



INTERUNIVERSITY PHD COURSE
“SUSTAINABLE LAND MANAGEMENT”
Cycle XXXVI

PhD Student:	Maria Grazia Giordano
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Title of the Research Project	Computational fluid dynamics as a tool for environmental impact assessment of wastewater diffusion in surface water bodies
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Summary of the Research Project

To minimize the environmental impact of outfall systems, through which wastewater is discharged in receiving water bodies after having undergone treatment, a careful design process is of the utmost importance. It is paramount to study the processes that take place inside the mixing zone, where contaminants are reduced by more than 99% due to the turbulent behaviour of jets discharged from diffusers and where entrainment plays a crucial role in diluting wastewater. This phenomenon can be analyzed with the help of mathematical and numerical models, both using pre-existing software and developing ad-hoc code. This project aims to develop models that can accurately describe diffusion and dilution of wastewater in receiving water bodies, employing computational fluid dynamics techniques that allow the study of systems both at large and at small scales. To validate and calibrate such models data obtained from laboratory and field experiments will be used. The goal is to achieve a detailed hydrodynamic description of jets discharged in water bodies and to offer new and effective tools as an aid for comparative assessments during outfall system design processes.

References:

- 1 - Malcangio D., Cuthbertson A., Ben Meftah M., & Mossa M. (2020). Computational simulation of round thermal jets in an ambient cross flow using a large-scale hydrodynamic model, *Journal of Hydraulic Research*, 58(6), 920-937.
- 2 - Baum M. J., & Gibbes B. (2020). Field-Scale Numerical Modeling of a Dense Multiport Diffuser Outfall in Crossflow, *Journal of Hydraulic Engineering*, 146(1), 05019006.
- 3 - Roberts, P., Salas, H., Reiff, F., Libhaber, M., Labbe, A., & Thomson, J. (2010). *Marine Wastewater Outfalls and Treatment Systems*. IWA Publishing.



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