INTERNATIONAL CONFERENCE ON
URBAN DRAINAGE 2021
25 - 28 OCTOBER 2021 VIRTUAL MEETING

Quality-based drainage of urban rainwater
Potential analysis for the catchment of Hildesheim, GER

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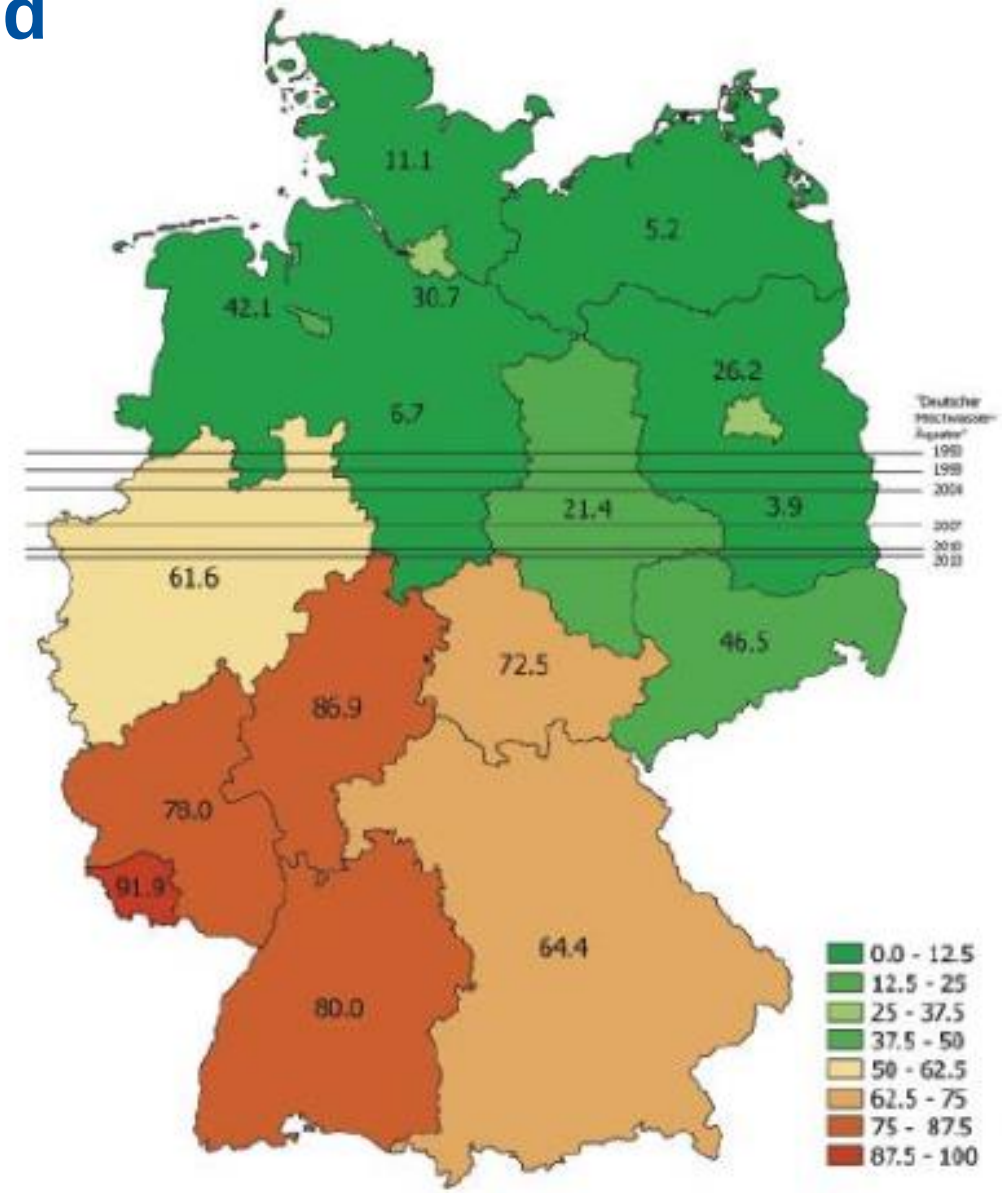
German current design background

- Since 200 years cities have been built up including a comprehensive sewer network
  - → > 97% drainage connection rate
  - → 580,000 km pipes
  - → 60% combined sewer systems
- Current focus: adapting the existing infrastructure to
  - → new technical regulations concerning flow seperation and water protection
  - → heavy rainfall events / climate change
  - → Emerging pollutants

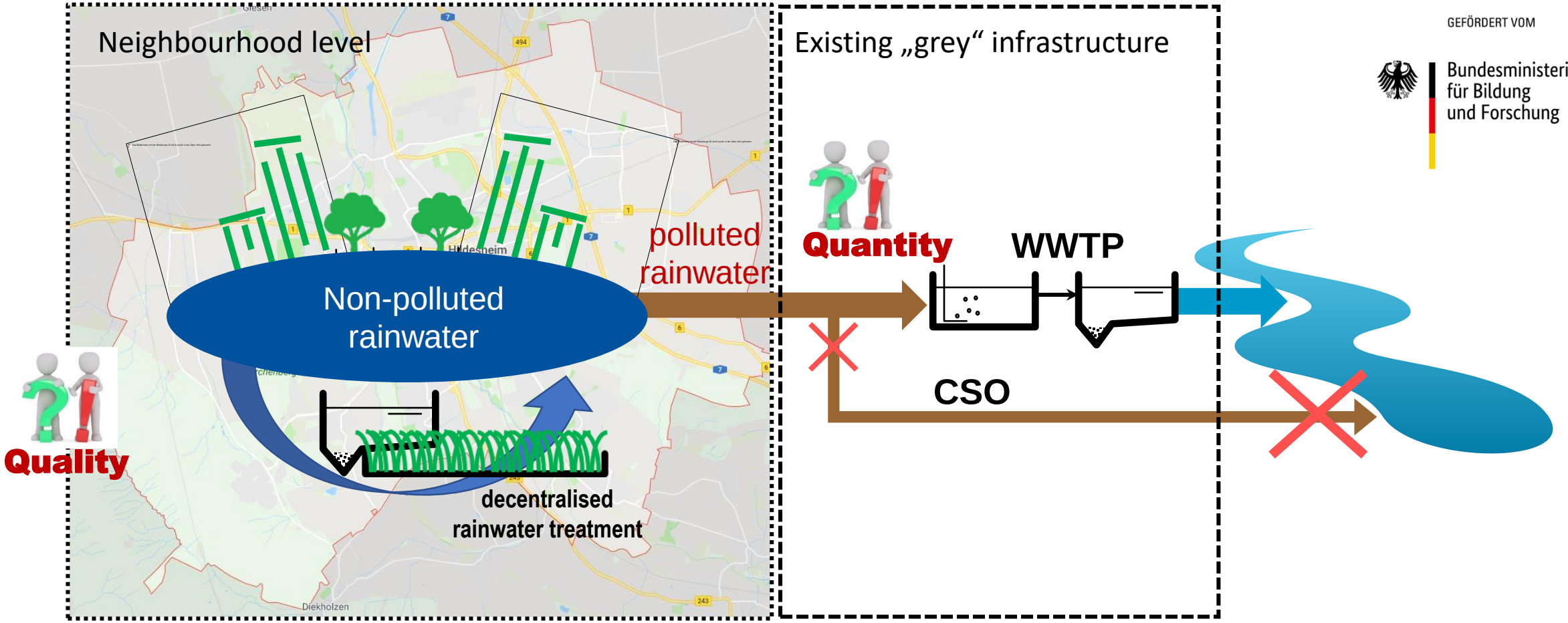


Brombach & Dettmar 2016

Our vision

4´19 – 6´22

A modified drainage system in which all polluted wastewater and rainwater is treated at wastewater treatment plants while non-polluted rainwater is available as water resource



GEFÖRDERT VOM
Bundesministerium für Bildung und Forschung

Stormwater Quality (Run off)

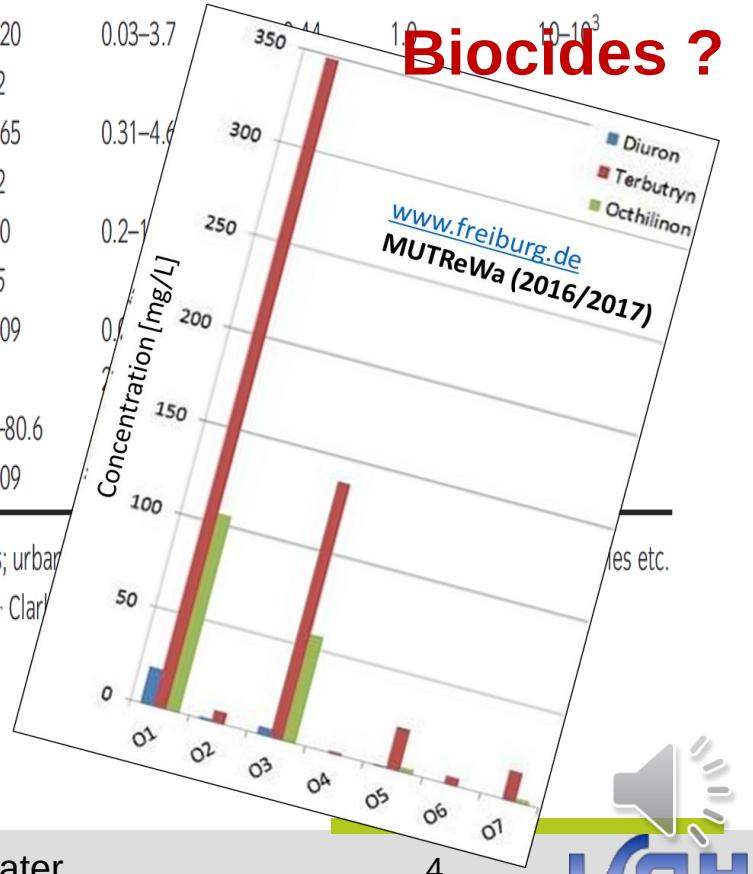
- **Local variation**
- Temporal variations

Microplastic ?

Source type	EMC concentration and range (mg/L) TSS	TVS	BOD	COD	NH_4	Pb	PAH (ng/L)	*Escherichia coli* (MPN/100 mL)
Urban open areas	126.3	–	7.9	36.0	0.1	0.061		
Residential areas	85.1		8.5	80.0	0.56	0.141		
	21–1104	28–124	5–17	20–120	0.03–3.7		1.0	$10–10^3$
Commercial areas	50.4		9.9	146.2				
	18–2582	75–85	5–22	37–365	0.31–4.6			
Industrial areas	50.4		9.9	146.2				
	45–375	35–72	8–17	40–70	0.2–1			
Highways	**194.5**		23.9	*136.5*				
	156.9	18–86	8–32	89–209	0.9			
	11–5700							
Roof runoff	12.3–216	40–88	2.8–8.1	57.9–80.6				
Gully pot liquors	15–840	185	6.8–241	25–109				

Values in **bold** type are for Motorways and *italics* are for other main roads; urban … es etc.
… compiled from Hall & Ellis (1985), Luker & Montague (1994), Butler & Clark

Biocides ?



Leaf Litter

Street Dust

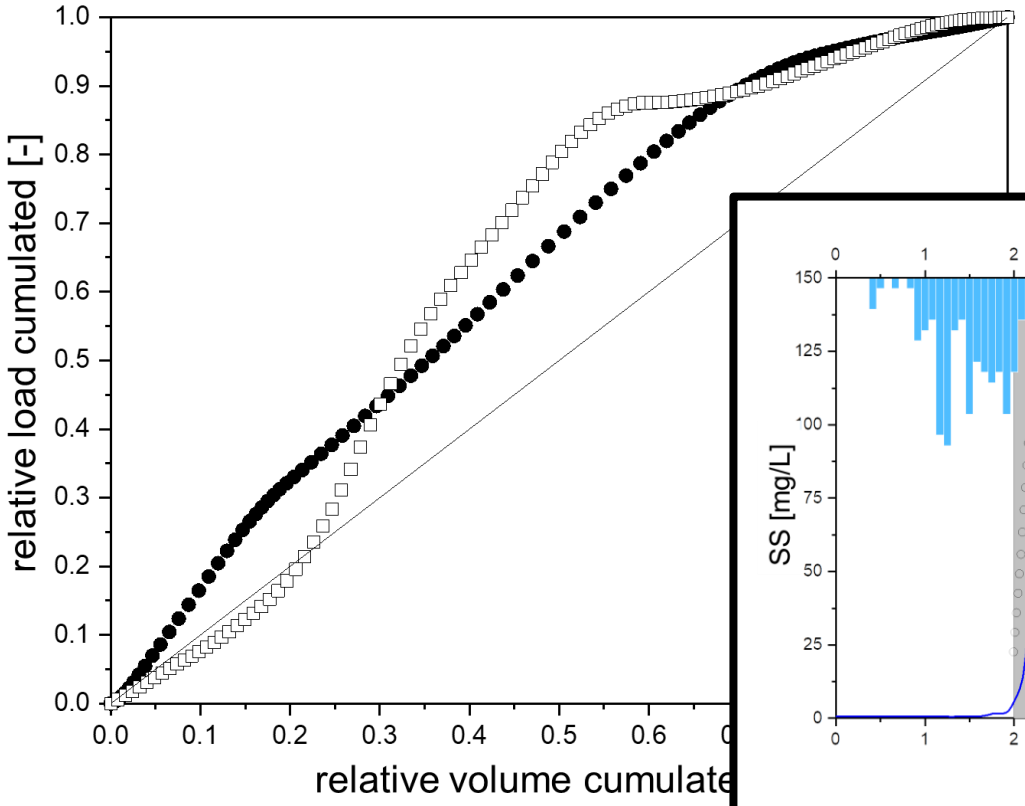
Decomposing

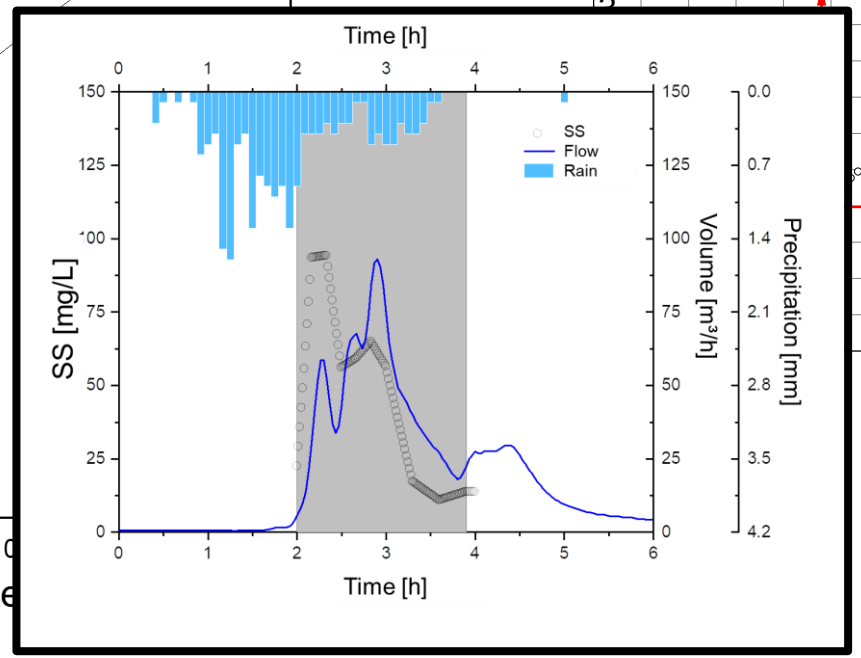
©ISAH 2018

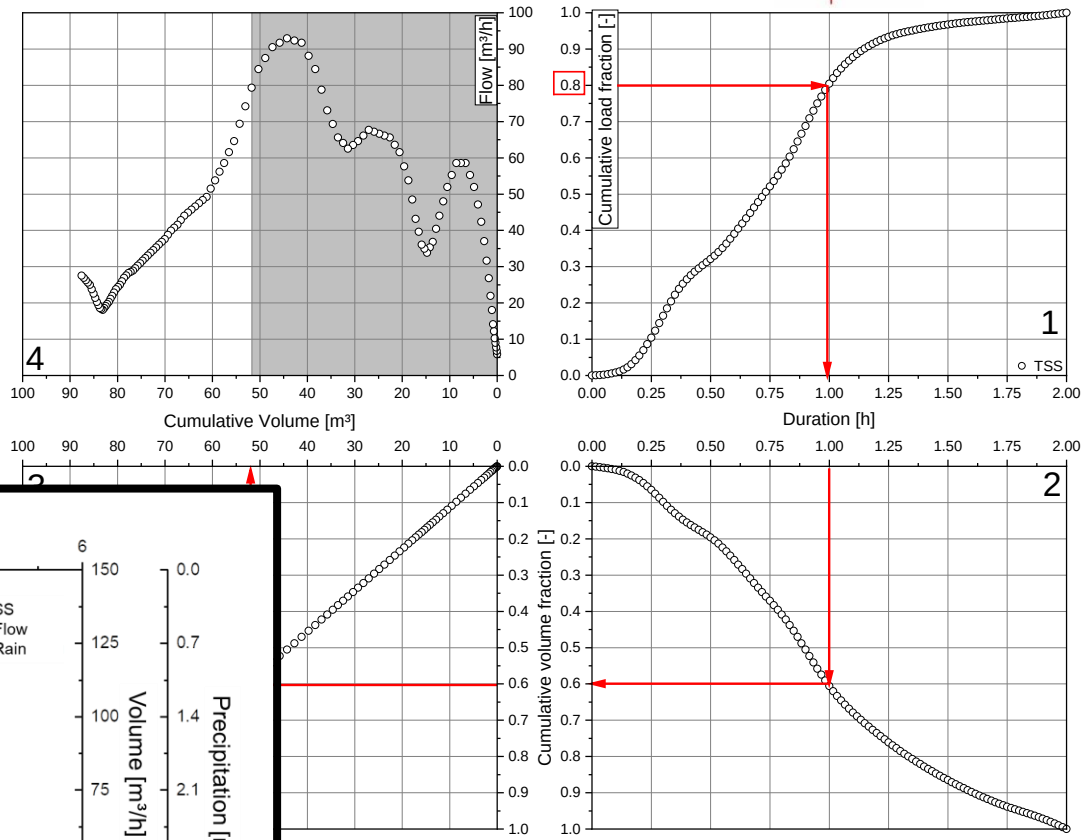
dissolved organic matter ?

Rainwater Quality (Run off)

- Local variation
- **Temporal variations**



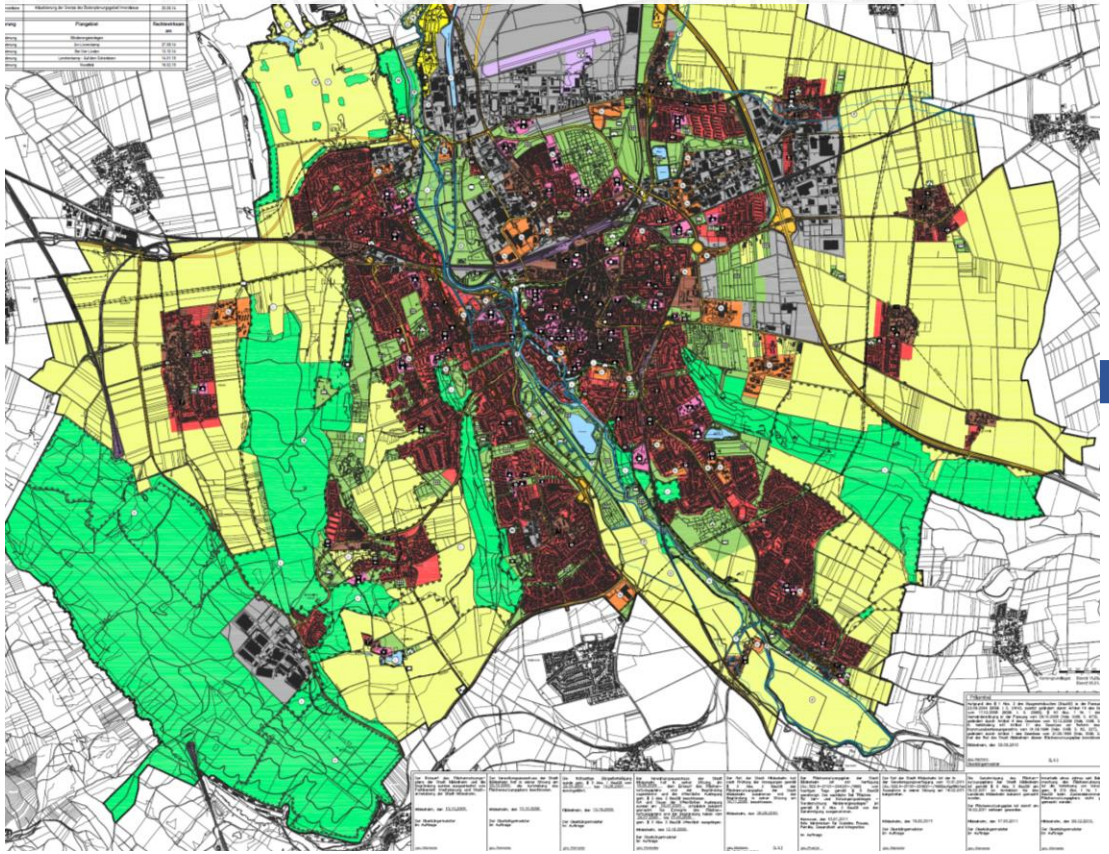


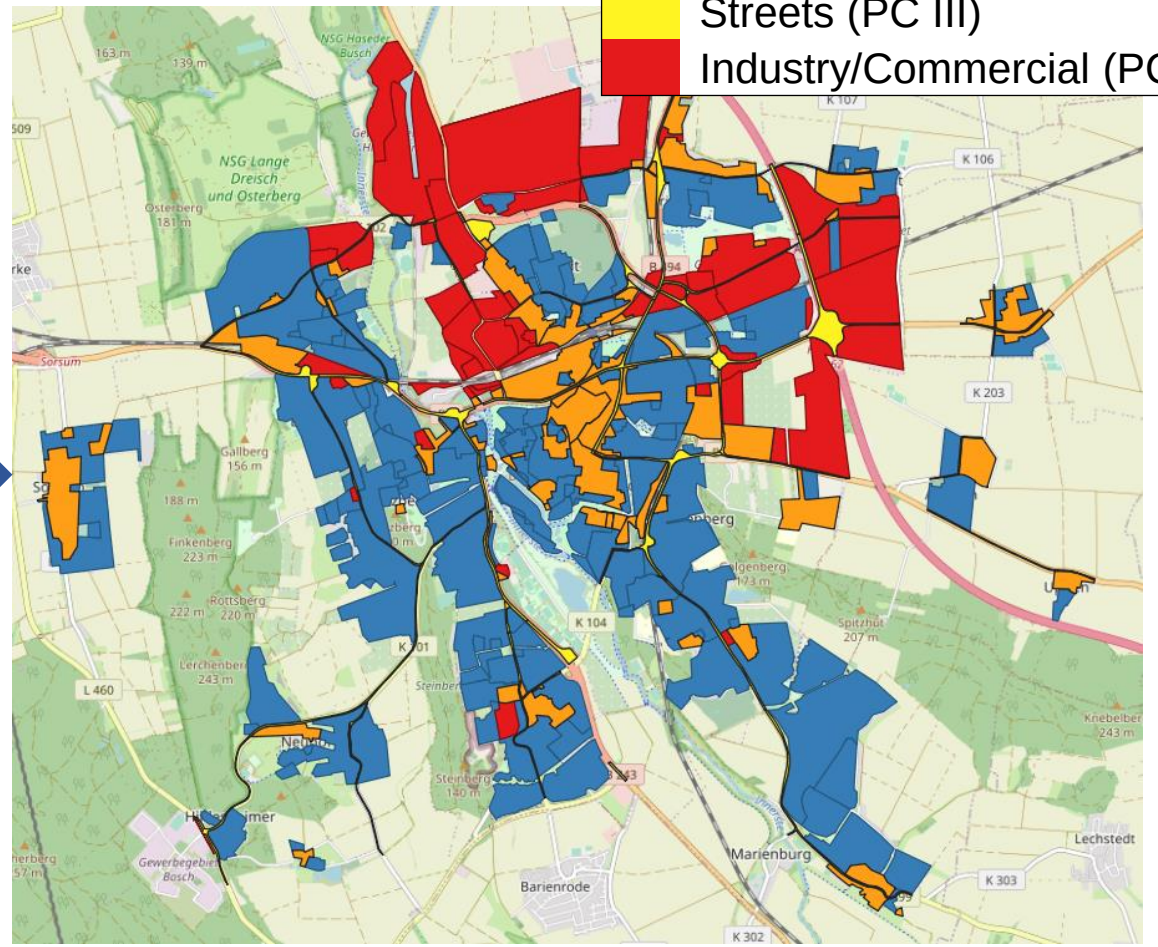


Potential analysis Hildesheim - Method l (Pollution)

- Estimation of rainwater pollution via land use

Regional land use plan of Hildesheim



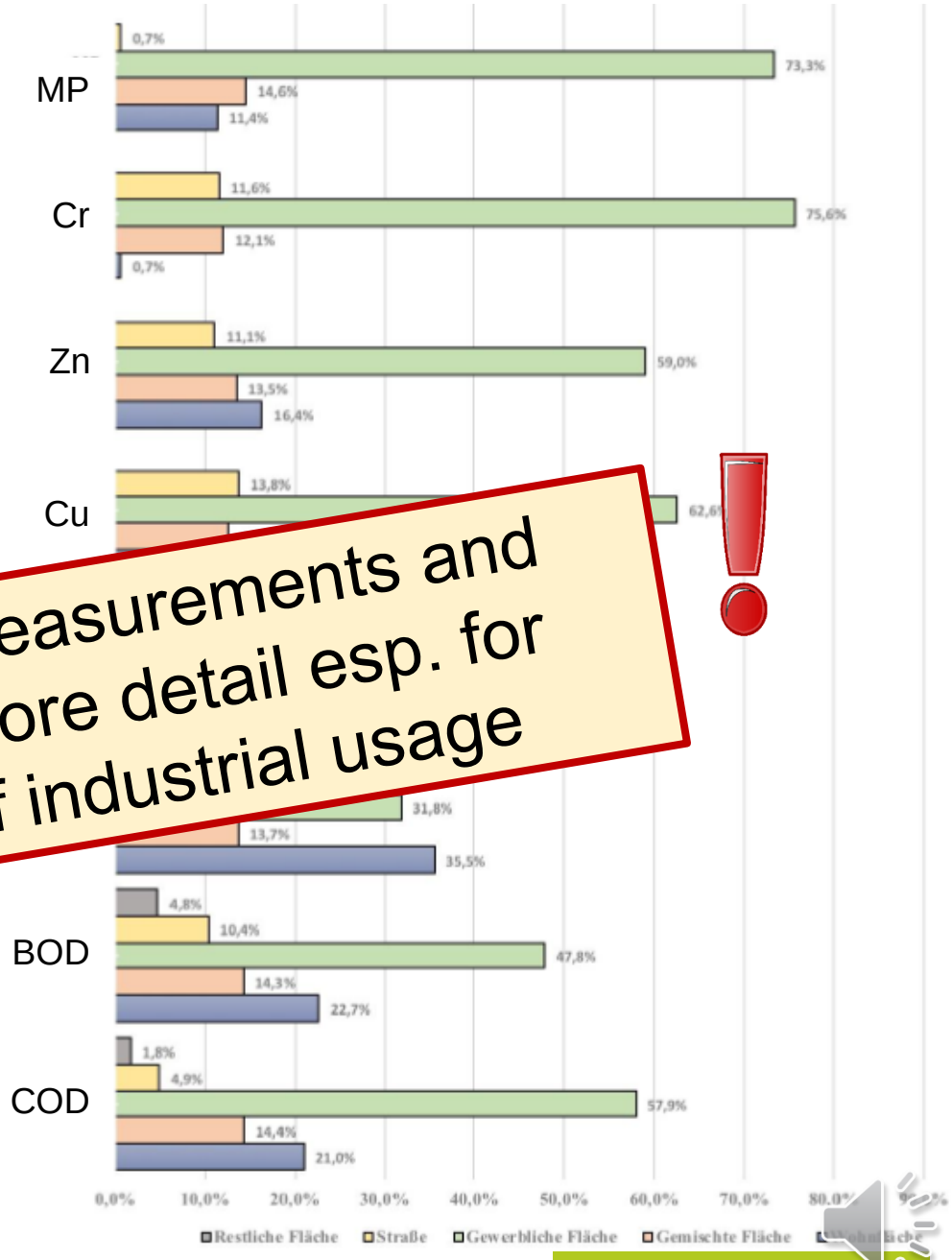


PC: Pollution Class

Calculated pollution

based on 4 different utilisation types

% runoff		% area
45.5	Industry	23.5
30.1	Living Areas	35.6
14.6	Mixed Areas	
4.1	Streets	
5.7	Rest	28.4



to be verified by measurements and differentiated in more detail esp. for different types of industrial usage

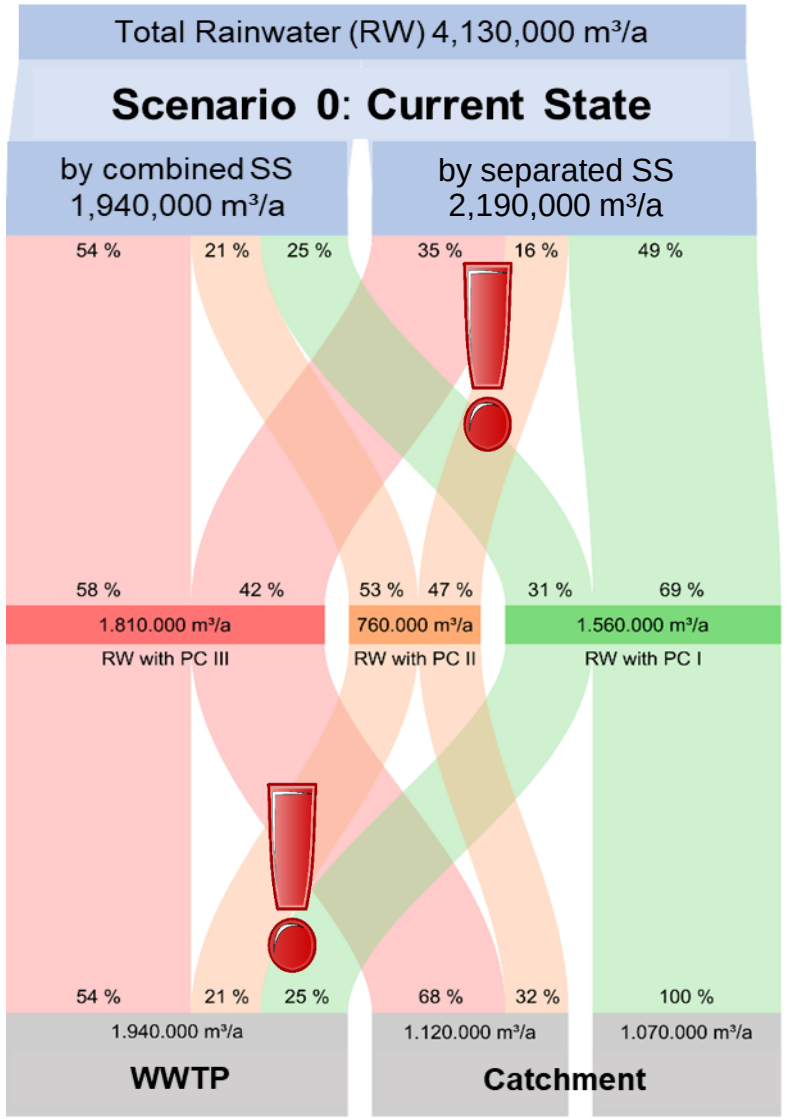
Potential analysis Hildesheim - Method II (Flows)

- Common sealing degrees from literature
- 10-year rainfall series with an average of 660.5 mm/a
- Average runoff coefficient of 0.7 was applied

- Considered Scenarios:

Scenario	Industry/Commercial	Streets	Mixed	Residential
S0	current state (sub-catchments with combined sewer systems are connected to WWTP)			
S1	connected to WWTP	connected to WWTP	decoupled from WWTP	decoupled from WWTP
S2	connected to WWTP	connected to WWTP	temporarily (first 30 min.) connected to WWTP	decoupled from WWTP

Potential analysis Hildesheim – Results I

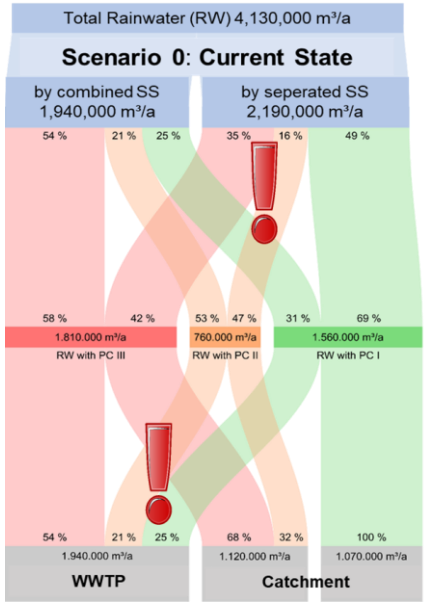


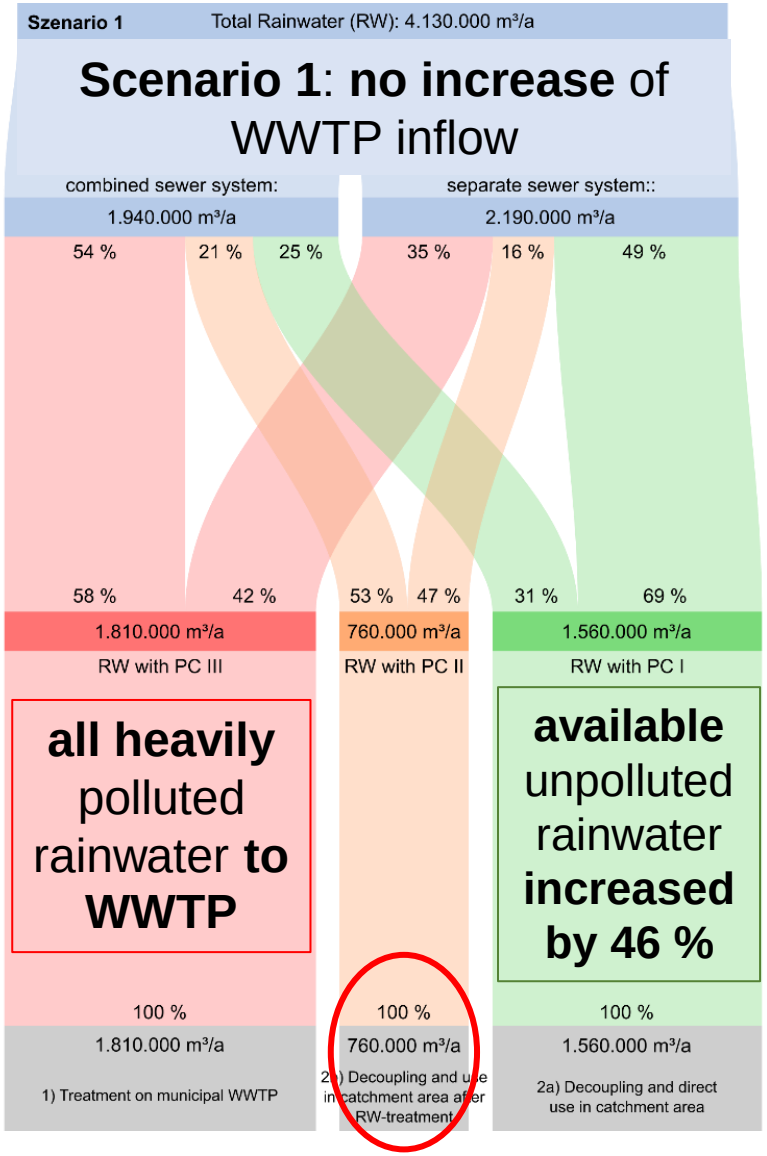
Scenario 0: Current State

- strong interweaving of the various sub-streams
- **475,000 m³/a** of Pollution Class I are not available in the catchment and burdens the WWTP unnecessarily
- **1,120,000 m³/a** rainwater of Pollution Class II and III from areas with a separate sewer system must be treated by additional treatment facilities

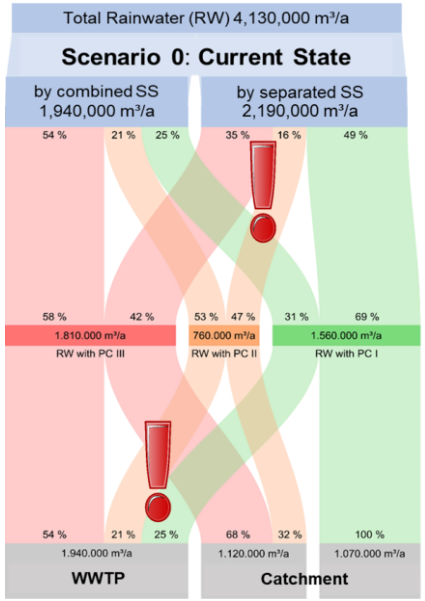
no optimal rainwater management

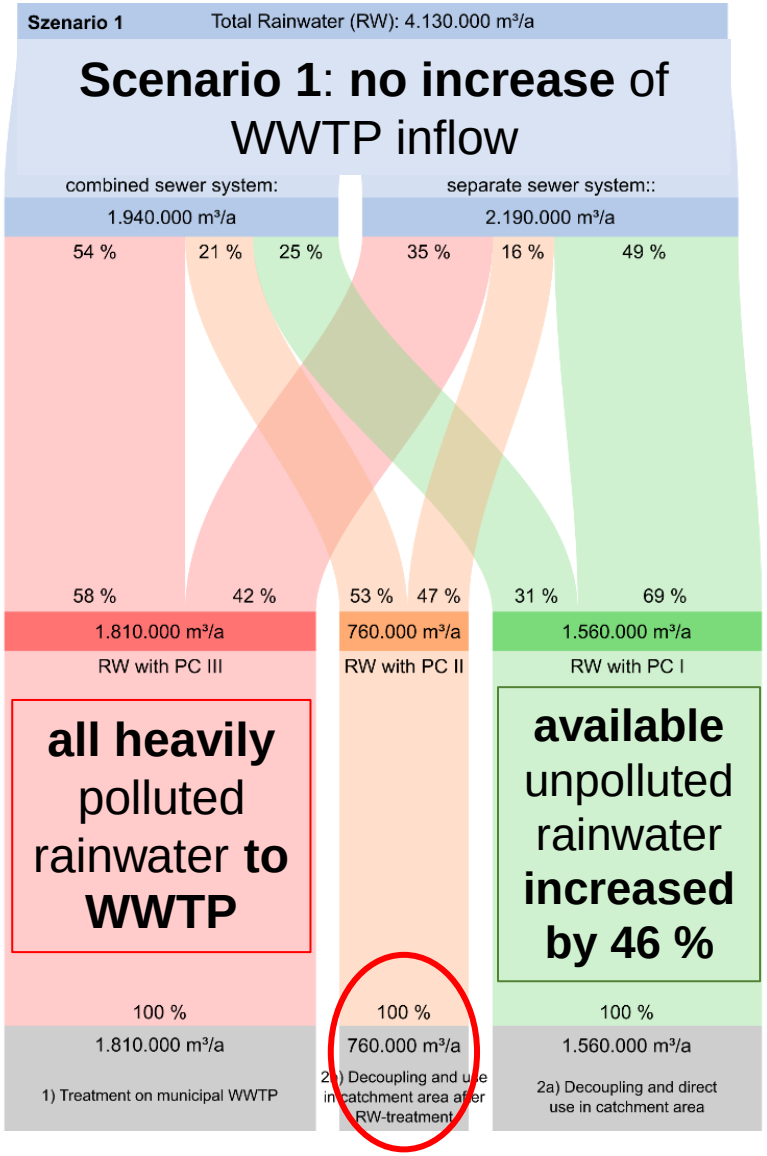
Potential analysis Hildesheim – Results II

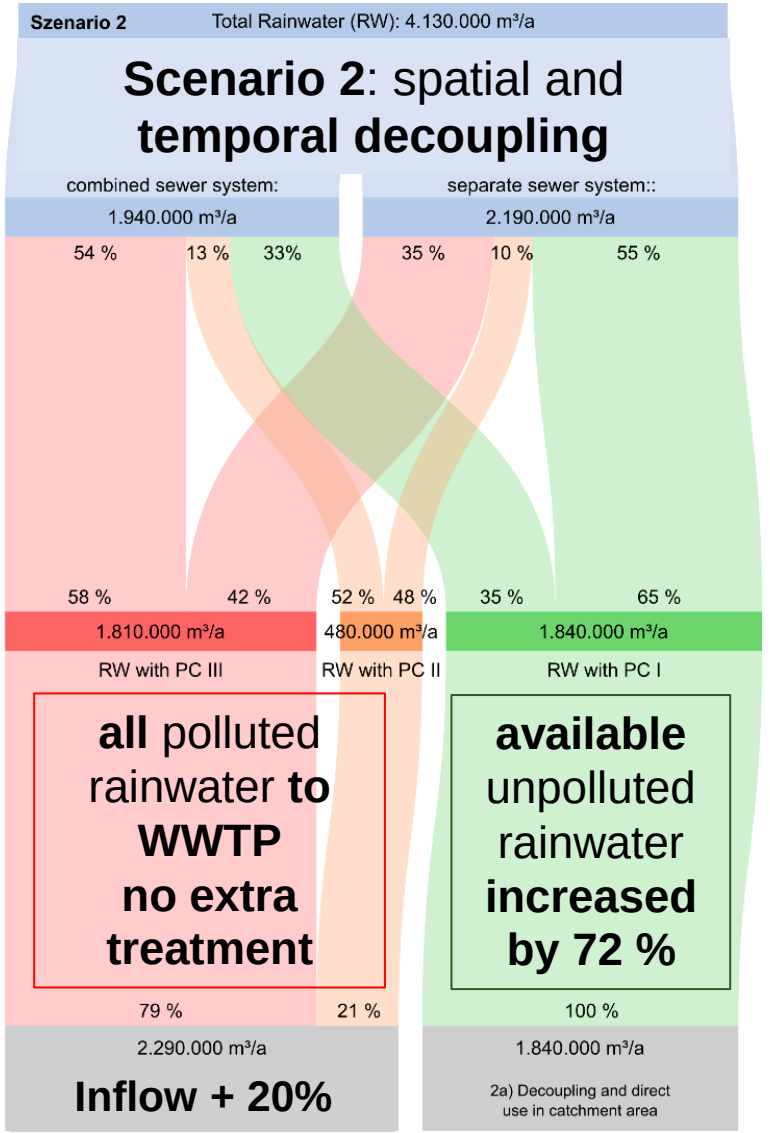




Potential analysis Hildesheim – Results II







Conclusion

The idea of a quality-based rainwater management shows very promising results:

- High utilisation of the existing infrastructure
  - Major part of polluted rainwater could be treated by existing WWTP with high efficiency of large and centralised facilities
  - The need for additional rainwater treatment facilitites can be reduced by 68% up to zero

  → **cost-effective**

- Increasing water supply in the neighbourhood up to 72 %

  → **eco-friendly**

Thank you for your listening!

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