

CBRN research projects and their results for Berlin Water

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Water Supply Berlin

Agenda

1. Introduction of Berlin Water company (BWB)
2. Motivation for research
3. Projectes and their results for BWB
4. outlook



Water supply Berlin

Background information on Berlin

Urban area (without surrounding boroughs): 900 km²

Population: approx. 3,500,000

Germany's center of government

Center of service and media

Green areas: approx. 35 %, water surface 7 %,

Population density: 3,800 inhabitants /km²



Overview of the various process stages

Wells

Aeration

Filtration

Storage

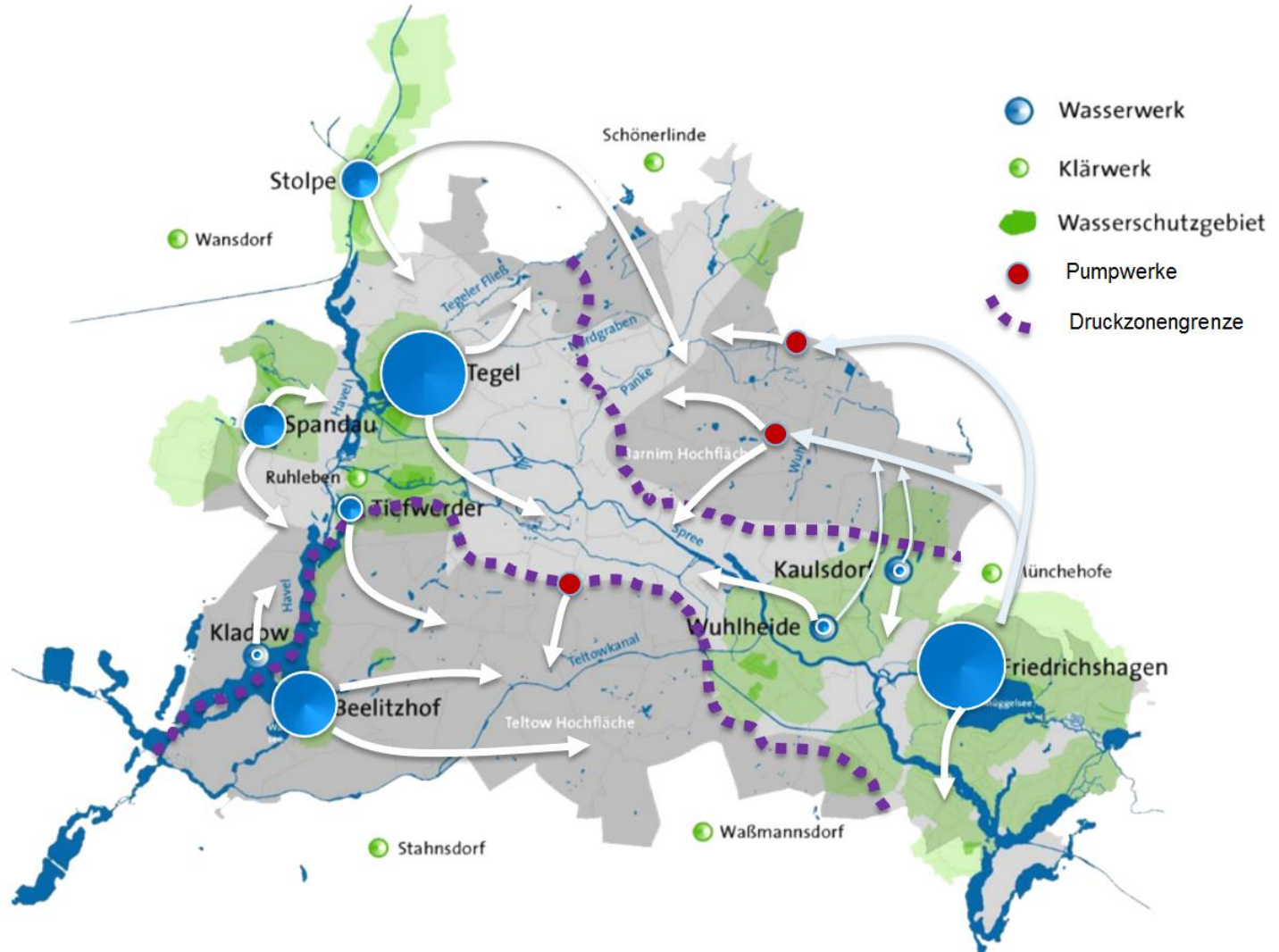
Pumps

Distribution



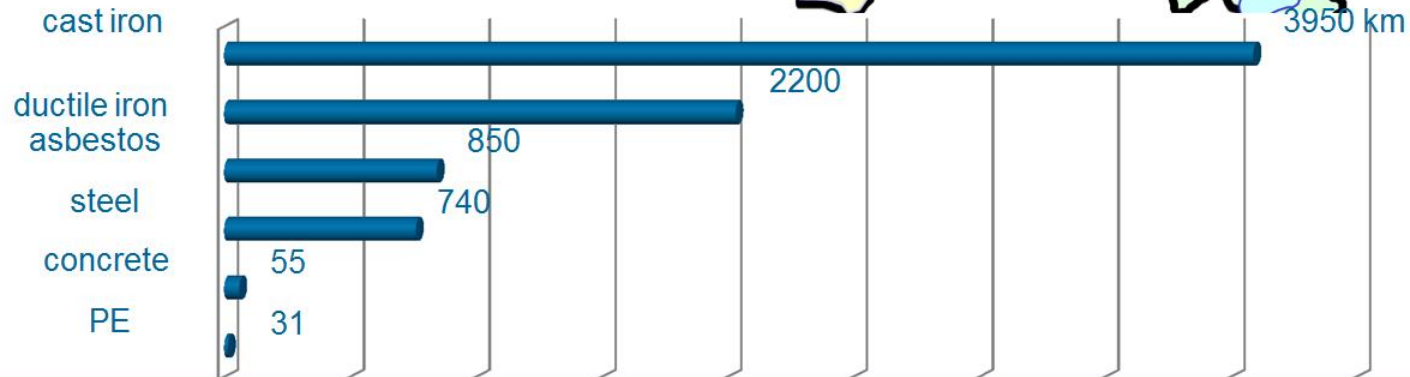
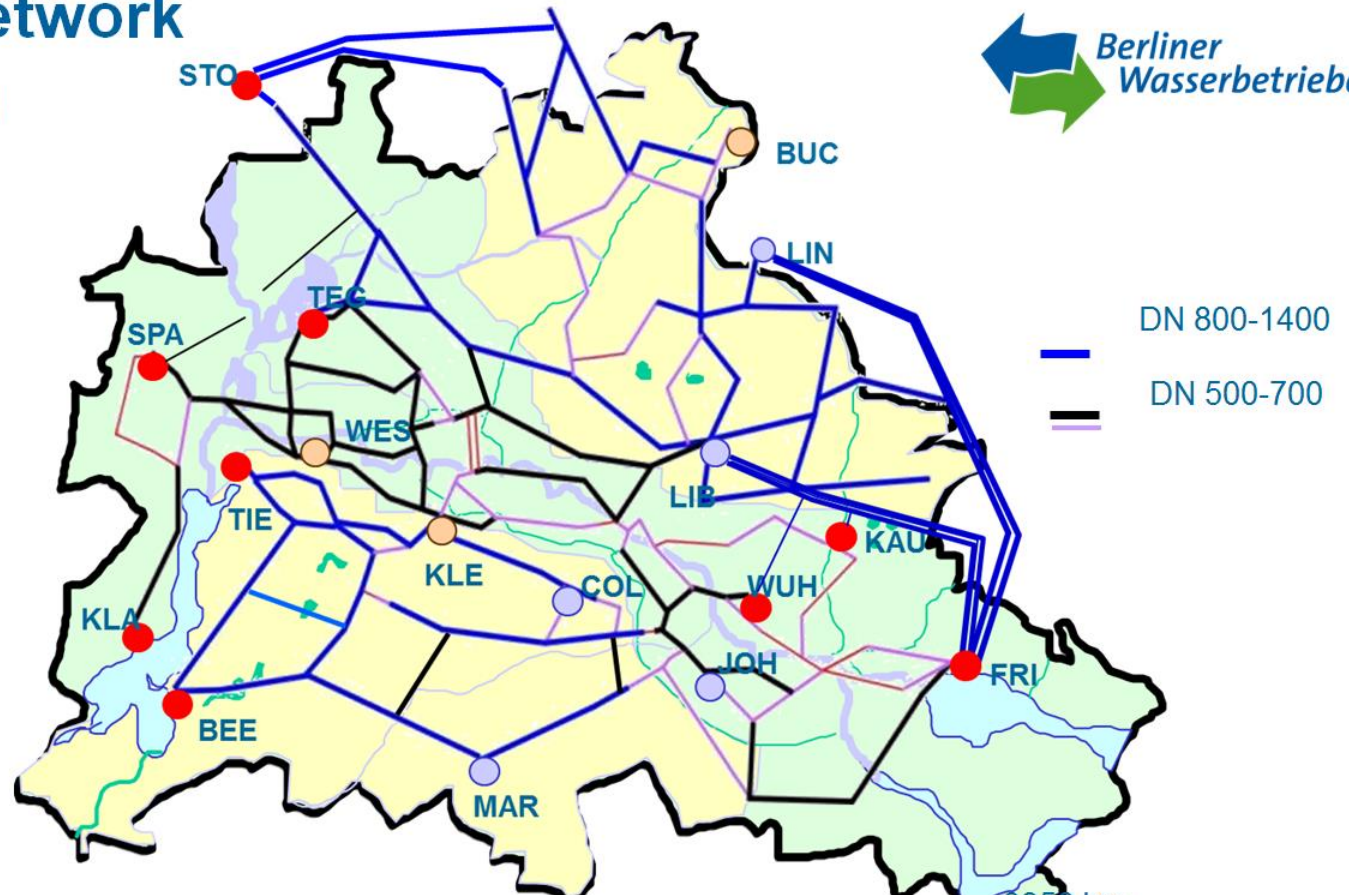
- Simple and rugged processes
- **No Desinfection (chlorine)**

Water supply in Berlin



Distribution Network

7900 km



Risik analysis – plant sensitivity

- technical failure -

Wells

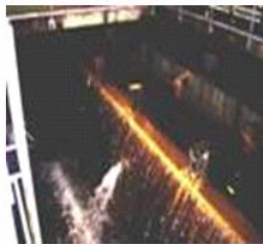
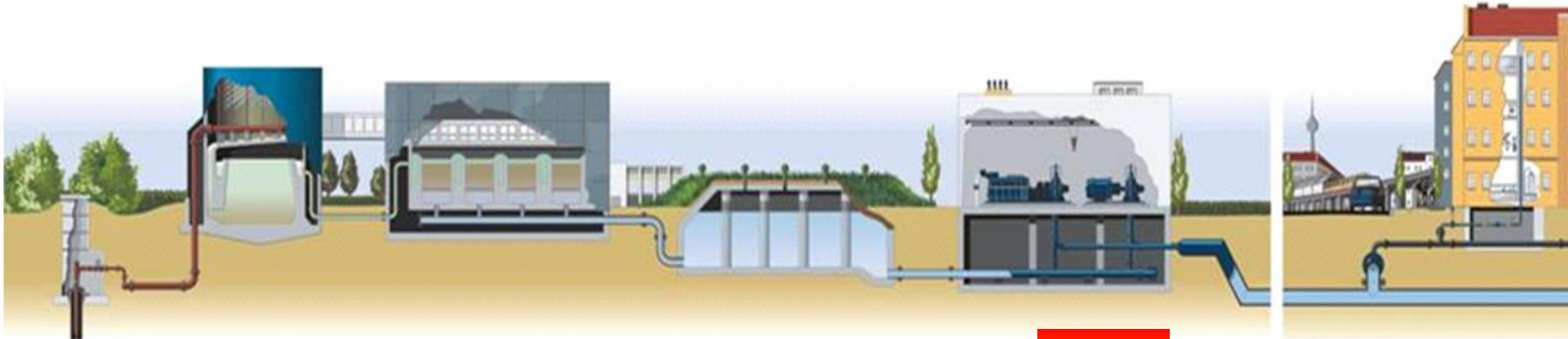
Aeration

Filtration

Storage

Pumps

Distribution



high
(power)

low

glowering

low

low

low

Risik analysis – plant sensitivity

- Crime, Terrorism -

Wells

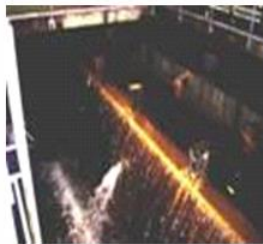
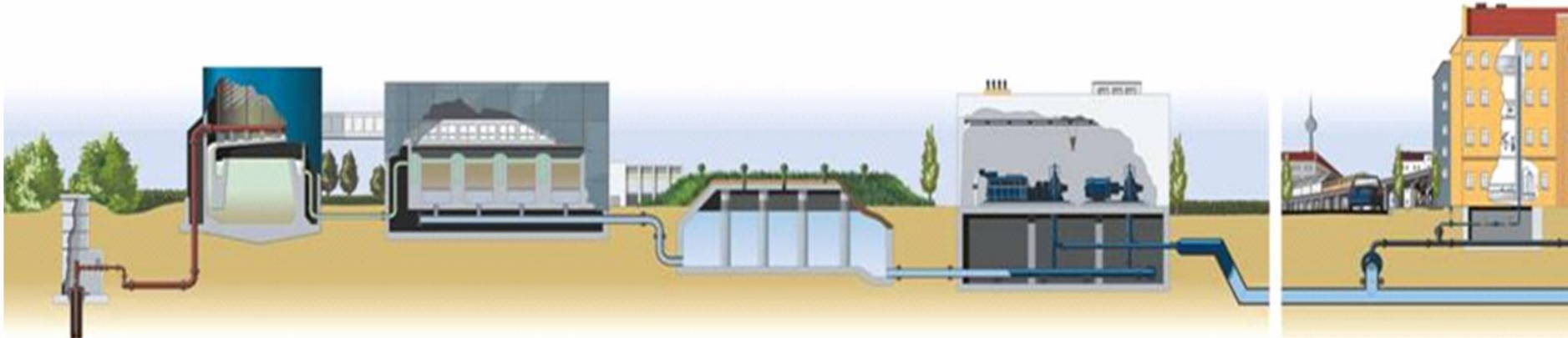
Aeration

Filtration

Storage

Pumps

Distribution



low

moderate

moderate

moderate

low

high

Framework program of the Federal Government:

Research for Civil Security 2012 – 2017

■ **Security of critical infrastructures**

- **Objective:** Improving the security of water supply system
- **Approach:** decision support tools for contamination events

■ **Crisis management (cascading)**

- **Objective:** decision support tools for cascading events
- **Approach:** harmonised common situation report for all involved parties

Motivations and aims

No satisfying quality monitoring system for WDN

Need for

early warning systems

and

decision support Tools



- **Sensors**
- **for** continuous and near time **detection of CBRN**
- **IT Security**
- **for** automation **systems**

- **Information**
 - **Management of sensor data**
 - **Alarmgeneration**
 - **Sensor placement**
 - **Simulation for decision support**

Research projects:

early warning sensors

■ **Sensors for detecting:**
chemicals and neurotoxins

AquaBioTox

Sensaguard

Fishtoximeter

■ **Sensors for detecting:**
biological and virus
contaminants

EDIT

PHOIBE

■ **Sensors for detecting:**
physical and chemical
anomaly

Intellitect sonde

early warning sensors

results of research and BWB projects

- **AquaBioTox:** Prototype is ready;
(2007 - 2010) further development in **ResiWater**



- **Sensaguard:** Test periode ended;
(2015-2016) portable at Test



- **Intellitect sondes:** Test periode ended;
(2009-2011) three sondes in use;



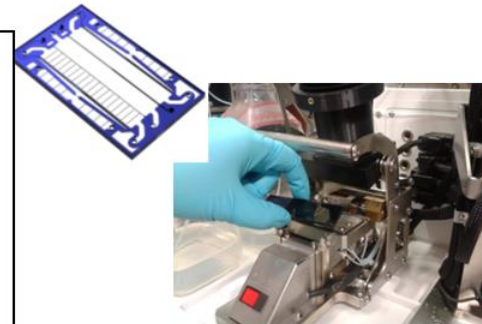
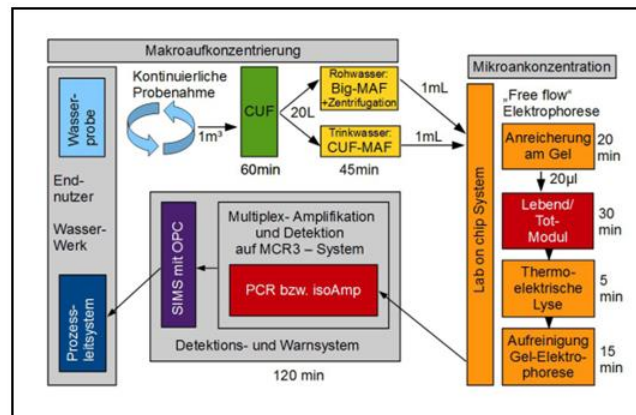
early warning sensors

Ongoing research projects

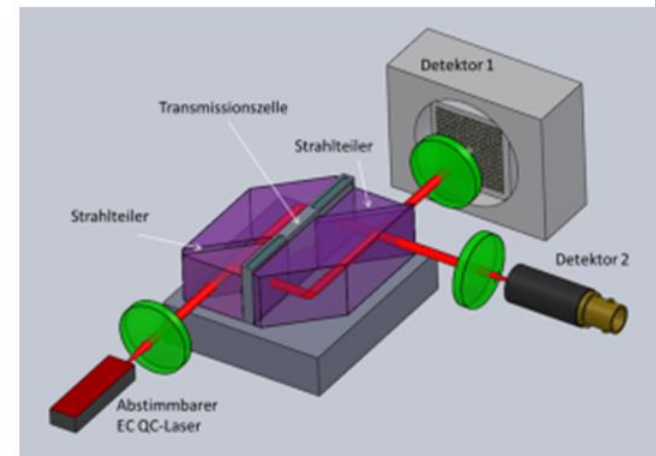
EDIT

Lab on Chip detection technique for pathogene bacterial contamination

(2014-2017)



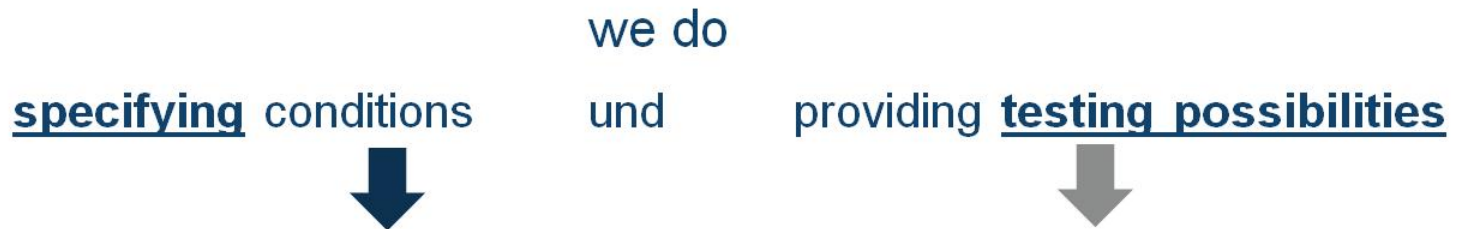
PHOIBE continuous Infrared-Laser-spectroskoy
for chemical, bacteriological and virological
detection
(2015-2018)



Requirements from end users perspective

Reliability and Practicability

specifying conditions we do und providing testing possibilities



■ requirements on the systemes:

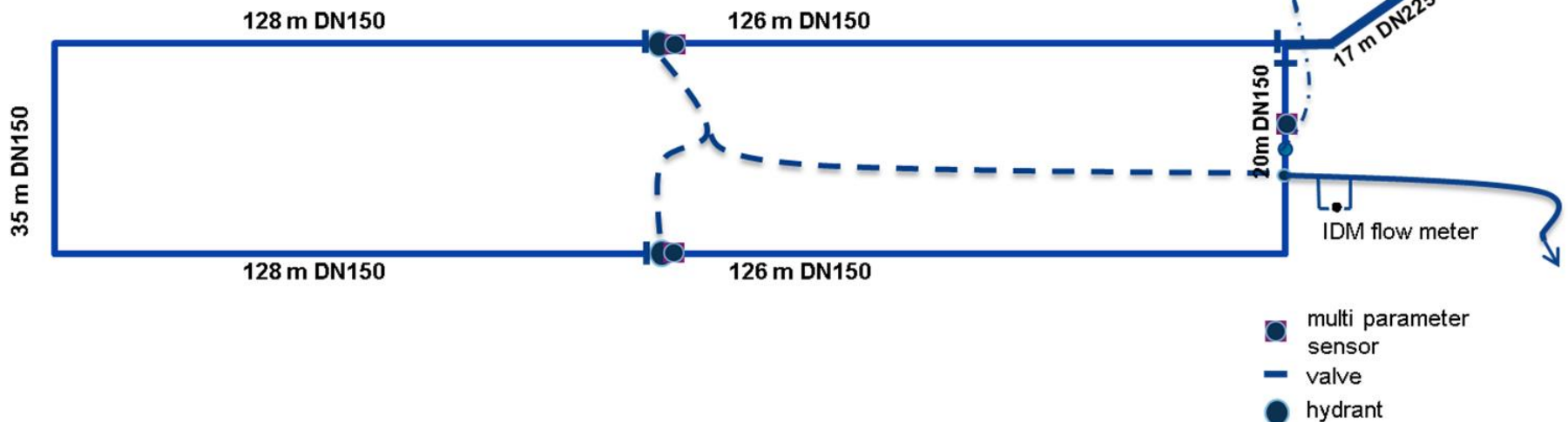
- operating expenses
- robustness
- long time stability

■ experiments to evaluate:

- functionality
- operating limits
- applicability and usability

Test track:

Material, age and use are representativ for pipes in Germany



Current Situation of Sensors



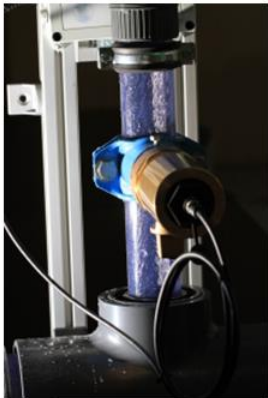
quality parameters and TOC



Spectrolyser

KAPTA™3000-AC4

water quality
parameters



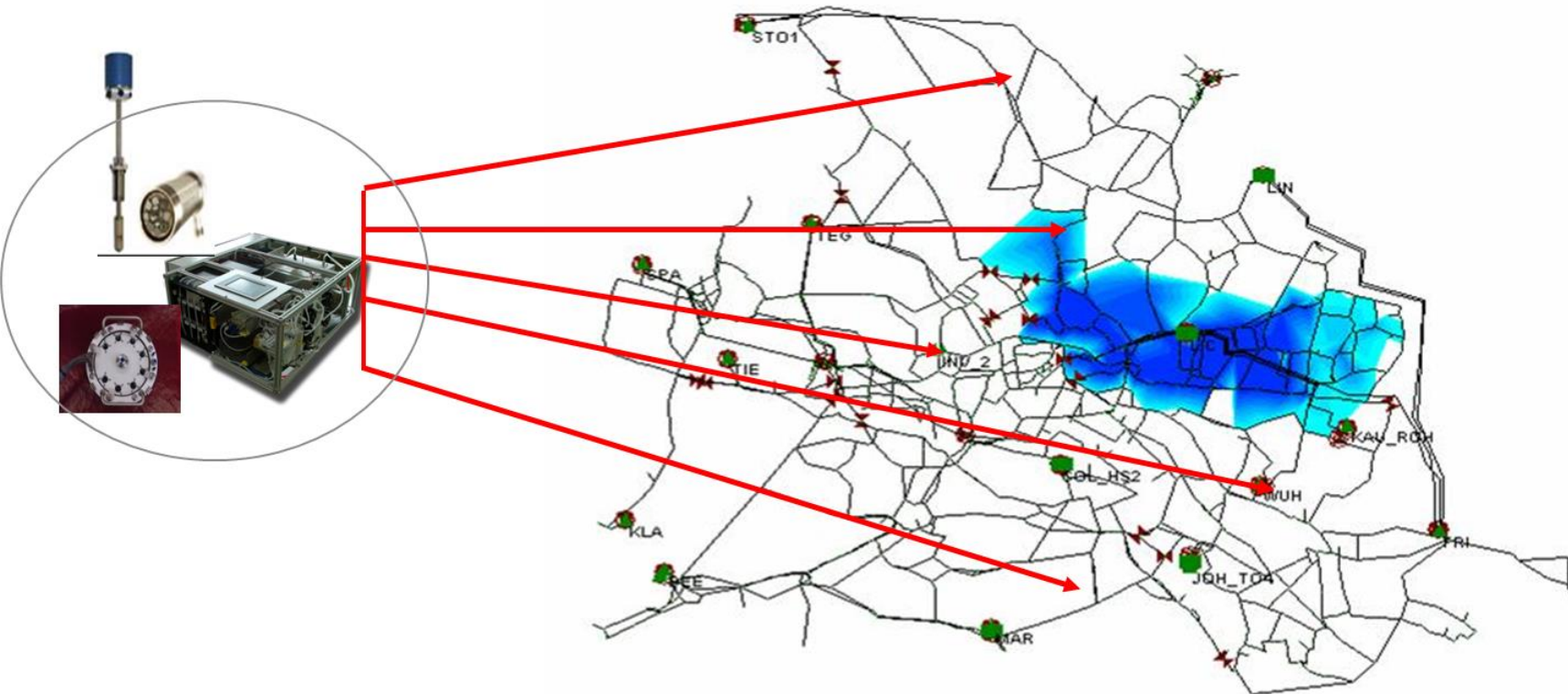
Bio-monitors using Daphnia or fish



Sensors alone are not enough!

What we need is ...

A decision support tool to initiate the right action for each situation



other Research projects;

and German-French announcement:

decision support-Tools

- sensor placement
- source identificatin
- transport model

SMaRT-Online^{WDN}

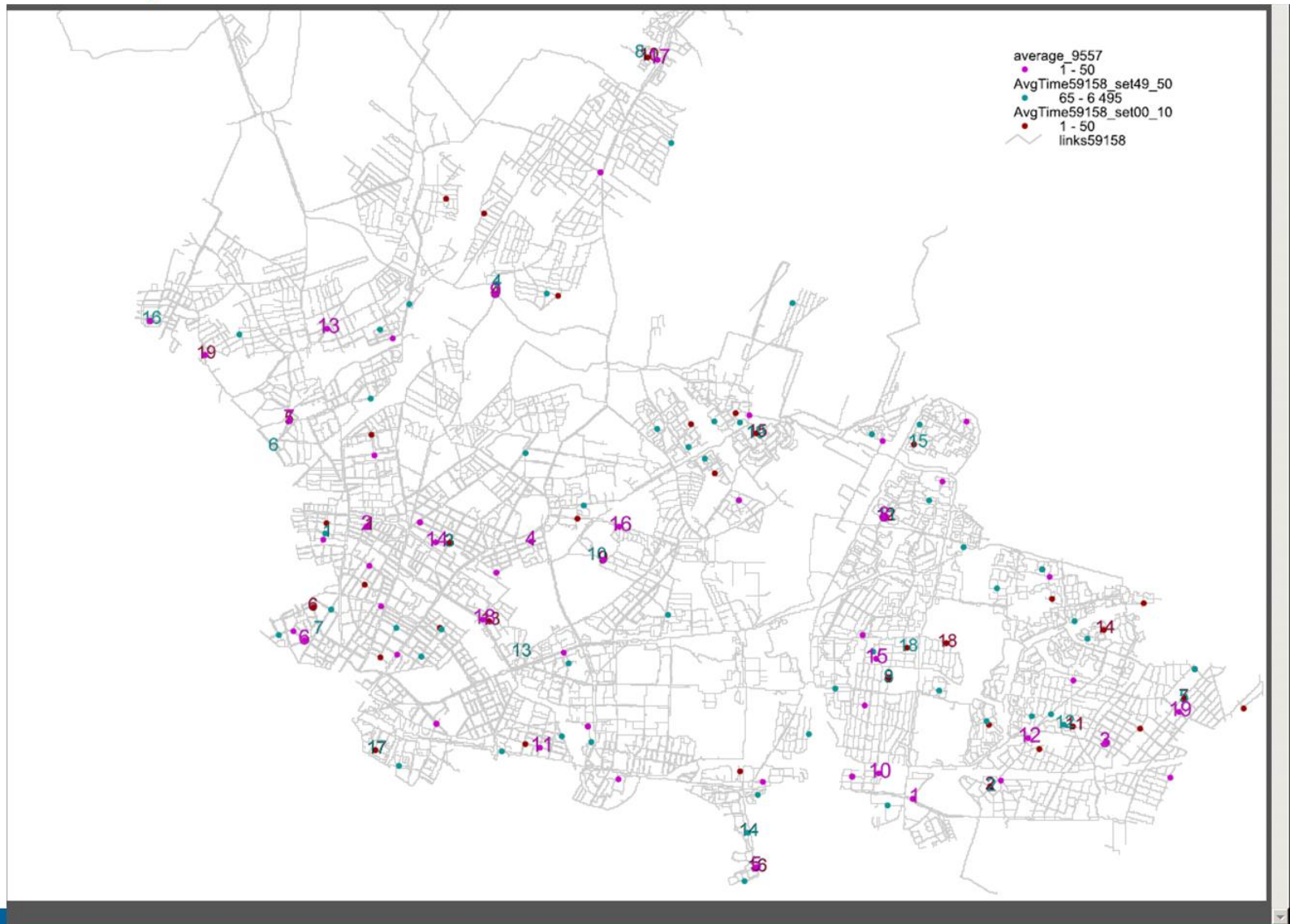
- Improving resilience
- recovering from the crisis and full restoration of the normal functioning

ResiWater

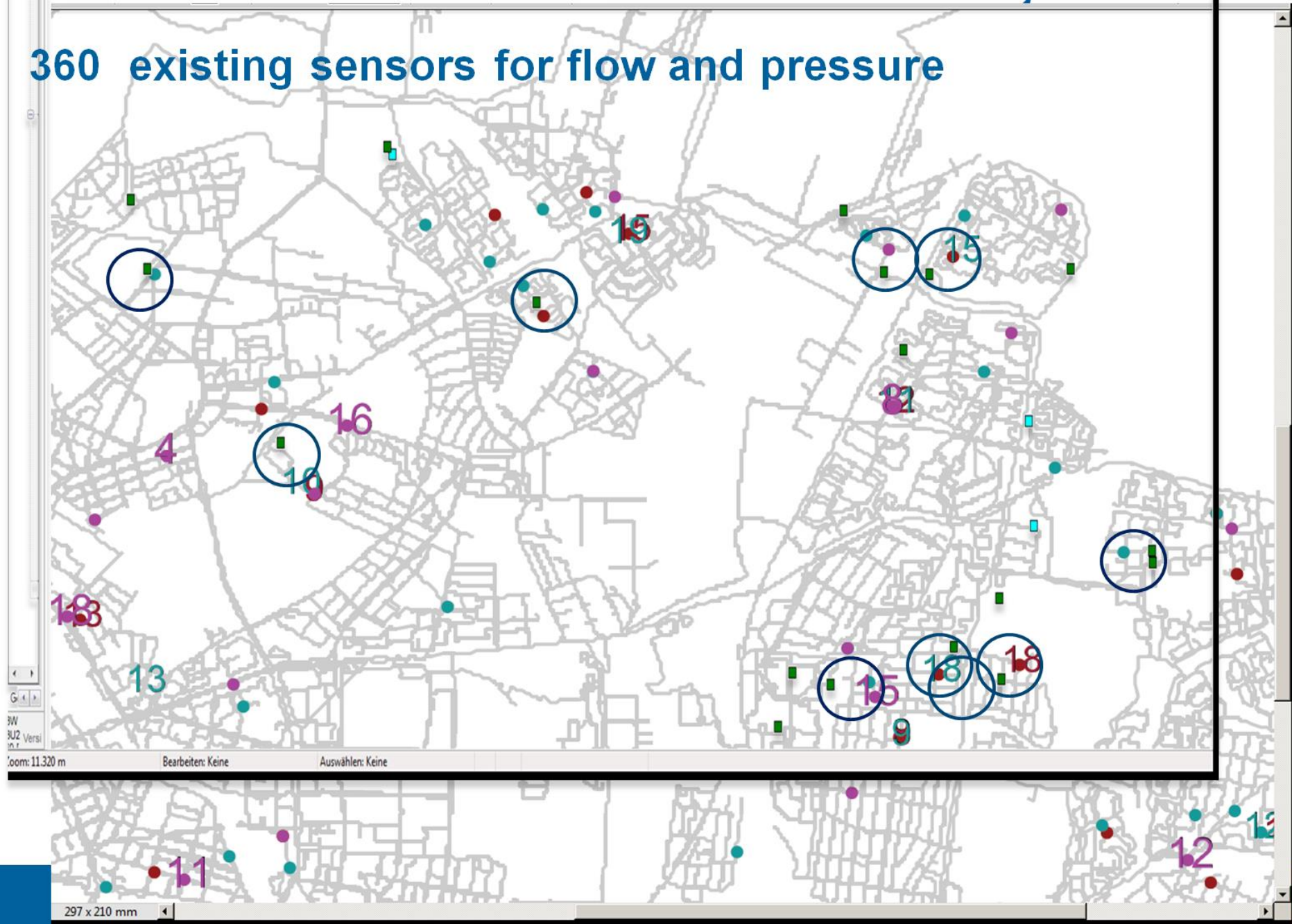
- secure wireless data transfer
- reliablity of sensordata

Steuerung

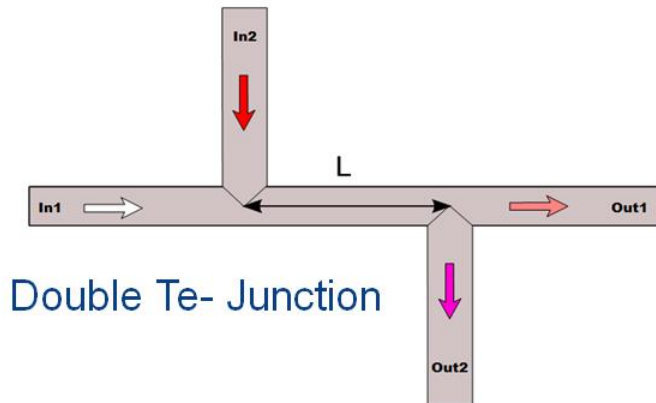
Sensor placement



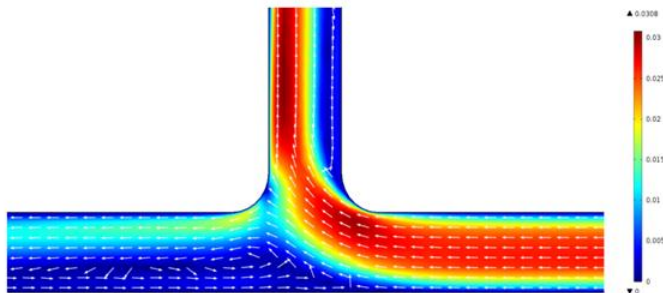
360 existing sensors for flow and pressure



Transport Model



Double Tee- Junction

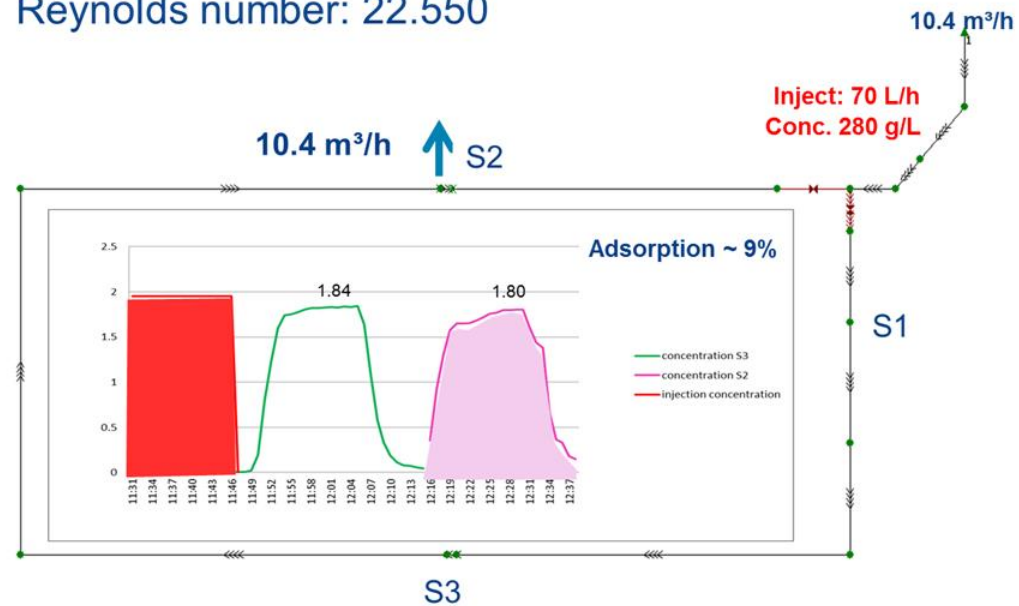


complete mixing??

Experiments



Reynolds number: 22.550



Injection	S1	S2	S3	Velocity (m/s)	Distance	calc./measur. travel time [min]	max. concentration [g/l]
11:31				0.2	42	3.68	
11:31			11:49	0.2	191	15.92/18	1.84
11:31		12:13		0.2	482	40.17/42	1.80

Outlook...

1: Ongoing research work

- water utilities need to find a cost effective way to provide models with real time information
- Improving resilience of WDN; recovery costs and efforts

2: Further security research work

- balance between technology, administration, politics and society...

**Thank you for your attention
to be continued...**