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Technical Report Series

**DISTRICT GROUNDWATER BROCHURE
TIRUNELVELI DISTRICT, TAMIL NADU**

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Government of India
Ministry of Water Resources
Central Ground Water Board
South Eastern Coastal Region
Chennai
April 2009

DISTRICT AT A GLANCE (TIRUNELVELI DISTRICT)

S.NO	ITEMS	STATISTICS	
1.	GENERAL INFORMATION		
	i. Geographical area (Sq. km)	6823.08	
	ii. Administrative Divisions as on 31-3-2007		
	Number of Taluks	9	
	Number of Blocks	19	
	Number of Villages	586	
	iv. Population (as on 2001 Censes)		
	Total Population	2723988	
	Male	1333939	
	Female	1390049	
	v. Average Annual Rainfall (mm)	879.78	
2.	GEOMORPHOLOGY		
	i. Major physiographic Units	Papanasam Upper Slopes, Kalakkadu Upper Slopes, Chittar Plains, Tamarabarani Plains & Naguneri Plains	
	ii. Major Drainages	Thambarabarani, Nambiar, Chithar & Karamaniyar.	
3.	LAND USE (Sq. km) during 2005-06		
	i. Forest area	1208.01	
	ii. Net area sown	1666.21	
	iii. Cultivable waste	474.42	
4.	MAJOR SOIL TYPES	Deep Red soil, Block Cotton Soil, Red Sandy Soil, Saline Coastal Alluvium and River Alluvium.	
5.	AREA UNDER PRINCIPAL CROPS (AS ON 2005-2006)	1. Paddy: 86397 Ha, 62 % 2. Sugarcane: 4614, 3% 3. Groundnut: 2553 Ha, 2 % 4. Pulses: 2193 Ha, 2 %	
6.	IRIGATION BY DIFFERENT SOURCES (During 2005-06)	Number	Area irrigated (Ha)
	i. Dug wells	-	45376
	ii. Tube wells	-	971
	iii. Tanks	22272	46980
	iv. Canals	285	17556
	vi. Net irrigated area	111132 ha	
	vii. Gross irrigated area	139776 ha	
7.	NUMBERS OF GROUND WATER MONITORING WELLS OF CGWB (AS ON 31.03.2007)		
	i. No of dug wells	32	
	ii. No of piezometers	24	
8.	PREDOMINANT GEOLOGICAL FORMATIONS	Recent Alluvium, Granite Gneiss & Charnockite	

9.	HYDROGEOLOGY	
	i. Major water bearing formations	Alluvium, weathered Granite Gneiss & Charnockite.
	ii. Pre- monsoon depth to water level (May 2006)	1.19 to 13.35 m bgl
	iii. Post- monsoon depth to water level (Jan'2007)	0.18 to 07.97 m bgl
	iv. Long term water level trend in 10 years (1998-2007) in m/yr	Annual
		Rise (m/year) Fall (m/year)
		Min : 0.0021. Min : 0.0169. Max :1.1284. Max: 0.6893.
10.	GROUND WATER EXPLORATION BY CGWB (As on 31-03-2007)	
	i. Number of Exploratory wells	25.
	ii. Number of Observation wells	5.
	iii. Number of Piezometers under Hydrology Project.	25.
	iv. Depth range (m)	20.40 to 212.0 m. bgl.
	v. Discharge (lps)	1 to 4.50.
	vi. Storativity (S)	1.87×10^{-5} to 4.8×10^{-3}
	vii. Transmissivity (m^2 / day)	3 to 475
11.	GROUND WATER QUALITY AS ON MAY 2006	
	i. Presence of chemical constituents more than permissible limit	NO ₃ , Cl, & TDS .
	ii. Type of water	NaCl , & Mixed
12.	DYNAMIC GROUND WATER RESOURCES (as on 31.03.2004) in MCM	
	i. Annual Replenishable Ground Water Resources	897.49
	ii. Total Annul Ground Water Draft for all purposes	465.69
	iii. Projected demand for Domestic and Industrial Uses up to 2025	40.38
	iv. Stage of Ground Water Development	52 %
13.	AWARENESS AND TRAINING ACTIVITY	
	i. Mass Awareness Programmes Organized	
	Date	2005-06
	Place	Sankarankoil
	No of Participants	300
	ii. Water Management Training Organized	
	Date	2005-06
	Place	Tirunelveli.
	No of Participants	28
14.	EFFORTS OF ARTIFICIAL RECHARGE & RAINWATER HARVESTING	
	Technical Guidance were provided as when sought	
	i. Projects completed by CGWB in IX five year plan (RWH Structures)	Nil
	ii Amount spent	
15.	GROUND WATER CONTROL AND REGULATION	
	i. Number of OE Blocks	4
	ii. Number of Critical Blocks	Nil
	iii. Number of Blocks Notified	Nil
16.	MAJOR GROUND WATER PROBLEMS AND ISSUES.	
	Water scarcity in select pockets of the district due to over exploitation.	

1.0 INTRODUCTION

1.1 Administrative Details

Tirunelveli district is divided into 9 taluks. The taluks are further divided into 19 blocks, which further divided into 586 villages.

S.No.	Taluk	Block	No.of Villages
1	Tirunelveli	Manur	66
2	Palayamkottai	Palayamkottai	74
3	Sankarankoil	Sankarankoil	24
		Kuruvikulam	51
		Melaneelitha nallur	24
4	Sivagiri	Vasudevanallur	25
5	Tenkasi	Tenkasi	24
		Kadayanallur	16
		Kelapavoor	18
		Alangulam	28
6	Senkottai	Senkottai	10
7	Nanguneri	Nanguneri	37
		Kalakkadu	37
8	Ambasamudram	Ambasamudram	22
		Pappakudi	24
		Cheranmadevi	34
		Kadayam	22
9	Radhapuram	Radhapuram	27
		Valliyur	23
	Total		586

1.2 Basin and sub-basin

The district is part of the composite east flowing river basin,“ Between Vaippar and Nambiar ” as per the Irrigation Atlas of India. Tambarabarani, Vaipar and Nambiar are the important Sub-basins.

1.3 Drainage

Tamarabarani, Nambiar, Chittar and Karamanar are the important rivers draining the district. Tamarabarani originating from Papanasam flows through the district. The Nambiar river originates in the eastern slopes of the Western ghats near Nellikalmottai about 9.6 km west of Tirukkurugundi village at an altitude of about 1060 m amsl. At the foot of the hills, the river is divided into two arms. The main arm is joined by Tamarabarani at the foothills. Chittar originates near Courtallam and flows through Tenkasi and confluences with Tamarabarani. The hilly terrains have resulted in number of falls in the district. There are three major falls in Manimuttar Reservoir catchments area and there are few falls in the Tamarabarani river also. A series of falls in Chittar river in Courtallam comprising Five Falls, Honey Falls, Main falls and Old Courtallam Falls are some of the important falls in the area. The drainage pattern in general is dendritic. In addition, there are eight dams at the places as given below for irrigation and power generation purposes.

Papanasam, Servalar, Manimuttar, Gadana Nadhi, Ramanathi, karuppanadhi, Gundat & Advainainar Koil.

1.4 Irrigation Practices

The nine-fold lands use classification for the district is given below. (2005-06)

S.No	Classification	Area (Ha)
1	Forests	120801
2	Barren & Uncultivable Lands	30961
3	Land put to non agricultural uses	103669
4	Cultivable Waste	47442
5	Permanent Pastures & other grazing lands	5271
6	Groves not included in the area sown	10009
7	Current Fallows	32053
8	Other Fallow Lands	165481
9	Net Area sown	166621
	Total	682308

(Source: Department of Economics & Statistics, Govt. of Tamil Nadu)

The chief irrigation sources in the area are the tanks, reservoirs and followed by wells and bore wells.

The block wise and source wise net area irrigated in Ha is given below (2005-06).

S. No	Block	Net area irrigated by					Total Net Area irrigated
		Canals	Tanks	Tube/Bore wells	Ordinary wells	Other Sources	
1	Manur	2453	2997	0	1856	0	7306
2	Palayamkottai	2314	3672	0	967	0	6953
3	Sankarankoil	0	2019	0	3276	0	5295
4	Kuruvikulam	0	943	0	3989	0	4932
5	Melaneelitha nallur	0	1264	49	2390	0	3703
6	Tenkasi	1178	2904	79	1032	2	5195
7	Kelapavoor	598	2891	0	1760	0	5249
8	Alangulam	0	775	0	3847	0	4622
9	Kadayanallur	503	3244	114	2567	0	6428
10	Senkottai	1052	1749	0	522	0	3323
11	Vasudevanallur	0	6311	0	6331	247	12889
12	Ambasamudram	2578	1253	8	329	0	4168
13	Kadayam	1700	1916	51	1517	0	5184
14	Cheranmadevi	2762	2492	25	1129	0	6408
15	Pappakudi	1486	1903	0	3204	0	6593
16	Nanguneri	16	4636	324	2668	0	7644
17	Kalakkadu	916	4161	6	2007	0	7090
18	Radhapuram	0	975	161	2685	0	3821
19	Valliyur	0	875	154	3300	0	4329
	Total	17556	46980	971	45376	249	111132

(Source: Department of Economics & Statistics, Govt. of Tamil Nadu)

1.5 Studies/Activities carried out by CGWB

Central Ground Water Board carried out the Systematic hydrogeological surveys in the district during the period between 1977-78, 1978-79 and 1989-90. Detailed Geophysical investigations (Electrical Resistivity Surveys and Profiling) were carried out in parts of Nanguneri, Sattankulam and Tiruchendur taluks in 1978. Reappraisal hydrogeological surveys were conducted during the period of 1993 – 94.

CGWB carried out exploratory drilling in the coastal sedimentary tract of the area and six exploratory boreholes were drilled down to the basements in depth ranging from 45 to 130m bgl. Groundwater exploration was also taken up by CGWB in hard rock. In hard rock areas 12 bore holes were drilled down to a depth of 200m bgl.

CGWB is monitoring the groundwater regime for the changes in water level and water quality through 32 dug wells and 24 piezometers. The monitoring of water levels are carried out during May (Pre monsoon), August (Middle of south west monsoon), November (post south west monsoon & initial stage of north east monsoon) & January (Post North east monsoon) to study the impact of rainfall on groundwater regime. Water samples are collected during May for determining the changes in chemical quality of groundwater.

2.0 RAINFALL AND CLIMATE

The district receives the rain under the influence of both southwest and northeast monsoons. The northeast monsoon chiefly contributes to the rainfall in the district. Rainfall data from IMD stations over the period 1901-2000 were utilized and a perusal of the data shows that the normal annual rainfall over the district is 879 mm. It is the maximum around Senkottai, Sankarankoil and all along the coast and it decreases towards inland. The areas around Ambasamudram, Tirunelveli and Kadayanallur receive minimum rainfall.

The district enjoys a Sub tropical climate. The period from May to June is generally hot and dry. The weather is pleasant during the period from December to January. The relative humidity is on an average between 79 and 84%. The mean minimum temperature is 22.9°C and mean maximum daily temperature is 33.5°C respectively.

3.0 GEOMORPHYLOGY AND SOIL TYPES

3.1 Geomorphology

Tirunelveli district is bordered by Western Ghats (Ridge and valley complex) in the West. A major part of the district constitutes a plain terrain with a gentle slope toward East and Southeast, except for the hilly terrain in the west. The general elevation of the area varies from less than 10 to 1408 m amsl (Tulukkaparai hill range)

The prominent geomorphic units identified in the district through interpretation of Satellite imagery are Structural Hill, Bazada Zone, Valley Fill, Flood Plain, Pediment, Shallow buried pediment, Deep buried pediment and Coastal Plain.

3.2 Soils

Soils in the area have been classified into i) Deep Red soil ii). Red Sandy Soil. iii) Block Cotton Soil. iv) Saline Coastal Alluvium, and v) River Alluvium. Major parts

of the area are covered by Deep Red soil and are found in Sivakasi, Tenkasi, Senkottai and Sankarankoil blocks and it is suitable for cultivating coconut and palmyrah trees. Red sandy soil also in reddish yellow in colour and are found in Nanguneri, Ambasamudram, and Radhapuram blocks and it is suitable for cultivating groundnut, millets and pulses etc., The Block Cotton Soil is found in Tirunelveli, Palayankottai and Sankarankoil blocks, and it is suitable for cultivating Paddy, Ragi, and Cholam etc., The Saline Coastal Alluvium are dark grey to deep brown in colour and spread over the Nanguneri and Radhapuram blocks. The River alluvial soils occur along the river courses of Tamrabarani and Chittar river covering in the blocks Tirunelveli and Palayankottai and it is suitable for cultivating Groundnut, Chillies and Cumbu.

4.0 GROUND WATER SCENARIO

4.1 Hydrogeology

The district is underlain by both porous and fissured formations. The important aquifer systems in the district are constituted by i) Weathered and fractured hard rock formations of Archaean age. ii) Porous sedimentary formations ranging in age from Tertiary and Recent.

The porous formations are found as small patch in the southeastern part of the district and include sandstones, Limestones, Laterite and Clays from Tertiary to Quaternary. Isolated occurrence of calcareous sandstone and fossiliferous limestone are seen in coastal area on the southeastern side. The fossiliferous limestone is found south west of Kudankulam covering an area of 3 sq.km. Laterites are exposed as patches along Radhapuram-Edakkadu, Vijayanarayanam-Kumarapuram, Ittamoli, Nanguneri and Uramozi area. Beach sand occurs as a patch along the coast with a width varying from 50-250m in Idindakarai-Ovari Belt. The river alluvium is found along the river courses and the thickness of alluvium is restricted to 5-6m.

The exploration in sedimentary tract has revealed that the depth to basement occurs at a depth of 120m bgl and granular zones are encountered between the depths of 20 to 92 m bgl. The yield of bore wells varies from 1-4.5 lps. The aquifer at the shallow depth is under unconfined condition and aquifer at depth is under semi-confined to confined condition. The shallow aquifer is developed through dug wells and deeper aquifer through tube wells. The dug well can sustain a pumping of 4 to 6 hours while the tube wells can sustain a pumping of 6-8 hours.

The water-bearing properties of crystalline formations, which lack primary porosity, depend on the extent of development of secondary intergranular porosity. These aquifers are highly heterogeneous in nature due to variation in lithology, texture and structural features even within short distances. Ground water generally occurs under phreatic conditions in the weathered mantle and under semi-confined conditions in the fissured and fractured zones at deeper levels. The thickness of weathered zone in the district is in the ranges up to 30m bgl.

The yield of large diameter wells in the district, tapping the weathered mantle of crystalline rocks ranges from 50 to 250 lpm and are able to sustain pumping for 3 to 5 hours per day. The Specific capacity of large diameter wells tested in crystalline rocks ranges from 25 to 300 lpm / m. of drawdown. The yield characteristics of wells

vary considerably depending on the topographic set-up, lithology and nature of weathering.

The groundwater exploration in the district down to a depth of 200m bgl has revealed that in the western part of the district potential fractures are encountered beyond 100m bgl while in the rest of the area, potential fractures are restricted to 100m bgl. The yield of the wells varies from 1 to 3.6 lps. In general, the wells drilled by various State agencies mainly for domestic purposes have yield in the range of 63 to 270 lpm.

The depth to water level in the district varied between 1.19 to 13.35 m bgl during pre-monsoon depth to water level (May 2006) and varied between 0.18 to 7.97 m bgl during post monsoon depth to water level (Jan 2007). The seasonal fluctuation shows a fall in water level, which ranges from -0.12 to -2.14 m bgl, and rise in water level, which ranges from 0.33 to 11.24 m bgl. The piezometric head varied between 1.72 to 13.65 m bgl (May 2006) during pre monsoon and 0.47 to 13.25 m bgl during post monsoon.

4.1.1 Long Term Fluctuation (1998-2007)

The long-term water level fluctuation for the period 1998-2007 indicates both rise and fall in different parts of the district. The rise in water level is in the range of 0.0021 to 1.1284 m/year, while the fall is the water level varies between 0.0169 and 0.6893 m/year.

4.1.2 Aquifer Parameters

Formation	Yield of wells (lps)	Transmissivity (m ² /day)	Hydraulic Conductivity (m/day)	Specific Yield (%)	Storativity
Porous Formation	1.0-4.5	50-250	20-65	3-6	1.98X10 ⁻⁴
Weathered Rock	<1 – 4.0	25-150	<1 -15	1.5	-
Fractured Rock	1.0-3.6	25-250	<1-25	-	1.87X10 ⁻⁵ to 4.8X10 ⁻³

4.2 Ground Water Resources

The ground water resources have been computed jointly by Central Ground Water Board and State Ground & Surface Water Resources and Development Centre (PWD, WRO, Government of Tamil Nadu) as on 31st March 2004 and salient features of the computations are furnished as a table.

4.3 Ground Water Quality

The chemical characteristics of ground water in the phreatic zone in Tirunelveli district has been studied using the analytical data of ground water samples collected from Network Hydrograph Stations of CGWB and for deeper aquifers from water samples collected during exploration programme of CGWB.

Block	Net Groundwater Availability (M.Cu.m)	Existing Gross Draft for Irrigation (M.Cu.m)	Existing Gross Draft for Domestic and industrial water supply (M.Cu.m)	Existing Gross Draft for all uses (M.Cu.m)	Allocation for Domestic and Industrial Requirement supply up to next 25 years (2029) (M.Cu.m)	Net groundwater Availability for future Irrigation Development (M.Cu.m)	Stage of Ground water Development (%)	Category of Block
Alangulam	46.92	34.77	2.21	36.98	2.29	9.86	79	Semi Critical
Ambasamudram	38.30	1.52	2.97	4.49	3.07	33.71	12	Safe
Cheranmadevi	45.01	11.49	2.54	14.03	2.63	30.88	31	Safe
Kadayam	43.47	13.48	1.96	15.44	2.03	27.96	36	Safe
Kadayanallur	51.45	21.00	1.29	22.29	1.34	29.12	43	Safe
Kalakkadu	41.36	17.24	0.87	18.10	0.90	23.23	44	Safe
Kelapavoor	43.58	23.54	3.00	26.54	3.10	16.94	61	Safe
Kuruvikulam	48.72	30.90	2.28	33.19	2.36	15.42	68	Safe
Manur	69.80	20.16	2.41	22.58	2.50	47.13	32	Safe
Melaneelithanallur	36.29	35.78	1.77	37.55	1.83	-0.13	103	Over-Exploited
Nanguneri	66.02	23.33	2.09	25.42	2.17	40.52	39	Safe
Palayamkottai	56.66	14.82	3.28	18.09	3.39	38.45	32	Safe
Pappakudi	35.94	17.31	1.48	18.79	1.53	17.10	52	Safe
Radhapuram	24.45	23.44	1.42	24.86	1.47	-0.46	102	Over-Exploited
Sankarankoil	39.96	39.11	1.85	40.97	1.92	-1.07	103	Over-Exploited
Senkottai	36.14	3.41	1.53	4.94	1.59	31.14	14	Safe
Tenkasi	47.49	12.50	2.00	14.50	2.07	32.91	31	Safe
Valliyur	27.79	26.50	1.53	28.03	1.58	-0.29	101	Over-Exploited
Vasudevanallur	98.15	56.35	2.54	58.89	2.63	39.17	60	Safe
Total	897.49	426.68	39.01	465.69	40.38	430.42	51.89	

Ground water quality of phreatic aquifers in Tirunelveli district, in general, is colourless, odourless and slightly alkaline in nature. The specific electrical conductance of ground water in phreatic zone (in MicroSeimens at 25° C) during May 2006 was in the range of 510 to 9320 $\mu\text{S}/\text{cm}$. And major parts are having the electrical conductivity below 1500 $\mu\text{S}/\text{cm}$.

The quality of formation water in the fractured aquifer varies from place to place. Electrical Conductivity varies from 487 (Kuruvikulam) to 3620 $\mu\text{S}/\text{cm}$ (Taruvai) at 25° C and Chloride content varies from 28 to 1049 mg/L. Electrical conductivity in major parts of the district is less than 2000 $\mu\text{S}/\text{cm}$ at 25°C.

The quality of groundwater in porous formation shows variations with depth. The exploration at Puttataruvai (near the boundary of Thoothukudi District) revealed the presence of good quality water in the depth range of 24-32m while the saline water was noticed in the depth range of 49-54 & 75-78m bgl.

It is observed that the ground water is suitable for drinking and domestic uses in respect of all constituents except few places are having higher concentration of NO₃ than the BIS permissible limit.

4.4 Status of Ground Water Development

The estimation of groundwater resources for the district has shown that 1 block is “Semi Critical”, four blocks are “Over-Exploited” and 14 blocks is under “Safe” category. The shallow alluvial aquifers along Thamarabarani river serve as an important source of drinking water and irrigation development for Tirunelveli district. Dug wells are the most common ground water abstraction structures used for irrigation in the district. The yield of dug wells range from 15 to 100 Cu.m per day for a pumping of 4-6 hours while the bore well can yield about 30-100 Cu.m per day for a pumping of 8-10 hours in a day.

5.0 Groundwater Management Strategy

5.1 Groundwater Development

In view of the comparatively high level of ground water development in Melneelithinallur, Valiyur, Sankarankoil & Radhapuram Blocks, further groundwater development cannot be taken up without augmenting the potential. In rest of the blocks, dug well or bore well can be used as groundwater abstraction structure. The depth of dug well will depend on the thickness of the weathered residuum and the availability of saturation thickness during the pre monsoon period. The feasibility of bore well will depend on the availability of fractures. In the western part of the district, there is a chance of getting potential fractures beyond 100m bgl while in the rest of the district, the potential fractures are restricted to 100m bgl.

The map showing the development prospects for the district is shown in Plate VI.

5.2 Water Conservation and Artificial Recharge

CGWB had prepared a master plan to augment groundwater potential by saturating the shallow aquifer taking into consideration the available unsaturated space during

post monsoon and available uncommitted surplus run off. Subsequently, computations have been made for Drought Prone Area Programme (DPAP) for over exploited and critical blocks in the districts warranting immediate attention. Institute of Remote Sensing, Anna University had prepared block wise maps demarcating potential zones for artificial recharge for the State of Tamil Nadu. Subsequently, State Government agencies have constructed artificial recharge structures with their own fund or with fund from Central Government, dovetailing various government programmes.

Ministry of Water Resources, Government of India has initiated Dug Well Recharge Scheme in the State. The scheme is being implemented by the Nodal Department (SG&SWRDC, PWD, WRO, Government of Tamil Nadu) with the technical guidance of CGWB. The subsidy of Rs4000/- for small and marginal farmers and Rs2000/- for the other farmers is credited to the beneficiaries' bank account through NABARD. The scheme after implementation will prove to be beneficial to the irrigation sector. The available uncommitted surplus run off has to be recomputed, taking into consideration the quantum of recharge effected through existing irrigation dug wells also. The existing structures and uncommitted surplus flow should be considered for further planning of artificial recharge programme.

On the basis of experimental studies, it has been found that desilting of existing tanks followed by percolation pond with recharge wells, recharge shafts are economical.

There is considerable scope for implementation of roof – top rainwater harvesting in the district. Recharge pits / Shafts / trenches of suitable design are ideal structures for rainwater harvesting in such areas. Central Ground Water Board is also providing free technical guidance for implementation of rooftop rainwater harvesting schemes.

6.0 Groundwater related Issues & Problems

In view of the comparatively high level of ground water development in Melneelithinallur, Valiyur, Sankarankoil & Radhapuram Blocks, these blocks may be considered as vulnerable to water level depletion. Radhapuram Block being on the coast, the high level of groundwater development may result in seawater intrusion in future if augmentation measures are not taken up.

7.0 Awareness & Training Activity

Mass Awareness Campaign was conducted in Sankarankoil during the period 2005-06 nearly 300 persons participated the Campaign.

Water Management Training Programme (WMTP) was also conducted in Tirunelveli during the period 2005-06 and about 30 trainees from State Departments, Academic Institutions and NGOs participated in the training programme.

8.0 Area Notified by CGWA/SGWA

Central Ground Water Authority has not notified any area in the district. Government of Tamil Nadu vide G.O.No. 53 has restricted groundwater development for irrigation in the over exploited blocks of Tamil Nadu. In Tirunelveli district the over exploited blocks are as follows.

1. Melaneelitha nallur
2. Radhapuram

3. Sankarankoil
4. Valliyur

9.0 Recommendations

As the development of ground water has still in safe stage in many blocks of this district, further development of ground water for creation of additional irrigation potential has to be carried out with extreme caution.

Necessary measures for regulating the exploitation of ground water may be implemented in the Over Exploited blocks of the district.

Intensive monitoring of ground water levels and water quality has to be taken up in the coastal areas of the district to monitor the movement of fresh water – saline water interface.

Waste land development programme and micro irrigation system has to be implemented for increasing the agricultural produces by way of more food and income per drop of water in view of the limited water resources in the districts.

PLATE - I

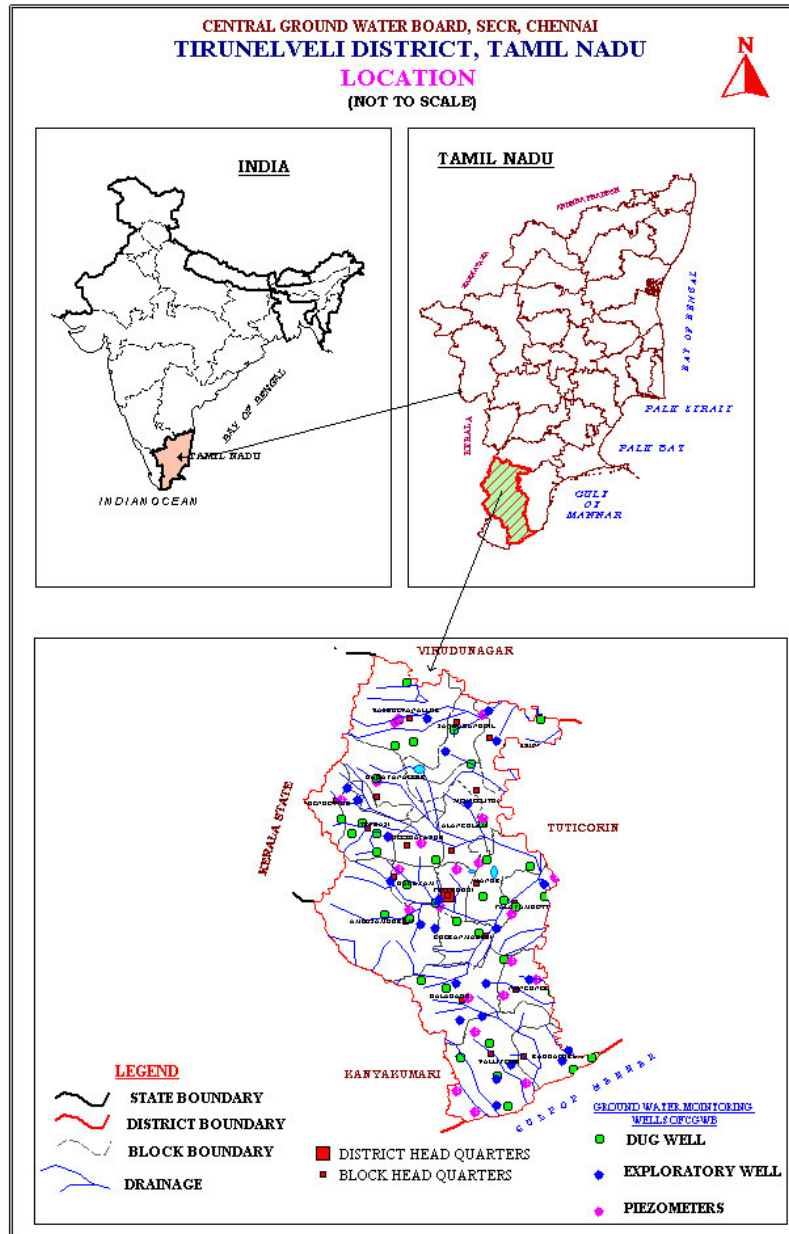


PLATE - II

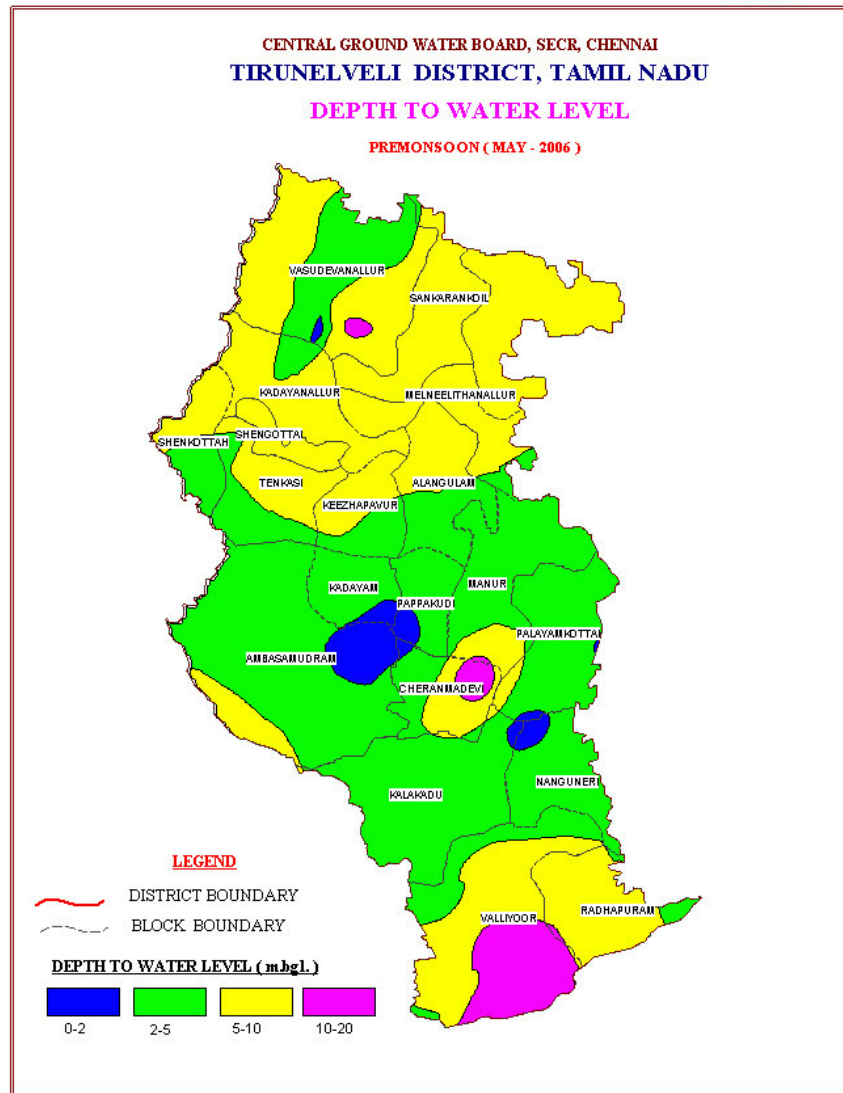


PLATE III

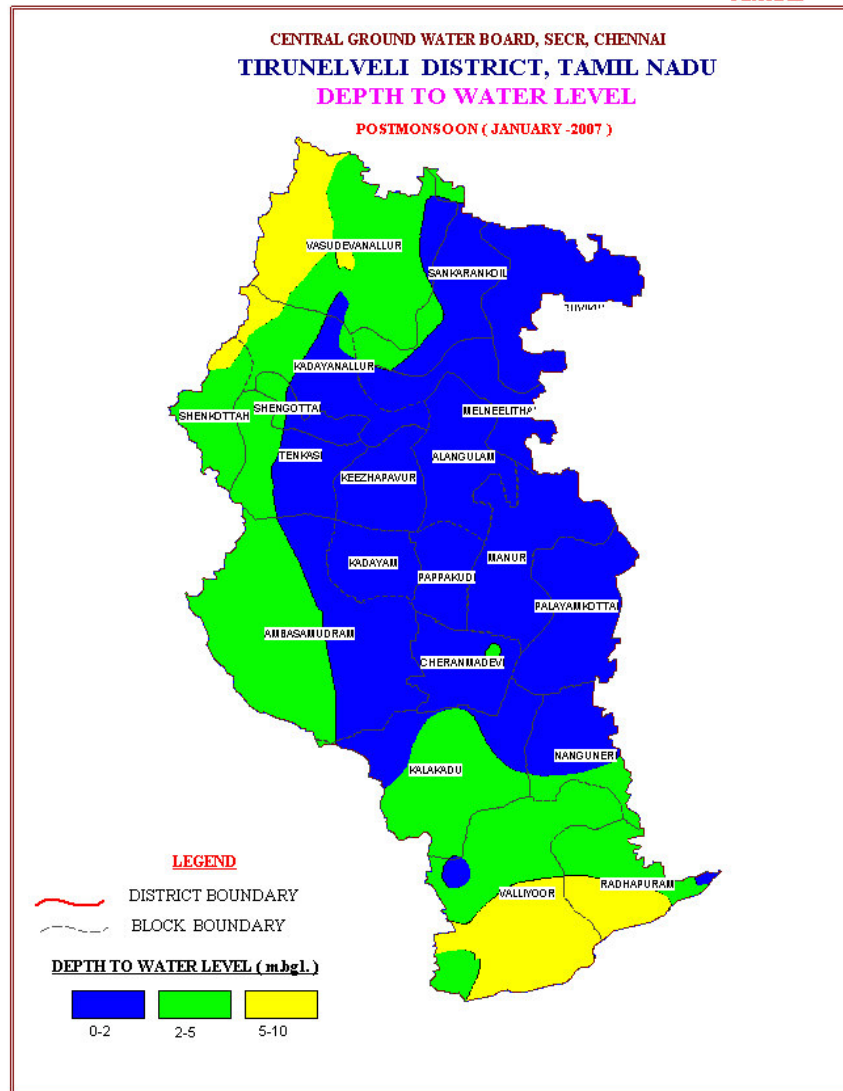


PLATE IV

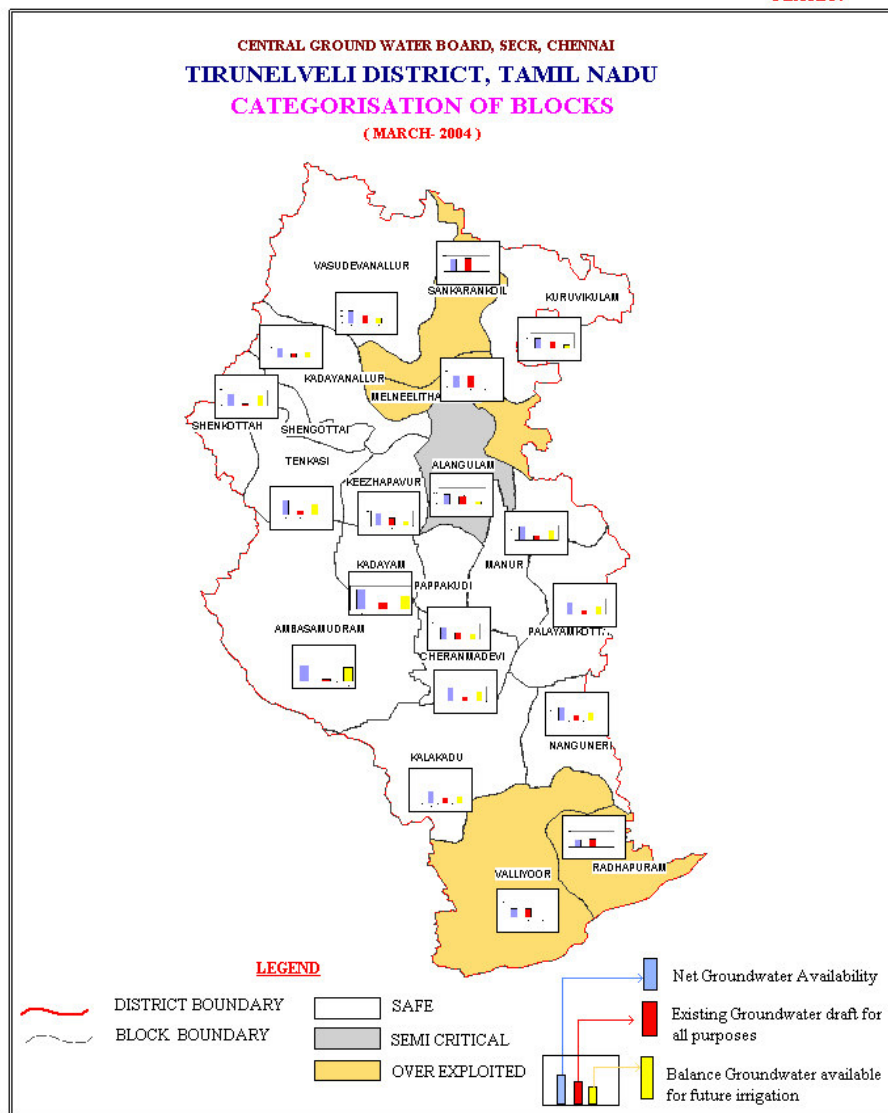
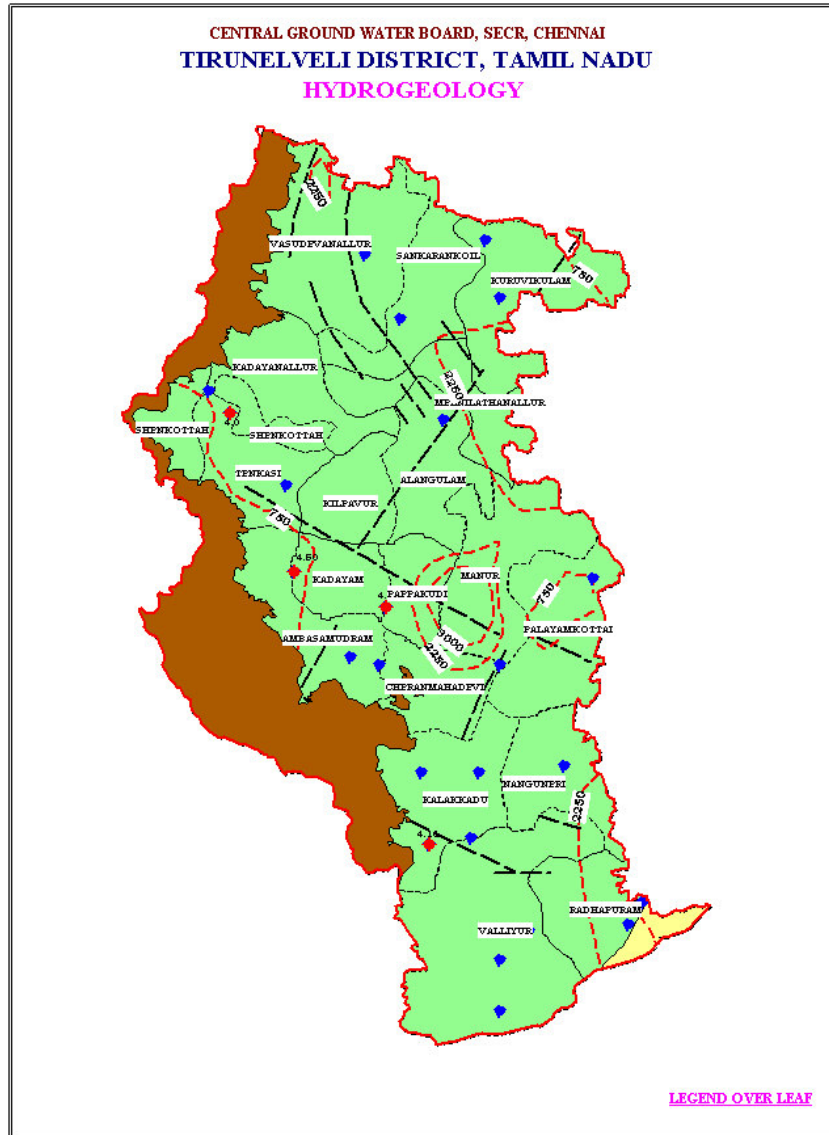







PLATE V





LEGEND FOR PLATE V


ADMINISTRATIVE SETUP

-  STATE BOUNDARY
-  DISTRICT BOUNDARY
-  BLOCK BOUNDARY
-  HILLY AREA
-  TRIANGULATION HEIGHT
[elevation in meters]


GROUND WATER HYDROLOGY

-  EXPLORATORY BORE WELL [CGWB]
-  HIGH YIELDING BORE WELL [CGWB]

HYDROCHEMISTRY

 750 ISOCONS [Sp ELECTRICAL CONDUCTANCE [$\mu\text{s}/\text{Cm}$ at 25° C]

STRUCTURE

 TRACE OF LINEAMENT



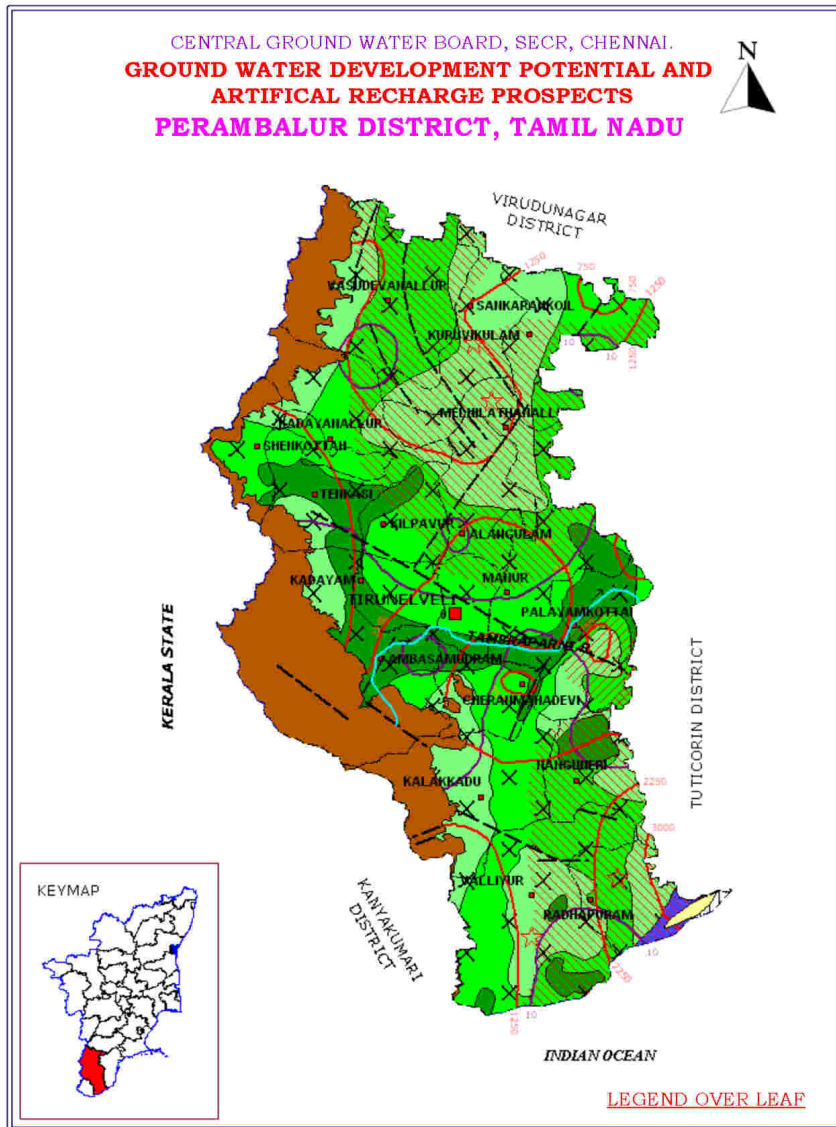














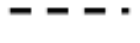



<u>AQUIFER</u>	<u>AGE</u>	<u>LITHOLOGY</u>	<u>GROUND WATER CONDITIONS</u>	<u>YIELD PROSPECTS (CU.M/D)</u>	<u>GROUND WATER DEVELOPMENT STRATEGIES</u>	
	UNCONSOLIDATED	RECENT	RIVER ALLUVIUM, VALLEY FILL-DEPOSITS	DISCONTINUOUS, THIN, UNCONFINED TO SEMI CONFINED	> 200	DEVELOPMENT THROUGH LARGE DIAMETER DUG WELLS AND SHALLOW TUBE WELLS.
	CONSOLIDATED	ARCHAEAN	GRANITES, GNEISSES, CHARNOKITE.	DISCONTINUOUS, UNCONFINED TO SEMI CONFINED AQUIFERS, RESTRICTED TO WEATHERED RESIDUUM AND FRACTURES	< 50 NEAR WATERSHED DIVIDES & HIGH GROUND S. 50 - 200 NEAR THIRD ORDER STREAMS AND LOW GROUND S.	SUITABLE FOR DEVELOPMENT THROUGH DUG WELLS BOREWELLS FEASIBLE IN FRACTURE ZONES, BEST LOCATIONS BEING INTERSECTION OF FRACTURES

PLATE VI



LEGEND PLATE FOR VI

DISTRICT –TIRUNELVELI

	Wells Feasible	Rigs Suitable	Depth Of Well (M)	Discharge (LPM)	Suitable Artificial Recharge Structures
 Soft Rock Aquifer	Dug Well Tube Well	Manual Direct Rotary	20 90-120	60 - 180	Percolation Roads
 Hard Rock Aquifer	Dug Well Bore Well	Manual DTH	12-15 60-100	10 - 60	Check Dams/ Percolation Ponds In Plain Areas
 Hard Rock Aquifer	Dug Well Bore Well	Manual DTH	12-15 60-75	60 - 180 50 - 100	Check Dams/ Percolation Ponds In Plain Areas
 Hard Rock Aquifer	Dug Well Dug Well Bore Well	Manual Manual DTH	10-12 12-15 60-100	More Than 180	Check Dams Across River/ Percolation Roads In Plain Areas
	Vulnerable For Seawater Intrusion				Rain Water Harvesting
	State Boundary			District Boundary	
	Hilly Area			Block Boundary	
	District Headquarter			Block Headquarters	
	Water Level Pre-Monsoon (Decashl Mem 1993-2002) bhgl			EE In Microsims / Cm. At 25°C	
	River			Lienent	
	Fluoride Greater Than Maximum Permissible Limit (1.5mg/L)			Nitrate Greater Than Maximum Permissible Limit (45mg/L)	
	Saline Zone				

OTHER INFORMATION

Geographical Area	6828.08 Sq Km.
Number Of Blocks	19
Major Drainage	Tambaparnai, Chittar, Karanazhiyar & Nambiyar.
Population (2001)	27,23,988
Average Annual Rainfall	880mm
Annual Range Of Temperature	23 - 45°C
Regional Geology	Soft Rocks: Sandstone, Limestone and Shale Hard Rocks: Charnodites, Gneisses and Hornblites
Net Ground Water Availability For Future Irrigation	430mcn/yr
Stage Of Ground Water Development As On January 2003	52 %
Name Of Blocks Showing Intensive Ground Water Development	★ Over-Exploited: Melkuchtharallur, Reddiperam., Sarabani Kott & Vallyur

SAVE WATER

AND

CONSERVE WATER