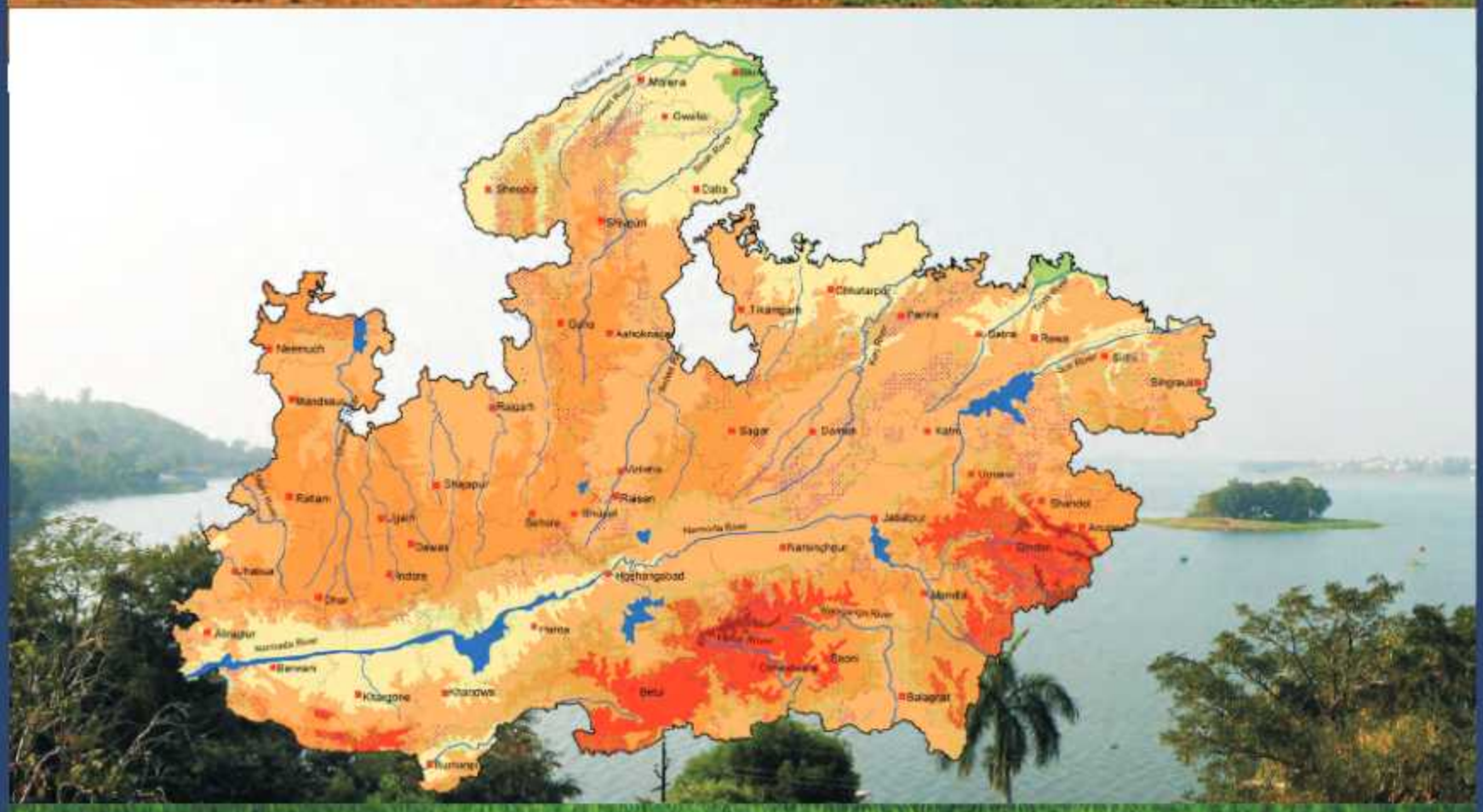
AQUIFER SYSTEMS OF MADHYA PRADESH



CENTRAL GROUND WATER BOARD
NORTH CENTRAL REGION
MINISTRY OF WATER RESOURCES
GOVERNMENT OF INDIA
December 2013

GOVERNMENT OF INDIA

MINISTRY OF WATER RESOURCES

CENTRAL GROUND WATER BOARD

AQUIFER SYSTEMS OF MADHYA PRADESH

NORTH CENTRAL REGION

BHOPAL

December 2013

सुशील गुप्ता
Sushil Gupta

अध्यक्ष
भारत सरकार
केन्द्रीय भूमि जल बोर्ड
जल संसाधन मंत्रालय
भूजल भवन एन. एच. 4 फरीदाबाद

Chairman
Government of India
Central Ground Water Board
Ministry of Water Resources
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Foreword

Ground Water, one of the most widely used components of the World's fresh water resource, has played a pivotal role towards development of society. Increased demand for fresh and potable water has resulted in an unprecedented withdrawal of ground water, which often results in lowering of the water table as also deterioration in ground water quality at some places. Sustainability of ground water resource can be achieved through a holistic management of aquifers which act as the repository of ground water.

Central Ground Water Board has taken up the National Aquifer Management Programme under which subsurface disposition and characteristics of underlying aquifers will be established on an appropriate scale by using the latest available technologies in the field of hydrogeology, geophysics, drilling, remote sensing, mathematical modelling etc. The ultimate goal is to formulate aquifer level management plans for use of the stakeholders and planners to foster community level management of this precious resource. As a first step in this regard, thematic maps and database on various attributes of the aquifers have been compiled in the form of an Aquifer Atlas based on the available data. The Aquifer Atlas of Madhya Pradesh is a compendium, which brings out a framework of ground water situation and issues for ground water development and management in the State.

I appreciate the sincere efforts made by the team of officers of Central Ground Water Board, North Central Region, Bhopal in bringing out the Aquifer Atlas of Madhya Pradesh. I am confident that the Atlas will prove useful in formulating area specific ground water development and management plans, and will benefit ground water users, scientific community as well as planners in the State.

(**Sushil Gupta**)
Chairman, CGWB

प्राक्कथन

विश्व के स्वच्छ जल संसाधन के सबसे अधिक उपयोगी घटक के रूप में भूजल ने समाज के सतत् विकास की दिशा में अपनी महत्वपूर्ण भूमिका निभाई है। स्वच्छ एवं पेयजल की बढ़ती मांग के कारण भूजल के दोहन में अप्रत्याशित वृद्धि हुई है जिसके कारण कुछ स्थानों में जल तालिका में गिरावट आती है तथा कई स्थानों पर जल की गुणवत्ता पर विपरीत प्रभाव पड़ता है। भूजल संसाधन की स्थायित्वता जलभृतों के समग्र प्रबंधन के माध्यम से ही संभव है जो भूजल के भंडार के रूप में कार्य करता है।

केंद्रीय भूमिजल बोर्ड द्वारा राष्ट्रीय जलभृत प्रबंधन कार्यक्रम प्रारम्भ किया गया है जिसके अंतर्गत भूजलविज्ञान, भूभौतिकी, वेधन, दूरसंवेदी, गणितीय मॉडलिंग आदि के क्षेत्र में उपलब्ध नवीनतम प्रौद्योगिकी के उपयोग द्वारा उपयुक्त पैमाने पर जलभृतों की उपसतही अवस्थिति एवं विशिष्टता का निर्धारण किया जाएगा। इसका लक्ष्य हितधारकों एवं आयोजकों के उपयोग के लिए जलभृत स्तरीय प्रबंधन योजना तैयार करना है ताकि इस अमूल्य संसाधन का सामुदायिक स्तर पर प्रबंधन सुनिश्चित किया जा सके। इस दिशा में पहले कदम के रूप में उपलब्ध आंकड़ों पर आधारित जलभृतों के विभिन्न लक्षणों पर विषयपरक मानचित्रों एवं डेटाबेस का संकलन कर जलभृत एटलस तैयार किया जा रहा है। इस क्रम में मध्य प्रदेश का जलभृत एटलस एक संग्रह है जिसके माध्यम से राज्य की भूजल स्थिति तथा भूजल विकास एवं प्रबंधन संबंधी विषयों को प्रकाशित किया गया है।

मध्य प्रदेश के जलभृत एटलस को तैयार करने की दिशा में केंद्रीय भूमिजल बोर्ड, उत्तर मध्य क्षेत्र, भोपाल के अधिकारियों के दल द्वारा किए गए सार्थक प्रयासों की मैं सराहना करता हूँ। यह एटलस, क्षेत्र विशिष्ट भूजल विकास एवं प्रबंधन योजनाओं को तैयार करने में उपयोगी सिद्ध होगा। मुझे विश्वास है कि राज्य में भूजल प्रयोक्ता एवं वैज्ञानिक समुदाय के साथ–साथ आयोजक भी इससे लाभान्वित होंगे।

(सुशील गुप्ता)
अध्यक्ष
केंद्रीय भूमिजल बोर्ड

AQUIFER SYSTEMS OF MADHYA PRADESH

LIST OF CONTRIBUTORS

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AQUIFER SYSTEMS OF MADHYA PRADESH

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AQUIFER SYSTEMS OF MADHYA PRADESH

PREAMBLE

Water is the median for development of civilizations all over the world and plays vital role in socio-economic development. Ground water is the most preferred resource to meet various requirements and is the Nation's principal reserve of fresh water. Ground water is major source of irrigation in Madhya Pradesh and about 6,714,300 hectare of land is irrigated through ground water. It is estimated that more than 90% of the rural and more than 50% of urban water supply is being met by ground water. As per the latest well census, the number of ground water abstraction structures have increased to about 4369672 with an estimated annual ground water draft of about 18 Billion Cubic Meter (BCM).

Rapid developments in the water resources sector have been taking place in the country in the last few decades, resulting in various undesirable environmental impacts. The drying up of a large number of dug wells/ bore wells in some areas due to declining ground water levels have a direct impact on water supply for irrigation, industrial and domestic needs in Madhya Pradesh. Demands for safe drinking water and requirements to maintain healthy ecosystems are increasing and complex social and scientific questions have arisen about how to assess and manage ground water resources.

The sustainability of ground water resources are jeopardised due to various reasons, concerns about ground water resources involve questions about depletion of ground water levels, reductions in resources, sustainability of wells, potential loss of ground water dependent ecosystems and changes in ground water quality etc. In order to evolve the remedies for such issues understanding of the system in which ground water is contained and its relationship with the surrounding ecosystem is very essential. The understanding of occurrence and distribution of ground water in time and space essentially requires establishing the lateral and vertical extent of aquifer systems along with their characterization. In view of this, an exercise of aquifer mapping is being carried out by CGWB by collating the existing data on ground water and related themes and bringing them into common GIS platform.

The atlas entitled "Aquifer Systems of Madhya Pradesh" provides a state wide overview and summary of the most important information available for each principal and major aquifer systems. It is an outcome of the extensive hydrogeological studies carried out by Central Ground Water Board (CGWB) including exploration, geophysical survey, hydro-chemical analysis, hydrological investigations etc. since its inception.

PURPOSE

- To define the extent of principal and major aquifer systems of Madhya Pradesh with their characterisation on regional scale and depict aquifer wise ground water scenario along with major issues and challenges which needs immediate attention for sustainable management of ground water resources.
- Creating a baseline data in GIS platform for initiating National Aquifer Mapping Programme and demarcating priority areas for aquifer wise management of ground water resources on scientific and sustainable basis.

The Atlas describes the location, extent, aquifer characteristics of all the important aquifers in the state. The purpose of the Atlas of "Aquifer Systems of Madhya Pradesh" is to summarize the ground water data in one publication through a common format illustrating the important ground-water related information that has been collected over many years by the CGWB.

The Atlas has been prepared keeping in view the utilities and user friendliness in understanding by the nonprofessional as well as professional Hydrogeologist. Simple presentation of tables is used to explain aquifer wise ground water scenario in the state. An attempt has been made to represent the correlations of various thematic layers such as topographic and geological settings on the occurrence, movement, and chemical quality of ground water in map forms. The Atlas will be of immense use for Regional ground-water resources planning by the Policy makers and anyone who needs to understand ground-water scenario. This Atlas will be very handy tool for academia at the institution level and as an overview of ground water conditions for stakeholders who need aquifer specific information.

AQUIFER MAPPING

Aquifer mapping is a multidisciplinary scientific process wherein a combination of geological, hydrogeological, geophysical, hydrological and quality data is integrated to characterize the quantity, quality and movement of ground water in aquifers. Hydrogeological information

collected by CGWB through its survey, investigations and exploration were collated, analysed and integrated to define the extent and characteristics of aquifer systems.

CGWB is mandated to carry out hydrogeological mapping aided with ground water exploration, geophysical surveys, and evaluation of aquifer parameters, ground water resource estimation and ground water regime monitoring. Over the years, CGWB through its studies has created huge database in the form of water levels, water quality, sub-surface lithological & geophysical logs and aquifer parameters. Analysis of the database has enabled the preparation of hydrogeological maps including the ground water management plans where the aquifer wise area suitable for ground water recharge, development and conservation have been identified.

The present endeavour is an effort of aquifer mapping on 1:250,000 scale by integrating the geological and hydrogeological data of GSI & CGWB respectively and various other ground water related thematic data/ information from other Agencies. This includes preparation of paper maps showing the major aquifer systems on 1:250,000 scale for the state.

In order to carry out the present exercise, all the data generated by CGWB along with data collected from different agencies is integrated in GIS platform. The outputs are depicted as thematic layers with location of ground water observation wells, exploratory wells, ground water quality hot spots in terms of high incidence of geogenic contaminants, stage of ground water development etc. in different maps. Detailed accounts of the aquifer types, their characteristics and spatial extents are given in the succeeding sections. Attempt has also been made to delineate aquifer wise areas suitable for conservation, recharge as well as exploitation of ground water.

Based on the hydrogeological characteristics, the entire State has been classified into 12 Principal Aquifer Systems and 25 major aquifers. Basalt is the major aquifer system which covers maximum area of around 47.36% in the western and south western parts of the state. The alluvium aquifer system covers around 10.14% area of the state and occurring in northern most part of the state mainly in Bhind, Morena, parts of Datia, Gwalior and Sheopur districts and along the Narmada River valley. Shale aquifer system accounts for around 8.68% area of the State and is spread in Damoh, Panna, Rewa, Satna, Neemuch, Sheopur, Gwalior and Shivpuri distrcits. About 4.72% of the area of the State is covered by Banded Gneissic Complex (BGC) aquifer system, which is available in Balaghat, Seoni, Betul, and Singrauli districts and in patches in many districts of the state. About 5.91 % of the area is covered by the granite aquifers mostly in the Bundelkhand area covering Tikamgarh, Chhatarpur, Datia and Shivpuri districts.

Around 17.61% of the area of the State is covered by sandstone aquifers and occur in patches in many districts of the state.

The rest 5.58% of the entire area is covered by aquifers namely; limestone, schist, quartzite, laterite, gniess and intrusives.

An attempt has been made to prioritize areas based on the sustainability and quality related ground water issues. Various ground water management strategies have also been suggested.

Central Ground Water Board, Ministry of Water Resources is contemplating National Aquifer Mapping Programme on 1:50,000 or larger scales during XII and XIII Plan periods. This ambitious venture will involve compilation and synthesis of all relevant data collected by CGWB and various other agencies, to identify existing data gaps, creation of additional data through suitable investigations and finally, to bring out comprehensive aquifer maps along with their ground water potential as well as realistic and scientific management plans to ensure long-term sustainability.

The present compilation will form a base for National Aquifer Mapping Programme as an overview of the aquifer systems in the country. Further downscaling can be taken up based on the regional understanding of the aquifers presented in the atlas.

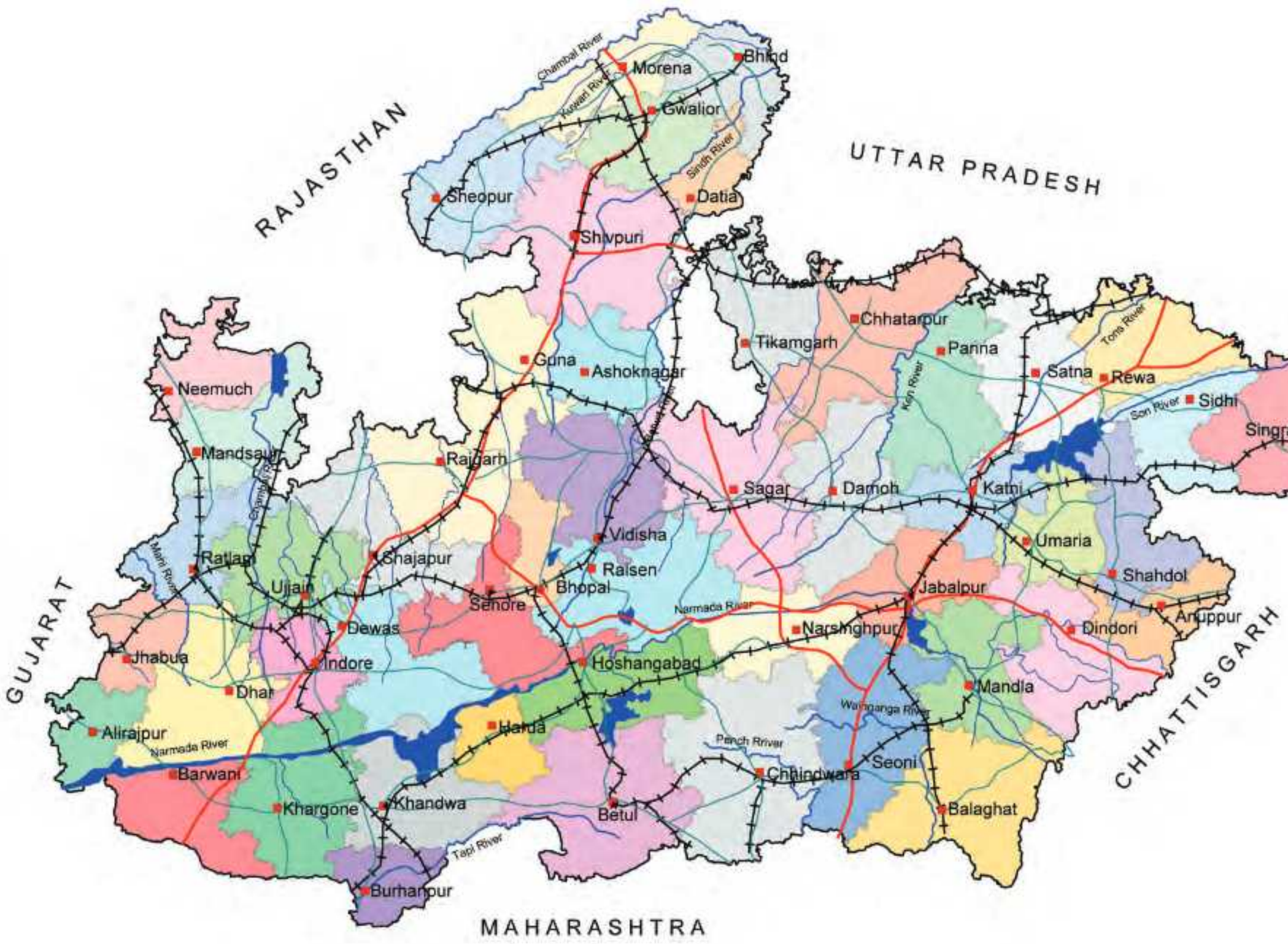
Table 1: Administrative Divisions of Madhya Pradesh

Sl No	District Name	Area (Sq km)	Number of Tehsils	Number of Development Blocks	Number of Towns
1	Alirajpur	3318	3	6	1
2	Anuppur	3724	4	4	2
3	Ashoknagar	4674	5	4	2
4	Balaghat	9229	10	10	3
5	Barwani	5422	9	7	2
6	Betul	10043	8	10	3
7	Bhind	4459	8	6	2
8	Bhopal	2772	2	2	1
9	Burhanpur	3233	3	2	2
10	Chhatarpur	8687	11	8	2
11	Chhindwara	11815	12	11	4
12	Damoh	7306	7	7	2
13	Datia	2691	4	3	1
14	Dewas	7021	8	6	1
15	Dhar	8153	8	13	3
16	Dindori	5725	2	7	
17	Guna	6390	7	5	2
18	Gwalior	4564	4	4	2
19	Harda	3330	6	3	1
20	Hoshangabad	6704	8	7	4
21	Indore	3898	5	4	1
22	Jabalpur	5221	7	7	3
23	Jhabua	3460	5	6	1
24	Katni	4894	7	6	1
25	Khandwa	7524	5	7	1
26	Khargone	8030	9	9	3
27	Mandla	7544	6	9	2
28	Mandsaur	5535	8	5	1
29	Morena	4989	6	7	4
30	Narsinghpur	5133	5	6	2
31	Neemuch	4200	5	3	1
32	Panna	7135	8	5	1
33	Raisen	8467	8	7	3
34	Rajgarh	6155	7	6	3
35	Ratlam	4861	8	6	2
36	Rewa	6314	11	9	1
37	Sagar	10252	11	11	6
38	Satna	7502	10	8	2
39	Sehore	6578	8	5	2
40	Seoni	8758	8	8	1
41	Shahdol	5841	4	5	2
42	Shajapur	6195	9	8	3
43	Sheopur	6606	5	3	1
44	Shivpuri	10278	8	8	1
45	Sidhi	4854	6	5	1
46	Singrauli	5672	3	3	1
47	Tikamgarh	5048	9	6	1
48	Ujjain	6130	7	6	5
49	Umaria	4539	5	3	1
50	Vidisha	7371	10	7	3
	Total	**308245**	**342**	**313**	**100**

ADMINISTRATIVE DIVISIONS

N
W E
S

0 100 200
kilometers



LEGEND

- State Capital
- District Headquarter
- State Boundary
- District Boundary
- River
- Railway Line
- National Highway
- State Highway
- Water Body

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

Table 2: River Basins of Madhya Pradesh

Sl No	Basin	Place of origin of main river	Catchment area (Sq km)		Major tributaries
			Total	In Madhya Pradesh	
1	Chambal	Singar Chouri peak near Mhow in Indore District (Madhya Pradesh)	1,30,671	57,054	Kshipra, Parvati, Gambhir, Kalisindh and Nevaj
2	Godavari	Trimbak, Nashik District (Maharashtra)	3,12,812	24,627	Wainganga and Pench
3	Lower Ganga	Gangotri, Uttarkashi District (Uttarakhand)	2,46,607	28,942	Son, Banas, Choti Mahanadi and Johila
4	Mahanadi	Sihawa hills, Dhamtari District (Chhattisgarh)	1,41,589	149	Minor tributries of Hasdo
5	Mahi	Minda village near Sardarpur in Dhar District (Madhya Pradesh)	38,699	7,188	Minor tributaries of Mahi
6	Narmada	Amarkantak, Anuppur District (Madhya Pradesh)	98,796	85,444	Hathni, Kunda, Chota Tawa, Tawa, Machak, Ajanal, Jamner, Kolar, Dudhi, Shakkar, Hiran and Sher
7	Tapi	Multai, Betul District (Madhya Pradesh)	63,345	9,368	Minor tributaries of Tapi
8	Upper Ganga	Gangotri, Uttarkashi District (Uttarakhand)	2,31,125	12,257	Tons, Paisuni and Satna
9	Yamuna	Yamunotri, Uttarkashi District (Uttarakhand)	2,03,642	83,218	Sindh, Kunwari, Betwa, Ken and Dhasan
	Total		**14,67,286**	**3,08,245**	

Area in Sq Km

RIVER BASINS

0 100 200
kilometers

LEGEND

River Basins

- Chambal
- Yamuna
- Upper Ganga
- Lower Ganga
- Narmada
- Mahi
- Tapti
- Mahanadi
- Godavari

- State Capital
- District Headquarter
- State Boundary
- District Boundary
- River
- Water Body

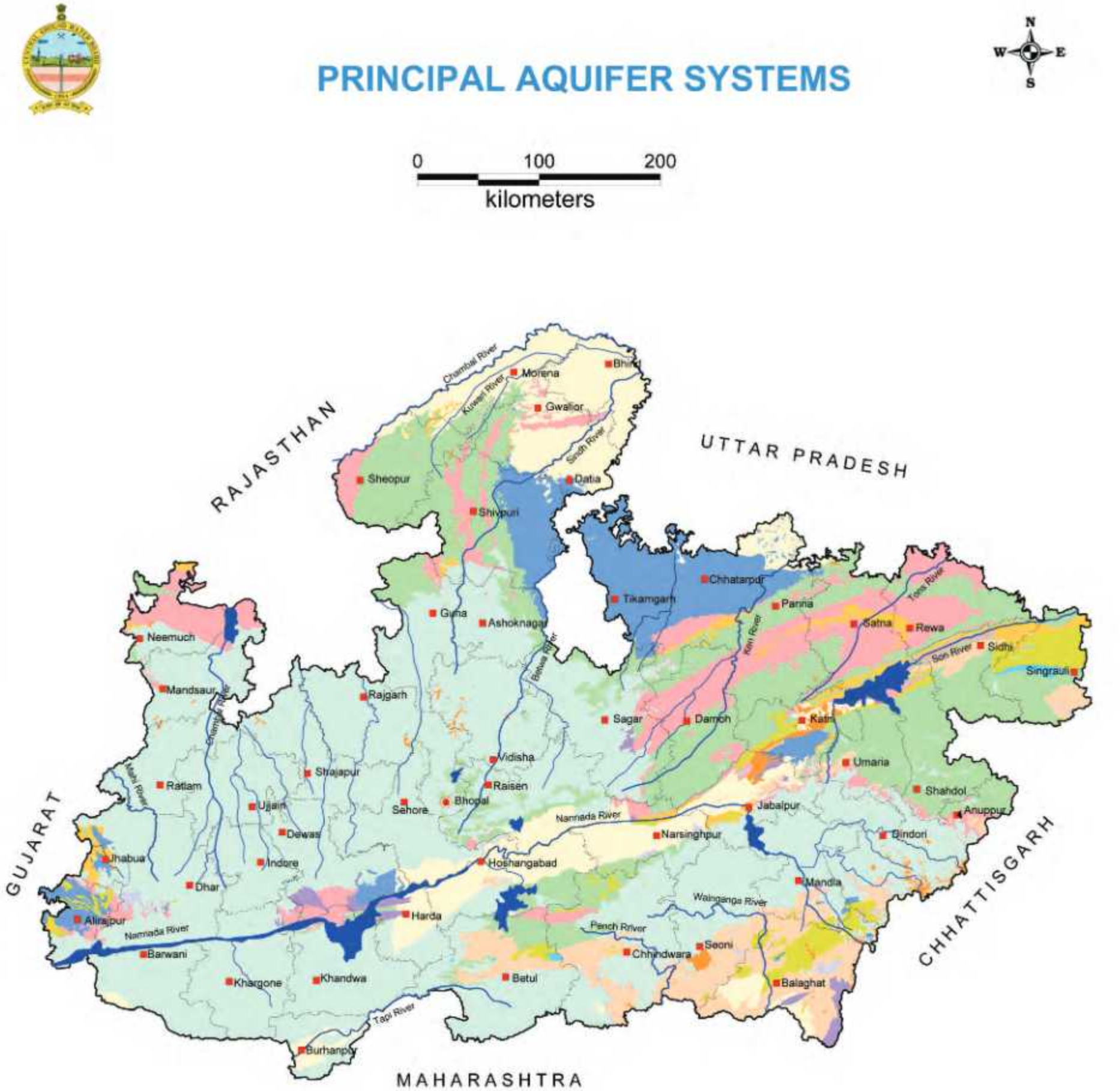
Central Ground Water Board
North Central Region
Ministry of Water Resources
Government of India

Table 3 : District wise Distribution of Principal Aquifer Systems

Sl No	District Name	Alluvium	Laterite	Basalt	Sandstone	Shale	Limestone	Granite	Schist	Quartzite	BGC	Gneiss	Intrusives	Total
1	Alirajpur			1022		422	56	1343	462			28		3332
2	Anuppur		81	1964	1138	439					179			3802
3	Ashoknagar			3435	1050	52		206						4742
4	Balaghat	1282	182	360		12		61	2074	669	4416	186		9242
5	Barwani	255		5183										5438
6	Betul			6267	1329	205			293		1903		83	10080
7	Bhind	4441				14								4455
8	Bhopal		34	2395	323									2751
9	Burhanpur	1031		2170										3200
10	Chhatarpur	1432		183	1006	820	391	4816						8648
11	Chhindwara	74	19	6834	1916	438	5		309		2237		2	11834
12	Damoh			67	4464	2872	26							7429
13	Datia	2201				77		238						2516
14	Dewas	126		4959	95	614		707		471				6974
15	Dhar			7546		332		28	6			253		8166
16	Dindori		446	5863		111		50	241	2	368			7081
17	Guna		5	4580	1517	211	14							6328
18	Gwalior	2656	15		1029	771	9	113						4592
19	Harda	1399		1391	122			41	2	365				3320
20	Hoshangabad	3922		1342	1345	5			2		110			6727
21	Indore			3916										3916
22	Jabalpur	1735	304	1931	54	402	294	55	215	122	210	28		5350
23	Jhabua			2523	36	48	549	279						3435
24	Katni	577	521	64	1861	293	329	743	438	7	48			4882
25	Khandwa			6546	242	585			3	78				7456
26	Khargone			7783	8	191				79				8061
27	Mandla		32	5081		43	6	40	188	12	767			6169
28	Mandsaur		22	4699	32	890								5642
29	Morena	3828	2		971	115	78							4994
30	Narsinghpur	2970		683	981	308	201		119	14	13	151		5440
31	Neemuch		24	1312	380	2284	171							4170
32	Panna	124	21	5	3864	2304	190	617	0					7125
33	Raisen	1407		5746	1665	75								8894
34	Rajgarh		33	6085	10									6127
35	Ratlam		13	4814										4826
36	Rewa				2598	3519	237			0				6354
37	Sagar			6817	2209	925	29	167	0	143				10290
38	Satna	88	28		2649	3517	1180	50		0	35			7546
39	Sehore	1054		5458	33	25		14						6585
40	Seoni	2	255	5739					125	5	2558	67		8751
41	Shahdol			423	4601	516	7		226	23	76			5872
42	Shajapur		23	6277										6300
43	Sheopur	432	13		5032	1048	88							6613
44	Shivpuri	107	46	657	3125	1502	103	3630						9170
45	Sidhi	3		12	2907	392	679		188		642			4823
46	Singrauli	7		57	2575		350		1776		682	47	333	5827
47	Tikamgarh				8			5015						5023
48	Ujjain			6093										6093
49	Umaria	90		609	2984	378	18		51	100	299			4529
50	Vidisha		112	7095	107					9				7324
	Total Area	**31244**	**2232**	**145987**	**54269**	**26752**	**5006**	**18214**	**6719**	**2100**	**14545**	**759**	**418**	**308245**

Area in Sq km

PRINCIPAL AQUIFER SYSTEMS



LEGEND

Aquifers

- Alluvium
- Laterite
- Basalt
- Sandstone
- Shale
- Limestone
- Granite
- Schist
- Quartzite
- Banded Gneissic Complex
- Gneiss
- Intrusives

- State Capital
- District Headquarter
- State Boundary
- District Boundary
- River
- Water Body

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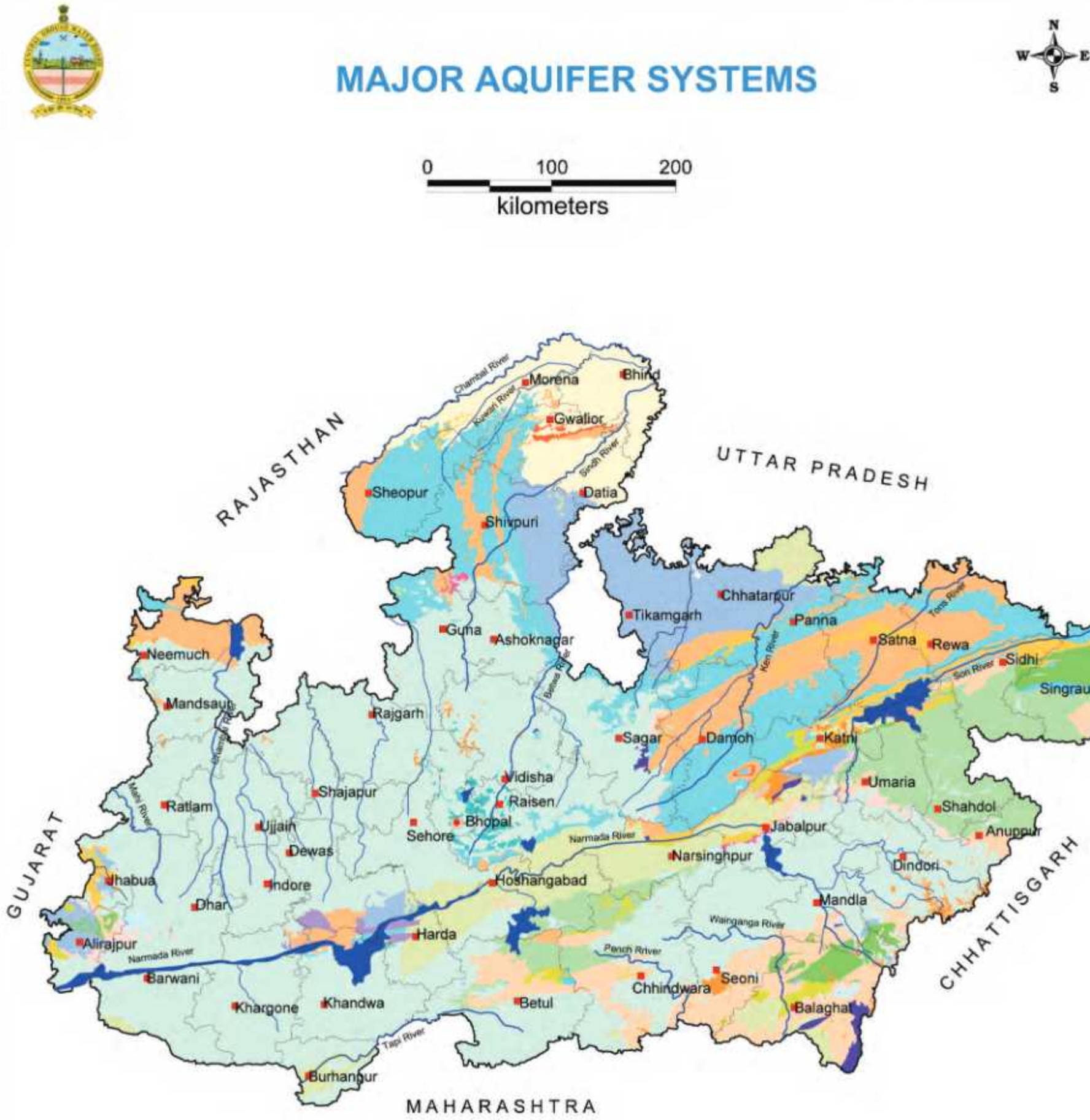
North Central Region
Ministry of Water Resources
Government of India

Table 4 : Major Aquifer Systems of Madhya Pradesh

Sl No	Principal Aquifer System		Aquifer Characteristics				Major aquifers		Age (As per Geological time scale)	Area (Sq km)	Area %
	Code	Name	DTW-Decadal Average, May 2003-12 (m bgl)	Thickness of Aquifer/Weathered Zone (m)	Granular/Fractured Zones Encountered (m bgl)	Yield (m^3 / day)	Code	Name			
1	AL	Alluvium (31,244 Sq km) (10.14 %)	4 - 41	28 - 220	20 - 130	7 - 4968	AL01	Fluvial Alluvium (Clay/Silt/Sand/ Calcareous concretions)	Quaternary	17621	5.72
2							AL03	Older Alluvium	Quaternary	13623	4.42
3	LT	Laterite (2,232 Sq km) (0.72 %)	7 - 15	5 - 20	25 -55	5 - 1800	LT01	Laterite / Ferruginous concretions	Quaternary	2232	0.72
4	BS	Basalt (1,45,987 Sq km) (47.36 %)	2 - 40	5 - 30	30 - 200	9 - 2385	BS01	Basic Rocks (Basalt)	Mesozoic to Cenozoic	145987	47.36
5	ST	Sandstone (54,269 Sq km) (17.61 %)	3 - 29	20 - 300	20 - 290	4 - 1358	ST01	Sandstone	Upper Palaeozoic to Cenozoic	21	0.01
6							ST02	Sandstone with Shale	Upper Palaeozoic to Cenozoic	18798	6.10
7							ST05	Sandstone/Conglomerate	Proterozoic to Cenozoic	34334	11.14
8							ST06	Sandstone with Shale	Proterozoic to Cenozoic	1116	0.36
9	SH	Shale (26,752 Sq km) (8.68 %)	4 - 28	20- 50	20 -185	10 - 1676	SH02	Shale with Sandstone	Upper Palaeozoic to Cenozoic	33	0.01
10							SH03	Shale, limestone and sandstone	Upper Palaeozoic to Cenozoic	2516	0.82
11							SH04	Shale	Upper Palaeozoic to Cenozoic	933	0.30
12							SH05	Shale/Shale with Sandstone	Proterozoic to Cenozoic	22848	7.41
13							SH06	Shale with Limestone	Proterozoic to Cenozoic	422	0.14
14	LS	Limestone (5,006 Sq km) (1.62 %)	5 - 19	10- 200	20 - 150	5 - 3485	LS02	Limestone/Dolomite (semi-consolidated)	Upper Palaeozoic to Cenozoic	209	0.07
15							LS03	Limestone/Dolomite (consolidated)	Proterozoic	4695	1.52
16							LS05	Marble	Azoic to Proterozoic	102	0.03
17	GR	Granite (18,214 Sq km) (5.91 %)	4 - 18	20 - 30	30 - 50	10 - 350	GR02	Acidic Rock (Pegmatite, Granite, Syenite, Rhyolite ect.)	Proterozoic to Cenozoic	18214	5.91
18	SC	Schist (6,719 Sq km) (2.18 %)	3 - 16	5 - 70	10 - 180	5 - 800	SC01	Schist	Azoic to Proterozoic	2397	0.78
19							SC02	Phyllite	Azoic to Proterozoic	4322	1.40
20	QZ	Quartzite (2,100 Sq km) (0.68 %)	10 - 12	8 - 30	15 - 100	5 - 800	QZ01	Quartzite	Proterozoic to Cenozoic	1106	0.36
21							QZ02	Quartzite	Azoic to Proterozoic	994	0.32
22	IN	Intrusives (418 Sq km) (0.14 %)	10 - 12	-	-	-	IN01	Intrusives	Proterozoic to Cenozoic	418	0.14
23	BG	Banded Gneissic Complex (BGC) (14,545 Sq km) (4.72 %)	2 - 15	50 - 100	15 - 260	10 - 1400	BG01	Banded Gneissic Complex (BGC)	Azoic	14545	4.72
24	GN	Gneiss (759 Sq km) (0.25 %)	15 - 16	5 -20	20 - 100	10 - 1000	GN01	Undifferentiated meta-sedimentaries/ Undifferentiated metamorphic	Azoic to Proterozoic	80	0.03
25							GN02	Gneiss	Azoic to Proterozoic	679	0.22
	Total									308245	100.00

MAJOR AQUIFER SYSTEMS



LEGEND

- State Capital
- State Bondary
- District Boundary
- River
- Water Body

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

Table 5: Aquifer wise area of Parliamentary Constituencies

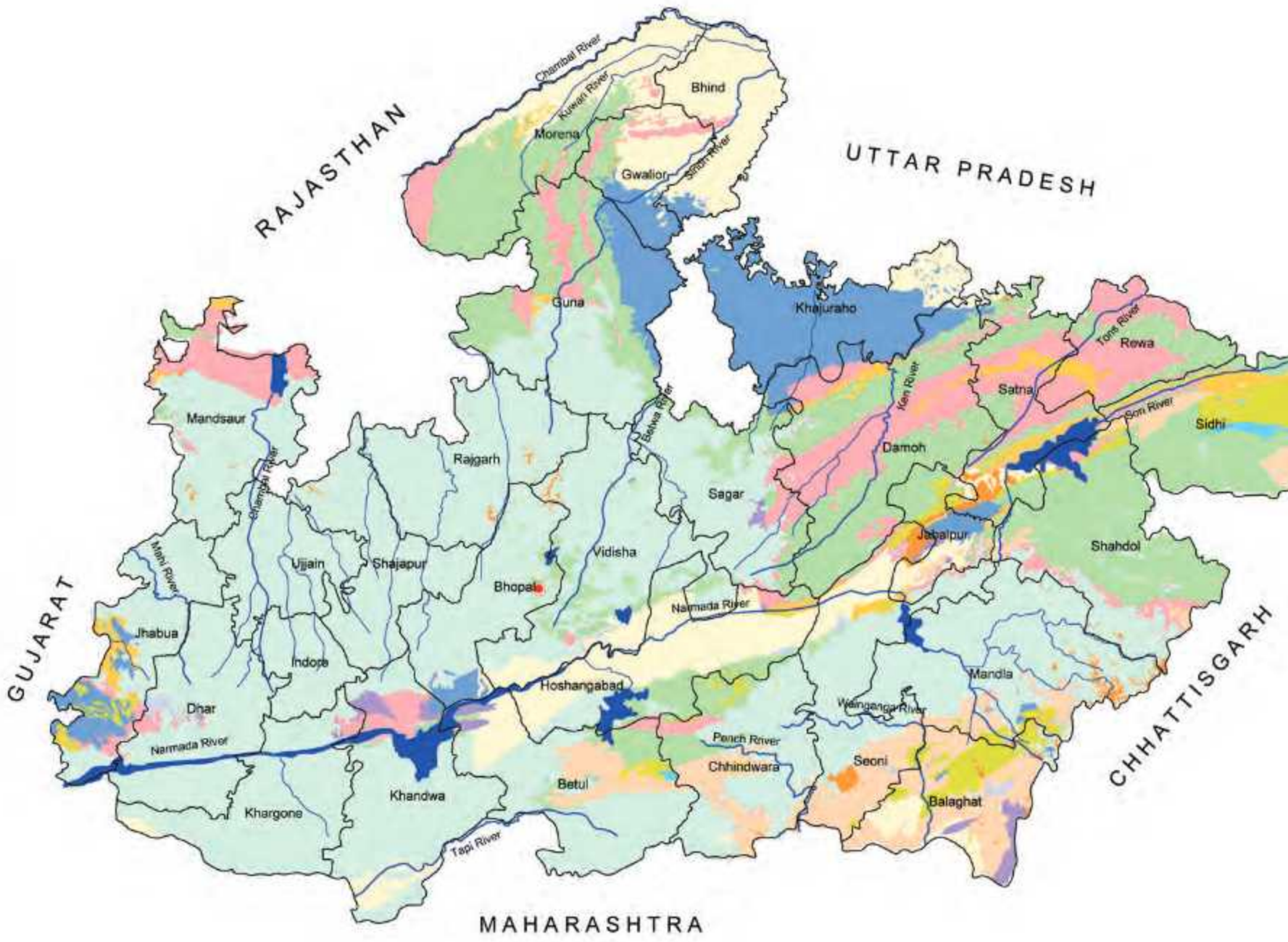
Sl No	Parliamentary Constituency	Alluvium	Laterite	Basalt	Sandstone	Shale	Limestone	Granite	Schist	Quartzite	BGC	Gneiss	Intrusives	Area (Sq km)
1	Balaghat	1231	175	333		10		61	1982	663	4315	187		**8957**
2	Betul	1375		7403	1411	160		53	300	384	1912		81	**13077**
3	Bhind	6350				136		350						**6837**
4	Bhopal	112	20	7533	347	11		586						**8608**
5	Chhindwara	74	15	6714	1786	454	5		287		2146		4	**11487**
6	Damoh	115	22	262	9179	5960	598	1478						**17614**
7	Dhar			10446		323		28	6			259		**11062**
8	Guna		40	5615	6206	1700	118	2675						**16352**
9	Gwalior	2708	16		818	754	9	1309						**5613**
10	Hoshangabad	7124		1974	2274	291	196		142	14	125	65		**12205**
11	Indore			3873										**3873**
12	Jabalpur	920	135	244	1226	224	113	534	285	57	259			**3997**
13	Jhabua			6286	36	486	598	1592	456			24		**9478**
14	Khajuraho	1398			11	151	7	8890						**10456**
15	Khandwa	1016		9830	295	1203		103	2	523				**12972**
16	Khargone	220		10094	7	198				91				**10610**
17	Mandla		481	13236		160	6	90	505	15	1219			**15712**
18	Mandsaur		59	7093	362	2877	165							**10556**
19	Morena	4644	24		6692	1243	166	6						**12774**
20	Rajgarh		81	11054	30									**11165**
21	Rewa		5		2374	4123	403							**6905**
22	Sagar			7071	2149	953	34	122		144				**10473**
23	Satna	444	446	7	3251	3103	1301	300	152		23			**9026**
24	Seoni	1570	530	6260	243	320	225	17	372	77	2679	183		**12476**
25	Shahdol	76	79	2828	8644	1381	29		269	123	562			**13991**
26	Shajapur		23	8953										**8976**
27	Sidhi	10		70	5431	430	1033		1961		1306	42	333	**10616**
28	Ujjain			6952										**6952**
29	Vidisha	1858	83	11856	1499	101		20		10				**15428**
	Total	**31244**	**2232**	**145987**	**54268**	**26752**	**5006**	**18214**	**6719**	**2100**	**14545**	**759**	**418**	**308245**

Area in Sq km

PARLIAMENTARY CONSTITUENCIES

N
W E
S

0 100 200
kilometers



LEGEND

Aquifers

- Alluvium
- Laterite
- Basalt
- Sandstone
- Shale
- Limestone
- Granite
- Schist
- Quartzite
- Banded Gneissic Complex
- Gneiss
- Intrusives

- State Capital
- State Boundary
- River
- Water Body
- Constituency Boundary

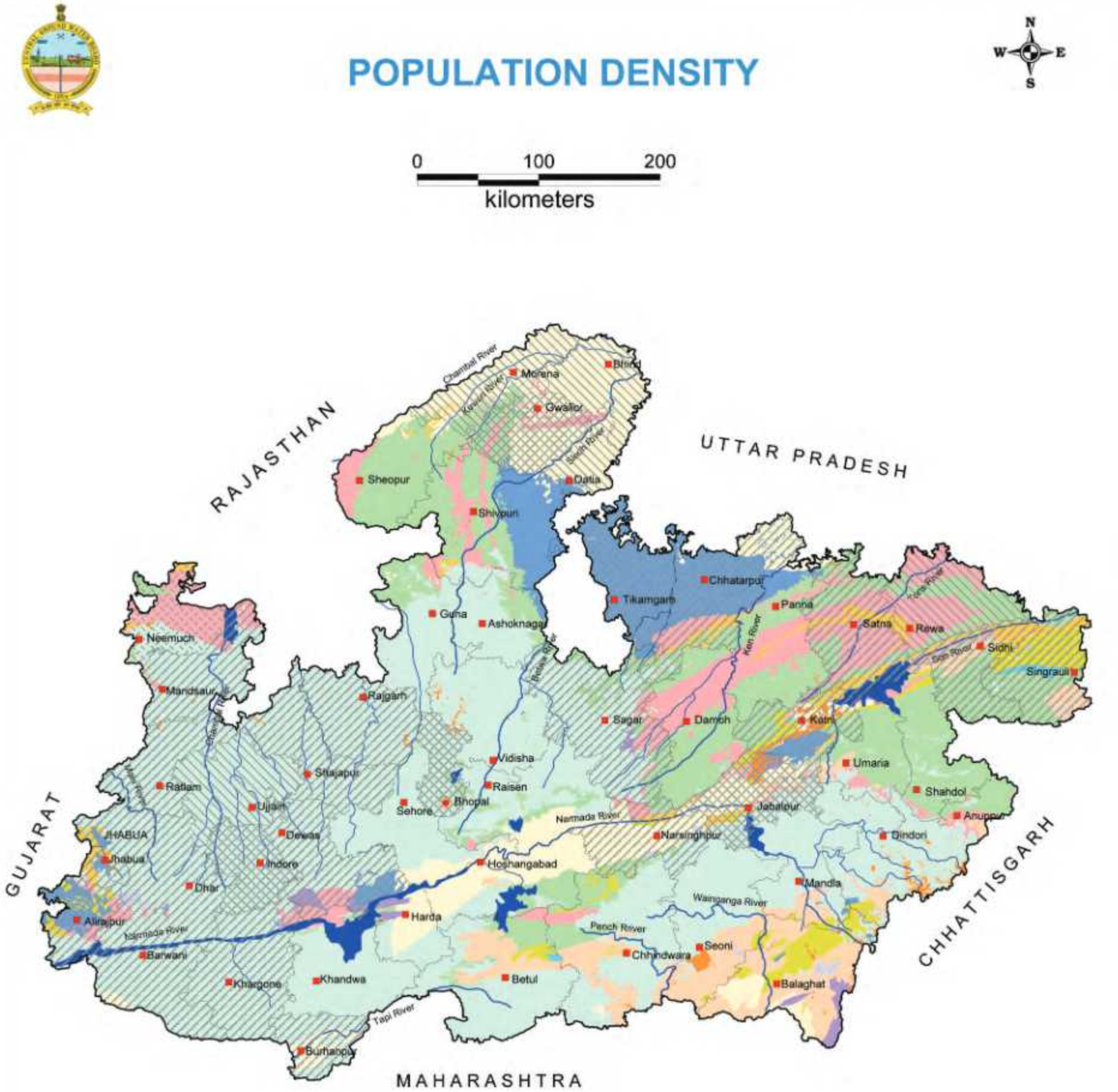
Central Ground Water Board
North Central Region
Ministry of Water Resources
Government of India

Table 6: Population Census of Madhya Pradesh (2011)

Sl No	District Name	Males	Females	Total	Density/Sq km	Sex ratio (Female Per 1000 Male)
1	Alirajpur	362748	365929	728677	229	1009
2	Anuppur	379496	370025	749521	200	975
3	Ashoknagar	444651	400328	844979	181	900
4	Balaghat	841794	859362	1701156	184	1021
5	Barwani	699578	686081	1385659	256	981
6	Betul	799721	775526	1575247	157	970
7	Bhind	926940	776622	1703562	382	838
8	Bhopal	1239378	1128767	2368145	854	911
9	Burhanpur	388040	368953	756993	221	951
10	Chhatarpur	935906	826951	1762857	203	884
11	Chhindwara	1063302	1027004	2090306	177	966
12	Damoh	660478	603225	1263703	173	913
13	Datia	419432	366943	786375	292	875
14	Dewas	805212	757895	1563107	223	941
15	Dhar	1114267	1070405	2184672	268	961
16	Dindori	351344	352874	704218	94	1004
17	Guna	649591	591347	1240938	194	910
18	Gwalior	1090647	939896	2030543	445	862
19	Harda	295208	275094	570302	171	932
20	Hoshangabad	648970	592005	1240975	185	912
21	Indore	1700483	1571852	3272335	839	924
22	Jabalpur	1278448	1182266	2460714	472	925
23	Jhabua	514830	509261	1024091	285	989
24	Katni	663064	628620	1291684	261	948
25	Khandwa	673491	635952	1309443	178	944
26	Khargone	953617	918796	1872413	233	963
27	Mandla	525495	528027	1053522	182	1005
28	Mandsaur	681439	658393	1339832	242	966
29	Morena	1068364	896773	1965137	394	839
30	Narsinghpur	569618	522523	1092141	213	917
31	Neemuch	421640	404318	825958	194	959
32	Panna	532866	483162	1016028	142	907
33	Raisen	701114	630585	1331699	157	899
34	Rajgarh	791038	755503	1546541	251	955
35	Ratlam	737365	717118	1454483	299	973
36	Rewa	1224918	1138826	2363744	374	930
37	Sagar	1254251	1124044	2378295	232	896
38	Satna	1156734	1071885	2228619	297	927
39	Sehore	683703	627305	1311008	199	918
40	Seoni	694916	683960	1378876	157	984
41	Shahdol	541208	523781	1064989	172	968
42	Shajapur	779900	732453	1512353	244	939
43	Sheopur	361685	326267	687952	104	902
44	Shivpuri	919405	806413	1725818	168	877
45	Sidhi	577091	549424	1126515	232	952
46	Singrauli	614885	563247	1178132	208	916
47	Tikamgarh	759891	685029	1444920	286	901
48	Ujjain	1016432	970165	1986597	326	954
49	Umaria	329527	314052	643579	158	953
50	Vidisha	768799	689413	1458212	198	897
	Total	**37612920**	**34984645**	**72597565**	**236**	**930**

Source: Census 2011

POPULATION DENSITY



LEGEND

Population Density

- < 200
- 200 to 300
- 300 to 400
- >400

Aquifers

- Alluvium
- Laterite
- Basalt
- Sandstone
- Shale
- Limestone
- Granite
- Schist
- Quartzite
- Banded Gneissic Complex
- Gneiss
- Intrusives

- State Capital
- District Headquarter
- State Boundary
- District Boundary
- River
- Water Body

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

Table 7 : Aquifer Distribution - River Basin Wise

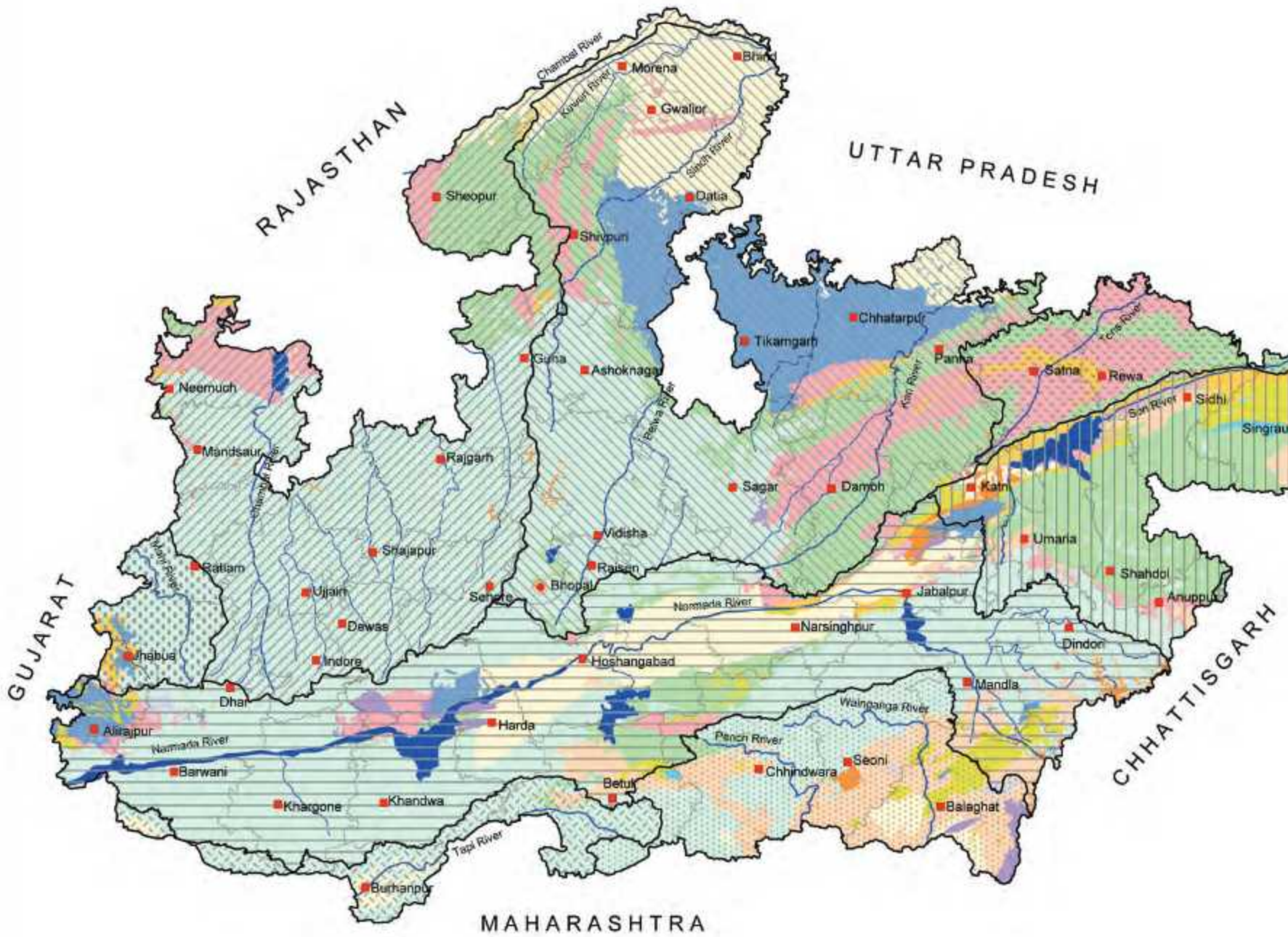
Sl No	Name of Basin	Alluvium	Laterite	Basalt	Sandstone	Shale	Limestone	Granite	Schist	Quartzite	BGC	Gneiss	Intrusives	Total Area
1	Chambal	1,848	176	42,591	7,444	4,603	392							**57,054**
2	Godavari	1,352	310	11,190	480	89		29	1,377	670	8,856	205	68	**24,627**
3	Lower Ganga	523	476	3,920	14,574	2,168	1,849	467	2,510	123	1,953	46	333	**28,942**
4	Mahanadi		16	9	116	8								**149**
5	Mahi			6,101	47	89	564	354	32					**7,188**
6	Narmada	12,711	1,019	50,522	6,341	3,888	566	2,482	2,729	1,155	3,516	507	7	**85,444**
7	Tapi	1,281		7,628	228						220		9	**9,368**
8	Upper Ganga		12		4,645	6,650	951							**12,257**
9	Yamuna	13,528	223	24,024	20,394	9,257	685	14,882	71	153				**83,218**
	Total	**31,244**	**2,232**	**1,45,987**	**54,269**	**26,752**	**5,006**	**18,214**	**6,719**	**2,100**	**14,545**	**759**	**418**	**3,08,245**

Area in Sq km

AQUIFERS - RIVER BASIN WISE

N
W E
S

0 100 200
kilometers



LEGEND

River Basin

- Uppar Ganga
- Mahi
- Tapi
- Mahanadi
- Lower Ganga
- Godavari
- Chambal
- Narmada
- Yamuna

Aquifers

- Alluvium
- Laterite
- Basalt
- Sandstone
- Shale
- Limestone
- Granite
- Schist
- Quartzite
- Banded Gneissic Complex
- Gneiss
- Intrusives

- State Capital
- District Headquarter
- State Boundary
- District Boundary
- River
- Water Body

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

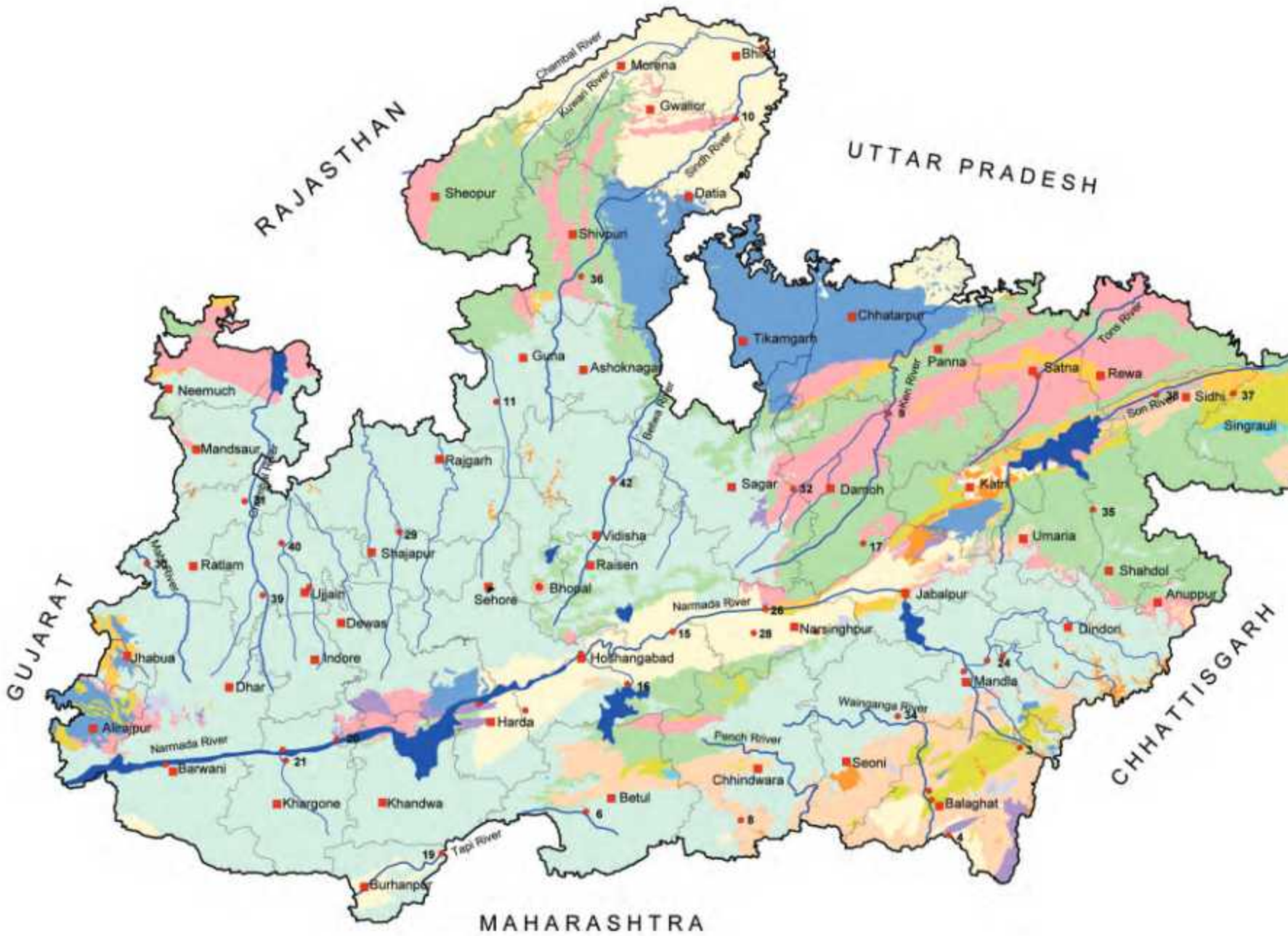
Table 8: River Gauge and Discharge (G & D) Sites in Different Aquifers of Madhya Pradesh

Sl No.	District Name	River	Tributary	Station Name	Aquifer system
1	Balaghat	Godavari	Pranhita	Balaghat	Schist
2	Balaghat	Godavari	Pranhita	Kumhari	Schist
3	Balaghat	Narmada	Banjar	Mukki	Schist
4	Balaghat	Godavari	Pranhita	Rajegaon	Alluvium
5	Barwani	Narmada		Rajghat	Basalt
6	Betul	Tapi		Teska	Banded Gneissic Complex
7	Bhind	Ganga	Chambal	Bhind	Alluvium
8	Chhindwara	Godavari	Pranhita	Ramakona	Banded Gneissic Complex
9	Damoh	Yamuna	Ken	Gaisabad	Shale
10	Datia	Ganga	Sindh	Seondha	Alluvium
11	Guna	Parwati		A.B. Road X-ing	Basalt
12	Harda	Narmada	Ganjal	Chhidgaon	Alluvium
13	Harda	Narmada		Handia	Banded Gneissic Complex
14	Hoshangabad	Narmada		Hoshangabad	Alluvium
15	Hoshangabad	Narmada		Sandia	Alluvium
16	Hoshangabad	Narmada	Tawa	Tawa Dam	Banded Gneissic Complex
17	Jabalpur	Narmada	Hiran	Patan	Sandstone
18	Burhanpur	Tapi		Burhanpur	Alluvium
19	Burhanpur	Tapi		Dedtalai	Alluvium
20	Khandwa	Narmada		Mortakka	Basalt
21	Khargone	Narmada	Kundi	Kogaon	Basalt
22	Khargone	Narmada		Mandleshwar	Basalt
23	Mandla	Narmada		Mandla	Shale
24	Mandla	Narmada		Manot	Basalt
25	Mandla	Narmada	Burhner	Mohgaon	Basalt
26	Narsinghpur	Narmada		Barmanghat	Basalt
27	Narsinghpur	Narmada	Sher	Belkhedi	Alluvium
28	Narsinghpur	Narmada	Shakkar	Gadarwara	Alluvium
29	Rajgarh	Kalisindh		Sarangpur	Basalt
30	Ratlam	Mahi		Mataji	Basalt
31	Ratlam	Chambal		Tal	Basalt
32	Sagar	Ganga	Sunar	Garhakota	Shale
33	Satna	Ganga	Tons	Satna	Shale
34	Seoni	Godavari	Pranhita	Keolari	Basalt
35	Shahdol	Ganga	Son	Goverdheyghat	Sandstone
36	Shivpuri	Ganga	Sindh	Pachauli	Sandstone
37	Sidhi	Ganga	Son	Jhokoo	Schist
38	Sidhi	Ganga	Son	Kuldah Bridge	Shale
39	Ujjain	Chambal		Dhareri	Basalt
40	Ujjain	Shipra		Mahidpur	Basalt
41	Ujjain	Shipra		Ujjain	Basalt
42	Vidisha	Ganga	Betwa	Basoda	Basalt

Source: CWC, Statistical Handbook, 2011

RIVER GAUGE AND DISCHARGE SITES

0 100 200
kilometers



LEGEND

Gauge and Discharge Sites

Aquifers

- Alluvium
- Laterite
- Basalt
- Sandstone
- Shale
- Limestone
- Granite
- Schist
- Quartzite
- Banded Gneissic Complex
- Gneiss
- Intrusives

- State Capital
- District Headquarter
- State Boundary
- District Boundary
- River
- Water Body

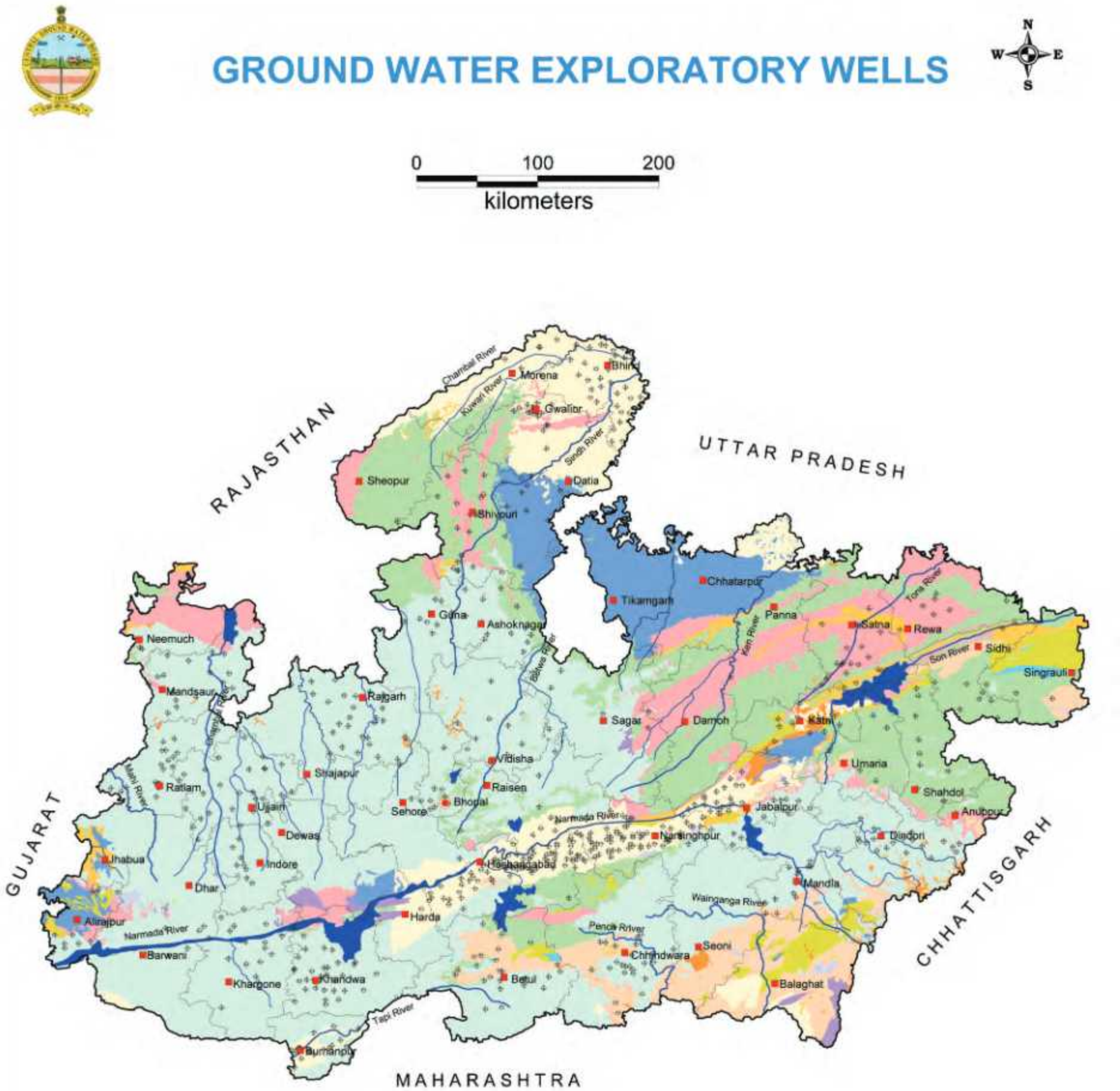
Central Ground Water Board
North Central Region
Ministry of Water Resources
Government of India

Table 9: District wise and Aquifer wise distribution of Exploratory Wells

Sl No	District Name	Alluvium	Laterite	Basalt	Sandstone	Shale	Limestone	Granite	Schist	Quartzite	BGC	Gneiss	Intrusives	Total
1	Alirajpur			13		3		2						18
2	Anuppur			9	2	1								12
3	Ashoknagar			12	3									15
4	Balaghat													0
5	Barwani			3										3
6	Betul			19	3						13			35
7	Bhind	36												36
8	Bhopal			12	4									16
9	Burhanpur	15		3										18
10	Chhatarpur													0
11	Chhindwara			25	1						5			31
12	Damoh													0
13	Datia													0
14	Dewas													0
15	Dhar			4										4
16	Dindori			17										17
17	Guna			10										10
18	Gwalior	16				4		1						21
19	Harda	1												1
20	Hoshangabad	81		1	1						2			85
21	Indore			9										9
22	Jabalpur	21		11			1					1		34
23	Jhabua													0
24	Katni	3	2		3	1	1	1	5					16
25	Khandwa			36		1								37
26	Khargone			15										15
27	Mandla			25							3			28
28	Mandsaur			14	2									16
29	Morena	6												6
30	Narsinghpur	69		3		1				1		1		75
31	Neemuch			4										4
32	Panna													0
33	Raisen	6		5	1									12
34	Rajgarh			34										34
35	Ratlam			44										44
36	Rewa				2	4	1							7
37	Sagar			4		2								6
38	Satna				1	16	4							21
39	Sehore			3										3
40	Seoni													0
41	Shahdol				11					1				12
42	Shajapur													0
43	Sheopur													0
44	Shivpuri			5	10	7		10						32
45	Sidhi				10		2				1			13
46	Singrauli													0
47	Tikamgarh													0
48	Ujjain			26										26
49	Umaria				8									8
50	Vidisha			10										10
	Total	**254**	**2**	**376**	**62**	**40**	**9**	**14**	**5**	**2**	**24**	**2**	**0**	**790**

No Exploration has been done in Intrusives

GROUND WATER EXPLORATORY WELLS



LEGEND

Aquifers

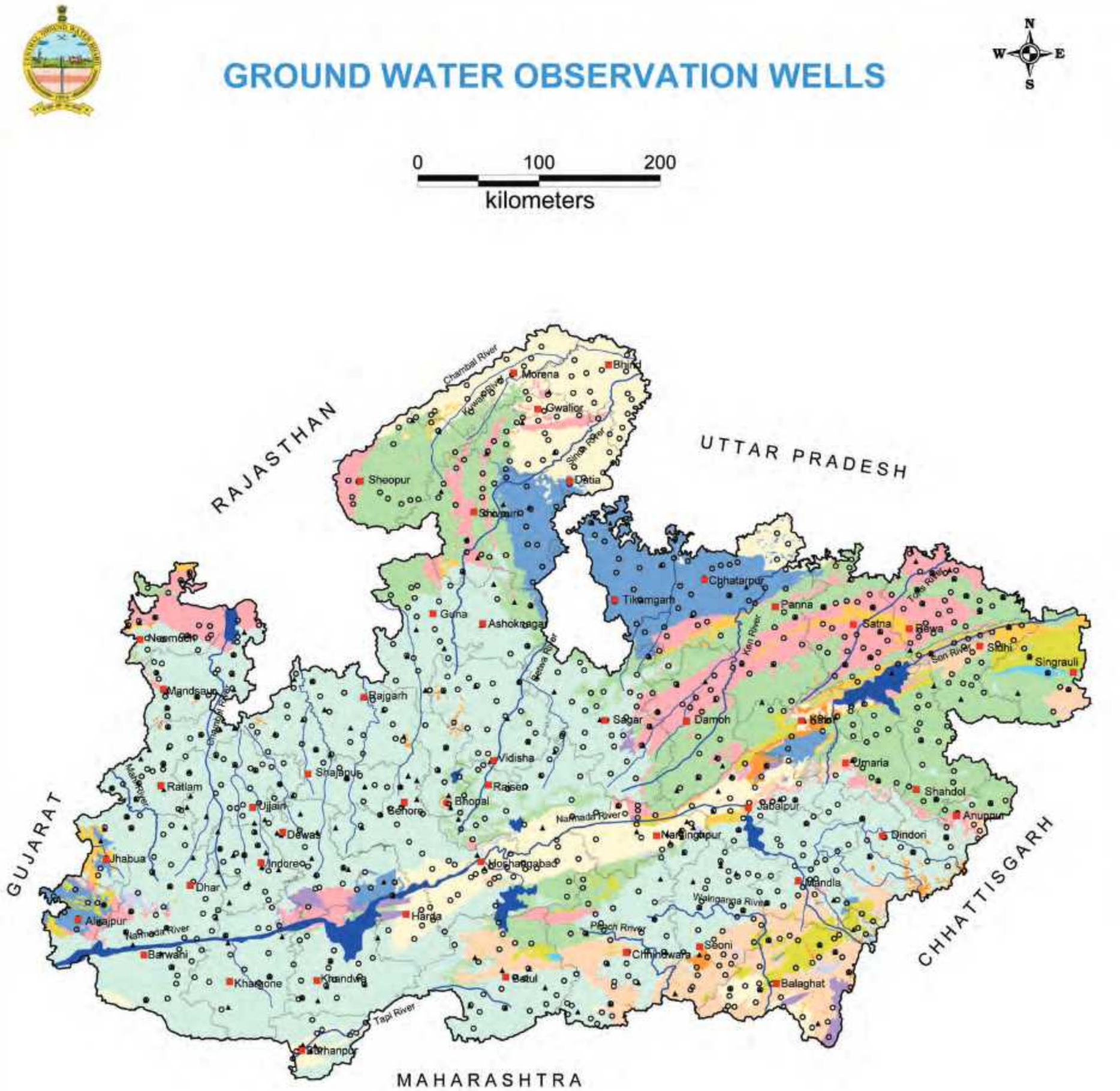
- Exploratory Tube Wells / Bore Wells
- Alluvium
- Laterite
- Basalt
- Sandstone
- Shale
- Limestone
- Granite
- Schist
- Quartzite
- Banded Gneissic Complex
- Gneiss
- Intrusives
- State Capital
- District Headquarter
- State Boundary
- District Boundary
- River
- Water Body

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

Table 10: District wise and Aquifer wise distribution of GW Observation Wells (Dugwells/ Piezometers)

Sl No	District Name	Alluvium		Laterite		Basalt		Sandstone		Shale		Limestone		Granite		Schist		Quartzite		BGC		Gneiss		Intrusives		Total Number of DW	Total Number of Pz	Total Nos.
		DW	Pz	DW	Pz	DW	Pz	DW	Pz	DW	Pz	DW	Pz	DW	Pz	DW	Pz	DW	Pz	DW	Pz	DW	Pz	DW	Pz			
1	Alirajpur													7	1	2	1									9	2	11
2	Anuppur			1		3	2	4	2	3	1									1						12	5	17
3	Ashoknagar					5	3	1	2																	6	5	11
4	Balaghat	10	3	1		1	1							1		8	2	1		12	3					34	9	43
5	Barwani					8	4																			8	4	12
6	Betul					17	3	3												3	4					23	7	30
7	Bhind	16	1																							16	1	17
8	Bhopal					9	6																			9	6	15
9	Burhanpur	8	5			3																				11	5	16
10	Chhatarpur	3				1		1		3				16	7											24	7	31
11	Chhindwara	1				22	7	7	1											3	4					33	12	45
12	Damoh					1	1	5	2	11	5															17	8	25
13	Datia	6					10			1				1	2											8	12	20
14	Dewas					12				2				2												16	0	16
15	Dhar					19	13			1	2			1								1				22	15	37
16	Dindori					11	6									2										13	6	19
17	Guna					15	7	3																		18	7	25
18	Gwalior	11	3					1		6	1			1												19	4	23
19	Harda	6	1			1	1							1	1											8	3	11
20	Hoshangabad	18	1			2		2												1						23	1	24
21	Indore					11	21																			11	21	32
22	Jabalpur	5	3	1		7	3			1		1	2			1		1	1	1						18	9	27
23	Jhabua					5	5					2			2											7	7	14
24	Katni	5	1	4	1			4	1					1		2										16	3	19
25	Khandwa		2			16	7																			16	9	25
26	Khargone					14	7											1								15	7	22
27	Mandla					21	7							1						2						24	7	31
28	Mandsaur					19	12			2																21	12	33
29	Morena	13						1				1														15	0	15
30	Narsinghpur	9	6			2	1			4	1	1				1							1			17	9	26
31	Neemuch					8	1	2		8	2	1	1													19	4	23
32	Panna	1						3	1	8	3			3												15	4	19
33	Raisen	2	1			13	5	3	1	1																19	7	26
34	Rajgarh					14	14																			14	14	28
35	Ratlam					18	18																			18	18	36
36	Rewa							9	7	17	6															26	13	39
37	Sagar					20	6	3		5	2			1	1											29	9	38
38	Satna							8	2	18	9	3	2													29	13	42
39	Sehore	3				9	13																			12	13	25
40	Seoni			2	1	18	8									1				12	1					33	10	43
41	Shahdol					3		15	5																	18	5	23
42	Shajapur					19	12																			19	12	31
43	Sheopur	3	2					8	1	5																16	3	19
44	Shivpuri					1	1	6	3	8	2			12	1											27	7	34
45	Sidhi							7	3	7	3	3	1							4						21	7	28
46	Singrauli							1	1							1	1			3	2			1	1	6	5	11
47	Tikamgarh													12	7											12	7	19
48	Ujjain					19	14																			19	14	33
49	Umaria	1						8	2	1																10	2	12
50	Vidisha			1	1	18	5																			19	6	25
	Total	**121**	**29**	**10**	**3**	**385**	**224**	**105**	**34**	**112**	**37**	**12**	**6**	**60**	**22**	**18**	**4**	**3**	**1**	**42**	**14**	**1**	**1**	**1**	**1**	**870**	**376**	**1246**

GROUND WATER OBSERVATION WELLS



LEGEND

Aquifers

- Alluvium
- Laterite
- Basalt
- Sandstone
- Shale
- Limestone
- Granite
- Schist
- Quartzite
- Banded Gneissic Complex
- Gneiss
- Intrusives

- Dug wells
- Piezometers
- State Capital
- District Headquarter
- State Boundary
- District Boundary
- River
- Water Body

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

Table 11: Depth to Water Level (May, 2012)

Sl No	District Name	Alluvium		Laterite		Basalt		Sandstone		Shale		Limestone		Granite		Schist		Quartzite		BGC		Gneiss		Intrusives			
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	**Min**	**Max**
1	Alirajpur													3.45	13.82	4.65	10.15									**3.45**	**13.82**
2	Anuppur			12.50	12.50	4.33	11.04	3.07	6.82	4.92	9.70									5.52	5.52					**3.07**	**12.50**
3	Ashoknagar					3.42	20.68	6.61	18.96																	**3.42**	**20.68**
4	Balaghat	3.83	11.73	6.86	6.86	4.40	4.40							9.40	9.40	5.60	11.38	1.65	1.65	2.20	12.65					**1.65**	**12.65**
5	Barwani					4.55	20.86																			**4.55**	**20.86**
6	Betul					2.20	12.20	2.00	9.50											5.00	16.40					**2.00**	**16.40**
7	Bhind	4.85	47.00																							**4.85**	**47.00**
8	Bhopal					1.76	18.40																			**1.76**	**18.40**
9	Burhanpur	6.43	32.35			6.38	14.38																			**6.38**	**32.35**
10	Chhatarpur	5.75	10.58			16.50	16.50	8.79	8.79	6.76	14.88			5.49	14.17											**5.49**	**16.50**
11	Chhindwara	10.00	10.00			3.40	35.00	1.60	19.50											8.80	12.90					**1.60**	**35.00**
12	Damoh					25.00	25.00	2.62	14.60	4.10	21.32															**2.62**	**25.00**
13	Datia	4.50	14.27							27.30	27.30			15.70	15.70											**4.50**	**27.30**
14	Dewas					2.98	24.47			3.15	11.95			5.53	8.84											**2.98**	**24.47**
15	Dhar					4.65	21.35			9.15	9.95			8.45	8.45							14.50	14.50			**4.65**	**21.35**
16	Dindori					3.20	12.35									3.18	6.03									**3.18**	**12.35**
17	Guna					4.94	18.69	2.95	11.77																	**2.95**	**18.69**
18	Gwalior	7.10	29.00					4.95	4.95	2.90	22.70			8.48	8.48											**2.90**	**29.00**
19	Harda	4.02	16.27			3.81	10.37							5.25	9.85											**3.81**	**16.27**
20	Hoshangabad	4.20	17.22			6.32	14.87	5.70	9.20											4.50	4.50					**4.20**	**17.22**
21	Indore					3.17	39.40																			**3.17**	**39.40**
22	Jabalpur	6.95	11.90	6.35	6.35	2.30	7.69			8.90	8.90	6.00	11.40			13.07	13.07	16.80	16.80	5.70	5.70					**2.30**	**16.80**
23	Jhabua					3.70	11.57					3.64	7.32													**3.64**	**11.57**
24	Katni	4.29	12.77	6.25	16.60			6.42	14.40					10.20	10.20	6.14	15.20									**4.29**	**16.60**
25	Khandwa					6.39	14.98																			**6.39**	**14.98**
26	Khargone					4.20	12.70											9.63	9.63							**4.20**	**12.70**
27	Mandla					1.90	10.70							5.90	5.90					4.20	5.20					**1.90**	**10.70**
28	Mandsaur					4.40	21.50			13.50	25.40															**4.40**	**25.40**
29	Morena	5.51	31.78					10.51	10.51																	**5.51**	**31.78**
30	Narsinghpur	4.15	18.35			5.80	5.80			5.91	11.85															**4.15**	**18.35**
31	Neemuch					5.45	18.90	12.15	15.00	4.85	15.90	6.10	6.10													**4.85**	**18.90**
32	Panna	8.20	8.20					6.35	12.60	2.45	20.80			5.30	9.62											**2.45**	**20.80**
33	Raisen	5.28	9.43			4.07	19.12	6.86	14.32	11.70	11.70															**4.07**	**19.12**
34	Rajgarh					4.75	22.32																			**4.75**	**22.32**
35	Ratlam					4.28	23.40																			**4.28**	**23.40**
36	Rewa							8.20	18.75	4.85	29.32	15.55	15.55													**4.85**	**29.32**
37	Sagar					2.63	36.52	9.28	11.80	7.79	16.95			6.70	7.55											**2.63**	**36.52**
38	Satna							3.75	18.28	2.85	30.40	9.26	15.41													**2.85**	**30.40**
39	Sehore	9.65	14.00			4.30	16.86																			**4.30**	**16.86**
40	Seoni			5.52	12.62	2.32	26.56									9.48	9.48			4.25	12.45					**2.32**	**26.56**
41	Shahdol					6.65	11.31	5.47	13.15																	**5.47**	**13.15**
42	Shajapur					6.90	23.40																			**6.90**	**23.40**
43	Sheopur	10.60	11.65					3.90	17.25	9.70	29.40															**3.90**	**29.40**
44	Shivpuri					13.85	13.85	8.15	17.70	4.70	19.55			4.35	12.90											**4.35**	**19.55**
45	Sidhi							3.45	13.20	5.82	23.66	12.85	23.12							2.60	9.45					**2.60**	**23.66**
46	Singrauli							5.20	8.65							15.97	18.50			4.13	11.09			11.30	11.30	**4.13**	**18.50**
47	Tikamgarh													3.34	14.52											**3.34**	**14.52**
48	Ujjain					5.20	21.51																			**5.20**	**21.51**
49	Umaria	4.92	4.92					6.30	16.77	5.92	5.92															**4.92**	**16.77**
50	Vidisha					2.80	21.80																			**2.80**	**21.80**
		3.83	**47.00**	**5.52**	**16.60**	**1.76**	**39.40**	**1.60**	**19.50**	**2.45**	**30.40**	**3.64**	**23.12**	**3.34**	**15.70**	**3.18**	**18.50**	**1.65**	**16.80**	**2.20**	**16.40**	**14.50**	**14.50**	**11.30**	**11.30**	**1.60**	**47.00**

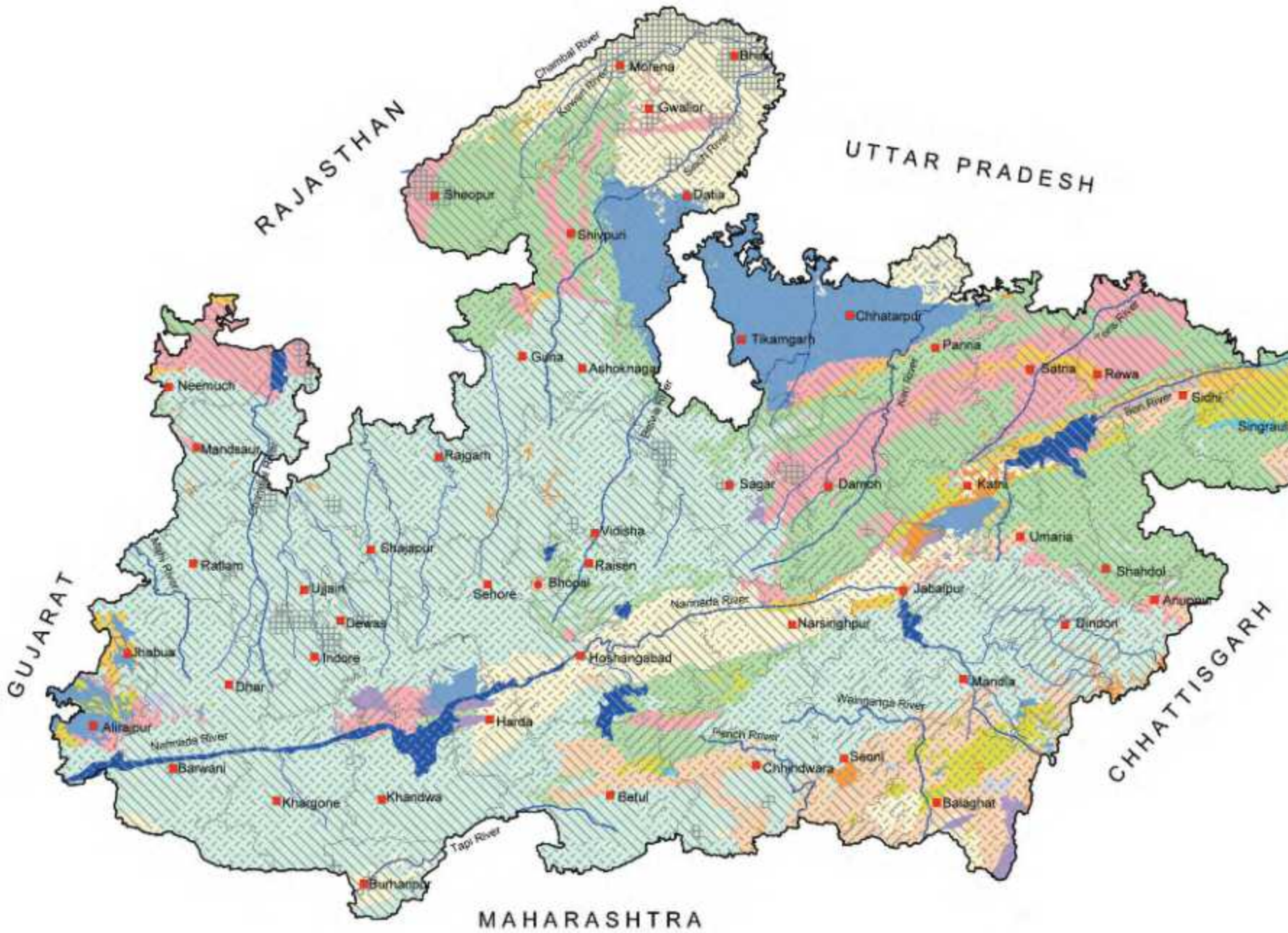
All figures in meter below ground level

DEPTH TO WATER LEVEL

(MAY, 2012)

N
W E
S

0 100 200
kilometers



LEGEND

Depth to Water Level (m bgl)

- < 2
- 2 to 5
- 5 to 10
- 10 to 20
- 20 to 40
- > 40

Aquifers

- Alluvium
- Laterite
- Basalt
- Sandstone
- Shale
- Limestone
- Granite
- Schist
- Quartzite
- Banded Gneissic Complex
- Gneiss
- Intrusives

- State Capital
- District Headquarter
- State Boundary
- District Boundary
- River
- Water Body

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

Table 12: Depth to Water Level (November, 2012)

Sl No	District name	Alluvium		Laterite		Basalt		Sandstone		Shale		Limestone		Granite		Schist		Quartzite		BGC		Gneiss		Intrusives			
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	**Min**	**Max**
1	Alirajpur													3.00	6.50	2.30	11.10									**2.30**	**11.10**
2	Anuppur			10.90	10.90	1.66	5.45	2.02	5.08	2.65	14.57									3.52	3.52					**1.66**	**14.57**
3	Ashoknagar					2.34	14.26	3.92	6.54																	**2.34**	**14.26**
4	Balaghat	2.30	4.90													2.35	3.20			3.42	6.98					**2.30**	**6.98**
5	Barwani					3.20	41.75																			**3.20**	**41.75**
6	Betul					0.71	9.75	1.83	3.45											2.97	8.01					**0.71**	**9.75**
7	Bhind	2.40	47.00																							**2.40**	**47.00**
8	Bhopal					1.14	11.61																			**1.14**	**11.61**
9	Burhanpur	2.05	32.35			3.52	9.13																			**2.05**	**32.35**
10	Chhatarpur	2.26	6.69					2.82	2.82	7.32	8.41			2.92	9.24											**2.26**	**9.24**
11	Chhindwara	6.83	6.83			1.40	17.19	1.52	5.00											2.80	11.30					**1.40**	**17.19**
12	Damoh					4.90	4.90	0.25	5.73	0.38	8.43															**0.25**	**8.43**
13	Datia	1.90	11.57							27.00	27.00			3.60	3.60											**1.90**	**27.00**
14	Dewas					2.09	15.19			0.43	2.50			0.06	11.40											**0.06**	**15.19**
15	Dhar					3.00	12.80			5.03	5.03			5.85	5.85							10.60	10.60			**3.00**	**12.80**
16	Dindori					0.55	7.50									1.88	2.63									**0.55**	**7.50**
17	Guna					2.85	17.40	4.19	6.26																	**2.85**	**17.40**
18	Gwalior	6.25	29.00					3.19	3.19	1.45	22.70			7.64	7.64											**1.45**	**29.00**
19	Harda	3.12	17.80			0.30	6.93							2.19	7.28											**0.30**	**17.80**
20	Hoshangabad	2.35	13.47			1.98	6.45	1.24	6.80											1.80	1.80					**1.24**	**13.47**
21	Indore					2.01	11.71																			**2.01**	**11.71**
22	Jabalpur	1.26	9.68	2.75	2.75	0.37	8.70			4.20	4.20	4.30	10.20			6.70	6.70	2.70	2.70	5.25	5.25					**0.37**	**10.20**
23	Jhabua					2.00	5.20					2.20	2.70													**2.00**	**5.20**
24	Katni	2.90	10.32	3.98	11.44			3.49	8.90					3.55	3.55	3.27	9.25									**2.90**	**11.44**
25	Khandwa					1.45	7.07																			**1.45**	**7.07**
26	Khargone					1.90	11.70											7.10	7.10							**1.90**	**11.70**
27	Mandla					0.10	5.05							3.40	3.40					0.30	0.30					**0.10**	**5.05**
28	Mandsaur					1.20	11.35			4.45	6.25															**1.20**	**11.35**
29	Morena	2.83	31.78					6.75	6.75																	**2.83**	**31.78**
30	Narsinghpur	4.20	17.90			4.10	4.10			2.70	13.80					20.72	20.72									**2.70**	**20.72**
31	Neemuch					1.15	22.75	9.15	9.15	2.28	11.15	1.40	1.40													**1.15**	**22.75**
32	Panna	5.50	5.50					2.28	4.95	1.85	17.65			3.12	7.21											**1.85**	**17.65**
33	Raisen	2.81	3.72			1.33	17.03	4.71	5.14	6.76	6.76															**1.33**	**17.03**
34	Rajgarh					0.47	17.83																			**0.47**	**17.83**
35	Ratlam					1.48	14.28																			**1.48**	**14.28**
36	Rewa							1.90	13.73	1.60	17.70	15.55	15.55													**1.60**	**17.70**
37	Sagar					1.82	1.82																			**1.82**	**1.82**
38	Satna							1.15	15.70	1.25	16.90	2.96	8.20													**1.15**	**16.90**
39	Sehore	4.01	6.71			3.26	13.51																			**3.26**	**13.51**
40	Seoni			3.40	7.90	0.90	17.00									4.50	4.50			1.90	9.00					**0.90**	**17.00**
41	Shahdol					3.45	5.86	2.40	17.86																	**2.40**	**17.86**
42	Shajapur					1.07	15.08																			**1.07**	**15.08**
43	Sheopur	5.40	8.60					0.55	13.30	1.30	15.55	5.92	5.92													**0.55**	**15.55**
44	Shivpuri					4.25	4.25	3.65	13.95	2.78	14.90			3.12	9.35											**2.78**	**14.90**
45	Sidhi							2.50	14.13	1.05	10.35	8.85	12.05							3.45	7.75					**1.05**	**14.13**
46	Singrauli							2.94	3.45							14.67	15.17			3.05	5.98			6.53	7.85	**2.94**	**15.17**
47	Tikamgarh													2.01	11.31											**2.01**	**11.31**
48	Ujjain					0.80	10.48																			**0.80**	**10.48**
49	Umaria	2.42	2.42					3.55	10.57	2.95	2.95															**2.42**	**10.57**
50	Vidisha					2.01	9.58																			**2.01**	**9.58**
		1.26	**47.00**	**2.75**	**11.44**	**0.10**	**41.75**	**0.25**	**17.86**	**0.38**	**27.00**	**1.40**	**15.55**	**0.06**	**11.40**	**1.88**	**20.72**	**2.70**	**7.10**	**0.30**	**11.30**	**10.60**	**10.60**	**6.53**	**7.85**	**0.06**	**47.00**

All figures in meter below ground level

DEPTH TO WATER LEVEL

(NOVEMBER, 2012)

0 100 200

kilometers

LEGEND

Depth to Water Level (m bgl)

- < 2
- 2 to 5
- 5 to 10
- 10 to 20
- 20 to 40
- > 40

Aquifers

- Alluvium
- Laterite
- Basalt
- Sandstone
- Shale
- Limestone
- Granite
- Schist
- Quartzite
- Banded Gneissic Complex
- Gneiss
- Intrusives

- State Capital
- District Headquarter
- State Boundary
- District Boundary
- River
- Water Body

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

Table 13: District wise Pre monsoon Depth to Water Level (Decadal Mean 2003-2012)

Sl No	District Name	Alluvium		Laterite		Basalt		Sandstone		Shale		Limestone		Granite		Schist		Quartzite		BGC		Gneiss		Intrusives			
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
1	Alirajpur													4.54	12.67	4.40	8.49									4.40	12.67
2	Anuppur			13.74	13.74	4.27	11.04	6.51	12.52	5.47	14.46									5.52	5.52					4.27	14.46
3	Ashoknagar					5.14	19.89	8.16	16.18																	5.14	19.89
4	Balaghat	5.21	11.76	7.52	7.52	4.17	4.17							8.91	8.91	3.18	12.96			2.54	9.84					2.54	12.96
5	Barwani					6.24	12.99																			6.24	12.99
6	Betul					3.26	12.97	3.16	8.06											4.49	12.80					3.16	12.97
7	Bhind	7.87	33.00																							7.87	33.00
8	Bhopal					2.26	18.22	2.68	7.26																	2.26	18.22
9	Burhanpur	6.56	29.82			6.22	13.11																			6.22	29.82
10	Chhatarpur	5.57	10.30			14.30	14.30	6.32	6.32	6.55	14.80			7.58	13.61											5.57	14.80
11	Chhindwara	10.88	10.88			5.62	21.82	4.15	10.99											8.24	14.57					4.15	21.82
12	Damoh							3.19	11.95	4.32	14.36															3.19	14.36
13	Datia	7.71	13.97							27.52	27.52			15.66	15.66											7.71	27.52
14	Dewas					3.62	21.10			5.34	11.23			5.02	17.64											3.62	21.10
15	Dhar					5.96	18.01			8.12	8.12			10.41	10.41							15.89	15.89			5.96	18.01
16	Dindori					3.13	12.17									3.87	9.35									3.13	12.17
17	Guna					7.16	17.60	3.29	11.39																	3.29	17.60
18	Gwalior	12.31	25.62					9.20	9.20	4.46	19.46			10.34	10.34											4.46	25.62
19	Harda	4.17	15.77			3.32	9.04							5.93	10.03											3.32	15.77
20	Hoshangabad	4.30	16.31			7.70	13.71	5.55	8.95											4.73	4.73					4.30	16.31
21	Indore					3.17	39.40																			3.17	39.40
22	Jabalpur	7.80	9.77	7.09	7.09	2.86	9.91			7.61	7.61	6.86	18.38			14.15	14.15									2.86	18.38
23	Jhabua					3.43	10.58					4.66	7.05													3.43	10.58
24	Katni	4.03	12.14	8.58	14.76			6.41	14.12					9.54	9.54	7.96	14.14									4.03	14.76
25	Khandwa					6.88	13.21																			6.88	13.21
26	Khargone					4.59	13.78											10.95	10.95							4.59	13.78
27	Mandla					3.29	12.32							7.68	7.68					6.05	6.05					3.29	12.32
28	Mandsaur					6.00	19.94			11.96	14.64															6.00	19.94
29	Morena	7.31	41.35					12.38	12.38																	7.31	41.35
30	Narsinghpur	4.65	19.34							6.32	11.65															4.65	19.34
31	Neemuch					7.21	18.22	11.53	13.10	6.99	14.19	7.27	7.27													6.99	18.22
32	Panna	9.42	9.42					7.14	10.98	6.69	19.50			5.61	9.99											5.61	19.50
33	Raisen	5.25	17.42			4.74	19.40	7.96	9.16	11.56	11.56															4.74	19.40
34	Rajgarh					6.09	17.96																			6.09	17.96
35	Ratlam					5.99	24.69																			5.99	24.69
36	Rewa							7.20	12.69	7.93	21.48	13.81	13.81													7.20	21.48
37	Sagar					3.70	21.96	8.42	11.49	9.44	17.11			6.42	8.97											3.70	21.96
38	Satna							4.99	17.42	5.60	27.41	10.71	12.75													4.99	27.41
39	Sehore	7.72	11.34			6.07	21.47																			6.07	21.47
40	Seoni			6.62	13.48	2.09	20.56									9.55	9.55			4.97	12.09					2.09	20.56
41	Shahdol					7.33	10.34	6.04	12.33																	6.04	12.33
42	Shajapur					8.03	18.48																			8.03	18.48
43	Sheopur	8.74	11.91					5.26	28.86	9.30	27.92															5.26	28.86
44	Shivpuri					13.10	13.10	7.37	15.49	5.19	16.93			6.36	16.15											5.19	16.93
45	Sidhi							3.63	14.39	5.98	20.21	14.54	19.04							7.56	10.38					3.63	20.21
46	Singrauli							5.36	10.27							16.18	16.31			6.98	10.25			11.38	11.38	5.36	16.31
47	Tikamgarh													6.21	12.81											6.21	12.81
48	Ujjain					7.09	16.79																			7.09	16.79
49	Umaria	5.32	5.32					6.71	7.94																	5.32	7.94
50	Vidisha					4.76	14.69																			4.76	14.69
		4.03	**41.35**	**6.62**	**14.76**	**2.09**	**39.40**	**2.68**	**28.86**	**4.32**	**27.92**	**4.66**	**19.04**	**4.54**	**17.64**	**3.18**	**16.31**	**10.95**	**10.95**	**2.54**	**14.57**	**15.89**	**15.89**	**11.38**	**11.38**	**2.09**	**41.35**

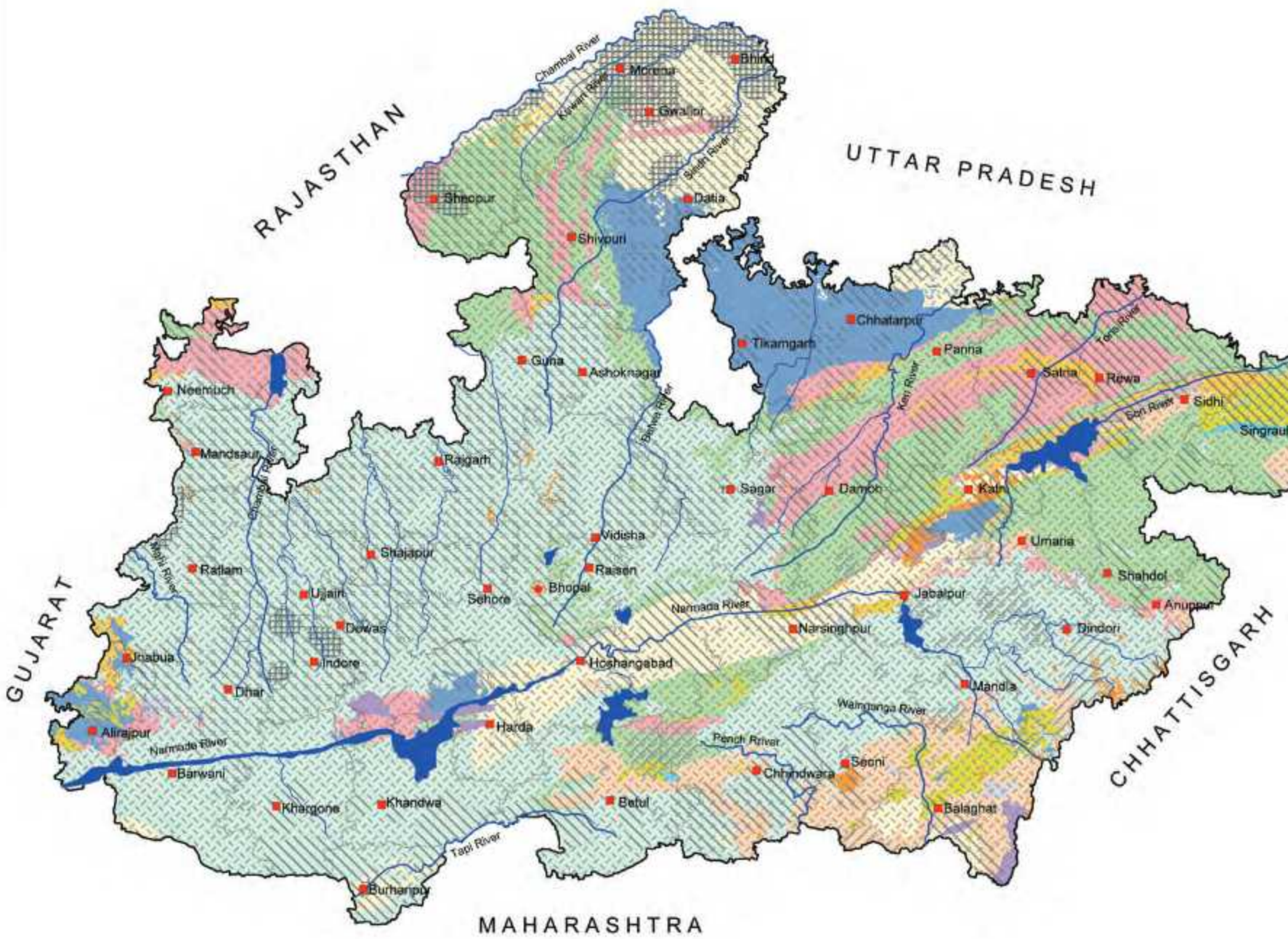
All figures in meter below ground level

DEPTH TO WATER LEVEL

DECADAL MEAN (MAY, 2003-2012)

0 100 200

kilometers



LEGEND

Depth to Water Level (m bgl)

- < 2
- 2 to 5
- 5 to 10
- 10 to 20
- 20 to 40
- > 40

Aquifers

- Alluvium
- Laterite
- Basalt
- Sandstone
- Shale
- Limestone
- Granite
- Schist
- Quartzite
- Banded Gneissic Complex
- Gneiss
- Intrusives

- State Capital
- District Headquarter
- State Boundary
- District Boundary
- River
- Water Body

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Table 14: District wise Post Monsoon Depth to Water Level (Decadal Mean 2003-2012)

Sl No	District Name	Alluvium		Laterite		Basalt		Sandstone		Shale		Limestone		Granite		Schist		Quartzite		BGC		Gneiss		Intrusives			
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
1	Alirajpur													3.28	6.67	2.50	7.34									2.50	7.34
2	Anuppur			11.81	11.81	2.04	4.71	2.48	6.24	2.63	14.48									3.39	3.39					2.04	14.48
3	Ashoknagar					3.50	13.77	5.22	10.27																	3.50	13.77
4	Balaghat	2.23	4.79													3.64	5.48			2.04	6.86					2.04	6.86
5	Barwani					3.29	11.81																			3.29	11.81
6	Betul					0.85	8.44	2.40	4.24											3.66	9.41					0.85	9.41
7	Bhind	5.17	41.15																							5.17	41.15
8	Bhopal					1.15	13.97																			1.15	13.97
9	Burhanpur	2.81	27.92			3.87	9.70																			2.81	27.92
10	Chhatarpur	2.32	6.46					2.55	2.55	7.40	10.34			3.57	9.90											2.32	10.34
11	Chhindwara	8.27	8.27			1.17	15.24	3.75	5.68											3.15	10.69					1.17	15.24
12	Damoh					4.32	4.32	2.00	4.97	0.61	12.33															0.61	12.33
13	Datia	5.98	11.88							26.12	26.12			10.10	10.10											5.98	26.12
14	Dewas					2.51	17.21			2.55	5.23			1.80	10.61											1.80	17.21
15	Dhar					2.55	16.26			4.23	4.23			6.31	6.31							12.35	12.35			2.55	16.26
16	Dindori					0.81	9.38									1.99	2.85									0.81	9.38
17	Guna					3.41	16.82	3.25	5.60																	3.25	16.82
18	Gwalior	6.20	25.82					5.08	5.08	4.22	19.59			8.03	8.03											4.22	25.82
19	Harda	2.98	10.72			1.77	5.72							2.80	8.59											1.77	10.72
20	Hoshangabad	2.39	14.16			4.09	10.12	1.70	7.54											2.44	2.44					1.70	14.16
21	Indore					2.01	12.35																			2.01	12.35
22	Jabalpur	1.72	8.32	2.19	2.19	2.14	5.81			4.12	4.12	6.07	11.02			6.60	6.60	10.41	10.41	0.99	0.99					0.99	11.02
23	Jhabua					0.90	6.39					3.15	3.89													0.90	6.39
24	Katni	2.96	9.04	4.76	12.09			4.33	12.58					5.19	5.19	3.36	9.32									2.96	12.58
25	Khandwa					2.31	7.28																			2.31	7.28
26	Khargone					2.23	12.12											8.46	8.46							2.23	12.12
27	Mandla					1.00	8.88							4.20	4.20					2.19	2.19					1.00	8.88
28	Mandsaur					2.81	11.39			7.39	7.63															2.81	11.39
29	Morena	3.97	39.75					9.62	9.62																	3.97	39.75
30	Narsinghpur	6.49	17.52			5.66	5.66			3.05	8.54					19.92	19.92									3.05	19.92
31	Neemuch					2.50	16.35	9.78	9.78	2.83	11.14	2.20	2.20													2.20	16.35
32	Panna	7.10	7.10					2.75	4.58	3.10	15.65			2.85	5.54											2.75	15.65
33	Raisen	2.72	3.25			2.14	13.20	4.06	6.85	7.08	7.08															2.14	13.20
34	Rajgarh					3.56	15.89																			3.56	15.89
35	Ratlam					2.58	13.11																			2.58	13.11
36	Rewa							3.40	10.48	5.32	16.59	10.60	10.60													3.40	16.59
37	Sagar					4.98	4.98																			4.98	4.98
38	Satna							1.87	15.97	2.58	11.40	4.50	9.34													1.87	15.97
39	Sehore	2.96	7.16			3.32	16.34																			2.96	16.34
40	Seoni			2.58	6.41	1.93	16.28									5.69	5.69			1.41	8.64					1.41	16.28
41	Shahdol					4.10	6.34	3.66	19.10																	3.66	19.10
42	Shajapur					2.76	14.35																			2.76	14.35
43	Sheopur	7.75	9.49					4.69	14.96	5.71	20.15	5.96	5.96													4.69	20.15
44	Shivpuri					7.69	7.69	5.00	13.95	3.44	14.96			4.80	11.23											3.44	14.96
45	Sidhi							3.06	13.21	3.95	15.27	9.87	16.29							5.34	8.79					3.06	16.29
46	Singrauli							3.39	5.33							14.73	15.45			5.28	7.69			9.48	9.49	3.39	15.45
47	Tikamgarh													3.72	9.83											3.72	9.83
48	Ujjain					3.09	15.34																			3.09	15.34
49	Umaria	2.99	2.99					3.79	11.34	3.43	3.43															2.99	11.34
50	Vidisha					2.21	11.46																			2.21	11.46
		1.72	41.15	2.19	12.09	0.81	17.21	1.70	19.10	0.61	26.12	2.20	16.29	1.80	11.23	1.99	19.92	8.46	10.41	0.99	10.69	12.35	12.35	9.48	9.49	0.61	41.15

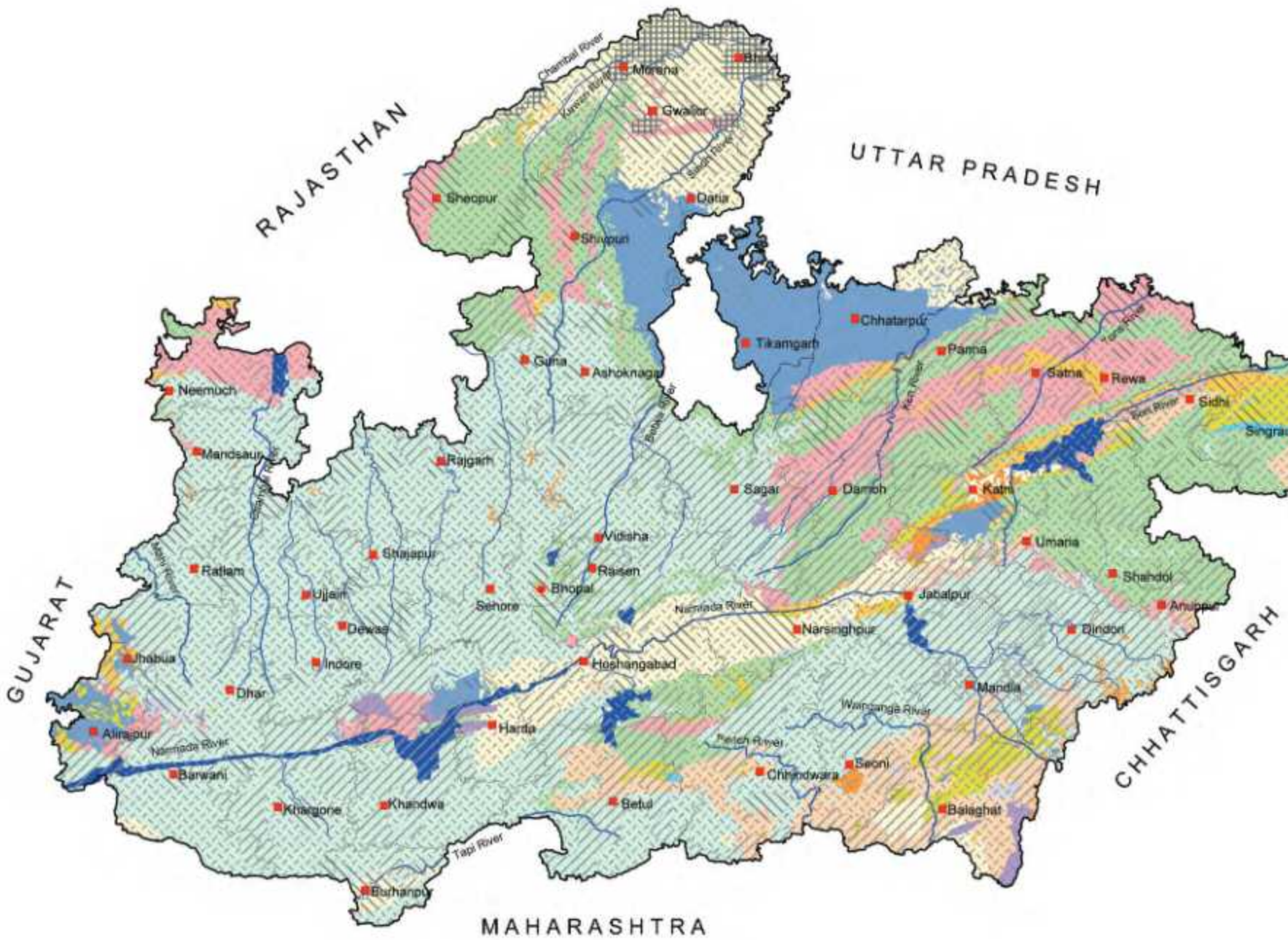
All figures in meter below ground level

DEPTH TO WATER LEVEL

DECADAL MEAN (NOVEMBER, 2003-2012)

0 100 200

kilometers



LEGEND

Depth to Water Level (m bgl)

- < 2
- 2 to 5
- 5 to 10
- 10 to 20
- 20 to 40
- > 40

Aquifers

- Alluvium
- Laterite
- Basalt
- Sandstone
- Shale
- Limestone
- Granite
- Schist
- Quartzite
- Banded Gneissic Complex
- Gneiss
- Intrusives

- State Capital
- District Headquarter
- State Boundary
- District Boundary
- River
- Water Body

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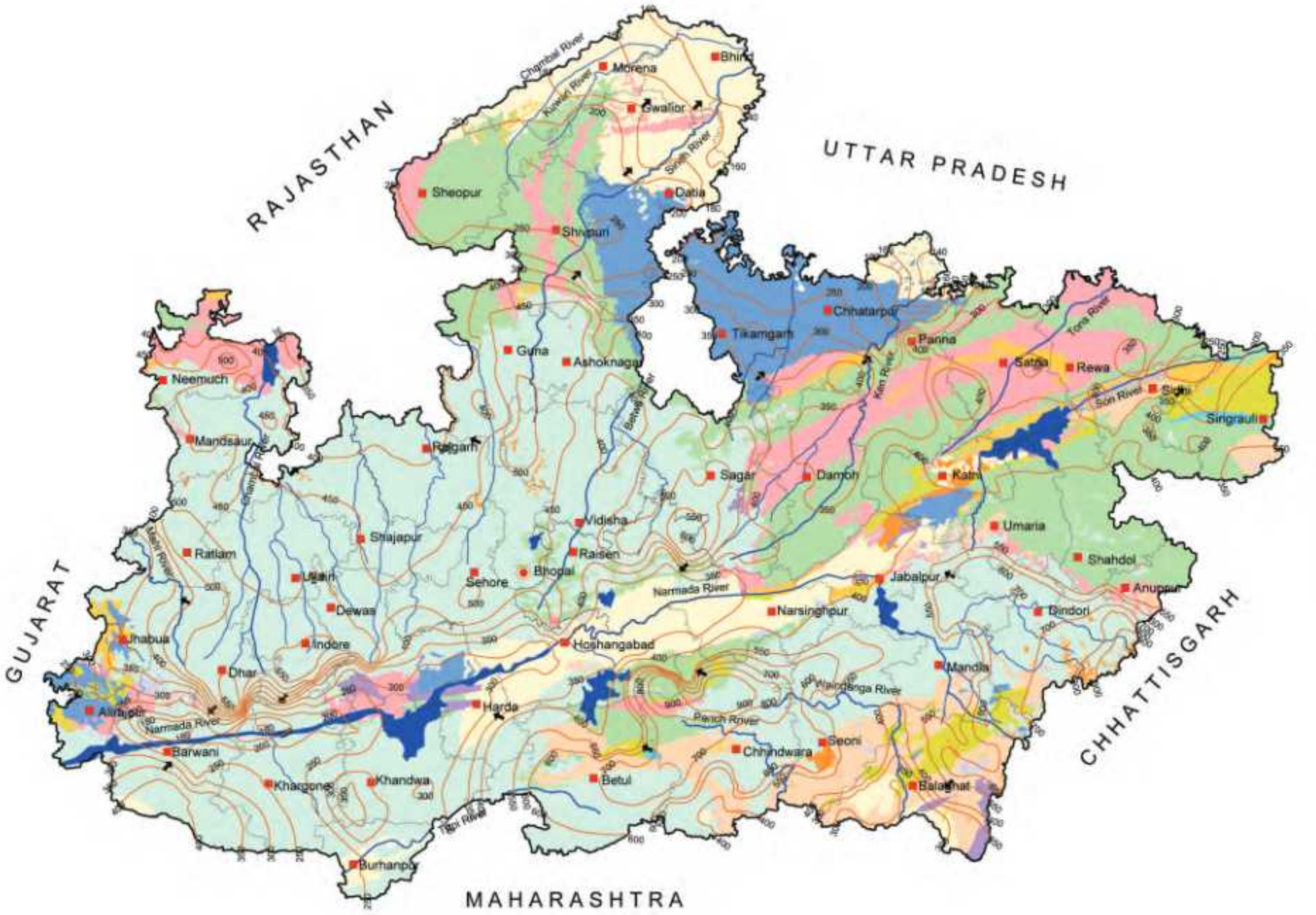
Ministry of Water Resources
Government of India

WATER TABLE ELEVATION

(MAY, 2012)

0 100 200

kilometers



LEGEND

Water Table Contour (m amsl) — 350

Ground Water Flow Direction

Aquifers

Alluvium	Granite
Laterite	Schist
Basalt	Quartzite
Sandstone	Banded Gneissic Complex
Shale	Gneiss
Limestone	Intrusives

State Capital

District Headquarter

State Boundary

District Boundary

River

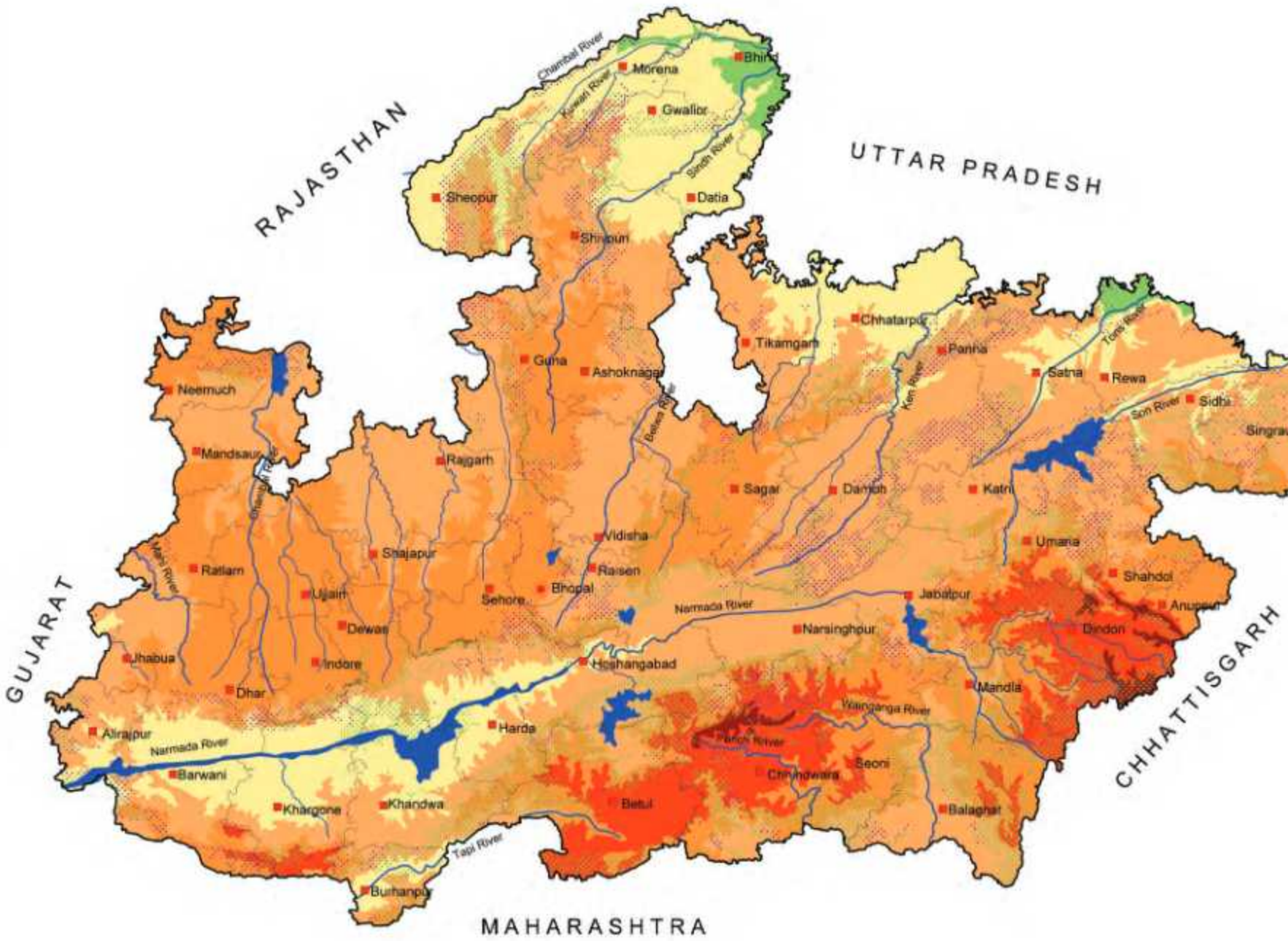
Water Body

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

SURFACE ELEVATION

N
W E
S

0 100 200
kilometers



LEGEND

Height (m amsl)

- < 150 m
- 150 to 300
- 300 to 450
- 450 to 600
- 600 to 900
- > 900

Forest

- Open Forest
- Dense Forest

- State Capital
- District Headquarter
- State Boundary
- District Boundary
- River
- Water Body

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Table 15: Area Affected by Salinity (Electrical Conductivity > 3000 µS/cm, at 25 °C) in Ground Water of Madhya Pradesh

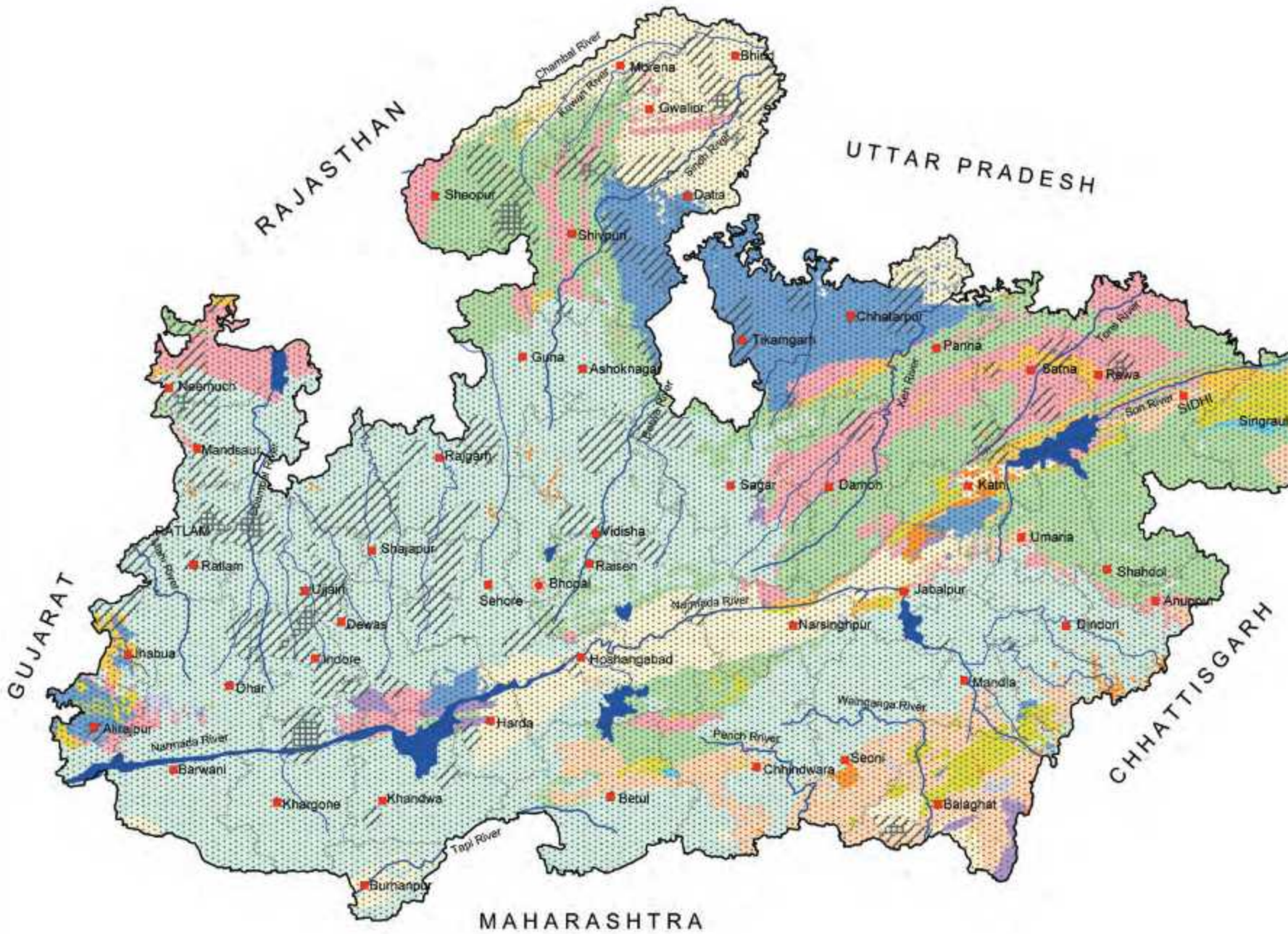
Sl No	District Name	Locations	EC > 3000 µS/cm, at 25 °C
1	Balaghat	Miragpur	3570
2	Bhind	Alampur	3210
3	Bhind	Mau	3800
4	Gwalior	Mohna	3270
5	Indore	Sanwer	3780
6	Indore	Ushapura	3100
7	Khargone	Pipliya Buzrug	4150
8	Neemuch	Harkiyakhal	4040
9	Ratlam	Badawada	3170
10	Ratlam	Jaora	3688
11	Ratlam	Malakhera	3240
12	Rewa	Raipur	3700
13	Satna	Kotar	3140
14	Sheopur	Kuno	5620
15	Shivpuri	Amola	3182
16	Ujjain	Mahidpur Road	3680
17	Ujjain	Panth Piplai	3350

ELECTRICAL CONDUCTIVITY

(SHALLOW AQUIFER)

0 100 200

kilometers



LEGEND

Electrical Conductivity (micro-siemens/cm)

- <1500
- 1500 to 3000
- > 3000

Aquifers

- Alluvium
- Laterite
- Basalt
- Sandstone
- Shale
- Limestone
- Granite
- Schist
- Quartzite
- Banded Gneissic Complex
- Gneiss
- Intrusives

- State Capital
- District Headquarter
- State Boundary
- District Boundary
- River
- Water Body

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Government of India

Table 16: Area Affected by Fluoride (>1.5 mg/litre) in Ground Water of Madhya Pradesh

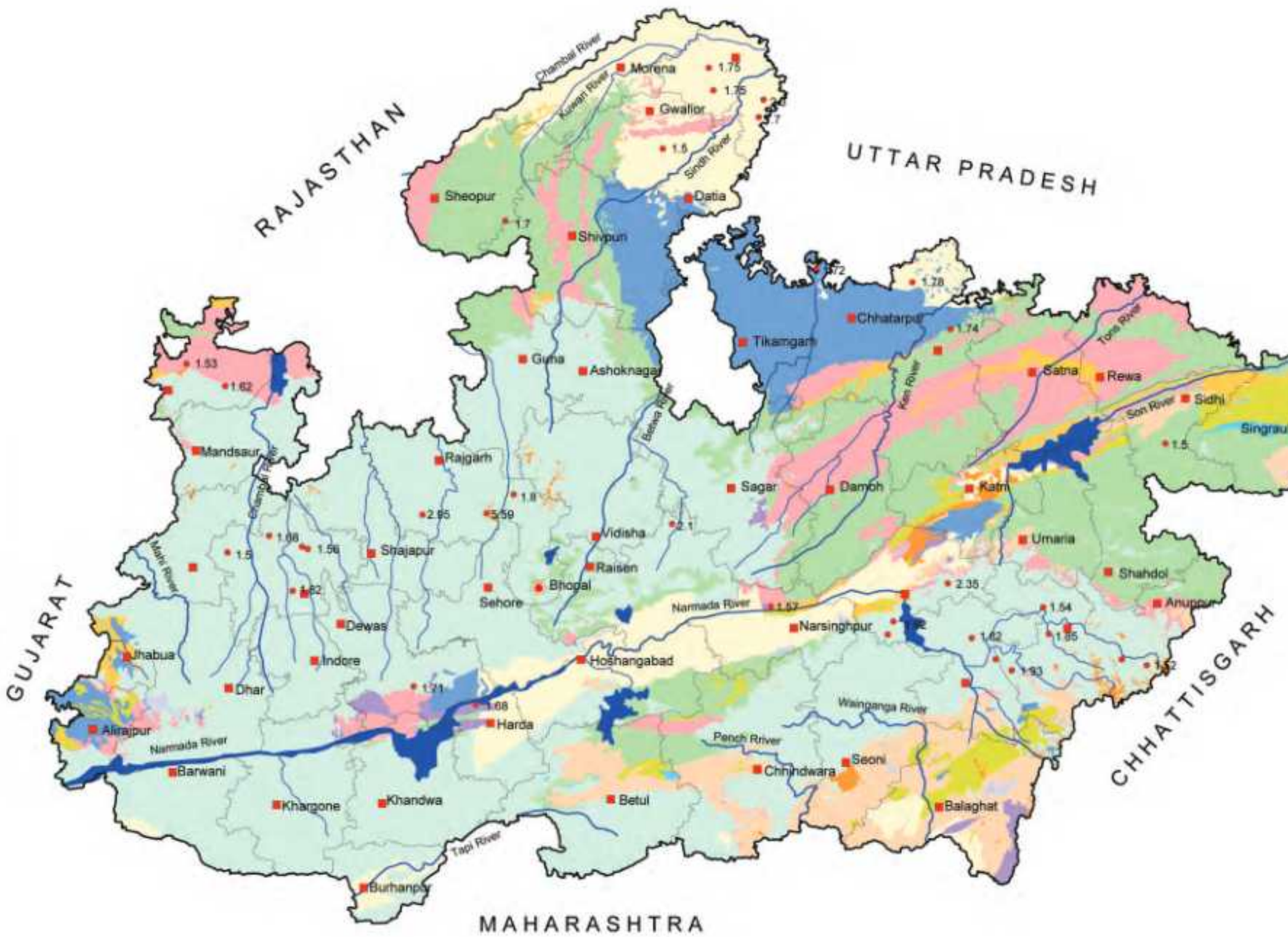
Sl No	District Name	Locations	F >1.5 mg/litre
1	Bhind	Balaji	2.3
2	Bhind	Chirole	1.75
3	Bhind	Lahar	1.7
4	Bhind	Mehgaon	1.75
5	Bhopal	Nagirabad	1.8
6	Chhatarpur	Kukrel	1.72
7	Chhatarpur	Laundi	1.78
8	Dewas	Kantaphor	1.71
9	Dindori	Gorakhpur	1.66
10	Dindori	Karanjiya	1.52
11	Dindori	Salaiya	1.85
12	Dindori	Vikrampur	1.54
13	Harda	Handia	1.68
14	Jabalpur	Bargi	1.92
15	Jabalpur	Bishanpura	2.35
16	Jabalpur	Sukri	2.05
17	Mandla	Babaliya	1.62
18	Mandla	Ghughari	1.93
19	Mandla	Indira	2.81
20	Narsinghpur	Betli	1.57
21	Neemuch	Kukreshwar	1.62
22	Neemuch	Morban	1.53
23	Panna	Pandepurwa	1.74
24	Raisen	Begumganj	2.1
25	Rajgarh	Gandhigram	5.59
26	Rajgarh	Udhankheri	2.95
27	Sheopur	Kuno	1.7
28	Ujjain	Delchi Buzurg	1.68
29	Ujjain	Khera Khajuria	1.88
30	Ujjain	Mohanpura	1.82
31	Ujjain	Raghvi	1.56

FLUORIDE

(SHALLOW AQUIFER)

0 100 200

kilometers



LEGEND

- Fluoride > 1.5 mg/l

Aquifers

- Alluvium
- Laterite
- Basalt
- Sandstone
- Shale
- Limestone
- Granite
- Schist
- Quartzite
- Banded Gneissic Complex
- Gneiss
- Intrusives

- State Capital
- District Headquarter
- State Boundary
- District Boundary
- River
- Water Body

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Table 17: Area Affected by Nitrate (>45 mg/litre) in Ground Water of Madhya Pradesh

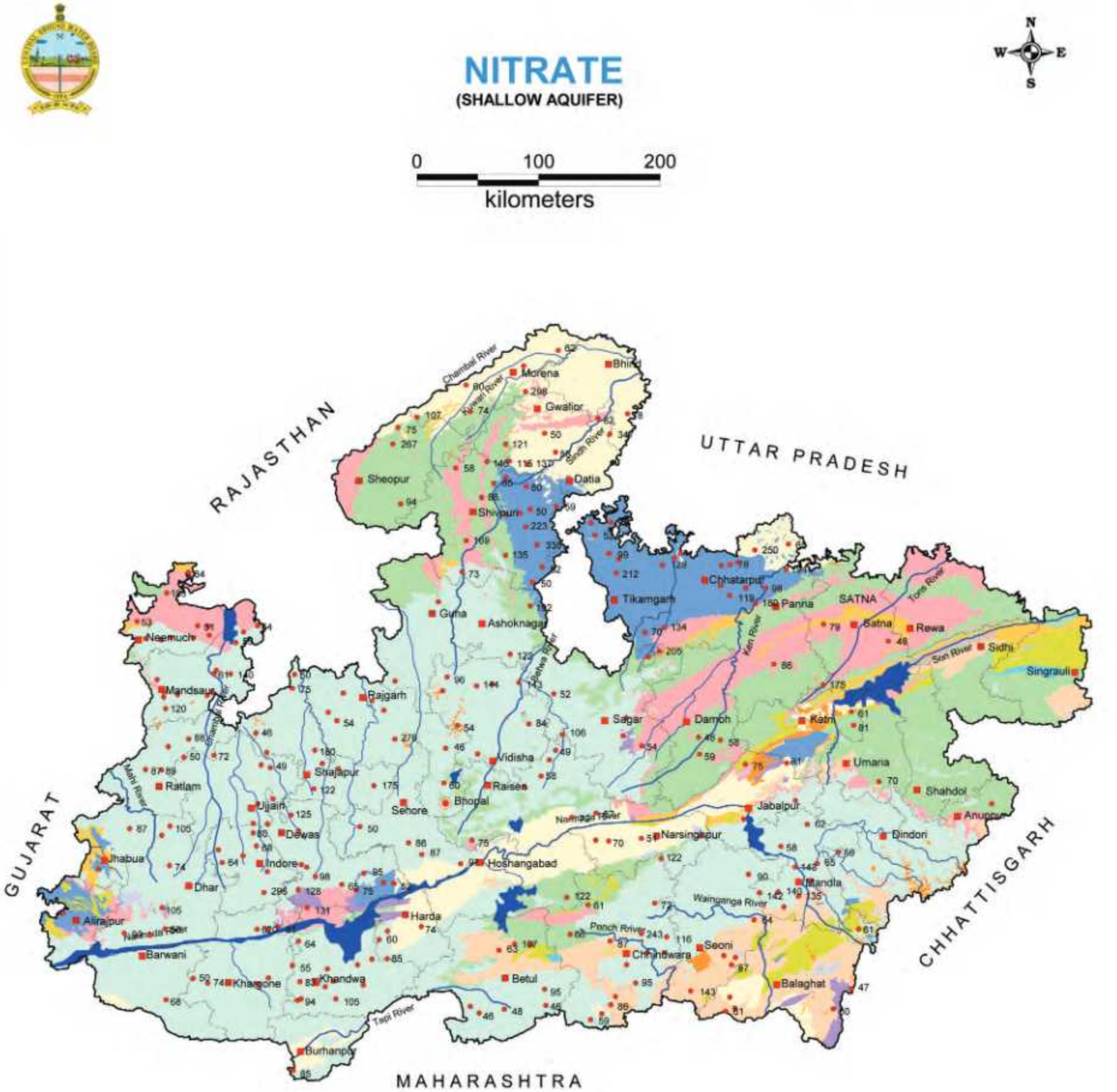
Sl No	District Name	Locations
1	Alirajpur	Alirajpur, Chandpur
2	Anuppur	Kotma
3	Ashoknagar	Bahadurpur, Chanderi
4	Balaghat	Bonkatta, Deverbeli, Jawaditula, Katedara, Miragpur, Saletekri
5	Barwani	Sendhwa
6	Betul	Athner, Betul, Bhainsdehi, Ghoradongri, Gudagaon, Multai, Nimpani, Pattan, Sarni
7	Bhind	Alampur, Lahar
8	Bhopal	Berasia, Islamnagar
9	Burhanpur	Ichchapur
10	Chhatarpur	Chhatarpur, Ganj, Ghuara, Khajuraho, Kurri, Laundi, Maharajpur,
11	Chhindwara	Chaurai, Damua, Delakheri, Goni, Kundali, Linga, Markamdhana, Pipla Narayanwar, Rajna, Ramakona, Ramgarh, Sausar, Singhori, Sonapipri, Surla
12	Damoh	Abhana, Bamhori, Tejgarh
13	Datia	Seondha
14	Dewas	Bagli, Bamohri, Bhesuni, Bhonrasa, Dewas, Kannod, Kantaphor, Karnawad, Khategaon, Pipilianankar, Pipri, Satwas, Tonkkala, Udainagar
15	Dhar	Chayan, Dasai, Kukshi, Manawar, Rajod, Singhana, Zeerabad
16	Guna	Guna, Patai, Penchi
17	Gwalior	Aron, Bhitarwar, Dabra, Dongarpur, Makoda, Mohna
18	Harda	Chhipawad, Harda, Mandla, Mohanpur, Morgarhi
19	Hoshangabad	Pachmarhi
20	Indore	Depalpur, Dharampuri, Dudhiya, Hatod, Nandpura, Rangwasa, Sanwer
21	Jabalpur	Kundam, Majholi, Manegaon, Umariapan
22	Jhabua	Petlawad, Tikadimoti
23	Katni	Barhi, Kewlari
24	Khandwa	Amalpura, Balwara, Borisaray, Chhanera, Chhegaonmakhan, Jaswadi, Jawar, Karoli, Khalwa, Khandwa, Kusumbiya, Pandhana, Roshiya
25	Khargone	Baddiya, Bamnala, Barwah, Bhikangaon, Khargone, Pipliya Buzrug, Segaon, Un
26	Mandla	Bamhni, Chabi, Devgaon, Dithori, Gwari, Kudomali, Niwas, Pathri patpara, Pindrai, Rampuri
27	Mandsaur	Barkheranayak, Basakheda, Bhanpura, Botalganj, Daloda, Dharmarajeswar, Dudhkheri, Khejriya, Mandsaur, Nayakhera, Sandhara, Shamgarh, Surjani
28	Morena	Gangarampura, Huseinpur, Khera Mewda, Pahargarh, Porsa
29	Narsinhpur	Deori Badwani, Gadarwara, Jhoteshwar, Kareli, Narsinghpur
30	Neemuch	Besla, Bhadana, Girdola, Jamalpura, Jawad, Kundaliya, Manasa, Ratangarh, Savan, Singoli
31	Panna	Ajaigarh, Bariyarpur, Madla, Panna, Powai
32	Raisen	Barkheda, Begumganj, Dehgaon, Deori, Gairatganj, Khiria, Paloha
33	Rajgarh	Bawari, Biora, Chhapiheda, Ganayari, Khilchipur,Sandavata
34	Ratlam	Badawada, Jaora, Mindli, Namli, Ratlam, Sailana
35	Sagar	Baroda, Hirapur, Hurra, Khurai, Parsoria, Rehli, Shahgarh
36	Satna	Amdara, Mauhari Katra, Nagod, Satna
37	Sehore	Ashta, Bhaya, Larkui, Nadan
38	Seoni	Banjal, Borghat, Ghansor, Kalyanpur, Kauria, Khawasa
39	Shajapur	Guradi Bangla, Kalapipal, Mohan Barodia, Matkotra, Panwadi, Salsalai, Soyat, Tanodiya, Tilawad Govind
40	Sheopur	Harkui, Karahal, Pura, Sheopur, Shyampur
41	Shivpuri	Achhroni, Amola, Awas, Badarwas, Bamorkalan, Behgawan, Bhotni, Girwani, Karera, Mangroni, Manipura, Masoori, Narwar, Pichhore, Santanwara, Sarsod, Shivpuri
42	Sidhi	Sidhi
43	Tikamgarh	Bela, Birorakhet, Digaura, Ladhaura, Nenguwan, Niwari, Orchha, Palera, Tikamgarh
44	Ujjain	Dablahardu, Mahidpurroad, Palkhanda, Panth Piplai, Patpala, Rupakhedi
45	Umaria	Birsinghpur
46	Vidisha	Anandpur, Bilari, Ghatera, Kurwai, Lateri, Mohanpura, Patharia, Sironj

NITRATE

(SHALLOW AQUIFER)

0 100 200

kilometers



LEGEND

Nitrate > 45 mg/l

Aquifers

- Alluvium
- Laterite
- Basalt
- Sandstone
- Shale
- Limestone
- Granite
- Schist
- Quartzite
- Banded Gneissic Complex
- Gneiss
- Intrusives

- State Capital
- District Headquarter
- State Boundary
- District Boundary
- River
- Water Body

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Table 18a: Aquifer Wise Area Under Over Exploited Blocks of Madhya Pradesh (As on 2009)

Sl No	District Name	Blocks	Alluvium	Laterite	Basalt	Sandstone	Shale	Limestone	Granite	Schist	Quartzite	BGC	Gneiss	Intrusives	Block Area
1	**Barwani**	Pansemal	231		357										**588**
2	**Dewas**	Dewas			985										**985**
		Sonkatch			835										**835**
3	**Dhar**	Badnawar			1056										**1056**
		Dhar			534										**534**
		Dharampuri			541										**541**
		Nalchha			562										**562**
4	**Indore**	Depalpur			1028										**1028**
		Indore			1030										**1030**
		Sanwer			763										**763**
5	**Mandsaur**	Mandsaur		15	1229	12	58								**1314**
		Sitamau		7	1350	8									**1365**
6	**Ratlam**	Alot			952										**952**
		Jaora		3	788										**790**
		Piploda		10	552										**563**
		Ratlam			1334										**1334**
7	**Satna**	Rampur Baghelan				312	312								**624**
8	**Shajapur**	MomanBadodia			595										**595**
		Nalkheda			558										**558**
		Shujalpur			761										**761**
		Susner			745	0									**746**
9	**Ujjain**	Badnagar			1250										**1250**
		Ghatia			422										**422**
		Ujjain			970										**970**
	Total		**231**	**35**	**19197**	**333**	**370**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**20165**

Area in Sq km

Table 18b: Aquifer Wise Area Under Critical Blocks of Madhya Pradesh (As on 2009)

Sl No	District Name	Blocks	Alluvium	Laterite	Basalt	Sandstone	Shale	Limestone	Granite	Schist	Quartzite	BGC	Gneiss	Intrusives	Block Area
1	**Narsinghpur**	Narsinghpur	479		494	307	23	130		10			16		1459
2	**Satna**	Amarpatan				54	425	50							528
3	**Satna**	Sohawal		5		2	787	479							1273
4	**Shajapur**	Agar		2	678										679
	Total		**479**	**7**	**1172**	**363**	**1235**	**659**	**0**	**10**	**0**	**0**	**16**	**0**	**3940**

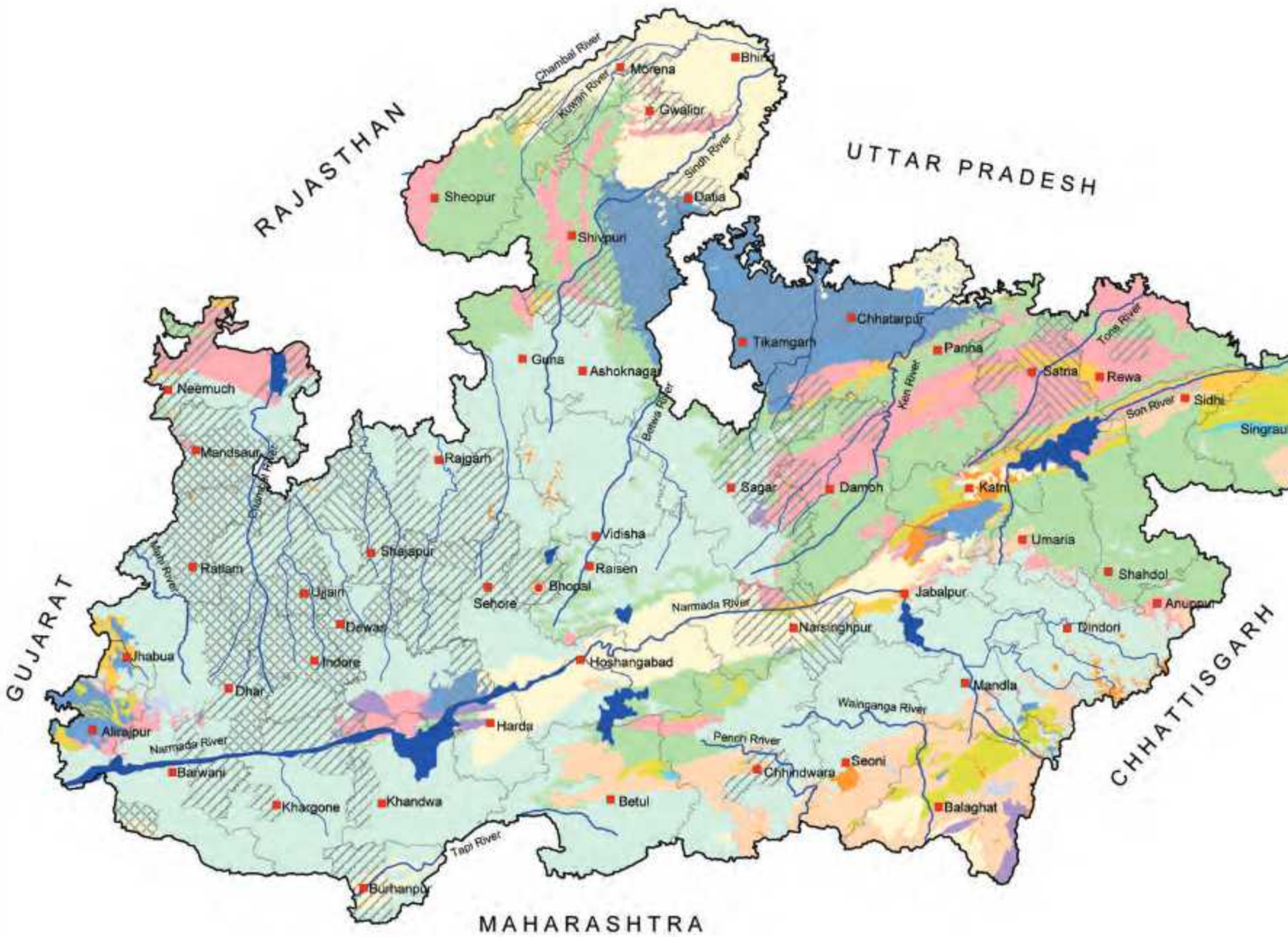
Area in Sq km

CATEGORIZATION OF GROUND WATER ASSESSMENT UNITS

(As on 2009)

0 100 200

kilometers



LEGEND

Category

- Over Exploited
- Critical
- Semi-Critical
- Safe

Aquifers

- Alluvium
- Laterite
- Basalt
- Sandstone
- Shale
- Limestone
- Granite
- Schist
- Quartzite
- Banded Gneissic Complex
- Gneiss
- Intrusives

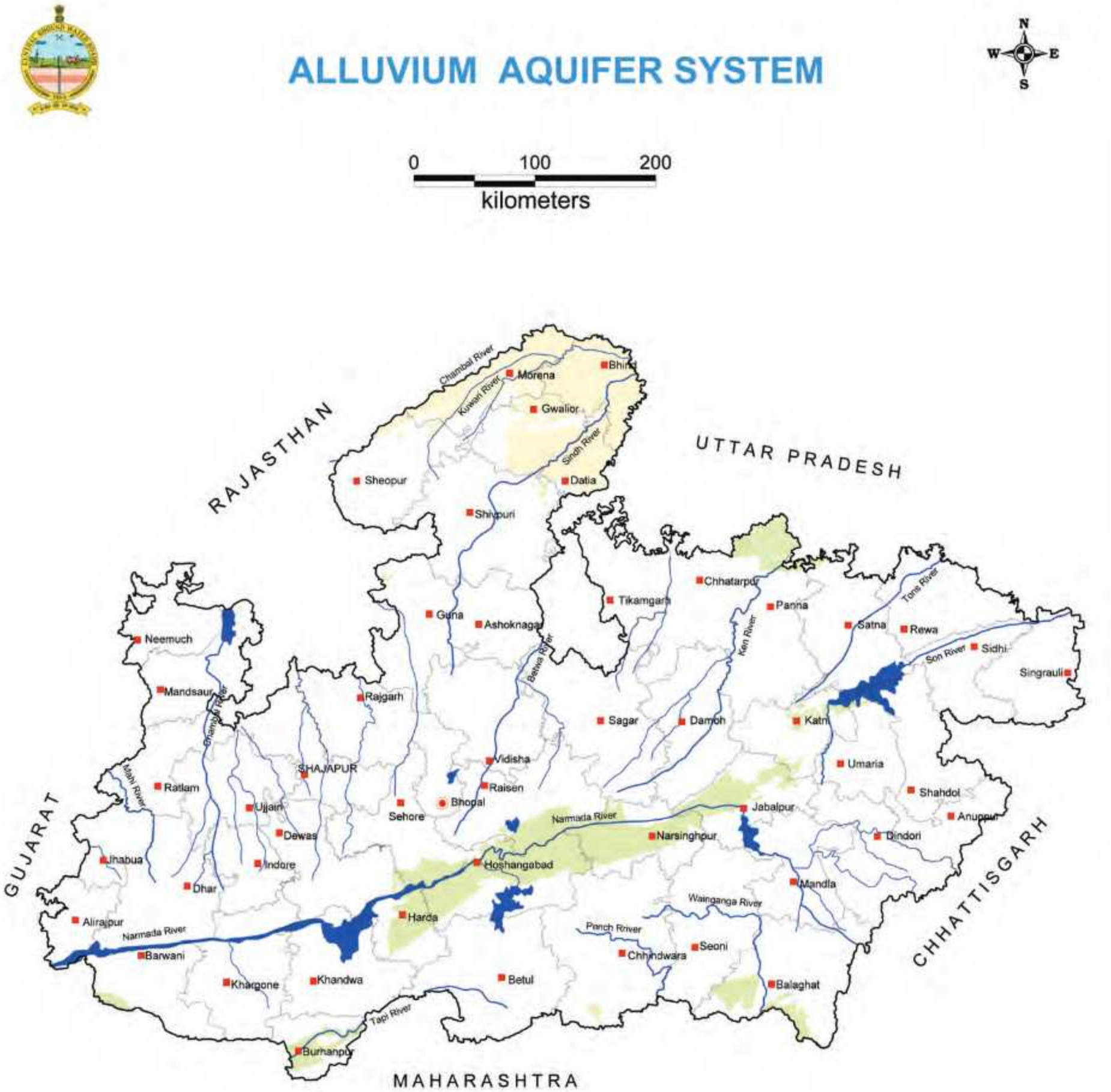
- State Capital
- District Headquarter
- State Boundary
- District Boundary
- River
- Water Body

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

Table 19: District wise Distribution and Characteristics of Alluvium Aquifer System

Sl No	District Name	*Major Aquifers (Area in Sq km)*		*Aquifer Properties*								
		Younger Alluvium	Older Alluvium	Aquifer System	Type of Aquifer	Thickness (m)	Zone Tapped (m bgl)	Depth to Water Level (m bgl)	Transmissivity (m^2/day)	Yield (m^3/day)	Specific Yield (%)	Electrical Conductivity (µS/cm, at 25 °C)
		AL01	AL03									
1	Balaghat	1289										
2	Barwani	256										
3	Bhind		4460	Multiple	Semi-Confined to Confined	55.2 - 185	40-50, 60-75 and 90-120	5.02-35.47	29-6710	54-4670	$1.8X10^{-6}$ to $6.36X10^{-2}$	660-8400
4	Burhanpur	1035		Multiple	Semi-Confined to Confined	105.1 - 220.8	20-30, 60-80 and 90-130	4.80-53.25	5.16-96	9-1365	$1.71X10^{-4}$ to $0.41X10^{-3}$	470-880
5	Chhatarpur	1438										
6	Chhindwara	74										
7	Datia		2210									
8	Gwalior	40	2629	Single	Semi-Confined to Confined	40.0 - 60.0	20-40	3.90-28.7	30-3219	109-4752	$9.5X10^{-4}$ to $3.5X10^{-3}$	823-2920
9	Harda	1405		Single	Semi-Confined	28.00						
10	Hoshangabad	3939		Multiple	Semi-Confined to Confined	24.23 - 160	20-30, 70-80 and 110-130	2.05-25.04	50.8-5100	8-4907	$4.38 X10^{-4}$ to $8.69X10^{-2}$	312-1493
11	Jabalpur	1742		Multiple	Semi-Confined to Confined	52.7 - 103.3	20-30, 50-60 and 80-90	2.62-24.74	17.2-3400	260-4795	$1.69 X10^{-4}$ to $6.70X10^{-2}$	415-1060
12	Katni	580		Multiple	Semi-Confined to Confined	70-0 - 80.0	20-30, 40-50 and 65-75	3.40-12.3	4-127	397-881		
13	Morena		3845	Multiple	Semi-Confined to Confined	83.78 - 164.75	50-70, 90-95 and 100-112	2.02-28.5	470-5465	725-4968	$2.8 X10^{-5}$ to $1.6X10^{-2}$	520-930
14	Narsinghpur	2983		Multiple	Semi-Confined to Confined	33.5 - 199.0	20-30, 70-80 and 110-130	9.5-13.5		17-4527	$2.01 X10^{-6}$ to $9.88X10^{-2}$	458-1468
15	Panna	125										
16	Raisen	1414		Single	Un-Confined to Semi-Confined	34.0 - 46.5	25-40	8.0-8.0	100	1095-2160		647
17	Satna	89										
18	Sehore	1059		Single	Un-Confined to Semi-Confined	47.73 - 47.73	35-45		3309	20-3265	$5.26 X10^{-5}$	618
19	Sheopur		434									
20	Shivpuri	62	45									
21	Umaria	91										
	Total	17621	13623									

ALLUVIUM AQUIFER SYSTEM



LEGEND

Aquifers

- Younger Alluvium (AL01)
- Older Alluvium (AL03)

- State Capital
- District Headquarter
- State Boundary
- District Boundary
- River
- Water Body

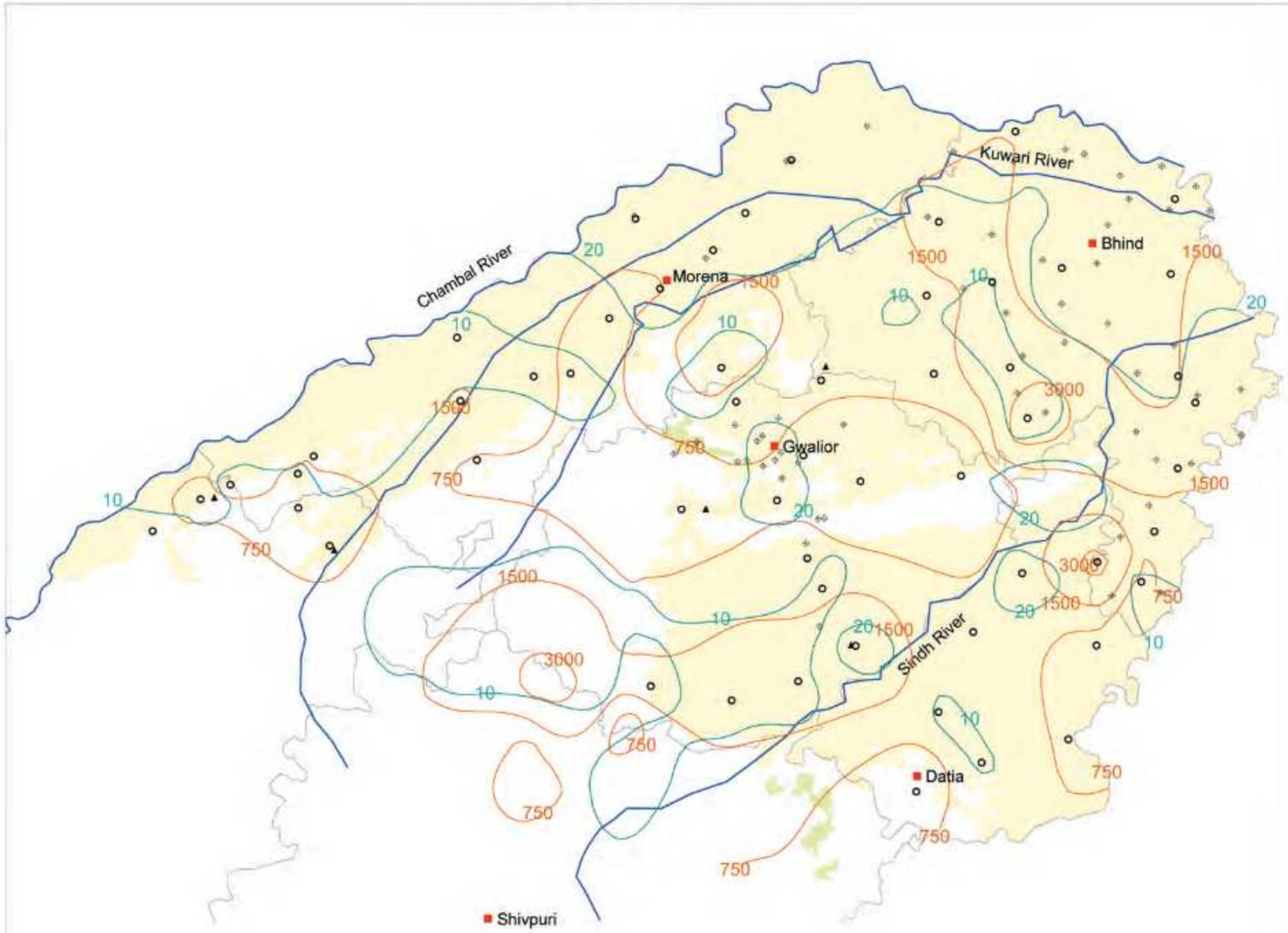
Central Ground Water Board
North Central Region
Ministry of Water Resources
Government of India

ALLUVIUM AQUIFER SYSTEM

(CHAMBAL BASIN)

N
W E
S

0 100 200
kilometers



LEGEND

Aquifers

- Observation Well
- Piezometer
- Exploratory Well
- 10 — Depth to Water Level (m bgl)
- 750 — Electrical Conductivity
- Younger Alluvium (AL01)
- Older Alluvium (AL03)
- District Headquarter
- District Boundary
- River

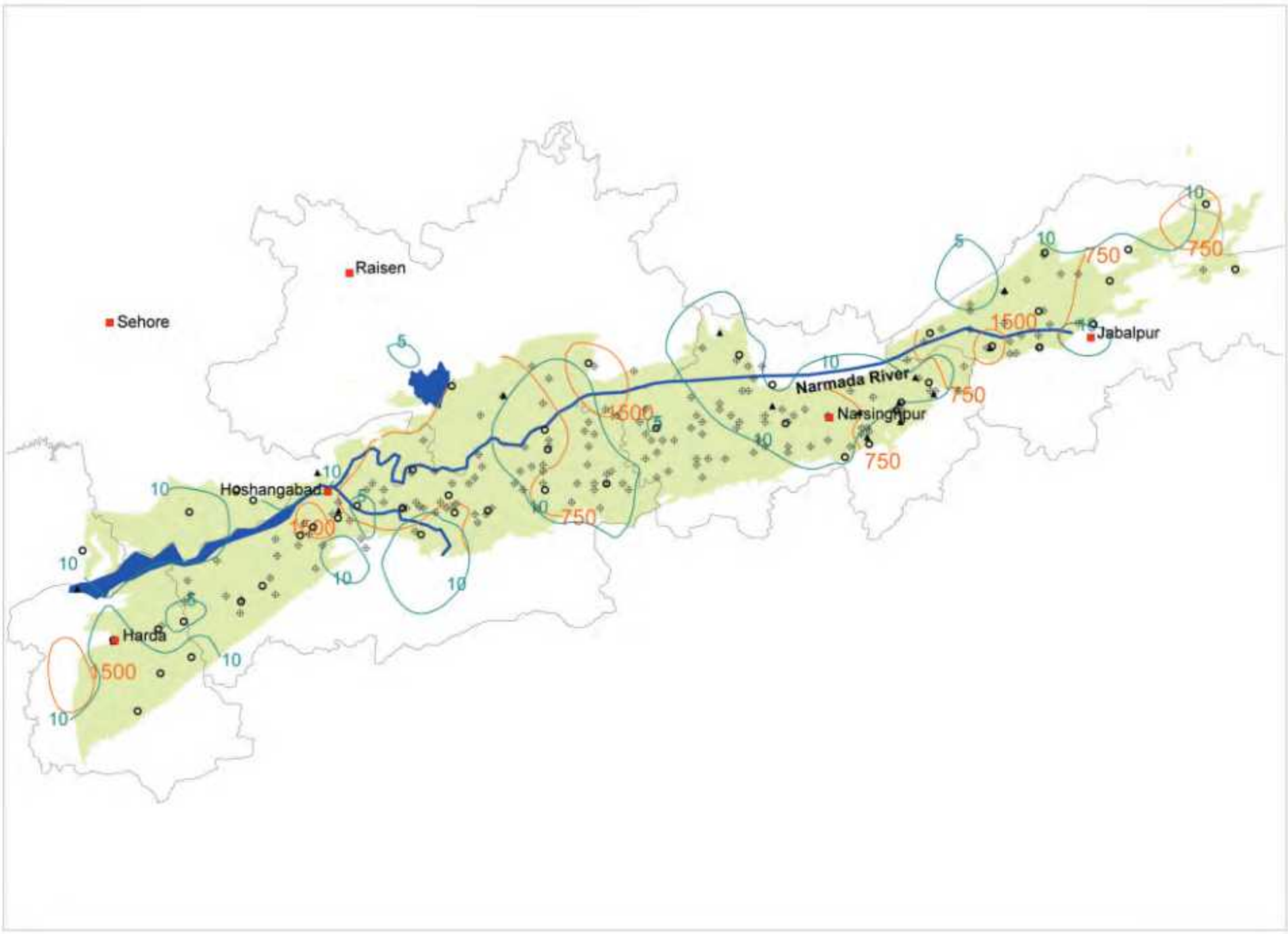
Central Ground Water Board
North Central Region
Ministry of Water Resources
Government of India

ALLUVIUM AQUIFER SYSTEM

(NARMADA BASIN)

0 100 200

kilometers



LEGEND

Aquifers

- Observation Well
- Piezometer
- Exploratory Well
- 10 — Depth to Water Level (m bgl)
- 750 — Electrical Conductivity
- Younger Alluvium (AL01)
- District Headquarter
- District Boundary
- River
- Water Body

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

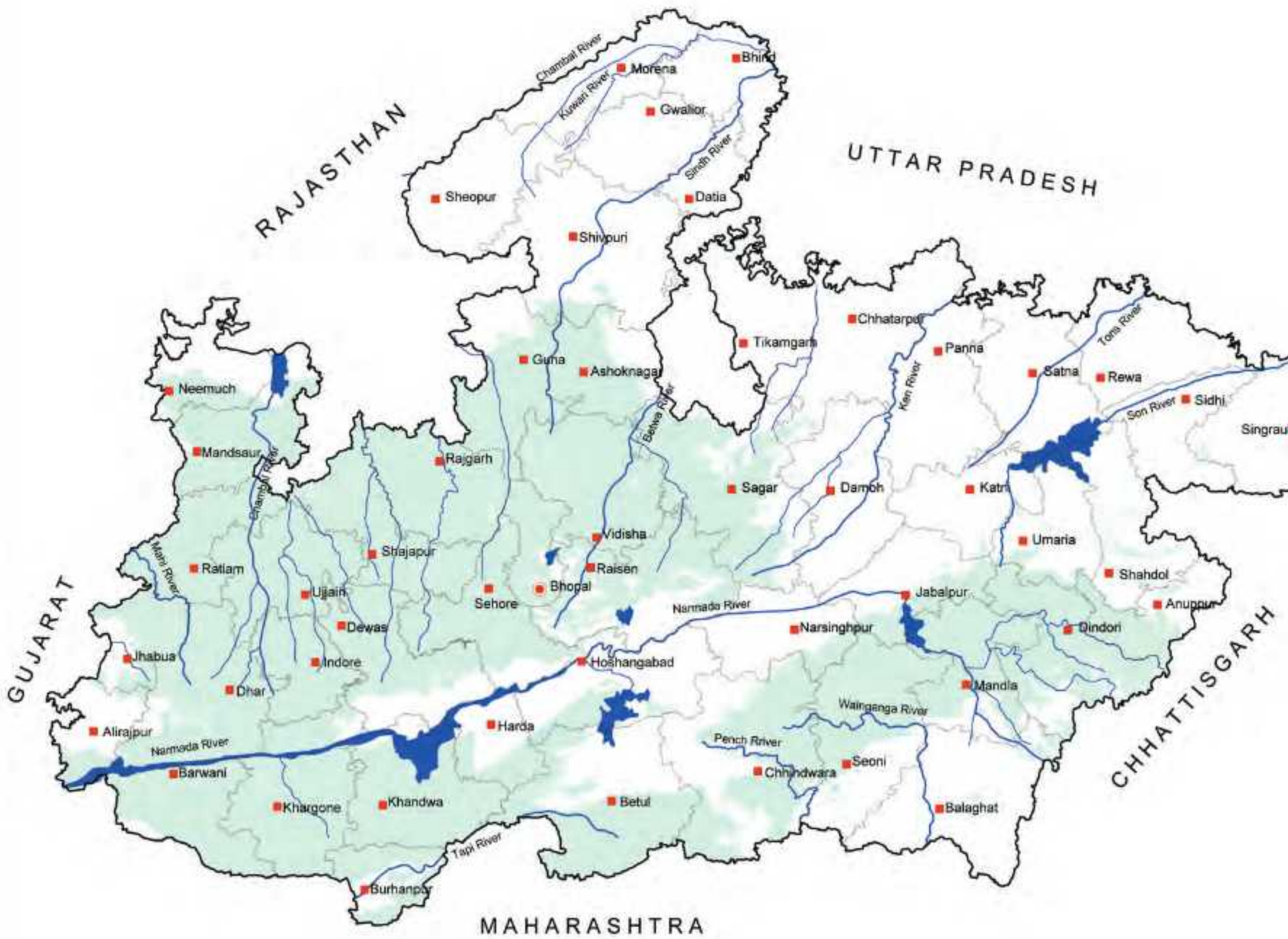
Table 20: District wise Distribution and Characteristics of Basalt Aquifer System

Sl No	District Name	*Major Aquifers (Area in Sq km)*	*Aquifer Properties*								
		Basic Basalt	Aquifer System	Type of Aquifer	Thickness (m)	Zone Tapped (m bgl)	Depth to Water Level (m bgl)	Transmissivity (m^2/day)	Yield (m^3/day)	Specific Yield (%)	Electrical Conductivity (µS/cm, at 25 °C)
		Basalt (BS 01)									
1	Alirajpur	1024	Multiple	Semi-Confined to Confined	65.74-177.0	25-35, 40-50 and 120-130	0.2-22.2	2.4-55.48	26-2385	$5.6X10^{-5}$ to $7.7X10^{-3}$	
2	Anuppur	1975	Multiple	Semi-Confined to Confined	83-150.0	20-30 and 50-60	7.44-39.6		86-2183		193-453
3	Ashoknagar	3442	Multiple	Semi-Confined to Confined	59.9-201.3	35-50, 85-95 and 115-125	8.24-51.4	12.3-50.3	17-994		585-1747
4	Balaghat	361									
5	Barwani	5195	Multiple	Semi-Confined to Confined	61.86-129	35-45 and 120-130	4.24-12.12	7-32.3	9-441		
6	Betul	6281	Multiple	Semi-Confined to Confined	8.25-293.0	30-45, 70-90 and 150-160	2.01-49.7	3.16-553.35	65-1210	$6.5X10^{-5}$ to $1.8X10^{-3}$	617-1458
7	Bhopal	2378	Multiple	Semi-Confined to Confined	91.17-309.46	15-30, 50-60 and 100-110	0.75-47.0	0.24-164.7	17-900	$6.8X10^{-4}$	568-1215
8	Burhanpur	2175	Multiple	Semi-Confined to Confined	93.3-200.8	20-30, 40-50 and 100-110	8.3-18.3	27.7-52	173-886	$8.4X10^{-5}$ to $3.5X10^{-4}$	407-582
9	Chhatarpur	147									
10	Chhindwara	6842	Multiple	Semi-Confined to Confined	24.4-183.3	20-30, 80-90 and 115-125	6.5-88.6		35-705		400-1559
11	Damoh	103									
12	Dewas	4970									
13	Dhar	7562	Multiple	Semi-Confined to Confined	21-153.05	15-25 and 35-50	5.5-14.2	7-182	115-570		666-1339
14	Dindori	5876	Multiple	Semi-Confined to Confined	43.9-202.5	15-25 and 90-100	4.96-25.0	25.00	73-1270		400-1350
15	Guna	4702	Multiple	Semi-Confined to Confined	73.2-193.0	30-40, 70-80 and 170-185	12.1-60.0		216-690		683-930
16	Harda	1390									
17	Hoshangabad	1352									
18	Indore	3925	Multiple	Semi-Confined to Confined	82.5-238.5	20-30 and 45-55	1.48-12.47	0.093-149.6	43-544		
19	Jabalpur	1935	Multiple	Semi-Confined to Confined	112.0-189.0	35-50 and 100-115	3.95-114.7	20-63.5	9-760	$1.29X10^{-4}$ to $5.2X10^{-1}$	446-632
20	Jhabua	2529									
21	Katni	66									
22	Khandwa	6560	Multiple	Semi-Confined to Confined	100.8-301.0	50-70, 85-130 and 190-200	3.06-43.0	11.44-119	89-1503	$1.1X10^{-2}$ to $1.1X10^{-1}$	459-652
23	Khargone	7798	Multiple	Semi-Confined to Confined	61.6-232.45	55-65, 80-85 and 150-160	3.8-13.35	2-250	95-1142	$1.99X10^{-3}$ to $4.78X10^{-3}$	650-720
24	Mandla	5092	Multiple	Semi-Confined to Confined	47.0-182.0	25-35 and 90-100	1.0-29.6		9-2350		390-1451
25	Mandsaur	4709	Multiple	Un-Confined to Semi-Confined	23.0-200.85	25-35, 60-70 and 100-105	6.35-28.38	1.82-149	35-1002	$4.0X10^{-4}$ to $2.4X10^{-2}$	678-5640
26	Narsinghpur	684									
27	Neemuch	1315	Multiple	Semi-Confined to Confined	60.15-120.0	50-65 and 110-120	2.28-4.46		35-181		3950.00
28	Panna	5									
29	Raisen	5387	Multiple	Semi-Confined to Confined	42.25-195.8	50-60 and 100-110	5.04-10.16	17-336	43-821	$3.4X10^{-3}$	
30	Rajgarh	6089	Multiple	Semi-Confined to Confined	29.6-210.3	30-45, 70-80 and 100-115	1.49-44.4	0.15	60-1145	$4.0X10^{-4}$	484-3366
31	Ratlam	4824	Multiple	Semi-Confined to Confined	32.2-301.5	25-35, 80-90 and 120-130	2.67-86.0		9-1045		
32	Sagar	6833	Multiple	Un-Confined to Semi-Confined	85.94-171.33	20-30, 40-50 and 160-170	0.7-4.7	0.32-38	52-260		638-1187
33	Sehore	5472	Multiple	Semi-Confined to Confined	116.5-290.41	15-25 and 35-45	7.8-7.8	0.94	100-300		842.00
34	Seoni	5751									
35	Shahdol	409									
36	Shajapur	6291									
37	Shivpuri	659									
38	Sidhi	12									
39	Singrauli	58									
40	Ujjain	6098	Multiple	Semi-Confined to Confined	116.6-203.6	20-30, 70-80 and 115-125	2.75-61.3	1--32	26-873		403-1760
41	Umaria	617									
42	Vidisha	7096	Multiple	Semi-Confined to Confined	85.71-241.61	25-35, 70-80 and 100-110	4.7-24.93	2.07-107.2	153-720	$1.6X10^{-3}$ to $4.68X10^{-4}$	219-3129
	Total	**145987**									

BASALT AQUIFER SYSTEM

N
W E
S

0 100 200
kilometers



LEGEND

Aquifers

- Basalt (BS01)

- State Capital
- District Headquarter
- State Boundary
- District Boundary
- River
- Water Body

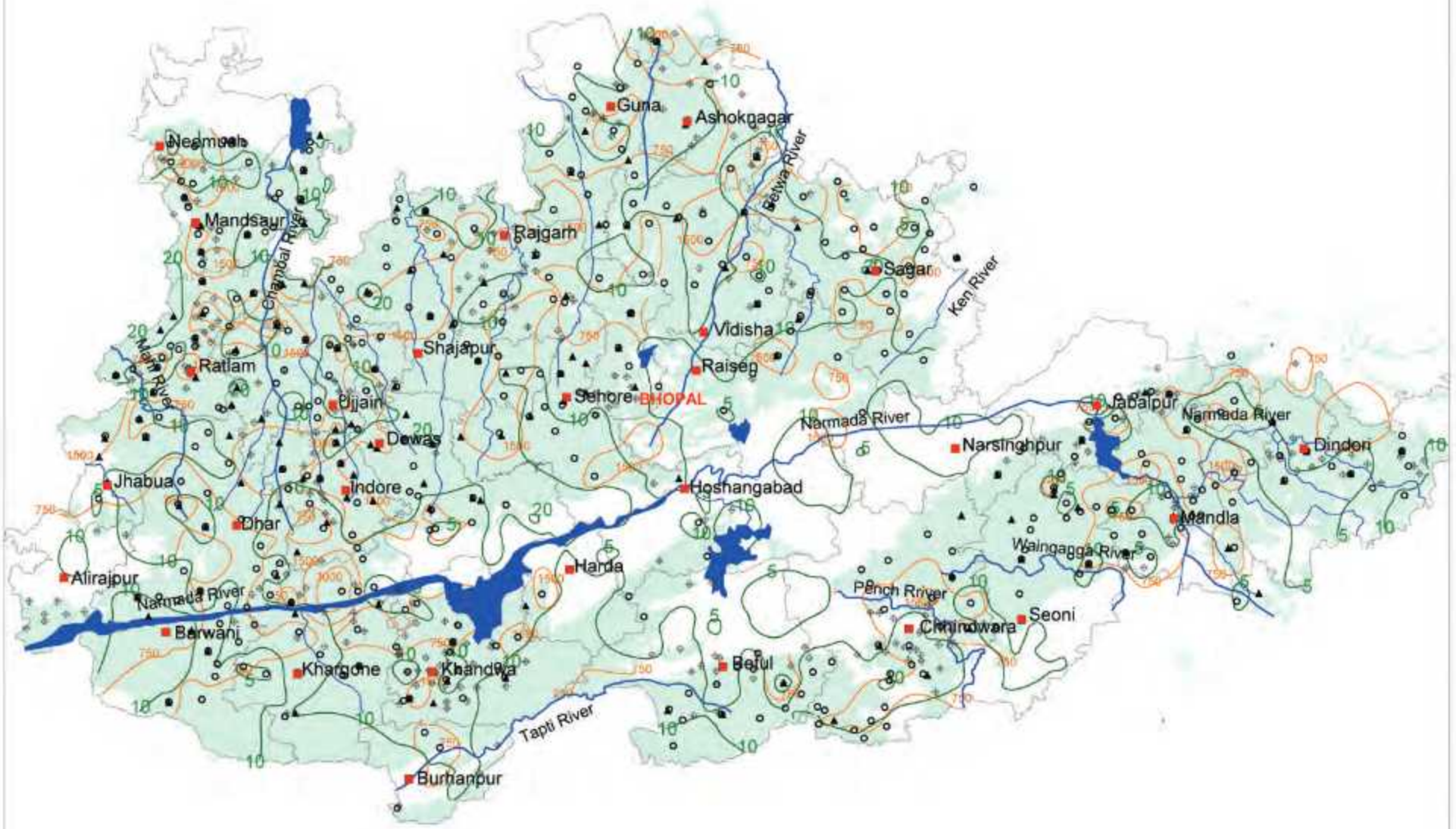
Central Ground Water Board
North Central Region
Ministry of Water Resources
Government of India

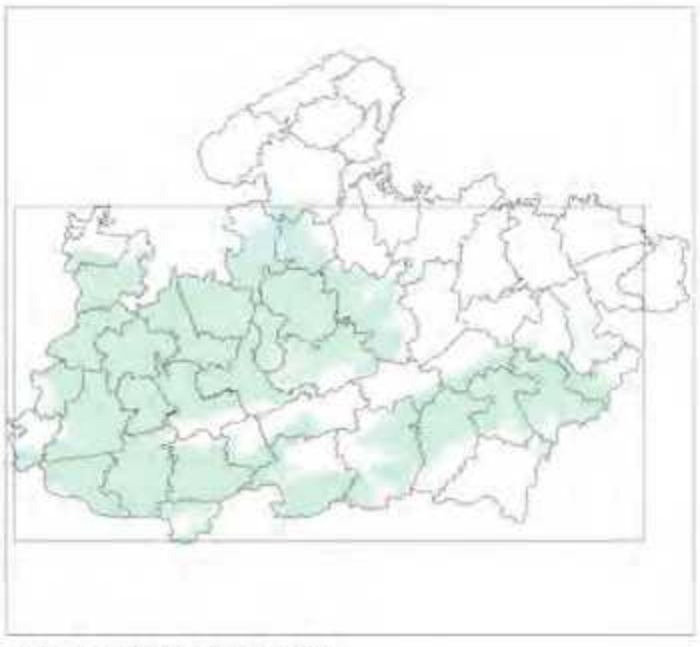
BASALT AQUIFER SYSTEM

(Malwa Plateau and Satpura Area)

0 100 200

kilometers





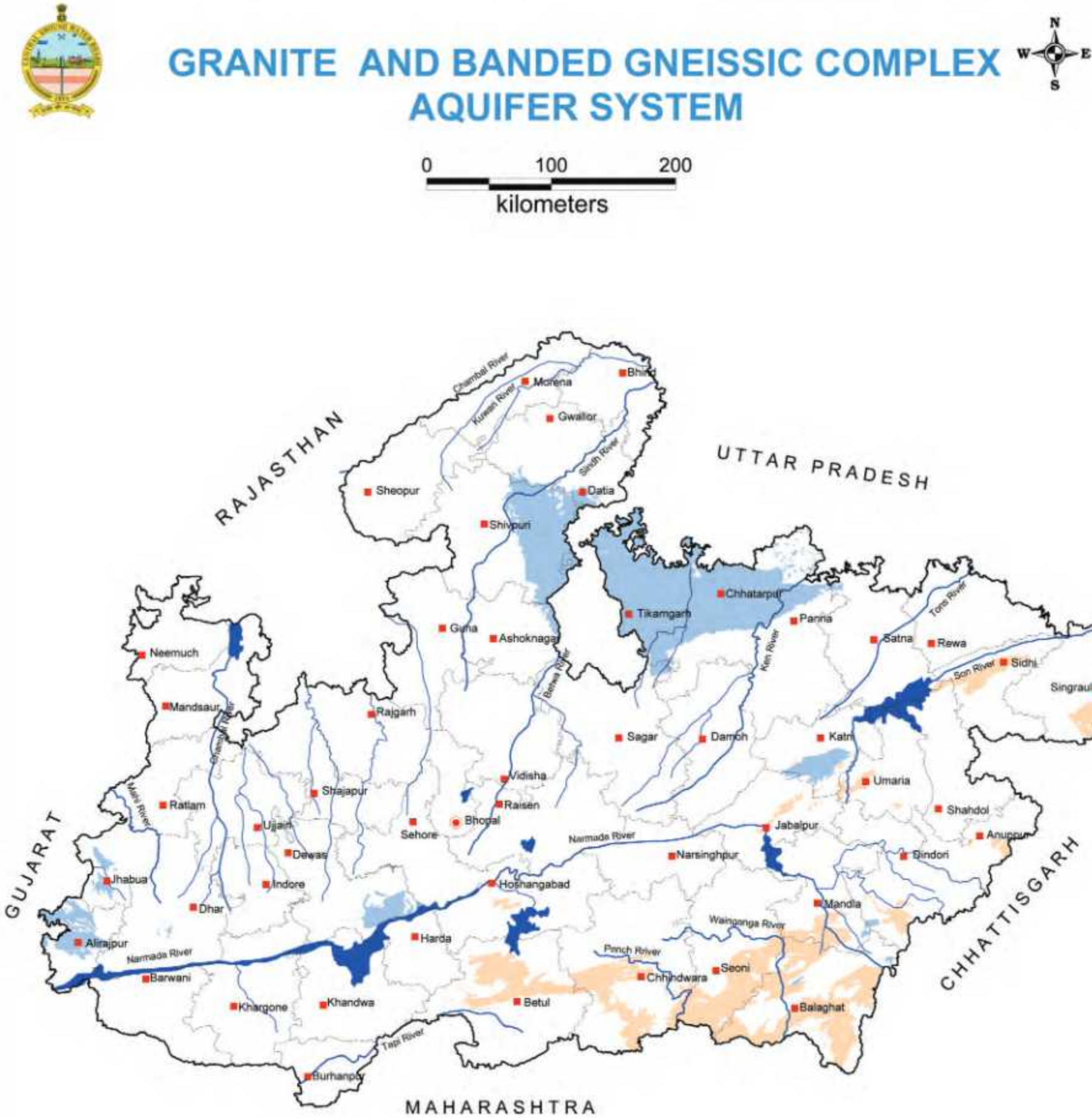
LEGEND

Aquifers

- Basalt (BS01)
- Observation Well
- Piezometer
- Exploratory Well
- 10 — Depth to Water Level (m bgl)
- 750 — Electrical Conductivity
- District Headquarter
- District Boundary
- River
- Water Body

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

GRANITE AND BANDED GNEISSIC COMPLEX AQUIFER SYSTEM



LEGEND

Aquifers

- Granite (GR02)
- Banded Gneissic Complex (BG01)

- State Capital
- District Headquarter
- State Boundary
- District Boundary
- River
- Water Body

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

Table 21: District wise Distribution and Characteristics of Banded Gniessic Complex and Granite Aquifer System

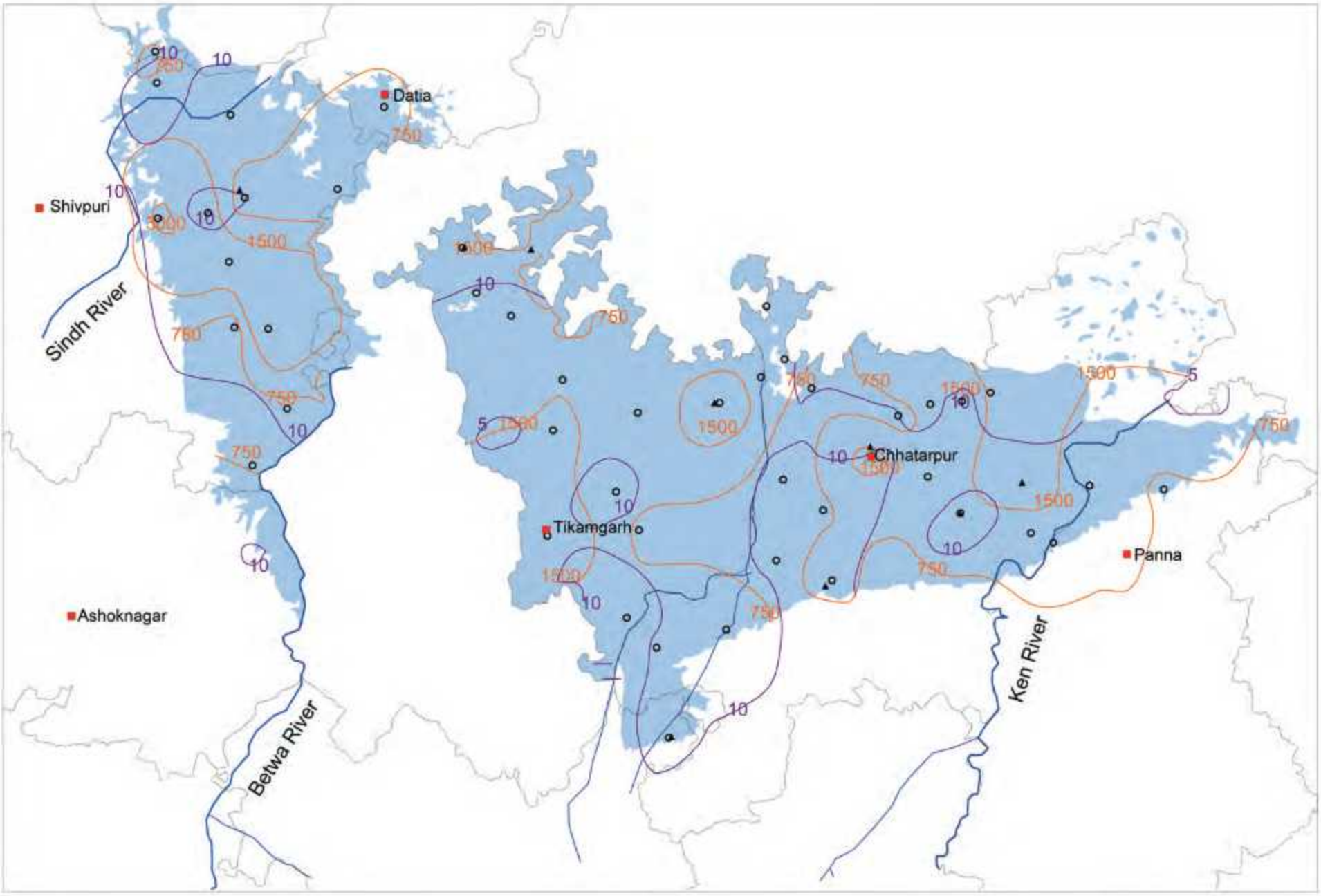
Sl No	District Name	*Major Aquifers (Area in Sq km)*		*Aquifer Properties*								
		BGC	Granite	Aquifer System	Type of Aquifer	Thickness (m)	Zone Tapped (m bgl)	Depth to Water Level (m bgl)	Transmissivity (m^2/day)	Yield (m^3/day)	Specific Yield (%)	Electrical Conductivity (µS/cm, at 25 °C)
		BG01	GR02									
1	Alirajpur	115	1242									
2	Anuppur	185										
3	Ashoknagar		208									
4	Balaghat	4441	61									
5	Betul	1913		Multiple	Unconfined to Semi-Confined	49.8-305.1	15-25, 150-160 and 250-260	8.8-36.2	3.4-23.08	19-1382	$6.25X10^{-5}$ to $9.1X10^{-4}$	456-926
6	Chhatarpur		4869									
7	Chhindwara	2249		Multiple	Unconfined to Semi-Confined	162-201.3	20-30, 40-50 and 80-90	3.25-15.8		17-346		648-922
8	Datia		241									
9	Dewas		745									
10	Dhar		28									
11	Dindori	370	63									
12	Gwalior		114									
13	Hoshangabad	111		Multiple	Unconfined to Semi-Confined	32-103.48	40-50 and 60-70	7.72-7.72	136-210	500-1089	$1.95X10^{-4}$ to $2.1X10^{-2}$	654
14	Jabalpur		197									
15	Katni	55	807	Multiple	Unconfined to Semi-Confined	183-183		2.7-2.7		50-75		594
16	Mandla	771	29	Multiple	Unconfined to Semi-Confined	142.45-201.5	25-30 and 80-90	6.2-6.2		43-75		
17	Narsimhapur	14										
18	Panna		623									
19	Sagar		169									
20	Satna		51									
21	Sehore		26									
22	Seoni	2573										
23	Shivpuri		3670	Single	Unconfined to Semi-Confined	124.4-203.5	20-30	2.7-12.9	0.29-5.7	17-294		310-1610
24	Sidhi	753		Single	Unconfined to Semi-Confined	145.5-145.5	20-31	26.0-26.0		30-60		
25	Singrauli	685										
26	Tikamgarh		5070									
27	Umaria	309										
	Total	**14545**	**18214**									

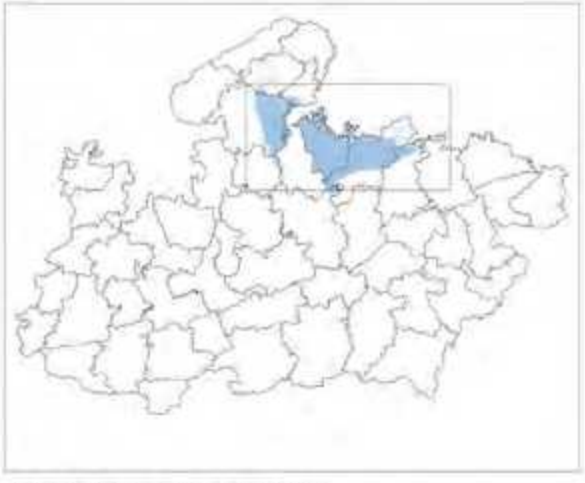
GRANITE AQUIFER SYSTEM

(Bundelkhand Area)

N
W E
S

0 100 200
kilometers





LEGEND

Aquifers

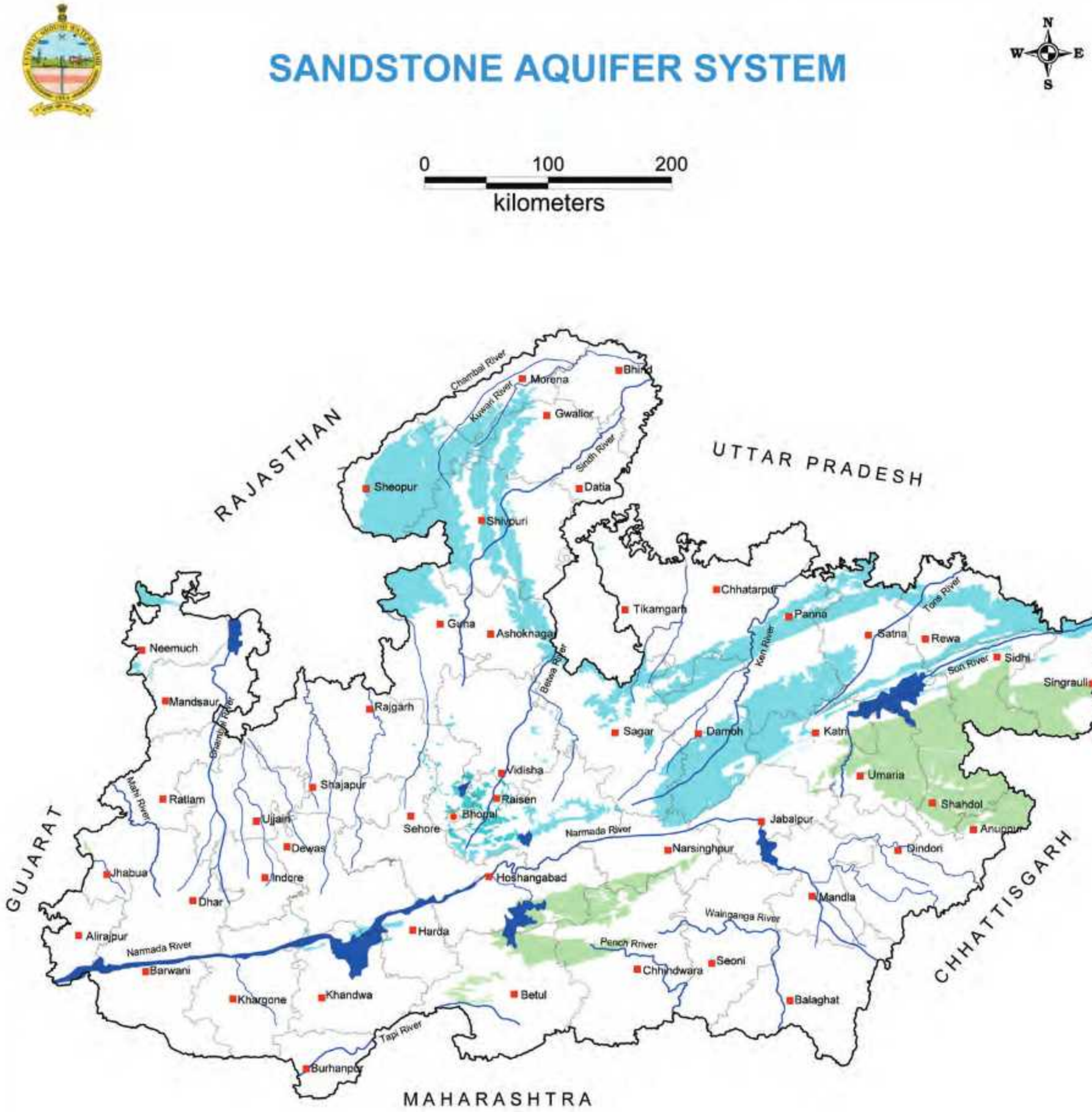
- Observation Well
- Piezometer
- Exploratory Well
- 10 — Depth to Water Level (m bgl)
- 750 — Electrical Conductivity
- Granite
- State Capital
- District Headquarter
- District Boundary
- River

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

Table 22: District wise Distribution and Characteristics of Sandstone Aquifer System

Sl No	District Name	*Major Aquifers (Area in Sq km)*				*Aquifer Properties*								
		Sandstone / Conglomerate	Sandsone with Shale	Sandstone / Conglomerate	Sandstone with Shale	Aquifer System	Type of Aquifer	Thickness (m)	Zone Tapped (m bgl)	Depth to Water Level (m bgl)	Transmissivity (m^2/day)	Yield (m^3/day)	Specific Yield (%)	Electrical Conductivity (µS/cm, at 25 °C)
		ST01	ST02	ST05	ST06									
1	Anuppur		1122			Multiple	Semi-Confined to Confined	90.4-232.0	35-50, 60-70 and 100-115	12.36-13.65		217-1210		122
2	Ashoknagar			1035		Multiple	Semi-Confined to Confined	158.5-201.3	20-30 and 130-150	12.95-21.8		156-354		1114
3	Betul		1298	12		Multiple	Semi-Confined to Confined	103.89-292.8	50-60, 115-125 and 280-290	3.25-41.9		35-283		540
4	Bhopal				318	Multiple	Semi-Confined to Confined	112.9-305.0	25-45, 60-70 and 80-90	14.6-14.6				
5	Chhatarpur			991										
6	Chhindwara		1888											
7	Damoh			4399										
8	Dewas		7	87										
9	Guna			1385										
10	Gwalior			1014										
11	Harda			120										
12	Hoshangabad		1326			Single	Un-Confined to Semi-Confined	108.5-108.5	20-30	10.61-10.61	655	500-909	$6.55X10^{-2}$	1082
13	Jabalpur		20	34										
14	Jhabua		36											
15	Katni	21	650	1164		Multiple	Semi-Confined to Confined	82.0-94.5	15-30, 50-60 and 70-80	9.31-12.85	5-1075	130-1358		422
16	Khandwa			239										
17	Khargone			8										
18	Mandsaur			31		Multiple	Semi-Confined to Confined	183.0-189.1	15-30 and 40-50	6.16-9.87		50-58		815-881
19	Morena			957										
20	Narsinghpur		508	193										
21	Neemuch			375										
22	Panna			3809										
23	Raisen			937	704	Multiple	Semi-Confined to Confined	125.38-125.38	50-60					
24	Rajgarh			1	8									
25	Rewa			2561		Multiple	Semi-Confined to Confined	67.0-154.0	15-30 and 70-90	4.39-7.83		60-118		
26	Sagar			2177										
27	Satna			2610		Single	Un-Confined to Semi-Confined	215.3-215.3	20-30	18.4				
28	Sehore			4	28									
29	Shahdol		4496	39		Multiple	Semi-Confined to Confined	88.85-303.0	20-40, 130-140 and 210-240	0.2-32.4	3.54-98.75	36-1354	$1.2X10^{-4}$	
31	Sheopur			4960										
32	Shivpuri			4238		Multiple	Semi-Confined to Confined	148.6-203.4	20-30, 50-70 and 170-180	5.4-53.0	0.94-30	9-242		659-1681
33	Sidhi		2418	447		Multiple	Semi-Confined to Confined	83-301.5	20-40, 130-140 and 210-240	3.1-19.5	7.579-152.42	4-886		
34	Singrauli		2095	443										
35	Tikamgarh			8										
36	Umaria		2935	7		Multiple	Semi-Confined to Confined	118.2-251.69	20-40, 130-140 and 210-240	0.4-24.6		112-441		104-813
37	Vidisha			49	57									
	Total	**21**	**18798**	**34334**	**1116**									

SANDSTONE AQUIFER SYSTEM



LEGEND

Aquifers

- Sandstone (ST01)
- Sandstone with shale (ST 02)
- Sandstone (ST05)
- Sandstone with shale (ST06)

- State Capital
- District Headquarter
- State Boundary
- District Boundary
- River
- Water Body

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

SANDSTONE AQUIFER SYSTEM

(Vindhya and Satpura Area)

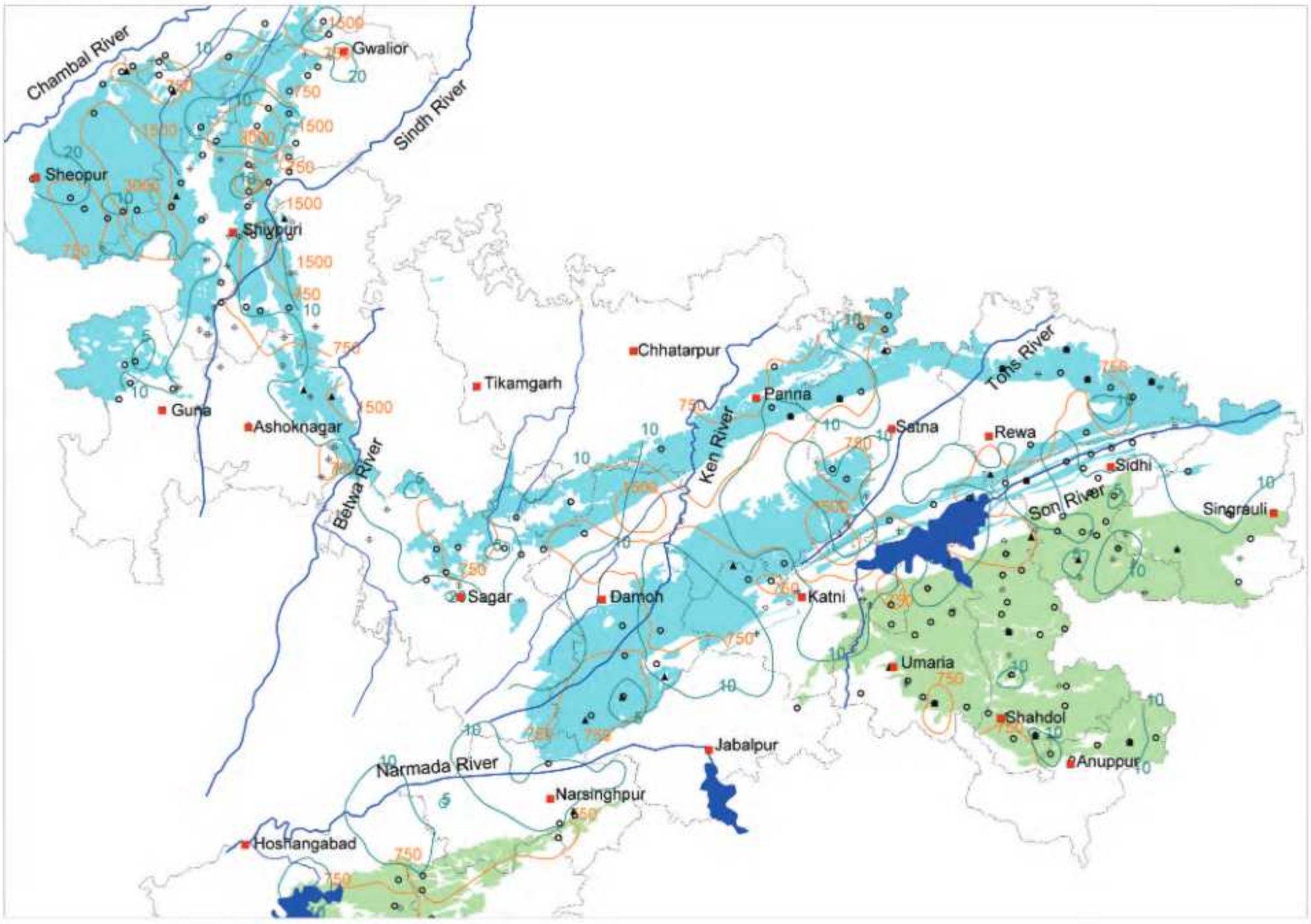
0 100 200

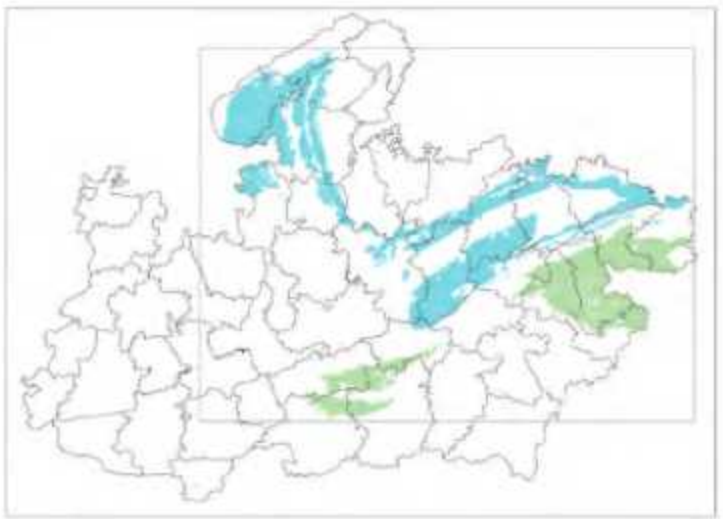
kilometers

N

W E

S





LEGEND

- Observation Well
- Piezometer
- Exploratory Well
- 20 — Depth to Water Level (m bgl)
- 750 — Electrical Conductivity

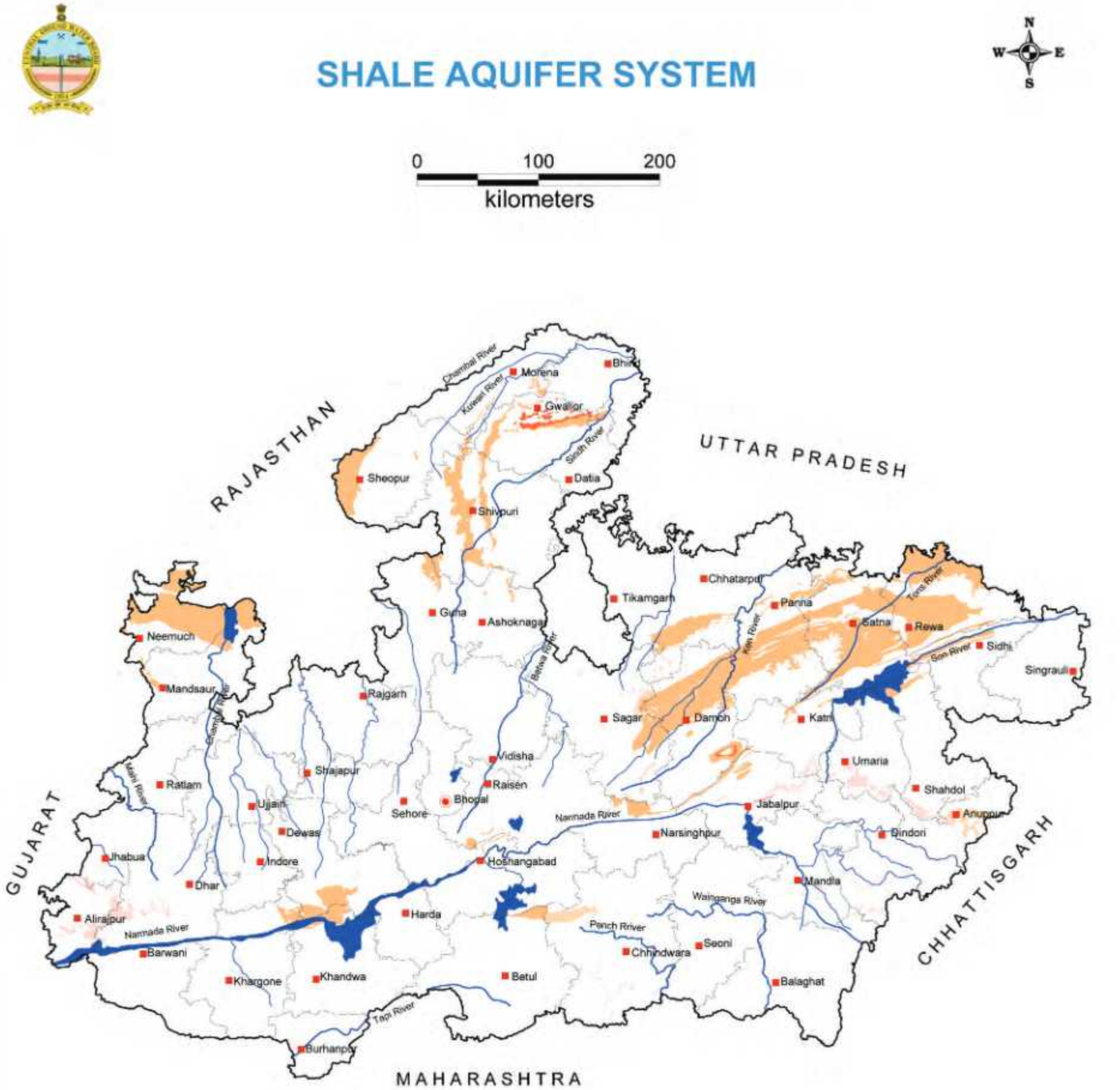
Aquifers

- Sandstone with shale (ST02)
- Sandstone (ST05)

- State Capital
- District Headquarter
- District Boundary
- River
- Water Body

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

SHALE AQUIFER SYSTEM



LEGEND

Aquifers

- Shale with sandstone (SH02)
- Shale, limestone and sandstone (SH03)
- Shale (SH04)
- Shale/Shale with sandstone (SH05)
- Shale with limestone (SH06)

- State Capital
- District Headquarter
- State Boundary
- District Boundary
- River
- Water Body

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

Table 23: District wise Distribution and Characteristics of Shale Aquifer System

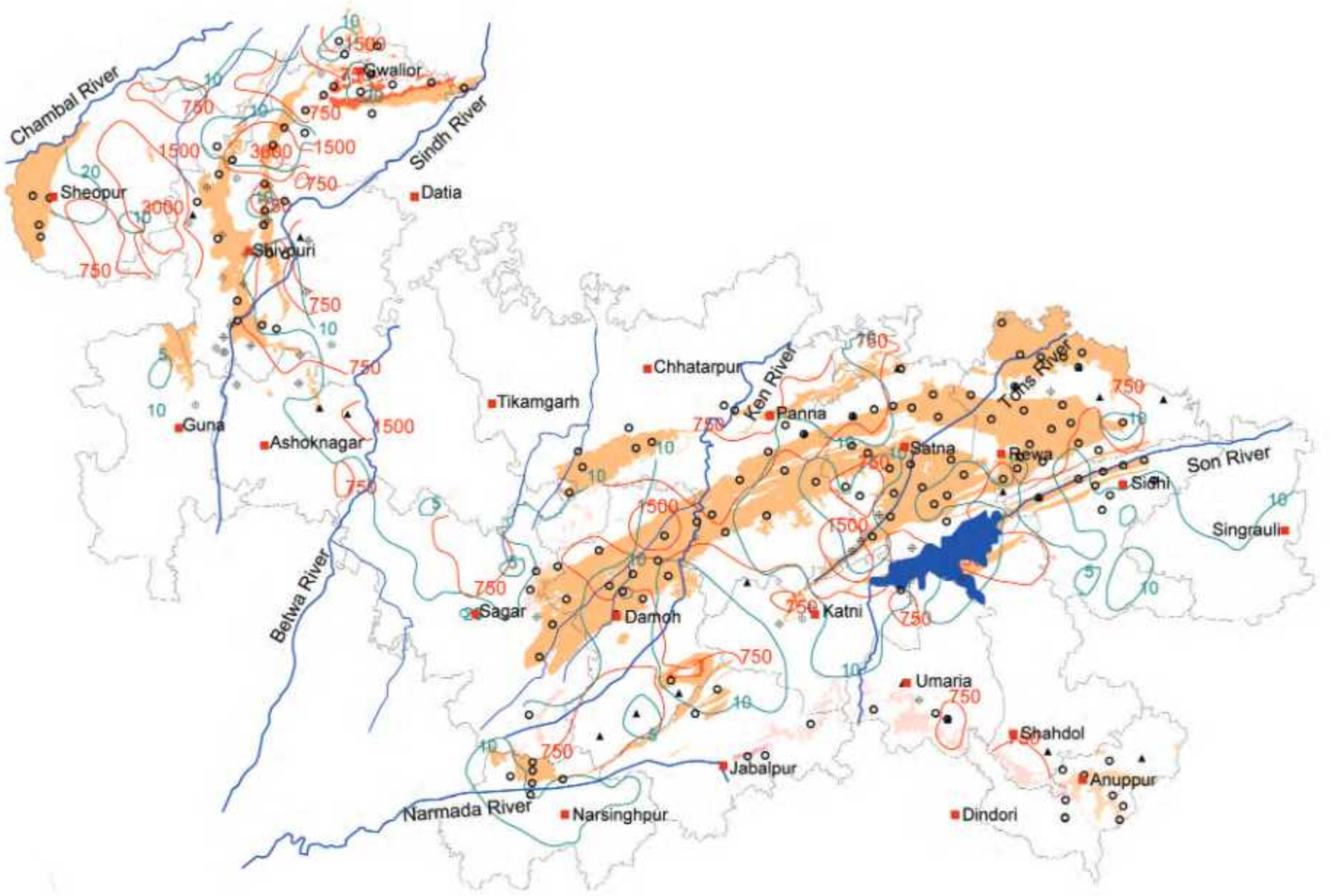
Sl No	District Name	*Major Aquifers (Area in Sq km)*					*Aquifer Properties*								
		Shale with Sandstone	Shale, Limestone and Sandstone	Shale	Shale/ Shale with Sandstone	Shale with Limestone	Aquifer System	Type of Aquifer	Thickness (m)	Zone Tapped (m bgl)	Depth to Water Level (m bgl)	Transmissivity (m^2/day)	Yield (m^3/day)	Specific Yield (%)	Electrical Conductivity (µS/cm, at 25 °C)
		SH02	SH03	SH04	SH05	SH06									
1	Alirajpur		422				Multiple	Unconfined to Semi-confined	134.2-188.8	45-60 and 180-185	2.4-3.47		14-1676		
2	Anuppur		15	425			Multiple	Unconfined to Semi-confined	166.8-166.8	35-45, 85-95 and 100-108			10-22		950
3	Ashoknagar				52										
4	Balaghat		12												
5	Betul				205										
6	Bhind					14									
7	Chhatarpur		35		786										
8	Chhindwara		86	352											
9	Damoh		4	89	2736	48									
10	Datia					77									
11	Dewas				615										
12	Dhar		332												
13	Dindori		111												
14	Guna				211										
15	Gwalior				488	283	Multiple	Unconfined to Semi-confined	201.3-300.0	30-35, 45-50 and 120-130	25.9-45.2		622-1244		511-918
16	Jabalpur	33	138		232										
17	Jhabua		48												
18	Katni		167		127		Single	Unconfined to Semi-confined	70.1-70.1	50-70	6.16-6.16	13.00	600-1270	$0.24X10^{-2}$	
19	Khandwa				586										
20	Khargone				191										
21	Mandla		43												
22	Mandsaur				866										
23	Morena				115										
24	Narsinghpur				308										
25	Neemuch			12	2268										
26	Panna				2307										
27	Raisen				75										
28	Rewa		196	55	3273		Multiple	Unconfined to Semi-confined	63.0-109.0	25-30 and 60-70	12.5-23.42		48-709		
29	Sagar		10		916		Multiple	Unconfined to Semi-confined	50.1-185.0	20-30 and 50-70	5.59-11.69	746	57-1470	$1.1X10^{-3}$	500-4050
30	Satna				3521		Multiple	Unconfined to Semi-confined	50.8-203.3	20-30, 50-70 and 80-100	2.83-29.8	2.51-70	13-260		320-3200
31	Sehore				25										
32	Shahdol		517												
33	Sheopur				1049										
34	Shivpuri				1504		Multiple	Unconfined to Semi-confined	101.0-203.0	20-30, 70-80 and 108-116	3.1-28.4	0.34-119	22-1382		301-1482
35	Sidhi				393										
36	Umaria		379												
	Total	**33**	**2516**	**933**	**22848**	**422**									

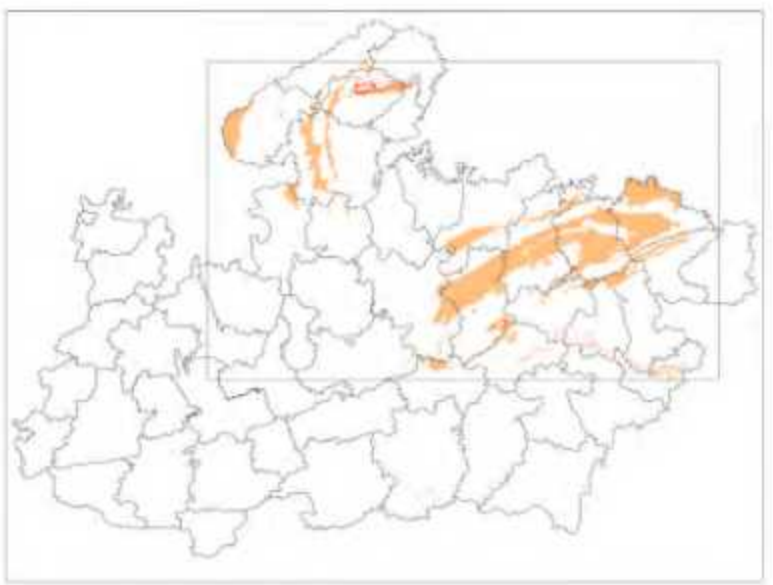
SHALE AQUIFER SYSTEM

(Vindhya and Satpura Area)

0 100 200

kilometers





LEGEND

Aquifers

- Shale with sandstone (SH02)
- Shale, limestone and sandstone (SH03)
- Shale (SH04)
- Shale/Shale with sandstone (SH05)
- Shale with limestone (SH06)

- Observation Wells
- Piezometer
- Exploratory Well
- 20 — Depth to Water Level (m bgl)
- 750 — Electrical Conductivity

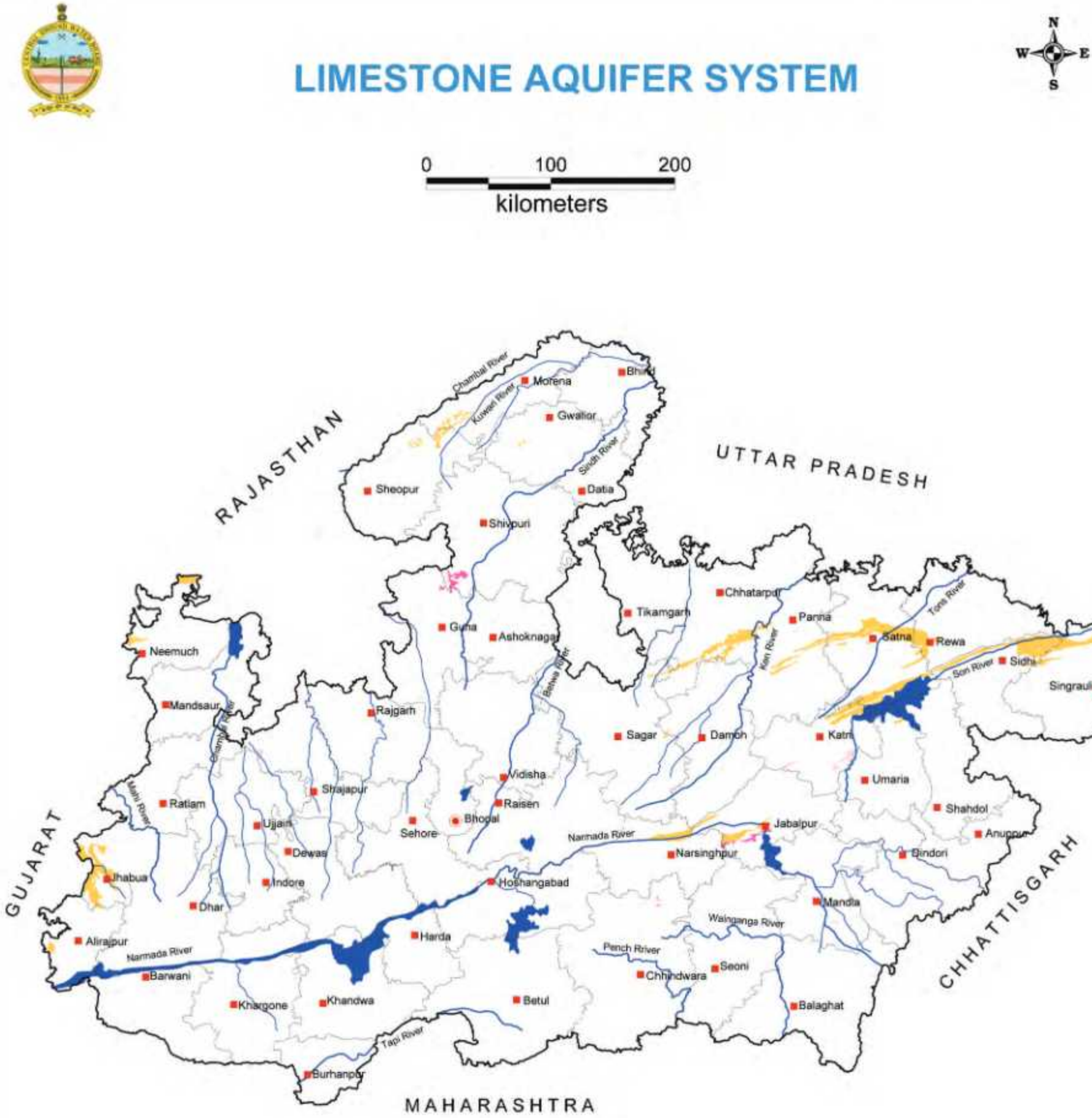
- State Capital
- District Headquarte
- District Boundary
- River
- Water Body

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

Table 24: District wise Distribution and Characteristics of Limestone Aquifer System

Sl No	District Name	*Major Aquifes(Area in Sq km)*			*Aquifer Properties*								
		Limestone/Dolomite (Semi-Consolidated)	Limestone/Dolomite (Consolidated)	Marble	Aquifer System	Type of Aquifer	Thickness (m)	Zone Tapped (m bgl)	Depth to Water Level (m bgl)	Transmissivity (m^2/day)	Yield (m^3/day)	Specific Yield (%)	Electrical Conductivity (µS/cm, at 25 °C)
		LS02	LS03	LS05									
1	Alirajpur		56										
2	Chhatarpur		390										
3	Chhindwara	5											
4	Damoh		26										
5	Guna	14											
6	Gwalior		9										
7	Jabalpur	87	207		Multiple	Unconfined to Semi-confined	58.52-58.52	20-30 and 40-50	7.77-7.77	3000	1580-3485	$3.0x10^{-3}$	
8	Jhabua		549										
9	Katni		232	96	Multiple	Unconfined to Semi-confined	59.2-59.2	15-25 and 40-55	8.05-8.05	993	1000-1580		
10	Mandla			6									
11	Morena		78										
12	Narsinghpur		201										
13	Neemuch		170										
14	Panna		189										
15	Rewa		237		Multiple	Unconfined to Semi-confined	108.0-108.0	30-40 and 85-105	12.53-12.53		215-513		
16	Sagar		29										
17	Satna		1180		Multiple	Unconfined to Semi-confined	124.0-203.3	15-20 and 30-40	6.93-6.93	150	600-1270	$1.17x10^{-3}$	683
18	Shahdol		7										
19	Sheopur		88										
20	Shivpuri	103											
21	Sidhi		679		Multiple	Unconfined to Semi-confined	39.08-42	20-30. 85-95 and 125-150	12.69-13.96	1164.76	156-985	$12.8x10^{-4}$	
22	Singrauli		350										
23	Umaria		18										
	Total	**209**	**4695**	**102**									

LIMESTONE AQUIFER SYSTEM



LEGEND

Aquifers

- Limestone/Dolomite(LS02) (Semi-consolidated)
- Limestone/Dolomite (LS03) (Consolidated)
- Marble (LS05)

- State Capital
- District Headquarter
- State Boundary
- District Boundary
- River
- Water Body

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

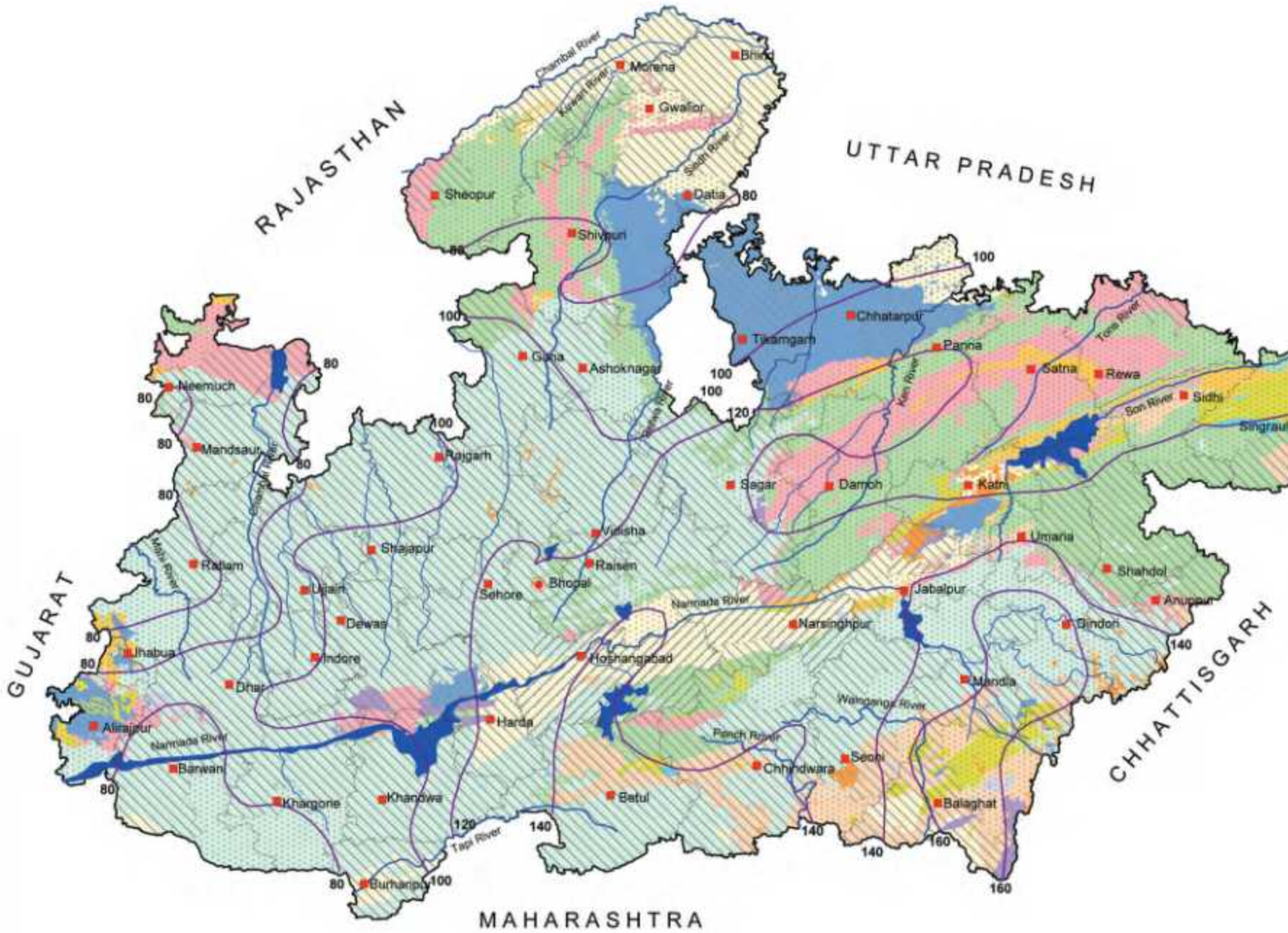
Table 25: District wise and Aquifer wise Annual Replenishable Ground Water Recharge (m/yr)

Sl No	District Name	Alluvium		Laterite		Basalt		Sandstone		Shale		Limestone		Granite		Schist		Quartzite		BGC		Gneiss		Intrusives			
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
1	Alirajpur					0.07	0.074							0.056	0.083	0.069	0.069									0.056	0.083
2	Anuppur					0.106	0.106	0.164	0.187	0.131	0.131															0.106	0.187
3	Ashoknagar					0.084	0.107	0.075	0.075																	0.075	0.107
4	Balaghat	0.102	0.18															0.096	0.096	0.098	0.193					0.096	0.193
5	Barwani					0.077	0.121																			0.077	0.121
6	Betul					0.129	0.188	0.107	0.145											0.112	0.139					0.107	0.188
7	Bhind	0.12	0.225																							0.12	0.225
8	Bhopal					0.125	0.125	0.136	0.136																	0.125	0.136
9	Burhanpur	0.126	0.133																							0.126	0.133
10	Chhatarpur	0.083	0.086							0.079	0.092			0.085	0.104											0.079	0.104
11	Chhindwara					0.099	0.212	0.166	0.166											0.131	0.165					0.099	0.212
12	Damoh							0.052	0.081	0.077	0.097															0.052	0.097
13	Datia	0.158	0.176											0.077	0.077											0.077	0.176
14	Dewas					0.11	0.195							0.157	0.157											0.11	0.195
15	Dhar					0.109	0.21															0.102	0.102			0.102	0.21
16	Dindori					0.08	0.107																			0.08	0.107
17	Guna					0.106	0.14	0.115	0.115																	0.106	0.14
18	Gwalior	0.097	0.217					0.066	0.066																	0.066	0.217
19	Harda	0.106	0.248					0.17	0.17																	0.106	0.248
20	Hoshangabad	0.251	0.62			0.257	0.257																			0.251	0.62
21	Indore					0.119	0.183																			0.119	0.183
22	Jabalpur	0.133	0.263	0.116	0.116	0.062	0.088					0.213	0.213					0.109	0.109							0.062	0.263
23	Jhabua					0.062	0.091					0.049	0.05													0.049	0.091
24	Katni	0.055	0.091					0.08	0.086	0.077	0.077					0.065	0.065									0.055	0.091
25	Khandwa					0.118	0.156	0.115	0.115																	0.115	0.156
26	Khargone					0.086	0.121											0.115	0.115							0.086	0.121
27	Mandla					0.082	0.115									0.103	0.103									0.082	0.115
28	Mandsaur	0.116	0.116			0.113	0.122																			0.113	0.122
29	Morena	0.142	0.193					0.121	0.121																	0.121	0.193
30	Narsinghpur	0.221	0.313																							0.221	0.313
31	Neemuch					0.122	0.122			0.066	0.157															0.066	0.157
32	Panna							0.074	0.08	0.056	0.07			0.112	0.112											0.056	0.112
33	Raisen	0.093	0.093			0.121	0.171																			0.093	0.171
34	Rajgarh					0.137	0.153																			0.137	0.153
35	Ratlam					0.077	0.214																			0.077	0.214
36	Rewa							0.081	0.087	0.076	0.104															0.076	0.104
37	Sagar					0.096	0.175	0.118	0.118	0.09	0.09															0.09	0.175
38	Satna							0.055	0.055	0.072	0.099	0.073	0.073													0.055	0.099
39	Sehore	0.253	0.253			0.158	0.226																			0.158	0.253
40	Seoni					0.09	0.115													0.092	0.109					0.09	0.115
41	Shahdol					0.16	0.16	0.113	0.156	0.091	0.091															0.091	0.16
42	Shajapur					0.146	0.18																			0.146	0.18
43	Sheopur							0.04	0.153																	0.04	0.153
44	Shivpuri							0.053	0.078	0.091	0.095			0.069	0.091											0.053	0.095
45	Sidhi							0.086	0.188											0.07	0.084					0.07	0.188
46	Singrauli							0.095	0.095							0.053	0.053			0.116	0.116					0.053	0.116
47	Tikamgarh													0.102	0.13											0.102	0.13
48	Ujjain					0.109	0.165																			0.109	0.165
49	Umaria					0.092	0.092	0.108	0.131																	0.092	0.131
50	Vidisha					0.12	0.135																			0.12	0.135
		0.055	0.62	0.116	0.116	0.062	0.257	0.04	0.188	0.056	0.157	0.049	0.213	0.056	0.157	0.053	0.103	0.096	0.115	0.07	0.193	0.102	0.102			0.04	0.62

ANNUAL REPLENISHABLE GROUND WATER RECHARGE

N
W E
S

0 100 200
kilometers



LEGEND

Unit Recharge (m/yr)

- < 0.1
- 0.1 to 0.25
- >0.25
- 80 Isohyet (cm) (Normal)

Aquifers

- Alluvium
- Laterite
- Basalt
- Sandstone
- Shale
- Limestone
- Granite
- Schist
- Quartzite
- Banded Gneissic Complex
- Gneiss
- Intrusives

- State Capital
- District Headquarter
- State Boundary
- District Boundary
- River
- Water Body

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

Table 26 : Area Suitable for Water Conservation and Harvesting

Sl No	District Name	Alluvium	Laterite	Basalt	Sandstone	Shale	Limestone	Granite	Schist	Quartzite	BGC	Gneiss	Intrusives	Area
1	Barwani	231		1625										1856
2	Bhopal			1059	290									1349
3	Burhanpur	640		1139										1779
4	Chhatarpur	1		184	471	270	75	3310						4311
5	Chhindwara			691		2			11		206			910
6	Damoh			22	460	1138	26							1646
7	Datia	706						272						978
8	Dewas	125		2329				486						2940
9	Dhar			3477		1		5	7					3490
10	Gwalior	684				300								984
11	Indore			3914										3914
12	Khandwa			809										809
13	Khargone			3359	8	188				79				3634
14	Mandsaur	25	22	4685	32	866								5631
15	Narsinhpur	2024		671	363	309	201		91	14		155		3827
16	Neemuch		24	680	378	1090	171							2342
17	Panna	123			24	7		535						688
18	Rajgarh		33	3927	8									3968
19	Ratlam		13	4165										4178
20	Rewa				272	422								694
21	Sagar			1534	936	759	5			121				3356
22	Satna	1	5		966	2592	897							4461
23	Sehore			3008	32									3040
24	Shajapur		21	5593										5615
25	Shivpuri	108	5	654	1079	343	104	3678						5970
26	Tikamgarh							3406						3406
27	Ujjain			5052										5052
	Total	**4669**	**122**	**48577**	**5318**	**8286**	**1478**	**11692**	**109**	**214**	**206**	**155**		**80827**

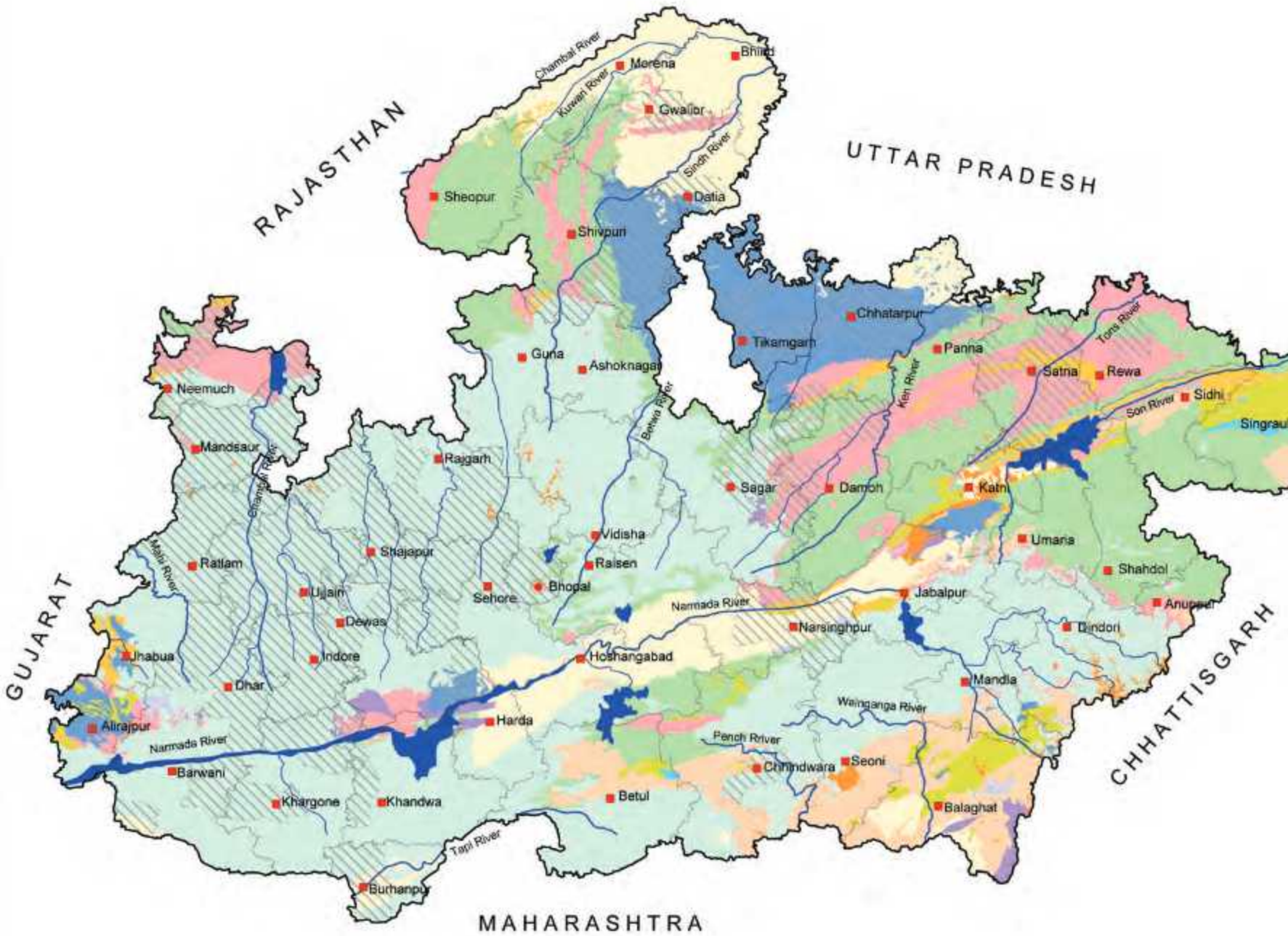
Area in Sq km

WATER CONSERVATION AND HARVESTING PRIORITY AREA

(AQUIFER MANAGEMENT PLAN)

N
W E
S

0 100 200
kilometers



LEGEND

Ground Water Recharge - Priority Area

Aquifers

- Alluvium
- Laterite
- Basalt
- Sandstone
- Shale
- Limestone
- Granite
- Schist
- Quartzite
- Banded Gneissic Complex
- Gneiss
- Intrusives

- State Capital
- District Headquarter
- State Boundary
- District Boundary
- River
- Water Body

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

Table 27: Area Suitable for Ground Water Development in Madhya Pradesh

Sl No	District Name	Alluvium	Laterite	Basalt	Sandstone	Shale	Limestone	Granite	Schist	Quartzite	BGC	Gneiss	Intrusives	Area
1	Alirajpur			1016		420	56	1325	461			30		3308
2	Anuppur		79	1968	1123	439					177			3786
3	Ashoknagar			3440	1031	52		200						4723
4	Balaghat	1276	182	355		12		60	2080	663	4428	183		9239
5	Barwani	23		3554										3576
6	Betul			6258	1311	205			292		1906		84	10056
7	Bhind	4426				15								4441
8	Bhopal		35	1335	31									1400
9	Burhanpur	391		1027										1419
10	Chhatarpur	1448			520	551	314	1475						4308
11	Chhindwara	75	18	6129	1900	439	5		301		2025		1	10894
12	Damoh			45	3950	1735								5730
13	Datia	1489				79								1568
14	Dewas			2636	93	613		214		473				4029
15	Dhar			4061		335		22				250		4669
16	Dindori		441	5806		106		89	227		369			7037
17	Guna	30	5	4676	1353	209	14							6287
18	Gwalior	1963	16		1022	471	9	111						3592
19	Harda	1395		1386	121			45	3	368				3316
20	Hoshangabad	3927		1336	1319	3			2		110			6699
21	Jabalpur	1636	326	1884	39	393	294	49	238	129	193	27		5208
22	Jhabua			2515	36	48	546	275						3421
23	Katni	670	505	98	1859	307	327	741	414		65			4986
24	Khandwa			5735	239	592			3	79				6648
25	Khargone			4424										4424
26	Mandla		31	5145		48	6		199	15	768			6211
27	Morena	3811	2		953	115	77							4958
28	Narsinhpur	960		6	341	2			37		14	3		1362
29	Neemuch			627		1186								1814
30	Panna		21	5	3776	2303	190	85						6381
31	Raisen	1395		5754	1642	74								8865
32	Rajgarh			2145	1									2146
33	Ratlam			638										638
34	Rewa				2282	3095	238							5614
35	Sagar			5292	1238	160	24	166		21				6902
36	Satna	86	23		1658	921	289	51			33			3060
37	Sehore	1042		2456	1	26		14						3540
38	Seoni		257	5751					121	5	2553	66		8752
39	Shahdol			412	4373	515	7		226	25	78			5634
40	Shajapur		2	676										678
41	Sheopur	431	13		4948	1050	88							6529
42	Shivpuri		41		3183	1163		56						4444
43	Sidhi	2		12	2864	398	675		182		643			4776
44	Singrauli	7		57	2537		351		1773		677	45	333	5781
45	Tikamgarh				7			1544						1551
46	Ujjain			1038										1038
47	Umaria	91		616	3092	387	18		51	99	301			4657
48	Vidisha		113	7093	105					10				7321
	Total	**26575**	**2110**	**97409**	**48951**	**18466**	**3528**	**6522**	**6610**	**1886**	**14339**	**604**	**418**	**227418**

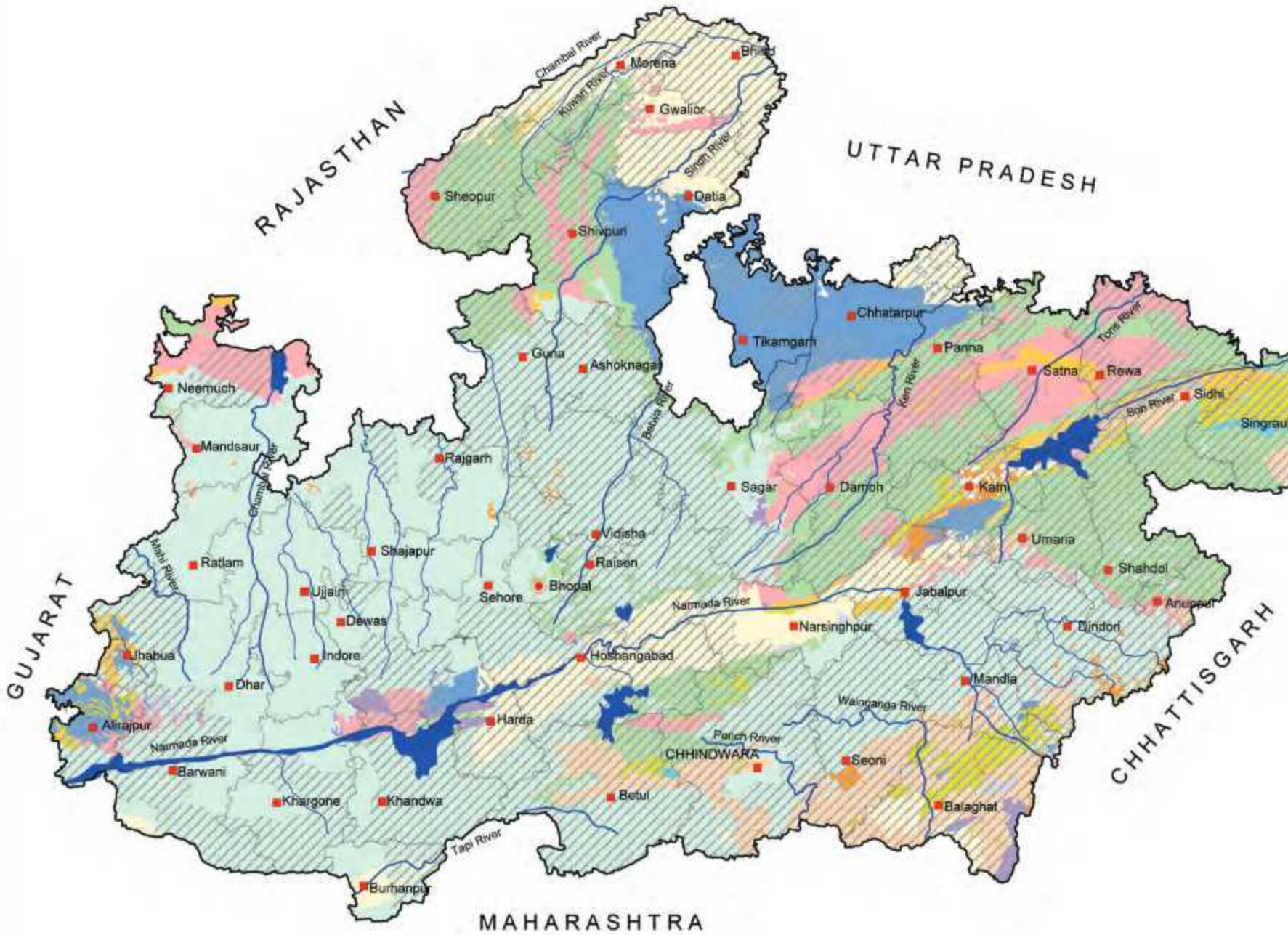
Area in Sq km

AREA SUITABLE FOR GROUND WATER DEVELOPMENT

(AQUIFER MANAGEMENT PLAN)

0 100 200

kilometers



LEGEND

Area Suiatable for Ground Water Development With Sustainable Measures

Aquifers

- Alluvium
- Laterite
- Basalt
- Sandstone
- Shale
- Limestone
- Granite
- Schist
- Quartzite
- Banded Gneissic Complex
- Gneiss
- Intrusives

- State Capital
- District Headquarter
- State Boundary
- District Boundary
- River
- Water Body

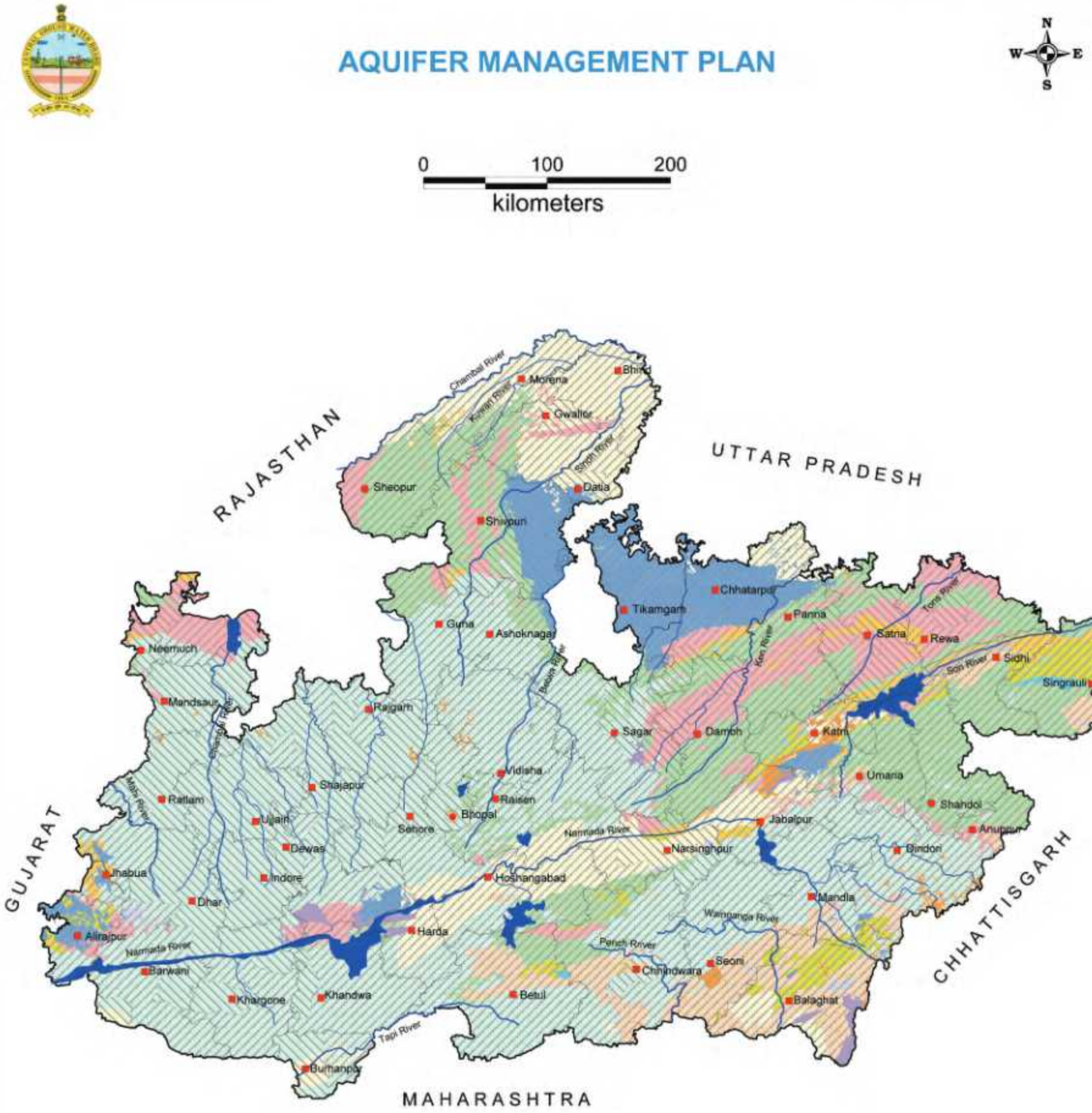
Central Ground Water Board
North Central Region
Ministry of Water Resources
Government of India

Table 28: Aquifer wise Ground Water Management Plan of Madhya Pradesh

Sl No	Name of Aquifer	Area covered	Area Suitable for Development		Area Suitable for Artificial Recharge/ Conservation	
			Area	%	Area	%
1	Alluvium	31244	26575	85	4669	15
2	Laterite	2232	2110	95	122	5
3	Basalt	145987	97409	67	48578	33
4	Sandstone	54269	48951	90	5318	10
5	Shale	26752	18466	69	8286	31
6	Limestone	5006	3528	70	1478	30
7	Granite	18214	6522	36	11692	64
8	Schist	6719	6610	98	109	2
9	Quartzite	2100	1886	90	214	10
10	BGC	14545	14339	99	206	1
11	Gneiss	759	604	80	155	20
12	Intrusives	418	418	100		
	Total	**308245**	**227418**		**80827**	

Area in Sq km

AQUIFER MANAGEMENT PLAN



LEGEND

Management Plan

- Area Suiatable for Ground Water Development With Sustainable Measures
- Ground Water Recharge - Priority Area

Aquifers

- Alluvium
- Laterite
- Basalt
- Sandstone
- Shale
- Limestone
- Granite
- Schist
- Quartzite
- Banded Gneissic Complex
- Gneiss
- Intrusives

- State Capital
- District Headquarter
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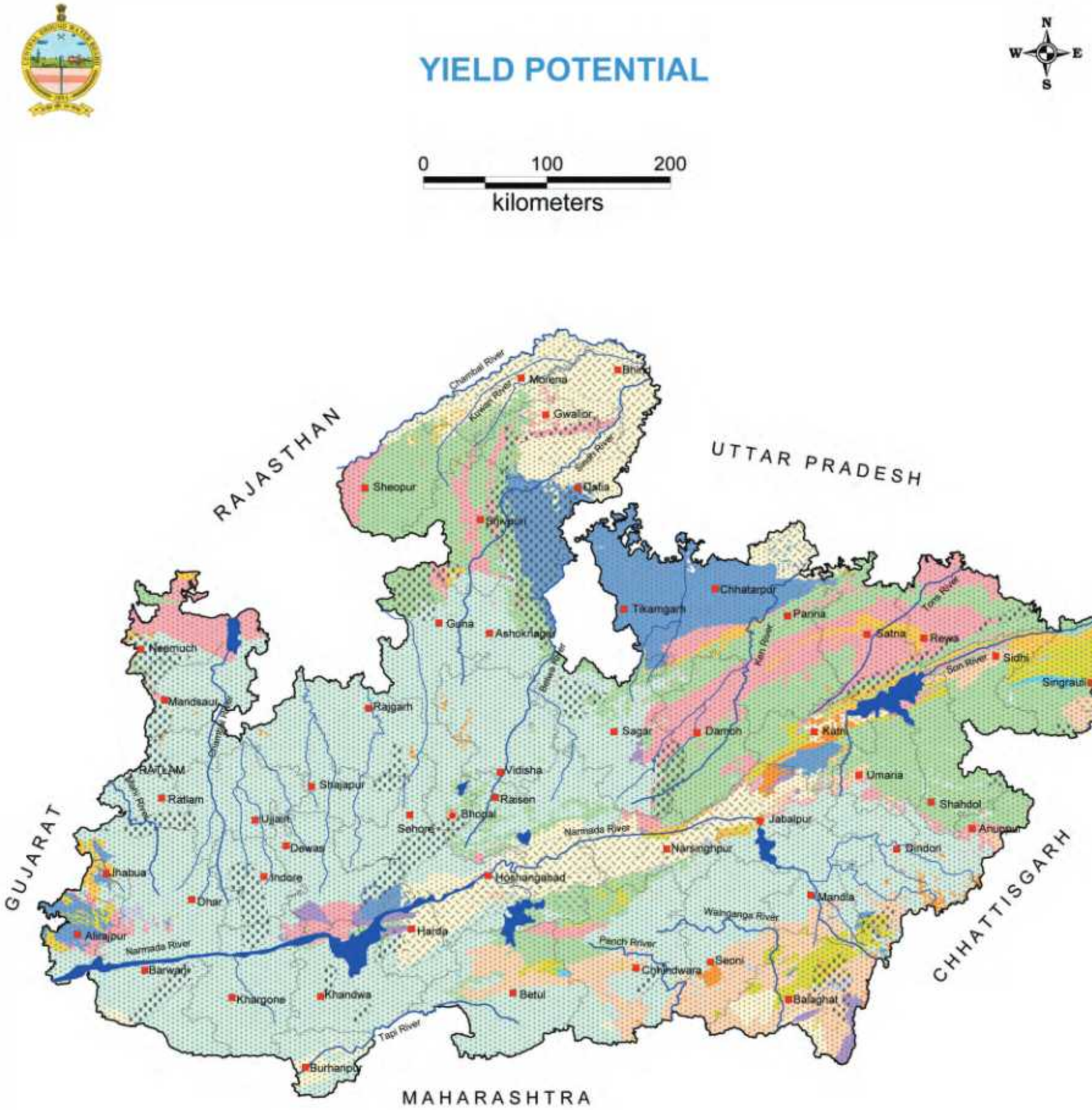
YIELD POTENTIAL



LEGEND

Yield Potential (lps)

- < 1
- 1 to 25
- 25 to 40
- > 40

Aquifers

- Alluvium
- Laterite
- Basalt
- Sandstone
- Shale
- Limestone
- Granite
- Schist
- Quartzite
- Banded Gneissic Complex
- Gneiss
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WAY FORWARD

Ground Water has emerged as an important component of socio-economic development in India. In the state of Madhya Pradesh the dependence on ground water is increasing rapidly. The increased dependence on ground water for irrigation is also being reflected by the surge of number of ground water abstraction structures in the recent past. More than 80% of the geographical area of the state is underlain by the hard rock formations. Due to wide variation in rock types, topography, water use and ground water potential, availability differs from place to place. In addition water quality issues related to geogenic contamination such as fluoride, anthropogenic contamination such as nitrate and inland salinity are the matter of concern in isolated areas of the state.

The western part of the Madhya Pradesh state of is facing acute shortage of water due to adverse hydrogeological conditions, causing over-exploitation situation. There is urgent need of judicious and planned use of ground water as the extraction of ground water is increasing rapidly. A comprehensive approach for artificial recharge and rain water harvesting in state is required for sustainable management of this resources.

In order to address the challenges, this aquifer atlas in its present form is primarily baseline data for prioritisation of areas of ground water management through community involvement. There is a need to further classify aquifers into smaller aquifer management units based on detailed surveys by characterization of local geology, hydrogeology and hydro-geochemistry on 1:50,000 scale.

Further, the information so collected need to be utilized for preparation of conceptual model of the aquifer system for managing the ground water resources through aquifer response model. This would require dovetailing of activities being taken up by administrators, stakeholders, researchers, planners and professionals and managing the resources in participatory mode.

INFORMATION / DATA SOURCE

1. Central Ground Water Board, Ministry of Water Resources, Govt. of India
2. Central Water Commission, Ministry of Water Resources, Govt. of India
3. Directorate of Census, Ministry of Home Affairs, Govt. of India
4. Election Commission of India
5. Forest Survey of India, Ministry of Environment & Forest , Govt. of India
6. Geological Survey of India, Ministry of Mines, Govt. of India
7. India Metrological Department, Ministry of Earth Sciences, Govt. of India
8. Survey of India, Ministry of Science & Technology, Govt. of India

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