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Sludge Accummulation
Clyde River Sewage Lagoon, Nunavut

Dear Mr Roy:

A question has been raised regarding the rate of sludge accumulation in the lagoon proposed in Clyde River. There is very limited data regarding the operational behaviour of lagoons in arctic environments. Due to this lack of data, various assumptions, which are summarized as follows, were used to develop an estimate of sludge accumulation rates.

Assumptions

1. Individual suspended solids contribution is assumed to be 90 grams/capita·day. This is based upon the rate of suspended solids typically found in municipal sewage.

2. A complex set of mechanisms is responsible for removal of contaminants in a lagoon. These mechanisms include sedimentation, aerobic oxidation and anaerobic sludge volume reduction, which reduce the solids contribution from influent sewage. The biological processes also create solids in the forms of bio-mass (bio-solids). It has been assumed that the net outcome of the various biological process that both create and reduce solids leads to a rate of sludge contribution at the same rate as the individual suspended solids contribution.

3. The sludge that accumulates in the lagoon is made up of sedimented suspended solids and a large amount of water. These solids remain undisturbed in the bottom of the lagoon for several years. This provides the opportunity for gravity thickening of these solids over a protracted period of time. For the purposes of these calculations it has been assumed that an ultimate sludge density of 10% will be achieved.

The preceding assumptions lead to an annual per capita rate of sludge accumulation of 32.85 kg that represents a per capita volume of 0.329m^3. The working volume of the proposed lagoon in Clyde River is 58,500 m^3. Ongoing sludge accumulation should lead to annual reduction of operating volume by less than 1% per year.

The following table summarizes the rate of sludge accumulation anticipated in Clyde River.

Sludge Accumulation Estimate

Year	Population	Sludge Generated	Accumulated Volume of Sludge
2010	982	323.1	323.1
2011	1007	331.3	654.4
2012	1028	338.2	992.6
2013	1050	345.5	1338.1
2014	1072	352.7	1690.8
2015	1095	360.3	2051.1
2016	1121	368.8	2419.9
2017	1144	376.4	2796.3
2018	1167	383.9	3180.2
2019	1190	391.5	3571.7
2020	1214	399.4	3971.1
2021	1242	408.6	4379.7
2022	1270	417.8	4797.5
2023	1300	427.7	5225.2
2024	1330	437.6	5662.8
2025	1360	447.4	6110.2
2026	1391	457.6	6567.8
2027	1423	468.2	7036.0
2028	1456	479.0	7515.0
2029	1490	490.2	8005.2

The proposed lagoon has 3,400 m3 of dead zone which is intended for use as sludge storage. This does not include the dead zone in the existing lagoon. Therefore the sewage lagoon has sufficient sludge storage for approximately 9 years.

Operations of the lagoon and the decision to desludge the lagoon should continue to be based on the performance of the lagoon, as this is the best indicator of when the lagoon needs to be desludged.

If you have any questions or require additional information please contact Steven Burden at (613) 225-9940 extension 257.

Yours truly,

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