Groundwater Investigation in Saddu Residential Area – A Field Survey Report

Submitted to:

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Disclaimer

This is a general groundwater investigation report prepared by the students of MSc (Geology) II Semester as a part of course syllabus for academic learning and hands on field experience. The specific content and level of detail varies depending on the project's scope, objectives, and regulatory requirements. It's essential to consult with relevant experts and authorities to ensure the report's accuracy and compliance. The investigation was carried out by the students of School of Studies in Geology & WRM, Pt. Ravishankar Shukla University, Raipur namely, Tarun, Aman Singh Rajput, Kabir Patel, Md Faizan, Vishubha Singh and Yogendra Singh.

This exercise is a part of introduction to real-world problem identification, adopting a methodology leading to solution, execution of field-work, data collection, data analysis, inference making and report writing.

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1. Introduction to Study Area

The purpose of the present groundwater investigation is to gather information about the availability of groundwater in Housing Board Colony, Saddu area. This information is crucial for various purposes, including water supply, assessing the suitability of groundwater as a drinking water source and developing sustainable water supply plans. The study will help to assess the impact of land use

activities on groundwater regime and developing groundwater protection strategies for long-term sustainability.

The study area has numerous government and private housing schemes developed on the NE part of Raipur along he left bank of Chokra nala. The residential area has taken its present shape over a decade. Due to lack of systematic water supply in the area, the residents depended on private groundwater borehole for domestic water requirements.

2. Geology

Geology plays a fundamental role in hydrogeological investigations. Integration of geological and hydrogeological information provides an essential insight into the subsurface conditions that influence groundwater occurrence and movement. The geology of Raipur is characterized by sedimentary formations those belong to Chhattisgarh Supergroup. The existing geological map (Source: District Resource Map, GIS) indicates prominent presence of limestone intercalated with shale. At places, these are overlain by laterite.

3. Methodology

The methodology adopted for the present hydrogeological investigation includes collection of data on geology, hydrogeology, existing data review, borehole details (location, total depth and depth to water level) and image analysis of remote sensing data.

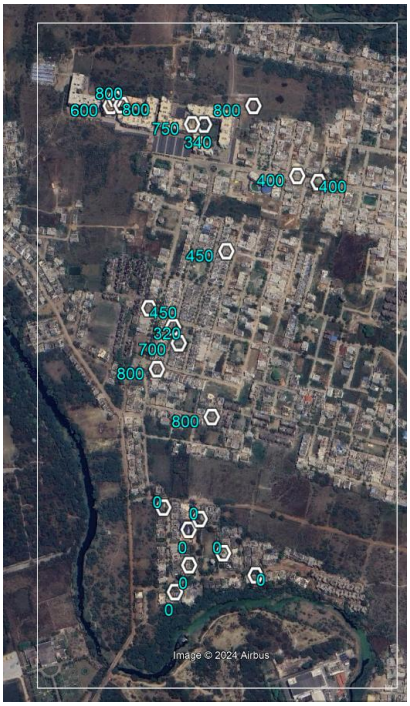

Figure No. 1. Water level observations during Monsoon Month

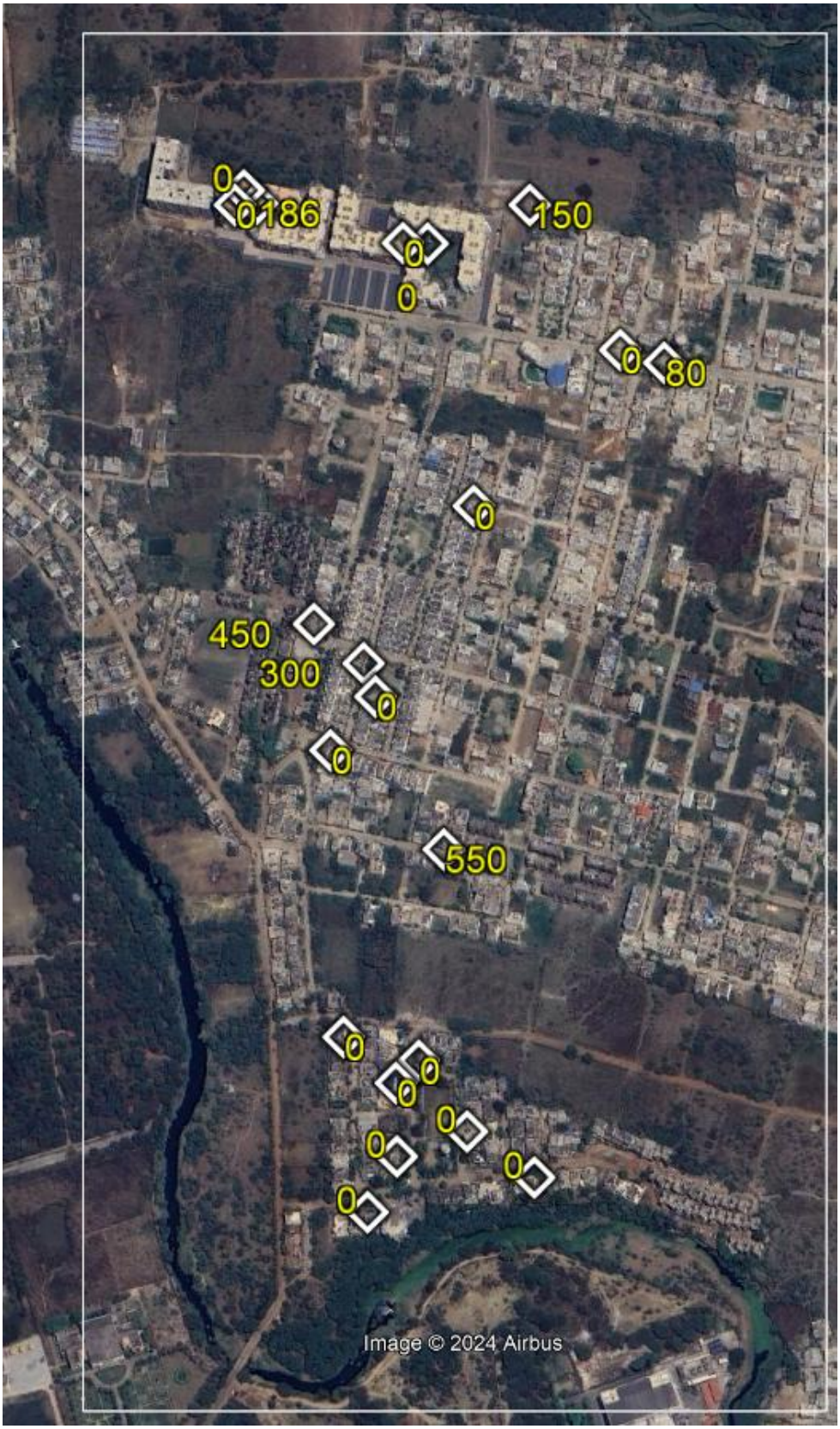

Figure No. 2. Water level observations during Summer Month

As part of this study field data on status of existing 21 borewell, location of borewells, depth of borewell, and water level in borewells were collected tabulated to understand the prevailing

hydrogeological conditions. The data for two-seasons, namely May 2004 and October 2024, were considered to understand the seasonal fluctuation of water table in the study area.

Existing landuse of the study area was extracted from the Sentinel-2A 2B satellite data of the study area. For mapping of landuse classification standard categories as proposed by the National Landuse atlas of NRSC, Hyderbad (source: www.bhuvan.nrsc.gov.in) were used. The landuse map shows that the study area is classified under *Built-up Peri-urban category* with Chokra Nala present in the western margin of the study area.

The field collected data were plotted on satellite images of google earth, available landuse and geological map of the study area.

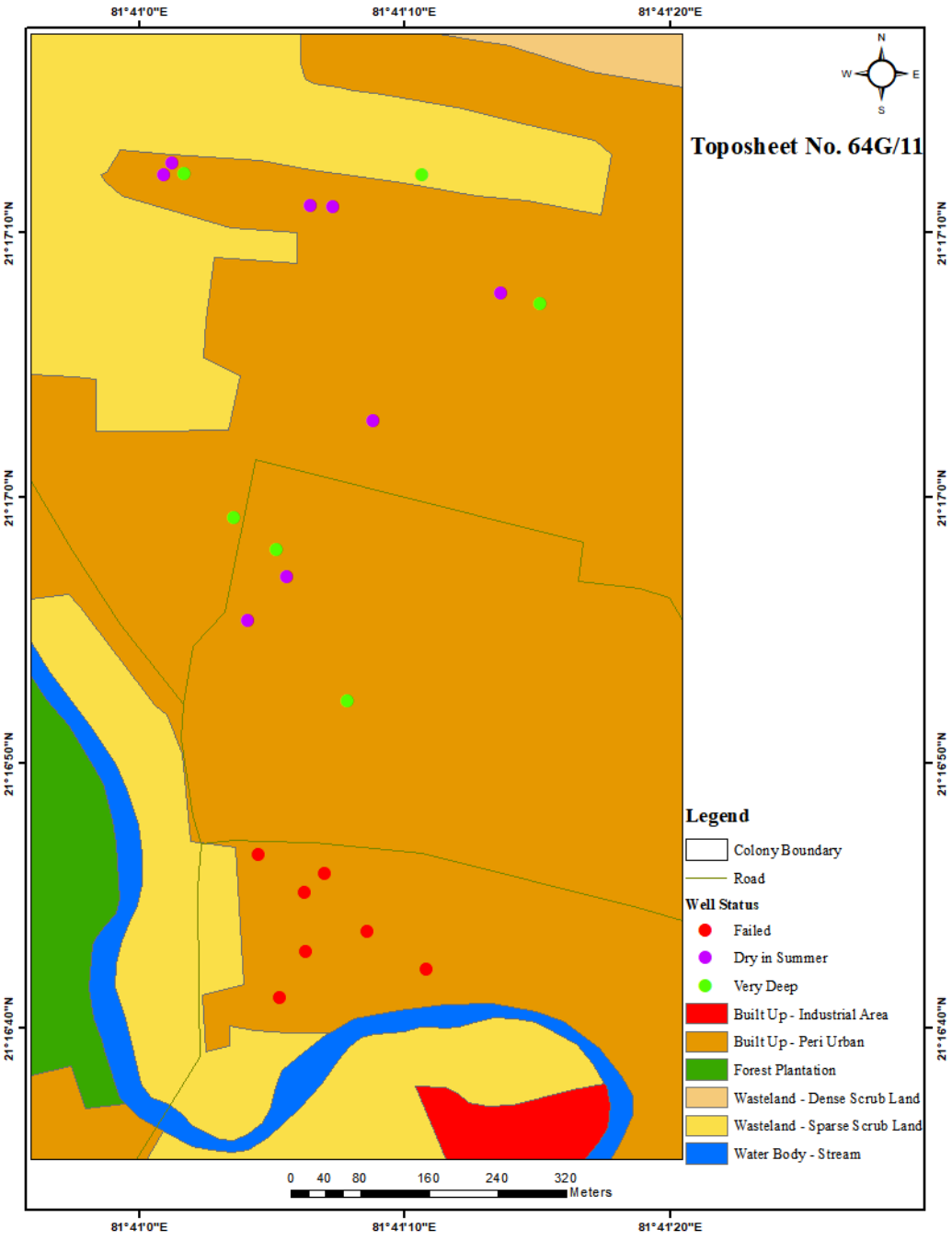

Figure No. 3. Overlay of Surveyed Borewells on Landuse of the Study Area

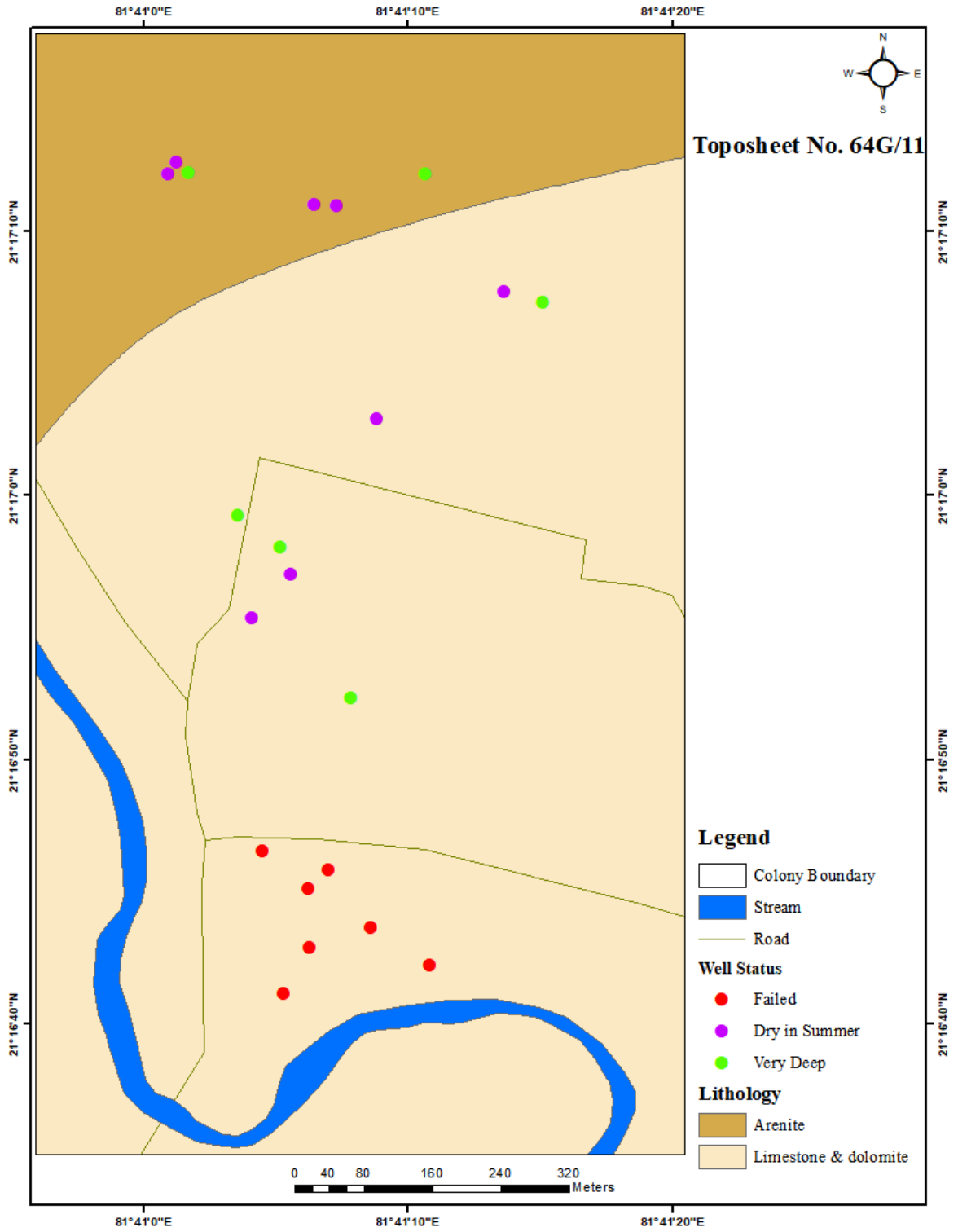

Figure No. 4. Overlay of Surveyed Borewells on Geological map of the Study Area

4. Results

The well inventory data reveals that limestone forms the major aquifer in the study area, and is unconfined in nature. The groundwater flow direction is from east to west, towards the natural drainage i.e. Chokra nala.

The groundwater table levels for the months of May 2004 and October 2024, indicates that monsoon precipitation is the only source of recharge for the aquifer.

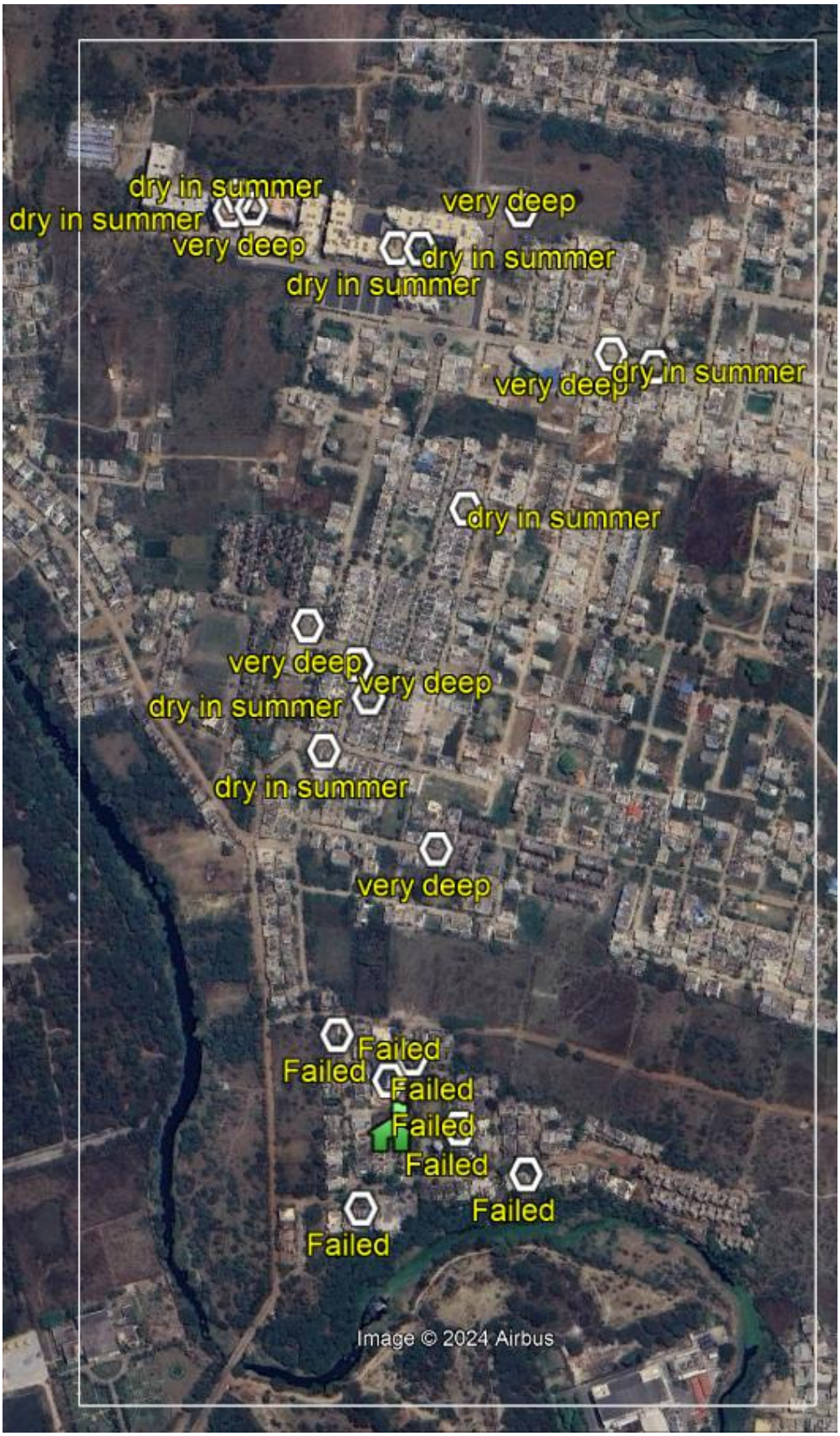

Figure No. 5. Field Observations of Surveyed Borewells in the Study Area

5. Analysis and Interpretation

The sedimentary formation of limestone intercalated with shale has been identified as the major aquifer. The aquifer has been characterised as unconfined in nature. The well inventory data indicates monsoon precipitation as the only source of recharge. The depth to water level for the months of May 2004 and October 2024 exhibits a wide range of fluctuation. The large fluctuations in groundwater levels can be ascertained to seasonal variation in rainfall, indicating the aquifer response to rainfall. This property is characteristic of unconfined limestone aquifers. Further, the area has experienced large scale urbanisation in short span of time, changing the landuse, and thus adversely affecting the groundwater recharge. The lowering of water levels can be ascertained to change in landuse and decreasing in the size of recharge areas.

The geological features in the limestone area namely, karst topography, provides permeable zones which can act as recharge areas for groundwater. But due to urbanisation, these recharge areas are destroyed. Further, the groundwater base-flow is towards Chokra nala, i.e. from east to west direction, which drains the groundwater into natural drainage thus being the reason for fluctuation.

The present investigation highlights that limestone aquifer, present in the study area, is highly sensitive to natural and anthropogenic factors. The climatic factor directly affects the recharge to the aquifer, aggravated by loss of recharge areas due to urbanisation. The large fluctuation of water level in the unconfined limestone aquifer that occupies the study area is vulnerable, and can be ascertained due to climatic and urbanisation factors.

6. Conclusion

The groundwater regime of the study area is under threat due to human interference in the natural water cycle. The rate of discharge (natural and by excessive pumping) is higher that the rate of recharge (by rainfall), thus leading to lowering of water level in the area.

A protection strategy needs to be devised on the basis of geological knowledge that is essential for developing effective groundwater protection strategies, including land use planning and well siting. Further, by integrating geological data with hydrogeological information, researchers can make informed decisions regarding groundwater resource management, protection, and development.

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