RETASTE Conference Abstracts
RETASTE-AWR-1493-In-person Oral
Rethymno, September 16-18, 2026
© Author(s) 2026 CC BY 4.0 License
DOI:10.5281/zenodo.23678089

Novel Challenges for Nature-Based Solutions Towards Safe Wastewater Treatment and Reuse

Thrassyvoulos Manios[1,*], Ioannis Daliakopoulos[1], Hans Brix[2], Pedro Carvalho[2], Joaquim Comas[3] and Gianluigi Buttiglieri[3]

[1]*Hellenic Mediterranean University, Greece*
[2]*Aarhus University, Denmark*
[3]*Catalan Institute of Water Research, Spain*

ACCEPTED

Abstract

In recent years, there have been increasing efforts to promote the implementation of Nature-Based Solutions (NBS) in domestic wastewater treatment. The new EU directive for Wastewater Treatment (EU 2024/3019) could easily lead to the conclusion that this new legislation creates opportunities for NBS in domestic wastewater treatment, by lowering the population threshold for mandatory sewage treatment from 2,000 person equivalents (p.e.) to 1,000 p.e.. However, the real situation is more complex and reveals a paradoxical conflict between the promotion of NBS and the practical, regulatory, and socio-economic challenges and constraints associated with their implementation. In fact, NBS (as any other relevant technology) serving less than 10,000 p.e. are excluded from the newly imposed effluent quality requirements, as well as from critical environmental and climate-related monitoring obligations, namely energy consumption and greenhouse gas emissions. However, this might not be entirely true.

The scientific community, moreover, is increasingly recognising contaminants of emerging concern (CECs), for example pharmaceuticals and personal care products, PFAS, microplastics and nanoplastics, and especially antibiotic-resistant bacteria and genes, as real threats to human health, environmental quality and biodiversity. This is likely to increase pressure for the relevant limits and monitoring requirements included in EU 2024/3019 to be expanded to all types and sizes of wastewater treatment facilities, and potentially to become stricter. Probably before that happens, the EU wastewater reuse regulation (EU 2020/741) could be amended to impose stricter quality thresholds for CECs in reusable effluents, as a response to the above-mentioned risk concerns. There is a large volume of raw-eaten vegetables that are currently irrigated with treated wastewater in which, however, CECs are not monitored. It should be noted that Regulation 2020/741 is a legal document that is far less strict than any of the national wastewater reuse legislations in the southern European states (Spain, Italy, Greece, Cyprus, among others). This change could partially come about because central wastewater treatment facilities will be able to achieve improved quality standards as a direct result of the EU 2024/3019 requirements.

This in return could create a paradox, where a decentralised wastewater treatment facility, such as an NBS, may comply with disposal legislation but will be unable to support effluent reuse, because reuse legislation will apply stricter limitations equally across sewage treatment

facilities, regardless of size. The effect of this on NBS development and operation could be devastating, especially in the Mediterranean basin, where climate crisis adaptation will require the utilisation of all available water resources. Based on the above, it is clear that NBS need to demonstrate that they can be upgraded to achieve the anticipated standards, regardless of whether this is legally required at the moment, in order to secure their future role in wastewater treatment and reuse.

Keywords: NBS, Wastewater Reuse

Acknowledgments: Horizon WIDERA - Novel NBS

ACCEPTED