JWARP> Vol.2 No.2, February 2010

OPEN ACCESS

Comparative Identification of Wellhead Protection Areas for Municipal Supply Wells in Gaza

PDF (Size:3082KB) PP. 105-114 DOI: 10.4236/jwarp.2010.22012

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ABSTRACT

Groundwater is the only source of fresh water in Gaza Strip while its inhabitants and its water consumption increased rapidly. This study aims at preserving and protecting the groundwater from any pollutants caused by 141 industrial installations through the work of delineation of Wellhead Protection Areas (WHPA) for 47 Municipal Supply Wells in Gaza Governorate boundaries. WHPA has been determined in three different methods: Calculated Fixed-Radius Method (CFR), Analytical Method (AM), and Wellhead Analytic Ele-ment Model (WhAEM2000) which is currently used by the United States Environmental Protection Agency (EPA). These methods mainly depend on the time it takes groundwater to travel a specified horizontal dis-tance. Three well zones were delineated for each municipal production well, the first zone is 50 days time of travel (TOT), the second zone is 2 years TOT and the third zone is 5 years TOT. Different values of the ra-dius of WHPA of each well were obtained using the three methods. Consequently, several industrial installa-tions were laid inside the WHPA according to the radius values. The results show that CFR method is the weakest method because it does not take into account regional groundwater flow, causing a hydraulic gradi-ent. WHPAs identified by these methods may be either too large or too small, resulting in wellhead overpro-tection or under protection. Analytical Method incorporates hydrogeologic characteristics of the aquifer, groundwater flow, and hydrogeologic boundaries into the model. Often produces a WHPA that is smaller than the one produced using CRF. WhAEM2000 method is the best method because it uses a hydrogeologi-cal computer model of groundwater flow and it provides a more accurate delineation of the WHPA. It often produces a smaller area to manage than other methods. The study concluded that all industrial installations located in the WHPA should be carefully checked and investigated by governmental authorities. Mitigation measures for pollutants and licenses for the establishment of any new industrial installations could be based on the delineation of WHPAs using the previously mentioned methods.

KEYWORDS

Groundwater Well, Protection Plan, Travel Time, Pollution

Cite this paper

Y. Mogheir and G. Tarazi, "Comparative Identification of Wellhead Protection Areas for Municipal Supply Wells in Gaza," *Journal of Water Resource and Protection*, Vol. 2 No. 2, 2010, pp. 105-114. doi: 10.4236/jwarp.2010.22012.

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