DISTRICT GROUND WATER INFORMATION BOOKLET

DEWAS DISTRICT

MADHYA PRADESH

Ministry of Water Resources

Central Ground Water Board

North Central Region

BHOPAL

2013

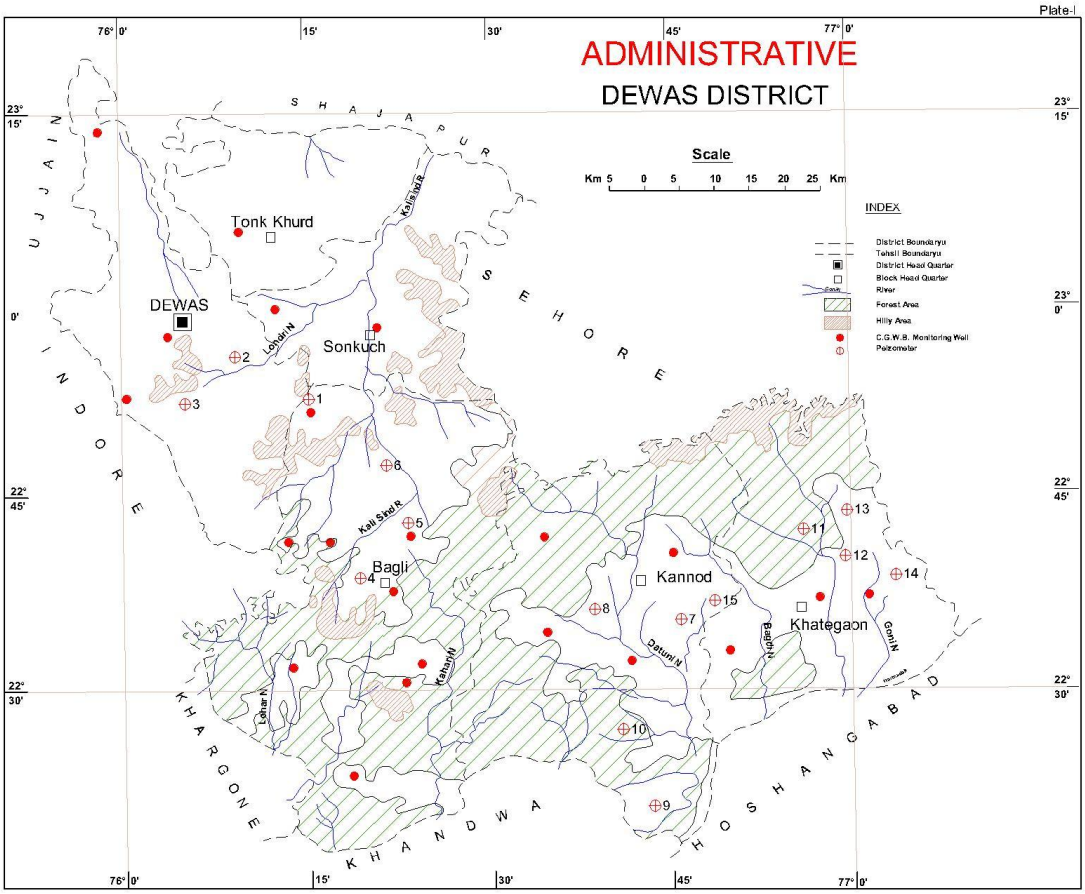
DISTRICT PROFILE - DEWAS DISTRICT

S.No.	ITEMS	Statistics	
1.	**GENERAL INFORMATION**		
	i) Geographical area (sq. km)	7020.84	
	ii) Administrative Divisions (As on 2011) Number of Tehsil Number of Blocks Number of Panchayats Number of Villages	 6 6 497 1127	
	iii)Population (Census 2011)	289438	
	iv)Normal Rainfall (mm)	1083	
2.	**GEOMORPHOLOGY**		
	i) Major Physiographic Units ii) Major Drainage	1.Dewas Plateau 2. Kali Sindh Basin 3. Vindhyan Range 4. Middle Narmada Valley Kshipra sub-basin Kali Sindh sub-basin Chotti Kali Sindh sub-basin Kanhar sub-basin Khari sub-basin Datuni sub-basin Jamner sub-basin Narmada direct catchment	
3.	**LAND USE (ha)**		
	i) Forest area:	206600	
	ii) Net area sown:	388400	
	iii) Cultivable area:	624500	
4.	**MAJOR SOIL TYPES**	Black cotton , Sandy loam, Clayey loam,, Murram	
5.	**AREA UNDER PRINCIPAL CROPS (2009)**	Wheat, Soyabean, Groundnut, Cotton, etc	
6.	**IRRIGATION BY DIFFERENT SOURCES**	**No of Structures**	**Area (ha)**
	Dug wells	36531	65900
	Tube wells/Bore wells	23119	93100
	Tanks/Ponds	169	4760
	Canals	15	6760
	Other Sources	-	11044
	Net Irrigated Area	-	193640
7.	**NUMBER OF GROUND WATER MONITORING WELLS OF CGWB (As on 31.3.2013)** No. of Dug Wells No. of Piezometers	 16 11	
8	**PREDOMINANT GEOLOGICAL FORMATIONS**	Deccan trap lava flows	
9	**HYDROGEOLOGY** Major Water Bearing Formation (Pre-monsoon depth to water level during 2012)	 Weathered/Fractured Basalt 2.90 – 24.47 mbgl	

	(Post-monsoon depth to water level during 2012) Long Term water level trend in 10 years (2003-2012) in m/yr	0.06 – 15.19 mbgl 0.007 to 2.74 m (Rise) 0.109 to 0.27 m (Fall)
10.	**GROUND WATER EXPLORATION BY CGWB (As on 31.3.2012)**	
	No of wells drilled (EW,OW,PZ,SH, Total)	EW-32, PZ-12, Total -44
	Depth Range (m)	150m – 200m
	Discharge (litres per second)	1 – 5.28lps
	Storativity (S)	-
	Transmissivity (m^2/day)	5-40 m^2/ day
11.	**GROUND WATER QUALITY**	
	Presence of Chemical constituents more than permissible limit (eg EC, F, As,Fe)	Fluoride
	Type of Water	Alkaline earth- bicarbonate
12	**DYNAMIC GROUND WATER RESOURCES (31.3.2009) in ham**	
	Net annual Ground Water availability	**79141**
	Gross Annual Ground Water Draft for all uses	63383
	Projected Demand for Domestic and Industrial Uses upto 2033	3449
	Stage of Ground Water Development	80 %
13	**EFFORTS OF ARTIFICIAL RECHARGE & RAINWATER HARVESTING**	
	Projects completed by CGWB (No.)	4
	Projects under technical guidance of CGWB (Numbers)	5
14	**Ground Water Control And Regulation**	
	Number of OE Blocks	02 (Dewas & Sonkutch)
	Number of Semi-Critical Blocks	01 (Khategaon)
	Number of Notified Blocks	Nil

1.0 Introduction

The Dewas district lies in the central part of the state and covers an area of 7020.84 sq km. It lies between North latitude 22°17'00" & 23°20'00" and east longitude 75°50'00" & 77°10'00", falling in Survey of India topo sheet Nos 46M, 46N, 55A, 55B & 55F. The Tropic of Cancer passes through the district near Nemawar village south of Khategaon town. Dewas lies north-east of Indore, south-east of Ujjain and southwest of Shajapur. The city is located on the level plains of the Malwa plateau; to the south, the land rises gently to the Vindhya Range, which is the source of the Chambal and Kali Sindh rivers.



The district is divided into six Tehsils and six development Blocks. There are 1061 villages and 11 towns in the district.

Table: Administrative Divisions, District Dewas, M.P.

S No	Block	Area (Sq Km)	No of towns
1.	**Bagli**	2045.40	3
2.	**Dewas**	1007.44	1
3.	**Kannod**	1463.00	4
4.	**Khategaon**	1145.00	1
5.	**Sonkatch**	681.00	2
6.	**Tonk khurd**	679.00	-

SOIL : Almost three fourths of the area in the district is covered by black cotton soils, which is occupied by Deccan Basalts. The southern part has red-yellow mixed soils derived from sandstone, shale, gneiss. The alluvial soils are found along the river courses. The higher elevations i.e. the hilly regions have a cover of murum, which comprises small rounded pieces of weathered trap. The Vindhyans and Bijawars have a thin cover of sandy loams. The soils in granitic area are clayey. The schist has a thin capping of loam with lot of quartz grains. The alluvium is derived from hill slopes by numerous streams and watercourses.

DRAINAGE: The district falls under two major drainage basins - the Ganga in the north and the Narmada in the south. The rivers are rivers of antiquity. They have broad, flat, shallow valleys with low imperceptible gradients, because their channels have reached the base level of erosion. Vertical erosion has ceased and lateral erosion is taking place.

IRRIGATION: Ground water is the main source of irrigation and accounts for 82% of the irrigation. Other sources and ponds contribute a small amount – 18%. Only 50% of the net sown area is irrigated. Thus 50% sown area is rain-fed.

CROPPING PATTERN : The principal crop grown in the district is soyabean, wheat, ground-nut, cotton, etc.

WORK CARRIED OUT BY CGWB

Systematic Hydrogeological surveys carried out in parts of Dewas district between 1970 & 1988 and reappraisal hydrogeological surveys in 1993-94.

World Bank assisted Hydrology Project- I: Eleven shallow and deep piezometers have been drilled by the Central Ground Water Board and 26 piezometers have been drilled by the State Ground Water Department in the district, for water level and quality monitoring.

Ground water exploration program of the Central Ground Water Board, 17 exploratory wells have been drilled in the district.

Artificial recharge studies have been carried out in Londri flood plain area, Chhoti Kali Sindh watershed, Nagda watershed and Dewas Bank Note Press areas of the district. Roof top rainwater harvesting has been done at Government Hospital, Dewas, Tribal Hostel, Sonkutch and Primary School, Tappa village. For Promoting roof top rain water harvesting 1000 filters, each costing Rs. 600.00 were distributed among the people of Dewas City.

Central sector Scheme: One Demonstrative Project "Dewas Watershed" in collaboration with Public Health Engineering Department, Dewas, Madhya Pradesh Government, is taken up in the year 2006 in "The Upper Reaches of Choti Kali Sindh River", under this project Stop Dam –11, Gabion-10, Recharge Shaft –01, Percolation tank –01, Sub-Surface Dyke-01 & Rooftop Rain water harvesting –02 is being constructed and impact analysis is to be done.

2.0 Rainfall & Climate:

The average annual rainfall of Dewas district is 1083 mm, based on average of 3 stations. Rainfall increases from west to east and is lowest in the southwestern portion. About 90 % of the rainfall takes place from June to September, only 5 - 8% takes place in the winter months and only about 2% in summer. It is only during the monsoon that surplus water for deep percolation is available in the district. The normal rainfall follows a normal distribution during the year.

The climate of Dewas district is semi- tropical, characterised by hot summer and well distributed rainfall during the south west monsoon season. January is the coldest month with the temperature falling as low as 2^{o} - 3^{o}C. The period from March to first week of June is the summer season. May is the hottest month when the temperature may go upto 45^{o}C.

3.0 Geomorphology & Soil Types :

The district can be divided into four broad physiographic divisions (1) Dewas plateau (2) Kali Sindh Basin (3) Vindhyan Range (4) Middle Narmada valley.

The Dewas plateau extends over the north-western part of Sonkatch block and western part of Dewas block. This division is a part of the Malwa plateau with higher elevation in the north and plain land topography in the south. Chhoti Kali Sind and Kshipra rivers drain this region. Dewas town is situated on this plateau. The maximum elevation is 700 m amsl, north of Dewas town. A conical hill housing the shrine of Goddess Chamunda is located in Dewas town.

The Kali Sindh Basin is situated in the northeastern part of the district in a north-south column covering Tonk Khurd and part of Sonkautch blocks. The Kali Sindh river flowing in the centre forms its drainage system. This is the most fertile tract of the district.

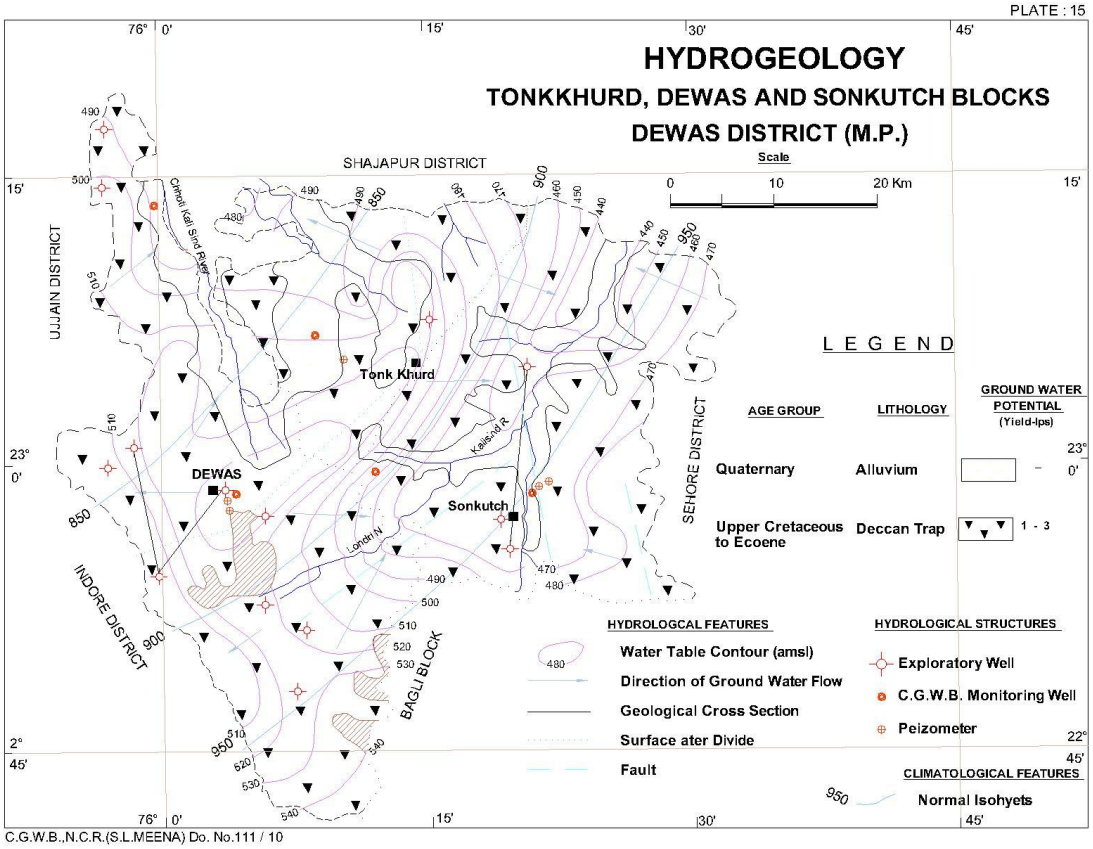
The Vindhyan Hill Range passes through the middle of the district in an east-west direction forming a narrow strip. Kshipra and Kali Sindh rivers originate from north of this range, while the tributaries of the Narmada originate from south of it. The maximum elevation is 758 m amsl at Bhainsore and minimum is 456 m amsl near village Palasi, both in Bagli Block.

Middle Narmada valley division falls in the Malwa plateau and covers the southeastern part of the district. It covers the Khategaon, Kannod and southern part of Bagli blocks. The Narmada river flowing east-west forms the southern boundary of this division, as well as, of the district. The division is covered by extensive forests. It is a low lying area with a maximum elevation of 405 m amsl near village Serali in Kannod block and minimum 200 m amsl near village Kotmir in Bagli Block.

4.0 Ground Water Scenario :

4.1 Hydrogeology - Aquifer System and Aquifer Parameters

Archaean These rocks are basically hard and compact with no primary porosity. Ground water occurs in these in the secondary porosity created by weathering, jointing and fracturing. The intensity and depth of weathering and



the frequency of joints and fractures control the ground water potential. These formations form poor to moderate aquifers. The depth of weathered mantle varies from a thin film to about 15m in topographic lows. The joints and fractures close down below 25 to 30 m. Ground water occur under water table conditions. These rocks mostly support dug wells with a few tube wells at some places. The tube wells yield 1-2 lps for considerable draw downs. The dug wells range in depths between 5 - 15 m and 2- 8 m in diameter. Open wells yield about 8 lps on an average for about 2 - 3 hours of pumping.

Bijawar: These rocks are impervious and devoid of joints and fractures. The weathering in these rocks is limited to the upper surface only between 10 to 25 m. Ground water occurs in the weathered portions under water table conditions with limited potential. Dug wells are generally constructed with

depths between 8 - 16 m and diameters of the order of 3 - 8 m. The open wells yield about 1 lps or less.

Vindhyan: The Vindhyan sandstones have primary porosity, but this depends on the degree of compaction. It could vary from impervious to as high as 30%. Hence again ground water availability is controlled by secondary porosity generated by weathering, jointing and fracturing. Lineaments and their intersections are holders of ground water, which occurs under water table conditions. The open wells may yield about 1lps or less.

Bagh Beds: These form unconfined aquifers when the sandstone and conglomerate are rendered permeable due to secondary porosity. But as these formations occupy a very small area in the district they are not significant.

Deccan Trap: These form the most important aquifers due to the large aerial extent in the district. The district is covered by a large number of basaltic lava flows. The weathered, jointed, fractured or vesicular unit of each flow forms moderately potential aquifers. The zeolitic basalt when weathered also forms potential aquifers. The Red Bole is unproductive but forms a confining layer and also indicates the presence of a productive horizon below. Dug wells in this formation range in depth from 4 - 22 m having diameters between 2 - 11m. Ground water occurs mainly under water table conditions. The discharges vary from 13 - 29 m^3/hr for small draw down, less than 1.7m. The specific capacity ranges from 26 - 170 lpm/m of draw down. It is high in highly weathered basalt, widely variable in weathered basalt and low in jointed massive basalt. The yields are mostly upto 5 lps, being higher, 10 – 12 lps in some cases; the yields are higher in Khategaon block. In multiple flow areas ground water is also found under semi confined to confined conditions sustaining tube wells.

Alluvium: The alluvium forms good aquifers wherever sufficiently thick. But the occurrence of alluvium in the district is limited and thickness is only between 10 - 25 m. Ground water occurs under water table conditions.

WATER LEVELS

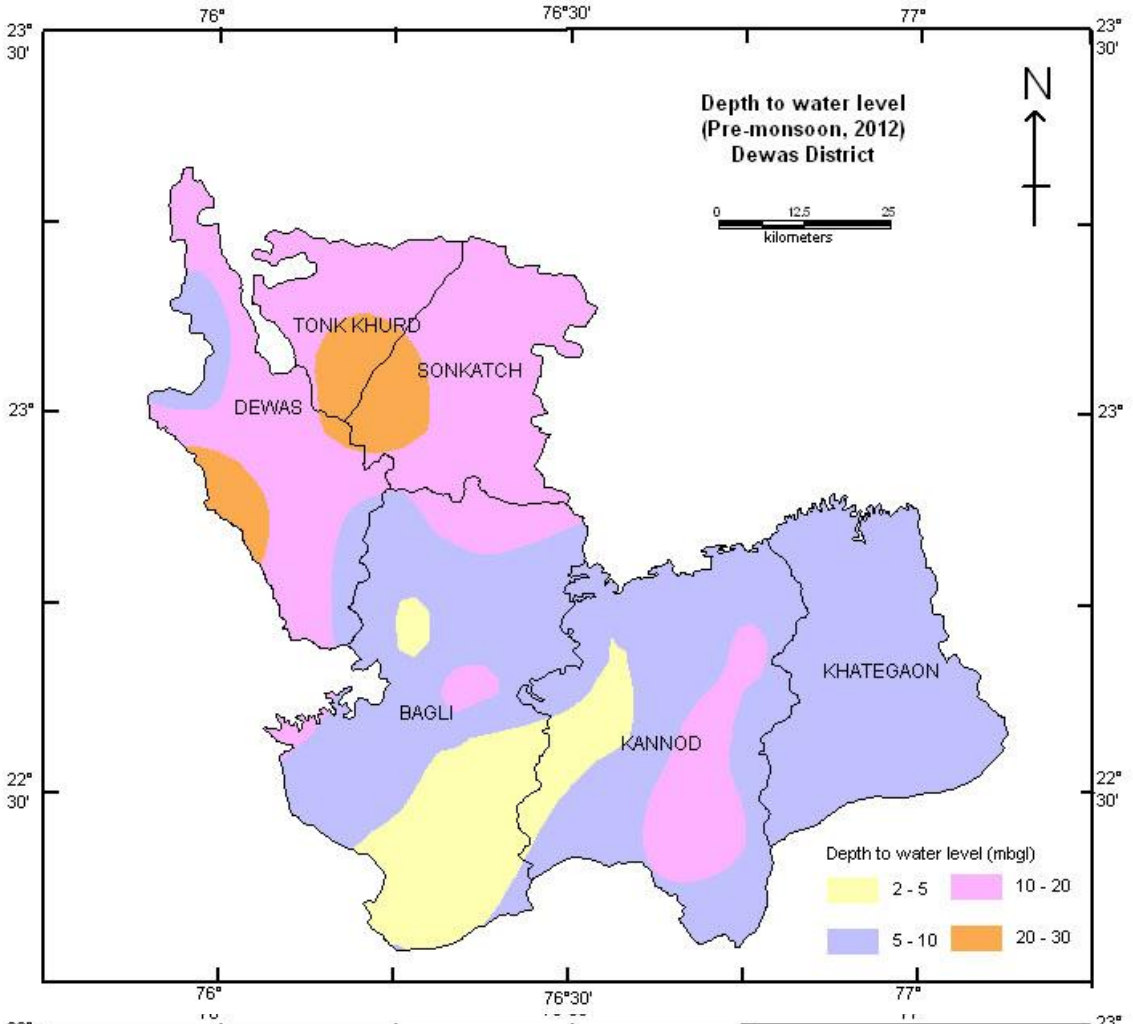
Ground water levels form a very important parameter of the ground water system, as these are its physical reflection. The groundwater balance expresses itself in the change in water levels; hence a continuous record is important and useful. CGWB has 16 National Hydrograph Stations (NHS) and 11 Peizometers in Dewas district. Due to large-scale ground water development the dug wells are drying up.

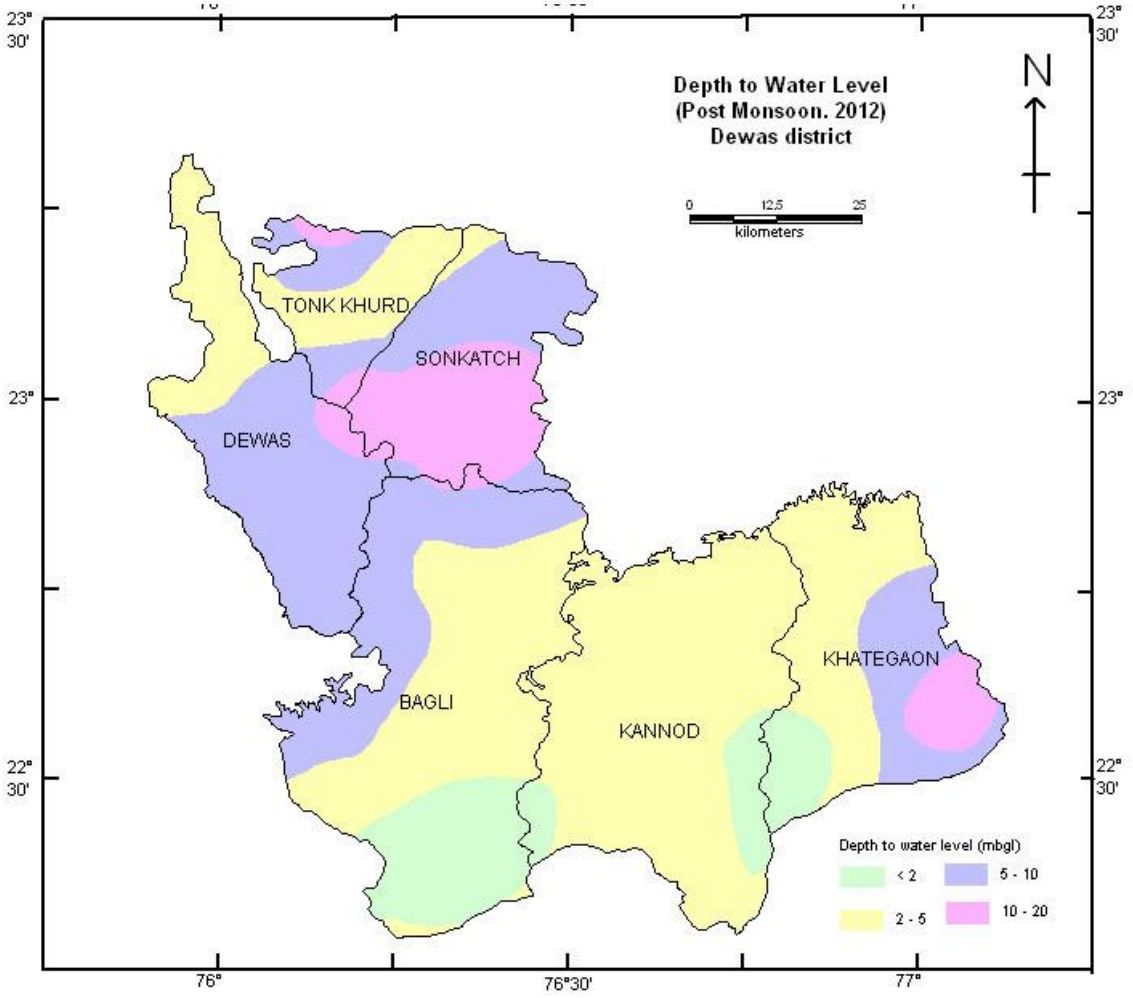
Pre-monsoon (May 2012)

Depth to water level during pre-monsoon, 2012 ranged between 2.90m bgl at Pipri and 24.47m bgl at Bhonrasa. Water levels, in general fall between 5 - 20 m bgl. Shallow water levels of less than 5 m bgl occur in a patch in the south-western part of the district falling in Bagli and Kannod blocks. Deeper water levels, more than 20 m occur in Sonkach, Tonk Khurd and Dewas blocks. In Dewas, Sonkach and Tonk khurd blocks wells are fast drying up perhaps due to higher ground water development.

Post-monsoon (November 2012)

During post-monsoon period of the same year, November 2012, the water levels varied from 0.06m bgl at Dhayali to 15.19m bgl at Bhonrasa. The water level, in general lies between 2 to 10 m bgl during this period. Shallow water levels, less than 5 m bgl occur in a large central part of the district covering parts of Bagli, Kannod & Khategaon blocks. Deep water levels above 10 m bgl occur in the northern part in Dewas, Sonkach, eastern part of Khategaon and northnern part of Tonk khurd blocks.


Depth to water level
(Pre-monsoon, 2012)
Dewas District
N
0 12.5 25
kilometers
TONK KHURD
SONKATCH
DEWAS
BAGLI
KANNOD
KHATEGAON
Depth to water level (mbgl)
2 - 5
5 - 10
10 - 20
20 - 30
76°
76°30'
77°
23° 30'
23°
22° 30'


Depth to Water Level
(Post Monsoon. 2012)
Dewas district
N
0 12.5 25
kilometers
TONK KHURD
SONKATCH
DEWAS
BAGLI
KANNOD
KHATEGAON
Depth to water level (mbgl)
< 2
2 - 5
5 - 10
10 - 20
76°
76°30'
77°
23° 30'
23°
22° 30'

4.2 Ground Water Resources :

Dynamic ground water resources of the district have been estimated for base year -2008/09 on block-wise basis. Out 6,98,044 ha of geographical area, 5,56,382 ha (80%) is ground water recharge worthy area and 1,41,662 ha (20%) is hilly area. There are six number of assessment units (block) in the district which fall under non-command (98 %) and command (2.% Bagli and Kannod) sub units. Bagli, Kannod and Tonkkhurd blocks of the district are categorized as safe blocks. Kahtegaon block of the district is categorized as semi critical block (safe in 2003/04), Dewas and Sonkatch (critical in 2003/04) blocks as over exploited with highest stage of ground water development of 113 % in Dewas block. The net ground water availability in the district is 79,141 ham and ground water draft for all uses is 63,383 ham, making stage of ground water development 80% (66 % in 2004) 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 14,849 ham.

Table: Ground Water Resources (31.3.2009)

District/ 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 d development (ham)	Stage of Ground water Development (%)	Category
Dewas									
Bagli	Command	567	67	19	86	27	473	15	Safe
	Non-Command	18271	11490	567	12057	750	6031	66	Safe
	Block Total	**18838**	**11557**	**586**	**12143**	**777**	**6504**	**64**	Safe
Dewas	Command								
	Non-Command	14856	16288	514	16802	514	-1946	113	Over Exploited
	Block Total	**14856**	**16288**	**514**	**16802**	**514**	**-1946**	**113**	Over Exploited
Kannod	Command	1345	296	88	384	103	947	29	Safe
	Non-Command	9787	5836	382	6218	689	3261	64	Safe
	Block Total	**11133**	**6132**	**470**	**6602**	**792**	**4208**	**59**	Safe
Khategaon	Command								

	Non-Command	13035	9950	340	10290	543	2542	79	Semi Critical
	Block Total	**13035**	**9950**	**340**	**10290**	**543**	**2542**	**79**	Semi Critical
Sonkutch	Command								
	Non-Command	10787	10520	326	10846	326	**-59**	**101**	Over Exploited
	Block Total	**10787**	**10520**	**326**	**10846**	**327**	**-60**	**101**	Over Exploited
Tonkkhurd	Command								
	Non-Command	10492	6396	304	6700	496	3600	64	Safe
	Block Total	**10492**	**6396**	**304**	**6700**	**496**	**3600**	**64**	Safe
	District Total	**79141**	**60843**	**2540**	**63383**	**3449**	**14849**	**80**	

4.3 Ground Water Quality

The electrical conductivity (EC) is a measure of total dissolved solids and hence of salinity. Ground water is in general fresh in the district, EC being below 2000 µ S /cm at 25^{o}C except at Bhesuni village where EC is 2930 µ S /cm at 25^{o}C. The EC is below 1000 µ S /cm in large parts of Khategaon and Kannod blocks and patches in the remaining blocks. The EC is higher 1000 - 1500 µ S /cm in four blocks and patches in Khategaon and Kannod blocks. EC between 1500 - 2000 µ S /cm occurs around Dewas, Matmor, Pipri and Kanthaphor. The data shows that the EC of deeper ground water varies from 621 - 4007 µ S /cm at 25^{o}C. However, it is on the higher side of the range, being above 2000 µ S/cm in 55% samples in Dewas, Sonkatch and Tonk Khurd blocks.

Fluoride is high in 10% samples. Use of phosphatic fertilizers and bird droppings might be contributing to fluoride concentration in ground water. Low fluoride concentration is also a health hazard. A minimum of 0.6 mg/l of fluoride should be present in ground water. However, in 52% samples the flouride concentration is too low. Hence, it may be said that fluoride problem, either way, occurs in a large area represented by 62% samples.

Nitrate pollution in ground water of Dewas district occurs around major towns Dewas, Sonkatch, Bagli, Kanthaphor and Satwas, besides Bhesuni and Pipri. It also occurs at deeper levels in some areas of Dewas block.

4.4 Status of Ground Water Development

Ground water is the main source for drinking and irrigation in the Dewas district. About 82% of irrigation in the district is from ground water. The total number of dug wells and tube wells in the district during 2009-10 were 36531 and 23119 respectively. On the drinking water front, 8 out of 11 urban areas have entire supply from ground water, while Khategaon has partly from ground water. A total of 235 villages in the district have tubewells for water supply. There has been a steady rise in ground water development in the district. The Stage of Development in the district as on 31.3.2011 was 82%.

5.0 Ground Water Management Strategy :

5.1 Ground Water Development

In general geology of the area along with climatological and pedalogogical parameters provide the hydrological environment which governs the ground water development and management of the district. In view of the limited regional extent and poor ground water potential of deeper aquifers in the district, exploitation of this aquifer should be restricted and left for drinking water supply needs. In Bijawars dug wells are feasible. In Archeans dug cum bore wells are suitable. In Vindhyans shallow tube wells are feasible. In Deccan trap deep tube wells are feasible.

5.2 Water Conservation & Artificial Recharge

Artificial Recharge Studies by CGWB

The Central Ground Water Board, under the Central Sector Scheme, has been extending technical and financial support to the State Government for implementing practices in rural and urban areas of the district. Five such projects were taken up. Besides, a study for artificial recharge was also conducted in Bank Note Press located in Dewas city.

5.2.1 Artificial Recharge Structures in Londri watershed, Dewas district

The Londri watershed lies in the Sonkutch block of Dewas district. The central part of this watershed is occupied mainly by alluvium, which is primarily a flood plain deposit. Studies had indicated that in the alluvium area, out of 6.35 MCM annual utilizable recharge, the annual ground water draft is only 0.11 MCM. Owing to the valley gradient, there is outflow of water to the

Londri river in the form of base flow. The ground water fluctuation in the area is also high, ranging from 2.0 to 5.0 m. Conservation of base flow will provide additional ground water for irrigation and other uses during the lean season.

In the central part of the Londri river, an area of 34.5 sq. km is covered by alluvium. It occurs along the banks of the Londri river and its thickness generally ranges between 7.0 to 27.0 m. It is predominantly a flood plain deposit comprising sand, gravel, silt, *kankar* and clay. The alluvium is more clayey and shows wide variations in textural characteristics.

These structures have low cost design and demonstrate the applicability of various artificial recharge structures. The approximate distance between the structures is 700 to 750 meters. The salient features of the design are given below

(a) Gabion structure:- a gabion structure of length 24 m, height 1.20m and depth 0.90m has been constructed across the Londri river. The bottom width is 0.60 m and top width is 0.30 m. Boulders have been enveloped in a steel mesh. This structure helps in arresting the soil erosion, reducing the silt content of the surface runoff apart from recharging the phreatic aquifer.

(b) Boulder Check Dam:- A boulder check dam of length 13.10 m, height 1.0 m, slope1:3 m in the upstream side and 1:2 m in the downstream side has been constructed. The puddle filling is down to a depth of 0.6 m.

(c) Stop Dam:- A stop dam of length 24.40 m. top width 1.40 m and bottom width 2.30 m has been constructed across the Londri river. The depth of the dam is 1.50 m while the height is 0.70 m.

(d) Sub-surface dyke:- The length of the subsurface dyke is 26.20 m, depth 4.90 m, top width 3.0 m and bottom width 2.0 m. The puddle filling is of black cotton soil, which has been wrapped in a cross-laminated polythene sheet.

These artificial recharge measures have had a good impact in the area. Due to the construction of the subsurface dyke and related structures, the water level in the area has shown a rising trend. The water level in the existing boreholes increased by 0.30 to 2.00 m. Dug wells, which were drying up by January end have water column till the end of April.

5.2.2 Roof Top Rain Water Harvesting in Dewas city

Dewas is an important city of the Malwa region of the Madhya Pradesh. With coming of industries in the area, demand for water has increased many folds. During summer, water for drinking and industrial use in Dewas city is being supplied by tankers and was even brought by special water trains in the past years.

Due to industrialization, urbanization and overall development process of the city, the paved area has also increased, resulting in reduction of natural ground water recharge and increased rainfall runoff.

Realizing the gravity of the situation, the State government intiated management aspects of ground water through **'Bhujal Samvardhan Mission'** to emphasize mass awareness about water conservation and artificial recharge and executing schemes of artificial recharge through peoples' participation.

In Dewas city and surrounding areas, 1000 houses having service boreholes were selected where the users agreed to implement rooftop rain water harvesting. The roof top rainfall was diverted to the borehole via a drainage pipe. The water of the first rain was allowed to go through the flush drain. An online filter was fitted on the drainage pipe and the outlet of the filter was connected to the borehole.

The filter is of a cylindrical shape having a diameter of 200 mm. This filter is fitted on the drainage pipe with a reducer of 100 mm diameter. There are three wire mesh screens at the inlet, middle part and the outlet. The filter is filled with sand, gravel and pebbles in a graded manner. The outlet of this filter is connected to the borehole. In between, there is an opening with a cap for inspection as well as chlorination of water, if required.

It has been estimated that a recharge of 50,000 m^3 of water was recharged and an area of around one sq. km was benefited (the above figures are for the year 2001 during which period Dewas had a deficit rainfall of around 40%). There was a marked increase of water levels in the bore wells (3-5 m) and the ground water abstraction structures showed increased sustainability. Moreover, there was a perceptible increase in the quality of ground water. Similar figures have been reported from places outside Dewas city where the filter was installed.

5.2.3 Construction of Recharge Shafts in Dewas district

In Dewas district, it was observed that there were a number of dug wells which were dry or had deep water levels, in spite of having a village tank nearby. This condition was attributed to the deposition of a non-permeable layer at the bottom of the tank, which proved to be a hydraulic barrier between the surface water and the phreatic aquifer. This layer was to be punctured by a recharge shaft providing a connection between the surface water and the phreatic aquifer. As the existing tanks were being used by the villagers for 'nistar' purposes, the shafts would be constructed at 50% RL of the Full Tank Level (FTL). Thus, only 50% of the water would be recharged and 50% would remain in the tank for 'nistar' purposes. Construction of recharge shafts in two tanks viz. Harnawada in Tonkkhurd block and Mendkichak in Dewas block was initially proposed. After that Polay and Agrod in Tonkkhurd block and Randankhedi in Dewas block were selected. Total No of-14 Shafts were constructed.

5.2.4 Artificial Recharge Studies in Dewas Bank Note Press Area

Central Ground Water Board has also extended technical know-how to Bank Note Press authorities in Dewas city for recharging ground water. The Bank Note Press (BNP), which is an undertaking of Government of India, is situated within the municipal limits of Dewas city. It covers an area of 1.95 Sq.km and is situated between elevations 539 and 543 m amsl with a gentle slope towards south west and north east. Thus, a NW-SE water divide runs through the BNP and divides semi-perennial Shipra in the west and Choti Kalisindh in the southeast.

In the BNP premises, around 32 boreholes have been drilled within the depth range of 80 to 150 m. The large number of bore holes in close proximity to each other, and continuous pumping without consideration to the duration of pumping and safe pumping rates has resulted in dewatering of the first and second semi-confined aquifers occurring within the depth of 40 to 70 m.

Hydrogeological studies in and around the BNP complex revealed that there are aquifer systems within the depth range of 527 to 500 m amsl, which had dried up. This was also confirmed through slug tests conducted on a dug well and a defunct tube well.

The only suitable and appropriate method of artificial recharging in the area was to inject water through conduit pipe down to the aquifer at the required depth. In view of the situation in the BNP complex, storm water or surface run off from the ground catchments was managed in such a way that the arrested water found its way through injection wells constructed in recharging pits with inverse gravel sand filter. These structures are basically low cost with simple construction details to facilitate downward journey of water to the aquifers within the depth range of 27-33 m.

5.2.4 Roof Top Rain Water Harvesting in District Hospital Dewas city

Total roof area of the Hospital building is 3850 sq.km, where as normal annual rainfall is about 1045 mm, the total water available for recharging works out to 4023 cubic meter. Roof Top Rain Water of Hospital building passes through Filter Pit and then poured into Dug Well. Depth of dug well is 11m.bgl and diameter is 4.80 m.

5.2.5 Demonstrative Project for Artificial Recharge –"Dewas Watershed"

Under the Central sector Scheme of CGWB one Demonstrative Project "Dewas Watershed" is taken up with Public Health Engineering Department, Dewas, Madhya Pradesh Government.

Ministry of water resources has financed Rs 49.06 Lakhs to construct various artificial recharge structures in the Upper Reaches of Choti Kalisindh River, under this project Stop Dam –11, Gabion-10, Recharge Shaft –01,Percolation tank –01,Sub-Surface Dyke-01 and Rooftop Rain water harvesting –02 is to be constructed and impact analysis is to be done in the year 2007-08.

6.0 Ground Water related issues & problems :

The Dewas district is a hard rock terrain where the capacity of the formations to hold and transmit water is poor. Alluvial formations, which are unconsolidated and form better aquifers, have a very limited extent in the district. Even the Narmada does not form significant alluvium in the district. In Dewas district, nitrate more than permissible limit is found in shallow ground

water of many towns due to urban pollution. In these places, dug wells and shallow tube wells should be constructed only after chemical analysis of water sample.

EC of deeper ground water varies from 300 -2930 μ S /cm at 25^{o}C. Fluoride is above desirable limit in 10% samples. Fluoride is higher at deeper levels.

7.0 Recommendations :

1. Dewas district is presenting a dismal picture from ground water point of view. Though presently ground water is meeting most of the water needs of the district but it is not going to last long. The average water levels of the district are deep, the decadal fluctuations and the long-term trends are showing a decline, the water balance left is limited. The population and progress coupled with poor aquifers are responsible for this alarming situation. Thus special caution is to be observed while developing the resource.
2. In Dewas and Sonkatch blocks further development of ground water would result in further mining of the resource.
3. In Bijawars dug wells are feasible. In Archeans dug cum bore wells are suitable. In Vindhyans shallow tube wells are feasible. In Deccan trap deep tube wells are feasible. The yields, however, would be low to moderate.
4. Artificial Recharge practices in rural areas should be taken up earnestly to improve the ground water situation.
5. Change in cropping pattern is another measure, which will relieve the situation. Presently Soya bean crop is being grown in large areas, which has a high water requirement.
6. Roof top rainwater harvesting should be made mandatory considering the water scarcity in urban areas. This would mitigate the situation.