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Findings

Groundwater is a vital resource for human survival and economic development. However, its availability is often at risk due to over-exploitation and mismanagement. To address these challenges, groundwater modelling has become an essential tool for understanding the dynamics of groundwater systems and predicting future scenarios. In this article, we discuss the results and implications of a groundwater modelling study conducted in a region of India.

The study utilized the methodologies and techniques of groundwater modelling to generate various maps and data, including water level fluctuations, lithology, aquifer geometry, parameters, boundary conditions, groundwater draft and recharge, conceptual and numerical models, future predictions, mass balance, zone budgets, and rainwater harvesting potential. These details enabled us to predict the future groundwater resource development plan across the study area and help the management and governing bodies to draft regulations accordingly for sustainable future development.

A transient state groundwater model was developed using Visual MODFLOW 2011.1 for the proposed study area. The model was used to generate water balance, zone budgets, head fluctuations, and other relevant data. The groundwater level and flow budget were also calculated as outputs of the model. The model predicted that the eastern portion of the study area, including Sonipat, Murthal, and Rai, lies under the "over-exploited" category, and the aquifer in the region is much stressed. Therefore, it is imperative that the water demand of the area should be reduced and augmented with treated water as much as possible. Also, the area is experiencing a lot of influx of industries which is leading to over-abstraction of groundwater. This over-abstraction is often unaccounted for; therefore, strict regulations shall be implemented and monitored to derive the area to a "safe" category of groundwater development.

The eastern portion of the study area is under intensive irrigation and cultivation. Low water requirement crops shall be sown specifically during non-monsoon seasons. This will help in reducing the overall water demand and stress on the aquifer.

In conclusion, groundwater modelling has proved to be a valuable tool for understanding the dynamics of groundwater systems and predicting future scenarios. The results of this study have highlighted the need for sustainable groundwater management practices in the study area. The model can be further utilized for groundwater modelling studies to ensure sustainable development of groundwater resources in the region. It is imperative that governing bodies take note of these findings and implement appropriate regulations to ensure sustainable use of this precious resource.