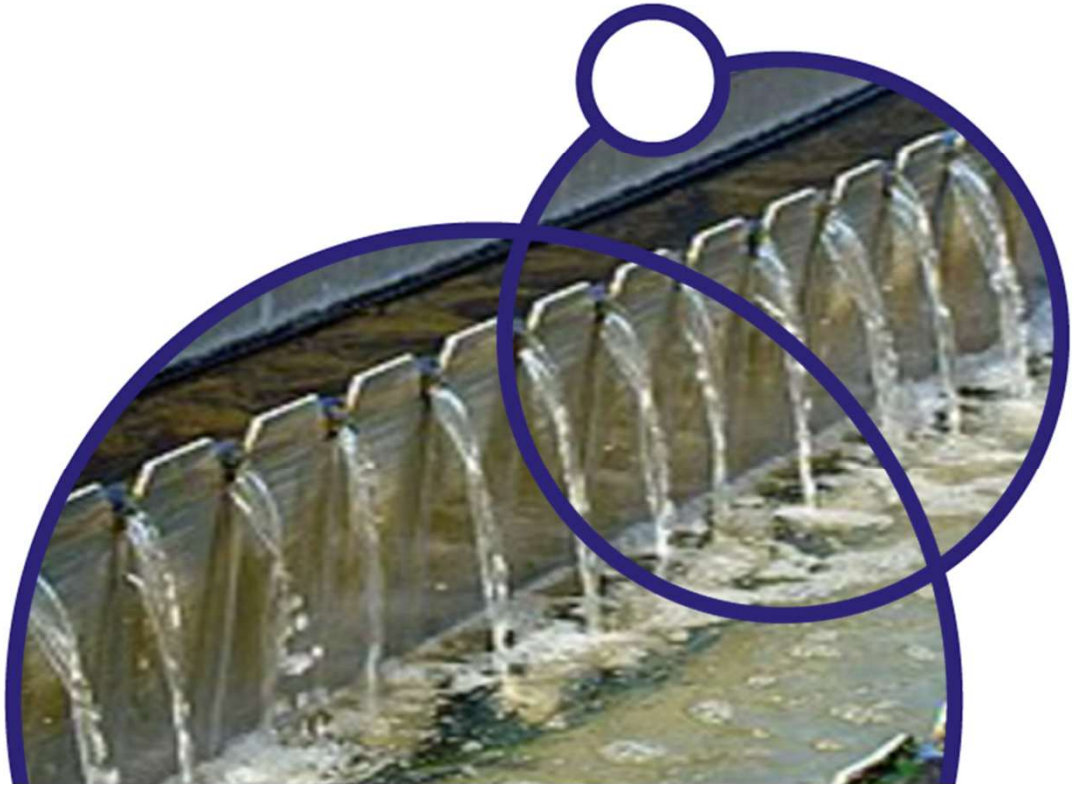
monitoring
of pharmaceuticals and other nasty compounds

Bert Palsma (STOWA)



Monitoring do’s and dont’s

- Do:
  - Clear objective,
  - Find your weakest link
  - Inform and instruct all staff involved (including management)
- Dont
  - Interpret a result without asking why? and how?
  - present results without uncertainty info, original data

Monitoring objectives

- **Surface water quality**
- Choise and dimensioning of additional technique
- Operational optimisation of WWTP and additional techniques.
- Reporting to national - or European authorities

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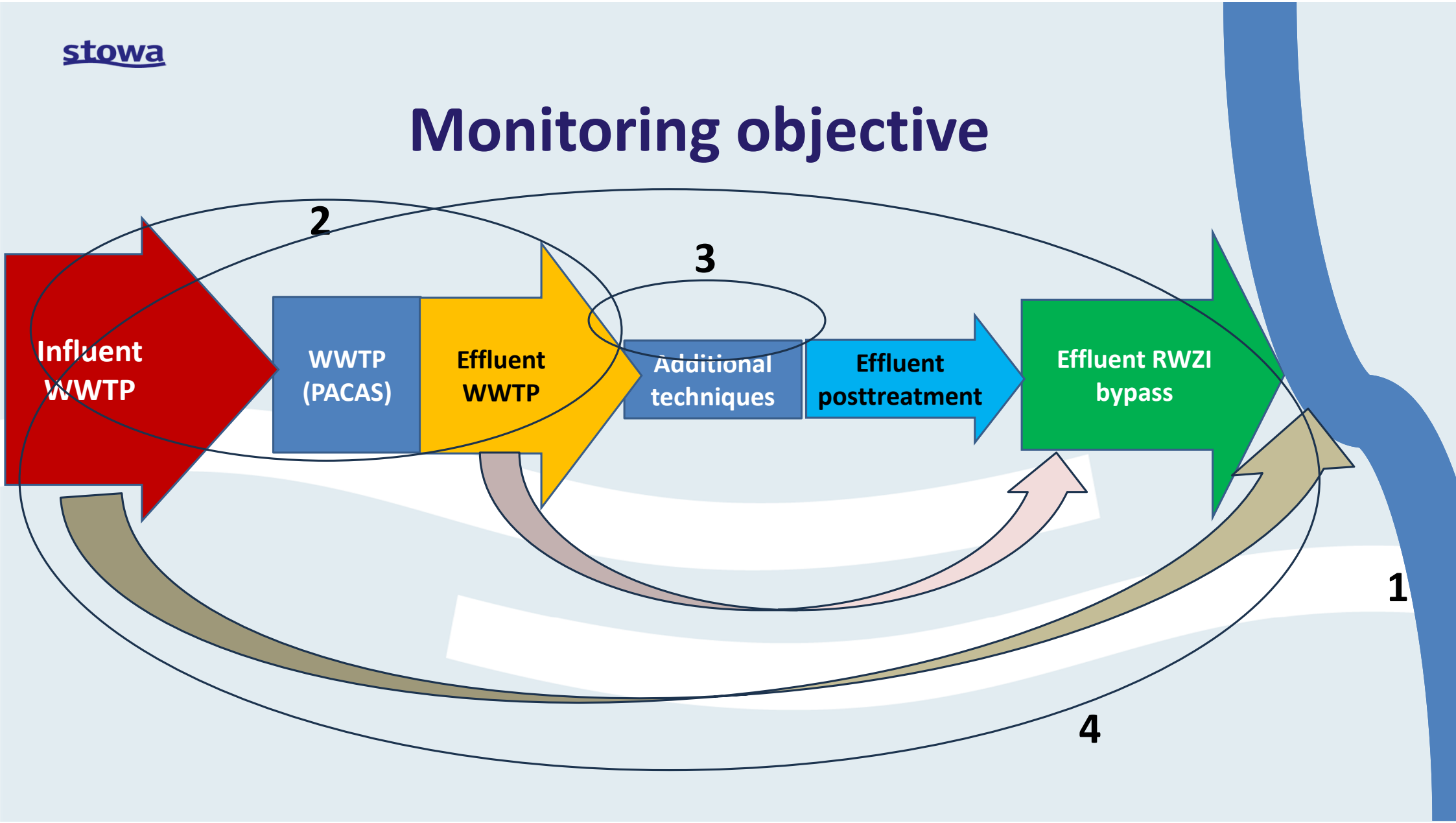
Monitoring objective



What happened earlier

- Huge discrepancies of removal rate of pharmaceuticals between different WWTP's
- Improved method of chemical analyses and conservation; ILOW (STOWA 2021-15)
- Comparison on basis of exemplary compounds which:
  - can be analysed
  - poor removal in WWTP
  - can be oxidized and or adsorbed.

What happened earlier

Carbemazepine	Trimethoprim
Diclofenac	Venlafaxine
Gabapentine	Benzotriazol
Irbesartan	Som 4-,5-methylbenzotriazol
Metoprolol	Hydrochloorthiazide
Sotalol	

11 compounds as an example, as guide

- 48 hour sampling of influent and effluent
- 24h delay between influent and effluent.
- Sampling only during dry weather

** 2020 04 03 V.07 STOWA voorlopige werkinstructie Medicijnresten bemonstering en analyses (STOWA 2021-15)

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Problems

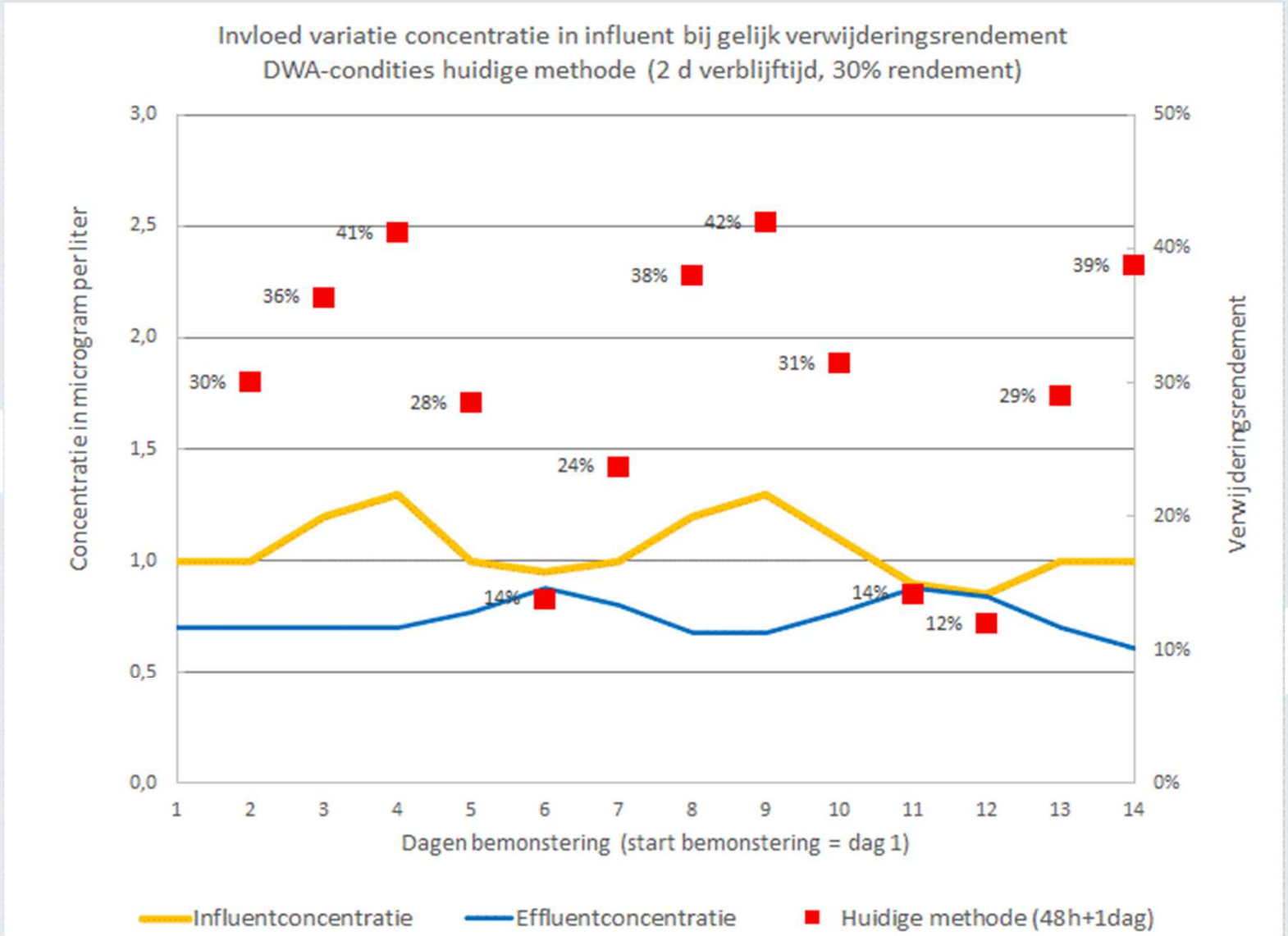
- Practice is of sampling is subjected to errors and logistical problems (o.a. stormwater)
- Removal rates show huge discrepancies : **10-70% for same compound**
- What to do with “outliers” , “negative removal rates”

How to improve?

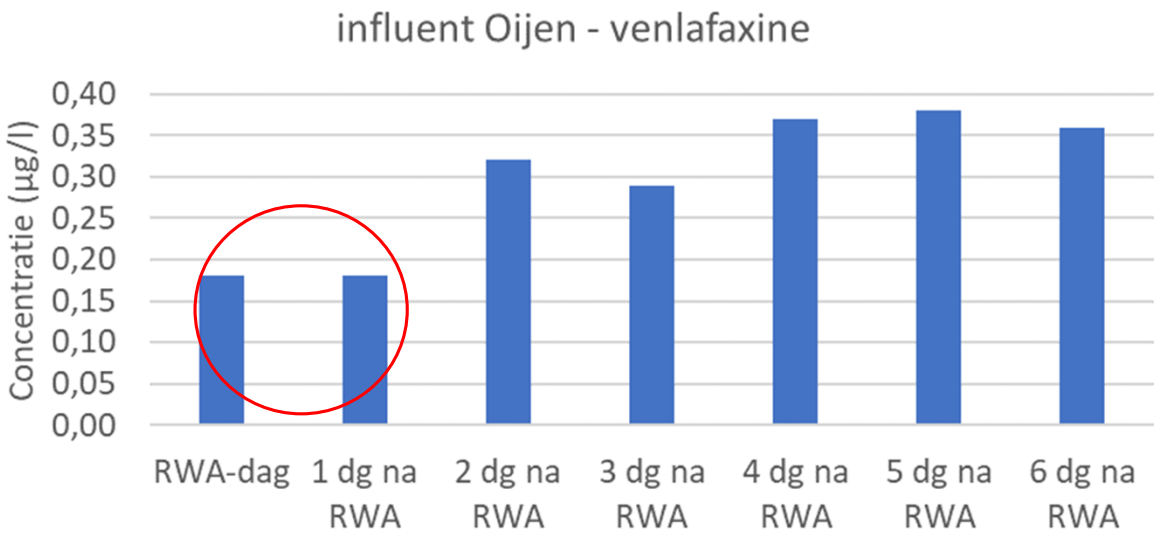
More data, better data?

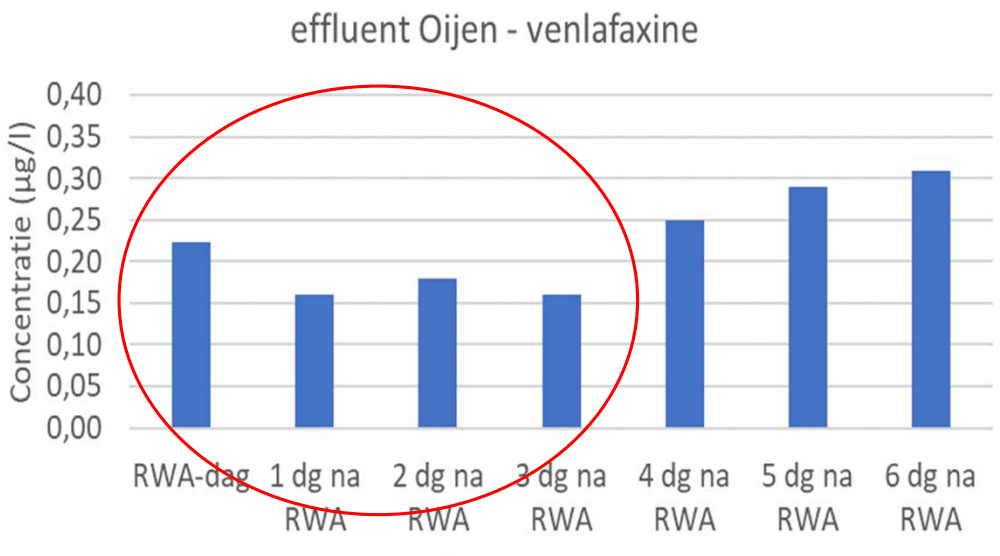
8 WWTP; two times 14 days consecutive 24 hours sampling

Changing concentration in influent and effluent (DWF)



Effect of stormwater; 3 days after

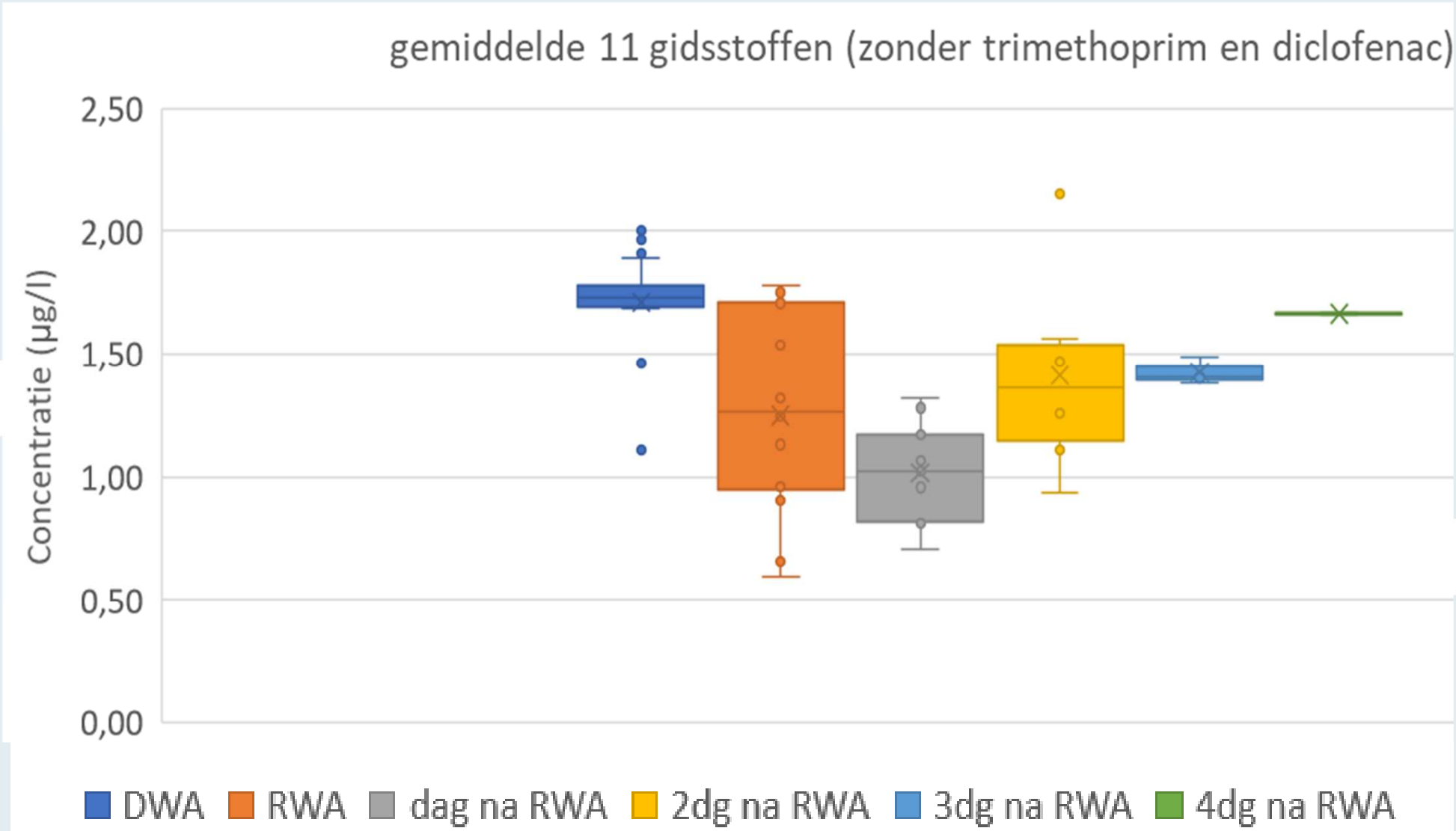




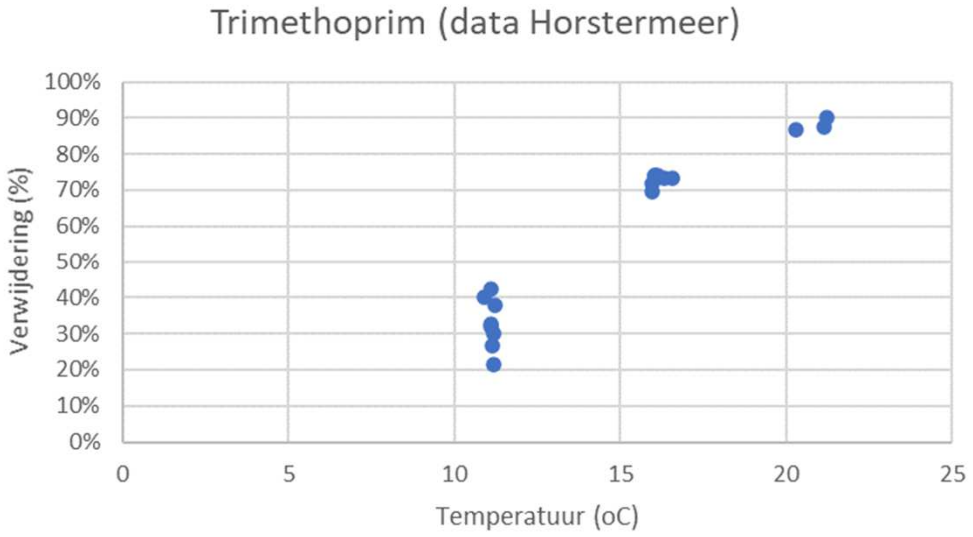
Oijen (2,5 days residence time)

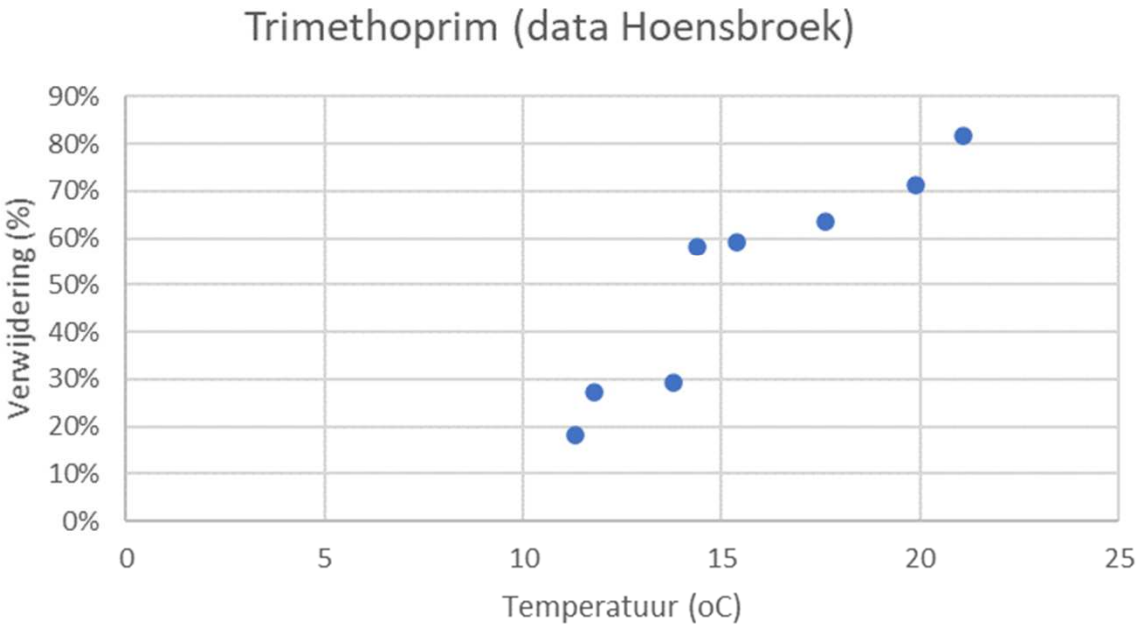
- removal rate (current instruction):
  - 30-35% at day 1 or day 2 after a rainfall event
  - 19% at start of influent sampling on day 3 after a rainfall event
  - 14% after day 4

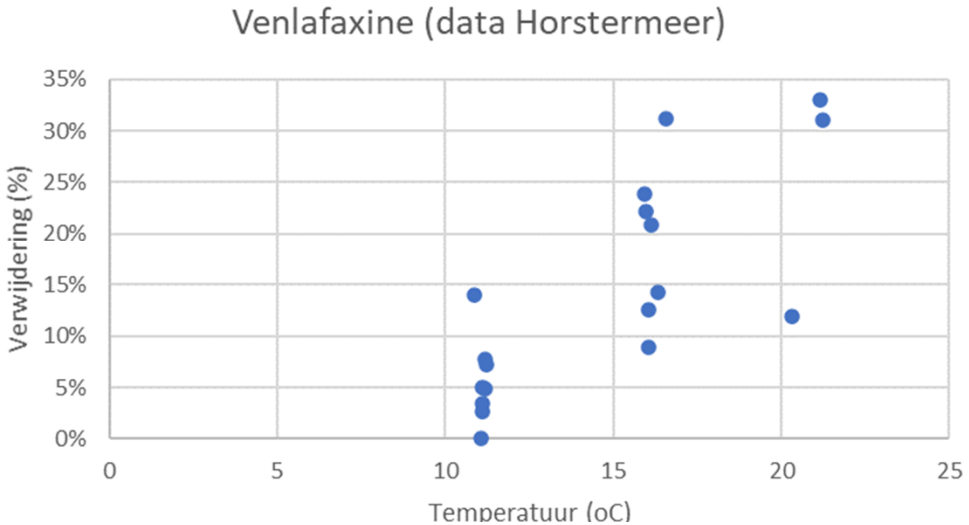
Effect of stormwater: 11 compounds WWTP Hapert effluent (residence time 2 days)



WW temperature







- Relevant temperature effect for Trimethoprim and Venlaflaxine.
- Limited data…… take into account!

How to proceed?

Adjust the existing protocol:

- 14-day consecutive sampling
- Staff and equipment; instruction, training, **communication**
- Quality check, conservation
- Analyses
  - DWF samples
  - One proportionally mixed sample
- Removal rate (+ uncertainty) + (concentration)

Implementing and learning!

- EU- wastewater directive
- Monitoring / evaluation of method and results
- Frequency, number of samples, number of WWTP, etc etc

To complicated?

Just a maximum concentration in effluent for diclofenac and some other compounds.

- Technology choice will be focused on diclofenac
- Do you need any additional technique at all?
- What will be the effluent concentration on a winter day, after rainfall, on a blue monday?
- Surface water asks for reduction of total toxic pressure.
- Possible solution;dillution with stormwater!

Please bare in mind

- Incorporate as many monitoring objectives as possible
  - surface water quality
  - Choise and dimensioning of additional technique
  - Operational optimisation of WWTP and additional technique.
  - Reporting to national - or European authorities
- As cheap as possible
- High quality data
- Involve staff and management (training and explaining)

Good monitoring is money well spent;
better investments and better operations

Sampling

Training
Explaining