Quantifying Groundwater Drainage: A Case Study in New Orleans

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In this study, the consequences of the mismanagement of water infrastructure systems were identified by investigating groundwater drainage in New Orleans, Louisiana. Due to the age of these systems, damage caused during natural disasters like Hurricane Katrina, the ground movement sensitivity of the region and the existing land subsidence, these networks are in poor shape. The interactions between three water infrastructure systems and the groundwater were analysed and quantified: the sanitary sewer system, the storm water drainage system, and the drinking water system.

For the sanitary sewer system, an existing QGIS model and daily wastewater treatment plant (WWTP) influent time series were used to quantify the amount of groundwater drained into the sewer system via manholes, illicit connections, and damaged pipes. The quantification of the volume of water drained through the storm water drainage system was done by comparing both hourly and daily precipitation time series and pumping station runtime data. Lastly, the amount of drinking water infiltrated into the groundwater was quantified by using a water audit written in 2019. In the water audit, the total water losses are built up of the real losses and apparent losses. in which the real losses consist of the of transmission and distribution main leakages, and service connection leakages, while the apparent losses include customer metering inaccuracies, water theft, illegal connections, data handling issues, and errors in the billing system. In this study, only the real losses were examined when quantifying the water leaking into the ground.

The following notable conclusions were drawn: 1) 50 % of the total water treated in the WWTP is groundwater, adding a large amount of unnecessary stress to the treatment process, 2) the storm water drainage system is the largest groundwater drainage component contributing to 58 % of the total groundwater drainage and 3) 55 % of the produced drinking water infiltrates into the ground during distribution, meaning the drinking water losses are a larger groundwater recharge component than the annual precipitation surplus. The conclusions made in this study reveal the severe consequences of damaged water infrastructure systems and the importance of having regular maintenance.