

Macro and microplastics in stormwater in Paris megacity



Robin TREILLES*¹, Johnny GASPERI¹, Mohamed SAAD¹, Alain RABIER², Jérôme BRETON², Vincent ROCHER³, Sabrina GUERIN³, Bruno TASSIN¹

¹Laboratoire Eau, Environnement, Systèmes Urbains (**LEESU**)

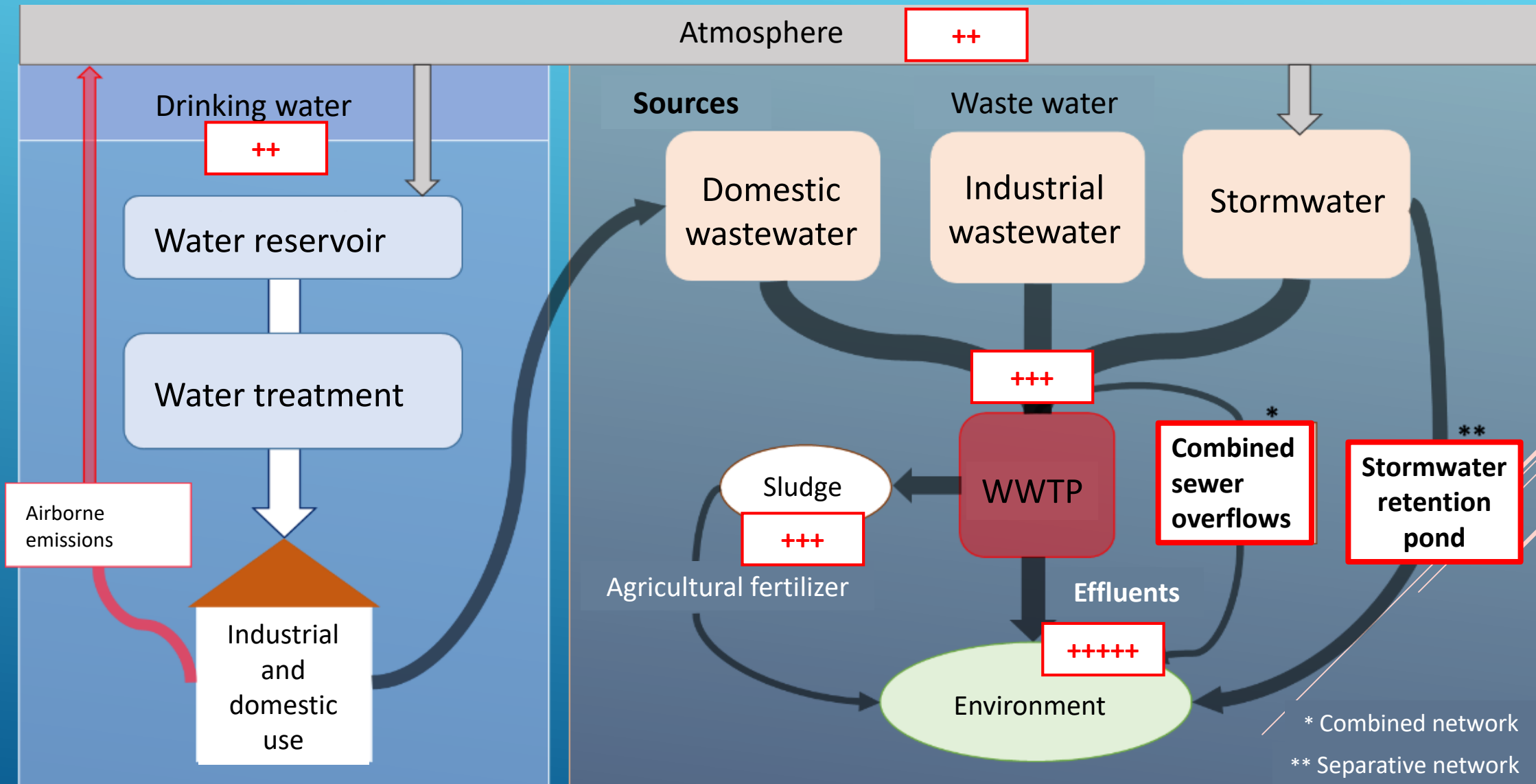
²Direction des Services de l'Environnement et de l'Assainissement du Val-de-Marne (**DSEA**)

³Service public de l'assainissement francilien (**SIAAP**)

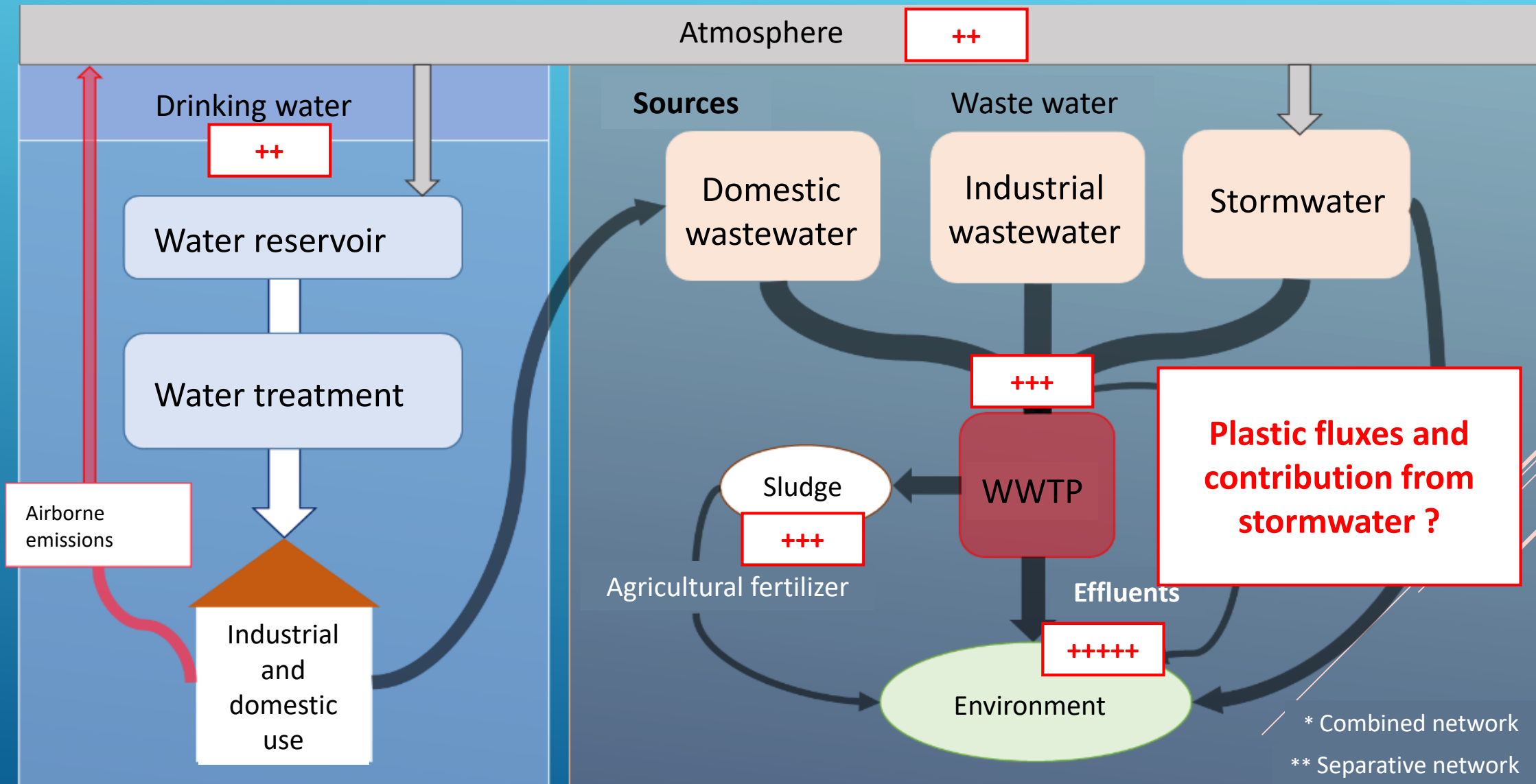
*robin.treilles@enpc.fr



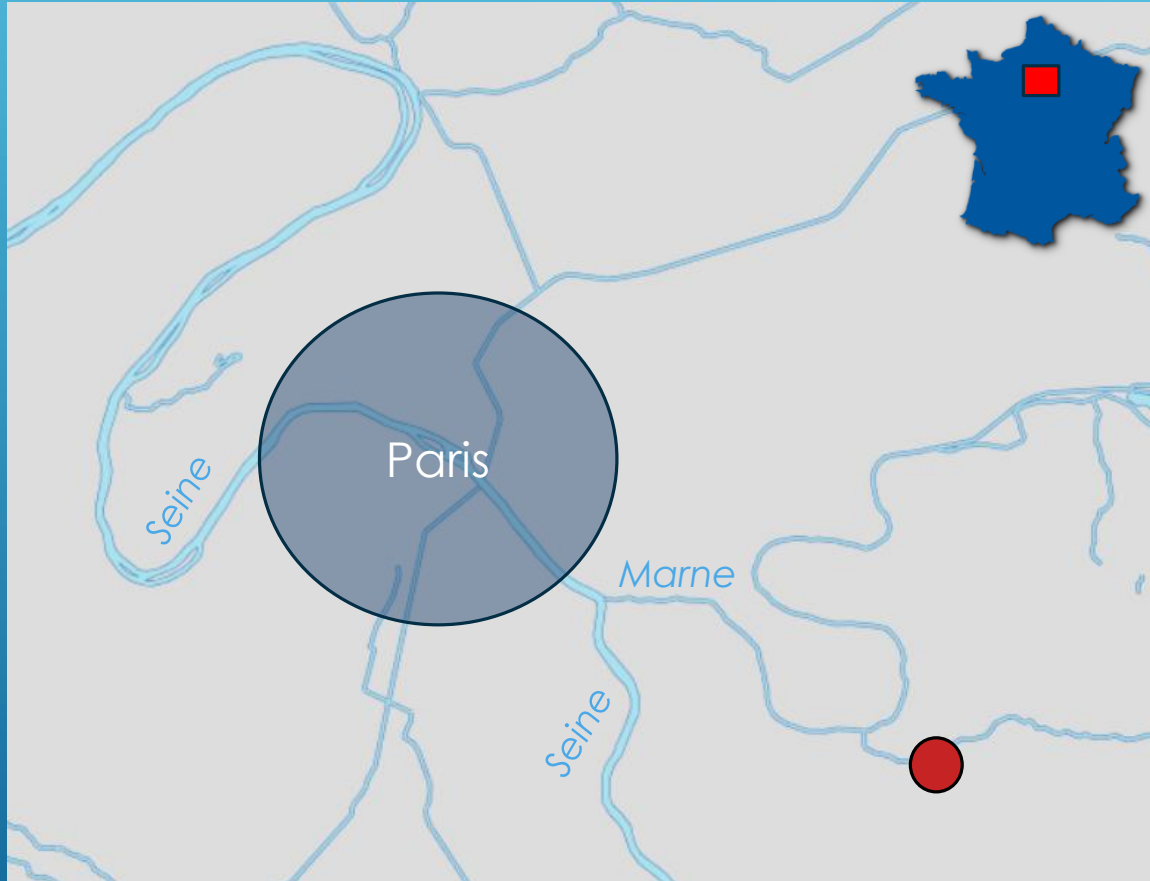
Introduction: plastics in urban waters



Introduction: plastics in urban waters



Methods: sampling site

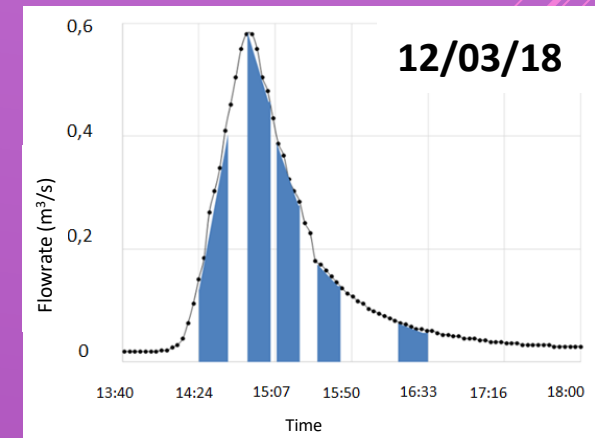


Runoff water at the Sucy-en-Brie catchment outflow (DSEA Val de Marne)

Macrowaste are collected from two grid refusals (6 and 1 cm) **once per month**.



Microplastics are collected **during rain events**.



Characteristics of the Sucy-en-Brie catchment

Runoff water at the Sucy-en-Brie catchment **outflow**



Macrowaste (> 1 cm) and microplastics (> 50 μm) in stormwater of Sucy-en-Brie

Catchment	Surface (km ²)	Runoff Coefficient (%)	Land use	Inhabitants
Sucy-en-Brie	2.28	21	Mainly a residential area with large number of multi-occupancy family houses, limited commercial activities	~ 20 000

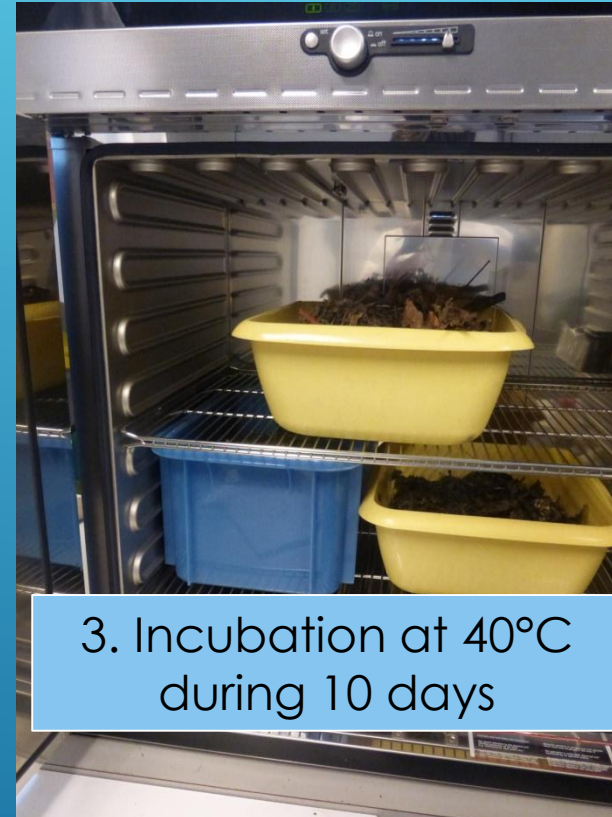
Methods: **macrowaste** in stormwater of Sucy-en-Brie



1. Debris from the runoff water are collected from two grid refusals (**GR1 6 cm** and **GR2 1 cm**)



2. Samples are weighted

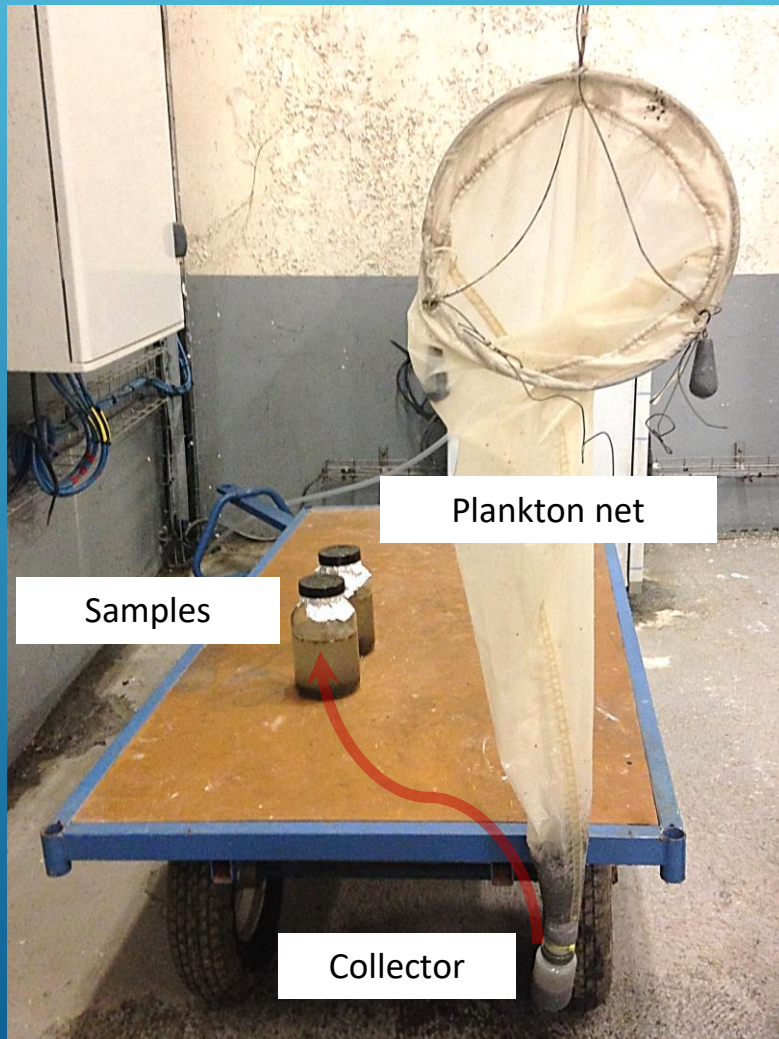


3. Incubation at 40°C during 10 days

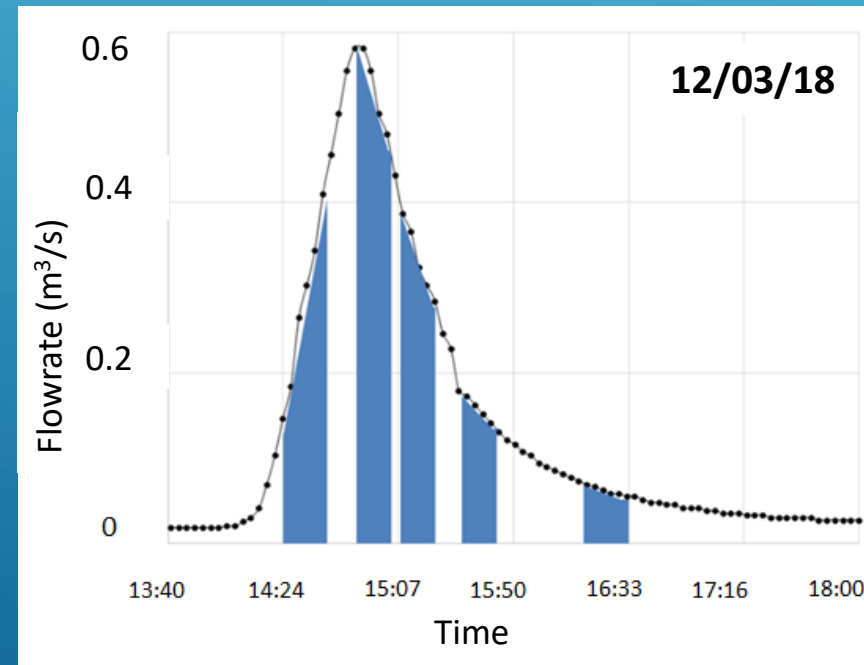


4. Debris are sorted and classified

Methods: microplastics in stormwater of Sucy-en-Brie



- **80-100L of runoff water** are collected upstream of the grid refusals **during rain events** for microplastic analysis.
- This water is then **filtered** with a **80 μm net** and microplastics are analyzed.



Methods: **microplastics** in stormwater of Sucy-en-Brie

> 5 mm

1-5 mm



1

2

3

4

Sieving

Particles > 5 mm
Particles > 1 mm
Particles < 1 mm

SDS

$C = 3.5 \text{ g.L}^{-1}$
 $T = 40^\circ\text{C}$
 $t = 24 \text{ h}$
300 rpm

H₂O₂ Digestion

$C = 30\%$
 $T = 40^\circ\text{C}$
 $t = 48 \text{ h}$
300 rpm

Density separation

$\text{NaI } (\rho = 1.65 \text{ g.cm}^{-3})$
 $t = 24 \text{ h}$



< 1 mm



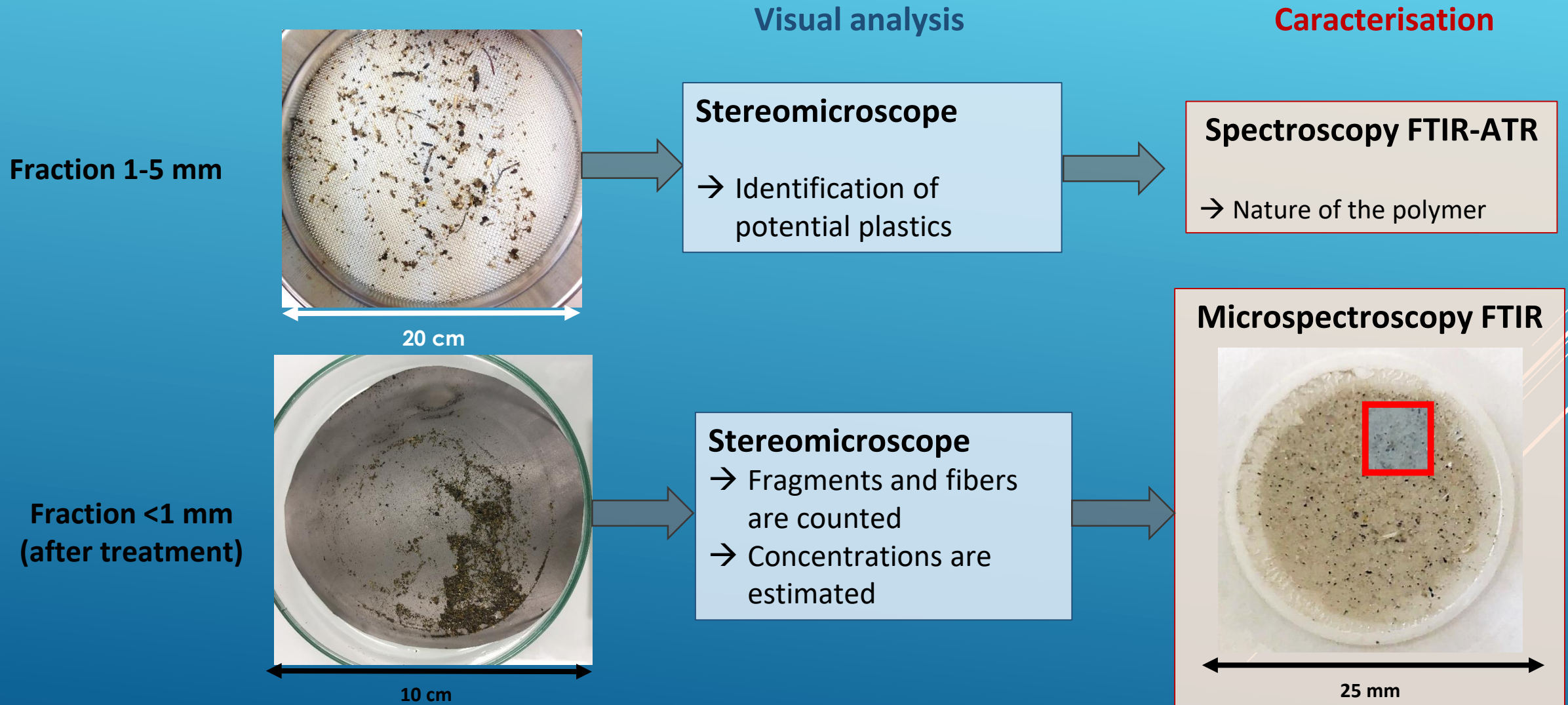
Filter after SDS + digestion



Filter after density separation

Filtration on metal filter $\varnothing=90 \text{ mm}$; porosity $10 \mu\text{m}$

Microplastics analyses



Results: **macrowaste** in stormwater of Sucey-en-Brie



Grid refusal 1 (mesh size = 6 cm)



Results: **macrowaste** in stormwater of Sucey-en-Brie



Grid refusal 1 (mesh size = 6 cm)



Results: **macrowaste** in stormwater of Sucey-en-Brie



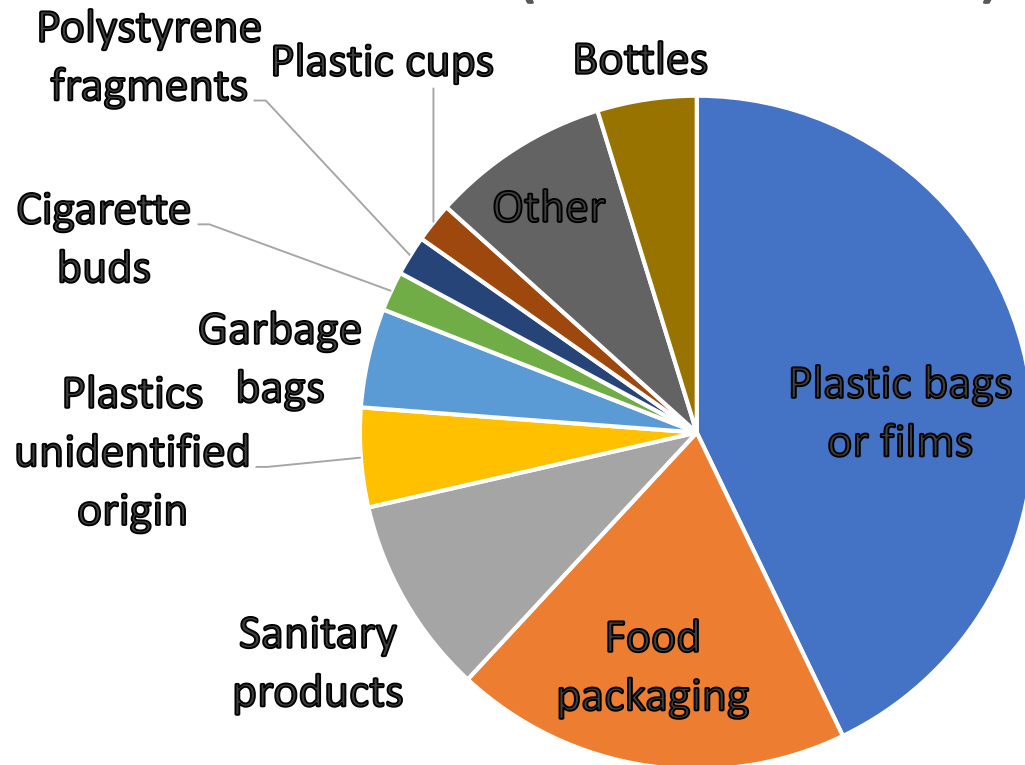
Grid refusal 2 (mesh size = 1 cm)



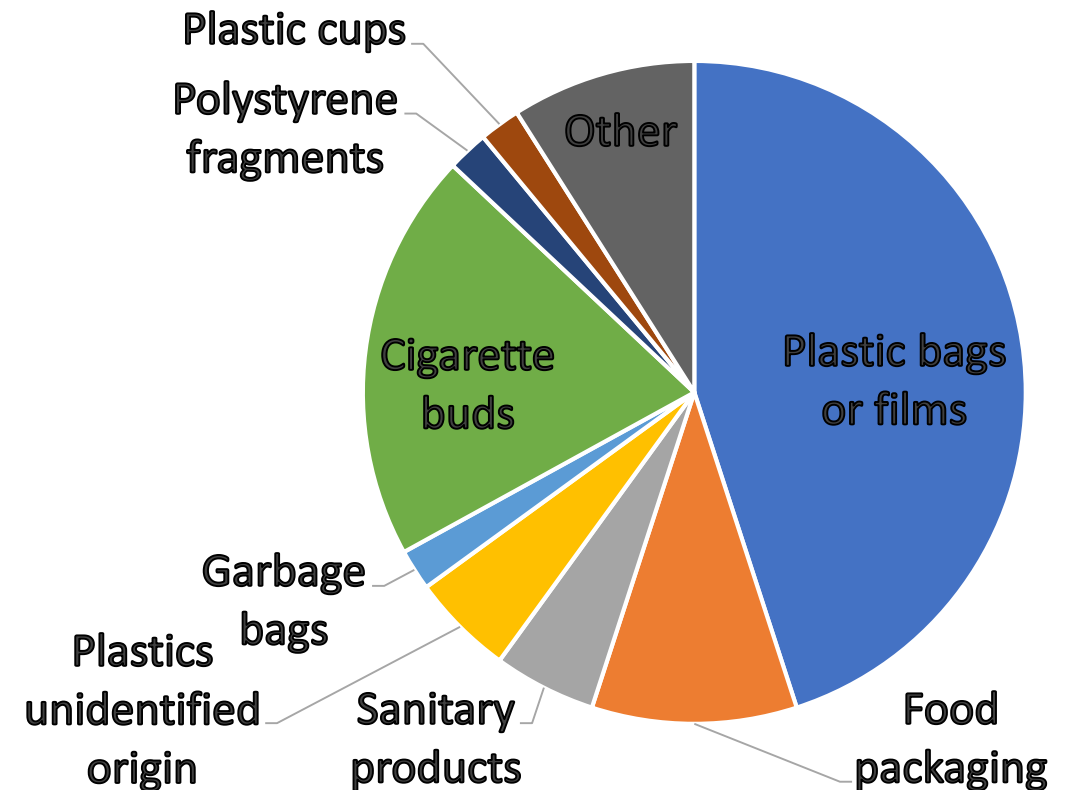
Results: macrowaste in stormwater of Sucy-en-Brie

- **Nine waste categories correspond to more than 95 % of all the macrowaste of Sucy-en-Brie (% number of objects accumulated on grid refusals):**

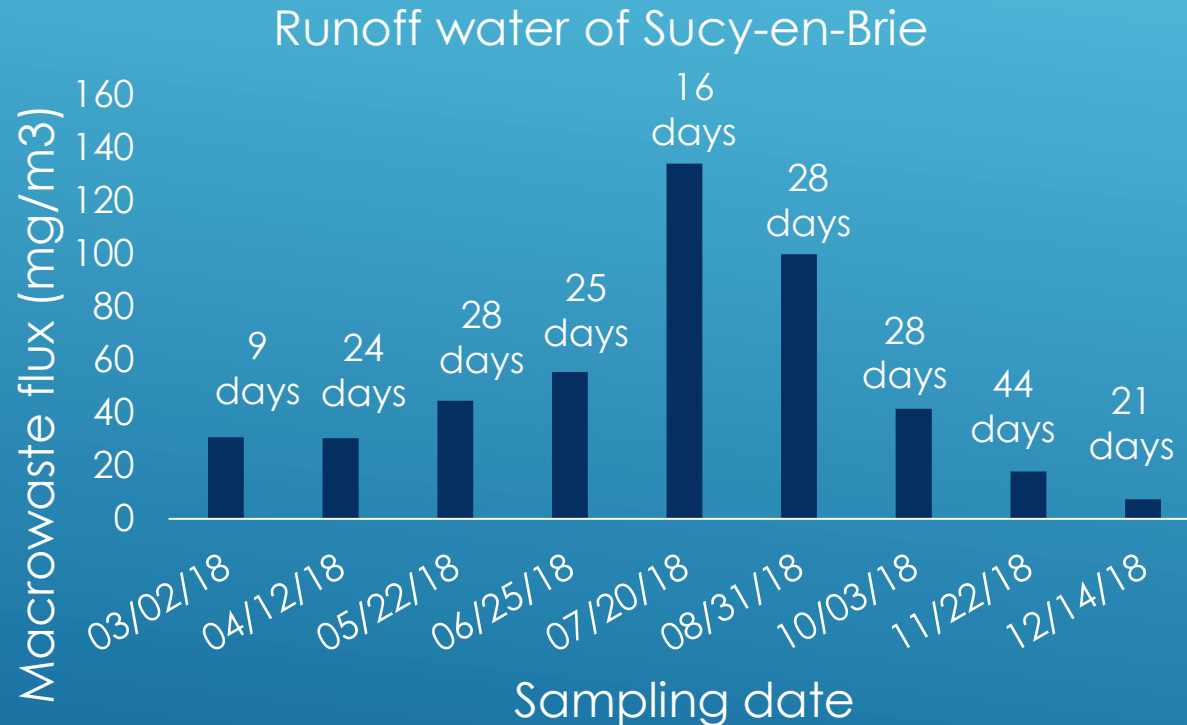
GR1 (mesh size = 6 cm)



GR2 (mesh size = 1 cm)

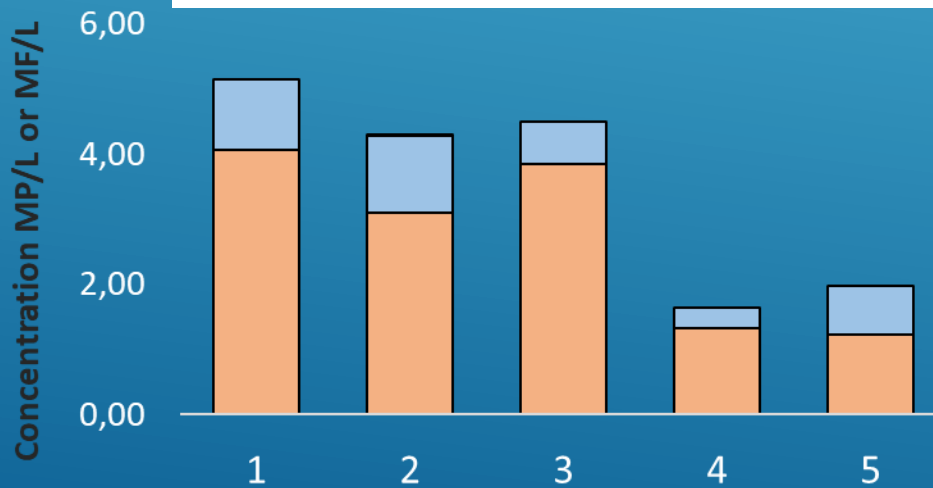
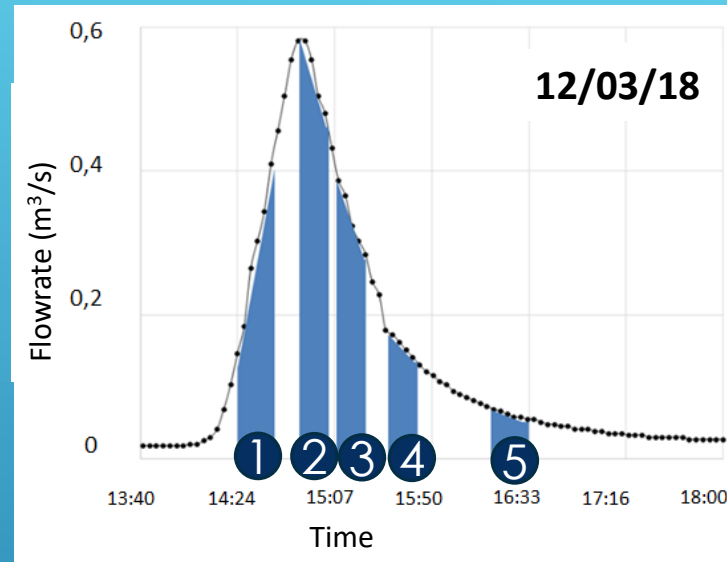
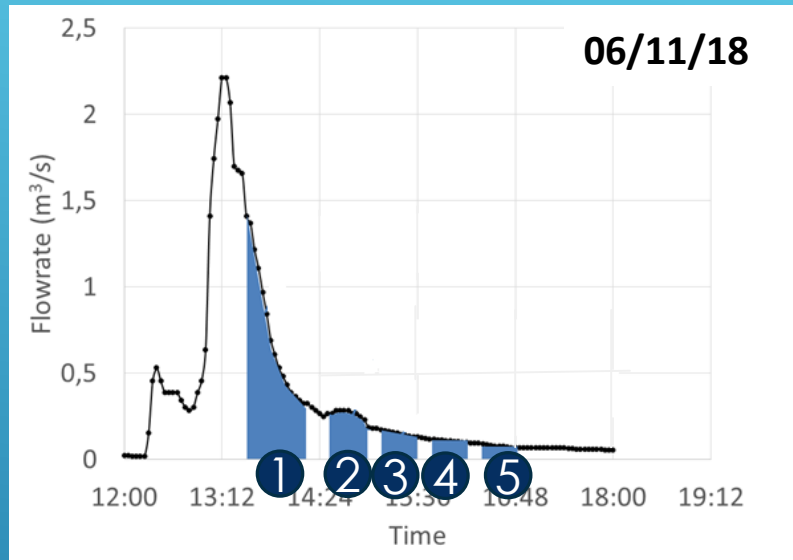


Results: **macrowaste** in stormwater of Sucey-en-Brie

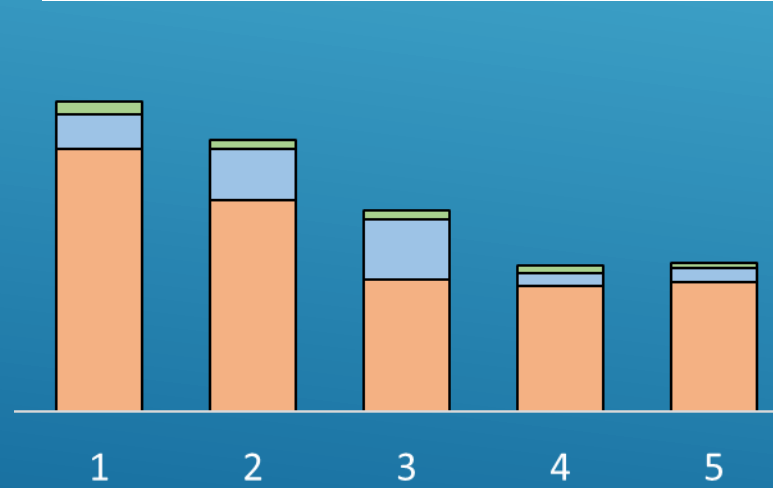


- **Macrowaste fluxes after x days of accumulation on both grid refusals**
- **Plastic waste in stormwater of Sucey-en-Brie ~ 10 to 100 mg/m³**
- **If applied to Paris megacity population: 12 to 40 tonnes of macrowaste/year in stormwater.**
- **July and august correspond to the strongest values (recreational activities, storms ?)**

Results: microplastics in stormwater of Sucy-en-Brie



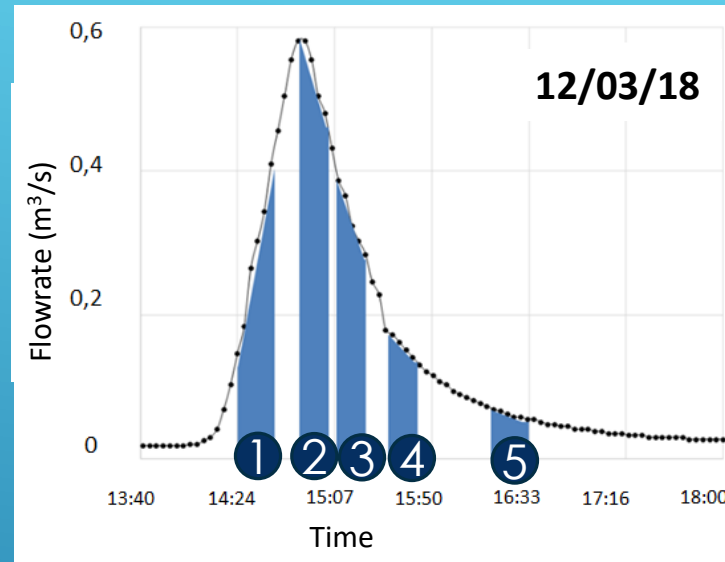
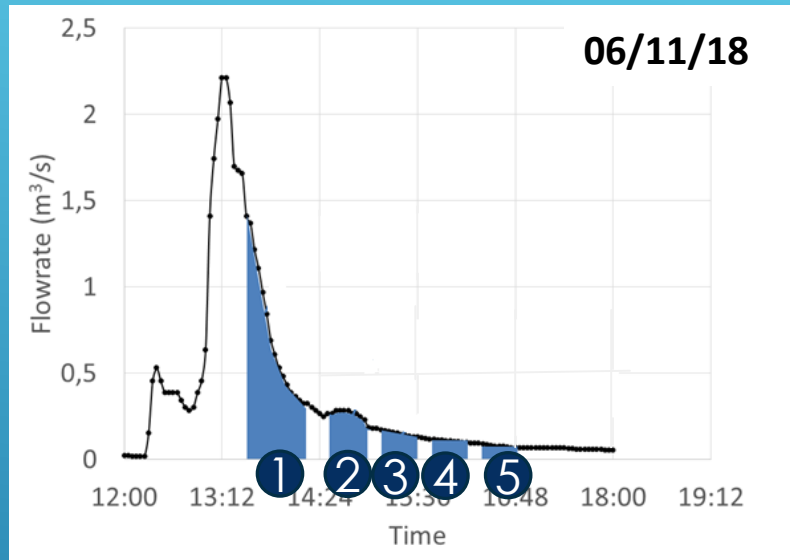
Rain event 1: 06/11/18



Rain event 2: 12/03/18

- Fragments 1-5 mm (MP/L)
- Fragments <1 mm (MP/L)
- Fibres <1 mm (MF/L)

Results: microplastics in stormwater of Sucy-en-Brie

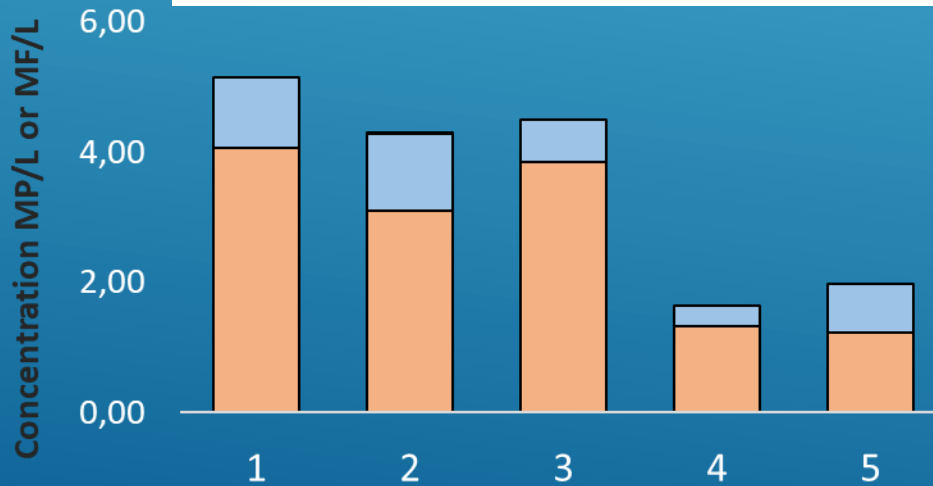


➤ **Characterisation on μ FTIR (first results):**

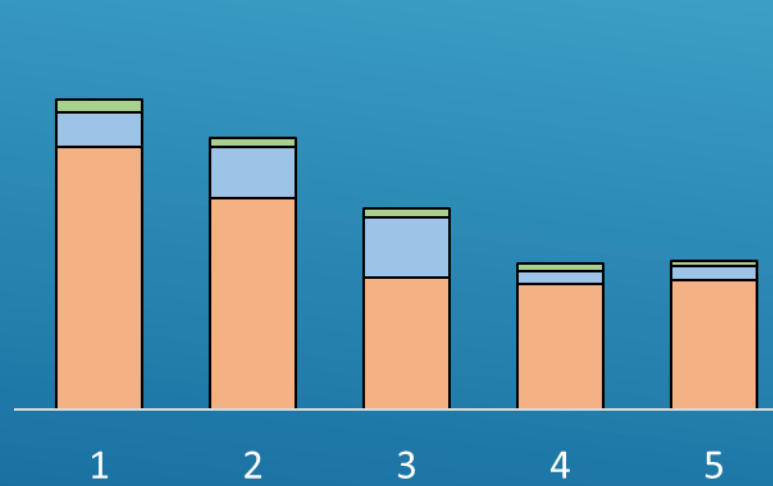
Polyethylene 48%

Polystyrene 37%

Polypropylene 15%



Rain event 1: 06/11/18



Rain event 2: 12/03/18

■ Fragments 1-5 mm (MP/L)

■ Fragments <1 mm (MP/L)

■ Fibres <1 mm (MF/L)

Conclusion

- ▶ For **macrowaste** in stormwater:
 - ▶ **Nine waste categories correspond to more than 95 % of all the macrowaste** of Sucy-en-Brie.
 - ▶ Macrowaste flux ~ **10 to 100 mg/m³**.
- ▶ For **microplastics**:
 - ▶ Microplastic concentration ranges between **2 and 5 MP/L**
 - ▶ Small decrease is observed over time.
 - ▶ More rain events will be studied.

Thank you for your attention!



Any questions???

robin.treilles@enpc.fr

Results : **microplastics** in stormwater of Sucy-en-Brie

➤ **Comparaison with other studies :**

$4,9 \cdot 10^{-1}$ - 22,9 MP/L
Danemark (Liu et al., 2019)

2 - 29 MP/L
Grand Paris (Dris et al., 2018)

➤ **Characterisation on μ FTIR (fragments, first results) :**

Polyethylene 48%

Polystyrene 37%

Polypropylène 15%

