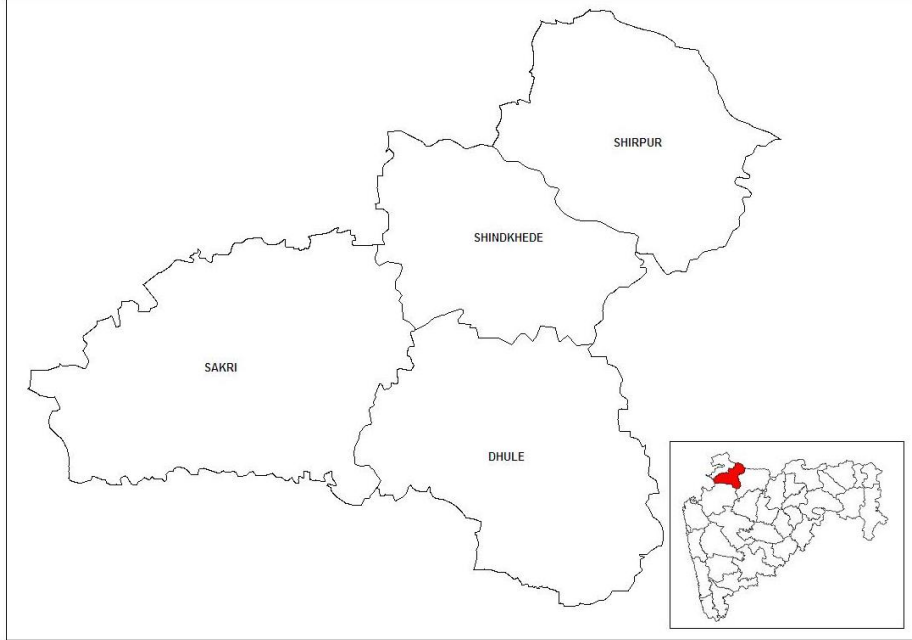




भारतसरकार
जलसंसाधनमंत्रालय
केंद्रीयभूजलबोर्ड

GOVERNMENT OF INDIA
MINISTRY OF WATER RESOURCES
CENTRAL GROUND WATER BOARD

महाराष्ट्र राज्य के अंतर्गत धुले जिले
की भूजल विज्ञान जानकारी
GROUND WATER INFORMATION
DHULE DISTRICT
MAHARASHTRA



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मध्य क्षेत्र, नागपुर
CENTRAL REGION
NAGPUR
2013

DHULE DISTRICT AT A GLANCE

1. GENERAL INFORMATION

Geographical Area	:	8061 sq. km.
Administrative Divisions (As on 31/03/2011)	:	Taluka- 4, Dhule, Sakri, Shirpur and Shindkheda.
Villages	:	681
Population	:	2,048,781
Average Annual Rainfall (2011)	:	547.21 mm

2. GEOMORPHOLOGY

Major Physiographic unit	:	2; Tapi valley proper and the region of the dykes and residual hills of the Sahayadri Spurs
Major Drainage	:	1; TapiRiver

3. LAND USE (2011-11)

Forest Area	:	2088 sq. km.
Cultivable Area	:	4864 sq. km.
Net Area Sown	:	4310 sq. km.

4. SOIL TYPE

3; Deep fertile soils in Alluvial areas and medium deep coarse soils to shallow stony soils away from TapiRiver in Basaltic areas.

5. PRINCIPAL CROPS (2008-09)

Cotton	:	1150 sq. km.
Pearl millet	:	1047 sq. km.
Groundnut	:	358 sq. km.
Maize	:	347 sq. km.
Wheat	:	360 sq. km.

6. IRRIGATION BY DIFFERENT SOURCES (2006-2007)

Nos./Area Irrigated (Ha)

Dugwells	:	59339/1194.41
Borewells	:	7767/119.64
Surface flow Schemes	:	1740/544.77
Surface Lift Schems	:	2626/353

7. GROUND WATER MONITORING WELLS (As on 30/11/2011)

Dugwells	:	28
Piezometers	:	4

8. GEOLOGY

Recent	:	Alluvium
Upper Cretaceous-Lower Eocene	:	Deccan Trap Basalt
Middle - Upper Cretaceous	:	Bagh Beds

9. HYDROGEOLOGY

Water Bearing formation	:	Basalt-Weathered/fractured/ jointed vesicular/massive, under phreatic and semi-confined to confined conditions. Alluvium- Sand and Gravel under phreatic and semi- confined to confined conditions.
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Premonsoon Depth to Water Level	:	2.51 to 19.00 m bgl (May-2011)
Postmonsoon Depth to Water Level	:	0.14 to 8.15 m bgl (Nov-2011)

Premonsoon Water Level Trend : Rise:0.0290 (Nardana) to 1.148 (Kalamsare) m/year
(2001-2010)

Fall: 0.021 (Sangivi) to 0.596 (Gotane) m/year

Postmonsoon Water Level Trend : Rise: 0.0036 (Ajnale) to 0.453 (Deobhane) m/year
(2001-2010)

Fall: 0.0071 (Hisala) to 0.79 (Songir) m/year

10. GROUND WATER EXPLORATION (As on 31/03/11)

Wells Drilled : EW-11, OW-04, PZ-1+5

DepthRange : 41.1 to 250 m bgl

Discharge : 0.067 to 17.55 lps

11. GROUND WATER QUALITY

Good and suitable for drinking and irrigation purpose, however localized nitrate and fluoride contamination is observed.

Type of Water : Ca-HCO₃ and Ca-Cl

12. DYNAMIC GROUND WATER RESOURCES- (As on 2009)

Net Annual Ground Water : 118790.26HAM

Availability

Annual Ground Water Draft : 1790.44HAM

(Domestic+Industrial)

Allocation for Domestic and : 3574.91HAM

Industrial requirement up to next 25 years

Stage of Ground Water : 48.68 %

Development

14. GROUND WATER CONTROL & REGULATION

Over-Exploited Taluka : None

Critical Taluka : None

Notified Taluka : None

16. MAJOR GROUND WATER PROBLEMS AND ISSUES

The drought area has been observed in western and southern parts of the district occupying parts of Sakri and Dhuletalukas. The moderate to deeper water levels of 5 to 10 m bgl is observed in almost all parts of Dhule, Shirpur, Sakri and a small patch in the SE part of Sindkhedataluka and falling water level trends are observed in most parts of the district, occupying Dhule and Shirpurtalukas and eastern parts of Sindkheda and parts of Sakritalukas. Ground water quality is adversely affected by nitrate contamination in 54% of the samples with Nitrate. The total hardness (TH) is beyond permissible limit in Avdhan, Methi and Palasner.

Ground Water Information Dhule District

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Ground Water Information

Dhule District

1.0 Introduction

Dhule district, formerly known as west Khandesh is located in northern part of Maharashtra State. It is bounded between north latitude 20°38' to 21°61' and east longitude 73°50' to 75°11'. The district is bounded by Nandurbar district in the north west, Nashik district in south and Jalgaon district in east. The district headquarters is located at Dhule town. For administrative convenience, the district is divided in 4 talukas viz, Dhule, Sakri, Shirpur, Shindkheda. The district has a geographical area of 8061 sq. km. out of which 2088 sq.km. is covered by forest, whereas cultivable area is 4864 sq. km. and net sown area is 4310 sq. km. Agriculture is the main occupation of the people. The major part of the district comes under Tapi basin.

The population of Dhule district is 2,048,781 persons and the population density is 254.16 persons/sq.km. as per the 2011 census. Central Ground Water Board has taken up several studies in the district. A list of studies conducted in different parts of the district is presented in Table-1.

Table 1: Studies undertaken by CGWB.

S. No.	Year	Surveyed area	Type of Survey/Study
1.	1965-66	Covering parts of Toposheet No's 46-K/3,46-K7, and 46-K/11	Systematic Hydrogeological Survey
2.	1986-87	Covering parts of Toposheet No's 46-K/4,46-K8, and 46-K/12	Systematic Hydrogeological Survey
3.	1988-89	Covering parts of Toposheet No's 46-G/11 and 46-G/12	Systematic Hydrogeological Survey
4.	1997-98	Entire district	Reappraisal Hydrogeological Studies

A report on hydrogeology of the district entitled "Ground Water Resources and Development Potential of Dhule District, M.S." was compiled by Shri D.B. Shetye Scientist-C in the year 1996.

Apart from above studies, ground water exploration in the Tapi Alluvial areas of the district has also been taken up during 1982-87. Apart from this under Hydrology Project 5 Piezometer was constructed at Dhavda, Laling, Gothni, Ner2 and Kalamsare in 1997-98. Further ground water exploration was taken up in 2012-13 in the Alluvium/ Basalt Contact Areas. The salient features of ground water exploration are given in Table-2.

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Table 2: Salient Features of Ground Water Exploration (upto March 2013).

S. No.	Taluka	Formation	Wells			Depth (m bgl)	SWL (m bgl)	Discharge (lps)	Draw Down (m)	Zones (m bgl)
			EW	OW	PZ					
1	Shirpur	Alluvium	5	3	1	36.70 - 104.25	15.55- 30.00	1.50 - 6.00	0.78- 13.00	30.00- 99.00
		Basalt	3	1	0	201.00- 250.00	29.25 to >100.00	0.67-3.17	10.15	102.00- 202.80
2	Sindkheda	Basalt	4	0	0	156.00- 218.00	7.40-87.50	Traces - 2.16	33.4	24.40- 184.50
	Total		11	4	1	36.70 - 250.00	7.40- >100.00	Traces - 6.00	0.78- 33.40	24.40- 202.80

In the district, 11 exploratory wells (EW), 4 observation wells (OW) and 5 Piezometer (PZ) were constructed. In Alluvial area of the district, 5 exploratory wells (EW), 3 observation wells (OW) and 1 Piezometer (PZ) were constructed. The depth of the wells ranged from 36.70 to 104.25 metres below ground level (m bgl). The discharge from these wells varied from 1.50 to 6.00 litres per second (lps), among 2 EW's were found to be high yielding with discharge > 3 lps, whereas static water levels ranged from 15.55 to 30.00 m bgl. Deeper aquifer zones have been encountered in most of the wells 30.00 to 99.00 m bgl.

In the contact areas where Basalt is overlain by alluvium, 7 EW and 1 OW were constructed. The depth of the wells ranged from 156.00 to 250.00 m bgl. The discharge from these wells varied from traces to 3.17lps, amongst these 1 EW was found to be high yielding with discharge > 3 lps, whereas static water levels ranged from 7.40 to > 100.00 m bgl. Deeper aquifer zones have been encountered in most of the wells 65.00 to 202 m bgl. The thickness of alluvium overlying the basalt varied from 15 to 80 m bgl.

A map of the district showing the taluka boundaries, taluka headquarters, and location of monitoring wells is presented as Figure-1.

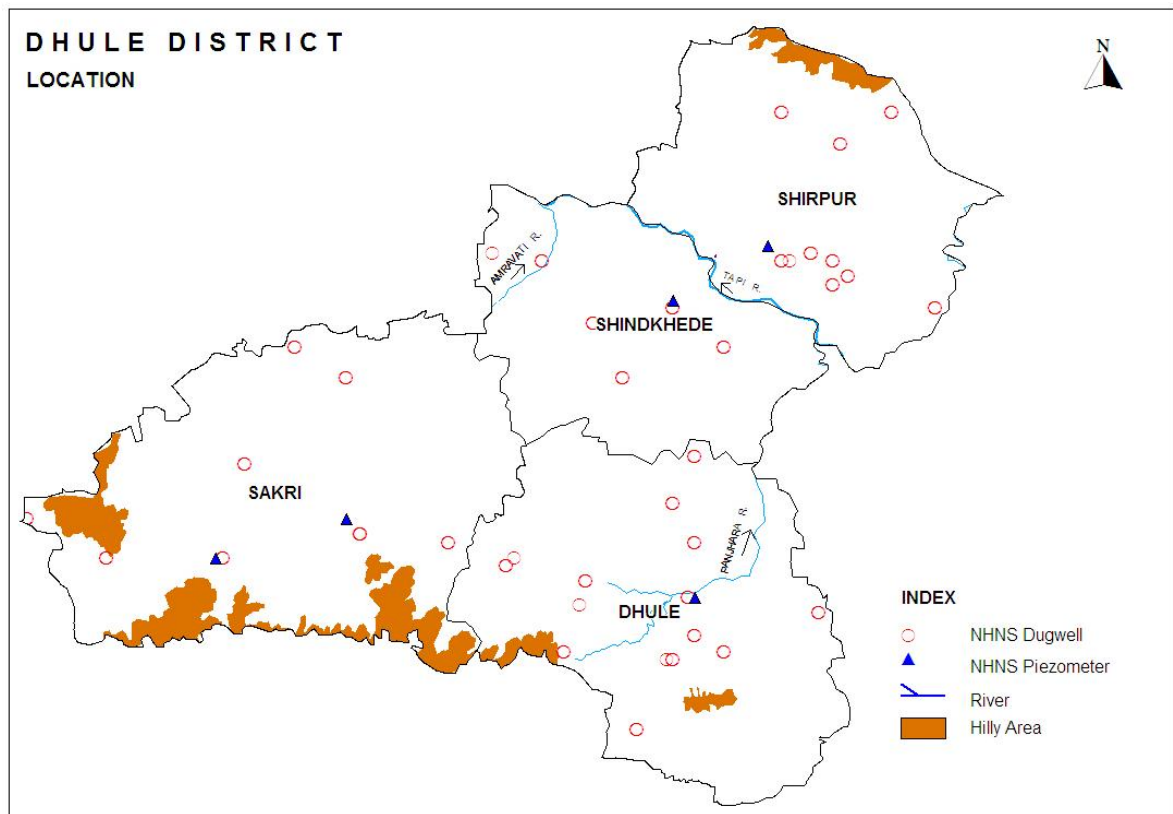


Figure-1: Location

2.0 Climate and Rainfall

The Climate of the district is characterized by a hot summer and general dryness throughout the year except during the south-west monsoon season, i.e., June to September. The daily mean minimum temperature was 16°C and mean maximum temperature was 45°C. The annual average rain fall in mm ranges from 499 to 864.

The decadal average of annual rainfall is identified to be lowest in Dhuletaluka (589 mm) and highest Shirpurtaluka (875 mm) and the same is presented in Table-3. It is the minimum in the central parts of the district around Dhule and Sakri and Sindkhed and increases northwards and westwards. The study of negative departures of the annual rainfall over normal reveals that western and southern parts of the district experienced moderate and severe drought conditions for more than 20% of years. Hence this parts occupying parts of Sakri and Dhuletalukas can be categorized as drought area.

Table 3: Annual Rainfall Data (2002-2011) (mm)

Taluka	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Average
Dhule	412	718	851	318	727	668	492	568	641	500	589.5
Sakri	457	701	633	687	880	798	538	634	608	546	648.2
Shirpur	702	1175	889	605	1195	1061	624	922	965	610	874.8
Shindkheda	513	863	762	386	970	747	398	748	533	533	645.3

(Source: www.agri.mah.nic.in)

3.0 Geomorphology and Soil Types

The district can be broadly divided into 2 physiographic units namely Tapi valley proper and the region of the dykes and residual hills of the Sahyadri Spurs with eastward trending streams in between. The TapiRiver valley is observed on both sides of TapiRiver in parts of Shirpur and Sindkheldtalukas, whereas the region of dykes and residual hills of the Sahyadri Spurs comprises southern part of Sindkheda and entire Sakri and Dhuletalukas. The district is drained by TapiRiver and its tributaries. TapiRiver flows westward through the central part of the district. Panjra and Aner rivers are the main tributaries of Tapi flowing northward and southward respectively to join TapiRiver

In the Tapi valley proper, the soils are deep black and extremely fertile except in some portions near the main river and its tributaries, which have cut down the land very badly and removed the top soil. Otherwise the soils grade from the deep fertile soils to coarse shallow to stony soils away from the river either northwards towards the Satpudas or south ward towards the residual hills and dykes.

4.0 Ground Water Scenario

4.1 Hydrogeology

The major part of the district occupying northern parts of Shirpur, southern parts of Sindkhed and entire Dhule and Sakritalukas is covered by Basaltic flows commonly known as Deccan Traps intruded by dykes of Upper Cretaceous-Lower Eocene age. Tapi Alluvial deposits are observed in TapiRiver valley occupying parts of Sindkhed and Shirpurtalukas. A map depicting the hydrogeological features is shown in **Figure-2**.

4.1.1 Hard Rock Areas

4.1.1.1 Deccan Trap Basalt

The Deccan Trap includes several flows of Basalt which are supposed to have extruded from fissure volcanoes. The flows have been intruded by large number of dykes of doleritic composition. The dykes are aligned in an ENE-WSW direction and a few gave N-S or WNE-ESE trends. Basalt includes the "pahoehoe" and the "aa" types of flows, the former being very common.

The ground water occurs in the near surface strata down to the depth of 20 m under unconfined conditions in the weathered zone, vesicular/amygdaloidal Basalt, jointed and fractured massive Basalt. The water bearing strata occurring below 30 m depth, beneath the redbole and dense massive Basalt exhibit semi-confined to confined conditions. On the elevated plateau tops having good areal extent, local water table develops in top most layers and the wells in such areas show rapid decline water levels in postmonsoon season and go dry during peak

summer. In the foot hills zone the water table is relatively shallow near the water courses and deep away from it and near the water divides. In the valleys and plains of river basin the water table aquifer occurs at shallow depth and the wells in such areas do not go dry and sustain perennial yield except in extreme summer or drought conditions. The yield of the dugwells varies from 60 to 125 m³/day, whereas those of borewells varies from 2 to > 20 m³/hr, however in most of the borewells it ranges between 2 to 10 m³/hr.

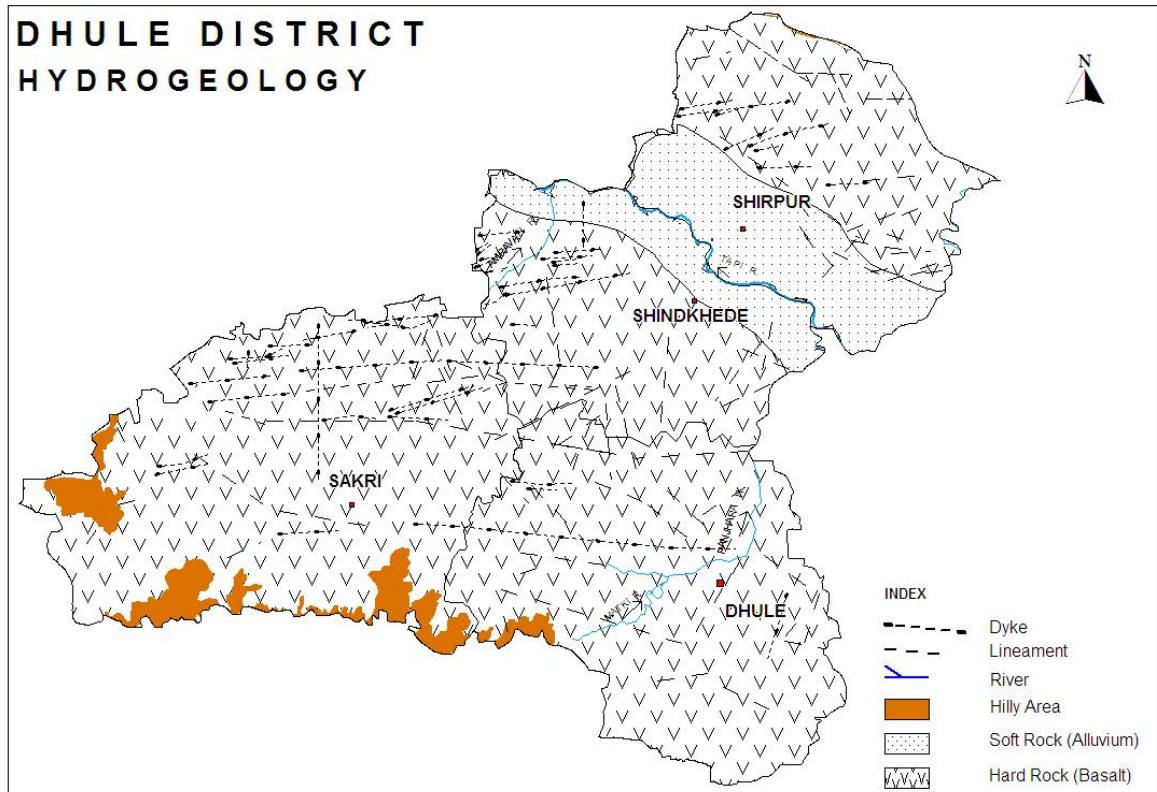


Figure-2: Hydrogeology

4.1.2 Soft Rock Areas

4.1.2.1 Alluvium

Alluvial deposits of Tapi River valley occurs in long narrow basin, which are probably caused by faulting. About a 15% of the district is occupied by Alluvium. It consists of clays, silt, sand, gravels and boulders etc. The beds of sand and gravels are discontinuous and lenticular and pinch out laterally within short distance. They are mixed with large proportions of clayey material rendering delimiting of individuals granular horizons difficult. As per ground water exploration data Alluvium is encountered down to 100 m depth. Ground water occurs under water table, semi-confined and confined conditions in inter granular pore spaces of gravel and sand. The yield of the dugwells varies between 150 and 200 m³/day, whereas that of exploratory wells varies from 1.50 to 6.00 lps as per exploration data. The yields of the tubewells drilled by State ground water department/agency ranges from 20 to 250 m³/hr.

4.2 Water Level Scenario

Central Ground Water Board periodically monitors 32 National Hydrograph Network Stations (NHNS) stations in the Dhule district, four times a year i.e. in January, May (Premonsoon), August and November (Postmonsoon).

4.2.1 Depth to Water Level – Premonsoon (May-2011)

The depth to water level in the district during May 2011 ranges between 2.51 to 19.00 mbgl. Depth to water level during premonsoon (May 2011) has been depicted in **Figure-3**. Shallow water levels within 2- 5 m bgl are observed in small isolated patches in south eastern (Dhule and Sindhkhedatalukas) and also in minor part of Sakritaluka. The water levels between 5 and 10 m bgl are observed in major parts of the district in southern parts, central parts and extreme north eastern parts. The moderate to deeper water levels of 10 to 20 m bgl are observed in northeastern to south western part of the district, occupying major parts of Shirpur, and some parts of Sakri, dhule and Sindhkhedatalukas in very small patches. Premonsoon Water Level Trend for the period of 2001-2010 is characterized by Rise in Nardana and Kalamsare (0.0290 and 1.148 m/year respectively). And pre monsoon fall is characterized by fall in sangivi and Gotane (0.021 and 0.596 m/year respectively).

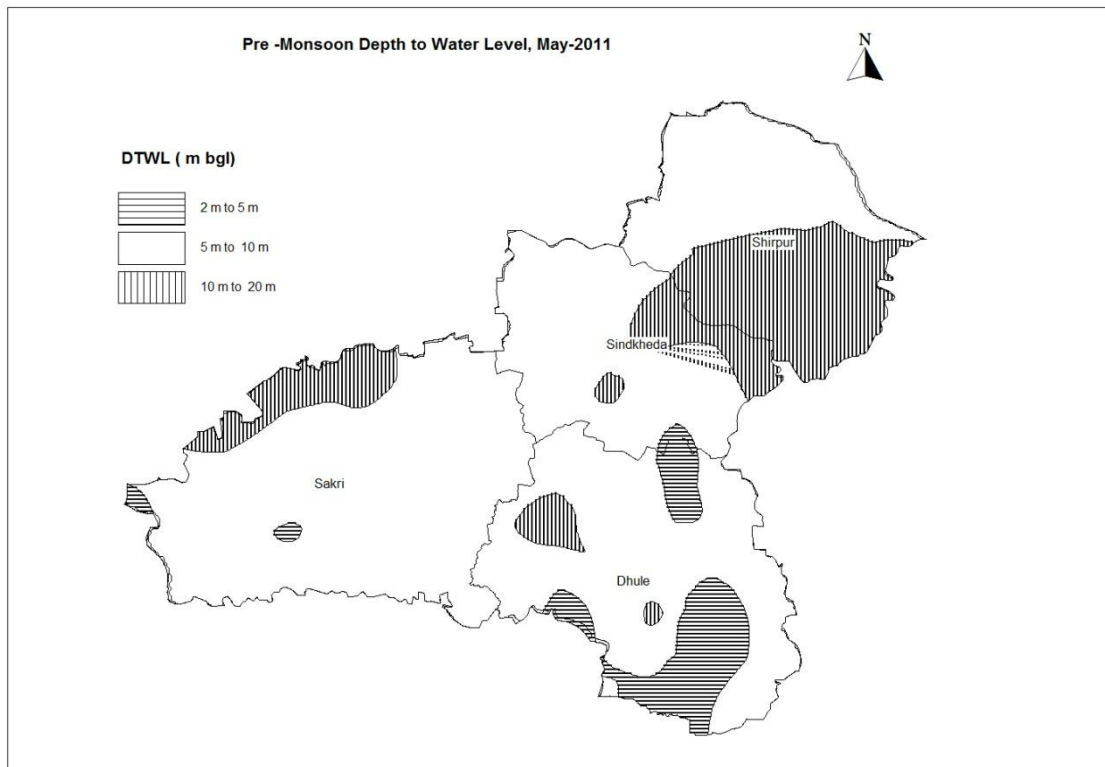


Figure-3: Depth to Water Level (Premonsoon- May 2011)

4.2.2 Depth to Water Level–Postmonsoon (Nov 2011)

The depth to water level during postmonsoon (Nov. 2011) ranges between 0.14 m bgl and 8.15 m bgl. Spatial variation in postmonsoon depth to water level is shown in **Figure-4**. In major parts of the district water levels are between 5 and 10 m bgl primarily in Sindhkheda, Shirpur, Sakri and parts of Dhuletaluka. Shallow water levels, within 2-5 m bgl are seen south eastern, north eastern and south western parts of the district in Shirpur, Dhule and Sakri talukas. Water levels less than 2 mbgl are observed in southern parts of the district as patches. The post monsoon rising trend is observed for the period of 2001-2011 in Ajnale and

Deobhane(0.0036 and 0.453 m/year respectively). Also falling trend is seen in Hisala and Songir (0.0071 and 0.79 m/year respectively;y)

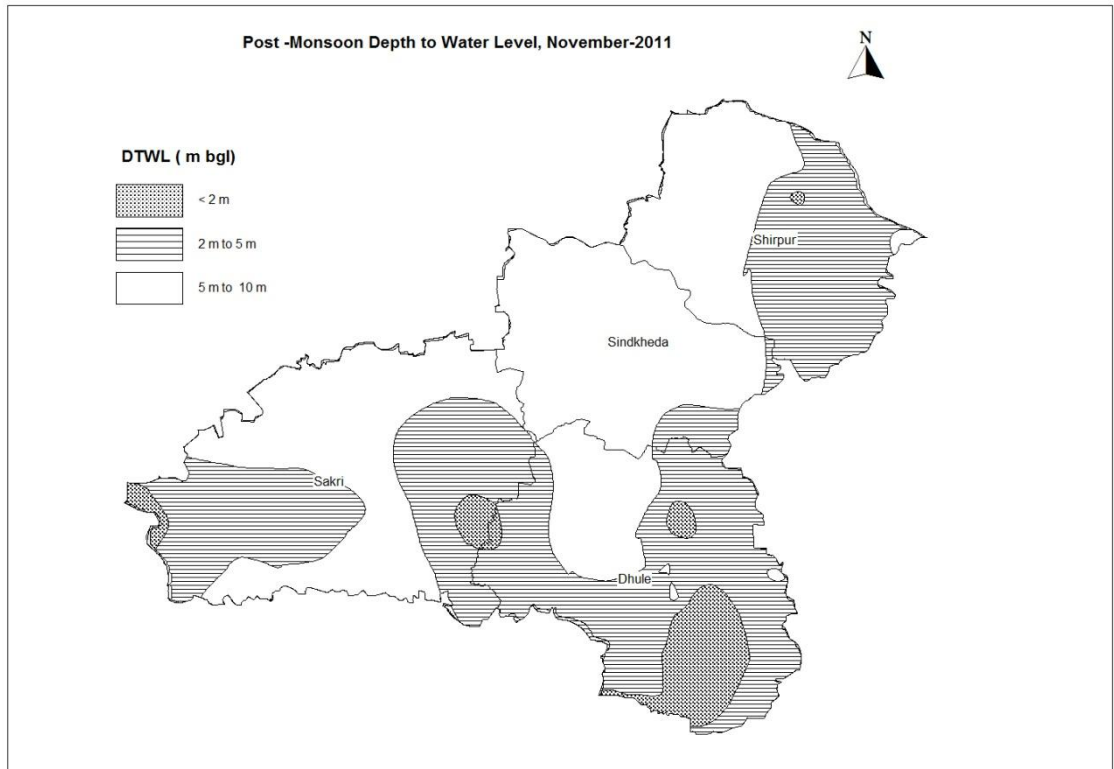


Figure-4: Depth to Water Level (Postmonsoon- Nov.2011)

4.2.3 Seasonal Water Level Fluctuation– (May-Nov. 2011)

Waterlevel fluctuations of 0-2 m,bgl is observed in SE parts of Sindhkhedataluka and parts of DhuleTaluka at some patches. In major parts district fluctuation is within the range of 2-4 mbgl (major part of Dhule, Northern part of Sindhkheda, Southern Shirpur; SW and NE parts of Sakritaluka). Fluctuations greater than 4 mbgl is observed in Northern part of Shirpurtaluka where predominant lithology is alluvium. Also water level fluctuation greater than 4 mbgl is seen in central and NW parts of Dhule and NW part of Sakritalukas.

4.3 Aquifer Parameters

The aquifer parameters of shallow aquifer as determined during previous studies carried out by the Board are presented in Table-4. In Basalt transmissivity ranges from 6 to 96 m²/day, the storativity varies between 0.017 to 0.0429 and the specific capacity ranges from 41 to 220 lpm/m of drawdown, whereas in Alluvium transmissivity is about 70 m²/day and the specific capacity ranges from 173 to 616 lpm/m of drawdown.

Table 4: Aquifer Parameters.

S. No.	Aquifer	Specific Capacity (lpm/m of drawdown)	Transmissivity (m ² /day)	Storativity
1.	Fractured and moderately weathered Massive Basalt	80 - 220	5.70 – 88.50	0.017 – 0.048
2.	Moderately to highly weathered Basalt	48 – 155	77 – 96	-
3.	Vesicular Amygdaloidal Basalt	41 – 112	11 – 56	0.0429
4.	Alluvium	173 – 616	70	-

4.4 Yield of Dugwells and Borewells

The yields of the wells are function of the permeability and transmissivity of aquifer encountered and it varies with location, diameter and depth of wells etc. There are mainly two types of ground water abstraction structures in the district i.e., dugwells and borewells/tubewells, however the yield of wells also vary according to nature of formation tapped and its saturated thickness. Therefore, the dugwells located in the topographic lows, morphological depressions and on or near the lineaments yield comparatively more water than the located elsewhere, which is particularly true in basaltic terrain. The yield of dugwell also varies depending on the season. The yields of dugwells for different formations are presented in Table-5.

Table 5: Yield of Dugwells.

S. No.	Aquifer	DepthRange (m bgl)	YieldRange (m ³ /day)
1	Predominantly Amygdaloidal Basalt	10 – 15	75 – 95
2	Predominantly Vesicular/Zeolitic Basalt	9 – 12	100 – 125
3	Predominantly Massive Basalt	10 – 14	60 - 75
4	Alluvium	25 - 30	150 - 200

The borewells drilled by State ground water department/agency in Deccan Trap Basalt indicate wide variation and it varies from 2 to > 20 m³/hr, however in most of the borewells it ranges between 2 to 10 m³/hr. The yield of exploratory wells constructed by CGWB ranges from 0.067 to 17.55 lps as seen from exploration data. The yields of the tubewells drilled by State ground water department/agency ranges from 20 to 250 m³/hr.

4.5 Ground Water Resources

Central Ground Water Board and Ground Water Survey and Development Agency (GSDA) have jointly estimated the ground water resources of Dhule district based on GEC-97 methodology. The same is presented in Table-6. Ground Water Resources assessment was done for 6368.19 sq. km. area of which 479.16 sq. km. is under command and 5889.03 sq. km. is non-command. Taluka wise ground water resources are shown in **Figure-5**.

As per the estimation, the total groundwater availability in dhule district is 118790.26ham. The gross draft for all uses is estimated at 57822.10ham with irrigation sector being the major consumer having a draft of 56031.66ham. The

allocation for domestic and industrial requirements for the next 25 years are worked out at 3574.91ham, whereas the net ground water availability for future irrigation is estimated at 59183.69 ham. The stage of ground water development varies from 29.96% (Shirpur) to 62.25% (Dhule) and all the talukas falls in “Safe” category. The overall stage of ground water development for the district is 48.68 %.

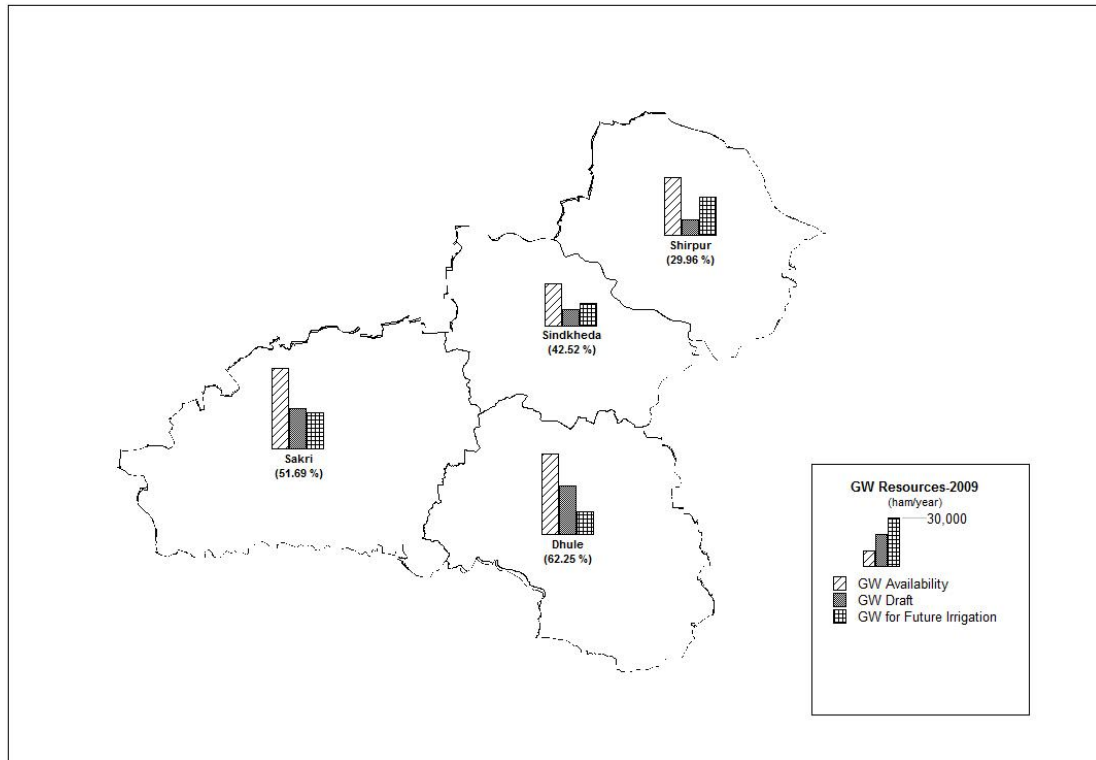


Figure 5: Ground Water Resources (March 2009)

4.6 Ground Water Quality

Central Ground Water Board monitors the ground water quality of the district through analysis of water samples collected from its National Hydrograph Network Stations (NHNS) which represent the shallow aquifer of the district only. The objective behind quality monitoring is to understand an overall picture of ground water quality of the district. During year 2010, CGWB has carried out the ground water quality monitoring of 21 samples and the pH of these water samples varies from 7.8 to 9. EC varies from 360 to 3600 $\mu\text{S/cm}$. TA varies from 130 to 570 mg/l; TH from 135 to 860 mg/l, NO_3 from 1 to 253 mg/l, F from 0.10 to 1.20 mg/l and RSC varies -13.40 to 5.40.

Table 6: Ground Water Resources (March 2009).

District	Administrative Unit	Net Annual Ground Water Availability	Existing Gross Ground Water Draft for irrigation	Existing Gross Ground Water Draft for domestic and industrial water supply	Existing Gross Ground Water Draft for All uses (11+12)	Provision for domestic and industrial requirement supply to 2025	Net Ground Water Availability for future irrigation development (10-11-14)	Stage of Ground Water Development {13/10 * 100}%
Dhule	Dhule	36626.82	22380.52	418.65	22799.17	835.52	13403.38	62.25
Dhule	Sakri	36609.31	18400.97	523.18	18924.15	1030.99	17080.27	51.69
Dhule	Shirpur	26051.01	7362.78	442.64	7805.42	885.29	17802.95	29.96
Dhule	Sindkheda	19503.12	7887.40	405.97	8293.37	823.11	10897.09	42.52
Total		118790.26	56031.66	1790.44	57822.10	3574.91	59183.69	48.68

(Units in HAM)

4.6.1 Suitability of Ground Water for Drinking Purpose

The suitability of ground water for drinking purpose is determined keeping in view the effects of various chemical constituents in water on the biological system of human being. Though many ions are very essential for the growth of human, but when present in excess, have an adverse effect on human body. The standards proposed by the Bureau of Indian Standards (BIS) for drinking water (IS-10500-91, Revised 2003) were used to decide the suitability of ground water. The classification of ground water samples was carried out based on the desirable and maximum permissible limits for the parameters viz., TDS, TH and NO₃ prescribed in the standards and is given in Table-7.

Table 7: Classification of Ground Water for Drinking based on BIS Drinking Water Standards (IS-10500-91, Revised 2003).

Parameters	DL (mg/L)	MPL (mg/L)	Samples with conc. < DL	Samples with conc. in DL-MPL	Samples with conc. >MPL
TDS	500	2000	6	10	Nil
TH	300	600	5	8	3
NO ₃	45	No relaxation	7	Nil	9
F	1.0	1.5	13	1	2

(Here, DL- Desirable Limit, MPL- Maximum Permissible Limit.)

The perusal of Table-7 shows that the potability of groundwater in 54.55% of wells monitored has been affected by the high concentration of nitrate in ground water. The total hardness (TH) is beyond permissible limit in Avdhan, Methi and Palasner. Fluoride concentration is found to be within maximum permissible limit. In Avdhan TDS is above maximum permissible limit. Overall, the ground water quality scenario of the wells monitored in the district is not bright.

4.6.2 Suitability of Ground Water for Irrigation Purpose

The water used for irrigation is an important factor in productivity of crop, its yield and quality of irrigated crops. The quality of irrigation water depends primarily on the presence of dissolved salts and their concentrations. Residual Sodium Carbonate (RSC) is an most important quality criteria, which influence the water quality and its suitability for irrigation.

4.6.2.1 Residual Sodium Carbonate (RSC)

Residual Sodium Carbonate (RSC) is considered to be superior to SAR as a measure of sodicity particularly at low salinity levels. The classification of ground water samples based RSC values for its suitability for irrigation purpose is shown below in Table-8.

Table 8: Classification of Ground Water for Irrigation based on RSC.

RSC	<1.25		1.25-2.50		>2.50	
Category	Good		Doubtful		Unsuitable	
Total Samples	No. of Samples	%	No. of Samples	%	No. of Samples	%
22	19	86	2	9	1	5

The perusal of Table-8 clearly indicates that 86 % of the samples are good for irrigation and 9 % are doubtful for irrigation use. Only in 1 sample collected from Dhule town has RSC value more than 2.50 thereby rendering it unsuitable for irrigation.

5.0 Ground Water Management Strategy

Ground water has special significance for agricultural development in the district. The ground water development in some parts of the district has reached a critical stage resulting in decline of ground water levels over a period of time. Thus, there is a need to adopt an integrated approach of development of ground water resources dovetailed with ground water augmentation to provide sustainability to ground water development.

5.1 Ground Water Development

Major part of the district is underlain by Deccan Trap Basalt. The development potential of ground water in Deccan Trap Basalt is low to medium in parts of Sakri, Sindkheda and Dhule talukas and ground water in these areas can be developed through dugwells and dug-cum-bored wells (DCB) and borewells. However, the dugwells are the most feasible structures and borewells should normally be avoided as they generally tap deeper fractures, which may not be sustainable. Besides, the borewells should only be used for drinking water supply and not for irrigation. The sites for borewells also need to be selected only after proper scientific investigation so as to minimise the rate of failure.

As per 2006-2007 minor irrigation census in Dhule district there exists 59339 dug wells and it has created an irrigation potential of 1194.41 Sq.km area, where as bore wells (7767 Nos.) has created the irrigation potential of 119.64 Sq.km. The irrigation potential created by surface flow schemes is 544.77 sq.km (out of 1740 schemes). And the surface lift schemes (of 2626 numbers) created an irrigation potential of 353 sq.km.

In the southern parts of Shirpurtaluka mainly occupied by Alluvium, the groundwater potential is medium to high and groundwater can developed through dugwells and shallow tubewells. The overall stage of ground water development for the district is at halfway stage, i.e., 46.61% thus there is a scope for further development of ground water resources particularly in Sakri, Shirpur and Sindkhedatalukas. In Dhule taluka stage of development has reached upto 62%, so further development must be accompanied by suitable artificial recharge plans. However, the ground water development needs to be carried out with proper care and planning, since in these areas falling water level trends are observed.

The nature and yield potential of the aquifers occurring in different areas is given below in **Table-9**

5.2 Water Conservation and Artificial Recharge

A number of water conservation structures in the form of check dams, percolation tanks, and KT weirs have already been constructed in the district. In Basaltic area, the artificial recharge structures feasible are check dams, gully plugs, percolation tanks, nalla bunds, etc. The structures like gully plugs, contour bunds are most favourable in the hilly areas, occurring in the central part of the district. Existing dugwells can also be used for artificial recharge, however, the source water should be properly filtered before being put in the wells. The artificial recharge structures suitable for alluvial areas are percolation tanks and recharge wells/shafts. These sites need to be located where the hydrogeological conditions are favourable, i.e., where sufficient thickness of de-saturated/unsaturated aquifer exists and water levels are more than 5 m deep. Such areas are observed in almost entire district as seen from postmonsoon water level scenario.

Table 9: Nature and Yield Potential of Aquifers.

S. No.	Taluka	Main Aquifer	Yield Potential	Type of Wells Feasible
1.	Dhule	Basalt	Low to Medium	Dugwell, DCB and Borewell
2.	Sakari	Basalt	Low to Medium	Dugwell, DCB and Borewell
3.	Sindkheda	Basalt	Low to Medium	Dugwell, DCB and Borewell
4.	Shirpur	Alluvium	Medium to High	Dugwell and Shallow Tubewell

6.0 Ground Water Related Issues and Problems

The drought area has been observed in western and southern parts of the district occupying parts of Sakri and Dhule talukas. The moderate to deeper water levels of 10 to 20 m bgl (parts of Shirpur and Sindkheda talukas) and falling water level trends are observed in most parts of the district, occupying Dhule and Shirpur talukas and eastern parts of Sindkheda and parts of Sakri talukas. Thus artificial recharge and water conservation structures need to be prioritised in these areas.

Almost 54.55% of wells monitored has been affected by the high concentration of nitrate in ground water. The total hardness (TH) is beyond permissible limit in Avdhan, Methi and Palasner. Fluoride concentration is found to be within maximum permissible limit. In Avdhan TDS is above maximum permissible limit. Overall, the ground water quality scenario of the wells monitored in the district is not bright. Continuous intake of high nitrate concentration water causes infant methaemoglobinemia, popularly known as Blue Babies. Thus all the wells used for water supply should be first analysed for nitrate and fluoride contents and if the contents are found beyond permissible limits then the ground water may be used for other than drinking purpose. Adequate sanitary protection to the wells may be provided to control the nitrate contamination.

7.0 Areas Notified by CGWA/SGWA

As per ground water resource estimation all the talukas have been categorised as "Safe" and hence none of the taluka has been notified either by CGWA or SGWA.

8.0 Recommendations

1. Major part of the district is underlain by Deccan Trap Basalt, where only dugwells are the most feasible structures for ground water development.
2. The sites for borewells need to be selected only after proper scientific investigation. Borewells generally tap deeper fractures, which may not be sustainable. Besides, the borewells should only be used for drinking water supply and not for irrigation.
3. The overall stage of ground water development for the district is at less than halfway stage, i.e., 48.68 % thus there is a scope for further development of ground water resources particularly in Shirpur, Sakri and Sindkheda talukas. However, the ground water development needs to be

carried out with proper care and planning, since in these areas falling water level trends are observed.

4. The stage of ground water development has already reached about 62% in Dhuletaluka, hence future ground water development is not recommended without adhering to the precautionary measures i.e., artificial recharge to augment the ground water resources and adoption of ground water management practices in the taluka.
5. The scope exists for construction of suitable artificial recharge structures in the district. The structures recommended for the hilly- Deccan Trap Basalt area in the central part are: contour bunds, gully plugs, nala bunds and check dams. For other basaltic areas, the nala bunds, check dams and KT weirs are suggested. The existing dugwells may also be used for artificial recharge of ground water provided source water is free of silt and dissolved impurities.
6. In Alluvial area of the district, percolation tanks and recharge wells/shafts are suggested.
7. The existing village ponds/tanks need to be rejuvenated to act both as water conservation and artificial recharge structures.
8. Ground water quality is adversely affected by nitrate contamination in 54.55 % samples in May 2010. Thus all the wells used for water supply should be first analyzed for nitrate. And those are found beyond permissible limits may be used for purposes other than drinking. Adequate sanitary protection to the wells may be provided to control the nitrate contamination.