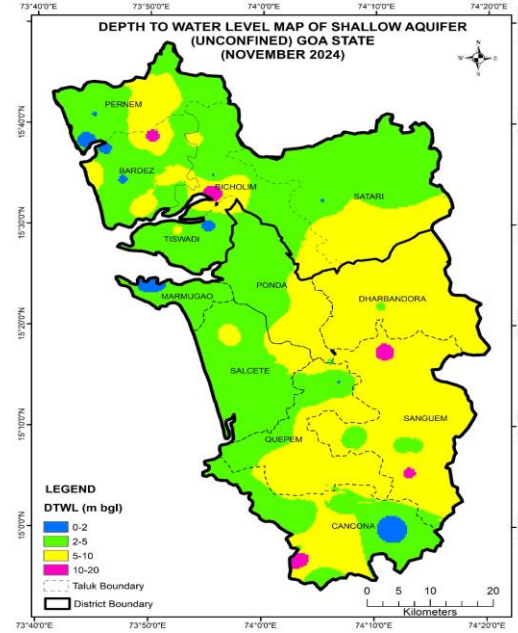


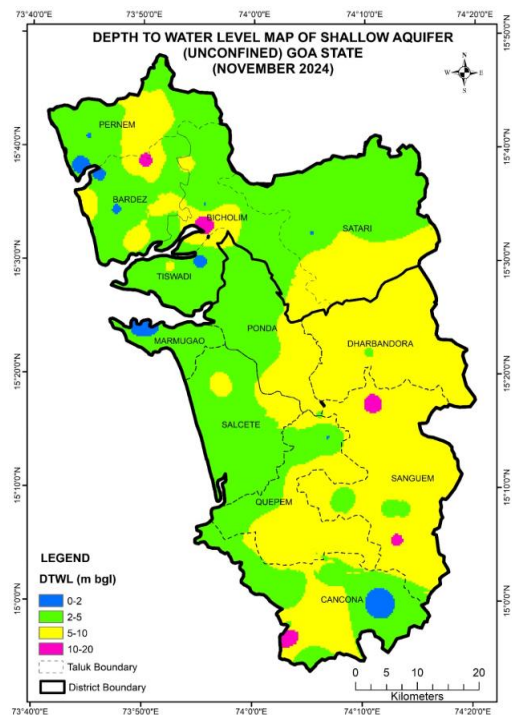
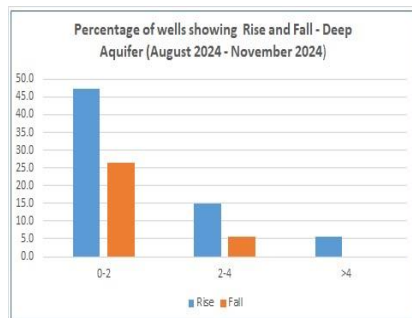
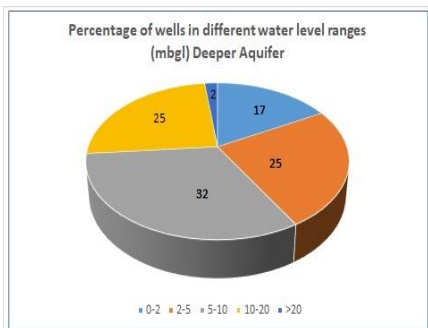


## GROUND WATER LEVEL BULLETIN NOVEMBER 2024 - GOA STATE

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जल संसाधन, नदी विकास और गंगा संरक्षण विभाग/Department of Water Resources, RD & GR  
केन्द्रीय भूजल बोर्ड /Central Ground Water Board  
दक्षिण पश्चिम क्षेत्र /South Western Region  
बेंगलुरु /Bengaluru  
January 2025



### 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

South Western Region, Bangalore

# GROUND WATER LEVEL BULLETIN NOVEMBER 2024 - GOA STATE

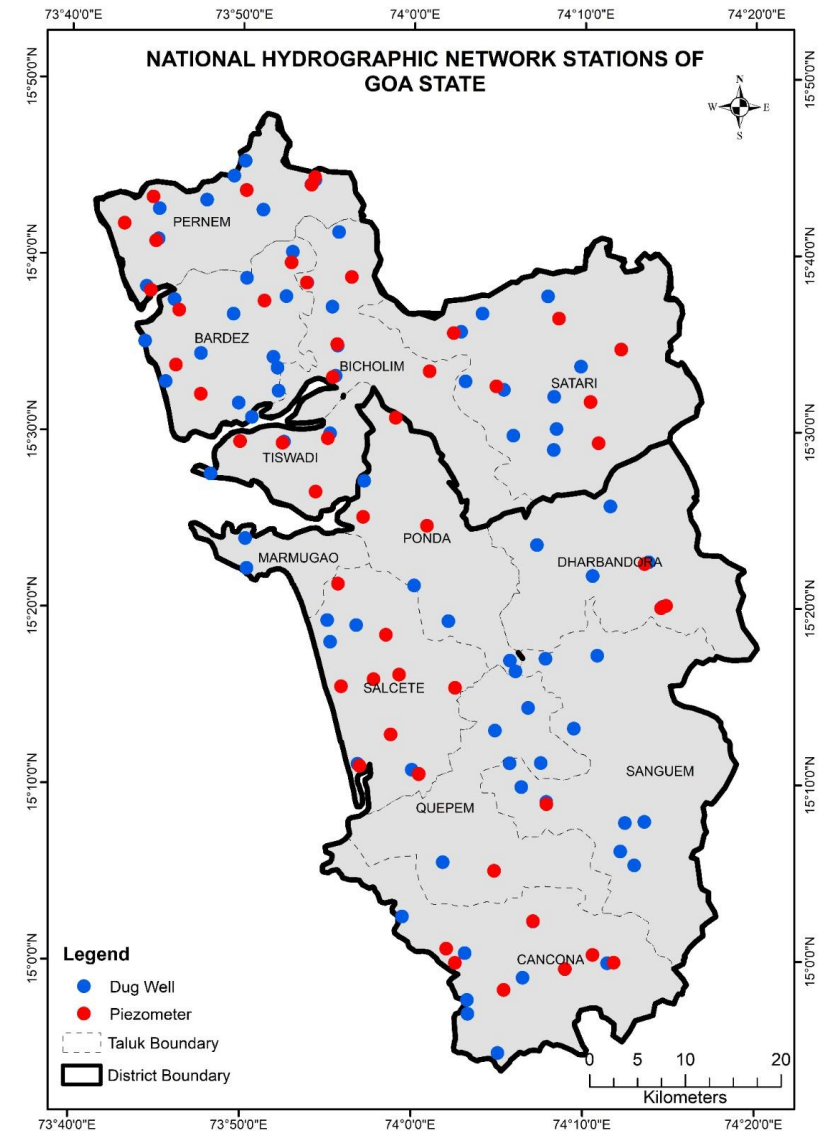
# GROUND WATER LEVEL BULLETIN NOVEMBER 2024 - GOA STATE

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## 1. Introduction:

Goa state having a total geographical area of 3702 sq.km is administratively divided into 2 districts and 12 taluks. In the State of Goa, groundwater has emerged as an important source to meet the water requirements of various sectors especially tourism, domestic and industrial sectors. The state has a tropical-maritime monsoonal type climate with distinct aerographic influence. Due to proximity to the Arabian Sea humidity throughout the year is more than 60% and it ranges from 80 to 90% during monsoon period. Rain occurs during the South West monsoon period from June to September (almost 90% of annual rainfall). As a result of orographic influence rainfall increases towards the Western Ghats from the coast. The normal annual rainfall for entire Goa State is 3367.86 mm. Geomorphologically, Goa state is divided into four morphological units namely, the 1. Coastal plains with dominant marine land forms on the west, followed successively towards the east by the 2. Vast etchplain, 3. Low dissected denudational hills and table land and 4. Deeply dissected high Western Ghats with denudational hills occurring all along the eastern part of Goa rising to a maximum of 832 meters above mean sea level (m amsl). The principal perennial rivers are Terekhol, Chapora, Mandovi, Zuavari and Galjibagh. Kumbharaja canal is an important feature of natural drainage of Goa and it links Mandovi River with Zuavari River about 20 km east of the coast and it provides natural link connecting two major rivers of Goa. Soils of the state can be grouped into 5 classes: Lateritic soil. Alluvial, hilly area soil, saline soil and Marshy soil.



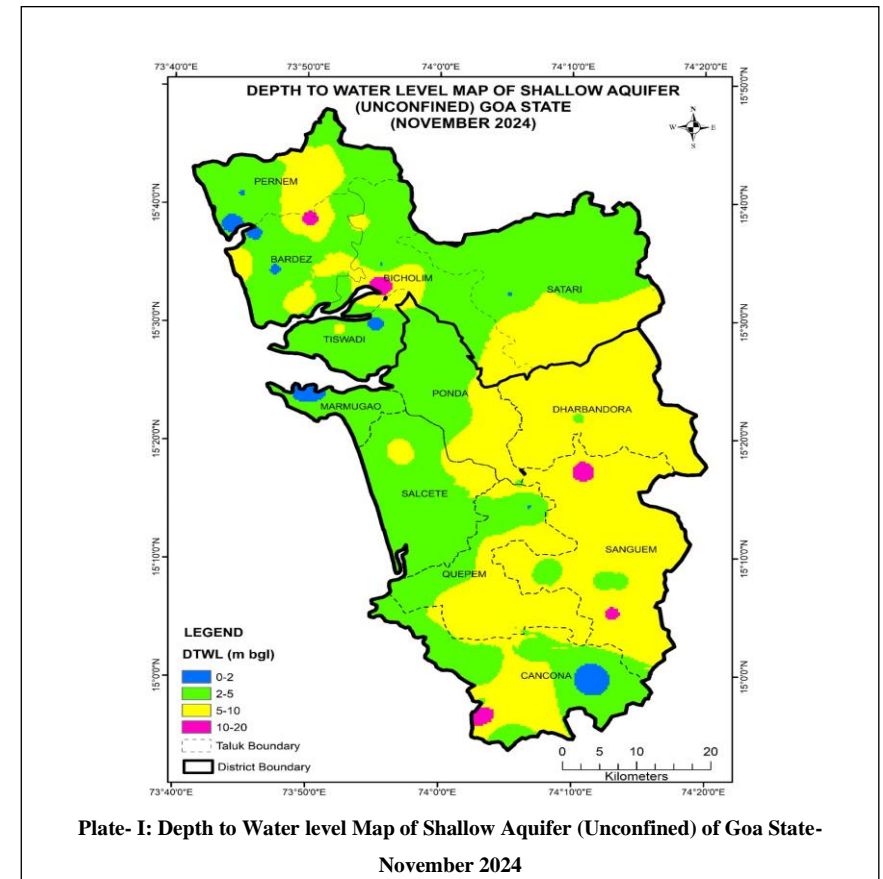
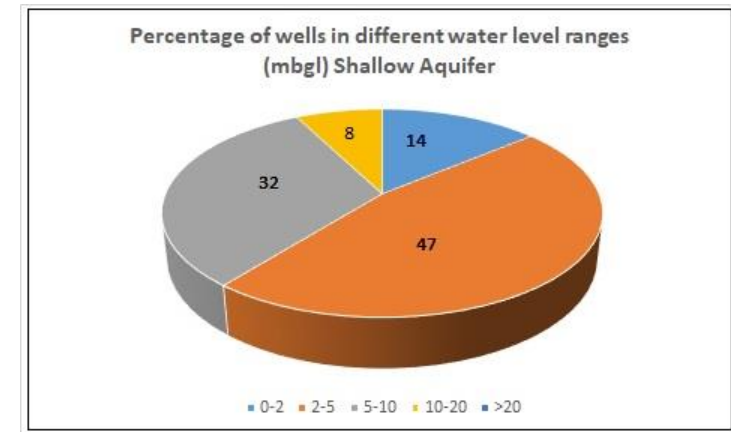
Goa state is dominantly covered by the formations of the Goa group belonging to Dharwad Super Group of Archaean to Proterozoic age, except for a narrow strip along the north eastern corner occupied by Deccan Trap of Upper Cretaceous to Lower Eocene age. The Goa group is consisting of green schist facies of the metamorphic rocks and is divided into Barcem, Sanvordem, Bicholim and Vageri formations in the ascending order of super position. The Goa groups of rocks have been intruded by granite gneiss, feldspathic gneiss, hornblende gneiss and porphyritic granite, followed by basic intrusive. During The Sub-Recent and Recent times the rocks have been subjected to lateritisation of varying thickness. Coastal alluvium occurring along the coastal planes consists of fine to coarse sands with intercalations of sandy loam, silt and clay. Ground water bearing formations in Goa state are alluvium, laterite, granite and granite gneiss, meta-volcanics and sedimentaries.

Monitoring of ground water levels was carried out in **138** ground water monitoring wells in the State of Goa during the month of November 2024. Among the wells monitored, **84** are dug wells and **54** are piezometers/tube wells.

## 2. Depth to water level of Shallow aquifer (unconfined) of November 2024 of Goa State:

Salient features of the depth to water level scenario during November 2024 are given below.

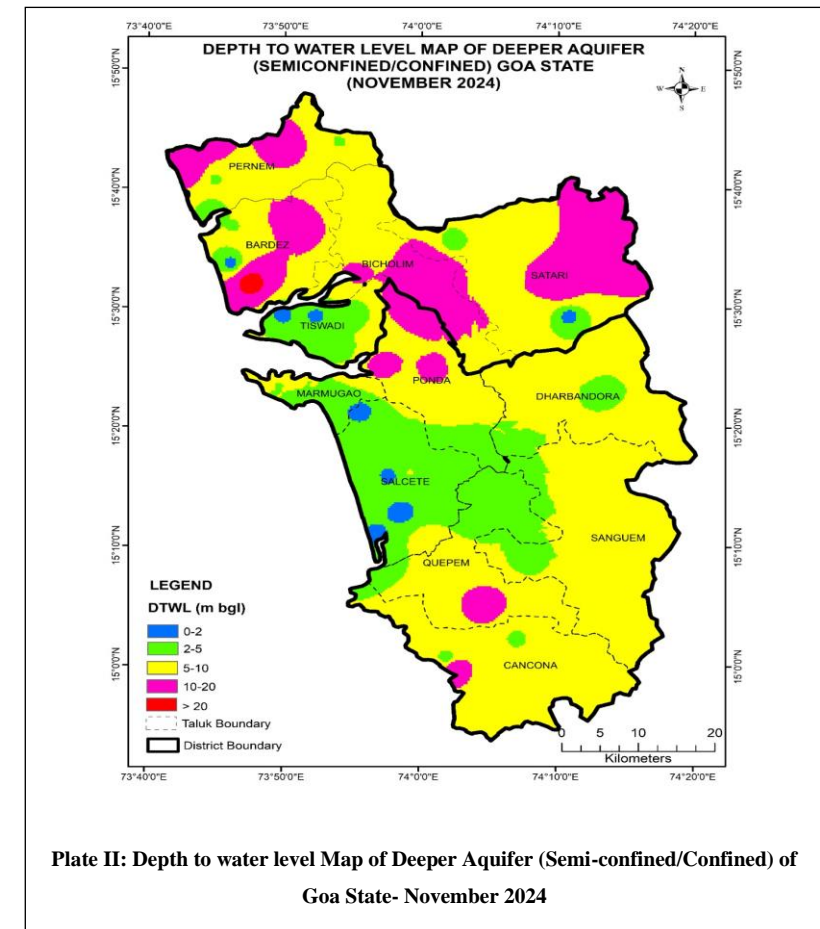
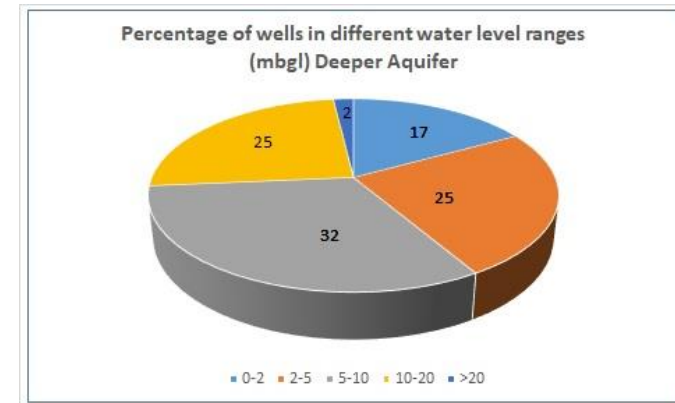
1. A perusal of the water level data reveals that the depth to water level ranged from Ground Level in Canacona taluk to **15.8 m bgl** (Canacona taluk). Both shallow and deep water level is reported in Canacona taluk.
2. The salient feature of the analysis is that the depth to water level over major part of the State lies within 10 m bgl i.e. **92%** of wells analysed, while **8%** of wells show depth to water level in the 10-20 m bgl range.
3. Depth to water level of less than 2 m bgl has been recorded in **13.9%** of wells analysed and noted in Bardez, Canacona, Mormugoa, Pernem, Satari and Tiswadi taluks.
4. Depth to water level in the range of 2 to 5 m bgl has been recorded in **46.8%** of wells analysed and noted in all the taluks except Marmagaoa taluk.
5. Depth to water level in the range of 5 to 10 m bgl has been recorded in **31.6%** of wells analysed and noted in all the taluks.
6. Depth to water level in the range of 10 to 20 m bgl has been observed in **7.6%** of wells analysed and noted in Bicholim, Bardez, Canacona and Sangeum taluks.



### 3. Depth to water level of Deeper aquifer (semi-confined/confined) of November 2024 of Goa State:

Depth to water level of deeper aquifer has been recorded from piezometers spread in hard rock areas all over the State. The statement showing depth to water level of Deeper aquifer is given in **Plate-II** depicts the Piezometric ground water scenario in November 2024. Salient features of the depth to water level of deeper aquifer during November 2024 are given below;

1. The depth to water level of deeper aquifer ranges from **0.75 m bgl (Ground Level)** in Salcete taluk to **26.33 m bgl** (Bardez taluk) in Goa State.
2. **74%** of wells have recorded depth to water level of deeper aquifer within 10 m bgl and **26%** of wells show depth to water level of deeper aquifer more than 10 m bgl.
3. Depth to water level of deeper aquifer of less than 2 m bgl has been recorded in **17%** of wells analysed and this has been noted in Bardez, Salcete & Tiswadi Taluks.
4. Depth to water level of deeper aquifer in the range of 2 to 5 m bgl has been recorded in **25%** of wells analysed and noted in Canacona, Pernem, Salcete, Sanguem, Satari and Tiswadi taluks.
5. Depth to water level of deeper aquifer in the range of 5 to 10 m bgl has been recorded in **32%** of wells analysed and noted in all the taluks.
6. Depth to water level of deeper aquifer in the range of 10 to 20 m bgl has been observed in **25%** of wells analysed and noticed in all taluks except Bardez, Bicholim, Canacona, Pernem, Ponda, Quepem and Satari Taluks.
7. Depth to water level of deeper aquifer in the range more than 20 m bgl has been observed in **1%** of wells analysed and noticed in Bardez taluk.



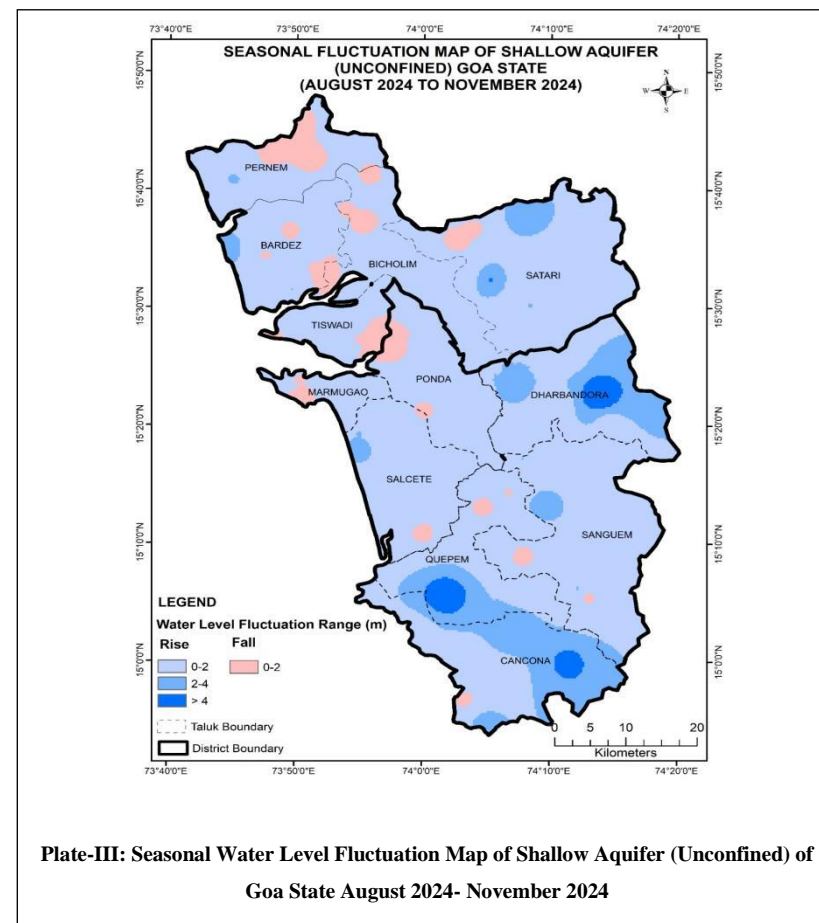
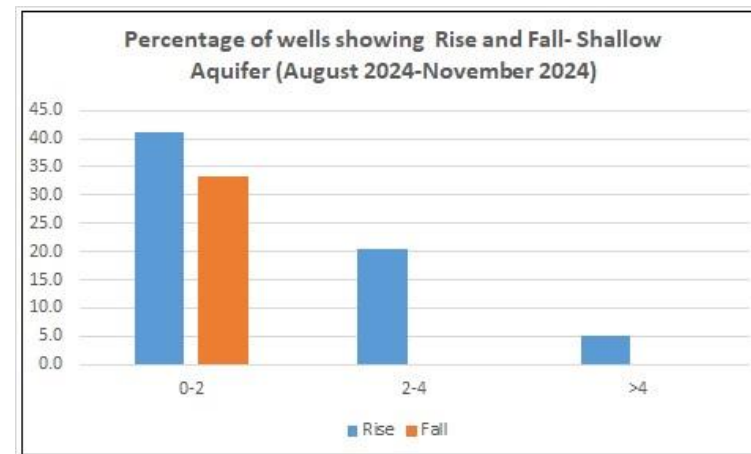
**Plate II: Depth to water level Map of Deeper Aquifer (Semi-confined/Confined) of Goa State- November 2024**



#### 4. Change in seasonal water level of Shallow aquifer (unconfined) - August 2024 to November 2024 of Goa State:

A comparison of water level of November with August shows that a rise in the water level is recorded in **67%** of wells analyzed, while 33% recorded fall. The Seasonal fluctuation in water level of Shallow aquifer has been plotted in **Plate III**. A perusal of the plate shows that a general rise in the range of 0 – 2 m is noticed in major part of the area, and further breakup is given below.

1. Rise in the water level in the range of 0-2 m has been observed in **41%** of wells analysed and observed in all the taluks.
2. Rise in the water level in the range of 2-4 m has been observed in **21%** of wells analysed in Bardez, Canacona, Pernem, Salcete, Sangem and Satari taluks.
3. Rise in the water level in the range of >4 m has been observed in **5%** of wells analysed and observed in Canacona, Quepem, Sangem, Salcete, Satari taluks.
4. The fall in water level in the range of 0-2 m has been observed in **33%** of wells analysed and noted in all taluks except Dharbondara taluk.



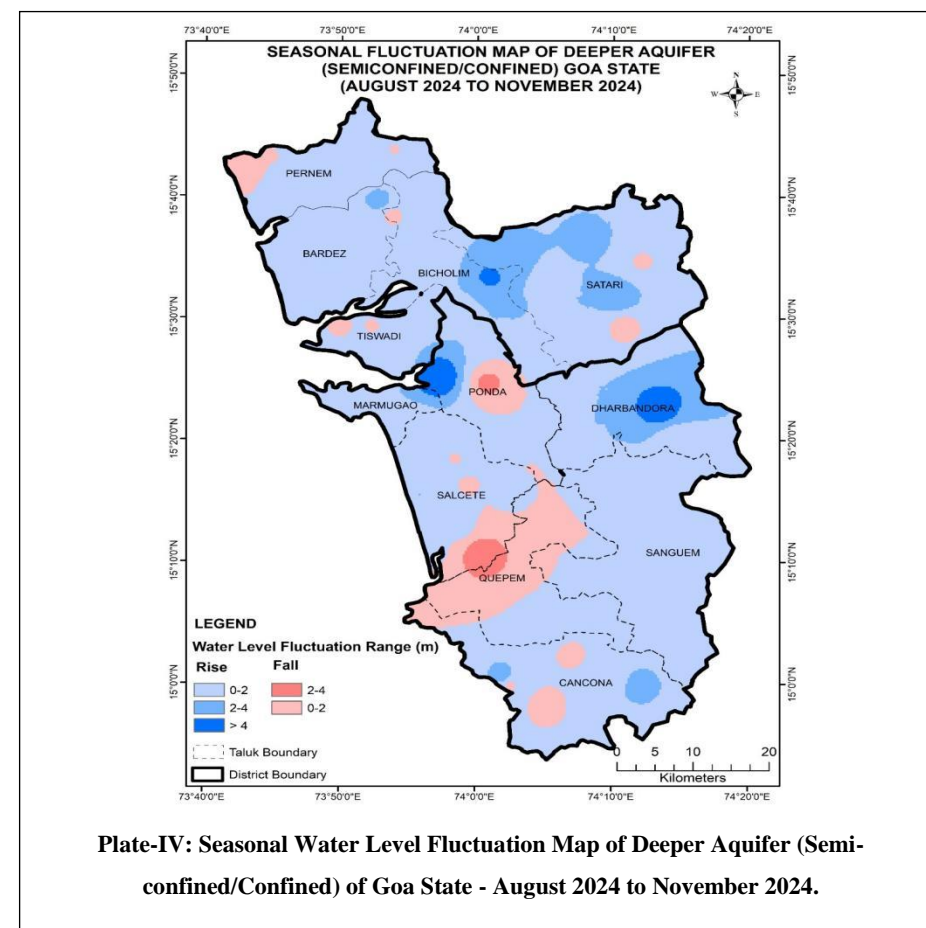
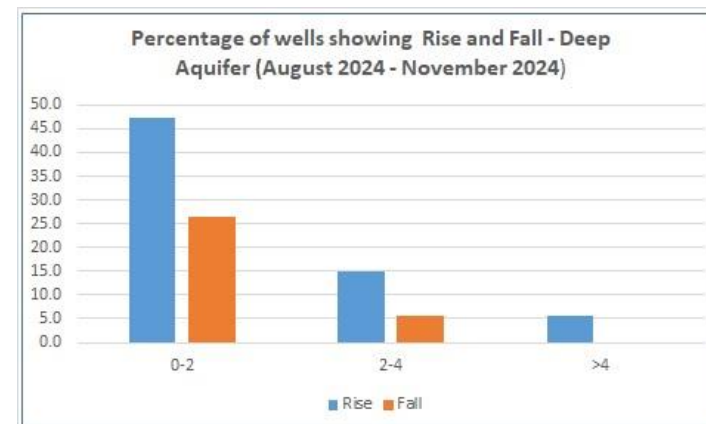
**Plate-III: Seasonal Water Level Fluctuation Map of Shallow Aquifer (Unconfined) of Goa State August 2024- November 2024**



## 5. Change in seasonal water level of Deeper aquifer (Semi-confined/Confined)- August 2024 to November 2024 of Goa State:

A comparison of water level shows that a rise in the water level is recorded in **68%** of wells analyzed & fall of water level recorded in **32%** of wells analysed. The Seasonal fluctuation in water level of Deeper aquifer has been plotted in **Plate IV**. A perusal of the plate shows that a general rise in the range of 0 – 2 m is noticed in major part of the area, and further breakup given below.

1. Rise in the water level in the range of 0-2 m has been observed in **47%** of wells analysed and observed in all the taluks.
2. Rise in the water level in the range of 2-4 m has been observed in **15%** of wells analysed in Bardez, Canacona, Salcete and Sattari taluks.
3. Rise in the water level in the range of >4 m has been observed in **6%** of wells analysed and observed in Bicholim, Ponda, and Sanguem taluks.
4. Fall in the water level in the range of 0-2 m has been observed in **26%** of wells analysed and observed in Bardez, Canacona, Pernem, Salcete, Sattari and Tiswadi taluks.
5. Fall in the water level in the range of 2-4 m has been observed in **6%** of wells analysed and observed Salcete, Quepem and Ponda taluks

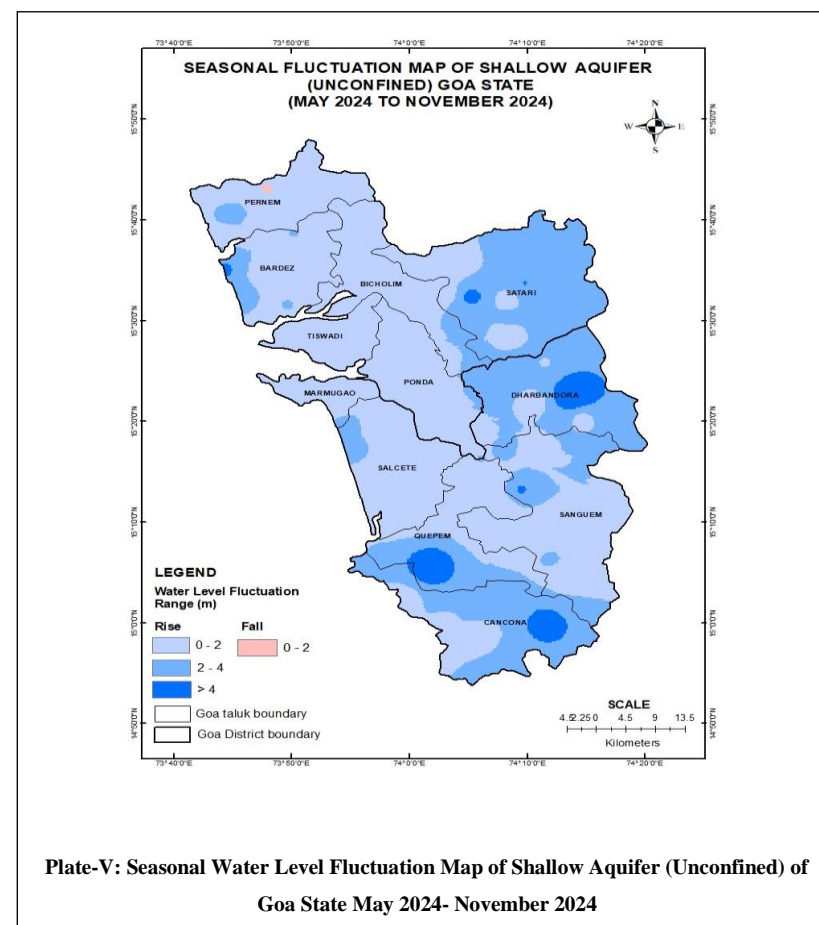
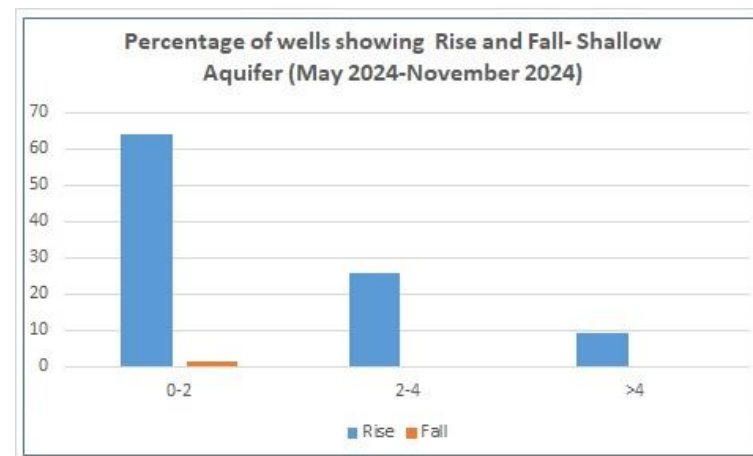


**Plate-IV: Seasonal Water Level Fluctuation Map of Deeper Aquifer (Semi-confined/Confined) of Goa State - August 2024 to November 2024.**

## 6. Change in seasonal water level of Shallow aquifer (unconfined) - May 2024 to November 2024 of Goa State:

A comparison of water level of November with August shows that a rise in the water level is recorded in **99%** of wells analyzed, while **1%** recorded fall. The Seasonal fluctuation in water level of Shallow aquifer has been plotted in **Plate V**. A perusal of the plate shows that a general rise in the range of 0 – 2 m is noticed in major part of the area, and further breakup is given below.

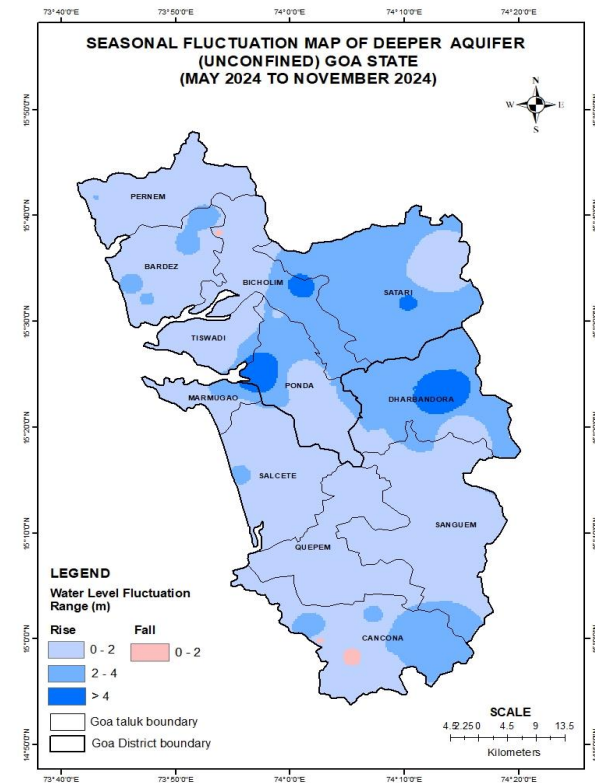
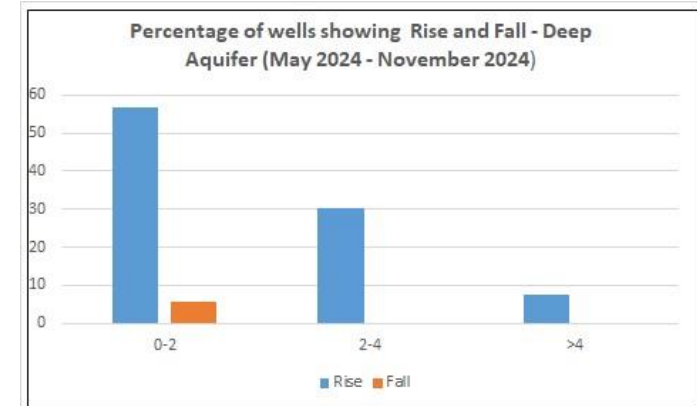
1. Rise in the water level in the range of 0-2 m has been observed in **64%** of wells analysed and observed in all the taluks.
2. Rise in the water level in the range of 2-4 m has been observed in **26%** of wells analysed in Bardez, Bicholim, Canacona, Pernem, Quepem, Salcete, Sangem and Satari taluks.
3. Rise in the water level in the range of >4 m has been observed in **5%** of wells analysed and observed in Bardez, Canacona,, Salcete, Sangem and Satari taluks.
4. The fall in water level in the range of 0-2 m has been observed in **1%** of wells analysed and noted in Pernem taluk.



## 7. Change in seasonal water level of Deeper aquifer (Semi-confined/Confined) - May 2024 to November 2024 of Goa State:

A comparison of water level shows that a rise in the water level is recorded in **94%** of wells analyzed & fall of water level recorded in **6%** of wells analysed. The Seasonal fluctuation in water level of Deeper aquifer has been plotted in **Plate VI**. A perusal of the plate shows that a general rise in the range of 0 – 2 m is noticed in major part of the area, and further breakup given below.

1. Rise in the water level in the range of 0-2 m has been observed in **57%** of wells analysed and observed in all the taluks.
2. Rise in the water level in the range of 2-4 m has been observed in **30%** of wells analysed in Bardez, Canacona, Dharbondara, Ponda, Salcete and Sattari taluks.
3. Rise in the water level in the range of >4 m has been observed in **8%** of wells analysed and observed in Bicholim, Ponda and Sanguem and Sattari taluks.
4. Fall in the water level in the range of 0-2 m has been observed in **26%** of wells analysed and observed in Bardez, Bicholim and Canacona taluks.

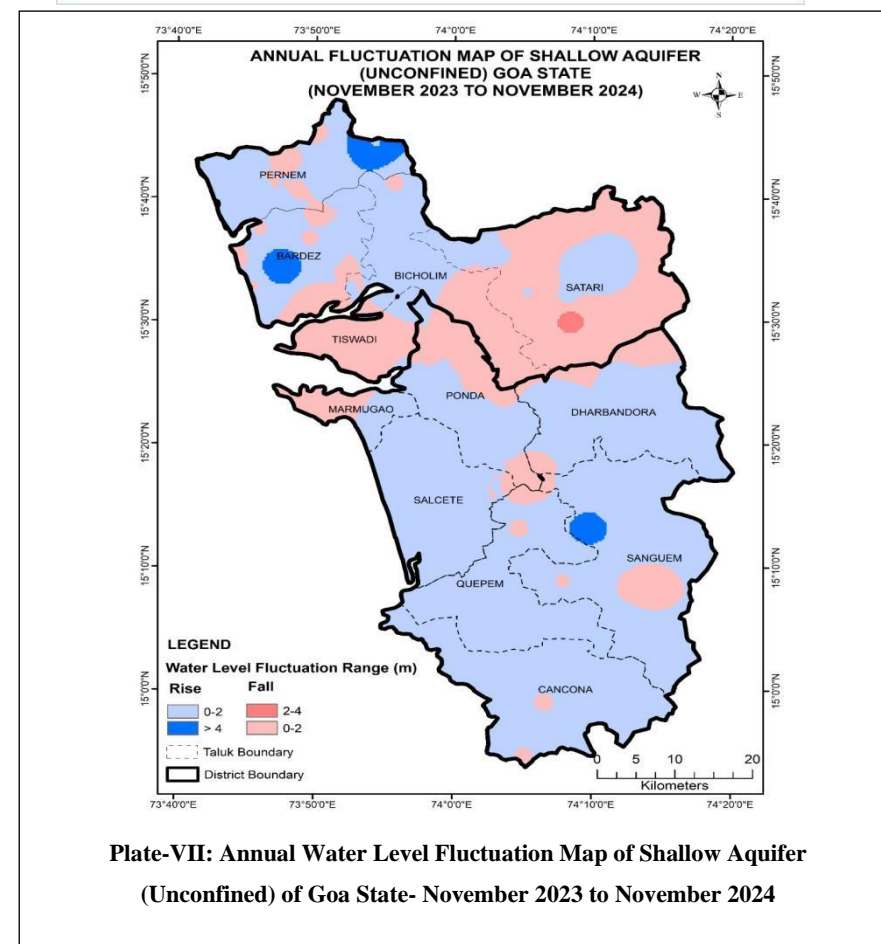
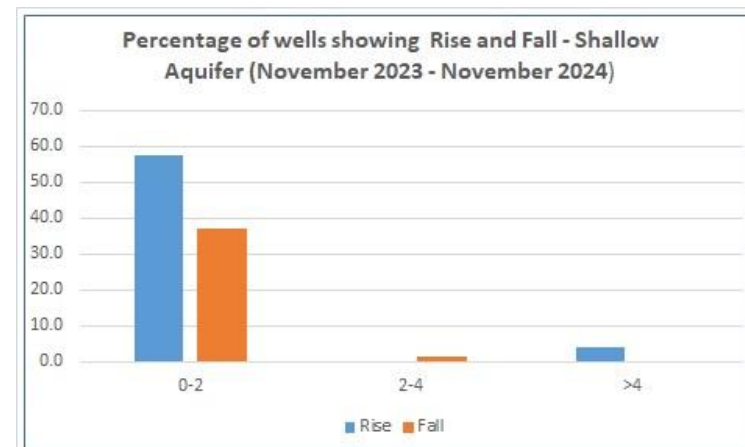


**Plate-VI: Seasonal Water Level Fluctuation Map of Deeper Aquifer (Semi-confined/Confined) of Goa State -May 2024 to November 2024.**

## 8. Change in annual water level of Shallow aquifer (unconfined) – November 2023 to November 2024 of Goa State:

A comparison of water level shows that a rise in the water level is recorded in **62%** of wells analyzed, while **38%** recorded fall. The Annual fluctuation in water level of Shallow aquifer has been plotted in **Plate VII**. A perusal of the plate shows that a general rise in the range of 0 – 2 m is noticed in major part of the area, and further breakup is given below.

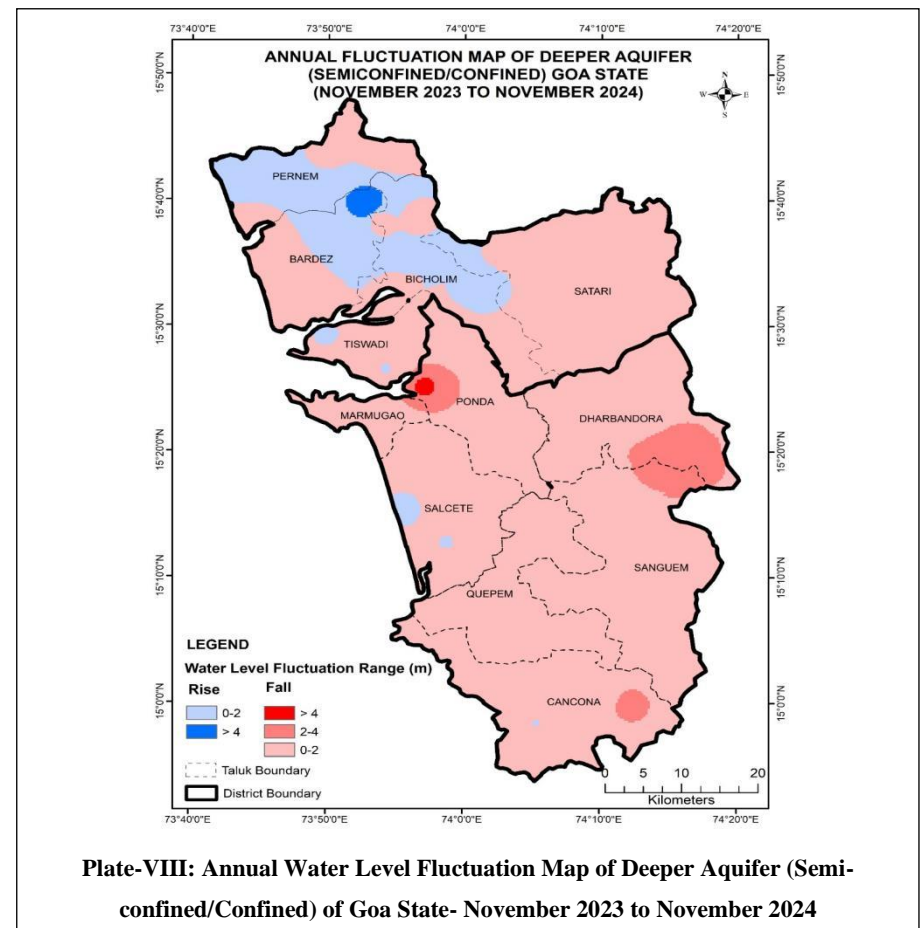
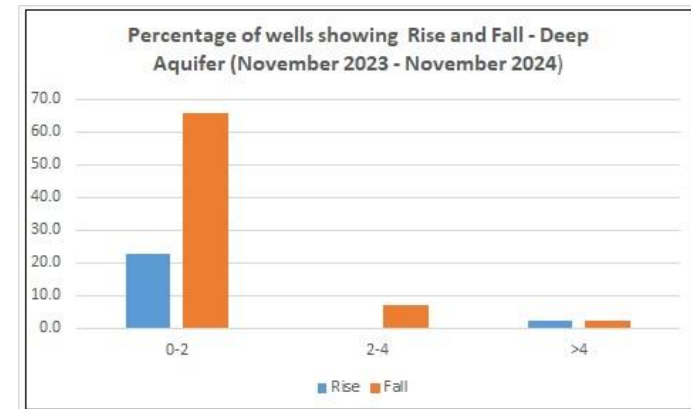
1. Rise in the water level in the range of 0-2 m has been observed in **58%** of wells analysed and observed in all taluks.
2. Rise in water level more than 4 m has been observed in **4%** of wells analysed and noted in Bardez, Pernem, and Sanguem taluks.
3. Fall in water level in the range of 0-2 m has been observed in **37%** of wells analysed and noted in all the taluks. Major part of Satari, tismwadi, Murmugoa and Ponda talukls shows fall
4. The Fall in the water level in the range of 2-4 m has been observed in **1%** of wells analysed and noted in Sattari taluk.



## 9. Change in annual water level of Deeper aquifer (Semi-confined/Confined) - November 2023 to November 2024 of Goa State:

The statement showing the distribution of ground water monitoring wells annual fluctuation in different ranges in comparison with November 2023 of Deeper aquifer is presented in **Annexure-VIII**. A comparison of water level shows that a rise in the water level is recorded in **25%** of wells analyzed, while **75%** recorded fall. The Annual fluctuation in water level of Deeper aquifer has been plotted in **Plate VIII**. A perusal of the plate shows that a general fall in the range of 0 – 2 m is noticed in major part of the area, and rise in water level is concentrated in the north-western part of the state. The fall in water level above 2m is founded as isolated pockets and further breakup is given below.

1. Rise in the water level in the range of 0-2 m has been observed in **23%** of wells analysed and observed in Bardez, Bicholim, Canacona, Salcete, Pernem and Tiswadi taluks.
2. Rise in water level more than 4 m has been observed in **2%** of wells analysed and noted in Bardez taluk.
3. The Fall in water level in the range of 0-2 m has been observed in **66%** of wells analysed and noted in all the taluks.
4. The Fall in the water level in the range of 2-4 m has been observed in **7%** of wells analysed and noted in Sanguem and Canacona taluks.
5. The Fall in the water level in the range >4 m has been observed in **2%** of wells analysed and noted in Ponda taluk.



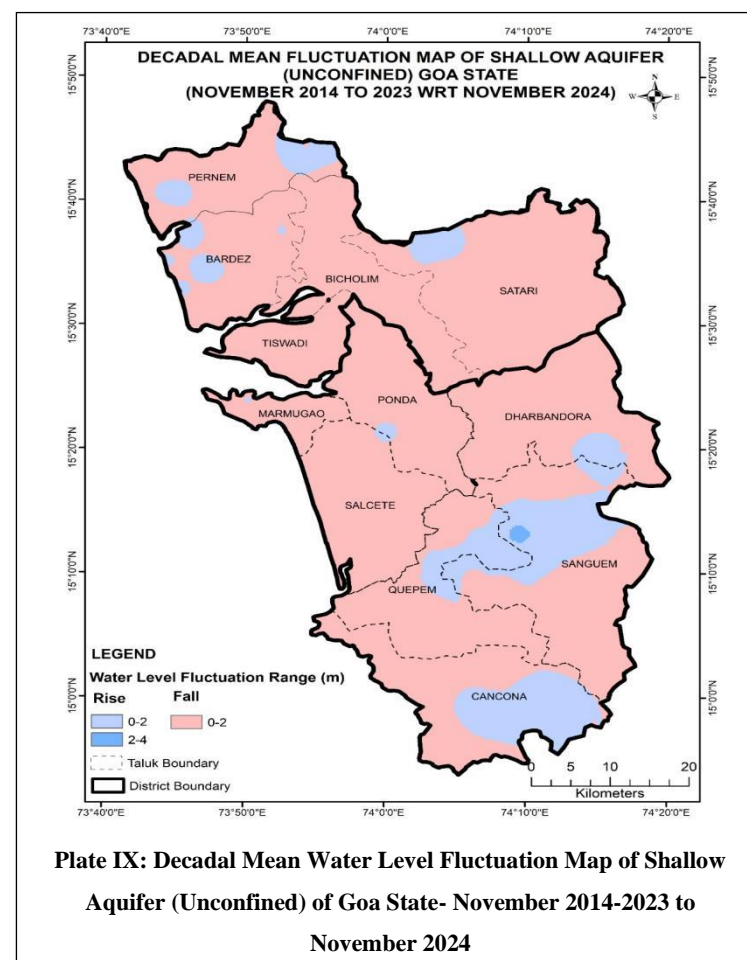
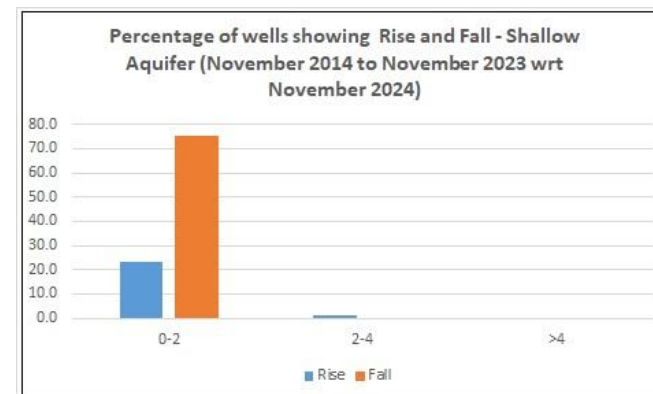
**Plate-VIII: Annual Water Level Fluctuation Map of Deeper Aquifer (Semi-confined/Confined) of Goa State- November 2023 to November 2024**



## 10. Mean decadal water levels fluctuation of Shallow aquifer (unconfined) for the period November 2014-2023 & November 2024 of Goa State:

The statement showing the distribution of decadal water level fluctuation in Shallow aquifer is presented in **Annexure-IX**. The Decadal fluctuation of water level of Shallow aquifer has been plotted in **Plate VII**. A comparison of water level shows that a rise in the water level is recorded in **25%** of wells analysed, while **75%** recorded fall. Major part of the state shows fall of water level with in 2 m. Salient features of the comparison of water levels are given below.

1. Rise in the water level in the range of 0-2 m has been observed in **24%** of wells analysed and noted in Bardez, Canacona, Pernem, Sangeum, Sattari and Tiswadi taluks.
2. Rise in the water level in the range of 2-4 m has been observed in **1 %** of wells analysed and noted in Sanguem taluk.
3. Fall in water level in the range of 0-2 m has been observed in **75%** of wells analysed and noted in all the taluks.



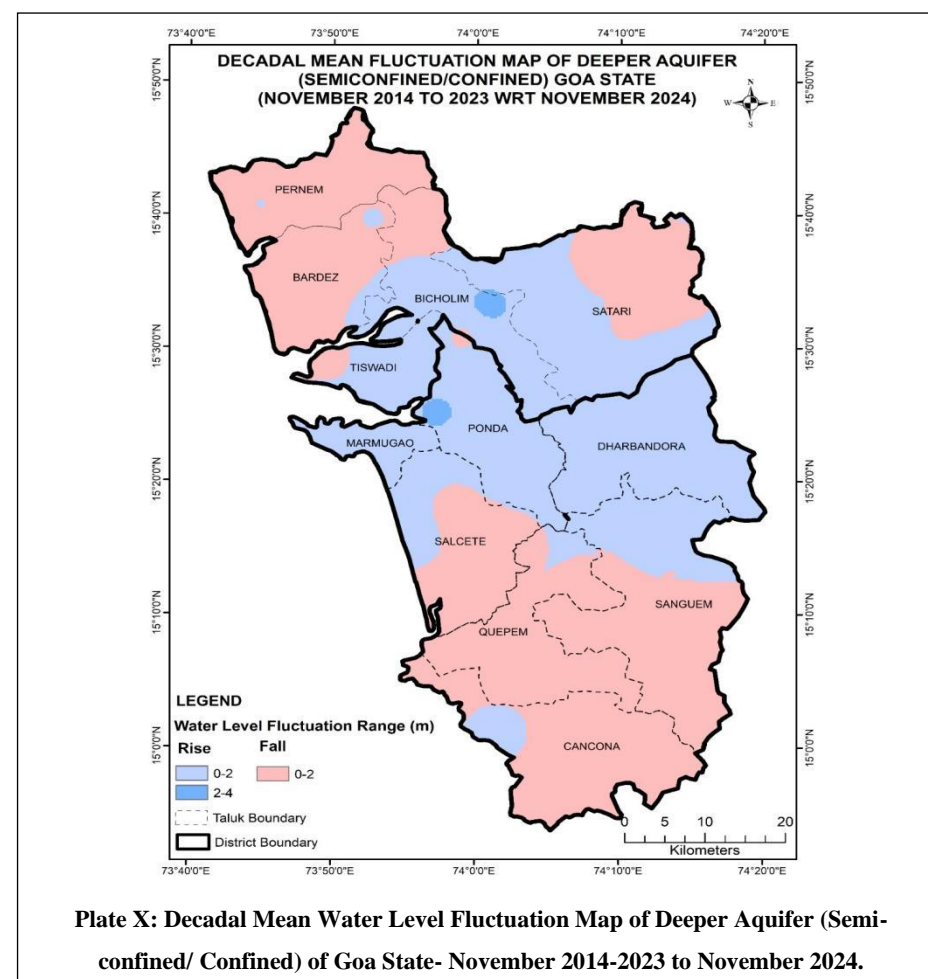
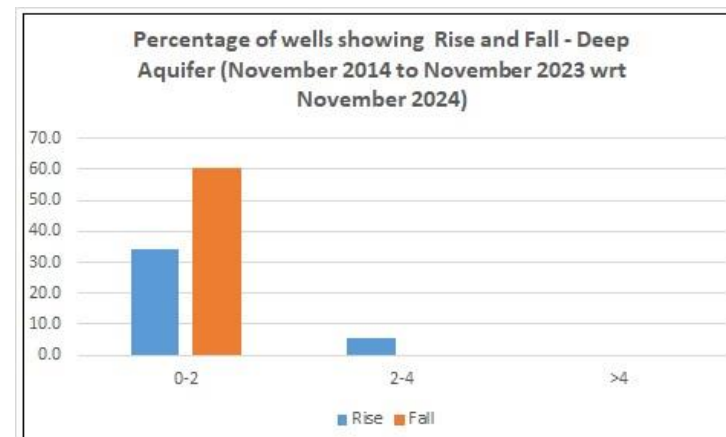
**Plate IX: Decadal Mean Water Level Fluctuation Map of Shallow Aquifer (Unconfined) of Goa State- November 2014-2023 to November 2024**



## 11. Mean decadal water levels fluctuation of deeper aquifer (Semi confined/ confined) for the period November 2014-2023 & November 2024 of Goa State:

The statement showing the distribution of ground water monitoring wells decadal fluctuation in deeper aquifer is presented in **Annexure-X**. The decadal fluctuation of water level of Shallow aquifer has been plotted in **Plate VIII**. A comparison of water level shows that a rise in the water level is recorded in **39%** of wells analysed, while **61%** recorded fall. Salient features of the comparison of water levels are given below.

1. Rise in the water level in the range of 0-2 m has been observed in **34%** of wells analysed, noted in all the taluks.
2. Rise in the water level in the range of 2-4 m has been observed in **5%** of wells analysed and noted in Ponda and Bicholim taluks.
3. The Fall in water level in the range of 0-2 m has been observed in **61%** of wells analysed and noted in all taluks except Dharbondara and Marmugoa taluks.



**Plate X: Decadal Mean Water Level Fluctuation Map of Deeper Aquifer (Semi-confined/ Confined) of Goa State- November 2014-2023 to November 2024.**

## 12. Conclusions:

The behaviour of ground water table during **November 2024** in Goa State has been studied by monitoring the dug wells and bore wells. The data on water levels was analyzed in detail and salient features are as under.

1. Depth to water level of Shallow aquifer (Unconfined) over major part of the State covering the is within 10 m bgl in about **92%** of wells analysed, while **8%** of wells show depth to water level between 10 to 20 m bgl.
2. **74%** of wells have recorded depth to water level of Deeper aquifer (Semi-confined/Confined) within 10 m bgl, while **26%** of wells show depth to water level of Deeper aquifer (Semi-confined/Confined) in more than 10 m bgl.
3. **67%** of wells have recorded seasonal rise in water levels of Shallow aquifer (Unconfined) and **33%** of wells have recorded fall in Seasonal water levels fluctuation during November 2024 in comparison to August 2024.
4. **68%** of wells have recorded seasonal rise in water levels of Deeper aquifer (Semi-confined/Confined) and **32%** of wells have recorded fall in Seasonal water levels fluctuation during during November 2024 in comparison to August 2024.
5. **99%** of wells have recorded seasonal rise in water levels of Shallow aquifer (Unconfined) and **1%** of wells have recorded fall in Seasonal water levels fluctuation during November 2024 in comparison to May 2024.
6. **94%** of wells have recorded seasonal rise in water levels of Deeper aquifer (Semi-confined/Confined) and **6%** of wells have recorded fall in Seasonal water levels fluctuation during during November 2024 in comparison to May 2024.
7. **62%** of wells have recorded annual rise in water levels of Shallow aquifer (Unconfined) and **38%** of wells have recorded fall in Annual water levels fluctuation during November 2024 in comparison to November 2023.
8. **25%** of wells have recorded decadal rise in water levels of Deeper aquifer (Semi-confined/Confined) and **75%** of wells recorded fall in Annual water levels fluctuation during November 2024 in comparison to November 2023.
9. **25%** of wells have recorded annual rise in water levels of Shallow aquifer (Unconfined) and **75%** of wells have recorded fall in water levels during November 2024 in comparison to decadal mean for the month of November (2014-23).
10. **39%** of wells have recorded decadal rise in water levels of Deeper aquifer (Semi-confined/Confined) and **61%** of wells recorded fall in water levels during November 2024 in comparison to decadal mean for the month of November (2014-23).

### 13. SUMMARY

**In Goa state, 62%** of wells have recorded annual rise in water levels of Shallow aquifer & **25%** of wells have recorded rise in Deeper aquifer during November 2024 in comparison to November 2023. **25%** of wells have recorded decadal rise in water levels of Shallow aquifer (Unconfined) and **39%** of wells have recorded decadal rise in water levels of Deeper aquifer (Confined) during November 2024 in comparison to decadal mean for the month of November (2014-23).

### 14. RECOMMENDATIONS

In order to enhance the groundwater scenario of Goa state utmost effort should be made to harvest the rainwater received during monsoon days and use it for artificial recharge. Periodic maintenance of the structures is also recommended to maintain the efficiency of the structure. Abandoned bore wells/dug well / Mine pits can be used to recharge the aquifer utilizing the surplus surface runoff available during rainy days. Master plan for artificial recharge of Goa as well as NAQUIM reports of CGWB help in selecting sites for artificial recharge structures.

- Spring-shed development should be taken up for developing the springs.
- Point recharge structures are recommended to recharge deeper aquifers
- Efficient micro irrigation practices can save up-to 40% of water
- Sea water ingress should be arrested.
- Use of Grey water after treatment, opting for water efficient fixtures and low flow plumbing fixtures reduce the stress on groundwater. Low flow technology is normally used in faucets, aerator, shower heads and toilets.