Short-term behaviour of an experimental constructed wetland at low temperatures

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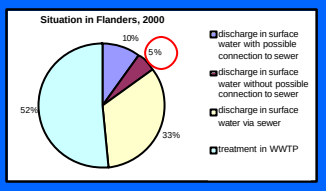
INTRODUCTION

Although the domestic wastewater treatment capacity of major cities in Flanders has strongly increased over the last decade - from 29.6 % treated wastewater in 1991 to 52 % in 2000 - treatment of diffuse pollution arising from rural areas remains an unsolved problem. An important group within the different small wastewater treatment systems which can handle this problem at the source is made up by the constructed wetlands.



PROBLEM FORMULATION

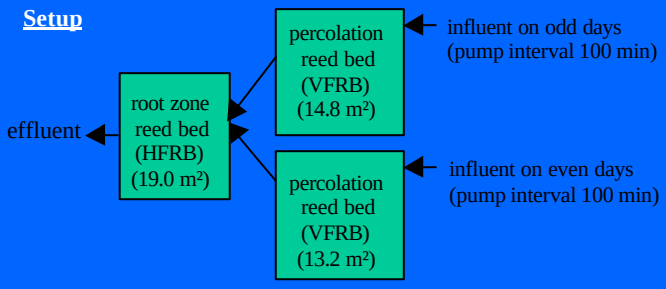
Today, a vast amount of information is available in the literature concerning a wide range of constructed wetland types operating under different climatic conditions. Because of inconsistent removal efficiencies and management strategies reported about this type of wastewater treatment, water managers often remain quite sceptical about this purification technique.

AIM : to gain knowledge about wetland processes → ~~black box~~ ➔ white box

TOOLS : intensive monitoring campaigns, model building and simulation

MATERIALS AND METHODS

Setup



Influent

- primary effluent from the WWTP Aartselaar
- 20 – 25 January 2001 : 1.0 DWF or 1.3 m³/day
- 25 – 29 January 2001 : 1.5 DWF or 1.9 m³/day

Sampling frequency

	1 DWF	1.5 DWF
Influent	mixed samples over 2 hours	mixed samples over 2 hours
Effluent percolation reedbed	mixed samples over 4 hours	mixed samples over 3 hours
Effluent root zone reedbed	mixed samples over 8 hours	mixed samples over 6 hours

Variables

- COD, BOD, SS, NH_4-N, NO_3-N, KjN, TN, OP, TP, pH, DO
- water and air temperature (T_w, T_a) and precipitation (P)

RESULTS

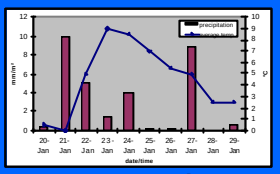


Fig. 1. Meteo conditions

Table 1. Average Removal Efficiencies (%)

variable	percolation	root zone	combined system
COD	81	16	84
BOD	86	23	89
SS	92	23	94
KjN	76	20	81
NH_4-N	75	25	81
NO_3-N	(-1699)	0	(-1695)
TN	7	4	11
OP	46	12	52
TP	72	19	78

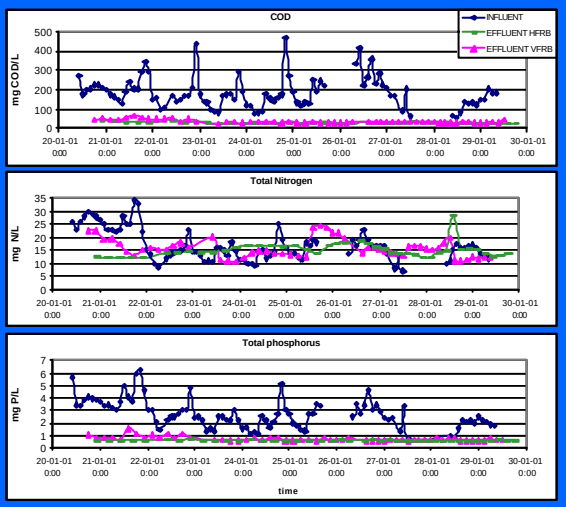


Fig 2. Wastewater concentration series

CONCLUSIONS

• The constructed wetlands exert a strong buffering : high influent variations, small effluent variations. A low effluent sampling frequency can be justified.

• Despite the low temperatures (-1 °C till +9 °C), all legal standards for small scale WWTPs (250 mg COD/l; 50 mg BOD/l; 60 mg SS/l) were largely met. Effluent concentrations even complied with the standards for large scale WWTPs except for nitrogen (125 mg COD/l; 25 mg BOD/l; 35 mg SS/ ; 15 mg N/l; 2 mg P/l).

• The higher influent flow rate starting from 25/01/2001 has no influence on the system's performance.