

# **Quantitative Analysis of Geomorphologic Characteristics for Surface Runoff Determination in Amala River Catchment in Kenya**

## **ABSTRACT**

Hydrological response of a catchment is a function of rainfall as influenced by catchment characteristics comprising geomorphology, land cover and management practices. In this study, the analysis mainly focused on how geomorphological characteristics influence the catchment hydrological response. Geomorphological analysis can be used to characterize the catchment features that affects drainage network. These characteristics are catchment specific and therefore unique. The geomorphologic characterization of a catchment provides an insight on its hydrologic response. The objective of this research was to quantitatively analyze geomorphologic characteristics of Amala catchment using ArcGIS tools and infer its hydrological behavior. The morphometry of the catchment was derived from the DEM within ArcMap environment. These parameters as well as mathematical map equations were used to derive geomorphological characteristics. The results show that Amala catchment is elongated with uniform lithology and a higher probability of delayed peak hydrographs due to longer lag time and time of concentration. The catchment exhibits dendritic drainage pattern with an average bifurcation ratio of 4.26 which is closer to the upper bound value of 5. This indicates a reduction in peak flows and a delayed time to peak. The surface runoff conveyance efficiency was low and non-uniform with average drainage density of 1.073 km/km<sup>2</sup>. The catchment was characterized by higher infiltration characteristics as compared to surface flows, this varied spatially, with sub-catchments far North of the outlet having high infiltration than those near the outlet. The catchment relief was characterized as steep and therefore high stream velocity were inferred. The investigation and findings of these study on catchment geomorphology and inferred hydrologic behavior will be of great importance in catchment management, water resource planning within the catchment and water harvesting at spatial scale. Thus, the outcomes provide a baseline for informed water pan and water harvesting structures siting.

**Keywords:** *Drainage density, Geomorphologic characteristics, Infiltration number, bifurcation ratio, dendritic drainage.*

## **1. INTRODUCTION**

Hydrology is an important study that entails occurrence, distribution and environmental aspects of water on, below and above the surface of the earth. A river catchment is a basic part of runoff generation. The runoff resulting from a catchment is a response function of rainfall received within the catchment [1]. The hydrological response of a catchment