

Environmental Protection Operations
Prairie and Northern
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29 July 2011

EC file: 4782 014
MVLWB file: MV2011L3-0001

Zabey Nevitt
Executive Director
Mackenzie Valley Land and Water Board
P.O. Box 2130
Yellowknife, NT, X1A 2P6

Via Email at permits@mvlwb.com

Dear Mr. Nevitt:

RE: MV2011L3-0001 - Type A Water License Renewal Application; Town of Fort Smith – Closing Arguments

Please find attached Environment Canada's closing comments concerning the renewal of the Town of Fort Smith's Water Licence (MV2011L3-0001).

Intervenors were given the opportunity following the public hearings held on July 20th 2011 to submit in writing their closing comments, additional clarifications as well as any outstanding responses to questions raised during the hearings.

It is important to be aware that Environment Canada is in the process of developing regulations under the authority of the Fisheries Act, based on the CCME Canada-wide Strategy for the Management of Municipal Wastewater Effluent. The North, including the Northwest Territories, is excluded from this regulation for a 5-year period for research on factors that affect performance of wastewater facilities in northern conditions and discussion among jurisdictions. In the meantime, effluent quality requirements captured under existing authorizations including Subsection 36(3) of the Fisheries Act which prohibits any person from depositing or permitting the deposit of a deleterious substance of any type in water frequented by fish, will continue to apply.

Improved Sewage Treatment

Pollution prevention is a priority for Environment Canada. As defined in *CEPA 1999*, pollution prevention means "the use of processes, practices, materials, products, substances or energy that avoid or minimize the creation of pollutants and waste and reduce the overall risk to the environment or human health".¹ Similarly, the Mackenzie Valley Land and Water Board have identified the following objective in their Water and Effluent Quality Management Policy with regards to regulating waste:

*The amount of waste to be deposited to the receiving environment is minimized.
The Boards expect proponents to identify and implement waste prevention and/or minimization measures, whenever feasible. Implementation of such measures may be stipulated in the*

¹ *Canadian Environmental Protection Act, 1999*, Statutes of Canada 1999, Chapter 33, Act assented to 14 September 1999, Section 3(1).

terms and conditions of a water licence. The Boards can assess how these measures are expected to impact effluent from a project in order to set EQC that proponents can reasonably and consistently achieve.²

The SNP sampling data of BOD, TSS and ammonia, indicates that biological treatment is lowest in the winter and highest during the summer months. With only 90 days of retention time in the lagoon, winter effluent appears to be at a primary treatment level, having undergone physical settling of solids. On the other hand, summer effluent appears to have received secondary treatment through biological breakdown of the sewage.

Environment Canada recommends that the Board apply terms and conditions to the water licence requiring the Town to implement waste minimization measures by reducing the concentrations of BOD, TSS, nutrients and fecal coliforms in the wastewater effluent. Modifications to or expansion of the system would likely be required to achieve greater pollutant reduction, through the implementation of Best Available Technologies and Best Management Practices. It would be prudent for the Town to move towards a system that discharges effluent having received secondary treatment. A reasonable timeline should be applied for these measures to be assessed and implemented, requiring planning to commence within the first year of the term of the licence.

Environment Canada's Wastewater (www.ec.gc.ca/eu-ww) website is a good resource for information on wastewater system improvements. Furthermore, EC staff at the Yellowknife office would be open to discuss options or share information resources to assist in the planning for an improved treatment facility.

Effluent Quality Standards

The Board has requested that EC provide some recommendations for Effluent Quality Criteria (EQC) and receiving environment Water Quality Standards in the application of the Board's Water and Effluent Quality Management Policy. The Board's consultant, Golder Associates Ltd., provided a technical memorandum titled "Development of Effluent Quality Criteria for the Town of Fort Smith's Municipal Discharge" on July 5, 2011. The Public Hearing was the first occasion for questions and discussion on the memo, following which EC is providing its recommendations in these Closing Arguments.

Environment Canada agrees that the parameters identified are appropriate for monitoring system performance (i.e., BOD, fecal coliforms, TSS, pH, phosphorus, nitrite, nitrate and ammonia). However, EC disagrees with the recommended EQC monthly limits for BOD, fecal coliforms, and TSS. The average monthly limits identified as BOD=300mg/L, fecal coliforms=1.00x10⁶, TSS=200mg/L are representative of raw sewage concentrations as has been supported through the references in the table below.

² Mackenzie Valley Land and Water Board, 2011, Water and Effluent Quality Management Policy. Section 6.2.

Table 1. Raw Sewage Characteristics

Location	Fort Smith	Yellowknife	Undefined	Undefined	United States
BOD (mg/L)	79-198	Mean: 98 Range: 20-262	400	110-400	190-350
TSS (mg/L)	70-260	Mean: 101 Range: 50-140	350	100-350	210-400
Fecal coliforms (counts/100mL)	2.8E+06 – 3.5E+06	Mean: 3.3E+06 Range: 0.9E+06 - 8.9E+06	1.5E+07		10E+04 – 10E+08
Wastewater Strength	Piped	Piped	Trucked	Conventional Diluted (flow = 200-730L/person/day)	Medium to High Strength (240L – 460L/person/day)
Reference	Cold climate Sewage Lagoon Performance Evaluation	Lagoon Treatment of Municipal Effluent in a Subarctic Region of Canada	Sewage Treatment Using Tundra Wetlands	Cold Climate Utilities Manual	Wastewater Engineering: Treatment and Reuse, 4 th Edition
Author	FSC	Soniassy and Lemon	Dillon Consulting Limited	Smith et al.	Metcalf and Eddy
Year	1991	1986	1997	1986	2004

Environment Canada does not support the discharge of untreated sewage. Furthermore, the Guidelines for the Discharge of Treated Municipal Wastewater in the Northwest Territories (1992) and the Water and Effluent Quality Management Policy (2011) both require treatment before discharge. The Board's consultant applied a decision process that compared the water quality-based EQC's to technology based EQCs, and chose the more stringent of these. As was discussed at the Public Hearing, there are currently no technology-based limits specific to the NWT, but instead Municipal Wastewater Effluent Quality Guidelines which are based on the receiving environment's capacity to mix and dilute the wastewater.³ Without a minimum standard of treatment identified through a technology-based limit, the Board is faced with little guidance in the way of appropriate EQCs. At this time, EC is not able to recommend specific target values for the parameters identified for EQCs. However, EC does recommend that the Board move towards secondary treatment as a minimum standard, as has been established and agreed upon between jurisdictions through the CCME Canada-Wide Strategy.

Acute Toxicity

Environment Canada is responsible for enforcing and administering subsection 36(3), the pollution prevention provisions of the *Fisheries Act*, which prohibits the deposit of deleterious substances into fish bearing waters or a deposit of deleterious substance that may enter such waters. A deleterious substance can be defined as any substance with a potentially harmful chemical, physical or biological effect on fish or fish habitat. Please note that with respect to compliance with the general prohibition of the *Fisheries Act*, it is the responsibility of the entity discharging the waste to ensure it is not

³ Mackenzie Valley Land and Water Board. Transcripts from Public Hearing Session for Town of Fort Smith Type A Water Licence Renewal MV2011L3-001. July 20th, 2011, p. 83

deleterious. The acute lethality bioassay test is one indicator currently accepted by the courts as a measure of toxicity.

A variety of factors may cause acute lethality, including ammonia, oxygen demand, pH and heavy metals. It has been demonstrated through SNP monitoring of effluent at the Fort Smith Sewage Treatment Facility that levels of ammonia, BOD, TSS and pH are subject to seasonal variation. Because of the seasonal variation in treatment afforded by the lagoon, the effluent may fail an acute toxicity test at certain times of the year, and pass at other times.

To date, there have been consistent passes for fall acute toxicity testing of samples collected in the receiving environment mixing zone. However, there have been no acute toxicity tests conducted on whole effluent to demonstrate whether or not the effluent is acutely lethal to rainbow trout. Therefore, EC recommends that acute lethality tests be conducted to demonstrate due diligence with the Fisheries Act. It is the responsibility of the owner of the facility to operate and manage the facility to discharge an effluent that is compliant with the Fisheries Act. At this time, however, EC does not see a necessity to include acute lethality testing as a condition of the licence.

Ammonia

Several factors are known to affect the toxicity of ammonia in freshwater, including pH, temperature, dissolved oxygen concentration, ionic strength, salinity, previous acclimatization to ammonia, fluctuating or intermittent exposure, and the presence of other toxic substances. Of these, pH is thought to be the most important factor influencing ammonia toxicity.⁴

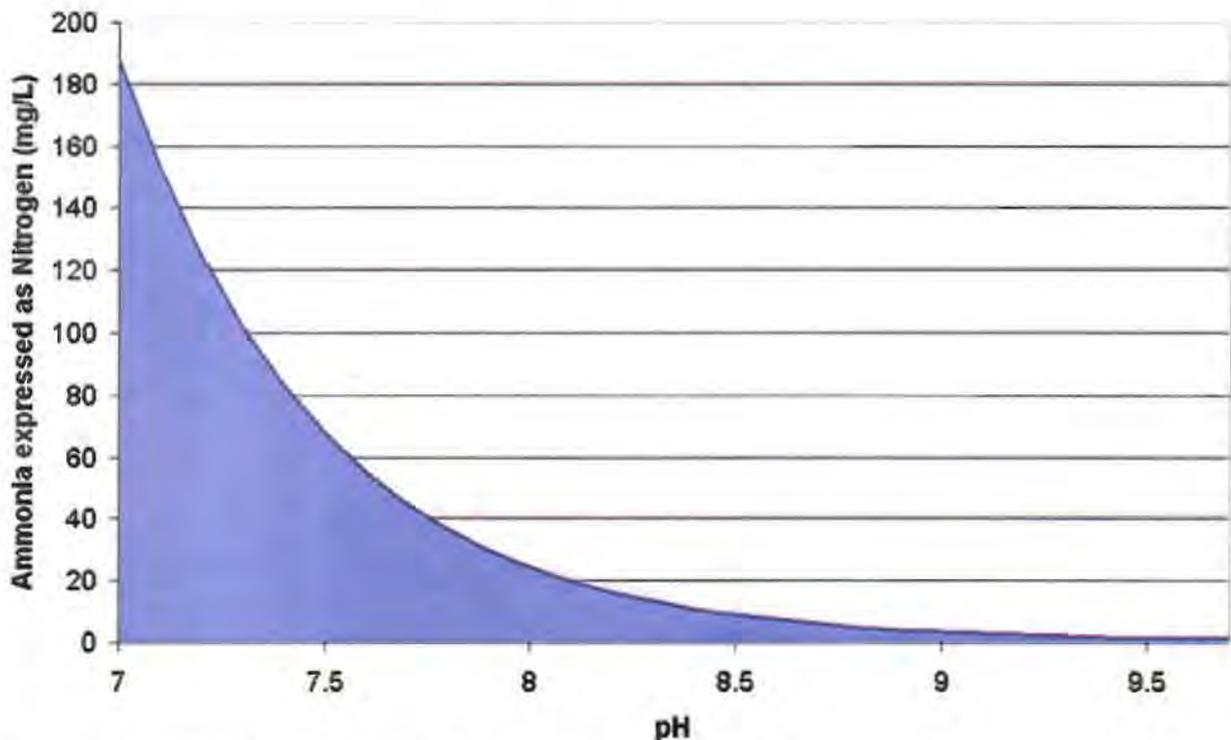


Figure 1: Threshold Acute Concentration for Ammonia versus pH.⁵

⁴ Canadian Council of Ministers of the Environment, 2010. Canadian Water Quality Guidelines for the Protection of Aquatic Life. Ammonia, p. 39.

⁵ Environment Canada. 2004. CEPA 1999 Guideline for the Release of Ammonia Dissolved in Water Found in Wastewater Effluents. Appendix A

Through scientific testing, the LC₅₀ for rainbow trout has been found to be in the range of 0.158 mg/L to 1.090 mg/l NH₃, with a mean of 0.481 mg/L NH₃.⁶ Furthermore, it has been identified that when the unionized ammonia value is greater than or equal to 1.25mg/L NH₃-N, the effluent would be acutely lethal to rainbow trout at 15°C.⁷ To determine the concentration of unionized ammonia based on the speciation of total ammonia at a given pH and temperature, the following calculation can be used:

$$\text{Unionized ammonia (NH}_3\text{)} = \text{Total Ammonia (NH}_3\text{ + NH}_4\text{)} \times \text{Fraction of NH}_3$$
$$\text{NH}_3 = [\text{NH}_3 + \text{NH}_4] \times 1 / [10^{(\text{pKa} - \text{pH})} + 1],$$

where pKa = 0.0901821 + 2729.92 / (T + 273.15)
and T = Temperature in °C

The above calculation was applied to the SNP sampling results where both pH and total ammonia-N were reported by the Town, using a temperature of 15°C, the temperature at which the acute lethality test is conducted.⁸ In only 1 of the 93 sampling results, the unionized ammonia concentration was greater than 1.25 mg/L. Therefore, by assessing the ammonia levels alone, it is not possible to determine whether the wastewater effluent is acutely lethal to rainbow trout.

For these reasons, Environment Canada recommends that the Town discharge a level of ammonia that is not acutely lethal and that the Board apply an EQC of 1.25 mg/L unionized ammonia or an equivalent or more stringent total ammonia concentration.

Groundwater Monitoring of Solidwaste Facility

In its previous review of Earth Tech's Groundwater Monitoring Program Evaluation - Fort Smith Landfill (May 2006), Environment Canada noted the groundwater concentrations for aluminum, arsenic, chromium, iron and lead frequently exceeded Environment Canada's Federal interim groundwater quality guidelines by one to two orders of magnitude. However, after reviewing the latest groundwater monitoring report compiled by AECOM for the 2006-2010 data, Environment Canada noted dramatic concentration reductions of the aforementioned metals and also a lower frequency of guideline exceedences. Specifically, there were no more than 4 guideline exceedences, each, for aluminum, arsenic, chromium and lead. Further, all exceedences were within one order of magnitude of their respective guideline. Iron was the only metal that continued to frequently exceed guidelines across all wells in the more recent data set. In spite of this, the 2010 results yielded no detectable concentrations of iron in any well. These findings suggest some improvements have been made to managing the metal leaching from the landfill. To that end, EC commends the Town of Fort Smith for their efforts.

At the recent hearing and in the latest groundwater monitoring report, arguments were tabled to support the direction of groundwater flow (northern direction) and identification of up-gradient (i.e. BH-01A, BH-01B, BH-02) and down-gradient wells (i.e. all other wells). However, EC's review of the groundwater data does not support this position. In particular, there were a number of occurrences where one or more of the 'up-gradient' wells had higher concentrations than the majority of down-gradient wells (e.g. aluminum for Sept 2004, Aug. 2005, Oct. 2005; chromium and copper for Sept. 2004, Aug. 2005, Oct. 2005; iron for Sept. 2004, Oct. 2005; lead Sept. 2004, Aug. 2005, Oct 2005, arsenic for Sept.

⁶ Environment Canada. 2001. Ammonia in the Aquatic Environment - Priority Substances List Assessment Report.

⁷ Environment Canada 2008. Supplementary Background and Guidance for investigating Acute lethality of Wastewater Effluent to Rainbow Trout. Method Development and Applications Section, Environment Canada, Ottawa, Ontario.

⁸ Environment Canada. 2000. Biological Test Method: Reference Method for Determining Acute Lethality of Effluents to Rainbow Trout EPS1/RM/13 – Second Edition, p.2.

2008). Further, the dramatic reductions seen at the up-gradient wells over the short life of the license suggests these concentrations are not representative of background or reference conditions since background concentrations are expected to remain constant over time. Therefore, EC does not accept wells BH-01A, BH-01B and BH-02 represent background conditions and should not be used by the Town of Fort Smith as a point of comparison when encountering elevated metal concentrations in the landfill groundwater wells. Going forward, EC recommends new groundwater wells should be located external to the landfill site to determine true background conditions.

If you wish clarification on any aspect of this submission, please contact Ms. Sarah-Lacey McMillan at (867) 669-4724 or by email at sarah-lacey.mcmillan@ec.gc.ca.

Yours truly,



Allison Dunn
Senior Environmental Assessment Coordinator, EPO, EC, Iqaluit, NU
Environmental Protection Operations
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cc:

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Rhonda Miller - MVLWB

From: McMillan, Sarah-Lacey [Yel] [Sarah-Lacey.McMillan@EC.GC.CA]
Sent: July-29-11 12:58 PM
To: permits@mvlwb.com
Cc: Ogilvie, Carey [Yel]; Lowman, Lisa [Yel]; Forbrich, Susanne [Edm]; Dunn, Allison [Iqa]; Kelly, Mary [Yel]; EANorthNU [Yel]
Attachments: MV2011L3-0001 Type A WL Fort Smith - EC closing comments.pdf

Hi Lynn,

Please find attached a copy of EC's closing arguments for the Town of Fort Smith's Water Licence Renewal. If you have any questions or concerns please feel free to contact me.

Thanks,

Sarah-Lacey McMillan

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