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DISTRICT GROUNDWATER BROCHURE
PUDUCHERRY REGION,
U. T. OF PUDUCHERRY

By

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चेन्नई/Chennai

दिसंबर / December 2013

DISTRICT AT A GLANCE (PUDUCHERRY REGION)

S. No.	ITEMS	STATISTICS
1.	**GENERAL INFORMATION**	
	i. Geographical area (Sq. km.)	293.78
	ii. Administrative Divisions (As on 31-3-2013) Number of Communes Number of Villages	 5 164
	iii. Population (Census, 2011) Total Population Male Female	 **946600** 466143 480457
	iv. Average Annual Rainfall (mm)	1383
2.	**GEOMORPHOLOGY**	
	i. Major physiographic Units	Coastal plain, Alluvial plain and Uplands
	ii. Major Drainages	Gingee and Ponnaiyar
3.	**LAND USE (During 2010-11)**	(Ha.)
	i. Forest area ii. Net area sown iii. Cultivable waste	Nil 11,354 1,646
4.	**MAJOR SOIL TYPES**	1.Red soil, 2.Black soil, 3.Alluvial soil and 4.Colluvial soil
5.	**AREA UNDER PRINCIPAL CROPS (During 2010-2011)**	1. Paddy -13308Ha (3 crops) 2. Sugarcane – 1764 Ha 3. Groundnut – 411Ha 4. Casuarina – 1227 Ha
6.	**IRRIGATION BY DIFFERENT SOURCES (During 2010-11)**	**Net Area Irrigated (Ha)**
	i. Dug wells	-
	ii. Tube wells	10000
	iii. Tanks	-
	iv. Canals	-
	v. Other Sources	-
	vi. Net Irrigated area	10000
	vii. Gross Irrigated area	18699
7.	**NUMBER OF GROUNDWATER MONITORING WELLS OF CGWB (As on 31.03.2013)**	

	i. Number of dug wells	4			
	ii. Number of piezometers	7			
8.	**PREDOMINANT GEOLOGICAL FORMATIONS**	Recent Alluvium, Sandstones, Clay- stones & Lime-stones of Cretaceous & Tertiary era.			
9.	**HYDROGEOLOGY**				
	i. Major water bearing formations	(i) Fissured and fractured crystalline formations and (ii) Porous sedimentary formations comprising Cuddalore & Vanur Sandstones.			
	ii. Pre monsoon (May 2012)	(mbgl)			
	Depth to water level in Alluvial Aquifer	4.00 – 30.50			
	Depth to Piezeometric Surface in Tertiary Aquifer	6.50 – 34.00			
	Depth to Piezeometric Surface in Cretaceous Aquifer	8.00 – 64.50			
	iii. Post monsoon (January 2013)	(mbgl)			
	Depth to water level in Alluvial Aquifer	3.00 – 29.50			
	Depth to Piezeometric Surface in Tertiary Aquifer	6.00 – 33.00			
	Depth to Piezeometric Surface in Cretaceous Aquifer	7.50 – 55.50			
	iv. Long-term water level trend in 10 years (2002-2012)	**Pre monsoon**			
		Rise (m/year)		**Fall (m/year)**	
		Min	**Max**	**Min**	**Max**
	Alluvial Aquifer	0.02	1.31	0.06	3.28
	Tertiary Aquifer	0.07	0.91	0.02	1.50
	Cretaceous Aquifer	0.05	0.85	0.06	2.25
10.	**GROUNDWATER EXPLORATION BY CGWB (As on 31-03-2013)**				
	i. Number of Exploratory wells	12			
	ii. Number of Observation wells	8			
	iii. Number of Piezometers including HP	9			
	iv. Number of Slim Holes	4			
	v. Number of Deposit wells	14			
	iv. Depth range(mbgl)	19.50.00 - 601.45			
	v. Discharge(lps)	1.0 - 60.0			
	vi. Storativity (S)	$8.90 \times 10^{-4} – 4.30 \times 10^{-3}$			
	vii. Transmissivity (m^2/day)	50 - 2000			
11.	**GROUNDWATER QUALITY (As on May 2012)**				
	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 GROUNDWATER RESOURCES (As on 31.03.2009) in MCM**				
	i. Annual Replenishable Groundwater Resources	102.58			
	ii. Total Annual Groundwater Draft for all purposes	142.29			
	iii. Projected demand for Domestic and Industrial Uses up to 2025	27.32			
	iv. Stage of Groundwater Development	139 %			

13.	**AWARENESS AND TRAINING ACTIVITY**	
	i. Mass Awareness Programs Organized	
	Year	2003-2004
	Place	PASIC Complex, Thattanchavadi, Puducherry
	Number of Participants	250
	ii. Water Management Training Organized	
	Year	2003-2004
	Place	PASIC Complex, Thattanchavadi, Puducherry
	Number of Participants	36
	III. Awareness through Painting Competition on water conservation /save water for School children(IV –VIII std)	
	Year	2011, 2012 & 2013
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.	**GROUNDWATER CONTROL AND REGULATION**	
	i. Number of OE Blocks	1
	ii. Number of Critical Blocks	-
	iii. Number of Commune Notified	**1 (Puducherry)**
16.	**MAJOR GROUNDWATER PROBLEMS AND ISSUES**	i) High groundwater development in Sandstones. ii) Sea water ingress. iii) Industrial pollution.

DISTRICT GROUNDWATER BROCHURE
PUDUCHERRY REGION, U. T. OF PUDUCHERRY

1.0 INTRODUCTION

1.1 Administrative Details

Puducherry region is situated on the Coromandel coast between 11^{o} 45' and 12^{o} 03' N latitudes and 79^{o} 37' and 79^{o} 53' E longitudes with an area of 293 sq. km. It is divided into five communes, which comprise 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 34 km 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 groundwater.

1.4 Irrigation Practices

The nine-fold lands use classification for the region (2010-11) is given below.

Sl. No.	Classification	Area (Ha)
1	Forests	-
2	Barren & Uncultivable Lands	71
3	Land put to non agricultural uses	11,951
4	Cultivable Waste	1,646
5	Permanent Pastures & other grazing lands	-
6	Groves not included in the area sown	518
7	Current Fallows	2,602
8	Other Fallow Lands	1,236
9	Net Area sown	11,354
	Total	**29378**

(Source: Directorate of Economics and Statistics, Puducherry)

The entire irrigation is covered from groundwater 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 (2010-2011).

Sl. No.	Net area irrigated by	
1	Canals	-
2	Tanks	-
3	Tube wells	10000
4	Ordinary wells	-
5	Other sources	-
6	Total Area Irrigated (Net)	10000
7	Area irrigated more than once	8699
8	Total Gross Area irrigated	18699

(Source: Directorate of Economics and Statistics, Puducherry)

1.5 Studies/Activities carried out by Central Ground Water Board (CGWB)

CGWB has carried out Groundwater Exploration by drilling exploratory wells (12 Nos.), observation wells (8 Nos.) slim holes (4 Nos.) Piezometers (9 Nos.) ranging in depth between 58 and 601 m bgl in Puducherry Region from the year 1973 to till date. Subsequently on request, 14 deposit wells ranging in depth between 65.70 and 198.53 m bgl were constructed.

CGWB carried out systematic hydrogeological surveys during 1972, 1978 and 1984 and reappraisal hydrogeological surveys were carried out in 1987 and 2001. Systematic and Groundwater Management studies were made in 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 1383 mm. Sixty two percent 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 GEOMORPHOLOGY 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 100 m 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 GROUNDWATER SCENARIO

4.1 Hydrogeology

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

i) Fissured Formation

Groundwater 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 ranges from 2 to 12 m. The depth of the wells ranged from 4 to 15 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.

ii) 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. Groundwater 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. In case of Cretaceous aquifer, some of the areas have not been considered for development as the overlying Tertiary aquifer is highly potential.

Alluvial Aquifers

Sands and gravels constitute the alluvial aquifers. Alluvial deposits occupy nearly 75 % 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, groundwater occurs under water table or semi-confined conditions. The depth of tube wells tapping these aquifers range between 25 and 50 mbgl.

The depth to water level in the region varied between 4.00 and 30.50 m bgl during pre-monsoon (June 2011) (**Plate – III**) and 3.00 – 29.50 m bgl during post monsoon (Jan 2012) (**Plate – IV**).

Tertiary Aquifer

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 aquifers. 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. Groundwater occurs in this aquifer mainly under confined conditions and is developed by means of tube wells ranging in depths between 27 and 366 mbgl. 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, it is between 13 and 37 m.

The piezometric head varied between 6.50 and 34.00 m bgl (May 2011) (**Plate – V**) during pre monsoon and 6 and 33 m bgl during post monsoon (January 2012) (**Plate – VI**).

Cretaceous Aquifer

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 mbgl, 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 lime-stones. The yields of the wells tapping these aquifers vary between 1015 and 2210 lpm for draw-downs ranging from 6.6 to 25 m. The piezometric head varied between 8.00 and 64.50 m bgl (June 2011) (**Plate – VII**) during pre monsoon and 7.50 and 55.50 m bgl during post monsoon (Feb' 2012) (**Plate – VIII**).

4.1.1 Long-term Fluctuation (2002-2012)

Aquifer	Pre monsoon (m/yr)	
	Rise	Fall
Alluvial	0.02 – 1.31	0.06 – 3.28
Tertiary	0.07 – 0.91	0.02- 1.5
Cretaceous	0.05 – 0.85	0.06- 2.25

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 Groundwater Resources

The dynamic groundwater resources have been computed jointly by CGWB and Groundwater Unit of Department of Agriculture, Government of Puducherry as on 31st March 2011. The salient features of the computations are furnished below.

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DYNAMIC GROUNDWATER RESOURCES OF PUDUCHERRY REGION,
UNION TERRITORY OF PUDUCHERRY (As on 31st March 2011) (Ham)

Sl. No.	Assessment Unit / Region	Net Natural Groundwater Availability	Existing gross groundwater draft for Irrigation	Existing gross groundwater draft for domestic & industrial water supply	Existing gross groundwater draft for all units	Provision for domestic & industrial Irrigation supply to 2025	Net Groundwater Availability for future Irrigation Development	State of Groundwater development
1	**2**	**10**	**11**	**12**	**13**	**14**	**15=(10-11-14)**	**16=(13/10* 100)%**
1.	Puducherry Region	10258.24	11838	2391.63	14229.63	2732.17	Nil	139

4.3 Groundwater Quality

4.3.1 Alluvial Aquifers

The analytical data of water samples from shallow tube wells 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 a 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 groundwater 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 (EC0 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. Localised patches with increase in salinity of EC more than 30,000 µS/cm at 25°C was noticed along the coastal belt.

4.3.2 Tertiary Aquifers

The quality of groundwater 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 hydro-stratigraphic 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 a few wells along the coastal belt where it reached a maximum of 2975 mg/l at Murungapakkam. The fluoride value in general ranged from 0.2 to 0.4 mg/l, except at Kanniakoil, Kizhparikalpet, Murungapakkam and Uchchimedu falling in the extreme southeastern parts of the region, where it is 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 EC 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 groundwater 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 mg/l, 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 mg/l and the maximum at Katterikuppam. The maximum value of sulphate 288 mg/l was noticed at Sedarapet.

The EC 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.

Groundwater 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 groundwater 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 Groundwater Development

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

Tube wells are the only groundwater 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 groundwater by shallow tube wells in the alluvium is of the order of 2.5 ha.m./year. 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.

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 groundwater management in the regions.

As per the groundwater resource estimation based on GEC 1997 norms, the level of groundwater development as in March 2011 is 139 percent in Puducherry region. As the groundwater development in the Puducherry region is 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 groundwater 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) Revitalization 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 groundwater in the district in view of the variations in the geomorphic set-up and the complex hydrological and hydrogeological conditions.

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. Technical guidance for implementation of roof-top rain water harvesting schemes are provided by CGWB.

6.0 GROUNDWATER RELATED ISSUES & PROBLEMS

Based on the high level of groundwater 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 water level depletion in the region. As the groundwater 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 indicates 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 groundwater and electricity. The State Groundwater Department has constructed a battery of tube wells 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 groundwater in recent years.

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 “Groundwater Management, Regulation & Conservation” was organized at PASIC complex, Thattanchavadi, Puducherry during the year 2003-2004.

Under State Level painting competition for School children, Painting competition is being held for U.T. of Puducherry at Puducherry from year 2010.

The findings of exploration carried out by CGWB, the results of Geophysical investigations for source finding and their limitations, Groundwater resource potential of Puducherry Region of U.T. of Puducherry, Techniques on Groundwater 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 notified Puducherry Region, U. T. of Puducherry. 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 Groundwater 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 2011 is 139 percent in Puducherry region. As the groundwater 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 groundwater resources to recharge the depleted aquifer systems.

Intensive monitoring of groundwater 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 groundwater through cost-effective rain water harvesting systems may be popularized 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 groundwater resources in the region.

A long term strategy to control and reverse the sea water ingress by limiting the groundwater 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.

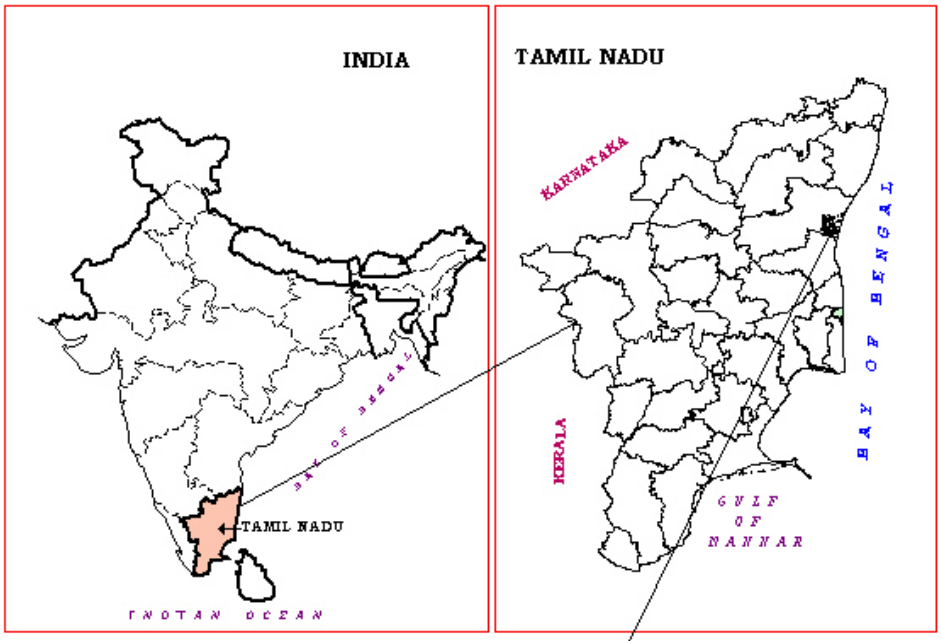
Since there are a large number of irrigation tanks in the region suitable measures for increasing the quantum of storage by desilting, raising of bunds, etc have to be taken up immediately, which will facilitate recharge of the shallow water table aquifer to a considerable extent. For recharging deeper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

PLATE - I

CENTRAL GROUND WATER BOARD, SECR, CHENNAI

PUDUCHERRY REGION, U. T. OF PUDUCHERRY

LOCATION



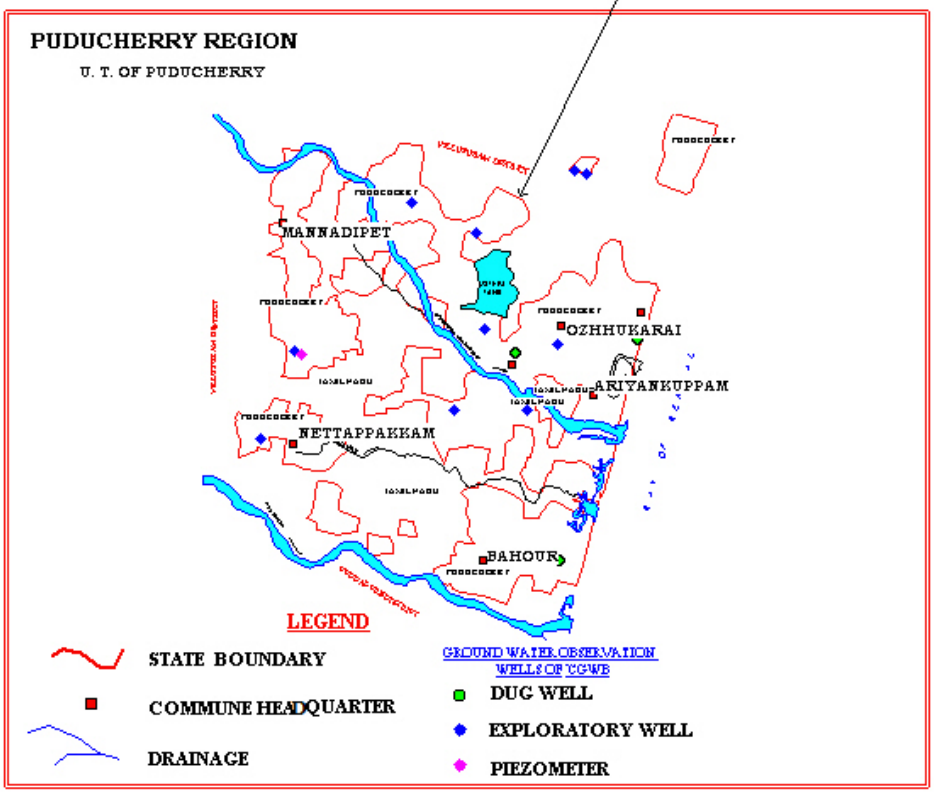
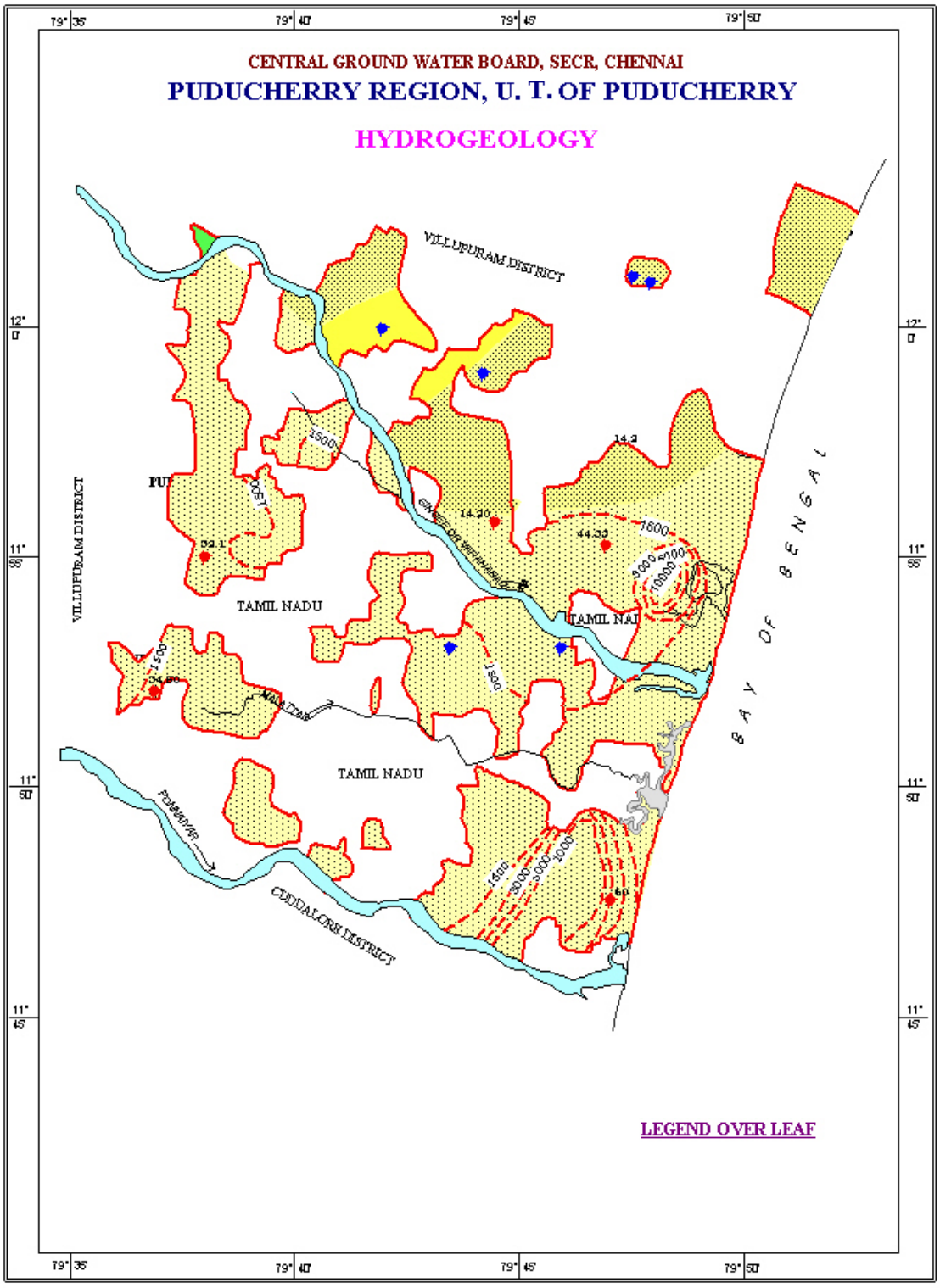


PLATE - II


CENTRAL GROUND WATER BOARD, SECR, CHENNAI
PUDUCHERRY REGION, U. T. OF PUDUCHERRY
HYDROGEOLOGY
VILLUPURAM DISTRICT
TAMIL NADU
TAMIL NADU
TAMIL NADU
BAY OF BENGAL
CUDDALORE DISTRICT
LEGEND OVER LEAF

LEGEND FOR HYDROGEOLOGY MAP

ADMINISTRATIVE SETUP

STATE BOUNDARY

HYDROCHEMISTRY

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

STRUCTURE

TRACE OF LINEAMENT

GROUND WATER HYDROLOGY

EXPLORATORY BORE WELL [CGWB]

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

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

PLATE - III

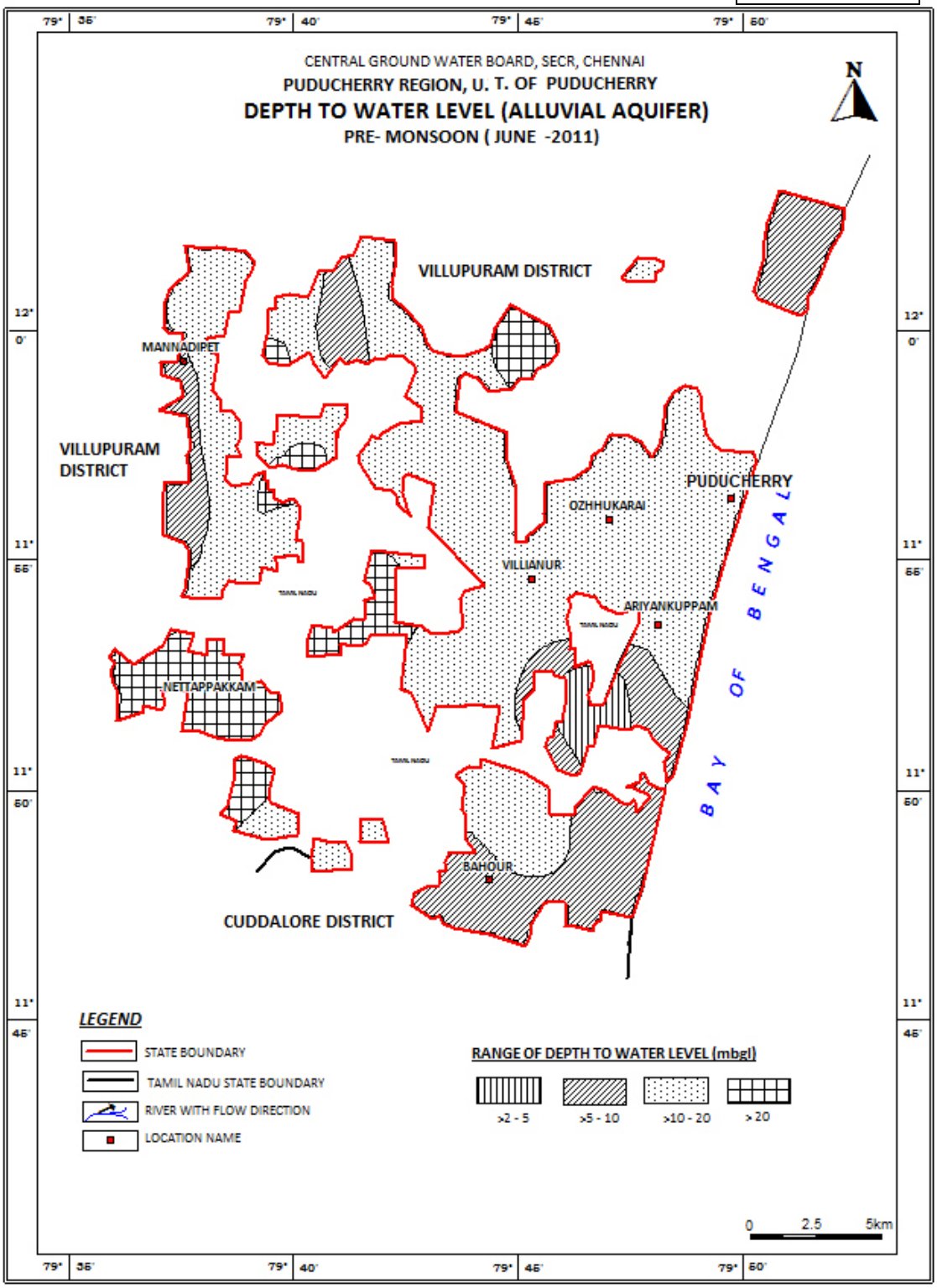

CENTRAL GROUND WATER BOARD, SECR, CHENNAI
PUDUCHERRY REGION, U. T. OF PUDUCHERRY
DEPTH TO WATER LEVEL (ALLUVIAL AQUIFER)
PRE- MONSOON (JUNE -2011)
N
79° 35'
79° 40'
79° 45'
79° 50'
12° 0'
11° 55'
11° 50'
11° 45'
VILLUPURAM DISTRICT
MANNADIPET
VILLUPURAM DISTRICT
PUDUCHERRY
OZHUKARAI
VILLIANUR
ARIYANKUPPAM
NETTAPPAKKAM
BAHOUR
CUDDALORE DISTRICT
BAY OF BENGAL
LEGEND
STATE BOUNDARY
TAMIL NADU STATE BOUNDARY
RIVER WITH FLOW DIRECTION
LOCATION NAME
RANGE OF DEPTH TO WATER LEVEL (mbgl)
>2 - 5
>5 - 10
>10 - 20
> 20
0 2.5 5km

PLATE - IV

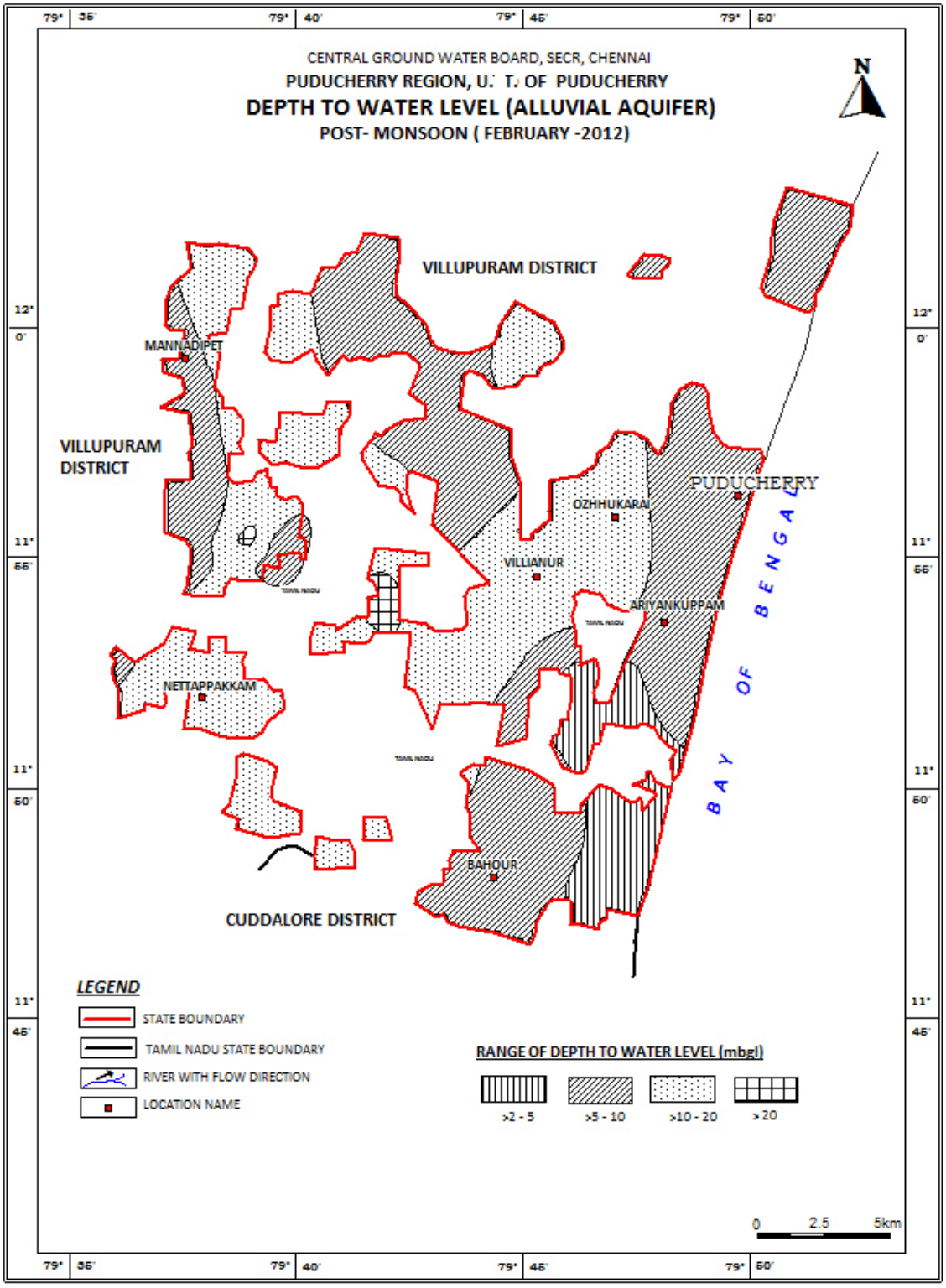

CENTRAL GROUND WATER BOARD, SECR, CHENNAI
PUDUCHERRY REGION, U. T. OF PUDUCHERRY
DEPTH TO WATER LEVEL (ALLUVIAL AQUIFER)
POST- MONSOON (FEBRUARY -2012)
N
VILLUPURAM DISTRICT
MANNADIPET
VILLUPURAM DISTRICT
PUDUCHERRY
OZHUKARAI
VILLIANUR
ARIYANKUPPAM
NETTAPPAKKAM
BAHOUR
CUDDALORE DISTRICT
BAY OF BENGAL
LEGEND
STATE BOUNDARY
TAMIL NADU STATE BOUNDARY
RIVER WITH FLOW DIRECTION
LOCATION NAME
RANGE OF DEPTH TO WATER LEVEL (mbgl)
>2 - 5
>5 - 10
>10 - 20
> 20
0 2.5 5km
79° 35' 79° 40' 79° 45' 79° 50'
12° 0'
11° 55'
11° 50'
11° 45'

PLATE - V

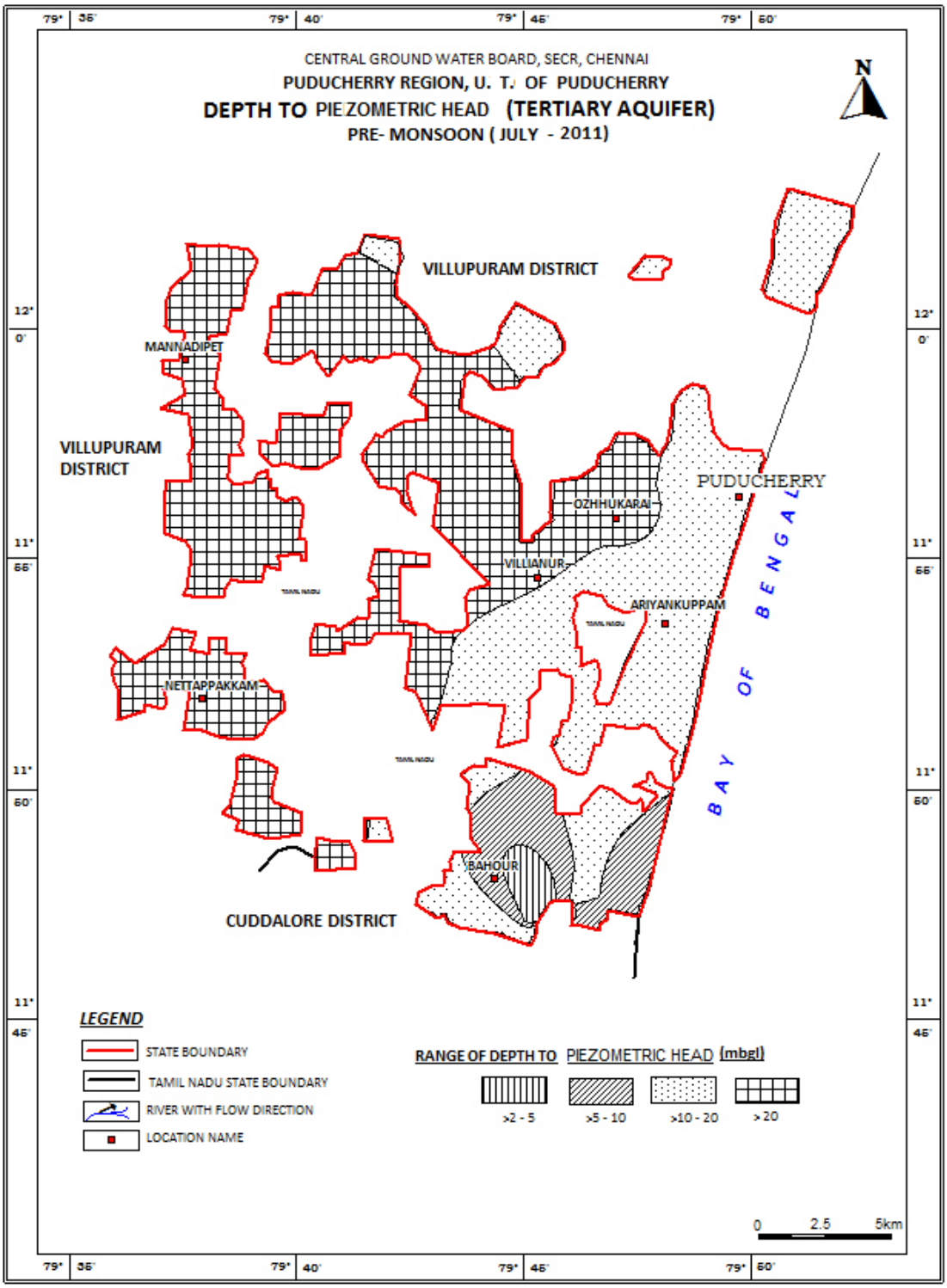

CENTRAL GROUND WATER BOARD, SECR, CHENNAI
PUDUCHERRY REGION, U. T. OF PUDUCHERRY
DEPTH TO PIEZOMETRIC HEAD (TERTIARY AQUIFER)
PRE- MONSOON (JULY - 2011)
N
79° 35' 79° 40' 79° 45' 79° 50'
12° 0' 11° 55' 11° 50' 11° 45'
VILLUPURAM DISTRICT
MANNADIPET
VILLUPURAM DISTRICT
PUDUCHERRY
OZHHUKARAI
VILLIANUR
ARIYANKUPPAM
NETTAPPAKKAM
BAHOUR
CUDDALORE DISTRICT
BAY OF BENGAL
LEGEND
STATE BOUNDARY
TAMIL NADU STATE BOUNDARY
RIVER WITH FLOW DIRECTION
LOCATION NAME
RANGE OF DEPTH TO PIEZOMETRIC HEAD (mbgl)
>2 - 5
>5 - 10
>10 - 20
> 20
0 2.5 5km

PLATE - VI

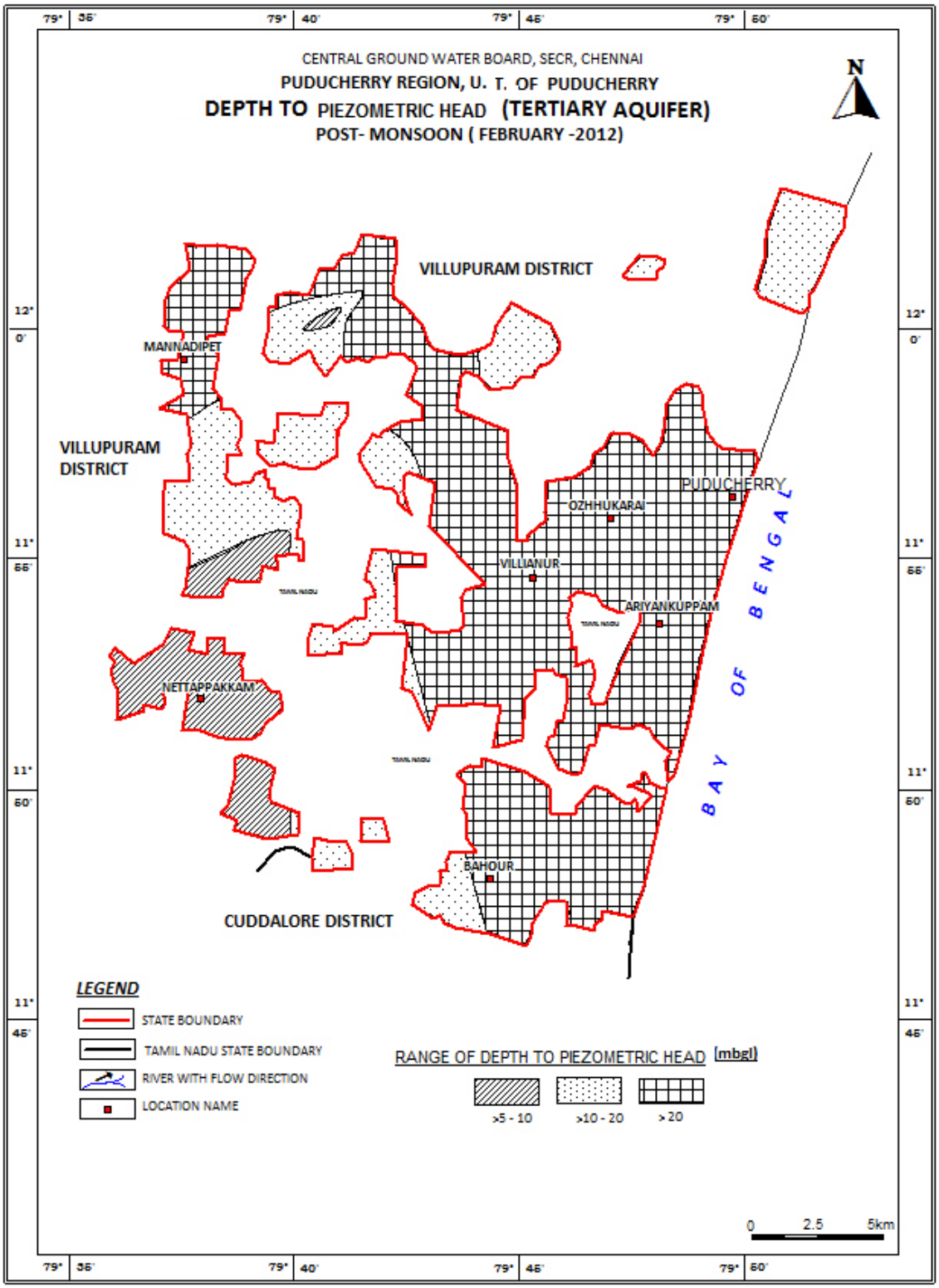

CENTRAL GROUND WATER BOARD, SECR, CHENNAI
PUDUCHERRY REGION, U. T. OF PUDUCHERRY
DEPTH TO PIEZOMETRIC HEAD (TERTIARY AQUIFER)
POST- MONSOON (FEBRUARY -2012)
N
VILLUPURAM DISTRICT
MANNADIPET
VILLUPURAM DISTRICT
PUDUCHERRY
OZHHUKARAI
VILLIANUR
ARIYANKUPPAM
NETTAPPAKKAM
BAHOUR
CUDDALORE DISTRICT
BAY OF BENGAL
LEGEND
STATE BOUNDARY
TAMIL NADU STATE BOUNDARY
RIVER WITH FLOW DIRECTION
LOCATION NAME
RANGE OF DEPTH TO PIEZOMETRIC HEAD (mbgl)
>5 - 10
>10 - 20
>20
0 2.5 5km
79° 35' 79° 40' 79° 45' 79° 50'
12° 0'
11° 55'
11° 50'
11° 45'

PLATE - VII

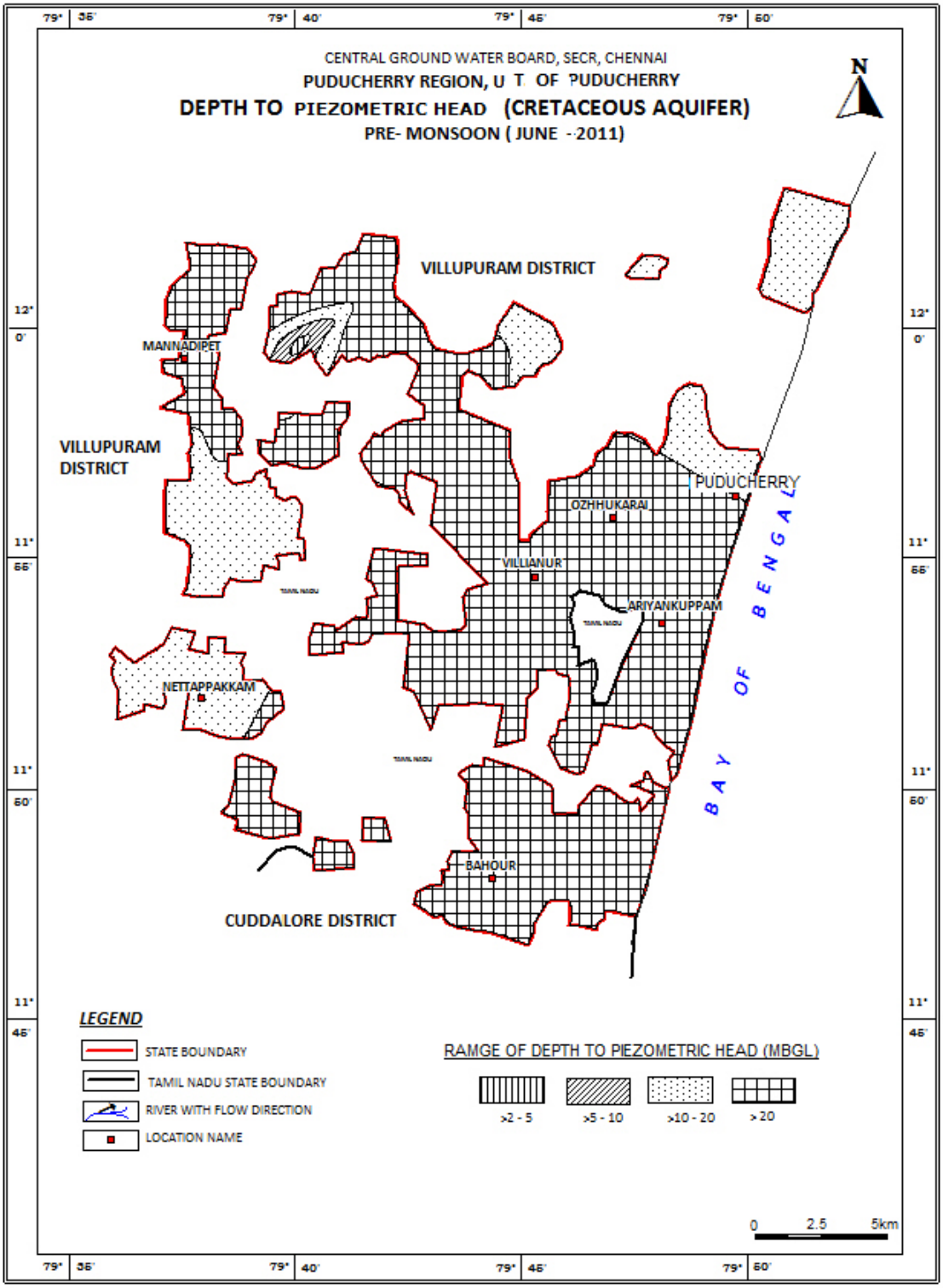
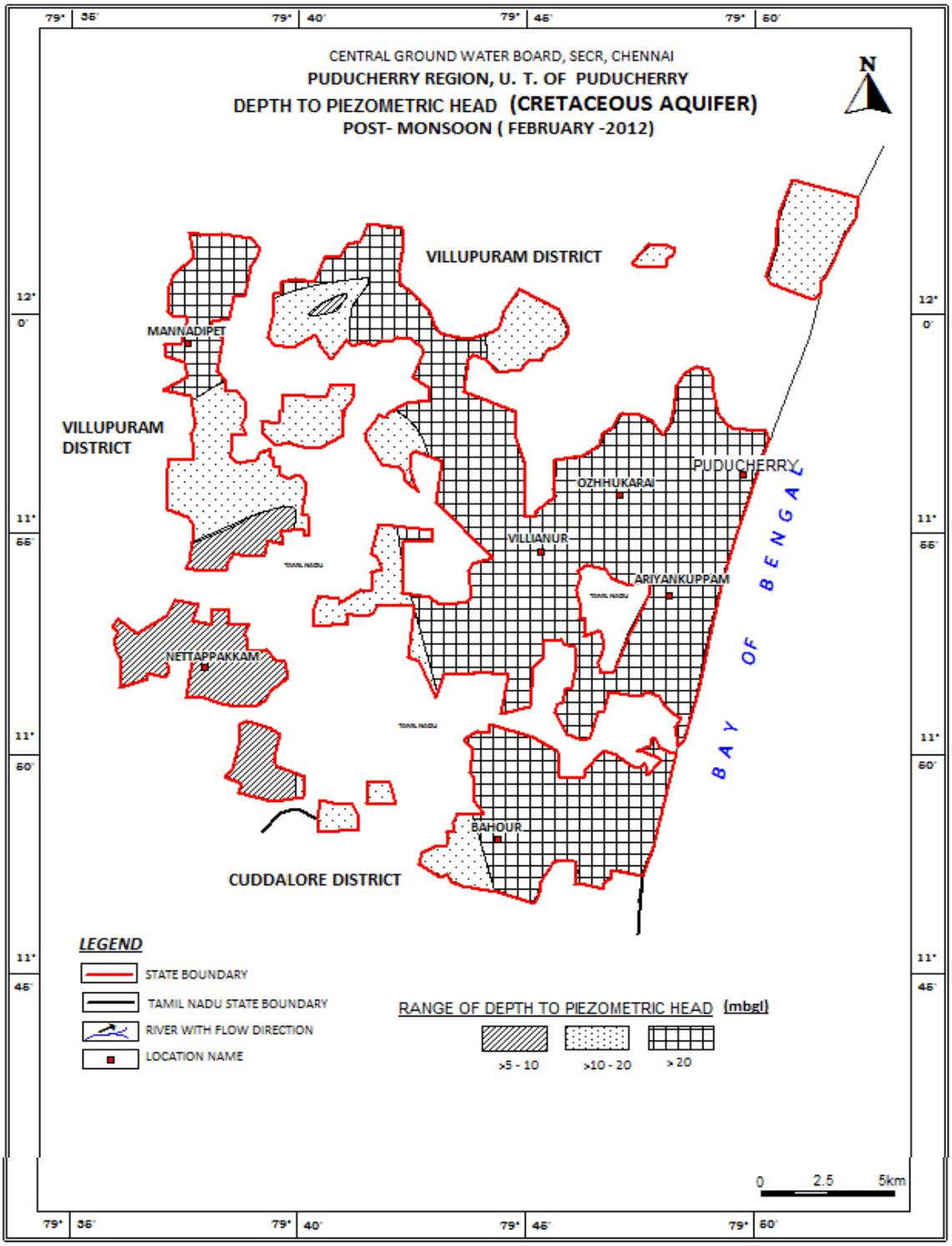

CENTRAL GROUND WATER BOARD, SECR, CHENNAI
PUDUCHERRY REGION, U T OF PUDUCHERRY
DEPTH TO PIEZOMETRIC HEAD (CRETACEOUS AQUIFER)
PRE- MONSOON (JUNE -2011)
N
VILLUPURAM DISTRICT
MANNADIPET
VILLUPURAM DISTRICT
PUDUCHERRY
OZHUKARAI
VILLIANUR
ARIYANKUPPAM
NETTAPPAKKAM
BAHOUR
CUDDALORE DISTRICT
BAY OF BENGAL
TAMIL NADU
79° 35'
79° 40'
79° 45'
79° 50'
12° 0'
11° 55'
11° 50'
11° 45'
LEGEND
STATE BOUNDARY
TAMIL NADU STATE BOUNDARY
RIVER WITH FLOW DIRECTION
LOCATION NAME
RAMGE OF DEPTH TO PIEZOMETRIC HEAD (MBGL)
>2 - 5
>5 - 10
>10 - 20
> 20
0 2.5 5km

PLATE - VIII


CENTRAL GROUND WATER BOARD, SECR, CHENNAI
PUDUCHERRY REGION, U. T. OF PUDUCHERRY
DEPTH TO PIEZOMETRIC HEAD (CRETACEOUS AQUIFER)
POST- MONSOON (FEBRUARY -2012)
N
VILLUPURAM DISTRICT
MANNADIPET
VILLUPURAM DISTRICT
PUDUCHERRY
OZHUKARAI
VILLIANUR
ARIYANKUPPAM
NETTAPPAKKAM
BAHOUR
CUDDALORE DISTRICT
BAY OF BENGAL
LEGEND
STATE BOUNDARY
TAMIL NADU STATE BOUNDARY
RIVER WITH FLOW DIRECTION
LOCATION NAME
RANGE OF DEPTH TO PIEZOMETRIC HEAD (mbgl)
>5 - 10
>10 - 20
> 20
0 2.5 5km

நீர் பாதுகாப்பு
மற்றும்
நீர் சேமிப்பு செய்

जल बचाओ
और
जल संरक्षण करना

SAVE WATER
AND
CONSERVE WATER

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