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A SIMULATION-OPTIMIZATION MODEL FOR MANAGED AQUIFER RECHARGE THROUGH SURFACE INFILTRATION

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ABSTRACT: Managed aquifer recharge is increasingly being viewed as a water augmentation strategy to increase water supplies in many fast growing areas around the world. In particular, the use of surface infiltration systems is appealing because it exploits the vadose zone to provide additional treatment and as such can be used to recharge and reuse treated effluent. However, the success of soil aquifer treatment (SAT) systems critically hinges on a variety of factors including the way the water is delivered to these systems and the regulatory requirements on the recharging waters. In particular, the inadvertent introduction of pathogens into drinking water aquifers is a major concern. Combined simulation-optimization models have been seen as useful planning tools to evaluate the feasibility of water resources systems and facilitate stakeholder-driven planning and management. Therefore, the focus of this study was to develop combined simulation-optimization models to simulate ASR system operation. The simulation model is used to describe the movement of water in the vadose zone and is coupled to a transport model that simulates the fate of organic pollutants and microbes (viruses). The optimization model estimates the maximum amount of water that can be put into the SAT system over an assumed planning period and also provides the timing for these injections as well (cyclic operations). The constraints of the model include acceptable concentrations in the recharging water, availability of water to recharge during several stages of the planning horizon. The results of the modeling study indicate that cyclical operation of the SAT systems provides better infiltration capacities than a continuous model. The regulatory constraints on the model have a significant impact on the amount of water that can be recharged. The model can be used in an interactive mode to facilitate discussions with regulatory decision makers and evaluate the feasibility of SAT systems during water resources planning.

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