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Inspiring Groundwater

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- Strategy 1: Optimization under constraints considering the management requirements of an existing well field (maximum drawdown, maximum pumping rate of each well);
- Strategy 2: Optimization to study the opportunity of drilling and exploiting new wells while taking advantage of the existing water-supply pipe network.

Though it is usually considered that preserving groundwater quality necessarily implies restricted exploitation, this work shows that other exploitation strategies can reach this objective with a significant gain in the total extracted volume without creating new wells. Well-by-well analysis of the results shows that real-life tests can be carried out, first test show results in accordance with simulations.

Moreover, two alternative configurations, incorporating the creation of new wells, were tested for maximizing the capacity of the well field and optimizing the effective capacity of the existing pipe network. Substantial gains are expected from those configurations, reaching an additional 2.2 to 5.5 M m³/year.

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Preliminary Assessment Of Sediment Transport And Associated Bacteriological Contamination In A Mountainous Rural Karst Area (Sierra De Ubrique, S Spain)

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In rural karst areas, where agricultural and cattle activities are developed and quite often urban waste waters are not properly treated, the high probability of groundwater pollution occurrence together with the high vulnerability of carbonate aquifers poses a potential risk for human health. Sierra de Ubrique is a karstified carbonate aquifer system developed in Jurassic limestones and dolostones located in one of the wettest regions in Spain (NE of Cádiz province). This karst aquifer is recharged by rainfall infiltration through karst features, but also from concentrated runoff through Villaluenga shaft which is connected to a well-developed karst network with several syphons.

Groundwater discharge, which is mainly produced through three karst springs (Algarrobal and Cornicabra -permanent- and Garciago -overflow-), is also used for drinking water supply of Ubrique town (17,000 inhabitants). During flooding conditions, high turbidity events at the two permanent springs (up to 350 NTU) are simultaneous to maximum discharge, hindering the exploitation of groundwater for human consumption. This work aims to identify and characterize the main contamination sources and to understand the role of sediment transport in the occurrence of polluted groundwater episodes. For that purpose, a complete climate and groundwater monitoring network has been installed including a weather station and field devices for continuous record of physical-chemical parameters (discharge, electrical conductivity, water temperature, turbidity and tryptophan-like-fluorescence -TLF-). Additionally, numerous surface and groundwater sampling campaigns (December 2020 to March 2021) were performed to take samples for chemical and bacteriological determinations. The obtained results allowed the identification of different contamination types of anthropogenic origin as (1) organic (poorly treated waste waters, fecal remains from cattle activity and food factories) and (2) inorganic (leakage of waste water of storm tanks). The response times in output signals of the two main springs, maximum thresholds of pollutants and statistical correlations among specific chemical/bacteriological-like parameters lead to explain the main contaminant transport mechanisms, which greatly differ in the examined karst connections. Even though, the influence of the concentrated recharge is clear in both of the springs, as clayey sediments from the shaft catchment erosion and its remobilization from inside the system serve as the main transport vector for contaminants, so that pathogens and trace metals mainly travel attached to particles through adsorption and binding processes. The main outcomes and the methodology applied in this research will be transferable to intensely karstified areas worldwide where karst groundwater represents the main water source for urban development.