

Identification of Groundwater Potential Zones Using Geographic Information System and Multi-Criteria Decision Analysis: A Case Study in Bagmati River Basin

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Abstract : The availability of clean and reliable groundwater is essential for the sustainment of human and environmental health. Groundwater is a crucial resource that contributes significantly to the total annual supply. However, over-exploitation has depleted groundwater availability considerably and led to some land subsidence. Determining the potential zone of groundwater is vital for protecting water quality and managing groundwater systems. Groundwater potential zones are marked with the assistance of Geographic Information System techniques. During the study, a standard methodology was proposed to determine groundwater potential using an integration of GIS and AHP techniques. When choosing the prospective groundwater zone, accurate information was generated to get parameters such as geology, slope, soil, temperature, rainfall, drainage density, and lineament density. However, identifying and mapping potential groundwater zones remains challenging due to aquifer systems' complex and dynamic nature. Then, ArcGIS was incorporated with a weighted overlay, and appropriate ranks were assigned to each parameter group. Through data analysis, MCDA was applied to weigh and prioritize the different parameters based on their relative impact on groundwater potential. There were three probable groundwater zones: low potential, moderate potential, and high potential. Our analysis showed that the central and lower parts of the Bagmati River Basin have the highest potential, i.e., 7.20% of the total area. In contrast, the northern and eastern parts have lower potential. The identified potential zones can be used to guide future groundwater exploration and management strategies in the region.

Keywords : groundwater, geographic information system, analytic hierarchy processes, multi-criteria decision analysis, Bagmati

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