An Analytical Solution for Predicting Transient Seepage into Partially Penetrating Ditch Drains Receiving Water from a Ponded Field

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A b s t r a c t

A transient analytical model is worked out for predicting seepage from a ponded field of infinite extent to a network of equally spaced ditch drains in a homogeneous and anisotropic soil underlain by an impervious barrier at a finite distance from the surface of the soil. The solution can account for finite width and finite level of water in the ditches, finite penetration of the drains in the soil, and also a variable ponding field at the surface of the soil. The study highlights the fact that the transient state duration of a partially penetrating ponded drainage scenario may be considerable should the drains be dug in a lowly conductive soil with a high storage coefficient, particularly if the underlying impervious layer lies at a large distance from the bottom of the ditches and the separation between the adjacent ditches is also large at the same time.

Key words: ponded drainage, partially penetrating drains, transient solution, hydraulic conductivity, specific storage.