जल वर्ष 2007 Water Year 2007

स्वच्छ सुरक्षित जल – सुन्दर खुशहाल कल

CONSERVE WATER - SAVE LIFE

GOVERNMENT OF INDIA
MINISTRY OF WATER RESOURCES
CENTRAL GROUND WATER BOARD

# GROUND WATER INFORMATION BOOKLET OF PALGHAT DISTRICT, KERALA STATE


**By**

**Dr. SHAJI.E**, Scientist 'B', **T.S. ANITHA SHYAM**, Scientist 'B',

**MINI CHANDRAN**, Scientist 'B' & **S.P. NAYAGAM**, Assistant Hydrogeologist


**KERALA REGION**

**Trivandrum**

**July, 2007**

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**KERALA REGION**
**KEDARAM, PATTOM PO**
**TRIVANDRUM – 695 004**
**TEL: 0471-2442175**
**FAX: 0471-2442191**

**BHUJAL BHAVAN**
**NH-IV, FARIDABAD**
**HARYANA- 121 001**
**TEL: 0129-12419075**
**FAX: 0129-2142524**

**GROUND WATER INFORMATION BOOKLET OF PALGHAT DISTRICT, KERALA STATE**

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## DISTRICT AT A GLANCE

| Sl.No | GENERAL | | | |
|---|---|---|---|---|
| 1 | Geographical area (sq.km) | | | 4480 |
| 2 | Taluks | | | 5 |
| 3 | Revenue villages | | | 163 |
| 4 | Municipalities | | | 4 |
| 5 | Development blocks | | | 13 |
| 6 | Panchayats | | | 90 |
| | **POPULATION - 2001** | | | |
| 7 | Population (Total) | | | 2617072 |
| 8 | Density of population sq.km | | | 584 |
| 9 | Literacy rate (Total) % | | | 84.31 |
| | **CLIMATE** | | | |
| 10 | Normal annual rainfall (mm) | | | 2348 |
| 11 | Number of rainy days/year | | | 108 |
| 12 | Maximum Temperature $^0$C | | | 37.4 |
| 13 | Minimum Temperature $^0$C | | | 22.2 |
| | **HYDROGEOLOGY, CHEMICAL QUALITY** | | | |
| 14 | Aquifer types | Alluvium, | laterite | crystallines |
| 15 | DTW April ( mbgl) | 4.0 - 11.5 | 4 - 11.0 | 3.0 -15.5 |
| 16 | Yield $m^3$/day | 2 - 50 | 2 - 20 | 2 - 30 |
| 17 | Bore well depth (m) | | | 100-300 |
| 18 | Bore well yield $m^3$/day | | | 5 - 50 |
| 19 | Water quality | good | good | good |
| | Fluoride problem seen in Chittoor, Attapady blocks (up to 5.75 ppm) | | | |
| | **GROUNDWATER RESOURCES as on 31-3-04** | | | |
| 20 | Number of Exploratory wells drilled by CGWB | | | 39 |
| 21 | Number of National Hydrograph Stations (NHS) | | | 54 |
| 22 | Total groundwater resources (MCM) | | | 823.88 |
| 23 | Net groundwater resources (MCM) | | | 750.33 |
| 24 | Net groundwater availability (MCM) | | | 396.81 |
| 25 | Stage of groundwater development (%) | | | 43.67 |
| 26 | Category;- (a) Safe blocks | | | 6 |
| | (b) Semi critical blocks | | | 2 |
| | ( c) Critical | | | 3 |
| | (d) Over exploited | | | 1 |
| | (Malampuzha block (newly created) is included in Palghat and Kuzhalmannam blocks) | | | |

## 1.0 INTRODUCTION

Palakkad (Palghat) (Fig.1) is the land of Palmyrahs and Paddy fields. Palakkad is a major Paddy growing area of the State. It is often called as the "Gateway of Kerala". There is considerable change in the land use and cropping pattern in the district for the last five years. Due to low income from paddy and coconut, farmers are changing the cropping pattern to cash crops like sugarcane, vegetables and flower cultivation. Over dependence on groundwater for domestic, irrigation and industrial purposes in the district has led to the lowering of water table and water scarcity especially along the eastern parts. In most of the areas especially in eastern part of the district decline of water levels necessitates deepening of existing dug wells and putting deep bore wells thereby increasing cost of pumping and quality deterioration. Local enquiry revealed that farmers have taken loan from the banks for putting bore wells and fitting pump sets for irrigation purposes. The district receives on an average 2348 mm of rainfall annually. During 1998 the district recorded a good rainfall of 2407 mm and subsequently the rainfall has been decreased considerably. During 1999 the district received only 2422 (mm), 2000 -1831(mm), 2001-1970 (mm), 2002-1833 (mm) and 2003-1728(mm). This continuous five year deficient rainfall has contributed a lot in crop failures and reduction in groundwater recharge as well as in water level decline, especially in Chittur and Kollenkode blocks. All these years the farmers had availed loans from the Land Development Banks and other financial institutions for various agricultural purposes. Due to the crop failure farmers could not repay the amount to the Land Development Banks/institutions. These farmers are mostly from Eruthenpathy and Vadakarapathy Panchayaths. Added to these there was a reduction in the price of their crops. Without much technical knowledge the farmers are putting bore wells and dug wells in their agricultural lands by obtaining loans from different sources. As per the agricultural production commissioner data 29 farmers committed suicide in this district up to 2006 (Year wise break – 2001-8, 2002-3, 2004 –10 ,2005 – 5 , 2006- 2) (Annexure-1). But it is gathered that no suicide is reported from Palghat district exclusively due to well failures.

### 1.1 Work carried out by CGWB

The compilation on Hydrogeological condition in Palakkad district was done by John Kurian (1981) and subsequent reappraisal surveys by him during 1981 - 82. Reappraisal survey in parts of Palakkad district was carried out by K. Md. Najeeb, (1990 - 91). Exploration was carried out during first and second phases of SIDA project during 1973-78 and 1983-88 respectively. Drilling activities were carried out by CGWB during 2001-2003. The report on "Ground Water Resources and development potential of "Palakkad district" was published in 1997. E. Shaji, Scientist 'B' carried out Reappraisal hydrogeological survey during 2002 – 03 and 2005-06. Micro level study was carried out in Chittur block for identifying the fluoride in groundwater during 2002-03. Peizometer construction is being carried out in over exploited and industrial belts of the district during the current FSP. Mass awareness and groundwater management trainings were organized at Palghat and Chittur blocks during 1999, 2002, and 2005. Pamphlets depicting groundwater scenario of the district were distributed to the public during each function.

### 1.2 Drainage and Irrigation

The district is drained mainly by two rivers, viz Bharathapuzha and Bhavani rivers. Of these Bhavani is east flowing and form a tributary of the Cauvery river. Bharathapuzha basin can be divided into 50 watersheds and 290 mini watersheds. Soil erosion is more in the upstream parts of the basin. Dendritic is the common drainage pattern. The 75 % of the population is depending on surface water resources for their irrigation needs, mainly from Bharathapuzha, its tributaries and other water bodies. There are 12 reservoirs in the district associated with two major rivers and its tributaries viz - Parambikulam, Peruvaripallam, Thoonakadavu, Chulliyar, Pothundi, Moolathara, Meenkara, Walayar, Malampuzha, Gayathri, Kanjirapuzha and Mankulam.

There are number of irrigation projects both major and minor, existing in the district. The major projects are Malampuzha, Chittoorpuzha, Kuriar Kutty, Karapara, Kanjirapuzha and Attappady Valley Irrigation Project.

The major irrigation schemes are irrigating about 90,000 hectare of land and minor schemes irrigating about 2000 hectares of land. The main crops grown under the irrigation scheme are paddy, coconut, aracanut, plantain, grams, vegetables etc.

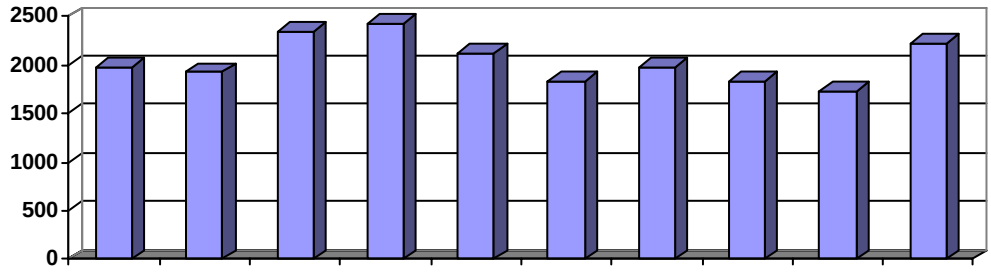
The Shiruvani dam constructed across the river Shiruvani, a tributary of Bhavani is the source of drinking water for the Coimbatore urban population.

## 2.0 RAINFALL AND CLIMATE

Based on Thornthwaite's climatic classifications the district experiences humid type of climate. The district receives maximum rainfall during the south west monsoon followed by the north east monsoon. The other months receive considerably less rainfall. The temperature is pleasant from December to February. The annual rainfall varies from 1757.6 to 2849.5 mm based on long term normal .The district receives on an average 2348 mm of rainfall annually. Major rainfall is received during June to September in the southwest monsoon (71%). The northeast monsoon contributes about 18%. The western part of the district around Mannarghat receives the maximum rainfall (2849 mm) whereas in the rain shadow area of Chittur in the eastern part receives the minimum rainfall (1758 mm). The last 10 years of data is presented below and in Figure 2.

| Year | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 |
|---|---|---|---|---|---|---|---|---|---|---|
| Rainfall( mm) | 1977 | 1925 | 2349 | 2422 | 1831 | 1970 | 1833 | 1728 | 1631 | 2221 |

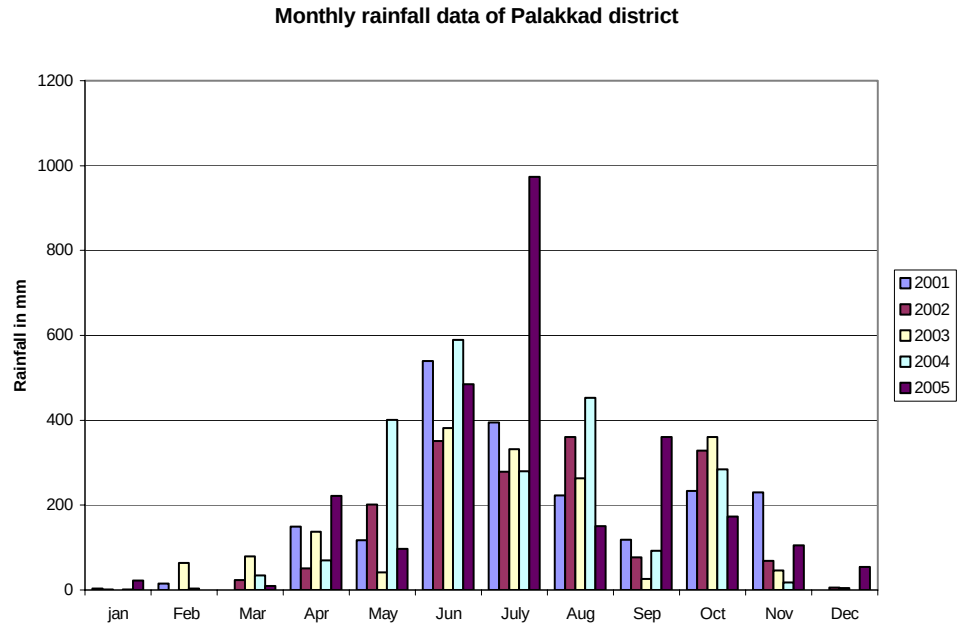
**Figure 2: Rainfall variations (1996-2005)**




The monthly rainfall data (2001-2005) is given below and in Figure 2 (a).

| Year | Rainfall Data | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Jan | Feb | March | April | May | June | July | Aug | Sep | Oct | Nov | Dec |
| 2001 | 3 | 16 | 0 | 150 | 117 | 539 | 395 | 223 | 119 | 234 | 230 | 0 |
| 2002 | 1 | 0 | 24 | 51 | 201 | 351 | 279 | 361 | 77 | 328 | 69 | 6 |
| 2003 | 0 | 64 | 80 | 137 | 42 | 382 | 332 | 263 | 26 | 360 | 46 | 5 |
| 2004 | 1 | 3 | 34 | 70 | 401 | 589 | 280 | 453 | 93 | 285 | 18 | 0 |
| 2005 | 22 | 0 | 10 | 222 | 97 | 485 | 973 | 151 | 360 | 173 | 105 | 55 |

Figure 2(a)




During 1999 the district received only 2422 (mm), 2000 -1831(mm), 2001-1970 (mm), 2002-1833 (mm), 2003-1728(mm) and 2004-1631 of rainfall. This continuous five year deficient rainfall has contributed a lot in crop failures and to reduce the groundwater recharge as well as water level decline, especially in Chittur and Kollenkode blocks.

At Palakkad the maximum temperature ranges from 28.1 to $37.4^0$C whereas the minimum temperature ranges from 22.2 to $25.3^0$C. The average annual maximum temperature is $32.3^0$C and the average annual minimum temperature is $23.4^0$. The wind is predominantly from west and east during morning as well as in the evening hours. The wind speed is high during August (13.6 kmph). The humidity is higher during the monsoon period i.e. from June to September. It is around 90% during this period. All through the year, the humidity is high during the morning hours.

## 3.0 GEOMORPHOLOGY AND SOIL

Physiographically the district can be divided into two parts viz, the high land and mid land. Ottapalam taluk lies completely in the mid land region whereas all other taluks lie both in midland and high land regions. The district is not blessed with coastal tract and natural lakes. The elevation of the landforms varies from 20 to 2386 m amsl.

The most important physiographic feature of the district is the Palakkad gap. The train and road link between Kerala and rest of the country mainly passes through the 32 - 40 km wide gap. The important peaks are Anginda (2386 m), Padagiri (1585 m) and Karimala Gopuram (1440 m).

Table 3.1: Terrain units in Palakkad District Area %

| | |
|---|---|
| Low lying terrain including flood plain and terrace | 27 |
| Moderately undulating mid land terrain with flood plain | 26 |
| Highly undulating terrain | 12 |
| Hilly area including scrap slope | 35 |

The highlands of Bhavani basin are occasionally devoid of thick forest unlike those of Ponnani basin, which is marked, by dense forest, the silent valley.

### 3.1 Soil types

There are four types of soil

(1) Laterite soil
(2) Virgin forest soil
(3) Black cotton soil
(4) Alluvial soil

(1) Laterite soil - Seen in major part of Ottappalam, Alathur, Chittur and Palakkad taluks. These are most predominant soil type in the midland and gap areas. Laterites on high grounds are more compact when compared to the low lying areas.

(2) Virgin Forest Soil - Seen in Manarkad taluk and in forest areas. They are rich in humus and organic matter.

(3) Black Cotton Soil - Seen in Chittur and Attapady Valley of the Mannarkad Taluk, which is used for the cultivation of cotton. They exhibit mud cracks and have high water retaining power.

(4) Alluvial soils are found along the banks of Bharathapuzha and its tributaries. In the Valley portion Valley fill deposits composed by talus and scree material are observed.

## 4.0 GROUNDWATER SCENARIO

Palakkad district is underlain by rocks of Archaean metamorphic complex. They include the granulite group, the gneisses and the schists above which laterite and alluvium are observed. Intrusives of pegmatites and quartz veins are also common in the northeastern parts of the district.

Groundwater occurs in all the geological formation from Archaean crystalline (hard rock) to Recent alluvium (soft rock). Groundwater occurs in phreatic condition in the laterite, alluvium and weathered crystallines. It is in semi confined to confined condition in the deep fractured rocks.

### 4.1 Hydrogeology

The entire district can be divided into three units based on hydrogeological information.

1) Valley fills/Alluvium 2) Laterite terrain 3) Crystallines.

Valley fills are noticed along the valley portion and along the river terraces/banks (near Ottapalam, Pattambi area) and are shown in the hydrogeological map. These are mainly seen in Mannarghat, Ottapalam and Pattambi, Trithala blocks. The water level ranges from 2- 12 m bgl (premonsoon) and 1- 6 m bgl (post monsoon). The fluctuation is generally high up to 5 m. The yield of dug well ranges from 5 to 20 $m^3$/ day.

The laterite province is limited in extent, noticed in Trithala Ottapalam and Pattambi blocks. The water level ranges from 4 to 11.0 mbgl during pre monsoon and post monsoon water level ranges from 3 to 8 m mbgl. The fluctuation between pre and post monsoon varies between 2 to 6 m. The yield ranges from 5 to 30 $m^3$/ day. In these areas the extraction is less. The specific capacity ranges from 10- 125 l/min/mdd.

The hard rock province covers 80 % of the area. This province can be divided into further zones based on weathering characteristics. The blocks covered under crystallines are Chittur, Kollenkodu, Nenmara, Palghat, Attapady, Sreekrishnapuram, Alathur, Kuzhalmannam, and Mannarghat.

Overall groundwater regime is shown in the hydrogeological map of the district. In the northern part of the area, the high land region (Attapady block), groundwater occurs in

semi confined to unconfined condition in the crystalline rocks. The depth of the water level ranges from 5 to10 m bgl. In these areas (Zone A) borewells are feasible along the fractures/lineaments (Figure-3). Exploratory studies of CGWB have revealed that the yield of bore wells ranges from 0.5 to 19 lps. Restricted development through bore well is possible in this area. The depth of weathering is more in the area and ranges from10 to 23 m bgl. Hence proper casing is required for bore wells. Dug wells are feasible along the valley portions and adjoining rivers/ river lets. The yield varies from 5 to 25 $m^3$/ day. In this zone the fractures are encountered above 170m. In very few areas it is below 150 m. Hence the depth of bore wells can be restricted to 200m (Annexure 2).

Along the middle portion (Zone B) of the district which includes the Palakkad gap ( Malampuzha, Palghat, KuzhalMannom blocks etc), the thickness of weathering is more. The thickness of weathering is more than 10 m. The major hard rock aquifer is hornblende biotite gneiss and khondalite. The yield ranges from 2 to 30 lps. The water level in bore wells of the region is going down considerably. For example the Bore well constructed at Velamthavalam during 1990 recorded a static water level of 3.89 m bgl and the water level in the bore well drilled close by during 2002 is 64.40 m bgl. The yield of bore well in this zone is site specific. Along the E-W and NW-SE fractures, the bore wells are better yielding. Scientific site location is required in the region before constructing bore wells. Common abstraction structures feasible in the area are dug well, dug cum bore well and bore well. The yielding fracture zones, in general, are encountered generally within 125m and in exceptional cases up to 175m. Now the farmers are constructing bore wells having a depth of more than 300m. In general high yielding fractures are rare beyond a depth of 200m. Hence farmers need not go beyond 200 m depth for their bore wells. The dug well yield ranges from 5 to 30 $m^3$/ day. But most of the dug wells are getting dry during summer season.

In the eastern parts of the district, ie Chittur and Kollenkode blocks, the weathered thickness is less than 10 m (Zone C), and the topsoil thickness is also less. The exploration of CGWB has revealed that the bore wells can yield up to 24 lps. The well drilled at Nellipallam yielded 24 lps and the fracture encountered at 108 m bgl. The major fracture in the E-W direction is highly yielding. The high yielding fractures are getting recharge from

a distant source. The piezometers constructed in Chitur blocks yielded more than 16 lps and the fractures were encountered at depth of 80 to 100 m. In general high yielding fractures are encountered between 80 and 130 m bgl. The yield varies from place to place. Hence detailed geophysical investigation is required in this area for site selection of bore wells. Here also farmers are drilling deep bore wells having depth of more than 200m. The maximum recommended depth of bore well is 200m. The main feature noticed in the area is overdraft of groundwater. This area is a rain shadow region compared to the rest of the region due to which groundwater recharge is comparatively less. This is a potential zone for bore well. The industrial draft and irrigation draft through borewells is more. Most of the borewells are in the private sector.

Here also farmers are constructing borewells without any norms/permission. Hence the actual information on the structures is not available. In this zone the quality of the groundwater is also poor in some pockets. Areas like Nedupeni, Kuduvayoor and Kozhinjampara, Gopalapuram inland salinity is observed within the phreatic zone. Fluoride content is more in groundwater samples of both bore wells and dug wells in Chittoor and Attapadi blocks. The highest fluoride content up to 5.74 ppm is reported from Kopanur area. The other places affected are Kozhinjampara, Eruthenpathi, Chinnammolathara, RVP Pudur and Chittur town. Taking into account of all these factors, further groundwater development is not recommended in the zone.

The pre to post monsoon (April – Nov 2006) fluctuation in the district varies from place to place. The fluctuation varies from 2 to 6 m bgl and the maximum fluctuation is noticed in the eastern part of the district. In the central and western part the fluctuation ranges from 2- 4 m. Long term trend of premonsoon and post monsoon water level, between 1996 and 2006 is analysed. In the eastern side of the district around Chittor, Gopalapuram, Kozhinjampara area ( Chittur block), the water levels are declining at the rate 0.4 m per year. Rest of the areas, the water level decline is less and is in the range of 0.2 to 0.3m per year. Rising trend is reported in the central western part of the district. The depth to water level maps (pre and post monsoons) and fluctuation map are shown in

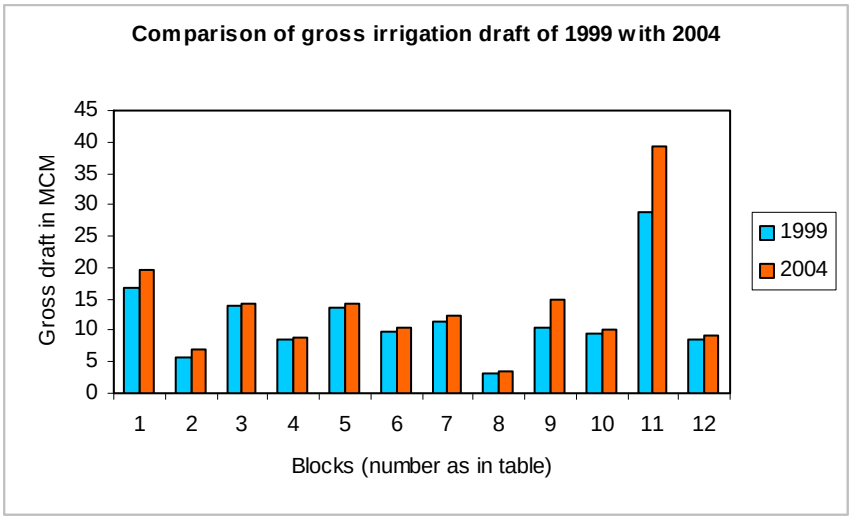
Figures 4, 5 and 6 respectively. Hydrographs are shown in Figure 6(a) and the long term trend is shown in figure 6 (b)

### 4.2 Groundwater resources

The groundwater assessment was done block wise using GEC-1997 methodology and is computed based on the data as on March 2004.

**Table 1: Comparison of gross draft for all uses of 1999 with 2004**

| Sl. No | Name of Blocks | Net annual Ground water Availability (MCM) | Existing gross ground water draft for irrigation (MCM) | | Existing gross ground water draft for domestic & industrial works supply (MCM) | | Existing gross ground water draft for all uses (MCM) | |
|---|---|---|---|---|---|---|---|---|
| | | | As on 31.03.99 | As on 31.03.04 | As on 31.03.99 | As on 31.03.04 | As on 31.03.99 | As on 31.03.04 |
| 1 | Kollengode | 76.23 | 16.81 | 19.67 | 8.52 | 4.66 | 25.33 | 24.33 |
| 2 | Nenmara | 37.91 | 5.81 | 7.03 | 2.73 | 5.11 | 8.54 | 12.14 |
| 3 | Thrithala | 28.12 | 13.81 | 14.24 | 6.67 | 6.88 | 20.48 | 21.12 |
| 4 | Otttappalam | 30.47 | 8.47 | 9.03 | 5.102 | 5.25 | 13.58 | 14.28 |
| 5 | Alathur | 113.57 | 13.68 | 14.38 | 10.65 | 9.56 | 24.33 | 23.94 |
| 6 | Pattambi | 35.37 | 9.67 | 10.31 | 9.44 | 10.03 | 19.12 | 20.34 |
| 7 | Palakkad | 102.15 | 11.46 | 12.5 | 25.76 | 30.80 | 37.22 | 43.30 |
| 8 | Attappadi | 54.03 | 3.25 | 3.5 | 2.52 | 2.49 | 5.77 | 5.99 |
| 9 | Kuzhalmannam | 105.09 | 10.51 | 14.8 | 53.3 | 50.84 | 63.81 | 65.64 |
| 10 | Mannarghat | 60.79 | 9.6 | 10.11 | 8.18 | 10.88 | 17.79 | 20.99 |
| 11 | Chittur | 66.73 | 28.83 | 39.38 | 21.09 | 21.16 | 49.92 | 60.54 |
| 12 | Sreekrishnapuram | 39.87 | 8.54 | 9.06 | 5.88 | 6.08 | 14.42 | 15.14 |
| | Total | 750.33 | 140.44 | 164.01 | 159.842 | 163.74 | 300.31 | 327.75 |




The draft Figures are increased considerably in Chittur, Palghat and Thrithala blocks.

**Table 2: Categorisation for groundwater development as on 31st March, 2004 and the details**

| Sl. No | Block | Stage of GW Development | Is there a significant decline of premonsoon water Table levels | Is there a significant decline of post monsoon water Table levels | Categorization for future GW development | Remarks |
|---|---|---|---|---|---|---|
| 1 | Kollengode | 31.91 | Yes | Yes | Critical | Sharp decline in water level |
| 2 | Nenmara | 32.02 | No | No | Safe | |
| 3 | Thritala | 75.11 | Yes | Yes | Critical | |
| 4 | Ottapalam | 46.87 | No | No | Safe | |
| 5 | Alathur | 21.07 | No | No | Safe | |
| 6 | Patambi | 57.51 | Yes | Yes | Safe | |
| 7 | Palakkad | 42.40 | No | Yes | Critical | |
| 8 | Attapadi | 11.08 | Yes | Yes | Semi critical | Sharp decline in water level |
| 9 | Kuzhalmannam | 62.45 | Yes | No | Safe | |
| 10 | Mannarghat | 34.52 | Yes | Yes | Safe | |
| 11 | **Chittur** | **90.71** | **Yes** | **Yes** | **Over exploited** | **Sharp decline in water level** |
| 12 | Sreekrishnapuram | 37.96 | Yes | Yes | Semi critical | Sharp decline in water level |

During the earlier computation as on 1999 data all the blocks were under safe category. But the 2004 computations indicate that two blocks fall in semi critical ,three in critical and one under over exploited Category (Fig. 7)

### 4.3 Groundwater Quality

Based on the chemical analyses it is inferred that the quality of the groundwater in shallow aquifer is in general good (Annexure 3). However certain pockets are showing some quality deterioration especially eastern part of Palghat district where fluoride content is slightly high (Fig. 8).

The dug wells are showing fluoride in the range of 1 - 5.75 ppm. The higher values recorded from Kopanur (5 .75 ppm). The bore wells are showing high concentration of fluoride, ranges from 0.3 to 3.12 ppm. The highest concentration is reported from Chinnamoolathara (EW of CGWB).

The water supply bore well of Eruthanpathy is also showing 1.76 ppm of fluoride. The fluoride content can be brought down to permissible limits by mixing with KWA pipe water supply. Inland salinity is noticed from Kadumthuruthi (Yakkara) and Kuduvayoor area. About 1 sq km area is affected in both the areas. The dug wells in the Kadumthuruthi colony (about 40 numbers) area showing high EC (Electrical Conductivity) values in the range of 2000 - 6700 microseimens/cm at $25^0$ C. In the Kuduvayoor area about 25 dug wells are showing high EC values of 756 - 7200 micro seimens/cm at $25^0$ C.

Based on Wilcox classification the 40 samples were categorized for irrigation suitability. The data is presented in the following Table.

**Table 3: Categorisation for Irrigation Suitability**

| Classification of Irrigation waters | EC range in µs/cm at $25^0$ C | Number of samples | % |
|---|---|---|---|
| Excellent | < 250 | 11 | 27 |
| Good | 250 - 750 | 12 | 30 |
| Permissible | 750 - 2000 | 15 | 38 |
| Doubtful | 2000 - 3000 | 0 | 0 |
| Unsuitable | > 3000 | 2 | 5 |

It is found that almost all samples are suitable for irrigation except two samples (The places are Koduvayoor and Kadumthuruthi). The quality deterioration is due to inland salinity in these areas. These finding are based on the Reappraisal survey carried out by CGWB during 2002-03.

### 4.4 Status of groundwater development

The stage of groundwater development in the district during 2004 is 43.67 % leaving scope for future development. But there is a spurt in the development over the last 5 years (ie the development was 39 % during 1999). During the earlier computation based on 1999 data all the blocks were under safe category. But the 2004 computations indicate that two blocks are semi critical ,three blocks critical and one block under over exploited. The groundwater development in the Chittur block found to be more.

During 2002-2004 this block was declared as drought affected. Hence future development may be restricted in this block. Groundwater based multinational companies are operating in this district compared to other districts of the State. Proper care should be taken before sanctioning any schemes in the district as a whole and especially in Chittur and Thrithala blocks large scale development shall be restricted. Since number of

abstraction structures including private bore wells is on the increasing trend without any proper record, proper census of the abstraction structures is necessary for recommending new structures for future development.

There are about four urban water supply schemes and 154 rural water supply schemes available in the district. In addition about 1250 bore wells are operating which were drilled under Technology Mission. Majority of the water supply schemes are maintained by Kerala Water Authority and local bodies. About 52% of the population is getting water from these water supply schemes. But water supply schemes are not equally distributed on all parts of district and all are not need based. Most of the rural water supply schemes use groundwater as the source whereas the urban schemes depend on surface water or both. Rest of the population (48%) is depending on groundwater by their own dug wells and bore wells. In this district 10971 public taps and 37276 domestic connections are supplying water to people as per the 1998 statistics.

Groundwater is used for irrigation through dug wells, dug-cum bore wells and bore wells. The dug wells located along the valleys of midland and hilly area and the bore wells located along the fractures and lineaments are yielding more water during summer months. Coconut, banana, sugarcane and vegetables are being irrigated using groundwater during summer months. About 40 companies are operating in Kanjikode and Chittur area, which are extracting groundwater heavily for industrial needs. Hence this district records highest industrial and irrigation draft in the State.

Cost of construction of an open well in the alluvial area with pump sets comes to Rs. 20,000 to 25,000 and the same in the laterite area is around Rs. 20,000 to 25,000. A bore well with pump set will cost around Rs. 40,000 to 50,000. The financial requirement was worked out considering the above unit cost, the geology and physiographic features.

Recently there is a tendency for the farmers to go in for bore wells in place of dug wells. Due to this the thickness of the unsaturated zone has increased.

Based on the studies the following areas are identified as water scarce areas and these areas need special attention.

**Table 4: Water Scarce Areas**

| No | Block | Areas/Villages |
|---|---|---|
| 1 | Palakkad | Mundoor, Keralasseri, Kongad panchayaths |
| 2 | Mannarkkad | Alanallur (part) Thachampara (part) Chellathur in Thachanattukara, |
| 3 | Attapady | Agali, Puthoor, Sholayar |
| 4 | Alathur | Kannambra Part of Alathur |
| 5 | Thrithala | Kappur, Anakara, Thithala |
| 6 | Pattambi | Koppam, Vallappuzha |
| 7 | Ottapalam | Chathuvatta, Lakkidi part , Vaniyamkulam (Part) |
| 8 | Kollengode | Vadavannur , Elavncheri |
| 9 | Chittur | Vadakarapathi, Eruthenpathi, Perumatti and Moolathara |
| 10 | Sreekrishnapuram | Pookottukavu, Srerkrishnapuram |
| 11 | Nenmara | Ayilur (part) |
| 12 | Kuzhalmannam | Kuannathur, Thenkurisi (part) |

## 5.0 GROUNDWATER MANAGEMENT STRATEGY

Groundwater in the district is mostly developed through dug wells and bore wells for domestic, agricultural and for industrial needs. A good percentage of the households in the district have their own drinking water wells. Recently the bore well culture has picked up and gained momentum in the district. In the crystalline terrain the groundwater is developed through dug wells, dug cum bore wells and bore wells. Along the valley fills and laterite terrain groundwater is developed through dug wells.

Groundwater development and management should be coupled with rainwater and surface water. More stress should be given for watershed management which will help in conserving the groundwater and supplementing the recharge.

The existing water resources and dug wells, ponds, streams, should be cleaned, protected and conserved. Rainwater harvesting and artificial recharge schemes should be practiced in the district. Conjunctive use of surface and groundwater shall be practiced effectively.

In Thachampara panchayath there are plenty of springs (locally known as cholas) especially at Vakottu mala and Irumbumutty mala areas. These have not been developed so far effectively. These are the perennial source for drinking water schemes. Attention may be given to these cholas. Meenvallam and Alta waterfalls can also be used effectively for the drinking water supply schemes. This will reduce the stress on groundwater in the district directly. In situ collection of rainwater coupled with artificial recharge to groundwater can be practiced in the mid land regions.

There should be proper water budgeting in the district. There are plenty of minor irrigation and water supply schemes in the district, which require maintenance and attention. Priority should be given to small-scale water supply projects.

Mass awareness programmes should be organised in Panchayath level to make awareness among people about the importance of conservation of this precious resource, especially in Chittur, Palakkad, Thrithala and Kollenkode blocks. Stress should be given for integrated water shed management and conjunctive use in the district. A comprehensive artificial recharge report has to be prepared for this district for a better water management.

**5.1 Groundwater Development**

The number of groundwater abstraction structures that can be constructed for 70% development of the resource is expected to be around 26,700 and for 90% development about 34300 structures can be constructed. However, no abstraction structures are recommended in the district without a feasibility study, as most of the blocks are showing decline trend in water levels. The census figures presently available about the abstraction structures are not matching with the ground reality. In Chittur block the wells are getting

dry during summer season. Any sort of abstraction structures should be constructed with proper site selection and technical support from CGWB and GWD or reputed agencies.

Indiscriminate construction of bore wells in private sector is common in the district especially in the Chittur block both for industrial and irrigation purposes. Hence 100% well census data is a must for computation of the actual draft and also to arrive at. Since there is spurt in the groundwater development in the district over the last 5 years the recommendation for groundwater abstraction shall be restricted or controlled. Actual remedial measures can only be taken up in a practical manner as soon as the well census data is obtained which may help in computing the actual draft.

**5.2 Water conservation and Artificial Recharge**

Groundwater development should be coupled with management of rainwater harvesting and surface water. More stress should be given for watershed development through which better groundwater management can be achieved. The existing water resources and dug wells, ponds, streams, should be cleaned, protected and conserved. Rainwater harvesting and artificial recharge schemes should be practiced in the district.

It has also been observed that the existing surface water structures like ponds, tanks and cultivable land, irrigated canal are being encroached for settlement purposes which reduce natural recharge. CGWB has implemented a number of artificial recharge and rainwater harvesting schemes in the district. They are

| S.No. | Location | Year | Structure |
|---|---|---|---|
| 1. | Anangadi | 1979 | Sub-surface Dam |
| 2. | Bavaji Nagar | 1998 | Sub-surface Dam |
| 3. | Allanallur | 1998 | Sub-surface Dam |
| 4. | Komauttichella | 2003 | Sub-surface Dam |
| 5. | Chunnambukalthodu | 2003 | Check Dam |

These schemes are successful and are very much useful for the district. The farmers are being benefited by the schemes. The subsurface dyke constructed at Bavaji Nagar received wide appreciation. The agricultural production on the upstream side has increased. The dug well near by the structure maintained higher water level during summer season and yielded more water.

There is abundant water Resource in the district, to meet the requirement of the farmers. But the resources have to use judiciously and sustainably. Most of the panchayat wells in the district are having sufficient water. But these wells are not in use but for waste dumping. 1000 wells can be desilted and cleaned and protected as a first stage in Chittur and Kollengode blocks. These wells can be fitted with pump sets and used for community level. There are plenty of ponds/tanks having sufficient water, but most of them are silted and with collapsed side walls. These tanks have to be renovated and can be used for irrigation propose. These tanks can be effectively used for water storage from canals intermittently. In Thachampara panchayat of Mannarkad block there are plenty of springs locally known as cholas, especially at Vakott Mala and Irumbumutti mala area. These springs have not seen developed so far. Meenavallam and Alta water falls can be used for major schemes. This will reduce stress on ground water development in the district.

A comprehensive plan for suitable abstraction structures and AR schemes are very much essential in the district. Since the yield of the bore well is site specific, the farmers has to take technical support from CGWB/GWD or reputed NGO's before putting bore wells for irrigation purposes. However domestic wells can be constructed without much technical guidance. A data bank has to be maintained in CGWB which has to be disseminated to the farmers through GWD/NGOs or panchayats.

There are about 13 blocks and 90 panchayats in the districts. All these panchayats need a separate plan for AR schemes. As it involved money and time priority and action plan has to fix for implementation. Initially Chittur, Kollamkode, Palghat (Malampuzha), Tritalala, Attapady block are to be considered for the AR schemes implementation. In Chittur block 6 panchayats needs, 8 sub surface dykes and 12 bore well recharge schemes (using Bore well only) . 2 ponds from each panchayat have to desilted and cleaned. And also roof for rain water harvesting is to be implemented wherever fluoride is higher than the permissible limit in two panchayats.

In Kollenkode block, 5 panchayats need AR schemes separately. 5 sub surface dykes and 10 ponds from each panchayats have to be cleaned and resulted and 6 roof top harvesting with recharge facilities are suggested. 4 Bore well recharge scheme is required.

In Palghat and Malampuzha block, gully plugging is required, and 50 rain pits/trenches are required in the area since the weathered thickness is more.

In Attapady block 6 numbers of gully plug and 3 sub surface dykes are required. Trithala Block, Two sub surface dyke and 4 rain water harvesting schemes required. Sand mining and water level decline has to be checked. Roof top Rain water harvesting with recharges facility is required in all blocks. No additional structures are recommended in the district. Though majority of the block are safe, a declining trend in water level trend is noticed. Most of the ground water is going as base flow.

Block wise artificial Recharge Schemes proposed for the district for immediate implementation are given below

**Table 5: Artificial Recharge Scheme Proposal (Figure 9)**

| S.No. | Block | Panchayat | Artificial Recharge Schemes | | | | | Approximate cost |
|---|---|---|---|---|---|---|---|---|
| | | | SSD | GP | BWR | Ponds/Tank | RWH | |
| 1 | Chittur (B in Fig. 9) | Eruthenpathy | 2 | | 2 | 2 | 2 | Sub surface dyke- unit cost 5 lakhs |
| | | Kozhinjampara | 1 | | 2 | 2 | 2 | |
| | | Nellipally | 1 | | 2 | 2 | | |
| | | Pattenchery | 1 | | 2 | 2 | | |
| | | Perumatty | 1 | | 2 | 2 | | BWR-unit cost 2 lakhs |
| | | Vadekakapathy | 2 | | 2 | 2 | | |
| 2 | Kollenkode (E in Fig. 9) | Kollenkode | 1 | | 2 | 2 | 2 | |
| | | Koduvayoor | 1 | | | 2 | 2 | Ponds/Tank-1 lakh |
| | | Muthalamada | 1 | | 2 | 2 | 2 | |
| | | Padunagaran | 1 | | | 2 | | |
| | | Vadevannur | 1 | | | 2 | | RWH with recharge-2 lakhs |
| 3 | Attappady (C in Fig. 9) | Agali | 1 | 2 | | | 1 | |
| | | Pudoor | 1 | 2 | | | 1 | |
| | | Shalayar | 1 | 2 | | | 1 | |
| 4 | Trithala (D in Fig. 9) | Trithala | 1 | | | 2 | 2 | Gully plug-3 lakhs each |
| | | Chalusseri | 1 | | | 2 | 2 | |
| 5 | Palghat (including Malampuzha) (A in Fig. 9) | Kudumba | | | | 2 | 2 | |
| | | Mondur | | | | 2 | 2 | |
| | | Malampuzha | | | | 2 | | |
| | | Puthussery | | | | 2 | 2 | |
| | | Elapully | | | | 2 | 2 | |
| | | Akathethara | | | | 2 | 2 | |

SSD - Sub surface dyke
GP - Gulley Plugging
BWR -Bore well recharge
Ponds/Tank- Desilting and renovation of tanks and ponds
RWH - Roof Top Rainwater Harvesting with Recharge

In Chittur and eastern blocks, farmers can practice bore well recharge and rainwater harvesting, for which incentives can be given to farmers. Bore well recharging has to practiced in the Chittur block and Kollenkodu blocks since the aquifer can take water even during rainy season. The canal water may be diverted to the near by ponds and tanks for groundwater recharge. The roof water also can be diverted to the existing bore wells. There are plenty of dry bore well in the Chittur block, which can be used for recharging.

## 6.0 GROUNDWATER RELATED ISSUES AND PROBLEMS

Certain pockets in the eastern parts are showing some quality deterioration especially eastern part of Palghat district where fluoride content is slightly high .The dug wells are showing fluoride in the range of 1 - 5.75 ppm. The higher values recorded from Kopanur (5 .75 ppm). The bore wells are showing high concentration of fluoride, ranges from 0.3 to 3.12 ppm. The highest concentration is reported from Chinnamoolathara (EW of CGWB). The water supply bore well of Eruthanpathy is also showing 1.76 ppm of fluoride. The fluoride content can be brought down to permissible limits by mixing with KWA pipe water supply. Inland salinity is noticed from Kadumthuruthi (Yakkara) and Kuduvayoor area. About 1 sq km area is affected in both the areas. The dug wells in the Kadumthuruthi colony (about 40 numbers) area showing high EC (Electrical Conductivity) values in the range of 2000 - 6700 microseimens/cm at $25^0$ C. In the Kuduvayoor area about 25 dug wells are showing high EC values of 756 - 7200 micro seimens/cm at $25^0$ C.

The Coco Cola factory which is extracting groundwater for its products was operating in the Chittur Block and has invited agitation in a big way. The company is presently non operational. Pepsi ltd Company is operating in the industrial belt of Malampuzha block which is also extracting groundwater for its product.

## 7.0 AWARENESS & TRAINING ACTIVITY

In addition to the normal activities of CGWB, more thrust was given to Mass Awareness to educate people about the need to conserve and protect the precious groundwater resources. Such programmes where being conducted from1996 onwards. In addition to this, CGWB started imparting training on Rain Water Harvesting and artificial recharge to groundwater resources for the public. Mass awareness progarmmes were conducted during 2000, 2003 and 2005. During the period April 2006 – March 2007 one training programme and one mass awareness programmes (MAP) were conducted in Palaghat district. To impart training on rainwater harvesting, especially the water scares and problematic areas have been selected. The training programmes have been found very useful by the participants as was evident by the number of queries and discussions that followed the lectures. These Mass Awareness and Training Programmes were very helpful in making the public conscious of the importance of the groundwater – to keep it safe from pollution, to conserve it and recharge and not to waste it. A lot of people are approaching the office for follow up action. Wide media coverage has been witnessed for the various training programmes.

## 8.0 NOTIFICATIONS BY CGWA/SGWA

Chittur block of Palghat is district notified by CGWA and SGWA for registration of abstraction structures and further restriction since the block is categorized as over exploited.

## 9.0 RECOMMENDATIONS

1. The stage of groundwater development in the district during 2004 is 43.67 % leaving scope for future development. But care should be taken since there is a spurt in the development over the last 5 years ie the development was 39 % during 1999 presently increased to 43.67 %.
2. The groundwater development in the Chittur and Trithala blocks is found to be more. During 2002-2004 this block was declared as drought affected. The water

level in the area is also showing falling trend in both the seasons. Hence future development may be restricted in this block. Groundwater based industries are operating in this district. Care should be taken before sanctioning any schemes in the district as a whole and Chittur and Thrithala blocks in particular.

3. As number of abstraction structures including private bore wells is on the increasing trend without proper dissemination, proper census of the abstraction structures is necessary for recommending new structures for future development.
4. Groundwater development should be limited with conjunctive use of rainwater and surface water. More stress should be given for watershed development for better water management. The existing water resources, dug wells, ponds, tanks and streams, should be cleaned, protected and conserved.
5. In order to assess the groundwater of the district in realistic manner, block wise micro level study is recommended. Micro level study should cover 100% well inventory and collection of relevant data regarding draft.
6. In the inland salinity area of Koduvayoor and Kadumthuruthi, bore wells can be constructed with proper casing by blocking the top zone. Rainwater harvesting schemes can also be implemented.
7. In Thachampara panchayath, there are plenty of springs (locally known as Cholas) especially at Vakottu mala and Irumbumutty mala area. These have not been developed so far effectively. These are the perennial sources for drinking water schemes. Attention may be given to these cholas. Meenvallam and Alta waterfalls can also be used effectively for the drinking water supply schemes.
8. The depth to bore wells may be restricted to 200m only.
9. In the fluoride affected area dilution method can be practiced to reduce the fluoride level in the drinking water.
10. There should be proper water budgeting in the district. There are plenty of minor irrigation and water supply schemes in the district, which require maintenance and attention. Priority should be given to micro level water supply projects.
11. Mass awareness programmes should be organised in Panchayath level to make awareness among people about the importance of conservation of this precious

resource. Stress should be given for integrated water shed management and conjunctive use in the district.

12. A comprehensive artificial recharge and groundwater conservation report has to be prepared for this district for a better water management. Rainwater harvesting and artificial recharge schemes should be practiced in the district. In situ rainwater collection and artificial recharge to groundwater can be practiced in the mid land regions. A draft proposal is given in the report as a first step.
13. A technical data base center has to be created at CGWB Regional Office, incorporating data from GWD and other agencies. This may be disseminated to the public through local bodies and NGOs.
14. Bore well recharge is recommended in Chittur Block and other eastern blocks of the district.
15. The groundwater conservative measures, method of drilling and site selection etc are given in the text part which may be followed.

FIGURE 1

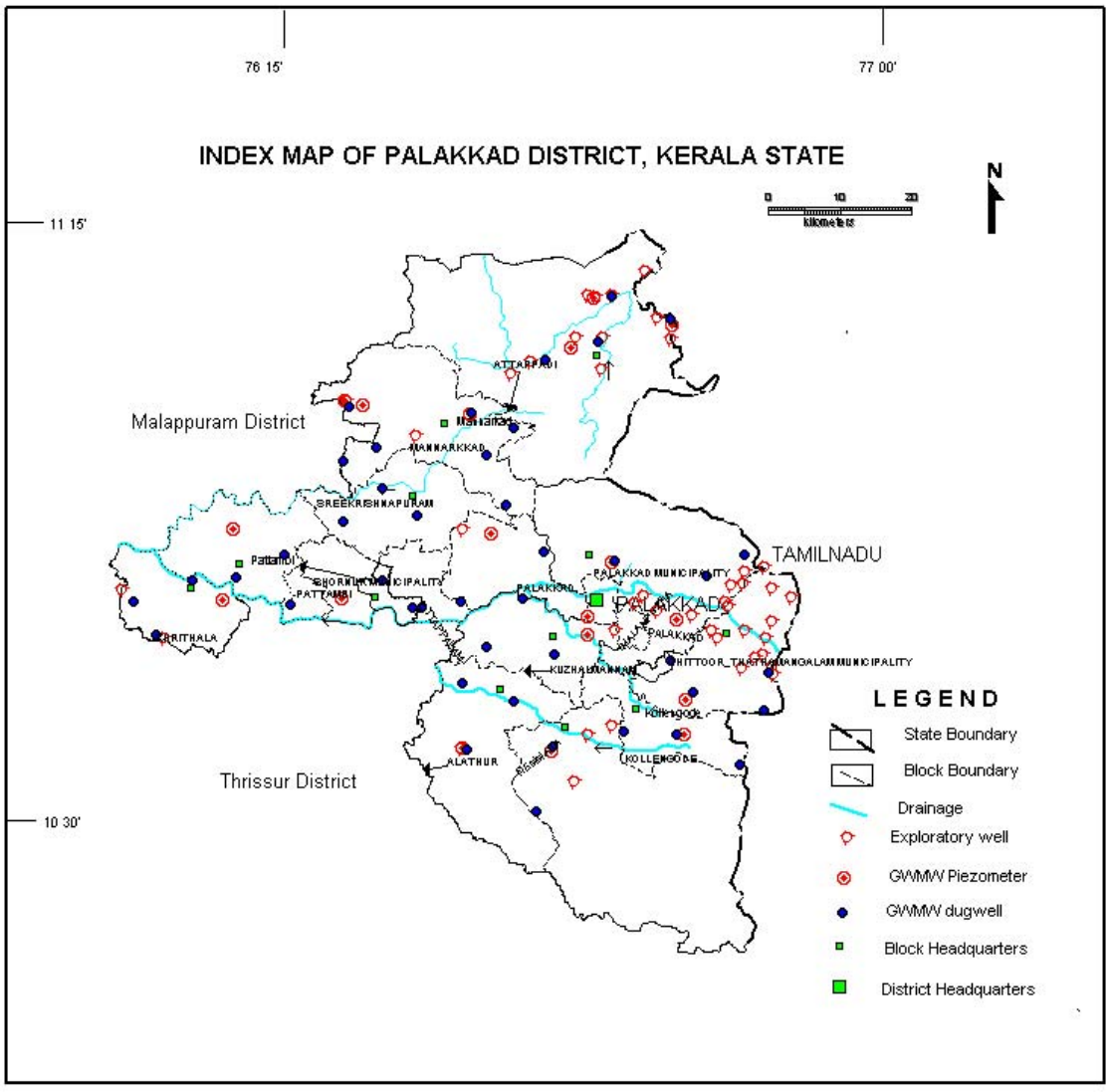
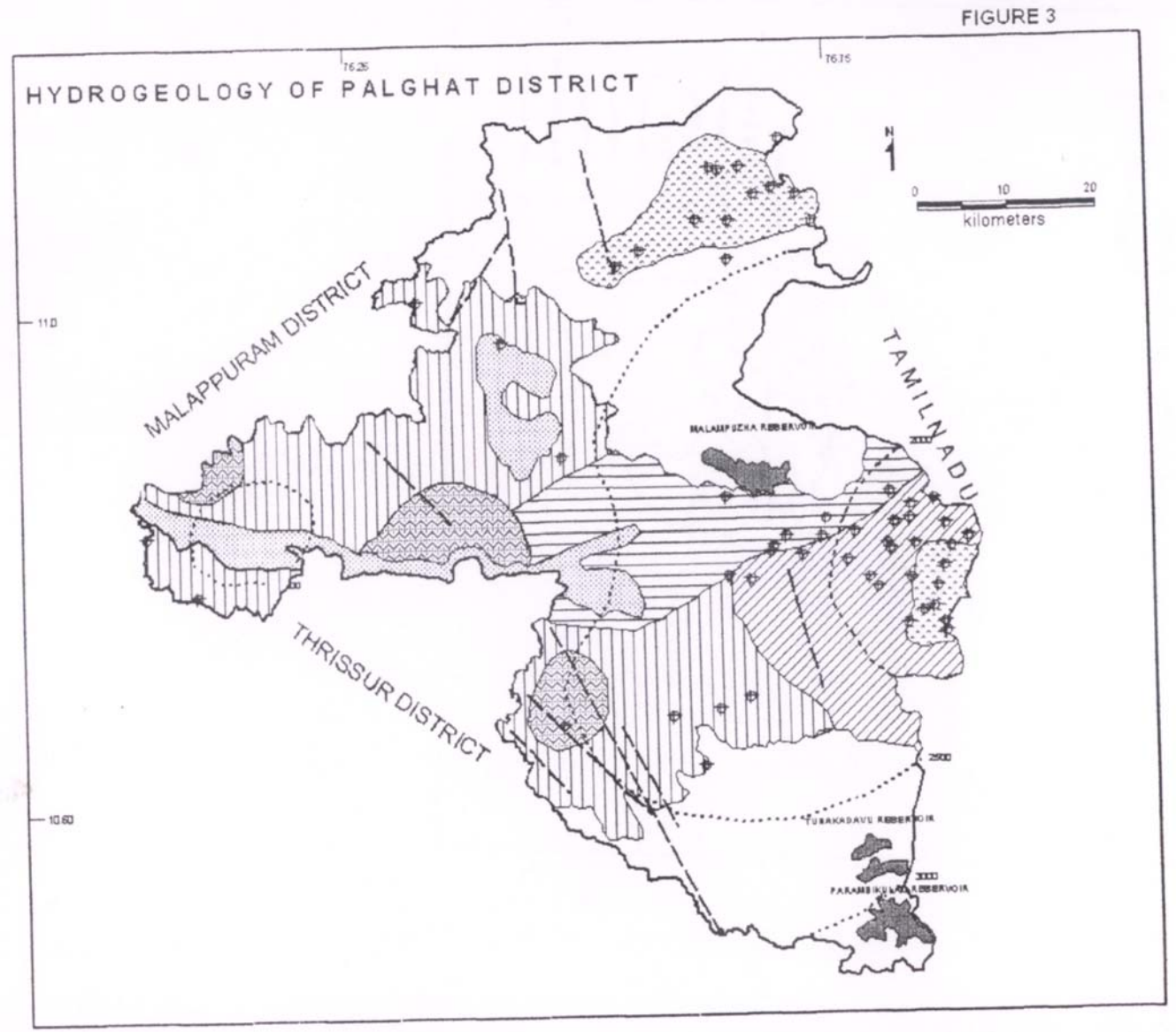

INDEX MAP OF PALAKKAD DISTRICT, KERALA STATE
76 15'
77 00'
11 15'
10 30'
N
Malappuram District
Thrissur District
TAMILNADU
PALAKKAD
ATTAPPADI
MANNARKKAD
SREEKRISHNAPURAM
Pattambi
PATTAMBI
CHORKULAM MUNICIPALITY
PALAKKAD MUNICIPALITY
PALAKKAD
KUZHALMANNAM
CHITTOOR_THATHAMANGALAM MUNICIPALITY
KOLLENGODE
ALATHUR
LEGEND
State Boundary
Block Boundary
Drainage
Exploratory well
GWMW Piezometer
GWMW dugwell
Block Headquarters
District Headquarters

FIGURE 3


HYDROGEOLOGY OF PALGHAT DISTRICT
76.25
76.15
11.0
10.60
N
1
0
10
20
kilometers
MALAPPURAM DISTRICT
TAMILNADU
THRISSUR DISTRICT
MALAMPUZHA RESERVOIR
2000
2500
3000
3000
TUNAKADAVU RESERVOIR
PARAMBIKULAM RESERVOIR

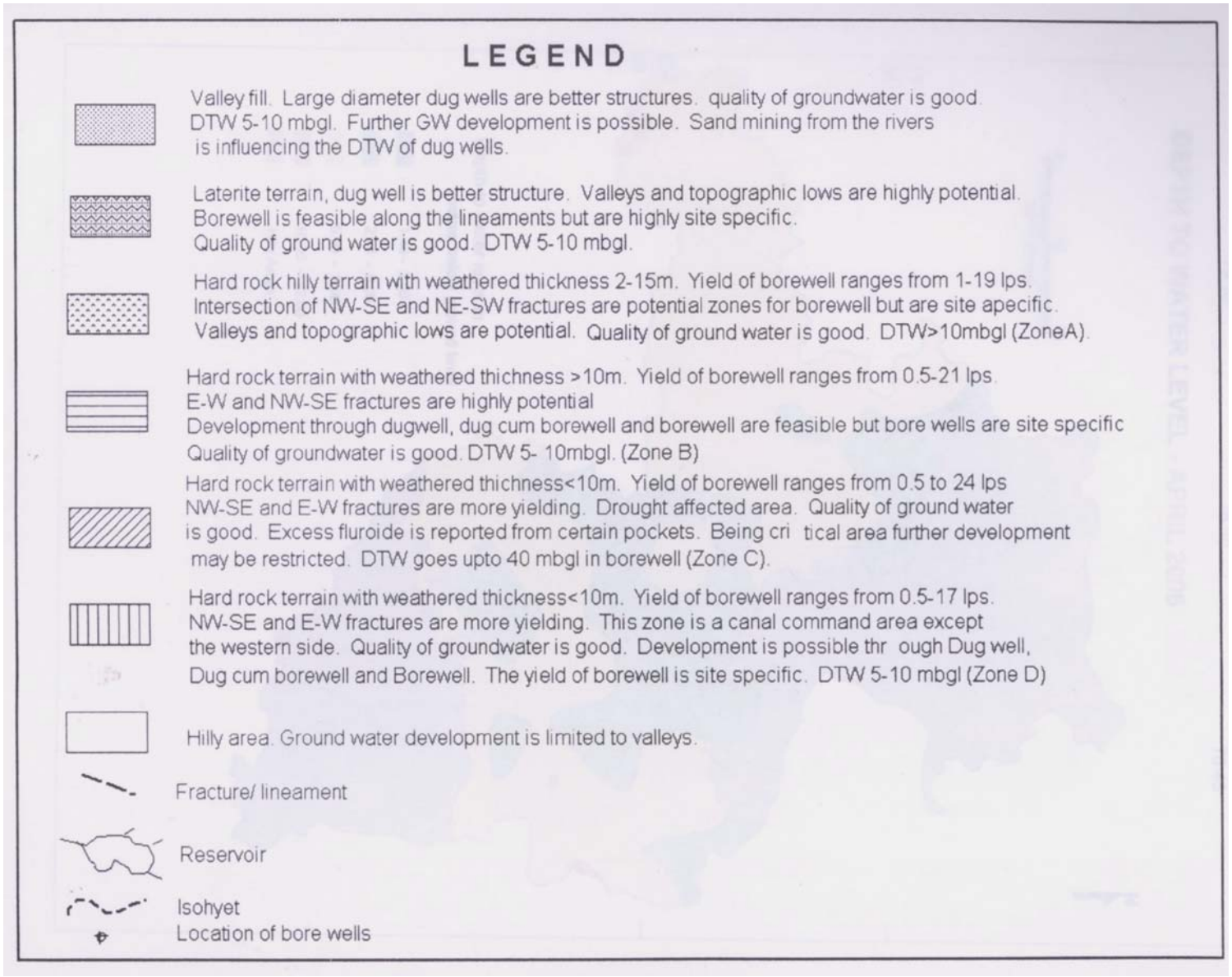

LEGEND
Valley fill. Large diameter dug wells are better structures. quality of groundwater is good. DTW 5-10 mbgl. Further GW development is possible. Sand mining from the rivers is influencing the DTW of dug wells.
Laterite terrain, dug well is better structure. Valleys and topographic lows are highly potential. Borewell is feasible along the lineaments but are highly site specific. Quality of ground water is good. DTW 5-10 mbgl.
Hard rock hilly terrain with weathered thickness 2-15m. Yield of borewell ranges from 1-19 lps. Intersection of NW-SE and NE-SW fractures are potential zones for borewell but are site apecific. Valleys and topographic lows are potential. Quality of ground water is good. DTW>10mbgl (ZoneA).
Hard rock terrain with weathered thichness >10m. Yield of borewell ranges from 0.5-21 lps. E-W and NW-SE fractures are highly potential Development through dugwell, dug cum borewell and borewell are feasible but bore wells are site specific Quality of groundwater is good. DTW 5- 10mbgl. (Zone B)
Hard rock terrain with weathered thichness<10m. Yield of borewell ranges from 0.5 to 24 lps NW-SE and E-W fractures are more yielding. Drought affected area. Quality of ground water is good. Excess fluroide is reported from certain pockets. Being cri tical area further development may be restricted. DTW goes upto 40 mbgl in borewell (Zone C).
Hard rock terrain with weathered thickness<10m. Yield of borewell ranges from 0.5-17 lps. NW-SE and E-W fractures are more yielding. This zone is a canal command area except the western side. Quality of groundwater is good. Development is possible thr ough Dug well, Dug cum borewell and Borewell. The yield of borewell is site specific. DTW 5-10 mbgl (Zone D)
Hilly area. Ground water development is limited to valleys.
Fracture/ lineament
Reservoir
Isohyet
Location of bore wells

FIGURE 4

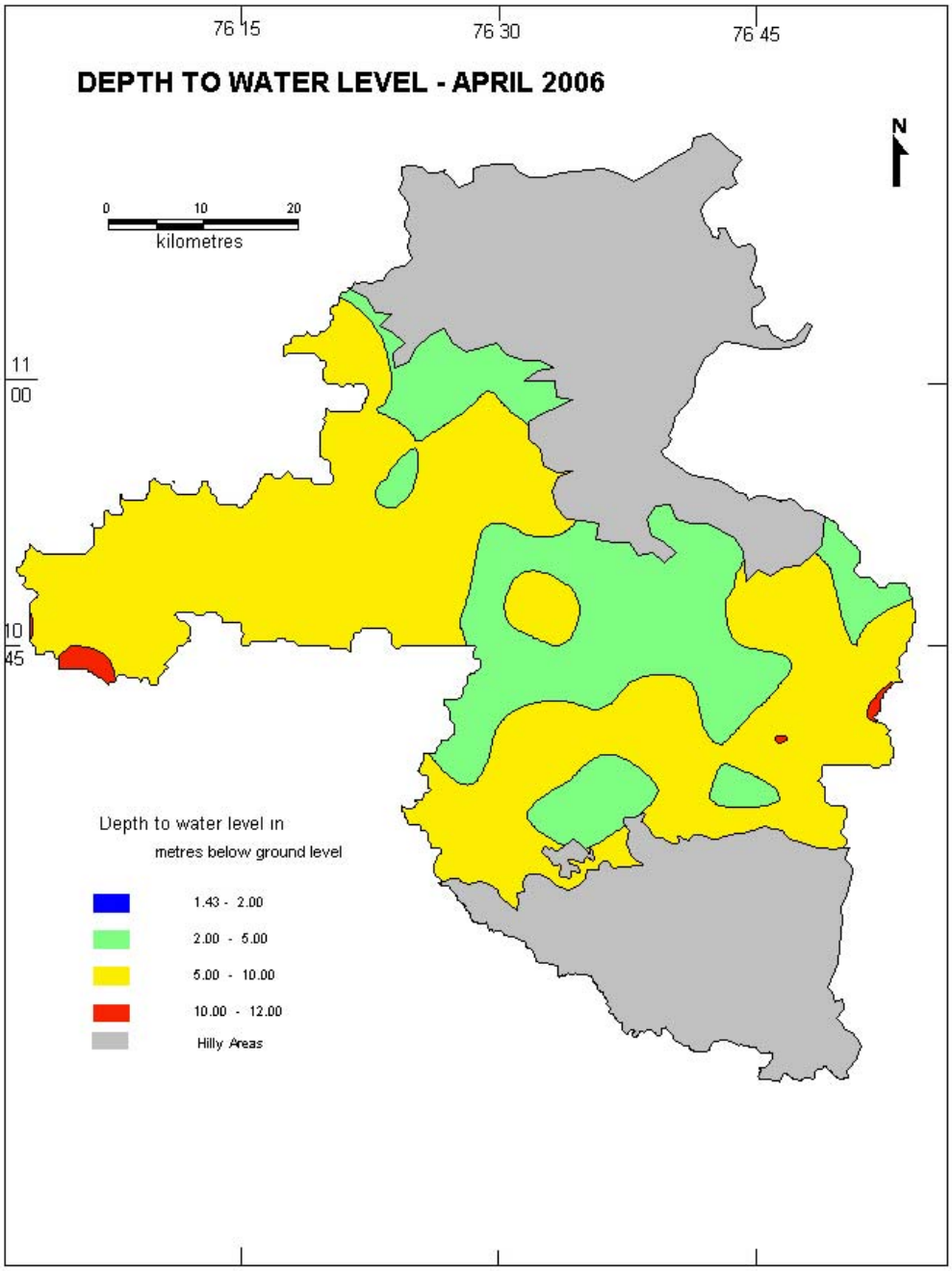

76 15
76 30
76 45
DEPTH TO WATER LEVEL - APRIL 2006
N
0
10
20
kilometres
11
00
10
45
Depth to water level in
metres below ground level
1.43 - 2.00
2.00 - 5.00
5.00 - 10.00
10.00 - 12.00
Hilly Areas

FIGURE 5

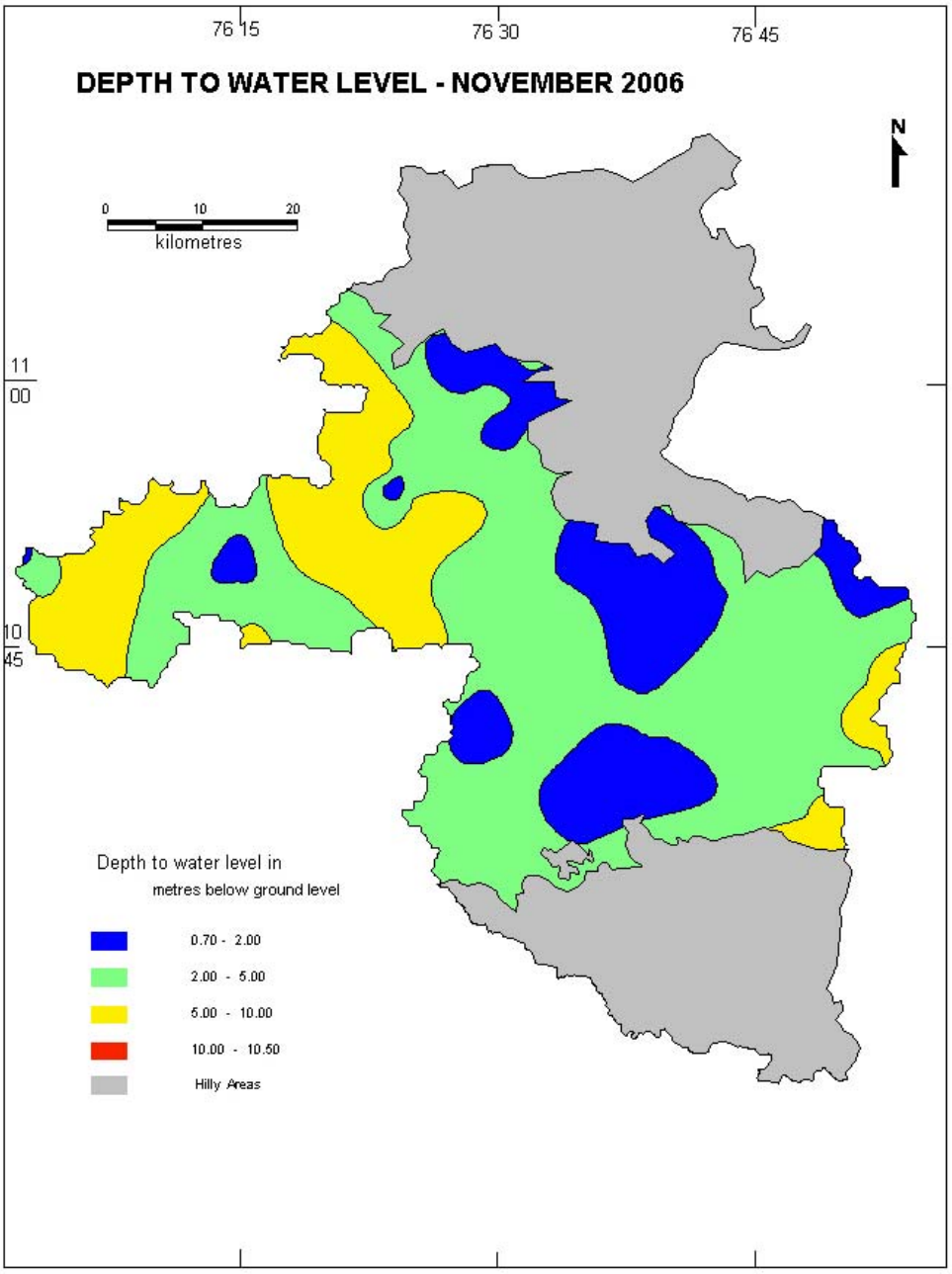

76 15
76 30
76 45
DEPTH TO WATER LEVEL - NOVEMBER 2006
N
0
10
20
kilometres
11
00
10
45
Depth to water level in
metres below ground level
0.70 - 2.00
2.00 - 5.00
5.00 - 10.00
10.00 - 10.50
Hilly Areas

FIGURE 6

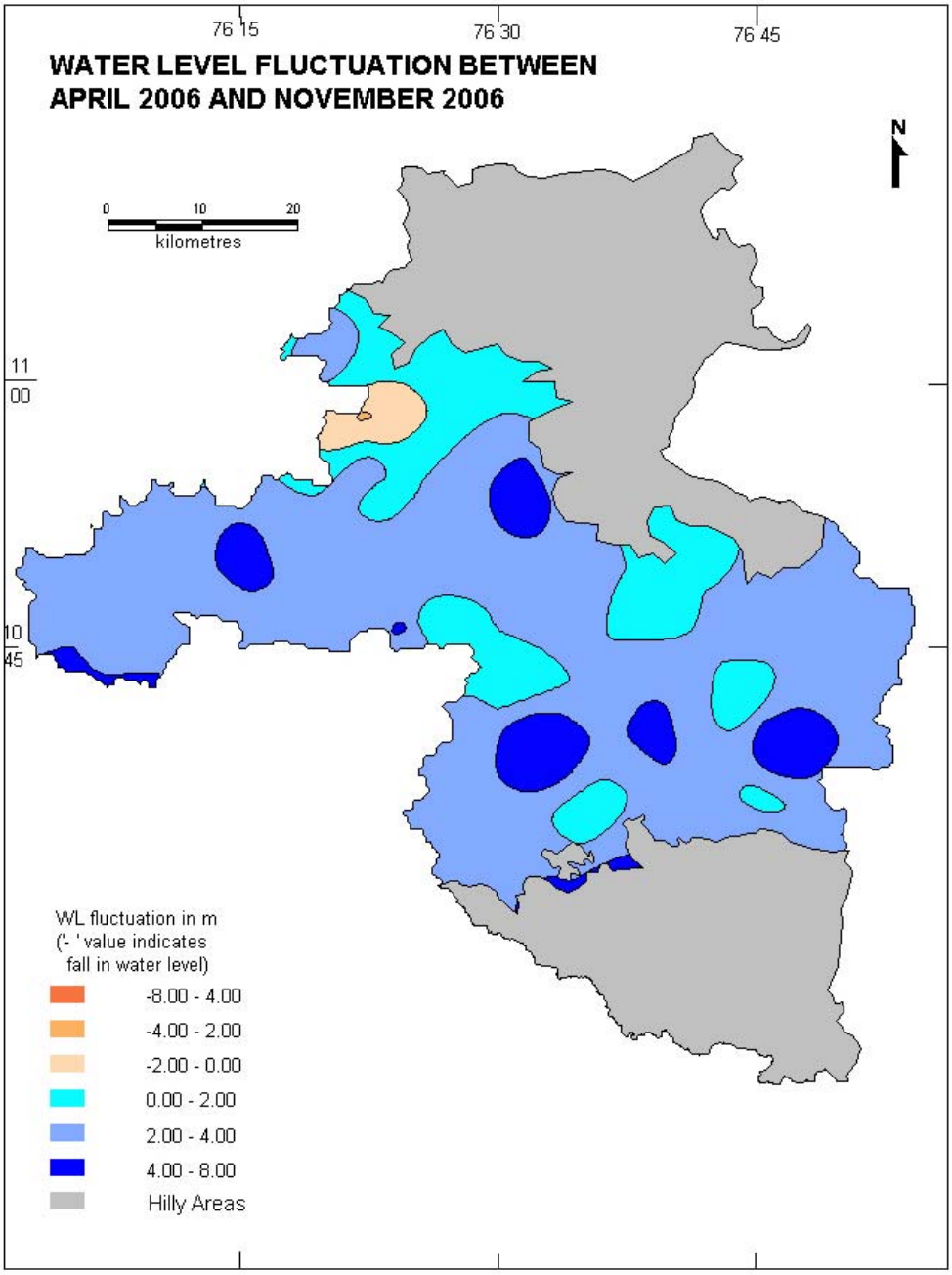
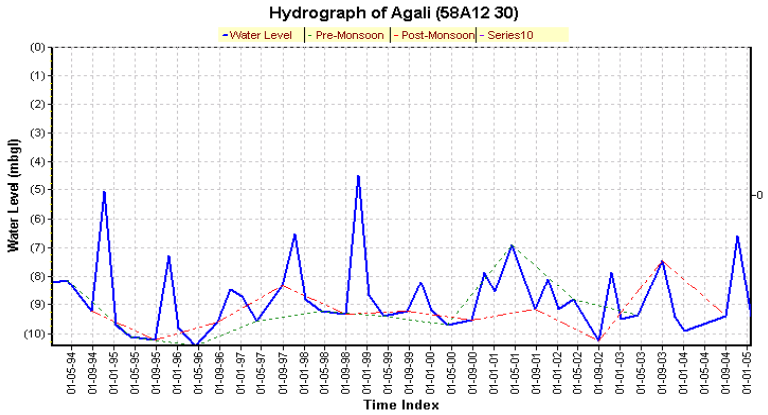
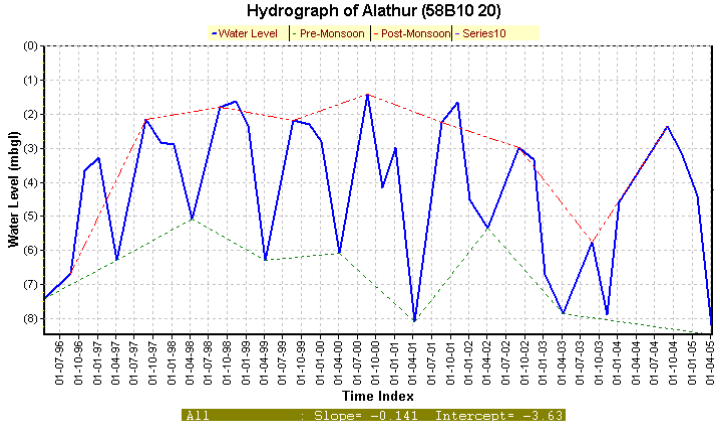
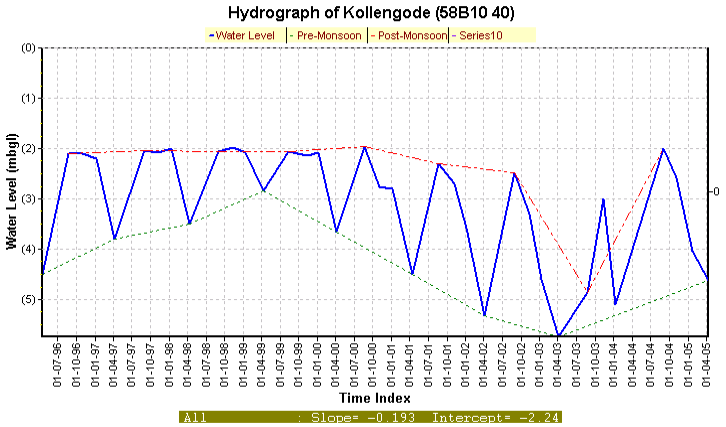
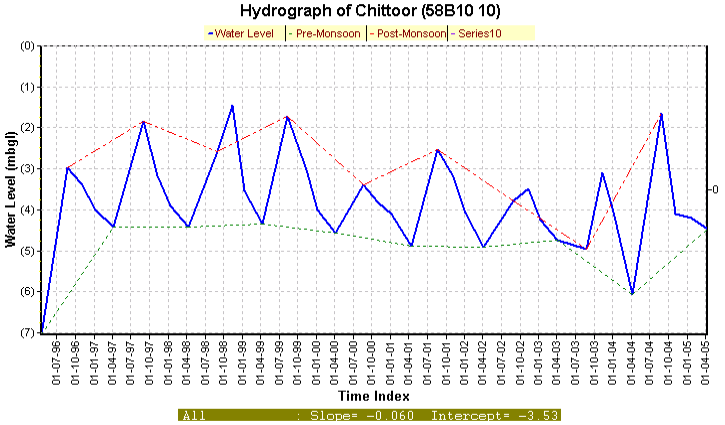

76 15
76 30
76 45
WATER LEVEL FLUCTUATION BETWEEN
APRIL 2006 AND NOVEMBER 2006
N
0
10
20
kilometres
11
00
10
45
WL fluctuation in m
('- ' value indicates
fall in water level)
-8.00 - 4.00
-4.00 - 2.00
-2.00 - 0.00
0.00 - 2.00
2.00 - 4.00
4.00 - 8.00
Hilly Areas

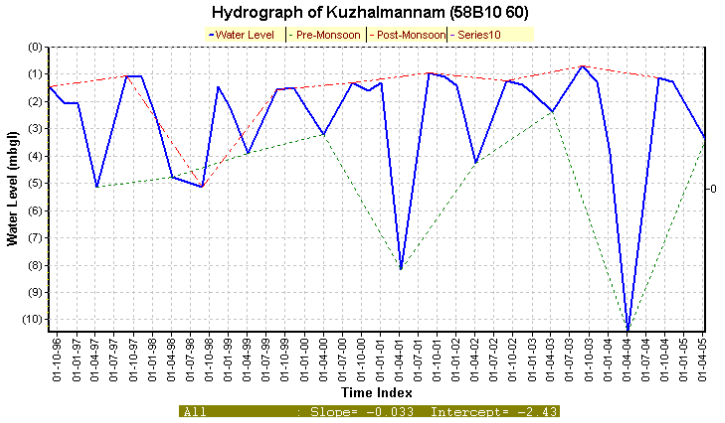
**FIGURE 6a**

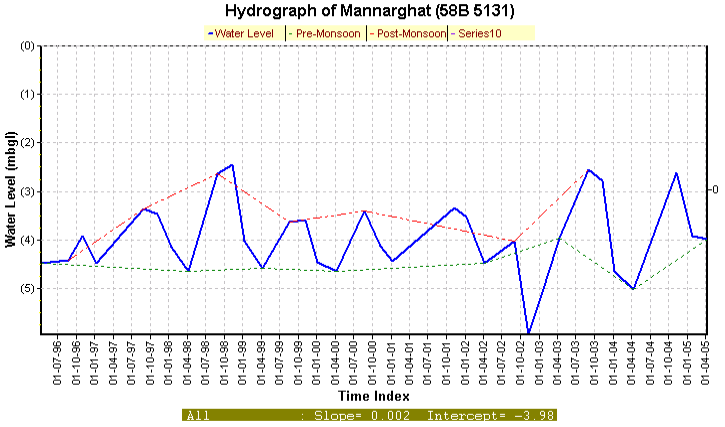

Hydrograph of Agali (58A12 30)
Water Level
Pre-Monsoon
Post-Monsoon
Series10
Water Level (mbgl)
Time Index

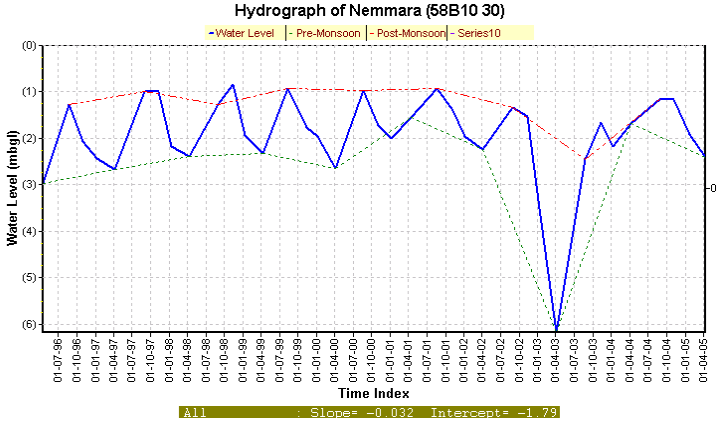

Hydrograph of Alathur (58B10 20)
Water Level
Pre-Monsoon
Post-Monsoon
Series10
Water Level (mbgl)
Time Index
All : Slope= -0.141 Intercept= -3.63

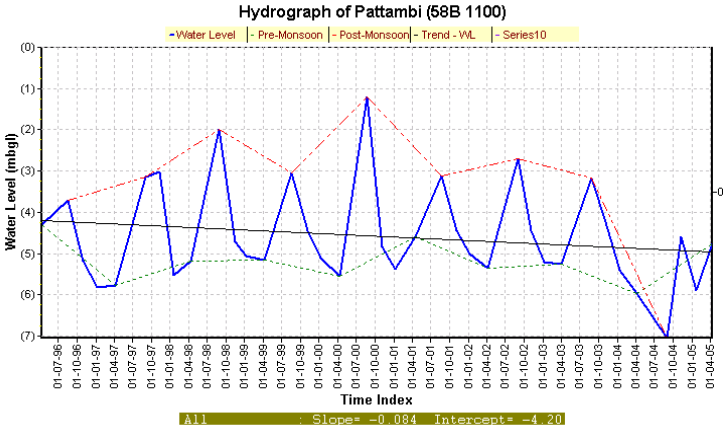

Hydrograph of Kollengode (58B10 40)
Water Level
Pre-Monsoon
Post-Monsoon
Series10
Water Level (mbgl)
Time Index
All : Slope= -0.193 Intercept= -2.24


Hydrograph of Chittoor (58B10 10)
Water Level
Pre-Monsoon
Post-Monsoon
Series10
Water Level (mbgl)
Time Index
All : Slope= -0.060 Intercept= -3.53


Hydrograph of Kuzhalmannam (58B10 60)
Water Level
Pre-Monsoon
Post-Monsoon
Series10
Water Level (mbgl)
Time Index
All : Slope= -0.033 Intercept= -2.43


Hydrograph of Mannarghat (58B 5131)
Water Level
Pre-Monsoon
Post-Monsoon
Series10
Water Level (mbgl)
Time Index
All : Slope= 0.002 Intercept= -3.98


Hydrograph of Nemmara (58B10 30)
Water Level
Pre-Monsoon
Post-Monsoon
Series10
Water Level (mbgl)
Time Index
All : Slope= -0.032 Intercept= -1.79


Hydrograph of Pattambi (58B 1100)
Water Level
Pre-Monsoon
Post-Monsoon
Trend - WL
Series10
Water Level (mbgl)
Time Index
All : Slope= -0.084 Intercept= -4.20

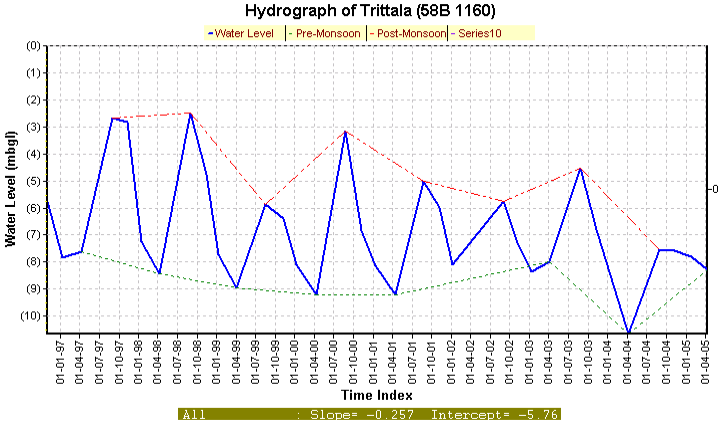

Hydrograph of Trittala (58B 1160)
Water Level
Pre-Monsoon
Post-Monsoon
Series10
Water Level (mbgl)
Time Index
All : Slope= -0.257 Intercept= -5.76

FIGURE 6 b

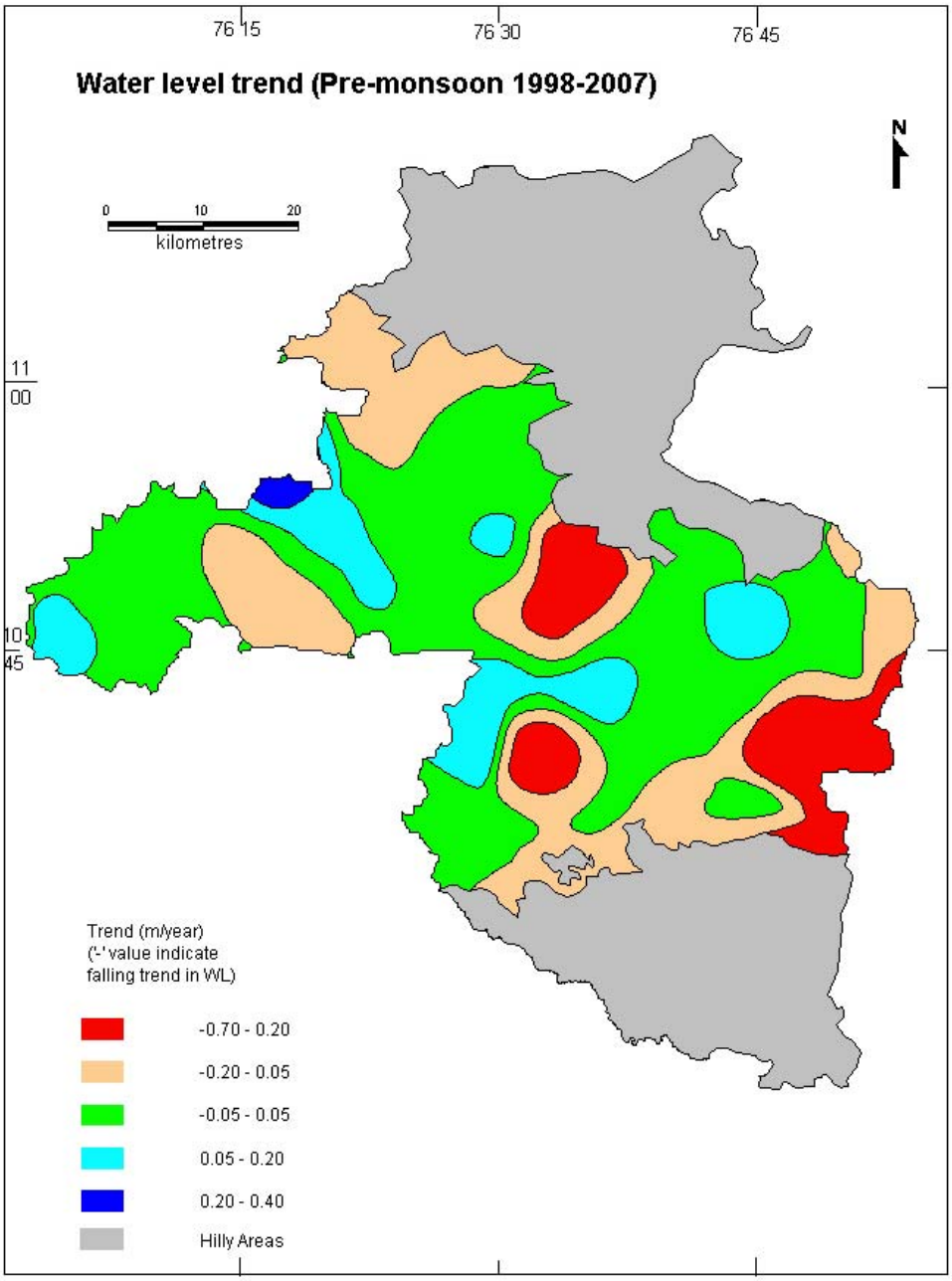

76 15
76 30
76 45
Water level trend (Pre-monsoon 1998-2007)
N
0
10
20
kilometres
11
00
10
45
Trend (m/year)
('-' value indicate
falling trend in WL)
-0.70 - 0.20
-0.20 - 0.05
-0.05 - 0.05
0.05 - 0.20
0.20 - 0.40
Hilly Areas

FIGURE 7

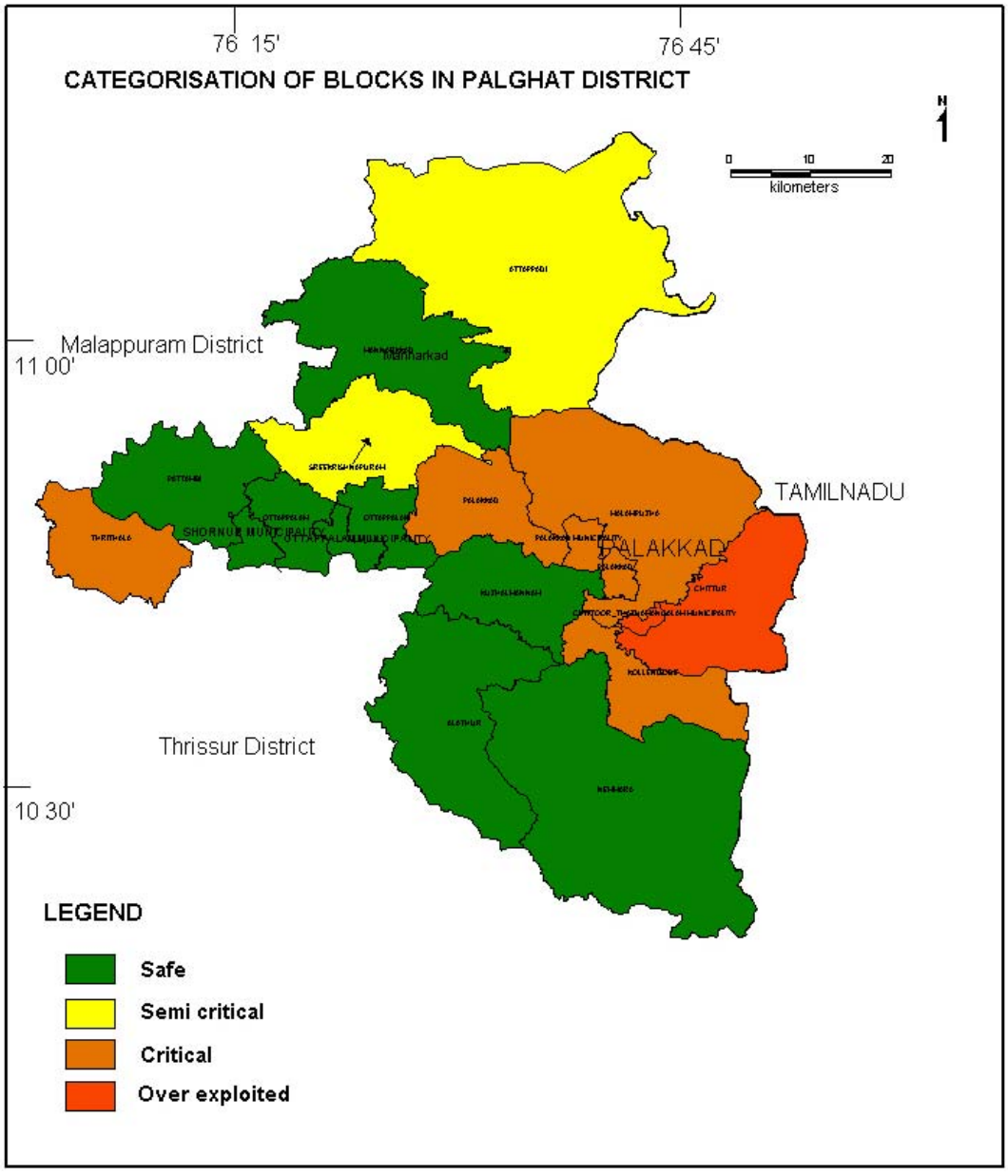

76 15'
76 45'
CATEGORISATION OF BLOCKS IN PALGHAT DISTRICT
N
0 10 20
kilometers
Malappuram District
11 00'
Mannarkad
TAMILNADU
PALAKKAD
SHORNUR MUNICIPALITY
Thrissur District
10 30'
LEGEND
Safe
Semi critical
Critical
Over exploited

FIGURE 8

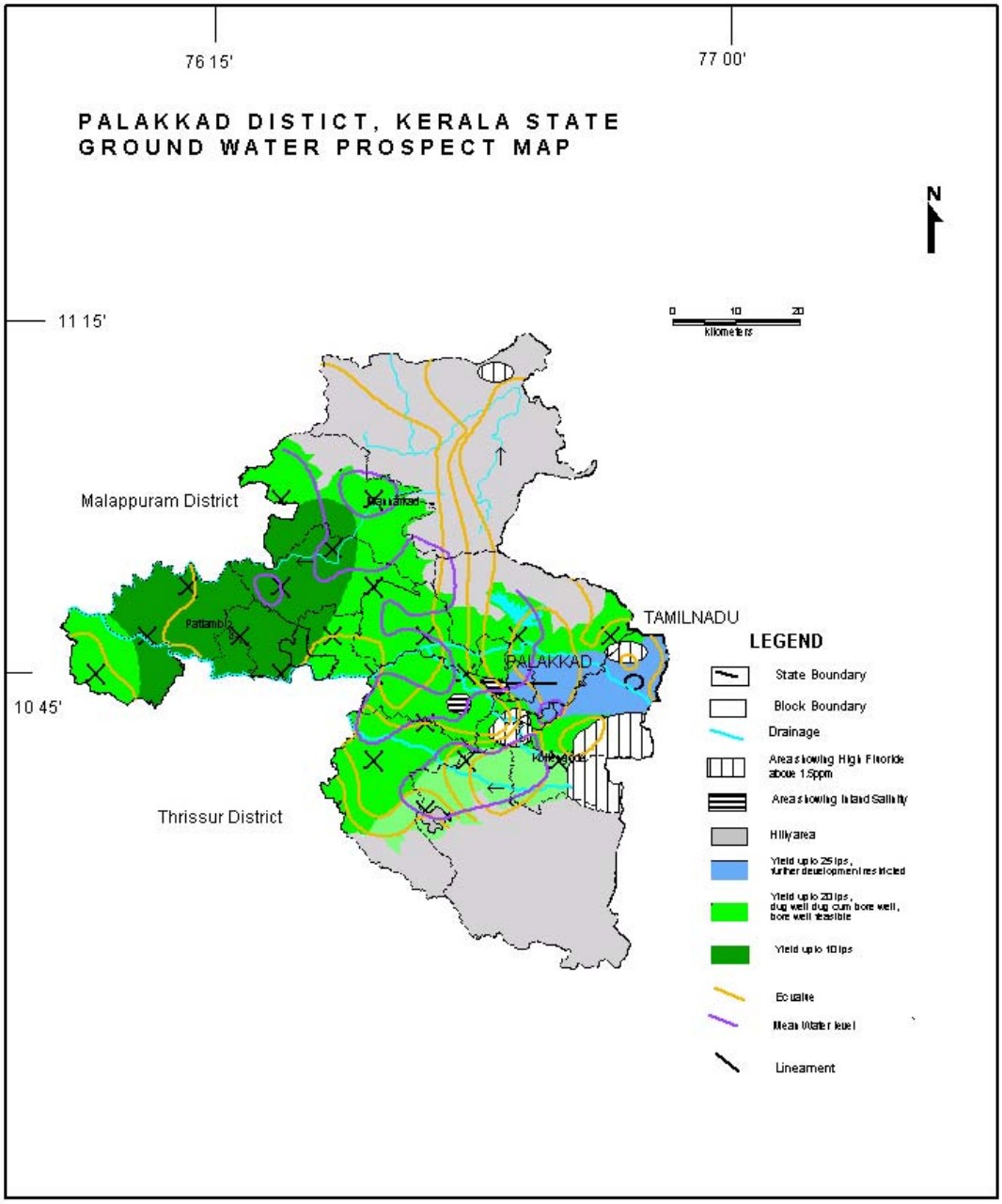
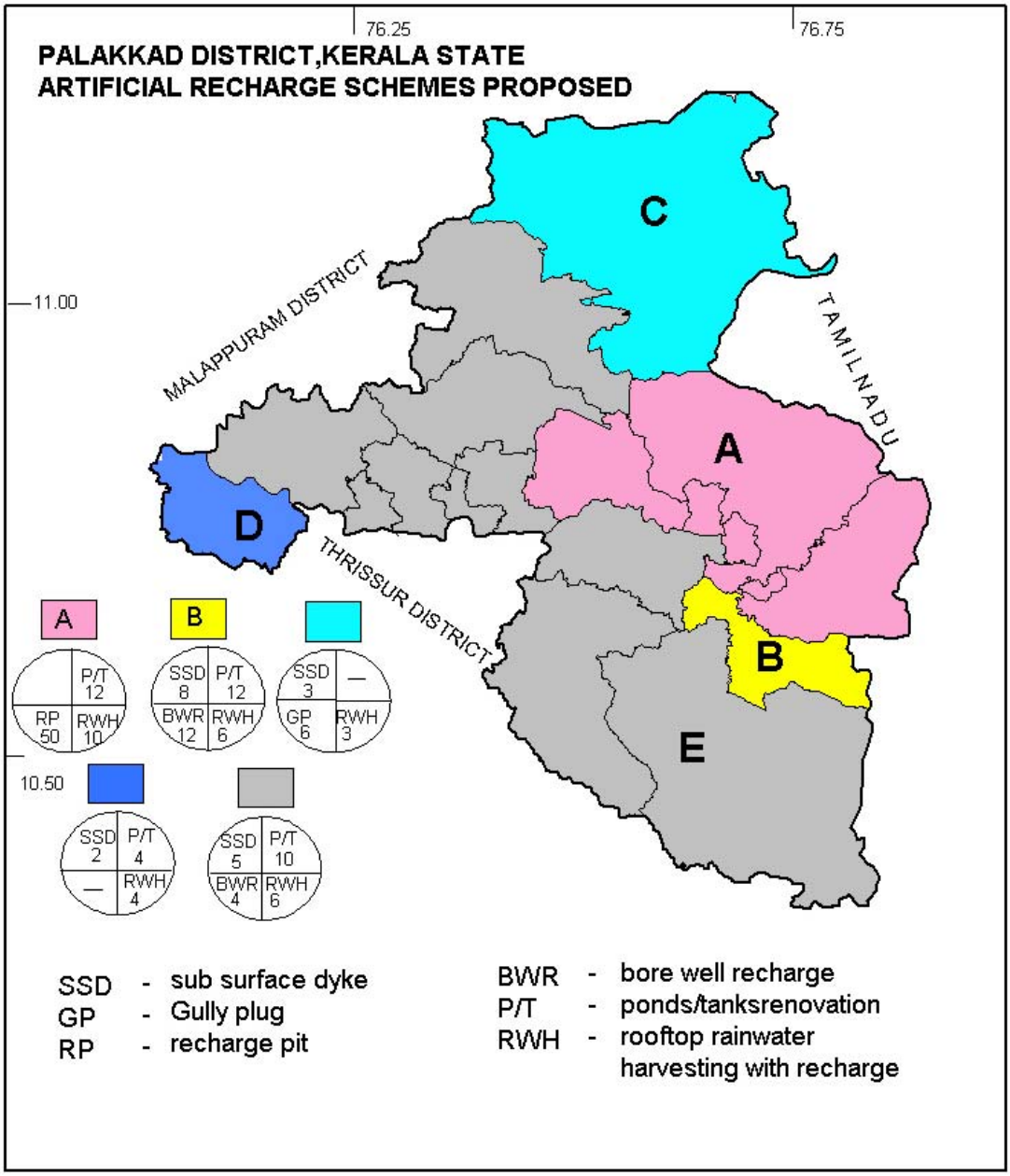

76 15'
77 00'
PALAKKAD DISTICT, KERALA STATE
GROUND WATER PROSPECT MAP
N
11 15'
10 45'
0 10 20
Kilometers
Malappuram District
Pattambi
Mannarkad
PALAKKAD
TAMILNADU
Kollengode
Thrissur District
LEGEND
State Boundary
Block Boundary
Drainage
Areas showing High Fluoride above 1.5ppm
Areas showing Inland Salinity
Hilly area
Yield up to 2 lps, further development restricted
Yield up to 2 lps, dug well dug cum bore well, bore well feasible
Yield up to 1 lps
Isohaline
Mean Water level
Lineament

FIGURE 9


76.25
76.75
PALAKKAD DISTRICT,KERALA STATE
ARTIFICIAL RECHARGE SCHEMES PROPOSED
11.00
10.50
MALAPPURAM DISTRICT
TAMILNADU
THRISSUR DISTRICT
C
A
D
B
E
A
P/T 12
RP 50
RWH 10
B
SSD 8
P/T 12
BWR 12
RWH 6
SSD 3
—
GP 6
RWH 3
SSD 2
P/T 4
—
RWH 4
SSD 5
P/T 10
BWR 4
RWH 6
SSD - sub surface dyke
GP - Gully plug
RP - recharge pit
BWR - bore well recharge
P/T - ponds/tanksrenovation
RWH - rooftop rainwater harvesting with recharge

Annexure I

No. 20761/Ag2/06/AD

Agriculture (Agri) Department
Thiruvananthapuram
Dated: 31.07.2006

From
The Agricultural Production Commissioner

To
Sri. Alok Sinha
Additional Secretary
Government of India
Ministry of Agriculture
Dept. of Agriculture & Co-operation
Krishi Bhavan, New Delhi

Sir,

Sub: Farmers' Suicide in Kerala - district wise and year wise details - Reg:
Ref : Your letter No. 3-1/2006-Policy dated 31.07.2006

I invite your attention to the D.O letter cited and to forward herewith the district wise and year wise break up of the farmers' suicide in the State of Kerala from 1999 to June 2006.

The causes of suicides are attributed to indebtedness on account of fall in prices of cash crops, loss on account of earlier droughts, low yields due to pests and diseases etc.

Government have already sanctioned solatium @ Rs. 50,000/- to each of the families of farmers who have committed suicide. Government have already issued orders for the write off of agricultural loans of farmers who have committed suicide. Government have also submitted a rehabilitation package on the lines of the Vidarbha Package announced by the Hon. Prime Minister. The package covers the districts of Wayanad, Palakkad and Kasaragod. Further, inclusion of Idukki district is also suggested in the proposal submitted to Government of India.

Yours faithfully,

M. Archangelo
Joint Secretary
for Agricultural Production Commissioner

## DETAILS OF FARMERS SUICIDE, KERALA STATE

| Sl No | District | Year | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 ( up to June) | **Total** |
| 1 | Thiruvananthapuram | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 3 | **9** |
| 2 | Kollam | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 0 | **4** |
| 3 | Pathanamthitta | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | **1** |
| 4 | Alappuzha | 0 | 0 | 0 | 0 | 0 | 2 | 3 | 2 | **7** |
| 5 | Kottayam | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | **3** |
| 6 | Idukki | 0 | 1 | 9 | 5 | 4 | 12 | 15 | 9 | **55** |
| 7 | Ernakulam | 0 | 0 | 0 | 0 | 1 | 3 | 0 | 0 | **4** |
| 8 | Thrissur | 0 | 0 | 0 | 0 | 0 | 2 | 4 | 2 | **8** |
| 9 | Palakkad | 0 | 0 | 8 | 3 | 0 | 10 | 6 | 2 | **29** |
| 10 | Malappuram | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| 11 | Kozhikode | 0 | 0 | 0 | 0 | 0 | 4 | 3 | 1 | **8** |
| 12 | Wayanad | 15 | 21 | 34 | 47 | 50 | 68 | 68 | 18 | **321** |
| 13 | Kannur | 0 | 0 | 0 | 0 | 0 | 7 | 1 | 0 | **8** |
| 14 | Kasaragod | 1 | 5 | 5 | 14 | 19 | 18 | 16 | 14 | **92** |
| **Total** | | **16** | **27** | **56** | **69** | **74** | **135** | **120** | **52** | **549** |

**Annexure 2**

| Details of wells drilled in Hard rock area, Palakkad District, Kerala | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Well No** | **Location** | **Year of construction** | **coordinates & toposheet No.** | **lineament Direction** | **Depth drilled** | **Depth of casing mbgl** | **Fracture zones** | **Discharge lpm** | **SWL in mbgl** | **T $m^2/day$ S** | **EC micromhoms/cm at $25^0C$** | **Cl ppm** | **Rock type** | **Remarks** |
| 1 | Vadakkancheri | | $10^0$35'20", $76^0$28'30", B/6 | NNW-SSE | 137.46 | 7.62 | 8-39, 69-74, 76-82, 99-118, 126-135/650 | 650 700 | 4.86 | 51.73 $3.52*10^{-3}$ | 215 | 12.4 | Biotite gneiss | |
| 2 | Velanthavalam | | $10^0$40'52", $76^0$52'25", B/4 | NE | | 3.04 | 26-41, 46-51, 98-101/2300 | 2300 900 | | 43.15 | 987 | 76 | Biotite gneiss | |
| 3 | Vannamada | | $10^0$42'10", $76^0$51", B/14 | NE-SW | | 1.52 | 41-46, 81-87, 123-128/400 | 412 250 | | 1.59 $2.96*10^{-3}$ | 970 | 49 | Biotite gneiss | |
| 4 | Chalisseri | | $10^0$43'40", $76^0$05'45", 58 B/2-1B | E-W | 170.05 | 8.70 | 46-57, 76, 141.5-152.8, 164.4-170.0/600 | 600, 530 | 3.23 | 43 | 270 | 18 | Charnockite gneiss | |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 | Kozhinjampara | | $10^0$44'10", $76^0$50'15", B/4 | EW | 152.40 | 1.52 | 7.6-20, 31-42, 78-152/120 | 132<br>120 | 4.14 | 2.59<br>$1.02*10^{-3}$ | 1175 | 188 | Qz. Fed. gneiss | |
| 6 | Nallepalli | | $10^0$44'15", $76^0$47'40", B/14 | NE-SW | 89.92 | 7.62 | 26-27, 32-37, 40-60, 73-90/1500 | 1500<br>700 | 1.51 | 39.7 | 690 | 22 | Biotite gneiss | free flow 25 lpm. |
| 7 | Pallatheri | | $10^0$45'40", $76^0$43'30", B/9 | NW | 182.88 | 3.04 | 52.57, 78.82, 117-138/170 | 177<br>150 | 2.95 | 4.19<br>$4.28*10^{-5}$ | 931 | 34 | Biotite gneiss | |
| 8 | Maruda Road | | $10^0$4615, $76^0$41'45", B/9 | NW-SE | 300.00 | 1.52 | Nil | dry | | NA | NA | NA | Biotite gneiss | |
| 9 | Kumaranallur | | $10^0$47'15", $76^0$02'35", 58 B/1-3A | N-S | 300.81 | 7.20 | 19-27, 84-88, 160-187/150 | 150<br>168 | 1.63 | 21.7 | 450 | 22 | Charnockite gneiss | |
| 10 | Kolippara | | $10^0$47'45", $76^0$50'10", B/13 | NE | 107.90 | 1.52 | 58.4-85.5/500 | 530<br>600 | 4.42 | 11.66<br>$7.32*10^{-4}$ | 790 | 34 | Biotite gneiss | |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 11 | Kumarambattur | | $10^0$58'50", $76^0$25'0", 58 B/5-1B | N-S | 137.5, | 5.60 | 6.2, 8-15, 51, 70-75, 78-84, 122, 130-138/1050 | 1062 2580 | 1.71 | 270 | 270 | 13 | Biotite gneiss | |
| 12 | Palakkazhi | | $11^0$01'25", $76^0$19'45", 58 A/8-3A | N-S | 300.81 | 13.82 | 90, 111-122, 185, 201/75 | 78 18 | 5.91 | 0.53 | 150 | 7.1 | Charnockite gneiss | |
| 13 | Para | | | | 193.40 | 5.50 | | 12.00 | 4.30 | | | | Biotite gneiss | |
| 14 | Menonpara | | | | 175.20 | 12.80 | | 600.00 | 6.50 | | 2600 | | Biotite gneiss | |
| 15 | Pudussery | | | | 59.00 | 7.00 | | 960.00 | 2.10 | | 700 | | Biotite gneiss | |
| 16 | S.N.Pallam | 2000-01 | | | 89.70 | 12.50 | | 960.00 | 9.50 | | 560 | | Hb-Biotite Gneiss | |
| 17 | Akkathethara | 2000-01 | | | 200.00 | 4.30 | | 30.00 | | | good | | Hb-Biotite Gneiss | |
| 18 | Vattapara | 2000-01 | | | 200.00 | 16.50 | | 180.00 | | | good | | Hb-Biotite Gneiss | |
| 19 | Kanjikode | 2000-01 | | | 138.50 | 16.50 | | 840.00 | 4.66 | | good | | Hb-Biotite Gneiss | |
| 20 | Maniyeripallam | 2000-01 | | | 200.00 | 22.00 | | 43.80 | | | good | | Hb-Biotite Gneiss | |
| 21 | Kirampara | 2000-01 | | | 200.00 | | | 6.00 | | | good | | Hb-Biotite Gneiss | |
| 22 | Nallaveeruchella | 2000-01 | | | 200.00 | 13.50 | | 120.00 | | | good | | Hb-Biotite Gneiss | |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 23 | Palghat | 2000-01 | | | 200.00 | 19.60 | | 24.00 | | | good | | Hb-Biotite Gneiss | |
| 24 | Kottathara | 2000-01 | | | 193.00 | 10.30 | | 108.00 | | | good | | Hb-Biotite Gneiss | |
| 25 | Agali goat farm | 2000-01 | | | 200.00 | 5.90 | | 36.00 | | | good | | Hb-Biotite Gneiss | |
| 26 | Chavadiyur | 2001-02 | | | 169.00 | 17.33 | 16-17.5, 37-39, 8-83 &169 | 462.00 | 10.01 | | good | | Hb-Biotite Gneiss | |
| 27 | Melachundapetti | 2001-02 | | | 187.20 | 6.30 | 22-25.6, 74.4-77.5, 126-129, 169-171 | 30.00 | 17.72 | | good | | Hornblende Gneiss | |
| 28 | Kulukkur | 2001-02 | | | 129.00 | | 31.4-34.5, 113.5-115, 127-129 | 900.00 | 15.30 | | good | | Hb-Biotite Gneiss | |
| 29 | Vatulakki | 2001-02 | | | 193.00 | | 32.8-34, 52-54 | 36.00 | 16.36 | | potable | | Quartz feldspar Biotite Schist | |
| 30 | Agali | 2001-02 | | | 193.00 | | 46.5-48, 104-106 | 48.00 | 15.88 | | potable | | Hb-Biotite Gneiss | |
| 31 | Chittur | 2001-02 | | | 200.00 | | 77-78, 129-132, 151-152 | 18.00 | 14.52 | | potable | | Quartz Biotite Schist | |
| 32 | Chemmannur | 2001-02 | | | 200.00 | | 63-65 | 48.00 | 2.64 | | good | | Hornblende Gneiss | |
| 33 | Mukkali | 2001-02 | | | 133.40 | | 67-71, 74.5-77.5, 92-95, 109-114, 132.4-133.4 | 1140.00 | 0.12 | | good | | Hornblende Gneiss | |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 34 | Moolakombupirivu | 2001-02 | | | 200.00 | | 19-20, 53-55, 106-168 | 420.00 | 17.70 | | good | | Hornblende Gneiss | |
| 35 | Ummathampadi | 2001-02 | | | 200.00 | | 14-16, 44-47, 103-106, 142-146 | 240.00 | 9.44 | | good | | Hornblende Gneiss | |
| 36 | Kunnanchala | 2001-02 | | | 187.30 | | 151-153 | negligible | 30.35 | | good | | Hornblende Gneiss | |
| 37 | Velanthavalam | 2002-03 | | | 104.90 | 2.15 | 101.0-104.9 | 300.00 | 64.40 | | | | Biotite gneiss/ Pegmatite | |
| 38 | Palayamanthurai | 2002-03 | | | 89.70 | | 31.0-32.0 45.0-47.0 65.0-68 84.0-86.5 | 780.00 | 16.64 | | | | Biotite gneiss/ Pegmatite | |
| 39 | Erumakaranur | 2002-03 | | | 80.00 | 3.00 | 65.0-67.0, 79.0-80.0 | 600.00 | 29.70 | | | | Hornblende Biotite gneiss | |
| 40 | Malayandikaundannur | 2002-03 | | | 101.35 | 8.60 | 55.6-56.0 71.7-74.9 77.0-80.0 | 360.00 | 2.70 | | | | Biotite Gneiss | |
| 41 | R.G.Dasalaksham Colony | 2002-03 | | | 200.00 | 10.40 | 77.5-80.5 | 36.00 | 12.00 | | 1154.00 | | Biotite Gneiss | |
| 42 | Mallampathy | 2002-03 | | | 200.00 | | 78-80.0 152.0-153.0 | 38.40 | | | | | Biotite Gneiss | |
| 43 | Puzhapallam | 2002-03 | | | 101.35 | 9.85 | 27.10-28.15 78.95-80 92.2-93.2 | 360.00 | 3.60 | | 1467.00 | | Hornblende Biotite gneiss | |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 44 | Chinnamoolathara | 2002-03 | | | 120.00 | 3.75 | 43.4-44.4<br>49.5-51.5 | 120.00 | 32.80 | | | | Biotite Gneiss | |
| 45 | Moongalmada (Gopalapuram) | 2002-03 | | | 200.00 | 11.40 | 11.4-13.4<br>68.3-71.4<br>144.6-147.6 | 60.00 | 14.79 | | | | Biotite Gneiss | |
| 46 | Kinarpallam | 2002-03 | | | 200.00 | | | dry | | | | | Biotite Gneiss | |
| 47 | Nellipalam | 2002-03 | | | 92.70 | | 19.3-21.6<br>65.3-68.0<br>89.9-92.7 | 1500.00 | 0.40 | | | | Biotite Gneiss | |
| 48 | Vallickad | 2002-03 | | | 200.00 | 9.00 | 104-108 | 120.00 | 3.00 | | | | Biotite Gneiss | |
| 49 | 6th mile | 2002-03 | | | 101.35 | | 45.4-47.5<br>61.7-76.95<br>92.0-101.4 | 60.00 | 10.10 | | | | Biotite Gneiss | |
| 50 | Kumbalakode | 2002-03 | | | 200.00 | 9.60 | 16.5-19.5 | 60.00 | 6.00 | | | | Biotite Gneiss | |
| 51 | Pothundy | 2002-03 | | | 147.70 | 6.10 | 144.6-147.7 | 150.00 | 1.85 | | | | Biotite Gneiss | |
| 52 | Mambran | 2002-03 | | | 101.35 | 9.00 | 69.8-70.8 | 180.00 | 9.82 | | | | Biotite Gneiss | |
| 53 | Kadumthrithi | 2002-03 | | | 85.80 | 22.45 | 20.0-22.0<br>24.8-25.8<br>47.1-48.1<br>51.2-52.2 | 900.00 | 7.40 | | | | Biotite Gneiss/ Schist | |
| 54 | Kollenkode Mundikavu | 2002-03 | | | 65.00 | 6.05 | 22.8-23.8<br>40.1-41.1<br>44.3-50.3 | 1020.00 | 16.38 | | | | Biotite Gneiss | |

**Annexure 3**

| Chemical analysis result of groundwater samples from Palakkad District | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Concentration in milligrams per litre | | | | | | | | | | | | | | | |
| **Sl No.** | **Location** | **Source** | **pH** | **EC (μ S/cm) at 25° C** | **TH** | **Ca** | **Mg** | **Na** | **K** | **$CO_3$** | **$HCO_3$** | **$SO_4$** | **Cl** | **F** | **$NO_3$** |
| 1 | Alathur | NHS | 8.6 | 527 | 188 | 36 | 24 | 26 | 3 | 10 | 120 | 16 | 50 | 0.43 | 14 |
| 2 | Kuzhalmanam | NHS | 8.94 | 748 | 162 | 37 | 16 | 84 | 4 | 22 | 144 | 32 | 128 | 0.94 | 0 |
| 3 | Palghat | NHS | 9.01 | 557 | 176 | 31 | 24 | 46 | 4 | 26 | 141 | 26 | 64 | 0.41 | 8.2 |
| 4 | Meenakshipuram | NHS | 8.18 | 1390 | 470 | 136 | 32 | 132 | 10 | 0 | 348 | 88 | 185 | 0 | 102 |
| 5 | Meenkara | NHS | 8.7 | 1080 | 256 | 40 | 38 | 120 | 4 | 36 | 283 | 46 | 170 | 1.53 | 0 |
| 6 | Chempanampathy | NHS | 8.4 | 1211 | 470 | 84 | 63 | 102 | 14 | 24 | 330 | 50 | 241 | 0 | 170 |
| 7 | Kollenkodu | NHS | 8.49 | 1219 | 470 | 72 | 70 | 132 | 4 | 17 | 270 | 61 | 185 | 0.44 | 83 |
| 8 | Adiparanda | NHS | 8.34 | 251 | 54 | 10 | 7 | 17 | 6 | 0 | 66 | 3 | 21 | 0.25 | 0 |
| 9 | Kanjikode | NHS | 8.88 | 1557 | 450 | 28 | 92 | 138 | 11 | 50 | 260 | 60 | 262 | 0 | 104 |
| 10 | Chullimada | NHS | 8.72 | 847 | 168 | 20 | 28 | 100 | 1 | 22 | 134 | 21 | 150 | 0.45 | 24 |
| 11 | Walayar | NHS | 8.48 | 572 | 250 | 48 | 32 | 30 | 4 | 18 | 148 | 17 | 43 | 0 | 42 |
| 12 | Kalladikode | NHS | 8.34 | 92 | 110 | 1.5 | 2.4 | 8 | 0.2 | 0 | 7.3 | 3 | 14 | 0.3 | 5 |
| 13 | Pattambi | NHS | 7.88 | 208 | 102 | 11 | 14 | 13 | 3 | 0 | 42 | 12 | 28 | 0 | 1.4 |
| 14 | Chalisseri | NHS | 7.55 | 134 | 30 | 7 | 3 | 8 | 3 | 0 | 22 | 3 | 11 | 0 | 12.06 |
| 15 | Ottapalam | NHS | 7.55 | 265 | 44 | 9 | 5 | 13 | 2 | 0 | 29 | 3 | 21 | 0 | 23 |
| 16 | Palapuram | NHS | 7.64 | 702 | 220 | 32 | 31 | 66 | 21 | 0 | 52 | 30 | 106 | 0 | 120 |
| 17 | Anakkathy | NHS | 8.7 | 1654 | 570 | 40 | 114 | 174 | 10 | 24 | 122 | 150 | 262 | 1.01 | 116 |
| 18 | Mututhukadu | NHS | 8.56 | 250 | 62 | 14 | 7 | 5 | 3 | 4 | 131 | 12 | 7 | 0.1 | 8 |
| 19 | Chavadiyoor | NHS | 8.88 | 548 | 170 | 9 | 36 | 30 | 3 | 32 | 161 | 31 | 42 | 0.8 | 3 |
| 20 | Kakupady | NHS | 8.24 | 145 | 48 | 17 | 2 | 5 | 1 | 7 | 46 | 4 | 7 | 0 | 0.8 |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 21 | Kanjirapuzha | NHS | 8.01 | 98 | 28 | 11 | 4 | 4 | 0.4 | 0 | 34 | 7 | 7 | 0 | 2 |
| 22 | Ariyur | NHS | 7.75 | 83 | 36 | 7 | 4 | 2 | 0.2 | 0 | 39 | 4 | 4 | 0.1 | 0.8 |
| 23 | Kannadi | NHS | 8.19 | 1248 | 410 | 76 | 54 | 102 | 2.9 | Tr | 293 | 11 | 270 | 1.15 | 0.5 |
| 24 | Koduvayur – 1 | NHS | 8.6 | 756 | 225 | 44 | 28 | 70 | 2.0 | 12 | 152 | 24 | 121 | 0.9 | 18 |
| 25 | Koduvayur – 2 | NHS | 7.72 | 4130 | 1340 | 300 | 143 | 290 | 28 | 0 | 195 | 48 | 1280 | 0.35 | 5.7 |
| 26 | Ambathupala | NHS | 8.3 | 392 | 90 | 90 | 6.3 | 36 | 2.0 | Tr | 115 | 50 | 57 | 0.43 | 0.8 |
| 27 | Karukamani | NHS | 8.23 | 729 | 265 | 34 | 44 | 53 | 1.5 | Tr | 293 | 29 | 78 | 0.98 | 6 |
| 28 | Kozhinjampara | NHS | 8.32 | 810 | 265 | 265 | 22 | 56 | 2.5 | 9.6 | 140 | 35 | 128 | 0.55 | 47 |
| 29 | Chunambukalthode | NHS | 8.22 | 1272 | 470 | 104 | 51 | 67 | 3.2 | Tr | 177 | 57 | 199 | 0.89 | 177 |
| 30 | Mookilmada | NHS | 7.96 | 1322 | 530 | 68 | 88 | 54 | 12 | 0 | 329 | 7.6 | 206 | 0.94 | 131 |
| 31 | Kundanthode | NHS | 8.01 | 820 | 600 | 32 | 54 | 75 | 24 | 0 | 488 | 28 | 28 | 1.18 | 8 |
| 32 | Odannur | NHS | 8.02 | 114 | 30 | 30 | 3.9 | 6.4 | 3.0 | 0 | 29 | 7.9 | 11 | 0.19 | 4.1 |
| 33 | Punchapadam | NHS | 7.45 | 74 | 14 | 14 | 1 | 5.2 | 4.1 | 0 | 22 | 1.3 | 8.5 | 0.19 | 1.7 |
| 34 | Randammel | NHS | 8.37 | 182 | 72 | 72 | 11 | 11 | 1.6 | 7.2 | 88 | 2.8 | 8.5 | 0.52 | 0.2 |
| 35 | Kaumba | NHS | 7.93 | 21 | 70 | 70 | 10 | 10 | 1.8 | 0 | 2.32 | 6.5 | 17 | 0.27 | 0.1 |
| 36 | Walayar 1 | NHS | 8.23 | 490 | 176 | 30 | 24 | 32 | 4.3 | | 238 | 16 | 32 | 0.67 | 0.4 |
| 37 | Pudur | NHS | 8.54 | 415 | 160 | 23 | 25 | 25 | 3.5 | 18 | 189 | 16 | 14 | 0.4 | 4.2 |
| 38 | Kopanur | NHS | 9.0 | 1826 | 120 | 12 | 22 | 415 | 1.5 | 144 | 555 | 53 | 206 | 5.75 | 4.6 |
| 39 | Kopanur – 2 | NHS | 6.7 | 1167 | 90 | 12 | 15 | 238 | 3.4 | 54 | 390 | 30 | 128 | 2.98 | 0.8 |
| 40 | kadumthuruthi | NHS | 7.7 | 5090 | 2250 | 400 | 304 | 124 | 5.4 | 0 | 110 | 8.5 | 1725 | 0.26 | 9.8 |
| **Chemical analysis of Bore Well samples** | | | | | | | | | | | | | | | |
| **Sl No.** | **Location** | **Source** | **pH** | **EC (μ S/cm) at 25° C** | **TH** | **Ca** | **Mg** | **Na** | **K** | **$CO_3$** | **$HCO_3$** | **$SO_4$** | **Cl** | **F** | **$NO_3$** |
| 1 | Chinnamoolathara | BW | 8.5 | 2000 | 340 | 28 | 66 | 338 | 8.6 | 60 | 537 | 218 | 227 | 3.12 | 2.5 |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | Moongilmada | BW | 8.3 | 1430 | 450 | 48 | 80 | 124 | 9.6 | 12 | 134 | 445 | 85 | 1.14 | 1.1 |
| 3 | Kadapuram | BW | 7.4 | 1123 | 260 | 60 | 27 | 112 | 14 | 0 | 134 | 8.6 | 284 | 0.36 | 6.6 |
| 4 | 6th Mile Anganvady | BW | 7.8 | 1235 | 460 | 126 | 35 | 89 | 4.8 | 0 | 390 | 28 | 192 | 0.96 | 80 |
| 5 | Mambram Anganvady | BW | 8.3 | 508 | 174 | 34 | 21 | 48 | 5.5 | 7.2 | 285 | 11 | 21 | 1.36 | 0.2 |
| 6 | Kaipamangalam | BW | 7.7 | 935 | 145 | 34 | 15 | 146 | 7.9 | 0 | 220 | 21 | 196 | 0.5 | 3.8 |
| 7 | Eruthenpathy | BW | 8.1 | 1278 | 430 | 68 | 63 | 89 | 5.6 | 0 | 250 | 127 | 227 | 1.76 | 13 |