

Environmental Impact Assessment (EIA) of Effluents from Constructed Wetlands on Water Quality of Receiving Watercourses

Natalia Donoso

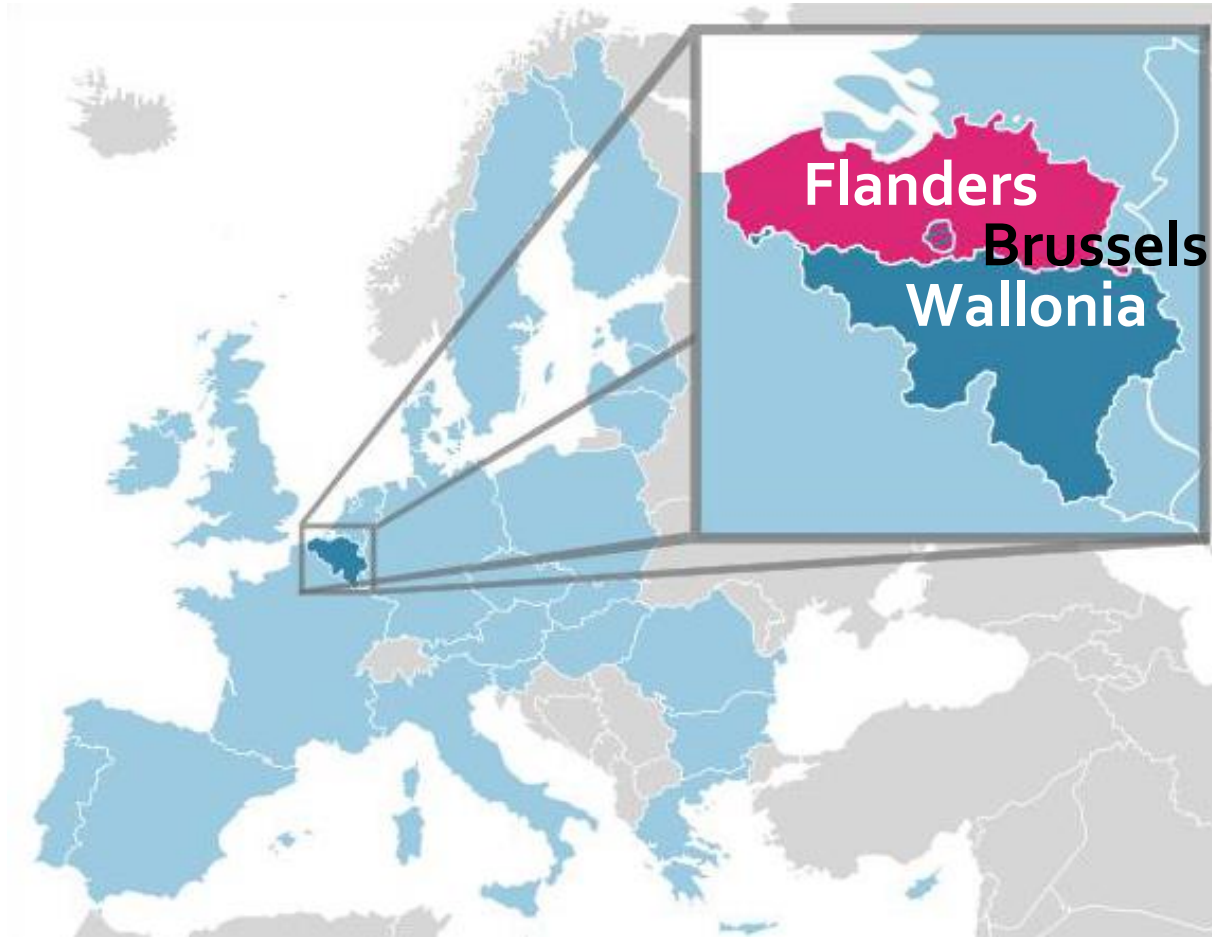
PhD Candidate

Promoters

Prof. P. Goethals

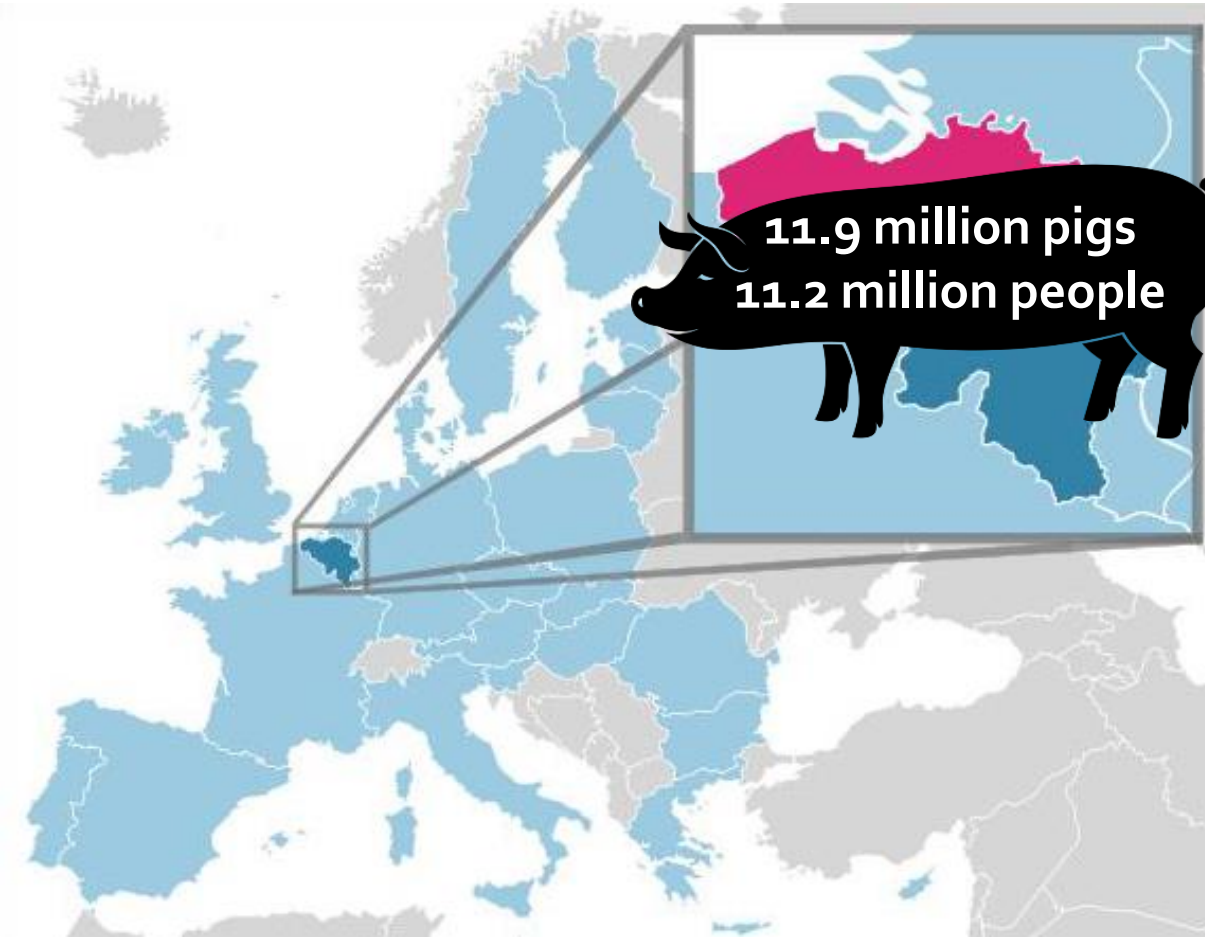
Prof. E. Meers

BELGIUM









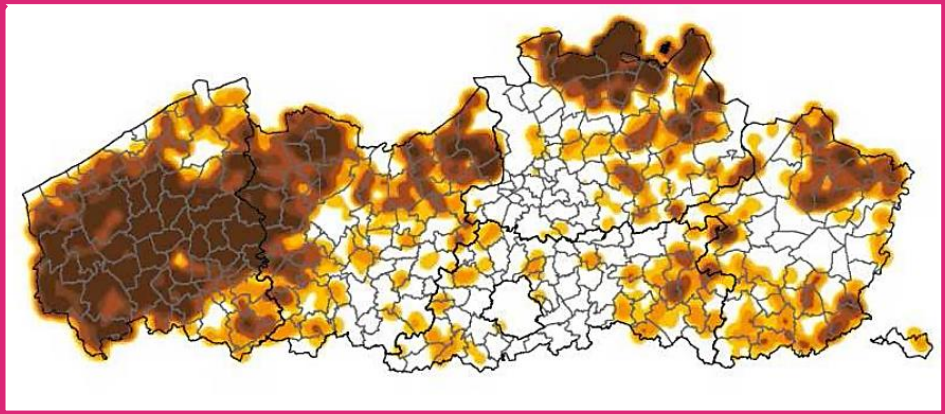
BELGIUM

3rd highest pig breeding country across Europe

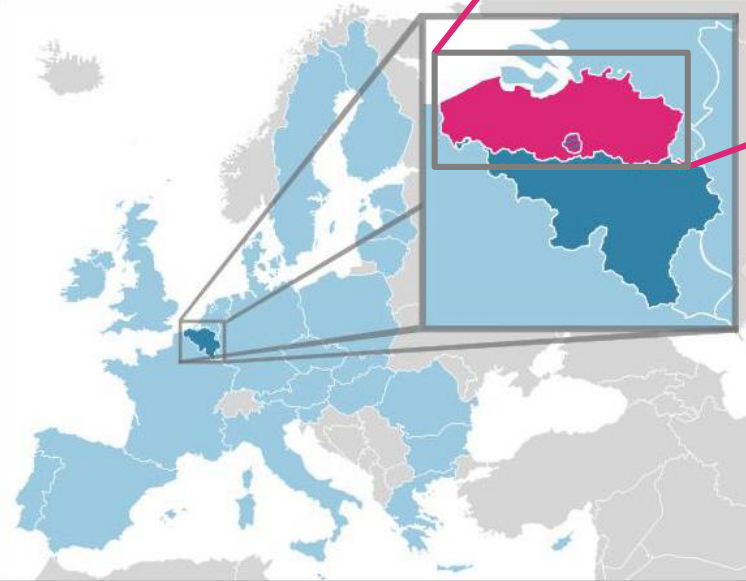


PIG PRODUCTION AND MARKETING VALUE

-  <200
-  200 – 500
-  500 – 1000
-  1000 – 2000
-  2000 – 3000
-  > 3000 (max 14.253)

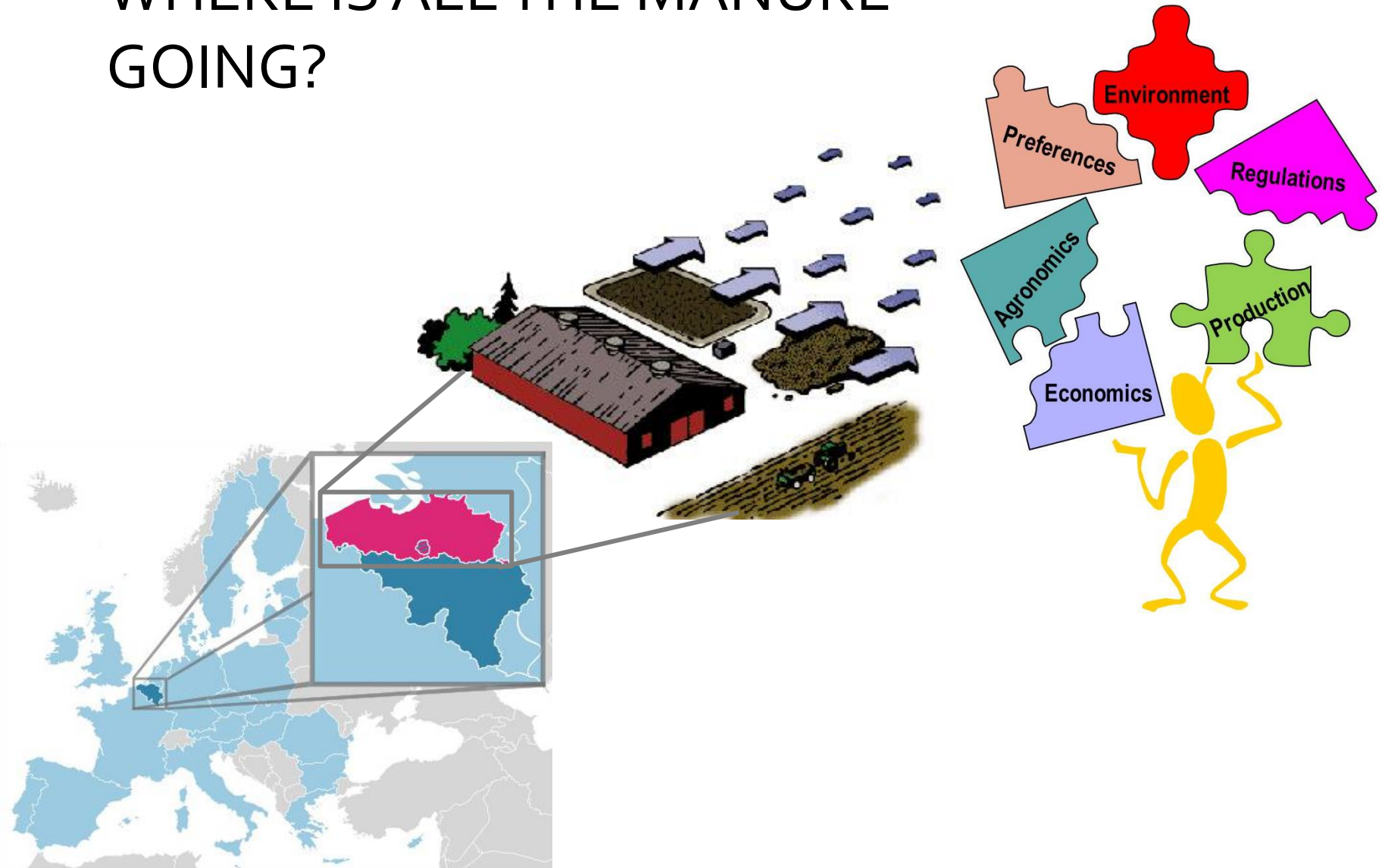


(Lara 2012)

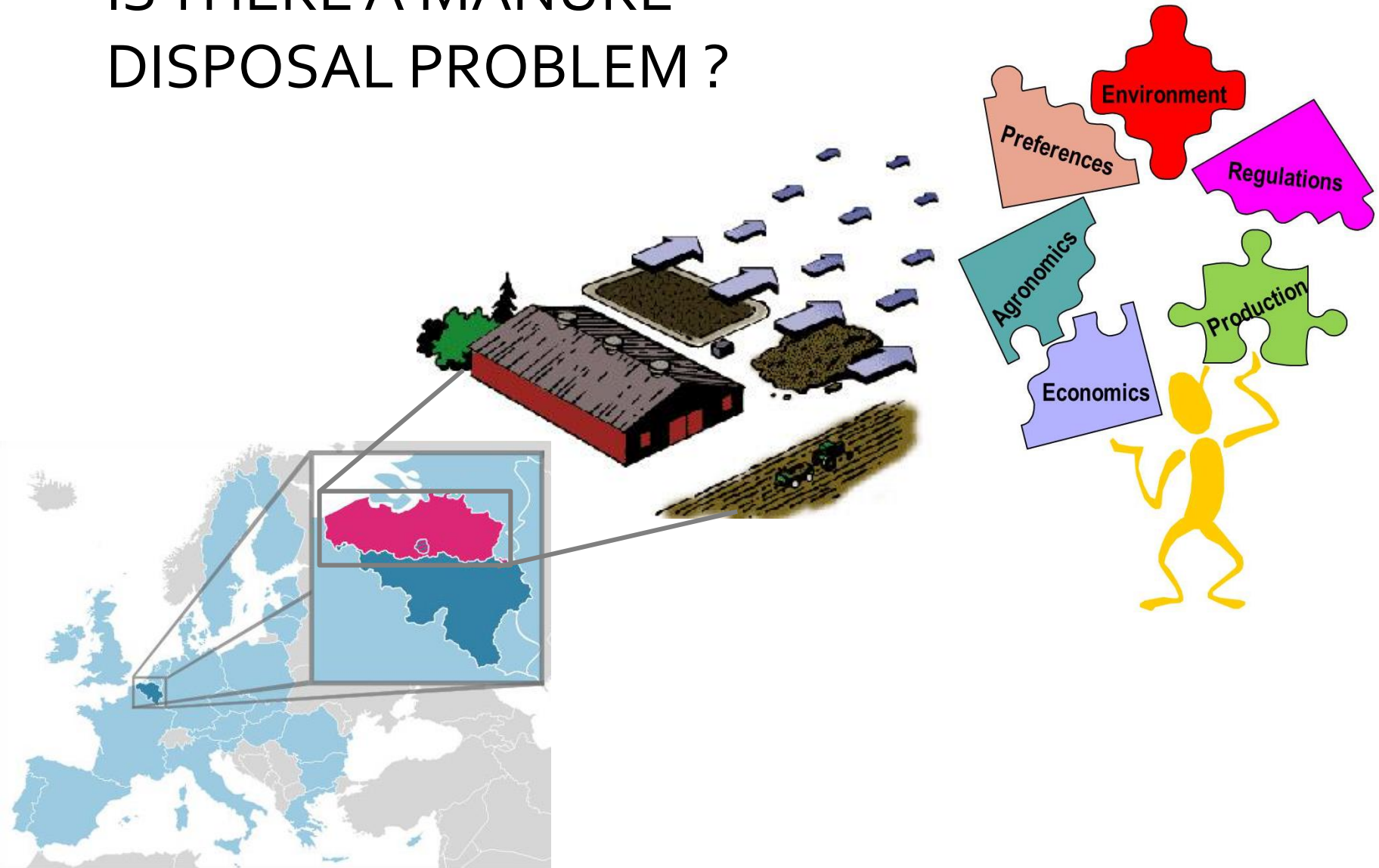


Pig production in euro per hectare
in 2010

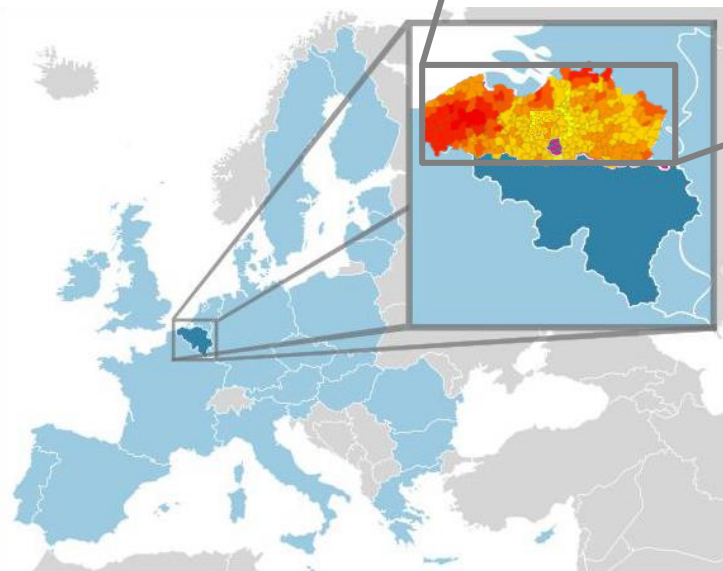
WHERE IS ALL THE MANURE GOING?



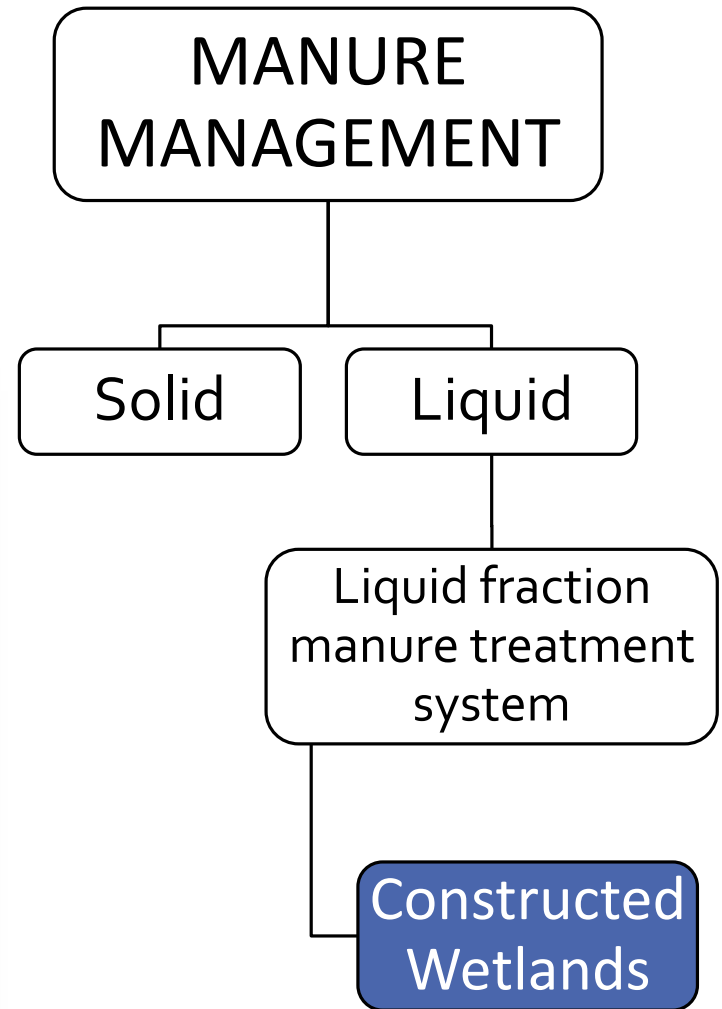
IS THERE A MANURE DISPOSAL PROBLEM ?



YES!

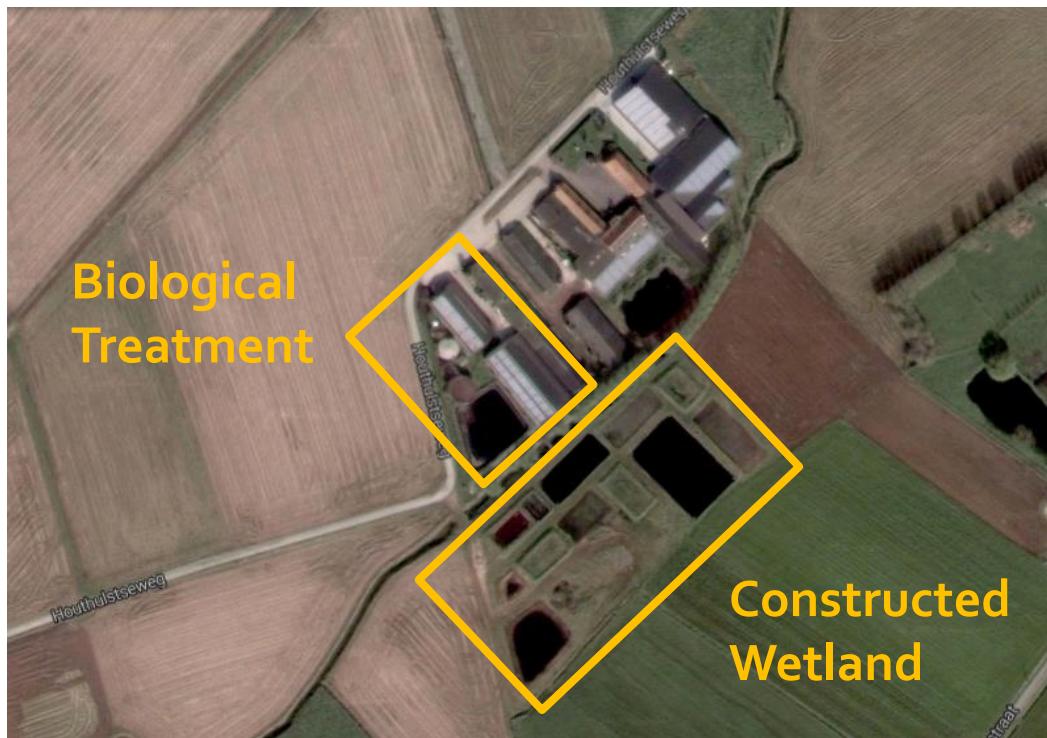


- < 50 mgNO₃⁻/l
- > 50 mgNO₃⁻/l



IMPACT ASSESSMENT OF EFFLUENTS FROM CONSTRUCTED WETLANDS

Case study



Studied Variables

TN

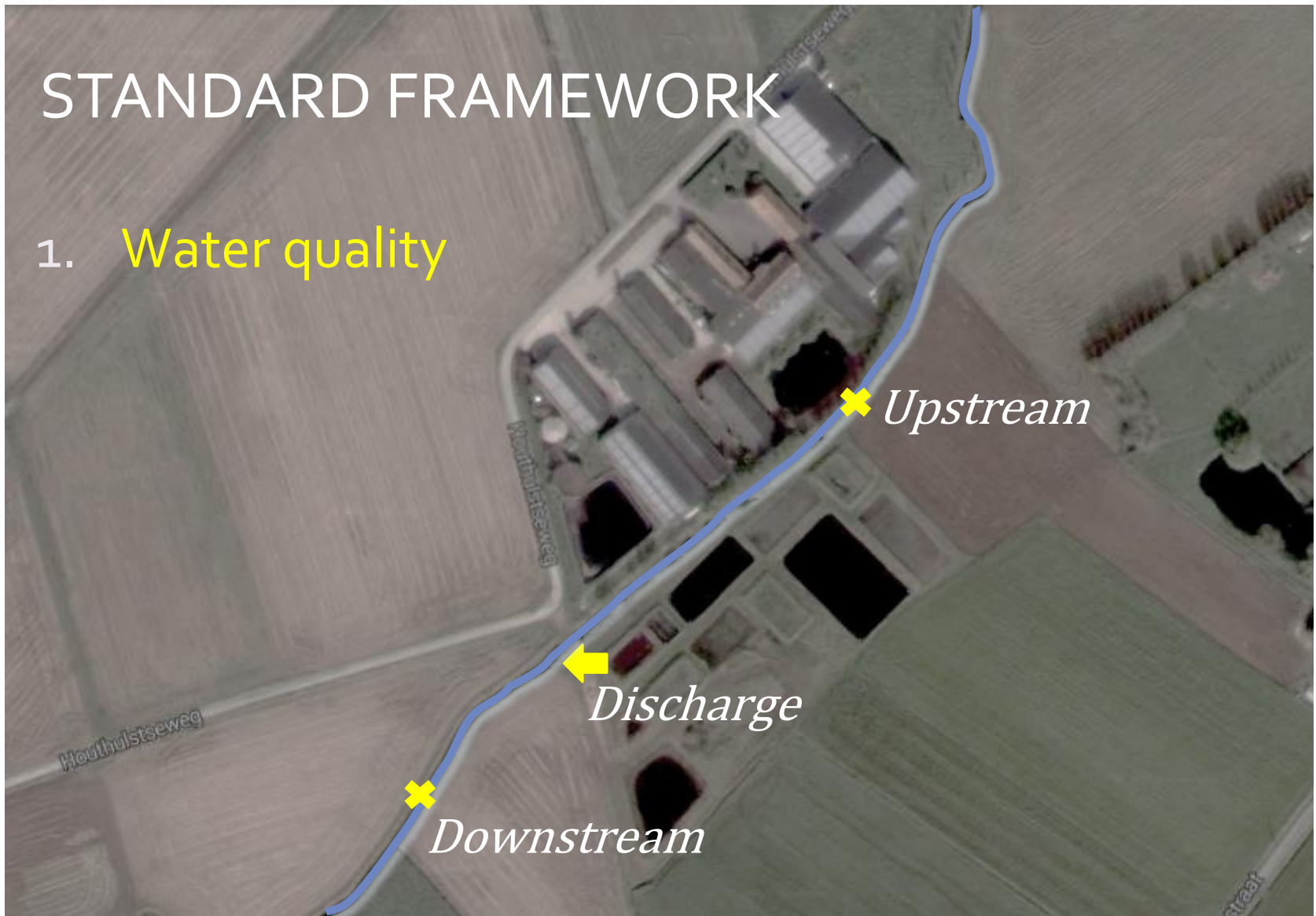
TP

Cl⁻

SO₄²⁻

STANDARD FRAMEWORK

1. Water quality



STANDARD FRAMEWORK

2. Impact

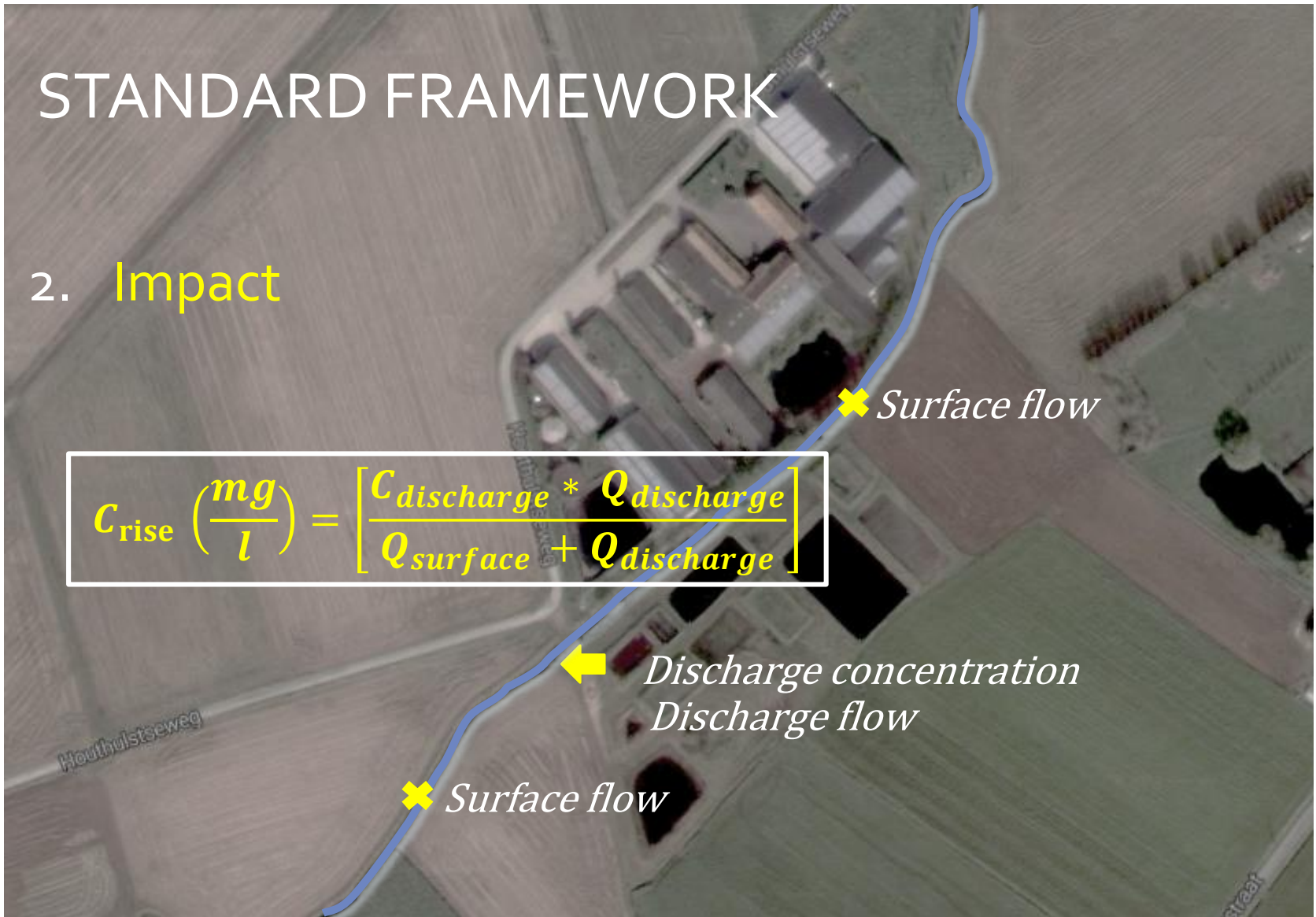
$$C_{\text{rise}} \left(\frac{mg}{l} \right) = \left[\frac{C_{\text{discharge}} * Q_{\text{discharge}}}{Q_{\text{surface}} + Q_{\text{discharge}}} \right]$$

✖ *Surface flow*



Discharge concentration
Discharge flow

✖ *Surface flow*



STANDARD FRAMEWORK

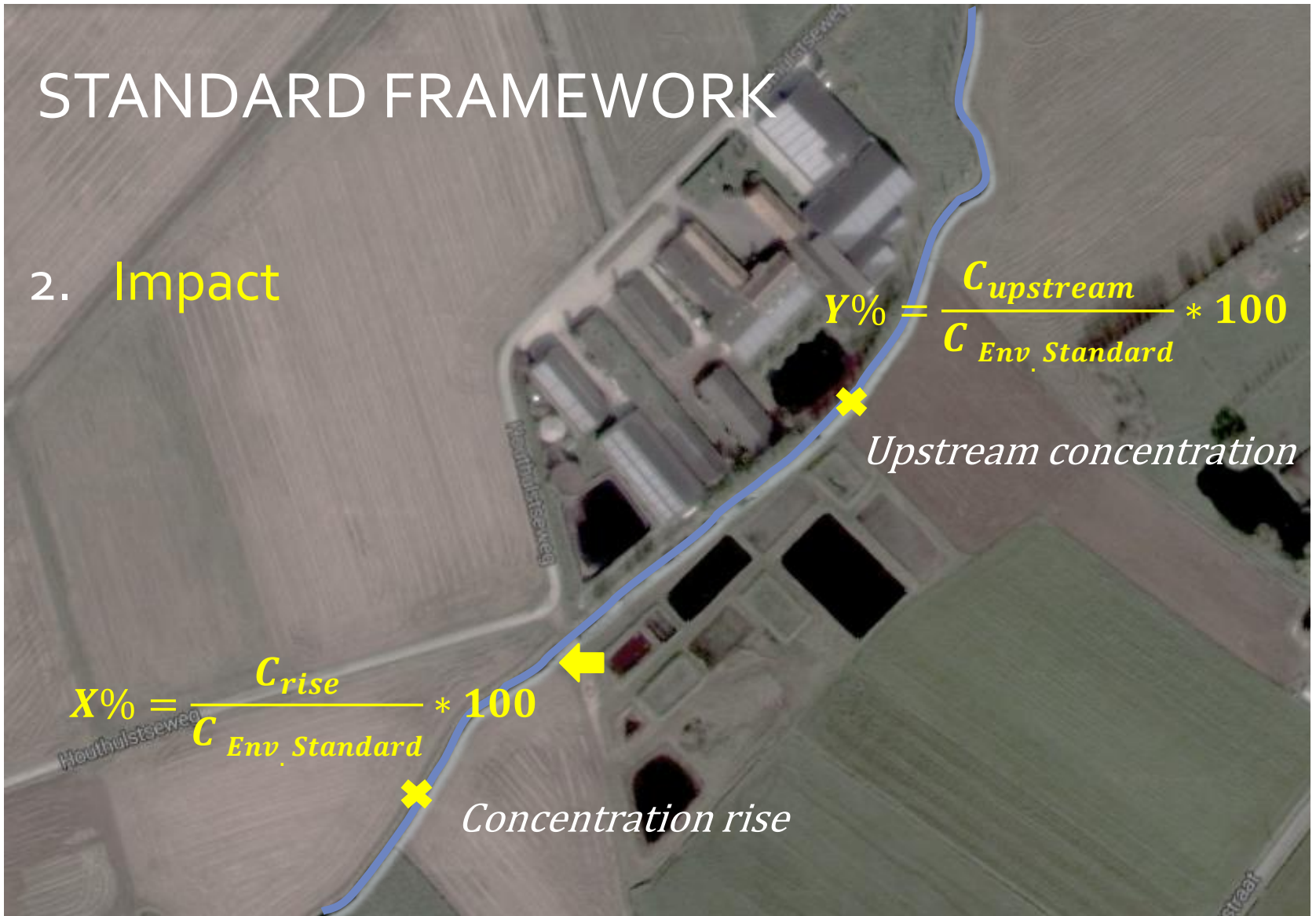
2. Impact

$$Y\% = \frac{C_{\text{upstream}}}{C_{\text{Env. Standard}}} * 100$$

Upstream concentration

$$X\% = \frac{C_{\text{rise}}}{C_{\text{Env. Standard}}} * 100$$

Concentration rise



IMPACT CONTRIBUTION

■ Significant

■ Relevant

■ Limited

□ No contribution

C_{upstream} vs. C_{standard} \ / C_{rise} vs. C_{standard}	$1\% < X < 10\%$	$10\% < X < 20\%$	$X > 20\%$
$Y < 50\%$	Limited	Limited	Relevant
$50\% < Y < 75\%$	Limited	Relevant	Significant
$Y > 75\%$	Relevant	Significant	Significant

TWO SITUATIONS / THREE CASE SCENARIOS

Bad water quality

Good water quality

Average

$Q_{\text{effluent}} = 13824 \text{ m}^3/\text{d}$

Worst

$Q_{\text{effluent}} = 2592 \text{ m}^3/\text{d}$

Real

$Q_{\text{effluent}} = 13824 \text{ m}^3/\text{d}$

TN = 16mg/l
TP = 1.1 mg/l
Cl⁻ = 154 mg/l
SO₄²⁻ = 130 mg/l

TN = 4mg/l
TP = 0.1 mg/l
Cl⁻ = 150 mg/l
SO₄²⁻ = 150 mg/l

RESULTS

BAD WATER QUALITY

Worst	TN	TP	Cl ⁻	SO ₄ ²⁻
Average	TN	TP	Cl ⁻	SO ₄ ²⁻
Real	TN	TP	Cl ⁻	SO ₄ ²⁻

GOOD WATER QUALITY

Worst	TN	TP	Cl ⁻	SO ₄ ²⁻
Average	TN	TP	Cl ⁻	SO ₄ ²⁻
Real	TN	TP	Cl ⁻	SO ₄ ²⁻

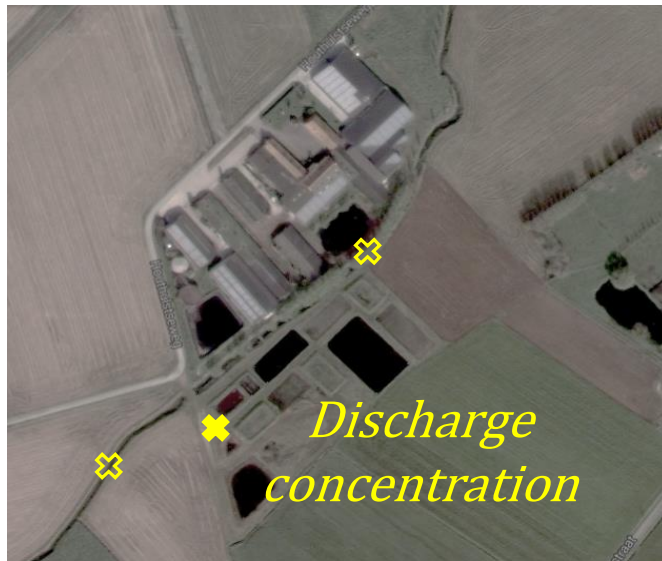
■ Relevant

■ Limited

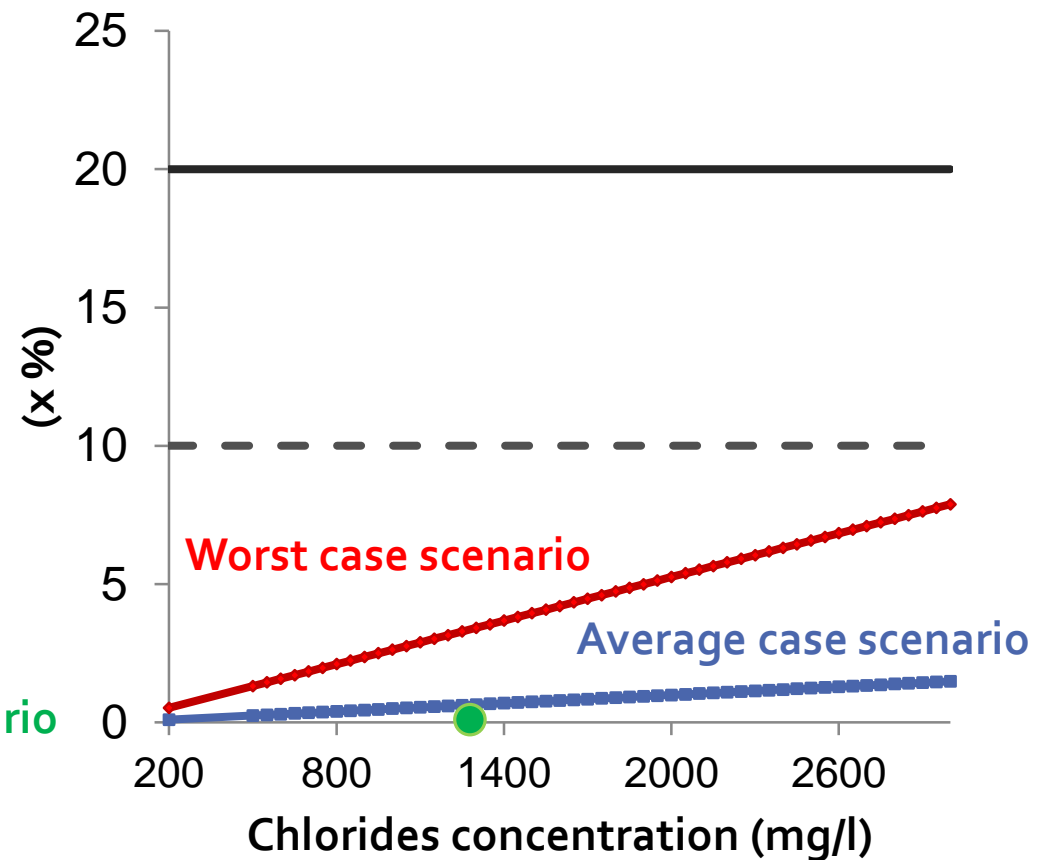
□ No Contribution

Standard Framework

3. Sensitivity analysis (Cl⁻)

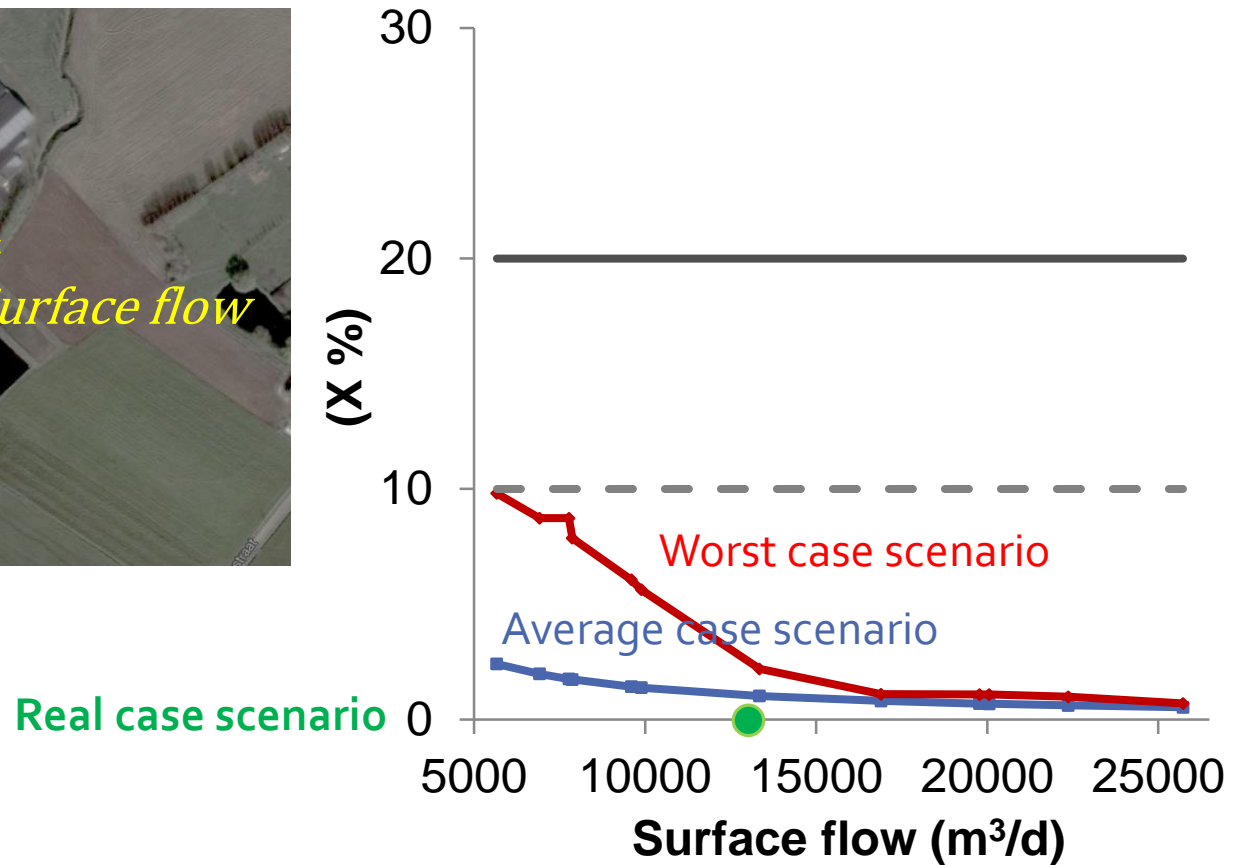
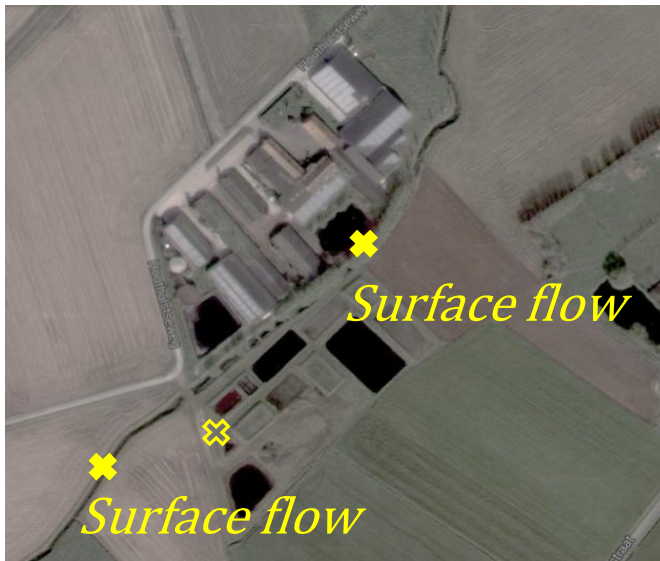


Real case scenario



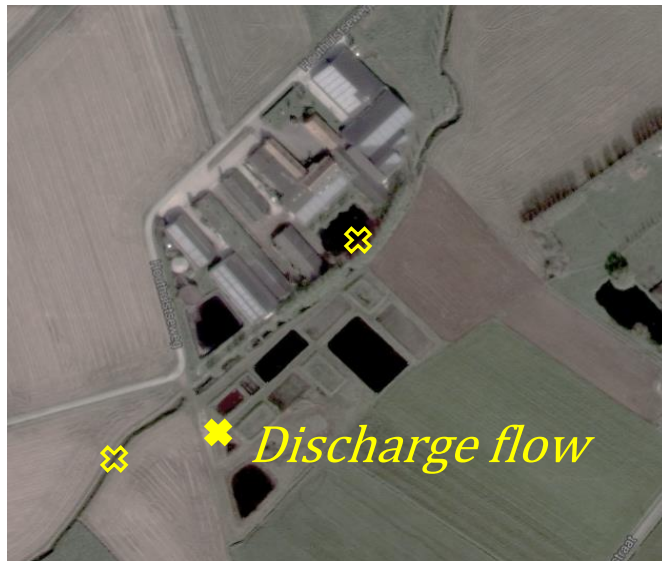
Standard Framework

3. Sensitivity analysis (Cl⁻)

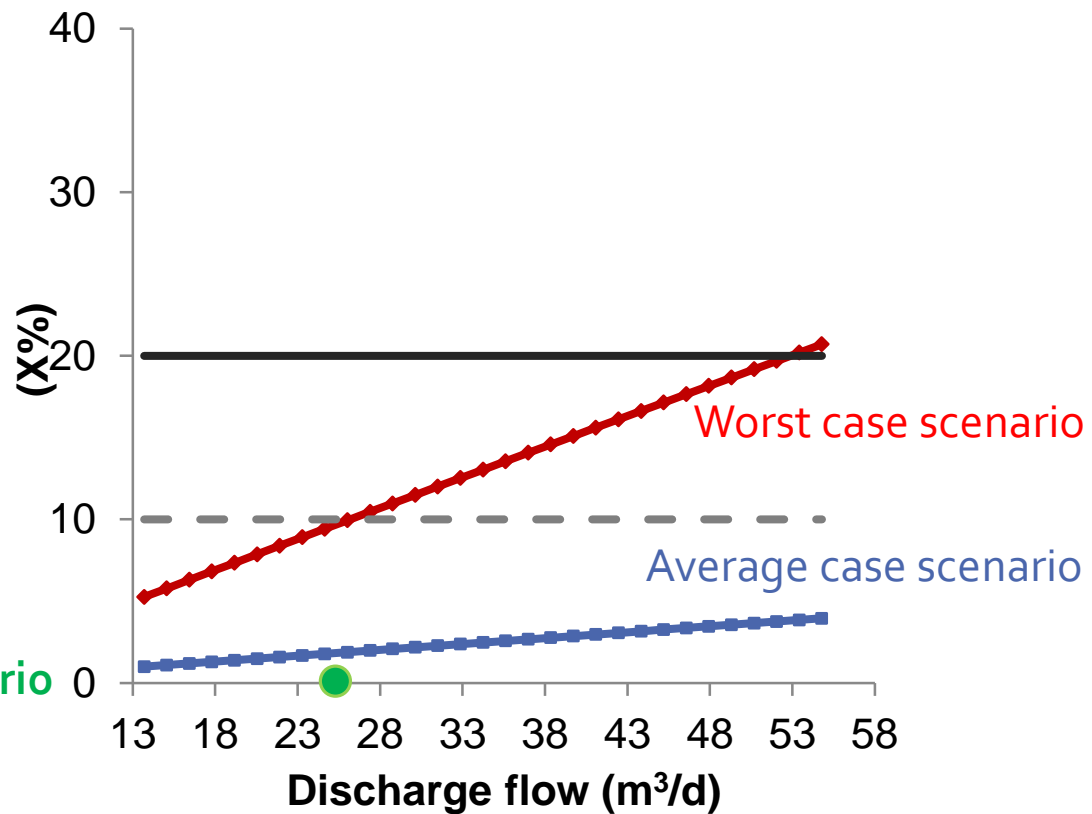


Standard Framework

3. Sensitivity analysis (Cl⁻)



Real case scenario



CLOSING REMARKS

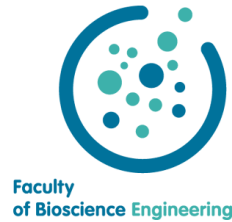
Site-specific analyses

- Weather conditions
- Monitoring stations
- Anthropogenic pressures
- Clear method

Mitigating Measures

- Rain water harvesting
- Buffer or reserve pond

**Standard limits based on literature vs.
appropriate limits**



Further questions

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