comments were received in an email, sent March 13, 2006, by Claude Constantineau, a resident of Cape Dorset.

- 1. The reasons for selecting the lagoon over the mechanical treatment plant are as follows:
  - Considering 20 years life cycle analysis, the P-Lake lagoon option has a lower life cycle cost compared to the Mechanical Treatment Plant option.
  - The concern and unavailability of hiring and training qualified operators in the community.
  - The Hamlet of Cape Dorset has identified a sewage Lagoon and wetlands system "P Lake" as their preferred sewage treatment option.
- 2. The P Lake site was selected based on the elimination of three other possible sites. The Q Lake site (small lake located northeast of the community) was dismissed because the community's water supply pipeline froze in the winter of 2001/02 and Q Lake was used as the emergency back-up water supply source. Site R (flat area northeast of the community) is located at the end of the runway and the Airports Division expressed concerns over the potential for increased bird strike hazard. A mechanical sewage treatment plant was considered at the existing lagoon site. However, there were concerns about the higher operational costs and the ability to hire and train qualified operators in the community. P Lake has been identified by the Hamlet as their preferred option.
- 3. Concern has been raised that sewage may flow from P Lake lagoon to Tee Lake, the Hamlet's drinking water source. There are several reasons why the risk of sewage contamination to the drinking water source is extremely low:
  - Research relating to groundwater movement in permafrost indicates that flow is seasonal, and confined to the active layer (2.0 to 2.5 m in Cape Dorset). Flow within permafrost has been identified in some literature; however, flow measurements suggest that contaminants migrate at a geological pace. In this case, groundwater flow will be restricted to the active layer.
  - P Lake and Tee Lake are approximately 1 km apart. The surface of Tee Lake is located at 150.5 m above sea level (masl), significantly higher than P Lake, which is located at 113.0 masl. This suggests that sewage flowing from P Lake to Tee Lake is highly unlike. In addition, the land mass between P and Tee Lakes is higher than P lake, inhibiting flow to Tee Lake.
  - P Lake lagoon has been designed to promote plug-flow dynamics, with sewage flowing from the truck discharge point towards Telik Inlet (away from Tee Lake). There is a steep drop off following the sewage discharge point, which will also promote the plug flow towards the inlet.

4. Since the Lagoon system life cycle cost is cheaper and easy for maintenance, the Hamlet did community consultation and approved through a Council motion to proceed with "P-lake and wetland" as their community wastewater treatment process.

Yours truly,

Gary Strong, P.Eng. *Project Manager* 

On behalf of Art Stewart Senior Administrative Officer Hamlet of Cape Dorset