Geographic Information Systems Based Urban Drainage Efficiency Factors

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SUMMARY

Urban areas in the developing world are experiencing increasingly dangerous flood events due to urban constructions and climate change. Urban flooding has become a major global concern, and for obvious reasons it is mostly an urban phenomenon. Urbanization creates impervious ground surfaces, inhibiting infiltration. Ill-advised urbanization practices lead to the blockage of natural flow routes. Urban centres are growing very fast in Africa. Where drainages are constructed they are mostly road edge drainages constructed to protect the roads instead of landscape drainages. Urban flooding can only be taken care of by efficient landscape drainages. The research work reported here determined efficiency factors of drainages which include the locations, alignments, slopes and sizes of drainages on a Geographic Information Systems (GIS) platform. The aim of the drainage efficiency factors guidelines is to ensure that the drainages will serve to convey runoff in ways that eliminate the danger of either erosion or flooding to the environment. The research effort created a Digital Elevation Model (DEM) of Owerri in Southeast Nigeria, using data from topographical maps of the city. The data was authenticated using three dimensional (3D) coordinates of sample points derived from Global Navigational Satellite Systems (GNSS) surveys. The DEM was processed by the ArcHydro software to determine primary natural flow routes and the sub-catchments that flood them. The primary landscape unit for drainage design is the subcatchment. The size of each sub-catchment useful for computing volumes of runoff that would have to be conveyed by the constructed urban drainages were determined using GIS. A scheme of urban drainage network as a runoff collector system that conveys runoff from the entire landscape to the primary drainage routes is suggested. The efficiency factors determined for Owerri were used to test the existing drainage systems. The failure of the existing drainages to conform with the guidelines explains why the study area would flood at every rain storm event.

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