INTERIM REPORT
ON
HYDRO-GEOMORPHOLOGICAL STUDIES
OF
AMARAVATI CAPITAL AREA

Submitted To

Andhra Pradesh Capital Region Development Authority (APCRDA)
Government of Andhra Pradesh

Submitted By

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List of Contents

List of Figures

Interim Report on Hydro-geomorphological Studies of Amaravati Capital Area

I. Introduction

BlueEnergy Build Private Limited was awarded the Letter of Intent (LOI) by the Andhra Pradesh Capital Region Development Authority (APCRDA) on 10 April 2025 for conducting a hydrogeomorphological study of Amaravati capita city area.

The objective is to assess the surface and subsurface water systems to strategically plan retention ponds, stormwater drains, and their interconnectivity. These interventions are designed not only to mitigate flood risks but also to enhance groundwater recharge, particularly given the region's unique hydrogeomorphological setting. The toposheet map of Amaravati capital area along with village boundaries given in Fig.1.

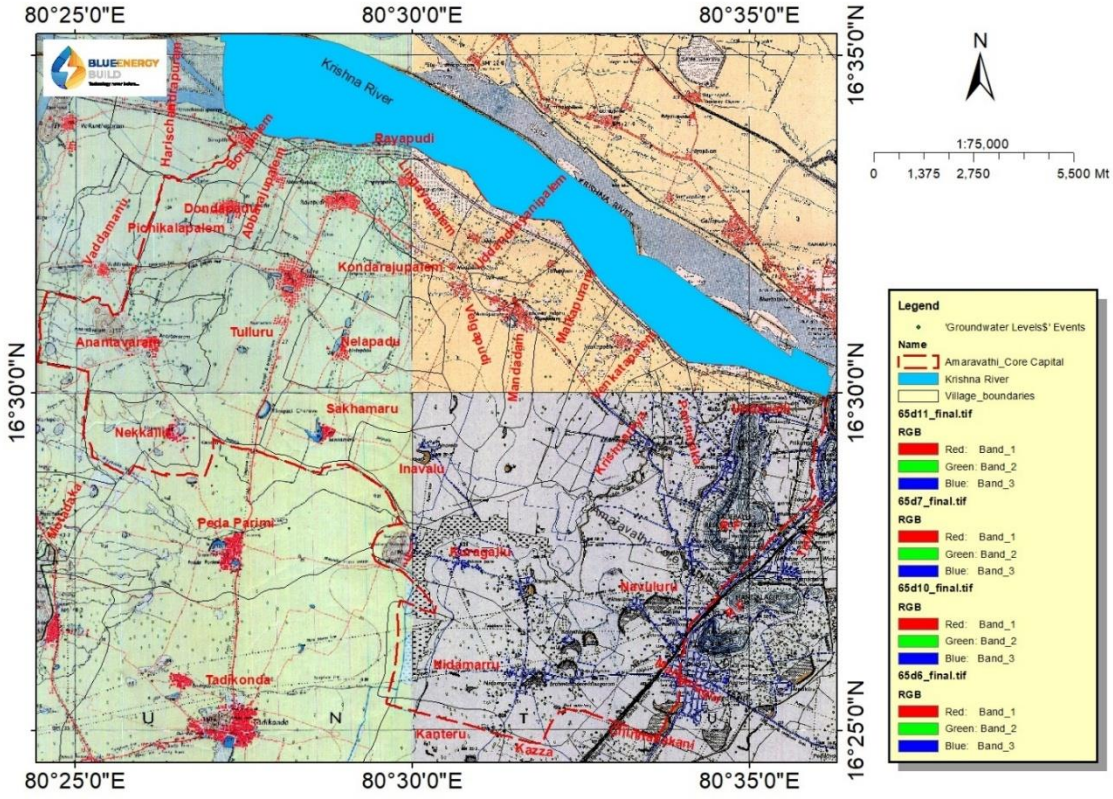

Figure 1: Toposheet map (SOI maps of 1970 and 1975) of Amaravati Capital Area along with village Boundaries.

II. Hydrogeomorphological Significance of Planned Retention Ponds in Amaravati's Core Capital Zone

The Andhra Pradesh Capital Region Development Authority (APCRDA) as part of the award of contract on 10.4.2025, has assigned an initial task of assessing the planned retention ponds, an outcome of the Hydrological studies conducted by APCRDA and Amaravati Development Corporation Limited (ADCL) during 2016 and 2017, in terms of hydrogeomorphological aspects considering the relevant secondary data on Amaravati region conducted by government agencies, private parties and field visits.

Following the formal agreement signed on 15th April 2025, reconnaissance visits were conducted on 18th and 20th April 2025, to assess the local physiography and hydrological systems. Baseline data from Geological Survey of India (GSI), Andhra Pradesh Capital Region Development Authority (APCRDA), Amaravati Development Corporation Limited (ADCL) and Central Ground Water Board (CGWB) and Private Parties includes Aarvee Associates, Tata Engineering Consultants and etc. were integrated to guide the study. The visited locations along with the travel path (black lines) are given in Fig. 2.

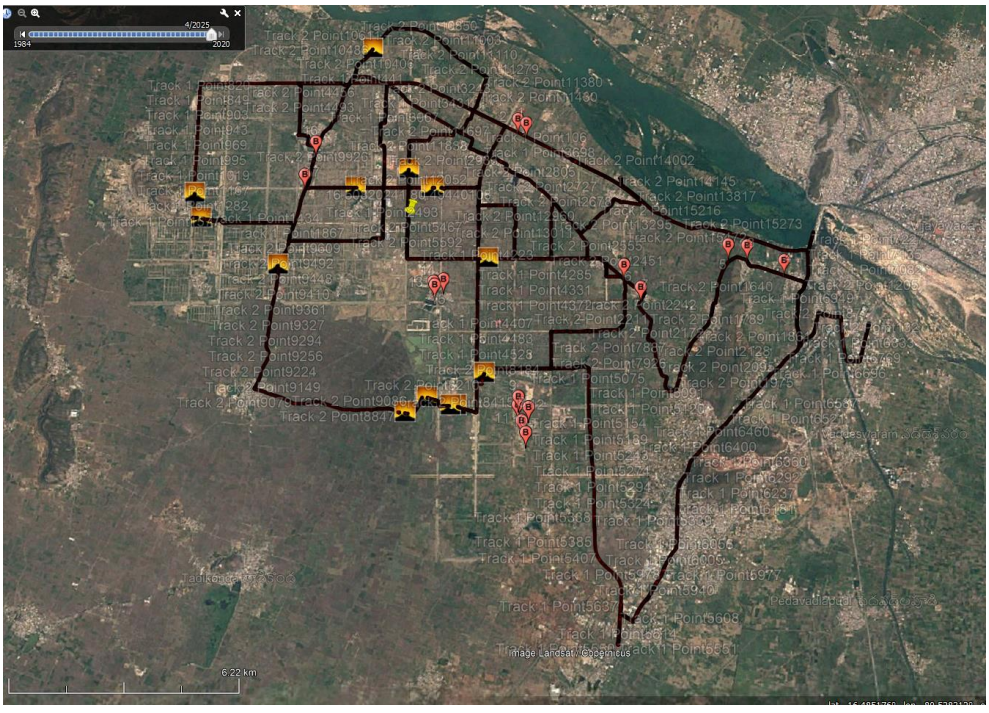

Figure 2: Visited Places along with Satellite Map

III. Key observations in Amaravati Capital Area

1. Strategic Terrain and Slope Conditions:

The capital area exhibits gently sloping terrain (1–9 degrees), characterized by a predominantly flat landscape with a northeastward gradient and low relief. These geomorphological conditions are highly conducive to surface water accumulation, making the region particularly suitable for the construction of reservoirs and retention ponds through strategic excavation and deepening within the designated zones of the master plan. The slope map of the study area given in Fig. 3.

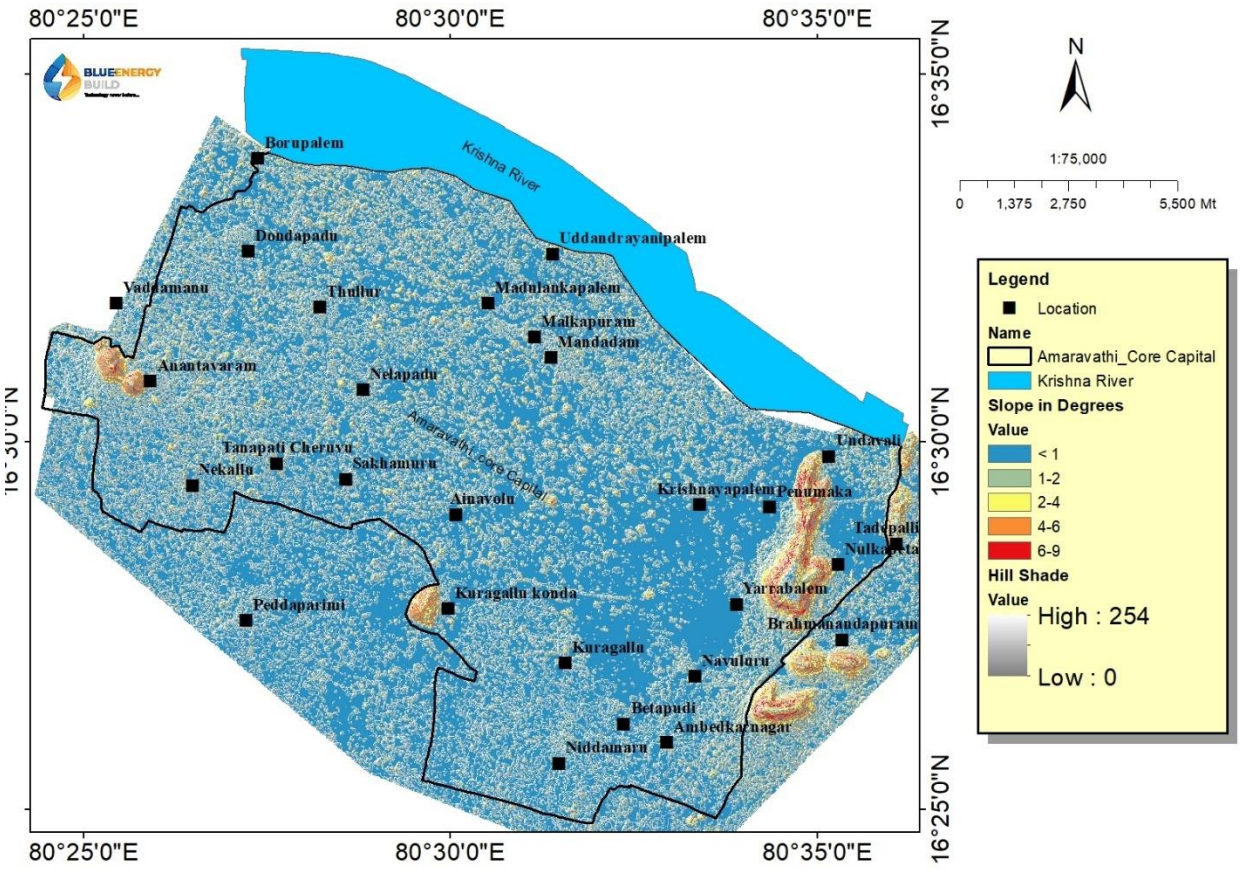

Figure 3: Slope map of the Study Area

2. Surface Water Flow Patterns:

The region's natural drainage, defined by the Krishna River and streams like Kondaveeti Vagu and Pala Vagu, converges across a sub-dendritic network. The planned ponds are tactically aligned along these drainage paths, enabling them to act as both flood cushions and

recharge facilitators by capturing and slowing runoff. The Drainage and stream network map of the study area is given in Fig. 4.

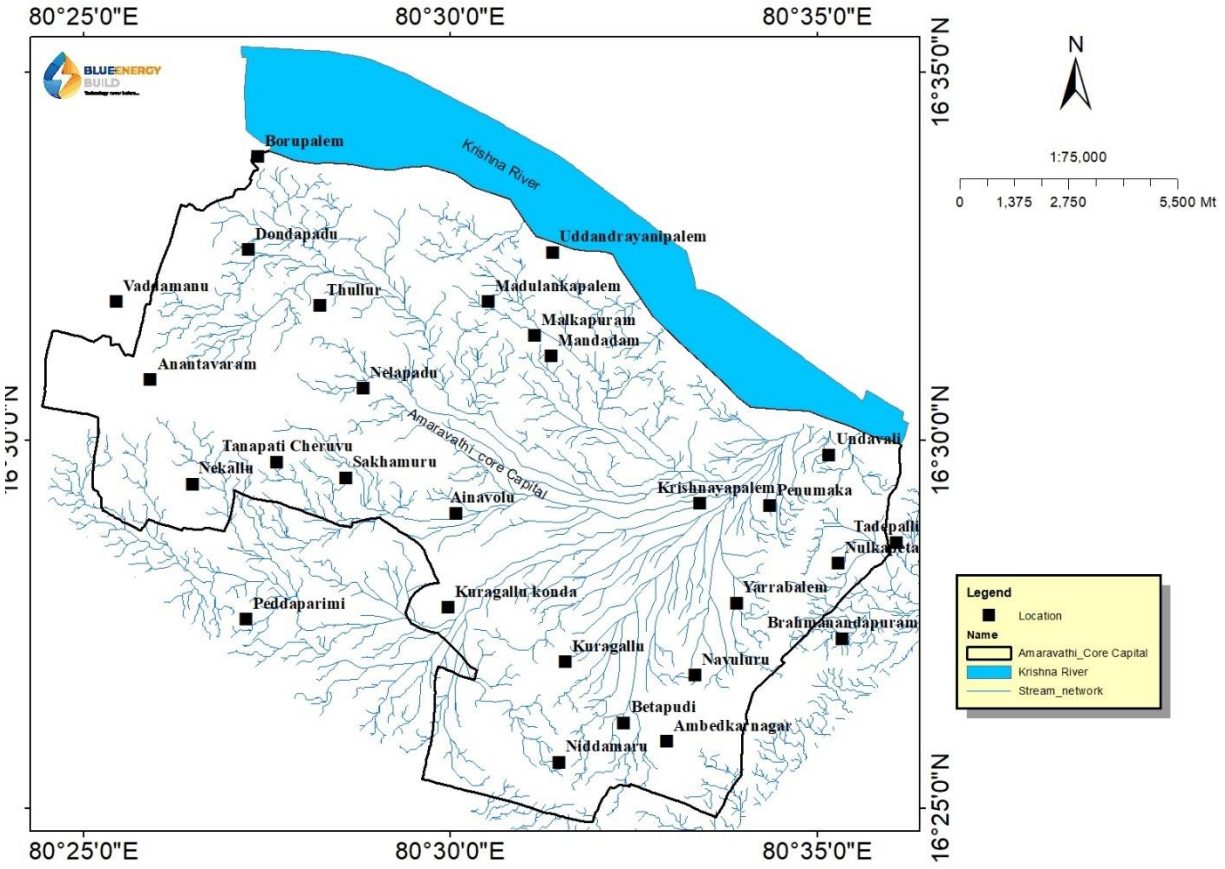

Figure 4: Drainage and stream map of the study area (after GSI, 2021)

3. Soil and Geological Conditions:

Although black cotton soil and clays dominate the area—with poor permeability and engineering challenges, they also contribute to water retention. Properly engineered, these soils can hold surface water longer, allowing more time for infiltration in suitably fractured or weathered rock zones beneath. Lithological, structural and geomorphological map of the study area is given in Fig. 5 , Fig.6 and Fig.7.

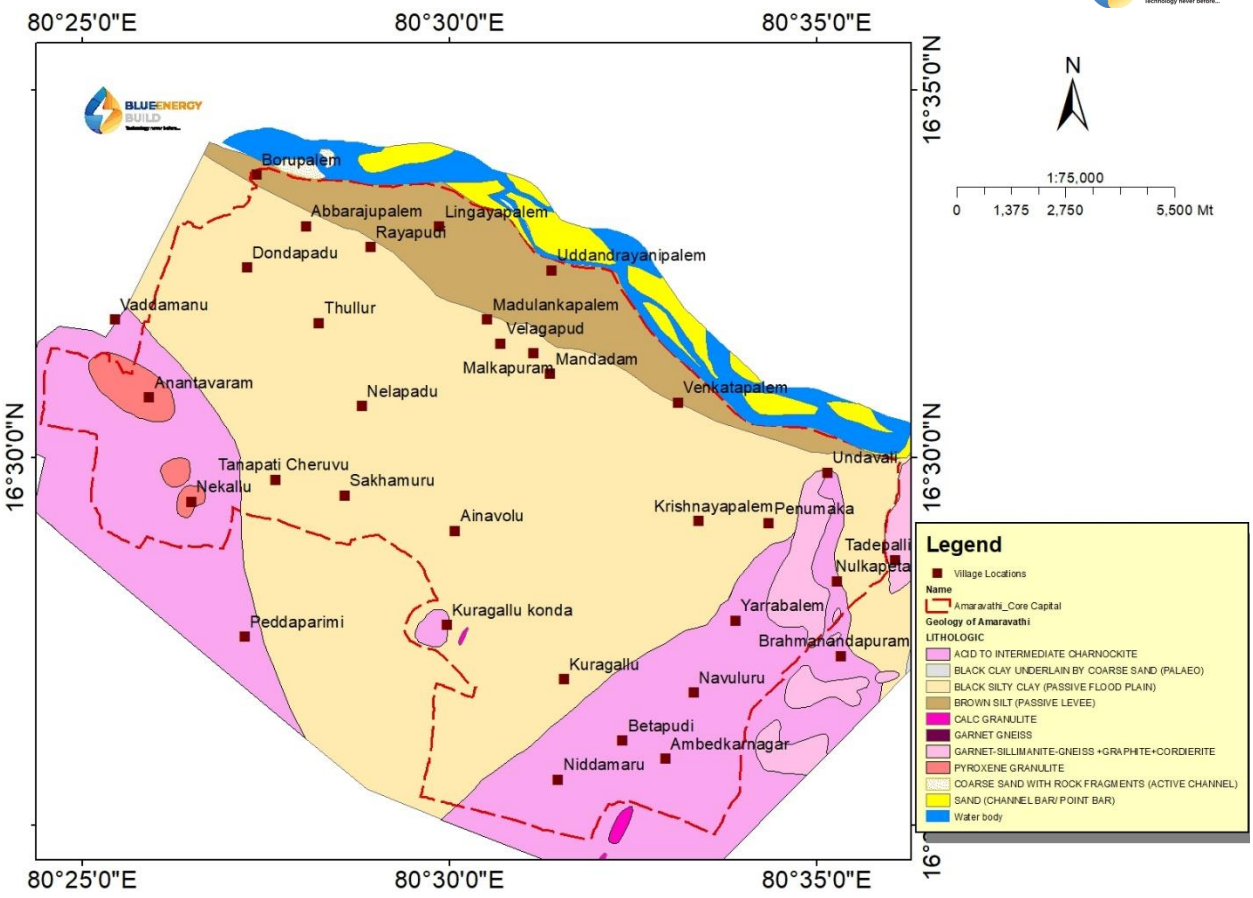

Figure 5: Lithology map of the study area (after GSI, 2021)

4. Shallow and Fractured Aquifer System:

Aquifers in Amaravati occur in both shallow (0.5–5 m bgl) and deeper zones (30–100 m bgl), with productive groundwater often found in fractured crystalline rocks (Charnockites, Khondalites) and alluvium (reference to the secondary data to be given). Many planned reservoirs—such as Neerukonda, Krishnayapalem, and Sakhamuru—are located in areas where the water table is shallow, facilitating strong interaction between stored surface water and aquifers. The groundwater table map of the study area is given in Fig. 8.

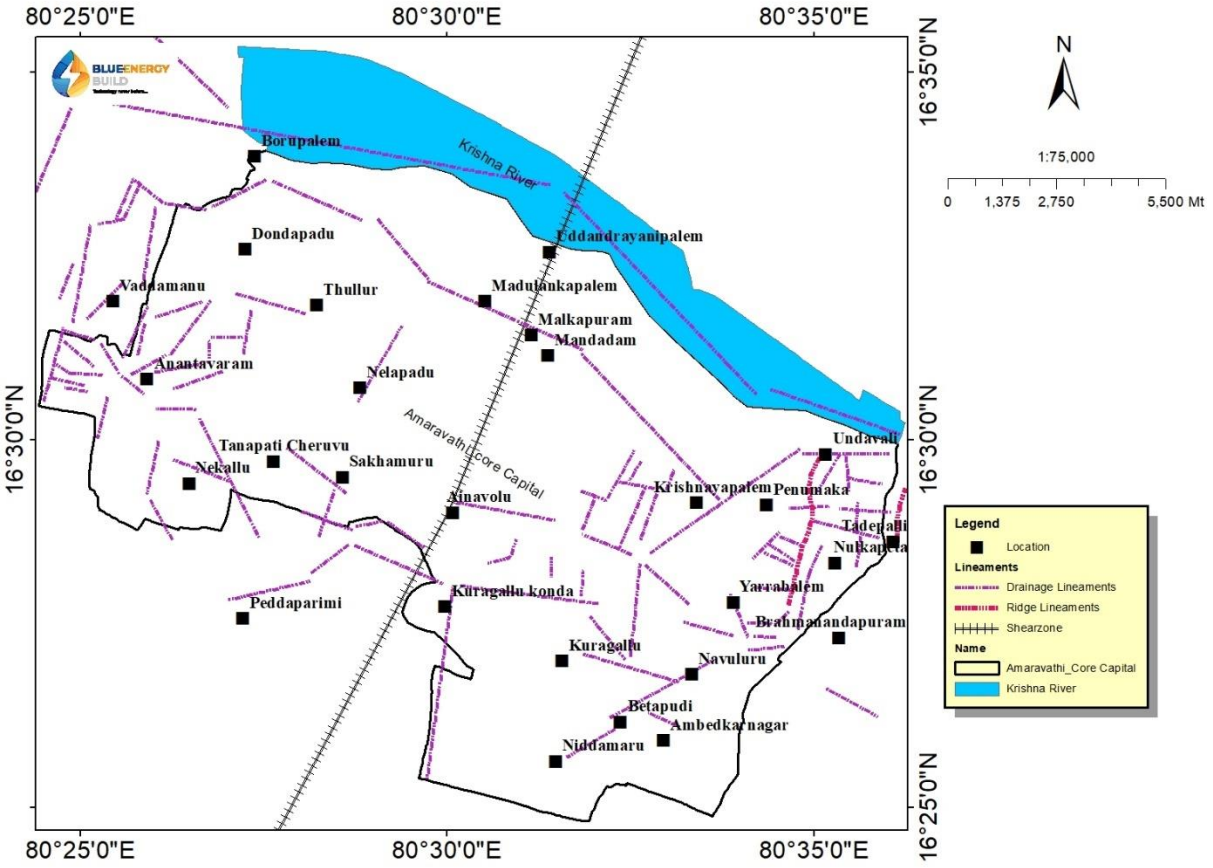

Figure 6: Lineament map of the study area

IV. Retention Ponds as Dual-Function Structures: Flood Control and Recharge

Geomorphologically Suitable Sites:

The selected sites for the planned water retention ponds are carefully located in low-lying, flat regions prone to periodic inundation, making them natural basins for water collection. By leveraging these depressions, the reservoirs serve as efficient flood attenuation mechanisms during heavy rainfall, while also functioning as recharge basins during dry periods.

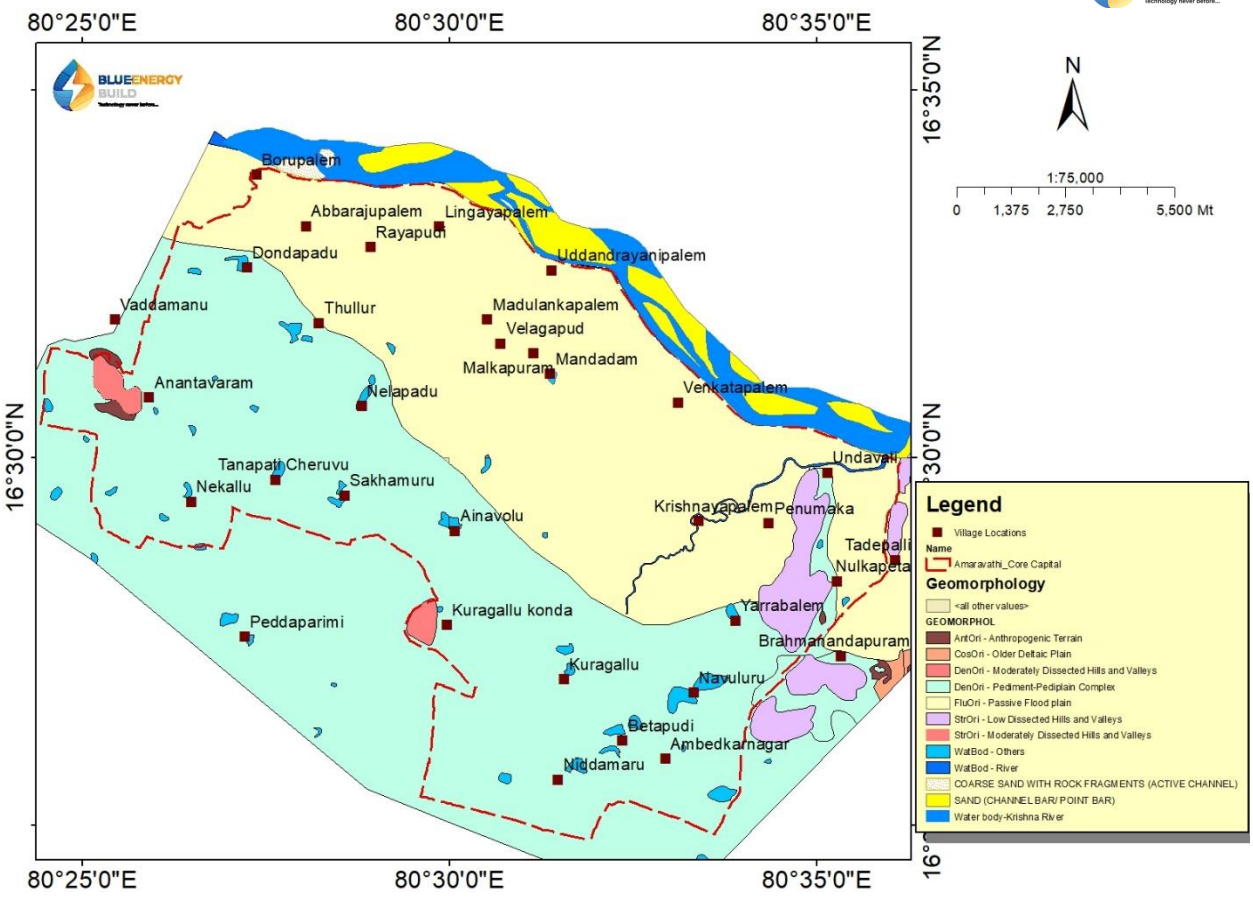

Figure 7: Geomorphological Map of the study area (after GSI, 2021)

Hydraulic Connection to Aquifers:

With borewell data (reference) confirming shallow water tables and fractured aquifers beneath, the stored water in retention ponds is expected to directly percolate into subsurface zones, enhancing aquifer recharge, particularly during monsoons. This is further supported by groundwater levels (reference) found at depths of just 1.5–6.0 metres in most parts of the region during monsoon and deeper during non monsoon season. The water table map of the study area is given in Fig. 8.

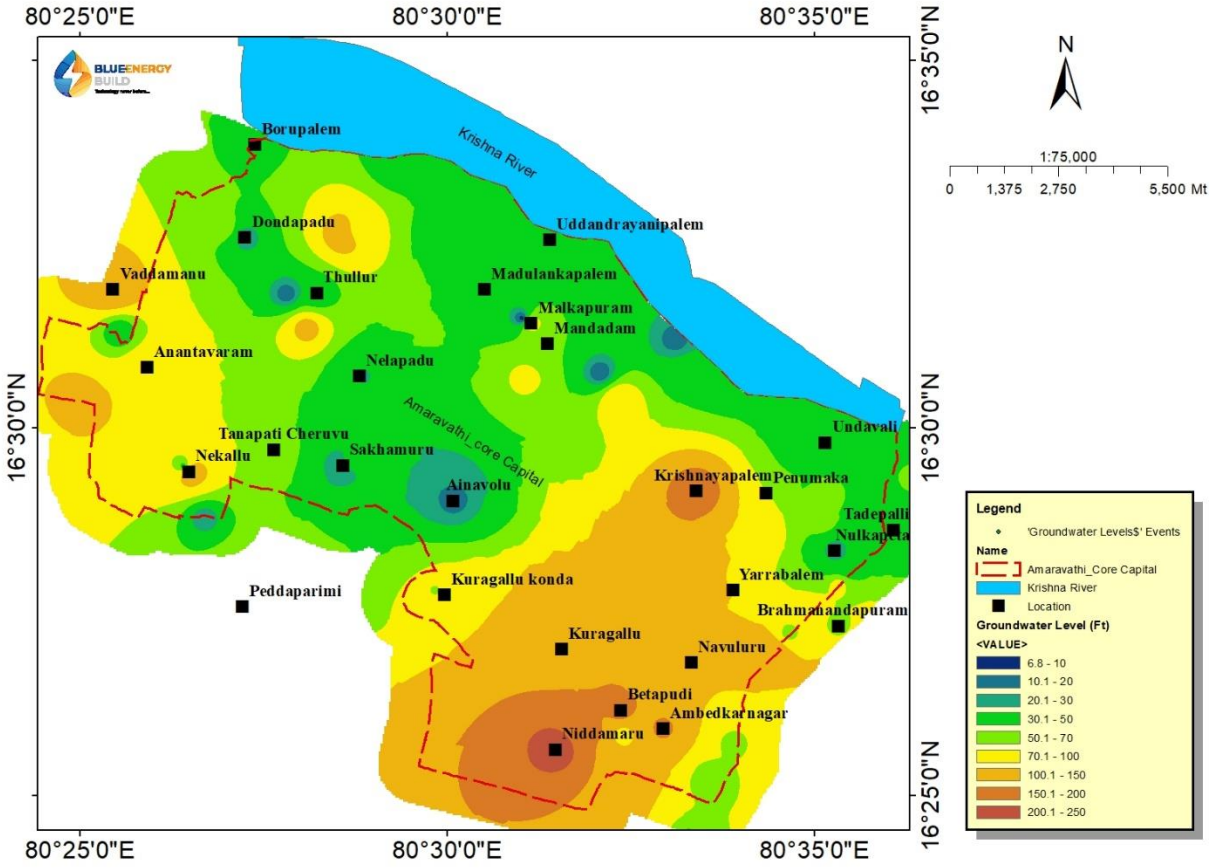

Figure 8: Water Table Map of the Study Area (after GSI, 2021)

V. Flood Mitigation through Systematic Water Management

Upper Catchment Regulation:

Reservoirs like Lam, Pedaparimi, and Vykuntapuram are planned upstream of the capital to intercept and divert floodwaters, reducing downstream pressure. These are aligned along natural flow paths and topographic lows for gravity-based diversion into the Krishna River.

Intra-City Flood Attenuation:

Within the city, reservoirs at Neerukonda, Krishnayapalem, and Sakhamuru are designed for immediate flood attenuation and multi-use purposes such as navigation, recreation, and water supply. Their locations were selected based on hydrogeomorphological suitability—low elevation, high runoff zones, and proximity to shallow aquifers.

Stormwater Infrastructure Integration:

Canals and storm drains are engineered to direct runoff into these reservoirs, which not only prevents flooding but also channels clean stormwater into water bodies for percolation. Planned separate drainage and sewage networks are ensuring system integrity and promote groundwater recharge.

VI. Sustainable and Resilient Urban Water Planning

Amaravati's master plan integrates geomorphology with engineering design. The flat terrain, shallow aquifers, and structural depressions have been leveraged to create a cohesive flood management and groundwater recharge framework:

- **Total storage capacity** of ~1.33 TMC across reservoirs.
- **1215 acres** of additional water bodies planned.

Despite constraints such as shallow water tables and low-permeability soils in the Amaravati Capital Area, the awarded hydrogeomorphological study will play a crucial role in guiding the planning and proper siting of recharge structures across the city—making them highly effective for both flood mitigation and groundwater recharge.

VII. Conclusion:

The retention ponds planned for Amaravati's core capital zone are not only scientifically grounded but also optimally located from a hydrogeomorphological standpoint. Their design supports immediate urban flood control and long-term groundwater sustainability. This integrated water management approach ensures resilience against climate extremes and secures water availability for the future growth of the capital region.

VIII. References

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8. Nagadi Consultants Private Limited Geotechnical Consultants. *Soil Profile Project: Proposed Flood Management Works at Mangalagiri, Amaravathi, Tadepalli and Tadikonda Mandals* (Job No. G(C)8914). Undated.
9. Aarvee Associates architects engineers consultants pvt.ltd.. *Report on Flood Modelling & Management Measures of Kondaveeti Vagu*. 17 May 2016, Revision No: R2.

IX. Field Photographs

Bare soils with bushes at south east of Ananthavaram

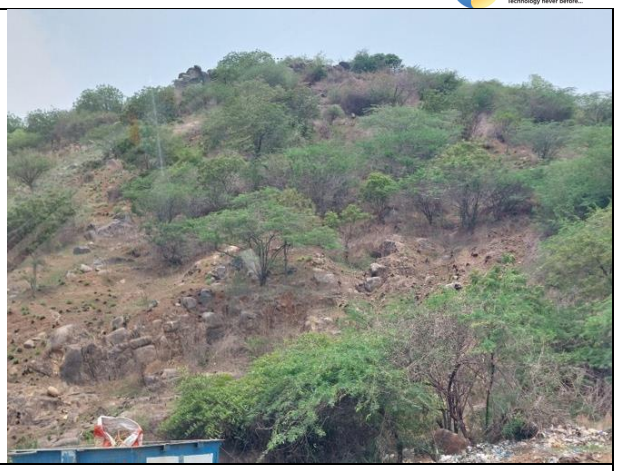
Bush Development near east of Ananthavaram

Road along with adjoining bushes at VIT AP University Road

Bushes and exposed soils at High court of Andhra Pradesh

Vegetation at SRM university east of Neerukonda Village

Bridge over vagu Northeast of SRM university

	
Bridge over vagu near in between Neerukonda and SRM university	Topography at southern side of Neerukonda hill
	
Bush clearance along Vagu in between Nekkallu and Sakhamuru	Land scape near norht of Rayapudi
	
Road along with bushes near VIT university Road	Construction work at E road and observations of Soils