WOW! CLOSING EVENT – PART 2
FRIDAY SEPTEMBER 8TH – DUBLIN

Interreg North-West Europe WOW!
EUROPEAN UNION
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Constructed Wetlands with biochar

Case study for a small catchment area

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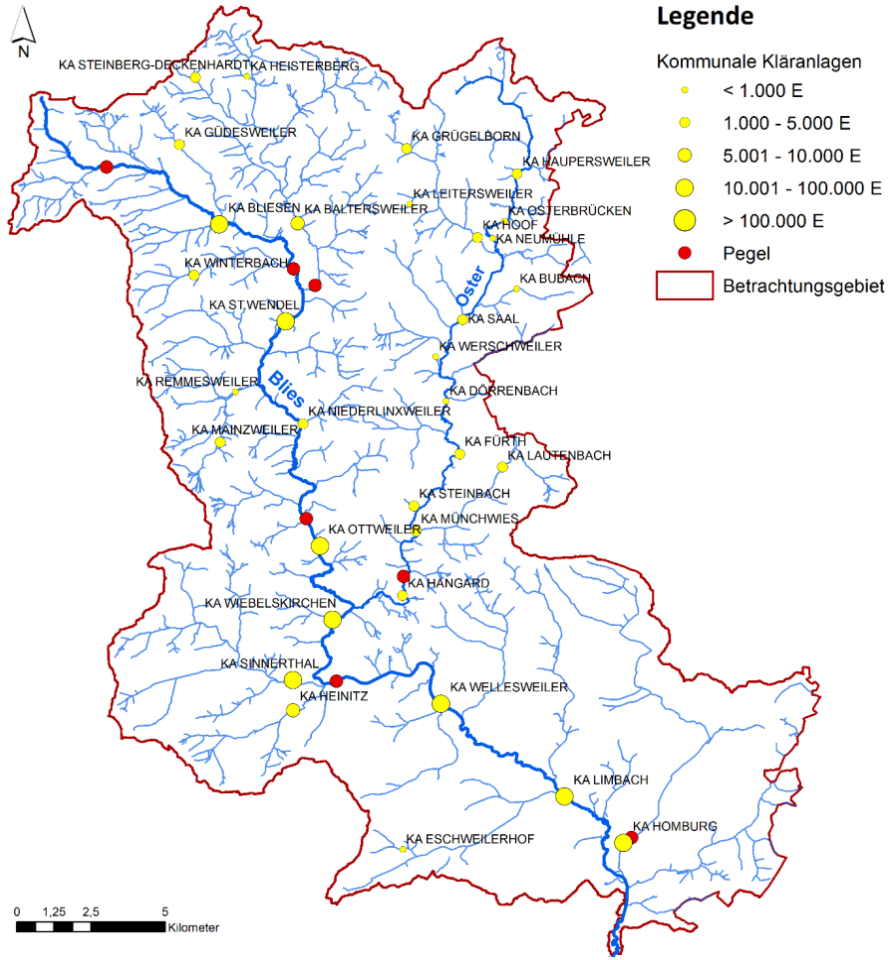
Agenda

- Boundary conditions of the case study
- Solution for micro-pollutant elimination at small STPs
- Design of fine sieve and constructed wetlands with $WOW_{Biochar}$
- Result of the case study

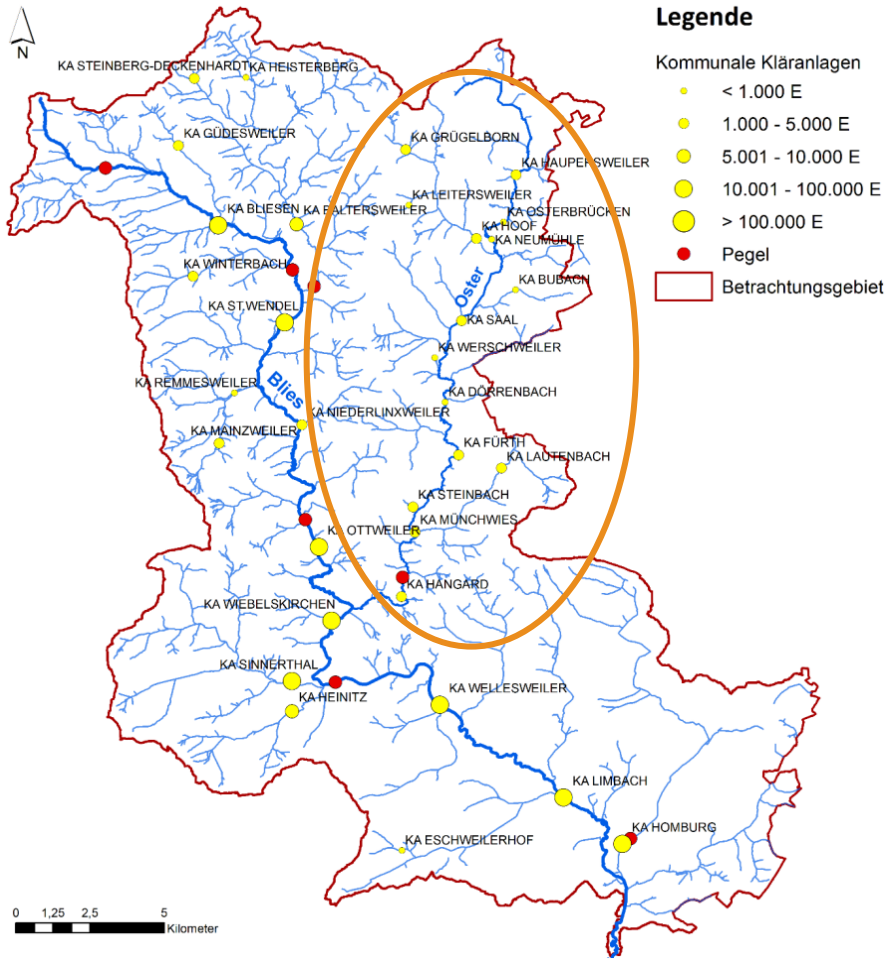
Boundary conditions

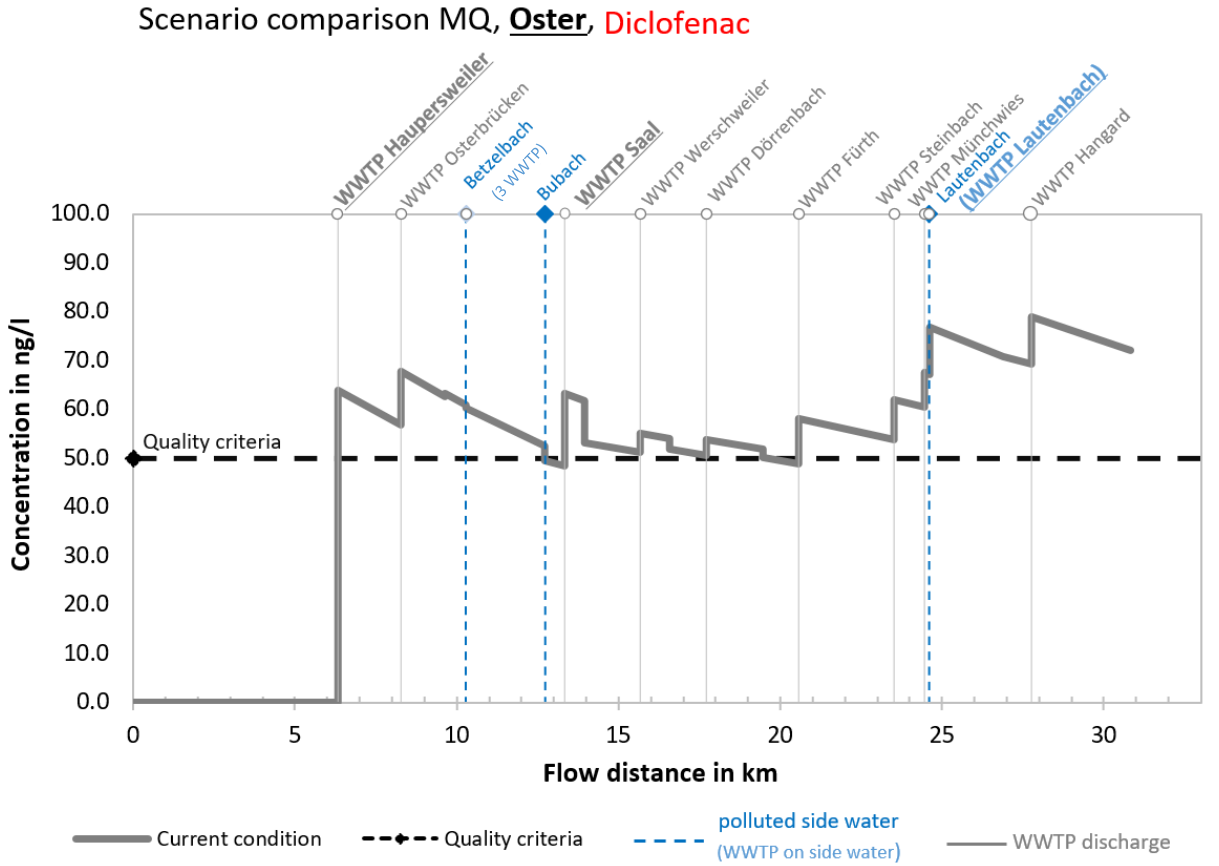


- River: Blies (Saarland, Germany)
- Rural area
- 22 STPs < 5.000 PE
- Small receiving water courses
- Discharge of STPs partly close to the source

Reference: Schmitt, T.G.; Knerr, H.; Valerius, B.; Kolisch, G. und Taudien, Y. (2019)

Boundary conditions



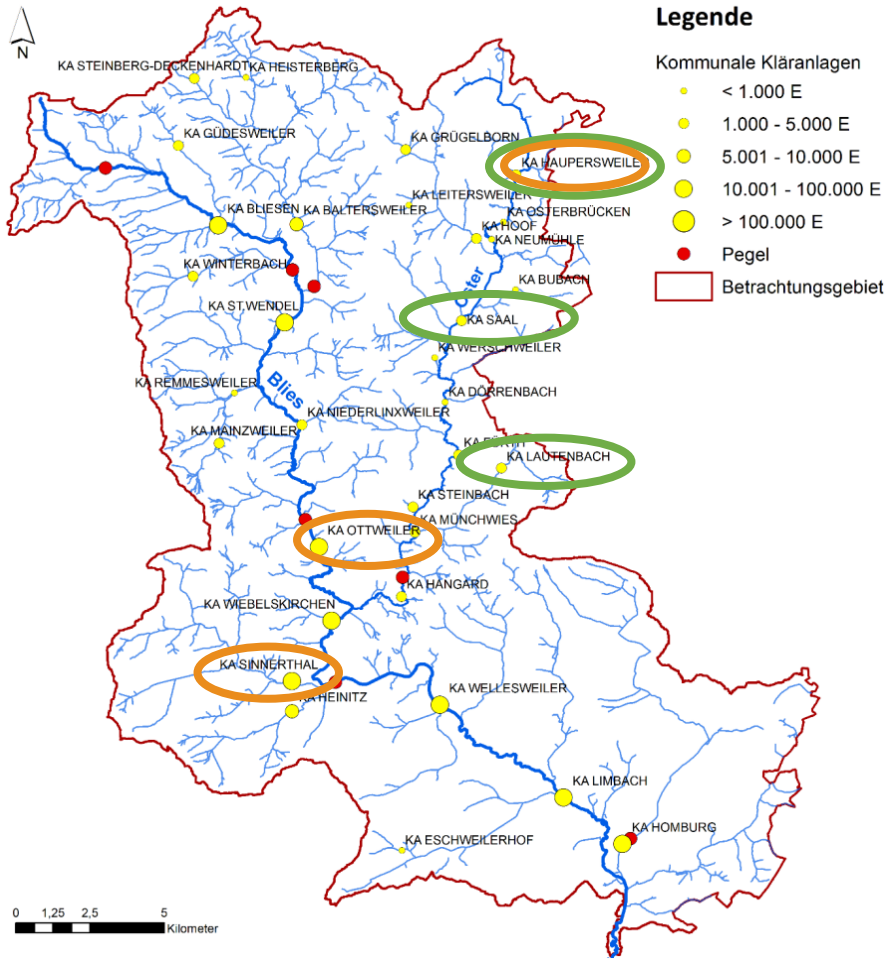


Requirements for pollutant elimination at small STP:

- technically simple
- low operational effort

Reference: Schmitt, T.G.; Knerr, H.; Valerius, B.; Kolisch, G. und Taudien, Y. (2019)

Pollutant elimination at small STPs



- Implementation of fine sieves at larger STP to recover cellulose
- Use of the cellulose in order to produce $WOW_{Biochar}$
- Implementation of three constructed wetlands with biochar at small STPs

WWTP with constructed wetlands

WWTP with fine sieves

Reference: Schmitt, T.G.; Knerr, H.; Valerius, B.; Kolisch, G. und Taudien, Y. (2019)

Design: fine sieve + cellulose recovery

- Location: WWTP without primary clarifier & digester
- Layout: max. inflow water volume, specific cellulose load: 32 g/PE/d
- Biochar-production for the CW

Advantage for the WWTP:

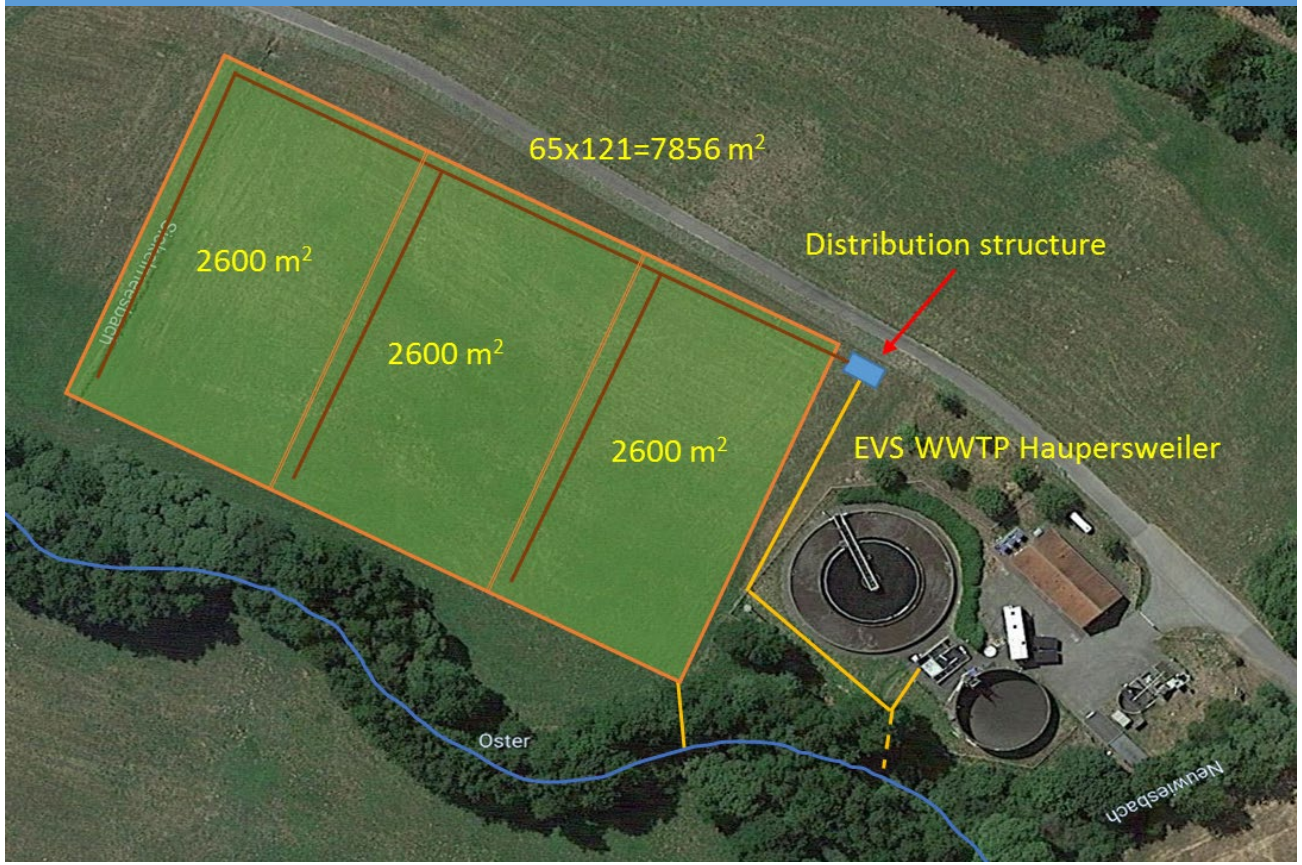
- Reduced oxygen demand or
- Additional treatment capacity

Finesieves in Ede (Reference: (WOW, 2022) Report on the production of biochar (activated carbon), bio-oil and pyroligneous acid from cellulose)

Design: Constructed wetland + $WOW_{Biochar}$

WWTP	unit	Haupersweiler
Input Data		
Connected PE	PE	3,033
Annual flow	m^3/a	794,346
Waste water flow to constructed wetland	m^3/a	635,477
Wetlands Data		
Length	m	118
Width	m	65
Filterbody	m^3	4986
Volume: Sand	m^3	4238
Volume: WOW_{Char}	m^3	748
Amount of WOW-Biochar (50% straw/cellulose)	kg	**1,121,738**
→ Amount of straw	kg	2,804,344
→ Amount of cellulose	kg	2,804,344
Average filter velocity	m/h	0.009
Maximum Hydraulic Volume Rate	$L/(m^2 \cdot d)$	302.657

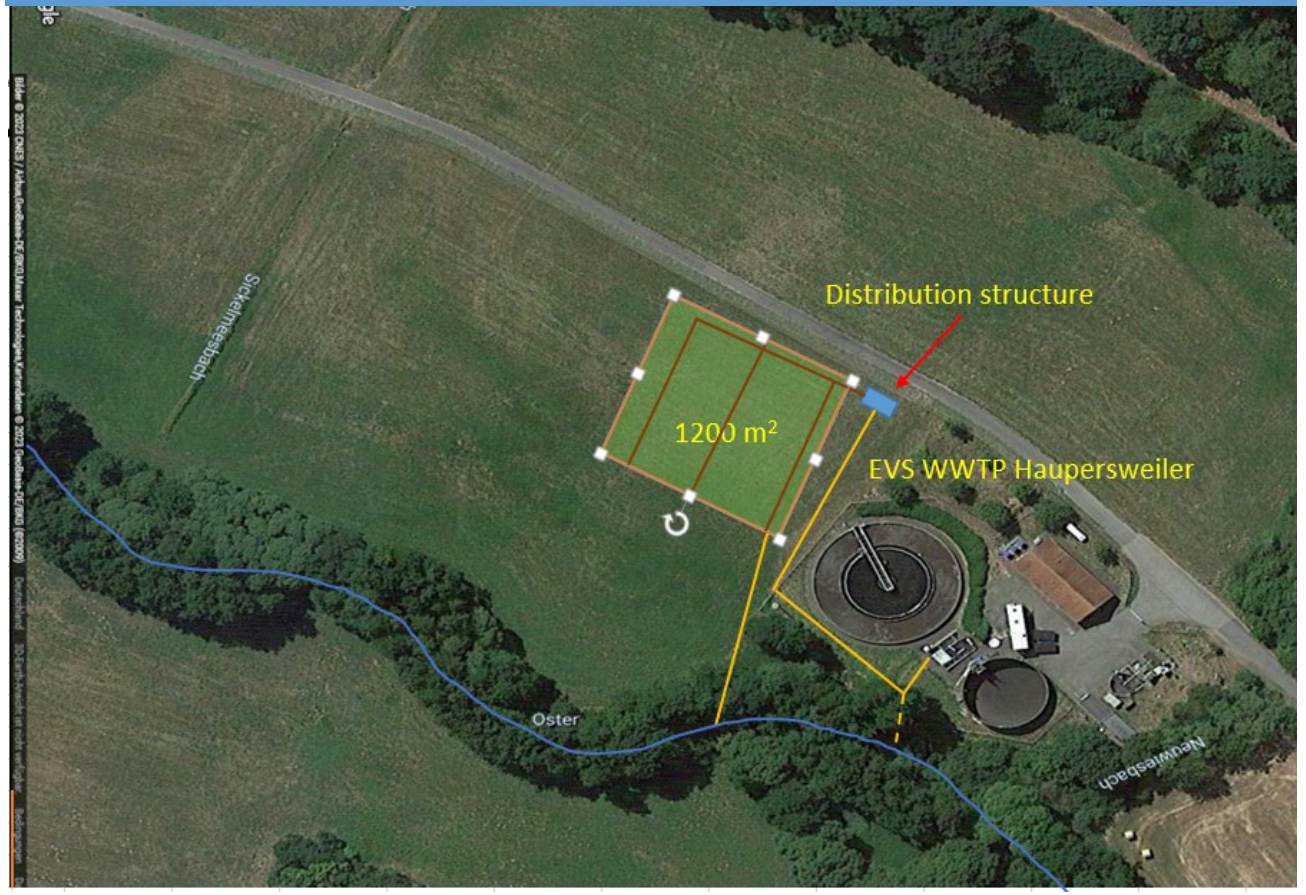
A_{CW} = 0.2 $m^3/m^2/d$ * 635,477 m^3/a / 365 d = 7,800 m^3



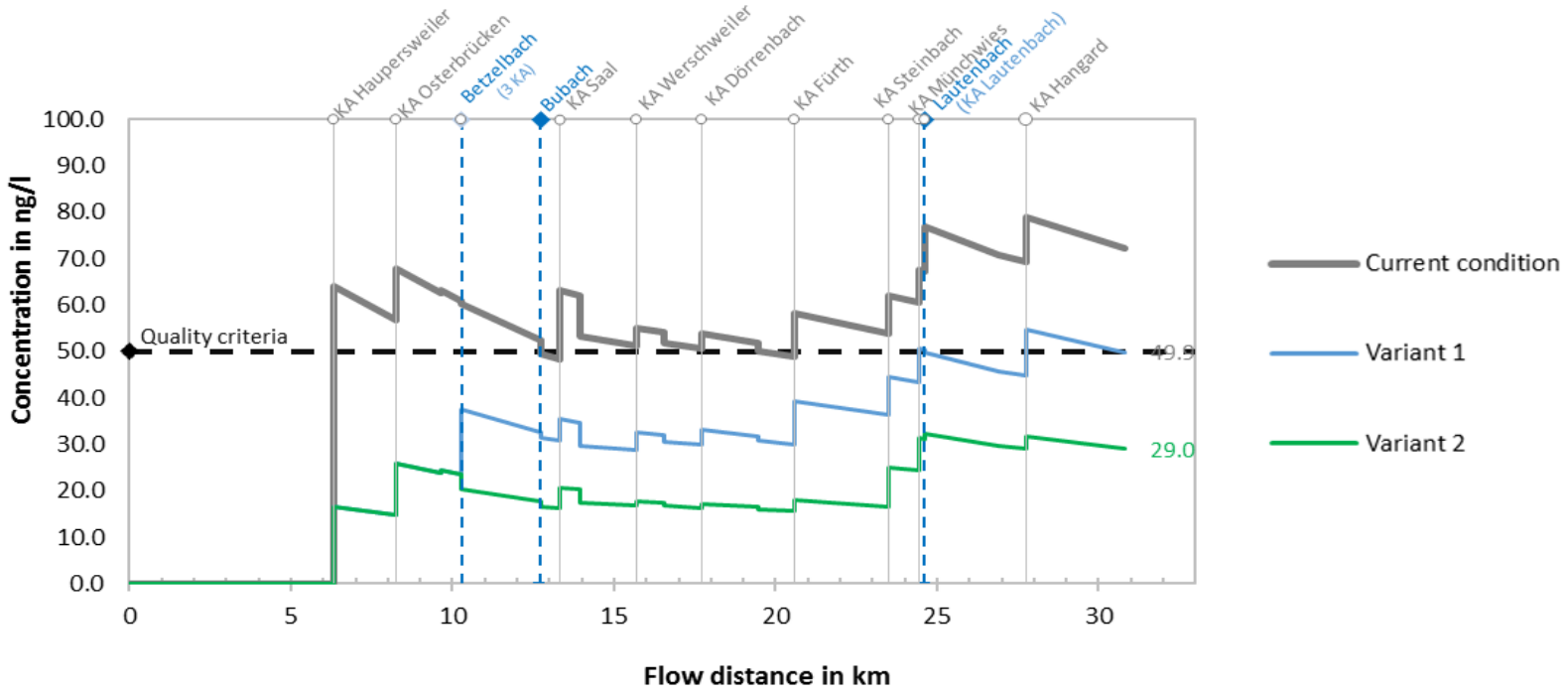
Design: Constructed wetland + WOW_{Char}

WWTP	unit	Haupersweiler
Input Data		
Connected PE	PE	3.033
Annual flow	m^3/a	794.346
Waste water flow to constructed wetland	m^3/a	635.477
Wetlands Data		
Length	m	31
Width	m	40
Filterbody	m^3	806
Volume: Sand	m^3	685
Volume: WOW_{Char}	m^3	121
Amount of WOW-Biochar (50% straw/cellulose)	kg	**181.350**
→ Amount of straw	kg	453.375
→ Amount of cellulose	kg	453.375
Average filter velocity	m/h	0,059
Maximum Hydraulic Volume Rate	$L/(m^2 \cdot d)$	1872

A_{CW} = 0.4 m²/PE * 3000 PE = 1,200 m²



Results of the case study



Conclusions

- Combination of cellulose recovery with fine sieves in order to provide $WOW_{Biochar}$ for constructed wetlands for mircro pollutant removal in a river catchment is possible
- Alltough the load reduction from small WWTP in comparisan to the whole load from all WWTP in the catchment is small, the impact on the river quality is high
- For implementation further investigation into hydraulic load and invest costs is necessary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Reference

- Schmitt, T.G.; Knerr, H.; Valerius, B.; Kolisch, G. und Taudien, Y. (2019): „Stoffflussmodellierung der Gesamtemissionen an Spurenstoffen im Einzugs-gebiet der Blies und Übertragung der Ergebnisse auf das Saarland“, Studie im Auftrag des Entsorgungsverband Saar (EVS)
- WOW - Cellulose team (2022): Report on the production of biochar (activated carbon), bio-oil and pyroligneous acid from cellulose) https://vb.nweurope.eu/media/17026/deliverable_3_1_wow_cellulose-final-report-3-march-2022.pdf