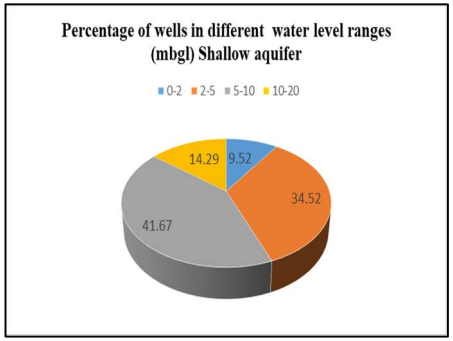
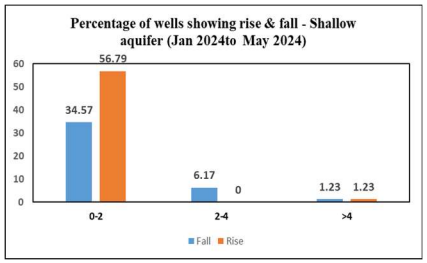
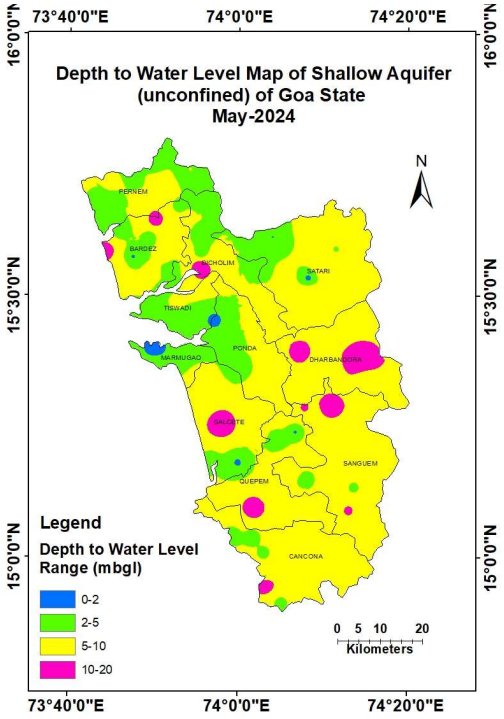






GROUND WATER LEVEL BULLETIN MAY 2024- GOA STATE

Abstract

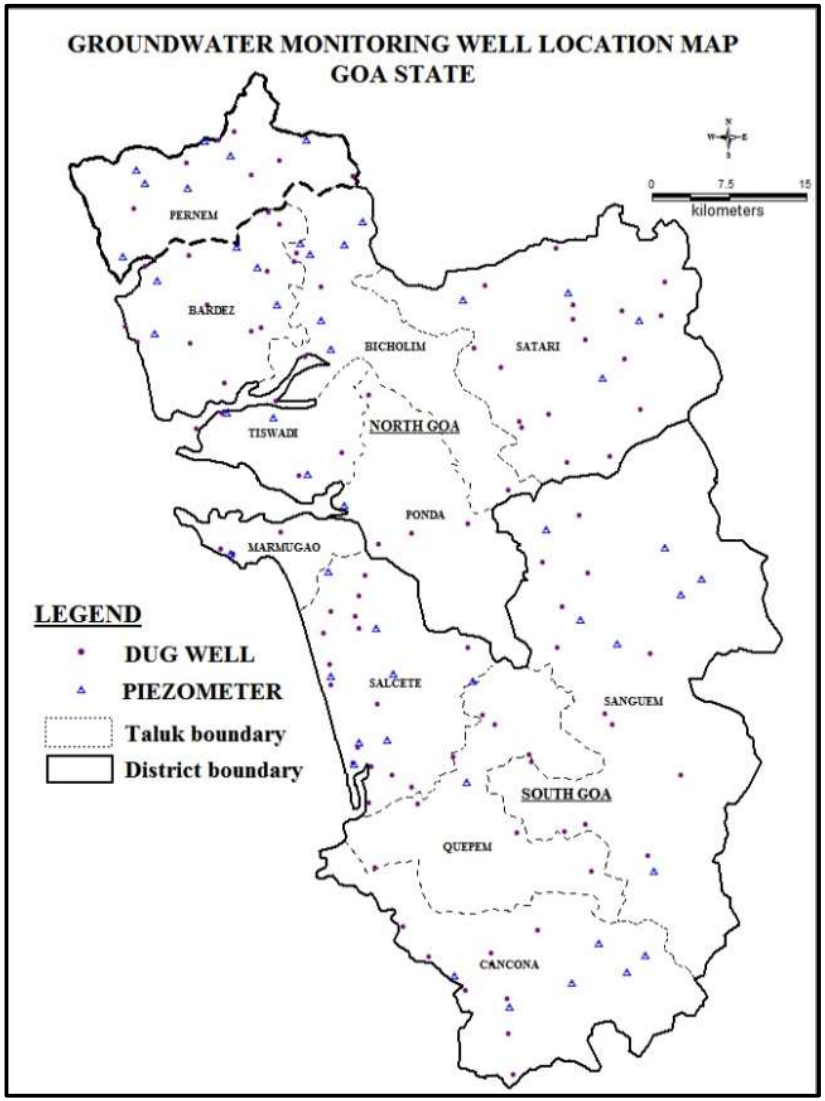
Ground water level Scenario during May -2024 highlighting the findings, status of ground water level in different aquifers and its seasonal, annual and decadal comparison

South Western Region, Bangalore

Contents

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 (over 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 etch plain, 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 in to 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 **135** ground water monitoring wells in the State of Goa during the month of May 2024. Among the wells monitored, **87** are dug wells and **48** are piezometers/tube wells.

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

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

1. A perusal of the water level data reveals that the depth to water level ranged from **0.91 m bgl** (Salcete taluk) to **15.6 m bgl** (Salcete taluk).

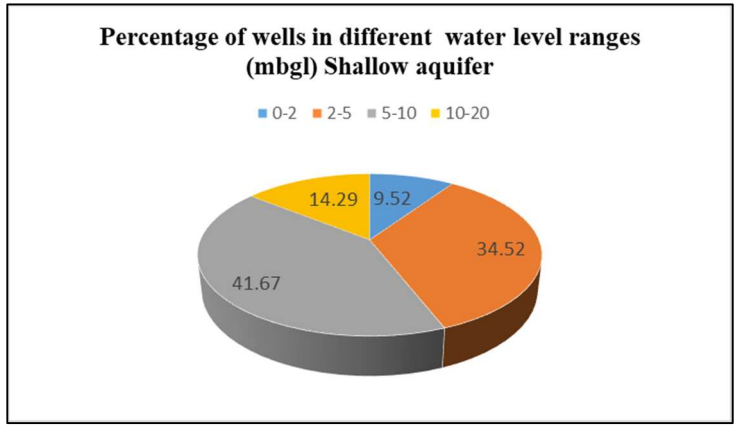
2. The salient feature of the analysis is that the depth to water level over major part of the State lies within 10 m bgl i.e. **85.5%** of wells analysed, while **14.5%** of wells show depth to water level in the 10-20 m bgl range.

3. Depth to water level of less than 2 m bgl has been recorded in **9.52%** of wells analysed and noted in Bardez, Ponda, Quepem, Salcete, Sattari and Tiswadi taluks.

4. Depth to water level in the range of 2 to 5 m bgl has been recorded in **34.52%** of wells analysed and noted in all the taluks except Dharbandara Taluk.

5. Depth to water level in the range of 5 to 10 m bgl has been recorded in **41.67%** of wells analysed noted in all taluks except Dharbandara & Marmugoa taluks .

6. Depth to water level in the range of 10 to 20 m bgl has been observed in **14.29%** of wells analysed and noted in Bardez, Bicholim, Canacona, Dharbandara, Salcete and Sangeum taluks.



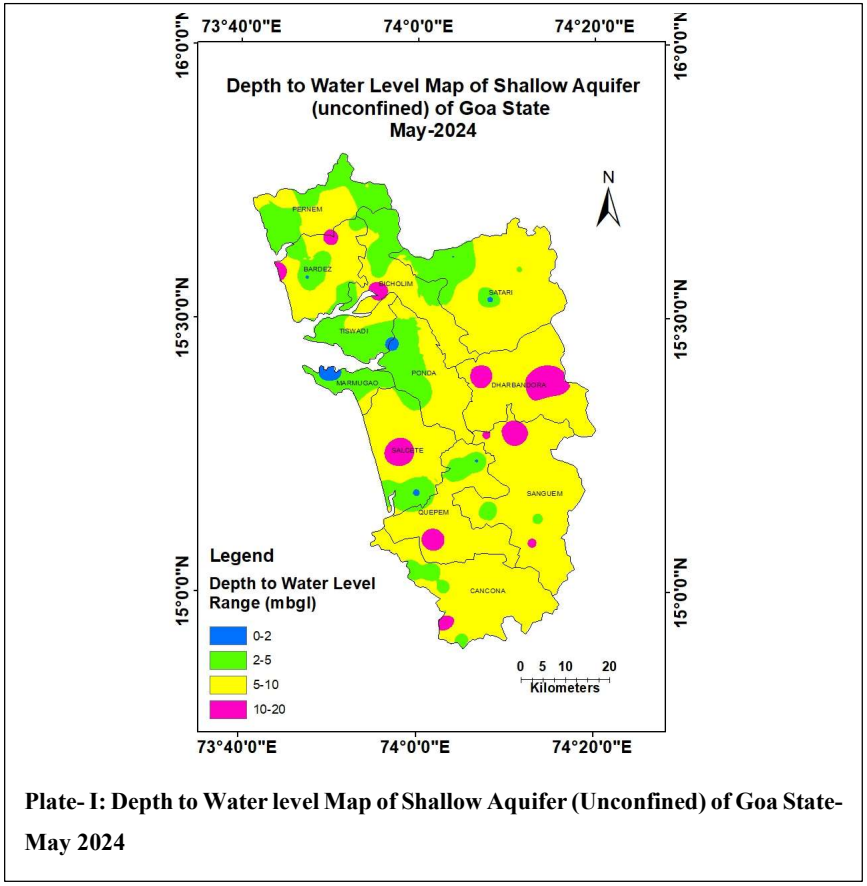
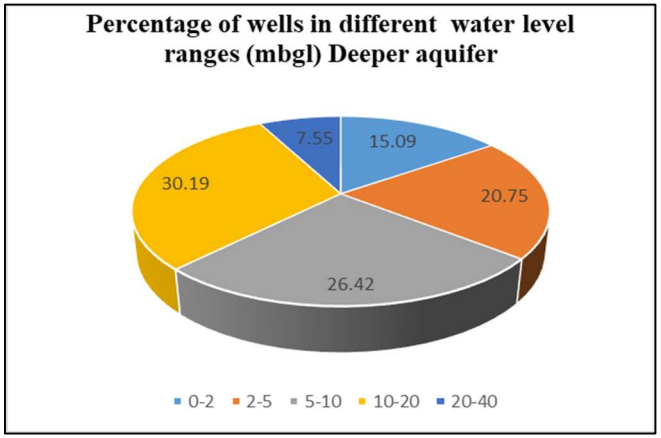


Plate- I: Depth to Water level Map of Shallow Aquifer (Unconfined) of Goa State- May 2024

3. Depth to water level of Deeper aquifer (semi-confined/confined) of May 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 May 2024. Salient features of the depth to water level of deeper aquifer during May 2024 are given below;

1. The depth to water level of deeper aquifer ranges from **1.15 m bgl** (Tiswadi taluk) to **28.5 m bgl** (Bardez taluk) in Goa State.
2. **62.25%** of wells have recorded depth to water level of deeper aquifer within 10 m bgl and **37.75%** 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 **15.09%** of wells analysed and this has been noted in Canacona, Pernem, Salcete, Sangeum & Tiswadi Taluk.
4. Depth to water level of deeper aquifer in the range of 2 to 5 m bgl has been recorded in **20.75%** of wells analysed and noted in Bardez, Pernem, Salcete, Sanguem, Tiswadi taluks.
5. Depth to water level of deeper aquifer in the range of 5 to 10 m bgl has been recorded in **26.42 %** of wells analysed and noted in all taluks except Ponda, Quepem Sanguem, Tiswadi taluks.
6. Depth to water level of deeper aquifer in the range of 10 to 20 m bgl has been observed in **30.19%** of wells analysed and noticed in all taluks except Salcete,Sanguem,Tiswadi Taluks.



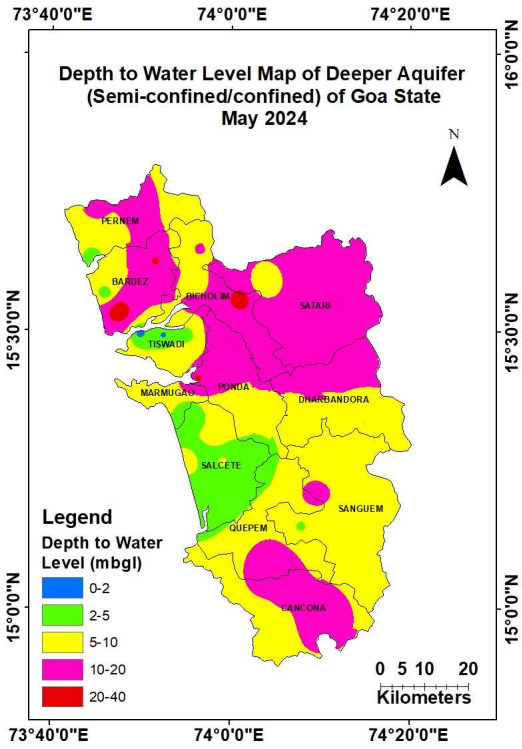
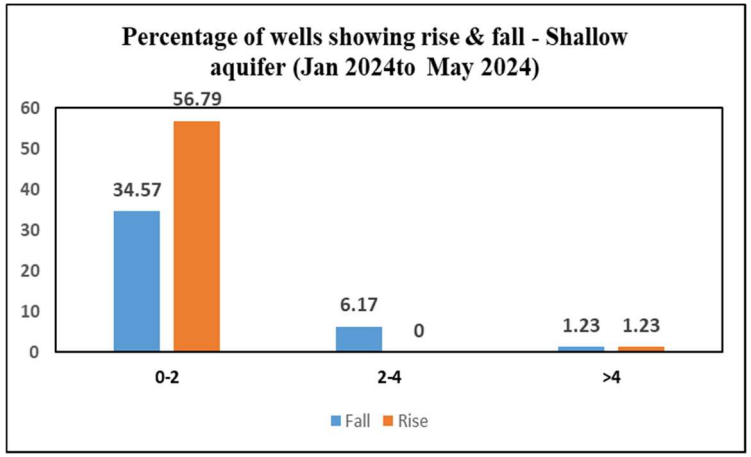


Plate II : Depth to water level Map of Deeper Aquifer (Semi-confined/Confined) of Goa State- May 2024

4. Change in seasonal water level of Shallow aquifer (unconfined)- January 2024 to May 2024 of Goa State:

A comparison of water level shows that a rise in the water level is recorded in **58%** of wells analyzed, while 42**%** 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 given below.

1. Rise in the water level in the range of 0-2 m has been observed in **56.8%** of wells analysed and observed in all taluks.
2. Rise in the water level in the range of >4 m has been observed in **1.23%** of wells analysed and observed in Pernem taluk.
3. The fall in water level in the range of 0-2 m has been observed in **34.57%** of wells analysed and noted in all taluks except Ponda taluk.
4. The fall in the water level in the range of 2-4 m has been observed in **6.17%** of wells analysed in Bardez, Canacona, Ponda, Salcete taluks.
5. The fall in the water level in the range of >4 m has been observed in **1.23%** of wells analysed in Salcete taluk.



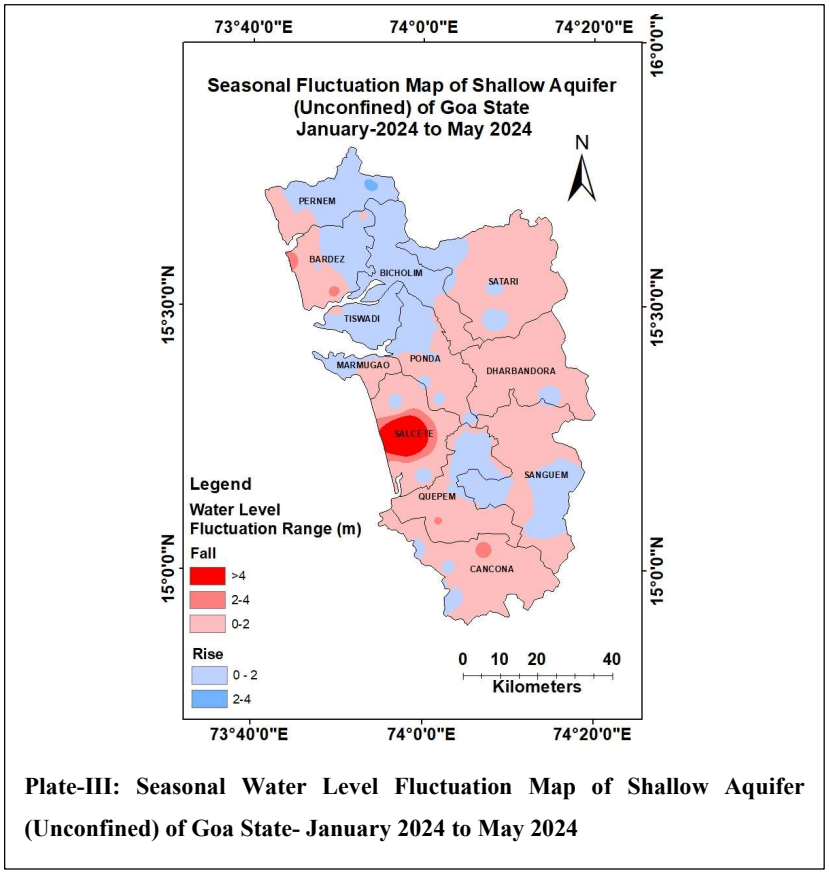
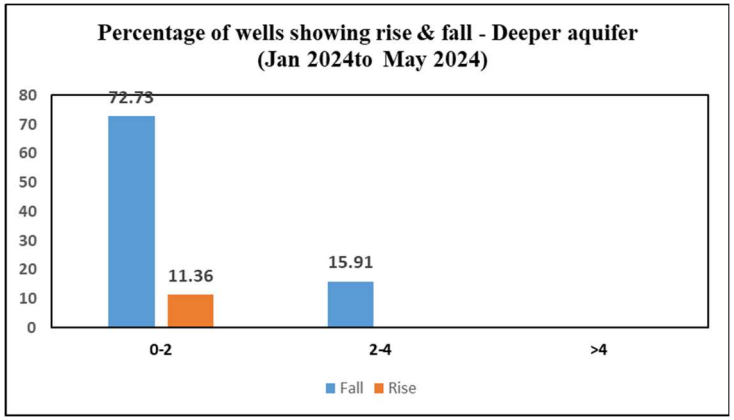


Plate-III: Seasonal Water Level Fluctuation Map of Shallow Aquifer (Unconfined) of Goa State- January 2024 to May 2024

5. Change in seasonal water level of Deeper aquifer (semi-confined/confined)- January 2024 to May 2024 of Goa State:

A comparison of water level shows that a fall in the water level is recorded in **88.63%** of wells analyzed & rise of water level recorded in 11.36 % 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 fall 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 **11.36%** of wells analysed and observed in Canacona, Salcete, Sattari, Tiswadi taluks.
2. Fall in the water level in the range of 0-2 m has been observed in 72.73**%** of wells analysed and observed in all the taluks except Quepem taluk .
3. Fall in the water level in the range of 2-4 m has been observed in **15.91%** of wells analysed and observed in Bicholim, Canacona, Ponda, Quepem, Sangeum, Sattari taluks.



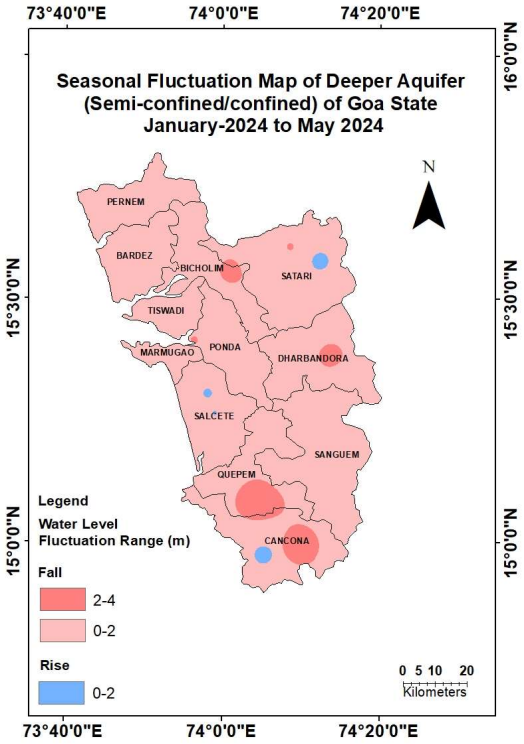
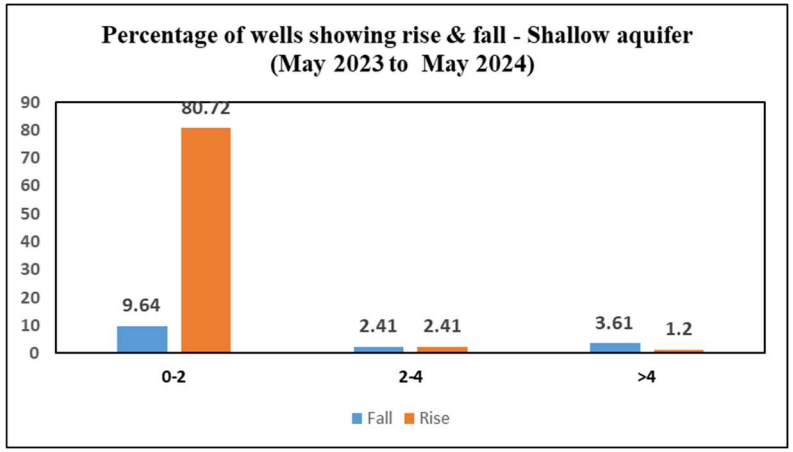


Plate-IV: Seasonal Water Level Fluctuation Map of Deeper Aquifer (Semi-confined/Confined) of Goa State - January 2024 to May 2024

6. Change in annual water level of Shallow aquifer (unconfined)- May 2023 to May 2024 of Goa State:

A comparison of water level shows that a rise in the water level is recorded in **84.34%** of wells analyzed, while **15.66%** recorded fall. The Annual 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 **80.72%** of wells analysed and observed in all taluks .
2. Rise in the water level in the range of 2-4 m has been observed in **2.4%** of wells analysed in Sattari & Tiswadi taluk.
3. Rise in water level more than 4 m has been observed in **1.20%** of wells analysed and noted in Bicholim taluk.
4. The Fall in water level in the range of 0-2 m has been observed in **9.64%** of wells analysed and noted in all taluks except Bardez, Dharbandara, Salcete taluks.
5. The Fall in the water level in the range of 2-4 m has been observed in **2.41%** of wells analysed and noted in Bardez taluk.
6. The fall in water level more than 4 m has been observed in **3.61%** of wells analysed and noted in Canacona, Dharbandara and Salcete taluks.



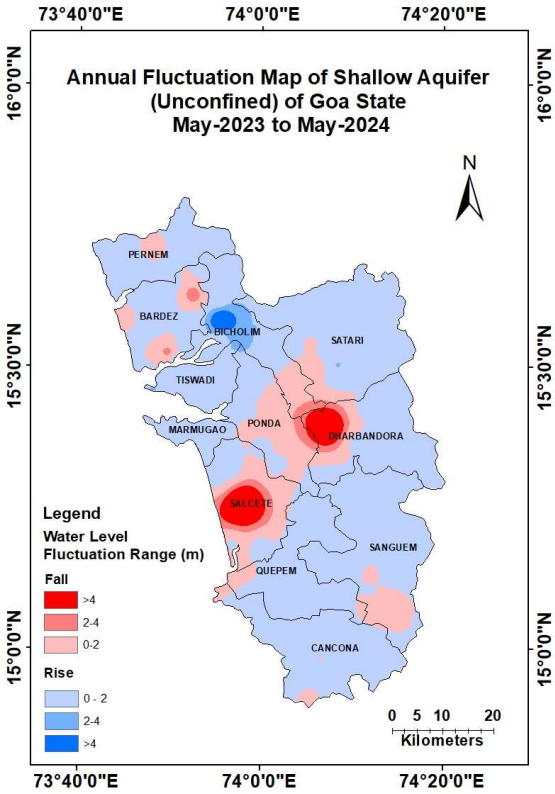
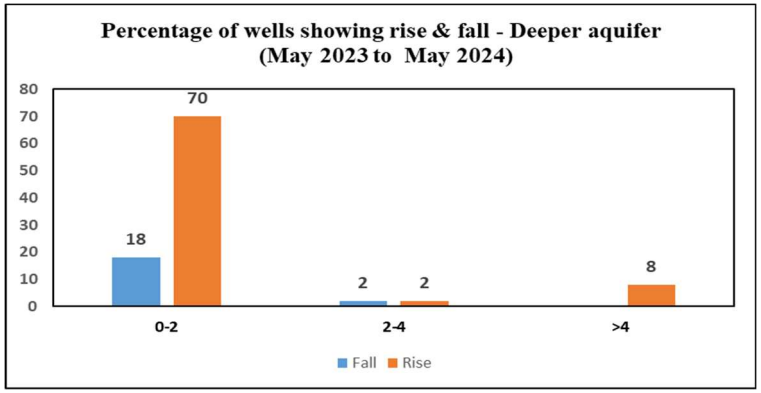


Plate-V: Annual Water Level Fluctuation Map of Shallow Aquifer (Unconfined) of Goa State- May 2023 to May 2024

7. Change in annual water level of Deeper aquifer (semi-confined/confined)- May 2023 to May 2024 of Goa State:

The statement showing the distribution of ground water monitoring wells annual fluctuation in different ranges in comparison with May 2023 of Deeper aquifer is presented in **Annexure-VI**. A comparison of water level shows that a rise in the water level is recorded in **78.7%** of wells analyzed, while **21.3 %** recorded fall. The Annual 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 **70%** of wells analysed and observed in all taluks.
2. Rise in the water level in the range of 2-4 m has been observed in none of wells analysed
3. Rise in water level more than 4 m has been observed in **4.26%** of wells analysed and noted in Bicholim & Sangeum taluk.
4. The Fall in water level in the range of 0-2 m has been observed in 19.15**%** of wells analysed and noted in Bardez, Canacona, Pernem, Sangeum, Sattari taluks.
5. he Fall in the water level in the range of 2-4 m has been observed in **2.13%** of wells analysed and noted in Sattari taluk



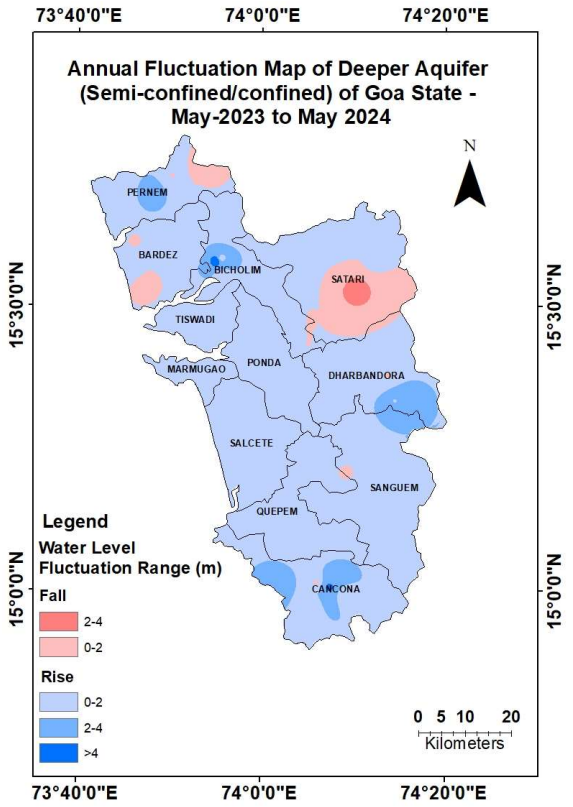
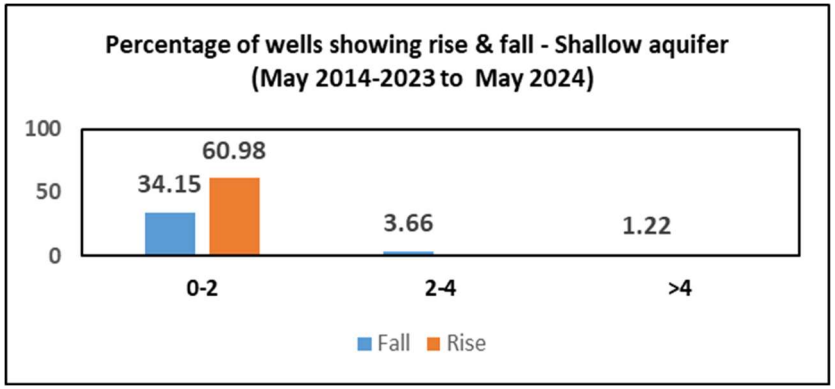


Plate-VI: Annual Water Level Fluctuation Map of Deeper Aquifer (Semi-confined/Confined) of Goa State- May 2023 to May 2024

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

The statement showing the distribution of decadal water level fluctuation in Shallow aquifer is presented in **Annexure-VII**. 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 **61%** of wells analysed, while **39%** 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 **61%** of wells analysed, and noted in all the taluks.
2. The Fall in water level in the range of 0-2 m has been observed in **34.15%** of wells analysed and noted in Bardez, Bicholim, Canacona, Pernem, Ponda, Salcete, Sangeum, Sattari and Tiswadi taluks.
3. The Fall in water level in the range of 2-4 m has been observed in **3.66%** of wells analysed and noted in Bardez & Ponda taluks.
4. The Fall in water level of more than 4 m is observed in 1.22% of wells analysed & noted in Canacona taluk.



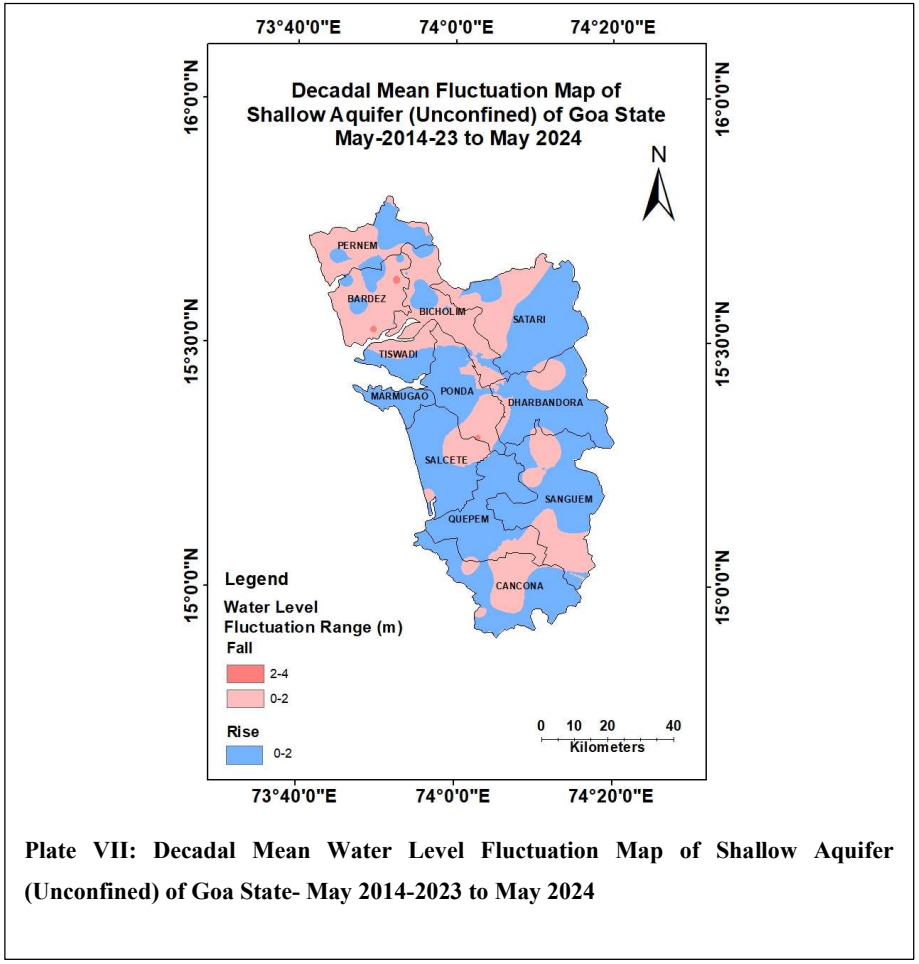
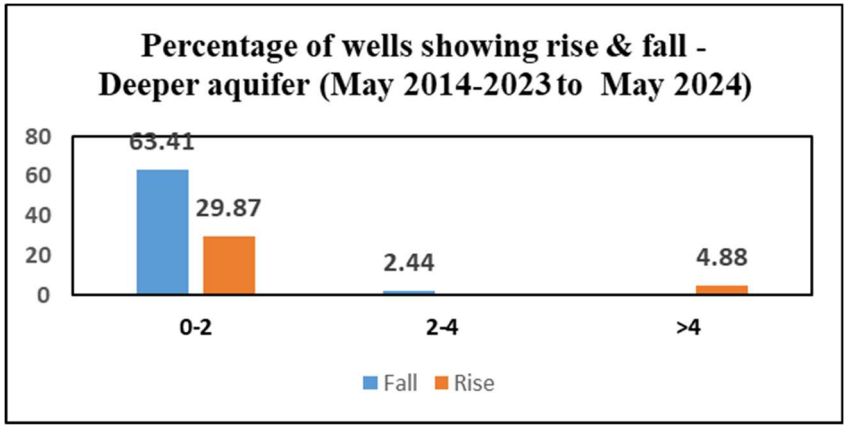


Plate VII: Decadal Mean Water Level Fluctuation Map of Shallow Aquifer (Unconfined) of Goa State- May 2014-2023 to May 2024

10. Mean decadal water levels fluctuation of Deeper aquifer (semi confined/ confined) for the period May 2014-2023 & May 2024 of Goa State:

The statement showing the distribution of ground water monitoring wells decadal fluctuation in deeper aquifer is presented in **Annexure-VIII**. The decadal fluctuation of water level of Shallow aquifer has been plotted in **Plate VIII**. A comparison of water level shows that a fall in the water level is recorded in **65.86%** of wells analysed, while **34.14%** recorded rise. 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 **29.27%** of wells analysed, noted in Bicholim, Canacona, Pernem, Ponda, Quepem, Salcete, Sangeum, Sattari taluks.
2. Rise in the water level in the range of >4 m has been observed in **4.88%** of wells analysed, noted in Pernem & Salcete taluks.
3. The Fall in water level in the range of 0-2 m has been observed in **63.41%** of wells analysed and noted in Bardez, Bicholim, Canacona Pernem, Ponda, Salcete, Sangeum, Sattari and Tiswadi taluks.
4. The Fall in water level in the range of 2-4 m has been observed in **2.44%** of wells analysed and noted in Sattari taluk.



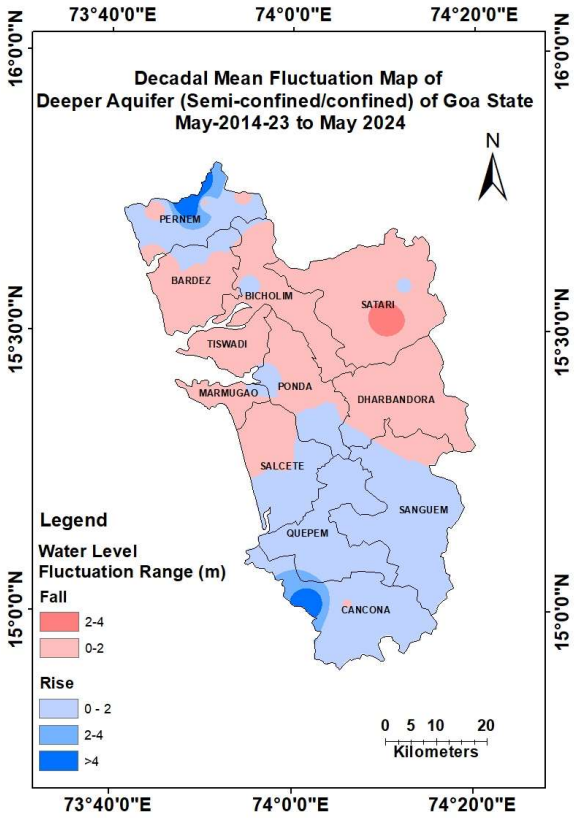


Plate VIII: Decadal Mean Water Level Fluctuation Map of Deeper Aquifer (Semi-confined/ Confined) of Goa State- May 2014-2023 to May 2024

11. Conclusions:

The behaviour of ground water table during **May 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 **85.5%** of wells analysed, while **14.5%** of wells show depth to water level between 10 to 20 m bgl.
2. **62.25%** of wells have recorded depth to water level of Deeper aquifer (Semi-confined/Confined) within 10 m bgl, while **37.75%** of wells show depth to water level of Deeper aquifer (Semi-confined/Confined) in more than 10 m bgl.
3. **42%** of wells have recorded seasonal fall in water levels of Shallow aquifer (Unconfined) and **58%** of wells have recorded rise in Seasonal water levels fluctuation during May 2024 in comparison to Jan 2024.
4. **88.63%** of wells have recorded seasonal fall in water levels of Deeper aquifer (Semi-confined/Confined) and **11.36%** of wells have recorded rise in Seasonal water levels fluctuation during during May 2024 in comparison to Jan 2024.
5. **84.34%** of wells have recorded annual rise in water levels of Shallow aquifer (Unconfined) and **15.66%** of wells have recorded fall in Annual water levels fluctuation during May 2024 in comparison to May 2023.
6. **21.3%** of wells have recorded annual fall in water levels of Deeper aquifer (Semi-confined/Confined) and **78.7%** of wells have recorded rise in Annual water levels fluctuation during May 2024 in comparison to May 2023.
7. **61%** of wells have recorded decadal rise in water levels of Shallow aquifer (Unconfined) and **39%** of wells recorded fall in water levels during May 2024 in comparison to decadal mean for the month of May (2014-23).
8. **34.14%** of wells have recorded decadal rise in water levels of Deeper aquifer (Confined) and **65.86%** of wells recorded fall in water levels during May 2024 in comparison to decadal mean for the month of May (2014-23).

12. SUMMARY

In Goa state, 84.34% of wells have recorded annual rise in water levels of Shallow aquifer & **78.7%** of wells have recorded rise in Deeper aquifer during May 2024 in comparison to May 2023. **61%** of wells have recorded decadal rise in water levels of Shallow aquifer (Unconfined) and **34.14%** of wells have recorded decadal rise in water levels of Deeper aquifer (Confined) during May 2024 in comparison to decadal mean for the month of May (2014-23).

13. 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 ingression 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.