

PFAS flux to improve groundwater management and treatment

Erik Bosmans



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Contents

1. Introduction: FLUX concept
2. PFAS Validation of iFLUX
3. Project preparation
4. Practice



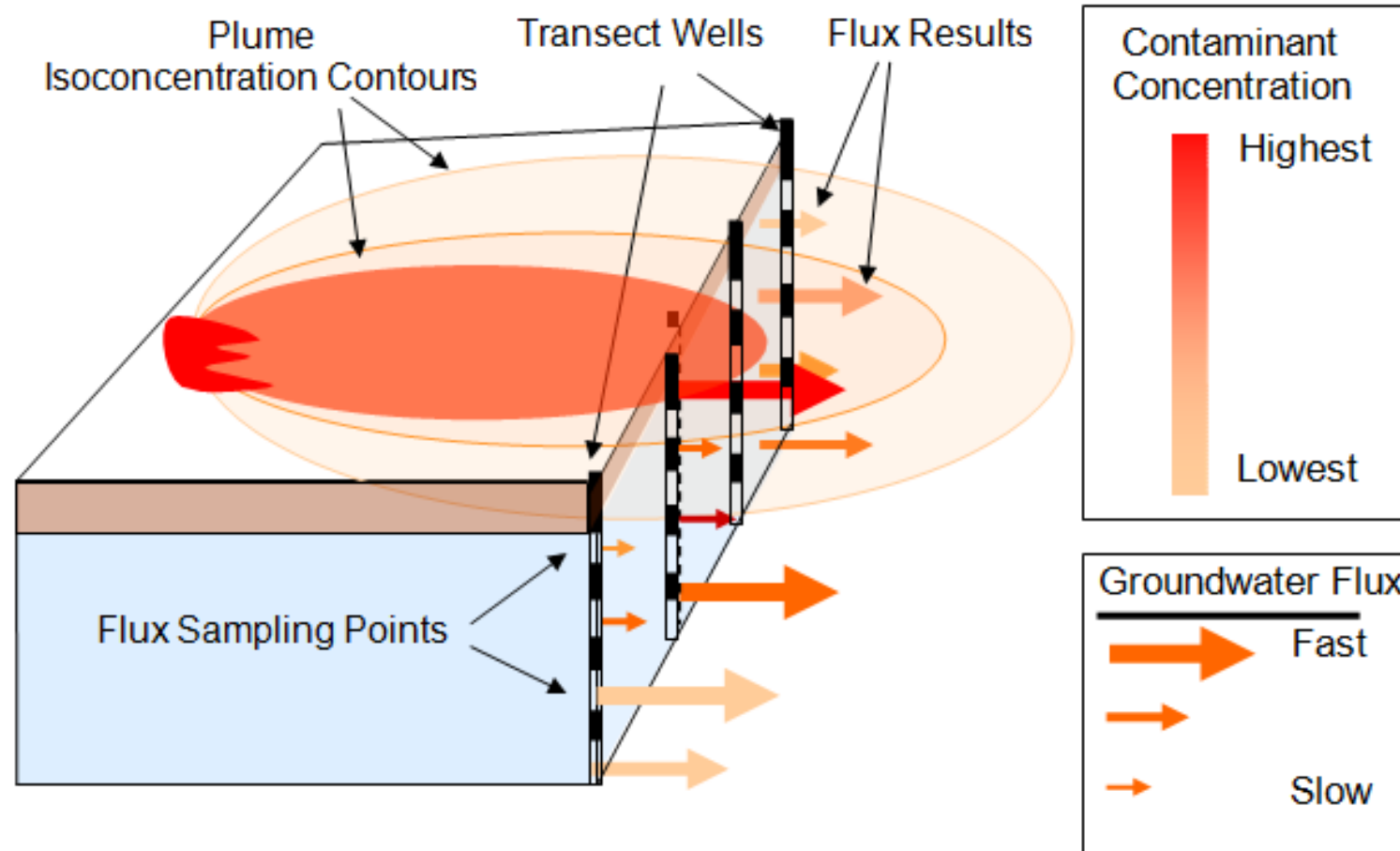
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1

Introduction: FLUX concept

Why: variation over time and space !

Groundwater flux vs PFAS mass flux



2

PFAS validation of iFLUX

PFAS validation of iFLUX

- Resins (sorbent matrix) and PFAS analyses (11 compounds)
 - **SGS validation → QUANTITATIVE results**
 - ✓ PFHxA
 - ✓ PFHpA
 - ✓ PFOA
 - ✓ PFNA
 - ✓ PFDA
 - ✓ PFUdA
 - ✓ PFDoA
 - ✓ PFBS
 - ✓ PFHxS
 - ✓ PFOS
 - ✓ PFOSA
 - **Without validation → QUALITATIVE results**
- PFAS analysis of production parts and installation equipment

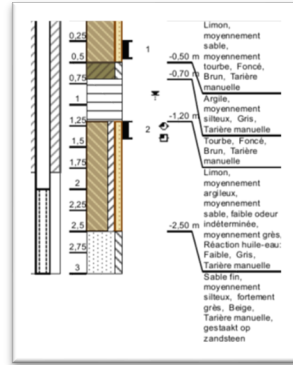
3

Project preparation

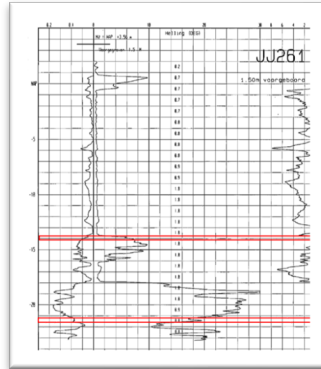
Preparation: available data ?



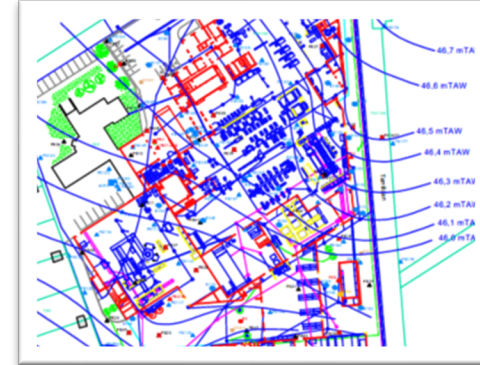
Location



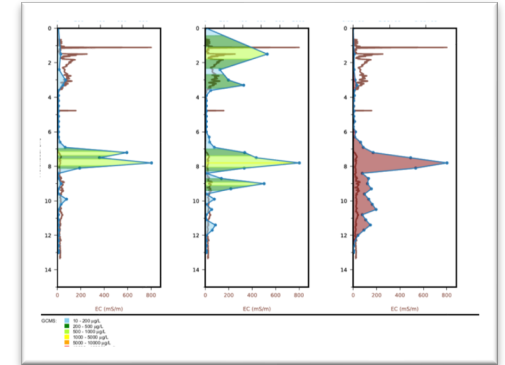
Logs



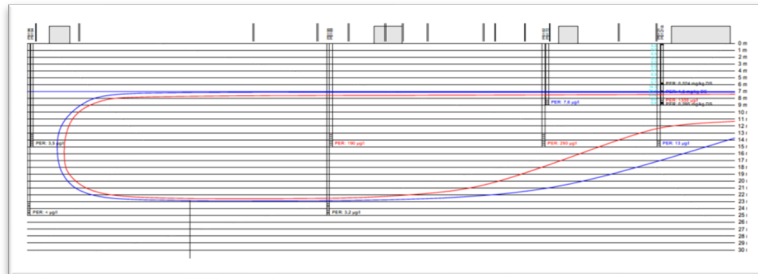
Soil probing



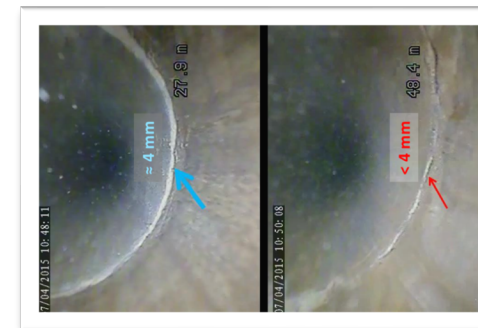
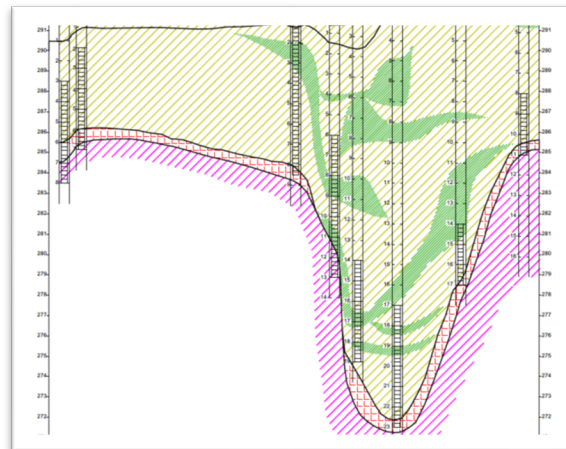
Isohyse



MIP



Transects



Video/Pictures

Parameters	U.M.	07/08/23	08/08/23	03/08/23	27/09/23	03/11/2
Aluminium	µg/l Al	<10.0	<10.0	<10.0	<10.0	18.8
Arsenic	µg/l As	53.5	32.8	47.2	78.5	20.6
Cobalt	µg/l Co	4.150	2.220	2.030	314	1.09
Manganese	µg/l Mn	276	197	250	135	114
Ozone	µg/l	10.5	5.6	4.9	0.88	0.88
Benzene	µg/l	29.6	27.7	3.9	0.87	12
Chloroethane	µg/l	<0.04	5.7	<0.04	<0.04	<0.04
Chloroform	µg/l	1.8	19.000	0.088	0.041	7
Methyl chloride	µg/l	0.37	1.08	0.32	0.122	0.202
1,2-Dichloroethane	µg/l	0.38	5.4	0.135	0.06	0.065
1,1,1-Trichloroethane	µg/l	0.88	3.8	0.159	0.106	0.087
1,1,2-Trichloroethane	µg/l	0.087	0.32	0.085	0.092	<0.050
1,1,1,2-Tetrachloroethane	µg/l	6.5	4.3	0.96	0.199	0.47
1,2-Dichloropropane	µg/l	0.092	0.98	<0.010	<0.010	0.0134
2,3-Dichloropropane	µg/l	0.46	1.51	<0.00100	0.0085	<0.0010
1,1,1-Trichloroethane	µg/l	<0.017	<0.1	<0.017	<0.017	<0.017
1,1,2-Trichloroethane	µg/l	2.9	3.9	1.17	0.3	<0.08

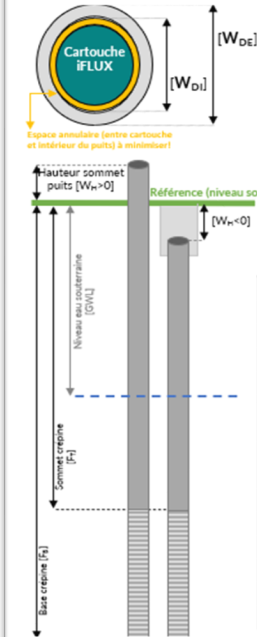
Analysis results

Preparation: iFLUX documents



Guide d'installation et de retrait

Ce guide fournit toutes les informations nécessaires à l'installation et au retrait des échantillonneurs iFLUX afin d'obtenir des résultats optimaux.



iFLUX Caractéristiques des puits

Client:	Nom du client
Contact:	Nom personne de contact + adresse courriel + N° mobile
Site:	Adresse du site (ou Localité)
Livraison:	Adresse de livraison (si différente de l'adresse du site)

[illegible]

!! INSIDE DIAMETERS: PRELIMINARY TESTS (DUMMY CARTRIDGES)!!

Preparation : installation plan



INSTALLATION		Date	2023-09-26 12:00	2023-09-25 12:00
Niv. Eau [m-sommet Pz]	8.25		2.71	
Fond Pz [m-sommet Pz]	<input type="checkbox"/> 13.48	<input type="checkbox"/> 9.55
HF mesuré [m-réf]	<input type="checkbox"/> 0.48	<input type="checkbox"/> 0.55
<hr/>				
RETRAIT		(Dernière) date	2023-10-19 12:00	2023-10-19 12:00
Niv. Eau [m-sommet Pz]	3.34		2.34	

Diagram illustrating the iFLUX Cartridge installation. The cartridge is shown with dimensions D_{ext} , D_{int} , S_c-B_c , $D_{int}-D_{ext}$, and H_F . The reference level (Référence niveau) is indicated by a green line. The water level (Niveau eau souterraine [Niv Eau]) is shown below the reference level. The diagram also shows the position of the cartridge relative to the ground surface and the water level.

PzS10	MW12
4.0-13.0m-ref	1.5-9.0m-ref
Ø80-90mm	Ø80-90mm
+ 0.48m-ref	+ 0.55m-ref

11.36m

O1037 10.90m-ref
W1246 11.04m-ref

4.49m

O1034 3.96m-ref
W1248 4.11m-ref

4

Practice

Practice

- Measurement of PFAS and Darcy FLUX: 6 wells and 8 measurement points

Exposure period: 31 days

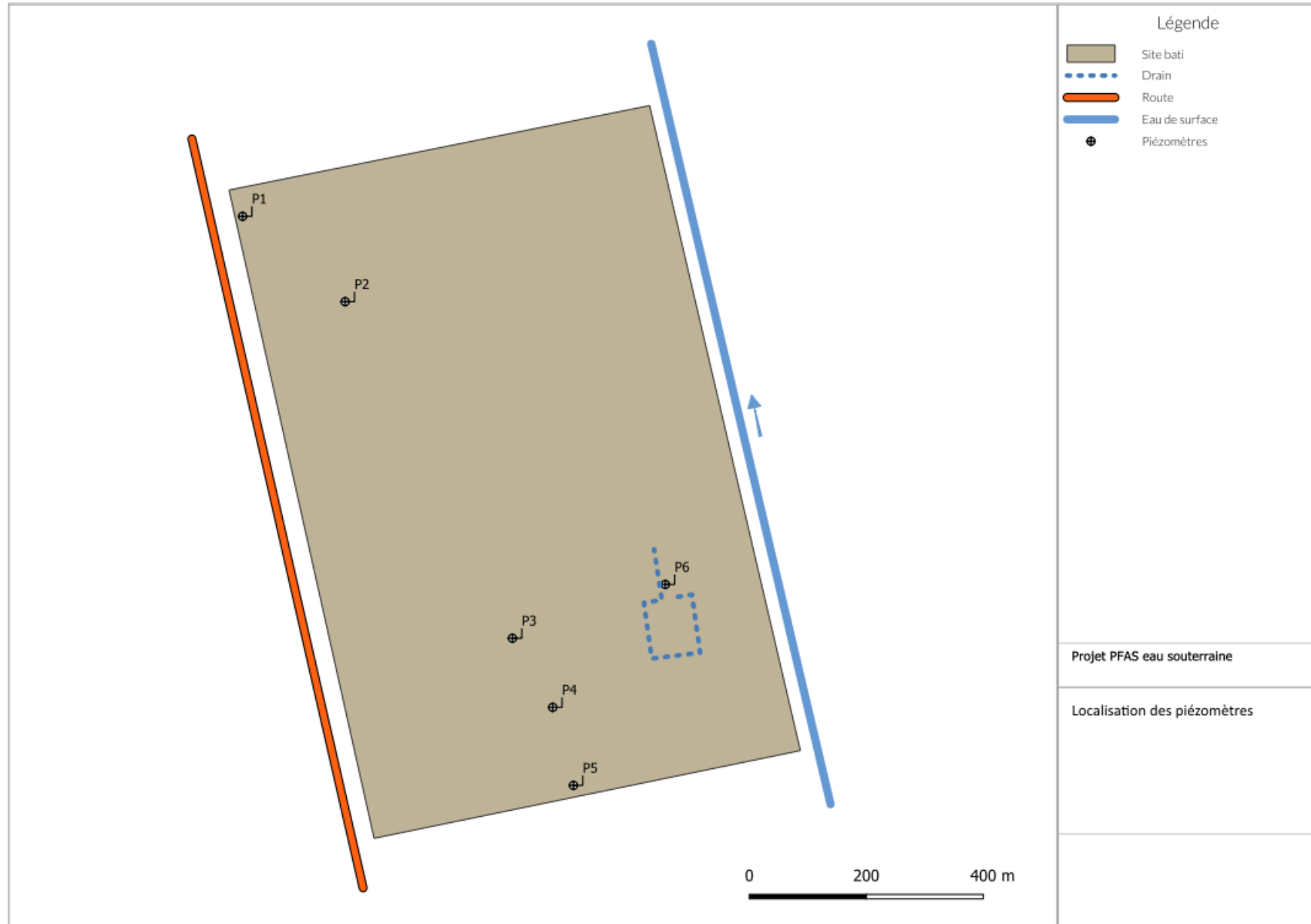
- ✓ Duration >>> traditional sampling (a few minutes)
- ✓ Results averaged over time: realistic exposure scenario
- ✓ Higher probability of detecting contaminants of interest
- ✓ Better understanding of the dynamics

Objectives:

- ✓ Measure PFAS flux
- ✓ Identify PFAS source
- ✓ Measurements at different depths per well
- ✓ Preferential flow paths: dispersion potential
- ✓ Assess possible treatment techniques
- ✓ Over time: monitoring treatment effectiveness

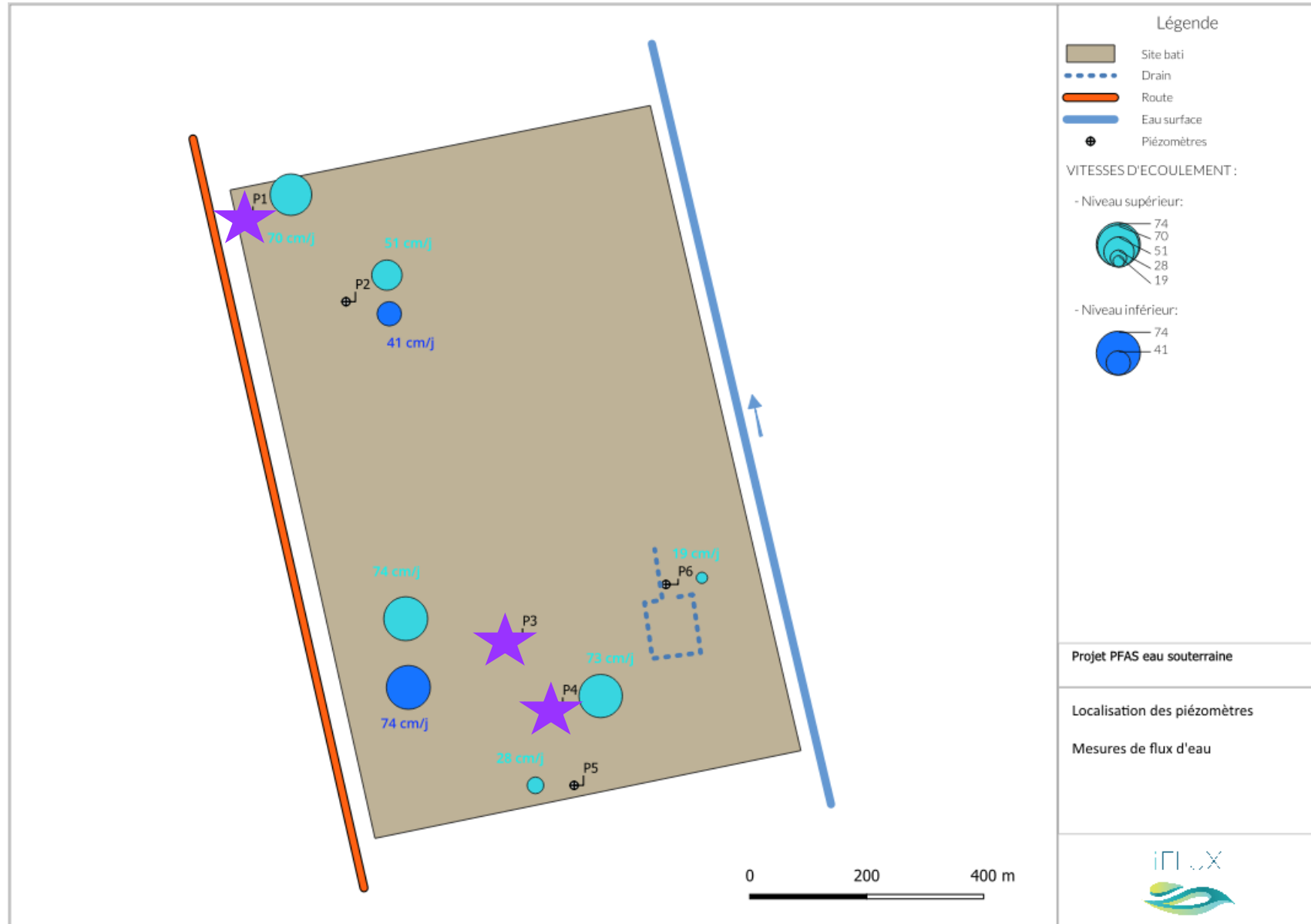
Practice

Wells



Practice : Groundwater Flux

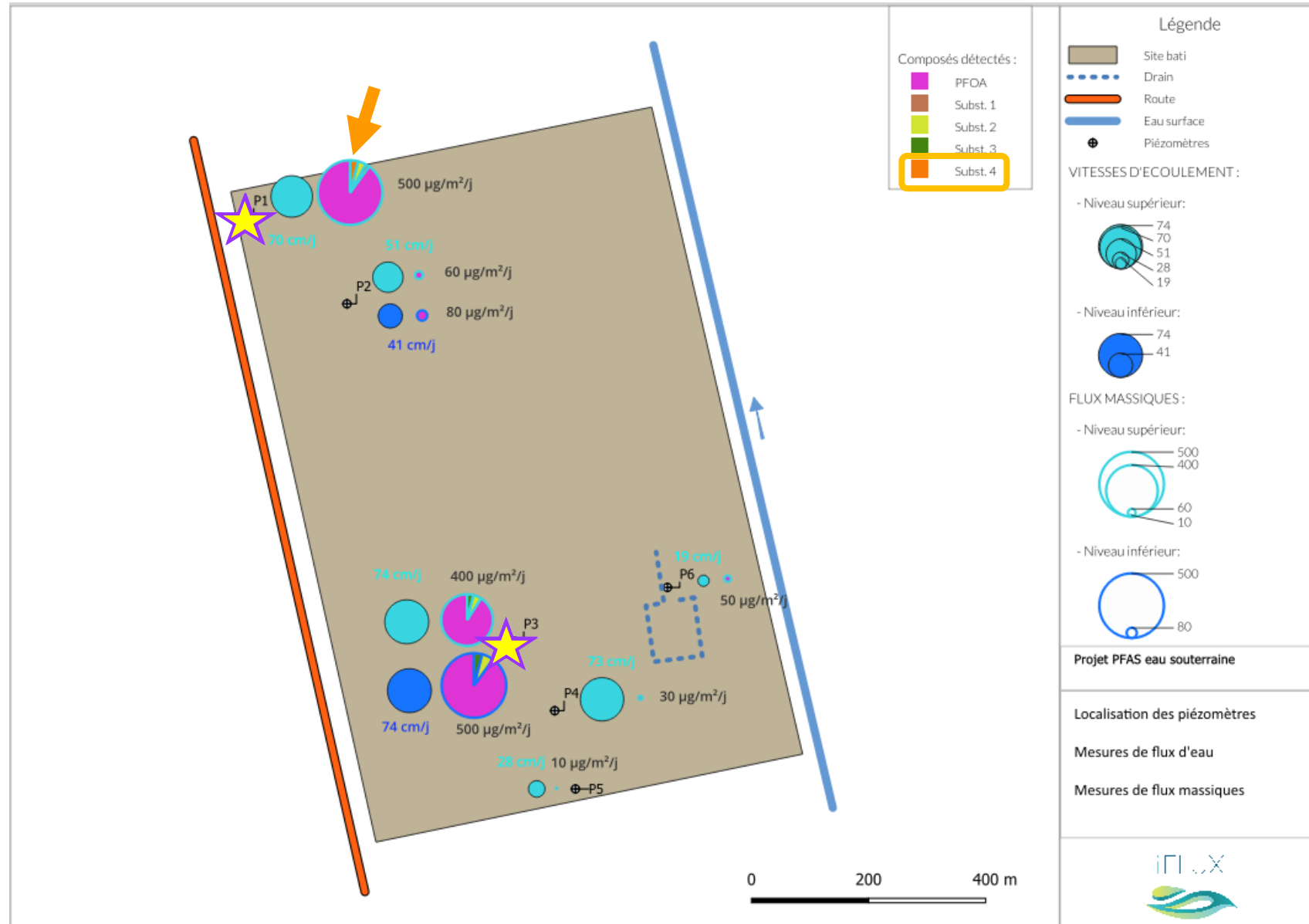
Preferential pathways



Water flux:
cm³/cm²/day

Practice : Groundwater Flux and PFAS Flux

Dispersion risk

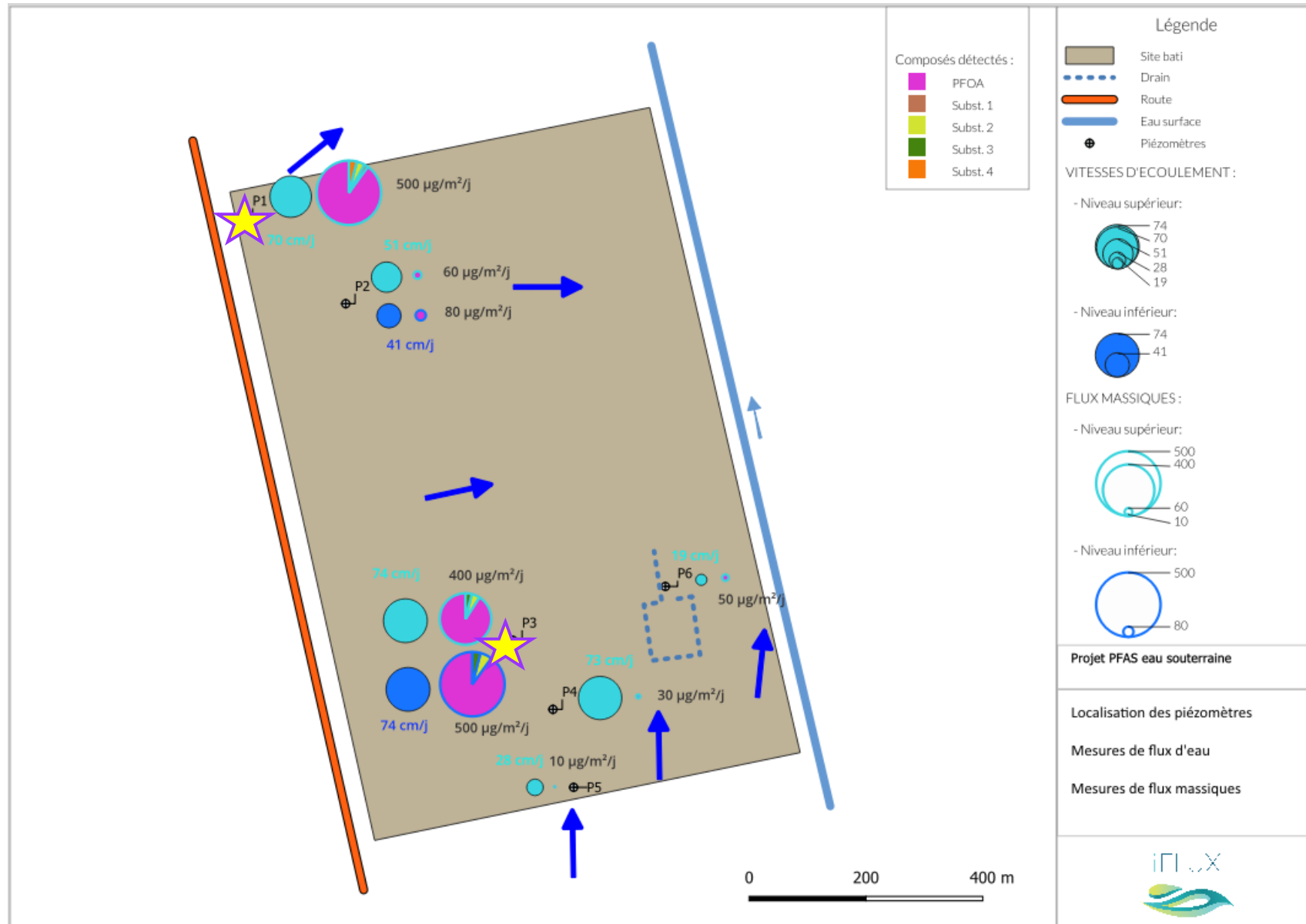


Water flux:
 $\text{cm}^3/\text{cm}^2/\text{day}$

PFAS flux:
 $\mu\text{g}/\text{m}^2/\text{day}$

Practice : Groundwater Flux and PFAS Flux

Flow direction



Water flux:
 $\text{cm}^3/\text{cm}^2/\text{day}$

PFAS flux:
 $\mu\text{g}/\text{m}^2/\text{day}$

Composés détectés :

- PFOA
- Subst. 1
- Subst. 2
- Subst. 3
- Subst. 4

Légende

- Site bati
- Drain
- Route
- Eau surface
- Piézomètres

VITESSES D'ÉCOULEMENT :

- Niveau supérieur: 74, 70, 51, 28, 19
- Niveau inférieur: 74, 41

FLUX MASSIQUES :

- Niveau supérieur: 500, 400, 60, 10
- Niveau inférieur: 500, 80

Projet PFAS eau souterraine

Localisation des piézomètres

Mesures de flux d'eau

Mesures de flux massiques

0 200 400 m

PFAS flux:
 $\mu\text{g}/\text{m}^2/\text{day}$



Thank you! Thoughts?



Erik@iflux.be



+32 471 90 41 12