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## **Modelling the impact of implementing Water Sensitive Urban Design at a catchment scale.**

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Stormwater management using Water Sensitive Urban Design (WSUD) is expected to be part of future drainage systems. This project aimed to develop a set of hydraulic models of the Harrestrup Å catchment (close to Copenhagen) in order to demonstrate the importance of modeling WSUDs at different scales, ranging from models of an individual soakaway up to models of a large urban catchment. The models were developed in Mike Urban with a new integrated soakaway model. A small-scale individual soakaway model was used to determine appropriate initial conditions for soakaway models. This model was applied to a 22 year rain time series and statistical analysis performed. Results show that soakaways, depending on the design criteria, are on average 20-60% full at the beginning of rain events; outflow intensities from soakaways are reduced depending on the soakaway design return period, and the annual infiltration is > 80% of the annual precipitation even for small soakaway volumes.

A local scale (<10ha) model examined the benefit of employing soakaways and detention basins for reducing flooding. A baseline scenario was set up and the areas which must be disconnected in order to avoid flooding identified. Different WSUD solutions such as soakaways and basins ('skybrudsfaskiner') were applied to these areas, with the WSUDs being dimensioned using simple estimation methods. Results showed that soakaways would require big volumes if events > 0.5 year return period are to be handled. However, smaller temporary detention volumes can reduce peak flows.

The catchment scale model was then used to determine the potential impact of different percentages of impervious area disconnection (30, 50 and 70%) on catchment flooding and Combined Sewer Overflows (CSO). Results show that 30% disconnection would considerably reduce CSOs, whereas 70% disconnection is required to significantly reduce flooding.

This study showed that WSUDs can significantly reduce flooding and runoff volumes discharged into the sewer system. However, large storage volumes are required to reduce flooding for design events. It was shown that combined soakaway-basin solutions require much less volume for peak reduction compared to ordinary soakaways and they are more robust towards peak reductions. An improved method for choosing initial conditions for soakaway models was proposed. This study presented an approach for designing WSUDs at the catchment scale and demonstrated the importance of employing both individual soakaway and catchment scale simulations. Flooding was shown to be generated by either excess inflow from upstream parts of the catchment or by reduction of downstream drainage capacity. From a hydraulic point of view WSUDs are shown to have the potential for flood and runoff volume reductions.