



## Using integral pumping tests in urban hydrogeology to estimate sewer leakage

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The new research platform “WASSER Leipzig” (Water And Sewershed Study of Environmental Risk in Leipzig) was founded to investigate the impact of urban land-use on groundwater quality and quantity. The research is focused on the occurrence and transport of micropollutants like PPCP (Pharmaceuticals and Personal Care Products) in urban aquifers, a topic that recently has become a subject of major research interest. Many studies show that these substances origin from sewage in urban areas. Currently, 20 % of the sewer network in Germany needs to be reconstructed. Thus, 5 – 20 % of the dry-weather flow in the sewer network is lost into the subsurface and the untreated sewage may contaminate groundwater resources. In first sampling programmes the PPCP carbamazepine and galaxolide were detected in the groundwater of Leipzig in concentrations exceeding 50 and 150 ng/l, respectively. In the next step of the research project we plan to investigate the impact of a leaky sewer section on the groundwater quality. Leakage flows are characterized by a high spatial and temporal variability. Small damages in the sewer network cause a large number of different point sources. Sampling in surrounding observation wells would only give point information which may not provide sufficient data for reliable results for mass flux estimations. Integral approaches to measure the concentrations of PPCP in the groundwater near a leaky sewer can overcome the problem of spatial heterogeneity. Integral pumping tests have already been successfully applied for estimation of mass fluxes and average concentrations at numerous contaminated sites. We present a new methodology to estimate leakage from a sewer section using the integral pumping test approach. The test arrangement consists of pumping wells located along two control planes perpendicular to the natural flow. The control planes are situated upstream and

downstream from the leaky sewer. Leakage from the sewer section will increase PPCP concentrations from the upstream control plane to the downstream control plane. This new leakage estimation methodology may be a useful tool to reliably quantify substance import from the sewer network into the groundwater.