EDAL DRILLING COMPANY LTD.

BOREHOLE SITTING REPPORT FOR HASTINGS EBOLA TREATMENT CENTRE

PREPARED BY:

EDAL DRILLING COMPANY
35A CLEWRY'S LANE, OFF MAIN MOTOR ROAD
CONGO CROSS
FREETOWN
SIERRA LEONE

SUBMITTED TO:

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INTERNATIONAL PROCUREMENT CONSTRUCTION SERVICES
8 ECOWAS STREET
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1. INTRODUCTION

An EBOLA treatment centre under construction is located at Hastings, along the Freetown-Waterloo highway in the Western area.

The project contractor wants to explore the possibility of getting groundwater for the activities of the center after completion.

In the quest to search for groundwater, Mr. Mohamed Hijazi- project contractor requested **EDAL** Drilling Company to drill a number of boreholes for the centre. Mr. Hijazi then requested **EDAL** Drilling Company to carry out Hydrogeological Studies and Geophysical investigations in sitting the borehole positions at the center.

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

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

2. BACKGROUND / GEOLOGY OF PROJECT AREA

The project area lies between the Bullom sedimentary formation and the Freetown Basic Complex.

The Bullom Group 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.

The Freetown Basic Complex on the other hand outcrops in the west as a result of younger igneous intrusions and it is predominantly of basaltic magmatism. The Freetown Complex is a layered gabbroic anorthosite intrusion, emplaced gneisses and schist of the Kasila group. The Bullom Group is resting unconformably on the Freetown Complex.

3. FIELD WORK

3.1 Field Reconnaissance Survey

The aim of the reconnaissance survey was to select target areas for geophysical survey. The field reconnaissance survey was undertaken together with the site Engineers. The reconnaissance survey took place on the 27TH October, 2014 and the activities that were carried out involved:

- Geomorphologic survey of area
- Geological survey to determine the formation of the area and to identify the possible hydrogeological features
- Demarcation of area for traverse lines for geophysical survey.
- Location of GPS coordinates

3.1.1 Selection of Traverse Line

Traverse lines were run on the basis of geomorphologic and physical features as well as hydrogeological features encountered at the studied area. There were no visible strike directions of the geologic formation of the area due to the ongoing construction at the site. Selected points for Vertical Electrical Sounding (VES) were marked with pegs.VES points are identified by the inscriptions such as **Point A** and Point **B** respectively.

3.2 Geophysical Survey

The Geophysical survey consisted mainly of Electrical Resistivity i.e. Vertical Electrical Sounding (VES) using ABEM Terrameter Resistivity meter.

3.2.1 Selection of VES points

The Vertical Electrical Sounding (VES) points were selected based on the site location and geological features.

3.2.2 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 finding the possibility of obtaining fractures at depth. The Schlumberger electrode configuration and the required procedures were used for the VES.

DATA ANALYSIS AND INTERPRETATION

The Vertical Electrical Sounding data and their corresponding curves are presented below.

Table 1: Selection of Promising Points from VES Data

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)
1	A	1 2 3 4	2 4.52 14.5 -	2 6.52 -	1284 4841 209 164191	30-60	1ST	100
2	B	1 2 3	2.03 4.52 --	2.03 6.48 -	423 6605 0.744	30-70	2nd	80

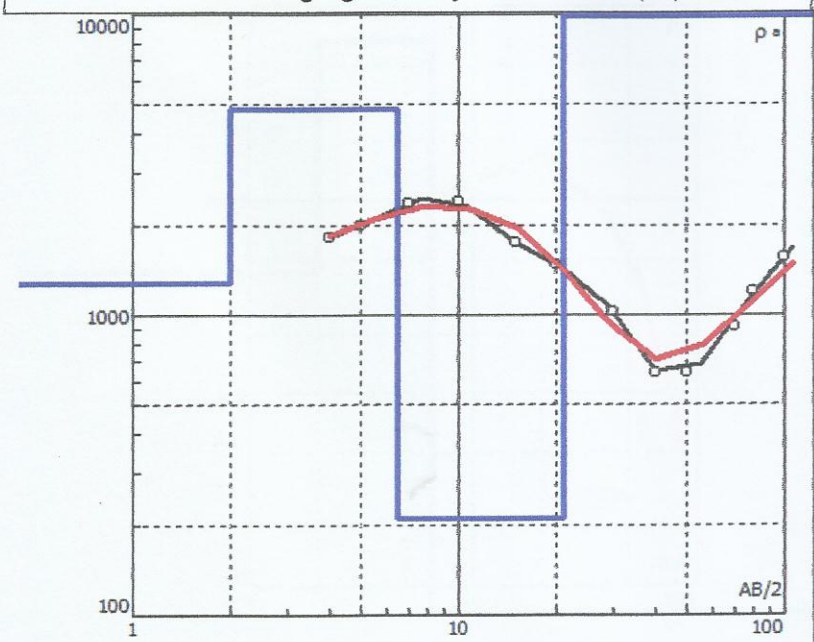
Figure 1. Schlumberger Array VES Data and Corresponding Curve and Model at Point A.

Client: **Mr. Mohamed Hijazi**	Community: **Hastings**
*Project: **Borehole Drilling***	*Sounding Number: A*
District: **Western Area**	GPS Coordinate East: **0705874**
Date: **28th Octber, 2014**	GPS Coordinate North: **0927812**
Field Operator: **Morlai Kanu**	Elevation: **43m**

Schlumberger Array VES Field Data

No.	AB/2	MN	Resistance (ohm)	Apparent Resistivity (ohm-m)
1	4	0.8	29.322	1824.2
2	5	0.8	20.355	1985.8
3	7	0.8	12.323	2363.8
4	10	0.8	5.992	2394.7
5	15	1.5	4.593	1747.9
6	20	1.5	1.755	1468.4
7	30	1.5	0.545	1026.9
8	40	3.8	0.192	642.9
9	50	3.8	0.622	638.7
10	70	3.8	0.452	913.8
11	80	7.0	0.839	1195.7
12	100	7.0	0.697	1556.4

Schlumgerger Array– VES curve (A)



Model Parameters

N	ρ	h	d	Alt
1	1284	2	2	-2
2	4841	4.52	6.52	-6.52
3	209	14.5	21	-21.02
4	164191			

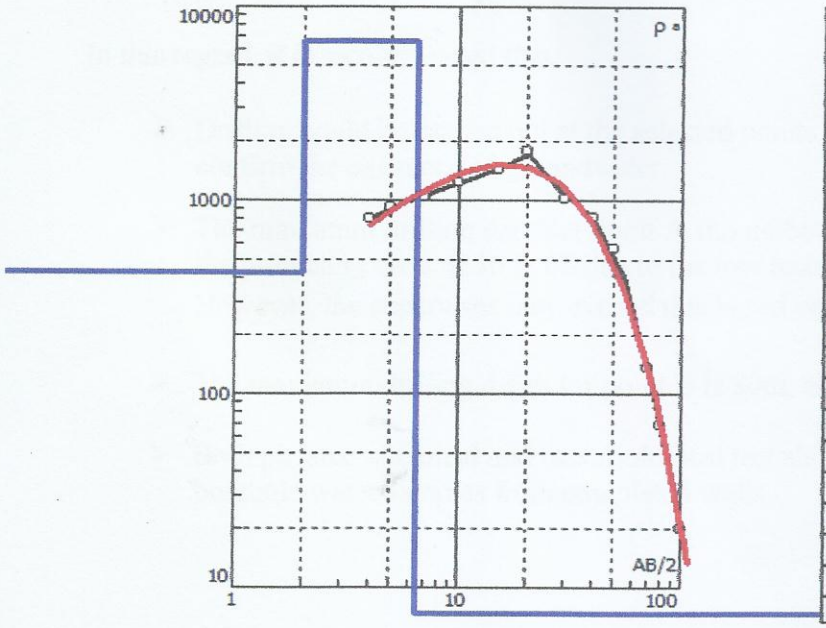
Figure 2. Schlumberger Array VES Data and Corresponding Curve and Model at Point B.

Client: **Mr. Mohamed Hijazi**	Community: **Hastings**
Project: ***Borehole Drilling***	*Sounding Number*: ***B***
District: **Western Area**	GPS Coordinate East: **0705926**
Date: **28th October, 2014**	GPS Coordinate North:**0927866**
Field Operator: **Morlai Kanu**	Elevation: **42m**

Schlumberger Array VES Field Data

No.	AB/2	MN	Resistance (ohm)	Apparent Resistivity (ohm-m)
1	4	0.8	13.032	811.1
2	5	0.8	9.551	932.6
3	7	0.8	5.437	1042.8
4	10	0.8	3.087	1233.8
5	15	1.5	3.778	1437.0
6	20	1.5	2.130	1782.1
7	30	1.5	0.547	1029.6
8	40	3.8	0.246	822.8
9	50	3.8	0.576	573.0
10	70	3.8	0.068	136.8
11	80	7.0	0.049	69.2
12	100	7.0	0.009	20.0

Schlumberger Array –VES Curve (B)



Model Parameters

N	ρ	h	d	Alt
1	423	2.03	2.03	-2.03
2	6605	4.45	6.48	-6.48
3	0.744			

CONCLUSION AND RECOMMENDATION

Conclusion

Based on the analyses of the entire results, and in line with the aims of the study, the drawn conclusions are;

- The project area lies between the Bullom Sedimentary formation and the Freetown basic Complex.
- Because of the location of the project area, the sedimentary formation of the Bullom Group is probably underlain by the Freetown Igneous Complex.
- Groundwater potential could be high if found within the sedimentary formation especially at depth between 30 to 60m. Otherwise, at depth greater than 70m, ground water potential could be low due to the sharp increase in the resistivity values indicative of hard, probably igneous formation at point A.
- It is also worth to note that clay as a sedimentary material has very low resistivity values. As such, the low resistivity values from 30 to 60m at point A and 40 to 100m at point B holds prospect for water but it can as well be clay formation with no water potential.

5.1 Recommendation

In this regard, it is recommended that,

- Drilling could be carried out at the selected points A and B respectively to confirm the existence of groundwater.
- The maximum drilling depth at Point A should be 100m if water is found within the promising zone of 30 to 60 due to the low resistivity values within this zone. However, the supervisor may exceed this based on the field conditions.
- The maximum drilling depth for point B is 80m, all other things being equal.
- Both physico-chemical and bacteriological test should be carried out on the borehole water samples from completed wells.

REPORT SUBMITTED BY

05/11/14

Morlai Kanu
Geologist/ Field Operator