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Development of sustainable stormwater management using simulation-optimization approach under climate change

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Climate change had altered the hydrological processes globally with result that the extreme events have an increase in both the magnitude and the frequency. In particular, the high intensity rainfall cause the severe flooding had significantly impacted on human life and property in recently year. The traditional facility to handle runoff is the drainage system which is designed in accordance with the intensity-duration-frequency (IDF) curve. However, the flooding occurs once the drainage capacity is overwhelmed by excess stormwater. Thus the general solution are that expanding and upgrading the existing drainage system or increasing the design return period for new development areas to reduce flooding. Besides, another technique which is low impact development(LID) is regarded as more sustainable solution for stormwater management. The concept of LID is to control stormwater at the source by decentralized practices and mimic the predevelopment hydrologic conditions including storage, retention and high rate of infiltration. In contrast to conventional drainage system aims to move runoff away as quickly as possible, the LID approach attempts to keep runoff on site to reduce peak and volume of flow. The purpose of this research is to identify the most cost-effective measures for stormwater management after the analysis of the strategies combining drainage system and LID on various land use planning. The case study is a rural community in Hsinchu in Taiwan, and having residential areas, farms and pond. It is assumed that two land use layout are planned and drainage system are designed for 2-,and 5-year return period events. On the other hand, three LID technologies, namely green roof, porous pavement and rain barrel, are selected to place in the scenario of the drainage system for 2-year return period event, and the minimal peak flow is target to optimize LID placement by simulated annealing algorithm. Moreover, the design storm under climate change are derived from the revised IDF curve. After that the storm water management model (SWMM) is used to simulate these strategies for a spectrum of design storms, the cost and the benefit can be analyzed to provide government an advice in developing stormwater management under uncertain conditions of climate change.