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Gewässerschutzverband Region Zug

Sammelt und reinigt Abwasser.

Micropollutant elimination in practice: PAC Dosage on Sandfilter

WWTP Schönauf

23. September 2025

Anita Wittmer



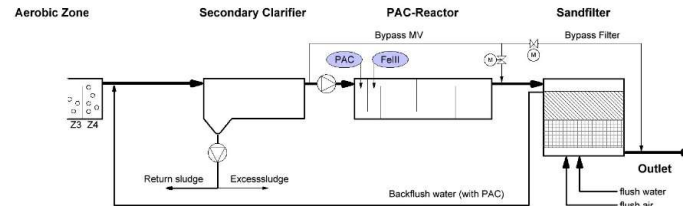
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Content

I: WWTP Schönauf



II: PAC on Sandfilter Technology and it's challenges



III: Measuring Micropollutant Sampling and Eliminationrates





175'000 connected inhabitants

85 km sewers

50'000 m³/d treated Wastewater (dry weather)

Maximum capacity 1600 L/s

4 Treatment steps

Removal of MP since 2019

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WWTP Schöna

Inlet

Mechanical Treatment:

- Screen
- Sand-/Fat trap
- Primary Clarifier

Biological Treatment:

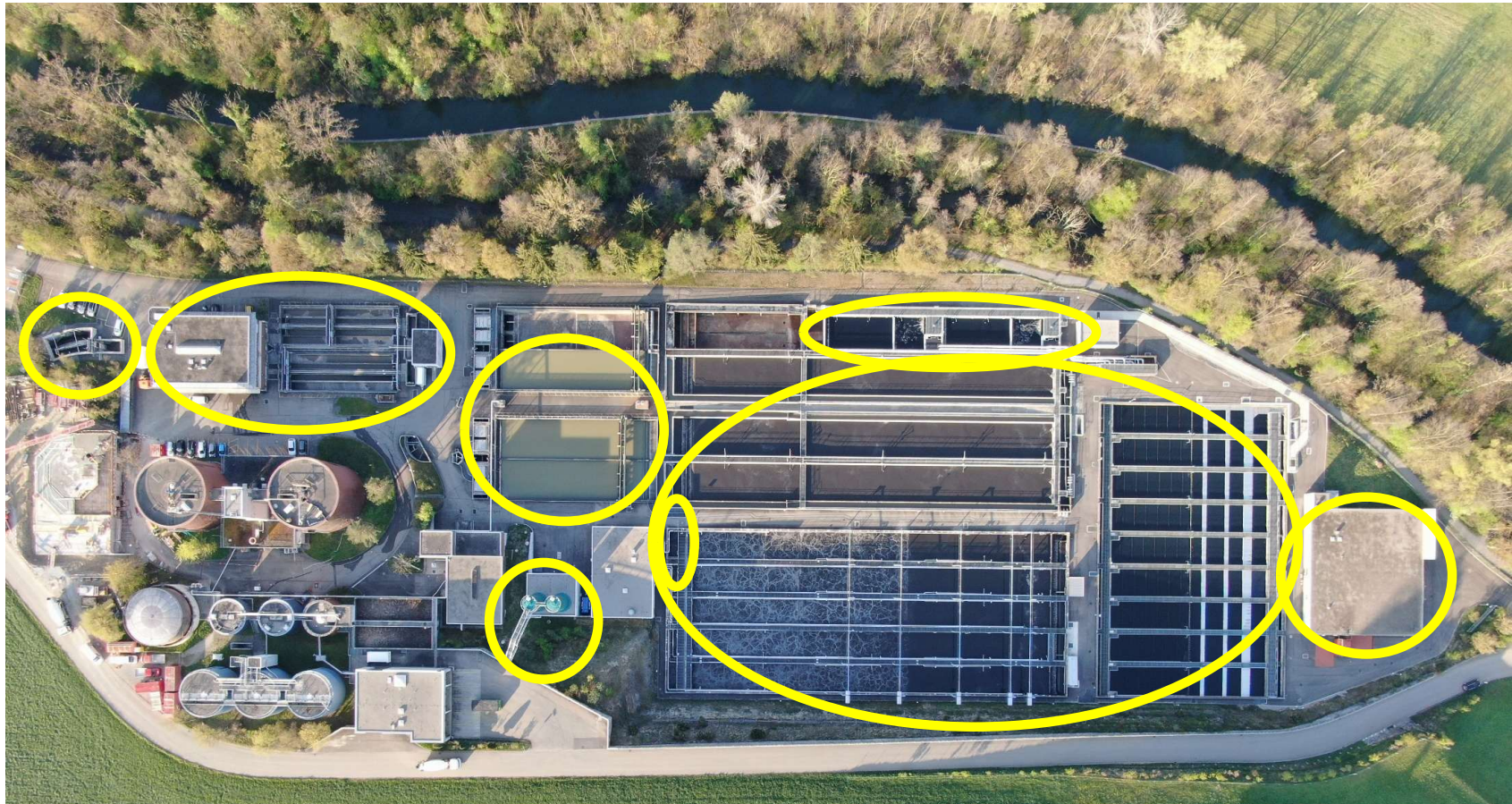
- Bio-P
- Denitrification
- Nitrification
- Secondary Clarifier

Chemical Treatment:

- Chemical P-Removal

Elimination of MP:

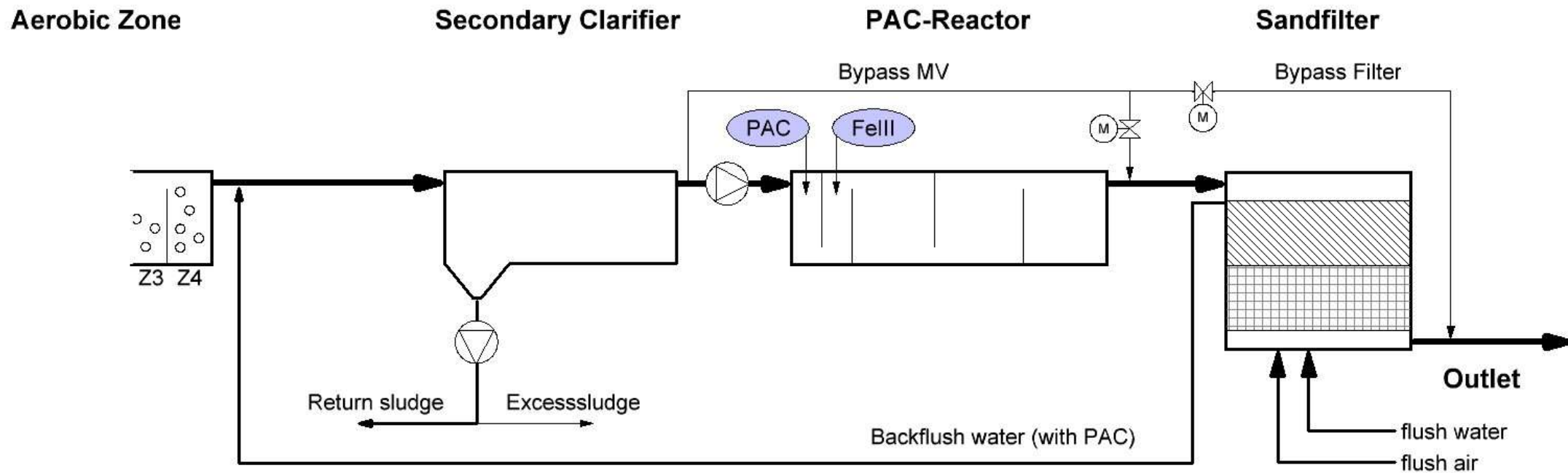
- PAC Reactor
- Sand filter



Micropollutant elimination in practice

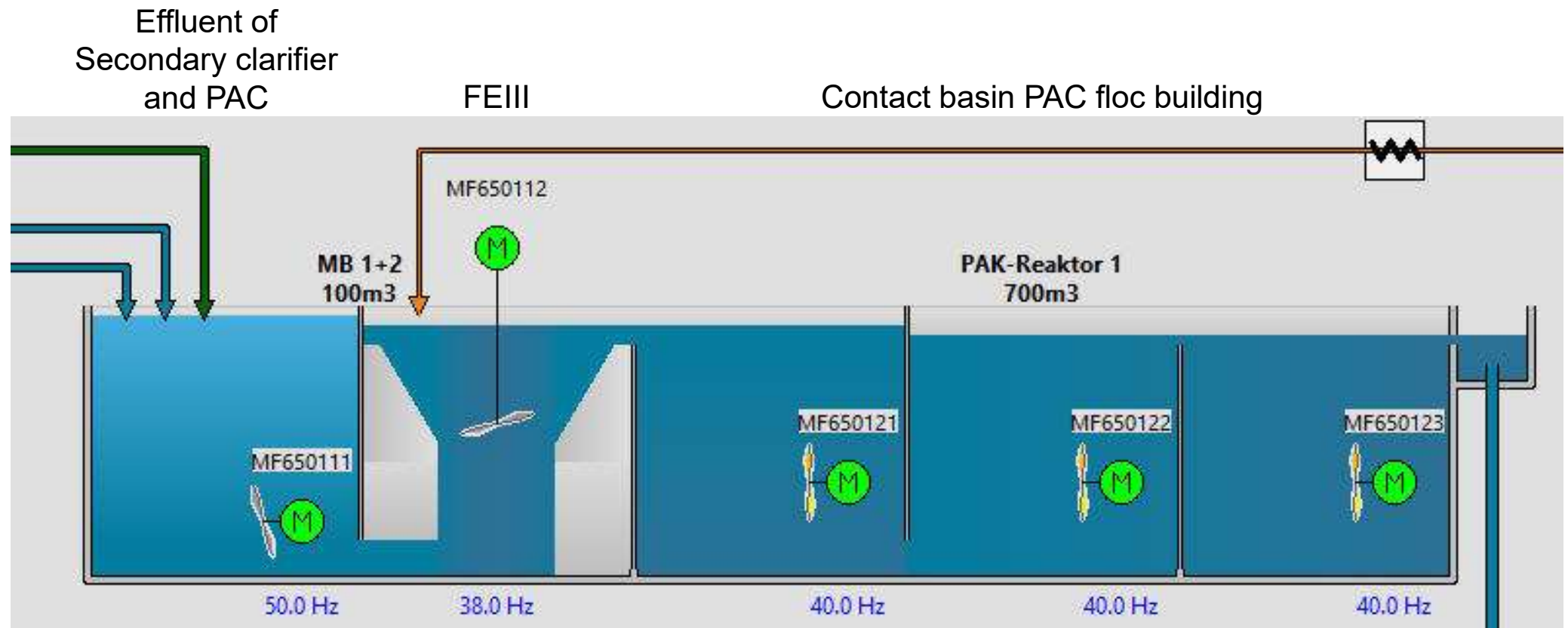
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PAC dosage on Sand filter

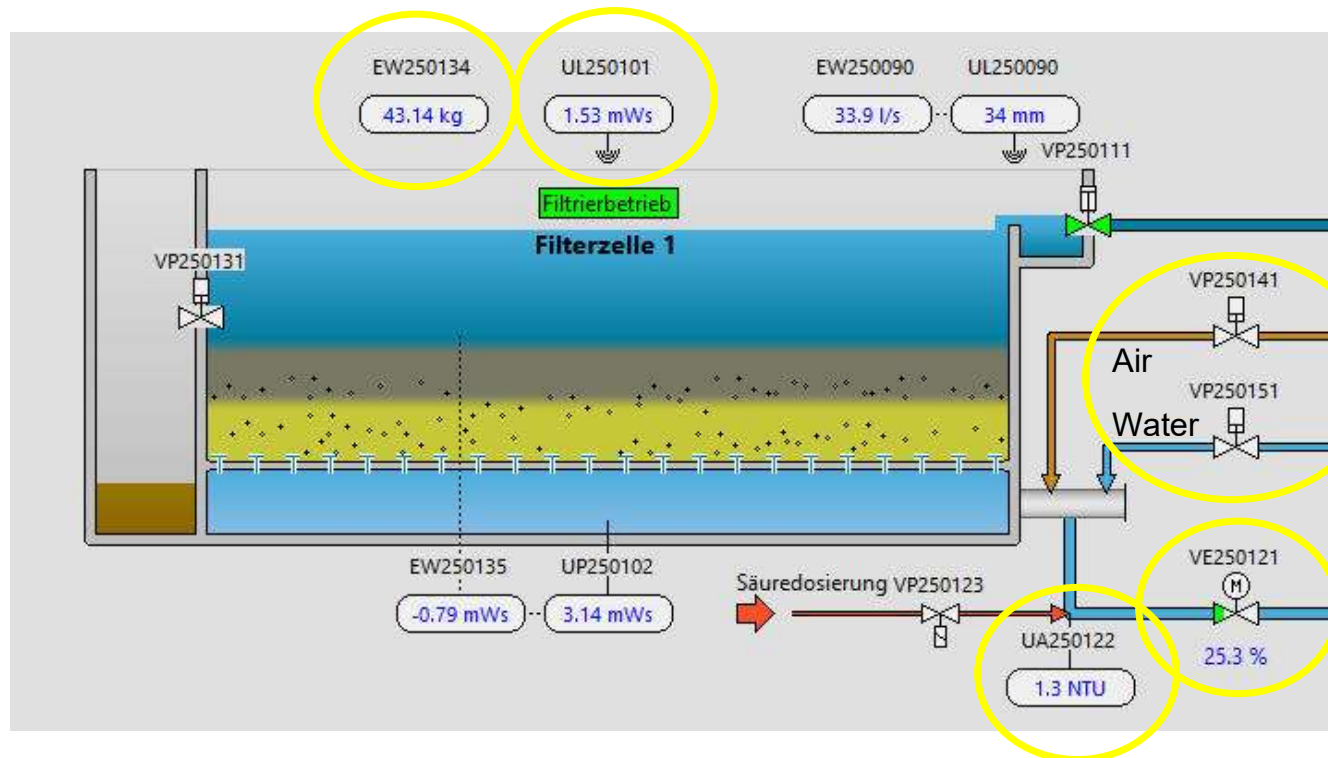


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PAC Reactor

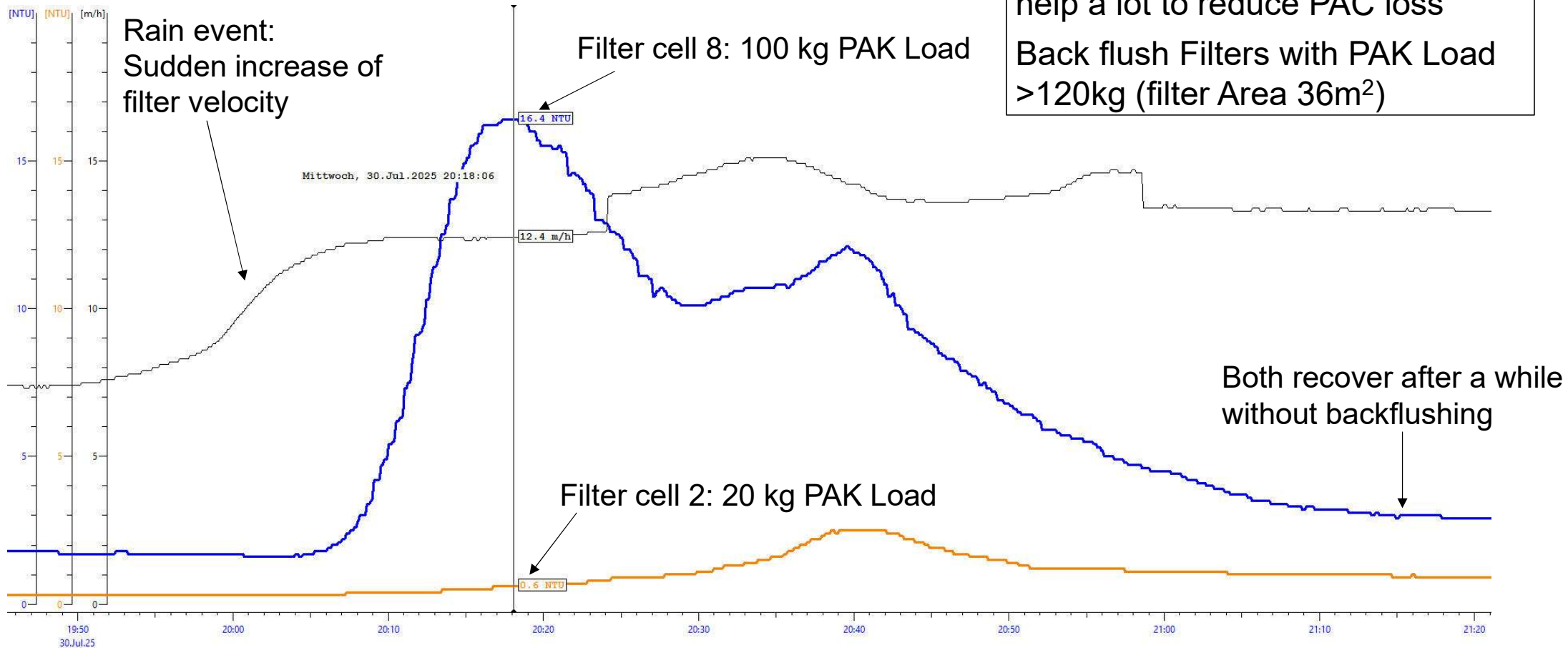


Filter cell equipment



- Fill level is used to control the outlet valve: smoothly
- Backflush system with water and air
- Calculated PAC Load on each filter cell (Main parameter for Backflush)
- Turbidity measurement in each cell: Verry helpful to conduct and observe the Maintenance and especially in the beginning to find the correct parameters for Backflush

PAC Loss – Turbidity: Hydraulic pressure



Hydraulic shocks causes PAC loss
Damping of hydraulic shocks will
help a lot to reduce PAC loss
Back flush Filters with PAC Load
>120kg (filter Area 36m²)

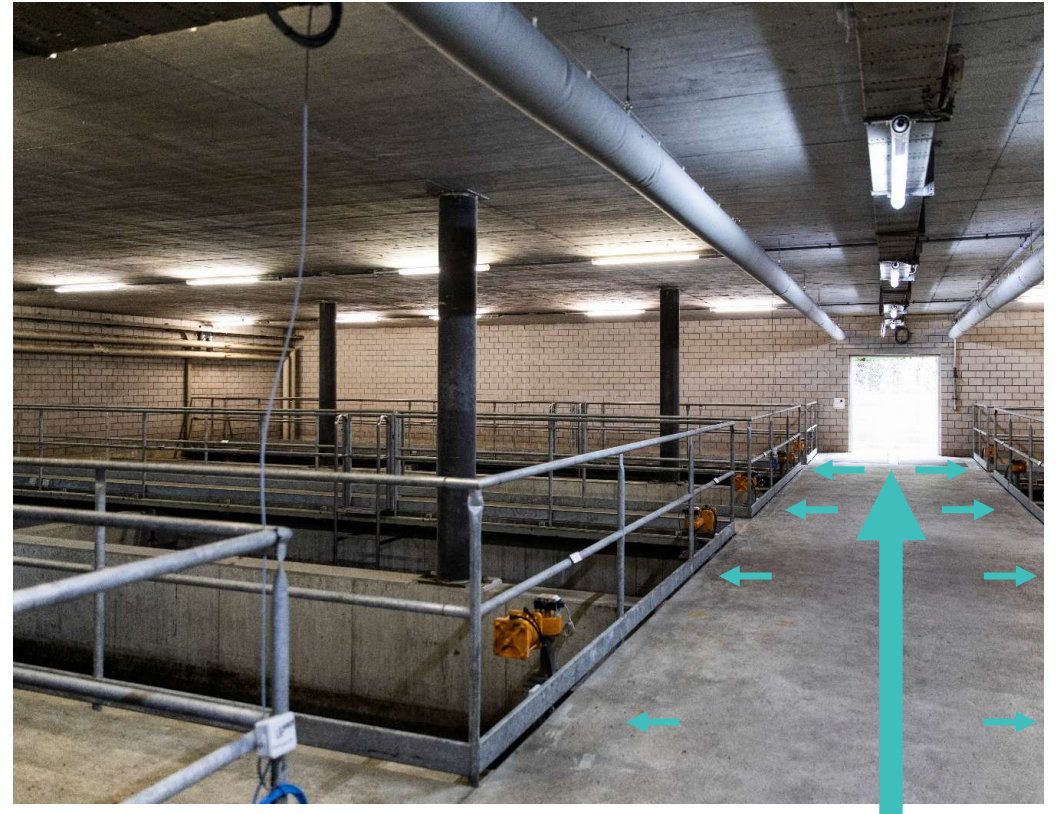
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12 Filter cells

- Depending on Filter flow velocity 4 to 12 Filter cells are operated
- Main goal is to stay within 5 to 7.5 m/h
- Low Flow velocities lead to surface clogging by the PAC-flocs
- During Rain events up to 16 m/h
- Reduction of hydraulic shock is very important
- Good Cleaning (Backflush) procedure is important

Recommendation:

- Flow velocities: not more than 12 m/h
- Calculate with one Filtercell reserve (backflush takes up to 30 min)



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PAC Dosage

Two PAC Silos:

Redundance is verry helpful

- Pollution of PAC
- Flexibility for delivery

4 Dosage units:

- Each Unit 6 – 60 Kg/h
- Usually 1 Unit in operation
- For higher dosage 2 units are necessary during rain events
- If one Silo is not in use, there are only 2 Units that can be operated

Micropollutant elimination in practice



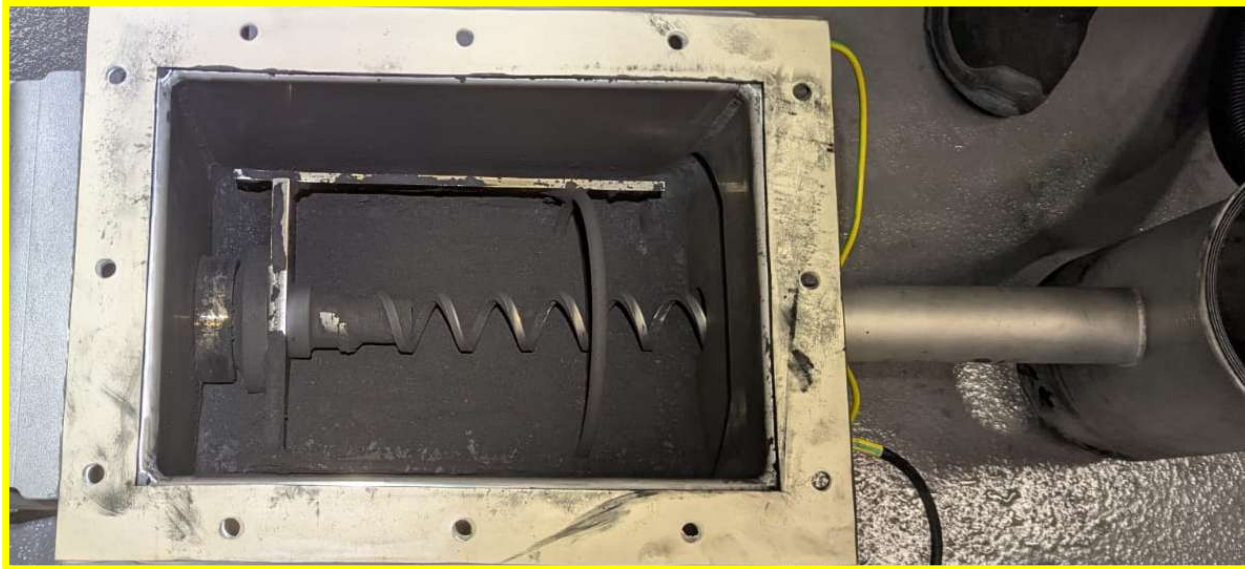
PAC Dosage unit



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PAC Dosage: PAC Balance



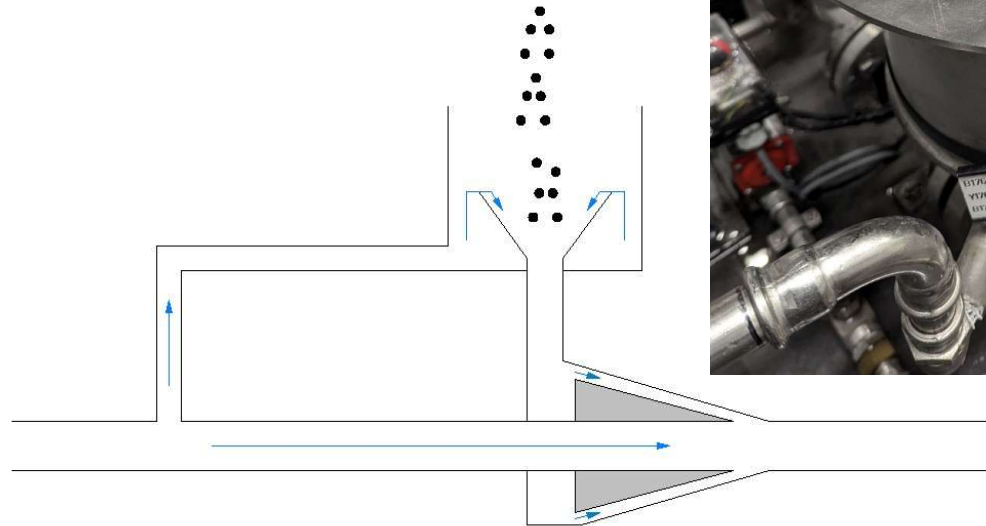
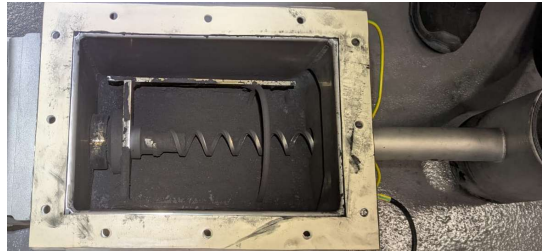
- Verry sensitive
- Needs to be dry (security valve closes automatically when Vortex is blocked)
- PAC Dosage 6 - 60 kg/h (separate control unit)

Micropollutant elimination in practice



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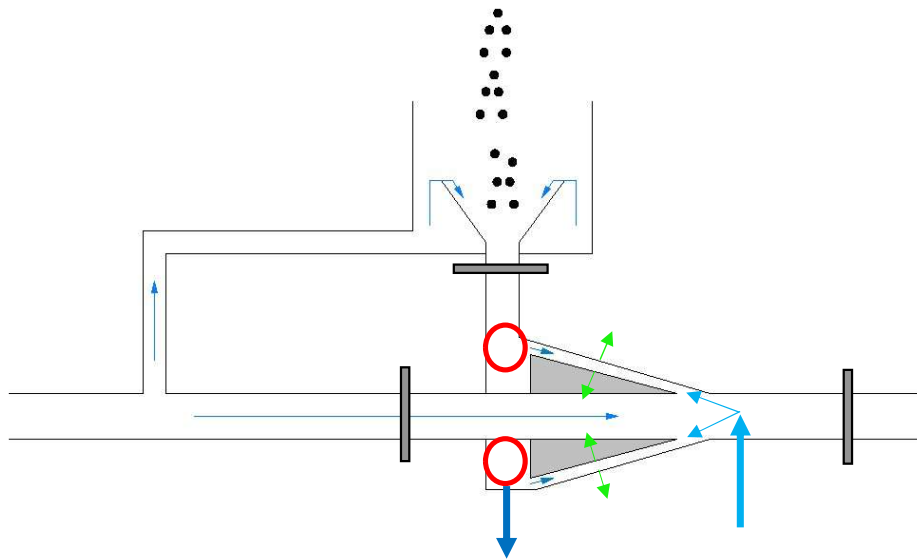
PAC Dosage: Vortex – PAC Suspension



Micropollutant elimination in practice

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PAC Dosage: Main Issue Blockage



Dismantling and cleaning takes several hours

→ Installation of a backflush system

→ Enlarge the gap



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PAC Silo: Filling

Make sure no larger particles are filled into the Silo

PAC is filled through a filter unit

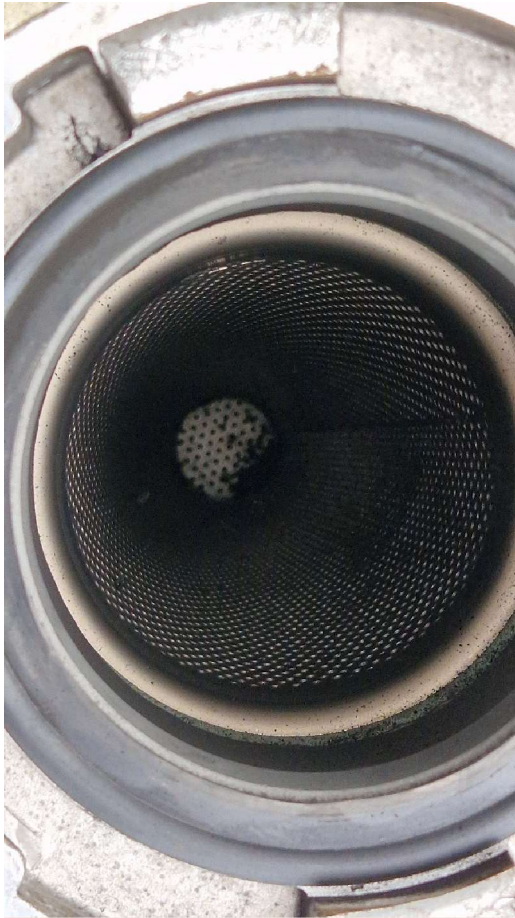


Micropollutant elimination in practice



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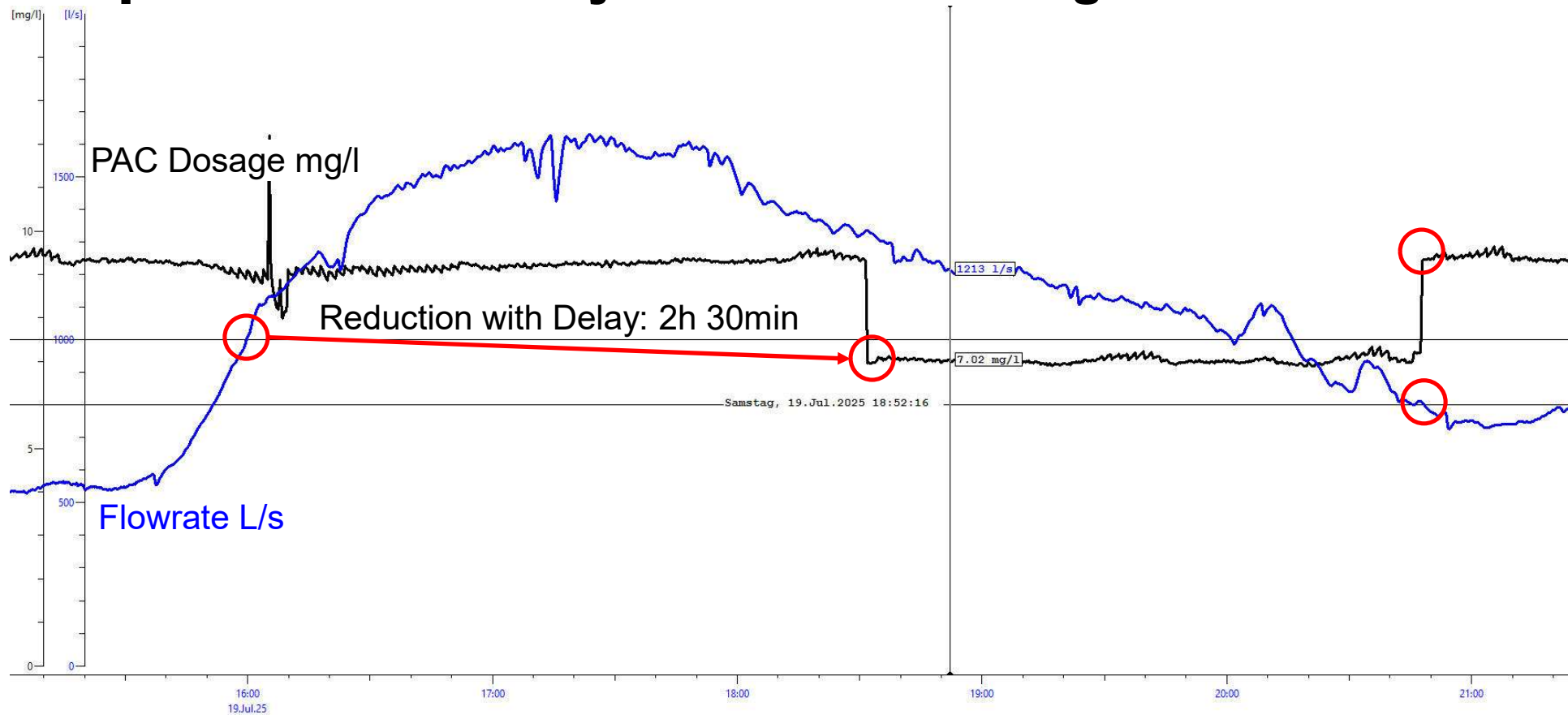
PAC Silo: Filter unit



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PAC Dosage Strategy: Q Proportional with delayed reduction during rain events



Micropollutant elimination in practice

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Micropollutant Measurement: Sampling

Sampler:

- 4 Buckets (each 24L)
- chilled

Sampling:

- 24h mixed sample
- Q Proportional
- Automatic switch to Time proportional during rain events

→ MP Measurement with 48h mixed sample

Micropollutant elimination in practice



Micropollutant Measurement: Sampling

Preparing and distributing the Samples

- 20 L are heavy, good handles are necessary
- Mixing the 20L to get homogeneous samples



Micropollutant elimination in practice

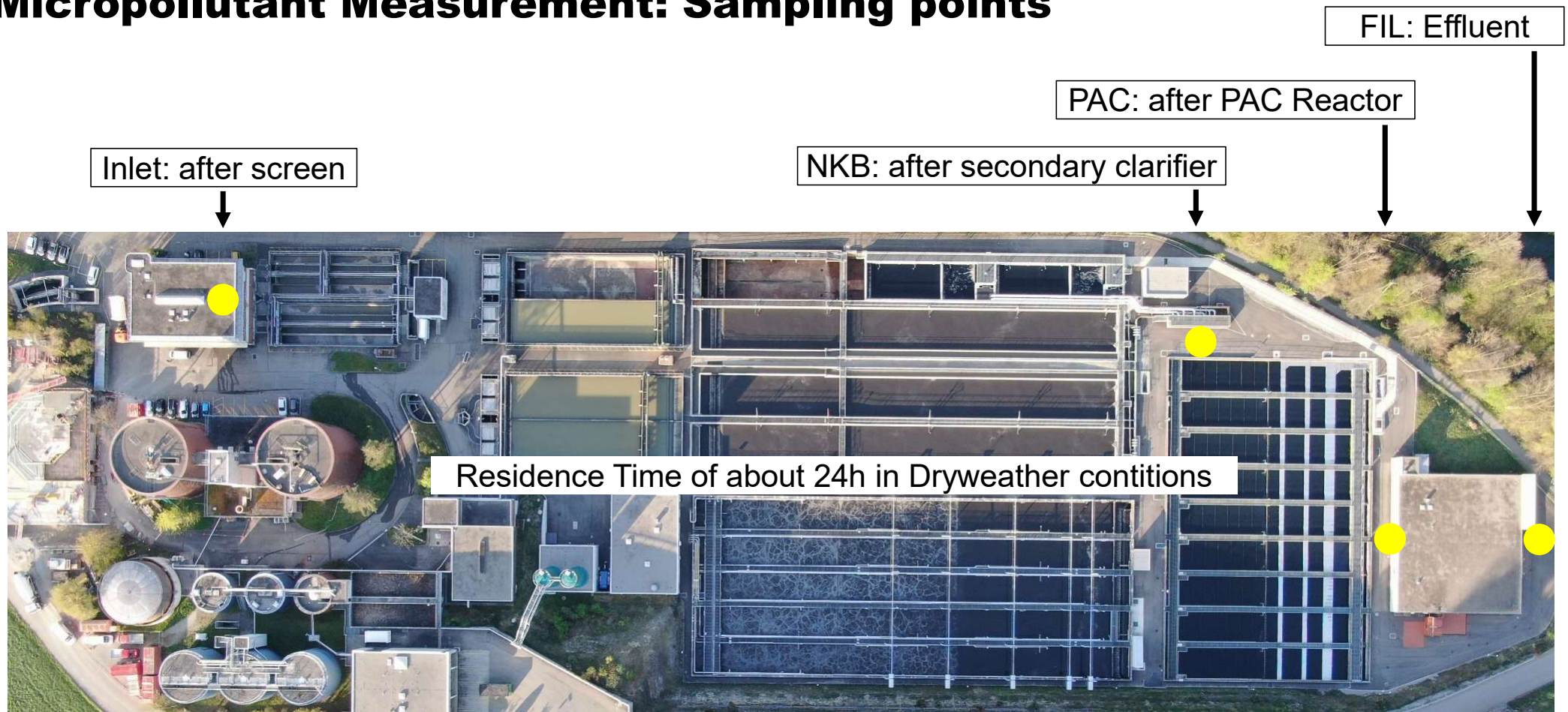
Cleaning the buckets



- Cleaning the buckets very carefully before a sampling campaign is very important
- Buckets from Inlet should not be used in Effluent to avoid cross contamination

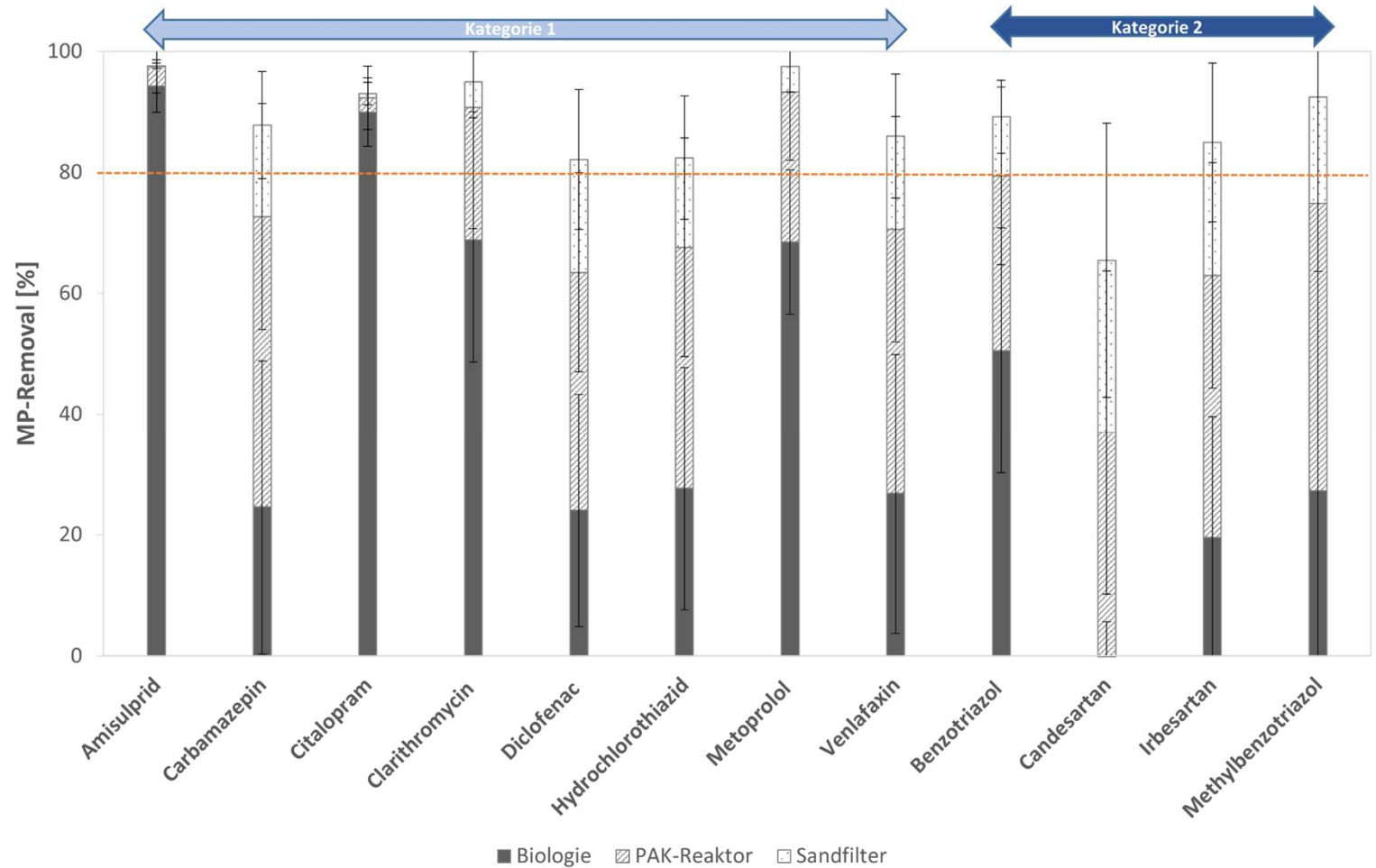
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Micropollutant Measurement: Sampling points



Elimination of different Micropollutant

- 80% Elimination can be well achieved
 - Substances react differently in different parts
 - Some Substances show regularly negative Elimination in Biology
- No online Measurement to observe actual Elimination efficiency
- Charges of PAC can vary in their adsorption efficiency



Conclusion

- After almost 7 years of experience and optimization:
«The Process runs fine and most of the time without larger maintenance effort»
- It was a good solution regarding the little construction space that was available
- Having only the Sand filter as barrier to the receiving water is a risk and should be planned carefully
- PAC has a high grey energy
We try to use biogen or even wood carbon only
And we further try to optimize the dosage to reduce the amount of PAC without losing removal efficiency and certainty to achieve the 80% removal required

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Thanks for your attention

Thanks to the whole GVRZ team that helps to optimize and keeps everything running



Micropollutant elimination in practice

Photographs: © GVRZ
Cover photo: Stefanie Fretz
Aerial view catchment area: Peter Raimann