

Interactions within wastewater systems

Summary

The research project Interactions within wastewater systems focussed on analysing the importance of these interactions on wastewater system performance. Based on literature, measurements and model results wastewater treatment plants are shown to be sensitive to fluctuations in both the influent flow and composition. A sensitivity analysis using a well-calibrated ASM1 model resulted in minimum requirements for sewer process models to be used within an integrated approach.

The quality of model results achievable with state of the art sewer models was analysed for the most important in sewer processes. These processes were analysed using both field data and a thorough analysis of the sewer models. Based on the results it is concluded that current models are sufficient with respect to hydrodynamics and the transport of solutes in order to be able to analyse the interactions within the wastewater system during both dry and wet weather flow.

Finally, the impact of the interactions within the wastewater system on wastewater system performance is illustrated in a semi-hypothetical case study. In this case study, the impact of measures such as additional storage or pumping capacity on total wastewater performance was analysed for the parameters CSO volume, ammonium, total nitrogen and biodegradable COD. The results confirm literature in showing that the optimal configuration of the wastewater system in terms of storage or pumping capacity depends on the parameter selected to assess wastewater system performance. This is due to the fact that increasing the storage and pumping capacity can have a detrimental impact on wwtp performance, especially with respect to nitrogen removal. In addition, it was shown that the characteristics of a storm event determine the available optimisation potential of wastewater systems. For large storm events causing CSO's to spill, a trade-off has to be found between reducing the pollution discharged via the CSO and the wwtp. For smaller storms, comprising the majority of storm events, wastewater system performance could easily be improved by temporarily reducing the pumping (or interceptor) capacity to a level just not causing the CSO's to spill. It has to be noted, however, that this is of course only one of the options available for wastewater system optimisation. Moreover, it is illustrated that due to the typically diurnal dwf profile, the time of the onset of a storm event is very important with respect to the total pollutant load discharged via both the wwtp effluent and the CSO.

The main conclusion is that the interactions are indeed important with respect to wastewater system performance and that current knowledge allows assessing these interactions. Clearly, wastewater system optimisation studies, as often applied in the Netherlands, could benefit from this knowledge in terms of determining a trade off between measures reducing CSO discharges and discharges via the effluent of a wastewater treatment plant.