CENTRAL GROUND WATER BOARD
MINISTRY OF WATER RESOURCES
GOVERNMENT OF INDIA

GROUND WATER INFORMATION
ADILABALD DISTRICT, ANDHRA PRADESH

SOUTHERN REGION
HYDERABAD
JULY, 2007

CENTRAL GROUND WATER BOARD
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GROUND WATER INFORMATION
ADILABAD DISTRICT, ANDHRA PRADESH

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GROUND WATER INFORMATION
ADILABAD DISTRICT, ANDHRA PRADESH

BY

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GROUND WATER INFORMATION
ADILABAD DISTRICT, ANDHRA PRADESH

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DISTRICT AT A GLANCE

1. GENERAL

Location	North Latitude	18^0 40' 40" and	19^0 56' 00"
	East Longitude	77^0 46' 00' and	80^0 00' 00"

Geographical area (ha)		16,203 sq.km
Headquarters		Adilabad
No. of revenue mandals		52
No. of revenue villages		1748
Population (2001)	Urban	6,56,343
	Rural	18,23,004
Total		24,79,347
Population density (persons/sq.km)		153
Work force		
	Cultivators	3,41,296
	Agricultural labour	3,43,456

Major rivers	Godavari, Pranahita Wardha, Kadam and Pedavagu
Soils	Black and Red loamy soils
Agroclimatic zone	Zone 10 - Northern Telangana Zone

2. RAINFALL

Normal annual rainfall	Total	1153 mm
	Southwest monsoon	1003 mm
	Northeast monsoon	81 mm

Cumulative departure from normal rainfall for the last 5 years	-80%

3. LAND USE (2005-'06) (Area in ha.)

Forest	690000
Barren and uncultivated	44000
Cultivable waste	15000
Current fallows	156000
Net area sown	537000

4. IRRIGATION (2005-'06) (Area in ha.)

Source of irrigation		
	Canals	20000
	Tanks	19000
	Dug wells	18000
	Bore / Tube wells	29000
	Others	2000
Net area irrigated		88000
Gross area irrigated		110000
Major irrigation projects		
	Sriramsagar project	14468
	Kadiam project	27582
Medium irrigation proejcts		
	Vattivagu, Santhala,	28459
	NTR Sagar, Khanpur, Swarna	

5. GEOLOGY

Major rock types	Granites, Gneisses, Basalts, Sandstones Limestones, shales etc.

6. GROUND WATER

Well census (2005-'06)			
	Dug wells		20,038
	Shallow tube / bore wells		15193
	Deep tube / bore wells		68
Exploration by CGWB			
	No. of wells drilled		76
	Major aquifer zones (m)		30 to 70m in hard rocks down to 175 m in soft rocks
	Aquifer parametres		
	Transmissivity (sq.m/day)	Hard rock	1 to 34
		Soft rock	1 to 196
	Storage Co-efficient	Hard rock	7.34 - 53.77
		Soft rock	2.5-50.46
Monitoring			
	No. of observation wells		50
	Dug wells		36
	Piezometers	Manual	3
		Digital	11
	Range of water levels (May 2005)		
	Minimum (m below ground level)		4.3
	Maximum (m bgl)		28.97
	General range (m bgl)		20-May

7. GROUND WATER RESOURCES (MCM)

Net annual ground water availability	1591.9
Net annual draft	525.86
Balance resource	1066.04

Stage of ground water development	33%

8. GROUND WATER DEVELOPMENT CATEGORY

No. of mandals categorised as	
Safe (<70 % of net available resource)	47
Semi Critical (70 - 90 %)	5
Critical (90 - 100 %)	Nil
Over exploited (> 100 %)	Nil
No. of villages notified for restricted development (by State Ground Water Authority)	80

9. CHEMICAL QUALITY

Electrical Conductivity (micro Siemens / cm at 25 deg. C)		545 to 1750
Chloride	(mg/l)	14 to 245
Fluoride	(mg/l)	1.16 to 4.23
Nitrate	(mg/l)	6.6 to 211

GROUND WATER INFORMATION
ADILABAD DISTRICT, ANDHRA PRADESH

1.0 INTRODUCTION

The Adilabad district is the second largest in the Telangana region and fifth largest district in the State with geographical area of 16,203 sq.km. The district is located in the northern most part of the State and forms border with the States of Maharashtra and Chhatisgarh. The district lies in between North Latitudes 18º 40ô& 19º 50ôand East longitudes 77º 46ôand 80º 00ô (**Fig.1**)

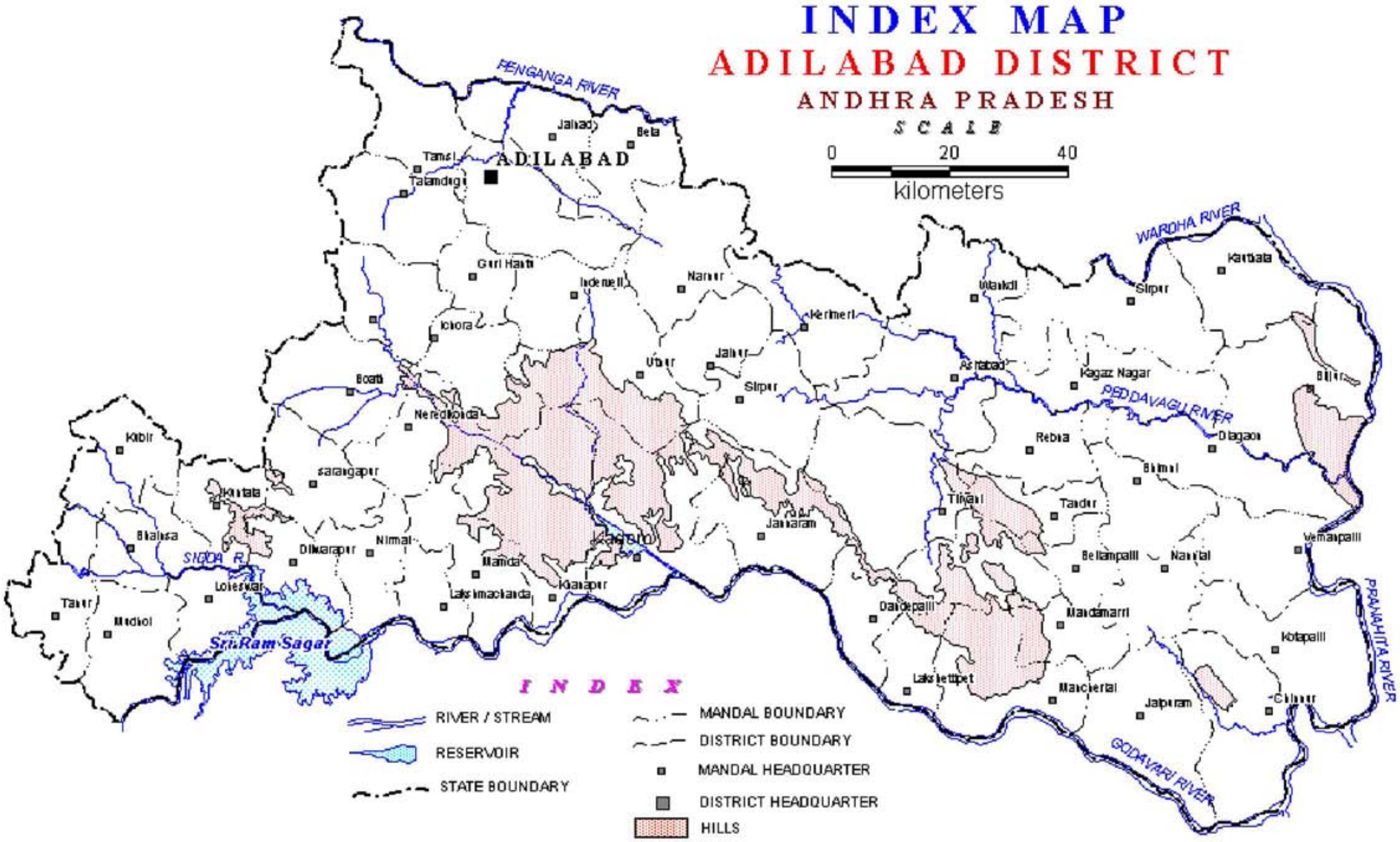
Most of the population of the district live in rural areas whose mainstay is Agriculture. It is the least literate district in the State. As per 2001 census, the district has a population of 24,79,347 with decadal growth rate of 19.06% (1991-2001). The density of population is 153 per sq.km.

1.1 Farmers' Distress Situation:

Failure of monsoon specially during the years 1999-2004 in the district led to failure/low yields of crops especially of rainfed crops mostly cotton. Inferior quality of the produce due to spurious seeds and sub standard pesticides lead to denial of minimum supporting prices in the market. Increase in input cost, small land holdings (mostly taken on lease basis), failure of bore wells in some areas, lack of awareness landed the farmers in huge debts causing much distress specially among small farmers, ultimately leading to suicides mostly of cotton growing farmers in the district.

Since 1998 onwards there are number of reported cases of farmers distress suicides. So far, 284 cases have been identified as genuine cases (of farmers suicides) in 30 mandals out of 52 mandals or the district

Fig.-1


INDEX MAP
ADILABAD DISTRICT
ANDHRA PRADESH
SCALE
0
20
40
kilometers
PENGANGA RIVER
WARDHA RIVER
PEDDAVAGU RIVER
PRANAHITA RIVER
GODAVARI RIVER
SIDDA R.
Sri Ram Sagar
ADILABAD
Jainad
Bela
Gudi Hatnur
Indervelli
Narnur
Kerimeri
Wankdi
Sirpur
Kagaz Nagar
Asifabad
Utnoor
Jainur
Boath
Neredigonda
Sarangapur
Nirmal
Dilawarpur
Khanapur
Laxmanchanda
Lokeswaram
Mudhol
Tanur
Bhainsa
Kubir
Kuntala
Jannaram
Dandepalli
Tiryani
Tandur
Rebba
Bhimini
Dahegaon
Bellampalli
Nennal
Vemanpalli
Mandamarri
Mancherial
Luxettipet
Jaipuram
Kotapalli
Chinnur
INDEX
RIVER / STREAM
RESERVOIR
STATE BOUNDARY
MANDAL BOUNDARY
DISTRICT BOUNDARY
MANDAL HEADQUARTER
DISTRICT HEADQUARTER
HILLS

respective of whether the mandal is falling in command or non-command, whether low or high ground water development. 10 to 25% farmers suicidesôare reported due to failure of bore wells in the District. Mandal-wise Farmers Suicidal deaths since May,2004 (Post-cases) are presented in **Table –1**.

Table 1: MANDALS HAVING FARMERS DISTRESS

Sl. No.	**Name of the Mandal**	**No.of suicides** (since 2004)
1	Kotapally	6
2	Mamda	3
3	Lokeswaram	5
4	Kadam	8
5	Utnoor	1
6	Dilwarpur	6
7	Nirmal	2
8	Mancherial	2
9	Khanapur	5
10	Boath	3
11	Laxmanchanda	4
12	Mudhole	6
13	Kuntala	4
14	Bazarhatnoor	2
15	Chennur	8
16	Nennel	2
17	Kubeer	6
18	Luxettipet	2
19	Jaipur	2
20	Talamadugu	4
21	Sarangpur	7
22	Kautala	2
23	Jainath	2
24	Dandepally	1
25	Bhainsa	2
26	Tamsi	2
27	Bhimni	1
28	Indervelly	1
29	Ichoda	1
	Total no.of suicides	100

1.2 Drainage:

The main rivers that drain the district are the Godavari, Pranhita, Wardha, Kadam and Peddavagu. Godavari river forms southern boundary of the district. The river Pranahita in the east flows in southernly direction forming the eastern boundary of the district and joined the river Godavari near south east corner of the district. The Penganga flows along north western and northern boundary of the district. The river Wardha flowing north-north east of the border of the district joins the Pranhita river east of Veeradandi. The Kadem and Peddavegi flowing in southern part of the district and tributaries of Godavari. Besides these there are riverlets like the Santala the Swarnavagu and the Suddervagu, which drain the district

1.3 Land Use

The land use particulars of the district for the year 2005 ï 06 are shown in Table 2.

Table 2: Land Use Pattern (2005-'06)

Sl.No.	Category	Area in '000' Ha	% to the total geographical area
1	Forest	690	42.59
2	Barren & un-utilisable lands	44	2.72
3	Land put to non-agriculture use	61	3.76
4	Cultivable Waste	15	0.92
5	Permanent pastures and other grazing lands	14	0.86
6	Land under miscellaneous, tree, crops and grooves not included in net sown area	8	0.49
7	Other fallow lands	95	5.86
8	Current fallow lands	156	9.63
9	Total cropped area	565	34.88

1.4 Irrigation

Irrigation is mainly through surface and ground water. About 47 percentage of the net area was irrigated under surface water and 53% of area under ground water during the year 2005-2006.

The details of the source ï wise irrigation pattern is presented in Table ï 3.

Table – 3: Area Irrigated by different sources (2005 – '06)

Sl.No.	Source	Gross Area in '000' Ha	% to total gross area	Net Area	% to total net area
1.	Canals	21	19	20	22.73
2.	Tanks	20	18.18	19	21.5
3.	Tube Wells & Filter Points	43	39.09	29	32.95
4.	Other Wells	22	20	18	20.45
5.	Other Sources	4	3.64	2	2.27
6.	Surface Water	45	41	41	46.6
7.	Ground Water	65	59	59	53.4
8.	Area Irrigated	110		88	

i) Surface Water: The district is served by two major irrigation projects namely Sriramsagar project (left canal ï Saraswathi canal) with ayacut of 14468 hectares and Kadiam project with an ayacut of 27582 hectares. There are five medium irrigation projects namely Vattivagu, Santhala, NTR Nagar, Khanpur channel and Swarna with an ayacut of 28459 hectares. In addition to these, there are several minor irrigation projects. The total net area irrigated under surface water during the year 2005-2006 ins 41000 hectares, which includes 20,000 hectares under major and medium projects and 21000 hectares under minor projects.

ii) Ground Water: Dug wells, bore wells, tube wells and filter point wells constitute sources of ground water under ground water, net area of 47000 hectares is irrigated in the year 2005-2006.

For the year 2005-06, the net area irrigated is about 16 percent of net area sown.

Under rainfed crops, cotton, jowar, soya bean, green gram, maize etc. are grown. Under surface water mostly paddy is grown and under ground water turmeric, chillies, groundnut, paddy etc. are raised in the district, presently. The total cropped area is 565000 hectares during 2005-06, 302000 hectares under food crops and 26300 hectares under Non-food crops.

1.5 Studies/Activities carried out by CGWB

The Central Ground Water Board (CGWB), initiated systematic hydrogeological surveys way back in 1961-62 in the district. The entire district was covered by the surveys by the end of March, 1987.

The C.G.W.B, being an Apex organisation in the ground water investigations, exploration and assessment in the country, took up a programme under ôDeposit wellô scheme to construct 10 tube wells for Irrigation Rehabilitation project covering an area of 33 sq.km in erstwhile Sirpur Taluk. Exploratory drilling was carried out at 5 sites in limestone areas of Adilabad Taluk and 7 bore wells were also constructed for water supply to Cement Corporation of India.

The Board also provided priority for ground water exploration in the tribal areas of the district. Exploratory drilling was taken up in sedimentary rock areas of the district during 1975-76, drilled 9 exploratory wells and 2 observation wells.

During 1987-90, the Board also carried out ground water exploration in hard rock areas covering an area of 2500 sq.km. In all, 22 exploratory wells, 15 observation wells were drilled. During 1990-94, ground water exploration was carried out in the district and in all, 12 exploratory wells and 9 observation wells were drilled. A network of dug wells and bore wells is maintained to monitor ground water regime in the district. The network includes 36 dug well and 14 purpose built piezometers (bore wells).

2.0 RAINFALL

The annual normal rainfall of the district is 1153 mm, which ranges from 995 mm at Tiryani mandal to 1348 mm at Indervally mandals. The annual rainfall data of 49 mandals for the period 2000-2005, along with its departure from normal rainfall is given in Table-4. The table indicates that the district mean rainfall has been below normal by 1%, 10%, 24%, 5% and 40% in 2000, 2001, 2002, 2003 and 2004, respectively. The district mean rainfall for the period 1996-2005 is plotted along with departure from normal and depicted in Fig.2. It was below normal during the period 1996-2005. The year 2004 has received least amount of rainfall, which is 40% below normal. The year 2000 received highest rainfall during the period, which is 1% below normal.

The cumulative departure of annual rainfall from normal indicates the extent of drought at a place. In the district, the cumulative departure of annual rainfall was scanty i.e., more than 60% below normal, in 30 mandals and deficit i.e., below normal by 20% to 59% in 17 mandals. In the remaining 2 mandals, the rainfall was above normal. On an average, the district rainfall condition was below normal by 80%. The cumulative

effect of rainfall by May, 2005 was scanty. The average rainfall condition of the district is scanty.

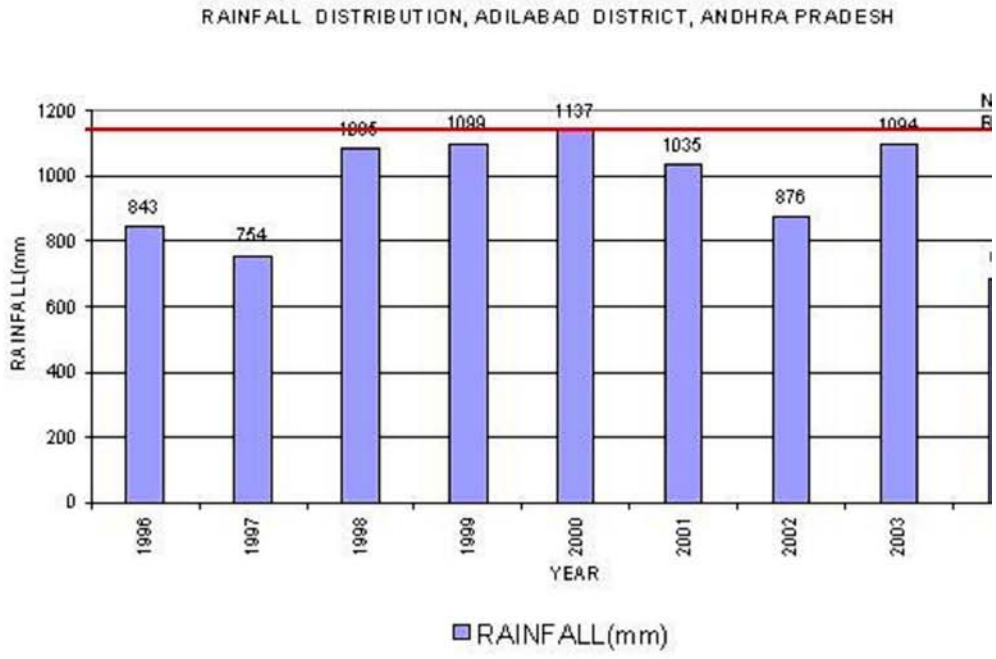
Table-4

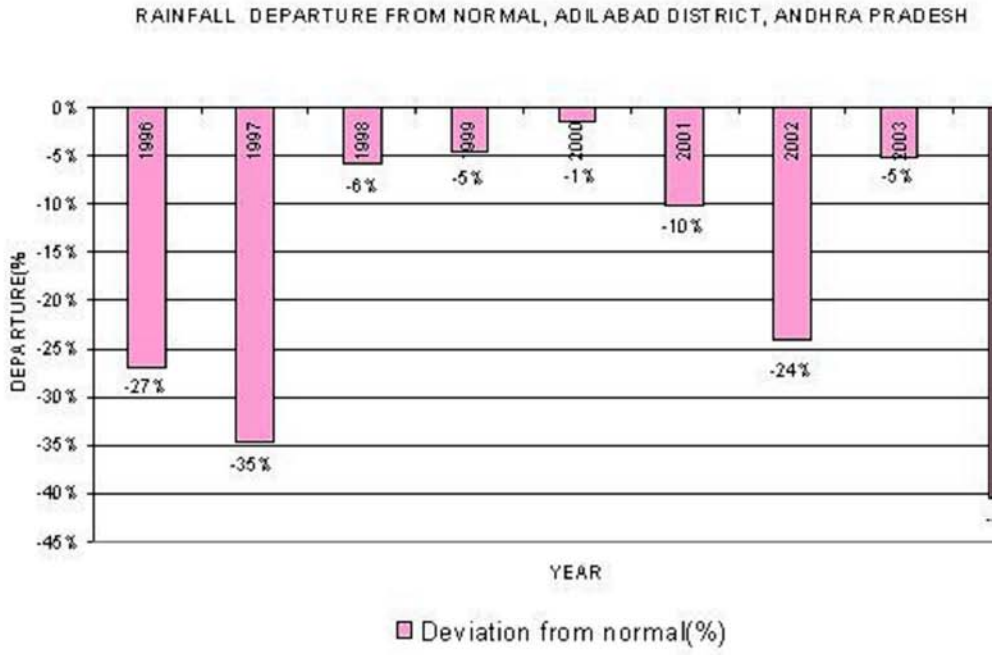
MANDAL-WISE ANNUAL RAINFALL AND ITS DEPARTURE FROM NORMAL
ADILABAD DISTRICT

SL.NO	MANDAL	(Rainfall in mm)						Departure from Normal						
		Normal	2000	2001	2002	2003	2004	2000	2001	2002	2003	2004	CUMMULATIVE DEPARTURE	REMARK
1	Adilabad	1207	963	1051	1159	967	781	-20%	-13%	-3%	-20%	-35%	-91%	Scanty
2	Aaifabad	1134	1280	1266	812	982	995	13%	12%	-28%	-13%	-15%	-32%	Deficit
3	Bazarhatnoor	1134	964	1146	1079	1400	625	-15%	1%	-5%	23%	-45%	-40%	Deficit
4	Bejjur	1296	1340	1593	824	1418	820	6%	26%	-36%	12%	-36%	-26%	Deficit
5	Bela	1219	1536	1363	1252	1441	717	26%	13%	3%	18%	-41%	19%	Scanty
6	Bellampally	1009	1396	863	803	1250	632	35%	-14%	-20%	24%	-37%	-13%	Normal
7	Bhainsa	1035	1112	1085	920	957	848	7%	5%	-11%	-8%	-18%	-25%	Deficit
8	Bheemmi	1250	1264	552	780	1205	589	1%	-56%	-38%	-4%	-53%	-149%	Scanty
9	Boath	1167	989	1052	1061	1390	676	-15%	-10%	-9%	19%	-42%	-57%	Deficit
10	Chennur	1162	1255	785	887	1156	455	8%	-32%	-24%	0%	-60%	-108%	Scanty
11	Dandepally	1076				1115	673				4%	-37%	-34%	Deficit
12	Dahelgaon	1242	1149	1242	675	1020	912	-8%	0%	-46%	-18%	-27%	-98%	Scanty
13	Dilwarpur	1123	898	1179	940	898	820	-20%	5%	-16%	-20%	-27%	-78%	Scanty
14	Gudihatnoor	1102	1041	922	968	1528	817	-5%	-16%	-12%	39%	-26%	-21%	Deficit
15	Ichoda	1174	1116	1241	1097	1429	595	-5%	6%	-7%	22%	-49%	-33%	Deficit
16	Indervally	1348	1317	1080	1259	1720	1030	-2%	-20%	-7%	28%	-24%	-25%	Deficit
17	Jainad	1218	1037	1123	1314	1072	701	-15%	-8%	8%	-12%	-42%	-69%	Scanty
18	Jainoor	1343	1268	1019	929	921	654	-4%	-24%	-31%	-31%	-51%	-141%	Scanty
19	Jaipur	1266	893	719	858	1116	456	-29%	-43%	-32%	-12%	-64%	-181%	Scanty
20	Jannaram	1267	1255	1014	818	1171	801	-1%	-20%	-35%	-8%	-37%	-101%	Scanty
21	Kaddam	1189	1071	1017	891	1302	734	-10%	-14%	-25%	9%	-38%	-78%	Scanty
22	Kagaznagar	1156	1314	1147	739	953	914	13%	-1%	-36%	-18%	-21%	-63%	Scanty
23	Kasipet	1096	1482	966	829	1128	808	35%	-12%	-25%	2%	-27%	-26%	Deficit
24	Keramari	1036	1172	933	632	959	664	13%	-10%	-39%	-7%	-36%	-79%	Scanty
25	Kotapally	1107	1266	868	736	1016	322	14%	-22%	-34%	-8%	-71%	-120%	Scanty
26	Konthala	1168	1185	1384	1026	935	902	0%	17%	-14%	-21%	-24%	-43%	Deficit
27	Kubeer	1063	795	896	756	889	593	-27%	-17%	-29%	-18%	-45%	-136%	Scanty
28	Kuntala	1172	725	922	642	927	644	-38%	-21%	-45%	-21%	-45%	-171%	Scanty
29	Lokeswaram	1063	618	951	514	781	496	-42%	-11%	-52%	-27%	-53%	-184%	Scanty
30	Luxettipet	1093	1034	775	605	956	725	-5%	-29%	-45%	-13%	-34%	-125%	Scanty
31	Malinda	1083	943	887	748	893	335	-13%	-18%	-31%	-18%	-69%	-148%	Scanty
32	Mancherial	1117	1185	955	958	1158	717	6%	-14%	-14%	4%	-36%	-55%	Deficit
33	Mandamarri	1031	1582	882	739	1079	725	53%	-14%	-28%	5%	-30%	-14%	Normal
34	Narnoor	1295	1217	1053	925	1109	623	-6%	-19%	-29%	-14%	-52%	-119%	Scanty
35	Nennel	1141	1527	795	648	819	464	34%	-30%	-43%	-28%	-59%	-127%	Scanty
36	Neradigonda	1142	1007	1148	1084	1083	587	-12%	1%	-5%	-5%	-49%	-70%	Scanty
37	Nirmal	1162	1093	1209	884	896	821	-6%	2%	-25%	-24%	-31%	-85%	Scanty
38	Reddena	1074	1341	1148	662	1097	618	25%	7%	-38%	2%	-43%	-47%	Deficit
39	Sarangpur	1150	805	1011	938	1056	739	-30%	-12%	-18%	-8%	-36%	-104%	Scanty
40	Sirpur(T)	1150	1219	1169	736	958	907	6%	2%	-36%	-16%	-21%	-65%	Scanty
41	Sirpur(U)	1284	1417	1241	1036	917	864	10%	-3%	-19%	-29%	-48%	-89%	Scanty
42	Tallamadugu	1147	1030	1033	1174	1128	649	-10%	-10%	2%	-2%	-43%	-63%	Scanty
43	Tamsi	1080	909	964	1174	1128	649	-16%	-11%	9%	4%	-40%	-54%	Deficit
44	Tandur	1057	1318	949	775	1228	592	25%	-10%	-27%	16%	-44%	-40%	Deficit
45	Tanur	1026	790	951	585	804	743	-23%	-7%	-33%	-22%	-28%	-113%	Scanty
46	Tiryani	995	1136	821	686	1112	676	14%	-17%	-31%	12%	-32%	-55%	Deficit
47	Utnoor	1304	1327	1123	1065	1294	853	2%	-14%	-18%	-1%	-35%	-63%	Scanty
48	Vemahally	1173	1266	1094	500	617	216	8%	-7%	-57%	-47%	-82%	-185%	Scanty
49	Wankidi	1150	1139	1334	917	1295	695	-1%	16%	-20%	10%	-40%	-35%	Deficit
	MEAN	1153	1145	1040	879	1095	687	-1%	-10%	-24%	-5%	-40%	-80%	Scanty

Source: Department of Economics and Statistics, Andhra Pradesh

FIG 2.


RAINFALL DISTRIBUTION, ADILABAD DISTRICT, ANDHRA PRADESH
RAINFALL(mm
1200
1000
800
600
400
200
0
843
754
1086
1099
1137
1035
876
1094
1996
1997
1998
1999
2000
2001
2002
2003
YEAR
RAINFALL(mm)


RAINFALL DEPARTURE FROM NORMAL, ADILABAD DISTRICT, ANDHRA PRADESH
DEPARTURE(%
0%
-5%
-10%
-15%
-20%
-25%
-30%
-35%
-40%
-45%
1996
1997
1998
1999
2000
2001
2002
2003
-27%
-35%
-6%
-5%
-1%
-10%
-24%
-5%
YEAR
Deviation from normal(%)

3.0 GROUND WATER SCENARIO

3.1. HYDROGEOLOGY

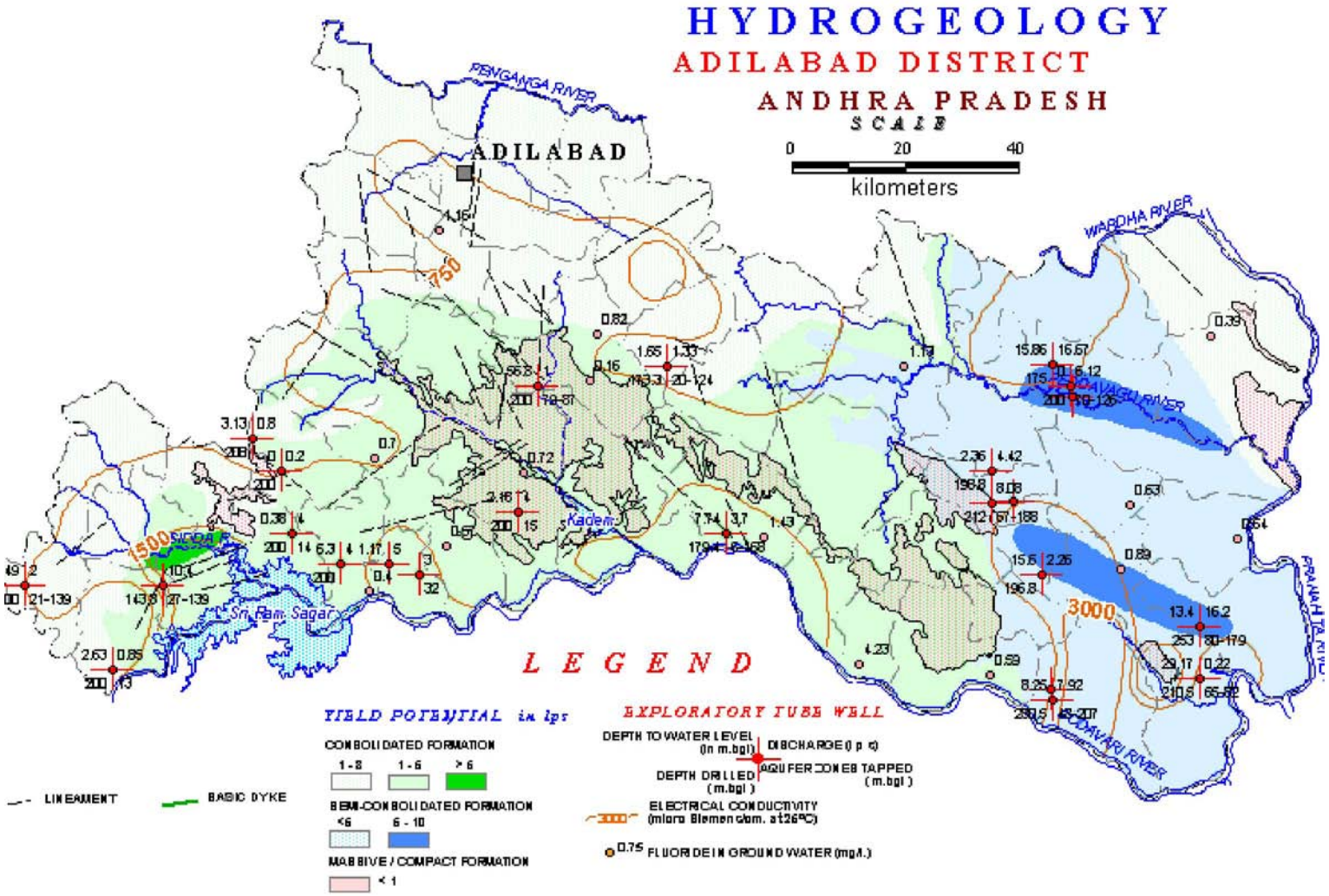
The main factors that play a vital role in the occurrence and movement of ground water are climate, distribution & intensity of rainfall, topography, geological setting, nature and thickness of weathered mantle, geometry of work planes like joints, fractures, fissures, bedding planes, etc., recharge conditions, transmissivity nature & storage conditions of the aquifers, etc. In the district, ground water occurs in almost all the geological formations and the potential zones depend upon the controlling factors specified above.

More than fifty percent of the district is underlain by hard rocks and the rest by the semi-consolidated sedimentary rocks and unconsolidated alluvial deposits. The conditions of occurrence and behaviour of ground water, formation-wise, in the district are discussed in the following paragraphs. The hydrogeological conditions with yield prospects in the district are presented in **Fig.3.**

3.1.1 Consolidated rocks: Granites, gneisses, schists, limestones, dolerites, basalts etc. form the group of consolidated rocks. This group of rocks occupy the entire eastern and central part of the district. Granites, gneisses and schists occur in the areas of Nirmal, Khanapur, Utnoor and Luxettipet. Compact Limestone and Sandstones occur in the areas north of Adilabad and Asifabad. Basaltic rocks (Deccan Traps) occur in the western and central part of he district near Mudhole, Boath, Ichora and north of Utnoor.

3.1.1.1 Granites and Gneisses: Ground water in these rocks occurs in the secondary porosities (except Basalts and Inter-Trappeans) developed due to weathering process and tectonic.

Fig.-3


HYDROGEOLOGY
ADILABAD DISTRICT
ANDHRA PRADESH
SCALE
0 20 40
kilometers
ADILABAD
PENGANGA RIVER
WARDHA RIVER
PRANHITA RIVER
GODAVARI RIVER
Kadem
Sri Ram Sagar
750
1500
3000
LEGEND
YIELD POTENTIAL in lps
CONSOLIDATED FORMATION
1 - 2
1 - 5
> 5
SEMI-CONSOLIDATED FORMATION
<5
5 - 10
MASSIVE / COMPACT FORMATION
< 1
LINEAMENT
BASIC DYKE
EXPLORATORY TUBE WELL
DEPTH TO WATER LEVEL (in m.bgl)
DISCHARGE (lps)
DEPTH DRILLED (m.bgl)
AQUIFER ZONES TAPPED (m.bgl)
ELECTRICAL CONDUCTIVITY (micro Siemens/cm. at 25°C)
0.75 FLUORIDE IN GROUND WATER (mg/l.)

activities. Consequently, the occurrence and prospects for development of ground water in these rocks is highly variable and limited. Ground water occurs under unconfined conditions in the shallow weathered mantle and semi-confined conditions in the fractured and fissured zones.

The depth of weathering ranges between 6 and 15 m below ground level (mbgl) and the depth of fracturing is extended down to depths varying in general, from 30 to 60 m and sometimes even down to 150 m and beyond as observed in the exploratory boreholes drilled at Khanapur (168-169 m) and Utnoor (125-126 m). Ground water is generally tapped from shallow weathered zone through large diameter dug wells in the district. The occurrence of fractures at deeper levels offers scope for development of ground water locally by dug-cum bore wells and bore wells. The depths of open wells in the granites generally range between 4 and 16 m bgl with depth to water level varying from 2 to 5 mbgl. The yields of open wells in the consolidated rocks vary from 40 to 277 cu.m/day.

3.1.1.2 Schists

Presence of foliation planes, fractures and fissures form potential aquifers in the schistose rocks of Dharwars. The total depth of open wells between 3 and 27 m bgl in schistose rocks the fractures are observed to extent down to depths of 60 to 70 m bgl. The occurrence of fractures at deeper levels below weathered zone enhances the chances of development of ground water by dug-cum-bore wells. The yields of the dug wells usually vary from 10 to 30 cu.m/day.

3.1.1.3 Compact Sandstone and Limestones

The sandstones and limestones of Penganga and Sulliavais, though belong to sedimentary origin, are mostly hard and compact due to which the rocks behave similar to consolidated crystalline rocks. However, aquifers are formed due to weathering and fracturing. The group of rocks also comprise shales. The limestones form good aquifers due to the development of solution channels except in areas where they are siliceous. Though the shales are splintery in nature, having fractures and well developed joints favouring the movement of ground water, wells penetrating them usually get dried up in summer. Average yields of the dug wells vary between 30 to 60 cu.m/day in these formations. The ground water exploration carried out by the Ground Water Department of Government of Andhra Pradesh down to a depth of 80 m indicated that the discharge vary from 70 to 180 liters per minute (lpm), specific capacity from 6.4 to 12 lpm/m of drawdown and the transmissivity from 1.2 to 34 cu.m/day.

3.1.1.4 Deccan Traps (Basalts)

The Basaltic rocks, occurring in the western and central part of the district, form the fringe of the vast Deccan Plateau of Central India. Successive lava flows resulted in a layered crystalline rock with intervening beds of clay, ash, etc. The contact zones of successive flows and between basalt and inter-trappean beds form good aquifers in addition to the top weathered zones and fractured zones. The vesicles present in the top portion of the each lava flows also form potential zone for ground water. This unique set-up in the basaltic rocks presents a multi-aquifer system. Sometimes, this multi-aquifer system with wide variation in its compaction poses problems for

constructing production wells. Under ground water exploration programme of CGWB, these multi-stage aquifers were explored in backward and tribal areas during the years from 1987 to 1997.

The depth of open wells ranges between 9 and 26 meters bgl. In general in massive basalts, depth of open wells varies between 4.2 and 6 meters bgl whereas in vesicular basalt the depth of wells ranges between 9 and 11 meters bgl.

3.1.2 Semi-consolidated formations

The Gondwana Formations comprising sandstones, shales, limestones, etc. form a thick sequence of sediments. They are generally the bedded deposits with well-defined lithological units and are affected by structural disturbances and may show vertical and lateral variations in lithology within short distances due to which the hydorgeological properties of the formations vary widely. The sanstones become friable and loose due to weathering. The ferruginous kankary material of 1 to 3 m thickness formed on the surface due to weathering augments the infiltration and saturates the underlying sandstones. They are generally medium to coarse grained and form good aquifers except where they occur as the intercalations and argillaceous in nature.

The depth of wells in the sandstones varies between 6 and 12.5 meters. In the limestone and shales, the depth of wells varies between 9.15 and 16.75 m. The shales, due to fracturing and well developed joints, offer good scope for percolation but due to rapid variations in structure, they fail to form good aquifers. The development of solution channels and sub-terrain cavern in the silicious limestones is insignificant and hence is of no importance the ground water point of view. But when they occur

alternately with shales, the contact between the formations forms good conduit for ground water movement. Dug wells tapping these formations are reported to yield from 30 to 100 cu.m/day.

3.1.3 Unconsolidated formations

In this group of formations, ground water occurs in the primary pores of the formations. Because of high percentage of primary porosity and pore-connectivity, these formations form very good aquifers. Laterite is formed, as a product of weathering and leaching process, over the basaltic rocks. Though the thickness of formation is limited, it forms potential aquifer system wherever favourable conditions exist. The average yields of dug wells in laterites generally range between 18 and 180 cu.m/day.

The loose and unconsolidated formation of alluvium comprises mainly gravel, sand and silt. It occurs along the river courses as result of deposition of weathered material from catchment areas. Ground water occurs under phreatic and confined conditions in the formations. Ground water in this formation is generally developed through small diameter dug wells, filter point wells and tube wells. Wells tapping these alluvial aquifers are reported to yield around 40 cu.m/hour on an average. Dug wells constructed in this formation yield from 36 to 60 cu.m/hour and can sustain 8 to 10 hours of pumping in a day.

3.2 Depth to Water level

Ground water levels are monitored by C.G.W.B from a network of observation wells four times in a year viz., in the months of January, May, August and November.

3.2.1 Pre-monsoon

During the pre-monsoon period, in the month of May, 2005, depth to water levels varied between 4.30 and 29 meters with a general depth to Water level of 5-20 meters. A majority of the observation wells (68%) registered water levels in the range of 5-10 meters and 22% wells registered water levels in the range of 10-20 m. The deeper water levels of more than 20 m are observed in an isolated area in mid portion. Distribution pattern of the water level is presented in Fig.-4.

3.2.2 Post-monsoon

During post monsoon period of the year 2005 viz., during the month of November, the depth to water level varied between G.L and 11.65 m. with general range of 2-5 meters 60% of observation wells registered water levels in the range of 2-5 meters, 20% wells in the range of 0-2 m, 16% wells recorded water levels in the range of 5-10 m and only 4% wells recorded water levels beyond 20 m. In the command areas, water levels mostly range from <2 to 5 m. During post-monsoon, depth to water level of 10-20 m is observed in an isolated area on northern side of mid portion of the district in Non-command area. Distribution pattern of the water level is presented in **Fig.-5.**

Fig.-4

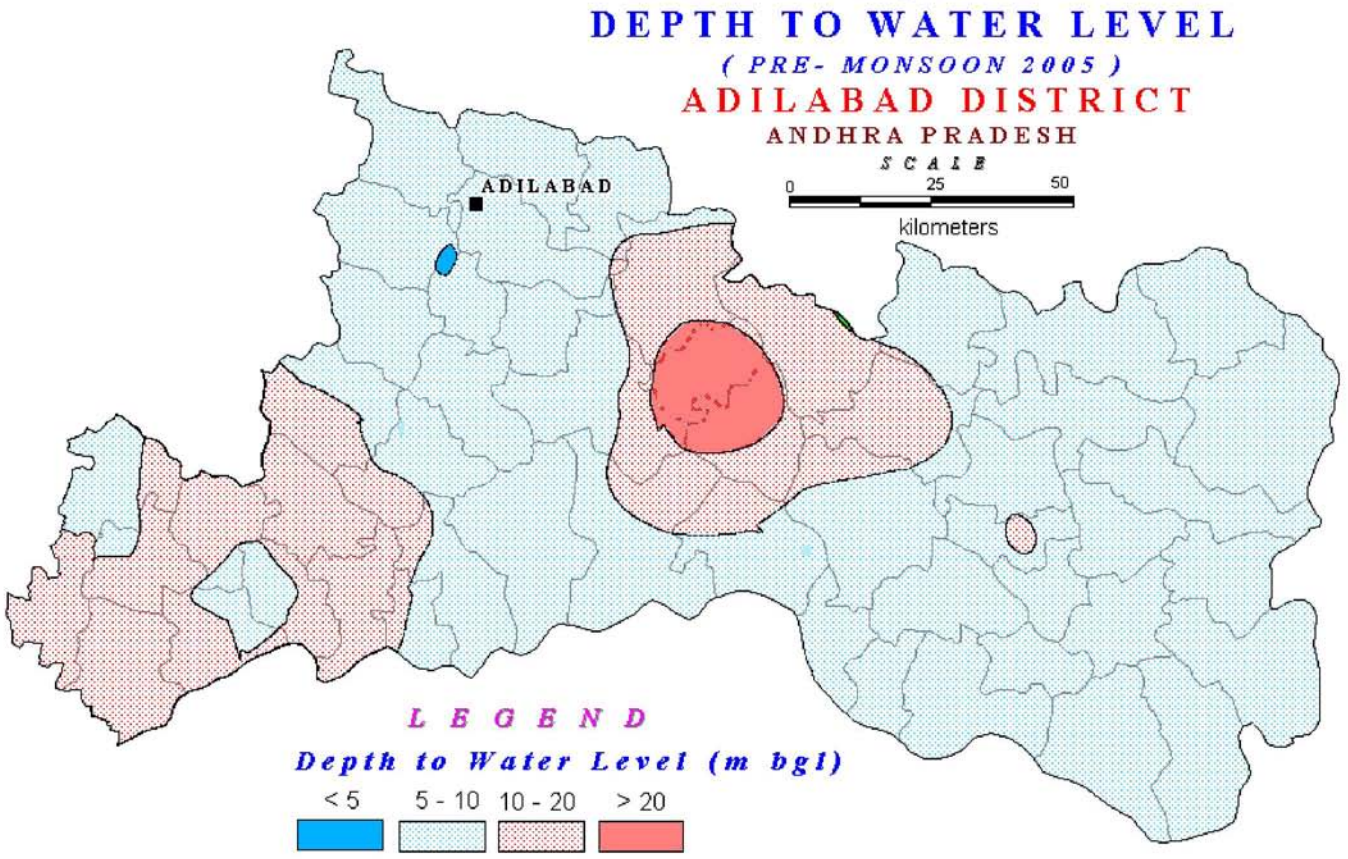

DEPTH TO WATER LEVEL
(PRE- MONSOON 2005)
ADILABAD DISTRICT
ANDHRA PRADESH
SCALE
0
25
50
kilometers
ADILABAD
LEGEND
Depth to Water Level (m bgl)
< 5
5 - 10
10 - 20
> 20

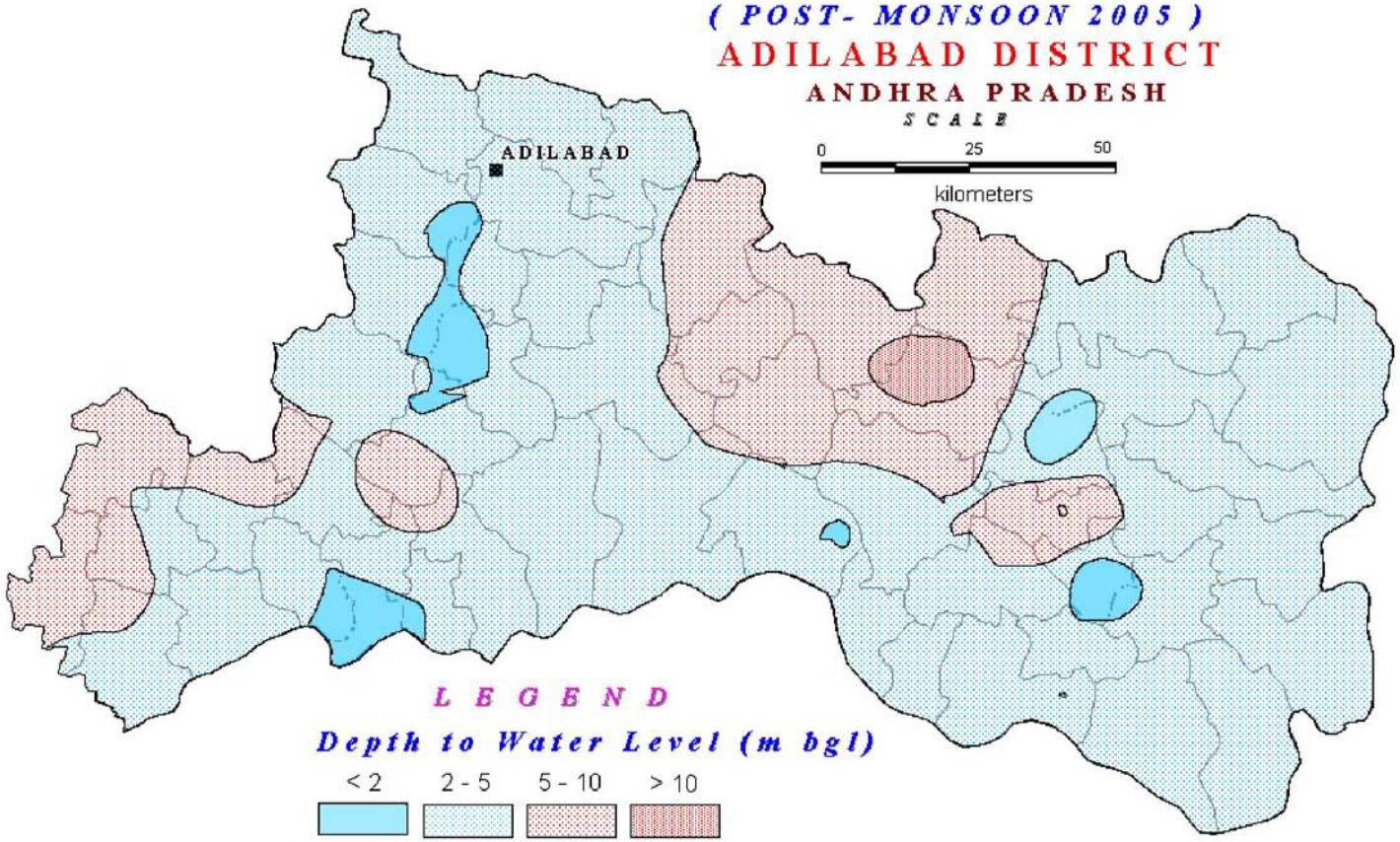
Fig.-5

DEPTH TO WATER LEVEL

(POST- MONSOON 2005)

ADILABAD DISTRICT

ANDHRA PRADESH



3.2.3 Water level fluctuation:

The rise in water levels between pre-monsoon and post-monsoon ranges between 0.05 and 20.72 m. The rise in water levels is mostly between 2 to 10 m. Fall in water levels of less than 2 m is observed in isolated area on the northern side of the district in Non-command area bordering Chanda district of Maharashtra State. Distribution pattern of the water level is presented in **Fig.-6**.

3.2.4 Long term water levels:

An analysis of observation wells data of Central Ground Water Board for pre monsoon period shows decline in water levels, in 68% wells, while 32% wells show rise in water levels during the last decade (1996-2005) based on water level trend (Fig. 7). The decline in water levels varies between 0.05 and 15.78 m. A majority area of the district shows water level decline of less than 2 m, water level decline of 2-4 metes is restricted to south western portion of the district while fall of more than 4 m is of sporadic occurrence. Rise in water levels is observed mostly in North eastern portion of the district.

Post monsoon water level (November) analysis for the period from 1996-2005 (last decade) shows that there is a decline in 72% observation wells, based on water level trend for the last decade (1996-2005) and only 28% wells show rise in water levels.

Fig.-6

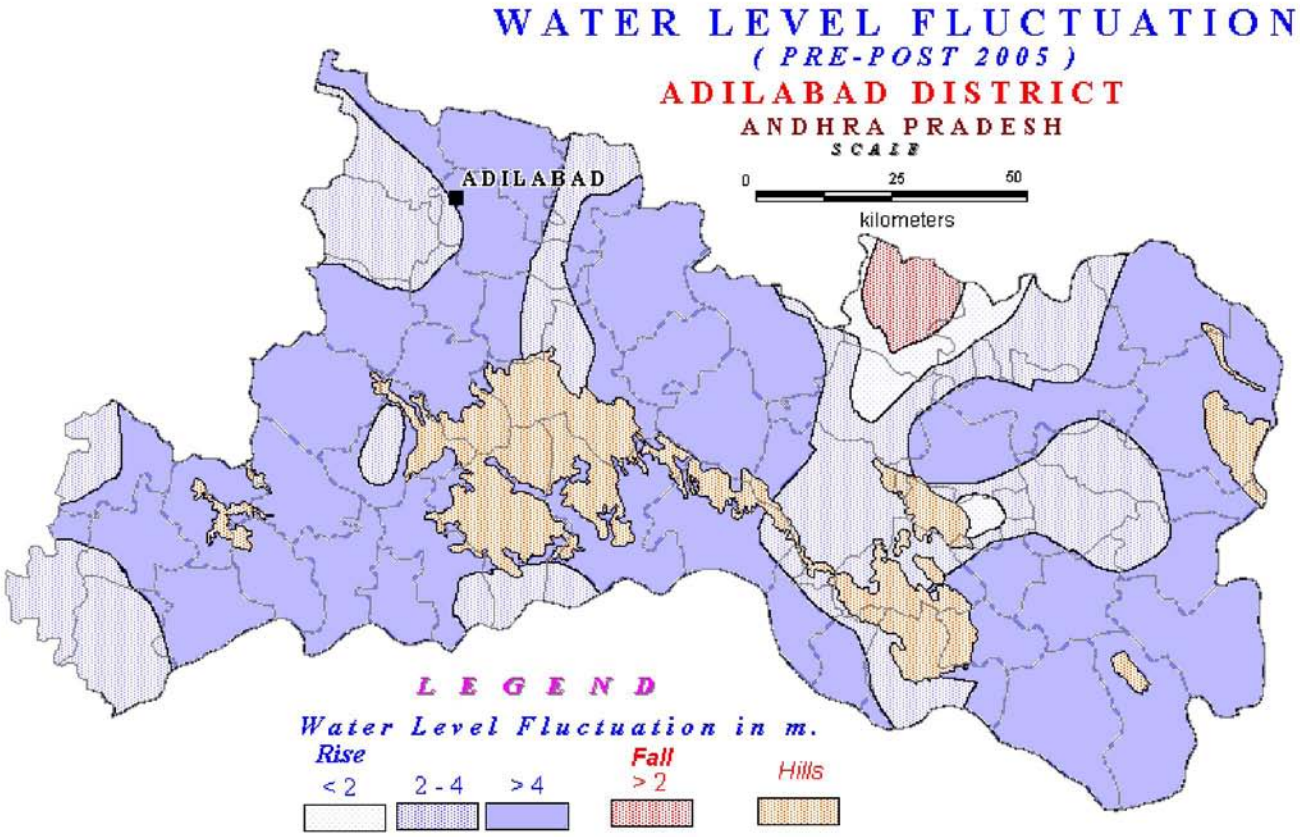
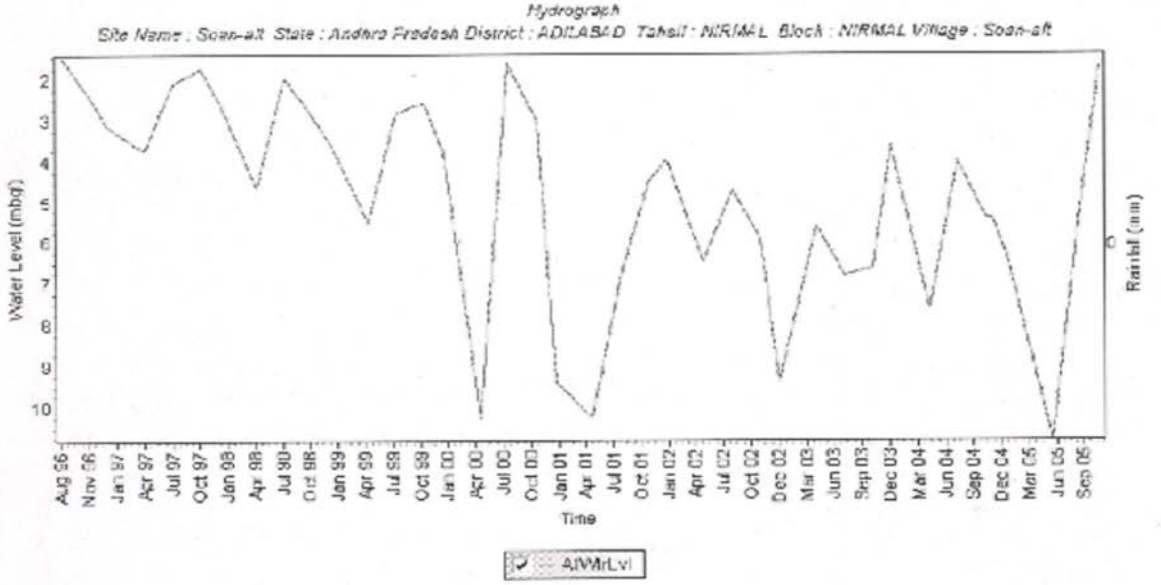
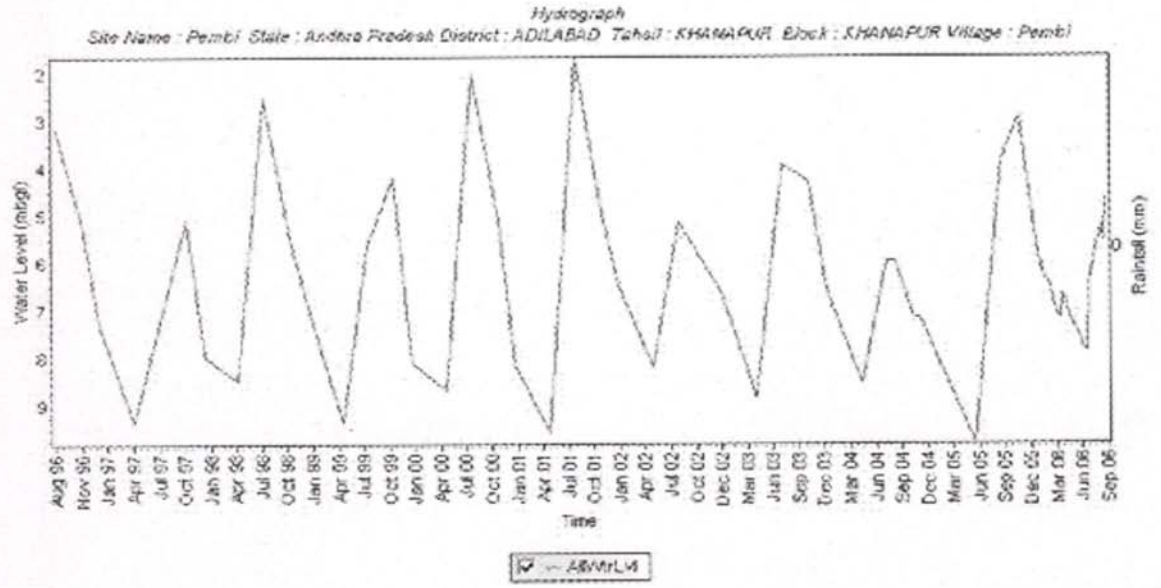

WATER LEVEL FLUCTUATION
(PRE-POST 2005)
ADILABAD DISTRICT
ANDHRA PRADESH
SCALE
0
25
50
kilometers
ADILABAD
LEGEND
Water Level Fluctuation in m.
Rise
< 2
2 - 4
> 4
Fall
> 2
Hills

Fig 7

HYDROGRAPHS OF GROUND WATER MONITORING WELLS





3.3 Ground Water Resources

Based on the Ground Water Estimation Committee (GEC-97) norms ground water assessment was done in 2004. The mandal wise details of ground water resources for all the 52 mandals is presented in Table- 5. The total ground water resource available in the district is 159190 ha.m viz., 39649 ha.m in command area and 119541 ha.m in non-command area. Total ground water utilisation is 52586 ha, 13177 ha.m in command area and 39480 ha in non-command area, respectively. Thus, the total ground water balance draft is of the order of 106606 ham, 26473 ha.m in command area and 80133 ha.m in non-command area.

Based on the stage of ground water development, the district falls under safe category with stage of development of 33 per cent. On the whole, of the 52 mandals of the district, 47 mandals fall under safe category, while only 5 mandals fall under semi-critical category. (**Fig.8**)

Village wise speaking, there are 80 villages notified in the district under Section 11 of APWALTA as shown in Table- 6

Table – 5

MANDAL WISE GROUNDWATER RESOURCE 2004
ADILABAD DISTRICT, ANDHRA PRADESH

S.No	Mandal	Groundwater availability Ha.m.			Groundwater utilisation Ha.m.			Groundwater balance Ha.m.			Stage of Development %			Category		
		C	NC	Total	C	NC	Total	C	NC	Total	C	NC	Total	C	NC	Total
1	*2*	*6*			*7*			*8=(6-7)*			*9 = { (7/6)*100}*			*10*		
1	Adilabad	924	3131	4055	136	1187	1323	788	1944	2732	15	38	33	Safe	Safe	Safe
2	Asifabad	0	1880	1880	0	291	291	0	1589	1589	NA	15	15	NA	Safe	Safe
3	Bazarhatnur	0	1435	1435	0	623	623	0	812	812	NA	43	43	NA	Safe	Safe
4	Bejjur	0	5840	5840	0	314	314	0	5526	5526	NA	5	5	NA	Safe	Safe
5	Bela	0	1807	1807	0	844	844	0	962	962	NA	47	47	NA	Safe	Safe
6	Bellampally	0	1575	1575	0	595	595	0	980	980	NA	38	38	NA	Safe	Safe
7	Bhainsa	0	2708	2708	0	1833	1833	0	875	875	NA	68	68	NA	Safe	Safe
8	Bhimini	0	1610	1610	0	225	225	0	1385	1385	NA	14	14	NA	Safe	Safe
9	Boath	0	2244	2244	0	1591	1591	0	653	653	NA	71	71	NA	SC	SC
10	Chennur	0	2955	2955	0	1061	1061	0	1894	1894	NA	36	36	NA	Safe	Safe
11	Dahegaon	0	2856	2856	0	352	352	0	2503	2503	NA	12	12	NA	Safe	Safe
12	Dandepally	5683	14	5697	1953	0	1953	3731	14	3745	34	0	34	Safe	Safe	Safe
13	Dilwarpur	0	2554	2554	0	1756	1756	0	797	797	NA	69	69	NA	Safe	Safe
14	Gudihatnur	0	1472	1472	0	579	579	0	893	893	NA	39	39	NA	Safe	Safe
15	Ichoda	0	1868	1868	0	1032	1032	0	836	836	NA	55	55	NA	Safe	Safe
16	Indravelly	0	3356	3356	0	723	723	0	2633	2633	NA	22	22	NA	Safe	Safe
17	Jainad	2996	1132	4128	474	575	1049	2522	557	3079	16	51	25	Safe	Safe	Safe
18	Jainoor	0	1644	1644	0	309	309	0	1335	1335	NA	19	19	NA	Safe	Safe
19	Jaipur	0	3559	3559	0	1332	1332	0	2227	2227	NA	37	37	NA	Safe	Safe
20	Jannaram	3940	1394	5334	843	185	1029	3097	1208	4305	21	13	19	Safe	Safe	Safe
21	Kaddam	4587	2985	7571	1507	434	1940	3080	2551	5631	33	15	26	Safe	Safe	Safe
22	Kagaznagar	0	3522	3522	0	270	270	0	3252	3252	NA	8	8	NA	Safe	Safe
23	Kasipet	0	3128	3128	0	574	574	0	2554	2554	NA	18	18	NA	Safe	Safe
24	Kerameri	0	791	791	0	185	185	0	606	606	NA	23	23	NA	Safe	Safe
25	Khanapur	2712	4182	6895	960	1231	2191	1752	2952	4704	35	29	32	Safe	Safe	Safe
26	Kotapally	0	3676	3676	0	696	696	0	2980	2980	NA	19	19	NA	Safe	Safe
27	Kowthala	0	2715	2715	0	547	547	0	2169	2169	NA	20	20	NA	Safe	Safe
28	Kubeer	0	2607	2607	0	1458	1458	0	1148	1148	NA	56	56	NA	Safe	Safe
29	Kuntala	0	2195	2195	0	1293	1293	0	902	902	NA	59	59	NA	Safe	Safe

Table – 5

S.No	Mandal	Groundwater availability Ha.m.			Groundwater utilisation Ha.m.			Groundwater balance Ha.m.			Stage of Development %			Category		
		C	NC	Total	C	NC	Total	C	NC	Total	C	NC	Total	C	NC	Total
1	*2*	*6*			*7*			*8 =(6-7)*			*9 = { (7/6)*100}*			*10*		
30	Laxmanchanda	2435	0	2435	1618	177	1796	817	-177	640	66	NA	74	Safe	NA	SC
31	Lokeshwaram	0	2176	2176	0	1868	1868	0	308	308	NA	86	86	NA	SC	SC
32	Luxettipet	4007	201	4208	1613	23	1636	2394	178	2572	40	12	39	Safe	Safe	Safe
33	Mamada	3394	3097	6491	836	1065	1902	2558	2032	4590	25	34	29	Safe	Safe	Safe
34	Mancherial	3904	2969	6874	973	1612	2585	2931	1357	4289	25	54	38	Safe	Safe	Safe
35	Mandamarri	0	1438	1438	0	465	465	0	973	973	NA	32	32	NA	Safe	Safe
36	Mudhole	0	2106	2106	0	1771	1771	0	335	335	NA	84	84	NA	SC	SC
37	Nannel	0	1988	1988	0	273	273	0	1715	1715	NA	14	14	NA	Safe	Safe
38	Narnoor	0	4254	4254	0	532	532	0	3722	3722	NA	13	13	NA	Safe	Safe
39	Neradigonda	0	1821	1821	0	735	735	0	1086	1086	NA	40	40	NA	Safe	Safe
40	Nirmal	2630	1449	4078	1382	1822	3205	1247	-374	873	53	126	79	Safe	OE	SC
41	Rebbuna	0	2525	2525	0	316	316	0	2208	2208	NA	13	13	NA	Safe	Safe
42	Sarangapur	2436	1903	4339	881	933	1815	1556	970	2526	36	49	42	Safe	Safe	Safe
43	Sirpur-T	0	2955	2955	0	355	355	0	2600	2600	NA	12	12	NA	Safe	Safe
44	Sirpur-U	0	2293	2293	0	293	293	0	2000	2000	NA	13	13	NA	Safe	Safe
45	Talamadugu	0	2622	2622	0	1228	1228	0	1394	1394	NA	47	47	NA	Safe	Safe
46	Tamsi	0	1624	1624	0	794	794	0	830	830	NA	49	49	NA	Safe	Safe
47	Tandur	0	1295	1295	0	366	366	0	930	930	NA	28	28	NA	Safe	Safe
48	Tanur	0	1999	1999	0	908	908	0	1091	1091	NA	45	45	NA	Safe	Safe
49	Tiryani	0	3593	3593	0	484	484	0	3109	3109	NA	13	13	NA	Safe	Safe
50	Utnoor	0	3304	3304	0	723	723	0	2581	2581	NA	22	22	NA	Safe	Safe
51	Vemanpally	0	1926	1926	0	400	400	0	1525	1525	NA	21	21	NA	Safe	Safe
52	Wankidi	0	1170	1170	0	167	167	0	1003	1003	NA	14	14	NA	Safe	Safe
	Total	**39649**	**119541**	**159190**	**13177**	**39408**	**52586**	**26473**	**80133**	**106606**	**33**	**33**	**33**	**Safe**	**Safe**	**Safe**

Note: NA = Not applicable; OE = Over exploited; SC = Semi critical; C = Command; NC = Non command

Fig.-8

GROUND WATER DEVELOPMENT

ADILABAD DISTRICT

ANDHRA PRADESH

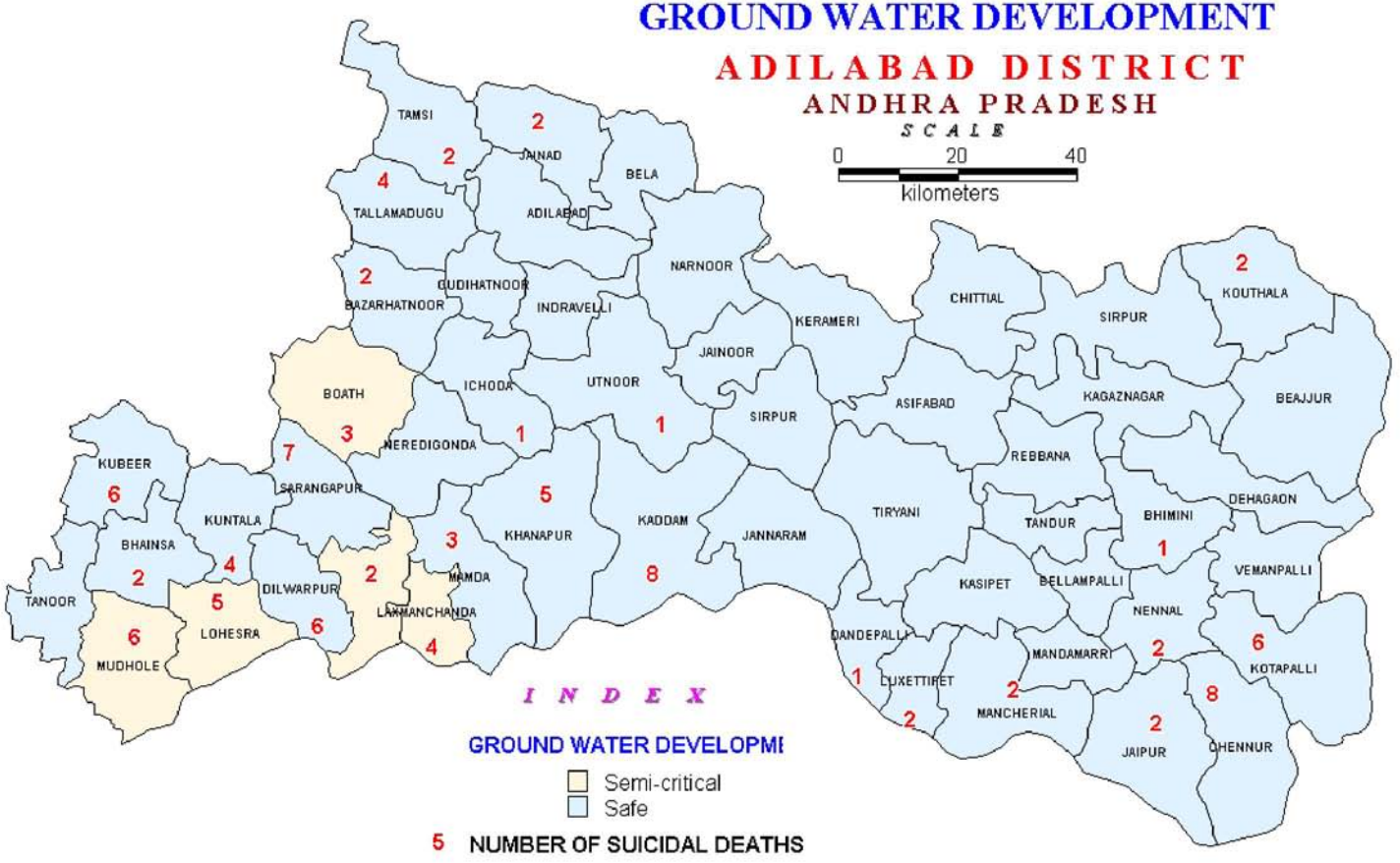


Table 6 -NUMBER OF VILLAGES PROPOSED FOR NOTIFICATION UNDER SECTION 11 OF AP WALTA ACT DISTRICT, ANDHRA PRADESH

Sl. No.	Name of the Mandal	Number of villages proposed for notification
1	Bhainsa	19
2	Lokeswaram	14
3	Dilwarpur	5
4	Kuntala	9
5	Mudhala	7
6	Nirmal	9
7	Sarangpur	12
8	Kubeer	5
	8 mandals	80 villages

The minimum stage of development of 5% is in Bejjur mandal, while maximum stage of development of 86% in Lokeswaram mandal.

3.4 GROUND WATER QUALITY

The chemical quality of ground water is important, as quantity is an essential component of ground water studies since it appraises the suitability of ground water for drinking and irrigation purposes.

In order to know the quality of the ground water, chemical quality data of ground water monitoring wells of CGWB and Ground Water Department of Andhra Pradesh State of the water samples collected during May, 2005 is studied.

The ground water in general is alkaline with pH values varying between 6.7 and 7.9 Electrical Conductivity (EC) values vary between 545 and 1750 micro siemens/cm at 25° C. The carbonate is absent in most of the samples. Bicarbonate values range from 220 to 793 mg/litre. The chloride values range between 14 and 245 mg/l. Nitrate

values are mostly below 100 mg/l, the permissible limit, and Fluoride content is mostly below permissible limit of 1.5 mg/l.

Thus, ground water in the district is in general suitable for drinking purposes and as the water is mostly moderately low and needs to be softened before use for drinking purposes.

From Agriculture point of view, ground water of the district from shallow aquifer falls mostly under C2S1 and C3S1 categories with medium to high EC and low sodium alakali hazard as per U.S. salinity classification.

The residual sodium carbonate (R.S.C) values range from ï 7.82 to 1.80.

Thus, the ground water of the district is in general suitable for Irrigation purposes.

4.0 STATUS OF GROUND WATER DEVELOPMENT

The district is dependent on ground water for both for irrigation and domestic needs. 53% of irrigated area is through ground water. The main ground water extraction structures that are used for irrigation and domestic purposes are dug wells, bore wells and tube wells. Small diameter dug wells generally of 1 to 4 m diameter and of total depths of 5 to 33 meters, generally down to 15 m depth, are in vogue to serve the domestic needs. The water from these wells is lifted by means of bucket and rope and also by electric motors of 1 to 2 HP.

Large diameter/large dimension dug wells with in - well bore wells specially in non-command areas are in vogue for Irrigation purposes. In hard rocks, total depths vary between 4 and 22 m. with yields of 10 to 277 cu.m/day with general yields of 50 to 80 cu.m/day.

The bore wells/tube wells are operated by electric motors fitted with submersible pumps of 5 to 10 HP. In soft rocks, the total depths of open wells vary between 6 to 16.75 m. The yields vary between 30 to 100 cubic metre per day generally are around 50 cu.m/day.

In alluvium (unconsolidated formation) the total depth of open wells vary between 5 to 10 meters and the yields vary between 100 to 300 cu.m/day.

The dug/dug-cum-bore wells are operated mostly by 3 to 7.5 HP electric motors and also by diesel engines fitted with centrifugal pumps, for lifting the well waters.

The weathered and fractured zones are tapped by bore wells of 30-100 m in general. The discharge varies between 3.6 and 18 cu.m/hr in general. The potential zones in hard rocks have been identified down to 125 m. maximum by CGWB.

The tube wells constructed in semi-consolidated rocks, vary between 70 and 200 m. The yields vary between 10 and 50 cu.m/hr.

The filter points constructed in alluvium of 5-10 m depth, yield water at the rate of 25 to 50 cu.m/hour.

About 10-25% suicide cases are reported due to failure of bore wells, mostly in semi-critical mandals in the district. In this mandals, the success rate of bore wells is reported to be 40-60%. About 80% of the failure of bore wells are accounted to selection of sites on non-scientific lines as water divining methods, etc.

5.0 GROUND WATER MANAGEMENT STRATEGY

Ground water resource, a vital element for human existence has to be managed carefully, keeping in view of its sensitive nature to many stresses that act on its quantity

and quality. The resource has to be carefully monitored and then utilised wherever it is in great demand.

It is estimated that there is about 1066 MCM of ground water resource available for development in the district with average of 33% development in the district. There is good scope in most of the mandals for development of ground water except in Laxmmchauda, Lokeswaram, Mudahole, Nirmal and Boath mandals, which fall in semi-critical category. It is necessary to develop the ground water resource on scientific basis and in a phased manner to avoid over-exploitation of the resource.

5.1 Spacing Between Wells :

Ground water management practices have to be initiated specially in the aforesaid five mandals. Spacing between two wells was made mandatory by the Government of India while sanctioning institutional financing. Spacing of 100-160 m between 2 dug wells is to be followed, depending on whether the wells are in ayacut or non-ayacut areas. Similarly spacing of 300-500 m should be adopted between 2 tube wells bore wells depending on whether the wells fall in ayacut or non-ayacut areas. Spacing of 120 to 180 m is to be maintained between 2 filter points, depending on the ayacut or non-ayacut areas. Spacing should be 2 times the radius of influence estimated on the basis of pumping tests for different categories of pump ages. Required spacing between is shown in **Table -7.**

Table 7: Recommended spacing between wells

S.No.	Situation	Spacing to be maintained in meters between any two adjacent wells		
		Dugwells	Filter points/shallow tube wells	Tube wells or Bore wells
1	Non-Ayacut	160	120	300 ï 500
2	Ayacut	100	160	200 ï 300
3	Near perennial Source like river or tank	100	160	200 ï 300
4	Non-Perennial streams within 100 m.	150	180	300 ï 500

Source: NABARD

5.1.1 Unit Cost of wells:

As the district possesses varied geological rock types and hydrogeological conditions, different types of ground water extraction structures are feasible. The unit cost of different type of wells was worked out based on NABARD norms and approved by the State Unit Cost Committee for financing the ground water abstraction structures for irrigation and cost of pump sets in Adilabad district. The details are furnished in the **table -8**.

Table 8 : Unit Cost of Wells

Geology	Type of Well	Dimension of dug wells			Dimension of bore wells		Existing unit cost (Rs.)
		Dia-meter (m)	Depth (m)	Staining Depth (m)	Dia-meter (m)	Depth (m)	
Granite and related rocks	a. DW b. DW c. DCB	6 6 6	10 12 10	4 4 4	- - 100	- - 30	21000 27200 26000
Sand Stones	a. DW b. DCB	3 3	12 12	4 4	- 100	- 30	6500 11500
Borewellsin hard rocks	BW	-	-	-	150	30	12500

Inwells bores in all geological formations	IWB	-	-	-	100	25	5000
Deep tube wells in semi-consolidated formations	TW	-	-	-	-	80 100	5325 101690

DW: Dug Well, BW: Bore Well, DCB: Dug Cum Bore Well, IWB: In Well Bore Well, TW: Tube Wells

The district has command area of over 16 mandals under major and medium irrigation projects and the entire command area is falling under safe category with balance ground water resource of 264.73 MCM. As such, conjunctive use of surface and ground water should be adopted through construction of dug wells/bore wells for optimum utilisation of ground water not only to increase the irrigation potential but to avoid water logging and hence salinity problems.

Care should be exercised in semi-critical mandals by continuous maintenance of ground water regime and selection of sites for drilling borewells/tube wells should be merely on scientific basis in the areas where rainwater is in high demand.

For a viable farm model (Table-9) with ground water as an irrigation source crops such as Maize-Turmeric, Chillies-Pulses, Paddy-Groundnut ï pulses combinations are to be adopted. Sprinkle irrigation for ID crops and drip irrigation for mango, citrus, guava, sugarcane, turmeric, chillies, vegetables etc. for better management of ground water as well as better crop yields.

5.2 Ground Water Development

Ground water development in the district is developed through dug wells/shallow wells in command areas and through moderately deep to deep bore wells/tube wells in non-command areas.

In command areas, dug wells of 9-15 meters tapping the weathered mantle, with diameter of 2-4 meters at a discharge of 3 lps are desirable.

In hard rocks of non-command area bore wells of 6 ½ò dia and total depths of 75-125 m depth could be constructed tapping the fracture zones depending on the hydrogeological or geophysical investigations.

Similarly, in the sedimentary terrain of non-command area, tube wells of 100-200 m depth with 254 mm housing, 152 mm casing could be constructed after hydrogeological and geophysical investigations optimum entrance velocity to be maintained at 0.152/min for required discharge of 50 cu.m/hr.

Filter points are more suitable in shallow alluvial aquifers and valley fills along stream and river courses.

Apart from above, for optimum yields, well design transmissivity of the aquifer, radius of influence saturated thickness of aquifer, safe draw down, cropping pattern etc. are to be taken into consideration.

Table - 9

1. Viable Model Forms District Adilabad.

Following are the details of farming situation in the district existing cropping pattern and recommended pattern in each farming situation.

Sl. No.	Farming situation	Extent Hect.	Cropping patter Existing	Recommended cropping programme
1	2	3	4	5
I	Rainfed-Black Soils High Rainfall	289928	a) Cotton - Fallow	Cotton-Bengalgram (In case of Bt-Cotton)
			b) Jowar-Bengalgram-Fallow	Jowar-Bengalgram
			c) Dry Paddy-Fallow-Fallow	Paddy-Bengalgram
			d) Soyabean-Fallow-Fallow	Soyabean-Bengalgram/Safflower/Mustered
			e) Greengram/Blackgram-Sunflower-Fallow	Pulses-Sunflower- Pulses (Under ID)
			f) Cotton+Redgram-Fallow	---
II	Rainfed-Black soils Medium Rainfall	52488	a) Cotton-Fallow	Cotton+Inter crop-Fallow
			b) Jowar-Fallow-Fallow	Pulses
			c) Dry Paddy-Bengalgram-Fallow	---
			d) Soyabean-Fallow-Fallow	Soyabean+Redgram-Fallow
			e) Greengram/Blackgram-Sunflower-Fallow	---
			f) Redgram-Fallow	---
			g) Fallow-Sesamum-Fallow	Pulses-Sesamum-Fallow
			h) Fallow-Jowar-Fallow	Pulses-Jowar-Fallow
III	Rainfed-Red soils High Rainfall	12856	a) Maize-Fallow-Fallow	Maize-Sunflower-Pulses under ID.
IV	Rainfed-Red Soils Medium Rainfall	25100	a) Maize-Fallow-Fallow	Maize-Sunflower/Pulses
			b) Redgram - Fallow	Redgram-Fallow

Viable Model Forms District Adilabad.

Source ; Joint Director, Agriculture Dept. Adilabad

Table – 9

V	Irrigated areas Tanks	19823	a) Paddy-Paddy-Fallow	Paddy-ID Crop-Fallow
VI	Irrigated areas Canals	45440	a) Paddy-Paddy-Fallow	Paddy-ID Crop-Fallow
VII	Irrigated-Black Soils - Wells	30232	a) Turmeric-Fallow	Maize+Turmeric-Fallow
			b) Chillies-Fallow	Chillies-Pulses
			c) Paddy-Groundnut-Fallow	Paddy-Groundnut-Pulses
VIII	Irrigated-Red soils - Wells	34292	a) Turmeric-Fallow	Maize+Turmeric-Fallow
			b) Chillies-Fallow	Chillies-Pulses
			c) Paddy-Groundnut-Fallow	Paddy-Groundnut-Pulses
IX	Saline soils-Paddy under Tanks	162	a) Paddy-Paddy-Fallow	Paddy-IC Crops-Fallow
		510321		

2 Irrigation Methods:

a) **Ground Water:**

Area under Wells/Bore Wells: 64,524 ha. the crops that are grown under I.D. is Sunflower, Maize, Groundnut, & other vegetable crops.

Suggested Methods:

I) Sprinkler Irrigation: This method of irrigation is used to grow I.D. crops and also to give supplementary irrigation in Cotton, which is major in the District.

ii) Drip Irrigation: Mainly this type of irrigation is used in the plantation crops like Mango, Citrus, Guava, Sugarcane etc Vegetable crops like Tomato, Brinjal, Sprices and Candimets crops like Turmeric, Chillies are irrgated by this method.

In both above methods water is saved and more area brought under I.D. crops. When compared to irrigated Paddy.

b) **Surface Water:**

Canal Water, released from Projects and Tanks will be used for mainly Paddy cultivation. Sugarcane, Turmeric also can be irrigated through the surface water under surface water, flood, Canal irrigation methods are adopted.

5.3 Water Conservation and Artificial Recharge

Ground water conservation and artificial recharge works have ben taken up on large scale in the district since 2002 under Neeru-Meeru. Watershed, RIDF and other programmes. District watershed management agency constructed 202 check dams, 454 dug out ponds, 4703 rock fill dams, 150 farm ponds, 2342 contour trenches, 2860 and 1671 percolation tanks. These artificial structures are constructed to improve recharge of bore wells from Central Ground Water point of view.

Artificial recharge structures should be taken up in non-command areas of the district, specially in critical and over-exploited mandals. The most ideally selected artificial recharge structures are percolation tanks and check dams. The works should be taken up on watershed basis after carefully assessing the available surface run off after meeting the needs of the existing structures.

Roof top harvesting in urban and rural areas should be made mandatory for enhancing the ground water recharge.

6.0 RECOMMENDATIONS:

- Majority of the farmers who committed suicide are cotton growing farmers. Cotton is mostly rain fed crop in this district. Failure or inferior quality cotton crop specially during the period between 1999-2004 due to failure of monsoon, use of spurious seeds, adulterated pesticides and insecticides, higher input costs, denial of minimum supporting prices in market landed the farmers in huge debts**.** Viable farm model and irrigation methods suggested in this Report in table -9

may be adhered to, for better management of Ground Water and better yields of crops.

- 10- to 25% farmers suicide cases are reported due to failure of bore wells. Of the failure of bore well cases, 80% are reported due to water dowsing methods followed in the district. Investigations on scientific basis to be ensured for selection of sites for sinking the wells. Aerial photos and remote sensing tools to be applied followed by field checks, for identification of ground water horizons.
- Strict implementation of APWALTA Act with continuous monitoring of ground water regime, specially in semi-critical mandals to be adopted, immediately. Roof top harvesting of rain water both in urban and rural areas to be made mandatory to enhance recharge to ground water system.
- Large scale artificial recharge structures like Gully plugs, check dams, percolation tanks, recharge ponds etc., are to be launched on war footing basis, specially in semi-critical mandals in non-command areas where, ground water is in good demand.
- Conjunctive utilisation of ground water and surface water to be adopted to avoid water-logging conditions, which will lead to ground water salinity problems, there by lands becoming unsuitable for irrigation, in the long run.
- The hydraulic structures for ground water extraction are to be designed based on scientific considerations as detailed in the report at page no. 17.
- Well design as discussed in the Report be adopted for better results and economic viability.

- Mass awareness programmes to be taken up at village levels, specially in non-command areas to educate the farmers regarding water conservation and management techniques, regarding cropping pattern and modern irrigation methods to be adopted, well design techniques etc.
- Authorised financial institutions may during more number of farmers, especially the small farmers under its roof and advance the necessary loans after conducing necessary economic feasibility studies, for Agriculture, for sinking wells etc. so that farmers, specially the small farmers do not approach private money lenders, who charge abnormal interest rates. Lending item in the huge debts, ultimately leading to committing suicides.
- Ground water development to be taken first in virgin areas to be exploited in phased manner, keeping an eve on the ground water regime, and thereby enhance irrigation potential under ground water
- Sinking of wells in the lands of poor farmers to be taken up at free of cost by Government and technical guidance be given to them regarding cropping pattern, pump sets etc as and when required.
- Sale of branded seeds and pesticides need to be done through Government authorised shops only.
- Insurance of crops especially for poor farmers should be made mandatory.
- Farmers should form their cooperative Societies at Mandal level and sell their produce without interference of middlemen to get due share of their profits.

- Farmers need to be educated regarding extent of land to be irrigated and the type of crop to be raised in a particular year depending on availability of water resource and financial position.
- Pension to be provided by Government to eldest member of the deceased family.

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