MODELING OPEN CHANNEL FLUID FLOW PAST A TRAPEZOIDAL CROSS-SECTION WITH A SEGMENT BASE HAVING LATERAL INFLOW CHANNEL

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DECLARATION AND RECOMMENDATION

Declaration

This Thesis is my original work and has not been presented for an award of Diploma or conferment of Degree in any other University.

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Recommendation

This Thesis has been examined, passed and submitted with our approval as University Supervisors.

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DEDICATION

This thesis is dedicated to my wife Rachel Mwaniki and to my son Victor Mwaniki. Thankyou for your immense support.

To Katheri Boys High School administration, thank you for creating a very conducive environment for my studies and research.

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ABSTRACT

A fluid flow in an enclosed conduit is termed as an open channel flow if it has a free surface. A free surface is the surface of a fluid that is subject to zero parallel shear stress such as interface between two homogeneous fluids. Floods particularly in flood- stricken areas have been a major threat to the survival of lives and livelihoods in various aspects. For instance, increased pot-holes, road disconnection and tearing off as well as bridges being carried away by floods have led to increased cases of accidents lead- ing to loss of lives. This has led to Government over-stretching budgetary allocations to cater for maintenance and repair of roads and bridges. This study has developed a model for fluid flow past an open trapezoidal cross-section channel with a segment base having lateral inflow channel. The parameters considered for the flow regime include the surface roughness, cross- section area, the length, angle of inclination and velocity of the lateral inflow channel while flow parameters in the main channel include velocity and depth of the fluid. The turbulent formation between the lateral inflow channel and the main channel will be assumed to be negligible and hence the flow is considered to be laminar and unsteady. The model equations, developed from the general continu- ity and momentum equations governing the fluid flow will be discretized and solved using finite-difference method and the numerical values simulated using Matlab soft- ware. The study showed that an increase in the length of the lateral channel leads to a decrease in the flow velocity of the main channel. As the coefficient of roughness of the lateral channel increases, the flow velocity in the main channel decreases. When the cross-section area of the lateral channel is increased, there is an increase in discharge to the main channel leading to an increase in flow velocity. An angle of inclination of the lateral channel at a range of 30^0 to 45^0 exhibit higher values of flow velocity in the main channel compared to other angles. However, maximum velocity at the main channel is attained at an inclination angle of 30^0. At this angle, there is minimum shear stress hence less resistance to the flow profile. The results of this study will be employed by engineers to optimize channel hydraulic geometries in designing efficient channels for maximum discharge. The well designed channels with optimal dimensions will be highly applied in the construction of drainage systems in roads, sewer buildings, street drainage, airport construction and dams for electric power plants.