

ILLUDAS-NPS Model for Computation of Nonpoint-Source Pollutant Loads in Urban Drainage

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The ILLUDAS-NPS (Illinois Urban Drainage Area Simulator- NonPoint Source) model was proposed to calculate the nonpoint-source pollutant loads in urban drainage. This model is based on the existing ILLUDAS model, and modified for use in the water quality analysis process during dry and rainy periods. For dry periods, we used the coefficient specification method for discharge and water quality, and for rainy periods we used the daily pollutant accumulation method and the washoff equation for computing water quality for each specified point in time. The land uses are separately classified as single family residential, multi-family residential, commercial/industrial, and park/agricultural land. After considering impervious area and dry periods, we calculated accumulated pollutant loads before incipient rain. The ILLUDAS-NPS model has not much input data, average in complexity, and is able to analyze five water-quality constituents (SS, BOD, COD, TN, TP). In addition, this model can convert calculation time intervals in accordance with rainfall data variation, and simulates hydrographs and pollutographs in major nodes of a drainage system. In this research we analyze the runoff, quality characteristics in the target basins and evaluate the difference between ILLUDAS-NPS and other models (SWMM, STORM). We also carried out optimization and sensitivity analyses for the major parameters. Based on the results, we investigated the variation of pollutant loads by runoff, EMC, and unit loads. Sensitivity analysis showed that among the major variables the dry day and pollutant buildup coefficients are the most sensitive to changes of peak concentration, followed by the SS availability coefficient, the washoff coefficient, and the SET availability coefficient in order. In pollutant loads that varied in accordance with runoff characteristics, the washoff increased due to concentrated rainfall intensity in cases of the Hong-je Basin (Event-3) and Gun-ja drainage area (Event-5). The results of verification showed that the ILLUDAS-NPS model provides outputs generally similar to the measured data on runoff volume, peak runoff, total loadings, peak concentration and time of peak concentration for five rainfall events in the Hong-je Basin and Gun-ja drainage area in Seoul. The outputs also proved to be similar to those of the SWMM and STORM models. keywords: Urban Drainage, Water Quality, NPS, ILLUDAS, ILLUDAS-NPS, SWMM, STORM