

# Land Resource its appraisal, Management and Planning: A case study of East Champaran District

**Vandana Kumari**  
Research scholar  
Department of Geography  
B.R.A. Bihar University, Muzaffarpur

## Abstract

Land resource is a precious and the most widely distributed resource in the east champaran district and unlike any other mineral resource. Land resources include all those features and processes of the land, which can, in some way, be used to fulfill certain human needs. As can be seen from the definition of “land” these resources are numerous and complex. To study land resources as a general academic exercise is not impossible, but it can only be done with major simplifications. It is easier therefore to study land resources from a more defined standpoint. For this text, the self-evident standpoint to take is that of the use of land resources within agricultural land utilization types. Only occasionally will some reference be made to other rural land utilization types.

keywords:-Land, Resource, , Surface Water, Agriculture, Irrigation

## Introduction

The name Champaran owes its origin to Champa-aranya. Champa means Magnolia and aranya means forest. Hence, Champaranya means forest of Magnolia (Champa) trees. The area was inhabited by ascetics scholars. Historically, East Champaran is a part of parent Champaran district. Champaran constituted a part of the ancient kingdom of Videha .The Aryan Videhas settled east of the Gandak or Narayani river.

## Methodology

The present research work based on the observational description and observational rational methods in order to decipher the theme of the research. Various statistical and cartographic methods has applied where ever needed. The present research study based on both primary and secondary data. The primary data collected through personal observation, interview, questionnaires schedule etc. while the secondary data collected from concerned district or block headquarters. Map and diagrams, graphs etc. have been widely used in this research papers

## Objectives

1. To ensure regulated exploitation and optimum & judicious use of land resources..
2. To effectively implement conjunctive use of surface water and ground water in the context of land resource.
3. To promote efficient methods of land utilization in the areas.

## Study Area

East Champaran district of Bihar state lies between N 26° 15' 10" and 27° 01' 30" and E 84° 30' and 84° 17' 50" covering an area of 3968 Sq. Km. The district is bounded in the North by Nepal, South by Muzaffarpur, part of Gopalganj, East by Sitamarhi and Sheohar and West by West Champaran and part of Gopalganj district. On 1st of December 1971, Champaran district was split up into two districts, viz. East Champaran and West Champaran. The headquarter of East Champaran district is at Motihari.

The district headquarter is Motihari which is well connected to different parts of the state by all weather roads and rail. It is about 170 Km from Patna by road. Location of the district is of strategic and historical importance. The district has been the centre of communication for the border areas of Nepal. It has six sub-divisions with 27 blocks. Administrative details of East Champaran district are given below in As per the census of 2011, the district has a population of 5,082,868 with 2,674,037 males and 2,408,831 females. The population density has been found to be 1281 persons per sq. km. The male female sex ratio has been found to be 901 females per 1000 males. Literacy rate is 58.26% with 68.02% for male and 47.36% for female. Overall literacy percentage in the district is 58.26% with 68.02% of male and 47.36% of females literacy.

## Irrigation practices

The economy of the district mainly depends upon agriculture. The major crops of the district are Paddy (Basmati Rice), Mustard, Sugarcane, Jute, Lentils and Vegetables. The irrigation in the district is mostly influenced by the presence of canal system in the northern and eastern parts. This has greatly improved the irrigation facilities in the district. Irrigation through lifting of water by means of swing buckets, by constructing bunds on the river and distribution of the water by means of 'Pynes'. Other irrigation means are shallow tubewells, tanks and wells. Gross irrigated area reported from the district is 183000 hectares of land with Net irrigated area of 141000 hectares of land. Along with this, total cropped area is 390473 hectares and net sown area is 304875 hectares of land.

## SOIL RESOURCE OF EAST CHAMPARAN (MOTIHARI) DISTRICT, BIHAR

1. **Surveyed Area** : East Champaran district, Bihar
2. **Location** : Latitude 26°15' 16 '' to 27° 01' 13'' N  
Longitude 84°29' 13'' to 85° 17' 55'' E
3. **Agroclimatic Region** : Middle Gangetic Plain  
(Zone – IV as per planning commission)
4. **Total Area of the District** : 396803 ha
5. **Kind of Survey** : Soil Resource Mapping using Remote Sensing and GIS Techniques
6. **Base Map** : IRS-ID Geocoded Satellite Imagery (1:50,000 scale)  
Survey of India Topographical maps on 1:50,000 scale.
7. **Scale of Mapping** : 1:50,000
8. **Period of Survey** : January, 2015

9. *Soil Series Association mapped and their respective area:*

Sl. No.	Mapping Unit	Soil Series Association	Area(ha)	Area%
01	ALb1a1	Kesaria, Rariaha	29773	7.50
02	ALb1a2	Bhawanipur, Partapur, Jhitkahia	70624	17.80
03	ALb1a3	Champapur, Jhajhara, Karmoulia	40742	10.27
04	ALb1a4	Bhakhari, Mathia Mohan	82363	20.75
05	ALb2a1	Mathbanbari, Jhakra	83043	20.93
06	ALb2a2	Sakrar, Parsaunikapur, Fatuha	29482	7.43
07	ALb2b1	Dhekha, Fatuha	2073	0.52
08	ALe2a1	Dumariya Ghat, Madhubani Ghat	10277	2.59
09	ALe2d1	Dumariya Ghat	7279	1.83
10	ALg3a1	Piprakothi, Jitwara	6968	1.76
11	ALn2a1	Tharghatma, Jitwara	9828	2.48
12	Miscellaneous	Habitation	4035	1.02
		River & Waterbody	20316	5.12
		<b>Grand Total</b>	<b>396803</b>	<b>100</b>

**Salient Features:**

⇒ Physiographic division of the soils of the East Champaran district of Bihar:

Landscape	Physiography	Area (ha)	Area(%)
Alluvium	Alluvial Plain	338100	85.20
	Flood Plain	9828	2.48
	Levee	17556	4.42
	Stream/River Banks	6968	1.76
Miscellaneous	Habitation	4035	1.02
	River & Waterbody	20316	5.12
<b>Total</b>		<b>396803</b>	<b>100</b>

⇒ Soils of the district fall in two slope classes:

Sl. No.	Slope Classes	Area (ha)	Area (%)
1.	Nearly level	223502	56.33
2.	Very gently slope	141982	35.77
3.	Very gentle to gentle slope	6968	1.76
	Misc.	24351	6.14
	<b>Total</b>	<b>396803</b>	<b>100</b>

⇒ Various land use / land cover classes of the district are as under

Sl.No.	Land Use	Area (ha)	Area (%)
1.	Agriculture (Single/Multi crop)	363100	91.51
2.	Plantation	2073	0.52
3.	Open scrub/scrub's lands	7279	1.83
	Misc. Land	24351	6.14
	<b>Total</b>	<b>396803</b>	<b>100</b>

ð Erosion classes of the soils of the district are as under

- The soils comprising of 336027 ha. (84.68 %) fall under non to slight erosion.
- The soils comprising of 29457 ha. (7.42 %) fall under slight to moderate erosion.
- The soils comprising of 6968 ha (1.76 %) fall under moderate to severe erosion
- Miscellaneous 24351 ha (6.14%)

ð Soils of the area are taxonomically classified into three orders i.e Alfisols, Inceptisols. and Entisols. All the 21 soils series identified in the area are further classified into 6 sub order, 6 great group, 11 sub group and 17 families.

## Optimum use of the resource

This report embodied the results of the Soil Resource Mapping of East Champaran district, Bihar providing information on the geographical setting of the district such as location, extent, physiography, relief, drainage, climate, geology, natural vegetation, agriculture, land use and soils.

The report contains other information on interpretative grouping of soils such as land capability classes, land irrigability classes, soil suitability grouping and hydrological grouping and also recommendation for crops; horticulture development, forest, forage and grassland development; water harvesting, water storage and water management that are essential for soil and land resource management. The genesis and classification of the soils are also discussed in. East Champaran district of Bihar is spread over an area of 396803 ha. The district is covered by 10 SOI topographical sheets on the scale of 1:50,000 which are used as base material along with satellite imageries.

Each soil mapping units is marked by mapping unit i.e ALb1a1 (Alluvium; alluvial plain; 0-1% slope; agriculture land use; soil series association describing Kesaria as dominant series in association with Rariaha series). Each soil association is restricted to a maximum of three soil series.

For the use of the soil resource report, first locate the area of interest on the map and note down the soil mapping units. Permanent features such as road, stream, lakes and village habitation etc. shown on the map, help to locate the area of interest on the map. For the detailed information on soil mapping unit in respect of soil series of the area of interest, its extent, present and proposed land uses and reference may be made.

## Studies/Activities of CGWB

Central Ground Water Board has covered the district under systematic hydrogeological survey and a major part the district has been covered under ground water management study. District hydrogeological report and ground water management study report has been issued. As per the Dynamic Ground Water Resource of Bihar State (2009) the net annual ground water availability in the district is 124861 ha.m. and net ground water availability for future irrigation development in the district is 67797 ha.m. Under exploratory programme, CGWB has drilled 7 exploratory wells and 3 observation wells. Wells upto a maximum depth of 348 mbl have been constructed in the district. The list of wells drilled is given in the table : There are 16 Hydrograph Network Stations (HNS) in the district, which are monitored four times in a year to measure the water level of the phreatic aquifer.

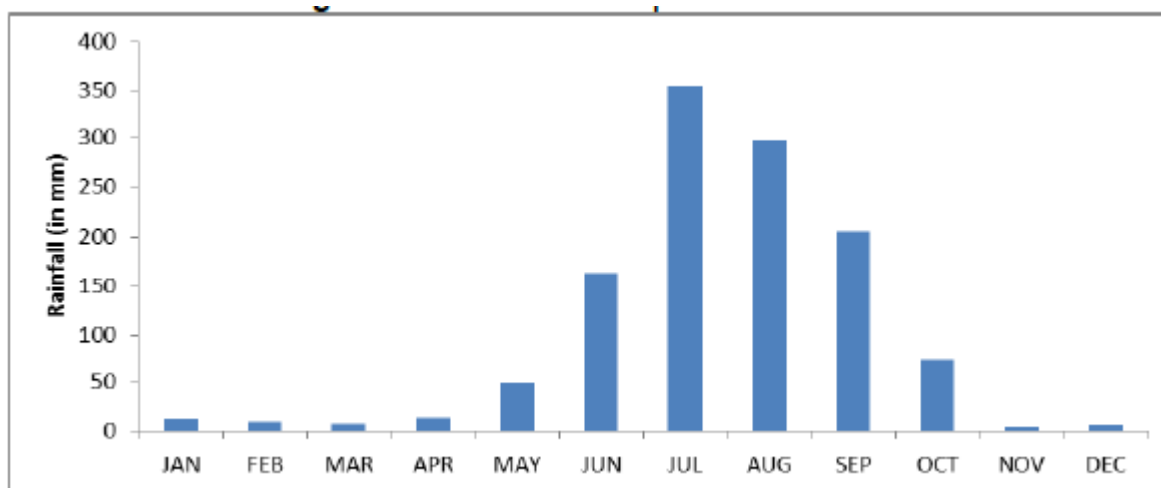
## Climate and Rainfall

Flood and drought has remained a regular feature of the area. The district of East Champaran is known for its hot summers and severe winters. The summer season starts from the end of March with average temperature of about 35° C and maximum temperature of 46° C in the months of May and June. In

winter season the temperature goes down to 4 - 5° C. Lowest temperature is reported from the end of December to January.

The rainfall in the region is received through South West Monsoon during June to end of September in the area. During the rest of the period the rainfall is sporadic or scanty. The average rainfall reported from the area is 1241.6 mm. Very heavy rainfall is reported in the month of July to September. Winter rains along with pre monsoon showers are common in the district. A plot showing month wise rainfall (in mm) of East Champaran district is given below .

Fig. 1. Month-wise rainfall plot for the district



### Geomorphology and Soils

The topography of the area is fairly even and has fertile alluvial plains. These alluvial plains are divided into two tracts by the river Burhi Gandak (Little Gandak) with both the plains having remarkably different characteristics. The river Sikarashtra (Burhi Gandak) divides the tract from North West to South East. The northern portion of the tract is of older alluvium and has low land area which is suited for cultivation of kharif but is unsuitable for rabi crops.

The southern portion of the tract has recent alluvium deposits of the river Gandak which has changed its course moving further west. This southern portion is suited for cultivation of both Kharif and Rabi crops. The area of this region is characterized by stretches of upland varying in places by large marshy depressions known as 'Chaur'. The major slope of the area is due south-east.

The most remarkable feature of the district is presence of a chain of nearly 40 lakes running through the centre of the district covering an area of around 350 sq. km. The important lakes are located at Sugaon, Talsaraiya, Turkaulia, Motihari, Pipra, Siraha, Nawada and Tetaria. The depth of the lakes varies from 1-5 m and remains mostly filled up with water during summers. The prevalent soil is older alluvial type which is characteristic feature of the Gangetic plain. The soil is lighter in texture. In the northern region the soil is strong clay known locally as 'Bangar' covering an area of about two-fifth of the district. In this area, paddy crops are cultivated during sufficient rainfall seasons. In the Southern region of the river, the soil is mainly light sandy loam not suitable for kharif but yields good crops of wheat, mustard linseed etc. Major soil types found in the area are Paleustalfs, Haplaquents and Udifluvents soils.

## Discussion

East Champaran district lies east of the Gandak River in the North Ganga Plain. Thick alluvial deposits down to depth of 300 m have been explored. Potential aquifers can be tapped both at shallow depth (~ 50 m bgl) as well as deeper level up to 200 m bgl in general. Discharge is high enough to meet the requirement for drinking and irrigation.

## Hydrogeology

Geologically, the district has unconsolidated alluvial sediments of Quaternary age. The geological succession as per Geological Survey of India is as follows:

Group	Formation	Lithology
Quaternary	Recent alluvium	Clay, Silt and Sand gravel, Calcareous nodules (kankars)

The predominant soil is of older alluvial type which is a characteristic feature of the Gangetic plain. The entire alluvial tract is exposed to fluvial action of recent times. Ground water occurs under unconfined conditions in the phreatic aquifer, which is generally disposed within 70 m below ground. Aquifers situated at deeper levels have ground water levels under confined condition.

The hydrogeological map of the district is shown in .



## Ground Water Resources

As per the dynamic ground water resources calculated for the districts, as on 31st March 2009, the net annual replenishable ground water resource works out to be 124861 ha.m. The gross annual draft for all uses works out to be 52836 ha.m. Allocation of ground water for domestic and industrial use for 25 years works out to be 11754 ha.m. The stage of ground water development is 42.3%. The stage of ground water development is highest in Madhuban (79.7%) and lowest in Kesaria (24%). As stages of ground water development in all the blocks are less than 70% except Mahduban (79.7%), Phenhara (77.5%), Piparikothi (76.2%) and Tetaria (73.3%), and there is no long-term decline in water levels, on the basis of stage of ground water development and water long term water level trend all the blocks are categorized under safe category.

Taking into consideration, the long-term decadal (2001-2011) water level fluctuation for pre monsoon, there is a variation in water level from 0.50 to 1.18 mbgl and for post monsoon, it shows variation in water level between 0.26 to 2.18 mbgl. During pre-monsoon nearly 28.5% of the wells showed rise and 71.4% of wells showed falling trend in water level whereas during post monsoon 50% of the well showed rise and rest 50% of the well showed fall trend in water level.

On compaing the water level fluctuation of May 2011 and August 2011, it is seen that there is rise of 3.58 mbgl of water level. The depth range of the wells showing rise in water level ranged from 2-4m. Similarly, comparing the water level fluctuations of May 2011 and November 2011, there is rise of water level upto 3.41 mbgl. This rise in water level varies from 2 to 4 mbgl. On comparing the water level fluctuations of May 2011 and January 2012, there is rise of water level upto 3.17 mbgl.

Ground water in the district can be developed through shallow tube well in the range of 30-50 m below ground which can yield upto 40-70 metre cube per hour. The deep tubewell can be of 125 m depth will be capable to yield 100 to 150 metre cube per hour by tapping aquifer for about 18-24 m. No water conservation or artificial recharge structure has been constructed by CGWB in the district. The district is by enlarge underlain by potential, unconsolidated quaternary aquifers with good recharge potential.



Fig. 2. Hydrogeological map of the district

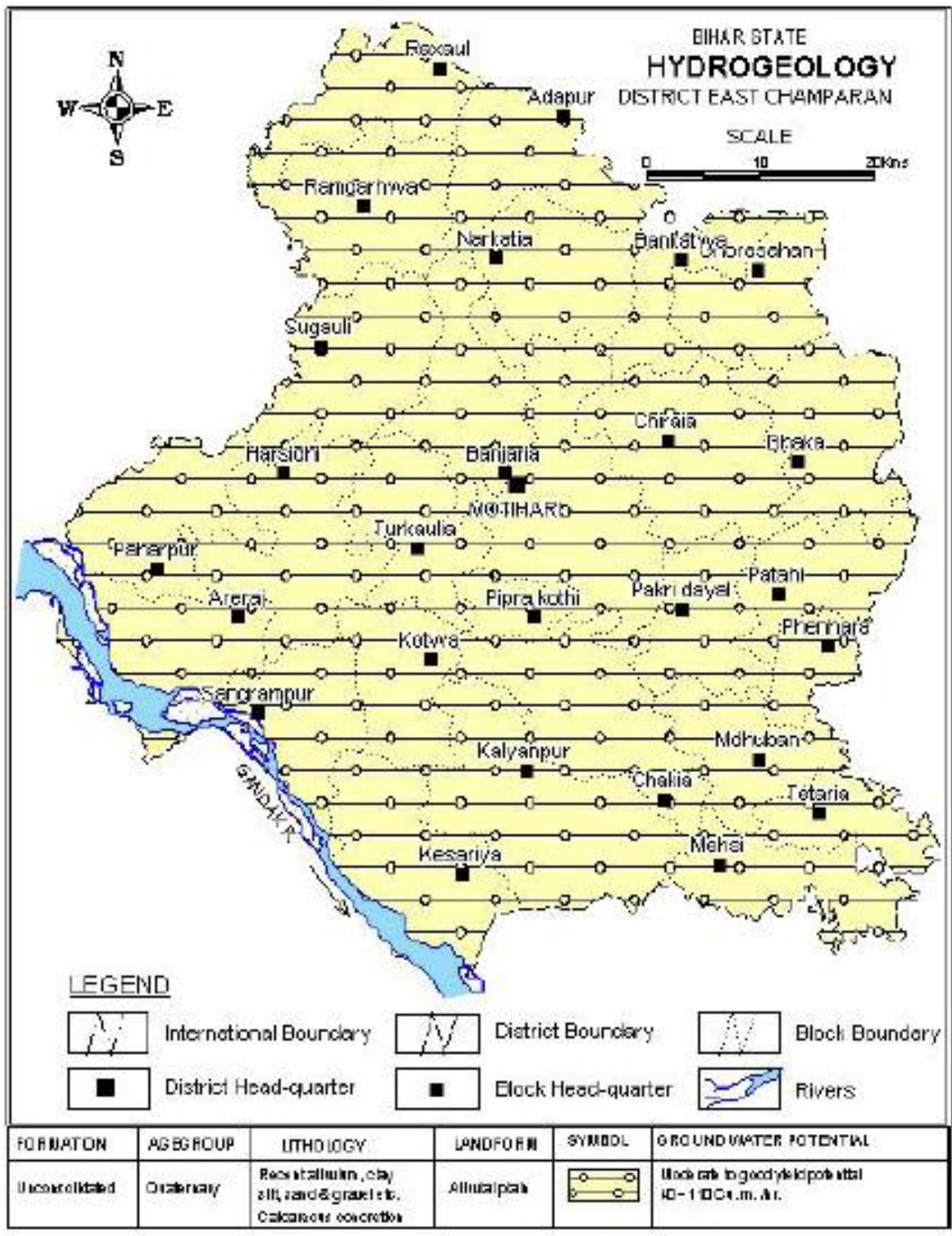
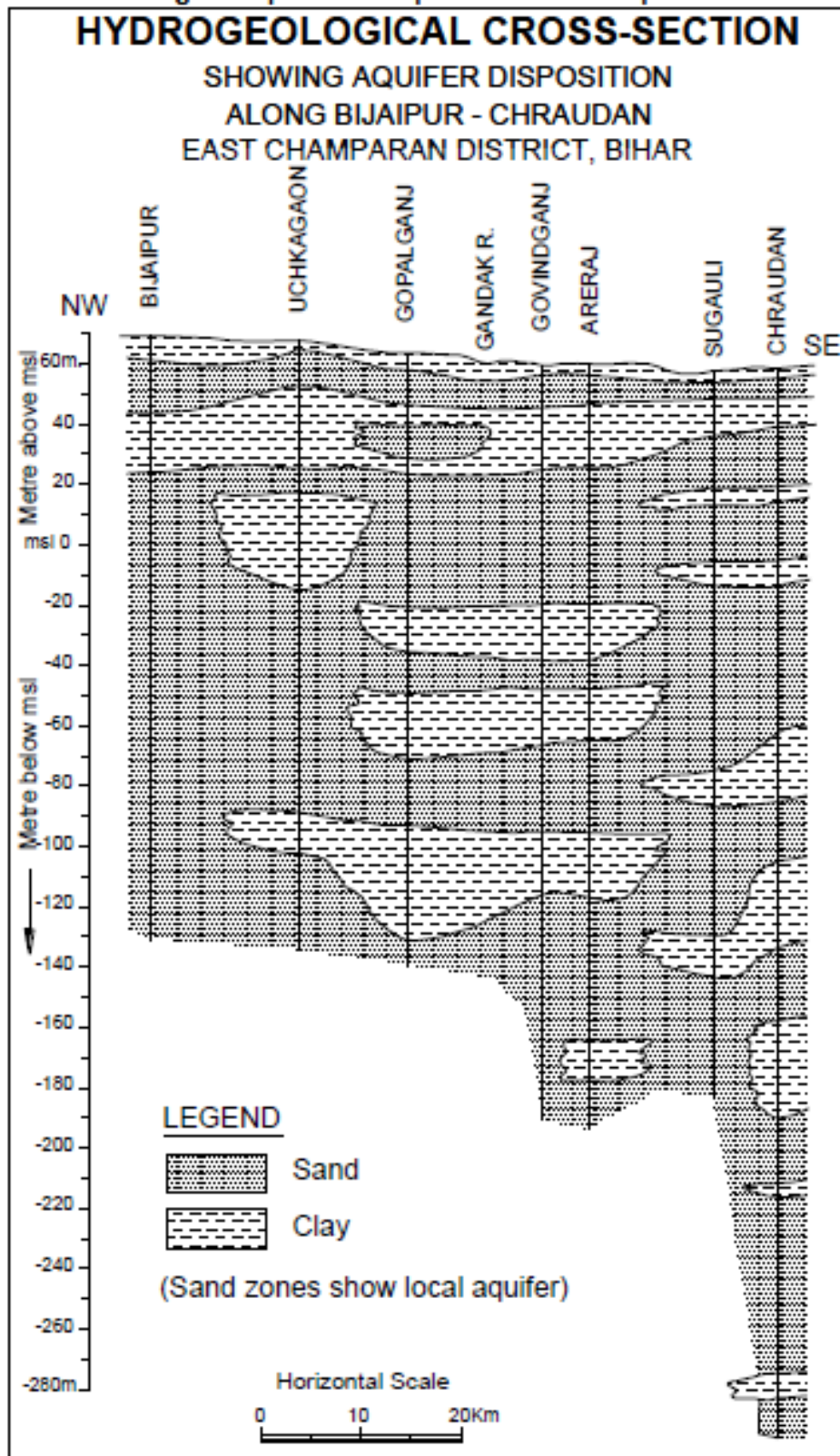


Fig. 3. Disposition of Aquifers in East Champaran



The water level fluctuation in the area can be noticed through continuous monitoring of Hydrograph Network Station (HNS) wells in the district. The HNS monitoring is being done four times a year as per the following schedules (Table No. 2):

**Table** HNS monitoring schedule

Sl. No.	Month	Date	Period
1	May	20 – 30	Pre-monsoon
2	August	20 – 30	Mid-monsoon
3	November	1 – 10	Post-monsoon
4	January	1 – 10	Recession

In East Champarn, most of the wells have depth range of 2-5m. The pre-monsoon (May 2011) depth to water level generally varies from 1.5 to 6 m bgl in major part of the district (Fig. 4.) The post-monsoon (August 2011) water level generally varies from 0.65 to 2.24 mbgl. Similarly, for the month of November 2011 the water level varied from 0.80 to 3.25 mbgl (Fig. 5) and in January 2012 from 1.15 to 3.50 mbgl.

### Ground Water Exploration

The district having an area of 3968 sq km lies between north latitude 26° 15' 10" : 27° 01' 30" and east longitude 84° 30' : 85° 17'. The district is mainly drained by Gandak and Sikrahna rivers. Geologically, the district is occupied by unconsolidated alluvial sediments of Quaternary age. The Quaternary sediment of the district has been divided into two groups (a) Newer alluvium and (b) Older alluvium. The Newer alluvium occupies the low lying area restricted to flood plains whereas older alluvium occupies the high grounds. The lowest water table contour value is 50 m above MSL and maximum value is found to be 74 m above MSL.

1. Electrical conductivity: of ground water of parts of East Champaran District ranges between 510 – 1520 micro siemens /cm. at 25OC.
2. PH: Ground water of the parts of Ranchi districts are slightly alkaline in nature where PH varies between 7.68 to 8.30.
3. Chloride: concentration of chloride varies between 4 to 121 mg/l.
4. Bicarbonate: concentration of bicarbonate is between 342 to 598 mg/l.
5. Calcium: Calcium is found between 26 to 42 mg/l.
6. Magnesium: It occurs between 12 to 114 mg/l.
7. Sodium and Potassium: concentration of sodium is between 18 to 132 mg/l while potassium occurs between 1 to 84 mg/l.

## Finding and Conclusion

The district of East Champaran is underlain by prolific and regionally extensive aquifers of huge thickness. The aquifers of good repositories are confined in medium to coarse grained sand layers in the alluvial sequences. Open wells or Dug wells with a diameter of 1 to 3 metres, upto depth range 2 to 7 m bgl, are tapping the upper part of the zone of saturation. The stage of ground water development in the district is 42.3% overall however in the four blocks namely Kotwa, Phenara, Piprikothi and Tetaria the stage of development has exceeded 70%. In these blocks, further ground water development should be done in a careful manner. As per the resource evaluation of 2009, the stage of development is 42.3%. The net ground water availability for future irrigation is 67797 ha. m. This indicates that there is a vast scope for ground water development to increase the irrigation intensity in the district. The potential aquifer of the district is capable of supplying drinking water need for rural and urban population.

No measure ground water related problem has yet been reported from the district. In local scale, fluoride exceeds the limit for drinking as reported Mass Awareness Programme (MAP) and Water Management Training Program (WMTP) yet to be organized in this district

## Recommendations

1. Sufficient scope exists for development of land resource for agriculture.
2. Conjunctive use of surface and ground water can be a better option for the district for maximum utilization of the resource
3. Non conventional energy sources can be used for energization of tubewells for better irrigation

## References

1. Dakshinamurti ,C; Michael , A.M. & Mohan , S, (1972) : Water Resources of India and their utilization in Agriculture , IARI , Monograph No-3 , New Delhi
2. Ground Water Information Booklet, East Champaran District, Bihar State (CGWB) Ministry of water Resources (Government of India) Mid-Eastern Region, Patna, September 2013.
3. Hydrogeology and Ground Water Resources Development plan of East Champaran District Bihar, 2013.
4. East Champaran District Population Census 2001,2011.