Water production and distribution in The Netherlands

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- Water in the Netherlands
- Amsterdam situation
- Possible solutions

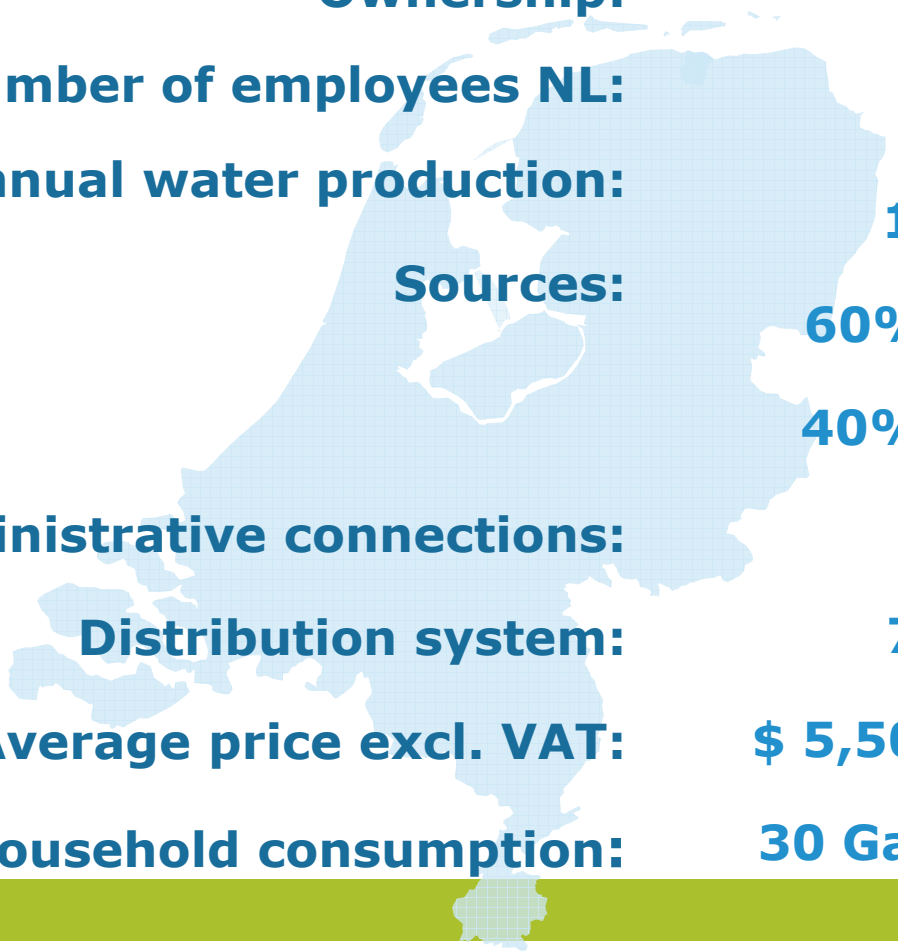
Development of water supply
(2 x New Jersey)

2015:

10 utilities

Dutch water supply – key figures

Number of water companies:	**10**
Ownership:	**public**
Number of employees NL:	**5.228**
Annual water production:	**1.136 m^3 (mln)**
Sources:	**60% ground water**
	40% surface water
Number of administrative connections:	**7,3 million**
Distribution system:	**73.500 miles**
Average price excl. VAT:	**$ 5,50 per 1000 Gallon**
Average household consumption:	**30 Gallon/person/day**



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Regulatory environment

Drinking Water Act (2011)

- ownership restricted to local/regional authorities
- national supervision with main focus on water quality / continuity (public health), new ”costs”
- companies governed by local/regional shareholders

  (investments, tariffs, efficiency)

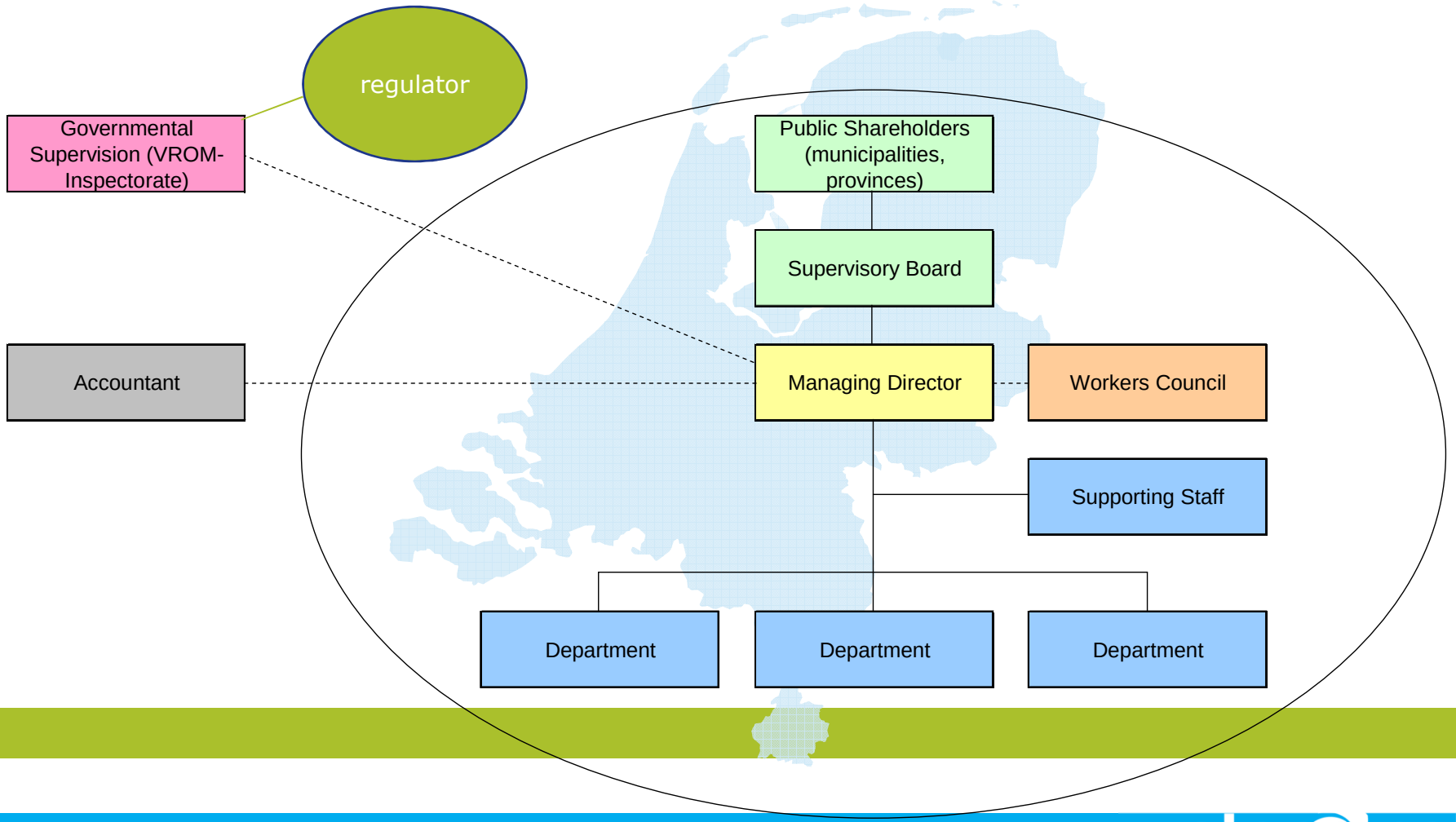
Regulatory environment (2)

- **safeguarding water quality/continuity**
  - water safety plans (water quality)
  - contingency management (risk analysis, capacity planning, security measures, reliability plan, crisis management plan, emergency water supply, exercises)

Regulatory environment (3)

- full cost recovery
- reasonable tariffs
- limitation to profit (wacc)
- mandatory benchmarking

Public limited liability company



Water in The Netherlands

- National level
  - government – national water policy
  - Rijkswaterstaat – coastal flood protection
- Regional level
  - 12 provinces – ground water policy
  - 26 Water Boards – regional flood protection, surface water quality, wastewater treatment
  - 10 Water Companies – water supply
- Local level
  - 421 municipalities – sewer system, municipal water systems

Public water government

City of Amsterdam

- Drinking water
- Sewerage
- Storm water
- Groundwater
- Shipping and inland waterways

Regional Water Authority Amstel, Gooi and Vecht

- Flood protection
- Water level management
- Water quality control
- Waste water treatment

Waternet foundation

Public water government:
The Watercycle Company Waternet

City of Amsterdam

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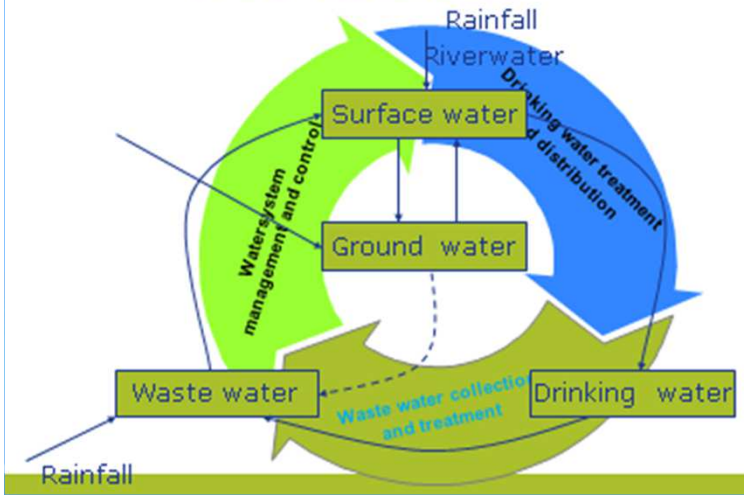
Waternet foundation

The first watercycle company of the Netherlands



Core Values

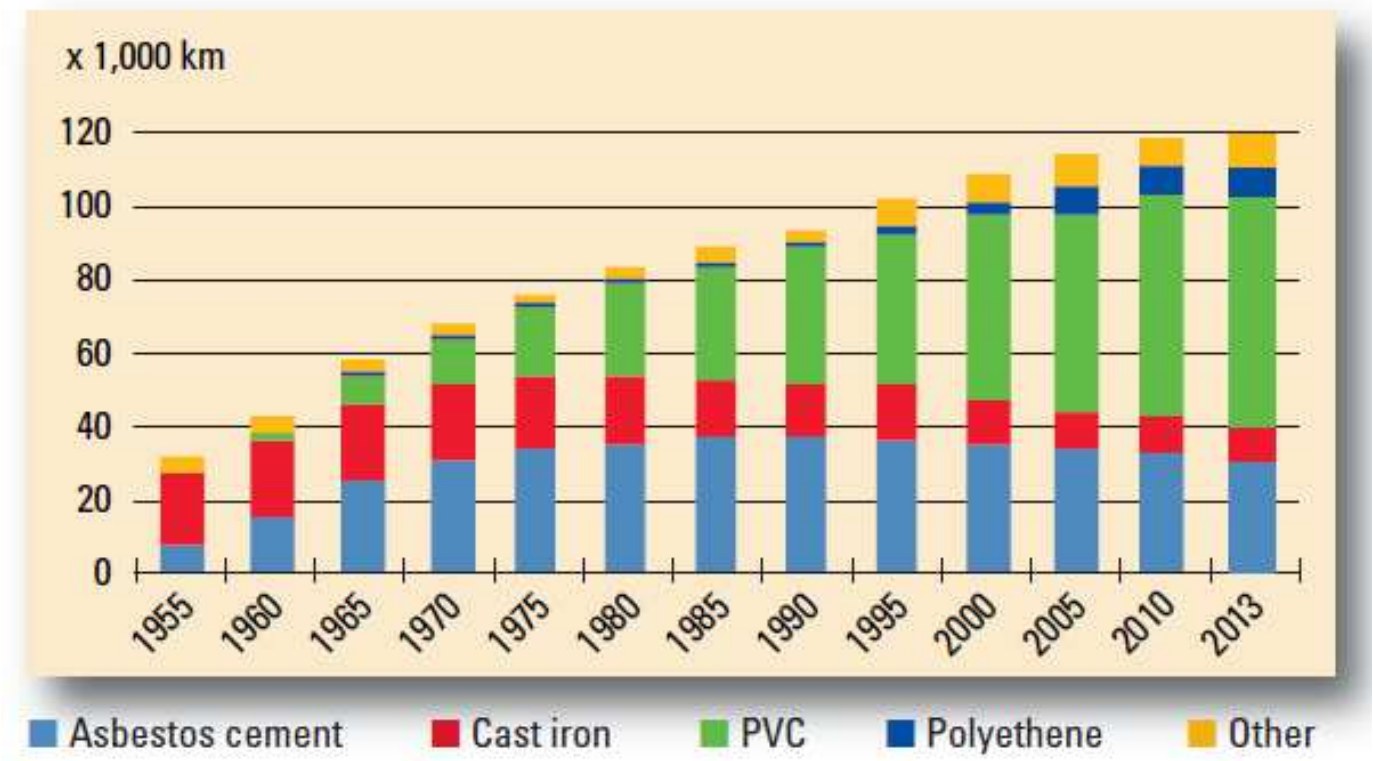
- Adequate
- Sustainable
- Customer Oriented

Waternet: some key factors

- Customers 1,2 million
- Municipalities 20
- Employees 1850
- Annual budget € 400 million = $ 450 million
- Drinking water 90 million m³/y 23,775 million gallons
- Leakage **2-3%**
- Non-revenue water 0%
- Waste water 125 million m³/y , 33,000 million gallons
- Sewage connection 100%, almost no sewage overflow, separate system
- Waste water treatment plants 12
- Sewage 4000 km, 2500 miles
- Dikes 800 km, 500 miles
- Nature (resources) 4200 hectares = 10,400 acres

waternet

Development of the drinking water network

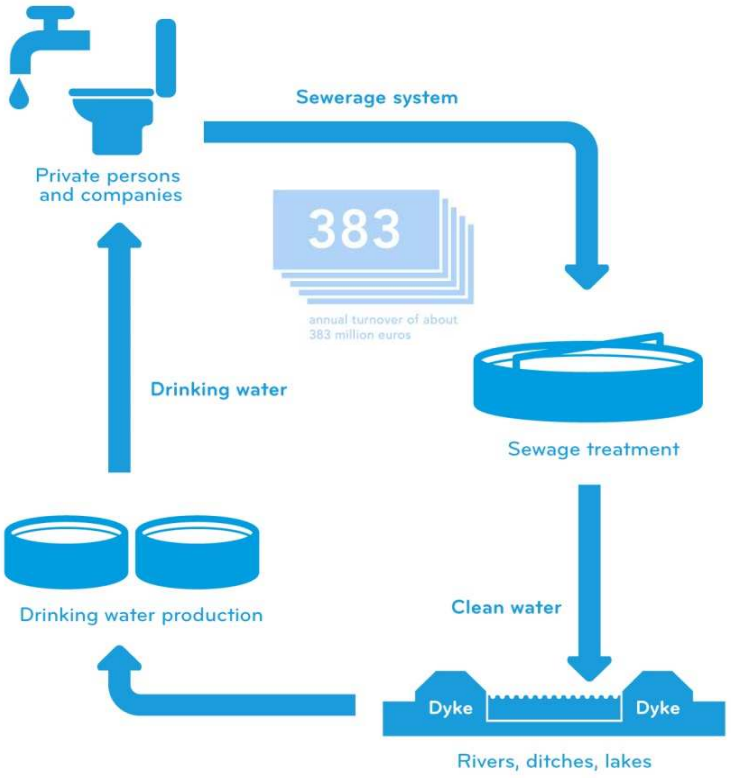


Waternet:

PVC	1000 km	30%
PE	370 km	11%
AC	90 km	3%
CI	1250 km	36%
Total	3440 km	

Core values

- Expedient
- Sustainable
- Customer oriented



Tariff

a 4 person household in 2015 has to pay:

•Watermanagement levy:	€ 142
•Waste water treatment levy:	€ 161
•Drinking water charge:	€ 205
•Sewage levy:	€ 149 +
Total watercosts:	**€ 657**
	$ 730

= total cost recovery

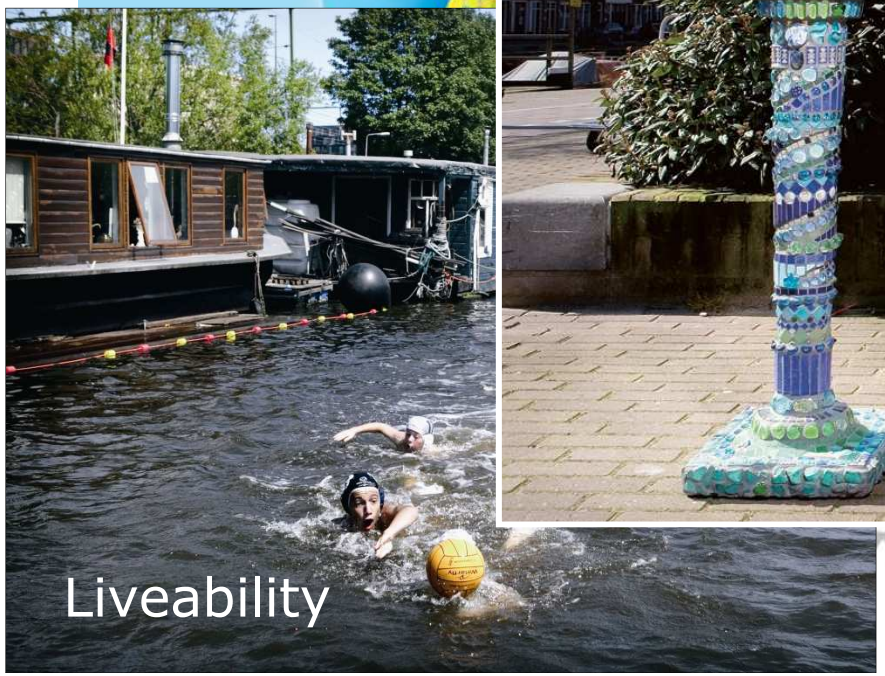
= 2% average annual income

Non profit customer service

• Satisfied customers	83%
• Brand awareness	91%

waternet

Present challenge: Connecting water



Biological Proces

- Main problem: regrowth of bacteria
- Two generic approaches:
  - Use of a persistent disinfectant
  - Production and distribution of hygenically safe and biologically stable drinking water without persistent disinfectant: the Dutch approach

The Dutch approach

- Hygienically safe water: no pathogens
- Biologically stable water: no regrowth →

  Water:

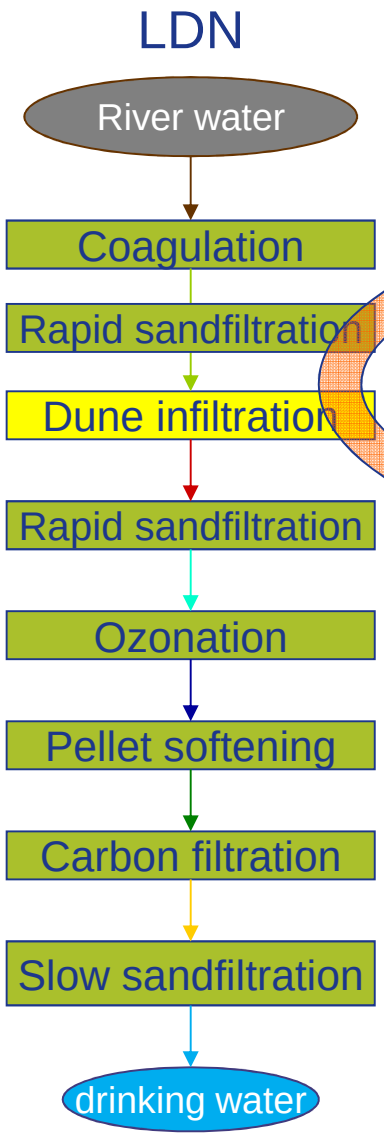
  - AOC = assimilable organic carbon < 10 µg/l
  - BFR = biofilm formation rate < 10 pg ATP/cm^2.d

  Materials:

  - No regrowth promoting materials

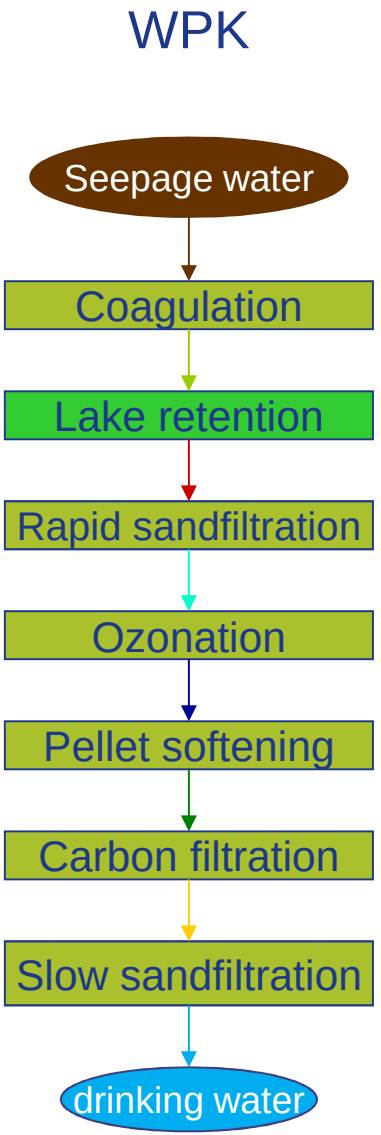
- EU harmonization: 2025(?)

Treatment philosophy for water quality

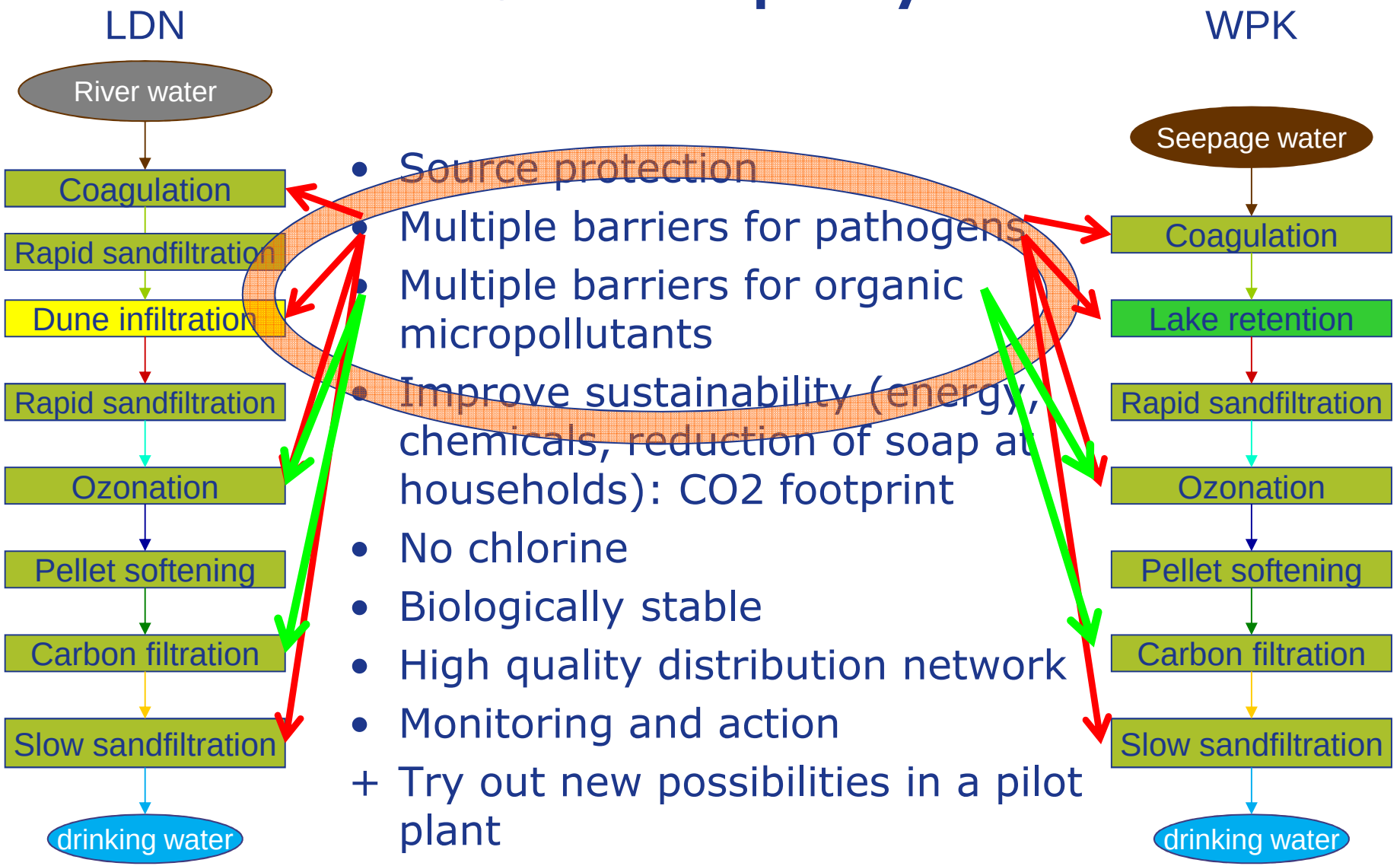


- Source protection
- Multiple barriers for pathogens
- Multiple barriers for organic micropollutants
- Improve sustainability (energy, chemicals, reduction of soap at households): CO2 footprint
- No chlorine
- Biologically stable
- High quality distribution network
- Monitoring and action

\+ Try out new possibilities in a pilot plant



Treatment philosophy for water quality



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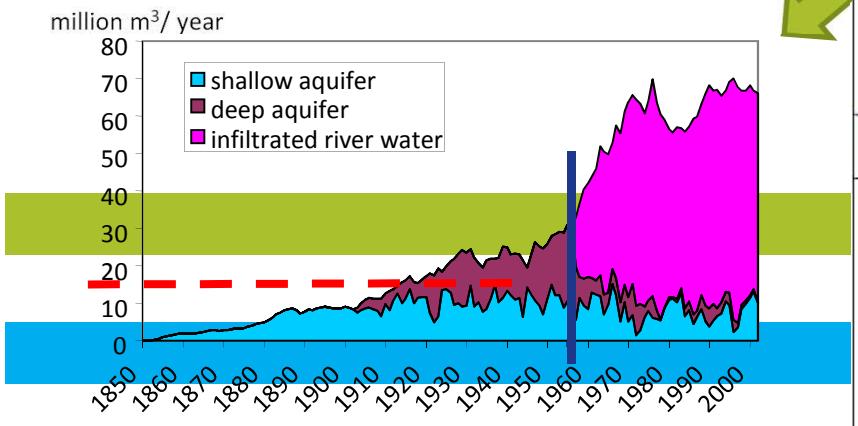
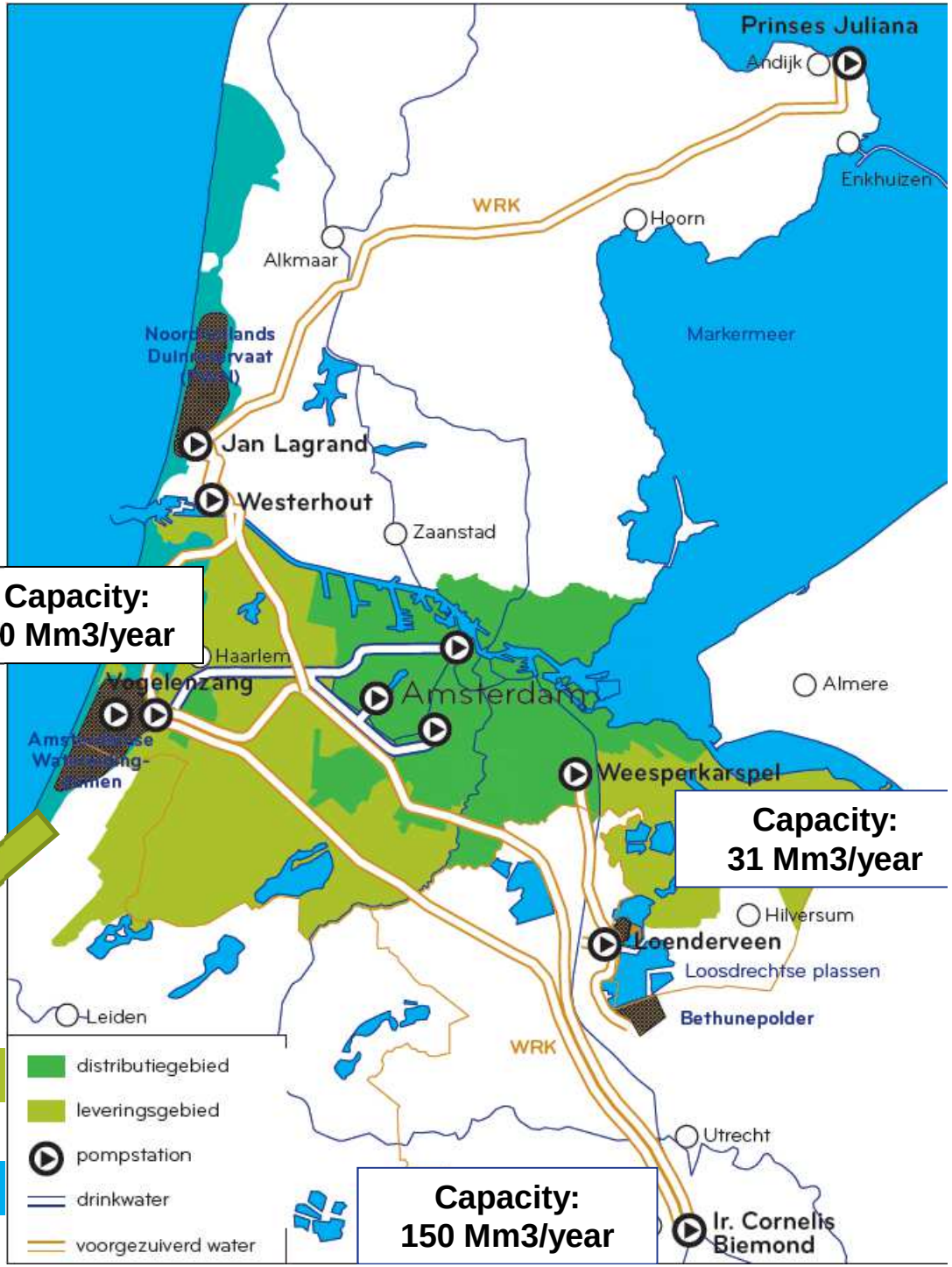
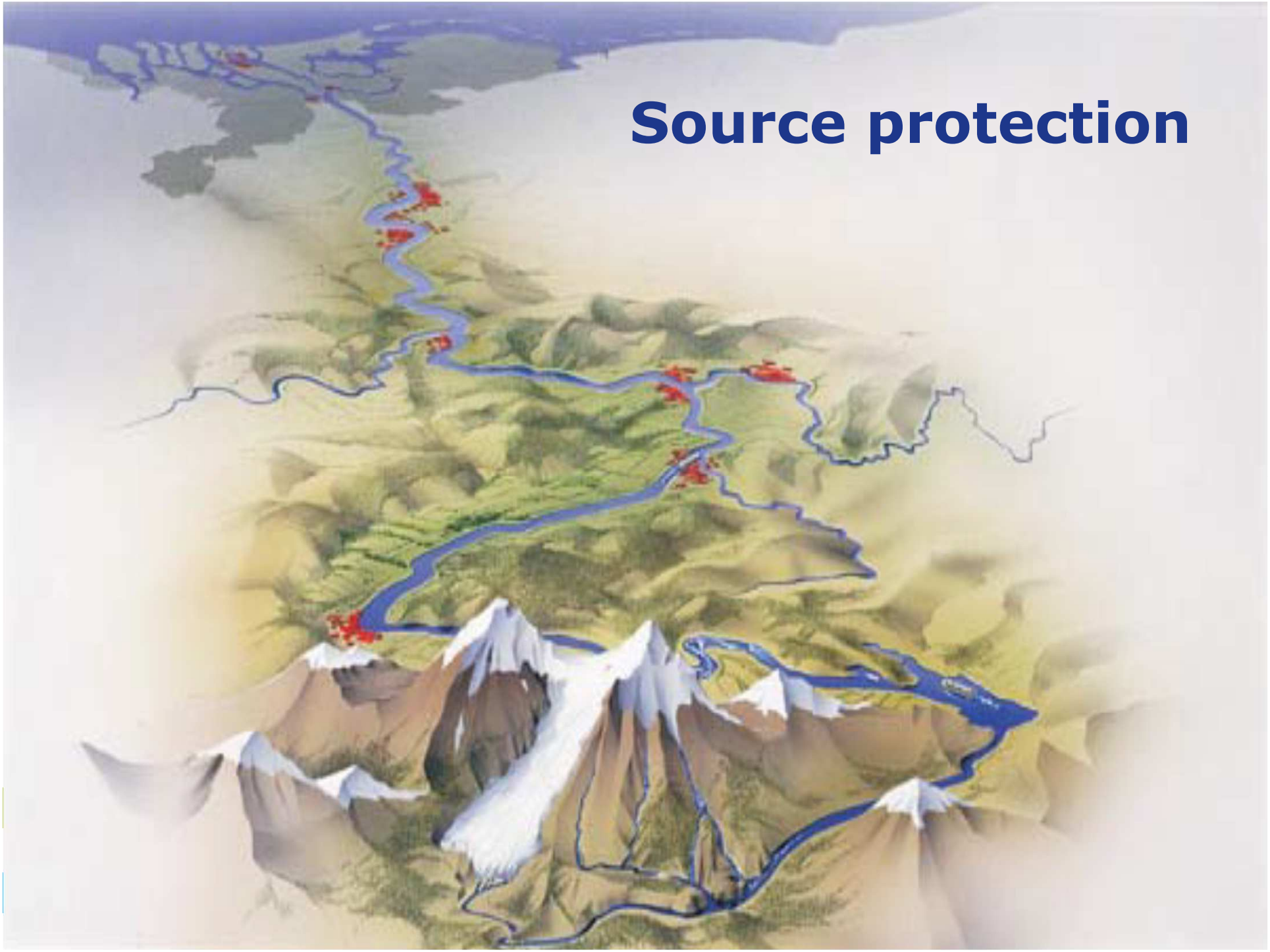
Artificial recharge (since 1957)

Drinking water & nature management



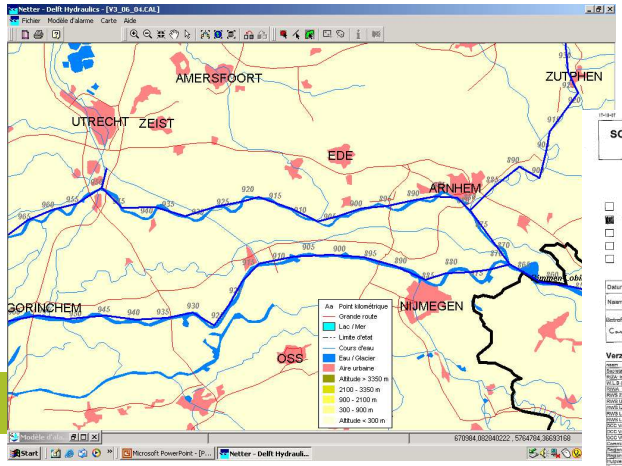


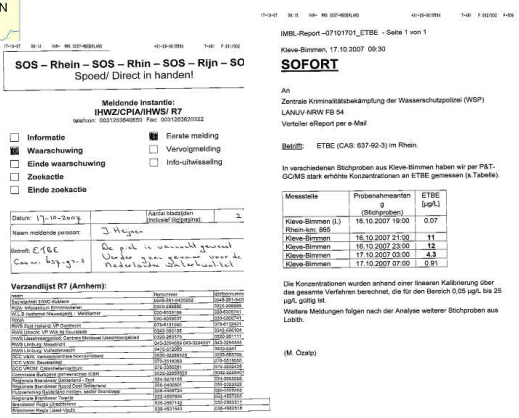
Source protection



International warning system

- Permanently manned stations
- Spillings in simulation model
- Expected time and concentration via hotline to regional/national/international water authoroties downstream
- Chemical monitoring and biological warning




SOS – Rhein – SOS – Rhin – SOS – Rijn – SO
Spoed/ Direct in handen!

IMBL-Report –07101701_ETBE - Seite 1 von 1

Kleve-Bimmen, 17.10.2007 09:30

SOFORT

An
Zentrale Kriminalitätsbekämpfung der Wasserschutzpolizei (WSP)
LANUV NRW FB 54
Verteiler eReport per e-Mail

Betrifft: ETBE (CAS: 637-92-3) im Rhein.

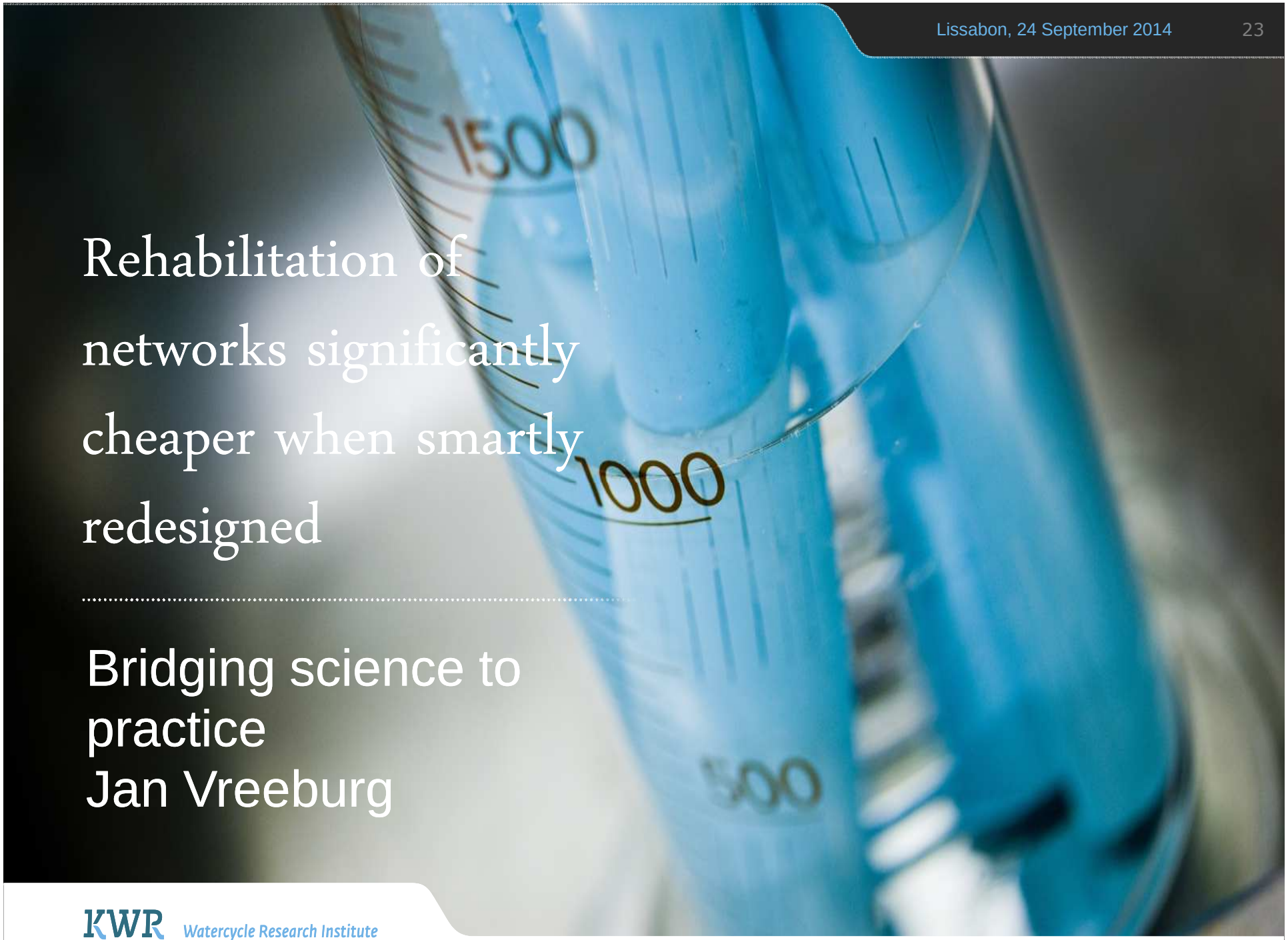
In verschiedenen Stichproben aus Kleve-Bimmen haben wir per P&T-GC/MS stark erhöhte Konzentrationen an ETBE gemessen (s.Tabelle).

Messstelle	Probenahmeanfang (Stichproben)	ETBE [µg/L]
Kleve-Bimmen (L)	16.10.2007 19:00	0.07
Rhein-km: 865		
Kleve-Bimmen	16.10.2007 21:00	11
Kleve-Bimmen	16.10.2007 23:00	12
Kleve-Bimmen	17.10.2007 03:00	4.3
Kleve-Bimmen	17.10.2007 07:00	0.91

Die Konzentrationen wurden anhand einer linearen Kalibrierung über das gesamte Verfahren berechnet, die für den Bereich 0,05 µg/L bis 25 µg/L gültig ist.

Weitere Meldungen folgen nach der Analyse weiterer Stichproben aus Lobith.

(M. Özalp)



Rehabilitation of networks significantly cheaper when smartly redesigned

Bridging science to practice

Jan Vreeburg

Lead in drinking water

- Toxic and undesirable
- Neuroligical damage at lifetime exposures
- Most threatened group: Small babies fed with powdered milk

- Situation in the Netherlands:
- Leadnorm till end of nineties: 50 ppb
  - Treatment of water (softening and pH increase
- leadnorm now: 10 ppb.
  - Replacement of lead connection pipes
  - Stimulation of lead replacement in houses
  - Targeted eductation of young mothers in old city areas through baby health care system

Lead in drinking water

Replacement Lead pipes Amsterdam

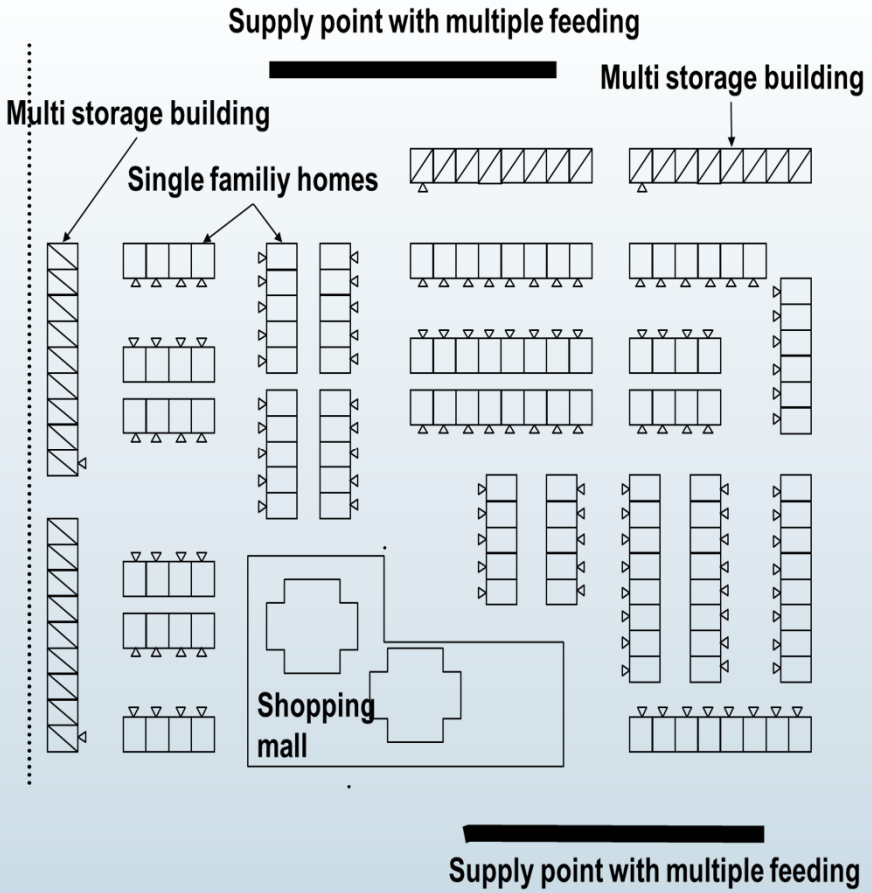
- 1995-2000
- 13.000 lead pipes in old city districs
- By Contracters
- Pipes in the house, responsibility house owners (advise: use toilet before consume)
- Communication, stimulation
  - Waternet,
  - Munipality Build Environment Dept
  - Ministry of Environment (subsidy house owners)

Some short cuts for the Flint situation
"Dutch direct"

- Multiple problems:
  - Ageing network
  - Decreasing population
  - Compromised trust in water company
  - New major source change coming up
- Acute problem managed by dosing orthophosphate
- Long term solution is needed, both in network as in installation

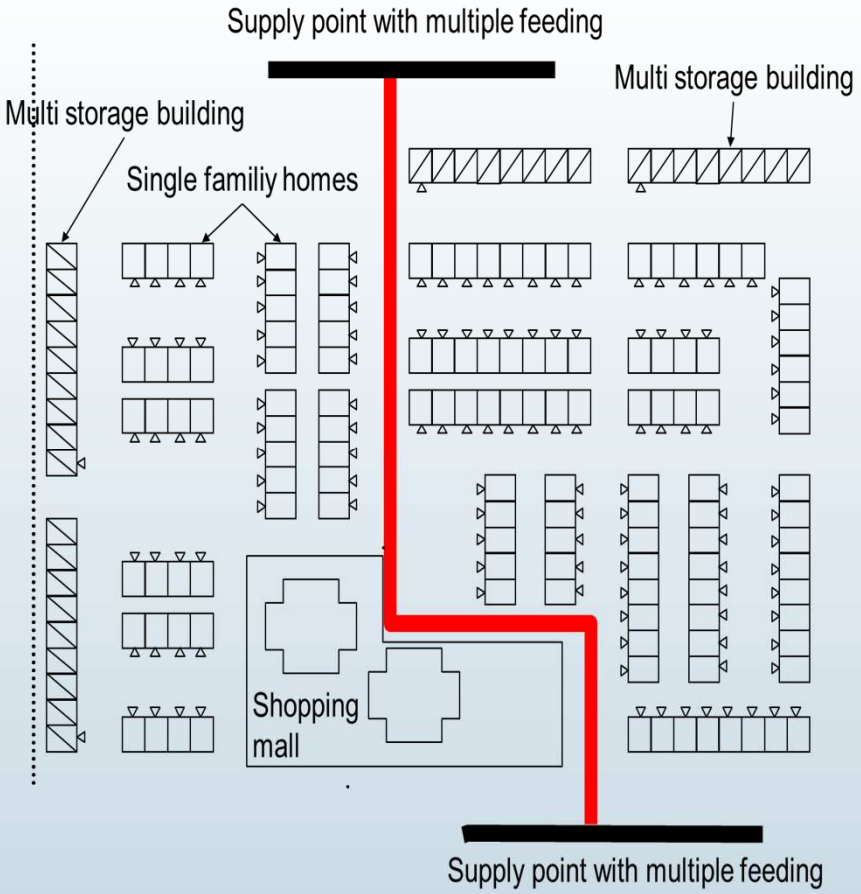
Conventional Network
The suppply area

- An area with low and medium high buildings
- One ‘special’ location (shopping mall)
- Two independent feeding point located on Primary or Secondary Network



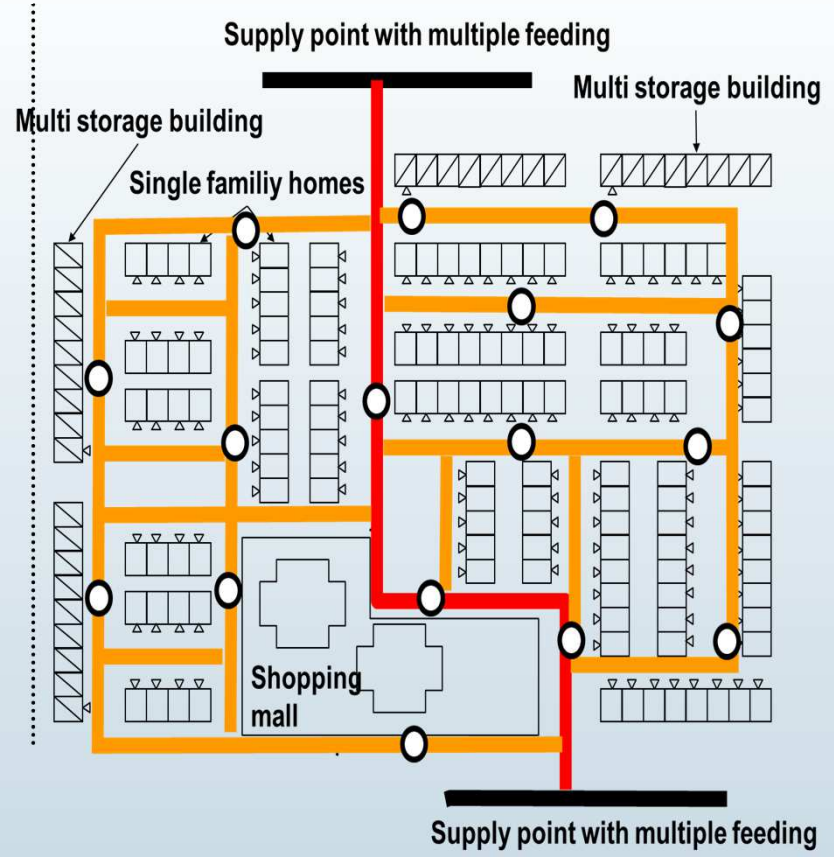
Conventional Network

- The Secondary network



Conventional Network

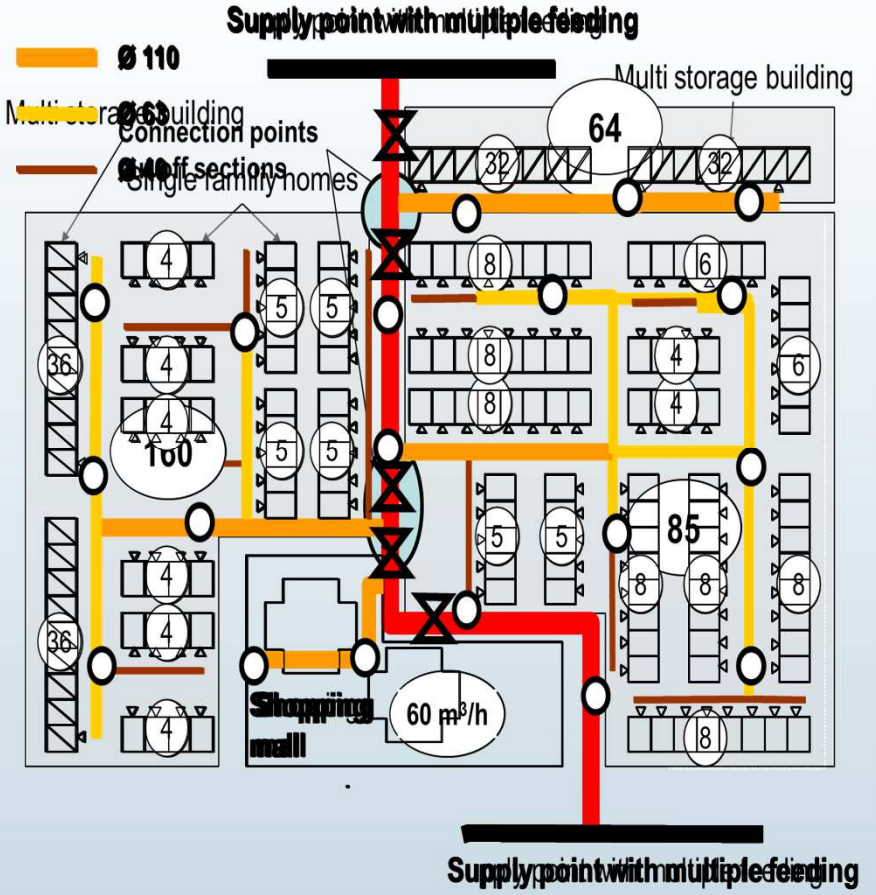
- The Distribution Network and the hydrants



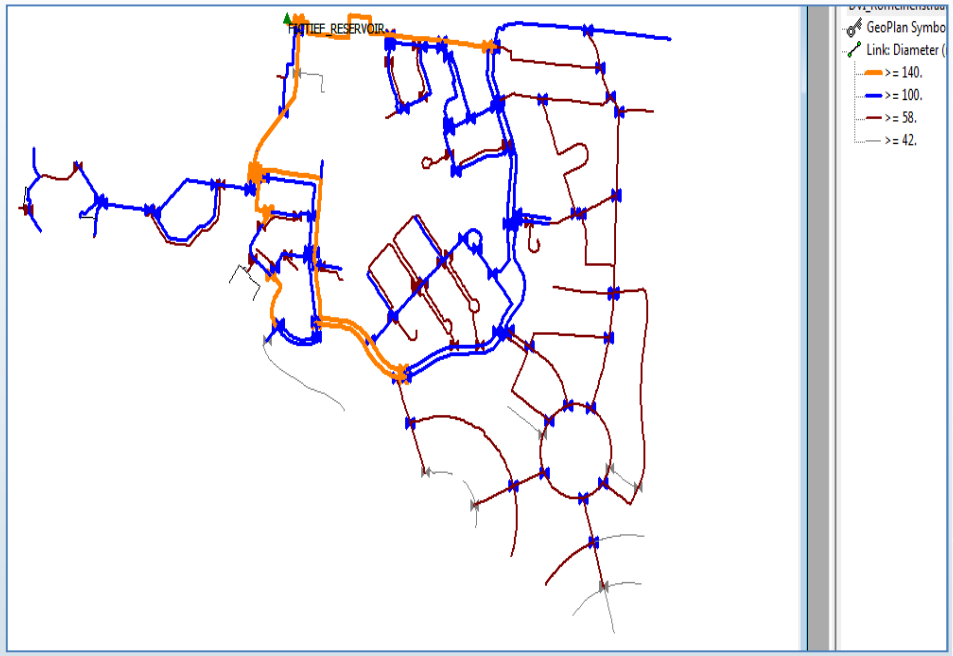
Self Cleaning Network

Up till the Secundary Network the same

- Design the sections
- First design
- Second design with critical hydrant
- Final design with hydrants and valves

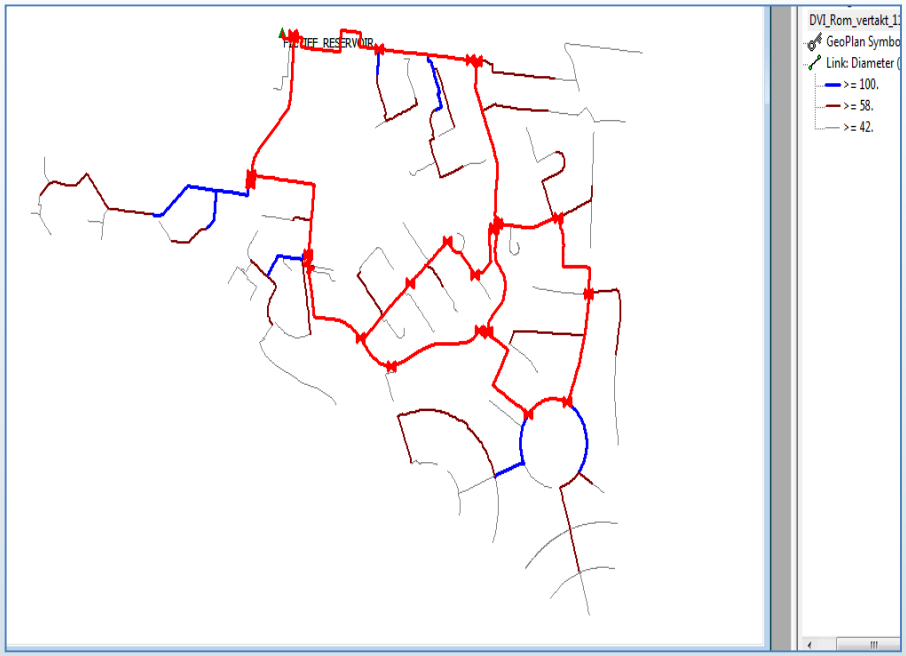


In reality
The existing conventional design



	Original
Mains Length (m)	14338
Number of Connections	985
Total Pipe Volume (m3)	110
Average residence time (h)	7.3
Number of Section isolation valves	140
Number of valve sections	96
Average number of customers per section	10,3
Number of loops	48

In reality
The blueprint of the new design



	Original	Redesigned
Mains Length (m)	14338	10783
Number of Connections	985	985
Total Pipe Volume (m3)	110	60
Average residence time (h)	7.3	4.0
Number of Section isolation valves	140	26
Number of valve sections	96	25
Average number of customers per section	10,3	39,4
Number of loops	48	3

Conclusions

- Network design criteria are not constant over time
- In network replacement, the pipe-for-pipe approach doesn't fit all new requirements
- Redesigning distribution networks (Tertiary Networks) pays off:
  - 25% shorter
  - 80% less valves
  - 45 % less volume
  - No maintenance

A lot cheaper

Suggested way forward

- Analysis of effects of new treatment
  - *Based on trials and scientific analysis*
- Target this to handling lead.
  - *Lots of experience in the Netherlands*
- Set in a policy of rehabilitation of the network
  - Re-design the network: downsizing using new insights
    - *Innovative approach self cleaning networks: same capacity networks are 30% cheaper than traditional networks (paradigm shift necessary for the water company)*
  - Advice or subsidise in rehabilitation of in house installation (one safe tap in every home)
    - Coating is mostly no option because of bends in the pipes and very small diameter.