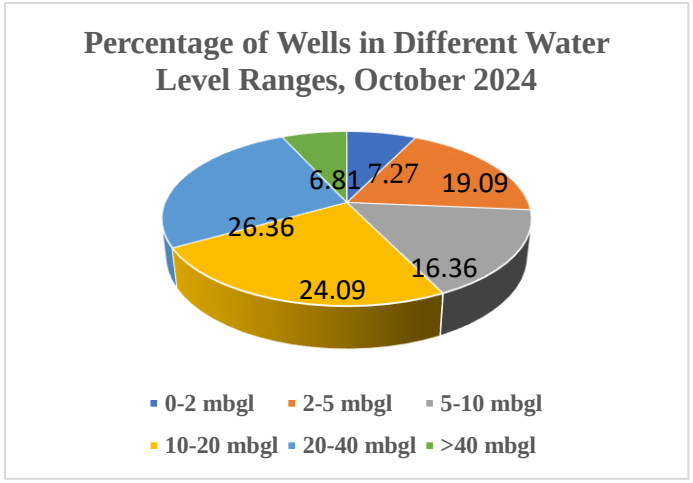

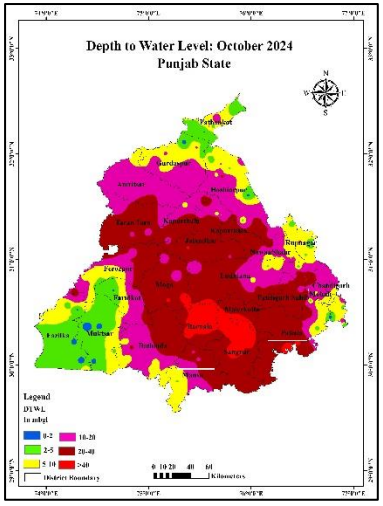

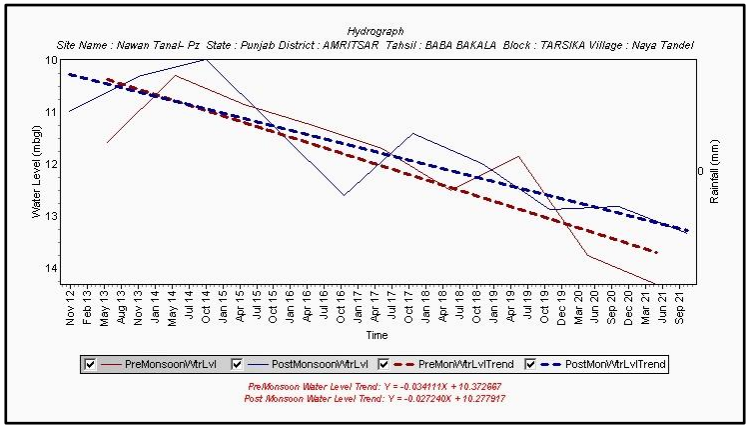

GROUND WATER LEVEL BULLETIN

PUNJAB STATE AND CHANDIGARH UT

ABSTRACT

Ground water level Scenario during October-2024 highlighting the **findings, status of ground water level in different aquifers andits** 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 systems and 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

The Punjab State is located between North latitudes 29° 32’ and 32° 28’ and East longitudes 73° 50’ and 77° 00’. The total geographical area of the state is 50476 sq. km. It is surrounded by the states of Himachal Pradesh in the northeast, Jammu and Kashmir in the north and Haryana and Rajasthan in the south and southwest respectively. The State has a flat alluvial plain except a narrow belt along the southwestern parts where stable sand dunes are seen dotting the landscape. The area occupied by the mountains (Himalayan foothills) in northeast, is about 1243 sq km. Perennial Rivers Sutlej, Beas, Ravi and ephemeral river Ghaggar drain the state. It has a vast network of canal system. With the inception of canals, the fertile land of the State started converting into green fields and experienced spectacular achievement in agricultural production with emphasis on cultivation of paddy and high yielding varieties of crops, as a consequence demand for water increased manifold resulting in over exploitation of ground water resources.

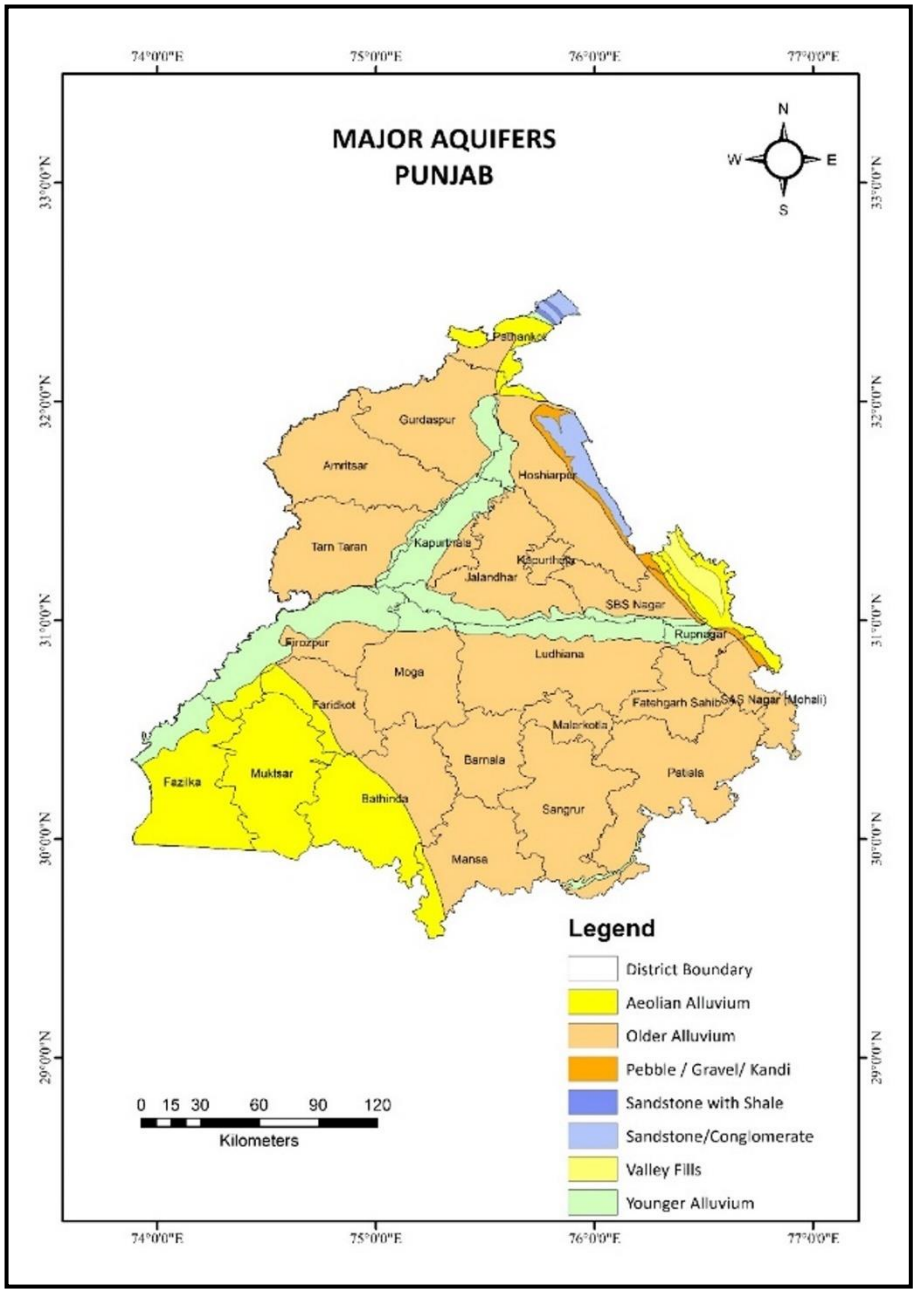

Figure-1: Map showing major aquifers and Hydrogeology of Punjab State & Chandigarh UT

The State has been divided into four main divisions viz. Jalandhar, Patiala, Ferozpur and Faridkot, which are further sub-divided into 23 districts, which are further divided into 77 sub-divisions /tehsils and 146 community development.

The State forms a part of vast Indo-Genetic alluvial plain. Physiographically, the State can be divided into seven distinct units, which run parallel to each other.

I Hilly area: Siwalik Hills on the north and northeastern part.

II Eroded hills with flat land (Plateau): forms top of hills.

III Intermountain valleys

IV Piedmont area: (Kandi zone) immediately southwest of hills.

3.0 GROUND WATER LEVEL MONITORING

The Central Ground Water Board, North Western Region, has established 521 Ground water observation wells in Punjab State and Union Territory of Chandigarh for monitoring water level. As on 31.3.2024 there were 498 Ground Water Observation Wells of CGWB in Punjab which include 114 dug wells and 384 piezometers for monitoring shallow & deeper aquifers in Punjab. There are 23 observation wells in Chandigarh, 1 dug wells and 22 Piezometers for monitoring shallow & deeper aquifers.

About 80% of the Ground water observation wells fall in the canal command areas of various canal systems, the areas falling out of the major command is part of Pathankot, Hoshiarpur, Nawanshahr, Ropar and SAS Nagar districts, parts of Gurdaspur, Jalandhar and Ludhiana districts. 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.

V. Sirowal Zone: lies further southwest of Kandi area which merges with the alluvium of Ravi, Beas, Sutlej and Ghaggar rivers. 2

VI. Alluvial plains:

a) Active/recent flood plains include meanders and present flood plains.

b) Abandoned flood plains include terraces of rivers, abandoned during Recent age.

c) Bar upland areas: Higher elevated land which remained beyond the reach of rivers but are composed of ancient river channels deposits (older alluvium) plains.

VII. Sand Dunes: Covering southwest part

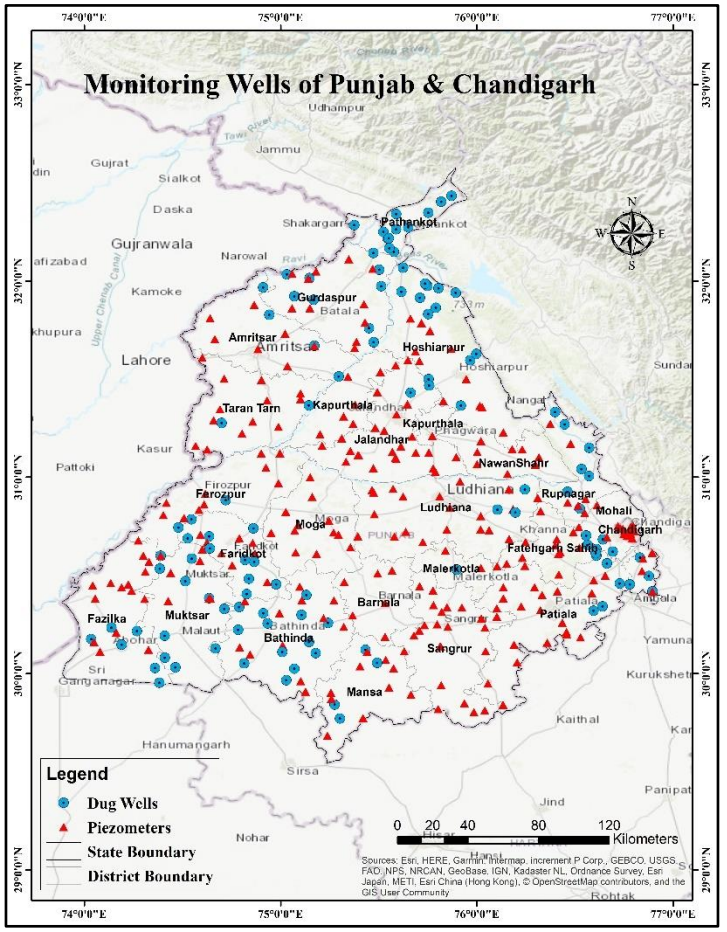

Figure- 2: Map showing locations of monitoring wells (NHNS) in Punjab

S. No.	District	Dug Well	Tube Well	Total
1	Amritsar	3	14	17
2	Barnala	0	7	7
3	Bathinda	14	20	34
4	Faridkot	11	10	21
5	Fatehgarh Sahib	3	19	22
6	Fazilka	7	18	25
7	Firozpur	2	19	21
8	Gurdaspur	10	21	31
9	Hoshiarpur	13	17	30
10	Jalandhar	2	43	45
11	Kapurthala	0	18	18
12	Ludhiana	3	31	34
13	Mansa	4	15	19
14	Moga	0	14	14
15	Muktsar	7	7	14
16	Pathankot	13	0	13
17	Patiala	4	32	36
18	Rupnagar	7	8	15
19	Sangrur	1	32	33
20	Sas Nagar	8	11	19
21	Sbs Nagar	0	9	9
22	Tarn Taran	2	19	21
23	Chandigarh UT	1	22	23
Grand Total		**115**	**406**	**521**

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

4.0 GROUND WATER LEVEL SCENARIO (OCTOBER, 2024)

4.1 SHALLOW AQUIFER (UNCONFINED)

4.1.1 DEPTH TO WATER LEVEL

Depth To Water Level in Unconfined Aquifer (October, 2024)

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

The depth to water level lies between 0.85 mbgl in SAS Nagar district and 48.12 mbgl in Barnala district. Very shallow water levels of 0-2 m (causing water logging) occur in 7.27% of wells and 0.36% area of the state in isolated patches in Muktsar, Fazilka and Pathankot districts. Shallow water levels of 2-5 m have been observed in 19.09% of the wells and 11.17% of the total area that lies in south western parts of state i.e Muktsar, Fazilka, Faridkot and parts of Gurdaspur, Pathankot, and Rupnagar districts. These are mainly canal command areas and use canal water for their agricultural needs. The water levels between 5-10 m are observed in Fazilka, Faridkot, Muktsar, Ferozepur, Bathinda, Mansa, Gurdaspur, Pathankot, Hoshiarpur, SBS Nagar and Rupnagar districts. About 16.36% of wells and 16.11% of the area fall in this range. Moderately Deep water levels (10-20 m) are observed in 24.09% wells covering about 26.78% area of the State Pathankot, Gurdaspur, Amritsar, SBS Nagar, Hoshiarpur, Jalandhar, Tarn Taran, Kapurthala, Moga, Ludhiana, Fazilka, Ferozpur, Faridkot, Bathinda, Mansa, Rupnagar & SAS Nagar districts. Deep water levels (20-40 m) are observed in parts of Amritsar, Taran taran, Jalandhar, Kapurthala, SBS Nagar, Hoshiarpur, Bathinda, Mansa, Moga, Ludhiana, Fatehgarh Sahib, Patiala, Sangrur, Barnala and SAS Nagar districts and observed in 26.36% wells covering about 40.65% area of the state. Very deep water levels (>40 m) are observed in 6.81% wells as patches in Sangrur, Barnala, Malerkotla, Patiala & SAS Nagar districts covering 4.78% area of the State.

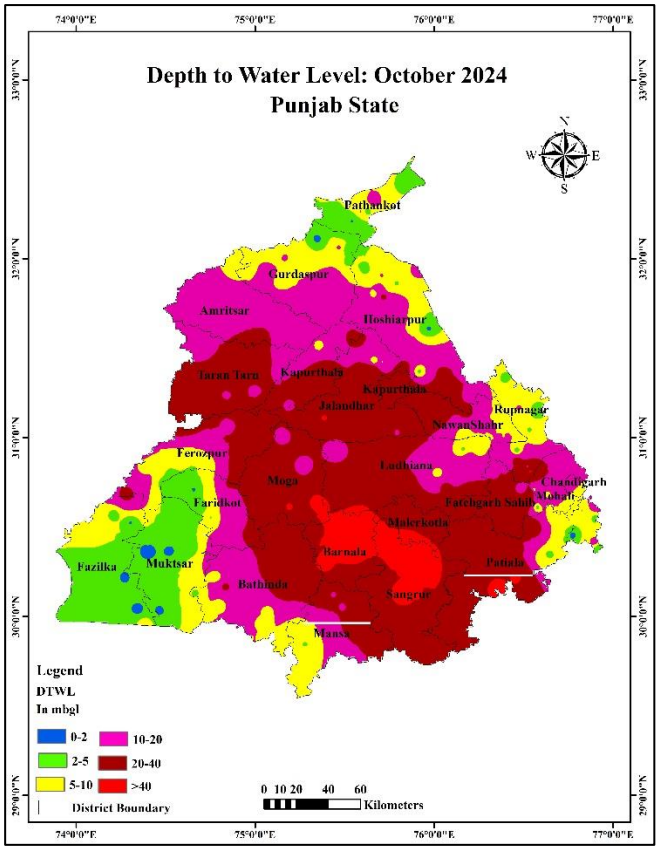

Figure-3: Depth to Water Level Map Unconfined Aquifer, October 2024

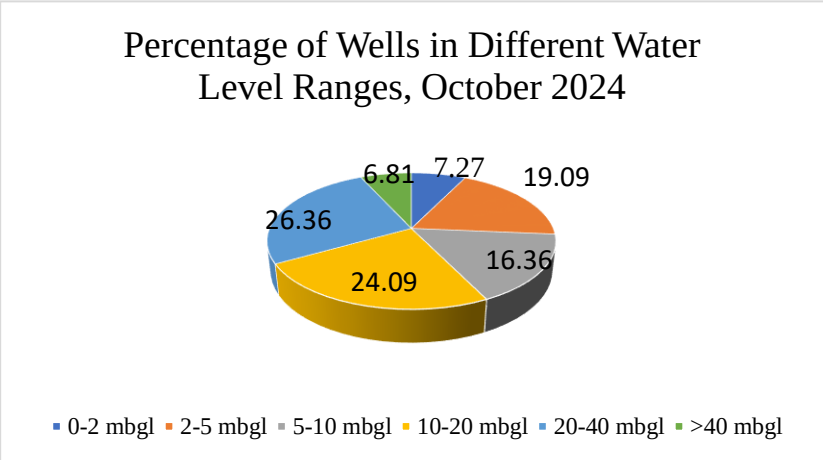

Figure-4: Percentage of wells in different water level ranges in unconfined aquifer.

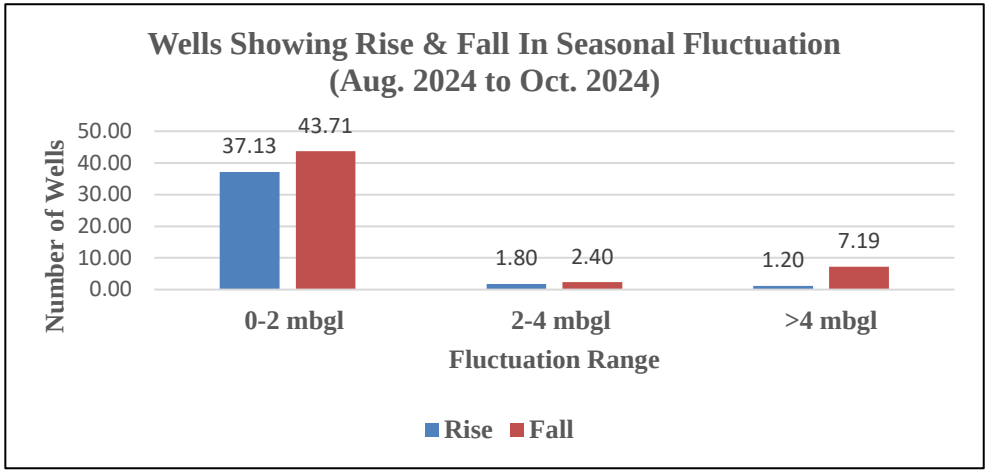

Figure-5: Percentage of wells showing rise and fall in WL in unconfined aquifer(August 2024 to October 2024)

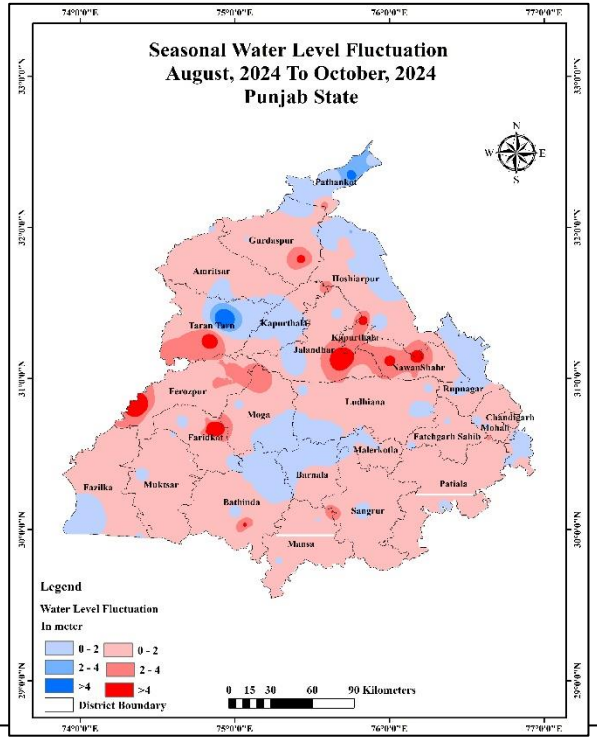

Figure-6: Seasonal water level fluctuation in unconfined Aquifer (August 2024 to October 2024)

4.1.2 SEASONAL FLUCTUATION IN WATER LEVEL

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

Water level data of October 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 42.94% of wells monitored and covering 20.61% area of the State. Water level rise in the range of 0-2 m is observed in 37.13% of wells and 19.48% of the area. Water level rise 2-4m is observed in 1.80% of the wells & less than 1% area. Water level rise of >4m is observed in 1.20% wells and in less than 1% area as isolated patches in Nawanshahar, Kapurthala, Ferozpur and Patiala districts.

Fall in Water Levels:

The seasonal fluctuation shows that there is a general decline of water levels in 57.06% of wells monitored and covering 79.39% 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 43.71% of wells and 70.69% of area. Water level decline in the range of 2-4 m is observed in 2.40% of wells and 7.22% of area. Water level decline of >4m is observed in 7.19% of wells and 1.35% of area as isolated patches in Kapurthala, Bathinda, Muktsar, Pathankot & Faridkot districts.

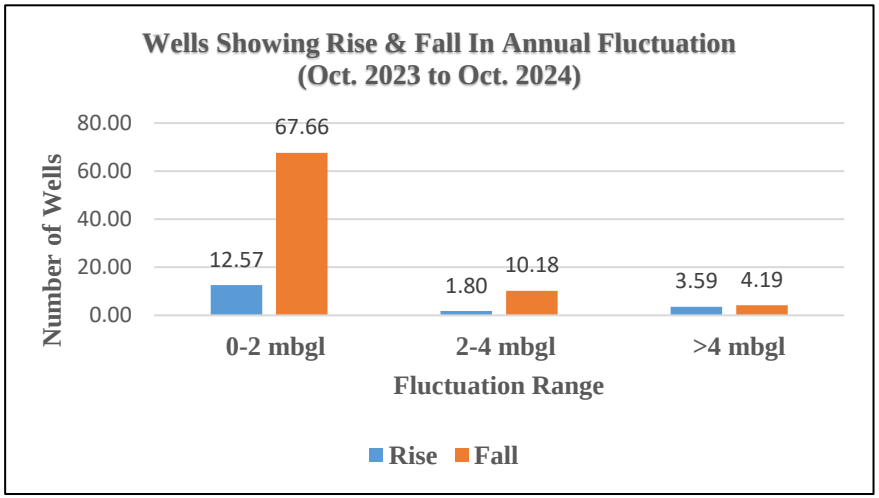

Figure-7: Percentage of wells showing Rise and Fall in WL in unconfined aquifer (October 2023 to October 2024)

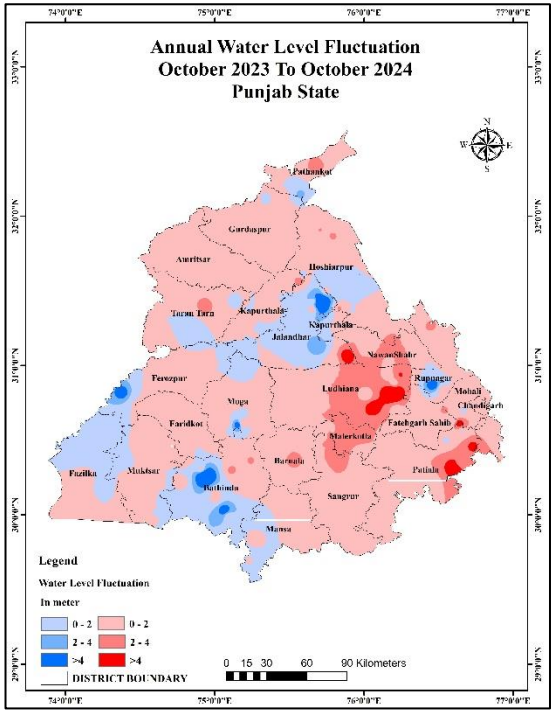

Figure-8: Annual water level fluctuation in unconfined aquifer(October 2023 to October 2024)

4.1.3 ANNUAL FLUCTUATION IN WATER LEVEL

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

In order to know the impact of rainfall and ground water withdrawal during last one year, annual water level fluctuations for period October 2023 and October 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 17.96% of wells monitored and covering 11.73% area of the State. Water level rise in the range of 0-2 m is observed in 12.57% wells and 10.31% of area. Water level rise 2-4m is observed in 1.80% wells and 1.23% of area. The water level rise of >4m is observed in 3.59% wells and less than 1% of area as isolated patches in Tarn Taran, Faridkot, Hoshiarpur and Chandigarh UT.

Fall in Water Levels:

The annual fluctuation depicts general decline of water levels in 82.04% of wells monitored and covering 88.27% 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 67.66% of wells and 36.26% of the area. Water level decline in the range of 2-4 m is observed in 10.18% of wells and 35.93% of the area. Whereas, the water level decline of >4m is observed in 4.19% of wells and 15.95% of the area during the period, as isolated patches in Faridkot, Moga, Sangrur, Barnala and Kapurthala districts.

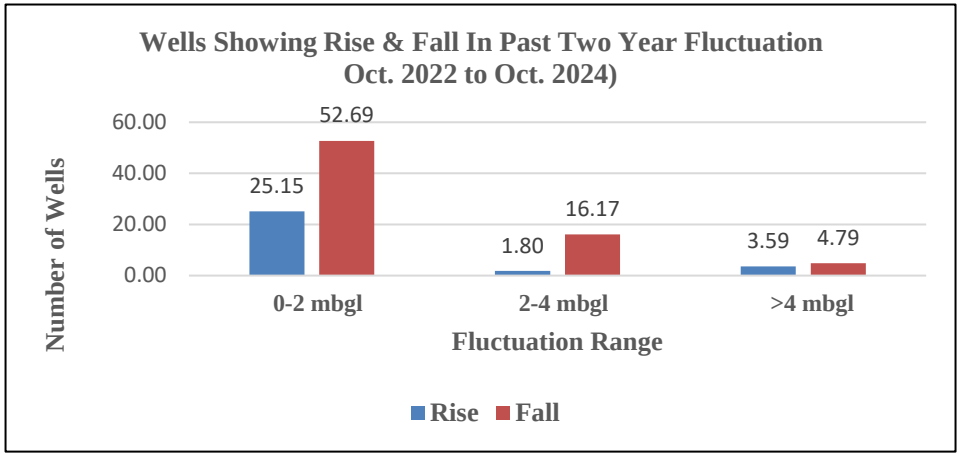

Figure-9: Percentage of wells showing Rise and Fall in WL in unconfined aquifers (October 2022 to October 2024)

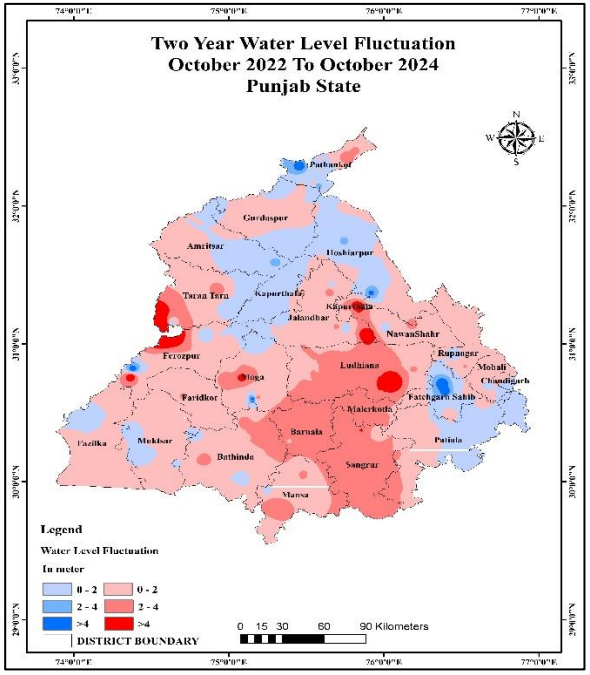

Figure-10: Water Level Fluctuation Map (October 2022 to October 2024)

4.1.4 PAST TWO YEAR FLUCTUATION IN WATER LEVEL

Past Two Year Fluctuation of Water Level in Unconfined Aquifer (October 2022 to October 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 October 2022 and October 2024 are calculated. The behaviour 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 29.31% of wells monitored and covering 23.79% area of the State. Water level rise in the range of 0-2 m is observed in 25.15% wells and 20.28% of area. Water level rise 2-4m is observed in 1.80% wells and 2.69% of area. The water level rise of >4m is observed in 3.59% wells and less than 1% of area as isolated patches in Patiala, Sangrur, Barnala and Moga districts.

Fall in Water Levels

The annual fluctuation depicts general decline of water levels in 70.69% of wells monitored and covering 76.21% 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 52.69% of wells and 55.04% of the area. Water level decline in the range of 2-4 m is observed in 16.17% of wells and 19.53% of the area. Whereas, the water level decline of >4m is observed in 4.79% of wells and 1.45% of the area during the period, as isolated patches in Patiala and Sangrur districts.

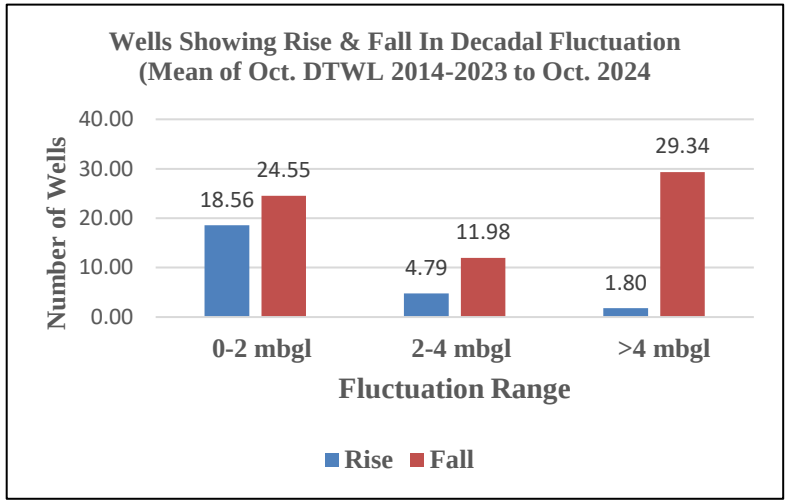

Figure-11: Percentage of wells showing rise and fall in WL in unconfined Aquifer (Decadal Mean October (2014-2023) to October 2024)

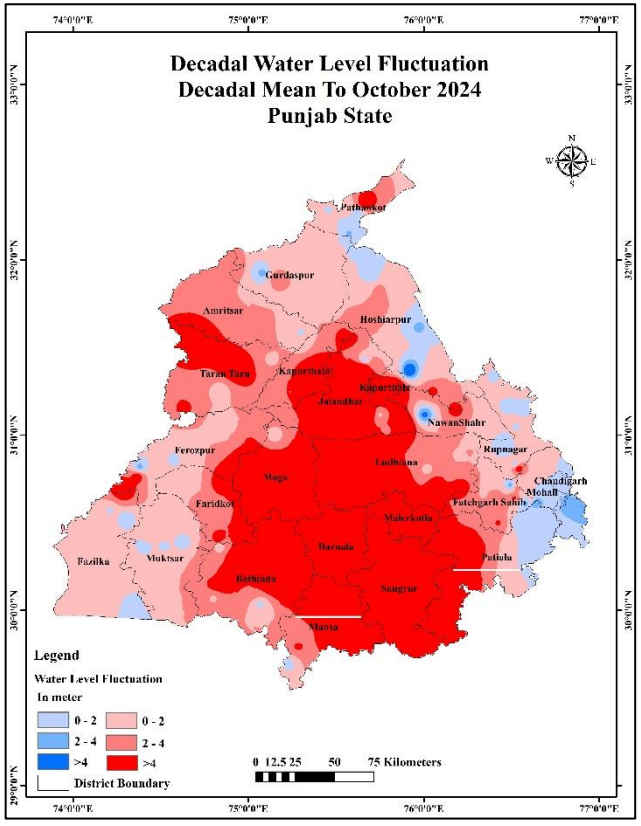

Figure-12: Water level fluctuation in unconfined Aquifer(Decadal Mean October (2014-2023) to October 2024)

4.1.5 DECADAL FLUCTUATION IN WATER LEVEL

Decadal Fluctuation of Water Level in Unconfined Aquifer (Decadal Mean October (2014-2023) to October 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 October 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 27.63% of observation wells monitored covering about 8.07% area of the state. Water level rise in the range of 0-2 m is observed in 18.56% of wells and 7.29% of the area. Water level rise of 2-4m is observed in 4.79% of wells and less than 1% of the area. Water level rise of >4m is observed in 1.80% of wells and less than 1% of the state area as isolated patches in Hoshiarpur district.

Fall in Water Levels:

The decadal mean fluctuations show that decline in 72.36% of observation wells monitored covering about 91.93% 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 24.55% of wells and 29.64% of area. Water level decline of 2-4 m is observed in 11.98% of the wells and 22.42% of the area. Water level decline of >4m is observed in 29.34% of the wells and 39.73% of area during the period, in Barnala, Sangrur, Malerkotla, Moga, SBS Nagar, Jalandhar, Kapurthala, Patiala and Bathinda districts.

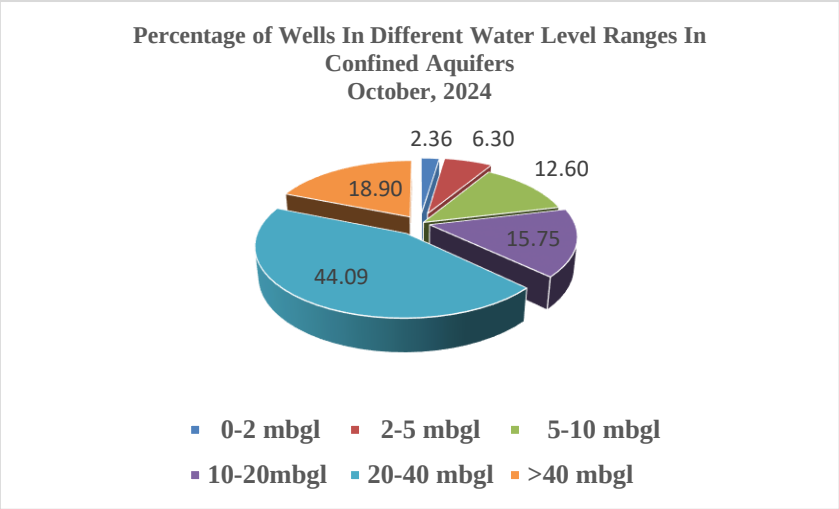

Figure-13: Percentage of wells in different water level ranges in Confined/Semi-Confined aquifer.

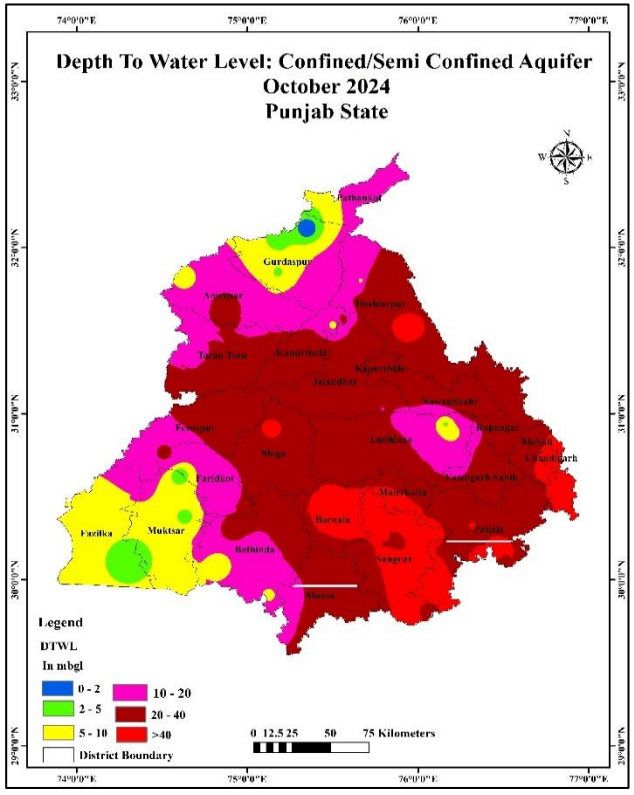

Figure-14: Depth to Water Level Map Confined/Semi-Confined Aquifer, October 2024

4.2 DEEPER AQUIFER (CONFINED/ SEMI-CONFINED)

4.2.1 DEPTH TO PIEZOMETRIC LEVEL

The behavioral pattern of water level in October 2024 along with depth to water level map (Fig. 14) is discussed here. The depth to water level lies between 0.22mbgl in Gurdaspur district and 87.09mbgl in SAS Nagar district. Very shallow water levels of 0-2 m (causing water logging) does occur in 2.36% of the wells and less than 1% of the state's area. Shallow water levels of 2-5 m have been observed in 6.30% of the wells and 2.30% of the total area. The water levels between 5-10 m are about 12.60% of wells and 12.8% of the area fall in this range. Moderately Deep-water levels (10-20 m) are observed in 15.75% wells covering about 23.49% area of the State. Deep water levels (20-40 m) are observed in 44.09% wells covering about 50.70% area of the state. Very deep-water levels (>40 m) are observed in 18.90% of the wells covering 10.38% area of the State.

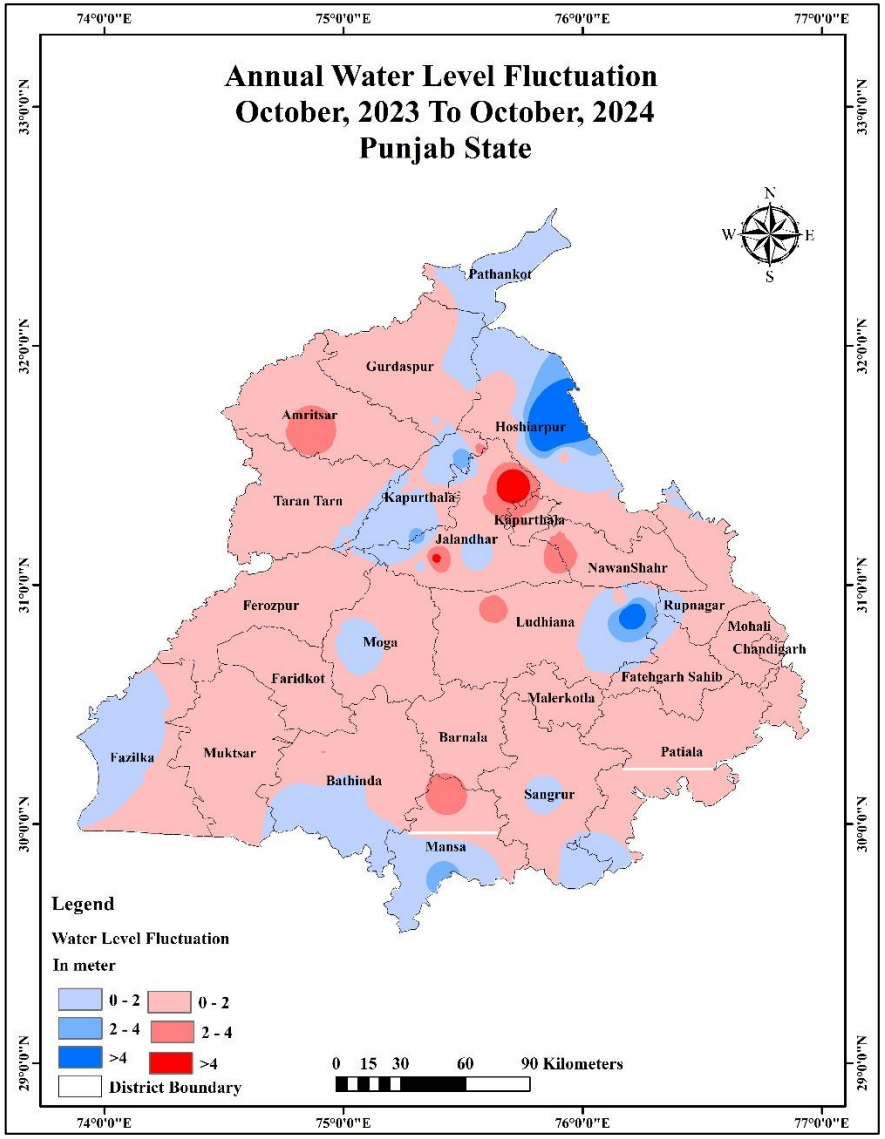

Figure-15: Annual water level fluctuation in Confined/Semi-Confined aquifer (October 2023 to October 2024)

4.2.2 ANNUAL FLUCTUATION IN WATER LEVEL

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

In order to know the impact of rainfall and ground water withdrawal during last one-year, annual water level fluctuations for period October 2023 and October 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 22.40% area of the State. Water level rise in the range of 0-2 m is observed in 19.80% of area. Water level rise 2-4m is observed in 1.34% of area. The water level rise of >4m is observed in 1.26% of area as in Mansa, Sangrur, Patiala, Gurdaspur and Hoshiarpur districts.

Fall in Water Levels:

The annual fluctuation depicts general decline of water levels in 77.60% 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 74.54% of the area. Water level decline in the range of 2-4 m is observed in 2.60% of the area. Whereas, the water level decline of >4m is observed in less than 1% of the area during the period, as isolated patches in Moga, Barnala, Jalandhar and Kapurthala districts.

5.0 Recommendations to improve decline in ground water level:

The declining trend of ground water level in Punjab 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