

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

EGU General Assembly 2022

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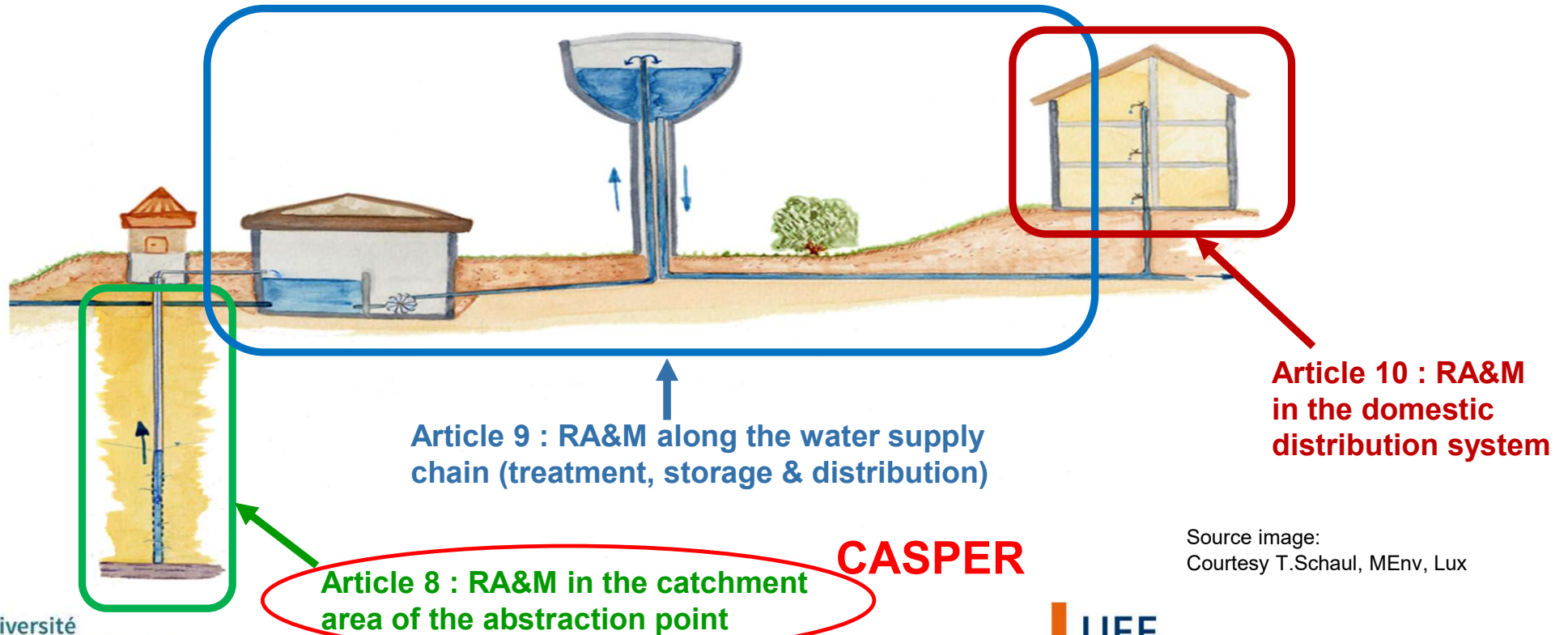
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Thursday, May 25th, 2022

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



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

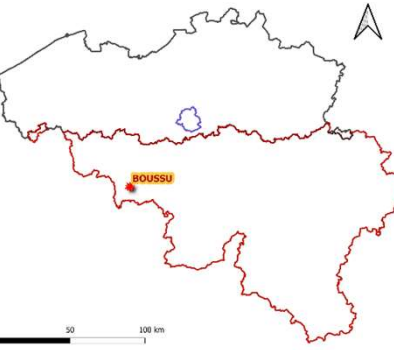


Measure pollutant mass fluxes/
discharge in groundwater

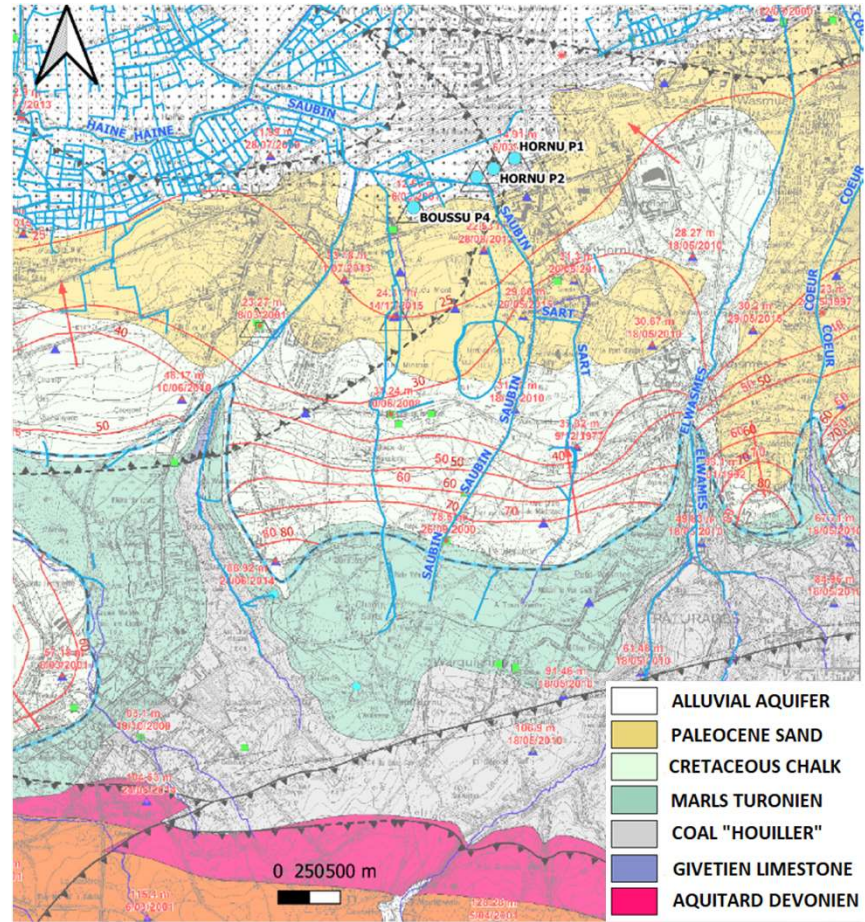
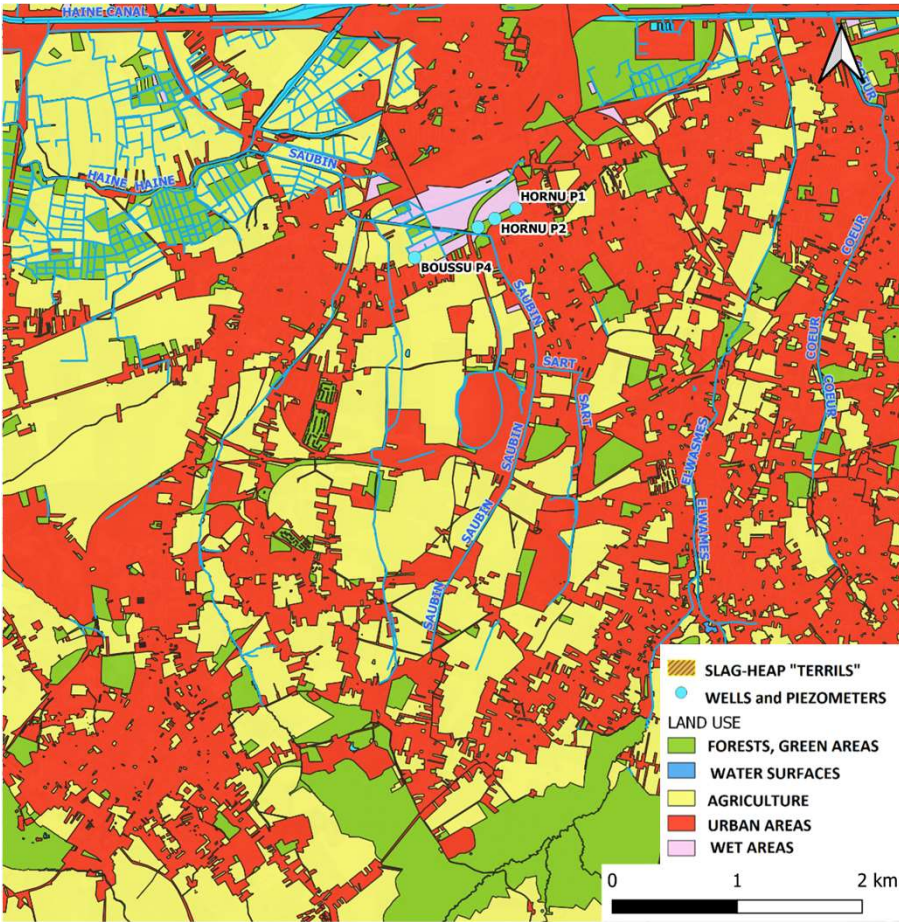


Catchment-scale groundwater flow
and transport modelling as a
support to Flux-based RA&M

Supporting case study : the SWDE groundwater abstraction site of Boussu

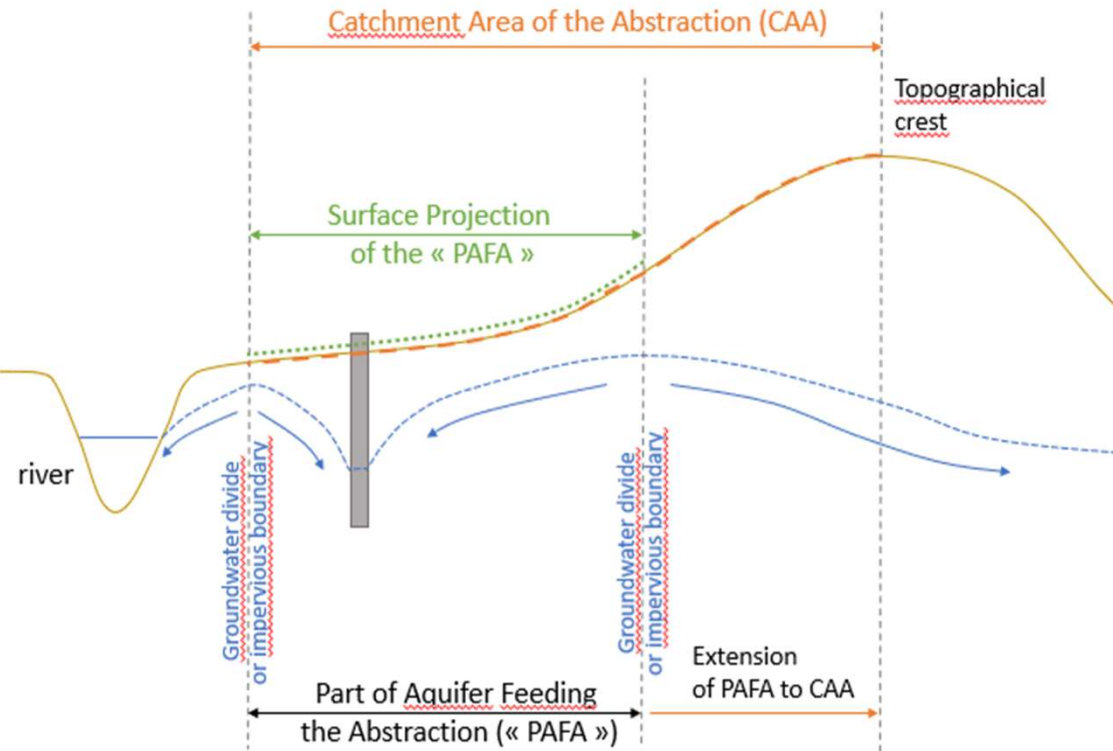


Pumping rate
2 Mm³/year

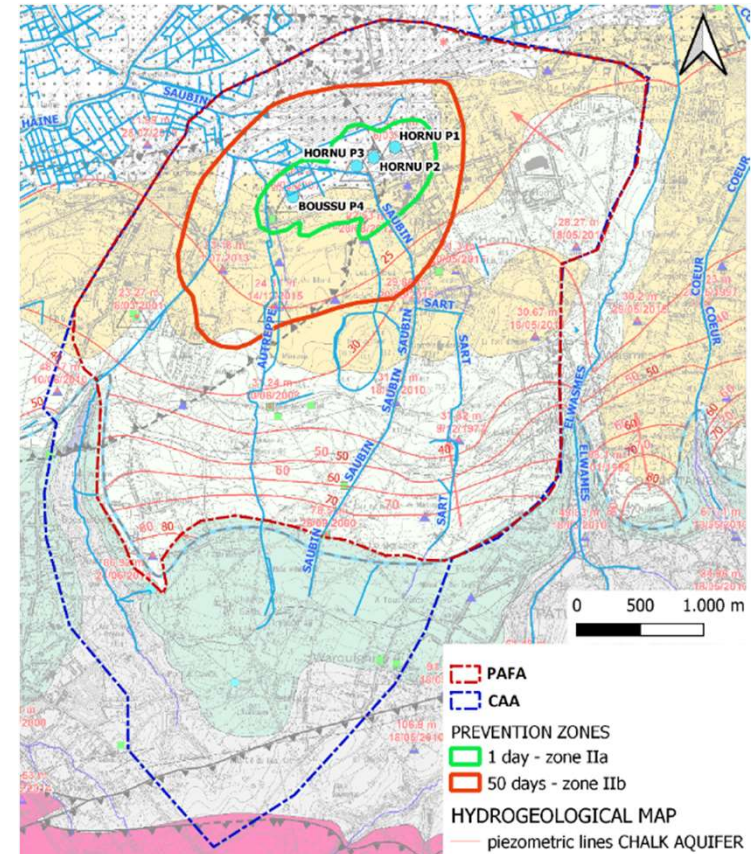


Delineation of the groundwater catchment area

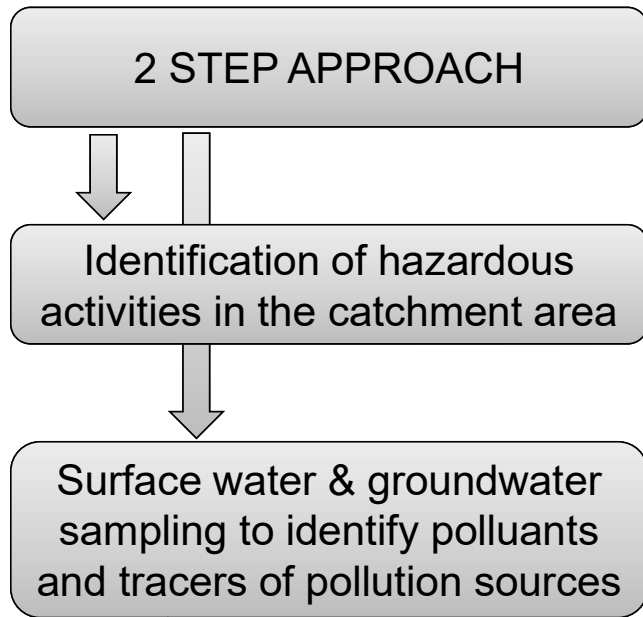
In theory ...



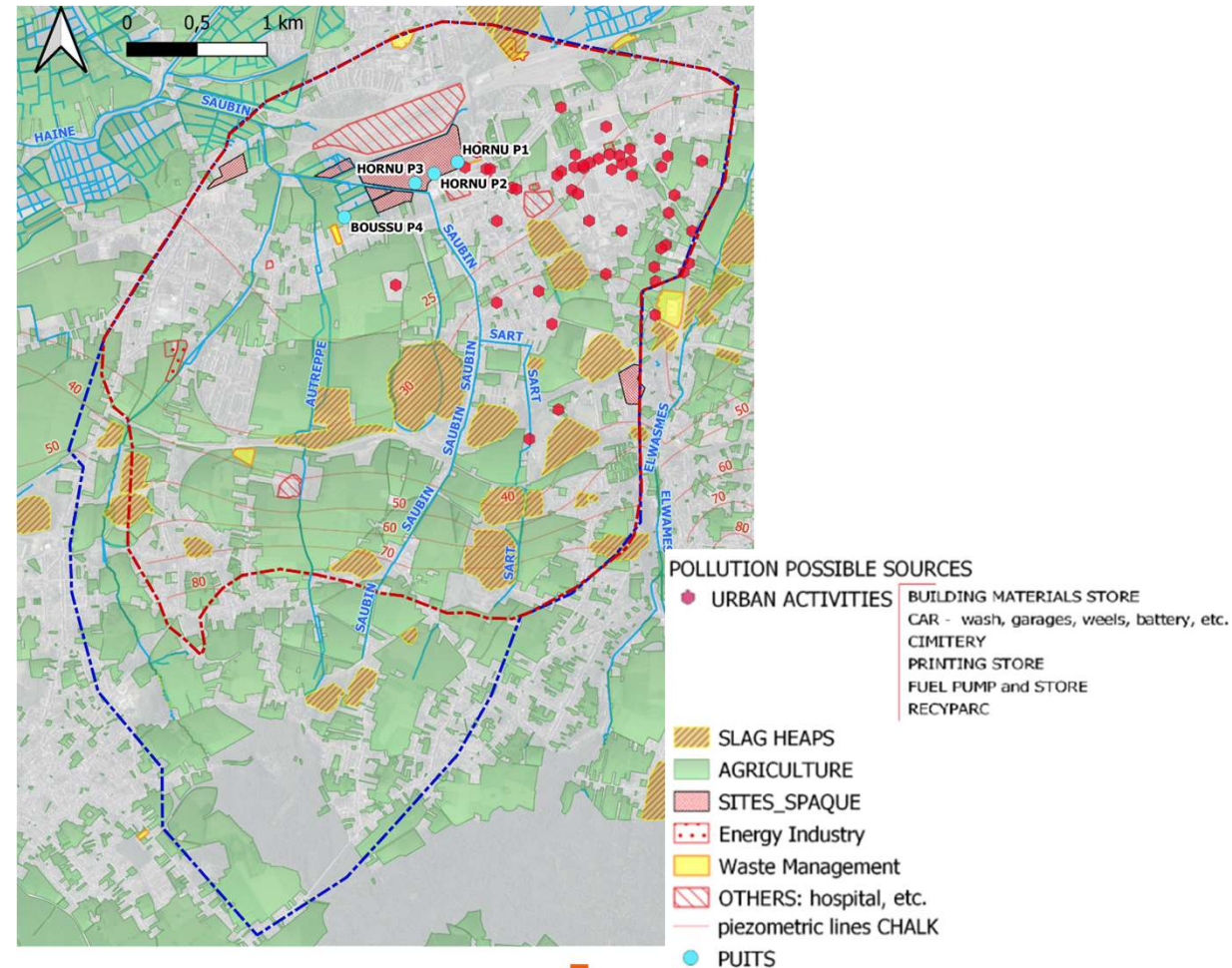
... in practice



Identification of existing & potential pollution sources in the catchment area

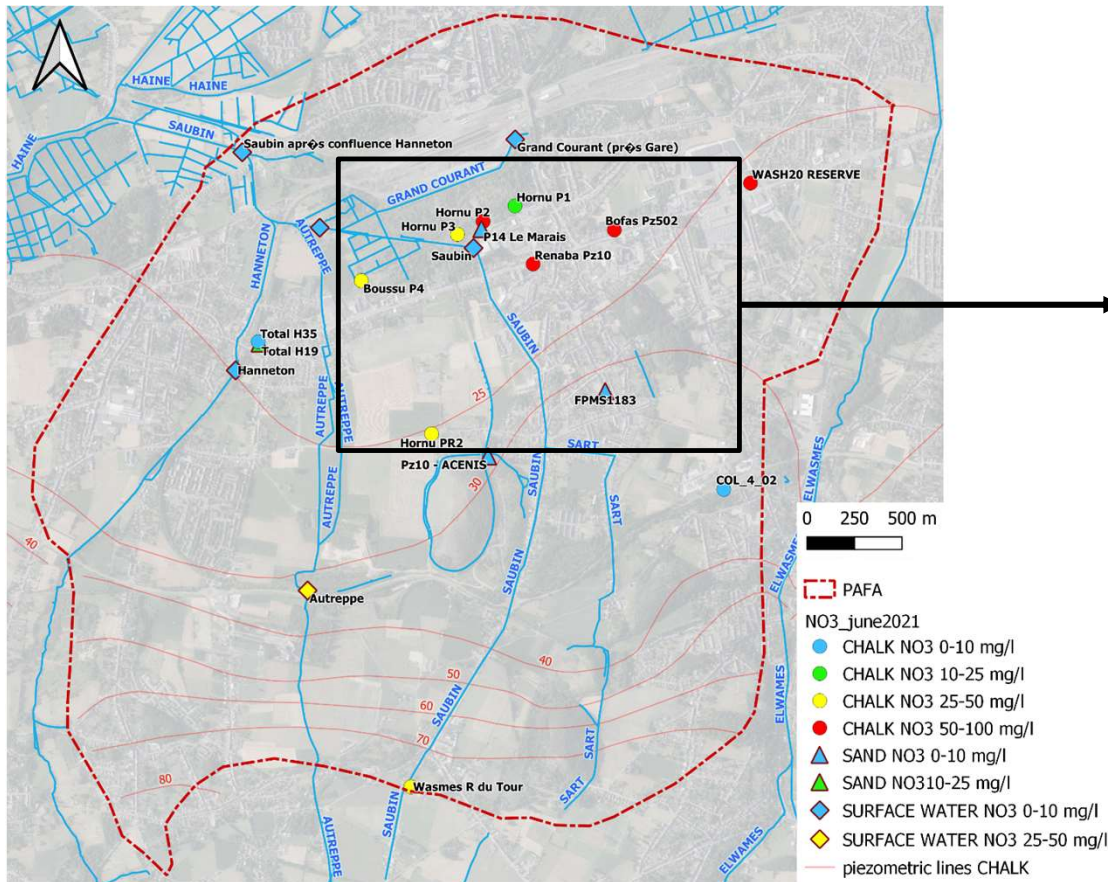


See talks **EGU22-8553** Christiaens et al. at 17:35 and **EGU22-11248** Balzani et al. at 17:42

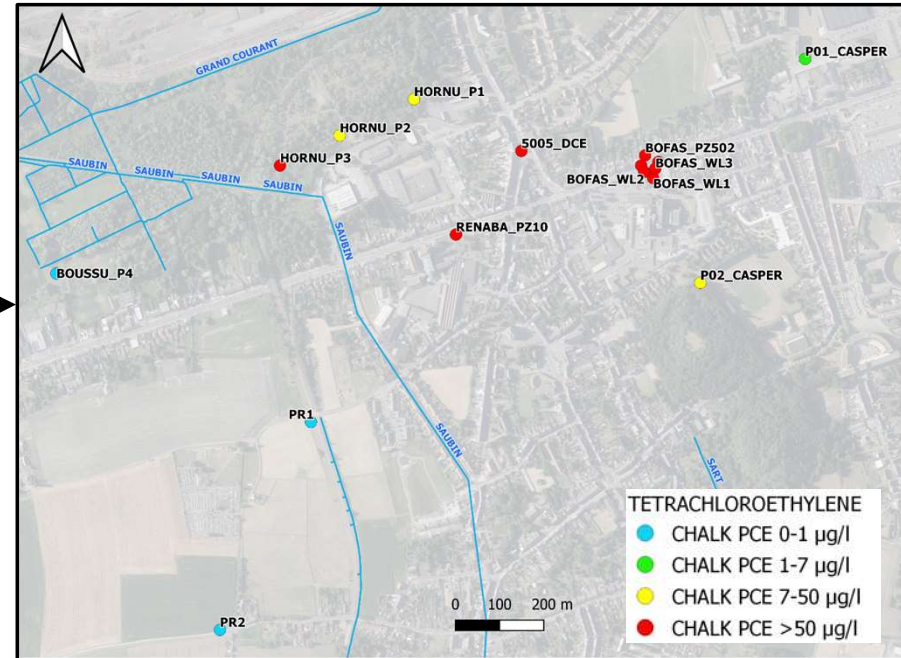


Identification of existing & potential pollution sources in the catchment area

Nitrate (diffuse pollution)



PCE (point pollution)

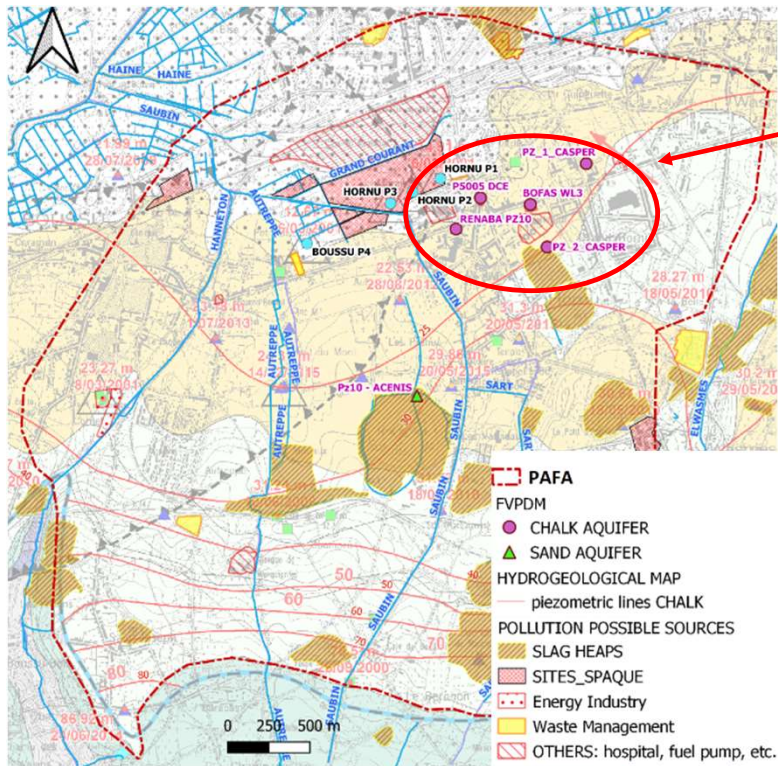


**Big challenge that remains:
To make the link between potential sources
and pollutants detected in groundwater!**

Measurement of pollutants mass fluxes and discharge through groundwater

Concept behind?

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

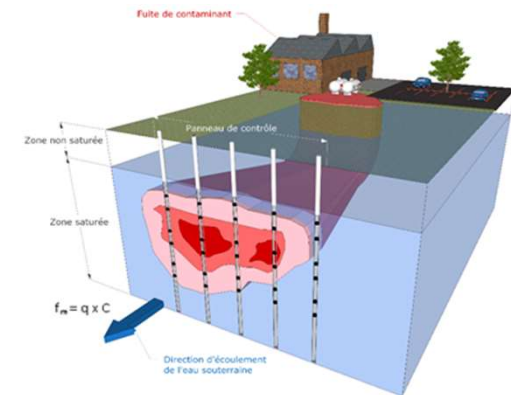
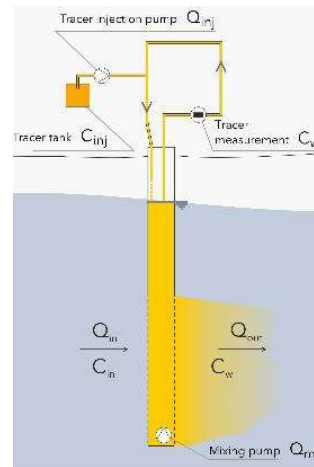


Pollutants concentrations measurements

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

Pollutants mass fluxes and discharge through groundwater

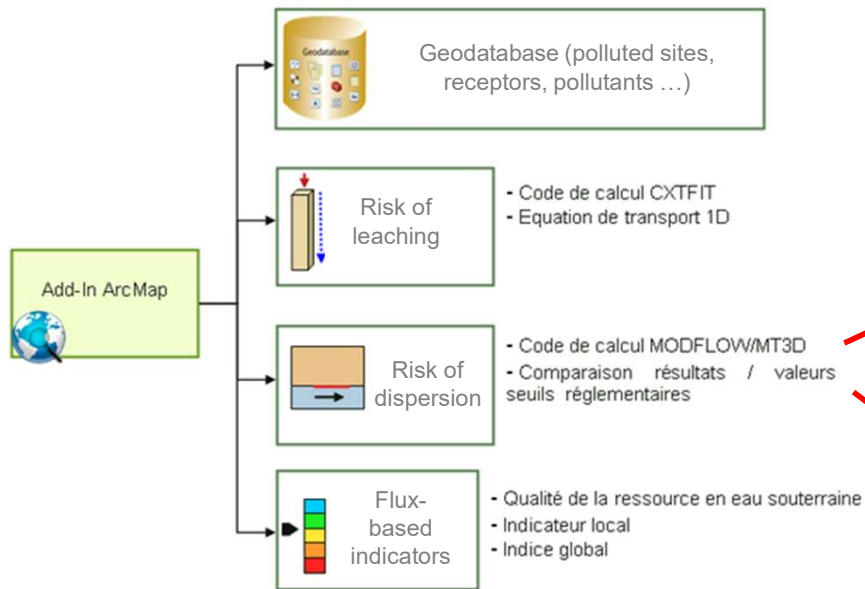
Flux-based risk assessment



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

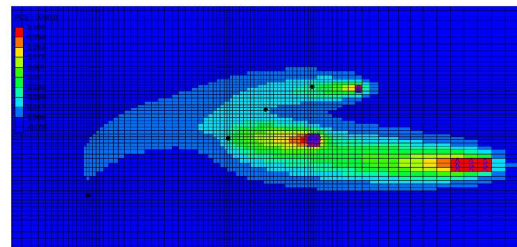
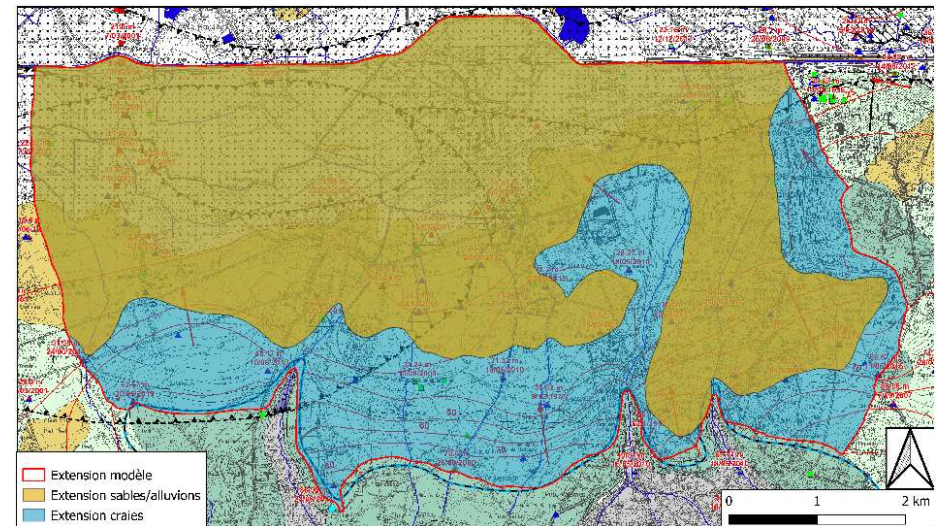


FIGURE 31 – Extension modélisée des panaches de PCE après 25 ans selon les processus d'advection/dispersion

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 GS-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. 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!
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Cited references

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- Protection of peri-urban groundwater catchments: a multi-tracer approach for the identification of urban pollution sources, Laura Balzani, Philippe Orban, and Serge Brouyère, EGU Meeting, Vienna, 26 May 2022
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- Jamin, P., Dollé, F., Chisala, B., Orban, P., Popescu, I. C., Hériveaux, C., Dassargues, A., & Brouyère, S. (2012). A regional flux-based risk assessment approach for multiple contaminated sites on groundwater bodies. *Journal of Contaminant Hydrology*, 127(1-4), 65-75. <http://hdl.handle.net/2268/101984>
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