GROUND WATER LEVEL BULLETIN

MAY 2024

HIMACHAL PRADESH

ABSTRACT

Ground water level Scenario during May-2024 highlighting the findings, status of ground water level in different aquifers and its seasonal, annual and decadal comparison.

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 climatic parameters like rainfall, evapotranspiration etc., whereas anthropogenic influences include pumpage 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 Groundwater 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.

STUDY AREA

Himachal Pradesh is located between the north latitude30º22'40" &33º12'40"and east longitude 75º47'55" & 79º04'20". It falls in Survey of India topographic sheets Nos. 52D, 52H, 52L, 53A, 53B, 53F, 53E and 53I and covers an area of 55,673 sq km. It is one of the predominantly hilly states in India, which lies in the western Himalayas. The length of Himachal Pradesh is about 355 km i.e., from northwestern part of Chamba to southeastern part of Kinnaur. The breadth of the state is about 270 km i.e., from western part of Una to northeast part of Lahaul and Spiti Disrtict. The state is bounded by the state of Jammu & Kashmir in north, Punjab state in west, Haryana state in south and Uttrakhand state in southeast and shares an international border with China (Tibet) in northeast.

Administratively, the state is divided in 12 Districts, 76 Tehsils, 34 Sub-Tehsils and 78 Blocks. There are 20,690 villages, 3,226 Gram Panchayats, 59 towns, 28 Nagar Panchayats and 25 Nagar Parishads including Municipal Corporations. Lahaul & Spiti is the largest and Hamirpur is the smallest District of the state with geographical area of 12,835 and 1,118 sq km respectively.

The state has a population of 68,64,602 persons (Census 2011) having an average population density of 128 person per sq km. The male population in the state is 34,81,873 persons and female population is 33,82,729. The rural

and urban population in the state is 61,76,050 and 6,00,552 persons respectively. The density of population in the state varies from as low as 2 persons/sq.km in Lahaul and Spiti District to 406 persons/sq km in Hamirpur District as compared to the state average of 128 persons/sq km.

Himachal region presents an intricate mosaic of mountain ranges, hills and valleys with altitude ranging from 350 m to 6500 m amsl. The Dhauladhar range looks in supreme majesty over the Kangra valley while the Pir Panjal, the Great Himalaya and the Zanskar ranges guard over Chamba, Lahaul & Spiti, Kullu and Kinnaur Districts. The mountain slopes are covered with forests and meadows. The valleys below are interspersed with numerous streams, fields and quiet homesteads. There is general increase in elevation from east to west and from south to north. The physiographic divisions from south to north are the Outer Himalayas also known as Siwaliks (350 to 1500 m amsl), the Lesser Himalayan Range (1500-5000 m amsl), Great Himalayan Range (5000 – 6000 m amsl) and Zanskar Range (> 6000 m amsl)

Himachal state has a unique distinction of having drainage systems of both the Indus and the Ganga basin. The major river systems of the region are the Chandra-Bhaga or the Chenab, the Ravi, the Beas, the Satluj and the Yamuna. The catchments of the rivers are fed by snow and rainfall, And are protected by fairly extensive cover of natural vegetation. Major rivers of the Indus River basin are the Chenab, the Ravi, the Beas and the Satluj. The Yamuna is the only river contributing water to Ganga basin.

The southwestern monsoon contributes about 70% of rain fall during monsoon period from July to September and about 30%occurs during non-monsoon period due to western disturbances and in the form of thunder storm. Generally, rainfall increases from south to north. Western disturbances also shower rainfall in winters. Beyond Kullu towards Lahaul & Spiti and Kinnaur, rain fall decreases due to rain shadow effect. Spiti is the driest area with 50 mm rainfall because of being enclosed by High Mountain from all sides. The average annual rainfall in the Districts of the state varies from about 600 mm in Lahaul & Spiti to more than 2400 mm in Kangra.

GROUND WATER LEVEL MONITORING

Central Ground Water Board, Northern Himalayan Region, is monitoring changes in groundwater regime in Himachal Pradesh state on quarterly basis continuously. This is facilitated by a network of monitoring stations in the State located in diverse hydrogeological and geomorphic units. The number of operational wells till January 2024 was 213 which include 136 dug wells, 53 piezometers and 24 springs. In May 2024, 220 wells which include 137 dug wells, 56 piezometers and 27 springs. The district-wise breakup of the water level monitoring stations is given in **Table-1**.

Sl. No	Name of the District	Number of GW Monitoring Stations (MAY-2024)				
		Dug Well	Piezometer	Hand pump	Spring	Total
1	Hamirpur	6	3	-	-	9
2	Bilaspur	4	8	-	-	12
3	Kangra	46	18	-	2	66
4	Kullu	2	3	-	-	5
5	Mandi	10	-	-	4	14
6	Sirmaur	19	9	-	-	28
7	Solan	14	5	-	-	19
8	Una	34	8	-	-	42
9	Chamba	2	2	-	21	25
	TOTAL					**220**

Table-1 District-wise breakup of the water level monitoring stations

RAINFALL

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 – May 2024. Table-2 gives the district-wise rainfall data for the period January 2024 – May 2024.

S.N.	Name of Districts	Rainfall 01.01.2024 to 31.05.2024 (mm)
1	BILASPUR	189
2	CHAMBA	487.7
3	HAMIRPUR	200.5
4	KANGRA	236.7
5	KINNAUR	225.2
6	KULLU	539.6
7	LAHAUL & SPITI	385.8
8	MANDI	305.3
9	SHIMLA	261.3
10	SIRMAUR	219.1
11	SOLAN	166.1
12	UNA	138.5

Table-2 District-wise Rainfall from 01.01.2024 to 31.05.2024

DEPTH TO WATER LEVEL (MAY-2024)

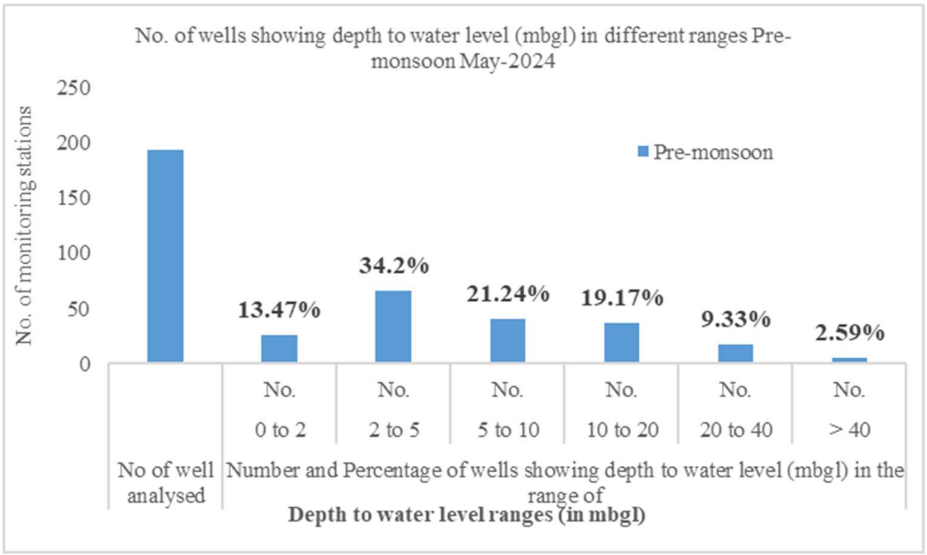
The depth to water level, recorded during May 2024 ranged between 0.38 m (Mandi District) and 94.2 m bgl (Tikkri (Pz) Solan District). Out of 193 stations monitored, the majority of 144 NHS (74.61%) recorded DTWL, in the range between 2 - 20 m bgl. 26 stations (13.47%), recorded shallow water levels, less than 2 m bgl and 23 stations (12.92%), recorded deep water levels, more than 20 m bgl in the state.

A perusal of the DTWL map of May 2024 shows that the shallow water level area of less than 2 m bgl, occurs in eastern and southern part of Kangra-Palampur valley, northern part of Kullu valley and southern part of Balh valley in Mandi District. 2-5 m bgl and 5-10 m bgl water level occupies in

most of the monitoring area of all the valleys of Himachal Pradesh, mainly in Kangra- Palampur valley, Nurpur- Indora valley, southern part of Kullu valley and Balh Valley. Water level 10-20 m bgl in shown northern part of Kangra Palampur valley and northern part of Indora valley. Deeper water levels, between 20-40m bgl are shown in Nalagarh and western part of Paonta valley.

Season	No of well analysed	Number and Percentage of wells showing depth to water level (mbgl) in the range of											
		0 to 2		2 to 5		5 to 10		10 to 20		20 to 40		> 40	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Pre-monsoon	193	26	13.47	66	34.2	41	21.24	37	19.17	18	9.33	5	2.59

Depth to Water Level Distribution of Percentage of Observation Wells Pre -monsoon 2024



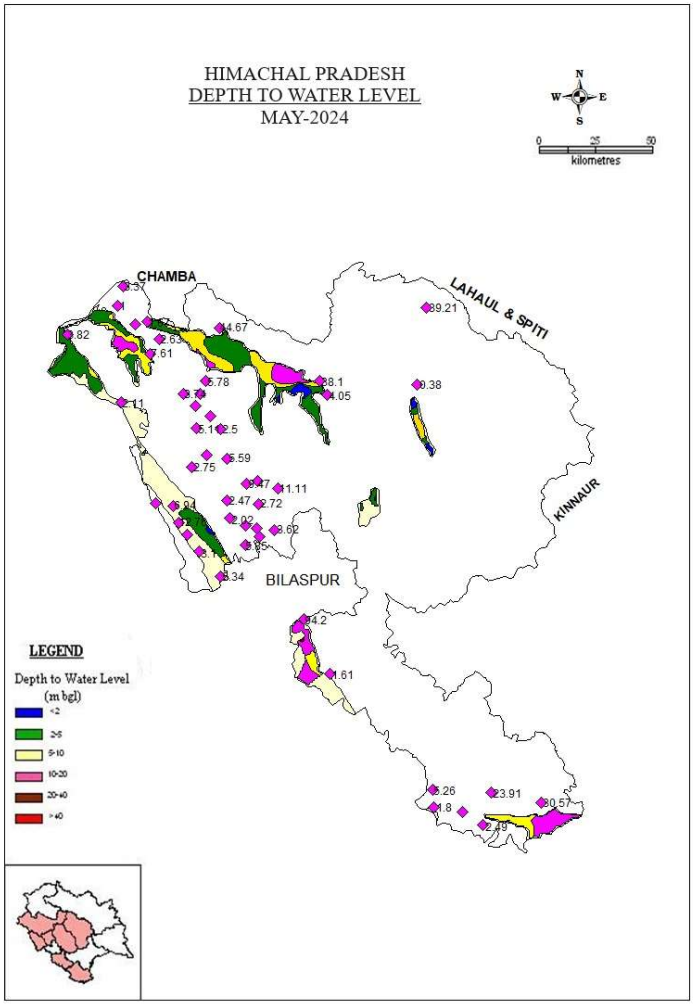


Fig:1 Depth to Water Level May-2024

SEASONAL WATER LEVEL FLUCTUATION

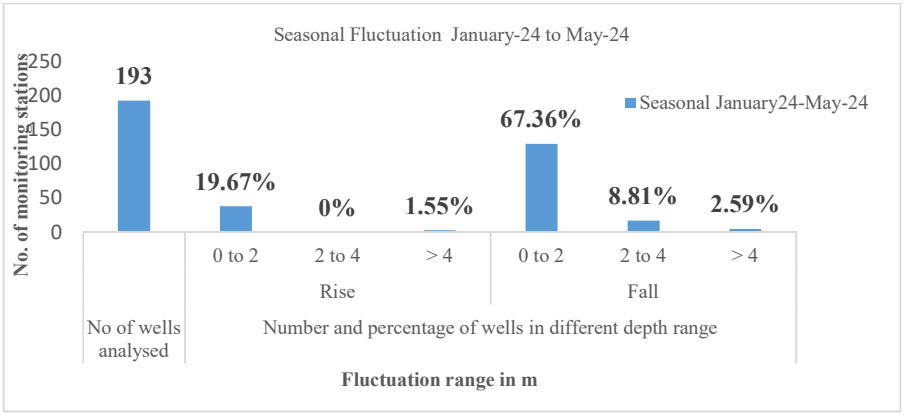
To study the effect of monsoon and subsequent utilization for various needs like agriculture, irrigation and domestic etc, changes in water level are studied and are discussed below.

January 2024 to May 2024

Seasonal fluctuation of water level was analyzed for 193 stations for the period January 2024 – May 2024. Out of the 193 stations, 41 stations have shown rise in water level and remaining 152 stations have shown fall in water level.

The minimum rise in water level of 0.02 m was observed in Kangra District and the maximum rise 9.61 m was noticed in Kullu District (Palchan Pz). Out of the 41 stations which have shown rise in water level, 38 stations show rise between the range of 0 to 2 m, 0 stations between 2 to 4 m and remaining 3 stations show rise more than 4 m.

Comparison	Season	No of wells analysed	Number and percentage of wells in different depth range											
			Rise						Fall					
			0 to 2	%	2 to 4	%	> 4	%	0 to 2	%	2 to 4	%	> 4	%
Seasonal	January 24-May-24	193	38	19.67	0	0	3	1.55	130	67.36	17	8.81	5	2.59



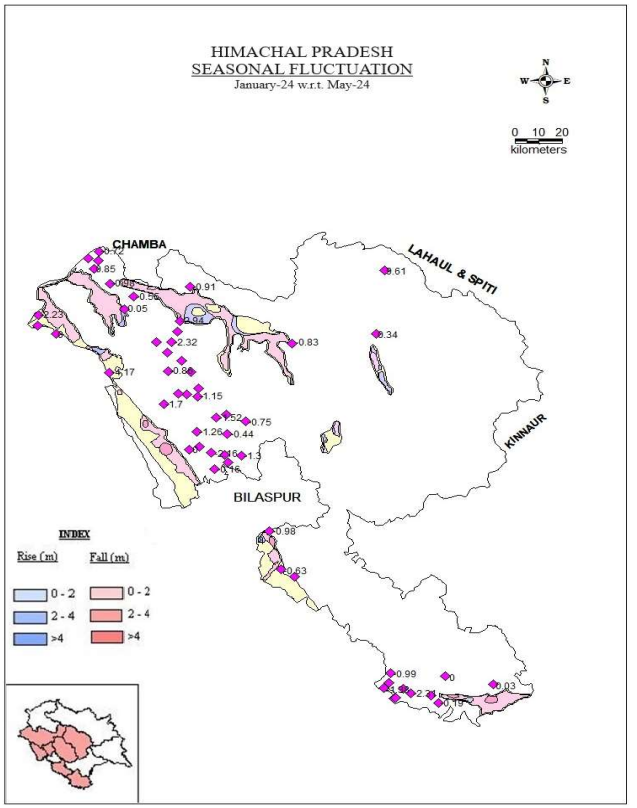


Fig:2 Seasonal fluctuations for the period January 2024 – May 2024

ANNUAL WATER LEVEL FLUCTUATION

Annual fluctuation in water level of GWMS during different monitoring period was analysed and discussed below.

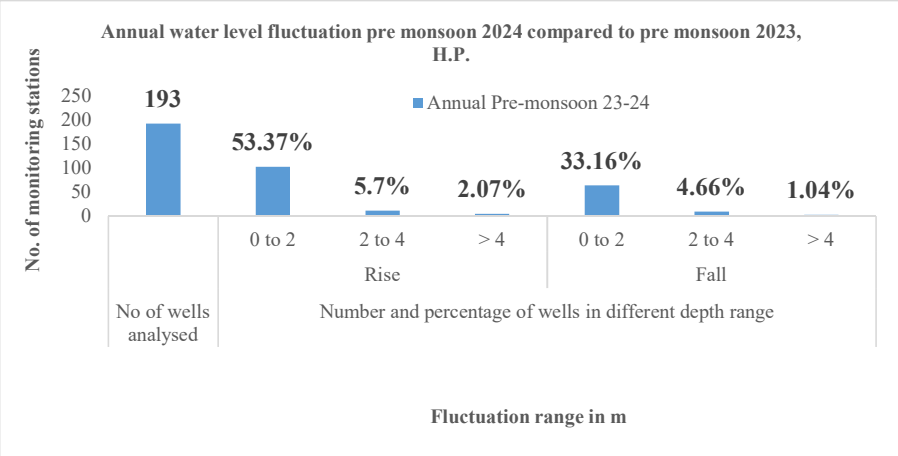
May 2023 to May 2024

Annual fluctuation of water level, has been worked out by comparing depth to water level of May 2023, with May 2024 and the data presented its frequency distribution in various rise and fall ranges.

Out of the 193 stations analysed, 118 stations (61.14%) have shown rise in water level ranging from 0.01 (Kangra District) to 8.37 m (Sirmaur District). Out of 118 stations which have shown rise in water level, 103 stations (87.29%) show rise between the range of 0 to 2 m, 11 station (9.32%) has shown rise between 2 to 4 m and 4 station (3.39%) shown rise more than 4 m. Similarly, for 75 stations which have shown fall in water level, 64 stations (85.33%) show fall between the range of 0 to 2 m, 9 stations (12%) have shown fall between 2 to 4 m and 2 stations (2.67%) has shown fall more than 4 m.

A perusal of map of Annual Water Level Fluctuation for May 2021 to May 2022 shows fall in water level in majority of monitoring areas, specially in Una valley and Indora-Nurpur valley, except a couple of areas. Fall of 0-2 m in shown in Kangra-Palampur valley of Kangra District, Kullu Valley, major part of Nurpur and Indaura Valley and small pockets of Una Valley. Fall >4 m is noticed in small pockets of Nurpur valley and Indora Valley. Rise in water level is noticed in Kangra Palampur valley, small pockets of Una valley, northern part of Kullu valley and southern of Part of Balh valley.

Comparison	Season	No of wells analysed	Number and percentage of wells in different depth range											
			Rise						Fall					
			0 to 2	%	2 to 4	%	> 4	%	0 to 2	%	2 to 4	%	> 4	%
Annual	Pre-monsoon 23-24	193	103	53.37	11	5.7	4	2.07	64	33.16	9	4.66	2	1.04



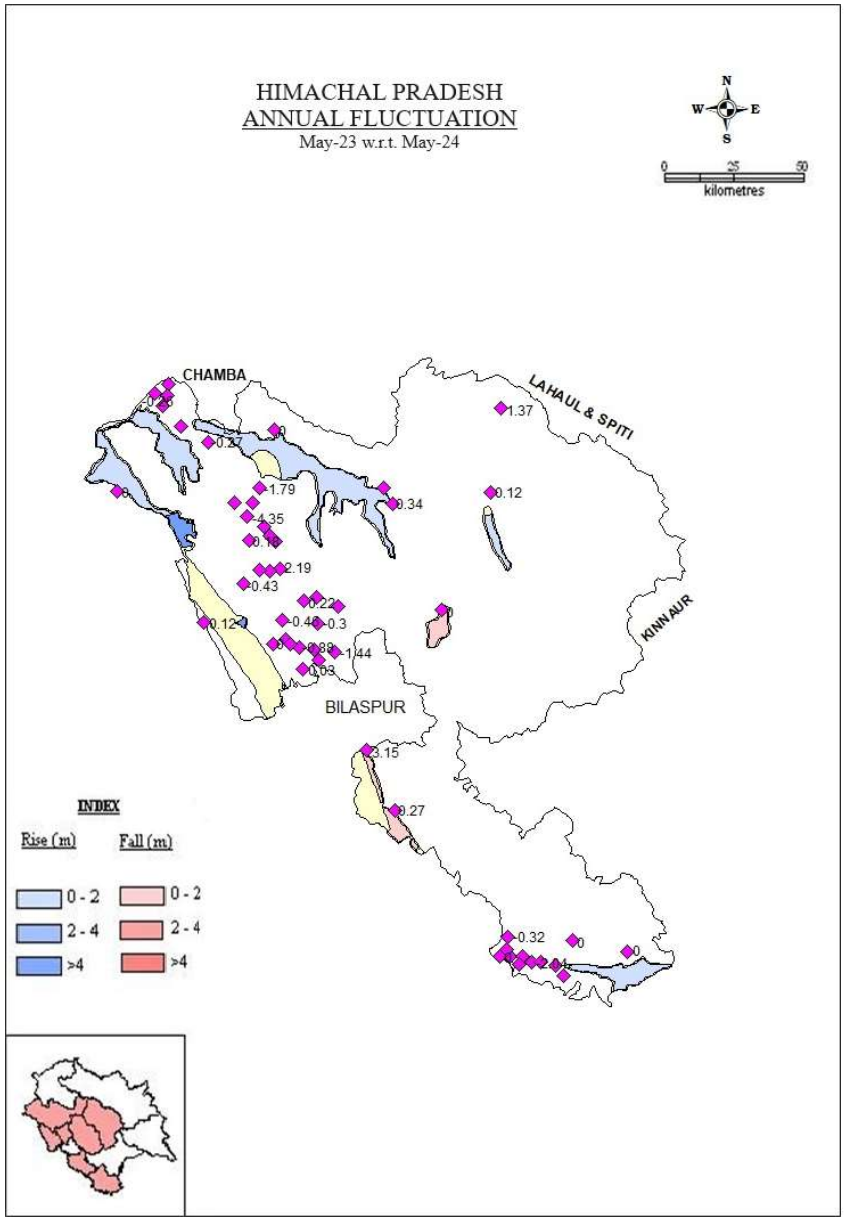


Fig:3 Annual fluctuations for the period May 2023 – May 2024

DECADAL FLUCTUATIONS

The decadal variations were analyzed considering the decadal average of water level and the water level for the respective period.

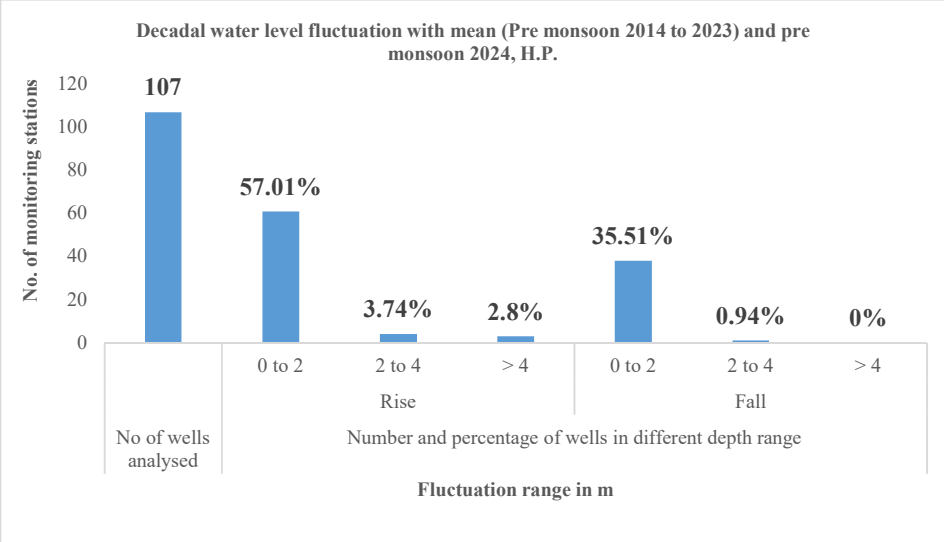
Decadal average of May (2014-2023) to May 2024

Decadal water level fluctuation has been worked out by comparing water level data of May 2024 with the average mean of 10 years' water level data of May (2014-2023) and is presented frequency distribution in various ranges.

A perusal shows that out of 107 stations analyzed, 68 stations (63.55%) have shown rise and 39 stations (36.45%), have shown fall in water level. Out of 68 stations 61 stations (91.04%) are showing rise in water level between 0 to 2 m, 4 stations (5.98%) between 2 to 4 m and 3 stations (4.48%), more than 4 m. Out of 39 stations, 38 stations (97.44%) show fall in water level between 0 to 2 m, 1 stations (2.56 %) between 2 to 4 m and 0 stations (0%) more than 4 m. A minimum rise in water level of 0.003 m was noticed in Una Districts and the maximum rise of 8.27 m is noticed in Sirmaur District. Similarly, the minimum fall of 0.002 m is noticed in Kangra District & maximum fall of 2.11 m is noticed in Sirmaur District.

A perusal of map of Decadal Variation - Average of May (2014 - 2023) with May 2024 reveals fall less than 2 m, in all the valleys of Kullu District, and part of Bahl valley under Mandi District. Central part of Una valley is also showing fall Una District except at some places in Indaura valley, Balh valley & Kangra-Palampur valley and Nurpur valley, which is showing rise.

Comparison	Season	No of wells analysed	Number and percentage of wells in different depth range											
			Rise						Fall					
			0 to 2	%	2 to 4	%	> 4	%	0 to 2	%	2 to 4	%	> 4	%
Decadal	Pre-monsoon	107	61	57.01	4	3.74	3	2.8	38	35.51	1	0.94	0	0



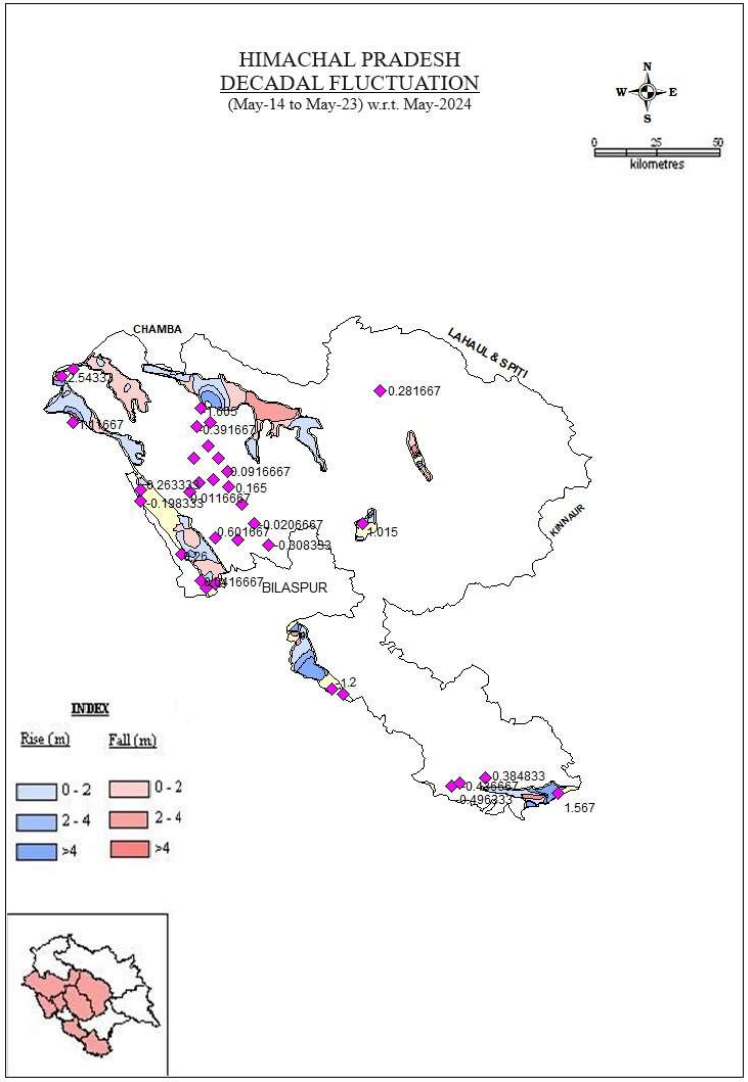


Fig. 4: Decadal water level fluctuation, Decadal mean pre-monsoon (2014-2023) Vs pre-monsoon 2024

SUMMARY

As a component of the National Ground Water Monitoring Programme, the CGWB, NHR, Dharamshala conducts monitoring of the ground water conditions on a quarterly basis: in January, pre-monsoon May, post-monsoon August, and November. Additionally, a yearly assessment of ground water quality is performed in May. As of May-2024, the Northern Himalayan Region of the Central Ground Water Board monitored 137 dug wells, 56 piezometers and 27 springs. This comprehensive effort aims to portray the variations in the state's ground water conditions across different aquifers.

In May 2024, around 88% of the state's area exhibited a depth to water level within 20 meters below ground level. Deeper water levels of more than 20 m cover 12 % area of the State covering mainly Una, Sirmaur,Solan, Kangra, districts.

Annual water level comparison with previous year May-2023 to May-2024 has shown that about 61.14% area of the state experienced rise in annual water level fluctuation. 63.55% of the area experienced rise in decadal mean water level of 2014-2023 with respect to May, 2024.