INTRODUCTION

A package extended aeration sewage treatment plant, consisting of an aerated equalization tank, aeration tank, final clarifier, pressure sand filter, and UV irradiation for surface discharge, was installed in 1999 for the 25 m^3/d design flow from a YMCA camp on Beausoleil Island in Georgian Bay (Figs. 1a, 1b). Alum and sodium bicarbonate (alkalinity) addition are used for phosphorus and ammonium removal. The plant performed well for BOD removal, fair for TSS and phosphorous removal, but was not able to nitrify ammonium to compliance levels for surface discharge to Georgian Bay.

FIGURE 1a.

A proposal was put forward to retrofit the existing plant with a Waterloo Biofilter absorbent trickling filter (Jowett and McMaster, 1995) as a polishing unit primarily to nitrify ammonium (Masaud et al., in prep; Figs. 1b, 2), but assurance was requested that the retrofit would succeed in meeting compliance. The difficulty was that the type of wastewater expected at this site, being low BOD/high NH_4-N, was not the type that Waterloo had experience with at the required high hydraulic loading rates.

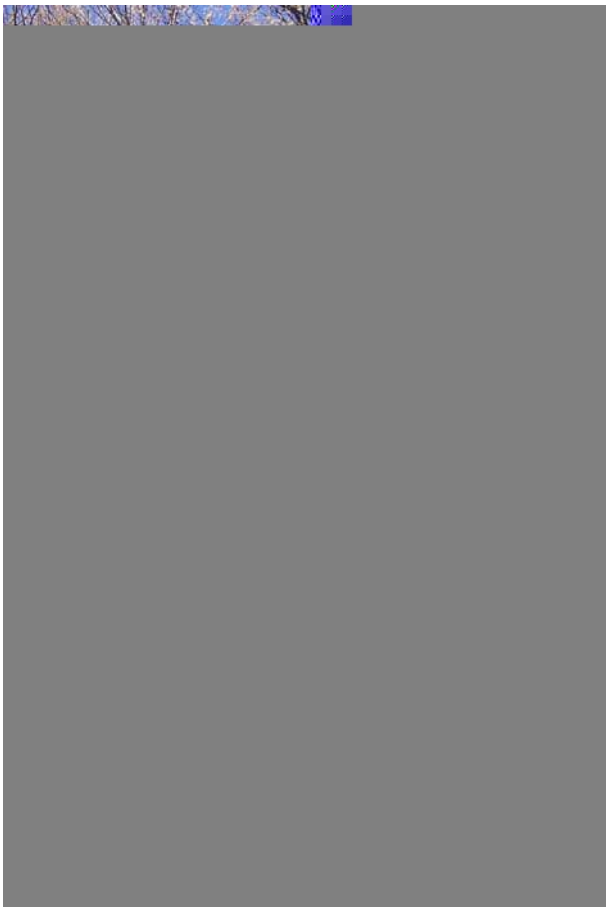


FIGURE 2.
Polyethylene Biofilter tanks on platform

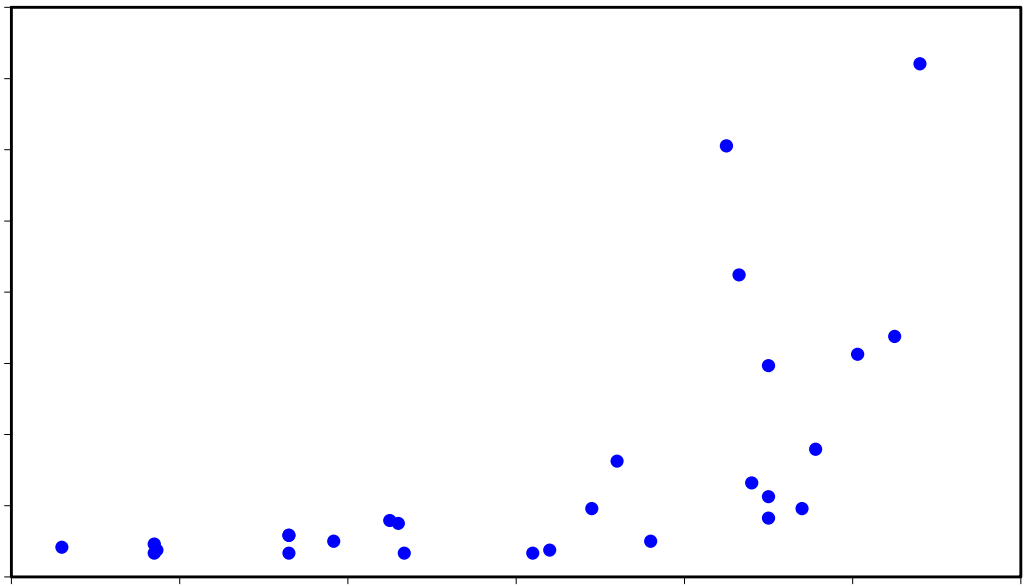
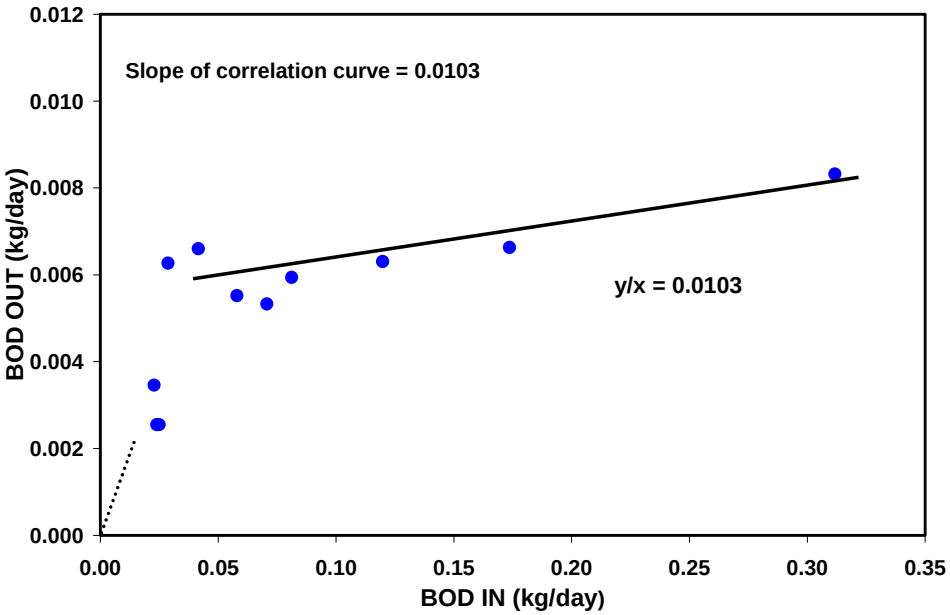


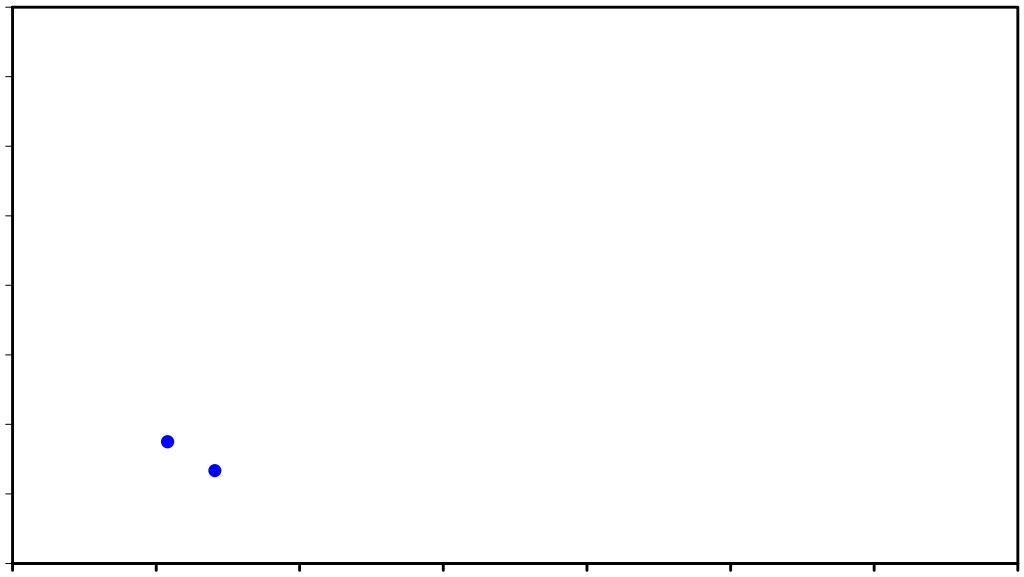
FIGURE 3a.
Low-Strength hydraulic flow vs. mg/L NH4-N – All Flows

FIGURE 3b.
Low-Strength mass NH4-N vs. mg/L NH4-N – All Flows

Correlation for Lower Flow Rates

When only lower hydraulic loading


Slope of correlation curve = 0.0103
y/x = 0.0103
BOD OUT (kg/day)
BOD IN (kg/day)
0.012
0.010
0.008
0.006
0.004
0.002
0.000
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35



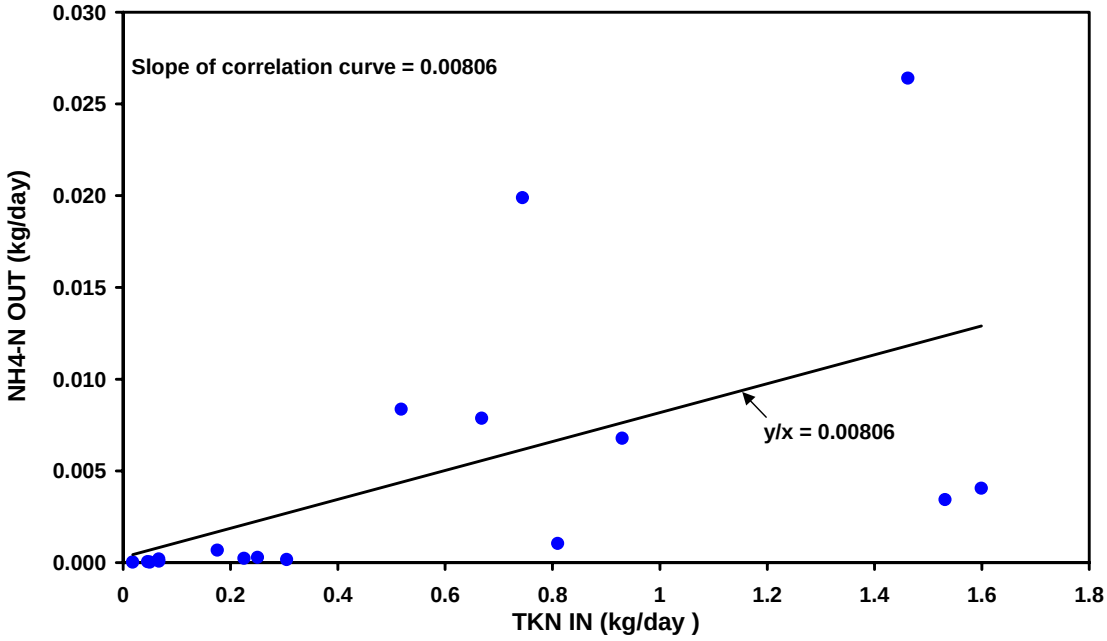


FIGURE 5a.
High-strength mass TKN IN vs. mass NH4-N OUT

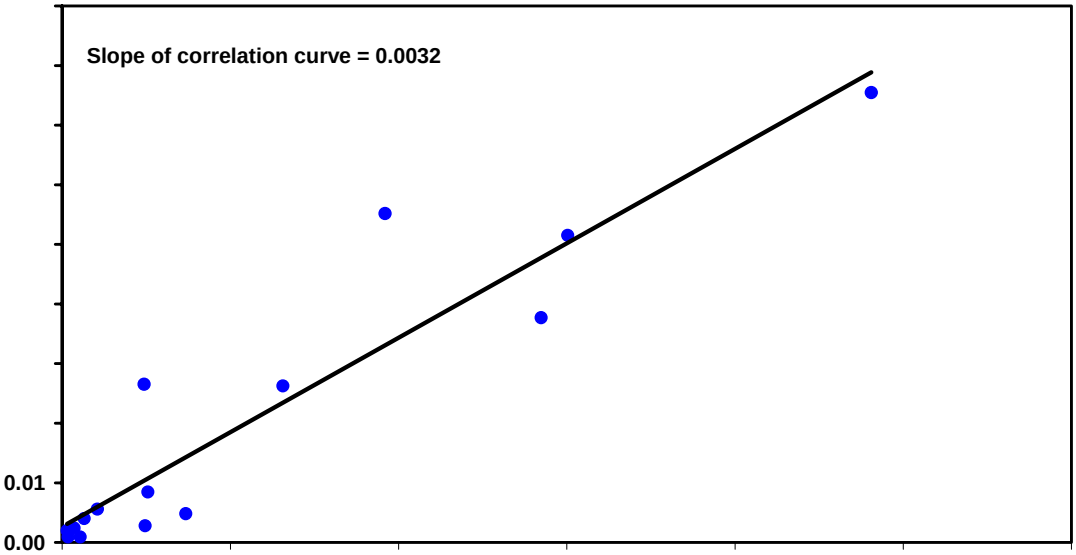


FIGURE 5b.
High-strength mass BOD IN vs. mass BOD OUT

effluent mass load of 0.0077 kg/d NH_4-N. With 56 m^3 medium in the ClubLink site, this results in 0.0077/56 = 0.0001375 kg/d per m^3 medium.

Using the proposed 15 m^3 medium at Beausoleil, this would be 15*0.0001375 = 0.0021 kg/d NH_4-N in the effluent, less than the 0.075 kg/d compliance and 0.025 kg/d target set for the polishing BIOFILTER

FIELD RESULTS OF NITRIFYING POLISHER

The Waterloo Biofilter polishing system was installed and commissioned in May 2002. The results are provided in Table 1 below and show that the retrofitted system was within compliance in every parameter throughout the summer. Better than that, the effluent concentration was within target limits in every situation but NH_4-N in July when the system was at its peak usage, with the 2.3 mg/L correlating closely with the peak of 2.2 mg/L NH_4-N predicted above. No results for 2003 are available, but no phone calls have been received.

Parameter	**cBOD**	**TSS**	**NH_4-N**
Compliance/Target	*15/10*	*15/10*	*3.0/1.0*
May	**2.5**	**7.0**	**0.35**
June	**2.8**	**3.0**	**0.1**
July	**7.2**	**3.8**	**2.29**
August	**5.0**	**4.3**	**0.22**

TABLE 1.
Effluent values in 2002 after polishing (monthly averages in mg/L)

CONCLUSIONS

Sewage treatment systems having difficulty meeting compliance can be retrofitted with a high-rate BIOFILTER polisher to remove residual solids, organics, and ammonium. The analysis of operational data from two dissimilar wastewaters such as low BOD/low NH_4-N and high BOD/high NH_4-N can successfully predict the performance of a retrofitted polisher on a third wastewater with low BOD/high NH_4-N.

ACKNOWLEDGEMENTS

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