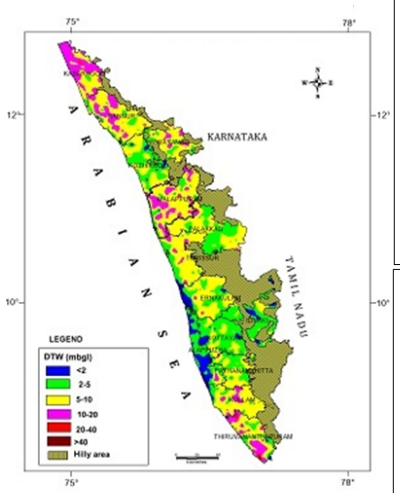

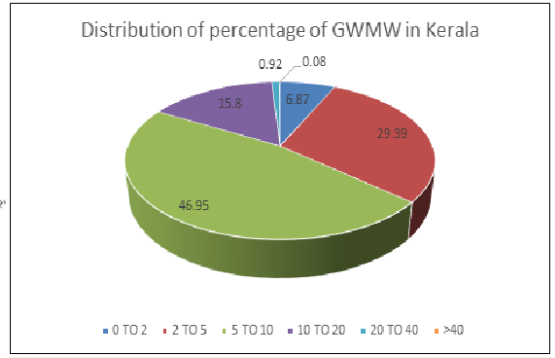

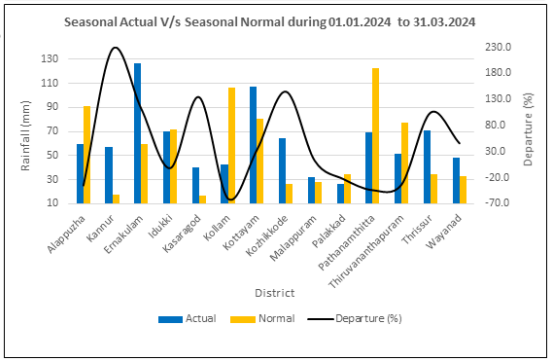

GROUND WATER LEVEL BULLETIN

APRIL 2024/KERALA STATE

ABSTRACT

The behavior of ground water table during the Pre-Monsoon period (April-2024) in Kerala State has been studied by monitoring Board's groundwater monitoring dug wells and purpose-built piezometers. As of April 2024, Central Ground Water Board, Kerala Region, monitors 1383 dug wells and 276 piezometers to study the ground water scenario of Kerala State.

The State has received normal rainfall from January 2024 to March 2024, with a departure of +8% from the normal, however, with spatial variation especially in southern and northern districts of the State. During the period of study, the depth to water levels of phreatic aquifers of the State varies within 10 m bgl in most of the parts in the State (83% of the GWMS), while remaining 17 % of wells show depth to water level more than 10 m bgl.

Annual depth to water level of phreatic aquifer during April 2023 and 2024 indicates that, 43.47 % of analyzed wells shows rise in water level and 56.53 % fall in water levels. The comparison between April decadal mean with respect to April 2024 shows that 46.03% of wells in rising and 53.97 % of wells in falling trend.

In confined/semi-confined aquifers, annual fluctuation of piezometric head shows falling trend in 67% of the analyzed wells and the rest shows rising trend. Similarly, the long-term fluctuation in piezometric head of confined/semi-confined aquifers indicates that 62% of the wells show fall in head, while the remaining wells show a rise in head.

CGWB, KERALA REGION, THIRUVANANTHAPURAM

1.0 INTRODUCTION

Groundwater bulletin is prepared by CGWB depicting changes in groundwater regime of the country through different seasons. It is an effort to obtain information on groundwater levels through representative monitoring wells. The important attributes of groundwater regime monitoring are groundwater level.

The natural conditions affecting the groundwater regime involve meteorological parameters like rainfall, evapotranspiration etc., whereas anthropogenic influences include extraction from the aquifer, recharge due to irrigation systems and other practices like waste disposal etc.

Groundwater levels are being measured by Central Ground Water Board four times a year during January, March/April/May, August and November. The regime monitoring started in the year 1969 by Central Ground Water Board. A network of 25437 observation wells called **National Hydrograph Network Stations (NHNS)**, as on 30.04.2023, located all over the country is being monitored.

2.0 STUDY AREA

Kerala State is a narrow stretch of land lies between North latitudes $08^0 18'$ and $12^0 48'$ and East longitudes $74^0 52'$ and $77^0 22'$ covering an area of 38863 sq.km, which is bordered by the Lakshadweep Sea on the western side and Tamil Nadu and Karnataka States on the eastern side. The length of the State from north to south is 560 km and the average width is 70 km, with a maximum of 125 km.

Due to urbanization and industrialization, the stress on groundwater has increased in the past few years, which resulted in problems like decline in water table and contamination of groundwater at many places. Change in rainfall pattern in recent years and the increased utilization of ground water put concern among the public that water may become scarce commodity in future.

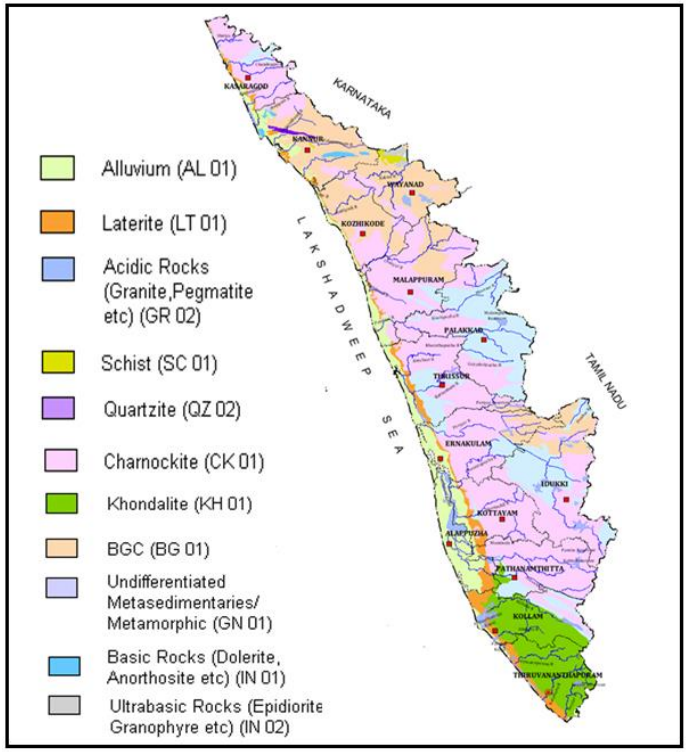

Figure-1: Map showing major aquifers and administrative divisions of Kerala

Physiographically, the State of Kerala is divided into three major units viz. the lowland, the midland and the high land. The lowlands are those areas where the elevation is less than 7.6m above mean sea level (amsl) whereas the elevation of the midland ranges from 7.6 to 76 m amsl and that of the highland is more than 76 m amsl. Along the highlands there are two distinct plateau regions - Wayanad plateau and Munnar plateau.

Geologically 88% of the State is underlained by crystalline rocks of Archaean age, which is a part of the peninsular shield. The crystalline complex of Kerala is composed of charnockites, gneisses, schists, migmatites and rocks of the Wayanad supracrustals.

Along the western part of the State, the crystalline rocks are topped by the sedimentary formations of Palaeogene, Neogene Periods and alluvial formations of Quaternary to Recent periods. The Palaeogene and Neogene sequence has been divided into four beds viz. Alleppey, Vaikom, Quilon and Warkali, with age ranges from Eocene to Lower Miocene. Laterites of Sub-Recent age derived from the crystalline as well as sedimentary formations, and are seen all along the midlands. Along the coastal plains, the sedimentary formations and laterites are overlained by Recent Alluvium deposits.

3.0 GROUND WATER LEVEL MONITORING

In order to assess the real situation of ground water conditions, it is very essential to monitor the groundwater level and water quality over time and space. Central Ground Water Board has established 1659 Ground Water Monitoring Wells (GWMW) throughout the Kerala State for monitoring seasonal ground water level. Water level is being monitored four times a year during January, April, August and November months and water quality is being monitored from the water samples collected from optimized GWMW during April. The total number of GWMW as on 31.03.2024 is 1656. Out of these, 1383 are dug wells representing phreatic aquifers and 276 are bore wells/tube wells representing deeper aquifers of confined / semi-confined nature. These GWMW are spread over all the physiographic divisions of the State. The district-wise breakup of the water level monitoring stations is given in **Table-1**.

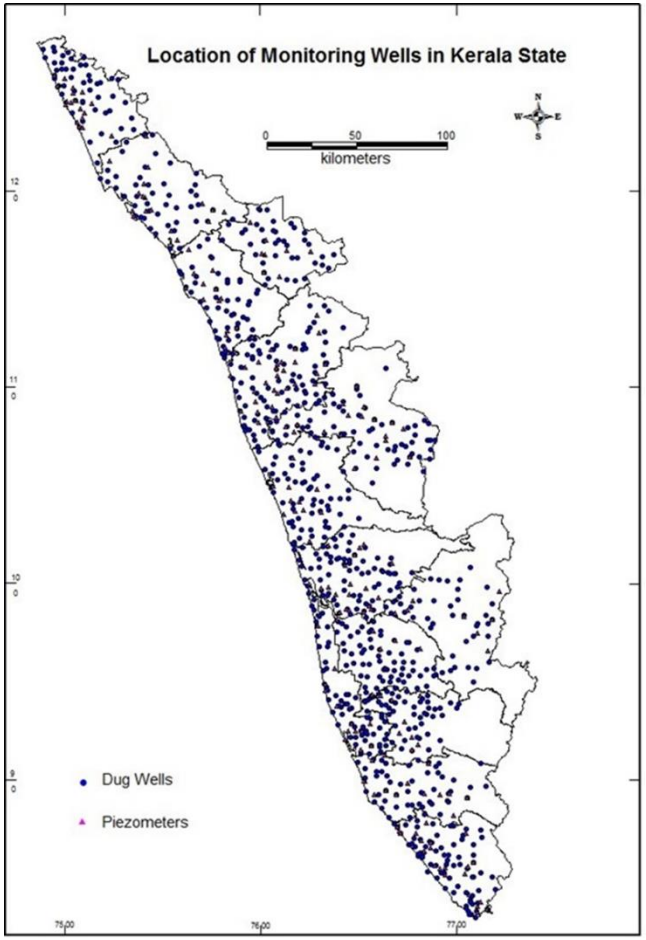

Figure- 2: Map showing locations of monitoring wells (GWMS) in Kerala state

Table-1: District-wise distribution of water level monitoring stations

SR. No.	District	Number of Water Level Monitoring Stations				
		2022	2023	2024		
		Total	Total	DW	PZ	Total
1	Thiruvananthapuram		125	106	22	128
2	Kollam		120	114	13	127
3	Pathanamthitta		92	84	11	95
4	Alappuzha		93	78	15	93
5	Kottayam		102	97	8	105
6	Idukki		76	71	9	80
7	Ernakulam		143	123	20	143
8	Thrissur		131	110	19	129
9	Palakkad		157	119	44	163
10	Malappuram		146	116	30	146
11	Kozhikode		103	85	25	110
12	Wayanad		83	76	9	85
13	Kannur		112	99	17	116
14	Kasaragod		127	105	34	139
	Total		**1610**	**1383**	**276**	**1659**

4.0 RAIN FALL

The rainfall data collected and compiled from weekly and monthly weather reports from India Meteorological Department were used to analyze the rainfall for the period January 2024 - March 2024. Table-2 gives the district-wise rainfall data for the period January to March 2023 & 2024, normal and the departure of January- March 2024 rainfall with other periods.

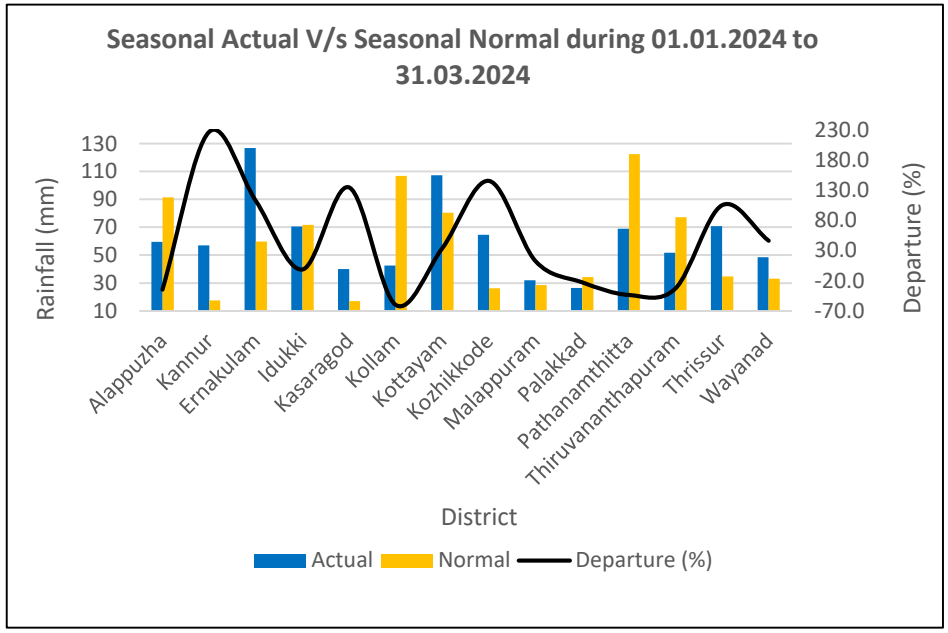

Figure-3: Rainfall deviation (January 2024-March 2024) from normal rainfall

Table-2: District wise variability of rainfall in Kerala (2023-2024)

S No	District	Rainfall (Jan-March 24)	Rainfall (Jan-Mar 23)	Normal Rainfall	Departure from 2023 (%)	Departure from Normal (%)	Status
1	Alappuzha	59.6	46.2	91.5	22.5 %	-34.9 %	Deficient
2	Kannur	57.1	0	17.5	100.0 %	226.3 %	Large Excess
3	Ernakulam	126.8	31.1	59.7	75.5 %	112.4 %	Large Excess
4	Idukki	70.5	66.7	71.6	5.4 %	-1.5 %	Normal
5	Kasaragod	40.1	2.1	17.1	94.8 %	134.5 %	Large Excess
6	Kollam	42.6	65.3	106.8	-53.3 %	-60.1 %	Large Deficient
7	Kottayam	107.4	56.8	80.4	47.1 %	33.6 %	Excess
8	Kozhikkode	64.5	11.9	26.3	81.6 %	145.2 %	Large Excess
9	Malappuram	31.9	4.3	28.4	86.5 %	12.3 %	Normal
10	Palakkad	26.4	19.4	34.2	26.5 %	-22.8 %	Deficient
11	Pathanamthitta	68.9	101.5	122.5	-47.3 %	-43.8 %	Deficient
12	Thiruvananthapuram	51.7	41.6	77.2	19.5 %	-33.0 %	Deficient
13	Thrissur	70.9	12.2	34.6	82.8 %	104.9 %	Large Excess
14	Wayanad	48.5	55.9	33.2	-15.3 %	46.1 %	Excess

5.0 GROUND WATER LEVEL SCENARIO (APRIL 2024)

5.1 SHALLOW AQUIFER (UNCONFINED)

5.1.1 DEPTH TO WATER LEVEL

Depth to Water Level in Unconfined Aquifer (April 2024)

The depth to water level of 1310 wells is used for the analysis. The salient feature of the analysis is that the depth to water level over major part of the State lies within 10 m bgl in 83 % of wells analyzed, whereas, 17 % of wells show depth to water level more than 10 m bgl. During the month of April 2024, the depth to water level of phreatic aquifer in the State varied from 0.1 to 16.7 mbgl with median of 6.3 m bgl. The outliers of 24 data points ranges from 17.6 m bgl to 46.48 m bgl, majority of which belongs to the phreatic zones of Neogene sedimentary sequence along the western margin of Thiruvananthapuram district. Shallow water level in the range of 0 to 2 mbgl is observed mostly in parts of Alappuzha, Ernakulam and Idukki districts. 6.87 % of the analyzed wells are having depth to water level less than 2 mbgl. Water level in the range of 2 to 5 mbgl and 5 to 10 m bgl are observed for 29.39 % and 46.95% of the analyzed wells respectively in the State. It is to be noted that major part of the State shows depth to water level in the range of 5 to 10 m bgl, during April-2024. Water level in the range of 10 to 20 mbgl is recorded for about 15.8 % of the analyzed wells, and are mostly belongs to Kasaragod, Thiruvananthapuram, Wayanad, Kannur, Malappuram and Kollam districts. As mentioned earlier, deeper water levels more than 20 m bgl are observed in about 1% wells, most of them belongs to the western margin of Thiruvananthapuram district.

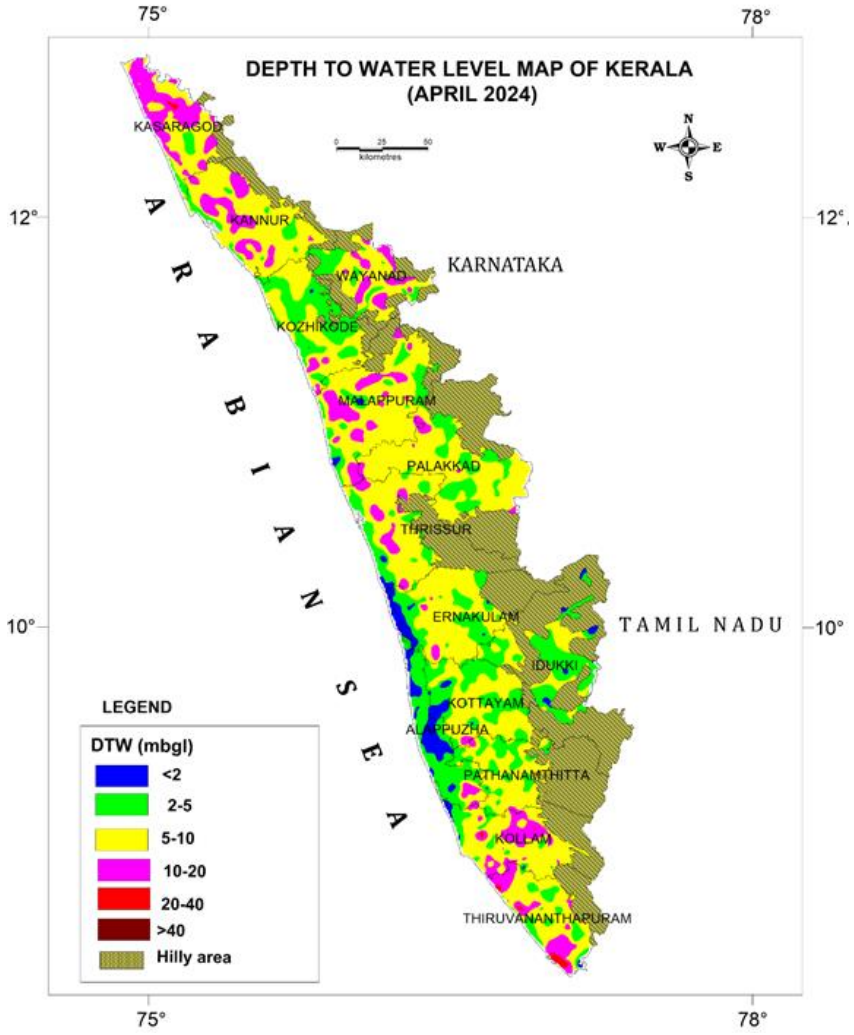

Figure-4: Depth to water Level in phreatic aquifer in Kerala during April 2024

5.1.2 ANNUAL FLUCTUATION IN WATER LEVEL

Annual Fluctuation of Water Level in Unconfined Aquifer (April 2023 to April 2024)

Rise in Water Levels:

Out of 496 wells, water level rise of less than 2 m is recorded in 41% wells, 2 to 4 m in 2% wells and more than 4 m in 0.44% of the wells. Water level rise of less than 2 m is seen in all the districts, significantly in Kasaragod, Thrissur, Malappuram, Kannur districts. Water level rise of 2 to 4 m is observed in limited number of wells and not recorded in Alappuzha, Idukki, Wayanad districts. Rise of more than 4 m is observed in a few wells located in Kollam, Malappuram and Thiruvananthapuram districts.

Fall in Water Levels:

Out of 655 wells that have registered fall in water levels, 51% have recorded less than 2 m while 5% in the range of 2 to 4 m and remaining 1% wells registered water level fall of more than 4 m. Fall of less than 2 m is mainly observed in parts of Wayanad, Alappuzha, Pathanamthitta, Idukki, Kottayam, Kollam, Kozhikkode and Palakkad districts. Fall of 2 to 4 m is observed mainly in Thiruvananthapuram, Kottayam, Palakkad districts. Fall of beyond 4 m is observed in some pockets located in Kottayam, Thiruvananthapuram districts.

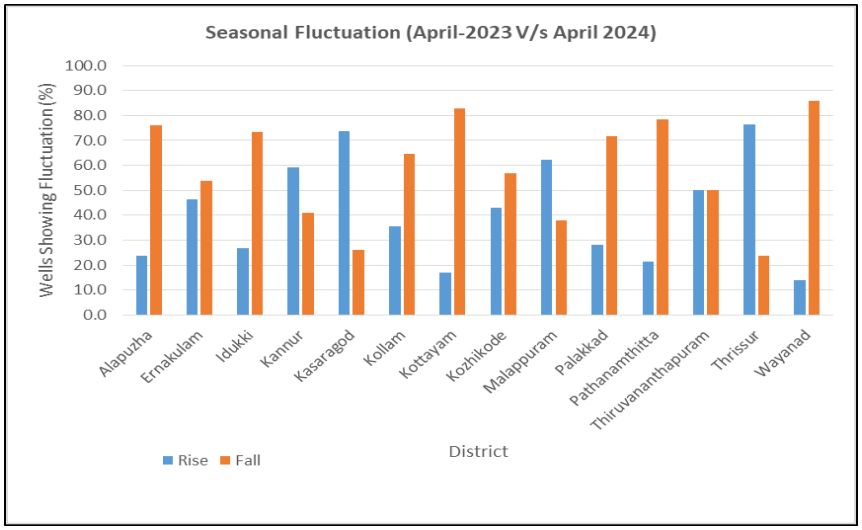

Figure-10: Percentage of wells showing rise and fall in WL in unconfined aquifer (April 2023 to April 2024)

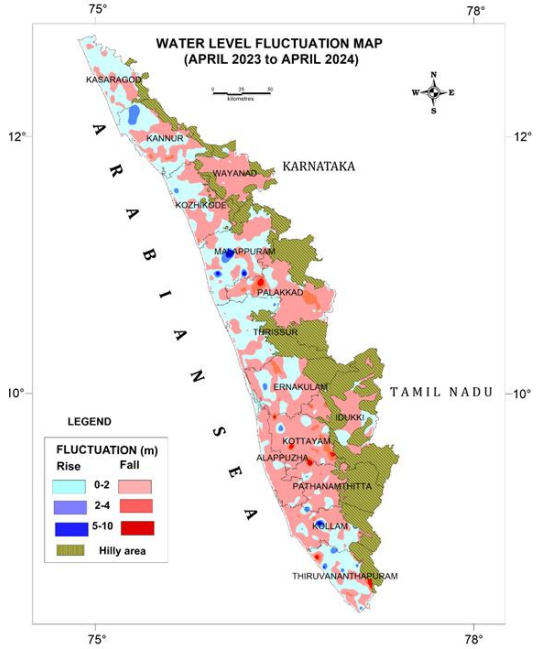

Figure-11: Annual water level fluctuation in unconfined aquifer(April 2023 to April 2024)

5.1.3 DECADAL FLUCTUATION IN WATER LEVEL

Decadal Fluctuation of Water Level in Unconfined Aquifer (Decadal Mean April (2014-2023) to April 2024)

Rise in Water Levels:

Out of 563 wells, water level rise of less than 2 m is recorded in 93% wells, 2 to 4 m in remaining 7% wells. Water level rise of less than 2 m is seen in all the districts, significantly in Kasaragod, Malappuram, Thrissur and Kannur districts. Water level rise of 2 to 4 m is observed in some wells located in Thiruvananthapuram, Malappuram, Kollam, Ernakulam, Palakkad districts.

Fall in Water Levels:

Out of the 660 wells that have registered fall in water levels, 94% have recorded less than 2 m while 6% in the range of 2 to 4 m. Fall of less than 2 m is observed in all districts mainly in parts of Wayanad, Kottayam, Pathanamthitta, Palakkad, Kozhikkode, Idukki, Ernakulam, Alappuzha districts. Fall of 2 to 4 m, recorded in Kannur, Ernakulam, Kozhikkode, Malappuram, Thiruvananthapuram districts. Fall beyond 4 mis recorded a well located in Thiruvananthapuram district.

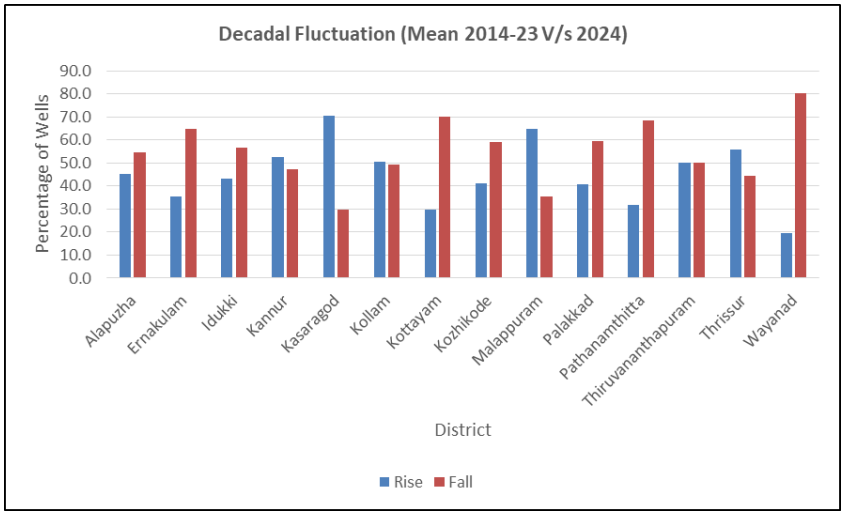

Figure-12: Percentage of wells showing rise and fall in WL in unconfined Aquifer (Decadal Mean April (2014-2023) to April 2024)

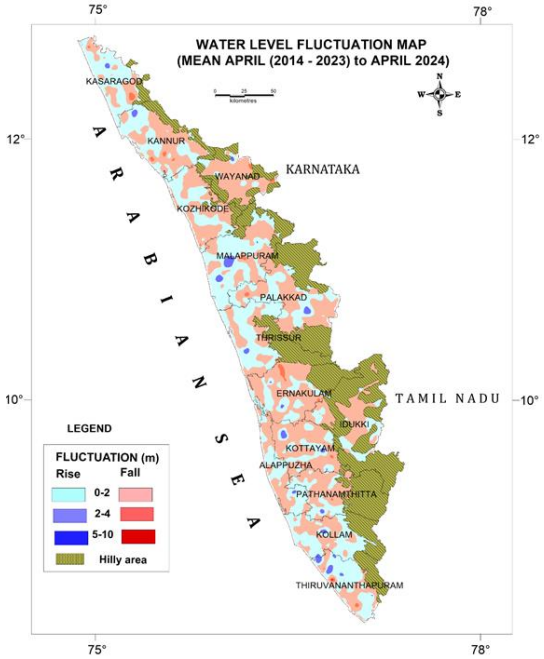

Figure-13: Water level fluctuation with respect to decadal mean (April (2014-2023) to April 2024)

5.2 DEEPER AQUIFER (CONFINED/ SEMI-CONFINED)

5.2.1 DEPTH TO PIEZOMETRIC LEVEL

Depth to Piezometric Level in Confined/Semi-Confined Aquifer(April 2024)

CGWB has 276 piezometers in various districts of the State which are being monitored four times a year. Out of these 50 piezometers (Tube wells) are tapping the Palaeogene-Neogene Aquifers. The depth of these piezometers ranges from 10 m to 450 m. The remaining 226 piezometers (Bore wells) are in hard rock areas and the depth of these wells ranges from 10 m. to 300 m. About 44% of these bore wells are tapping shallow fracture zones within 30 meters depth. In the Palaeogene-Neogene aquifer system, ground water is under confined to semi-confined condition. However, in the phreatic aquifers of both Palaeogene-Neogene formations and in Quaternary-Recent alluvial formations, ground water occurs under unconfined to semi-confined condition.

The Piezometric head is analyzed for 231 wells and district-wise well frequency for different ranges of piezometric head during April 2024 has been prepared. It is observed that the depth to piezometric head ranges from 0.78 m bgl (Arattukadavu, Thrissur district) to 95.95 m bgl (Villooni, Palakkad district). In 65.07% of the monitored piezometers depth to piezometric head varies from 5 to 20 m bgl and 20.55 % of wells showing depth to piezometric head within 5 m bgl. 14.38% wells show depth to piezometric head more than 20 m bgl.

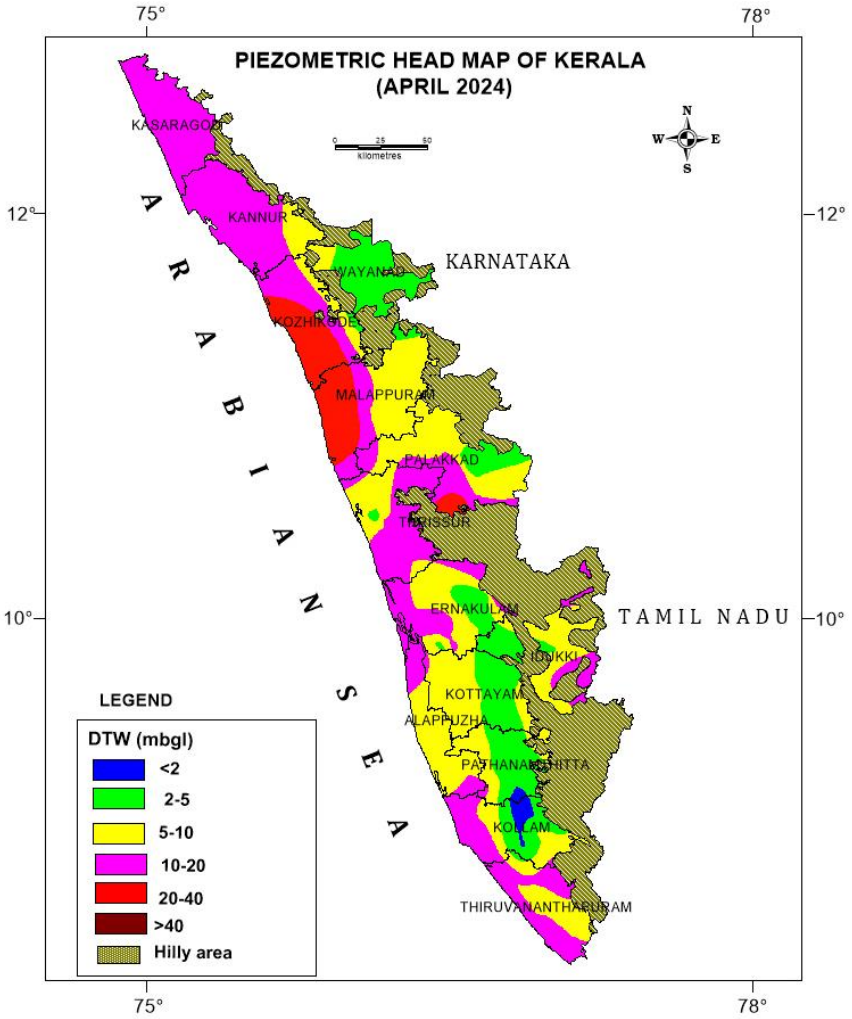

Figure-15: Depth to piezometric Level in deeper aquifer in April 2024.

5.2.2 ANNUAL FLUCTUATION IN PIEZOMETRIC LEVEL

Annual Fluctuation of Piezometric Level in Confined/ Semi-Confined Aquifer (April 2023 to April 2024)

Rise in Piezometric Levels:

Out of 231 wells, piezometric level rise of less than 2 m is recorded in 28.07 % wells, 2 to 4 m in 5.26% wells. Piezometric level rise of less than 2 m is seen in all the districts, significantly in Thiruvananthapuram, Kollam, Ernakulam districts. Piezometric level rise of 2 to 4 m is observed in districts such as Wayanad, Palakkad, and Thiruvananthapuram. Rise of more than 4 m is not observed in any of the districts.

Fall in Piezometric Levels:

Out of 231 piezometers, 30% have recorded less than 2 m while 11% in the range of 2 to 4 m and remaining 26% wells registered piezometric level fall of more than 4 m. Fall of less than 2 m is mainly observed in parts of Thiruvananthapuram, Kollam, Palakkad, Kasaragod, Kottayam, Alappuzha districts. Fall of 2 to 4 m is observed mainly in Kasaragod, Malappuram, Kannur districts. Fall of beyond 4 m is observed as isolated patches in Palakkad, Malappuram, Ernakulam, Thrissur, districts.

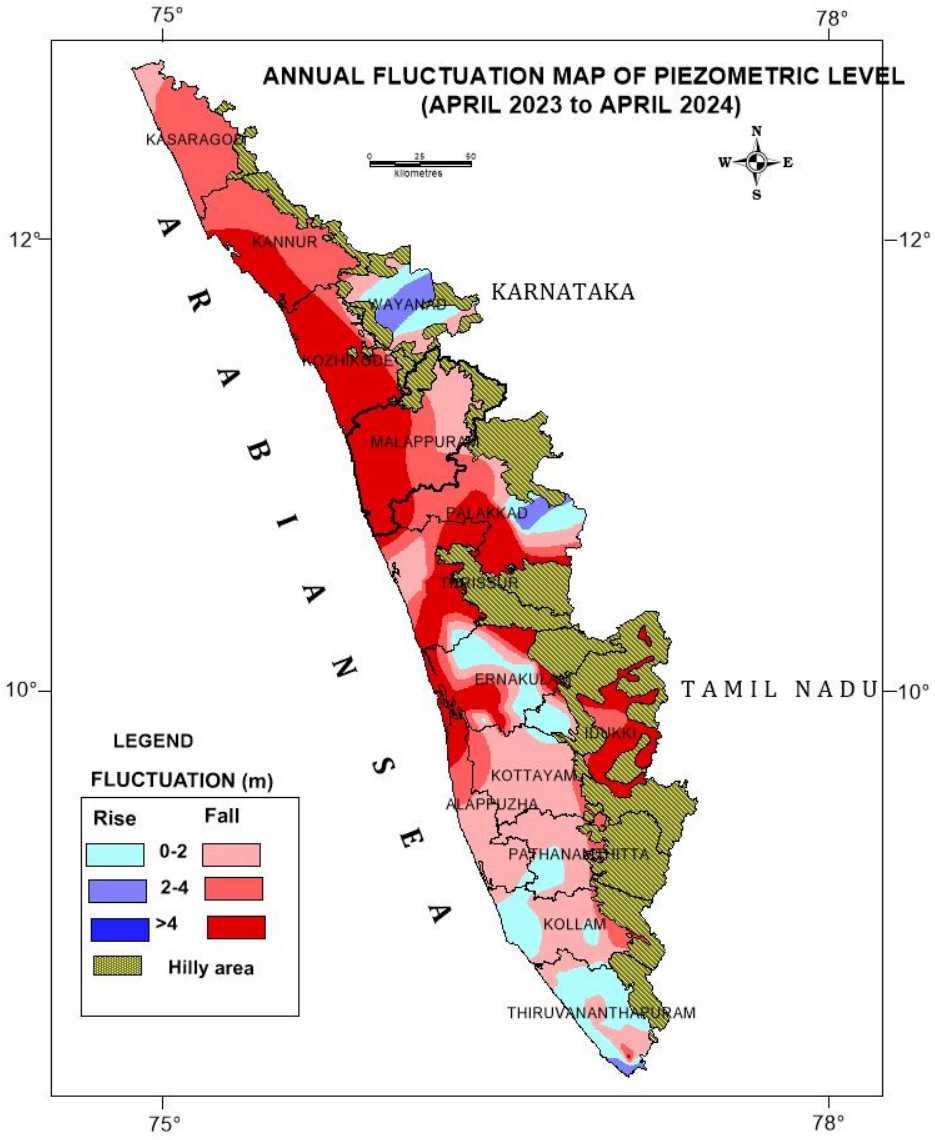

Figure-15: Annual water level fluctuation in confined/semi-confined aquifer (April 2023 to April 2024).

5.2.3 DECADAL FLUCTUATION IN PIEZOMETRIC LEVEL

Decadal Fluctuation of Piezometric Level in Confined /Semi-confined Aquifer (Decadal Mean April (2014-2023) to April 2024)

Rise in piezometric levels:

Out of 128 wells analyzed, piezometric level rise of less than 2 m is recorded in 30% wells, 2 to 4 m in 4% wells and more than 4 m in 2% of the wells. Piezometric level rise of less than 2 m is seen significantly in Alappuzha, Ernakulam, Kasaragod, Kozhikode, Palakkad, Thiruvananthapuram districts. Piezometric level rise of 2 to 4 m is observed in Palakkad, Thrissur, Ernakulam districts.

Fall in piezometric levels:

Out of 128 wells analyzed, piezometric level rise of less than 2 m is recorded in 36% wells, 2 to 4 m in 11% wells and more than 4 m in 15% of the wells. Piezometric level rise of less than 2 m is seen in almost all the districts, significantly in Alappuzha, Kannur, Kasaragod, Kollam, Kozhikode, Malappuram, Palakkad, Thiruvananthapuram, Wayanad districts. Piezometric level rise of 2 to 4 m is observed in Malappuram, Palakkad, Kozhikode, Thiruvananthapuram districts. Rise of more than 4 m is significantly observed in Kasaragod, Palakkad, and Thrissur districts.

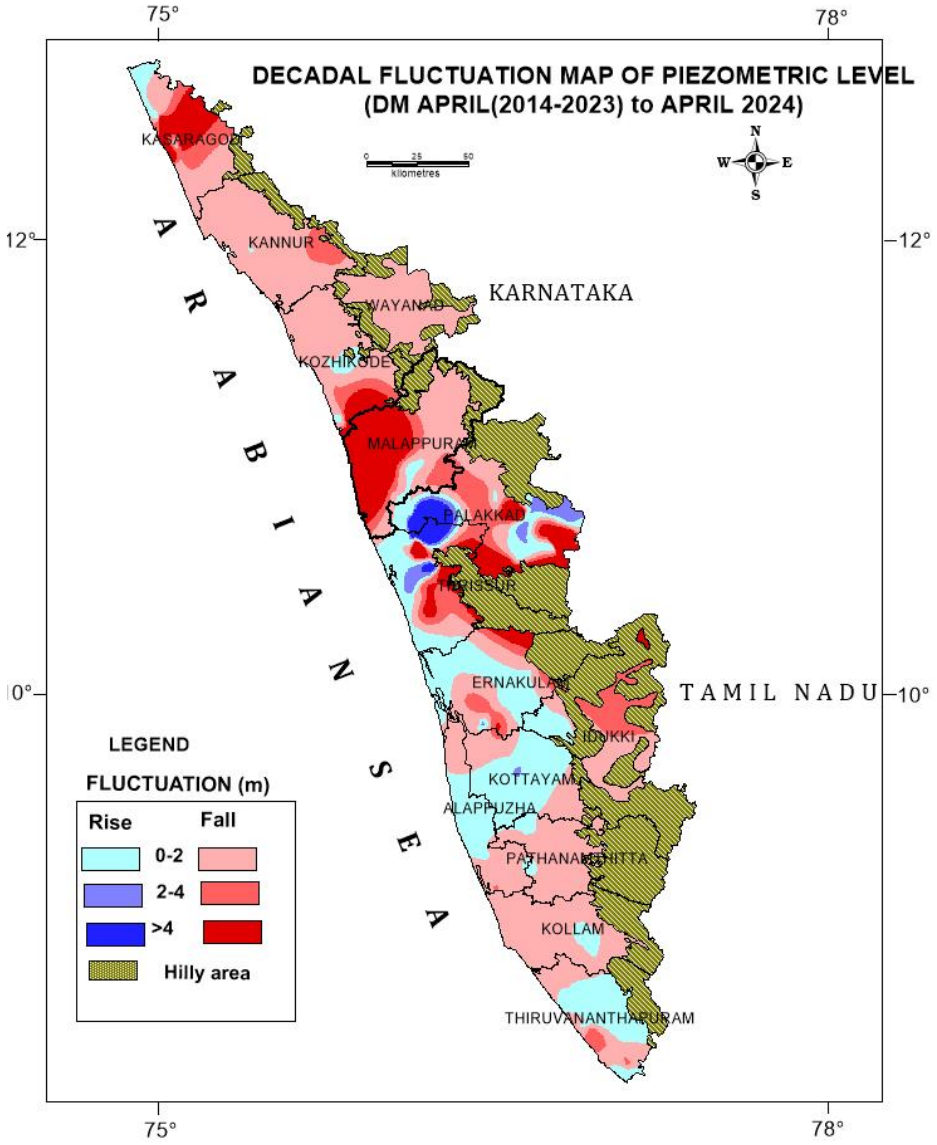

Figure-19: Piezometric level fluctuation with respect to decadal mean (April (2014-2023) to April 2024) in confined/semi-confined aquifer

6.0 SUMMARY

As a vertical of the National Ground Water Monitoring Programme, the CGWB, Kerala Region, Thiruvananthapuram carry out monitoring of the ground water conditions of the State during four times in an year: viz January, April, August, and November. Additionally, a yearly assessment ofground water quality is performed in April month. As of April, 2024, the Region monitors 1383 dug wells and 281 piezometers. This comprehensive effort aims to portray the variations in the state's ground water conditions across different aquifers.

In April 2024, out of the 1383 dug wells monitored representing unconfined aquifer, depth to water level is within 10 m bgl in most of the parts in the State with 83%, while remaining 17 % of wells show depth to water level more than 10 m bgl.

The State has received normal rainfall from January 2024 to March 2024. with a departure of +8% from the normal. However, the rainfall pattern varies spatially such that the southern districts and Palakkad has received significantly less rainfall than the normal, whereas the northern districts are classified as rainfall ‘Excess’. This spatial variation in rainfall distribution is obviously reflected in groundwater scenario of the State.

Comparison of depth to water level between April 2023 and 2024 indicates that 43.47 % of analyzed wells shows rise in water level and 56.53 % fall in water levels. The comparison between April decadal mean with respect to April 2024 shows that 46.03% of wells in rising and 53.97 % of wells in falling trend.