Use of Electrical Resistivity Method for Investigating Geological and Hydrological Conditions at Proposed Site for Institute of Technology, University of Moratuwa

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Abstract: Resistivity survey is one of the geophysical methods which can be used to identify subsurface ground conditions. The research is focused on determining the bed rock depth, variation of soil overburden thickness and areas suitable for ground water exploitations at the proposed site for Institute of Technology, University of Moratuwa by using the Vertical electrical sounding. The survey was carried out using Schlumberger electrode configuration along three main profile lines, with 18 resistivity points. The results of the survey were provided 2-3 distinct geo-electrical layers overlying the bedrock. The first thin upper layer represents of Sandy Silt/sandy gravel and second layer corresponds to lateritic soil. The third represents the saturated soil materials with less resistivity. The forth layer corresponds to the bedrock and the depth ranging from 8 to 26m from the surface. Geo-electrical results based upon I-D models, which were created by IX1Dv3 software, provide a satisfactory approximation of the various soil and rock components. Based on the above results, it is confirmed the soil overburden in the Northern part of the site, constitutes an aquifer, with a thickness of about 1.3m above the bed rock covering an area of about 100 m^2.

Keywords: Vertical electrical Sounding (VES), Geo-electrical layers, Aquifer

1 Introduction

Electrical resistivity is one of the most effective geophysical methods, widely used to investigate the characteristics of subsurface geology and hydrogeology, map vertical extent of certain types of soil and groundwater contaminations. During the current study Electrical Resistivity Survey method has been used to investigate geological and hydrological conditions at the proposed site for Institute of Technology, University of Moratuwa (ITUM). In this survey four electrode

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array Schlumberger configuration has been used. Data received has been utilized to obtain one-dimensional model by using "Interpex IX1Dv3" software.The proposed ITUM is located at Diyagama, off Homagama along the Horana-Homagama road.

The extent of the land is approximately 8 hectares. The elevation of the proposed site varies from 20-30 m having gentle slope towards the northern side of the land. Northern slope continue towards marsh/paddy land adjoining the site. Southern, Eastern and Western boundaries are demarcated by existing road network in the area. General geology of the area shows, that it is underlain by Pre-Cambrian metamorphic rocks belongs to the South-West group of Sri Lanka. There are three types of rock underlying the area.

Few rock exposures are visible in the NE part of the land the areas with higher elevation and existence of reddish brown sandy lateritic soil cover is shown. Sandy silt soil is shown as a top soil in the Northern part of the area.

2. Methodology

Literature survey was carried out on resistivity method, geomorphology, Terrameter SAS 1000 and manual interpretation as well as interpretation by using software.

2.1 Map preparation

The site map was digitalized and geo-corrected with entering the GPS coordinates of the four assured locations of the site, which were gathered via the GPS by using the ARC Map 9.2 software throughout the least amount of RMS error. After geo correcting the map, the map was rectified and saved as a corrected map.

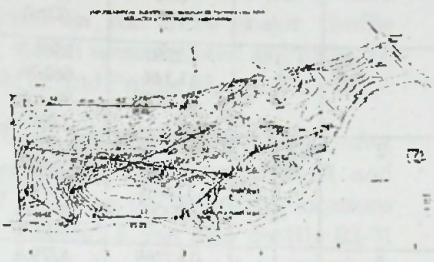

Figure 1 – Site Map of ITUM

2.2 Site work

A total of 18 VES stations were surveyed in the study area.

Resistivity measurement was obtained with respect to increasing the current electrode distance according to the pre define table up to possible traverse distance and readings were obtained. The above procedure was repeated after selecting each location points to carry on the VES resistivity survey.

2.3 Interpretation Procedure

Interpretations were carried out by using "Interpex 1X1Dv3" software. The data can be entered to the software, either manually or directly from the ABEM Instrument. However the manually data entering method was used for the interpretations. Number of soil layers, bed rock and aquifer were identified by using the "estimate smooth mode" command. Then model (Resistivity Vs Electrode spacing graph) was split according to the above data. And the thickness of the each layer was obtained from the "Resistivity model" table.

3. Results

Interpreted results from the resistivity software are listed in the table below.

Table 1- Interpreted Results

Location	Layers	Thickness (m)	Apparent resistivity (Ωm)
1	1	1.2791	5566.7
	2	11.144	662.86
	3	13.917	96.366
	4		12652
2	1	0.99124	6801.2
	2	6.7671	350.66
	3	3.3616	31.723
	4	6.1636	872.64
	5		60679
3	1	0.63769	4779.6
	2	4.5835	1160.7
	3	2.8614	211.89
	4		646.25
5	1	1.1176	1503.6
	2	7.0438	436.13
	3	6.5806	73.185
	4		7.98E+05
6	1	1.0247	2056.4
	2	4.3939	872.66
	3	247.25	211
	4		2.6379
7	1	1.0205	9433.4
	2	7.8227	726.2
	3	6.2244	22.085
	4		2772.9
8	1	5.85E-02	236.36
	2	0.59731	9801.8
	3	4.753	480.03
	4	3.4763	43.893
	5	48.901	611.19
	6		28702
9	1	1.5651	7945.1
	2	5.9915	470.32
	3	11.334	24.501
	4		70094
10	1	1.4227	9814.9
	2	5.7653	541.78
	3	7.2778	15.994
	4		9908.5
14	1	1.972	2602.4
	2	7.9165	450.63
	3		146.66
15	1	1.7276	2355.1
	2	9.994	631.5
	3		409.23
16	1	3.7894	2901.3
	2	10.775	1859.8
	3		583.69
17	1	0.22875	646.75
	2	0.33687	15392
	3	12.195	1356.7
	4	9.7427	5685.4
	5		46.092
18	1	2.9697	2002.6
	2	10.997	704.72
	3	9.9055	229.03
	4		3612

4. Discussion

The results which were obtained from the "Interpex 1X1Dv3 software, were analyzed in the three major profile lines, which were denoted as Profile 01, Profile 02 and Profile 03.

The three soil strata is identified, after analyzing not only **profile 01-01** and **01-02** by using the resistivity locations 1, 2, 3, 7 and 8, but also **profile 02-01** and **02-02** by using the resistivity locations 9, 14, 15, 16, 17 and 18. **Profile 03-01** was analyzed by using resistivity locations 5, 6 and 10.

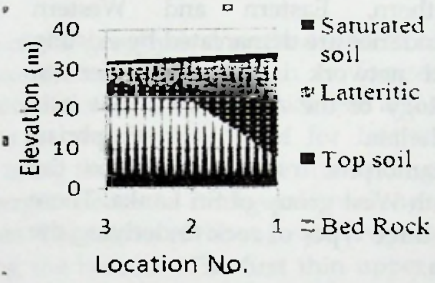

Figure 2 – profile 01-01

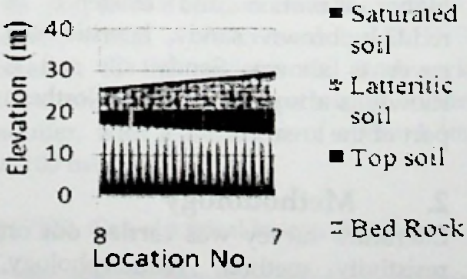

Figure 3 – profile 01-02

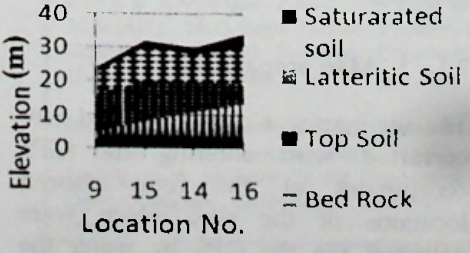

Figure 4 – profile 02-01