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Groundwater modeling to investigate the oil spill contamination of Chunnakam aquifer in Jaffna peninsula

T. Thivaakaran¹, S. Keerththana¹, R. A. Babilraj¹, M. Vithanage² and B. C. L. Athapattu^{1*}

¹*Department of Civil Engineering, Faculty of Engineering Technology, Open University of Sri Lanka, Nawala, Nugegoda, Sri Lanka*

²*Faculty of Applied Sciences, University of Sri Jayewardenepura, Gangodawila, Nugegoda, Sri Lanka*

In Jaffna peninsula groundwater is the only water source for sustaining life and the environment. Four groundwater aquifers are available for water consumption based on the capacity and quality of water; namely, Vadamarachchi-East aquifer, Chavakachcheri aquifer, Chunnakam aquifer and Kayts aquifer. Among these aquifers, Chunnakam aquifer has the largest capacity and acceptable quality of water for drinking and other usage. Overextraction of groundwater and anthropogenic activities affect the quality of ground water in different ways. Similarly, the Chunnakam aquifer is affected by the fossil fuel power station in Chunnakam, and this was identified in 2013. An analysis showed that the intake well and the adjacent wells are contaminated with oil. Modflow 6 - MT3DMS software was used to identify contaminant transport and the change of their concentration with time. ArcGIS was used to create the groundwater level contour map and spatial distribution of oil and grease concentration. Based on the groundwater contour map, groundwater level is varying from 4.0 msl to - 1.5 msl and the flow is towards the lagoon from NE to SW direction. According to the spatially distributed contamination map, the high oil and grease concentration layers were observed in the surroundings of the Chunnakam power station. Around 375 m surrounding area of the Chunnakam power station having a high risk of contamination. The results revealed that there are high concentrations of oil and grease in the water samples fluctuating around 7 mg/l. This finding suggests that oil and grease contamination affects the groundwater quality even today (2021). However, the groundwater modeling shows that oil and grease concentrations in the Chunnakam aquifer decreases with the time. These results could help to recognize and prioritize areas for future sustainable groundwater development plans.

Keywords: Chunnakam aquifer, Oil and Grease, groundwater quality, Groundwater modeling, Fossil fuel disposal

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E-mail: bcliy@ou.ac.lk