

# DISTRICT GROUND WATER INFORMATION BOOKLET



## SINGRAULI DISTRICT MADHYA PRADESH



Ministry of Water Resources  
Central Ground Water Board  
North Central Region  
Bhopal  
2013

## SINGRAULI DISTRICT AT A GLANCE

S.No.	Items	Statistics	
1	<b>General Information</b>		
	i) Geographical Area	567200 ha	
	ii) Administrative Division		
	Number of Tehsil/Block	3/3	
	Number of Gram Panchayat/Janpad Panchayat	316	
	Number of Villages (2011)	746	
	Population (As per census 2011)	1178132	
	Normal annual rainfall	879.8	
2.	<b>Geomorphology</b>		
	1. Major Physiographic Units :	Kaimur Range, Central Part, Southern Part	
	2. Major Drainage :	Son River, Gopad River, Rihand River	
3.	Land use		
	a) Forest Area	239689 ha	
	b) Net area sown	240670 ha	
	c) Double Cropped area	61928 ha	
4.	<b>Major Soil Types</b>		
5.	<b>Area Under Principal Crops</b>		
	Paddy, Wheat, Gram, Pulses, maize		
6.	<b>Irrigation By Different Sources</b>		
	Structures	<b>Nos.</b>	<b>Area (ha)</b>
	Dug Wells	6115	13002
	Tube wells/Bore wells	654	264
	Tanks/Ponds	11	363
	Canals	73	6656
	Other sources	-	8512
	Net sown Area		
	Gross Irrigated Area	-	28797 ha
	Area Irrigated by Ground Water		
7.	<b>Number of Ground Water Monitoring</b>		
	Wells of CGWB Dug Wells	6	
	No. of Piezometers	1	
8.	<b>Predominant Geological Formations</b>		
	Granites, Gneisses, Sandstone, Alluvium		
9.	Hydrogeology		
	i) Major water bearing formation	Gondwana, Vindhayan	
	ii) Pre monsoon depth to water level (2012)	4.13 to 18.50	
	iii) Post monsoon depth to water level	2.94 to 15.17	
	iv) Long term water level trend (2003-2012)	.0018m/y to 0.27 m/y (fall)	

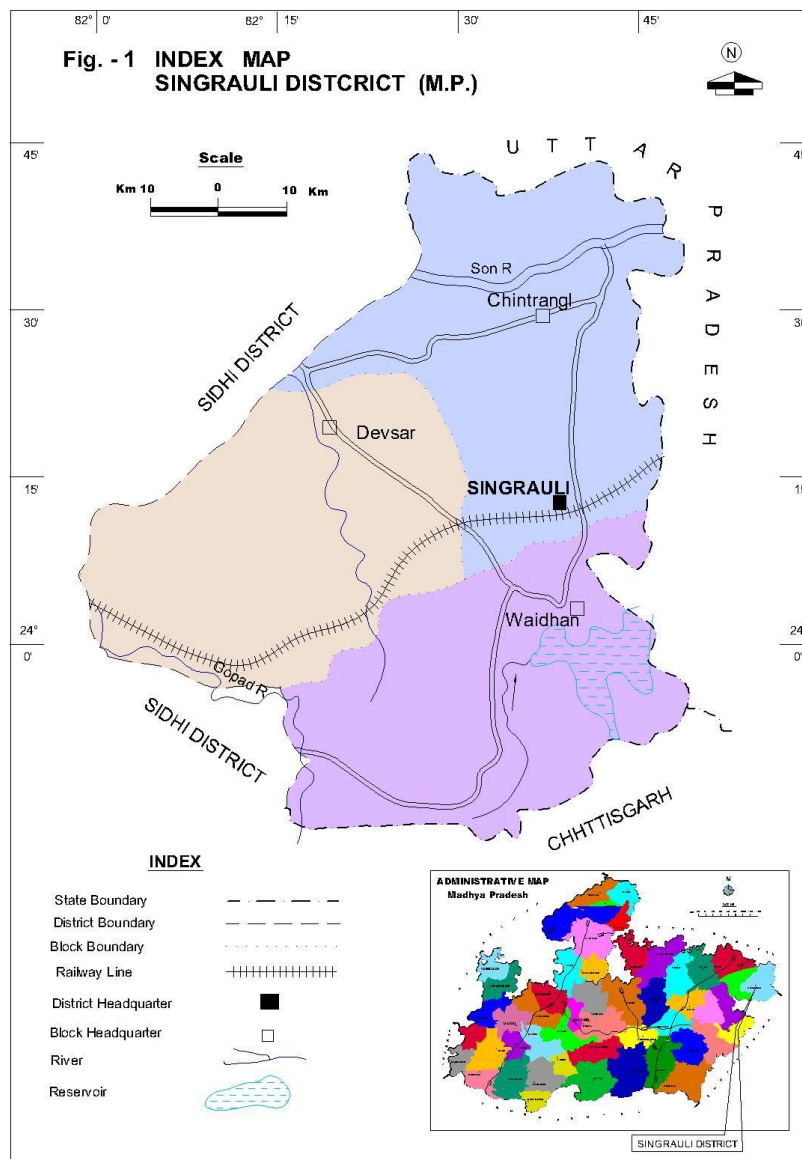
10.	<b>Ground Water Exploration by CGWB</b>	
	Exploration well Depth Static Water level Discharge Ground Water Quality Ground Water Resources (2009) i) Net Annual Ground Water Availability ii) Existing Gross Ground Water Draft iii) Projected Demand for Domestic and Industrial uses upto 25 years iv) Stage of Ground Water Development	EW-5,OW-1, Pz-5 83 – 302 M bgl 3.1 – 26 M bgl 0.69 – 5.88 lps. EC-160-775, nitrate-6.7-17, F-0.04-1.2 36653 ham 11225 ham 3380 ham  31%
11.	<b>Ground Water Quality</b>	
		EC-160-775, nitrate-6.7-17, F-0.04-1.2

# 1.0 Introduction

The Singrauli district is located in the north eastern part of Madhya Pradesh having a geographical area of 567200 ha and extended by North latitudes 23°49' and 24°42' and east longitude. 81°18' to 82°48'.

The district is bounded in the North by Rewa and Sidhi district in the east by Uttar Pradesh, in the south by Sarguja and West by Shahdol district. The district is divided into 3 Tehsil - Deosar, Chitrangi and Singrauli. There are 3 development blocks Deosar, Chitangi and Waidhan. other towns and 746 villages in the district.

The administrative divisions of Singrauli district are shown in figure I.



**SOIL CHARACTERISTICS (Pedology) :**

The Singrauli District is generally covered with Alluvial soil, red Sandy soil and yellow loamy Sandy soil, laterite soil and red loam soil. The district comprises sedimentary, crystalline and metamorphic rocks, weather into red soil. Similarly the red colour of the laterite soil is more due to diffusion of Iron compounds rather than due to high proportion of Iron oxides. The alluvial soil is mostly restricted by along the banks of major rivers, whose thickness varies from few meters to 25 meters.

**Land use Irrigation and cropping pattern :-**

The statistical dates of caned use, Irrigation and cropping pattern of singrauli district has been extracted bone the district statistical Booklet, 2008 issued by the statistical Department.

Total geographical area, cultivated and non cultivated area, area under forest, fallow land, area under double crop, total cropped area and area suitable for agriculture of Singrauli district are tabulated in Table 1 & 2, area irrigated by canals, tube wells, dugwells and tanks of Singrauli district are tabulated in Table 3.

**Table – 1, Blockwise land use in District Singrauli**

S.No.	District Block	Geographical Area In Hact.	Forest area In Hact.	Land not available for cultivation In Hact.	Total Cultivable area In Hact.
1.	Deosar	184559	78102	13952	55333
2.	Chitrangi	192290	77614	14755	67465
3.	Waidhan	190424	83973	11446	55944
	<b>Total District</b>	<b>567273</b>	<b>239689</b>	<b>40153</b>	<b>178742</b>

**Table – 2 Blockwise land use in District Singrauli**

S.No.	District Block	Followup	Net Shown Area	Double Cropped area	Gross shown area Total cropped area
1.	Deosar	16272	72497	17164	89661
2.	Chitrangi	10779	89930	22465	112395
3.	Waidhan	27982	78243	22299	100542
	<b>Total Area</b>	<b>55033</b>	<b>240670</b>	<b>61928</b>	<b>302598</b>

**Table – 3 Blockwise area irrigated in District Singrauli**

S. No.	District Block	Canals		Tubewells		Dug Wells		Tank	
		Nos.	Area Irrigated	Nos.	Area Irrigated	Nos.	Area Irrigated	Nos.	Area Irrigated
1.	Deosar	20	2784	38	-	1477	2724	4	83
2.	Chitrangi	10	-	52	-	1314	1738	4	195
3.	Waidhan	43	3872	564	264	3324	8540	3	85
	<b>Total District</b>	73	6656	654	264	6115	13002	11	363

It may be seen that of the total area sown i.e. 240670 ha, 20285 ha is irrigated by all sources out of which 13266 ha is irrigated by ground water.

## 2.0 Hydrometrology

### CLIMATE & RAINFALL

Their nearest observatory is Sidhi and hence the data of Sidhi District is taken for analysis. The climate of Singrauli district is characterized by hot summer & well distributed rainfall during south west monsoon. The year can be divided into four seasons. The winter commences from end of November and lasts till first week of March. The period from March to middle of June conditions hot weather. May is the hottest month of the year. The south west monsoon starts from middle of June and continues till end of September. October & November are the months of post monsoon/retreating of monsoon.

The temperature starts rising from beginning of February and reaches maximum during the month of May. The daily mean maximum temperature in May is 42.0°C and daily mean minimum is 25.8°C. The day temperature on individual days during the period April to first week of June gets up to 44°C to 45°C. Monsoon generally arrives in the middle of June and there is an appreciation drop in temperature and the weather becomes pleasant. After withdrawal of monsoon in the first week of October there is a slight increase in day's temperature, hot nights become progressively cooler. January is generally the coldest month of the year. The maximum daily mean temperature in January is 24.3°C and minimum daily temperature about 8.1°C.

The summer season is the district period of the year. The humidity is the lowest in April i.e. about 35%, during south west monsoon the humidity is the highest due to heavy rains, attaining its maximum of about 85% in August. The humidity again decreases in October due to high temperature and retreating of monsoon. The daily mean annual relative humidity of Singrauli is 66%.

The wind velocity is high during the Premonsoon period as compared to post monsoon period. The highest wind velocity is in June about 6.50 km/hr and lowest in December about 1.6 km/hr. The daily annual mean wind velocity of Singrauli district is 3.6km/hr.

The normal rainfall of the district is 1132.7mm. The maximum rainfall takes place during south west monsoon period. Rainfall 89% of the annual rainfall takes place during monsoon period i.e. June to September. July is the wettest month of the year. Only 11% of the annual rainfall takes place between October to May period. Table :-

**Normal Climatologically PARA METERS of (Singrauli District) -**

Parameters	Jan	Feb	Mar.	April	May	June	July	Aug	Sep.	Oct.	Nov.	Dec.	Annual
Max. Temp.	24.3	27.6	33.4	39.1	42.0	39.2	32.9	31.7	32.3	32.6	29.5	25.3	32.5
Min. Temp.	8.1	10.8	15.5	21.5	25.8	27.5	25.1	24.6	23.8	19.4	13.0	8.3	18.6
R.H. %	76	68	51	38	35	58	83	85	82	73	69	74	66
W. Speed in Km/hr.	2.1	2.7	3.3	4.5	5.1	6.5	5.3	4.5	3.9	2.4	1.8	1.6	3.6
Rainfall in m.m.	27.0	18.4	13.2	3.4	8.8	133.5	338.2	325.3	211.8	33.4	12.1	7.7	1132.7

### 3. Geomorphology

The district as a whole constitutes a hilly terrain most part of the district is covered by kaimur hilly ranges. The district is divided into three physiographic divisions: - (i) Kaimur hilly ranges (ii) The Central part hilly ranges and (iii) Southern hilly ranges

In the district three main river flows along with several tributaries rivers the major rivers are the son, Gopal and Rihand. The Kaimur range stretching from NE and SW direction and covered most part of the district. The central part of the district forms a series of hill ranges. The Southern part of district the elevation of hills ranges varies between 365 and 488m above MSL. The general slope of the area is towards North east.

The entire district drained by the above mentioned 3 major rivers and their tributaries for us the Ganges drainage System. The pattern of drainage is dendrite in hectare excepting the localized radial pattern in the hilly terrain.

### 4. Hydrogeology

The geology of the district reveals that the Occurrence of various work formation as old as granites of Achaeon age to the Alluvium of Recent age. The other important formations Outcropping in the district are Deccan trap of cretaceous – Eocene, Gondwanas of Paleozoic to Mesozoic Sandstone and other ranks of Vindhayans and Phyllites. Quartzites, Schist Gneisses

and Granites of Archeans age. The Geology of the district is shown in the Hydrogeological Map. The general Stratigraphical Succession obtained in the district is given as under:-

<b>Period</b>	<b>Series/stage</b>	<b>Lithology</b>	
Recent Pleistocene	Alluvium	Alluvium and soil cap comprising clay, sand gravel etc.	
Cretaceous to Eocene	Deccan Traps	Basaltic Lava flows	
Permian to up Carboniferous	Gondwanas	Upper Gondwana formation Ranging formation Talchir formation	Sandstone Shale Gneiss conglomerate and Glaucophane
Cambrian	Vindhyan	Kaimur Series Semri Series	Porcellanite sandstone Orthoquartzite and conglomerate
Pre Cambrian	Archeans	Phyllite, Quartzites, Granite, Schist, gneisses metabasic sedimentary and intrusives	

#### **4.1 Hydrogeology**

Ground water is the principal source of irrigation in the district. The district area is underlain by hard rocks as well alluvium. The occurrence and movement of ground water in different formations varies with rock type. The weathered and fractured zones occurring at shallow depths provide scope of ground water storage and movement.

Ground water in Archeans rocks occur in joints and fractures plane and in the weathered zones mostly under the water table conditions occurrence and movement of ground water is controlled by the extended size and interconnection of Joints and the degree of weathering which varies specially areas having a fairly high degree of fracturing and weathering and fracturing can sustain tube wells.



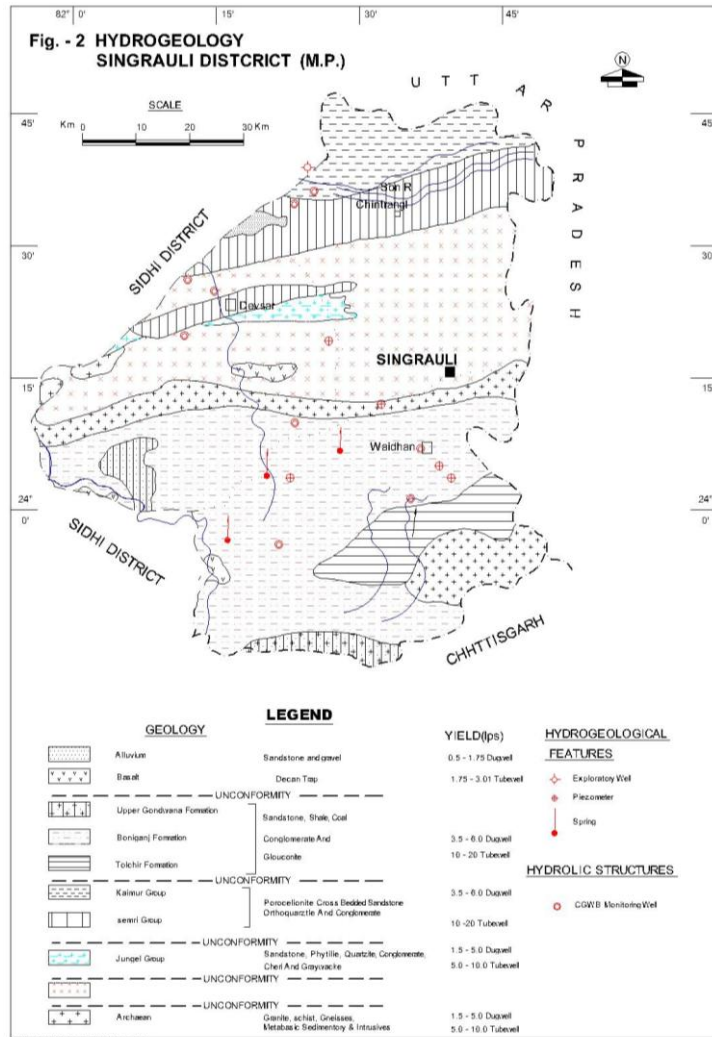
The area occupied by Achaean rocks comprising mostly granites schist's phyllites gneisses and quartzites where ground water occurs under phreatic conditions in the shallow weathered, Jointed and fractured zones of these rock types the thickness of weathered zone generally varies from 7 to 18 mbgl. The depth of the dug wells ranged between 3 to 21 mbgl with depth to water level varies from 2.41 to 16.70 mbgl.

The area underlain by Archean rocks could be developed by large decimeter dug wells with dier varying between 6 to 9m and 15 to 20m depth piercing the full thickness of weathered Jointed an fractured zones available in this formation.

The Vindhyan Sandstone and limestone, when occurring oucing at lower elevations and having well developed joints, yield modulate quantities of ground water. The semri limestone has well developed and interconnected solution openings and ground water occurs under confined conditions. The depth to dug wells range between 6 to 24m bgl with depth to water level varying between 3.72 to 21.50m bgl

Lower gondwana formations are represented by Talchir formation occupy in the northern part of the district wells located in topographic lows and piercing the Talchir Sandstones yield vary between 200 to 400m<sup>3</sup>/day.

The upper gondwana formations mainly consists of sandstones and clays and appear as hilly terrain in the southern part of the district the depth to water level in the upper gondwana formations verging between 3.15 to 11.32. The well discharge varies between 100 to 150m<sup>3</sup>/day during summer months and can be developed by large diameter dug wells with diameter dug wells with diameter varying between 5 to 10m with 15 to 20m depth piercing the full thickness of weathered Jointed and fractured zones available in this formation.



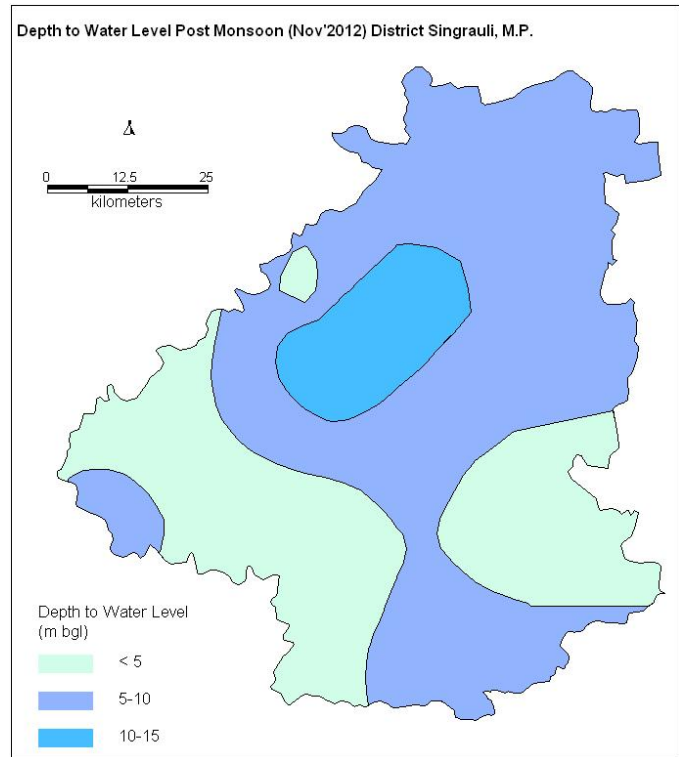
The Alluvium includes mainly fine sands with pebbles and clay occupy small patch in the northern part of the district water occurs in alluvium under water table condition. The depth of the wells varied between 10 to 25m. The water table is sloping towards Son River and its tributaries as result of their effluent nature.

## **4.2 Ground Water Scenario**

### **Depth to water level**

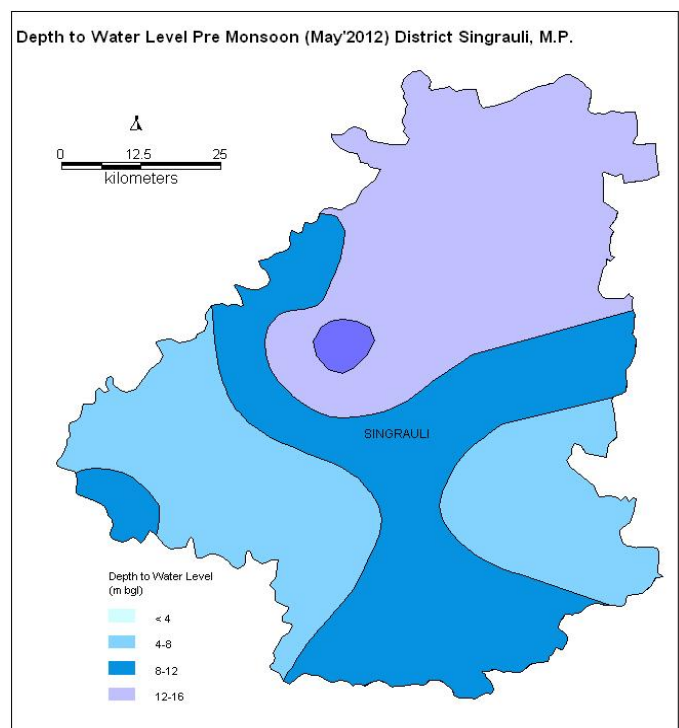
#### **Pre-monsoon (May2012)**

The pre-monsoon depth to water level in the district ranges between 4.13 m bgl and 18.50m bgl. Major part of the district have water level in the range of 8-12m bgl during the pre monsoon.



#### **Post-monsoon (November 2012)**

During post-monsoon period, water level varies from 2.94m bgl to 15.17m bgl. In major part of the district, water level lies between 5 & 10 m bgl.



### Groundwater level trend (May 2003 to May 2012)

Analyses of Groundwater level data of pre-monsoon period indicate that there is declining trend in the range of 0.0018 - 0.27 m/yr.

### 4.3 Ground Water Exploration

Under Central Ground Water exploration program in Singrauli district exploration was taken up during AAP 1990-91 and 93-94. The drilling was done with target depth of 100-300m bgl with a density of one bore per 250sq. km.

One bore well at Lohradol was drilled up 302m bgl in Sandstone with yield potential of 5.88 LPS.

### 4.4 Ground Water Resource Estimation :-

Singrauli district is underlain by Archaean granite and Gondwana sandstone. Dynamic ground water resources of the district have been estimated for base year -2008/09 on block-wise basis (Table). There are three assessment units (block) in the district which fall under non-command (99 %) and command (1 % Deosar,Waidhan) sub units. All the blocks of the district are categorized. as safe. The highest stage of ground water development is computed as 32 % in Deosar block. The net ground water availability in the district 36653 ham and ground water draft for all uses is 11225 ham, making stage of ground water development 31 % as a whole for district. After making allocation for future domestic and industrial supply for next 25 years, balance available ground water for future irrigation would be 24,191ham.

S. No.	Assessment Unit	Sub-unit Command/ Non-Command/	Net Annual Ground water Availability (ham)	Existing Gross Ground water Draft for Irrigation (ham)	Existing Gross Ground water Draft for Domestic & Industrial water Supply (ham)	Existing Gross Ground water Draft for All uses (ham)	Provision for domestic, and industrial requirement supply to next 25 year (2033) (ham)	Net Ground water Availability for future irrigation development (ham)	Stage of Ground water Development (%)	Category
1	Chitrangi	Command								
		Non-Command	8591	1677	723	2400	997	5917	28	Safe
		Block Total	<b>8591</b>	<b>1677</b>	<b>723</b>	<b>2400</b>	<b>997</b>	<b>5917</b>	<b>28</b>	<b>safe</b>
2	Deosar	Command	199	12	60	73	122	65	36	Safe
		Non-Command	12382	3350	607	3957	917	8115	32	Safe
		Block Total	<b>12581</b>	<b>3362</b>	<b>667</b>	<b>4029</b>	<b>1039</b>	<b>8181</b>	<b>32</b>	<b>Safe</b>
3	Waidhan	Command	716	56	101	157	207	<b>453</b>	22	Safe

	Non-Command	14764	3987	652	4639	1137	<b>9640</b>	31	Safe
	Block Total	<b>15480</b>	<b>4043</b>	<b>753</b>	<b>4796</b>	<b>1344</b>	<b>10093</b>	<b>31</b>	<b>Safe</b>
	<b>District Total</b>	<b>36653</b>	<b>9082</b>	<b>2143</b>	<b>11225</b>	<b>3380</b>	<b>24191</b>	<b>31</b>	

## 5.0 Hydrochemistry

Ground water quality (Shallow Aquifer) in Singrauli district has been brought out by analyzing the 6 water samples collected from National Hydrograph Monitoring wells during May, 2012. The water samples were analyzed for detailed chemical analysis for thirteen parameters.

Quality of Ground Water for Drinking Purpose: The pH value of water samples ranged in between 7.71 to 8.14 hence proved alkaline in nature and within permissible limit (6.5 to 8.5) as described by BIS (1991). The salinity of the water is represented by the electrical conductivity. The electrical conductivity depends upon the concentration of dissolved inorganic salts in the water. The EC values in district were within BIS limit ( $1000 \mu\text{S}/\text{cm}^2$ ) and found to be in the range of 160 to  $775 \mu\text{S}/\text{cm}^2$  at  $25^\circ\text{C}$ . The anion chemistry shows that the chloride concentration in the district ranged in between 04 - 67 mg/l within the permissible safe limit of 250 mg/l. The concentration of  $\text{NO}_3$  The nitrate concentration in the district ranges 6.7 to 17 mg/l. The fluoride concentration in the district ranges between 0.4 to 1.2 mg/l. There is no problem of excess fluoride in the shallow ground water of the district.