

CT5520 – Drinking water treatment 2

Design project

# Harderbroek (Vitens)

## Improving iron removal

*Chiara Di Silvestro*

*Silvia Guerreschi*

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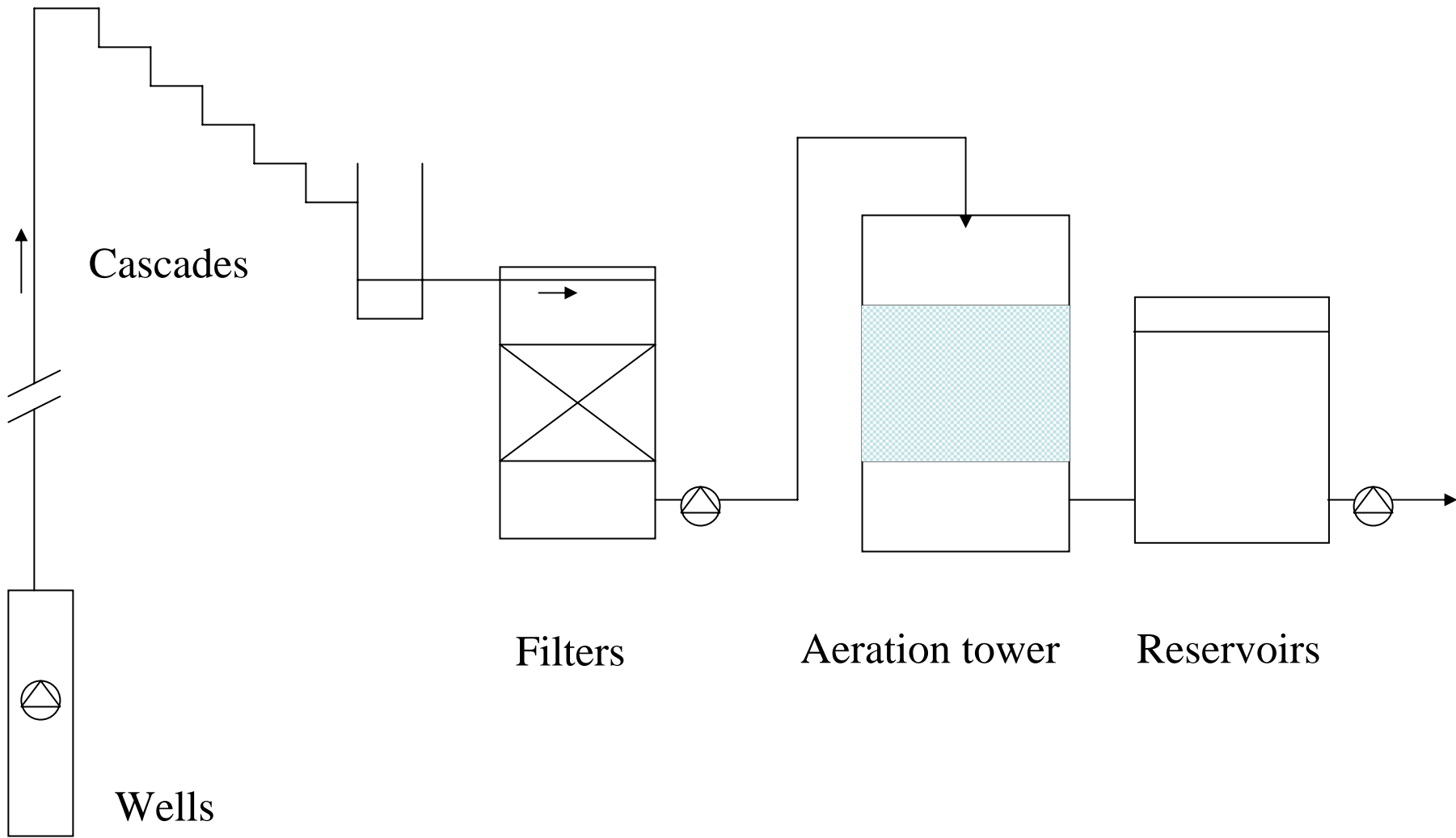
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# Introduction



- Harderbroek is situated in the province of Flevoland
- It is in operation since October 1997
- Vitens

# PROCESS SCHEME



# TREATMENTS

- **ABSTRACTION** → There are 10 wells with a capacity of 200m<sup>3</sup> each. Groundwater is caught from 120/170 m below groundlevel through 4 pumps.
- **CASCADES** → There are 4 cascades each one of 6 steps. The maximum capacity is of 450 m<sup>3</sup>. This aeration system is preferred because of the presence of big quantities of CO<sub>2</sub> and because of possible problems of clogging.
- **RAPID SAND FILTRATION** → There are 8 filters each one with a flow capacity of 225 m<sup>3</sup>/h. It is done to remove suspended and colloidal particles. So with this mechanism we can remove the iron flocs.

▪ TOWER AERATION →

There are 3 towers each one with a maximum capacity of 320 m<sup>3</sup>/h. It is necessary to restore the level of oxygen in the water.

▪ RESERVOIRS →

The treated water is stored in 1 reservoir of 2000m<sup>3</sup> and 2 of 1500m<sup>3</sup>.

## PROBLEM DEFINITION

- Decrease the iron concentration in the treated water
- Fe<sup>2+</sup> or Fe<sup>3+</sup>

## MECHANISM OF REMOVAL



- Oxidation
- Formation of iron hydroxide flocks

|                    |        | gezamenlijk ruwwater pompstation Harderbroek |         |         |
|--------------------|--------|--|---------|---------|
|                    |        | gemiddeld                                    | minimum | maximum |
| tempratuur         | °C     | 12,9   | 12,0    | 13,0    |
| zuurstof           | mg/l   | 0,705  | <0,500  | 1,000   |
| zuurgraad          |        | 7,47   | 7,42    | 7,50    |
| EGV 20 °C          | mS/m   | 16,4   | 16,2    | 16,6    |
| waterstofcarbonaat | mg/l   | 84,9   | 83,4    | 87,5    |
| chloride           | mg/l   | 7,50   | 7,23    | 7,67    |
| sulfaat            | mg/l   | 8,44   | 8,28    | 8,74    |
| natrium            | mg/l   | 6,39   | 6,31    | 6,48    |
| calcium            | mg/l   | 25,8   | 25,5    | 25,9    |
| magnesium          | mg/l   | 2,07   | 2,06    | 2,11    |
| totale hardheid    | mmol/l | 0,729  | 0,721   | 0,734   |
| ammonium           | mg/l   | <0,040                                       | <0,040  | 0,061   |
| nitriet            | mg/l   | <0,0070                                      | <0,0070 | <0,0070 |
| nitraat            | mg/l   | <0,50  | <0,50   | <0,50   |
| ijzer              | ug/l   | 1400   | 1360    | 1500    |
| mangaan            | ug/l   | 122,0  | 121,0   | 123,0   |

- The standard value of the concentration of iron in The Netherlands is 0,2mg/l.
- The recommended value is 0,05mg/l.



## CAUSES

- Insufficient capacity of treatment of the plant
- The filter is not working good

## POSSIBLE SOLUTIONS

- Increase aeration capacity
- Change the aeration system
- Add chemicals before rapid filtration

THANKS FOR YOUR  
ATTENTION