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Application of LID control technologies to the urban drainage systems

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Nowadays the evaluation of the consequences of climate change in urban drainage systems represents one of the most challenging aspect in the field of environmental and hydraulic engineering.
This issue is particularly crucial in the least developed countries of the world, where an uncontrolled expansion of the cities and of the activities is often observed [1]. Therefore, the analysis of the evolution of run-off events and the transformation of the hydrological cycle should be intended as a fundamental step for the sustainable design and management of hydraulic systems.
With this aim, Best Management Practices (BMPs) are often adopted in urban drainage systems. They consist of strategies, practices and methodologies for the prevention, the reduction and the suppression of the risks of flooding and of discharging pollutant loads caused by rainfall in receiving water bodies. Two different BMP categories are usually considered: non-structural measures based on the issuing of laws and rules, and structural interventions, aimed at reducing both the pollution loads of rainfall waters and the related hydrographs.
In this study, the second category is addressed, and in particular the use of LID (Low Impact Development) practices. In fact, green roofs, rain gardens, infiltration trenches, permeable pavements, rain barrels, vegetative swales and bio-retention cells are analyzed in order to verify their effectiveness in reducing peak flows. The quantification of the hydrological losses caused by infiltration and evapo-transpiration, is also taken into account.
The SWMM 5.1 hydraulic solver [2], released by the U.S. Environmental Protection Agency (EPA), is used in reference to an ideal urban basin, by observing the software options of modeling the LID applications in urban catchments. A sensitivity analysis is developed about the LIDs parameters, and the benefits due to each available practice are compared in terms of reduction of peak flows and of the delay of discharge release in downstream drainage systems.

[1] CLUVA (CLimate Change and Urban Vulnerability in Africa), "Introduction to the CLUVA Project", http://www.cluva.eu.

[2] Rossman L.A. (2010), Storm Water Management Model. User's Manual v. 5.0, Water Supply and Water Resources Division. National Risk Management Research Laboratory, Cincinnati (US).