



















**Introduction for the group of the
Helsinki University of Technology
in the
Amsterdam Water Supply Dunes**

Frank Smits

Leiduin, March 29th, 2010

- introduction
- Waternet ?
- World Waternet
- history of the water supply of Amsterdam
- the Amsterdam Water Supply Dunes
- purification of the drinking water
- safari by bike in the Water Supply Dunes

✖ Amsterdam
✖
✖



Service for
Watermanagement & Sewerage

Waterboard Amstel, Gooi & Vecht

Amsterdam Water Supply

Waternet is the first and only governmental organisation in the Netherlands that manages the complete watercycle :

- surface water,
- groundwater,
- drinking water,
- sewerage and
- treatment of sewerage water.

topography

cities with inhabitants

- more than 500 000
- 100 000 - 500 000
- 50 000 - 100 000
- 10 000 - 50 000



topography

cities with inhabitants

- ☒ more than 500 000
- ☒ 100 000 - 500 000
- ☒ 50 000 - 100 000
- ☐ 10 000 - 50 000

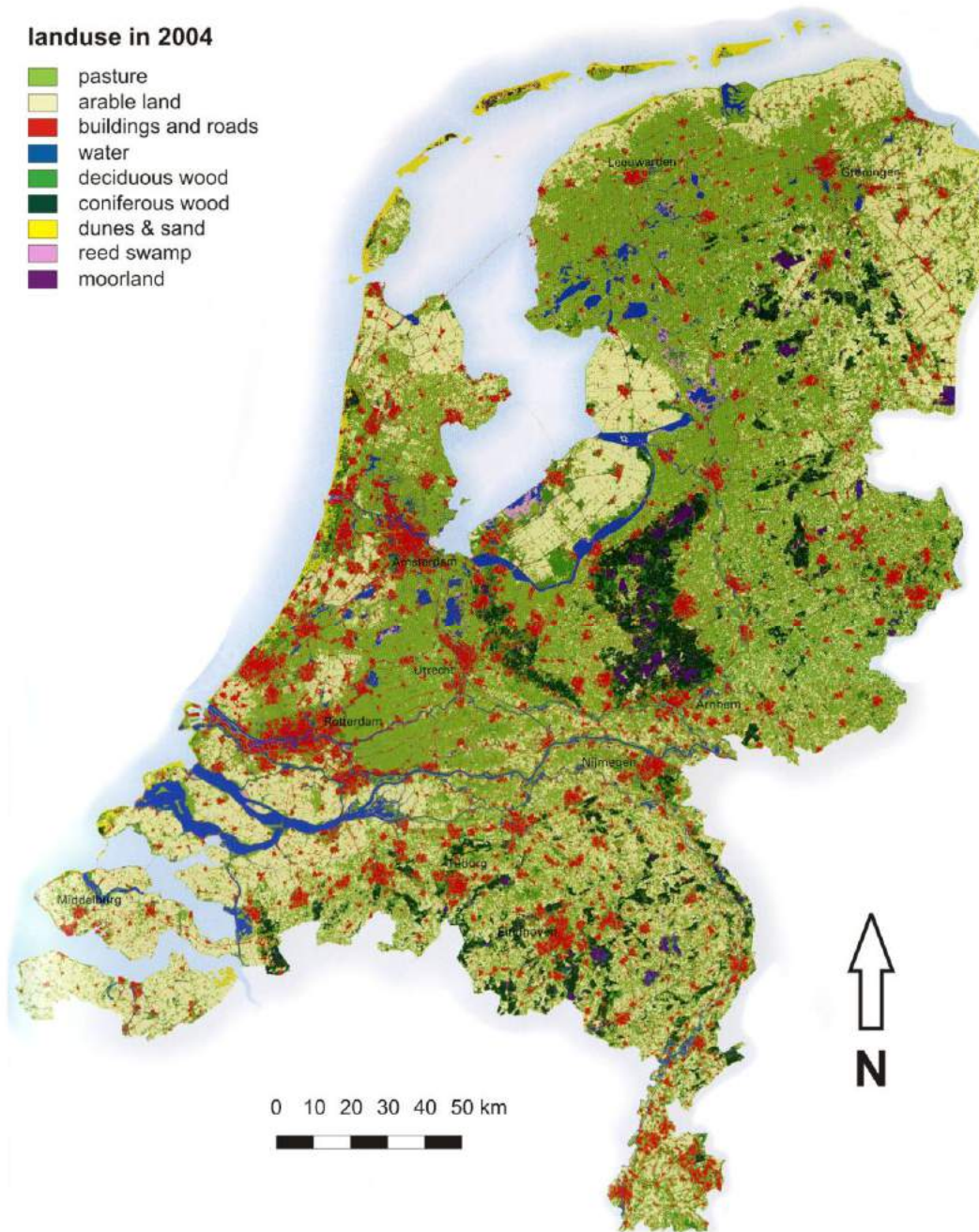






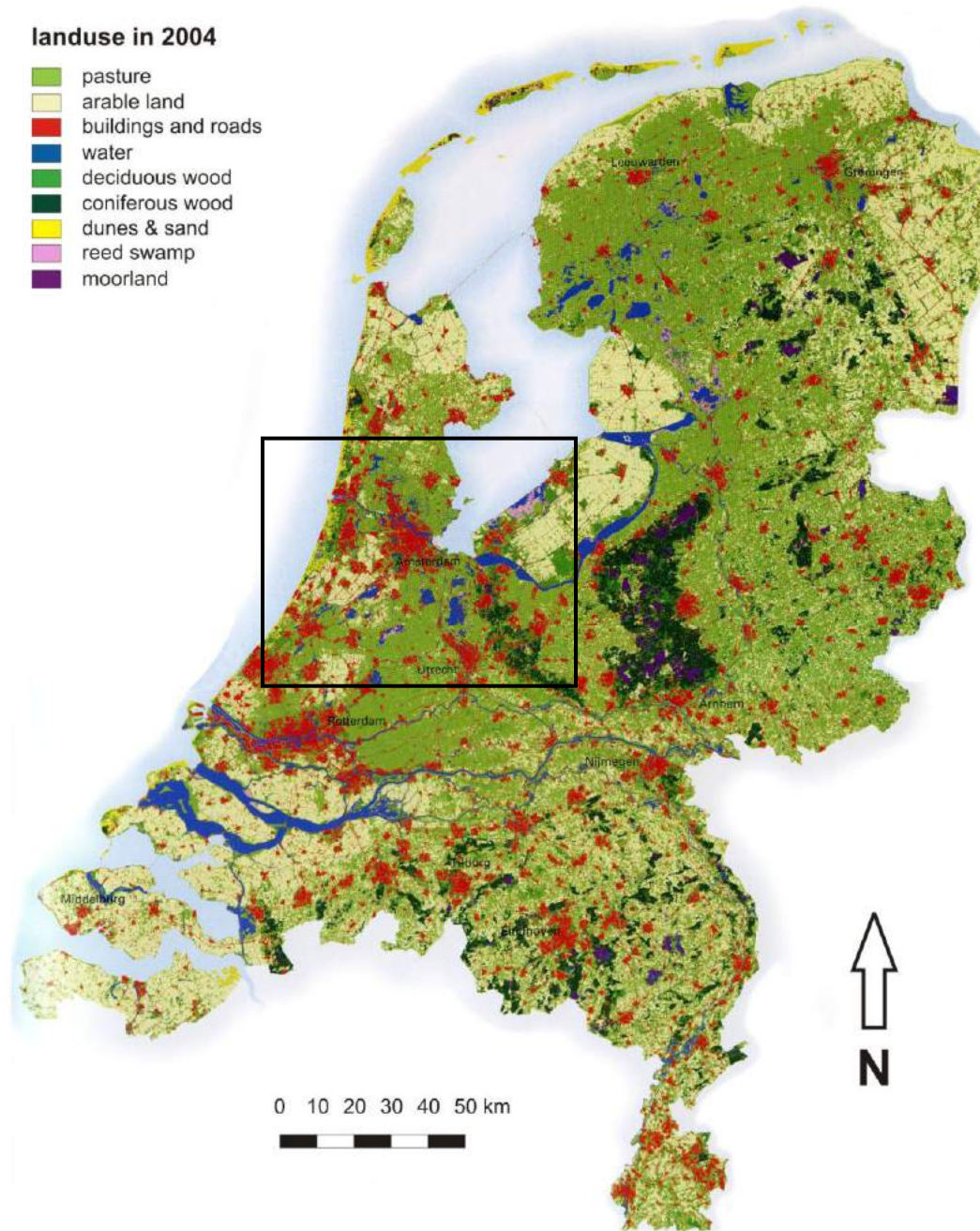
landuse in 2004

- pasture
- arable land
- buildings and roads
- water
- deciduous wood
- coniferous wood
- dunes & sand
- reed swamp
- moorland



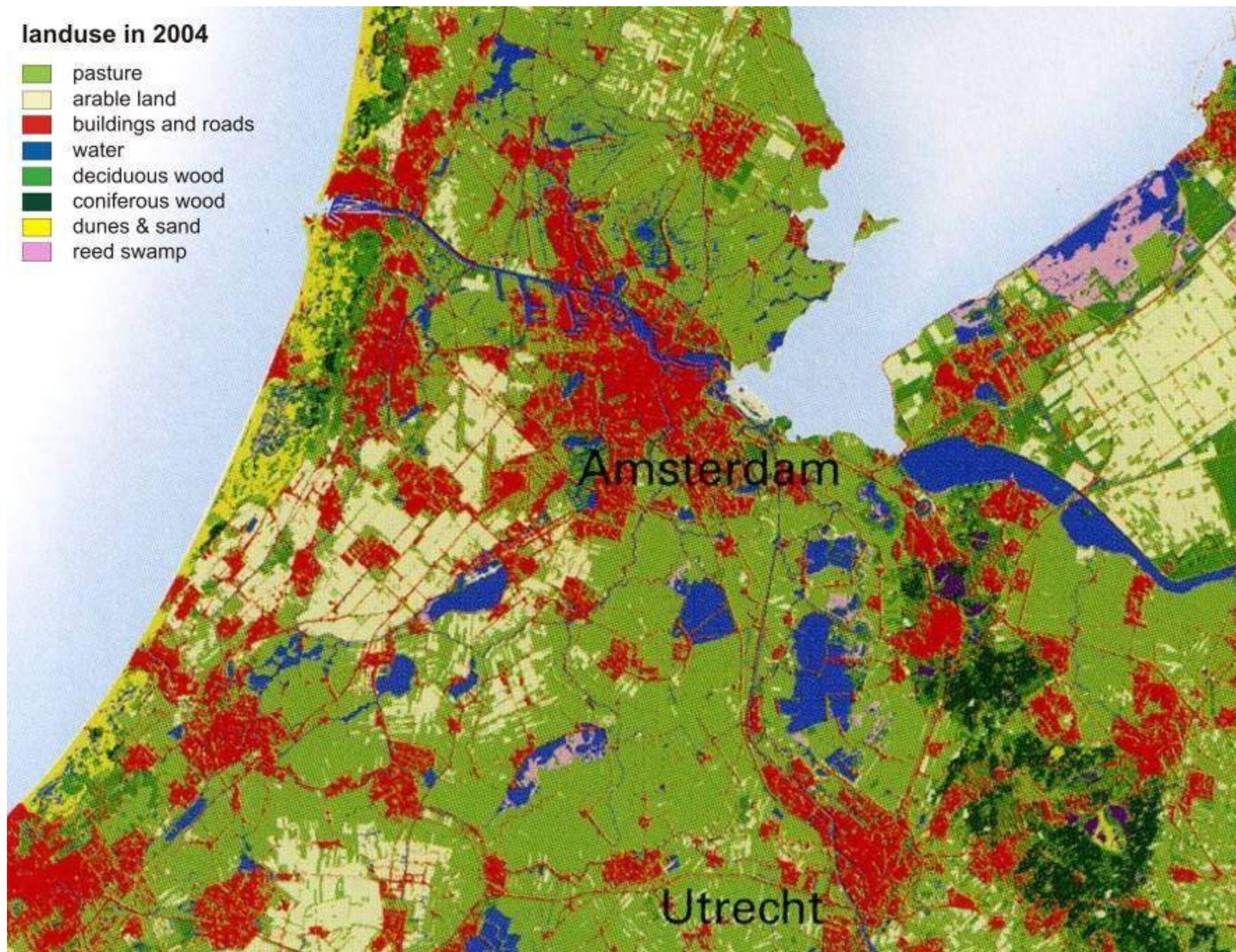
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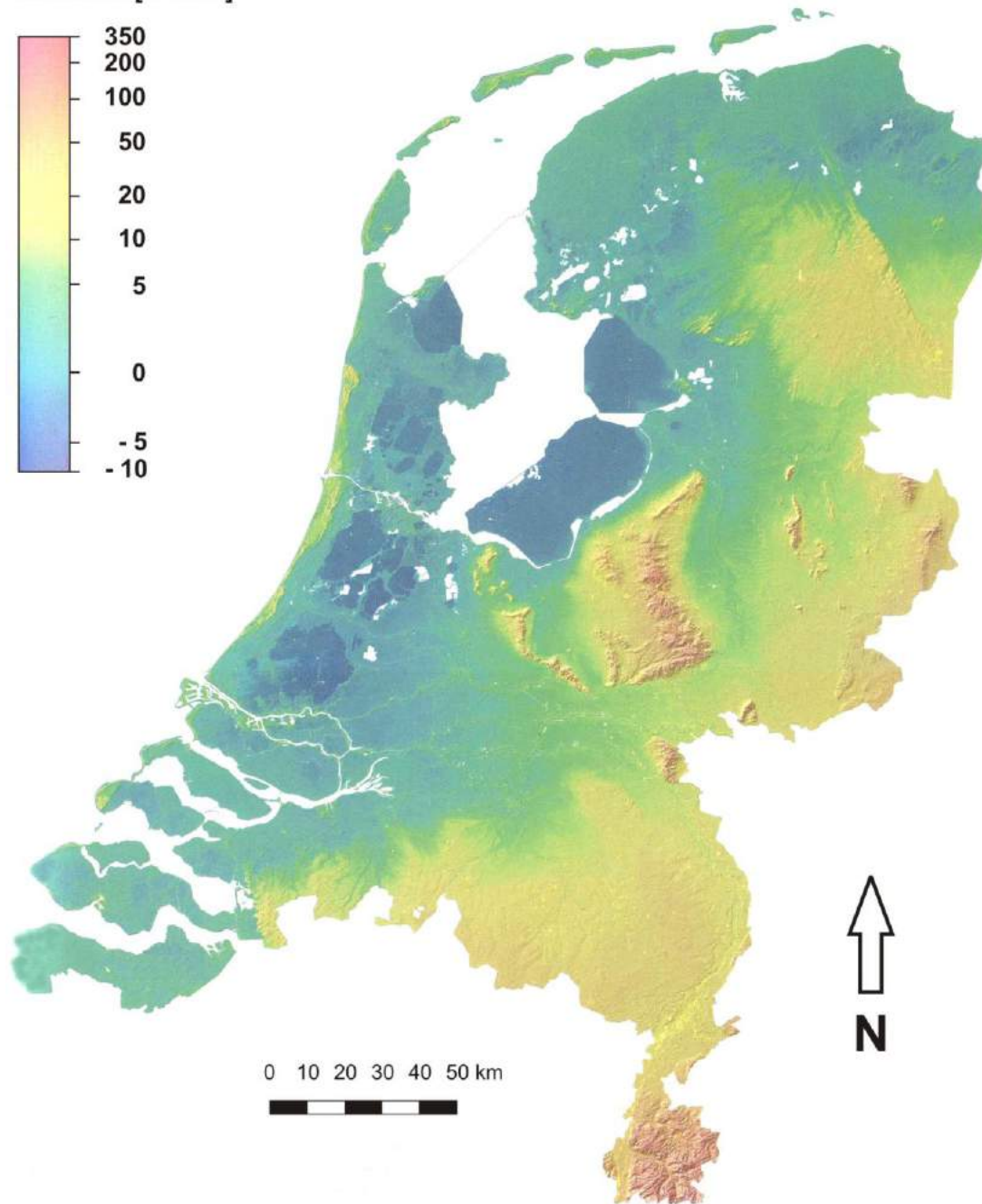
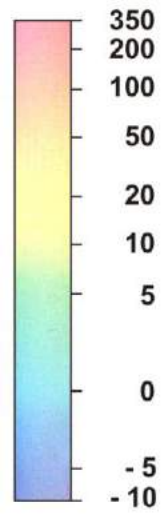


landuse in 2004

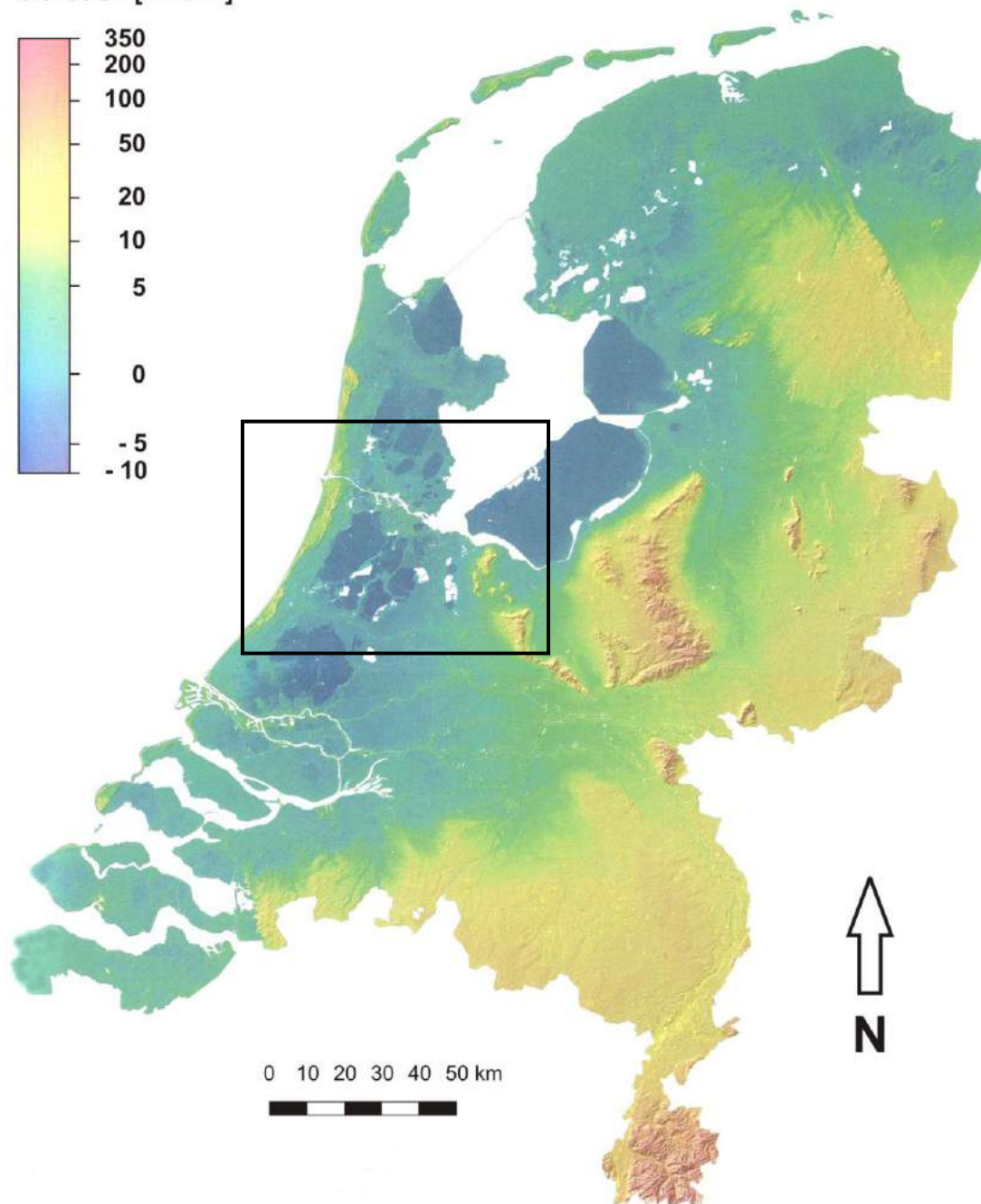
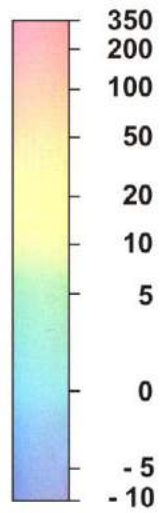
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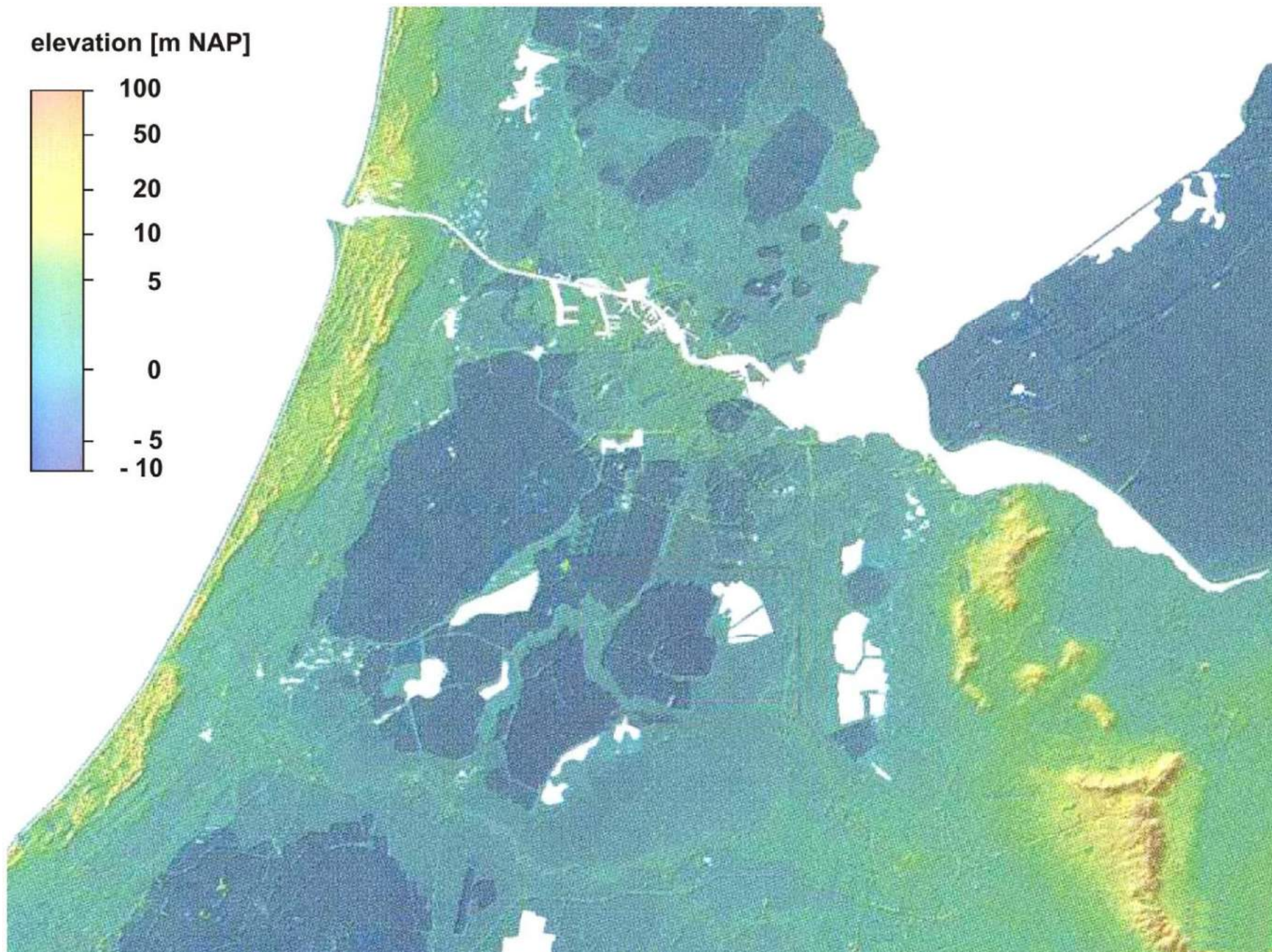
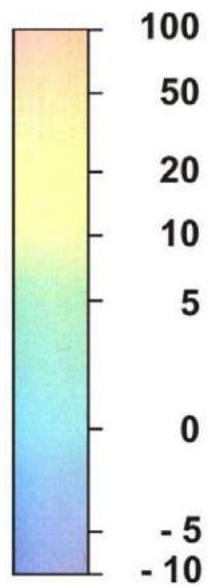
elevation [m NAP]

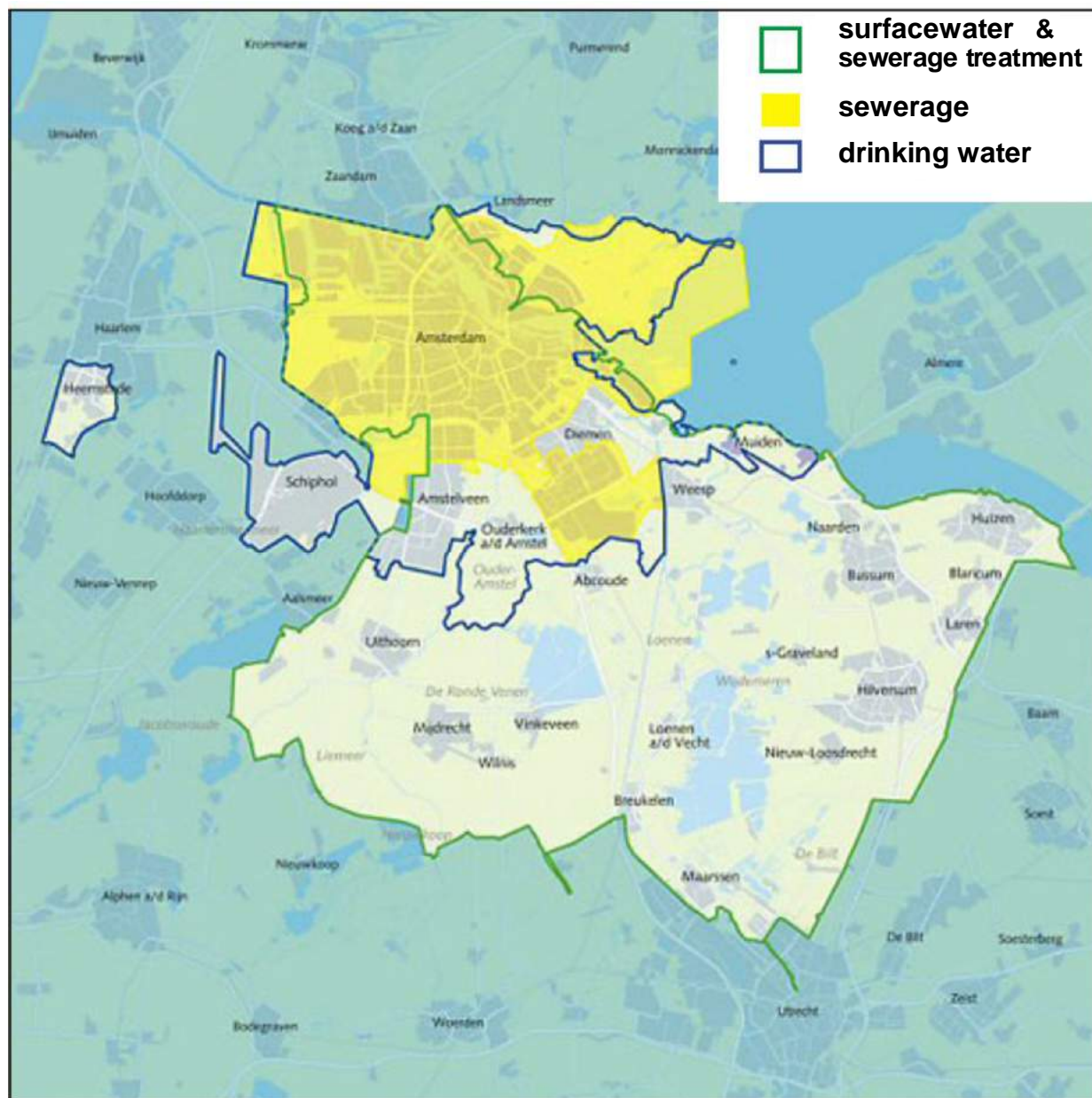


elevation [m NAP]



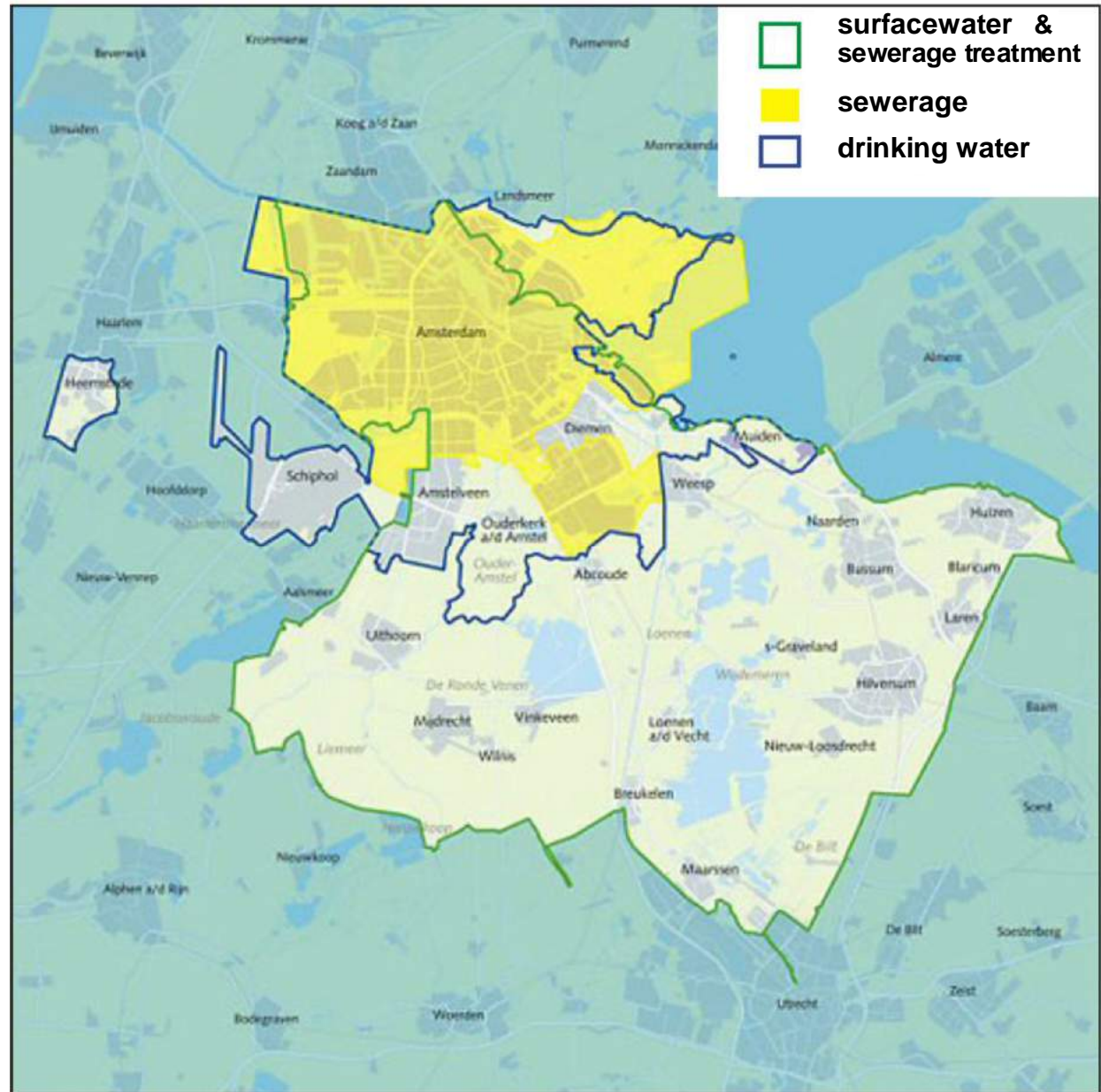
elevation [m NAP]





700 km²
managed area

1700 km dike











Tienhovense Plassen



Ankeveense Plassen





Laarder Wasmeren

Gein

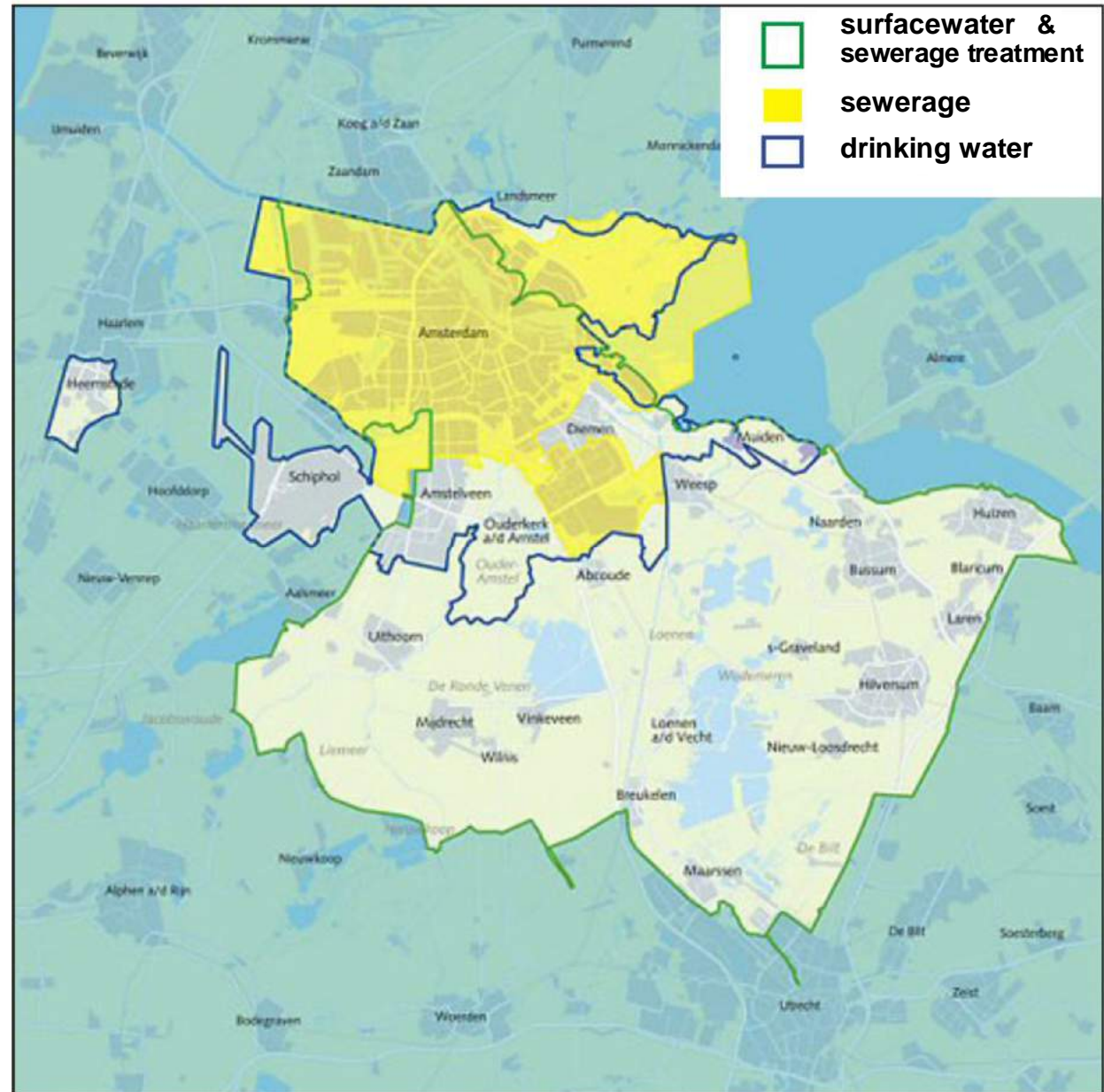


Loosdrechtse Plassen

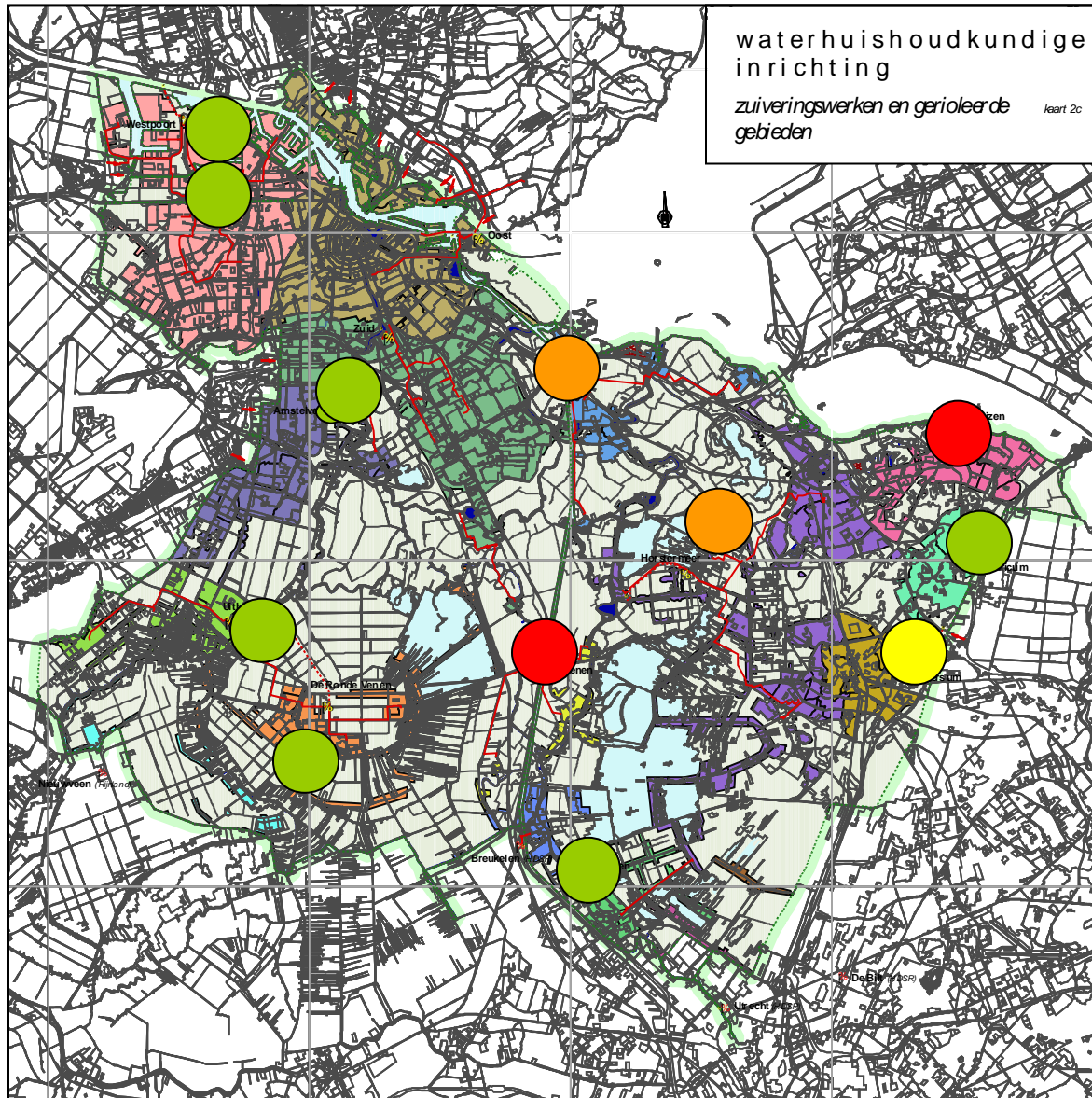


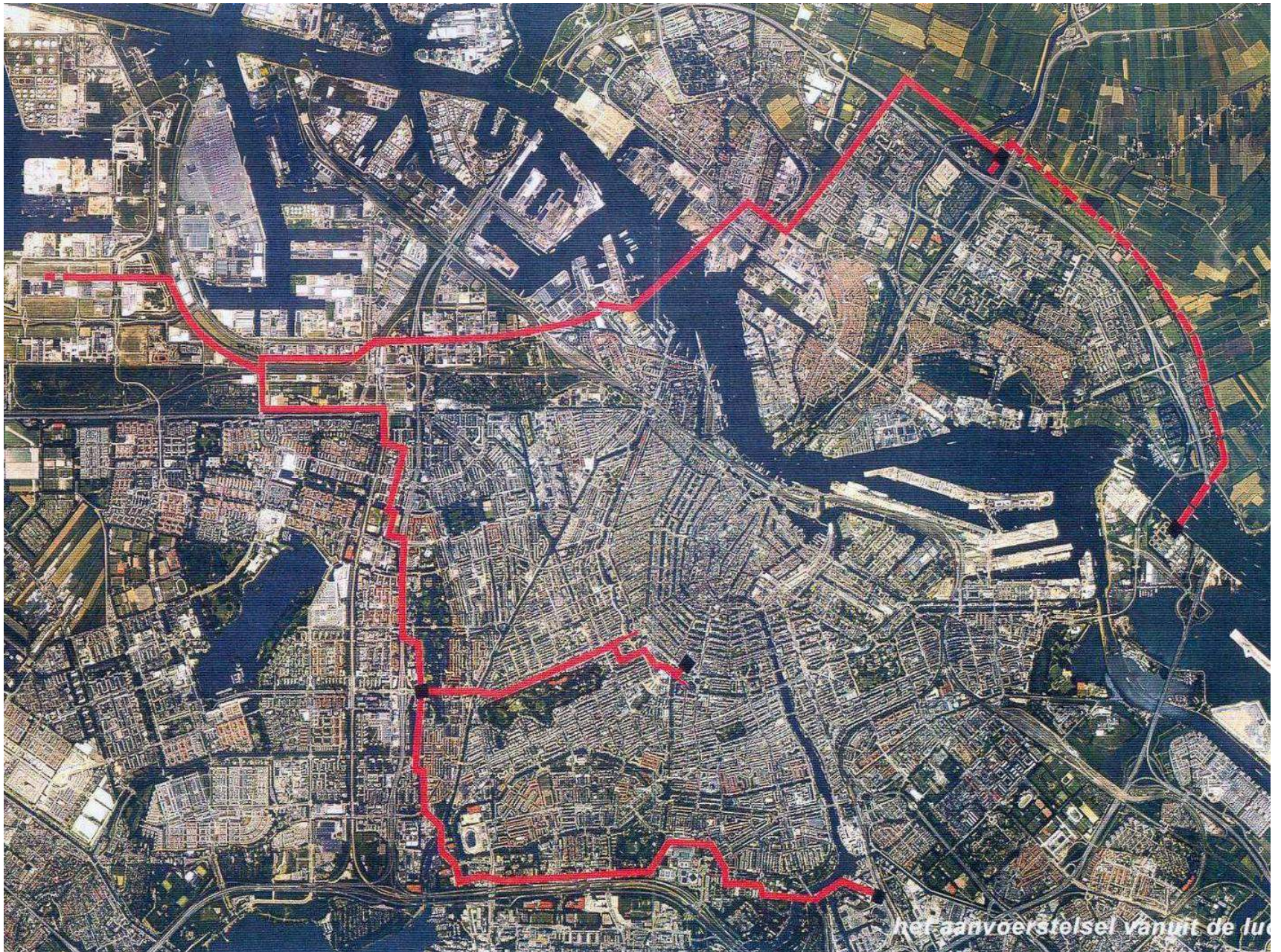
4000 km of
sewer pipe

treatment of
130 million m³
sewerage water
per year



sewage treatment plants





het aanvoerstelsel vanuit de lue

1.000.000 i.e.

max. 30.000 m³/h

small footprint

8 m deep AT's

central sludge treatment

coupling with incineration plant







12 drinking water companies

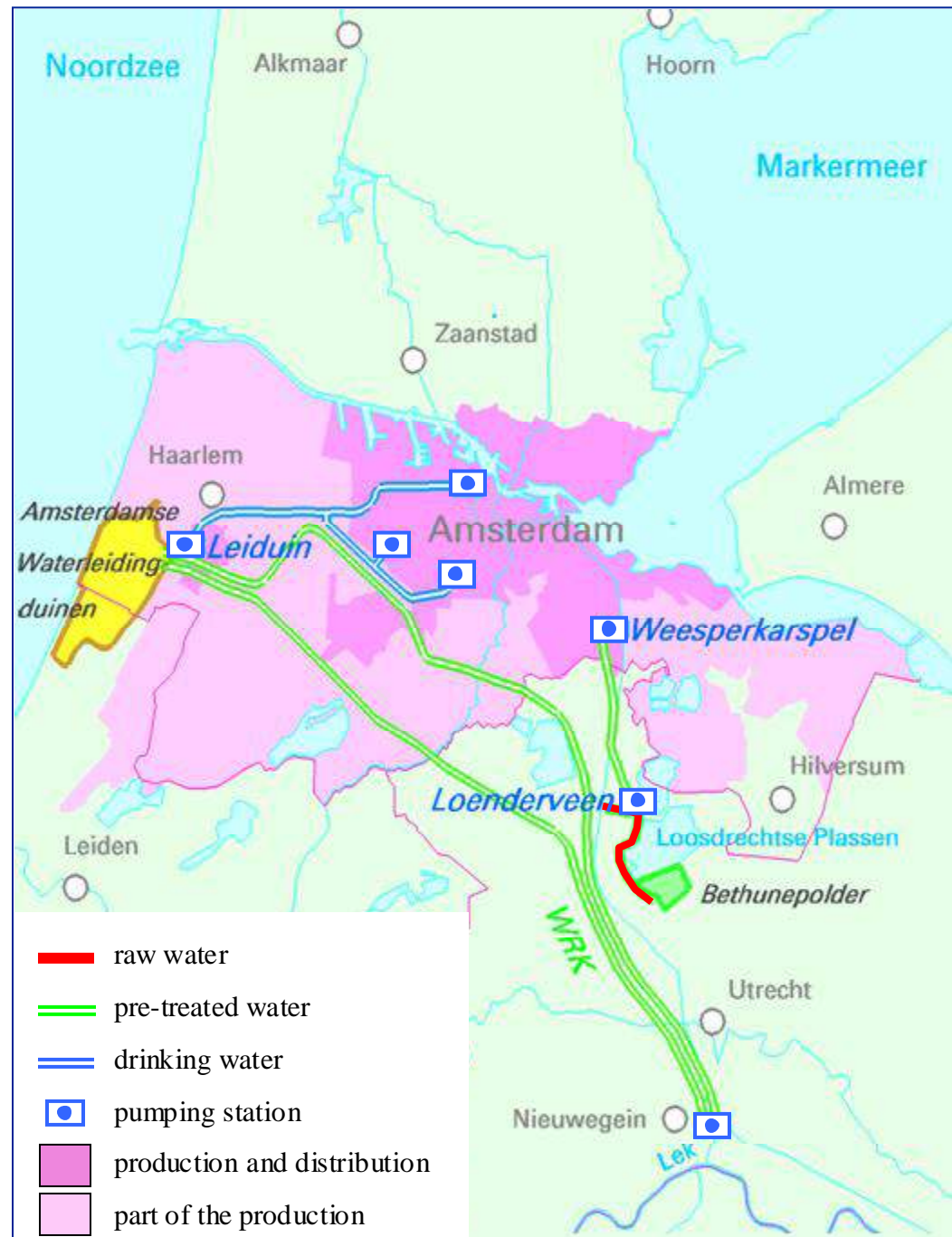
1200 * Mm³ per year

2/3 ground water

1/3 surface water from
the river Rhine and Meuse



transport system and the drinking water distribution area



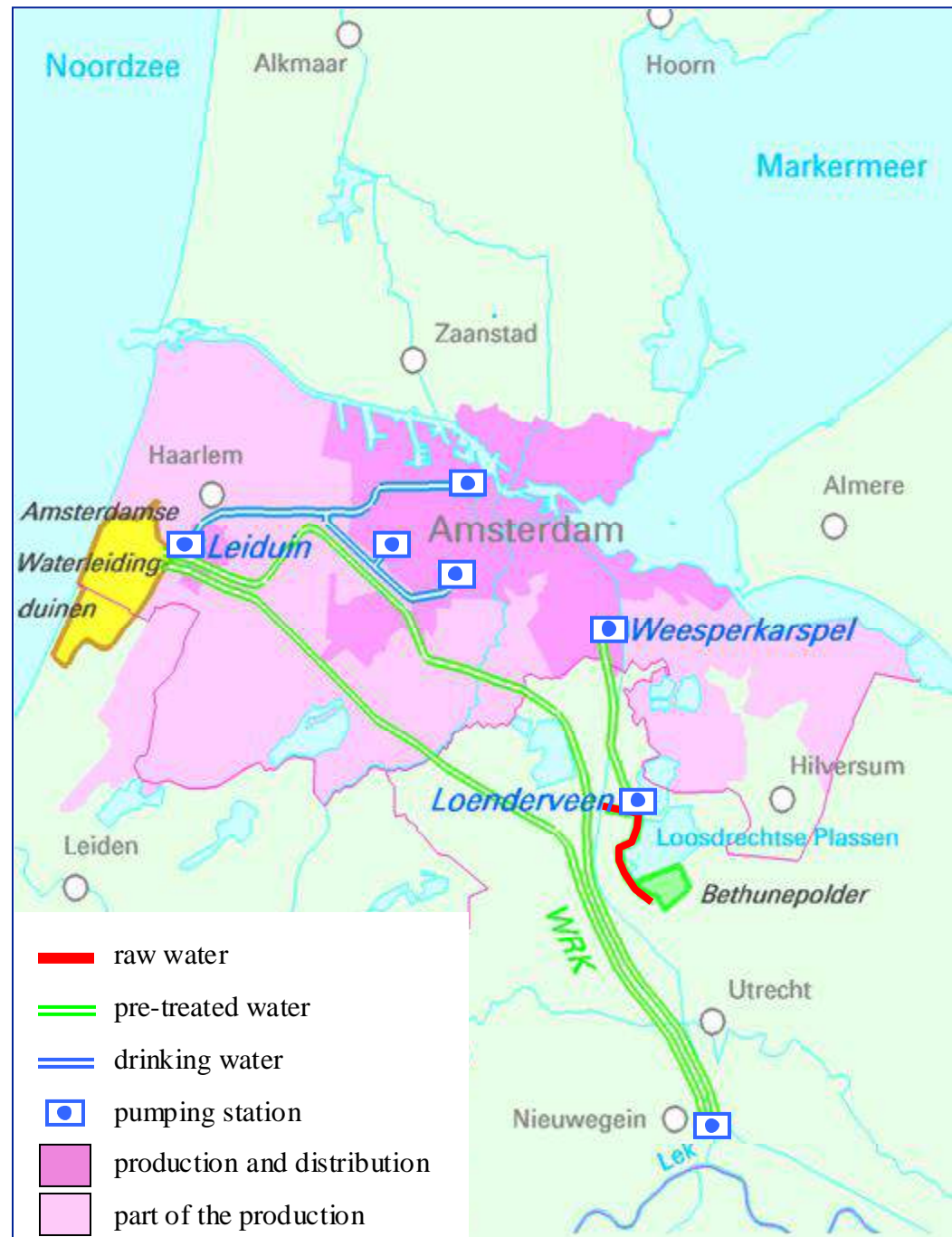
transport system
and the drinking water
distribution area

2700 km of pipes

95 million m³ per year
for

0,8 million people

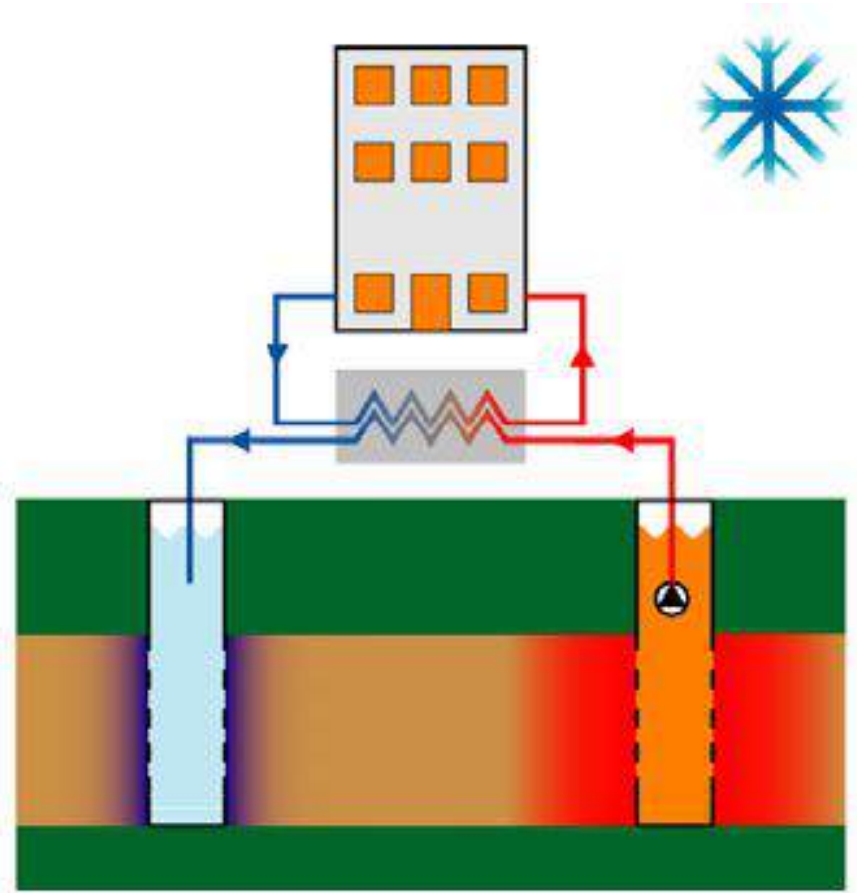
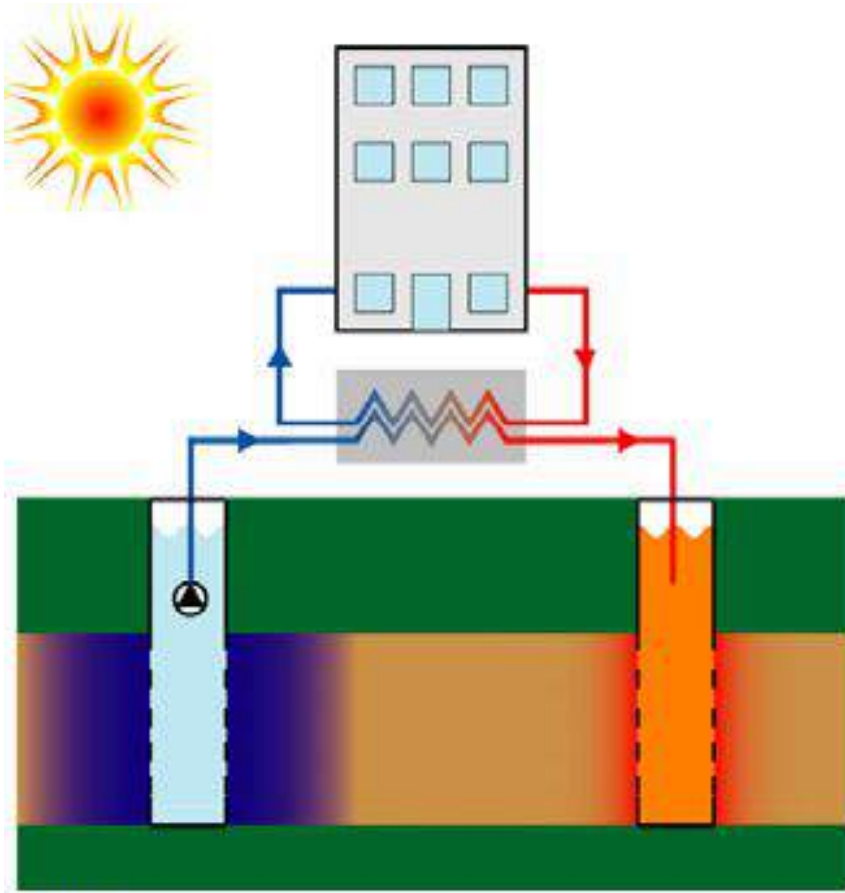
1,35 euro / m³



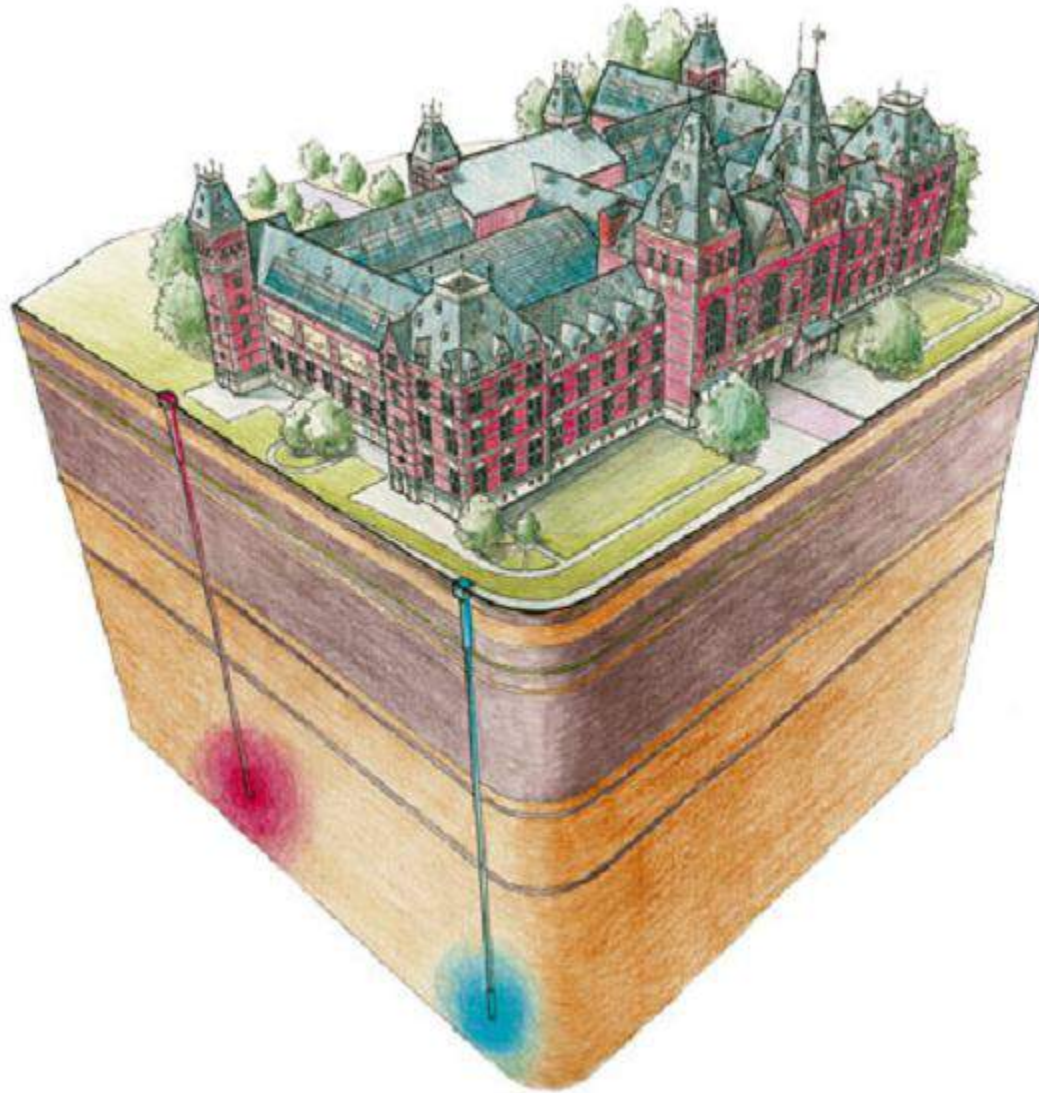
aquifer thermal energy storage



aquifer thermal energy storage

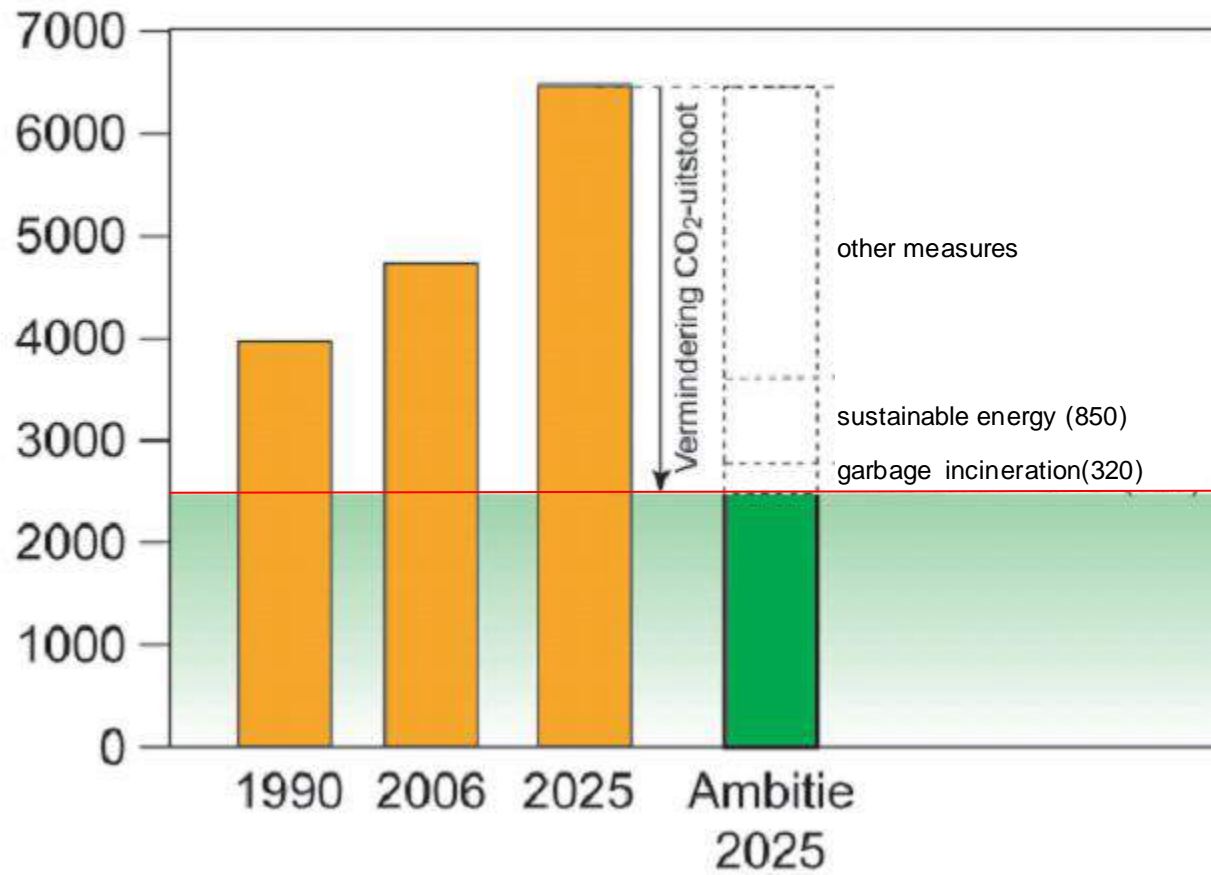


aquifer thermal energy storage

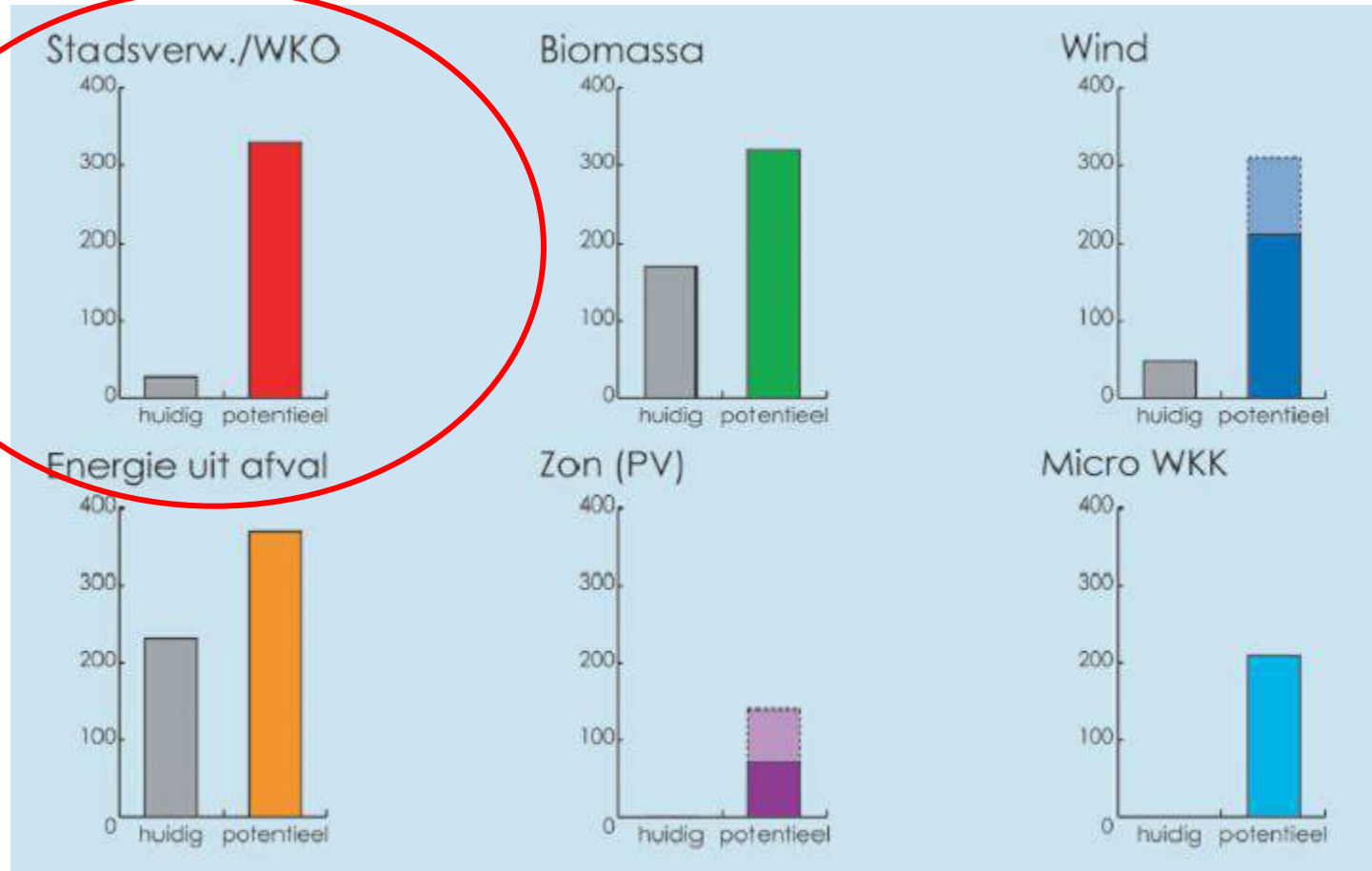


aquifer thermal energy storage

CO₂-emission of Amsterdam [kiloton]

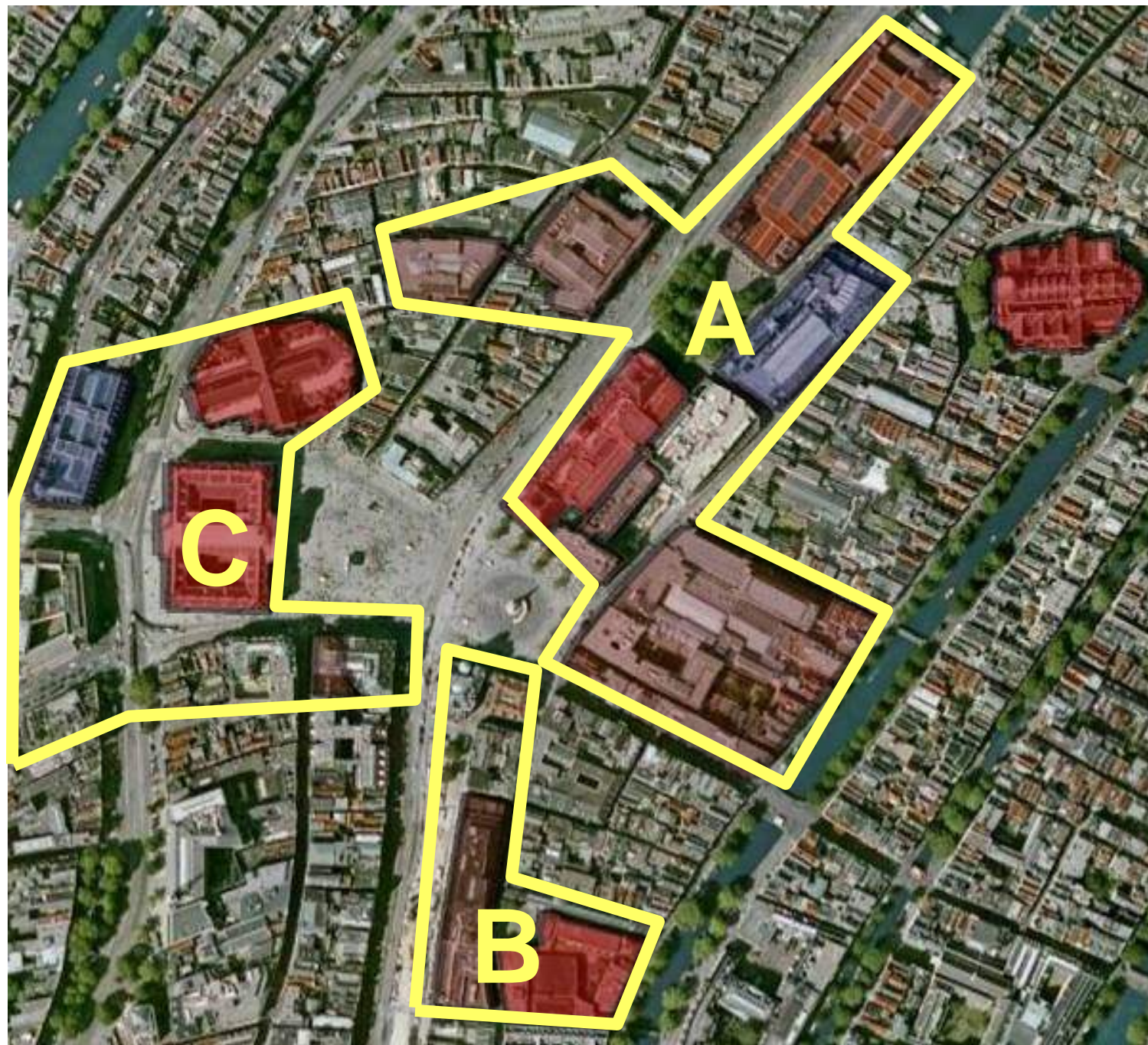


aquifer thermal energy storage



current use of sustainable energy versus potential use in 2025
[prevented kiloton CO₂]





saving of energy in three situations

new construction

C&A

up to 50 %

renovation

Beurs

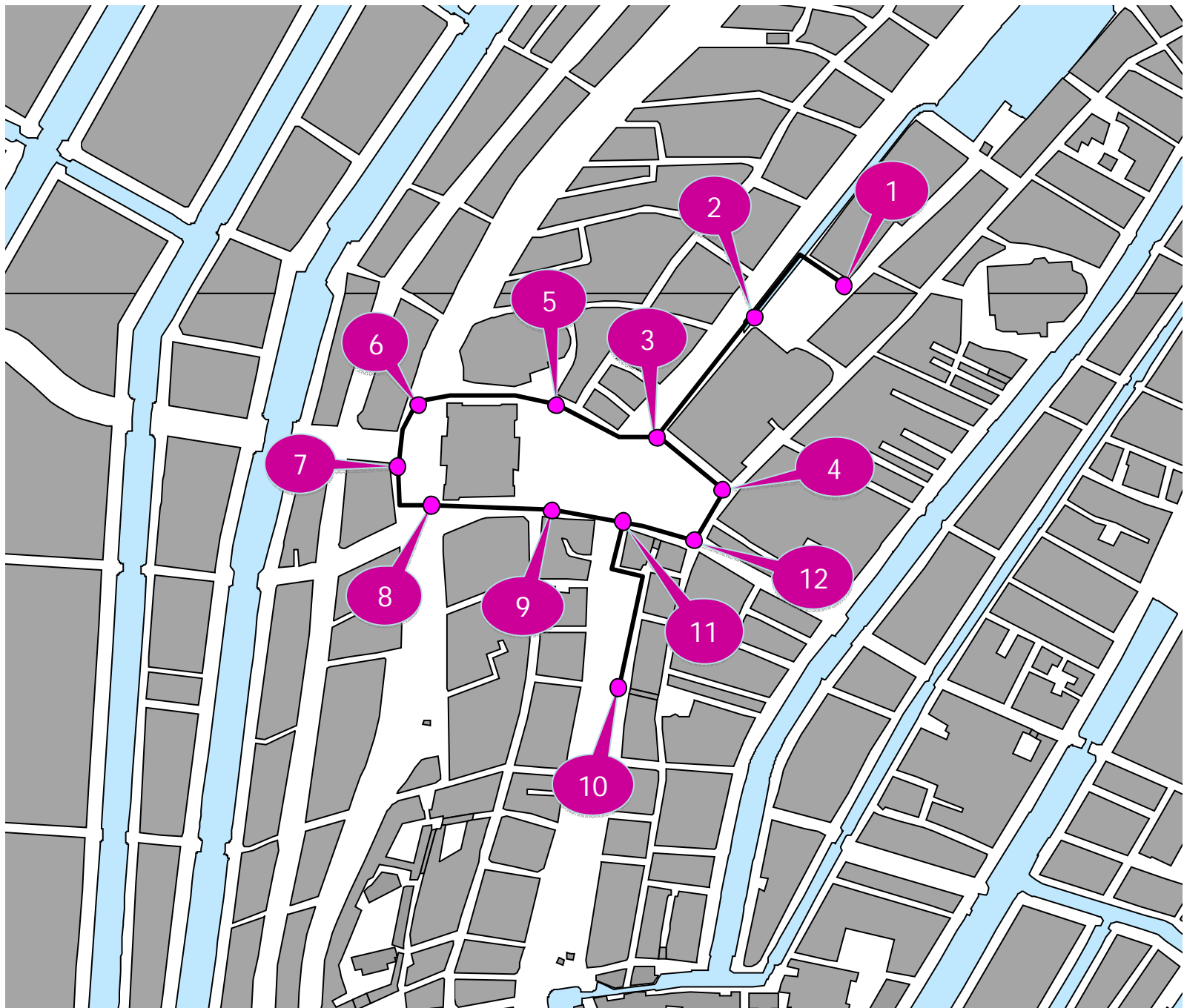
30 to 40 %


existing installation

Bijenkorf

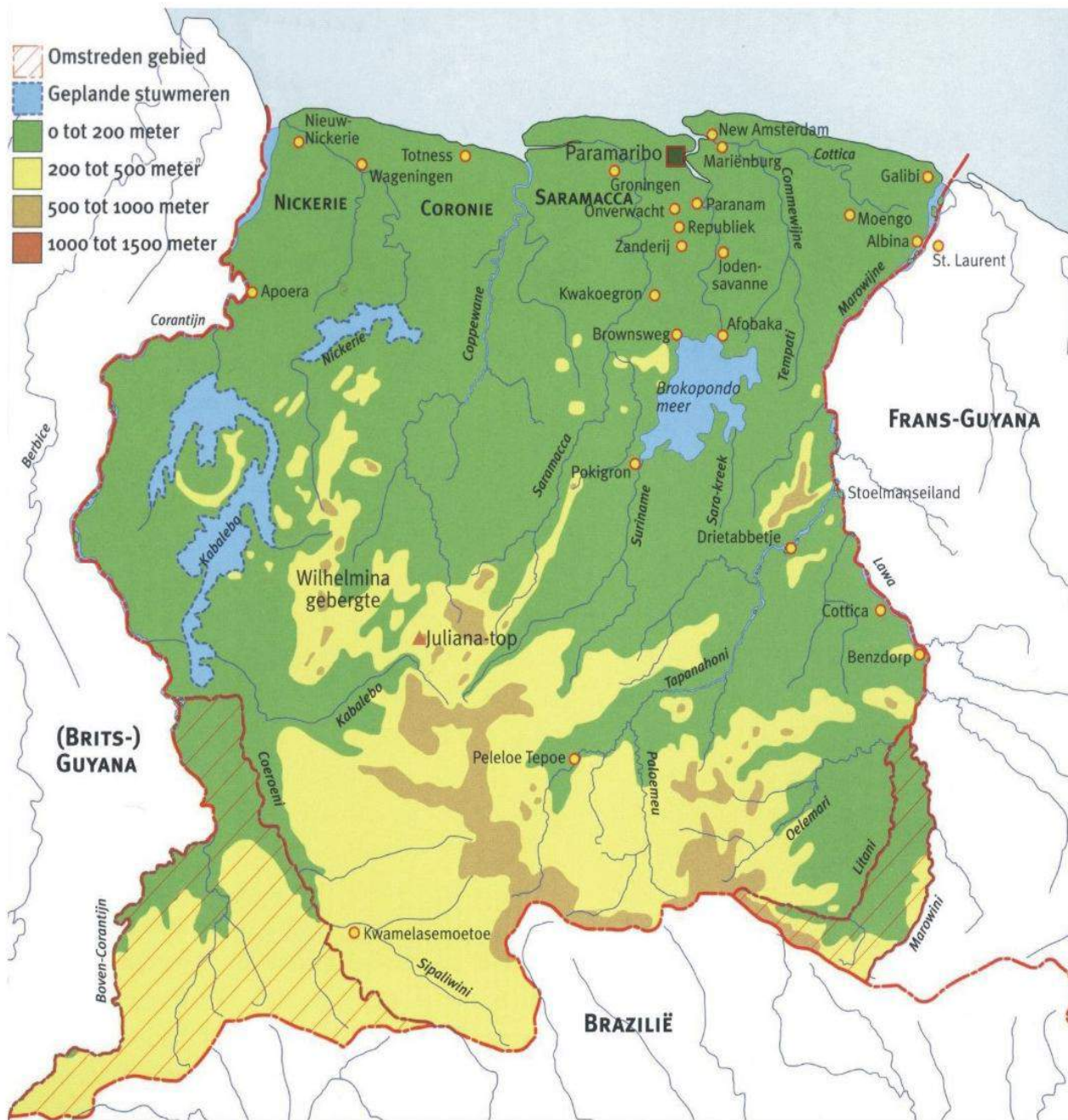
up to 30 %

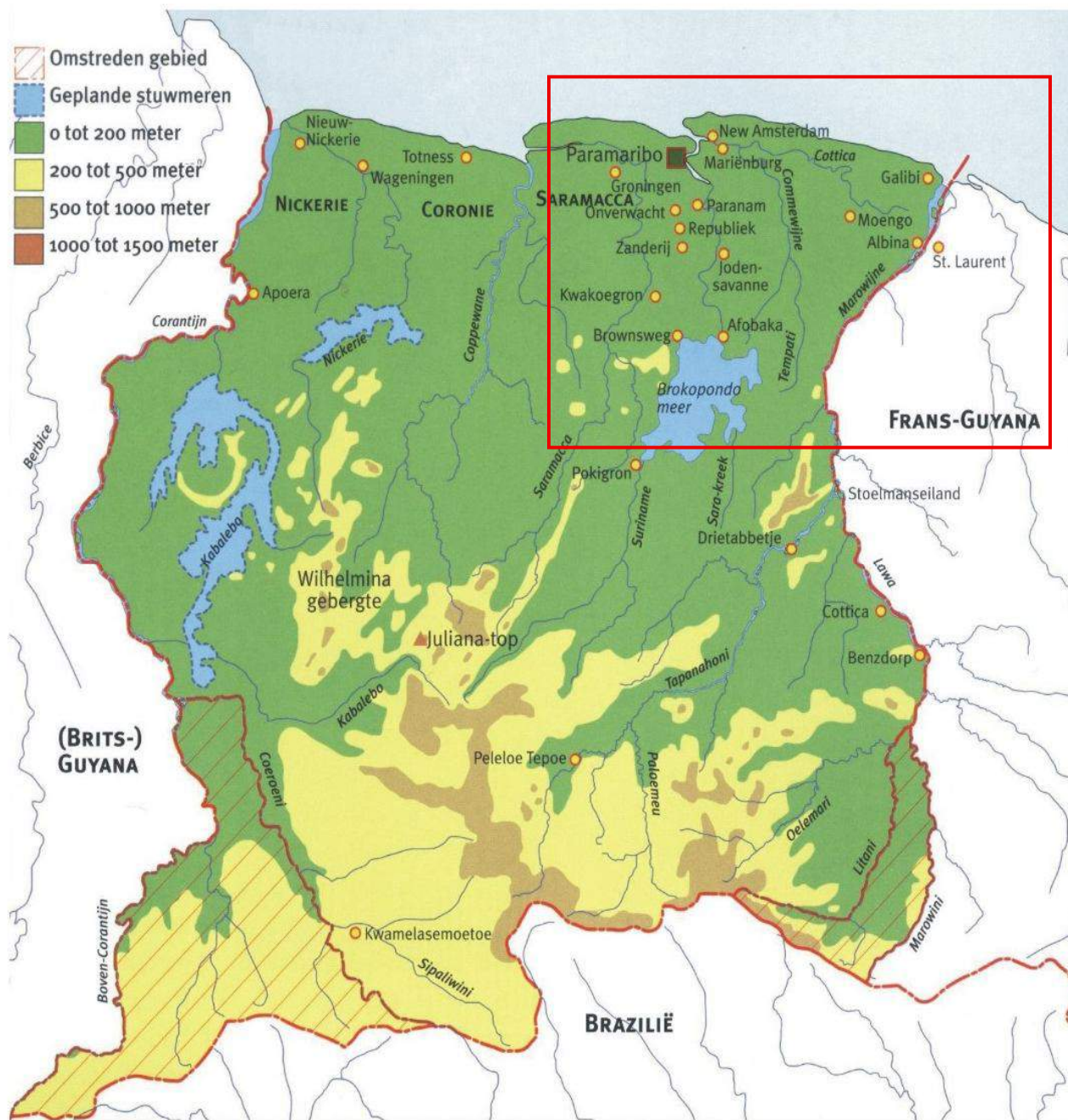


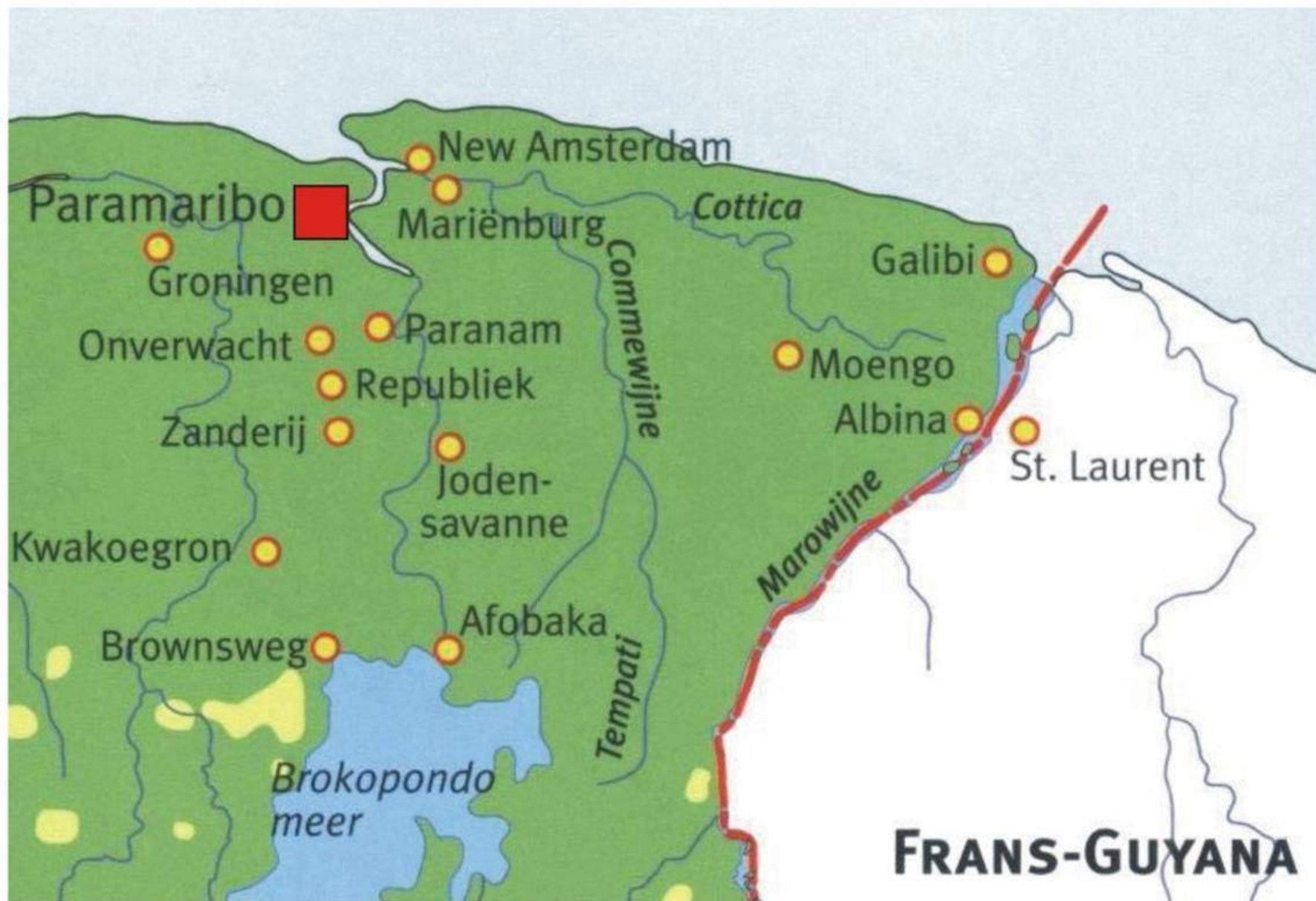


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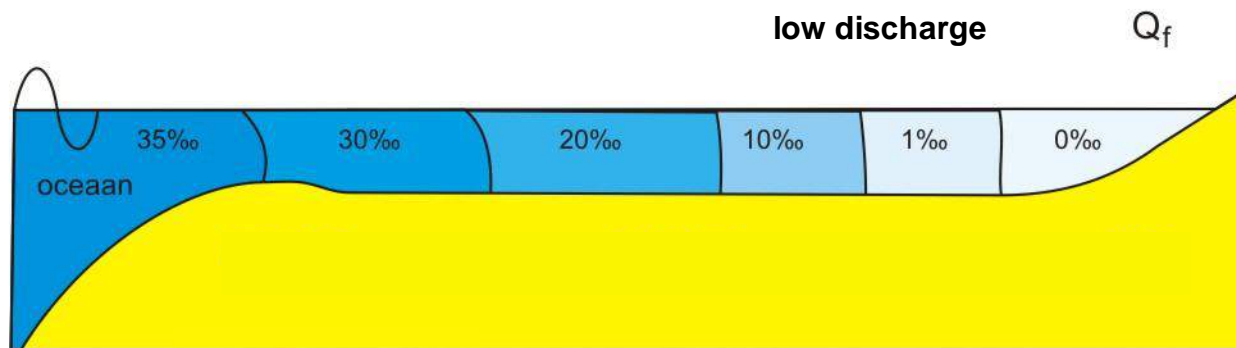
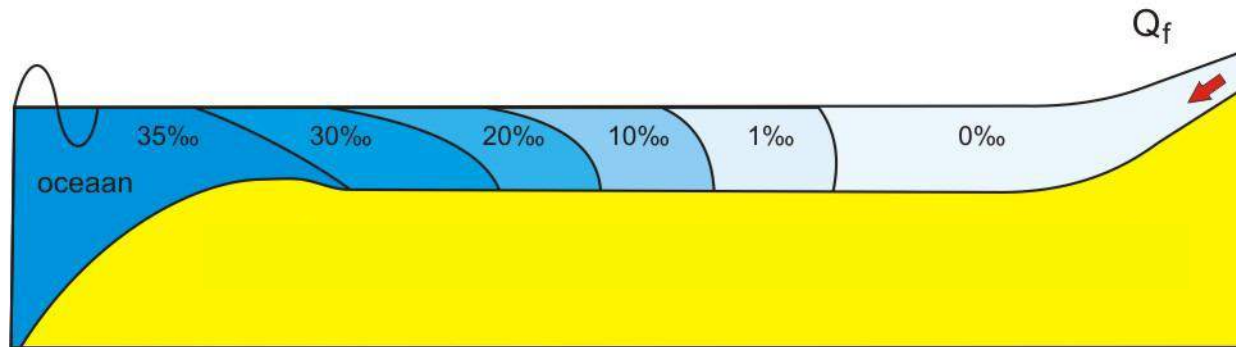
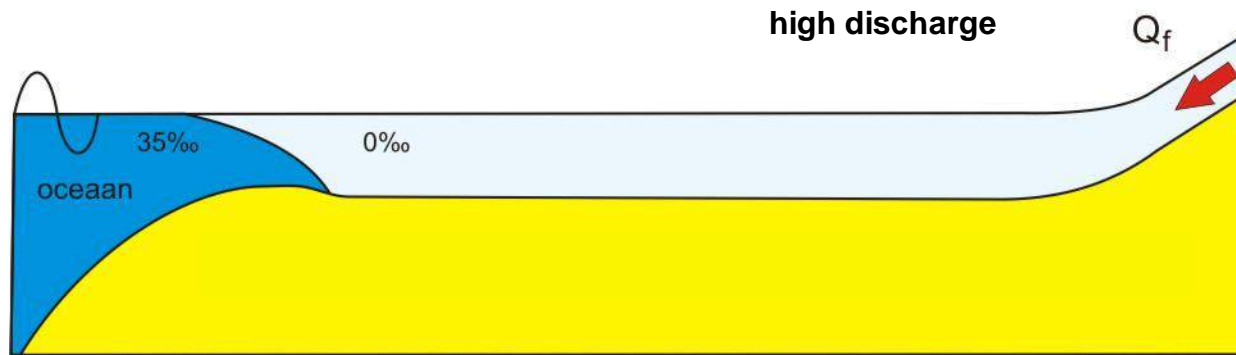








distribution of the salt










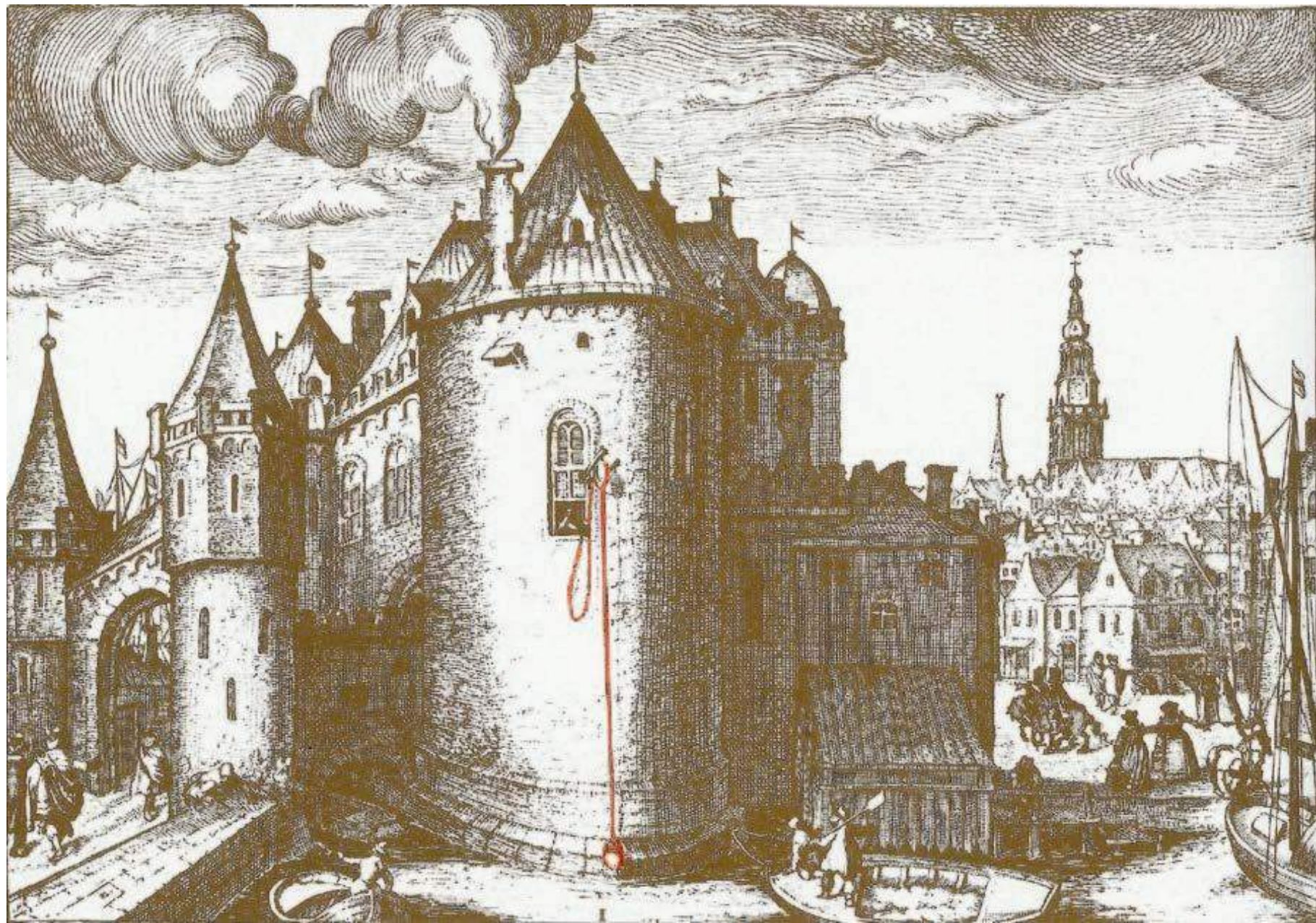






Waternet, started in 2006, is a relatively young organisation, but its roots date back to 1307 when the oldest predecessor of the Waterboard officially was founded, and to 1851 when the Amsterdam Water Supply started.

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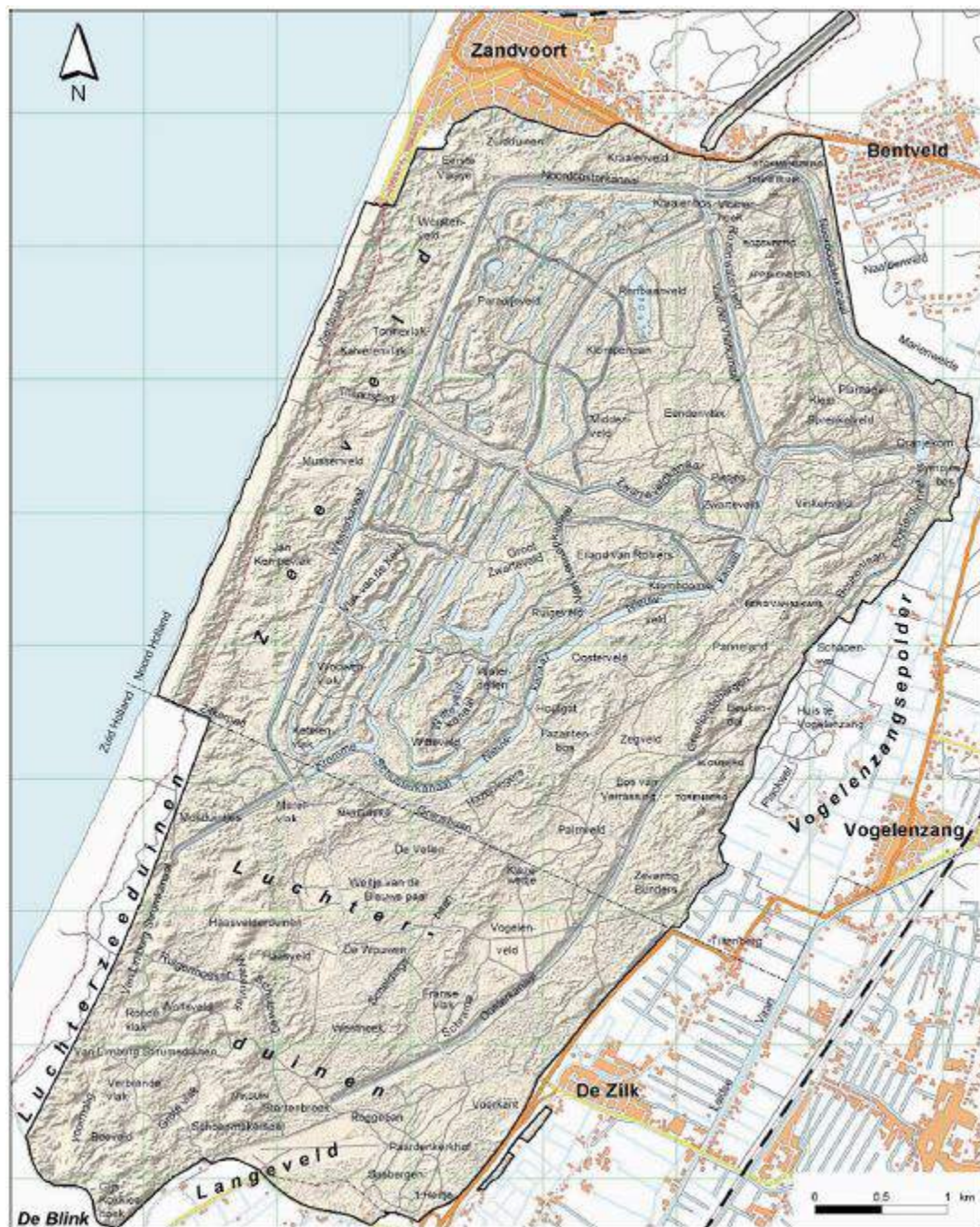
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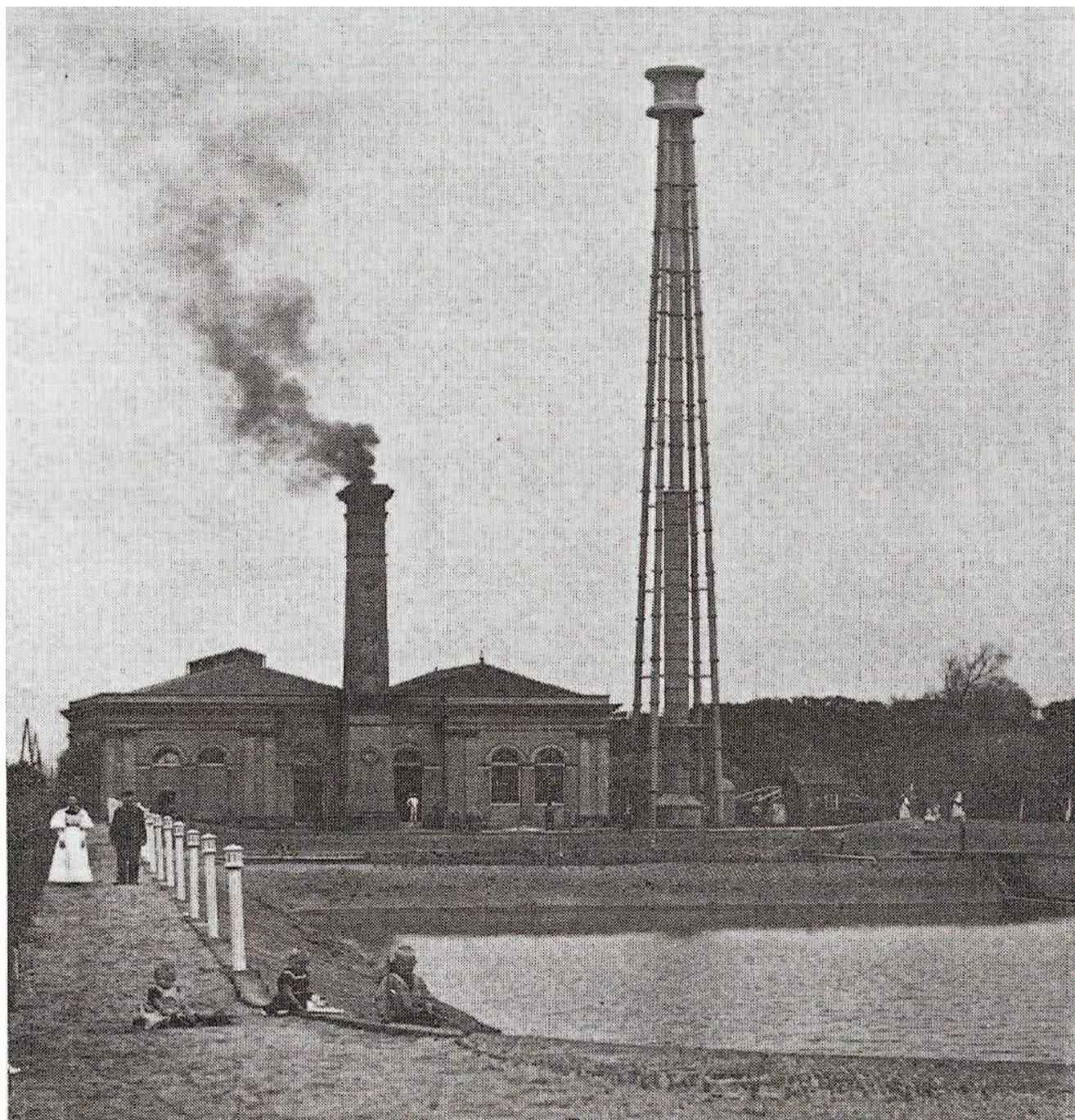


country estate Leyduin, Jacob van Lennep

drinking water from the dunes

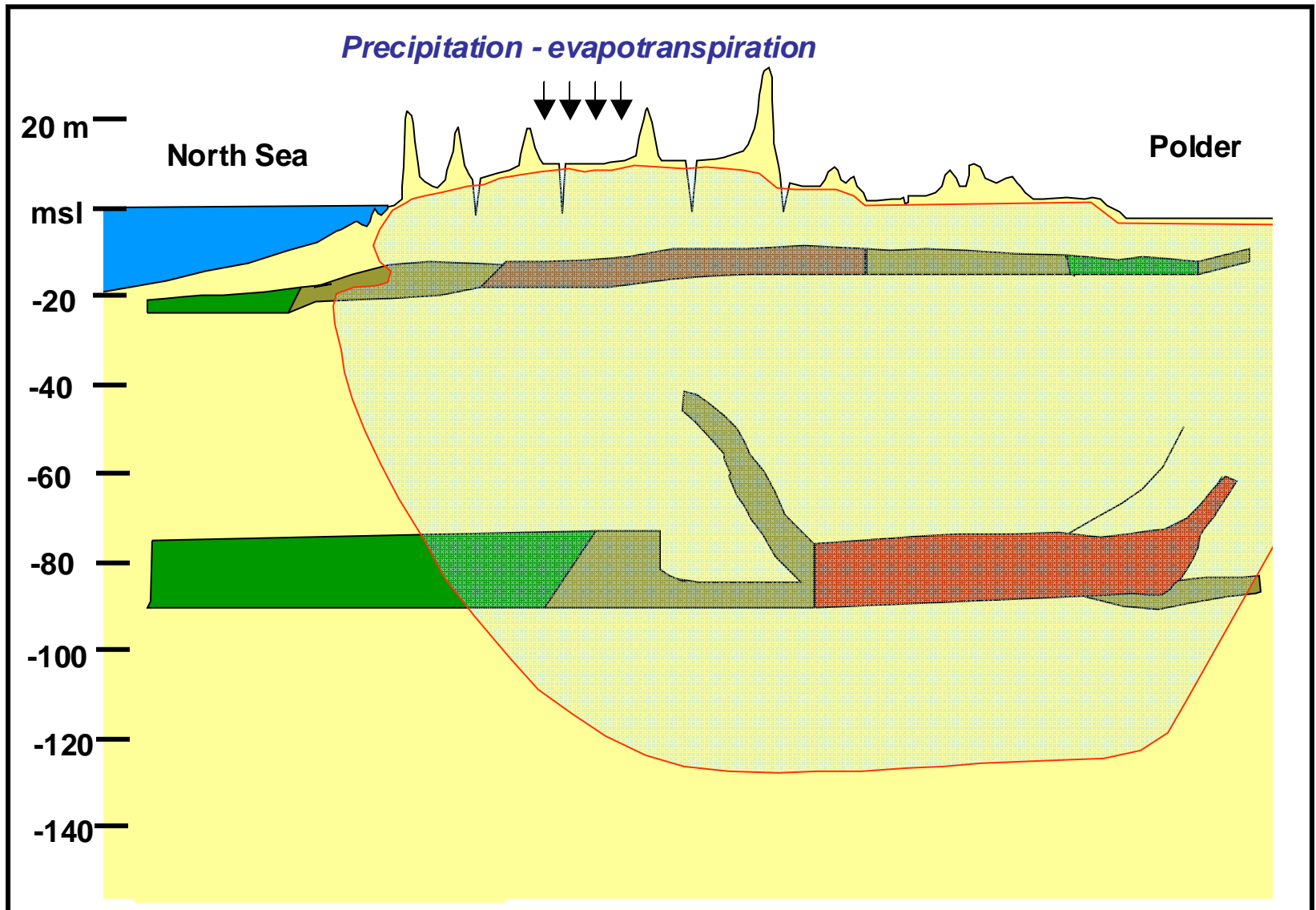
- 1853 shallow dune water extraction
- 1903 deep extraction with wells
- 1957 artificial infiltration in the dunes with pretreated water from the Lek Canal and further extraction



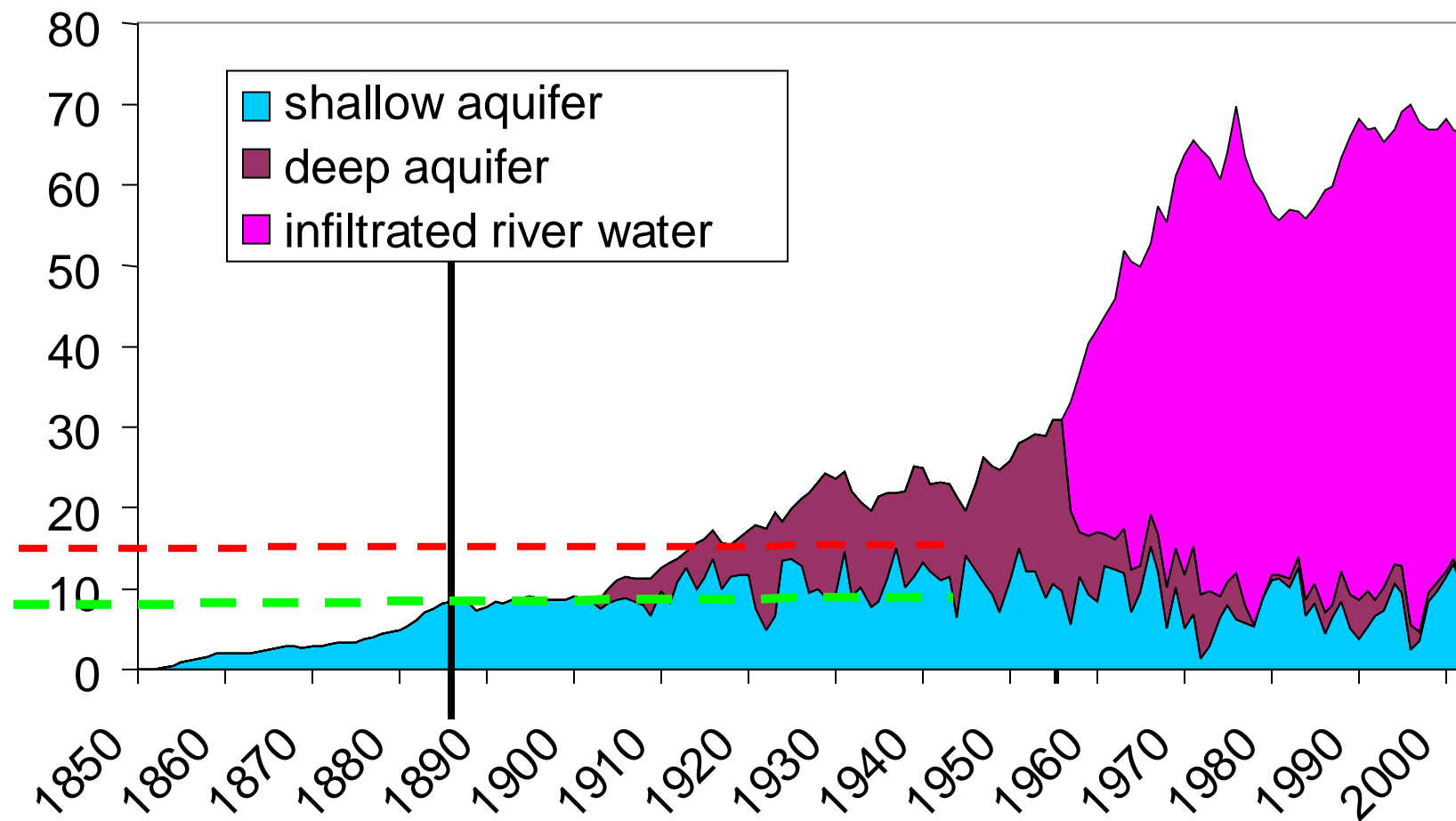




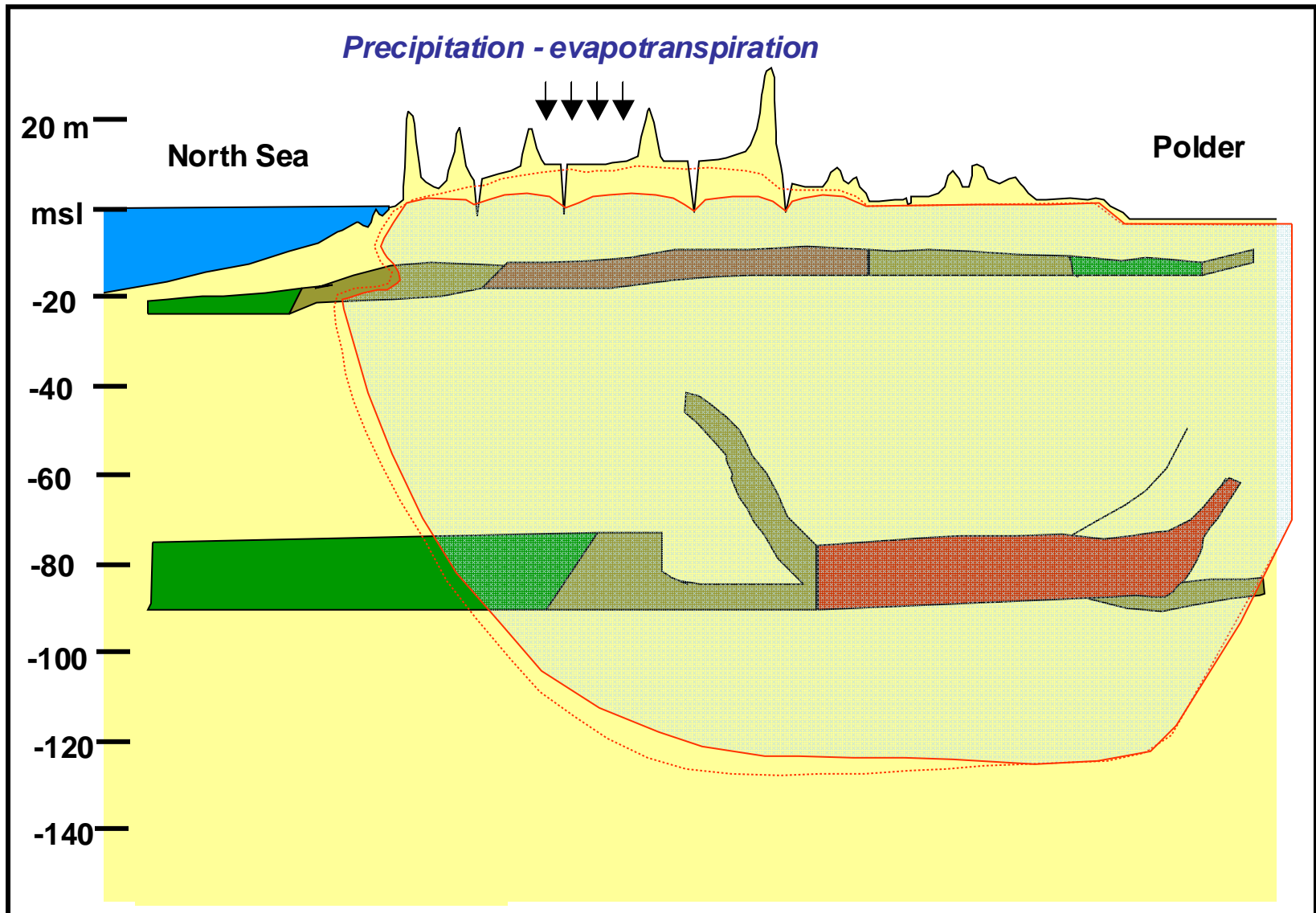
canal extraction 1853-1903



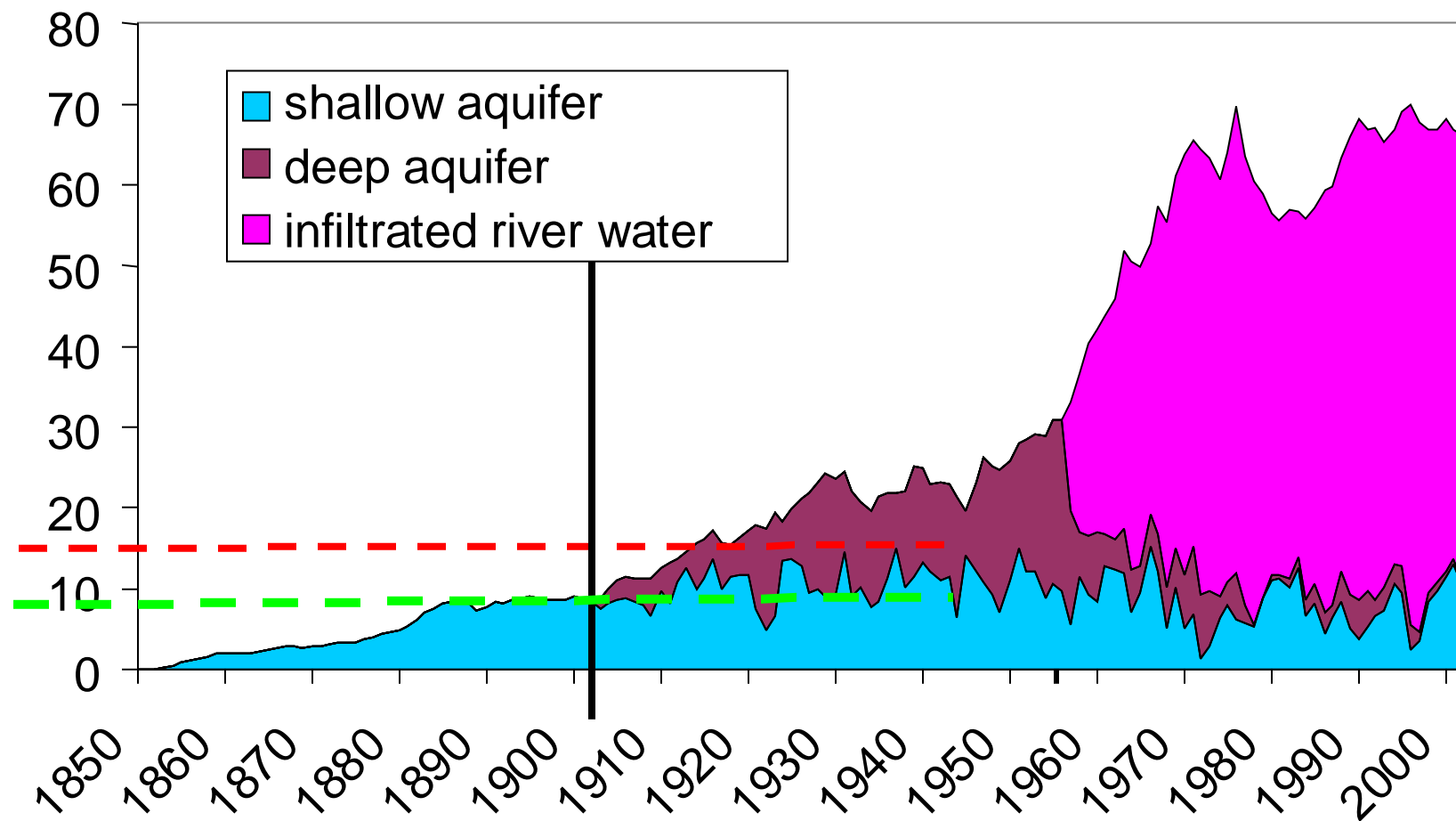
million m³/ year



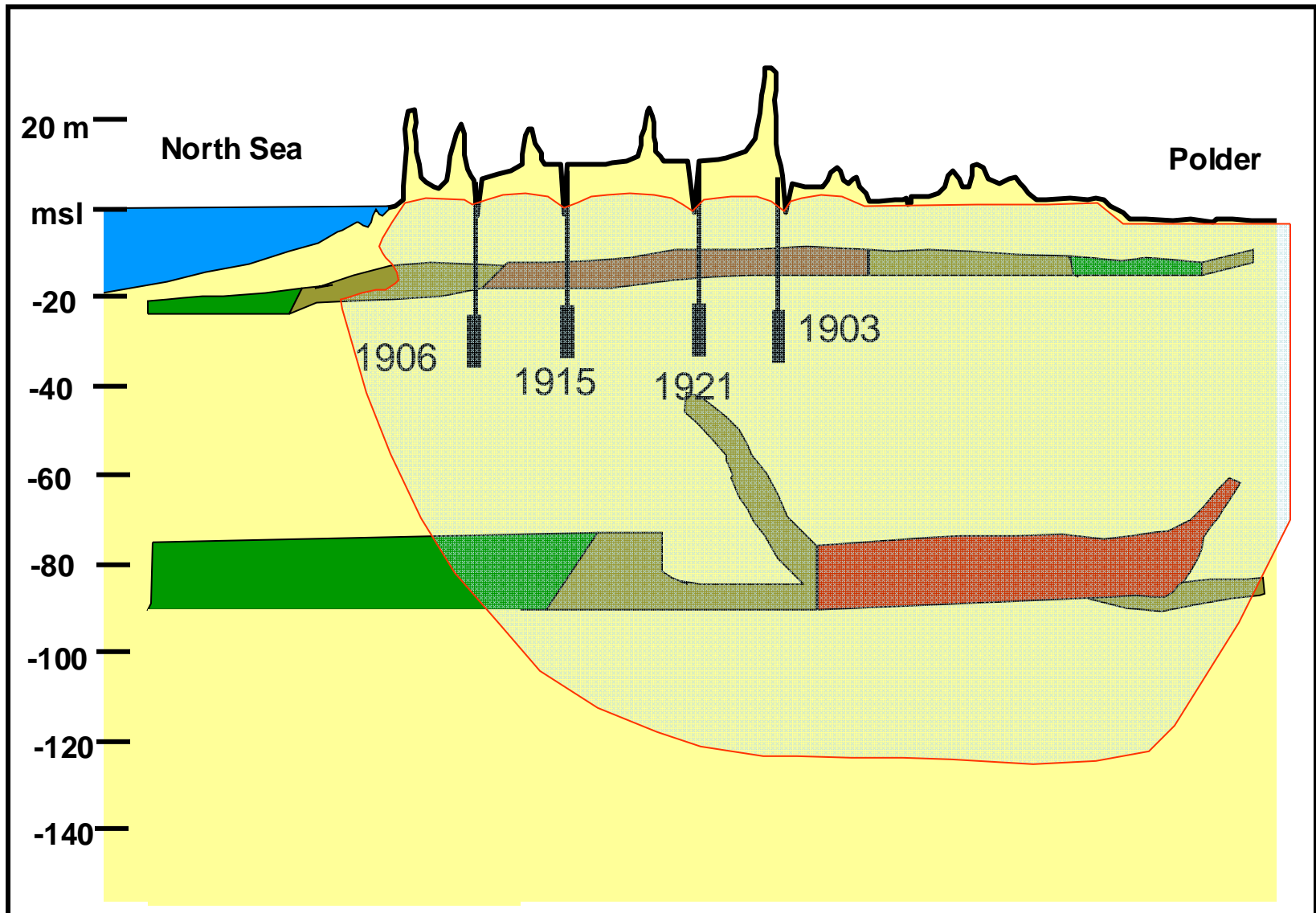
canal extraction 1903



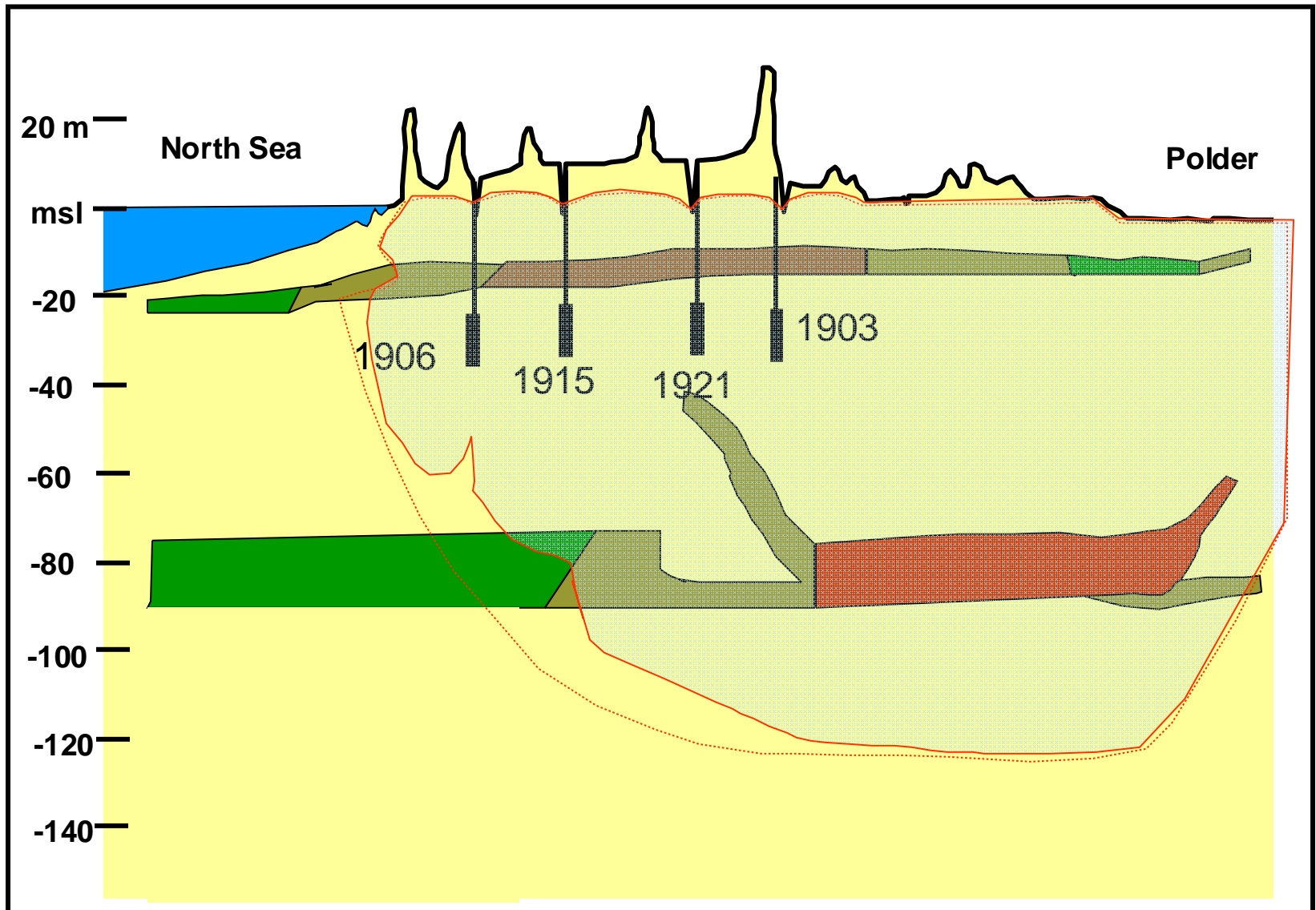
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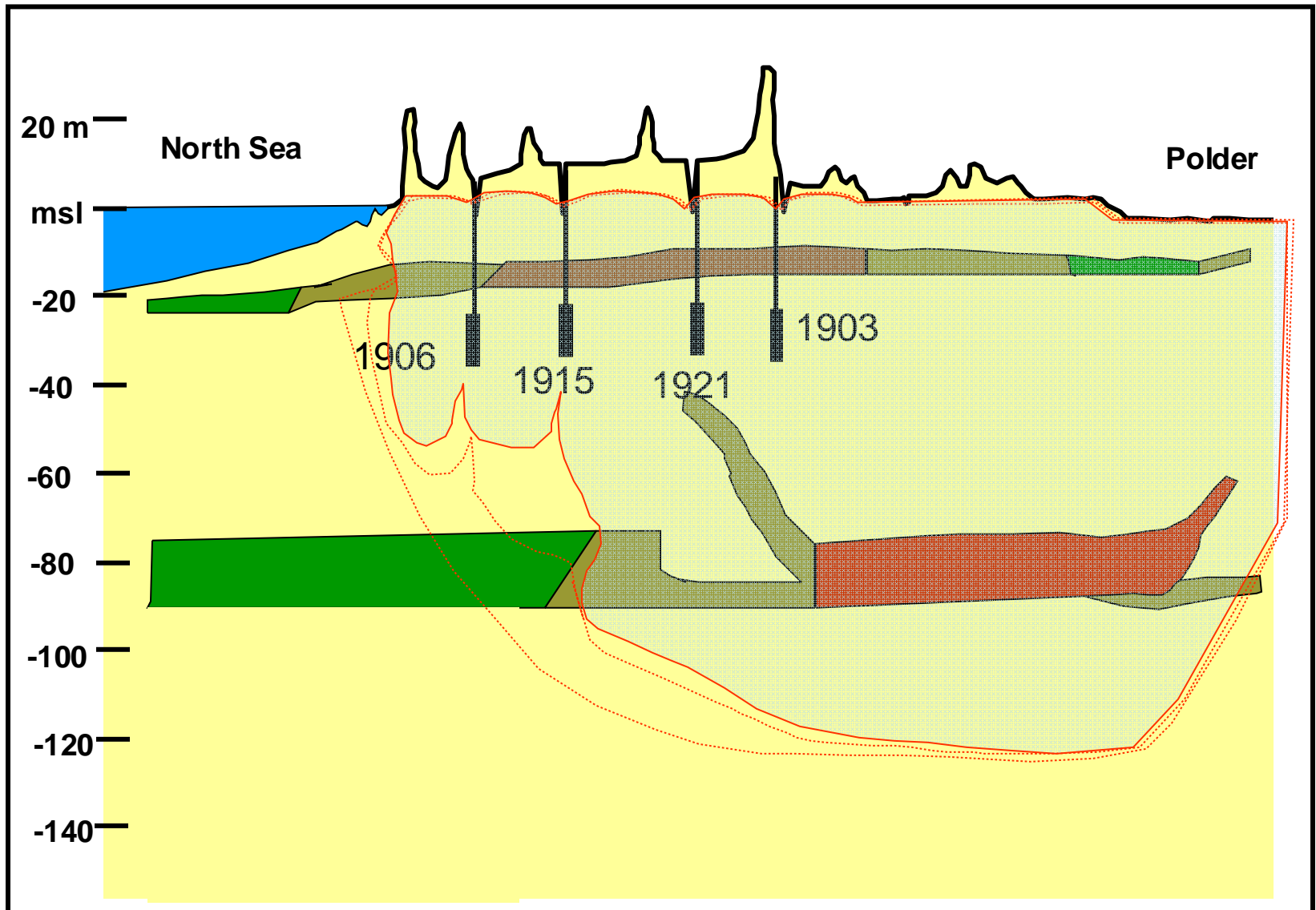
deep extraction with wells 1903



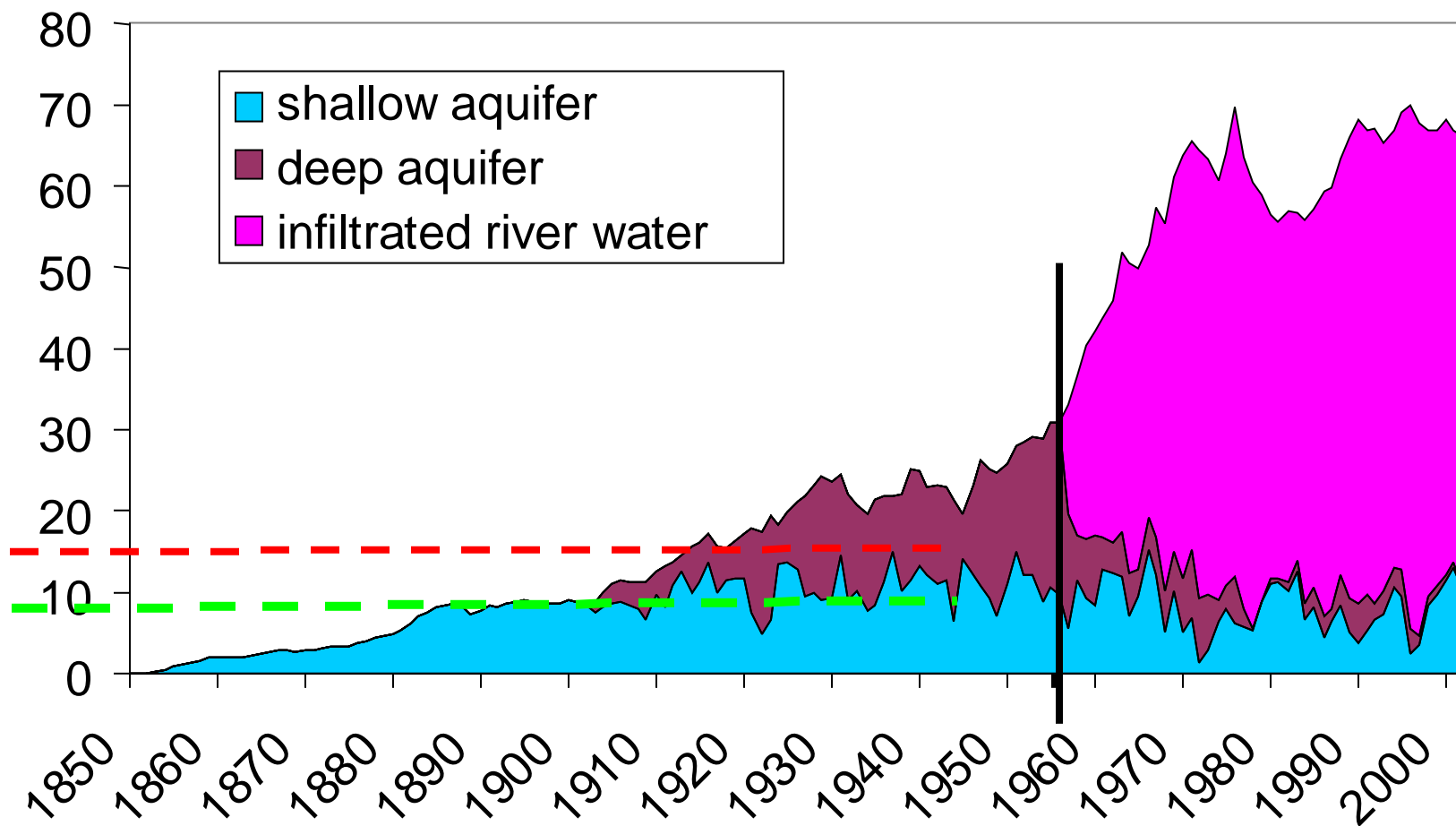
deep extraction with wells 1939



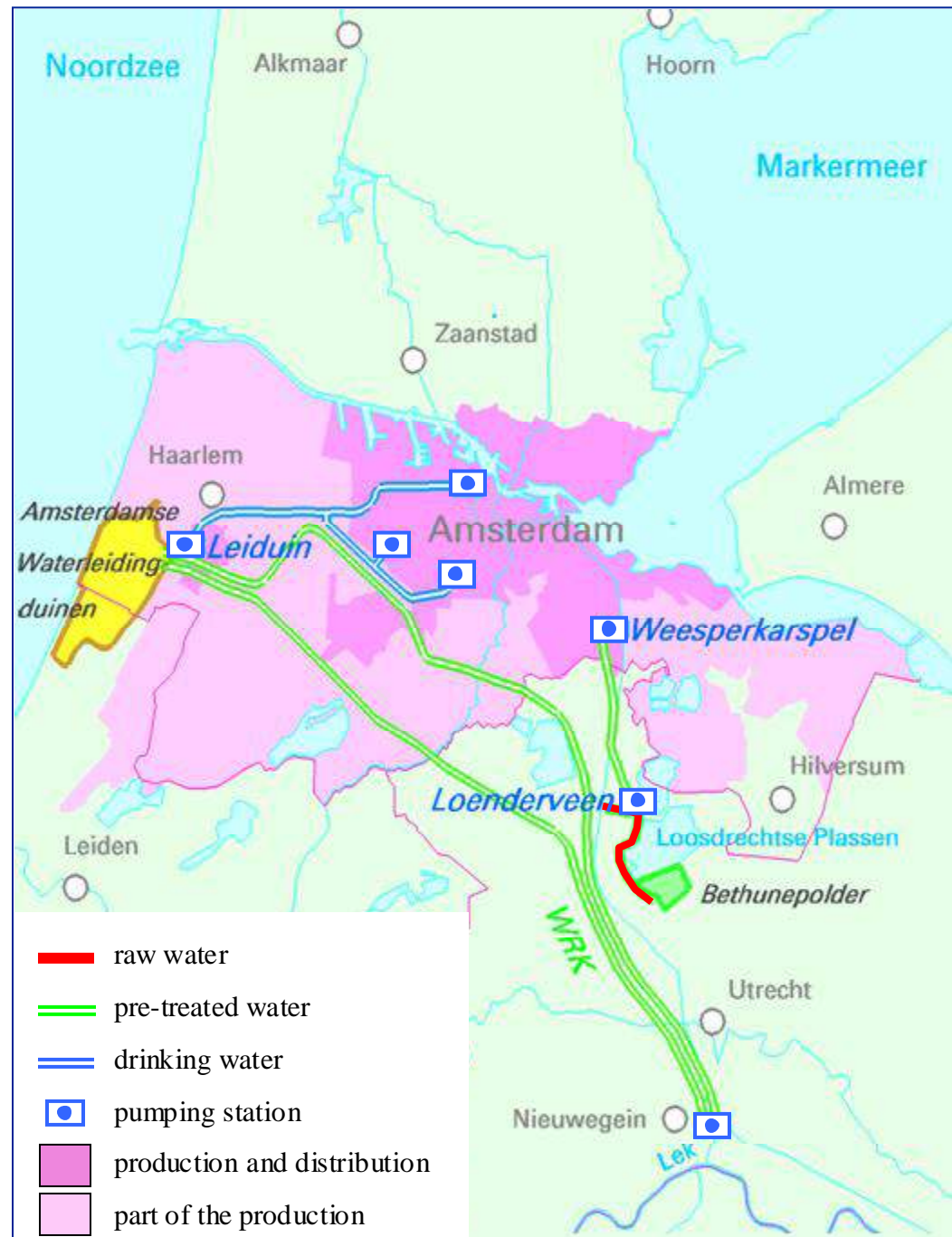
deep extraction with wells 1956



million m³/ year

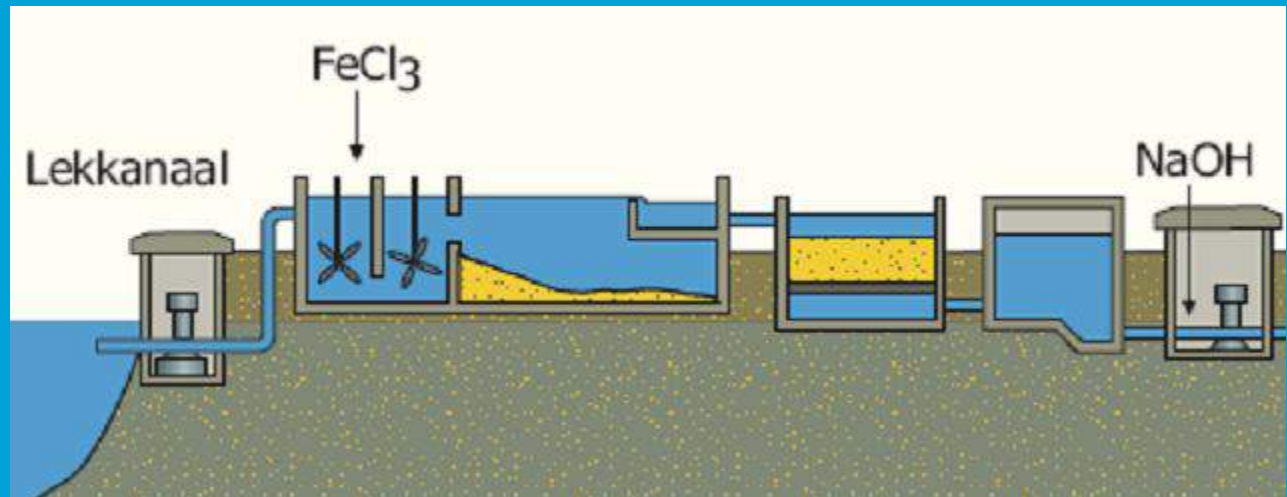


transport system and the drinking water distribution area

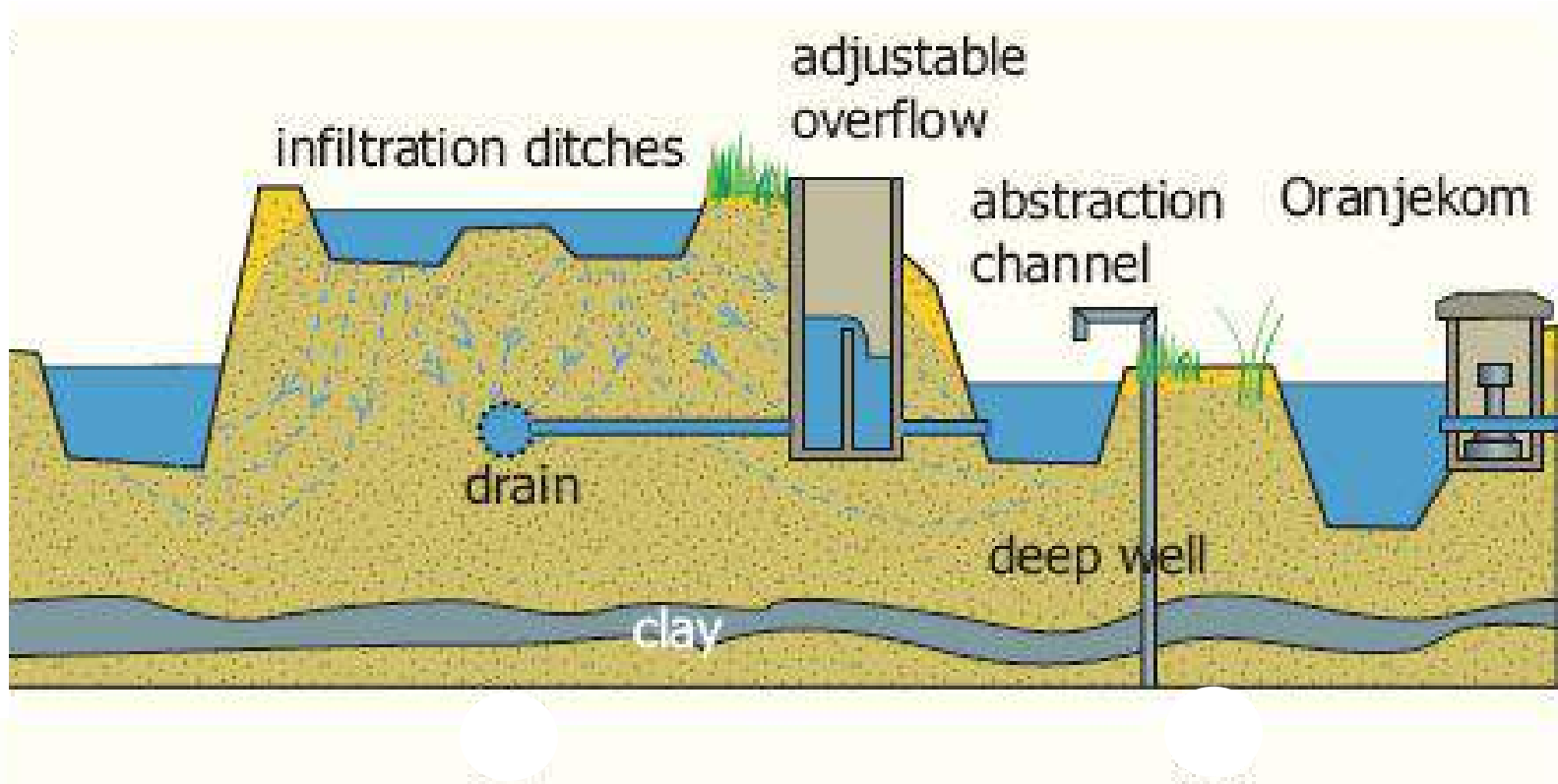


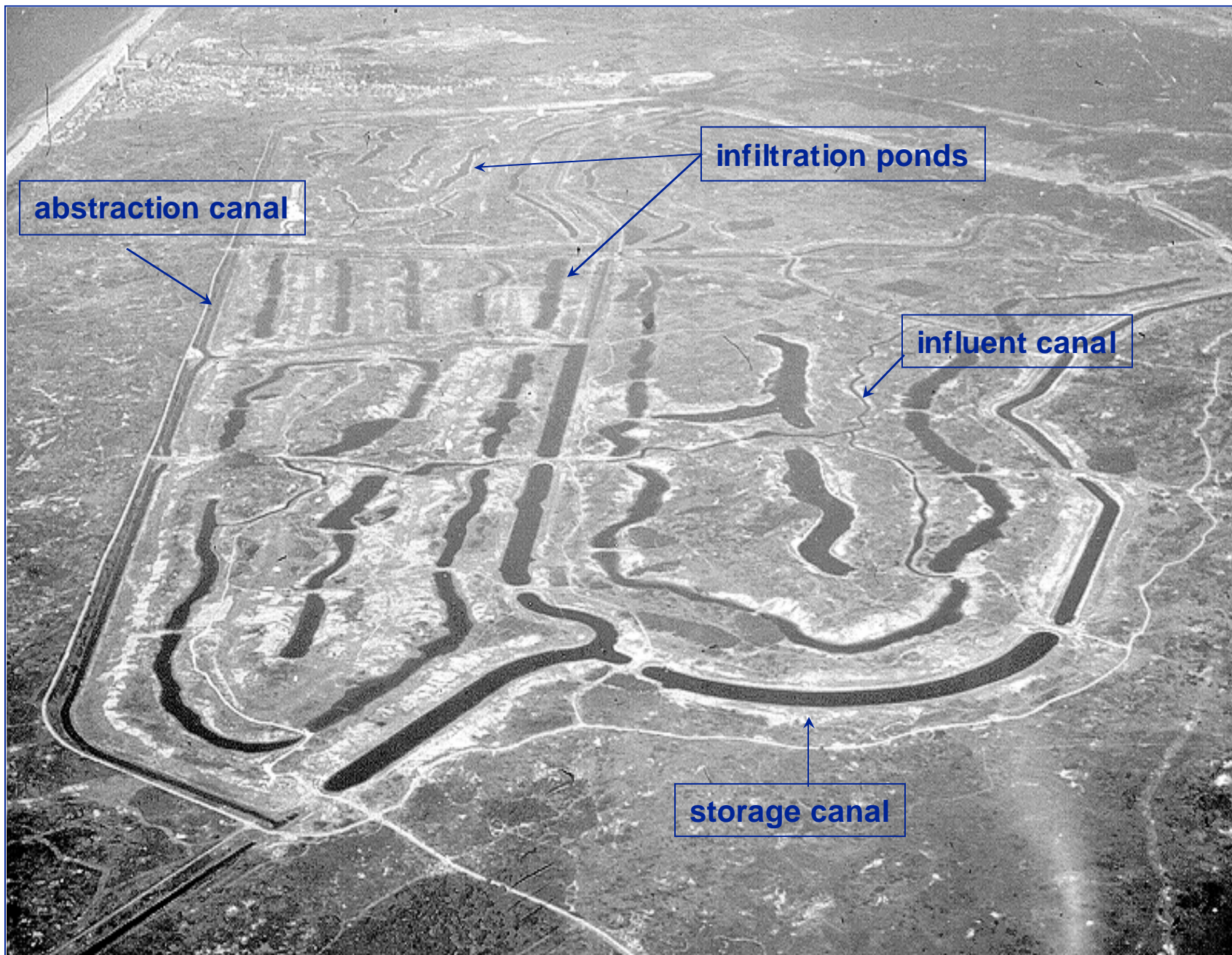
coagulation - sedimentation - rapid sand filtration

- flocculant: ironchloride
- removal of: sludge, phosphate, organics, bacteria, heavy metals



infiltration of river water in the AWD

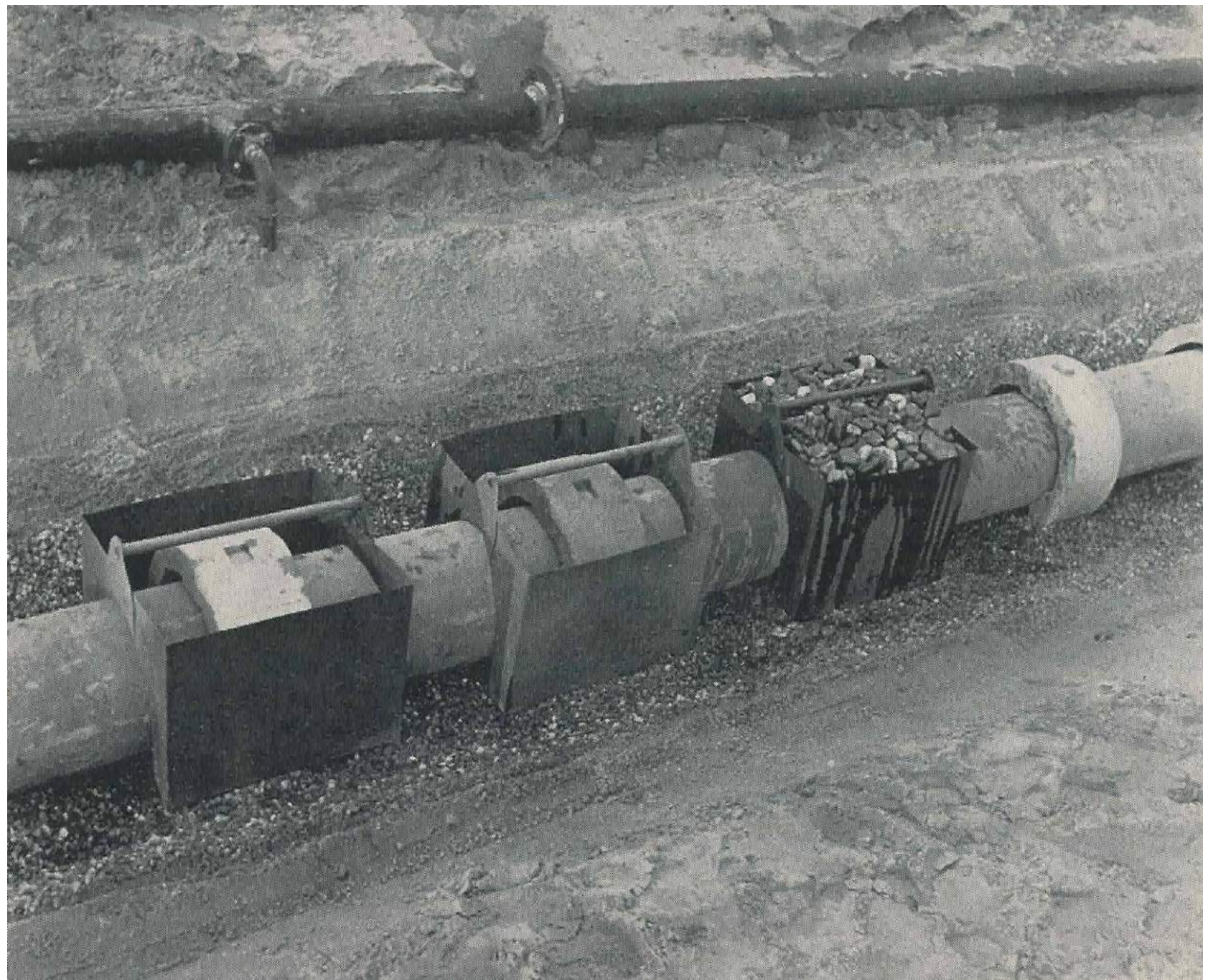


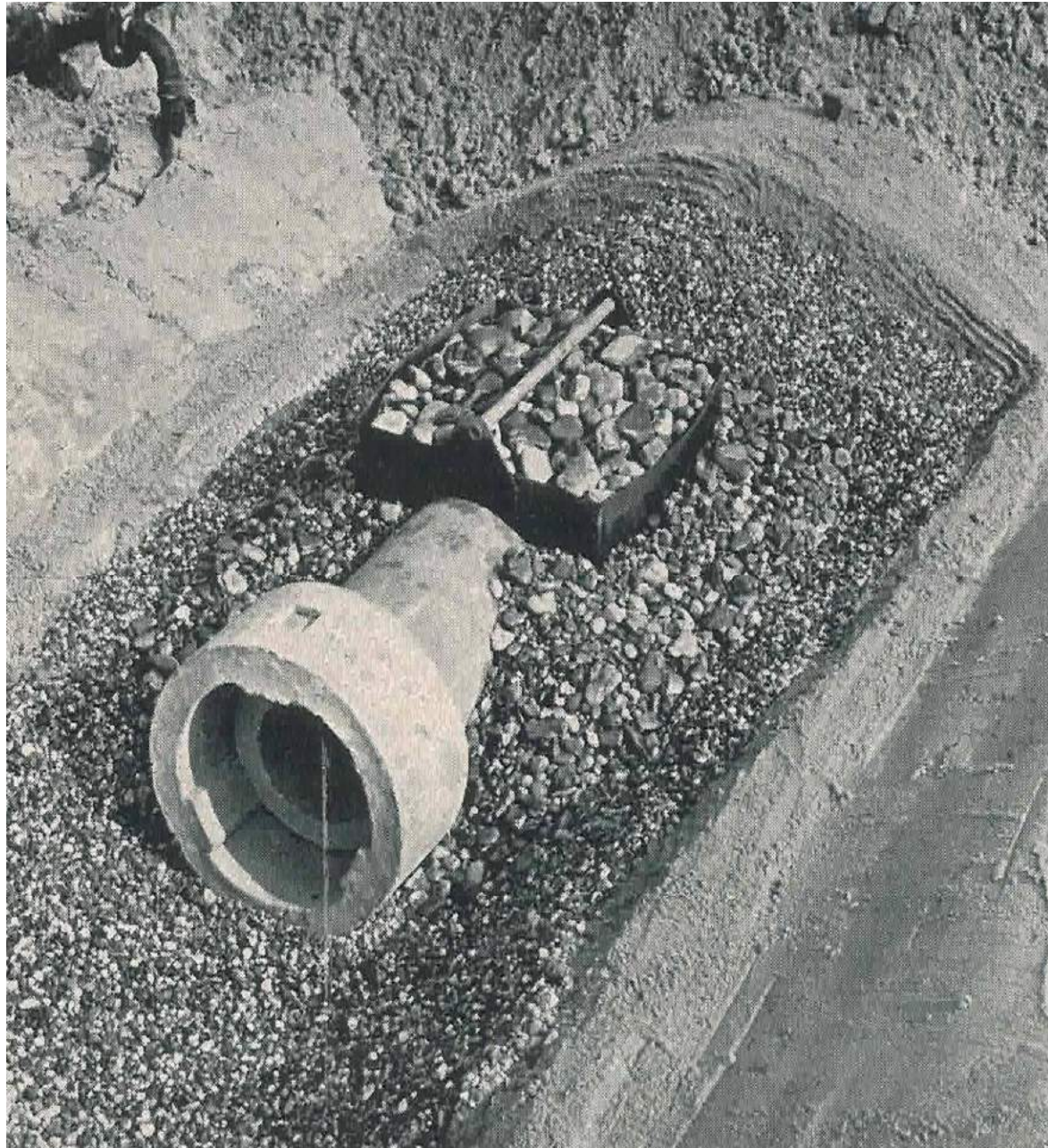




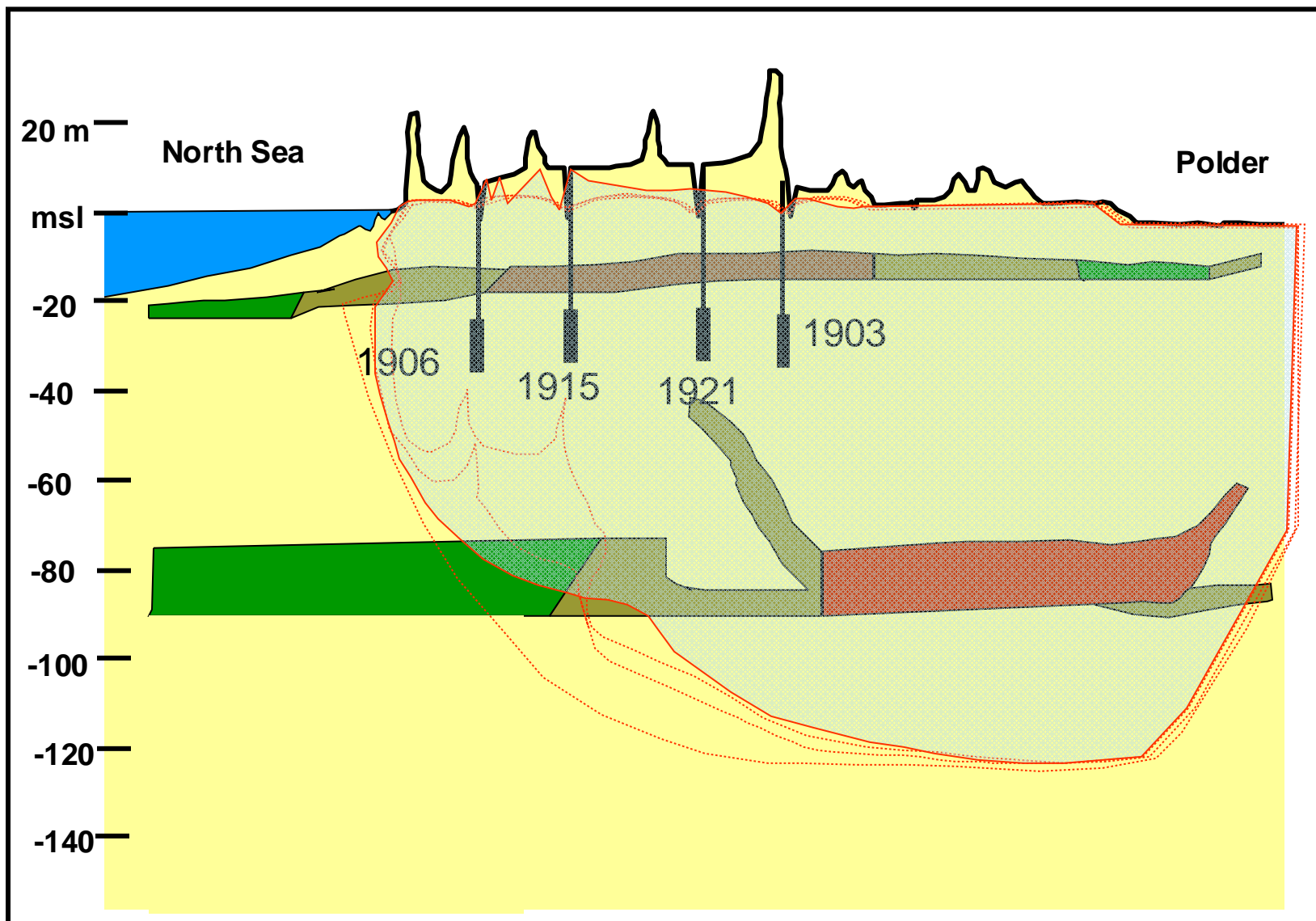


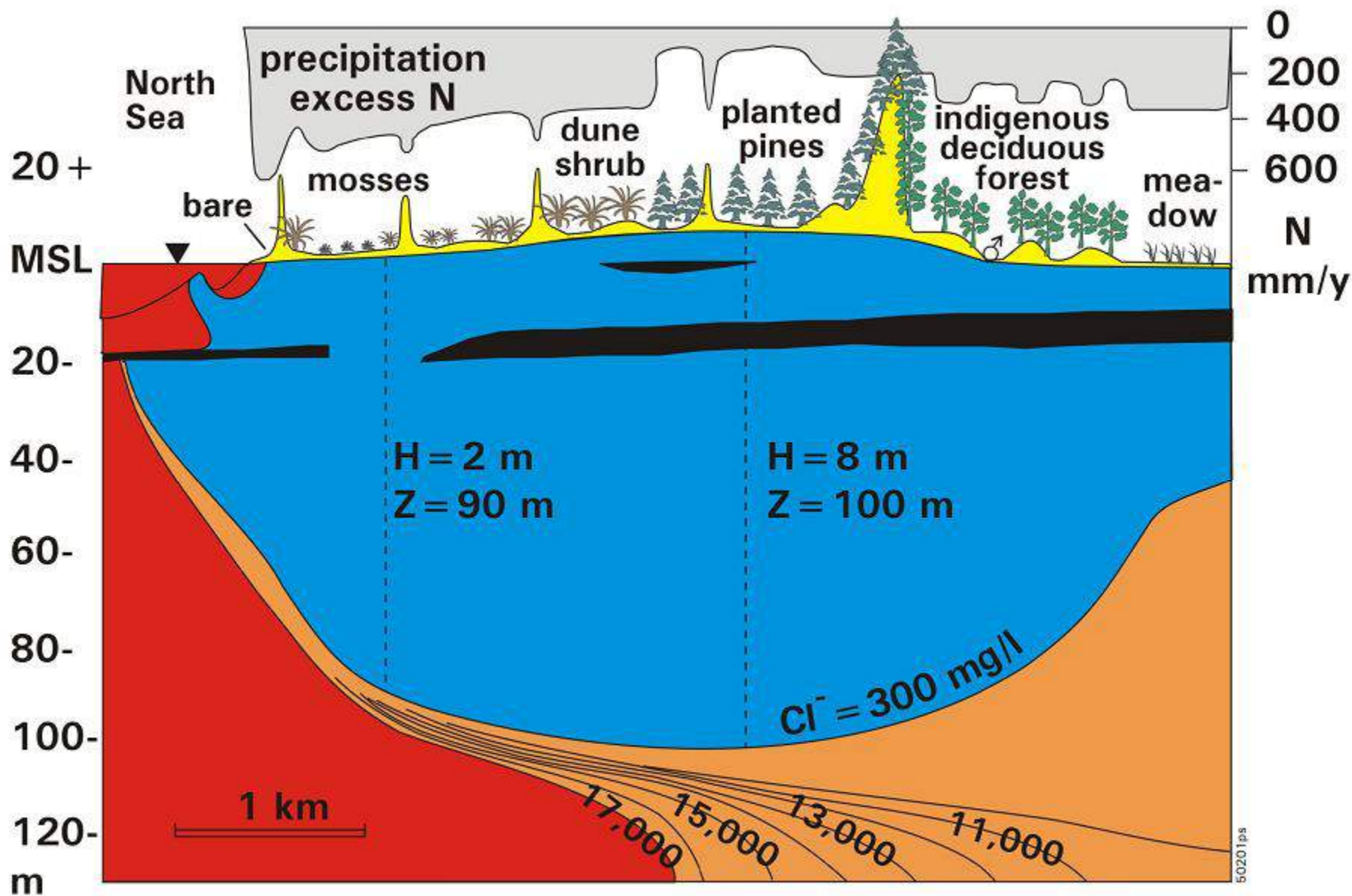






recovery without wells 1981





why infiltration in the dunes ?

- natural filter for bacteria and viruses
- natural filter for organic contaminants
- smoothing of water quality and temperature
- storage buffer to overcome intake stops

different roles in the dunes

- drinking water production
- management of nature
- recreation

these are partly conflicting interest !





ID: 26
C113 ->
drain <-
Westerveld

08.02.06

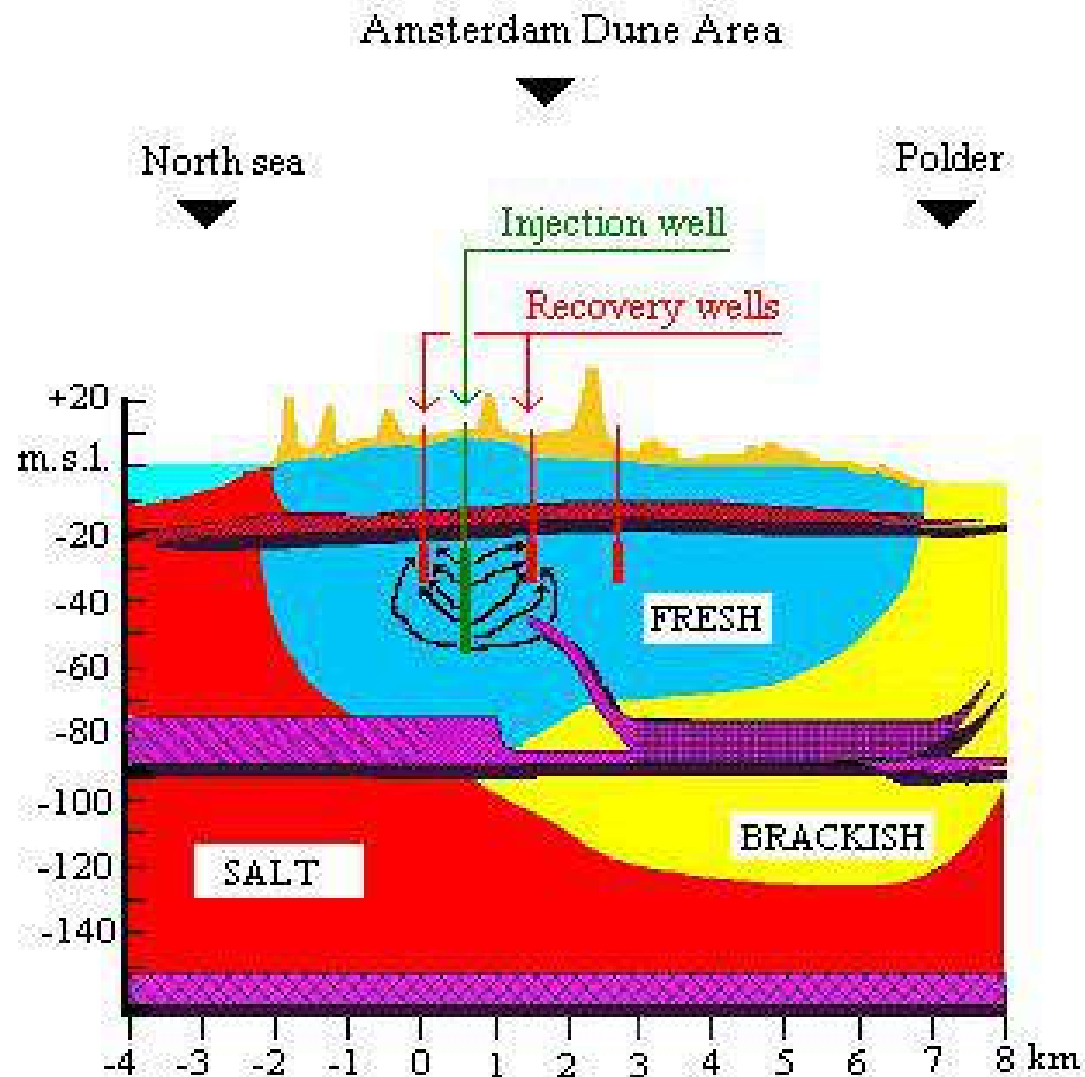
15:54:05

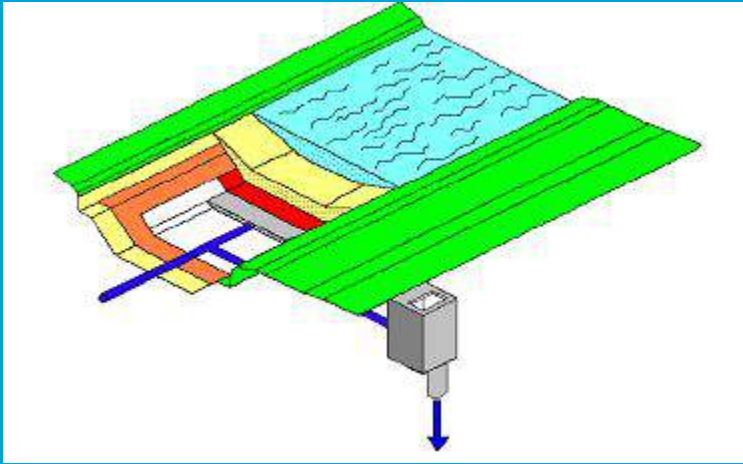
200 200
Li-12, 1% 006, 4m↑



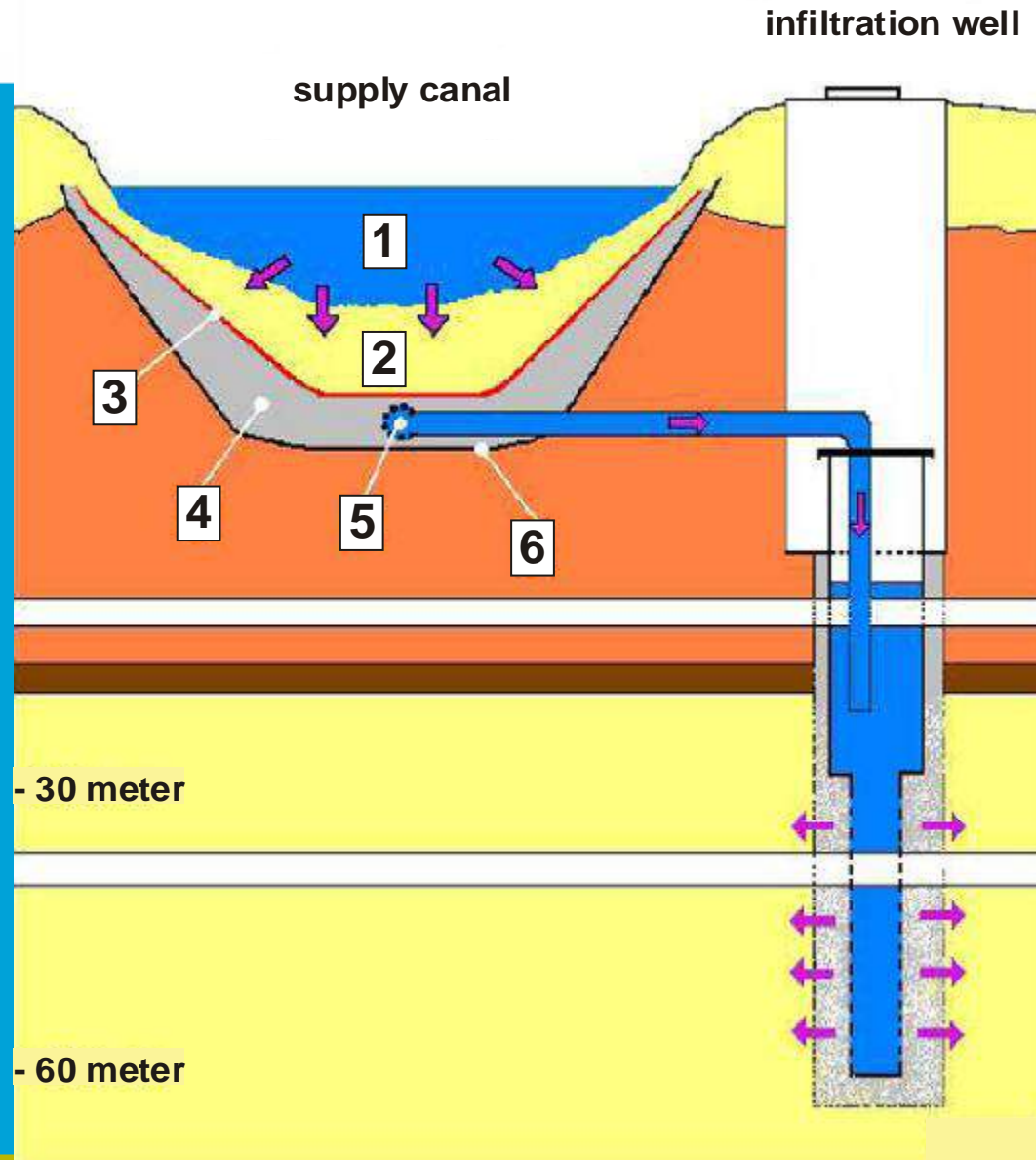
deep infiltration system

- 4 infiltration wells
filters located
20-50 m deep
- total injection capacity
0.7 million m³/year
- part of the old deep
extraction system as
recovery wells





6.4 million m³ injected







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treatment philosophy

- multiple barriers
 - pathogens
 - organic micropollutants
- central softening
- biologically stable
- no chlorine

coagulation

sedimentation

rapid sand filter

artificial infiltration

aeration

rapid sand filter

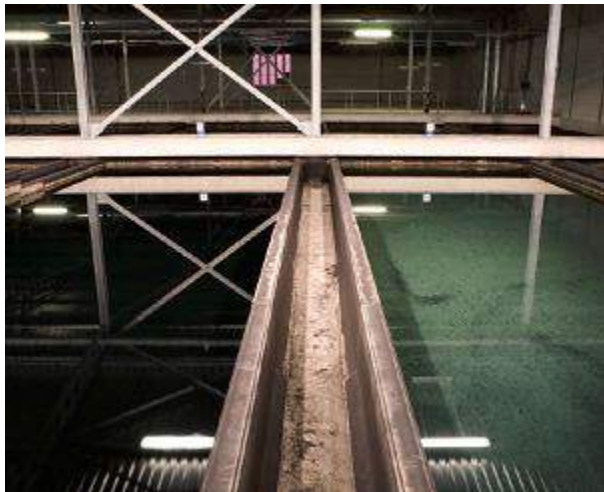
ozonation

pellet softening

activated carbon filter

slow sand filter

DRINKING WATER



water treatment

physical en chemical water quality:

- removal of suspended solids
- removal of heavy metals
- removal of iron and manganese
- hardness reduction
- reduction of colour, taste and odour
- barrier against micro-pollutants like pesticides

water treatment

biological water quality:

- disinfection
- nutrient removal
- no chlorine
- only in combination with a high quality distribution system

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Waternet, Onderzoek & Advies

**Vogelenzangseweg 21
2114 BA Vogelenzang**

**Korte Ouderkerkerdijk 7
1096 AC Amsterdam**

020 608 75 46 06 532 714 39

frank.smits@waternet.nl