CHARACTERISING THE HYDRAULIC PROPERTIES OF QUATERNARY SANDS ATTENUATING FAECAL EFFLUENT IN THE THIAROYE AQUIFER OF DAKAR USING PEDO-TRANSFER FUNCTIONS

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Pouye A*., Cissé Faye S*., Diedhiou M*., Gaye C.B*., Taylor R.G**.

*Geology Department, Faculty of Sciences and Techniques, University Cheikh Anta Diop, Dakar
**Department of Geography University College London (UCL) United Kingdom

Outline

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2. Research goals
3. Methods
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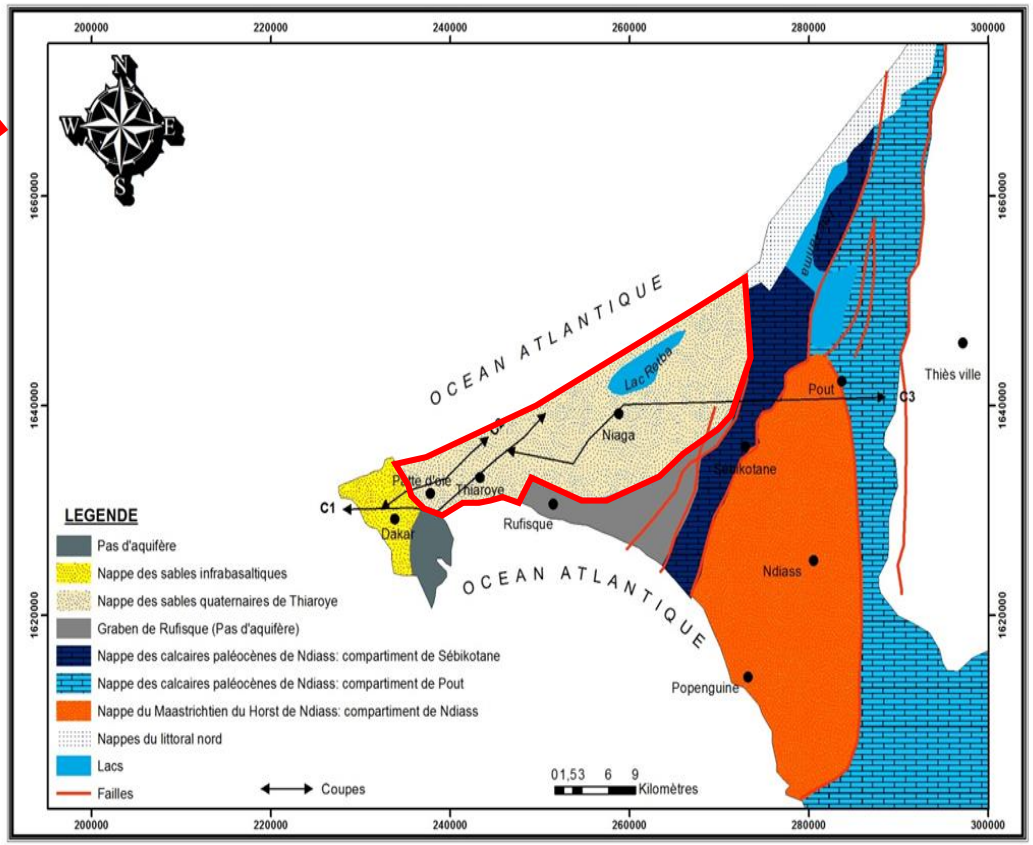
5. Discussions and perspectives

1. INTRODUCTION



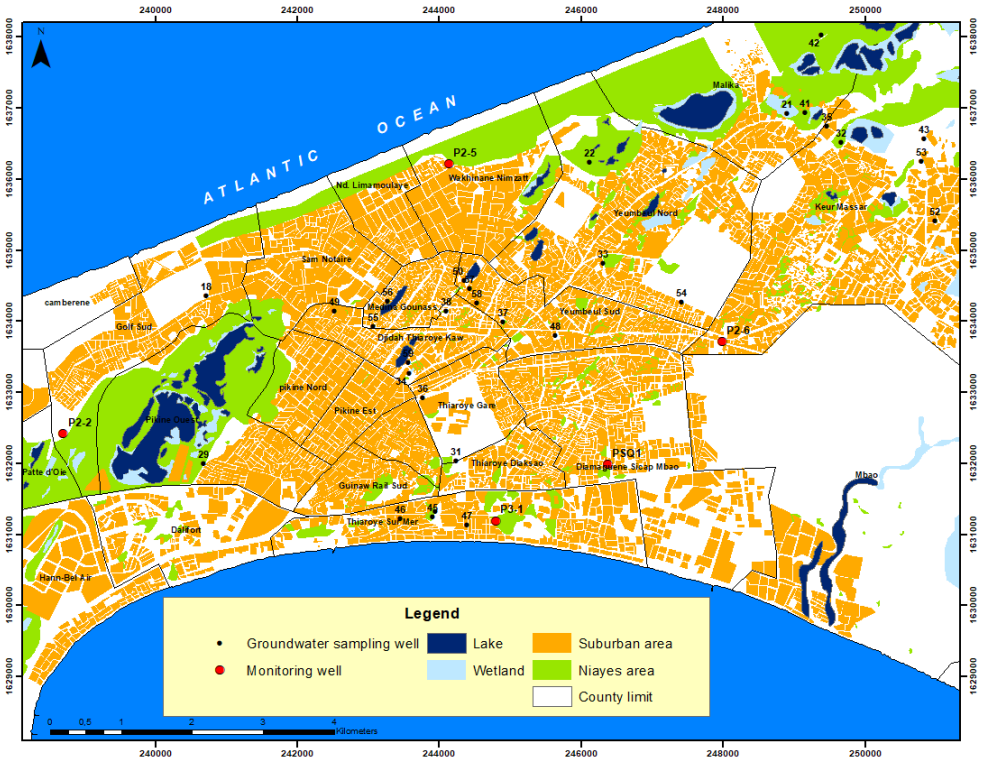
studied system:

Thiaroye Aquifer - unconsolidated

Quaternary sand

- ❑ Unconfined
- ❑ Coastal
- ❑ Climate change
- ❑ Urbanisation
- ❑ Pollution

1. INTRODUCTION



Periurban area characteristics:

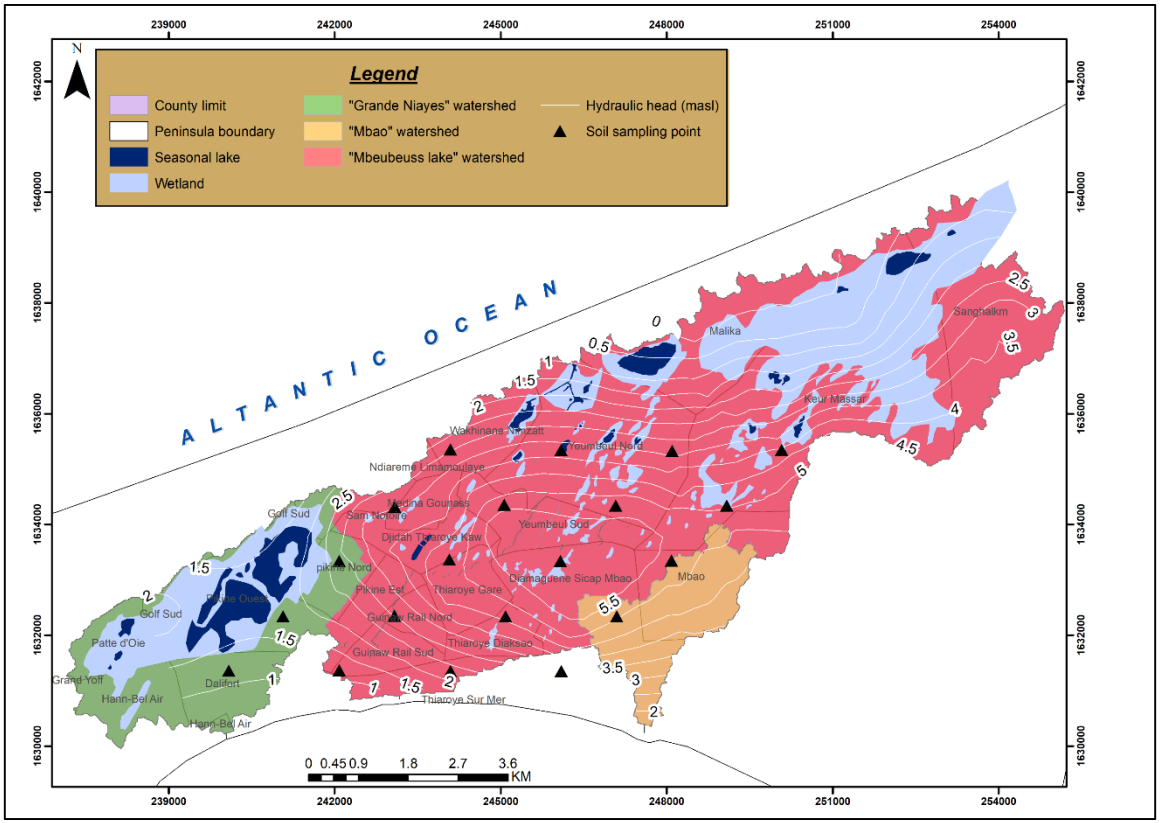
- ❑ Densely populated
- ❑ Shallow aquifer
- ❑ On-site sanitation (septic tanks)
- ❑ Groundwater management as well as sanitation are the main challenges

2. RESEARCH GOALS

To develop an improved understanding of the hydraulic properties of the unsaturated zone to evaluate pollutant transport from these sources.

- Textural analyses and some soil physical parameters. measurements (Porosity, bulk density, organic matter);
- Determination of the Pedotransfer functions parameters using textural classes and bulk density;
- Soil water retention and Hydraulics curves estimations ;

3. METHODS



- 20 logs of the unsaturated zone (up to 3 metr3s) following core sampling at a watershed scale
- Gravimetric analyses to assess bulk density, moisture content and total porosity;
- Particle-size analyses by hydrometer tests (Lesikar et al, 2005)
- Organic matter by digestion with hydrogen peroxide (Gee et Bauder, 1986)

3. METHODS

- **Pedo-transfer functions** are used to describe water retention and hydraulic conductivity curves;

$$\theta(h) = \theta_r + \frac{\theta_s - \theta_r}{[1+(\alpha h)^n]^{1-1/n}}$$ Van-Genuchten equation (1980)

$$K(S_e) = K_0 S_e^L \left\{1 - \left[1 - S_e^{n/(n-1)}\right]^{1-1/n}\right\}^2$$ Mualem equation (1976)

Where θ_r and θ_s are residual and saturated moisture respectively, α and n are the curves shape parameters, L is an empirical parameter, h is pressure head, K_0 the saturated hydraulic conductivity and S_e is the effective saturation.

- **ROSETTA** employing Van-Genuchten model for water retention parameters and saturated hydraulic conductivity and Mualem model for unsaturated hydraulic conductivity from basic soil properties.

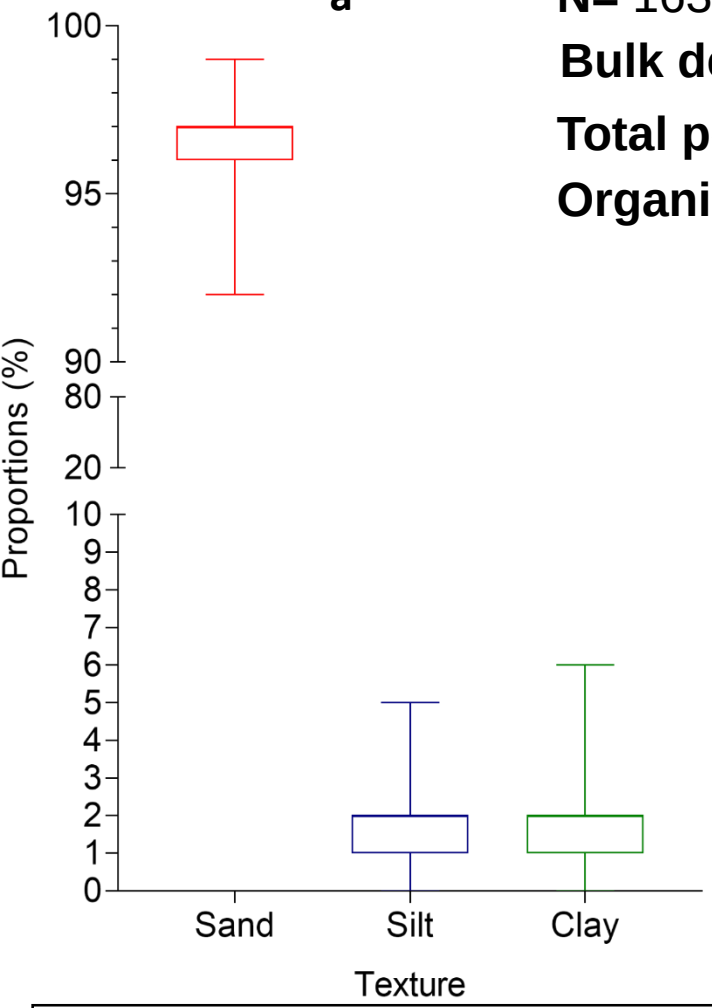
4. RESULTS

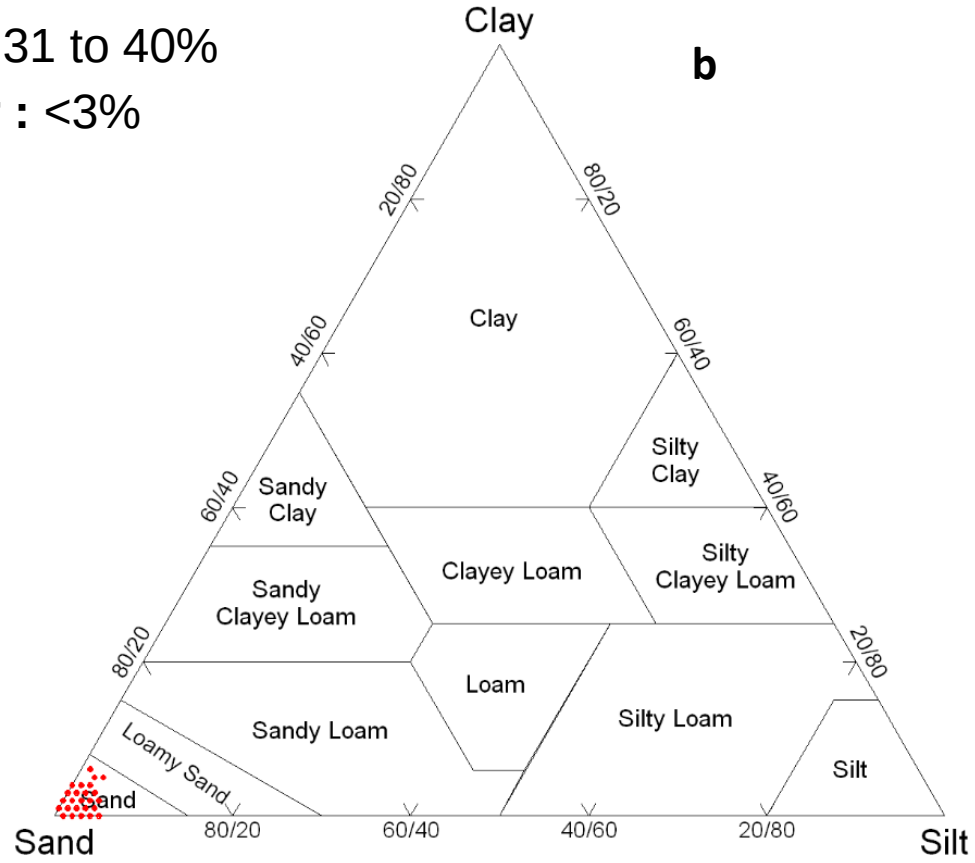
N= 163 samples

Bulk density: 1.54 - 1.84 g/cm^3

Total porosity: 31 to 40%

Organic matter : <3%





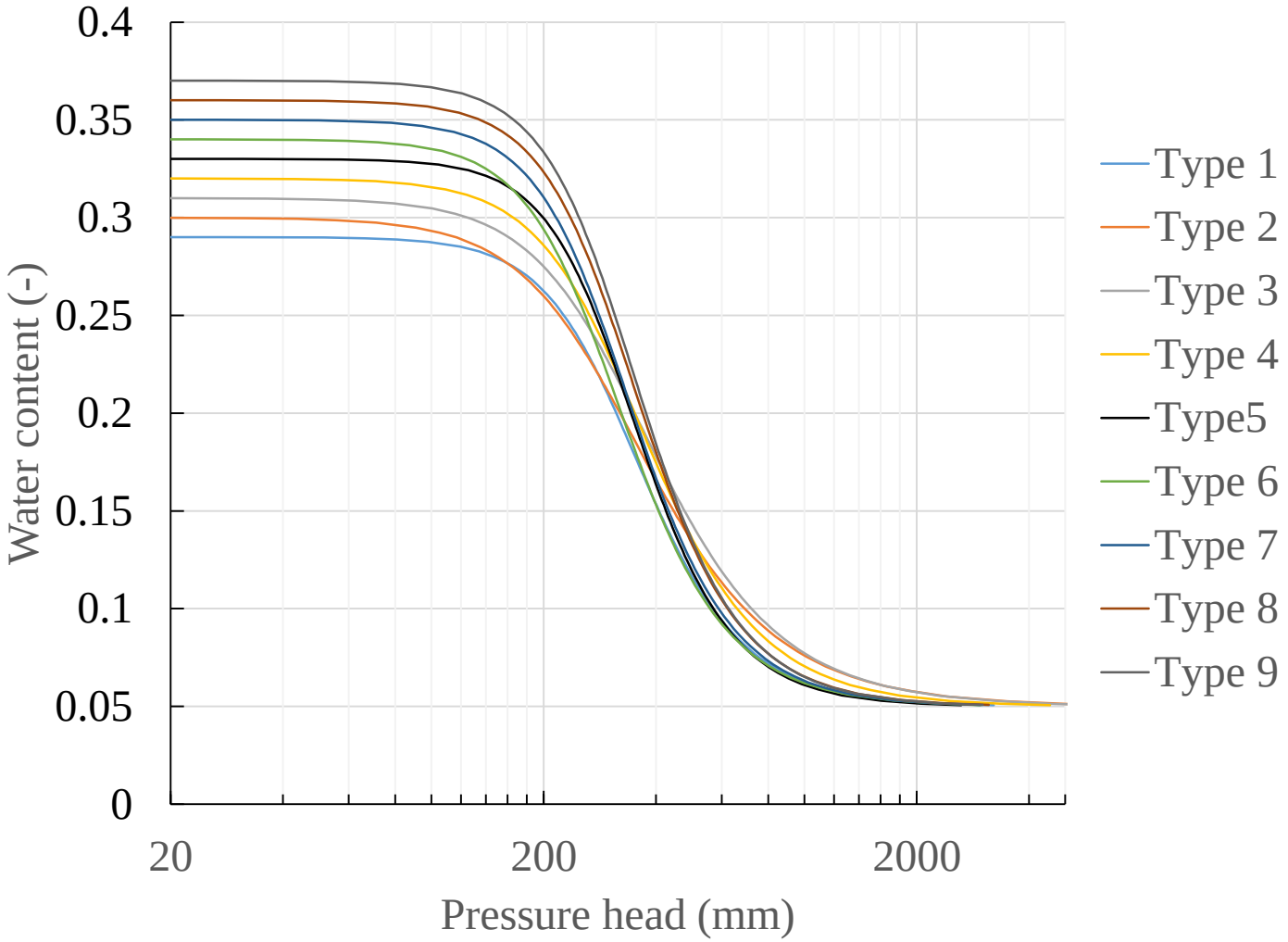
Particle size distribution (a) Sand, Silt and Clay proportions; (b) USDA texture classification of samples

4. RESULTS

Table 1: Van Genuchten - Mualem model parameters and inferred Specific yield

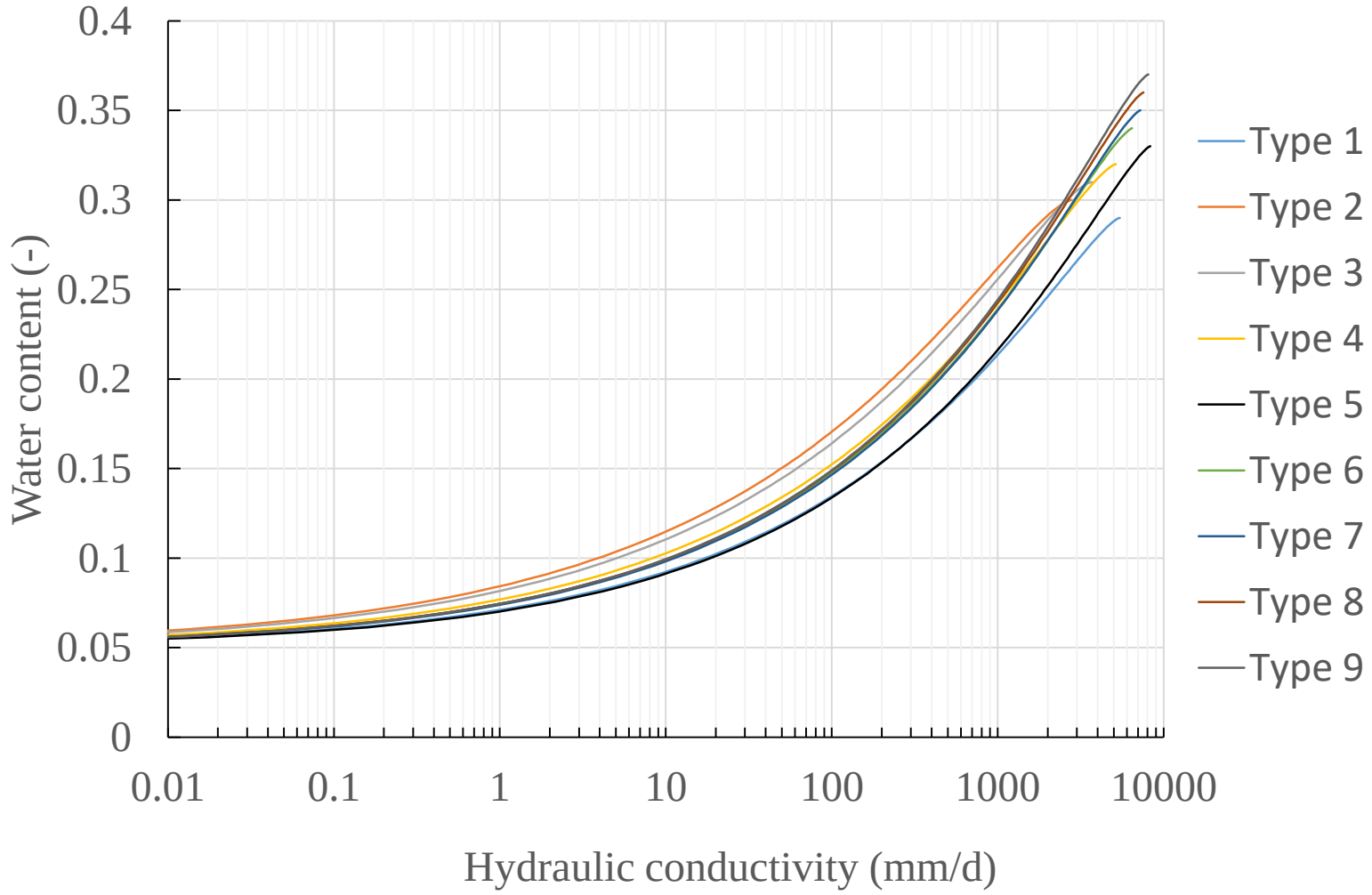
	Van Genuchten - Mualem model parameters						Sy
Type	θr	θs	α	n	l	Ks (m/d)	Freeze and Cherry (1979)
1	0.05	0.29	0.00312	3.59	0.5	5.4	0.24
2	0.05	0.30	0.00332	2.87	0.5	2.8	0.25
3	0.05	0.31	0.00311	2.97	0.5	3.7	0.26
4	0.05	0.32	0.00312	3.25	0.5	5.1	0.27
5	0.05	0.33	0.00314	3.83	0.5	8.3	0.28
6	0.05	0.34	0.00347	3.56	0.5	6.4	0.29
7	0.05	0.35	0.00328	3.63	0.5	7.2	0.30
8	0.05	0.36	0.00316	3.61	0.5	7.6	0.31
9	0.05	0.37	0.00314	3.66	0.5	8.1	0.32

4. RESULTS



Soil water retention curves

4. RESULTS



Soil hydraulic conductivities

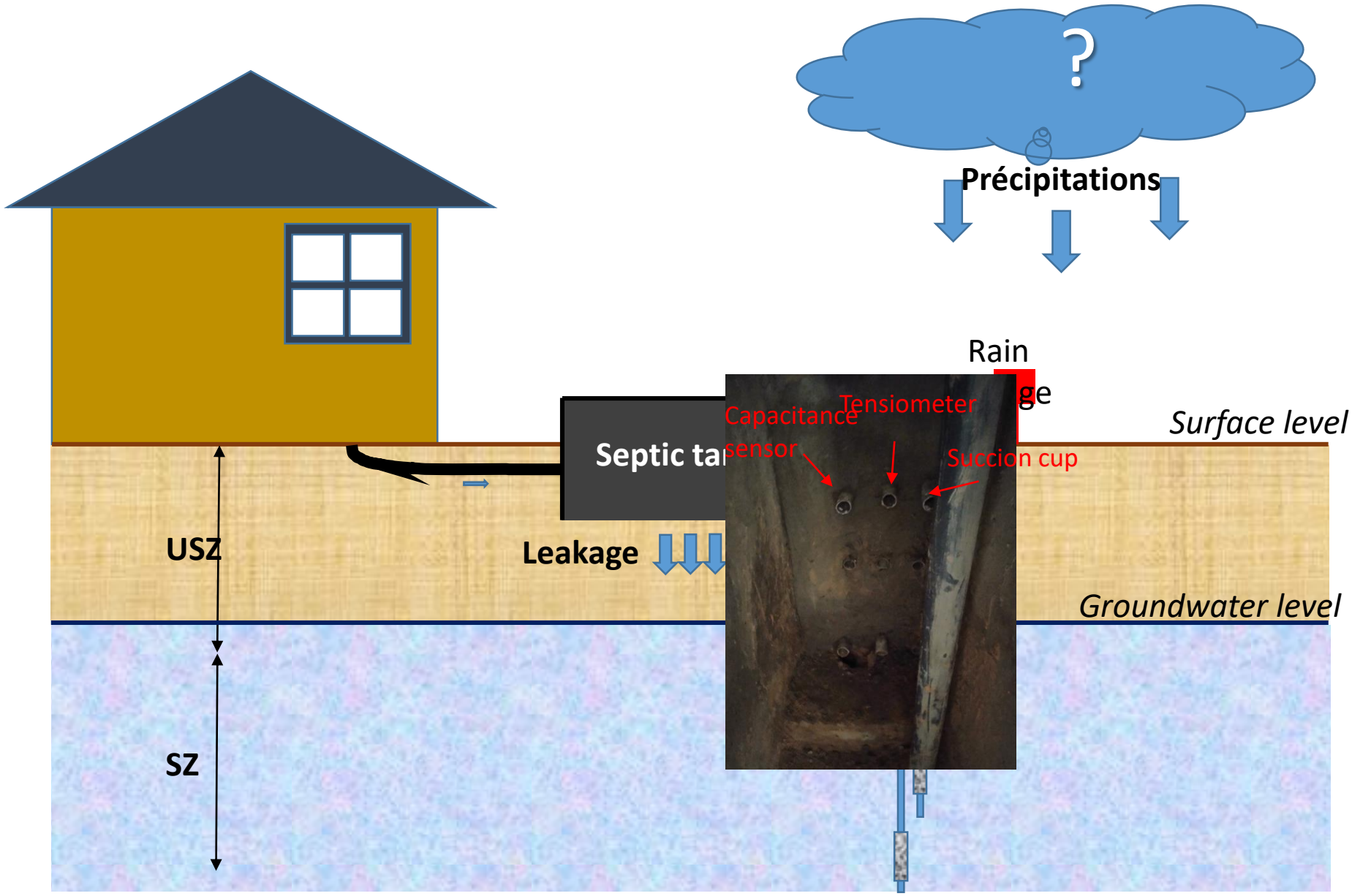
5. DISCUSSIONS AND PERSPECTIVES

- Particle size analysis show a sandy homogeneous vadose zone with low proportion of silt and clay.

- Depletion of clay as well as organic matter likely cause a low holding capacity.

- Soil retention and hydraulic conductivity curves show water transfer from the surface to shallow groundwater occurs relatively quickly amplifying pollution risk.

5. DISCUSSIONS AND PERSPECTIVES



THANK YOU FOR
YOUR ATTENTION