

The use of SIG technology in water resources development : The case of artificial recharge of aquifers

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Abstract:

The aim of aquifer artificial recharge is to use the storage capacity that can potentially offer a rock aquifer by providing a quantity of additional water in comparison with what it receives in the normal hydrological conditions to which it is submitted. This technique can offer advantages on a more or less long term basis.

It is therefore from the viewpoint of the regularization of the water resources that artificial recharge appears attractive at a first sight, but only the knowledge of the reservoir geometry and the dynamics of groundwater on which theoretical concepts are based truly allow us replying to the practical questions about planning and groundwater management.

In general, we can say that the artificial recharge of aquifer systems can have the objective to restore depressing piezometric surfaces, by injection into the basement of the excess water from rivers or streams, or by the development of some works to artificially change the aquifer system.

The method of groundwater artificial recharge solves the problem of groundwater overexploitation and indirectly recycles surface water having deteriorated quality. This technique can be used permanently to support a highly stressed groundwater, alternatively it can be used on a cyclical or seasonal basis, allowing superficial reservoirs to replenish groundwater.

The proposed artificial recharge depends on two basic elements: the availability of suitable areas for infiltration after development of suitable works and the availability of surface water to be injected. The first element is directly dependent on geomorphological, geological and hydrogeological conditions, and also depends on the state of the soils. The determination of suitable sites for injection of surface water depends on all these physical and natural characteristics, which should be acquired and analyzed.

The water resources engineer should organize these elements in a data base and locate the desired sites. For this, the techniques of Geographic Information Systems (GIS) are very useful for organizing data and identifying sites sought through modules integrated into the functionality of the GIS, in particular the Raster Calculator. The latter, through a simple arithmetic formula containing the various physical parameters of the aquifer domain, allows the resource engineer to classify the model in favorable or unfavorable areas to the artificial recharge project. The use of this methodology on several

Moroccan aquifers showed the usefulness of the method and allowed the identification of suitable sites for artificial recharge projects. In this work, we present the results for an aquifer located in an arid environment and where groundwater resources are limited and vulnerable.

Key words: Water resources development – GIS – Raster calculator – aquifer artificial recharge – Data base.