ISSUE	INAC	GN	EC	AE	BGC	NWB
Application before the NWB	The proponent is encouraged to submit a license renewal application that addresses all municipal activities related to freshwater consumption and waste disposal practices as soon as possible.					
	The need for developing a municipal license application supplementary questionnaire should be considered.					
Construction of P-Lake Sewage Lagoon						
Design	INAC recommends that the NWB require the applicant to file final design plans that are stamped, signed, and dated by a qualified professional, with in advance of project implementation.	NWB ensure that all final design and construction drawings are signed by a registered professional engineer, registered in Nunavut, prior to issuing the water license.	Proponent is to ensure that all construction activities on the sewage lagoon do not result in sedimentation of any surrounding water bodies. Preventative measures, such as the use of silt curtains/fences should be used to help mitigate any potential impacts.	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.	3.1(1)The review copy is not signed and professionally sealed. The Board should confirm to BGC that the original documents received from Dillon are signed and bear the professional seal of the responsible engineer, registered to practice in Nunavut.	
					3.1(2) In Section 1 there should be a paragraph noting that this document addresses the concerns and issues raised by the previous review, particularly the items noted to Dillon during the September 19, 2006 Technical hearing.	
					3.1 (4) In section 2 the water license requirements should include the technical requirements derived from the technical hearing held in Cape Dorset, September 19, 2006	
					3.1(5) There is no section that discusses the design criteria or design constraints.	
					3.1(6) There are numerous typo's, formatting problems and missing details [ ] to suggest that this is draft version, not a final document. The Board should insist that Dillon submit a completed version, especially considering that the report may not be signed and sealed.	Confirm hardcopy on the public registry signed and sealed by Dillon
					3.1(7) In Section 4.1 there are minor discrepancies with respect to the design volume of sewage to be treated. At he top of page 9, a value of 96,100 m3 is given, Table 4.1 shows 96,047 m3 and at the bottom of the page it is set at 96,000m3.	

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Qualitative and Quantitative Effects of the Deposit of Waste				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	3.1(8) In Section 5.4 Dillon noted that chart 5.1 indicates a significant recharge component to P Lake an that in this respect, P Lake is not practical as a sewage lagoon unless recharge water is directed away from the proposed lagoon. Therefore the use of ditching to divert recharge water is carried forward in the conceptual design development. There is however, no further discussion of this issue in the rest of the design document, nor are diversion ditches shown in the drawing or mentioned in the specifications It is noted that the north and south berms are intended to act as diversion berms. However they are constructed out of granular materials of their effectiveness needs to be demonstrated. BGC also notes that use of ditches in permafrost affected terrain in not recommended.	
				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.	3.1 (9) The statements made in Section 5.5 regarding groundwater movement from the lagoon are not supported. As discussed later in subsequent section of this memorandum, the site investigation and analyses completed to date do not support the fact that the lagoon, as currently designed will hold water.	
				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 ?		

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Fisheries				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 Telik 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.		
					3.1(10) The design report lack details concerning the design and construction of the lagoon dikes. This is a major deficiency, considering the previous comments made by BGC, the discussions of the technical hearing and the fact that additional site investigations were carried out, leading to a revised design. No discussion is provided regarding the basis for the design changes from the previous submission.	
					3.1 (11) In section 11, Dillon noted that "The design elements have used standard engineering practices an reviewed by the geotechnical engineer:. This statement is not supportable based on the geotechnical deficiencies noted in this memorandum. In addition, this section omits addressing the specific issues previously raised by the Board.	

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				qualitative and quantitative effects of the use of waters or the 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.		
				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.		
				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.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.		

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Talik under P-Lake			The proponent should provide confirmation the presence of a through talik under P-lake that could result in contamination of groundwater and facilitate the transport of contaminants. If a through talik is present, EC recommends that the bottom of the lagoon be lined with an impermeable liner to prevent contamination of the groundwater. Movement of sewage through ground water is not to be used as a dilution factor for treatment.			
Technical Specifications					3.3 (1) The specification do not seem to be properly updated: [ ] The Board must be satisfied that this supporting document to the water license application reflects the current plans.	
					3.3(2) What is the revised construction schedule?	
	The proponent should state whether berm liners will extend into non-fractured bedrock so as to reduce the likelihood of subsurface water flow beyond the sewage lagoon footprint.			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 ?	3.3(4) In section 02072 "Geotextiles":	
					Part 1.3.1 define "GCL";	
					Part 2.1.1, 2.1.2 and 2.1.6, and Tables 1523-3-1 and 1523-3-2 were not found.	
					Part 3.1.10 seems to be written generically. The Drawings do not show a clay liner, a granular sub-liner sampler blanket or a geomembrane. The term "geosynthetic clay liner" is introduced. If this means "GCL" then it is in conflict with the drawings , which show "Granular Clay Liner"	
					3.3(5) Section 02315, "Excavating, Trenching and Backfilling", Part 1.3.4, unsuitable materials should include massive ice lenses.	
					3.3(6) Section 02316, "rock Removal":	
	The proponent should state which aggregate borrow sources it intends to exploit for the sewage lagoon's construction. Furthermore, the proponent should identify the quantity of required aggregate resources by grain size and whether the extracted material will be processed to ensure that the lagoon is properly constructed.		Any stockpiled material should be stored above the high water mark of any water body and in such a manner as to prevent sedimentation of surrounding water bodies.		Part 1,2,1 , not sure what circumstances would warrant a minimum rock excavation of "50mm"	

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					Part 3.2, the drawings do not distinguish between soil and rock, but show excavated slopes (i.e. liner trench) vertical, assuming rock conditions. There is no guidance with respect to excavated slopes in	
					3.3(7) Section 02661, "Sewage Storage Lagoons";	
					Part 2, in several locations there is reference to a rip rap specification. There is no Section 02371 [ ] or Section 02454 - Rip Rap.	
	The proponent should provide justification that its frozen core dyke concept is realistic. Furthermore, the proponent should explain whether a low-permeability soil cut-off wall designed for unfrozen performance will be established within the dyke and if or if not, why?				Part 3.3.2, indicates that dike is to be constructed in the summer in unfrozen conditions. There is no statement regarding the foundation condition, although summer construction would indicate that it too would not necessarily be frozen. Based on these specifications, the berms are not being constructed as a frozen dam. As such the GCL is the primary liner. This is not the normal application of a GCL. The role of a GCL is to act as a secondary liner as would have been the case if the berm was designed and constructed as a frozen dam. A HDPE liner is considered to be a primary liner and should be backed up with a GCL for secondary	
					Part 3.3.3 ASTM D 698 [application in question for the type of material] For this material, compaction specifications should be based on relative density, as per ASTM D4253 [ ] and D 4254 [ ]. The dike fill is considered to be structural fill and should be places as dense as possible, based on field trials. Compaction of granular fill should include moisture conditioning to improve density. The field trials should establish the maximum relative density achievable using the available equipment.	
					Part 3.5 Flexible Lining - assume this is the same as GCL. Terminology for the liner should be consistent.	

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					Part 3.5.1 requires that a layer of granular material in unfrozen condition be placed on the bottom and sides of the lagoon as indicated. Where is this detailed indicated? Normally there should be a layer of bedding sand on either side of the GCL. This is not shown. Note that the liner is shown being placed on a 1:1 slope on Drawing 111. This slope appears too steep to safely work on and to carry out the installation procedures as specified and would also be too steep for placing any of the bedding material that has been omitted from the drawings, but alluded to in the specification (part 3.1.10). Compaction of the cover layer on a 1:1 slope would be difficult. Dillon should confirm if placing the liner on a 1:1 slope is in compliance with the manufacturer's	
					Part 3.5.9 indicates that the liner sheets are to be cut to fit accurately around inlets, outlets, sleeves, concrete structures and other projections through the lining. There are no further details provided in either the specification or the drawings with respect to this critical component of the lagoon retention system.	
					Part 3.7 Leakage Testing. This section is completely inadequate for the purpose intended and poorly conceived. The purpose of the lagoon is to retain water in order for the sewage to be treated. There is no way that the method given in the specification will yield any defensible data to determine that a leak exists or to conclusively direct the contractor to undertake repairs at no cost to the owner.	
					Some of the major concerns with respect to the methodology provided are as follows: **[refer to page 7 of the submission from BGC]**	

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Drawings	INAC also recommends that the NWB require the applicant to file final as-built designs that are stamped, signed, and dated by a qualified professional, prior to the lagoon's start-up operation date.				BGC was provided copies of drawings 101, 109, 111, and 112 to review. These copies were unstamped-presumably originals on file with the Board are stamped copies. If not, they should be.	NWB has stamped/sealed drawings "issued for tender March 2006"
				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.	It is assumed that other drawing pertain to the access road and were not included in the present submission. The Board should however be satisfied with the details and the as-built information with respect to the road, for completeness, in order to issue a water license for the entire facility.	
					Drawing 101: There is no information to show that the lateral extent of the GCL is sufficient to prevent end=run seepage around the ends of the liner at the abutments for both the east and west berms.	
					Drawing 109: The north berm is constructed using Type II granular material. It is also designed to act as a surface water runoff diversion berm. There is a minor fines component in this material, however it will not act as a seepage barrier, particularly since the steepest hydraulic gradient is straight through he berm. Therefore , some seepage into the lagoon can be expected. The same problem applies to the road on the south side of the lagoon.	
					Drawing 111 **[Refer to submission from BGC page 8-9]**	
Geotechnical Investigations				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 ?	**Refer to submission from BGC Section 4/5 page 9-13**	
Water Use						
Waste Disposal						
Sewage Effluent	The proponent proposes that the new sewage lagoon's effluent have a discharge criteria of 80 mg/L biological oxygen demand, 100 mg/L total suspended solids, and 10E fecal Coliforms.	For a marine discharge of 150-600 liters per capita per day with a mixing conditions similar to a bay or fjord these standards are; BOD 120 mg/l and TSS 180 mg/l. Additionally as the proposed discharge point is close to local harvesting and recreational areas, criteria for fecal Coliform should also be applied;	Hamlet must ensure that any effluent discharged must be in compliance with Section 36(3) of the Fisheries Act.	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.		

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				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.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 ?		
Solid Waste						
Hazardous Waste						
Waste Oil						
Spill Contingency Planning		DOE would like to ensure that as condition of the license an updated plan is submitted to NWB prior to commissioning of the new facility	The proponent should produce a Spill Contingency Plan which includes the new operations and infrastructure. The plan should facilitate response to spills which might occur during construction and operation of the project. The plan should include a list of available spill response equipment and the names of trained personnel who will be on-site and available in the case of a spill.			

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Operation and Maintenance		DOE requests that submission and approval of sewage disposal plan be a condition of the license.	An updated Operations and Maintenance Manual should be submitted for approval. The O & M Plan should include removal and disposal of sewage sludge. Estimates should be made of the quantities of sludge likely to be produced, the required frequency of extraction from the lagoons; and operational procedures developed for environmentally sound removal and disposal.			
Abandonment and Restoration						
Monitoring	The proponent should commit to monitoring the effectiveness of its sewage lagoon's treatment process. Developing a municipal wastewater effluent quality trend analysis for these three parameters and others of interest, such as pH, ammonia nitrogen, and total phosphorus, effluent temperature, and air temperature would be a useful. By doing this, the proponent can analyze colleted data and determine whether the timing of effluent discharge is adequate.	DOE would like to see the license specify a monitoring station at the last point of effluent control. With a likely fall discharge period of approximately 60 days, samples taken for the purposes of monitoring effluent quality should be collected on the first and last day of discharge, and 30 days after the first day of discharge.	the proponent monitoring the quality of the effluent being discharged at the outlet of the wetland treatment area, sampling be completed at the outfall of the lagoon, in order to understand treatment efficiency.	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.		
	The proponent should establish subsurface water quality monitoring wells down gradient of the proposed sewage lagoon to determine whether municipal wastewater effluent is seeping through the lagoon's base into the active layer, and if so, whether the quality of the subsurface water meets requirements set by the NWB.					
	The proponent should develop a detailed monitoring program for the NWB's consideration as it drafts municipal license terms and conditions. This is due to the proponent's familiarity with the project area. A monitoring program should specify sampling site locations by global positioning system coordinates, parameters to be analyzed at each sampling site, when samples are to be taken, who will collect the samples, where the samples will be sent, and a quality assurance/quality control plan for sample collection procedures.			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.		

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				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 Telik Inlet. o 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		