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1. INTRODUCTION

Geological and Hydrogeological/ Geophysical surveys were conducted at the Saint Luke Health Post- Congo Water on the 23rd September, 2015 to explore the groundwater potentials of the area.

These studies among others, provided enough data and information used in assessing the possibility of striking groundwater in the project area.

This report therefore documents the work carried out during the investigations at the site.

2. BACKGROUND / GEOLOGY OF PROJECT AREA

The project area lies within the Bullom sedimentary formation.

The Bullom sedimentary Formation is comprised of unconsolidated to poorly consolidated sediments occupying the coastal plains of Sierra Leone. The deposits extend up to 50k inland and are found at heights up to 40m above present sea level (Culver and Williams, 1979). Although outcrop of the Bullom Group are rare and generally poor, the available evidence suggest a lateral variable sequence of poorly consolidated, near horizontal, often iron-stained gravels, sands, clays with occasional intra- formational laterites.

However, groundwater potential is very high in the Bullom Sedimentary Formation because of its aquifer characteristics.

3. FIELD WORK

3.1 Reconnaissance Survey

The aim of the reconnaissance survey was to select suitable area (s) for geophysical survey; considering the geological/hydrogeological, environmental and other physical conditions.

The reconnaissance survey included the following:

- **Geomorphological Survey of the Area**

This includes the landscape and other physical features.
The project area is relatively flat with minor elevated grounds in the immediate surroundings. The Geomorphology of the area therefore suggests high groundwater potentials.

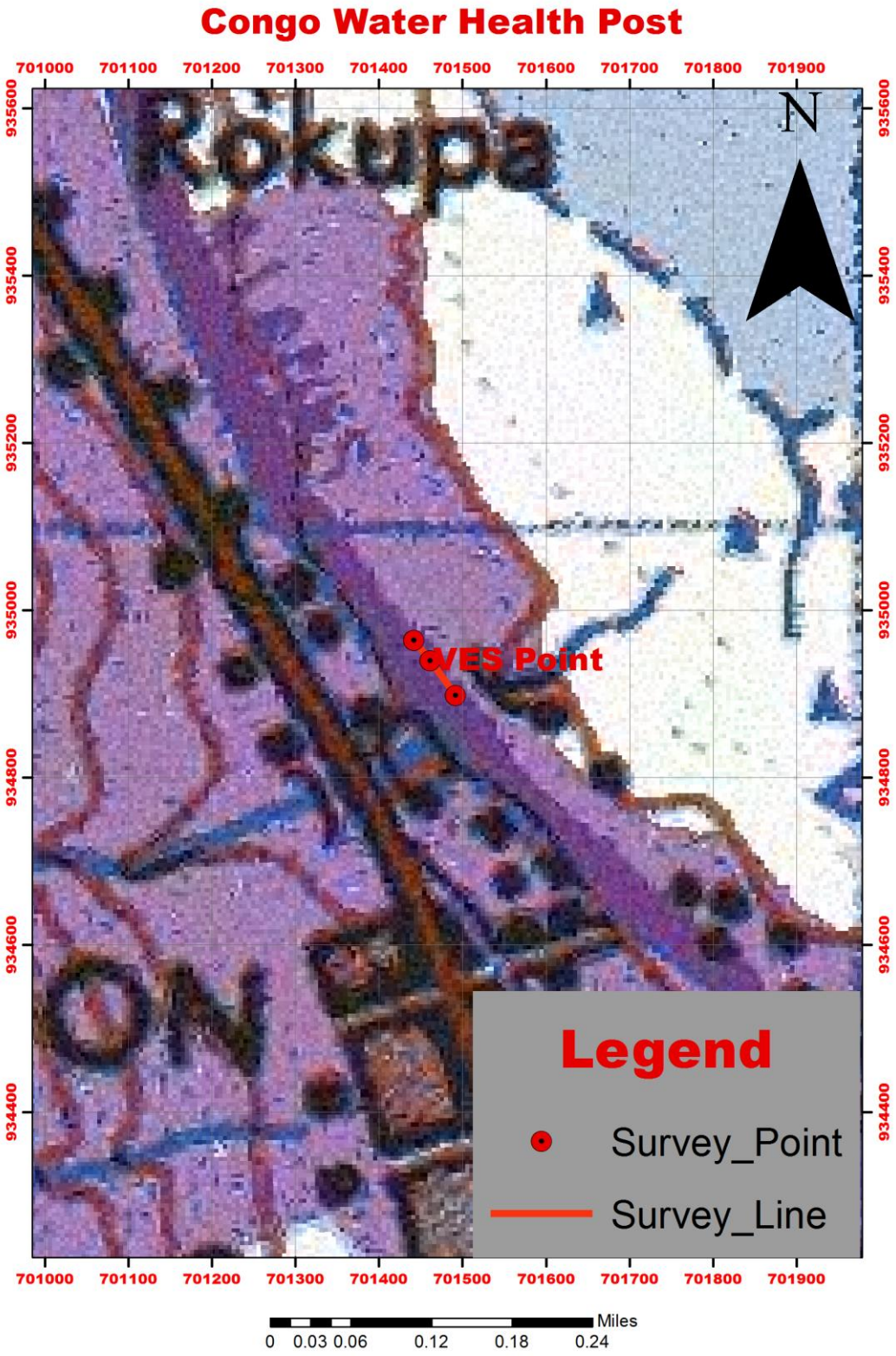


Figure 1.Topographic Map of the Area

- **Geological Survey to Determine the Formation of the Area and to Identify Possible Features.**

The project area is overlain by loose sedimentary materials which holds high groundwater potentials .

- **Selection of Traverse Line for geophysical Survey**

The traverse line for resistivity survey was selected on the basis of geomorphologic and geological/hydrogeological features as well as the location of the project area. Engineering activities have created difficulties to determine strike directions.

Point for the Vertical Electrical Sounding (VES) was selected based on the location of the project area, considering the environmental and other physical conditions and was marked with a peg for identification.

3.2 Geophysical Survey

The Geophysical survey consisted mainly of Electrical Resistivity i.e. Vertical Electrical Sounding (VES) using the Syscal Junior Iris Instrument (Resistivity Meter)

Figure 2 Geophysical Survey Using Syscal Junior Iris Instrument

3.2.3 Vertical Electrical Sounding (VES)

Vertical Electrical Sounding (VES) was carried out with the aim of determining the formation resistivities and the depth to bedrock, as well as the possibility of finding water bearing formations or aquifer(s) at depth with the corresponding thicknesses of such aquifer(s). The Schlumberger electrode configuration and the required procedures were used for the VES at the selected point.

4.0 DATA ANALYSIS AND INTERPRETATION

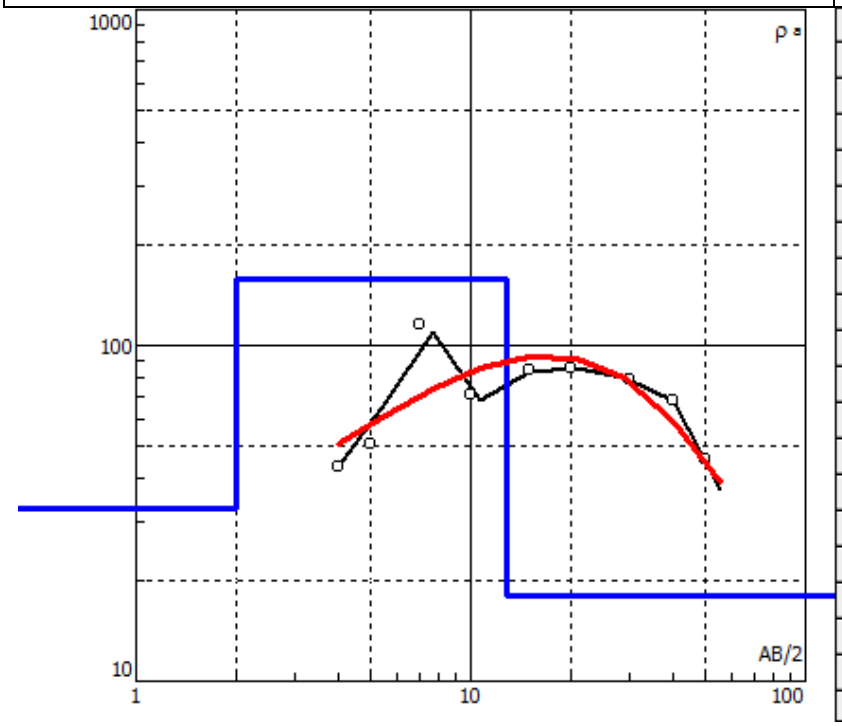
The Vertical Electrical Sounding (VES) data and corresponding curve are presented below:

Table 1: Schlumberger Array VES Data at Point A

Client: **ACF**			Community: **Congo Water**
Project: **Geophysical Survey**			Sounding Number: **3**
District**: Western Area**			GPS Coordinate East: **0701461**
Date: **23rd September, 2015**			GPS Coordinate North: **0934940**
Field Operator: **Morlai Kanu**			Elevation:
Schlumberger Array VES Field Data			
No.	**AB/2**	**MN**	**Apparent Resistivity (ohm-m)**
1	4	0.8	043.6
2	5	0.8	050.7
3	7	0.8	071.0
4	10	0.8	084.4
5	15	1.5	085.5
6	20	1.5	079.2
7	30	1.5	068.6
8	40	7.6	045.6

The VES data is first presented in the form of a table (as shown above) from which a graph of Apparent Resistivity ($p_{a)}$ Vs half the Current Electrode Spacing (AB/2) is plotted.

Schlumgerger Array– VES curve



Model Parameters

N	ρ	h	d	Alt
1	32.7	2	2	-2
2	157	10.7	12.7	-12.75
3	17.9			

Figure 3. Schlumberger Array VES Curve and Model

The data shows a two-layer subsurface in which $p_1 > p_2$. The unusually low apparent resistivity registered in layers 1 and 2 are indicative of the presence of pore electrolyte, possibly groundwater within the sedimentary top layer and underlying sedimentary formations. The equivalent layer thicknesses are 2m and 10.7m respectively.

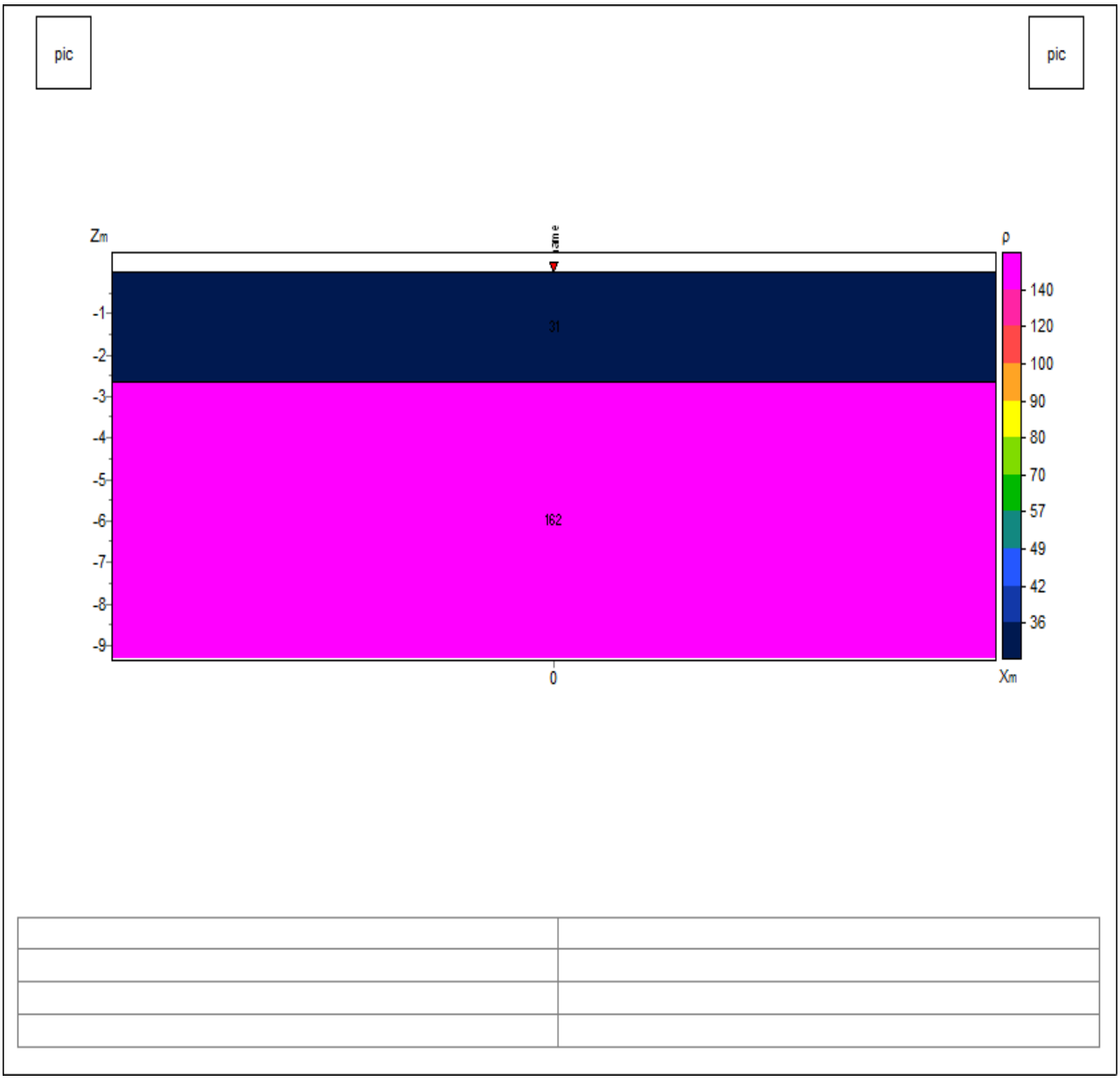


Figure 4. Pseudo - section Showing Apparent Resistivities and Layer Thicknesses

Table 2: List of VES Points in Order of Preference for Drilling

No.	VES POINT	LAYER	THICKNESS (m)	DEPTH (m)	APPARENT RESISTIVITY (Ohm-m)	POSSIBLE WATER ZONES (M)	RANKING	MAX DRILLING DEPTH (M)
3	C	1 2 3	2 10.7	2 12.7	32.7 157 17.9	10-45	3rd	50m

5.0 CONCLUSIONS AND RECOMMENDATIONS

Conclusions

Based on the analyses of the result, and in line with the aims of the study, the conclusions are as follows:

- The project area lies within the Bullom Sedimentary formation.
- Groundwater potential could be high in the Bullom Formation
- The potential water zone is found between 10- 45m.
- It is premature, however, to estimate quantities, which could only be determined during test drilling and test pumping.
- The borehole location was selected in accordance with both national and international borehole siting guidelines.

Recommendation

In this regard, it is recommended that;

- Drilling should be carried out at the selected point to confirm the existence of groundwater.
- The borehole must be constructed using the correct and standard materials for water quality and high yield.
- The maximum drilling depth should be 50m.
- Both physico-chemical and bacteriological test should be carried out on the borehole water sample after completion.

REPORT SUBMITTED BY:

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