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A case study of a rainwater harvesting system for the irrigation of green areas within an urban reconversion project

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RainWater Harvesting (RWH) and the use of the collected rainwater for the irrigation of urban green areas allow saving potable water resources with respect to a traditional supply from the urban water distribution system. The potential for RWH and reuse depends on the urban surfaces made available for rainwater collection, the associated runoff coefficient and the statistics about the frequency and intensity of rainfall events in the region (the rainfall climatology), compared to the irrigation demand.

In this work we present a case study of a RWH system in course of realization within a reconversion project of a former military area, located in Genova (Italy). The project provides for the rainwater, suitably treated if necessary, to be collected and used for irrigation in the park. Three rainwater collection scenarios (from ground surfaces, sheet metal roof and brick roof) are investigated also by varying the size of the storage tank from 30 to 480 cubic meters. The daily rainfall data as observed in the period 1833-2008 in Genova are used.

We implement a behavioural model to simulate the operation of the RWH system in different conditions. The model is updated with a suitable algorithm for the optimization of the irrigation system in case of significant precipitation events and in the following days. The algorithm accounts for the actual soil water availability for the vegetation and its decay with time, considering the soil type and vegetation.

As the performance indicators for the RWH system, two temporal reliability indexes (fraction of time when storage is not empty and when the demand is fully met) and two volumetric reliability indexes (efficiency and overflow ratios) are calculated per each scenario, upon varying the size of the tank. Finally, the detention time is calculated to assess the water quality deterioration while stored in the tank. The optimal sizing of the storage tank and the mean annual potable water saved are calculated for the three examined rainwater collection scenarios and compared.

The results of the present case study can be applied to a larger scenario by contributing to the cost reduction for irrigation of green urban areas, the street washing and the toilet flushing that do not require using precious potable water.