

Fluctuation monitoring of seasonal ground water levels in Kayampur area, Mandsaur District, Madhya Pradesh, India

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Abstract

The present paper deals with the fluctuation monitoring of seasonal groundwater open dug wells existing in the Kayampur area, located in Mandsaur district of Madhya Pradesh in India. The examination of 35 dug wells has been carried out and recorded data in respect of wells such as location, diameter, depth of well, static water levels during post- and pre-monsoon session and mode of lifting water. The well diameter varies from 3.5 to 11 meters; depth of wells ranges from 8.7 to 23.5 meters b.g.l., static water levels differ pre-monsoon from 5.3 to 16.5 meters b.g.l. and post-monsoon from 1 to 5.5m. b.g.l. The seasonal fluctuation analysis of open dug wells recorded during post and pre monsoon period indicate a fluctuation range from 4 to 14.2 meter, b.g.l. The mode of lifting of water is both manual and pumping set. The ground water levels contour maps of post- and pre-monsoon periods indicate, pattern of the ground water potential zones and movement of groundwater flow direction. Probable reasons responsible for seasonal groundwater level fluctuation include geological conditions, topography, rainfall variation in amount and frequency and climatic variation.

Keywords: Fluctuation, monitoring, seasonal, ground water.

Introduction

This paper deals with the application of hydrogeological analysis of a part of Kayampur area, Sitamou block, located in Mandsour district of Madhya Pradesh, within latitudes $24^{\circ}5'$ to $24^{\circ}10'N$ and longitudes $75^{\circ}15'$ to $75^{\circ}25' E$ (Survey of India toposheet no. 45 P/8, Figure-1), for the identification of favorable groundwater potential sites for exploitation. The study area is more or less flat with a few hillocks and is mainly drained by Gir Nala and minute seasonal streams. The climate is dry except in the south-west monsoon season. The post monsoon period is characterized by a pleasant climate. Temperature rises rapidly from March to May with a maximum of $45^{\circ}C$ and minimum of $10.4^{\circ}C$. Most of the rainfall is witnessed during monsoon season. Annual rainfall ranges from 402.3mm. to 1394.2mm with an average of 849.39mm. The humidity ranges from $< 25\%$ to $> 70\%$ and winds are generally light and variable in direction, except during the later period of summer.

Geology and Geomorphology

Geologically, Kayampur area constitutes a part of the Deccan Trap Volcanic Province, which is extending from the Bombay, Kathiawar, Kutch, and Madhya Pradesh, Central India (covering an area of 5,10,000sq. km). The Geological Survey of India has prepared the geological and tectonic maps of the area of study. Middle lava flow of Deccan Traps (locally known as Malwa Trap) has occupied the area of study. Two lava flows of massive, and vesicular basalt have been observed¹⁻⁴. Most of the area is covered by the lava plains (Figure-2).

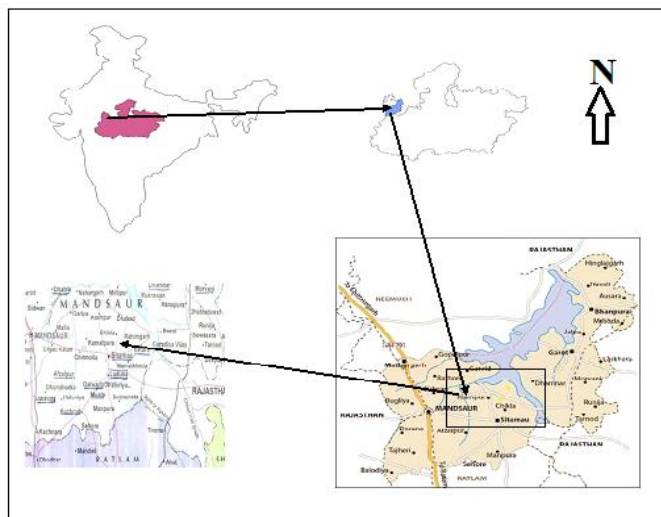


Figure-1: Location Map of Kayampur (area of study), Mandsaur District.

Geomorphology is a science and art that mainly concerns with the study of landforms and surface processes. Landforms are resulted due to both erosional and depositional relief features of earth. The description of landforms based on genesis was first published by Davis and Russel recognized different stages in the development of landforms, Sparks described the application of morphometric analysis⁵⁻⁷. Geomorphologically, the study area exhibits survival of both the erosional and depositional landforms, which include hill, lava plain, valley, soils and is mainly drained by the Shivna River with tributaries.

Hydrogeological Analysis

The Hydrogeological setting of a basin or a particular geographic area is commonly called as hydrogeology that deals with the nature of water regime below the surface of the earth⁸⁻¹¹. The study covers mode of occurrence movement and detection of quality of subsurface or ground water. The term hydrogeology was first used by Russian and Soviet hydrogeologists. This term in fact is referred to an engineering field with Sub-surface fluid hydrology.

The hydrogeological Survey has been conducted on the basis of topographic and geological Maps of the area. The hydrogeological survey involves the examination of various types of wells existing in a particular area. The relevant data in respect of the wells as location, diameter of the well, total depth

of well, depth of the static water levels and mode of lifting of water have been collected in respect of 35 open dug wells of the area. The tube wells in the area are rare in occurrence and become almost dry during summer session. The details of tube wells were not collected as the present work has been limited to the analysis of shallow ground water regime.

Analysis of Well Data

The present study area constitutes a part of Deccan volcanic province comprising of different basaltic lava flows. The ground water occurs under both unconfined and confined conditions. The hydrogeological data in respect of open dug wells existing in the area have been collected to delineate the nature of shallow ground water frame work.

Table-1: Showing the detailed the well inventory and water level fluctuation in metres (m) below ground level (bgl) in the well of the study area around Kayampur Block Mandasaur district M.P.

Well No.	Location Name of Place	Dimetr of Well (M.)	Total Depth of well (M.)	Bench Mark	Water level during pre monsoon	Reduced water-level pre monsoon	Water level during post monsoon	Reduced water-level Post monsoon	Water level fluctuation	Mode of Lifting
1	Nipaniya	3.5	8.7	444	6.5	437.5	2.5	441.5	4	Manual
2	Sedra	6.5	14	438	10.3	427.7	2.5	435.5	7.8	Pump
3	Khajuri Gor	6.2	10	436	7.7	428.3	3.5	432.5	4.2	Manual
4	Dhakad Pipliya	6.3	15.2	440	11.5	428.5	1	439	10.5	Pump
5	Bisniya	5.5	15	430	12.1	417.9	3.3	426.7	8.8	Pump
6	Kotda Bhadur	4.7	20.13	438	16.3	421.7	2.1	435.9	14.2	Pump
7	Sakhar Kheri	5.6	20.9	410	12.1	397.9	5.5	404.5	6.6	Pump
8	Bajkheri	6	14	412	8.7	403.3	1.5	410.5	7.2	Pump
9	Motipura	6.7	23.5	415	14.3	400.7	4.2	410.8	10.1	Pump
10	Bhatkheri	11	11	428	7.7	420.3	1	427	6.7	Pump
11	Kotdamata	8	13	434	11.7	422.3	2.8	431.2	8.9	Pump
12	Bisniya	8.3	10.5	431	8.5	422.5	3	428	5.5	Pump
13	Guradiya	6.3	15.3	427	7.3	419.7	2.5	424.5	4.8	Pump
14	Panpur	5.7	14	435	8.7	426.3	3.5	431.5	5.2	Pump
15	khanderiya	8	8.1	442	5.3	436.7	1.2	440.8	4.1	Pump
16	Kotri Manda	7.6	11.7	433	8.1	424.9	1.5	431.5	6.6	Pump
17	Fatehgarh	6.1	10.2	409	7.4	401.6	2	407	5.4	Pump
18	Rupni	6.3	14.1	421	11.6	409.4	2.8	418.2	8.8	Pump
19	Panpur	7.1	15.2	433	9.3	423.7	3.1	429.9	6.2	Munual

20	Kayampur	5.2	10.5	427	8.5	418.5	1	426	7.5	Pump
21	Boliya	6.3	12.1	437	9.3	427.7	2.1	434.9	7.2	Munual
22	Boliya	7.1	15.5	436	9.8	426.2	3.1	432.9	6.7	Pump
23	Betikheri	5	13.5	410	10.2	399.8	2	408	8.2	Pump
24	Kayampur	6.1	13.2	424	11.6	412.4	3.5	420.5	8.1	Pump
25	Risthal	6.5	12.1	450	8.3	441.7	2.1	447.9	6.2	Pump
26	Nataram	6.1	11.2	421	6.3	414.7	2	419	4.3	Pump
27	Kelukheri	6.5	13.5	425	8.9	416.1	3.5	421.5	5.4	Pump
28	Risthal	5.3	12	451	8.7	442.3	1.8	449.2	6.9	Pump
29	Kachnara	6.1	13.2	429	10.2	418.8	2.1	426.9	8.1	Pump
30	Betikheri	5.15	12.1	412	8.3	403.7	3.5	408.5	4.8	Pump
31	Khanderia	6.5	13.2	440	10.2	429.8	3	437	7.2	Pump
32	Barod	5.1	12.5	433	9.1	423.9	3.2	429.8	5.9	Pump
33	Rajakheri	6.2	13.2	426	8.15	417.85	3.15	422.85	5	Munual
34	Khajuri Manda	5.2	12.15	438	9.2	428.8	2.1	435.9	7.1	Pump
35	Kotri manda	8.3	13.2	434	10.9	423.1	2.8	431.2	8.1	Munual

Diameter of Well: The measurements of diameter of open dug well indicate a range of variation from 3.5m to 11m. The diameter range of dug well has been recorded in Table-2. The analysis of Data indicates that the large diameter wells are rare in the area.

Table-2: Showing diameter range of dug wells existing in the area of investigation.

Diameter Range	Number of wells	Percentage (%)
5 – 4	1	2.85
4 – 5	2	5.71
5 – 6	10	28.57
6 – 7	14	40
7 – 8	5	14.28
8 – 9	2	5.71
9 – 10	-	-
10 – 11	1	2.85
Total	35	99.97

Total Depth of well: The depth measurements of the wells reveal a range from 8.7m to 23.5m. b.g.l. (below ground level). The total depth range of dug wells has been displayed in Table-3. The analysis of Total depth of wells exhibits that the maximum number of the wells are characterized by a depth range.

Water level Depth: The depth of the static water levels in open dug wells of the study area have been recorded during the periods of pre and post monsoon (Table-4). It is noticed that the wells having depth of the static water levels more than 1 m. become dry in the monsoon (pre) period. Table-4 indicates that there is decrease in water level from post-monsoon to pre-monsoon period within range of 2.85 to 37.14.

Movement of Ground Water: Pre and Post Monsoon

Groundwater movement has been studied using water level contour maps prepared for pre and post monsoon periods (Figure-2). Water level contour maps reveal the nature of groundwater occurrence and groundwater flow direction which is indicated on maps by means of lines. The lines indicating the groundwater flow direction are recognized by drawing perpendiculars on water level contour of higher value towards a water level contour of lower value¹²⁻¹⁶. The direction of movement of groundwater of area of study has been shown in

the Figure-2. The slope of groundwater flow is determined by the difference between the attitudes of contours of highest and lowest value in the area divided by the normal distance between these two contours.

The direction of groundwater in general, is towards the Gir Nala in the eastern and western sectors of the area. The trend of ground water flow points out that the river receives ground water from all parts of the area and reflect condition of the Gir Nala. Ground water flow in opposite direction from North – South and South North indicating the presence of mound. The wide spacing of contours in the south East, South-West of the area, indicate favorable condition for groundwater exploration. Direction of groundwater movement during post-monsoon and pre-monsoon is more or less same with on almost negligible change. The comparative study of ground water level maps prepared for post-monsoon and pre-monsoon season reveals that the prominent change is observation only in the values of water level contour lines and to some extent in shape of water level contours. If the extraction rates exceed replenishment or recharge rates, aquifers can become depleted since groundwater is a finite resource¹⁷.

Table-3: Showing dug wells (total depth) in the area of study.

Total depth of wells (m.bgl)	Number of wells	Percentage (%)
8 – 9	2	5.71
9 – 10	1	2.85
10 – 11	4	11.42
11 – 12	2	5.71
12 – 13	8	22.85
13 – 14	6	17.14
14 – 15	4	11.42
15 – 16	5	14.28
16 – 17	-	-
17 – 18	-	-
18 – 19	-	-
19 – 20	-	-
20 – 21	2	5.71
21 – 22	-	-
22 – 23	-	-
23 – 24	1	2.85
Total	35	99.94

Table-4: Depth range of water levels in dug wells.

Depth range of water levels (m.bgl)	Number of well		Percentage	
	Per Monsoon	Post Monsoon	Pre Monsoon	Post Monsoon
0 – 1	-	3	-	8.57
1 – 2	-	7	-	20.00
2 – 3	-	13	-	37.14
3 – 4	-	10	-	28.57
4 – 5	-	1	-	2.85
5 – 6	1	1	2.85	2.85
6 – 7	2	-	5.71	-
7 – 8	4	-	11.42	-
8 – 9	10	-	28.57	-
9-10	5	-	14.28	-
10-11	5	-	14.28	-
11-12	4	-	11.42	-
12-13	2	-	5.71	-
13-14	-	-	-	-
14-15	1	-	2.85	-
15-16	-	-	-	-
16-17	1	-	2.85	-
Total	35	35	99.94	99.98

Water Level Fluctuation: (Post Monsoon and Pre-monsoon)

The fluctuation of groundwater level of the area of study is calculated on the basis of data of dug wells collected from the during post and pre monsoon. Groundwater levels are noted which in the fluctuations range of (Table-5) the maximum number of wells reveal fluctuation of water levels within the range of meters¹⁸.

Conclusion

The mode of occurrence of groundwater, movement and characterization of shallow ground water regime of Kayampur area. The systematic hydrogeological survey of this area has

been carried out by recording the relevant data in respect of 35 open dug wells. The ground water level measurements indicate a range of fluctuation from 4 to 14.2 (m) b.g.l. The possible causes of groundwater level have been assigning to the nature of topography, geology, soil conditions, rainfall amount of ground water resource. The groundwater levels recorded during post and pre-monsoon periods signify the direction of groundwater flow and also help in demarcation of probable groundwater

potential sites. At this present stage of investigation, it is opined the demand of water supply through open dug wells can be selected in the catchment area of Kayampur block and in adjoining area particularly in topographic depressions the scheme of development of rain water harvesting structure such as construction of pits and trenches stop dams, percolation tank and nala bunds and subsurface dykes are considered more feasible in process of the ground water recharge.

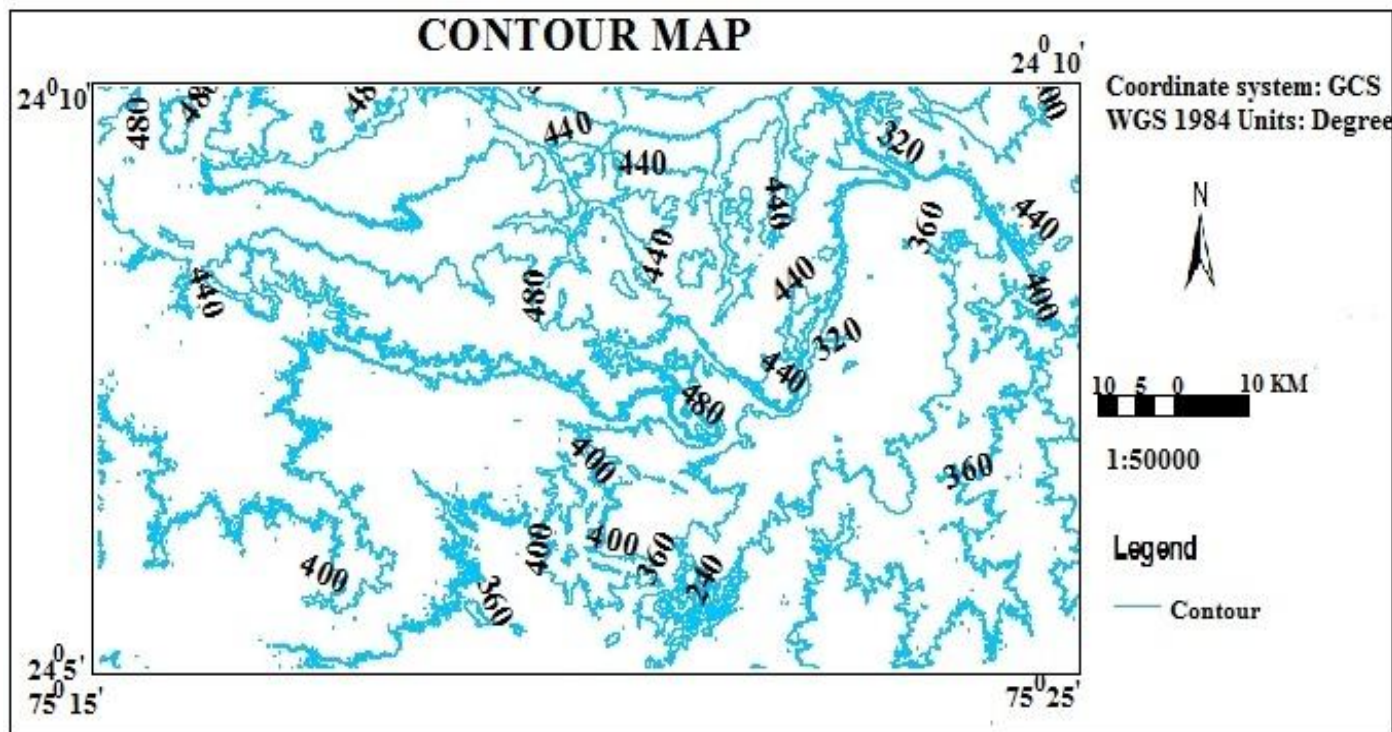


Figure-2: Water Level Contour Map in Kayampur Area, Mandsaur District, M.P.

Table-5: Showing the fluctuation range of water level of the study area.

Fluctuation range (m)	Number of wells	Percentage (%)
4-5	7	20.00
5-6	5	14.28
6-7	7	20.00
7-8	6	17.14
8-9	7	20.00
9-10	-	-
10-11	2	5.71
11-15	1	2.85
Total	35	99.98

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