

DISTRICT GROUND WATER INFORMATION BOOKLET



GWALIOR DISTRICT MADHYA PRADESH



Ministry of Water Resources
Central Ground Water Board
North Central Region
Government of India

2013

GWALIOR DISTRICT AT A GLANCE

Sl. No.	ITEMS	STATISTICS																
1	<u>GENERAL INFORMATION</u> i) Geographical area (Sq Km) ii) Administrative Divisions a. Number of Tehsil b. Number of Blocks c. Number of Panchayats/Villages iii) Population (Census 2011) iv) Normal Annual Rainfall (mm)	4,564 Sq Km 3 (Gird, Pichhor & Bhitwarwar) 4 (Ghatigaon, Morar, Dabra & Bhitwarwar). 300/612 20,32,036 764.4 mm																
2	<u>GEOMORPHOLOGY</u> Major Physiographic Units Major Drainage	Alluvial plain, Inter mountain valley, Misa, Ridges, Denudational Hills, Plateau and Pediment. Parbati, Neon, Morar and Sind.																
3	<u>LAND USE (Sq Km)</u> a) Forest area b) Net area sown c) Cultivable area	1,111.0 Sq Km 1,957.03 Sq Km 1957.38 Sq Km																
4	<u>MAJOR SOIL TYPES</u>	Clayey soil, fine soil, loamy soil.																
5	<u>AREA UNDER PRINCIPAL CROPS</u> (As on 30.06.2012)	1,18,378 Hectare Wheat, Paddy, Jawar, Bajra & Others.																
6	<u>IRRIGATION BY DIFFERENT SOURCES</u> Dug wells Tube wells/ Bore wells Tank/Ponds Canals Other sources Net Irrigated area Gross Irrigated area	<table style="width: 100%; border: none;"> <thead> <tr> <th style="text-align: left;"><u>No.</u></th> <th style="text-align: left;"><u>Area (ha).</u></th> </tr> </thead> <tbody> <tr> <td>15,615</td> <td>43100</td> </tr> <tr> <td>5,778</td> <td>11600</td> </tr> <tr> <td>05</td> <td>200</td> </tr> <tr> <td>03</td> <td>77000</td> </tr> <tr> <td>---</td> <td>7,226</td> </tr> <tr> <td>---</td> <td>1,06300</td> </tr> <tr> <td>---</td> <td>1,37,300</td> </tr> </tbody> </table>	<u>No.</u>	<u>Area (ha).</u>	15,615	43100	5,778	11600	05	200	03	77000	---	7,226	---	1,06300	---	1,37,300
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---	7,226																	
---	1,06300																	
---	1,37,300																	
7	<u>NUMBER OF GROUND WATER MONITORING WELLS OF CGWB</u> (As on 31.03.2013)	No of Dug Wells : 17 No of Piezometers : 04																
8	<u>PREDOMINANT GEOLOGICAL FORMATIONS</u>	Bundelkhand Granite, Gwalior formation, Vindhyan rocks and Alluvium.																

9	<p><u>HYDROGEOLOGY</u> Major Water bearing Formation Pre-Monsoon depth to water level during 2012 Post-Monsoon depth to water level during Nov, 2012 Long-term water level trend in 10 years (2003-2012) in m/yr.</p>	<p>Alluvium.</p> <p>4.06 mbgl-29 mbgl</p> <p>1.45 mbgl-29.00 mbgl</p> <p>0.23 to 1.4m/yr rise 0.2 to 0.41 m/yr fall.</p>
10	<p><u>GROUND WATER EXPLORATION BY CGWB (As on 31.03.2013)</u> No. of wells Drilled EW, OW and Pz (Total) Depth Range (m). Discharge (Lps) Storativity Transmissivity (m²/day)</p>	<p>37, 06 and 08 (51) 50.87 to 205 m. 1 to 55(lps) 1.8 x 10⁻² to 9.5 x 10⁻⁴ 3.70 to 3219 m²/day.</p>
11	<p><u>GROUND WATER QUALITY</u> Presence of Chemical constituents more than permissible limits (e.g. Nitrate, EC, F, As, Fe),</p>	<p>NO3-146, Cl-799 at Mohnavill.</p> <p>C1-S1,C2-S2,C3S1,C4-S2</p>
12	<p><u>DYNAMIC GROUND WATER RESOURCES (2009)</u> Annual Replenish able Ground Water Resources Net Annual Ground Water Draft Projected Demand for Domestic and Industrial Uses upto 2035 Stage of Ground Water Development</p>	<p>50786 ham 21557 ham</p> <p>3650 ham 42%</p>
13	<p><u>AWARENESS & TRAINING ACTIVITY</u> Mass Awareness Programme Organised- Place: State Institute of Health Management & Communication Centre, Gwalior Water Management Training Programme</p>	<p>Date: 10/03/03</p> <p>NIL</p>
14	<p><u>EFFORTS OF ARTIFICIAL RECHARGE & RAIN WATER HARVESTING</u> Projects completed by CGWB Projects under technical guidance of CGWB</p>	<p>NIL NIL</p>
15	<p><u>GROUND WATER CONTROL AND REGULATION</u> Number of OE/ Critical/ Notified Blocks</p>	<p>NIL</p>
16	<p><u>MAJOR GROUNDWATER PROBLEMS AND ISSUES</u></p>	<p>There is urgent need for regulating indiscriminate use of ground water in order to arrest depletion of ground water levels and emphasis should be given on artificial recharge to Ground water.</p>

1.0 INTRODUCTION

Gwalior District lies between North latitude 25°43' and 26°21' and East longitude 77°40' and 78°39' of Madhya Pradesh. The district is bounded by Bhind and Morena in the North, Datia in the East and Shivpuri in the southern direction. There are 3 Tehsils and 4 Blocks in the district. The block headquarters are Ghatigaon, Morar, Dabra and Bhitwar and the total population of the district is 2032036 (As per census 2011). Gwalior district falls under Ganga basin, Yamuna Sub Basin, Sind and Kunwari Minor basin. (Fig-1)

The entire area of Gwalior district falls in Sindh & Kunwari sub basin of Yamuna basin. The major tributaries of river Sindh are Parbati, Baisali and Pahuj. The tributaries of Kunwari are Sank and Asan. Sank & Asan are the other major drainages of Kunwari river in the district.

IRRIGATION PRACTICES:

Surface Water irrigation facilities are available in parts of all the four blocks of district by canals. The maximum surface water irrigated area is in Bhitwar block and covers an area of 27037 hectare and minimum irrigated area about 498 hectare is available in Ghatigaon block. The other irrigation practices adopted in the district are through Dug wells, Tube wells & Tanks. Ground Water also plays a major role in irrigation.

The different irrigated area as on 30.06.2012 are as under: -

S.No	Irrigation structure	Number	Irrigated area (Hectare)
1.	Canals	03	77000
2.	Tube wells	5778	11600
3.	Dug wells	15615	43100
4.	Tanks	05	200

CROPPING PATTERN:

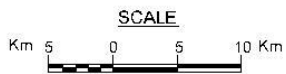
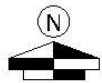
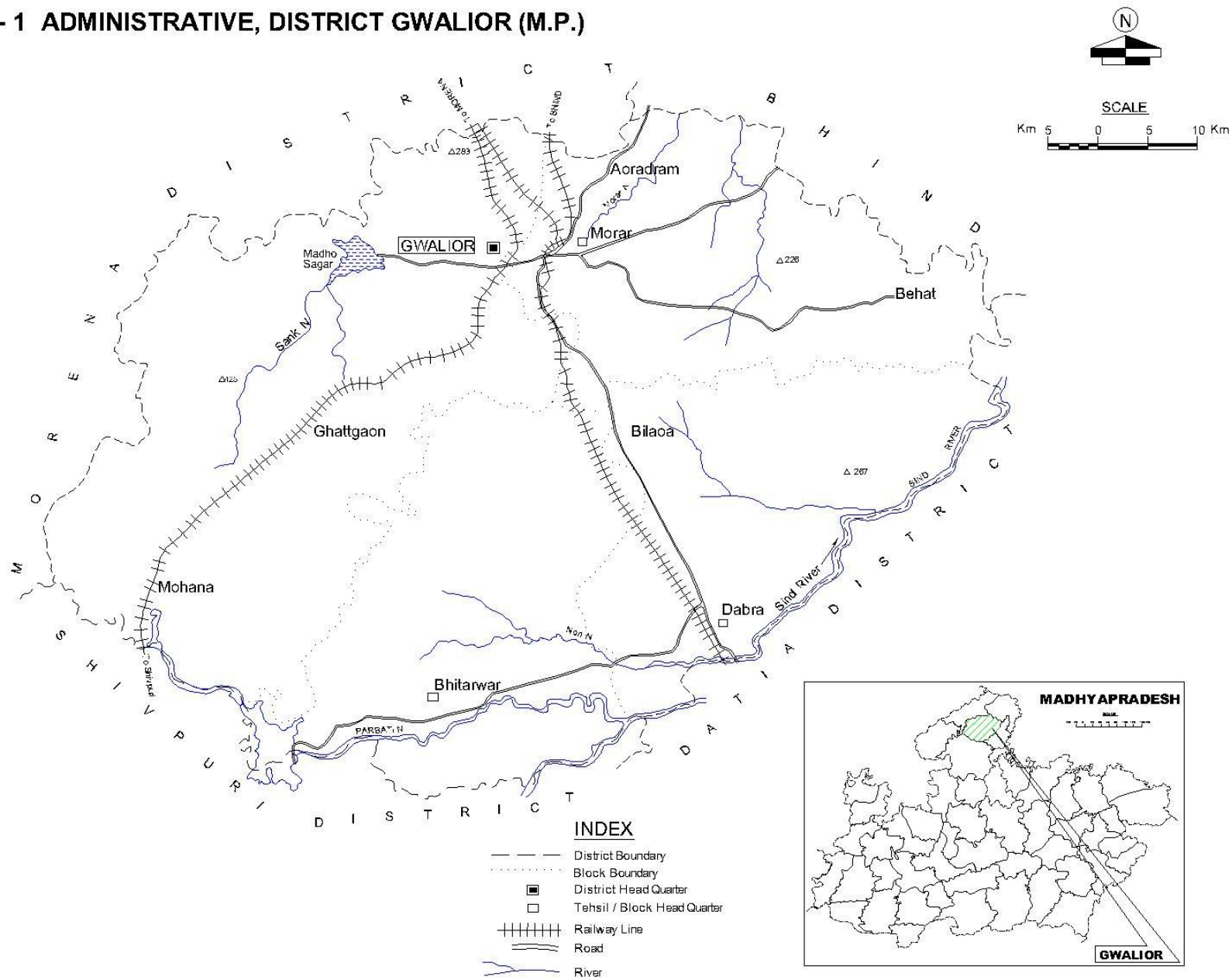
The major crops grown in the district are Wheat, rice, Jawar, Bajra and others crops in a total area of 1,95,700 Hectare. The other major crops sown in the areas are gram and other pulses in an area of 56,100 Hectare. The total sown area in Kharif and Rabi i.e. gross crop area was 2, 51,800 Hectare.

CGWB ACTIVITIES:

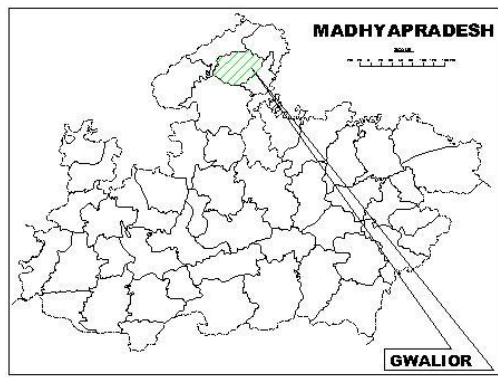
- 1) Systematic Hydrogeological Surveys: Sh. D.K. Jain, FSP 85-86, Sh. M.L. Parmar, FSP 86-87, Sh. R.M. Joshi, FSP 90-91 and Sh. A.V. Singh, FSP 90-91 carried out Systematic Hydrogeological Surveys in Gwalior District.
- 2) Reappraisal Hydrogeological Surveys: Sh. A.K. Jain, Sc 'B' during AAP 2002-03 and Sh. Seraj Khan, AHG during AAP 2002-03 carried out reappraisal Hydrogeological Surveys in parts of Gwalior District.

- 3) Ground Water Exploration: Under Ground Water Exploration, a total of 20 EW, 09 OW's & 04 Pz were constructed between 2001-2002 to 2004-2005 by Department Rigs and 14 exploratory wells were constructed by

Fig. - 1 ADMINISTRATIVE, DISTRICT GWALIOR (M.P.)



- INDEX**
- District Boundary
 - Block Boundary
 - District Head Quarter
 - Tehsil / Block Head Quarter
 - +++++ Railway Line
 - ==== Road
 - ~~~~~ River



Contractual Rigs under Accelerated Exploratory Drilling Programme (AAP 2001-02).

- 4) Short-term water supply investigations have been carried out by Shri HS Namdeo, Scientist 'C' for Defense Establishments in MES, Morar, Maharajpur Airport and Takenpur whenever requests have been received.
- 5) A Mass Awareness programme on conservation and recharge to Groundwater was conducted at State Institute of Health Management and Communication Centre, in Jeewaji University, Gwalior on 10.03.03 during AAP-2002-2003.
- 6) The Urban Hydrogeology and Ground water Development of Gwalior city was undertaken during AAP 2001-2002.

2.0 CLIMATE AND RAINFALL

The normal annual rainfall of Gwalior district is 764.4 mm. Gwalior District receives maximum rainfall during southwest monsoon period i.e. June to September. About 89.1% of the annual rainfall received during monsoon period and only 10.9% takes place during non- monsoon period between October to May.

The surplus water for ground water recharge is available only during the monsoon period. The maximum rainfall received at Gwalior is 895.9 mm and minimum at Dabra is 693.1 mm.

The climate of Gwalior district is characterized by hot summer and dryness except during southwest monsoon season. The year can be divided into four seasons. The winter season commences from December to February followed by the hot season from March to middle of June.

The period from middle of June to September is the monsoon season; October and November form the post monsoon or transition period.

The normal maximum temperature recorded during the month of May is 42.1° C and minimum during the month of January is 7.1°C. The relative humidity generally exceeds 83% and the wind velocity is higher during pre-monsoon period as compared to post-monsoon period.

3.0 GEOMORPHOLOGY AND SOIL TYPES

Physiographically Granite rocks of Gwalior formation and Vindhyan system forms the Hillocks and Alluvial plain forming the flat terrain. The maximum elevation is 440 mamsl near Laxmanpura village and minimum elevation is 166.46 m near Baisora village.

In Gwalior district 8 groups of geomorphic units have been classified on the basis of differential erosion and deposition of rock material.

S.No.	Geomorphic unit	Lithology
1	Younger Alluvial Plain	Unconsolidated material consisting of gravel, sand, silt and clay.
2	Older Alluvial Plain	Gravel, sand, silt and clay.
3	Inter mountain valley	Fluvial deposits of varying grain size.
4	Mesa	Flat top hill of Vindhyan sandstone.
5	Ridges (sedimentary)	Shales & sand stones.
6	Denudational Hills	Sandstone, limestone and shale of Vindhyan group.
7	Plateau	Composed of Vindhyan sandstone.
8	Pediment	Granite dominating as underlying lithology

The soil of Gwalior district can broadly be divided into 4 groups: -

1. Well drained clayey soil on moderate slopes.
2. Deep well drained firm soil on gently sloping.
3. Very shallow, well drained loamy soil on gentle slopes.
4. Moderately deep to deep, well drained to mod drained fine soils on very gentle slopes.

4.0 GROUND WATER SCENARIO

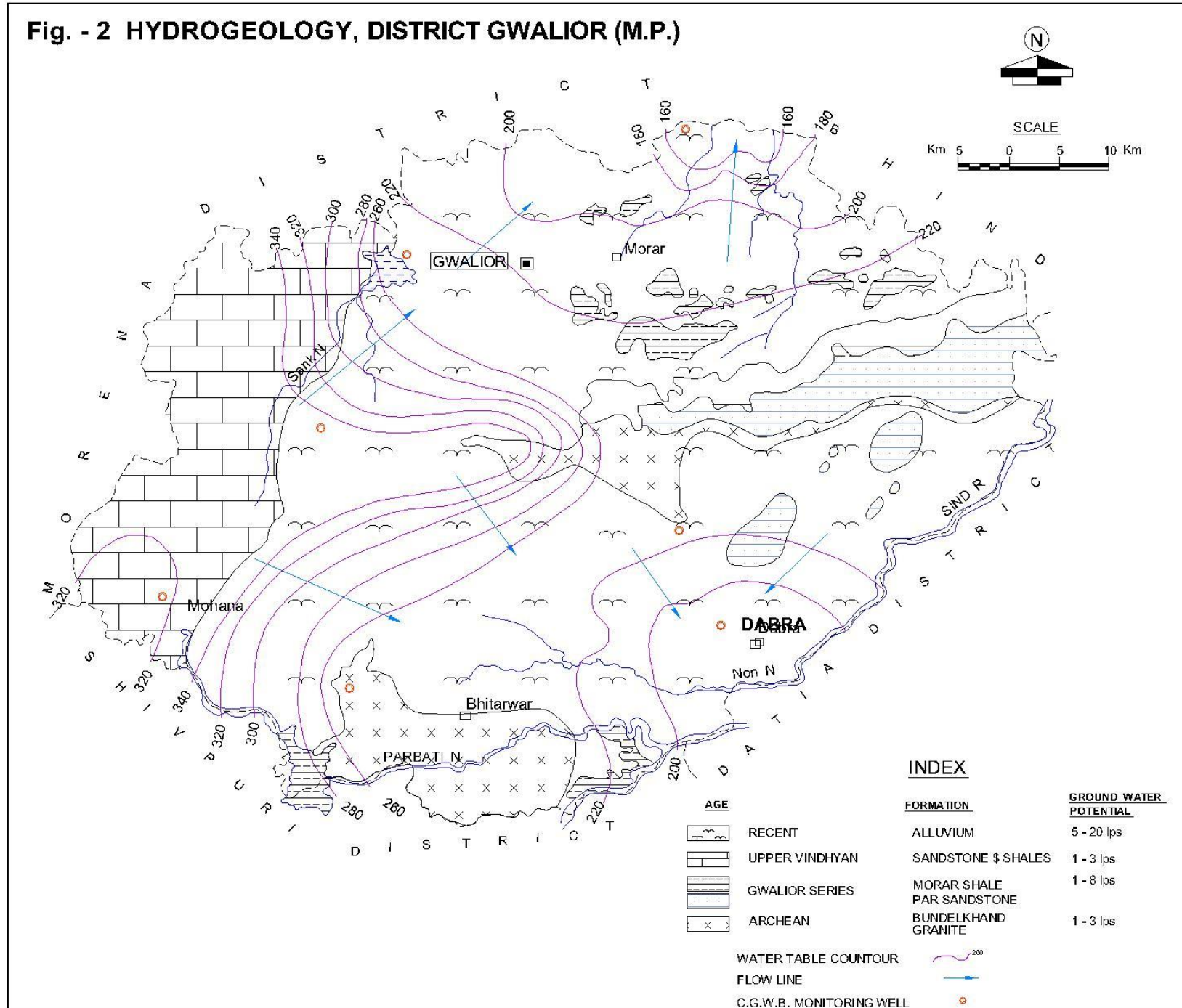
4.10 HYDROGEOLOGY: Aquifer System and Aquifer Parameters

The district is covered with recent Alluvium of quaternary age deposited over the rocks of Vindhyan system, Gwalior system and Bundelkhand granites.(Fig-2)

Bundelkhand Granites:

The Bundelkhand granite is the oldest rock in the area and form basement and occurs in Northern part of Dabra block of Gwalior district. Ground water occurs in unconfined to semi-confined conditions in weathered and fractured granites. Ground water is tapped mostly from Dug wells and yield ranges from 1 to 2.5 lps.

Fig. - 2 HYDROGEOLOGY, DISTRICT GWALIOR (M.P.)



The transmissivity in the granite area of shallow aquifers varies between 10m²/day to 150m²/day.

Gwalior Series:

The rocks belonging to Gwalior series are exposed near Gwalior and are divided into Par and Morar Series. The Par series consists of thin bedded sandstone with some shale beds. The Morar series consists of Ferruginous Shales with banded Jasper. The ground water occurs under unconfined to semi-confined conditions in the weathered and fractured rocks. The ground water is tapped mostly through dug wells or shallow tube wells and yield ranges from 1 to 3 lps.

Vindhyan:

These comprise sandstone, shale and flagstone belonging to Kaimur and lower Rewa series in the district. The ground water occurs mostly under unconfined to semi-confined conditions and tapped through dug wells with yield ranging from 1 to 3 lps.

Alluvium:

The alluvium forms the main aquifer system in the area and its thickness varies from 13-40m. The ground water occurs under unconfined to semi-confined in shallow aquifers and confined in deeper aquifers. The dug wells and shallow tube wells tap mainly the Kankar horizons inter bedded with silt and clays. The yield of dug wells and shallow tube wells ranges between 4 to 16 lps. A high yielding well of 43 lps was constructed at Gadwa Ki Gote by CGWB in Gwalior district and has carried ground water exploration to a maximum depth of 305 m.

WATER LEVELS:

Ground Water Levels form a very important parameter of the ground water system. CGWB has 19 National Hydrograph stations and 5 Piezometers in the district.

Pre-monsoon (MAY 2012):

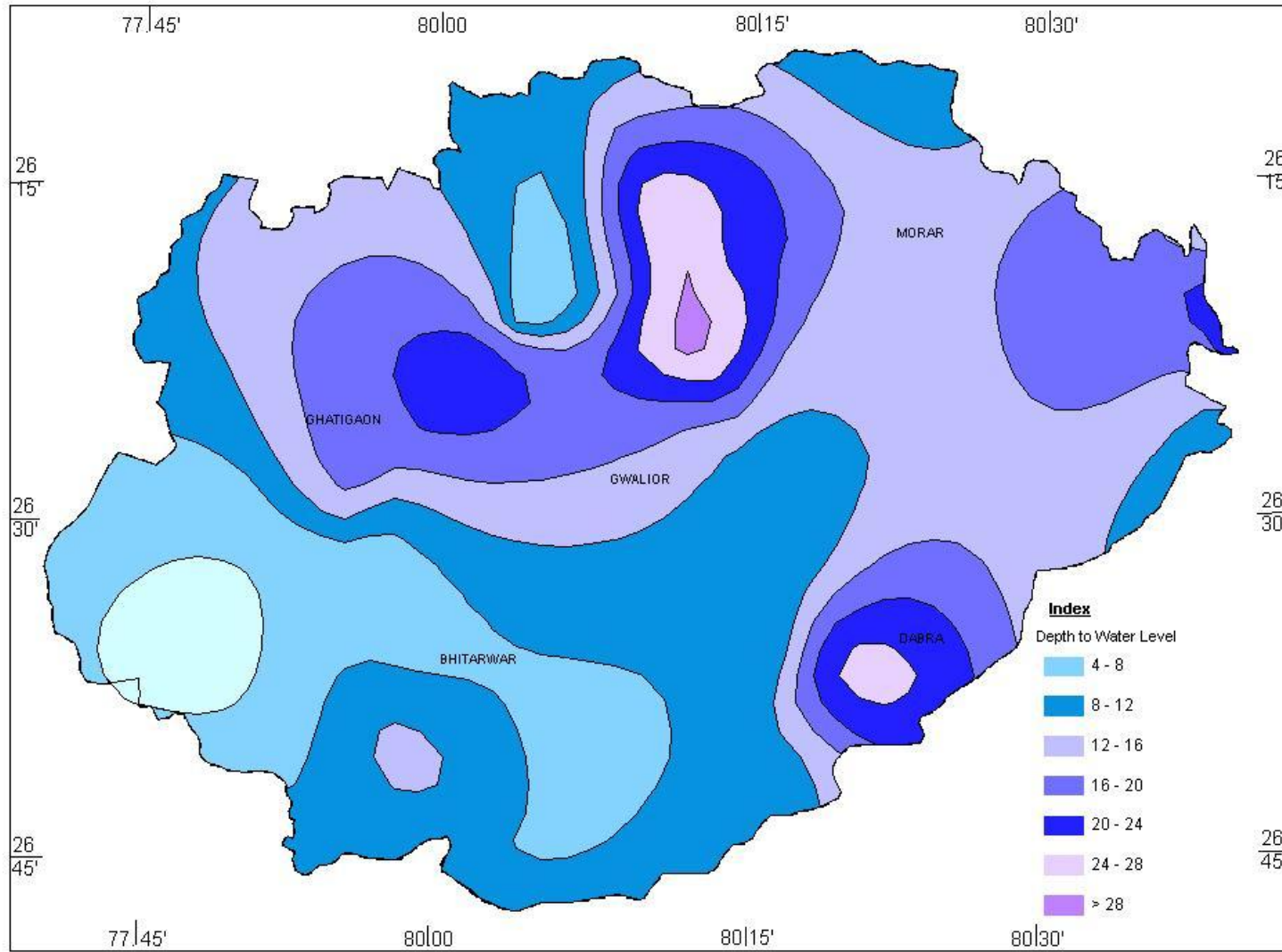
The Pre-monsoon depth to water level ranges between 4.06 – 29.0 mbgl. The maximum Central part of the district has DTW between 10-20m and western & south eastern part having DTW between 5-10 m and deepest water level > 28m recorded in Bhatkheri Village of the district.(Fig-3)

Post-monsoon (2012):

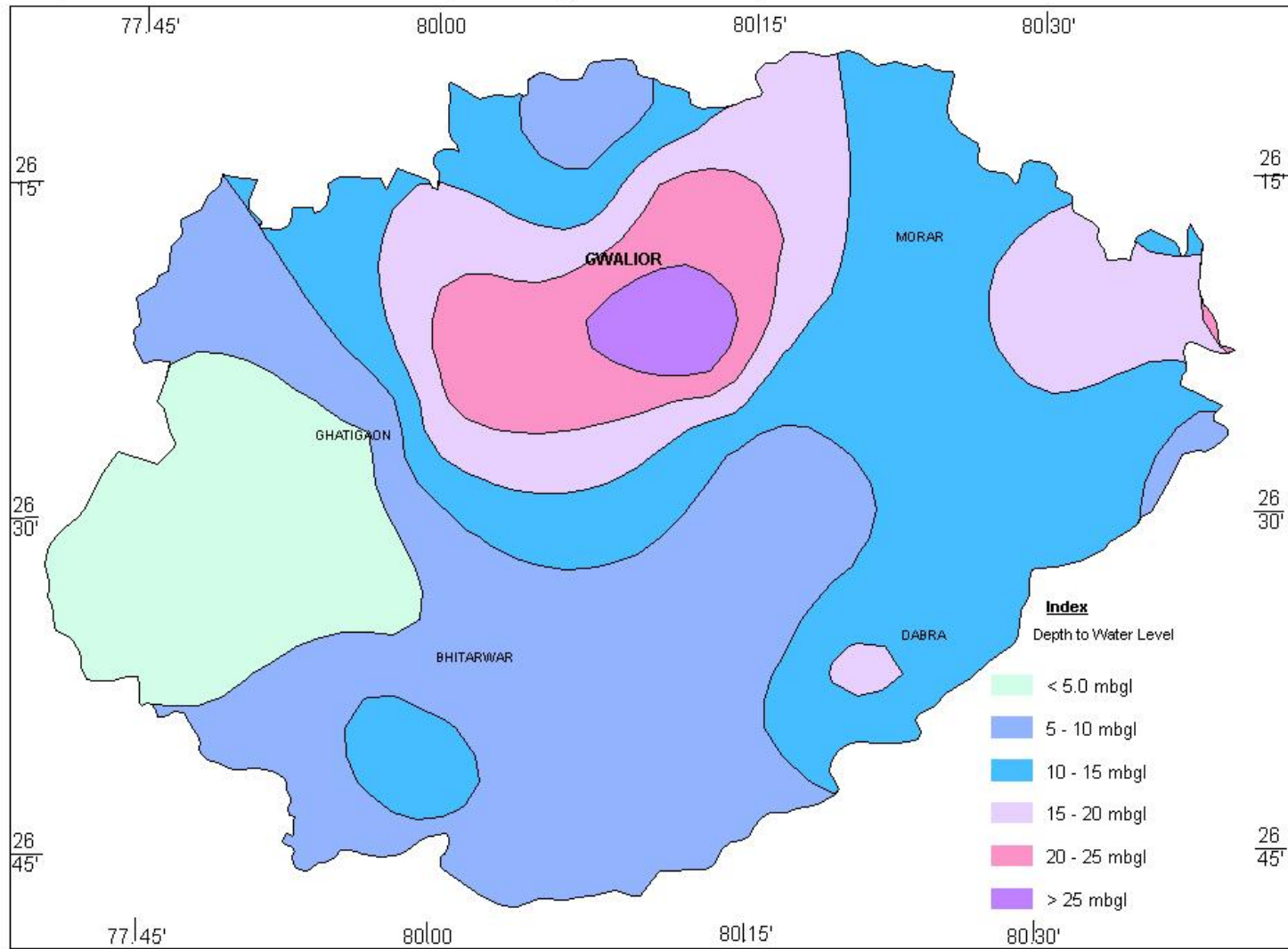
The post-monsoon depth to water level ranges between 1.45 to 29.00 (Fig.4). During post monsoon, the central part of the district has DTW between 10-20 m and in northern and southern part; DTW varies between 5-10 m with some patches having DTW more than 20 m and in southern part of the district having DTW ranging between 4 to 6m.

Decadal water level trend(2003-2012): The decadal water level trend shows a fall ranging between 0.029 to 1.58 m/yr during Pre-monsoon and 0.0068 to 1.08 m/yr during post-monsoon. However some wells are showing rising trend in the range of 0.2305 to 1.4019 m/yr during Pre-monsoon and 0.0945 to 1.1078 m/yr during post-monsoon.

Depth to Water Level Pre Monsoon (May 2012) District Gwalior, M.P.



Depth to Water Level - Post Monsoon (Nov '2012) , District Gwalior, M.P.



4.2 GROUND WATER EXPLORATION:

The Hydrological details of exploratory wells, under Accelerated Exploratory Drilling Programme constructed through out -source agencies is given (Fig-5) in table below-

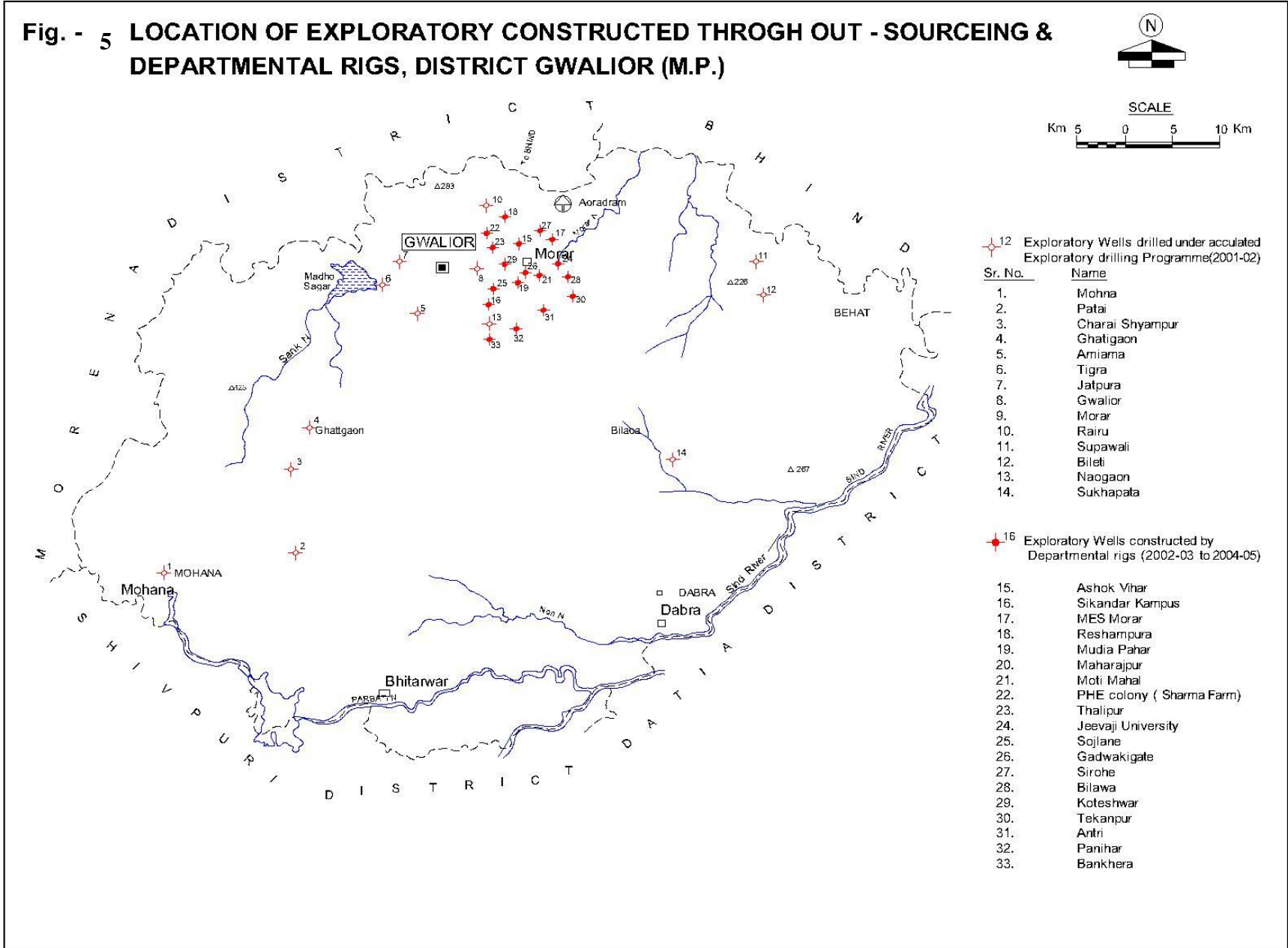
Hydrological Details of Exploratory Wells constructed through out-sourcing under Accelerated Exploratory Drilling Programme. (2001-2002).

S No.	Location	Depth Drilled (m)	Zones Tapped	Geology	Static Water Level (mbgl)	Discharge (lps)	Draw Down (m)
1	Mohna	106.74	41-48, 82-89	Sandstone	10.10	1.0	1.40
2	Patai	117.5	76-87	Sandstone	15.25	1.0	1.25
3	Ami-Ama	200	50-60	Sandstone	8.80	1.0	11.0
4	Ghatigaon	200	50-57	Sandstone	12.10	1.0	14.10
5	Chari-Shyampur	200	28-37, 153-160	Sandstone	17.04	1.0	10.26
6	Nowgawan	200	24-34, 146-158	Sandstone	---	4.0	---
7	Talpura	200	---	Basic rock	---	Meager	---
8	Tigra	200	---	Basic rock	---	Dry	---
9	Raipu	200	41-50	Sandstone	12.00	0.5	---
10	Bihti	200	25-34, 146-162	Sandstone	9.00	1.0	22.0
11	Supawali	200	37-48, 78-87	Sandstone	11.04	1.0	31.0
12	Gwalior	110.28	25-38	Alluvium	17.06	2.7	0.94
13	Morar	50.87	---	Alluvium	9.71	1.0	0.48
14	Sukhapati	200.00	---	Granite	---	0.5	---

Hydrological Details of CGWB Exploratory Wells by Departmental Rigs. (2002-03 to 2004-05).

S No.	Village	Depth Drilled (mbgl)	Depth of well construction (mbgl)	Zones Tapped (mbgl)	Aquifer material	Static Water Level (mbgl)	Discharge (lps)	Draw Down (m)
1.	Ashok Vihar	300.00	300.00	33-39, 105-200	Morar Shale	18.0	26	5.14
2.	Sikandar Kampu	190.25	190.25	30-42, 48-52	Alluvium /shale	17.10	55	--
3.	MES, Morar	202.00	202.00	23-39, 52-62, 102-124	Alluvium /shale	11.34	7.0	14.25
4.	Reshampura	51.20	51.20	18-35	Weathered S.St	15.65	19.0	4.77
5.	Mudia-Pahar	201.30	201.30	29-35, 45.5-51.5, 120-128.5, 190-192	Morar Shale	25.90	11.60	7.30
6.	Maharajpur	250.80	250.80	13.5-19.5, 47-52, 151-154, 180.7-183.7	Alluvium/ Morar shale	9.30	3.67	4.52
7.	Moti Mahal	280.60	280.60	37-43, 44.8-50.8, 155-158	--do--	16.87	8.80	18.28
8.	P.H.E. Colony (Sharma form)	281.90	281.90	42.5-50.5, 58-66, 242-245	Alluvium	10.72	20	3.17
9.	Thatipur	298.9	298.9	30-42, 274-283	Alluvium/ Morar shale	14.55	20	1.07
10.	Jeewaji University, Gwalior	305.00	305.00	30-42, 281-296	Morar Shale	21.97	12.20	4.95
11.	Sojlana	305.00	305.00	---	Dry	---	--	--
12.	Gadwe ki gote	305.00	305.00	27-39, 49-51, 137-151	Alluvium/ Morar shale	28.00	12.0	4.41
13.	Siroli	193.00	193.00	12-18, 34-40, 88-94	--do--	19.89	1.75	26.33
14.	Bilaua	250.10	250.10	---	--do--	7.20	0.35	--
15.	Koteshwar	274.00	274.00	39-48.60, 100-104, 205-213	--do--	12.85	3.66	13.97
16.	Tekanpur	274.00	274.00	9-12, 23-24	Weathered granite	3.90	2.0	--
17.	Antri	305.00	305.00	26-35, 271-274	--do--	23.70	2.0	--
18.	Panihar	274.50	274.50	74.70-82, 83-89	Morar Shale	45.308	4.0	--
19.	Banhera	300.00	300.00	161-167	Par quartzite	41.50	2.0	--

Fig. - 5 LOCATION OF EXPLORATORY CONSTRUCTED THROUGH OUT - SOURCEING & DEPARTMENTAL RIGS, DISTRICT GWALIOR (M.P.)



4.3 GROUND WATER RESOURCES:

Dynamic ground water resources of the district have been estimated for base year -2008/09 on block-wise basis.. There are four number of assessment units (block) in the district which fall under command (17 %) and non-command (79 %) sub units. All blocks of the district are categorized as safe blocks, except Morar block under non command is categorized as semi critical with highest stage of ground water development of 71 %. The net ground water availability in the district 50,786 ham and ground water draft for all uses is 21,5570 ham, making stage of ground water development 42 % 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 27,916 ham.

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 (%)
Gwalior								
Bhitarwar	Command	10318	1460	160	1620	257	8601	16
	Non-Command	6944	2900	240	3140	386	3659	45
	Block Total	17262	4359	400	4759	643	12259	28
Dabra	Command	9949	1708	274	1983	491	7749	20
	Non-Command	4742	2060	215	2275	386	2296	48
	Block Total	14691	3768	490	4258	877	10045	29
Ghatigaon	Command	1685	254	52	306	154	1277	18
	Non-Command	8093	4833	668	5501	970	2289	68
	Block Total	9778	5087	720	5807	1124	3566	59
Morar	Command							
	Non-Command	9056	6006	727	6733	1005	2045	74
	Block Total	9056	6006	727	6733	1005	2045	74
	District Total	50786	19220	2337	21557	3650	27916	42

4.4 GROUND WATER QUALITY OF GWALIOR DISTRICT:

Quality of Ground Water for Drinking Purpose: In general the Chemical quality of Ground water in phreatic and deeper aquifers is good. The electrical conductivity EC of ground water is a direct measure of the total dissolved solids present in water, which is exceeding 1000 μ s/cm at five villages- Mohna(3270 μ s/cm), Dabra(2020 μ s/cm), Dongarpur(1970 μ s/cm) and Bhitarwar(1800 μ s/cm) . The ground water is alkaline and fresh in nature except northern part of Morar block. The concentration of NO₃ is exceeding BIS limit of 45mg/l at 42.85% wells, highest at Mohana- 146mg/l The range of different chemical constituents in the area is given below in mg/l:-

EC in μ s/cm at 25 °C	-	200 – 3270
HCO ₃ (mg/l)	-	166 – 433
Cl	-	7- 799
N O ₃	-	1 - 146
Ca	-	28 -122
Mg	-	1 – 54
F	-	0.2 – 1.5

Quality of Ground Water for Irrigation Purpose: In classification of water for irrigation purpose, it is assumed that the water will be used under average conditions with respect to soil texture, infiltration rate, drainage and climate. The chemical data of all the water samples pertaining to Gwalior a district was plotted on U.S. Salinity Laboratory diagram. The data brought out the fact that two locations namely Behat and Manpura could confirmed under C₁-S₁ Class (Low Salinity & Low Sodium) which implies that these waters are safe for most crops with no chances of development of soil salinity. Further 28.57 % wells of study area namely Bhatkheri, Ghantigaon, Harsibandh, and Nayagaon were observed under C₂-S₁ Class (Medium Salinity & Low Sodium) which means that these waters can be used for irrigation purpose without any fear for most of the crops with no chances of development of soil salinity. The ground waters representing the wells of Aron, Bhitwar, Dabra, Dongarpur, Rairu, and Tekanpur were grouped under C₃-S₁ (High Salinity & Low Sodium) class. These waters can be used on soils with restricted drainage. The only well of Mohna village was grouped as C₄-S₂ (Very High Salinity & Medium Sodium). This water can be used in growing high salt tolerant crops. Special management practices are required for salinity control.

4.5 STATUS OF GROUND WATER DEVELOPMENT:

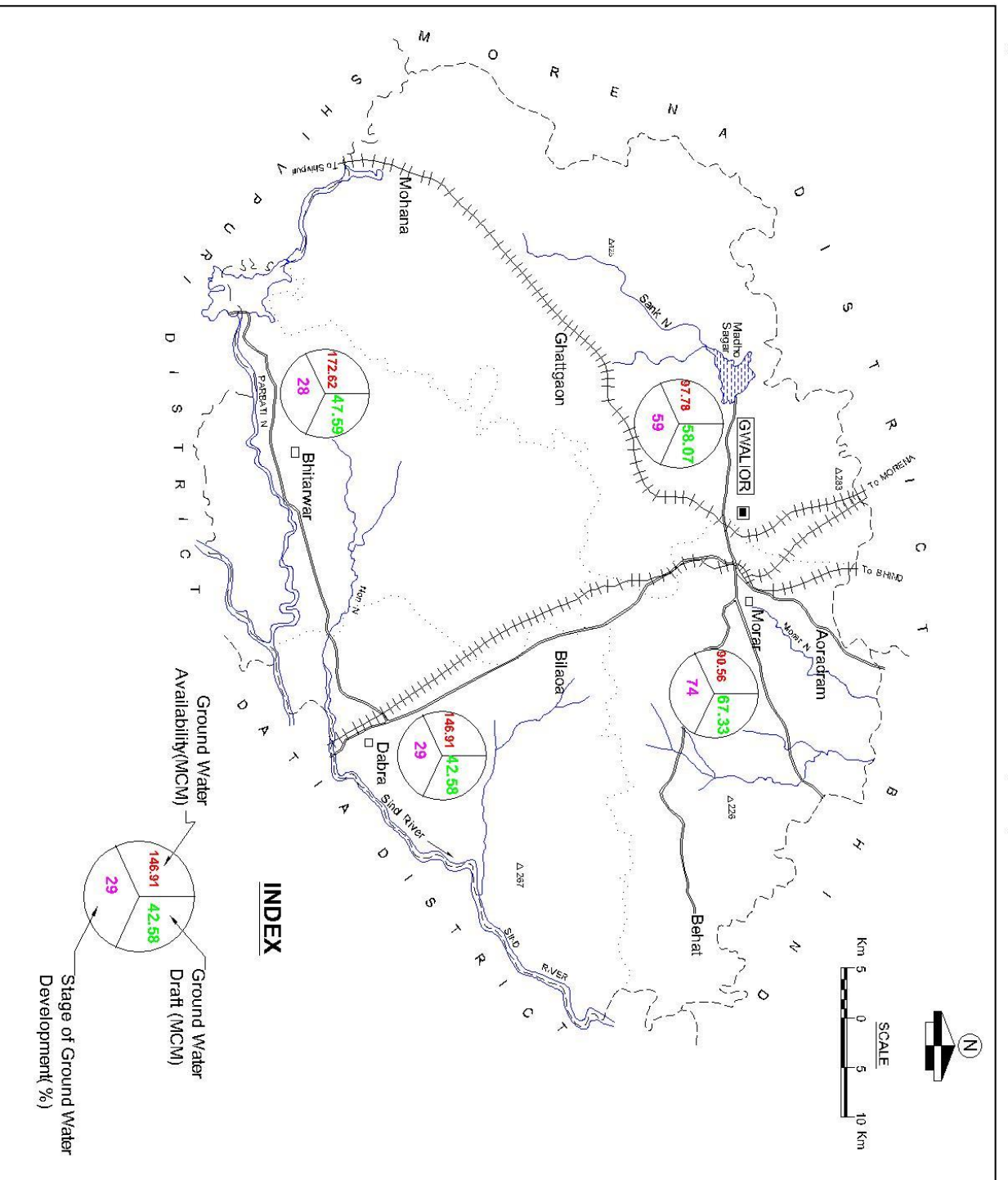
Ground water is the main source of irrigation and drinking water except Morar town where water supply for drinking is from a small tank and Tigra Dam. The drinking water supply in the area is managed by Municipal Corporation in Urban area and Panchayat in the rural areas and is met through bore wells and tube wells. Till 1960, farmers were dependent mostly on Monsoon rainfall and very few dug wells existed to irrigate by moat. The deep aquifers were totally unexploited till 1960, but after that the ground water development in the district progressed and till June 2012, the number of irrigation dug wells reached to 15615 and tube wells/ bore wells reached to 5778.

The total water supply to Gwalior city is met through 504 tube wells installed with Power pumps, 54 dug wells, 574 hand pumps, 2 stop dams and Tighra reservoir. Out of the total requirement, 18% of water comes from ground water. The depth of these bore wells varies from 50-80 mbgl with discharge ranging from 5000 to 8000 Gallons/hour.

The rural water supply of the villages is mostly met from dug wells and hand pumps.

GROUND WATER RESOURCES)AND STAGE OF DEVELOPMENT

Fig. - 6 : GROUND WATER RESOURCES, DISTRICT GWALIOR (M.P.)



5.0 GROUND WATER MANAGEMENT STRATEGY

5.1 GROUND WATER DEVELOPMENT:

The development of ground water is increasing every year. The construction of wells for irrigation purpose has increased in the recent past without much consideration of well spacing resulting adverse impact on ground water regime.

The stage of development is safe. The development of ground water can be notified by visualizing long term water level trends as observed declining trend in non – command area. Artificial Recharge to ground water is felt necessary to tackle the situation.

5.2 ARTIFICIAL RECHARGE AND GROUND WATER CONSERVATION:

Ground water development in the recent past has increased sharply causing depletion of ground water levels to maintain the ground water regime in equilibrium condition. There is need to conserve the ground water through artificial recharge. There are many ways to adopt this practice but, the structures which are feasible in area are as under:-

1. Contour bunding.
2. Gully plugs.
3. Check Dams.
4. Percolation Tanks.
5. Recharge shafts.
6. Sub-surface dykes.
7. Roof top Rain water harvesting in urban area.

6.0 GROUND WATER RELATED ISSUES AND PROBLEMS

Central Part is hilly, northern and southern plain form Ganga basin. The area is mainly drained by Sindh River flowing northerly and its tributaries which are effluent in nature. The major part of the district is occupied by alluvium consisting of clay, silt and sand varying in thickness up to 40m. The ground water in the area is fresh with isolated occurrence of marginal quality of water. The Nitrate and Fluoride concentration are also within limit.

7.0 RECOMMENDATIONS

The Management of ground water is of utmost necessity and there is urgent need for regulating indiscriminate boring and withdrawal of ground water in order to arrest the depleting trend of ground water levels. The normal irrigation practice of flood irrigation followed by cultivators should be curbed.

The necessity of artificial recharge to ground water is felt in parts of Ghatigaon and Morar blocks by construction of percolation tanks and other structures at suitable sites.

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