

Hydrogeological characterization of shallow, intermediate and deep aquifers – implications for the installation of arsenic-safe drinking water tubewells and their sustainability

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More than 90% of drinking water supply in Bangladesh depends on groundwater and the most widely means of tapping groundwater. More than 90% of 10 million manually operated suction mode hand tubewells serve the population living in rural areas have been installed by the local community by the the local local tubewell drillers. The presence of natural arsenic (As) in groundwater brought millions of people under severe health risk. Among all alternative safe water options attempted, tubewell has been recognized as the socially accepted option. In the practice of tubewell installation, depth of the tubewell is a key parameter as it is related to groundwater quality and cost of installation. For installation of safe tubewell, The most important task is to identify safe aquifers for installation of drinking water wells which will remain sustainable as a source of safe water supply.

Piezometers nests were installed at 15 locations targeting shallow, intermediate and deep aquifers in Matlab, an As hot-spot in southeastern Bangladesh. Sediment characterization for delineation of hydrostratigraphy and monitoring of groundwater level and water quality over a three years period of time allowed us to distinguish the groundwaters in different aquifers, hydraulic connectivity among the contaminated and safe aquifers and temporal behavior of As. In all cases, As was found consistent within a very narrow band of fluctuation. Shallow aquifers are mostly As-contaminated excepting those tapping water from red and off-white sediments and mostly characterized by Ca-Mg-HCO₃ type and Ca-Na-Mg-HCO₃ type.. The intermediate and deep aquifers were found As-safe over the time and are mostly Na-Ca-Mg-Cl-HCO₃ to Na-Cl-HCO₃ type.. As-safe aquifers at intermediate depth and deeper reaches are hydraulically separated from As-contaminated shallow aquifers reflected from pattern of groundwater level hydrographs and presence of aquitard. Intermediate and deep aquifers groundwaters