

Delft University of Technology

Faculty of Civil Engineering and Geosciences

Section of Sanitary Engineering

CT5520 – Drinking water treatment 2

Design project

Loenderveen (Waternet) – Enhancing NOM removal

## 1. Problem definition

The presence of natural organic matter (NOM) in drinking water influences both the efficiency of treatment steps, and processes in the distribution network such as the formation of biofilms and the uptake of copper and lead.

Seepage water of the Bethunepolder is used as source for drinking water. This water contains much NOM and enhanced NOM removal is required. Develop practical alternatives for the enhanced removal of NOM to solve the problems related to high NOM concentrations. Think about:

- Choice of the system and the materials/media used.
- Place of the system in the pre-treatment (before or after coagulation).
- Variations in source water quality
- Effects of NOM removal on following treatment steps

Detailed information of Treatment plant Loenderveen is given in the annexes.

## 2. Actual situation

Mostly seepage water from the Bethunepolder is used as source water, but at low water levels in the polder it is also possible to abstract water from the Amsterdam-Rhine canal.

The treatment at Loenderveen consists of coagulation, self-purification in a lake with a residence time of 100 days and rapid sand filtration.

After this pre-treatment, the water is transported to Weesperkarspel.

The post-treatment at Weesperkarspel consists of: ozonation, softening, activated carbon filtration and slow sand filtration.

An overview of several parameters in the raw water is given in table 1:

The treatment plant is characterised by the following data:

### Design capacity:

The design flow of the treatment plant can be determined with the following data:

Year capacity:	15 mln m <sup>3</sup>
Average daily capacity:	47,000 m <sup>3</sup> /dag
Maximum day factor (peak factor):	1.8
Minimal day factor:	0.7

### Coagulation:

Number of basis	2
Surface area per basin:	40x80 m

### Lake water reservoir:

Residence time:	about 100 days
Surface area:	123 ha
Volume:	6.9 million m <sup>3</sup>

Filters:

Number:	24 filters
Surface area:	48 m <sup>2</sup> per filter
Max. filter loading:	6 m/h

Transport mains:

Length:	10 km
Diameter:	2 x 1000mm

Buffering reservoir:

Surface area:	1.12 ha
Volume:	40.000 m <sup>3</sup>

**Annexes:**

1. Water quality
2. Proces scheme
3. Main water flow scheme
4. Hydraulic line scheme
5. Map

*Water quality of Treatment plant Loenderveen.*

Parameter	Unit	Raw water Bethune Polder			Raw water Amsterdam Rhine Canal			After pre-treatment			After post-treatment		
		Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max
Temperature	oC	10.9	<0.5	20.5	13.9	2.5	25.2	11.9	2.3	22	12.3	2.3	22.1
pH	pH	7.36	7.17	7.72	7.93	7.49	8.19	7.62	7.45	7.79	8.06	7.84	8.44
Turbidity	FTE	35	20	85	14	3.2	37	0.2	0.12	0.27	0.12	<0.1	0.32
UVA254	1/m	30	23.9	75.5	13	6.8	28.7	14.6	13.5	15.8	4.4	3.1	6.2
DOC	mg/l C	9.2	6	17	5	2.8	9.8	6	5.4	6.6	3.3	2.5	4.2
Colour	mg/l pt	34	22	142	17	8	37	10	7	15	2	<1	5
Oxygen	mg/l O2	3.2	<1	8.6	9.5	7	12.9	-	-	-	8	5	12.8
Suspended solids	mg/l	15	8.3	23	26	16	36	<1	<1	<1	<1	<1	<1
Conductivity	mS/m	53.2	37.5	58.4	60	49.7	65.7	53.2	51.5	54.6	50.8	48.5	52.2
Chloride	mg/l cl	44	29	49	75	54	97	75	69	79	79	71	85
HCO3	mg/l HCO3	291	270	309	181	160	204	204	196	213	176	170	186
Calcium	mg/l ca	88	81	95	72	64	79	80	78	83	49	47	53
Magnesium	mg/l mg	6.6	6.2	7.2	10.4	9.3	11.6	6.5	6.1	6.8	6.4	5.6	6.8

# Process scheme Pre-treatment plant Loenderveen

## Process scheme Pre-treatment plant Loenderveen

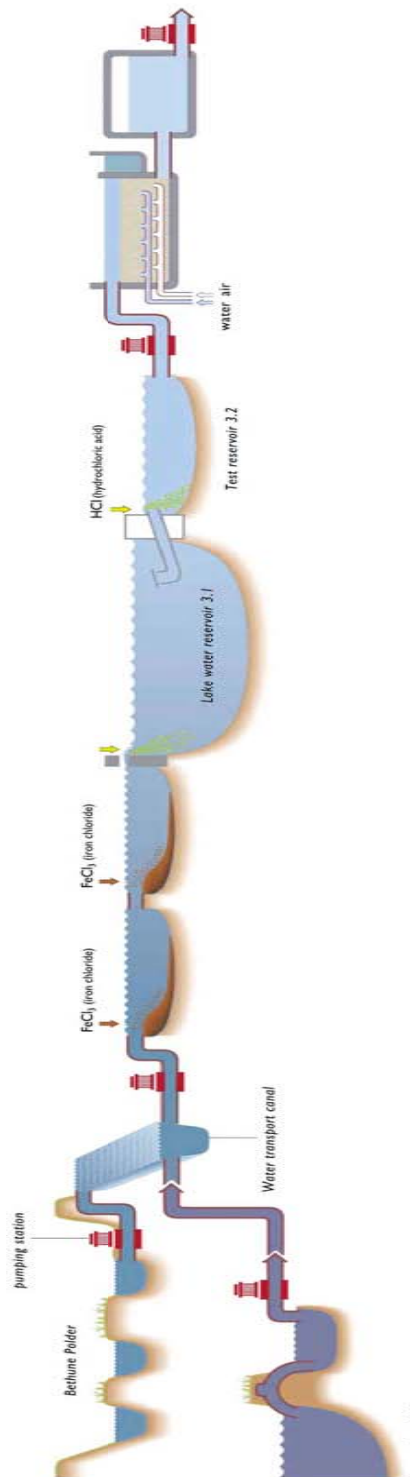
Year capacity:  
15 mln m<sup>3</sup>

Coagulation:  
2 basins  
Surface area  
per basin: 40 x 80 m

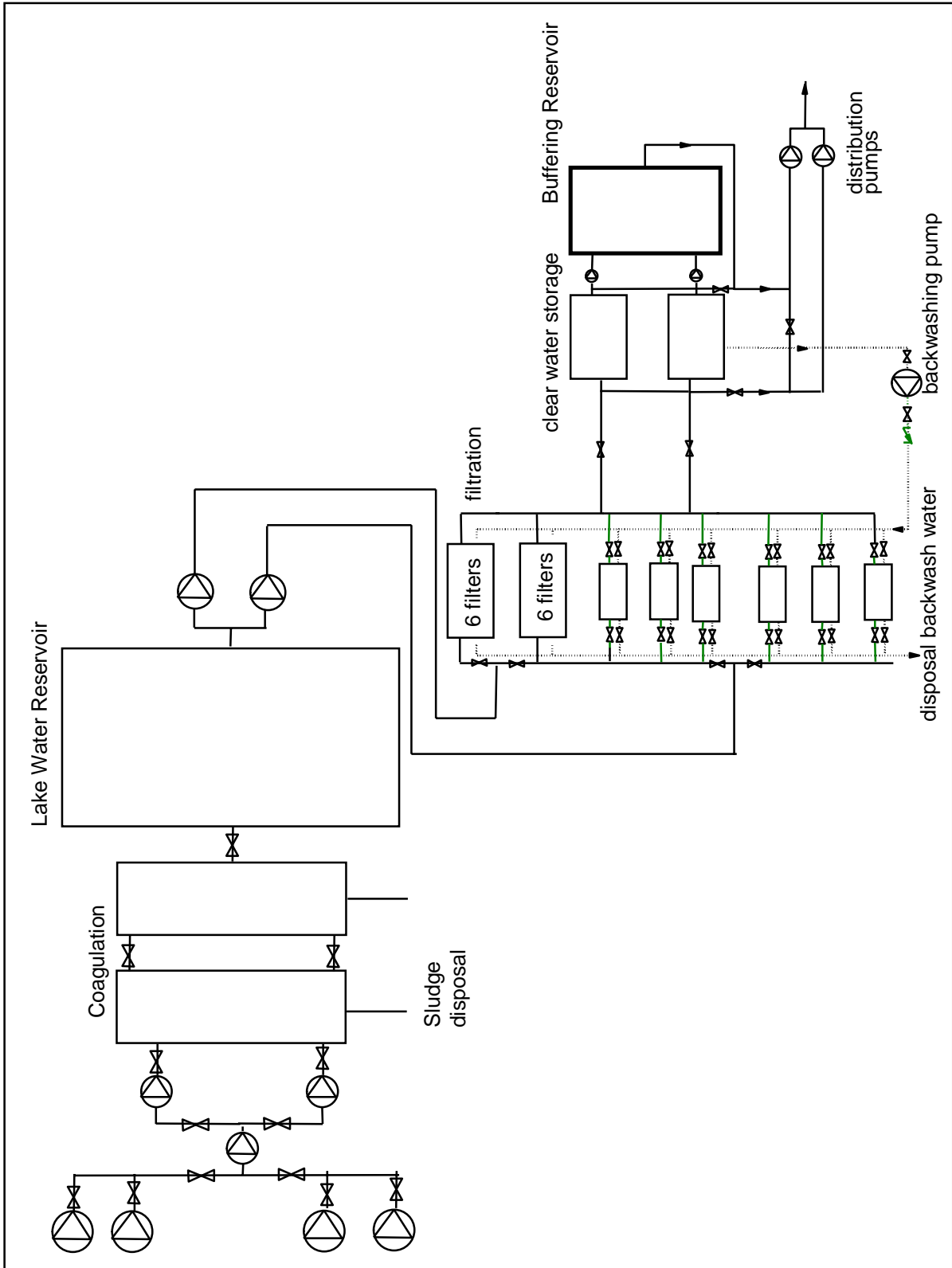
Lake Water Reservoir  
Residence time: about 100  
days  
Surface area: 123 ha  
Volume: 6.0 Mm<sup>3</sup>

Filters:  
Number: 24 filters  
Surface area: 48 m<sup>2</sup> per  
filter  
Max. filter loading: 6 m<sup>3</sup>/h

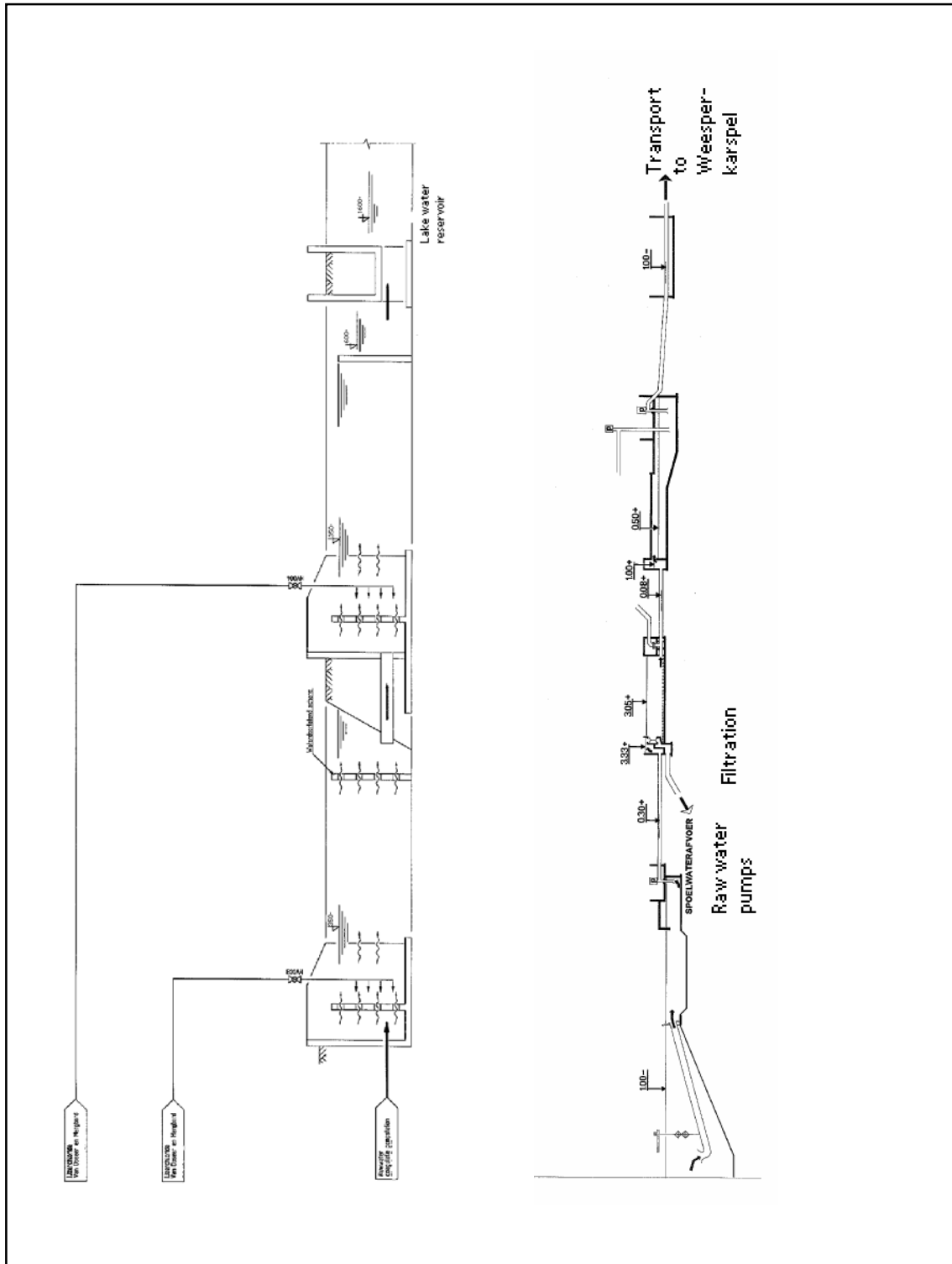
Transport and buffering:  
Main: Length: 10 km  
Diameter: 2 x 1000 mm  
Buffer reservoir:  
Surface area: 1.12 ha  
Volume: 40,000 m<sup>3</sup>



Main flow diagram Pre-treatment plant Loenderveen



# Hydraulic line scheme Pre-treatment plant Loenderveen





# Terrain lay out Treatment plant Loenderveen

