Introduction to Aarhus Vand A/S

Operations, investments, technologies & challenges

Webinar, December 17th 2020

Marmara Union of Municipalities, Royal Danish Consulate General and Turkish Union of Municipalities

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Aarhus Vand A/S

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Agenda

Subjects of Interest:

1. Water supply and drinking water treatment systems – New WTP and water storage tanks

2. Efficient water distribution and management of transmission pipelines – Automization and Artificial Intelligence in the water supply network, NRW reduction, advanced pipeline rehabilitation management (Asset Management)

3. Subscription management – Tariffs & cost recovery

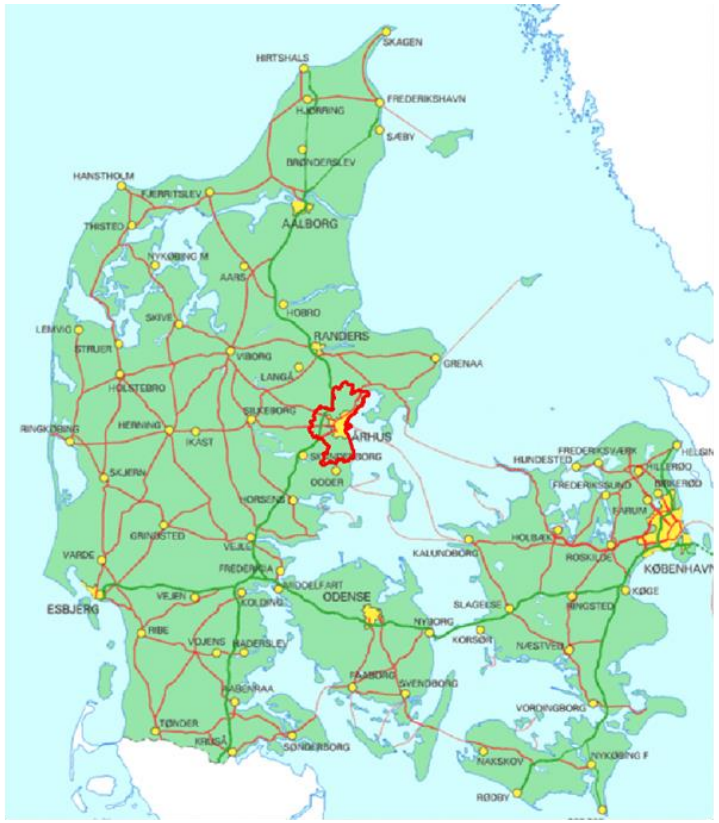
4. Wastewater treatment systems according to the discharge point – The energy positive WWTP

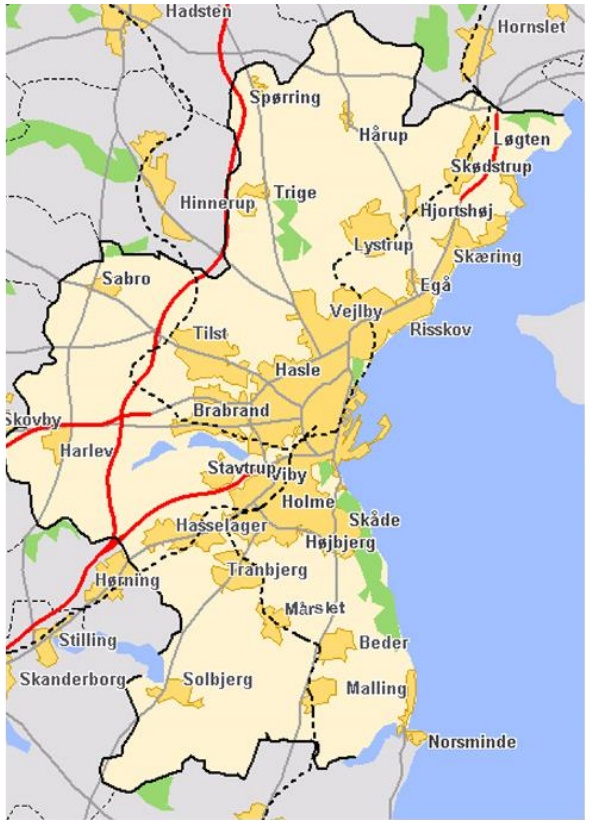
5. Digital tracking technologies: Scada systems, Geographic Information Systems etc. – GIS for Burst registration & Pipeline Asset Management

6. Good water quality and protection practices for sensitive areas –protection of the groundwater resource

7. Strategic water/basin management, water budget management and action plans for fighting against drought – Groundwater mapping and water resource modelling and management, rainwater harvesting

Settings of Aarhus





Area	43.000 km^2		468 km^2
Population	5.5 mio		0.3 mio
Population density	127 /km^2		629 /km^2

Introduction

Our purpose is to create health through the supply of clean water – for people and the planet

Our vision is to create a national platform as a driver for local and global solutions for a healthier water cycle

Our mission is to offer and develop resource-efficient services throughout the entire water cycle, creating a climate-adapted, sound environment, growth and export, all of which will be of benefit to customers and stakeholders

We adopt water knowledge by

- A holistic approach to the entire water cycle
- Forming innovation partnerships
- Forming international alliances that support knowledge exchange around intelligent, sustainable and efficient water solutions
- Operating and developing state of the art resource recovery plants that recover resources and produce energy from wastewater
- Protecting groundwater to ensure future high quality and safe water supplies
- Automating and digitalizing in order to achieve an intelligent efficient water system
- Separating storm water from wastewater

Key figures

230
competent and dedicated employees

15
mio. m^3 of drinking water a year

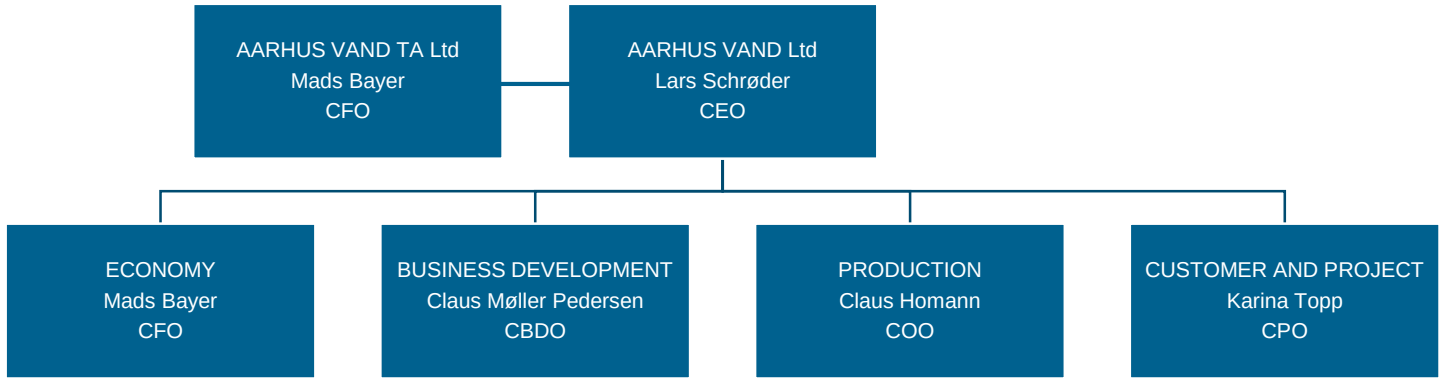
30
mio. m^3 of purified wastewater a year

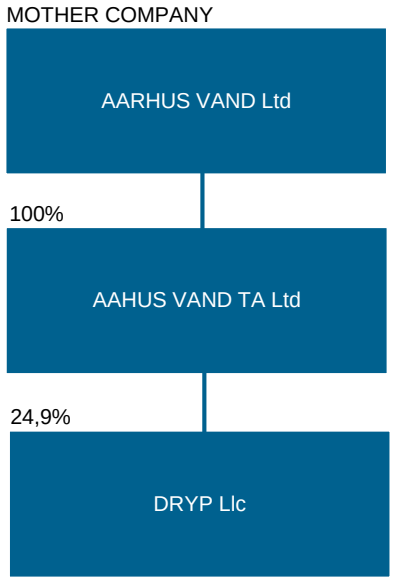
1,500
kilometres of pipeline network

2,800
kilometres of mains network

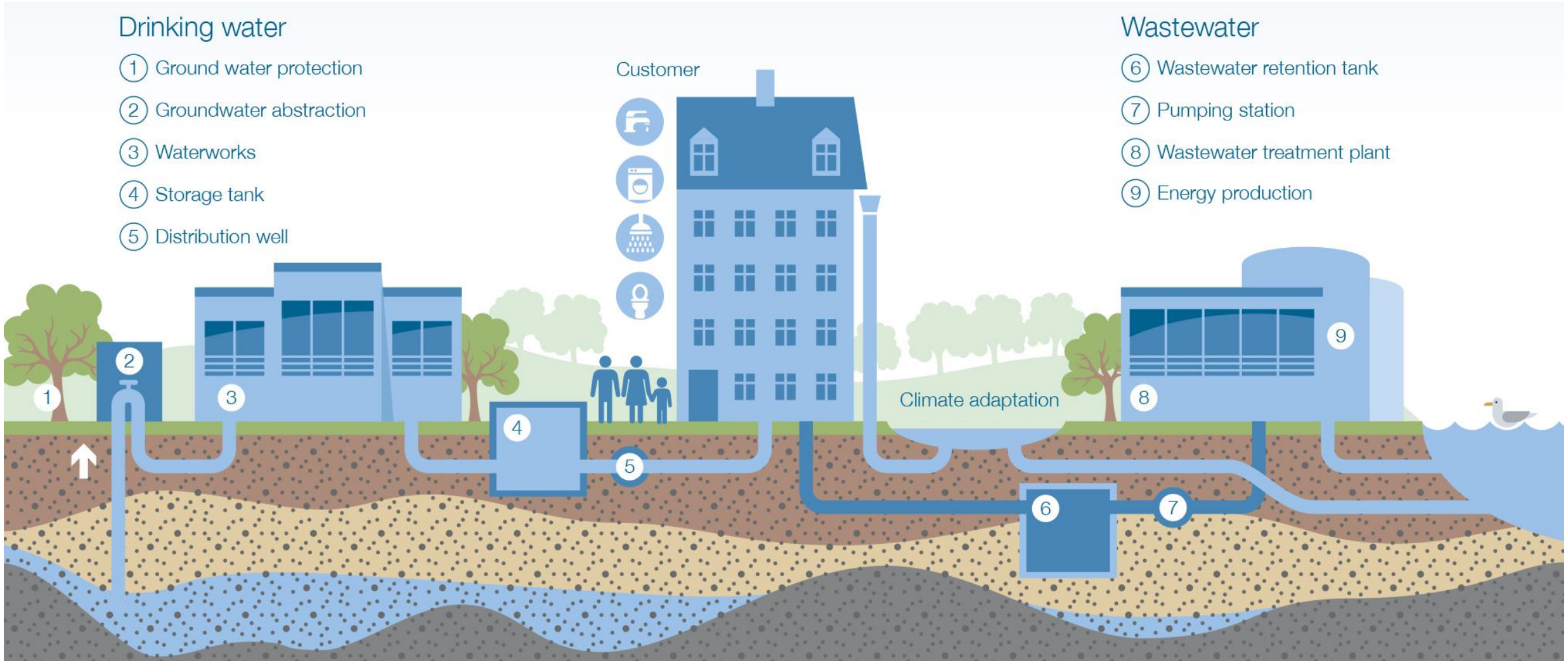
350,000
citizens in Aarhus Municipality

Company structure



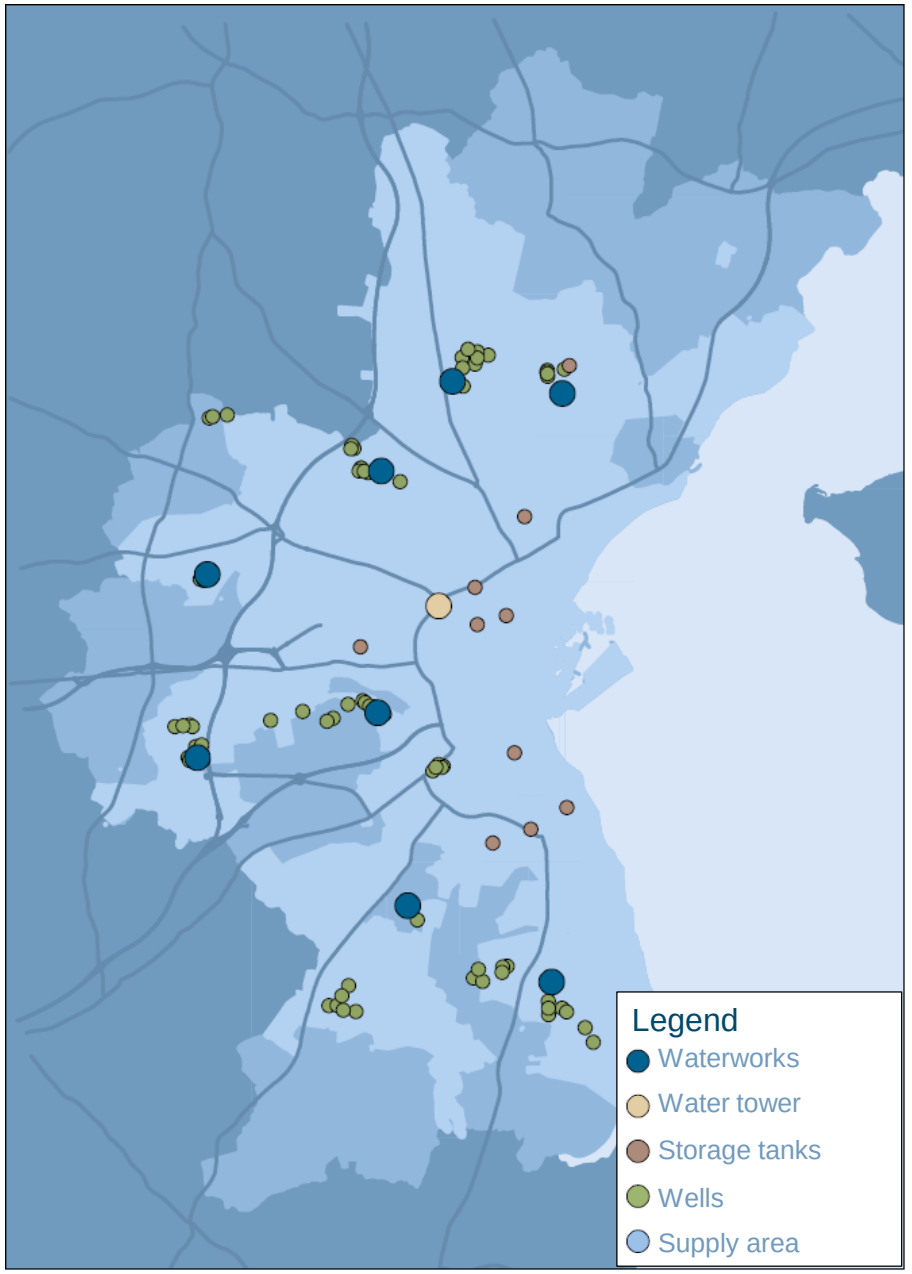


Operator of the water cycle



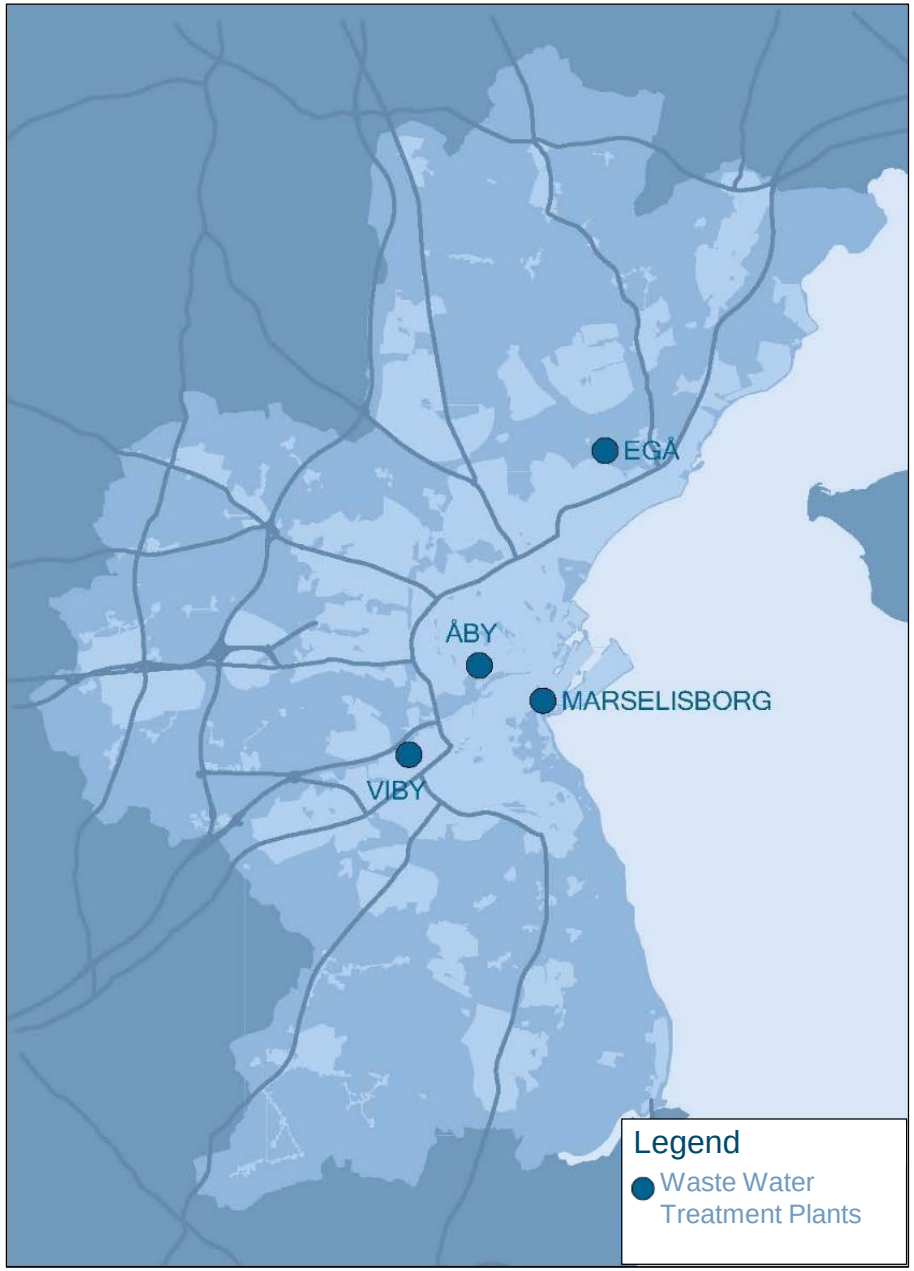
Drinking water

- 85% of inhabitants in Aarhus Municipality
- 275.000 customers
- 15.000.000 m^3/year
- 1.500 km supply lines
- 90 production wells
- 8 waterworks
- 11 elevated storage tanks/pumping stations
- 1 water tower
- 62.000 water meters



Wastewater

- 95 % of inhabitants in Aarhus Municipality
- 335.000 customers
- 460.000 PE load/year
- 30 - 35.000.000 m³/year
- 2.800 km of mains
- 4 waste water treatment plants
- 100 pumping stations
- 2 Phosphorus recovery plant
- 26 % combined system
- 1.400.000 m³ volume for rainwater
- 120.500 m³ volume for wastewater retention

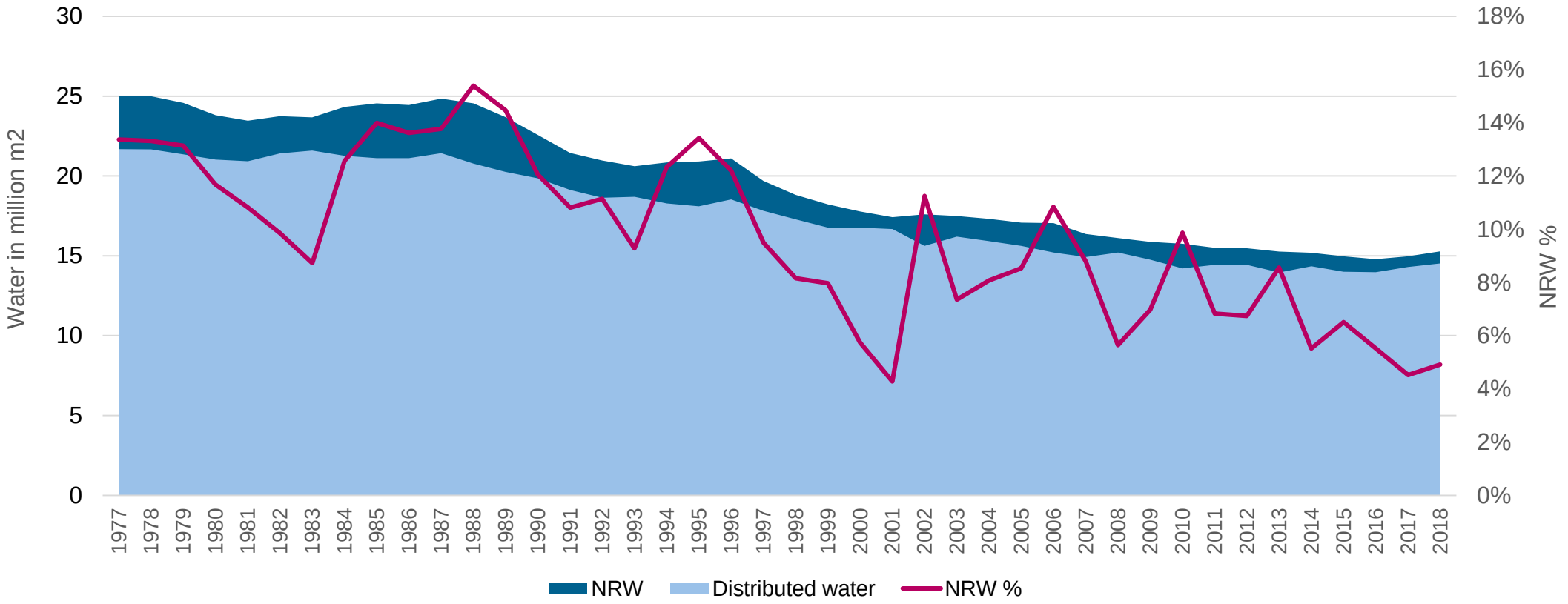


Water tariffs 2020

Elements of the water tariffs	DKK/m³	EUR/m³	TRY/m³
Production of drinking water	8,14	1,09	10,42
Wastewater treatment	22,62	3,03	28,94
Government water tax	6,37	0,85	8,15
VAT	9,28	1,24	11,87
Total water price per m3 incl. VAT	46,41	6,21	55,39

- Average per capita comsumption 99 l/pers/day
- Complete vost recovery by the tariffs, including operations, investments and re-investments
- All larger Danish water utilities are subject to benchmarking and annual savings on OPEX/CAPEX of around 2%

Non-Revenue Water in Aarhus

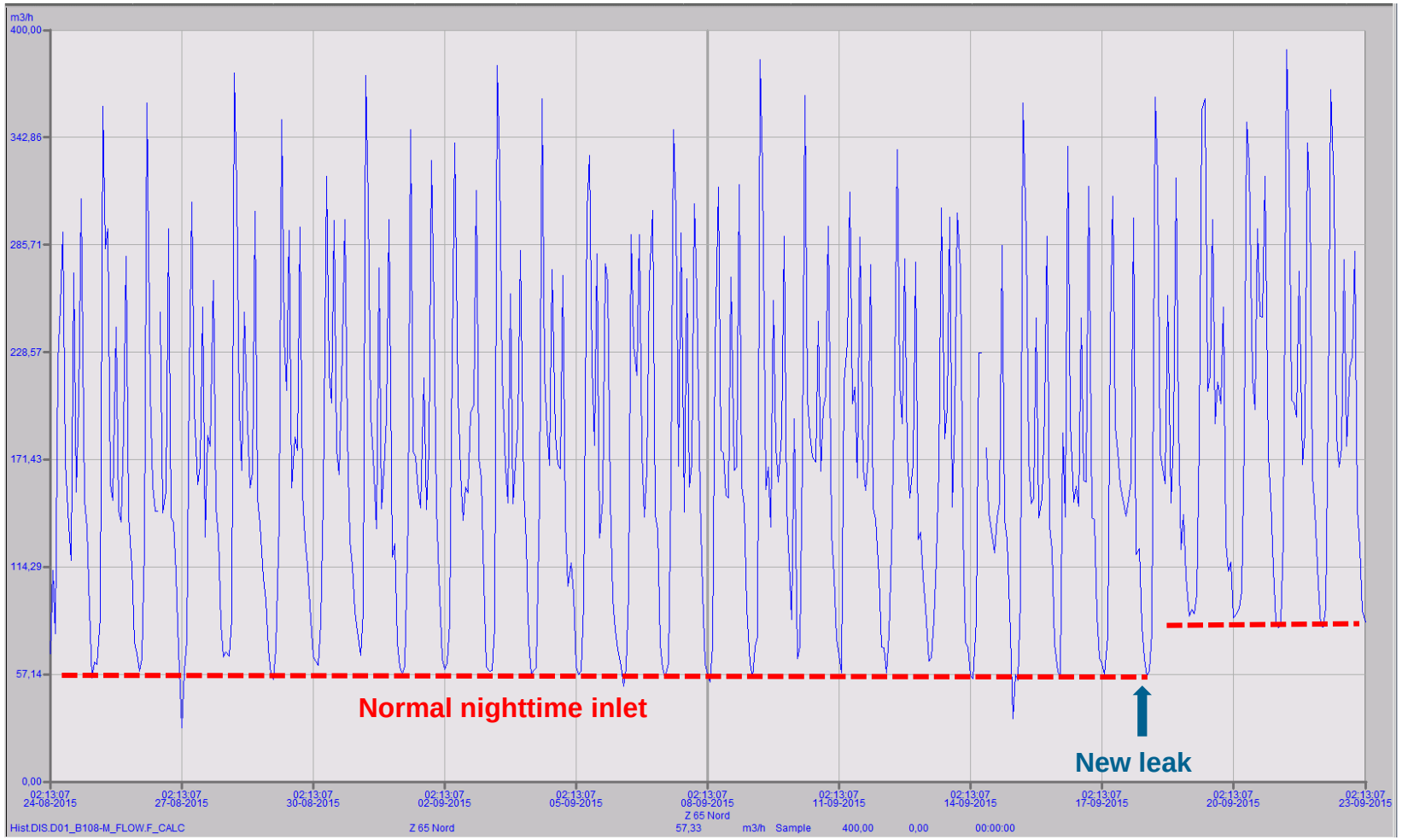


Technologies

Selected activities

NRW reduction – Use of DMAs & Night Time consumption

- Look for change in night-time water consumption
- Calculate an expected nighttime consumption to compare (at 2 – 4 AM)



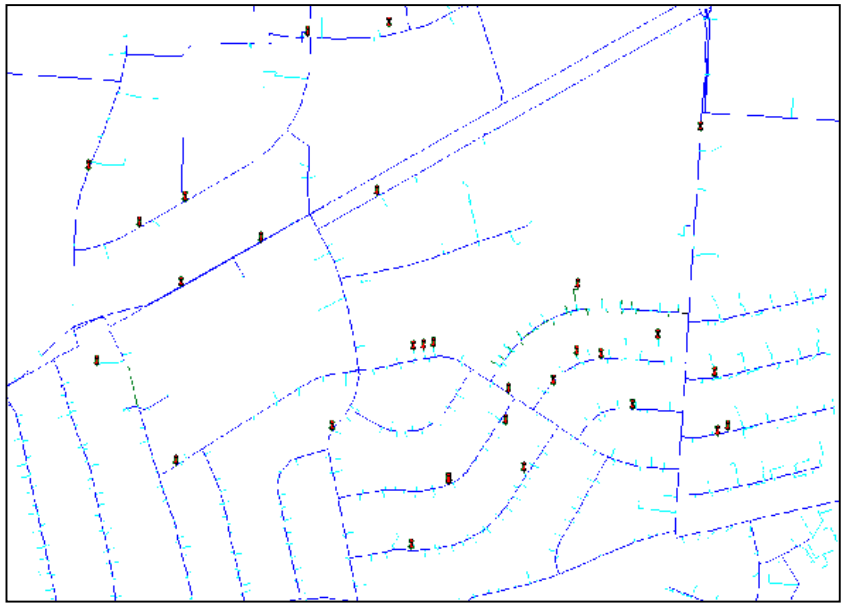
Mobile leak detection

- 80 % reduction in time spent searching for leaks
- The principle is the same as DMA (District Metering Areas) - isolation an area and measure the consumption from a mobile water source
- The method has proven itself in the last 4 years
- The method I patented by Aarhus Vand

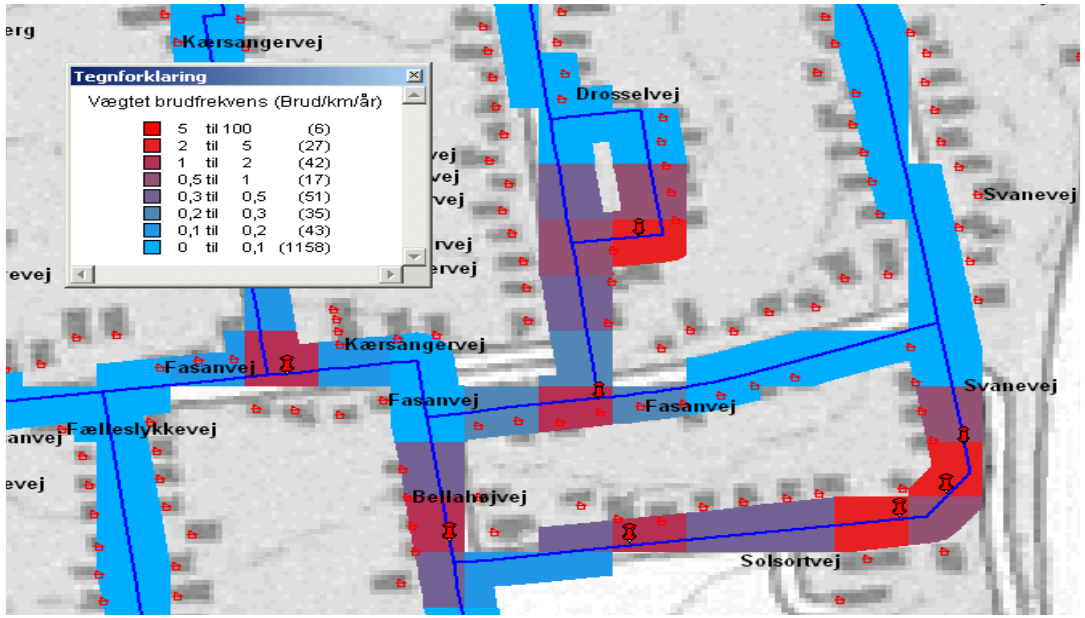
Use of burst registration

- GIS-visualisation of bursts and information
- Spatial evaluation of hot spots
- Calculation of spatial burst ratios
- Statistical analysis by material, year laid etc.

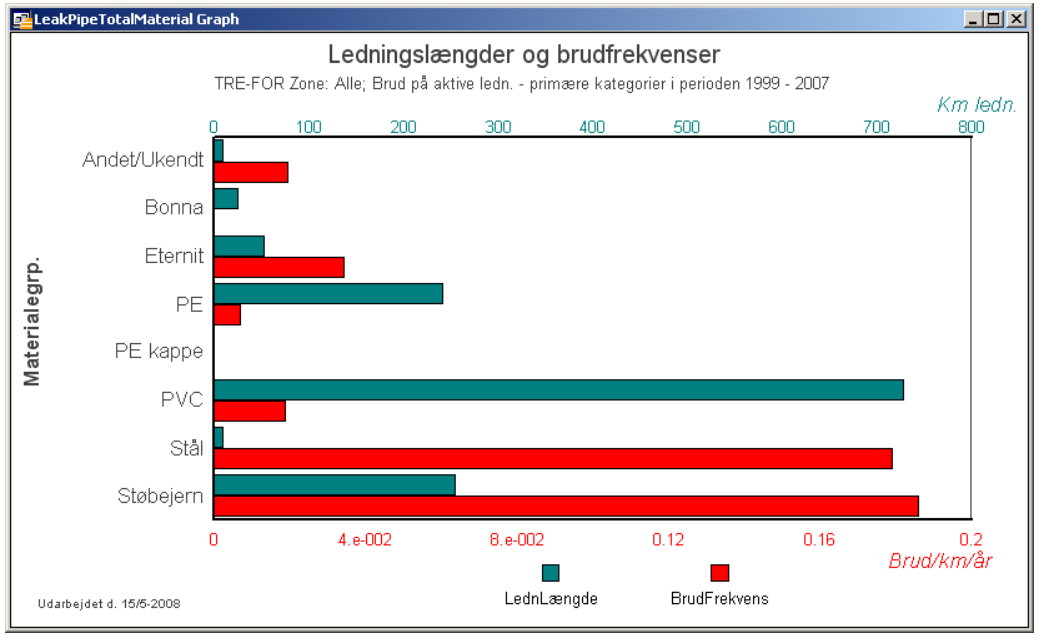
Burst report registration



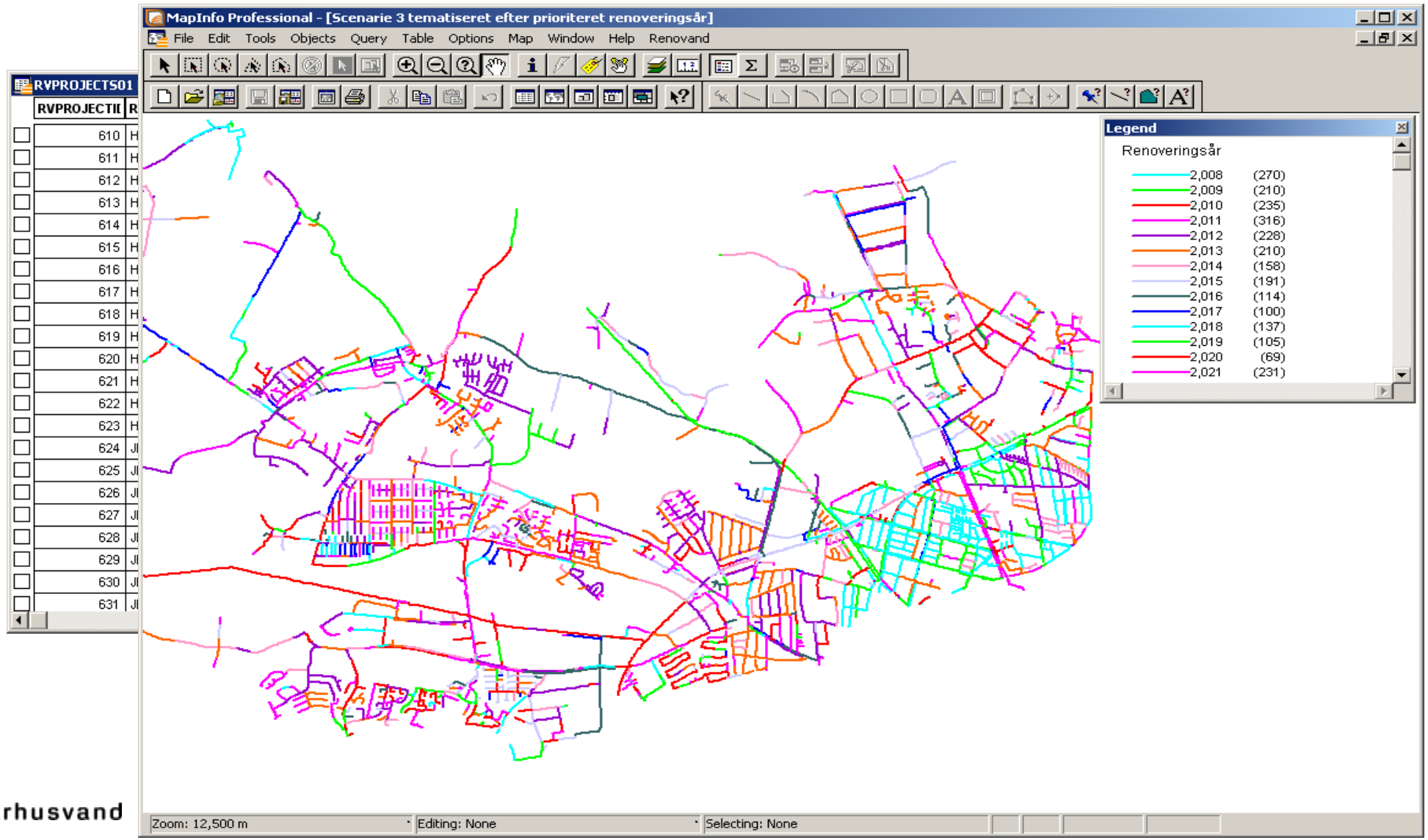
Burst ratio – hot-spots



Burst ratio by material



Planning of rehabilitation investments



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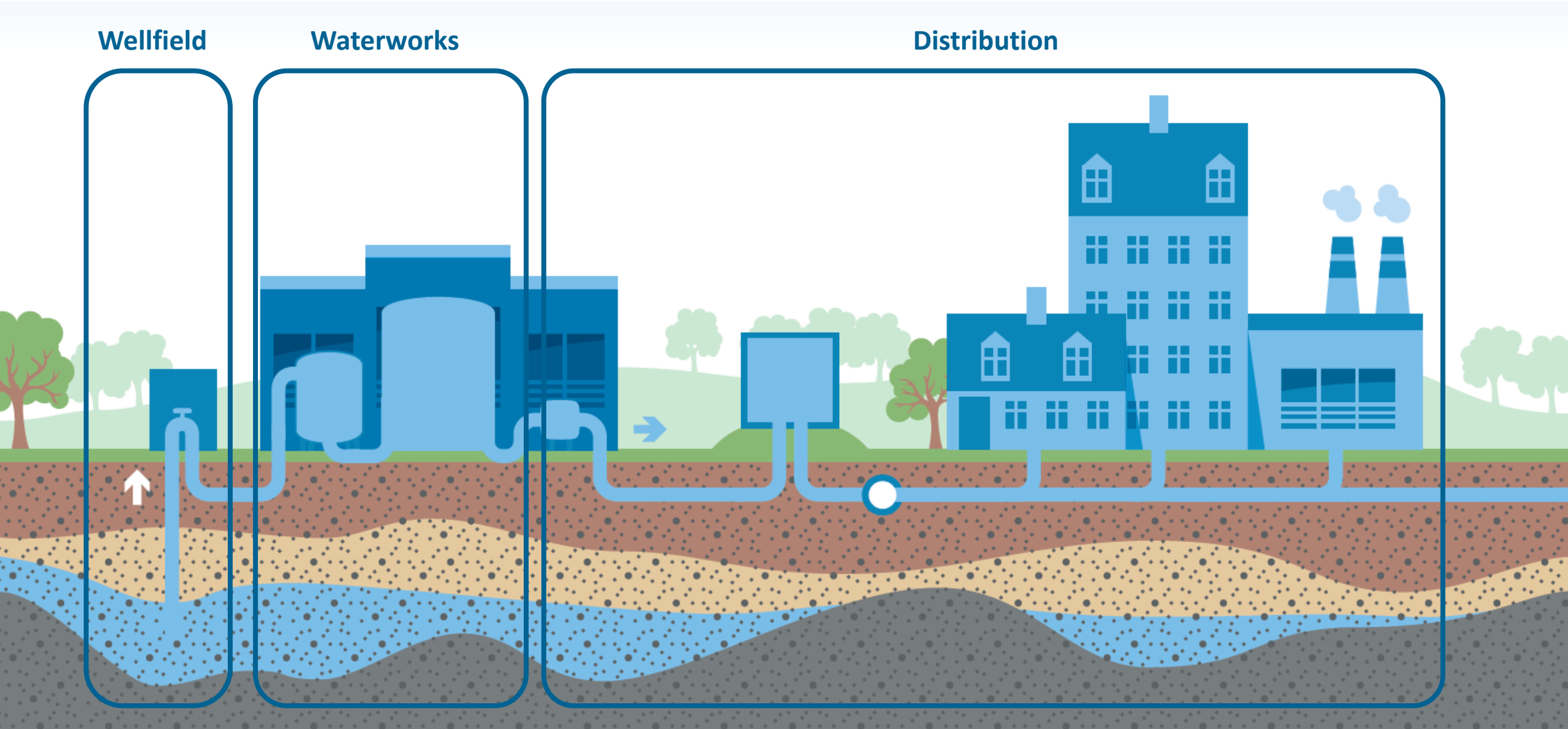
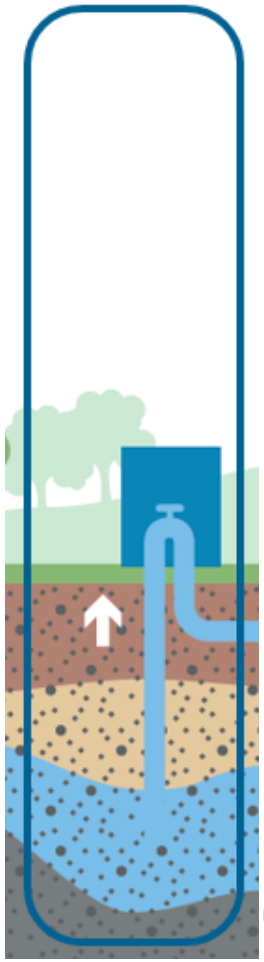
Automation; From source to tap

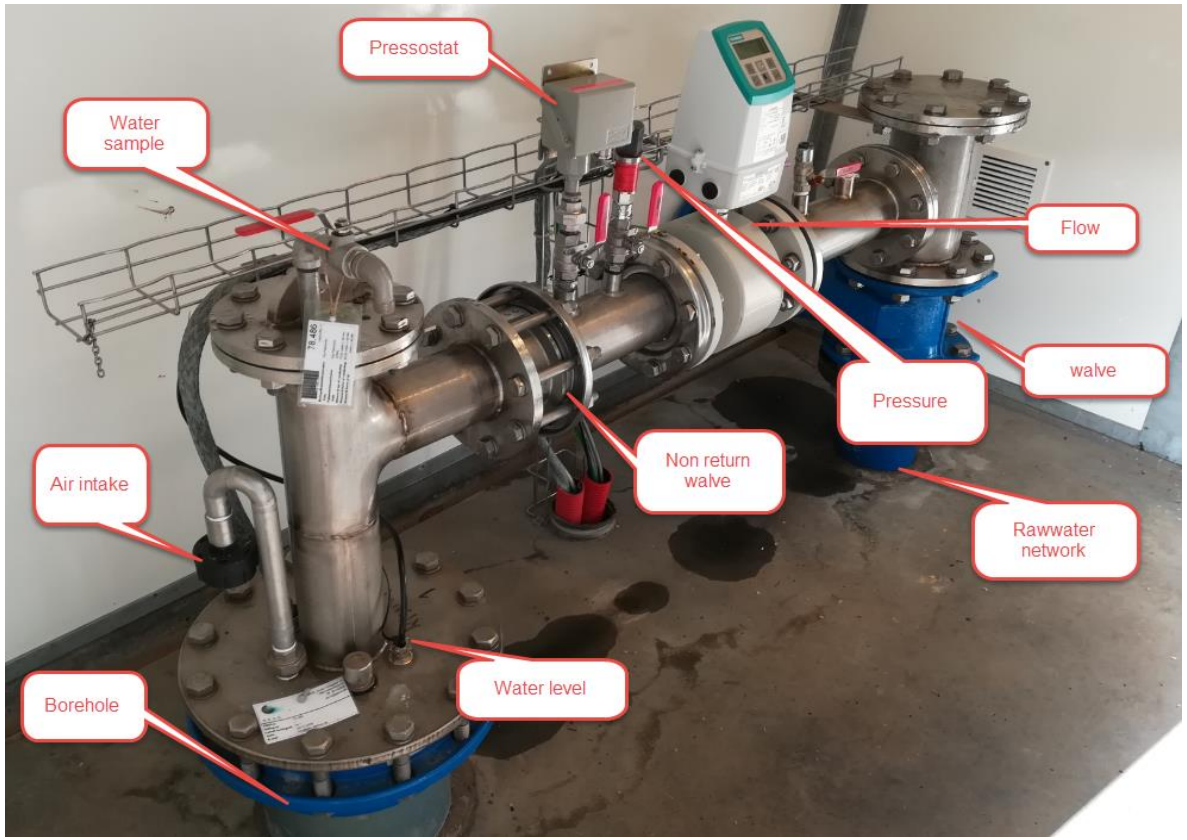
1: Abstraction
2: Aeration
3: Filtration
4: Storage tank
5: Booster pumps
6: DMA metering
7: Consumption

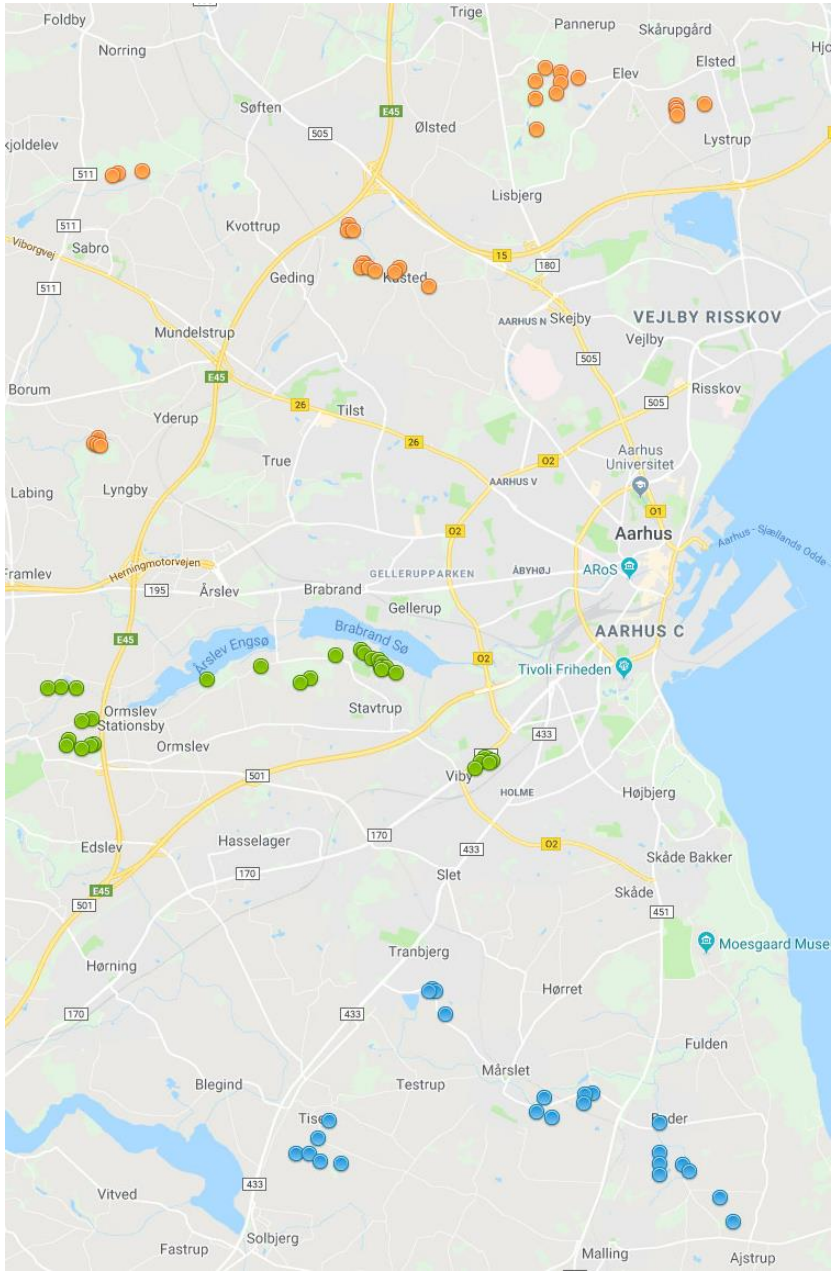
From source to tap



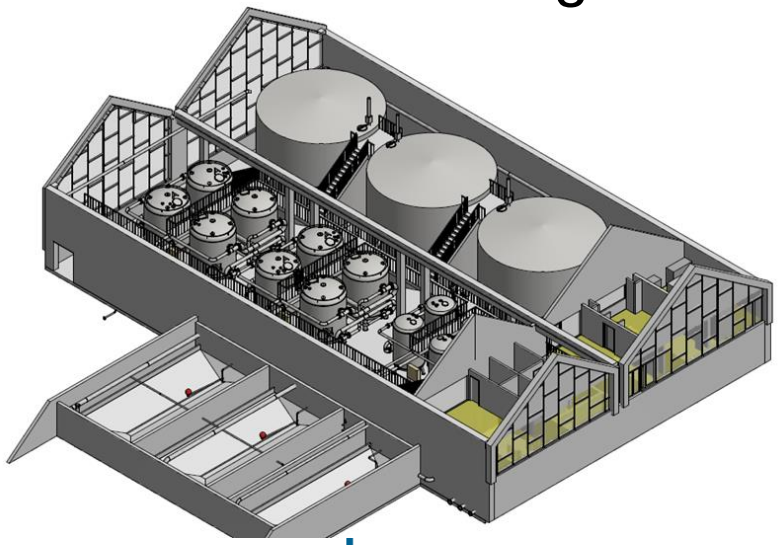
Wellfield

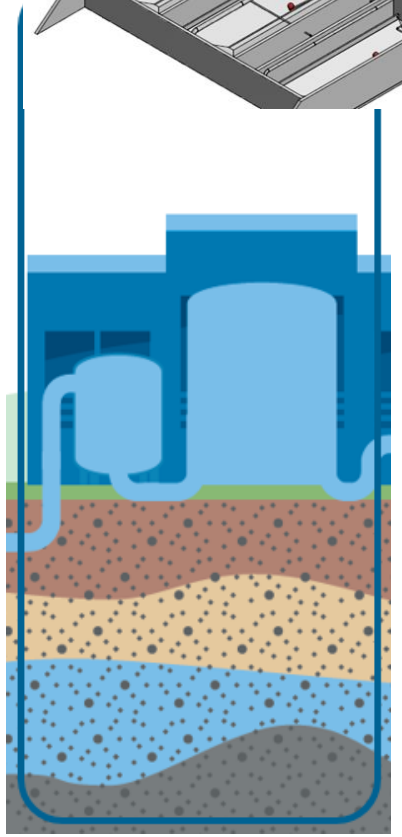



Pressostat
Water sample
Flow
walve
Pressure
Non return walve
Air intake
Rawwater network
Water level
Borehole

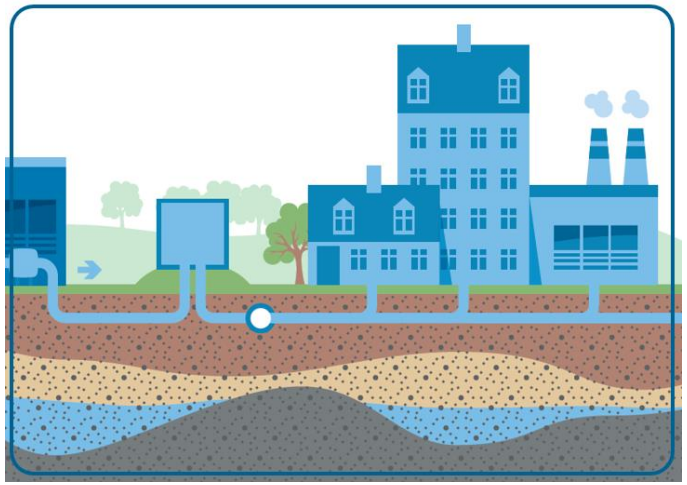

Foldby
Trige
Pannerup
Skårupgård
Norring
Elsted
Elev
Søften
Ølsted
Lystrup
Lisbjerg
Kvottrup
Sabro
Geding
Mundelstrup
VEJLBY RISSKOV
Vejlby
Risskov
Borum
Yderup
Tilst
Aarhus Universitet
True
Labing
Lyngby
Aarhus
ARoS
Brabrand
Gellerup
AARHUS C
Tivoli Friheden
Ormslev Stationsby
Stavtrup
Ormslev
Viby
Højbjerg
Edslev
Hasselager
Slet
Skåde Bakker
Skåde
Moesgaard Muse
Tranbjerg
Hørning
Hørret
Fulden
Blegind
Testrup
Mårslet
Vitved
Fastrup
Solbjerg
Malling
Ajstrup

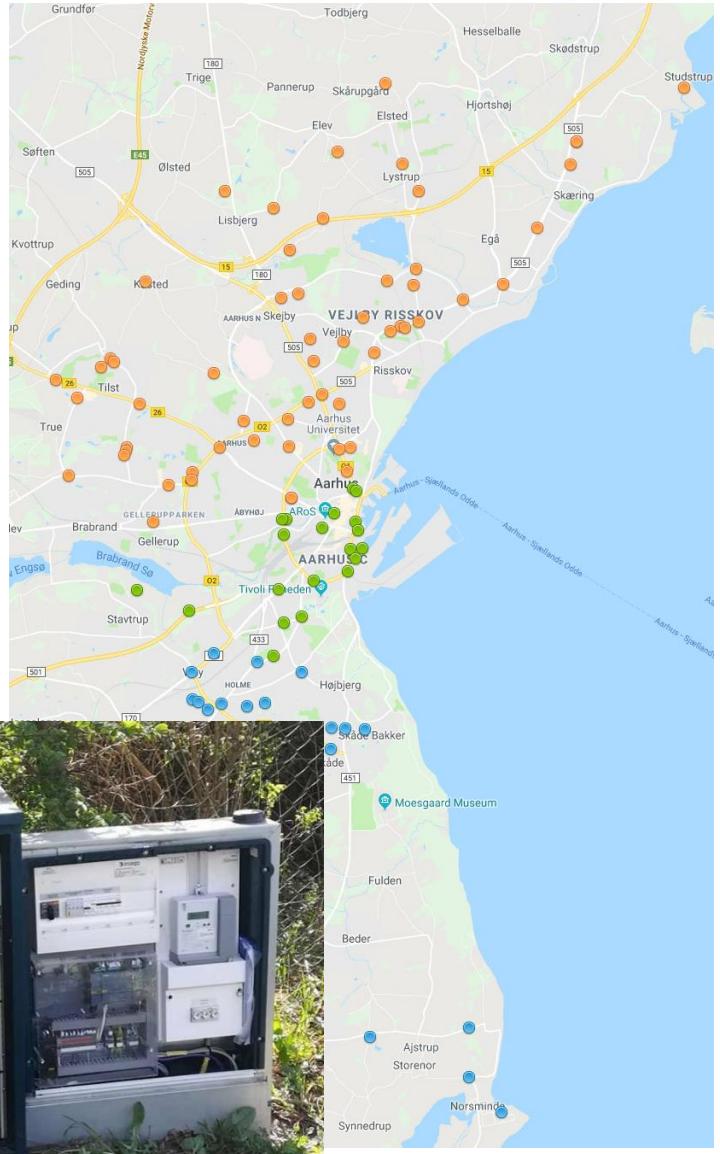
Waterworks and storage tanks

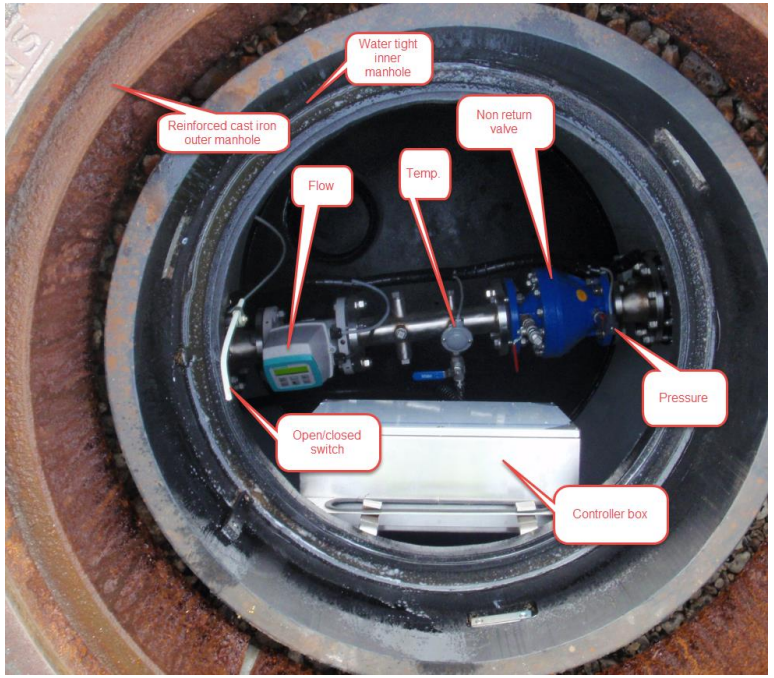




Distribution

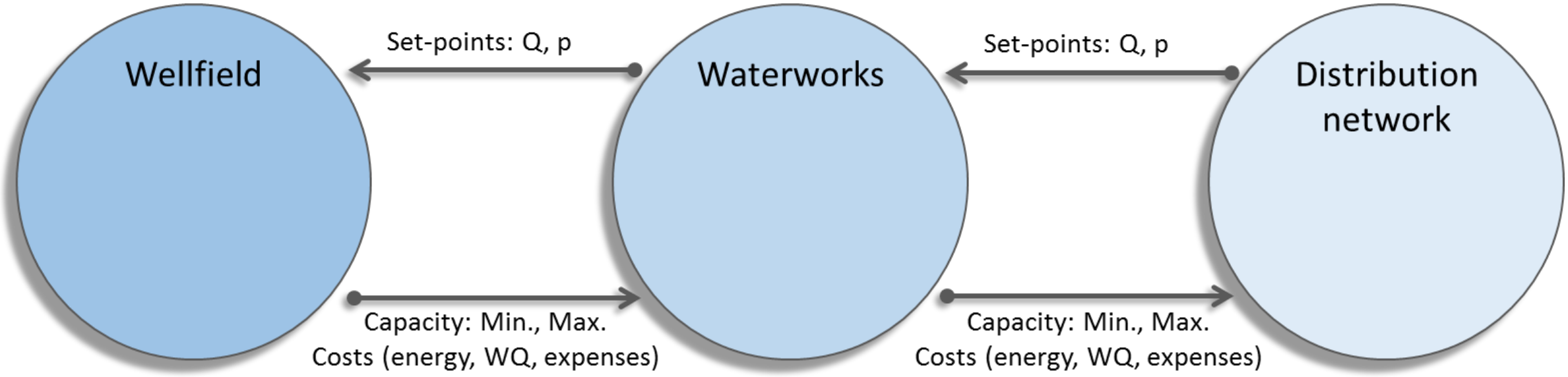


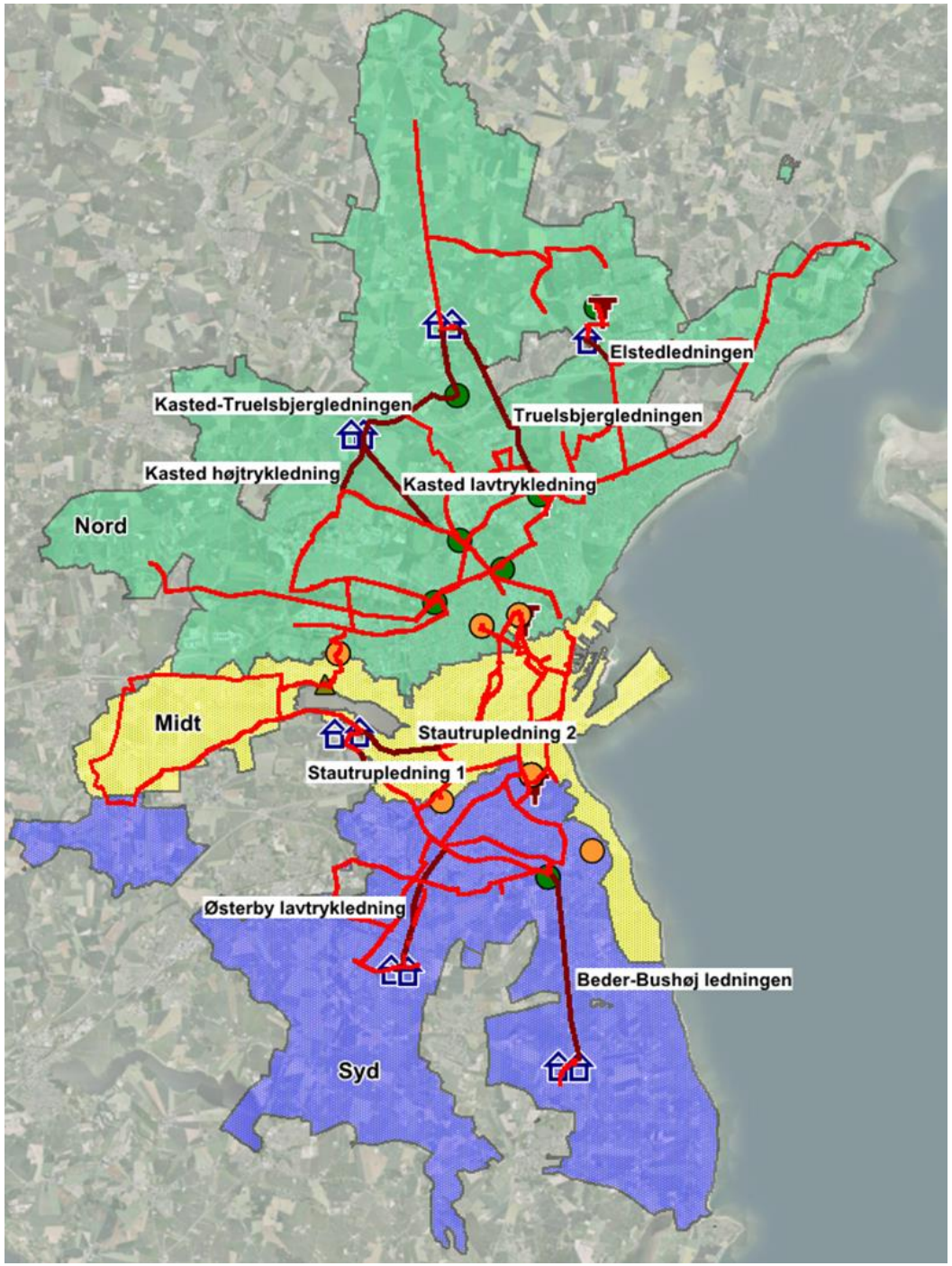


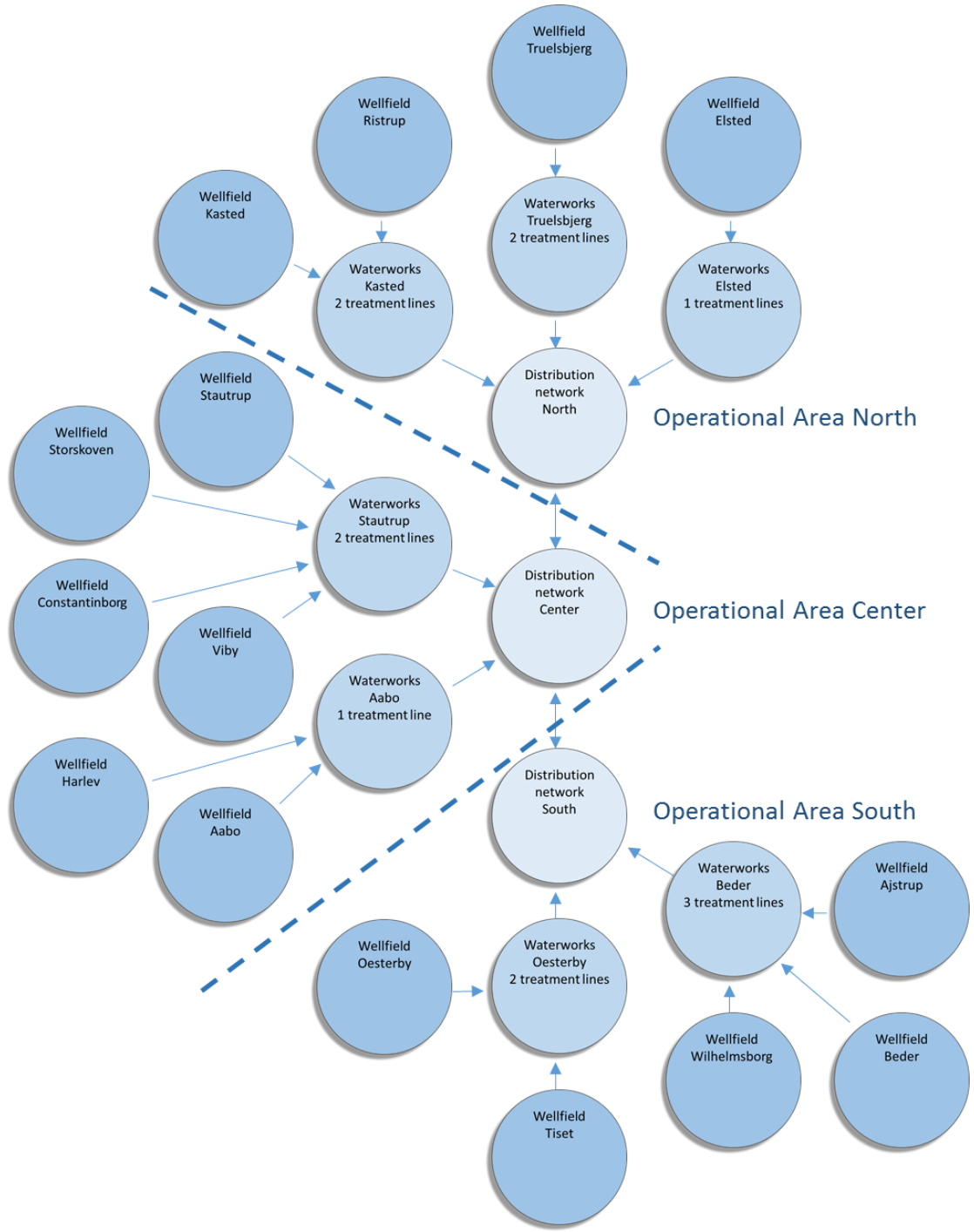


Generations of District Metering – latest version to the right

Concept: Demand Driven Water Supply




Elstedledningen
Kasted-Truelsbjergledningen
Truelsbjergledningen
Kasted højtrykledning
Kasted lavtrykledning
Nord
Midt
Stautrupledning 2
Stautrupledning 1
Østerby lavtrykledning
Beder-Bushøj ledningen
Syd


Wellfield Truelsbjerg
Wellfield Ristrup
Wellfield Elsted
Wellfield Kasted
Waterworks Truelsbjerg 2 treatment lines
Waterworks Kasted 2 treatment lines
Waterworks Elsted 1 treatment lines
Wellfield Stautrup
Distribution network North
Operational Area North
Wellfield Storskoven
Waterworks Stautrup 2 treatment lines
Wellfield Constantinborg
Distribution network Center
Operational Area Center
Wellfield Viby
Waterworks Aabo 1 treatment line
Wellfield Harlev
Distribution network South
Operational Area South
Wellfield Aabo
Waterworks Beder 3 treatment lines
Wellfield Ajstrup
Wellfield Oesterby
Waterworks Oesterby 2 treatment lines
Wellfield Wilhelmsborg
Wellfield Beder
Wellfield Tiset

Groundwater – an unique water resource

- 100 % ground water
- Abstraction 60 – 140 meter below terrain
- Requires only simple treatment
- No disinfection
- 15 million m^3/year
- Balancing abstraction in respect to impact on surface water

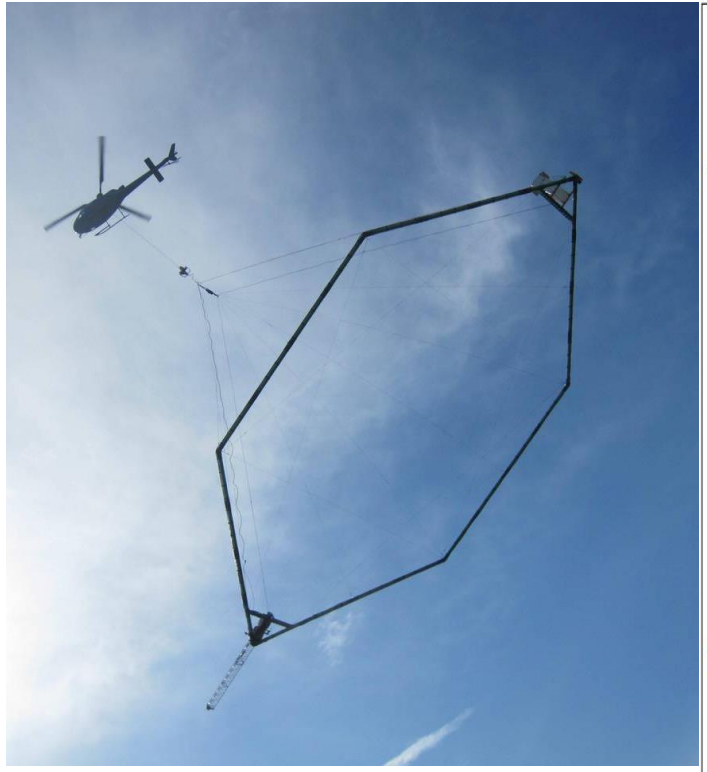
Aquifer mapping

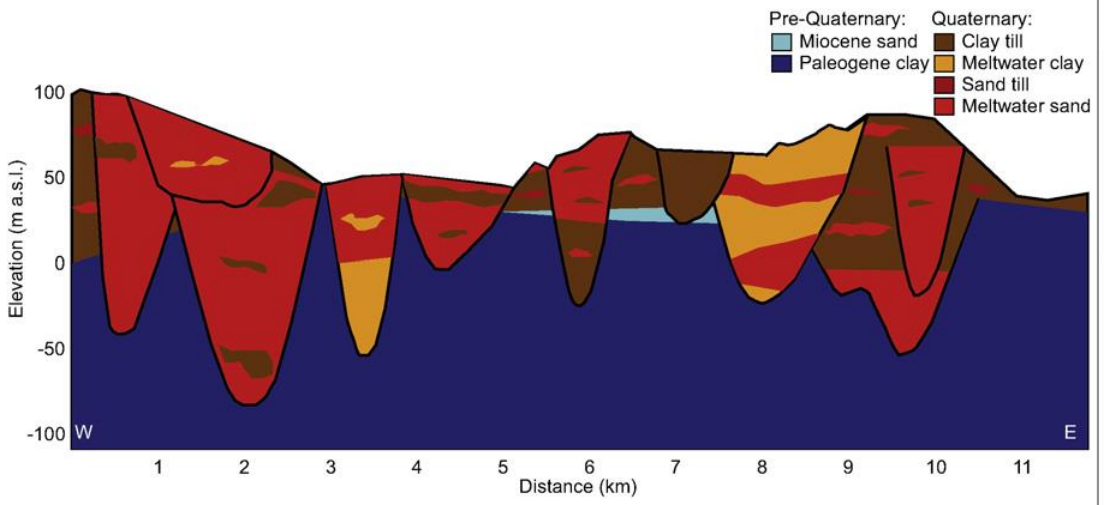
The survey has been carried out by the Danish Environmental Protection Agency in most parts of Denmark

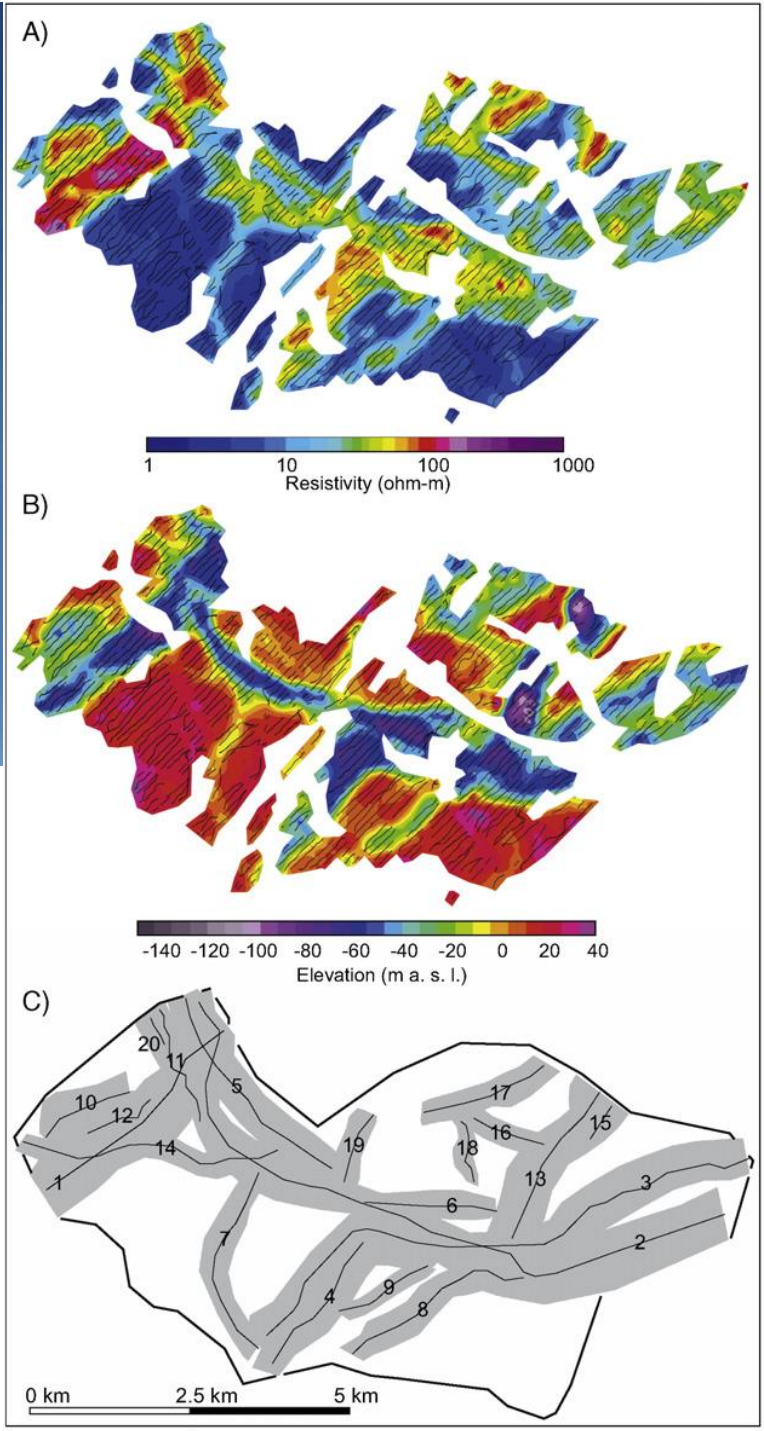
- Mapping aquifers and their vulnerability

Using big datasets as inputs to models

- Borehole informations
- SkyTEM surveys
- Groundwater Chemistry
- Pumping tests







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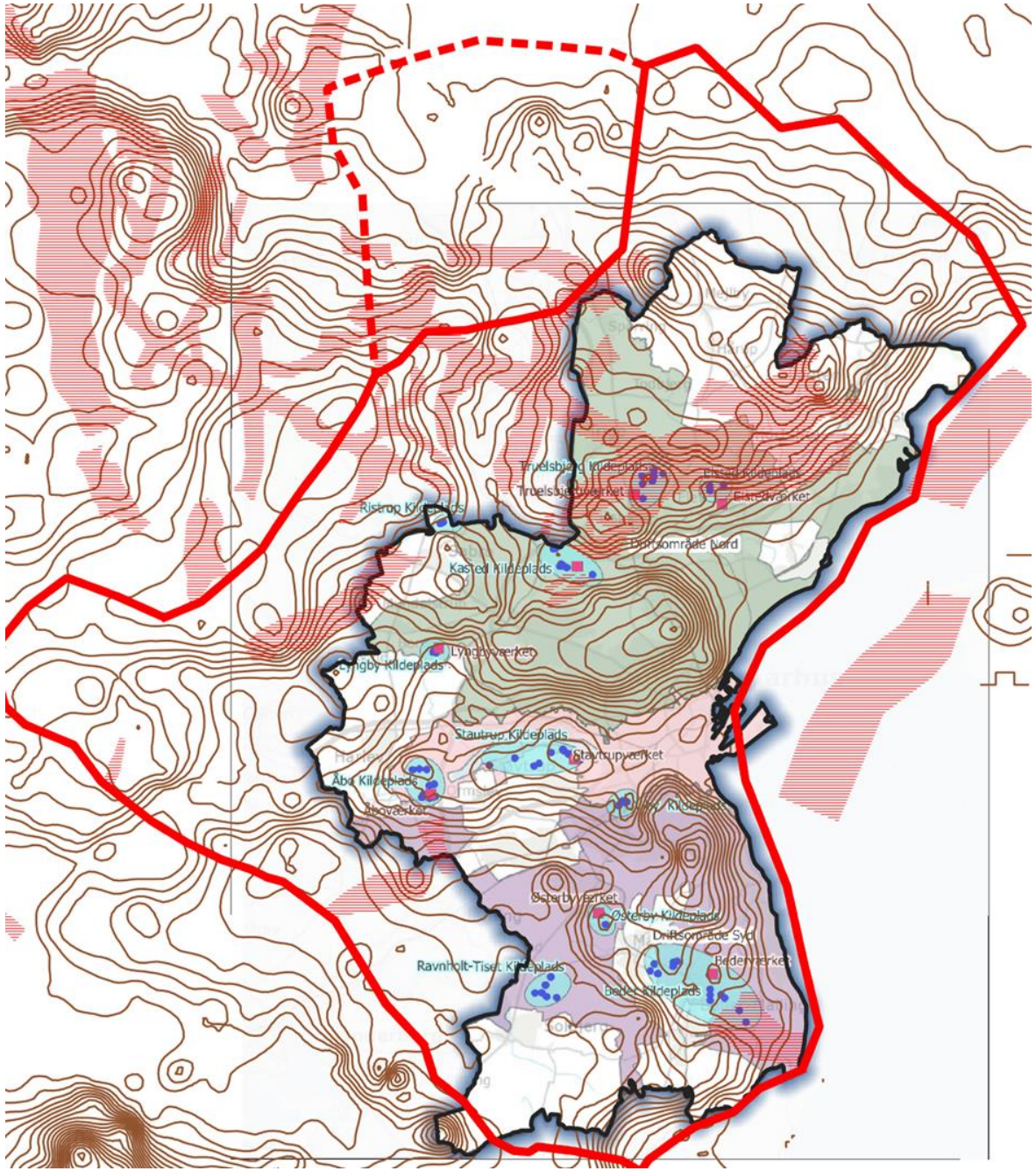
Water resource modeling

Integrated numerical hydraulic model for the entire municipality.

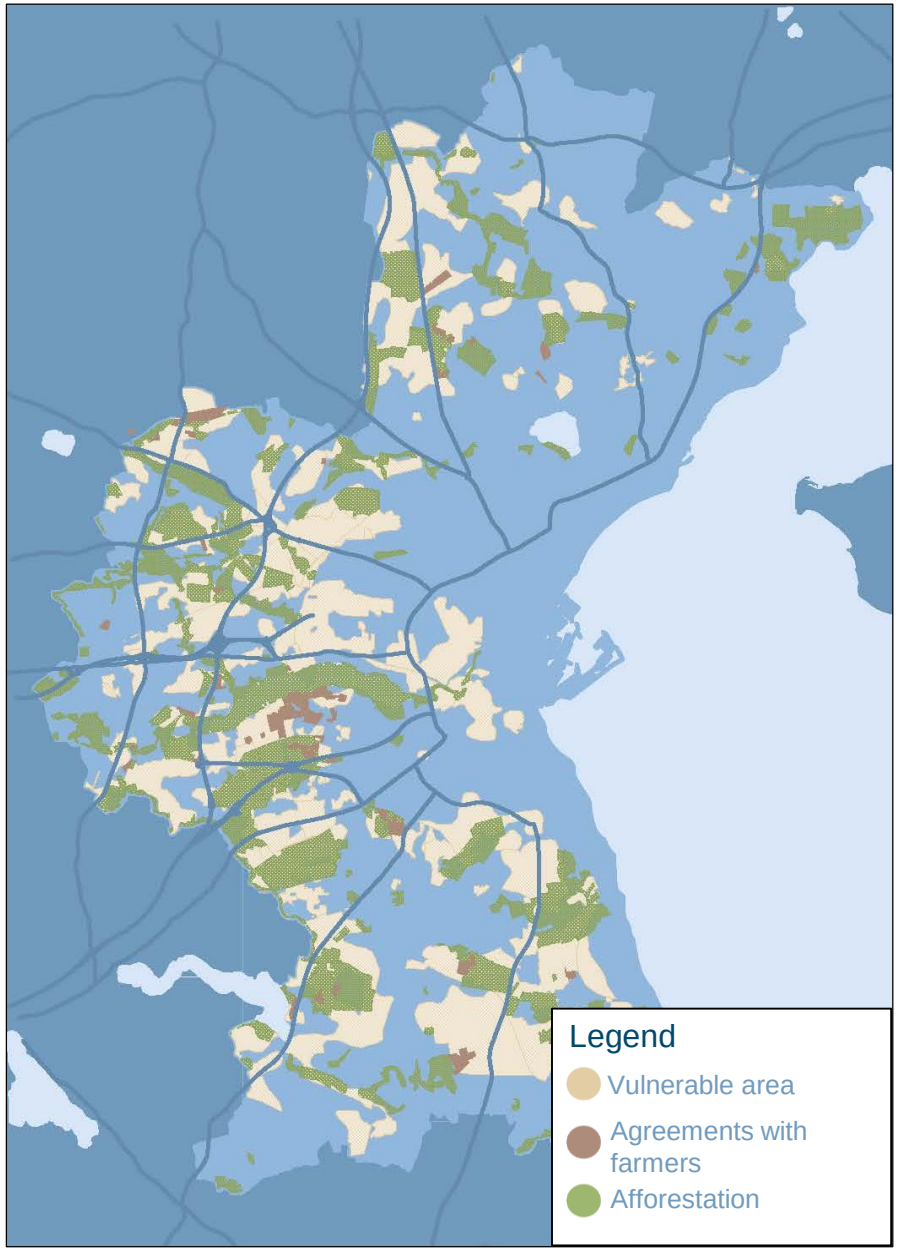
Available for calculations on;

- Future abstraction scenarios
- Effects on the surface water and nature from water abstraction
- Climate change scenarios
- Planning of new wellfield and management of existing wellfields
- Etc…

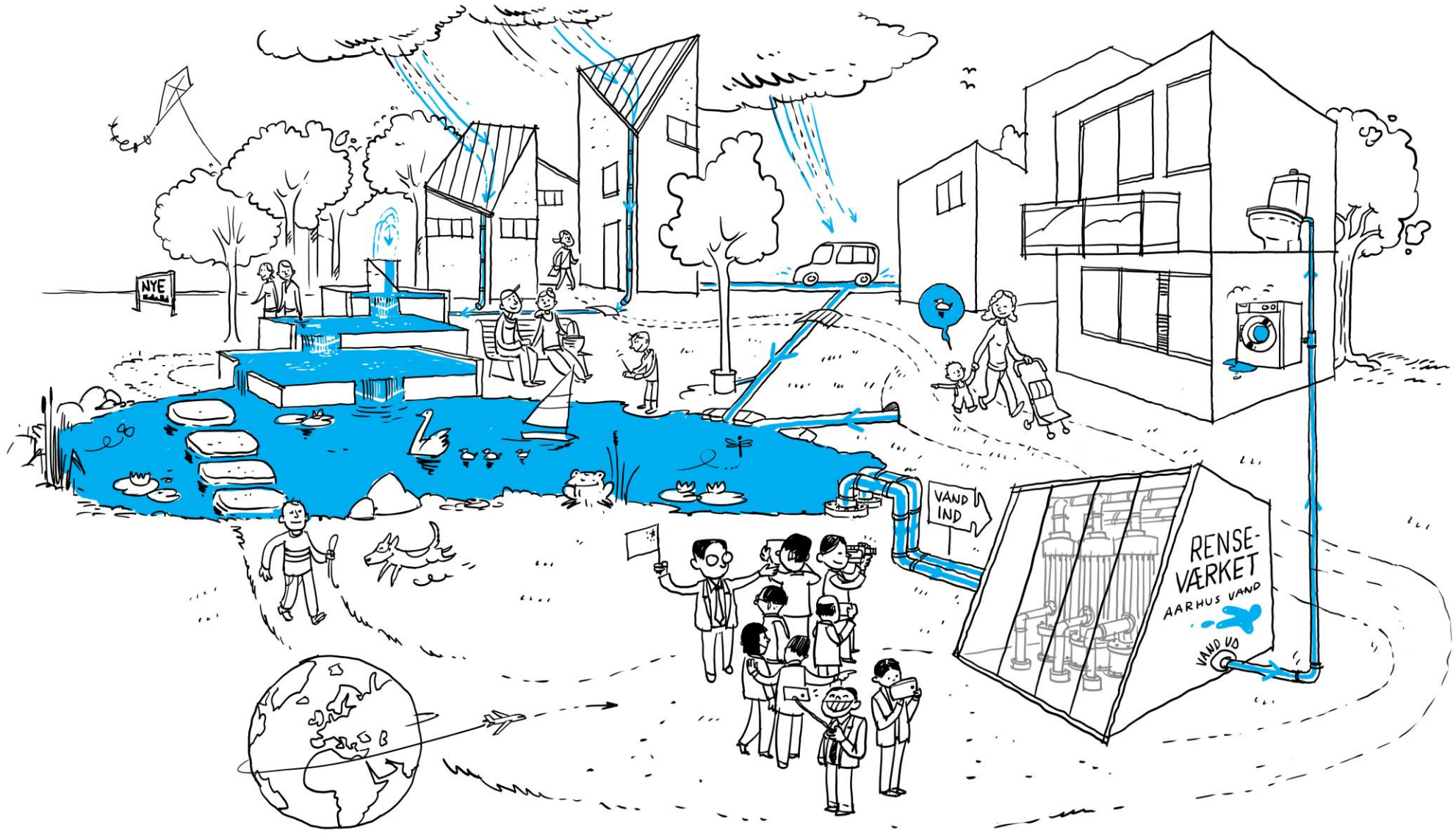


Groundwater protection

- Vulnerable areas within the catchment area – 7,200 hectares
- Findings of pesticides in wells
  - 35 % with traces
  - 18 % exceeds the limit for drinking water
- Rural areas
  - Handling of pesticides at farms
  - Restriction of pesticide use close to wells
  - Afforestation
- Private household
  - Information campaigns



Rainwater harvesting



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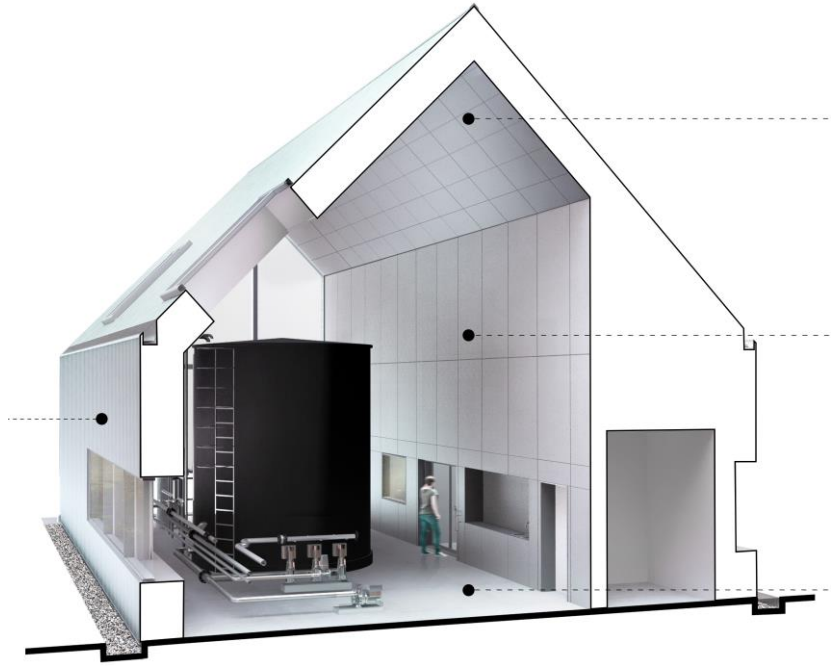

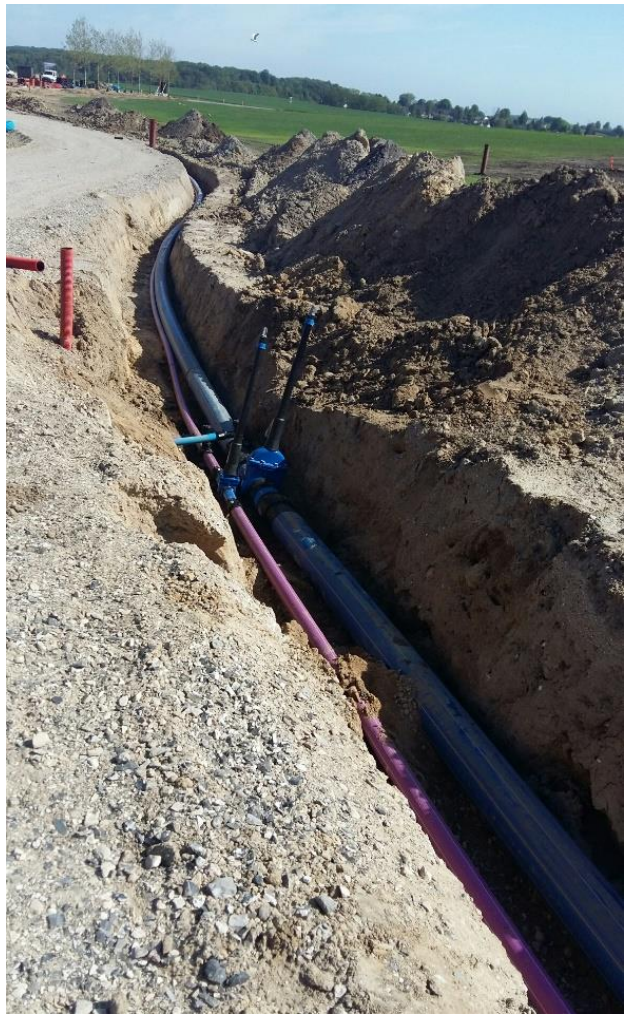

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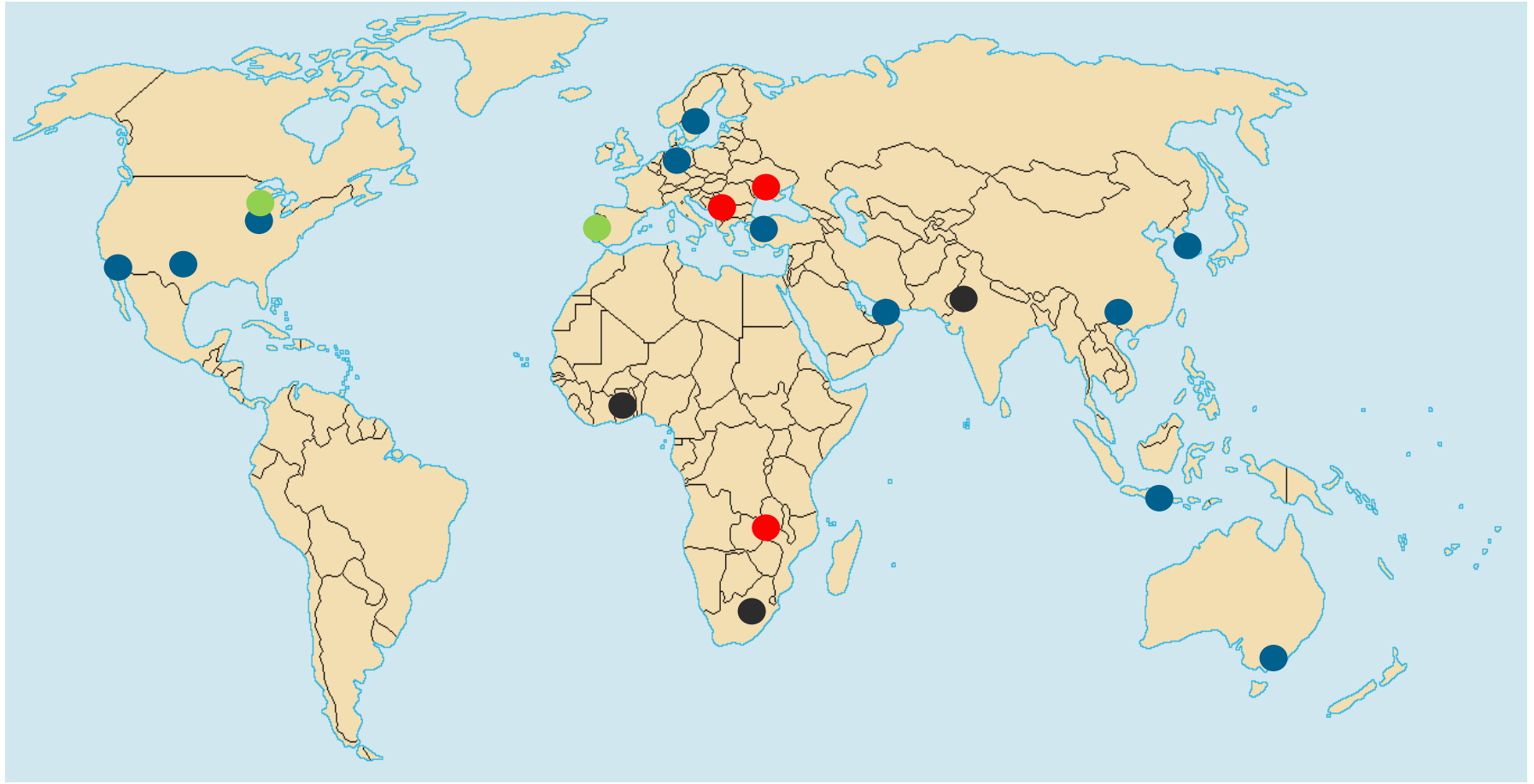
Aarhus Vand – International partnerships



- water sector export support (WTA)
- City-to-city cooperation
- Training activities
- Water Utility partnership

Thank you for your attention

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