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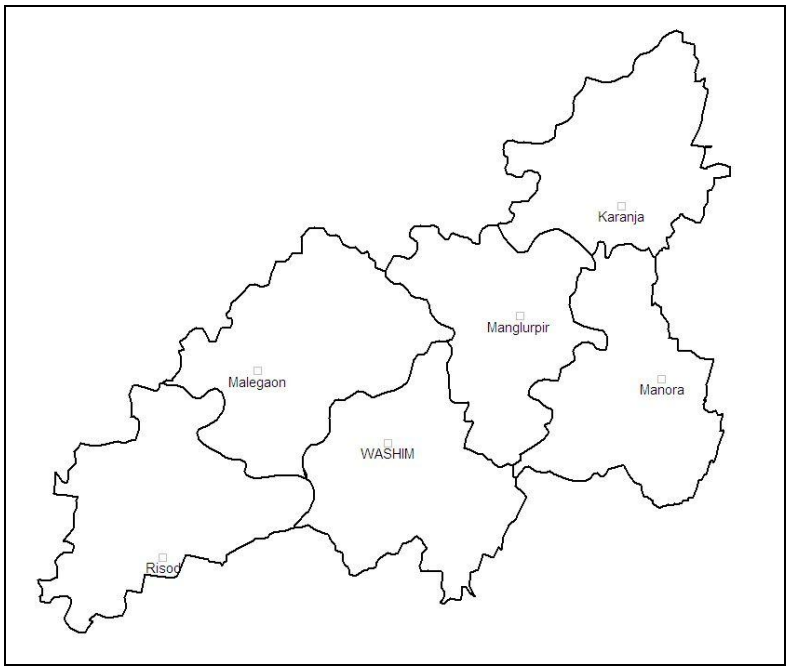
भारत सरकार
जल संसाधन मंत्रालय
केंद्रीय भूजल बोर्ड

GOVT OF INDIA
MINISTRY OF WATER RESOURCES
CENTRAL GROUND WATER BOARD

महाराष्ट्र राज्य के अंतर्गत वाशिम जिले की भूजल विज्ञान जानकारी

GROUND WATER INFORMATION WASHIM DISTRICT MAHARASHTRA



By
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द्वारा
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मध्य क्षेत्र, नागपुर
CENTRAL REGION
NAGPUR
2013

WASHIM DISTRICT AT A GLANCE

1. GENERAL INFORMATION

Geographical Area	:	5140 sq. km.
Administrative Divisions (As on 31/03/2011)	:	Taluka-6: Washim, Karanja, Manora, Mangrulpir, Malegaon, Risod.
Villages	:	789
Population (As per Census 2011)	:	11,97,500
Male	:	6,21,228
Female	:	5,75,486
Literacy	:	81.70%
Sex Ratio	:	926
Normal Annual Rainfall	:	872 mm to 966 mm

2. GEOMORPHOLOGY

Major Physiographic unit	:	One: Balaghat Plateau
Major Drainage	:	One: Penganga

3. LAND USE (2010-11)

Forest Area	:	355 sq. km.
Net Area Sown	:	3862 sq. km.
Cultivable Area	:	4178 sq. km.

4. SOIL TYPE

Medium black and Deep black soil.

5. PRINCIPAL CROPS (2010-11)

Soyabean	:	1701 sq. km.
Cotton	:	836 sq. km.
Jowar	:	487 sq. km.
Total Pulses	:	901 sq. km.

6. IRRIGATION BY DIFFERENT SOURCES (2010-11)
Nos./Potential Created (ha)

Dugwells	:	26045/65920 (MI census)
Borewells	:	1024/2499
Tanks/Ponds	:	2846/4997
Other Minor Surface Sources	:	862/47979
Net Irrigated Area	:	26141 ha

7. GROUND WATER MONITORING WELLS (As on 31/03/2011`)

Dugwells	:	21
Piezometers	:	6

8. GEOLOGY

Recent	:	Alluvium
Upper Cretaceous-Lower Eocene	:	Deccan Trap Basalt

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-2011)	:	4.70 to 16.00 m bgl
Postmonsoon Depth to Water Level (Nov.-2011)	:	2.70 to 11.50 m bgl
Premonsoon Water Level Trend	:	Rise: 0.0018 to 0.3398 m/year

(2002-2011)		Fall: 0.0328 to 0.4483 m/year
Postmonsoon Water Level Trend	:	Rise: 0.0206 to 0.3245 m/year
(2002-2012)		Fall: 0.0299 to 0.2004 m/year

10. GROUND WATER EXPLORATION (As on 31/03/2012)

Wells Drilled	:	EW-19, OW-10, Pz-6
Depth Range	:	30.00 to 208.65 m bgl
Discharge	:	0.14 – 9.84 lps
Storativity	:	3.1×10^{-3} to 6.6×10^{-6}
Transmissivity	:	8.10 to 1638.73 m^2/day (Basalt)

11. GROUND WATER QUALITY

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

Type of Water	:	Ca-Cl and Ca-HCO_3

12. DYNAMIC GROUND WATER RESOURCES- (2008-09)

Annual Replenishable GW Resources	:	561.87 MCM
Total draft (Irrigation+Domestic)	:	200.23 MCM
Projected Demand (Domestic + Industrial)	:	37.09 MCM
Stage of Ground Water Development	:	36%

13. AWARENESS AND TRAINING ACTIVITY

Mass Awareness Programme	:	One
a. Date	:	25/01/07
b. Place	:	Washim
c. Participants	:	300
Water Management Training Programme:	:	One
a. Date	:	23 to 24/01/07
b. Place	:	Washim
c. Participants	:	45

14. ARTIFICIAL RECHARGE & RAINWATER HARVESTING

Projects Completed	:	Nil
Projects under Technical Guidance	:	Nil

15. GROUND WATER CONTROL & REGULATION

Over-Exploited Taluka	:	None
Critical Taluka	:	None
Notified Taluka	:	None

16. MAJOR GROUND WATER PROBLEMS AND ISSUES

Ground water quality is adversely affected by nitrate contamination.

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Washim District

1.0 Introduction

Washim is one of the 11 districts of Vidarbha and was carved out of Akola district on 1st July 1998. It is situated in the north eastern part of the State abutting Madhya Pradesh and lies between north latitudes 19°61' and 21°16' and east longitude 76°07' and 77°14' and falls in parts of Survey of India degree sheets 55 D, 55 H, 56 A and 56 E. The district has a geographical area of 5140 sq. km.

The district headquarters is located at Washim Town. For Administrative convenience, the district is divided in 6 talukas viz, Washim, Karanja, Malegaon, Mangrulpir, Manora and Risod. It has a total population of 11,97,500 as per 2011 census. The district has 4 Nagar Parishads, 6 Panchayat Samitis and 493 Gram Panchayats. The district forms part of Godavari and Tapi basin. Penganga River is the main river flowing through the district.

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

Table 1: Studies undertaken by CGWB.

S. No.	Officer	AAP	Type of Survey/Study
1.	S/Shri Sirsikar, D.Y. and Rai, J.N.	1982-83	Systematic Hydrogeological Surveys
2.	S/Shri Jain, S.K. and Joshi, Devendra	1988-89	Systematic Hydrogeological Surveys
3.	S/Shri Suresha, A; and Arumugam	1990-91	Systematic Hydrogeological Surveys
4.	Shri Toppo, Sunil.	2002-03	Reappraisal Hydrogeological Studies
5.	Shri Davithuraj, J.	2002-03	Reappraisal Hydrogeological Studies
6.	Shri Warke, B.N.	2002-03	Reappraisal Hydrogeological Studies

Dr. P.K. Jain, Scientist-D in 2005, compiled the report entitled "Ground Water Resources and Development Potential of Washim District, M.S."

Ground water exploration in the district was undertaken during 1997 to 2001. A total number of 19 Exploratory Wells (EW) and 10 Observation Wells

(OW) were drilled at 19 sites. Pumping tests to determine aquifer parameters were also conducted at 4 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	Wells			Depth (mbgl)	SWL (mbgl)	Dis-charge (lps)	Draw-Down (m)	Zones (mbgl)
		EW	OW	PZ					
1.	Karanja	4	3	-	40 - 172	3.05-26.65	1.37-4.43	0.89 – 12.38	8 – 44
2.	Malegaon	2	-	-	200.00	17.57-45.00	0.56-0.78	-	4 - 65
3.	Mangrulpir	3	3	-	30 - 184	2.66-57.00	0.38-9.84	11.4 – 27.25	5 – 58
4.	Manora	3	-	-	117 – 200	5.75-12.75	0.14-1.37	13.93	5 – 86
5.	Risod	3	3	-	60 – 200	6.42-26.55	2.16-5.94	0.55 – 15.35	7 – 192
6.	Washim	4	1	-	111 – 208.65	4.60-5.15	0.14-1.37	15.0 – 15.10	6 –193
	Total	**19**	**10**	**-**	**30.00-208.65**	**2.66-57.00**	**0.14 - 9.84**	**0.89 – 27.25**	**4.00 – 193.00**

The depth of the wells varies from 30 to 208 metres below ground level (m bgl), while discharge varies between 0.14 and 9.84 litres per second (lps). Out of 19 exploratory wells drilled in the district, 5 exploratory wells have shown discharges more than 3 lps. Except for the exploratory wells at Lohara, Medsi, Mutha, Dhanora (Bk.), Masela Pen and Belkheda water levels were shallow in other wells, with the deepest water level being recorded at Dhanora (Bk) i.e., 57.00 m bgl. Deeper aquifer zones have been encountered in many wells beyond 50 m depth, the deepest being at 193 m at Devthana (Bk) exploratory well in Washim 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**.

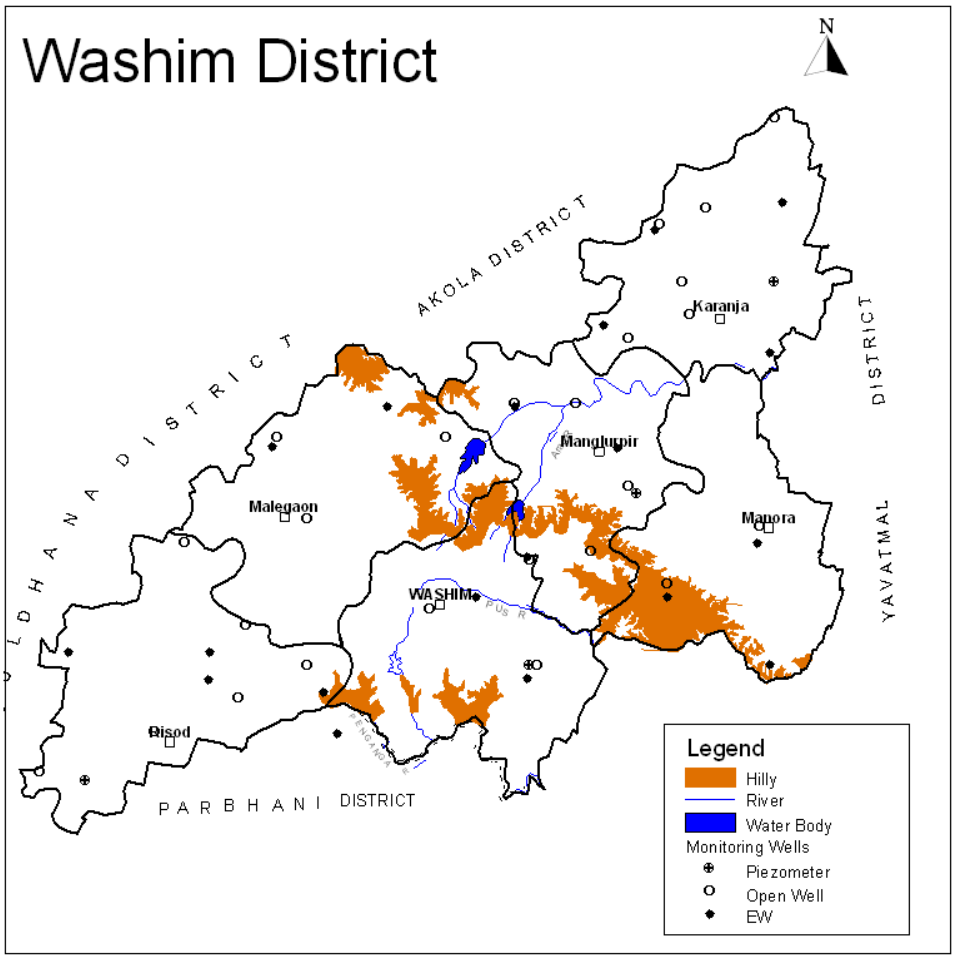

Figure-1: Location map of wells drilled in Washim district

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 12°C and mean maximum temperature is 42°C.

The normal annual rainfall over the district varies from 872 mm (Risod) to about 966 mm (Washim). The average annual rainfall for the period 2002-2011 ranges from 788.39 mm (Manora) to 1124.75 mm (Washim) and the same is presented in **Table-3**.

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

Taluka	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Taluka Avg.
Washim	2160	1235.7	1059.2	1167.2	1359.5	852	752.7	764.2	1162.3	734.7	**1124.75**
Risod	1377.4	683.9	547.9	773.6	1005.4	861	772	634	1012.5	634.8	**830.25**
Malegaon	1691	1017	684.2	906.8	1098.3	767	771	699	1153.9	613.3	**940.15**

Mangrulpir	1108	543	482.5	1001.3	1310.2	826.4	562.5	586.8	1101.9	791.5	**831.41**
Manora	1059.8	687.2	486.6	938.8	1039.5	724.2	518.4	435.1	1176.5	817.8	**788.39**
Karanja	915	743.5	546.2	1062.3	1312.3	949.6	561.1	688.2	835.4	766.9	**838.05**
District Avg.	**1385.2**	**818.38**	**634.43**	**975.00**	**1187.53**	**830.03**	**656.28**	**634.55**	**1073.75**	**726.5**	**892.16**

3.0 Geomorphology and Soil Types

The district forms part of Deccan Plateau with slope towards southeast from Sahayadri hills and has a varied topography consisting of hills, plains and undulating topography near riverbanks. The district forms a part of Godavari and Tapi basins. The Balaghat Plateau comprises of low-lying hills forming water divide. Many of the tributaries to Godavari and Tapi rivers originate from the Balaghat Plateau. Penganga River is the main river flowing through the district. Other rivers are Adol, Aran, Kapsi, Nirguna and Mun. Based on geomorphological setting and drainage pattern, the district is divided into 36 watersheds.

The soil of the district is basically derived form Deccan Trap Basalt and major part of the district is occupied by medium black soil of 25-50 cm depth occurring in the plains in entire south western, north eastern and northern parts of the district, whereas the shallow black soil of 7.5 to 25 cm depth occur in restricted hilly parts of the district in central elongated part and the northern peripheral part.

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**.

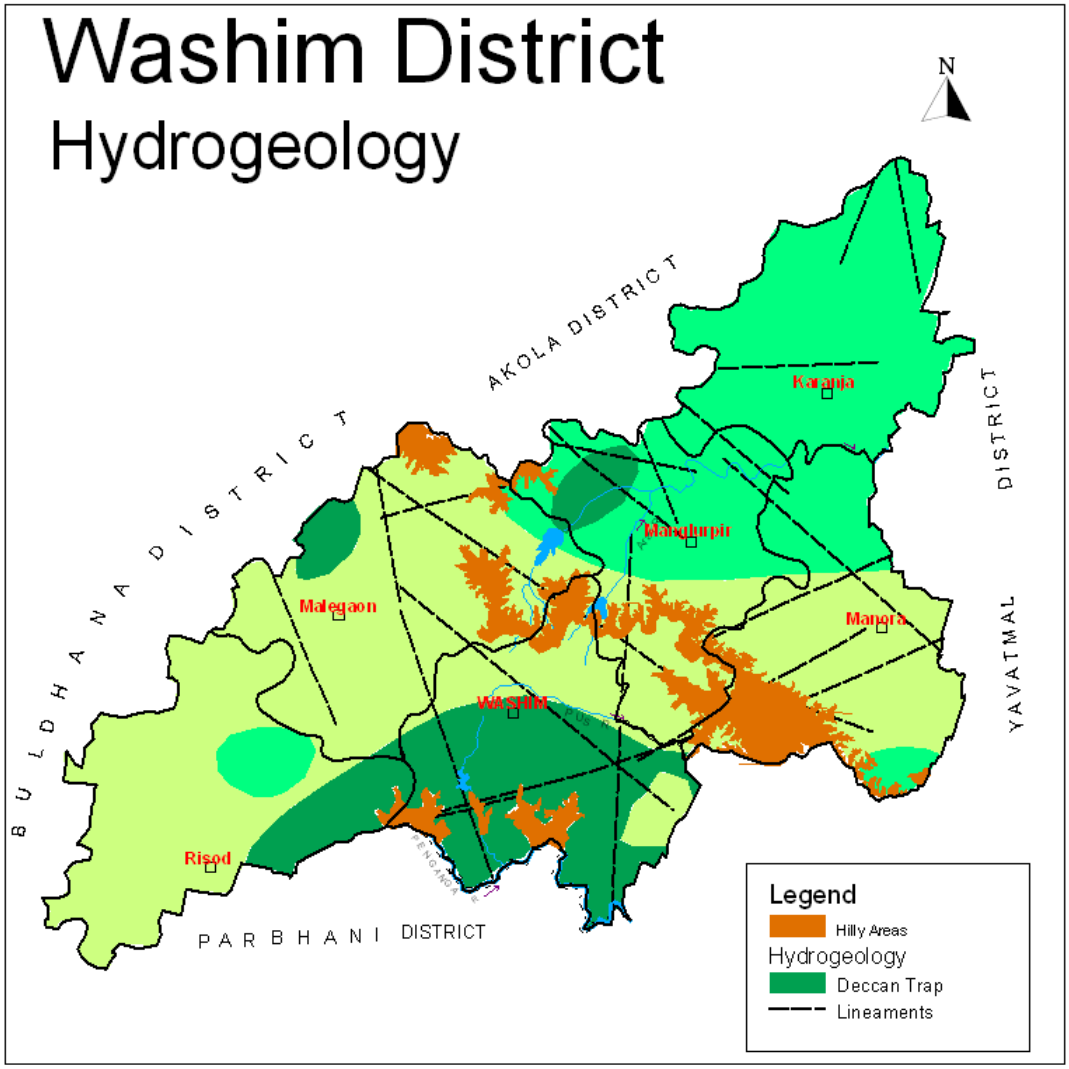

Figure-2: Hydrogeology

4.1.1 Deccan Trap Basalt

Deccan Traps occurs as Basaltic lava flows, which are 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 50 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 The vesicular portion of different lava flow varies in thickness from 8 to 10 m and forms the potential zones.

4.1.2 Water Level Scenario

Central Ground Water Board periodically monitors 26 (Including 6 piezometers) National Hydrograph Network Stations (NHNS) stations in Washim 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 (2001-10) are given in **Table- 4**.

Table 4: Water Level Data (2011) with Long Term Trends (2001-10).

Sl.No.	Location	Pre-monsoon Water level (mbgl)	Post-monsoon Water level (mbgl	Fluctuation (m)	Pre-monsoon Trend		Post-monsoon trend	
					Rise (m/yr)	Fall (m/yr)	Rise (m/yr)	Fall (m/yr)
1	Vilegaon (Kherda)	5.7	3.7	2.00	0.0018	-	-	0.0739
2	Medshi	6.3	3.7	2.60	0.2301	-	0.0389	-
3	Sangaon	10.4	4.2	6.20	-	0.0772	-	0.1107
4	Chikli	8.8	4.9	3.90	-	0.1018	0.0626	-
5	Pimpalgaon3	9.3	2.8	6.50	-	-	0.2702	-
6	Wada	10.8	4.2	6.60	-	0.2729	0.0881	-
7	Washim	7.7	2.7	5.00	0.0894	-	0.1192	-
8	Kenwad	4.7	4.6	0.10	0.2276	-	0.3245	-
9	Risod	8.15	4.6	3.55	-	0.0328	0.0237	-
10	Karanja	7.9	2.7	5.20	-	0.4483	-	0.0894
11	Sakhar Doha	8	6.3	1.70	0.0786	-	0.0657	-
12	Rithad	12	5.5	6.50	-	0.1507	-	0.0299
13	Kamargaon	5.7	3.4	2.30	-	0.1281	-	0.0378
14	Sendurjan Adhao	9.5	5.35	4.15	0.1774	-	0.0206	-
15	Dapuri	9.2	7.3	1.90	-	0.0470	0.0250	-
16	Jogaldari	16	11.5	4.50	-	-	-	-
17	Loni	7.35	2.8	4.55	0.1185	-	0.1049	-
18	Dhanaj Khurd	7.8	-	-	0.1078	-	0.0786	-
19	Shaha	-	9.2	-	-	0.1526	-	0.2004
20	Bitoda (Bhoyar)	-	7	-	-	0.0505	-	0.0407
21	Kinhi Raja	9.4	-	-	-	0.1169	0.0536	-
22	Karanja_Pz	-	10.5	-	-	-	-	-
23	Yevta Bandi_Pz	-	7.45	-	-	-	-	-
24	Malegaon_Pz	-	6.3	-	-	-	-	-
25	Mangrulpir_Pz	-	6	-	-	-	-	-
26	Manora_Pz	-	6.65	-	-	-	-	-
27	Kurha_Pz	-	7.45	-	-	-	-	-

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

The depth to water levels in the district during May 2011 ranges between 4.70 (Kenwad) and 16.00 (Jogaldari) m bgl. Depth to water levels during premonsoon (May 2011) has been depicted in **Figure-3**. Shallow water

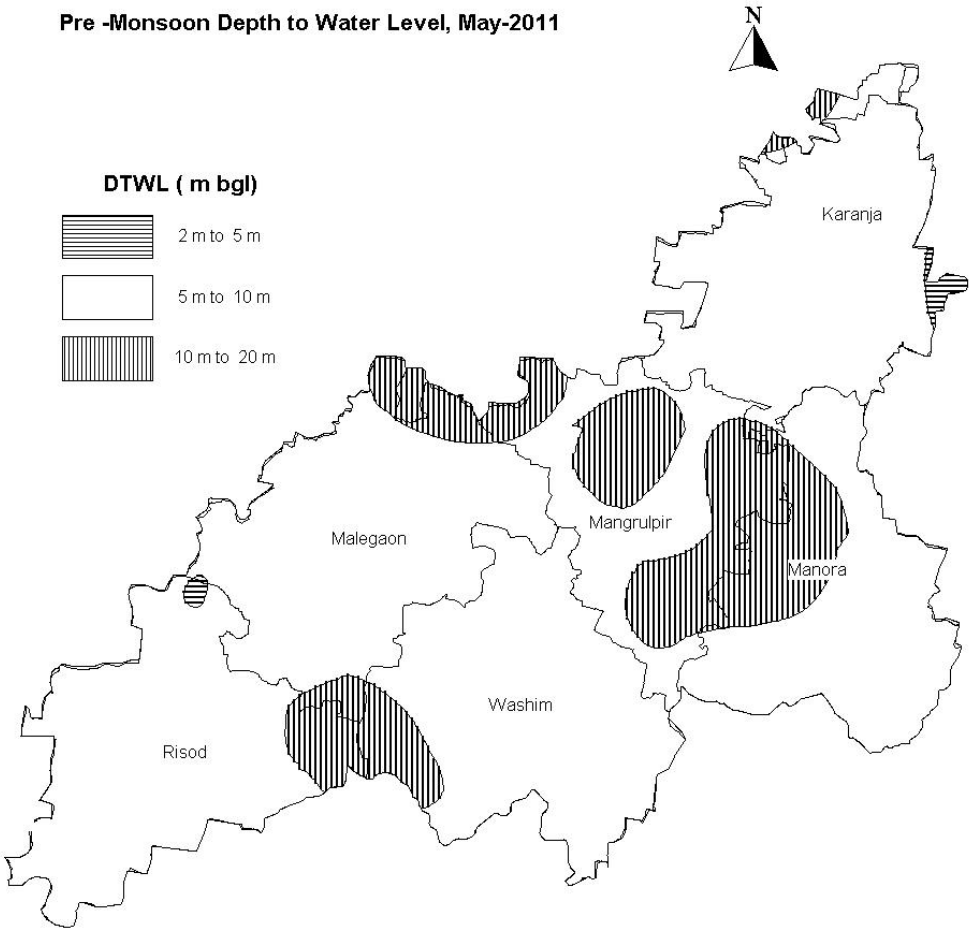

Figure-3: Depth to Water Level (Premonsoon- May 2011)

levels within 10 m bgl are seen in almost entire district, i.e., northern part of Risod taluka and almost entire Malegaon, Washim, 50% of Mangrulpir, Manora and Karanja talukas. Water levels in the range of 10-20 m bgl are observed in isolated patches in eastern part of Risod taluka, northern part of Malegaon taluka, northern, western and southern part of Mangrulpir and north western part of Manora taluka.

4.1.3 Depth to Water Level – Postmonsoon (Nov.-2011)

The depth to water levels during Nov. 2011 ranges between 2.70 m bgl (Washim) and 11.50 m bgl (Jogaldari). 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. Water levels within 10 m bgl is the most dominant range occupying almost entire district. Water levels of 10-20 m bgl are also observed in isolated patch i.e., in southeastern part of Mangrulpir.

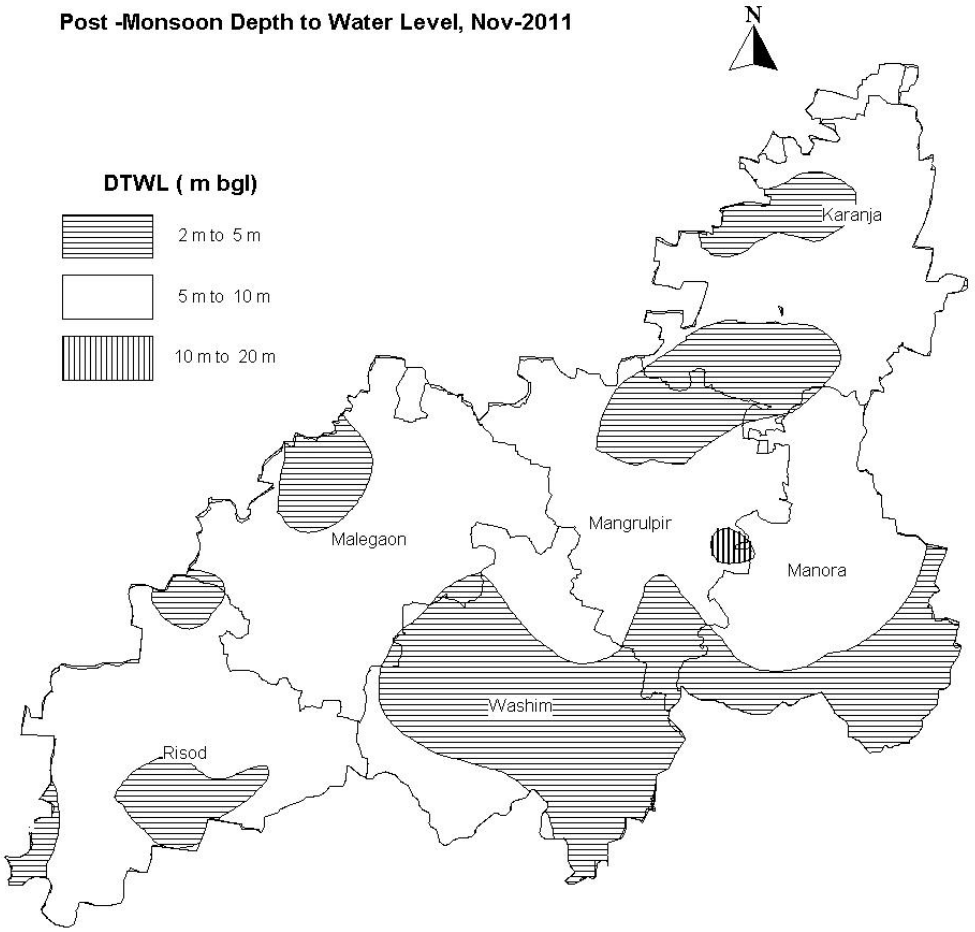

Figure-4: Depth to Water Level (Postmonsoon- Nov.2011)

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

In major part of the district rise in water levels in the range of 0.10 (Kenwad) to 6.60 m (Wada) is observed. In entire district rise in water levels has been observed. Major part of the district covering entire Risod, Washim and Malegaon talukas and parts of Mangrulpir, Manora and Karanja talukas show rise of more than 4m. Rise in the range of 2 to 4 m is the next major range occupying major parts of Mangrulpir and Manora talukas and south

eastern parts of Karanja taluka.

4.1.5 Water Level Trend (2001-10)

Trend of water levels for premonsoon and postmonsoon period for last ten years (2001-10) have been computed for 21 NHNS and are given in **Table-4**.

Analysis of trend indicates that during premonsoon period, rise in water levels has been recorded at only 8 stations and it ranges between 0.0018 m/year (Vilegaon kherda) and 0.2381 m/year (Medshi). Fall in water levels has been observed at 11 stations in the range of 0.0328 m/year (Risod) to 0.4483 m/year (Karanja). During postmonsoon period, rise in water levels has been recorded at 13 stations and it ranges from 0.0206 m/year (Sendurjana Adhao) to 0.3245 m/year (Kenwad), whereas at 7 stations, fall in water levels ranging between 0.0299 m/year (Rithad) and 0.2004 m/year (Shaha) is observed. Thus in 6 stations of district, both during pre and postmonsoon periods, declining trend of water levels has been observed.

4.1.6 Aquifer Parameters

The aquifer parameters are available from pumping tests conducted at 4 exploration sites. The transmissivity of Deccan Traps varies between 8.10 (Lohara) and 1638.73 m^2/day (Shelu Bazar) while the storage coefficient of the formation varies from $3.1x10^{-3}$ to $6.6x10^{-6}$.

4.2 Ground Water Resources

Central Ground Water Board and Groundwater Survey and Development Agency (GSDA) have jointly estimated the ground water resources of Washim district based on GEC-97 methodology. The same is presented in **Table-5**. Ground water resources estimation was carried out for 4811.97 sq. km. area out of which 273.46 sq. km. area is under command and 4538.51 sq. km. is non-command. As per the estimation the total annual ground water recharge is 591.47 MCM with the natural discharge is 29.59 MCM, thus the net annual ground water availability comes to be 561.87 MCM. The total gross draft for all uses is estimated at 200.23 MCM with irrigation sector being the major consumer having a draft of 181.68 MCM. The domestic and industrial water requirements are worked at 37.09 MCM. The net ground water availability for future irrigation is estimated at 324.56 MCM. Stage of ground water development varies from 27% (Manglurpir) to 41% (Karanja).

The overall stage of ground water development for the district is 36%. All the talukas and watersheds have been categorised as “Safe”

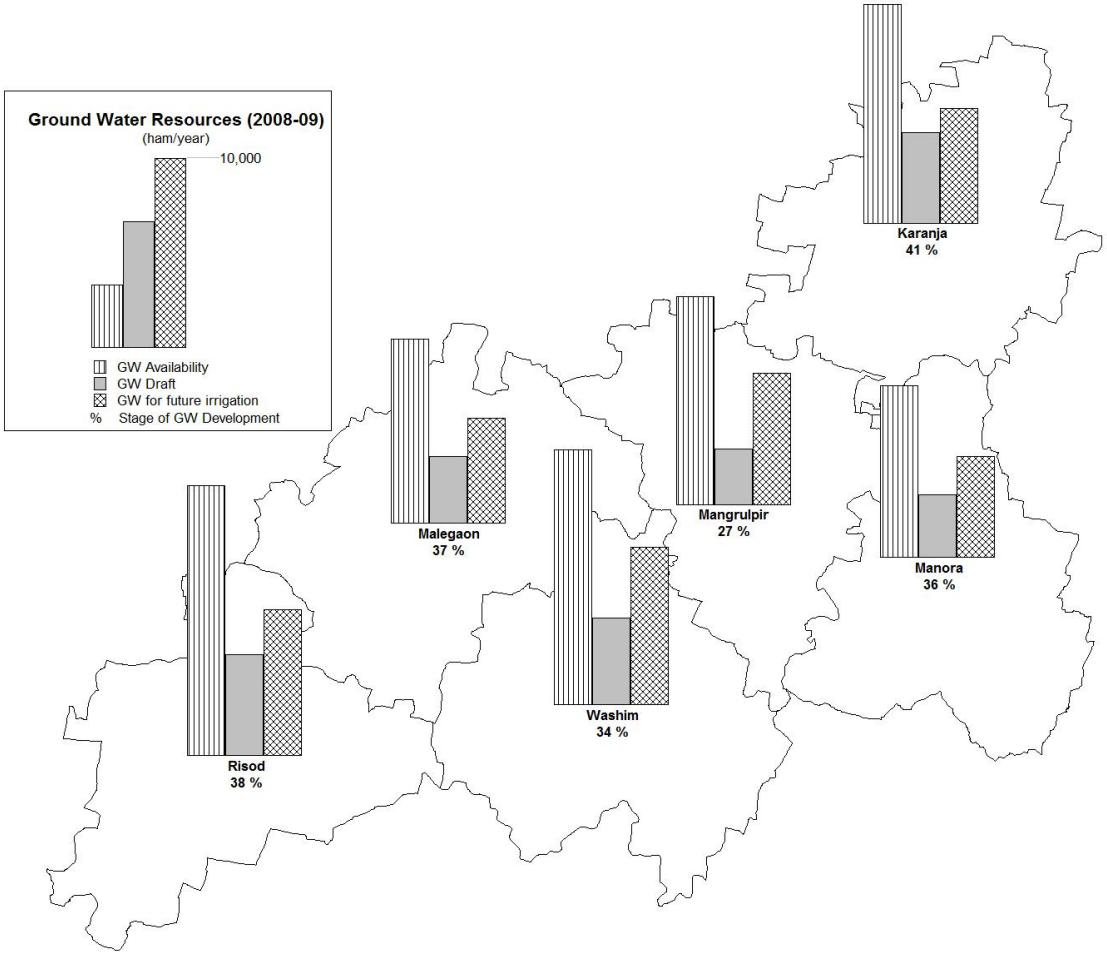

Figure-5: Ground Water Resources

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

Taluka	Net Annual Ground water Availability (ham/yr)	Existing Gross Groundwater Draft for Irrigation (ham/yr)	Existing Gross Groundwater Draft for Domestic & Industrial water Supply (ham/yr)	Existing Gross Groundwater Draft for All uses (ham/yr)	Allocation for domestic & industrial requirement supply upto next 25 years (ham/yr)	Net Groundwater Availability for future irrigation development (ham/yr)	Stage of Groundwater Development (%)
WASHIM	10965	3496	262	3758	563	6741	34
RISOD	11550	4092	288	4380	572	6261	38
MALEGAON	7912	2456	443	2899	916	4483	37
KARANJA	9426	3521	358	3879	749	4973	41
MANGRULPIR	8931	2147	297	2444	521	5675	27
MANORA	7403	2456	207	2663	388	4323	36
TOTAL	**56187**	**18168**	**1855**	**20023**	**3709**	**32456**	**36**

4.3 Ground Water Quality

In the district, 7 ground water samples were collected during May 2010 for complete chemical analysis and the results are given in Table 6.

Table 6. Chemical analysis results of Washim district.

S.No.	District	Well No.	Village	pH	EC	TA	TH	NO_3	F	RSC
1	Washim	G/WM-003	Washim	8.1	720	220	245	46	BDL	-0.50
2	Washim	G/WM-005	Risod	7.8	2100	395	305	82	BDL	1.80
3	Washim	T/WM-011	Medshi	8.1	720	200	205	30	BDL	-0.10
4	Washim	G/WM-012	Sakhar Doha	8.2	710	295	320	18	0.14	-0.50
5	Washim	T/WM-023	Chikli	7.8	990	195	315	145	BDL	-2.40
6	Washim	G/WM-028	Loni	7.9	860	230	235	101	0.66	-0.10
7	Washim	G/WM/004	Kenwad	7.7	1220	200	325	166	BDL	-2.50

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., pH, TDS, TH, and NO_3 prescribed in the standards and is given in **Table-7**.

Table-7 Classification of Ground Water Samples 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
pH	6.5	8.5	-	7	-
TH (mg/L)	300	600	3	4	-
NO_3 (mg/L)	45	No relaxation	2		5
F (mg/L)	1.0	1.5	7	-	-

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

The **Table-7** shows that out of the 7 ground water samples, 5 samples (71%) have NO_3 concentration more than MPL (>45 mg/L) while the concentration of all the other parameters is within MPL. This indicates that the potability of ground water is mainly affected due to NO_3.

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 Residual Sodium Carbonate (RSC) are the most important quality criteria, which influence 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**.

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	%
7	6	86	1	14	-	-

The **Table-8** shows that the ground water samples from all the wells have RSC values below 1.25 except in one sample at Risod, where RSC value is found to be 1.80. 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 two type of abstraction structures i.e., borewells and dugwells. However dugwells are the

main ground water abstraction structures in the district. The yield of such structures varies from 120 to 350 m^3/day. High yielding dugwells are generally located in weathered and fractured Basalt occurring in physiographic depressions.

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 2002, GSDA, Government of Maharashtra was successfully operating 2393 borewells for rural water supply under various schemes in the district, out of which 81 are fitted with electric pumps and the rest with hand pumps. In addition to this, 3994 dugwells are also the main source of water supply, out of which 1762 are public and 2237 are private dugwells.

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. The central and western parts of the district comprising parts of Risod, Malegaon, Washim, Mangrulpir and Manora talukas have low ground water development potential. The areas with medium ground water development potential are observed in northern part of the district comprising entire Karanja and northern parts of Mangrulpir and Manora talukas. The southern parts of the district comprising parts of Risod and Washim talukas 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 20 to 120 m^3/day depending on the local hydrogeological conditions.

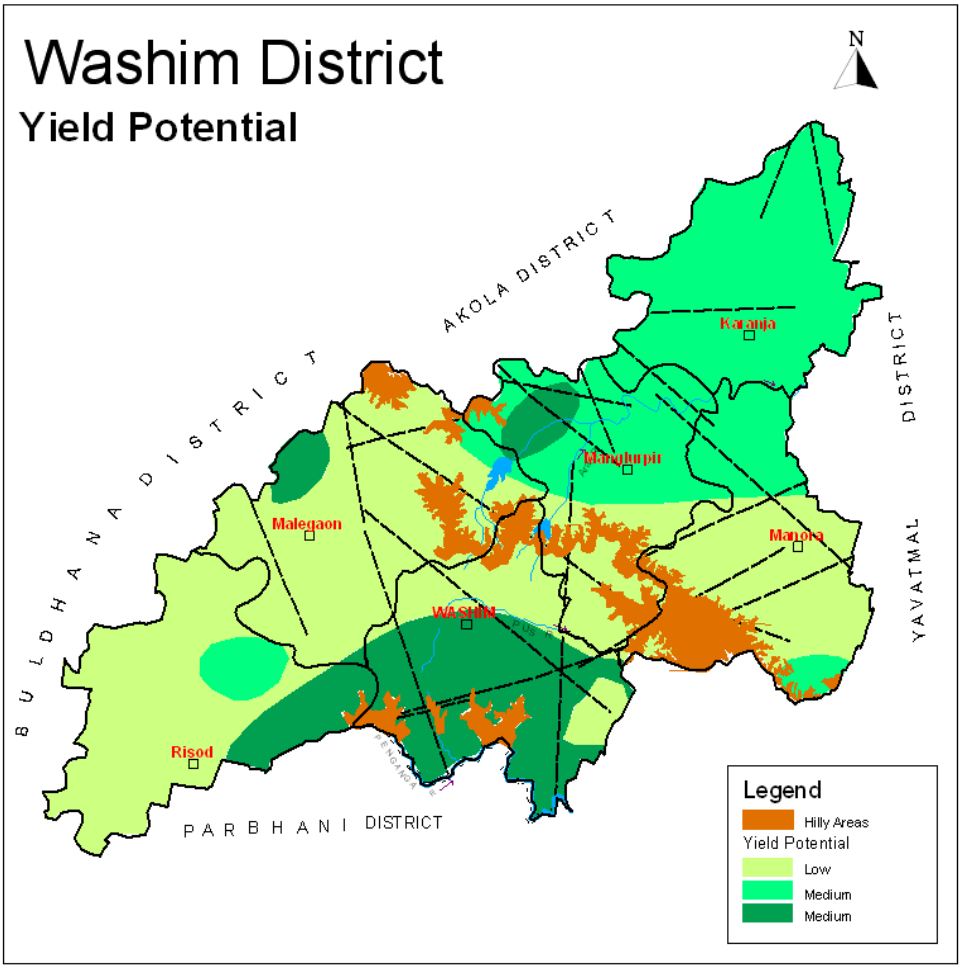

Figure-6: Yield Potential of Aquifers

The nature and yield potential of the aquifers occurring in different areas is given below in **Table-9**, whereas the map is presented as **Figure-6**.

Table-9: Nature and Yield Potential of Aquifers.

Sl. No.	Taluka	Main Aquifer	Yield Potential	Type of Wells Suitable
1.	Karanja	Basalt	Medium	Dugwell DCB
2.	Malegaon	Basalt	Low	Dugwell DCB
3.	Mangrulpir	Basalt	Low to Medium	Dugwell DCB
4.	Manora	Basalt	Low to Medium	Dugwell DCB
5.	Risod	Basalt	Low	Dugwell DCB
6.	Washim	Basalt	Low to High	Dugwell DCB

5.2 Water Conservation and Artificial Recharge

A large number of water conservation structures in the form of check dams, percolation tanks and KT weirs have been constructed in the district. As per the data available, 117 percolation tanks had been constructed with total storage capacity of 21 MCM. KT weirs at 110 locations and 21 diversion dams have also been constructed. As a part of soil and land conservation measure, 2806 bushwood dams, 3125 line check dams, 14550 loose boulder dams 4201 gully plugs/earthen dams, 884 earthern nala bunds, 693 cement nala bunds and 318 underground bandharas have also 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 area located in the central parts, in parts of Malegaon, Mangrulpir, Washim and Malegaon. 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 analyses for the period 1901-2001 indicates drought area in the western part of the district i.e., in major part of Risod taluka with moderate drought occurring for 20% of years during the period. The normal annual rainfall during the period is also minimum in this part. Thus future water conservation and artificial recharge structures in the district may be prioritised in this part of the district. Ground water quality is adversely affected by nitrate contamination in 71% of the samples collected in May 2010. Continues intake of water with high nitrate concentration causes infant methaemoglobinamea, popularly known as Blue Babies disease. Thus all the wells used for water supply should be first analysed for nitrate contents and if the nitrate content is found beyond permissible limit the ground water may be used for other purposes than drinking. Adequate sanitary protection to the wells may be provided to control the nitrate contamination. Proper severage

disposal may be adopted to avoid nitrate contamination of ground water.

7.0 Mass Awareness and Training Activities

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

Till March 2007, 1 MAP and 1 WMTP had been organised in the district at Washim. The details are given in **Table-10**.

Table-10: Status of MAP and WMTP.

S. No.	Item	AAP	Venue	Date	No of Persons Attended
1	MAP	2006-07	Washim	25/01/07	300
2	WMTP	2006-07	Washim.	23 & 24/01/07	45

7.2 Participation in Exhibition, Mela, Fair etc.

During the MAP and WMTP at Washim, an exhibition depicting rainwater harvesting model, various ground water related posters, leaflets, literature and technical reports were displayed along with maps of Washim district. The models, maps, posters were explained to the visitors in details.

8.0 Areas Notified by CGWA/SGWA

As per ground water resource estimation, all the talukas of the district fall under “Safe” category, hence till March 2007 the area has not 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 Ground water quality is adversely affected by nitrate contamination in 71% of the samples collected in May 2010. Thus all the wells used for water supply should be first analysed for nitrate contents and if the

nitrate content is found beyond permissible limit the ground water may be used for other purposes than drinking. Adequate sanitary protection to the wells may be provided to control the nitrate contamination.

4 The overall stage of ground water development for the district is only 36%, therefore, scope for further development of ground water resources exists.

5 The southern parts of the district comprising parts of Risod and Washim 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 20 to 120 m^3/day depending on the local hydrogeological conditions.

6 Drought prone and deeper water levels area has been observed in south-western parts of Risod taluka. Thus future water conservation and artificial recharge structures needs to be prioritised in these parts of the district.

7 The scope exists for constructing of suitable artificial recharge structures in the district. The structures recommended for the hilly-Basaltic area in the central parts in parts of Malegaon, Mangrulpir, Washim and Malegaon 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 the source water is free of silt and dissolved impurities.

8 The existing village ponds need to be rejuvenated to act both as water conservation and artificial recharge structures.