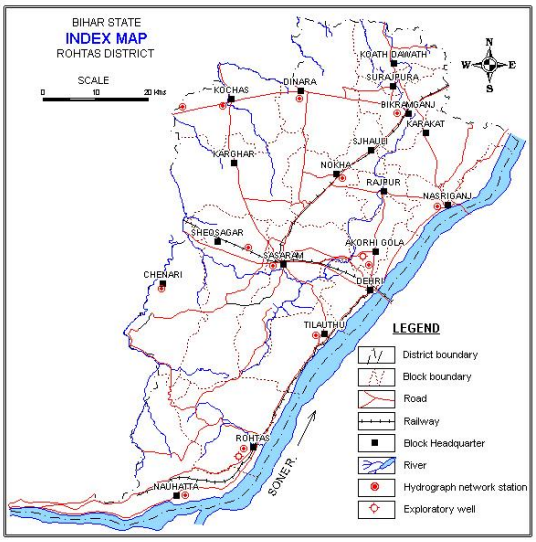
भूजल सूचना पुस्तिका

रोहतास जिला, बिहार

Ground Water Information Booklet
Rohtas District, Bihar State



केन्द्रीय भूमिजल बोर्ड
जल संसाधन मंत्रालय
(भारत सरकार)
मध्य-पूर्वी क्षेत्र
पटना

Central Ground water Board
Ministry of Water Resources
(Govt. of India)
Mid-Eastern Region
Patna

सितंबर 2013

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ROHTAS DISTRICT

ROHTAS DISTRICT AT A GLANCE

SN	ITEMS	STATISTICS
1.	**GENERAL INFORMATION**	
	I Geographical Area (Sq. Km.)	3851
	II Administrative Divisions	3
	No. of Panchayats/Villages	244/2088
	Number of Tehsil/Block	19
	III Population (As per 2011 Census)	Rural: 2103116
		Urban: 347632
	IV Average Annual Rainfall (mm)	1144.20
2	**GEOMORPHOLOGY**	
	Major Physiographic Units	flat terrain, sub-hilly region
	Major Drainages	Sone river
3	**LAND USE**	
	i) Forest Area	667.23 sq.km
	j) Net Area Sown	2386.7 sq.km
	k) Cultivable Area	2817.96 sq. km
4	**MAJOR SOIL TYPES**	Udifluvents, Paleustalfs, Haplaqents, Haplustalfs, Rhodustalfs
5	**PRINCIPAL CROPS**	Rice, Maize
6	**IRRIGATION BY DIFFERENT SOURCES**	
	(Area in hectares)	
	Dugwells	-
	Tubewells/Borewells (STW)	22069
	Tanks/ponds	-
	Canals	163686
	Other Sources	6610
	Net Irrigated Area	192365
	Gross Irrigated Area	-

7	**NUMBER OF GROUND WATER MONITERING WELLS OF CGWB (2011)**	
	No. of Dugwells	14
	No. of Piezometers	Nil
8	**PREDOMINANT GEOLOGICAL FORMATIONS**	Alluvium, Sandstone & Limestone
9	**HYDROGEOLOGY**	
	Major water bearing formations	Alluvium & Sandstone
	Pre-monsoon Depth to water level during 2011	4.98 – 12.08 m bgl
	Post-monsoon Depth to water level during 2011	1.25 -7.98 m bgl
	Long term water level trend in last 10 yrs(2002 –2011) in m/yr	No significant decline
10	**GROUND WATER EXPLORATION BY CGWB (As on 31-03-2013)**	
	No. of well drilled (EW,OW, PZ, SH, Total)	EW-2
	Depth Range (m)	-
	Discharge (m^3/hr)	-
	Storativity (s)	-
	Transmissitivity (m^2/day)	-
11	**GROUND WATER QUALITY**	
	Presence of Chemical constituents more than the permissible limit (e.g. EC, F, As, F)	F at places
	Type of Water	Potable
12	**DYNAMIC GROUND WATER RESOURCES (as on 31st March 2009) in mcm.**	Fluoride contamination
	Annual Replenishible Ground Water Resources	1070.53 ha.m
	Net Annual Ground Water Draft	38519 ha.m
	Projected Demand for Domestic and Industrial Uses up to 2025	7370 ha.m
	Stage of Ground Water Development	36.0%
13	**AWARENESS AND TRAINING ACTIVITY**	
	One day Training Programme Organized	Nil
	Date	-
	Place	-
	No. of Participants	-
14	**GROUND WATER CONTROL AND REGULATION**	
	No. of OE Blocks	Nil
	No. of Critical Blocks	Nil
	No. of Blocks Notified	Nil
15	**MAJOR GROUND WATER PROBLEMS AND**	High fluoride concentration

1.0 INTRODUCTION

1.1 Location, Area and Administrative Details

Rohtas is one of the thirty-eight districts of Bihar located in the south-western part of the State and occupies an area of 3851 Sq Km. Rohtas district extends between N. latitude 24°29' and 25°22'40" and E. longitudes 83°19' and 84°29' and falls in Survey of India Degree Sheet No. 63O, 63P, 72C, and 72D. It bounded on the north by the district of Buxer and Bhojpur on the South by the district of Palamu & Garhwa of Jharkhand State on the east, by the district of Aurangabad and part of Gaya district and on the west, the district of Kaimur (Bhabhua). The river Sone forms the southern and eastern boundary of the district.

After independence, Rohtas remained a part of the Bhojpur district but in 1972, Rohtas formed a separate district which have been administratively divided into three sub-divisions namely Sasaram, Bikraganj, Dehri with district headquarter at Sasaram. At present the district comprises 19 administrative blocks, 244 Panchayat and 2088 villages.

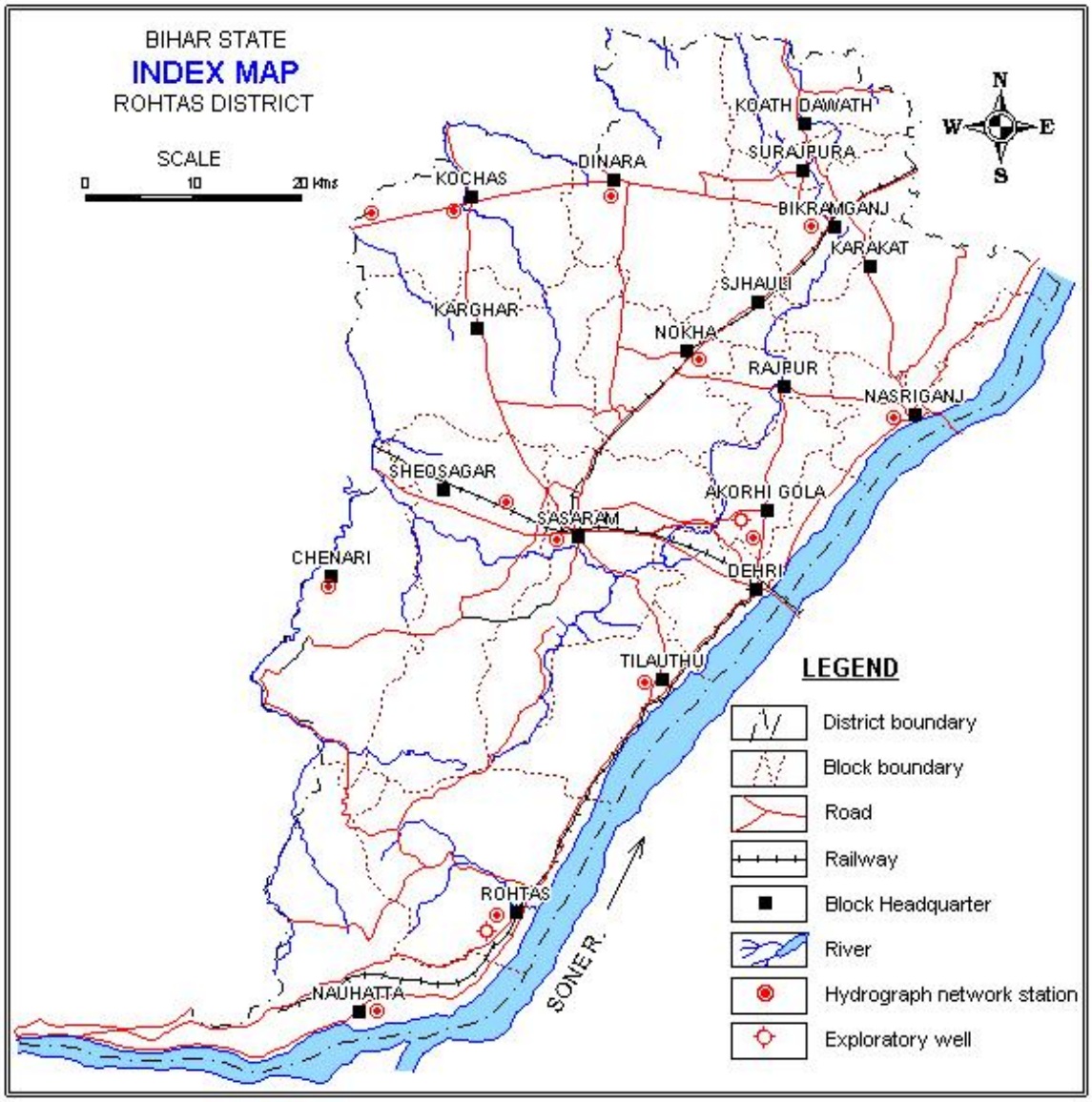
As per the Census of India – 2011, the total human population of the district was 2,962,593 (2.85% of the total population of Bihar) in which male and female population was 1,547,856 and 1,414,737 respectively. The sex ratio was 914 female per 1000 male. The population density was 763 per Sq. Km. and the decadal growth rate was 20.22. The total literate person of the district was 1,866,684 where the literacy rate of male and female was 85.29% and 64.95% respectively.

The districts headquarter Sasaram of Rohtas district is well connected to different parts of the State and other States by all-weather roads and rail. Sasaram is about 172 km away from the State capital Patna by road.

***Table 1**: Administrative Unit of Rohtas district*

District	Sub-division	Block
Rohtas	Bikramganj	Bikramganj
		Dawath
		Dinara
		Karakat
		Nasriganj
		Rajpur
		Sanjhouli
		Surajpur
	Dehri	Akhorigola
		Dehri
		Nauhatta
		Rohtas
		Tilothu
	Sasaram	Chenari
		Karagar
		Kochas
		Nokha
		Sasaram
		Sheosagar

Figure 1: *Map of Rohtas district showing administrative details.*



1.2 Basin/Sub-Basin and Drainage

There are two sub-basin in the Rohtas district. The western part of the district is situated on 'Ghaghra confluence to Gomti confluence' sub-basin which is a part of Upper Ganga Basin whereas the narrow eastern part, along with the river Sone, falls in Sone Sub-basin which is a part of Lr. Ganga Basin.

The Sone is an main river in the district which originates in the plateau area of Amarkantak in Madhya Pradesh State. It enters the district at the junction of Palamu, Mirzapur (U.P.) Kaimur and Rohtas district and forms southern and eastern boundary of the district. The small tract of land in the western part of the district between Kaimur plateau knows as Sone valley is formed by this river. The river is the main source of the famous Sone-sand used extensively for the construction of building.

1.4 Land use, Agriculture and Irrigation Practices

As per the record of Department of Agriculture, Government of Bihar (2009-10), the forest covers of the district is 66723 ha. The total copped area is 23870 ha whereas the total non-agricultural land is 152052 ha. The land use pattern is given in table -

***Table 2**: Land utilization*

Forest Area			1	66723
Land put to Non-agriculturable use	Land Area		2	38489
	Water	Parenial	3	8961
		Temporary	4	309
	Total of rows 2, 3 & 4		5	47759
Barren Uncultur-able Area			6	16831
Permanent Pastures & Grazing Land			7	99
Land under Misc. Tree crop& Groves not included in net area sown			8	2879
Culturable Waste Land			9	1102
Fallow Land	Other Fallow Land		10	789
	Current Fallow land		11	15870
	Total		12	16659
Total Non-Agricultural Land			13	152052
Net Sown Area			14	238670
Total Cropped Area			15	281796
Area Sown more than once			16	43126

Source: http://krishi.bih.nic.in
Unit in ha

Agriculture is the main livehood of the population. The agriculture calendar starts from the month of July and continued to the month of June of the succeeding year before the onset of monsoon every year. Thus a calendar year is divided into four agriculture season viz., Bhadai, Aghani Rabi and Garma.

***Table 3**: Agriculture seasons and major crops*

Kharif		Rabi (Nov. – Mar.'Apr.)	Garma (Marc.-Apr/Jun.)
Bhadai (Apr. - Aug./Sept.	Aghani (Jun. – Oct.)		
Paddy, Maize	Paddy, Maize	Wheat, Pulses, Spices, Maize, Oilseed	Paddy, Maize, Vegetables, Pulses Millet

Irrigation plays a vital role in the agriculture in this district and irrigation is practiced from both surface and groundwater. The surface water is the major source of irrigation in the district. Total 192365 hactare areas of the district are irrigated out of which, 163686 hactare area is irrigated by the canals. The Sone River is the main source of canal system. The groundwater is used for agriculture purpose by boring and about 22069 hactare area is irrigated by the tubewells and only 6610 hactare area is irrigated by the other sources. As per the record of Department of Agriculture,

Government of Bihar (2010-11) the total production of rice, wheat & barley and Maize is 286533, 1312, and 289 M.T. respectively.

1.5 Studies/Activities carried by CGWB

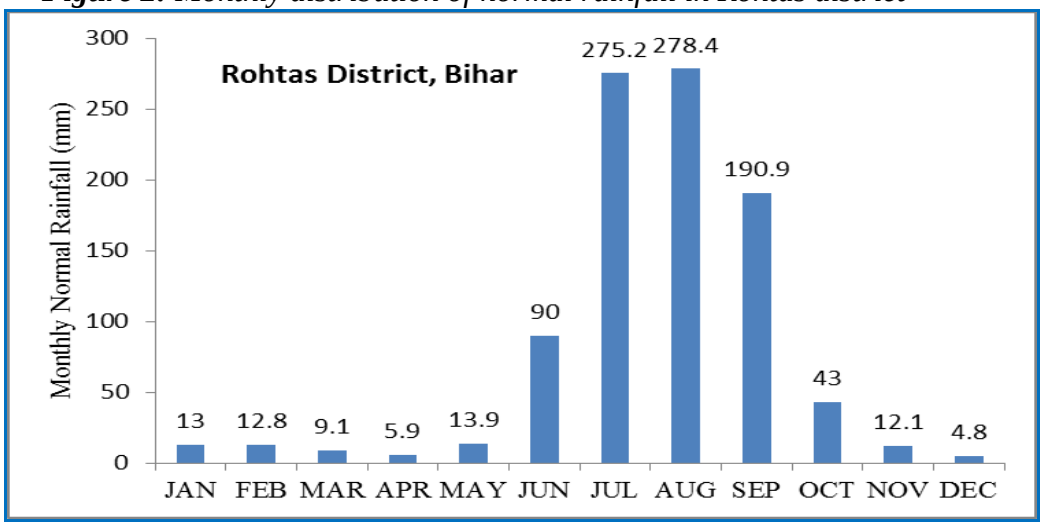
The CGWB has drilled two Exploratory Wells in the Akhorigola and Rohtas blocks. There are 14 groundwater monitoring stations representing the phreatic aquifer, are being monitored four times in a year. The water level data of these monitoring stations responds the monsoonal pattern and represents seasonal ground water scenario of the districts. It is also used in the estimation of ground water availability in the district for irrigation, domestic and industrial purposes. The ground water samples collected in the month of May every year for the chemical analysis for its major chemical constituents. Besides above, the hydrogeological survey had been carried out in the year 1980, 1983, 1992 and 2004.

2.0 CLIMATE AND RAINFALL

The climate of the district is sub-tropical monsoonic, characterized by hot summer, high humidity and dry winter. January is the coldest month when the minimum temperature comes down to approximately 4°C. Winter season starts from the month of November and lasts till February. The temperature begins to rise in the March and it reaches the peak in the month of May when the mercury touches about 45°C.

Rains sets sometimes in June also and lasts till middle of September. The district gets easterly wind from June to September, whereas westerly wind blows from October till May. The district gets maximum rainfall during the months of July and August. Some winter rains occurs in January and February. About 90 % of rainfall is received during the monsoon months between June to September. The average annual rainfall is 1144.2 mm. The monthly distribution of normal rainfall in Rohtas district is given in Fig. 2.

Figure 2: *Monthly distribution of normal rainfall in Rohtas district*



3.0 GEOMORPHOLOGY AND SOIL

3.1 Geomorphology

The district has complex features having alluvium in the northern part to the sub-hilly region in the south. The district has a general slop towards the north but the eastern narrow part of the district, along the river Sone, towards Sone (East). The major (northern) part of the district is a characteristically flat terrain without any undulation and rocky isolated patches in between. The general elevation of the flat terrain with respect to mean sea level is 80-90 m and the gradient is 0.60 m/km from south to north

3.2 Soil

Rohtas district which treasures various geological formation ranging from Vindhyan to Recent have diversified paedogenesis depending upon the composition of the parents materials, palaeogeographical and climatic conditions to which it was subjected. The major soil group which have got strategic significance in present day land utilisation are described below

(a) The forest and hilly area in the south of the GT road with yellowish brown to reddish brown soil.

(b) Alluvial soils, light grey to dark grey in colour of recent age occurs in the north of GT road (NH-2) in Gangetic plain.

(c) Marginal alluvial soils, (Colluvial deposits) greyish yellow in colour to the south of GT road upto the foothill of Kaimur plateau.

The hilly soil are characterised by low nitrogen, medium to high potash, acidic and light to medium textured. The alluvial soils in the northern part of the district are neutral to slightly alkaline, heavy textured. The alluvial plain soil is practically unaltered alluvium representing a broad spectrum of sand, silt and humus bog clay depending on landform component. The marginal alluvial soils are heavy textured, calcareous, with more than 10% of $CaCO_3$.

4.0 GROUND WATER SCENARIO

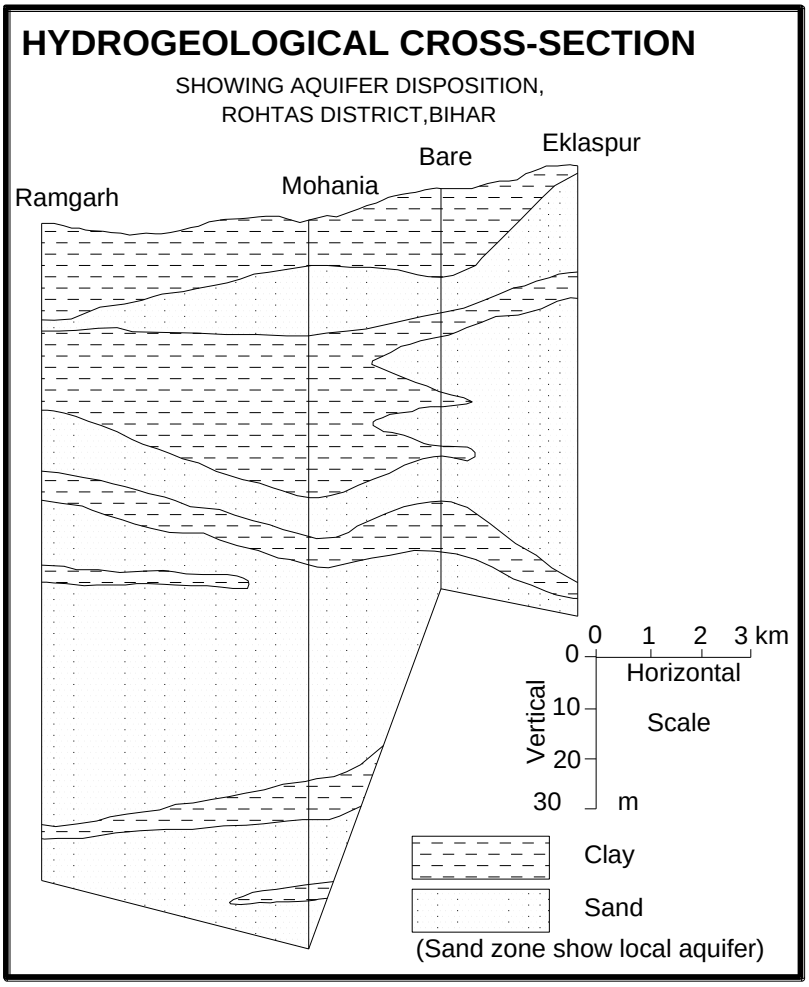
4.1 Water Bearing Formations

Based on the behavior and occurrence of ground water in alluvium in the district can be described under these two distinct categories:

(a) Shallow Aquifer : Occurring within the depth of 50 m

(b) Deeper Aquifer: Beyond the depth of 50 m bgl down to 300 m bgl

***Fig. 3**: Hydrogeological Cross-Section*



(a) *Shallow aquifer zone:* The shallow aquifer occurring within a depth of 50 m from land surface. (Fig. 3) It constituents the mixture of sand, silt and clay with calcareous nodules at places. The thickness of saturated aquifer varies from 5 to 20 m. Ground water in these sediments occurs under water table to semi-confined condition. Open wells and shallow tubewells are used to develop groundwater from this aquifer. This aquifer gets recharged mainly from local precipitation. Separated from this shallowest water bearing zone by few meter thick clay, second saturated horizon often tapped by dug-cum-borewell with some boring from the base of the open wells.

(b) *Deeper aquifer zone:* Considerably, there is a variation of granularity and thickness of the aquifer in this zone. Even tube wells which are in proximity of each other are tapping aquifer at different depth. The aquifers consist of fine to medium sand with intercalation of clay. Within the depth range of 50 to 300 m bgl, there are three to four major aquifer zones exists within this depth range where ground water occurs under semi-confined to confined condition.

4.2 Depth to Water Level

Depth to water level in the district is quite variable. Various factor like topography, proximity of drainage channel, surface water bodies etc. influence the depth to water level. In general the depth to water level is more near foot hills and less in the plain. There are 14 monitoring wells (Dug wells) in the district. Depth to water level observed in Rohtas district during pre-monsoon period (May 2011) varied from 4.98 to 12.08 m bgl, whereas, during the post-monsoon period (Nov. 2011) it was ranged from 1.25 to 7.98 m bgl.

Fig. 4 & 5 depicts the depth to water level scenario in Rohtas district during pre and post-monsoon period respectively.

During pre-monsoon, major part of the district, remarkably the northern part, has shown water level in the range of 5 to 10 m bgl, whereas in the foothills, the water level has shown the deeper range of >10 m bgl. The southern part of the district is also in the range of 5 to 10 m bgl . This variation often more perceptible because of there is a marked elevation difference between northern and extreme southern parts.

During post-monsoon period (Nov. 2011), major part of the district are categorised in the depth range of 2 to 5 m bgl. There are two separate localised areas in the northern and southern part of the district where water level observed in the range of < 2 m bgl. Deeper water level (>10) has also been observed in a localised area in the eastern part and as a patch in the western part.

***Fig. 4** : Pre-monsoon Depth to Water Level map*

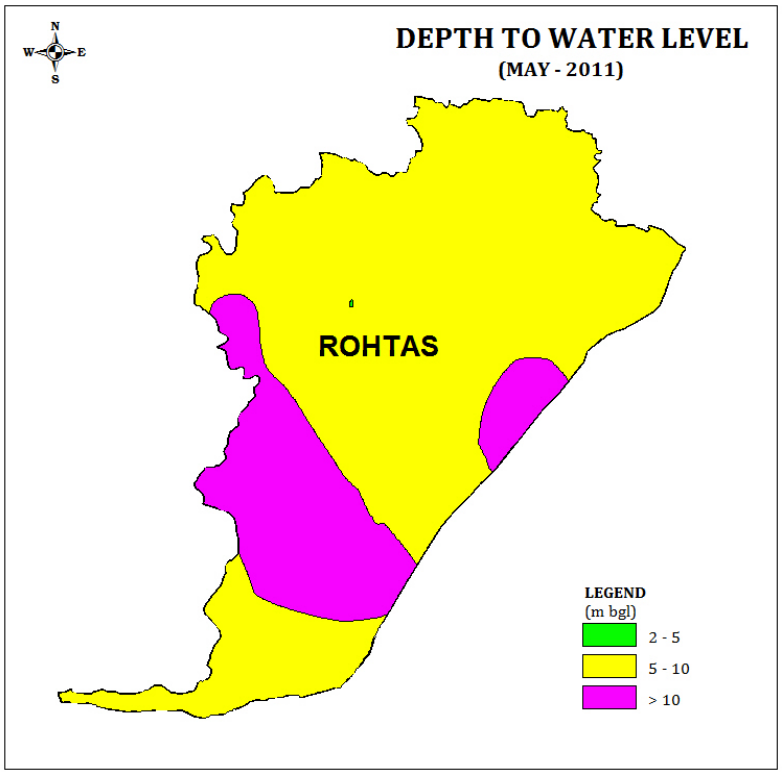
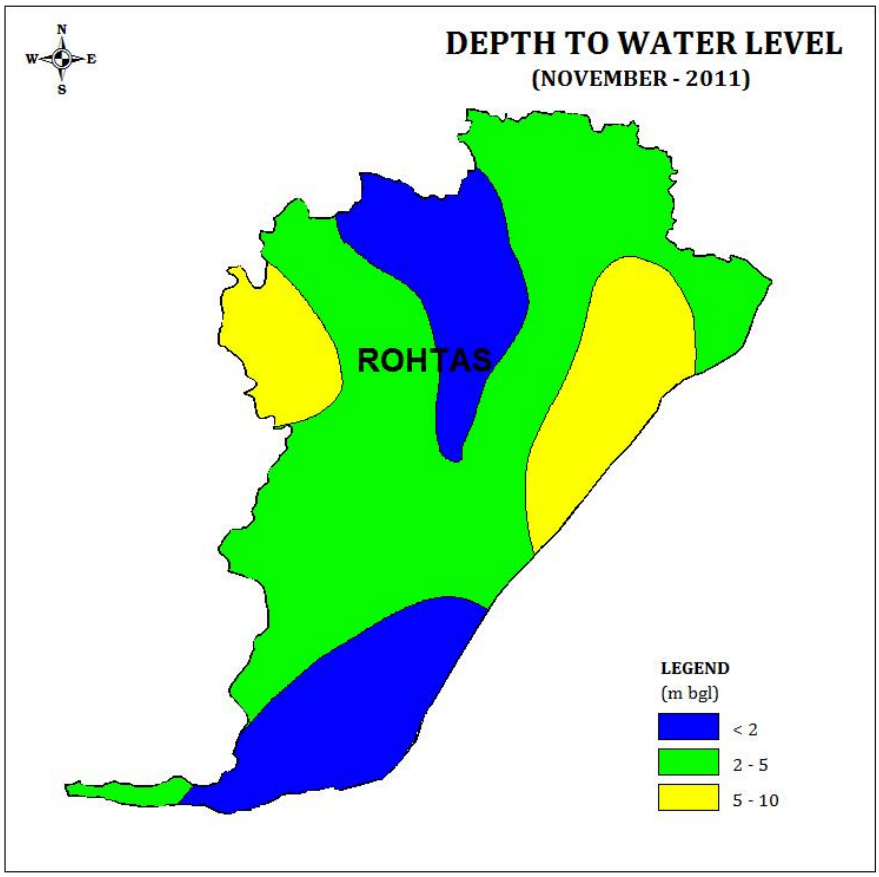


Fig. 5*: *Pre-monsoon Depth to Water Level map



4.3 Ground Water Quality

The chemical quality of ground water is influenced by precipitation and its solvent reaction in the soil. The ground water samples are collected every year from the monitoring wells (Dug wells) during the month of May and chemically analyzed at the Chemical Lab of CGWB at Patna. At some places in the north of GT road and most of the places in southern part, high fluoride concentration has been observed.

In the year 2011, with the minimum and maximum in Ambuwaha and Dinara blocks respectively, the Electrical Conductivity ranged from 271 to 2000 µs at 25°c. The highest concentration of magnesium is 147 mg/lit. The concentration of major ions in groundwater samples collected in the month of May 2011, is given in Table 4 & 5.

Table 4: *Ground Water Quality in Rohtas District.*

SN	Location	EC (µs @25°c)	pH	CO_3^{2-}	HCO_3^-	Cl^-	Ca^{2+}	Mg^{2+}	TH	Na^+	K^+
				(in mg/lit)							
1	Ambuwaha	271	7 - 8	ND	134	14	32	6.1	105	11	3.9
2	Amwangate	687	7 - 8	ND	293	60	18	22	135	86	2.7
3	Biklanganj	900	7 - 8	ND	354	99	16	55	265	78	1.1
4	Chenari	647	7 - 8	ND	305	53	62	30	280	19	1.6
5	Dinara	2000	7 - 8	ND	275	337	12	147	786	80	5
6	Karbindiya	400	7 - 8	ND	220	11	38	17	165	14	1.6
7	Kochas	1014	7 - 8	ND	360	149	34	50	290	100	0.78
8	Maliobag	752	7 - 8	ND	268	35	42	51	315	27	2.4
9	Nazirganj	341	7 - 8	ND	189	3.5	28	16	135	11	0.2
10	Sasaram	675	7 - 8	ND	268	74	30	38	230	46	3.1
11	Tilouthu	400	7 - 8	ND	171	39	54	8.5	170	11	1.2

Table 5*: Minimum and Maximum range of Chemical Parameters.*

Major Chemical Parameter		Range		Drinking Water Standard (BIS)	
		Min.	Max.	Acceptable limit	Undesirable effect outside the acceptable Limit
EC (µs @25°c)		271 to	2000	*For irrigation ** Excellent < 250; Good 250 – 750; Medium 750 – 2,250; Bad 2,250 – 4,000; Very bad > 4,000	-
pH		07-Aug		6.5-8.5	Beyond this range the water will affect the mucous membrane and/or water supply system
CO_3^{2-}	(mg/lit)	-		-	-
HCO_3^-		134 to	360	-	-
Cl^-		3.5 to	337	250	Beyond this limit taste corrosion and palatability are affected.
Ca^{2+}		12 to	62	75	Encrustation in water supply structure and adverse effects on domestic use
Mg^{2+}		6.1 to	147	30	Encrustation in water supply structure and adverse effects on domestic use.
TH		105 to	315	200	Encrustation in water supply structure and adverse effects on domestic use.
Na^+		11 to	100		
K^+		0.2 to	3.9		

Drinking Water Standard: *http://bis.org.in*
**http://www.nih.ernet.in*

4.4 Ground Water Resources

The block-wise ground water resource is given in Table 6. The net annual replenishable ground water resource as on 31st March 2009 has been worked out to be 107053 ha.m. The gross annual draft for all uses stands at 38519 ha.m. The average stage of ground water development for the district is 36%; the maximum being in the block Tilouthu (79.8.1%) and the minimum at Chenari and Nasriganj (21.8.4%). Except Tilouthu, The stage of ground water development in all the blocks is less than 70%. There is no significant long-term decline in water levels recorded in the blocks. Thus, all the blocks are categorised under 'safe' category. The stage of ground water development is depicted in Fig 8.

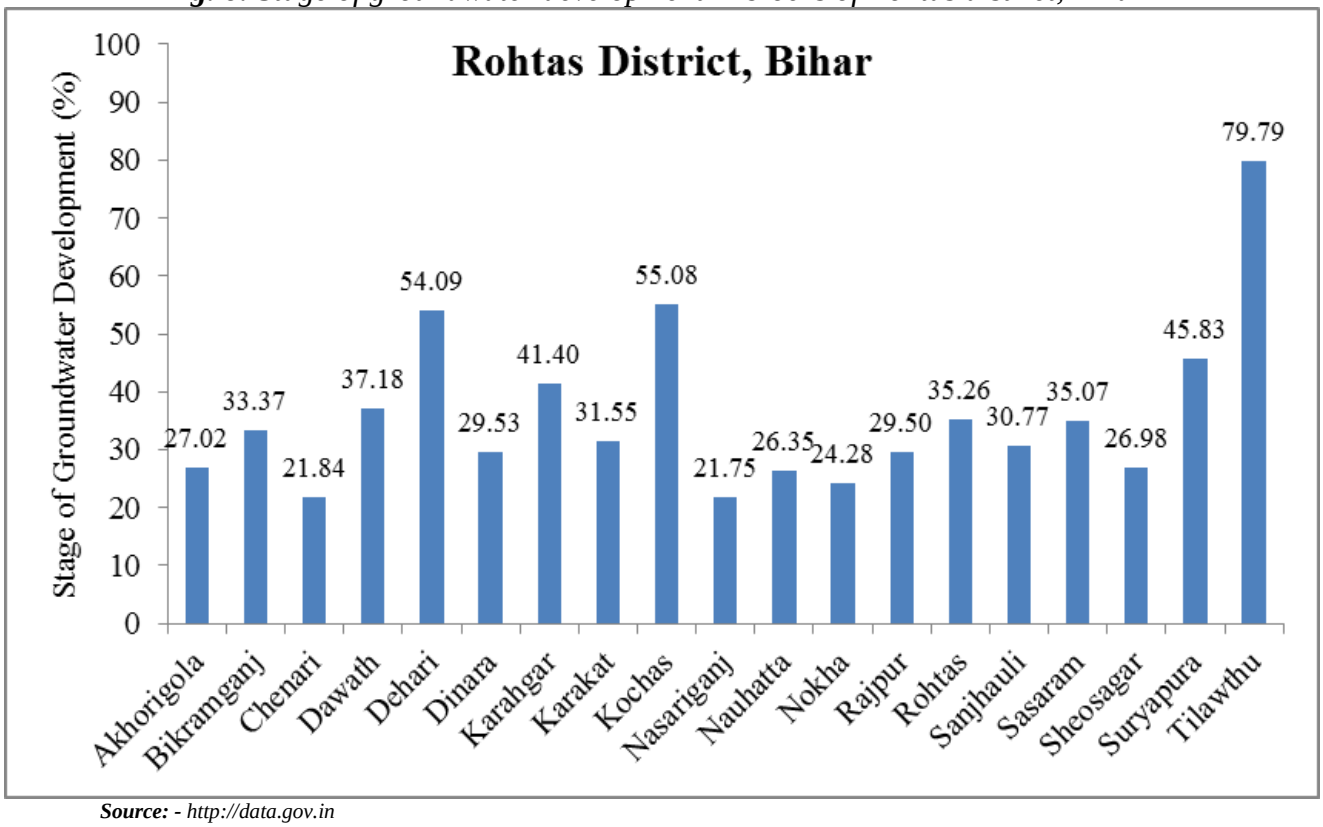
Table 6: *Net groundwater availability (ham) and stage of groundwater development in Rohtas district, Bihar (As on 31st March 2009).*

SN	Assessment unit/District	Recharge from Rainfall during monsoon season	Recharge from other sources during monsoon season	Recharge from Rainfall during non-monsoon season	Recharge from other sources during non-monsoon season	Total Annual Ground Water Recharge 3+4+5+6	Natural Discharge during non-monsoon	Net Annual Ground Water Availability ,7-8
1	2	3	4	5	6	7	8	9
1	Akhorigola	2839	650	319	316	4124	412	3712
2	Bikramganj	3722	1531	419	613	6286	629	5657
3	Chenari	4581	1247	590	418	6835	342	6493
4	Dawath	2884	283	325	85	3577	358	3219
5	Dehari	3449	1461	495	636	6041	302	5739
6	Dinara	5790	2354	943	1108	10195	510	9685
7	Karahgar	6987	3135	1012	1384	12518	626	11892
8	Karakat	5518	467	621	140	6746	675	6072
9	Kochas	5885	1262	662	397	8205	821	7385
10	Nasariganj	3147	763	402	389	4700	235	4465
11	Nauhatta	4261	359	709	107	5436	272	5164
12	Nokha	3691	977	516	498	5682	284	5398
13	Rajpur	1909	483	215	232	2838	284	2555
14	Rohtas	4323	487	730	146	5685	569	5117
15	Sanjhauli	1233	718	208	292	2452	245	2207
16	Sasaram	5644	1170	833	501	8148	407	7741
17	Sheosagar	7106	591	1011	177	8884	444	8440
18	Suryapura	1428	214	174	64	1881	94	1787
19	Tilawthu	2818	1228	317	443	4807	481	4327
	Total	**77214**	**19381**	**10500**	**7946**	**115041**	**7988**	**107053**

Contd.

SN	AssessmentUnit/ District	Net Annual Ground water Availability	Existing Gross Ground Water Draft for Irrigation	Existing Gross Ground water Draft for Domestic and Industrial Water Supply	Existing Gross Ground Water Draft For all Uses (10+11)	Allocation for Domesticand Industrial Requirement suply upto next 25 years	Net Ground Water Availability for future irrigation development (9-10-13)	Stage of Ground Water Development (12/9)*100 (%)
2	3	9	10	11	12	13	14	15
1	Akhorigola	3712	827	175	1003	283	2601	27.0
2	Bikramganj	5657	1492	396	1888	604	3561	33.4
3	Chenari	6493	1227	191	1418	308	4958	21.8
4	Dawath	3219	969	228	1197	354	1897	37.2
5	Dehari	5739	2694	410	3104	629	2416	54.1
6	Dinara	9685	2518	342	2860	552	6615	29.5
7	Karahgar	11892	4604	319	4924	516	6772	41.4
8	Karakat	6072	1597	319	1916	515	3960	31.6
9	Kochas	7385	3855	213	4068	343	3186	55.1
10	Nasariganj	4465	759	213	971	343	3363	21.8
11	Nauhatta	5164	1226	135	1361	218	3720	26.3
12	Nokha	5398	962	348	1310	542	3894	24.3
13	Rajpur	2555	646	108	754	174	1735	29.5
14	Rohtas	5117	1665	140	1804	226	3226	35.3
15	Sanjhauli	2207	587	92	679	148	1471	30.8
16	Sasaram	7741	2195	520	2715	803	4743	35.1
17	Sheosagar	8440	2021	256	2277	414	6005	27.0
18	Suryapura	1787	733	86	819	139	915	45.8
19	Tilawthu	4327	3292	160	3452	259	776	79.8
	Total	**107053**	**33870**	**4650**	**38519**	**7370**	**65814**	**36.0**

Fig. 6: *Stage of groundwater development in blocks of Rohtas district, Biha*



Source: *- http://data.gov.in*

5.0 GROUND WATER MANAGEMENT STRATEGY

5.1 Ground Water Development

As per the resource evaluation (31st march 2009) the average utilisation of ground water in the district is only 36%, which means none of the blocks in the district comes under semi-critical/critical or over exploited category. There the ample scope exists for the further development of groundwater.

5.2 Design and construction of Tube Wells

5.2.1 Construction and yield of wells

As per MI census 2000-2001, a total of 20513 shallow tube wells and only 4780 dug were in use in Rohtas district. Most of the STWs in the district are constructed within the depth of 50 m. The shallow tubewell and dugwells can be constructed for domestic and minor purpose in the district. The deep tube well drilled down to the depth of 300 m bgl can yield 2000 to 4000 lit. per hour.

5.2.2 Design of Tube Wells

(a) Sallow Tube Wells

There are two shallow aquifer zone exists within the depth of 50 m bgl. The 1st aquifer exists within the depth range of 5 to 20 m. This aquifer can be developed for domestic and minor purpose. The 2nd aquifer, separated from the 1st one by a thick layer of clay. Cumulatively these two zones are able to supply copious quantity of water for irrigation.

A well assembly of about 76 to 102 mm diameter with about 5 to 15 m slotted pipe can be used for construction of such wells.

(c) Deep Tube Wells

Since there is a variation of granularity and thickness of the deeper aquifers in the district, the depth of construction and slot opening of the slotted pipe may vary place to place. Hence a model has been proposed for the deep tube well given in table 7.

Table 7: *Proposed designl of deep tube wells in Rohtas district*

Sl. No.	Discharge (lit./hr)	Proposed Depth of well (m bgl)	Proposed Dia. of well (mm)	Assembly Length (m)
1	2000 to 4000	50 to 300	306 – casing pipe 153 – slotted pipe 153 – blank pipe	18 to 36

The slot size should be recommended depending on the grain size of the granular zones as given below;

Table 9: *Proposed slot openings for slotted pipes*

Fine sand	: 1/64” (0.04 cm) to 1/32” (0.08 cm)
Medium to coarse sand	: 1/16” (0.15 cm)
Gravel	: 1/8” to 1/16”

Both the shallow as well deep tube wells should be artificially packed with gravels of size ranging within 2–4 mm and a bail plug of 2–5 m should be provided at the bottom of the well in order to the yield and life of the well.

5.3 Water Conservation and Artificial Recharge:

No such water conservation and artificial structure has been constructed in the district so far.

6.0 GROUND WATER RELATED ISSUES AND RELATED PROBLEMS:

At some place in the north of GT road and most of the places in southern part, high fluoride concentration has been observed.

7.0 MASS AWARENESS AND TRAINING PROGRAMME:

Mass awareness programme is yet to be carried out in Rohtas district.

8.0 AREA NOTIFIED BY CENTRAL GROUND WATER AUTHORITY/ STATE GROUND WATER AUTHORITY

Since all blocks of the district come under ‘safe’ category from groundwater development point of view, no area is notified either by Central Ground Water Authority or State Ground Water Authority till date.

9.0 RECOMMENDATIONS

- There is ample scope exists for development of groundwater for domestic, industrial and irrigation purposes without disturbing the groundwater regime in the district.
- Since there is high variability in groundwater availability in the quartzitic sandstones, (Southern part of the district), the construction of tube well in this area should be preceded by geophysical investigations for drilling-site selection.
- The sub-hilly area in the western part of the district is suitable for water conservation and rain water harvesting.
- Chemical quality of groundwater, in general, suitable for drinking, industrial and irrigation purpose but especially in the southern part of the district i.e. south of GT road may be chemically tested for its fluoride concentration.

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