



Afr. J. Agric. Res.

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African Journal of Agricultural Research Vol. 1 (3), pp. 047-056, October 2006
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Full Length Research Paper

Lithological Mapping of the Unsaturated Zone of a Porous Media Aquifer to Delineate Hydrogeological Characteristic Areas: Application to Israel's Coastal aquifer

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Accepted 20 October, 2006

Abstract

With water quality steadily decreasing, decision-making with regard to water supply must improve aquifer management models, which are based upon various assumptions. Amongst these are assumptions concerning subsurface aquifer lithology. The objective of this study is to present a means of improving information and assumptions, as well as providing guidelines to characterise the unsaturated zone media. This media integrates soils and the "parental material" of soils, which results in a more realistic picture of the surficial layers of the aquifer. This is a key factor for understanding the behavior of the upper border of coastal aquifers and simulation of their hydrogeological models. Developing a digital GIS unsaturated zone map enables 3-dimensional depiction by illustrating the varying permeability characteristics of the stratigraphic layers. The resultant map conveys information about areas having low to high permeability and areas in which perched aquifers might be found. This can consequently contribute to better understanding of the recharge process, and of the reasons for deterioration of groundwater quality in the aquifer. In the case of aquifers prone to stress from significant anthropogenic land-use, the map highlights areas whose vadose zone has the ability to convey liquids and pollutants to the aquifer below. The focus of this study is Israel's Coastal aquifer, a resource of critical significance to the country's water supply, which underlies the most populated areas of the country. This aquifer has been chosen because of its variegated lithology and water quality, the quantities of water being pumped from it, the large amount of existing data, and the potential of water which can be readily stored in it. This aquifer would appear to be an appropriate example of coastal aquifers around the world, to demonstrate the utility of such unsaturated zone mapping. This mapping can prove a tool for developing recommendations with regard to irrigation, land-use planning, and

aquifer management.

Key words: GIS mapping, Unsaturated zone/vadose zone, lithology, confined aquifer, phreatic aquifer, Coastal aquifer,

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