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Identification of Recharge Source for Jodhpur City

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Abstract : Utility of hydrological data in sustainable development of ground water resources in the country is well established. Besides the hydrological data is use for solution of different ground water problems. Jodhpur city has been experienced the problem of rising ground water levels, causing seepage in underground basement of shops and houses in these areas and weakening the foundations and reducing the life of building due to dampness of the walls.

The paper attempts to present that there is a clear potentiality of using these data for find out the source of recharge in parts of Jodhpur city and adjoining area. The water level data of pre-monsoon, post-monsoon and monthly water level data at few places collected from monitoring stations. The water level variation, hygrographs, water level trend at particular station and water table contour maps of the study area have been prepared and discussed. The average water level varies from 5 to 35 m bgl. from place to place due to different hydrological formation and structures. Hydrograph of the monitoring station have been prepared. A perusal of these hydrographs clearly indicates the rise of water level. Trend analysis of ground water table has been carried out based on the detailed hydrological studies. In this analysis various types of data such as rainfall, ground water table and water level of Kailana lake were utilized to show the comparative variations. The counter maps of RL of water table have been prepared for pre and post monsoon seasons for the entire study area. The water table contour map shows the ground water flows direction which, fallows the ground slope in the area under study. The flow of water is predominantly in two directions namely east and south-east.

INDRODUCTION

The ground water is the major resource for meeting the water demand of the population for drinking, agriculture and industries through out the year. The indiscriminate use of this precious resource leads to several environmental problems like decline in ground water table and rise in ground water table in certain regions and water logging, increase in soil salinity and intrusion of saline water in certain other locations. This situation warrants concerted efforts to evolve approximate strategies for maximizing the availability of hazards free water resources. Therefore, there is need to focus on a more holistic ground water management for resources evolution and sustainable use. It may appear strongly that water is going to be scarcer and scarcer day by day if this resource is not properly conserved and utilized. A world wide water crisis is not unlikely in the near future. The signals are already being received in many countries including India.

The state of Rajasthan in India, especially western Rajasthan is prone to recurring droughts due to poor monsoon rainfall. In Jodhpur city some traditional water impounding structures such as Baories, Ponds, Jhalaras and major water reservoirs (Kailana – Takht sagar & Ummed sagar) are available which provide sustained water supply. In the beginning, these water impounding structures were made to store water from the rainfall as well as from Jawai dam in Pali district by gravity flow directly. Due to vagaries of monsoon these reservoirs were further connected with the Rajiv Gandhi Lift Canal (RGLC) in 1997-98 which supplies water to these reservoirs. However, to fulfill the ever increasing demand of growing population the storage capacity of these reservoirs has been increased resulting in enhancement of the water level of these reservoirs. Due to unforeseen conditions, some part of the city is face rise in water table causing seepages in underground basements of houses and shops. The major affected area cover Kunj Bihari Ji ka Mandir, Sunaro ka bas, Tripolia, Sojati gate, Nai sarak, Chandpole, Fateh sagar, Nehru park and later on Laxmi nagar. The problem has gradually extende and surrounded more and more areas in sequence as shown in Fig. 1.

METHODOLOGY

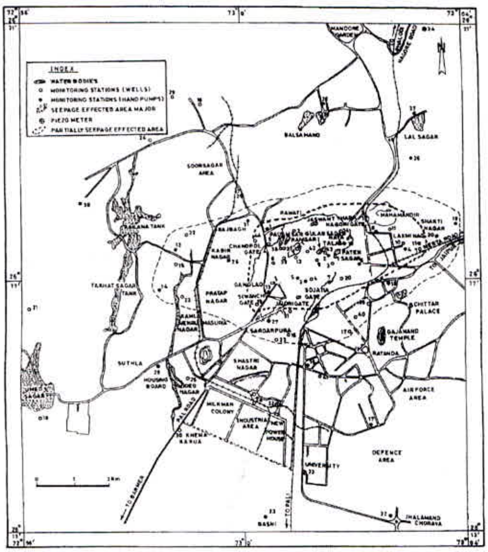


Fig. 1. Location Map of Jodhpur city showing existing water bodies and Monitoring Stations.

Initially the water level data were collected at 21 monitoring stations. Ten more observation wells were selected in the problematic area between 1998 to March 2000, which reached up to 31 in number. The water table data of Pre and Post-monsoon period starting from 1994 to 2001 were taken for the study. Apart from these, monthly water table data were also recorded at few places in the study area. The water table variation, hydrograph, water table trend at the particular station and water table contour maps of the area have been prepared and discussed.

Ground Water Table

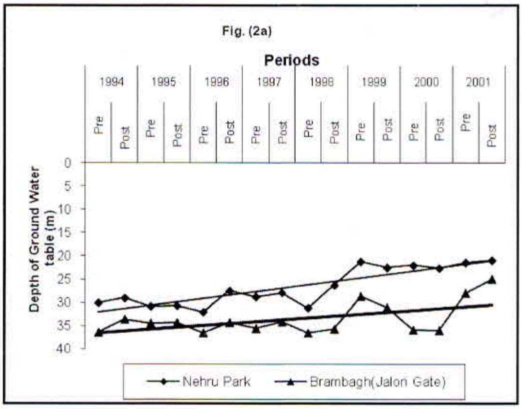
The critical study of water table data reveals that the average depth of water table varies from 5 to 35 m. It is highly variable from place to place. The depth to water table in the area varies from 0.5 m to 33.9 m based on pre-monsoon 2001 data at various places due to different hydrological formation and structures.

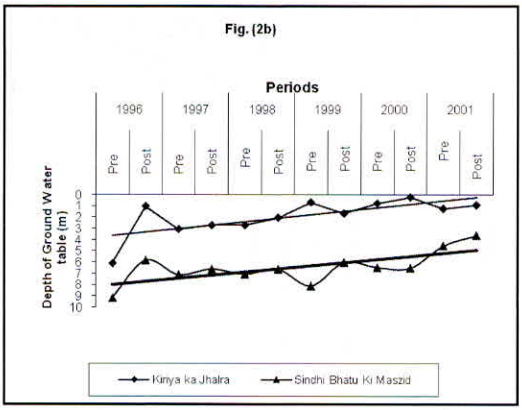
Shallow water table (less than 5 m bgl.) was observed in old walled city as well as North-East part of the city which covers Siwanchi Gate, Jalori Gate, Sojati Gate, Nagori Gate, Jodhpur high court and Laxmi Nagar area.

Very shallow ground water table (less than 3 m) was traced around Chandpol area, City Kotwali, near Gulab sagar, Tripolia, Naisarak, Fateh sagar, Hathi Ram Ka Oda and Laxmi Nagar area.

Hydrographs

The water table data collected at different monitoring stations were used for the preparation of hydrographs. For the simplicity, these hydrographs were prepared taking the data of pre and post-monsoon periods. The entire data of only six monitoring stations, namely Nehru park, Brahmbagh (Jalori gate), Kiriya ka Jhalara, Sindhi Bhattu ki Maszid, Mohalla Laykan and Ghantaghar have been presented in Fig. (2a, b and c). Fig. (2a) shows the variation of water table at Nehru Park and Brahmbagh (Jalori gate) for the period of 1994 – 2001. Fig. (2b) shows the variation of water table at Kiriya ka Jhalara, Sindhi Bhattu ki Maszid for the period of 1996 – 2001 and Fig. (2 c) shows the variation of water table at Mohalla Laykan and Ghantaghar for the same period. All the figures show the rise trend of water table during the entire period of study at each station. This fact clearly states that there is continue supply of water





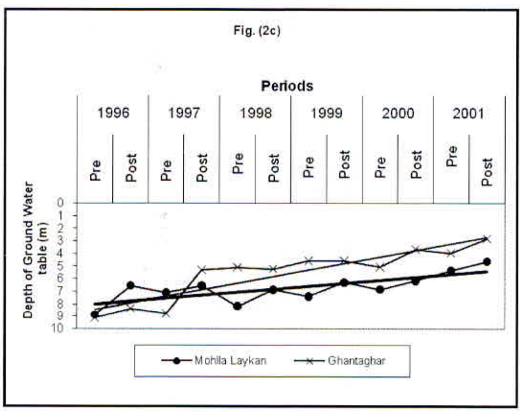


Fig. 2. Hydrographs for monitoring stations, namely
(a) Nehru Park and Brambagh (Jalori Gate);
(b) Kiriya ka Jhalra and Sindhi Bhatu ki Maszid; and
(c) Mohalla Laykan and Ghantaghar.

through the under ground sources or through surface reservoirs in the close vicinity.

Ground Water Trend Analysis

Trend analysis of ground water table has been carried out based on the detailed hydrological studies. In these analyses various types of data such as rainfall, ground water table and water level of Kailana Lake were utilized to show the comparative variations.

The total rainfall during monsoon season versus time period has been presented in Fig. (3). Figure shows too much fluctuation in the rainfall during these years. The trend analysis for the above period shows that the tendency of rainfall is almost constant and shows no significant variation. It infers that the possibility of contribution of rainfall towards rise in water table is very limited or almost negligible.

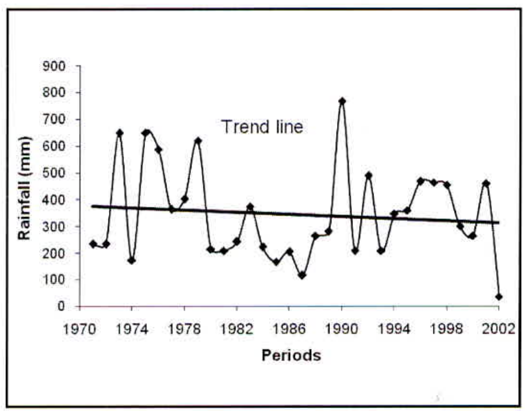


Fig. 3. Showing the variation in the monsoon total rainfall.

The trend analysis of ground water table with Kailana Lake has been prepared. Fig. (4a) shows the variation in water table data of Chandpol (W-5) with water level data of Kailana Lake during post-monsoon season of 1994 to 2001 and Fig. (4b) shows the variation in water table data of Ghantaghar (W-9) with water level data of Kailana

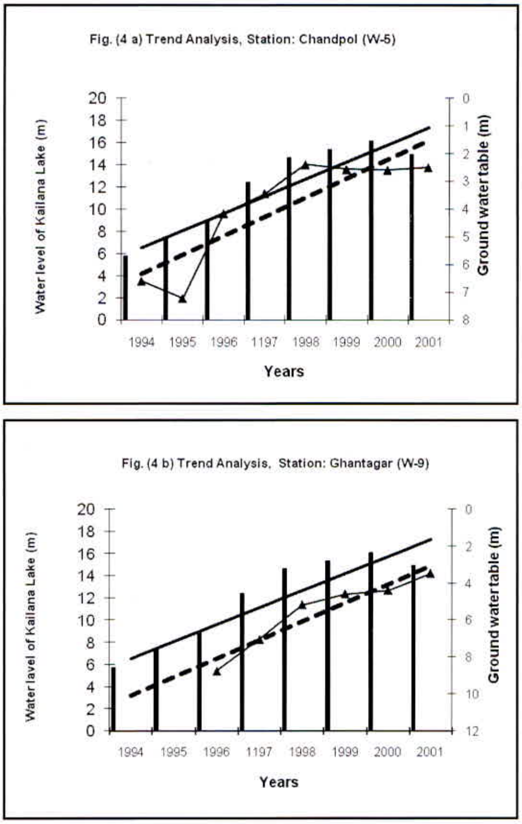


Fig. 4. Comparison of trend of ground water table with water level of Kailana Lake.

Lake These figures have been drawn while taking time period on the x-axis whereas, left hand side of y-axis contains water level data of Kailana Lake and right hand side of y-axis contains depth of water table data. A trend line is fitted with water level data of Kailana Lake continuous bold line and water table data of dotted line. The trend analysis is clearly indicated the figures show similar characteristic features. The increase in water level of Kailana Lake fully corresponds with the rise in water table of these places.

Water Table Contour Maps

The depth of water table was converted with reference to the mean sea level as a reference level (R.L.) of water table. The contour maps of RL of water table have been prepared for pre and post monsoon seasons. Fig. 5 shows the contour maps of water table (R.L.) of pre and post-monsoon for a period 2000. The contour maps for the pre and post-monsoon seasons show the hydraulic gradient of the area. The comparative studies of figures clearly indicate that pattern of the contours are similar in nature whereas the magnitude of highest value of contour for post- monsoon is slightly higher. The flow of water starts from the higher altitude to the lower altitude of R.Ls. of water table. In the area under study, the flow of water is predominantly in two directions namely, East and South-East. However, the hydraulic gradient is steeper in the eastern side compared to the south-eastern side.

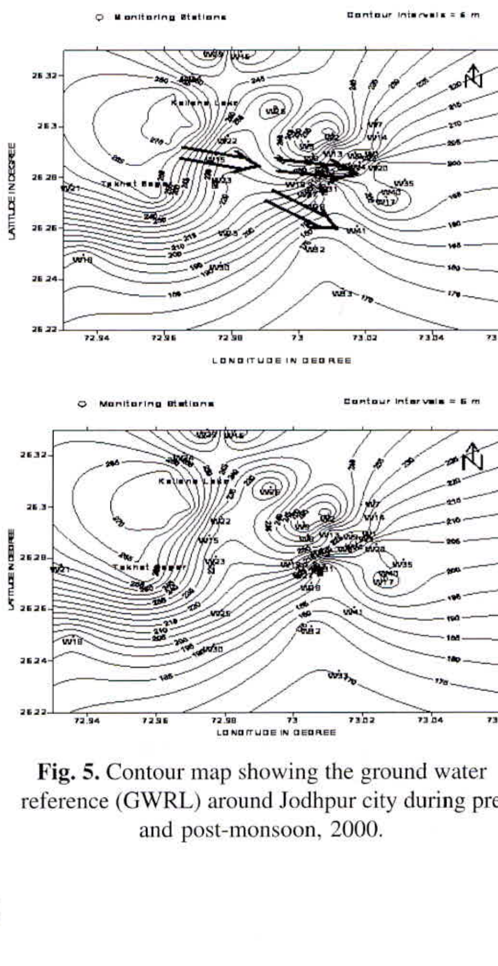


Fig. 5. Contour map showing the ground water reference (GWRL) around Jodhpur city during pre and post-monsoon, 2000.

CONCLUSIONS

The main conclusion of the study is that the use of hydrological data to find out the source of recharge in problematic area. The results are based on the data available during the problem. After identify the source of recharge is Kailana lake. The competent authority maintains a water level of reservoir at beginning stage to minimize the problem. It is understood that a long-term data would provide a better picture of such variations with time

However, the conclusion derived in this study, i.e, water table data reveals that the average depth of water table varies from 5 to 35 m. Shallow water table (less than 5 m bgl.) was observed in old walled city as well as north-east part of the city. Hydrographs indicate the rise trend of water table. The trend analysis of rainfall shows the possibility of contribution of rainfall towards rise in water table is quite negligible. From the trend analysis of Kailana lake with ground water table, it is observed that depth of water table is decrease during entire period of study. This fact clearly states that there is continue supply of water through the under ground sources or through surface reservoirs lying in the close vicinity of the area.

The flow of water is predominantly in two directions namely, east and south-east and ground water flows from the high altitude side to the low altitude side.

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