



## **APPENDIX B – Exp Memo for Taloyoak Water License Amendment**





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## Technical Memorandum

<b>Date:</b>	April 12, 2021	<b>From:</b>	Ken Johnson, MASC, P.Eng.
<b>To:</b>	David Browne, MASC, P.Eng.	<b>Project No.:</b>	OTT-000254843-4
<b>Prepared By:</b>	Ken Johnson, MASC, RPP, P.Eng. Environmental Engineer		
<b>Project Name:</b>	Community of Taloyoak – Water Licence Amendment – Effluent Quality Standard		
<b>Subject:</b>	Passive Wastewater Treatment in the Arctic and Application of Wastewater Systems Effluent Regulations		

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The Government of Nunavut is advancing a project to construct a new sewage lagoon in Taloyoak, which will discharge into the existing wetland system, and ultimately into the ocean. To reflect the operating limitations of a passive lagoon / wetland system in an Arctic environment, the GN is requesting a change in the effluent wastewater parameters at the final discharge in conjunction with this work. The wastewater treatment system currently serving the Hamlet of Taloyoak operates under Water Licence 3BM – TAL1926, which stipulates under the Wastewater Systems Effluent Regulations (WSER) an Effluent Quality Standard of 25 mg/L for CBOD and 25 mg/L for Total Suspended Solids (TSS) upon final discharge of the wetland (at Monitoring Program Station TAL6). This limit for the Taloyoak water licence should be changed to a threshold which is more achievable for a passive wastewater treatment system in the Arctic.

Research by Dalhousie University (2015 Treatment Performance of Municipal Wastewater Stabilization Pond in Nunavut) concluded that the WSER for secondary treatment are not reliably achievable in Arctic environments for passive wastewater treatment systems. A report by EXP (2017 Nunavut Wastewater Standards Development Final Report) recommended Technology-Based Effluent Limitations of 120 mg/L for TSS and 100 mg/L for CBOD for passive systems discharging to a marine environment. Both documents are grounded on research conducted in the Arctic, and performance information collected from the past several decades. A 1999 technical paper by Johnson and Wilson (Sewage Treatment Systems in Communities and Camps of the Northwest Territories and Nunavut Territory) further supports these conclusions and recommendations.

Historical sampling from the Taloyoak wetland discharge (TAL6) during the month of July has measured values of CBOD of less than 12 mg/L and TSS of less than 5 mg/L in three consecutive sampling years (2016, 2017 and 2018), which are below the WSER threshold. Corresponding measurements in September 2018 were CBOD of 34 mg/L and TSS of 14 mg/L. The July sampling would coincide with spring runoff, and no biological activity within the wetland, and therefore the low effluent values may be attributed exclusively to dilution of the wastewater. The September sampling would correspond with biological activity in the system, and no runoff within the wetland. These measurements suggest that without spring runoff, the wastewater discharge would not meet the WSER for the CBOD requirement. The proposed operation of the new lagoon / wetland in Taloyoak will operate for retention and a seasonal discharge within the window of August and September, and therefore will not be subject





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to any freshet dilution from the catchment area. The discharge from the lagoon wetland would be like the effluent quality measurement in 2018 and likely exceed the WSER limits.

A natural wastewater treatment system operating in an Arctic environment is ultimately under the influence of the seasonal weather conditions of the region. Temperature is a dominant weather condition that influences the performance of a passive wastewater treatment system (lagoon / wetland) which will fluctuate from year to year depending upon the weather of that particular year. The extreme cold weather in the Arctic generates two drastically different operating conditions for passive wastewater systems. For at least 8 months of the year the system has no biological activity because of the cold temperatures. For at most 4 months of the year the system has limited biological activity depending upon the weather. Johnson and Wilson (1999) also noted the seasonal variations and reported that “for lagoon type systems, performance efficiency has season variations, for example TSS level are very low from November to March, while licences exceedances tend to occur during period of runoff. Fecal coliforms and BOD5 show the opposite trend, meeting limits during the open water season.”

Based upon the information presented in this memo it can be concluded that the WSER discharge requirement cannot be achieved by the passive wastewater treatment systems used in the Canadian Arctic, and therefore the WSER standard of 25 / 25 CBOD / TSS should not be applied for lagoon / wetland systems in the Arctic, that is the Taloyoak lagoon / wetland system.

A handwritten signature in black ink that reads 'Ken Johnson'.

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