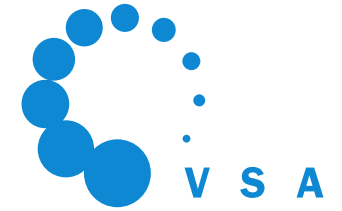




11% of Swiss population is actually connected to a WWTP with micropollutant treatment

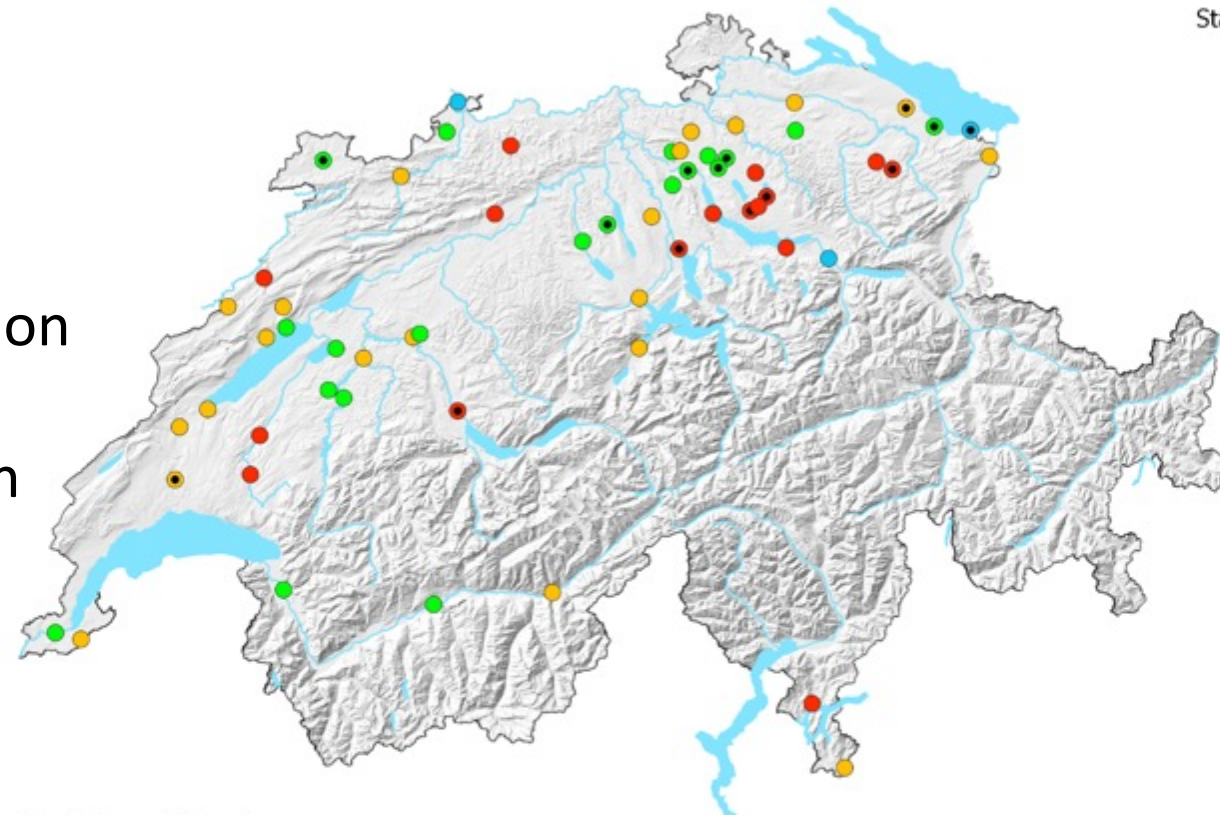


Stand September 2021

14 mp treatments in operation:

- 6 ozonation + sandfiltration
- 5 PAC processes + sandfiltration
- 2 GAC treatments
- 1 combination ozone + GAC filtration

45 projects in planning/construction phase



Verfahren, Stand

● GAK In Betrieb

● GAK Planung/Bau

● PAK In Betrieb

● PAK Planung/Bau

● Kombi In Betrieb

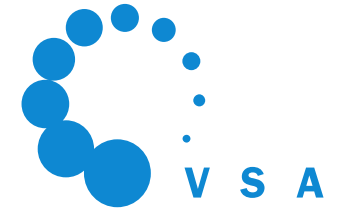
● Kombi Planung/Bau

● Ozon In Betrieb

● Ozon Planung/Bau

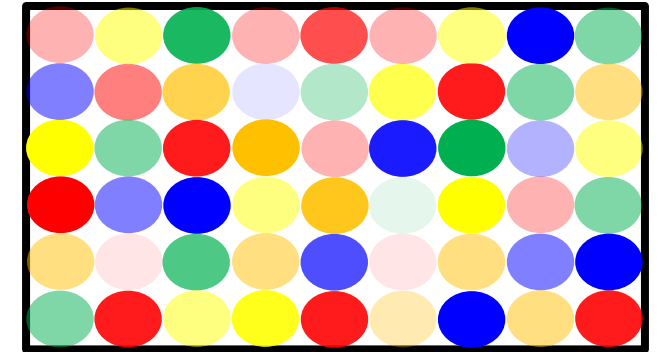
Quelle: Bundesamt für Landestopographie

Key to success: Set clear and simple framework conditions



Aims → basis for WWTP selection:

- Protection of sensitive water bodies
- Quality control of drinking water resources
- Load reduction
- Reduction goal: 80% (inflow WWTP – outflow WWTP) of a list of 12 substances, representative of a broad range of organic micropollutants, 48h composite sample
- At any time (also during rain) → large influence on investment costs
- Longterm financing solution

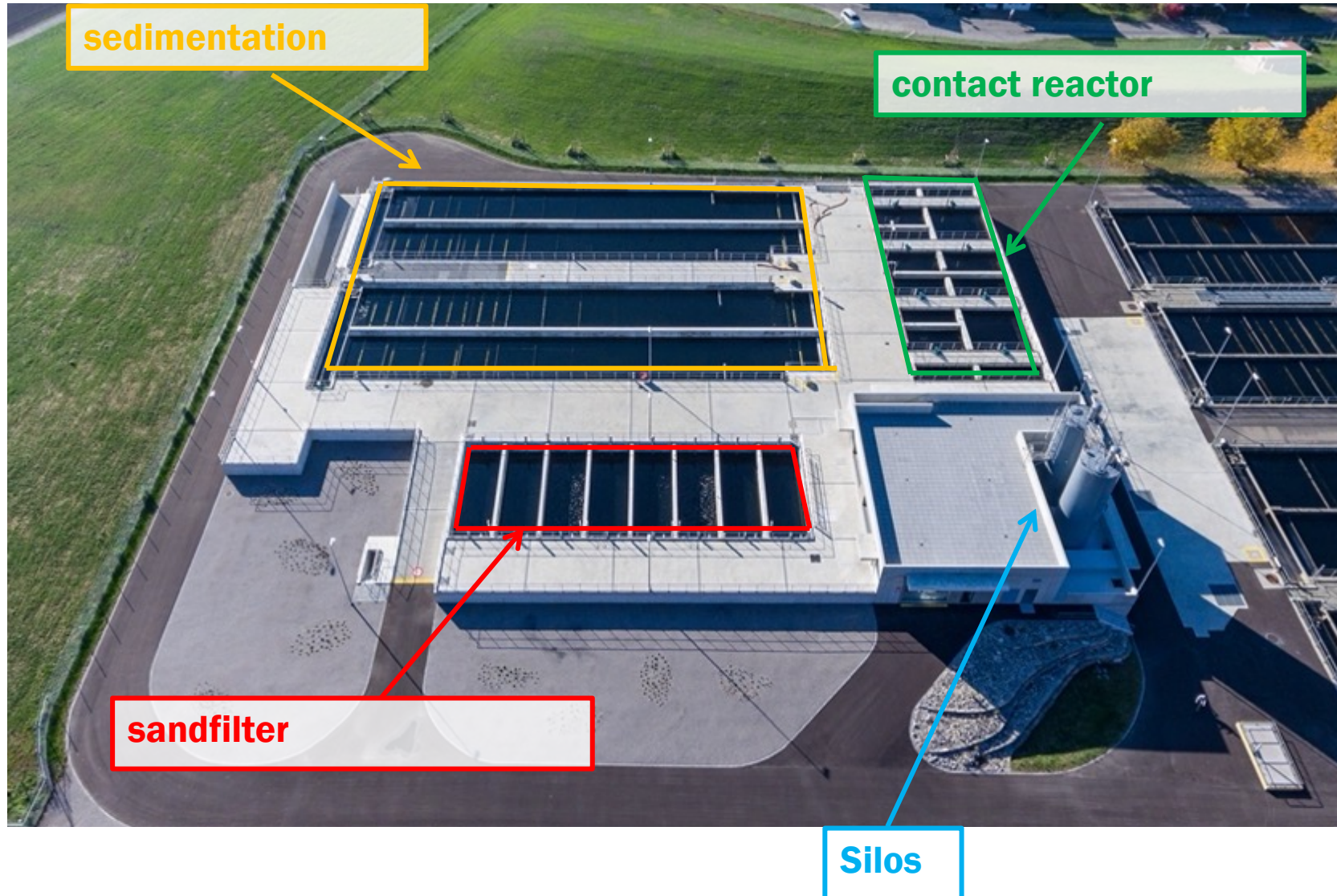
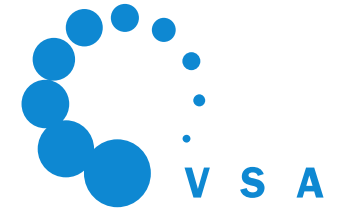


Some challenges when it rains

- Representative samples: The change from dry weather to rainy weather within a 48h composite sample is the most difficult situation to monitor → not the same water package
- Dosage of O₃/AC because of variable ww composition → like a pilot flying blind
 - Ozonations: complex steering concept
 - PAC: optimale dose from experience for one PAC product



PAC + sedimentation + sandfiltration → reliable, stable, low PAC use



- Technology of PAC dosage station optimized

Photo and source: WWTP Thunersee

PAC + sandfiltration → compact, low PAC use, risk of PAC loss is higher because of no sedimentation

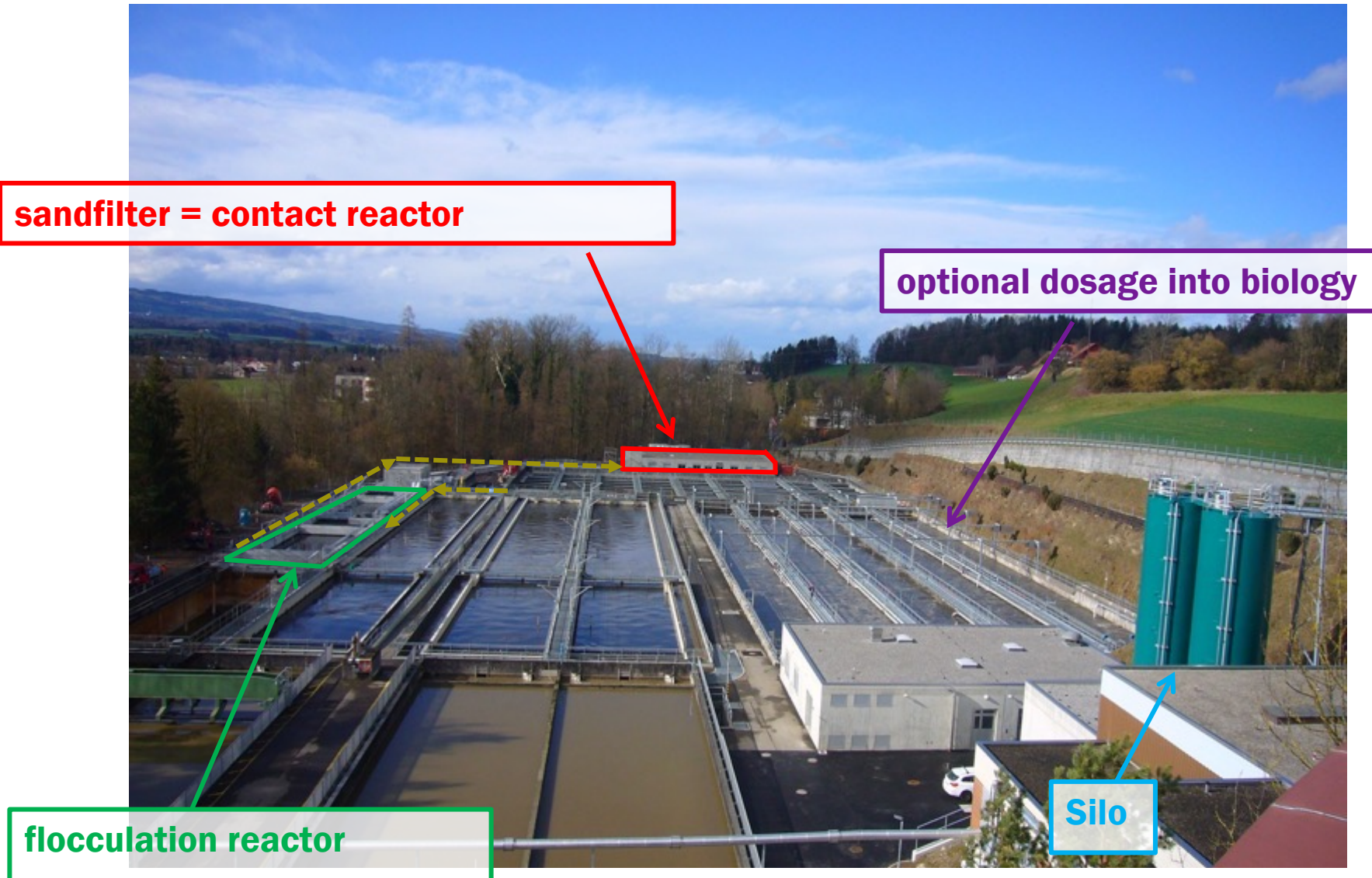
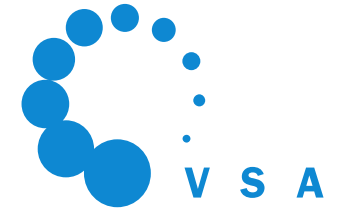


Photo: WWTP Schönaau, Cham
Source: GVRZ

PAC dosage into AS + sandfiltration → very low investment costs, simple and it works, higher PAC use

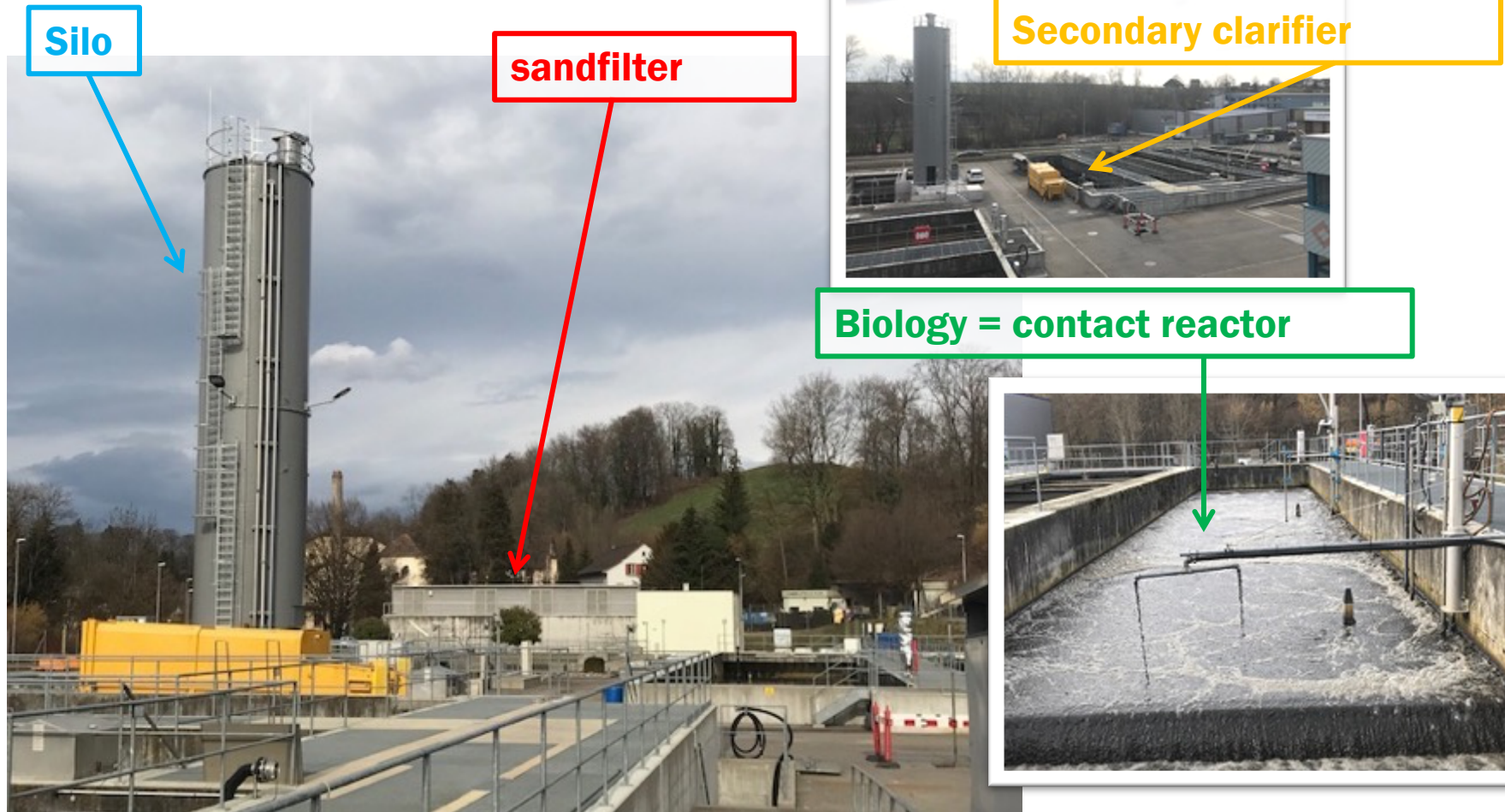
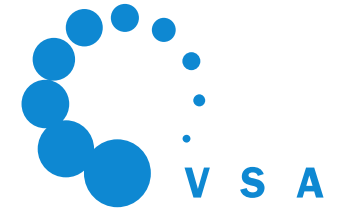
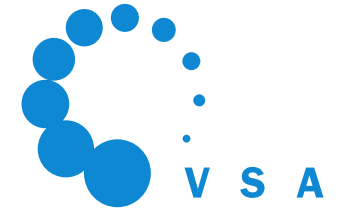


Photo and source: WWTP Wetzikon

GAC filtration is an important alternative → low maintenance, lower CO₂ footprint than PAC



- Good experience from pilot tests
- A minimum empty bed contact time is crucial
- Large competition of DOC
- Several open questions remain - longterm experience to economic efficiency, elimination during rain events, exchange criterion,...

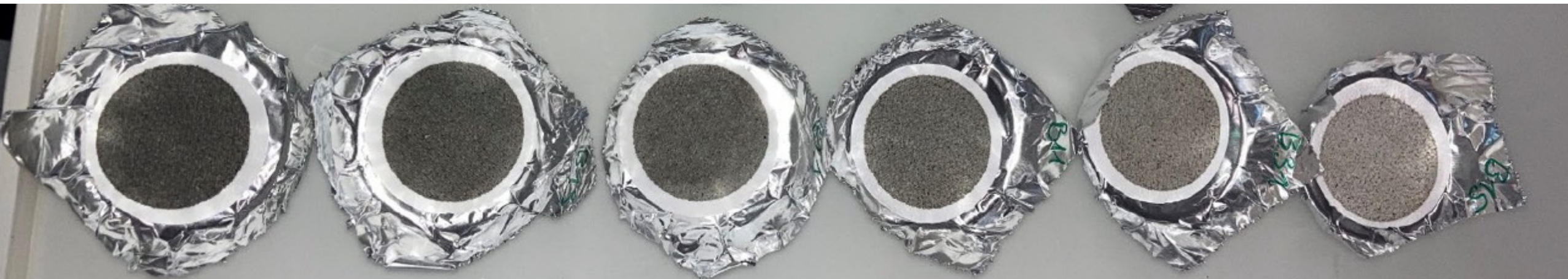


Photo: Pilot test WWTP Glarnerland, source Eawag

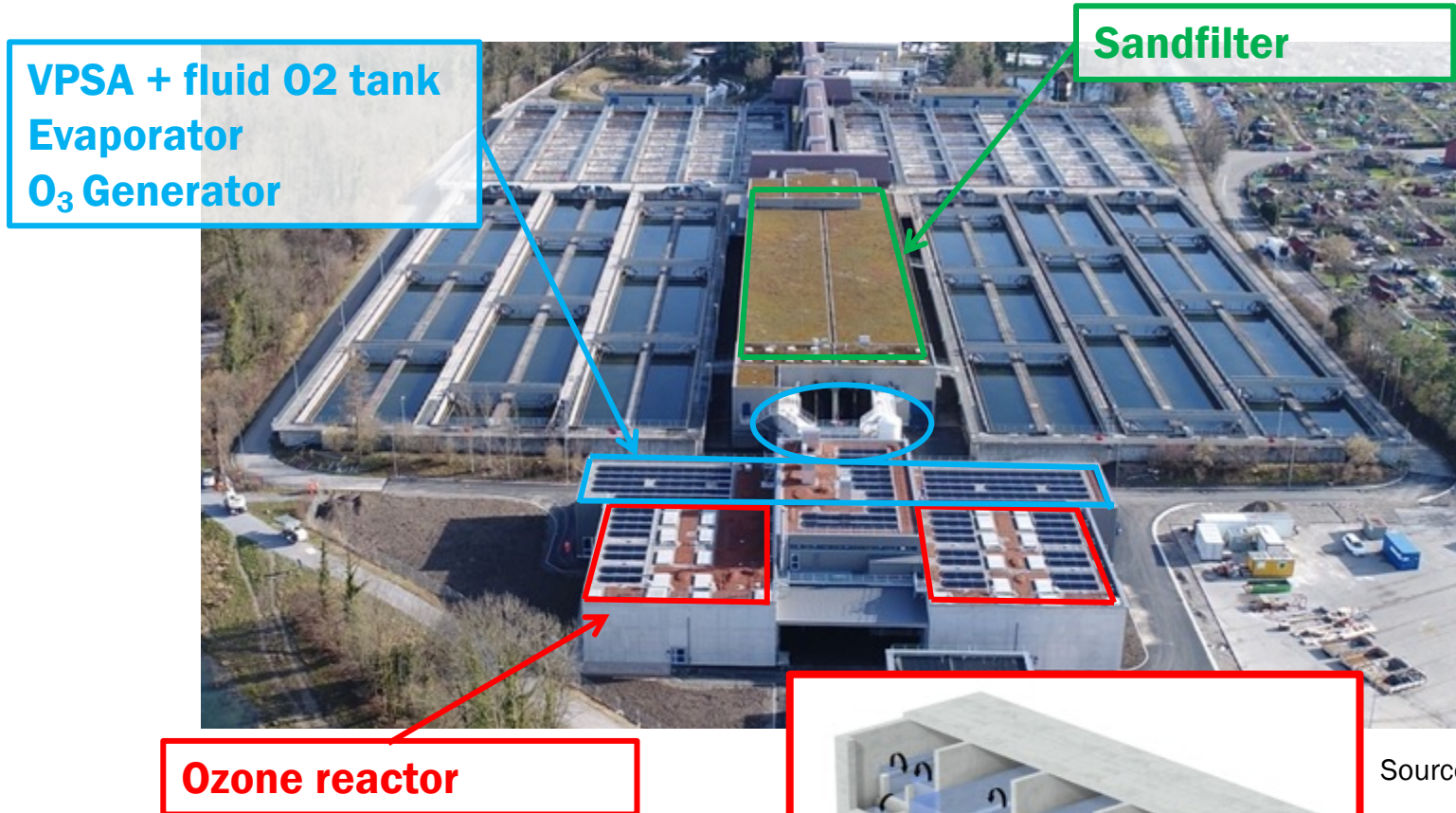
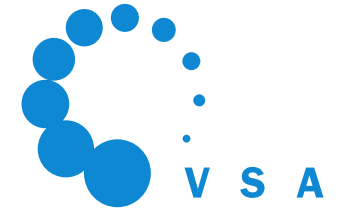
Minimise AC loss

- AC retention of more than 95% is technically feasible, taking into account measurement inaccuracies
- Monitoring of the solids content in the effluent of the WWTP recommended at various operating conditions using total undissolved solids, turbidity measurements and direct AC loss measurements
- High uncertainty for measuring method of AC loss (thermographically): project ongoing at FHNW to optimise AC measurement

Photo: Filter plates from outflow with different AC loss, source: J. Lutz FHNW



Ozonation + sandfiltration → efficient, low annual costs, not suitable for every wastewater



Ozone dose can be reduced:

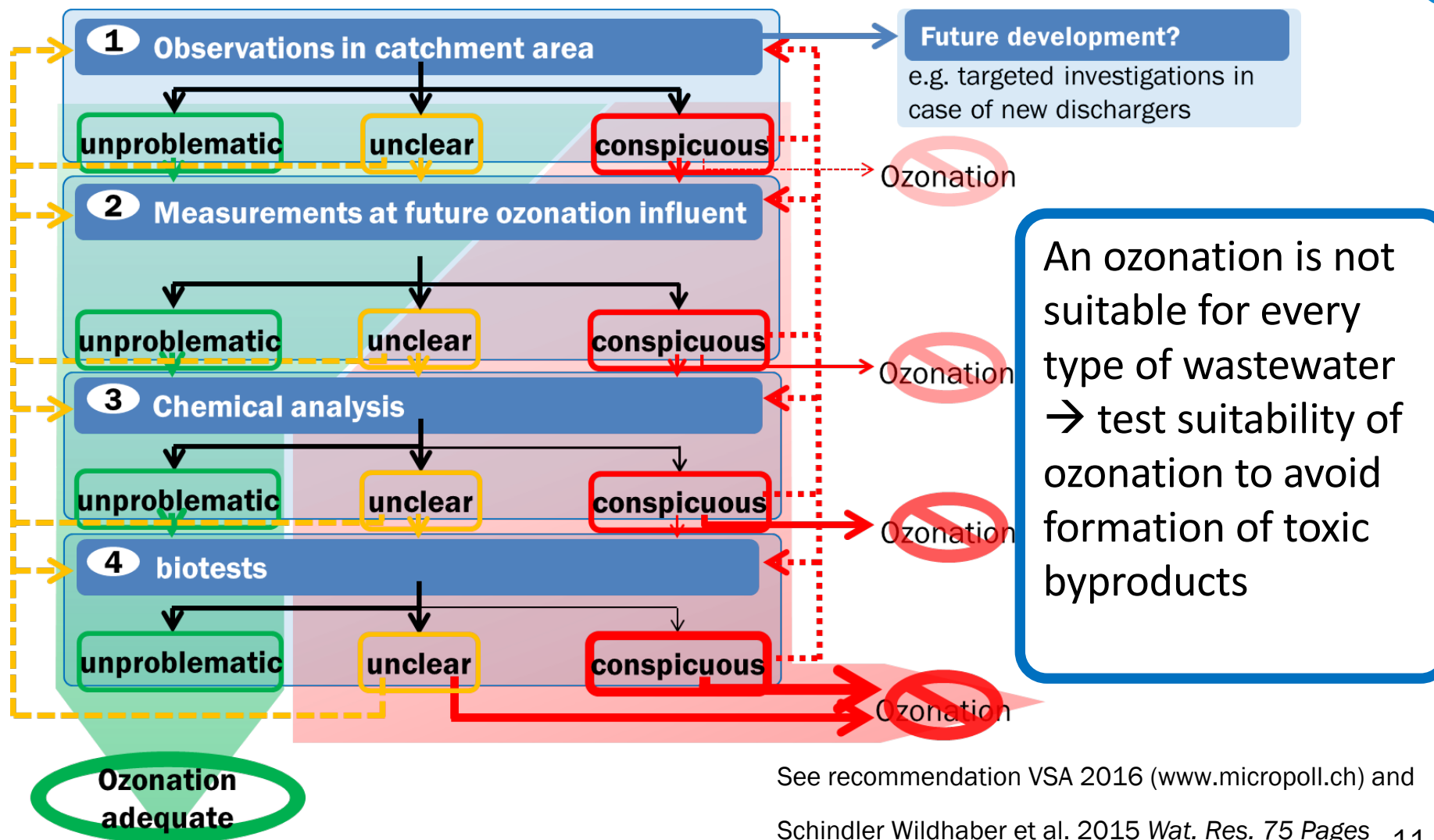
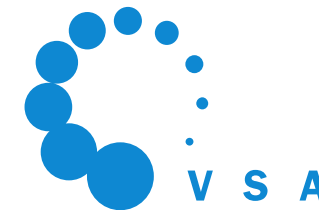
- with optimised control and regulation with UV sensors
- By using two chambers of ozone diffusers

Find optimized form of reactor with hydraulic simulations

Source: ERZ

Photo: WWTP Werdhölzli, Zürich
Source: ERZ

Stepwise procedure to analyse the suitability of ozonation (recommendation of VSA)

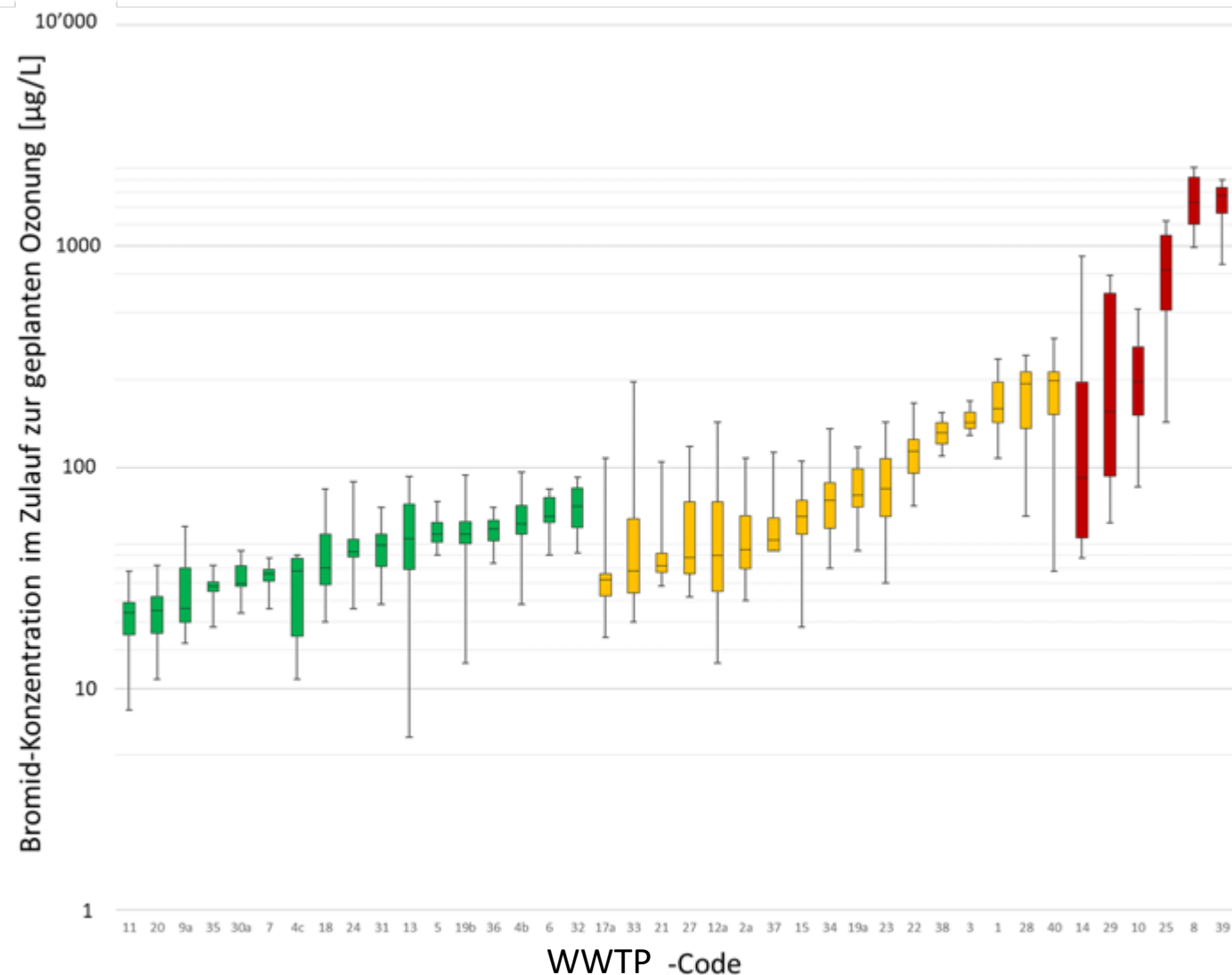
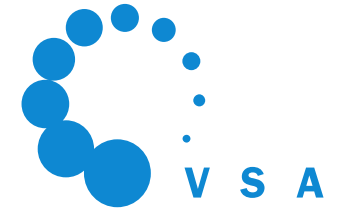


See recommendation VSA 2016 (www.micropoll.ch) and

Schindler Wildhaber et al. 2015 *Wat. Res.* 75 Pages 11

324–335

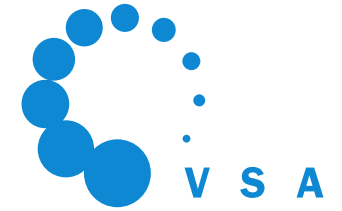
Bromide concentrations in tested 40 wastewaters



Bromide
concentrations:

- <100µg/L:
unproblematic
- 100-400µg/L: unclear
– look for source
- >400µg/L:
conspicuous

To sum up: Positive experiences, some open questions remain



- Treatments get more compact
- Challenges at rainy weather
- Test for treatability with ozone is necessary – ozonation is not suitable for WWTP with high bromide concentrations in the inflow
- Minimise loss of activated carbon
- Treatments are more and more optimised
- GAC treatments and combinations with open questions

Outlook

- Communication of experiences
- Monitoring: at WWTP, in receiving waters, biomonitoring
- Answers for open technical questions



Photo: aquarium WWTP Morgental

Thank you for your attention!

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picture: WWTP Herisau (2020) with additional
treatment step for micropollutant elimination

