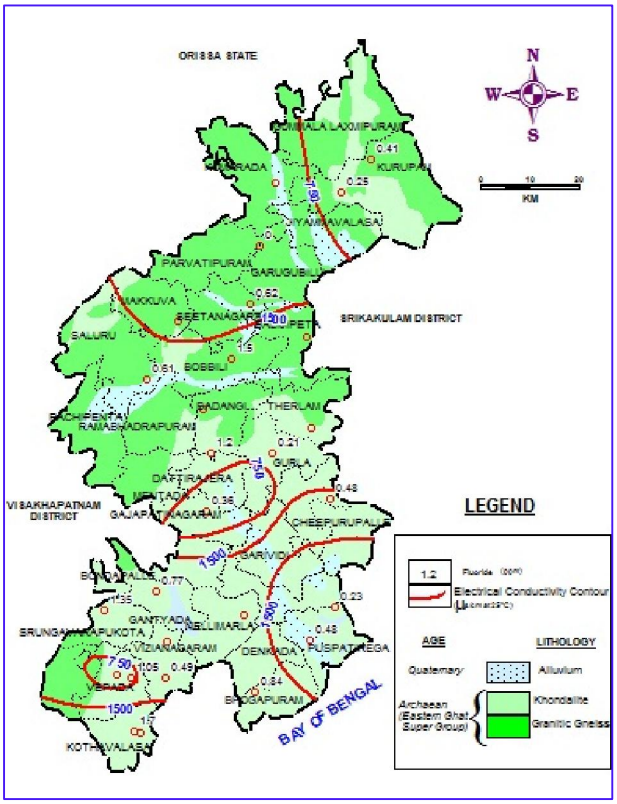
For Official Use Only

CENTRAL GROUND WATER BOARD
MINISTRY OF WATER RESOURCES
GOVERNMENT OF INDIA

GROUND WATER BROCHURE
VIZIANAGARAM DISTRICT, ANDHRA PRADESH



SOUTHERN REGION
HYDERABAD
September 2013

CENTRAL GROUND WATER BOARD
MINISTRY OF WATER RESOURCES
GOVERNMENT OF INDIA

GROUND WATER BROCHURE
VIZIANAGARAM DISTRICT, ANDHRA PRADESH
(AAP-2012-13)

BY

G. BHASKARA RAO
SCIENTIST-D

SOUTHERN REGION
GSI Post, Bandlaguda
Hyderabad-500068
Andhra Pradesh
Tel: 040-24225201
Gram: Antarjal

BHUJAL BHAWAN,
NH.IV, FARIDABAD -121001
HARYANA, INDIA
Tel: 0129-2418518
Gram: Bhumijal

District at a Glance

Sl No.	ITEMS	STATISTICS
1.	GENERAL INFORMATION	
	I. Geographical area (sq. km)	6,539
	II. Administrative Divisions a. Number of Tehsil/Blocks b. Number of Punchayat/villages	 12 1551
	III. Population (as on 2011 Census)	23,42,868
	IV. Average Annual Rainfall (mm)	1131.00
	v. Annual Rainfall (2012) mm	1298
2.	GEOMORPHOLOGY	
	Major physiographic units	Structural hills, pediplains, alluvial plains
	Major Drainages	Nagavali, Gostani and Chempavati
3.	LAND USE (Ha.) 2012	
	a. Forest	1,19,303
	b. Net area sown	2,86,556
	c. Cultivable waste	4,243
4.	MAJOR SOIL TYPES	Red loamy and sandy loam
5.	IRRIGATION BY DIFFERENT SOURCES (Ha.)	Irrigated area
	Dugwells	5,399
	Tubewells/Borewells	13,878
	Tanks/ponds	80,720
	Canals	41,930
	Other sources	5,064
	Net irrigated area	1,46,991
	Gross irrigated area	1,78,788
7.	NUMBER OF GROUND WATER MONITORING WELLS OF CGWB (As on 31-03-2012) No. of Dug Wells	25
8.	PREDOMINANT GEOLOGICAL FORMATIONS	
9.	HYDROGEOLOGY	
	➢ Major Water bearing formation	Weathered and fractured crystalline rock formations Khondalites & Granite-Gneisses.
	➢ Pre-monsoon Depth to water level, Range (2012)	3.14 to 10.20 m.bgl
	➢ Post-monsoon Depth to water level,	0.15 to 5.87 m.bgl

	Range (2012) Water Level Trends (2002-2012) Pre-monsoon : Rise Fall : Post-monsoon : Rise : Fall	 0.0006 –0.2803m/y 0.0070-0.2159 m/y 0.0031-0.2159 m/y 0.0056-0.0321 m/y
10.	GROUND WATER EXPLORATION BY CGWB	
	No. of wells drilled (EW, OW,)	49 EW, 11 OW
	Depth Range (m.bgl)	52.00 To200.00
	General yield range (liters per second)	0.1 to 2
	Storativity(S) Range	$0.81x10^{-4}$ To $4.5x10^{-3}$
	Transmissivity (m^2/day) Range	2.0 to 20
11.	GROUND WATER QUALITY	
	Electrical conductivity, (miro.siemens/c.m) Range	390 to 2970 . Groundwater from shallow depths, by and large, is suitable both for drinking and irrigation purposes
12.	DYNAMIC GROUND WATER RESOURCES (2008) in Ha.m	
	Net Annual Ground Water Availability	81853
	Annual Ground Water Draft	17233
	Projected Demand for Domestic and industrial Uses upto 2025.	6666
	Stage of Ground water Development	21%
13.	AWARENESS AND TRAINING ACTIVITY	
	Mass Awareness Programmes organized	
	Date	2/12/04, 14/12/06
	Place	Kothavalsa & Bhogapuram
	No of participants	250 Each.
	Date	12^{th} & 13^{th} December, 2006
	Place	Vizianagaram
	No. of participants	40

GROUND WATER SCENARIO
VIZIANAGARAM DISTRICT, ANDHRA PRADESH

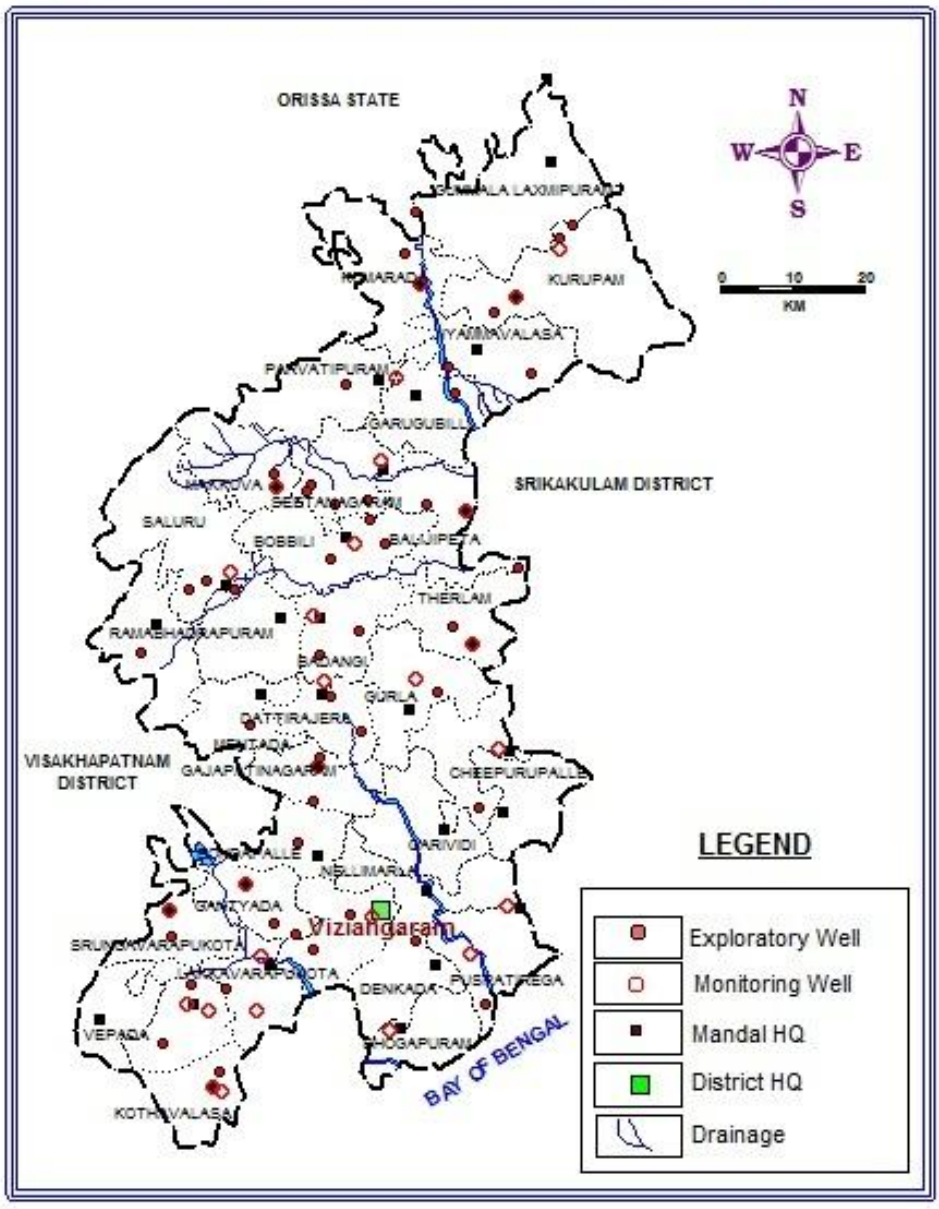
CONTENTS

Figure

1.0 Introduction

Vizianagaram district is one of the nine coastal districts of Andhra Pradesh having an area of 6.539 Sq.km and is spread over in 34 mandals, which are housing 1551 villages. For administrative convenience the district is divided into 2 revenue divisions viz., Vizianagaram and Parvathipuram (Fig.1).

Fig. 1 ADMINISTRATIVE DIVISIONS - VIZIANAGARAM DISTRICT



The district is physiographically comprises Eastern Ghat hilly region in the west and north. Plains with scattered hills in the central, southern and eastern parts. The topographic elevation of the hilly area varies from 300 to 950 m.amsl, whereas the elevation of plains varies from 10 to 150 m.amsl. The major rivers that drain the district are Nagavali, Gosthani and

Champavathi and their tributaries viz. Swarnamukhi, Janjavati and Vegavathi. Nagavali, Swarnamukhi and Vegavathi are perennial in nature and the remaining are of ephemeral type. The drainage exhibits sub-dendritic to dendritic pattern and is of medium to coarse texture and drainage density is worked out to be 0.6 to 1km/sq.km.

The principal crops grown in the district are paddy, jowar, maize, ragi, pulses, chilies, sugarcane, vegetables, fruits, groundnut, tobacco and cotton. The total food crops both during kharif and rabi seasons grown in about 280798 ha. and non-food crops in 92437 ha. and the gross area sown is 373235 ha. There are no major irrigation projects except 12 medium irrigation projects. As per 2012 data the area irrigated through canals 41930 ha; tank irrigation 80720 ha; tubewells and filter point wells irrigate 13878ha; other sources 5064 ha. The gross area irrigated in the district is 178788 ha. And net area irrigated is 146991 ha.

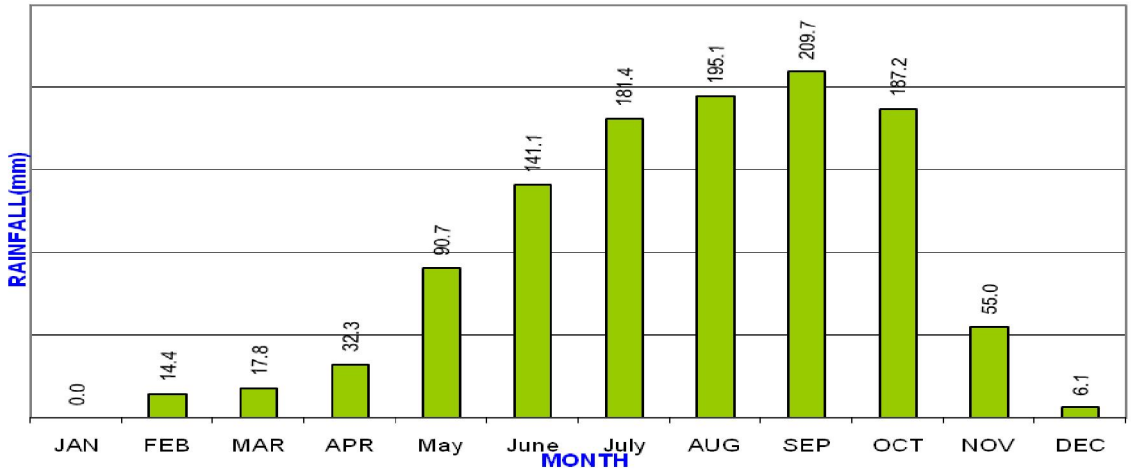
The geo-hydrological surveys in parts of Vizianagaram taluk of S.kota and Salur were carried out by Shri.P.N.Rao (1967-68) and Shri.R.K.R.Konala (1969-70) and Shri.P.Prabhakar Rao (1970-72) under the erstwhile groundwater wing of G.S.I. and later on C.G.W.B. took up systematic hydrogeological surveys in the district and carried out hydrogeological investigations were carried out by Shri.G.Suryanarayana (1986-87) in parts of Cheepurupalli taluk. In the tribal sub plan areas of Gajapathinagaram, Pachipenta and Salur taluks by Shri. K.Lakshminarayana (1987-88) and in parts of Badangi, Bobbili, Gajapathinagaram, Parvathipuram and salur taluks by shri.P.N.Rao (1987-88), afterwards under groundwater management (reappraisal studies) in the district were taken up by Shri.Siddartha kumar and M.V.Gopal during the A.A.P.1997-98 and again in parts of the district by Shri. C. Paul Prabhakar during the years A.A.P.2006-07 and 2007-08 respectively. Under the Ground water exploration programme C.G.W.B. drilled a total of 49 exploratory wells and 11 observation wells. The geophysical studies involving resistivity surveys in Vizianagaram district were carried out during the AAP 2001-02 & 2002-03 and a total of 36VES werecompleted. The Central Ground water Board initiated long term groundwater regime studies over the last two decades by establishing 22 groundwater monitoring observation wells and monitoring them 4 times in a year with groundwater sampling in the month of May.

2.0 Rainfall and Climate

The average annual rainfall of the district is 1131 mm, monthly rainfall ranges from nil rainfall in January to 209.7 mm in September. September is the wettest months of the year. The mean seasonal rainfall distribution is 727 mm in southwest monsoon (June-September), 248 mm in northeast monsoon (Oct-Dec), 14 mm rainfall in Winter (Jan-Feb) and 141 mm in summer (March – May). The percentage distribution of rainfall, season-wise, is 64.32% in southwest monsoon, 21.96 % in northeast monsoon, 1.27 percentage in winter and 12.45 % in summer. The mean monthly rainfall distribution is given in Fig. 2. The annual rainfall ranges from 783 mm in 2002 to 1648 mm in 2010. The annual rainfall departure ranges from -35 % in 2002 to 46 % in

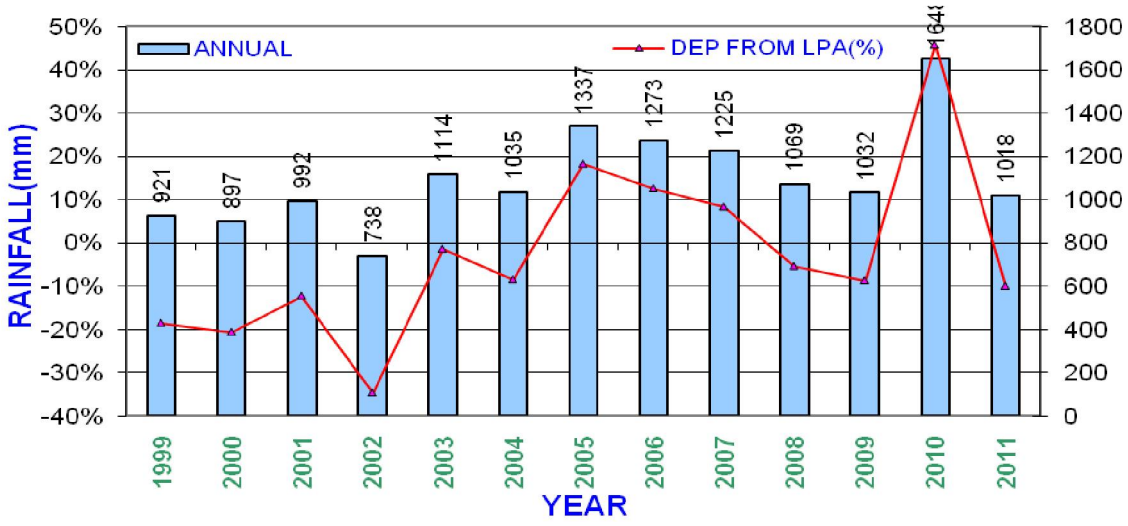
2010. The southwest monsoon rainfall contributes about 64 % of annual rainfall. The annual rainfall during 2012 is 1298 mm.

Fig. 2 : Monthly Rainfall Distribution of LPA



It ranges from 521 mm in 2002 to 981 mm in 2006. The year 2002 experienced drought conditions in the district as the annual rainfall recorded is 35% less than the long period average (LPA) respectively. The cumulative departure of annual rainfall from LPA is presented in Fig.3. It indicates that, the rainfall departure as on 2011 is positive i.e. 36%, showing rainfall deficit.

Fig. 3: Annual Rainfall and Rainfall Departure from LPA



Humidity: The mean monthly relative humidity is 79 % in the morning hours and 77% in the evening hours. It ranges between 70% to 82% in the evening hours and 75% to 85% in the morning hours. The relative humidity increases after the onset of monsoon.

Wind Speed: The monthly wind speed ranges from 8km/hr in Jan to Feb to 16.5km/hr in May. During the monsoon period the wind speed is 13 km/hr and

it decreases to 9.3km/hr during post monsoon period and further decreases to 8km/hr in winter.

Evapotranspiration: The mean monthly evapotranspiration ranges from 97mm in December to 170mm in May. The annual evapotranspiration is 1511mm, except from July to October. During the rest of the year the monthly evapotranspiration is more than the monthly rainfall.

3.0 GEOMORPHOLOGY & SOIL TYPES

3.1 Geomorphology

Geomorphologically the district can be broadly divided into 4 distinct units viz.; structural hills, pediplains, alluvial plains and coastal plains.

Structural hills: Major parts of the western and northern parts of Vizianagaram district is occupied by structural hills and also they occur in isolated patches in the remaining parts of the district. They occur as linear to arcuate hills showing definite trend lines and all are composed of charnockites and Khondalites. The groundwater prospects in this unit are generally poor. Most moderate yields may be expected along the fractures.

Pediplain: The pediplains comprising shallow buried pediplain, deeply buried pediplain, pediment, residual hills and inselbergs are generally occupied by granites and gneisses and areally they occupies large parts of the district. Generally they form poor aquifers except along the major fractures. The pediment is a broad and generally sloping rocky surface with low relief and thin veneer of detritus. The groundwater prospects in this unit is generally meager, however moderate yields can be expected along major fractures. Depending on the degree of weathering, the pediplain is classified into shallow, moderate and deeply buried pediplains and are generally developed on charnockites and khondolites.The shallow buried pediplain consists of overburden of weathered mantle of 5 meters thickness and its groundwater prospects are generally meager to moderate. The moderately buried pediplain having 5-15 meters thick weathered mantle forms moderate to good aquifers. The deep buried pediplain has more than 15-meter thick weathered mantle and constitute good aquifer with good yields.

Alluvial plains: The alluvial plains are developed along major river courses, valleys and at the feet of structural hills in the district. The alluvial plains along major river courses are known as floodplains and consist of unconsolidated gravels, sands, silts and clays. The flood plains of fairly good thickness usually form shallow to deep fresh water aquifers with good to very good yields. The alluvial plains along valley fills consists of gravels, sands, silts and clays and the thickness of valley fills is considerable extending upto 35 meters, they are generally capable of giving very high yields. The occurrence of alluvial plains in the district is seen partly in the northwest, northeast and in the central mid plains and also in the southeast and south western parts.

Coastal plains: The coastal plain occurs parallel and nearer to the sea and is of marine origin consisting of generally saline aquifers except on beach ridges where moderate to fresh water aquifers occur. The beach ridges are suitable for construction of very shallow dug wells of 2-3m.in depth and infiltration galleries.

3.2 Soil

The predominant soil types in the district are red loamy and sandy loam occupying 37.8% and 48.3% of the area respectively. The slopes of the hills and hill ranges are occupied by talus material. Red loamy soils occur beneath the talus which is fertile promoting forest growth. The narrow valleys between the hills are covered by ferruginous red soils, which support good vegetation. The soils along the river courses are sandy and the thickness of the soil cover varies from less than a metre near the hill slopes to as much as 5 meters along the river/stream courses in the district.

4.0 GROUND WATER SCENARIO

4.1 Hydrogeology

The hydrogeological conditions prevailing in the district generally depends on various factors like climate, rainfall, topography, geological setting and structure. In turn the occurrence and movement of groundwater also depend on these factors. The rocks occurring in the district can be broadly classified as two types viz; hard and soft rocks. Crystalline formations like khondolites, charnockites, migmatites and gneisses etc. can be grouped as hard rocks, while the unconsolidated formations like the alluvial sediments can be classified as soft rocks. The semi consolidated formations like sandstones are grouped under soft rocks, though limited in occurrence. The Hydrogeology of Vizianagaram district is shown in Fig.4. The occurrence and movement of groundwater in the different geological formations of the area is described in the following paragraphs.

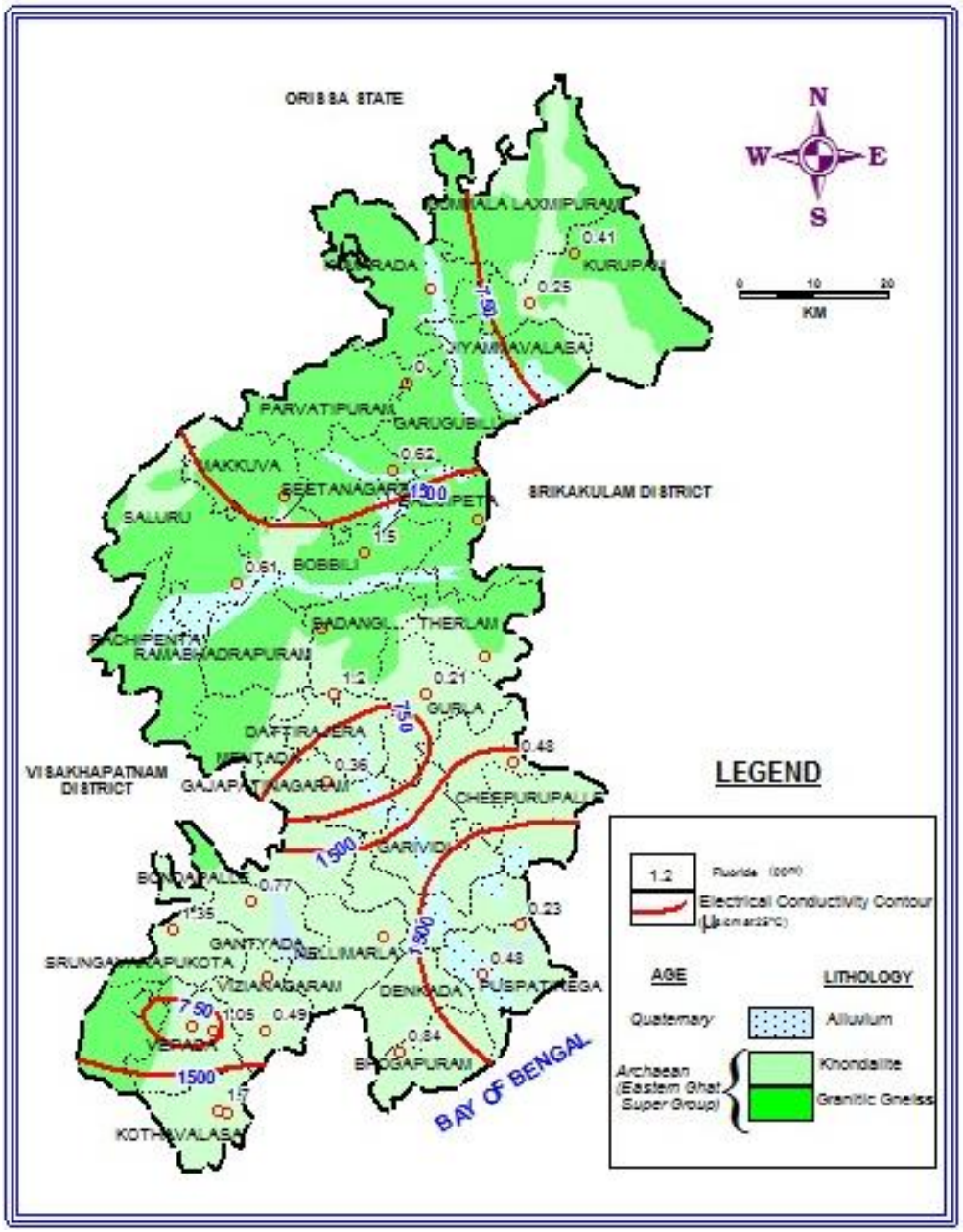
Groundwater in crystalline (Hard rock) formations

The hard crystalline formations generally lack primary porosity and hence usually the secondary porosity developed through weathering and fracturing plays a dominant role. The degree and depth of weathering in the crystalline formations varies from place to place depending upon the topography and structure etc. The thickness of weathered mantle on the hilltops and outcrops is less than a metre whereas it is maximum as much as 40 m. in valleys and topographic lows.

The groundwater generally occurs under phreatic condition in the shallow weathered mantle and under semi-confined conditions in the fracture zones. Groundwater in crystalline rocks is generally developed by means of dugwells, dug cum borewells and borewells. The dugwells in the district are

generally circular in shape with diameter ranging from 0.8 and 5.6m and depth of the wells vary between 4 and 12m.b.g.l. and the depth to water level

Fig. 4: Hydrogeology - Vizianagaram District, A.P.



varies from 1.35 to 10.0m.b.g.l.The yield of the wells piercing the weathered zone vary from 3.0 to 237.6 cu.m./day depending on the location. The depth range of bore wells is between 30 to 200m.b.gl. with yields varying from 43.2cub.m./day to 432cu.m./day. The specific capacity of the wells varies from 3.77 to 17.1lpm/m/m.d.d. and the transmissivity of the aquifer varies from 6.0 to 85mts.sq./day.

Ground water in unconsolidated/semi-consolidated formation (soft rock)

Alluvial formations comprising fine to coarse sands, pebble beds and gravels constitute the aquifer horizons. Groundwater occurs under both phreatic and semiconfined conditions. The thickness of alluvium varies from a few meters to over 20 metres. Groundwater is developed through dugwells, filter point wells and shallow tube wells to a limited extent in the district at places in the area. The depth to water level in dug wells varies from 1.50 to 11.0 m.b.g.l.

Depth of shallow filter point/tube wells range between 8.0. and 20 m.b.g.l. and the yield of the wells vary depending on the thickness of granular zones encountered and generally ranges between 96 cu.m/day to 120 cu.m/.day. The dune sands or wind blown sands are limited in their areal extent in the district and having no sufficient granular zones. However potable groundwater occurs in these sands at shallow depths. In coastal sands, the depth to water level varies from 1.36 to 5.20 m.b.g.l. and the depth of the wells range between 3.0. to 7.50 m.b.g.l. The specific capacity of the shallow tube wells vary from 73 to 631 lpm/m/m.d.d. and the transmissivity value for alluvial aquifer range between 160 and 675 m.sq/day.

4.2 Ground water regime studies

To understand ground water levels, its behaviour, fluctuation and long term ground water level trends in the district the C.G.W.B. has established 25 national groundwater monitoring observation wells in the Vizianagaram district and these are monitored during the months of January, May, August and November each year.

The pre-monsoon (May2012) and post monsoon (Nov., 2012) depth to water levels of Vizianagaram district are presented in Figs.5 and 6. The pre monsoon (May, 2012) water levels varied from 3.14 to 10.20 m bgl. In areas close to Chemapavathi, Vegavathi, Swarnamukhi and Nagavali rivers where it ranges between 2.0 and 5.0mbgl. During this period the shallowest water level, 3.14 m.bgl, is noticed at S.Kota village and while the deepest water level, 10.20 m bgl, was recorded at Chipurupalli. In post monsoon period (Nov.2012) in most parts of the area, the depth to water levels are observed less than 5.00m.bgl.The shallowest water level of 0.15m.bgl was recorded at Payakapadu and the deepest level of 5.87 m.bgl was recorded at Komarada. Depth to water levels during post monsoon is shallow compared with that of pre monsoon levels because of monsoonal recharge.

The water table fluctuates due to changes in groundwater storage and draft in response to rainfall incidence, applied irrigation, influent and effluent seepages and draft from groundwater, which is reflected in well hydrographs. About 3.00 m. average water level fluctuation between pre and post monsoon period is noticed in the district.

The long term (2002 to 2012) water level trends indicate that a total number of 18 wells showing rising trend ranging from 0.0006 to 0.2803 m/y and falling trend ranging from 0.0070 to 0.1001 m/y at 7 locations is noticed

during pre monsoon period. Rising trend ranging from 0.0031 to 0.1784 m/y is observed at 23 stations and declining trend is noticed at S.Kota (0.0056 m/y) and Bobbili.

Fig. 5: Depth to Water Level – Pre monsoon (May 2012)

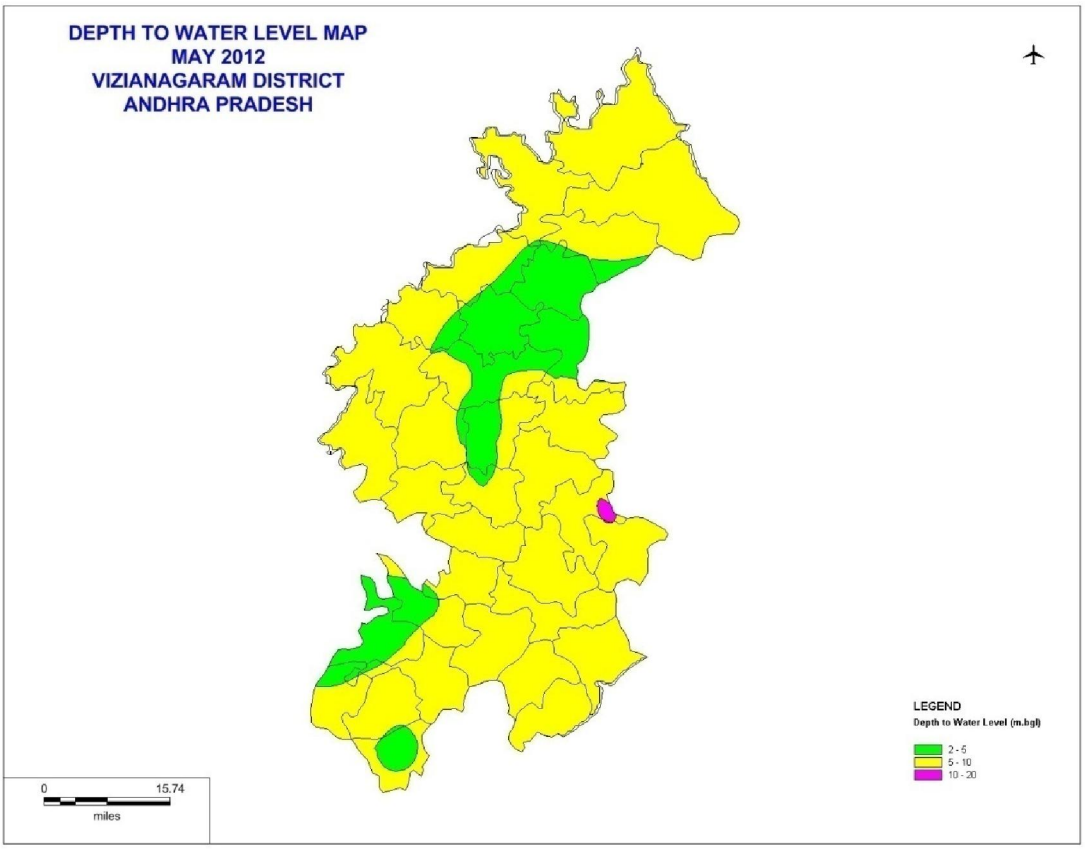
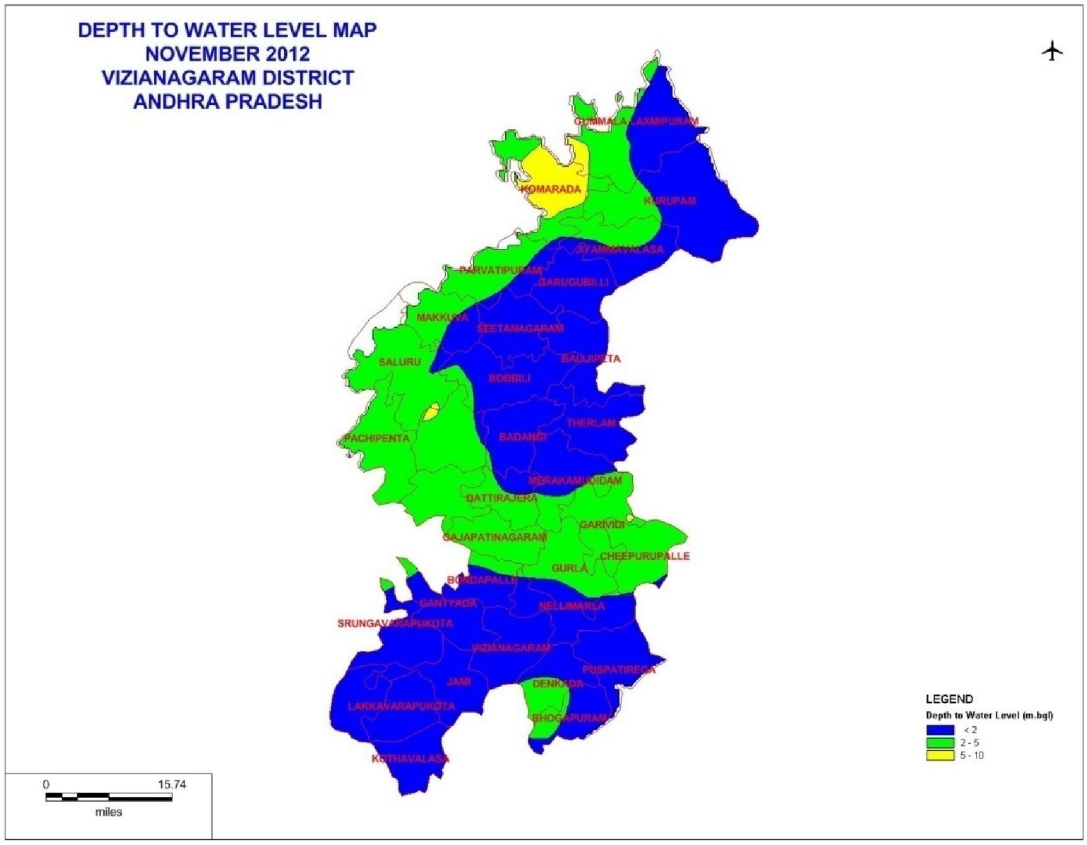


Fig. 6 : Depth to Water Level – Post monsoon (Nov-2012)



4.3 Ground Water Resources

As per the ground water resource estimation (year 2008-2009) the net annual ground water availability is 81853 ha. m. out of which 27884 ha. m. is available in command area, 53969 ha. m. in non-command area.

Based on the stage of development of ground water, the mandals are grouped into the following categories.

(a) The very high usage mandals. (Overall development of ground water is > 70%) Do not exist in the district.

(b) The high usage mandals (over all development of ground water is > 50% and < 70%) are 3. viz., P.P.Rega, Garividi and Cheepurupalli.

(c) The moderate usage mandals (over all development of ground water is > 30% and < 50%) are 9, viz. Nellimarla, Denkada, Datirajeru, Gurla, Badangi, G.P.Nagaram, Vizianagaram, S.Kota and Ramabadrapuram.

(d) Low usage mandals (over all development of ground water < 30%.) are 22 viz., Merakamudidam, Kothavalasa, Garuguballi, Therlam, Seethanagaram, Gantyada, L.Kota, Parvathipuram, Jami,

Bhogapuram, Salur, Bondapalli, Vepada, Bobbili, Balizapeta, Jiyammavalasa, Kurupam, Mentada, Makkuva, Pachipenta, Komarada and Gummalakshmipuram.

Based on the present stage of ground water development all mandals fall under safe category. Mandal wise ground water resource potential and stage of ground water development are presented as Table-1.

4.4 Ground Water Quality

The quality of ground water plays an important role as its physical, bacterial and chemical characteristics determine its usefulness for domestic, industrial and agricultural purposes. The quality of ground water depends on the hydrogeological environments through which it flows. The hydro chemical study involves determination of various chemical constituents and concentration of salts present in relation to water use. The quality of ground water is monitored every year in the month of May to study the hydro chemical changes with time. The distribution of electrical conductivity of the groundwater of the district is shown in Fig.3.

The electrical conductivity is a measure of degree of mineralization in groundwater represented by total dissolved solids present. The E.C. values generally range between 390 & 2970 miro.siemens/c.m. at 25 ^{o}C., as such all the samples falling under permissible range for drinking water standard of BIS. pH of the groundwater in the district varies from 7.2 to 8.4. Indicating that the water is generally alkaline in nature.

The chloride concentration in groundwater increase the alkalinity of the water and chloride concentration up to 250 mg/litre is desirable though it is permissible upto 1000mg/litre for drinking purpose. The chloride concentration in the district ranges between 32 to 681 mg/litre., and values more than 250 mg/litre are noticed at 7 locations. In the entire district the chloride concentration is within the permissible limits of 1000mg/litre. The concentration of calcium and magnesium varies from 6 to 172 mg/litre and 12.3 to 96.1mg/litre respectively. The bicarbonate content in the samples ranges from 122 to 982 mg/litre and within the prescribed standard limits of drinking and irrigation water requirements of district.

Chemical pollution by way of applying nitrogenous fertilizers in the agriculture sector is the root cause of high nitrate content in the groundwater. Nitrate concentration of about 45 mg/litre is desirable for drinking water standards, but when no alternative is available nitrate up to 100mg/litre is permissible. The presence of high nitrate content in drinking water causes infantile globinema; Nitrate values more than 100mg/litre is noticed at Vijayanagaram, Chipurapalli, Payakapadu, Gharbam, and Kanimetta stations and except at these locations in the remaining areas the nitrate concentration is within desirable to permissible limits.

The suitability of groundwater for irrigation based on the Sodium Absorption Ratio-SAR shows that the water is suitable for irrigation purpose as the values are in the range of 0.8 to 5.8 and falls in good category , except at Kothavalasa where the value of SAR is11.9.

Based on the analytical results the groundwater from shallow depths, by and large is suitable both for drinking and irrigation purposes except at few locations

4.5 Ground Water Development

The ground water development at present in the district is at very low key except in the one or two mandals, where also the development is on moderate scale only. The assessment of groundwater potential of the district brings to light that there is ample scope for developing the groundwater resource available to boost the irrigation potential. Hence besides the ground water development for agriculture, it is imperative for its scientific management, judicious use and optimum utilization. For this purpose the wells have to be suitably designed, constructed and properly spaced. In practice wells of large diameter are constructed to store large quantity of water investing huge amount of finances, which should be avoided by properly designing the wells based on local hydro geological conditions, water requirement and cropping pattern etc.

GROUNDWATER RESOURCES OF THE VIZIANAGARAM DISTRICT

[in ha.m.]

Sl. No.	Administrative Unit	Sub-Unit	Total Annual Ground Water Recharge	Provision for Natural Discharges	Net Annual Ground Water Availability	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	2	3	8	9	10	7	8	9	4	9
1	BADANGI	Command	599	60	539	180	44	328	33	Safe
		Non-command	1222	122	1100	382	71	669	35	Safe
		Total	1821	182	1639	562	115	997	34	Safe
2	BALIJIPETA	Command	1935	193	1742	44	120	1585	3	Safe
		Non-command	1181	118	1063	258	107	703	24	Safe
		Total	3116	311	2805	302	227	2288	11	Safe
3	BHOGAPURAM	Command	756	76	680	55	83	549	8	Safe
		Non-command	906	91	815	195	125	504	24	Safe
		Total	1662	167	1495	250	208	1053	17	Safe
4	BOBBILI	Command	4295	429	3866	499	206	3173	13	Safe
		Non-command	983	98	885	271	101	521	31	Safe
		Total	5278	527	4751	770	307	3694	16	Safe
5	BONDAPALLI	Command	1492	104	1388	56	81	1256	4	Safe
		Non-command	1455	73	1382	274	170	956	20	Safe
		Total	2947	177	2770	330	251	2212	12	Safe

6	CHEEPURUPALLI	Command	0	0	0	0	0	0	0	
		Non-command	1303	130	1173	603	158	423	51	Safe
		Total	1303	130	1173	603	158	423	51	Safe
7	DATTIRAJERU	Command	193	19	174	11	4	160	6	Safe
		Non-command	2385	239	2146	898	68	1248	42	Safe
		Total	2578	258	2320	909	72	1408	39	Safe
8	DENKADA	Command	869	130	739	226	77	444	31	Safe
		Non-command	959	96	863	599	130	148	69	Safe
		Total	1828	226	1602	825	207	592	51	Safe
9	GAJAPATHI NAGARAM	Command	964	48	916	248	80	594	27	Safe
		Non-command	798	40	758	336	50	381	44	Safe
		Total	1762	88	1674	584	130	975	35	Safe
10	GANTYADA	Command	925	93	832	131	98	608	16	Safe
		Non-command	1355	136	1219	317	138	779	26	Safe
		Total	2280	229	2051	448	236	1387	22	Safe
11	GARIVIDI	Command	0	0	0	0	0	0	0	
		Non-command	1964	196	1768	935	190	670	53	Safe
		Total	1964	196	1768	935	190	670	53	Safe
12	GARUGUBILLI	Command	620	62	558	185	31	345	33	Safe
		Non-command	1439	72	1367	313	111	959	23	Safe
		Total	2059	134	1925	498	142	1304	26	Safe
13	GUMMALAXMIPURAM	Command	0	0	0	0	0	0	0	
		Non-command	4177	209	3968	37	196	3741	1	Safe
		Total	4177	209	3968	37	196	3741	1	Safe
14	GURLA	Command	786	39	747	195	50	510	26	Safe
		Non-command	1821	182	1639	720	210	743	44	Safe

		Total	2607	221	2386	915	260	1253	38	Safe
15	JAMI	Command	1939	194	1745	156	116	1480	9	Safe
		Non-command	942	94	848	161	82	620	19	Safe
		Total	2881	288	2593	317	198	2100	12	Safe
16	JIYYAMMAVALASA	Command	2594	259	2335	239	142	1972	10	Safe
		Non-command	653	65	588	71	47	478	12	Safe
		Total	3247	324	2923	310	189	2450	11	Safe
17	KOMARADA	Command	0	0	0	0	0	0	0	
		Non-command	3478	348	3130	131	209	2804	4	Safe
		Total	3478	348	3130	131	209	2804	4	Safe
18	KOTHAVALASA	Command	0	0	0	0	0	0	0	
		Non-command	2052	205	1847	529	206	1143	29	Safe
		Total	2052	205	1847	529	206	1143	29	Safe
19	KURUPAM	Command	27	3	24	0	1	23	0	Safe
		Non-command	1862	186	1676	165	122	1417	10	Safe
		Total	1889	189	1700	165	123	1440	10	Safe
20	LAKKAVARAPUKOTA	Command	0	0	0	0	0	0	0	
		Non-command	1830	183	1647	299	176	1196	18	Safe
		Total	1830	183	1647	299	176	1196	18	Safe
21	MAKKUVA	Command	3886	389	3497	295	172	3049	8	Safe
		Non-command	193	19	174	6	5	167	3	Safe
		Total	4079	408	3671	301	177	3216	8	Safe
22	MENTADA	Command	1150	115	1035	100	115	833	10	Safe
		Non-command	1604	160	1444	160	64	1242	11	Safe
		Total	2754	275	2479	260	179	2075	10	Safe
23	MERAKAMUDIDAM	Command	152	15	137	19	6	113	14	Safe

		Non-command	2472	247	2225	683	167	1414	31	Safe
		Total	2624	262	2362	702	173	1527	30	Safe
24	NELLIMARLA	Command	232	23	209	47	22	143	22	Safe
		Non-command	1604	160	1444	754	233	481	52	Safe
		Total	1836	183	1653	801	255	624	48	Safe
25	PACHIPENTA	Command	1400	140	1260	87	198	989	7	Safe
		Non-command	4381	438	3943	137	86	3741	3	Safe
		Total	5781	578	5203	224	284	4730	4	Safe
26	PARVATHIPURAM	Command	0	0	0	0	0	0	0	
		Non-command	2820	282	2538	445	218	1902	18	Safe
		Total	2820	282	2538	445	218	1902	18	Safe
27	PUSAPATIREGA	Command	2069	103	1966	1040	213	734	53	Safe
		Non-command	85	9	76	55	12	11	72	Safe
		Total	2154	112	2042	1095	225	745	54	Safe
28	RAMABHADRAPURAM	Command	0	0	0	0	0	0	0	
		Non-command	2095	182	1913	529	92	1309	28	Safe
		Total	2095	182	1913	529	92	1309	28	Safe
29	SALURU	Command	811	81	730	197	80	455	27	Safe
		Non-command	2543	254	2289	391	173	1737	17	Safe
		Total	3354	335	3019	588	253	2192	19	Safe
30	SEETHANAGARAM	Command	2535	253	2282	223	83	1983	10	Safe
		Non-command	1085	109	976	430	94	481	44	Safe
		Total	3620	362	3258	653	177	2464	20	Safe
31	SRUNGAVARAPUKOTA	Command	537	54	483	62	37	391	13	Safe
		Non-command	1409	141	1268	506	199	582	40	Safe
		Total	1946	195	1751	568	236	973	32	Safe

32	THERLAM	Command	0	0	0	0	0	0	0	
		Non-command	2647	265	2382	602	214	1608	25	Safe
		Total	2647	265	2382	602	214	1608	25	Safe
33	VEPADA	Command	0	0	0	0	0	0	0	
		Non-command	2083	208	1875	276	198	1432	15	Safe
		Total	2083	208	1875	276	198	1432	15	Safe
34	VIZIANAGARAM	Command	0	0	0	0	0	0	0	
		Non-command	1638	98	1540	470	185	900	31	Safe
		Total	1638	98	1540	470	185	900	31	Safe
	District	**Command**	**30766**	**2882**	**27884**	**4295**	**2059**	**21717**	15	
		Non-command	**59424**	**5455**	**53969**	**12938**	**4607**	**37110**	24	
		Total	**90190**	**8337**	**81853**	**17233**	**6666**	**58827**	21	

5.0 GROUND WATER MANAGEMENT STRATEGY

5.1 Ground Water Development

At present the ground water abstraction in the district is quiet low as the over all level of ground water development is only 21% and there is a vast scope for further ground water development construction of additional wells. To achieve this without interfering with already existing wells the well are to be properly designed and should have proper spacing between them.

5.2 Well design and spacing

The wells should be designed in such a way that the dimensions are optimum. The optimum design of a well depends on the quantum of water to be discharged and the cropping pattern. The recommended dimensions of dug wells in crystalline formations is 6mx12m, circular wells in diameter and these wells need masonry lining in the case of crystalline rocks or RCC rings with weep holes in alluvial areas down to about 4m. depending on the thickness of loose material as a preventive measure against caving or collapsing.

For dug cum bore wells in crystalline rocks depending on the availability of fractures and week zones in the well, bores of 100mm diameter down to 30 m. from the bottom of the dug well portion of the wells is recommended. Bore wells down to 40 to 60 m. are recommended in crystalline formation, with a casing of about 10 to 15 m. against the weathered mantle to prevent caving or collapsing. In alluvial areas where the thickness of saturated zone exceeds 5m. filter point wells of 25.4 mm diameter down to a depth of 15m deep are recommended. The old dug wells can be revitalized by deepening them to about 10m. deep depending on the weathered thickness of the formation and this may improve the yield by about 30 percent or even more.

Based on the present irrigation practices, the economic viability of various types of ground water abstraction structures with the required spacing are viz. in the non command areas the spacing norms to be observed between two adjacent wells in the area is for dug wells 160m, for filter point /shallow tube wells is 120m, and for deep bore wells 300-500m.Whereas in command area 100m for dug wells, 160m. for filter point /shallow tube wells and deep bore wells between 200-300m. Similarly for wells located near perennial sources like river or tank within 200m the spacing should be 100 and 160m for dug wells and filter point wells and 200-300m for deep bore wells. In the case of wells located away the perennial stream within 100m the spacing of 150m for dug wells,180m for shallow filter point wells and 300-500 meters for deep bore wells is to be observed.

In addition to the above spacing norms, caution should be taken to avoid construction of wells at least one kilometre from coastline to prevent ingression of sea water. According to the studies, the fresh water aquifers adjacent to shore line, exceeding up to 200 to 500 m from the shoreline land

ward is found to be extremely sensitive to the fluctuations of the water table and needs judicious ground water withdrawal. As per the norms prescribed in the national water policy of India 1978 ground water development in coastal aquifers has to be taken up cautiously. This may be accomplished by the use of low capacity pumps to prevent the possibility of salt-water intrusion from the sea into fresh water zone.

5.4 Unit cost of different types of groundwater abstraction structures

The unit cost of different type of wells as adopted by the National bank for agriculture and rural development (NABRAD) and duly approved by the state unit cost committee (SUCC) for financing ground water development schemes for irrigation in Vizianagaram district shows that for a dug well of 10m. deep and 6m. dia. In the crystalline rock formation like granite and related rocks the unit cost of the abstraction structure is Rs.16300 whereas for a dug cum bore well of 10m deep and 6m diameter for in well boring at the bottom of the well of 100mm diameter with 4m screen length and 30 m deep is Rs.23400. Bore well of 150mm diameter and 40 m depth the unit cost is Rs.12500 to 14500.

In sandstone formation the unit cost of a dug well of 3metre diameter and 12 m depth is Rs.6500 whereas for a dug cum bore well of 12mx3m for the in well boring at the bottom of the well of 100mm diameter with 4m screen length and 30 m deep is Rs.31250, for a filter point well in alluvium of 100mm diameter and 15 m deep the unit cost of the structure is Rs.5000. In all the geological formations to revitalize the abstraction structure by in well boring of 100mm diameter and 25 m depth the unit cost works out to be Rs.5000.

5.5 Drinking water supply schemes

The ground water forms the main source of supply for drinking water schemes in both rural and urban areas of Vizianagaram district. The protected water supply schemes (PWS) and de fluoridization plants are maintained by the Panchayat Raj dept. Govt. of A.P. and these schemes include river lift, surface flow lift schemes, bore wells and large diameter dug wells, dug cum bore wells and hand pump fitted shallow bore wells. There are about 397 public water supply schemes, 1432 bore wells, 1156 open wells and 99 other sources of supply thus, covering 1484 inhabited villages in 34 mandals of the district catering to the drinking water needs of the district.

5.6 Irrigation by ground water resources

Ground water is the most dependent water resource for irrigation. The utilization of ground water for agriculture is practiced by the ground water abstraction structures such as dug wells, dug cum bore wells and bore wells. The area irrigated by ground water in the district during the year 2009-10 is 47915 ha Out of the total irrigated area ground water irrigation is accounted for 31%. The A.P. State Government (DWMA) has carried out integrated watershed development programme in Vizianagaram district in various

mandals of the area under various phases of watershed development. A total area of 48500 hectares is covered with a cost of 2664 lakhs.

5.7 Water Conservation & Artificial Recharge

Since almost all the Mandals in the district fall under safe category so far as ground water development is concern hence till date CGWB has not taken up any studies where in any conservation or artificial recharge structures are to be constructed.

6.0 GROUND WATER RELATED ISSUES & PROBLEMS

No ground water related problems exist in the district except that the in few of the mandals the exploratory drilling has failed in hard rock terrain.

7.0 AWARENESS & TRAINING ACTIVITY

Mass Awareness Programme & Water Management Training Programmes

CGWB has organized two Mass Awareness programs (MAP) i.e. at Kothavalasa and Bhogapuram in the district and one Water Management Training Programme at Vizianagaram. Mass Awareness program at Kothavalasa was organized on 2nd December, 2004. It was attended by about 300 people constituting Farmers representatives, DWAKRA members, School children and members of the media. The second mass awareness program was organized at Bhogapuram on 14th December, 2006.

8.0 RECOMMENDATIONS

1. As per the ground water resource estimation (year 2008-2009) the net annual ground water availability is 81853 ha.m., out of which 27884 ha.m. is available in command area, 53969 ha.m. in non-command area. The stage of ground water development in the district at present stands only 21% out of which 24% is in non-command area and 15% is in command area hence, there is a big scope for ground water development in the district
2. While taking up development schemes priority may be given to the mandals where the ground water development is less than 30%.
3. The development activities of the district may be reviewed critically once the level of ground water development crosses 50%. This will enable to understand how the ground water regime is responding to the increase in stress as well as to the recharge component.
4. The development of ground water should be planned in a scientific manner such a way that it does not interfere with the ecological balance in the district.