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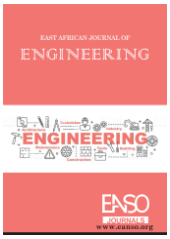

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Original Article

Mathematical Modelling of Sewage Overflow Through Pipe-Manhole Drainage Sewer Systems Using CFD; A Case of Mbale City, Eastern Uganda

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ABSTRACT

The major objective of this study was to design a model to optimize sewage flow through pipe-manhole drainage systems using Computational Fluid Dynamics (CFD). Multi-phase flows like two-phase flow in transport pipes is a common occurrence in many industrial applications such as sewage, water, oil, gas transportation and power generation. Accurate prediction of fluid velocity and pressure drop is of utmost importance to ensure effective design and operation of fluid transport systems. Numerical simulations were performed at different pipe inclinations and fluid flow velocities. A two-dimensional pipe of 0.5 m in diameter and 20 m long was used with a Standard $k-\varepsilon$ turbulence and the volume of fraction (VOF) free surface model to solve the turbulent mixture flow of air and water. The CFD approach is based on the Navier-Stokes equations. Results show that the flow pattern behaviour and numerical values of liquid velocities and pressure drop compare reasonably well. It is concluded that the most effective way to optimize a sewer network system in order to minimize the overflows through Pipe-manhole drainage system for Mbale Municipality conditions is by considering minimum and maximum sewer velocities in the range 0.67 ms^{-1} to 5.5 ms^{-1} respectively, sewer diameters, slope gradients for optimal sewer design and expanding the number of sewer network connections of household, municipal and industries.

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