



Water Treatment Works Kluizen

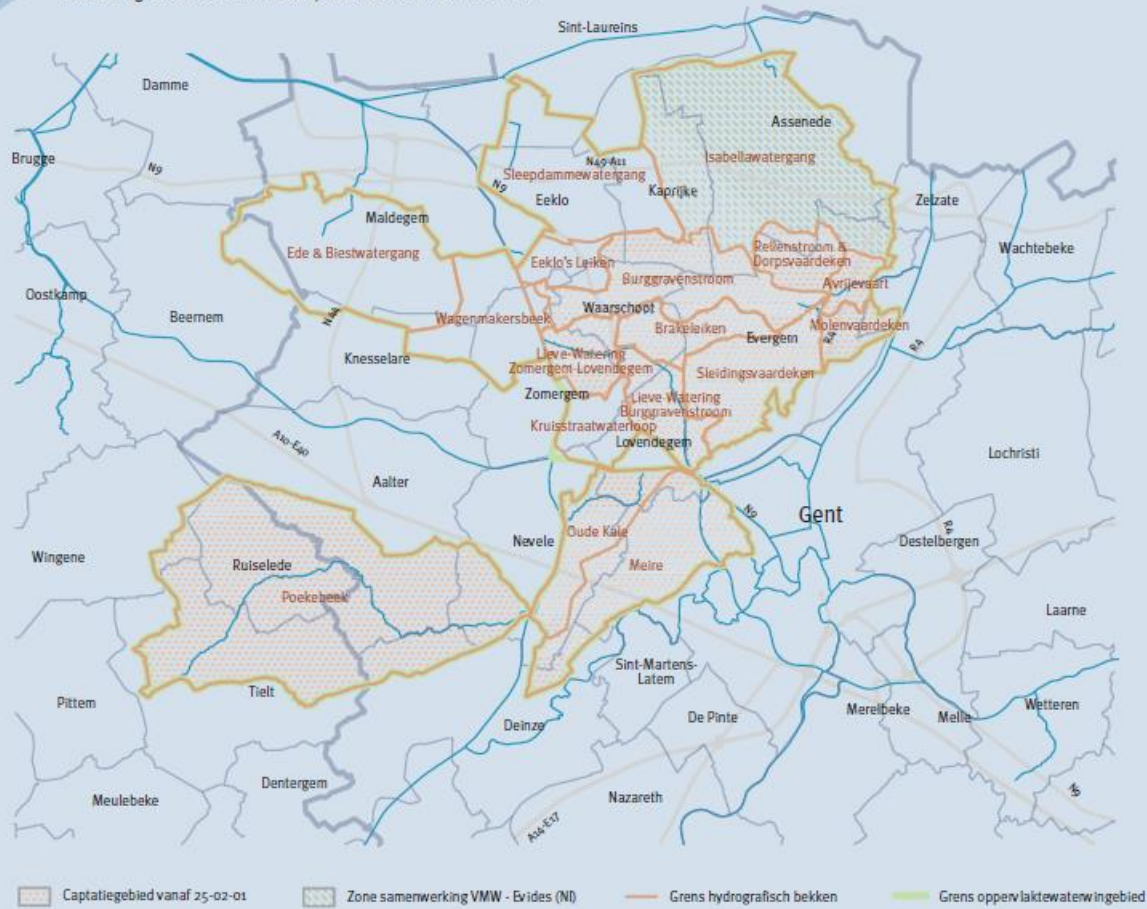
DOC2C's Workshop

October 5, 2017



Raw water source

Fig. 6 Waterwingebied van het waterproductiecentrum Kluzen

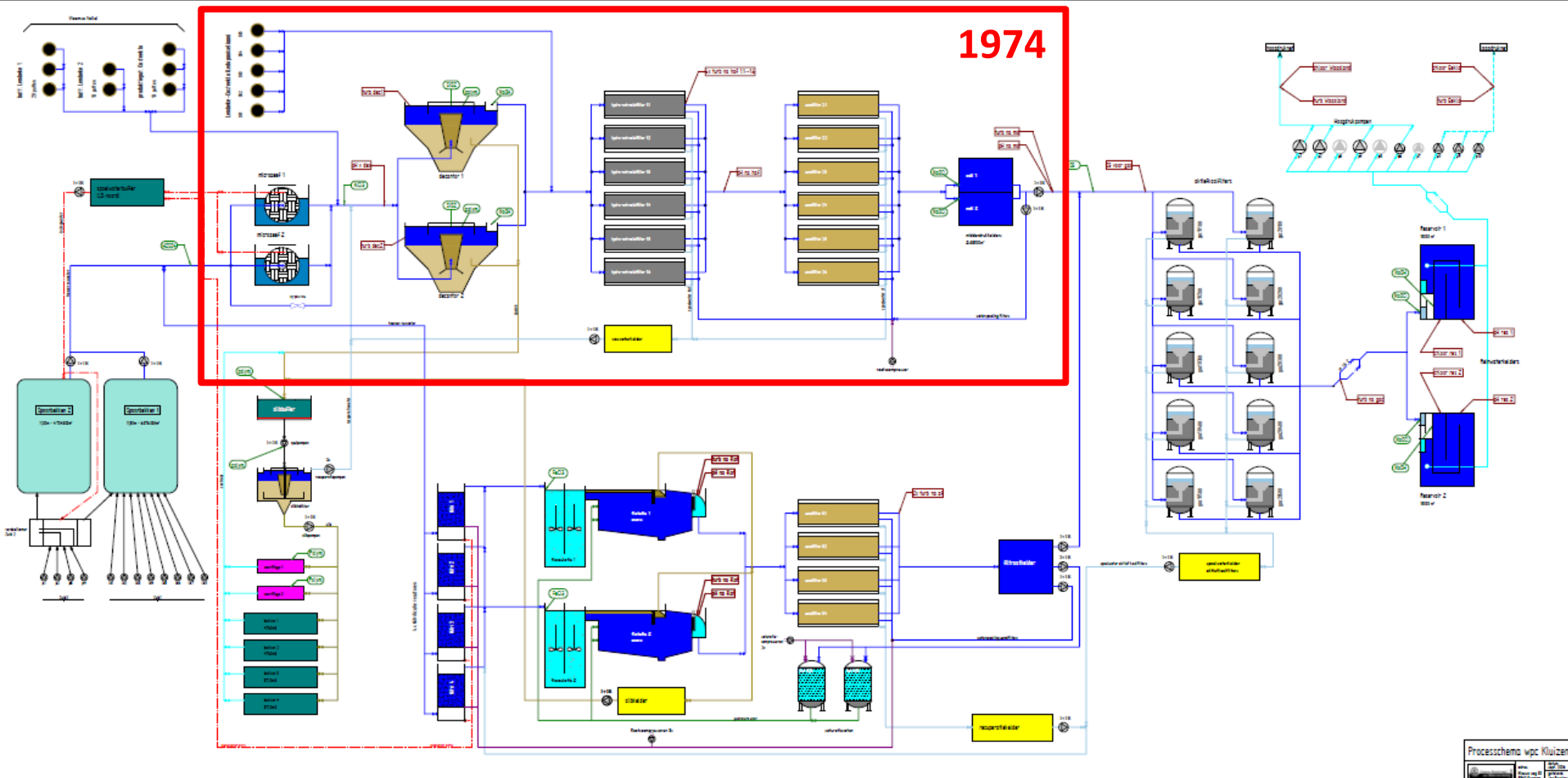


Raw water quality

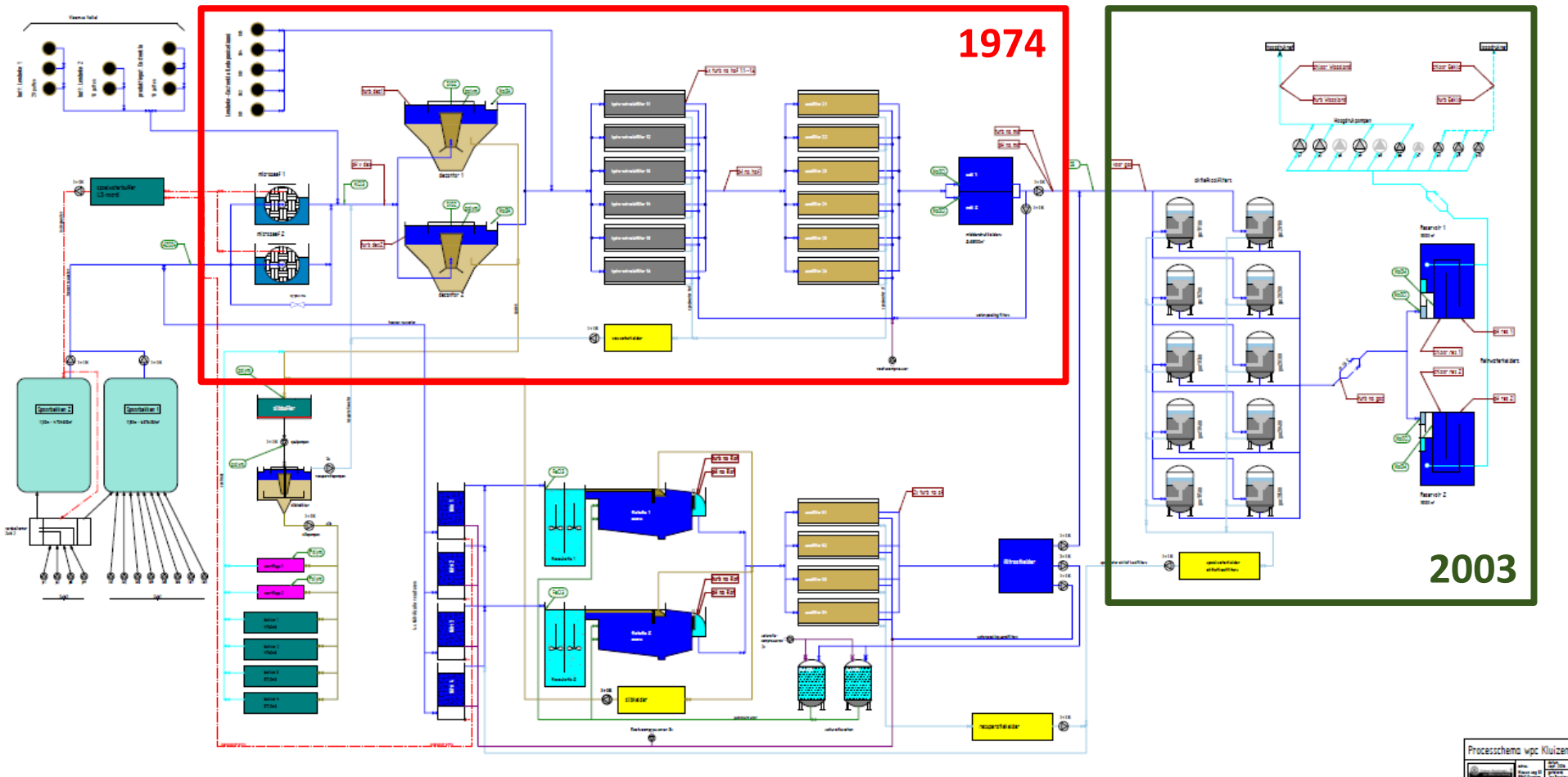


	Kluizen	Blankaart
NPOC (mg C/l)	10,3	13,1
Alkalinity (meq/l)	4,0	3,8
pH (-)	8,0 – 8,7	8,0 – 9,2
Conductivity (µS/cm)	574	859
Chloride (mg/l)	48	121
Sulfate (mg/l)	55	88
Hardness (°F)	26	26
Turbidity (NTU)	1,9	4,4
Suspended solids (mg/l)	2,6	9,7
Manganese (µg/l)	114	102
NH ₄ ⁺ (mg/l)	0,2	0,6
Nitrate (mg/l)	6	10
Orthofosfate (mg/l)	0,3	0,8
Chlorofyl (µg/l)		32
C perfringens (/100 ml)	51	166
Coli (/100 ml)	591	1009
Enterococcus (/100 ml)	18	67
E. Coli (/100 ml)	58	230
HPC 22°C (/100 ml)	1612	5910

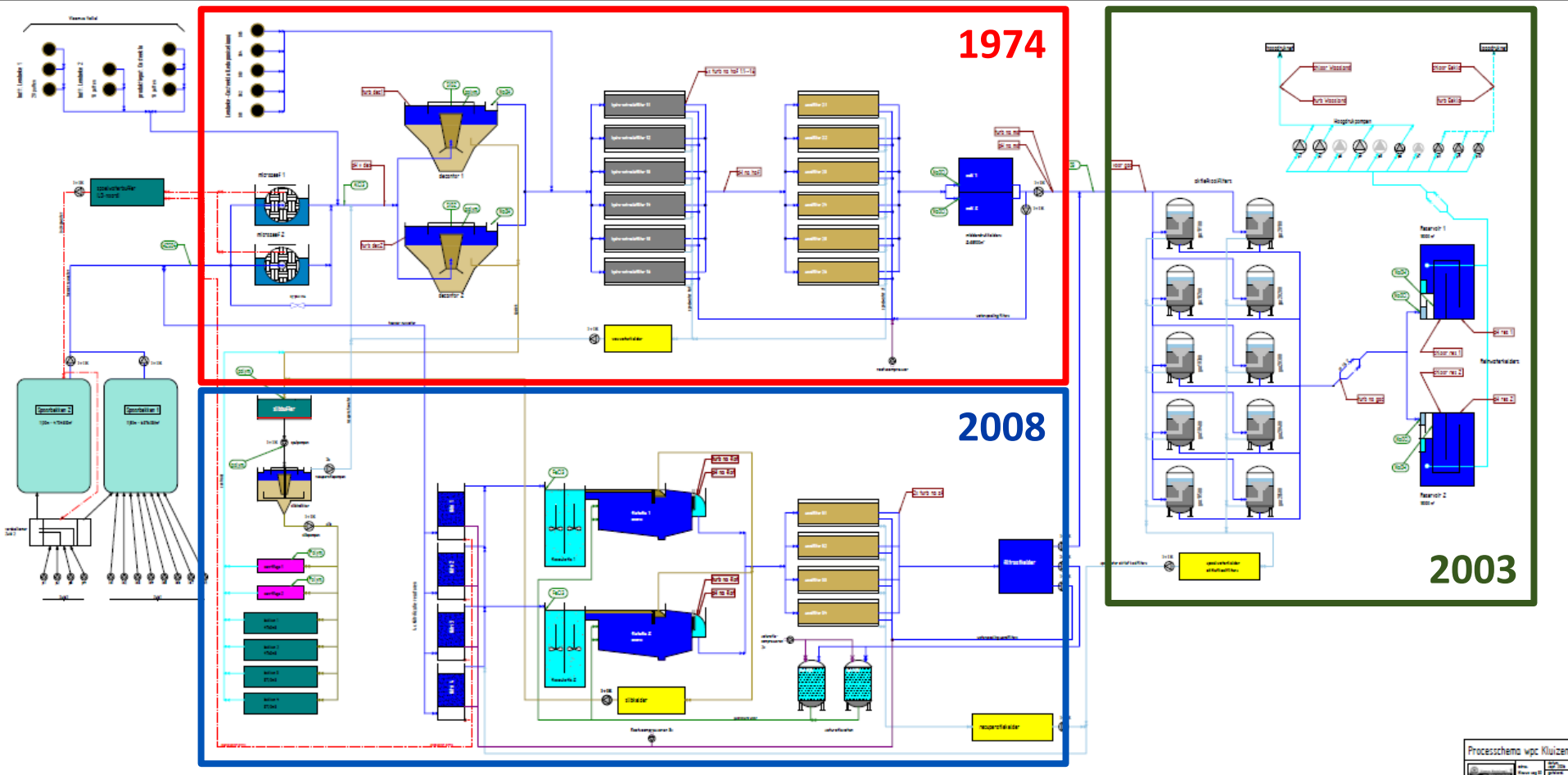
The treatment plant



The treatment plant



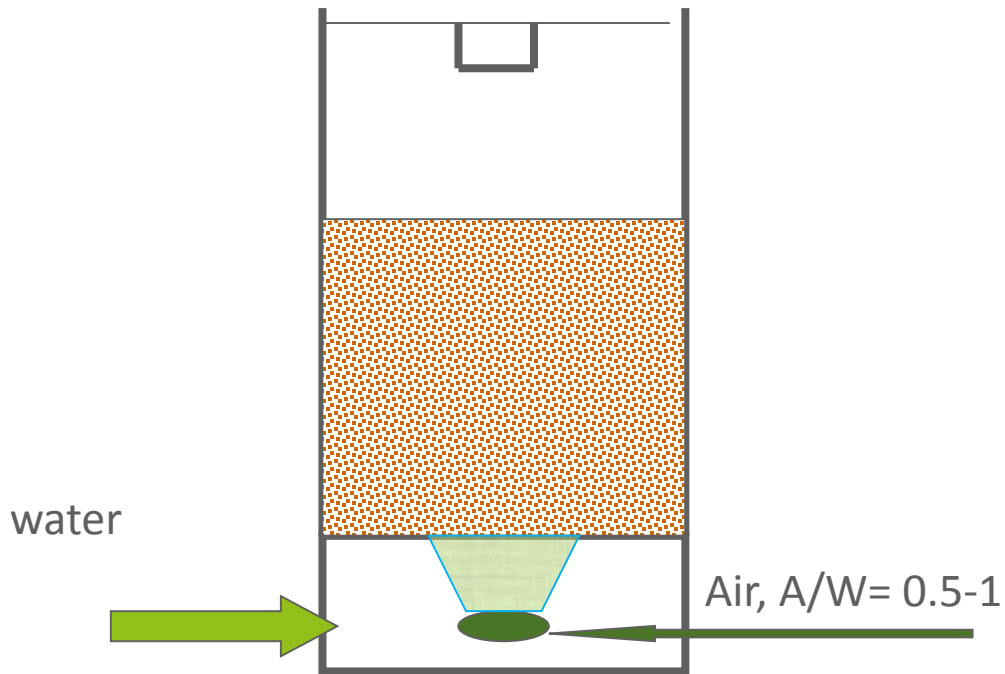
The treatment plant



Processchema wpc Kluiszen

Nitrification reactors

- Biological oxidation of ammonia to nitrate



$$\delta(NH_4^+) = 13.5 \times e^{t/9.9} \text{ mg/L.h}$$

t= temperature °C



Coagulation - flotation

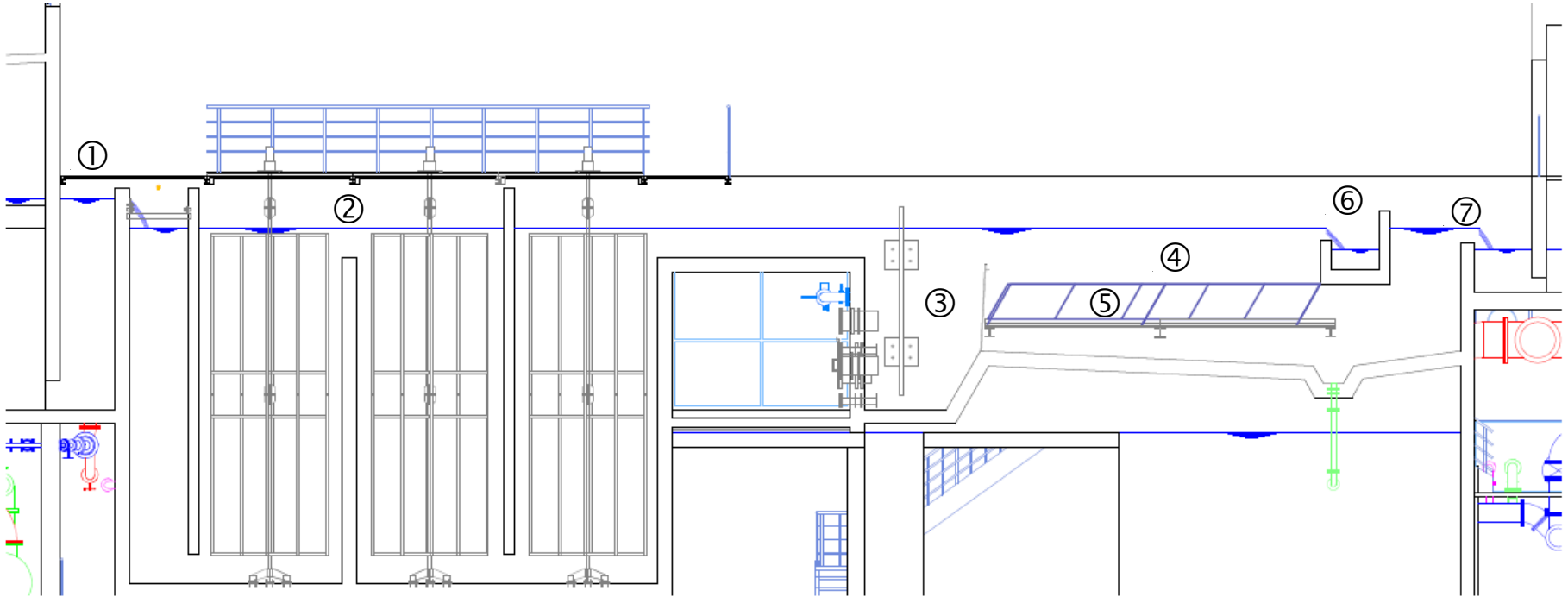
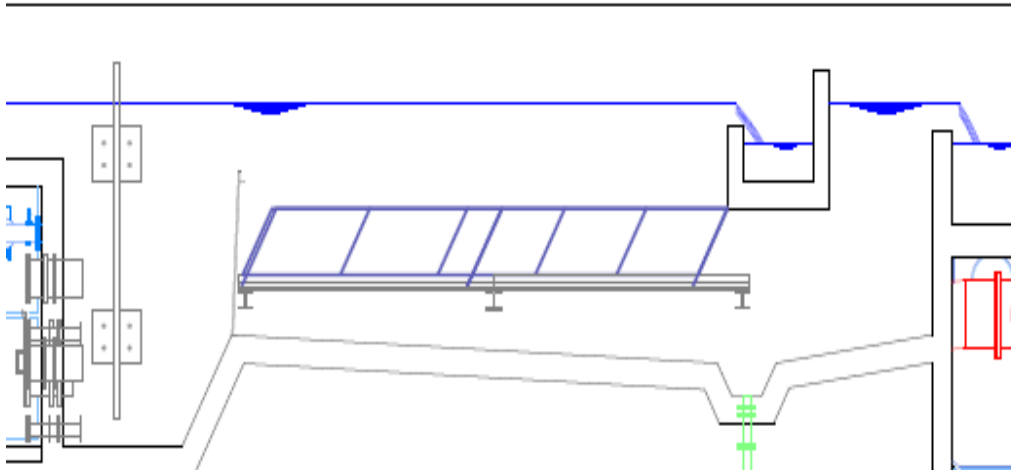


Figure 1. Cross section of the flotation plant, with (1) coagulation unit, (2) flocculators, (3) contact zone, (4) separation zone, (5) lamella separators, (6) removal of the froth layer and (7) overflow weir for effluent withdrawal.

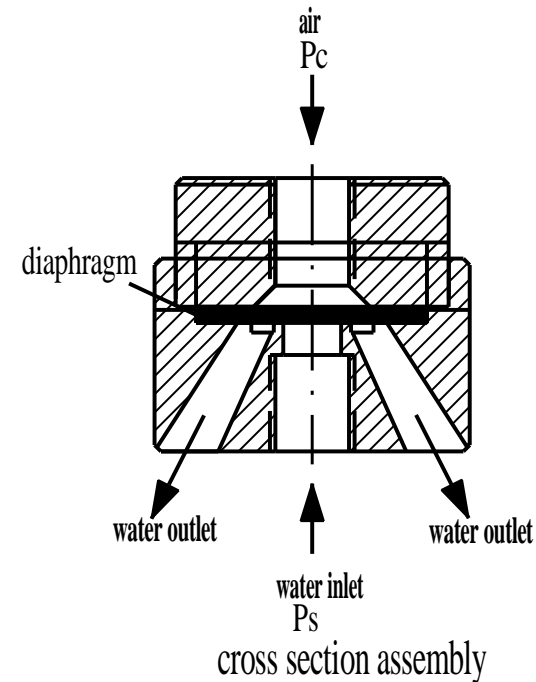
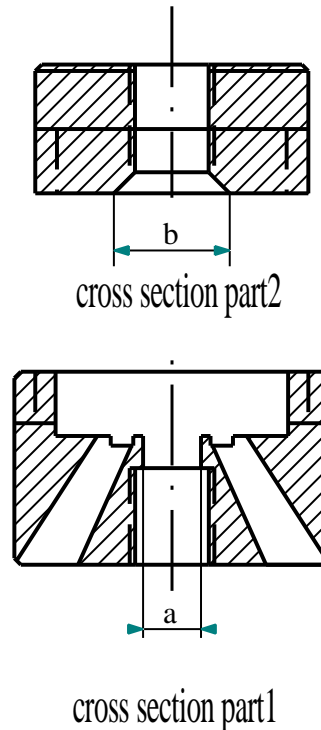
Lamellae separators in separation zone

- Improved flow pattern



Pneumatically adjustable flotation nozzle

- Disadvantage of fixed orifice nozzles: limited range of flow variation
- “PAN”

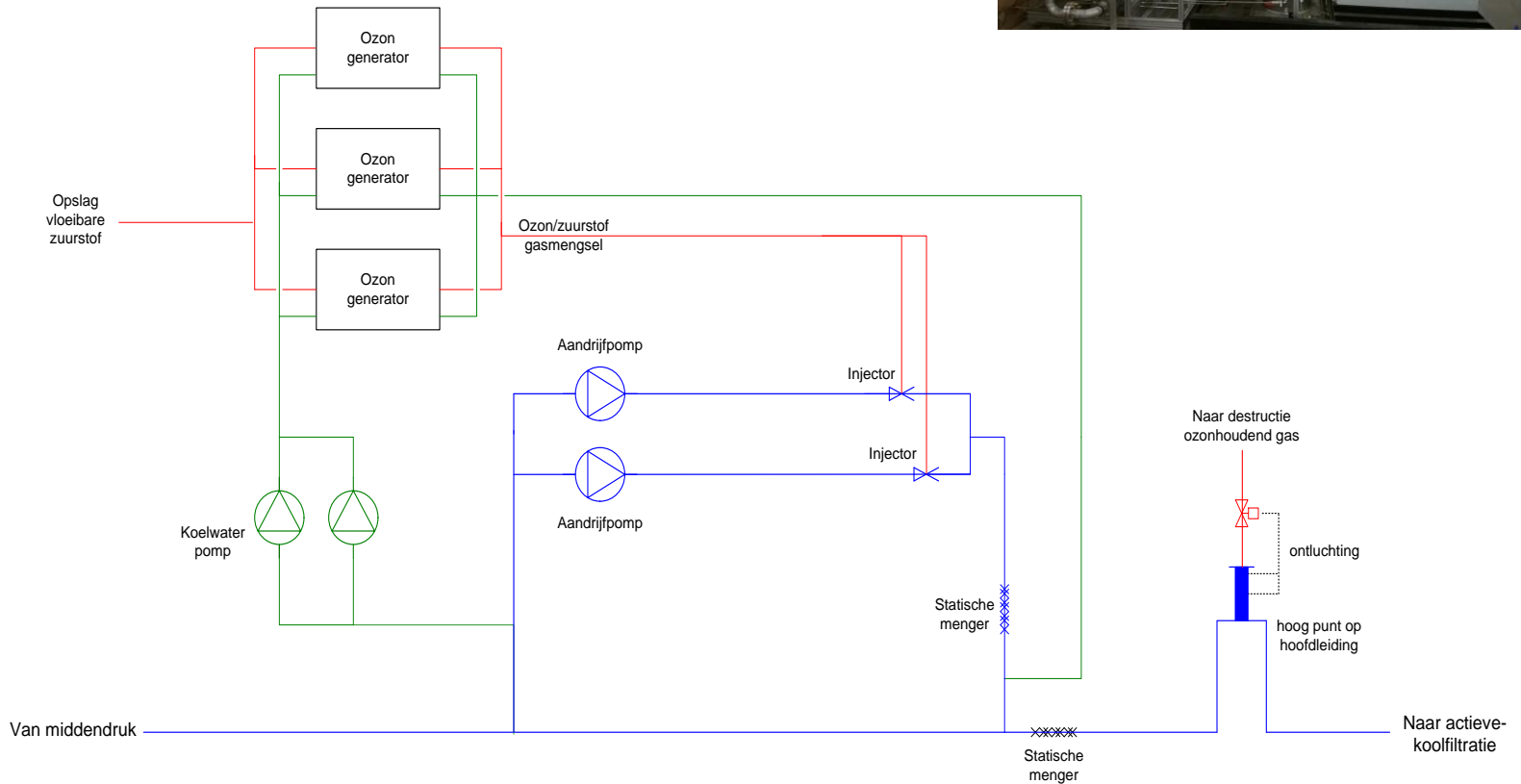


Pneumatically adjustable flotation nozzle



Ozonation

- Ozone dose 2 mg/l

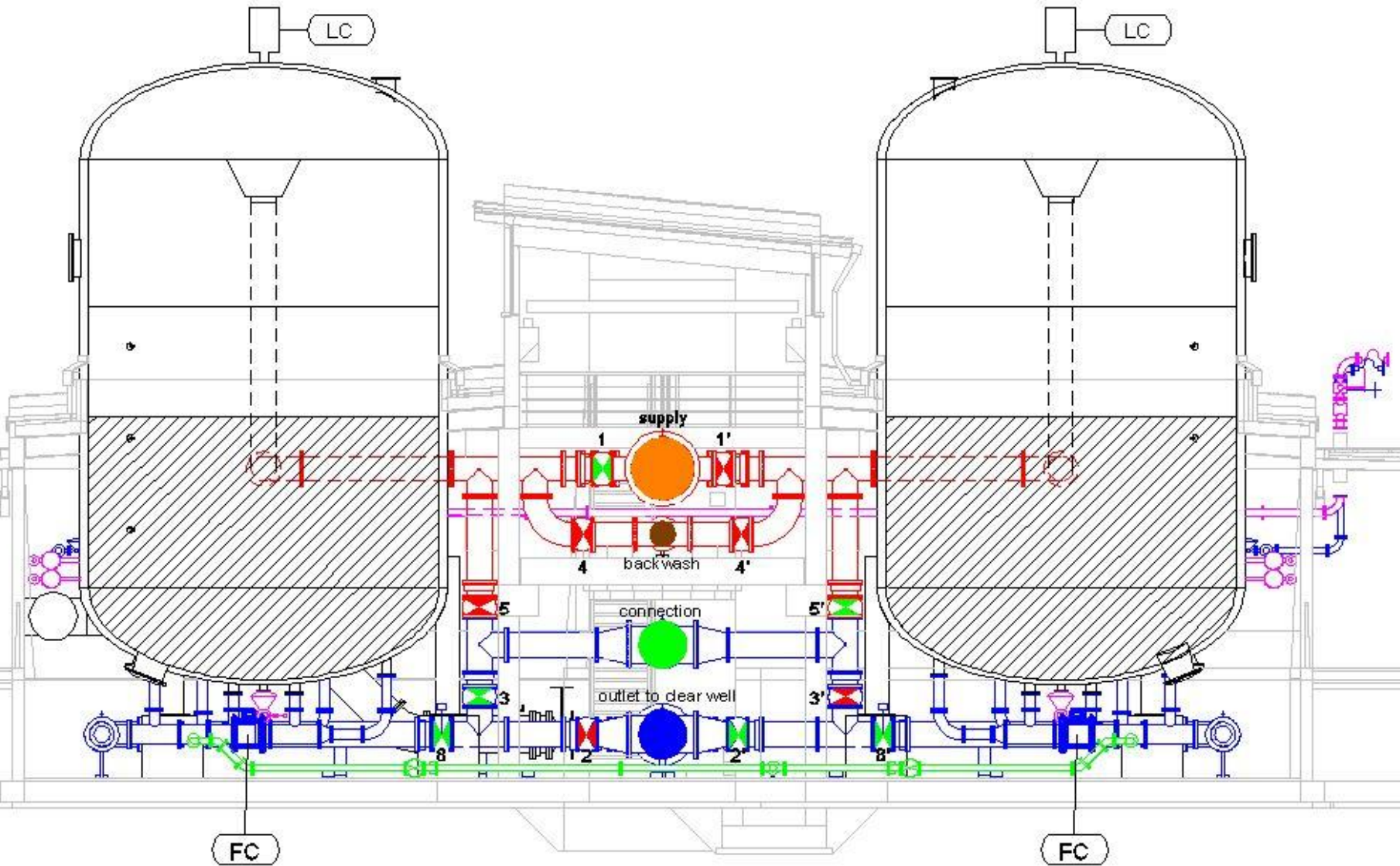


Dual stage GAC filtration

- Dual stage GAC filtration CT 2 x 15 min
 - GAC stage 1 – mainly biodegradation
 - GAC stage 2 – mainly adsorption

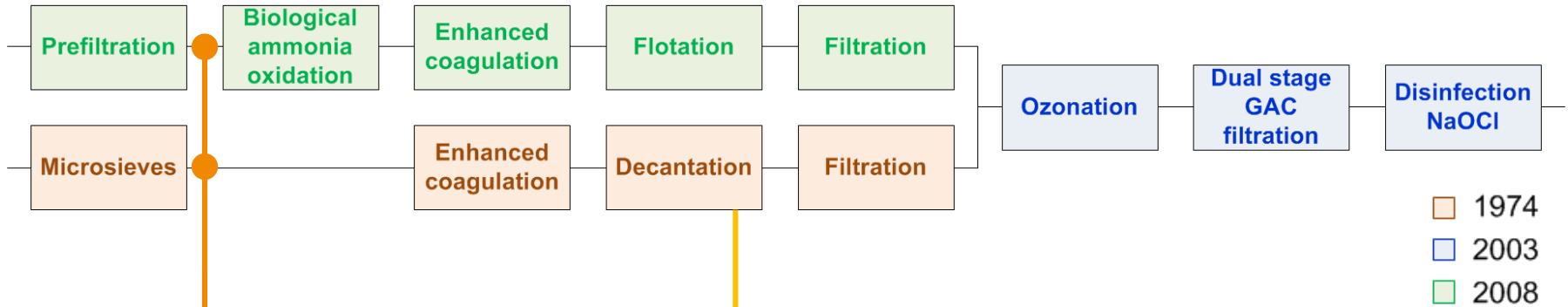


Dual stage GAC filtration

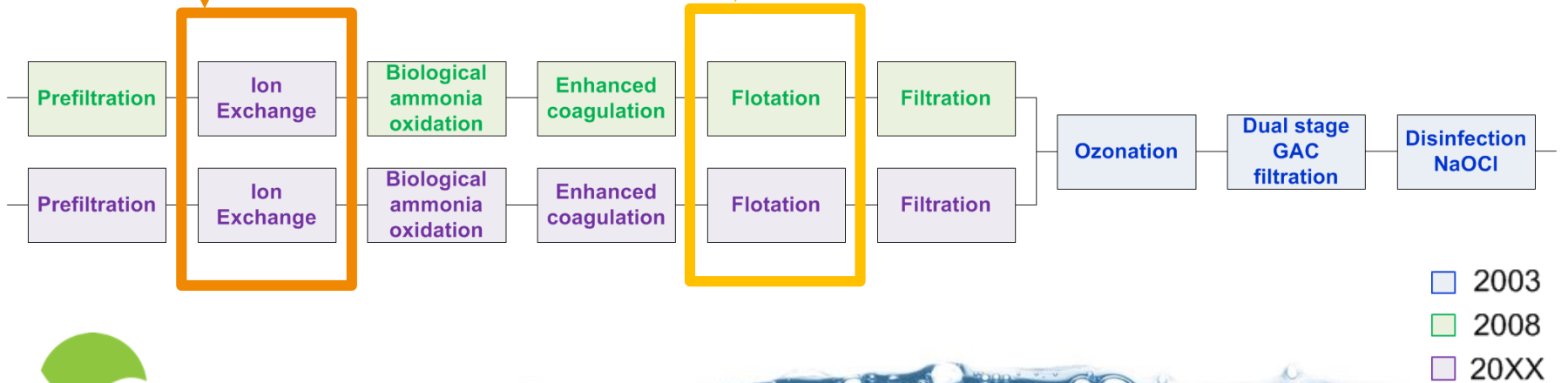


Future plans

Current treatment scheme



Future treatment scheme



Choice for IEX – coagulation - flotation

- Based on more than 10 years of NOM research
- Coagulant dose reduction > 80%
- Improved overall DOC removal efficiency
- Lower mineralisation
- IEX investment cost compensated by lower operational cost

