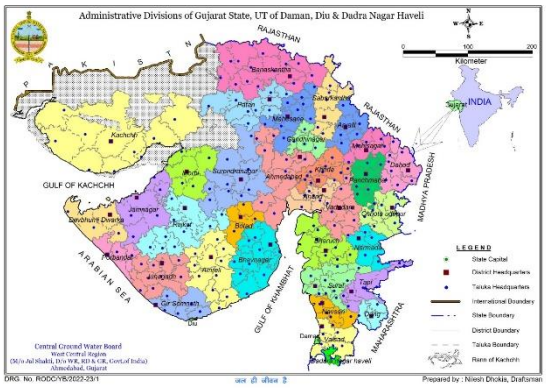
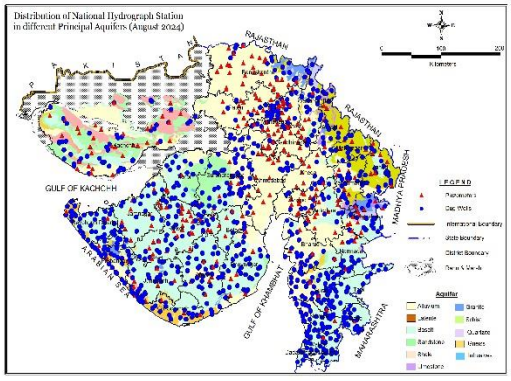
GROUND WATER LEVEL BULLETIN

AUGUST 2024

Gujarat





ABSTRACT

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

CGWB, WEST CENTRAL REGION, GUJARAT

Introduction

Groundwater bulletin is prepared by CGWB, WCR, Ahmedabad 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 pumping 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, May, August and November. Initially, the monitoring commenced in the year 1969 with the establishment of 82 observation wells spread uniformly over the entire state, and since then, the number of stations were added regularly so as to get proper hydrological information of different hydrogeological and geo-morphological units.
A network of 1293 observation wells called National Hydrograph Network Stations (NHNS), as on 31.08.2024, located all over the Gujarat state is being monitored. Administrative map shown in Fig.-1.

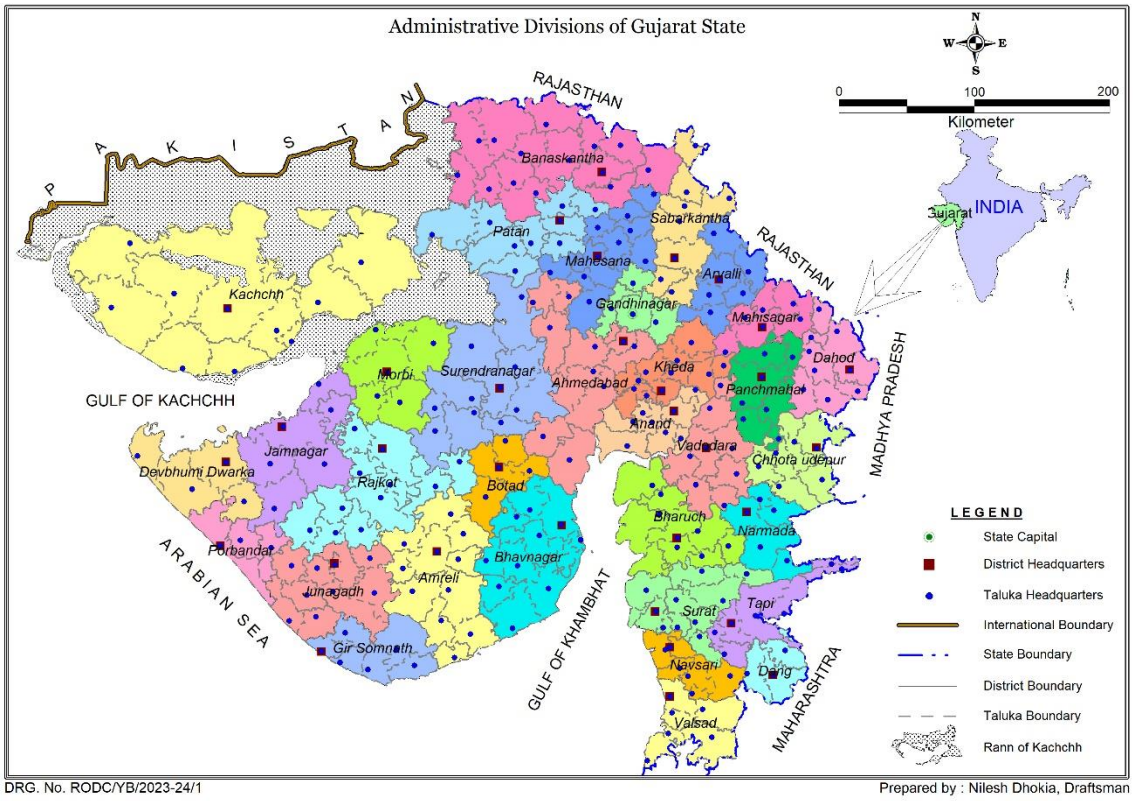


Figure 1: Map showing administrative divisions of Gujarat State

Study Area

The Gujarat is one of India's most prosperous states is situated along the western coast of India between North latitudes 20° 06' 00" to 24° 42' 00" and East longitudes 68° 10' 00" to 74° 28' 00" (Figure. 1). It has nearly 1600 km long coastline, which is the longest as compared to any other state in the country. It is extending from Lakhpat in north to Daman in south. The State has common boundaries with the states of Rajasthan, Madhya Pradesh and Maharashtra and shares international border with Pakistan in northwest.

Gujarat is fifth largest state in India by area, covering about 1,96,024 km^2. There are 18,225 villages and 348 towns in Gujarat including 16 towns with more than 1,00,000 populations. The total population is 60,383,628 the state has a sex ratio of 918 females for every 1000 males of which 31,482,282 are males and 28,901,349 are females (2011 census).

Administratively, Gujarat currently has 33 districts. The capital of Gujarat is Gandhinagar, with Ahmedabad as its largest city. Kutch is the largest district of Gujarat while Dang is the smallest. Ahmedabad is the most populated district while Dang is the least. There are 252 Talukas (subdivisions of districts) in Gujarat.

Ground Water level monitoring

Central Ground Water Board, as a part of its national program, has established a network of observation wells in the state of Gujarat for periodic monitoring of groundwater levels and to study its quality variation in time and space. WCR, has set up a network of observation wells known as the Ground Water Monitoring Wells (GWMW's) located all over Gujarat which comprises 1293 GWMWs. The distributions of monitoring wells in different districts are given in Table 1. Map showing hydrograph stations monitored during the year and their distribution in different basin and the district is presented as Fig. 2.

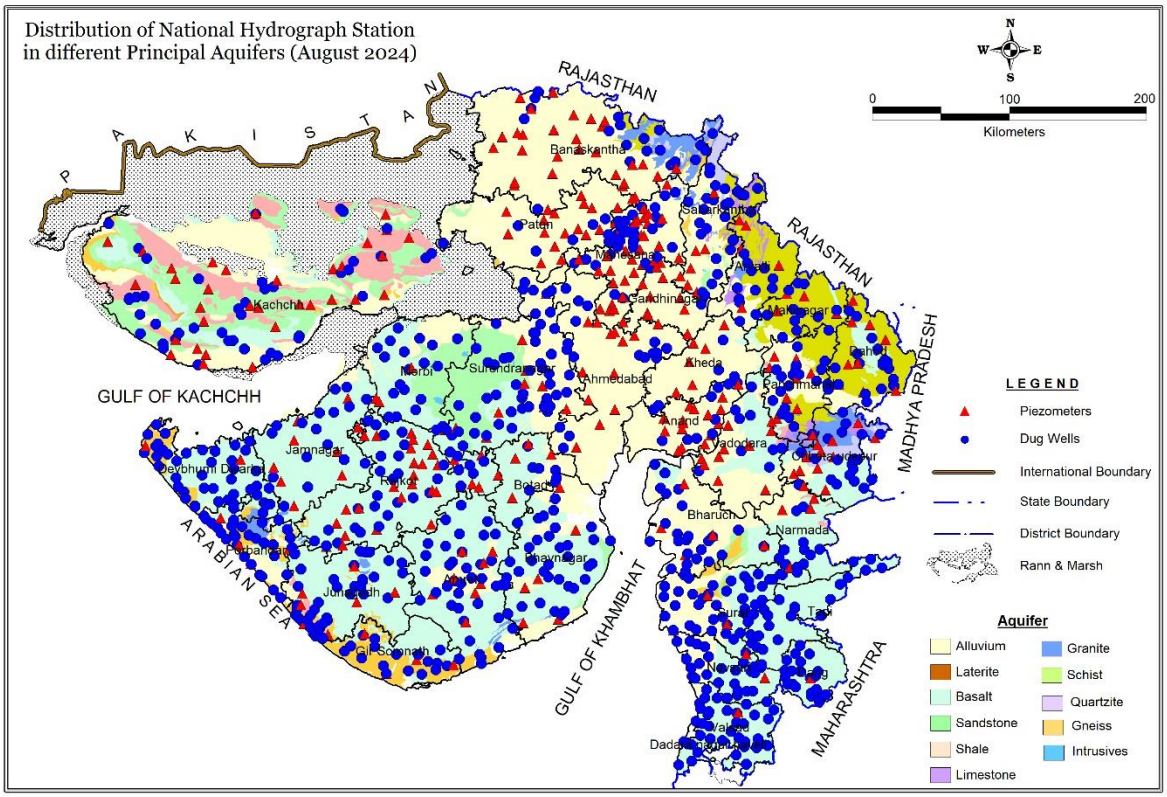


Figure 2 Map showing locations of monitoring wells (NHNS) in Gujarat state

Table 1. The distributions of monitoring wells in districts.

S.N.	District	Number of Water Level Monitoring Stations 2024		
		Pz	Dug Well	Total
1	Ahmedabad	40	19	56
2	Amreli	11	43	54
3	Anand	21	13	33
4	Arvalli	8	15	20
5	Banas Kantha	42	19	52
6	Bharuch	7	30	34
7	Bhavnagar	17	35	48
8	Botad	3	7	10
9	Chhotaudepur	13	16	28
10	Dahod	15	24	33
11	Dangs	1	20	21
12	Devbhumi Dwarka	2	43	44
13	Gandhinagar	27		13
14	Gir Somnath	5	20	24
15	Jamnagar	8	21	25
16	Junagadh	11	39	49
17	Kachchh	51	44	86
18	Kheda	14	12	24
19	Mahesana	54	35	79
20	Mahisagar	5	12	16
21	Morbi	1	17	17
22	Narmada	11	8	19
23	Navsari	2	17	18
24	Panch Mahals	21	20	33
25	Patan	37	11	39
26	Porbandar	6	29	34
27	Rajkot	25	35	50
28	Sabar Kantha	10	26	35
29	Surat	6	39	45
30	Surendranagar	12	52	60
31	Tapi	1	17	17
32	Vadodara	16	15	29
33	Valsad	1	36	37
	Total	504	789	1293

GROUNDWATER SCENARIO (August 2024)

Depth to Water Level

Depth to Water Level in Unconfined Aquifer (August 2024) – Gujarat State

The depth to water level of 920 wells are used for the analysis. Analysis of depth to water level data of 920 wells show that water levels vary between 0 mbgl (Muliyad, Kheda. Hambusar, Devbhumi Dwarka. Jamvala, Gir Somnath) to 105.14 m bgl (Deesa, Banas Kantha district).

Water level of less than 2 m bgl is recorded in 35.45 % of wells, between 2 to 5 m bgl in 35.65% of wells, between 5 to 10 m bgl in 15% of wells, between 10 to 20 m bgl in 10.65 % of wells, between 20-40 m bgl in 2.61% of wells and water level more than 40 m bgl is registered in 0.54 % of wells. Shallow water level of less than 2 m bgl occurs as isolated patches in all the districts of Gujarat except Banas Kantha, Gandhinagar, Amerli and Botad. Water level of 2 to 5 m bgl is observed in all the districts of Gujarat state except in Gandhinagar and Patan. 15% area of the State is covered by depth to water level of 5 to 10 m bgl is observed throughout the state except in Anand, Gandhinagar, Dangs, Morbi and Rajkot. Water level of 10 to 20 m bgl is covered in Ahmedabad, Anand, Aravalli, Banaskantha, Gandhinagar, Kheda, Mahesana, Patan, Sabarkantha, Bharuch, Chhotaudepur, Surat, Amreli, Bhavnagar, Gir Somnath, Devbhumi Dwarka, Junagadh, Kachcha, districts. Water levels of 20-40 m covering mainly Banaskantha, Anand, Ahmedabad, Aravalli, Gandhinagar, Kheda, Sabarkantha, Amrelli, Bhavnagar, Kachch districts. Deeper water level of more than 40 m covering districts of Banaskantha, Kheda, Mahesana, and Patan. Map and graph of Depth to Water Level in Unconfined Aquifer (August 2024) shown in Fig.3 and Fig.4 respectively.

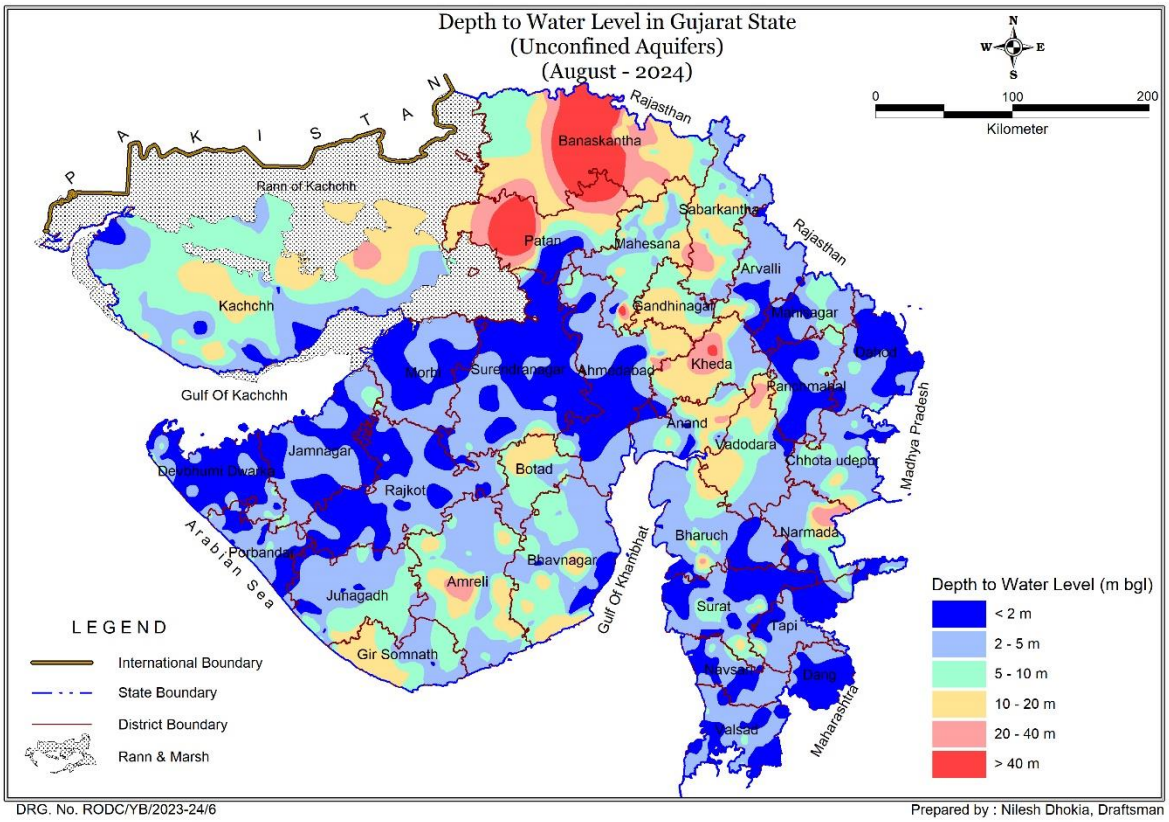


Figure 3: Depth to Water Level in Unconfined Aquifer (August 2024) – Gujarat State

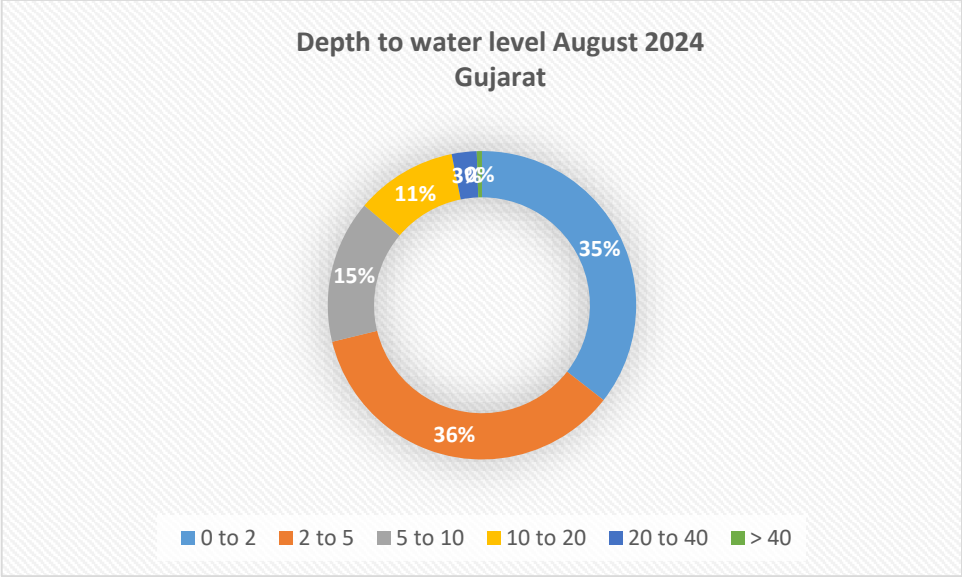


Figure 4: Well wise categorisation of depth to water level (Unconfined)

Depth to Peizometric Surface in Confined Aquifer (August 2024) - Gujarat State

The depth to water level of 241 wells is used for the analysis. Analysis of depth to water level data of 241 wells shows water levels vary between 0.24 mbgl (Dhamalpur, Rajkot) to 185.02 m bgl (Nanota, Banaskantha district). Water level of less than 2 m bgl is recorded in 13.3 % of wells, between 2 to 5 m bgl in 13.7% of wells, between 5 to 10 m bgl in 9.1% of wells, between 10 to 20 m bgl in 12.4 % of wells, between 20-40 m bgl in 10.4% of wells and water

level more than 40 m bgl is registered in 41.1 % of wells. Shallow water level of less than 2 m bgl occurs in Junagarh, Jamnagar, Morbi, Porbander, Rajkot, Surendranagar, Kachch, Panchmahal, Dahod, Ahmedabad, Bharuch, Chhotaudepur, Narmada district. Water level of 2 to 5 m bgl is observed in Anand, Aravalli, Banaskantha, Panchmahal, Sabarkantha, Bharuch, Chhotaudepur, Narmada, Amreli, Botad, Jamnagar, Morbi, Rajkot, Surendranagar, Jamnagar, Kachch. water level of 5 to 10 m bgl is observed in Banaskantha, Dahod, Kheda, Panchmahal, Patan, Narmada, Amreli, Gir Somnath, Botad, Rajkot, Kachch. Water level of 10 to 20 m bgl significant presence in Ahmedabad, Anand, Banaskantha, Kheda, Mahesana, Patan, Chhotaudepur, Surat, Vadodara, Bhavnagar, Porbander, Rajkot, Kachcha, districts. Water levels of 20-40 m covering mainly Banaskantha, Anand, Ahmedabad, Kheda, Mahesana, Patan, Sabarkantha, Narmada, Vadodara, Kachch districts. Deeper water level of more than 40 m covering districts of Ahmedabad, Ghandhinagar, Banaskantha, Mahesana, Sabarkantha, Patan, Amreli, Surendranagar, Kuchch. Map and graph of Depth to Peizometric surface in Confined Aquifer (August 2024) shown in Fig.5 and Fig.6 respectively.

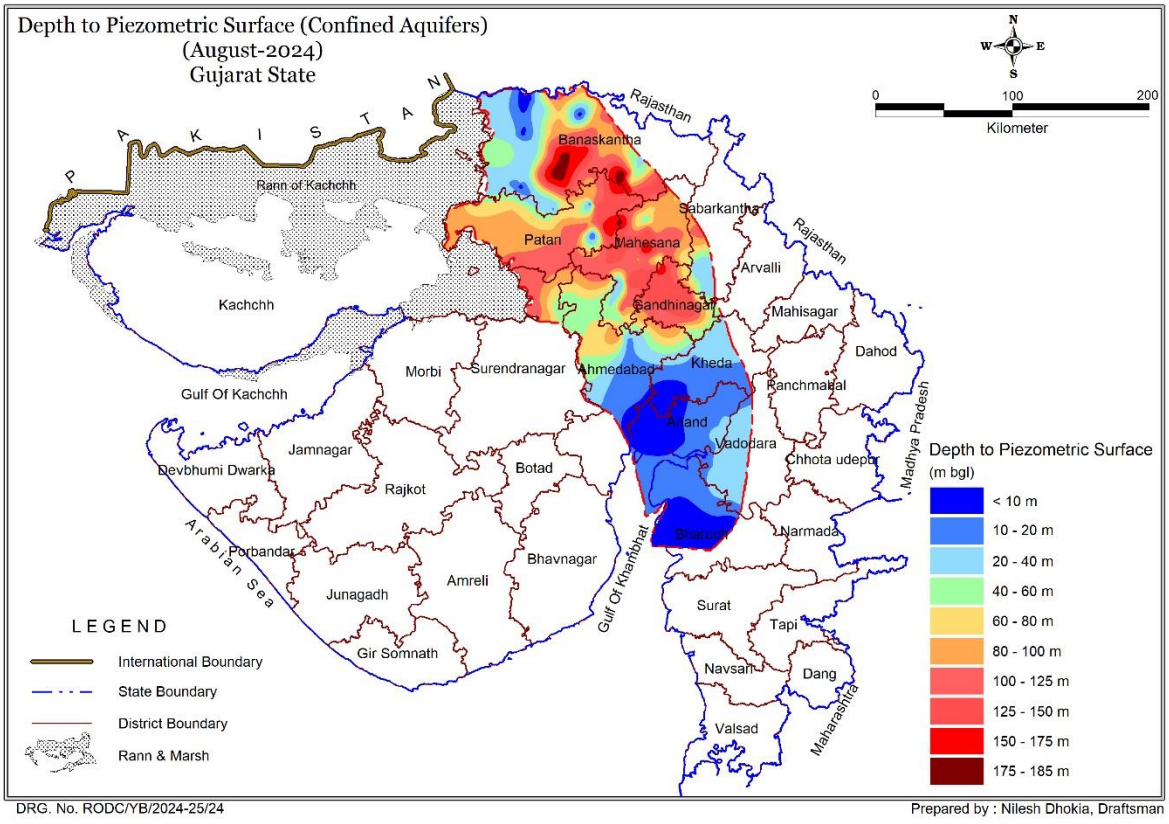


Figure 5: Depth to Peizometric Level in Confined Aquifer (August 2024) - Gujarat State

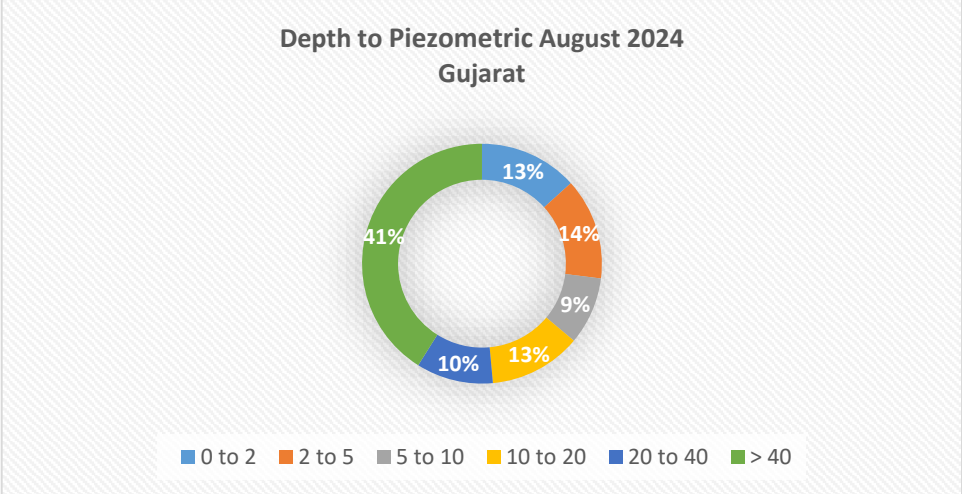


Figure 6: Well wise categorisation of depth to Piezometric (confined)

Annual Water Level Fluctuation

Annual Water Level Fluctuation (August 2023 to August 2024)- Unconfined

Rise in piezometric levels:

Out of 202 wells, piezometric level rise of less than 2 m is recorded in 21% wells, 2 to 4 m in 5.4% wells and more than 4 m in 5.7% of the wells. Piezometric level rise of less than 2 m is seen in all the districts except in Ahmedabad, Gandhinagar and Botad districts. Piezometric level rise of 2 to 4 m is observed mainly in districts such as Kheda, Patan, Sabarkantha, Bharuch, Surat, Vadodara, Jamnagar, Junagarh, Bhavnagar, Amreli, Botad, Valsad, Kachchh, Rajkot districts. Rise of more than 4 m is significantly observed in Ahmedabad, Kheda, Banas Kantha, Mahesana, Sabarkantha, Bharuch, Chhotaudepur, Amreli, Bhavnagar, Junagarh, Devbhumi Dwarka, Gir Somnath, Botad, Kachchh districts.

Fall in Piezometric Levels:

Out of 427 wells that have registered fall in piezometric levels, 43.1% have recorded less than 2 m while 15.1% in the range of 2 to 4 m and remaining 9.7% wells registered piezometric level fall of more than 4 m. Fall of less than 2 m is seen in all the districts except Botad district. Fall of 2 to 4 m is observed mainly in BanasKantha, Dahod, Mahesana, Mahisagar, Panchmahal, Sabarkantha, Surat, Chhotaudepur, Bharuch, Tapi, Dangs, Vadodara, Devbhumi Dwarka, Junagarh, porbander, surendranagar, Rajkot region. Fall of beyond 4 m is observed in Banaskantha, Mahesana, Sabarkantha, Dahod, Panchmahal, Chhotaudepur, Tapi, Amreli, Devbhumi Dwarka, Surendranagar, Kachchh districts. Map and graph of Annual Water Level Fluctuation (August 2023 to August 2024)-Unconfined shown in Fig.7 and Fig.8 respectively.

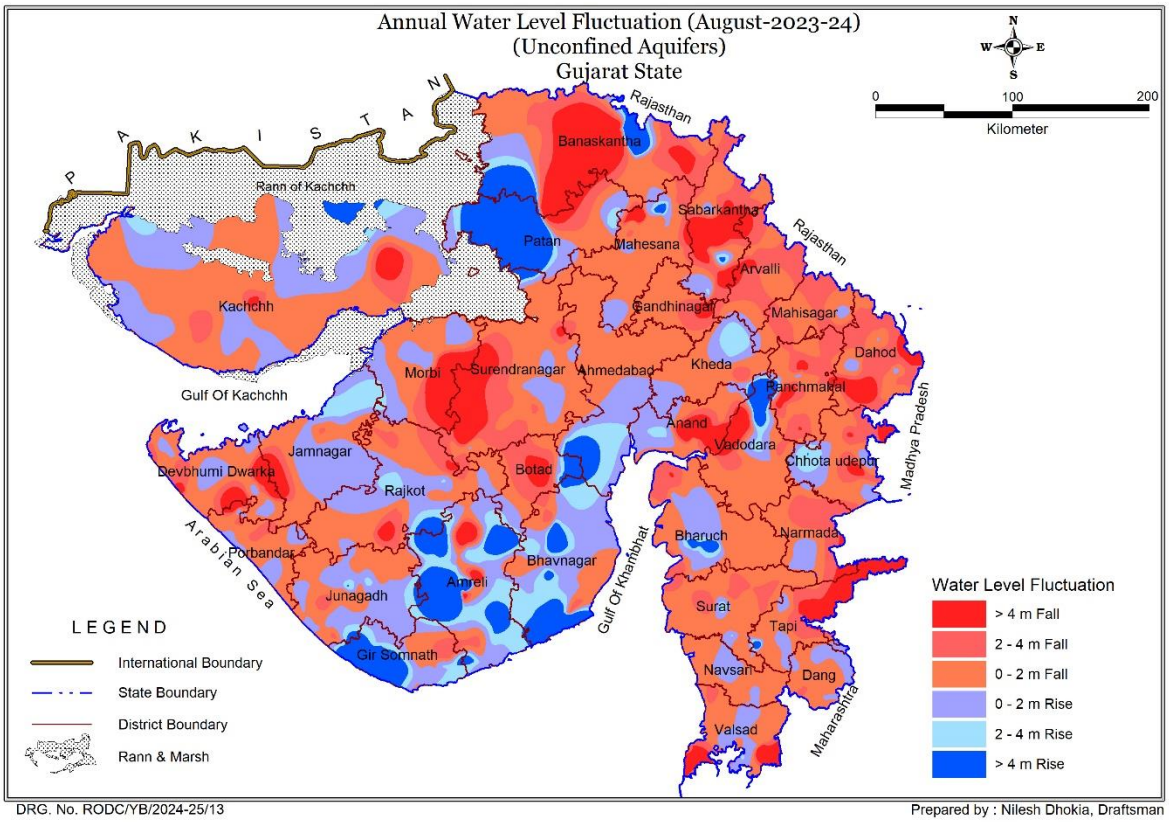


Figure 7: Annual Water Level Fluctuation (August 2023 to August 2024)- Unconfined

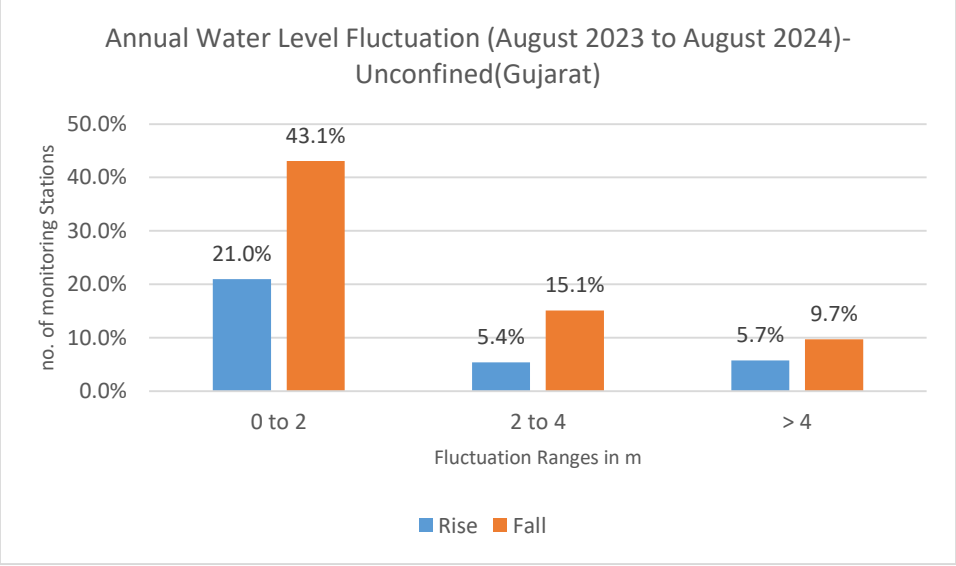


Figure 8: Annual Water Level Fluctuation (August 2023 to August 2024)- Unconfined

Annual Fluctuation in Piezometric surface (August 2023 to August 2024)- Confined

Rise in Piezometric Levels:

Out of 59 wells, piezometric level rise of less than 2 m is recorded in 22.2% wells, 2 to 4 m in 7% wells and more than 4 m in 4.7% of the wells. Piezometric level rise of less than 2 m is Significantly observed

mainly in districts such as Ahmedabad, Mahesana, Banaskantha, Patan, Mahesana, Panchmahal, Kachch districts. Piezometric level rise of 2 to 4 m is observed mainly in districts such as, Ahmedabad, Rajkot, Bhavanagar districts. Rise of more than 4 m is significantly observed in Patan, Chhotaudepur districts.

Fall in Piezometric Levels:

Out of 112 wells that have registered fall in piezometric levels, 34.5% have recorded less than 2 m, 2 to 4 m in 12.9% wells and more than 4 m in 17% of the wells. Fall of less than 2 m is mainly observed in Ahmedabad, Ghandhinagar, Mahesana, Banaskantha, Patan, Kachchh districts. Fall of 2 to 4 m is observed mainly in Gandhinagar, Panchmahal, Kachchh, Bhavnagar, Banaskantha region. Fall of beyond 4 m is observed in Chhotaudepur, Kheda, Mahesana, Narmada, Kachch districts. Map and graph of Annual Fluctuation in Peizometric surface (August 2023 to August 2024)- confined shown in Fig.9 and Fig.10 respectively.

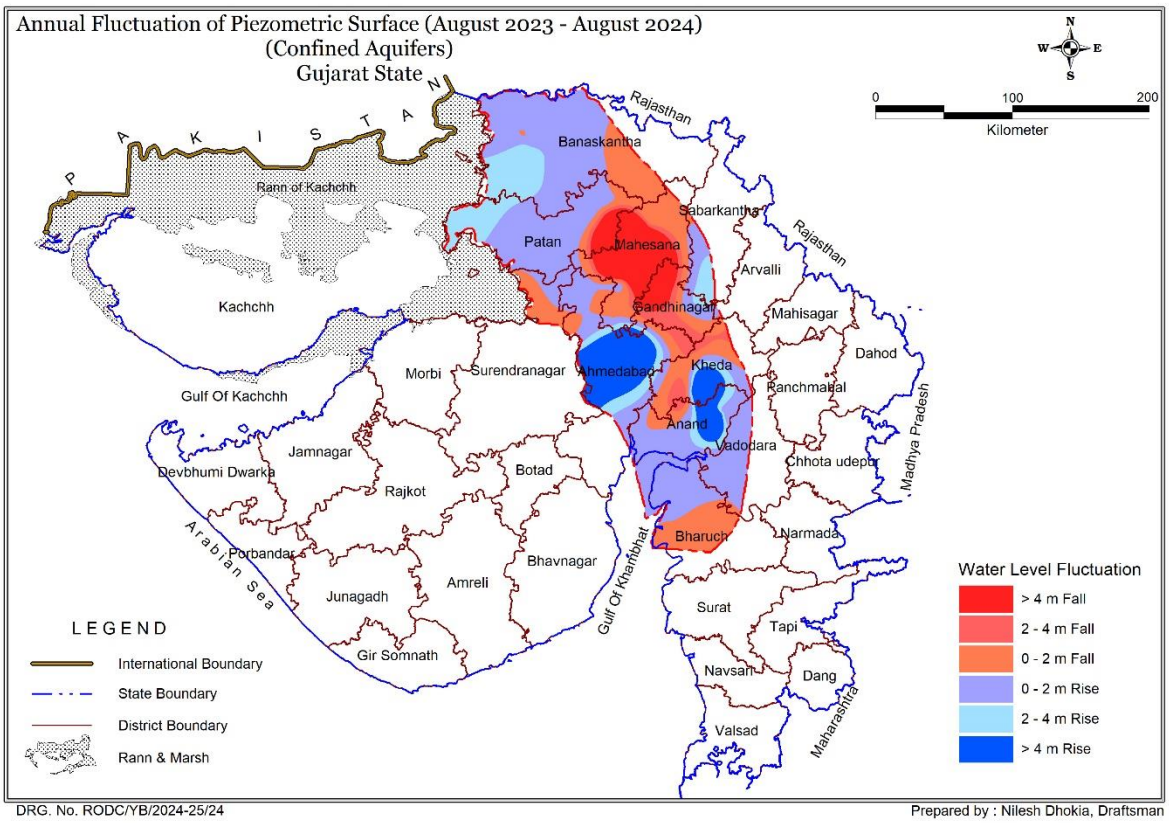


Figure 9: Annual Fluctuation Peizometric surface (August 2023 to August 2024)- Confined

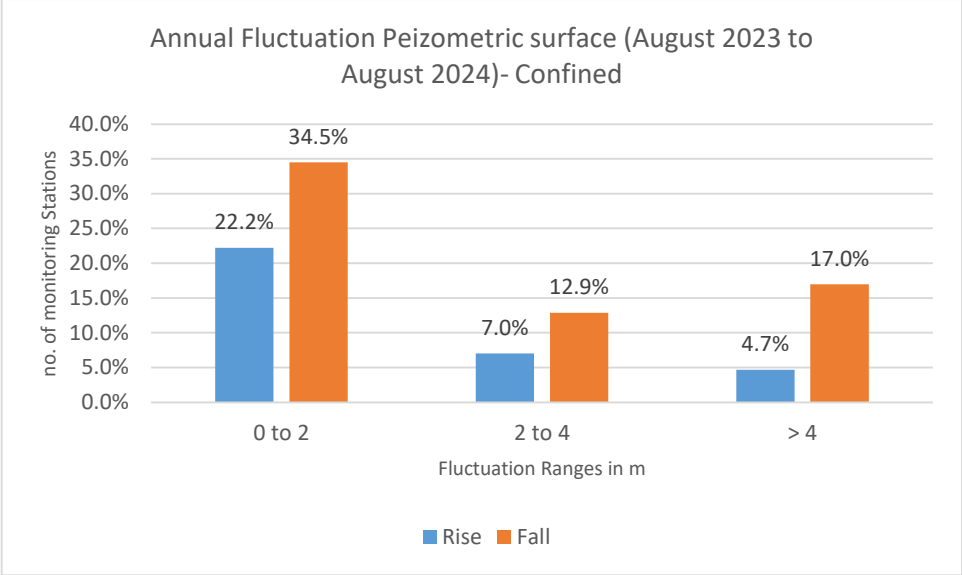


Figure 10: Annual Fluctuation Peizometric surface (August 2023 to August 2024)- Confined

Seasonal Water Level Fluctuation

Seasonal Water Level Fluctuation (May 2024 to August 2024)- Unconfined Aquifer, Gujarat state
Out of 786 Well analysed in the Gujarat state about 94.4% area have recorded the rise and 5.6% have recorded fall in water level between May 2024 to August 2024. Rise in water level is observed in all districts of Gujarat state. In the state, the maximum rise of 27 m is at Junagarh district whereas the maximum decline of 21.36 m is observed at Narmada district.

In North Gujarat region, water level rises mainly observed in 92.6% of the total well analysed and maximum rises (33.2%) are in the range of 0 to 2 m. The fall of water level observed in 7.4% of wells analysed.

The 92% of the total wells in the area of south Gujarat have recorded rise and maximum (50.5%) in the range greater than 4 m of rise in the region in August 2024 as compared to May 2024. The fall is 8% of total well and maximum (3.7%) in the range of 0 to 2 m.

Over all 97.4% of total well analysed are shown rise in water level in the entire Saurashtra region. About 58.5% of areas have shown rise of water level greater than 4 m all the districts of Saurashtra region. Fall of water level is observed in 2.6% of wells analysed all over the region. The fall > 4 m is observed only in Amerli district of Saurashtra region

In Kachchh, 90.5% of the total well analysed recorded rise in water level. The rise is mostly in the range greater than 4 m and is observed in 46.1% of the total well. The total fall of water level has been observed in 9.5% of the total well in the region. Map and graph of Seasonal Water Level Fluctuation (May 2024 to August 2024)- Unconfined Aquifer, Gujarat state shown in Fig.11 and Fig.12 respectively.

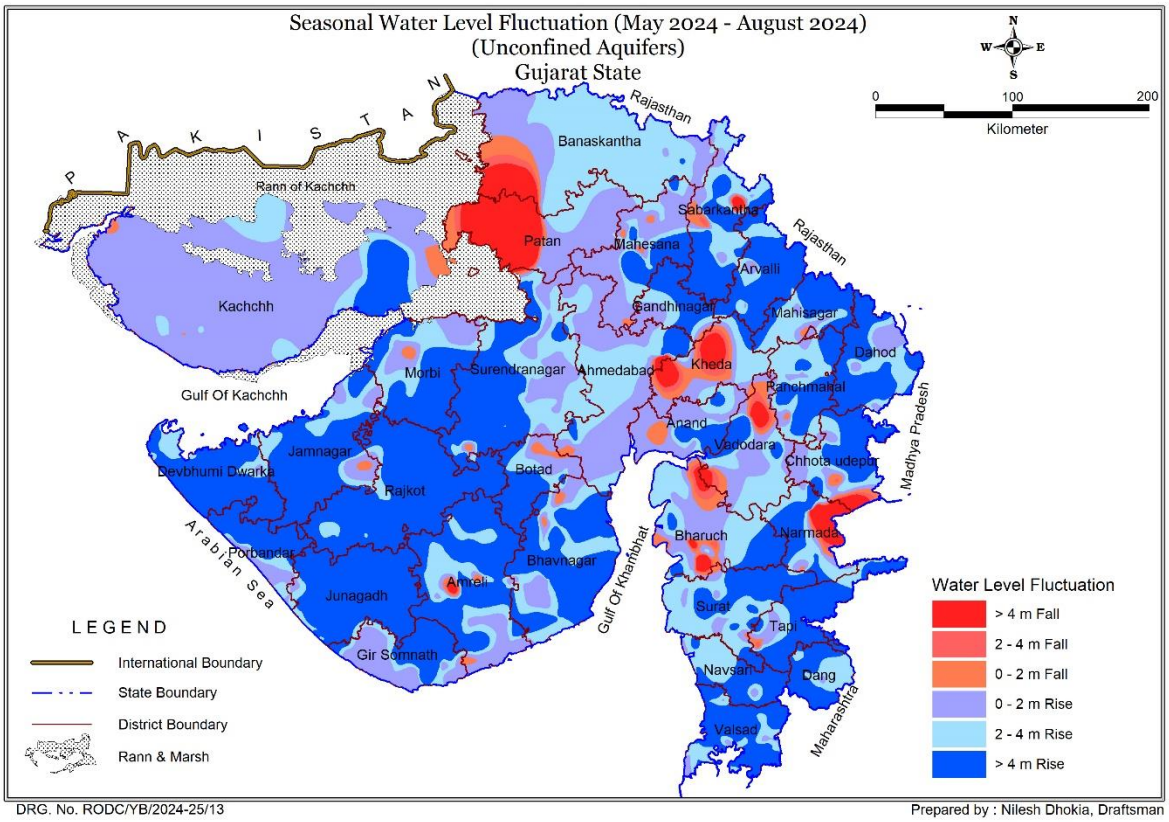


Figure 11: Seasonal Water Level Fluctuation (May 2024 to August 2024)- Unconfined Aquifer, Gujarat state

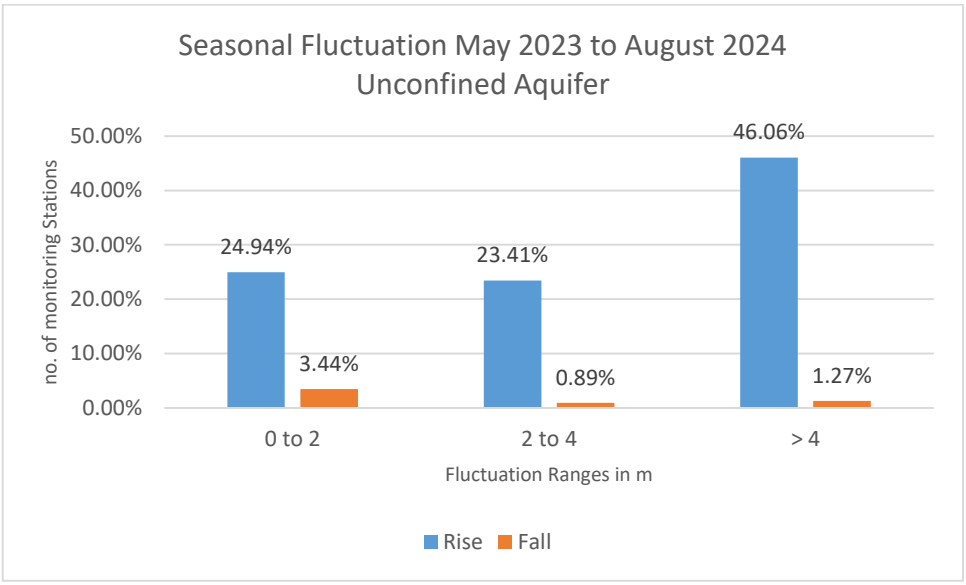


Figure 12: Seasonal Water Level Fluctuation (May 2024 to August 2024)- Unconfined Aquifer, Gujarat state

Seasonal Fluctuation in Peizometric surface (May 2024 to August 2024) – Confined and Semi-confined aquifer, Gujarat state

Out of 192 Well analysed in the Gujarat state about 83.9% area have recorded the rise and 16.1% have recorded fall in water level between May 2024 to August 2024. Rise in water level is observed in most of districts of Gujarat state. In the state, the maximum rise of 21.9 m is at Anand district whereas the maximum decline of 55.01 m is observed at Amreli district.

In North Gujarat region, water level rises mainly observed in 85.6% of the total well analysed and maximum rises (34.7%) are in the range greater than 4m. The fall of water level observed in 14.4% of wells analysed.

The 90.5% of the total wells in the area of south Gujarat have recorded rise and maximum (52.4%) in the range greater than 4 m of rise in the region in August as compared to May 2024. The fall is 9.5% of total well and maximum (9.5%) in the range of 0 to 2 m.

Over all 87% of total well analysed are shown rise in water level in the entire Saurashtra region. About 47.8% of well have shown rise of water level greater than 4 m. Fall of water level is observed in 13% of wells analysed all over the region. The fall > 4 m is observed only in Amerli and porbander district of Saurashtra region

In Kachchh, 70% of the total well analysed recorded rise in water level. The rise is mostly in the range 0-2 m and is observed in 50% of the total well. The total fall of water level has been observed in 30% of the total well in the region. Map and graph of Seasonal Water Level Fluctuation (May 2024 to August 2024)- Confined and Semi-confined aquifer, Gujarat state shown in Fig.13 and Fig.14 respectively.

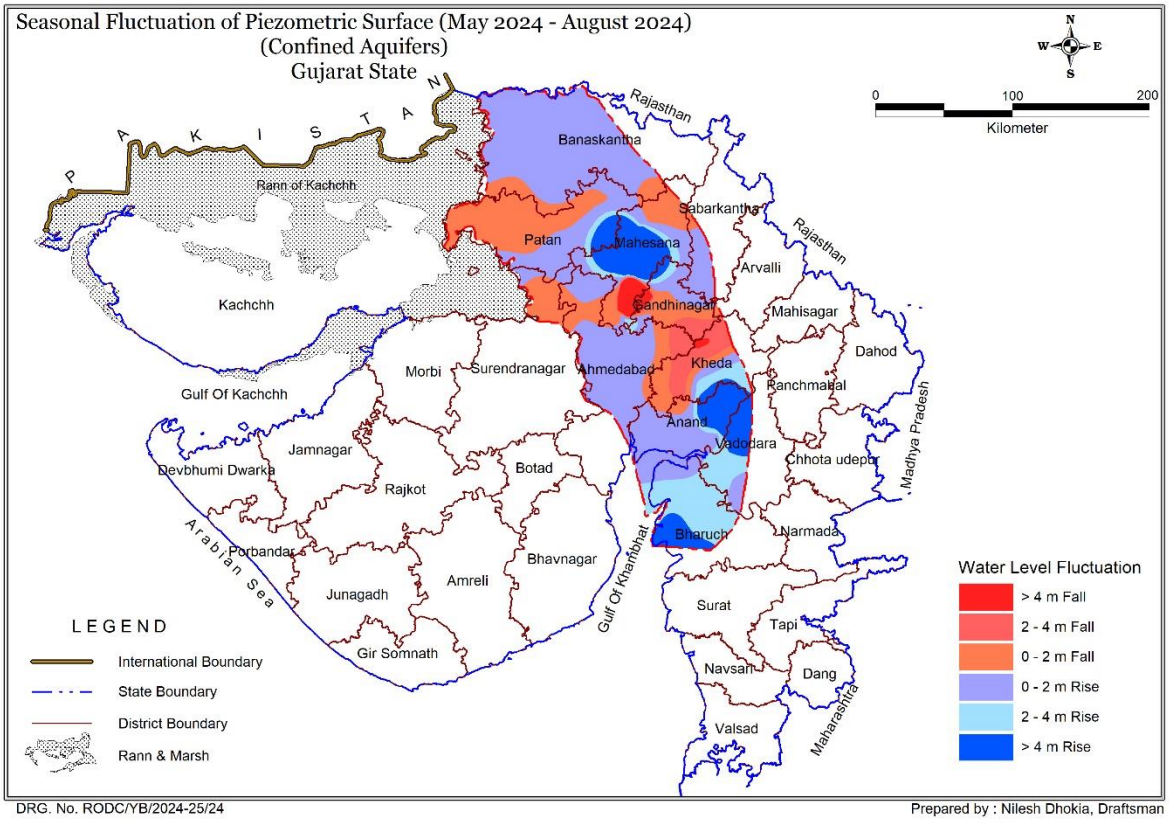


Figure 13: Seasonal Fluctuation in Piezometric surface (May 2024 to August 2024)- Confined and Semi-confined aquifer,Gujarat state

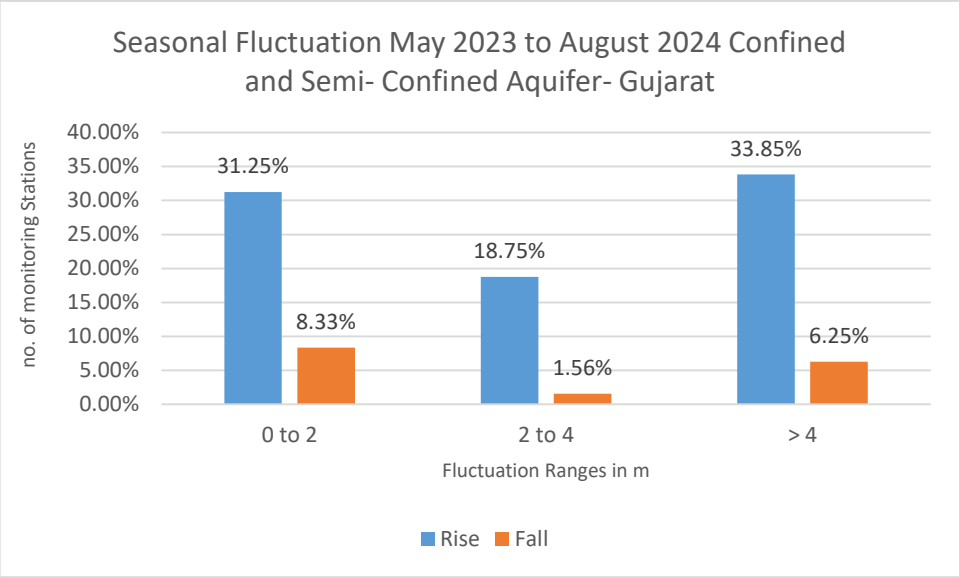


Figure 14: Seasonal Fluctuation in Piezometric surface (May 2024 to August 2024)- Confined and Semi-confined aquifer,Gujarat state

Decadal Water level Fluctuation

Decadal Water level Fluctuation: Decadal average of August (2014 to 2023) to August 2024 in Unconfined Aquifer

A comparison of the water level of the August 2024 with the average water level of the August for last one decade (2014-2023) reveals that there is the rise in 73.7% of well analysed. Rise is mostly in the range of 0 to 2 m (41.3% of total wells). Fall in water levels is observed in 26.3% of well analysed. The maximum rise of 22.47m is recorded in Anand district whereas the maximum decline of 24.58 m is recorded in Narmada district.

In *North Gujarat*, 74.4% of wells have shown rise and mostly in range of 0 to 2 m (35.6 % of wells). Rise of more than 4 m is prominently observed in, Sabar kantha,and Dahod districts. The fall of 25.6% in water level is observed in the almost all area of north Gujarat where > 4m observed in Ahmedabad and Mahesana districts.

South Gujarat has experienced the rise in 70.7% of wells analysed whereas 29.3% shows fall. In the range of 0 to 2 m, 21.7% of well shows the fall while 56.7 % of wells shows the rise. More than 4 m of fall in water level shows in Bharuch, Narmada and Vadodara districts of South Gujarat region.

In *Saurashtra* region, 75.4% of total well shows the rise in water level where as 24.6% shows the fall. The fall of water level mainly observed in range of 0-2 m (16.7%). The rise in water level is observed in all districts of the Saurashtra region and rise of more than 4 m in water level is observed 19.4% wells of Saurashtra region.

In Kachchh, 71% of the wells analysed have recorded the rise in water levels whereas 29% shows the fall. Fall is mostly (16.1% of wells) in the range of 0 to 2 m. Rise is observed

mostly in the range of 0-2 meter (41.9 % wells) and more than 4-meter rise is shown in 12.9% wells analysed. Map and graph of Decadal Fluctuation in Unconfined Aquifer Decadal average of August (2014 to 2023) to August 2024 shown in Fig.15 and Fig.16 respectively.

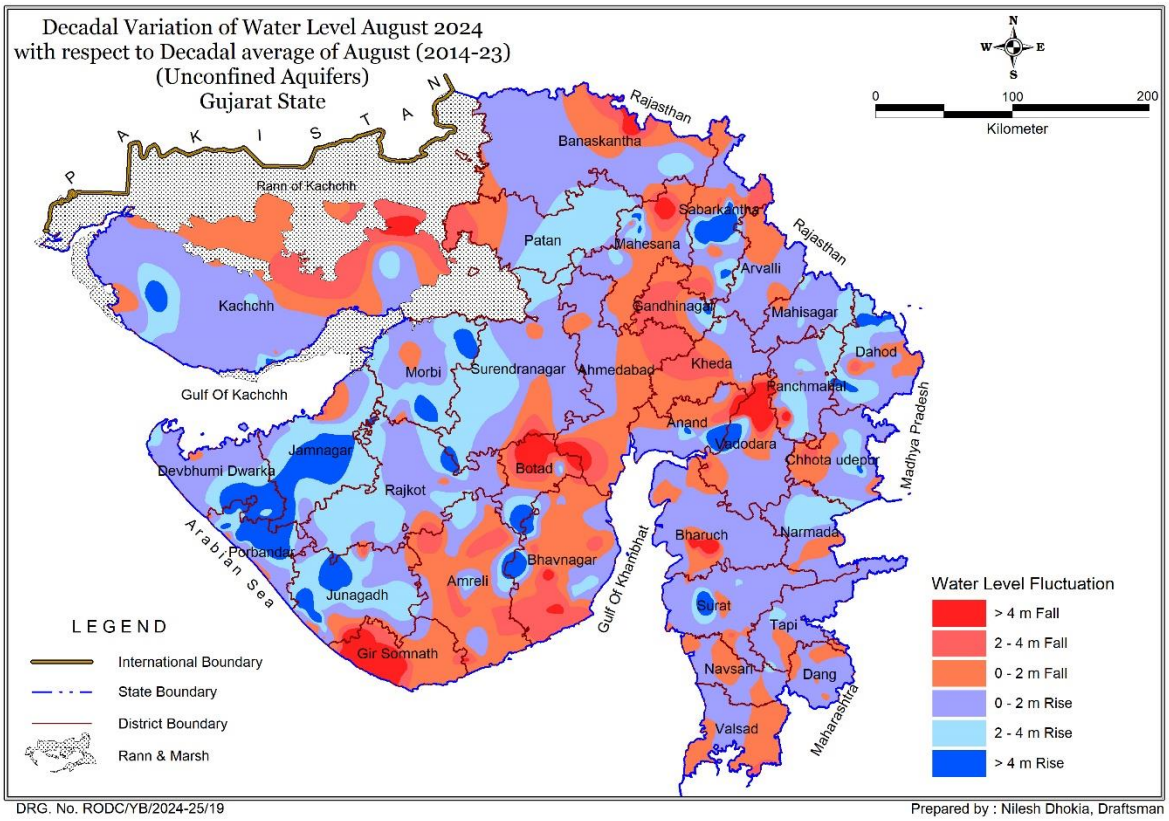


Figure15: Decadal Fluctuation in Unconfined Aquifer (Decadal average of August (2014 to 2023) to August 2024)

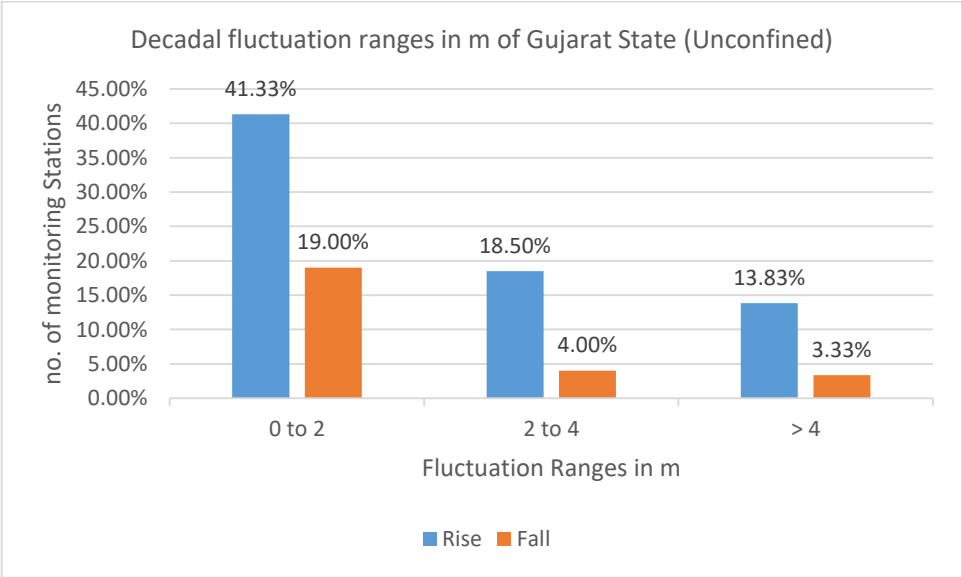


Figure 16: Decadal Fluctuation in Unconfined Aquifer (Decadal average of August (2014 to 2023) to August 2024)

Decadal Fluctuation in Peizometric surface: Decadal average of August (2014 to 2023) to August 2024 in confined and Semi-confined Aquifer

A comparison of the water level of the August 2024 with the average water level of the August for last one decade (2014-2023) reveals that there is the rise in 57.4% of well analysed. Rise is mostly in the range of 0 to 2 m (29.6% of total wells). Fall in water levels is observed in 42.6% of well analysed. The maximum rise of 20.24m is recorded in Narmada district whereas the maximum decline of 22.68 m is recorded in Banas Kantha district.

In *North Gujarat*, 50 % of wells have shown rise and mostly in range of 0 to 2 m (26.7 % of wells). The fall of 50% in water level is observed in the almost all area of north Gujarat where > 4m observed in Banas Kantha, Gandhinagar and Mehesana.

South Gujarat has experienced the rise in 60% of wells analysed whereas 40% shows fall. In the range of 0 to 2 m, 20% of well shows the fall while 30% of wells shows the rise. More than 4 m of fall in water level shows only in Vadodara districts of South Gujarat region.

In *Saurashtra* region, 66.7% of total well shows the rise in water level where as 33.3% shows the fall. The fall of water level mainly observed in range of 0-2 m (44.4%). The rise in water level is observed in Amerli, Bhavnagar, Botad, Porbandar and Rajkot districts of the Saurashtra region and rise of more than 4 m in water level is observed only in Bhavnagar district of Saurashtra region.

In Kachchh, 80% of the wells analysed have recorded the rise in water levels whereas 20% shows the fall. Rise is observed mostly in the range of greater than 4 meter (60 % wells). Map and graph of Decadal Fluctuation in Confined Aquifer Decadal average of August (2014 to 2023) to August 2024 shown in Fig.17 and Fig.18 respectively.

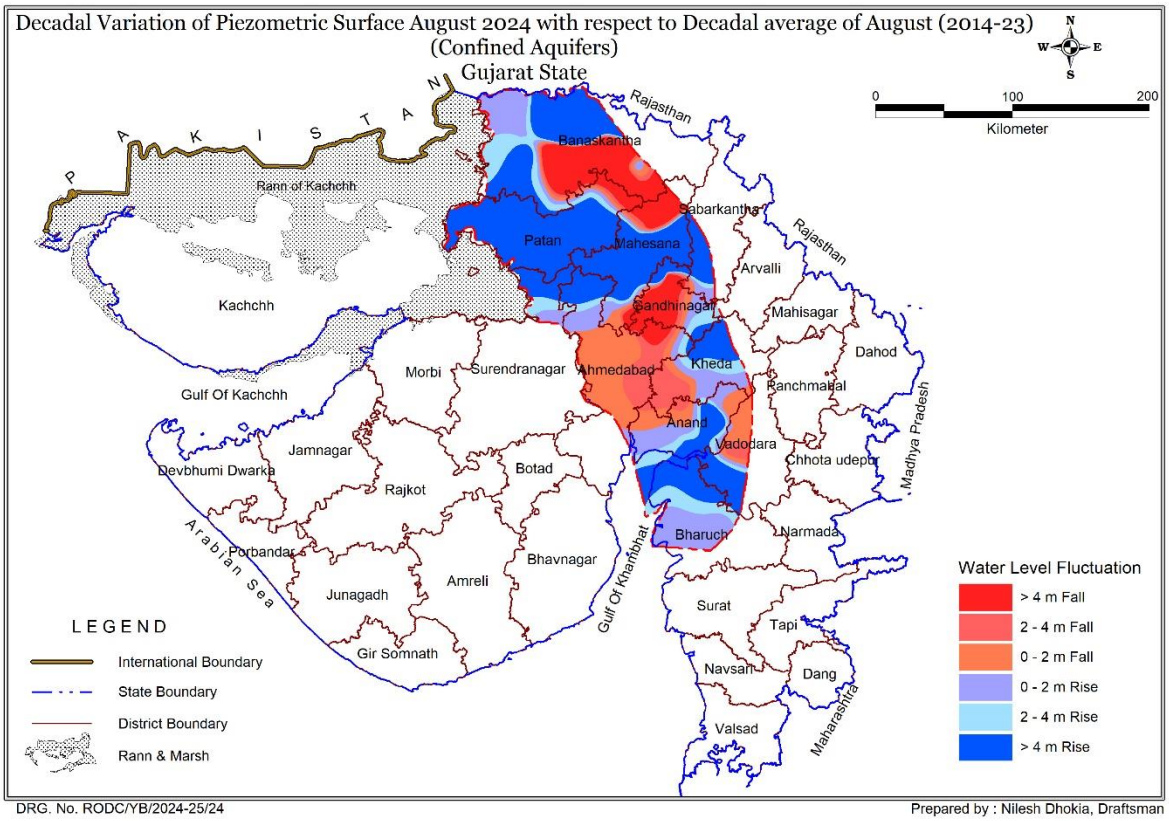


Figure 17: Decadal Fluctuation of Piezometric Level in Confined / Semi- confined Aquifer Decadal average of August (2014 to 2023) to August 2024

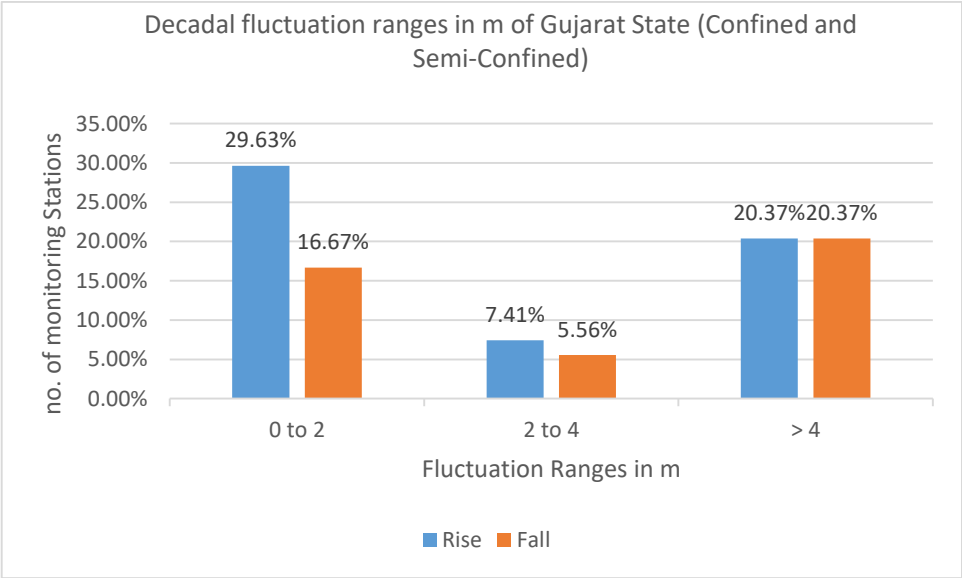


Figure 18: Decadal Fluctuation of Piezometric Level in Confined / Semi- confined Aquifer Decadal average of August (2014 to 2023) to August 2024

Summary

As a component of the National Ground Water Monitoring Programme, the CGWB, WCR, Ahmedabadconducts monitoring of the ground water conditions on a quarterly basis: in January, pre-monsoon May, post monsoon August, and November. As of August 31, 2024, the WCR of the Central Ground WaterBoard supervises 789 dug wells and 504 piezometers. This comprehensive effort aims to portray the variations in the state's ground water conditions across different aquifers.

In August 2024, depth to water level of >40 m bgl is observed about 41.1% of district. During August 2024, decadal fluctuation for Peizometric head in *North Gujarat*, 50 % of wells have shown rise and mostly in range of 0 to 2 m (26.7 % of wells). The fall of 50% in water level is observed in the almost all area of north Gujarat where > 4m observed in Banas Kantha, Gandhinagar and Mehesana. In August 2024, In confined aquifer, annual fluctuation of >40 m bgl is Rise of more than 4 m is significantly observed in Patan, Chhotaudepur districts.