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TOWARDS THE MILLENNIUM DEVELOPMENT GOALS

Assessment of groundwater potentials of Abuja environs

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IN THE RECENT times, Abuja the Capital of Nigeria has been facing severe water shortage due to increase in population, social and economic activities. Consequently, in order to meet the short fall in portable water supply, groundwater has been a ready source of water supply. A geoelectric survey employing vertical electrical sounding (VES) and profiling was carried out in different parts of the city, with the intention of providing productive boreholes for water supply to private individuals, organization and government agencies. This was followed up with borehole drilling programme at these surveyed sites. The results of the drilling logs when correlated with the surface geophysical investigations already executed indicated a layering of 3 to 5 geoelectric sections with resistivities of the layers ranging from 35 to 3200 Ohm-m depending on the lithology. Groundwater is found in he variable weathered/transition zone and fractures, joints and cracks of the crystalline basement. Borehole yields in the area vary from 19.2 to 173m^3/day with a mean value of 99m^2/day while borehole transmissivity range from 5.6 to 26.5 m^2/day. The static water levels vary from 2 to12.5 with average of 6.7m. The general elevation of Abuja varies considerably due to the rocky nature of the Federal Capital City. This study clearly shows that some areas like Gwarimpa, Karu/Nyanya, Kado and parts of Asokoro and Wuse districts have very good groundwater potentials. There is the need for comparism of geophysical survey results with drilling data for better resistivity interpretations for productive and effective borehole construction.

Introduction

This paper assesses the groundwater potentials of Abuja and it's Environs. The study area is located in the centre of the country. It covers an approximate area of about 7400sqm. It is bounded in the North by Kaduna, in the East by Nassarawa, in the southwest by Kogi and in the west by Niger State respectively. The general elevation of the study area varies considerably. Several rivers and their tributaries drain the area, the major rivers include River Usman, Jabi and Dwako.

The climate of the area is made up of two major seasons. A dry season, which usually last from November to February with warm sunshine and hazy harmattan around December and January, and a rainy season which lasts from April to November. Mean monthly temperature range from about 27^o to 30^o C and the annual precipitation is about 1,131m.

Abuja being the capital of Nigeria attracts a lot of population and industries, hence the demand for potable water supply is high. The city presently obtains it's water from treated water from Lower Usman Dam and boreholes drilled by various organisations and individuals in the area. Nevertheless water supply shortages for domestic use is a common phenomenon as people have to buy water at exhorbitant prices for household use from water vendors.

In the light of the above, there is a need to study the groundwater potential of the area, so that it can be use to complement the existing supply and to lay a proper framework for future development of this resources in the area.

Review of geology and hydrogeology

Abuja is underlain by crystalline basement rocks. The rocks include different textures of granites, coarse to fine, consisting essentially of biotite, feldspars and quartz. In most cases the rock have weathered into reddish micaceous sandy clay to clay materials capped by laterites. (Offodile 1992).

Generally only small amount of water can be obtained in the freshly unweathered bedrock below the weathered layers. Groundwater is found mainly in the variable weathered/transition zone and in fractures, joints and cracks of the crystalline basement. Fissure systems in Nigeria rarely extend beyond 50m, as evidenced by the available drilling data. (Clark 1985). The local water table depth is controlled by textural and compositional changes within the regolith vertical profile and the bedrock topography (David & Ofrey 1989).

Methodology

The method of study includes geophysical investigation using resistivity method and analysis of records on one hundred and one boreholes located within the city, Fig. 1 shows location of these boreholes. The records include data on geology and parameters determine from pumping test. Not all the boreholes contain enough information for the calculation of such aquifer parameters like transmissivity. For boreholes where required data are complete, transmissivities were determined using Jacob's modified method. Table 1 shows the summary of borehole parameters in the project area. The whole area was divided into ten zones for easy classification.

Result and discussion

The results of the geophysical survey indicated a layering of three to five geoelectric sections with resistivities of the

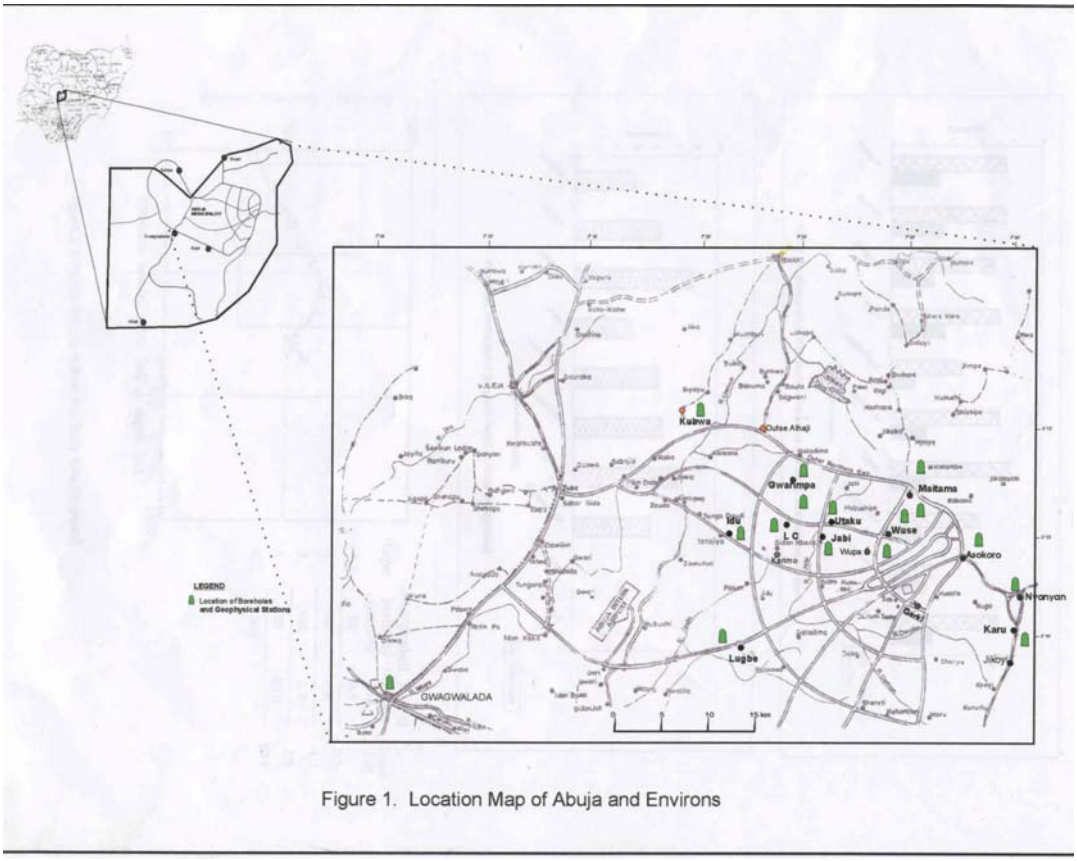

Figure 1. Location Map of Abuja and Environs

layers ranging from 35 to 3200 ohm-m depending on the lithology. These layers can be grouped into top lateritic soil, the sandy clay or clayey sand with intercalation of silts/clays, the weathered regolith transition zone and the fresh basement rock.

The drilling results correlates closely with the VES carried out during the survey. The thickness of the overburden in the project area varies depending on the location.Table 1 shows the average overburden thickness in each zone. (Fig. 2a)

Borehole yields in the area vary from 0.8 - 7.2m^3/hr (Table 1). Kubwa, Jabi/Idu, Asokoro, Gwarinpa and Lugbe areas have very good groundwater potential. The low yield experienced in other areas can be attributed to thin overburden and lack of fractures in the bedrock. The static water level ranges between 2 - 12.5m with average of 6.72m(Fig. 2b) while borehole transmissivity ranges between 5.6-26.5m^2/day.

Table 1. Hydrogeological Parameters in Abuja and Environs

S/No	Area	No. Of Boreholes Considered	Overburden (m)			Yield (m^3/hr)			Stativc Water Level (m)			Transmissivity (m^3/day)
			Max	Min	Average	Max.	Min	Average	Max	Min	Average	
1	Maitama	24	36	6	19	4	0.8	2.95	12.4	4	8	20
2	Asokoro	10	27	12	19	5.4	3	4.25	16	3	9	4.8
3	Gwarinpa	17	25	12	17	6.7	2	5.8	9	5.8	7	26.5
4	Wuse	9	32	11	18	4	1	2.75	12.5	4.5	9	-
5	Lugbe/Airport	8	28	8	12	7.2	2.5	4.1	8	2	4	18.2
6	Jabi/LC/Idu	7	26	11	18	5	3.96	4.32	7.2	4.8	6	5.6
7	Kubwa	7	10	32	20	6	3.96	5.12	11	3.4	6	14.5
8	Nyanyan/Karu	8	22	8	15	5.4	1.5	3.75	6.7	3	5	25.3
9	Gwagwalada	4	8	5	7						6	-
10	Utako	4	24	8	18				7.8	6.6	7.2	-

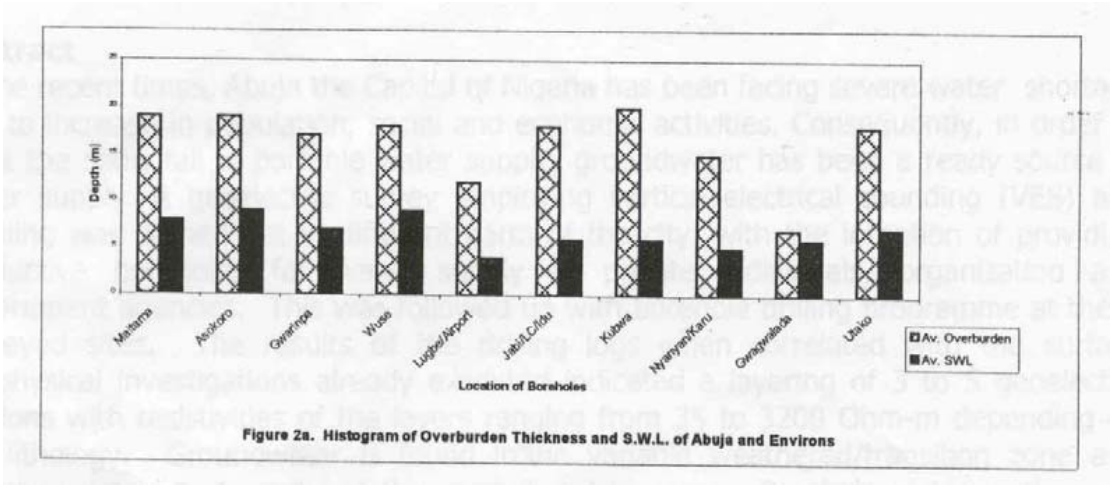

Figure 2a. Histogram of Overburden Thickness and S.W.L. of Abuja and Environs

Conclusion and recommendations

This study has gone a long way to establish the fact that some parts of the Federal Capital Territory contain reasonable amount of groundwater which if well tapped will go a long way to alleviate the water problem in the city. There is a need for proper understanding of the groundwater condition of the area, the foundation of which has been laid through this study. This could be achieved by carrying out comprehensive predrilling hydrogeological studies for the entire area and all boreholes should be properly designed and properly developed and pump tested. The knowledge of this will reduce borehole failures and low yield currently experienced in some parts of the project area.

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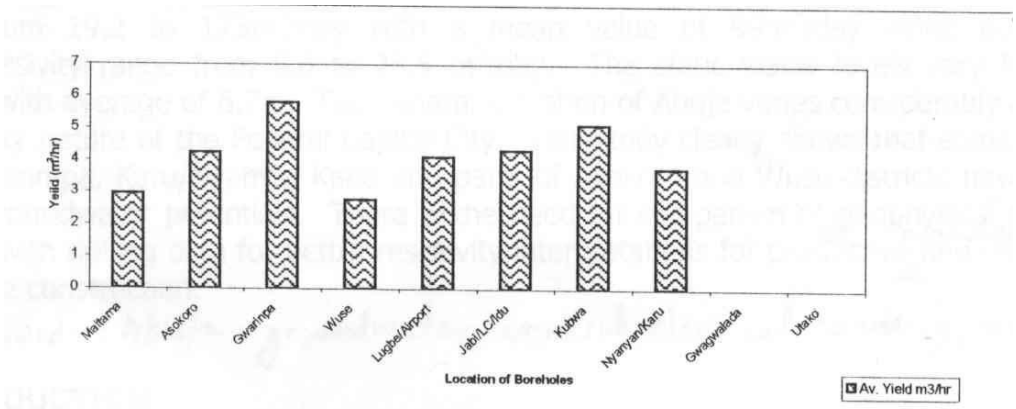

Figure 2b. Histogram of Borehole Yields of Abuja and Environs