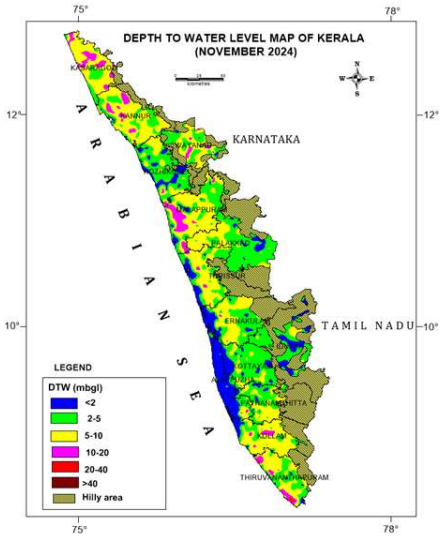
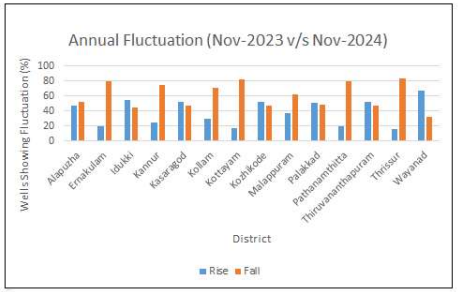
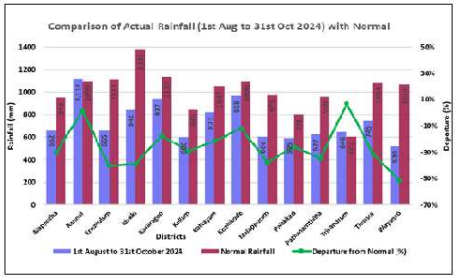






GROUND WATER LEVEL BULLETIN
NOVEMBER 2024
KERALA STATE

ABSTRACT

The behavior of ground water table during the Post-Monsoon period (November-2024) in Kerala State has been studied by monitoring Board's groundwater monitoring dug wells and purpose-built piezometers. As of November 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 deficient rainfall from August 2024 to October 2024, with a departure of -27% 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 (92% of the GWMS), while remaining 8 % of wells show depth to water level more than 10 m bgl.

Annual depth to water level of phreatic aquifer during November 2023 and 2024 indicates that, 37.36 % of analyzed wells shows rise in water level and 62.64 % fall in water levels. The comparison between November decadal mean with respect to November 2024 shows that 55.53% of wells in rising and 44.47 % of wells in falling trend.

In confined/semi-confined aquifers, annual fluctuation of piezometric head shows falling trend in 54% 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 74% of the wells show fall in head, while the remaining wells show a rise in head.

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. Anetwork of 25437 observation wells called **National Hydrograph Network Stations (NHNS)**, as on 30.04.2024, 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.

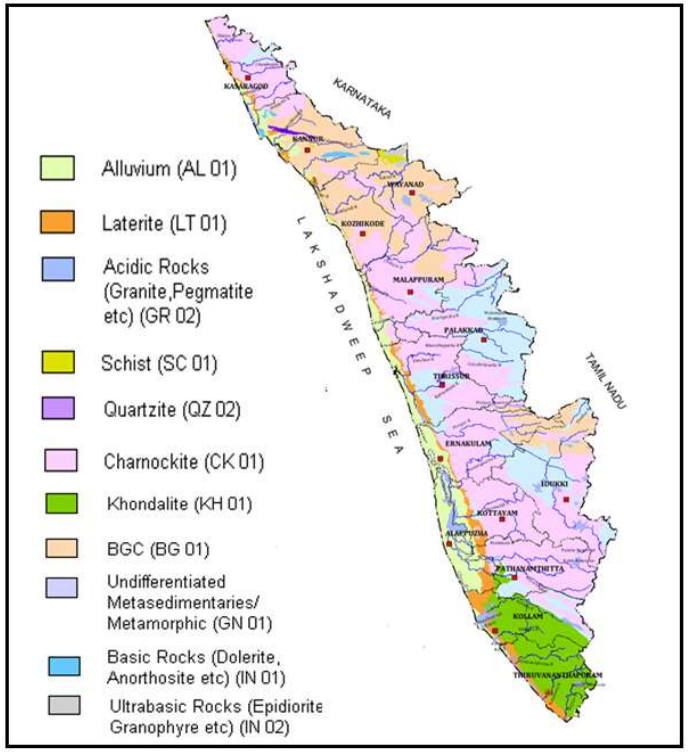


Figure-1: Map showing major aquifers and administrative divisions of Kerala

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 7.6 m 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**.

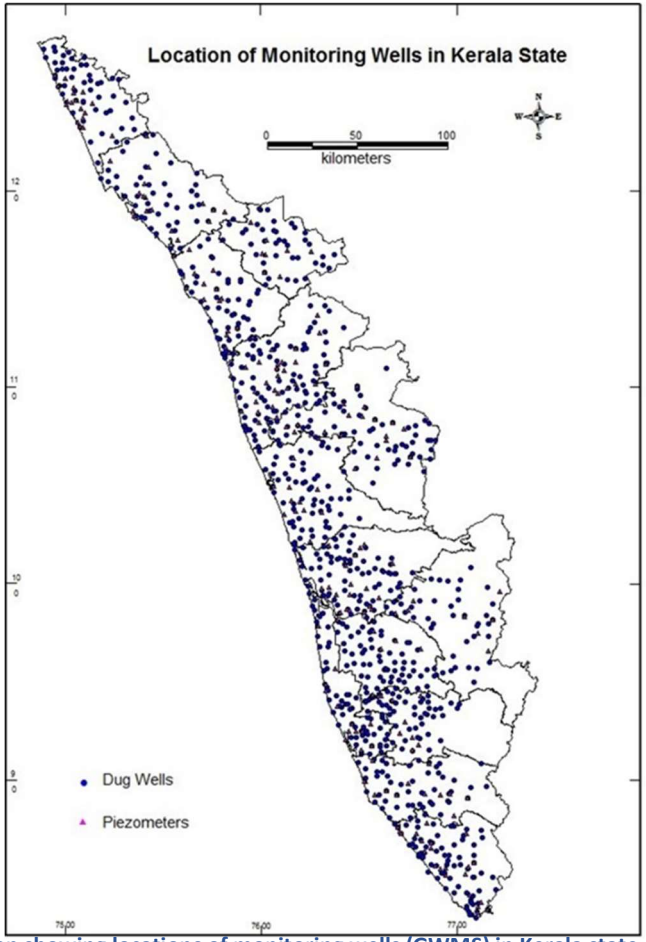


Figure- 2: Map showing locations of monitoring wells (GWMS) in Kerala state

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 August 2024 - October 2024. Table-2 gives the district-wise rainfall data for the period August to October 2023 & 2024, normal and the departure of August- October 2024 rainfall with other periods.

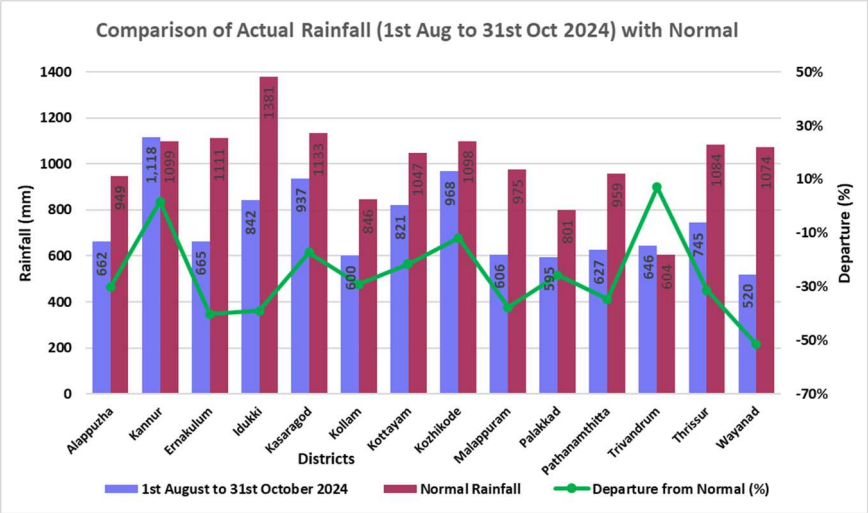
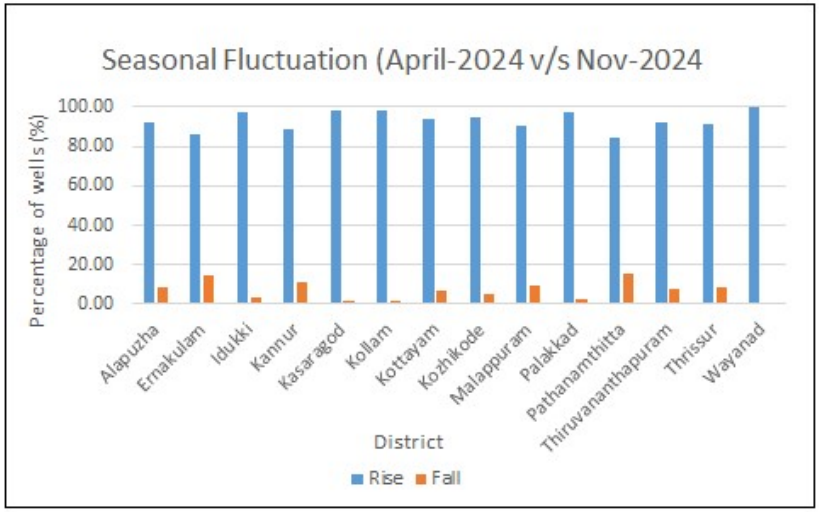


Figure-3: Rainfall deviation (August 2024-October 2024) from normal rainfall

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

Name of the District	Rainfall (mm)		Departure from 2023 (%)
	1st Aug to 31st Oct 2024	1st Aug to 31st Oct 2023	
Alappuzha	662.1	1081.3	-39%
Kannur	1117.9	826.9	35%
Ernakulam	664.5	978.7	-32%
Idukki	841.6	726.8	16%
Kasaragod	936.8	865.2	8%
Kollam	600.1	843.9	-29%
Kottayam	821.2	844.2	-3%
Kozhikode	967.6	885.3	9%
Malappuram	605.7	726.6	-17%
Palakkad	595.4	499.5	19%
Pathanamthitta	626.9	1137.4	-45%
Thiruvananthapuram	645.9	825.3	-22%
Thrissur	744.6	714.5	4%
Wayanad	520.4	365.2	42%
State Mean	**739.3**	**808.6**	**-9%**



5.0 GROUND WATER LEVEL SCENARIO (NOVEMBER 2024)

5.1 SHALLOW AQUIFER (UNCONFINED)

5.1.1 DEPTH TO WATER LEVEL

Depth to Water Level in Unconfined Aquifer (November 2024)

The depth to water level of 1383 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 92 % of wells analyzed, whereas, 8 % of wells show depth to water level more than 10 m bgl. During the month of November 2024, the depth to water level of phreatic aquifer in the State varied from 0.06 to 10.81 mbgl with median of 4.63 m bgl. The outliers of 86 data points ranges from 10.83 m bgl to 45.13 m bgl, majority of which belongs to the phreatic zones in part of Kasaragod, Malappuram, and Thiruvananthapuram districts. Shallow water level in the range of 0 to 2 mbgl is observed mostly in parts of Alappuzha, Kottayam, Palakkad and Idukki districts. 20.9 % 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 33.1 % and 38 % 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 November-2024. Water level in the range of 10 to 20 mbgl is recorded for about 7.6 % of the analyzed wells, and are mostly belongs to Kasaragod, Malappuram, Thiruvananthapuram, Wayanad and Kannur districts. As mentioned earlier, deeper water levels more than 20 m bgl are observed in less than 1% wells.

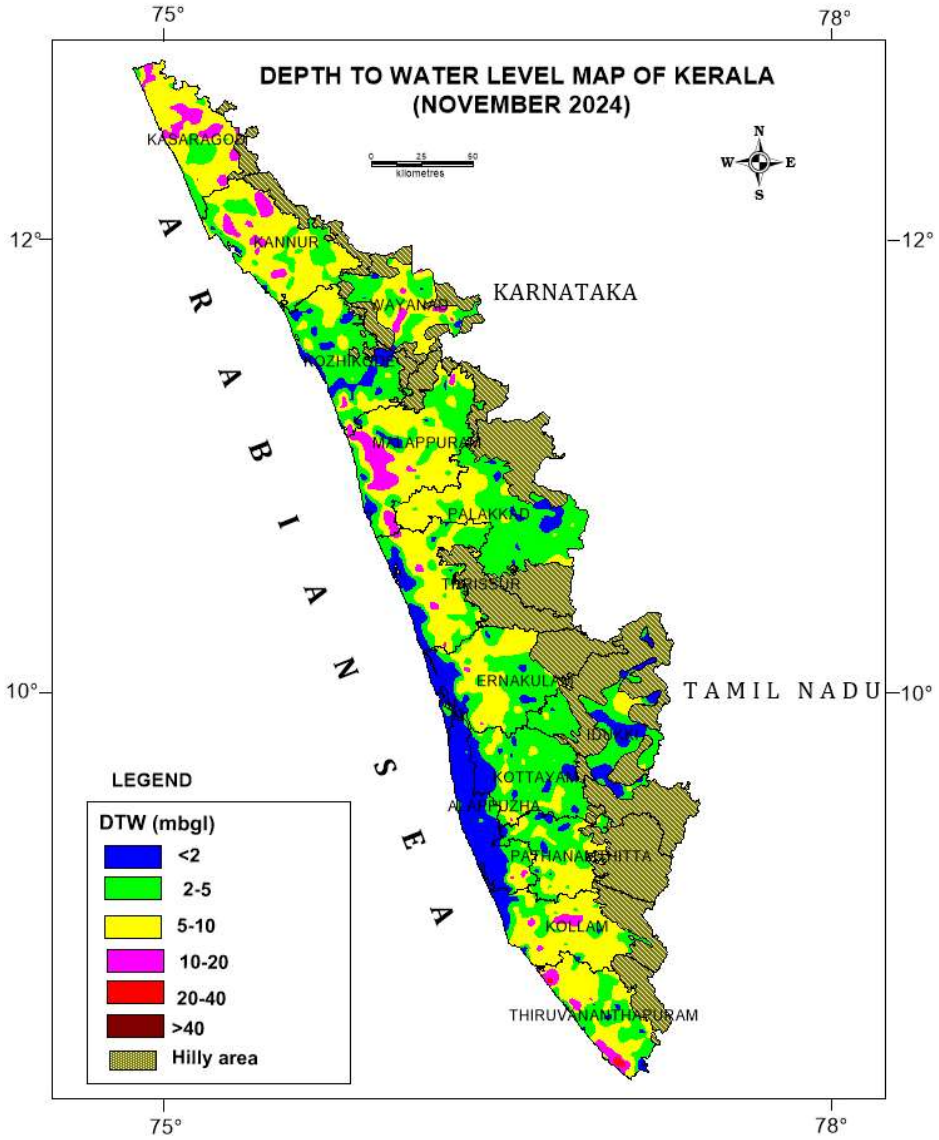


Figure-5: Depth to water Level in phreatic aquifer in Kerala during November 2024

5.1.2 SEASONAL FLUCTUATION IN WATER LEVEL

Seasonal Fluctuation of Water Level in Unconfined Aquifer (April 2024 to November 2024)

Rise in Water Levels:

Out of 1175 wells, water level rise of less than 2 m is recorded in 63% wells, 2 to 4 m in 29% wells and more than 4 m in 8% of the wells. Water level rise of less than 2 m is seen in all the districts, significantly in all districts except Thiruvananthapuram and Wayanad districts. Water level rise of 2 to 4 m is observed in limited number of wells and not recorded in Palakkad, Thiruvananthapuram, Kollam and Wayanad districts. Rise of more than 4 m is observed in some wells located in Kasaragod, Palakkad, Wayanad and Thiruvananthapuram districts.

Fall in Water Levels:

Out of 113 wells that have registered fall in water levels, 87% have recorded less than 2 m while 12% 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 Ernakulam, Thiruvananthapuram, Malappuram, Pathanamthitta, and Thrissur districts. Fall of 2 to 4 m is observed in few wells located in Pathanamthitta, Thiruvananthapuram, Ernakulam districts. Fall of beyond 4 m is observed in 2 wells located in Thiruvananthapuram and Kannur districts.

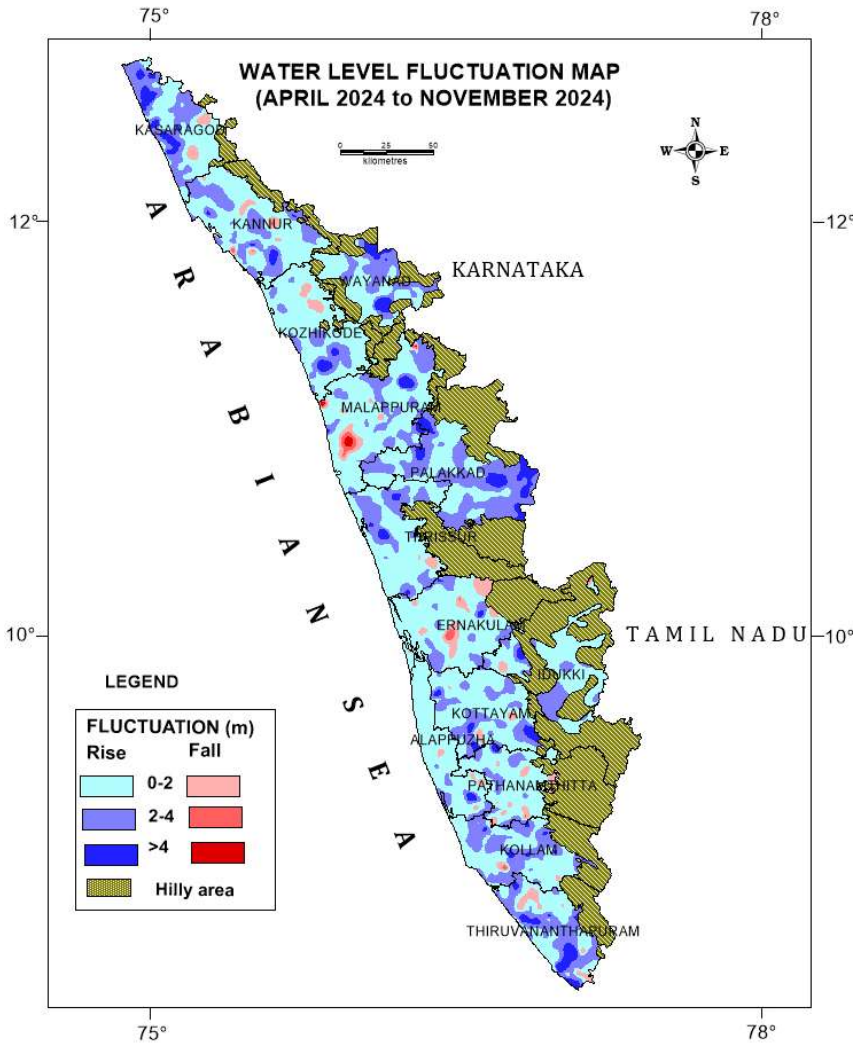


Figure-6: Seasonal water level fluctuation in unconfined aquifer in Kerala during November 2024

5.1.3 ANNUAL FLUCTUATION IN WATER LEVEL

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

Rise in Water Levels:

Out of 458 wells, water level rise of less than 2 m is recorded in 91% wells, 2 to 4 m in 8% wells and more than 4 m in 1% of the wells. Water level rise of less than 2 m is seen in all the districts, significantly in Kasaragod, Idukki, Kozhikode, Wayanad, Alappuzha districts. Water level rise of 2 to 4 m is observed in limited number of wells and not recorded in Kasargod, Pathanamthitta, Thrissur districts. Rise of more than 4 m is observed in a few wells located in Wayanad, Malappuram and Thiruvananthapuram districts.

Fall in Water Levels:

Out of 768 wells that have registered fall in water levels, 91% have recorded less than 2 m while 7% in the range of 2 to 4 m and remaining 2% wells registered water level fall of more than 4 m. Fall of less than 2 mis mainly observed in parts of Ernakulam, Alappuzha, Kannur, Malappuram, Pathanamthitta, Kottayam, Kollam and Thrissur districts. Fall of 2 to 4 m is observed mainly in Pathanamthitta, Kottayam, Ernakulam districts. Fall of beyond 4 m is observed in some pockets located in Pathanamthitta, Thiruvananthapuram, Kannur, Ernakulam districts.

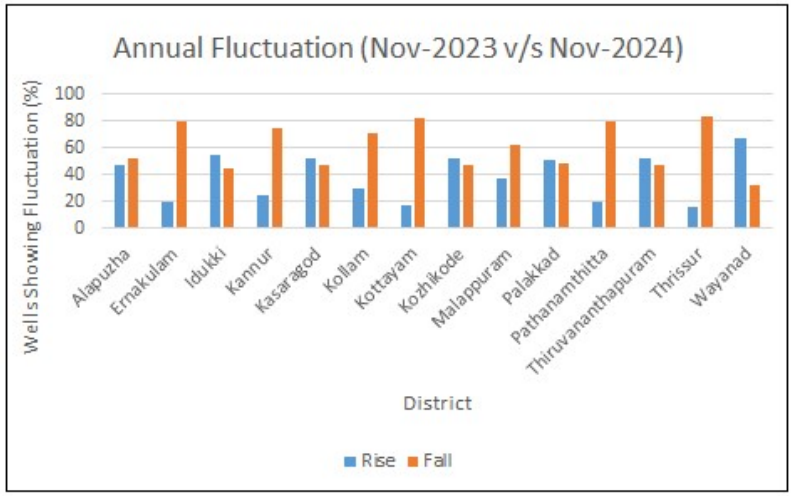


Figure-7: Percentage of wells showing rise and fall in WL in unconfined aquifer (November 2023 to November 2024)

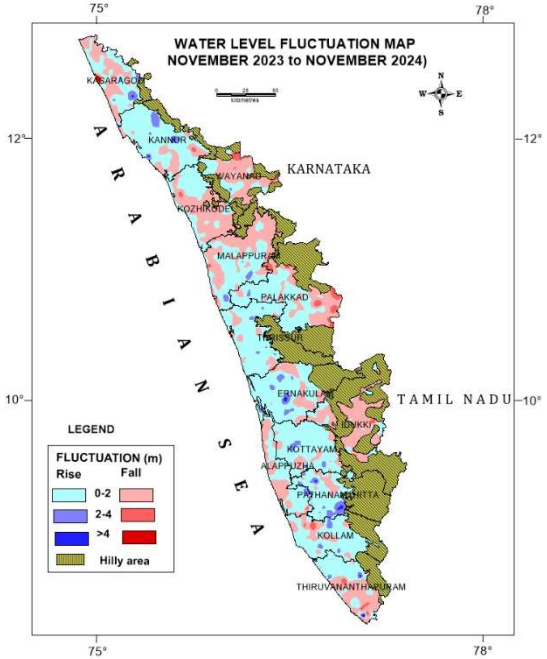


Figure-8: Annual water level fluctuation in unconfined aquifer(November 2023 to November 2024)

5.1.4 DECADAL FLUCTUATION IN WATER LEVEL

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

Rise in Water Levels:

Out of 698 wells, water level rise of less than 2 m is recorded in 93% wells, 2 to 4 m in 6% wells, and more than 4 m in remaining 1% wells. Water level rise of less than 2 m is seen in all the districts, significantly in Ernakulam, Kasaragod, Malappuram, Palakkad, Thiruvananthapuram and Thrissur districts. Water level rise of 2 to 4 m is observed in some wells in all districts except Pathanamthitta. Rise in water level more than 4 m is recorded in few wells located in Thiruvananthapuram, Kozhikode, Idukki, Ernakulam districts.

Fall in Water Levels:

Out of the 559 wells that have registered fall in water levels, 94% have recorded less than 2 m while 5% in the range of 2 to 4 m. Fall more than 4m was observed in 1% of the wells analyzed. Fall of less than 2 m is observed in all districts mainly in parts of Kollam, Malappuram, Kottayam, Pathanamthitta, Thrissur, districts. Fall of 2 to 4 m, recorded in Kollam, Pathanamthitta, Thrissur, Wayanad districts. Fall beyond 4 mis recorded in few wells located in Kannur, Kozhikode, Malappuram, Thiruvananthapuram districts.

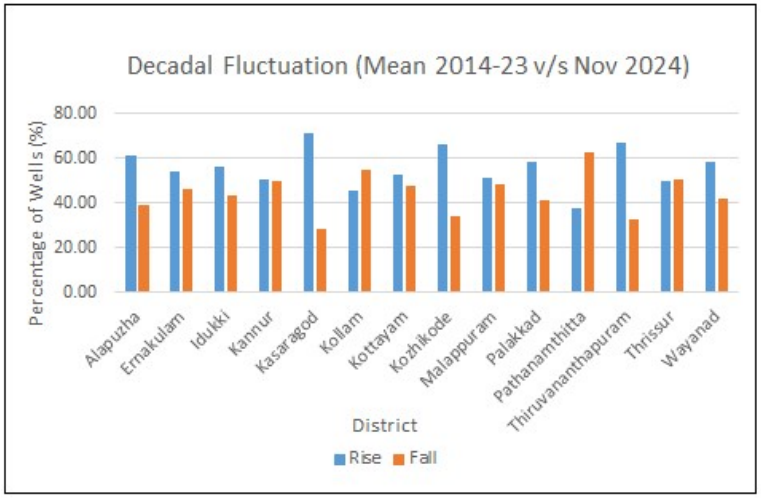


Figure-9: Percentage of wells showing rise and fall in WL in unconfined Aquifer (Decadal Mean November (2014-2023) to November 2024)

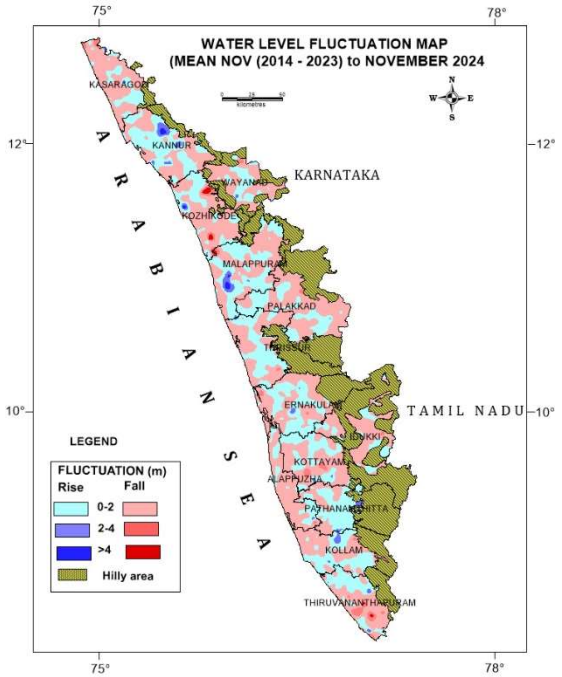


Figure-10: Water level fluctuation with respect to decadal mean (April (2014-2023) to April 2024)

5.2 DEEPER AQUIFER (CONFINED/ SEMI-CONFINED)

5.2.1 DEPTH TO PIEZOMETRIC LEVEL

Depth to Piezometric Level in Confined/Semi-Confined Aquifer (November 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 250 wells and district-wise well frequency for different ranges of piezometric head during November 2024 has been prepared. It is observed that the depth to piezometric head ranges from 0.26 m bgl (Mannamkandam, Idukki district) to 55.98 m bgl (Anakkara, Idukki district). In 69.2% of the monitored piezometers depth to piezometric head varies from 0 to 10 m bgl and 32.4 % of wells showing depth to piezometric head within 5 m bgl. 31.2% wells show depth to piezometric head more than 10 m bgl.

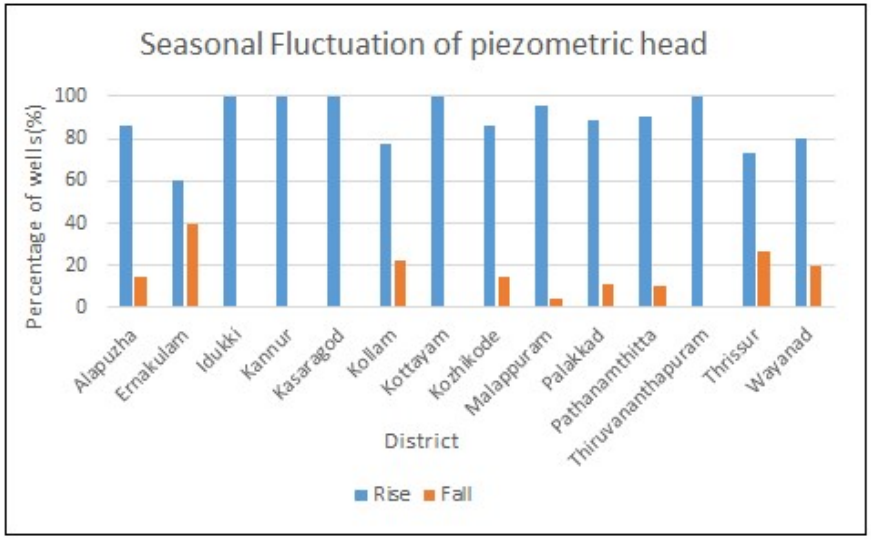


Figure-11: Percentage of wells showing rise and fall in WL in confined/semi-confined aquifer(April 2024 to November 2024)

5.2.2 SEASONAL FLUCTUATION IN PIEZOMETRIC LEVEL

Seasonal Fluctuation of Piezometric Level in Confined/ Semi-Confined Aquifer (November 2023 to November 2024)

Rise in Piezometric Levels:

Out of 206 wells analyzed, piezometric level rise of less than 2 m is recorded in 37 % wells, 2 to 4 m in 27 % wells and 25% wells registered piezometric level fall of more than 4 m. Piezometric level rise of less than 2 m is seen in all the districts, significantly in Alappuzha, Ernakulam, Kozhikode, Malappuram, Palakkad, Pathanamthitta districts. Piezometric level rise of 2 to 4 m is observed in districts such as Kasaragod, Kozhikode, Malappuram, Palakkad and Thiruvananthapuram. Rise of more than 4 m is observed mainly in Kasaragod, Malappuram, Palakkad, Pathanamthitta and Thrissur districts.

Fall in Piezometric Levels:

Out of 206 piezometers, 8% have recorded less than 2 m while 1% in the range of 2 to 4 m and remaining 2% wells, registered piezometric level rise of more than 4 m. Fall of less than 2 m is mainly observed in parts of Kollam, Palakkad, Ernakulam, Thrissur districts. Fall of 2 to 4 m is observed in Ernakulam and Palakkad districts. Fall of beyond 4 m is observed as isolated patches in Palakkad, Alappuzha, Ernakulam, Kozhikode, districts.

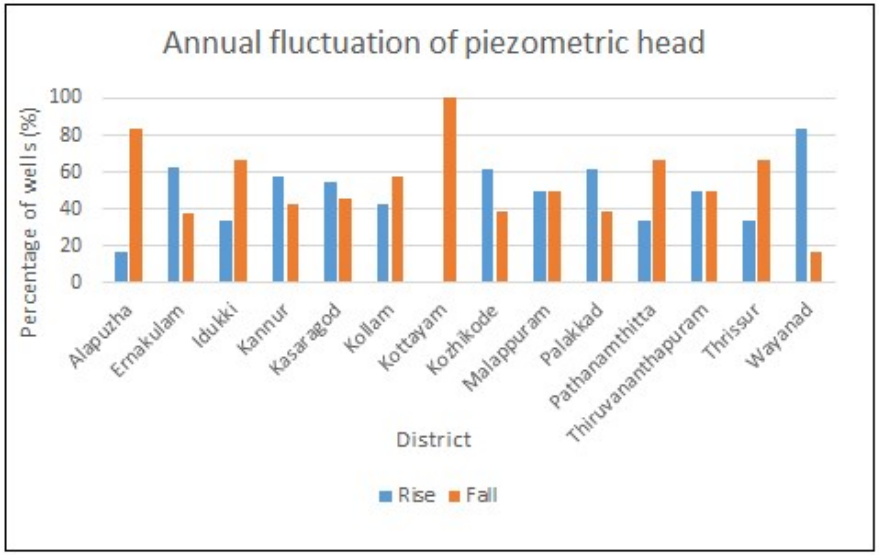


Figure-12: Percentage of wells showing rise and fall in WL in confined/semi-confined aquifer (November 2023 to November 2024).

5.2.2 ANNUAL FLUCTUATION IN PIEZOMETRIC LEVEL

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

Rise in Piezometric Levels:

Out of 206 wells, piezometric level rise of less than 2 m is recorded in 40 % wells, 2 to 4 m in 4% wells and 5% wells registered piezometric level rise of more than 4 m. Piezometric level rise of less than 2 m is seen in all the districts, significantly in Palakkad, Thiruvananthapuram, Kasaragod, Kozhikode, Malappuram districts. Piezometric level rise of 2 to 4 m is observed in districts such as Palakkad, Thiruvananthapuram. Rise of more than 4 m is observed in 4.5% of wells and seen in Palakkad and Malappuram districts.

Fall in Piezometric Levels:

Out of 206 piezometers, 45% have recorded less than 2 m while 2% in the range of 2 to 4 m and remaining 4% wells registered piezometric level fall of more than 4 m. Fall of less than 2 m is mainly observed in parts of Thiruvananthapuram, Palakkad, Kasaragod, Ernakulam, Pathanamthitta Alappuzha districts. Fall of 2 to 4 m is observed mainly in Thrissur, Malappuram, Kottayam districts. Fall of beyond 4 m is observed as isolated patches in Palakkad, Kasaragod, Ernakulam, districts.

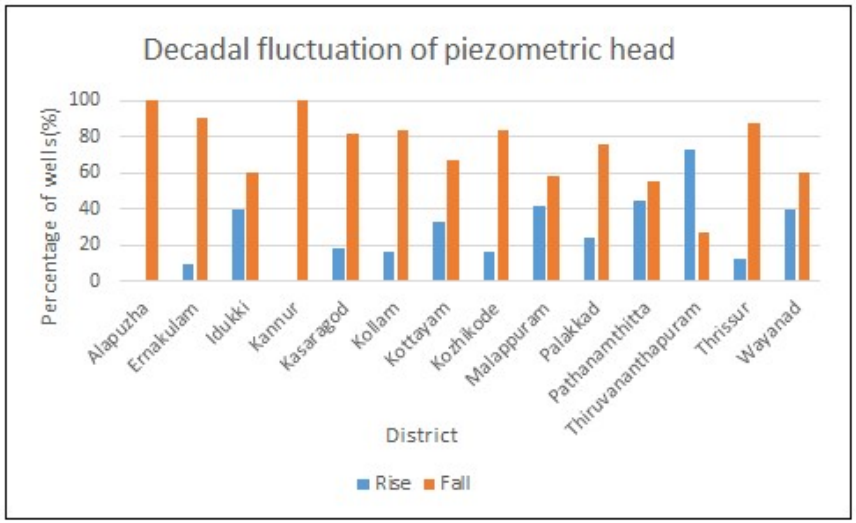


Figure-13: Percentage of wells showing rise and fall in WL in confined/semi-confined aquifer (Decadal Mean November (2014-2023) to November 2024).

5.2.3 DECADAL FLUCTUATION IN PIEZOMETRIC LEVEL

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

Rise in piezometric levels:

Out of 132 wells analyzed, piezometric level rise of less than 2 m is recorded in 24% wells, 2 to 4 m in 2% wells and more than 4 m in 1% of the wells. Piezometric level rise of less than 2 m is seen significantly in Idukki, Kottayam, Malappuram, Wayanad, Thiruvananthapuram districts. Piezometric level rise of 2 to 4 m is observed in Palakkad, Thiruvananthapuram, Malappuram districts.

Fall in piezometric levels:

Out of 132 wells analyzed, piezometric level rise of less than 2 m is recorded in 58% wells, 2 to 4 m in 7% wells and more than 4 m in 8% of the wells. Piezometric level fall of less than 2 m is seen in almost all the districts, significantly in Alappuzha, Kannur, Kasaragod, Kollam, Kozhikode, Ernakulam, Thrissur districts. Piezometric level rise of 2 to 4 m is observed in Malappuram, Palakkad, Kozhikode, Alappuzha districts. Rise ofmore than 4 m is significantly observed in Kasaragod, Palakkad, and Thrissur districts.

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 assessment of ground water quality is performed in April and November months. As of November, 2024, the Region monitors 1388 dug wells and 281 piezometers. This comprehensive effort aims to portray the variations in the state's ground water conditions across different aquifers.

In November 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 92%, while remaining 8 % of wells show depth to water level more than 10 m bgl.

The State has received deficient rainfall from August 2024 to October 2024. with a departure of -27% from the normal. However, the rainfall pattern varies spatially such that the southern districts except Thiruvananthapuram has received significantly less rainfall than the normal, whereas the northern districts are classified as rainfall ‘normal’. This spatial variation in rainfall distribution is obviously reflected in groundwater scenario of the State.

Comparison of depth to water level between November 2023 and 2024 indicates that 37.36% of analyzed wells shows rise in water level and 62.64% fall in water levels. The comparison between November decadal mean with respect to November 2024 shows that 55.53% of wells in rising and 44.47 % of wells in falling trend.