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## Possibilities of rainwater utilisation in densely populated areas including precipitation runoffs from traffic surfaces

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### Abstract

Although Germany is not considered a water-poor country, rainwater utilisation in households became widespread since the 1980s. Today, about 50,000 professional rainwater plants are being installed every year mostly in new one-family houses. These plants collect exclusively water from the roof which is filtered, stored and primarily used for toilet flushing, garden watering and household laundry. A novel approach in Germany is the use of the more polluted rainwater draining from streets and courtyard surfaces for treatment and reuse as service water, which is the topic of this paper. Intensive investigations have shown that rainwater needs to be treated if street runoffs are diverted to the cistern. Stormwater in this case originates from roofs, courtyards and a one-way street with low traffic density. Compared to high traffic density areas, the rainwater is relatively low polluted (COD: mean 14 mg/L, max 36 mg/L; BOD<sub>7</sub>: mean 6.4 mg/L, max 45 mg/L; *E. coli*: median 1060/100 mL, max 43,000/100 mL). Treatment follows in a substrate filter (aerobic biological treatment) with an eventual UV disinfection of the treated rainwater. This treatment proved to be inexpensive with good effluent quality for use in toilet flushing and garden watering (COD: mean 6.8 mg/L, max 15.8 mg/L; BOD<sub>7</sub>: mean 0.9 mg/L, max 3 mg/L; *E. coli*: median < 4/100 mL, max 43/100 mL). This form of harvesting could be considered a viable option for densely populated urban areas. It also contributes in reducing the drinking water consumption and wastewater production as well as minimising pollutant entry into surface waters, without the need for a sewer connection. About 70% of the toilet-flush demand (about 2500 m<sup>3</sup>/a) was replaced by treated stormwater without any comfort loss. A total energy demand of only 0.88 kWh/m<sup>3</sup> is required for treatment and distribution. Compared to the Berlin drinking water quality, the use of the much softer rainwater has also the advantage of less lime depositions on sanitary facilities.

*Keywords:* Rainwater harvesting; Stormwater recycling; Traffic surfaces; Biological treatment; UV-disinfection; Toilet flushing; Service water

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