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भारत सरकार

जल संसाधन मंत्रालय

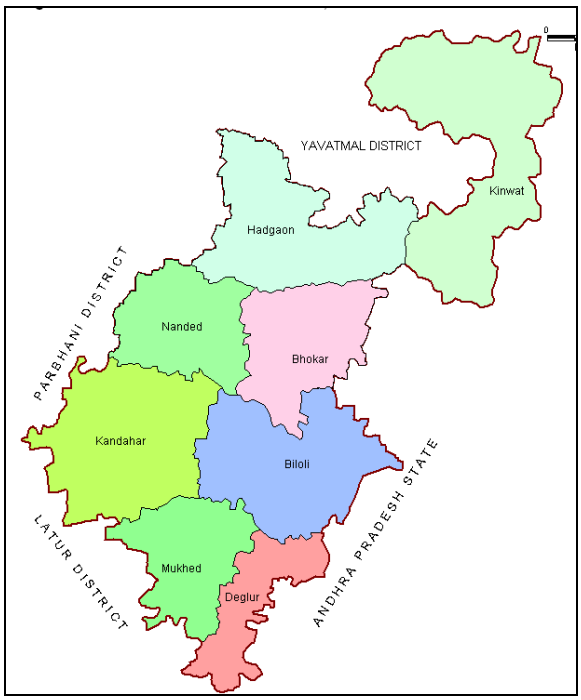
केंद्रीय भूजल बोर्ड

GOVERNMENT OF INDIA
MINISTRY OF WATER RESOURCES
CENTRAL GROUND WATER BOARD

महाराष्ट्र राज्य के अंतर्गत नांदेड़ जिले की

भूजल विज्ञान जानकारी

GROUND WATER INFORMATION
NANDED DISTRICT
MAHARASHTRA



By

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Scientist-B

द्वारा

अभय निवसरकर

वैज्ञानिक - ख

मध्य क्षेत्र, नागपुर

CENTRAL REGION, NAGPUR

2013

NANDED DISTRICT AT A GLANCE

1. GENERAL

Geographical Area	:	10502 sq. km
Administrative Divisions (As on 31/03/2007)	:	Taluka- 16; Mahur, Kinwat, Himayatnagar, Hadjav, Ardhapur, Nanded,Mudkhed, Umri, Dharmabad, Biboli, Nyegaon, Loha Jandhar, Mukhed Dejlur,
Villages	:	1580
Population (2011 Census)	:	33.57 lakhs
Average Annual Rainfall (2010)	:	767 to 1285 mm
Urban Centers	:	13

2. GEOMORPHOLOGY

Major Physiographic unit	:	Plateau's having plain terrain with undulations
Major Drainage	:	One ; Godawari

3. LAND USE (2000-01)

Forest Area	:	91916 ha.
Net Area Sown	:	711000 sq. km.
Cultivable rea	:	7,80,600 sq. km.

4. SOIL TYAPE

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

5. PRINCIPAL CROPS (2010-11)

Soyabeen	:	24108.04 MT
Jowar	:	24077 MT
Cotton	:	21603.69 MT
Pulses	:	12581.87 MT
Sugarcane	:	14416.00 MT
Rice	:	503.04 . MT
Wheat	:	5249.78 MT

6. IRRIGATION BY DIFFERENT SOURCES (2000-01)**-**
Nos./Potential Created (ha)

Major scheme	:	5
Medium	:	10
Minor	:	312
Lift irrigat	:	40
Gross irrigated area	:	47,455 ha
Net Irrigated Area	:	38,317 ha
Surface water irrigation	:	8,883 ha
Ground water irrigation	:	29,434 ha

7. GROUND WATER MONITORING WELLS (As on 31/05/2007)

Dugwells	:	41
Piezometers	:	04

8. GEOLOGY

Recent	:	Alluvium
Upper Cretaceous-Lower Eocene	:	Basalt (Deccan Traps)
Precambrian	:	Vindhyan (Sandstone and Limestone)
Archean	:	Peninsular Granite Gneisses Complex, Intrusive Pink and Grey Granite, Dolerire Quartz vain, BHQ (Dharwar System)

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)	:	2.93 to 13.98 m bgl
Postmonsoon Depth to Water Level (Nov.-2011)	:	1.9 to 7.93 m bgl
Premonsoon Water Level Trend (2000-2011)	:	Rise: Negligible to 0.52 m/year Fall: 0.01 to 1.09 m/year
Postmonsoon Water Level Trend (2000-2011)	:	Rise: 0.01 to 0.68 m/year Fall: Negligible to 1.34 m/year
Ground water exploration		72 (37 EW+26 OW+9 PZ)
High yielding well	:	38 (Discharge > 3 lps)
Depth Range	:	12.85 – 208 m
10. Quality of ground water	:	Good suitable for drinking & irrigation purposes excluding few areas
Occurrence of heavy metals	:	Traces of Pb, Mn& Cd in Tupa MIDC area, Nanded

11. DYNAMIC GROUND WATER RESOURCES (As on 31/03/2009)

Net Annual Ground Water Availability	:	138692.55 ham
Total Draft (Irrigation + Domestic)	:	2654.91ham
Provision for domestic and industrial requirement supply to 2025	:	5309.82 ham
Net Ground Water Availability for future irrigation development (10-11-14)	:	94201.35 ham
Stage of GW Development	:	30.16%

12. AWARENESS AND TRAINING ACTIVITY

A	Mass Awareness Programme	:	(2005-06)
	a. Date	:	09.08.2005
	b. Place	:	Biloli
	c. Participants	:	300
B	Water Management Training Programme	:	(2005-06)
	Date	:	10.08.2005
	Place	:	Nanded
	Participants	:	45
13	**Ground water Control Regulation**	:	OE Taluka NIL Critical Taluka NIL Notified Taluka NIL

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1.0 Introduction

Nanded District lies between 18°16' to 19°55' North latitude and 76°56' and 78°19' east longitude in the eastern part of Marathwada Region, which corresponds to Aurangabad Division of Maharashtra. The district is bounded by Nizamabad, Medak and Adilabad districts of Andhra Pradesh on the east, by Bidar District of Karnataka on the south, by Parbhani and Latur districts of Marathwada on the west, and Yavatmal District of Vidarbha region on the north. The geographical area of the district is 10502 sq km . According to 2001 census the population of the district is 33.57 lakhs

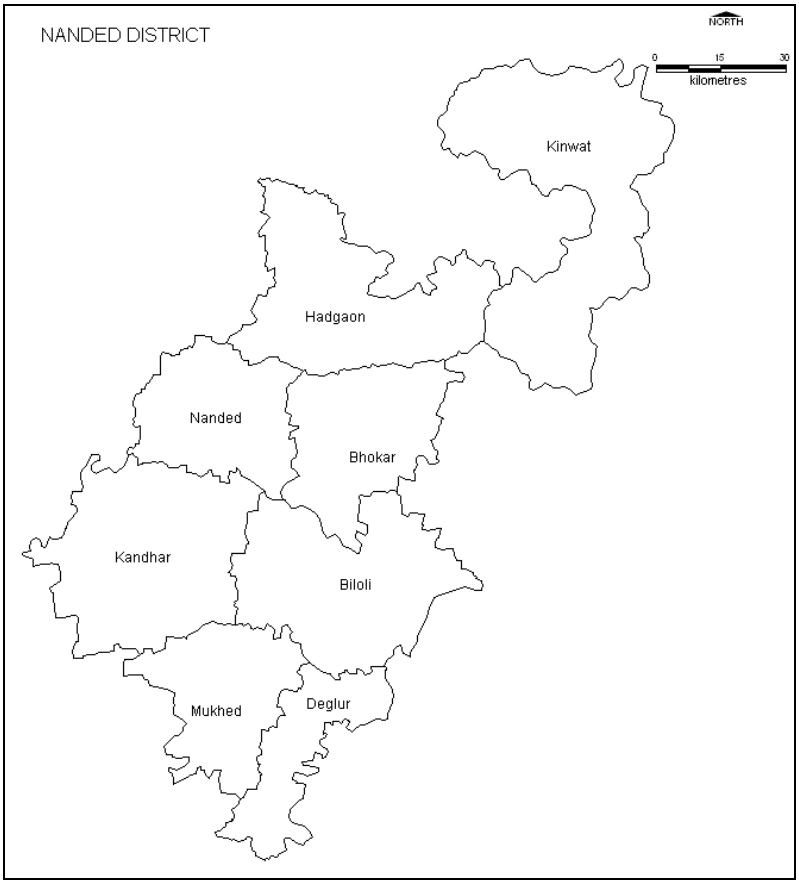

Figure 1: Administrative Map

Administratively, the district is subdivided into three revenue sub-divisions, namely Nanded, Deglur and Kinwat. These three subdivisions together comprise of 16 talukas. There are total 1580 village out of which 1515 are unhabitated and the rest emhabitated and 13 urban center in the district .Nanded is district headquarter and other important town are Dharmabad, Biloli, Duglur, Mukhed, Kandhar, Hadgaon, Kiwat, Umri, Mudkahed and Loha etc. Administrative map is shown in Figure 1.

The total area under forest in the district is 91916 hectares. The soil of the district are black and fertile . The district has got net cultivable area of 7,80,600 ha. Food grains are grown in 62.74 % of the area and the main cash crops are cotton, banana and sugarcane. The gross irrigated area is 47,455 ha and the net irrigated area is 38,317 ha. Out of this surface water and ground water irrigated area is 8,883 and 29,434 ha (1994-95) respectively

Central Ground Water Board has conducted following studies in the district

- Systematic Hydrogeological survey was taken up by CGWB in Nanded district in year 1983-84 and was completed by 1989-90
- The Reappraisal Hydrogeological studies were taken up by CGWB from 1993-94 and total of 8821 sq. km was covered till 1997-98.
- Ground water exploration was undertaken during 1995-1998 to determine formation wise aquifer parameter for deciphering the ground water conditions. The district was fully covered by constructing 37 exploratory well and 26 observation wells.
- Nine piezometer have also been constructed under World Bank added National Hydrology Project during 1998-99 for continuous monitoring of water level by installing depth to water level recorder (DWLR) on 3 Piezometer.
- Surface Geophysical surveys have been carried out in the district at 19 locations all over the district for site selection of exploratory wells.
- An urban study detailing the hydrogeology of Nanded Waghala Municipal Corporation and impact of population on ground water regime was taken up during year 2001-02.
- A pollution study was also taken up during year 2002-03, to assess the impact of industrial effluents on ground water quality in the vicinity of Tuppa village MIDC

area, Nanded.

Central Ground Water Board, Central region carried out ground water exploratory drilling by deploying DTH rig. from 1995 to 1998. A total of 37 Exploratory and 26 Observation wells were drilled in the district. Apart from above, under the World Bank aided Hydrology Project 9 Piezometers were drilled to monitor ground water level in the district. Out of 72 wells 38 wells yielded more than 3 lps discharge. Exceptionally high discharge of around 70,000 lph was recorded at 8 places in Bhokar, Biloli, and Kandhar Talukas. The salient feature of the wells drilled under exploration programme and Hydrology project is presented in the table 1.

Table 1: Salient Features of Exploratory wells Drilled in Nanded District

Sl no	Taluka	EW	OW	PZ	Total	Depth Range (mbgl)	Yield Range (LPH)	No of well with >3 lps Discharge		Transmissivity (m^2/day)	Storativity
								No	%		
1	Nanded	5	4	0	9	52.00-208.00	2808 to 67212	7	77.77	25 -85.64	0.00262 to 0.029
2	Bhokar	4	3	1	8	86.05-178.15	504 to 67212	6	85.71	74.05 – 156.156.14	0.00074 to 0.0024
3	Hadgaon	5	1	2	5	134.00-202.00	Dry to 52236	2	33.33	546.11	
4	Kinwat	8	5	2	15	86.05 – 183.65	504 to 37224	6	46.15	16.90 – 593.36	0.00035
5	Biloli	5	3	3	11	55.55 – 130.00	21060 to 70776	4	50.00	46.65 – 73.67	0.0732
6	Deglur	2	1		3	54.00 – 122.00	Traces-12060	2	66.66	212.01	0.01169
7	Muedkh	3	1		4	78.00 – 107.50	Traces-18540	2	50.00	2.62	0.000869
8	Kandhar& Loha	5	8	1	14	12.85 – 201.95	504 to 64717	10	76.92	22.96 – 73.57	0.00002 – 0.00035
9	Total	37	26	9	72	12.85 – 208.00	504 to 70776	38	60.82	2.62 – 393.36	0.00035-0.0732

2.0 Climate and Rainfall

The climate of the district is generally dry except in monsoon season. The district gets 89% of the rain from south west monsoon. The rainfall increases from west to east. Average annual rainfall is in the range of 767 to 1285 mm with an average of 47 rainy days.

The mean daily maximum and maximum temperatures are 13.1°C and 42° during December and during May respectively. The relative humidity is high during SW

monsoon season when it ranges between 60% and 80%. Winds are generally light during October to March and they get strength in the later half of the summer and south west monsoon season. Thunderstorms occur in summer and monsoon months. Their frequency being higher in June and September. Dust raising winds are common during summer afternoons. Taluka wise rainfall dada for the period 2008-2012 is given in table 2.

Table 2: Taluka wise Rainfall Data of Nanded District (in mm)

Taluka	2008	2009	2010	2011	2012	Average
Biloli	636	407.6	743	603	674	612.72
Deglur	429	547	781	692	643.4	618.48
Nanded	384	458	1271	581	506	640
Naigaon khurd	659	507	969	668	489	658.4
Loha	642	637	1031	674	389	674.6
Mukhed	657	429	879	737	745	689.4
Hadgaon	530	443	1154	674	685	697.2
Kandhar	472	516	1213	817	527	709
Dharmabad	734	637	989	773	597	746
Bhokar	644	805	1288	440	685	772.4
Ardhapur	672	631	1281	657	651	778.4
Mudkhed	530	674	1374	672	667	783.4
Umari	758	583	1214	846	594	799
Himayat Nagar	794	553	1315	720	829	842.2
Mahur	713	683	1149	923	886	870.8
Kinwat	884	579	1335	835	1004	927.4

It is observed from table 2 that average rainfall for the period 2008-2012 varies from 612.72 mm at Biloli to 927.04 mm at Kinwat. Highest rainfall has occurred during 2010 at all the stations.

3.0 Geomorphology

The district is situated on plateau's having plain terrain with undulations. The main trend from hills is northwest to south west. There are three distinct traces of elevation 350, to 570 masl, 570 to 600 masl, and >600 masl.

The principal rivers of the district are the Godavari, the Penganga, the Manjara

and the Mansar. The river Godavari runs 140 kms and it has three tributaries Asna, Sita, and Siddha in the district. The river Manjara forms the district boundary on south east side for 40 km and has two tributaries viz. Mannar and Lendi. The Penganga river forms northern boundary of the district and flows west to east with a big "S" shape curve. A water fall of 10-12 m named as a "Sahastrakunda Fall" is situated near Islapur village in Kinwat taluka and it has two tributaries viz., Kayadhu and Tamsa nala.

Based on geomorphic setting and drainage pattern the basin of the district are divided into 49 watersheds and out of these 17,18 and 14 watershed fall in runoff zone , Recharge zone and discharge zone respectively.

4.0 Ground Water Scenario

4.1 Hydrogeology

The main water bearing formation of the district is Alluvium, Deccan trap basalt and Granite. A map depicting the hydrogeological features is shown in figure 2. A brief description of water bearing formations is given below.

These Archeans have negligible primary porosity. However, joints fissure due to weathering and faulting of the formation develop secondary porosity. The thickness of weathering of these rocks in the district varies from place to place and ranges between 6 – 29 m depth as observed in Deglur and Bitoli Taluka. The joints and fractured porosity reduces with depth. Based on ground water exploration results, the aquifers are usually limited down to depth of 177 m bgl.

The water bearing capacity of vesicular basalt depends upon the size, percentage, density and degree of interconnection of vesicles. The vesicular basalt has moderate water bearing capacity, which is susceptible to weathering. It is generally observed that 'Pahoehoe" flows having uniformly distributed vesicle have good porosity and permeability hence constitutes a good aquifer. The massive basalt are hard and compact in nature and are basically devoid of any primary porosity and permeability. It is seen that when the thickness of these zones is appreciable say 30-60% of a flow , it forms an aquifer of moderate to high potential. The inter-trappeans and bole beds are saturated with water but are relatively impermeable thus they are act as aquiclude and do not yield appreciable quantity of water.

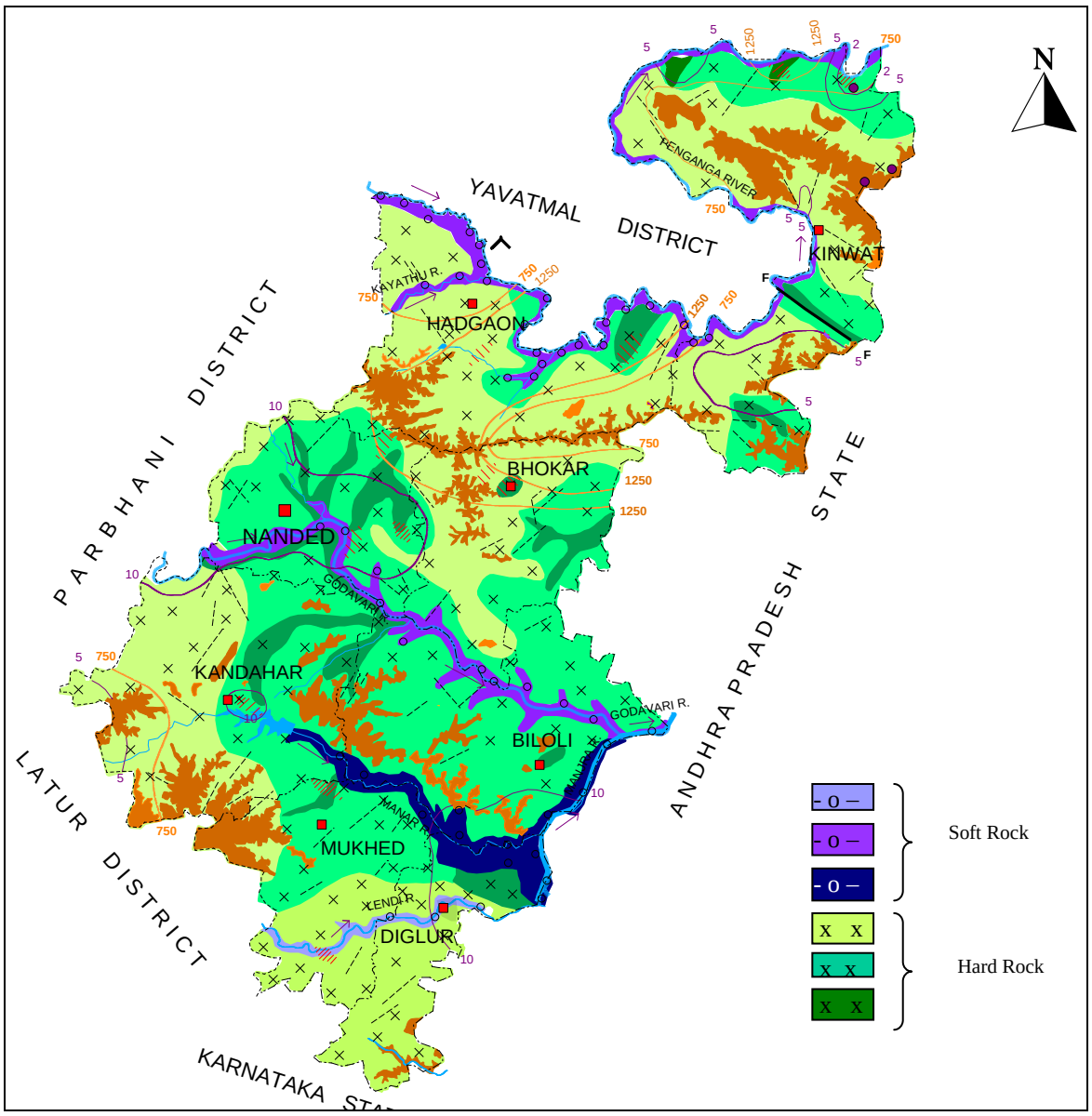

Figure 2: Hydrogeology

The alluvium deposits are restricted along the river courses and total area of alluvium is about 528 sq km and these have individual extension of 5 to 20 km^2 and 12 to m in thickness. These are generally comprised of clay, still, gravels and occasionally cobbles. The coarser granular strata when occurring below water level form productive aquifer and the porosity of there granular zone range from 10 to 15%. It is noticed that deeper water levels have been recorded from the wells located on the bank of the river.

4.2 Water Level Scenario

The depth to water level data from 41 National Hydrograph Network Stations (NNHS) in the district four times a year i.e. January, May (Pre monsoon), August and November (Post monsoon).

4.2.1 Depth to Water Level (Pre monsoon 2011)

It is observed that premonsoon water level (May 2011) varies from 2.93 m at Unkeshwar to 13.98 at Jamb Buzurg. Arial distribution of depth to water level during pre monsoon has been depicted in figure 3. Depth to water level between 10-15mbgl are observed in major part of the district. Water level between 5-10m is observed in the southern part of the district and also as isolated patches. Shallow water level between 2-5mbgl are observed in the northern most part of the district.

4.2.2 Depth to Water Level (Post monsoon 2011)

Post monsoon depth to water level varies between 1.9 Unkeshwar and 7.93 at Dhawari Buzurg in the district. Areal distribution of depth to water level during post monsoon has been depicted in figure 4. Water level in the range of 2-5 are observed in major parts of the district. Water level between 5-10mbgl are observed in the central and north eastern parts whereas, water level of less than 2 mbgl is observed as small patch in the south western parts of the district.

4.2.3 Seasonal Water Level Fluctuation

Seasonal water level fluctuation varies from 0.53m at Naigaon to 9.08m at Jam Buzurg. Majority of the wells have recorded fluctuation of less than 3m.

4.2.4 Water Level Trend (2002-2011)

4.2.4.1 Pre-monsoon Trend

The decadal long term water level data from 2002 to 2011 of both pre and post monsoon season has been analysed to study the behavior of water level over a period of time. It is observed that during pre monsoon period rise of water level has been observed in the range of negligible to 0.52m/Year whereas fall is observed in the range of 0.01 to 1.09m per year. Out of 18 , the 03 well showing rise in decadal water level whereas 16 wells shows decadal fall in water level.

4.2.4.2 Post monsoon Trend

Trend analysis of post monsoon water level data from November 2002 to November 2011 shows rise as well as fall in the water level trends. A rise in the range of 0.01 to 0.6m /year and fall in the range of negligible to 1.34m / year have been recorded in the district.

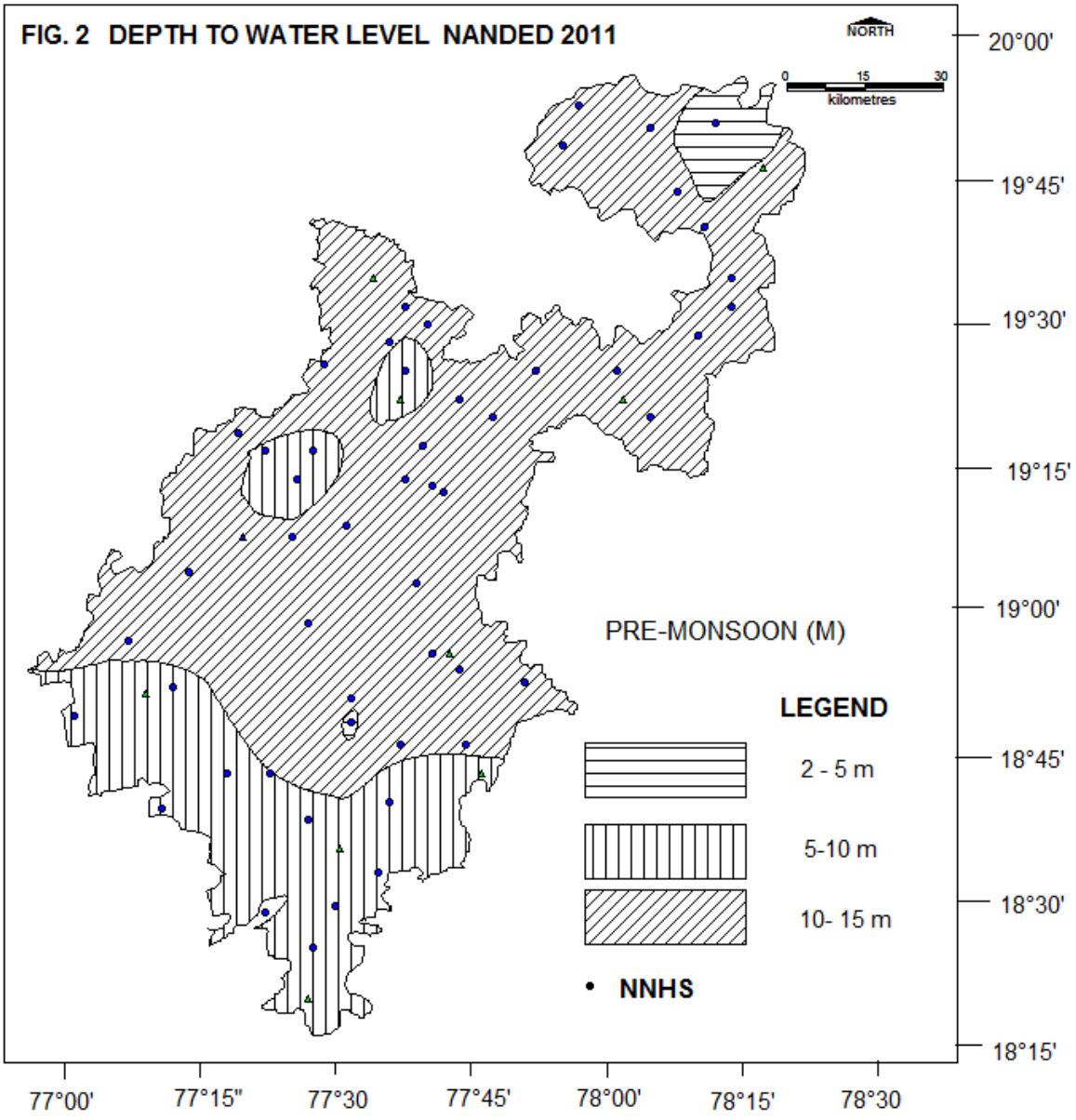

Fig. 3: Depth to water level In Nanded District (Pre-monsoon)

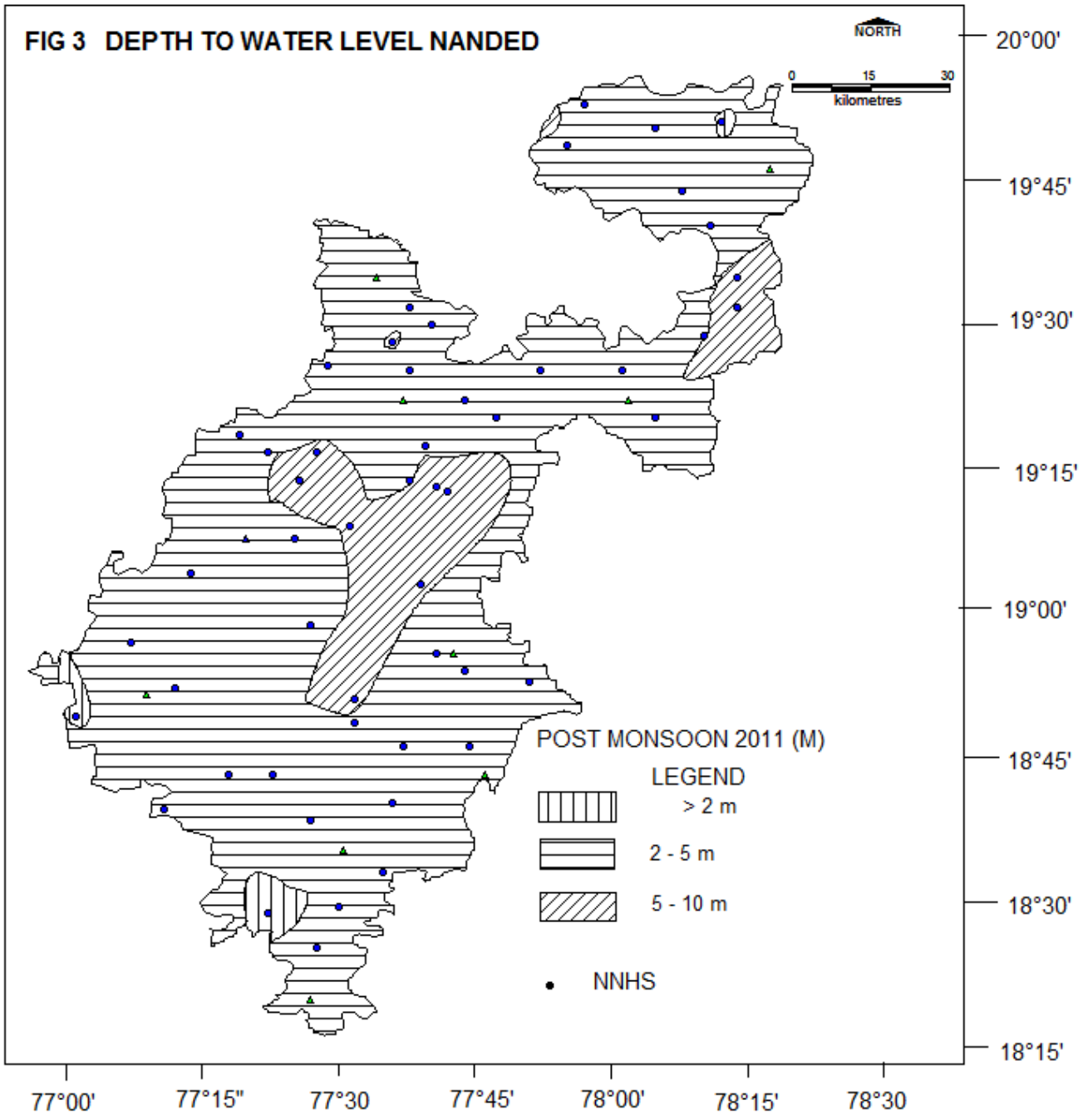

Fig. 4: Depth to water level In Nanded District (Post-monsoon)

4.3 Aquifer Parameters

Ground water abstraction structures commonly observed in the district are mainly of two types i.e. dug well and bore well tapping shallow and deeper aquifer respectively.

Dug wells

Dug wells generally range in depth from 10 m to 15 m and 2 to 5 m in diameter and normally have water column 2 to 7 m. There are 41977 irrigation dug wells in the district out of which 64187 are electric pump and 1675 diesel pumps where as 445 wells are not in use. Most of the irrigated wells have been fitted with pumps of 3 to 5 HP. On average these wells are sustaining pumping for 2 to 4 hour and irrigate 2 to 4 acre land. For full recuperation of water level, these wells take 12 to 24 hours.

The specific capacity of the wells varies from 25.8 to 456.2 lpm/m in basalt and 36 to 669.6 lpm/m in granite gneisses. The transitivity varies from 35 to 114 m^3 /day in basalts and in granites between 24 to 191 m^3 /day . The storativity varies from 0.0013 to 0.008 in basalt and .0005 to 0.0025 in granites.

Bore well

Ground water exploration carried out in the district by Central Ground Water Board to delineate the extent of aquifer their characteristics, quantity and quality of ground water with respect to depth. The discharge of the these ore wells varied from 504 lph to 70776 lph . Out of total 63 bore well , 37 bore wells are high discharge yielding (>3lps discharge) and their discharge ranges from 11250 lph to 70776 lph. Ground Water Survey and Development Agency (GSDA) Govt. of Maharashtra has also drilled 7804 bore wells (Up to March 1997) under the Rural Water Supply Scheme out of which 5993 bore wells are successful and 883 bore wells are high yielding having a discharge more then 5000 lph.

4.4 Ground Water Resources

Central Ground Water Board and Groundwater Survey and Development Agency (GSDA) have jointly estimated the ground water resources of Wardha district based on GEC-97 methodology as on 2009. The same is presented in **Table-3.** As per the estimation the net annual ground water availability is 1386.92 MCM. The gross draft for all uses is estimated at 418.36 MCM with irrigation sector being the major consumer having a draft of 391.81 MCM. The domestic and industrial water requirements for the

year 2025 are worked at 53.10 MCM. The net ground water availability for future irrigation is estimated at 942.01 MCM. Stage of ground water development varies from 18.61% (Kinwat) to 65.72% (Ardhapur). The overall stage of ground water development for the district is 30.16%. In general, the level of ground water development in the district is quite low and all the talukas fall in "Safe" Category. .

Table 3: Taluka wise Ground water Resources (2009)

Sl No.	Administrative Unit	Net Annual Ground Water Availability	Existing Gross Ground Water Draft for irrigation	Existing Gross Ground Water Draft for domestic and industrial water supply	Existing Gross Ground Water Draft for All uses	Provision for domestic and industrial requirement supply to 2025	Net Ground Water Availability for future irrigation development	Stage of Ground Water Development (%)	Category
1	Ardhapur	4510.15	2888.45	75.57	2964.02	149.93	1588.06	65.72	Safe
2	Bhokar	9086.59	2591.58	87.37	2678.95	176.01	6319.04	29.48	Safe
3	Biloli	7501.89	1492.01	108.97	1600.98	242.47	6071.38	21.34	Safe
4	Degloor	7808.42	1590.54	304.39	1894.93	611.51	5608.72	24.27	Safe
5	Dharmabad	3558.03	722.03	52.97	774.99	121.52	2742.75	21.78	Safe
6	Hadgaon	15133.52	5041.52	213.85	5255.38	428.37	9745.05	34.73	Safe
7	Himataytnahar	6412.18	2423.25	66.76	2490.01	151.57	3859.74	38.83	Safe
8	Kandhar	12465.55	2775.85	204.1	2979.95	400.98	9291.29	23.91	Safe
9	Kinwat	18361.97	3146.18	270.16	3416.34	537.83	14682.28	18.61	Safe
10	Loha	12805.36	4472.97	223.95	4696.93	447.64	7909.71	36.68	Safe
11	Mahur	6010	1477.75	125.64	1603.39	235.9	4277.91	26.68	Safe
12	Mudkhed	4518.82	2726.51	66.92	2793.43	131.9	1615.04	61.82	Safe
13	Mukhed	11424.68	2386.93	287.11	2674.04	578.23	8489.29	23.41	Safe
14	Naigaon	7655.55	1570.37	125.88	1696.25	231.82	5588.56	22.16	Safe
15	Nanded	6539.92	2605.81	340.98	2946.79	681.18	3005.53	45.06	Safe
16	Umari	4899.9	1269.63	100.29	1369.91	182.95	3407.02	27.96	Safe
	TOTAL	138692.5	39181.38	2654.91	41836.29	5309.81	94201.37	30.16	Safe

4.5 Ground water Quality

CGWB is monitoring the ground water quality of the Nanded district since the last four decades through its established monitoring wells. The objectives behind the monitoring are to develop an overall picture of the ground water quality of the district. During the year 2011, the Board has carried out the ground water quality monitoring of water samples from 10 monitoring wells. These wells are mainly dug wells representing the shallow aquifer. The sampling of ground water from these wells was carried out in the month of May 2011 (pre-monsoon period). The water samples after collection were immediately subjected to the analysis of various parameters in the Regional Chemical Laboratory of the Board at Nagpur. The parameters analyzed include pH, Electrical Conductivity (EC), Total Alkalinity (TA), Total Hardness (TH), Nitrate (NO_3) and Fluoride (F). The sample collection, preservation, storage, transportation and analysis were carried out as per the standard methods given in the manual of American Public Health Association for the Examination of Water and Wastewater (APHA, 1998). The ground water quality data thus generated was first checked for completeness and then the validation of data was carried out using standard checks. Subsequently, the interpretation of data was carried out to develop the overall picture of ground water quality in the district in the year 2011.

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., TH, NO_3 and F prescribed in the standards and is given in **Table-4**.

Table-4: 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
TH (mg/L)	300	600	1	7	2
NO_3 (mg/L)	45	No relaxation	1	-	9
F (mg/L)	1.0	1.5	8	1	1

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

The perusal of **Table-4** shows that the concentrations of all the parameters except nitrate in most of the samples are the maximum permissible limit of the within BIS standards. It is also seen from the **Table-4** that the potability of ground water in the wells is mainly affected due to the Nitrate (NO_3) as its concentration exceeds more than MPL in 90% of samples. Overall, it can be concluded that the ground water quality in the wells monitored in the district is affected because of high NO_3 concentrations.

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. Electrical Conductivity (EC) and Residual Sodium Carbonate (RSC) are the most important quality criteria, which influence the water quality and its suitability for irrigation.

Electrical Conductivity (EC)

The amount of dissolved ions in the water is best represented by the parameter electrical conductivity. The classification of water for irrigation based on the EC values is as follows.

Low Salinity Water (EC: 100-250 µS/cm): This water can be used for irrigation with most crops on most soils with little likelihood that salinity will develop.

Medium Salinity Water (EC: 250 – 750 µS/cm): This water can be used if moderate amount of leaching occurs. Plants with moderate salt tolerance can be grown in most cases without special practices for salinity control.

High Salinity Water (EC: 750 – 2250 µS/cm): This water cannot be used on soils with restricted drainage. Even with adequate drainage, special management for salinity control may be required and plants with good salt tolerance should be selected.

Very High Salinity Water (EC: >2250 µS/cm): This water is not suitable for irrigation under ordinary condition. The soils must be permeable, drainage must be adequate, irrigation water must be applied in excess to provide considerable leaching and very salt tolerant crops should be selected.

The classification of ground water samples collected from monitoring wells for was carried out irrigation purpose and given below in Table-5.

It is clear from the Table-5 that maximum number of samples (90%) falls under the category of high salinity water while nearly 10% of samples fall in medium salinity water category. This shows that the ground water in the pre-monsoon season from shallow aquifer in the district should be used for irrigation with proper soil and crop management practices.

Table-5: Classification of Ground Water for Irrigation based on EC.

Type	**EC (µS/cm)**	**No. of Samples**	**% of Samples**
Low Salinity Water	<250	Nil	Nil
Medium Salinity Water	250-750	1	10
High Salinity Water	750-2250	9	90
Very High Salinity Water	>2250	-	-
Total		**10**	**100.0**

4.6 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 vary 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.

Dug wells generally range in depth from 10 m to 15 m and 2 to 5 m in diameter and normally have water column 2 to 7 m. There are 41977 irrigation dug wells in the district out of which 64187 are electric pump and 1675 diesel pumps where as 445 wells are not in use. Most of the irrigated wells have been fitted with pumps of 3 to 5 HP. On average these wells are sustaining pumping for 2 to 4 hour and irrigate 2 to 4 acre land. For full recuperation of water level, these wells take 12 to 24 hours.

The specific capacity of the wells varies from 25.8 to 456.2 lpm/m in basalt and 36 to 669.6 lpm/m in granite gneisses. The transitivity varies from 35 to 114 m^3 /day in basalts and in granites between 24 to 191 m^3 /day . The storativity varies from 0.0013 to 0.008 in basalt and .0005 to 0.0025 in granites.

Bore well

Ground water exploration carried out in the district by Central Ground Water Board to delineate the extent of aquifer their characteristics, quantity and quality of ground water with respect to depth. The discharge of the these ore wells varied from 504 lph to 70776 lph . Out of total 63 bore well , 37 bore wells are high discharge yielding (>3lps discharge) and their discharge ranges from 11250 lph to 70776 lph. Ground Water Survey and Development Agency (GSDA) Govt. of Maharashtra has also drilled 7804 bore wells (Up to March 1997) under the Rural Water Supply Scheme out of which 5993 bore wells are successful and 883 bore wells are high yielding having a discharge more then 5000 lph.

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

The ground water development scenario of the district is favorable for further ground water development in the years to come as the stage of ground water development

for the district is merely 30.16% and ground water available for future irrigation development is 942.01 MCM. The development of this resource the irrigation potential manifold and it will be less expensive in time and cost as compared to surface water. However the development is to be carried out in planned manner using suitable ground water structures depending on the terrain, aquifer potential and quality aspects.

5.2 Water Conservation and Artificial Recharge

The rapid and even in some cases , haphazard development, coupled with absence of ground water regularity measures, has resulted in depletion of ground water resources in some part of the district. In such a scenario there is an urgent need to judiciously manage and efficiently regulate this precious resources . Artificial recharge to ground water is one of the best possible options to provide sustainable ground water resources to present and future generations.

Scope of artificial recharge to ground water is ascertained from thickness of unsaturated strata available above the water table in an unconfind aquifer. Depth to water level data is used to calculate the volume of unsaturated strata available above it.

Based on CGWB studies, the criteria for selection of area suitable for artificial recharge are as given below.

- Area showing water level between 3-6 m bgl with declining trend (>0.10m/year).
- Area showing water level between 6-9 m bgl with declining trend (>0.10m/year).
- Area showing water level between 6-9 m bgl with declining trend (<0.10m/year).

The overall ground water development in the district is 30.16%. In Ardhapur taluka, the ground water development has reached up to 65.72% , hence it is necessary to adopt water conservation and artificial technique to augment the ground water resources. A large number of water conservation structures in form of percolation tank, underground bandaras, (UGB) diversion dams, village tanks and KT weirs are recommended to be constructed at suitable sites. Though social forestry and agriculture department, Govt. of

Maharashtra has taken up many schemes with an aim to check monsoon runoff to conserve water and soil in the district.

In basaltic area, the artificial recharge structures feasible are check dams nala bunds etc. The structures like gully plugs contour bunds are most feasible in hilly area. The most feasible artificial recharge structures, suitable for alluvial area restricted along bank of major river and their tributaries, are shallow recharge well on the river bed of the tributaries. Percolation tanks are also suitable wherever source water availability is there. Sites for artificial recharge structure need to be located where the hydrogeological conditions are favorable i.e. where sufficient thickness of desaturated aquifer exits and water level is more then 5 m deep.

6.0 Ground water Related Issues and Problems

In the central and north western part the post monsoon water level ranges between 5-10 m bgl. These are the area where the ground water scarcity is quite common when rain fall is deficient. Hence special attention is required in above mentioned area and immediate steps like ground water augmentation by artificial recharge practice and water conservation should be adopted

The ever increasing demand of for domestic, industrial and irrigation needs have laid stress on ground water resources. The problem arises due to the urbanization and industrial pollution are main problems facing the district. The Central Ground Water Board has undertaken ground water studies in the Nanded–Waghola Municipal Corporation area and Tuppa, MIDC, industrial area Nanded in 2001-02.

Ground water quality in NWMC area is suitable for drinking purpose excluding Asdullabad, New Mondha, Gokulnagar, Nandigram Society, Khandakpura, Madinanagar & Khudbainagar where the Chloride and Nitrate concentration is above the permissible limits.

7.0 MASS AWARENESS AND TRAINING ACTIVITIES

Till 2011, one Mass Awareness Programmes and one Water Management Training Programme have been organized in the district. The details are as below:

A	**Mass Awareness Programme**	:	(2005-06)
	a. Date	:	09.08.2005
	b. Place	:	Biloli
	c. Participants	:	300
B	**Water Management Training Programme**	:	(2005-06)
	Date	:	10.08.2005
	Place	:	Nanded
	Participants	:	45

8.0 AREAS NOTIFIED BY CGWB/SGWA

As per the Ground water Resource Estimation 2008-09, all talukas fall under safe category, hence till March 2011, no area has been notified either by CGWB or SGWA.

9.0 RECOMMENDATION

Based on the hydrogeological studies in the district, the following recommendations are made to achieve the sustainable development in planed and scientific manner

- The overall stage of ground water development for the district is only 30.16, thus a lot of scope for further development exists.
- Most of the part of the district is underlain by Deccan Trap Basalt where dug well are most feasible structure for ground water development. In order to delineate and pinpoint favorable site, micro level survey and along with geophysical survey should be carried out. Wherever possible, borehole should be located in close vicinity of lineament.
- The scope exists for construction of suitable artificial recharge structures in the district. The structures recommended for the hilly-Basaltic area 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.

- Sewage nalas and lagoon should be lined horizontally and vertically to avoid ground water pollution due to seepage of sewerage.
- Suitable measures should be taken up against the industries violating ETP norms. Any laxity on this part may lead to further determination of quality of ground water.
- The Nala carrying the treated effluents from MIDC area to Godavari river should be lined laterally in order to prevent seepage of effluents into the ground water
- Periodic analysis of ground water samples should be carried out to check the suitability of water for drinking and irrigation purpose