



DYNAMIC GROUNDWATER RESOURCES OF KERALA (MARCH 2013)



Prepared by

**Ground Water Department & Central Ground Water Board,
Government of Kerala Government of India**

**Thiruvananthapuram
May 2017**

DYNAMIC GROUNDWATER RESOURCES OF KERALA (MARCH 2013)

Prepared by



**Ground Water Department
Government of Kerala**



**& Central Ground Water Board
Government of India**

**THIRUVANANTHAPURAM
May 2017**



V. J. KURIAN
ADDITIONAL CHIEF SECRETARY

**WATER RESOURCES, COASTAL SHIPPING &
INLAND NAVIGATION DEPARTMENTS
GOVERNMENT OF KERALA
THIRUVANANTHAPURAM**

Phone { Office : 2329599
2518485
Res : 2340614
Mobile : 9847065507

FOREWORD

Kerala, the southernmost State of India is said to be abundant in surface water resources with 44 rivers and a large number of lakes and ponds. The State receives an average annual rainfall of about 3000 mm per year. However, in spite of the apparent riches, water scarcity is becoming commonplace in parts of the State, especially during summer months. This is so, because, none of the 44 rivers fall under the category of major rivers and only 4 are falling in the category of medium rivers, whereas the remaining 40 are all minor rivers. Secondly, the unique topographic and geomorphic settings of the State and finally the limited storage space available in the sub-surface (due to peculiar geology), can be attributed as the natural causes of scarcity. However, over and above the natural causes, it is the lack of judicious management of available fresh water resources which is largely responsible for the scarce situation.

Ground water extraction by means of simple dug wells has traditionally been the prevalent source of fresh water for various uses in Kerala. With nearly 90 percent of the total geographical area of the State underlain by massive hard rocks, the ground water development prospects are very limited. Increasing demand of fresh water resources to satisfy the requirements of an increasing population especially the density of population has been putting these limited resources under increasing stress in recent decades. Rapid urbanization coupled with changes in land use pattern has led to reduction in the recharge into the ground water reservoirs and subsequent depletion of ground water resources of the State. Contamination of ground water resources from natural and anthropogenic sources is also emerging as a major threat to the sustainability of ground water sources in many areas. Anticipated changes in precipitation pattern and rise in sea levels due to global warming and climate change, though as yet largely uncertain, are also matters of serious concern for Kerala State. Strategies for scientific management of ground water resources in the State have become imperative to ensure prevention of their depletion, contamination and to ensure their long-term sustainability.

Realistic assessment of ground water resource availability, status of its utilization and balance available for development are basic prerequisites for building a sound ground water management strategy. It is heartening to note that the Central Ground Water Board, Ministry of Water Resources, RD& GR, Government of India, jointly with the Ground Water Department, Government of Kerala has reassessed the ground water resources of the State as in March 2013 as per the norms of the Ground Water Estimation Committee (GEC). This effort deserves appreciation as it will help Government of Kerala identify and prioritize necessary management interventions and initiatives including regulation and augmentation measures to ensure long-term sustainability of ground water resources in the State and to ensure its water security for the future generations.

I take this opportunity to congratulate the Central Ground Water Board, Kerala Region, Thiruvananthapuram and the Ground Water Department, Government of Kerala, Thiruvananthapuram for the collection, compilation, and analysis of voluminous data on various aspects of ground water resources and for bringing out this compilation in such a comprehensive fashion. I hope this document will be of immense use to administrators, planners and other stakeholders to have a better understanding of the ground water scenario of the State and for planning and implementing various projects and schemes to ensure their long-term sustainability.

Thiruvananthapuram
2nd December 2015


V.J. Kurian

PREFACE

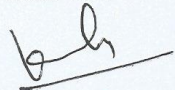
The State of Kerala, located in the Southwestern tip of India, has a total area of about 39,000 sq. km, which is only 1.2 percent of the geographical area of India. The State is home to about 3 percent of the population of the country. Though richly endowed with surface water sources such as rivers, tanks and ponds and having average annual rainfall of about 3000 mm, the topographic and geomorphic settings of the State allows utilization of only a small portion of the available resources. Nearly 88 percent of the total geographical area of the State is underlain by crystalline rocks devoid of any primary porosity, with limited ground water prospects. In the alluvial formations having multiple aquifer systems, quality is sometimes a constraint in the optimal development of available resources. Increasing population, rapid urbanization and industrialization has resulted in increasing use of ground water resources over the last few decades in the State. Judicious and planned development of ground water and its scientific management have become necessary to ensure long-term sustainability of this precious natural resource in Kerala. This requires realistic estimates of the availability of ground water resources and the current status of its utilization.

The dynamic ground water resources of the State are being periodically assessed jointly by the State Ground Water Department, Government of Kerala and the Central Ground Water Board, Ministry of Water Resources, Government of India, following the methodology recommended by the Groundwater Estimation Committee (GEC), constituted by the Government of India. The previous assessment was carried out in 2011. Salient features of the estimation of dynamic ground water resources of Kerala, as in March 2013, as per modified GEC-97 recommendations are presented in this report.

This report has been prepared through the sincere and painstaking efforts of the officers of the Ground Water Department, Government of Kerala, Thiruvananthapuram and Central Ground Water Board, Kerala Region, Thiruvananthapuram by the supervision and guidance of the then Regional Director Dr. Nandakumaran P. I take this opportunity to thank each and every one of them for their help and cooperation in the preparation of this report. I am also thankful to the Chairman and members of the State Level Committee for Re-estimation of the Ground Water Resources of Kerala for their valuable guidance and encouragement during the course of the estimation and for finalizing the report. Thanks are also due to various organizations of Government of Kerala and Government of India for fruitful discussions and for providing data required for the assessment of ground water resources of the State.

All possible care has been taken to assess various components of the ground water resources of the State as realistically as possible. I hope this compilation will be of help to the planners, administrators and all stakeholders in Kerala and will serve as a useful guide for the optimal and sustainable management of the limited ground water resources of Kerala.

Thiruvananthapuram
18 March 2016


(V. Kunhambu)
Regional Director

DYNAMIC GROUNDWATER RESOURCES OF KERALA (MARCH 2013)

CONTENT

1.0 Introduction	1
1.1 Background	1
1.2. Constitution Of The State Level Committee	1
1.3 Ground Water Estimation Procedure	2
2.0 Hydrogeology	4
2.1 Physiography.....	4
2.2 Rainfall	4
2.3 Geology.....	4
2.4 Occurrence Of Groundwater	5
2.5 Ground Water Level Conditions In 2012-13.....	7
2.6 Quality Of Ground Water	8
3.0 Ground Water Resources Estimation Methodology, 1997.	9
3.1 Ground Water Recharge	9
3.2 Total Ground Water Resource	10
3.3 Net Ground Water Availability.....	10
3.4 Annual Ground Water Draft.....	10
3.5 Future Utilization Of Ground Water Resource.....	10
3.6 Net Ground Water Available For Future Irrigation Requirement.....	11
3.7 Poor Quality Ground Water.....	11
3.8 Apportioning Of Ground Water Assessment From Watershed To Development Unit.....	11
3.9 Additional Potential Recharge	11
3.10 Stage Of Ground Water Development.....	11
3.11 Categorization Of Assessment Units.....	11
4.0 Procedure Followed In The Assessment Of Dynamic Ground Water Resources Of Kerala (March 2013).....	13
4.1 Norms Used In The Computation Of Resources	13
5.0 Computation Of Dynamic Ground Water Resources Of Kerala (2013)	15
5.1 Introduction	15
5.2. Method Adopted For Computing Rainfall Recharge During Monsoon:.....	15
5.3 Total Annual Ground Water Recharge	15
5.4 Net Ground Water Availability.....	17
5.5 Ground Water Draft.....	18
5.6 Provision For Domestic And Industrial Requirements For The Year 2025	19
5.7 Net Ground Water Availability For Future Irrigation Development	19
5.8 Stage Of Ground Water Development.....	20
5.9 Categorization Of Blocks	20
5.10 District-Wise Ground Water Resource Scenario	20
5.11 Comparison Of The Dynamic GW Resources As In (2011) & (2013)	27

LIST OF TABLES

Table 2.1: Stratigraphic Succession of Geological Formations in Kerala	5
Table 3.1: Criteria for Categorization of Assessment Units	12
Table 4.1: Values of Rainfall Infiltration Factor used for Computation of Dynamic Ground Water Resources of Kerala.....	13
Table 4.2: Specific Yield Values of Different Hydrogeological Units Used in the Computation of Ground Water Resources of Kerala.....	13
Table 4.3: Unit Ground Water Draft for Irrigation in Different Types of Wells in Kerala.....	14
Table 5.1: List of Urban Habitations in Kerala which have been Combined with Adjacent Blocks for Assessment of Dynamic Ground Water Resources (2013)	16
Table 5.2: Summary of Major Components of Dynamic Ground Water Resources of Kerala (2013)...	24
Table 5.3: Comparison of Major Components of Dynamic Ground Water Resources of Kerala (2013 & 2011)	28

LIST OF FIGURES

Figure 2.1: Distribution of Annual Normal Rainfall over Kerala.....	4
Figure 2.2: Hydrogeology of Kerala.....	5
Figure 2.3: Spatial Distribution of Ground Water Levels in Kerala (Apr. 2012).....	7
Figure 5.1: Contribution of districts to the Total Annual Ground Water Recharge in Kerala	17
Figure 5.2: Spatial Distribution of Total Annual Ground Water Recharge in Kerala (2013).....	18
Figure 5.3: Distribution of ground water draft in Kerala as in March 2013	19
Figure 5.4: Status of Net Ground Water Availability & Ground Water Draft (AS in March 2013)	19
Figure 5.5: Categorization of Blocks in Kerala (As in March 2013).....	21

LIST OF ANNEXURES

ANNEXURE I: GOVERNMENT ORDER ON CONSTITUTION OF STATE LEVEL COMMITTEE FOR RE-ESTIMATION OF DYNAMIC GROUND WATER RESOURCES OF KERALA.....	31
ANNEXURE II: MINUTES OF THE MEETINGS OF THE STATE LEVEL COMMITTEE.....	33
ANNEXURE III A: GENERAL DESCRIPTION OF GROUND WATER ASSESSMENT UNITS.....	37
ANNEXURE III B: DATA VARIABLES USED IN THE ASSESSMENT OF DYNAMIC GROUND WATER RESOURCES OF KERALA (2013)	52
ANNEXURE III B (Contd.): DATA VARIABLES USED IN THE ASSESSMENT OF DYNAMIC GROUND WATER RESOURCES OF KERALA (2013)	67
ANNEXURE III C: PARAMETERS USED IN THE ASSESSMENT OF DYNAMIC GROUND WATER RESOURCES OF KERALA (2013)	85
ANNEXURE III D: ASSESSMENT OF DYNAMIC GROUND WATER RESOURCES OF KERALA (March 2013)	113
ANNEXURE III D (Contd.): ASSESSMENT OF DYNAMIC GROUND WATER RESOURCES OF KERALA (2013).	128
ANNEXURE III E: ASSESSMENT OF DYNAMIC GROUND WATER RESOURCES OF KERALA - ASSESSMENT UNIT WISE CATEGORIZATION(2013)	143
ANNEXURE III F: ASSESSMENT OF DYNAMIC GROUND WATER RESOURCES OF KERALA - ADMINISTRATIVE UNIT- WISE CATEGORIZATION (2013).....	158
ANNEXURE III G: JUSTIFICATION FOR CHANGE IN CATEGORIZATION OF BLOCKS IN 2013 COMPARED TO 2011.....	164
ANNEXURE III H: ADDITIONAL POTENTIAL RECHARGE UNDER SPECIFIC CONDITIONS IN KERALA	166

DYNAMIC GROUNDWATER RESOURCES OF KERALA

(As on March 31, 2013)

1.0 INTRODUCTION

Kerala is a tiny strip of land, located in the southwestern tip of India between North latitudes 8° 18' and 12° 48' and East longitudes 74° 52' and 77° 22', occupying only 1.2 percent of India's land area. Its geographical contours can be described as an elongated strip of land, cushioned between the Western Ghats on the east and the sandy shores of the Arabian Sea on the west. Its land area is 38,863 sq.km, stretching 580 km in length and 30.130 km in average breadth. In terms of area, though Kerala forms only 1.2% of the total area of India (3,287,263 sq. km), 3 percent of country's population inhabits the State. The State is subdivided into 14 districts and 152 blocks for administrative convenience.

The occurrence and availability of ground water vary considerably from place to place within the State depending on the prevailing climatic, geomorphological and hydrogeological conditions. About 88 percent of the total geographical area of the State is underlain by crystalline rocks devoid of any primary porosity, with limited ground water prospects. In the alluvial formations having multiple aquifer systems, quality is sometimes a constraint in the optimal development of available resources. Increasing population, rapid urbanization and industrialization has resulted in increasing use of ground water resources over the last few decades in the State. Judicious and planned development of ground water and its scientific management have become necessary to ensure long-term sustainability of this precious natural resource in Kerala. The dynamic ground water resources of the State are being periodically assessed by the Central Ground Water Board (CGWB), jointly with the State Ground Water Department and other Central Government as well as State Government agencies, according to the methodology recommended by the Groundwater Estimation Committee constituted by Govt. of India from time to time. The previous assessment was carried out in 2011. Salient features of the estimation of dynamic ground water resources of Kerala as on March 2013, as per modified GEC-97 recommendations are presented in this report.

1.1 Background

The first attempt to estimate the groundwater resources of the country on a scientific basis dates back to the year 1979, when the 'Ground Water Over-Exploitation Committee' was constituted by Agriculture Refinance and Development Corporation (ARDC) of Reserve Bank of India for the purpose. The ground water resources of India were assessed based on the norms recommended by the above Committee. Subsequently, with the objective of refining the assessment methodology, the "Groundwater Estimation Committee (GEC)" headed by the Chairman, Central Ground Water Board (CGWB) came into existence. Based on the information gathered during the studies carried out by CGWB, the Committee formulated the detailed methodology for estimation of groundwater resources in 1984 (GEC' 84). The methodology was reviewed in 1997 in the light of feedback from different agencies and information gathered from a modified methodology was formulated in 1997 (GEC'97) for computation of groundwater resources. This methodology has since undergone minor modifications and the modified GEC-1997 norms are currently being used for estimation of dynamic ground water resources of the country.

1.2. Constitution of the State Level Committee

Directions were issued by the Ministry of Water Resources, Government of India vide D.O.No.3/16/2008-GW dated 05.01.2010 to all States/Union Territories for constitution of State Level Committees for co-ordination of various activities related to estimation of dynamic ground water resources as in 2009. A request was made for constitution of the committee by

the Regional Director, Central Ground Water Board, Kerala Region, Thiruvananthapuram also vide Letter No.11 (T20)/10-11/561 dated 29.04.2010. In response, Water Resources Department, Government of Kerala issued orders vide G.O. (Rt) No.590/2010/WRD dated 18.05.2010 constituted the State Level Committee for Re-estimation of Ground Water Resources of Kerala with the following members:

Principal Secretary, Water Resources Department	Chairman
Director, Ground Water Department	Member
Director, Agriculture Department	Member
Managing Director, Kerala Water Authority	Member
Chief Engineer, Irrigation & Administration	Member
Director, Dept. of Industries & Commerce	Member
General Manager, NABARD, Thiruvananthapuram	Member
Executive Director, Centre for Water Resources Development & Management, Kozhikode	Member
Regional Director, CGWB, Thiruvananthapuram	Member Secretary

Copy of the Government order constituting the Committee is Annexed (**Annexure I**)

1.3 Ground Water Estimation Procedure

As per directions of the Central Ground Water Board, dedicated Ground Water Resource Assessment Cells were constituted at both Central Ground Water Board and State Ground Water Department to facilitate realistic and coordinated estimation of dynamic ground water resources. The exercise of resource estimation commenced with the collection, collation, compilation and validation of relevant data from various sources. A critical evaluation of the results of the ground water resource assessment taken up during 2004 was undertaken with focus on assessment units categorized as “Over-exploited” and “Critical”. The present ground water scenario in these assessment units were reviewed with the help of field data and enquiries with the field hydrogeologists/local residents and units where the ground truth did not match with the categorization were identified.

The estimation of dynamic ground water resources (March 2013) was undertaken as per the modified GEC-1997 methodology and dynamic ground water resources were computed for all the assessment units. The results were validated in consultation with field professionals of CGWB and State Ground Water Department. Additional field data was collected and incorporated into the computations wherever required before finalizing the results.

The Ministry of Water Resources, Government of India has since directed that state-wise ground water resources of the country will now be computed once every two years. As per these directions, CGWB initiated action for computation of dynamic ground water resources of the country, state-wise, as on 31.03.2011 jointly by State Ground Water Departments and Regional Offices of CGWB. The modalities of the computation were finalized in the 5th meeting of the State Level Committee held on 09.03.2012. It was mentioned in the meeting that the re-organization of blocks in Kerala in 2010 has resulted in the deletion of 7 existing blocks and creation of 7 new blocks in the State. The boundaries of certain blocks have also changed in the process. As the ground water resources are to be computed block-wise, it was felt that the basic data pertaining to the blocks need to be re-computed. It was also noted that ground water extraction data collected during the 4th Minor Irrigation Census (2006-07) was used for assessment of dynamic ground water resources as in 2008-09. As the 5th Minor irrigation Census is yet to be completed, no data regarding increase/decrease in ground water extraction in the State is available. However, available statistics on agriculture appears to indicate no significant increase in ground water extraction for irrigation due to reduction in the cultivation of irrigated food-crops. On the other hand, there is increase in the ground water draft for drinking and domestic uses consequent on the population rise. The minor irrigation census data was updated wherever possible by collecting the number of abstraction structures from different

government offices and utilized for irrigation draft calculations as on March 2013. The domestic draft was calculated on the basis of the population projected to the year 2013.

The assessment of the dynamic ground water resources of Kerala as in March 2013 was computed as per GEC 1997 norms and was approved in the 7th Meeting of the State Level Committee on 27.11.2015.

The approved minutes of the 7th meetings of the State Level Committee for Re-estimation of Ground Water Resources of Kerala are given in Annexure – II.

2.0 HYDROGEOLOGY

The occurrence and movement of groundwater in various litho-units underlying the State are mainly controlled by the physiography, geological setting and structural features.

2.1 Physiography

The State can be sub-divided into three major units based on their geomorphic characteristics viz. the coastal plains, the midlands and the hill ranges. The coastal plains have an elevation of less than 7.6m above mean sea level (a.m.s.l). The elevation of the midland region ranges from 7.6 to 76 m amsl and that of the hill ranges is more than 76 m above mean sea level. Along the hill ranges two distinct plateau regions are seen, the important being the Wayanad plateau, covering major part of Wayanad district, with elevations above 700 m.amsl and the Munnar plateau, located along the northern part of Idukki district with a general elevation of about 1000 m.amsl are the prominent plateaus in the hilly region of the State.

2.2 Rainfall

Kerala receives normal annual rainfall of 3060 mm, received mainly during the Southwest Monsoon period, extending from May to September, followed by the Northeast Monsoon in the months of November and December. The period between May and October accounts for about 87 percent of the annual rainfall. This period has been considered as monsoon season for computation of monsoon rainfall recharge. The amount of rainfall received shows a gradual decrease from North to South. The spatial distribution of normal annual rainfall in the State is shown in **Fig.2.1**.

2.3 Geology

As much as 88% of the State is underlain by crystalline rocks of Archaean age comprising schistose formations, Charnockites, Khondalites and gneisses. All these formations are intruded by dykes of younger age. The

sedimentary formations of Tertiary age occurring along the western parts of the State comprise four distinct beds viz. Alleppey, Vaikom, Quilon and Warkali. The crystalline and the Tertiary formations are lateritized along the midland area. Alluvial deposits of Recent origin are seen along the coastal plains. The general stratigraphic sequence is given in **Table 2.1**.

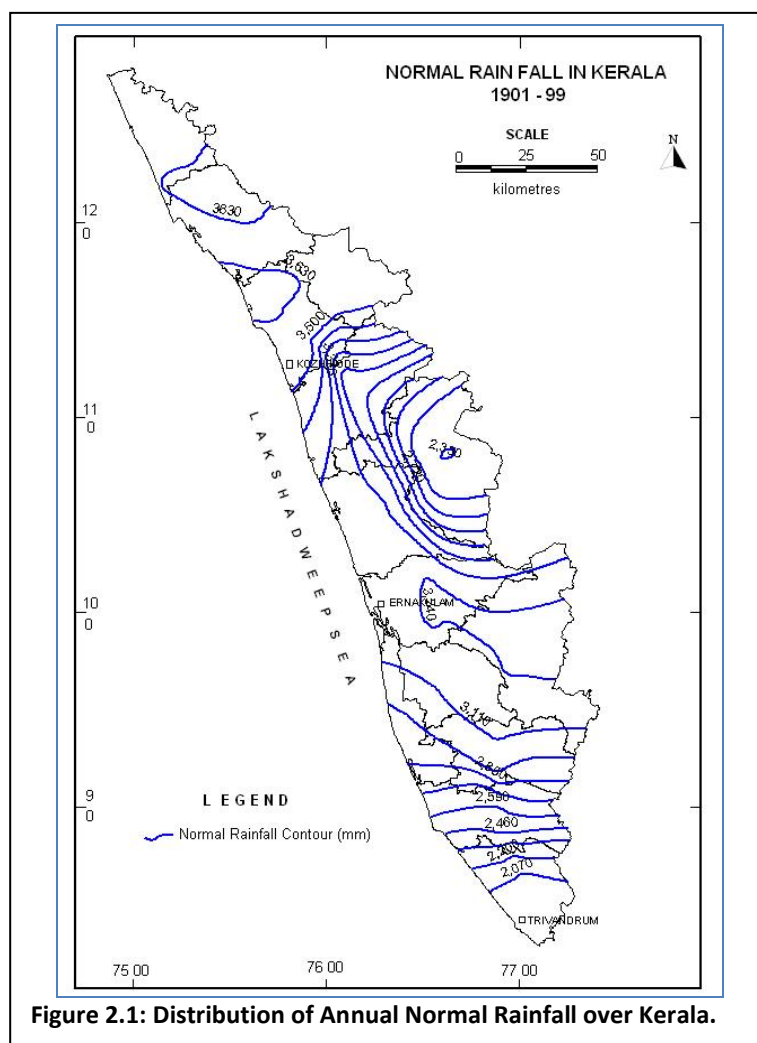


Figure 2.1: Distribution of Annual Normal Rainfall over Kerala.

Table 2.1: Stratigraphic Succession of Geological Formations in Kerala

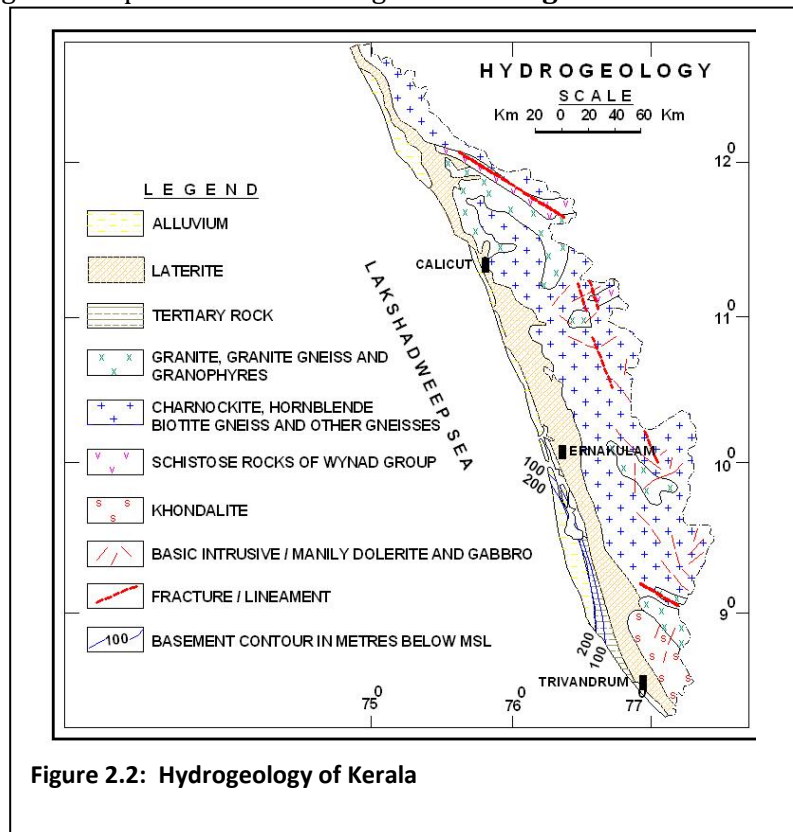
AGE	FORMATION	LITHOLOGY
Recent	Alluvium	Sand, clay, riverine alluvium etc.
Sub-recent	Laterite	Derived from crystalline and sedimentaries
Tertiary	Warkali	Sand stone, clays with lignite
	Quilon	Lime stone, marl and clay
	Vaikom	Sandstone with pebbles, clay and lignite
	Alleppey	Carbonaceous clay and fine sand
Undated	Intrusives	Dolerite, Gabbro, Granites, Quartzo - feldspathic Veins.
Archaean	Wayanad group	Granitic gneiss, Schists etc.
	Charnockites	Charnockites and associated rocks
	Khondalites	Khondalites suite of rocks and its associates

2.4 Occurrence of Groundwater

A generalized Hydro-geological Map of Kerala is given in **Fig.2.2**. In hard rock terrain, comprising weathered crystallines and laterites, ground water occurs under phreatic conditions in the weathered residuum and the shallow fractures hydraulically connected to it, whereas it is under semi-confined to confined conditions in the deep fracture zones. In the alluvial terrain, ground water in the shallow aquifer systems is in phreatic condition. Granular zones in the Tertiary sedimentary formations at deeper levels form potential confined to semi-confined aquifers.

2.4.1 Crystalline Rock Aquifers

The shallow aquifers of the crystalline rocks are made up of the highly decomposed weathered zone or partly weathered and fractured rocks. Thick weathered zone is seen along the midland area either beneath the laterites or exposed. In the hill ranges thin weathered zone is seen along topographic lows and area with lesser elevation and gentle slope. In areas along the hill ranges generally rock exposures are seen. The depth to water level in this aquifer varies from 2 to 16 m.bgl and the yield of the well ranged between 2 to 10 m³ per day.

**Figure 2.2: Hydrogeology of Kerala**

Exploratory drilling carried out by Central Ground Water Board in the State in the crystalline formations has indicated that the potential fractures are encountered at depths ranging between 60 to 175 m.bgl with yield varying from less than 1 to as much as 35 litres per second (lps). In Charnockites, more than 40% of the wells have yielded more than 10 lps or above indicating that in Kerala, Charnockite suite of rocks are better aquifers compared to Khondalite group.

2.4.2 Tertiary Rock Aquifers

Groundwater occurs under phreatic condition in the shallow zone and under semi-confined to confined conditions in the deeper aquifers. The Tertiary formation of Kerala coast is divided into four distinct beds viz. Alleppey, Vaikom, Quilon and Warkali. These formations except the Alleppey beds are seen as outcrops and they are lateritized wherever they are exposed. The maximum thickness of Tertiary sediments is found between Karunagapally and Kattoor and all the four beds are found in this area.

Groundwater is commonly developed through dug wells tapping the sandy zones at shallow depth in the Tertiary sediments. The depth to water level in this shallow zone ranges from 3.0 to 27 m.bgl and the yield of the wells range from 500 to 20000 litres per day.

The Vaikom and Warkali beds form the most potential aquifers in the Tertiary group. The Alleppey bed has been encountered at deeper levels in the bore holes drilled in the coastal tract of Alappuzha district and the formation water is found to be saline and hence, no tube well has been constructed tapping this formation.

In the Vaikom aquifers, the piezometric level is between 2 m above msl to 20 m below msl. The yield of the tube wells constructed in this formation ranges from 1 to 57 lps. This bed forms auto flow zones along the coast between Karunagapally in Kollam district and Nattika and Kaipamangalam in Thrissur district. The water is generally fresh south of Karuvatta in Alappuzha district. Recent exploration by CGWB proved that good quality groundwater pockets are in existence in this formation in and around Cochin.

Warkali aquifers are the most developed aquifer system among the Tertiary group. The urban and rural water supply in the coastal area between Kollam and Cherthala is mostly dependent on this. The piezometric head is about 3 m. above msl along the eastern part of the sedimentary basin whereas it is 10 m. below msl in and around Alappuzha. The yield of the wells tapping this formation ranges from 3 to 14 lps.

The hydrogeological information on Quilon beds is very limited. The formation is considered to be a poor aquifer compared to Vaikom and Warkali beds.

2.4.3 Laterite Aquifers

Laterites are the most widely distributed lithological unit in the State and the thickness of this formation varies from a few meters to about 30 m. Laterite forms potential aquifers along topographic lows and valleys. The depth to water level in this formation ranges from 2 to 25 mbgl and the yield ranges from 0.5 to 30 m³ per day. The occurrence and movement of groundwater in the laterites are mainly controlled by the topography. Laterite is a highly porous rock formation, which can form potential aquifers along topographic lows. However, due to the porosity, groundwater is drained from elevated places and slopes at shortest duration after monsoon and hence water scarcity is experienced in the elevated places and slopes.

2.4.4 Alluvial Aquifers

The alluvial deposits forms potential aquifer along the coastal plains and groundwater occurs under phreatic and semi-confined conditions in this aquifer. The thickness of this formation varies from few meters to above 100 m and the depth to water level ranges from less than a meter to 6 mbgl. Filter point wells are feasible wherever the saturated thickness exceeds 5m.

This potential aquifer is extensively developed by dug wells and filter point wells throughout the State and the yield ranges from 5 to 35 m³ per day.

2.5 Ground Water level Conditions in 2012-13

The depth to water level was monitored from 1006 monitoring wells distributed throughout the State during the months of April, August, November and January. The water level measured during the month of April is taken as pre-monsoon water level and the data of November is taken as post-monsoon water level, on the basis of temporal distribution of long-term rainfall in the State.

The depth to water level mostly depends on the hydrogeological conditions of the area as well as topography, rainfall pattern, etc. In coastal plains the depth to water level is generally restricted to 6 mbgl. In midland areas, where the undulating topography is seen, the depth to water level generally varies from near ground level to 25 mbgl. The variation is mostly due to topographical variations, thickness of lateritic overburden etc. In areas where laterites are underlain by sedimentary aquifers of Tertiary age, the water level goes very deep, even to the extent of 55 mbgl. In highlands the depth to water level is in the range of few cm to 10 mbgl depending on the topography and thickness of overburden (weathered zone).

2.5.1 Depth to water level during Pre-monsoon Period (April 2012)

The pre-monsoon water level in Kerala State as measured from Ground Water Monitoring Wells (GWMW) during April 2012 ranged from 0.30 to 25.75 metres below ground level but mostly falls within the range of 5 – 15.0 mbgl as shown by Monitoring wells (GWMW). Shallow water level in the range of 0.3 – 2.0 mbgl is seen in Alappuzha district, in the coastal tracts of Ernakulam and Thrissur districts and also eastern parts of high ranges along valleys in Idukki district. The areas falling in the midland region generally show water level in the range of 3 – 12 mbgl. In Kasargod, Kannur and Thiruvananthapuram districts deep water level more than 20mbgl is noticed in certain pockets of areas where thick lateritic overburden is seen. A map showing the spatial distribution of ground water levels in the phreatic zone during pre-monsoon period is given as **Fig.2.3**

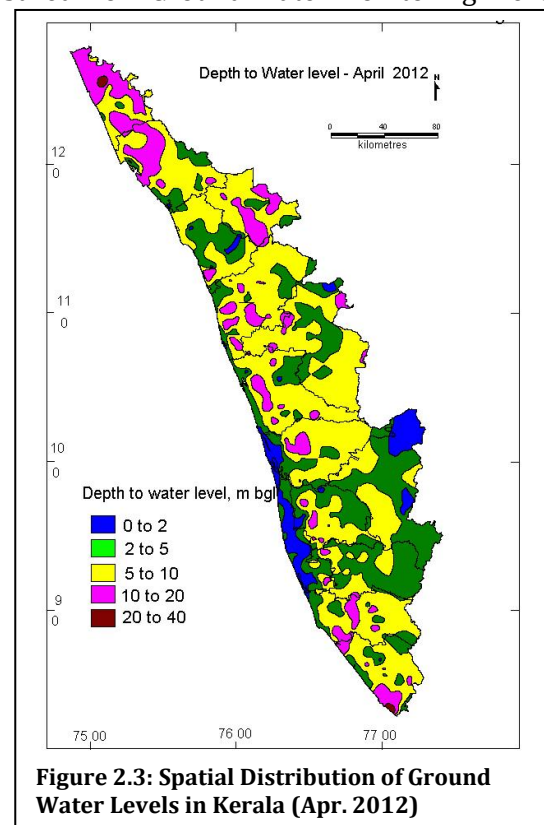


Figure 2.3: Spatial Distribution of Ground Water Levels in Kerala (Apr. 2012)

2.5.2 Depth to water level during August 2012

During the month of August 2012 the depth to water level varies widely from 0.10 to 23.75 mbgl but mostly falls within the range of 3 – 10.0 mbgl as shown by GWMWs. Shallow water level in the range of 0.2 – 2.0 mbgl is seen all along the coastal tracts and also in eastern parts of high ranges in Idukki district. The areas falling in the midland region generally show water level in the range of 2 – 10 mbgl. In Kasaragod and Thiruvananthapuram districts deep water level more than 20 mbgl is noticed in certain pockets of areas where thick lateritic overburden is seen.

2.5.3 Depth to Water Level during Post-monsoon Period (November 2012)

Depth to water level in Kerala State ranged from 0.10 to 24.00 metres below ground level but mostly falls within the range of 3 – 10 mbgl as shown by Ground Water Monitoring Wells (GWMW). Shallow water level of less than 2mbgl is seen along the coastal tracts of Kollam, Alappuzha, Ernakulam, Thrissur, Kozhikode and Kannur districts and also in the northeastern

parts of high ranges in Idukki district. The midland areas show water level in the range of 2 – 10 mbgl. In central parts of Kasargod, northern parts of Kannur and in certain areas of Wayanad districts show water level in the range of 10 – 20 mbgl. In Kasargod and Thiruvananthapuram districts water level deeper than 20 bgl are noticed in certain pockets of areas where thick lateritic overburden is seen.

2.5.4 Depth to water level during January 2013

Depth to water level varies widely from 0.30 to 25.0 mbgl during the month of January 2013 but mostly falls within the range of 3 – 10 mbgl as shown by GWMWs. Shallow water level of less than 2mbgl is seen along the coastal tracts of Alappuzha, Ernakulam and Thrissur districts and northeastern parts of high ranges in Idukki district and also as small patches in Kozhikode, Kannur, Kollam and Malappuram districts. The midland areas show water level in the range of 2 – 10 mbgl. In central parts of Kasargod, northern parts of Kannur and in certain areas of Wayanad districts show water level in the range of 10 – 20 mbgl. In Kasargod and Thiruvananthapuram districts moderately deep water level is more than 20 m bgl is noticed in certain pockets of areas where thick lateritic overburden is seen.

2.5.5 Fluctuation of Ground Water Levels between April 2012 and November 2012

Comparison of November 2012 water level with that of April 2012 indicates rise in water level in the range of 0.0 to 3.0 m in most parts of the State. Decline in water levels is noticed in isolated pockets in parts of Thiruvananthapuram, Pathanamthitta, Ernakulam and Thrissur districts. Major part of the State recorded a rise in water level of less than 3 meters as revealed by 88.79% of observation wells.

2.5.6 Long-term Fluctuation of Ground Water levels

The long-term fluctuations in ground water levels in the State have been studied by comparing the pre-and post-monsoon water levels during 2012 with the average fluctuation of the previous 10 years (2002-2011).

2.5.6.1 Fluctuation between Mean April (2002-2011) and April 2012

The change in water level over the last ten years period is brought out by the comparison of April 2012 water level with the mean value of April measurements of the period 2002 – 2011. This analysis indicates that the change in water level is mostly restricted to + 2(rise) to –2(fall) m as recorded by 89.87% of dug wells monitored. Fall in water level is prominently seen in most of the districts except Idukki, Kottayam, Pathanamthitta and Kollam districts.

2.5.6.2 Fluctuation between Mean November (2002-2011) and November 2012

A comparison of water levels recorded during November 2012 with the average water levels during the month for the period 2002-2011 indicates that the change in the water level is mostly restricted to +2 (rise) to –2 (fall) m as recorded in 95.3% of observation wells. Rise in water levels is observed in about 69% of wells, predominantly in Palakkad, Thrissur, Malappuram, Kozhikode and Kannur districts.

2.6 Quality of Ground Water

Ground water in phreatic aquifers in Kerala, in general, is fresh and suitable for domestic, irrigation and industrial uses. About 95% observation wells tapping the phreatic zone have Specific Electrical Conductance below 500 $\mu\text{S}/\text{cm}$ at 25°C. Isolated occurrence of brackish/saline ground water has been observed, mainly in the coastal districts and in the vicinity of tidal estuaries and streams. Fluoride in excess of permissible limits of 1.5 mg/l has been observed in parts of Palakkad districts and presence of Iron in excess of permissible limits in parts of most of the districts. Nitrate is another constituent present in excess of permissible limits in parts of most of the districts in the State. Bacterial contamination is observed all along coastal area and it is found more in Alappuzha district

3.0 GROUND WATER RESOURCES ESTIMATION METHODOLOGY, 1997.

Ground water resources of Kerala was assessed during 2004 as per the recommendations of Groundwater Estimation Committee-1984 (GEC-84). The GEC-84 methodology was subsequently modified in the light of enhanced data base and new findings of experimental studies in the field of hydrogeology. The present methodology used for resource assessment is based on Groundwater Resource Estimation Methodology-1997 (GEC -97). A brief description of the salient aspects of the methodology is furnished below:

In GEC-97, two approaches were recommended for estimation of ground water recharge - water level fluctuation method and rainfall infiltration method. The water level fluctuation method is based on the concept of storage change due to difference between various input and output component. Input refers to recharge from rainfall and other sources and subsurface inflow into the unit of assessment. Output refers to groundwater draft, evapotranspiration, base flow to streams and subsurface outflow from the unit. Since the data on subsurface inflow/outflow are not readily available, it is advantageous to adopt the unit for groundwater assessment as basin/sub basin/watershed, as the inflow/outflow across these boundaries may be taken as negligible.

Thus it is ideal to have the groundwater resources assessment unit as watershed particularly in hard rock areas. In case of alluvium areas and where there is no data on water shed wise is available, administrative block can also be the assessment unit. In each assessment unit, hilly areas having slope more than 20% are deleted from the total area to get the area suitable for recharge. Further, areas where the quality of groundwater is beyond the usable limits should be identified and handled separately. The remaining area after deleting the hilly area and separating the area with poor groundwater quality is to be delineated into command and non-command areas. Groundwater assessment in command and non-command areas are done separately for monsoon and non-monsoon seasons.

3.1 Ground Water Recharge

a. Monsoon season

The resources assessment during monsoon season is estimated as the sum total of the change in storage and gross draft. The change in storage is computed by multiplying water level fluctuations between pre and post monsoon periods with the area of assessment and specific yield of the formation. Monsoon recharge can be expressed as

$$R = (h \times S_y \times A) + DG$$

Where,

h = rise in water level in the monsoon season,

A = area for computation of recharge

Sy = specific yield, and

DG= gross groundwater draft

The monsoon groundwater recharge has two components- rainfall recharge and recharge from other sources. Mathematically it can be represented as:

$$R \text{ (Normal)} = R_{rt} \text{ (normal)} + R_c + R_{sw} + R_t + R_{gw} + R_{wc}$$

where R_{rt} is the normal monsoon rainfall recharge. The other sources of groundwater recharge during monsoon season include R_c , R_{sw} , R_t , R_{gw} , R_{wc} which are recharge from seepage from canals, surface water irrigation, tanks and ponds, groundwater irrigation and water conservation structures respectively.

The rainfall recharge during monsoon season computed by Water Level Fluctuation (WLF) method is compared with recharge figures from Rainfall Infiltration Factor (RIF) method. In case the difference between the two sets of data are more than 20% then RIF figure is considered, otherwise monsoon recharge from WLF is adopted. While adopting the rainfall recharge figures, weightage is to be given to WLF method over ad hoc norms method of RIF. Hence, wherever the difference between RIF and WLF is more than 20%, data have to be scrutinized and corrected accordingly.

b. Non-Monsoon season

During non-Monsoon season, rainfall recharge is computed by using Rainfall Infiltration Factor (RIF) method. Recharge from other sources is then added to get Total Non-Monsoon recharge.

3.2 Total Ground Water Resource

The total ground water resource of the area is the sum of monsoon and non-monsoon recharge. An allowance is kept for natural discharge in the non monsoon season by deducting 5% of annual replenishable groundwater resource, where ever WLF method is employed to compute rainfall recharge during monsoon and 10% if RIF method is employed.

3.3 Net Ground Water Availability

The Net annual ground water availability has been computed after deducting the natural discharge from the Annual Replenishable Ground Water Resource and can be expressed as:

$$\text{Net Groundwater Availability} = \text{Total Groundwater Resource} - \text{Natural discharge during non-monsoon season.}$$

3.4 Annual Ground Water Draft

Annual groundwater draft has been calculated for Irrigation, Domestic and Industrial uses. The gross groundwater draft would include the groundwater extraction from all existing groundwater structures during monsoon as well as during non-monsoon period. While the number of groundwater structures should preferably be based on latest well census, the average unit draft from different types of structures should be based on specific studies or ad-hoc norms given in GEC'97 report.

3.5 Future Utilization of Ground Water Resource

The demand for domestic and industrial water supply has been kept based on projected population for the year 2025. Future allocation of ground water resources for utilization is computed based on projected population, fractional load on ground water and per-capita requirement as given below:

Case I:

When $GWav \geq Dgi + Alld$

Allocation for future domestic requirement = $Alld$

Case II:

When $GWav < Dgi + Alld$

Allocation for future domestic requirement = $(GWav - Dgi)$ or Dgd , whichever is more.

Where,

$GWav$ = Net Annual Ground Water Availability

Dgi = Existing Ground Water draft for Irrigation

- Dgd = Existing Ground Water draft for Domestic use
 Dg = Existing Ground water draft for all uses
 Alld = Computed value of allocation for domestic use

3.6 Net Ground Water Available for Future Irrigation Requirement

The ground water available for future irrigation has been computed by deducting the projected demand for Domestic and Industrial use and existing irrigation draft from the Net Annual Ground Water Availability.

3.7 Poor Quality Ground Water

Computation of groundwater recharge in poor quality water is to be done on the same line as described above. However, in saline areas, there may be practical difficulty due to non availability of data, as there will usually be no observation wells in such areas. Recharge assessment in such cases may be done based on rainfall infiltration factor method.

3.8 Apportioning of Ground Water Assessment from Watershed to Development Unit

Where the assessment unit is a watershed, the groundwater assessment is converted in terms of an administrative unit such as block / taluk / mandal. This is done by converting the volumetric resource into depth unit and then multiplying this depth with the corresponding area of the block.

3.9 Additional Potential Recharge

In shallow water table areas, particularly in discharge areas, rejected recharge would be considerable and water level fluctuation are subdued resulting in under estimation of recharge component. In the areas where the groundwater level is less than 5 m below ground level or in waterlogged areas, groundwater resources have to be estimated up to 5 mbgl based on the following equation.

$$\text{Potential groundwater recharge} = (5-D) \times A \times \text{Specific Yield}$$

Where D= depth to water table below ground surface in pre monsoon season in shallow aquifers and A= area of shallow water table zone.

3.10 Stage of Ground Water Development

The stage of Groundwater development has been computed as given below

$$\text{Stage of Groundwater Development (\%)} = \frac{\text{Existing Gross Groundwater Draft for all uses}}{\text{Net annual Groundwater Availability}} \times 100$$

3.11 Categorization of Assessment Units

The units of assessment are categorized for groundwater development based on two criteria viz. (a) stage of groundwater development and (b) long term trend of pre and post monsoon water levels. There are four categories based on the above norms (1) 'Safe' areas which have groundwater potential for development; (2) 'Semi-Critical' areas where cautious groundwater development is recommended. (3) 'Critical' areas and (4) 'Over-Exploited' areas where there should be intensive monitoring and evaluation and future groundwater development be linked with water conservation measures and micro level studies. The details of criteria for categorization of assessment units are given in **Table 3.1**.

Table 3.1: Criteria for Categorization of Assessment Units

Sl.No.	Stage of Groundwater Development	Significant Long term Decline		Categorization
		Pre-monsoon	Post-monsoon	
1	< = 70%	No	No	Safe
		Yes/No	No/Yes	To be re-assessed
		Yes	Yes	To be re-assessed
2	>70% and <=90%	No	No	Safe
		Yes/No	No/Yes	Semi-Critical
		Yes	Yes	To be re-assessed
3	>90% and <=100%	No	No	To be re-assessed
		Yes/No	No/Yes	Semi-Critical
		Yes	Yes	Critical
4	>100%	No	No	To be re-assessed
		Yes/No	No/Yes	Over-Exploited
		Yes	Yes	Over-Exploited

Note: 'To be re-assessed' means that data is to be checked and reviewed. If the groundwater resource assessment and the trend of long term water levels contradict each other, this anomalous situation requires a review of the groundwater resource computation, as well as the reliability of water level data.

The long-term groundwater level data should preferably be for the period of 10 years. The significant rate of water level decline may be taken between 10 and 20 cm per year depending upon the local hydrogeological conditions.

4.0 PROCEDURE FOLLOWED IN THE ASSESSMENT OF DYNAMIC GROUND WATER RESOURCES OF KERALA (MARCH 2013)

The dynamic ground water resources of Kerala, as in 2011 have been assessed as per the modified GEC-97 norms.

4.1 Norms used in the Computation of Resources

Salient details of the norms used in the estimation of dynamic ground water resources are discussed below in brief:

4.1.1 Rainfall Infiltration Factor (RIF)

In the absence of documented studies for determination of Rainfall Infiltration Factor (RIF) in the State, standard values recommended by GEC have been used. The RIF values used for various geological formations in the State are shown below (**Table.4.1**)

Table 4.1: Values of Rainfall Infiltration Factor used for Computation of Dynamic Ground Water Resources of Kerala.

Sl.No	Geological Formation	Rainfall Infiltration Factor (RIF) (%)
1	Alluvium	8-12
2	Laterite	6-8
3	Weathered Granites/Gneisses	5-9
4	Rocks of Granulite facies	4-6
5	Massive/poorly fractured rock	1-3

4.1.2 Specific Yield

Specific yield values were taken as per the recommended norms in general, with appropriate corrections, considering the field conditions and data availability. The specific yield values taken for computation are given below (**Table.4.2**).

Table 4.2: Specific Yield Values of Different Hydrogeological Units Used in the Computation of Ground Water Resources of Kerala.

Sl.No.	Hydrogeological unit	Specific yield (%)
1	Sandy alluvial area	12-18
2	Valley fills	10-14
3	Silty/clayey alluvial area	5-12
4	Granites	0.2-2
5	Laterite	2-5
6	Weathered Granites & Gneisses	1-4
7	Massive/poorly fractured rocks	0.2-0.5

4.1.3 Unit Ground Water Draft

As in the previous assessment (2011), ground water draft for domestic uses has been computed based on the population in 2011, projected to the year 2013. A per-capita requirement of 150 Litre/ day has been assumed for domestic uses in the State. The fractional load of this requirement is computed on the basis of the extent of surface water supply for domestic use in the assessment unit.

Values of unit ground water draft for irrigation for different types of wells, adopted in the previous assessment (2010-11), modified wherever necessary based on sample surveys have been used in the present assessment for computation of ground water draft. The unit draft values for different types of wells in the State are shown in Table.4.3.

Table 4.3: Unit Ground Water Draft for Irrigation in Different Types of Wells in Kerala.

Sl. No.	Type of Well	Unit Draft (ha.m)
1	Non-energized dug wells	0.06 to 0.12
2	Energized dug wells	0.3 to 0.54
3	Shallow tube/bore wells	0.30 to 1.0
4	Domestic wells used for irrigation	0.007 to 0.05

5.0 COMPUTATION OF DYNAMIC GROUND WATER RESOURCES OF KERALA (2013)

5.1 Introduction

In the absence of watershed wise data on various components of recharge and discharge, the ground water resources have been computed for administrative units in the State, with block as the assessment unit. Accordingly, the computations have been made for 152 assessment units spread across 14 districts of the State. The ground water resources of urban habitations comprising 5 Municipal Corporations, 60 Municipalities and 1 Township have not been assessed separately due to constraints of data availability. Instead, they have been combined with one of the adjoining blocks based on their hydrogeologic setting. The list of such urban habitations and the blocks with which they have been combined is given in **Table.5.1**.

The area under command and non command could not be separated mainly due to non availability of data pertaining to canal command areas of the State. Further, the irrigation projects of Kerala are mostly planned for irrigating paddy along the topographic lows and as such the irrigation canals are all center controlled. Hence in each unit there are large areas along the upstream side of the canal, which do not get benefits of surface water irrigation. Due to the highly undulating topography of the mid land area where most of the canals exist, it is quite difficult to accurately demarcate the areas under command and non-command. In view of the factors mentioned above, the computations have been made by taking all assessment units as non-canal command area. The recharge from canal segments and return seepage from irrigation due to surface water in the command area have, however, been incorporated into the computations. Salient details of assessment units in the State are furnished in **Annexure IIIA**. Data variables used in the estimation are shown in **Annexure IIIB** and details of parameters used in the computation in **Annexure IIIC**.

The data required for computation of resources have been collected, to the extent possible, with 2012 as the base year. Wherever data pertaining to 2012 are not available, the data pertaining to the most recent period have been collected and used for computation. Due to non-availability of relevant data for computation of recharge from other sources during non-monsoon period, data used in the earlier assessment has been used in the current assessment as well.

5.2. Method Adopted for Computing Rainfall Recharge During Monsoon:

Based on the analysis of long-term rainfall data in the State, the period from May to October has been considered as the monsoon period and from November to April as non-monsoon period. The method adopted for computation of rainfall recharge during monsoon season depends on the Percentage Departure (PD), which is the difference between the recharge computed using Water Table Fluctuation (WTF) method and Rainfall Infiltration Factor (RIF) methods, expressed as a percent of recharge computed by the latter method. In cases where PD is between +20 and -20, monsoon rainfall recharge computed by Water Table Fluctuation Method is used, whereas in other cases, recharge computed by Rainfall Infiltration Method is used.

5.3 Total Annual Ground Water Recharge

The Total Annual Ground Water Availability in Kerala State as on March 31, 2013 has been computed as **5.664 Billion Cubic Metre (BCM)**. Rainfall recharge accounts for about **82** percent of the annual recharge, with the remainder contributed by other sources. The contribution of districts to the total annual recharge of the State is shown in **Fig.5.1**. Details of block-wise total annual ground water recharge are shown in **Annexure IIID**.

Table 5.1: List of Urban Habitations in Kerala which have been Combined with Adjacent Blocks for Assessment of Dynamic Ground Water Resources (2013)

Sl.No	District	Urban Habitation	Habitation Type	Block
1	Alappuzha	Cherthala	Municipality	Thycattusserry
2		Alappuzha	Municipality	Aryad
3		Kayamkulam	Municipality	Muthukulam
4		Chengannur	Municipality	Chenganur
5		Mavelikara	Municipality	Mavelikara
6	Ernakulam	Aluva	Municipality	Vazhakulam
7		Angamaly	Municipality	Angamaly
8		Kalamassery	Municipality	Vazhakulam
9		Kothamangalam	Municipality	Kothamangalam
10		Maradu	Municipality	Palluruthy
11		Muvattupuzha	Municipality	Muvattupuzha
12		Paravur	Municipality	Paravur
13		Perumbavur	Municipality	Koovapady
14		Thrissur	Municipality	Mulanthuruthy
15		Kochi (Cochin)	Municipal Corporation	Eapally
16		Eloor	Municipality	Eapally
17		Thrissur	Municipality	Vazhakulam
18	Idukki	Idukki Township	Township	Idukki
19		Thodupuzha	Municipality	Thodupuzha
20	Kannur	Kannur	Municipality	Kannur
21		Koothuparambu	Municipality	Koothuparambu
22		Mattanur	Municipality	Iritty
23		Payyannur	Municipality	Payyannur
24		Thaliparambu	Municipality	Thaliparambu
25		Thalassery	Municipality	Thalassery
26	Kasargod	Kanhangad	Municipality	Kanhangad
27		Kasargod	Municipality	Kasargod
28		Nileswarem	Municipality	Nileswar
29	Kollam	Karunagappalli	Municipality	Oachira
30		Kollam	Municipal Corporation	Mukhathala
31		Paravoor	Municipality	Ithikara
32		Punalur	Municipality	Pathanapuram
33	Kottayam	Pala	Municipality	Lalam
34		Vaikom	Municipality	Vaikom
35		Kottayam	Municipality	Pallom
36		Chanaganassery	Municipality	Madapally
37	Kozhikode	Kozhikode	Municipal Corporation	Kozhikode
38		Quilandy	Municipality	Panthalayani
39		Vadakara	Municipality	Vadakara
40	Malappuram	Kottakkal	Municipality	Vengara
41		Malappuram	Municipality	Malappuram
42		Manjeri	Municipality	Arekode
43		Nilambur	Municipality	Nilambur
44		Perinthalamanna	Municipality	Perinthalamanna
45		Ponnani	Municipality	Ponnani
46		Tirur	Municipality	Tirur
47	Palakkad	Chittur- Thathamangalam	Municipality	Chittur
48		Ottapalam	Municipality	Ottapalam
49		Palakkad	Municipality	Palakkad
50		Shoranur	Municipality	Pattambi
51	Pathanamthitta	Adoor	Municipality	Parakkode
52		Pathanamthitta	Municipality	Konni

53		Thiruvalla	Municipality	Mallapally
54	Thiruvananthapuram	Attingal	Municipality	Chirayinkeezh
55		Nedumangad	Municipality	Nedumanagad
56		Neyyattinkara	Municipality	Athiyannur
57		Varkala	Municipality	Varkala
58		Trivandrum	Municipal Corporation	Nemom
59	Thrissur	Chalakkudy	Municipality	Chalakkudy
60		Chavakkad	Municipality	Chavakkad
61		Guruvayur	Municipality	Chavakkad
62		Irinjalakuda	Municipality	Irinjalakuda
63		Kodungalur	Municipality	Mathilakam
64		Kunnamkullam	Municipality	Chowannur
65		Thrissur	Municipal Corporation	Puzhakkal
66	Wayanad	Kalpetta	Municipality	Kalpetta

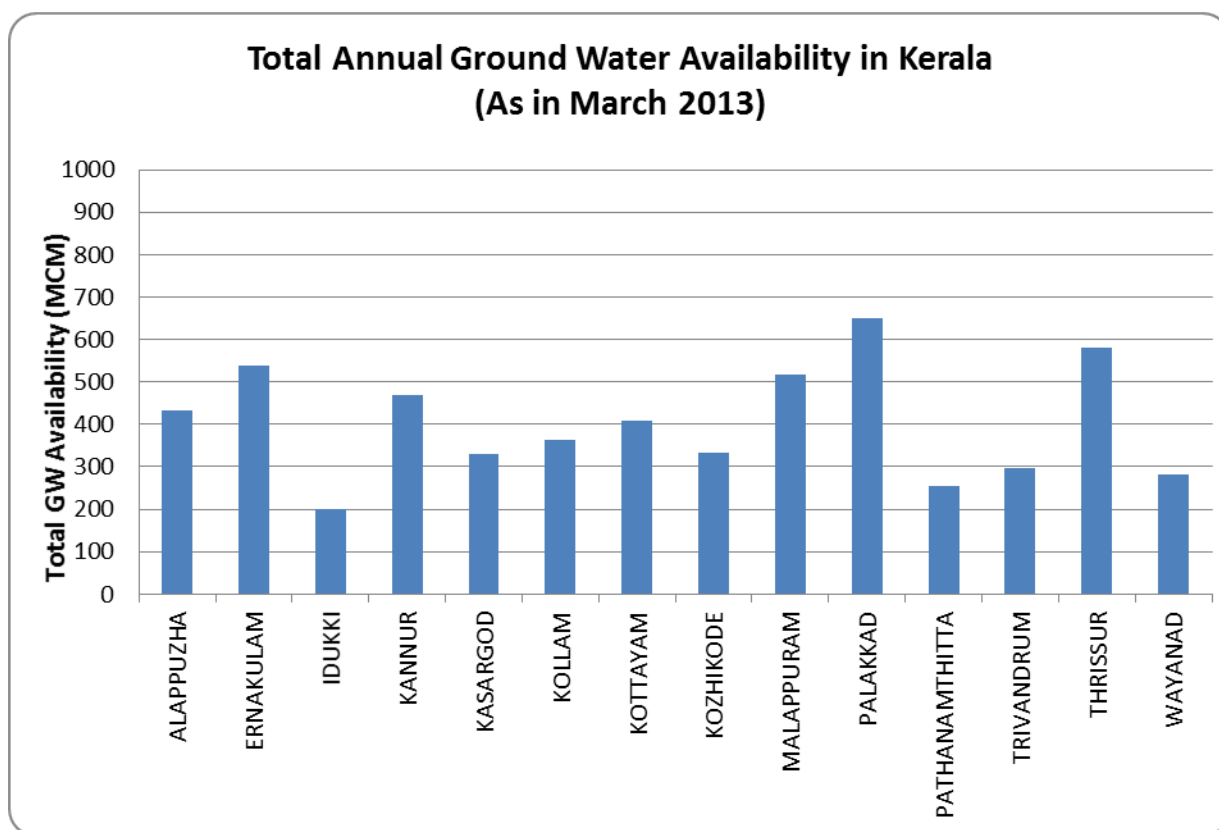


Figure 5.1: Contribution of districts to the Total Annual Ground Water Recharge in Kerala

The spatial distribution of Total Annual Ground Water Recharge in Kerala as in March 2013 in depth units (m) is shown in **Fig.5.2**.

5.4 Net Ground Water Availability

The net groundwater availability was calculated as per the norms recommended in the 1997 methodology by deducting un-accounted losses and natural discharge during the non-monsoon season from the Total Annual Recharge available. Such losses were considered to account for 10% of the total annual recharge in assessment units where the monsoon rainfall recharge was calculated using Rainfall Infiltration Factor Method and 5% in assessment units where the monsoon rainfall re-charge was calculated by Water Level Fluctuation Method. Block wise Net Ground Water Availability in the State as in March 2011 is given in **Annexure III D**. As per the computation, Net Ground Water Availability for the entire State is **5.664 billion cubic metre**

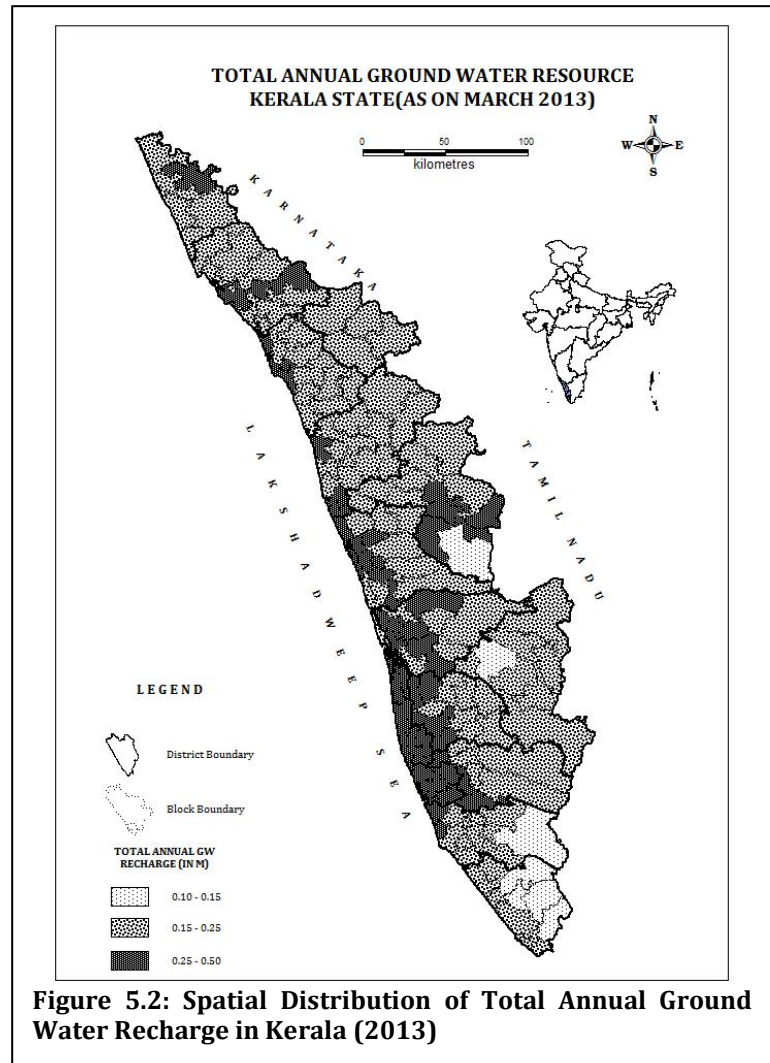
(BCM). The district-wise availability in the State ranges from **200.43MCM** in Idukki district to **637.83MCM** in Palakkad district.

5.5 Ground Water Draft

Ground water draft in Kerala is mainly for domestic uses and for irrigation. In view of the non-availability of data on the number of wells being used for domestic purposes, the ground water draft for domestic uses has been computed block-wise on the basis of 2011 population, projected to the year of assessment (2013). Domestic requirement of water in the State has been computed as the product of the population and the per-capita water requirement (assumed as 150 L / day/person). The share of ground water in the requirement has been computed as a percentage varying from 25 to 100%, arrived at on the basis of availability of surface water sources for domestic water supply.

The ground water draft has been computed from the data on the block-wise number of irrigation wells collected by the State Ground Water Dept., Government of Kerala. The ground water draft figures are arrived at by multiplying the number of wells with the corresponding unit draft.

The Annual Ground Water Draft for all uses in the State is of the order of **2.635 BCM** and ranges from **54.74 MCM** in Wayanad district to **352.85 MCM** in Palakkad district. Details of block-wise groundwater draft are given in **Annexure IIID**. The spatial distribution of ground water draft among districts in the State is shown in **Fig.5.3**.



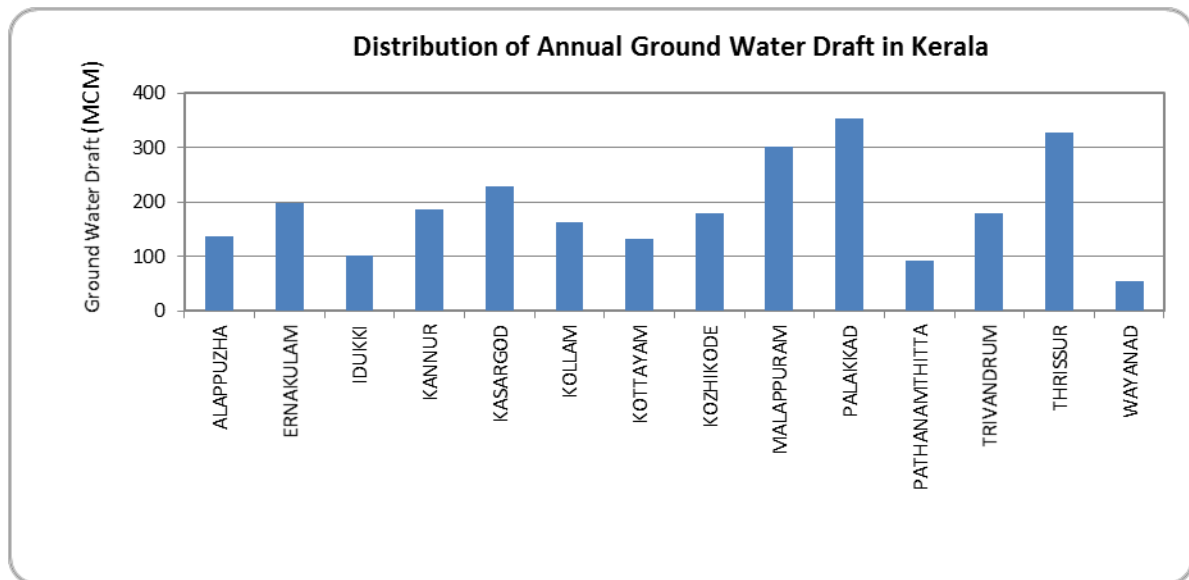


Figure 5.3: Distribution of ground water draft in Kerala as in March 2013

5.6 Provision for Domestic and Industrial Requirements for the Year 2025

The provision of ground water resources for domestic and industrial uses for the year 2025 has been computed as per GEC 1997 norms and is of the order of **1.55 BCM**. The block-wise figures are given in **Annexure III D**

5.7 Net Ground Water Availability for Future Irrigation Development

The availability of ground water resources for future development has been computed as the difference between the Net Annual Ground Water Resource available and the Annual Ground Water Draft for all purposes. The Net Ground Water Availability for future irrigation development in the State as in March 2013 is of the order of **2.94 BCM**. The district-wise net ground water availability ranges from **98.65 MCM** in Kasargod district to **325.33 MCM** in Ernakulam district. The block-wise balance ground water available is shown in **Annexure III D**. District-wise status of Net Ground Water Availability and Annual Ground Water Draft for all uses is shown in **Fig.5.4**.

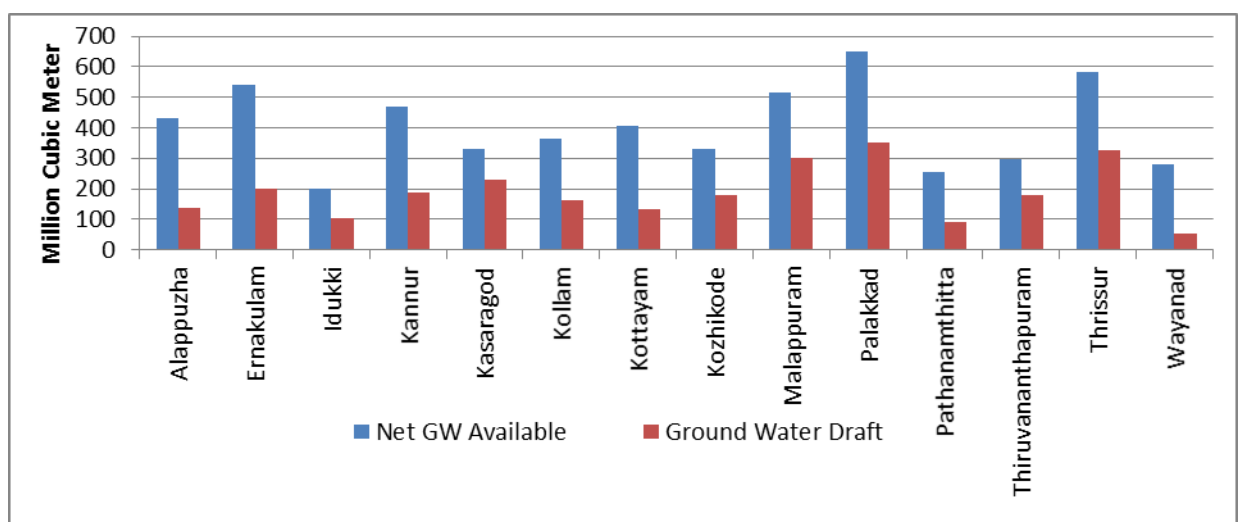


Figure 5.4: Status of Net Ground Water Availability & Ground Water Draft (As in March 2013)

5.8 Stage of Ground Water Development

The stage of ground water development of assessment units, computed as the ratio of Existing Gross Ground Water Draft for all uses and the Net Annual Ground Water Availability is of the order of **47** percent for the State of Kerala as a whole. The average stage of ground water development is the highest in Kasargod district (**69%**) and the lowest in Wayanad district (**19%**). Block-wise details of Stage of Ground Water Development as in March 2013 are given in **Annexure III D**.

5.9 Categorization of Blocks

The Assessment units have been categorized as “Over-exploited”, “Critical”, “Semi-critical” or “Safe” on the basis of Stage of Ground Water Development and the long-term decline of average ground water levels in the observation wells in the assessment unit, as per the criteria suggested in GEC-1997 methodology. In cases where the Water Level Fluctuation (WLF) method has been used for computation of ground water recharge during monsoon season, the assessment units have been categorized strictly as per the norms.

Decline of ground water levels of 15 cm per year or more has been considered significant in the State while categorizing the blocks. However, in such units where the monsoon recharge has been computed by ad-hoc method on account of the water level data not being representative, categorization has been done primarily on the basis of stage of development and the existing ground situation. Out of 152 assessed units in the State, Chittur block of Palakkad district has been categorized as ‘Over-exploited’ and 2 blocks (Kasargod block of Kasargod district and Malampuzha block of Palakkad district) have been categorized as “Critical”. Out of the remaining blocks, 18 blocks are “Semi-critical” and **131** blocks are “Safe”. The block-wise details of categorization, along with ground water quality issues wherever prevalent are furnished in **Annexure IIIE** and district-wise details of blocks under different categories are furnished in **Annexure IIIF**. The stage of ground water development and the block-wise long-term (2003-2012) water level trends of the observation wells being monitored by Central Ground Water Board and the State Ground Water Department for pre and post-monsoon were considered for categorization of the blocks. The spatial distribution of different categories of assessment units is given in **Figure 5.5**.

5.10 District-wise Ground Water Resource Scenario

A summary of major components of dynamic ground water resources of Kerala is furnished in **Table. 5.2**. Brief accounts of the resource scenario in the districts are given below:

5.10.1 Alappuzha

The district is underlain by unconsolidated sediments of Recent age and formations of Tertiary age. The sedimentary formations cover about 83% of the geographical area of the district. The alluvium and laterite forms potential phreatic aquifers. The water level fluctuation ranges from 1.0 to 2.5 m in general. The shallow ground water is generally fresh with low fluoride and nitrate content and is suitable for drinking, irrigation and industrial uses. Net annual ground water availability of the district is **431.61 MCM** and existing gross ground water draft is of the order of **137.48 MCM**. Stage of ground water development is 32%. All the blocks in the district are Safe from the point of view of ground water development.

5.10.2 Ernakulam

Charnockites and gneisses of Achaean age, laterite of sub recent age form the main geological units in the district. Ground water occurs under phreatic conditions in the weathered and fractured hard crystalline rocks, laterites and unconsolidated coastal sediments. The quality of ground water from the shallow zone in hard rocks, residual laterite and coastal alluvium is suitable for drinking and agricultural purposes. Localized salinity problems are observed. Net

ground water resource of the district is estimated at **538.72 MCM** and the stage of development **37%**. All the blocks in the district are Safe from the point of view of ground water development.

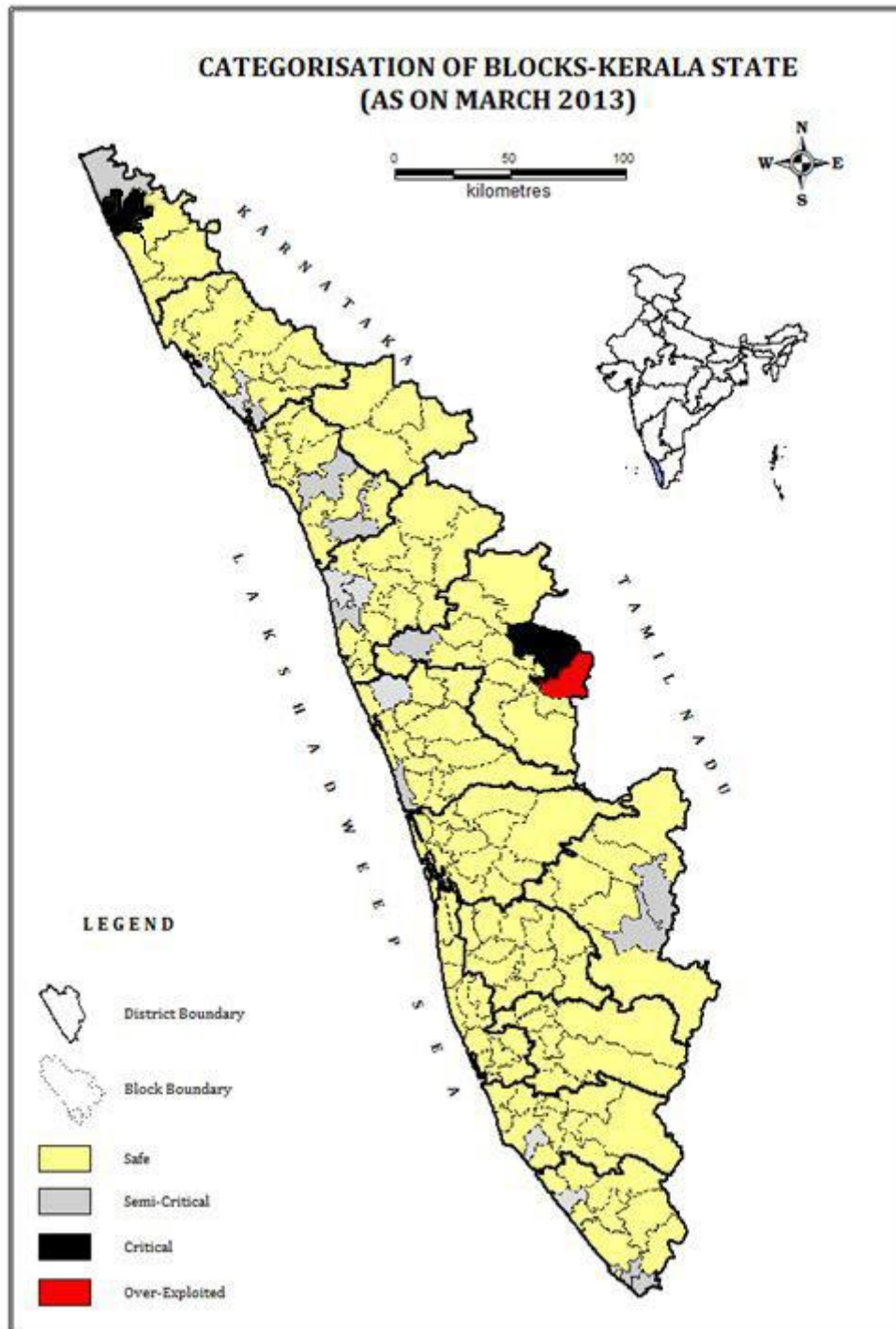


Figure 5.5: Categorization of Blocks in Kerala (As in March 2013)

5.10.3 Idukki

Groundwater occurs under phreatic condition in the weathered crystallines and laterite throughout the district. The thickness of weathering and lateritization generally ranges from 3 to 20 mbgl. Along steep slopes and high ranges, the weathered mantle is absent or very thin, and is devoid of perennial phreatic aquifers. Net ground water resource of the district is **200.43**

MCM and the stage of ground water development **51%**. Out of 8 blocks in the district, 2 have been categorized as 'Semi-critical' and 6 blocks as 'Safe'.

5.10.4 Kannur

The district receives an average annual rainfall of 2666 mm. Laterites and underlying crystallines form important aquifers in the district. Bore wells and large diameter dug wells are the most common groundwater abstraction structures in the district. The water level fluctuation between pre and post monsoons is generally less than 5 metre. The chemical quality of ground water is generally good. Net ground water availability of the district is **469.01 MCM** and the stage of ground water development **40%**. Out of 11 blocks in the district, 3 have been categorized as 'Semi-critical' and 8 blocks as 'Safe'.

5.10.5 Kasargod

The major aquifer types are Alluvium, Laterite and Crystallines. The yield of wells in alluvium ranges from 10 to 50m³/day. The dug wells have the depth ranges from 4 to 8 mbgl. Filter point wells with a depth of about 6 meters are constructed long the coastal areas especially along Kasargod, Kanhangad and Padannakkad areas. The yield of wells in laterite ranges from 5 to 60 m³ /day in winter period and it returns to 2 to 20 m³ /day in summer. In weathered crystallines the yield of well ranges from 1 to 10 m³ /day in summer period. The net annual ground water availability is **334.42 MCM** and the stage of ground water development is **70%**. Out of 6 blocks in the district, 1 has been categorized as 'Critical', 1 as 'Semi-critical' and 4 blocks as 'Safe'.

5.10.6 Kollam

The aquifer system of the district can be divided into three provinces i.e. the crystalline provinces covering the eastern upland, foot hills and hilly tract, laterite province covering the midland region and the coastal province covering the alluvium and Tertiary sediments. The depth of weathering in crystalline (hard rock) province varies from 15 to 20m. The wells tapping these aquifers range in diameter from 2 to 5m and their depth vary from 5.0 to 20.0 mbgl. The yield of these wells is of the order of 2 to 12 m³/day. The wells located in charnockite vary in depth from 6 to 13 mbgl. The yield of the wells ranges from 4 to 5 m³/day. A major part of the district is underlain by Laterite. The thickness of laterite capping in charnockite area varies from 1 to 3 m and from 15 to 20 m in khondalites. The depth of wells in laterite ranges from 5 to 30 mbgl. The coastal province has Tertiary sediments and Quaternary alluvium. The Tertiary formation consists of Warkali, Quilon and Vaikom beds overlain by 10 to 15 m thick alluvium. Ground water occurs in Warkali formation under phreatic and confined conditions. The dug wells in the Warkali beds tap groundwater from the laterite cappings. Often very deep dug wells are sunk into the underlying sandstone beds. Shallow dug wells sunk into the alluvium overlying the lateritic horizon of Tertiary sediments range in depth from 2 to 15 mbgl.

Apart from the coastal alluvial deposits, alluvial material composed mainly of clay and sand which are limited in aerial extent are confined to the flood plains of Achenkovil river and vary in depth from 3 to 5 m. Another type of aquifers are the inter mountain valley fills, which are composed of a highly assorted mixture of sand, gravels, pebbles and boulders. Net ground water availability of the district is **364.55 MCM** and the stage of ground water development **45%**. Out of 11 blocks in the district, 1 is 'Semi-critical' and 10 blocks are 'Safe'.

5.10.7 Kottayam

The aquifers in the district can be grouped into four distinct groups viz. alluvial aquifers, lateritic aquifers, Tertiary sedimentary aquifers and crystalline rock aquifers. The crystalline rock aquifers can further be classified as shallow and deep aquifers. The shallow aquifers of the crystalline rocks in the area occur within a depth of 15 mbgl. They are composed of weathered crystalline and fractured crystalline occurring just below the weathered zone. The Tertiary

sediments in the district are composed mainly of Vaikom beds. Groundwater occurs under phreatic condition in the shallow zone and under confined condition in the deeper zones. Groundwater is developed through both dug wells and tube wells in this formation. Laterites form potential aquifers along valley and topographic lows where the saturated zone is more and can sustain large diameter open wells. Alluvial aquifer is the most potential aquifer in the district and is commonly developed through dug wells. Net ground water availability is **407.74 MCM** and the stage of ground water development **32%**. All the blocks in the district are in 'Safe' category.

Table 5.2: Summary of Major Components of Dynamic Ground Water Resources of Kerala (2013)

Sl. No.	District	Command / non-Command / Total (Sq.km)	Recharge from rainfall during monsoon season (MCM)	Recharge from other sources during monsoon season (MCM)	Recharge from rainfall during non-monsoon season (MCM)	Recharge from other sources during non-monsoon season (MCM)	Total Annual Ground Water Recharge (MCM)	Provision for Natural Discharges (MCM)	Net Annual Ground Water Availability (MCM)
							[(4) + (5) + (6) + (7)]		[(8)-(9)]
1	2	3	4	5	6	7	8	9	10
1	ALAPPUZHA	1414.03	287.00	0.67	70.91	108.69	467.27	35.66	431.61
2	ERNAKULAM	2269.48	387.88	3.04	72.64	135.02	598.58	59.86	538.72
3	IDUKKI	1178.91	170.48	1.89	32.76	17.57	222.70	22.27	200.43
4	KANNUR	2323.96	452.81	0.00	0.00	68.31	521.12	52.11	469.01
5	KASARGOD	1631.30	317.46	7.70	0.00	46.43	371.58	37.16	334.42
6	KOLLAM	2110.97	273.79	1.38	89.49	38.80	403.46	38.91	364.55
7	KOTTAYAM	1945.10	315.97	1.05	66.07	69.94	453.04	45.30	407.74
8	KOZHIKODE	1661.80	353.93	1.48	0.00	13.17	368.58	36.86	331.44
9	MALAPPURAM	2541.81	421.01	3.30	64.01	85.52	573.83	56.96	516.87
10	PALAKKAD	2997.28	334.73	8.95	60.68	304.33	708.7	70.87	637.83
11	PATHANAMTHITTA	1296.65	202.00	1.21	63.44	35.08	301.74	29.01	272.73
12	TRIVANDRUM	1942.97	224.97	2.40	66.03	30.50	323.89	27.65	296.24
13	THRISSUR	2366.85	463.81	8.75	0.00	170.04	642.61	60.86	581.75
14	WAYANAD	1056.88	305.53	0.30	0.00	6.34	312.17	31.22	280.96
	KERALA STATE	26737.99	4495.53	42.89	583.14	1129.75	6251.31	599.77	5664.30
	(BCM)		4.50	0.04	0.58	1.13	6.25	0.60	5.66

Table.5.2 (Continued)

Sl. No.	District	Command/ non-Command/ Total	Net Annual Ground Water Availability (MCM)	Existing Gross Ground Water Draft for irrigation (MCM)	Existing Gross Ground Water Draft for domestic and industrial water supply (MCM)	Existing Gross Ground Water Draft for All uses (MCM)	Provision for domestic, and industrial requirement supply up to 2025 (MCM)	Net Ground Water Availability for future irrigation development (MCM)	Stage of Ground Water Development (%) (13*100/10)
1	2	3	10	11	12	13	14	15	16
1	ALAPPUZHA	Non-Command	431.61	38.93	98.55	137.48	94.53	298.15	31.85
2	ERNAKULAM	Non-Command	538.72	77.00	121.78	198.78	136.38	325.33	36.90
3	IDUKKI	Non-Command	200.43	55.16	46.37	101.53	40.46	104.81	50.65
4	KANNUR	Non-Command	469.01	80.12	105.67	185.79	109.99	278.89	39.61
5	KASARGOD	Non-Command	334.42	163.97	65.61	229.58	71.80	98.65	69.81
6	KOLLAM	Non-Command	364.55	49.95	112.82	162.77	128.93	185.67	44.65
7	KOTTAYAM	Non-Command	407.74	48.50	82.82	131.32	91.55	267.69	32.21
8	KOZHIKODE	Non-Command	331.44	44.11	134.29	178.39	145.90	141.44	53.78
9	MALAPPURAM	Non-Command	516.87	95.60	206.54	302.14	238.86	182.41	58.46
10	PALAKKAD	Non-Command	637.83	218.58	134.26	352.85	141.12	290.10	55.32
11	PATHANAMTHITTA	Non-Command	272.73	36.47	56.45	92.92	54.33	181.93	36.57
12	TRIVANDRUM	Non-Command	296.24	52.91	125.63	178.54	128.88	114.45	60.27
13	THRISSUR	Non-Command	581.75	204.70	123.37	328.08	129.38	247.66	56.40
14	WAYANAD	Non-Command	280.96	15.76	38.98	54.74	37.77	227.43	19.48
	KERALA STATE		5664.30	1181.77	1453.14	2634.91	1549.87	2944.62	46.52
	(BCM)		5.66	1.18	1.45	2.63	1.55	2.94	46.52

5.10.8 Kozhikode

Groundwater occurs under phreatic conditions in the weathered and fractured crystalline rocks, laterite and shallow coastal aquifers. It occurs under semi confined to confined conditions in the deep seated fractured aquifers of the crystalline rocks. The depth of dug wells tapping the shallow zones in the weathered/fractured crystalline area varies from 3 to 11 mbgl. Net ground water availability of the district is **331.44 MCM** and the stage of ground water development **54%**. Out of 12 blocks in the district, 2 are 'Semi-critical' and others are 'Safe'.

5.10.9 Malappuram

Ground water occurs in phreatic condition in almost all the geological formations in the district and under semi confined to confined condition in the deep seated fractures in the crystalline rocks and in Tertiary sediments. Broadly the aquifer system in the district can be divided into three provinces viz. the crystalline province covering the eastern uplands, foot hills and hilly tracts, the laterite province (covering the midland regions) and the coastal province covering the alluvium and Tertiary sediments. The eastern crystalline province essentially constitutes the hard rock aquifers and other intrusives. The depth of weathering varies from a few metres to 22 m and major portion of the district is covered by laterites and the thickness of it varies highly. Along the western part of the district coastal alluvium of Recent age is seen as a thin strip. Vaikom beds of Tertiary group are seen underlying the coastal alluvium Net ground water availability of the district is **516.87 MCM** and the stage of ground water development is **59%**. Out of 15 blocks in the district, 3 are 'Semi-critical' and remaining blocks are 'Safe'.

5.10.10 Palakkad

Groundwater occurs in phreatic condition in the laterites, alluvium and in weathered crystallines. It is under semi confined to confined conditions in the deeper fractured rocks. Alluvium encountered along the bank of Bharathapuzha river (the largest river in Kerala) act as potential phreatic aquifer. The yield of the wells tapping the alluvium ranges from 5000 to 50000 lpd. The thickness of laterites varies from 2 to 15 mbgl and the depth of dug wells ranges from 4 to 10 mbgl. The thickness of laterites increases towards the western parts of the district where the dug wells are potential. Along the western part the yield of the dug wells ranges from 500 to 10000 lpd. Along the eastern part the dug wells are quite deep and it varies in depth from 7 to 32 mbgl with a varying yield in the range of 200 to 10000 lpd. The shallow and deep fractures in the crystalline rocks also form potential aquifers in the district and bore wells tapping these aquifers range in depth from 80.77 to 300.81 mbgl. The yield of these bore wells ranges from 2 to 25 lps. Net ground water availability of the district is **637.83 MCM** and the stage of ground water development **55%**. Out of 13 blocks in the district, 1 each are 'Over-exploited', 'Critical', 'Semi-critical' and 10 blocks are 'Safe'.

5.10.11 Pathanamthitta

Groundwater in the district occurs under phreatic condition in the alluvium, laterite and weathered/fractured crystalline rocks. It occurs in semi confined/confined condition in the Tertiary sediments and deep seated fractured aquifers in crystalline rock. Charnockites are the dominant crystalline rock type of the district. The dug wells in the crystalline rock area ranges in depth from 11 to 15 mbgl. The Tertiary sediments belonging to the Vaikom bed occurs below the alluvium and form potential semi consolidated aquifers. Groundwater occurs under confined/semi confined condition. The average thickness of unconsolidated Recent alluvium range from 4 to 6m. The district has a net ground water availability of **272.73 MCM** and the stage of ground water development **37%**. All the 8 blocks of the district have been categorized as 'Safe'.

5.10.12 Thiruvananthapuram

A major part of the district is underlain by the crystalline rocks. At places, sedimentary formations overlie the crystallines, especially in the western part of the district. Coastal belt is mostly occupied by the alluvial deposits of Recent origin. Ground Water exploration in the deeper aquifers of hard rock area has indicated that yield varies from 1 to 7 lps whereas the sedimentaries, the yield goes up to 10 lps. The shallow aquifers are generally developed through dug wells in the hard rock areas; the yield varies from 1 to 3 lps. In alluvial areas, dug wells/ filter point wells are common structures; the yield varies from 2 to 5 lps. Net annual ground water availability is **296.24 MCM** and the stage of ground water development is 60%. Out of 11 blocks, 3 are 'Semi critical' and 8 are 'Safe'.

5.10.13 Thrissur

Groundwater occurs both under water table and confined/semi confined condition in almost all the geological formations in the district. Confined/semi confined conditions are encountered in the deep fracture of the crystalline rocks and in the Vaikom beds of the sedimentaries. The dug wells tapping the phreatic aquifers range in depth from 3.5 to 22 mbgl. The yield of these wells ranges from 1200 to 20000 lph. The Vaikom beds are encountered at depth ranges of 6-51 mbgl. The thickness of the beds ranges from 8-30m. The yield of tube wells tapping Vaikom beds varies from 24000 to 115000 lph. The laterite formations encountered along the midland regions of the districts act as a very good water table aquifer along valleys and low lying regions. The depth of dug wells tapping the laterite formation ranges from 9 to 19 mbgl and the yield of these wells ranges from 800 and 20000 lpd. The sandy coastal alluvium also constitutes a potential water table aquifer with depth of dug wells ranging between 4 and 7 m. Shallow filter point tube wells are constructed in areas where the thickness of the alluvium exceeds about 5 m. The yield of wells tapping the coastal alluvium ranges between 15000 and 40000 lpd. Net ground water availability is **581.75 MCM** and the stage of ground water development **56%**. Out of 16 blocks in the district, 2 are 'Semi-critical'. All the other blocks are safe.

5.10.14 Wayanad

The district is covered by peninsular shield of Western Ghats and form the tri-junction of the charnockites of the Western Ghats – The Nilgiri range and the southern extension of the Dharwars of Mysore. Major rock types are Wayanad supracrustals, gneisses and charnockites of Archaean, basic and acidic intrusives of Proterozoic, laterite of Sub-Recent age and the alluvium of the Recent age. Groundwater occurs in the weathered rocks, fractures of crystalline rocks and the alluvial formations. In weathered formations water occur under phreatic conditions and is mostly developed by dug wells for domestic and irrigation purposes. Net ground water availability of the district is **280.96 MCM** and the stage of ground water development of the order of **20%**. All four blocks in the district are 'Safe'.

5.11 Comparison of the Dynamic Ground Water Resources as in (2011)&(2013)

A comparison of the major components of dynamic ground water resources of Kerala during 2011 and 2013, along with justification is given in **Table.5.3**

A comparative analysis of the components of dynamic ground water resources during 2011 and 2013 shows that the net annual ground water availability for Kerala during 2013 has decreased by 6.71% when compared with the corresponding figures during 2011. The annual ground water draft for all uses has decreased by 7.08% during the period. The net ground water availability for future irrigation development in the State as a whole shows a decrease of 3.94% in 2013 when compared to the corresponding figures computed in 2011. The stage of ground water development in the State shows a marginal decrease from 46.70% during 2011 to 46.52% during 2013. The variation in

the spatial distribution of various recharge and discharge components resulting from the changes in ground water levels and re-organization of blocks has resulted in the change in the number of blocks in various categories when compared to the previous assessment. The number of 'Semi-critical' blocks in the State has decreased from 23 to 18 whereas the number of 'Safe' blocks increased from 126 to 131.

Table 5.3: Comparison of Major Components of Dynamic Ground Water Resources of Kerala (2011 & 2009)

Sl. No	Component			Variation in 2013 w.r. to 2011	Variation (%)	Remarks /Justification
		2013	2011			
1	Total Annual Replenishable Resources (Ha.m)	6251	6686	73	1.10	Variation mainly due to the changes in the precipitation and consequent water level fluctuations.
2	Net Ground Water Availability (MCM)	5651	6072	421	6.93	- do -
3	Total Ground Water Draft (MCM)	2635	2836	201	7.08	Variation attributed to increased domestic demand due to population increase
4	Projected demand for domestic and industrial uses as in 2025 (MCM)	1550	1705	155	9	
5	Net Ground Water Availability for Future Irrigation use (MCM)	2945	3065	90	3.94	Variation mainly due to the changes in the precipitation and consequent water level fluctuations.
6	Stage of Ground Water Development (%)	47	47	0	0	

CONTRIBUTORS PAGE

I. Computation of dynamic Ground Water Resources

Central Ground Water Board

- | | |
|-----------------------|---------------------|
| 1. Dr.Nandakumaran. P | Regional Director |
| 2. K.Balakrishnan | Scientist _ D |
| 3. Smt. Mini Chandran | Scientist – C |
| 4. Smt.Rani V.R | Scientist – C |
| 5. G.Sreenath | Asst.Hydrogeologist |

Ground Water Department, Government of Kerala

- | | |
|------------------|------------------------|
| 1. Babu N Joseph | Director |
| 2. P.Varadarajan | Suptdg. Hydrogeologist |

II. Scrutiny & Finalization of Report

- | | |
|----------------------|---|
| 1. Dr.Nandakumaran.P | Regional Director, CGWB
Kerala Region, Trivandrum |
| 2. V.Kunhambu | Regional Director, CGWB
Kerala Region, Trivandrum. |
| 3. K.S.Madhu | Director, Ground Water Dept
Government of Kerala. |

ANNEXURES

ANNEXURE I

GOVERNMENT ORDER ON CONSTITUTION OF STATE LEVEL COMMITTEE FOR RE-ESTIMATION OF DYNAMIC GROUND WATER RESOURCES OF KERALA.

‘Emblem’
GOVERNMENT OF KERALA
Abstract

Water Resources Department-State Level Committee for Re-estimation of Ground Water Resources-Constituted – Orders issued

WATER RESOURCES (GROUND WATER) DEPARTMENT
G.O. (Rt)No:590/2010/WRD.

Dated, Thiruvananthapuram, 18.05.2010

Read: 1. G.O. (Rt) No.900/2008/WRD. Dated 29.08.2008
2. G.O. (Rt) No. 262/2010/WRD. Dated, 06.08.2010
3. Letter No.11(T 20)/10-11/561 dated 29.04.2010 from the Regional Director, Central Ground water Board, Kerala region, Thiruvananthapuram

ORDER

Government have constituted a Committee for Estimation of Ground Water Resources of Kerala, as per the Ground Water Estimation Committee 1997 methodology with 2007-08 as base year vide Government Order read as 1st paper above. The above Committee is made a permanent Standing Committee for the State to do the ground water estimation of the State, vide Government Order 2nd cited.

Now the Regional director, Central Ground Water Board in his letter read as 3rd paper above has requested Government to constitute the State Level Committee for Re-estimation of Ground Water Resources as per the recommendation of Central Headquarters. After examination of the suggestion by the Regional director, Central Ground Water Board, Government are pleased to constitute a State Level Committee for Re-estimation of Ground Water Resources of Kerala, with the following members:

The Principal Secretary, Water Resources Department	-	Chairman
The Director, Ground Water Department, Thiruvananthapuram	-	Member
The Director, Agriculture Department	-	Member
The Managing Director, Kerala Water Authority	-	Member
The Chief Engineer, Irrigation & Administration	-	Member
The Director, Department of Industries & Commerce	-	Member
The General Manager, NABARD, Thiruvananthapuram	-	Member
The Executive Director, Centre for Water Resources Development and Management	-	Member
The Regional Director, Central Ground Water Board Thiruvananthapuram	-	Member Secretary

Terms of reference : The broad terms of reference of the Committee will be as follows:

- (1) To estimate annual replenishable ground water resources of the State in accordance with the ground water resources estimation methodology
- (2) To estimate the status of utilization of the annual replenishable ground water resource.

The Committee will submit its report within 6 months from the date of its constitution.

(BY ORDER OF THE GOVERNOR)

L. RADHAKRISHNAN
PRINCIPAL SECRETARY TO GOVERNMENT

To

The Members of the Committee
S/F, O/C

Forwarded / By order
Sd/
Section Officer

ANNEXURE II

MINUTES OF THE MEETINGS OF THE STATE LEVEL COMMITTEE

Minutes of the 2nd meeting of the Joint Committee on Ground Water Resource Estimation Comprising of Officers of CGWB and State GWD

The Second meeting of joint committee comprising of CGWB and GWD on Ground Water Resource Estimation is held today (6/11/2015) at 2.30 pm at GWD office to discuss and finalize the report on Ground Water Resources of Kerala as in 2013. The following Officers attended the meeting.

Sl.No	Name & Designation	Organization
1.	Shri. K.S Madhu, Director	GWD, Trivandrum
2.	Shri. V.Kunhambu, Regional Director (I/C)	CGWB, Trivandrum
3.	Shri. Jose James, Suptdg Hdroteologist	GWD, Trivandrum
4.	Shri.K. Balakrishnan, scientist D	CGWB, Trivandrum

The committee approved the decisions taken during the first meeting of the committee held on 6/02/2015.

The above said officers made a perusal of the Report on the Ground Water Resources of Kerala as in 2013, prepared jointly by the CGWB & GWD. The irrigation draft has been estimated based on the 4th Minor Irrigation Census data updated after field check by Officers of GWD. A team of Officers from CGWB, and GWD jointly carried out the Ground Water estimation work. The total Ground Water Resources work out to be 5.65 bcm and the total Ground Water draft 2.63 bcm indicating the stage of development as 46.62 %. Similarly block-wise and district-wise Ground Water Resources has been compiled separately. Based on this, categorization of blocks as Over-exploited, Critical, Semi-critical and Safe have been finalized for presenting before the State Level Committee.

Shri. K.S Madhu, Director
GWD, Trivandrum

Shri. V.Kunhambu
Regional Director (I/C)
CGWB, Trivandrum

Shri. Jose James, Suptdg
Hdroteologist , GWD,
Trivandrum

Shri.K. Balakrishnan,
scientist D CGWB,
Trivandrum

MINUTES OF THE SEVENTH MEETING OF THE STATE LEVEL STANDING COMMITTEE FOR RE-ESTIMATION OF GROUND WATER RESOURCES OF KERALA, HELD ON 27.11.2015.

The seventh meeting of the State Level Standing Committee for Re-estimation of Groundwater resources of Kerala was held at 11.30 hrs in the Chamber of Secretary, Water Resource Department, Govt of Kerala at Thiruvananthapuram on 27.11. 2015. The meeting was chaired by Smt Tinku Biswal, IAS, Secretary (Water Resources), Govt of Kerala. The following members /invitees attended the meeting:

1.	Shri. N.S Harinarayan, Chief Engineer(I&A), Irrigation Department, Government of Kerala	Member
2.	Shri K.S. Madhu, Director (I/C), State Ground Water Department, Government of Kerala, Thiruvananthapuram	Member
3.	Shri. K.K. Naik, Asst General Manager, NABARD, Thiruvananthapuram	Member
4.	Shri V.Prakash Tampi, Joint Director, Directorate of Agriculture, Government of Kerala	Member
5.	Shri .K.Balakrishnan, Scientist D, CGWB,KR, Thiruvananthapuram	Invitee
6.	Shri Jose James, Superintending Hydrogeologist, State Ground Water Department, Thiruvananthapuram	Invitee
7.	Smt. T S Anitha Shyam, Scientist D, CGWB,KR, Thiruvananthapuram	Invitee
8.	Shri. Harilal.V, Draftsman Gr I(HG), planning, Irrigation Department, Government of Kerala	Invitee
9.	Shri V.Kunhambu, Head of Office, CGWB, Kerala Region, Thiruvananthapuram	Member Secretary

The Chairman of the committee welcomed the members at the outset. Sh. V. Kunhambu, Member Secretary apprised the committee of the completion of the draft report on Dynamic Ground Water Resources of Kerala (as in march 2013) and placed the same for the approval of the committee. The Secretary opened discussions on the report as per the agenda.

Agenda Item No. 7.1: Estimation of Dynamic Ground Water Resources of Kerala (As in March 2013).

The Member Secretary informed the Committee that the Dynamic Ground Water Resources of Kerala as in March 2013 have been assessed following the procedure of GEC 1997 methodology jointly by the Ground Water Department, Government of Kerala and the Central Ground Water Board. Further, Sh.K.Balakrishnan, Scientist D, CGWB explained the various steps involved in the methodology adopted for the estimation of resources and the final results of the computations were deliberated in detail by the committee.

- The committee was informed that the assessment has been carried out for 152 blocks of the State.
- The irrigation draft data has been taken from the 4th Minor Irrigation Census by Minor Irrigation wing of Irrigation Department, and updated with field checks by field Officers of GWD.

- Ground water draft for domestic uses in the assessment units have been updated based on projected population keeping 2011 census as base.
- As per the assessment carried out, the Net Annual Ground Water Availability and Gross Ground Water Draft for all uses in Kerala are of the order of 5.65 bcm and 2.63 bcm respectively. The net Ground Water Availability for Irrigation Development has been computed as 2.94 bcm. The Stage of Ground Water Development, computed as the ratio of Gross Ground Water Draft to Net Ground Water Availability as in March 2013 is 46.62%.
- Based on the assessment of available resources and quantum of ground water extraction, Chittur block in Palakkad district has been categorized as 'Over-exploited'. Two blocks viz. Malampuzha (Palakkad district) and Kasargod (Kasargod district) have been categorized as 'Critical' and 18 blocks, spread over various districts except Alappuzha, Kottayam, Pathanamthitta, Ernakulam and Waynad come under 'Semi-Critical' category. Remaining 131 blocks in the State fall under 'Safe' category as in March 2013.
- A comparison of the major components of dynamic ground water resources of Kerala during 2011 and 2013 indicate a decrease of 6.93 mcm in Net Annual Ground Water Availability and 7.08 mcm in Gross Annual Ground Water Extraction for all uses. Since both have decreased, the stage of ground water development during two periods remains constant at about 47 %. As far as the categorization of assessment units is concerned, the number of Semi-Critical blocks has decreased from 23 in 2011 to 18 in 2013. The number of over-exploited and critical blocks remained the same during both the assessments.

Agenda Item No. 7.2: Any other item with permission of chair:

The Director, GWD opined that the exercise of estimation of ground water resources is presently being estimated every two years. The major component of the gross draft is irrigation draft, the figures of which are computed from the minor irrigation census data which is done only once, every 5 years. As this data will be generated once in 5 years, it would be appropriate if the estimation of ground water resources were also restricted to one in five years. All the members were also in agreement to the suggestion. Chairperson of the committee sought an explanation from Member Secretary on the significance of MI census in Ground water draft calculation and the same is explained in detail. Based on this the committee unanimously decided to request Govt. of India to relook the frequency of Ground Water Resource Estimation at par with that of MI Census .

The assessment of dynamic ground water resources of Kerala as in March 2013 was unanimously approved by the Committee.

The meeting ended with thanks to the Chair.

APPROVED FOR ISSUE

-sd-

(TINKU BISWAL)
SECRETARY (WATER
RESOURCES)
GOVT. OF KERALA

ANNEXURE III A
GENERAL DESCRIPTION OF GROUND WATER
ASSESSMENT UNITS

District		ALAPPUZHA							
Assessment Year		2013							
Sl. No.	Name of Ground water Assessment Unit	Type of rock formation	Areal extent						
			(in hectares)						
			Total Geographical Area	Hilly Area	Ground Water Recharge Worthy Area			Shallow Water Table Area	Flood Prone Area
					Command area	Non-command area	Poor ground water quality area		
1	Ambalappuzha	Alluvial	6890.00	0.00	0.00	6890.00	0.00	6890.00	0.00
2	Aryad	Alluvial	8772.00	0.00	0.00	8772.00	0.00	8772.00	0.00
3	Bharanikkavu	Alluvial	12995.00	0.00	0.00	12995.00	0.00	0.00	0.00
4	Champakkulam	Alluvial	15383.00	0.00	0.00	15383.00	0.00	2150.00	0.00
5	Chengannur	Alluvial	14996.00	0.00	0.00	14996.00	0.00	6890.00	0.00
6	Harippad	Alluvial	11439.00	0.00	0.00	11439.00	0.00	11000.00	0.00
7	Kanjikkuzhy	Alluvial	11013.00	0.00	0.00	11013.00	0.00	9000.00	0.00
8	Mavelikkara	Alluvial	10044.00	0.00	0.00	10044.00	0.00	0.00	0.00
9	Muthukulam	Alluvial	11651.00	0.00	0.00	11651.00	0.00	2500.00	0.00
10	Pattanakkad	Alluvial	10871.00	0.00	0.00	10871.00	0.00	10871.00	0.00
11	Thycattussery	Alluvial	14159.00	0.00	0.00	14159.00	0.00	13190.00	0.00
12	Veliyanad	Alluvial	13190.00	0.00	0.00	13190.00	0.00	10050.00	0.00
Total (ha)			141403.00	0.00	0.00	141403.00	0.00	82351.00	0.00
Total (Sq.km)			1414.03	0.00	0.00	1414.03	0.00	823.51	0.00

District		ERNAKULAM							
Assessment Year		2013							
Sl. No.	Name of Ground water Assessment Unit	Type of rock formation	Areal extent						
			(in hectares)						
			Total Geographical Area	Hilly Area	Ground Water Recharge Worthy Area			Shallow Water Table Area	Flood Prone Area
					Command area	Non-command area	Poor ground water quality area		
1	Alangad	Hard Rock	7331.00	0.00	0.00	7331.00	0.00	5090.00	0.00
2	Angamaly	Hard Rock	23197.00	2000.00	0.00	21197.00	0.00	0.00	0.00
3	Edappally	Alluvial	16053.00	0.00	0.00	16053.00	0.00	12000.00	0.00
4	Koovappady	Hard Rock	38560.50	3000.00	0.00	35560.50	0.00	1891.00	0.00
5	Kothamangalam	Hard Rock	82997.00	60000.00	0.00	22997.00	0.00	0.00	0.00
6	Moovattupuzha	Hard Rock	21480.00	1500.00	0.00	19980.00	0.00	0.00	0.00
7	Mulamthuruthy	Hard Rock	16327.00	0.00	0.00	16327.00	0.00	0.00	0.00
8	Palluruthy	Alluvial	6651.00	0.00	0.00	6651.00	0.00	5000.00	0.00
9	Pampakkuda	Hard Rock	18740.00	1000.00	0.00	17740.00	0.00	0.00	0.00
10	Parakkadavu	Hard Rock	11881.00	0.00	0.00	11881.00	0.00	5000.00	0.00
11	Paravoor	Alluvial	7665.00	0.00	0.00	7665.00	0.00	0.00	0.00
12	Vadavukodu	Hard Rock	18595.00	0.00	0.00	18595.00	0.00	0.00	0.00
13	Vazhakkulam	Hard Rock	19328.00	0.00	0.00	19328.00	0.00	0.00	0.00
14	Vypeen	Alluvial	5642.00	0.00	0.00	5642.00	0.00	4000.00	0.00
	Total (ha)		294447.50	67500.00	0.00	226947.50	0.00	32981.00	0.00
	Total (Sq.km)		2944.48	675.00	0.00	2269.48	0.00	329.81	0.00

District		IDUKKI							
Assessment Year		2013							
Sl. No.	Name of Ground water Assessment Unit	Type of rock formation	Areal extent						
			(in hectares)						
			Total Geographical Area	Hilly Area	Ground Water Recharge Worthy Area			Shallow Water Table Area	Flood Prone Area
					Command area	Non-command area	Poor ground water quality area		
1	Adimali	Hardrock	51914.00	30714.00	0.00	21200.00	0.00	0.00	0.00
2	Azhutha	Hard rock	107442.00	92900.00	0.00	14542.00	0.00	0.00	0.00
3	Devikulam	Hard Rock	96343.00	80300.00	0.00	16043.00	0.00	0.00	0.00
4	Elam Desom	Hardrock	18722.00	9000.00	0.00	9722.00	0.00	0.00	0.00
5	Idukki	Hard Rock	73482.00	60000.00	0.00	13482.00	0.00	0.00	0.00
6	Kattappana	Hard rock	37238.00	26000.00	0.00	11238.00	0.00	0.00	0.00
7	Nedumkandam	Hardrock	34190.00	22000.00	0.00	12190.00	0.00	0.00	0.00
8	Thodupuzha	Hardrock	16474.00	6000.00	0.00	10474.00	0.00	0.00	0.00
	Total (ha)		435805.00	326914.00	0.00	108891.00	0.00	0.00	0.00
	Total (q.km)		4358.05	3269.14	0.00	1088.91	0.00	0.00	0.00

District		KANNUR							
Assessment Year		2013							
Sl. No.	Name of Ground water Assessment Unit	Type of rock formation	Areal extent						
			(in hectares)						
			Total Geographical Area	Hilly Area	Ground Water Recharge Worthy Area			Shallow Water Table Area	Flood Prone Area
					Command area	Non-command area	Poor ground water quality area		
1	Edakkad	Hard Rock	14049.00	0.00	0.00	14049.00	0.00	0.00	0.00
2	Irikkur	Hard Rock	41290.00	5000.00	0.00	36290.00	0.00	0.00	0.00
3	Iritty	Hard Rock	42709.00	11200.00	0.00	31509.00	0.00	0.00	0.00
4	Kallyasseri	Hard Rock	14339.00	0.00	0.00	14339.00	0.00	0.00	0.00
5	Kannur	Hard Rock	7577.00	0.00	0.00	7577.00	0.00	0.00	0.00
6	Kuthuparamba	Hard Rock	18235.00	5300.00	0.00	12935.00	0.00	0.00	0.00
7	Panur	Hard Rock	7383.00	0.00	0.00	7383.00	0.00	0.00	0.00
8	Payyannur	Hard Rock	39212.00	5000.00	0.00	34212.00	0.00	0.00	0.00
9	Peravoor	Hard Rock	42542.00	21200.00	0.00	21342.00	0.00	0.00	0.00
10	Taliparamba	Hard Rock	57403.00	16700.00	0.00	40703.00	0.00	0.00	0.00
11	Thalassery	Hard Rock	12057.00	0.00	0.00	12057.00	0.00	0.00	0.00
	Total (ha.)		296796.00	64400.00	0.00	232396.00	0.00	0.00	0.00
	Total (Sq.km)		2967.96	644.00	0.00	2323.96	0.00	0.00	0.00

District		KASARGOD							
Assessment Year		2013							
Sl. No.	Name of Ground water Assessment Unit	Type of rock formation	Areal extent						
			(in hectares)						
			Total Geographical Area	Hilly Area	Ground Water Recharge Worthy Area			Shallow Water Table Area	Flood Prone Area
					Command area	Non-command area	Poor ground water quality area		
1	Kanhangad	Hard Rock	24508.00	500.00	0.00	24008.00	0.00	0.00	0.00
2	Karadka	Hard Rock	37247.00	11700.00	0.00	25547.00	0.00	0.00	0.00
3	Kasaragod	Hard Rock	25876.00	500.00	0.00	25376.00	0.00	0.00	0.00
4	Manjeswar	Hard Rock	34136.00	1000.00	0.00	33136.00	0.00	0.00	0.00
5	Nileswarem	Hard Rock	19695.00	0.00	0.00	19695.00	0.00	3350.00	0.00
6	Parappa	Hard Rock	54668.00	19300.00	0.00	35368.00	0.00	0.00	0.00
	Total (ha.)		196130.00	33000.00	0.00	163130.00	0.00	3350.00	0.00
	Total(Sq.km)		1961.30	330.00	0.00	1631.30	0.00	33.50	0.00

District		KOLLAM							
Assessment Year		2013							
Sl. No.	Name of Ground water Assessment Unit	Type of rock formation	Areal extent						
			(in hectares)						
			Total Geographical Area	Hilly Area	Ground Water Recharge Worthy Area			Shallow Water Table Area	Flood Prone Area
					Command area	Non-command area	Poor ground water quality area		
1	Anchal	Hard Rock	94622.00	30000.00	0.00	64622.00	0.00	0.00	0.00
2	Chadayamangalam	Hard Rock	24903.00	0.00	0.00	24903.00	0.00	0.00	0.00
3	Chavara	Alluvial	7490.00	0.00	0.00	7490.00	0.00	3500.00	0.00
4	Chittumala	Hardrock	12125.00	0.00	0.00	12125.00	0.00	0.00	0.00
5	Ithikkara	Alluvial	12573.00	0.00	0.00	12573.00	0.00	1202.00	0.00
6	Kottarakkara	Hard Rock	13310.00	0.00	0.00	13310.00	0.00	0.00	0.00
7	Mukhathala	Alluvium	14703.00	0.00	0.00	14703.00	0.00	0.00	0.00
8	Oachira	Alluvium	11641.00	0.00	0.00	11641.00	0.00	3500.00	0.00
9	Pathanapuram	Hardrock	27992.00	8000.00	0.00	19992.00	0.00	0.00	0.00
10	Sasthamkotta	Hard Rock	12791.00	0.00	0.00	12791.00	0.00	0.00	0.00
11	Vettikkavala	Hardrock	16947.00	0.00	0.00	16947.00	0.00	0.00	0.00
Total (ha)			249097.00	38000.00	0.00	211097.00	0.00	8202.00	0.00
Total (Sq.km)			2490.97	380.00	0.00	2110.97	0.00	82.02	0.00

District		KOTTAYAM							
Assessment Year		2013							
Sl. No.	Name of Ground water Assessment Unit	Type of rock formation	Areal extent						
			(in hectares)						
			Total Geographical Area	Hilly Area	Ground Water Recharge Worthy Area			Shallow Water Table Area	Flood Prone Area
					Command area	Non-command area	Poor ground water quality area		
1	Erattupetta	Hard Rock	28251.00	13000.00	0.00	15251.00	0.00	0.00	0.00
2	Ettumanoor	Hard Rock	14172.00	0.00	0.00	14172.00	0.00	0.00	0.00
3	Kaduthuruthy	Hard Rock	18775.00	0.00	0.00	18775.00	0.00	0.00	0.00
4	Kanjirappally	Hard Rock	34200.00	12000.00	0.00	22200.00	0.00	0.00	0.00
5	Lalam	Hard Rock	18939.00	0.00	0.00	18939.00	0.00	0.00	0.00
6	Madappally	Alluvial	15854.00	0.00	0.00	15854.00	0.00	0.00	0.00
7	Pallom	Hard Rock	23214.00	0.00	0.00	23214.00	0.00	0.00	0.00
8	Pampady	Hard Rock	16630.00	0.00	0.00	16630.00	0.00	0.00	0.00
9	Uzhavoor	Hard Rock	22096.00	0.00	0.00	22096.00	0.00	0.00	0.00
10	Vaikom	Alluvial	13155.00	0.00	0.00	13155.00	0.00	3000.00	0.00
11	Vazhoor	Hard Rock	14224.00	0.00	0.00	14224.00	0.00	0.00	0.00
Total (ha)			219510.00	25000.00	0.00	194510.00	0.00	3000.00	0.00
Total (Sq.km)			2195.10	250.00	0.00	1945.10	0.00	30.00	0.00

District		KOZHIKODE							
Assessment Year		2013							
Sl. No.	Name of Ground water Assessment Unit	Type of rock formation	Areal extent						
			(in hectares)						
			Total Geographical Area	Hilly Area	Ground Water Recharge Worthy Area			Shallow Water Table Area	Flood Prone Area
					Command area	Non-command area	Poor ground water quality area		
1	Ballussery	Hard Rock	27853.00	13900.00	0.00	13953.00	0.00	0.00	0.00
2	Chelannur	Hard Rock	13866.00	0.00	0.00	13866.00	0.00	0.00	0.00
3	Koduvally	Hard Rock	39048.00	11750.00	0.00	27298.00	0.00	0.00	0.00
4	Kozhikode	Hard Rock	16351.00	0.00	0.00	16351.00	0.00	0.00	0.00
5	Kunnamangalam	Hard Rock	33794.00	16800.00	0.00	16994.00	0.00	0.00	0.00
6	Kunnummal	Hard Rock	26252.00	13100.00	0.00	13152.00	0.00	0.00	0.00
7	Melady	Alluvial	8407.00	0.00	0.00	8407.00	0.00	4500.00	0.00
8	Panthalayani	Alluvial	9855.00	0.00	0.00	9855.00	0.00	1500.00	0.00
9	Perambra	Hard Rock	27502.00	9600.00	0.00	17902.00	0.00	0.00	0.00
10	Thodannur	Hard Rock	9677.00	0.00	0.00	9677.00	0.00	0.00	0.00
11	Tuneri	Hard Rock	14397.00	2900.00	0.00	11497.00	0.00	0.00	0.00
12	Vadakara	Hard Rock	7228.00	0.00	0.00	7228.00	0.00	1000.00	0.00
	Total (ha)		234230.00	68050.00	0.00	166180.00	0.00	7000.00	0.00
	Total (Sq.km)		2342.30	680.50	0.00	1661.80	0.00	70.00	0.00

District		MALAPPURAM							
Assessment Year		2013							
Sl. No.	Name of Ground water Assessment Unit	Type of rock formation	Areal extent						
			(in hectares)						
			Total Geographical Area	Hilly Area	Ground Water Recharge Worthy Area			Shallow Water Table Area	Flood Prone Area
					Command area	Non-command area	Poor ground water quality area		
1	Areacode	Hard Rock	33357.00	5000.00	0.00	28357.00	0.00	0.00	0.00
2	Kalikavu	Hard Rock	68912.00	44500.00	0.00	24412.00	0.00	0.00	0.00
3	Kondotty	Hard Rock	18624.00	0.00	0.00	18624.00	0.00	0.00	0.00
4	Kuttippuram	Hard Rock	17868.00	0.00	0.00	17868.00	0.00	0.00	0.00
5	Malappuram	Hard Rock	18032.00	0.00	0.00	18032.00	0.00	0.00	0.00
6	Mankada	Hard Rock	15245.00	0.00	0.00	15245.00	0.00	0.00	0.00
7	Nilamboor	Hard Rock	62120.00	40300.00	0.00	21820.00	0.00	0.00	0.00
8	Perinthalmanna	Hard Rock	28203.00	1000.00	0.00	27203.00	0.00	0.00	0.00
9	Perumpadappu	Alluvial	5899.00	0.00	0.00	5899.00	0.00	0.00	0.00
10	Ponnani	Alluvial	9706.00	0.00	0.00	9706.00	0.00	0.00	0.00
11	Thanur	Hard Rock	12756.00	0.00	0.00	12756.00	0.00	0.00	0.00
12	Tirur	Alluvial	11105.00	0.00	0.00	11105.00	0.00	0.00	0.00
13	Thriurangadi	Hard Rock	13001.00	0.00	0.00	13001.00	0.00	0.00	0.00
14	Vengara	Hard Rock	14845.00	0.00	0.00	14845.00	0.00	0.00	0.00
15	Wandoor	Hard Rock	25308.00	10000.00	0.00	15308.00	0.00	0.00	0.00
	Total (ha)		354981.00	100800.00	0.00	254181.00	0.00	0.00	0.00
	Total (Sq.km)		3549.81	1008.00	0.00	2541.81	0.00	0.00	0.00

District		PALAKKAD							
Assessment Year		2013							
Sl. No.	Name of Ground water Assessment Unit	Type of rock formation	Areal extent						
			(in hectares)						
			Total Geographical Area	Hilly Area	Ground Water Recharge Worthy Area			Shallow Water Table Area	Flood Prone Area
					Command area	Non-command area	Poor ground water quality area		
1	Alathur	Hard Rock	37117.00	12000.00	0.00	25117.00	0.00	0.00	0.00
2	Attappadi	Hard Rock	70323.00	48000.00	0.00	22323.00	0.00	0.00	0.00
3	Chittur	Hard Rock	27595.00	0.00	0.00	27595.00	0.00	0.00	0.00
4	Kollengode	Hard Rock	16322.00	1500.00	0.00	14822.00	0.00	0.00	0.00
5	Kuzhalmannam	Hard rock	19212.00	0.00	0.00	19212.00	0.00	0.00	0.00
6	Malampuzha	Hard rock	46804.00	20000.00	0.00	26804.00	0.00	0.00	0.00
7	Mannarkkad	Hard rock	48235.00	16000.00	0.00	32235.00	0.00	0.00	0.00
8	Nenmara	Hard Rock	74135.00	51894.00	0.00	22241.00	0.00	0.00	0.00
9	Ottappalam	Hard rock	19775.00	0.00	0.00	19775.00	0.00	0.00	0.00
10	Palakkad	Hard Rock	23248.00	0.00	0.00	23248.00	0.00	0.00	0.00
11	Pattambi	Hard Rock	25699.00	0.00	0.00	25699.00	0.00	0.00	0.00
12	Sreekrishnapuram	Hard Rock	21941.00	0.00	0.00	21941.00	0.00	0.00	0.00
13	Thrithala	Hard rock	17216.00	0.00	0.00	17216.00	0.00	0.00	0.00
	Total (ha)		447622.00	149394.00	0.00	299728.00	0.00	0.00	0.00
	Total (Sq.km)		4476.22	1493.94	0.00	2997.28	0.00	0.00	0.00

District		PATHANAMTHITTA							
Assessment Year		2013							
Sl. No.	Name of Ground water Assessment Unit	Type of rock formation	Areal extent						
			(in hectares)						
			Total Geographical Area	Hilly Area	Ground Water Recharge Worthy Area			Shallow Water Table Area	Flood Prone Area
					Command area	Non-command area	Poor ground water quality area		
1	Elanthoor	Hard Rock	10622.00	0.00	0.00	10622.00	0.00	0.00	0.00
2	Koipuram	Hard Rock	12367.00	0.00	0.00	12367.00	0.00	0.00	0.00
3	Konni	Hard Rock	86477.00	60500.00	0.00	25977.00	0.00	0.00	0.00
4	Mallappally	Hard Rock	15418.00	0.00	0.00	15418.00	0.00	0.00	0.00
5	Pandalam	Hard Rock	11641.00	0.00	0.00	11641.00	0.00	0.00	0.00
6	Parakode	Hard Rock	27152.00	4510.00	0.00	22642.00	0.00	0.00	0.00
7	Pulikeezh	Alluvium	6866.00	0.00	0.00	6866.00	0.00	5000.00	0.00
8	Ranni	Hard Rock	92132.00	68000.00	0.00	24132.00	0.00	0.00	0.00
Total (ha)			262675.00	133010.00	0.00	129665.00	0.00	5000.00	0.00
Total (Sq.km)			2626.75	1330.10	0.00	1296.65	0.00	50.00	0.00

District		THIRUVANANTHAPURAM							
Assessment Year		2013							
Sl. No.	Name of Ground water Assessment Unit	Type of rock formation	Areal extent						
			(in hectares)						
			Total Geographical Area	Hilly Area	Ground Water Recharge Worthy Area			Shallow Water Table Area	Flood Prone Area
					Command area	Non-command area	Poor ground water quality area		
1	Athiyannur	Hard Rock	7629.00	0.00	0.00	7629.00	0.00	0.00	0.00
2	Chirayinkil	Hard Rock	10151.00	0.00	0.00	10151.00	0.00	0.00	0.00
3	Kilimanoor	Hard Rock	17977.00	0.00	0.00	17977.00	0.00	0.00	0.00
4	Nedumangad	Hard Rock	15603.00	0.00	0.00	15603.00	0.00	0.00	0.00
5	Nemom	Hard Rock	33727.00	0.00	0.00	33727.00	0.00	0.00	0.00
6	Parassala	Hard Rock	8221.00	0.00	0.00	8221.00	0.00	0.00	0.00
7	Perumkadavila	Hard Rock	28538.00	1500.00	0.00	27038.00	0.00	0.00	0.00
8	Pothencode	Alluvium	7415.00	0.00	0.00	7415.00	0.00	0.00	0.00
9	Vamanapuram	Hard Rock	42115.00	15000.00	0.00	27115.00	0.00	0.00	0.00
10	Varkala	Alluvial	10209.00	0.00	0.00	10209.00	0.00	0.00	0.00
11	Vellanad	Hard Rock	37212.00	8000.00	0.00	29212.00	0.00	0.00	0.00
	Total (ha)		218797.00	24500.00	0.00	194297.00	0.00	0.00	0.00
	Total (Sq.km)		2187.97	245.00	0.00	1942.97	0.00	0.00	0.00

District		THRISSUR							
Assessment Year		2013							
Sl. No.	Name of Ground water Assessment Unit	Type of rock formation	Areal extent						
			(in hectares)						
			Total Geographical Area	Hilly Area	Ground Water Recharge Worthy Area			Shallow Water Table Area	Flood Prone Area
					Command area	Non-command area	Poor ground water quality area		
1	Anthikkad	Alluvial	9904.00	0.00	0.00	9904.00	0.00	0.00	0.00
2	Chalakkudy	Hard Rock	61069.00	40700.00	0.00	20369.00	0.00	0.00	0.00
3	Chavakkad	Alluvial	9917.00	0.00	0.00	9917.00	0.00	0.00	0.00
4	Cherpu	Hard Rock	8448.00	0.00	0.00	8448.00	0.00	0.00	0.00
5	Chowannur	Hard Rock	17774.00	0.00	0.00	17774.00	0.00	0.00	0.00
6	Iringalakkuda	Hard Rock	12073.00	0.00	0.00	12073.00	0.00	0.00	0.00
7	Kodakara	Hard Rock	29812.00	9000.00	0.00	20812.00	0.00	0.00	0.00
8	Mala	Hard Rock	12713.00	0.00	0.00	12713.00	0.00	0.00	0.00
9	Mathilakom	Alluvial	14635.00	0.00	0.00	14635.00	0.00	2500.00	0.00
10	Mullassery	Alluvial	6585.00	0.00	0.00	6585.00	0.00	0.00	0.00
11	Ollukkara	Hard Rock	31572.00	11000.00	0.00	20572.00	0.00	0.00	0.00
12	Pazhayannur	Hard Rock	23695.00	0.00	0.00	23695.00	0.00	0.00	0.00
13	Puzhakkal	Hard Rock	22892.00	0.00	0.00	22892.00	0.00	0.00	0.00
14	Thalikkulam	Alluvial	6568.00	0.00	0.00	6568.00	0.00	2000.00	0.00
15	Vellangallur	Hard Rock	11069.00	0.00	0.00	11069.00	0.00	0.00	0.00
16	Vadakkancherry	Hard Rock	23659.00	5000.00	0.00	18659.00	0.00	0.00	0.00
	Total (ha)		302385.00	65700.00	0.00	236685.00	0.00	4500.00	0.00
	Total (Sq.km)		3023.85	657.00	0.00	2366.85	0.00	45.00	0.00

District		WAYANAD							
Assessment Year		2013							
Sl. No.	Name of Ground water Assessment Unit	Type of rock formation	Areal extent						
			(in hectares)						
			Total Geographical Area	Hilly Area	Ground Water Recharge Worthy Area			Shallow Water Table Area	Flood Prone Area
					Command area	Non-command area	Poor ground water quality area		
1	Kalpetta	Hard Rock	58351.00	17000.00	0.00	41351.00	0.00	0.00	0.00
2	Mananthavady	Hard Rock	66651.00	25600.00	0.00	41051.00	0.00	0.00	0.00
3	Panamaram	Hard Rock	35086.00	11800.00	0.00	23286.00	0.00	0.00	0.00
4	Sulthanbathery	Hard Rock	52974.00	15900.00	0.00	37074.00	0.00	0.00	0.00
	Total (ha)		160088.00	54400.00	0.00	105688.00	0.00	0.00	0.00
	Total (Sq.km)		1600.88	544.00	0.00	1056.88	0.00	0.00	0.00

ANNEXURE III B

**DATA VARIABLES USED IN THE ASSESSMENT OF DYNAMIC GROUND
WATER RESOURCES OF KERALA (2013)**

State		KERALA				
District		ALAPPUZHA				
Assessment Year		2013				
Sl. No.	Assessment Unit	Command/ Non-command/ Poor GW Quality	Rainfall (mm)	Average Pre- monsoon Water level (mbgl)	Average Post- monsoon Water Level (mbgl)	Average Fluctuation (m)
1	Ambalappuzha	Non-Command	1845.70	1.91	1.16	0.75
2	Aryad	Non-Command	1845.70	1.64	0.86	0.78
3	Bharanikkavu	Non-Command	1845.70	8.90	6.90	2.00
4	Champakkulam	Non-Command	1845.70	1.39	0.53	0.85
5	Chengannur	Non-Command	1845.70	4.41	3.10	1.31
6	Harippad	Non-Command	1845.70	1.50	0.72	0.78
7	Kanjikkuzhy	Non-Command	1845.70	1.62	1.10	0.52
8	Mavelikkara	Non-Command	1845.70	3.11	1.74	1.37
9	Muthukulam	Non-Command	1845.70	2.97	1.70	1.26
10	Pattanakkad	Non-Command	1845.70	1.94	0.96	0.98
11	Thycattussery	Non-Command	1845.70	2.06	1.21	0.85
12	Veliyanad	Non-Command	1845.70	0.48	0.35	0.13
	Total	Non-Command	1845.70	2.66	1.69	0.97

State		KERALA				
District		ERNAKULAM				
Assessment Year		2013				
Sl. No.	Assessment Unit	Command/Non-command/Poor GW Quality	Rainfall (mm)	Average Pre-monsoon Water level (mbgl)	Average Post-monsoon Water Level (mbgl)	Average Fluctuation (m)
1	Alangad	Non-Command	2610.20	2.13	1.70	0.43
2	Angamaly	Non-Command	2610.20	6.03	5.37	0.66
3	Edappally	Non-Command	2610.20	2.12	1.70	0.42
4	Koovappady	Non-Command	2610.20	6.79	5.84	0.95
5	Kothamangalam	Non-Command	2610.20	4.22	3.69	0.53
6	Moovattupuzha	Non-Command	2610.20	5.60	4.32	1.28
7	Mulamthuruthy	Non-Command	2610.20	5.98	4.53	1.45
8	Palluruthy	Non-Command	2610.20	1.30	0.76	0.54
9	Pampakkuda	Non-Command	2610.20	5.93	5.37	0.56
10	Parakkadavu	Non-Command	2610.20	6.67	4.96	1.72
11	Paravoor	Non-Command	2610.20	0.97	0.91	0.06
12	Vadavukodu	Non-Command	2610.20	5.21	4.85	0.36
13	Vazhakkulam	Non-Command	2610.20	5.69	5.05	0.64
14	Vypeen	Non-Command	2610.20	0.83	0.72	0.11
	Total	Non-Command	2610.20	4.25	3.56	0.69

District		IDUKKI				
Assessment Year		2013				
Sl. No.	Assessment Unit	Command/Non-command/Poor GW Quality	Rainfall (mm)	Average Pre-monsoon Water level (mbgl)	Average Post-monsoon Water Level (mbgl)	Average Fluctuation (m)
1	Adimali	Non-Command	2601.60	5.92	4.91	1.02
2	Arudai	Non-Command	2601.60	4.52	2.80	1.72
3	Devikulam	Non-Command	2601.60	1.80	1.32	0.48
4	Elam Desom	Non-Command	2601.60	3.92	2.93	0.99
5	Idukki	Non-Command	2601.60	4.85	3.82	1.03
6	Kattappana	Non-Command	2601.60	2.84	2.15	0.70
7	Nedumkandam	Non-Command	2601.60	4.67	2.85	1.82
8	Thodupuzha	Non-Command	2601.60	5.43	4.06	1.37
TOTAL		Non-Command	2601.60	4.25	3.10	1.14

District		KANNUR				
Assessment Year		2013				
Sl. No.	Assessment Unit	Command/Non-command/Poor GW Quality	Rainfall (mm)	Average Pre-monsoon Water level (mbgl)	Average Post-monsoon Water Level (mbgl)	Average Fluctuation (m)
1	Edakkad	Non-Command	2666.90	6.88	3.99	2.89
2	Irikkur	Non-Command	2666.90	5.13	3.97	1.16
3	Iritty	Non-Command	2666.90	7.56	6.24	1.32
4	Kallyasseri	Non-Command	2666.90	7.02	5.41	1.62
5	Kannur	Non-Command	2666.90	10.52	8.13	2.39
6	Kuthuparamba	Non-Command	2666.90	5.49	3.49	2.00
7	Panur	Non-Command	2666.90	8.41	6.70	1.71
8	Payyannur	Non-Command	2666.90	9.18	7.00	2.17
9	Peravoor	Non-Command	2666.90	5.33	4.42	0.91
10	Taliparamba	Non-Command	2666.90	10.14	7.65	2.49
11	Thalassery	Non-Command	2666.90	2.51	1.48	1.03
Total		Non-Command	2666.90	7.10	5.32	1.79

District		KASARGOD				
Assessment Year		2013				
Sl. No.	Assessment Unit	Command /Non-command /Poor GW Quality	Rainfall (mm)	Average Pre-monsoon Water level (mbgl)	Average Post-monsoon Water Level (mbgl)	Average Fluctuation (m)
1	Kanhangad	Non-Command	3872.20	8.29	6.77	1.52
2	Karadka	Non-Command	3872.20	11.27	10.32	0.95
3	Kasaragod	Non-Command	3872.20	10.78	9.33	1.45
4	Manjeswar	Non-Command	3872.20	11.18	9.45	1.73
5	Nileswaram	Non-Command	3872.20	4.64	2.54	2.11
6	Parappa	Non-Command	3872.20	8.89	7.92	0.97
	Total	Non-Command	3872.20	9.18	7.72	1.45

District		KOLLAM				
Assessment Year		2013				
Sl. No.	Assessment Unit	Command/Non-command/Poor GW Quality	Rainfall (mm)	Average Pre-monsoon Water level (mbgl)	Average Post-monsoon Water Level (mbgl)	Average Fluctuation (m)
1	Anchal	Non-Command	1655.60	6.93	5.37	1.56
2	Chadayamangalam	Non-Command	1655.60	7.51	6.23	1.27
3	Chavara	Non-Command	1655.60	3.63	2.94	0.69
4	Chittumala	Non-Command	1655.60	10.76	9.62	1.14
5	Ithikkara	Non-Command	1655.60	9.36	8.24	1.11
6	Kottarakkara	Non-Command	1655.60	9.49	7.68	1.81
7	Mukhathala	Non-Command	1655.60	5.70	5.02	0.68
8	Oachira	Non-Command	1655.60	2.22	1.03	1.19
9	Pathanapuram	Non-Command	1655.60	6.95	4.59	2.36
10	Sasthamkotta	Non-Command	1655.60	5.55	4.46	1.09
11	Vettikkavala	Non-Command	1655.60	7.37	5.73	1.64
Total		Non-Command	1655.60	6.86	5.54	1.32

District		KOTTAYAM				
Assessment Year		2013				
Sl. No.	Assessment Unit	Command/Non-command/Poor GW Quality	Rainfall (mm)	Average Pre-monsoon Water level (mbgl)	Average Post-monsoon Water Level (mbgl)	Average Fluctuation (m)
1	Erattupetta	Non-Command	2298.70	2.65	2.27	0.38
2	Ettumanoor	Non-Command	2298.70	5.26	4.21	1.05
3	Kaduthuruthy	Non-Command	2298.70	4.75	4.53	0.21
4	Kanjirappally	Non-Command	2298.70	5.94	4.28	1.66
5	Lalam	Non-Command	2298.70	5.13	4.10	1.02
6	Madappally	Non-Command	2298.70	7.73	5.85	1.88
7	Pallom	Non-Command	2298.70	7.01	5.52	1.49
8	Pampady	Non-Command	2298.70	4.87	3.56	1.31
9	Uzhavoor	Non-Command	2298.70	3.57	1.92	1.64
10	Vaikom	Non-Command	2298.70	2.05	1.26	0.79
11	Vazhoor	Non-Command	2298.70	5.46	4.41	1.06
Total		Non-Command	2298.70	4.95	3.81	1.14

District		KOZHIKODE				
Assessment Year		2013				
Sl. No.	Assessment Unit	Command/Non-command/Poor GW Quality	Rainfall (mm)	Average Pre-monsoon Water level (mbgl)	Average Post-monsoon Water Level (mbgl)	Average Fluctuation (m)
1	Balusseri	Non-Command	2929.80	5.05	3.49	1.56
2	Chelannur	Non-Command	2929.80	5.68	3.43	2.25
3	Koduvally	Non-Command	2929.80	4.51	2.56	1.95
4	Kozhikode	Non-Command	2929.80	3.33	1.71	1.62
5	Kunnamangalam	Non-Command	2929.80	6.05	4.61	1.44
6	Kunnummal	Non-Command	2929.80	5.20	3.65	1.56
7	Melady	Non-Command	2929.80	6.96	4.54	2.42
8	Panthalayani	Non-Command	2929.80	5.20	3.05	2.15
9	Perambra	Non-Command	2929.80	3.69	2.30	1.39
10	Thodannur	Non-Command	2929.80	4.33	3.23	1.10
11	Tuneri	Non-Command	2929.80	8.80	6.81	1.98
12	Vadakara	Non-Command	2929.80	5.55	3.63	1.93
Total		Non-Command	2929.80	5.36	3.58	1.78

District		MALAPPURAM				
Assessment Year		2013				
Sl. No.	Assessment Unit	Command/Non-command/Poor GW Quality	Rainfall (mm)	Average Pre-monsoon Water level (mbgl)	Average Post-monsoon Water Level (mbgl)	Average Fluctuation (m)
1	Areacode	Non-Command	2945.00	8.85	5.34	3.51
2	Kalikavu	Non-Command	2945.00	5.90	4.70	1.20
3	Kondotty	Non-Command	2945.00	4.20	1.49	2.71
4	Kuttippuram	Non-Command	2945.00	7.71	5.58	2.13
5	Malappuram	Non-Command	2945.00	6.40	4.86	1.53
6	Mankada	Non-Command	2945.00	8.05	5.98	2.07
7	Nilamboor	Non-Command	2945.00	4.51	3.40	1.11
8	Perinthalmanna	Non-Command	2945.00	7.05	5.53	1.51
9	Perumpadappu	Non-Command	2945.00	6.67	3.85	2.82
10	Ponnani	Non-Command	2945.00	9.44	7.50	1.94
11	Tanur	Non-Command	2945.00	9.37	7.04	2.33
12	Tirur	Non-Command	2945.00	9.22	7.63	1.59
13	Tirurangadi	Non-Command	2945.00	5.45	4.12	1.33
14	Vengara	Non-Command	2945.00	9.97	9.13	0.84
15	Wandoor	Non-Command	2945.00	6.20	5.06	1.13
	Total	Non-Command	2945.00	7.27	5.41	1.85

District		PALAKKAD				
Assessment Year		2013				
Sl. No.	Assessment Unit	Command/Non-command/Poor GW Quality	Rainfall (mm)	Average Pre-monsoon Water level (mbgl)	Average Post-monsoon Water Level (mbgl)	Average Fluctuation (m)
1	Alathur	Non-Command	2608.20	4.82	2.67	2.14
2	Attappadi	Non-Command	2608.20	6.65	5.40	1.24
3	Chittur	Non-Command	2608.20	7.69	6.14	1.55
4	Kollengode	Non-Command	2608.20	5.59	3.85	1.74
5	Kuzhalmannam	Non-Command	2608.20	4.08	2.37	1.71
6	Malampuzha	Non-Command	2608.20	5.69	3.78	1.91
7	Mannarkkad	Non-Command	2608.20	5.78	4.38	1.40
8	Nenmara	Non-Command	2608.20	4.38	2.91	1.47
9	Ottappalam	Non-Command	2608.20	7.36	6.27	1.10
10	Palakkad	Non-Command	2608.20	3.73	2.60	1.13
11	Pattambi	Non-Command	2608.20	6.03	3.82	2.21
12	Sreekrishnapuram	Non-Command	2608.20	6.78	4.99	1.79
13	Thrithala	Non-Command	2608.20	8.43	6.37	2.06
	Total	Non-Command	2608.20	5.71	4.10	1.62

District		PATHANAMTHITTA				
Assessment Year		2013				
Sl. No.	Assessment Unit	Command/ Non-command/ Poor GW Quality	Rainfall (mm)	Average Pre-monsoon Water level (mbgl)	Average Post-monsoon Water Level (mbgl)	Average Fluctuation (m)
1	Elanthoor	Non-Command	1817.90	4.62	3.55	1.07
2	Koipuram	Non-Command	1817.90	7.22	6.42	0.81
3	Konni	Non-Command	1817.90	6.54	5.30	1.24
4	Mallappally	Non-Command	1817.90	7.23	5.42	1.82
5	Pandalam	Non-Command	1817.90	4.42	3.71	0.71
6	Parakode	Non-Command	1817.90	12.01	8.14	3.87
7	Pulikeezh	Non-Command	1817.90	3.26	2.21	1.05
8	Ranni	Non-Command	1817.90	4.89	4.11	0.77
	Total	Non-Command	1817.90	6.27	4.86	1.42

District		THIRUVANANTHAPURAM				
Assessment Year		2013				
Sl. No	Assessment Unit	Command /Non-command /Poor GW Quality	Rainfall (mm)	Average Pre-monsoon Water level (mbgl)	Average Post-monsoon Water Level (mbgl)	Average Fluctuation (m)
1	Athiyannur	Non-Command	1154.40	13.60	11.91	1.69
2	Chirayinkil	Non-Command	1154.40	5.43	4.22	1.21
3	Kilimanoor	Non-Command	1154.40	8.28	6.63	1.65
4	Nedumangad	Non-Command	1154.40	5.17	4.30	0.88
5	Nemom	Non-Command	1154.40	7.82	6.64	1.19
6	Parassala	Non-Command	1154.40	8.73	7.04	1.69
7	Perumkadavila	Non-Command	1154.40	6.82	6.32	0.50
8	Pothencode	Non-Command	1154.40	5.27	4.91	0.36
9	Vamanapuram	Non-Command	1154.40	5.67	3.91	1.76
10	Varkala	Non-Command	1154.40	12.41	11.14	1.27
11	Vellanad	Non-Command	1154.40	6.41	5.29	1.12
	TOTAL	Non-Command	1154.40	7.78	6.57	1.21

District		THRISSUR				
Assessment Year		2013				
Sl. No.	Assessment Unit	Command/Non-command/Poor GW Quality	Rainfall (mm)	Average Pre-monsoon Water level (mbgl)	Average Post-monsoon Water Level (mbgl)	Average Fluctuation (m)
1	Anthikkad	Non-Command	2361.40	3.31	1.20	2.11
2	Chalakkudy	Non-Command	2361.40	5.56	4.93	0.63
3	Chavakkad	Non-Command	2361.40	4.50	2.15	2.36
4	Cherpu	Non-Command	2361.40	9.93	7.15	2.78
5	Chowannur	Non-Command	2361.40	6.36	5.05	1.30
6	Irinjalakkuda	Non-Command	2361.40	7.10	5.95	1.16
7	Kodakara	Non-Command	2361.40	5.79	4.50	1.28
8	Mala	Non-Command	2361.40	6.58	5.05	1.53
9	Mathilakom	Non-Command	2361.40	2.52	1.66	0.85
10	Mullassery	Non-Command	2361.40	8.73	6.49	2.24
11	Ollukkara	Non-Command	2361.40	5.90	4.39	1.51
12	Pazhayannur	Non-Command	2361.40	3.85	2.53	1.32
13	Puzhakkal	Non-Command	2361.40	10.72	9.41	1.31
14	Thalikkulam	Non-Command	2361.40	3.99	2.49	1.50
15	Vellangallur	Non-Command	2361.40	8.57	7.43	1.14
16	Wadakkancherry	Non-Command	2361.40	7.70	5.43	2.26
	TOTAL	Non-Command	2361.40	6.32	4.74	1.58

District		WAYANAD				
Assessment Year		2013				
Sl. No.	Assessment Unit	Command /Non-command /Poor GW Quality	Rainfall (mm)	Average Pre-monsoon Water level (mbgl)	Average Post-monsoon Water Level (mbgl)	Average Fluctuation (m)
1	Kalpetta	Non-Command	1839.90	8.38	7.48	0.89
2	Mananthavady	Non-Command	1839.90	6.87	5.11	1.76
3	Panamaram	Non-Command	1839.90	5.67	4.27	1.41
4	Sulthanbathery	Non-Command	1839.90	6.55	5.84	0.71
	Total	Non-Command	1839.90	6.98	5.62	1.35

ANNEXURE III B (Contd..)

**DATA VARIABLES USED IN THE ASSESSMENT OF DYNAMIC GROUND
WATER RESOURCES OF KERALA (2011)**

District		ALAPPUZHA				
Assessment Year		2013				
Sl. No.	Assessment Unit	Sub-unit (Command/ Non-Command/ Poor Quality)		No. of Structures		
			Type of Structure	Irrigation	Domestic	Industrial
1	Ambalappuzha	Non-Command	DW	15	Domestic draft Computed on the basis of projected population, per capita requirement & fractional load on ground water	Industrial draft data provided by Dept. of Industries, Government of Kerala
			DW with pump	220		
			STW	0		
			*Others	6010		
2	Aryad	Non-Command	DW	12		
			DW with pump	325		
			STW	0		
			*Others	5950		
3	Bharanikkavu	Non-Command	DW	360		
			DW with pump	610		
			STW	0		
			*Others	8375		
4	Champakkulam	Non-Command	DW	102		
			DW with pump	21		
			STW/BW	0		
			*Others	5560		
5	Chengannur	Non-Command	DW	256		
			DW with pump	1392		
			STW	0		
			*Others	8750		
6	Harippad	Non-Command	DW	295		
			DW with pump	825		
			STW	0		
			*Others	8150		
7	Kanjikkuzhy	Non-Command	DW	12		
			DW with pump	130		
			STW	0		
			*Others	7625		
8	Mavelikkara	Non-Command	DW	362		
			DW with pump	185		
			STW	0		
			*Others	7820		
9	Muthukulam	Non-Command	DW	72		
			DW with pump	358		
			STW	0		
			*Others	8013		
10	Pattanakkad	Non-Command	DW	15		
			DW with pump	68		
			STW	0		
			*Others	9421		
11	Thycattussery	Non-Command	DW	29		
			DW with pump	159		
			STW	0		
			*Others	4621		
12	Veliyanad	Non-Command	DW	21		
			DW with pump	235		
			STW	0		
			*Others	2021		
			STW: Shallow tube wells and bore wells * Others: Irrigation through domestic wells			

District		ERNAKULAM				
Assessment Year		2013		No. of Structures		
Sl. No.	Assessment Unit	Sub-unit (Command/ non-Command/ poor quality)	Type of Structure	Irrigation	Domestic	Industrial
1	Alangad	Non - Command	DW	2	Domestic draft Computed on the basis of projected population, per capita requirement & fractional load on ground water	Industrial draft data provided by Dept. of Industries, Government of Kerala
			DW with pump	906		
			STW	55		
			*Others	5345		
2	Angamaly	Non - Command	DW	4		
			DW with pump	1662		
			STW	92		
			*Others	6470		
3	Edappally	Non - Command	DW	63		
			DW with pump	182		
			STW	6		
			*Others	4281		
4	Koovappady	Non - Command	DW	3		
			DW with pump	1881		
			STW	70		
			*Others	6708		
5	Kothamangalam	Non - Command	DW	58		
			DW with pump	1561		
			STW	88		
			*Others	8122		
6	Moovattupuzha	Non - Command	DW	0		
			DW with pump	2280		
			STW	91		
			*Others	6656		
7	Mulamthuruthy	Non - Command	DW	7		
			DW with pump	1108		
			STW	226		
			*Others	6371		
8	Palluruthy	Non - Command	DW	3		
			DW with pump	240		
			STW	4		
			*Others	2628		
9	Pampakkuda	Non - Command	DW	21		
			DW with pump	1577		
			STW	48		
			*Others	4991		
10	Parakkadavu	Non - Command	DW	0		
			DW with pump	1980		
			STW	99		
			*Others	7321		

District		ERNAKULAM				
Assessment Year		2011		No. of Structures		
Sl. No.	Assessment Unit	Sub-unit (Command/ non-Command/ poor quality)	Type of Structure	Irrigation	Domestic	Industrial
11	Paravoor	Non - Command	DW	0	Domestic draft Computed on the basis of projected population, per capita requirement & fractional load on ground water	Industrial draft data provided by Dept. of Industries, Government of Kerala
			DW with pump	1155		
			STW	0		
			*Others	6584		
12	Vadavukodu	Non - Command	DW	12		
			DW with pump	1194		
			STW	48		
			*Others	0		
13	Vazhakkulam	Non - Command	DW	0		
			DW with pump	2048		
			STW	52		
			Others	8755		
14	Vypeen	Non - Command	DW	7		
			DW with pump	125		
			STW	0		
			Others	0		
			STW: Shallow tube wells and bore wells * Others: Irrigation through domestic wells			

State		KERALA				
District		IDUKKI				
Assessment Year		2013				
Sl. No.	Assessment Unit	Sub-unit (Command/ non-Command/ poor quality)		No. of Structures		
			Type of Structure	Irrigation	Domestic	Industrial
1	Adimali	Non-command	DW	193	Domestic draft Computed on the basis of projected population, per capita requirement & fractional load on ground water	Industrial draft data provided by Dept. of Industries, Government of Kerala
			DW with pump	1052		
			STW	650		
			*Others (pl. specify)	871		
2	Azhutha	Non-command	DW	120		
			DW with pump	331		
			STW	85		
			Others (pl. specify)	8583		
3	Devikulam	Non-command	DW	160		
			DW with pump	371		
			STW	610		
			Others (pl. specify)	7242		
4	Elam Desom	Non-command	DW	377		
			DW with pump	700		
			STW	770		
			Others (pl. specify)	5840		
5	Idukki	Non-command	DW	203		
			DW with pump	473		
			STW	720		
			Others (pl. specify)	6626		
6	Kattappana	Non-command	DW	184		
			DW with pump	1105		
			STW	1655		
			Others (pl. specify)	9066		
7	Nedumkandam	Non-command	DW	197		
			DW with pump	690		
			STW	1855		
			Others (pl. specify)	7921		
8	Thodupuzha	Non-command	DW	301		
			DW with pump	843		
			STW	700		
			Others (pl. specify)	3586		
			STW: Shallow tube wells and bore wells * Others: Irrigation through domestic wells			

District		KANNUR				
Assessment Year		2013				
Sl. No.	Assessment Unit	Sub-unit (Command/ non-Command/ poor quality)		No.of Structures		
			Type of Structure	Irrigation	Domestic	Industrial
1	Edakkad	Non-command	DW	42	Domestic draft Computed on the basis of projected population, per capita requirement & fractional load on ground water	Industrial draft data provided by Dept. of Industries, Government of Kerala
			DW with pump	1598		
			STW	0		
			*Others (pl. specify)	9040		
2	Irikkur	Non-command	DW	62		
			DW with pump	985		
			STW	288		
			Others (pl. specify)	11325		
3	Iritty	Non-command	DW	78		
			DW with pump	1320		
			STW	9		
			Others (pl. specify)	13857		
4	Kallyasseri	Non-command	DW	25		
			DW with pump	1100		
			STW	18		
			Others (pl. specify)	9857		
4	Kannur	Non-command	DW	12		
			DW with pump	1764		
			STW	0		
			Others (pl. specify)	8874		
5	Kuthuparamba	Non-command	DW	48		
			DW with pump	11955		
			STW	35		
			Others (pl. specify)	9846		
6	Panur	Non-command	DW	20		
			DW with pump	764		
			STW	28		
			Others (pl. specify)	6580		
6	Payyannur	Non-command	DW	48		
			DW with pump	698		
			STW	232		
			Others (pl. specify)	6789		
7	Peravoor	Non-command	DW	96		
			DW with pump	1200		
			STW	29		
			Others (pl. specify)	7985		
8	Taliparamba	Non-command	DW	28		
			DW with pump	658		
			STW	94		
			Others (pl. specify)	15874		
9	Thalassery	Non-command	DW	18		
			DW with pump	674		
			STW	10		
			Others (pl. specify)	6040		
			STW: Shallow tube wells and bore wells * Others: Irrigation through domestic wells			

District		KASARGOD				
Assessment Year		2013				
Sl. No.	Assessment Unit	Sub-unit (Command/ non-Command/ poor quality)		No. of Structures		
			Type of Structure	Irrigation	Domestic	Industrial
1	Kanhangad	Non-command	DW	130	Domestic draft Computed on the basis of projected population, per capita requirement & fractional load on ground water	Industrial draft data provided by Dept. of Industries, Government of Kerala
			DW with pump	2700		
			STW	222		
			*Others (pl. specify)	7012		
2	Karadka	Non-command	DW	725		
			DW with pump	7750		
			STW	345		
			*Others (pl. specify)	6025		
2	Kasaragod	Non-command	DW	552		
			DW with pump	4802		
			STW	497		
			Others (pl. specify)	7692		
3	Manjeswar	Non-command	DW	1145		
			DW with pump	6325		
			STW	207		
			Others (pl. specify)	6920		
4	Nileswarem	Non-command	DW	79		
			DW with pump	1895		
			STW	159		
			Others (pl. specify)	7112		
5	Parappa	Non-command	DW	345		
			DW with pump	6485		
			STW	249		
			Others (pl. specify)	8123		

District		KOLLAM				
Assessment Year		2013				
Sl. No.	Assessment Unit	Sub-unit (Command/ non-Command/ poor quality)		No.of Structures		
			Structure	Irrigation	Domestic	Industrial
1	Anchal	Non-command	DW	344	Domestic draft Computed on the basis of projected population, per capita requirement & fractional load on ground water	Industrial draft data provided by Dept. of Industries, Government of Kerala
			DW with pump	742		
			STW	6		
			*Others (pl. specify)	13861		
2	Chadayamangalam	Non-command	DW	365		
			DW with pump	740		
			STW	7		
			Others (pl. specify)	12547		
3	Chavara	Non-command	DW	0		
			DW with pump	279		
			STW	20		
			Others (pl. specify)	8776		
4	Chittumala	Non-command	DW	433		
			DW with pump	882		
			STW	36		
			Others (pl. specify)	9336		
5	Ithikkara	Non-command	DW	205		
			DW with pump	510		
			STW	12		
			Others (pl. specify)	8530		
6	Kottarakkara	Non-command	DW	195		
			DW with pump	566		
			STW	7		
			Others (pl. specify)	9535		
7	Mukhathala	Non-command	DW	161		
			DW with pump	417		
			STW	51		
			Others (pl. specify)	10964		
8	Oachira	Non-command	DW	89		
			DW with pump	577		
			STW	18		
			Others (pl. specify)	13151		
9	Pathanapuram	Non-command	DW	289		
			DW with pump	859		
			STW	8		
			Others (pl. specify)	9547		
10	Sasthamkotta	Non-command	DW	271		
			DW with pump	580		
			STW	12		
			Others (pl. specify)	9913		
11	Vettikkavala	Non-command	DW	97		
			DW with pump	660		
			STW	9		
			Others (pl. specify)	10908		
			STW: Shallow tube wells and bore wells * Others: Irrigation through domestic wells			

District		KOTTAYAM				
Assessment Year		2013				
Sl. No.	Assessment Unit	Sub-unit (Command/ non-Command/ poor quality)		No.of Structures		
			Type of Structure	Irrigation	Domestic	Industrial
1	Erattupetta	Non-command	DW	32	Domestic draft Computed on the basis of projected population, per capita requirement & fractional load on ground water	Industrial draft data provided by Dept. of Industries, Government of Kerala
			DW with pump	691		
			STW	0		
			*Others (pl. specify)	5546		
2	Ettumanoor	Non-command	DW	89		
			DW with pump	275		
			STW	0		
			Others (pl. specify)	9852		
3	Kaduthuruthy	Non-command	DW	12		
			DW with pump	1198		
			STW	0		
			Others (pl. specify)	7425		
4	Kanjirappally	Non-command	DW	15		
			DW with pump	689		
			STW	0		
			Others (pl. specify)	9535		
5	Lalam	Non-command	DW	21		
			DW with pump	348		
			STW	0		
			Others (pl. specify)	4652		
6	Madappally	Non-command	DW	162		
			DW with pump	670		
			STW	0		
			Others (pl. specify)	9852		
7	Pallom	Non-command	DW	24		
			DW with pump	346		
			STW	0		
			Others (pl. specify)	12653		
8	Pampady	Non-command	DW	112		
			DW with pump	45		
			STW	0		
			Others (pl. specify)	6021		
9	Uzhavoor	Non-command	DW	210		
			DW with pump	456		
			STW	0		
			Others (pl. specify)	6686		
10	Vaikom	Non-command	DW	10		
			DW with pump	482		
			STW	0		
			Others (pl. specify)	4685		
11	Vazhoor	Non-command	DW	159		
			DW with pump	475		
			STW	0		
			Others (pl. specify)	5582		
			STW: Shallow tube wells and bore wells * Others: Irrigation through domestic wells			

District		KOZHIKODE				
Assessment Year		2013				
Sl. No.	Assessment Unit	Sub-unit (Command/ non-Command/ poor quality)		No.of Structures		
			Structure	Irrigation	Domestic	Industrial
1	Balussery	Non-command	DW	0	Domestic draft Computed on the basis of projected population, per capita requirement & fractional load on ground water	Industrial draft data provided by Dept. of Industries, Government of Kerala
			DW with pump	1607		
			STW	0		
			*Others (pl. specify)	10077		
2	Chelannur	Non-command	DW	0		
			DW with pump	692		
			STW	0		
			Others (pl. specify)	8642		
3	Koduvally	Non-command	DW	0		
			DW with pump	1031		
			STW	0		
			Others (pl. specify)	10777		
4	Kozhikode	Non-command	DW	0		
			DW with pump	873		
			STW	0		
			Others (pl. specify)	10690		
5	Kunnamangalam	Non-command	DW	0		
			DW with pump	1604		
			STW	0		
			Others (pl. specify)	13541		
6	Kunnummal	Non-command	DW	0		
			DW with pump	637		
			STW	0		
			Others (pl. specify)	7846		
7	Melady	Non-command	DW	0		
			DW with pump	570		
			STW	0		
			Others (pl. specify)	5032		
8	Panthalayani	Non-command	DW	0		
			DW with pump	470		
			STW	0		
			Others (pl. specify)	4240		
9	Perambra	Non-command	DW	0		
			DW with pump	816		
			STW	0		
			Others (pl. specify)	6935		
10	Thodannur	Non-command	DW	0		
			DW with pump	227		
			STW	0		
			Others (pl. specify)	5098		
11	Tuneri	Non-command	DW	0		
			DW with pump	520		
			STW	0		
			Others (pl. specify)	5345		
12	Vadakara	Non-command	DW	0		
			DW with pump	297		
			STW	0		
			Others (pl. specify)	4571		
			STW: Shallow tube wells and bore wells * Others: Irrigation through domestic wells			

District		MALAPPURAM				
Assessment Year		2013				
Sl. No.	Assessment Unit	Sub-unit (Command/ non-Command/ poor quality)	Type of Structure	No. of Structures		
				Irrigation	Domestic	Industrial
1	Areacode	Non-command	DW	10	Domestic draft Computed on the basis of projected population, per capita requirement & fractional load on ground water	Industrial draft data provided by Dept. of Industries, Government of Kerala
			DW with pump	1125		
			STW	106		
			*Others (pl. specify)	9321		
2	Kalikavu	Non-command	DW	15		
			DW with pump	812		
			STW	58		
			Others (pl. specify)	7112		
3	Kondotty	Non-command	DW	125		
			DW with pump	1098		
			STW	468		
			Others (pl. specify)	8412		
4	Kuttippuram	Non-command	DW	1325		
			DW with pump	1265		
			STW	86		
			Others (pl. specify)	7895		
5	Malappuram	Non-command	DW	16		
			DW with pump	901		
			STW	418		
			Others (pl. specify)	7998		
6	Mankada	Non-command	DW	0		
			DW with pump	895		
			STW	619		
			Others (pl. specify)	5812		
7	Nilamboor	Non-command	DW	0		
			DW with pump	565		
			STW	15		
			Others (pl. specify)	8		
8	Perinthalmanna	Non-command	DW	715		
			DW with pump	812		
			STW	1086		
			Others (pl. specify)	8317		
9	Perumpadappu	Non-command	DW	0		
			DW with pump	990		
			STW	1521		
			Others (pl. specify)	36154		
10	Ponnani	Non-command	DW	10		
			DW with pump	524		
			STW	15		
			Others (pl. specify)	4212		
11	Tanur	Non-command	DW	0		
			DW with pump	1225		
			STW	146		
			Others (pl. specify)	8185		
12	Tirur	Non-command	DW	0		
			DW with pump	1550		
			STW	43		
			Others (pl. specify)	9602		
13	Tirurangadi	Non-command	DW	0		
			DW with pump	855		
			STW	27		
			Others (pl. specify)	6478		

District		MALAPPURAM				
Assessment Year		2013				
Sl. No.	Assessment Unit	Sub-unit (Command/ non-Command/ poor quality)	Type of Structure	No.of Structures		
				Irrigation	Domestic	Industrial
14	Vengara	Non-command	DW	0		
			DW with pump	765		
			STW	0		
			Others (pl. specify)	6978		
15	Wandoor	Non-command	DW	12		
			DW with pump	476		
			STW	81		
			Others (pl. specify)	7812		
			STW: Shallow tube wells and bore wells * Others: Irrigation through domestic wells			

District		PALAKKAD				
Assessment Year		2013				
Sl. No.	Assessment Unit	Sub-unit (Command/ non-Command/ poor quality)		No.of Structures		
			Type of Structure	Irrigation	Domestic	Industrial
1	Alathur	Non-command	DW	17	Domestic draft Computed on the basis of projected population, per capita requirement & fractional load on ground water	Industrial draft data provided by Dept. of Industries, Government of Kerala
			DW with pump	5118		
			STW	0		
			*Others (pl. specify)	12129		
2	Attappadi	Non-command	DW	2		
			DW with pump	1837		
			STW	0		
			Others (pl. specify)	936		
3	Chittur	Non-command	DW	0		
			DW with pump	8250		
			STW	1000		
			Others (pl. specify)	7840		
4	Kollengode	Non-command	DW	0		
			DW with pump	2540		
			STW	0		
			Others (pl. specify)	6595		
5	Kuzhalmannam	Non-command	DW	40		
			DW with pump	1597		
			STW	0		
			Others (pl. specify)	8090		
6	Malampuzha	Non-command	DW	60		
			DW with pump	3066		
			STW	0		
			Others (pl. specify)	10657		
7	Mannarkkad	Non-command	DW	5		
			DW with pump	1116		
			STW	0		
			Others (pl. specify)	12032		
8	Nenmara	Non-command	DW	20		
			DW with pump	2334		
			STW	0		
			Others (pl. specify)	7325		
9	Ottappalam	Non-command	DW	198		
			DW with pump	1434		
			STW	0		
			Others (pl. specify)	7133		
10	Palakkad	Non-command	DW	0		
			DW with pump	1724		
			STW	0		
			Others (pl. specify)	9312		
11	Pattambi	Non-command	DW	0		
			DW with pump	5473		
			STW	0		
			Others (pl. specify)	11064		
12	Sreekrishnapuram	Non-command	DW	0		
			DW with pump	1679		
			STW	0		
			Others (pl. specify)	8122		
13	Thrithala	Non-command	DW	0		
			DW with pump	1138		
			STW	0		
			Others (pl. specify)	8614		
			STW: Shallow tube wells and bore wells			

			* Others: Irrigation through domestic wells					
District		PATHANAMTHITTA						
Assessment Year		2013						
Sl. No.	Assessment Unit	Sub-unit (Command/ non-Command/ poor quality)	Type of Structure	No.of Structures				
				Irrigation	Domestic	Industrial		
1	Elanthoor	Non-command	DW	50	Domestic draft Computed on the basis of projected population, per capita requirement & fractional load on ground water	Industrial draft data provided by Dept. of Industries, Government of Kerala		
			DW with pump	603				
			STW	0				
			Others (pl. specify)	6484				
2	Koipuram	Non-command	DW	296				
			DW with pump	574				
			STW	0				
			Others (pl. specify)	7449				
3	Konni	Non-command	DW	145				
			DW with pump	459				
			STW	0				
			Others (pl. specify)	9594				
4	Mallappally	Non-command	DW	626				
			DW with pump	344				
			STW	0				
			Others (pl. specify)	7183				
5	Pandalam	Non-command	DW	268				
			DW with pump	1278				
			STW	0				
			Others (pl. specify)	7943				
6	Parakode	Non-command	DW	608				
			DW with pump	1583				
			STW	0				
			Others (pl. specify)	9492				
7	Pulikeezh	Non-command	DW	10				
			DW with pump	474				
			STW	0				
			Others (pl. specify)	5095				
8	Ranni	Non-command	DW	620				
			DW with pump	351				
			STW	0				
			Others (pl. specify)	7910				
			STW: Shallow tube wells and bore wells * Others: Irrigation through domestic wells					

District		THIRUVANANTHAPURAM				
Assessment Year		2013				
Sl. No.	Assessment Unit	Sub-unit (Command/ non-Command/ poor quality)	Type of Structure	No.of Structures		
				Irrigation	Domestic	Industrial
1	Athiyannur	Non-command	DW	245	Domestic draft Computed on the basis of projected population, per capita requirement & fractional load on ground water	Industrial draft data provided by Dept. of Industries, Government of Kerala
			DW with pump	785		
			STW	0		
			Others (pl. specify)	8448		
2	Chirayinkil	Non-command	DW	12		
			DW with pump	265		
			STW	17		
			Others (pl. specify)	7325		
3	Kilimanoor	Non-command	DW	76		
			DW with pump	182		
			STW	410		
			Others (pl. specify)	9821		
4	Nedumangad	Non-command	DW	0		
			DW with pump	201		
			STW	48		
			Others (pl. specify)	18152		
5	Nemom	Non-command	DW	0		
			DW with pump	715		
			STW	0		
			Others (pl. specify)	7996		
6	Parassala	Non-command	DW	25		
			DW with pump	978		
			STW	0		
			Others (pl. specify)	9142		
7	Perumkadavila	Non-command	DW	15		
			DW with pump	598		
			STW	95		
			Others (pl. specify)	9945		
8	Pothencode	Non-command	DW	15		
			DW with pump	695		
			STW	25		
			Others (pl. specify)	9995		
9	Vamanapuram	Non-command	DW	25		
			DW with pump	653		
			STW	5		
			Others (pl. specify)	10956		
10	Varkala	Non-command	DW	21		
			DW with pump	398		
			STW	13		
			Others (pl. specify)	6978		
11	Vellanad	Non-command	DW	612		
			DW with pump	741		
			STW	0		
			Others (pl. specify)	12125		
			STW: Shallow tube wells and bore wells * Others: Irrigation through domestic wells			

District		THRISSUR				
Assessment Year		2013				
Sl. No.	Assessment Unit	Sub-unit (Command/ non-Command/ poor quality)	Structure	No. of Structures		
				Irrigation	Domestic	Industrial
1	Anthikkad	Non-command	DW	0	Domestic draft Computed on the basis of projected population, per capita requirement & fractional load on ground water	Industrial draft data provided by Dept. of Industries, Government of Kerala
			DW with pump	2895		
			STW	15		
			*Others (pl. specify)	6572		
2	Chalakkudy	Non-command	DW	15		
			DW with pump	3998		
			STW	18		
			Others (pl. specify)	7110		
3	Chavakkad	Non-command	DW	0		
			DW with pump	2365		
			STW	7920		
			Others (pl. specify)	4825		
4	Cherpu	Non-command	DW	0		
			DW with pump	3568		
			STW	22		
			Others (pl. specify)	4325		
5	Chowannur	Non-command	DW	12		
			DW with pump	4125		
			STW	123		
			Others (pl. specify)	8398		
6	Irinjalakkuda	Non-command	DW	0		
			DW with pump	2452		
			STW	529		
			Others (pl. specify)	4452		
7	Kodakara	Non-command	DW	0		
			DW with pump	4823		
			STW	3		
			Others (pl. specify)	9954		
9	Mala	Non-command	DW	0		
			DW with pump	6425		
			STW	3		
			Others (pl. specify)	6945		
10	Mathilakom	Non-command	DW	0		
			DW with pump	2851		
			STW	8852		
			Others (pl. specify)	11254		
11	Mullassery	Non-command	DW	15		
			DW with pump	2152		
			STW	4378		
			Others (pl. specify)	4125		
12	Ollukkara	Non-command	DW	0		
			DW with pump	1452		
			STW	278		
			Others (pl. specify)	6758		
13	Pazhayannur	Non-command	DW	0		
			DW with pump	2896		
			STW	182		
			Others (pl. specify)	7685		
14	Puzhakkal	Non-command	DW	0		

District		THRISSUR				
Assessment Year		2013				
Sl. No.	Assessment Unit	Sub-unit (Command/ non-Command/ poor quality)	Structure	No.of Structures		
				Irrigation	Domestic	Industrial
			DW with pump	3758		
			STW	1		
			Others (pl. specify)	7652		
15	Thalikkulam	Non-command	DW	0		
DW with pump	1825					
STW	10051					
Others (pl. specify)	5841					
16	Vellangallur	Non-command	DW	0		
DW with pump	2152					
STW	32					
Others (pl. specify)	9985					
17	Wadakkancherry	Non-command	DW	15		
DW with pump	3485					
STW	173					
Others (pl. specify)	5458					
			STW: Shallow tube wells and bore wells * Others: Irrigation through domestic wells			

District		WAYANAD				
Assessment Year		2013				
Sl. No.	Assessment Unit	Sub-unit (Command/ non-Command/ poor quality)		No.of Structures		
			Structure	Irrigation	Domestic	Industrial
1	Kalpetta	Non-command	DW	0	Domestic draft Computed on the basis of projected population, per capita requirement & fractional load on ground water	Industrial draft data provided by Dept. of Industries, Government of Kerala
			DW with pump	286		
			STW	49		
			Others (pl. specify)	9125		
2	Mananthavady	Non-command	DW	41		
			DW with pump	138		
			STW	0		
			Others (pl. specify)	7952		
3	Panamaram	Non-command	DW	15		
			DW with pump	166		
			STW	23		
			Others (pl. specify)	7985		
3	Sulthanbathery	Non-command	DW	25		
			DW with pump	286		
			STW	381		
			Others (pl. specify)	8021		
			STW: Shallow tube wells and bore wells * Others: Irrigation through domestic wells			

ANNEXURE III C

**PARAMETERS USED IN THE ASSESSMENT OF DYNAMIC GROUND WATER
RESOURCES OF KERALA (2013)**

State		KERALA											
District		ALAPPUZHA											
Assessment Year		2013											
Sl. No.	Assessment Unit	Sub-unit (Command/ Non-Command/ Poor Quality)	Specific Yield (in fraction)		Rainfall Infiltration Factor (in fraction)		Season-wise Unit draft (ha m)						
			Formation	Value	Formation	Value	Structure	Irrigation		Domestic		Industrial	
								Monsoon	Non-monsoon	Monsoon	Non-monsoon	Monsoon	Non-monsoon
1	Ambalappuzha	Non-Command	Alluvium	0.16	Alluvium	0.10	DW	0.012	0.048	Computed on the basis of projected population, per capita requirement & fractional load on ground water			
							DW with pump	0.06	0.24			4.095	4.095
							STW	0.02	0.08				
							*Others (pl. specify)	0	0.007				
2	Aryad	Non-Command	Alluvium	0.16	Alluvium	0.10	DW	0.016	0.064				
							DW with pump	0.06	0.24			0.000	0.000
							STW	0.02	0.08				
							Others (pl. specify)	0	0.07				
3	Bharanikkavu	Non-Command	Alluvium	0.11	Alluvium	0.08	DW	0.016	0.064				
							DW with pump	0.1	0.4			0.000	0.000
							STW	0.04	0.16				
							Others (pl. specify)	0	0.01				
4	Champakkulam	Non-Command	Alluvium	0.16	Alluvium	0.09	DW	0.012	0.048				
							DW with pump	0.06	0.24			0.010	0.010
							STW	0.04	0.16				
							Others (pl. specify)	0	0.01				
5	Chengannur	Non-Command	Alluvium	0.15	Alluvium	0.10	DW	0.012	0.048				
							DW with pump	0.1	0.4			0.750	0.750
							STW	0.04	0.16				
							Others (pl. specify)	0	0.01				
6	Harippad	Non-Command	Alluvium	0.16	Alluvium	0.09	DW	0.016	0.064				
							DW with pump	0.08	0.32			0.015	0.015
							STW	0.2	0.8				
							Others (pl. specify)	0	0.01				
7	Kanjikkuzhy	Non-Command	Alluvium	0.16	Alluvium	0.10	DW	0.012	0.048				
							DW with pump	0.08	0.32			0.000	0.000
							STW	0.2	0.8				
							Others (pl. specify)	0	0.01				

State		KERALA												
District		ALAPPUZHA												
Assessment Year		2013												
Sl. No.	Assessment Unit	Sub-unit (Command/ Non-Command/ Poor Quality)	Specific Yield (in fraction)		Rainfall Infiltration Factor (in fraction)		Season-wise Unit draft (ha m)							
			Formation	Value	Formation	Value	Structure	Irrigation		Domestic		Industrial		
								Monsoon	Non-monsoon	Monsoon	Non-monsoon	Monsoon	Non-monsoon	
8	Mavelikkara	Non-Command	Alluvium	0.14	Alluvium	0.10	DW	0.016	0.064					
							DW with pump	0.08	0.32			0.375	0.375	
							STW	0.04	0.16					
							Others (pl. specify)	0	0.01					
9	Muthukulam	Non-Command	Alluvium	0.16	Alluvium	0.10	DW	0.012	0.048					
							DW with pump	0.08	0.32			49.235	49.235	
							STW	0.2	0.8					
							Others (pl. specify)	0	0.01					
10	Pattanakkad	Non-Command	Alluvium	0.16	Alluvium	0.10	DW	0.012	0.048					
							DW with pump	0.06	0.24			34.185	34.185	
							STW	0.03	0.12					
							Others (pl. specify)	0	0.007					
11	Thycattussery	Non-Command	Alluvium	0.16	Alluvium	0.10	DW	0.012	0.048					
							DW with pump	0.06	0.24			0.450	0.450	
							STW	0.2	0.8					
							Others (pl. specify)	0	0.01					
12	Velianad	Non-Command	Alluvium	0.16	Alluvium	0.09	DW	0.012	0.048					
							DW with pump	0.06	0.24	0.000	0.000			
							STW	0.04	0.16					
							Others (pl. specify)	0	0.01					
							* Others: Irrigation through domestic wells STW: Shallow tube wells and bore wells							

State		KERALA												
District		ERNAKULAM												
Assessment Year		2013												
Sl. No.	Assessment Unit	Sub-unit (Command/ non-Command/ poor quality)	Specific Yield (in fraction)		Rainfall Infiltration Factor (in fraction)		Season-wise Unit draft (ha m)						Industrial	
			Formation	Value	Formation	Value	Structure	Irrigation		Domestic				
								Monsoon	Non-monsoon	Monsoon	Non-monsoon	Monsoon	Non-monsoon	
1	Alangad	Non - Command	Laterite	0.08	Laterite	0.08	DW	0.024	0.096	Computed on the basis of projected populatio n, per capita requireme nt & fractional load on ground water				
							DW with pump	0.108	0.432		23.435	23.435		
							STW	0.2	0.8					
							Others (pl. specify)		0.007					
2	Angamaly	Non - Command	Laterite	0.06	Laterite	0.08	DW	0.024	0.096					
							DW with pump	0.108	0.432		23.018	23.018		
							STW	0.2	0.8					
							Others (pl. specify)		0.007					
3	Edappally	Non - Command	Alluvium	0.16	Alluvium	0.10	DW	0.024	0.096					
							DW with pump	0.108	0.432		5.444	5.444		
							STW	0.2	0.8					
							Others (pl. specify)		0.007					
4	Koovappady	Non - Command	Laterite	0.05	Laterite	0.08	DW	0.024	0.096					
							DW with pump	0.108	0.432		6.315	6.315		
							STW	0.2	0.8					
							Others (pl. specify)		0.007					
5	Kothamangalam	Non - Command	Laterite	0.04	Laterite	0.07	DW	0.024	0.096					
							DW with pump	0.108	0.432		1.200	1.200		
							STW	0.2	0.8					
							Others (pl. specify)		0.007					
6	Moovattupuzha	Non - Command	Laterite	0.04	Laterite	0.07	DW	0.024	0.096					
							DW with pump	0.108	0.432	4.170	4.170			

State		KERALA												
District		ERNAKULAM												
Assessment Year		2013												
Sl. No.	Assessment Unit	Sub-unit (Command/ non-Command/ poor quality)	Specific Yield (in fraction)		Rainfall Infiltration Factor (in fraction)		Season-wise Unit draft (ha m)						Industrial	
			Formation	Value	Formation	Value	Structure	Irrigation		Domestic				
								Monsoon	Non-monsoon	Monsoon	Non-monsoon			
												Monsoon	Non-monsoon	
							STW	0.2	0.8					
							Others (pl. specify)		0.007					
7	Mulamthuruthy	Non - Command	Laterite	0.03	Laterite	0.07	DW	0.024	0.096					
							DW with pump	0.108	0.432		5.119	5.119		
							STW	0.2	0.8					
							Others (pl. specify)		0.007					
8	Palluruthy	Non - Command	Alluvium	0.16	Alluvium	0.10	DW	0.024	0.096					
							DW with pump	0.108	0.432		4.639	4.639		
							STW	0.2	0.8					
							Others (pl. specify)		0.007					
9	Pampakkuda	Non - Command	Laterite	0.04	Laterite	0.07	DW	0.024	0.096					
							DW with pump	0.108	0.432		2.574	2.574		
							STW	0.2	0.8					
							Others (pl. specify)		0.007					
10	Parakkadavu	Non - Command	Laterite	0.05	Laterite	0.08	DW	0.024	0.096					
							DW with pump	0.108	0.432		4.050	4.050		
							STW	0.2	0.8					
							Others (pl. specify)		0.007					
11	Paravoor	Non - Command	Alluvium	0.16	Alluvium	0.10	DW	0.024	0.096					
							DW with pump	0.108	0.432		7.200	7.200		
							STW	0.2	0.8					
							Others (pl. specify)		0.007					
12	Vadavukodu	Non - Command	Laterite	0.05	Laterite	0.08	DW	0.024	0.096					
							DW with pump	0.108	0.432		1.905	1.905		

State		KERALA												
District		ERNAKULAM												
Assessment Year		2013												
Sl. No.	Assessment Unit	Sub-unit (Command/ non-Command/ poor quality)	Specific Yield (in fraction)		Rainfall Infiltration Factor (in fraction)		Season-wise Unit draft (ha m)							
			Formation	Value	Formation	Value	Structure	Irrigation		Domestic		Industrial		
								Monsoon	Non-monsoon	Monsoon	Non-monsoon	Monsoon	Non-monsoon	
13	Vazhakkulam	Non - Command	Laterite	0.05	Laterite	0.08	STW	0.2	0.8					
							Others (pl. specify)		0.007					
							DW	0.024	0.096					
							DW with pump	0.108	0.432			3.255	3.255	
							STW	0.2	0.8					
							Others (pl. specify)		0.007					
14	Vypeen	Non - Command	Alluvium	0.16	Alluvium	0.08	DW	0.024	0.096					
							DW with pump	0.108	0.432			0.000	0.000	
							STW	0.2	0.8					
							Others (pl. specify)		0.007					

STW: Shallow tube wells and bore wells

State		KERALA											
District		IDUKKI											
Assessment Year		2013											
Sl. No.	Assessment Unit	Sub-unit (Command / non-Command/ poor quality)	Specific Yield (in fraction)		Rainfall Infiltration Factor (in fraction)		Season-wise Unit draft (ha m)						
			Formation	Value	Formation	Value	Structure	Irrigation		Domestic		Industrial	
								Monsoon	Non-monsoon	Monsoon	Non-monsoon	Monsoon	Non-monsoon
1	Adimali	Non-command	Crystalline	0.02	Crystalline	0.06	DW	0.012	0.048	Computed on the basis of projected population, per capita requirement & fractional load on ground water		0.575	0.575
							DW with pump	0.08	0.32				
							STW	0.08	0.32				
							*Others (pl. specify)		0.03				
2	Azhutha	Non-command	Crystalline	0.02	Crystalline	0.08	DW	0.012	0.048			3.040	3.040
							DW with pump	0.08	0.32				
							STW	0.2	0.8				
							Others (pl. specify)		0.03				
3	Devikulam	Non-command	Crystalline	0.02	Crystalline	0.06	DW	0.016	0.064			0.000	0.000
							DW with pump	0.05	0.2				
							STW	0	0				
							Others (pl. specify)		0.01				
4	Elam Desom	Non-command	Crysttalline	0.02	Crysttalline	0.07	DW	0.012	0.048			0.540	0.540
							DW with pump	0.08	0.32				
							STW	0.2	0.8				
							Others (pl. specify)		0.03				
5	Idukki	Non-command	Crystallines	0.02	Crystallines	0.08	DW	0.012	0.048			0.180	0.180
							DW with pump	0.08	0.32				
							STW	0.2	0.8				
							Others (pl. specify)		0.03				
6	Kattappana	Non-command	Crystallines	0.02	Crystallines	0.07	DW	0.012	0.048			0.660	0.660
							DW with pump	0.06	0.24				
							STW	0.2	0.8				
							Others (pl. specify)		0.01				

State		KERALA											
District		IDUKKI											
Assessment Year		2013											
Sl. No.	Assessment Unit	Sub-unit (Command / non-Command/ poor quality)	Specific Yield (in fraction)		Rainfall Infiltration Factor (in fraction)		Season-wise Unit draft (ha m)						
			Formation	Value	Formation	Value	Structure	Irrigation		Domestic		Industrial	
								Monsoon	Non-monsoon	Monsoon	Non-monsoon	Monsoon	Non-monsoon
7	Nedumkandam	Non-command	Crystallines	0.02	Crystallines	0.07	DW	0.012	0.048			0.590	0.590
							DW with pump	0.08	0.32				
							STW	0.2	0.8				
							Others (pl. specify)		0.01				
8	Thodupuzha	Non-command	Crystallines	0.02	Crystallines	0.07	DW	0.012	0.048			0.755	0.755
							DW with pump	0.08	0.32				
							STW	0.2	0.8				
							Others (pl. specify)		0.03				
							* Others: Irrigation through domestic wells STW: Shallow tube wells and bore wells						

State		KERALA											
District		KANNUR											
Assessment Year		2013											
Sl. No.	Assessment Unit	Sub-unit (Command / non-Command / poor quality)	Specific Yield (in fraction)		Rainfall Infiltration Factor (in fraction)		Season-wise Unit draft (ha m)						
			Formation	Value	Formation	Value	Structure	Irrigation		Domestic		Industrial	
								Monsoon	Non-monsoon	Monsoon	Non-monsoon	Monsoon	Non-monsoon
1	Edakkad	Non-command	Laterite	0.03	Laterite	0.07	DW	0.016	0.064	Computed on the basis of projected population, per capita requirement & fractional load on ground water		0.000	0.000
							DW with pump	0.1	0.4				
							STW	0.2	0.8				
							*Others (pl. specify)		0.03				
2	Iritty	Non-command	Laterite	0.02	Laterite	0.07	DW	0.016	0.064			0.000	0.000
							DW with pump	0.1	0.4				
							STW	0.2	0.8				
							Others (pl. specify)		0.03				
3	Irikkur	Non-command	Laterite	0.02	Laterite	0.07	DW	0.016	0.064			0.000	0.000
							DW with pump	0.1	0.4				
							STW	0.2	0.8				
							Others (pl. specify)		0.03				
4	Kallyasseri	Non-command	Laterite	0.04	Laterite	0.08	DW	0.016	0.064			0.000	0.000
							DW with pump	0.01	0.04				
							STW	0.1	0.4				
							Others (pl. specify)		0.03				
5	Kannur	Non-command	Laterite	0.09	Laterite	0.09	DW	0.016	0.064			5.070	5.070
							DW with pump	0.06	0.24				
							STW	0.2	0.8				
							Others (pl. specify)		0.01				
6	Kuthuparamba	Non-command	Laterite	0.03	Laterite	0.07	DW	0.016	0.064			0.000	0.000
							DW with pump	0.1	0.4				

State		KERALA											
District		KANNUR											
Assessment Year		2013											
Sl. No.	Assessment Unit	Sub-unit (Command / non-Command / poor quality)	Specific Yield (in fraction)		Rainfall Infiltration Factor (in fraction)		Season-wise Unit draft (ha m)						
			Formation	Value	Formation	Value	Structure	Irrigation		Domestic		Industrial	
								Monsoon	Non-monsoon	Monsoon	Non-monsoon	Monsoon	Non-monsoon
							STW	0.2	0.8				
							Others (pl. specify)		0.02				
7	Panur	Non-command	Laterite	0.03	Laterite	0.07	DW	0.016	0.064			0.000	0.000
							DW with pump	0.08	0.32				
							STW	0.2	0.8				
							Others (pl. specify)		0.02				
8	Payyannur	Non-command	Laterite	0.06	Laterite	0.08	DW	0.016	0.064			0.000	0.000
							DW with pump	0.1	0.4				
							STW	0.2	0.8				
							Others (pl. specify)		0.03				
9	Peravoor	Non-command	Laterite	0.02	Laterite	0.07	DW	0.016	0.064			0.000	0.000
							DW with pump	0.1	0.4				
							STW	0.2	0.8				
							Others (pl. specify)		0.03				
10	Taliparamba	Non-command	Laterite	0.04	Laterite	0.08	DW	0.016	0.064			2.999	2.999
							DW with pump	0.1	0.4				
							STW	0.2	0.8				
							Others (pl. specify)		0.03				
11	Thalassery	Non-command	Laterite	0.03	Laterite	0.07	DW	0.016	0.064			2.100	2.100
							DW with pump	0.1	0.4				
							STW	0.2	0.8				
							Others (pl. specify)		0.03				

State		KERALA											
District		KASARGOD											
Assessment Year		2013											
Sl. No.	Assessment Unit	Sub-unit (Command / non-Command/ poor quality)	Specific Yield (in fraction)		Rainfall Infiltration Factor (in fraction)		Season-wise Unit draft (ha m)						
			Formation	Value	Formation	Value	Structure	Irrigation		Domestic		Industrial	
								Monsoon	Non-monsoon	Monsoon	Non-monsoon	Monsoon	Non-monsoon
1	Kanhangad	Non-command	Laterite	0.03	Laterite	0.07	DW	0.024	0.096	Computed on the basis of projected population, per capita requirement & fractional load on ground water		0.855	0.855
							DW with pump	0.1	0.4				
							STW	0.1	0.4				
							*Others (pl. specify)		0.03				
2	Karadka	Non-command	Laterite	0.03	Laterite	0.08	DW	0.016	0.064			1.740	1.740
							DW with pump	0.08	0.32				
							STW	0.2	0.8				
							Others (pl. specify)		0.02				
3	Kasaragod	Non-command	Laterite	0.03	Laterite	0.07	DW	0.016	0.064			0.743	0.743
							DW with pump	0.108	0.432				
							STW	0.2	0.8				
							Others (pl. specify)		0.03				
4	Manjeswar	Non-command	Laterite	0.03	Laterite	0.07	DW	0.016	0.064			0.860	0.860
							DW with pump	0.108	0.432				
							STW	0.2	0.8				
							Others (pl. specify)		0.02				
5	Nileswaram	Non-command	Laterite	0.03	Laterite	0.07	DW	0.016	0.064			0.000	0.000
							DW with pump	0.108	0.432				
							STW	0.2	0.8				
							Others (pl. specify)		0.02				
6	Parappa	Non-command	Laterite	0.03	Laterite	0.07	DW	0.016	0.064			0.855	0.855

State		KERALA											
District		KOLLAM											
Assessment Year		2013											
Sl. No.	Assessment Unit	Sub-unit (Command / non-Command/ poor quality)	Specific Yield (in fraction)		Rainfall Infiltration Factor (in fraction)		Season-wise Unit draft (ha m)						
			Formation	Value	Formation	Value	Structure	Irrigation		Domestic		Industrial	
								Monsoon	Non-monsoon	Monsoon	Non-monsoon	Monsoon	Non-monsoon
1	Anchal	Non-command	Laterite	0.03	Laterite	0.06	DW	0.012	0.048	Computed on the basis of projected population, per capita requirement & fractional load on ground water		0.045	0.045
							DW with pump	0.08	0.32				
							STW	0.2	0.8				
							*Others (pl. specify)		0.03				
2	Chadayamangalam	Non-command	Laterite	0.03	Laterite	0.07	DW	0.012	0.048			0.608	0.608
							DW with pump	0.08	0.32				
							STW	0.08	0.32				
							Others (pl. specify)		0.02				
3	Chavara	Non-command	Alluvium	0.16	Alluvium	0.10	DW	0.024	0.096			0.435	0.435
							DW with pump	0.06	0.24				
							STW	0.08	0.32				
							Others (pl. specify)		0.02				
4	Chittumala	Non-command	Laterite	0.04	Laterite	0.07	DW	0.012	0.048			0.000	0.000
							DW with pump	0.06	0.24				
							STW	0.06	0.24				
							Others (pl. specify)		0				
5	Ithikkara	Non-command	Alluvium	0.11	Alluvium	0.09	DW	0.012	0.048			0.653	0.653
							DW with pump	0.06	0.24				
							STW	0.06	0.24				
							Others (pl. specify)		0.02				

State		KERALA											
District		KOLLAM											
Assessment Year		2013											
Sl. No.	Assessment Unit	Sub-unit (Command / non-Command/ poor quality)	Specific Yield (in fraction)		Rainfall Infiltration Factor (in fraction)		Season-wise Unit draft (ha m)						
			Formation	Value	Formation	Value	Structure	Irrigation		Domestic		Industrial	
								Monsoon	Non-monsoon	Monsoon	Non-monsoon	Monsoon	Non-monsoon
6	Kottarakkara	Non-command	Alluvium	0.03	Alluvium	0.07	DW	0.012	0.048			0.690	0.690
							DW with pump	0.08	0.32				
							STW	0.08	0.32				
							Others (pl. specify)		0.02				
7	Mukhathala	Non-command	Alluvium	0.16	Alluvium	0.10	DW	0.012	0.048			0.390	0.390
							DW with pump	0.06	0.24				
							STW	0.06	0.24				
							Others (pl. specify)		0.02				
8	Oachira	Non-command	Alluvium	0.16	Alluvium	0.10	DW	0.012	0.048			0.045	0.045
							DW with pump	0.06	0.24				
							STW	0.06	0.24				
							Others (pl. specify)		0.02				
9	Pathanapuram	Non-command	Laterite	0.03	Laterite	0.08	DW	0.012	0.048			0.225	0.225
							DW with pump	0.06	0.24				
							STW	0.06	0.24				
							Others (pl. specify)		0.02				
10	Sasthamkotta	Non-command	Laterite	0.04	Laterite	0.07	DW	0.012	0.048			0.120	0.120
							DW with pump	0.08	0.32				
							STW	0.08	0.32				
							Others (pl. specify)		0.03				
11	Vettikkavala	Non-command	Laterite	0.03	Laterite	0.07	DW	0.012	0.048			0.090	0.090
							DW with pump	0.08	0.32				
							STW	0.08	0.32				

State		KERALA											
District		KOLLAM											
Assessment Year		2013											
Sl. No.	Assessment Unit	Sub-unit (Command / non-Command/ poor quality)	Specific Yield (in fraction)		Rainfall Infiltration Factor (in fraction)		Season-wise Unit draft (ha m)						
			Formation	Value	Formation	Value	Structure	Irrigation		Domestic		Industrial	
								Monsoon	Non-monsoon	Monsoon	Non-monsoon	Monsoon	Non-monsoon
							Others (pl. specify)		0.02				
							* Others: Irrigation through domestic wells STW: Shallow tube wells and bore wells						

State		KERALA											
District		KOTTAYAM											
Assessment Year		2013											
Sl. No.	Assessment Unit	Sub-unit (Command/ non-Command/ poor quality)	Specific Yield (in fraction)		Rainfall Infiltration Factor (in fraction)		Season-wise Unit draft (ha m)						
			Formation	Value	Formation	Value	Structure	Irrigation		Domestic		Industrial	
								Monsoon	Non-monsoon	Monsoon	Non-monsoon	Monsoon	Non-monsoon
1	Erattupetta	Non-command	Lateriite	0.03	Lateriite	0.07	DW	0.012	0.048	Computed		0.000	0.000
							DW with pump	0.08	0.32				
							STW	0.2	0.8				
							*Others (pl. specify)		0.03				
2	Ettumanoor	Non-command	Laterite	0.08	Laterite	0.08	DW	0.012	0.048			0.000	0.000
							DW with pump	0.08	0.32				
							STW	0.2	0.8				
							Others (pl. specify)		0.02				
3	Kaduthuruthy	Non-command	Laterite	0.04	Laterite	0.07	DW	0.012	0.048			0.000	0.000
							DW with pump	0.08	0.32				
							STW	0.2	0.8				
							Others (pl. specify)		0.02				
4	Kanjirappally	Non-command	Laterite	0.04	Laterite	0.08	DW	0.012	0.048			0.000	0.000
							DW with pump	0.08	0.32				

State		KERALA											
District		KOTTAYAM											
Assessment Year		2013											
Sl. No.	Assessment Unit	Sub-unit (Command/ non-Command/ poor quality)	Specific Yield (in fraction)		Rainfall Infiltration Factor (in fraction)		Season-wise Unit draft (ha m)						
			Formation	Value	Formation	Value	Structure	Irrigation		Domestic		Industrial	
								Monsoon	Non-monsoon	Monsoon	Non-monsoon	Monsoon	Non-monsoon
5	Lalam	Non-command	Laterite	0.03	Laterite	0.06	STW	0.2	0.8	on the basis of projected population, per capita requirement & fractional load on ground water			
							Others (pl. specify)		0.03				
							DW	0.012	0.048				
							DW with pump	0.08	0.32				
							STW	0.2	0.8				
6	Madappally	Non-command	Alluvial	0.08	Alluvial	0.09	Others (pl. specify)		0.03				
							DW	0.012	0.048				
							DW with pump	0.08	0.32				
							STW	0.2	0.8				
							Others (pl. specify)		0.03				
7	Pallom	Non-command	Laterite	0.08	Laterite	0.08	DW	0.012	0.048				
							DW with pump	0.08	0.32				
							STW	0.08	0.32				
							Others (pl. specify)		0.03				
							DW	0.012	0.048				
8	Pampady	Non-command	Laterite	0.03	Laterite	0.07	DW with pump	0.08	0.32				
							STW	0.08	0.32				
							Others (pl. specify)		0.03				
							DW	0.012	0.048				
							DW with pump	0.08	0.32				
9	Uzhavoor	Non-command	Laterite	0.03	Laterite	0.06	STW	0.2	0.8				
							Others (pl. specify)		0.03				
							DW	0.012	0.048				
							DW with pump	0.08	0.32				
							STW	0.2	0.8				
10	Vaikom	Non-command	Alluvial	0.12	Alluvial	0.07	Others (pl. specify)		0.03				
							DW	0.012	0.048				
							DW with pump	0.08	0.32				
							STW	0.08	0.32				
							Others (pl. specify)		0.03				
11	Vazhoor	Non-command	Laterite	0.03	Laterite	0.07	DW	0.012	0.048				
							DW with pump	0.08	0.32				
							STW	0.2	0.8				
							Others (pl. specify)		0.03				
							DW	0.012	0.048				

State		KERALA											
District		KOTTAYAM											
Assessment Year		2013											
Sl. No.	Assessment Unit	Sub-unit (Command/ non-Command/ poor quality)	Specific Yield (in fraction)		Rainfall Infiltration Factor (in fraction)		Season-wise Unit draft (ha m)						
			Formation	Value	Formation	Value	Structure	Irrigation		Domestic		Industrial	
								Monsoon	Non-monsoon	Monsoon	Non-monsoon	Monsoon	Non-monsoon
							* Others: Irrigation through domestic wells STW: Shallow tube wells and bore wells						

State		KERALA											
District		KOZHIKODE											
Assessment Year		2013											
Sl. No.	Assessment Unit	Sub-unit (Command/ non-Command/ poor quality)	Specific Yield (in fraction)		Rainfall Infiltration Factor (in fraction)		Season-wise Unit draft (ha m)						
			Formation	Value	Formation	Value	Structure	Irrigation		Domestic		Industrial	
								Monsoon	Non-monsoon	Monsoon	Non-monsoon	Monsoon	Non-monsoon
1	Ballussery	Non-command	Laterite	0.03	Laterite	0.07	DW	0.024	0.096	Computed on the basis of projected population, per capita requirement & fractional load on ground water		0.000	0.000
							DW with pump	0.08	0.32				
							STW	0.2	0.8				
							*Others (pl. specify)		0.02				
2	Chelannur	Non-command	Laterite	0.03	Laterite	0.07	DW	0.024	0.096			0.000	0.000
							DW with pump	0.06	0.24				
							STW	0.2	0.8				
							Others (pl. specify)		0.02				
3	Koduvally	Non-command	Laterite	0.03	Laterite	0.07	DW	0.024	0.096			0.000	0.000
							DW with pump	0.06	0.24				
							STW	0.2	0.8				
							Others (pl. specify)		0.02				
4	Kozhikode	Non-command	Laterite	0.05	Laterite	0.07	DW	0.024	0.096			0.515	0.515
							DW with pump	0.06	0.24				
							STW	0.2	0.8				
							Others (pl. specify)		0.01				
5	Kunnamangalam	Non-command	Laterite	0.03	Laterite	0.07	DW	0.024	0.096			0.000	0.000
							DW with pump	0.06	0.24				
							STW	0.2	0.8				
							Others (pl. specify)		0.01				
6	Kunnummal	Non-command	Laterite	0.02	Laterite	0.08	DW	0.024	0.096			0.000	0.000
							DW with pump	0.06	0.24				
							STW	0.2	0.8				
							Others (pl. specify)		0.02				
7	Melady	Non-command	Alluvial	0.16	Alluvial	0.10	DW	0.024	0.096			0.000	0.000
							DW with pump	0.05	0.2				
							STW	0.2	0.8				
							Others (pl. specify)		0.01				
8	Panthalayani	Non-	Alluvial	0.16	Alluvial	0.10	DW	0.024	0.096			0.000	0.000

State		KERALA											
District		KOZHIKODE											
Assessment Year		2013											
Sl. No.	Assessment Unit	Sub-unit (Command/ non-Command/ poor quality)	Specific Yield (in fraction)		Rainfall Infiltration Factor (in fraction)		Season-wise Unit draft (ha m)						
			Formation	Value	Formation	Value	Structure	Irrigation		Domestic		Industrial	
								Monsoon	Non-monsoon	Monsoon	Non-monsoon	Monsoon	Non-monsoon
		command					DW with pump	0.06	0.24				
							STW	0.2	0.8				
							Others (pl. specify)		0.03				
9	Perambra	Non-command	Laterite	0.03	Laterite	0.08	DW	0.024	0.096			0.000	0.000
							DW with pump	0.06	0.24				
							STW	0.2	0.8				
							Others (pl. specify)		0.03				
10	Thodannur	Non-command	Laterite	0.03	Laterite	0.07	DW	0.024	0.096			0.000	0.000
							DW with pump	0.06	0.24				
							STW	0.2	0.8				
							Others (pl. specify)		0.02				
11	Tuneri	Non-command	Laterite	0.03	Laterite	0.06	DW	0.024	0.096			0.000	0.000
							DW with pump	0.06	0.24				
							STW	0.2	0.8				
							Others (pl. specify)		0.02				
12	Vadakara	Non-command	Laterite	0.06	Laterite	0.08	DW	0.024	0.096			0.000	0.000
							DW with pump	0.14	0.56				
							STW	0	0				
							Others (pl. specify)		0.03				
							* Others: Irrigation through domestic wells STW: Shallow tube wells and bore wells						

State		KERALA											
District		MALAPPURAM											
Assessment Year		2013											
Sl. No.	Assessment Unit	Sub-unit (Command / non-Command/ poor quality)	Specific Yield (in fraction)		Rainfall Infiltration Factor (in fraction)		Season-wise Unit draft (ha m)						
			Formation	Value	Formation	Value	Structure	Irrigation		Domestic		Industrial	
								Monsoon	Non-monsoon	Monsoon	Non-monsoon	Monsoon	Non-monsoon
1	Areacode	Non-command	Laterite	0.03	Laterite	0.07	DW	0.012	0.048	Computed on the basis of projected population, per capita requirement & fractional load on ground water		0.000	0.000
							DW with pump	0.08	0.32				
							STW	0.08	0.32				
							*Others (pl. specify)		0.03				
2	Kalikavu	Non-command	Laterite	0.03	Laterite	0.08	DW	0.012	0.048			0.000	0.000
							DW with pump	0.08	0.32				
							STW	0.08	0.32				
							Others (pl. specify)		0.03				
3	Kondotty	Non-command	Laterite	0.03	Laterite	0.07	DW	0.012	0.048			0.000	0.000
							DW with pump	0.08	0.32				
							STW	0.08	0.32				
							Others (pl. specify)		0.03				
4	Kuttippuram	Non-command	Laterite	0.05	Laterite	0.08	DW	0.012	0.048			0.000	0.000
							DW with pump	0.08	0.32				
							STW	0.08	0.32				
							Others (pl. specify)		0.03				
5	Malappuram	Non-command	Laterite	0.03	Laterite	0.08	DW	0.012	0.048			0.000	0.000
							DW with pump	0.06	0.24				
							STW	0.06	0.24				
							Others (pl. specify)		0.02				
6	Mankada	Non-command	Laterite	0.04	Laterite	0.07	DW	0.012	0.048			0.000	0.000
							DW with pump	0.08	0.32				
							STW	0.08	0.32				
							Others (pl. specify)		0.03				
7	Nilamboor	Non-command	Laterite	0.03	Laterite	0.08	DW	0.012	0.048			0.000	0.000
							DW with pump	0.08	0.32				
							STW	0.2	0.8				
							Others (pl. specify)		0.03				
8	Perinthalmanna	Non-command	Laterite	0.02	Laterite	0.07	DW	0.012	0.048			0.000	0.000
							DW with pump	0.08	0.32				

State		KERALA											
District		MALAPPURAM											
Assessment Year		2013											
Sl. No.	Assessment Unit	Sub-unit (Command / non-Command/ poor quality)	Specific Yield (in fraction)		Rainfall Infiltration Factor (in fraction)		Season-wise Unit draft (ha m)						
			Formation	Value	Formation	Value	Structure	Irrigation		Domestic		Industrial	
Monsoon	Non-monsoon	Monsoon						Non-monsoon	Monsoon	Non-monsoon			
9	Perumpadappu	Non-command	Alluvial	0.16	Alluvial	0.10	STW	0.08	0.32			0.000	0.000
							Others (pl. specify)		0.03				
							DW	0.012	0.048				
							DW with pump	0.08	0.32				
							STW	0.06	0.24				
10	Ponnani	Non-command	Alluvial	0.11	Alluvial	0.08	Others (pl. specify)		0.03			0.000	0.000
							DW	0.012	0.048				
							DW with pump	0.08	0.32				
							STW	0.08	0.32				
							11	Thanur	Non-command			Laterite	0.03
DW	0.024	0.096											
DW with pump	0.08	0.32											
STW	0.08	0.32											
12	Thriurangadi	Non-command	Alluvial	0.05	Alluvial	0.09							
							DW	0.024	0.096				
							DW with pump	0.06	0.24				
							STW	0.08	0.32				
							13	Tirur	Non-command			Laterite	0.03
DW	0.024	0.096											
DW with pump	0.06	0.24											
STW	0.08	0.32											
14	Vengara	Non-command	Laterite	0.04	Laterite	0.07				Others (pl. specify)			
							DW	0.024	0.096				
							DW with pump	0.08	0.32				
							STW	0.2	0.8				
							15	Wandoor	Non-command	Laterite	0.03	Laterite	0.07
DW	0.024	0.096											
DW with pump	0.08	0.32											
STW	0.2	0.8											

State		KERALA											
District		PALAKKAD											
Assessment Year		2013											
Sl. No.	Assessment Unit	Sub-unit (Command/ non-Command/ poor quality)	Specific Yield (in fraction)		Rainfall Infiltration Factor (in fraction)		Season-wise Unit draft (ha m)						
			Formation	Value	Formation	Value	Structure	Irrigation		Domestic		Industrial	
								Monsoon	Non-monsoon	Monsoon	Non-monsoon	Monsoon	Non-monsoon
1	Alathur	Non-command	Weath. Crystalline	0.03	Weath. Crystalline	0.06	DW	0.012	0.048	Computed on the basis of projected population, per capita requirement & fractional load on ground water		0.000	0.000
							DW with pump	0.08	0.32				
							STW	0.2	0.8				
							*Others (pl. specify)	0	0.03				
2	Attappadi	Non-command	Weath. Crystallines	0.03	Weath. Crystallines	0.11	DW	0.012	0.048			0.000	0.000
							DW with pump	0.08	0.32				
							STW	0.2	0.8				
							Others (pl. specify)	0	0.02				
3	Chittur	Non-command	Weath. Crystallines	0.03	Weath. Crystallines	0.06	DW	0.024	0.096			29.030	29.030
							DW with pump	0.108	0.432				
							STW	0.2	0.8				
							Others (pl. specify)	0	0.05				
4	Kollengode	Non-command	Weath. Crystallines	0.03	Weath. Crystallines	0.07	DW	0.024	0.096			0.850	0.850
							DW with pump	0.108	0.432				
							STW	0.2	0.8				
							Others (pl. specify)	0	0.05				
5	Kuzhalmannam	Non-command	Weath. Crystallines	0.03	Weath. Crystallines	0.06	DW	0.024	0.096			36.000	36.000
							DW with pump	0.108	0.432				
							STW	0.2	0.8				
							Others (pl. specify)	0	0.05				
6	Malampuzha	Non-command	Crystalline	0.02	Crystalline	0.05	DW	0.012	0.048			129.720	129.720
							DW with pump	0.108	0.432				
							STW	0.2	0.8				
							Others (pl. specify)	0	0.05				
7	Mannarkkad	Non-command	Weath. Crystallines	0.03	Weath. Crystallines	0.06	DW	0.012	0.048			1.175	1.175
							DW with pump	0.08	0.32				
							STW	0.2	0.8				

State		KERALA											
District		PALAKKAD											
Assessment Year		2013											
Sl. No.	Assessment Unit	Sub-unit (Command/ non-Command/ poor quality)	Specific Yield (in fraction)		Rainfall Infiltration Factor (in fraction)		Season-wise Unit draft (ha m)						
			Formation	Value	Formation	Value	Structure	Irrigation		Domestic		Industrial	
								Monsoon	Non-monsoon	Monsoon	Non-monsoon	Monsoon	Non-monsoon
8	Nenmara	Non-command	Weath. Gneisses	0.03	Weath. Gneisses	0.06	Others (pl. specify)	0	0.03			0.000	0.000
							DW	0.012	0.048				
							DW with pump	0.08	0.32				
							STW	0.2	0.8				
							Others (pl. specify)	0	0.03				
9	Ottappalam	Non-command	Weath. Crystallines	0.02	Weath. Crystallines	0.08	DW	0.012	0.048			0.000	0.000
							DW with pump	0.08	0.32				
							STW	0.2	0.8				
							Others (pl. specify)	0	0.03				
10	Palakkad	Non-command	Laterite	0.02	Laterite	0.06	DW	0.024	0.096			7.300	7.300
							DW with pump	0.08	0.32				
							STW	0.2	0.8				
							Others (pl. specify)	0	0.03				
11	Pattambi	Non-command	Laterite	0.03	Laterite	0.09	DW	0.012	0.048			0.000	0.000
							DW with pump	0.08	0.32				
							STW	0.2	0.8				
							Others (pl. specify)	0	0.03				
12	Sreekrishnapuram	Non-command	Laterite	0.03	Laterite	0.07	DW	0.012	0.048			36.000	36.000
							DW with pump	0.08	0.32				
							STW	0.2	0.8				
							Others (pl. specify)	0	0.03				
13	Thrithala	Non-command	Laterite	0.02	Laterite	0.08	DW	0.024	0.096			0.000	0.000
							DW with pump	0.08	0.32				
							STW	0.2	0.8				
							Others (pl. specify)	0	0.03				
							* Others: Irrigation through domestic wells STW: Shallow tube wells and bore wells						

State		KERALA												
District		PATHANAMTHITTA												
Assessment Year		2013												
Sl. No.	Assessment Unit	Sub-unit (Command/ non-Command/ poor quality)	Specific Yield (in fraction)		Rainfall Infiltration Factor (in fraction)		Season-wise Unit draft (ha m)							
			Formation	Value	Formation	Value	Structure	Monsoon	Non-monsoon	Monsoon	Non-monsoon	Monsoon	Non-monsoon	
1	Elanthoor	Non-command	Laterite	0.03	Laterite	0.07	DW	0.012	0.048	Computed on the basis of projected population, per capita requirement & fractional load on ground water	0.000	0.000		
							DW with pump	0.08	0.32					
							STW	0.2	0.8					
							Others (pl. specify)		0.02					
2	Koipuram	Non-command	Laterite	0.03	Laterite	0.07	DW	0.012	0.048		0.000	0.000		
							DW with pump	0.08	0.32					
							STW	0.08	0.32					
							Others (pl. specify)		0.02					
3	Konni	Non-command	Laterite	0.03	Laterite	0.08	DW	0.012	0.048		0.000	0.000		
							DW with pump	0.08	0.32					
							STW	0.2	0.8					
							Others (pl. specify)		0.02					
4	Mallappally	Non-command	Alluvium	0.03	Alluvial	0.07	DW	0.012	0.048		0.000	0.000		
							DW with pump	0.08	0.32					
							STW	0.08	0.32					
							Others (pl. specify)		0.02					
5	Pandalam	Non-command	Laterite	0.08	Laterite	0.07	DW	0.012	0.048		0.000	0.000		
							DW with pump	0.08	0.32					
							STW	0.2	0.8					
							Others (pl. specify)		0.02					
6	Parakode	Non-command	Laterite	0.04	Laterite	0.07	DW	0.012	0.048		0.000	0.000		
							DW with pump	0.08	0.32					
							STW	0.08	0.32					
							Others (pl. specify)		0.02					
7	Pulikeezh	Non-command	Alluvium	0.15	Alluvial	0.10	DW	0.012	0.048		0.000	0.000		
							DW with pump	0.08	0.32					
							STW	0.2	0.8					
							Others (pl. specify)		0.02					
8	Ranni	Non-command	Laterite	0.03	Laterite	0.07	DW	0.012	0.048		0.000	0.000		
							DW with pump	0.08	0.32					
							STW	0.2	0.8					
							Others (pl. specify)		0.02					
							* Others: Irrigation through domestic wells							

							STW: Shallow tube wells and bore wells						
State		KERALA											
District		THIRUVANANTHAPURAM											
Assessment Year		2013											
Sl. No.	Assessment Unit	Sub-unit (Command / non-Command / poor quality)	Specific Yield (in fraction)		Rainfall Infiltration Factor (in fraction)		Season-wise Unit draft (ha m)						
			Formation	Value	Formation	Value	Structure	Monsoon	Non-monsoon	Monsoon	Non-monsoon	Monsoon	Non-monsoon
1	Athiyannur	Non-command	Laterite	0.07	Laterite	0.09	DW	0.012	0.048	Computed on the basis of projected population, per capita		0.016	0.016
							DW with pump	0.06	0.24				
							STW	0	0				
							Others (pl. specify)		0.01				
2	Chirayinkil	Non-command	Laterite	0.05	Laterite	0.07	DW	0.012	0.048			0.049	0.049
							DW with pump	0.08	0.32				
							STW	0	0				
							Others (pl. specify)		0.03				
3	Kilimanoor	Non-command	Laterite	0.04	Laterite	0.07	DW	0.012	0.048			0.000	0.000
							DW with pump	0.08	0.32				
							STW	0.08	0.32				
							Others (pl. specify)		0.02				
4	Nedumangad	Non-command	Laterite	0.04	Laterite	0.06	DW	0.012	0.048			0.000	0.000
							DW with pump	0.08	0.32				
							STW	0.08	0.32				
							Others (pl. specify)		0.02				
5	Nemom	Non-command	Laterite	0.05	Laterite	0.08	DW	0.024	0.096			0.000	0.000
							DW with pump	0.08	0.32				
							STW	0.2	0.8				
							Others (pl. specify)		0.03				
6	Parassala	Non-command	Laterite	0.09	Laterite	0.09	DW	0.012	0.048			0.000	0.000
							DW with pump	0.08	0.32				
							STW	0.2	0.8				
							Others (pl. specify)		0.03				
7	Perumkadavila	Non-command	Laterite	0.03	Laterite	0.07	DW	0.012	0.048			0.000	0.000
							DW with pump	0.08	0.32				
							STW	0.08	0.32				
							Others (pl. specify)		0.03				
8	Pothencode	Non-command	Alluvium	0.10	Alluvium	0.09	DW	0.012	0.048			1.085	1.085
							DW with pump	0.08	0.32				

State		KERALA											
District		THIRUVANANTHAPURAM											
Assessment Year		2013											
Sl. No.	Assessment Unit	Sub-unit (Command / non-Command / poor quality)	Specific Yield (in fraction)		Rainfall Infiltration Factor (in fraction)		Season-wise Unit draft (ha m)						
			Formation	Value	Formation	Value	Structure	Monsoon	Non-monsoon	Monsoon	Non-monsoon	Monsoon	Non-monsoon
							STW	0.08	0.32	requirement & fractional load on ground water			
							Others (pl. specify)		0.03				
9	Vamanapuram	Non-command	Laterite	0.03	Laterite	0.07	DW	0.012	0.048			0.000	0.000
							DW with pump	0.08	0.32				
							STW	0.08	0.32				
							Others (pl. specify)		0.03				
10	Varkala	Non-command	Laterite	0.07	Laterite	0.08	DW	0.012	0.048		0.000	0.000	
							DW with pump	0.08	0.32				
							STW	0.08	0.32				
							Others (pl. specify)		0.01				
11	Vellanad	Non-command	Laterite	0.03	Laterite	0.08	DW	0.012	0.048		0.000	0.000	
							DW with pump	0.08	0.32				
							STW	0.08	0.32				
							Others (pl. specify)		0.02				
							* Others: Irrigation through domestic wells STW: Shallow tube wells and bore wells						

State		KERALA											
District		THRISSUR											
Assessment Year		2013											
Sl. No.	Assessment Unit	Sub-unit (Command / non-Command/ poor quality)	Specific Yield (in fraction)		Rainfall Infiltration Factor (in fraction)		Season-wise Unit draft (ha m)						
			Formation	Value	Formation	Value	Structure	Irrigation		Domestic		Industrial	
								Monsoon	Non-monsoon	Monsoon	Non-monsoon	Monsoon	Non-monsoon
1	Anthikkad	Non-command	Alluvial	0.10	Alluvial	0.09	DW	0.024	0.096	Computed on the basis of projected population, per capita requirement & fractional load on ground water		0.972	0.972
							DW with pump	0.08	0.32				
							STW	0.08	0.32				
							*Others (pl. specify)		0.02				
2	Chalakkudy	Non-command	Weatered Granite	0.03	Weatered Granite	0.07	DW	0.012	0.048			5.400	5.400
							DW with pump	0.08	0.32				
							STW	0.08	0.32				
							Others (pl. specify)		0.02				
3	Chavakkad	Non-command	Alluvial	0.16	Alluvial	0.10	DW	0.024	0.096			0.000	0.000
							DW with pump	0.06	0.24				
							STW	0.04	0.16				
							Others (pl. specify)		0.03				
4	Cherpu	Non-command	Weath. Granite	0.06	Weath. Granite	0.08	DW	0.024	0.096			0.000	0.000
							DW with pump	0.06	0.24				
							STW	0.08	0.32				
							Others (pl. specify)		0.02				
5	Chowannur	Non-command	Laterite	0.06	Laterite	0.08	DW	0.012	0.048			0.420	0.420
							DW with pump	0.06	0.24				
							STW	0.08	0.32				
							Others (pl. specify)		0.007				
6	Iringalakkuda	Non-command	Weath. Granite	0.05	Weath. Granite	0.09	DW	0.024	0.096			0.370	0.370
							DW with pump	0.06	0.24				
							STW	0.08	0.32				
							Others (pl. specify)		0.02				
7	Kodakara	Non-command	Weath. Granite	0.03	Weath. Granite	0.08	DW	0.024	0.096			1.900	1.900
							DW with pump	0.06	0.24				
							STW	0.08	0.32				
							Others (pl. specify)		0.02				
8	Mala	Non-command	Laterite	0.05	Laterite	0.09	DW	0.024	0.096			0.000	0.000
							DW with pump	0.06	0.24				
							STW	0.08	0.32				

State		KERALA											
District		THRISSUR											
Assessment Year		2013											
Sl. No.	Assessment Unit	Sub-unit (Command / non-Command/ poor quality)	Specific Yield (in fraction)		Rainfall Infiltration Factor (in fraction)		Season-wise Unit draft (ha m)						
			Formation	Value	Formation	Value	Structure	Irrigation		Domestic		Industrial	
								Monsoon	Non-monsoon	Monsoon	Non-monsoon	Monsoon	Non-monsoon
9	Mathilakom	Non-command	Alluvial	0.16	Alluvial	0.10	Others (pl. specify)		0.02			0.000	0.000
							DW	0.024	0.096				
							DW with pump	0.06	0.24				
							STW	0.04	0.16				
10	Mullassery	Non-command	Alluvial	0.16	Alluvial	0.10	Others (pl. specify)		0.02			0.000	0.000
							DW	0.024	0.096				
							DW with pump	0.06	0.24				
							STW	0.04	0.16				
11	Ollukkara	Non-command	Weath. Granite	0.03	Weath. Granite	0.07	Others (pl. specify)		0.02			1.800	1.800
							DW	0.024	0.096				
							DW with pump	0.06	0.24				
							STW	0.06	0.24				
12	Pazhayannur	Non-command	Laterite	0.03	Laterite	0.08	Others (pl. specify)		0.02			0.000	0.000
							DW	0.012	0.048				
							DW with pump	0.06	0.24				
							STW	0.06	0.24				
13	Puzhakkal	Non-command	Laterite	0.07	Laterite	0.07	Others (pl. specify)		0.02			5.400	5.400
							DW	0.024	0.096				
							DW with pump	0.08	0.32				
							STW	0.08	0.32				
14	Thalikkulam	Non-command	Alluvial	0.16	Alluvial	0.10	Others (pl. specify)		0.03			0.000	0.000
							DW	0.024	0.096				
							DW with pump	0.08	0.32				
							STW	0.08	0.32				
15	Vellangallur	Non-command	Laterite	0.07	Laterite	0.08	Others (pl. specify)		0.03			0.000	0.000
							DW	0.024	0.096				
							DW with pump	0.08	0.32				
							STW	0.08	0.32				
16	Vadakkancherry	Non-command	Laterite	0.03	Laterite	0.08	Others (pl. specify)		0.03			3.205	3.205
							DW	0.024	0.096				
							DW with pump	0.08	0.32				
							STW	0.08	0.32				

State		KERALA											
District		WAYANAD											
Assessment Year		2013											
Sl. No.	Assessment Unit	Sub-unit (Command / non-Command/ poor quality)	Specific Yield (in fraction)		Rainfall Infiltration Factor (in fraction)		Season-wise Unit draft (ha m)						
			Formation	Value	Formation	Value	Structure	Irrigation		Domestic		Industrial	
								Monsoon	Non-monsoon	Monsoon	Non-monsoon	Monsoon	Non-monsoon
1	Kalpetta	Non-command	Weath. Granite	0.03	Weath. Granite	0.08	DW	0.016	0.064	Computed on the basis of projected population, per capita requirement & fractional load on ground water	36.000	36.000	
							DW with pump	0.08	0.32				
							STW	0.2	0.8				
							Others (pl. specify)		0.02				
2	Mananthavady	Non-command	Weat. Granite	0.03	Weat. Granite	0.08	DW	0.016	0.064		36.000	36.000	
							DW with pump	0.08	0.32				
							STW	0.2	0.8				
							Others (pl. specify)		0.04				
3	Panamaram	Non-command	Weath. Granite	0.03	Weath. Granite	0.08	DW	0.016	0.064		43.200	43.200	
							DW with pump	0.08	0.32				
							STW	0.2	0.8				
							Others (pl. specify)		0.03				
4	Sulthan Bathery	Non-command	Weath. Granite	0.03	Weath. Granite	0.08	DW	0.016	0.064		43.200	43.200	
							DW with pump	0.08	0.32				
							STW	0.2	0.8				
							Others (pl. specify)		0.03				
							* Others: Irrigation through domestic wells STW: Shallow tube wells and bore wells						

ANNEXURE III D
ASSESSMENT OF DYNAMIC GROUND WATER RESOURCES OF KERALA
(2013)

State		KERALA							
District		ALAPPUZHA							
Assessment Year		2013							
Sl. No.	Assessment Unit	Command / Non-Command / Total	Recharge from rainfall during monsoon season	Recharge from other sources during monsoon season	Recharge from rainfall during non-monsoon season	Recharge from other sources during non-monsoon season	Total Annual Ground Water Recharge [(4)+(5)+(6)+(7)]	Provision for Natural Discharges	Net Annual Ground Water Availability [(8)-(9)]
1	2	3	4	5	6	7	8	9	10
1	Ambalappuzha	Non-command	1375.21	0.00	362.41	470.00	2207.62	110.38	2097.24
2	Aryad	Non-command	2178.99	4.92	461.41	230.00	2875.32	143.77	2731.56
3	Bharanikkavu	Non-command	2027.64	16.97	546.83	2180.00	4771.44	477.14	4294.29
4	Champakkulam	Non-command	2700.27	0.00	728.23	1003.00	4431.50	443.15	3988.35
5	Chengannur	Non-command	3239.42	0.00	788.79	1110.00	5138.21	256.91	4881.30
6	Harippad	Non-command	2007.96	17.68	541.52	950.00	3517.16	351.72	3165.44
7	Kanjikkuzhy	Non-command	2147.98	0.00	579.28	550.00	3277.26	327.73	2949.53
8	Mavelikkara	Non-command	1958.98	5.33	528.31	1990.00	4482.62	448.26	4034.36
9	Muthukulam	Non-command	3067.88	7.38	612.84	900.00	4588.10	229.40	4358.69
10	Pattanakkad	Non-command	2887.80	12.56	571.81	78.00	3550.17	177.51	3372.67
11	Thycattussery	Non-command	2792.93	2.47	744.76	230.00	3770.16	188.51	3581.65
12	Veliyanad	Non-command	2315.32	0.00	624.41	1178.00	4117.73	411.77	3705.96
	TOTAL (ha.m)	Non-command	28700.36	67.31	7090.63	10869.00	46727.30	3566.25	43161.05
	TOTAL (MCM)	Non-command	287.00	0.67	70.91	108.69	467.27	35.66	431.61

State		KERALA							
District		ERNAKULAM							
Assessment Year		2013							
Sl. No.	Assessment Unit	Command/non-Command/ Total	Recharge from rainfall during monsoon season	Recharge from other sources during monsoon season	Recharge from rainfall during non-monsoon season	Recharge from other sources during non-monsoon season	Total Annual Ground Water Recharge [(4)+(5)+(6)+(7)]	Provision for Natural Discharges	Net Annual Ground Water Availability [(8)-(9)]
1	2	3	4	5	6	7	8	9	10
1	Alangad	Non-command	1493.76	19.23	279.75	688.50	2481.24	248.12	2233.12
2	Angamaly	Non-command	3743.22	34.09	701.03	1627.50	6105.84	610.58	5495.26
3	Edappally	Non-command	3634.40	5.23	680.65	513.36	4833.64	483.36	4350.27
4	Koovappady	Non-command	4830.54	4.85	904.66	2590.00	8330.05	833.00	7497.04
5	Kothamangalam	Non-command	3644.56	3.32	682.55	500.00	4830.43	483.04	4347.39
6	Moovattupuzha	Non-command	3302.13	45.60	618.42	400.00	4366.16	436.62	3929.54
7	Mulamthuruthy	Non-command	2587.50	26.70	484.59	216.83	3315.62	331.56	2984.06
8	Palluruthy	Non-command	1505.79	0.00	282.00	0.00	1787.79	178.78	1609.01
9	Pampakkuda	Non-command	2972.09	32.56	556.61	1091.20	4652.46	465.25	4187.22
10	Parakkadavu	Non-command	2044.29	40.54	382.85	248.85	2716.54	271.65	2444.89
11	Paravoor	Non-command	1735.36	23.10	325.00	125.34	2208.80	220.88	1987.92
12	Vadavukodu	Non-command	2946.94	24.88	551.90	2780.00	6303.71	630.37	5673.34
13	Vazhakkulam	Non-command	3325.65	40.96	622.83	2710.00	6699.44	669.94	6029.49
14	Vypeen	Non-command	1021.88	2.52	191.38	10.08	1225.86	122.59	1103.27
TOTAL (ha.m)		Non-command	38788.12	303.58	7264.21	13501.67	59857.57	5985.76	53871.81
TOTAL (MCM)		Non-command	387.88	3.04	72.64	135.02	598.58	59.86	538.72

State		KERALA							
District		IDUKKI							
Assessment Year		2013							
Sl. No	Assessment Unit	Command/non-Command/Total	Recharge from rainfall during monsoon season	Recharge from other sources during monsoon season	Recharge from rainfall during non-monsoon season	Recharge from other sources during non-monsoon season	Total Annual Ground Water Recharge [(4)+(5)+(6)+(7)]	Provision for Natural Discharges	Net Annual Ground Water Availability [(8)-(9)]
1	2	3	4	5	6	7	8	9	10
1	Adimali	Non-command	2879.81	20.02	553.32	86.60	3539.74	353.97	3185.77
2	Azhutha	Non-command	2633.85	34.62	506.06	215.00	3389.53	338.95	3050.57
3	Devikulam	Non-command	2179.28	12.90	418.72	60.32	2671.23	267.12	2404.11
4	Elam Desom	Non-command	1540.74	15.13	296.03	270.00	2121.91	212.19	1909.72
5	Idukki	Non-command	2441.86	24.47	469.17	158.00	3093.50	309.35	2784.15
6	Kattappana	Non-command	1781.00	50.23	342.20	553.00	2726.42	272.64	2453.78
7	Nedumkandam	Non-command	1931.87	0.00	371.19	193.00	2496.06	249.61	2246.45
8	Thodupuzha	Non-command	1659.92	31.76	318.93	221.00	2231.62	223.16	2008.45
TOTAL (ha.m)		Non-command	17048.33	189.13	3275.63	1756.92	22270.00	2227.00	20043.00
TOTAL (MCM)		Non-command	170.48	1.89	32.76	17.57	222.70	22.27	200.43

State		KERALA							
District		KANNUR							
Assessment Year		2013							
Sl. No.	Assessment Unit	Command/non-Command/Total	Recharge from rainfall during monsoon season	Recharge from other sources during monsoon season	Recharge from rainfall during non-monsoon season	Recharge from other sources during non-monsoon season	Total Annual Ground Water Recharge [(4)+(5)+(6)+(7)]	Provision for Natural Discharges	Net Annual Ground Water Availability [(8)-(9)]
1	2	3	4	5	6	7	8	9	10
1	Edakkad	Non-command	2568.72	0.00	0.00	1498.19	4066.91	406.69	3660.22
2	Iritty	Non-command	6035.44	0.00	0.00	334.95	6370.40	637.04	5733.36
3	Irikkur	Non-command	6951.23	0.00	0.00	2355.05	9306.28	930.63	8375.65
4	Kallyasseri	Non-command	2873.75	0.00	0.00	252.83	3126.58	312.66	2813.92
5	Kannur	Non-command	1682.25	0.00	0.00	414.00	2096.25	209.62	1886.62
6	Kuthuparamba	Non-command	2365.04	0.00	0.00	157.29	2522.33	252.23	2270.10
7	Panur	Non-command	1349.91	0.00	0.00	108.17	1458.08	145.81	1312.27
8	Payyannur	Non-command	7004.69	0.00	0.00	225.58	7230.27	723.03	6507.24
9	Peravoor	Non-command	4087.99	0.00	0.00	186.12	4274.11	427.41	3846.70
10	Taliparamba	Non-command	8157.49	0.00	0.00	907.28	9064.77	906.48	8158.29
11	Thalassery	Non-command	2204.50	0.00	0.00	391.42	2595.92	259.59	2336.33
	TOTAL (ha.m)	Non-command	45281.00	0.00	0.00	6830.89	52111.88	5211.19	46900.70
	TOTAL (MCM)	Non-command	452.81	0.00	0.00	68.31	521.12	52.11	469.01

State		KERALA							
District		KASARGOD							
Assessment Year		2013							
Sl. No.	Assessment Unit	Command/non-Command/ Total	Recharge from rainfall during monsoon season	Recharge from other sources during monsoon season	Recharge from rainfall during non-monsoon season	Recharge from other sources during non-monsoon season	Total Annual Ground Water Recharge [(4)+(5)+(6)+(7)]	Provision for Natural Discharges	Net Annual Ground Water Availability [(8)-(9)]
1	2	3	4	5	6	7	8	9	10
1	Kanhangad	Non-command	4569.78	74.23	0.00	486.97	5130.98	513.10	4617.88
2	Karadka	Non-command	5557.39	170.84	0.00	1002.61	6730.88	673.08	6057.76
3	Kasaragod	Non-command	4830.17	150.50	0.00	922.92	5903.58	590.36	5313.23
4	Manjeswar	Non-command	6307.24	183.12	0.00	1052.75	7543.11	754.31	6788.80
5	Nileswaram	Non-command	3748.83	52.73	0.00	346.36	4147.91	414.79	3733.12
6	Parappa	Non-command	6732.09	138.21	0.00	831.47	7701.76	770.18	6931.59
TOTAL (ha.m)		Non-command	31745.50	769.63	0.00	4643.08	37158.22	3715.82	33442.4
TOTAL (MCM)		Non-command	317.46	7.70	0.00	46.43	371.58	37.16	334.42

State		KERALA							
District		KOLLAM							
Assessment Year		2013							
Sl. No.	Assessment Unit	Command/non-Command/ Total	Recharge from rainfall during monsoon season	Recharge from other sources during monsoon season	Recharge from rainfall during non-monsoon season	Recharge from other sources during non-monsoon season	Total Annual Ground Water Recharge [(4)+(5)+(6)+(7)]	Provision for Natural Discharges	Net Annual Ground Water Availability [(8)-(9)]
1	2	3	4	5	6	7	8	9	10
1	Anchal	Non-command	6178.90	15.87	2217.83	423.00	8835.60	883.56	7952.04
2	Chadayamangalam	Non-command	2777.98	16.04	997.12	351.00	4142.13	414.21	3727.92
3	Chavara	Non-command	1790.41	4.56	428.43	90.00	2313.39	231.34	2082.05
4	Chittumala	Non-command	2144.79	24.41	513.23	129.61	2812.03	281.20	2530.83
5	Ithikkara	Non-command	2010.31	8.45	647.26	206.98	2872.99	143.65	2729.34
6	Kottarakkara	Non-command	1484.76	12.05	532.93	482.00	2511.73	251.17	2260.56
7	Mukhathala	Non-command	2343.07	7.50	841.01	455.02	3646.60	364.66	3281.94
8	Oachira	Non-command	2782.66	9.19	665.87	225.00	3682.72	368.27	3314.45
9	Pathanapuram	Non-command	2548.74	13.87	914.83	305.00	3782.45	378.24	3404.20
10	Sasthamkotta	Non-command	1426.86	12.65	512.15	642.00	2593.67	259.37	2334.30
11	Vettikkavala	Non-command	1890.47	13.67	678.56	570.00	3152.70	315.27	2837.43
TOTAL (ha.m)		Non-command	27378.94	138.25	8949.21	3879.61	40346.01	3890.95	36455.06
TOTAL (MCM)		Non-command	273.79	1.38	89.49	38.80	403.46	38.91	364.55

State		KERALA							
District		KOTTAYAM							
Assessment Year		2013							
Sl. No.	Assessment Unit	Command/non-Command/ Total	Recharge from rainfall during monsoon season	Recharge from other sources during monsoon season	Recharge from rainfall during non-monsoon season	Recharge from other sources during non-monsoon season	Total Annual Ground Water Recharge [(4)+(5)+(6)+(7)]	Provision for Natural Discharges	Net Annual Ground Water Availability [(8)-(9)]
1	2	3	4	5	6	7	8	9	10
1	Erattupetta	Non-command	2274.35	13.92	499.62	97.46	2885.35	288.54	2596.82
2	Ettumanoor	Non-command	2415.36	5.77	530.60	480.00	3431.73	343.17	3088.56
3	Kaduthuruthy	Non-command	2799.88	24.00	615.07	1760.00	5198.94	519.89	4679.05
4	Kanjirappally	Non-command	3783.59	13.83	831.17	126.81	4755.40	475.54	4279.86
5	Lalam	Non-command	2420.86	7.02	531.81	440.00	3399.69	339.97	3059.72
6	Madappally	Non-command	4559.67	13.89	667.77	550.00	5791.33	579.13	5212.20
7	Pallom	Non-command	3956.41	6.99	869.13	1500.00	6332.53	633.25	5699.28
8	Pampady	Non-command	2480.00	0.00	544.80	90.00	3114.80	311.48	2803.32
9	Uzhavoor	Non-command	2824.40	9.75	620.46	920.00	4374.60	437.46	3937.14
10	Vaikom	Non-command	1961.78	9.67	430.96	1000.00	3402.41	340.24	3062.17
11	Vazhoor	Non-command	2121.20	0.00	465.98	30.00	2617.17	261.72	2355.46
TOTAL (ha.m)		Non-command	31597.50	104.83	6607.36	6994.27	45303.96	4530.40	40773.56
TOTAL (MCM)		Non-command	315.97	1.05	66.07	69.94	453.04	45.30	407.74

State		KERALA							
District		KOZHIKODE							
Assessment Year		2013							
Sl. No.	Assessment Unit	Command/non-Command/ Total	Recharge from rainfall during monsoon season	Recharge from other sources during monsoon season	Recharge from rainfall during non-monsoon season	Recharge from other sources during non-monsoon season	Total Annual Ground Water Recharge [(4)+(5)+(6)+(7)]	Provision for Natural Discharges	Net Annual Ground Water Availability [(8)-(9)]
1	2	3	4	5	6	7	8	9	10
1	Ballussery	Non-command	2612.89	32.14	0.00	253.68	2898.72	289.87	2608.85
2	Chelannur	Non-command	2596.60	10.38	0.00	112.63	2719.61	271.96	2447.65
3	Koduvally	Non-command	5111.93	15.47	0.00	145.14	5272.54	527.25	4745.29
4	Kozhikode	Non-command	3061.95	13.10	0.00	92.95	3168.00	316.80	2851.20
5	Kunnamangalam	Non-command	3182.36	24.06	0.00	173.76	3380.18	338.02	3042.16
6	Kunnummal	Non-command	2814.74	9.56	0.00	101.35	2925.65	292.56	2633.08
7	Melady	Non-command	2249.04	7.13	0.00	53.94	2310.11	231.01	2079.10
8	Panthalayani	Non-command	3954.61	7.05	0.00	86.42	4048.09	404.81	3643.28
9	Perambra	Non-command	3831.31	7.05	0.00	80.42	3918.78	391.88	3526.90
10	Thodannur	Non-command	1812.15	3.41	0.00	60.51	1876.07	187.61	1688.46
11	Tuneri	Non-command	1845.41	7.80	0.00	76.06	1929.26	192.93	1736.34
12	Vadakara	Non-command	2320.36	10.40	0.00	49.13	2379.89	237.99	2141.90
TOTAL (ha.m)		Non-command	35393.38	147.52	0.00	1286.00	36826.89	3682.69	33144.21
TOTAL (MCM)		Non-command	353.93	1.48	0.00	12.86	368.27	36.83	331.44

State		KERALA							
District		MALAPPURAM							
Assessment Year		2013							
Sl. No.	Assessment Unit	Command/non-Command/Total	Recharge from rainfall during monsoon season	Recharge from other sources during monsoon season	Recharge from rainfall during non-monsoon season	Recharge from other sources during non-monsoon season	Total Annual Ground Water Recharge [(4)+(5)+(6)+(7)]	Provision for Natural Discharges	Net Annual Ground Water Availability [(8)-(9)]
1	2	3	4	5	6	7	8	9	10
1	Areacode	Non-command	4130.37	24.65	607.41	554.00	5316.42	531.64	4784.78
2	Kalikavu	Non-command	4063.72	17.45	597.61	609.00	5287.77	528.78	4758.99
3	Kondotty	Non-command	2712.70	22.34	398.93	609.00	3742.96	374.30	3368.66
4	Kuttippuram	Non-command	2974.38	31.00	437.41	256.00	3698.78	369.88	3328.90
5	Malappuram	Non-command	3001.68	19.83	441.42	467.80	3930.74	393.07	3537.66
6	Mankada	Non-command	2220.53	17.90	326.55	401.50	2966.47	296.65	2669.83
7	Nilamboor	Non-command	3632.24	11.60	534.15	499.84	4677.84	467.78	4210.05
8	Perinthalmanna	Non-command	4075.49	40.21	599.34	1419.30	6134.33	613.43	5520.90
9	Perumpadappu	Non-command	1841.20	42.62	599.34	348.04	2831.18	241.24	2589.95
10	Ponnani	Non-command	2423.55	10.81	237.60	650.00	3321.96	332.20	2989.77
11	Thanur	Non-command	2388.84	27.42	351.30	382.20	3149.76	314.98	2834.79
12	Thriurangadi	Non-command	2164.20	13.37	318.26	300.00	2795.83	279.58	2516.25
13	Tirur	Non-command	2079.66	24.11	305.83	580.00	2989.60	298.96	2690.64
14	Vengara	Non-command	2162.26	15.30	317.98	431.40	2926.94	292.69	2634.25
15	Wandoor	Non-command	2229.70	11.18	327.90	1044.00	3612.78	361.28	3251.50
	Total (ha.m)	Non-command	42100.51	329.76	6401.02	8552.08	57383.37	5696.45	51686.91
	Total (MCM)	Non-command	421.01	3.30	64.01	85.52	573.83	56.96	516.87

State		KERALA							
District		PALAKKAD							
Assessment Year		2013							
Sl. No.	Assessment Unit	Command/non-Command/Total	Recharge from rainfall during monsoon season	Recharge from other sources during monsoon season	Recharge from rainfall during non-monsoon season	Recharge from other sources during non-monsoon season	Total Annual Ground Water Recharge [(4)+(5)+(6)+(7)]	Provision for Natural Discharges	Net Annual Ground Water Availability [(8)-(9)]
1	2	3	4	5	6	7	8	9	10
1	Alathur	Non-command	2452.22	102.41	444.57	5573	8572.2	857.22	7714.98
2	Attappadi	Non-command	3995.64	36.75	724.38	163.18	4919.95	492	4427.96
3	Chittur	Non-command	2694.16	262.75	488.43	3910	7355.34	735.53	6619.8
4	Kollengode	Non-command	1688.29	68.58	306.07	5260	7322.94	732.29	6590.65
5	Kuzhalmannam	Non-command	1875.71	43.36	340.05	5867	8126.12	812.61	7313.51
6	Malampuzha	Non-command	2180.77	82.96	395.36	1513	4172.09	417.21	3754.88
7	Mannarkkad	Non-command	3147.168	22.34	570.56	952	4692.06	469.21	4222.86
8	Nenmara	Non-command	2171.43	46.74	393.67	395.72	3007.56	300.76	2706.8
9	Ottappalam	Non-command	2493.79	29.27	452.11	610	3585.17	358.52	3226.65
10	Palakkad	Non-command	2269.75	34.48	411.49	4539	7254.72	725.47	6529.25
11	Pattambi	Non-command	3763.57	109.46	682.31	779.64	5334.98	533.5	4801.48
12	Sreekrishnapuram	Non-command	2499.17	33.58	453.08	654	3639.83	363.98	3275.85
13	Thrithala	Non-command	2241.11	22.76	406.3	216.38	2886.55	288.66	2597.9
	Total (ha.m)	Non-command	33472.8	895.44	6068.38	30432.9	70869.5	7086.95	63782.6
	Total (MCM)	Non-command	334.73	8.95	60.68	304.33	708.7	70.87	637.83

State		KERALA							
District		PATHANAMTHITTA							
Assessment Year		2013							
Sl. No.	Assessment Unit	Command/non-Command/ Total	Recharge from rainfall during monsoon season	Recharge from other sources during monsoon season	Recharge from rainfall during non-monsoon season	Recharge from other sources during non-monsoon season	Total Annual Ground Water Recharge [(4)+(5)+(6)+(7)]	Provision for Natural Discharges	Net Annual Ground Water Availability [(8)-(9)]
1	2	3	4	5	6	7	8	9	10
1	Elanthoor	Non-command	1441.87	12.21	501.15	583	2538.23	253.82	2284.41
2	Koipuram	Non-command	1678.75	12.37	583.48	107.48	2382.06	238.21	2143.86
3	Konni	Non-command	3778.1	9.62	1313.14	400	5500.85	550.09	4950.76
4	Mallappally	Non-command	2092.9	8.76	727.42	160	2989.08	298.91	2690.17
5	Pandalam	Non-command	1580.2	26.36	549.23	820	2975.78	297.58	2678.2
6	Parakode	Non-command	4610.27	33.48	1068.25	1240	6952.01	695.2	6256.81
7	Pulikeezh	Non-command	1742.31	9.51	462.77	109.72	2324.31	116.22	2208.1
8	Ranni	Non-command	3275.77	8.88	1138.55	88.2	4511.4	451.14	4060.26
	Total (ha.m)	Non-command	20200.2	121.19	6343.99	3508.4	30173.7	2901.17	27272.6
	Total (MCM)	Non-command	202	1.21	63.44	35.08	301.74	29.01	272.73

State		KERALA							
District		THIRUVANANTHAPURAM							
Assessment Year		2013							
Sl. No.	Assessment Unit	Command/non-Command/ Total	Recharge from rainfall during monsoon season	Recharge from other sources during monsoon season	Recharge from rainfall during non-monsoon season	Recharge from other sources during non-monsoon season	Total Annual Ground Water Recharge [(4)+(5)+(6)+(7)]	Provision for Natural Discharges	Net Annual Ground Water Availability [(8)-(9)]
1	2	3	4	5	6	7	8	9	10
1	Athiyannur	Non-command	1171.04	22.52	298.40	83.00	1574.96	157.50	1417.47
2	Chirayinkil	Non-command	1268.79	5.68	323.31	340.00	1937.78	193.78	1744.00
3	Kilimanoor	Non-command	2353.98	21.72	599.83	400.00	3375.54	337.55	3037.98
4	Nedumangad	Non-command	1671.64	8.96	425.96	198.00	2304.57	230.46	2074.11
5	Nemom	Non-command	4541.40	25.74	1157.22	100.00	5824.36	582.44	5241.93
6	Parassala	Non-command	1317.57	35.34	335.74	192.80	1881.45	188.14	1693.30
7	Perumkadavila	Non-command	2253.02	25.03	861.16	850.00	3989.21	398.92	3590.29
8	Pothencode	Non-command	1096.35	26.00	293.88	234.00	1650.23	82.51	1567.72
9	Vamanapuram	Non-command	2590.54	23.79	876.80	300.00	3791.13	189.56	3601.57
10	Varkala	Non-command	1440.11	14.91	366.96	200.00	2021.98	202.20	1819.78
11	Vellanad	Non-command	2792.22	29.98	1063.32	152.29	4037.81	201.89	3835.92
	Total (ha.m)	Non-command	22496.66	239.67	6602.58	3050.09	32389.01	2764.94	29624.07
	Total (MCM)	Non-command	224.97	2.40	66.03	30.50	323.89	27.65	296.24

State		KERALA							
District		THRISSUR							
Assessment Year		2013							
Sl. No.	Assessment Unit	Command/non-Command/ Total	Recharge from rainfall during monsoon season	Recharge from other sources during monsoon season	Recharge from rainfall during non-monsoon season	Recharge from other sources during non-monsoon season	Total Annual Ground Water Recharge [(4)+(5)+(6)+(7)]	Provision for Natural Discharges	Net Annual Ground Water Availability [(8)-(9)]
1	2	3	4	5	6	7	8	9	10
1	Anthikkad	Non-command	2367.93	58.20	0.00	2120.00	4546.13	227.31	4318.83
2	Chalakkudy	Non-command	3222.38	80.38	0.00	1580.00	4882.75	488.28	4394.48
3	Chavakkad	Non-command	3361.86	35.48	0.00	271.63	3668.96	366.90	3302.07
4	Cherpu	Non-command	1527.40	53.96	0.00	1930.00	3511.36	351.14	3160.22
5	Chowannur	Non-command	3213.54	64.37	0.00	880.00	4157.91	415.79	3742.12
6	Iringalakkuda	Non-command	2319.22	47.36	0.00	1162.00	3528.58	352.86	3175.72
7	Kodakara	Non-command	3762.81	72.41	0.00	880.00	4715.21	471.52	4243.69
8	Mala	Non-command	2585.82	96.44	0.00	2090.00	4772.26	477.23	4295.03
9	Mathilakom	Non-command	3307.51	42.77	0.00	276.53	3626.81	362.68	3264.13
10	Mullassery	Non-command	2165.35	32.33	0.00	960.00	3157.67	315.77	2841.90
11	Ollukkara	Non-command	3254.49	25.95	0.00	180.36	3460.81	346.08	3114.72
12	Pazhayannur	Non-command	4284.06	46.17	0.00	358.13	4688.35	468.84	4219.52
13	Puzhakkal	Non-command	3621.51	75.18	0.00	3000.00	6696.69	669.67	6027.02
14	Thalikkulam	Non-command	2037.71	27.38	0.00	189.13	2254.22	112.71	2141.50
15	Vellangallur	Non-command	1976.26	43.68	0.00	610.00	2629.94	262.99	2366.95
16	Vadakkancherry	Non-command	3373.55	73.21	0.00	516.43	3963.18	396.32	3566.86
	Total (ha.m)	Non-command	46381.40	875.23	0.00	17004.21	64260.84	6086.07	58174.77
	Total (MCM)	Non-command	463.81	8.75	0.00	170.04	642.61	60.86	581.75

State		KERALA							
District		WAYANAD							
Assessment Year		2013							
Sl. No.	Assessment Unit	Command/non-Command/ Total	Recharge from rainfall during monsoon season	Recharge from other sources during monsoon season	Recharge from rainfall during non-monsoon season	Recharge from other sources during non-monsoon season	Total Annual Ground Water Recharge [(4)+(5)+(6)+(7)]	Provision for Natural Discharges	Net Annual Ground Water Availability [(8)-(9)]
1	2	3	4	5	6	7	8	9	10
1	Kalpetta	Non-command	8849.78	6.95	0.00	126.22	8982.95	898.29	8084.65
2	Mananthavady	Non-command	8785.57	3.50	0.00	165.55	8954.62	895.46	8059.16
3	Panamaram	Non-command	4983.58	3.96	0.00	131.80	5119.33	511.93	4607.39
4	Sulthanbathery	Non-command	7934.43	15.35	0.00	210.81	8160.58	816.06	7344.52
	Total (ha.m)	Non-command	30553.35	29.74	0.00	634.38	31217.47	3121.75	28095.73
	Total (MCM)	Non-command	305.53	0.30	0.00	6.34	312.17	31.22	280.96

ANNEXURE III D (Contd.)

**ASSESSMENT OF DYNAMIC GROUND WATER RESOURCES OF KERALA
(2013).**

State		KERALA							
District		ALAPPUZHA							
Assessment Year		2013							
Sl. No.	Assessment Unit/ Block	Command/ Non-Command/ Total	Net Annual Ground Water Availability	Existing Gross Ground Water Draft for irrigation	Existing Gross Ground Water Draft for domestic and industrial water supply	Existing Gross Ground Water Draft for All uses (11+12)	Provision for domestic, and industrial use up to 2025	Net Ground Water Availability for future irrigation development (10-11-14)	Stage of Ground Water Development {(13/10) * 100} (%)
1	2	3	10	11	12	13	14	15	16
1	Ambalappuzha	Non-Command	2097.24	569.27	624.79	1194.06	621.11	906.86	56.93
2	Aryad	Non-Command	2731.56	514.96	1362.50	1877.46	1372.46	844.14	68.73
3	Bharanikkavu	Non-Command	4294.29	423.15	760.66	1183.81	766.22	3104.93	27.57
4	Champakkulam	Non-Command	3988.35	69.82	495.66	565.48	499.26	3419.27	14.18
5	Chengannur	Non-Command	4881.30	806.46	866.77	1673.23	871.59	3203.25	34.28
6	Harippad	Non-Command	3165.44	435.10	731.90	1167.00	657.21	2073.13	36.87
7	Kanjikkuzhy	Non-Command	2949.53	128.97	743.48	872.45	748.92	2071.64	29.58
8	Mavelikkara	Non-Command	4034.36	184.76	789.44	974.20	794.46	3055.15	24.15
9	Muthukulam	Non-Command	4358.69	227.65	1149.35	1377.00	1058.56	3072.48	31.59
10	Pattanakkad	Non-Command	3372.67	345.46	1021.87	1367.33	960.47	2066.74	40.54
11	Thycattussery	Non-Command	3581.65	95.65	683.66	779.31	687.75	2798.25	21.76
12	Veliyanad	Non-Command	3705.96	92.17	624.79	503.89	414.73	3199.06	13.60
TOTAL (ha.m)		Non-Command	43161.05	3893.42	9854.87	13535.21	9452.74	29814.89	31.36
TOTAL (MCM)		Non-Command	431.61	38.93	98.55	135.35	94.53	298.15	31.36

State		KERALA							
District		ERNAKULAM							
Assessment Year		2013							
Sl. No.	Assessment Unit/ Block	Command/non-Command/ Total	Net Annual Ground Water Availability	Existing Gross Ground Water Draft for irrigation	Existing Gross Ground Water Draft for domestic and industrial water supply	Existing Gross Ground Water Draft for All uses (11+12)	Provision for domestic and industrial use up to 2025	Net Ground Water Availability for future irrigation development (10-11-14)	Stage of Ground Water Development {(13/10) * 100} (%)
1	2	3	10	11	12	13	14	15	16
1	Alangad	Non-Command	2233.12	421.94	693.09	1115.03	689.17	1122.01	49.93
2	Angamaly	Non-Command	5495.26	811.24	972.62	1783.86	988.16	3695.85	32.46
3	Edappally	Non-Command	4350.27	238.74	1899.84	2138.58	2014.48	2097.05	49.16
4	Koovappady	Non-Command	7497.04	298.27	826.96	1125.23	868.45	6330.32	15.01
5	Kothamangalam	Non-Command	4347.39	228.76	1065.72	1294.48	1133.98	2984.65	29.78
6	Moovattupuzha	Non-Command	3929.54	1045.12	1071.66	2116.78	1133.98	1750.44	53.87
7	Mulamthuruthy	Non-Command	2984.06	661.44	1079.24	1740.68	1140.05	1182.57	58.33
8	Palluruthy	Non-Command	1609.01	150.34	318.30	468.64	329.56	1129.11	29.13
9	Pampakkuda	Non-Command	4187.22	751.08	625.47	1376.55	661.55	2774.59	32.88
10	Parakkadavu	Non-Command	2444.89	957.22	741.38	1698.60	782.01	705.66	69.48
11	Paravoor	Non-Command	1987.92	593.68	47.50	641.18	883.54	510.69	32.25
12	Vadavukodu	Non-Command	5673.34	497.52	800.21	1297.73	849.32	4326.50	22.87
13	Vazhakkulam	Non-Command	6029.49	994.30	1478.47	2472.77	1569.79	3465.41	41.01
14	Vypeen	Non-Command	1103.27	50.42	557.41	607.83	594.45	458.40	55.09
TOTAL (ha.m)		Non-Command	53871.81	7700.07	12177.86	19877.93	13638.49	32533.26	36.90
TOTAL (MCM)		Non-Command	538.72	77.00	121.78	198.78	136.38	325.33	36.90

State		KERALA							
District		IDUKKI							
Assessment Year		2013							
Sl. No.	Assessment Unit/ Block	Command/non-Command/ Total	Net Annual Ground Water Availability	Existing Gross Ground Water Draft for irrigation	Existing Gross Ground Water Draft for domestic and industrial water supply	Existing Gross Ground Water Draft for All uses (11+12)	Provision for domestic and industrial use up to 2025	Net Ground Water Availability for future irrigation development (10-11-14)	Stage of Ground Water Development $\{ \frac{13}{10} \times 100 \}$ (%)
1	2	3	10	11	12	13	14	15	16
1	Adimali	Non-Command	3185.77	426.45	554.53	980.98	555.49	2203.82	30.79
2	Azhutha	Non-Command	3050.57	718.51	576.88	1295.39	557.53	1774.54	42.46
3	Devikulam	Non-Command	2404.11	258.05	497.30	755.35	0.00	2146.06	31.42
4	Elam Desom	Non-Command	1909.72	477.82	531.53	1009.35	518.12	913.78	52.85
5	Idukki	Non-Command	2784.15	688.16	475.72	1163.88	464.32	1631.68	41.80
6	Kattappana	Non-Command	2453.78	1095.20	780.16	1875.36	760.73	597.85	76.43
7	Nedumkandam	Non-Command	2246.45	1109.03	645.44	1754.47	629.28	508.14	78.10
8	Thodupuzha	Non-Command	2008.45	742.84	575.15	1317.99	560.30	705.31	65.62
Total (ha.m)		Non-Command	20043.00	5516.06	4636.71	10152.77	4045.77	10481.17	50.65
Total (MCM)		Non-Command	200.43	55.16	46.37	101.53	40.46	104.81	50.65

State		KERALA							
District		KANNUR							
Assessment Year		2013							
Sl. No.	Assessment Unit/ Block	Command/non-Command/ Total	Net Annual Ground Water Availability	Existing Gross Ground Water Draft for irrigation	Existing Gross Ground Water Draft for domestic and industrial water supply	Existing Gross Ground Water Draft for All uses (11+12)	Provision for domestic and industrial use up to 2025	Net Ground Water Availability for future irrigation development (10-11-14)	Stage of Ground Water Development $\{(13/10) * 100\}$ (%)
1	2	3	10	11	12	13	14	15	16
1	Edakkad	Non-Command	3660.22	1073.56	283.19	1356.75	299.48	2287.18	37.07
2	Iritty	Non-Command	5733.36	1086.45	1157.57	2244.02	1224.16	3422.74	39.14
3	Irikkur	Non-Command	8375.65	981.21	1000.48	1981.69	1058.03	6336.41	23.66
4	Kallyasseri	Non-Command	2813.92	361.71	1018.74	1380.45	1077.34	1374.87	49.06
5	Kannur	Non-Command	1886.62	618.90	886.64	1505.54	772.43	495.29	79.80
6	Kuthuparamba	Non-Command	2270.10	655.76	596.55	1252.31	630.86	983.47	55.17
7	Panur	Non-Command	1312.27	450.00	704.15	1154.15	744.66	117.61	87.95
8	Payyannur	Non-Command	6507.24	672.51	1219.69	1892.20	1289.85	4544.88	29.08
9	Peravoor	Non-Command	3846.70	861.73	678.19	1539.92	717.20	2267.77	40.03
10	Taliparamba	Non-Command	8158.29	854.46	1602.36	2456.82	1688.19	5615.65	30.11
11	Thalassery	Non-Command	2336.33	395.84	1419.81	1815.65	1497.04	443.44	77.71
TOTAL (ha.m)		Non-Command	46900.70	8012.13	10567.37	18579.50	10999.25	27889.32	39.61
TOTAL (MCM)		Non-Command	469.01	80.12	105.67	185.79	109.99	278.89	39.61

State		KERALA							
District		KASARGOD							
Assessment Year		2013							
Sl. No.	Assessment Unit/ Block	Command/non-Command/ Total	Net Annual Ground Water Availability	Existing Gross Ground Water Draft for irrigation	Existing Gross Ground Water Draft for domestic and industrial water supply	Existing Gross Ground Water Draft for All uses (11+12)	Provision for domestic and industrial use up to 2025	Net Ground Water Availability for future irrigation development (10-11-14)	Stage of Ground Water Development $\{(13/10) * 100\}$ (%)
1	2	3	10	11	12	13	14	15	15
1	Kanhangad	Non-Command	4617.88	1694.96	1278.67	2973.63	1400.29	1522.63	64.39
2	Karadka	Non-Command	6057.76	3537.25	739.09	4276.34	806.65	1713.86	70.59
3	Kasaragod	Non-Command	5313.23	3240.75	1568.52	4809.27	1718.38	354.09	90.52
4	Manjeswar	Non-Command	6788.80	3800.75	1113.28	4914.03	1218.91	1769.13	72.38
5	Nileswaram	Non-Command	3733.12	1196.81	952.41	2149.22	1040.23	1496.08	57.57
6	Parappa	Non-Command	6931.59	2926.56	909.41	3835.97	995.37	3009.66	55.34
TOTAL (ha.m)		Non-Command	33442.37	16397.08	6561.38	22958.46	7179.84	9865.46	68.65
TOTAL (MCM)		Non-Command	334.42	163.97	65.61	229.58	71.80	98.65	68.65

State		KERALA							
District		KOLLAM							
Assessment Year		2013							
Sl. No.	Assessment Unit/ Block	Command/non-Command/ Total	Net Annual Ground Water Availability	Existing Gross Ground Water Draft for irrigation	Existing Gross Ground Water Draft for domestic and industrial water supply	Existing Gross Ground Water Draft for All uses (11+12)	Provision for domestic and industrial use up to 2025	Net Ground Water Availability for future irrigation development (10-11-14)	Stage of Ground Water Development $\{ (13/10) * 100 \}$ (%)
1	2	3	10	11	12	13	14	15	16
1	Anchal	Non-Command	7952.04	669.75	323.53	993.28	1108.77	6173.52	12.49
2	Chadayamangalam	Non-Command	3727.92	571.64	997.30	1568.94	1016.57	2139.71	42.09
3	Chavara	Non-Command	2082.05	266.62	964.05	1230.67	982.99	832.44	59.11
4	Chittumala	Non-Command	2530.83	488.10	1056.23	1544.33	1077.96	964.77	61.02
5	Ithikkara	Non-Command	2729.34	339.50	1123.01	1462.51	1146.11	1243.73	53.58
6	Kottarakkara	Non-Command	2260.56	431.60	842.83	1274.43	858.76	970.20	56.38
7	Mukhathala	Non-Command	3281.94	369.34	2077.47	2446.81	2724.95	187.65	74.55
8	Oachira	Non-Command	3314.45	446.86	1036.70	1483.56	1057.93	1809.66	44.76
9	Pathanapuram	Non-Command	3404.20	468.38	933.86	1402.24	952.61	1983.21	41.19
10	Sasthamkotta	Non-Command	2334.30	451.32	986.44	1437.76	1006.49	876.49	61.59
11	Vettikkavala	Non-Command	2837.43	491.58	940.83	1432.41	960.01	1385.85	50.48
	TOTAL (ha.m)	Non-Command	36455.06	4994.69	11282.26	16276.95	12893.14	18567.23	44.65
	TOTAL (MCM)	Non-Command	364.55	49.95	112.82	162.77	128.93	185.67	44.65

State		KERALA							
District		KOTTAYAM							
Assessment Year		2013							
Sl. No	Assessment Unit/ Block	Command/non -Command/ Total	Net Annual Ground Water Availability	Existing Gross Ground Water Draft for irrigation	Existing Gross Ground Water Draft for domestic and industrial water supply	Existing Gross Ground Water Draft for All uses (11+12)	Provision for domestic and industrial use up to 2025	Net Ground Water Availability for future irrigation development (10-11-14)	Stage of Ground Water Development $\{(13/10) * 100\}$ (%)
1	2	3	10	11	12	13	14	15	16
1	Erattupetta	Non-Command	2596.82	444.70	580.31	1025.01	589.48	1562.63	39.47
2	Ettumanoor	Non-Command	3088.56	312.38	907.35	1219.73	921.69	1854.49	39.49
3	Kaduthuruthy	Non-Command	4679.05	628.42	711.82	1340.24	723.06	3327.57	28.64
4	Kanjirappally	Non-Command	4279.86	562.55	919.52	1482.07	934.04	2783.27	34.63
5	Lalam	Non-Command	3059.72	280.02	555.57	835.59	564.35	2215.35	27.31
6	Madappally	Non-Command	5212.20	573.28	1192.57	1765.85	1211.41	3427.51	33.88
7	Pallom	Non-Command	5699.28	519.43	1377.07	1896.50	1398.82	3781.03	33.28
8	Pampady	Non-Command	2803.32	205.35	598.00	803.35	1045.61	1552.36	28.66
9	Uzhavoor	Non-Command	3937.14	529.30	730.06	1259.36	1045.61	2362.23	31.99
10	Vaikom	Non-Command	3062.17	427.65	181.12	608.77	183.98	2450.54	19.88
11	Vazhoor	Non-Command	2355.46	367.00	528.14	895.14	536.48	1451.97	38.00
TOTAL(ha.m)		Non-Command	40773.56	4850.08	8281.53	13131.61	9154.54	26768.94	32.21
TOTAL(MCM)		Non-Command	407.74	48.50	82.82	131.32	91.55	267.69	32.21

State		KERALA							
District		KOZHIKODE							
Assessment Year		2013							
Sl. No	Assessment Unit/ Block	Command/non -Command/ Total	Net Annual Ground Water Availability	Existing Gross Ground Water Draft for irrigation	Existing Gross Ground Water Draft for domestic and industrial water supply	Existing Gross Ground Water Draft for All uses (11+12)	Provision for domestic and industrial use up to 2025	Net Ground Water Availability for future irrigation development (10-11-14)	Stage of Ground Water Development {(13/10) * 100} (%)
1	2	3	10	11	12	13	14	15	16
1	Ballussery	Non-Command	2608.85	844.34	1226.85	2071.19	1332.91	431.59	79.39
2	Chelannur	Non-Command	2447.65	380.44	1164.50	1544.94	1265.18	802.03	63.12
3	Koduvally	Non-Command	4745.29	524.84	1457.98	1982.82	1584.03	2636.42	41.79
4	Kozhikode	Non-Command	2851.20	368.80	2121.71	2490.51	2305.14	177.25	87.35
5	Kunnamangalam	Non-Command	3042.16	616.61	1912.26	2528.87	2077.59	347.96	83.13
6	Kunnummal	Non-Command	2633.08	348.02	990.69	1338.71	1076.34	1208.72	50.84
7	Melady	Non-Command	2079.10	192.82	594.35	787.17	645.74	1240.54	37.86
8	Panthalayani	Non-Command	3643.28	268.20	910.07	1178.27	988.75	2386.33	32.34
9	Perambra	Non-Command	3526.90	225.80	834.65	1060.45	906.81	2394.29	30.07
10	Thodannur	Non-Command	1688.46	170.06	681.70	851.76	740.64	777.76	50.45
11	Tuneri	Non-Command	1736.34	262.90	729.35	992.25	792.41	681.03	57.15
12	Vadakara	Non-Command	2141.90	207.90	804.42	1012.32	873.97	1060.03	47.26
TOTAL (ha.m)		Non-Command	33144.21	4410.73	13428.55	17839.28	14589.52	14143.95	53.82
TOTAL (MCM)		Non-Command	331.44	44.11	134.29	178.39	145.90	141.44	53.82

State		KERALA							
District		MALAPPURAM							
Assessment Year		2013							
Sl. No	Assessment Unit/ Block	Command/non-Command/ Total	Net Annual Ground Water Availability	Existing Gross Ground Water Draft for irrigation	Existing Gross Ground Water Draft for domestic and industrial water supply	Existing Gross Ground Water Draft for All uses (11+12)	Provision for domestic and industrial use up to 2025	Net Ground Water Availability for future irrigation development (10-11-14)	Stage of Ground Water Development $\{((13/10) * 100)\}$ (%)
1	2	3	10	11	12	13	14	15	16
1	Areacode	Non-Command	4784.78	772.63	2082.04	2854.67	2407.86	1604.29	59.66
2	Kalikavu	Non-Command	4758.99	562.26	1565.08	2127.34	1809.99	2386.74	44.70
3	Kondotty	Non-Command	3368.66	699.06	1565.08	2264.14	1809.99	859.61	67.21
4	Kuttippuram	Non-Command	3328.90	856.75	1364.97	2221.72	1578.57	893.58	66.74
5	Malappuram	Non-Command	3537.66	556.62	1702.11	2258.73	1968.48	1012.56	63.85
6	Mankada	Non-Command	2669.83	532.36	897.73	1430.09	1038.22	1099.25	53.57
7	Nilamboor	Non-Command	4210.05	232.24	1175.16	1407.40	1359.06	2618.76	33.43
8	Perinthalmanna	Non-Command	5520.90	1053.71	1723.66	2777.37	1993.40	2473.79	50.31
9	Perumpadappu	Non-Command	2589.95	1107.90	720.64	1828.54	833.41	648.64	70.60
10	Ponnani	Non-Command	2989.77	426.80	1095.70	1522.50	1267.16	1295.81	50.92
11	Thanur	Non-Command	2834.79	793.95	1345.65	2139.60	1556.22	484.61	75.48
12	Thriurangadi	Non-Command	2516.25	396.86	1522.81	1919.67	1761.11	358.27	76.29
13	Tirur	Non-Command	2690.64	674.24	1256.11	1930.35	1452.67	563.73	71.74
14	Vengara	Non-Command	2634.25	515.34	1508.77	2024.11	1744.88	374.03	76.84
15	Wandoor	Non-Command	3251.50	379.76	1128.06	1507.82	1304.60	1567.14	46.37
	Total (ha.m)	Non-Command	51686.91	9560.48	20653.57	30214.04	23885.62	18240.81	58.46
	Total (MCM)	Non-Command	516.87	95.60	206.54	302.14	238.86	182.41	58.46

State		KERALA							
District		PALAKKAD							
Assessment Year		2013							
Sl. No	Assessment Unit/ Block	Command/non-Command/ Total	Net Annual Ground Water Availability	Existing Gross Ground Water Draft for irrigation	Existing Gross Ground Water Draft for domestic and industrial water supply	Existing Gross Ground Water Draft for All uses (11+12)	Provision for domestic and industrial use up to 2025	Net Ground Water Availability for future irrigation development (10-11-14)	Stage of Ground Water Development {(13/10) * 100} (%)
1	2	3	10	11	12	13	14	15	16
1	Alathur	Non-Command	7714.98	2412.09	1340.58	3752.67	1457.73	3845.17	48.64
2	Attappadi	Non-Command	4427.96	753.64	268.01	1021.65	291.43	3382.89	23.07
3	Chittur	Non-Command	6619.80	5647.00	1032.34	6679.34	1059.41	0.00	100.90
4	Kollengode	Non-Command	6590.65	1701.35	656.05	2357.40	711.54	4177.76	35.77
5	Kuzhalmannam	Non-Command	7313.51	1271.68	945.11	2216.79	949.41	5092.41	30.31
6	Malampuzha	Non-Command	3754.88	2192.09	1272.65	3464.74	1101.76	461.04	92.27
7	Mannarkkad	Non-Command	4222.86	807.66	1425.00	2232.66	1546.97	1868.23	52.87
8	Nenmara	Non-Command	2706.80	1154.55	614.58	1769.13	668.29	883.96	65.36
9	Ottappalam	Non-Command	3226.65	799.47	910.67	1710.14	990.25	1436.93	53.00
10	Palakkad	Non-Command	6529.25	968.96	1451.48	2420.44	1562.44	3997.84	37.07
11	Pattambi	Non-Command	4801.48	2521.12	1540.41	4061.53	1675.03	605.34	84.59
12	Sreekrishnapuram	Non-Command	3275.85	915.26	964.98	1880.24	971.02	1389.57	57.40
13	Thrithala	Non-Command	2597.90	713.62	1004.22	1717.84	1126.75	757.52	66.12
	Total (ha.m)	Non-Command	63782.57	21858.49	13426.08	35284.57	14112.03	27898.66	55.32
	Total (MCM)	Non-Command	637.83	218.58	134.26	352.85	141.12	278.99	55.32

State		KERALA							
District		PATHANAMTHITTA							
Assessment Year		2013							
Sl. No	Assessment Unit/ Block	Command/non-Command/ Total	Net Annual Ground Water Availability	Existing Gross Ground Water Draft for irrigation	Existing Gross Ground Water Draft for domestic and industrial water supply	Existing Gross Ground Water Draft for All uses (11+12)	Provision for domestic and industrial use up to 2025.	Net Ground Water Availability for future irrigation development (10-11-14)	Stage of Ground Water Development $\{(13/10) * 100\}$ (%)
1	2	3	10	11	12	13	14	15	16
1	Elanthoor	Non-Command	2284.41	373.88	454.88	828.76	437.74	1472.79	36.28
2	Koipuram	Non-Command	2143.86	396.34	591.19	987.53	568.91	1178.60	46.06
3	Konni	Non-Command	4950.76	384.18	780.06	1164.24	750.67	3815.91	23.52
4	Mallappally	Non-Command	2690.17	318.82	578.81	897.63	557.00	1814.35	33.37
5	Pandalam	Non-Command	2678.20	686.14	657.64	1343.78	632.86	1359.20	50.17
6	Parakode	Non-Command	6256.81	859.52	1089.30	1948.82	1048.26	4349.02	31.15
7	Pulikeezh	Non-Command	2208.10	292.10	688.00	980.10	662.08	1253.91	44.39
8	Ranni	Non-Command	4060.26	335.80	805.34	1141.14	774.99	2949.47	28.11
	Total (ha.m)	Non-Command	27272.56	3646.78	5645.21	9291.99	5432.53	18193.25	34.07
	Total (MCM)	Non-Command	272.73	36.47	56.45	92.92	54.33	181.93	34.07

State		KERALA							
District		THIRUVANANTHAPURAM							
Assessment Year		2013							
Sl. No.	Assessment Unit/ Block	Command/ non-Command / Total	Net Annual Ground Water Availability	Existing Gross Ground Water Draft for irrigation	Existing Gross Ground Water Draft for domestic and industrial water supply	Existing Gross Ground Water Draft for All uses (11+12)	Provision for domestic, and industrial use up to 2025	Net Ground Water Availability for future irrigation development (10-11-14)	Stage of Ground Water Development $\{(13/10) * 100\}$ (%)
1	2	3	10	11	12	13	14	15	16
1	Athiyannur	Non-Command	1417.47	334.68	883.69	1218.37	907.40	175.38	85.95
2	Chirayinkil	Non-Command	1744.00	333.27	972.85	1306.12	998.90	411.83	74.89
3	Kilimanoor	Non-Command	3037.98	437.78	1055.67	1493.45	1084.05	1516.16	49.16
4	Nedumangad	Non-Command	2074.11	462.64	1041.14	1503.78	1069.13	542.34	72.50
5	Nemom	Non-Command	5241.93	525.88	3325.30	3851.18	3414.68	1301.37	73.47
6	Parassala	Non-Command	1693.30	666.96	791.91	1458.87	813.20	213.14	86.16
7	Perumkadavila	Non-Command	3590.29	576.45	993.29	1569.74	1019.98	1993.86	43.72
8	Pothencode	Non-Command	1567.72	588.75	643.80	1232.55	648.70	330.26	78.62
9	Vamanapuram	Non-Command	3601.57	483.42	951.31	1434.73	976.88	2141.27	39.84
10	Varkala	Non-Command	1819.78	305.22	879.48	1184.70	903.12	611.44	65.10
11	Vellanad	Non-Command	3835.92	575.62	1024.75	1600.37	1052.30	2208.00	41.72
	Total (ha.m)	Non-Command	29624.07	5290.67	12563.20	17853.87	12888.34	11445.06	60.27
	Total (MCM)	Non-Command	296.24	52.91	125.63	178.54	128.88	114.45	60.27

State		KERALA							
District		THRISSUR							
Assessment Year		2013							
Sl. No	Assessment Unit/ Block	Command/ non-Command/ Total	Net Annual Ground Water Availability	Existing Gross Ground Water Draft for irrigation	Existing Gross Ground Water Draft for domestic and industrial water supply	Existing Gross Ground Water Draft for All uses (11+12)	Provision for domestic and industrial use up to 2025	Net Ground Water Availability for future irrigation development (10-11-14)	Stage of Ground Water Development $\{(13/10) * 100\}$ (%)
1	2	3	10	11	12	13	14	15	16
1	Anthikkad	Non-Command	4318.83	1295.44	640.94	1936.38	675.85	2347.54	44.84
2	Chalakkudy	Non-Command	4394.48	1749.74	898.84	2648.58	936.40	1708.34	60.27
3	Chavakkad	Non-Command	3302.07	1091.85	868.48	1960.33	915.77	1294.45	59.37
4	Cherpu	Non-Command	3160.22	1165.70	459.09	1624.79	484.10	1510.43	51.41
5	Chowannur	Non-Command	3742.12	1346.21	1422.31	2768.52	1498.88	897.03	73.98
6	Iringalakkuda	Non-Command	3175.72	1036.24	701.69	1737.93	739.13	1400.36	54.73
7	Kodakara	Non-Command	4243.69	1647.18	868.82	2516.00	912.13	1684.39	59.29
8	Mala	Non-Command	4295.03	2067.60	707.06	2774.66	745.57	1481.87	64.60
9	Mathilakom	Non-Command	3264.13	1257.48	1279.96	2537.44	1349.67	656.98	77.74
10	Mullassery	Non-Command	2841.90	836.56	448.88	1285.44	441.29	1564.06	45.23
11	Ollukkara	Non-Command	3114.72	654.16	768.29	1422.45	806.34	1654.23	45.67
12	Pazhayannur	Non-Command	4219.52	1077.10	808.04	1885.14	852.05	2290.37	44.68
13	Puzhakkal	Non-Command	6027.02	1733.16	527.98	2261.14	545.35	3748.52	37.52
14	Thalikkulam	Non-Command	2141.50	865.34	591.93	1457.27	624.17	652.00	68.05
15	Vellangallur	Non-Command	2366.95	1073.30	531.09	1604.39	560.01	733.64	67.78
16	Wadakkancherry	Non-Command	3566.86	1573.26	814.03	2387.29	851.60	1142.00	66.93
	Total (ha.m)	Non-Command	58174.77	20470.32	12337.43	32807.75	12938.29	24766.17	56.40
	Total (MCM)	Non-Command	581.75	204.70	123.37	328.08	129.38	247.66	56.40

State		KERALA							
District		WAYANAD							
Assessment Year		2013							
Sl. No.	Assessment Unit/ Block	Command/non-Command/ Total	Net Annual Ground Water Availability	Existing Gross Ground Water Draft for irrigation	Existing Gross Ground Water Draft for domestic and industrial water supply	Existing Gross Ground Water Draft for All uses (11+12)	Provision for domestic and industrial use up to 2025	Net Ground Water Availability for future irrigation development (10-11-14)	Stage of Ground Water Development $\{(13/10) * 100\}$ (%)
1	2	3	10	11	12	13	14	15	16
1	Kalpetta	Non-Command	8084.65	321.40	1097.79	1419.19	1081.90	6681.36	17.55
2	Mananthavady	Non-Command	8059.16	388.06	1022.00	1410.06	1001.96	6669.14	17.50
3	Panamaram	Non-Command	4607.39	318.65	889.05	1207.70	846.55	3442.19	26.21
4	Sulthanbathery	Non-Command	7344.52	547.53	889.05	1436.58	846.55	5950.44	19.56
	Total (ha.m)	Non-Command	28095.73	1575.64	3897.89	5473.53	3776.96	22743.12	19.48
	Total (MCM)	Non-Command	280.96	15.76	38.98	54.74	37.77	227.43	19.48

ANNEXURE III E

**ASSESSMENT OF DYNAMIC GROUND WATER RESOURCES OF KERALA -
ASSESSMENT UNIT WISE CATEGORIZATION
(2013)**

State		KERALA					
District		ALAPPUZHA					
Assessment Year		2013					
Sl. No.	Assessment Unit	Stage of Ground Water Development (%)	Pre-monsoon		Post-monsoon		Category (Safe / Semi-critical / Critical / Over-exploited)
			Water level Trend (Rise (-) / Decline (+) (cm/year)	Is there a significant decline (Yes/ No)	Water level Trend (Rise (-) / Decline (+) (cm/year)	Is there a significant decline (Yes/ No)	
1	2	3	4	5	6	7	8
1	Ambalappuzha	56.93	-1.13	NO	1.42	NO	Safe
2	Aryad	68.73	4.08	NO	-1.49	NO	Safe
3	Bharanikkavu	27.57	-9.24	NO	3.93	NO	Safe
4	Champakulam	14.18	2.40	NO	0.23	NO	Safe
5	Chengannur	34.28	-1.70	NO	7.55	NO	Safe
6	Harippad	36.87	0.96	NO	-2.04	NO	Safe
7	Kanjikkuzhy	29.58	-0.81	NO	0.77	NO	Safe
8	Mavelikkara	24.15	-8.87	NO	1.77	NO	Safe
9	Muthukulam	31.59	14.11	NO	1.73	NO	Safe
10	Pattanakkad	40.54	3.17	NO	4.37	NO	Safe
11	Thycattusery	21.76	10.61	NO	4.56	NO	Safe
12	Veliyanad	13.60	-5.87	NO	-0.95	NO	Safe

State		KERALA					
District		ERNAKULAM					
Assessment Year		2013					
Sl. No.	Assessment Unit	Stage of Ground Water Development (%)	Pre-monsoon		Post-monsoon		Category (Safe/ Semi-critical/ Critical/ Over-exploited)
			Water level Trend (Rise (-) / Decline (+)) (cm/year)	Is there a significant decline (Yes/ No)	Water level Trend (Rise (-) / Decline (+)) (cm/year)	Is there a significant decline (Yes/ No)	
1	2	3	4	5	6	7	8
1	Alangad	49.93	-6.23	NO	3.34	NO	Safe
2	Angamaly	32.46	-2.39	NO	-8.24	NO	Safe
3	Edappally	49.16	-16.89	NO	-70.91	NO	Safe
4	Koovappady	15.01	2.28	NO	7.28	NO	Safe
5	Kothamangalam	29.78	4.61	NO	3.68	NO	Safe
6	Moovattupuzha	53.87	-2.74	NO	0.34	NO	Safe
7	Mulamthuruthy	58.33	-10.47	NO	-4.32	NO	Safe
8	Palluruthy	29.13	-6.57	NO	-3.30	NO	Safe
9	Pampakkuda	32.88	0.54	NO	6.86	NO	Safe
10	Parakkadavu	69.48	-2.41	NO	-1.48	NO	Safe
11	Paravoor	32.25	-1.15	NO	2.96	NO	Safe
12	Vadavukodu	22.87	5.54	NO	-3.15	NO	Safe
13	Vazhakkulam	41.01	-0.14	NO	0.95	NO	Safe
14	Vypeen	55.09	-1.98	NO	2.11	NO	Safe

State		KERALA					
District		IDUKKI					
Assessment Year		2013					
Sl. No.	Assessment Unit	Stage of Ground Water Development (%)	Pre-monsoon		Post-monsoon		Category (Safe/ Semi-critical/ Critical/ Over-exploited)
			Water level Trend [Rise (-) /Decline (+)] (cm/year)	Is there a significant decline (Yes/ No)	Water level Trend [Rise (-) /Decline (+)] (cm/year)	Is there a significant decline (Yes/ No)	
1	2	3	4	5	6	7	8
1	Adimali	30.79	-16.39	NO	-12.82	NO	Safe
2	Azhutha	42.46	-55.60	NO	5.15	NO	Safe
3	Devikulam	31.42	0.00	NO	19.41	NO	Safe
4	Elam Desom	52.85	9.52	NO	-1.17	NO	Safe
5	Idukki	41.80	-1.60	NO	-0.35	NO	Safe
6	Kattappana	76.43	15.63	YES	2.77	NO	*Semi Critical
7	Nedumkandam	78.10	-32.48	NO	1.43	NO	*Semi Critical
8	Thodupuzha	65.62	-0.33	NO	1.23	NO	Safe
* Water levels not representative							

State		KERALA					
District		KANNUR					
Assessment Year		2013					
Sl. No.	Assessment Unit	Stage of Ground Water Development (%)	Pre-monsoon		Post-monsoon		Category (Safe/ Semi-critical/ Critical/ Over-exploited)
			Water level Trend (Rise (-) /Decline (+)) (cm/year)	Is there a significant decline (Yes/ No)	Water level Trend (Rise (-) /Decline (+)) (cm/year)	Is there a significant decline (Yes/ No)	
1	2	3	4	5	6	7	8
1	Edakkad	37.07	10.68	NO	-1.38	NO	Safe
2	Iritty	39.14	-4.32	NO	9.27	NO	Safe
3	Irikkur	23.66	7.15	NO	-0.91	NO	Safe
4	Kallyasseri	49.06	-9.27	NO	-3.41	NO	Safe
5	Kannur	79.80	31.09	YES	1.12	NO	Semi-critical
6	Kuthuparamba	55.17	-13.47	NO	-10.04	NO	Safe
7	Panur	87.95	-6.57	NO	-15.39	NO	*Semi-critical
8	Payyannur	29.08	-4.47	NO	-12.99	NO	Safe
9	Peravoor	40.03	-6.00	NO	-3.97	NO	Safe
10	Taliparamba	30.11	12.84	NO	-9.47	NO	Safe
11	Thalassery	77.71	11.16	NO	14.96	NO	Semi-critical
* Water Level data not representative							

State		KERALA					
District		KASARGOD					
Assessment Year		2013					
Sl. No.	Assessment Unit	Stage of Ground Water Development (%)	Pre-monsoon		Post-monsoon		Category (Safe/ Semi-critical/ Critical/ Over-exploited)
			Water level Trend (Rise (-) / Decline (+)) (cm/year)	Is there a significant decline (Yes/ No)	Water level Trend (Rise (-) / Decline (+)) (cm/year)	Is there a significant decline (Yes/ No)	
1	2	3	4	5	6	7	8
1	Kanhangad	64.39	-10.57	NO	-13.25	NO	Safe
2	Karadka	70.59	-10.57	NO	-13.25	NO	Safe
3	Kasaragod	90.52	-29.79	NO	-55.27	NO	*Critical
4	Manjeswar	72.38	-21.22	NO	12.27	NO	*Semi-critical
5	Nileswaram	57.57	8.70	NO	-16.55	NO	Safe
6	Parappa	55.34	3.99	NO	-42.38	NO	Safe
* Water Levels not representative							

State		KERALA					
District		KOLLAM					
Assessment Year		2013					
Sl. No.	Assessment Unit	Stage of Ground Water Development (%)	Pre-monsoon		Post-monsoon		Category (Safe/ Semi-critical/ Critical/ Over-exploited)
			Water level Trend (Rise (-) /Decline (+)) (cm/year)	Is there a significant decline (Yes/ No)	Water level Trend (Rise (-) /Decline (+)) (cm/year)	Is there a significant decline (Yes/ No)	
1	2	3	4	5	6	7	8
1	Anchal	12.49	-6.96	NO	0.25	NO	Safe
2	Chadayamangalam	42.09	-1.90	NO	-2.45	NO	Safe
3	Chavara	59.11	15.79	YES	3.17	NO	Safe
4	Chittumala	61.02	129.31	NO	125.32	NO	Safe
5	Ithikkara	53.58	-3.32	NO	-1.60	NO	Safe
6	Kottarakkara	56.38	4.76	NO	3.92	NO	Safe
7	Mukhathala	74.55	7.28	NO	27.91	YES	Semi-critical
8	Oachira	44.76	1.93	NO	4.12	NO	Safe
9	Pathanapuram	41.19	4.51	NO	-10.31	NO	Safe
10	Sasthamkotta	61.59	-66.76	NO	-55.78	NO	Safe
11	Vettikkavala	50.48	-0.65	NO	6.05	NO	Safe
* Water levels not representative							

State		KERALA					
District		KOTTAYAM					
Assessment Year		2013					
Sl. No.	Assessment Unit	Stage of Ground Water Development (%)	Pre-monsoon		Post-monsoon		Category (Safe/ Semi-critical/ Critical/ Over-exploited)
			Water level Trend [Rise (-) / Decline (+)] (cm/year)	Is there a significant decline (Yes/ No)	Water level Trend [Rise (-) / Decline (+)] (cm/year)	Is there a significant decline (Yes/ No)	
1	2	3	4	5	6	7	8
1	Erattupetta	39.47	-14.39	NO	-11.90	NO	Safe
2	Ettumanoor	39.49	-13.70	NO	-7.04	NO	Safe
3	Kaduthuruthy	28.64	-9.24	NO	-0.68	NO	Safe
4	Kanjirappally	34.63	-10.54	NO	9.47	NO	Safe
5	Lalam	27.31	0.20	NO	-3.76	NO	Safe
6	Madappally	33.88	-2.68	NO	2.46	NO	Safe
7	Pallom	33.28	2.57	NO	7.29	NO	Safe
8	Pampady	28.66	-19.91	NO	10.25	NO	Safe
9	Uzhavoor	31.99	-1.88	NO	-2.88	NO	Safe
10	Vaikom	19.88	1.18	NO	3.65	NO	Safe
11	Vazhoor	38.00	15.65	YES	7.52	NO	*Safe

State		KERALA					
District		KOZHIKODE					
Assessment Year		2013					
Sl. No.	Assessment Unit	Stage of Ground Water Development (%)	Pre-monsoon		Post-monsoon		Category (Safe/ Semi-critical/ Critical/ Over-exploited)
			Water level Trend [Rise (-) / Decline (+)] (cm/year)	Is there a significant decline (Yes/ No)	Water level Trend [Rise (-) / Decline (+)] (cm/year)	Is there a significant decline (Yes/ No)	
1	2	3	4	5	6	7	8
1	Ballussery	79.39	8.31	NO	-5.552	NO	*Semi-critical
2	Chelannur	63.12	-10.27	NO	23.385	NO	Safe
3	Koduvally	41.79	-7.91	NO	-12.308	NO	Safe
4	Kozhikode	87.35	-1.28	NO	8.764	NO	Safe
5	Kunnamangalam	83.13	-8.22	NO	0.759	NO	*Semi-critical
6	Kunnummal	50.84	-1.88	NO	-5.379	NO	Safe
7	Melady	37.86	7.18	NO	-33.897	NO	Safe
8	Panthalayani	32.34	-0.61	NO	-3.964	NO	Safe
9	Perambra	30.07	-0.14	NO	10.109	NO	Safe
10	Thodannur	50.45	-5.70	NO	-3.485	NO	Safe
11	Tuneri	57.15	3.39	NO	4.479	NO	Safe
12	Vadakara	47.26	1.84	NO	2.500	NO	Safe
* Water levels not representative							

State		KERALA					
District		MALAPPURAM					
Assessment Year		2013					
Sl. No.	Assessment Unit	Stage of Ground Water Development (%)	Pre-monsoon		Post-monsoon		Category (Safe/ Semi-critical/ Critical/ Over-exploited)
			Water level Trend [Rise (-) / Decline (+)] (cm/year)	Is there a significant decline (Yes/ No)	Water level Trend [Rise (-) / Decline (+)] (cm/year)	Is there a significant decline (Yes/ No)	
1	2	3	4	5	6	7	8
1	Areacode	59.66	-0.81	NO	10.12	NO	Safe
2	Kalikavu	44.70	-14.12	NO	0.17	NO	Safe
3	Kondotty	67.21	-21.47	NO	-24.98	NO	Safe
4	Kuttippuram	66.74	-8.85	NO	-22.36	NO	Safe
5	Malappuram	63.85	-19.94	NO	-26.76	NO	Safe
6	Mankada	53.57	-4.45	NO	-7.33	NO	Safe
7	Nilamboor	33.43	-8.80	NO	-7.05	NO	Safe
8	Perinthalmanna	50.31	6.63	NO	-8.74	NO	Safe
9	Perumpadappu	70.60	-0.57	NO	-22.10	NO	Safe
10	Ponnani	50.92	12.45	NO	-6.58	NO	Safe
11	Tanur	75.48	0.47	NO	-1.96	NO	*Semi-critical
12	Thriurangadi	76.29	19.11	YES	14.14	NO	Semi-critical
13	Tirur	71.74	10.24	NO	14.14	NO	Safe
14	Vengara	76.84	-6.98	NO	-14.81	NO	Semi-critical
15	Wandoor	46.37	-5.94	NO	5.52	NO	Safe
* Water Levels not representative							

State		KERALA					
District		PALAKKAD					
Assessment Year		2013					
Sl. No.	Assessment Unit	Stage of Ground Water Development (%)	Pre-monsoon		Post-monsoon		Category (Safe/ Semi-critical/ Critical/ Over-exploited)
			Water level Trend [Rise (-) / Decline (+)] (cm/year)	Is there a significant decline (Yes/ No)	Water level Trend [Rise (-) / Decline (+)] (cm/year)	Is there a significant decline (Yes/ No)	
1	2	3	4	5	6	7	8
1	Alathur	48.64	-13.05	NO	-10.24	NO	Safe
2	Attappadi	23.07	-38.48	NO	-58.13	NO	Safe
3	Chittur	100.90	-71.41	NO	-24.14	NO	Overexploited
4	Kollengode	35.77	-31.64	NO	-19.92	NO	Safe
5	Kuzhalmannam	30.31	-20.15	NO	-4.98	NO	Safe
6	Malampuzha	92.27	-6.07	NO	-8.81	NO	*Critical
7	Mannarkkad	52.87	21.11	NO	3.99	NO	Safe
8	Nenmara	65.36	-27.43	NO	-18.07	NO	Safe
9	Ottappalam	53.00	4.56	NO	24.20	YES	Safe
10	Palakkad	37.07	-0.84	NO	-4.68	NO	Safe
11	Pattambi	84.59	11.98	NO	37.18	NO	*Semi-critical
12	Sreekrishnapuram	57.40	18.57	NO	14.14	YES	Safe
13	Thrithala	66.12	-15.54	NO	-31.35	NO	Safe

*Water levels not representative

State		KERALA					
District		PATHANAMTHITTA					
Assessment Year		2013					
Sl. No.	Assessment Unit	Stage of Ground Water Development (%)	Pre-monsoon		Post-monsoon		Category (Safe/ Semi-critical/ Critical/ Over-exploited)
			Water level Trend [Rise (-) / Decline (+)] (cm/year)	Is there a significant decline (Yes/ No)	Water level Trend [Rise (-) / Decline (+)] (cm/year)	Is there a significant decline (Yes/ No)	
1	2	3	4	5	6	7	8
1	Elanthoor	36.28	-28.21	NO	15.42	NO	Safe
2	Koipuram	46.06	1.60	NO	-3.10	NO	Safe
3	Konni	23.52	-8.40	NO	1.88	NO	Safe
4	Mallappally	33.37	-11.37	NO	-2.99	NO	Safe
5	Pandalam	50.17	2.64	NO	10.22	NO	Safe
6	Parakode	31.15	-13.50	NO	-24.55	NO	Safe
7	Pulikeezh	44.39	-6.52	NO	4.38	NO	Safe
8	Ranni	28.11	-11.10	NO	-5.69	NO	Safe

State		KERALA					
District		THIRUVANANTHAPURAM					
Assessment Year		2013					
Sl. No.	Assessment Unit	Stage of Ground Water Development (%)	Pre-monsoon		Post-monsoon		Category (Safe/ Semi-critical/ Critical/ Over-exploited)
			Water level Trend [Rise (-) / Decline (+)] (cm/year)	Is there a significant decline (Yes/ No)	Water level Trend [Rise (-) / Decline (+)] (cm/year)	Is there a significant decline (Yes/ No)	
1	2	3	4	5	6	7	8
1	Athiyannur	85.95	-2.08	NO	-2.08	NO	*Semi-critical
2	Chirayinkil	74.89	9.47	YES	-4.64	NO	Semi-critical
3	Kilimanoor	49.16	-3.08	NO	7.64	NO	Safe
4	Nedumangad	72.50	-1.56	NO	13.52	NO	Safe
5	Nemom	73.47	-7.97	NO	32.37	NO	Safe
6	Parassala	86.16	-13.00	NO	27.14	NO	*Semi-critical
7	Perumkadavila	43.72	-17.37	NO	8.82	NO	Safe
8	Pothencode	78.62	-0.95	NO	9.69	NO	Safe
9	Vamanapuram	39.84	-0.50	NO	-0.76	NO	Safe
10	Varkala	65.10	-22.95	NO	14.01	NO	Safe
11	Vellanad	41.72	-7.21	NO	5.72	NO	Safe
*Water levels not representative							

State		KERALA					
District		THRISSUR					
Assessment Year		2013					
Sl. No.	Assessment Unit	Stage of Ground Water Development (%)	Pre-monsoon		Post-monsoon		Category (Safe/ Semi-critical/ Critical/ Over-exploited)
			Water level Trend [Rise (-) / Decline (+)] (cm/year)	Is there a significant decline (Yes/ No)	Water level Trend [Rise (-) / Decline (+)] (cm/year)	Is there a significant decline (Yes/ No)	
1	2	3	4	5	6	7	8
1	Anthikkad	44.84	-15.42	NO	-2.64	NO	Safe
2	Chalakkudy	60.27	0.56	NO	-8.96	NO	Safe
3	Chavakkad	59.37	4.02	NO	-4.35	NO	Safe
4	Cherpu	51.41	8.93	NO	3.18	NO	Safe
5	Chowannur	73.98	4.36	NO	19.05	YES	Semi-critical
6	Iringalakkuda	54.73	6.42	NO	-6.87	NO	Safe
7	Kodakara	59.29	7.36	NO	3.13	NO	Safe
8	Mala	64.60	6.47	NO	2.18	NO	Safe
9	Mathilakom	77.74	8.19	NO	-0.80	NO	*Semi-critical
10	Mullassery	45.23	-2.82	NO	4.20	NO	Safe
11	Ollukkara	45.67	-5.19	NO	1.62	NO	Safe
12	Pazhayannur	44.68	-19.47	NO	-0.29	NO	Safe
13	Puzhakkal	37.52	-1.67	NO	5.05	NO	Safe
14	Thalikkulam	68.05	-0.92	NO	1.62	NO	Safe
15	Vellangallur	67.78	6.28	NO	-6.20	NO	Safe
16	Wadakkancherry	66.93	-5.56	NO	-1.23	NO	Safe
*Water levels not representative							

State		KERALA					
District		WAYANAD					
Assessment Year		2013					
Sl. No.	Assessment Unit	Stage of Ground Water Development (%)	Pre-monsoon		Post-monsoon		Category (Safe/ Semi-critical/ Critical/ Over-exploited)
			Water level Trend [Rise (-) / Decline (+)] (cm/year)	Is there a significant decline (Yes/ No)	Water level Trend [Rise (-) / Decline (+)] (cm/year)	Is there a significant decline (Yes/ No)	
1	2	3	4	5	6	7	8
1	Kalpetta	17.55	4.19	NO	0.85	NO	Safe
2	Mananthavady	17.50	-7.64	NO	-0.04	NO	Safe
3	Panamaram	26.21	-12.16	NO	-11.19	NO	Safe
4	Sulthanbathery	19.56	4.32	NO	-4.97	NO	Safe

ANNEXURE III F

**ASSESSMENT OF DYNAMIC GROUND WATER
RESOURCES OF KERALA - ADMINISTRATIVE UNIT- WISE
CATEGORIZATION (2013)**

Sl. No	District	Total No. of Assess-ment Units	No. of Assessment Units Categorized as												
			Over-exploited			Critical			Semi-critical			Safe			
			No	Name	Quality Problems encountere d (in parts of the block)	No	Name	Quality Problems encountered (in parts of the block)	No	Name	Quality Problems encountered (in parts of the block)	No	Name	Quality Problems encountered (in parts of the block)	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
1	Alappuzha	12	0	-		0	-		0	-		12	Ambalappuzha		
													Aryad	Iron, Fluoride (Deeper zone)	
													Bharanikkavu		
													Champakkulam		
													Chengannur		
													Harippad		
													Kanjikkuzhy	Iron	
													Mavelikkara	Iron	
													Muthukulam	Iron, Nitrate	
													Pattanakkad	Iron	
													Thycattussery	Iron	
2	Ernakulam	14	0	-		0	-		3	Parakkadavu	Iron	11	Alangad		
										Paravur			Angamaly		
										Vypeen			Edappally	Nitrate	
													Koovappady		
													Kothamangalam	Iron	
													Mulamthuruthy	Salinity	
													Muvattupuzha		
													Palluruthy		
													Pampakkuda	Iron	
													Vadavukodu	Iron	
													Vazhakkulam		
3	Idukki	8	0	-		0	-		2	Kattappana	Nitrate	6	Adimali		
										Nedumkandam	Iron		Arudai		
													Devikulam	Nitrate	
													Elam Desom	Iron	
													Idukki		

Sl. No	District	Total No. of Assessment Units	No. of Assessment Units Categorized as											
			Over-exploited			Critical			Semi-critical			Safe		
			No	Name	Quality Problems encountered (in parts of the block)	No	Name	Quality Problems encountered (in parts of the block)	No	Name	Quality Problems encountered (in parts of the block)	No	Name	Quality Problems encountered (in parts of the block)
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
4	Kannur	11	0	-		0	-		2			9	Thodupuzha	
										Kallyasseri			Edakkad	Nitrate
										Panur			Irikkur	Iron
													Iritty	
													Kannur	
													Koothuparamba	
													Payyannur	Iron
													Peravoor	
5	Kasargod	6	0	-		1	Kasargod	Iron,Nitrate	3	Kanhangad		2	Nileshvaram	Iron
										Karadka	Iron		Parappa	
										Manjeswar	Iron			
6	Kollam	11	0	-		0	-		1	Chittumala	Iron	10	Anchal	Iron
													Chadayamangalam	Iron, Nitrate
													Chavara	Iron, Heavy metals
													Ithikkara	Iron, Nitrate
													Kottarakkara	Iron
													Mukhathala	Iron
													Oachira	Iron, Nitrate
													Pathanapuram	Iron
													Sasthamkotta	Iron
7	Kottayam	11	0	-		0	-		0	-		11	Vettikkavala	Iron
													Erattupetta	
													Ettumanoor	
													Kaduthuruthy	
													Kanjirappally	Nitrate
													Lalam	
													Madappally	
													Pallom	
													Pampady	
													Uzhavoor	

Sl. No	District	Total No. of Assessment Units	No. of Assessment Units Categorized as											
			Over-exploited			Critical			Semi-critical			Safe		
			No	Name	Quality Problems encountered (in parts of the block)	No	Name	Quality Problems encountered (in parts of the block)	No	Name	Quality Problems encountered (in parts of the block)	No	Name	Quality Problems encountered (in parts of the block)
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
8	Kozhikode	12	0	-		0	-		2	Balussery	Iron	10	Vaikom	Salinity
										Kunnamangalam	Iron		Vazhoor	Iron
													Chelannur	Iron
													Koduvally	
													Kozhikode	Nitrate
													Kunnummal	
													Melady	
													Panthalayani	
													Perambra	Iron
													Thodannur	
9	Malappuram	15	0	-		0	-		3	Kondotty	Iron	12	Areacode	Iron
										Tirurangadi	Iron		Kalikavu	
										Vengara			Kuttippuram	Iron, Nitrate
													Malappuram	Iron
													Mankada	Iron
													Nilamboor	Nitrate
													Perinthalmanna	Iron
													Perumpadappu	
													Ponnani	Salinity, Nitrate
													Tanur	Iron
													Tirur	Iron, Nitrate
													Wandoor	
10	Palakkad	13	1	Chittoor	Salinity, Nitrate, Fluoride	1	Malampuzha	Fluoride	2	Pattambi	Iron	9	Alathur	Salinity
										Thrithala	Iron		Attappadi	Iron, Nitrate, Fluoride
													Kollengode	Nitrate, Fluoride
													Kuzhalmannam	Salinity, Iron
													Mannarkkad	Iron
													Nenmara	Iron

Sl. No	District	Total No. of Assessment Units	No. of Assessment Units Categorized as											
			Over-exploited			Critical			Semi-critical			Safe		
			No	Name	Quality Problems encountered (in parts of the block)	No	Name	Quality Problems encountered (in parts of the block)	No	Name	Quality Problems encountered (in parts of the block)	No	Name	Quality Problems encountered (in parts of the block)
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
													Ottappalam	Nitrate
													Palakkad	Nitrate, Fluoride
													Sreekrishnapuram	Iron
11	Pathanamthitta	8	0	-		0	-		0	-		8	Elanthoor	
													Koipuram	Iron
													Konni	Iron
													Mallappally	
													Pandalam	Iron
													Parakode	Iron
													Pulikeezh	
													Ranni	Iron
12	Thiruvananthapuram	11	0	-		0	-		3	Athiyanur	Nitrate	8	Chirayinkil	Iron, Nitrate
										Nedumangad	Iron, Nitrate		Kilimanoor	Iron, Nitrate
										Parassala	Nitrate		Nemom	Salinity, Iron, Nitrate
													Perumkadavila	Iron, Nitrate
													Pothencode	Nitrate
													Vamanapuram	Iron, Nitrate
													Varkala	Iron, Nitrate
													Vellanad	Iron
13	Thrissur	16	0	-		0	-		2	Mathilakam	Iron	14	Anthikkad	
										Thalikkulam	Iron		Chalakkudy	Iron
													Chavakkad	Iron
													Cherpu	Iron
													Chowannur	Iron
													Irinjalakkuda	
													Kodakara	Iron
													Mala	Iron, Nitrate
													Mullassery	
													Ollukkara	Iron
													Pazhayannur	
													Puzhakkal	Iron, Nitrate

Sl. No	District	Total No. of Assessment Units	No. of Assessment Units Categorized as											
			Over-exploited			Critical			Semi-critical			Safe		
			No	Name	Quality Problems encountered (in parts of the block)	No	Name	Quality Problems encountered (in parts of the block)	No	Name	Quality Problems encountered (in parts of the block)	No	Name	Quality Problems encountered (in parts of the block)
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
													Vellangallur	
													Wadakkancherry	
14	Wayanad	4	0	-		0	-		0	-		4	Kalpetta	Iron
													Mananthavady	Iron, Nitrate
													Panamaram	
													Sulthanbathery	
	KERALA STATE	152	1			2			23			126		

ANNEXURE III G
JUSTIFICATION FOR CHANGE IN CATEGORIZATION OF BLOCKS IN 2013
COMPARED TO 2011

Table. 5.4 Variation in Major components of Dynamic Ground Water Resources of Kerala between 2011 and 2013																			
Sl. No	Assessment Unit/District	Net Annual Ground water Availability (MCM)		Existing Gross Ground Water Draft for all uses (MCM)		Net Ground water Availability for future irrigation development (MCM)		Stage of Ground water development (%)		*Categorization of Blocks									
		As in		As in		As in		As in		As in 2011					As in 2013				
		2011	2013	2011	2013	2011	2013	2011	2013	OE	C	SC	Safe	Total	OE	C	SC	Safe	Total
1	Alappuzha	452.90	431.61	130.32	137.48	319.27	298.15	28.78	31.85	0	0	0	12	12	0	0	0	12	12
2	Ernakulam	583.27	538.72	242.40	198.78	327.22	325.33	41.56	36.90	0	0	3	11	14	0	0	0	14	14
3	Idukki	196.55	200.43	83.70	101.53	107.96	104.81	42.58	50.65	0	0	2	6	8	0	0	2	6	8
4	Kannur	480.13	469.01	218.82	185.79	251.37	278.89	45.58	39.61	0	0	2	9	11	0	0	3	8	11
5	Kasaragod	327.90	334.42	234.80	229.58	83.87	98.65	71.60	69.81	0	1	3	2	6	0	1	1	4	6
6	Kollam	422.21	364.55	159.48	162.77	251.90	185.67	37.77	44.65	0	0	1	10	11	0	0	1	10	11
7	Kottayam	445.70	407.74	127.05	131.32	303.75	267.69	28.51	32.21	0	0	0	11	11	0	0	0	11	11
8	Kozhikode	344.62	331.44	192.24	178.39	134.69	141.44	55.78	53.78	0	0	2	10	12	0	0	2	10	12
9	Malappuram	495.55	516.87	284.01	302.14	169.96	182.41	57.31	58.46	0	0	3	12	15	0	0	3	12	15
10	Palakkad	783.83	637.83	486.46	352.85	288.94	290.10	62.06	55.32	1	1	2	9	13	1	1	1	10	13
11	Pathanamthitta	253.02	272.73	94.67	92.92	155.34	181.93	37.42	36.57	0	0	0	8	8	0	0	0	8	8
12	Thiruvananthapuram	328.71	296.24	173.01	178.54	141.87	114.45	52.63	60.27	0	0	3	8	11	0	0	3	8	11
13	Thrissur	681.53	581.75	358.88	328.08	307.69	247.66	52.66	56.40	0	0	2	14	16	0	0	2	14	16
14	Wayanad	276.07	280.96	49.71	54.74	221.39	227.43	18.01	19.48	0	0	0	4	4	0	0	0	4	4
Total		6071.99	5664.30	2835.54	2634.91	3065.24	2944.62	46.70	46.52	1	2	23	126	152	1	2	18	131	152
Difference in comparison with 2011 (%)		-6.71		-7.08		-3.94		-0.18											
*OE - Over-exploited; C - Critical; SC - Semi-critical																			

ANNEXURE III H

**ADDITIONAL POTENTIAL RECHARGE UNDER SPECIFIC CONDITIONS IN
KERALA**

Additional Potential Recharge Under Specific Conditions in Kerala (2013)				
Sl. No.	Assessment Unit/ District	Potential Recharge in water logged and shallow water table area	Potential Recharge in flood prone area	Total Annual Additional Potential Ground Water Recharge
				(3+4)
1	2	3	4	5
District : Alappuzha				
1	Ambalapuzha	1515.80	0.00	1515.80
2	Aryad	2105.30	0.00	2105.30
3	Champakulam	752.50	0.00	752.50
4	Chenganur	2204.80	0.00	2204.80
5	Haripad	2420.00	0.00	2420.00
6	Kanjikuzhi	2430.00	0.00	2430.00
7	Muthukulam	725.00	0.00	725.00
8	Pattanakad	4348.40	0.00	4348.40
9	Thaikattussery	4088.90	0.00	4088.90
10	Veliyanad	4020.00	0.00	4020.00
District Total		20522.30	0.00	20522.30
District : Ernakulam				
1	Alangad	488.64	0.00	488.64
2	Edapally	2112.00	0.00	2112.00
3	Koovapad	136.15	0.00	136.15
4	Palluruthy	10400.00	0.00	10400.00
5	Paravur	570.00	0.00	570.00
6	Vypin	528.00	0.00	528.00
District Total		4874.79	0.00	4874.79
District : Kasargod				
1	Nileswaram	107.20	0.00	107.20
District Total		107.20	0.00	107.20
1	2	3	4	5
District : Kollam				
1	Chavara	560.00	0.00	560.00
2	Ithikkara	115.39	0.00	115.39
3	Oachira	532.00	0.00	532.00
District Total		1207.39	0.00	1207.39

District : Kottayam				
1	Vaikom	384.00	0.00	384.00
District Total		384.00	0.00	384.00
District : Kozhikode				
1	Melady	720.00	0.00	720.00
2	Thodannur	120.00	0.00	120.00
District Total		840.00	0.00	840.00
District : Pathananthitta				
1	Pulikeezh	800.00	0.00	800.00
District Total		800.00	0.00	800.00
District : Thrissur				
1	Mathilakam	360.00	0.00	360.00
2	Mala	42.00	0.00	42.00
District Total		402.00	0.00	402.00
		29137.68	0.00	29137.68
STATE TOTAL		291.38 MCM		291.38 MCM