



Implemented by



Incorporation with



# Reducing effects of seawater intrusion into freshwater resources through vulnerability mapping, assessment at Ramanathapuram coastal district of Tamil Nadu state under Water Security and Climate Adaptation

**Contract No. 83357763**

## FINAL REPORT



Submitted to

**Deutsche Gesellschaft Fur Internationale  
Zusammenarbeit (GIZ)**

By

**Suganthi Devadason Marine Research Institute (SDMRI)**  
**(Recognized by Manonmaniam Sundaranar University and U.G.C. &  
Recognized Scientific and Industrial Research Organization by the DSIR, GOI)**  
**44 - Beach Road, Tuticorin - 628 001, Tamil Nadu**  
**Tel: 0461 - 2336488, 2323007; E.mail: director@sdmri.in**  
**Web: <http://www.sdmri.in>**

**25.02.2020**

## TABLE OF CONTENTS

S. No.	Content	Page No.
1.	Background about the project	3
2.	About the present task	6
3.	Objectives	6
4.	Methodology	6
4.1.	Collection of groundwater samples	7
4.2.	Analysis of groundwater samples	8
4.3.	Water Quality Index (WQI) and Seawater Mixing Index (SMI)	9
4.4.	Spatial mapping using GIS	10
5.	Results	11
5.1.	pH	11
5.2.	Salinity	13
5.3.	Electrical Conductivity (EC)	14
5.4.	Total Dissolved Solids (TDS)	16
5.5.	Total Hardness (TH)	17
5.6.	Calcium (Ca)	19
5.7.	Magnesium (Mg)	20
5.8.	Sodium (Na)	22
5.9.	Potassium (K)	23
5.10.	Chloride (Cl)	25
5.11.	Nitrate (NO <sub>3</sub> )	27
5.12.	Sulphate (SO <sub>4</sub> )	28
5.13.	Total Alkalinity (TA)	30
5.14.	Water Quality Index (WQI)	34
5.15.	Seawater Mixing Index (SMI)	36
6.	Key findings	77
7.	Recommendations	78
8.	References	80
9.	Plates	81

## 1. BACKGROUND ABOUT THE PROJECT

The German Federal Ministry for Economic Cooperation and Development (BMZ) is one of the largest donors in the water sector, and it attaches priority to the human right-based approach and the Leave No One Behind (LNOB) principle contained in the 2030 agenda. According to India's Composite Water Management Index (2018), 600 million people in the country (44 percent of the total population) are suffering from an acute shortage of water. A shrinking and sometimes contaminated water supply, heavy reliance on rainfall and lack of efficient irrigation systems are major problems in rural areas, where almost 70 percent of the Indian population live. India is one of the countries the most affected by climate change, and it occupies the sixth place in the Global Climate Risk Index 2018. In this changing climate scenario, water security is therefore a prime concern.

Water Security and Climate Adaptation (WASCA) in Rural India is a bi-lateral project commissioned by the German Federal Ministry for Economic Cooperation and Development in partnership with the Ministry of Rural Development (MoRD), India and Ministry of Jal Shakti (MoJS), India. The objective of the project is to bring about improvement in water resource management in order to ensure water security and adaptation to the changing climate. Its implementation in four states namely, Tamil Nadu, Rajasthan, Madhya Pradesh and Uttar Pradesh, started in April 2019 will be in operation till March 2022.

Project WASCA seeks to address planning, financing and implementation mechanisms developed in the field of rural water resource management and climate change adaptation. As said above the main objective of the program is improving the rural water resource management with regard to enhancement of water security and climate adaptation at the national level and in the afore-mentioned four states namely Rajasthan, Madhya Pradesh, Uttar Pradesh and Tamil Nadu. The project has the following outputs:

- Improving existing planning and financing mechanisms
- Developing climate-resilient water management measures
- Strengthening cooperation with private sector, along with subsequently on
- Increasing the productivity and income of small farmers through climate-resilient and water-efficient management models.

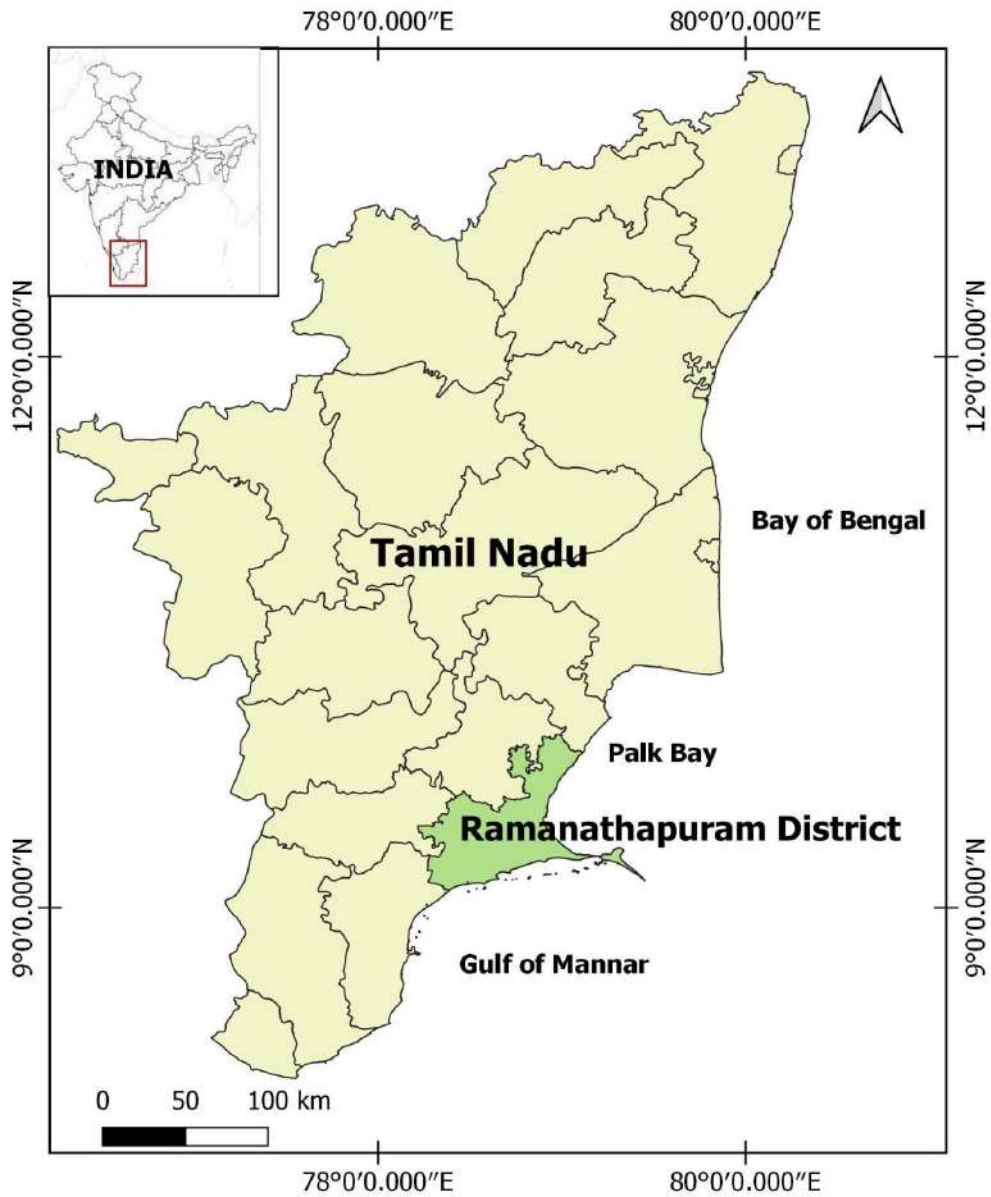
The key concept of the project is to develop Composite Water Resources Management (CWRM) plan at Gram Panchayat (GP) level, which helps to prepare a water budget by assessing the supply and demand. The various existing non-spatial information for the GP and the various available thematic layers for the GP from Bhuvan-NRSC will be used in CWRM. Developing an action plan for degraded lands and common lands under Watershed principles, agriculture, development of irrigation, grey water management, industrial wastewater use and identification of hotspots for piloting Climate Resilient Models. Identification of key challenges

in water sector at GP level, developing appropriate plans and management measures to match the supply and demand in water sector at GP level.

Tamil Nadu is one of the most water-stressed states in India. The state accounts for 6 per cent of the national population (Census 2011) but is endowed with only 3 per cent of water resources in India. The state's climate is semi-arid tropical monsoon. The climate of Tamil Nadu is strikingly different from the general climate of the country, and this is due to the state's geographical location and topographical features. The state receives maximum rainfall during the months of October, November, and December (post-monsoon), whereas in the rest of the country the maximum rainfall is received in the months of June, July, August, and September (monsoon). The major part of the state is rain-fed and approximately 43 per cent of its area is used for agricultural cultivation. Since the state is entirely dependent on rains for recharging its water resources, monsoon failures lead to acute water scarcity and severe droughts. The current total water potential in Tamil Nadu is assessed to be 42,748 MCM (1510 TMC), out of which the surface water potential contributes to 24,160 MCM (853) and the groundwater potential to about 18,588 MCM (657 TMC) (<https://www.twadboard.tn.gov.in/content/tamilnadu>). Almost 95 per cent of the surface water and 80 per cent of the groundwater have already been in use. Major uses of water include irrigation, human/animal consumption, and industrial use. In order to enhance the water security of the Tamil Nadu state under the changing climate scenario, an inclusive vulnerability assessment has been undertaken to identify the vulnerable districts. The bio-physical and socio-economic indicators are used to represent sensitivity and adaptive capacity of the state that helps determine rural water security. The districts ranked as highly vulnerable viz., Ramanathapuram and Thiruvannamalai are priority areas for pilot project demonstration of water security and climate adaptation in rural Tamil Nadu.

Ramanathapuram, one of the districts in Tamil Nadu (Fig. 1), suffers the most from the erratic nature of the monsoons in the state, and is hence the most vulnerable to drought. Drought is more recurrent during period from June to September. Similarly, an increasing trend of maximum temperature is observed in the district. The composite vulnerability Index (CVI) of Ramanathapuram district (0.7) is ranked higher than the other districts in Tamil Nadu. The geographical extent of Ramanathapuram District is 4,089.57 sq.km, accounting for 3.14 per cent of the geographical area of the state. It is a plain coastal district located in southern agro climatic zone. The district is divided into 38 firkas, containing 429 village panchayats. In 2015-16 the principal crops were Cotton (9.1 per cent), Cumbu (5.1 per cent), Cholam (3.8 per cent), Groundnut (1.8 per cent), Paddy (1.4 per cent), and Gingelly (1.1 per cent), the percentages being part of the total area sown. The net irrigated area was 53,599 ha in 2015-2016. Source-wise, open wells contribute the most to the net area irrigated. There are 24,633 tanks, 28,688 open wells and 278 tube wells. Generally the climate is hot, the mean annual maximum and minimum temperature during the long-term period is 1951-2015 is 32.6° C and is 23.8° C respectively. The annual average rainfall is 847.3 mm. Rainfall during the north-east monsoon is the major contributor, accounting for nearly 61 per cent of the total annual rainfall, and the south-west monsoon contributes 18 per cent of the total rainfall. Climate projection based on

global climate models indicate that there would be 1.1°C increase in maximum temperature around the middle of this century (2041-2070) and 1.9°C increase towards the end of the century (2071-2100). This increase is from the baseline of RCP 4.5 climate scenario. Hence Ramanathapuram is the district selected under WASCA program.



**Fig.1: Map showing the Pilot Project District**

## **2. ABOUT THE PRESENT TASK**

It was planned to develop Composite Water Resources Management (CWRM) plan at Gram Panchayat level for the entire Ramanathapuram district making use of the available non-spatial and spatial data. As Ramanathapuram is a coastal district, seawater intrusion is one of the major issues affecting the groundwater quality. The groundwater sources in Ramanathapuram are present in the porous as well as fissured formations. The aquifer system consists of unconsolidated and semi-consolidated formations and they are of weathered and fractured crystalline rocks. The groundwater levels in the district range from 6 to 777 m below ground level depending upon the type of the formation. The quality of groundwater in general is colorless, odourless and slightly alkaline in nature, and total hardness exceeds the permissible limits. From the irrigation point of view, the groundwater has high to very high salinity hazard, and medium to high alkali hazard, due to seawater intrusion and/or rock water interaction. So proper water management strategies are to be adopted before using the groundwater for drinking, domestic, irrigation and industrial purposes. For taking proper management action, it is necessary to undertake a detailed study of the extent of seawater intrusion in aquifers and to investigate the groundwater quality for the entire district. This will enable easy identification of the water challenges and facilitate water budget estimation and preparation of action plan under MGNREGs activities at Gram Panchayat levels as per CWRM plan. Suganthi Devadason Marine Research Institute was assigned the present task of conducting a study on 'Reducing effects of seawater intrusion into freshwater resources through vulnerability mapping and assessment for Ramanathapuram District'. The results are made available in the form of shapefile/kml format and they can be utilized in preparing CWRM plan at Gram Panchayat levels for the entire district.

## **3. OBJECTIVES**

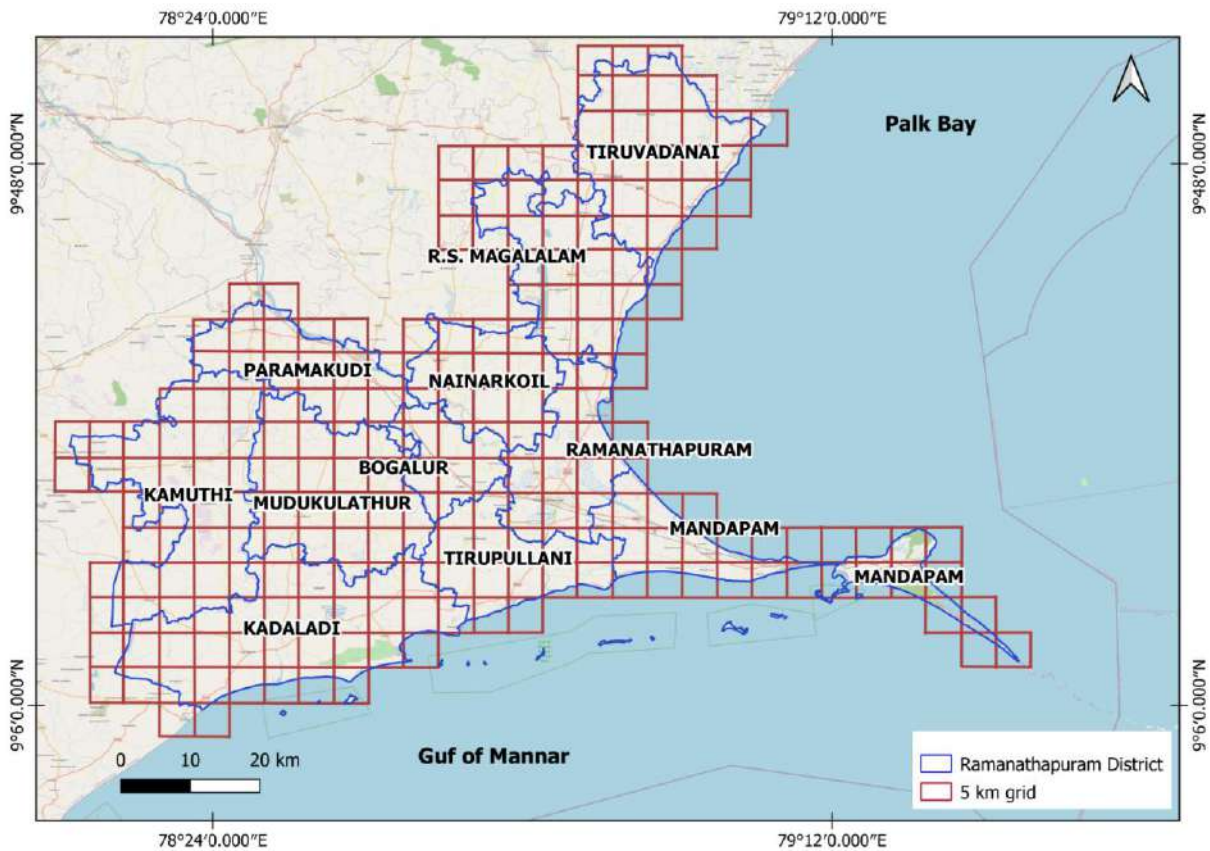
- To map vulnerability of the groundwater quality in aquifers, extent of seawater intrusion in the aquifers of Ramanathapuram District
- Estimate annual rate of sea water intrusion
- Develop effective plan, suitable methodology for the sustainable management for arresting/reducing seawater intrusion in Ramanathapuram district (with Climate Adaptation)

## **4. METHODOLOGY**

Suggested methodology includes: a) Evaluation of seawater intrusion include groundwater chemistry, pattern diagrams and geographical information studies; b) GIS, RS methodologies with high resolution, acceptable by RDPR, DRDA and PWD: SWGW Data Centre (NWM) and GIZ; and c) The agency closely works with DRDA, Ramanathapuram (MGNREGA), District Steering Committee - WASCA-Ramanathapuram, Director, RDPR, Saidapet, Chennai, SWGW Data Centre (NWM), Taramani, Chennai, and MSSRF (Technical Resource Agency Under WASCA-TN).

#### 4.1. Collection of groundwater samples

The entire Ramanathapuram District was divided into 227 grids of 5km from the coastline landwards (Fig. 2), and samples from the grids were collected at 1x1km. Samples were collected from the bore wells or open wells available in the grid. The sample collection was both during pre-monsoon and post-monsoon periods.



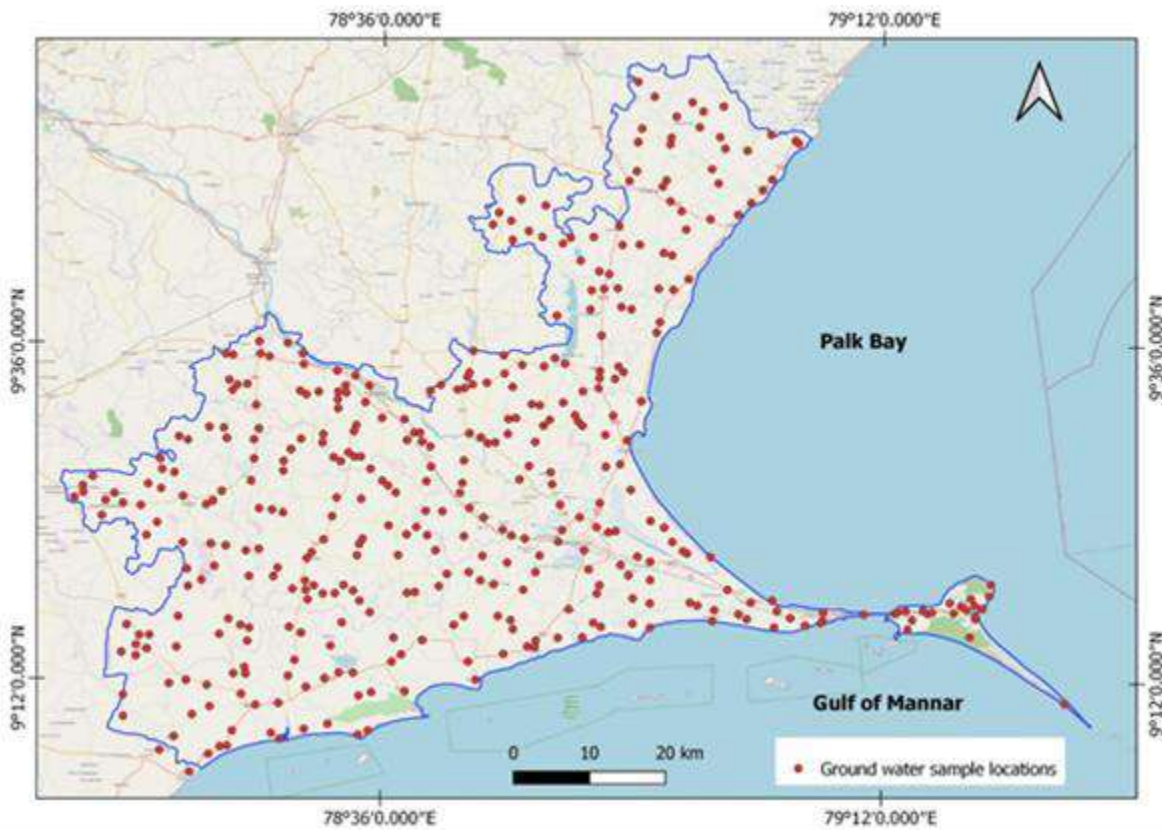
**Map.2: Map showing blocks of Ramanathapuram district with 5 km grid**

Extensive fieldwork was undertaken for the entire Ramanathapuram district from 15<sup>th</sup> to 18<sup>th</sup> July 2020 and from 18<sup>th</sup> to 21<sup>st</sup> August 2020, to collect groundwater samples for pre-monsoon season, the total number of groundwater samples collected being 378 (Fig. 3; Table 3). Similarly, 378 post-monsoon groundwater samples were collected during 5<sup>th</sup> to 12<sup>th</sup> January 2021.

Pre-cleaned one-liter bottles were used to collect groundwater samples. Samples were collected from bore wells or open wells in public or private land depending on their availability in the field. Handheld Global Positioning System (GPS) was used to mark the coordinates of the



bore wells and open wells. Water samples were collected after 2 to 3 minutes of pumping. The bottles were rinsed thoroughly with groundwater to avoid any possible contamination. The collected samples were labeled properly and taken to lab for further analysis.



**Fig.3: Map showing the groundwater sample locations for the Ramanathapuram district**

#### **4.2. Analysis of groundwater samples**

The physical as well as the chemical parameters of the groundwater samples were analysed using standard methodology (APHA 2005). Physical parameters like EC, pH and TDS were measured with handheld digital meter with an accuracy of 1  $\mu$ S/cm and 1ppm. Salinity was measured with handheld refractometer. Chemical parameters such as contents of Sodium (Na) and Potassium (K) were analysed with Flame Photometer; Calcium (Ca) and Magnesium (Mg) were determined titrimetrically using EDTA standard solution in the presence of eriochrome black T as an indicator. Alkalinity was determined by titration with H<sub>2</sub>SO<sub>4</sub> standard solution in the presence of methyl orange as an indicator. Chloride (Cl) was estimated by titrating against AgNO<sub>3</sub> standard solution in the presence of potassium chromate as an indicator, whereas Sulphate (SO<sub>4</sub>) and Nitrate (NO<sub>3</sub>) were estimated using UV-spectrophotometer.



### 4.3. Water Quality Index (WQI) and Seawater Mixing Index (SMI)

Water Quality Index is defined as a measure of rating that provides the composite influence of individual water quality parameter on the overall quality of water (Saedi et al. 2010; Wu et al. 2017). Similarly, Seawater Mixing Index is for the effective isolation of seawater mixing in groundwater in coastal regions. For the present study both the indices were applied.

**Water quality index-** The quality of groundwater is significant since it governs the suitability of water for drinking utility (Subba Rao et al. 2012). The range for drinking utilities as suggested by WHO (2004) has to be considered for calculating WQI. In the calculation of WQI four steps are generally followed. In the first step, the weightage ( $w_i$ ) of the 10 parameters (pH, TDS,  $\text{HCO}_3$ , Cl,  $\text{SO}_4$ ,  $\text{NO}_3$ , Ca, Mg, Na and K) are assigned by considering each parameter's rank in determining the quality of water for drinking utility (Table 1). The extreme weight of 5 is assigned to the TDS, 4 to Na, Cl and pH, 3 to  $\text{SO}_4$ ,  $\text{NO}_3$ , 2 to Ca, Mg and K, whereas  $\text{HCO}_3$  is assigned 1 as it plays a less significant role in determining the water quality. In the second step the relative weight ( $W_i$ ) is calculated using the formula given below.

$$W_i = \frac{w_i}{\sum_{i=1}^n w_i}$$

**Table 1:** shows the relative weight assigned for different water quality parameters.

S. No.	Physical and chemical parameters	World Health Organization (WHO 2004)	Weight (w)	Relative weight ( $w_i$ )
1	pH	8.5	4	0.133
2	Total dissolved solids (mg/l)	500	5	0.167
3	Bicarbonate (mg/l)	200	1	0.033
4	Chloride (mg/l)	200	4	0.133
5	Sulphate (mg/l)	200	3	0.100
6	Nitrate (mg/l)	45	3	0.100
7	Calcium (mg/l)	75	2	0.067
8	Magnesium (mg/l)	30	2	0.067
9	Sodium (mg/l)	200	4	0.133
10	Potassium (mg/l)	100	2	0.067

Where ( $W_i$ ) is the relative weight, ( $w_i$ ) is the weight of individual parameter and  $n$  is the total number of the parameters. In the next step a quality rating scale ( $q_i$ ) for each parameter is assigned by dividing the concentration of each element in water sample with standards, proposed by WHO (2004) and the resultant is multiplied by 100 by adopting the formula.

$$q_i = \frac{C_i}{S_i} \times 100$$

$$SI_i = W_i \times Q_i$$

Where  $q_i$  is the quality rating,  $C_i$  is the concentration of individual element in water samples represented in mg/l and  $S_i$  is the drinking water standard for individual chemical constituents (in mg/l) as per the guidelines of WHO (2004). Finally, the WQI is determined using the formula given below.

$$WQI = \sum_{i=1}^n SI_i$$

Where,  $SI_i$  is the sub-index of the  $i$ th. The WQI ranges and the corresponding types of water quality are categorized as follows (Table 2)

**Table 2: shows the WQI ranges and types of water.**

S. No.	Range	Water quality
1	<50	Excellent quality
2	50-100	Good quality
3	100-200	Medium quality
4	200-300	Poor quality
5	>300	Very poor quality

**Seawater mixing index** - For the effective isolation of seawater mixing in groundwater samples the 'seawater mixing index' (SMI) after Park et al. (2005) has been adopted. This parameter is mainly based on concentration of major ionic constituents in seawater (Na, Cl, Mg and  $SO_4$ ) as given below.

$$SMI = a \times \frac{C_{Na}}{T_{Na}} + b \times \frac{C_{Mg}}{T_{Mg}} + c \times \frac{C_{Cl}}{T_{Cl}} + d \times \frac{C_{SO_4}}{T_{SO_4}}$$

The measurements a, b, c and d represent the relative concentration percentage of  $Na^+$ ,  $Mg^{2+}$ ,  $Cl^-$  and  $SO_4^{2-}$  assumed respectively as: a = 0.31, b = 0.04, c = 0.57 and d = 0.08 in seawater. C represents the concentration (mg/l) of the  $i$ th ions in groundwater samples and  $T_i$  signifies the calculated regional threshold values for the  $i$ th ions interpreted from the cumulative prospect curves (Park et al. 2005; Omonona et al. 2014). SMI exceeding 1 denotes that groundwater is somewhat influenced by seawater mixing, and values less than 1 indicate fresh water (Mondal et al. 2011).

#### 4.4. Spatial mapping using GIS

Base map for the current study was prepared with the help of open street map and toposheet using ArcGIS software (QGIS). To this base map, the collected GPS points of the sampling sites were transferred from GPS to the GIS software. Attribute tables were created for each station and results for the collected samples were fed into the tables for the corresponding sample

locations. With this spatial data, spatial variations of the results for different water quality parameters were developed using Inverse Distance Weighted (IDW) interpolation method. Similarly, thematic map for WQI and SMI were prepared (Horvat 2013). This GIS data format of kml/shapefile can be used in preparing and developing effective CWRM plan.

## 5. RESULTS

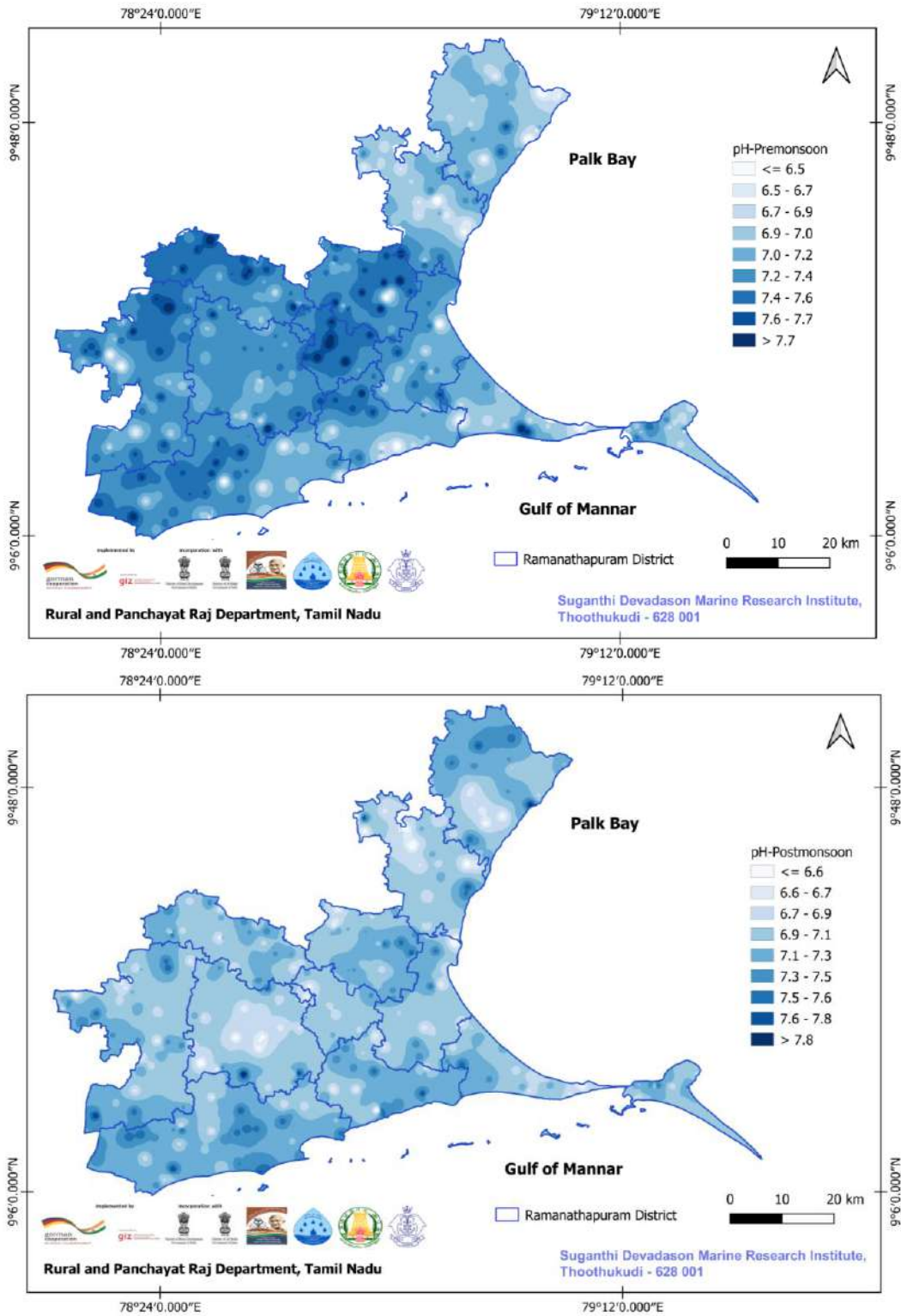
The various physico-chemical characters of pre-monsoon and post-monsoon groundwater quality for the collected locations are listed in Tables 4 & 5.

### 5.1. pH

pH of groundwater is important in determining the hydrological processes. Processes such as carbon absorption, ion exchange, and flocculation may be affected by pH. The pH of water indicates its quality and provides information regarding the types of geochemical equilibrium or solubility calculations (Hem, 1985). A measure of the acidity of water is pH, which is a measure of the hydrogen ion concentration. The pH scale ranges from 0 to 14. In general, water with a pH of 7 is neutral; a pH of < 7 is considered acidic and a pH of > 7 is alkaline. A one unit change in pH represents a 10 fold difference in hydrogen ion concentration. In the present project the pH values of groundwater samples range between 6.12 and 8.13 for the pre-monsoon and between 6.25 to 8.02 for the post-monsoon seasons (Table 4 & 5). Out of 378 samples 15 of pre-monsoon and 18 of post-monsoon were below the standard range recommended by BIS and WHO (2004) for drinking purpose (Table 6). The values of majority of the samples exist within the range of pH 7.

The spatial distribution of groundwater pH for the pre-monsoon season indicates that pH is higher in the central and western parts of the district (Fig. 4). The lowest pH is observed along the coastal region and northern part of the district. Minimum pH occurs in Raghunathapuram, while maximum pH is recorded from Tharakudi.

Similarly, the spatial distribution of groundwater pH for the post-monsoon season indicates that pH is higher in the southern and northern coastal regions, whereas the lowest pH is seen in the central and some parts of northern region of the district (Fig. 4). Minimum pH occurs in K. Madurai and Pathanadhal, while maximum pH is recorded from Poongulami. There is reduction in the value of pH in the central region and a slight increase in the pH in the coastal region during post-monsoon as compared to pre-monsoon.



**Fig. 4: spatial distribution of pH in the groundwater of Ramanathapuram district during pre-monsoon and post-monsoon**

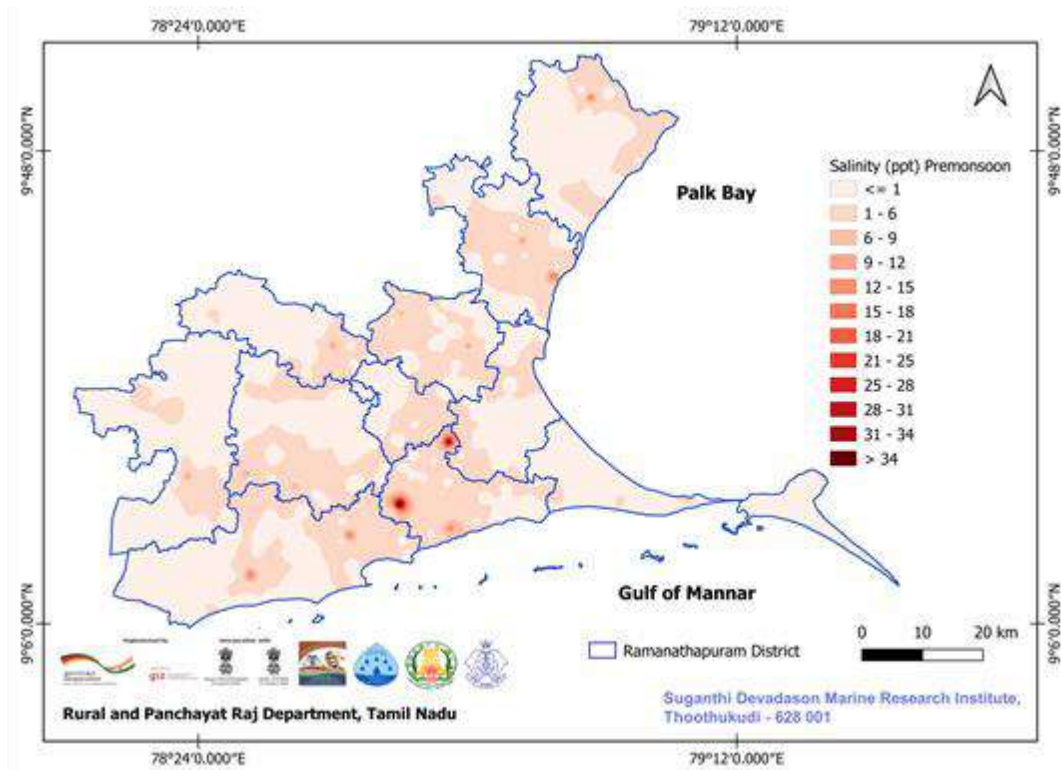
## 5.2. Salinity

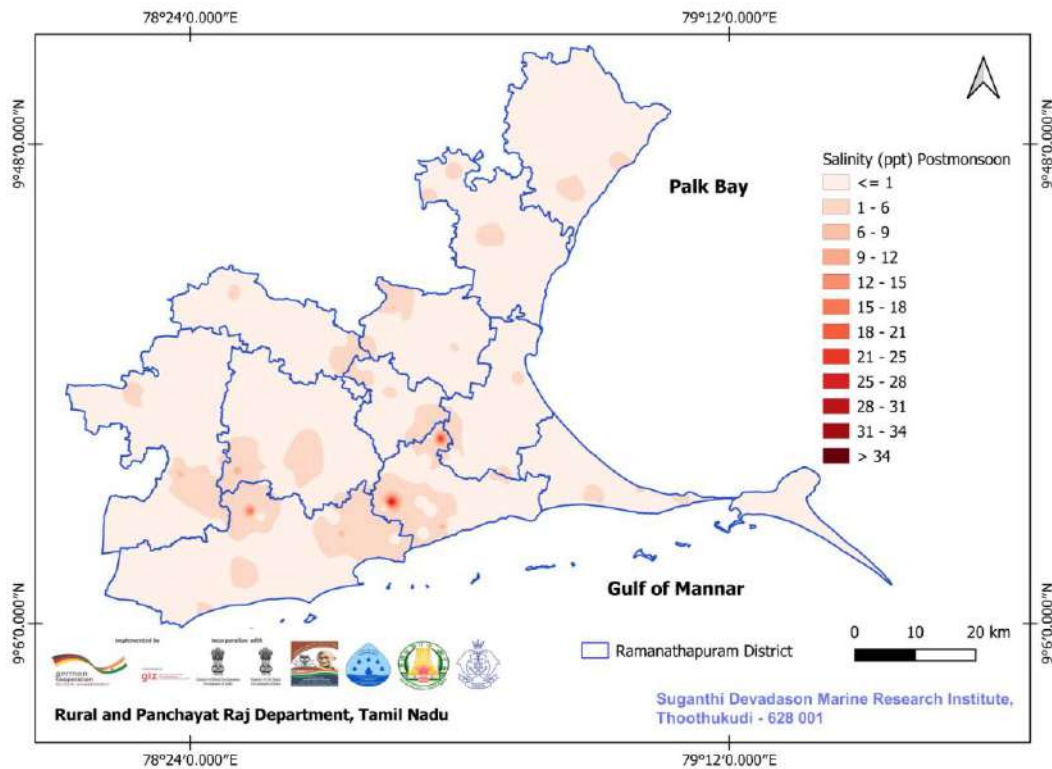
Groundwater salinity is generally of four types, 1) natural/ primary salinity caused by dissolution of minerals (e.g. halite, anhydrite, carbonate, gypsum, fluoride-salts and sulphate-salts) from bedrocks or accumulation of salts from rainfall built up over time, 2) dry land/secondary salinity caused by rising water levels which bring salt to the surface, 3) tertiary/irrigated salinity caused by repeated multiple irrigations of water where salt remains after evaporation and accumulate over time, 4) fourth/marine origin mostly found in coastal zones, where withdrawal of groundwater exceeds the recharge.

The salinity values of groundwater samples range between 0‰ and 40‰ for the pre-monsoon and 0‰ and 28‰ for the post-monsoon seasons (Table 4 & 5). Out of 378 samples 73 of pre-monsoon and 60 of post-monsoon exhibit salinity, while majority of the samples exhibits zero.

The spatial distribution of groundwater salinity for the pre-monsoon season indicates that salinity is present in the south-central and northern parts of district (Fig. 5). The highest value is recorded at Mariyarayapuram, which is about 8 km from the coast.

Similarly, the spatial distribution of groundwater salinity for the post-monsoon season indicates that salinity is higher in the central and some parts of the coastal regions of the district (Fig. 5). Mariyarayapuram records the highest value during post-monsoon season. There is reduction in salinity during post-monsoon when comparing with pre-monsoon





**Fig. 5: spatial distribution of salinity in the groundwater of Ramanathapuram district during pre-monsoon and post-monsoon**

### 5.3. Electrical Conductivity (EC)

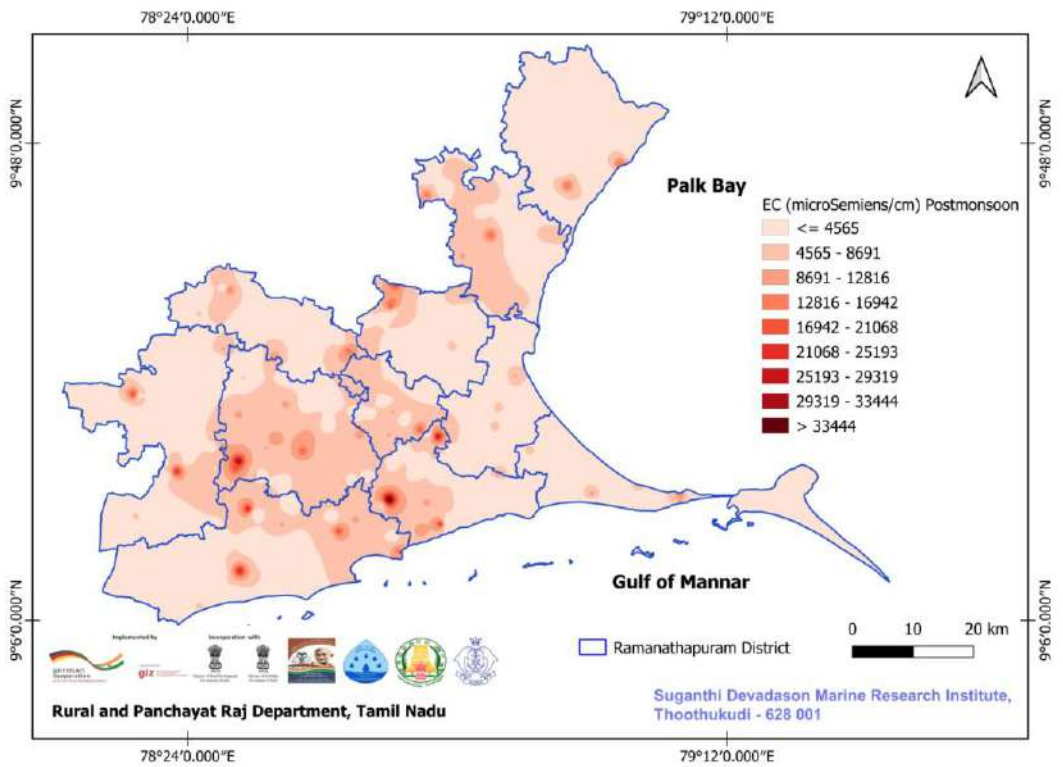
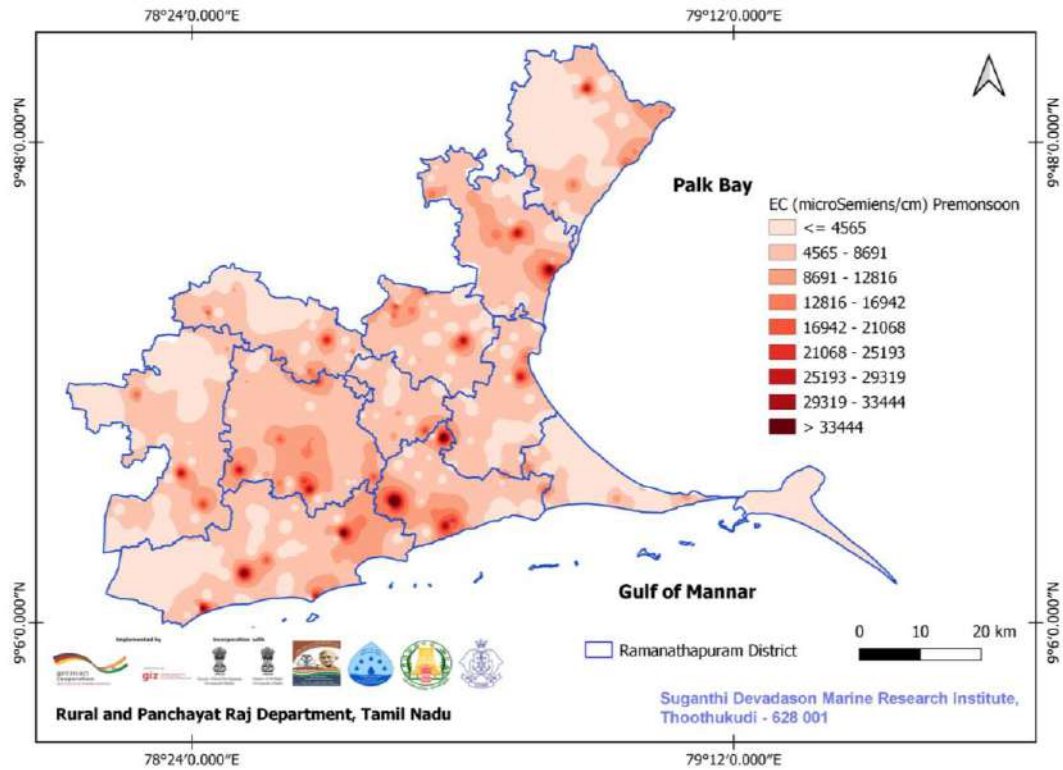
Electrical Conductivity is an important indicator in water quality assessment. EC of water is an indirect measure of its dissolved constituents. EC is expressed in terms of the specific electrical conductivity, which is defined as the reciprocal of electrical resistance in Ohm (Q), in relation to a water cube of edge length 1 cm at 25°C.

The EC value of groundwater samples range between 377  $\mu\text{S}/\text{cm}$  and 53,900  $\mu\text{S}/\text{cm}$  for the pre-monsoon and 167  $\mu\text{S}/\text{cm}$  and 23,740  $\mu\text{S}/\text{cm}$  for the post-monsoon seasons (Table 4 & 5). Majority of the samples are above 1000  $\mu\text{S}/\text{cm}$ , totally 77 of pre-monsoon and 119 of post-monsoon samples are within the range of 1000  $\mu\text{S}/\text{cm}$  (Table 6).

The spatial distribution of EC for the pre-monsoon season is higher in the south, central and northern regions and some parts of the coastal track of the district (Fig. 6). Minimum EC occurs at Solanthoor, while maximum EC at Mariyarayapuram.

Similarly, the spatial distribution of EC in the groundwater of post-monsoon season is higher in the south, central and some northwestern parts of the district (Fig. 6). Minimum pH occurs at Uttarakosamangai, while maximum occurs at Mariyarayapuram. There is considerable decrease in EC during post-monsoon when comparing with pre-monsoon.





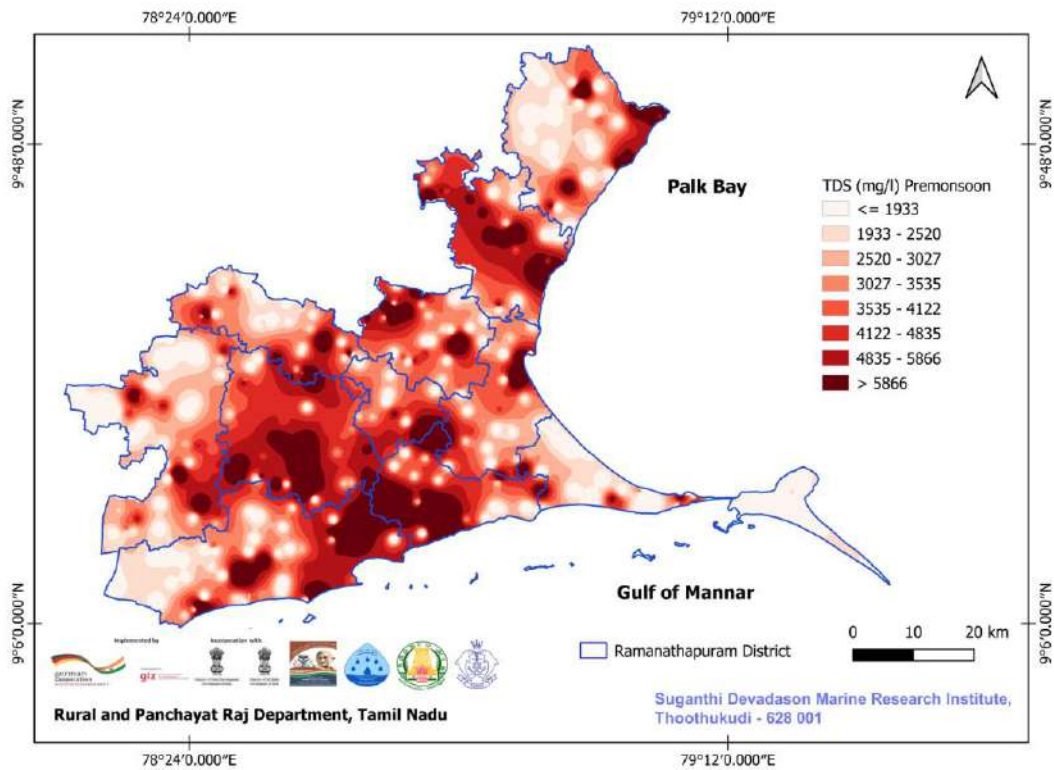
**Fig. 6: spatial distribution of Electrical Conductivity in the groundwater of Ramanathapuram district during pre-monsoon and post-monsoon**

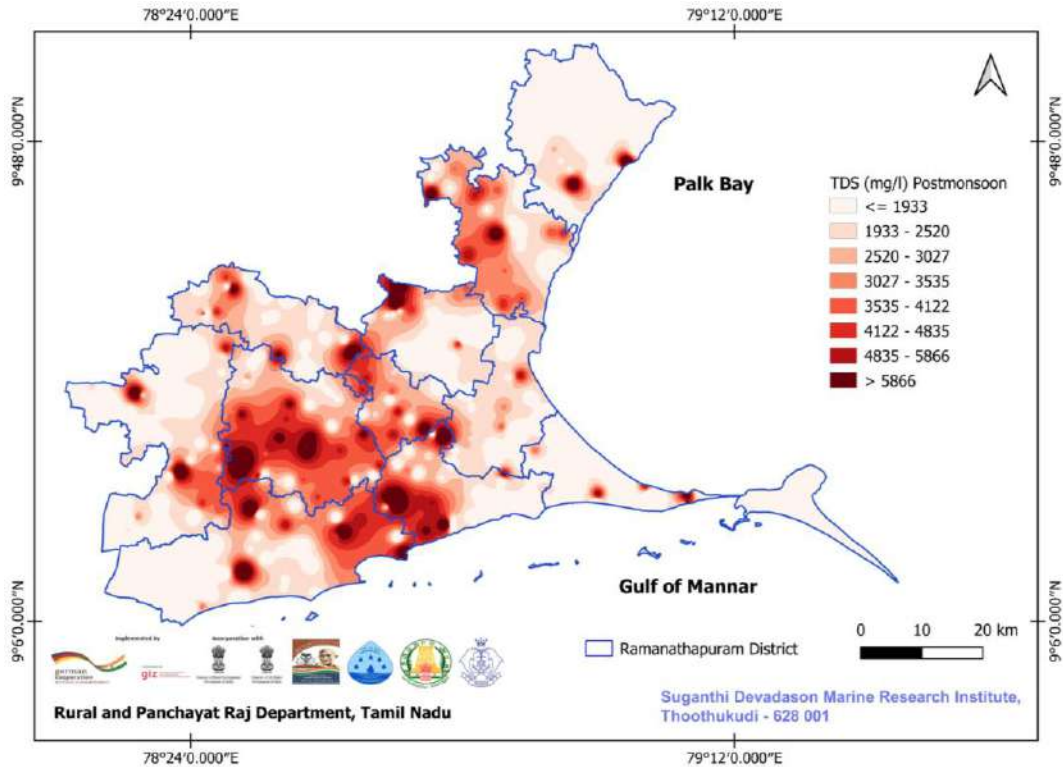
#### 5.4. Total Dissolved Solids (TDS)

Total dissolved solids refers to the total amount of all inorganic and organic substances including minerals, salts, metals, cations or anions that are dispersed within a certain volume of water. The concentration of TDS ranges between 214 mg/l and 32,020 mg/l for the pre-monsoon and between 118 mg/l and 23740 mg/l for the post-monsoon (Table 4 & 5). Majority of the samples are above the desirable limit of 500 mg/l, and totally 58 of pre-monsoon and 94 of post-monsoon samples are within the range of 500 mg/l (Table 6).

The spatial distribution of TDS for the pre-monsoon season is higher in the south, central and northern regions and some parts of the coastal track of the district (Fig. 7). Minimum TDS occurs at Solanthoor, while maximum TDS at Mariyarayapuram.

Similarly, the spatial distribution of TDS in the groundwater of post-monsoon season has higher concentration in the south, central and some parts of northwestern coastal region of the district (Fig. 7). Minimum TDS occurs at Uttarakosamangai, while maximum occurs at Mariyarayapuram. There is considerable decrease in TDS during post-monsoon when comparing with pre-monsoon.





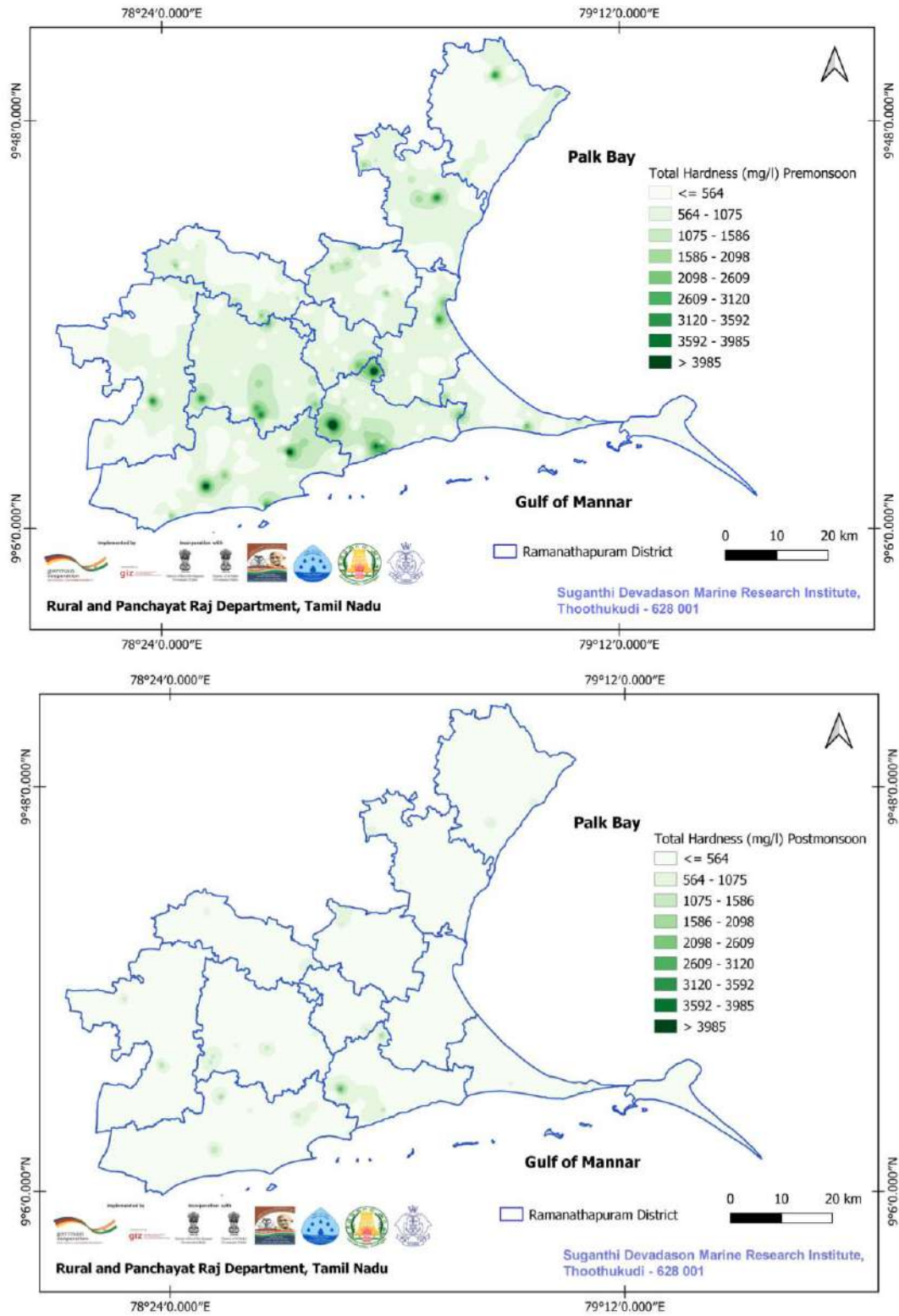
**Fig. 7: spatial distribution of Total Dissolved Solids concentration in the groundwater of Ramanathapuram district for pre-monsoon and post-monsoon**

### 5.5. Total Hardness (TH)

The levels of Total Hardness in groundwater samples range between 45 mg/l and 6,425 mg/l for pre-monsoon and between 20 mg/l and 2,835 mg/l for the post monsoon seasons (Table 4 & 5). Majority of the samples are above 300 mg/l, and totally 143 of pre-monsoon and 271 of post-monsoon samples are within the range of 300 mg/l (Table 6).

The spatial distribution of total hardness for the pre-monsoon season is higher in the south-central and a few regions in the northern parts of the district (Fig. 8). Minimum total hardness occurs at Solanthoor, while maximum TH at Mariyarayapuram.

Similarly, the spatial distribution of total hardness in the groundwater of post-monsoon season is higher in a few places in the south-central parts of the district (Fig. 8). Minimum total hardness occurs near Malakavanoor, while maximum occurs at Mariyarayapuram. There is considerable decrease in total hardness during post-monsoon when comparing with pre-monsoon.



**Fig. 8: spatial distribution of Total Hardness concentration in the groundwater of Ramanathapuram district for pre-monsoon and post-monsoon**

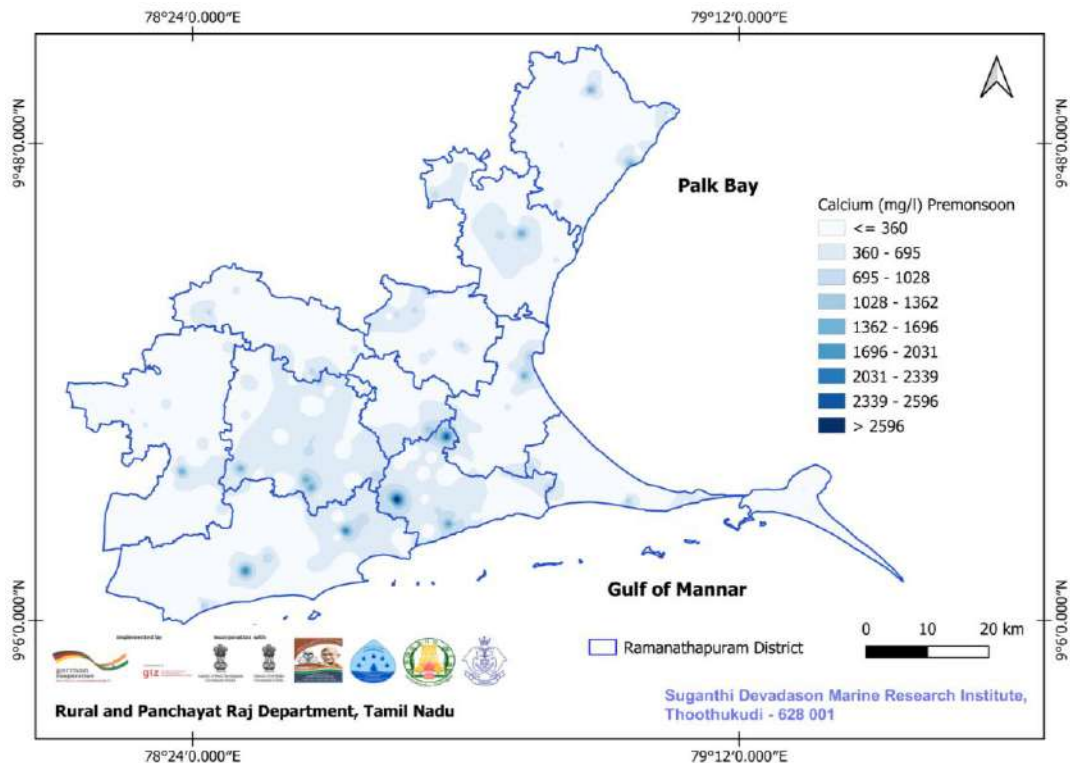


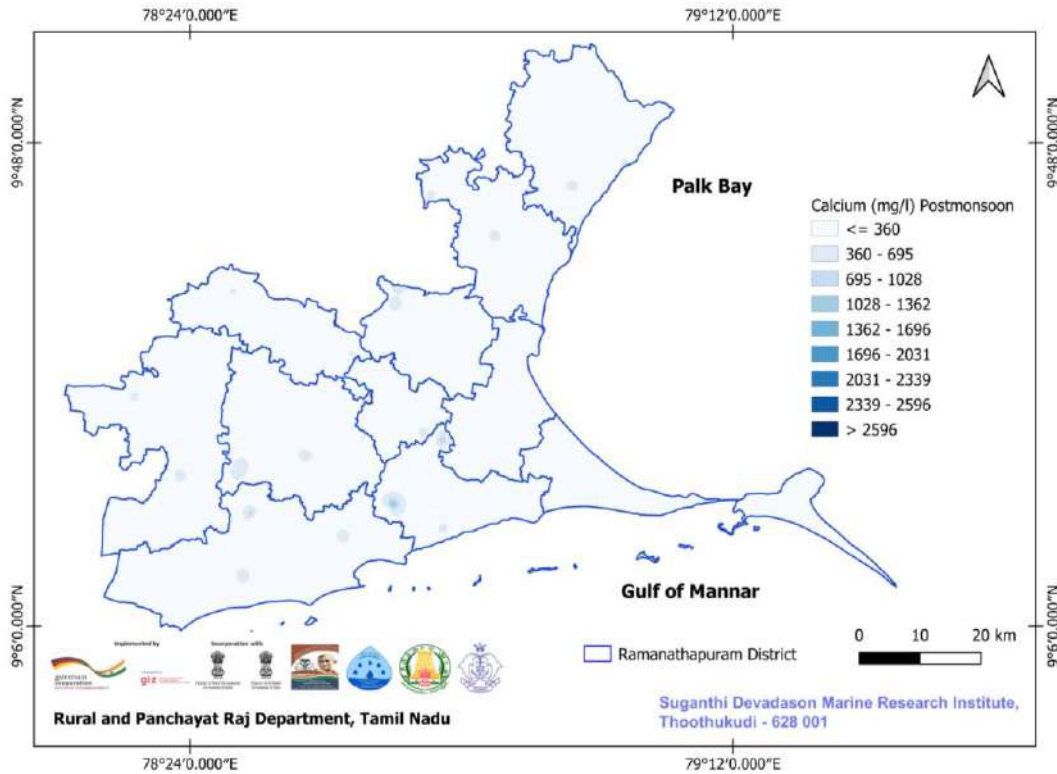
## 5.6. Calcium (Ca)

The levels of calcium in groundwater samples range between 21 mg/l and 2,937 mg/l for pre-monsoon and between 10 mg/l and 1,356 mg/l for the post monsoon seasons (Table 4 & 5). Majority of the samples are above 75 mg/l, and totally 77 of pre-monsoon and 187 of post-monsoon samples are within the range of 75 mg/l (Table 6). This accounts for the existence of calcium-rich minerals such as gypsum, limestone, etc.

The spatial distribution of Ca for the pre-monsoon season indicates higher concentration in the south-central and a few regions in the northern parts of the district (Fig. 9). Minimum Ca occurs at Mayakulam and Solanthoor, while maximum Ca at Mariyarayapuram.

Similarly, the spatial distribution of Ca in the groundwater of post-monsoon season indicates higher concentration in a few places in the south-central parts of the district (Fig. 9). Minimum Ca occurs near Malakavanoor, Uppur, Mochakudi and Uttarakosamagai, while maximum occurs at Mariyarayapuram. There is considerable decrease in Ca during post-monsoon when comparing with pre-monsoon.





**Fig. 9: spatial distribution of calcium concentration in the groundwater of Ramanathapuram district during pre-monsoon and post-monsoon**

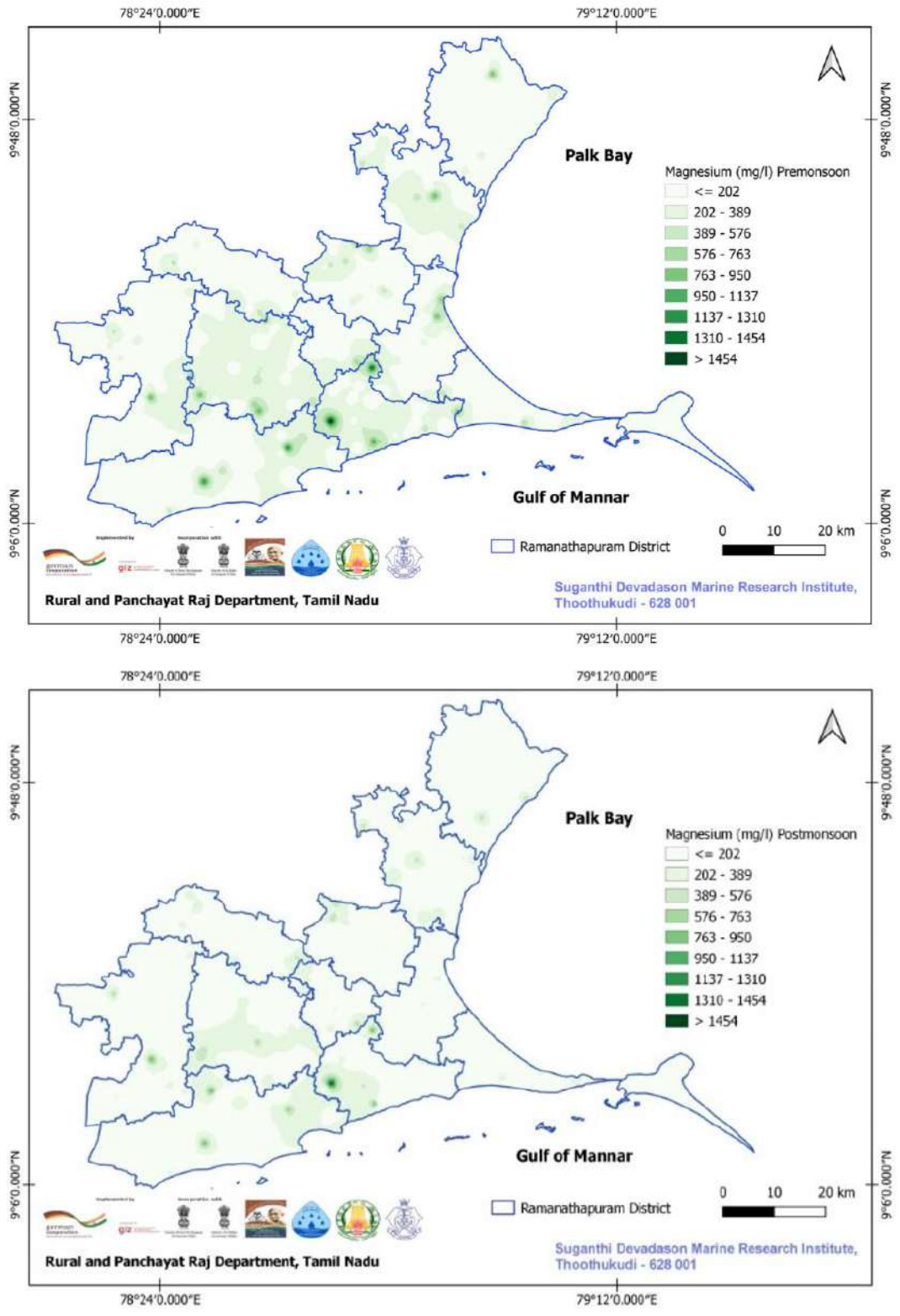
### 5.7. Magnesium (Mg)

The levels of magnesium in groundwater samples range between 12 mg/l and 1,645 mg/l for pre-monsoon and between 2 mg/l and 1,461 mg/l for the post monsoon seasons (Table 4 & 5). Majority of the samples are above 30 mg/l, and totally 64 of pre-monsoon and 91 of post-monsoon samples are within the range of 30 mg/l (Table 6).

The spatial distribution of Mg for the pre-monsoon season indicates higher concentration in the south, central and some northern parts of the district (Fig. 10). Minimum Mg occurs at T. Veppakulam, Mayakulam and Solanthoor, while maximum Mg at Mariyarayapuram.

Similarly, the spatial distribution of Mg in the groundwater of post-monsoon season indicates higher concentration in a few places in the south, central and a few northern parts of the district (Fig. 10). Minimum Mg occurs near Koodakulam, while maximum occurs at Mariyarayapuram. There is considerable decrease in Mg during post-monsoon when comparing with pre-monsoon.





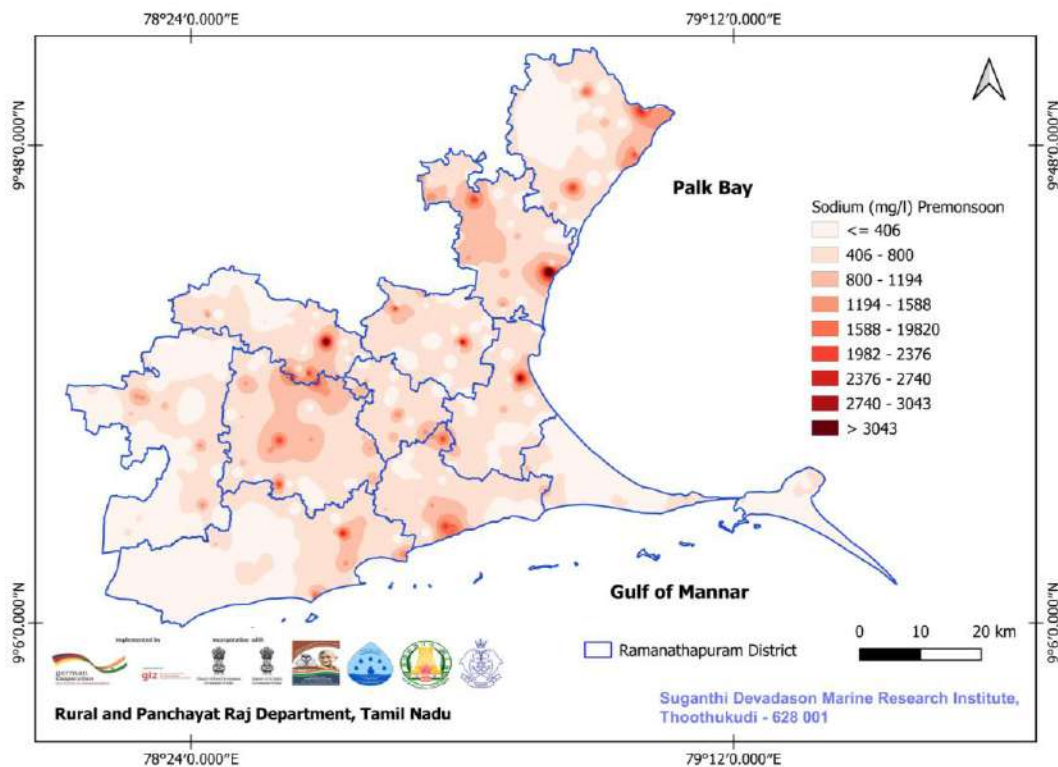
**Fig. 10: spatial distribution of magnesium concentration in the groundwater of Ramanathapuram district during pre-monsoon and post-monsoon**

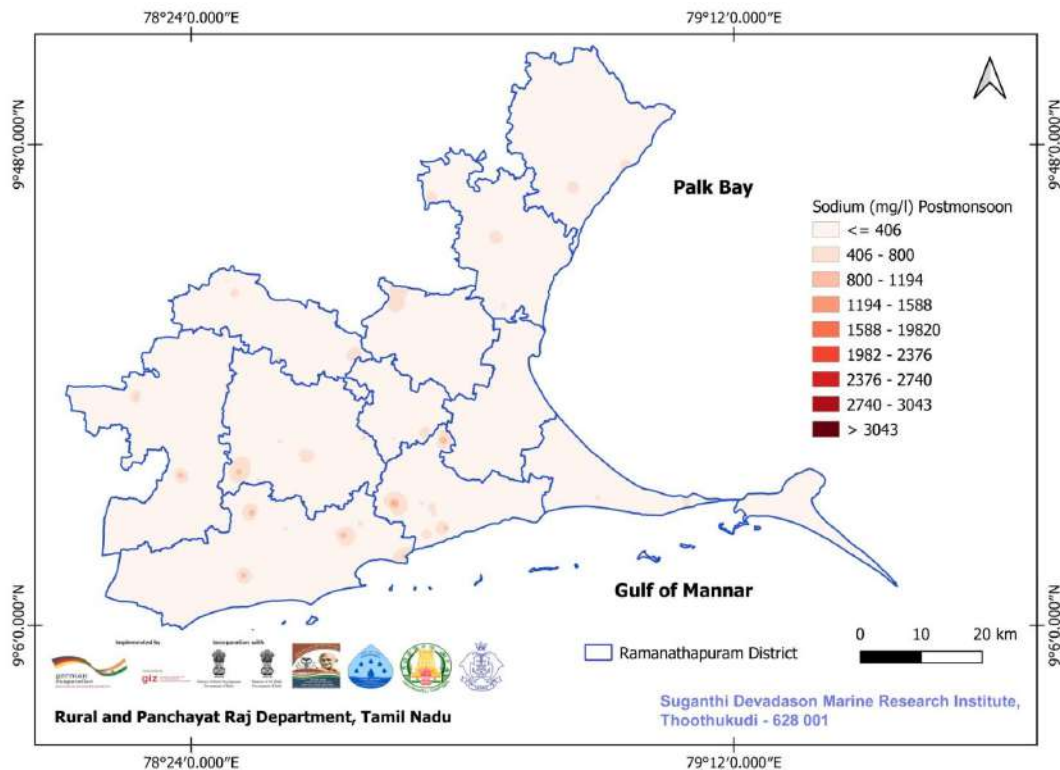
## 5.8. Sodium (Na)

Sodium amount present in earth is relatively small but significant amounts of Na are found in dissolved solids originating from the weathering of the rocks and soils, and from the dissolving lime, gypsum and other salt sources as water flows over or percolates through them. High Na % causes deflocculation and impairment of the permeability of soils. Sodium concentration is good if it is less than 200 mg/l (WHO, 2004). The sodium values of groundwater samples range between 10 and 4,270mg/l for the pre-monsoon and between 8 and 1,262 mg/l for the post-monsoon seasons (Table 4 & 5). Majority of the samples are above 200 mg/l, and totally 140 of pre-monsoon and 261 of post-monsoon samples are within the range of 200 mg/l (Table 6).

The spatial distribution of Na for the pre-monsoon season is higher in the north, central and south parts of the district (Fig. 11). Minimum Na occurs at Elangundram, while maximum Na occurs at Uppur.

Similarly, the spatial distribution of Na in the groundwater of post-monsoon season indicates higher concentration in a few places in the south, central and northwest parts of the district (Fig. 11). Minimum Na occurs near Uppur, while maximum occurs at Mariyarayapuram. There is considerable decrease in Na during post-monsoon when comparing with pre-monsoon.





**Fig. 11: spatial distribution of sodium concentration in the groundwater of Ramanathapuram district during pre-monsoon and post-monsoon**

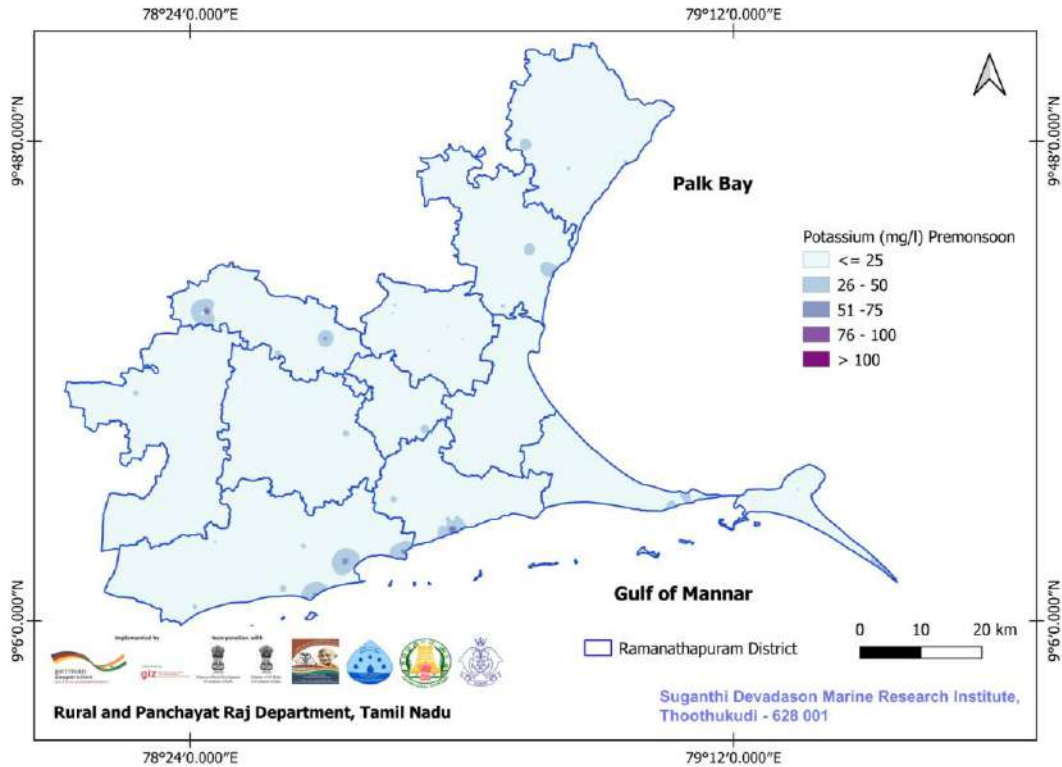
### 5.9. Potassium (K)

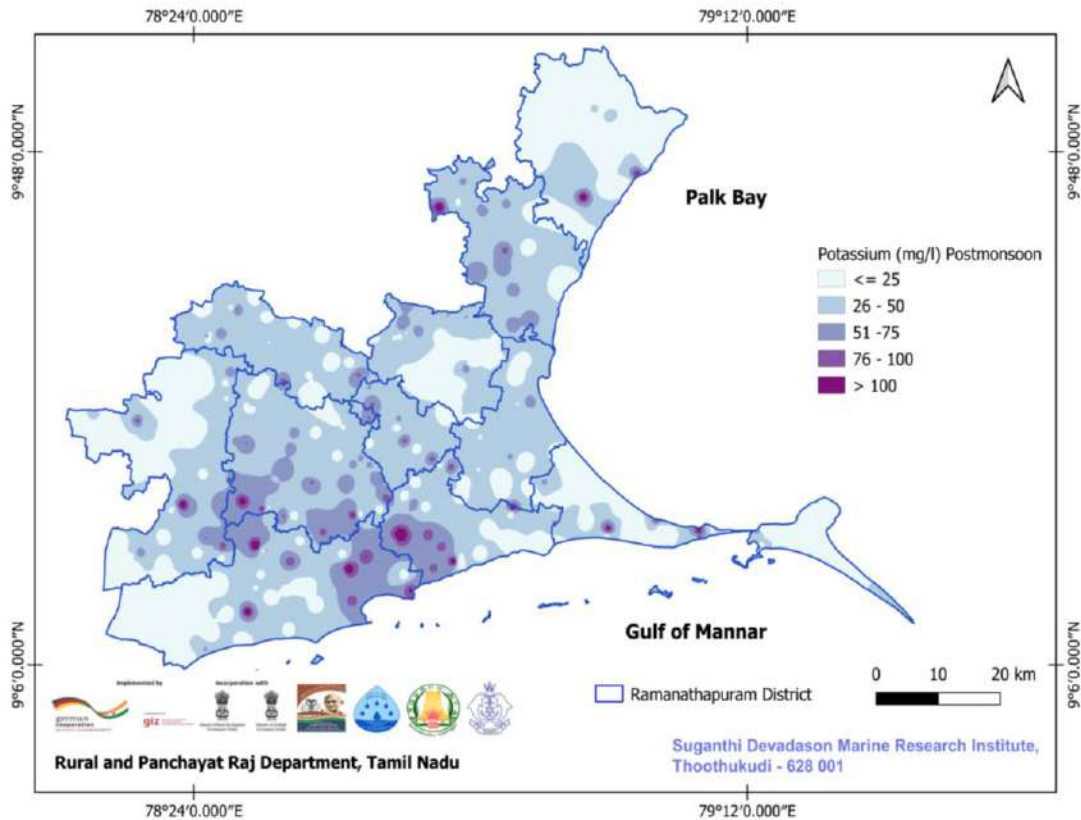
Potassium is nearly as abundant as sodium in igneous and metamorphic rocks but its concentration in groundwater is one-tenth or even as low as one-hundredth of sodium. The potassium content of water is derived from silicate minerals like orthoclase, microcline, nepheline, leucite and biotite. Parity in concentrations of sodium and potassium is found only in water with less mineral contents. Two factors are responsible for the scarcity of potassium in groundwater, one being the resistance of potassium minerals to decomposition by weathering and the other being the fixation of potassium in clay minerals formed due to weathering. Potassium concentration is good if it is less than 100 mg/l (WHO, 2004).

The potassium values of groundwater samples range between 1 and 97mg/l for the pre-monsoon and between 1 and 168 mg/l for the post-monsoon seasons (Table 4 & 5). All the samples of pre-monsoon are within the limit, while 361 samples of post monsoon samples are within the limit (100 mg/l; Table 6).

The spatial distribution of K for the pre-monsoon season is higher in some places in the southern, eastern and northern coastal region and western parts of the district (Fig. 12). Minimum K occurs at Thiruvadi, Rameswaram, Madaloor, Terbhogi, Seeniappadharg and N. Karisalkulam, while maximum K at PP Yenthal.

Similarly, the spatial distribution of K in the groundwater of post-monsoon season indicates higher concentration in a few places in the south, central, east and northwest parts of the district (Fig. 12). Minimum K occurs at Uppur, Mochakudi, Malakavanoor (near), Madaloor, Vagavai, Perygalur, Pudhuvalasai and Koodakulam, while maximum occurs at Mariyarayapuram. There is considerable increase in K during post-monsoon when comparing with pre-monsoon.





**Fig. 12: spatial distribution of potassium concentration in the groundwater of Ramanathapuram district during pre-monsoon and post-monsoon**

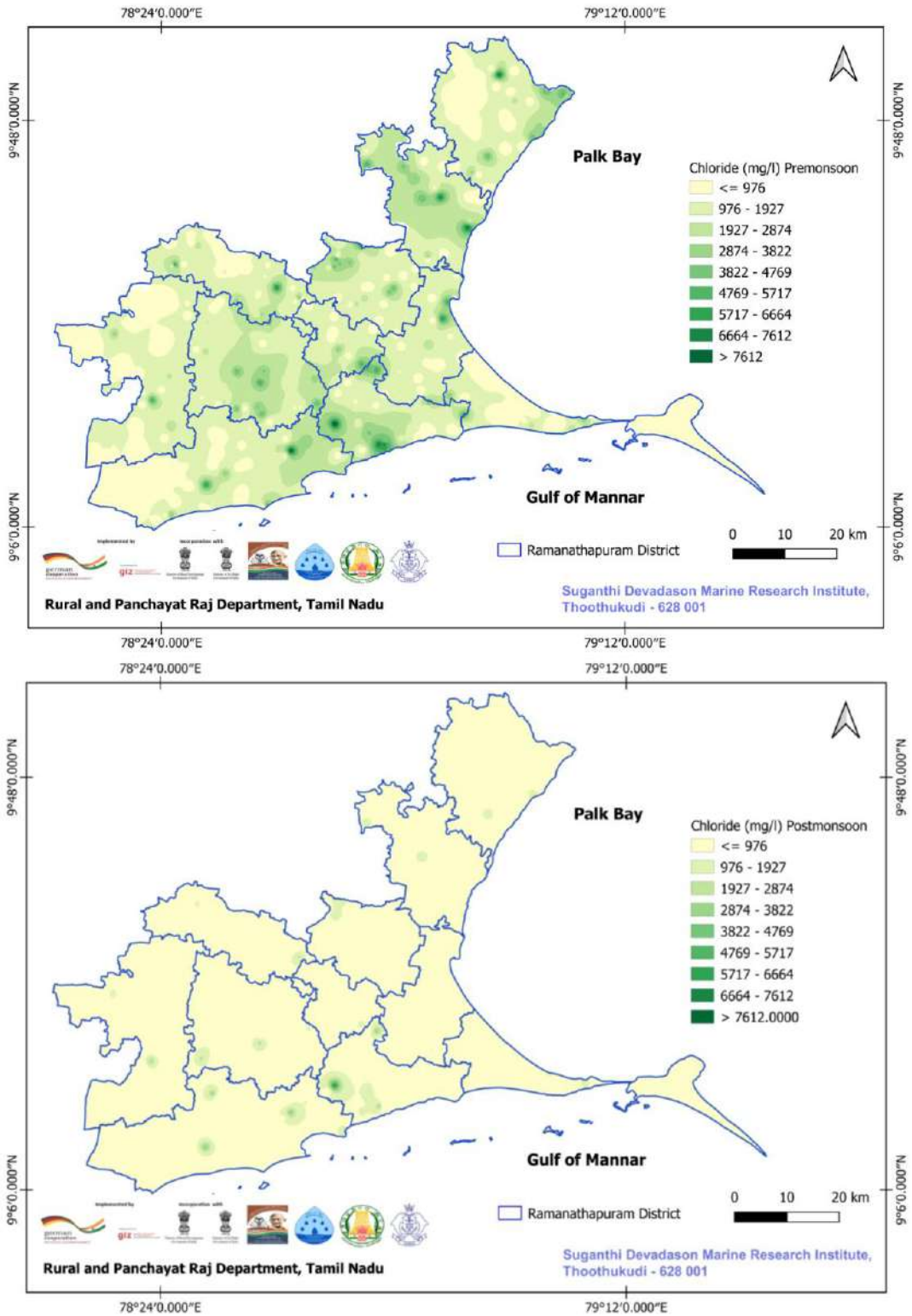
### 5.10. Chloride (Cl)

The concentration of chloride in groundwater could be due to replacement of hydroxide by chloride in the hornblende biotite gneissic rock (Kuroda and Sandell, 1953) and also may be due to seawater intrusion. The Cl values of groundwater samples range between 32 and 8609mg/l for the pre-monsoon and between 15 and 6452 mg/l for the post-monsoon seasons (Table 4 & 5). Majority of the samples are within 200 mg/l, and totally 58 of pre-monsoon and 183 of post-monsoon samples are within the range of 200 mg/l (Table 6).

The spatial distribution of Cl for the pre-monsoon season is higher in some places in the south, central and northern parts and along the coastal track of the district (Fig. 13). Minimum Cl occurs at Sudyur while maximum Cl at Mariyarayapuram.

Similarly, the spatial distribution of Cl in the groundwater of post-monsoon season indicates higher concentration in a few places in the south, central and northwest parts of the district (Fig. 13). Minimum Cl occurs at Uttarakosamangi. There is considerable increase in Cl during post-monsoon when comparing with pre-monsoon.





**Fig. 13: spatial distribution of chloride concentration in the groundwater of Ramanathapuram district during pre-monsoon and post-monsoon**

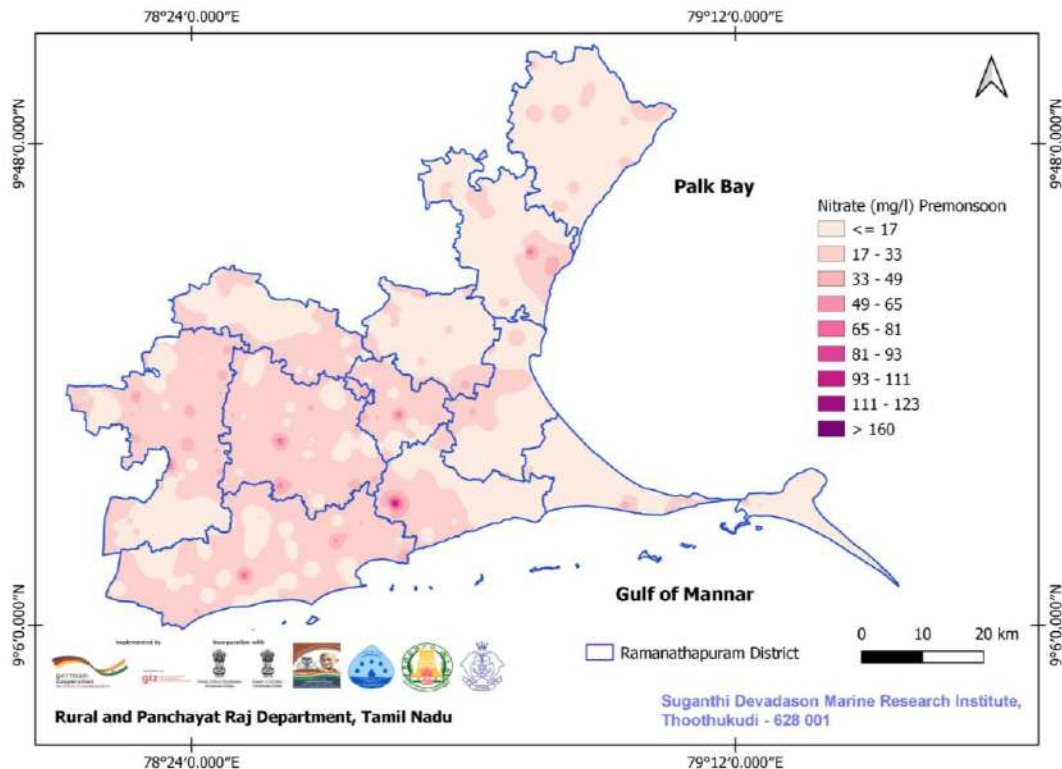


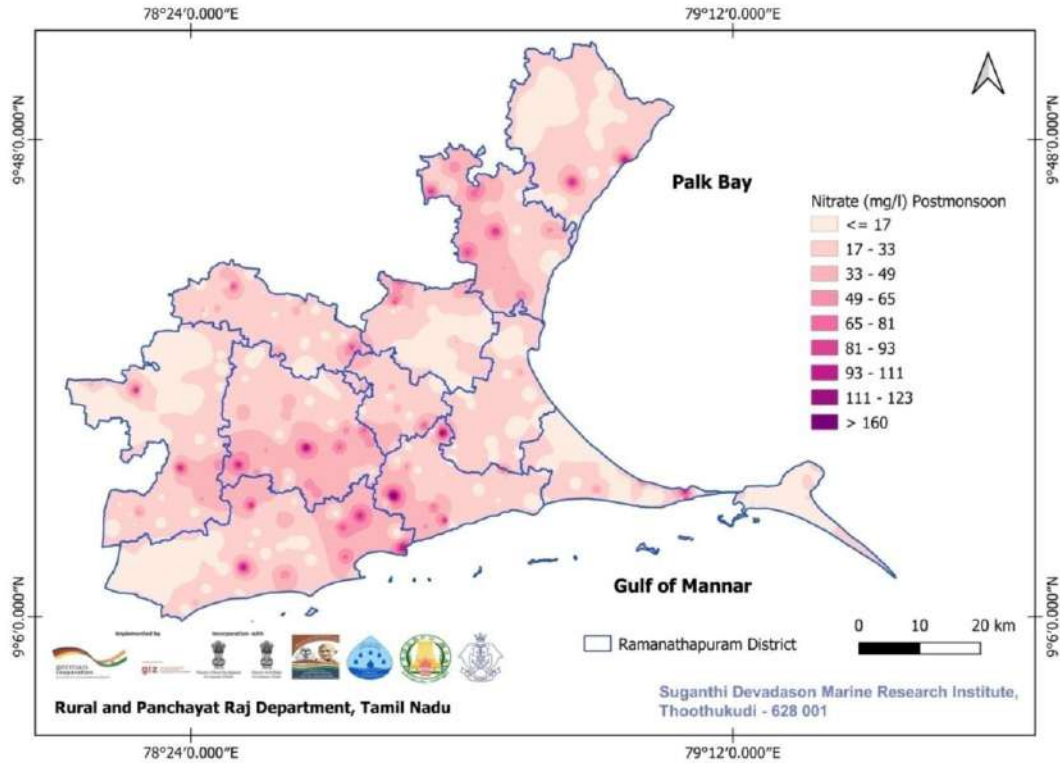
## 5. 11. Nitrate (NO<sub>3</sub>)

The NO<sub>3</sub> values of groundwater samples range between 1 and 140mg/l for the pre-monsoon and between 1 and 186 mg/l for the post-monsoon seasons (Table 4 & 5). Majority of the samples are within 45 mg/l, and totally 349 of pre-monsoon and 289 of post-monsoon samples are within the range of 45 mg/l (Table 6).

The spatial distribution of NO<sub>3</sub> for the pre-monsoon season indicates a few patches of higher concentration in south-central and western parts of the district (Fig. 14). Minimum NO<sub>3</sub> occurs at Nediamanickam, Olaikuda light house, Olaikudda, Rameshwaram and Ramarpatham while maximum NO<sub>3</sub> at Mariyarayapuram.

Similarly, the spatial distribution of NO<sub>3</sub> in the groundwater of post-monsoon season indicates higher concentration in some parts of south, central, north and western parts of the district (Fig. 14). Minimum NO<sub>3</sub> occurs at Uppur, Mochakudi, Near Melakavanoor, Madaloor, Vagavayal, Perygalur, Pudhuvalasai and Koodakulam. while maximum NO<sub>3</sub> at Mariyarayapuram. There is considerable increase in NO<sub>3</sub> during post-monsoon when comparing with pre-monsoon.





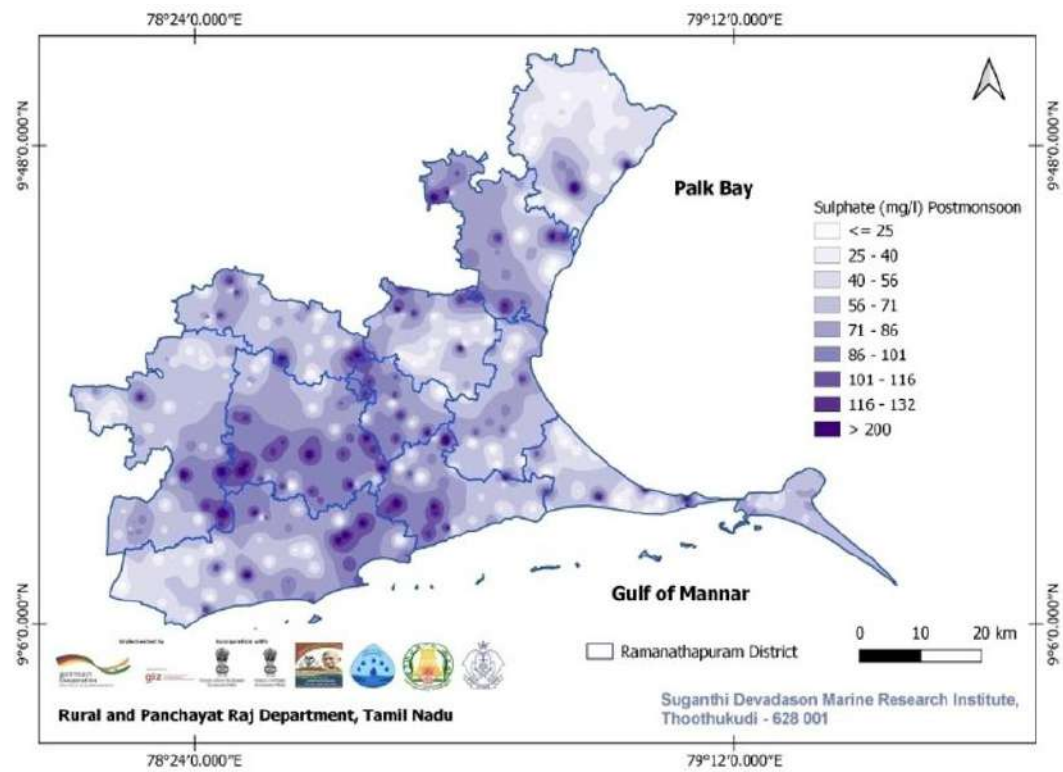
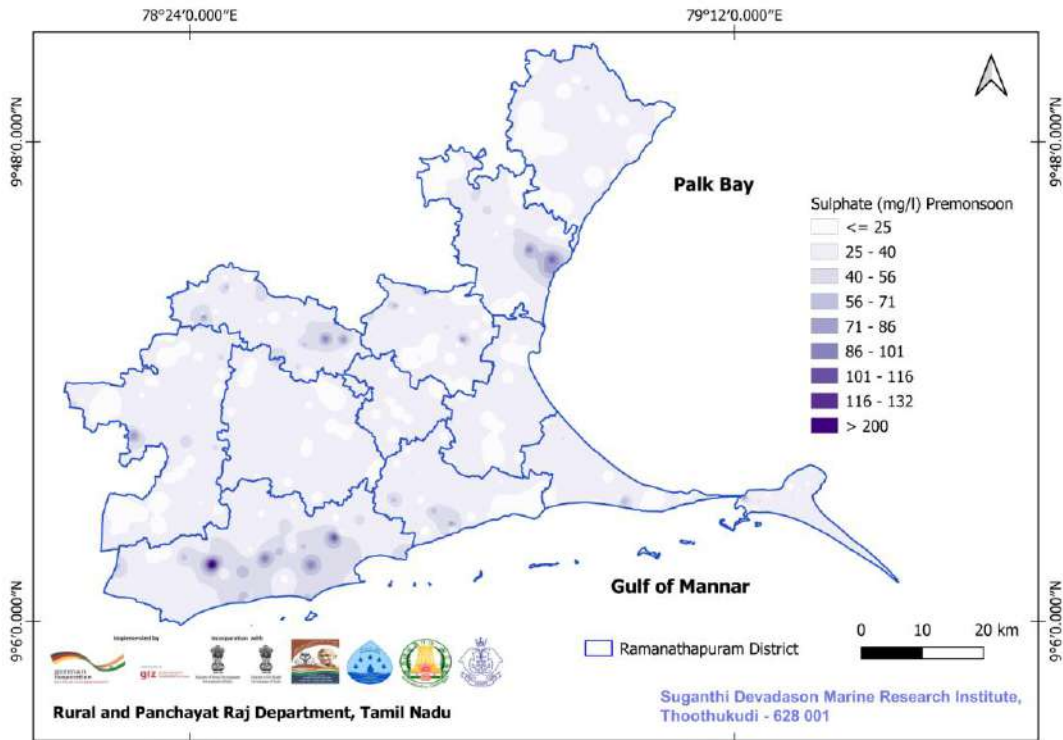
**Fig. 14: spatial distribution of nitrate concentration in the groundwater of Ramanathapuram district during pre-monsoon and post-monsoon**

## 5. 12. Sulphate (SO<sub>4</sub>)

The SO<sub>4</sub> values of groundwater samples range between 2 and 240mg/l for the pre-monsoon and between 2 and 268 mg/l for the post-monsoon seasons (Table 4 & 5). Majority of the samples are within 200 mg/l, and totally 377 of pre-monsoon and 268 of post-monsoon samples are within the range of 200 mg/l (Table 6).

The spatial distribution of SO<sub>4</sub> for the pre-monsoon season is higher in some places in the southern and northern coastal regions and a few places in western part of the district (Fig. 15). Minimum SO<sub>4</sub> occurs at Near Chinnakarusalkulam while maximum SO<sub>4</sub> at Pullandhai.

Similarly, the spatial distribution of SO<sub>4</sub> in the groundwater of post-monsoon season indicates higher concentration in a few places in the south, central and northwest regions and along the coastal track of the district (Fig. 15). Minimum SO<sub>4</sub> occurs at Uppur, Mochakudi, Near Melakavanoor, Madaloor, Odaikaal and Perygalur, while maximum SO<sub>4</sub> occurs at Mecca Nager. There is considerable increase in SO<sub>4</sub> during post-monsoon when comparing with pre-monsoon.



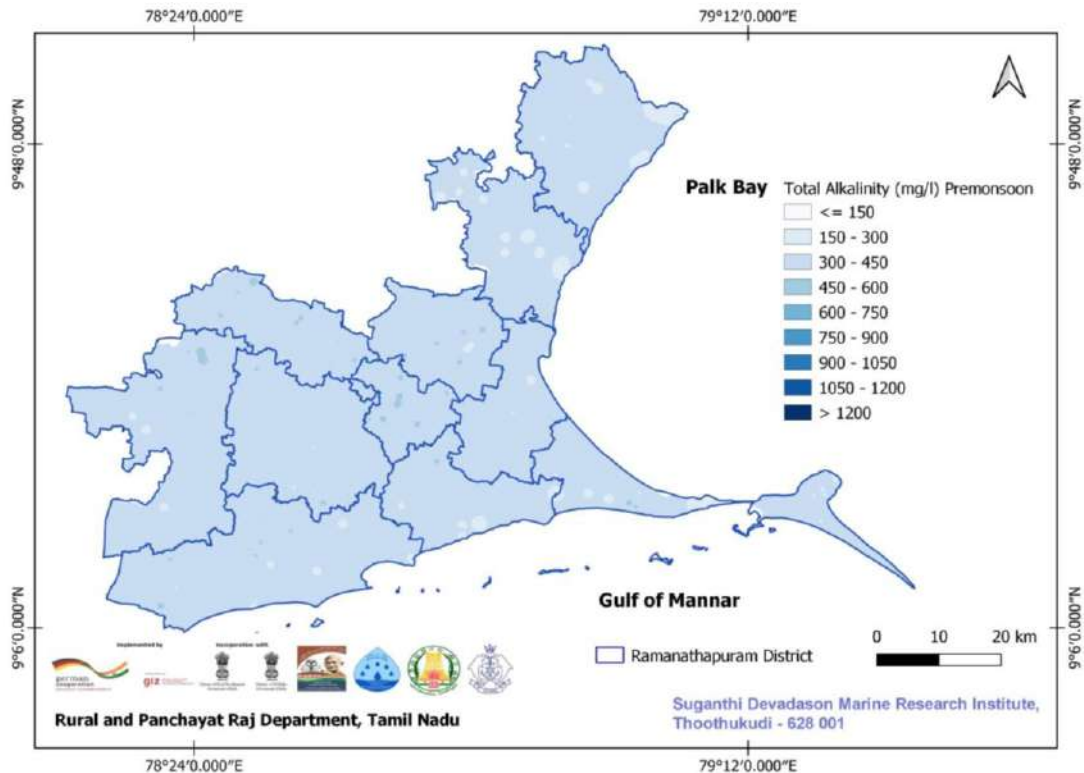
**Fig. 15: spatial distribution of sulphate concentration in the groundwater of Ramanathapuram district during pre-monsoon and post-monsoon**

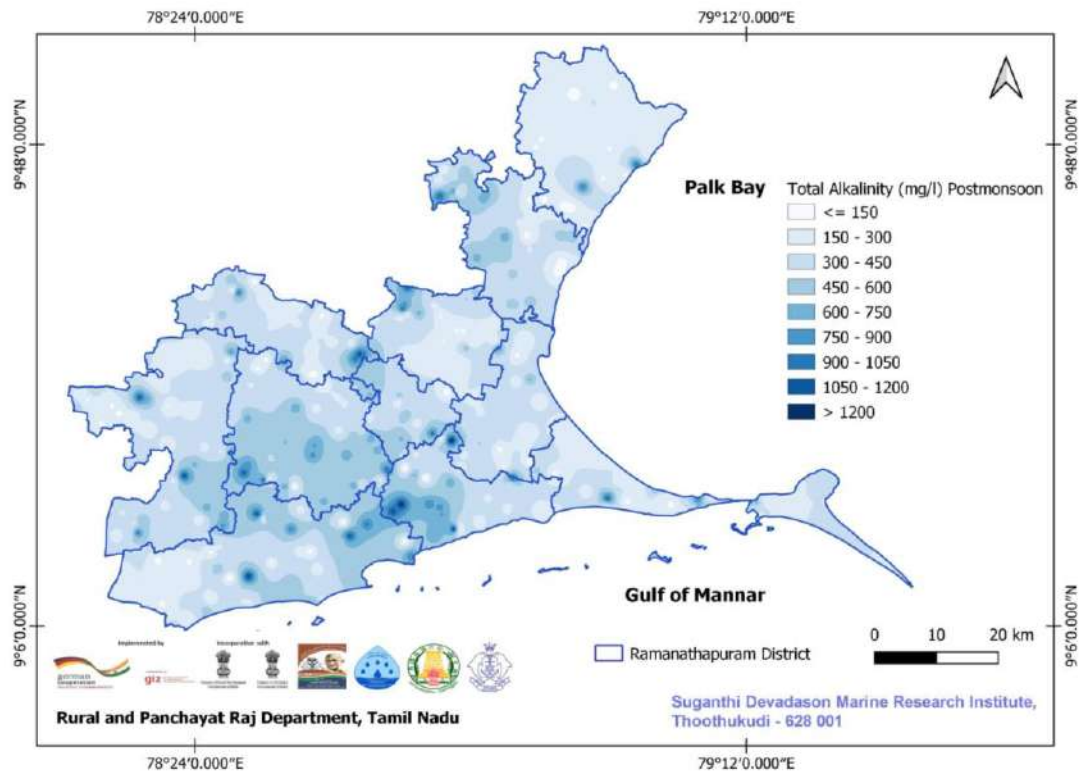
### 5.13. Total Alkalinity (TA)

Alkalinity in the water is a measure of dissolved carbonates and bicarbonates, which affects the taste of the water. The Total Alkalinity values of groundwater samples range between 220 and 481mg/l for the pre-monsoon and between 43 and 1297 mg/l for the post-monsoon seasons (Table 3 & 4). Majority of the samples are within 200 mg/l, and totally 377 of pre-monsoon and 268 of post-monsoon samples are within the range of 200 mg/l (Table 5).

The spatial distribution of TA for the pre-monsoon season is higher in south, central and western parts of the district (Fig. 16). Minimum TA occurs at Reghunathapuram while maximum TA at Tharaikudi.

Similarly, the spatial distribution of  $SO_4$  in the groundwater of post-monsoon season indicates higher concentration in the south, central west and a few places in the northern parts of the district (Fig. 16). Minimum TA occurs at Uttarakosamangai. while maximum TA at Mecca Nager. There is considerable increase in TA during post-monsoon when comparing with pre-monsoon.





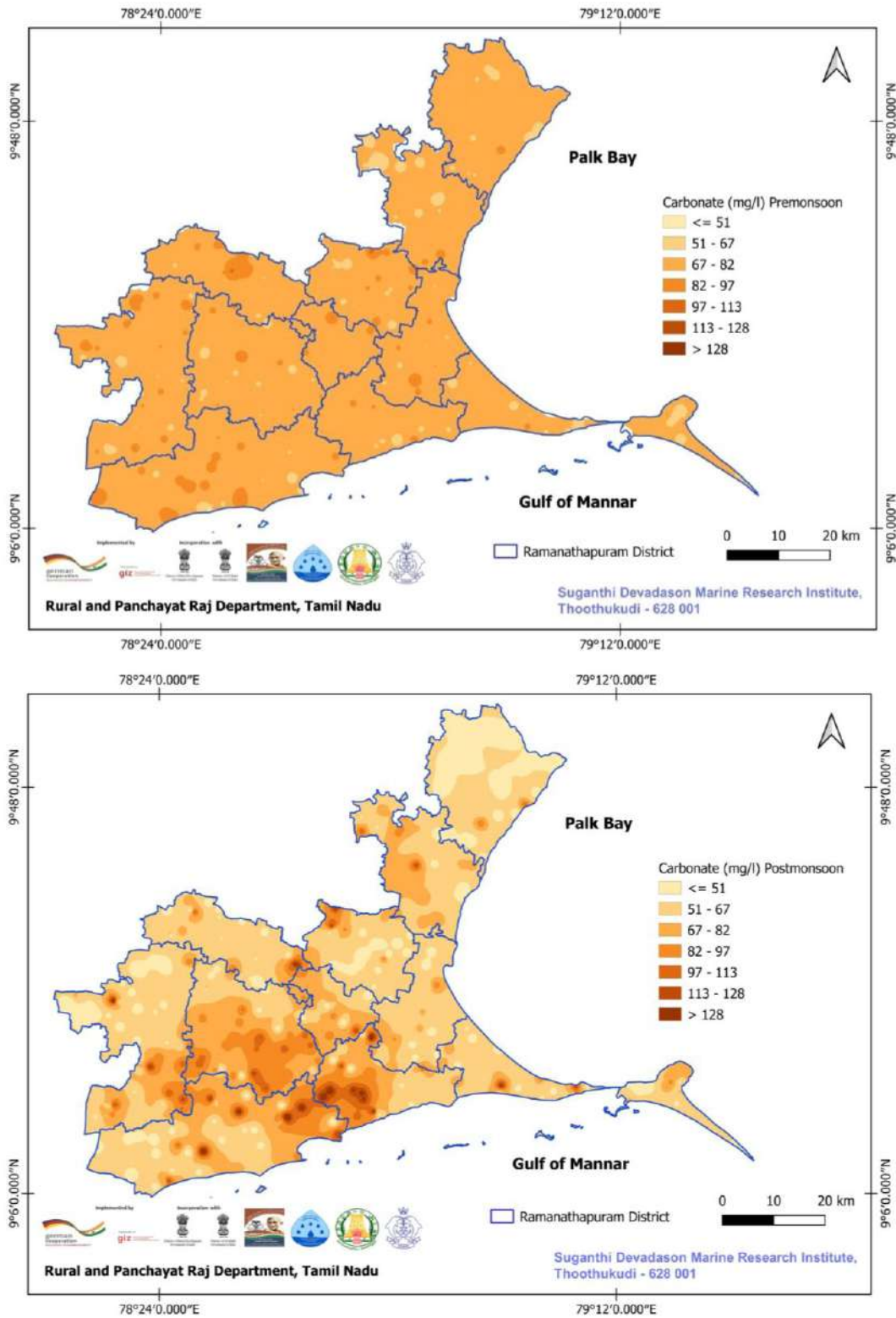
**Fig. 16: spatial distribution of Total alkalinity in the groundwater of Ramanathapuram district during pre-monsoon and post-monsoon**

The  $\text{CO}_3$  values of groundwater samples range between 34 and 152 mg/l for the pre-monsoon and between 3 and 279 mg/l for the post-monsoon seasons (Table 4 & 5). Majority of the samples are within 200 mg/l, and totally 377 of pre-monsoon and 268 of post-monsoon samples are within 200 mg/l (Table 6).

The spatial distribution of  $\text{CO}_3$  for the pre-monsoon season is higher in a few places in the southern, central and western regions of the district (Fig. 17). Minimum  $\text{CO}_3$  occurs at Odaikaal while maximum  $\text{CO}_3$  at Vathavaneri.

Similarly, the spatial distribution of  $\text{CO}_3$  in the groundwater of post-monsoon season indicates higher concentration in a few places in the southern, central and northwestern parts of the district (Fig. 17). Minimum  $\text{CO}_3$  occurs at Mallal, while maximum  $\text{CO}_3$  at Mecca Nager. There is considerable increase in  $\text{CO}_3$  during post-monsoon when comparing with pre-monsoon.





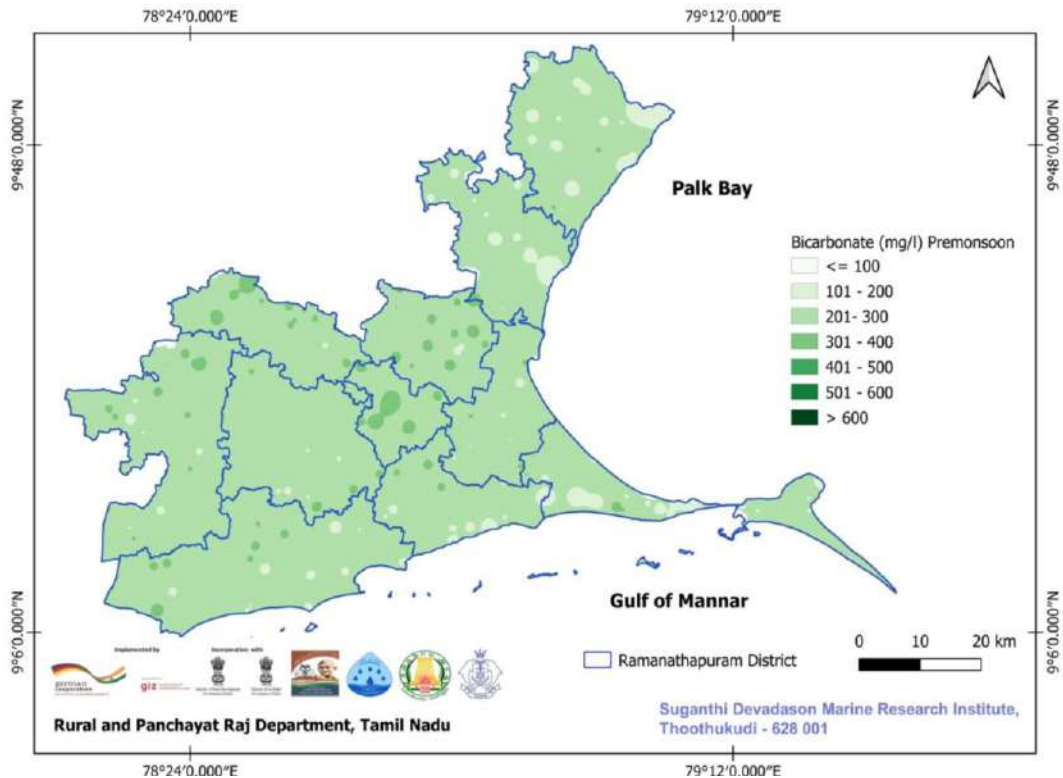
**Fig. 17: spatial distribution of carbonate in the groundwater of Ramanathapuram district during pre-monsoon and post-monsoon**

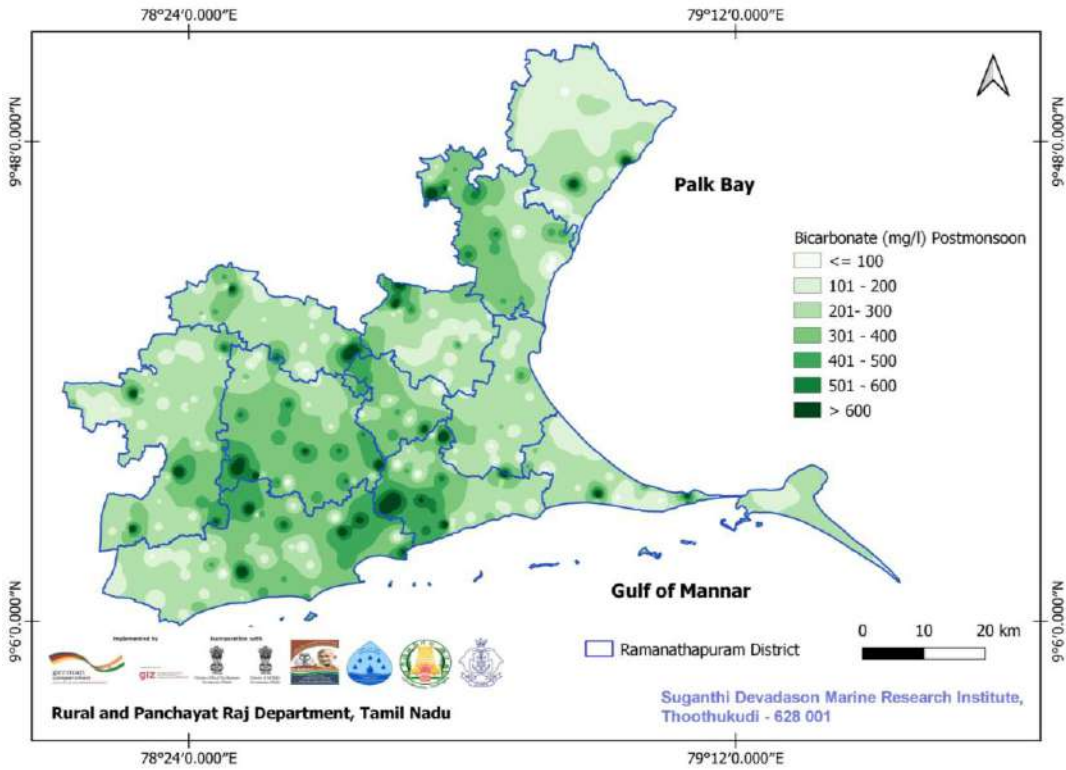


The  $\text{HCO}_3$  values of groundwater samples range between 121 and 363mg/l for the pre-monsoon and between 36 and 987 mg/l for the post-monsoon seasons (Table 3 & 4). Majority of the samples are within 200 mg/l, and totally 94 of pre-monsoon and 183 of post-monsoon samples are within the range of 200 mg/l (Table 5).

The spatial distribution of  $\text{HCO}_3$  for the pre-monsoon season is higher in some places in the south, central and western parts of the district (Fig. 18). Minimum  $\text{HCO}_3$  occurs at Raghunathapuram while maximum  $\text{HCO}_3$  at Tharaikudi.

Similarly, the spatial distribution of  $\text{HCO}_3$  in the groundwater of post-monsoon season indicates higher concentration in a few places in the south, central and northwest parts of the district (Fig. 18). Minimum  $\text{HCO}_3$  occurs at Uttarakosamangai, while maximum  $\text{HCO}_3$  at Mariyarayapuram. There is considerable increase in  $\text{HCO}_3$  during post-monsoon when comparing with pre-monsoon.

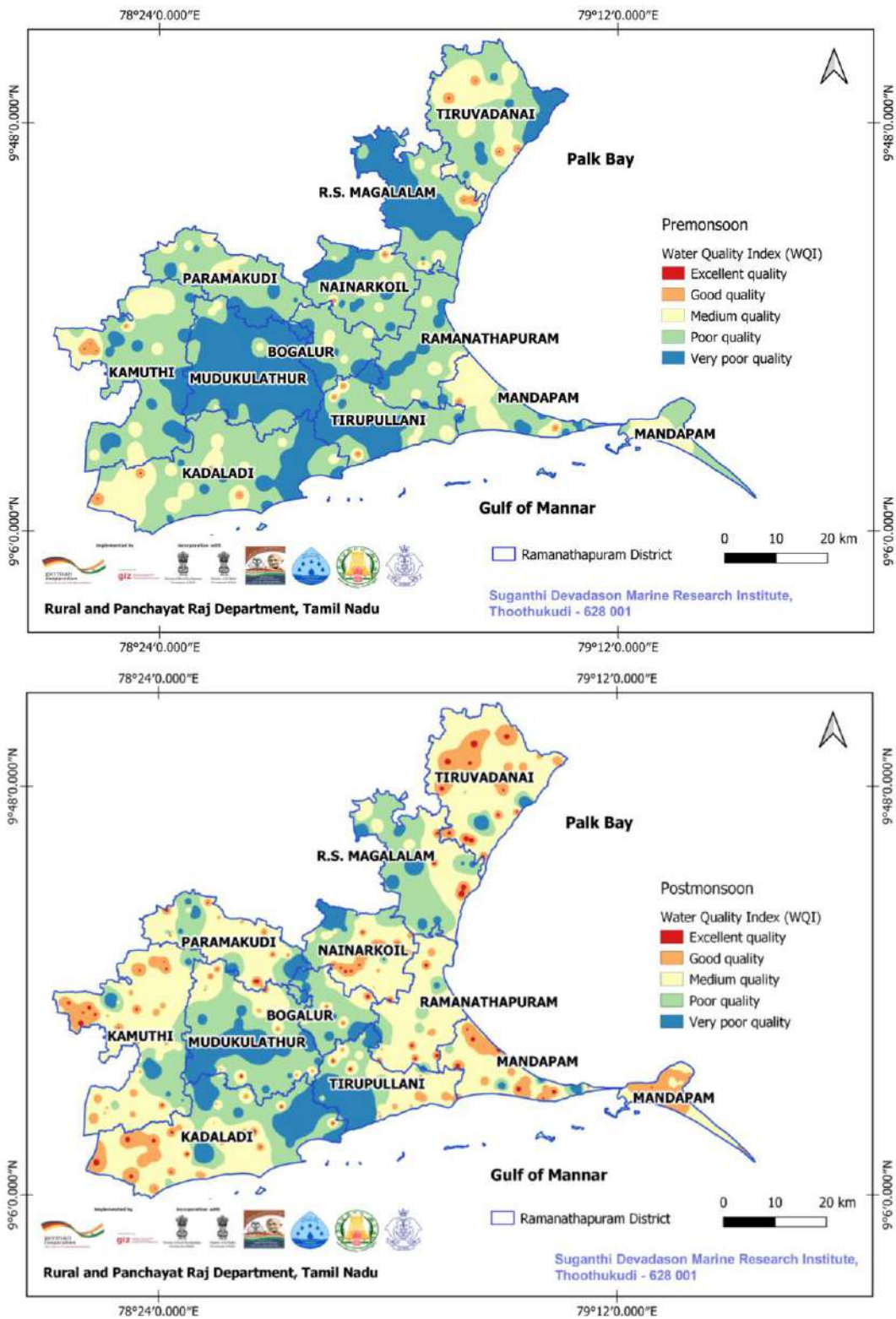




**Fig. 18: spatial distribution of bicarbonate concentration in the groundwater of Ramanathapuram district during pre-monsoon and post-monsoon**

#### 5.14. Water Quality Index (WQI)

The calculated WQI for individual locations are represented in Tables 4 & 5. The computed WQI concentration ranges from 34.9 to 2,971.9 during pre-monsoon and from 19.3 to 1825.5 during post-monsoon. The spatial distribution of pre-monsoon WQI indicates that nearly 50% of the samples fall under poor and very poor categories, in which 6.35% of groundwater samples are classified as “excellent water”, 19.58% as “good water”, 25.40% as “medium quality”, 10.32% as “poor water” and 38.36% as “very poor quality” during pre-monsoon (Fig. 19). The spatial distribution of post-monsoon WQI indicates that nearly 50% of the samples fall under excellent and good categories, in which 26.72% of groundwater samples are classified as “excellent water”, 21.43% as “good water”, 24.6% as “medium quality”, 6.35% as “poor water” and 20.9% as “very poor quality” (Fig. 19). There is increase in water quality of the Ramanathapuram district during post-monsoon when compared with pre-monsoon.



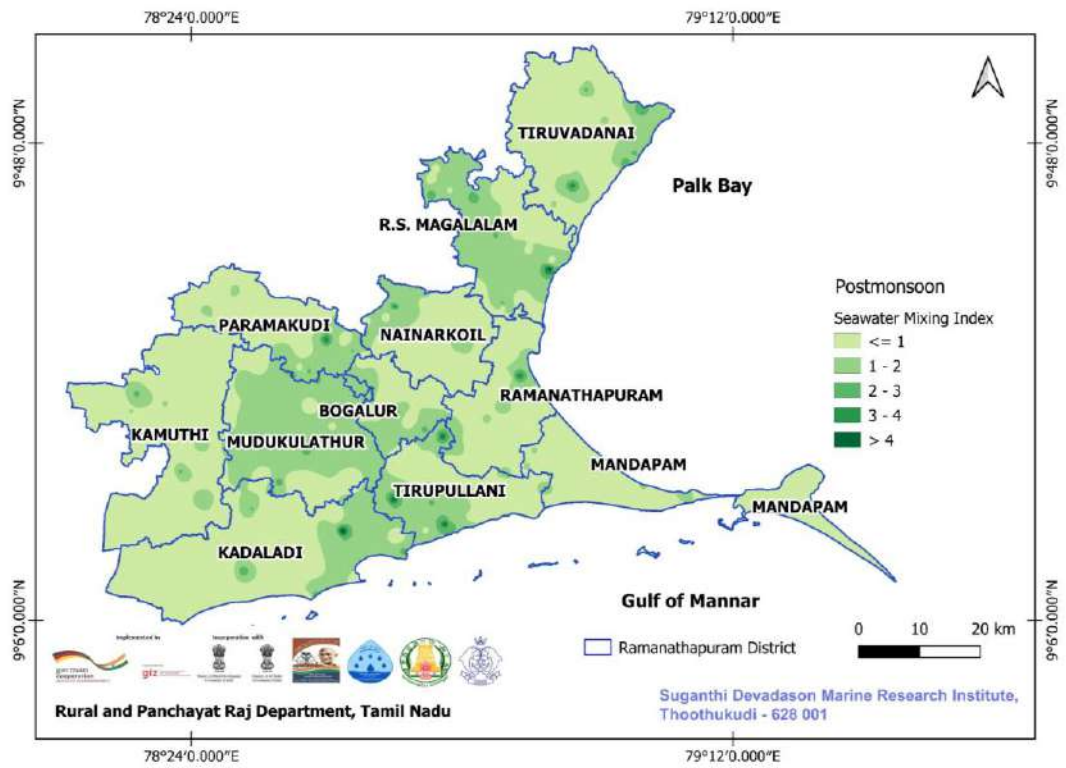
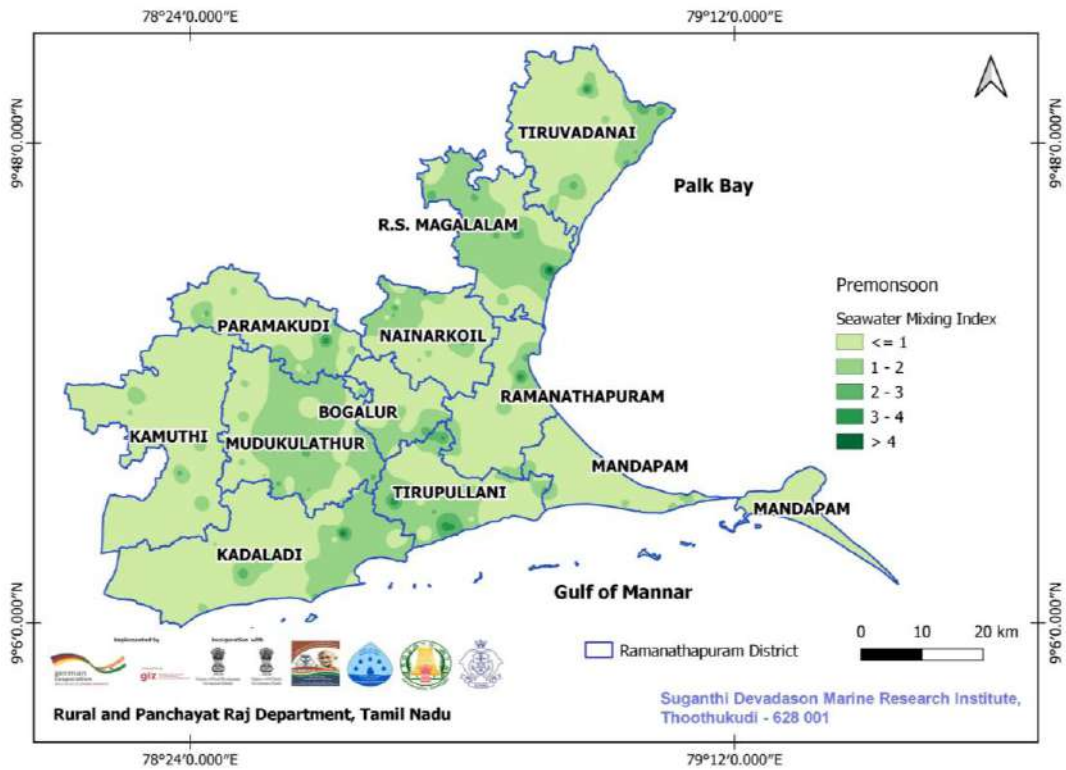
**Fig. 19: spatial distribution of Water Quality Index (WQI) in the groundwater of Ramanathapuram district during pre-monsoon and post-monsoon**

**Blocks showing the dominated groundwater Quality Index for pre-monsoon and post-monsoon**

S. No.	Blocks	Pre-monsoon	Post-monsoon
1	Mudukulathur block	Very poor	Poor and very poor
2	R.S. Magalam block	Poor and very poor	Poor and medium
3	Tirupullani block	Poor and Very poor	Medium and very poor
4	Kadaladi block	Poor, medium and very poor	Medium, poor and good
5	Bogalur block	Poor and very poor	Poor
6	Paramakudi block	Poor and medium	Medium and poor
7	Nainarkoil block	Poor	Medium, poor and good
8	Tiruvadana block	Medium and poor	Medium, good and very good
9	Ramanathapuram block	Poor	Medium
10	Kamuthi block	Poor and medium	Medium, poor and good
11	Mandapam block	Medium and poor	Medium and good

### 5.15 Seawater Mixing Index

Spatial representations of Seawater Mixing Index (SMI) calculated from selected chemical constraints (i.e., Na, Mg, Cl and SO<sub>4</sub>) are shown in Tables 4 & 5. The spatial plot for pre-monsoon demarcates the seawater intrusion and freshwater zone, where southern, central northern regions of the district are affected by seawater intrusion (Fig. 20). Similarly, during post-monsoon also the southern, central and northern regions are affected by seawater intrusion. The SMI values indicate that nearly 30% of the samples are influenced by seawater intrusion during pre-monsoon and post-monsoon. The slight increase in the spatial extent of seawater intrusion during post-monsoon could be due to increase of sulphate concentration during post-monsoon period.



**Fig. 20: spatial distribution of Seawater Mixing Index in the groundwater of Ramanathapuram district**

**Blocks showing the extend of seawater mixing index for pre-monsoon  
and post-monsoon**

<b>S. No.</b>	<b>Blocks</b>	<b>Pre-monsoon</b>	<b>Post-monsoon</b>
1	Mudukulathur block	L	L
2	R.S. Magalam block	L	L
3	Tirupullani block	M	M
4	Kadaladi block	M	M
5	Bogalur block	M	M
6	Paramakudi block	M	S
7	Nainarkoil block	S	S
8	Tiruvadanaï block	S	S
9	Ramanathapuram block	S	S
10	Kamuthi block	S	S
11	Mandapam block	S	S

L – Large area extend, M – Medium area extend and S – Smaller area extend



**Table 3: shows the groundwater sampling locations with latitude and longitude for pre-monsoon and post-monsoon for the Ramanathapuram district**

S.No.	Name of the locations	Latitude	Longitude
1	Sevalpatti	E 78° 21' 8.647"	N 9° 7' 56.521"
2	Kannirajpuram	E 78° 23' 39.034"	N 9° 6' 42.073"
3	Vettukadu	E 78° 24' 27.637"	N 9° 7' 14.138"
4	Narippaiyur	E 78° 24' 58.727"	N 9° 7' 17.465"
5	Near Narippaiyur	E 78° 25' 20.021"	N 9° 8' 22.06"
6	VadakuMookkaiyur	E 78° 28' 12.216"	N 9° 8' 9.996"
7	Mookkaiyur	E 78° 28' 40.058"	N 9° 8' 2.602"
8	Oppilan	E 78° 30' 29.983"	N 9° 8' 31.237"
9	T Mariyur	E 78° 32' 12.187"	N 9° 8' 53.357"
10	MelaMundhal	E 78° 34' 26.616"	N 9° 8' 6.277"
11	Mundhal	E 78° 34' 58.411"	N 9° 8' 19.389"
12	Dhanushkodi	E 79° 25' 11.068"	N 9° 10' 34.46"
13	Valinokkam	E 78° 38' 41.382"	N 9° 9' 51.472"
14	Valinokkam Salt Pan	E 78° 37' 43.342"	N 9° 11' 14.611"
15	Near Melakidaram	E 78° 34' 39.239"	N 9° 10' 57.254"
16	Kaduguchanthai	E 78° 30' 37.544"	N 9° 11' 30.703"
17	Katalati (Kuthiraimozhi)	E 78° 32' 21.176"	N 9° 9' 42.353"
18	Peiryakulam	E 78° 28' 38.69"	N 9° 10' 21.619"
19	Sayalkudi	E 78° 27' 0.619"	N 9° 10' 13.548"
20	Pullandhai	E 78° 25' 58.292"	N 9° 10' 59.426"
21	Sethurajapuram	E 78° 23' 42.562"	N 9° 10' 5.048"
22	Kuruvadi	E 78° 23' 30.091"	N 9° 11' 36.65"
23	Tharakudi	E 78° 22' 27.019"	N 9° 9' 30.614"
24	Karusalkulam	E 78° 17' 28.705"	N 9° 10' 52.558"
25	Uchanatham	E 78° 17' 29.965"	N 9° 9' 21.643"
26	Ramasamuthiram	E 78° 17' 20.184"	N 9° 13' 55.564"
27	Near Perunali	E 78° 18' 23.087"	N 9° 14' 2.123"
28	Perunali	E 78° 18' 59.958"	N 9° 14' 8.837"
29	T Veppakulam	E 78° 21' 59.846"	N 9° 11' 58.067"
30	TM Kottai	E 78° 20' 46.91"	N 9° 11' 43.508"
31	Pillayarkulam	E 78° 26' 11.548"	N 9° 12' 53.636"
32	Vagaikulam	E 78° 26' 16.843"	N 9° 12' 25.585"
33	S Alangkulam	E 78° 25' 23.858"	N 9° 12' 27.133"
34	Samathuvapuram (Near Kadaladi)	E 78° 29' 20.134"	N 9° 12' 18.007"
35	Kadaladi	E 78° 29' 47.429"	N 9° 13' 25.925"
36	Pasumpon Nagar	E 78° 31' 57.248"	N 9° 12' 8.323"

37	Melaselvanur	E 78° 32' 59.086"	N 9° 12' 32.612"
38	Kelaselvanur	E 78° 33' 59.875"	N 9° 12' 32.753"
39	Kothankulam	E 78° 36' 45.853"	N 9° 13' 21.184"
40	Sikkal	E 78° 37' 27.286"	N 9° 13' 52.259"
41	Ervadi	E 78° 42' 15.955"	N 9° 13' 23.174"
42	ChinnaErvadi	E 78° 42' 49.241"	N 9° 12' 5.684"
43	Mayakulam	E 78° 44' 48.109"	N 9° 13' 56.953"
44	Keelakarai	E 78° 47' 8.442"	N 9° 14' 6.331"
45	Natarajapuram	E 79° 18' 20.513"	N 9° 15' 18.85"
46	Rameswaram South	E 79° 18' 44.536"	N 9° 16' 37.477"
47	Ayyanthoppu	E 79° 14' 11.418"	N 9° 16' 30.205"
48	Thangachimadam south	E 79° 15' 19.388"	N 9° 17' 1.554"
49	Kunthukal	E 79° 13' 26.484"	N 9° 15' 39.877"
50	Kunthukal farm	E 79° 13' 46.476"	N 9° 15' 58.346"
51	Pamban South	E 79° 12' 54.615"	N 9° 16' 57.233"
52	Mandapam (Near Sea Park)	E 79° 10' 41.887"	N 9° 16' 53.594"
53	Mandapam South	E 79° 9' 6.205"	N 9° 16' 40.577"
54	Marakayarpattinam	E 79° 7' 46.027"	N 9° 16' 23.862"
55	Marakayarpattinam shore	E 79° 7' 36.232"	N 9° 16' 16.99"
56	Vedalai	E 79° 6' 30.391"	N 9° 16' 5.315"
57	Meenavarkuddiruppu	E 79° 7' 47.482"	N 9° 16' 59.484"
58	Kunjarvalasai	E 79° 5' 25.685"	N 9° 16' 36.48"
59	Seeniappadhurga	E 79° 4' 15.593"	N 9° 15' 56.491"
60	TM Kuddiruppu	E 79° 4' 27.721"	N 9° 17' 5.953"
61	Uchipuli	E 79° 0' 54.065"	N 9° 18' 36.486"
62	Pirappanvalasai	E 79° 2' 34.404"	N 9° 17' 42.043"
63	Ariyaman Beach	E 79° 4' 7.615"	N 9° 17' 51.133"
64	Nochiyurani Near	E 79° 1' 42.11"	N 9° 16' 52.248"
65	Nochiyurani	E 79° 2' 17.758"	N 9° 16' 31.49"
66	Pudhumadam	E 78° 59' 48.901"	N 9° 16' 22.919"
67	Indhiranagar	E 78° 55' 20.491"	N 9° 15' 52.441"
68	Periyapattinam	E 78° 54' 4.608"	N 9° 16' 9.89"
69	Sethukarai	E 78° 50' 28.277"	N 9° 15' 11.023"
70	Kalimankundu	E 78° 51' 15.62"	N 9° 16' 12.522"
71	Thinaikulam	E 78° 51' 48.175"	N 9° 15' 55.721"
72	Thilanianthal	E 78° 47' 9.024"	N 9° 14' 54.532"
73	Kanjirangudi	E 78° 48' 43.387"	N 9° 15' 7.002"
74	Keelakari outer	E 78° 47' 3.93"	N 9° 14' 31.171"
75	K Madurai	E 78° 46' 31.771"	N 9° 14' 29.785"
76	Palanchirai	E 78° 45' 28.94"	N 9° 15' 43.434"
77	Natham	E 78° 45' 18.335"	N 9° 16' 21.821"

78	Melamadai	E 78° 44' 23.575"	N 9° 16' 38.95"
79	Mariyarayapuram	E 78° 41' 56.954"	N 9° 16' 37.934"
80	Sikkal	E 78° 38' 58.258"	N 9° 14' 54.175"
81	Panaiyadiyenthal	E 78° 41' 13.153"	N 9° 15' 59.692"
82	Thirunallar	E 78° 36' 53.395"	N 9° 15' 3.971"
83	Melachirupodhu	E 78° 35' 10.979"	N 9° 16' 51.949"
84	Orivayal	E 78° 32' 21.754"	N 9° 14' 27.798"
85	Savariarpattanam	E 78° 33' 10.642"	N 9° 16' 7.356"
86	Appanoor	E 78° 29' 23.276"	N 9° 15' 47.538"
87	Punavasal	E 78° 30' 14.756"	N 9° 15' 22.802"
88	Punavasal near	E 78° 30' 2.65"	N 9° 15' 21.874"
89	Kumboddi	E 78° 26' 23.23"	N 9° 14' 46.19"
90	Kathanendhal	E 78° 26' 30.577"	N 9° 15' 42.613"
91	Kovilangulam	E 78° 25' 1.038"	N 9° 16' 20.741"
92	Erumaikulam	E 78° 24' 22.511"	N 9° 15' 14.702"
93	Ponthampuli	E 78° 21' 18.018"	N 9° 14' 19.309"
94	Maviangai	E 78° 21' 24.602"	N 9° 16' 29.932"
95	Veeramanachipatti	E 78° 19' 20.374"	N 9° 15' 10.015"
96	Thimmanathapuram	E 78° 18' 37.624"	N 9° 14' 59.309"
97	T.Balasubramaiapuram	E 78° 17' 42.216"	N 9° 15' 53.251"
98	Pappuraddiapatti	E 78° 18' 22.399"	N 9° 14' 24.464"
99	Vepungallam	E 78° 22' 5.714"	N 9° 18' 39.334"
100	Shokalingapuram	E 78° 23' 3.304"	N 9° 19' 6.47"
101	Pudukottai	E 78° 23' 59.017"	N 9° 20' 5.892"
102	Illanthaikulam	E 78° 26' 28.727"	N 9° 19' 23.567"
103	SonaiPiriyankottai	E 78° 28' 13.926"	N 9° 19' 23.761"
104	Enathi	E 78° 30' 15.66"	N 9° 18' 32.094"
105	Poongulam	E 78° 29' 57.347"	N 9° 18' 43.168"
106	Kandian	E 78° 30' 29.102"	N 9° 18' 53.039"
107	Elanjempur	E 78° 31' 48"	N 9° 18' 10.325"
108	Pookkulam	E 78° 32' 39.552"	N 9° 18' 11.826"
109	Sadayaneri	E 78° 33' 58.205"	N 9° 18' 23.706"
110	Kookondan	E 78° 34' 25.705"	N 9° 17' 40.87"
111	Pooseri	E 78° 38' 25.386"	N 9° 18' 19.771"
112	Athankotankudi	E 78° 37' 51.211"	N 9° 18' 15.926"
113	Thaliyarenthal	E 78° 40' 42.64"	N 9° 19' 38.014"
114	Kadampodai	E 78° 40' 8.332"	N 9° 18' 45.097"
115	Uttarakosamangi	E 78° 44' 4.189"	N 9° 18' 54.752"
116	Kannankudi	E 78° 43' 7.255"	N 9° 19' 10.967"
117	Kalari	E 78° 46' 12.518"	N 9° 18' 31.914"
118	Mallal	E 78° 42' 17.266"	N 9° 19' 45.937"

119	Tiruppullani	E 78° 49' 29.179"	N 9° 17' 9.604"
120	Vannikudi	E 78° 47' 4.924"	N 9° 19' 47.932"
121	Kattukavalkavan valasi	E 78° 51' 30.002"	N 9° 18' 17.82"
122	Valimadaivalasai	E 78° 51' 40.943"	N 9° 18' 53.071"
123	Pattinamkattan	E 78° 53' 46.388"	N 9° 19' 35.342"
124	Raghunthapuram	E 78° 55' 19.323"	N 9° 17' 36.824"
125	Pandiyanagar (Valuthur)	E 78° 55' 19.841"	N 9° 19' 16.41"
126	Rettaiyurani	E 78° 58' 11.764"	N 9° 17' 41.181"
127	Puduadam North	E 78° 59' 56.727"	N 9° 17' 9.185"
128	Mandapam Camp	E 79° 9' 13.843"	N 9° 17' 12.856"
129	Madapam	E 79° 9' 0.853"	N 9° 17' 8.633"
130	Pamban North	E 79° 13' 10.307"	N 9° 17' 4.833"
131	Akkalmadam North	E 79° 13' 44.205"	N 9° 17' 8.71"
132	Thangachi madam North	E 79° 14' 57.035"	N 9° 17' 5.154"
133	Thangachi madam	E 79° 15' 38.047"	N 9° 17' 3.843"
134	Ariyakundu	E 79° 16' 54.152"	N 9° 17' 44.038"
135	Erakadu	E 79° 17' 41.974"	N 9° 17' 30.062"
136	Ramarpatham	E 79° 18' 25.666"	N 9° 18' 1.319"
137	Rameswaram	E 79° 18' 41.159"	N 9° 17' 31.855"
138	Olaikudda	E 79° 19' 44.161"	N 9° 18' 14.603"
139	Olaikudda Light House	E 79° 19' 51.124"	N 9° 19' 2.996"
140	Semmamadam	E 79° 17' 10.446"	N 9° 17' 0.511"
141	Rameswarm	E 79° 18' 44.413"	N 9° 16' 47.632"
142	Attangarai	E 78° 59' 40.048"	N 9° 20' 56.287"
143	Alagankulam	E 78° 57' 58.761"	N 9° 21' 10.923"
144	Panaikulam	E 78° 56' 54.856"	N 9° 21' 59.729"
145	Vani	E 78° 54' 24.653"	N 9° 20' 56.911"
146	Kusavankudi	E 78° 53' 11.994"	N 9° 20' 19.734"
147	Ammankovil	E 78° 50' 54.442"	N 9° 20' 0.326"
148	Sethunagar	E 78° 50' 33.706"	N 9° 21' 21.841"
149	Kooriyur	E 78° 47' 22.042"	N 9° 20' 58.744"
150	Ramanathapuram	E 78° 48' 41.695"	N 9° 21' 58.464"
151	Mecca Nagar	E 78° 46' 18.048"	N 9° 22' 10.866"
152	Ekkakudi	E 78° 45' 2.498"	N 9° 20' 27.708"
153	VadukuKodikulam	E 78° 41' 55.158"	N 9° 22' 19.52"
154	Malangudi	E 78° 43' 15.312"	N 9° 20' 55.77"
155	Nediamanickam	E 78° 39' 16.859"	N 9° 22' 22.958"
156	Valanadu	E 78° 39' 53.06"	N 9° 21' 18.943"
157	Periyakaiyagm	E 78° 37' 11.33"	N 9° 20' 56.994"
158	Kodarendal	E 78° 37' 47.608"	N 9° 22' 25.91"
159	Kakkoor	E 78° 34' 13.926"	N 9° 20' 54.812"

160	Puliyangudi	E 78° 34' 23.707"	N 9° 21' 43.358"
161	Thanjakur	E 78° 34' 37.859"	N 9° 22' 6.535"
162	Vennervaikal	E 78° 31' 49.854"	N 9° 22' 2.212"
163	Muthukulathur	E 78° 30' 59.123"	N 9° 21' 7.24"
164	Muthukulathur outer	E 78° 30' 37.998"	N 9° 20' 41.42"
165	Chithirangudi	E 78° 28' 32.135"	N 9° 20' 0.254"
166	Peterpuram	E 78° 27' 10.292"	N 9° 21' 19.022"
167	Mettupatti	E 78° 26' 14.878"	N 9° 21' 12.845"
168	Sangappadai	E 78° 23' 42.965"	N 9° 21' 41.998"
169	Keelavalasai	E 78° 24' 47.833"	N 9° 21' 33.98"
170	Mudalnadu	E 78° 21' 42.419"	N 9° 21' 45.482"
171	Poomavilangai	E 78° 22' 1.261"	N 9° 19' 53.087"
172	Thirusiluvaipuram	E 78° 19' 5.434"	N 9° 22' 16.619"
173	K. Nedugulam	E 78° 19' 50.675"	N 9° 23' 11.353"
174	KeelaMandapasalai	E 78° 13' 53.573"	N 9° 25' 5.664"
175	N. Karisalkuam	E 78° 16' 7.381"	N 9° 24' 44.561"
176	Ramasampatti	E 78° 15' 52.308"	N 9° 23' 39.905"
177	Keelaramanathi (Farm)	E 78° 18' 40.19"	N 9° 24' 24.055"
178	Kavadipatti	E 78° 17' 22.726"	N 9° 24' 33.275"
179	Kamudi	E 78° 21' 41.918"	N 9° 25' 4.796"
180	Pasumpon	E 78° 23' 44.772"	N 9° 24' 43.607"
181	Pasumpon (Near)	E 78° 23' 51.407"	N 9° 24' 44.374"
182	Melakannicherry	E 78° 27' 38.916"	N 9° 24' 18.828"
183	Nalloor	E 78° 28' 31.076"	N 9° 24' 6.754"
184	KeelanThooval	E 78° 32' 44.927"	N 9° 25' 1.452"
185	Vilangalathur	E 78° 32' 25.865"	N 9° 23' 41.744"
186	Mahindi	E 78° 34' 30.796"	N 9° 24' 57.006"
187	Meesal	E 78° 36' 29.639"	N 9° 23' 3.541"
188	North Ulaiyur	E 78° 38' 29.778"	N 9° 22' 58.224"
189	A Puthur	E 78° 39' 9.58"	N 9° 24' 7.34"
190	Muthu Selvapuram	E 78° 40' 21.428"	N 9° 24' 5.573"
191	Sathirakudi	E 78° 42' 18.857"	N 9° 24' 20.876"
192	Theeyanur	E 78° 43' 20.114"	N 9° 23' 40.51"
193	Seyyalur	E 78° 44' 42.23"	N 9° 22' 48.324"
194	Karunkulam	E 78° 45' 19.919"	N 9° 22' 23.876"
195	Soorankottai	E 78° 48' 58.874"	N 9° 22' 48.4"
196	Thoruvalur	E 78° 48' 49.406"	N 9° 24' 36.331"
197	Ramanathapuram Bypass	E 78° 50' 14.078"	N 9° 23' 43.642"
198	Ramanathapuram Bypass	E 78° 51' 27.011"	N 9° 23' 1.878"
199	Near Palangulam (Farm)	E 78° 51' 40.802"	N 9° 24' 44.575"
200	Ramalan Nagar	E 78° 52' 20.053"	N 9° 22' 39.677"



201	Near Ramalan Nagar	E 78° 52' 42.701"	N 9° 22' 44.317"
202	Terbhogi	E 78° 55' 20.096"	N 9° 23' 29.328"
203	Pudhuvalasai	E 78° 56' 19.639"	N 9° 23' 1.335"
204	Chittrakottai	E 78° 53' 54.01"	N 9° 25' 41.675"
205	Agri-farm	E 78° 53' 7.688"	N 9° 27' 31.37"
206	SakkaravalaNallur	E 78° 52' 5.639"	N 9° 27' 20.408"
207	Perygalur	E 78° 48' 14.45"	N 9° 26' 4.236"
208	Vayaloor	E 78° 48' 7.682"	N 9° 26' 55.183"
209	Madaloor (Vaigai River)	E 78° 45' 53.701"	N 9° 26' 24.025"
210	Thethangal	E 78° 46' 34.334"	N 9° 27' 21.452"
211	Kamankottai	E 78° 41' 53.484"	N 9° 27' 43.355"
212	Muthuvayal	E 78° 41' 46.943"	N 9° 26' 6.907"
213	Near Muthuvayal	E 78° 41' 36.978"	N 9° 25' 24.78"
214	Poganoor	E 78° 39' 11.581"	N 9° 26' 13.826"
215	Thiruvadi	E 78° 39' 31.388"	N 9° 27' 16.376"
216	Vikrapandipuram	E 78° 36' 1.174"	N 9° 26' 14.658"
217	Siruthalai	E 78° 36' 26.046"	N 9° 25' 54.314"
218	Tiruvarangam	E 78° 36' 59.645"	N 9° 25' 24.733"
219	Pamboor	E 78° 34' 6.244"	N 9° 27' 56.635"
220	Near Malakavanoor	E 78° 34' 22.685"	N 9° 27' 57.11"
221	Muthuramalingapattinam	E 78° 35' 10.45"	N 9° 27' 5.411"
222	Puluthikulam	E 78° 32' 30.217"	N 9° 27' 54.238"
223	Near Puluthikulam	E 78° 33' 2.228"	N 9° 27' 37.58"
224	MerkuKottakudi	E 78° 28' 52.81"	N 9° 27' 7.261"
225	Perungarunai	E 78° 28' 57.731"	N 9° 27' 18.122"
226	Near Perungarunai	E 78° 28' 53.034"	N 9° 27' 17.191"
227	Sabathi	E 78° 26' 47.112"	N 9° 27' 46.04"
228	Abiramam	E 78° 26' 35.02"	N 9° 26' 10.889"
229	Nanthiseri	E 78° 24' 28.901"	N 9° 25' 26.537"
230	Valayapokulam	E 78° 21' 4.464"	N 9° 26' 45.478"
231	Near Mandalamanickam	E 78° 20' 28.435"	N 9° 27' 6.415"
232	Mandalamanickam	E 78° 20' 3.631"	N 9° 27' 43.229"
233	Yedaisoorani	E 78° 19' 45.646"	N 9° 25' 48.22"
234	Perumaldevanpatti	E 78° 19' 11.219"	N 9° 25' 56.294"
235	NeeraviChinnakarusalkulam	E 78° 16' 46.085"	N 9° 25' 14.905"
236	KeelamudiMannarkottai	E 78° 15' 11.97"	N 9° 26' 26.473"
237	KK Kottai	E 78° 14' 35.754"	N 9° 25' 44.321"
238	Near KK Kottai	E 78° 14' 25.112"	N 9° 25' 19.009"
239	Pothanathi	E 78° 22' 1.196"	N 9° 29' 5.237"
240	Koodakulam	E 78° 21' 37.127"	N 9° 29' 12.512"
241	Tharaikudi	E 78° 24' 49.349"	N 9° 29' 13.362"

242	T Kallikulam	E 78° 24' 36.4"	N 9° 29' 57.919"
243	ManikaThootam	E 78° 23' 33.652"	N 9° 30' 0.475"
244	Periyanaikulam	E 78° 27' 7.243"	N 9° 29' 54.377"
245	Kodumalur	E 78° 26' 46.104"	N 9° 29' 8.279"
246	Sanmuganathapuram	E 78° 29' 26.401"	N 9° 28' 27.109"
247	Near Sanmuganathapuram	E 78° 30' 9.702"	N 9° 29' 12.494"
248	Thattankudiyiruppu	E 78° 31' 45.476"	N 9° 29' 16.328"
249	MelaThattankudiyiruppu	E 78° 31' 42.251"	N 9° 29' 2.728"
250	Melakavanoor	E 78° 34' 7.961"	N 9° 30' 11.815"
251	S Kavanoor	E 78° 33' 57.715"	N 9° 29' 45.629"
252	Muthunagar	E 78° 33' 34.65"	N 9° 28' 14.527"
253	Thinaikulam Highway	E 78° 38' 37.09"	N 9° 29' 35.866"
254	Arriyananthai	E 78° 38' 17.869"	N 9° 29' 41.507"
255	Tthinaikulam	E 78° 37' 55.531"	N 9° 29' 18.103"
256	Manjoor	E 78° 39' 13.284"	N 9° 28' 44.72"
257	Pattithatti	E 78° 38' 57.372"	N 9° 29' 9.546"
258	ChinnaAkkiramesi	E 78° 42' 16.607"	N 9° 29' 40.07"
259	Arasadi Vandal	E 78° 43' 4.915"	N 9° 29' 21.948"
260	Pandiyur	E 78° 43' 35.483"	N 9° 28' 58.418"
261	Lakshmi Mangalam	E 78° 44' 8.542"	N 9° 29' 1.522"
262	SV Mangalam	E 78° 45' 1.933"	N 9° 29' 38.504"
263	Panthapanenthal	E 78° 45' 4.018"	N 9° 30' 41.89"
264	Kiliyoor	E 78° 47' 0.679"	N 9° 29' 4.495"
265	P Kodikulam	E 78° 47' 37.273"	N 9° 30' 14.447"
266	Vaigai	E 78° 50' 24.101"	N 9° 30' 14.472"
267	Madhavanoor	E 78° 52' 2.96"	N 9° 29' 36.64"
268	Devipattinam	E 78° 53' 37.543"	N 9° 29' 14.06"
269	ABC Kenbridge School	E 78° 52' 36.584"	N 9° 30' 58.327"
270	Pathanandhal	E 78° 54' 37.483"	N 9° 32' 1.018"
271	Pottagavayal	E 78° 50' 6.616"	N 9° 30' 47.549"
272	Kundathur	E 78° 50' 24.871"	N 9° 32' 42.202"
273	Vagavayal	E 78° 47' 19.59"	N 9° 31' 41.862"
274	Pottagavayal	E 78° 49' 0.397"	N 9° 31' 53.504"
275	Thaniyapuli	E 78° 48' 2.308"	N 9° 30' 40.072"
276	Koluoor	E 78° 45' 36.155"	N 9° 30' 46.087"
277	Kottakudi	E 78° 46' 44.749"	N 9° 31' 45.822"
278	Movaloor	E 78° 45' 21.452"	N 9° 32' 59.863"
279	Katchan	E 78° 43' 30.187"	N 9° 33' 16.981"
280	Paaparkootam	E 78° 42' 27.965"	N 9° 33' 8.975"
281	Nainaarkulam	E 78° 41' 53.934"	N 9° 32' 53.426"
282	Nainarkovil	E 78° 41' 23.935"	N 9° 32' 46.59"

283	Puthoorvalasi	E 78° 39' 44.608"	N 9° 32' 47.18"
284	Valasai	E 78° 39' 30.892"	N 9° 32' 41.968"
285	Ariyanenthal	E 78° 37' 35.342"	N 9° 30' 38.203"
286	Kumarakudi	E 78° 35' 58.387"	N 9° 30' 43.16"
287	Vengadesh Colony	E 78° 34' 46.142"	N 9° 31' 50.588"
288	Paramakudi	E 78° 35' 2.677"	N 9° 33' 1.447"
289	Somanathapuram	E 78° 33' 15.782"	N 9° 32' 54.208"
290	Nandupatti	E 78° 31' 24.834"	N 9° 32' 34.397"
291	Ambethkar Nagar	E 78° 32' 52.811"	N 9° 32' 27.326"
292	Vengalur	E 78° 30' 28.843"	N 9° 32' 22.898"
293	Ramalingampatti	E 78° 30' 15.653"	N 9° 32' 22.769"
294	PP Yenthal	E 78° 25' 24.568"	N 9° 33' 3.193"
295	KaatuEmaneshwaram	E 78° 26' 16.069"	N 9° 33' 5.738"
296	Mochakudi	E 78° 25' 13.685"	N 9° 32' 43.044"
297	Near Mochakudi	E 78° 25' 9.109"	N 9° 32' 54.305"
298	Pidaricheri	E 78° 24' 52.765"	N 9° 35' 14.323"
299	MelaParthibanoor	E 78° 27' 44.23"	N 9° 35' 5.896"
300	Parthibanoor	E 78° 27' 15.023"	N 9° 35' 16.231"
301	Rajakalpatti	E 78° 30' 19.519"	N 9° 34' 31.688"
302	KeelaPerungarai	E 78° 30' 14.029"	N 9° 35' 16.958"
303	TThelichatthanallur	E 78° 32' 44.135"	N 9° 34' 3.803"
304	KattuParamakudi	E 78° 34' 2.867"	N 9° 33' 43.474"
305	ThalaiyadiKottai	E 78° 42' 5.954"	N 9° 33' 40.691"
306	Memangalam	E 78° 42' 14.533"	N 9° 34' 0.091"
307	Radhapuli	E 78° 42' 31.025"	N 9° 35' 32.849"
308	Vathavaneri	E 78° 46' 2.114"	N 9° 34' 33.668"
309	Varunthi	E 78° 44' 43.066"	N 9° 35' 14.122"
310	Kaadarnthakudi	E 78° 44' 46.388"	N 9° 33' 56.473"
311	Kuyavanenthal	E 78° 49' 7.673"	N 9° 34' 40.264"
312	Ananthanenthal	E 78° 48' 23.576"	N 9° 35' 3.923"
313	Ariyankottai	E 78° 47' 36.874"	N 9° 34' 27.901"
314	Near Solanthoor	E 78° 51' 36.209"	N 9° 33' 56.221"
315	Solanthoor	E 78° 51' 36.725"	N 9° 33' 37.05"
316	Kathiyarkottai	E 78° 53' 13.297"	N 9° 34' 14.761"
317	Kadalur	E 78° 55' 55.974"	N 9° 37' 40.224"
318	Uppur	E 78° 55' 42.467"	N 9° 36' 55.584"
319	Kalangappuli	E 78° 53' 52.303"	N 9° 38' 34.663"
320	Paranoor	E 78° 53' 9.121"	N 9° 38' 44.7"
321	RS Mangalam	E 78° 50' 55.525"	N 9° 38' 33.324"
322	Mangalam	E 78° 51' 44.37"	N 9° 36' 41.364"
323	Sengudi	E 78° 48' 31.154"	N 9° 38' 5.374"

324	Sudiyur	E 78° 29' 9.758"	N 9° 36' 2.03"
325	Parakai	E 78° 27' 6.631"	N 9° 36' 7.466"
326	Sanaveli	E 78° 52' 15.557"	N 9° 41' 4.38"
327	Pullamadai	E 78° 51' 0.31"	N 9° 39' 54.745"
328	Odaikaal	E 78° 52' 53.544"	N 9° 40' 4.066"
329	Kannarenthal	E 78° 55' 49.854"	N 9° 40' 2.917"
330	A Manakudi	E 78° 56' 53.635"	N 9° 39' 59.198"
331	Puthupattanam	E 78° 57' 58.446"	N 9° 40' 44.494"
332	Thiruvetriyur	E 78° 56' 46.842"	N 9° 42' 26.201"
333	Pottakudi	E 78° 56' 10.943"	N 9° 42' 36.576"
334	Melapanaiyoor	E 78° 53' 11.98"	N 9° 43' 9.588"
335	Aayiraveli	E 78° 54' 26.989"	N 9° 43' 10.97"
336	Gudalur	E 78° 51' 7.754"	N 9° 43' 43.28"
337	Kavanakottai	E 78° 50' 12.16"	N 9° 42' 1.206"
338	Ayankudi	E 78° 49' 6.82"	N 9° 43' 16.237"
339	Karunkudi	E 78° 49' 28.279"	N 9° 43' 39.706"
340	Anandur	E 78° 46' 49.3"	N 9° 43' 51.528"
341	Valanai	E 78° 46' 32.279"	N 9° 43' 53.645"
342	Sattanoor	E 78° 45' 17.986"	N 9° 43' 28.61"
343	Nemam	E 78° 43' 52.093"	N 9° 44' 33.428"
344	Viruthanvayal	E 78° 44' 18.816"	N 9° 44' 57.368"
345	Annayankottai	E 78° 45' 10.958"	N 9° 44' 50.028"
346	Radhanur	E 78° 45' 41.335"	N 9° 45' 45.472"
347	Govindamangalam	E 78° 47' 20.782"	N 9° 45' 33.152"
348	Karkathakudi	E 78° 52' 57.893"	N 9° 44' 31.621"
349	Karungavayal	E 78° 57' 26.406"	N 9° 45' 35.388"
350	Achankudi	E 78° 56' 38.033"	N 9° 46' 17.641"
351	T Puthukudi	E 78° 59' 31.751"	N 9° 45' 1.462"
352	Sekunthidal	E 78° 57' 46.724"	N 9° 44' 17.164"
353	PV Pattanam	E 79° 2' 27.694"	N 9° 46' 12.241"
354	Velankudi	E 79° 1' 32.106"	N 9° 45' 21.737"
355	Vattanam	E 79° 3' 32.908"	N 9° 47' 27.085"
356	RC Nagar	E 79° 3' 18.709"	N 9° 47' 13.099"
357	Ettukudi	E 78° 59' 37.525"	N 9° 48' 35.651"
358	Palangulam	E 79° 0' 6.059"	N 9° 47' 35.272"
359	Near T. Keelaiyur	E 78° 56' 5.19"	N 9° 47' 20.242"
360	T. Keelaiyur	E 78° 56' 20.947"	N 9° 47' 47.472"
361	Bharathinagar	E 78° 54' 12.334"	N 9° 48' 25.808"
362	Kuruvankadu	E 78° 53' 41.114"	N 9° 47' 43.912"
363	Elangundram	E 78° 54' 17.878"	N 9° 50' 30.602"
364	Veliyankudi	E 78° 56' 36.913"	N 9° 50' 21.109"

365	Kunjankulam	E 78° 56' 41.104"	N 9° 50' 50.165"
366	NM Mangalam	E 79° 0' 11.916"	N 9° 50' 53.322"
367	Peruvakottai	E 78° 58' 43.514"	N 9° 51' 35.078"
368	Vellaiyapuram	E 79° 2' 10.655"	N 9° 49' 55.801"
369	Kuttivayal	E 79° 0' 34.34"	N 9° 50' 3.804"
370	Near SP Pattanam	E 79° 5' 38.663"	N 9° 50' 38.566"
371	OriyurPuthuvayal	E 79° 3' 52.952"	N 9° 51' 4.14"
372	SP Pattanam	E 79° 5' 51.824"	N 9° 50' 28.583"
373	Peramangalam	E 79° 0' 26.568"	N 9° 53' 4.621"
374	Arivithi	E 78° 58' 11.748"	N 9° 53' 21.473"
375	Andavoorani	E 78° 58' 58.681"	N 9° 52' 42.654"
376	Mangalakudi	E 78° 57' 3.132"	N 9° 52' 20.122"
377	Kurunthangudi	E 78° 55' 27.919"	N 9° 53' 45.056"
378	Keeppuli	E 78° 54' 16.29"	N 9° 54' 47.549"



**Table 4: shows the various groundwater quality of pre-monsoon samples for the Ramanathapuram district**

S. No.	Name of the locations	Well type	pH	Salinity	Ec (µS/cm)	TDS (mg/l)	TA (mg/l)	CO <sub>3</sub> (mg/l)	HCO <sub>3</sub> (mg/l)	TH (mg/l)	Ca (mg/l)	Mg (mg/l)	Na (mg/l)	K (mg/l)	SO <sub>4</sub> (mg/l)	Cl (mg/l)	NO <sub>3</sub> (mg/l)	WQI	SMI
1	Sevalpatti	Bore well	7.87	0	512	312	465	96	334	210	80	45	36	4	49	106	33	64.9	0.16
2	Kannirajpuram	Open well	7.15	0	3503	1987	327	95	213	418	191	107	156	6	26	724	26	184.3	0.39
3	Vettukadu	Open well	7.58	0	2416	1407	411	118	274	270	120	90	288	30	36	627	45	164.0	0.41
4	Narippaiyur	Bore well	7.43	2	37044	21640	392	131	236	2163	1102	483	421	8	28	3836	36	1232.0	1.72
5	Near Narippaiyur	Bore well	7.54	0	394	250	407	99	293	164	76	42	43	4	33	130	8	51.5	0.14
6	Vadakku Mookkaiyur	Open well	7.07	0	2936	1861	313	56	233	350	160	90	222	12	72	782	18	182.7	0.52
7	Mookkaiyur	Open well	6.97	0	3002	1734	306	47	229	358	164	92	268	3	96	877	13	188.0	0.62
8	Oppilan	Open well	7.32	0	5150	3170	357	65	262	614	281	157	282	6	58	1047	5	270.0	0.63
9	T Mariyur	Open well	7.41	0	736	413	386	141	231	88	40	23	148	30	34	180	23	64.7	0.19
10	MelaMundhal	Open well	6.93	0	1506	842	302	95	182	180	82	46	210	26	83	408	21	108.2	0.39
11	Mundhal	Open well	6.97	0	28130	17610	307	68	200	3353	200	358	1965	53	66	4202	35	1121.0	2.39
12	Dhanushkodi	Open well	7.07	0	1704	953	314	56	241	400	40	67	204	34	34	428	21	112.1	0.30
13	Valinokkam	Open well	7.08	0	6230	3780	314	66	234	743	340	190	264	17	35	1260	15	317.4	0.66
14	Valinokkam Salt Pan	Open well	6.93	0	8470	5270	302	56	187	420	80	45	1287	58	75	2372	5	456.3	1.45
15	Near Melakidaram	Open well	6.58	0	8390	5370	270	69	176	1000	457	256	456	10	136	1880	12	452.7	1.17
16	Kaduguchanthai	Open well	6.39	5	18810	11030	256	84	133	2242	1025	574	523	12	142	3560	39	885.1	1.89
17	Katalati (Kuthiraimozhi)	Open well	7.6	0	623	357	416	114	286	74	34	19	108	6	11	133	9	50.1	0.11
18	Peiryakulam	Bore well	7.67	15	38470	23560	436	116	283	4586	2096	1174	763	14	99	6182	88	1733.0	2.99
19	Sayalkudi	Open well	7.65	0	772	476	433	121	281	350	240	67	36	4	25	295	5	88.8	0.18
20	Pullandhai	Open well	7.56	0	2802	1685	409	115	266	402	153	96	285	16	240	810	24	194.4	0.88
21	Sethurajapuram	Open well	7.18	0	1955	1171	332	95	216	233	107	60	146	11	28	361	17	112.9	0.25
22	Kuruvadi	Bore well	7.51	0	1204	763	306	56	211	246	164	35	181	8	83	404	38	111.7	0.38
23	Tharakudi	Bore well	6.83	0	1799	1099	296	95	171	310	200	67	206	10	36	605	17	140.3	0.38
24	Karusalkulam	Bore well	7.42	0	2680	1624	391	103	254	319	146	82	286	14	87	495	37	162.5	0.46
25	Uchanatham	Bore well	7.73	0	566	341	442	121	284	67	31	17	98	9	47	103	16	49.9	0.16

26	Ramasamuthiram	Open well	7.58	0	1290	805	411	110	286	154	70	39	196	17	23	293	21	93.2	0.22
27	Near Perunali	Bore well	7.31	0	3589	2097	353	63	259	420	196	110	479	10	21	864	8	216.3	0.54
28	Perunali	Bore well	7.51	0	3226	1812	403	59	315	385	176	99	386	15	53	781	24	196.6	0.54
29	T Veppakulam	Open well	7.81	0	397	216	456	114	324	47	22	12	89	9	12	120	9	41.2	0.10
30	TM Kottai	Open well	7.63	0	1662	1014	426	96	314	198	91	51	156	10	8	330	6	100.0	0.20
31	Pillayarkulam	Bore well	7.53	0	6570	4120	406	98	298	480	360	45	916	27	53	1826	28	384.6	1.08
32	Vagaikulam	Bore well	7.74	0	1455	831	442	102	298	173	79	44	256	17	64	362	34	109.7	0.35
33	S Alangkulam	Bore well	7.54	0	683	412	421	99	287	137	88	33	129	5	25	236	6	68.0	0.18
34	Samathuvapuram(Near Kadaladi)	Bore well	7.8	0	539	304	456	118	314	64	29	16	96	3	18	126	10	46.6	0.12
35	Kadaladi	Bore well	7.81	0	789	495	457	114	324	94	43	24	89	6	26	102	10	54.6	0.12
36	Pasumpon Nagar	Open well	7.62	0	2208	1302	420	92	293	263	120	67	250	12	87	457	23	143.2	0.43
37	Melaselvanur	Open well	7.5	0	683	421	400	87	298	81	37	21	166	16	23	239	5	64.1	0.19
38	Kelaselvanur	Open well	7.29	0	3911	2455	350	96	228	466	213	119	436	27	81	1084	36	253.8	0.73
39	Kothankulam	Open well	7.18	0	3164	1649	332	96	216	377	172	97	386	18	167	784	64	204.8	0.76
40	Sikkal	Bore well	7.12	15	39350	24690	317	66	236	4691	2144	1201	2532	24	22	8244	43	2022.3	4.18
41	Ervadi	Open well	7.57	0	858	521	410	113	285	102	47	26	186	17	26	276	16	76.0	0.22
42	ChinnaErvadi	Open well	6.61	0	7750	4860	272	74	184	470	320	90	1404	54	76	2560	58	505.4	1.57
43	Mayakulam	Bore well	7.61	0	383	221	418	96	296	46	21	12	86	16	11	110	8	40.3	0.09
44	Keelakarai	Bore well	6.6	8	16713	10421	273	96	164	2874	890	484	2016	86	25	6033	37	1096.2	3.04
45	Natarajapuram	Open well	6.85	0	1327	804	298	58	224	158	72	41	173	14	27	316	20	92.4	0.23
46	Rameswaram South	Open well	6.61	0	2507	1455	274	85	156	450	40	134	218	25	45	597	16	154.0	0.41
47	Ayyanthoppu	Open well	7.04	0	764	465	312	96	188	91	42	23	124	10	52	169	21	62.9	0.21
48	Thangachimadam south	Open well	7.61	0	1414	825	418	97	284	169	77	43	183	21	34	433	16	103.6	0.29
49	Kunthukal	Open well	7.43	0	3055	1709	393	111	255	364	166	93	287	18	38	724	11	177.0	0.45
50	Kunthukal farm	Bore well	7.54	0	607	363	407	99	274	72	33	19	123	7	14	179	10	54.6	0.14
51	Pamban South	Open well	6.78	0	3978	2486	290	94	175	474	217	121	563	19	129	1182	54	275.7	0.90
52	Mandapam (Near Sea Park)	Open well	6.78	0	1104	698	290	101	163	474	217	121	235	8	26	463	6	129.8	0.32
53	Mandapam South	Open well	6.96	0	10880	5440	305	69	198	1297	593	332	652	34	53	2556	42	546.9	1.33
54	Marakayarpatinam	Open well	6.38	0	9060	4620	255	63	166	1080	494	277	686	37	35	2856	28	516.0	1.41

55	Marakayarpattinam shore	Open well	7.09	0	587	325	315	66	235	200	120	67	100	6	11	224	9	72.1	0.15
56	Vedalai	Open well	6.7	0	2540	1470	280	68	182	303	138	78	363	12	6	772	13	168.8	0.43
57	Meenavarkuddiruppu	Open well	6.3	4	12880	7400	246	57	160	1535	702	393	856	34	14	3637	24	714.1	1.74
58	Kunjarvalasai	Open well	7.07	0	589	314	314	88	187	70	32	18	111	11	14	176	6	50.3	0.13
59	Seeniappadhurga	Open well	7.25	0	819	510	344	66	254	240	80	134	55	1	6	380	10	96.9	0.20
60	TM Kuddiruppu	Bore well	6.86	0	877	538	300	95	195	400	120	112	111	5	11	456	8	104.7	0.25
61	Uchipuli	Open well	7	0	902	551	308	59	230	420	80	179	107	18	17	546	15	125.2	0.31
62	Pirappanvalasai	Open well	6.82	0	1380	789	294	69	191	450	120	112	146	7	33	456	15	118.1	0.30
63	Ariyaman Beach	Open well	6.95	0	5840	3720	304	89	198	696	318	178	426	2	51	1463	24	336.7	0.82
64	Nochiyurani Near	Open well	8.05	2	11600	6410	476	95	359	180	40	45	486	11	24	821	8	330.7	0.52
65	Nochiyurani	Bore well	7.82	0	7275	4650	458	116	305	2684	1120	623	436	12	97	2381	56	611.2	1.35
66	Pudhumadam	Open well	7.25	0	691	412	344	84	224	281	134	48	186	6	12	450	9	93.1	0.26
67	Indhiranagar	Open well	7.5	0	1048	671	400	96	262	372	184	75	189	12	13	358	3	105.7	0.23
68	Periyapattinam	Open well	7.1	0	1134	667	315	66	235	135	62	35	137	6	7	286	6	76.9	0.17
69	Sethukarai	Open well	6.86	0	1267	731	300	121	154	480	80	45	118	12	23	321	10	85.7	0.21
70	Kalimankundu	Open well	7.14	0	720	451	321	56	215	86	39	22	89	8	15	214	8	57.9	0.14
71	Thinaikulam	Open well	7.08	0	2456	1429	314	99	196	1006	346	563	114	20	11	352	13	253.7	0.31
72	Thilanianthal	Open well	6.51	6	23550	14780	263	59	181	980	560	381	1162	23	63	3984	14	988.2	2.06
73	Kanjirangudi	Bore well	6.28	0	5250	3250	240	43	186	626	286	160	667	18	14	1564	19	334.0	0.86
74	Keelakari outer	Open well	7.2	8	15812	10120	334	89	217	3561	1046	645	2040	28	126	7209	39	1218.1	3.72
75	K Madurai	Open well	6.93	15	34580	21300	303	63	227	4122	1884	1055	2406	21	64	7552	21	1795.9	3.93
76	Palanchirai	Open well	7.23	1	14520	8290	336	85	218	1731	791	443	1154	16	89	4056	37	817.5	2.15
77	Natham	Open well	7.28	1	11901	7564	348	99	226	1622	456	308	1283	9	34	3558	23	2971.9	1.87
78	Melamadai	Bore well	7.25	2	3471	2184	345	74	254	414	189	106	346	13	16	1102	37	231.0	0.57
79	Mariyarayapuram	Bore well	6.67	40	53900	32020	279	94	172	6425	2937	1645	660	29	86	8609	140	2359.7	3.94
80	Sikkal	Bore well	6.93	2	15030	9490	303	86	197	1792	819	459	908	16	56	3654	41	819.1	1.86
81	Panaiyadiyenthal	Open well	7.02	3	13380	8290	311	98	196	1595	729	408	810	8	28	3581	33	744.8	1.73
82	Thirunallar	Bore well	6.49	0	719	451	260	86	145	86	39	22	36	20	16	242	8	<b>56.0</b>	0.14
83	Melachirupodhu	Bore well	8.03	0	1068	628	474	93	358	630	320	291	36	6	8	262	10	149.5	0.19

84	Orivayal	Bore well	7.82	0	1624	1007	458	115	324	194	89	50	262	17	62	543	14	125.9	0.42
85	Savariarpattanam	Open well	7.47	0	2847	1797	397	89	295	339	155	87	287	25	21	882	24	190.7	0.48
86	Appanoor	Bore well	7.13	2	1724	1007	320	95	198	258	118	66	267	8	41	574	12	131.2	0.39
87	Punavasal	Bore well	7.48	0	3319	1063	398	85	286	396	181	101	205	13	16	625	8	144.5	0.35
88	Punavasal near	Bore well	7.83	0	607	368	459	114	328	72	33	19	99	6	26	186	23	57.5	0.16
89	Kumboddi	Bore well	7.37	0	4620	2731	369	69	270	551	252	141	325	22	34	978	8	248.1	0.56
90	Kathanendhal	Bore well	7.26	0	8670	5330	346	78	255	1034	472	265	156	9	15	1681	16	417.3	0.76
91	Kovilangulam	Bore well	6.88	6	21700	13250	301	58	226	490	120	291	1356	13	24	2841	11	812.1	1.60
92	Erumaikulam	Bore well	7.76	0	1973	1185	445	117	293	235	108	60	214	6	26	586	10	131.9	0.35
93	Ponthampuli	Bore well	7.69	0	596	331	437	117	284	370	160	157	66	3	12	260	8	96.5	0.17
94	Maviangai	Bore well	6.55	0	1058	581	267	69	174	283	106	33	126	7	10	250	3	73.1	0.16
95	Veeramanachipatti	Bore well	7.18	0	8610	5410	333	95	216	410	200	202	433	6	13	1430	12	382.2	0.74
96	Thimmanathapuram	Bore well	6.81	0	6320	3860	292	73	190	753	344	193	362	12	15	1580	22	348.7	0.77
97	T.Balasubramaiapuram	Bore well	7.45	0	3952	2431	394	97	286	471	215	121	206	15	11	1380	23	216.3	0.63
98	Pappuraddiapatti	Bore well	7.25	0	6300	3950	345	58	254	751	343	192	386	4	16	1390	16	339.2	0.71
99	Vepungallam	Bore well	7.59	0	1132	668	414	107	269	310	200	90	83	8	16	462	8	111.4	0.25
100	Shokalingapuram	Bore well	7.09	10	30360	14180	315	95	205	3619	1654	927	456	15	11	5568	16	1243.5	2.44
101	Pudukottai	Bore well	7.76	0	1973	1085	445	113	312	235	108	60	210	6	11	426	5	115.7	0.26
102	Illanthaikulam	Bore well	7.44	0	7680	4740	394	98	286	916	419	234	106	2	38	1274	46	363.2	0.63
103	SonaiPiriyankottai	Bore well	7.09	10	30360	17180	315	66	235	3619	1654	927	93	3	29	834	15	1003.6	0.59
104	Enathi	Bore well	7.55	0	3670	2233	408	97	293	450	120	134	315	5	42	831	36	213.6	0.52
105	Poongulam	Bore well	7.59	3	1031	615	415	108	270	123	56	32	296	7	19	367	19	94.3	0.27
106	Kandian	Open well	7.26	0	11120	7056	346	96	225	1326	606	339	463	4	33	2147	26	561.2	1.08
107	Elanjempur	Bore well	7.04	4	15860	9200	312	96	188	270	120	112	2287	18	29	4368	79	817.1	2.43
108	Pookkulam	Bore well	6.8	9	1900	1152	291	97	172	226	104	58	186	9	14	429	43	123.1	0.26
109	Sadayaneri	Open well	7.52	4	22656	14200	405	97	293	3045	1671	682	127	13	42	3954	27	1066.3	1.74
110	Kookondan	Bore well	6.83	0	31890	19880	296	68	192	3802	1738	973	122	15	50	4726	19	1374.8	2.11
111	Pooseri	Bore well	7.74	0	3933	2464	443	105	327	469	214	120	282	10	26	859	51	229.3	0.49
112	Athantokankudi	Bore well	7.58	0	3684	2294	412	106	295	439	201	112	288	14	28	837	41	217.6	0.48
113	Thaliyarenthal	Bore well	7.78	0	8140	5130	451	107	325	970	444	248	495	8	16	2147	21	459.9	1.04

114	Kadampodai	Bore well	7.47	0	18720	10350	397	98	265	2232	1020	571	1205	18	11	4799	47	986.7	2.32
115	Uttarakosamangi	Open well	7.77	0	2408	1405	446	114	296	287	131	74	346	15	24	752	22	167.4	0.45
116	Kannankudi	Bore well	7.56	0	5880	3711	386	101	256	1267	694	321	108	14	43	1824	11	402.9	0.87
117	Kalari	Bore well	7.77	0	2408	1405	448	108	327	287	131	74	252	10	29	451	16	139.6	0.32
118	Mallal	Open well	7.72	0	458	229	440	92	314	55	25	14	53	5	20	58	11	36.3	0.08
119	Tiruppullani	Open well	7.2	0	6850	4230	334	87	217	817	373	209	486	2	37	2138	2	409.3	1.07
120	Vannikudi	Open well	7.29	0	956	578	350	92	228	114	52	29	92	8	19	142	14	62.0	0.13
121	Kattukavalka van valasi	Open well	7.37	0	3155	1977	372	97	242	440	80	45	466	12	24	993	9	195.8	0.57
122	Valimadaivalasai	Open well	6.73	4	14490	9230	286	69	186	1727	790	442	886	19	41	4464	29	853.1	2.12
123	Pattinamkattan	Open well	7.63	0	16450	9940	427	85	306	1961	896	502	908	15	37	3871	26	861.5	1.91
124	Raghunthapuram	Open well	6.12	3	16840	9900	220	67	121	2761	1035	761	1200	20	15	4871	17	1011.1	2.39
125	Pandiyanagar (Valuthur)	Open well	6.83	0	520	302	296	94	186	122	32	53	36	4	28	85	9	47.1	0.11
126	Rettaiyurani	Open well	6.73	0	1512	898	284	96	155	186	78	34	99	2	38	356	14	90.5	0.25
127	Puduadam North	Open well	6.83	0	1628	1003	264	78	132	268	102	58	268	5	46	483	8	120.6	0.37
128	Mandapam Camp	Open well	6.63	0	9680	6010	276	84	154	1154	528	295	1380	11	22	2160	2	561.3	1.35
129	Madapam	Open well	6.79	0	645	402	292	98	155	77	35	20	89	9	31	114	11	49.7	0.14
130	Pamban North	Open well	7.23	0	1925	1162	336	96	218	229	105	59	352	10	29	452	4	129.1	0.35
131	Akkalmadam North	Open well	6.99	0	1186	679	307	69	200	230	200	22	65	13	27	432	10	93.8	0.24
132	Thangachi madam North	Open well	7.62	0	1280	781	424	92	291	321	185	43	47	10	19	467	5	101.0	0.24
133	Thangachi madam	Open well	7.32	0	1302	826	359	69	263	318	166	55	56	13	53	520	4	108.8	0.33
134	Ariyakundu	Open well	7.42	0	2354	1480	391	107	254	281	128	72	286	9	16	675	3	154.5	0.39
135	Erakadu	Open well	6.82	0	3409	2108	294	35	241	480	400	22	668	26	24	863	10	228.6	0.58
136	Ramarpatham	Open well	6.82	0	2655	1705	295	48	222	340	84	160	363	19	22	817	1	191.8	0.50
137	Rameswaram	Open well	6.82	0	2933	1864	295	69	192	305	79	188	451	13	35	820	1	209.2	0.56
138	Olaikudda	Open well	7	0	3192	1995	308	84	200	320	80	202	493	11	33	842	1	221.1	0.58
139	Olaikudda Light House	Open well	6.65	2	3088	1968	276	89	165	384	92	189	603	2	28	1027	1	236.6	0.67
140	Semmamadam	Open well	6.85	0	1327	824	298	58	224	158	72	41	242	3	51	401	5	100.5	0.33
141	Rameswarm	Bore well	7.69	0	1531	963	437	121	284	183	83	47	201	1	44	367	9	108.9	0.30



142	Attangarai	Open well	6.83	0	1795	1096	297	76	193	280	200	22	231	2	27	590	19	130.4	0.35
143	Alagankulam	Open well	7.38	0	878	532	375	95	244	105	48	27	156	2	38	204	14	68.7	0.21
144	Panaikulam	Open well	7.14	0	988	593	323	94	210	250	120	22	121	6	51	186	17	73.7	0.21
145	Vani	Bore well	7.11	0	3941	2479	317	45	236	470	215	120	632	13	42	1124	3	51.5	0.73
146	Kusavankudi	Open well	7.78	0	3430	2015	452	106	314	409	187	105	607	5	16	1044	7	232.1	0.63
147	Ammankovil	Open well	7.41	0	736	466	387	112	252	88	40	23	115	5	8	186	7	58.2	0.13
148	Sethunagar	Open well	7.64	0	1513	855	432	141	266	250	40	90	241	4	3	416	2	108.7	0.26
149	Kooriyur	Bore well	6.9	0	6680	4240	301	66	196	796	364	204	1073	9	32	1800	2	424.0	1.12
150	Ramanathapuram	Bore well	6.96	0	3224	1911	305	95	198	384	176	98	571	6	43	914	4	214.5	0.63
151	Mecca Nagar	Bore well	7.52	33	47080	28520	406	96	294	5612	2566	1437	2128	15	16	5924	38	2056.9	3.22
152	Ekkakudi	Bore well	7.9	0	3410	2105	467	92	334	407	186	104	489	16	34	1137	12	236.0	0.67
153	VadukuKodikulam	Bore well	7.47	0	9610	5810	397	74	295	1146	524	293	967	5	15	2227	4	532.0	1.23
154	Malangudi	Open well	7.33	0	498	295	362	84	265	59	27	15	89	4	22	74	11	41.7	0.10
155	Nediamanickam	Bore well	7.28	0	8310	5260	349	97	227	991	453	254	827	12	42	2447	1	504.9	1.31
156	Valanadu	Bore well	7.3	1	11350	7160	351	66	258	1353	619	346	1226	18	31	3615	10	709.7	1.87
157	Periyakaiyagm	Bore well	7.1	0	4810	2930	316	95	187	270	120	112	618	12	36	1112	5	263.4	0.70
158	Kodarendal	Bore well	7.13	0	5910	3850	320	36	258	705	322	180	653	32	14	1427	3	350.3	0.80
159	Kakkoor	Bore well	6.95	4	17190	10840	305	63	228	2049	937	525	1200	18	16	5574	15	1029.1	2.60
160	Puliyangudi	Bore well	6.77	0	13210	7600	289	69	188	1575	720	403	837	17	21	3350	20	703.3	1.64
161	Thanjakur	Bore well	7.38	0	13150	8370	378	97	246	1568	717	401	1334	12	26	3961	20	803.0	2.04
162	Vennervaiikal	Bore well	7.31	2	17840	10830	356	62	261	310	200	90	2250	19	45	4690	88	896.0	2.57
163	Muthukulathur	Bore well	7.32	0	8030	5010	358	67	263	957	438	245	1376	17	39	2149	32	517.1	1.36
164	Muthukulathur outer	Bore well	7.38	0	7270	4450	379	97	246	867	396	222	893	12	43	1891	35	440.8	1.12
165	Chithirangudi	Bore well	7.11	2	12240	7720	317	59	236	1459	667	374	989	8	26	1751	21	600.1	1.10
166	Peterpuram	Bore well	7.16	0	7460	4730	328	94	211	810	120	650	564	5	47	1855	12	490.6	1.10
167	Mettupatti	Bore well	6.91	0	5810	3600	302	66	226	693	317	177	678	7	55	1586	44	362.3	0.95
168	Sangappadai	Bore well	7.23	0	4369	2687	337	68	249	521	238	133	156	12	73	1047	59	249.4	0.61
169	Keelavalasai	Bore well	7.01	0	7980	4990	310	97	175	951	435	244	1356	5	40	2163	32	514.3	1.36
170	Mudalnadu	Bore well	7.51	0	1974	1187	404	97	283	235	108	60	310	5	46	617	31	145.6	0.43
171	Poomavilangai	Bore well	7.18	0	2964	1783	333	66	246	353	162	91	279	26	56	629	86	189.5	0.45

172	Thirusiluvaipuram	Bore well	7.38	0	1496	845	381	94	248	160	80	45	157	11	124	318	47	105.9	0.42
173	K. Nedugulam	Bore well	6.4	0	7250	329	257	36	197	864	395	221	122	18	23	186	36	136.1	0.20
174	KeelaMandapasalai	Open well	7.35	0	1099	699	365	96	237	346	122	72	26	7	57	316	48	98.5	0.25
175	N. Karisalkuam	Open well	7.69	0	497	308	438	136	263	59	27	15	55	1	5	126	6	41.8	0.08
176	Ramasampatti	Bore well	7.01	0	540	326	311	58	232	260	120	90	49	2	21	212	3	75.6	0.15
177	Keelaramanathi (Farm)	Bore well	6.4	0	7250	4620	257	84	141	864	395	221	852	2	50	1920	42	445.0	1.13
178	Kavadipatti	Bore well	7.74	0	489	283	443	108	318	58	27	15	43	6	8	85	12	39.3	0.06
179	Kamudi	Bore well	7.46	4	8473	5310	396	84	286	1010	462	259	985	13	25	1596	15	464.8	1.01
180	Pasumpon	Bore well	7.62	0	778	494	424	93	306	253	69	102	72	8	31	129	38	81.1	0.15
181	Pasumpon (Near)	Bore well	7.81	0	840	480	457	114	306	450	360	67	61	3	17	337	58	115.6	0.19
182	Melakannicherry	Bore well	7.45	0	2822	1800	396	95	287	387	164	92	70	4	20	602	42	162.1	0.31
183	Nalloor	Bore well	7.13	0	7260	4520	321	36	259	865	396	222	826	10	31	2250	18	457.7	1.21
184	KeelanThooval	Bore well	7.51	0	7480	4620	404	100	274	892	408	228	886	3	30	2152	15	460.3	1.19
185	Vilangalathur	Bore well	7.43	0	7150	4480	393	141	237	852	390	218	856	21	31	2348	16	464.2	1.25
186	Mahindi	Bore well	7.51	0	693	405	404	87	295	83	38	21	96	14	22	127	47	60.7	0.13
187	Meesal	Bore well	7.57	0	6800	4270	410	114	263	811	371	208	796	3	17	2186	35	441.0	1.15
188	North Ulaiyur	Bore well	7.55	0	5060	3120	408	99	295	603	276	154	611	11	23	1905	47	354.7	0.98
189	A Puthur	Bore well	7.8	0	3727	2260	456	114	312	444	203	114	524	7	31	1252	52	262.9	0.72
190	Muthu Selvapuram	Bore well	8	0	3751	2371	472	95	357	447	204	115	497	13	20	1174	41	257.6	0.66
191	Sathirakudi	Bore well	7.49	3	10000	6370	399	94	274	480	280	45	1561	11	19	3637	85	626.1	1.90
192	Theeyanur	Bore well	8.02	0	668	404	473	95	357	80	36	20	95	2	21	199	11	56.9	0.15
193	Seyyalur	Bore well	7.24	6	22130	14070	342	69	252	2638	1206	675	1356	34	47	5221	15	1184.0	2.61
194	Karunkulam	Bore well	7.34	6	1976	12400	321	67	235	2463	1406	521	1263	26	50	5324	19	1113.2	2.60
195	Soorankottai	Bore well	6.9	0	7610	4780	301	58	226	907	415	232	564	6	31	1593	11	406.8	0.88
196	Thoruvalur	Bore well	7.75	0	1605	901	445	109	309	191	87	49	176	3	36	401	49	112.2	0.29
197	Ramanathapuram Bypass	Bore well	7.04	0	4810	3000	312	88	209	573	262	147	766	15	12	1590	32	332.8	0.89
198	Ramanathapuram Bypass	Bore well	7.61	0	678	388	419	96	288	390	280	45	53	23	18	522	18	104.5	0.26
199	NearPalangulam (Farm)	Bore well	6.81	0	6990	4300	293	69	190	833	381	213	967	8	31	2554	9	474.0	1.36

200	Ramalan Nagar	Open well	6.85	0	3987	2494	299	94	194	475	217	122	79	2	43	598	16	191.3	0.36
201	Near Ramalan Nagar	Bore well	7.42	0	1360	820	391	106	254	162	74	42	218	4	36	331	8	95.3	0.27
202	Terbhogi	Open well	7.46	0	1612	963	319	71	211	244	126	46	111	1	19	295	14	96.4	0.19
203	Pudhuvalasai	Open well	7.16	0	1726	963	329	69	244	310	80	179	75	11	37	472	20	133.7	0.31
204	Chittrakottai	Open well	7.1	0	2844	1722	316	68	235	400	160	179	149	6	47	721	15	186.6	0.45
205	Agri-farm	Bore well	6.31	4	28470	17230	248	69	161	3394	1551	869	3172	22	29	6283	26	1554.2	3.59
206	SakkaravalaNallur	Open well	7.55	0	1770	1075	408	112	265	211	96	54	297	6	19	382	26	120.6	0.28
207	Perygalur	Bore well	7.59	0	1073	639	415	106	270	300	160	134	86	2	11	203	34	104.7	0.15
208	Vayaloor	Bore well	7.14	0	6570	4180	325	36	261	783	358	201	430	15	22	1729	57	385.7	0.87
209	Madaloor (Vaigai River)	Open well	7.82	0	1164	681	458	115	328	139	63	36	184	1	11	273	25	85.2	0.19
210	Thethangal	Bore well	7.43	0	2910	1758	393	121	244	347	159	89	237	3	24	502	18	158.8	0.33
211	Kamankottai	Bore well	7.85	0	1943	1170	464	141	293	232	106	59	281	7	18	436	22	132.8	0.30
212	Muthuvayal	Bore well	7.89	0	866	533	465	95	352	103	47	26	86	3	37	114	11	57.9	0.15
213	Near Muthuvayal	Bore well	8.06	0	874	536	478	97	361	510	80	67	98	2	19	176	25	77.4	0.15
214	Poganoor	Open well	7.41	0	6800	4200	390	102	254	811	371	208	1174	6	38	1729	57	439.3	1.13
215	Thiruvadi	Bore well	7.42	0	6000	3700	391	101	254	715	327	183	843	1	28	1137	16	341.7	0.78
216	Vikrapandipuram	Bore well	7.53	0	9080	5740	407	99	293	450	160	45	1438	14	17	1729	8	442.1	1.14
217	Siruthalai	Bore well	7.29	1	8060	5020	350	87	228	961	439	246	1083	14	12	1844	2	469.6	1.11
218	Tiruvarangam	Bore well	7.23	0	8370	5180	338	95	220	998	456	255	934	19	8	1726	13	463.1	1.01
219	Pamboor	Bore well	7.24	0	6080	3840	342	66	252	725	331	186	752	3	21	1283	29	353.5	0.80
220	Near Malakavanoor	Bore well	6.85	3	20740	12360	300	69	195	2472	1130	633	2530	27	11	3602	13	1077.9	2.30
221	Muthuramalingapat tinam	Bore well	6.93	4	23100	13180	303	39	227	2754	1259	705	2336	24	15	3715	28	1130.8	2.30
222	Puluthikulam	Bore well	7.22	4	9760	6070	334	86	217	1163	532	298	1924	9	10	2887	19	653.2	1.77
223	Near Puluthikulam	Bore well	7.35	2	10620	6710	367	85	269	380	80	112	2296	21	27	2781	21	613.1	1.84
224	MerkuKottakudi	Bore well	6.94	3	9800	6190	304	69	198	1168	534	299	1537	28	17	2246	25	591.6	1.42
225	Perungarunai	Bore well	7.29	0	7930	4850	350	96	228	945	432	242	1023	22	13	1854	21	463.9	1.09
226	Near Perungarunai	Bore well	7.22	0	5582	3520	344	86	212	894	356	232	861	6	22	1247	13	356.8	0.83
227	Sabathi	Bore well	7.18	0	2118	1258	333	97	216	252	115	65	196	13	19	674	53	149.5	0.36
228	Abiramam	Bore well	7.59	0	5170	3260	416	109	293	616	282	158	731	5	15	1120	41	314.3	0.71

229	Nanthiseri	Bore well	7.58	0	1963	1180	413	105	277	234	107	60	195	10	39	392	24	121.2	0.30
230	Valayapokulam	Bore well	7.89	0	1960	1123	467	97	344	234	107	60	237	7	24	401	13	119.7	0.28
231	Near Mandalamanickam	Bore well	7.42	0	617	365	392	119	255	74	34	19	73	2	19	91	9	45.1	0.10
232	Mandalamanickam	Bore well	7.04	0	5890	3680	312	95	199	702	321	180	734	13	31	1173	18	335.8	0.77
233	Yedaisoorani	Bore well	7.63	0	6640	4120	428	96	286	792	362	203	1354	25	22	1632	34	436.0	1.12
234	Perumaldevanpatti	Bore well	7.02	6	17650	10860	311	95	184	680	160	470	1347	28	33	3417	64	827.0	1.86
235	NeeraviChinnakarus alkulam	Bore well	7.77	0	549	301	448	103	327	65	30	17	59	6	2	124	9	43.4	0.07
236	KeelamudiMannark ottai	Bore well	7.22	0	3615	2206	334	95	229	320	280	22	573	13	29	971	18	223.9	0.60
237	KK Kottai	Bore well	7.46	0	1121	672	354	87	215	203	112	54	156	2	39	261	19	90.2	0.23
238	Near KK Kottai	Bore well	7.23	0	1410	869	347	78	237	267	134	78	93	7	14	367	26	107.2	0.21
239	Pothanathi	Open well	7.63	0	817	506	428	97	304	97	45	25	102	11	12	159	13	60.0	0.12
240	Koodakulam	Bore well	7.39	0	811	498	383	132	218	420	80	112	57	3	24	208	8	81.0	0.17
241	Tharaiyadi	Bore well	8.13	0	828	413	481	99	363	99	45	25	125	13	18	168	19	61.6	0.14
242	T Kallikulam	Bore well	7.64	0	806	487	475	85	278	148	72	36	163	9	29	203	38	77.5	0.19
243	ManikaThootam	Bore well	7.79	0	935	544	452	111	316	111	51	29	96	4	14	181	30	67.4	0.13
244	Periyanaikulam	Bore well	7.22	0	9660	6000	335	55	248	1152	526	295	63	2	39	1824	51	462.9	0.84
245	Kodumalur	Bore well	7.65	0	3131	1950	434	141	282	373	171	96	262	6	58	819	21	193.6	0.52
246	Sanmuganathapuram	Bore well	7.84	0	697	415	463	116	325	83	38	21	67	23	8	76	6	52.4	0.07
247	Near Sanmuganathapuram	Bore well	7.24	0	695	417	342	85	222	380	280	67	62	21	24	140	18	85.1	0.13
248	Thattankudiyiruppu	Bore well	7.24	1	12780	8050	342	97	222	1524	696	390	848	36	47	3527	21	729.3	1.76
249	MelaThattankudiyir uppu	Bore well	7.4	1	10740	6750	384	123	228	1280	585	328	626	16	123	2679	35	596.8	1.51
250	Melakavanoor	Bore well	7.12	0	2396	1497	318	85	207	286	131	73	294	22	86	746	35	171.8	0.55
251	S Kavanoor	Bore well	7.38	0	2257	1328	382	103	248	269	123	69	228	16	29	668	24	149.7	0.39
252	Muthunagar	Bore well	7.1	0	3572	2186	316	69	235	426	195	109	341	23	67	1092	16	229.5	0.67
253	Thinaikulam Highway	Bore well	7.21	0	2144	1243	375	85	265	361	153	96	243	8	32	667	20	154.9	0.41
254	Arriyananthai	Bore well	7.19	5	14370	9080	333	101	198	1713	783	439	992	26	21	4176	26	834.2	2.01
255	Tthinaikulam	Bore well	8.08	0	1664	929	478	95	361	198	91	51	186	7	17	489	18	113.4	0.29

256	Manjoor	Bore well	7.46	0	1212	759	443	96	315	226	116	64	154	10	51	353	22	103.4	0.29
257	Pattithatti	Bore well	7.61	0	1200	635	475	99	348	183	96	56	113	5	12	286	11	84.1	0.18
258	ChinnaAkkiramesi	Bore well	7.91	0	485	288	468	96	344	58	26	15	86	9	26	96	17	45.5	0.12
259	Arasadi Vandal	Bore well	7.07	0	6630	4200	314	47	234	790	361	202	362	16	16	1567	8	360.3	0.77
260	Pandiyur	Bore well	7.71	0	1265	733	440	96	316	310	240	45	121	9	11	476	13	111.7	0.25
261	Lakshmi Mangalam	Bore well	7.32	4	9330	5740	359	68	263	1112	508	285	431	13	26	2323	25	502.6	1.12
262	SV Mangalam	Bore well	7.49	2	8050	5050	399	86	298	960	439	246	558	26	13	2456	17	480.9	1.17
263	Panthapanenthal	Bore well	7.88	0	460	260	465	97	340	55	25	14	88	4	21	86	3	39.9	0.10
264	Kiliyoor	Bore well	7.97	0	995	597	471	96	356	119	54	30	86	6	16	160	6	62.8	0.12
265	P Kodikulam	Bore well	6.18	4	18460	10200	229	63	145	2201	1006	563	656	9	13	4187	11	890.8	1.92
266	Vaigai	Bore well	7.44	0	3075	1837	394	96	286	367	168	94	296	13	37	876	25	195.1	0.51
267	Madhavanoor	Open well	7.51	0	811	455	405	89	293	197	144	25	96	7	15	143	13	65.3	0.12
268	Devipattinam	Open well	7.12	5	17340	10860	442	108	311	2563	1147	785	909	13	11	5274	9	1065.2	2.45
269	ABC Kenbridge School	Open well	7.36	0	3614	2264	367	68	269	431	197	110	537	16	24	1260	26	256.8	0.71
270	Pathanandhal	Bore well	7.3	0	2812	1706	351	84	228	335	153	86	236	16	43	752	18	174.1	0.46
271	Pottagavayal	Bore well	7.76	0	1839	1019	446	111	317	219	100	56	214	8	13	611	8	125.4	0.33
272	Kundathur	Bore well	7.51	0	1213	753	427	121	267	338	164	86	134	12	18	468	13	115.3	0.27
273	Vagavayal	Bore well	7.95	0	997	600	470	98	336	119	54	30	119	14	23	206	18	71.7	0.17
274	Pottagavayal	Bore well	8.03	0	1020	582	475	93	359	122	56	31	123	6	17	216	9	69.7	0.16
275	Thaniyapuli	Bore well	6.65	10	34200	20130	278	65	181	320	80	90	2856	26	126	4789	14	1229.4	2.95
276	Kolloor	Bore well	7.63	0	1085	642	429	111	293	129	59	33	114	8	17	258	6	73.5	0.17
277	Kottakudi	Bore well	7.6	0	3039	1820	417	115	274	362	166	93	426	26	56	1015	24	213.9	0.64
278	Movaloor	Bore well	7.74	0	2983	1893	445	102	325	356	163	91	394	14	27	986	13	207.1	0.56
279	Katchan	Bore well	7.14	3	16250	9140	326	39	262	1937	886	496	856	17	15	4024	18	836.1	1.91
280	Paaparkootam	Bore well	7.2	5	11040	6900	334	58	247	1316	602	337	1026	6	23	4056	14	713.2	1.96
281	Nainaarkulam	Bore well	7.1	5	18260	11130	316	68	235	2177	995	557	1120	26	34	4485	26	977.2	2.21
282	Nainarkovil	Bore well	7.61	0	3601	2291	420	94	293	429	196	110	382	22	48	1148	18	244.9	0.67
283	Puthoorvalasi	Bore well	7.25	4	12010	7400	345	99	224	1432	654	367	846	16	63	3564	15	699.3	1.80
284	Valasai	Bore well	7.73	0	7820	4920	442	117	306	932	426	239	568	24	45	1757	22	430.8	0.97
285	Ariyanenthal	Bore well	7.49	0	1425	833	400	95	282	170	78	44	216	18	121	356	17	105.4	0.45

286	Kumarakudi	Bore well	6.82	10	26580	16300	296	95	182	420	280	134	3660	54	136	6865	34	1328.3	4.01
287	Vengadesh Colony	Bore well	7.25	0	3418	2010	346	68	255	407	186	104	326	15	61	887	16	206.5	0.58
288	Paramakudi	Bore well	7.78	0	2543	1571	452	102	315	303	139	78	289	13	39	750	22	171.2	0.46
289	Somanathapuram	Bore well	7.86	0	3388	2091	464	116	305	320	40	134	424	9	17	883	14	207.1	0.52
290	Nandupatti	Bore well	7.65	0	435	215	435	151	263	52	24	13	63	5	9	69	5	34.9	0.07
291	Ambethkar Nagar	Bore well	7.83	0	2273	1337	462	121	314	271	124	69	336	9	36	684	11	156.0	0.45
292	Vengalur	Bore well	7.42	0	3760	2386	392	113	255	448	205	115	471	13	27	1243	18	255.4	0.69
293	Ramalingampatti	Bore well	7	0	584	332	309	77	201	70	32	18	76	7	21	123	9	45.7	0.11
294	PP Yenthal	Bore well	7.33	4	21730	12860	364	46	287	2590	1184	663	1567	97	63	6162	13	1220.5	3.06
295	KaatuEmaneshwaram	Bore well	7.86	0	1068	632	464	98	345	127	58	33	124	10	14	236	3	71.9	0.16
296	Mochakudi	Open well	7.43	0	8550	5370	394	96	286	1019	466	261	486	31	136	2157	20	479.6	1.28
297	Near Mochakudi	Bore well	7.6	0	2954	1826	417	97	301	480	320	90	386	14	26	1153	25	231.6	0.62
298	Pidaricheri	Bore well	7.62	0	879	539	425	96	286	520	48	27	164	4	12	199	5	66.4	0.15
299	MelaParthibanoor	Bore well	7.81	0	9700	6160	457	114	324	1156	529	296	688	17	22	2767	15	566.3	1.36
300	Parthibanoor	Bore well	7.5	0	1483	851	401	95	275	177	81	45	136	13	88	275	25	95.6	0.33
301	Rajakalpatti	Bore well	7.62	0	1529	862	425	94	306	182	83	47	189	8	67	351	18	102.4	0.33
302	KeelaPerungarai	Bore well	7.63	0	2092	1284	430	131	286	249	114	64	256	14	57	486	13	135.3	0.39
303	TThelichatthanallur	Bore well	7.75	0	1216	712	445	116	316	145	66	37	178	6	26	269	11	83.9	0.22
304	KattuParamakudi	Bore well	7.32	0	3630	2284	362	69	265	420	160	112	480	22	38	1232	17	248.0	0.71
305	ThalaiyadiKottai	Bore well	7	10	24570	15130	309	59	231	610	240	336	2480	29	103	5499	33	1157.7	3.11
306	Memangalam	Open well	7.72	0	848	522	442	107	306	101	46	26	138	6	25	176	11	64.4	0.16
307	Radhapuli	Bore well	7.7	0	1917	1160	439	97	315	229	104	59	248	26	44	536	21	134.0	0.38
308	Vathavaneri	Open well	7.42	0	6350	4002	392	152	255	757	160	762	207	9	20	2586	14	519.5	1.23
309	Varunthi	Open well	7	10	25150	15530	310	68	232	2998	1371	768	1560	27	121	6782	32	1392.3	3.43
310	Kaadarnthakudi	Bore well	7.52	0	3673	2235	406	96	294	438	200	112	335	16	37	1075	17	229.7	0.60
311	Kuyavanenthal	Open well	7.97	0	2852	1720	471	93	356	340	155	87	430	12	12	889	13	195.2	0.51
312	Ananthanenthal	Bore well	7.46	0	1032	615	397	96	283	710	440	202	120	6	8	230	30	147.0	0.18
313	Ariyankottai	Bore well	7.78	0	456	268	452	112	314	54	25	14	48	6	10	53	9	36.1	0.06
314	Near Solanthoor	Open well	6.84	0	10370	6500	297	82	193	350	280	45	1586	20	26	3254	28	593.8	1.78
315	Solanthoor	Open well	7.76	0	377	214	446	121	291	45	21	12	61	28	13	69	10	37.2	0.07



316	Kathiyarkottai	Open well	7.57	0	901	561	410	117	263	107	49	28	123	8	10	213	12	67.3	0.14
317	Kadalur	Open well	6.56	0	7390	4600	268	87	157	881	403	226	589	16	156	1784	53	428.5	1.20
318	Uppur	Open well	6.47	15	38890	24450	259	94	151	590	80	470	4270	42	120	7567	47	1745.1	4.51
319	Kalangappuli	Bore well	6.56	5	8200	5190	269	86	151	978	447	250	587	37	134	2100	87	486.2	1.28
320	Paranoor	Bore well	7.15	0	6400	3900	327	68	243	763	349	195	754	15	50	2152	6	418.2	1.18
321	RS Mangalam	Bore well	7.14	0	7870	4930	327	87	213	938	429	240	1025	18	45	2658	8	517.8	1.45
322	Mangalam	Bore well	6.71	0	8250	5110	283	59	214	983	450	252	856	22	42	2562	5	509.4	1.36
323	Sengudi	Bore well	6.99	0	6600	4180	307	68	200	250	80	134	1252	25	32	2152	4	418.3	1.29
324	Sudiyur	Bore well	7.97	0	569	325	472	92	357	280	120	134	12	6	11	32	22	72.6	0.07
325	Parakai	Bore well	7.37	0	2938	1790	372	85	272	290	160	90	225	12	21	758	25	178.4	0.41
326	Sanaveli	Bore well	7.44	0	2867	1734	395	98	287	342	156	88	257	10	11	802	5	175.8	0.42
327	Pullamadai	Bore well	6.67	5	16340	9060	279	94	155	1948	890	499	1125	20	22	4758	6	898.4	2.28
328	Odaikaal	Open well	6.21	10	30670	18430	234	34	182	3656	1671	936	859	12	60	6985	12	1510.0	3.20
329	Kannarenthal	Open well	7.34	0	490	285	364	78	267	58	27	15	82	6	16	58	12	39.9	0.08
330	A Manakudi	Bore well	7.36	0	635	371	368	99	239	76	35	19	75	8	12	83	14	46.0	0.08
331	Puthupattanam	Open well	7.12	0	908	541	318	84	207	108	49	28	56	9	22	95	14	54.7	0.10
332	Thiruvetriyur	Open well	6.87	0	1372	795	300	69	195	164	80	45	125	10	10	298	21	88.4	0.18
333	Pottakudi	Open well	7.5	0	9940	6260	402	69	316	1185	542	303	1105	24	22	3215	22	631.5	1.66
334	Melapanaiyoor	Bore well	7.45	0	715	437	396	96	287	400	39	22	95	6	12	195	14	58.1	0.13
335	Aayiraveli	Bore well	7.04	0	856	427	313	66	233	102	47	26	101	5	11	182	6	56.3	0.13
336	Gudalur	Bore well	7.26	0	962	605	313	58	247	168	69	42	80	7	26	185	11	68.9	0.15
337	Kavanakottai	Bore well	6.89	1	11020	6900	301	94	196	1314	601	336	1124	24	58	3854	25	710.8	1.98
338	Ayankudi	Bore well	6.7	2	11670	7360	280	60	198	320	40	90	2365	19	58	4251	22	729.5	2.47
339	Karunkudi	Bore well	6.9	0	7500	4800	316	70	201	572	353	96	1205	17	52	2528	25	481.7	1.45
340	Anandur	Open well	6.7	0	6890	4390	281	58	213	821	375	210	562	15	44	1956	15	411.2	1.04
341	Valanai	Bore well	7.06	0	10020	6310	313	47	233	1194	546	306	1005	23	14	2715	35	596.0	1.42
342	Sattanoor	Bore well	6.63	3	15770	9890	276	69	186	1880	859	481	1526	22	15	5231	12	978.7	2.57
343	Nemam	Bore well	6.73	0	5040	2520	289	87	184	410	200	179	425	14	11	1520	12	285.9	0.76
344	Viruthanvayal	Bore well	6.85	0	8860	5520	300	68	195	106	48	27	1512	10	15	2452	10	472.9	1.43
345	Annayankottai	Bore well	7.48	0	2382	1491	398	96	265	284	130	73	285	8	12	652	12	155.5	0.37

346	Radhanur	Bore well	7.06	0	4280	2840	313	52	233	520	120	22	685	9	12	1250	12	254.2	0.71
347	Govindamangalam	Bore well	6.78	0	8650	4430	290	86	186	1031	471	264	586	8	12	2485	15	468.0	1.19
348	Karkathakudi	Bore well	6.9	0	3740	2270	301	98	184	450	280	22	452	12	12	1201	10	230.1	0.62
349	Karungavayal	Open well	7.12	0	6200	3800	318	72	207	739	338	189	566	26	33	1580	8	358.1	0.87
350	Achankudi	Open well	7.35	0	2067	1233	367	64	269	246	113	63	254	21	33	552	6	134.8	0.36
351	T Puthukudi	Open well	7.65	0	535	332	436	117	285	64	29	16	86	11	12	60	5	41.4	0.08
352	Sekunthidal	Bore well	6.52	5	15420	9810	262	89	149	630	320	246	2250	12	32	4526	25	880.0	2.51
353	PV Pattanam	Open well	6.21	5	17180	9590	235	57	153	1650	1480	202	1480	26	55	4523	29	917.0	2.31
354	Velankudi	Open well	7.12	0	637	388	318	86	207	76	35	19	72	12	22	80	14	46.6	0.10
355	Vattanam	Open well	7.23	3	8220	5170	339	66	250	980	448	251	854	12	12	2758	11	528.1	1.38
356	RC Nagar	Open well	6.62	0	14840	7070	275	67	179	420	200	45	2152	5	15	3582	12	659.8	2.06
357	Ettukudi	Bore well	7.17	0	2596	1512	332	97	216	309	141	79	105	20	32	525	13	139.6	0.31
358	Palangulam	Bore well	7.69	0	807	503	438	98	315	96	44	25	95	22	41	84	16	57.3	0.15
359	Near T. Keelaiyur	Bore well	7.16	0	1159	678	330	96	215	138	63	35	102	12	22	225	18	74.9	0.17
360	T. Keelaiyur	Open well	6.8	0	2617	1519	292	89	169	490	440	22	12	12	12	798	15	164.0	0.33
361	Bharathinagar	Bore well	6.81	0	1749	1034	293	79	190	208	95	53	225	22	22	523	10	120.0	0.32
362	Kuruvankadu	Open well	7.23	0	3825	2372	339	87	220	456	208	117	352	32	15	1025	16	233.1	0.55
363	Elangundram	Open well	7	0	582	341	310	98	186	250	120	22	10	11	14	65	24	49.7	0.06
364	Veliyankudi	Open well	6.84	0	1591	998	297	69	193	190	87	49	155	12	31	355	22	103.9	0.25
365	Kunjankulam	Bore well	7.23	0	2285	1342	340	89	221	260	80	45	252	22	41	458	25	129.6	0.34
366	NM Mangalam	Open well	7.3	0	1103	672	352	85	229	290	60	34	125	12	21	235	15	75.9	0.18
367	Peruvakottai	Bore well	7.22	0	1307	784	335	74	248	156	71	40	125	14	44	245	22	85.3	0.23
368	Vellaiyapuram	Open well	6.96	0	1918	1159	306	95	199	229	105	59	158	15	21	415	21	116.9	0.26
369	Kuttivayal	Open well	7.09	0	6670	4120	315	86	187	310	160	112	1055	16	22	2205	12	409.7	1.22
370	Near SP Pattanam	Bore well	6.48	4	14490	9140	259	76	168	1727	790	442	1452	19	22	5231	25	936.7	2.55
371	OriyurPuthuvayal	Open well	6.36	3	13330	8430	253	81	145	270	120	134	2532	24	52	4521	25	811.4	2.62
372	SP Pattanam	Bore well	6.93	0	8130	5160	304	87	198	390	280	45	1523	11	14	2652	16	501.1	1.51
373	Peramangalam	Open well	7.26	0	854	507	347	95	226	320	160	45	76	9	48	195	16	77.1	0.20
374	Arivithi	Open well	6.81	0	1540	971	294	66	191	184	84	47	240	12	20	530	6	115.4	0.32
375	Andavoorani	Open well	6.61	13	28930	17940	274	59	178	3449	1577	883	1956	22	55	7452	29	1582.6	3.70

376	Mangalakudi	Open well	7.26	0	488	290	348	68	256	58	27	15	105	6	11	95	8	42.8	0.09
377	Kurunthangudi	Bore well	7.24	0	2040	1268	342	95	222	350	120	22	365	19	36	635	13	141.8	0.43
378	Keppuli	Bore well	6.9	0	1685	946	302	95	186	201	92	51	201	18	15	458	21	112.4	0.27

**Table 5: shows the various groundwater quality of post-monsoon samples for the Ramanathapuram district**

S. No.	Name of the locations	Well type	pH	Salinity	Ec (µS/cm)	TDS (ppm)	TA (mg/l)	CO <sub>3</sub> (mg/l)	HCO <sub>3</sub> (mg/l)	TH (mg/l)	Ca (mg/l)	Mg (mg/l)	Na (mg/l)	K (mg/l)	SO <sub>4</sub> (mg/l)	Cl (mg/l)	NO <sub>3</sub> (mg/l)	WQI	SMI
1	Sevalpatti	Bore well	7.25	0	558	346	127	8	115	53	18	26	24	5	37	50	9	41.4	0.12
2	Kannirajpuram	Open well	7.36	0	773	479	163	12	138	56	24	26	36	8	33	68	12	47.2	0.26
3	Vettukadu	Open well	6.88	0	2690	1668	439	80	319	164	86	64	237	33	74	350	49	144.2	0.72
4	Narippaiyur	Bore well	6.91	3	5800	3596	593	183	380	471	187	270	252	55	194	650	32	287.8	1.29
5	Near Narippaiyur	Bore well	7.75	0	552	342	142	26	114	52	18	26	24	10	27	49	13	40.6	0.12
6	VadakuMookkaiyur	Open well	7.12	0	1220	756	289	17	251	98	39	47	63	13	54	109	17	69	0.39
7	Mookkaiyur	Open well	7.16	0	1342	832	256	42	183	102	52	37	83	21	73	139	19	75.9	0.48
8	Oppilan	Open well	6.91	0	3665	2272	576	83	455	296	118	171	179	35	142	328	20	182.7	0.77
9	T Mariyur	Open well	7.48	0	2767	1716	485	86	383	142	79	46	146	16	129	261	56	133.3	0.53
10	MelaMundhal	Open well	7.65	0	3350	2077	573	48	493	278	108	156	145	32	163	300	18	169.5	0.68
11	Mundhal	Open well	7.59	0	1770	1097	242	42	179	164	83	67	186	27	114	340	37	121.6	2.46
12	Dhanushkodi	Open well	7.09	0	1376	853	173	12	149	143	75	54	93	36	91	218	26	91.7	0.51
13	Valinokkam	Open well	7.44	0	5540	3435	492	116	362	371	152	203	240	60	167	456	28	249.8	0.90
14	Valinokkam Salt Pan	Open well	7.06	0	6240	3869	567	89	462	506	201	291	271	89	168	660	86	318	2.17
15	Near Melakidaram	Open well	7.27	0	706	438	183	16	146	64	23	33	31	7	47	63	4	45.3	0.57
16	Kaduguchanthai	Open well	7.42	0	534	331	127	8	110	50	28	17	24	7	26	61	4	37.3	0.62
17	Katalati (Kuthiraimozhi)	Open well	7.27	0	2665	1652	587	38	419	202	86	97	134	25	153	286	78	150.3	0.54
18	Peiryakulam	Bore well	7.07	6	25220	15636	1179	262	896	1591	713	862	934	121	222	3556	138	1136.4	4.68
19	Sayalkudi	Open well	7.14	0	361	224	68	5	57	35	18	11	32	8	17	62	3	31	0.12

20	Pullandhai	Open well	6.85	0	3098	1921	591	146	438	204	102	86	134	29	186	235	17	142.6	0.70
21	Sethurajapuram	Open well	7.19	0	781	484	172	11	161	65	25	34	42	11	52	70	8	49.7	0.27
22	Kuruvadi	Bore well	7.33	0	437	271	109	6	96	59	36	17	22	6	23	49	6	35.1	0.26
23	Tharakudi	Bore well	6.84	0	1155	716	276	50	216	85	42	31	102	8	81	152	13	69.6	0.44
24	Karusalkulam	Bore well	7.39	0	677	420	184	10	162	91	49	28	33	8	31	71	5	46.3	0.39
25	Uchanatham	Bore well	7.34	0	522	324	151	36	102	45	18	16	26	4	14	58	7	35.6	0.17
26	Ramasamuthiram	Open well	7.79	0	802	497	176	26	143	74	29	32	39	8	53	72	4	50	0.32
27	Near Perunali	Bore well	7.1	0	3440	2133	372	66	287	299	158	127	301	12	136	364	36	183.9	0.99
28	Perunali	Bore well	7.22	0	2941	1823	933	126	807	238	121	104	227	21	137	258	18	150.5	0.79
29	T Veppakulam	Open well	7.64	0	830	515	188	16	161	77	26	36	65	12	48	94	12	55.9	0.23
30	TM Kottai	Open well	7.61	0	334	207	94	5	78	52	32	11	26	4	22	52	2	31.1	0.23
31	Pillayarkulam	Bore well	6.7	0	1051	652	279	56	190	71	25	32	66	11	41	78	3	54.6	1.05
32	Vagaikulam	Bore well	7.63	0	2550	1581	335	57	263	209	86	106	136	18	71	280	14	131.5	0.62
33	S Alangkulam	Bore well	7.31	0	461	286	113	7	93	53	18	19	28	3	16	49	7	34.5	0.20
34	Samathuvapuram(Near Kadaladi	Bore well	6.67	0	2670	1655	321	38	262	197	83	99	136	23	82	267	16	131.1	0.45
35	Kadaladi	Bore well	7.07	0	1790	1110	317	26	275	148	53	76	94	17	66	179	11	94.8	0.34
36	Pasumpon Nagar	Open well	7.56	0	2436	1510	386	56	314	166	86	63	159	19	76	286	13	126.7	0.62
37	Melaselvanur	Open well	7.62	0	848	526	213	23	171	78	28	33	41	8	43	73	6	50.9	0.29
38	Kelaselvanur	Open well	7.54	0	358	222	96	13	71	45	19	12	16	3	18	36	2	28.6	0.50
39	Kothankulam	Open well	7.61	1	6910	4284	567	99	450	528	226	289	326	61	219	889	57	347.7	1.52
40	Sikkal	Bore well	7.34	8	19030	11799	1094	273	783	1379	626	734	986	133	234	3461	103	963.5	6.39
41	Ervadi	Open well	7.09	0	537	333	119	8	109	53	23	16	29	6	27	56	4	36.1	0.27
42	ChinnaErvadi	Open well	7.56	4	14000	8680	866	206	637	614	306	291	826	104	153	1282	136	578.4	2.90
43	Mayakulam	Bore well	7.02	0	10830	6715	726	155	563	741	342	384	466	84	195	1064	62	481.7	1.38
44	Keelakarai	Bore well	7.64	0	800	496	215	23	168	68	26	31	46	8	48	81	4	50.1	2.19
45	Natarajapuram	Open well	7.05	0	1354	839	317	29	273	113	59	41	68	13	66	136	7	72.8	0.38
46	Rameswaram South	Open well	7.04	0	2254	1397	351	88	243	159	83	61	126	21	149	327	28	123.8	0.69
47	Ayyanthoppu	Open well	7.17	0	590	366	153	18	126	52	22	16	46	3	41	69	5	40	0.23
48	Thangachimadam south	Open well	6.9	0	1276	791	195	18	166	121	46	57	63	4	81	124	8	72.5	0.39

49	Kunthukal	Open well	6.84	0	1902	1179	277	86	182	148	59	73	96	18	128	182	11	100.1	0.60
50	Kunthukal farm	Bore well	6.83	0	3246	2013	342	47	278	277	136	124	156	38	136	316	21	162.9	0.58
51	Pamban South	Open well	6.97	0	3245	2012	768	49	296	336	176	143	156	73	144	346	34	178.5	1.07
52	Mandapam (Near Sea Park)	Open well	6.98	0	926	574	210	36	158	71	31	26	48	12	42	114	10	54.5	0.40
53	Mandapam South	Open well	6.82	0	1731	1073	382	25	342	141	58	69	86	13	101	187	11	93.5	0.95
54	Marakayarpattinam	Open well	6.63	1	12100	7502	782	173	604	878	397	467	589	97	226	1868	110	605.5	2.85
55	Marakayarpattinam shore	Open well	6.98	0	590	366	127	8	96	53	26	17	31	4	16	86	6	39.4	0.21
56	Vedalai	Open well	6.67	0	3067	1902	237	36	186	239	102	124	148	32	86	285	23	150.9	0.75
57	Meenavarkuddiruppu	Open well	6.41	4	13500	8370	893	194	689	763	386	359	567	114	214	1359	127	578.1	2.48
58	Kunjarvalasai	Open well	7.09	0	356	221	96	18	71	23	13	6	21	4	10	33	4	26.2	0.16
59	Seeniappadhurga	Open well	6.93	0	769	476	186	32	128	65	31	22	29	6	17	89	11	45.9	0.16
60	TM Kuddiruppu	Bore well	7.24	0	778	482	195	39	149	63	22	31	37	8	46	73	7	48	0.23
61	Uchipuli	Open well	6.85	0	1380	856	238	47	173	118	57	43	64	14	87	136	10	74.7	0.33
62	Pirappanvalasai	Open well	6.74	0	791	490	184	41	143	73	23	38	36	8	33	86	13	50.6	0.27
63	Ariyaman Beach	Open well	6.75	2	8760	5431	578	126	436	646	283	343	435	86	226	1317	78	444.2	2.01
64	Nochiyurani Near	Open well	7.26	0	322	200	97	17	69	39	16	12	16	3	7	31	4	26.7	0.54
65	Nochiyurani	Bore well	6.7	0	916	568	197	40	137	68	26	29	43	4	33	97	15	52.8	0.58
66	Pudhumadam	Open well	6.98	0	1061	658	274	46	212	91	32	44	56	8	53	116	13	63	0.36
67	Indhiranagar	Open well	7.32	0	946	587	249	42	193	79	37	29	72	10	43	111	15	59.1	0.35
68	Periyapattinam	Open well	7.12	0	1132	702	197	54	135	87	28	46	76	12	38	183	12	69.9	0.36
69	Sethukarai	Open well	7.22	0	1649	1022	394	24	338	136	56	68	83	26	116	168	25	95.3	0.40
70	Kalimankundu	Open well	7.71	0	858	532	216	42	156	74	26	37	43	10	43	69	17	54.4	0.20
71	Thinaikulam	Open well	7.21	0	1362	844	331	57	143	116	43	58	66	13	62	146	26	82.4	0.33
72	Thiliananthal	Open well	7.39	0	1807	1120	258	87	159	137	56	68	89	18	89	198	34	101.4	1.47
73	Kanjirangudi	Bore well	7.42	0	956	593	146	34	97	81	30	38	48	11	62	96	23	61.1	0.84
74	Keelakari outer	Open well	7.59	0	815	505	165	32	123	74	34	29	37	9	34	96	16	52.9	2.21
75	K Madurai	Open well	6.25	10	22380	13876	1138	231	896	1623	735	864	1017	136	224	2966	128	1043.9	5.77
76	Palanchirai	Open well	7.26	0	8620	5344	768	224	526	641	273	356	426	95	206	1172	86	435.2	2.59
77	Natham	Open well	7.17	1	9720	6026	816	239	563	802	368	421	462	57	216	1334	32	479.8	2.90

78	Melamadai	Bore well	6.6	0	8540	5295	884	222	653	615	276	328	416	99	140	956	28	395.6	1.49
79	Mariyarayapuram	Bore well	6.55	28	38290	23740	1258	253	987	2835	1356	1461	1262	168	238	6452	186	1825.5	7.60
80	Sikkal	Bore well	6.76	1	9350	5797	925	234	676	676	356	304	426	101	216	987	124	443.1	2.15
81	Panaiyadiyenthal	Open well	7.24	0	3638	2256	1127	252	786	279	124	147	162	67	187	304	29	181.6	1.32
82	Thirunallar	Bore well	6.72	0	318	197	79	11	63	36	15	8	12	6	16	29	6	25.5	0.08
83	Melachirupodhu	Bore well	6.8	0	7090	4396	662	180	466	510	227	265	348	87	158	789	75	342.4	1.01
84	Orivayal	Bore well	7.65	0	9240	5729	873	232	625	679	294	367	435	97	137	903	59	426.3	1.35
85	Savariarpattanam	Open well	7.2	0	690	428	173	10	143	63	24	29	37	9	58	72	12	47.6	0.42
86	Appanoor	Bore well	6.67	18	25290	15680	1123	213	894	1851	896	934	1121	148	216	3192	126	1156.5	3.81
87	Punavasal	Bore well	7.14	0	2862	1774	631	93	510	207	103	89	117	56	184	263	31	144.4	0.65
88	Punavasal near	Bore well	7.12	0	576	357	167	28	115	55	29	14	23	6	26	49	12	37.9	0.18
89	Kumboddi	Bore well	7.32	0	3170	1965	796	145	643	247	96	138	145	16	186	386	23	167.1	0.90
90	Kathanendhal	Bore well	6.95	2	6490	4024	657	193	449	422	184	216	285	89	262	678	59	305.7	1.10
91	Kovilangulam	Bore well	6.95	2	7600	4712	678	176	476	469	216	234	267	76	198	635	63	328.3	2.23
92	Erumaikulam	Bore well	7.22	0	568	352	158	31	111	49	16	22	29	12	28	59	9	39.4	0.31
93	Ponthampuli	Bore well	7.57	0	1426	884	317	49	157	123	49	57	64	17	67	146	14	80	0.28
94	Maviangai	Bore well	6.68	0	851	528	234	32	186	56	26	23	58	13	38	94	17	52.2	0.26
95	Veeramanachipatti	Bore well	7.01	0	5500	3410	573	179	385	413	162	236	296	74	142	691	68	284.5	1.30
96	Thimmanathapuram	Bore well	7.2	0	1579	979	263	47	193	100	38	49	96	23	126	156	17	86.6	0.64
97	T.Balasubramaiapuram	Bore well	7.27	0	1134	703	283	56	213	89	36	41	59	14	68	114	19	67.2	0.39
98	Pappuraddiapatti	Bore well	7.17	0	1546	959	392	92	279	109	38	58	72	16	88	139	36	87	0.62
99	Vepungallam	Bore well	7.28	0	1271	788	252	53	184	83	29	37	56	18	86	126	24	71.5	0.29
100	Shokalingapuram	Bore well	6.79	9	22790	14130	1128	214	904	1650	734	894	967	127	237	2686	126	1037.4	3.51
101	Pudukottai	Bore well	7.24	0	2225	1380	633	132	486	190	83	99	116	47	138	214	38	127.2	0.56
102	Illanthaikulam	Bore well	7.06	0	4360	2703	551	162	381	306	169	124	256	73	245	386	78	221	0.73
103	SonaiPiriyanKottai	Bore well	6.29	10	19100	11842	1079	174	894	1232	637	573	988	126	239	2283	133	856.5	2.69
104	Enathi	Bore well	7.16	0	1164	722	257	17	183	92	49	32	54	13	79	116	34	70.5	0.51
105	Poongulam	Bore well	6.49	3	9740	6039	1056	140	904	623	326	281	464	109	184	966	79	432.3	1.48
106	Kandian	Open well	7.4	0	966	599	213	14	206	98	46	36	67	21	73	114	26	70	0.66



107	Elanjempur	Bore well	7.27	0	3780	2344	696	137	514	301	173	114	216	78	183	394	54	197.3	2.91
108	Pookkulam	Bore well	8.02	0	230	143	63	9	48	28	13	6	10	2	8	21	4	23.3	0.22
109	Sadayaneri	Open well	7.25	2	6820	4228	597	198	385	419	226	182	347	52	143	605	57	299.6	0.89
110	Kookondan	Bore well	7.02	0	5110	3168	573	173	362	370	186	171	235	68	186	437	76	246.7	0.75
111	Pooseri	Bore well	7.76	0	1074	666	308	66	227	99	53	37	49	13	79	87	23	66.3	0.45
112	Athankotankudi	Bore well	6.94	1	8800	5456	694	126	562	462	253	197	391	106	217	567	49	351.7	1.08
113	Thaliyarenthal	Bore well	7.02	0	8450	5239	997	121	865	599	316	271	367	98	237	553	59	366.8	1.31
114	Kadampodai	Bore well	6.92	0	974	604	255	34	189	94	32	49	37	6	57	96	13	59.7	1.38
115	Uttarakosamangi	Open well	7.45	0	167	104	43	6	36	25	10	6	8	3	11	15	4	20.5	0.38
116	Kannankudi	Bore well	7.2	0	5800	3596	628	183	435	443	186	243	286	74	167	525	66	283.7	0.82
117	Kalari	Bore well	7.62	0	2814	1745	723	140	561	191	96	83	146	27	146	267	18	137.7	0.66
118	Mallal	Open well	7.46	0	203	126	45	3	40	22	12	6	10	2	14	16	7	22.4	0.08
119	Tiruppullani	Open well	7.2	0	1084	672	256	26	221	91	33	47	58	8	67	102	8	63.4	0.66
120	Vannikudi	Open well	6.98	0	546	339	161	28	117	51	27	16	31	6	31	51	5	36.7	0.17
121	Kattukavalka van valasi	Open well	7.14	0	1264	784	299	45	238	95	43	38	56	13	57	106	16	67.7	0.64
122	Valimadaivalasai	Open well	6.62	4	10770	6677	1036	154	867	649	348	284	526	119	227	1097	89	474.3	2.25
123	Pattinamkattan	Open well	7.35	0	2011	1247	533	98	416	154	62	76	92	21	106	167	27	105.5	1.20
124	Raghunthapuram	Open well	7.12	0	3960	2455	317	89	217	275	146	117	182	55	183	327	23	183.8	1.73
125	Pandiyagar (Valuthur)	Open well	7.64	0	324	201	87	18	65	37	16	9	11	4	13	25	5	26.5	0.07
126	Rettaiyurani	Open well	7.35	0	953	591	233	34	180	98	32	49	47	13	48	119	15	62.6	0.27
127	Puduadam North	Open well	7	4	9990	6194	1015	223	765	700	386	296	479	108	209	981	63	446.5	1.49
128	Mandapam Camp	Open well	6.91	0	3518	2181	297	70	214	267	138	116	187	62	86	291	26	167.7	1.79
129	Madapam	Open well	6.93	0	784	486	173	11	162	78	25	37	34	7	52	70	4	48.4	0.21
130	Pamban North	Open well	7.34	0	1134	703	262	26	223	99	48	32	42	8	49	96	6	59.8	0.50
131	Akkalmadam North	Open well	7.09	0	902	559	184	24	146	89	36	42	48	6	81	83	14	58.6	0.23
132	Thangachi madam North	Open well	7.45	0	896	556	229	23	182	95	45	36	32	9	68	89	18	58.3	0.20
133	Thangachi madam	Open well	7.58	0	646	401	174	21	137	64	22	33	27	10	25	66	13	45.6	0.15
134	Ariyakundu	Open well	7.27	0	1426	884	282	69	198	121	67	39	72	16	73	135	11	76.5	0.50
135	Erakadu	Open well	6.96	0	2564	1590	352	126	212	195	86	92	128	24	113	243	19	128.2	1.04

136	Ramarpatham	Open well	7.07	0	1732	1074	345	87	246	134	72	46	82	19	83	149	21	89	0.60
137	Rameswaram	Open well	7.13	0	1932	1198	331	28	288	155	73	68	105	21	121	148	26	102.8	0.72
138	Olaikudda	Open well	6.86	0	1645	1020	356	96	246	141	51	73	79	11	85	153	15	89.3	0.74
139	Olaikudda Light House	Open well	7.04	0	2430	1507	337	106	216	166	66	84	126	23	107	204	24	120	0.93
140	Semmamadam	Open well	6.73	0	1164	722	241	86	143	104	56	34	48	15	76	108	9	64.4	0.43
141	Rameswarm	Bore well	7.52	0	1231	763	272	18	247	106	43	51	65	8	65	125	7	74.5	0.39
142	Attangarai	Open well	7.14	0	531	329	148	16	116	37	19	9	29	3	24	31	9	33.3	0.29
143	Alagankulam	Open well	7.04	0	895	555	261	56	176	81	38	31	43	6	37	88	6	52.1	0.28
144	Panaikulam	Open well	7.24	0	509	316	146	18	122	45	16	15	32	5	18	46	10	35.3	0.19
145	Vani	Bore well	6.8	0	5850	3627	426	95	317	374	176	193	246	57	164	553	36	263.4	1.37
146	Kusavankudi	Open well	7.01	0	314	195	82	6	73	39	18	11	16	4	16	33	8	27.7	0.67
147	Ammankovil	Open well	7.45	0	456	283	124	17	87	43	22	13	19	3	22	41	6	32.6	0.18
148	Sethunagar	Open well	7.45	0	430	267	104	13	77	44	16	17	23	2	16	52	8	33.5	0.31
149	Kooriyur	Bore well	6.67	0	1688	1047	216	45	156	137	52	71	70	10	86	113	15	86.3	1.29
150	Ramanathapuram	Bore well	6.95	0	3986	2471	458	113	333	312	135	158	186	24	21	361	32	186.6	0.99
151	Mecca Nagar	Bore well	6.54	23	26980	16728	1297	279	986	1826	968	834	1167	92	268	3321	159	1193.3	5.88
152	Ekkakudi	Bore well	6.89	0	3244	2011	347	96	242	238	121	98	143	31	143	296	26	154.6	0.94
153	VadukuKodikulam	Bore well	7.12	0	9060	5617	631	130	489	541	293	231	426	31	189	816	58	383	2.01
154	Malangudi	Open well	7.45	0	1138	706	251	33	189	86	33	39	47	8	53	116	10	63.1	0.26
155	Nediamanickam	Bore well	7.01	0	12200	7564	722	175	529	723	396	316	483	53	220	1176	96	515	2.27
156	Valanadu	Bore well	6.94	1	7730	4793	668	162	482	564	236	315	372	61	197	794	76	370.2	2.27
157	Periyakaiyagm	Bore well	6.94	0	8450	5239	733	179	538	524	226	288	392	67	186	720	92	378	1.56
158	Kodarendal	Bore well	6.95	0	5432	3368	504	121	375	443	198	231	358	56	167	651	73	287.7	1.50
159	Kakkoor	Bore well	6.45	4	17670	10955	829	153	663	1316	682	612	764	81	238	2315	156	829.1	3.85
160	Puliyangudi	Bore well	6.52	1	12180	7552	786	162	386	451	210	226	265	28	168	627	52	412.1	1.66
161	Thanjakur	Bore well	6.46	2	12630	7831	696	181	353	417	216	189	398	34	168	672	48	425	2.21
162	Vennervaiikal	Bore well	6.36	0	12470	7731	611	128	469	553	240	301	426	73	182	240	3	414.9	2.74
163	Muthukulathur	Bore well	6.75	1	9050	5611	528	130	386	628	292	322	392	48	200	811	49	399.4	2.44
164	Muthukulathur outer	Bore well	7.06	0	6310	3912	402	90	300	513	204	294	274	60	162	565	64	307.2	1.66

165	Chithirangudi	Bore well	6.73	5	31990	19834	865	159	692	1226	621	593	643	73	212	1314	71	1020.4	2.60
166	Peterpuram	Bore well	6.72	1	10030	6219	648	126	507	556	264	278	368	61	186	688	48	397.5	1.47
167	Mettupatti	Bore well	7.45	0	2581	1600	276	37	232	209	83	111	132	25	73	231	14	129.7	1.00
168	Sangappadai	Bore well	6.59	0	3669	2275	377	53	313	231	118	98	259	35	143	428	20	178.1	0.73
169	Keelavalasai	Bore well	7.37	0	1264	784	195	28	161	105	41	52	59	12	84	113	7	70.9	1.58
170	Mudalnadu	Bore well	7.36	0	864	536	148	12	118	64	28	23	38	8	57	78	5	49.1	0.45
171	Poomavilangai	Bore well	6.6	0	3387	2100	356	49	298	339	109	117	147	32	124	304	18	158.5	0.71
172	Thirusiluvaipuram	Bore well	7.33	0	2407	1492	313	60	239	161	88	71	168	10	112	430	3	131.7	0.70
173	K. Nedugulam	Bore well	7.16	0	736	456	175	11	152	72	24	34	32	7	49	66	4	46.5	0.24
174	KeelaMandapasalai	Open well	6.85	0	2114	1311	484	30	436	188	68	99	92	20	94	190	12	109.7	0.31
175	N. Karisalkuam	Open well	7.23	0	727	451	167	16	150	66	23	34	38	7	38	65	4	46.1	0.16
176	Ramasampatti	Bore well	7.46	0	503	312	126	13	106	30	12	9	23	3	10	38	3	32.3	0.10
177	Keelaramanathi (Farm)	Bore well	7.07	0	1733	1074	197	28	157	160	66	81	78	17	81	155	9	93.5	1.11
178	Kavadipatti	Bore well	7.58	0	658	408	105	12	86	49	21	17	26	6	44	49	4	39.5	0.13
179	Kamudi	Bore well	7.24	0	566	351	136	8	117	56	18	26	25	5	38	51	3	38.5	1.09
180	Pasumpon	Bore well	6.78	0	1095	679	161	14	142	159	82	62	71	13	71	69	11	70.5	0.21
181	Pasumpon (Near)	Bore well	6.87	0	1644	1019	286	54	219	142	53	77	134	16	109	169	9	95.2	0.34
182	Melakannicherry	Bore well	7.2	0	5660	3509	393	81	307	359	183	164	218	54	168	507	31	248.1	0.75
183	Nalloor	Bore well	6.7	0	10460	6485	704	134	556	494	278	197	335	76	192	637	57	387.3	1.68
184	KeelanThooval	Bore well	6.54	1	10720	6646	748	146	588	543	236	289	312	63	116	723	58	409	1.78
185	Vilangalathur	Bore well	6.84	0	8160	5059	595	117	469	468	216	236	283	59	99	632	44	330.8	1.63
186	Mahindi	Bore well	6.73	0	1214	753	201	17	172	90	39	42	53	12	37	109	7	63.3	0.25
187	Meesal	Bore well	6.6	0	764	474	176	11	158	65	25	28	38	7	51	63	4	45.3	0.92
188	North Ulaiyur	Bore well	6.67	0	6140	3807	411	73	324	381	198	167	238	54	137	453	33	256	1.22
189	A Puthur	Bore well	7.12	0	561	348	166	15	136	50	18	22	27	5	37	52	3	37.4	0.62
190	Muthu Selvapuram	Bore well	7	0	3696	2292	326	53	262	243	119	106	195	32	146	331	20	170.5	0.98
191	Sathirakudi	Bore well	6.73	0	8990	5574	592	129	453	521	290	218	289	85	197	718	49	364.1	2.52
192	Theeyanur	Bore well	7.09	0	626	388	147	9	129	60	20	28	36	6	41	56	3	41.4	0.19
193	Seyyalur	Bore well	6.8	4	18260	11321	973	202	763	1206	589	602	724	90	211	1336	99	750.1	3.00

194	Karunkulam	Bore well	7.22	0	1021	633	138	15	110	83	43	32	49	10	58	92	6	57.5	1.44
195	Soorankottai	Bore well	7.03	0	3934	2439	375	56	311	282	147	121	183	37	163	356	21	183.6	1.09
196	Thoruvalur	Bore well	6.89	0	2527	1567	267	36	221	169	96	62	112	24	93	189	14	114.7	0.46
197	Ramanathapuram Bypass	Bore well	6.98	0	3775	2341	348	54	278	275	122	146	226	36	143	416	32	191.7	1.35
198	Ramanathapuram Bypass	Bore well	6.6	1	6110	3788	414	88	321	379	187	169	291	58	155	547	34	265.9	0.76
199	NearPalangulam (Farm)	Bore well	6.94	0	5264	3264	374	75	285	399	170	215	307	50	149	523	29	255.1	1.67
200	Ramalan Nagar	Open well	6.84	0	1582	981	153	23	126	135	73	56	69	15	59	198	9	86	0.34
201	Near Ramalan Nagar	Bore well	6.93	0	1156	717	204	17	173	88	37	42	57	11	77	104	6	64.1	0.40
202	Terbhogi	Open well	6.7	0	2182	1353	291	61	213	152	78	63	95	21	93	196	12	104.6	0.40
203	Pudhuvalasai	Open well	6.91	0	887	550	175	32	121	51	18	25	28	18	32	52	1	44.7	0.16
204	Chittrakottai	Open well	7.06	0	1975	1225	216	42	167	99	46	41	89	28	96	136	12	89.4	0.38
205	Agri-farm	Bore well	6.56	2	9130	5661	621	131	482	573	311	246	313	71	186	617	50	368.4	4.06
206	SakkaravalaNallur	Open well	7.51	0	2478	1536	213	36	163	210	83	113	139	24	82	214	13	127.7	0.61
207	Perygalur	Bore well	7.33	0	510	316	119	18	96	68	36	21	25	10	2	48	1	35.8	0.14
208	Vayaloor	Bore well	7.37	0	3264	2024	327	47	271	226	94	116	163	31	117	293	18	155.4	0.85
209	Madaloor (Vaigai River)	Open well	7.35	0	469	291	79	8	63	24	11	6	10	2	2	22	1	26.1	0.21
210	Thethangal	Bore well	7.07	0	2066	1281	169	30	126	144	52	78	82	20	36	165	11	97.8	0.45
211	Kamankottai	Bore well	6.94	0	3997	2478	381	57	321	226	124	87	182	36	162	394	22	182.9	0.84
212	Muthuvayal	Bore well	7.05	2	6480	4018	492	93	385	397	169	213	367	58	186	683	51	301.8	0.97
213	Near Muthuvayal	Bore well	6.84	0	851	528	156	12	136	52	27	12	39	8	22	66	5	43.1	0.19
214	Poganoor	Open well	6.54	0	8260	5121	633	118	502	545	261	278	393	78	193	746	45	366.7	2.16
215	Thiruvadi	Bore well	6.45	2	8640	5357	604	106	517	509	279	216	367	82	186	721	38	357.2	1.78
216	Vikrapandipuram	Bore well	6.91	0	2541	1575	291	56	207	161	72	86	105	16	98	197	9	117	1.76
217	Siruthalai	Bore well	6.77	0	2485	1541	266	39	213	184	80	93	98	21	113	223	14	121.2	1.44
218	Tiruvarangam	Bore well	7.01	0	2432	1508	241	35	201	209	78	113	106	23	161	218	13	127.5	1.33
219	Pamboor	Bore well	7.47	0	347	215	81	5	71	34	16	10	15	3	23	31	2	27.4	0.82
220	Near Malakavanoor	Bore well	7.31	0	303	188	68	4	62	20	10	5	9	1	2	22	1	22.2	2.61
221	Muthuramalingapattinam	Bore well	7.62	0	391	242	93	6	82	39	18	11	17	2	6	36	2	28.5	2.43
222	Puluthikulam	Bore well	6.93	0	3192	1979	311	46	258	212	113	87	134	30	101	286	17	145.1	2.35

223	Near Puluthikulam	Bore well	6.91	0	3130	1941	476	42	268	235	120	91	128	26	97	267	14	142.5	2.71
224	MerkuKottakudi	Bore well	6.96	0	487	302	122	11	103	52	26	13	19	4	18	44	3	32.1	1.63
225	Perungarunai	Bore well	7.31	0	574	356	126	12	112	55	29	12	21	5	26	51	6	36.4	1.12
226	Near Perungarunai	Bore well	6.88	2	9740	6039	768	140	612	615	276	326	405	58	243	873	53	422	2.02
227	Sabathi	Bore well	6.99	0	2512	1557	554	36	218	208	81	113	134	24	69	225	14	127.2	0.50
228	Abiramam	Bore well	6.95	0	2914	1807	387	48	326	227	124	91	186	35	92	261	16	142.6	1.10
229	Nanthiseri	Bore well	7.02	0	1328	823	293	19	174	119	43	62	58	13	73	156	12	77.4	0.43
230	Valayapokulam	Bore well	7.15	0	1456	903	228	21	189	117	57	49	63	14	77	167	8	79.1	0.48
231	Near Mandalamanickam	Bore well	6.64	0	1698	1053	246	36	196	170	93	64	127	21	93	204	18	100.1	0.37
232	Mandalamanickam	Bore well	6.67	0	1655	1026	213	26	175	177	86	77	116	16	76	194	9	97	1.02
233	Yedaisoorani	Bore well	6.82	0	3421	2121	754	52	263	238	104	119	206	42	127	307	26	166.2	1.82
234	Perumaldevanpatti	Bore well	6.92	6	20770	12877	1089	246	824	1245	603	618	843	86	206	1627	125	839.5	3.28
235	NeeraviChinnakaruskulam	Bore well	7.2	0	558	346	136	15	106	49	23	13	19	3	26	48	3	34.4	0.13
236	KeelamudiMannarkottai	Bore well	6.39	0	3599	2231	378	78	286	244	106	124	224	35	133	346	44	178.1	1.07
237	KK Kottai	Bore well	7.37	0	493	306	125	7	102	51	16	23	21	5	39	49	8	37	0.25
238	Near KK Kottai	Bore well	7.34	0	893	554	147	13	124	73	29	33	43	9	59	82	12	54.4	0.23
239	Pothanathi	Open well	7.14	0	703	436	155	16	145	67	38	16	22	7	47	53	4	41.3	0.20
240	Koodakulam	Bore well	6.71	0	1564	970	218	16	194	31	16	2	116	8	110	290	1	78	0.45
241	Tharaikudi	Bore well	7.64	0	652	404	143	9	134	62	21	30	28	6	32	58	4	42.7	0.22
242	T Kallikulam	Bore well	7.55	0	900	558	198	18	165	70	35	19	23	9	46	62	5	47.4	0.27
243	ManikaThootam	Bore well	7.24	0	1116	692	246	16	137	71	36	23	18	11	34	51	6	51.1	0.18
244	Periyanaikulam	Bore well	6.63	1	9430	5847	769	135	617	622	321	286	357	72	121	845	36	396.4	1.06
245	Kodumalur	Bore well	6.96	0	2888	1791	228	43	174	171	86	73	186	19	48	182	16	126.2	0.50
246	Sanmuganathapuram	Bore well	7.24	0	777	482	88	11	67	54	30	13	18	5	27	54	4	41.5	0.15
247	Near Sanmuganathapuram	Bore well	7.34	0	827	513	101	12	83	65	37	16	21	4	33	51	5	43.2	0.15
248	Thattankudiyiruppu	Bore well	6.7	1	11970	7421	684	125	546	706	316	383	492	83	236	865	65	493.4	2.00
249	MelaThattankudiyiruppu	Bore well	6.85	0	10200	6324	799	141	643	633	346	273	395	81	217	883	53	426.2	1.76
250	Melakavanoor	Bore well	7.21	0	2151	1334	225	31	183	179	69	97	121	26	56	193	12	111.5	0.56
251	S Kavanoor	Bore well	7.28	0	2283	1415	233	42	170	217	113	92	116	22	72	205	18	119.5	0.51

252	Muthunagar	Bore well	7.05	0	2150	1333	189	33	143	191	97	83	138	13	93	176	16	112.6	0.62
253	Thinaikulam Highway	Bore well	6.7	5	13730	8513	1046	217	806	796	367	415	586	75	223	1176	75	569.3	1.69
254	Arriyananthai	Bore well	6.9	6	16730	10373	1166	236	913	920	426	482	736	86	214	2236	117	742.1	3.52
255	Tthinaikulam	Bore well	6.63	4	12100	7502	956	156	786	721	326	374	411	63	202	1216	66	510	1.64
256	Manjoor	Bore well	7.28	0	7460	4625	588	112	463	547	241	295	324	52	169	791	41	347.8	1.14
257	Pattithatti	Bore well	7.03	0	5570	3453	478	92	369	366	183	164	286	36	188	546	62	259.9	0.85
258	ChinnaAkkiramesi	Bore well	7.24	0	814	505	138	12	114	54	32	13	18	8	13	56	4	41	0.16
259	Arasadi Vandal	Bore well	7.19	0	737	457	162	16	132	55	28	16	21	6	26	61	5	40.8	0.46
260	Pandiyur	Bore well	7.29	0	739	455	171	34	131	26	12	5	23	5	18	41	6	35.6	0.18
261	Lakshmi Mangalam	Bore well	7.32	0	734	455	168	11	151	42	21	9	17	6	22	46	4	37.1	0.51
262	SV Mangalam	Bore well	7.02	0	735	456	149	17	128	55	24	21	17	7	27	66	5	41.5	0.66
263	Panthapanenthal	Bore well	7.26	0	740	459	164	15	137	56	22	19	26	7	32	61	4	41.6	0.18
264	Kiliyoor	Bore well	6.75	0	1490	924	143	21	114	135	66	53	81	13	99	187	13	85.6	0.37
265	P Kodikulam	Bore well	7.14	2	7839	4860	609	117	481	479	253	211	346	77	210	738	43	340	1.63
266	Vaigai	Bore well	7.11	0	3821	2369	842	73	287	273	123	138	246	36	154	469	21	194.1	0.93
267	Madhavanoor	Open well	7.23	0	552	342	114	8	99	49	19	17	13	3	17	37	3	33.3	0.15
268	Devipattinam	Open well	6.73	0	3850	2387	318	56	251	267	146	103	210	46	135	345	16	176.4	1.41
269	ABC Kenbridge School	Open well	7.52	0	1142	708	167	16	136	76	37	21	53	11	26	86	6	56	0.66
270	Pathanandhal	Bore well	6.25	0	3607	2236	304	52	243	259	116	128	218	34	121	323	20	171.9	0.69
271	Pottagavayal	Bore well	7.67	0	598	371	132	9	112	41	24	8	19	6	18	38	3	34.1	0.27
272	Kundathur	Bore well	7.35	0	834	517	195	18	172	72	27	33	36	11	24	75	5	48.8	0.24
273	Vagavayal	Bore well	7.57	0	626	388	109	14	87	51	18	19	17	4	19	27	1	35	0.17
274	Pottagavayal	Bore well	7.6	0	801	497	146	11	124	67	31	20	26	8	21	63	6	44.5	0.21
275	Thaniyapuli	Bore well	7.25	0	733	454	128	10	109	49	21	14	18	7	27	41	4	38.1	2.98
276	Koluoor	Bore well	7.1	0	605	375	134	9	125	66	20	28	26	6	40	54	3	40.2	0.21
277	Kottakudi	Bore well	7.02	0	552	342	122	8	114	53	26	14	21	5	37	49	3	35.4	0.52
278	Movaloor	Bore well	7.3	0	586	363	129	13	125	47	22	13	18	6	21	46	4	35	0.47
279	Katchan	Bore well	7.12	1	7440	4613	658	113	533	472	240	217	396	72	193	676	42	329.7	1.75
280	Paaparkootam	Bore well	7.29	0	2195	1361	195	31	152	181	76	92	112	23	67	197	12	112.1	1.32

281	Nainaarkulam	Bore well	7.15	0	1853	1149	176	27	136	153	60	76	124	18	72	230	10	102.4	1.45
282	Nainarkovil	Bore well	7.1	0	2506	1554	291	37	237	116	81	117	186	23	93	325	26	146.1	0.81
283	Puthoorvalasi	Bore well	7.14	0	2390	1482	266	42	211	167	91	64	172	18	73	267	32	124.1	1.21
284	Valasai	Bore well	7.01	0	2381	1476	267	34	224	184	96	74	168	23	86	318	37	131.6	0.99
285	Ariyanenthal	Bore well	7.31	0	758	470	167	11	156	71	24	35	33	7	50	68	4	47.7	0.34
286	Kumarakudi	Bore well	7.35	0	746	463	190	38	105	60	30	16	21	3	27	59	9	42.1	3.82
287	Vengadesh Colony	Bore well	6.81	0	2531	1569	231	36	187	196	83	98	133	28	68	227	28	127.6	0.63
288	Paramakudi	Bore well	7.45	0	962	596	112	14	92	67	36	18	26	9	17	49	6	46.5	0.36
289	Somanathapuram	Bore well	7.35	0	3359	2083	316	63	246	226	125	86	218	26	129	405	56	173.3	0.97
290	Nandupatti	Bore well	7.1	0	2320	1438	267	46	206	195	75	108	126	34	114	218	13	123.5	0.40
291	Ambethkar Nagar	Bore well	7.17	0	3528	2187	273	43	226	261	114	143	168	41	76	410	29	177.6	0.84
292	Vengalur	Bore well	7.16	0	2075	1287	179	22	146	178	68	97	113	22	63	286	31	119.8	0.84
293	Ramalingampatti	Bore well	6.41	0	3342	2072	369	67	291	233	126	95	236	41	51	406	38	168	0.55
294	PP Yenthal	Bore well	7.33	0	1413	876	246	36	196	75	37	26	68	15	62	134	12	70	1.79
295	KaatuEmaneshwaram	Bore well	6.75	0	8020	4972	553	93	453	539	236	289	403	75	186	719	48	361.3	1.05
296	Mochakudi	Open well	7.71	0	192	119	64	13	50	24	10	6	8	1	2	18	1	20.4	0.52
297	Near Mochakudi	Bore well	6.63	0	8110	5028	515	82	426	485	256	217	416	68	183	836	62	359.9	1.43
298	Pidaricheri	Bore well	7.45	0	671	416	148	13	116	56	28	16	19	5	26	53	10	40.3	0.25
299	MelaParthibanoor	Bore well	7	3	14450	8959	946	163	768	921	489	416	646	78	183	1295	106	612.8	2.23
300	Parthibanoor	Bore well	7.05	0	1632	1012	162	23	136	146	53	76	98	16	67	210	26	97.1	0.42
301	Rajakalpatti	Bore well	7.17	0	1648	1022	153	33	115	138	68	54	81	14	52	186	19	88.9	0.43
302	KeelaPerungarai	Bore well	6.69	0	2048	1270	167	29	126	166	87	63	124	31	83	192	26	107.6	0.54
303	TThelichatthanallur	Bore well	7.44	0	1347	835	135	21	105	143	68	61	89	13	54	210	13	85.5	0.45
304	KattuParamakudi	Bore well	6.84	0	3426	2124	346	49	286	259	113	124	193	35	143	384	49	177.9	1.02
305	ThalaiyadiKottai	Bore well	6.5	7	19540	12115	1028	216	795	1231	633	575	816	77	226	1896	106	818.9	4.72
306	Memangalam	Open well	6.59	5	16030	9939	825	168	644	1045	536	486	675	63	167	1326	87	662.6	1.69
307	Radhapuli	Bore well	6.41	5	19820	12288	1058	223	823	1256	606	624	767	68	203	1957	97	830	2.49
308	Vathavaneri	Open well	6.87	0	3703	2296	345	56	274	247	97	131	184	51	86	346	21	172.7	0.65
309	Varunthi	Open well	7.02	0	3588	2225	307	51	249	236	118	101	175	34	99	315	28	164.2	2.01



310	Kaadarnthakudi	Bore well	6.94	0	3842	2382	259	43	206	283	123	146	162	27	116	353	37	183.8	0.82
311	Kuyavanenthal	Open well	6.96	0	5630	3491	443	76	355	418	189	216	248	54	197	583	52	272.5	1.23
312	Ananthanenthal	Bore well	7.22	0	6220	3856	478	82	384	401	209	173	269	48	159	616	63	281	0.91
313	Ariyankottai	Bore well	6.95	0	5730	3553	456	78	363	396	193	186	247	51	188	568	47	265.4	0.81
314	Near Solanthoor	Open well	6.94	0	7330	4545	557	86	456	562	289	251	433	58	206	952	58	363.2	2.79
315	Solanthoor	Open well	6.73	0	7480	4638	432	72	346	542	246	278	409	62	187	845	47	356.3	1.12
316	Kathiyarkottai	Open well	6.94	0	6820	4228	524	93	423	577	268	295	395	74	156	811	79	351.9	1.12
317	Kadalur	Open well	7.65	0	279	173	79	16	60	32	13	9	11	2	5	27	2	24.2	0.63
318	Uppur	Open well	7.5	0	183	113	48	6	42	22	10	4	8	1	2	16	1	19.3	4.38
319	Kalangappuli	Bore well	7.06	1	3215	1993	355	57	286	253	135	106	246	42	116	421	38	174.6	1.14
320	Paranoor	Bore well	7.24	0	2264	1404	289	35	241	228	97	115	163	26	86	376	18	142.3	1.24
321	RS Mangalam	Bore well	6.75	0	5850	3627	485	88	380	339	173	153	266	62	134	563	61	260.5	1.75
322	Mangalam	Bore well	6.92	0	6530	4049	573	92	463	440	231	195	349	65	127	664	53	299.7	1.68
323	Sengudi	Bore well	6.93	1	9270	5747	672	105	549	586	278	296	385	73	148	746	104	403.7	2.20
324	Sudiyur	Bore well	7.38	0	689	427	108	13	86	68	36	21	27	7	46	63	6	43.7	0.12
325	Parakai	Bore well	6.81	0	7150	4433	522	85	427	505	225	267	416	49	187	816	46	342.6	1.25
326	Sanaveli	Bore well	7.17	0	2132	1322	274	46	210	174	69	93	99	25	96	243	35	119.2	0.60
327	Pullamadai	Bore well	6.71	5	16400	10168	746	185	539	168	567	486	683	86	186	1652	121	705.4	3.05
328	Odaikaal	Open well	6.83	0	274	170	73	13	57	34	15	10	11	3	2	37	6	24.8	0.92
329	Kannarenthal	Open well	6.39	1	6570	4073	549	84	452	483	256	213	376	39	212	726	67	317.4	1.03
330	A Manakudi	Bore well	6.57	1	7690	4768	586	93	486	576	276	289	334	46	195	762	56	356.3	1.05
331	Puthupattanam	Open well	7.25	0	544	337	113	23	86	62	36	14	22	2	8	72	4	36.6	0.14
332	Thiruvetriyur	Open well	7.38	0	273	169	69	13	53	39	21	8	9	2	6	36	4	25.2	0.17
333	Pottakudi	Open well	7.62	0	295	183	77	14	61	44	22	10	12	3	8	42	4	27.3	1.18
334	Melapanaiyoor	Bore well	7.08	0	701	435	103	13	86	52	28	15	23	8	13	56	4	38.8	0.17
335	Aayiraveli	Bore well	6.83	0	684	424	113	17	91	57	31	13	19	7	16	62	5	38.2	0.18
336	Gudalur	Bore well	7.15	0	6230	3863	438	73	356	376	193	176	275	58	121	613	48	276	0.83
337	Kavanakottai	Bore well	6.31	0	2556	1585	306	37	256	206	85	106	127	28	106	316	26	136.3	1.57
338	Ayankudi	Bore well	6.76	1	8420	5220	713	126	574	473	257	208	356	66	124	726	93	357.1	3.28

339	Karunkudi	Bore well	6.35	1	8100	5022	642	114	519	502	276	214	337	42	113	755	82	348.9	2.12
340	Anandur	Open well	6.99	0	1721	1067	210	26	176	161	66	81	96	13	47	234	16	99.2	0.86
341	Valanai	Bore well	7.1	0	3589	2225	791	51	740	296	116	167	156	34	238	322	20	183.1	1.58
342	Sattanoor	Bore well	6.47	3	14690	9108	1027	159	859	978	496	464	617	129	218	1506	113	647.1	3.33
343	Nemam	Bore well	6.52	0	4130	2561	326	66	246	326	167	143	212	43	125	571	38	212	1.14
344	Viruthanvayal	Bore well	6.4	0	3786	2347	325	53	266	319	134	168	243	37	142	535	44	208.7	2.23
345	Annayankottai	Bore well	7.72	0	2042	1266	211	32	173	177	78	86	97	26	97	266	22	116	0.66
346	Radhanur	Bore well	7.06	0	2442	1514	241	43	189	179	96	68	113	31	114	284	37	127.6	1.09
347	Govindamangalam	Bore well	6.68	2	5800	3596	499	82	406	385	177	192	238	54	155	526	76	267.9	1.29
348	Karkathakudi	Bore well	6.74	0	2884	1788	286	38	234	177	92	69	208	33	114	316	34	144.1	0.89
349	Karungavayal	Open well	6.62	0	2856	1771	306	42	251	206	85	105	186	27	138	366	41	154.9	1.08
350	Achankudi	Open well	6.73	0	2911	1805	348	51	289	218	106	93	169	37	144	340	39	153.1	0.74
351	T Puthukudi	Open well	6.5	0	719	446	128	18	106	67	36	19	28	4	13	51	4	39.6	0.15
352	Sekunthidal	Bore well	6.49	5	15520	9622	905	136	758	1088	564	501	683	118	242	1638	125	694.9	4.23
353	PV Pattanam	Open well	7.84	5	15960	9895	946	149	786	1026	487	523	658	103	215	1688	134	705.4	3.47
354	Velankudi	Open well	7.19	0	703	436	124	16	95	58	26	21	32	6	17	61	6	41.6	0.15
355	Vattanam	Open well	7	0	1857	1151	204	26	164	172	88	72	134	7	38	255	21	108.9	1.17
356	RC Nagar	Open well	6.87	0	1839	1140	225	33	185	188	93	81	129	11	46	268	31	111.4	2.52
357	Ettukudi	Bore well	7.16	0	1215	753	162	18	133	64	29	24	46	8	31	77	15	57.9	0.22
358	Palangulam	Bore well	7.31	0	755	468	136	14	115	56	27	16	22	9	42	58	11	43.5	0.19
359	Near T. Keelaiyur	Bore well	6.66	0	4420	2740	287	64	214	309	143	153	183	32	106	439	25	202.9	0.66
360	T. Keelaiyur	Open well	6.66	0	3910	2424	269	55	206	335	162	165	191	38	98	412	33	197.3	0.54
361	Bharathinagar	Bore well	7.22	0	570	353	128	8	116	49	26	12	19	4	8	52	4	34.4	0.29
362	Kuruvankadu	Open well	7.28	0	550	341	134	16	110	58	25	21	21	5	16	61	4	37.2	0.44
363	Elangundram	Open well	7.5	0	492	305	152	18	124	53	28	15	18	6	18	58	3	34.7	0.09
364	Veliyankudi	Open well	7.41	0	645	400	163	19	133	67	33	21	27	8	23	66	5	41.6	0.25
365	Kunjankulam	Bore well	7.1	0	837	519	185	12	173	80	27	39	36	8	56	75	6	51.6	0.39
366	NM Mangalam	Open well	7.31	0	2734	1695	286	42	236	199	99	82	169	33	43	326	15	135.6	0.51
367	Peruvakottai	Bore well	7.26	0	2881	1786	314	51	251	221	116	83	145	28	51	353	23	142.4	0.54

368	Vellaiyapuram	Open well	7.01	0	1373	851	206	26	166	138	67	58	96	15	43	188	16	83.8	0.40
369	Kuttivayal	Open well	6.9	0	1303	808	193	31	154	141	56	66	89	17	37	156	13	79.6	1.28
370	Near SP Pattanam	Bore well	7.24	0	1477	916	236	36	188	172	89	65	115	21	47	224	21	95.3	1.76
371	OriyurPuthuvayal	Open well	6.95	0	1402	869	192	23	162	155	67	73	112	19	53	241	26	95.3	2.89
372	SP Pattanam	Bore well	7.07	0	1418	879	186	20	155	160	82	64	104	13	61	210	29	93.2	1.83
373	Peramangalam	Open well	7.59	0	458	284	118	18	93	49	26	13	24	3	19	55	13	35.9	0.15
374	Arivithi	Open well	7.36	0	1388	861	193	22	162	164	86	65	113	16	44	243	23	94.4	0.54
375	Andavoorani	Open well	7.35	0	1423	882	208	26	174	173	71	88	114	14	47	267	28	101.7	2.32
376	Mangalakudi	Open well	7.66	0	228	141	60	10	48	38	18	8	8	2	6	34	4	24.2	0.15
377	Kurunthangudi	Bore well	7.11	0	2193	1360	216	33	176	198	89	93	138	14	37	282	18	119.8	0.70
378	Keppuli	Bore well	7.3	0	1671	1036	191	25	157	173	76	83	121	16	41	237	22	103	0.49

**Table 6: shows the ranges of various physico-chemical characters of pre-monsoon and post-monsoon groundwater quality against WHO and IS drinking water standards**

Parameters	Pre-monsoon	Post-monsoon	WHO standard	IS standard (BIS 10500:1991)	
				Desirable	Permissible
pH	6.1 to 8.1	6.25 to 8.0	8.5	6.5 to 8.5	6.5 to 8.5
Salinity (ppt)	0 to 40	0 to 28	-	-	-
EC ( $\mu$ S/cm)	377 to 53,900	167 to 38,290	-	-	-
TDS (mg/l)	214 to 32,020	104 to 23,740	500	500	2000
Total Alkalinity (mg/l)	220 to 481	43 to 1297	-	200	600
Carbonate (mg/l)	34 to 152	3 to 279	-	-	-
Bicarbonate (mg/l)	121 to 363	36 to 987	200		
Total hardness (mg/l)	45 to 6,425	20 to 2,835	-	300	600
Calcium (mg/l)	21 to 2,937	10 to 1,356	75	75	200
Magnesium (mg/l)	12 to 1,645	2 to 1,461	30	-	-
Sodium (mg/l)	10 to 4,270	8 to 1,262	200	-	-
Potassium (mg/l)	1 to 97	1 to 168	100	-	-
Chloride (mg/l)	32 to 8,609	15 to 6,452	200	250	1000
Nitrate (mg/l)	1 to 140	1 to 186	45	45	100
Sulphate (mg/l)	2 to 240	2 to 268	200	200	400

## 6. KEY FINDINGS

The present investigation of pre-monsoon and post-monsoon groundwater quality of Ramanathapuram district indicates that

- The groundwater quality of the district is greatly influenced by seasonal rainfall.
- **pH** - Most of the sample are within the prescribed drinking water standard. Seasonal rainfall infiltration into the groundwater reduces the pH levels in the central region of the district, which could be due to the load of organic material.
- **Salinity** – salinity is observed in the interior of the district, and reduction in the salinity is observed due to the seasonas rainfall.
- **EC & TDS** – Majority of the samples shows higher concentration of EC and TDS than the prescribed range. Remarkable changes in the concentration of electrical conductivity and total dissolved solids are observed during pre-monsoon and post-monsoon seasons.
- **Total hardness** – Some of the samples are above the permissible limit. Seasonal infiltration reduces the values of total hardness considerably.
- **Calcium and Magnesium** – Higher concentration in the levels of calcium and magnesium could be due to the existence of calcium-rich minerals such as gypsum, limestone etc and also may be due to seawater intrusion. Seasonal rainfall reduces the levels of calcium and magnesium.
- **Sodium and Chloride**– Higher concentration of sodium and chloride could be due to the intrusion of seawater into the freshwater aquifers. Seasonal rainfall reduces the levels of sodium and potassium.
- **Potassium** – Higher concentration of potassium could be due to seawater intrusion and maybe because of weathering of rocks. Increase in the concentration of potassium during post-monsoon could also be due to agriculture activities.
- **Alkalinity** – Higher concentration of alkalinity is observed, which could be due to rock water interaction. Seasonal rainfall increases the concentration of alkalinity in the groundwater.
- **Nitrate & Sulphate** – Seasonal rainfall increases the concentration of nitrate and sulphate in the groundwater of the district.

- The higher values of total hardness over total alkalinity clearly indicate seawater intrusion in the groundwater of Ramanathapuram district.
- **WQI** - Assessment of groundwater quality for drinking purpose as indicated by WQI shows that the pre-monsoon is dominated by poor and very poor quality, whereas post-monsoon is dominated by excellent and good. Seasonal infiltration has a significant impact on the quality of groundwater.
- **SMI** - Seawater Mixing Index indicates that south-central and north-central regions of the district are affected by seawater intrusion and nearly 30% of the samples are affected by the intrusion.
- The spatial distribution of various groundwater quality parameters, WQI and SMI clearly indicate that seawater intrusion is observed in the Ramanathapuram district particularly – from the south coastal tract to the central region in the Gulf of Mannar coast and in the east to west direction in the Palk Bay coastal region.

## 7. RECOMMENDATIONS

Following are the recommendation from the present study and field observations

- **Seasonal Rainfall** - As the study indicates that the seasonal rainfall greatly influences the quality of groundwater in the entire Ramanathapuram district, **implementation of various watershed activities** will enhance the groundwater quality in the district in future.
- **Waterbodies** - Ramanathapuram district is one of the districts in Tamil Nadu with large numbers of waterbodies. **Deepening and desilting** of the existing waterbodies will improve the groundwater quality.  
**Linking of waterbodies** must be done in the downstream direction.  
**Supply channels** must be strengthened, to increase the water carrying capacity to the waterbodies.  
Existing **Kanmais** can be rejuvenated with various water harvesting structures, supply channels and surplus weir.
- **Water harvesting structure – Recharge structures and rainwater harvesting structures** must be constructed in the existing waterbodies and other water logging areas. Recharge structures should be designed in a way to recharge the top shallow aquifer.
- **Trenches** - Construction of **water absorption trenches** in the barren land and along the agricultural field must be promoted wherever possible, to the increase the rainwater infiltration and soil moisture.

- **Wastewater management** – As quality of groundwater is one of the major problems in the district, proper wastewater management would have significant impact on the groundwater quality. Since purification of contaminated water is expensive and a time taking process, it is better to manage the wastewater in a proper manner. Suggestive measures: providing proper **wastewater drains** to channelize the domestic sewage; providing **soak pits**; avoiding **open defecation and urination**; abstaining from bathing, washing of clothes, utensils and animals near **open and bore wells**; collection and segregation of **solid waste** in proper manner.
- **Purification of groundwater** – Proper techniques must be adopted to increase the quality of groundwater before consumption.
  - pH** – to increase or decrease the pH, **chemicals must be added** in proper proportion (to increase – sodium carbonate; to decrease hydrogen peroxide);
  - Alkalinity (CO<sub>3</sub> & HCO<sub>3</sub>)** – to reduce the alkalinity, **lime** can be added or the water can be passed through **carbon resins**.
  - TDS** – to reduce the levels of TDS **membrane filter** can be used.
  - Ca & Mg** – can be reduced by various **softening techniques** or **ion-exchange**.
  - Temporary hardness** – can be removed by boiling the water.
  - Permanent hardness** – Ionic exchange or lime soda softening techniques has to be applied.
  - Sulphate** – resin absorbs the sulphate in the water.
  - Chlorine & Organic matter** – to remove free chlorine and organic matter.
  - Reverse osmosis** – to remove the excess salts in the water.
  - Ultra Violet treatment** – may be used to remove bacterial contamination in the water.
- **Taruvai** – Taruvai runnings parallel to the coast (Kannirajapuram to Mookaiyoor – approx. 10 km; T. Mariyur to Valinokam – approx. 10; Karan to Nochiyurani – 10 km; Mandapam to Vedalai – 5 km) is the region where excess runoff is collected during rainfall. Rejuvenation of taruvai can be done by **rising of bunds** and providing **surplus weir**.
- **Sand dune stabilization** - As the district has a long seacoast in the state, sand dune stabilization can be done along the coastal tract from Rogmanagar to Mandapam south in the Gulf of Mannar region and from Mandapam north to Pasipattinam in the Palk Bay region. Sand dune stabilization will increase the **carrying capacity of coastal aquifers** and thereby **preventing the seawater intrusion** and **improving groundwater quality**.
- **Coastal bio-shields** – As the district has considerable extends of coastal wetland, conservation of **mangrove and associated ecosystem** is imperative to strengthen the **coastal watershed**.



## 8. REFERENCES

APHA-American Public Health Association (2005) Standard methods for the examination of water and wastewater, 21st edn. American Public Health Association, Washington.

Census of India (2011) Retrieved from <https://censusindia.gov.in/>

Hem JD. (1992) Study and interpretation of the chemical characteristics of natural water. USGS Water-Supply Paper 2254, 264.

Horvat Z. (2013) Using landsat satellite imagery to determine land use and land cover changes in Medimurje County, Croatia 28: 5–28.

Kuroda PK and Sandell EB (1953) Chloride in igneous rocks. Bull. Geol. Soc. Am. 64: 879-896.

Mondal NC, Vijay P, Singh SS. (2011). Hydrochemical characteristic of coastal aquifer from Tuticorin, Tamil Nadu, India. Environ Monit Assess 175:531–50. doi:[10.1007/s10661-010-1549-6](https://doi.org/10.1007/s10661-010-1549-6).

Omonona VO, Okogbue GO and Isreal R. (2014). Hydrochemical characteristics of groundwater of a coastal aquifer in Southsouth Nigeria. Adv Appl Sci Res 5:77–90.

Park SC, Yun ST and Chae GT. (2005). Regional hydrochemical study on salinization of coastal aquifers, western coastal area of South Korea. J Hydrol 313:182–94.

Saeedi M, Abessi O and Sharifi F. (2010). Development of groundwater quality index. Environ Monit Assess 163:327–35.

Subba RN, Surya RP and Venktram RG. (2012). Chemical characteristics of groundwater and assessment of groundwater quality in Varaha River Basin, Visakhapatnam District, Andhra Pradesh, India. Environ Monit Assess 184:5189–214.

WHO (World Health Organization) 2004. Guidelines for Drinking Water Quality Recommendations, WHO, Geneva, 1:1-515.

Wu J, Xue C and Tian R. (2017). Lake water quality assessment: a case study of Shahu Lake in the semi-arid loess area of northwest China. Environ Earth Sci 76:232. doi:[10.1007/s12665-017-6516-x](https://doi.org/10.1007/s12665-017-6516-x)

## Groundwater sampling (Public borewells)

Pre-monsoon

Post-monsoon





## Groundwater sampling (Private bore wells)

Pre-monsoon



Post-monsoon





# Groundwater sampling (Public open wells)

Pre-monsoon

Post-monsoon





## Groundwater sampling (Private open wells)

Pre-monsoon



Post-monsoon





# Agricultural farms

## Pre-monsoon

## Post-monsoon





## Water bodies

### Pre-monsoon



### Post-monsoon







# Vaigai River



# Trauvai





# Wastewater management





## Coastal sand dunes



## Coastal bio-shields- mangroves and associates

