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Integrated monitoring technologies for the management of a Soil-Aquifer-Treatment (SAT) system.

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Artificial recharge of groundwater has an important role to play in water reuse as treated wastewater effluent can be infiltrated into the ground for aquifer recharge. As the effluent moves through the soil and the aquifer, it undergoes significant quality improvements through physical, chemical, and biological processes in the underground environment. Collectively, these processes and the water quality improvement obtained are called soil-aquifer-treatment (SAT) or geopurification.
The pilot site of Lavrion Technological & Cultural Park (LTCP) of the National Technical University of Athens (NTUA), involves the employment of plot infiltration basins at experimental scale, which will be using waters of impaired quality as a recharge source, and hence acting as a Soil-Aquifer-Treatment, SAT, system.
he LTCP site will be employed as a pilot SAT system complemented by new technological developments, which will be providing continuous monitoring of the quantitative and qualitative characteristics of infiltrating groundwater through all hydrologic zones (i.e. surface, unsaturated and saturated zone). This will be achieved by the development and installation of an integrated system of prototype sensing technologies, installed on-site, and offering a continuous evaluation of the performance of the SAT system.
An integrated approach of the performance evaluation of any operating SAT system should aim at parallel monitoring of all hydrologic zones, proving the sustainability of all involved water quality treatment processes within unsaturated and saturated zone.
Hence a prototype system of Time and Frequency Domain Reflectometry (TDR & FDR) sensors is developed and will be installed, in order to achieve continuous quantitative monitoring of the unsaturated zone through the entire soil column down to significant depths below the SAT basin. Additionally, the system contains two different radar-based sensing systems that will be offering (i) identification of preferential flow effects of the TDR/FDR sensors and (ii) monitoring of the water table within the shallow karst aquifer layer.
The above technique will offer continuous monitoring of infiltration rates and identify possible mechanical or biological clogging effects. The monitoring system will be connected to an ad-hoc wireless network for continuous data transfer within the SAT facilities.
It is envisaged that the development and combined application of all the above technologies will provide an integrated monitoring platform for the evaluation of SAT system performance.