# The CASPER project: an integrated approach for pollution risk assessment in peri-urban groundwater catchment areas


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Thursday, May 25th, 2022

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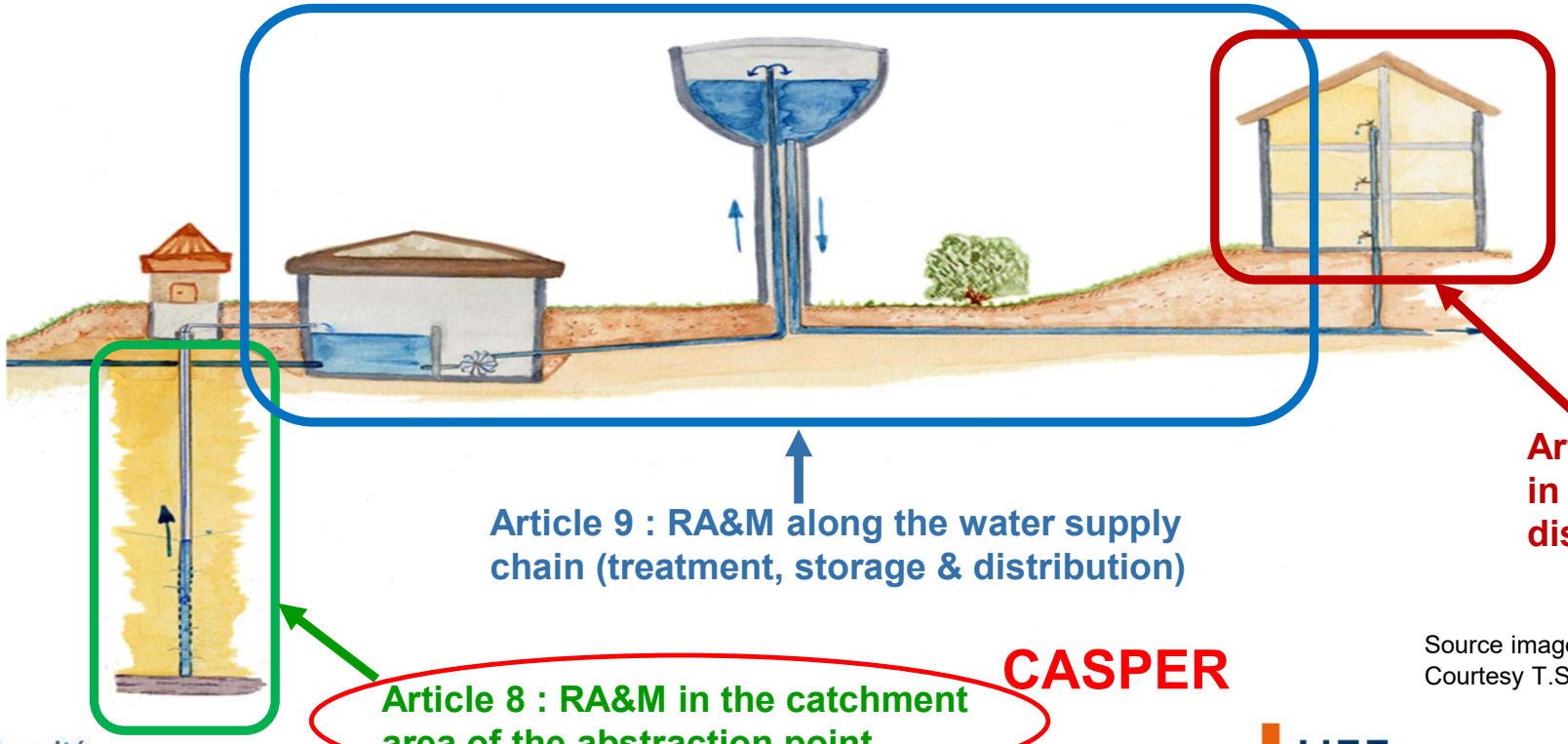
# Drinking Water Directive recast 2020 : 3-level risk assessment and management

**Article 7** → 'a complete risk-based approach to water safety, covering the whole supply chain from the catchment area, abstraction, treatment, storage and distribution to the point of compliance



**Article 10 : RA&M in the domestic distribution system**

**Article 9 : RA&M along the water supply chain (treatment, storage & distribution)**

**Article 8 : RA&M in the catchment area of the abstraction point**

**CASPER**

Source image:
Courtesy T.Schaul, MEnv, Lux

# CASPER : integrated methodology for the protection of catchments in urban areas

In sub-urban areas, groundwater catchments are potentially exposed to various **point** and **diffuse** pollution sources
→ needs for specific tools for the evaluation and manage of the risk of groundwater pollution


Source image:
http://www.groundwateruk.org/Image-Gallery.aspx

Delineation of the catchment area of the GW abstraction point

↓

Identification of potential & existing pollution sources

↓

Measure pollutant mass fluxes/ discharge in groundwater

↓

Catchment-scale groundwater flow and transport modelling as a support to Flux-based RA&M

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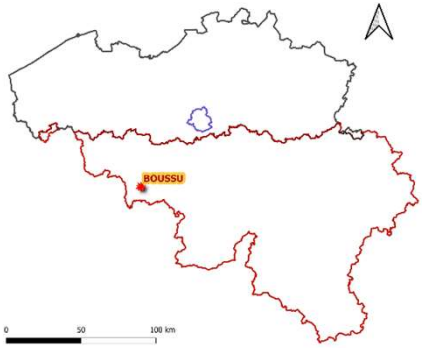
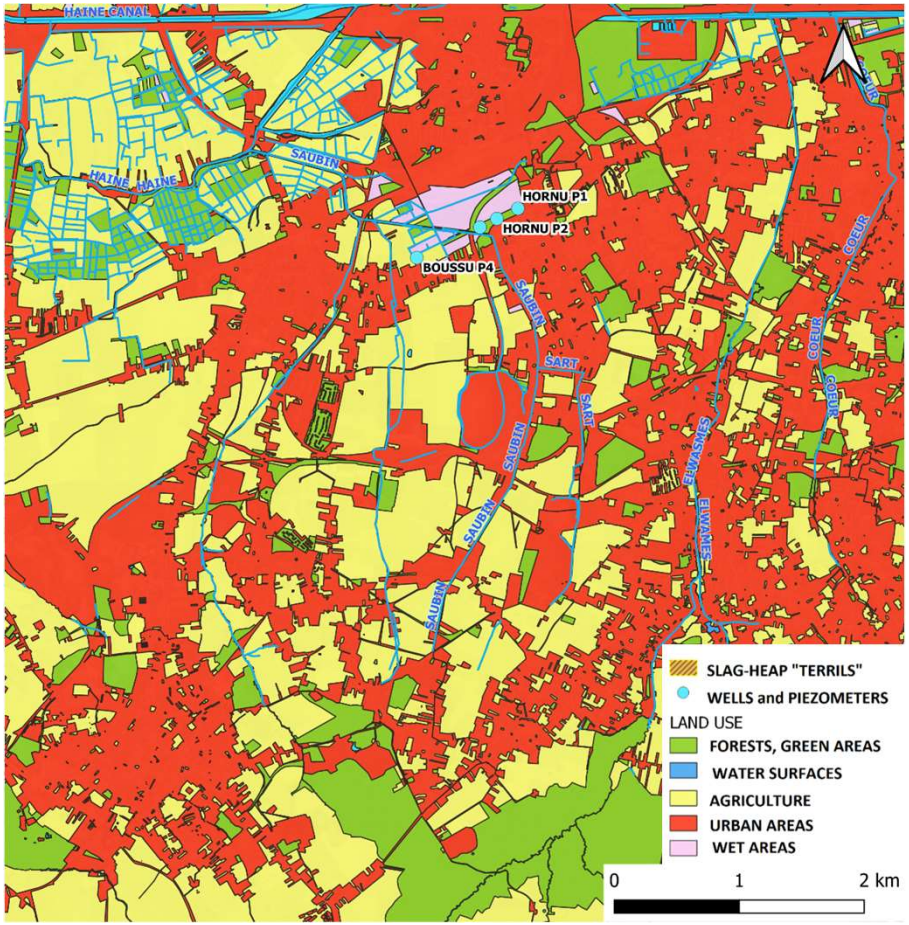
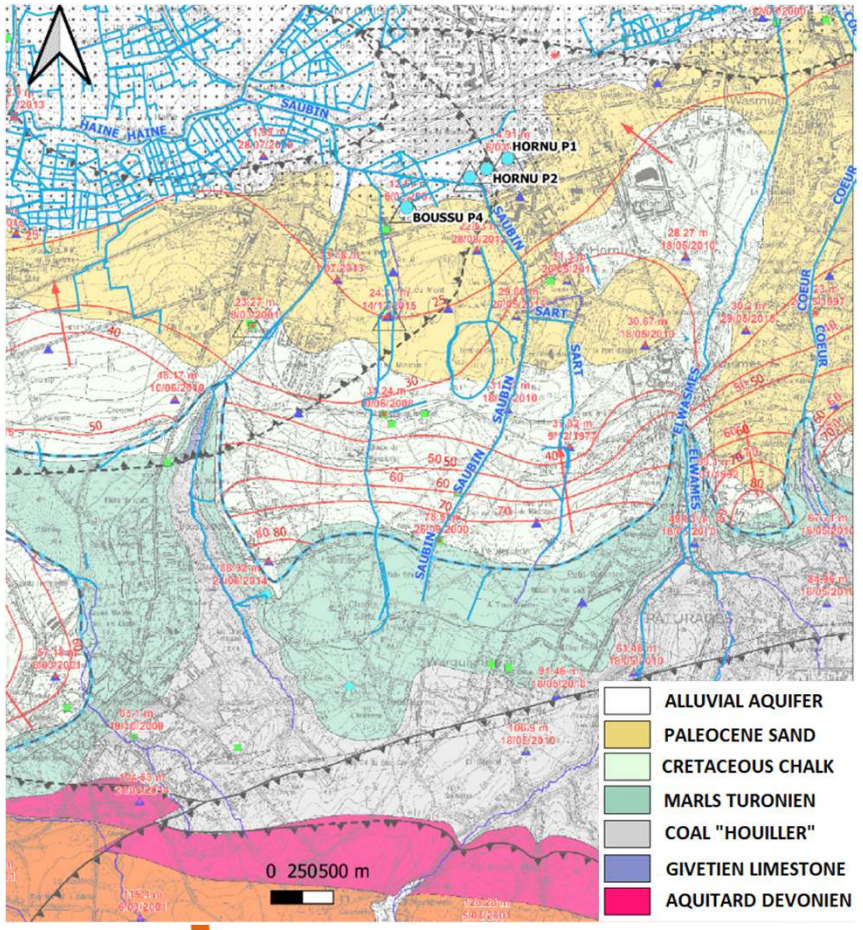
# Supporting case study : the SWDE groundwater abstraction site of Boussu




**Pumping rate**
**2 Mm³/year**

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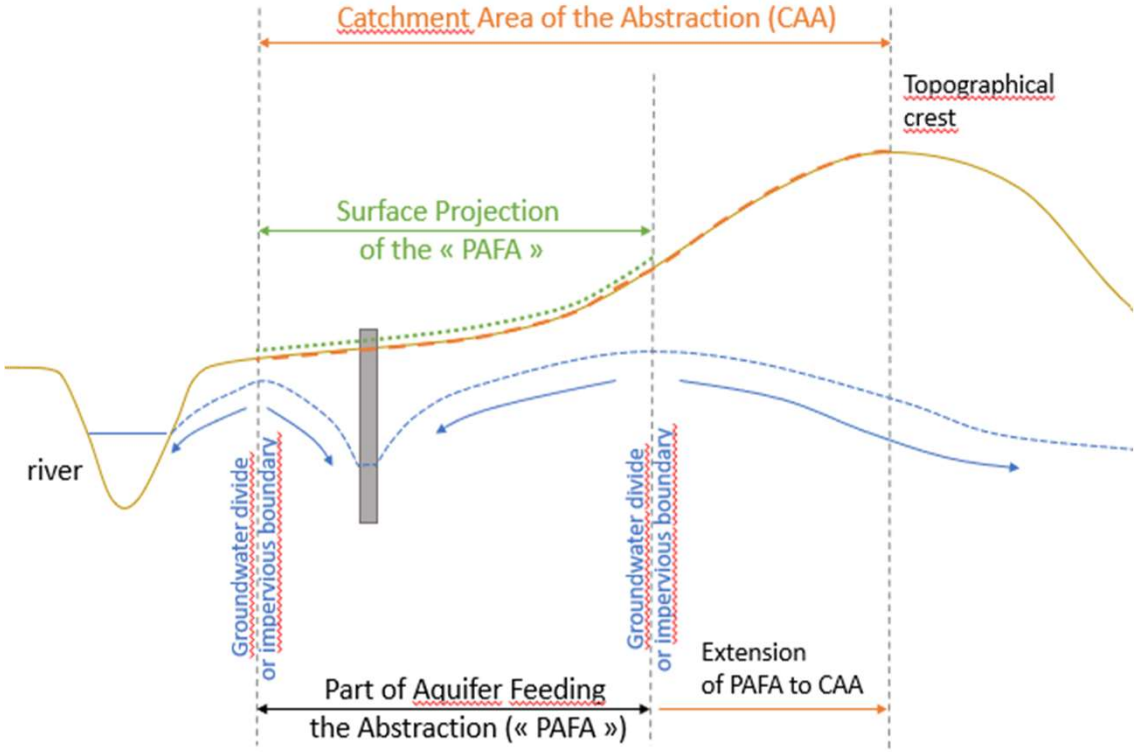
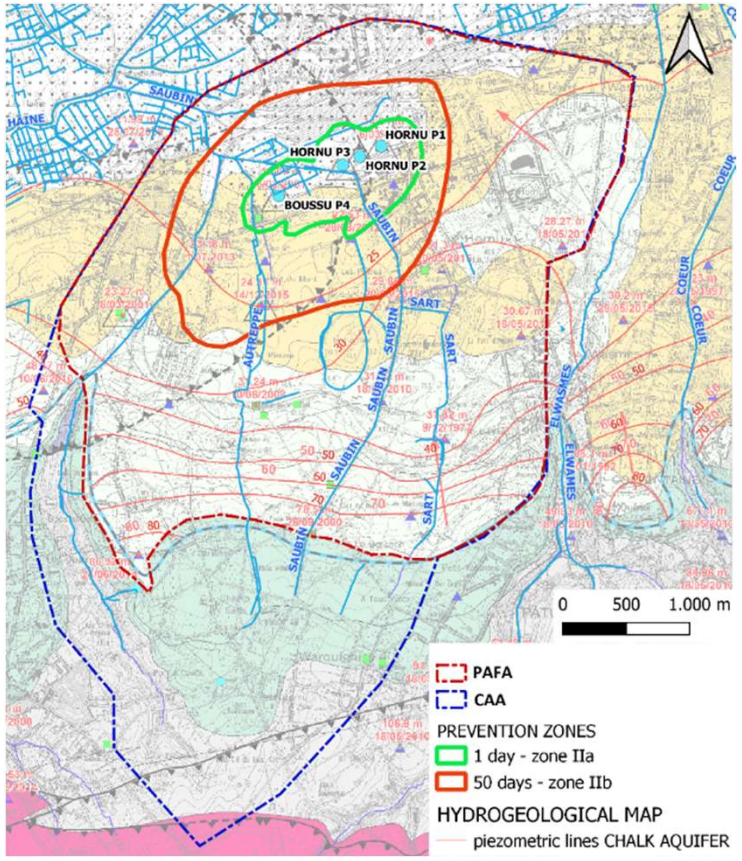
# Delineation of the groundwater catchment area

## In theory …




## … in practice

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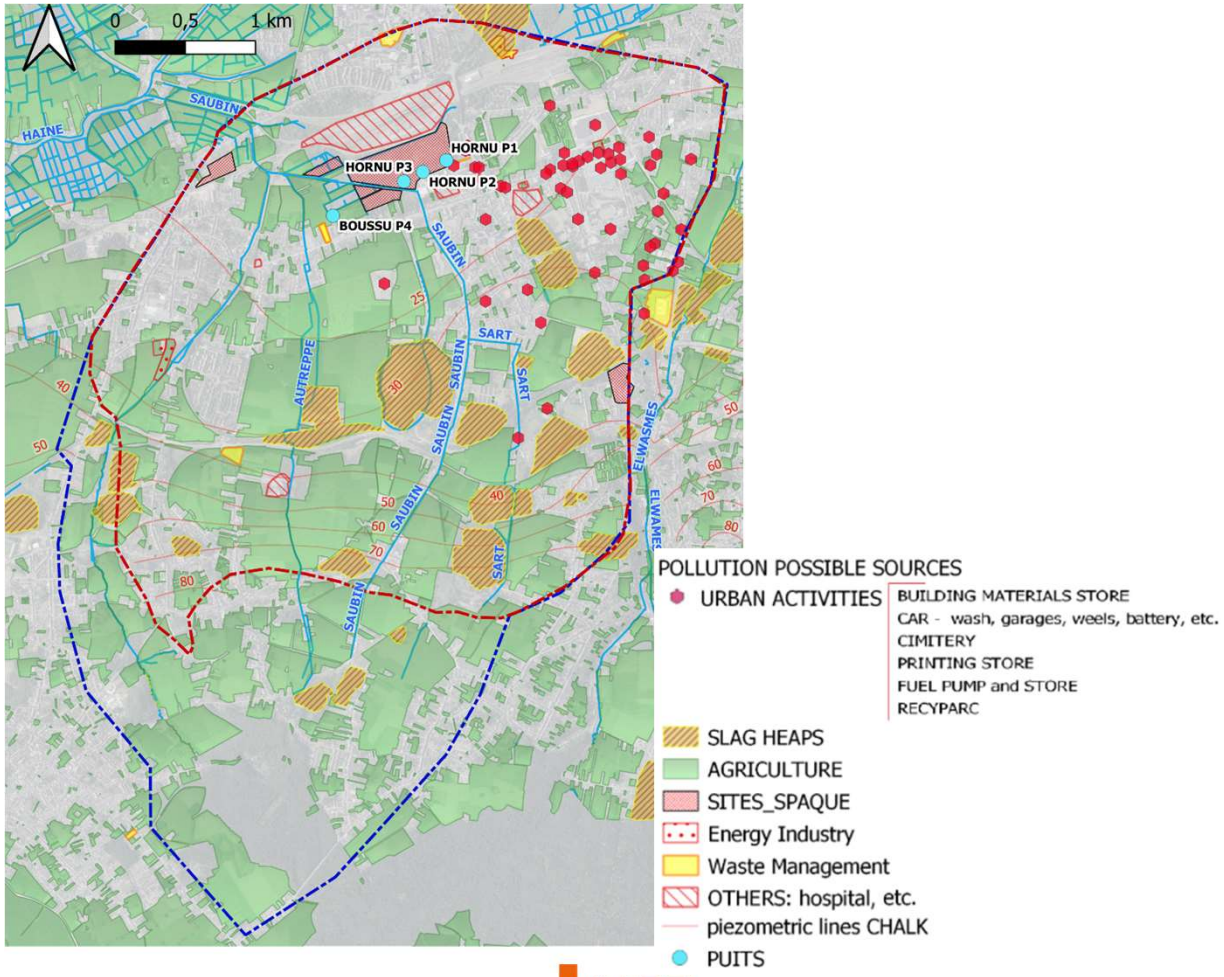
# Identification of existing & potential pollution sources in the catchment area

2 STEP APPROACH

Identification of hazardous activities in the catchment area

Surface water & groundwater sampling to identify polluants and tracers of pollution sources

See talks **EGU22-8553** Christiaens et al. at 17:35 and **EGU22-11248** Balzani et al. at 17:42

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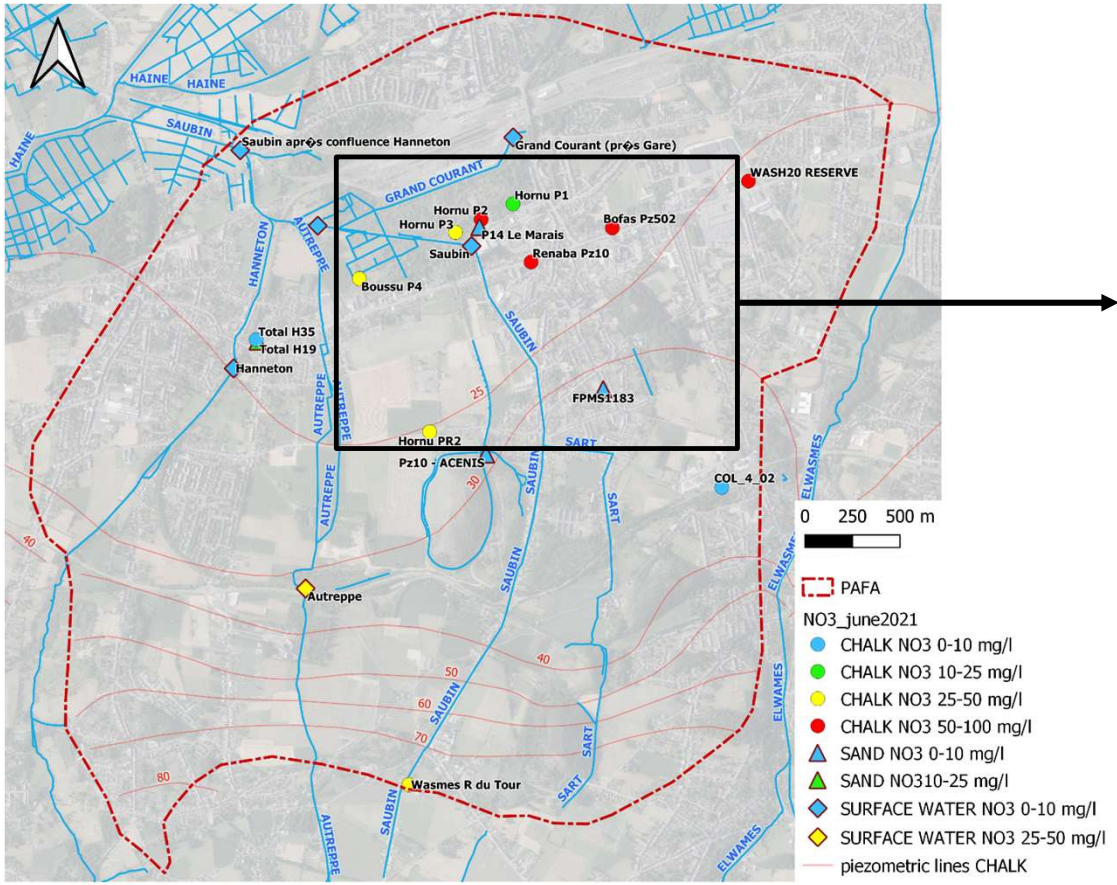
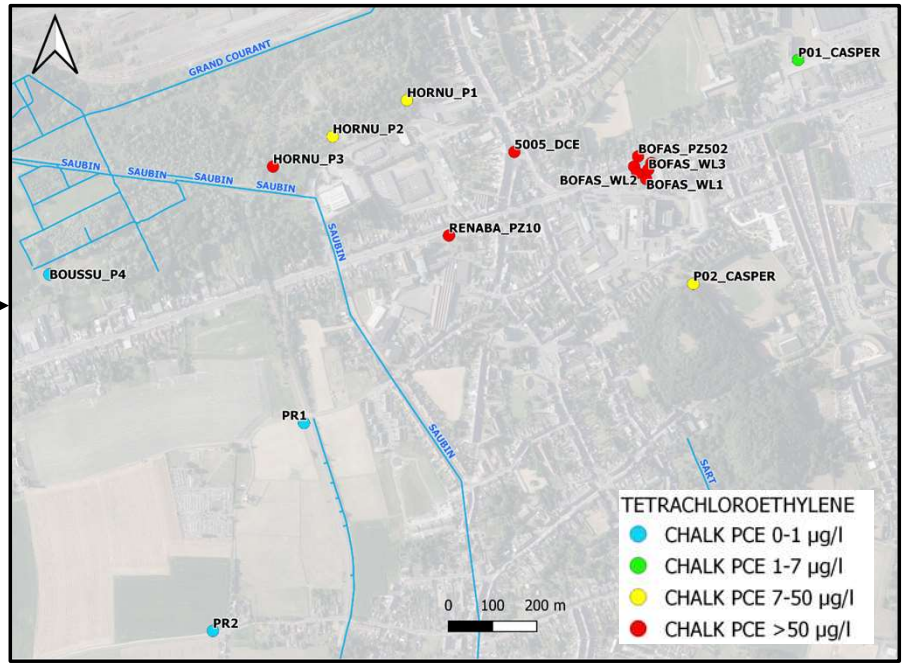
# Identification of existing & potential pollution sources in the catchment area

## Nitrate (diffuse pollution)




## PCE (point pollution)




Big challenge that remains:
To make the link between potential sources and pollutants detected in groundwater!

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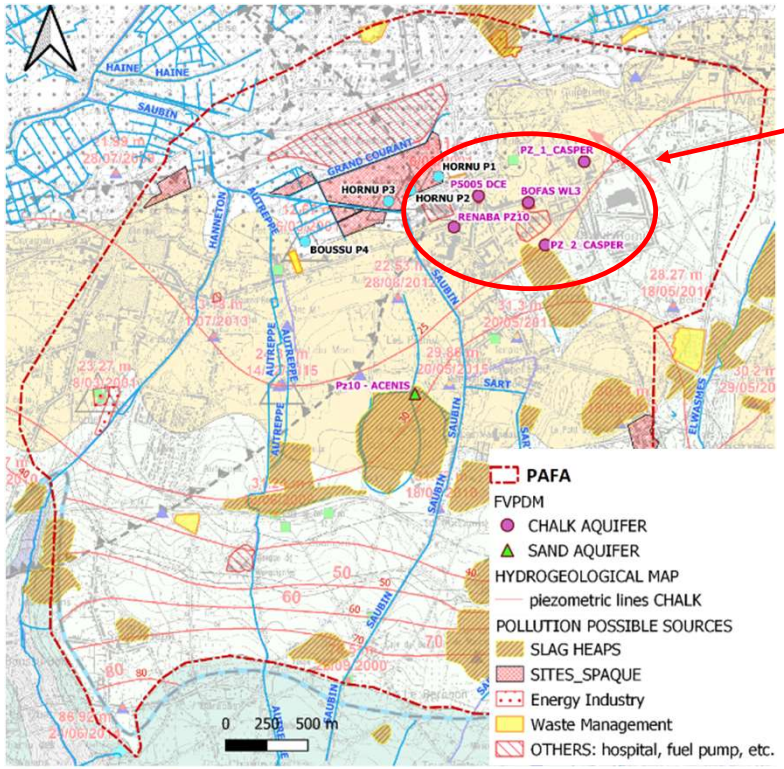
# Measurement of pollutants mass fluxes and discharge through groundwater

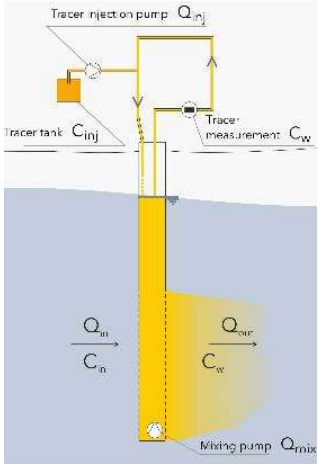
## Concept behind?

→ Pollutants are hazardous **only when they effectively migrate** through groundwater …



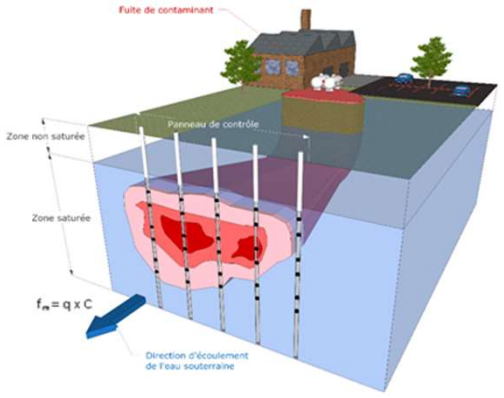

Pollutants concentrations measurements

Groundwater fluxes measurements using **FVPDM** single well tracer tests (Brouyère et al. 2008)




Pollutants mass fluxes and discharge through groundwater

**Flux-based risk assessment**

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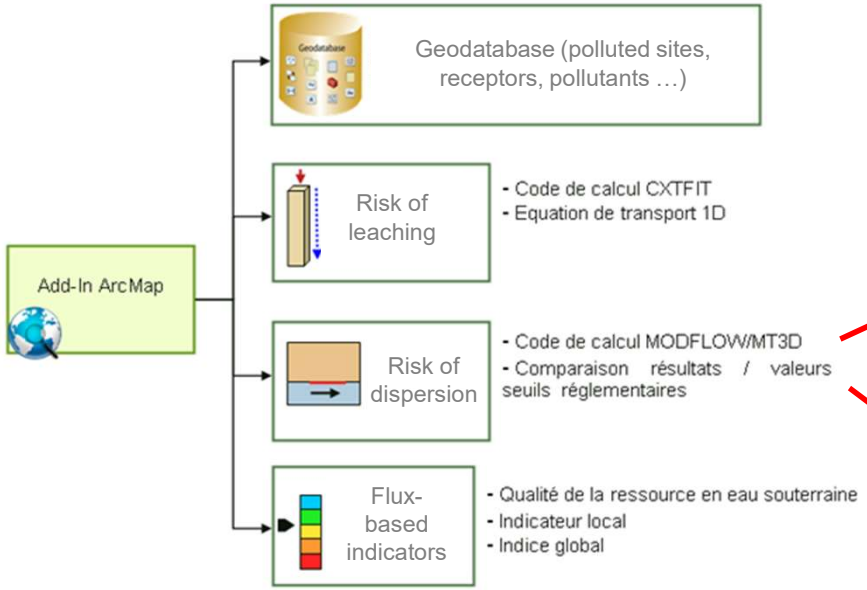
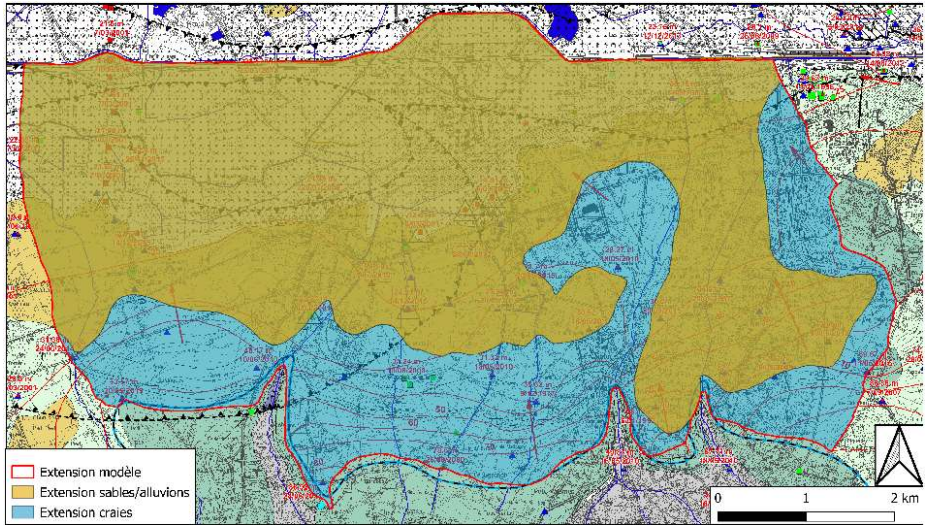
# Regional scale groundwater flow and transport modelling

## Regional-scale, flux-based, risk assessment approach (Jamin et al. 2012)

**PolluESO GIS-based DSS**




Regional-scale flow and transport modelling



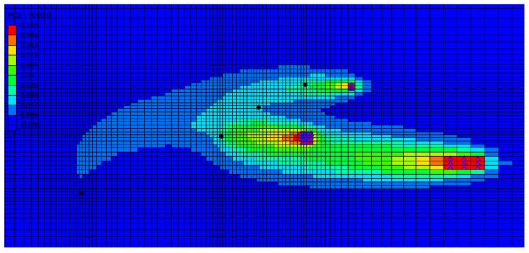



FIGURE 31 – Extension modélisée des panaches de PCE après 25 ans selon les processus d'advection/dipersion

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# Conclusions & Perspectives

- The CASPER RA&M methodology and tools fully comply with the 2020 recast of the DWD
- Key concepts behind?
  - Investigations undertaken at the scale of the groundwater catchment area
  - Dual approach on the identification of (potential) pollutants
  - Flux-based risk assessment approach
  - Everything integrated into a GIS-based PolluESO DSS
- Perspectives
  - Finalize the first application on the Boussu site (note: pollutants sources tracking remains a challenge!)
  - Better integrate diffuse pollution sources (i.e. combination with groundwater vulnerability assessment? E.g. process-based Apsû method, see Popescu et al. 2019)

# Acknowledgement


- Société Publique de Gestion de l'Eau – **SPGE** for financing the project

- **CASPER** project partners for useful collaborations and discussions


- Interested and willing to have more details? Please contact us! (**serge.brouyere@uliege.be**)

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