

WWTP Böblingen – Sindelfingen WWTP Dagersheim – Darmsheim Elimination of micropollutants



1. introduction of the existing WWTP
2. upgrading with activated carbon adsorption stages
3. elimination efficiency of micropollutants
4. investment and operational expense
5. future energy concept






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Zweckverband Kläranlage Böblingen-Sindelfingen









Kläranlagen

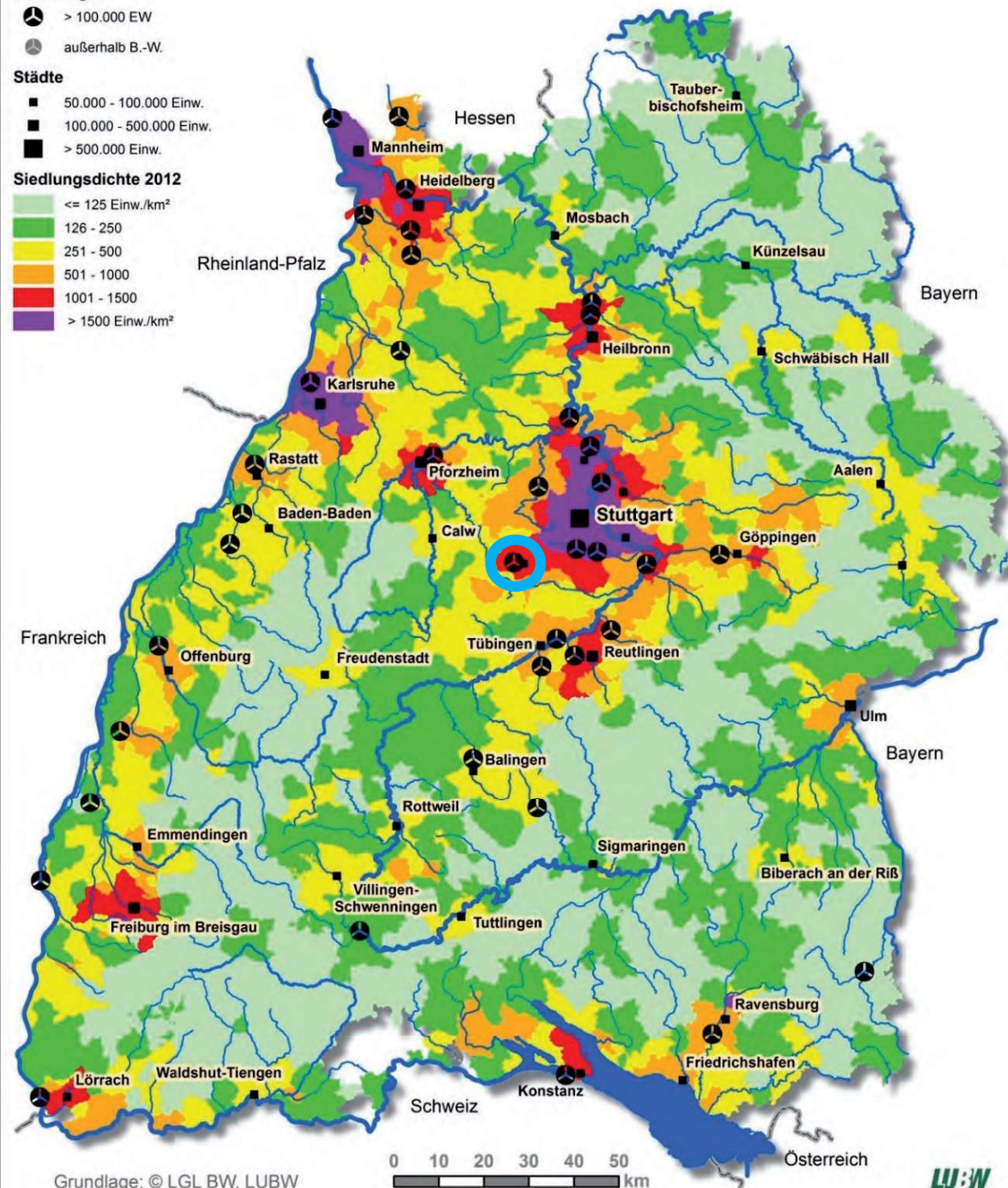
-  > 100.000 EW
-  außerhalb B.-W.

Städte

-  50.000 - 100.000 Einw.
-  100.000 - 500.000 Einw.
-  > 500.000 Einw.

Siedlungsdichte 2012

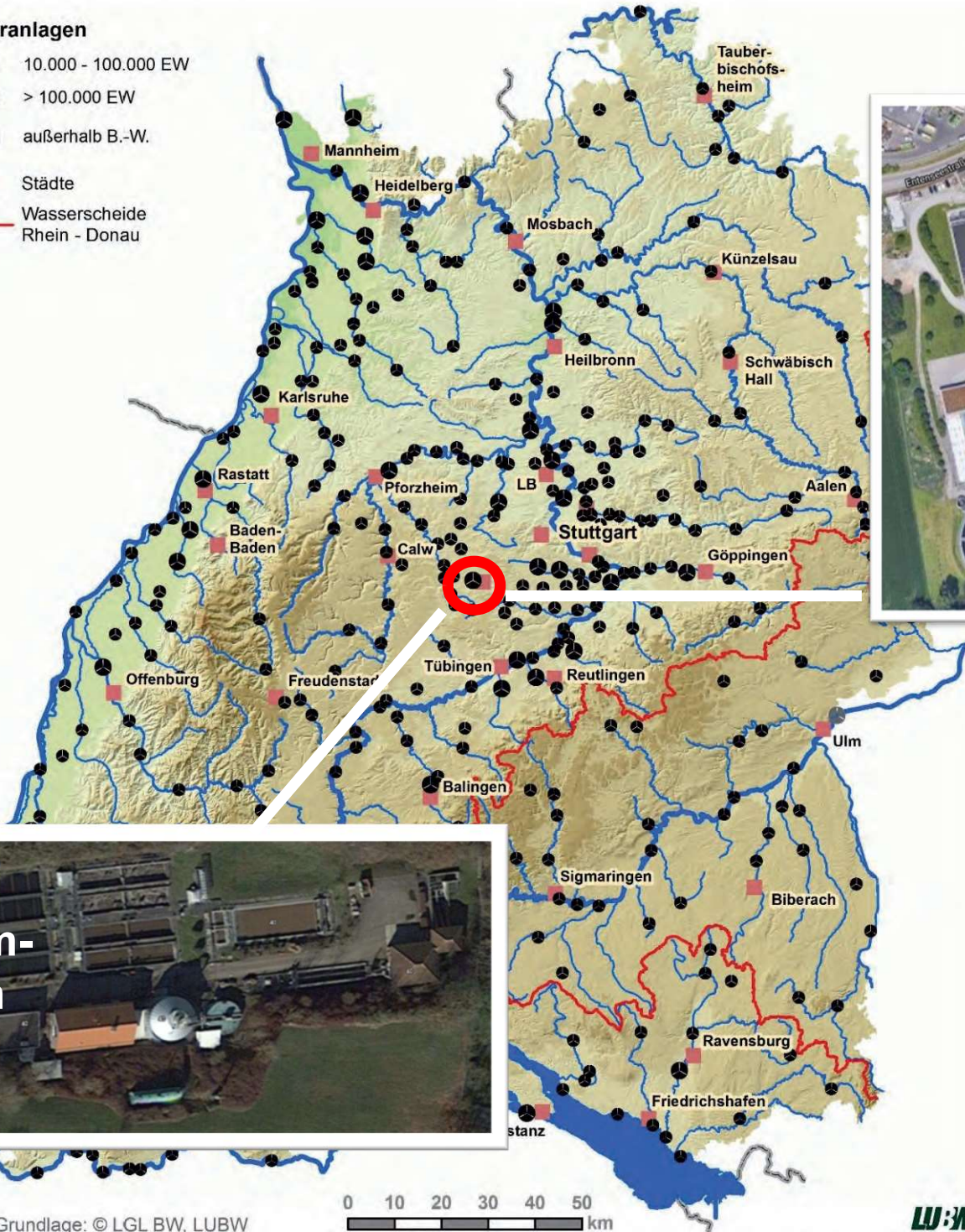
-  <= 125 Einw./km²
-  126 - 250
-  251 - 500
-  501 - 1000
-  1001 - 1500
-  > 1500 Einw./km²



report of
municipal
waste water
treatment 2017
UM Baden-
Württemberg

Kläranlagen

- 10.000 - 100.000 EW
- > 100.000 EW
- außerhalb B.-W.
- Städte
- Wasserscheide Rhein - Donau



report of
municipal
waste water
treatment 2017
UM Baden-
Württemberg

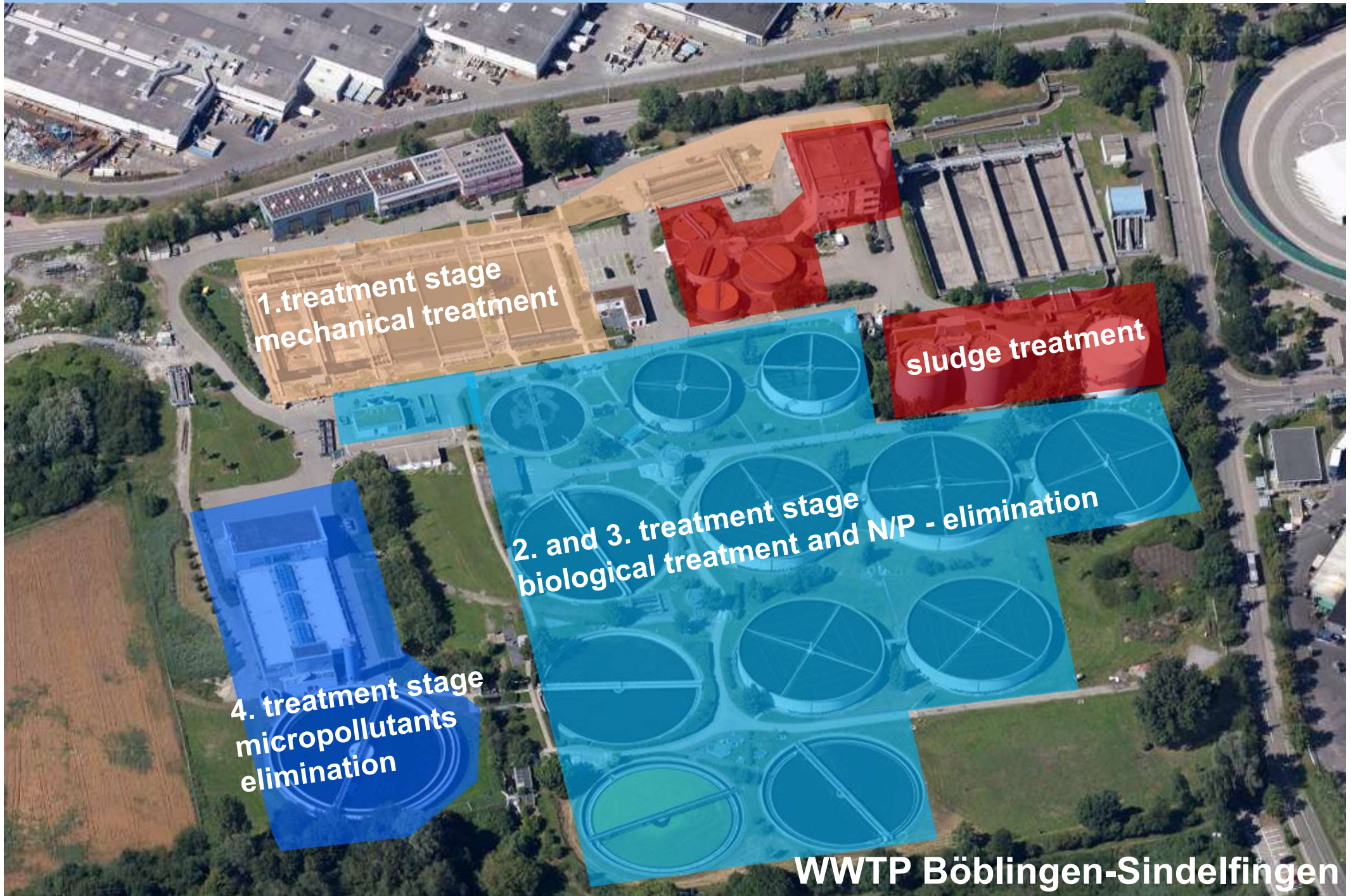
waste water sewage and treatment in Böblingen-Sindelfingen

WWTP Böblingen-Sindelfingen

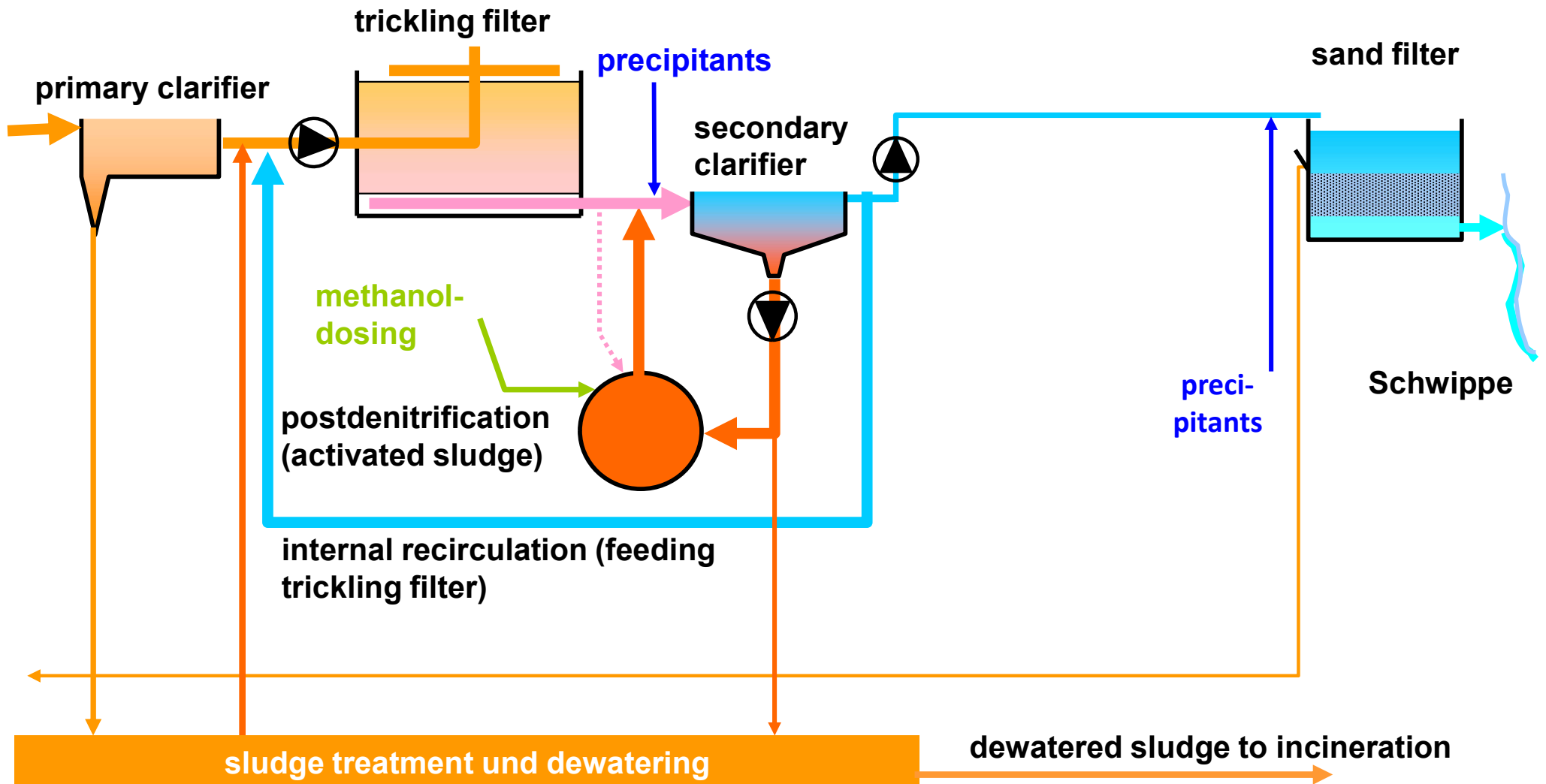
WWTP Böblingen-Sindelfingen	operation data	2020
design capacity		250 000 PE
current load (calculate with 120 g COD/(PE*d))		173 000 PE
Influent		
Influent by dry weather		26 000 m ³ /d
max. wet weather influent		2 000 l/s
		175 000 m ³ /d
total annual treated waste water		14 200 000 m ³ /a
infiltration water into sewer system		25%
COD load (average)		20 000 kg/d
COD load (85%-value)		27 000 kg/d
Effluent (annual average)		
COD		18 mg/L
P _{total}		0.2 mg/L
N _{total} (N _{anorg} + N _{org})		10.3 mg/L
NH ₄ -N		0.5 mg/L
Energy		
Consumption of electricity		4 890 763 kWh/a
		28.3 kWh/(PE*a)
Production of electricity with CHP		2 789 570 kWh/a
		16.1 kWh/(PE*a)

WWTP Dagersheim-Darmsheim

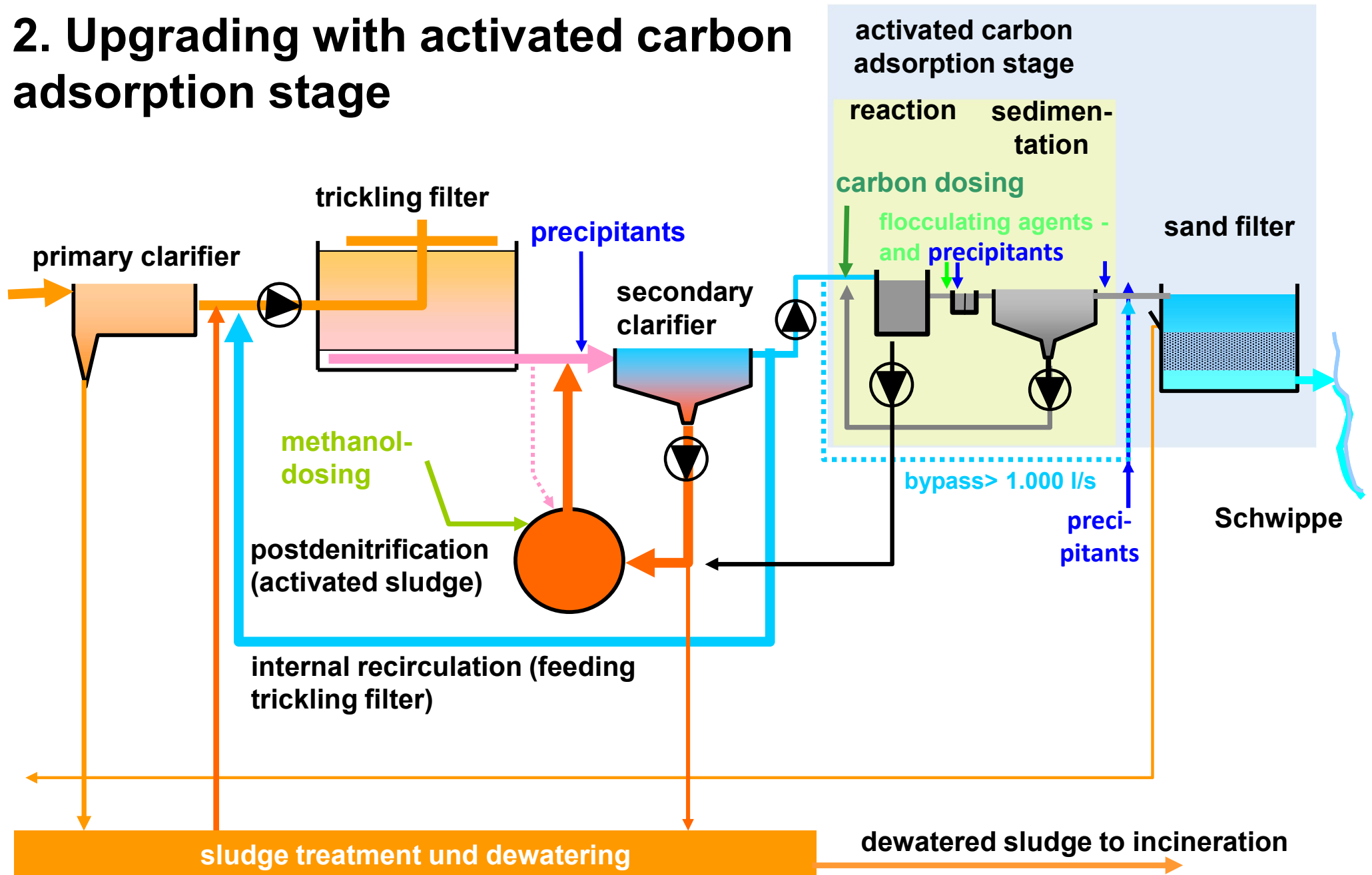
WWTP Dagersheim-Darmsheim	operation data	2020
design capacity		13 500 PE
current load (calculate with 120 g COD/(PE*d))		11 650 PE
Influent		
Influent by dry weather		1 600 m ³ /d
max. wet weather influent		110 l/s
		7500 m ³ /d
total annual treated waste water		910 000 m ³ /a
infiltration water into sewer system		15%
COD load (average)		1 400 kg/d
COD load (85%-value)		1 700 kg/d
Effluent (annual average)		
COD		23.6 mg/L
P _{total}		0.16 mg/L
N _{total} (N _{anorg} + N _{org})		6.0 mg/L
NH ₄ -N		0.7 mg/L
Energy		
Consumption of electricity		409 151 kWh/a
		35.1 kWh/(PE*a)
Production of electricity with CHP		150 751 kWh/a
		12.9 kWh/(PE*a)



2. Upgrading with activated carbon adsorption stage



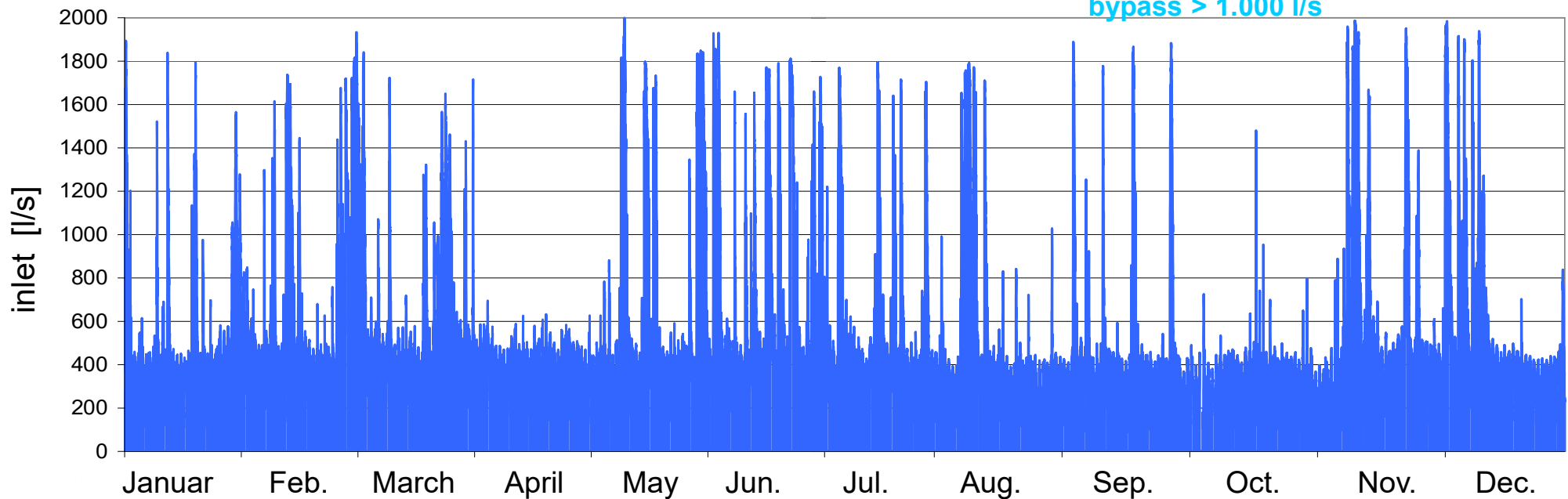
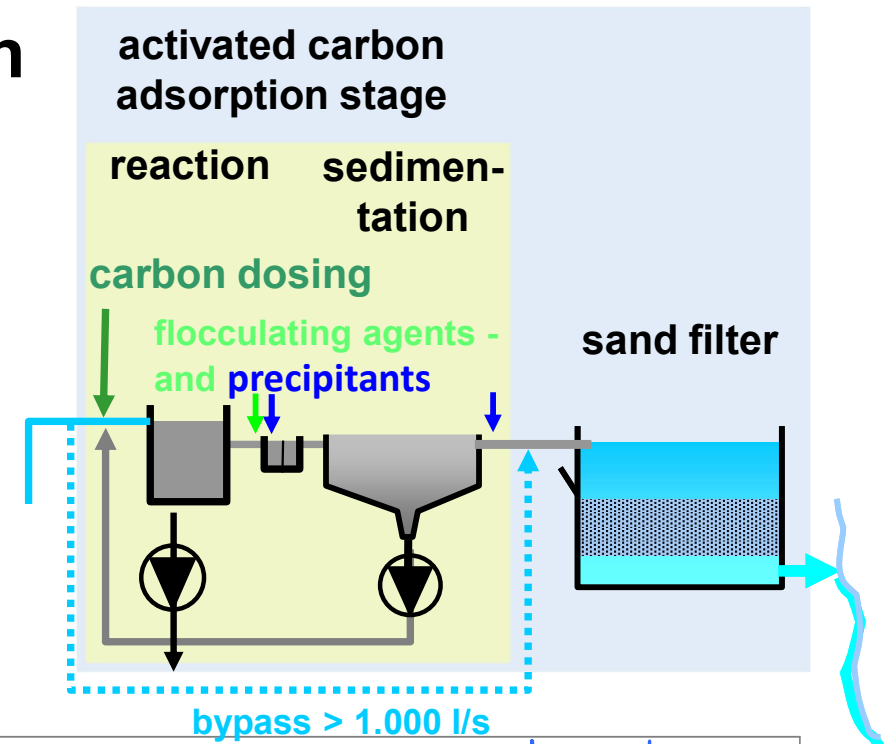
2. Upgrading with activated carbon adsorption stage



2. Upgrading with activated carbon adsorption stage

design parameters

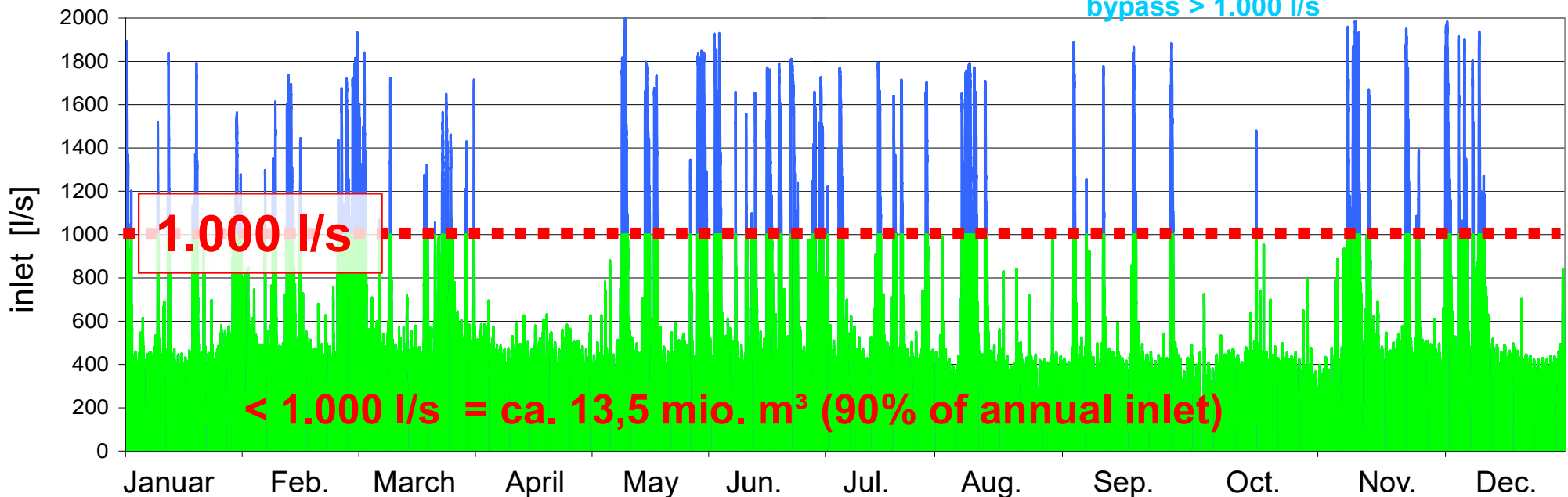
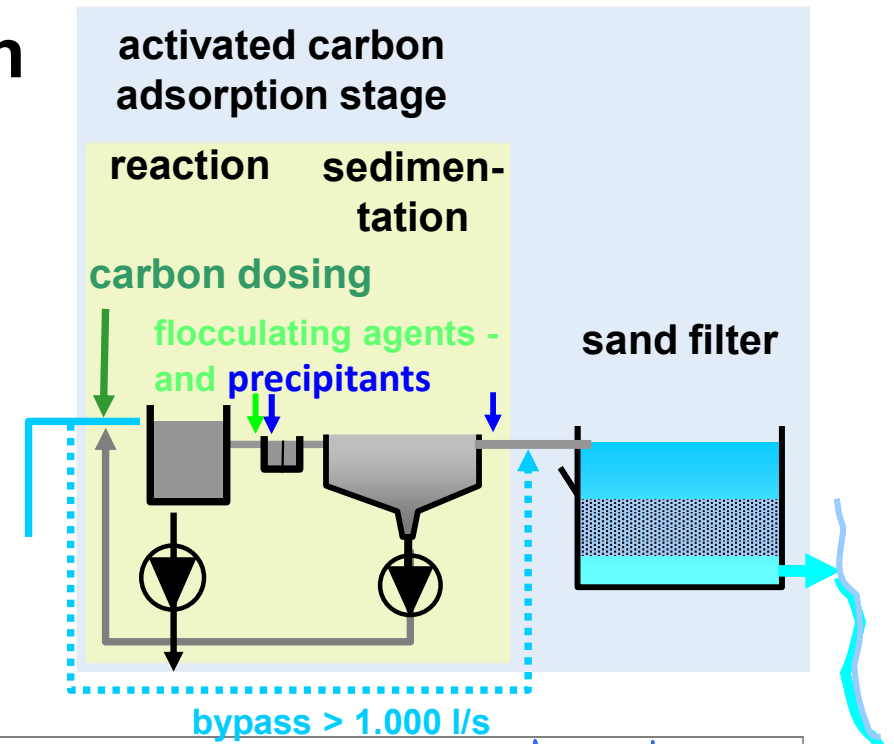
- reaction tank:
retention time 0.5 hour
- sedimentation tank:
retention time 2.0 hours
surface load 2.0 m/h



2. Upgrading with activated carbon adsorption stage

design parameters

- reaction tank:
retention time 0.5 hour
- sedimentation tank:
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surface load 2.0 m/h



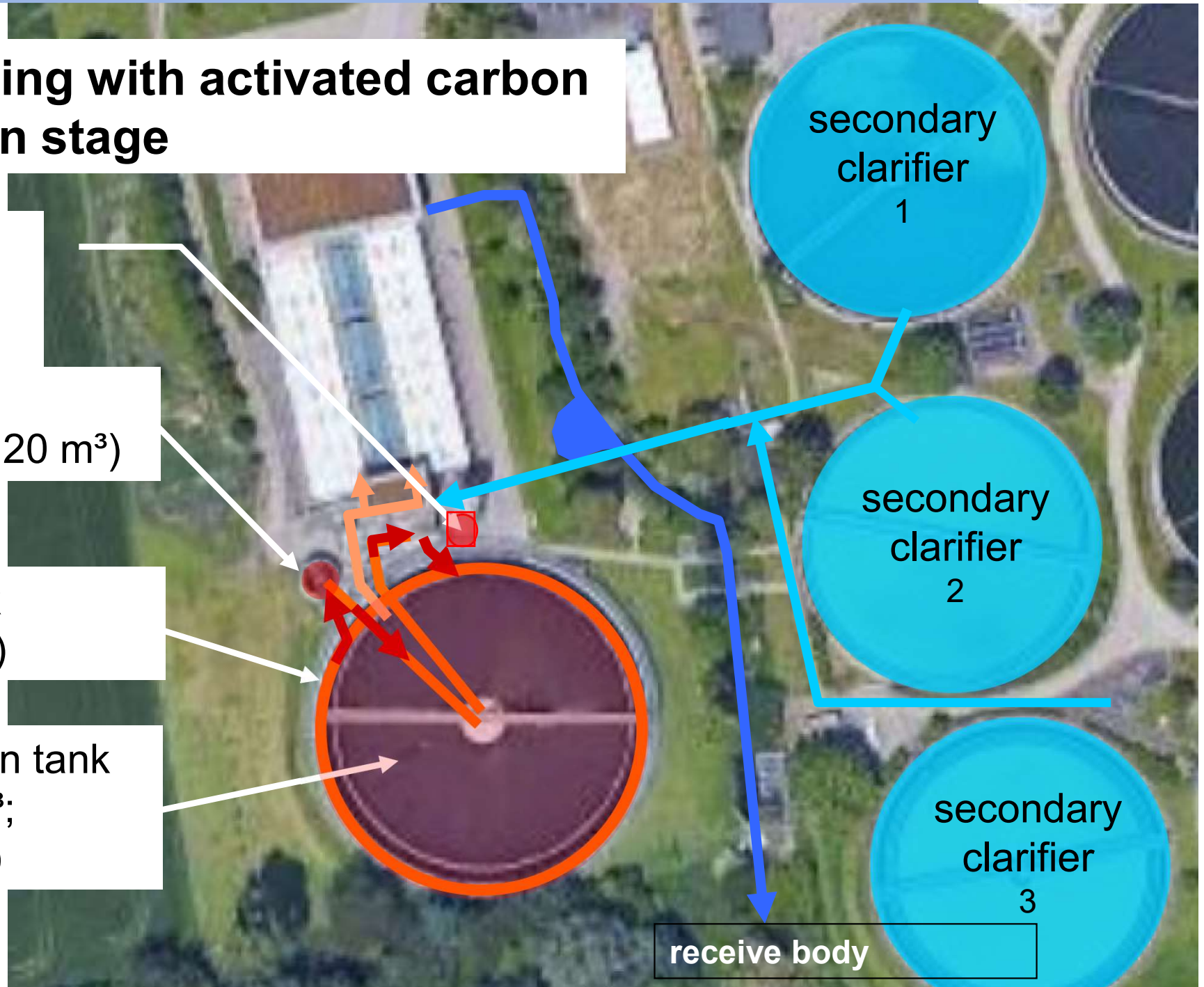
2. Upgrading with activated carbon adsorption stage

activated
carbon silo
 $V = 125 \text{ m}^3$

mixing tank
(12 m^3 und 120 m^3)

reaction tank
($V = 1800 \text{ m}^3$)

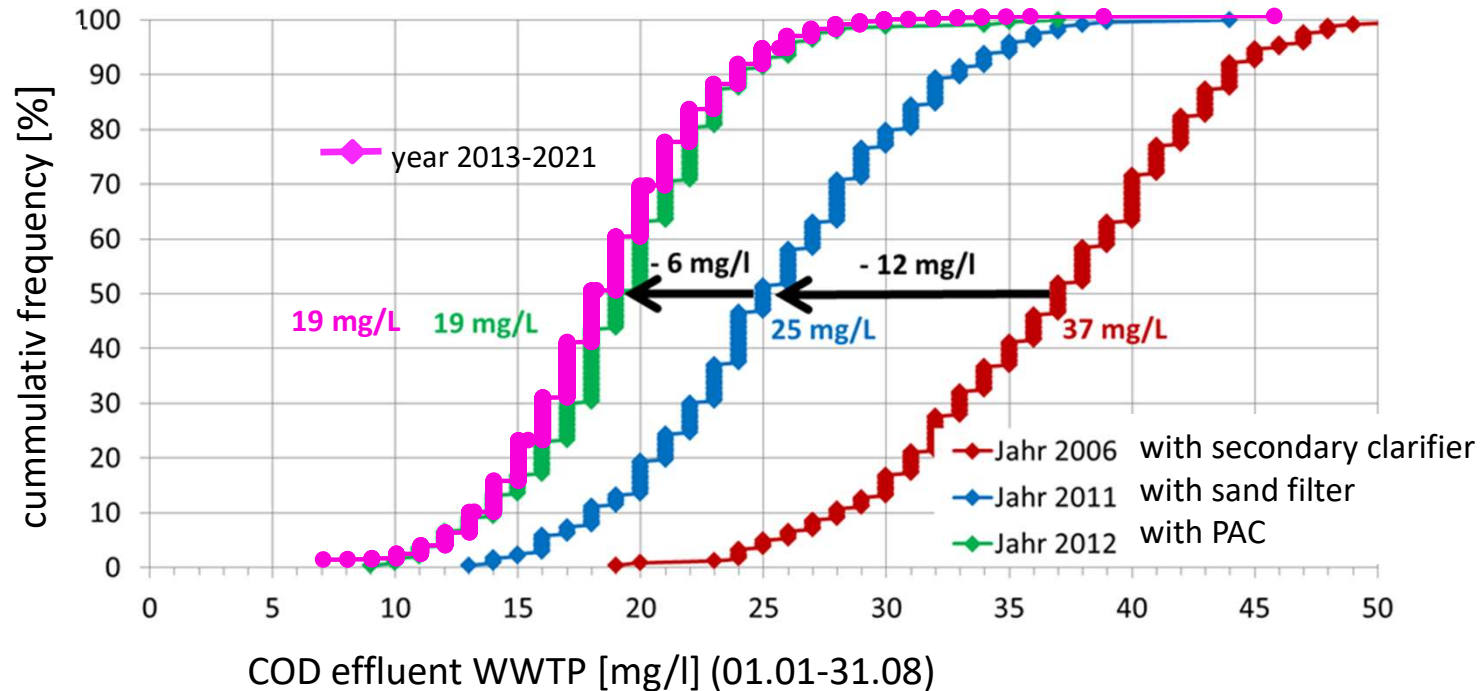
sedimentation tank
($V = 7200 \text{ m}^3$;
 $A = 1800 \text{ m}^2$)



receive body

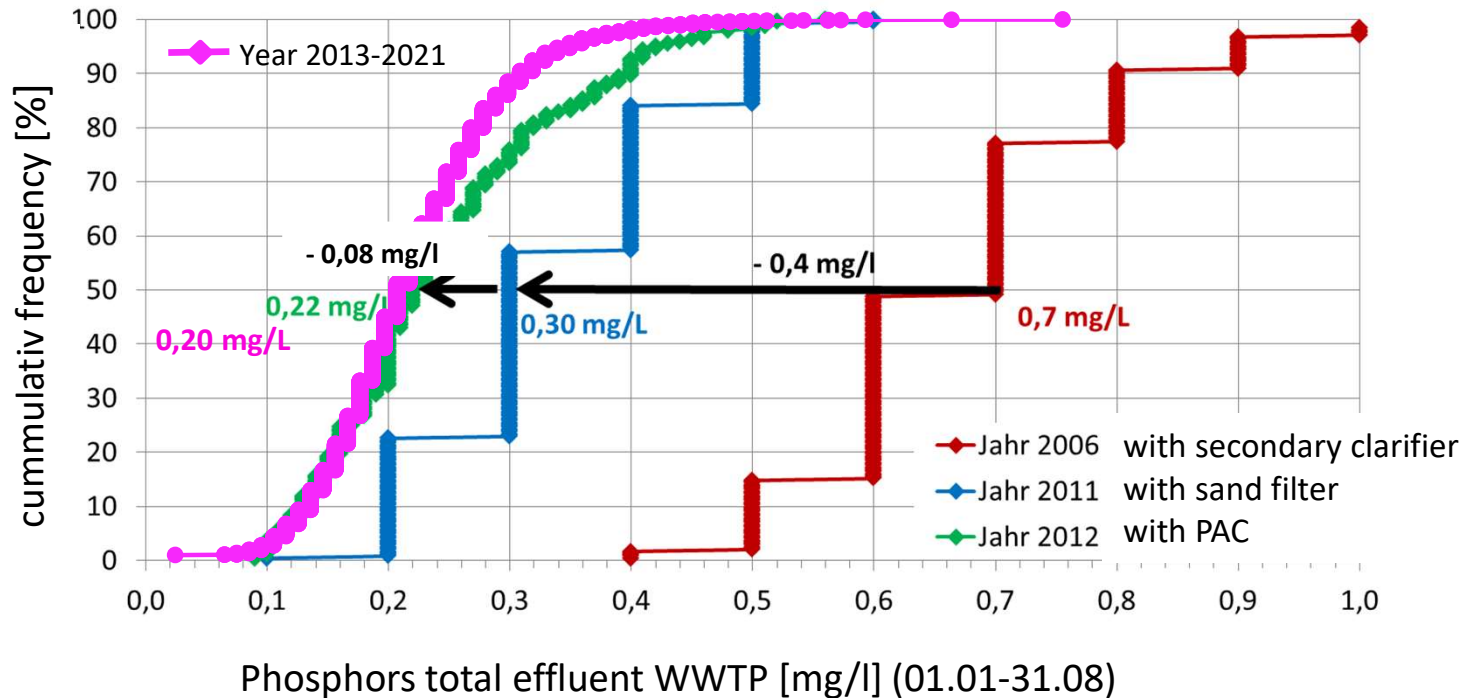


3. Elimination Efficiency



- operation of sand filter reduced COD!
- operation of activated carbon adsorption stage reduced COD!
- discharge below 20 mg/l of COD in average with 10 g PAC/m³ !

3. Elimination Efficiency



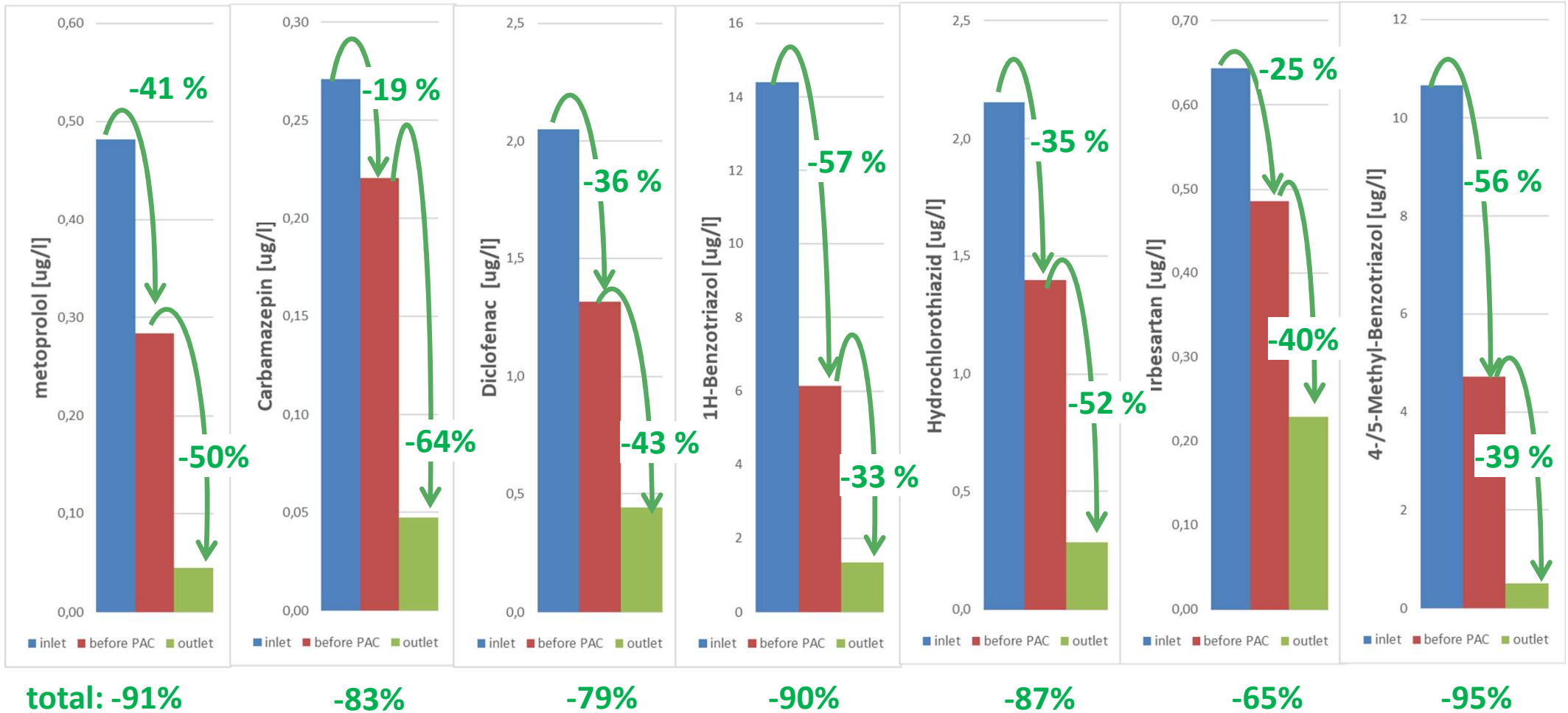
precipitant dosing (FeClSO4):

2006:	: 7 151 kg/d , $\beta = 1.83$
2011:	: 4 499 kg/d , $\beta = 1.32$
Jan. bis Aug. 2012	: 4 264 kg/d , $\beta = 1.20$
2013-2021	: 4 014 kg/d , $\beta = 1.17$



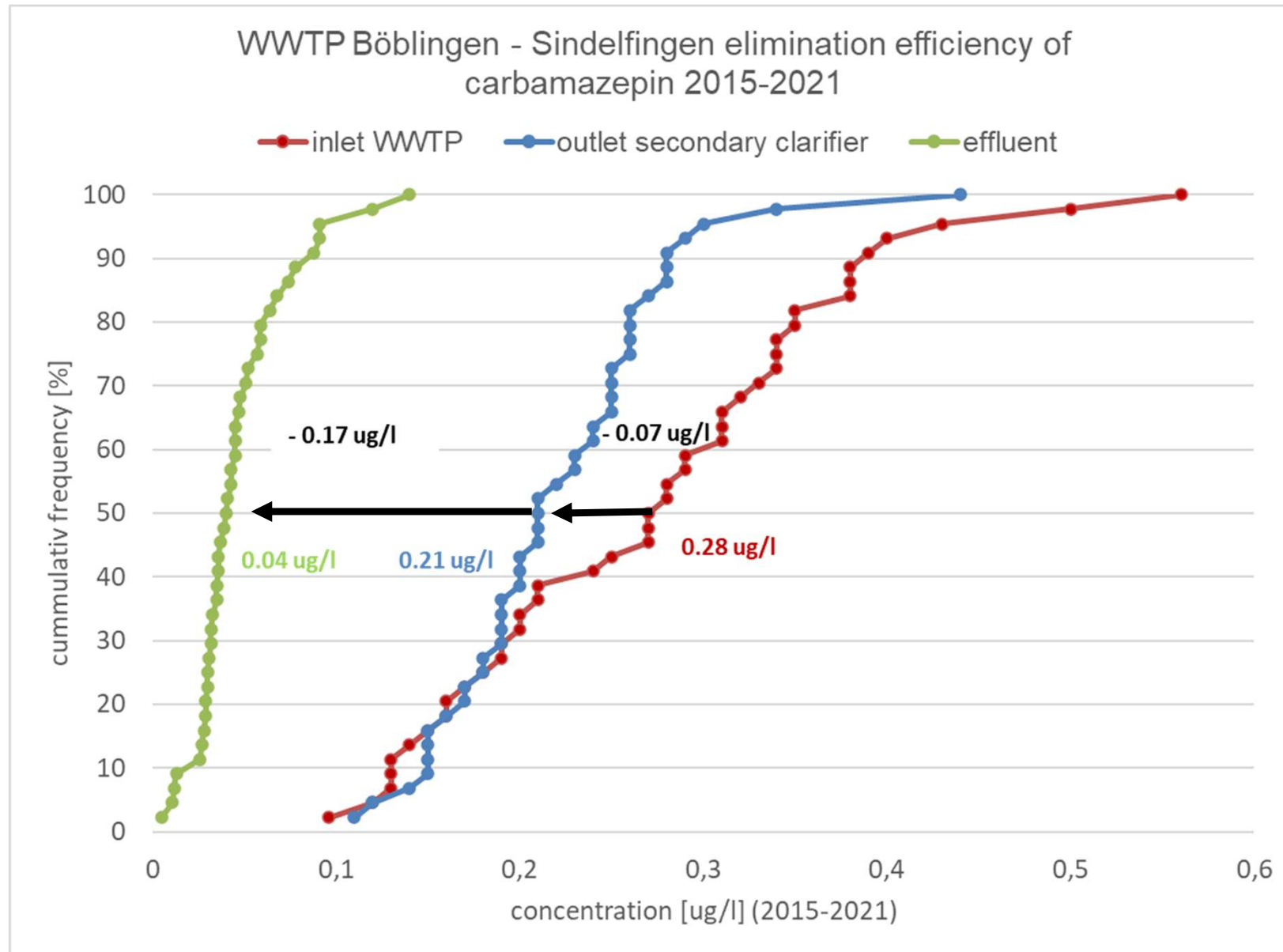
reducing of the precipitant consumption with operation of PAC

3. Elimination Efficiency

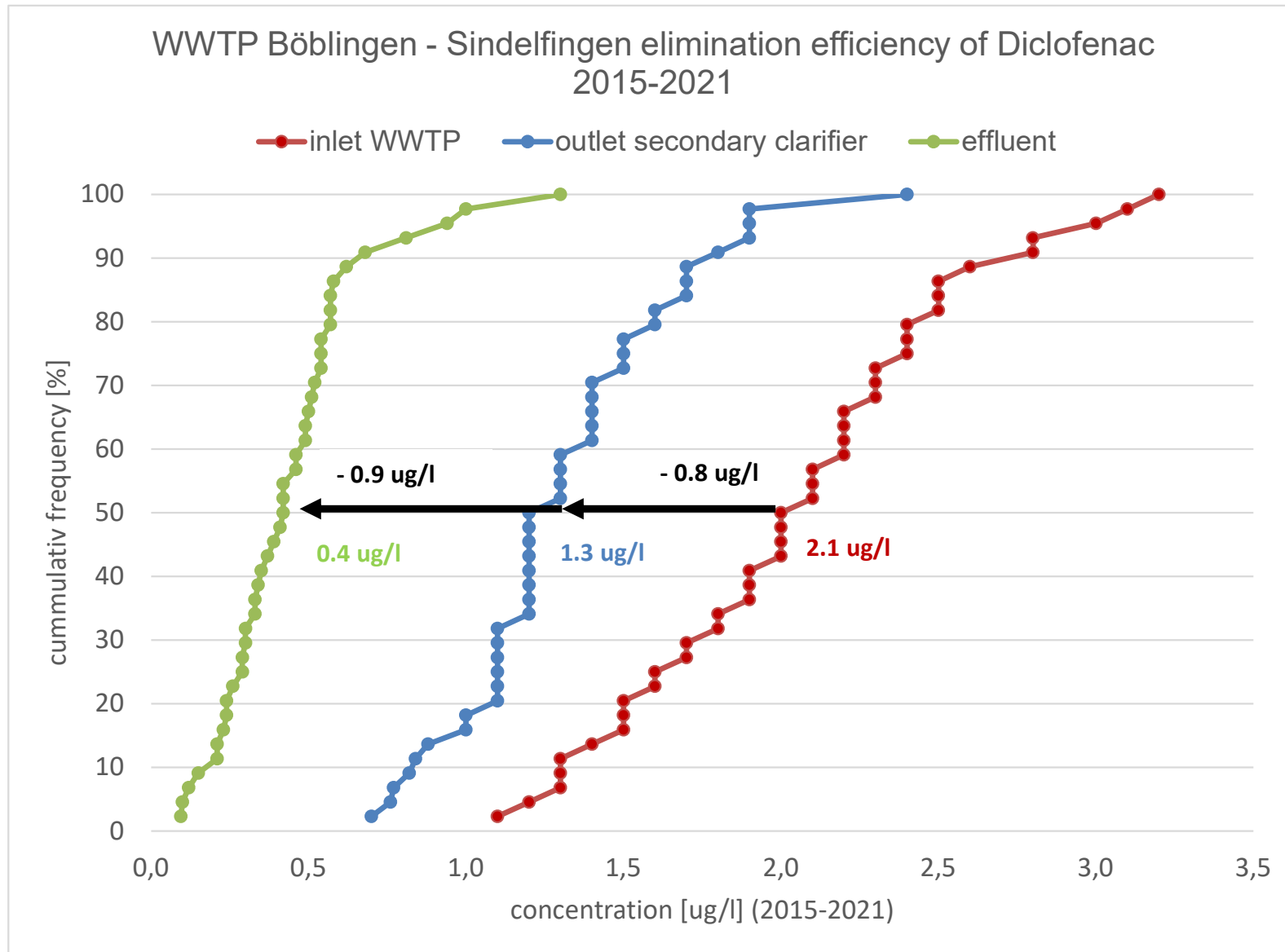


**elimination of micropollutants from 2015 until 2021
with PAC dosing of 10 mg/l in average**

3. Elimination Efficiency



3. Elimination Efficiency



WWTP Dagersheim-Darmsheim

1. Introduction of the existing WWTP



WWTP Dagersheim-Darmsheim

Elimination of micropollutants with granulated activated carbon (GAC)

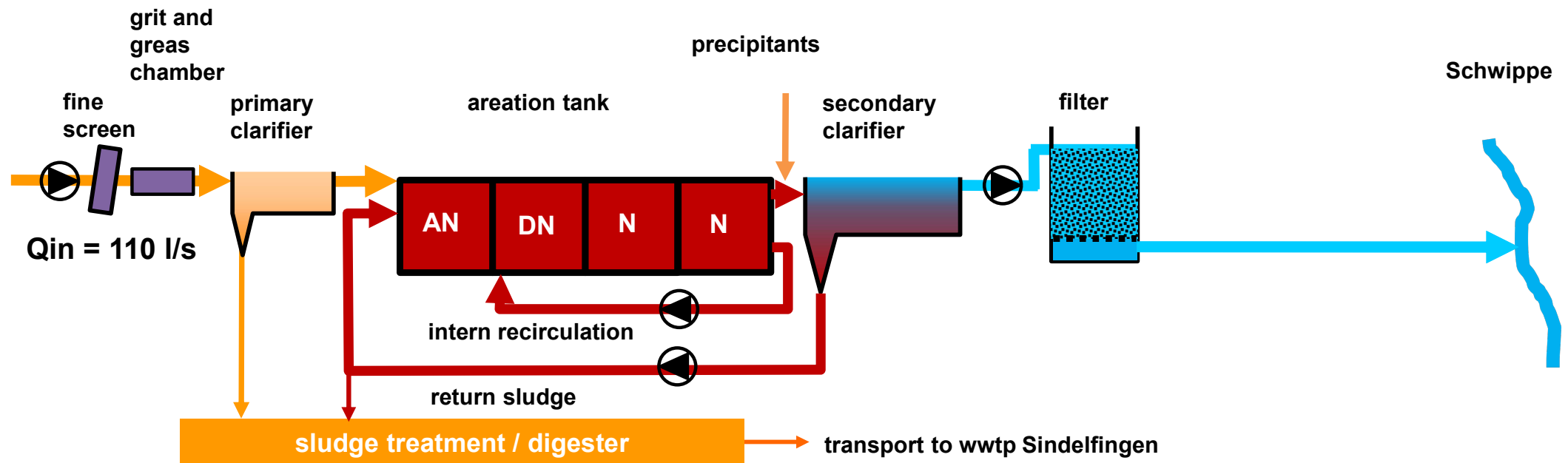


Construction project

- restructuring pumping station of the filter
- new piping connection with 4. treatment stage
- construction of a granulated activated carbon plant within the new building
- construction of a new GAC delivery area
- measurement and automatisisation system

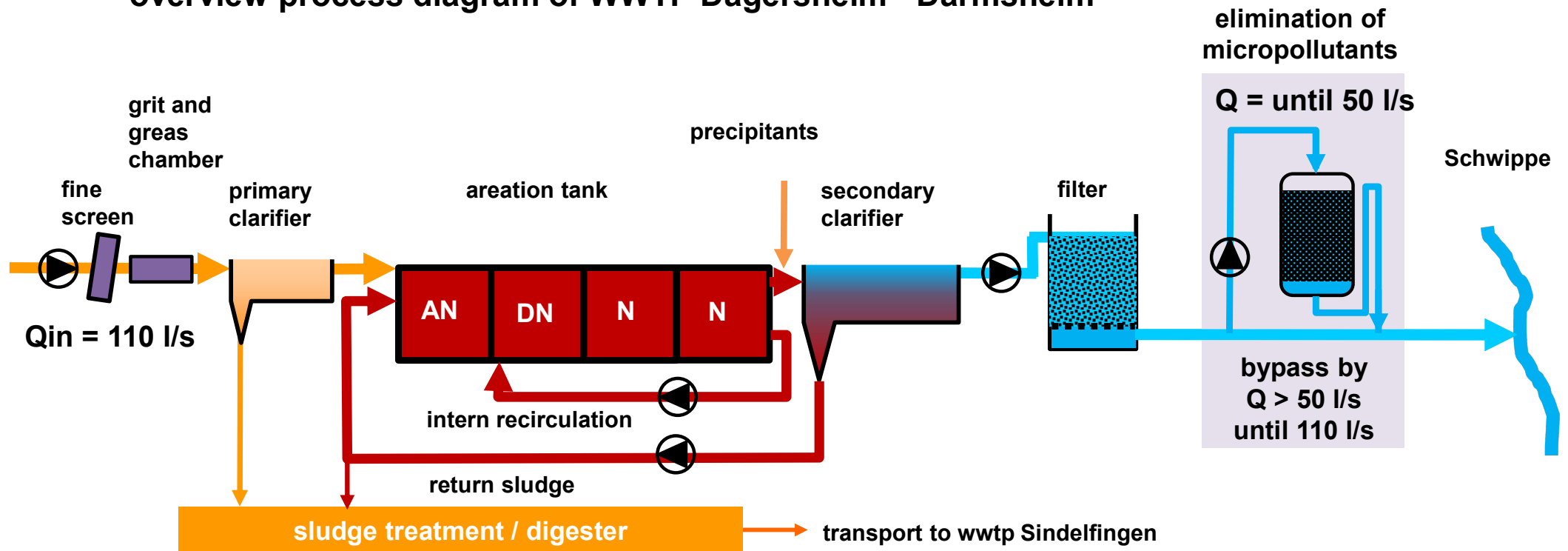
2. Upgrading with activated carbon adsorption stage

overview process diagram of WWTP Dagersheim - Darmsheim

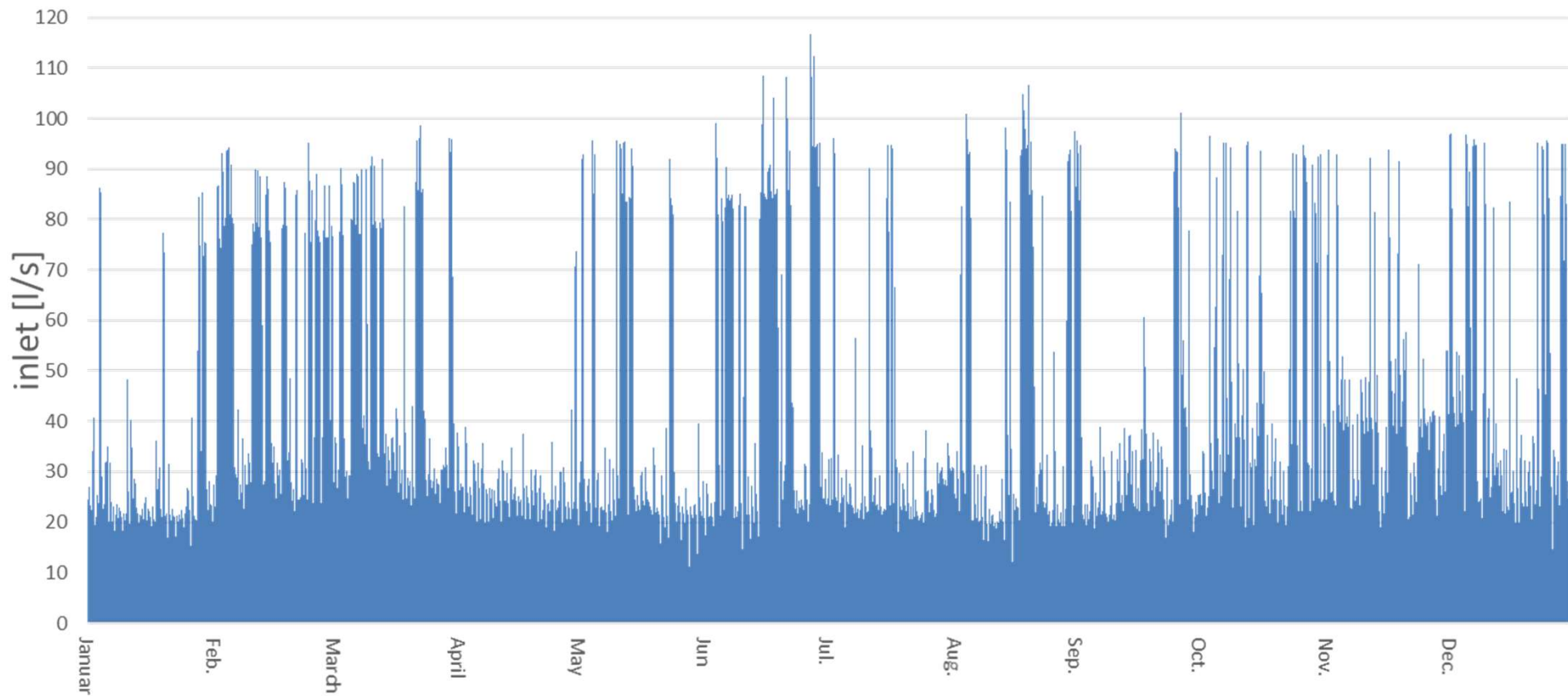


2. Upgrading with activated carbon adsorption stage

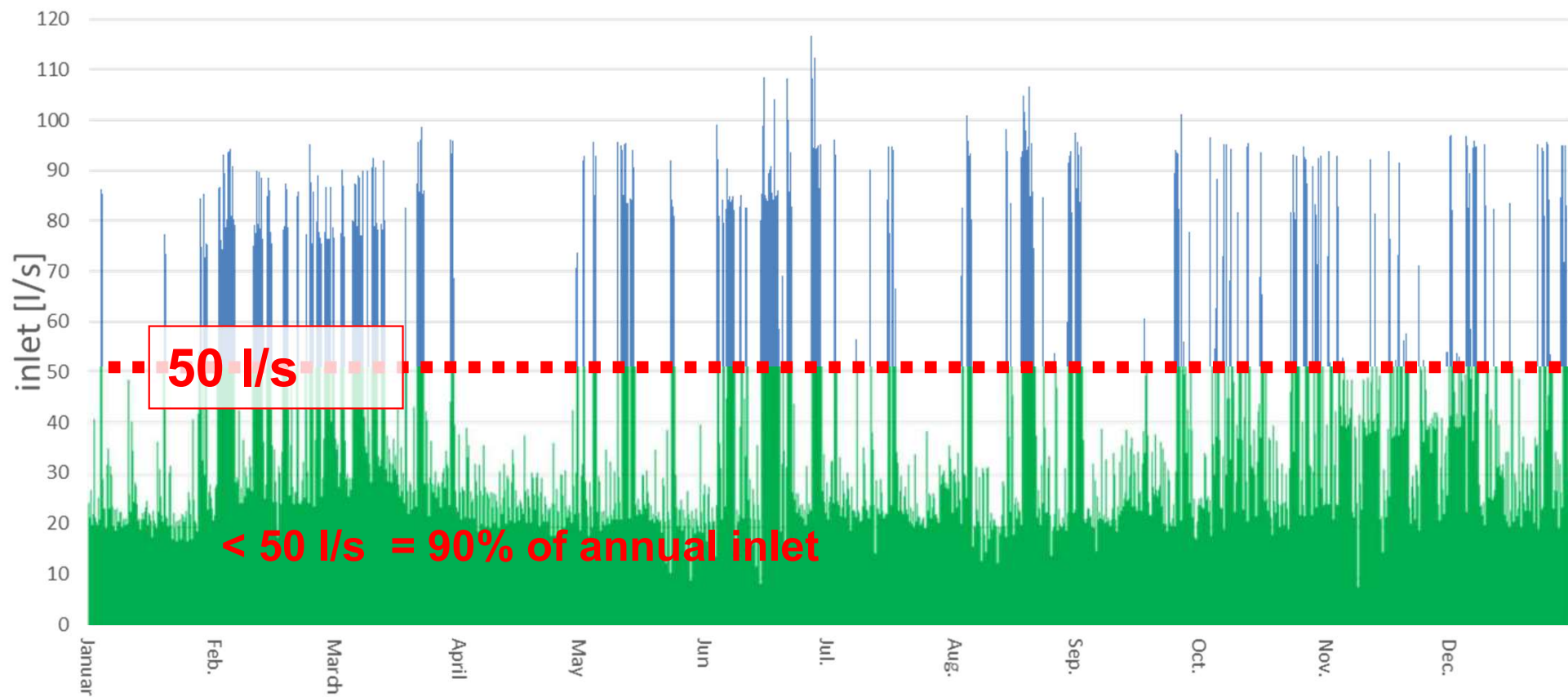
overview process diagram of WWTP Dagersheim - Darmsheim



2. Upgrading with activated carbon adsorption stage

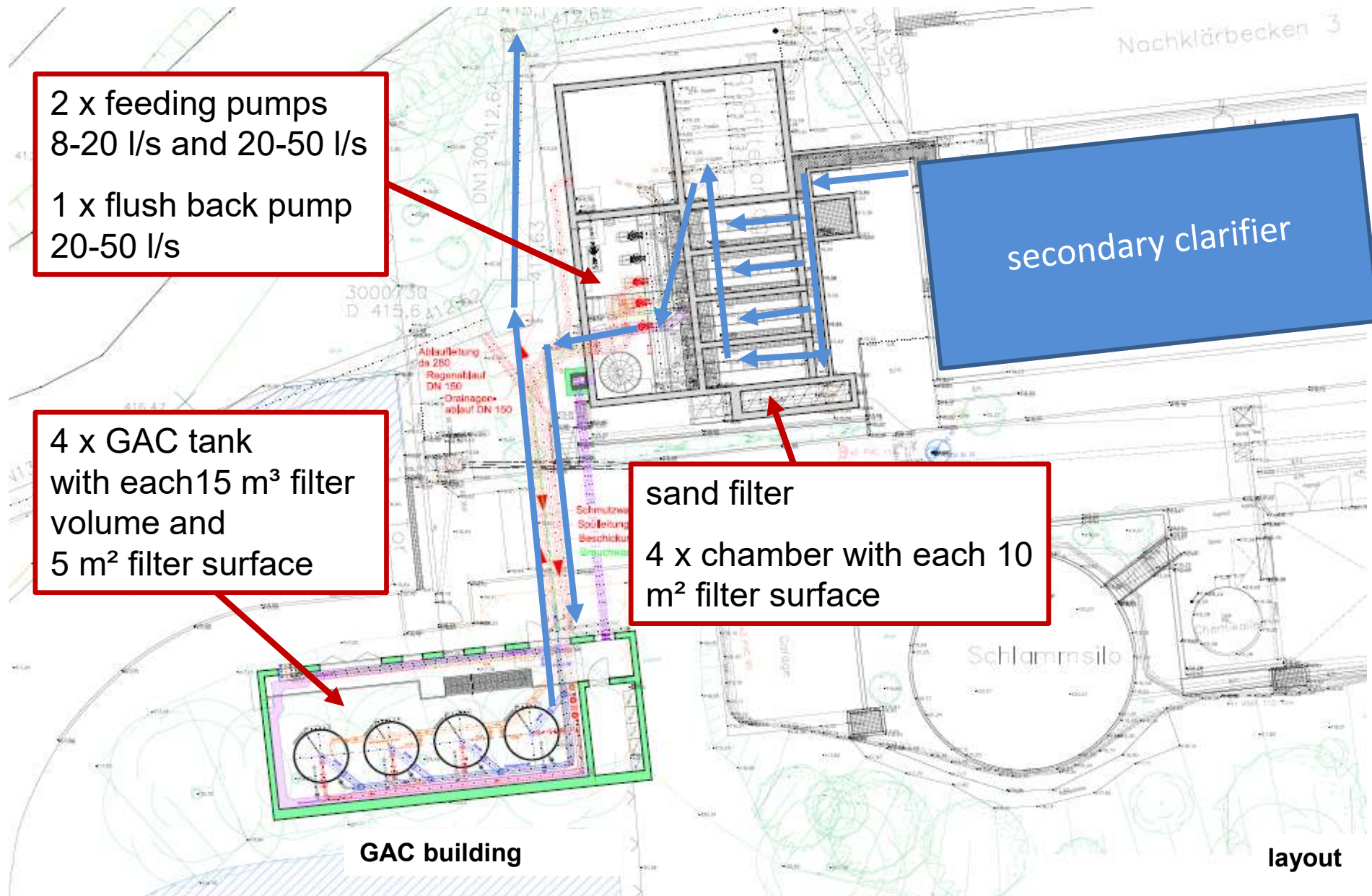


2. Upgrading with activated carbon adsorption stage



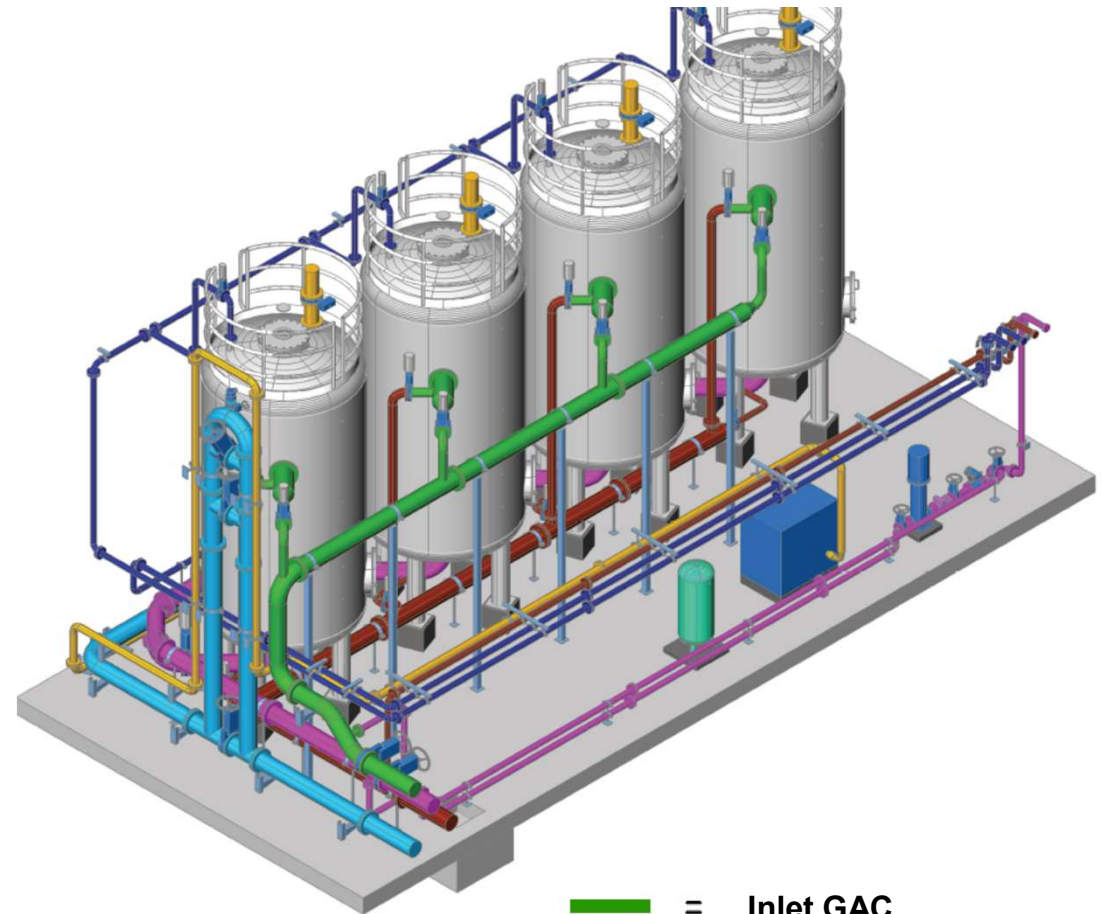
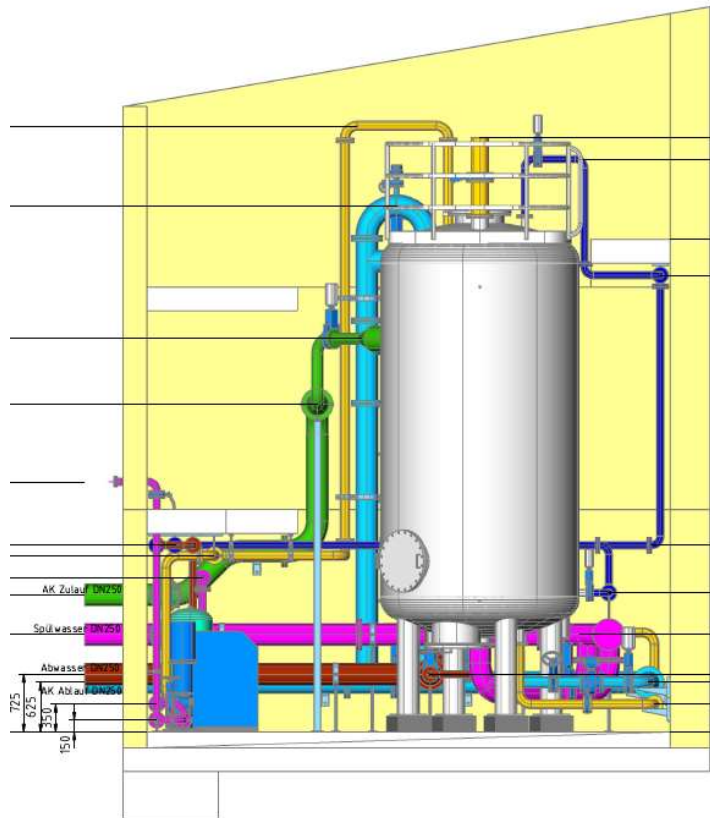
WWTP Dagersheim-Darmsheim

Elimination of micropollutants with granulated activated carbon (GAC)

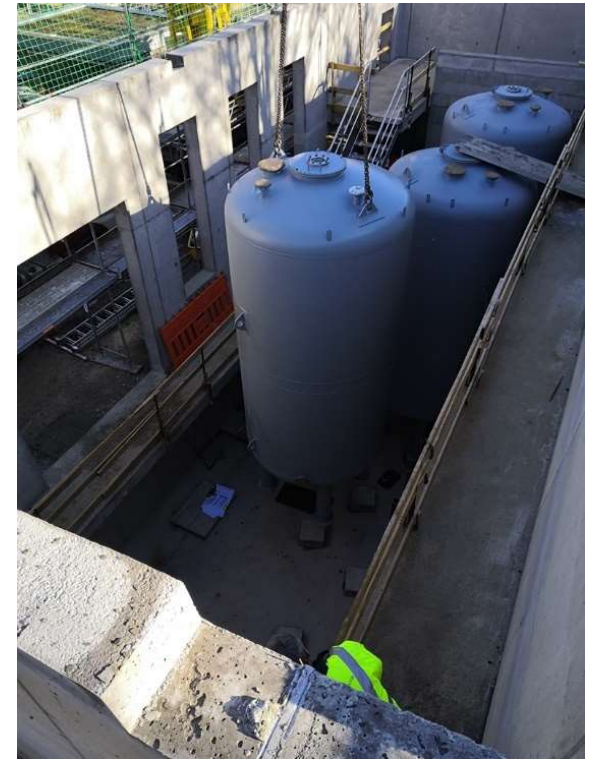


WWTP Dagersheim-Darmsheim

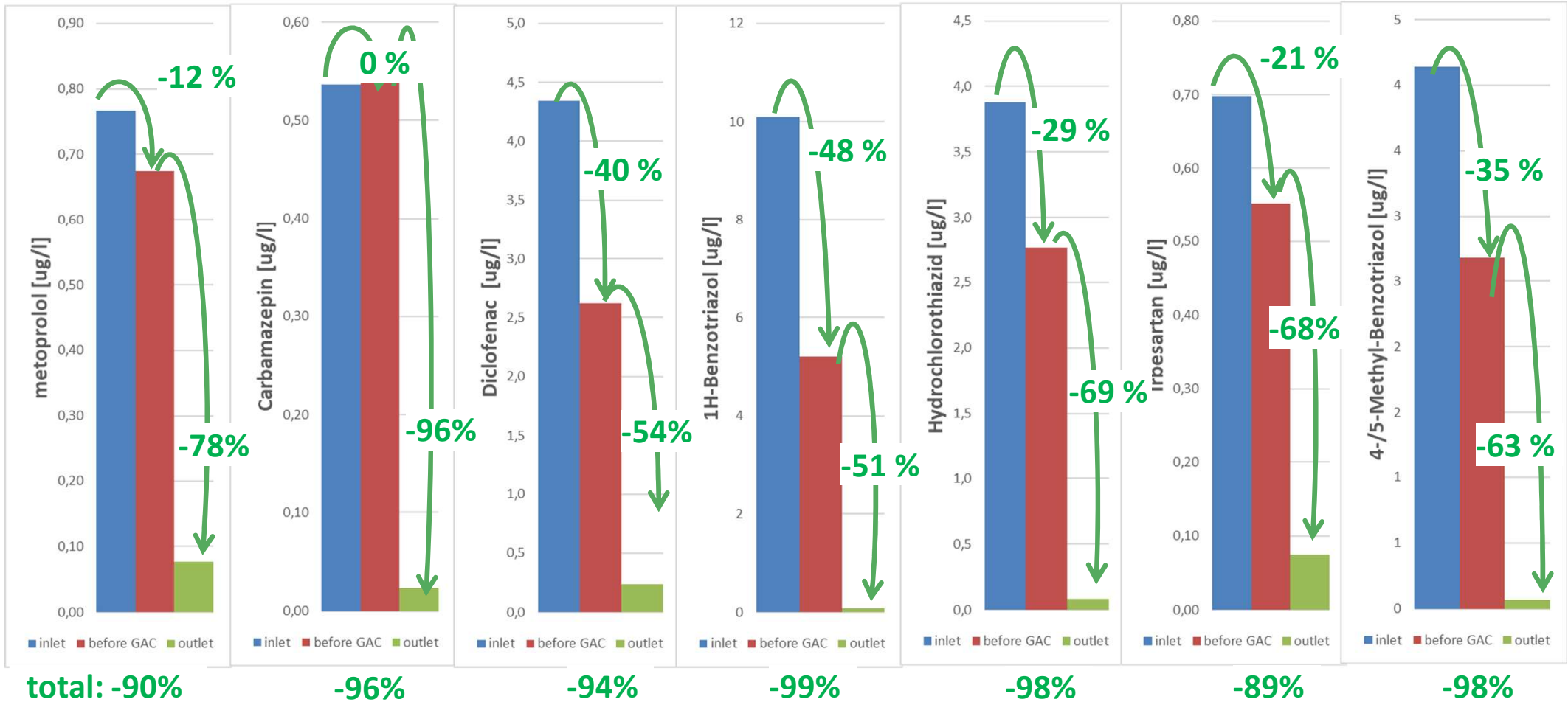
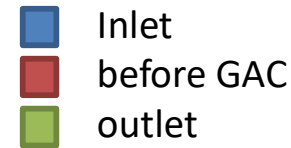
Elimination of micropollutants with granulated activated carbon (GAC)



-  = Inlet GAC
-  = Outlet GAC
-  = Return / flush water
-  = Sludge water
-  = Feeding GAC
-  = air

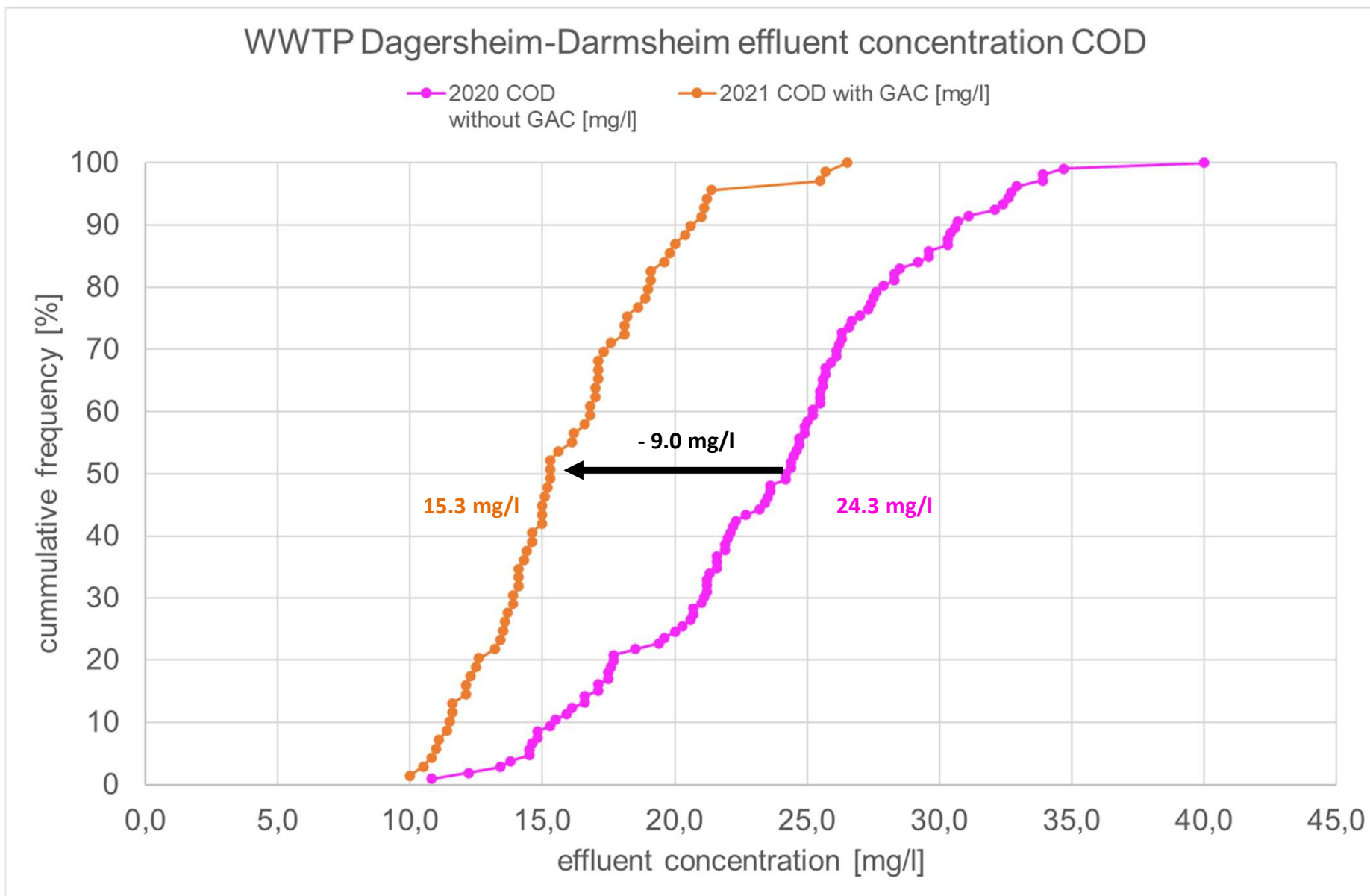


3. Elimination Efficiency

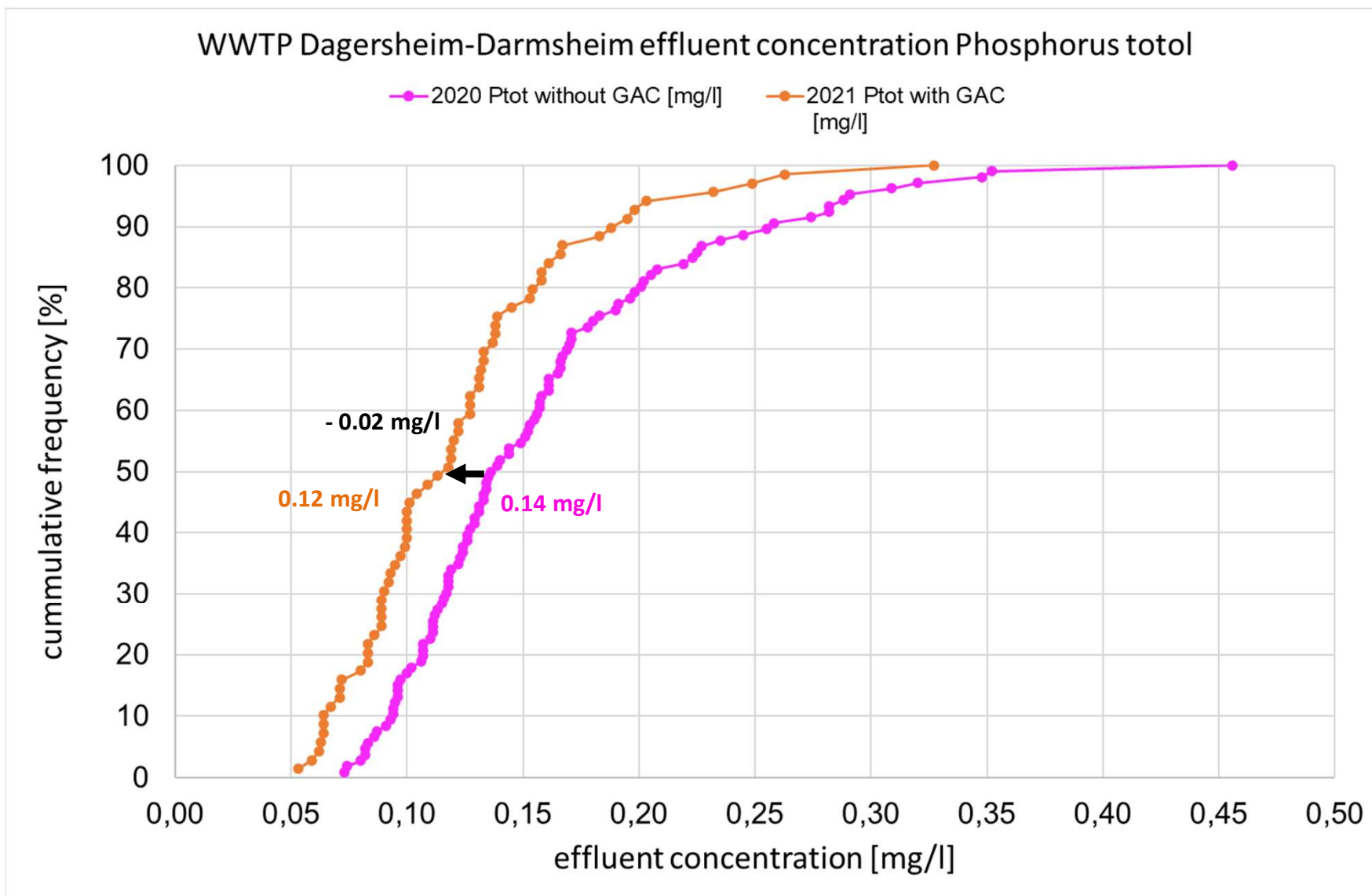


elimination of micropollutants after commissioning 2021
with 3 analyses by KOMS

3. elimination efficiency



3. elimination efficiency



4. Investment and operational expense

			WWTP Böblingen-Sindelfingen PAC	WWTP Dagersheim-Darmsheim GAC
investment				
	civil work	€	2.200.000	610.000
	mechanical work	€	1.380.000	600.000
	electrical work	€	240.000	200.000
	design and others	€	480.000	260.000
	total cost	€	4.300.000	1.670.000
contribution				
	contribution	€	2.100.000	290.000
	saving of the waste water duty SIFI		792.000	792.000
	saving of the waste water duty DH	€	42.000	42.000
operational cost				
	activated carbon and other consumable	€/a	271.000	44.000
	electricity	€/a	35.000	11.000
	personal	€/a	23.000	5.000
	maintenance	€/a	10.000	5.000
	total cost	€/a	339.000	65.000
annuell cost				
	total annuell cost	€/a	425.000	95.000
	total annuell cost for SIFI +DH	€/a	520.000	
waste water fee calculation				
		m ³ /a	7.450.000	
	price increasing	€/m ³	0,07	
	with 40 m³/(p*a)	€/(p*a)	2,79	

waste water fee
1.6 €/m³
approx. 60 €/(p*a)

5. Future energy concept

What to do for energy neutrality

decreasing electricity consumption (approx. - 20%)

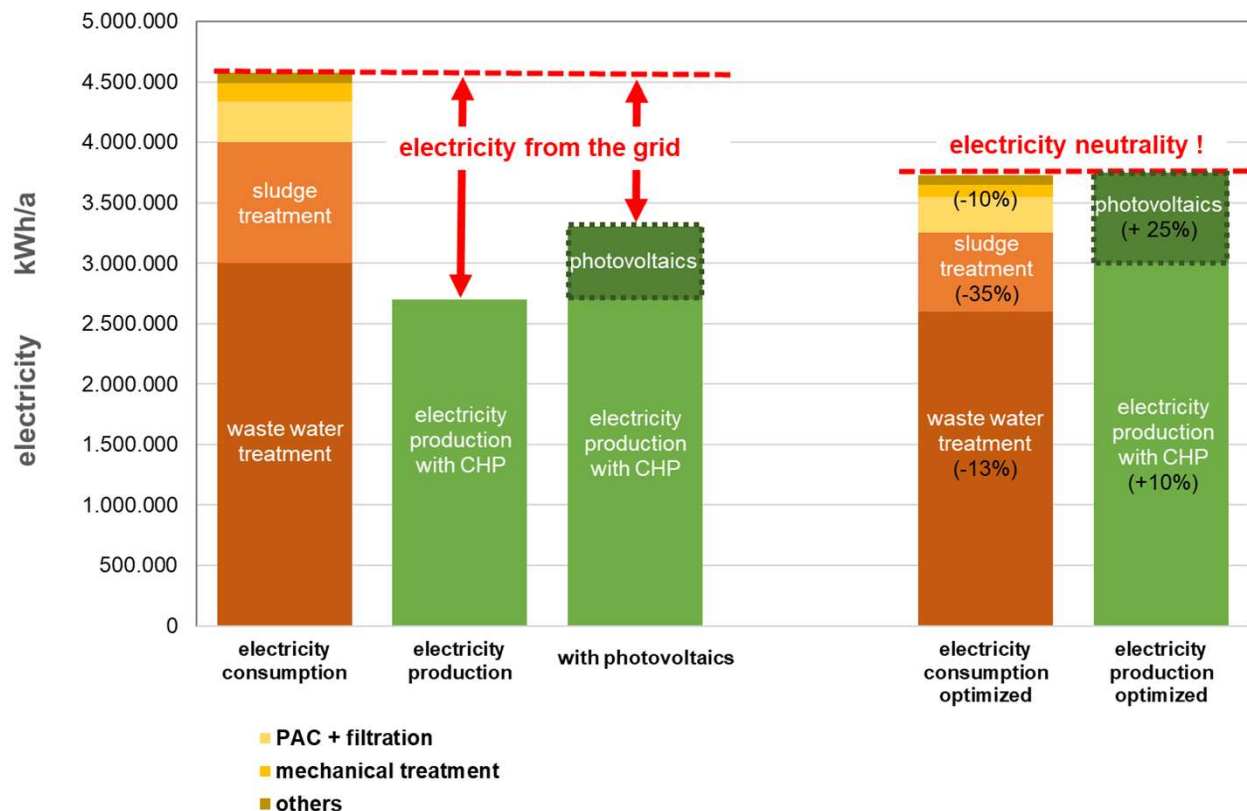
- process optimization
- high efficient motor

increasing electricity production (+ 15%)

- increasing efficiency CHP
- increasing biogas production
- extension of the existing photovoltaics

existing situation

„future“ optimization



**Wastewater treatment is not an end in itself
but rather a foresight to our existence!**

Thank you for your attention