Abstract

There is an essential need to construct hydraulic structures along any waterway as weirs, regulators….etc. Regulators are very important parts in the modern irrigation system, but they have some side effects as any other intervention. One of their negative impacts is the rise of the groundwater levels. This increase in water levels, both locally near the new barrages and upstream, will result in changes in groundwater levels in the aquifer system both upstream and downstream of the barrage.

The Egyptian Government replaces the existing Naga Hammadi barrage with a new barrage to incorporate a hydropower plant and to improve conditions for river traffic. This structure increases the water surface levels. The Ministry of Water Resources and Irrigation proposed and implemented a new system for lowering the groundwater level in the affected areas.

Laboratory and computational methods have been utilized to simulate the groundwater-lowering problem. The computational software used is MicroFEM, which is a three dimensional groundwater flow simulation model. The purpose of the laboratory experiments is to provide insight on a laboratory scale and help in verifying and calibrating the computational model. The experimental works were run also to derive equations to determine the optimal pipe holes percentage for different working conditions and the corresponding discharge. In this study the percentage of holes of the perforated pipe is defined experimentally as a function of the upper layer permeability, the initial head above the centerline of the pipe, and the inlet pipe discharge.

In this study, an area is chosen which suffers from a high groundwater level to study the problem and the alternatives for lowering the groundwater level. The study area is an area affected by the New Naga Hammadi Barrage (NNHB) called Bakhaness with a total of area about 1358fed. Bakhaness area is located some 1.5km south of the NNHB. The model is first used to simulate the laboratory results, and good agreement is achieved. Then, the groundwater flow in a region of Bakhaness area before and after construction of the NNHB is simulated. Alternatives for lowering the groundwater are proposed, simulated and evaluated. The alternatives, which are assessed, are the