WATER YEAR 2007

GROUND WATER BROCHURE
PUDUCHERRY REGION
U.T. OF PUDUCHERRY

जल वर्ष 2007 — Water Year 2007

स्वच्छ सुरक्षित जल – सुन्दर खुशहाल कल

CONSERVE WATER - SAVE LIFE

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

REGION AT A GLANCE (PUDUCHERRY REGION)

S.NO	ITEMS	STATISTICS
1.	**GENERAL INFORMATION**	
	i. Geographical area (Sq.km)	**293**
	ii. Administrative Divisions as on 31-3-2007 Number of Communes Number of Villages	 7 164
	iii. Population (as on 2001 Census) Total Population Male Female	 735332 369428 365904
	iv. Average Annual Rainfall (mm)	1272.70
2.	**GEOMORPHOLOGY**	
	i. Major physiographic Units	Coastal plain, Alluvial plain and Uplands
	ii. Major Drainages	Gingee & Ponnaiyar.
3.	**LAND USE (In Hectares) during 2005-06**	
	i. Forest area ii. Net area sown iii. Cultivable waste	Nil 12950 1586
4.	**MAJOR SOIL TYPES**	1.Red soil 2.Black soil 3.Alluvial soil 4.Colluvial soil
5.	**AREA UNDER PRINCIPAL CROPS (AS ON 2005-2006)**	1. Paddy -15759 Ha – 72% 2. Sugarcane – 2074 Ha – 9% 3. Groundnut – 1147 Ha – 5%
6.	**IRIGATION BY DIFFERENT SOURCES (During 2005-06)**	**Net Area irrigated (Ha)**
	i. Dug wells	-
	ii. Tube wells	11508
	iii. Tanks	-
	iv. Canals	-
	v. Other Sources	-
	vi. Net irrigated area	11508 ha
	vii. Gross irrigated area	21983 ha
7.	**NUMBERS OF GROUND WATER MONITORING WELLS OF CGWB (AS ON31.03.2007)**	
	i. No of dug wells	4
	ii. No of piezometers	7

8.	**PREDOMINANT GEOLOGICAL FORMATIONS**	Recent Alluvium, Sandstones, Claystones & Limestones of Cretaceous & Tertiary Sediments.			
9.	**HYDROGEOLOGY**				
	i. Major water bearing formations	Cuddalore & Vanur Sandstones.			
	ii. Pre monsoon (June 2006) Depth to water level in Alluvial Aquifer Depth to Piezeometric Surface in Tertiary Aquifer Depth to Piezeometric Surface in Cretaceous Aquifer	 3.82 – 31.94 6.09 – 33.87 8.60 – 63.24			
	iii. Post monsoon (Jan'2007) Depth to water level in Alluvial Aquifer Depth to Piezeometric Surface in Tertiary Aquifer Depth to Piezeometric Surface in Cretaceous Aquifer	 2.90 – 33.64 6.07 – 32.35 8.14 – 54.32			
	iv. Long term water level trend in 10 years (1998-2007) in m/yr	**Premonsoon**			
		Rise (m/year)		**Fall (m/year)**	
		Min	Max	Min	Max
	Alluvial Aquifer	0.028	1.311	0.061	3.278
	Tertiary Aquifer	0.078	0.901	0.027	1.506
	Cretaceous Aquifer	0.054	1.852	0.060	2.276
10.	**GROUND WATER EXPLORATION BY CGWB (As on 31-03-2007)**				
	i. Number of Exploratory wells ii. Number of Observation wells iii. Number of Piezometers under HP. iv. Number of Slim Holes v. Number of Deposit wells	11 10 6 4 14			
	iv. Depth range(m)	25.33 – 601.45			
	v. Discharge(lps)	0.5 – 60.0			
	vi. Storativity (S)	8.90×10^{-4} – 4.30×10^{-3}			
	vii. Transmissivity (m2/day)	2 - 9300			
11.	**GROUND WATER QUALITY AS ON MAY 2006**				
	i. Presence of chemical constituents more than permissible limit	Cl, Fe & F			
	ii. Type of water	Shallow aquifer: Ca-Mg-HCO_3, Deeper aquifer : Ca –Mg HO_3, Na-Cl			
12.	**DYNAMIC GROUND WATER RESOURCES (as on 31.03.2004) in MCM**				
	i. Annual Replenishable Ground Water Resources	85.5486			
	ii. Total Annual Ground Water Draft for all purposes	137.6902			
	iii. Projected demand for Domestic and Industrial Uses up to 2025	25.6332			
	iv. Stage of Ground Water Development	179%			

13.	**AWARENESS AND TRAINING ACTIVITY**	
	i. Mass Awareness Programmes Organized	
	Year	2003-2004
	Place	PASIC Complex, Thattanchavadi, Puducherry.
	No of Participants	250
	ii. Water Management Training Organized	
	Year	2003-2004
	Place	PASIC Complex, Thattanchavadi, Puducherry.
	No of Participants	36
14.	**EFFORTS OF ARTIFICIAL RECHARGE & RAINWATER HARVESTING**	Technical Guidance were provided as when sought
	i. Projects completed by CGWB Number of structures Amount spent	Nil
	ii. Projects under technical guidance of CGWB Number of structures	Nil
15.	**GROUND WATER CONTROL AND REGULATION**	
	i. Number of OE Blocks	1
	ii. Number of Critical Blocks	-
	iii. Number of Blocks Notified	**-**
16.	**MAJOR GROUND WATER PROBLEMS AND ISSUES.**	i) High level of ground water development in large areas in sedimentary aquifers and failure of abstraction structures with time ii) Sea water ingress iii) Industrial pollution.

1.0 INTRODUCTION

1.1 Administrative Details

Puducherry region is situated on the Coromandel coast between 11°45' and 12°03' N latitudes and 79°37' and 79°53' E longitudes with an area of 293 sq. km. It is divided into seven communes, viz, Puducherry, Ozhukarai, Bahour, Ariyankuppam, Villiyanur, Nettapakkam and Mannadipet and comprises 164 inhabited villages.

1.2 Basin and sub-basin

The district is part of the composite east flowing river basin.

1.3 Drainage

There are two major rivers draining this region 1) the Gingee river, which traverses the region diagonally from north-west to south-east and 2) the Ponnaiyar (Penniyar) river, which forms the southern border of the region. The river Gingee also known as the Varahanadi or Sankaraparani which has its source in the hills of Malayanur of Villupuram district, Tamil Nadu has a course of 34km in this region before it confluences with the Bay of Bengal. The river Ponnaiyar originates from the hills of Karnataka and enters the Puducherry region after flowing through the districts of Dharmapuri, Salem, Vellore and Cuddalore of Tamil Nadu. All the rivers are ephemeral in nature.

About 140 small and two big tanks are in the region. These tanks are interlinked and act as water storage for agricultural purposes as well as to recharge the ground water.

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	-
2	Barren & Uncultivable Lands	71
3	Land put to non agricultural uses	11643
4	Cultivable Waste	1586
5	Permanent Pastures & other grazing lands	-
6	Groves not included in the area sown	486
7	Current Fallows	1580
8	Other Fallow Lands	1062
9	Net Area sown	12950
	Total	**29378**

(Source: Directorate of Economics and Statistics, Puducherry)

The entire irrigation is covered from ground water by means of tube wells which constitute 100 percent of the net area irrigated. Irrigation by tanks and other sources constitutes a meager part of the net area irrigated.

The source wise net area irrigated in Ha is given below (2005-2006)

S.No.	Net area irrigated by	
1	Canals	-
2	Tanks	-
3	Tube wells	11508
4	Ordinary wells	-
5	Other sources*	-
6	Total Area Irrigated (Net)	11508
7	Area irrigated more than once	10475
8	Total Gross Area irrigated	21983

(Source: Directorate of Economics and Statistics, Puducherry)

1.5 Studies/Activities carried out by CGWB

Central Ground Water Board has carried out Ground Water Exploration by drilling 11 exploratory wells, 10 observation wells and 4 slim holes ranging in depth between 192.5 and 601 m bgl in Puducherry Region during the year 1973-76. Subsequently on request, deposit wells ranging in depth between 65.70 and 198.53 m bgl were constructed.

Central Ground Water Board carried out systematic hydrogeological surveys during 1972, 1978 and 1984 and reappraisal hydrogeological surveys were carried out in 1987 and 2001

Systematic and Ground Water Management studies were made under various phases.

2.0 RAINFALL AND CLIMATE

The region receives the rain under the influence of both southwest and northeast monsoons. Most of the precipitation occurs in the form of cyclonic storms caused due to the depressions in Bay of Bengal chiefly during Northeast monsoon period. Rainfall data analysis shows that the normal annual rainfall in the Puducherry region is 1272.7 mm. 62% of the annual normal is received during northeast monsoon season and about 26% during the southwest monsoon season, with November being the rainiest month. The heaviest rainfall in 24 hours recorded at Puducherry station was 167.0 mm on 23rd October 1990.

The region enjoys a hot and tropical climate characterised by little variation of temperature and humid weather. The summer season, which is very oppressive, is from March to May. January to the end of February is comparatively cool. The relative humidity is generally high, being about 80% during October to April. It is at its minimum of 70 to 73% in June and July. Winds are moderately strong throughout the year, except during the months July to October. During May to September winds are mainly southwesterly in the mornings.

May and early part of June constitute the hottest period of the year, with the mean daily maximum temperature at about 37°C and the mean daily minimum temperature at about 27°C. On individual days, the maximum temperature may even reach 43°C. The lowest temperature recorded is of the order of 11.1°C.

3.0 GEOMORPHYLOGY AND SOIL TYPES

3.1 Geomorphology

The Puducherry region in general is a flat peneplain with an average elevation of 15 m above mean sea level. The terrain becomes a little undulating with prominent high grounds varying from 30 to 100m above mean sea level towards northwest and northeastern parts of the region. Three major physiographic units are generally observed, viz., (i) Coastal plain, (ii) Alluvial plain and (iii) Uplands.

The coastal plain extends as a narrow stretch for about 22 km and of four to six hundred meters width on the eastern part of the region along the Bay of Bengal. The major part of the coastal plain comprises gently sloping land with a chain of sand dunes extending all along the coast. Other physiographic units which are characteristic of the coastal plains such as spit bars, mud flats, lagoons and tidal inlets also occur.

The alluvial plain, formed due to two major rivers namely Gingee and Ponnaiyar, in general is a monotonous plain with slope ranging from 1 to 3 percent. Besides the rivers and major canals, there are depressions acting as storage tanks, which are spread all over the terrain, to serve as surface water reservoirs.

The high grounds are known as Uplands with elevations of about 30 to 100m above mean sea level. These uplands which are popularly known as “Les Montagnes Rouges” or the “Red Hills of Puducherry” are intersected by a number of gullies and deep ravines giving rise to bad land topography

3.2 Soils

Soils in the area have been classified into i) Red soil ii) Black soil iii) Alluvial soil and iv) Colluvial soil. The major part is covered by Red soil of red sandy/clay loam type. Ferruginous red soils are also seen at places. Alluvial soils occur along the river courses and eastern part of the coastal areas. Sandy coastal

alluvium (arenaceous soil) are seen all along the sea coast as a narrow belt.

4.0 GROUND WATER SCENARIO

4.1 Hydrogeology

Ground water occurs in all the geological formations ranging in age from the Achaeans to Recent which can be broadly classified into two hydrogeological units viz., (i) Fissured and fractured crystalline formations and (ii) Porous sedimentary formations.

- **Fissured Formation**

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 range of 2 to 12 m. The depth of the wells ranged from 4.00 to 15.00 m bgl.

The yield of large diameter wells tapping the weathered mantle of crystalline rocks ranges from 100 to 500 lpm and are able to sustain pumping for 2 to 6 hours per day.

- **Porous Formations**

The porous sedimentary formations occur in almost the entire region and are represented by the semi-consolidated formations of Cretaceous and Tertiary and the unconsolidated Quaternary formations of Recent age. Among the porous sedimentary aquifers, the Vanur-Ramanathapuram Sandstone (Cretaceous) and the Cuddalore sandstone (Tertiary) aquifers and the shallow alluvial (Quaternary) aquifers constitute the three major potential aquifer systems, in the region. Ground water occurs in these formations both under water table as well as under confined conditions and is being developed by means of dug wells, dug-cum-borewells and tube wells.

The phreatic aquifer comprises mainly of alluvial aquifer and in patches Tertiary and cretaceous aquifers are also found as part of phreatic aquifer. Tertiary aquifer is not present at all places and hence while drawing the piezometric surface contours, only area having the Tertiary aquifer has been considered and the same has also been marked in the map. In case of Cretaceous aquifer, some of the areas have not been considered for development as the overlying Tertiary aquifer is highly potential. Hence observation wells have also been established only at places where cretaceous aquifer is being developed at present and hence contouring of piezometric surface has been attempted only for such areas and the same has been marked on the map.

- **Cretaceous Aquifers**

Among the various water bearing formations of Cretaceous age, the Ramanathapuram and Vanur formations form potential aquifers. They occur in the north-western part of Puducherry Region and are encountered in the boreholes drilled in the major part of the region. The aquifers of the above formations include sands and calcareous sandstones. They are coarse grained in the western part and grade into finer facies towards east and northeast. The thickness of these aquifers ranges from 38 to 92 m. The yields of the tube wells with depths between 65 and 400 m, tapping these aquifers vary between 800 and 1500 lpm.

The thickness of the aquifers in upper Cretaceous Ottai formations varies between 42 and 56 m and the water bearing property is mainly dependant on the few bands of fine grained sandstones and limestones. The yields of the wells tapping these aquifers vary between 1015 and 2210 lpm for drawdowns ranging from 6.6 to 25 m.

The piezometric head varied between 8.60 to 63.24 m bgl (Jume 2006) during premonsoon and 8.14 to 54.32 m bgl during post monsoon**.**

- **Tertiary Aquifers**

Cuddalore sandstone, Kadapperikuppam formation and Manaveli formation are the three stratigraphic units of Tertiary aquifers. Out of the three, the Manaveli formation of Paleocene is mainly an aquitard and the localised granular zones do not provide any appreciable yield. Another unit of this group namely the Kadapperikuppam formation contains some productive auifers. The thickness of this aquifer shows wide lateral and vertical variations.

The Cuddalore sandstones of Mio-Pliocene age constitute the most potential aquifers. The Cuddalore sandstones comprising sandstones, sands and gravels occupy an extensive area. The thickness of these aquifers ranges between 20 and 245 m. Ground water occurs in this aquifer mainly under confined conditions and is developed by means of tubewells ranging in depths between 27 and 366 m. The yields of the tube wells range between 200 and 3000 lpm for drawdowns varying from 5 to 10 m.

The Kadapperikuppam aquifers are constituted by the fine grained sandstones and give moderate to good supplies of water as seen around Sedarapalli, Pillaiyarkuppam and further northeast. The thickness of aquifer ranges between 52 and 90 m south of Gingee river, whereas in the area north of Gingee river river, it is between 13 and 37 m.

The piezometric head varied between 6.09 to 33.87 m bgl (June 2006) during premonsoon and 6.07 to 32.35 m bgl during post monsoon.

- **Alluvial Aquifers**

Sands and gravels constitute the alluvial aquifers. Alluvial deposits occupy nearly threefourth of the region. These aquifers form the most potential shallow aquifer system in the area. The thickness of these aquifers ranges between 5 and 34 m. Thick alluvial aquifers occur in the area bordered by Thirukanji, Odiyampet, Tavalapet, Villiyanur, Mangalam and Satyamangalam. In these, ground water occurs under water table or semi-confined conditions. The depth of tubewells tapping these aquifers range between 25 and 50 mbgl.

The depth to water level in the district varied between 3.82 – 31.94 m bgl during pre-monsoon (June 2006) and 2.90 – 33.64 m bgl during post monsoon (Jan 2007).

4.1.1 Long Term Fluctuation (1998-2007)

Aquifer	Pre monsoon (m)		Post Monsoon (m)	
	Rise	Fall	Rise	Fall
Alluvial	0.08 – 7.88	0.09 – 6.94	1.19 – 17.76	0.21 – 12.24
Tertiary	0.78 – 1.32	1.33 – 8.64	-	2.27 – 16.01
Cretaceous	6.30	0.58 - 25.54	1.16	4.61 – 36.37

4.1.2 Aquifer Parameters

Aquifer	Transmissivity (m^2/day)	Storativity	Specific Yield
Alluvial	275 – 770	-	6 - 15 %
Tertiary	1000 – 2000	9.583×10^{-5} and 8.9×10^{-4}.	-
Cretaceous	100 – 2000	2.93×10^{-5} to 1.36×10^{-4}	-
Weathered Crystallines	< 1 – 15	-	1.5 – 2%

4.2 Ground Water Resources

The dynamic ground water resources have been computed jointly by Central Ground Water Board and Groundwater Unit of Department of Agriculture, Government of Puducherry as on 31st March 2004. The salient features of the computations are furnished below.

Region	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 upto next 25 years (2029) (M.Cu.m)	Net groundwatre Availability for future Irriation Development (M.Cu.m)	Stage of Groundwater Development (%)	Category of Block
Puducherry	76.9937	113.0000	24.6902	137.6902	25.6332	Nil	179	Over Exploited

4.3 Ground Water Quality

4.3.1 Alluvial Aquifers

The analytical data of water samples from shallow tubewells tapping the alluvial aquifers are almost neutral to alkaline in nature, with pH values ranging from 7 to 9. The water is generally bicarbonate-chloride type, the bicarbonate predominating over chloride. Carbonate was generally absent or occurs in traces. The chloride content was generally within the permissible limit except few wells along the coastal belt in alluvial formations where it reached a maximum of 8650 mg/l at Murungapakkam. However in recent years due to unscrupulous development of ground water the shallow alluvial aquifers along the coast show signs of quality deterioration probably due to sea water intrusion leading to the occurrence of Sodium-Chloride type of water from Sodium-bicarbonate.

The Electrical Conductivity values, in major part of the region were less than 1500 µS/cm at 25°C, which increases to around 2000 µS/cm at 25°C near the coast in the east, central and small patch on southwestern part. A localised patches with increase in salinity of EC more than 30,000 µS/cm at 25°C was noticed along the coastal belt which may be due to sea water contamination.

4.3.2 Tertiary Aquifers

The quality of ground water tapped from Tertiary aquifers is alkaline with pH ranging from 7.4 to 9.8. Carbonate is almost nil in most of the samples. The water from these aquifers is, in general, Calcium-Magnesium-Bicarbonate type. However, formation water in most of the deeper wells constructed along the coast showed a change in quality leading to Sodium-Chloride type of water. Among the different hydrostratigraphic units, the water from Cuddalore sandstone group of Mio-Pliocene was comparatively better in quality than Kadaperikuppam and Manaveli aquifers. The chloride content was generally within permissible limit except few wells along the coastal belt where it reached a maximum of 2975 mg/l at Murungapakkam. The fluoride value in general ranged fro 0.2 to 0.4 mg/, except at Kanniakoil, Kizparikalpet, Murungapakkam and Utchimedu falling in the extreme southeastern parts of the region where recorded from 1.1 to 1.6 mg/l. However, higher concentrations of iron were recorded in

some pockets ranging from 0.29 to 20 mg/l and the maximum value was at Odiampet.

The Electrical Conductivity values were less than 1500 µS/cm at 25°C in major part of the region, except some patches along the coast where maximum EC value of 8280 µS/cm at 25°C were recorded at Murungapakkam, which may be due to sea water intrusion.

4.3.3 Cretaceous Aquifer

The quality of ground water in the Cretaceous aquifer system is slightly alkaline with pH ranging from 7.7 to 9.4. The concentration of chloride is generally within 150 ppm, except for the isolated areas at Madagadipet and Thondamanatham. The content of fluoride ranged from 0.2 to 0.6 mg/l in the region. The concentration of iron was varied from 0.3 to 5.5 mh/l abd the maximum at Katterikuppam. The maximum value of sulphate 288 mg/l was noticed at Sedarapet.

The Electrical Conductivity values are less than 1500 µS/cm at 25°C except a pocket in the western part where higher EC values of 7280 µS/cm at 25°C were observed at Madagadipet.

Ground water from all the aquifer systems is, in general, suitable both for domestic and irrigational needs except for isolated patches where high iron and chloride concentrations are reported. The water from Phreatic/Alluvial, Tertiary and Cretaceous aquifers from major parts of the region is of medium to high salinity and low sodium hazard as per U.S. Salinity lab classification. However water with high salinity and medium sodium hazard are reported from both Alluvial and Tertiary aquifers in the coastal areas of Puducherry region. Very high salinity and high sodium are reported from select wells along the coast due to sea water intrusion. The suitability of ground water for industries depends on the type of industry and the process involved. The waters have to be treated for softening for industrial uses at times.

4.4 Status of Ground Water Development

The estimation of groundwater resources for the region has shown that the Puducherry Region is over exploited.

Tube wells are the only ground water abstraction structures used for both domestic and irrigation in the region. The yield of tube wells in shallow Alluvial aquifers is of the order of 1 to 2 lakh litres/day. The extraction of ground water by shallow tube wells in the Alluvium is of the order of 2.5 ha.m./year. The average command area for tube well is about 3 ha.

The deep tube wells of 200 mm dia and 100 – 400 m depth in Tertiary and Cretaceous aquifers can yield as high as 1000 lpm discharge, which can be

pumped with 10 to 15 HP submersible pumps. The average annual draft of deep tube wells varies from 70 – 200 m^3/hr. Assuming 200 days pumping in a year, with average daily pumping of 10 hours, the annual draft varies from 0.14 to 0.40 MCM.

5.0 GROUNDWATER MANAGEMENT STRATEGY

5.1 Groundwater Development

In absence of forests and barren lands cover, about 49 percent of the total geographical area of the Puducherry region of U.T. of Puducherry has been categorised as land not available for cultivation, including current and other fallow lands. Hence, about 51 percent of the total geographical area is available for planning of ground water management in the regions.

As per the groundwater resource estimation based on GEC 1997 norms, the level of groundwater development as in March 2004 is 179 percent in Puducherry region. As the ground water development in the Puducherry region is rather very high, no further groundwater development is to be encouraged. On the other hand, there is an urgent need for regulation of over-exploitation, protection and augmentation of ground water resources to recharge the depleted aquifer systems.

In order to achieve this goal, the following activities may have to be taken up in the area.

a) realistic assessment of groundwater draft by various sectors
b) strict regulatory measures to ensure no further development of groundwater in over-exploited areas, except for drinking water supplies
c) measures for augmenting groundwater resources through rain water harvesting and artificial recharge
d) creation of mass awareness for change of cropping pattern to suit groundwater availability and
e) revitalisation of existing water harvesting structures and their supply channels.

The deeper semi-confined and confined aquifers in the area are also being extensively developed by various sectors. Study of the behaviour of groundwater levels in the area indicate the development of land ward hydraulic gradient in parts of both Tertiary and Cretaceous aquifers. In view of these and considering the fact that the overlying phreatic aquifers are already desaturated, no further development is considered feasible for the deeper aquifers as well.

A programme of intensive water level and water quality monitoring may be implemented in the area to monitor the efficacy of regulatory measures and recharge augmentation schemes being taken up in the area. Further development of groundwater resources could be considered only when

significant improvements in the groundwater resources in these aquifers have been established.

5.2 Water Conservation and Artificial Recharge

The topography of Puducherry region, in general, is suited for construction of various artificial recharge structures such as percolation ponds and check dams. However, detailed studies are necessary to formulate a comprehensive scheme for artificial recharge of phreatic ground water in the district in view of the variations in the geomorphic set-up and the complex hydrological and hydrogeological conditions.

The number and type of artificial recharge structures recommended for Puducherry region are furnished in Table 1. The exact locations of these structures, however, are to be decided on the basis of detailed field investigations and implementation of the schemes may be taken up in phases.

Table:1 Details of number and types of Artificial Recharge Structures recommended in Karaikal Region of UT of Puducherry

S.No	Region	Area Suitable for Ground water Develop-ment (sq.km)	Categorization as on March 2004	Surplus available for AR (MCM) *	Number of Structures	Cost of Structures (Lakhs)
					PP (1 in 15 sq.km). Capacity - 0.1 M.Cu.m	PP (Unit Cost - Rs 20 Lakhs)
	Puducherry	293	Over Exploited	19.00	20	400

** Data Source : Groundwater Unit of Department of Agriculture, Government of Puducherry*

It is also recommended that recharge wells may also be drilled to recharge the deeper aquifers wherever necessary as the deeper aquifers are also equally being developed in the region.

Free technical guidance for implementation of roof-top rain water harvesting schemes is also being provided by Central Ground Water Board.

6.0 GROUNDWATER RELATED ISSUES & PROBLEMS

Based on the high level of ground water development, it is inferred that a major part of the region could be considered vulnerable to water level depletion. Poor recharge conditions and over draft of available groundwater resources are mainly responsible for the high-level ground water development in the region. As the ground water in all the porous sedimentary formations in the eastern part of the

region is in hydraulic connection with the sea, the region is also vulnerable to saline water ingress.

The deeper semi-confined and confined aquifers in the area are also being extensively developed by various sectors. Study of the behaviour of groundwater levels in the area indicate the development of land ward hydraulic gradient in parts of both Tertiary and Cretaceous aquifers.

The water from Phreatic/Alluvial, Tertiary and Cretaceous aquifers from major parts of the region is of medium to high salinity and low sodium hazard as per U.S. Salinity lab classification. However water with high salinity and medium sodium hazard are reported from both Alluvial and Tertiary aquifers in the coastal areas of Puducherry region. Very high salinity and high sodium are reported from select wells along the coast due to sea water intrusion.

Many water based industries have been established in the Puducherry Region during early eighties because of availability of ground water and electricity. Some of the chemical industries started dumping the chemicals, both used and unused, in open yards and releasing untreated effluents on open ground/unlined channels. As a result, in Puducherry region, ground water is found polluted in the industrial estates, particularly in Mettupalayam area, leading to environmental degradation.

The State Ground Water Department has constructed a battery of tubewells tapping both shallow and deep aquifers along the coast to monitor the sea water intrusion and the salt-fresh water interface movement due to large scale development of ground water in recent years. Water levels and water samples are collected once in every one or two months. Effects of sea water intrusion and interface movement are noticed in some of the observation wells.

7.0 AWARENESS & TRAINING ACTIVITY

7.1 Mass Awareness Campaign (MAP) & Water Management Training Programme (WMTP) by CGWB

One WMTP was organized on “Rain Water Harvesting Training” at the meeting hall of PASIC complex, Thattanchavadi, Puducherry during the year 2003-2004. The training was attended by 36 officers from various State Government agencies, Representatives of Commune Panchayat Administration, Farmers Association, Social Welfare Organisation, Voluntary Organisation, Builders Association etc.

One Mass Awareness Campaign on “Ground Water Management, Regulation & Conservation” was organized at PASIC complex, Thattanchavadi, Puducherry during the year 2003-2004.

The findings of exploration carried out by CGWB, the results of Geophysical investigations for source finding and their limitations, Ground water resource potential of Puducherry Region of U.T. of Puducherry, Techniques on Ground water resource management and need for regulation and water conservation were explained to the gathering of 250 people.

7.2 Participation in Exhibition, Mela, Fair Etc.

Participated in Flower Show exhibition organized at Agricultural Department, Govt. of Puducherry, in the year 2004 & 2007.

8.0 AREA NOTIFIED BY CGWA/SGWA

Central Ground Water Authority has not notified any area in the region. Government of Puducherry has enacted "The Puducherry Control and Regulation Act 2002" and subsequently "The Puducherry Groundwater Control and regulation rules 2003" has been enacted for the purpose of regulation and control of development of groundwater. In accordance to the rules, Puducherry Ground Water Authority has also been constituted and it is taking care of groundwater control and regulation.

In addition, Government of Puducherry vide Act No 27 of 1999, made following provisions in the said act in connection with the groundwater development.

1. No person shall extract or use groundwater in the scheduled area for any purpose other than domestic purposes.
2. no person shall transport groundwater by means of lorry, trailer or any other goods vehicle

9.0 RECOMMENDATIONS

As per the groundwater resource estimation based on GEC 1997 norms, the level of groundwater development as in March 2004 is 179 percent in Puducherry region. As the ground water development in the Puducherry region is rather very high, no further groundwater development is to be encouraged. On the other hand, there is an urgent need for regulation of over-exploitation, protection and augmentation of ground water resources to recharge the depleted aquifer systems.

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.

Artificial recharge of ground water through cost-effective rain water harvesting systems may be popularised in the district by providing incentives to individuals/communities embarking upon such initiatives. A concerted effort involving various Government agencies and NGOs can create the necessary awareness among the rural masses.

Remedial measures and isolation of pollution by industrial units may be taken up to reduce the damage to the ground water resources in the region.

A long term strategy to control and reverse the sea water ingress by limiting the ground water extraction by involving local state holders is necessary. Also, the flood water diversion and recharge to coastal aquifer in the western side of established interface line is necessary and action plan in this direction with participation of state and central agencies and industrial establishments is recommended. Effective aquifer remediation technology can be identified and practiced to minimize the aquifer contamination in vulnerable pockets.

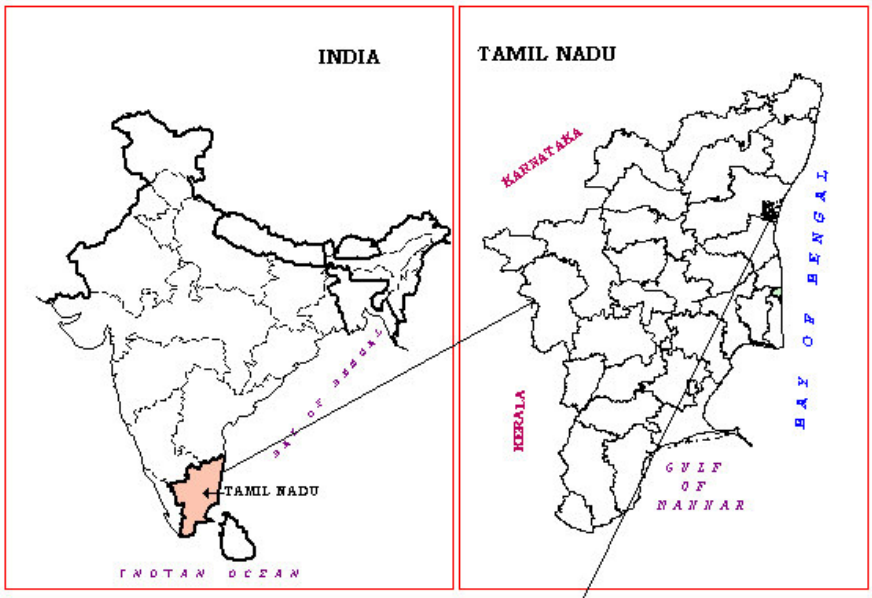
Since there are a large number of irrigation tanks in the region suitable measures for increasing the quantum of storage by desilting, raising of bunds etc have to be taken up immediately which will facilitate recharge of the shallow water table aquifer to a considerable extent. For recharging deeper aquifers and to prevent sea water intrusion, recharge tube wells in all favourable tanks and coastal areas is recommended.

PLATE - I

CENTRAL GROUND WATER BOARD, SECR, CHENNAI

PUDUCHERRY REGION, U.T.OF PUDUCHERRY

LOCATION



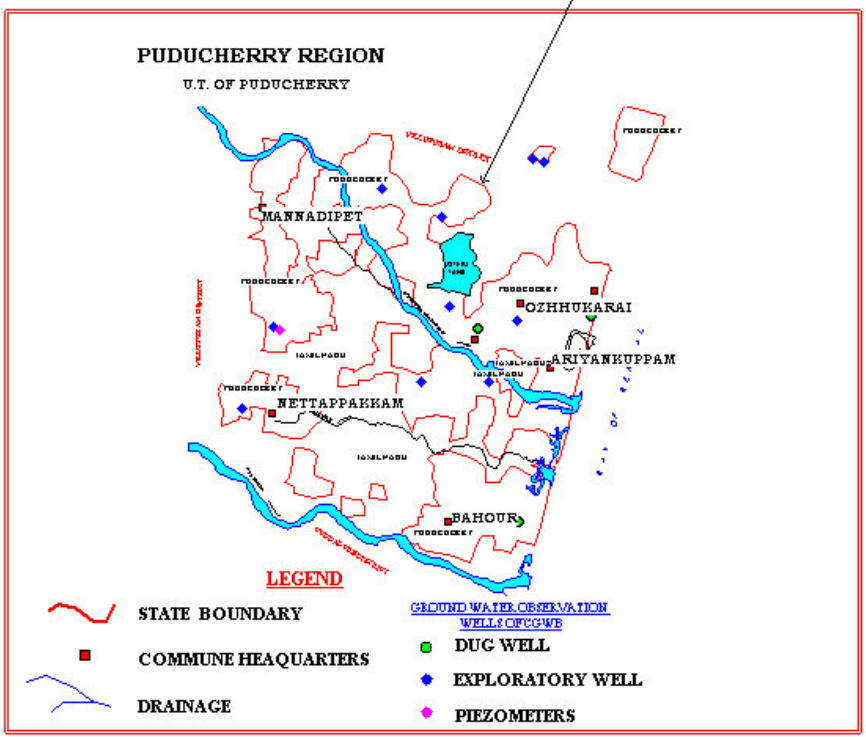


PLATE II

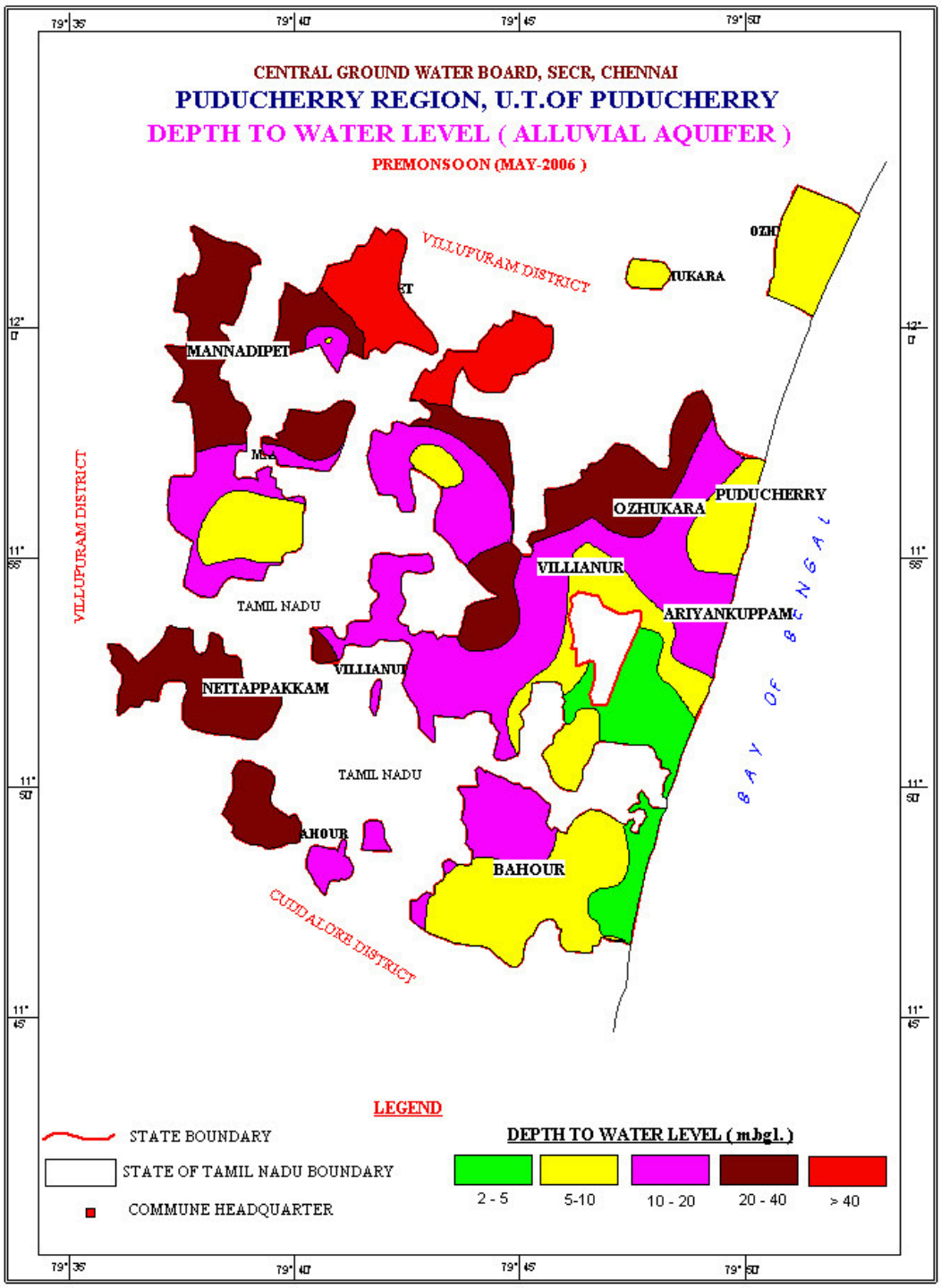

CENTRAL GROUND WATER BOARD, SECR, CHENNAI
PUDUCHERRY REGION, U.T.OF PUDUCHERRY
DEPTH TO WATER LEVEL (ALLUVIAL AQUIFER)
PREMONSOON (MAY-2006)
79° 35'
79° 40'
79° 45'
79° 50'
12° 0'
11° 55'
11° 50'
11° 45'
VILLUPURAM DISTRICT
MANNADIPET
OZHUKARA
PUDUCHERRY
VILLIANUR
ARIYANKUPPAM
TAMIL NADU
NETTAPPAKKAM
BAHOUR
CUDDALORE DISTRICT
BAY OF BENGAL
LEGEND
STATE BOUNDARY
STATE OF TAMIL NADU BOUNDARY
COMMUNE HEADQUARTER
DEPTH TO WATER LEVEL (mbgl.)
2 - 5
5-10
10 - 20
20 - 40
> 40

PLATE III

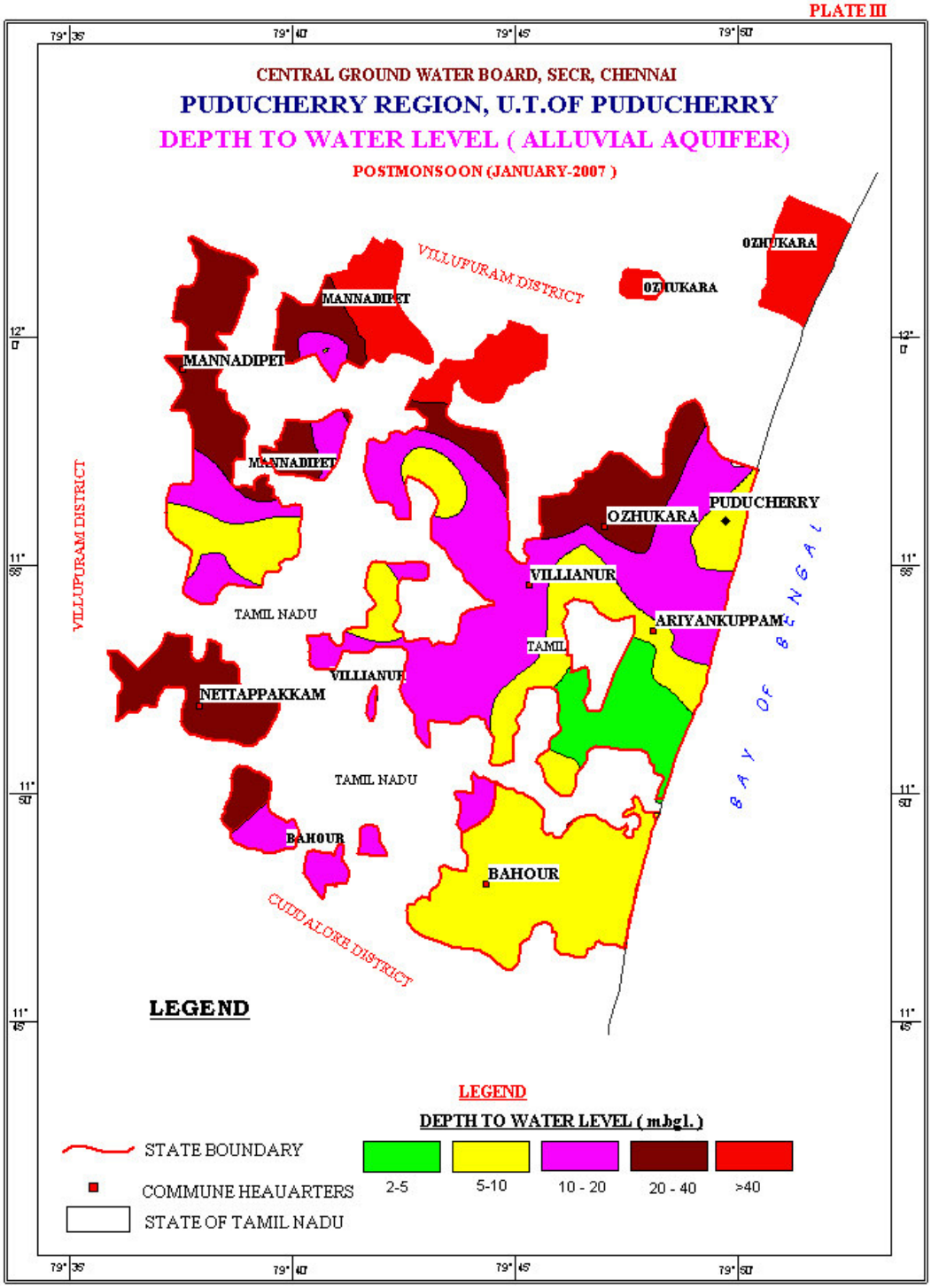

CENTRAL GROUND WATER BOARD, SECR, CHENNAI
PUDUCHERRY REGION, U.T.OF PUDUCHERRY
DEPTH TO WATER LEVEL (ALLUVIAL AQUIFER)
POSTMONSOON (JANUARY-2007)
79° 35'
79° 40'
79° 45'
79° 50'
12° 00'
11° 55'
11° 50'
11° 45'
VILLUPURAM DISTRICT
MANNADIPET
OZHUKARA
PUDUCHERRY
VILLIANUR
ARIYANKUPPAM
TAMIL NADU
NETTAPPAKKAM
BAHOUR
CUDDALORE DISTRICT
BAY OF BENGAL
LEGEND
LEGEND
DEPTH TO WATER LEVEL (m.bgl.)
STATE BOUNDARY
COMMUNE HEAUARTERS
STATE OF TAMIL NADU
2-5
5-10
10 - 20
20 - 40
>40

PLATE - IV

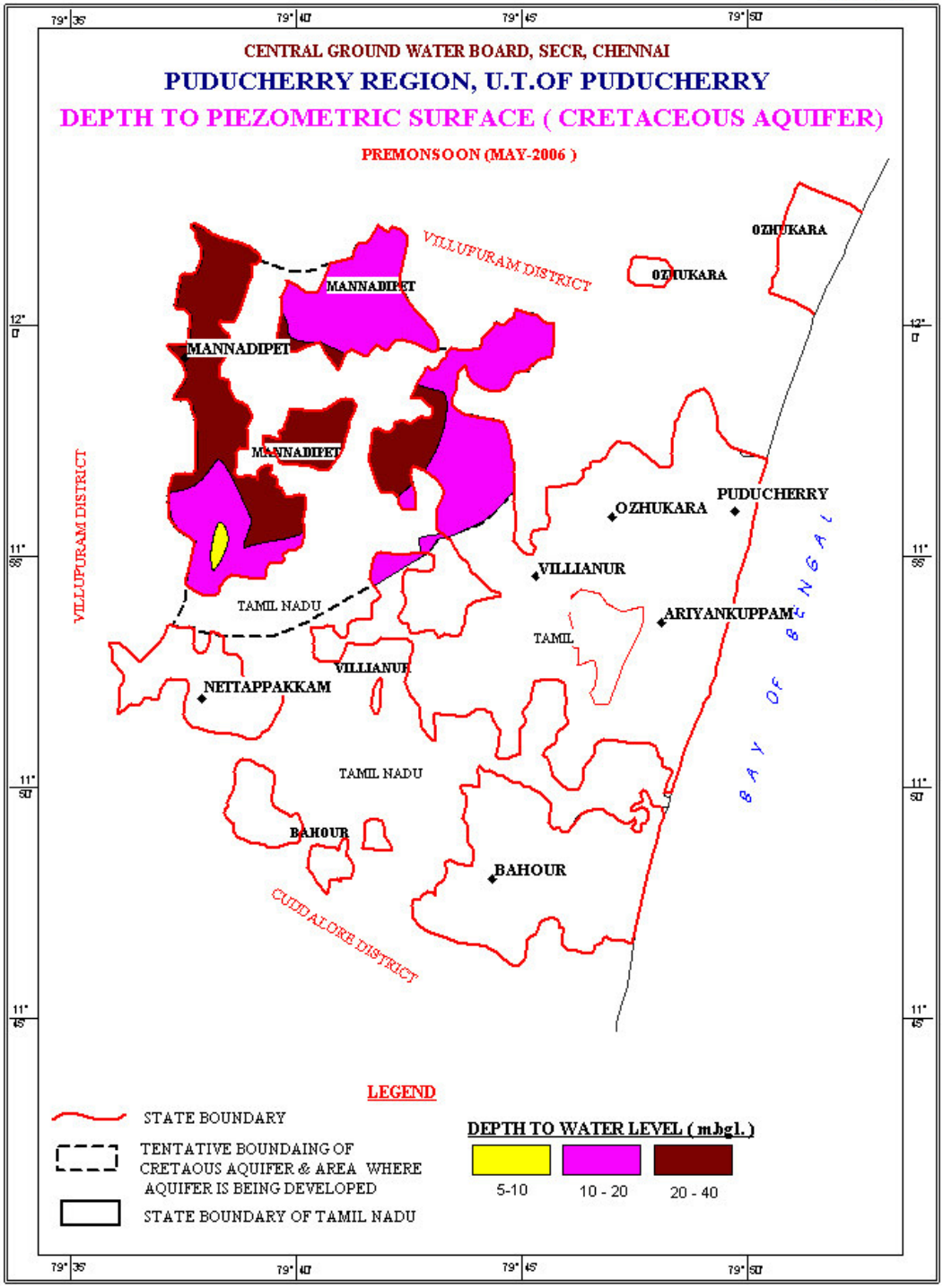

CENTRAL GROUND WATER BOARD, SECR, CHENNAI
PUDUCHERRY REGION, U.T.OF PUDUCHERRY
DEPTH TO PIEZOMETRIC SURFACE (CRETACEOUS AQUIFER)
PREMONSOON (MAY-2006)
79° 35'
79° 40'
79° 45'
79° 50'
12° 00'
11° 55'
11° 50'
11° 45'
VILLUPURAM DISTRICT
MANNADIPET
MANNADIPET
MANNADIPET
OZHUKARA
OZHUKARA
OZHUKARA
PUDUCHERRY
VILLIANUR
VILLIANUR
ARIYANKUPPAM
TAMIL NADU
TAMIL
TAMIL NADU
NEITAPPAKKAM
BAHOUR
BAHOUR
CUDDALORE DISTRICT
BAY OF BENGAL
LEGEND
STATE BOUNDARY
TENTATIVE BOUNDAING OF CRETAOUS AQUIFER & AREA WHERE AQUIFER IS BEING DEVELOPED
STATE BOUNDARY OF TAMIL NADU
DEPTH TO WATER LEVEL (mbgl.)
5-10
10 - 20
20 - 40

PLATE - V

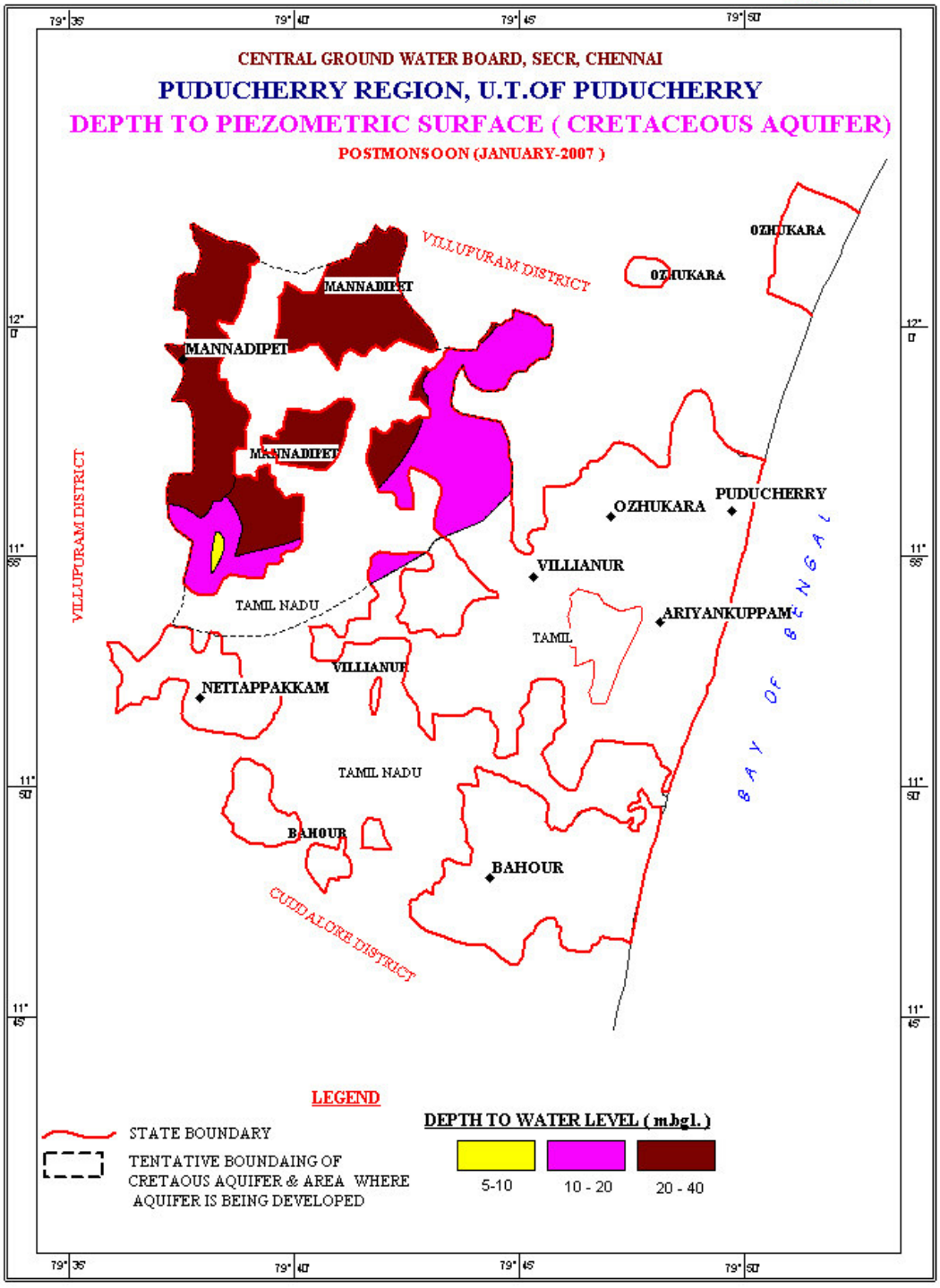

CENTRAL GROUND WATER BOARD, SECR, CHENNAI
PUDUCHERRY REGION, U.T.OF PUDUCHERRY
DEPTH TO PIEZOMETRIC SURFACE (CRETACEOUS AQUIFER)
POSTMONSOON (JANUARY-2007)
79° 35'
79° 40'
79° 45'
79° 50'
12° 0'
11° 55'
11° 50'
11° 45'
VILLUPURAM DISTRICT
MANNADIPET
MANNADIPET
MANNADIPET
VILLUPURAM DISTRICT
OZHUKARA
OZHUKARA
OZHUKARA
PUDUCHERRY
VILLIANUR
ARIYANKUPPAM
TAMIL NADU
TAMIL
VILLIANUR
NETTAPPAKKAM
TAMIL NADU
BAHOUR
BAHOUR
CUDDALORE DISTRICT
BAY OF BENGAL
LEGEND
STATE BOUNDARY
TENTATIVE BOUNDAING OF CRETAOUS AQUIFER & AREA WHERE AQUIFER IS BEING DEVELOPED
DEPTH TO WATER LEVEL (m.bgl.)
5-10
10 - 20
20 - 40

PLATE VI

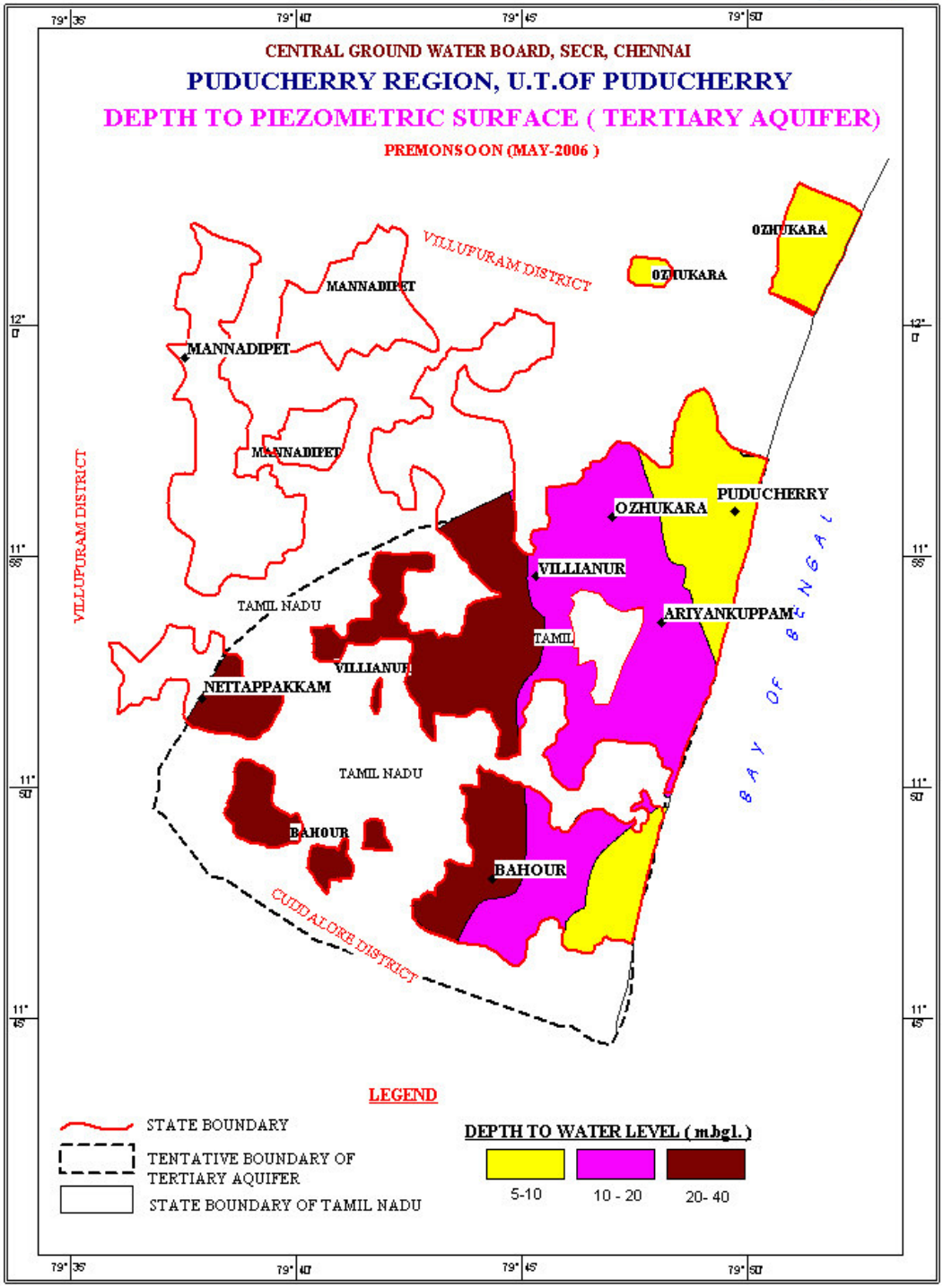

CENTRAL GROUND WATER BOARD, SECR, CHENNAI
PUDUCHERRY REGION, U.T.OF PUDUCHERRY
DEPTH TO PIEZOMETRIC SURFACE (TERTIARY AQUIFER)
PREMONSOON (MAY-2006)
79° 35'
79° 40'
79° 45'
79° 50'
12° 00'
11° 55'
11° 50'
11° 45'
VILLUPURAM DISTRICT
MANNADIPET
OZHUKARA
PUDUCHERRY
VILLIANUR
ARIYANKUPPAM
TAMIL NADU
NETTAPPAKKAM
BAHOUR
CUDDALORE DISTRICT
BAY OF BENGAL
LEGEND
STATE BOUNDARY
TENTATIVE BOUNDARY OF TERTIARY AQUIFER
STATE BOUNDARY OF TAMIL NADU
DEPTH TO WATER LEVEL (mbgl.)
5-10
10 - 20
20- 40

PLATE VII

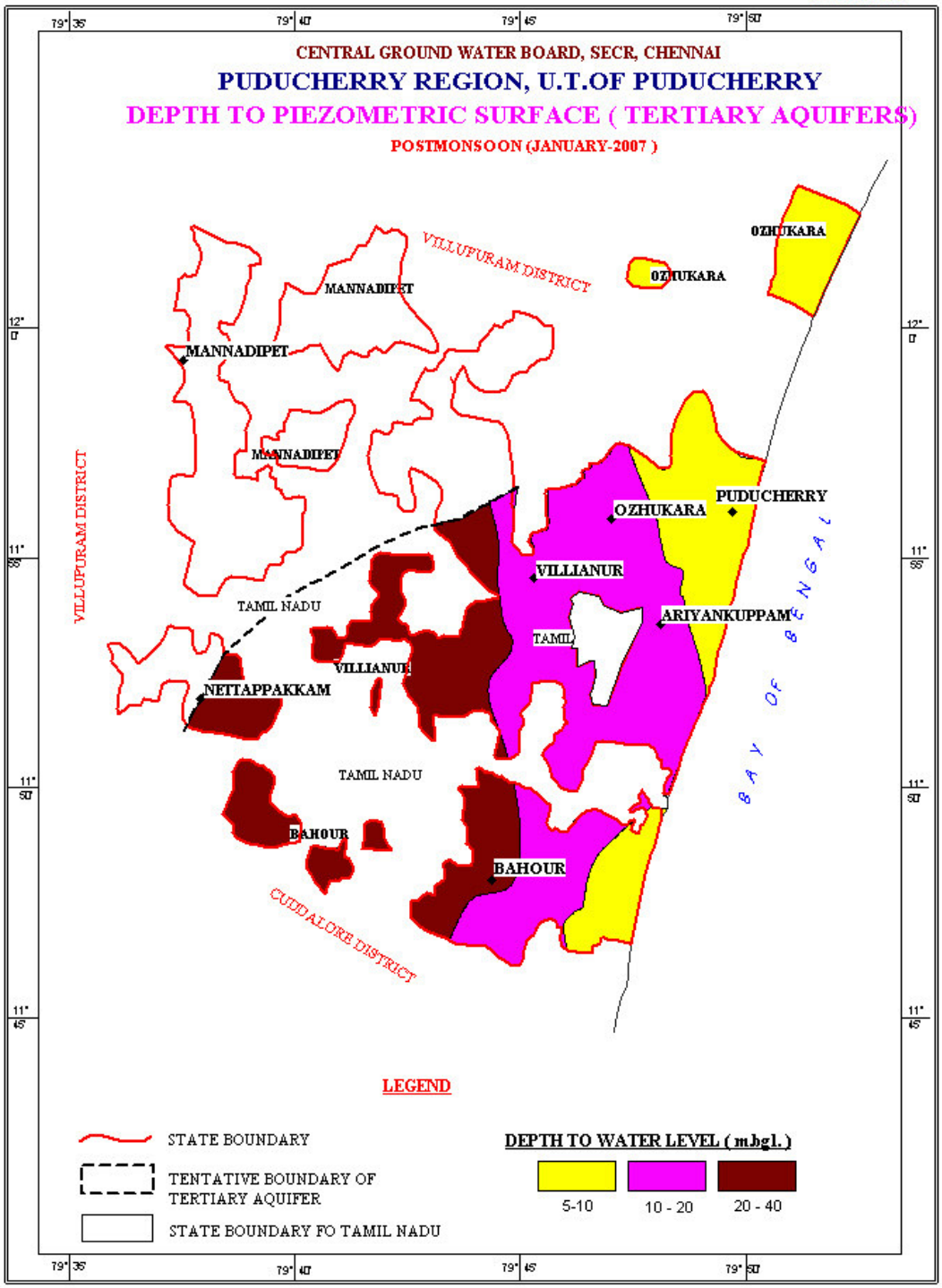
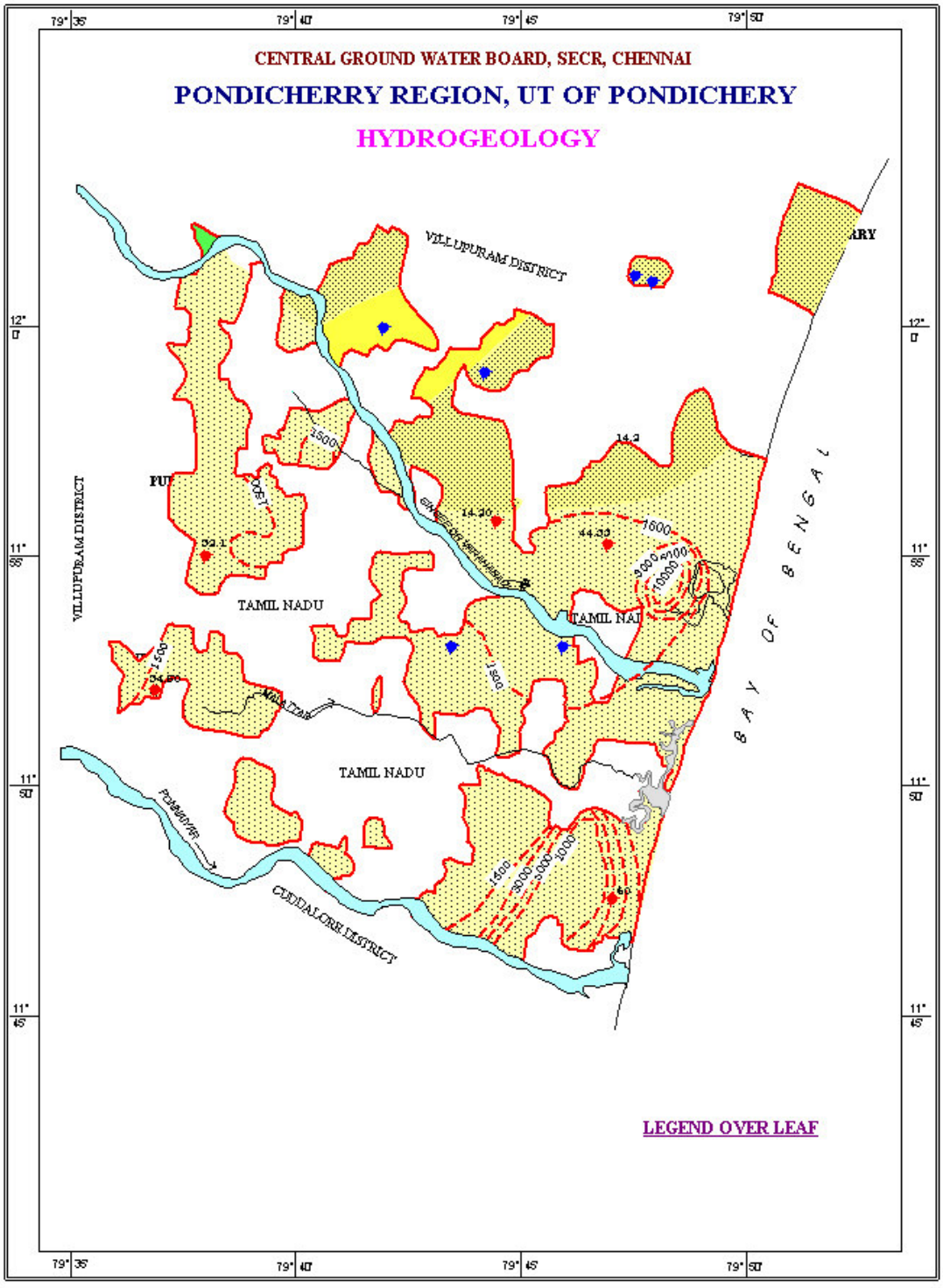

CENTRAL GROUND WATER BOARD, SECR, CHENNAI
PUDUCHERRY REGION, U.T.OF PUDUCHERRY
DEPTH TO PIEZOMETRIC SURFACE (TERTIARY AQUIFERS)
POSTMONSOON (JANUARY-2007)
79° 35'
79° 40'
79° 45'
79° 50'
12° 07'
11° 55'
11° 50'
11° 45'
VILLUPURAM DISTRICT
MANNADIPET
MANNADIPET
MANNADIPET
VILLUPURAM DISTRICT
OZHUKARA
OZHUKARA
OZHUKARA
PUDUCHERRY
VILLIANUR
VILLIANUR
ARIYANKUPPAM
TAMIL NADU
TAMIL
TAMIL NADU
NETTAPPAKKAM
BAHOUR
BAHOUR
CUDDALORE DISTRICT
BAY OF BENGAL
LEGEND
STATE BOUNDARY
TENTATIVE BOUNDARY OF TERTIARY AQUIFER
STATE BOUNDARY FO TAMIL NADU
DEPTH TO WATER LEVEL (mbgl.)
5-10
10 - 20
20 - 40

PLATE - VIII


CENTRAL GROUND WATER BOARD, SECR, CHENNAI
PONDICHERRY REGION, UT OF PONDICHERY
HYDROGEOLOGY
79° 35'
79° 40'
79° 45'
79° 50'
12° 00'
11° 55'
11° 50'
11° 45'
VILLUPURAM DISTRICT
TAMIL NADU
TAMIL NADU
TAMIL NADU
BAY OF BENGAL
CUDDALORE DISTRICT
1600
1800
3000
5000
10000
14.2
14.20
44.33
32.1
LEGEND OVER LEAF

LEGEND FOR PLATE VIII

ADMINISTRATIVE SETUP

STATE BOUNDARY

752 TRIANGULATION HEIGHT [elevation in m.amsl]

CREEK

GROUND WATER HYDROLOGY

EXPLORATORY BORE WELL [CGWB]

14.2 LOCATION OF HIGH YIELD IN EXPLORATORY WELL WITH DISCHARGE IN LPS[CGWB]

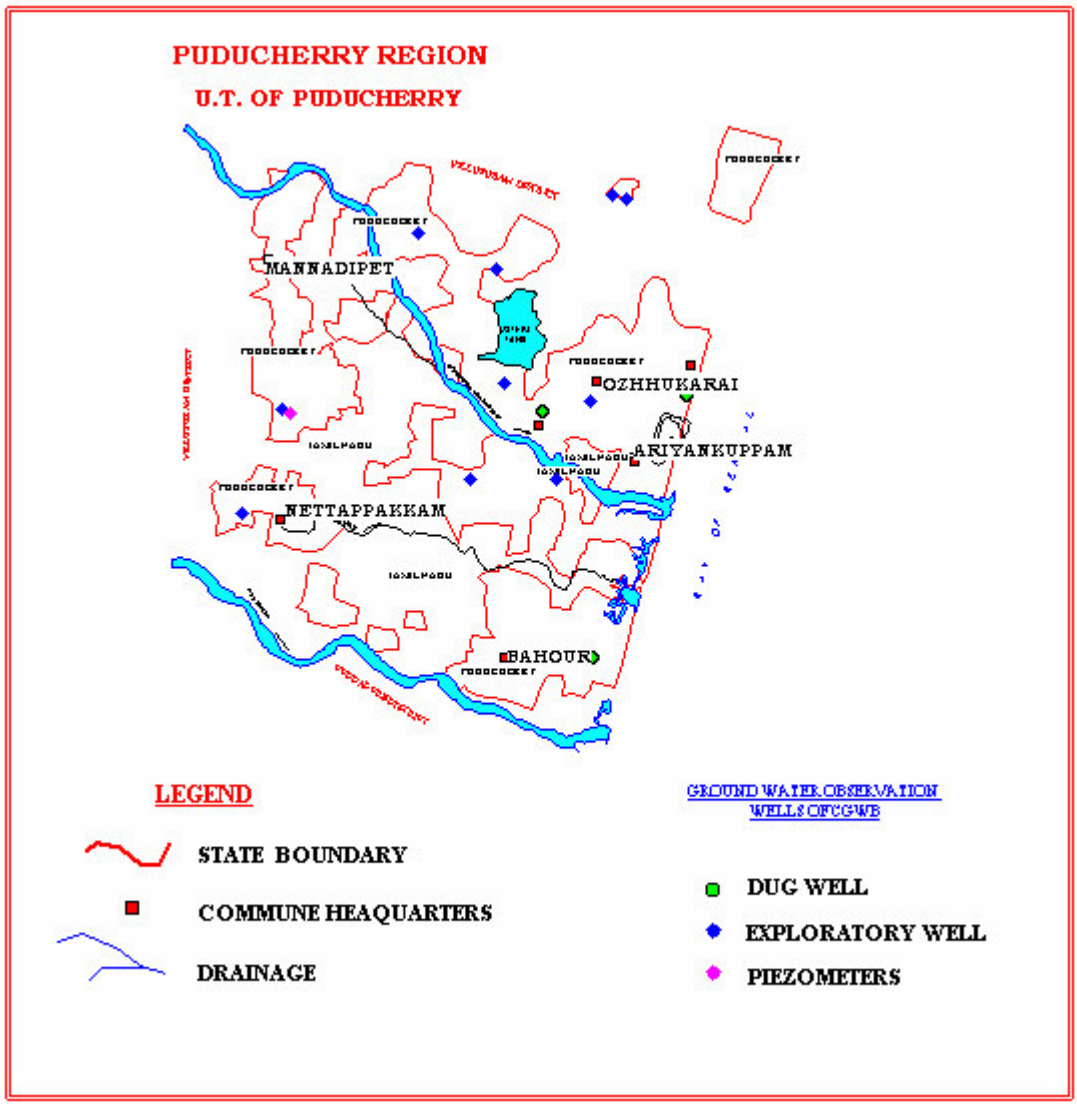
HYDROCHEMISTRY

750 ISOCONS [Sp ELECTRICAL CONDUCTANCE [µs /Cm at 25° C]

STRUCTURE

TRACE OF LINEAMENT

AQUIFER	AGE	LITHOLOGY	GROUND WATER CONDITIONS	YIELD PROSPECTS (CU.M/D)	GROUND WATER DEVELOPMENT STRATEGIES
UNCONSOLIDATED	RECENT	SAND & GRAVEL	UNCONFINED	< 200	DEVELOPMENT THROUGH TUBE WELLS OF 25 - 50 M DEPTH
UNCONSOLIDATED	TERTIARY	SANDSTONE	DISCONTINUOUS PATCHES OCCUR AS UNCONFINED AQUIFER. MAINLY OCCUR AS CONFINED AQUIFER	1000 - 2000	DEVELOPMENT THROUGH TUBE WELLS OF 25 - 350 M DEPTH
UNCONSOLIDATED	CRETACEOUS	CALCAREOUS SANDSTONE & LIMESTONE	DISCONTINUOUS PATCHES OCCUR AS UNCONFINED AQUIFER. MAINLY OCCUR AS CONFINED AQUIFER	700 - 1000	DEVELOPMENT THROUGH TUBE WELLS OF 65 - 400 M DEPTH
CONSOLIDATED	ARCHAEAN	CHARNOCKITE	OCCUR AS UNCONFINED AQUIFER IN WEATHERED MANTLE & SEMI CONFINED TO CONFINED AQUIFER IN FRACTURES	100 - 200	DEVELOPMENT THROUGH DUG WELLS OF 10 - 15 M DEPTH



Compiled by: Dr A.Asokan, Scientist-B, CGWB, SECR, Chennai

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🖂 cgwb@tn.nic.in