

On the relevance of sewer monitoring for water quality impact assessment

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Est-ce que les  dans les rivières se soucient des rejets pluviaux urbains ?

Et si oui, comment pouvons-nous savoir ce qui les met en colère?

Bottom Line

Lviv, Ukraine (2009)



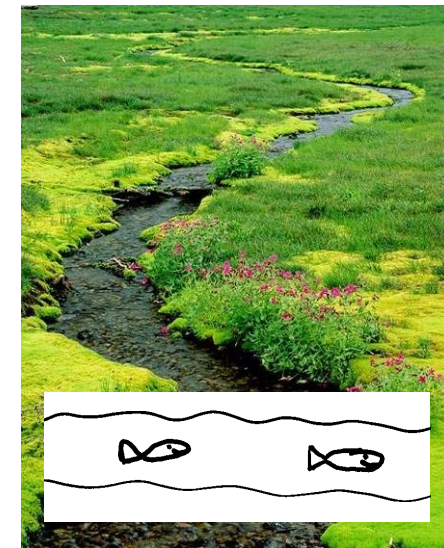
Plettenberg, Germany (2004)



Hooglinden, Belgium (2007)

Questions:

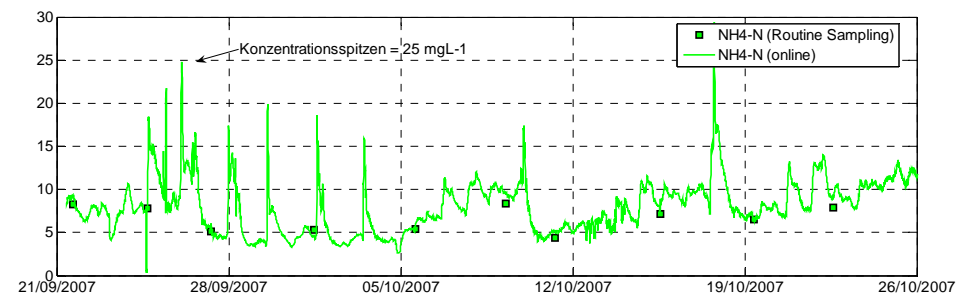
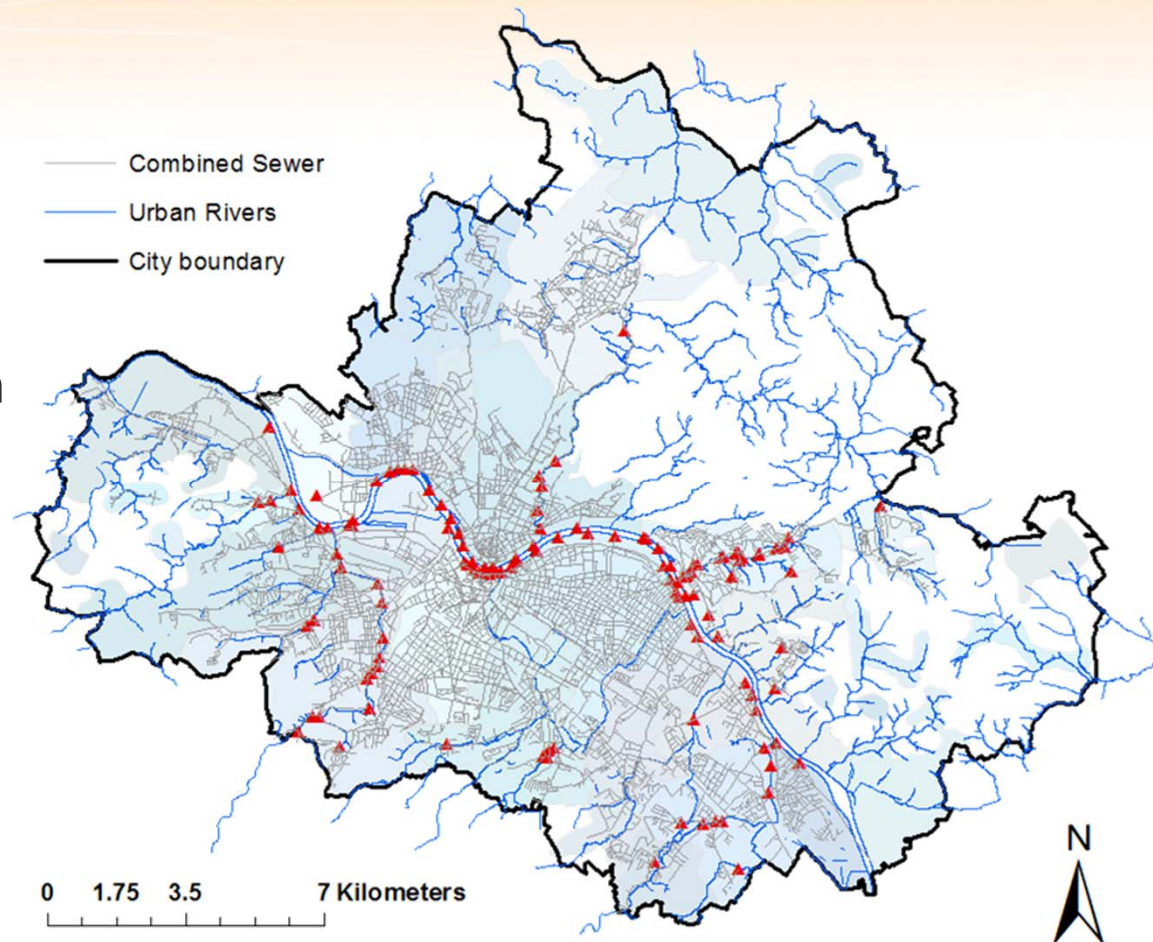
- How to mitigate impacts on water quality?
- **How** can we identify effective and cost-efficient solutions?



Focus

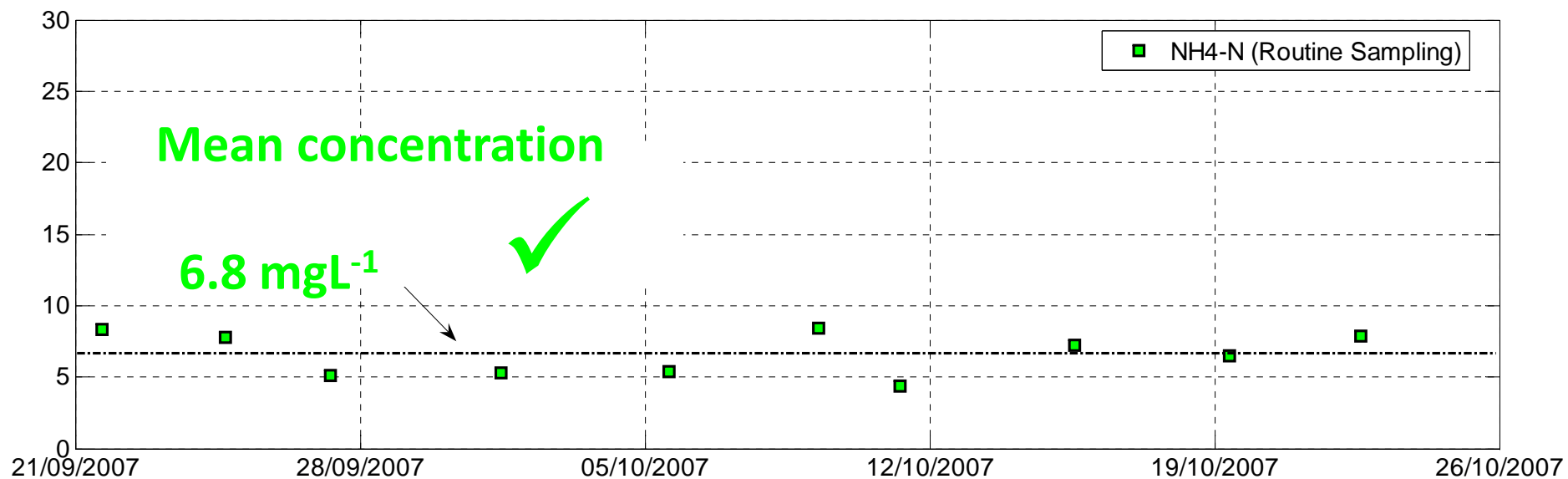
1. spatial differentiation of urban drainage impacts

2. Varying temporal scales, i.e. variability of process dynamics



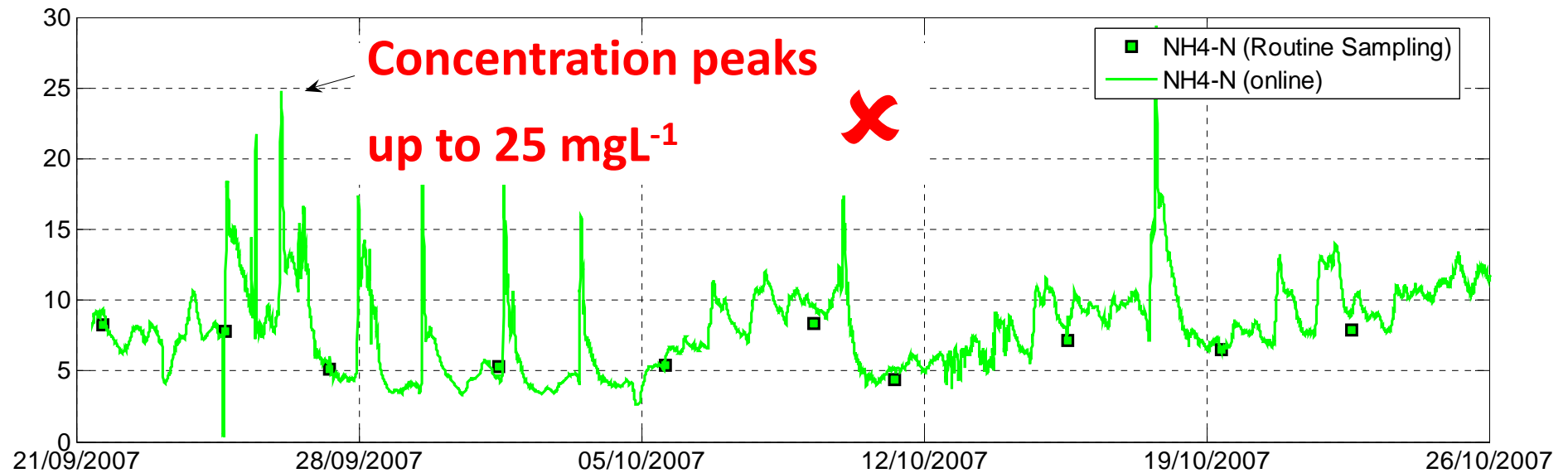
Water quality (grab) sampling (á 1 week)

River Water Quality NH₄-N [mgL⁻¹]



Online water quality monitoring (5')

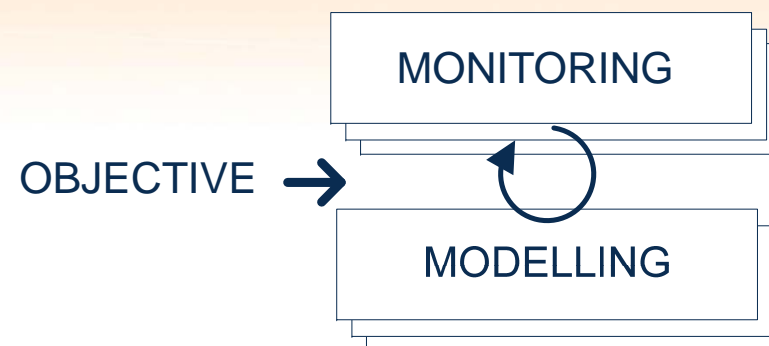
River Water Quality NH₄-N [mgL⁻¹]



→ dynamics?

How can we *efficiently* identify combined sewer overflows ?

→ Methods

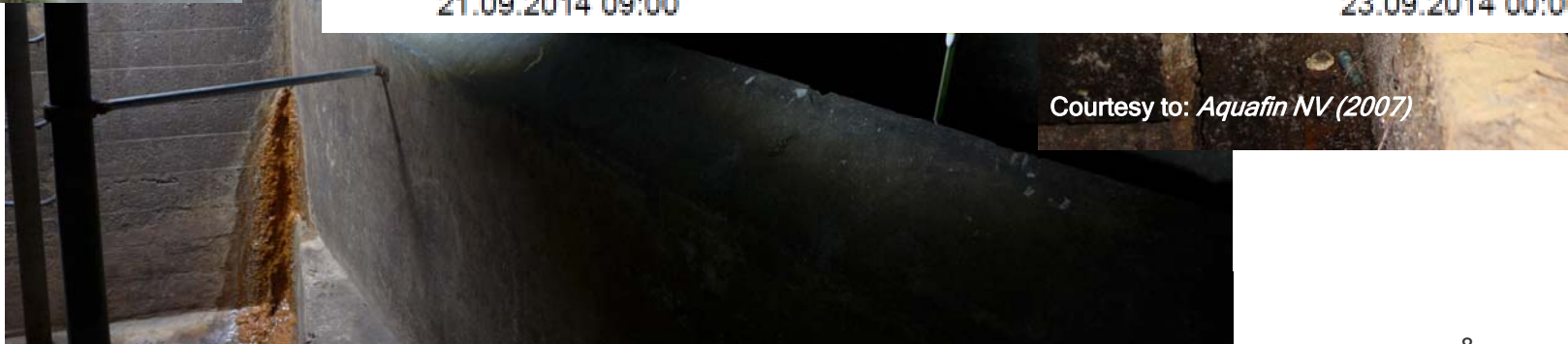
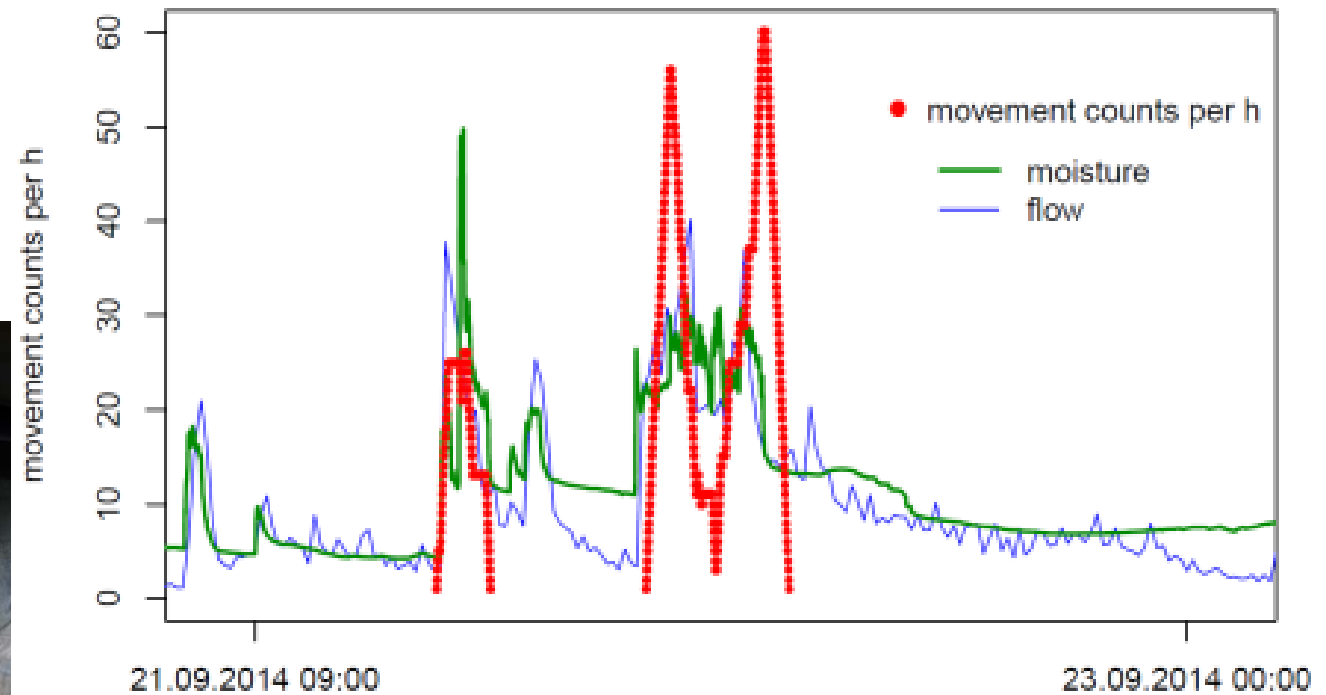


	Method		Data requirements				Information gain					'usefulness'	'effort'	
			rain	hydr	qual	infra-structure	CSO ident	CSO vol	CSO load	spatial relev.	RW impact			
monitoring	in-sewer	level monitoring (POLENI)				(x)	x	(x)		(x)			3	2
		flow/velocity monitoring					x	x					4	3
		pollution monitoring (load)					x	x	x				4	4
		'binary observations' (0/1)					x	??		x			3	1
monitoring	indirect	correlation with rain charact.	x	x			(x)			(x)			1	2
		RW quality monitoring	(x)				(x)	(x)	(x)		x		3	4
	ecology	sampling macro-invertebrates									x		3	2
modelling	hydraulics	hydrology ('grey-box model')	x	x		(x)		x		(x)			2	2
		hydrodynamics	x	x		x		x		x			3	3
	quality	pollution load ('grey-box')	x	x	x	(x)		x	x	(x)			3	4
		integrated water quality model	x	x	x	x	x	x	x	x	x		5	5

CSO detection using low-cost (,binary‘) sensors

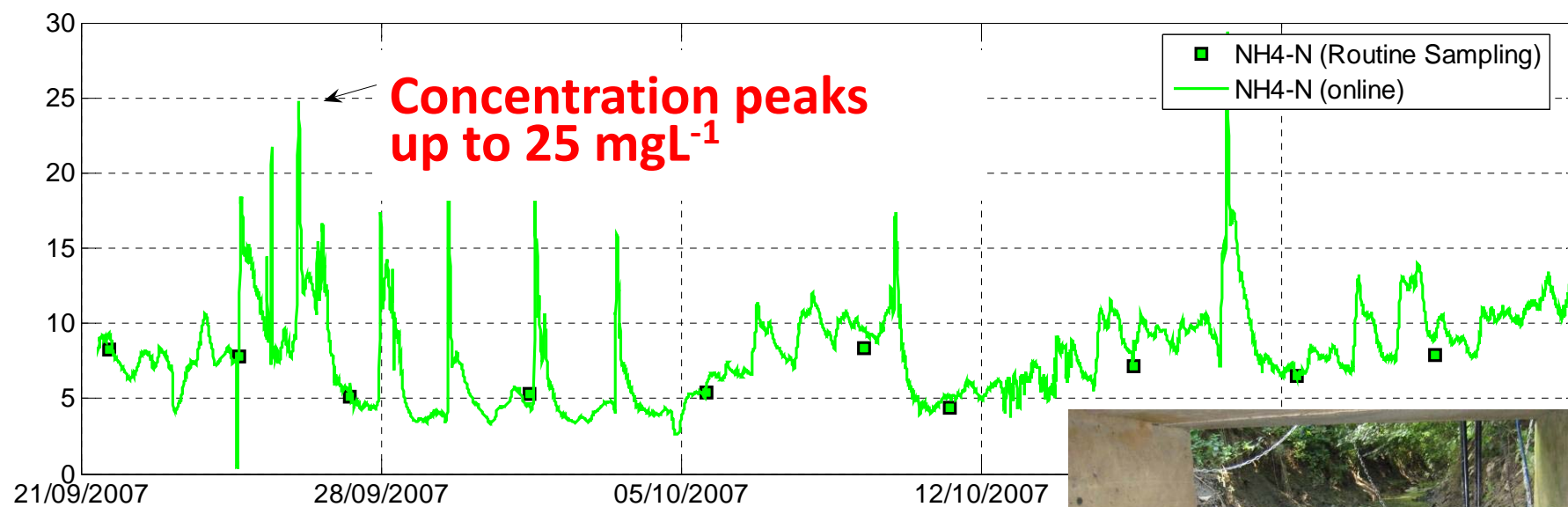


flow dynamics ~ humidity, movement



Courtesy to: Aquafin NV (2007)

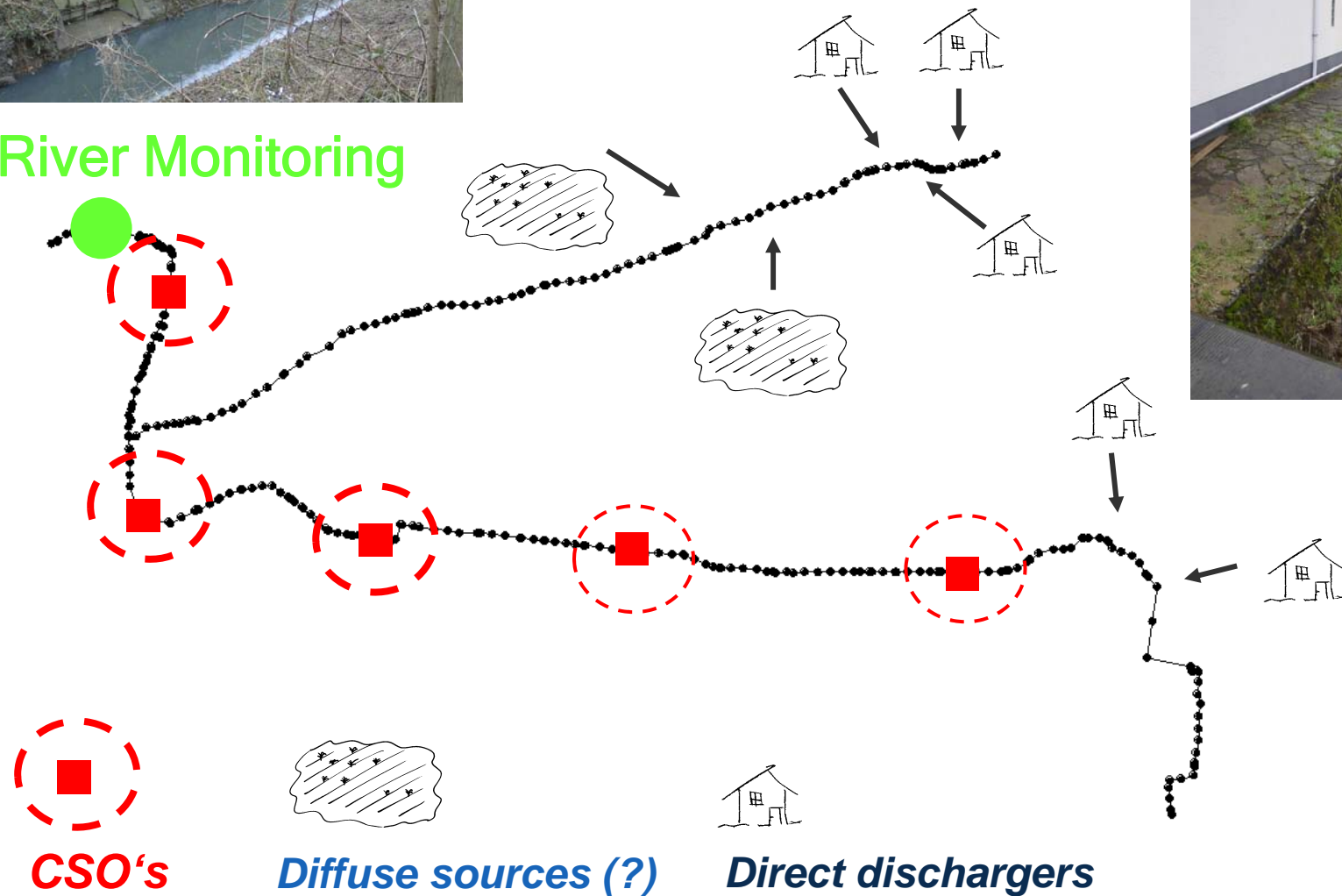
River Water Quality NH₄-N [mgL⁻¹]



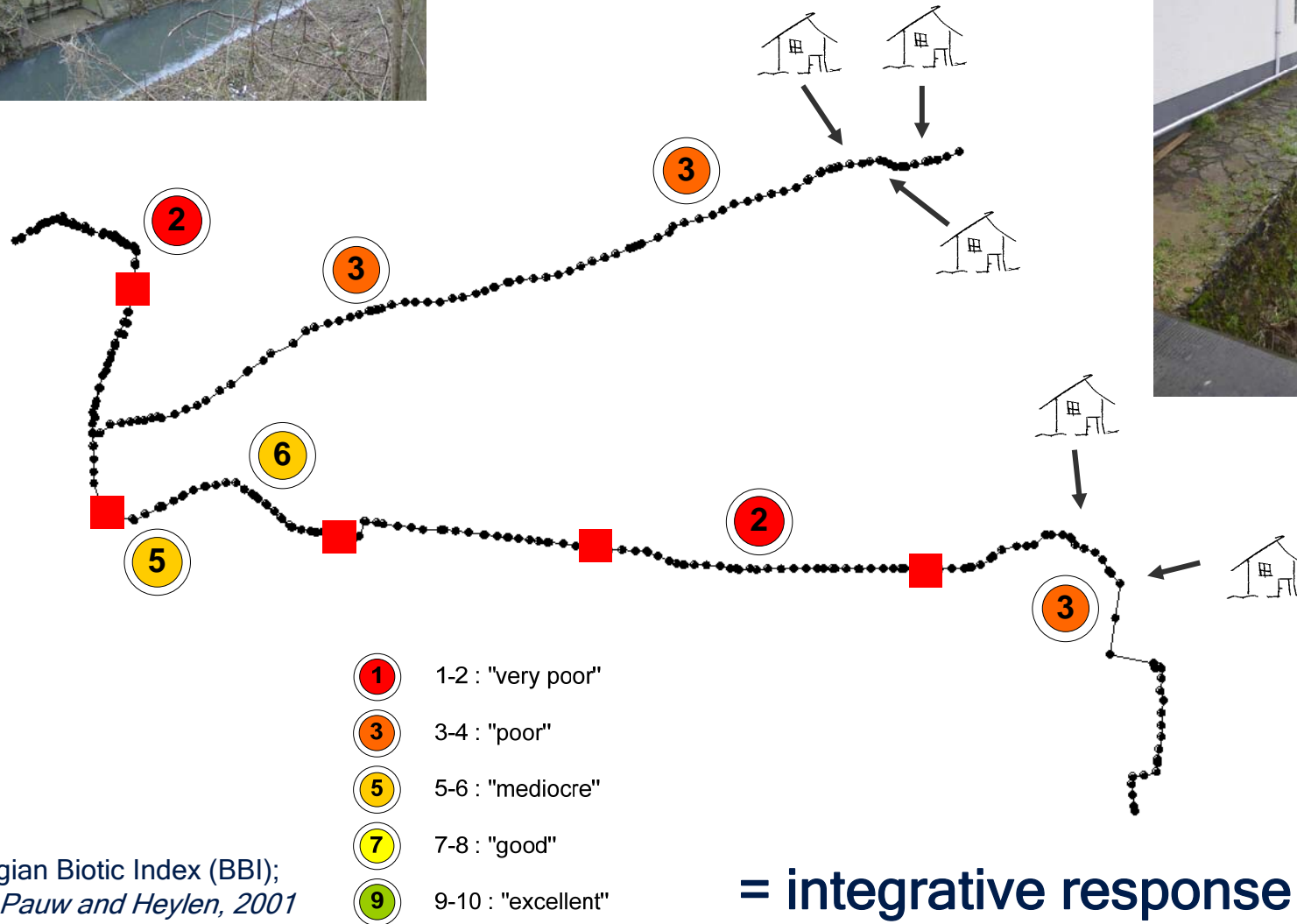
What we know... various pressures



River Monitoring



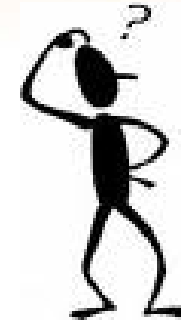
What we know... insufficient ecological status



Belgian Biotic Index (BBI);
De Pauw and Heylen, 2001

= integrative response

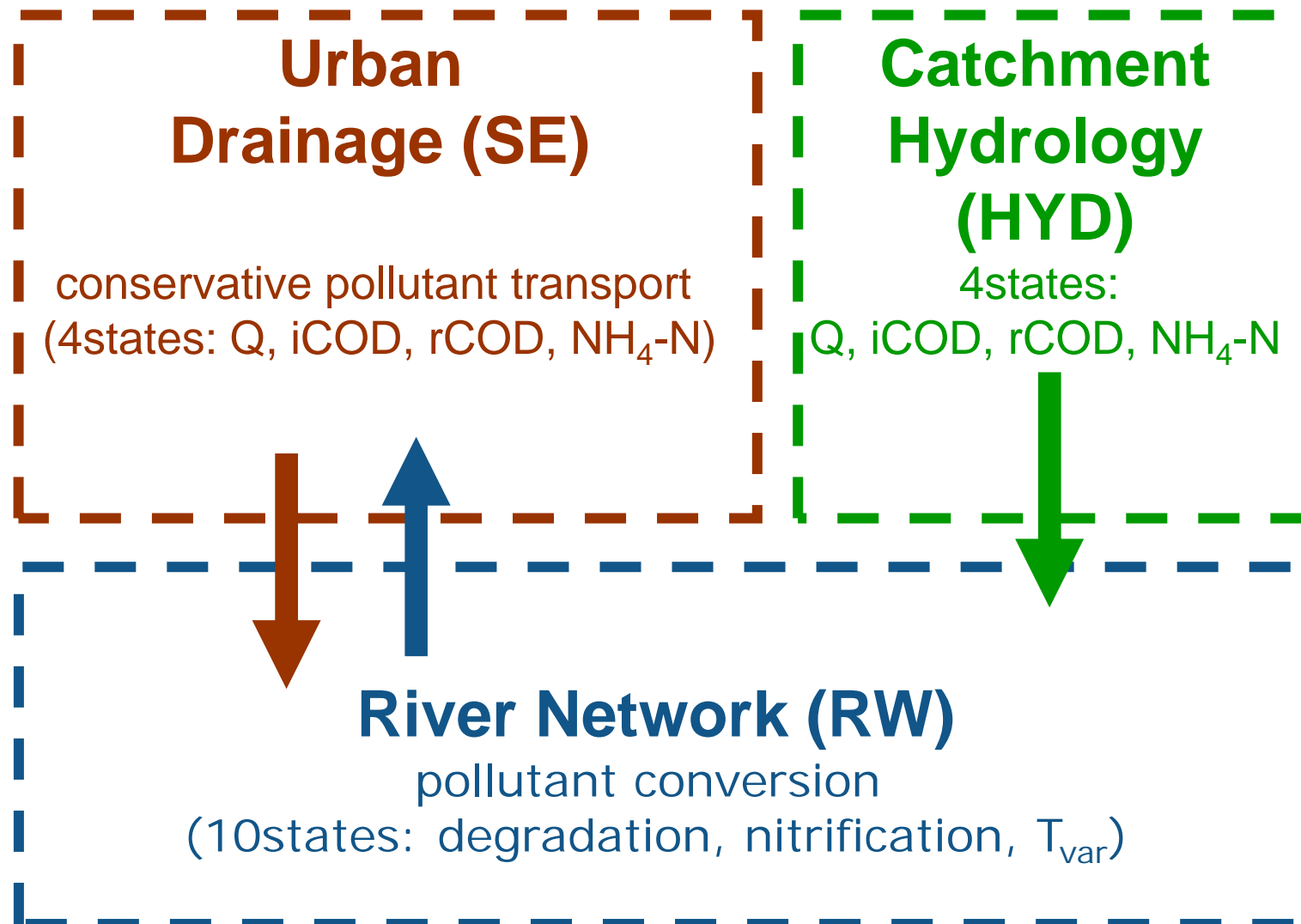
What we don't know...



- **Cause-effect-relations?**
- **Relevance of identified 'pressures'?**
 - Pollution dynamics?
 - Influence of sewer overflows?
 - Other influencing factors ...?
- **Effects of mitigation measures?**

**→ Combined approach:
online WQ monitoring || process modelling**

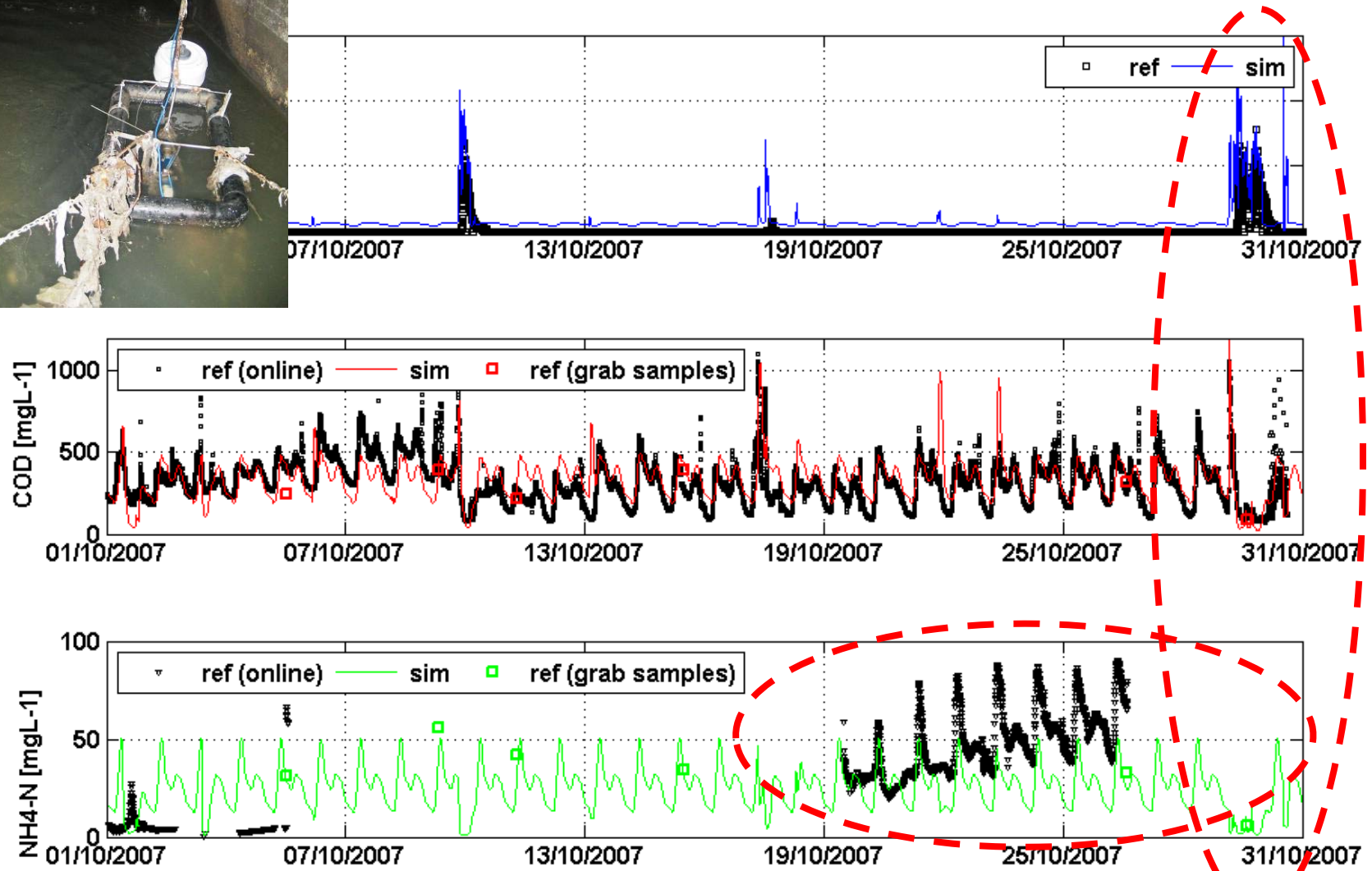
Integrated water quality model



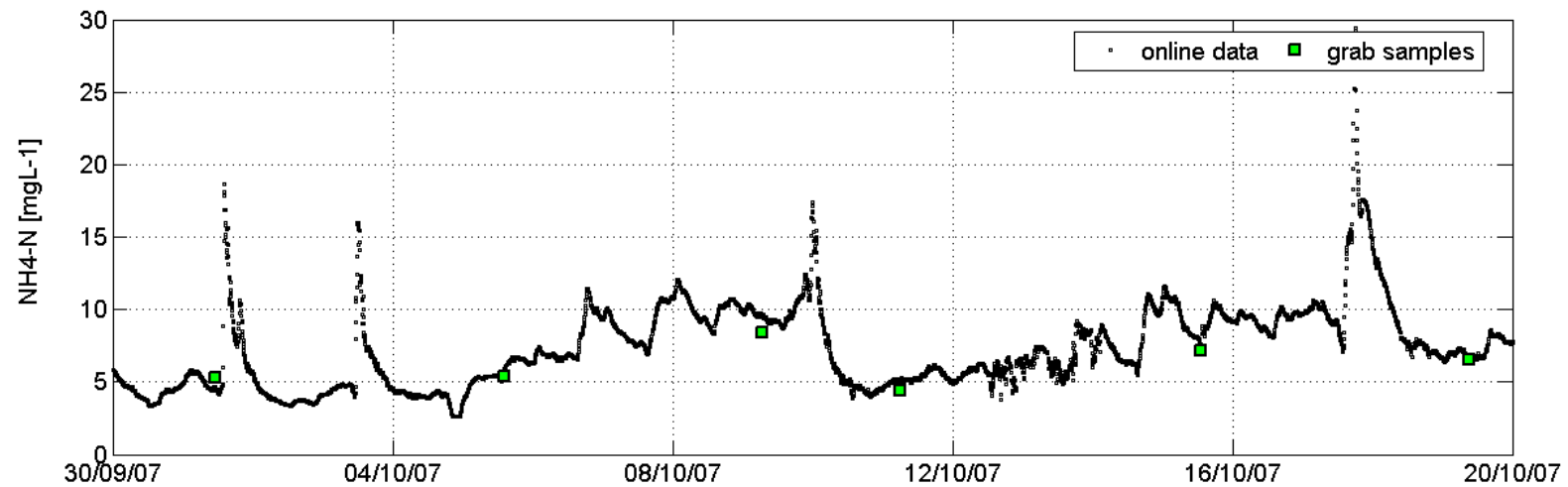
COD, NH4-N sensors @ sewer



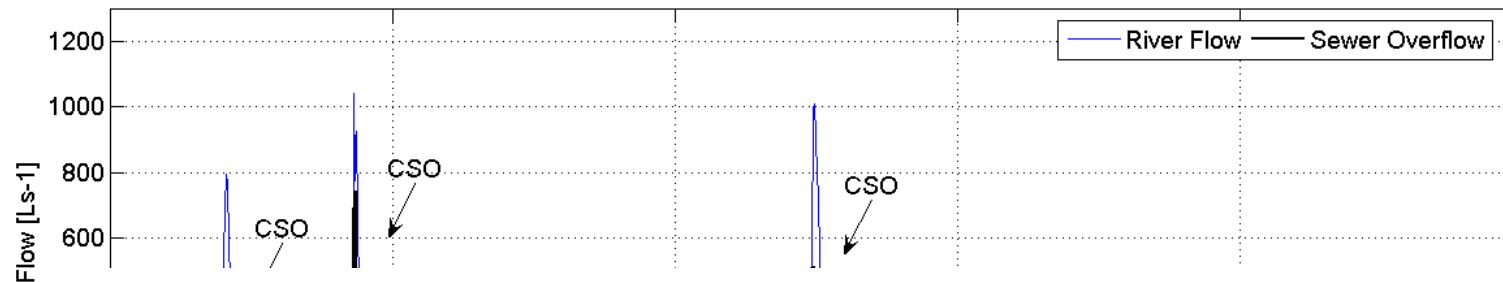
Calibration results: sewage flow and quality



Integrated water quality: monitoring vs. modelling



River water quality: monitoring vs. modelling



**Cause: hydraulic stress
(and *not* the pollution from the CSO)**

**Effect: remobilisation of
river sediments
-> NH₄-N release**

How can we *efficiently* identify combined sewer overflows ?


→ Methods

	Method		Data requirements				Information gain					'useful-ness'	'effort'
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		integrated water quality model	x	x	x	x	x	x	x	x	x	5	5

Key Conclusions

1. **Sewer (online) monitoring** is ... laborious, costly, sometimes frustrating...
→ but: **essential** to understand process dynamics
2. The lack of information is not a reason to discard the idea of modelling... →
but **adequate reference data are essential** to substantiate modelling results, and to so increase trustworthiness.
3. **Integrated numerical modelling** clearly **makes sense!** BUT: sensitivity analyses and the use of high resolution reference data should become integral parts of the modelling exercise.
4. **There is no standard, cookbook-like routine** that helps in solving future problems! Diverse methods needs to be combined in accordance to experience and resources.
5. **Engineers** need to **extend** their technical **expertise towards** a better **ecological understanding**. The 'missing link' (emission – ecology) remains a research & awareness challenge!



A photograph of a dam with water flowing over it. In the foreground, there is a wooden railing with water droplets on it. The background shows the dam structure and some greenery.

Thank you
for your attention!

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