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भारत सरकार

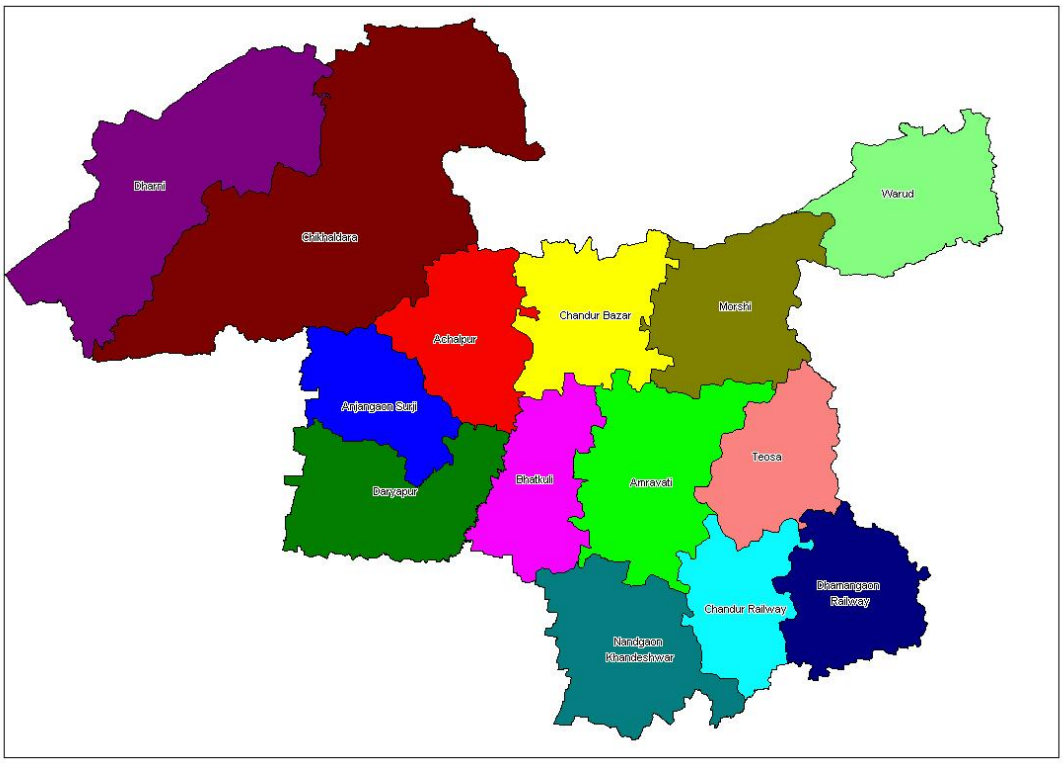
जल संसाधन मंत्रालय

केंद्रीय भूजल बोर्ड

GOVERNMENT OF INDIA
MINISTRY OF WATER RESOURCES
CENTRAL GROUND WATER BOARD

महाराष्ट्र राज्य के अंतर्गत अमरावती जिले की भूजल विज्ञान जानकारी

GROUND WATER INFORMATION
AMRAVATI DISTRICT
MAHARASHTRA



By

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Scientist-C

द्वारा

भूषण रा. लामसोगे

वैज्ञानिक- ग

मध्यवर्ती क्षेत्र

नागपुर

CENTRAL REGION

NAGPUR

2013

AMRAVATI DISTRICT AT A GLANCE

1. GENERAL INFORMATION

Geographical Area	:	12210 sq. km
Administrative Divisions (As on 31/03/2012)		Taluka- 14; Amravati, Morshi, Warud, Tiwsa, Chandur Railway, Nandgaon (Kh), Bhatkuli, Daryapur, Anjangaon, Dharni, Chikhaldhara, Achalpur, Chandur Bazar, Dhamangaon Railway
Towns / Villages /Grampanchayat	:	11 / 1698 / 843
Population (Census, 2011)	:	28,87,826
Average Annual Rainfall	:	700 to 1700 mm

2. GEOMORPHOLOGY

Major Physiographic unit	:	Two; Melghat Hill range area and Plain area of the Paynghat
Major Drainage	:	Two; Purna and Wardha

3. LAND USE (2008-09)

Forest Area	:	5213 sq. km.
Net Area Sown	:	7120 sq. km.
Cultivable Area	:	7476 sq. km.

4. SOIL TYPE

Medium to deep black soil and deep brown to red soil (Regur).

5. PRINCIPAL CROPS (2009-10)

Cotton	:	2143.59 sq. km.
Cereals	:	1217.52 sq. km.
Oil Seeds	:	997.65 sq. km.
Pulses	:	1701.89 sq. km.

6. IRRIGATION BY DIFFERENT SOURCES (2006-07)

		Nos.	Potential Created (ha)
Dugwells	:	81051	161826
Tubewells/Borewells	:	1599	3906
Surface Flow Schemes	:	1129	41235
Lift Irrigation Schemes	:	122	2835
Net Irrigated Area	:	209802	

7. GROUND WATER MONITORING WELLS (As on 31/05/2012)

Dugwells	:	48
Piezometers	:	14

8. GEOLOGY

Recent	:	Alluvium
Upper Cretaceous-Lower Eocene	:	Basalt (Deccan Traps)
Turonian	:	Lameta Beds
Upper Carboniferous - Permian	:	Gondwana
Archean	:	Metamorphics (Gneisses /Granites)

9. HYDROGEOLOGY

Water Bearing Formation	:	Basalt- Weathered/fractured/ jointed vesicular/massive, under phreatic and semi-confined to confined conditions. Alluvium- Sand and Gravel, under semi-confined to confined conditions.
Premonsoon Depth to Water Level (May-2011)	:	2.7 to 27.85 m bgl

Postmonsoon Depth to Water Level (Nov.-2011)	:	1 to 25.70 m bgl
Premonsoon Water Level Trend (2002-2011)	:	Rise: Negligible to 1.42 m/year Fall: 0.002 to 0.68 m/year
Postmonsoon Water Level Trend (2002-2011)	:	Rise: 0.018 to 1.79 m/year Fall: Negligible to 0.49 m/year

10. GROUND WATER EXPLORATION (As on 31/03/12)

Wells Drilled	:	EW-73, OW-24, Pz-33
Depth Range	:	15.15 to 300.10 m bgl
Discharge	:	0.23 to 23.50 lps
Transmissivity	:	1.87 to 835.14 m^2/day

11. GROUND WATER QUALITY

Good and suitable for drinking and irrigation purpose, except the saline areas of Purna Alluvium

Type of Water	:	Basalt- Ca-HCO_3 & Ca-Cl Alluvium- Na-HCO_3 & Na-Cl

12. DYNAMIC GROUND WATER RESOURCES (2008-09)

Annual GW availability	:	931.77 MCM
Total Draft (Irrigation + Domestic)	:	764.06 MCM
Net GW availability for future irrigation	:	46.80 MCM
Stage of GW Development	:	85.08 %

13. AWARENESS AND TRAINING ACTIVITY

A	Mass Awareness Programme	:	Two
B	Water Management Training Programme	:	Two

14. ARTIFICIAL RECHARGE & RAINWATER HARVESTING

Projects completed	:	2, Warud Taluka
Projects under technical guidance	:	Nil

15. GROUND WATER CONTROL & REGULATION

Over-Exploited Taluka	:	4, Morshi, Warud, Chandur Bazar, Daryapur
Semi-Critical Taluka	:	1, Achalpur
Notified Taluka	:	None

16. MAJOR GROUND WATER PROBLEMS AND ISSUES

Drought area has been observed in south-western parts of the district. Deeper water levels of more than 20 m bgl are also observed in small isolated patchs in parts of Achalapur, Chandur Bazar talukas, in central part of the district and in part of Chandur Railway in southern part of the district. The area of Purna River Alluvium, covering southern parts of Anjangaon and Achalpur talukas and entire Daryapur taluka, is affected by inland salinity problem.

Ground Water Information
Amravati District

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Ground Water Information
Amravati District

1.0 Introduction

Amravati District is one of the eleven districts of Vidarbha region of Maharashtra State. It is situated in the northern part of the State abutting Madhya Pradesh State and lies between north latitudes 20°32' and 21°46' and east longitudes 76°37' and 78°27'. The total area of the district is 12210 sq. km. and falls in Survey of India degree sheets 55 G, 55 H, 55 K and 55 L. The district is bounded on the north by Madhya Pradesh, on the east by Nagpur and Wardha districts, and on the south and south west by Yavatmal, Akola and Buldhana districts. Wardha River forms the eastern boundary of the district.

The district headquarters is located at Amravati Town. For administrative convenience, the district is divided in 13 talukas viz., Amravati, Morshi, Warud, Tiwsa, Chandur Railway, Nandgaon, Bhatkuli, Daryapur, Anjangaon, Dharni, Chikaldhara, Achalpur and Chandur Bazar. It has a total population of 28,87,826 of which male and female are 14,82,845 and 14,04,981 respectively as per 2011 census. The district has 13 towns and 1698 villages. Major part of the district comes under Purna-Tapi and Wardha River basins. The important rivers flowing through the district are Tapi, Purna, Wardha, Pedhi and Chandrabhaga.

Central Ground Water Board has taken up several studies in the district. A list of studies conducted in the district is presented in **Table-1**.

Table 1: Studies undertaken by CGWB

S. No.	Officer	AAP	Type of Survey/Study
1.	Shri Rao. G.N.	1961-62	Systematic Hydrogeological Survey
2.	Shri Mani, V.V.S.	1970-71	-do-
3.	S/Shri Mani, V.V.S and Sharma, S.K.	1973-74	-do-
4.	S/Shri Gajbhiye and Motghare	1987-88	-do-
5.	Shri Sundarshan, S.	1987-88	-do-
6.	Shri Bansal, S.K	1990-91	-do-
7.	S/Shri Anand, A.V.S.S. and Venkateshvaran, D.	1990-91	-do-
8.	Shri Ranjan, Binoy	1991-92	Reappraisal Hydrogeological Studies
9.	Shri G., Sudarshan	1992-93	-do-
10.	Shri A.V.S.S., Anand	1995-96	-do-
11.	S/Shri Mohanta, D. and Shende, Rahul R.	2003-04	-do-
12.	Shri Jain, P.K.	2001-02	Impact Assessment of RTRWH at Panchayat Samiti Office, Warud
13.	S/Shri. Jain, S.K., Ramaiah, S.N. and	VIII th 5 year plan	Artificial Recharge Studies in orange growing areas of WR-2

	Banerjee, K.P.		watershed, Warud Taluka.
14.	Shri. B. R. Lamsoge		Exploring the possibility of artificial recharge to ground water in an over exploited blocks Warud and Morshi, Amravati district, Maharashtra

Ground water exploration in the district has been taken up in different phases. The ground water exploration has been done in alluvial and hard rock areas occupied by Deccan Trap Basalt. A total of 73 Exploratory Wells (EW), 24 Observation Wells (OW) and 33 Peizometers (Pz) were constructed till March 2012.

Table 2: Salient Features of Ground Water Exploration.

S. No.	Taluka	Forma-tion	Wells			Depth (mbgl)	SWL (mbgl)	Discharge (lps)	Draw-Down (m)	Zones (mbgl)
			EW	OW	Pz					
1.	Amravati	Alluvium	2	-	3	37.6 – 79.00	0.7 – 1.37	0.38 –1.37	–	–
		Basalt	4	3	0	123.25 – 195.00	0.05 – 9.10	0.65 – 12.18	9.85 – 18.92	7.00 – 96.00
2.	Warud	Alluvium	1	–	–	150.55	4.35	0.38	–	10.35 – 13.35
		Basalt	3	0	2	40.00 – 204.5	10.60-36.00	Traces	–	0.38
3.	Morshi	Basalt	3	1	4	27.60– 202.45	6.78 – 35.00	0.56 – 7.78	–	24.00– 31.65
4.	Tiwsa	Basalt	3	–	–	184.25– 201.45	13.30	0.24– 0.56	–	7.00– 34.75
5.	Chandur Railway	Basalt	3	–	–	141.00– 200.00	4.02– 10.00	0.78–1.37	–	10.35– 15.50
6.	Dhamangaon Rly	Basalt	–	–	1	40.00	37.35	Traces	–	37.35
7.	Nandgaon Kh'war	Basalt	3	–	1	40.00– 200.00	6.95	0.43-0.78	–	–
8.	Bhatkuli	Alluvium	5	1	2	15.15– 128.60	3.65– 18.54	0.38– 16.80	0.75– 11.34	9.45-35.53
		Basalt	1	1		134.00-184.00	23.88-32.10	2.16 – 3.77	> 20.00	99.00-133.00
9.	Daryapur	Alluvium	7	1	1	32.00– 236.96	6.96– 13.65	0.78–6.20	0.16– 15.08	1.83– 177.30
		Basalt	2	-	-	35.00-300.00	50.00	0.01-1.40	–	–
10.	Anjangaon Surji	Alluvium	6	3	3	25.00– 300.10	5.91– 20.00	1.37– 23.50	2.44– 21.45	6.10– 47.85
11.	Dharni	Basalt	4	5	–	80.30– 200.00	2.50– 11.84	0.38– 20.77	8.00– 21.41	–
12.	Chikhaldara	Basalt	6	3	1	40.00 – 202.45	6.36– 40.44	0.38– 11.11	3.86– 28.84	10.00– 74.00
13.	Achalpur	Alluvium	6	1	3	39.00– 298.91	9.02– 20.58	1.37– 19.00	7.81– 9.59	6.00– 48.66
		Basalt	1	1	–	80.55-126.25	20.89	4.43– 16.21	12.90	–
14.	Chandur Bazar	Alluvium	6	2	4	42.00– 177.14	5.31– 17.80	1.37– 10.00	1.92 – 12.70	6.00– 122.32
	Total		73	24	33	15.15-300.10	0.05 – 40.44	0.24 - 23.50	0.16 – 28.44	1.83 – 177.30

In Deccan Trap Basalt 33 exploratory wells and 12 observation wells and 9 piezometer were drilled and their depth ranged from 74.45 to 202.45 metres below ground level (m bgl). The discharge from these wells varied from traces to 20.77 litres per second (lps). Static water levels ranged from 0.05 to 40.44 m bgl. Except for the exploratory wells at Dhaga and Nerpinglai, water levels were shallow in other wells. Deeper aquifer zones have been encountered in almost all the wells beyond 100 m depth, the deepest being at 167.0 m at Mahuli Jehangir exploratory well.

In Purna Alluvium 40 exploratory wells, 12 observation wells and 24 Peizometers were constructed. The alluvial area has been divided into fresh ground water belt in the north and saline area in the south, based on the ground water exploration findings. The northern most part of the fresh water zone is underlain by soft weathered boulders of Basalt and this is restricted to small patches of around 10 km^2 within Achalpur and Anjangaon taluka. This zone is termed as Bazada zone and exploration is yet to be done here. The southern saline area is distributed in parts of Daryapur, Bhatkuli and Amravati talukas and has been explored in detail by drilling. Depth of the wells ranged from 15.15 to 300.10 m bgl. Static water levels vary from 3.65 to 20.58 m bgl. Discharge from exploratory wells ranged from 0.38 to 23.50 lps for drawdowns ranging from 0.16 to 21.45 m. Granular zones have been encountered and screened at various depths. However, it is found that zones down to the depth of 70 m falling in younger alluvium have better yields and the water is less saline. This zone can be used for agricultural purposes by means of shallow tubewells constructed down to the depth of 65 m and yielding up to 10 lps for 30 m lift.

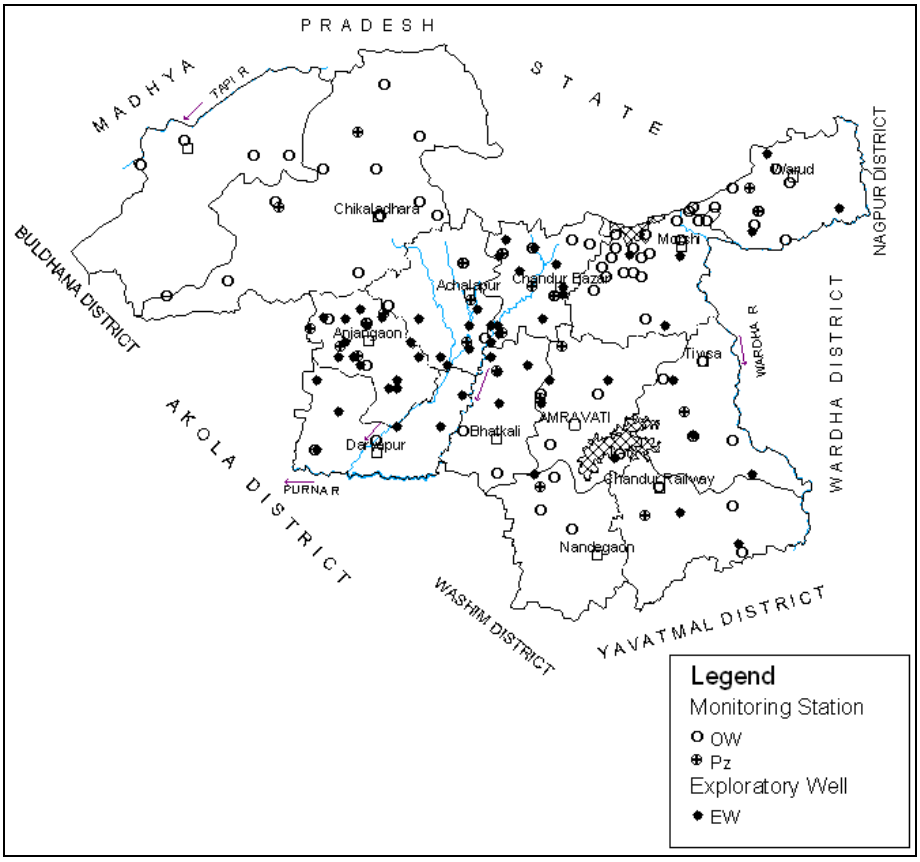

Figure 1: Location

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

2.0 Climate and Rainfall

The Climate of the district is characterised by a hot summer and general dryness throughout the year except during the south-west monsoon season, i.e., June to September. The mean minimum temperature is 15.1°C and mean maximum temperature is 42.2°C.

The normal annual rainfall over the district varies from 700 mm to about 1700 mm. It is the minimum in the south western parts of the district around Daryapur (709 mm). This increases towards north and reaches a maximum in the northern part around Chikaldhara (1647 mm). The average rainfall for the last ten years ranges from 712 mm (Daryapur) to 1407 mm (Chikhaldhara) and the same is presented in **Table-3**. The average annual rainfall for the last ten years when compared with the normal annual rainfall, it is observed that the average annual rainfall for the last ten years of the district is much less than the normal annual rainfall. Thus the rainfall has definitely decreased in the district over the period of time.

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

Sl. No.	Taluka	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Avg
1	Achalpur	646.5	625	572	654	1030.3	1334.24	384.4	656.1	1248.6	743.3	789.444
2	Amravati	672.5	681.8	511.62	886.4	931.35	1112.4	788	677.1	1405.1	900.5	856.677
3	Anjangaon	687.4	604.1	492.2	628.4	1168.38	1265.8	484.2	683.3	741.5	646.1	740.138
4	Bhatkuli	582.5	519.4	538.62	711.6	1063.33	1273.83	752.3	621.9	1029.1	787.2	787.978
5	Chandur	777.2	608.6	549.3	578	835	1513.6	543.9	727.4	892	780.6	780.56
6	Chandur Railway	859.7	850.9	418.03	1048.5	1029.55	906.74	479.2	646	1309.1	715.3	826.302
7	Chikhaldhara	1254	1373.2	1157.7	1358.2	1423.18	2154.86	1144	1059	1592.3	1555.7	1407.214
8	Daryapur	603.8	415.2	510.3	696.2	912.74	963.6	794.2	574.4	975	676	712.144
9	Dhamangaon Railway	851.3	750.8	630.6	1116.4	1057.3	959.44	537.3	797.7	1442.2	1049.3	919.234
10	Dharni	841.9	915	677.9	907.2	863.33	1232.22	736.8	618.4	902.1	1041.8	873.665
11	Morshi	763.1	750	659.8	696.3	736.69	1071	619.8	593.4	1185.8	609.2	768.509
12	Nandgaon-khandeshwar	768.4	520.4	441.4	1194.4	1059.32	1171.6	560.9	611.8	1346.7	1058.7	873.362
13	Tiwsa	642.2	618.5	568.05	964	740.23	848.38	724.2	717.5	1153.7	718.8	769.556
14	Warud	581.3	734.4	608.3	783.2	845.04	998.36	550	837.5	923.2	761.1	762.24
	Average	752.27	711.95	595.42	873.06	978.27	1200.43	649.94	701.54	1153.31	860.26	847.64

3.0 Geomorphology and Soil Types

The district can be broadly divided into two physiographic units i.e., the Melghat Hill range and the plain area of the Paynghat. The Melghat hills are made up of Gawilgarh hills, which are a part of the Satpura hill ranges. The eastern part of the district falls under Godavari basin and consists of 20 watersheds, whereas the western and north western parts fall in Tapi basin and consists of 23 watersheds. Two types of soils have been observed in the

district namely medium to deep black soil and deep brown to red soil (Regur).

4.0 Ground Water Scenario

4.1 Hydrogeology

Basaltic lava flows are the major rock formations along with alluvium, Lameta beds, Gondwana Sediments and unclassified metamorphic rocks. About 70% of the area is underlain by Deccan Traps and remaining by other soft rock formations, particularly the alluvium. A map depicting the hydrogeological features is presented as **Figure-2**.

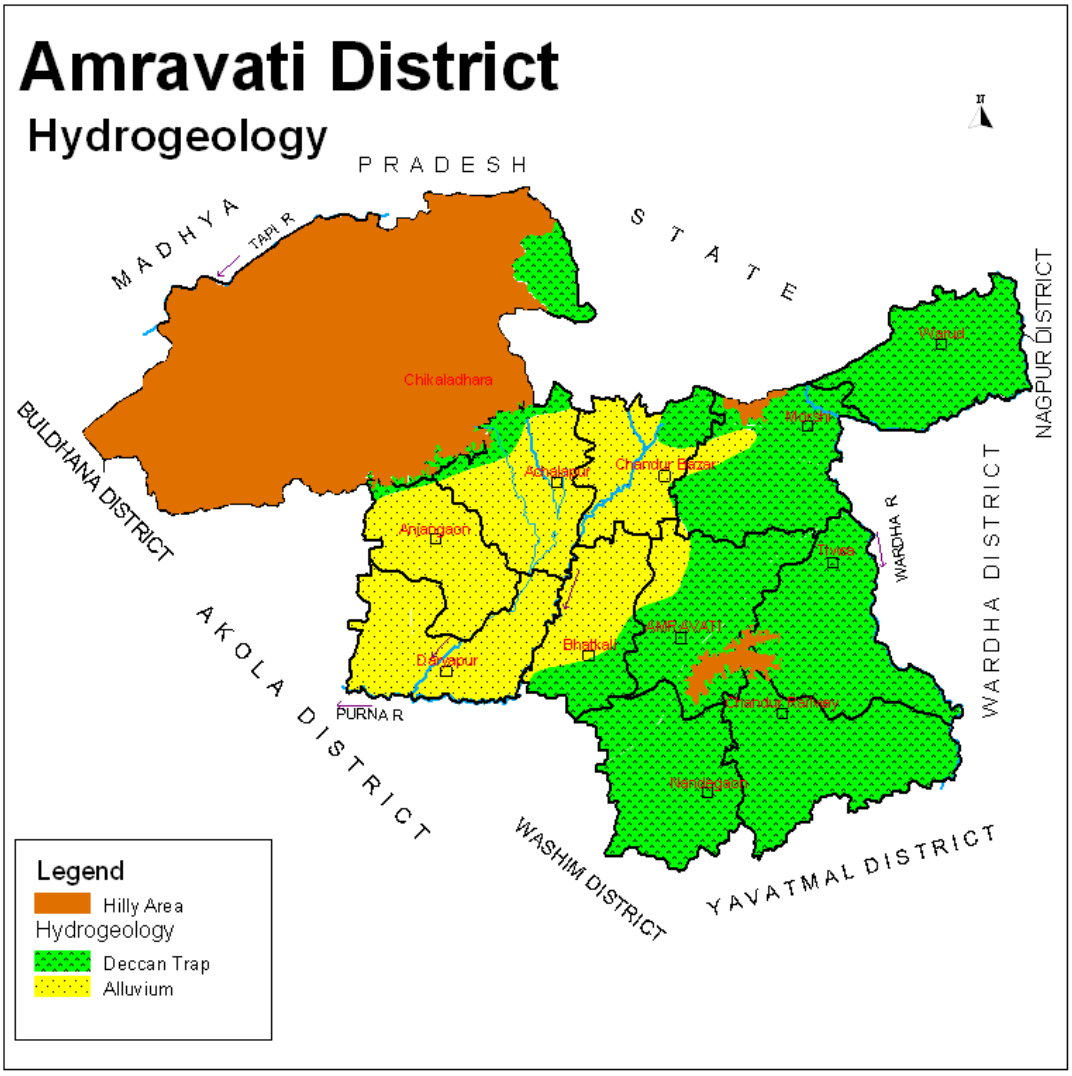

Figure 2: Hydrogeology

4.1.1 Deccan Trap Basalt

Deccan Trap Basalt belonging to upper Cretaceous to lower Eocene age occurs in the northwestern, southeastern and eastern parts of the district. The northwestern part, i.e., Dharni and Chikaldhara talukas, is hilly and rugged terrain where Basalt does not form potential aquifer due to limited thickness of weathered mantle. Ground water in Deccan Trap Basalt occurs mostly in the upper weathered and fractured parts down to 15-20 m depth. At places potential zones are encountered at deeper levels in the form of

fractures and inter-flow zones. The upper weathered and fractured parts form phreatic aquifer and ground water occurs under water table (unconfined) conditions. At deeper levels, the ground water occurs under semi-confined conditions.

4.1.2 Alluvium

The Alluvial deposits are termed as Purna Alluvial deposits, as they have been deposited in the Purna valley during Pleistocene to Recent period. Alluvium occupies nearly a third of the district on the northern side along Purna River system stretching over a width of 55 km and an area of 3500 sq. km. alluvium thickness ranges from 10-350 m and is divided into younger and older Alluvium with the younger one being more granular and the older more clayey. Ground water occurs under phreatic and semi-confined conditions down to a depth of 80 m i.e., in the younger Alluvium consisting of alternate beds of clay and sand. Two to five beds of coarse sand and gravel are encountered within the younger Alluvium, which form the productive aquifer. The older Alluvium is mostly clayey with only one or two thin beds of gravel at the base near the trap basement. In the deeper aquifers, ground water occurs in confined state. Younger Alluvium is lacustrine and older is marine in nature. The basement for Alluvium is Basalt met with at different depths, which may be due to pre-trappean topography or due to faults with up thrown and down thrown blocks. Predominant slope of trap basement is northwards.

Hydraulic gradient is towards south in the northern part of Purna River and towards north in the southern part of Purna River. Hydraulic gradient is 3.5 m/km in north and about 2.5 m/km in south of Purna River.

4.1.3 Water Level Scenario

Central Ground Water Board periodically monitors 66 Ground Water Monitoring Wells (GWMW) in the district, four times a year i.e. in January, May (Premonsoon), August and November (Postmonsoon). The data on premonsoon and postmonsoon water levels along with fluctuation during 2011 and long term water level trends (2002-2011) is given in **Table- 4**

Table 4: Water Level Data (2011) with Long Term Trend (2002-2011)

S. No.	Location	Pre monsoon Water Level (m bgl)	Post monsoon Water Level (m bgl)	Fluct-uation (m)	Premonsoon Trend		Postmonsoon Trend	
					Rise (m/yr)	Fall (m/yr)	Rise (m/yr)	Fall (m/yr)
1.	Ambada	NA	NA	NA	0.3935		0.6404	--
2.	Anjangaon Surji2	24.8	24.2	0.6	--	0.6804	--	0.4907
3.	Anjansingi	5	3.05	1.95	0.1203	--	--	0.0160
4.	Arao	3.5	1.1	2.4	0.1637	--	0.0199	--
5.	Ashtagaon	4.6	2.8	1.8	0.1805	--	0.1328	--
6.	Badnera	81	4.6	76.4	0.3055	--	0.2200	--
7.	Barukheda	NA	1.8	NA	0.0014	--	--	--
8.	Behali	5	3.8	1.2	0.3286	--	--	0.0523
9.	Bellora_Pz	NA	2.8	NA	--	--	--	--
10.	Belora	9.9	6	3.9	0.2715	--	0.1438	--
11.	Benoda (P1)	11.3	4.4	6.9	--	--	--	--
12.	Benoda_Pz	NA	3.5	NA	--	--	--	--
13.	Bhatkulijain	6.45	2.8	3.65	--	0.1608	0.1460	--

S. No.	Location	Pre monsoon Water Level (m bgl)	Post monsoon Water Level (m bgl)	Fluct-uation (m)	Premonsoon Trend		Postmonsoon Trend	
					Rise (m/yr)	Fall (m/yr)	Rise (m/yr)	Fall (m/yr)
14.	Bhokarbardi	5.2	1.8	3.4	0.0845	--	0.1639	--
15.	Chandur Bazar	27.85	25.7	2.15	--	0.5778	--	0.4658
16.	Chandur Railway	4.5	2.7	1.8	--	0.0300	0.0183	--
17.	Chicholi	8.25	3.9	4.35	0.0601	--	0.2486	--
18.	Chinkhedi	3.65	NA	NA	--	0.0621	--	--
19.	Dapori1	13.6	9.3	4.3	0.0789	--	0.7226	--
20.	Devgaon	5.65	3.8	1.85	0.2272	--	--	0.3105
21.	Dhargadh	NA	NA	NA	0.0981	--	0.0446	--
22.	Dhanrni	NA	NA		0.1454	--	0.0227	--
23.	Dhamangaon (Rly)	NA	2.5	NA	--	--	--	--
24.	Gadegaon1	16.6	15.7	0.9	0.3955	--	0.3466	--
25.	Ghat ladki	NA	NA	NA	0.2220	--	0.5378	--
26.	Harisal	9.5	5.8	3.7	--	0.0244	--	0.0194
27.	Hatru	5.4	NA	NA	--	0.1296	--	--
28.	Hiwarkheda	12.05	9.7	2.35	0.1151	--	0.3742	
29.	Jamgaon	9.55	5.2	4.35	0.4462	--	--	0.1394
30.	Karajgaon_Pz	NA	3.6	NA	--	--	--	--
31.	Khanapur	7.9	3	4.9	0.2489	--	0.6825	--
32.	Kher	4.7	3	1.7	0.3048	--	0.3945	--
33.	Kholapur	NA	11.7	NA	--	--	--	--
34.	Kolkaz	7.75	5.95	1.8	0.0300	--	--	0.0003
35.	Kolwihir_Pz	NA	1	NA	--	--	--	--
36.	Kurha	7.6	3.5	4.1	0.1292	--	0.2520	--
37.	Lawada	NA	3	NA	--	0.1112	0.0929	--
38.	Loni	19.6	13.8	5.8	0.1628	--	0.2312	--
39.	Mahuli	6.8	3.3	3.5	--	0.0711	0.1609	--
40.	Manjarkhed Kasba	NA	NA	NA	--	0.1683	1.7954	--
41.	Moorshi new	3.65	2.5	1.15	--	--	--	--
42.	Morshi_Pz	NA	2.6	NA	--	--	--	--
43.	Nandgaon	8.3	5.5	2.8	0.1926	--	0.2076	--
44.	Nimbhari	8.9	5.7	3.2	0.3956	--	--	0.1622
45.	Pala	9.75	8.4	1.35	0.1926	--	0.0584	--
46.	Pimpri	NA	1.7	NA	--	0.1880	0.0816	
47.	Pohra	2.7	2	0.7	--	0.1590	--	0.0583
48.	Rithpur	69	3.5	65.5	--	0.3440	0.6648	--
49.	Saiwada	9.4	6	3.4	--	0.0844	0.1358	--
50.	Sawarkheda	9.6	4.9	4.7	0.0413	--	0.3816	--
51.	Semadoh_Pz	NA	11.9	NA	--	--	--	--
52.	Shendurjana Khurd	6.6	3.5	3.1	0.2632	--	0.3159	
53.	Shivni1	6.3	2.7	3.6	0.0086	--	--	0.0086
54.	Silona	NA	3.3	NA	--	0.0392	--	0.1498
55.	Sindola	8.3	5.8	2.5	0.4252	--	0.4765	--
56.	Sirasgaon Kasba	15.8	NA	NA	0.1353	--	0.6804	--
57.	Temburkheda1	8.3	4.5	3.8	0.8871	--	0.6137	--
58.	Teosa	7.05	3.8	3.25	--	0.3258	--	0.0447

S. No.	Location	Pre monsoon Water Level (m bgl)	Post monsoon Water Level (m bgl)	Fluct-uation (m)	Premonsoon Trend		Postmonsoon Trend	
					Rise (m/yr)	Fall (m/yr)	Rise (m/yr)	Fall (m/yr)
59.	Udkhed_Pz	NA	4.2	NA	--	--	--	--
60.	Umarkhed	NA	6.9	NA	--	--	--	0.3861
61.	Wadgaon (Fattepur)	NA	6.8	NA	0.0501	--	--	0.0012
62.	Wadner gangai	7.6	6.2	1.4	0.3699	--	0.2370	--
63.	Walgaon	4.9	4	0.9	0.2377	--	0.2608	--
64.	Warud	11.1	7.6	3.5	0.3889	--	0.6947	--
65.	Wishroli1	7.55	7	0.55	1.4208	--	0.5332	--
66.	Yavali_Pz	NA	1.95	NA	--	--	--	--

4.1.3.1 Depth to Water Level – Pre-monsoon (May-2011)

The depth to water levels in the district during May 2011 ranges between 2.7 (Pohra) and 27.85 (Chandur bazar) m bgl. Depth to water levels during premonsoon (May 2011) has been depicted in **Figure-3**. Shallow water levels within 10 m bgl are observed in major parts of the district i.e., in southern parts of the district in parts of Daryapur, Bhatkuli, Amravati, Teosa, and Nandgaon Khandeshwar talukas; northeastern parts of the districts in Warud and Morshi talukas and in northwestern parts of the district in parts of Dharni and Chikaldhara talukas. In central and southern parts of the district comprising major parts of, Anjangaon, Achalapur, Chandur Bazar, Warud and small parts of Daryapur, Bhatkuli, Amravati, Morshi talukas, the water levels rests between 10 and 20 m bgl. Deeper water levels, i.e., more than 20 m bgl are observed in small isolated areas in parts of Anjangaon Surji, Achalpur, Chandur Bazar talukas in central part of the district.

4.1.3.2 Depth to Water Level – Post Monsoon (Nov.-2011)

The postmonsoon (Nov. 2011) depth to water levels ranges between 1 m bgl (Kolwihir) and 25.70 m bgl (Chandur bazar). Spatial variation in postmonsoon depth to water level is shown in **Figure-4**. Shallow water levels within 5 m bgl are observed in major parts of the district i.e., in eastern parts of the disctricts in parts of Dharni, Chikhaldara, DTWL from 5m to 10 m bgl in southern part of the district is Daryapur, northern part of Amravati, eastern parts of Warud and morshi and parts of Chikhaldara talukas. In major parts of Anjangaon Surji, Chandur bazaar, Achalpur, parts of Daryapur, Bhatkuli, Warud and Morshi, the water levels are between 10 and 20 m bgl. The deeper water levels of more than 20 m bgl are observed in north central part of the district falling in major parts of Achalpur, and Chandur Bazar talukas.

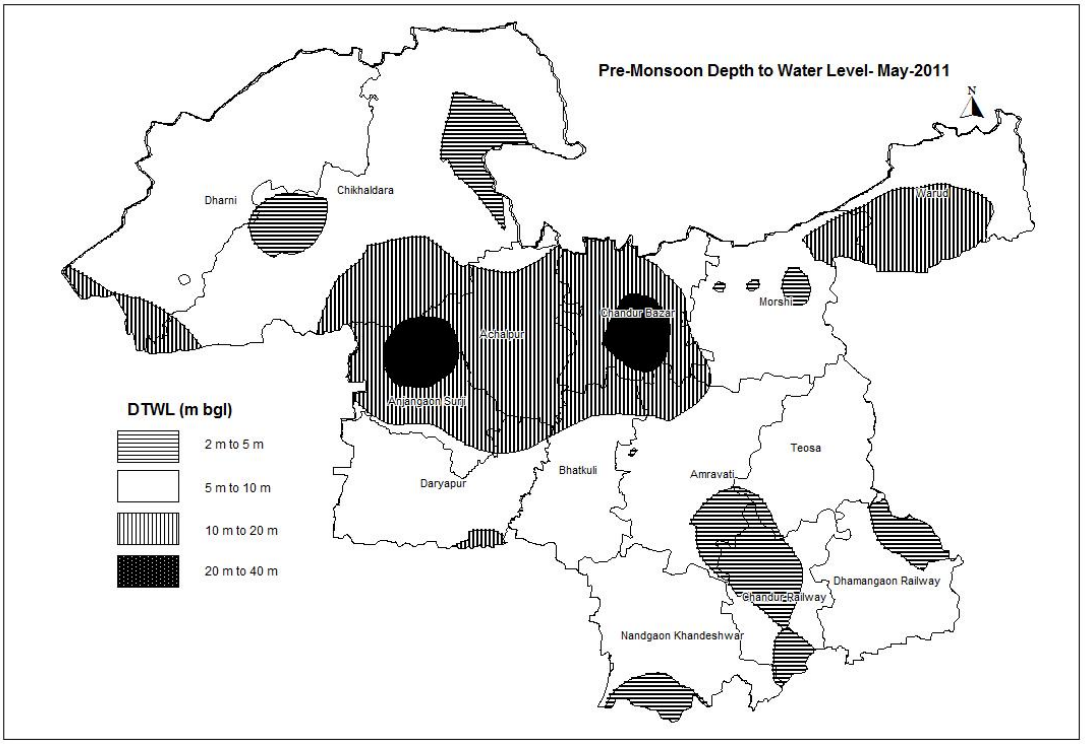

Figure 3: Depth to Water Level (Premonsoon- May 2011)

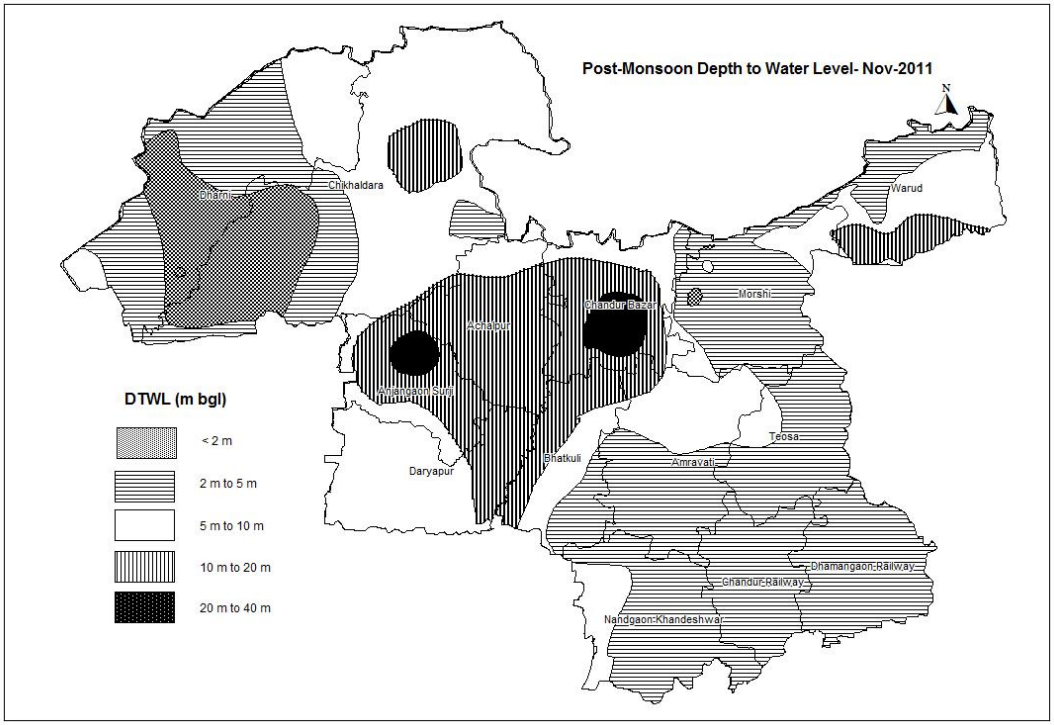

Figure 4: Depth to Water Level (Postmonsoon- Nov. 2011)

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

In entire district, rise in water levels in the range of 0.55 (Benoda) to 6.9 m (Wishroli) is observed. Rise in water level in the range of 0 to 2 m is the most dominant range observed in the north central, southern and northern parts of the district. In eastern, south western and north western parts, the rise

is in the range of 2 to 4 m. Rise of more than 4 m is observed in western, and eastern parts of the district in parts of Chikhaldara, Warud and Morshi talukas.

4.1.5 Water Level Trend (2002-2011)

Trend of water levels for premonsoon and postmonsoon periods for last ten years (2002-2011) have been computed for 66 GWMW and given in **Table-4**.

Analysis of trend indicates that during premonsoon period, rise in water levels has been recorded at 37 stations ranging between negligible at few stations and 1.42 m/year (Wishroli). Fall in water levels has been observed at 16 stations and ranging between 0.024 (Anjangaon Surji) and 0.68 m/year (Harisal). During postmonsoon period, rise in water levels has been recorded at 36 stations and it ranges from 0.018 (Chandur Rly) to 1.79 m/year (Manjarkhed Kasba), whereas at 15 stations, fall in water levels ranging between negligible at few stations and 0.49 m/year (Kolkaz) is observed. Thus in major part of the district, both during pre and postmonsoon periods declining trends of water levels have been observed.

4.1.6 Aquifer Parameters

Aquifer parameters for 30 exploratory wells constructed in alluvial formation are available. In these formation the transmissivity values ranged from 12.70 to 835.14 m^2/day and permeability varied from 10.28 to 668.26 m^2/day. It is observed that values of transmissivity and permeability are directly proportionate to the cumulative thickness of the aquifer and depends on the type of aquifer.

4.2 Ground Water Resources

Central Ground Water Board and Groundwater Surveys and Development Agency (GSDA), Govt. of Maharashtra, have jointly estimated the ground water resources of Amravati district based on GEC-97 methodology. The same is presented in **Table-5**, whereas the graphical representations of the resources are shown in **Figure-5**. Ground water resource assessment was done for 8392.39 sq. km. area of which 352.53 sq. km. area is under command and 6646.13 sq. km. is non-command area. About 1393 sq. km. area comes under poor ground water quality.

As per the estimation, the total annual ground water recharge is 982.91 MCM with the natural discharge of 51.14 MCM, thus the net annual ground water availability comes to be 931.77 MCM. The gross draft for all uses is estimated at 792.78 MCM with irrigation sector being the major consumer having a draft of 764.06 MCM. The domestic and industrial water requirements are worked at 46.80 MCM. The net ground water availability for future irrigation is estimated at 227.10 MCM.

Stage of ground water development varies from 26.32 % (Dharni) to 145.78 % (Warud). The overall stage of ground water development for the district is 85.08 %. Out of total 14 talukas, 4 talukas i.e., Morshi, Warud, Chandur Bazar and Daryapur are categorised as “Over-Exploited”, 1 taluka i.e., Achalpur falls in “Semi-Critical” category whereas remaining 9 talukas i.e., Amravati, Bhatkuli, Nandgaon (Kh), Anjangaon, Chandur Railway, Dharni, Chikhaldhara, Tiwsa and Dhmangaon fall in “Safe” category. Watershed wise

resources computation indicate that out of 59 watersheds PT-2, PT-20, PTC-2, PTP-2, WR-1, WR-2, WR-3, WRB-2 and WRC-1 watersheds fall in ”Over-Exploited”, PTC-1 PTCS-1 PTCS-2 PTP-3 PTP-6 WRB-1 fall in “Semi-Critical” category.

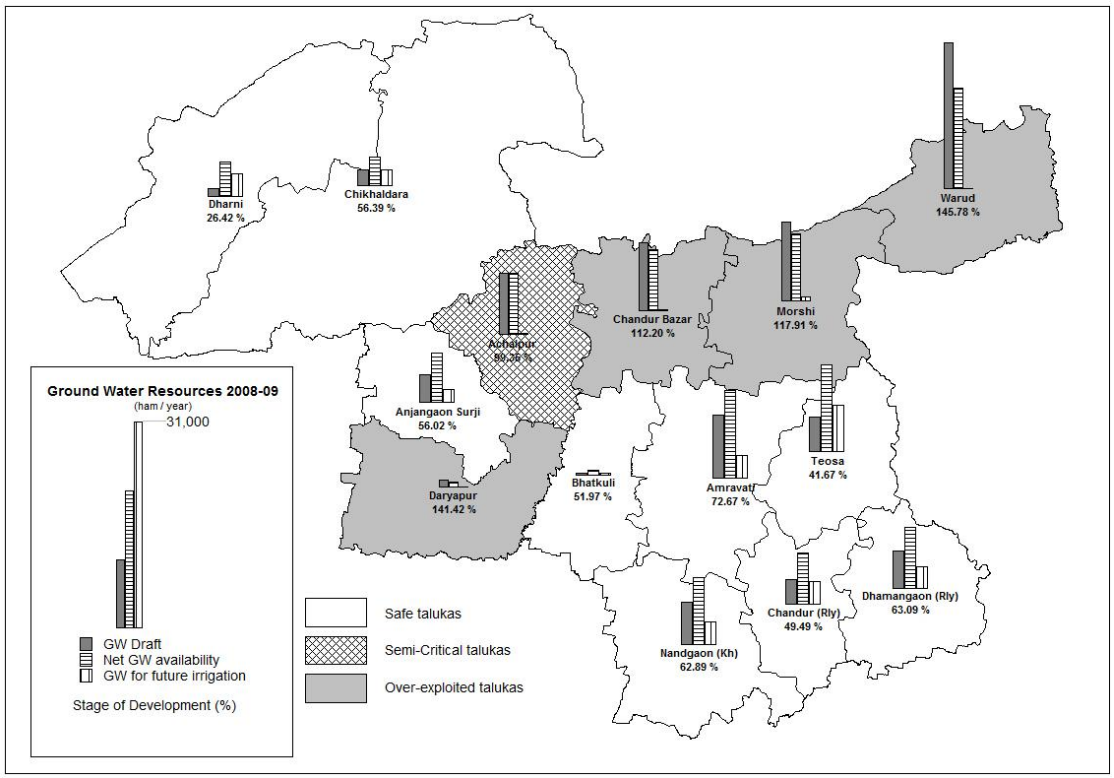

Figure 5: Ground Water Resources

Table-5: Taluka wise Ground Water Resources (2008-09)

Sr No.	Name of Takuka	Command / Non-Command / Total	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 (5+6)	Provision for domestic and industrial requirement supply to 2025	Net Ground Water Availability for future irrigation development (4-5-8)	Stage of Ground Water Development {7/4 * 100}%	Category
1	2	3	10	11	12	13	14	15	16	
1	Achlapur	Command	2348.26	687.89	40.75	728.64				Semi Critical
		Non Command	6257.08	7583.31	237.73	7821.03				
		Total	8605.34	8271.19	278.47	8549.67	483.20	301.47	99.35	
2	Amravati	Command	593.15	197.46	9.67	207.13				Safe
		Non Command	9029.22	6523.35	262.18	6785.53				
		Total	9622.37	6720.81	271.85	6992.66	519.51	2581.37	72.67	
3	Anjangaon Surji	Command	2466.34	541.13	57.21	598.34				Safe
		Non Command	3021.34	2401.12	74.79	2475.91				
		Total	5487.69	2942.25	132.00	3074.25	222.69	1472.84	56.02	
4	Bhatkuli	Command								Safe
		Non Command	582.79	284.26	18.62	302.89				
		Total	582.79	284.26	18.62	302.89	35.62	273.28	51.97	
5	Chandur Bazar	Command	307.71	55.60	6.33	61.93				Over Exploited
		Non Command	8203.91	9255.22	233.18	9488.40				
		Total	8511.62	9310.82	239.51	9550.33	313.47	303.01	112.20	
6	Chandur Railway	Command	643.54	177.45	27.38	204.83				Safe
		Non Command	4938.24	2437.40	120.42	2557.82				

Sr No.	Name of Takuka	Command / Non-Command / Total	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 (5+6)	Provision for domestic and industrial requirement supply to 2025	Net Ground Water Availability for future irrigation development (4-5-8)	Stage of Ground Water Development {7/4 * 100}%	Category
		Total	5581.77	2614.84	147.80	2762.65	285.43	2621.97	49.49	
7	Chikhaldara	Command	163.81							Safe
		Non Command	3088.27	1642.88	191.10	1833.99				
		Total	3252.07	1642.88	191.10	1833.99	401.95	1764.35	56.39	
8	Daryapur	Command								Over Exploited
		Non Command	819.07	1141.18	17.12	1158.30				
		Total	819.07	1141.18	17.12	1158.30	17.12	0.00	141.42	
9	Dhamangaon Railway	Command	546.91	154.08	2.17	156.24				Safe
		Non Command	6166.04	3880.59	198.53	4079.13				
		Total	6712.95	4034.67	200.70	4235.37	420.28	2393.27	63.09	
10	Dharni	Command	975.81	107.97	71.09	179.06				Safe
		Non Command	2927.88	662.26	189.84	852.10				
		Total	3903.69	770.23	260.93	1031.16	498.09	2593.99	26.42	
11	Morshi	Command	1594.94	450.04	43.93	493.97				Over Exploited
		Non Command	7710.44	10202.23	275.76	10477.99				
		Total	9305.38	10652.27	319.69	10971.96	381.84	673.90	117.91	
12	Nandgaon	Command	247.06	81.97	11.28	93.25				Safe
		Non Command	7251.91	4243.31	379.81	4623.12				

Sr No.	Name of Takuka	Command / Non-Command / Total	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 (5+6)	Provision for domestic and industrial requirement supply to 2025	Net Ground Water Availability for future irrigation development (4-5-8)	Stage of Ground Water Development {7/4 * 100}%	Category
		Total	7498.98	4325.28	391.09	4716.37	580.32	2608.24	62.89	
13	Tiwsa	Command	4338.83	914.73	67.89	982.62				Safe
		Non Command	5130.39	2896.03	67.06	2963.09				
		Total	9469.22	3810.76	134.96	3945.72	252.00	5122.56	41.67	
14	Warud	Command	1511.35	2858.62	83.48	2942.10				Over Exploited
		Non Command	12313.29	17026.22	184.57	17210.79				
		Total	13824.64	19884.84	268.05	20152.89	269.27	0.00	145.78	
District Total		**Command**	**15737.72**	**6226.93**	**421.19**	**6648.12**			**-**	
		Non Command	**77439.86**	**70179.35**	**2450.74**	**72630.09**			**-**	
		Total	**93177.58**	**76406.29**	**2871.93**	**79278.21**	**4680.80**	**22710.25**	**85.08**	

4.3 Ground Water Quality

In the district, 41 water samples were collected during May 2010, out of which 37 samples were representing Deccan Trap Basalt and 4 were representing Alluvium. The partial chemical analysis of these ground water samples is given in Table-5.

Table-5: Chemical analysis of these ground water samples

SN	Well No.	Village	pH	EC µS/cm	TA mg/L	TH mg/L	NO_3 mg/L	F mg/L	RSC
1.	G/AV-004	Warud	7.9	1350	335	400	124	0.30	-1.30
2.	G/AV-006	Shendurjana Kh	8.2	700	315	200	11	0.18	2.30
3.	G/AV-014	Sindola	7.6	2000	225	615	361	0.37	-7.80
4.	G/AV-016	Pohra	8.0	890	280	370	30	BDL	-1.80
5.	G/AV-018	Kurha	8.0	780	205	275	87	0.14	-1.40
6.	G/AV-020	Chandur Rly	8.2	1250	350	340	97	0.01	0.20
7.	G/AV-030	Teosa	7.9	970	165	270	110	BDL	-2.10
8.	G/AV-031	Deogaon	8.1	700	275	200	11	0.11	1.50
9.	T/AV-034	Chinkhedi	8.5	440	235	185	2	BDL	1.00
10.	T/AV-035	Behali	8.5	560	235	210	16	BDL	0.50
11.	T/AV-036	Rithpur	7.7	2400	210	670	281	0.79	-9.20
12.	T/AV-038	Barukheda	8.4	700	350	265	7	0.34	1.70
13.	T/AV-039	Bhokarbardi	7.9	1520	145	545	175	BDL	-8.00
14.	G/AV-040	Chicholi	8.3	1310	290	375	145	0.56	-1.70
15.	G/AV-041	Khanapur	8.4	1870	620	460	36	0.56	3.20
16.	G/AV-042	Ashtagaon	7.8	1660	340	420	208	0.43	-1.60
17.	G/AV-043	Saiwada	7.9	1040	275	320	152	0.53	-0.90
18.	G/AV-046	Ambada	8.3	1280	460	525	41	0.26	-1.30
19.	G/AV-053	Pala	7.9	1370	155	360	117	0.66	-4.10
20.	G/AV-057	Hiwarkheda	7.8	1200	285	360	101	0.06	-1.50
21.	G/AV-059	Jamgaon	8.3	920	225	250	45	0.82	-0.50
22.	G/AV-061	Loni	8.1	1240	360	430	101	0.11	-1.40
23.	G/AV-063	Anjansingi	7.9	1310	215	345	140	BDL	-2.60
24.	T/AV-069	Kolkaz	8.5	290	150	145	1	BDL	0.10
25.	T/AV-070	Lawada	8.4	340	165	160	12	BDL	0.10
26.	T/AV-072	Badnera	7.9	1050	315	315	77	0.33	0.00
27.	T/AV-096	Wisholi 1	8.5	490	250	125	7	0.87	2.50
28.	G/AV-097	Dapori 1	8.5	950	315	280	69	0.33	0.70
29.	G/AV-098	Tembhurkheda 1	8.4	1400	270	390	104	0.57	-2.40
30.	G/AV-099	Gadegaon 1	8.2	1240	420	380	78	BDL	0.80
31.	T/AV-100	Nimbhari	8.6	2600	840	280	104	1.28	11.20
32.	T/AV-102	Wadner gangai	8.3	5800	1165	1065	333	1.17	2.00
33.	G/AV-104	Shivani 1	8.1	1380	340	260	81	BDL	1.60
34.	G/AV-105	Morshi (new)	8.2	610	185	210	9	0.71	-0.50
35.	G/AV/005	Walgaon	8.7	3000	995	305	76	0.59	13.80
36.	G/AV/008	Chandur Bazar	8.4	1200	535	275	18	0.26	5.20
37.	G/AV-011	Harisal	8.3	670	205	275	38	BDL	-1.40
38.	G/AV-012	Silona	8.4	410	205	180	13	BDL	0.50

SN	Well No.	Village	pH	EC µS/cm	TA mg/L	TH mg/L	NO_3 mg/L	F mg/L	RSC
39.	G/AV-024	Hatru	8.4	630	245	250	6	0.01	-0.10
40.	G/AV-025	Arao	8.4	440	230	190	6	BDL	0.80
41.	G/AV-027	Belora	8.4	990	235	400	76	0.11	-3.30
		Average	8.2	1242.7	332.1	338.4	85.5	0.4	-0.1

a) The samples from Basaltic aquifer show Ca-HCO_3 and Ca-Cl type water. The samples, which are dominated by Na-HCO_3 and Na-Cl type of water belong to alluvial area. It is observed that the ground water samples representing Basaltic aquifer, which were of Ca-HCO3 type, have changed to Ca-Cl type. The type of water in Alluvium gives an idea about inland salinity problem existing in the Purna Alluvium basin of the district.

b) The pH values indicate that the CO_2 dissolved in water is present mainly in the form of HCO_3^- while it is also occurring as a CO_3^{--} in those samples where pH is more than 8.3. There are 21 sample locations identified where the high values of pH i.e., > 8.3 was found. The overall range and average value of pH of the ground water samples indicate that the ground water in the district is predominantly alkaline in nature.

c) The value of EC of water gives an idea about the ions concentration in the water. As the concentration of dissolved ions increases, the water becomes more conductive. The average value of EC of the samples suggests that the groundwater in the monitoring wells is fresh in nature. While sample location sites like Sindola, Rithpur, Nimbhari, Wadner gangai and Walgaon where the EC > 2000 µS/cm have been recorded, may be due to unutilised ground water resource.

d) The total hardness (TH) is the sum of calcium and magnesium concentration expressed in terms of $CaCO_3$ in mg/L. The carbonate and bicarbonate salts of Ca and Mg give temporary hardness to ground water while chloride and sulphate salts give permanent hardness. In the district, the TH of groundwater is found less than maximum permissible limit of BIS (600 mg/L) indicating the ground water is soft in nature, except at Sindola, Rithpur, Wadner gangai.

e) The total alkalinity (TA) of water is its acid neutralizing capacity and primarily a function of carbonate, bicarbonate and hydroxide content of water. It is expressed in terms of $CaCO_3$. In the ground water samples from monitoring wells the alkalinity is mainly due to bicarbonate ions as most of the samples are having pH less than 8.3. In the district, the TA of groundwater is found within maximum permissible limit (300-600 mg/L) except at Khanapur, Nimbhari, Wadner ganagai and Walgaon.

f) The nitrate concentration observed in ground water ie more than the maximum permissible limit of BIS (45 mg/L) in 23 water sample locations, while rest of the samples are falling in safe category. This is indicating the ground water contamination by nitrate may be due to anthropogenic activity.

g) The concentration of fluoride is within permissible limit i.e. below 1.5 mg/L in entire district.

4.3.1 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) is given in Table-6.

Table-6: BIS Drinking Water Standards (IS-10500-91, Revised 2003), for Drinking water

Parameters	DL	MPL
TDS (mg/L)	500	2000
TH (mg/L)	300	600
TA (mg/L)	200	600
Ca (mg/L)	75	200
Mg (mg/L)	30	100
Cl (mg/L)	250	1000
SO_4 (mg/L)	200	400
NO_3 (mg/L)	45	No relaxation
F (mg/L)	1.0	1.5

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

The perusal of Table-5 and 6 shows that concentration of NO_3 is beyond the maximum permissible limit in 23 of samples. In few samples, the concentration of parameter such as TA and TH have also crossed the maximum permissible limits. Overall, the potability of ground water in the monitored wells has been affected mainly due to high NO_3 in ground water. Therefore, it can be concluded that the ground water quality in majority of the area is good for drinking purpose except those places where NO_3 concentration crosses MPL.

4.3.2 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 suitability of irrigation water depends primarily on the presence of dissolved salts and their concentrations. Sodium Adsorption Ratio (SAR) and Residual Sodium Carbonate (RSC) are the most important quality criteria, which determine the water quality and its suitability for irrigation.

4.3.2.1 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 on RSC values for its suitability for irrigation purpose is shown below in Table-8.

The Table-8 shows that the ground water samples from 31 wells (75 %) have RSC values below 1.25 and are suitable for irrigation while 6 water samples (15%) have fall in doubtful category and 4 water sample (10 %) from Khanapur, Nimbhari, Walgaon, Chandur Bazar are unsuitable for irrigation.

Overall, the ground water quality in the wells monitored is good for irrigation purpose and there is a less possibility of developing sodium hazard.

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	%
41	31	75 %	6	15 %	4	10 %

4.4 Status of Ground Water Development

The yields of wells are functions of the permeability and transmissivity of aquifer encountered and varies with location, diameter and depth etc. There are four types of ground water structures in the area i.e. dugwells, borewells, tubewells and dug cum borewells (DCB). Their yield characteristics are described below.

Dugwells are generally used for both domestic water requirements and for minor irrigation purposes in this area. It is observed that the dugwells varying from 5.60 m to around 30 m in depth in basaltic lava flows can sustain assured water supply for domestic needs of about 500 people throughout the year. The reported yield of dugwells in basalt for irrigation purposes varies from 20 to 90 m^3/day. However, dugwells in alluvium and wells located in favourable area in basalt can yield 100 to 250 m^3/day. The dug cum borewells (DCB) are the major ground water abstraction structures in the alluvial parts of Chandur Bazar and Achalpur talukas, where deeper water levels exist, the DCB's tap the semi confined to confined zones in the depth range of 25-40 m bgl. Their yield ranges from 5 to 20 m^3/hr.

Ground water is predominantly used for irrigation, as it is the major ground water utilising sector. As per the data available for year 2007-08, out of total irrigated area of 512.80 sq km, the area irrigated by ground water is about 467.67 sq km, whereas surface water accounts for only 45.13 sq km of area. Thus, ground water is the major source for irrigation as it accounts for about 92% of net irrigated area. There are about 81051 dugwells in the district which create an irrigation potential of 1618.26 sq.km., out of which 1460.19 sq.km. of irrigation potential is utilised. In addition to this 35.71 sq.km of irrigation potential is utilised through 1599 borewells/tubewells during 2007-08.

State government has drilled large number of borewells and tubewells fitted with hand pumps and electric motors for rural drinking water purposes in the district. In all GSDA, Government of Maharashtra has drilled 5277 successful borewells under various schemes by the year ending 2010-11 for Rural Water Supply in the district of which 598 are reported to be high yielding. Yields of borewells range from 500 to 3000 lph. Shallow tubewells of about 15 to 20 m depth in alluvial area have a yield of around 15 to 22 m^3/hour. The ground water development in the district is mostly through dugwells. The success rate of borewells/tubewells drilled by GSDA is about 89%**.**

5.0 Ground Water Management Strategy

Ground water has special significance for agricultural development in the State of Maharashtra. The ground water development in some parts of the State has reached a critical stage resulting in decline in ground water levels. There is thus 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

A major part of the area is underlain by the Deccan Trap Basalt. The northwestern part of the district, comprising Dharni and Chikhaldhara talukas is primarily hilly and therefore has a poor ground water development potential. In eastern part, i.e., in Warud and part of Morshi talukas, Deccan Traps have low ground water development potential. The ground water in these areas can be developed through dugwells. The southeastern part of the district comprising Nandgaon (Kh), Chandur Railway and Tiwsa talukas occupied by Deccan Traps has medium ground water potential. Ground water in these areas can be developed through dugwells and DCB. Deccan Traps have relatively higher yields in the central part of the district i.e., in parts of Amravati, Bhatkuli and Morshi talukas. In these areas the ground water can be developed through dugwells, DCB and borewells. The nature and yield potential of the aquifers occurring in different areas are given in **Table-9**, whereas the map is presented as **Figure-6**.

Table-9: Nature and Yield Potential of Aquifers

S. No.	Taluka	Main Aquifer	Yield Potential	Type of Wells Suitable	Remarks
1.	Achalpur	Alluvium	High	Dugwells Tubewells	
2.	Amravati	Basalt	Medium to High	Dugwells Borewells	
3.	Anjangaon Surji	Alluvium	Medium to High	Dugwells Tubewells	Southern parts are having brackish to saline ground water
4.	Bhatkuli	Alluvium	Low to Medium	Dugwells DCB	Central and southern parts are having brackish to saline ground water
5.	Chandur Bazar	Alluvium	Medium to High	Dugwells Tubewells	
6.	Chandur Railway	Basalt	Medium	Dugwells Borewells	
7.	Chikhaldara	Basalt	Poor	Dugwell	Hilly Area
8.	Daryapur	Alluvium	Medium	Dugwells DCB	Southern parts are having brackish to saline ground water
9.	Dharni	Basalt	Poor	Dugwell	Hilly Area
10.	Morshi	Basalt	Low to Medium	Dugwells Borewells	
11.	Nandgaon	Basalt	Medium	Dugwells Borewells	

12.	Tiwsa	Basalt	Low to Medium	Dugwells Borewells	
13.	Warud	Basalt	Low	Dugwells DCB	

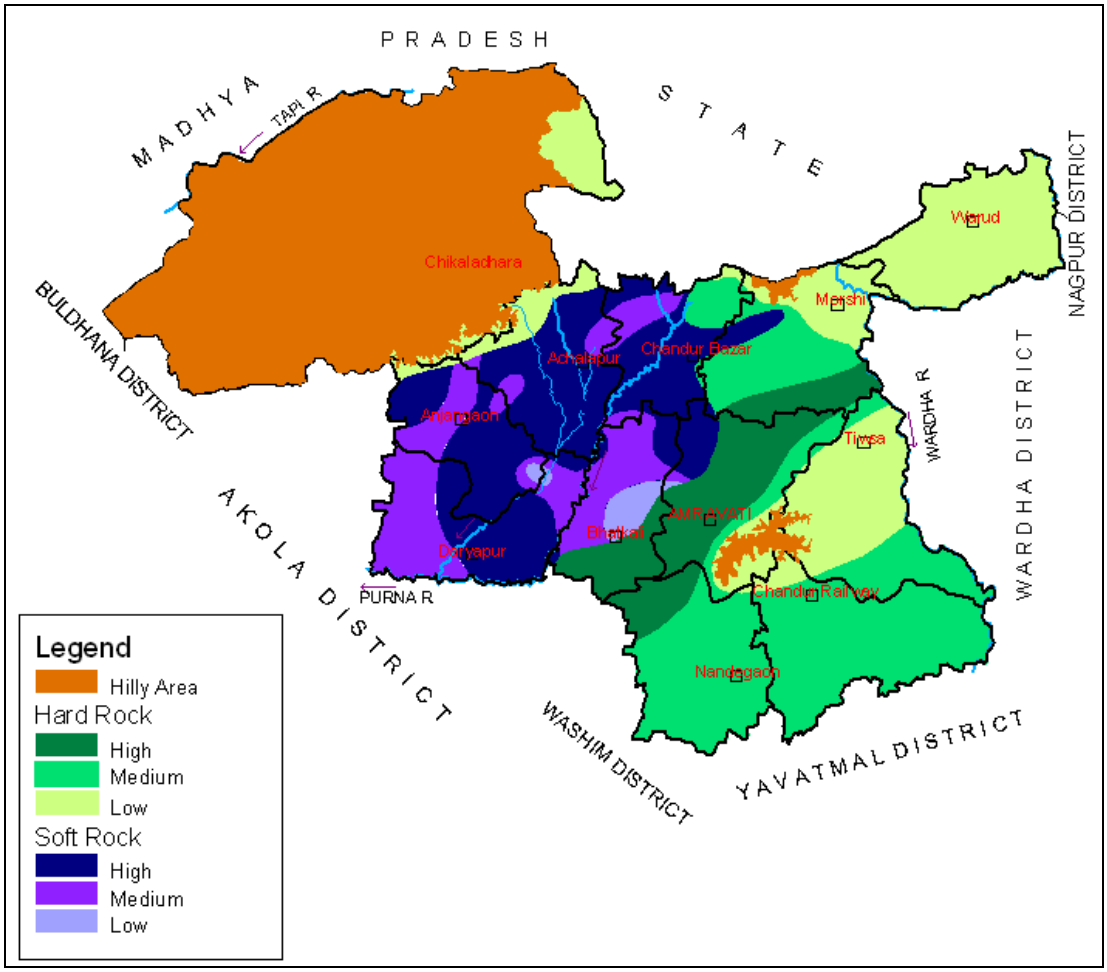

Figure 6: Yield Potential

5.2 Water Conservation and Artificial Recharge

Under Central Sector Schemes, Central Ground Water Board, Central region, Nagpur has constructed three (03) percolation tanks and ten (10) cement plugs during 1997-98 under pilot recharge projects. The gross storage capacity of three percolation tanks was varying from 71 to 221 TCM and recharge in the range of 49 to 132 TCM took place during 1997-98. Like wise gross storage capacity of ten cement plugs was varying from 22.1 to 7.42 TCM and a recharge of 58.7 TCM took place during 1997-98.

A roof top rainwater harvesting scheme was taken up at Panchayat Samiti Office premises, Warud, during 2001-02 and construction was completed in March 2002. A total roof area of 550 m^2 was utilised to harvest the rainwater and estimated volume of rainwater generated at normal annual rainfall of 965 mm was 477.2 m^3. However, as per impact assessment study a total of 311.3 m^3 of rainwater was generated at the rooftop out of which 280.17 m^3 was actually recharged into the dugwell during June to Sept 2002.

This reduction in estimated and actual recharge was due to the less rainfall during the period.

A large number of water conservation structures in the form of percolation tanks, under ground bandharas, diversion dams, village tanks and KT weirs have been constructed in the district. As per the data available for year 2010-11, 94 percolation tanks, 347 under ground bandharas, 68 irrigation tanks, 382 village tanks, 24 diversion dams had been constructed.

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, particularly in the Dharni and Chikaldhara talukas. 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. The ground water in a part of the alluvial area is saline. In such areas, quality of ground water needs to be considered before selecting the site. In the areas with poor ground water quality, the water conservation structures are more feasible.

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.

6.0 Ground Water Related Issues and Problems

Drought area has been observed in south-western parts of the district i.e., in part of Dharni, Daryapur, Anjangaon, Achalpur, Amravati, Bhatkuli and Nandgaon Khandeshwar talukas. Deeper water levels of more than 20 m bgl are also observed in small isolated pockets in parts of Achalapur and Chandur Bazar talukas, in central part of the district and in part of Chandur Railway taluka in southern part of the district. The special study carried out by CGWB in Purna River Alluvial basin indicates that in southern parts of Anjangaon and Achalpur talukas and entire Daryapur taluka brackish to saline ground water has been observed with EC ranging from 2000 to more than10000 μ mhos/cm at 25°C. Thus it is inferred that these areas of Purna River Alluvium are affected by inland salinity problem due to diagenetically altered meteoric water having longer residence time, high rate of evapotranspiration and it is restricted to the sandy aquifers inter-layered with clayey beds due to which less recharge of ground water is taking place.

7.0 Mass Awareness and Training Activities

7.1 M.A.P. and W.M.T.P.

Till March 2012, two Mass Awareness Programmes (MAP) and two Water Management Training Programmes (WMTP) were organised at Amravati. The details are given in **Table-10**.

7.2 Participation in Exhibition, Mela, Fair etc.

During the MAP at Amravati, an exhibition depicting rainwater harvesting model, various ground water related posters, leaflets, literatures and technical reports were displayed along with maps of Amravati district. The

models, maps, posters were explained to the visitors in details.

Table-10: Status of MAP and WMTP.

S. No.	AAP	Item	Venue	Date	No of Persons Attended
1	2000-01	MAP	Warud	29/12/2000	700
2	2002-03	WMTP	Amravati	18/02/2003	150
3	2008-09	MAP	Morshi	24/02/2009	235
4	2008-09	WMTP	Amravati	25 to 26/02/09	34

8.0 Areas Notified by CGWA/SGWA

As per ground water resource estimation, four talukas, i.e., Warud, Morshi, Chnadur Bazar and Daryapur fall under “Over-Exploited” category, while one taluka, i.e., Chandur Bazar, fall under “Semi-Critical”. However, till March 2012 the area has not been notified either by CGWA or SGWA.

9.0 Recommendations

1. Major part of the district is underlain by the Deccan Trap Basalt where only dug wells are most feasible structures for ground water development. The sites for borewell needs to be selected only after proper scientific investigation.
2. 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 ground water is brackish to saline in some parts underlain by alluvium. In such areas, the wells should be constructed after careful study of local hydrogeological conditions.
4. The overall stage of ground water development for the district is has already reached about 78%. Therefore, further development of ground water resources may be carried out with caution.
5. Morshi, Warud and Daryapur talukas fall under “Over-Exploited” category and Chandur Bazar falls under “Critical” category, therefore, further development of ground water resources is not recommended in these talukas. Also further ground water development is not recommended in watersheds PT-2, PT-20, PTC-2, PTP-2, WR-1, WR-2, WR-3, WRB-2 and WRC-1 falling in “Over-Exploited” category. Whereas dual approach of development coupled with artificial recharge measures needs to be adopted in PTC-1 PTCS-1 PTCS-2 PTP-3 PTP-6 WRB-1 falling in “Semi-Critical” category. Thus future water conservation and artificial recharge structures needs to be prioritised in these parts of the district

6. The scope exists for constructing suitable artificial recharge structures in the district. The structures recommended particularly for the hilly-basaltic area in the north (Dharni and Chikaldhara talukas) 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.
7. In the Alluvial area of the district, percolation tanks and recharge wells are suggested wherever the ground water is not saline. In saline areas, water conservation structures may be constructed.
8. The existing village ponds/tanks need to be rejuvenated to act both as water conservation and artificial recharge structures.