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Morphologic approach in studying developing urban watersheds

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It has been recognized that the main features of natural areas modified by urbanization and directly related to the quantity and rate of stormwater runoff are the natural surface detention, the soil infiltration characteristics and the drainage pattern formed by natural flow paths. At present, changes in the infiltration and storage characteristics due to urbanization are understood and considered in runoff drainage criteria, which attempt to imitate the natural infiltration and storages capacity. However, there is still an important lack of knowledge as to whether the drainage and control practices applied to an urbanizing watershed will actually preserve its natural dynamic equilibrium. Particularly, it is not clear how modifications of the drainage pattern in natural basins due to urbanization affect this equilibrium. The quantification of these changes has not been demonstrated in detail, and runoff drainage criteria currently do not take into account measures that attempt to imitate the natural structure and organization of drainage patterns.

Several approaches are currently available to characterize morphological and topological features and properties of natural basins. These approaches allow the quantification of these properties through indexes, metrics, power functions and scaling laws. Exten-

sive research by a number of investigators has proved that comparable characteristics and scaling properties can be observed at different locations, with diverse geological conditions, climates, vegetation and soils, with scaling parameters and morphologic descriptors being very similar for all these locations. These similarities respond to general operating criteria that control the manner in which river basins perform.

The objective of this work is to present the main characteristics and advantages of a morphologic approach to characterize urban watersheds and to evaluate and quantify the changes in the morphologic and topologic features characterizing natural areas associated with the urbanization process. A case study is presented and different morphological and topological descriptors are used to compare the pre- and post-development scenarios. Main descriptors included in this work are the width function and the scaling function of contributing areas and stream lengths. Preliminary results show that (1) the morphology and topology of natural areas drastically change once they are urbanized, and; (2) it is observed an underlying organization which might represent the way in which urban areas and drainage systems are developed.

The final results of this research will be relevant since they will explain in detail morphological and topological modifications associated with urbanization that currently are not clear. Additionally, this study will provide new knowledge to improve the hydrologic characterization of urbanization and the design of drainage systems allowing the reduction of negative impacts of urban areas.