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Research on the pollutant emission from storm drainage system of urban areas on the example of Łódź city

The effect of stormwater quality on the water receiver has a considerable influence for its aquatic wildlife. Polish law defines the maximum permissible total suspended solids concentration level in stormwater directed to the receiver as 100 mg/dm^3.

The dissertation presents the research results on pollution of stormwater emitted by the real storm drainage system. The drainage system has been equipped with a monitoring station consisted of a flowmeter and two samplers: at the main sewer outlet and the outflow from the storage-settling tank prior to the water receiver "Sokołówka".

In order to determine the quality and quantity of stormwater a hydrodynamic model of the real catchment has been created. In the study, an existing urban catchment area - a housing estate called "Liściasta", which is located in the northern part of the city of Lodz, has been used.

The numerical calculations have been performed using EPA SWMM v. 5.1.010 software and format of local input data has been adapted for the case of rainfalls distributed over the city area. In consequence, the simulation of all observed runoff events was based on real rainfall data obtained from the municipal pluviometric monitoring system.

In order to demonstrate the correlation of stormwater contamination and precipitation characteristics, the lab tests of total suspended solids, chemical oxygen demand, turbidity, content of nutrients (Kiejdahl nitrogen, total phosphorus, silicon) and the content of heavy metals (cadmium, lead, copper) have been performed. The analysis also included determining the accumulation and washoff of the analyzed pollutants on the catchment area. The amount of emitted loads were compared with rainfall parameters like its intensity, depth, duration as well as antecedent dry weather period.

Next, the model was calibrated and verified on the basis of all accepted measurements gathered at the outlet of the catchment. In addition, a sensitivity analysis of the model on its selected parameters was performed. Moreover, the basic parameters taken into account in the mathematical modeling of the surface runoff have been discussed. In addition, the effectiveness of stormwater treatment in the storage-settling tank together with determining pollutant loads discharged into the water receiver has been determined.

During this study, the exceedance of total suspended solids concentration in comparison to the permissible concentration level was determined. The results of presented analyses prove that quality and quantity monitoring of stormwater should be conducted on urban catchments. It enables the identification of the necessary effectiveness of its pretreatment.