

June 12, 2007

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Ms. Dionne Filiatraut, P. Eng.
A/Executive Director
Nunavut Water Board
PO Box 119
Gjoa Haven, NU
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Re: HAMLET OF CAPE DORSET SEWAGE LAGOON AMENDMENT REVIEW – Re-Submission

Dear Ms. Filiatraut:

Further to our teleconference with your office and other affected regulatory agencies as well as BGC Engineering (Mr. Holger Hartmaier, P. Eng.) on May 17, 2006, the Nunavut Water Board has requested Associated Engineering to provide a technical review of the Dillon Consulting Ltd. report entitled 'P Lake Sewage Lagoon Water License Application Design Report for Cape Dorset, NU', as it pertains to the community's requested Water License Amendment. Previously we had provided the Board with review comments on the following design documents and information posted on the Nunavut file transfer website, including:

- P Lake Area Sewage Lagoon System, Final Design Report (Dillon Consulting Ltd, January 30, 2006)
- Comments on the above noted Dillon report (Environment Canada letter, May 1, 2006)
- Comments on the above noted Dillon report (INAC letter, May 2, 2006)
- License NWB3CAP0207 Hamlet of Cape Dorset (Nunavut Water Board, September 2002)
- Amendment 1 to License NWB3CAP0207 Hamlet of Cape Dorset (Nunavut Water Board, September 22, 2004)
- Construction Tender Documents for the Cape Dorset P-Lake Sewage Lagoon (Government of Nunavut, April 2006)

I was also in attendance at a Technical Hearing held on September 19, 2006 in Cape Dorset where representatives of Dillon Consulting, the proponent and the Government of Nunavut (GN) provided additional technical information related to this amendment application and answered questions from interveners, the public, the Board's technical staff and its advisory consultants.

This letter summarizes Associated Engineering's review of the recent Dillon Water License Application Design Report dated December 21, 2006 as provided to us by the Board's staff. The Board may find these comments of interest in their deliberations towards the issuance of a license (or not) or in the determination that a hearing should or should not be called in this instance:

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1 SEWAGE LAGOON TREATMENT SYSTEM AND DESIGN – DILLON DESIGN REPORT

In general we agree that if the treatment and disposal system proposed by the community and the GN functions as intended and as outlined in the Dillon report, this would be an improvement over the current situation. The proposed system is estimated by Dillon to be capable of producing effluent of better quality than the current license requirements (120 mg/L for TSS and 180 mg/L for BOD) and the Guidelines for the Discharge of Treated Municipal Wastewater in the Northwest Territories (120 mg/L for TSS and 100 mg/L for BOD for Telik Inlet and 100 mg/L for TSS and 80 mg/L for BOD for P Lake itself). We do, however, have several specific observations and comments regarding this report for the Board's consideration.

We understand the proposed treatment and disposal system includes the following components:

- 8.0 m top all-weather, gravel access road
- Sewage truck pad & turn-around
- Discharge flume
- Constructed (dyked) annual retention/treatment lagoon
- P Lake
- Downstream Wetlands area
- Drainage course to Telik Inlet

The following comments comprise our review of Dillon's recent report; 'P Lake Sewage Lagoon Water License Application Design Report for Cape Dorset, NU', dated December 21, 2006:

- Title page; although not indicated on the title page, this report does not appear to be a **final** report given the number of typos, word processing and formatting errors. Further, the version of this report given to Board for review is not signed off, nor sealed, by a Professional Engineer registered to practice engineering in Nunavut. There is a concern that the Board is being asked to use an engineering document to support an amendment application that may not have been sealed by a Professional Engineer.
- Cover letter; it is dated March 30, 2007, which is a full three months after the version of the report which AE was asked to review – question: is there another more up-to-date version of this report, or is this one the only available version of this report ?
- p. 1, Section 1.1, 2nd para.; starting in 2001, Dillon has been involved in this project for 6, not 4 years as stated.
- p. 2, Section 2 Water License Requirements; it would have been useful for Dillon to summarize the results and conclusions of last fall's Technical Hearing in Cape Dorset
- p. 3, Article 48; states that an application in relation to a license shall contain ... information provided by the applicant ...re: the qualitative and quantitative effects of the use of waters or the

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deposit of waste (i.e. treated sewage effluent) on the drainage basin where the use is to be undertaken ... and the anticipated impact of the use or deposit on other users. We believe this report should go further in providing the Board with more information regarding the system's treatment capability, in the removal or reduction in nutrients, additional treatment capability of P Lake, the downstream wetlands and drainage course to Telik Inlet as well as the possible impact on fish and the environment in Telik Inlet to satisfy the applicant's responsibilities to meet this requirement of the Nunavut Waters and Nunavut Surface Rights Tribunal Act.

- Further, related to Article 48, it is clearly the applicant's responsibility to demonstrate, from an engineering and geotechnical perspective, that this proposed lagoon system would retain effluent for the prescribed retention period in order to achieve the required treatment prior to being able to safely release treated effluent back to the environment. Given the geotechnical concerns noted in all of BGC Engineering's comments on Dillon's and AMEC's work to date, there are reasons to be concerned that this system may not be sufficiently 'water-tight' and therefore with less retention time available, may not treat the sewage as predicted in this report.
- As a point of interest, there is no mention in the report of any predictable thawing/settlement of the underlying permafrost, which could de-stabilize the lagoon berms/dyke, or necessary mitigation thereof. Is the underlying soil at this site thaw-stable ?
- All of this raises serious concerns about the proposed design of this system. Has the requirement for a full liner across the entire bottom and sides of the pond to fully contain the treated effluent and achieve the desired level of treatment been examined and investigated ? This may warrant further discussion by the Board.
- p. 4, Article 57; states that before the Board issues a license it must be satisfied that any waste from the undertaking will be treated and disposed of in a manner that is appropriate for the maintenance of water quality standards and effluent standards that are prescribed by regulations or, those that the Board considers acceptable. Such standards or regulations should include the Fisheries Act where a deleterious substance (i.e. at the "end of pipe") cannot be discharged ... to a watercourse or the ocean. This report is silent on whether or not the predicted quality of this effluent will not be toxic to fish in terms of nutrient reduction or removal.
- There is no mention in the report of the effects of winter temperatures on the operation of the lagoon system – is the 0.5 m allowance for sludge enough depth to prevent the lagoon from freezing to the bottom once it is discharged to that elevation in the fall ? If not it will freeze to the bottom and result in sheet flow freezing solid as sewage is discharged from the truck down the discharge flume. In the spring then the entire lagoon could be frozen and the possible impact on the system's treatment processes and capability should be further examined.
- p. 5, Section 2.1 Summary, 2nd para.; the introductory sentence is not written correctly and in fact as written misrepresents Article 57 and reverses the likely intention of the sentence.
- p. 5, Section 3 Additional Documentation, 4th point; Yukon experience indicates that the ancillary works, in this case the access road, should be regulated as it is a key component to the success of

the proposed sewage collection and treatment system and should be properly engineered and constructed under license terms and conditions. If not, the noted NWB correspondence date and author should be referenced.

- p.9, Section 5 Qualitative and Quantitative Effects of the Deposit of Waste, 1st para.; states that “aquatic life in P Lake will be adversely affected but the report does not say how or why.
- p. 9, Section 5.1 P Lake Fisheries; this appears to be new information not previously presented in the earlier support documents submitted a year ago – why was this information that was collected in 2005 not previously presented to the Board?
- p. 9, 5.2 P Lake Area Wildlife; what are the various other types of mammals and birds and are there any concerns related to them if this system is constructed ? Besides ravens, are there any other water fowl or ducks that may use the lagoon as habitat and if so are there any concerns in this regard given the primary quality effluent that this lagoon will produce ?
- p. 9, Section 5.3 P Lake Bathymetry; it is unclear what is meant by “there is no conductivity to the marine environment” – clearly the sewage effluent from the lagoon will reach the marine waters of Telik Inlet, which has been stated as the compliance point for this system (refer to page 11, Section 5.5.2 Effluent Characteristics).
- p. 10, Section 5.4 P Lake Watershed, last para.; the first sentence should read: ... June and July, water recharges *into* the lake ...”, rather than “... water recharges from the lake...”.
- p. 11, 5.5 Groundwater Movement from the Lagoon; according to BGC Engineering, the conclusions of this section of the Dillon report are suspect based on their review of AMEC's more recent geotechnical work (see BGC Project Memorandum to the Board dated June 7, 2007). If this lagoon will not hold water, from seepage into the ground or through or under the berms, the sewage will not be retained long enough to be fully treated as Dillon describes.
- P. 11, Section 5.5.2 Effluent Characteristics. 1st bullet; typo – bearing should be bearing. Section 6 does not explain why the regulation point, or more correctly, the compliance point, is at the edge of Telik Inlet as suggested here, especially when the estimated effluent quality is for the outlet of the lagoon. If the two federal departments have agreed that effluent meeting the criteria set out in the Guidelines for the Discharge of Treated Municipal Wastewater in the Northwest Territories, 1992, is applicable to the Telik Inlet location, this should be fully referenced (who, how and when). I would suggest that effluent being discharged at this compliance point should be non-toxic to fish per the Fisheries Act (as measured by an LC₅₀ bioassay test) and this report is silent in this regard.
- p.12/13, Section 5.6 Annual Lagoon Kinetics; while the kinetic formula utilized is a common text book approach, it would have been useful to see performance data from other similar systems across the NWT, Nunavut, Yukon or Alaska and provide some real-life back-up data for comparison. For example Old Crow, Yukon, has had a single celled lagoon with wetlands treatment and disposal in operation since the late 1980's. On page 12, references for the assumed temperatures and treatment times are not indicated in the report text. These elements are fundamental and critical in the use of this formula, however treatment times of 70 to 90 days appear

- to be reasonable in this case. Are there any typical temperatures available from other NWT or Nunavut systems at this latitude to verify the 7 dC temperature limit ?
- p. 13, last para.; is the reference to 85% to 95% reduction in BOD in lagoons with detention times over 180 days for single celled lagoons or multi-celled lagoons as a comparison to this proposed single celled lagoon ?
 - p.13, Section 5.7 Fecal Coliform Reduction; the reference for the influent fecal coliform figure is text book and it would be beneficial to confirm this with some typical similar data from other North of 60 communities. The approach here may be considered to be too generic an application – can this be verified with data from other northern community lagoon systems ? Previously Dillon had stated that a “design standard” of 10^4 for Fecal Coliform coming out of the constructed retention lagoon and then P Lake was to be met. Is that standard still to be followed and if so what is that standard based on ?
 - p. 15, Section 5.8 TSS Reduction, 1st para.; is the reference to 85% to 95% reduction in TSS in lagoons with detention times over 180 days for single celled lagoons or multi-celled lagoons as a comparison to this proposed single celled lagoon ?
 - p. 15, Section 5.8 TSS Reduction, last para.; no details are provided for the suggested operational sequence of a fall discharge from the lagoon, such as start and end dates, rate of discharge, monitoring of effluent water quality and discharge flow rates, maximum flow rate to prevent rapid draw-down failure of the lagoon berms, etc.
 - other than the reference to a general sampling program in a proposed sampling/monitoring program found in Table 9.1, there are no specifics in the report regarding the expected degree of nutrient removal and toxicity to fish with respect to the proposed treatment and disposal system.
 - p.16, Section 6 P Lake Fisheries; re; the reference to forage fish – what is the source of this information and how were the specific species derived ? Are the Sticklebacks considered by DFO to be an important species that may be affected by the release of this effluent ? Under 6.1 why was there no electro-fishing done to determine the fish resource in P Lake ? What fisheries resource is present at the determined compliance point at Telik Inlet and what is the impact of this effluent on the ocean environment and fish habitat ? It appears that while a very short term fishery survey was carried out on P Lake, no such investigation was done for the fish habitat at the suggested compliance point.
 - p. 21, Section 6.3 Conclusion of Fisheries Investigation; Section 6 of the report concentrates on the possible fisheries resource and habitat implications at P Lake, rather than the location of the suggested compliance point at Teklik Inlet where virtually no time or effort was spent trying to characterize that environment in terms of fisheries resources, background environmental information and water quality or the possible impact of this effluent release to the ocean.
 - p. 12, Section 7 The Impact of the Deposit of Waste; While the text states that the deposit of waste will adversely impact the water quality of P Lake, the report does not indicate how or by how much or for what parameters. And nothing is indicated for the possible impacts on the water quality of

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Telik Inlet. The report suggests that there will be an increase in water fowl (what species ?) in this area. Given the primary treatment quality of this effluent, will these birds be negatively impacted ?

- p.23, Section 9.1; Sampling Protocol; we agree that the proposed sampling locations are appropriate, however no sampling location was identified for the compliance point located just before the effluent would enter Telik Inlet (unless the applicant is saying that water sampled at the end of the wetlands is considered to be the same water quality as that which would enter Telik Inlet). Individual effluent parameters to be monitored should include BOD, TSS, pH, Oil & Grease, dissolved oxygen, Fecal Coliforms, Total Coliforms, toxicity to fish - Biosassy Concentration (LC₅₀), Toxic Organic Substances, Phosphorus and Ammonia (Nitrogen).
- p.23, Section 9.1 Sampling Protocol; the suggested wetland study could become a license term and we agree it is required.
- p.25, Section 11 Assessment of the Requirements of the Nunavut Water Board; we do not believe the applicant through this report has fully investigated the qualitative and quantitative effects of the deposit of this waste on the P Lake basin, or more importantly, the Telik Inlet environment. Further not all of the possible adverse impacts of this potential effluent release have been fully identified or investigated.
- p. 26; the report states that the Nunavut Water Board has accepted the current NWT guidelines and regulations for municipal discharges where BOD, TSS and Coliform Bacteria are the only parameters considered to be included as license terms (at primary treatment levels only in this situation) and we are not certain that is the case.
- We note that the Dillon report did not include a Certification Page and therefore does not appear to be sealed by a Professional Engineer registered in the Territory.

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As part of this 2007 review of the current Dillon Water License Application Design Report we thought it would be useful to repeat our comments from a year ago related to the intervention letters received from Environment Canada and INAC Water Resources as well as the GN's tender package, presented below:

2 ENVIRONMENT CANADA REVIEW LETTER – MAY 1, 2006

The following table provides a comment for each of the issues that the EC discusses.

Specific Comments	Associated Engineering's Review Comment
1. Hydrology – inclusion of diversion ditches around the lagoon and P Lake in the report and in the drawings or the tendered contract documents.	AE agrees with this comment.
2. Hydrology – confirmation of talik or fault	AE agrees with this comment. Further is the underlying soil subject to permafrost degradation and is it thaw stable ?
3. Baseline Water Quality – additional baseline data.	AE agrees with this comment.
4. Quarry Operations – buffer zone of 100m.	AE agrees with this comment.
5. Treatment Efficiency – define "short" detention" and "long detention" as it pertains to this system.	AE agrees with this comment.
6. Treatment Efficiency – estimated value for BOD in P Lake compared to the values from Table 6.3.	AE agrees with this comment.
7. Treatment Efficiency – discrepancy in retention times used to estimate BOD reductions	AE agrees with this comment.
8. Treatment Efficiency – proponent should provide further information and justification re: predicted levels of treatment for all of the requisite parameters of concern, for both short and long term.	AE agrees with this comment. Further the consultant or applicant should seek out other performance data on similar lagoon systems 'North of 60' for comparison to this proposed system.
9. Sampling Program – two year sampling program.	AE agrees with this comment, further AE recommends that the sampling program be

	expanded to include compliance points and as such a full and appropriate Monitoring Program be established as a license condition effective for the life of the license.
10. Sampling Program - presence of fish in the wetland.	Although the likelihood of fish being present in the wetland is remote, this has not been checked out, therefore AE agrees with this comment. Nonetheless the Consultant/Applicant should confirm that the predicted level of treatment produces an effluent from this system that is not toxic to fish.
11. General – deposit of deleterious substances to any water body (fresh water or ocean), toxicity to fish and the requirement of the Fisheries Act (Section 36 (3)).	AE agrees with this comment. The Consultant/Applicant should confirm that the predicted level of treatment produces an effluent from this system that is not toxic to fish.
12. General - Signage	AE agrees with this comment, further the Board could consider also requiring as a license condition that the site be fenced and gated – this is quite common for Yukon and Alaska lagoon and wetland sites.
13. General – Operations and Maintenance Plan.	AE agrees with this comment.
14. General – 3 Celled Lagoon as Back-up	AE agrees with this comment.
15. General – Closure, Abandonment and Restoration of the 3 Celled Lagoon	AE agrees with this comment - if the old facility is not going to be used the Applicant should be required to submit a closure, abandonment & restoration plan.
16. General – Section 35 of the Migratory Bird Act	AE agrees with this comment.
17. General – Paragraph 6 (a) of the Migratory Bird Act	AE disagrees with this comment, as it is not practical or cost effective to prohibit on-site construction from 15 May to 1 August.

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3 INAC REVIEW LETTER – MAY 2, 2006

The following table provides a comment for each of the issues that INAC discusses.

Specific Comments	Associated Engineering's Review Comments
1. Assessment for alternative selection of sewage treatment design and system.	AE disagrees with this comment. It is our view that the proponent has justified its selection of a lagoon/wetlands system over mechanical systems. Further, we concur that a lagoon system for this type of small remote northern community is preferred over a mechanical sewage treatment plant, as is the case in many Nunavut, NWT, Yukon and Alaska examples.
2. Available geotechnical information/concerns regarding Dillon's interpretation of AMEC geotechnical-related statements and recommendations.	AE agrees with this comment.
3. The Proponent seriously consider/examine the use of an impermeable synthetic liner under the base (and along the lagoon sides and berms).	AE agrees with this comment. The proponent needs to do more to substantiate its proposed design in this regard.
4. Water diversion measures for surface water entering the lagoon area and P Lake.	AE agrees with this comment.
5. Quarry operation erosion protection and sedimentation control measures.	AE agrees with this comment.

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4 CONSTRUCTION TENDER DOCUMENTS FOR THE CAPE DORSET P-LAKE SEWAGE LAGOON (GOVERNMENT OF NUNAVUT, APRIL 2006)

The following comments on the tender package are provided for consideration:

- We note that the tender package has been released by the Nunavut Government prior to the issuance of an approved amendment to the Cape Dorset license by the Board.
- Further the design is based on the Dillon Final Design report, which is still under review by the Board, regulatory agencies, potential interveners and the public.
- There is no indication in the 'Schedule of Values' (unit price table) or in the site work specifications that diversion ditches at the lagoon site or P Lake are included in the contract.

We trust that this information will assist the Board in determining what the next steps should be in processing this application. Please call should you have any questions about the comments presented herein, or if you require further assistance in this matter.

Yours truly,

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JMG/kw