MODELLING INSIGHTS INTO POLLUTANT WASH-OFF FROM URBAN CATCHMENTS IN QUEENSLAND, AUSTRALIA

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EXTENDED ABSTRACT

The progressive development of catchments alters catchment hydrology and affects stormwater runoff quality. The rapid urbanisation of South East Queensland (SEQ) has had a significant impact on natural waterways in the area. Efforts to develop predictive models for pollutant wash-off, applicable to this region have been severely constrained due to the limited understanding of the behaviour of key pollutant parameters and relationships between parameters. This particularly applies to suspended solids (SS) which has been identified as a key pollutant in the context of water quality management. It acts as a potential carrier of other pollutants. Commonly, the removal of SS is a key management strategy adopted for urban stormwater water quality improvement. It is a fundamental parameter in the development of predictive models for water quality.

This paper presents a study on pollutant wash-off in SEQ Australia by analysing water quality data of three primary catchments and three subcatchments with differing land use in the Gold Coast region. Automatic monitoring stations were established at the outlet of each study area to record rainfall, stream-flow and a range of water quality parameters. The interactions of various pollutants and in particular suspended solids and its linkages with organic matter were explored. This is an important precursor to developing technically meaningful relationships to describe the impacts of catchment urbanisation. The outcomes derived provide a crucial insight essential for developing scientifically robust predictive models of pollutant washoff from urban catchments.

Based on a univariate statistical data analysis, it was found that from among the three primary catchments, stormwater runoff from the highly urban catchment has the highest mean concentration and standard deviation for the pollutant parameters. Among the three subcatchments, stormwater runoff from the area with detached housing exhibited the highest concentration and variability of pollutants. Multivariate chemometric analysis confirmed that as urbanisation becomes more intensive, much of the pollution is moving in dissolved form and is more bio-available. Secondly, SS is only weakly correlated with organic carbon. Hence most organic carbon would be present as dissolved organic carbon (DOC). From a water quality perspective, DOC plays a major role in the bioavailability of heavy metals and hydrocarbons.

This paper identifies appreciable insights into non-urban, urbanising and urban catchments in South East Queensland, Australia. The common management technique of dealing with suspended materials as a primary treatment for urban stormwater quality are shown to be ineffective as SS are not correlated with TN, TP or TOC. It could well be that this condition is linked to the climatic and rainfall conditions experience in this region which significantly influences pollutant composition, build-up and wash-off.

Key words: catchment urbanisation, urban water quality, chemometrics analysis