LIFE ADSORB PROJECT

Results obtained

The LIFE ADSORB project explores a number of aspects in order to gain a comprehensive view of stormwater treatment using a reed filter. The results obtained are presented in this section.

Socio-economic impact assessment

The Bugeaud storm spillway in the Bois de Boulogne has undergone major renovation. Previously, it discharged rainwater from a section of the ring road directly into the Seine, but the City of Paris has recently fitted it with a system for storing and treating this water using a reed filter before discharging it into the Bois de Boulogne drainage network and eventually into the Seine.

As part of the Life Adsorb project, a sociological component was included in order to analyse the appropriation of this structure by the local authority's technical services, local residents and visitors to the wood. The study of its socio-spatial integration is based on a framework for analysing social acceptability, distinguishing between the notion of an issue and that of an acceptability problem. To obtain a complete picture, the different phases of the project were examined.

The social acceptability of a facility to treat run-off water, which is perceived as polluted, must be analysed from two angles:

- **its operation** - i.e. the way it is used by those who operate and maintain it
- **its socio-spatial integration** - i.e. how it is perceived by local residents.

This study revealed that the structure does not give rise to any objections, mainly because the planted filter remains virtually invisible thanks to the landscaping. However, to maintain this discretion over the long term, the maintenance of the system needs to be optimised.

From an organisational point of view, the planted filter can be considered as a border object, situated at the intersection of several professional universes. It is subject to various interpretations and is the subject of numerous adjustments between the departments of the City of Paris, as well as between these departments and the researchers involved in the project.

The study highlights certain tensions, particularly in the definition of responsibilities between the various departments of the City, such as Green Spaces and Water/Sanitation. Differences may also emerge between the expectations of the researchers and the reality on the ground for the

operational players.

The persistent uncertainty as to the allocation of maintenance tasks and responsibilities after the end of the European project highlights a lack of capitalisation on the lessons learned from past projects. This deficit does not only concern the City of Paris, but also all the work available in scientific and professional literature.

It therefore seems essential to ensure that the knowledge gained from these initiatives is maintained, both within the local authorities that develop these alternative techniques and through better dissemination of the sociological and organisational knowledge acquired throughout the deployment of these innovative stormwater treatment systems.

Environmental impact assessment on ecosystems

Initial state: assessment prior to the construction phase

Some of the information obtained from the assessment of the initial state must be taken into account in the next stages in order to interpret the impact of the construction and operation of the prototype on the ecosystem.

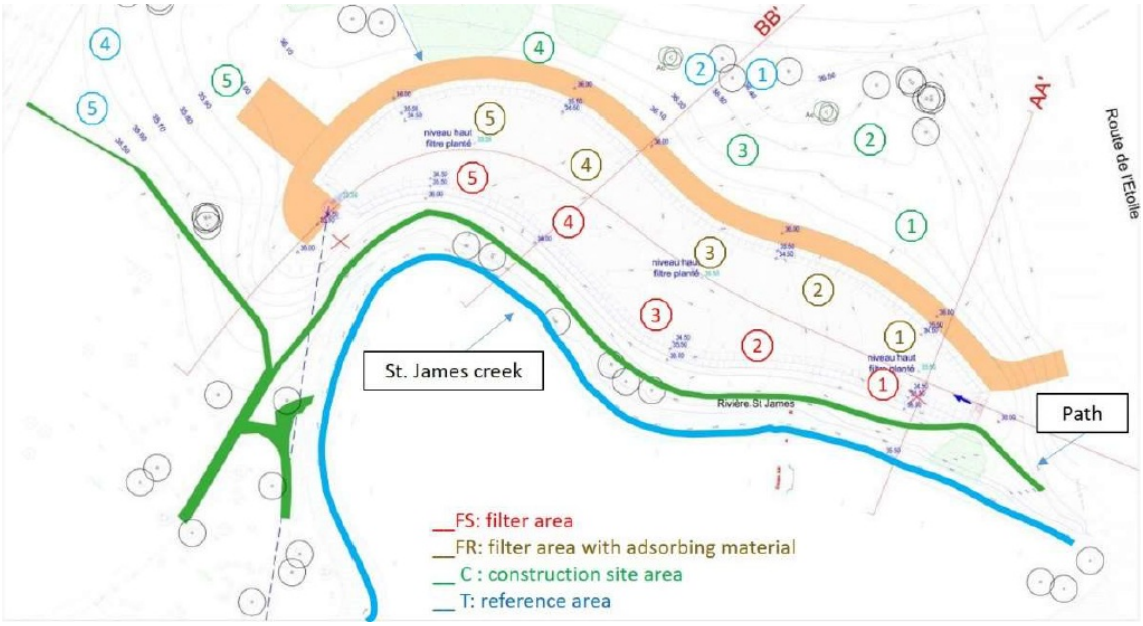
The siting area initially showed spatial variability, due to the differences observed, particularly in terms of vegetation cover. In addition, the proximity of major roads encouraged the accumulation of metallic and organic contaminants, resulting in a heterogeneous concentration of pollutants and site characteristics.

The unfavourable conditions made it difficult to characterise the oligochaete communities. However, the species identified appear to be representative of the site as a whole.

A floristic and faunistic study carried out in 2015 revealed that the site presented a low biodiversity challenge, as the species inventoried were common in the region.

State zero: evaluation after filter construction

Characterisation of the quality of the environment at ground zero will enable us to assess the impact of the construction site on the ecosystem and will serve as a reference for assessing the impact of the filter on its environment.



A significant difference in chemical and biological analyses was observed between the filter zone and zones T and C. It is therefore essential to set up intra-zone monitoring over time in order to accurately assess and monitor the impact of the filter.

The distribution of polycyclic aromatic hydrocarbons (PAHs) follows the trend observed during the initial assessment. However, some points in the construction site area show higher concentrations. However, these values must be put into perspective in relation to the concentrations measured in the control zone.

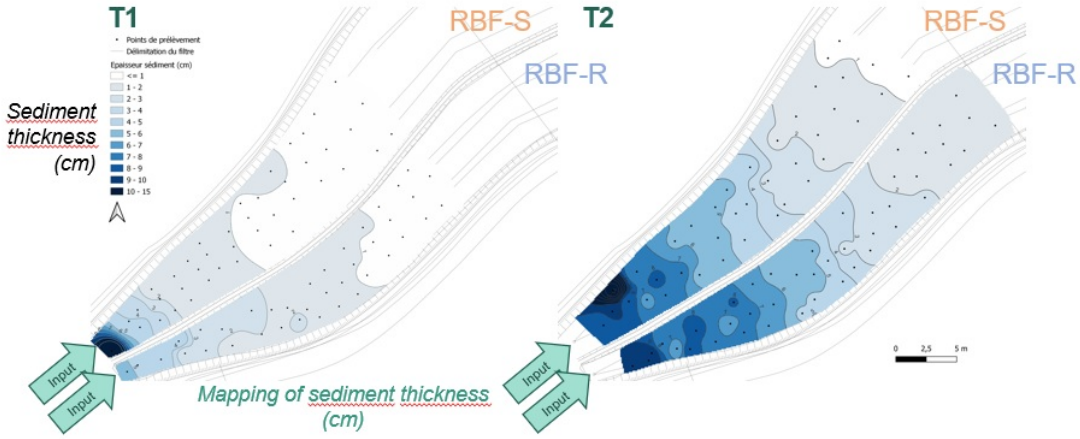
No significant difference was found for most of the enzymatic activities analysed between T0 and Tin.

The study of the soil fauna revealed a variation in terms of richness and abundance of oligochaete species between the filter zone and zones C and T. In addition, zone T had richer and more abundant communities of earthworms and enchytreids than zone C. Overall, these parameters appear to be higher than those observed during the Tin campaign.

Assessment of filter substrates over time and space

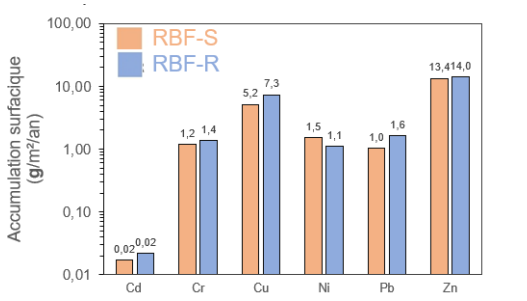
Spatial evaluation of sediment accumulation

Sedimentation and filtration are the predominant processes upstream and at the surface. Their impact decreases with distance, from 12 cm to less than 2 cm beyond 30 metres. Sediment is mainly present upstream, covering between 32% and 42% of the total surface area of the filter at T2. The average annual accumulation rate is estimated at 4.1 m^3/year (± 0.37) and tends to increase over time.

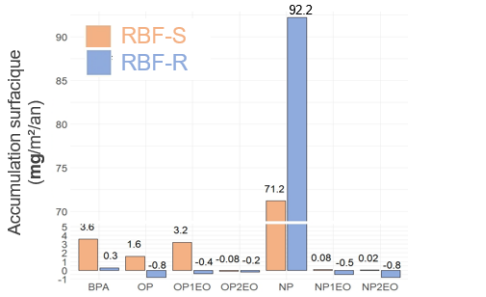


Annual accumulation in filters

At the filter scale after one year of feeding, trace metal elements accumulate while organic micropollutants (OMPs) do not, with the exception of 4-NP. No significant differences were observed between the two types of filter, the main variation being related to sediments.



Surface accumulation (**g/m²/year**) of TMs on the scale of RBFs

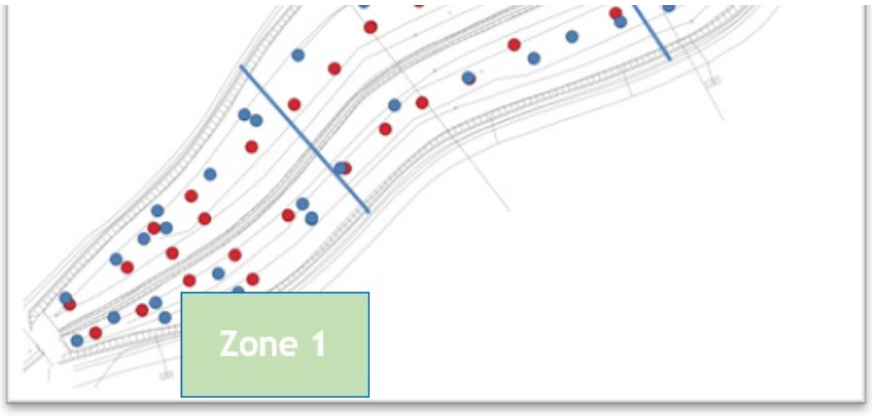


Surface accumulation (**mg/m²/year**) of OMPs on the scale of RBFs

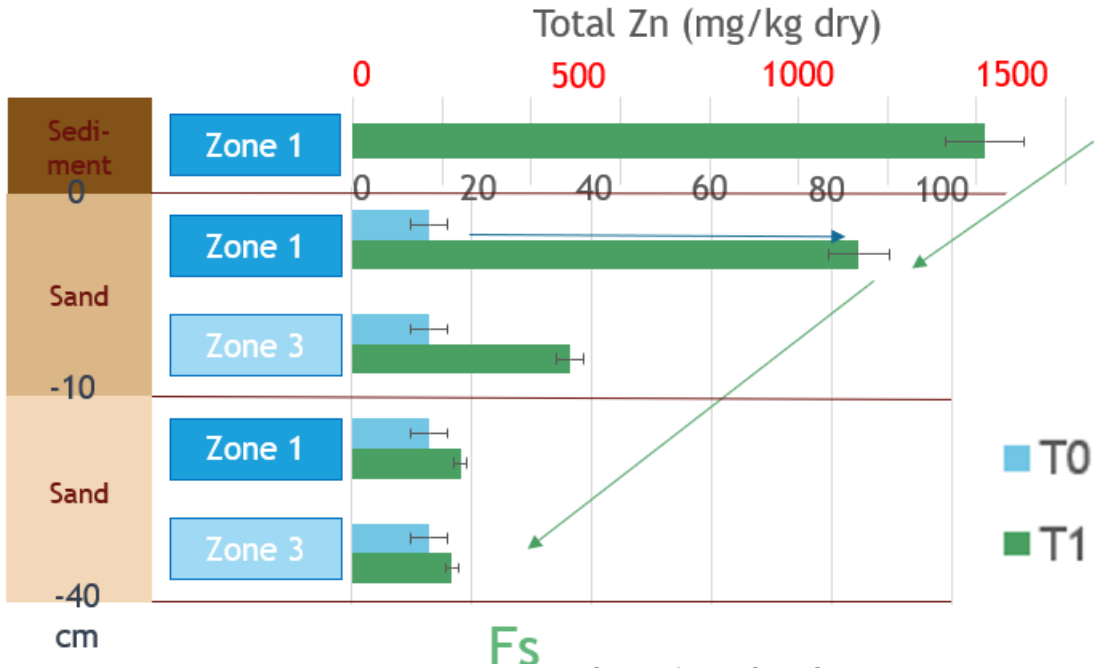
Vertical profile evaluation of zinc

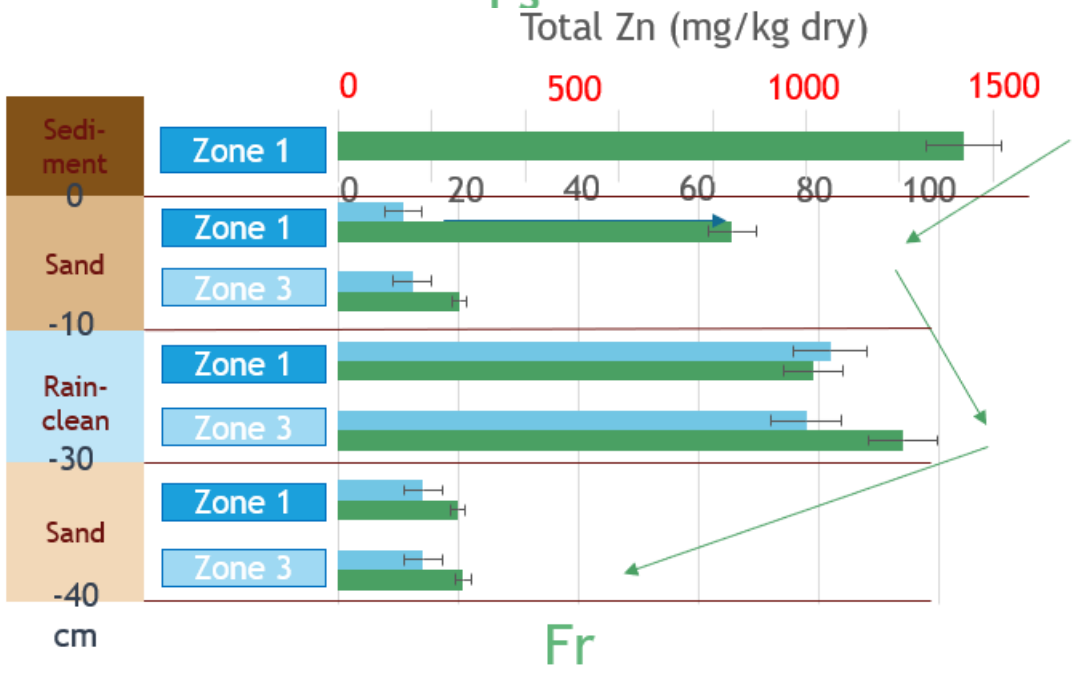
Zinc concentrations increased from one year to the next.

In terms of spatial distribution, the results show that after one year, most of the zinc is retained in zone 1, close to the water supply point, in both filters.



As for the vertical distribution, in the reference filter (Fs), a rapid decrease in concentrations was observed after the first 10 centimetres of depth. In the innovative filter (Fr), although the initial zinc concentration was higher in the surface sand, after one year it was close to that of the reference filter. This suggests that this metal is mainly retained in the surface layer of sand.





Finally, it is clear that the highest concentrations are found in the surface

Finally, it is clear that the highest concentrations are found in the surface sediment, which is consistent with the well-established fact that metals are strongly adsorbed onto suspended matter, which is trapped by the first layer of sand.

Accumulation of pollutants after 2 years of monitoring

Julia Roux's results

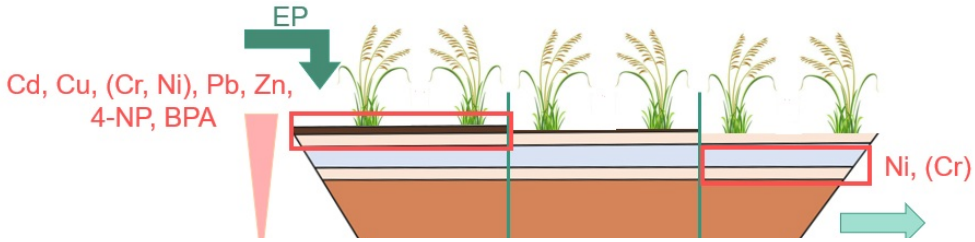
Thesis: Fate of micropollutants in a reed filter treating road runoff - Importance of microbial communities

Retention processes were assessed by studying the accumulation of micropollutants (MP). The heterogeneous water loads led to a spatial heterogeneity of contamination, with most of the micropollutants accumulating on the surface and upstream, in the surface sediments and sand. This reflects rapid trapping of the micropollutants, followed by low mobility, with the exception of chromium (Cr) and nickel (Ni), which tended to accumulate downstream and at depth, due to greater remobilisation by the water during dry periods.

The results showed that sedimentation and particle filtration were the dominant retention processes. Adsorption of organic micropollutants (OMPs) in sediments was also demonstrated, and was linked to hydrophobic interactions associated with high concentrations of organic carbon (Corg) in sediments.

Trace metals (TMEs) showed greater accumulation than organic micropollutants, with 4-NP predominating.

Finally, over a two-year period, filter-scale accumulation was similar, indicating a limited impact of Rainclean©, although local differences were observed. The water quality data will allow us to conclude whether a retention effect is present and whether the purification efficiency is improved in the RPFs, although a longer period is needed to fully assess its impact.

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