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A review of stormwater infiltration processes and applications in the Gaza Strip before 2023

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ABSTRACT

The key factor in enhancing groundwater recharge, providing flood protection, and ensuring sustainable management of water resources in coastal aquifers is stormwater infiltration, an essential hydrological process that enables stormwater to seep through the ground surface into the underlying soil layers. Global water demand is rising, and climate change is altering rainfall amounts and patterns over time, highlighting the need for a comprehensive understanding of the infiltration mechanism, influencing factors, estimation methods, and applications. This paper reviews and evaluates previously developed empirical and theoretical models used to estimate infiltration rates. Additionally, various recharging systems, such as artificial infiltration basins, vadose-zone wells, and injection wells, are discussed and assessed for their applicability in the Gaza Strip. The implementation of these systems may face several challenges, including soil characteristics, infiltrated water properties, and other natural conditions that significantly influence the infiltration rate and efficiency. The Gaza Strip particularly suffers from a scarcity of water resources, with rapidly depleting groundwater due to excessive extraction and seawater intrusion, which negatively impacts both the qualitative and quantitative properties of the groundwater. Therefore, stormwater infiltration has been widely applied in the Gaza Strip, and various techniques have been considered to enhance groundwater recharge. This study highlights the main challenges of different techniques applied in stormwater infiltration basins in the Gaza Strip. It was found that clogging of the infiltration basin floor is the bottleneck problem that substantially reduces basin infiltration capacity over time. Suspended particles in the captured stormwater settle and accumulate at the basin floor, forming a thick

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and dense low-permeability layer that prevents water from seeping and infiltrating into the underlying soil media. Sustainable and durable artificial infiltration basins require seasonal maintenance programmes, including cleaning, ploughing, and even soil replacement on the basin floor. Future studies are important to determine the most appropriate infiltration technique and optimal basin design that apply to the in-situ soil properties.

Keywords: Infiltration; stormwater; groundwater; infiltration basin; borehole; recharge; vadose-zone; percolation