Enabling the reuse of industrial wastewater to meet intense freshwater demands by greenhouse agriculture using Aquifer Storage and Recovery (ASR)

Niels Hartog[1], Koen G. Zuurbier[1], Klaasjan J. Raat[1], Gerard A. van den Berg[1]
[1]KWR Watercycle Research Institute, Nieuwegein, The Netherlands

ABSTRACT

Worldwide, the continuous and reliable availability of freshwater of high quality is a precondition to meet domestic, industrial or agricultural demands. Meeting these demands at locations where groundwater is brackish or saline, is challenging, particularly where fresh water requirements are intense and economic importance is high. The aim of this study was to realize an aquifer storage and recovery system to be able to reliably provide sufficient fresh water to intensive greenhouse horticulture overlying a confined, brackish aquifer at Dinteloord, The Netherlands. Here, 260 hectares of greenhouse area is developed although serious fresh water shortages arise during drought periods as insufficient rain can be collected in surface basins and the inflow of fresh surface water to the area is limited. Therefore, to meet the fresh water demands the wastewater from a nearby sugar factory was chosen as the source for irrigation water. This waste water was treated by rapid filtration, ultra-filtration (UF) and finally RO-treatment. Since the waste water production occurs in autumn a large scale aquifer storage and recovery (ASR) system was realized with the ASR well field connected to a 5 km distribution loop to ensure sufficient fresh water availability during drought periods in spring and summer. The ASR system was equipped with multiple partially penetrating wells to allow counteracting buoyancy induced recovery losses.Based on the results of a test cycle (10,000 m^3 injection and recovery) the system could be optimized to recovere virtually all the yearly infiltrated water in the subsequent cycles. Despite the strict sodium limit, the observed enriched sodium enrichments in the recovered water by cation-exchange during the test cycle are expected to cease based on the reactive transport modelling of future cycles. The release of Fe and Mn to the infiltrated water from the dissolution of carbonates however poses a risk for clogging of the irrigation system and therefore a threat for the direct use of the recovered water and will be studied in further detail as the ASR system develops to include 8 wells with a total storage capacity of 300,000 m^3 and a supply capacity of 100 m^3/hour (at a cost of 0.4 euro/m^3).

Contact Information: Niels Hartog, KWR Watercycle Research Institute, PO box 1072, NL-3430BB Nieuwegein, The Netherlands, Phone: +31 30-6069652, Email: niels.hartog@kwrwater.nl