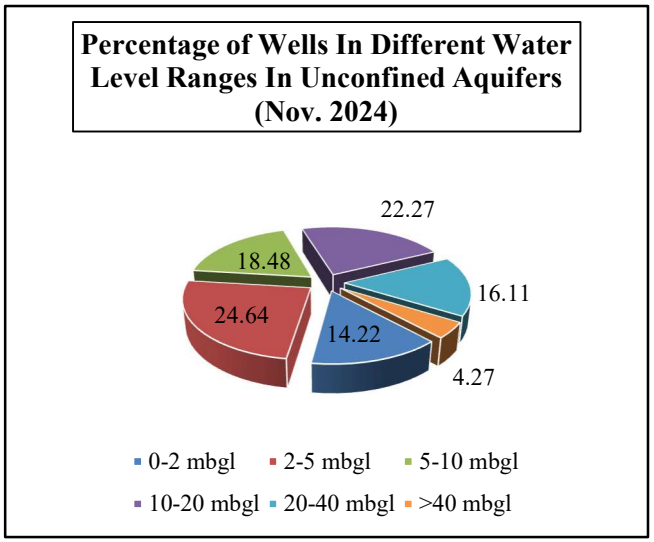

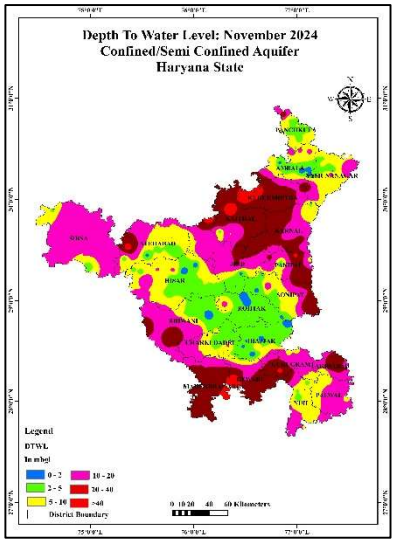

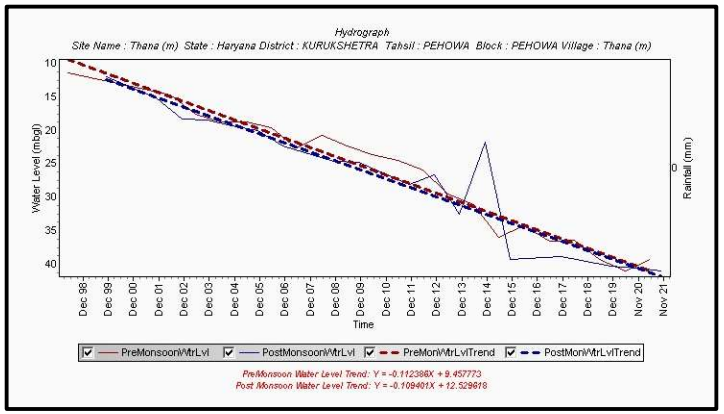

GROUND WATER LEVEL BULLETIN

HARYANA

ABSTRACT

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

CGWB, NORTH WESTERN REGION, CHANDIGARH

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 climatic parameters like rainfall, evapotranspiration etc., whereas anthropogenic influences include pumpage from the aquifer, recharge due to irrigation systemsand other practices like waste disposal etc.

Groundwater levels are being measured by Central Ground Water Board four times a year during January, June, August and November. The regime monitoring started in the year 1969 by Central Groundwater Board. A network of 1874 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

Ground water is among the Nation's most precious natural resources. Measurements of water levels in wells provide the most fundamental indicator of the status of this resource and are critical to meaningful evaluations of the quantity and quality of ground water and its interaction with surface water. Water-level measurements are made by Central Ground Water Board four times a year but the measurements in October are quite crucial as it provides the overall impact of rainfall recharge into ground water system during post monsoon season and ground water withdrawal for irrigation which counts nearly 65% of its annual irrigation demands during this period only.

The Haryana State is located between north latitudes 27^0 39' & 30^0 55' and east longitudes 74^0 27' & 77^0 35' covering an area of 44,212 sq. km. The State has been divided into four main divisions viz. Ambala, Gurgaon, Rohtak and Hissar, which are further sub-divided into 22 districts and 141 community development blocks. The state is sub-divided into nine physiographic units and is drained by two major rivers, Ghaggar and Yamuna. There are four

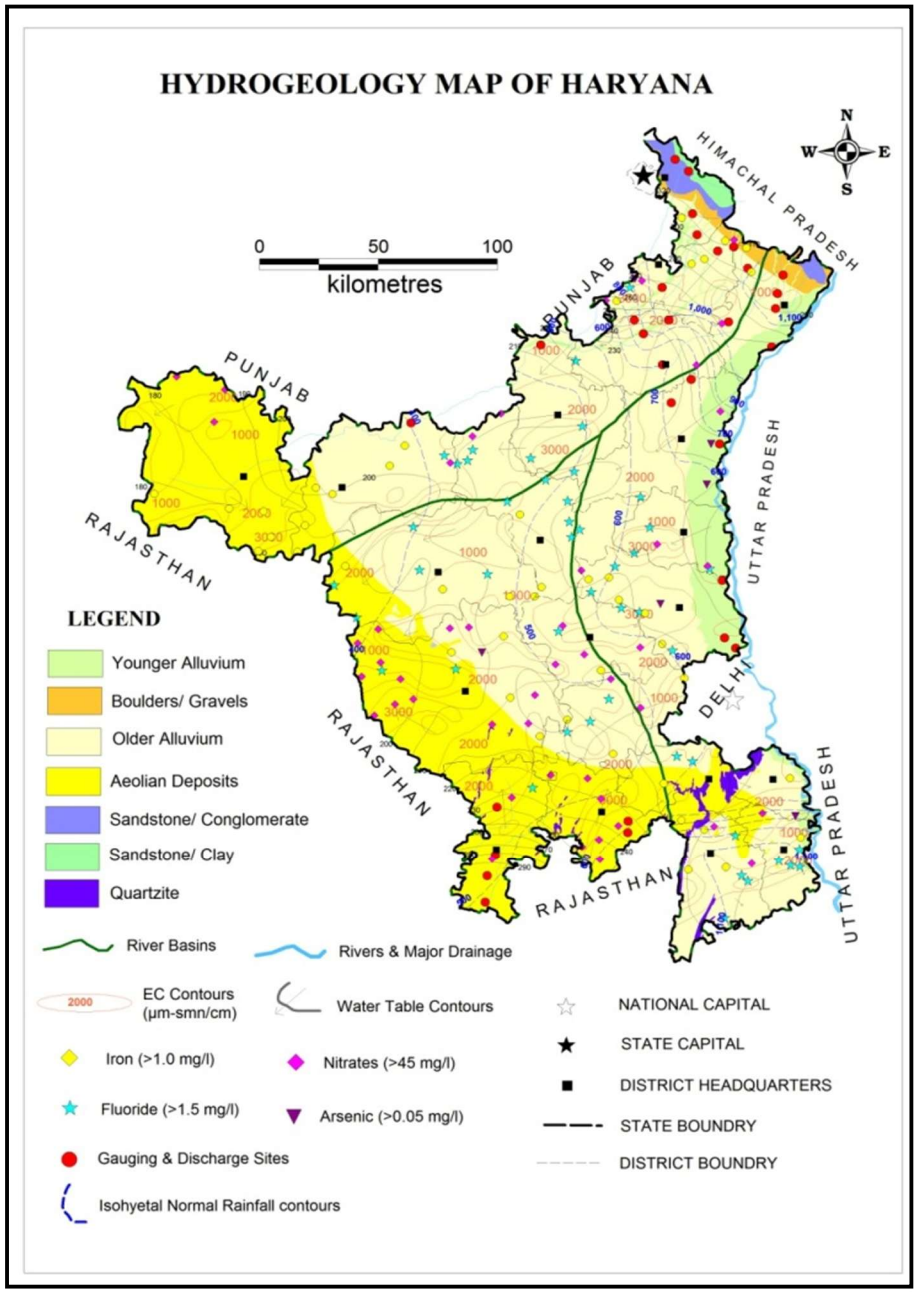

Figure-1: Map showing major aquifers and Hydrogeology of Haryana

irrigation systems in the state namely Western Yamuna Canal, Bhakra canal, Agra canal and Ghaggar canal. Three geological rock groups are prevalent in the state viz. Pre-Cambrian, Tertiary and Quaternary. The Quaternary Group comprises of alluvium which occupies 97% of the area of the State. The Tertiary Group is represented by the outermost zone of the Siwalik System composed mainly of sandstones, clay and boulders. The rocks of Pre-Cambrian Group which form part of the Aravalli Hill Ranges are exposed in Gurgaon, Mewat and Faridabad districts and as small outcrops in other Southern districts. The thickness of alluvium deposits decreases from North to South. The State of Haryana lies in the great Indo-Gangetic Plain. The Quaternary alluvium has been deposited at places on semi-consolidated Tertiary rocks (Siwalik Group) or on a basement of metamorphic and igneous rocks of Precambrian Era. The present and ancient rivers laid down the alluvial sediments since Pleistocene Epoch in the foredeep or a down wrap formed in front of the rising Himalayan ranges and these pediments represent the younger geological formation.

3.0 GROUND WATER LEVEL MONITORING

Central Ground Water Board, North Western Region, Chandigarh has established Ground Water Observation Wells (GWOW) in Haryana State for monitoring the water levels. As on 31.03.2024, there were 538 Ground Water Observation Wells which included 151 dug wells and 387 piezometers for monitoring unconfined, semi- confined & confined aquifers. The district wise details of Ground water observation wells are given in Table 1 and location of these Ground water observation wells is shown in Figure 2.

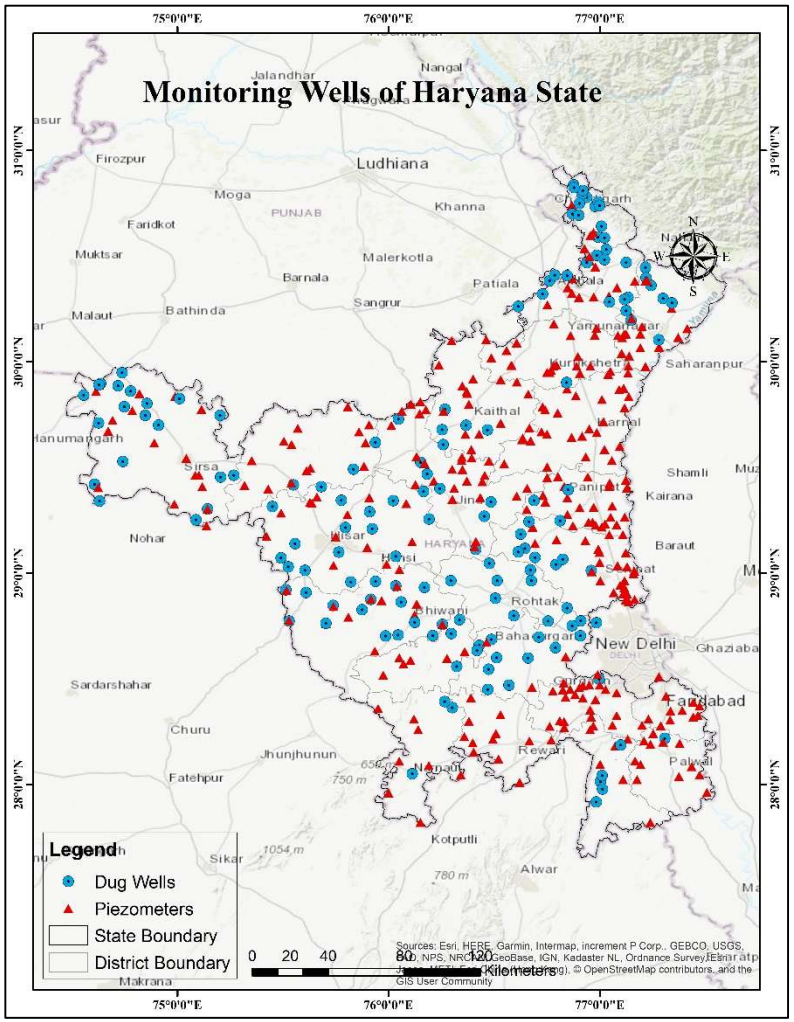

Figure- 2: Map showing locations of monitoring wells (NHNS) in Haryana

S. No.	District	Dug Well	Tube Well	Total
1	Ambala	10	21	31
2	Bhiwani	18	15	33
3	Charkhi Dadri	4	9	13
4	Faridabad	0	14	14
5	Fatehabad	2	19	21
6	Gurugram	1	25	26
7	Hisar	17	19	36
8	Jhajjar	11	3	14
9	Jind	6	30	36
10	Kaithal	6	24	30
11	Karnal	0	38	38
12	Kurukshetra	0	24	24
13	Mahendragarh	3	8	11
14	Nuh	5	4	9
15	Palwal	1	12	13
16	Panchkula	18	7	25
17	Panipat	3	28	31
18	Rewari	0	12	12
19	Rohtak	9	0	9
20	Sirsa	21	23	44
21	Sonipat	9	26	35
22	Yamunanagar	7	26	33
23	**Grand Total**	151	387	538

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

4.0 GROUND WATER LEVEL SCENARIO (NOVEMBER, 2024)

4.1 SHALLOW AQUIFER (UNCONFINED)

4.1.1 DEPTH TO WATER LEVEL

Depth to Water Level in Unconfined Aquifer (November 2024)

The behavioral pattern of water level in November 2024 along with depth to water level map (Fig.3) is discussed below.

The depth to water level lies between 0.1mbgl in Hisar district and 63.46mbgl in Rewari district. Very shallow water levels of 0-2 m (causing water logging) occur in 14.22% of wells and 1.19% area of the state in isolated patches in Jhajjar, Bhiwani and Rohtak districts. Shallow water levels of 2-5 m have been observed in 24.64% of the wells and 18.25% of the total area that lies in central parts of state i.e Hisar, Bhiwani, Rohtak, Jhajjar, Charkhi Dadri, Mahendragarh, Yamunanagar and Sonipat districts. The water levels between 5-10 m are observed in Fatehabad, Jind, Hisar, Bhiwani, Charkhi Dadri, Rohtak, Jhajjar, Mahendragarh, Nuh, Palwal, Ambala and Yamunanagar districts. About 18.48% of wells and 23.30% of the area fall in this range. Moderately Deep-water levels (10-20 m) are observed in 22.27% wells covering about 33.83% area of the State Sirsa, Fatehabad, Jind, Panipat, Karnal, Kurukshetra, Yamunanagar, Rewari, Gurgaon, Faridabad, Palwal, Bhiwani, Charkhi Dadri and Mahendragarh districts. Deep water levels (20-40 m) are observed in parts of Kurukshetra, Kaithal, Karnal, Panipat, Jind, Sirsa, Bhiwani, Gurgaon, Charkhi Dadri Rewari, Faridabad, Sonipat and Yamunanagar districts and observed in 16.11% wells covering about 21.60% area of the state. Very deep water levels (>40 m) are observed in 4.27% wells as patches in Gurgaon, Kurukshetra, Kaithal, Fatehabad and Sirsa districts covering 1.78% area of the State.

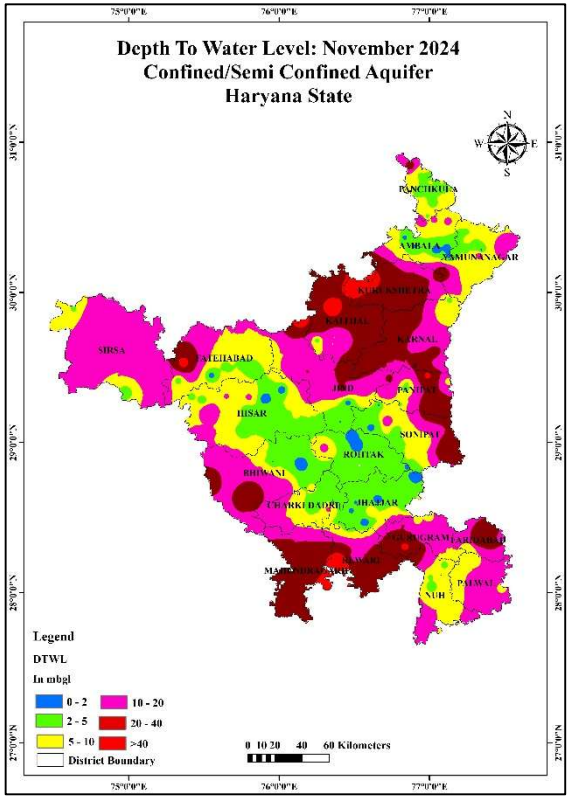

Figure-3: Depth to Water Level Map Unonfined Aquifer, November 2024

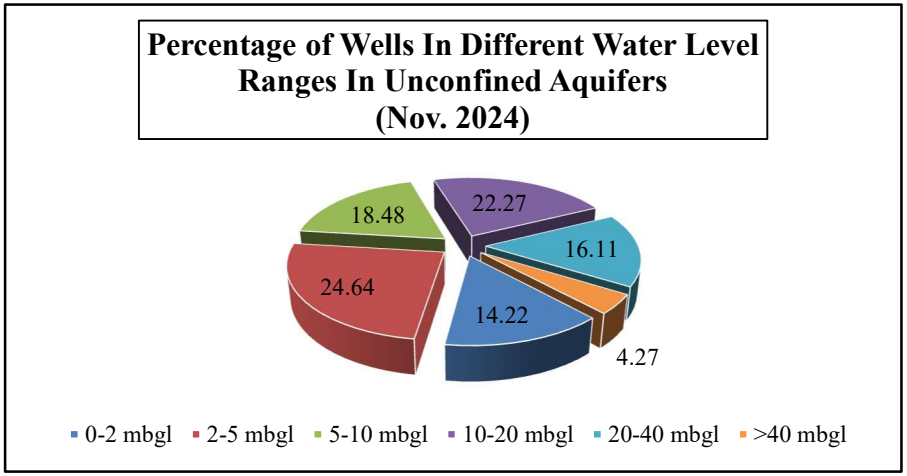

Figure-4: Percentage of wells in different water level ranges in unconfined aquifer.

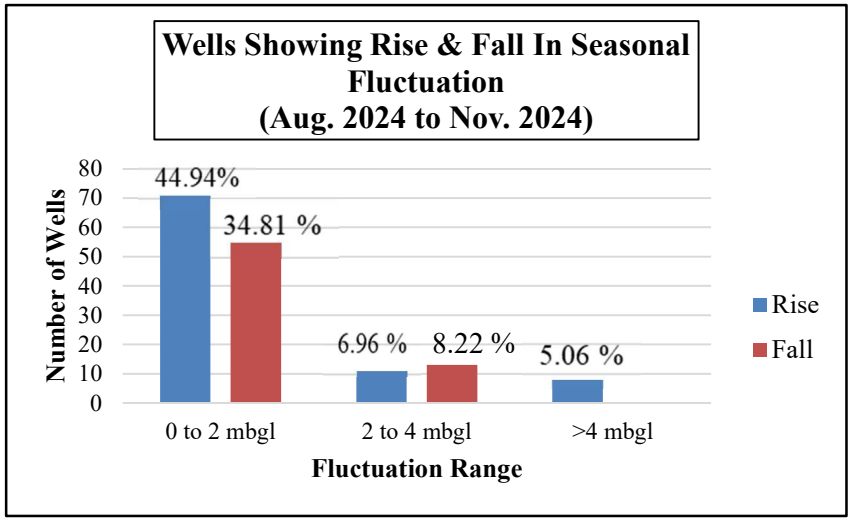

Figure-5: Percentage of wells showing rise and fall in WL in Unconfined aquifer (August 2024 to November 2024)

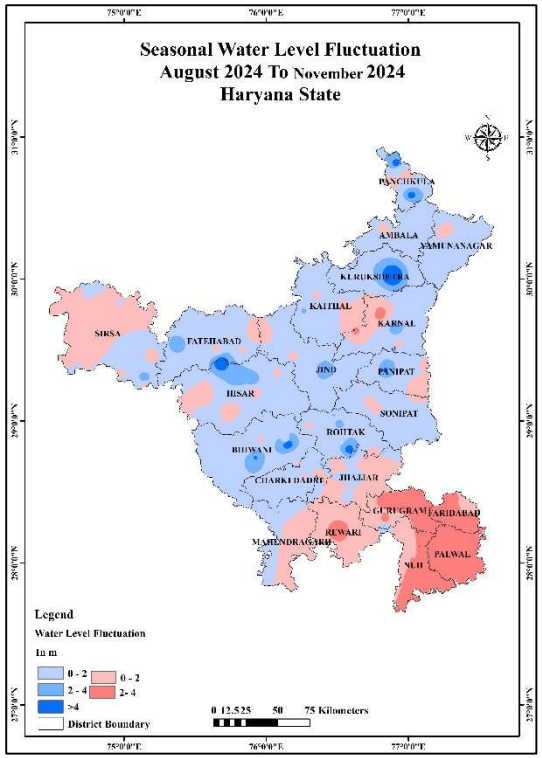

Figure-6: Seasonal water level fluctuation in unconfined Aquifer (August 2024 to November 2024)

4.1.2 SEASONAL FLUCTUATION IN WATER LEVEL

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

Water level data of November 2024 when compared with previous measurement data i.e. August 2024 is termed as seasonal water level fluctuations. The behavioral pattern of this seasonal fluctuation is discussed below. The map depicting seasonal water level fluctuations is shown in Fig.6.

Rise in Water Levels:

The water level rise has been recorded in 56.96% of wells monitored and covering 67.34% area of the State. Water level rise in the range of 0-2 m is observed in 44.94% of wells and 62.14% of the area. Water level rise 2-4m is observed in 6.96% of the wells & 4.39% area. Water level rise of >4m is observed in 5.06% wells and in less than 1% area as isolated patches in Hisar, Kaithal, Jind, Karnal and Ambala districts.

Fall in Water Levels:

The seasonal fluctuation shows that there is a general decline of water levels in 43.04% of wells monitored and covering 32.66% area of the State. The decline has been observed in all districts except some isolated patches scattered over the state. Water level decline in the range of 0-2 m is observed in 34.81% of wells and 23.44% of area. Water level decline in the range of 2-4 m is observed in 8.22% of wells and 9.17% of area. Water level decline of >4m is not observed in any well of the area as decline isolated patches found in Palwal, Gurugram and Faridabad districts.

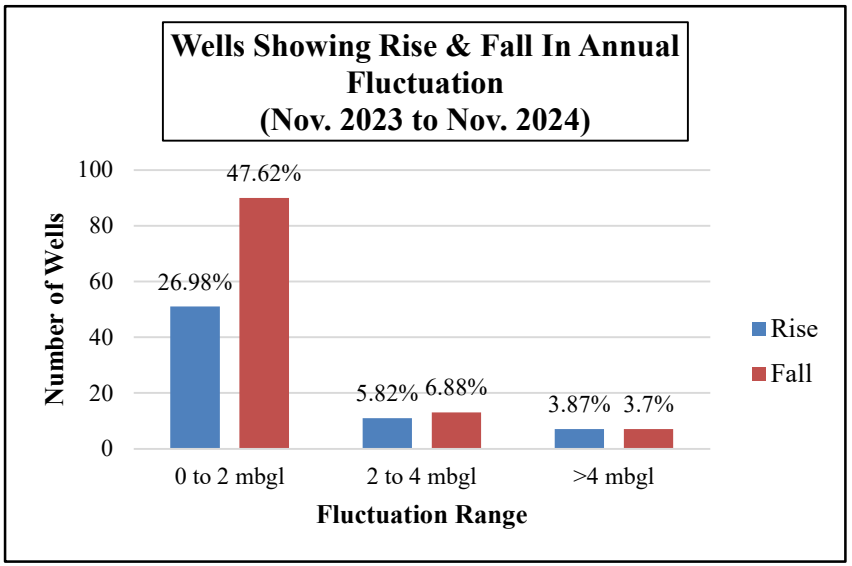

Figure-7: Percentage of wells showing rise and fall in WL in unconfined aquifer (November2023 to November 2024)

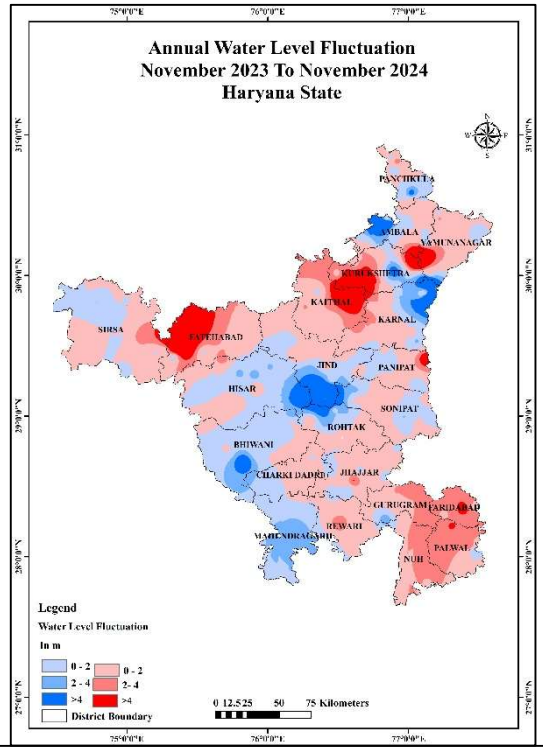

Figure-8: Annual water level fluctuation in unconfined aquifer(November 2023 to November 2024)

4.1.3 ANNUAL FLUCTUATION IN WATER LEVEL

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

In order to know the impact of rainfall and ground water withdrawal during last one-year, annual water level fluctuations for period November 2023 and November 2024 are calculated. The behavior of annual fluctuations is discussed in the following paragraph and depicted in Fig.8.

Rise in Water Levels:

The water level rise has been recorded in 38.55% of wells monitored and covering 37.80% area of the State. Water level rise in the range of 0-2 m is observed in 26.98% wells and 28.10% of area. Water level rise 2-4m is observed in 5.82% wells and 6.08% of area. The water level rise of >4m is observed in 3.87 % wells and 3.61% of area as isolated patch in Hisar, Jind, Bhiwani and Karnal district.

Fall in Water Levels:

The annual fluctuation depicts general decline of water levels in 61.45% of wells monitored and covering 62.2% area of the State. The decline has been observed in all districts of the state except Mahendragarh. Water level decline the range of 0-2 m is observed in 47.62% of wells and 45.50% of the area. Water level decline in the range of 2-4 m is observed in 6.88% of wells and 11.67% of the area. Whereas, the water level decline of >4m is observed in 3.7% of wells and 4.95% of the area during the period, as isolated patches in Kaithal, Kurukshetra and Fatehabad districts.

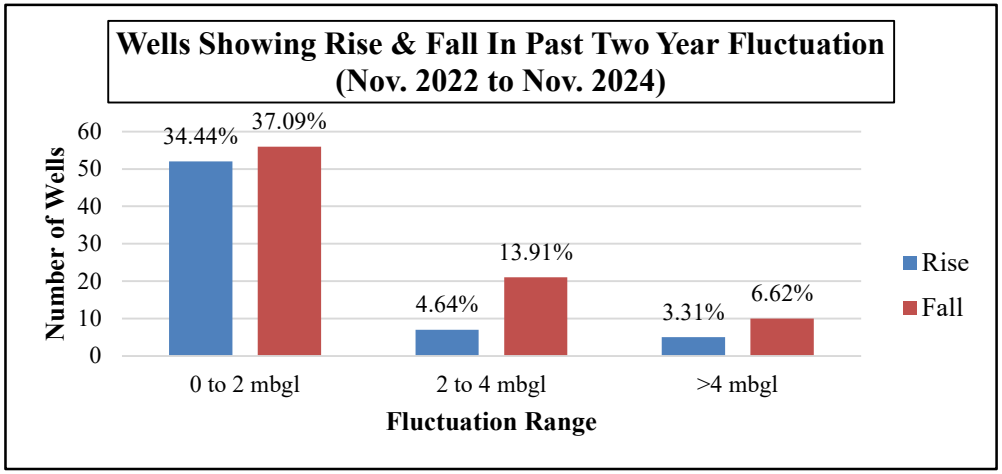

Figure-9: Percentage of wells showing rise and fall in WL in unconfined aquifers (November 2022 to November 2024)

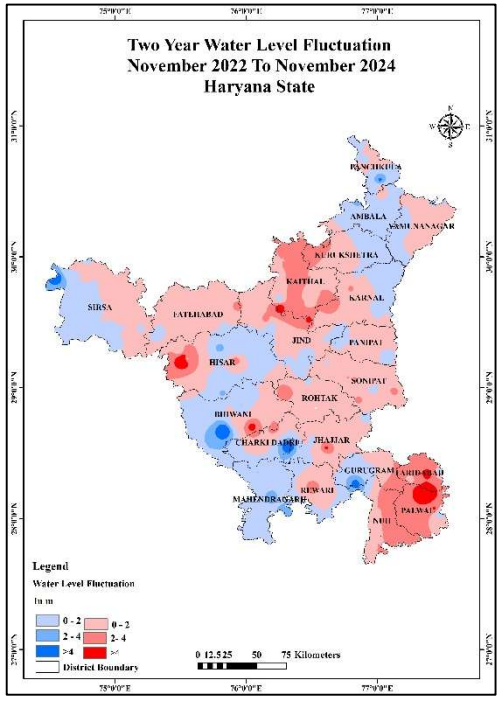

Figure-10: Water Level Fluctuation Map (November 2022 to November 2024)

4.1.4 PAST TWO YEAR FLUCTUATION IN WATER LEVEL

Past Two-Year Fluctuation of Water Level in Unconfined Aquifer (November 2022 to November 2024)

In order to know the impact of rainfall and ground water withdrawal during last two years, past two year water level fluctuations for period November 2022 and November 2024 are calculated. The behavior of annual fluctuations is discussed in the following paragraph and depicted in Fig.10.

Rise in Water Levels

The water level rise has been recorded in 42.38% of wells monitored and covering 36.56% area of the State. Water level rise in the range of 0-2 m is observed in 34.44% wells and 33.78% of area. Water level rise 2-4m is observed in 4.64% wells and 2.18% of area. The water level rise of >4m is observed in 3.31% wells less than 1% of area as isolated patches in Sirsa, Bhiwani, Charkhi Dadri, Karnal and Ambala districts.

Fall in Water Levels

The annual fluctuation depicts general decline of water levels in 57.62% of wells monitored and covering 63.44% area of the State. The decline has been observed in all districts of the state. Water level decline the range of 0-2 m is observed in 37.09% of wells and 49.78% of the area. Water level decline in the range of 2-4 m is observed in 13.91% of wells and 12.52% of the area. Whereas, the water level decline of >4m is observed in 6.62% of wells and 1.12% of the area during the period, as isolated patches in Bhiwani, Fatehabad, Hisar, Jind, Kaithal, Rewari and Charkhi Dadri districts.

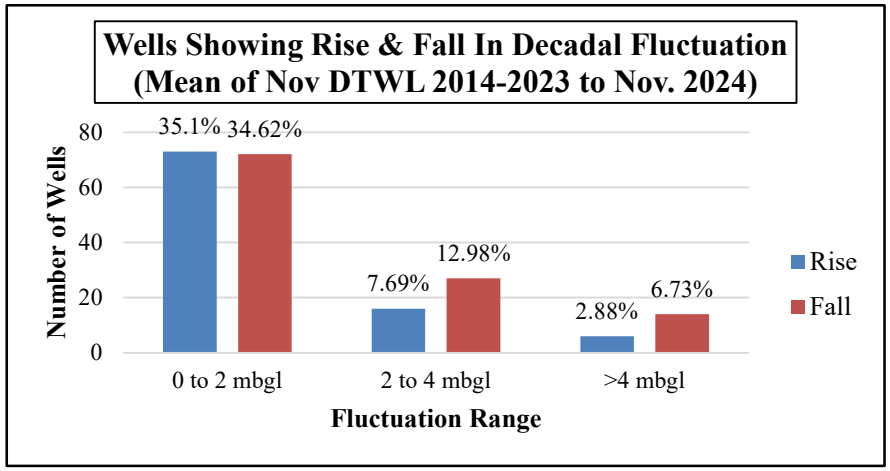

Figure-11: Percentage of wells showing rise and fall in WL in unconfined Aquifer (Decadal Mean November (2014-2023) to November 2024)

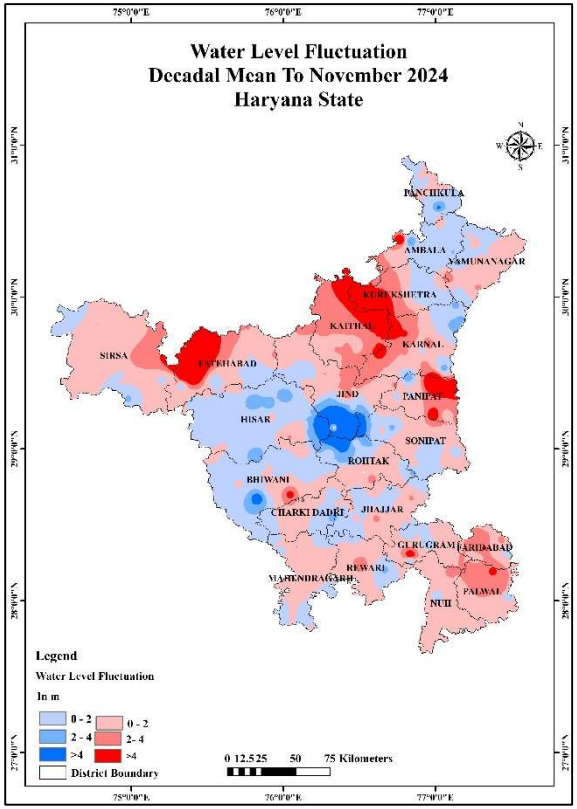

Figure-12: Water level fluctuation in unconfined Aquifer(Decadal Mean November (2014-2023) to November 2024)

4.1.5 DECADAL FLUCTUATION IN WATER LEVEL

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

Changes in water level behavior since last one decade are determined using decadal mean data. Water level mean of past one decade (2014-2023) for each ground water observation well is computed and compared with the respective water level data of November 2024. The behavior of water level over the period under reference is discussed in paragraph below along with Fig.12.

Rise in Water Levels:
The decadal mean fluctuations show that rise in 45.7% of observation wells monitored covering about 36.34% area of the state. Water level rise in the range of 0-2 m is observed in 35.1% of wells and 31.34% of the area. Water level rise of 2-4m is observed in 7.69% of wells and 3.13% of the area. Water level rise of >4m is observed in 2.88% of wells and 1.86% of the state area as isolated patch in Sirsa, Mahendragarh, Bhiwani and Ambala districts.

Fall in Water Levels:
The decadal mean fluctuations show that decline in 54.30% of observation wells monitored covering about 63.66% area of the state. The decline has been observed in all districts of the state. The decline of 0-2 m has been observed in about 34.62% of wells and 45.56% of area. Water level decline of 2-4 m is observed in 12.98% of the wells and 12.26% of the area. Water level decline of >4m is observed in 6.73% of the wells and 5.73% of area during the period, in Sirsa, Fatehabad, Karnal, Kaithal, Panipat, Rohtak, Rewari, Gurgaon, Bhiwani and Charkhi Dadri districts.

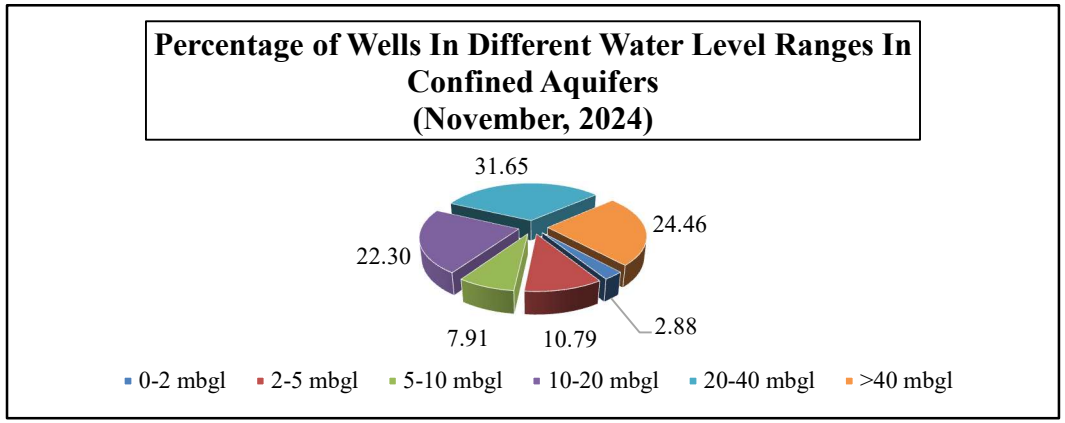

Figure-13: Percentage of wells in different water level ranges in Confined/Semi-Confined aquifer.

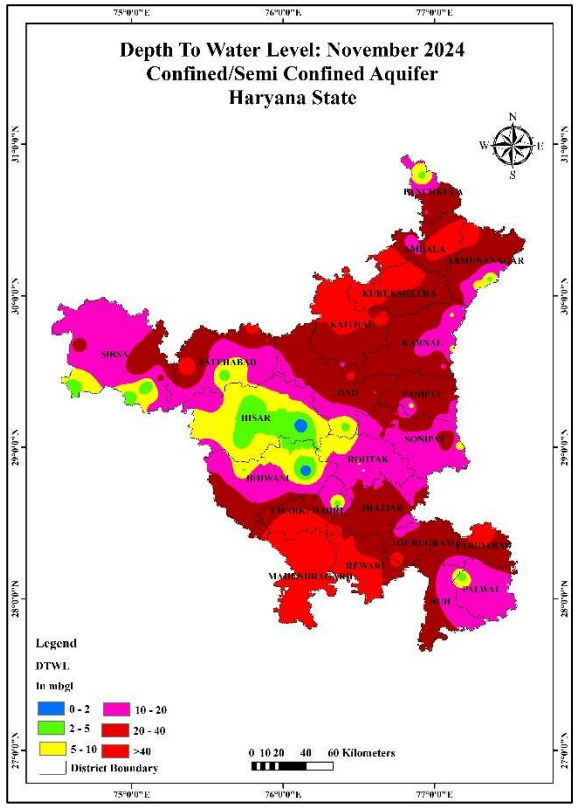

Figure-14: Depth to Water Level Map Confined/Semi-Confined Aquifer, November 2024

4.2 DEEPER AQUIFER (CONFINED/ SEMI-CONFINED)

4.2.1 DEPTH TO PIEZOMETRIC LEVEL

The behavioral pattern of water level in November 2024 along with depth to water level map (Fig. 14) is discussed here. The depth to water level lies between 0.8 mbgl in Bhiwani district and 98.22 mbgl in Mahendragarh district. Very shallow water levels of 0-2 m (causing water logging) do occur in 2.88% of the wells and less than 1% of the total area. Shallow water levels of 2-5 m have been observed in 10.79% of the wells and 4.21% of the total area. The water levels between 5-10 m are about 7.91% of wells and 9.97% of the area fall in this range. Moderately Deep-water levels (10-20 m) are observed in 22.30% wells covering about 30.72% area of the State. Deep water levels (20-40 m) are observed in 31.65% wells covering about 39.21% area of the state. Very deep-water levels (>40 m) are observed in 24.26% covering 15.57% area of the State.

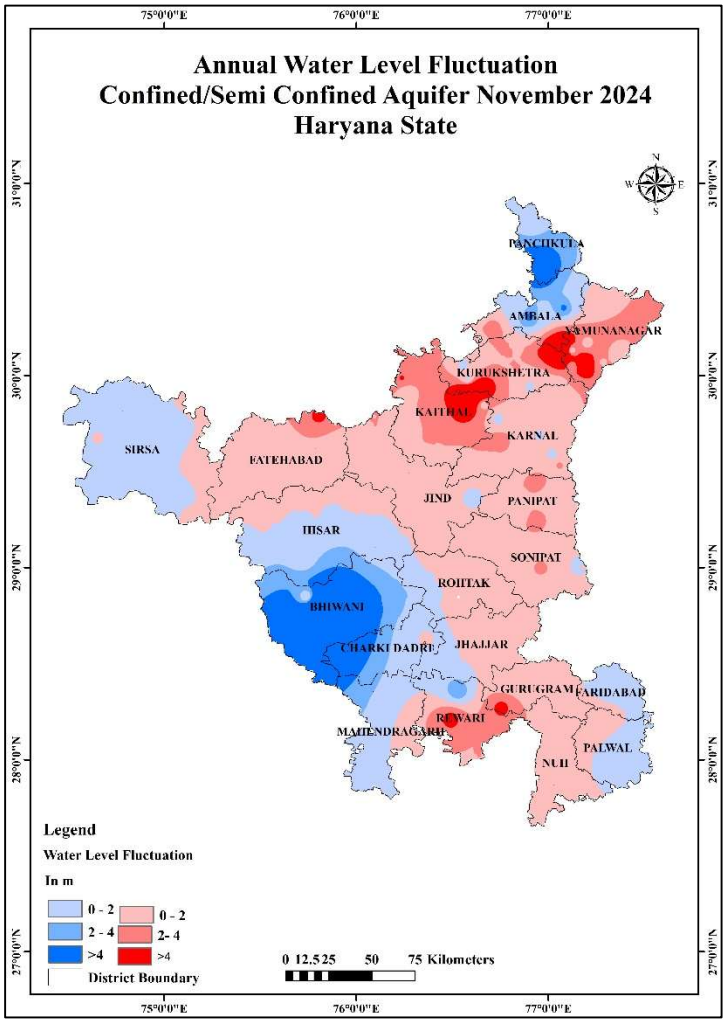

Figure-15: Annual water level fluctuation in Confined/Semi-Confined aquifer (November 2023 to November 2024)

4.2.2 ANNUAL FLUCTUATION IN WATER LEVEL

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

In order to know the impact of rainfall and ground water withdrawal during last one-year, annual water level fluctuations for period November 2023 and November 2024 for the confined aquifers and semi-confined aquifers are calculated. The behavior of annual fluctuations is discussed in the following paragraph and depicted in Fig 15.

Rise in Water Levels:

The water level rise has been recorded in 38.81% area of the State. Water level rise in the range of 0-2 m is observed in 26.42% of area. Water level rise 2-4m is observed in 5.24% of area. The water level rise of >4m is observed in 7.15% of area as in Sirsa, Hisar, Bhiwani and Panchkula districts.

Fall in Water Levels:

The annual fluctuation depicts general decline of water levels in 61.19% area of the State. The decline has been observed in most of the districts of the state. Water level decline the range of 0-2 m is observed in 48.80% of the area. Water level decline in the range of 2-4 m is observed in 10.16% of the area. Whereas, the water level decline of >4m is observed in 2.20% of the area during the period in Kaithal, Fatehabad, Jind, Panipat, Sonipat district.

5.0 Recommendations to improve decline in Groundwater

The declining trend of ground water level in Haryana can be improved by Demand and Supply-Side Interventions for Water Conservation which are as given below:

1. **Demand Side Interventions**
   i. Change in Paddy Variant – Switching from PUSA-44 (150 days maturity) to PR-126 (117 days maturity) can save 25% of groundwater.
   ii. Use of AI and Tensiometers – AI-based irrigation and tensiometers help optimize water usage, reducing irrigation needs from 1102 mm/acre to 820 mm/acre.
   iii. Reduction of Standing Water Column – Lowering the water column from 145 cm to 120 cm in rice cultivation reduces water consumption.
2. **Supply Side Interventions**
   i. Artificial recharge structures in government buildings can aid groundwater conservation. Lining of Unlined Channels – Converting unlined irrigation channels to lined ones can reduce groundwater overdraft.
   ii. Underground Pipelines – Expanding underground pipeline coverage can decrease groundwater development.
   iii. Canal Water for Irrigation – Maximizing canal water usage can improve groundwater recharge and reduce dependence on groundwater.
   iv. Artificial Recharge in Paleochannels – Excavating ponds and constructing recharge trenches in paleochannels can enhance groundwater recharge.
   v. Reuse of Wastewater – Treating and reusing pond water through the 3-pond system or Thapar model, with solar-powered lifting, helps conserve groundwater.
   vi. Construction of Injection Wells – Injection wells at minor canal outlets can use surplus canal water to recharge groundwater; a pilot project is already underway at Lehal Canal.
   vii. Rainwater Harvesting – Installing rainwater harvesting