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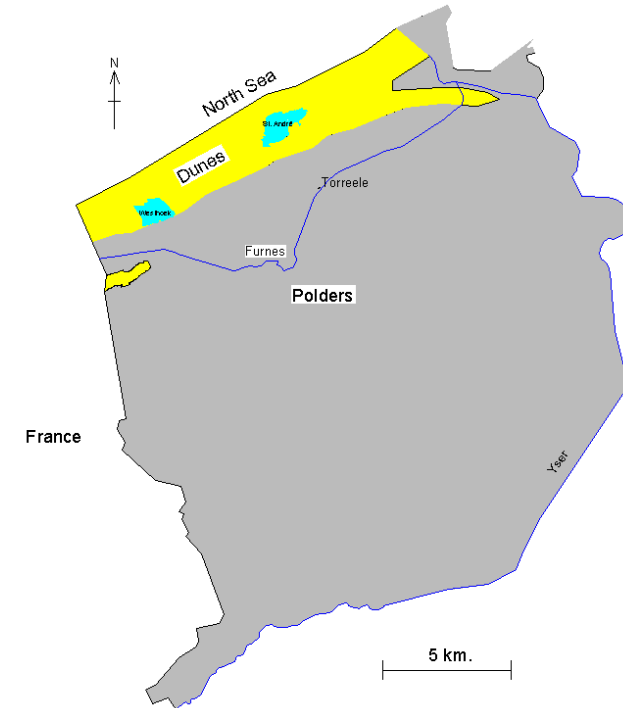
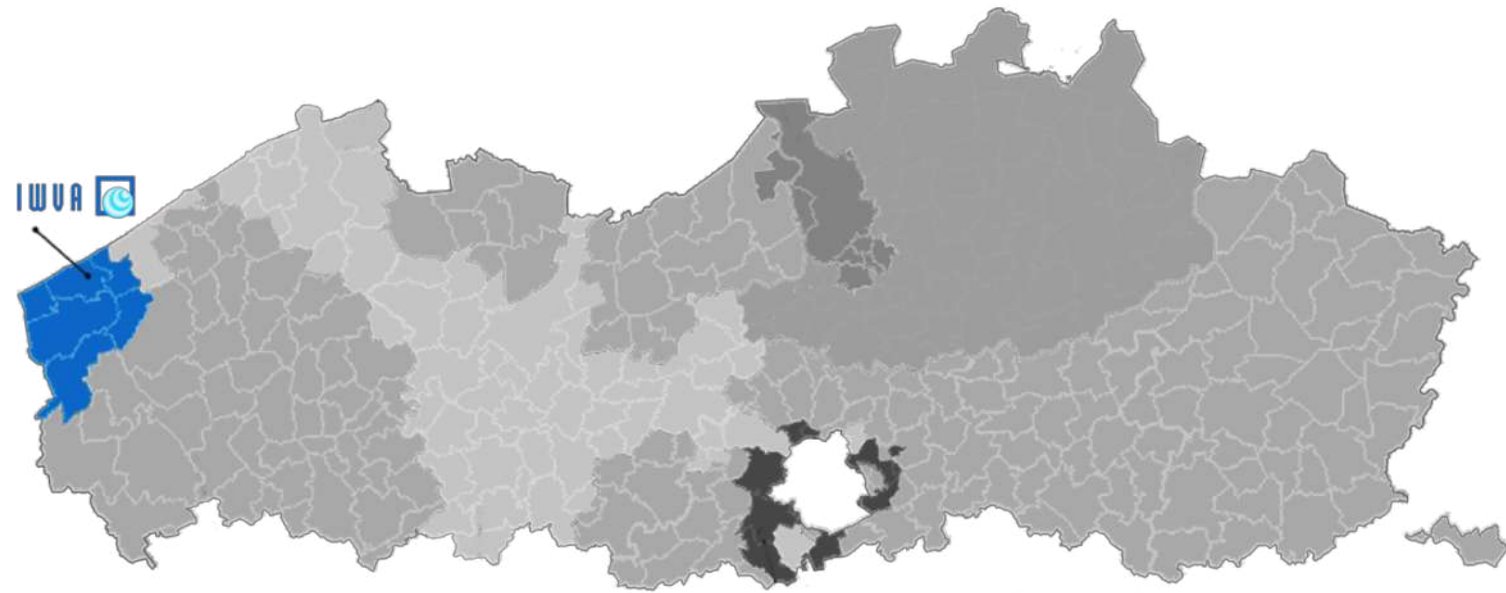
# Water reuse combined to infiltration for drinking-water production to the benefit of the environment

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**PROWATER event**

*5th of March 2019 - Canterbury Cathedral Lodge*

- IWVA produces and distributes drinking-water in 6 communities in the western part of the Flemish coast
- IWVA collects wastewater in 4 of these communities
- Drinking-water production based in the dune belt
- Varying demand according to touristical activity





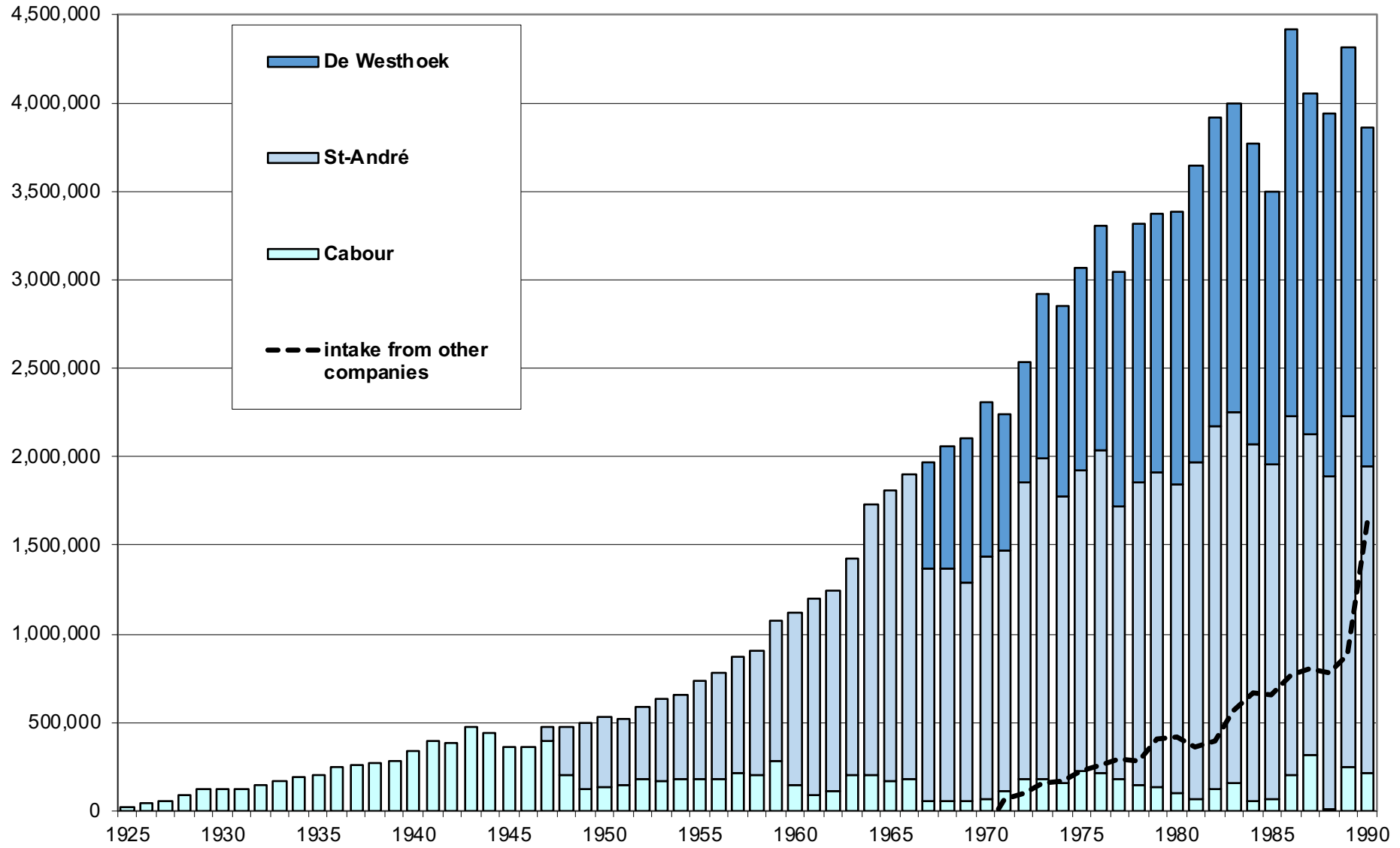
- Increasing demand since World War Two caused by more connections, more comfort and development of tourism



- Reduced capacity caused by presence of salt water north and south of the dunes



- Demand for ecological management of dune areas



# Looking for alternatives

**First test with infiltration in 1991**



Start of ecological management of the dunes in 1994



# Looking for infiltration water

**1996**

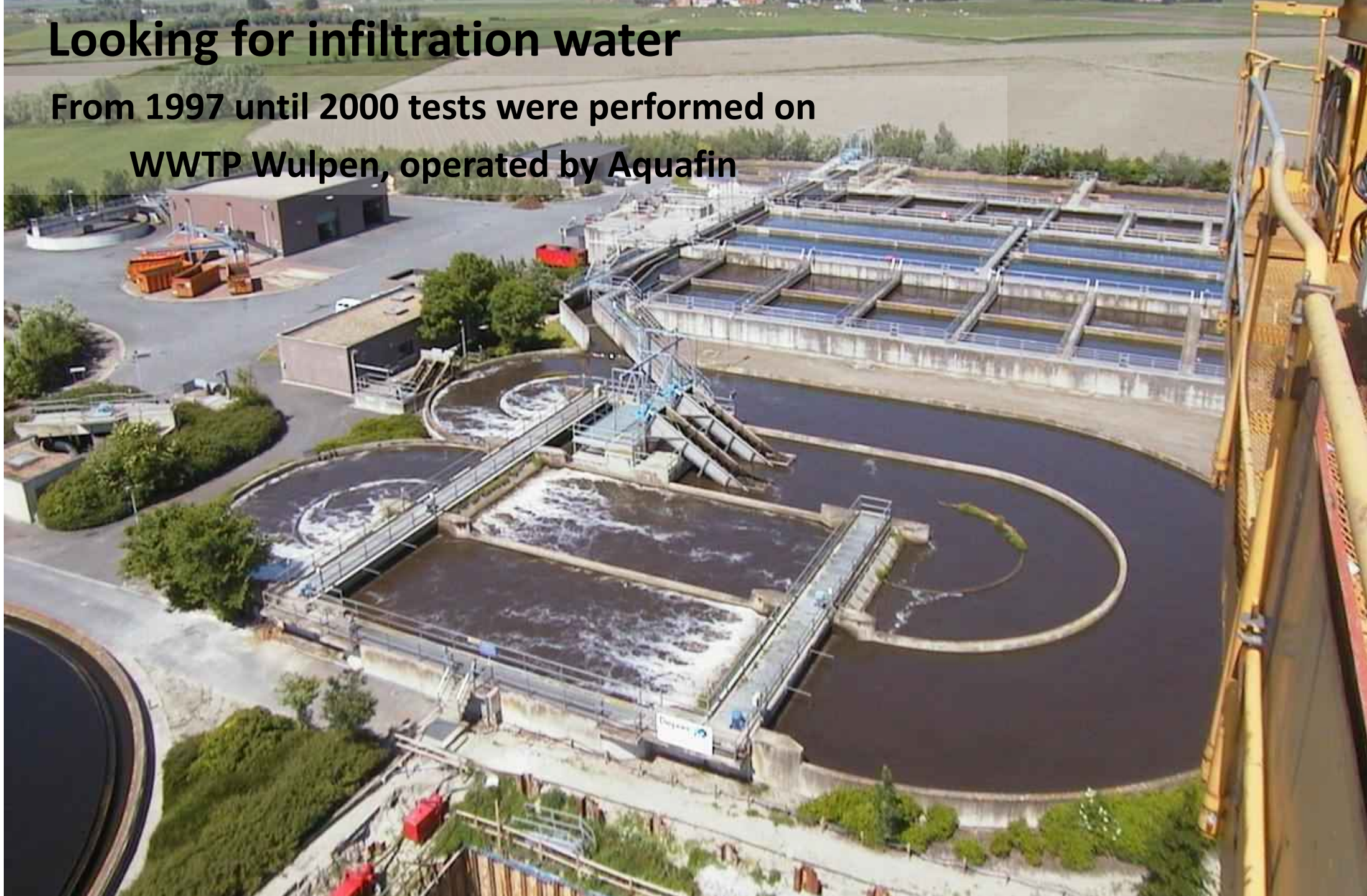
**The first test  
using  
membranes  
in the  
polder area  
(Avekapelle)**





# Looking for infiltration water

From 1997 until 2000 tests were performed on  
WWTP Wulpen, operated by Aquafin

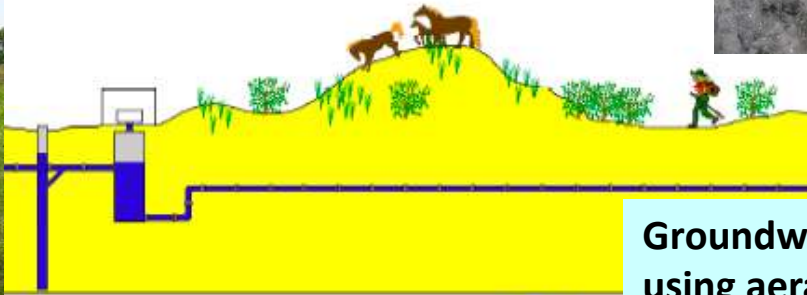


## **SELECTED ALTERNATIVE**

### **Groundwater recharge combined to water reuse**

- **Natural groundwater extraction reduced**
- **Implemented into ecological management of dunes**
- **Maximum use of existing infrastructure**
- **Wastewater treatment plant nearby**
- **Effluent available all year and of acceptable quality**

Recharge of dune aquifer  
Minimum residence time 30 days



Groundwater treatment  
using aeration and  
sand filtration



UV prior to  
distribution



**SUSTAINABLE**



**DRINKING-WATER PRODUCTION**

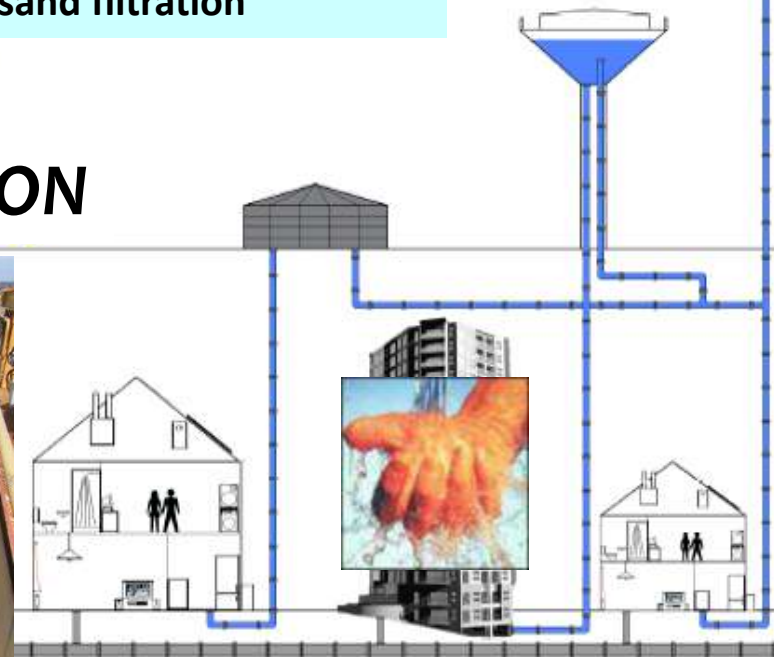


UF

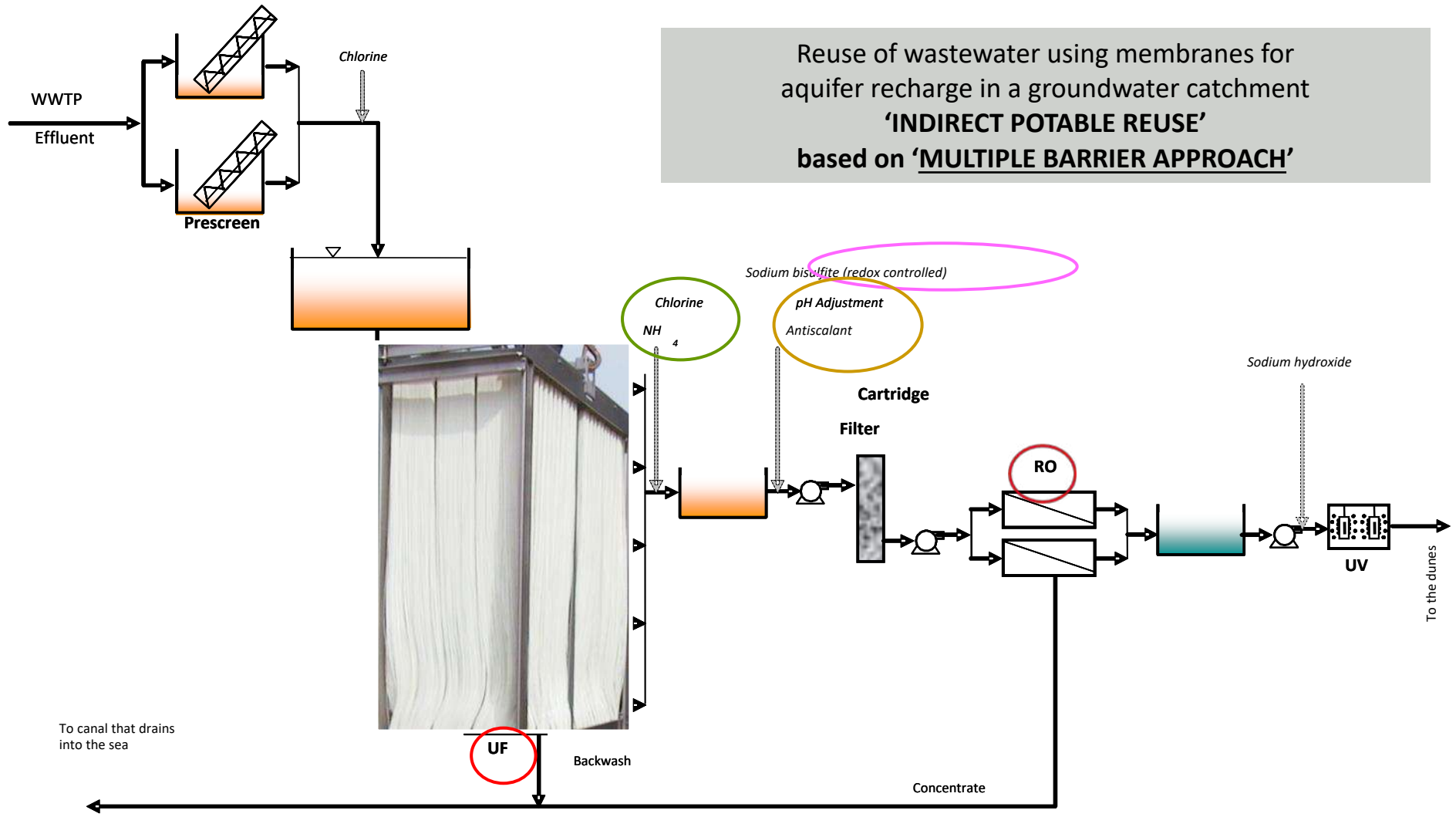
RO



WWTP Wulpen  
Conventional treatment  
of domestic ww



After use or consumption  
the water is collected  
and flows back to WWTP



Reuse of wastewater using membranes for aquifer recharge in a groundwater catchment  
**'INDIRECT POTABLE REUSE'**  
 based on **'MULTIPLE BARRIER APPROACH'**

**Multiple barrier approach for microbiological safety**

+ biofouling prevention by dosing of monochloramines

+ redox controlled dosing of bisulfite to protect membranes against chlorine

+ scaling prevention dosing sulfuric acid (pH correction ) and anti-scalant



What did we learn so far ?



### Torrelele – experience

- UF proves to be a good pretreatment for RO as bacteria and suspended solids are totally removed

*quality can be controlled by turbidity*

- RO removes salt, nutrients, hardness, bacteria, viruses, small organic substances (pesticides, pharmaceuticals)

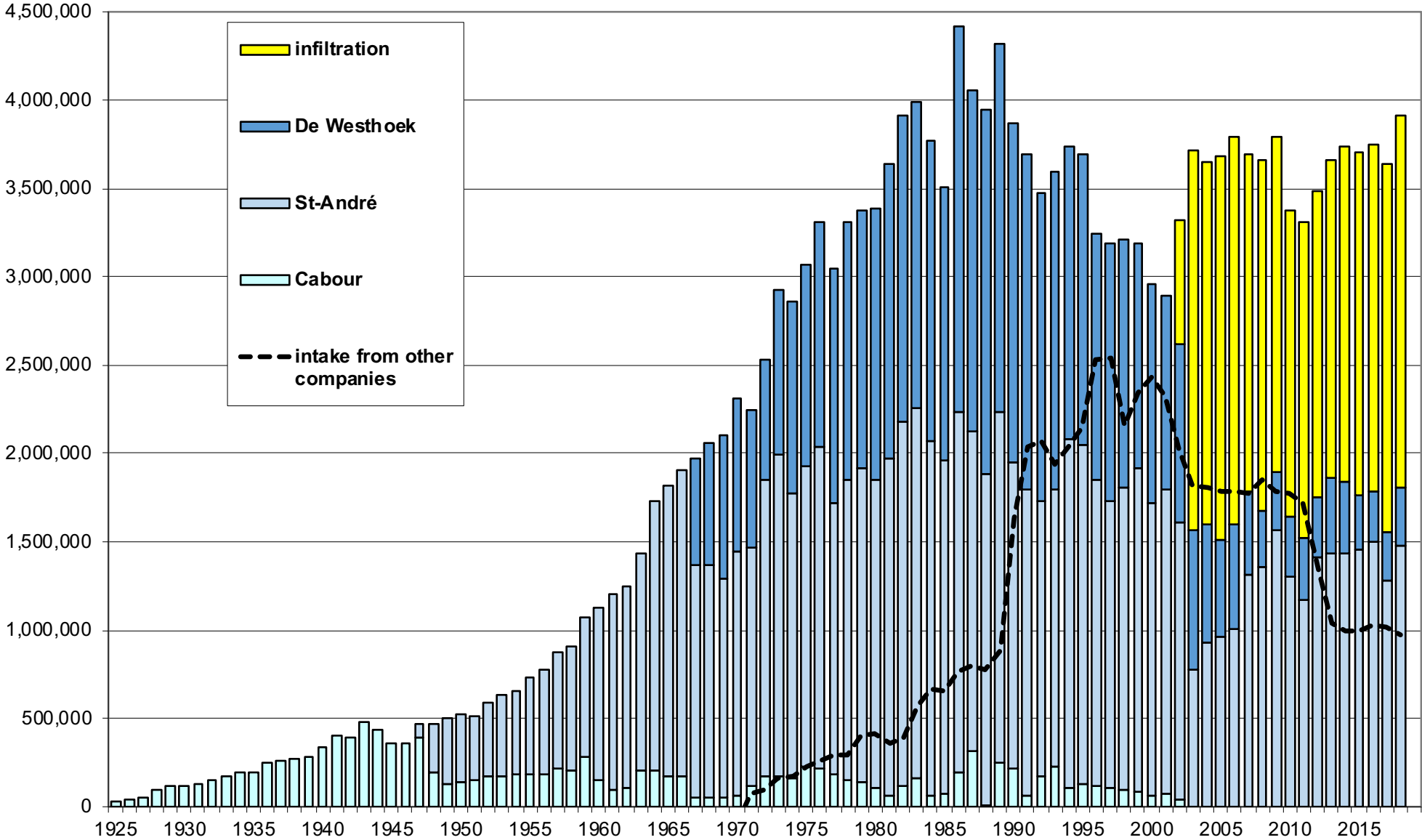
*performance/quality easy to control with conductivity*



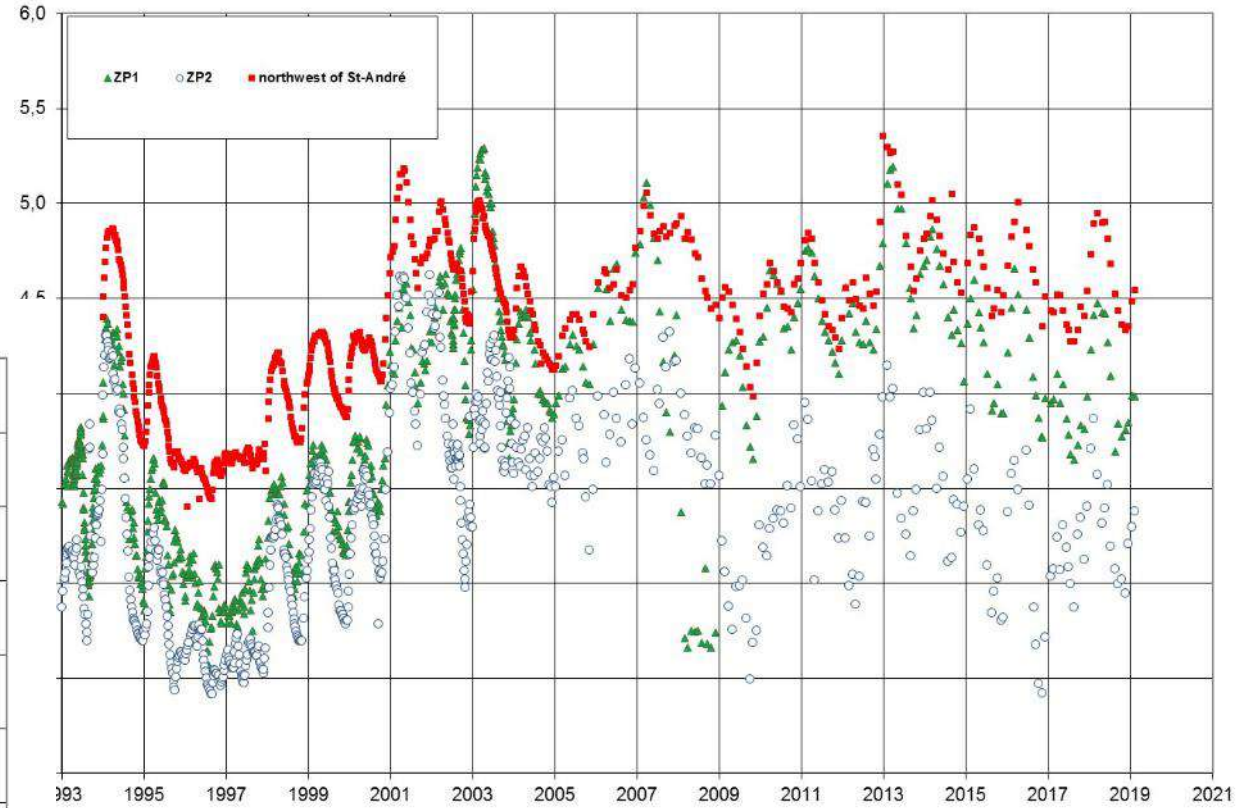
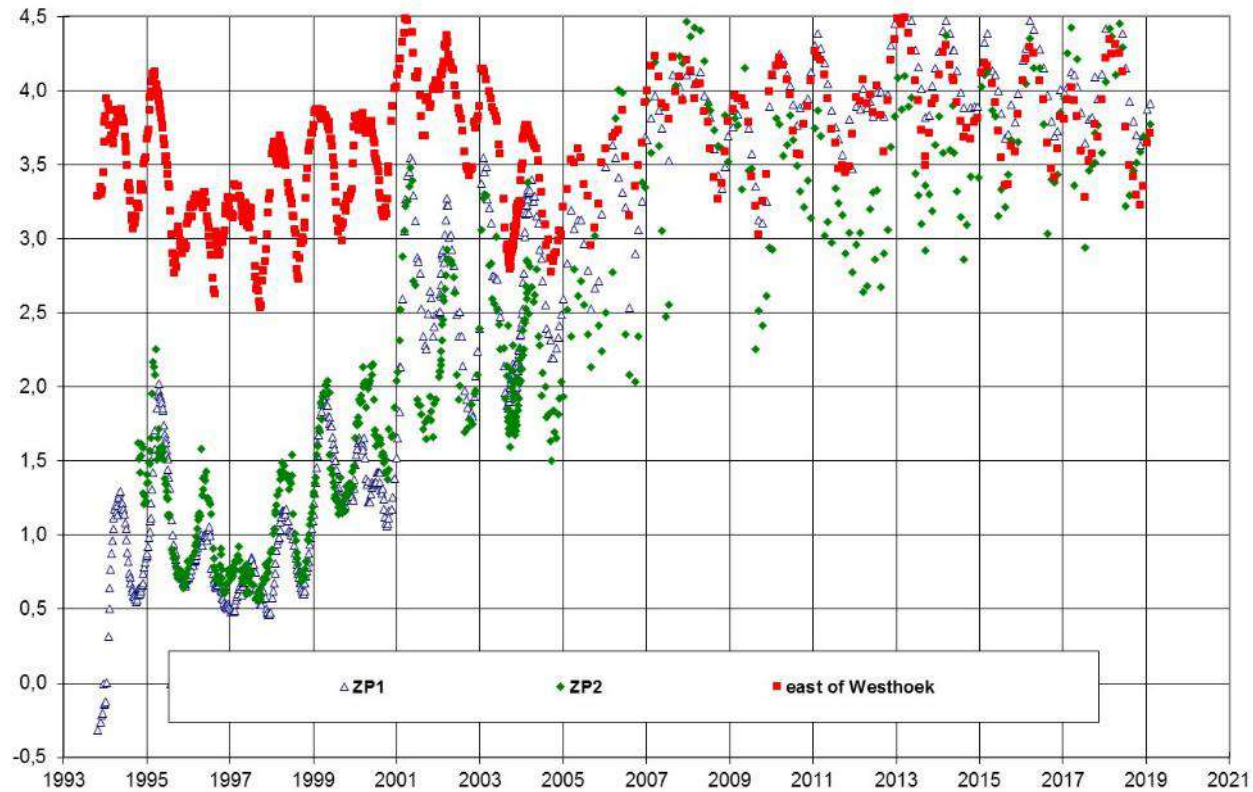
**Infiltration water is of excellent quality**

**Continuous monitoring of different parameters  
e.g. conductivity, pressures,  
turbidity, chlorine content**

# The infiltration resulted in a substantial decrease of water extraction



# Resulting in higher groundwater levels





# Higher groundwater levels resulted in enhanced natural values

**Parnassia**



**Wetlands**



**Orchids**

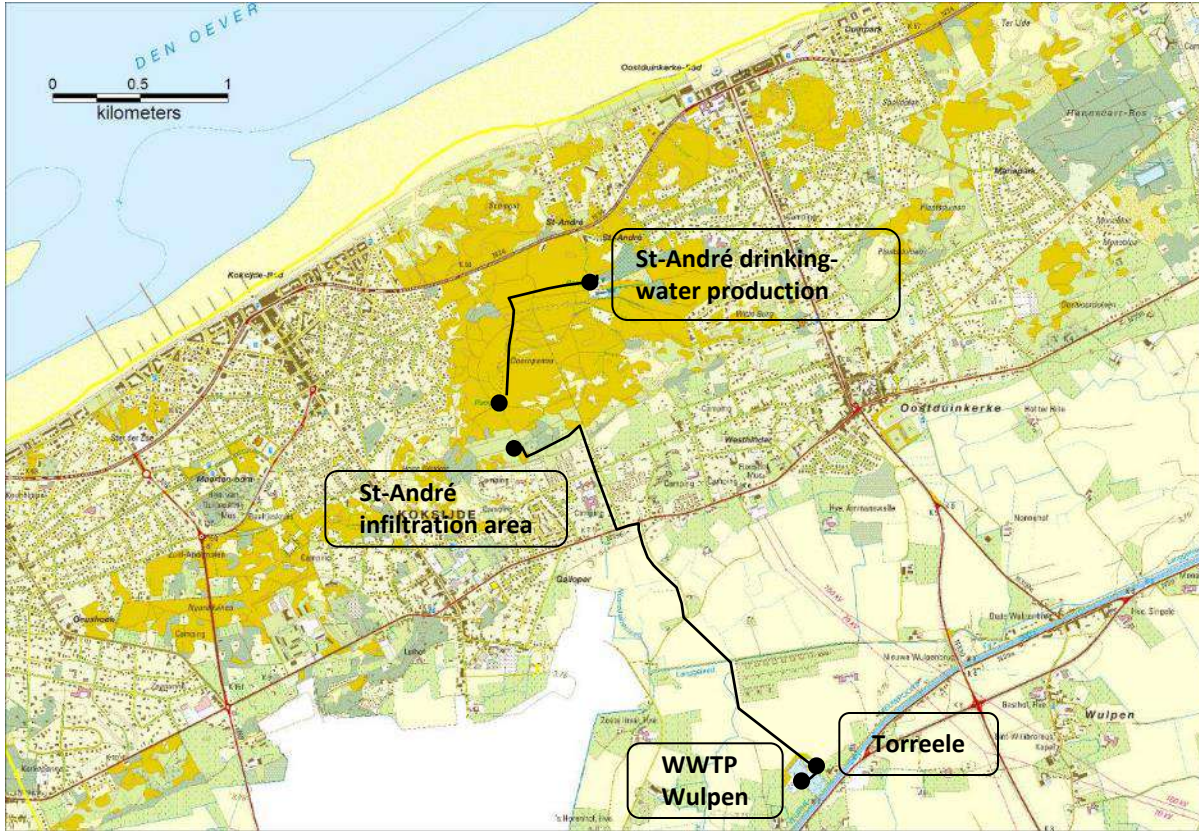
# IWVA's reuse/MAR project is ADAPTIVE to climate change

Expected sealevel rise –  
higher groundwater levels

Dryer summers and more frequent  
periods of heat –  
increased infiltration in summer  
will be possible due to higher  
temperatures;  
this will follow demand

The screenshot shows the 'Klimaatportaal Vlaanderen' website. The main heading is 'WAT BETEKENT KLIMAATVERANDERING VOOR VLAANDEREN?'. Below this is a map of Flanders with four callout boxes: 'Stijgend zeeniveau' (Rising sea level), 'Drogere zomers' (Drier summers), 'Nattere winters' (Wetter winters), and 'Meer hittegolven' (More heatwaves). Below the map are three image panels: 'DROOGTE' (DROUGHT) showing a window with a thermometer at 36.4°C; 'KLIMAATTOESTAND' (CLIMATE STATUS) showing a flooded area with a 'WATEROVERLAST' sign; and 'ZEESPIEGELSTIGING' (SEA LEVEL RISE) showing a beach with waves.

Integration of wastewater reuse into existing drinking-water production scheme by managed aquifer recharge (infiltration in the dunes) :  
good example of integrated water management



**Last 2 dry periods (2017, 2018) proved that combination of water reuse and MAR is robust; drinking-water was secured**

## **Resulting in better drinking-water quality**

- Hardness was halved since start of infiltration;**
- Less mineralized and less organics resulted in clearer water;**
- Stable microbiology**

# Temperature plays important role in infiltration capacity decreases with declining temperature



Infiltration was enhanced by implementation of 'subterranean infiltration' (since November 2014)

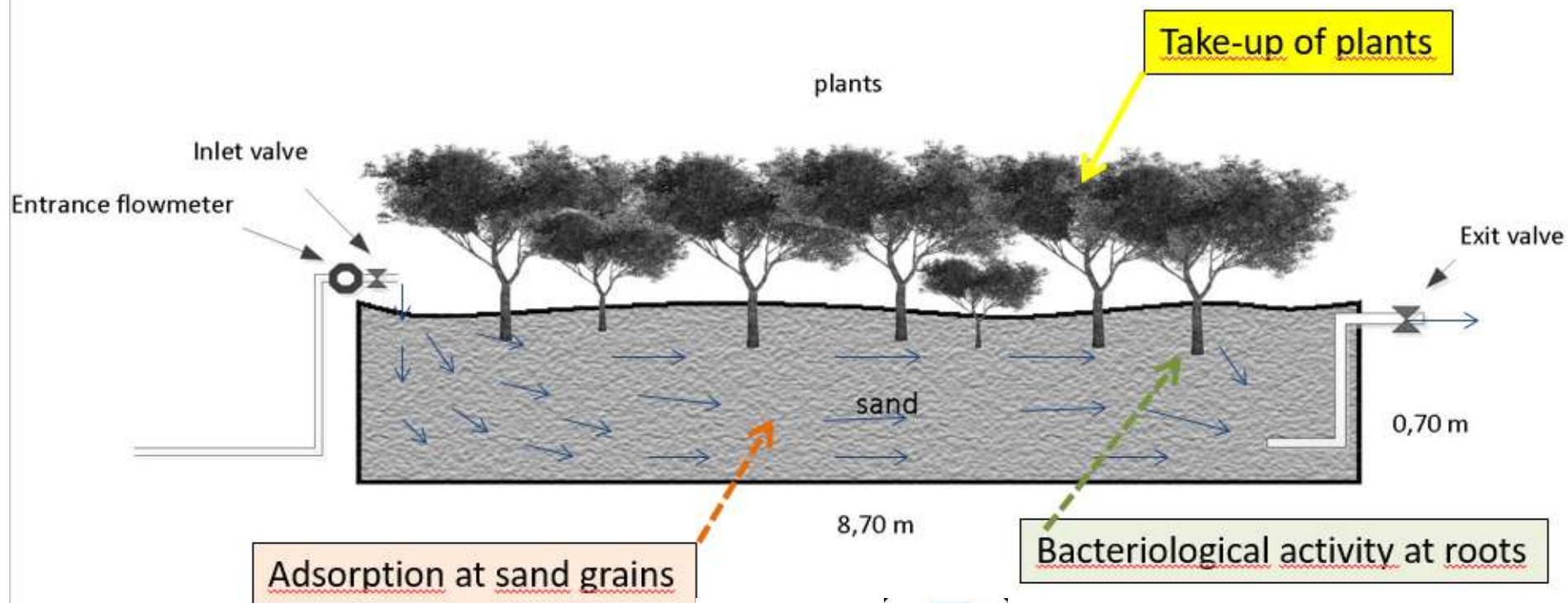
Infiltration pond was extended (since December 2018)



# Recent developments at Torreele

## TESTS TO MITIGATE IMPACT OF DISCHARGE OF RO CONCENTRATE BY USING A NATURAL TREATMENT

### WILLOW TEST FIELD



# WILLOW TREATMENT of RO concentrate

Start : 14/02/2011



04/05/2011



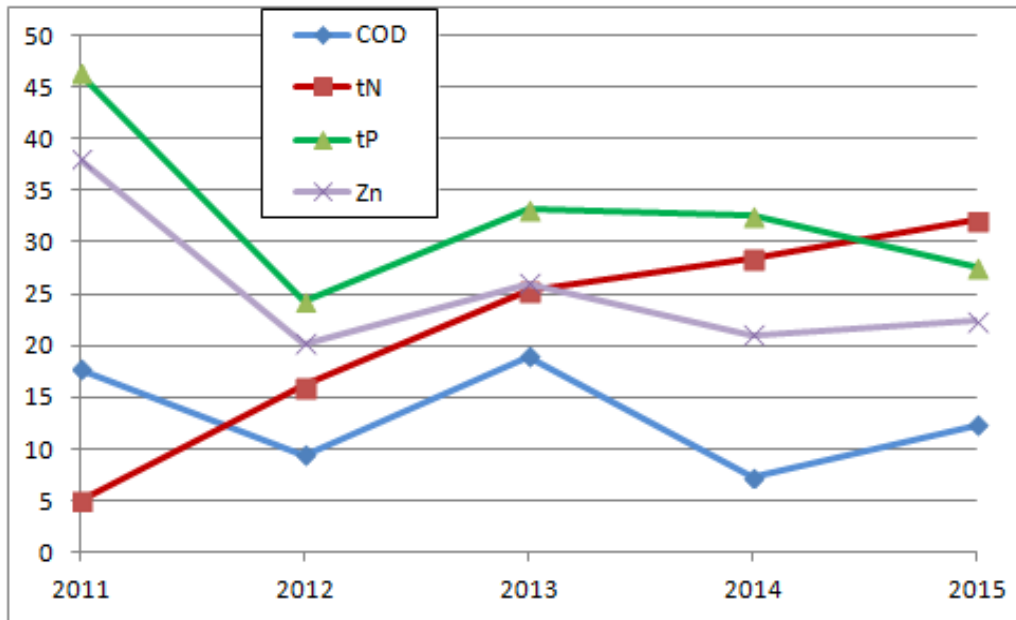
20/07/2011



30/11/2011



# WILLOW TREATMENT of RO concentrate



**Average removal throughout the years :**

- Improved for nitrogen : >30% in 2015;
- Phosphorous and zinc removal better in 1st year and stable since then :  
    around 30% for phosphorous and 20 to 25% for Zn;
- COD removal between 10 to 20%.





WATER REUSE FOR DRINKING | AROUND THE WORLD

<http://www.water360.com.au/>

Still unique in Europe

Thanks for listening.