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Groundwater aquifers susceptibility index of waterborne diseases outbreaks (ASIWD) in Nile Delta, Egypt

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ABSTRACT

The Corona pandemic and its significant economic and social effects, as well as the large spread of parasites, motivated us to conduct this research to develop a map of the sensitivity of groundwater pollution to waterborne pathogens. This study aims to create an index for evaluating groundwater aquifers' susceptibility to waterborne diseases outbreaks risks. During this study, groundwater Aquifer Susceptibility Index to Waterborne Disease outbreaks (ASIWD) was developed by appending a new attribute designated as waterborne diseases parameters such as urbanization, population density, water drains density, and existing sewage treatment systems. The study area covers eight governorates in Egypt, Menoufia, Beheira, Kafr El-Sheikh, Sharqia, Daqahlia, Qalyubia, Gharbia, and Damietta. By analyzing the ability of the aquifer to transmit infection for waterborne diseases, the main conclusions are: (i) In Qalyubia governorate, the percentage of the area is exposed to very high risks reaches more than 90% of the total area, while in Menoufia, Gharbia, Dakahlia, and Sharqia, it reaches 51%, 48%, 18%, and 17% respectively. (ii) the area is exposed to very high risks reaching 32%, 24%, 32%, and 32% of the total area in the governorates of Menoufia, Beheira, Gharbia, and Dakahlia, respectively. (iii) the area is exposed to medium risks representing 32%, 24%, 32%, and 32% of the area of Damietta, Sharkia, and Beheira governorates, respectively, and (iv) the area is exposed to Low to very low risks, reaches 98%, 55%, and 44% of the total area of Kafr El-Sheikh, Dakahlia and Beheira governorates respectively. ASIWD approved the importance of including anthropogenic parameters in susceptibility computations and its reliability as an effective tool for investigating groundwater aquifer susceptibility to waterborne disease outbreaks in Egypt's Nile Delta study area. Groundwater in the study is in hydraulic connection with surface water from Nile River branches, irrigation canals, and drainage networks; therefore, maintaining groundwater quality requires an integrated approach for both ground and surface water. so, it is recommended to improve the irrigation system and prevent the continuous drainage of sewage and wastewater to the canals and the drainage system. Sewage treatment services must be developed and concentrated in very high-risk governorates such as Qalyubia, Menoufia, and Gharbia. Also, highly recommended to make public awareness about the threats of pollution on groundwater resources, especially in susceptible areas.

Keywords: Nile delta; Groundwater; Aquifers; Susceptibility index; Waterborne diseases

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