Analytical Solution of a Ditch Drainage System for the restoration of waterlogged site considering a Subsurface Source/Sink

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Drainage plays an important role in the field of agricultural science, as it helps in removing excess water from the soil quickly. An analytical solution is developed for the prediction of transient seepage to a fully penetrating ditch drainage system receiving water from a ponded surface with an influence of subsurface source/sink. The proposed solution is quite versatile to tackle the presence of source and sink effect in the flow domain. A subsurface flow domain of confined nature is assumed as study area which is having finite extends in horizontal and vertical directions. The hydraulic property of the soil matrix is considered as homogeneous and anisotropic in nature. The accuracy of this solution is analyzed by comparing with numerical solution obtained from finite difference method and other existing simplified case on MATLAB programming software. With the imposition of the source and sink term in the flow domain, the path line and travel time of water molecules started deviating from their original position. It was observed that discharge to the drains has a strong influence of the source/sink term. It is expected that the proposed model will help in the understanding of the flow dynamics associated with the ditch drainage system subjected to source/sink in real field conditions.

Keywords: Transient seepage, Ditch drains, Source/sink, Water logging