

Technical Paper by J.P. Giroud, J.G. Zornberg and A. Zhao

HYDRAULIC DESIGN OF GEOSYNTHETIC AND GRANULAR LIQUID COLLECTION LAYERS

ABSTRACT: The present paper provides equations for the hydraulic design of liquid collection layers. The liquid collection layers can be, for example, leachate collection layers or leakage detection and collection layers in landfills, or drainage layers in geotechnical structures such as reservoirs, canals, dams, retaining walls, etc. A first series of equations gives the maximum thickness of the liquid collected in a liquid collection layer. These equations are used in design to check that the maximum liquid thickness is less than an allowable thickness. Some of the equations make it possible to rigorously calculate the liquid thickness, whereas other equations, which are simpler, give an approximate value of the liquid thickness. A comparison presented in the paper shows that it is always conservative to use the approximate values and that the approximate values provide an excellent estimate of the liquid thickness in most cases where geosynthetic liquid collection layers are used. A second series of equations makes it possible to calculate the required hydraulic conductivity of the liquid collection layer material and the required hydraulic transmissivity of the liquid collection layer. These equations are useful to select the material used to construct the liquid collection layer. The equations provided in the present paper include reduction factors to quantify the decrease in flow capacity of liquid collection layers due to thickness reduction (caused by the applied stresses) and hydraulic conductivity reduction (caused by clogging). Normalized solutions for the maximum liquid thickness are presented, which are helpful for comparing different equations and for designing liquid collection layers. Practical recommendations and design examples are presented for both geosynthetic and granular liquid collection layers.

KEYWORDS: Liquid collection layer, Leachate collection layer, Leakage detection and collection layer, Drainage layer, Thickness, Hydraulic conductivity, Hydraulic transmissivity, Granular, Geosynthetic, Geotextile, Geonet, Geomat, Geocomposite.

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PUBLICATION: *Geosynthetics International* is published by the Industrial Fabrics Association International, 1801 County Road B West, Roseville, Minnesota 55113-4061, USA, Telephone: 1/651-222-2508, Telefax: 1/651-631-9334. *Geosynthetics International* is registered under ISSN 1072-6349.

DATES: Original manuscript submitted 12 July 2000, accepted _____. Discussion open until _____ 2000.

REFERENCE: Giroud, J.P., Zornberg, J.G., and Zhao, A., 2000, "Hydraulic Design of Geosynthetic and Granular Liquid Collection Layers", *Geosynthetics International*, Special Issue on Liquid Collection Layers, Vol. 7, Nos. 4-6, pp. ____-____.
