Appendix 4.2
Options for calculation of equivalent depth in Hooghoudt's equation

1 Introduction

Hooghoudt's drainage equation requires calculation of an equivalent drainage depth, which is the depth that contributes to the drains. This depth is close to the depth to the aquitard (D) if the depth is small, but smaller than the depth to the aquitard, if the depth is large. Daisy includes three methods for calculating this equivalent depth: A method by van der Molen and Wesseling (1991), already described in section 4.5, a method by Moody (1966) and a method by Wesseling (1973). The equations required for the last two methods (in $draineqd.C$) are described below.

2 Calculation of equivalent depth by Moody (1966)

If $D/L <= 0.3$:

$$De = \frac{D}{\left(1 + \frac{D}{L} \cdot \left(\frac{8.0}{\pi} \cdot ln\left(\frac{D}{r}\right) - 3.4\right)\right)} \tag{1}$$

If $D/L > 0.3$:

$$De = \frac{D}{\left(1 + \frac{D}{L} \cdot \left(\frac{8.0}{\pi} \cdot ln\left(\frac{D}{r}\right) - 3.4\right)\right)} \tag{2}$$

where

L = the horizontal distance between the drains (default: 1800 [cm])

D = is the vertical distance between the drain and the aquitard [cm].

r = the radius of the drainpipe [cm]

De = equivalent depth [cm]

3 Calculation of equivalent depth by Wesseling (1973)

$$Dp1 = \frac{\left(L - \sqrt{2} \cdot D\right)^2}{8.0 \cdot D \cdot L} \tag{3}$$

$$Dp2 = \frac{1}{\pi} \cdot log\left(\frac{D}{r\sqrt{2}}\right) \tag{4}$$

$$De = \frac{L}{8.0 \cdot (Dp1 + Dp2)} \tag{5}$$

Parameters are explained above.

4 References

Wesseling, J. 1973. Subsurface flow into drains. in: Drainage principles and applications, Vol. II: Theories of field drainage and watershed runoff.

Moody, W.T., 1966. Nonlinear Differential Equation of Drain Spacing. J. Irrig. Drain. Div. 92, 1–10. https://doi.org/10.1061/JRCEA4.0000420

van der Molen, W.H., Wesseling, J., 1991. A solution in closed form and a series solution to replace the tables for the thickness of the equivalent layer in Hooghoudt's drain spacing formula. Agric. Water Manag. 19, 1–16. https://doi.org/10.1016/0378-3774(91)90058-Q

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