

**भारत सरकार**

**जल संसाधन मंत्रालय**

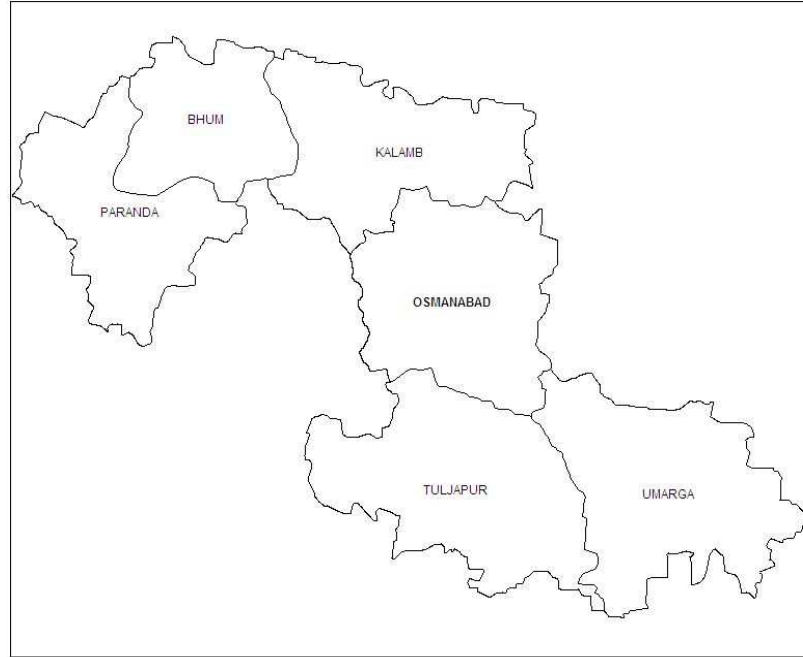
**केंद्रीय भूजल बोर्ड**

**GOVERNMENT OF INDIA  
MINISTRY OF WATER RESOURCES  
CENTRAL GROUND WATER BOARD**

**महाराष्ट्र राज्य का अंतर्गत उस्मानाबाद जिला की**

**भूजल विज्ञान जानकारी**

**GROUND WATER INFORMATION  
OSMANABAD DISTRICT  
MAHARASHTRA**



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**नागपुर**

**CENTRAL REGION  
NAGPUR  
2009**

## OSMANABAD DISTRICT AT A GLANCE

- 1. GENERAL INFORMATION**

Geographical Area	: 7512 sq. km.
Administrative Divisions (As on 31/03/2007)	: Taluka-8; Osmanabad, Tuljapur, Omerga, Lohara, Bhoom, Kallamb, Paranda and Washi.
Villages	: 729
Population	: 14,86,586
Normal Annual Rainfall	: 600 mm to 850 mm
- 2. GEOMORPHOLOGY**

Major Physiographic unit	: One; Balaghat Plateau
Major Drainage	: One; Manjra
- 3. LAND USE (2000-01)**

Forest Area	: 40.63 sq. km.
Net Area Sown	: 7716 sq. km.
Cultivable Area	: 7229 sq. km.
- 4. SOIL TYPE**

Shallow, Medium and Medium deep soils.
- 5. PRINCIPAL CROPS (1996-97)**

Jowar	: 2870.50 sq. km.
Total Pulses	: 1861.09 sq. km.
Wheat	: 362.02 sq. km.
Sugarcane	: 280.15 sq. km.
- 6. IRRIGATION BY DIFFERENT SOURCES (2000-01) -  
Nos./Potential Created (ha)**

Dugwells	: 39841/123298
Borewells	: 11116/34853
Tanks/Ponds	: 964/2513
Other Minor Surface Sources	: 3188/9846
Net Irrigated Area	: 136615 ha
- 7. GROUND WATER MONITORING WELLS (As on 31/03/2007)**

Dugwells	: 20
Piezometers	: 9
- 8. GEOLOGY**

Upper Cretaceous-Lower Eocene	: Deccan Trap Basalt
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- 9. HYDROGEOLOGY**

Water Bearing Formation	: Basalt- weathered/fractured/ jointed vesicular/massive, under phreatic and semi-confined to confined conditions
Premonsoon Depth to Water Level (May-2007)	: 4.60 to 23.10 m bgl
Postmonsoon Depth to Water Level (Nov.-2007)	: 0.80 to 13.90 m bgl
Premonsoon Water Level Trend (1998-2007)	: Rise: Negligible to 0.74 m/year Fall: Negligible to 0.504 m/year
Postmonsoon Water Level Trend (1998-2007)	: Rise: 0.04 to 0.09 m/year Fall: 0.02 to 0.28 m/year

**10. GROUND WATER EXPLORATION** (As on 31/12/07)

Wells Drilled : EW-48, OW-11, Pz-12, Total=71  
Depth Range : 30.00 to 204.15 m bgl  
Discharge : 0.22 – 20.24 lps  
Transmissivity : 0.22 to 20.24 m<sup>2</sup>/day (Basalt)

**11. GROUND WATER QUALITY**

Good and suitable for drinking and irrigation purpose, however localized fluoride contamination is observed in deeper aquifer and nitrate contamination in some parts of urban areas of Osmanabad town and localized places in rural areas.

Type of Water : Ca-HCO<sub>3</sub> and Ca-Cl

**12. DYNAMIC GROUND WATER RESOURCES-** (As on 31/03/2004)

Net Annual GW Availability : 1083.98 MCM

Annual GW draft : 701.20 MCM

(Irrigation+Domestic)

Allocation for Domestic and Industrial requirement up to next : 33.89 MCM

25 years

Stage of Ground Water : 64.69 %

Development

**13. AWARENESS AND TRAINING ACTIVITY**

Mass Awareness Programme : Yet to taken up

Water Management Training : Yet to taken up

Programme:

**14. ARTIFICIAL RECHARGE & RAINWATER HARVESTING**

Projects Completed : Nil

Projects under Technical : Nil

Guidance

**15. GROUND WATER CONTROL & REGULATION**

Over-Exploited Taluka : None

Semi-Critical Taluka : Osmanabad

Notified Taluka : None

**16. MAJOR GROUND WATER PROBLEMS AND ISSUES**

The severe drought conditions were experienced in all talukas except at Tuljapur, while moderate drought ranges from 11% at Kallamb to 28% at Tuljapur. It is coupled with declining trend of water levels in major part of the district, both during pre and postmonsoon periods. The ground water exploration reveals that the ground water quality in deeper aquifer is adversely affected by fluoride contamination in Osmanabad, Tuljapur and Omerga talukas. Some parts of urban areas of Osmanabad town and localized places in rural areas are also adversely affected by the nitrate contamination.

# Ground Water Information Osmanabad District

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# Ground Water Information

## Osmanabad District

### 1.0 Introduction

Osmanabad is one of the district of Marathwada region of Maharashtra and famous for Tuljabhavani temple at Tuljapur. It is situated in the southern part of the State abutting Andhra Pradesh in south and lies between north latitudes 17°37' and 18°42' and east longitude 75°16' and 76°47' and falls in parts of Survey of India degree sheets 47 N, 47 O, 58 B and 56 C. The district has a geographical area of 7512 sq. km.

The district headquarters is located at Osmanabad Town. It has 8 talukas i.e., Osmanabad, Tuljapur, Omerga, Lohara talukas in Osmanabad subdivision and Kallam, Bhoom, Paranda, Washi in Bhoom subdivision. It has a total population of 14,86,586 as per 2001 census. The district has 8 Nagar Parishads, 8 Panchayat Samitis and 622 Gram Panchayats. The district forms part of Godavari Basin and Manjra Subbasin. Manjra, Sina, Terna, Bori, Benitura, Banganga are the main rivers flowing through the district.

Central Ground Water Board has taken up Systematic Hydrogeological Surveys and urban hydrogeological study of Osmanabad town in the district as presented in **Table-1**. The district is yet to be covered under Reappraisal Hydrogeological Studies.

**Table 1: Studies undertaken by CGWB.**

S. No.	Officer	AAP	Type of Survey/Study
1.	Ramaiah, S. N.	1995-96	Systematic Hydrogeological Surveys
2.	Bansal S. K.	2000-01	Urban hydrogeology and impact of population on GW regime in Osmanabad Municipal Area, Osmanabad.

Shri S. K. Bansal, Scientist-D in 2000-01 compiled the report entitled "Ground Water Resources and Development Potential of Osmanabad District, M.S."

Ground water exploration in the district was undertaken in phases since 1977 (Sina-Man Project) to 2003. A total of 71 wells which includes 48 Exploratory Wells (EW) 11 Observation Wells (OW) and 12 Piezometers (Pz) were drilled. During 1977-78 under Sina-Man Project 9 EW and 6 OW were drilled while in 1994-95 5 EW were drilled to study the post-Killari earthquake effect on ground water scenario in Osmanabad district. Furthermore, during 1998, 12 Pzs were drilled under Hydrology Project and from 2001 to 2003, 34 EW and 5 OW were drilled under GW Exploration Programme. Pumping tests to determine aquifer parameters were also conducted at 7 sites. The taluka wise salient features of ground water exploration are given in **Table-2**.

**Table 2: Salient Features of Ground Water Exploration.**

S. No.	Taluka	Formation	Wells			Depth (mbgl)	SWL (mbgl)	Discharge (lps)	Draw-Down (m)	Zones (mbgl)
			EW	OW	Pz					
1	Osmanabad	Basalt	8	6	2	30.00-200.00	6.2-97.80	0.14-12.00	10.53-14.71	4.06-162.20
2	Tuljapur	Basalt	9	--	5	75.00-204.15	8.9-74.05	0.38-2.8	NA	5.00-141.40
3	Omerga	Basalt	12	1	1	39.00-200.00	7.72-98.1	0.02-14.89	NA	9.00-120.00
4	Kallam	Basalt	6	1	2	30.00-200.00	5.60-54.85	0.14-14.88	NA	9.00-118.00
5	Bhoom	Basalt	4	--	1	69.00-158.50	17.30-27.05	0.38-4.24	0.75	11.00-99.20
6	Paranda	Basalt	5	3	1	105.30-145.05	3.11-23.40	1.03-8.70	12.51-47.42	9.80-98.85
7	Lohara	Basalt	3	--	--	117.20-130.00	45.77-53.80	0.79-13.7	NA	56.00-114.00
8	Washi	Basalt	1	--	--	200.00	Dry	-	-	-
	Total		48	11	12	30.00-204.15	3.11-98.10	0.02-14.88	0.75-47.42	4.06-162.20

The depth of the wells varies from 30 to 204.15 metres below ground level (m bgl), while discharge varies between 0.02 and 14.88 litres per second (lps). Static water levels ranged from 3.11 to 98.10 m bgl. The potential aquifer zones have been encountered from 4.06 to 162.20 m bgl. The deepest water level being recorded at Talmol, Taluka Omerga. i.e., 98.10 m bgl. Deeper aquifer zones have been encountered in many wells beyond 50 m depth, the deepest being at 166 m at Osmanabad exploratory well in Osmanabad taluka.

A map of the district showing the 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 characterized 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 8.5°C and mean maximum temperature is 42.5°C.

The normal annual rainfall over the district varies from 600 mm to about 850 mm. It is minimum in the western parts of the district around Parand (629 mm) and increases towards east and reaches a maximum around osmanabad (840 mm). The average annual rainfall for the period 1998-2007 ranges from 546.85 mm (Paranda) to 842.80 mm (Kallab) and the same is presented in **Table-3**.

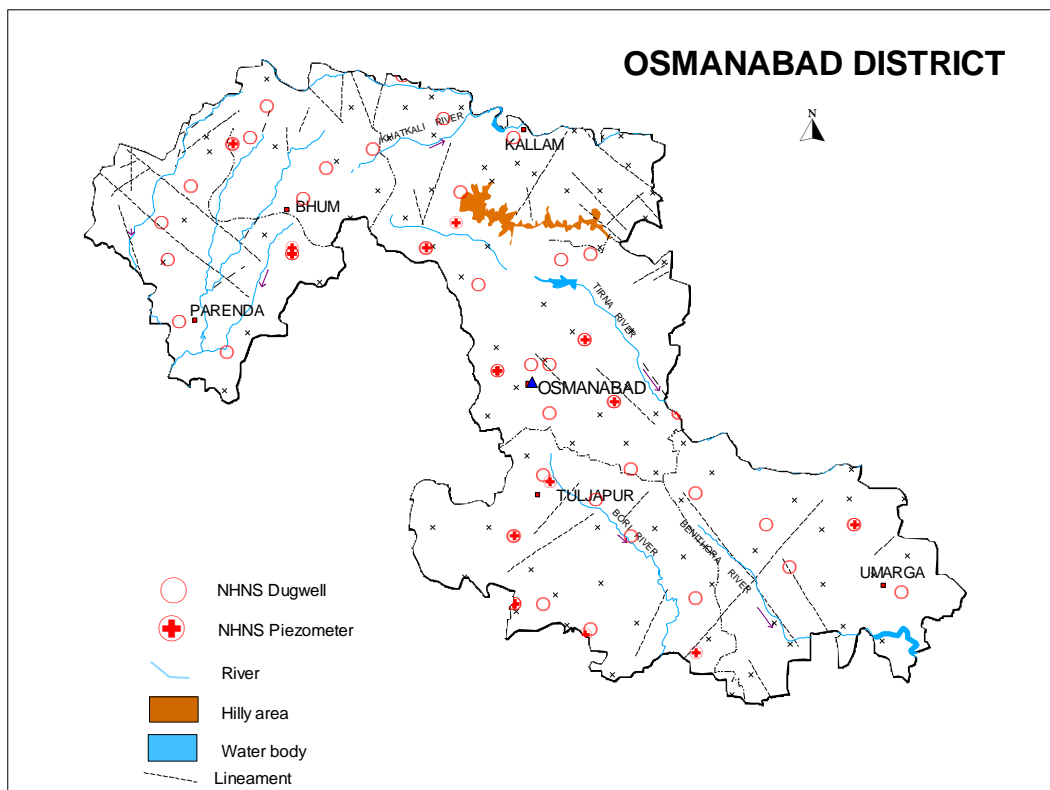


Figure-1: Location

Table 3: Annual Rainfall Data (1998-2007). (mm)

S. No.	Taluka	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	Average
1	Osmanabad	1278.4	591	948.8	614.9	679.2	431.4	741	857	673.6	979.4	779.47
2	Tuljapur	1408.8	598.4	864.4	684.7	651.2	498.2	882.4	874.2	857	821	814.03
3	Paranda	925.8	479.1	633.1	474.2	398.5	266	598	508	554	631.8	546.85
4	Bhum	1242.1	735.8	816.2	475	702.6	473	684.7	690	746	832.7	739.81
5	Kalamb	1416.2	873	827.2	596.3	668	576	915.5	1049	760	746.88	842.80
6	Omarga	1206.5	610.2	975.2	484.8	633.4	621	666.9	954.4	642	678.1	747.25
7	Lohara	556.6	NA	677.4	642.8	626.4	461.8	604.5	817.4	652	705.4	574.43
8	Vashi	1200.6	NA	746.8	552.6	605.6	383	696.9	747.6	782.6	797.56	651.326
	Average	1154.37	485.93	811.13	565.66	620.61	463.8	723.73	812.2	708.4	774.10	711.99

### 3.0 Geomorphology and Soil Types

The district forms part of Deccan Plateau, locally known as Balaghat Plateau, with slope towards southwest and south and has a varied topography consisting of hills, plains and undulating topography near riverbanks. The district forms a part of Godavari basin. The Balaghat Plateau comprises of low-lying hills forming water divide. Many of the tributaries to Godavari river originate from the Balaghat Plateau. Manjra River is the main river flowing through the district. Other rivers are Sina, Terna, Bori, Benitura and Banganga. Based on geomorphological setting and drainage pattern, the district is divided into 41 watersheds.

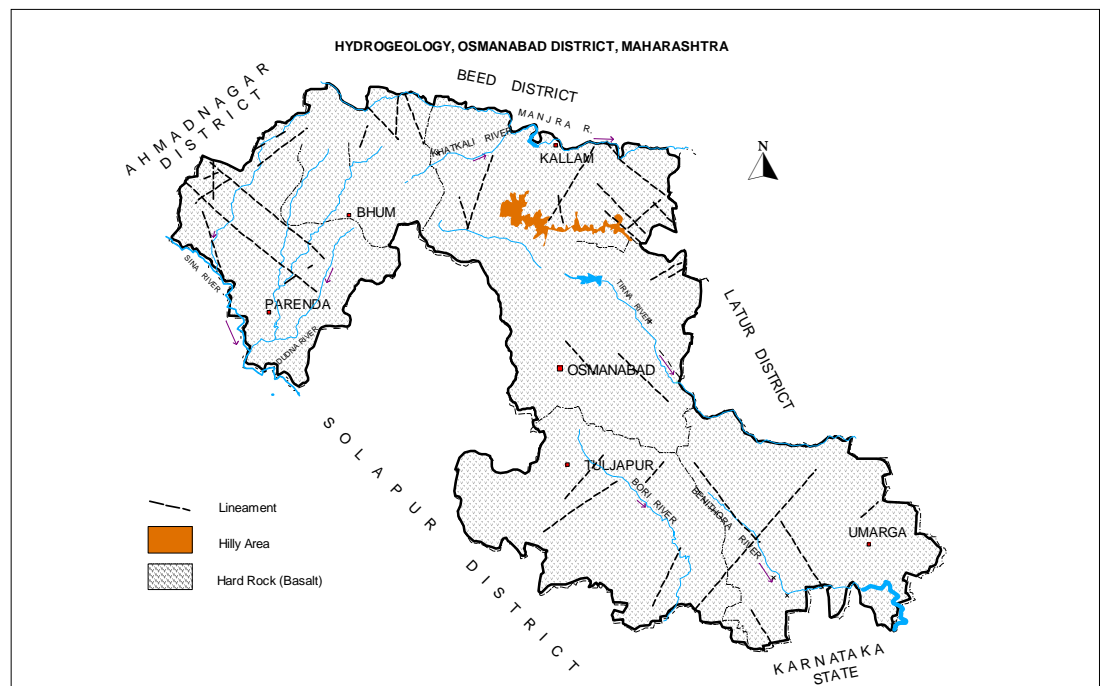
The soil of the district is basically derived from Deccan Trap Basalt and

the district is broadly classified into three major soil types. Shallow Soils occur in small patches in western and northwestern parts of the district. These soils are light brown to dark grey in colour and loamy to clayey loamy in texture. Medium Soils are found in parts of Bhoom, Kallamb and Osmanabad talukas. They are dark brown to dark grey in colour. Medium deep Soils occur in patches in Tuljapur taluka. The colour of these soils varies from dark grey brown to very dark grey. They are clayey in texture.

## 4.0 Ground Water Scenario

### 4.1 Hydrogeology

The entire district is underlain by the Basaltic lava flows of upper Cretaceous to lower Eocene age. The shallow Alluvial formation of Recent age also occur as narrow stretch along the major rivers flowing in the area but it does not play much important role from ground water point of view. A map depicting the hydrogeological features is shown in **Figure-2**



**Figure-2: Hydrogeology**

#### 4.1.1 Deccan Trap Basalt

Deccan Traps occurs as Basaltic lava flows, which are around 280 m thick, normally horizontally disposed over a wide stretch and give rise to tableland type of topography, on weathering also known as plateau. These flows occur in layered sequence ranging in thickness from few metres to 55 m. Flows are represented by massive portion at bottom and vesicular portion at top and are separated from each other by marker bed known as bole bed.

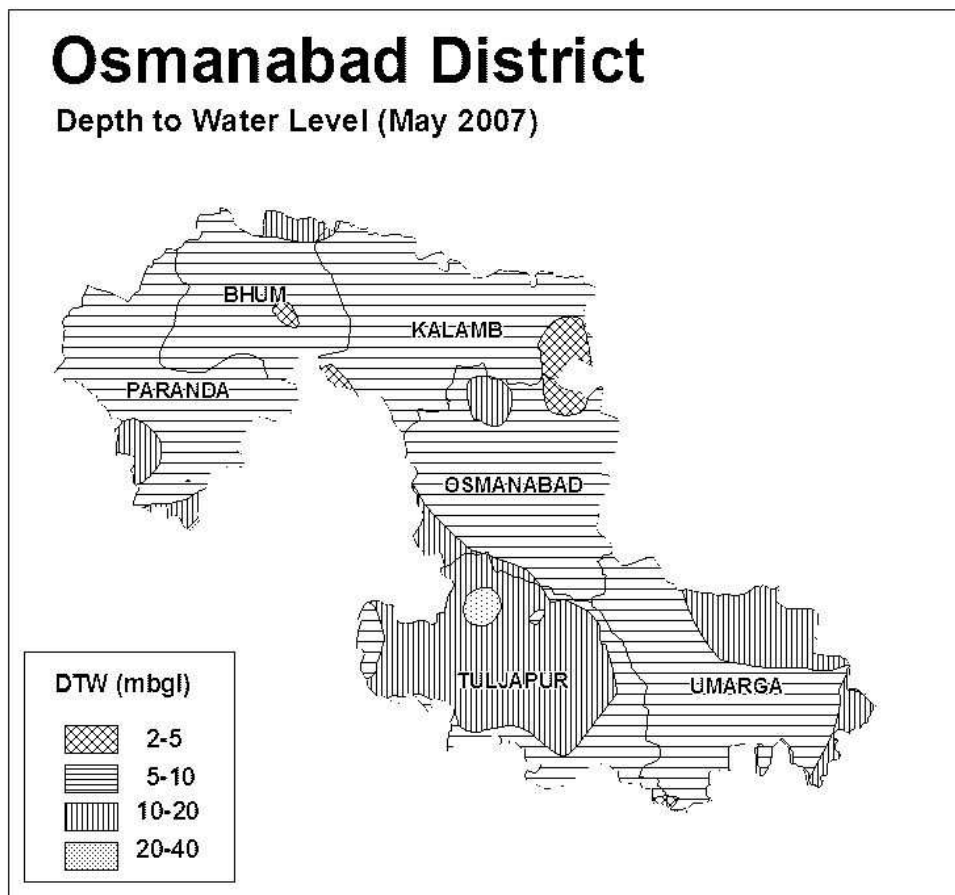
Ground water in Deccan Trap Basalt occurs under phreatic and semi-confined conditions. The weathered and fractured trap occurring in topographic lows form the main aquifer in the district.

#### 4.1.2 Water Level Scenario

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

##### 4.1.2.1 Depth to Water Level – Premonsoon (May-2007)

The depth to water levels in the district during May 2007 ranges between 4.60 m bgl (Wakvad) and 23.10 m bgl (Tuljapur). Depth to water levels during premonsoon (May 2007) has been depicted in **Figure-3**. Shallow water levels within 10 m bgl are seen in almost entire district, i.e., Bhoom, Paranda, Kallamb, Osmanabad, Omerga and SE part of Tuljapur talukas. Water levels in the range of 10-20 m bgl are observed in isolated patches in north of Bhoom, southwest of Paranda, north of Osmanabad, northeast and southeast of Omerga and almost entire Tuljapur taluka. The deeper water level in the range of 20-40 m bgl are observed only at northwest part of Tuljapur while small patches of shallow water level range of 2-5 m bgl are observed at north of Osmanabad.

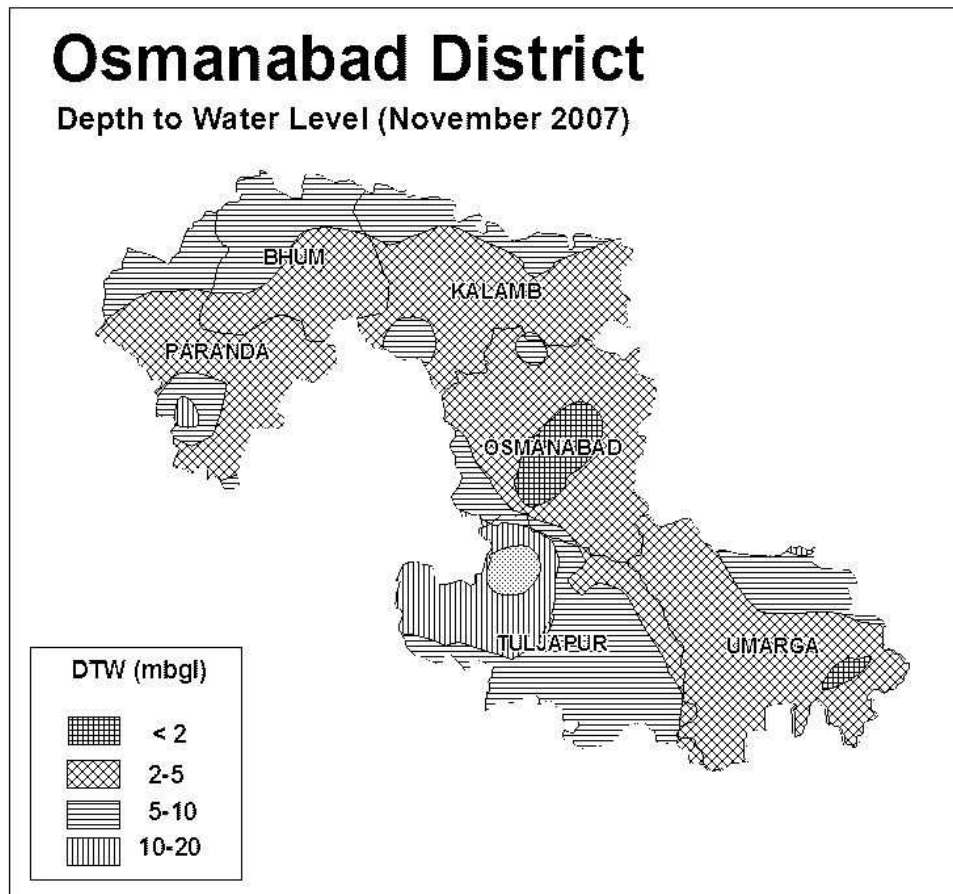


**Figure-3: Depth to Water Level (Premonsoon- May 2007)**

##### 4.1.3 Depth to Water Level – Postmonsoon (Nov.-2007)

The depth to water levels during Nov. 2007 ranges between 0.8 m bgl

(Vadgaon Siddheshwar) and 13.90 m bgl (Tuljapur). Spatial variation in postmonsoon depth to water levels is shown in **Figure-4**. In the entire district the water levels are shallow within 10 m bgl with few exceptions. Water levels of 2-5 m bgl is the most dominant range occupying almost entire Bhoom, Paranda, Kallamb, Osmanabad and Omerga talukas. Water levels of less than 2 m bgl are observed in isolated patches i.e., in central part of Osmanabad and southeast part of Omerga talukas. Water levels of 5-10 m bgl are also observed as a narrow continuous strip running in northern part of Bhoom, Paranda and Kallamb talukas, while major part of the Tuljapur taluka is also showing this range of water level. The deeper water level range i.e., 10-20 m bgl is observed only in northern part of Tuljapur engulfing a small part of 20-40 m bgl depth to water level.



**Figure-4: Depth to Water Level (Postmonsoon- Nov.2007)**

#### **4.1.4 Seasonal Water Level Fluctuation– (May-Nov. 2007)**

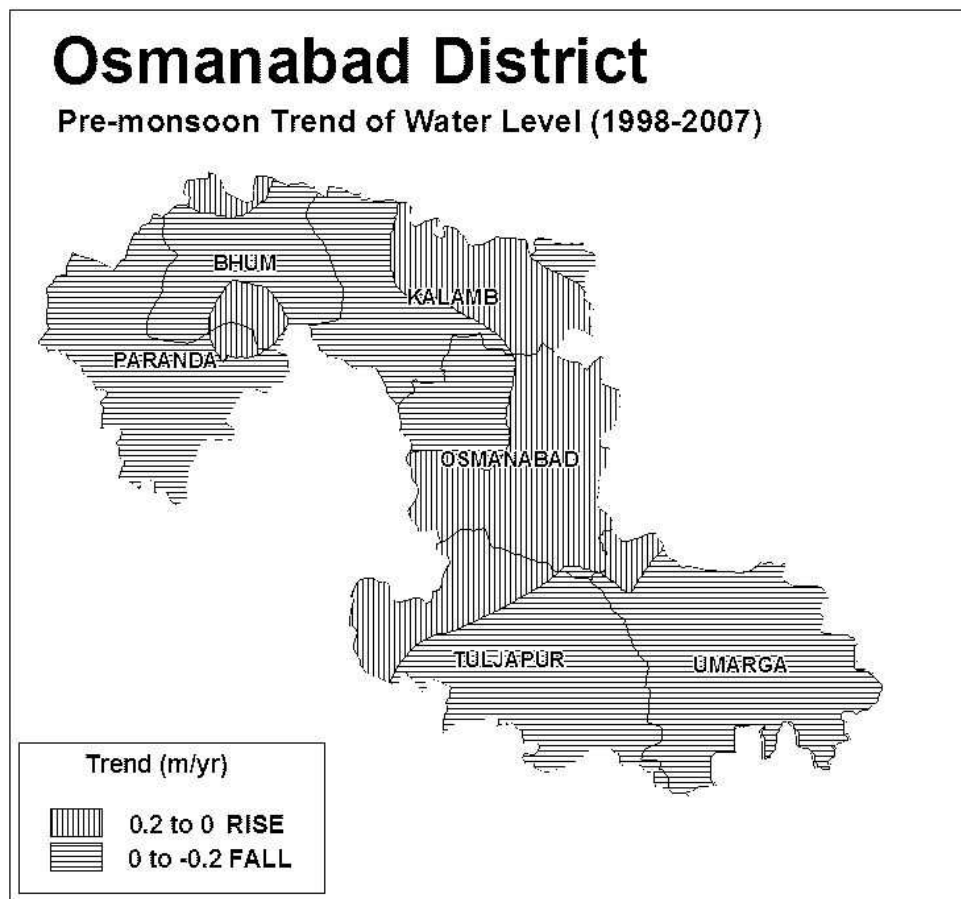
In major part of the district rise in water levels in the range of nil (Paranda) to 12.8 m (Gandhora) is observed. In entire district rise in water levels has been observed except at two places. Major part of the district is observing rise in water level in the range of 2-4 m. Rise in the range more than 4m is the next major range occupying major parts of the Osmanabad, central part of Tuljapur and Kallamb, southeast part of Omerga, western-southern-eastern parts of Paranda talukas. Rise in 0-2m range is observed in south part of Omerga and Tuljapur, northern part of Tuljapur and northwestern

part of Bhoom talukas. Fall of 0-2 m range is observed in northeastern part of Tuljapur taluka engulfing the small patch of 2-4 m fall.

#### 4.1.5 Water Level Trend (1998-2007)

Trend of water levels for premonsoon and postmonsoon period for last ten years (1998-2007) have been computed for 22 NHNS. Analysis of trend indicates that during premonsoon period, rise in water levels has been recorded at only 3 stations and it ranges between negligible and 0.74 m/year (Vadgaon Siddheshwar). Fall in water levels has been observed at 13 stations in the range of negligible to 0.50 m/year (Paranda). During postmonsoon period, rise in water levels has been recorded at 3 stations and it ranges from 0.04 m/year (Yermala) to 0.09 m/year (Sancha), whereas at 16 stations, fall in water levels ranging between 0.02 m/year (Turori) and 0.28 m/year (Lohara Bk.) is observed. Thus in major part of the district, both during pre and postmonsoon periods declining trend of water levels has been observed.

The premonsoon trend map was also prepared and the same is presented in **Figure-5**. It shows that the fall in water level trend of up to 20 cm/year is observed in major part of the district in southern and northwestern parts in almost entire Omerga, Tuljapur, Paranda and Bhum talukas and in parts of Kalamb and Osmanabad talukas. The rise of up to 20 cm/year has been observed mainly in central and eastern parts of the districts covering major part of Osmanabad taluka and parts of Kalamb and Tuljapur talukas.



**Figure-5: Water Level Trend (Premonsoon 1998-2007)**

#### 4.1.6 Aquifer Parameters

The aquifer parameters are available from pumping tests conducted on exploratory wells and it is observed that the transmissivity of Deccan Traps varies between 0.22 (Saudana Amba) and 20.24 m<sup>2</sup>/day (Khanapur).

#### 4.2 Ground Water Resources

Central Ground Water Board and Groundwater Survey and Development Agency (GSDA) have jointly estimated the ground water resources of Osmanabad district based on GEC-97 methodology. The same are presented in **Table-4**, whereas the graphical representations of the resources on the map are shown in **Figure-6**. Ground water resources estimation was carried out for 6716.28 sq. km. area out of which 402.45 sq. km. area is under command and 6313.83 sq. km. is non-command.

As per the estimation the total annual ground water recharge is 1141.62 MCM with the natural discharge is 57.64 MCM, thus the net annual ground water availability comes to be 1083.98 MCM. The annual ground water draft for all uses is estimated at 701.20 MCM with irrigation sector being the major consumer having a draft of 683.45 MCM. The allocation for domestic and industrial water requirements for next 25 years is 33.89 MCM. The net ground water availability for future irrigation is estimated at 367 MCM. Stage of ground water development varies from 47.14 % (Tuljapur) to 81.48 % (Osmanabad). The overall stage of ground water development for the district is 64.69 %.

Taluka wise assessments indicate that only Osmanabad taluka fall under “Semi-Critical” category, while other talukas are in “Safe category”. Watershed wise, out of 41 watersheds, 29 watersheds fall under “Safe category” while 12 watersheds fall under “Semi-Critical” category, namely, MR-9, MR-12, MR-16A, MR-17, MR-18, MR-20A, MR-21A, MR-22, MR-30, MR-36A, BM-7 and BM-9.

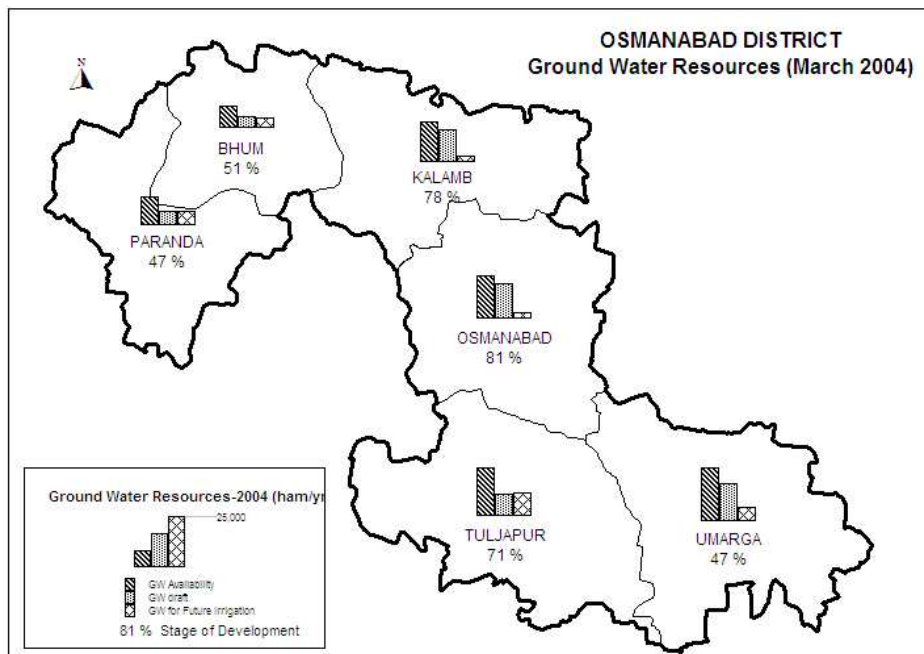


Figure-6: Ground Water Resources

**Table-4: Taluka wise Ground Water Resources (March 2004).**

Taluka	Area Type	Net annual ground water availability (ham/yr.)	Annual ground water draft (ham/yr.)			Allocation for domestic & industrial requirement supply upto next 25 years (ham/yr.)	Groundwater availability for future irrigation (ham/yr.)	Stage of groundwater development (%)	Category
			Irrigation	Domestic & industrial uses	Total				
Osmanabad	Command	1901.87	852.57	38.01	890.57	76.01	973.29	46.83	<b>Semi-Critical</b>
	Non command	18147.99	15162.33	283.30	15445.62	445.53	2577.07	85.11	
	<b>Total</b>	<b>20049.86</b>	<b>16014.89</b>	<b>321.30</b>	<b>16336.19</b>	<b>521.54</b>	<b>3550.36</b>	<b>81.48</b>	
Tuljapur	Command	1731.99	554.24	41.06	595.30	82.13	1095.63	34.37	<b>Safe</b>
	Non command	20084.78	9383.50	304.63	9688.13	609.26	10092.01	48.24	
	<b>Total</b>	<b>21816.77</b>	<b>9937.74</b>	<b>345.69</b>	<b>10283.44</b>	<b>691.39</b>	<b>11187.64</b>	<b>47.14</b>	
Omerga	Command	2258.29	980.18	38.64	1018.82	77.28	1200.84	45.11	<b>Safe</b>
	Non command	22257.44	16087.66	346.57	16434.23	654.66	5515.12	73.84	
	<b>Total</b>	<b>24515.73</b>	<b>17067.84</b>	<b>385.21</b>	<b>17453.05</b>	<b>731.94</b>	<b>6715.96</b>	<b>71.19</b>	
Bhoom	Command	1221.25	308.24	15.86	324.09	31.71	881.30	26.54	<b>Safe</b>
	Non command	9192.52	4888.94	144.95	5033.88	289.89	4013.69	54.76	
	<b>Total</b>	<b>10413.77</b>	<b>5197.17</b>	<b>160.80</b>	<b>5357.98</b>	<b>321.60</b>	<b>4894.99</b>	<b>51.45</b>	
Kalamb	Command	1433.92	182.87	16.62	199.49	33.24	1217.81	13.91	<b>Safe</b>
	Non command	17266.15	14007.03	364.94	14371.98	727.40	2531.72	83.24	
	<b>Total</b>	<b>18700.07</b>	<b>14189.91</b>	<b>381.57</b>	<b>14571.47</b>	<b>760.64</b>	<b>3749.53</b>	<b>77.92</b>	
Paranda	Command	1969.60	456.42	16.13	472.55	32.27	1480.92	23.99	<b>Safe</b>
	Non command	10932.61	5481.30	164.90	5646.21	329.81	5121.50	51.65	
	<b>Total</b>	<b>12902.21</b>	<b>5937.72</b>	<b>181.04</b>	<b>6118.76</b>	<b>362.08</b>	<b>6602.42</b>	<b>47.42</b>	
District total	<b>Command</b>	<b>10516.93</b>	<b>3334.51</b>	<b>166.32</b>	<b>3500.83</b>	<b>332.64</b>	<b>6849.79</b>	<b>33.29</b>	
	<b>Non command</b>	<b>97881.48</b>	<b>65010.77</b>	<b>1609.29</b>	<b>66620.06</b>	<b>3056.55</b>	<b>29851.11</b>	<b>68.06</b>	
	<b>Total</b>	<b>108398.41</b>	<b>68345.28</b>	<b>1775.61</b>	<b>70120.89</b>	<b>3389.19</b>	<b>36700.90</b>	<b>64.69</b>	

### 4.3 Ground Water Quality

In the district, 9 water samples were collected during May 2007. The geochemical classification of ground water samples is given in **Table-5**. As all the samples are from Basaltic aquifer, the type of water present in these samples should be of Ca-HCO<sub>3</sub> type. But the classification shows that 4 samples are having Ca-Cl type of water and 5 samples are of Ca- HCO<sub>3</sub> type indicating that the type of water in 4 samples have been changed from Ca-HCO<sub>3</sub> type to Ca-Cl type. This may be because of percolation of waste and wastewater containing high concentration of strong acid ions (Cl+NO<sub>3</sub>+SO<sub>4</sub>) to ground water.

**Table-5: Geochemical Classification of Ground Water Samples.**

S. No.	Classification	Type	No. of Samples	% of Samples
1	Alkaline earths (Ca+Mg > 50%) exceeds alkali metals and weak acids (CO <sub>3</sub> +HCO <sub>3</sub> > 50%) exceeds strong acids	Ca-HCO <sub>3</sub>	5	56
2	Alkali metal (Na+K > 50%) exceeds alkaline earths and weak acids (CO <sub>3</sub> +HCO <sub>3</sub> > 50%) exceeds strong acids.	Na-HCO <sub>3</sub>	--	--
3	Alkaline earths (Ca+Mg > 50%) exceeds alkali metals and strong acids (Cl+SO <sub>4</sub> +NO <sub>3</sub> > 50%) exceeds weak acids	Ca-Cl	4	44
4	Alkali metal (Na+K > 50%) exceeds alkaline earths and strong acids (Cl+SO <sub>4</sub> +NO <sub>3</sub> > 50%) exceeds weak acids	Na-Cl	--	--
	Total		<b>9</b>	<b>100</b>

#### 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) 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, Ca, Mg, Cl, SO<sub>4</sub> and NO<sub>3</sub> prescribed in the standards and is given in **Table-6**.

**Table-6: Classification of Ground Water Samples for Drinking based on BIS Drinking Water Standards (IS-10500-91, Revised 2003).**

Parameters	DL	MPL	Samples with conc. < DL	Samples with conc. in DL-MPL	Samples with conc. >MPL
TDS (mg/L)	500	2000	4	5	0
TH (mg/L)	300	600	2	6	1
Ca (mg/L)	75	200	7	1	1
Mg (mg/L)	30	100	0	8	1
Cl (mg/L)	250	1000	8	1	0
SO <sub>4</sub> (mg/L)	200	400	8	1	0
NO <sub>3</sub> (mg/L)	45	No relaxation	4	0	5
F (mg/L)	1.0	1.5	9	0	0

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

The perusal of **Table-6** shows that out of the 9 ground water samples, only one sample at Pimpalwadi have concentration of Calcium, Magnesium and Total Hardness more than MPL while the concentration of all the other parameters is less than MPL. However, the concentration of nitrate is found more than MPL at Pimpalwadi, Lohara Bk., Sonari, Bhoom and Dhoki, indicating high influence of anthropogenic activity in the vicinity of the wells, causing nitrate contamination.

The ground water exploration reveals that the ground water quality in deeper aquifer is adversely affected by fluoride contamination in Osmanabad, Tuljapur and Omerga talukas of Osmanabad district. The details are presented in **Table-7**.

**Table-7: Fluoride Concentration.**

S. No.	Location	Taluka	Fluoride Concentration (mg/L)
1.	Yedshi	Osmanabad	1.87-2.71
2.	Takwiki	Osmanabad	1.7
3.	Aarli Bk	Tuljapur	8.1
4.	Naldurg	Tuljapur	7.1
5.	Salgara Devti	Tuljapur	1.79
6.	Kaldora	Omerga	1.34
7.	Kasgi	Omerga	3.41

These deeper aquifers are having low TDS and high fluoride in contrast to the shallow aquifers. Concentration of bi-carbonate ions is found less in the deeper aquifers unlike in the shallow aquifers and has negative relation with fluoride.

Thus it is clear that in shallow aquifer potability of ground water is affected mainly by localised nitrate contamination, whereas in deeper aquifer it is affected by fluoride contamination in few talukas. Thus, in these areas, all the wells used for water supply should be first analysed for fluoride and nitrate concentration.

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

#### 4.3.2.1 Sodium Absorption Ratio (SAR)

Sodium Absorption Ratio (SAR) is an expression pertaining to cation make up of water and soil solution and is used for characterizing the sodium hazard of irrigation water.

SAR value is used to calculate the degree to which irrigation water tends to enter into cation exchange section in the soil. The main problem with high sodium concentration is its effect on soil permeability. Sodium also contributes directly to the total salinity of the water and may be toxic to sensitive crops such as fruit trees. The higher value of SAR indicates soil structure damage.

#### 4.3.2.2 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 SAR and RSC values for its suitability for irrigation purpose is shown below in **Table-8**.

**Table-8: Classification of Ground Water for Irrigation based on SAR and RSC.**

SAR	<10		10-18		18-26		>26	
Category	Good		Good to Permissible		Doubtful		Unsuitable	
Total Samples	No. of Samples	%	No. of Samples	%	No. of Samples	%	No. of Samples	%
9	9	100	Nil	Nil	Nil	Nil	Nil	Nil
RSC	<1.25		1.25-2.50		>2.50			
Category	Good		Doubtful		Unsuitable			
Total Samples	No. of Samples	%	No. of Samples	%	No. of Samples		%	
9	9	100	Nil	Nil	Nil		Nil	

The **Table-8** shows that the ground water samples from all the wells have SAR values less than 10. Similarly, RSC values are also below 1.25. Overall, the ground water quality in the wells monitored is good for irrigation purpose and there is a less possibility of developing sodium hazard.

### 4.4 Status of Ground Water Development

Ground water development depends on many factors viz., availability, crop water requirement, socio-economic fabric and on the yield of the aquifers existing in that area. The yields of wells are functions of the permeability and transmissivity of aquifer encountered and varies with location, diameter and depth etc. Ground water in the area is being developed by three type of abstraction structures i.e., dugwells, borewells and dug-cum-borewells. However dugwells are the main ground water abstraction structures in the

district. The yield of such structures varies from 10-40 m<sup>3</sup>/day for a drawdown of about 3 to 8m. High yielding dugwells are generally located in weathered and fractured Basalt occurring in physiographic depressions. Dug-cum-borewells have vertical bores generally of 30 to 50 m depth from the bottom of the well. The yield of borewells ranges from nil to as high as 40,000 lph.

Ground water is predominantly used for irrigation, as it is the major ground water utilising sector. As per the data available for year 1995-96, area irrigated by ground water is 729.10 sq.km., whereas surface water accounts for only 260.88 sq.km. and the net irrigated area is 989.88 sq.km. However recent data (2000-01) indicates there is increase in area irrigated by ground water by 40% to 1017.69 sq.km., whereas there is decrease in area irrigated by surface water by about 39% to 158.80 sq.km., and net irrigated area stands at 1366.15 sq.km., Thus it is clear that ground water is the major source of irrigation as it accounts for about 74.50 % of net irrigated area. As per 2000-01 data the district had 39841 irrigation dugwells, which create an irrigation potential of 1232.98 sq.km., out of which 991.83 sq.km., of irrigation potential is utilised. In addition to this 273.97 sq.km. of irrigation potential is utilised through 11116 borewells/tubewells.

State government has drilled large number of borewells fitted with hand pumps and electric motors for rural drinking water purposes in the district. In all till March 2007, GSDA, Government of Maharashtra was successfully operating 5187 borewells for rural water supply under various schemes in the district, out of which 793 are fitted with electric pumps and the 4394 are fitted with hand pumps. In addition to this, numerous dugwells are also the main source of water supply.

## **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 of 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**

The entire district is underlain by Deccan Trap Basalt. Most of the parts of Omerga, Kallamb and small parts of Bhoom-Paranda talukas have low ground water development potential. The areas with medium ground water development potential are observed in almost entire part of Osmanabad and Tuljapur talukas, central part of Bhoom and Paranda talukas. South-western part of Bhoom taluka, north-eastern part of Paranda taluka, north-western part of Osmanabad taluka, south-western part of Tuljapur taluka and southern part of Omerga taluka have high ground water development potential. In these areas the ground water can be developed through dugwells, dug-cum-bored wells (DCB) and borewells. The yield of dugwells in the district may be expected from 10 to 40 m<sup>3</sup>/day depending on the local hydrogeological conditions. The nature and yield potential of the aquifers occurring in different talukas is given in **Table-9**.

**Table-9: Nature and Yield Potential of Aquifers.**

<b>S. No.</b>	<b>Taluka</b>	<b>Main Aquifer</b>	<b>Yield Potential</b>	<b>Type of Wells Suitable</b>
1.	Osmanabad	Basalt	Low to High	Dugwell DCB
2.	Tuljapur	Basalt	Medium to High	Dugwell DCB
3.	Omerga	Basalt	Low to Medium	Dugwell DCB
4.	Bhoom	Basalt	Low to High	Dugwell DCB
5.	Paranda	Basalt	Low to High	Dugwell DCB
6.	Kallamb	Basalt	Low to Medium	Dugwell DCB

## **5.2 Water Conservation and Artificial Recharge**

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 area located in parts of Bhoom, Paranda, Kallamb, Tuljapur and Osmanabad talukas. Existing dugwells can also be used for artificial recharge; however, the source water should be properly filtered before being put in the wells.

These sites need to be located where the hydrogeological conditions are favourable, i.e., where sufficient thickness of unsaturated/de-saturated aquifer exists and water levels are more than 5 m deep.

## **6.0 Ground Water Related Issues and Problems**

The rainfall data analysed for the period 1901-1999 indicates that severe drought conditions were experienced in all stations except at Tuljapur, while moderate drought conditions ranges from 11% at Kallamb to 28% at Tuljapur. In major part of the district, both during pre and postmonsoon periods declining trend of water levels has been observed. Thus future water conservation and artificial recharge structures may be prioritised in these parts of the district.

The ground water exploration reveals that the ground water quality in deeper aquifer is adversely affected by fluoride contamination in Osmanabad, Tuljapur and Omerga talukas of Osmanabad district. The urban areas of Osmanabad town are also adversely affected by the nitrate contamination. Hence adequate sanitary protection may be provided to the wells to control the nitrate contamination. In shallow aquifer potability of ground water is mainly affected by localised nitrate contamination, whereas in deeper aquifer it is affected by fluoride contamination in few talukas. Thus, in these areas, all the wells used for water supply should be first analysed for fluoride and nitrate concentration.

## **7.0 Mass Awareness and Training Activities**

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

Till March 2007, MAP and WMTP are yet to be organised in the district.

## **8.0 Areas Notified by CGWA/SGWA**

As per ground water resource estimation all the talukas fall under “Safe” category, except Osmanabad taluka which fall under “Semi-Critical” category, hence till March 2007, no area has been notified either by CGWA or SGWA.

## **9.0 Recommendations**

- 1 The entire district is underlain by the Deccan Trap Basalt where only dugwells are most feasible structures for ground water development. The sites for borewell need 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 overall stage of ground water development for the district is 65 %, therefore, scope for further development of ground water resources exists with proper ground water development plan.
- 4 South-western part of Bhoom taluka, north-eastern part of Paranda taluka, north-western part of Osmanabad taluka, south-western part of Tuljapur and southern part of Omerga talukas have high ground water development potential. In these areas the ground water can be developed through dugwells, dug-cum-bored wells and borewells. The yield of dugwells in the district may be expected from 10 to 40 m<sup>3</sup>/day depending on the local hydrogeological conditions.
- 5 Drought and declining water level trend have been observed in major parts of the district. Thus future water conservation and artificial recharge structures needs to be prioritised in Omerga, Tuljapur, Paranda and Bhoom talukas and in parts of Kalamb and Osmanabad talukas of the district.
- 6 In shallow aquifer potability of ground water is affected mainly by localised nitrate contamination, whereas in deeper aquifer it is affected by fluoride contamination in few talukas. Thus, in these areas, all the wells used for water supply should be first analysed for fluoride and nitrate concentration. Likewise, adequate sanitary protection to the wells may be provided to control the nitrate contamination.
- 7 The scope exists for construction of suitable artificial recharge structures in the district. The structures recommended for the hilly-Basaltic area in parts of Bhoom, Paranda, Kallamb, Osmanabad and Tuljapur 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.
- 8 The existing village ponds needs to be rejuvenated to act both as water conservation and artificial recharge structures.