Steps towards Quantitative Assessment of the Effects of Water Sensitive Urban Design -
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For 150 years combined sewerage systems have been serving the task of efficiently draining Danish and other Nordic cities. Over the years, society’s expectations and needs have changed, and planners have upgraded and extended the systems. Current challenges include climate change, growth and densification of cities, and demands for sustainability and multifunctionality. One of the solutions suggested is decentralized source control management, also known as Water Sensitive Urban Design (WSUD). However, previous research has shown that WSUD must be seen in a wider context than the mere retrofitting of sewage systems, since it adds value to a city in many other ways. Thus successful planning of WSUD must bring together drainage engineers with city planners and architects. Our project aims to develop a decision support tool to assist in the interdisciplinary planning process of transition towards WSUD in existing urban areas. The tool will facilitate a quantification of the effects of implementing WSUD on a city district level.

This project considers an effect of implementing WSUD to be any measurable impact on the physical and social environment. The tool will include simple methods for assessing effects such as reduction in combined sewer overflow, increase in groundwater recharge, reduction in use of potable water, and increase in local recreational and property value. The tool will assess these effects for a number of different WSUD techniques, including green roofs, rainwater harvesting, swales, soakaways, rain gardens and retention ponds. Thus the tool will help answer questions such as what is the expected reduction in potable water consumption if rainwater harvesting is implemented in a given neighborhood. The global constraints, such as restrictions on usage of nonpotable water, and local constraints, such as the available area for collection of rainwater, will be taken into account in order to produce a realistic assessment. The assessments will be presented in an overview matrix to make the tool user friendly. The matrix results can further be summarized by using the optional weighting matrix according to stakeholder preferences.

Results presented will include findings from a review of the scientific literature and interviews with key stakeholders. These show that a large diversity of decision support tools for WSUD exist and are being used. However, decisions remain difficult because the tools use different framings and contextual information is difficult to include in their assessments. We will present results from applying our suggested approach on two case studies, one urban area in Århus and one in Copenhagen. Methods to select the optimal solution will be described, and the difficulties of composing decision criteria discussed. The best solution is also shown to be site specific, with local geographical constraints playing an important role in the outcome. An evaluation of the uncertainty in the predictions will be discussed, set in perspective against the general uncertainties in this type of planning. Finally we will present plans for implementing the tool in a software package to be made publicly available.

The results of this project are important because Danish cities are investing large amounts of resources in urban infrastructure renewal. For example, the Danish government agreed with the Danish municipalities to spend 2.5 billion DKK in 2013 on improving stormwater management to mitigate impacts of climate change. The municipalities are eagerly waiting for tools like the one developed in this project so that they can effectively prioritize their spending.

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