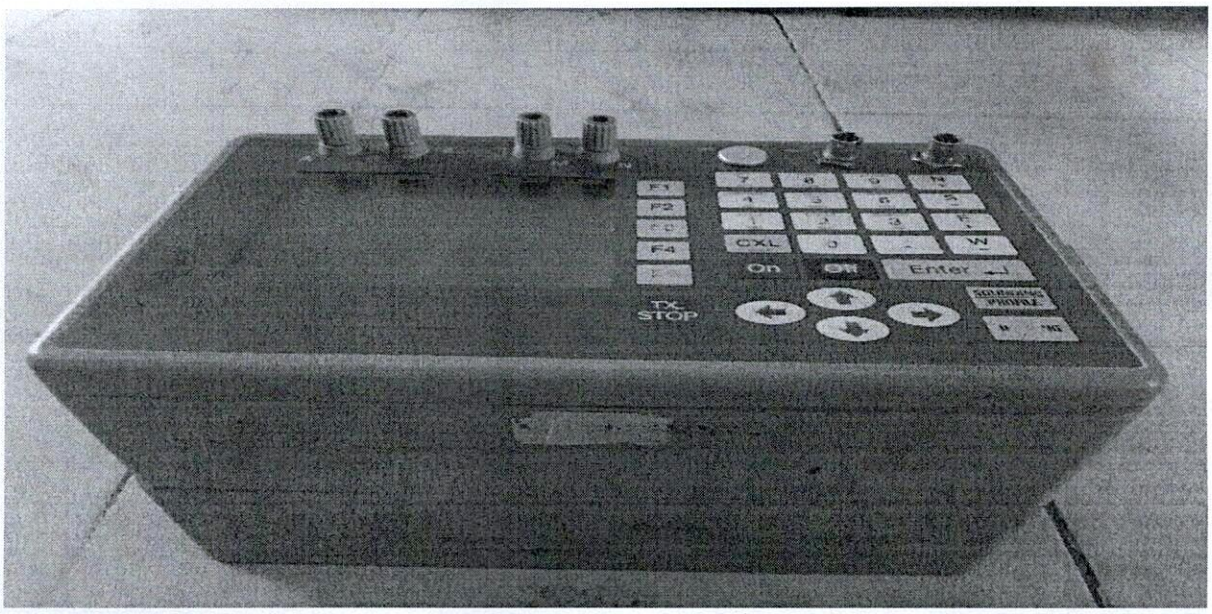
Blue Nile Region

Water, Environmental and Sanitation Project (WES)



GEOPHYSICAL STUDY FOR LOCATED SITE FOR MINI WATER YARD AT BOFAI

BOFAI VILLAGE

BAU – LOCALITY

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WES Project Blue Nile

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For Contractings

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Geophysical study to locate suitable site for Groundwater borehole drilling (Mini Water Yard) in Bofai Area –Bau Locality – Blue Nile Region .

1- Study area

The study area lies in Bofai Village which located about 110 KM South Damazin town (the capital of Blue Nile Region)

2- Objectives and methodology

The main objectives of this study are to locate sitable site for drilling of water borehole for Mini water yard.

These objectives will be achieved through the following methodological steps:

- Assessment of the groundwater conditions in the study area.
- Conduction Geophysical study using electrical resistivity methods (Vertical Electrical Sounding VES) at selected site to detect potential water-bearing horizons.
- Collection and analysis of existing well data to support the study.
- Integration of all results to provide recommendations for selecting the most suitable location for water well drilling.



- Geology and Geomorphology of the study area :

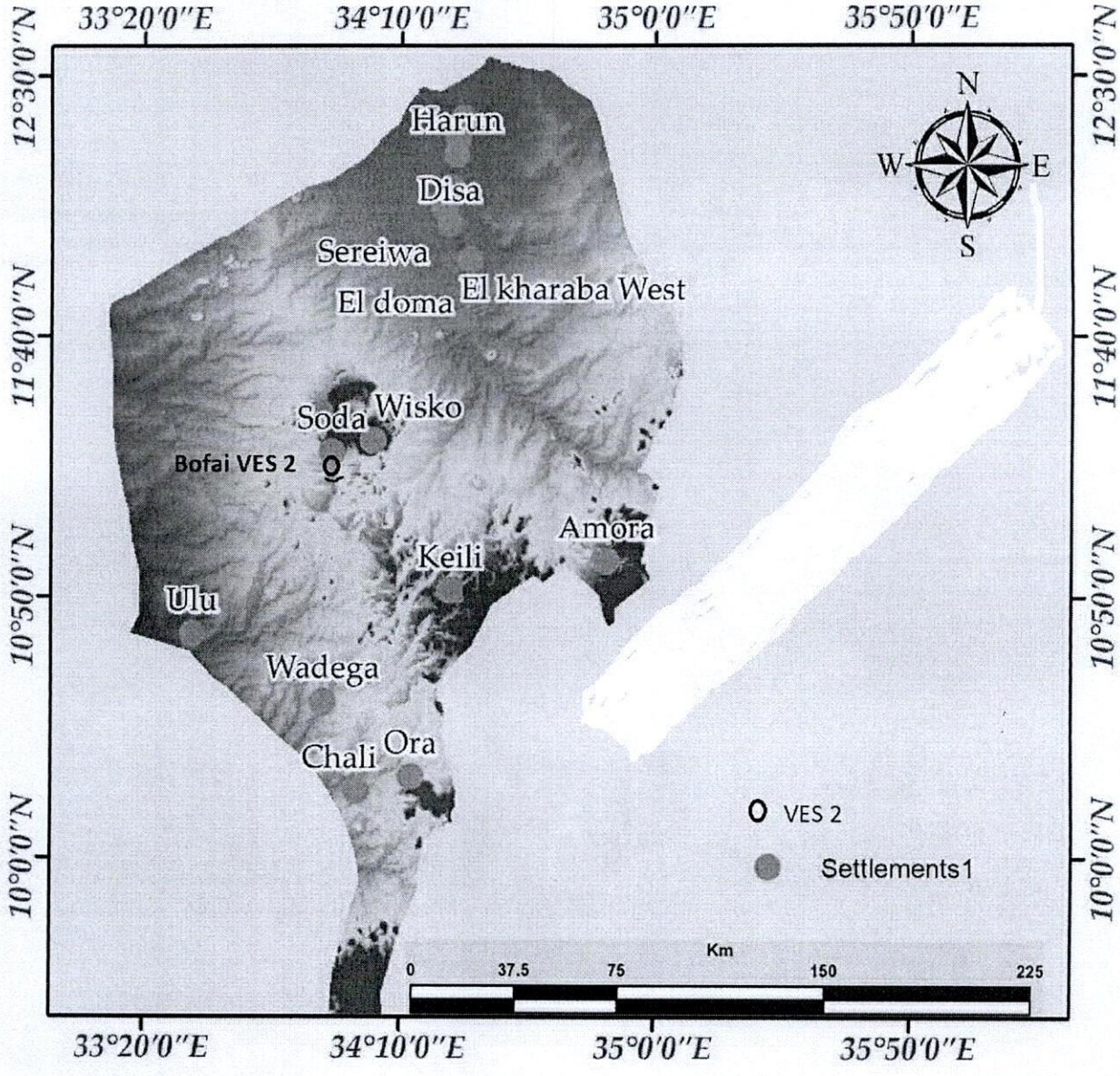
The general geology of the Blue Nile Region consists of the following geologic units

- The basement complex Rocks
- Alatshan formation
- Alluvian Deposits
- Superficial Deposits

The superficial deposits are Pleistocene to recent unconsolidated sediments which are mainly composed of clays, sands and gravels that are distributed over most of the region. It forms the dark grey thick soil (cotton soil) which is very good for agriculture. In addition to very weathered basement cropped out around and loose sand that is confined to the beds of the wadis and its tributaries. Wadi Lever which runs southwest ward represents the main drainage in the area, consists of sand and clay are deposited. The basement complex rocks are of Precambrian age and cover all the study area. It composed of metamorphic and igneous rocks including gneiss, schists, followed by Paleozoic granite and quartzites. All these units are cropping out in different parts of the area Bofai ,Bok and Wad Abok mountains and vicinity. The crystalline rocks are also expected to provide aquifers in their weathered and/or fractured parts in case of good recharge conditions.



Location Map





Geophysical work:

The geophysical work conducted in the study area consisted mainly of electrical resistivity measurements. It consists of two methods: Horizontal Electrical Resistivity Profiling (HEP) and Vertical Electrical Sounding (VES), performed using a geophysical SARIS apparatus. This method was used to investigate the subsurface geological and hydrogeological conditions of the study sites.
The objectives of the geophysical survey were to :
a. Determine the vertical distribution of sediments overlying the Basement complex Rocks.
b. Exploration of fractured and/or weathered crystalline rocks within the basement rocks .
c- Search for water-bearing horizons, their depth, thickness and quality of their water content.
d- Location of suitable sites for drilling of boreholes for domestic uses.

Geophysical study results and recommendations One Horizontal Electrical Resistivity Profile (HEP) along selected favorable geological conditions (parallel to Wadi Lever) has been carried out for every selected area. Two Vertical Electrical Sounding (VES) have been conducted according to anomalies that result from the HEP measurements. The length of profiles was 400 m. The AB/2 and MN/2 were 75m and 25m respectively for HEP with station interval of 25m, whereas AB/2 was 300m for both two VESes (. VES 1 – VES 2).
The recommended VES point for drilling and its coordinates and expected depth is shown in table below.

AB/2 = 100 m , MN/2 = 25 m Station = 25 m

profile (1) :

(513.5 , <u>510.0</u> , 605.2 , 759.2 , 896.0 , 647.3 , 725.5 , 1040 , 1084 , 930.7 , 783.0
(548.4 , ,627.1 , 531.6 , <u>503.6</u> , 512.0 , 557.3)



VES (1) Lat : 11.31008 Elevation = 549 m

Long: 33.72828

AB/2	MN/2	Resistivity(0hm-m)
1.5	0.5	40.48
2.5		58.40
4		52.69
6		68.93
8		64.62
10		67.43
12		75.60
15		93.66
15	5	99.46
20		121.6
25		147.7
30		178.3
30	10	164.3
40		223.3
50		273.1
60		321.5
75		398.2
75	25	403.2
100		512.9
125		639.2
150		598.7
150	50	780.1
175		754.6
200		806.3

Descriptions of Layers:

From – To (meter)	Descriptions
0 - 4 m	Clay
4 – 27 m	Highly Weatherd Rock
27 – 45 m	Hard Rock
45 – 50 m	Fracture Rock
50 m >	Hard Rock



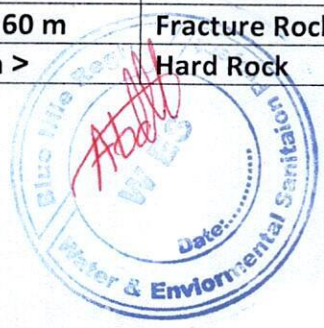
VES (2) Lat : 11.31214 Elevation = 549 m

Long: 33.72784

AB/2	MN/2	Resistivity(0hm-m)
1.5	0.5	26.94
2.5		21.61
4		23.35
6		31.81
8		38.67
10		46.29
12		54.63
15		67.29
15	5	73.95
20		106.5
25		138.9
30		170.7
30	10	165.8
40		234.6
50		288
60		334.6
75		407
75	25	395
100		477
125		559.2
150		633.7
150	50	727.7
175		775.1
200		802.4

Descriptions of Layers:

From – To (meter)	Descriptions
0 - 3 m	Clay
3 – 25 m	Highly Weatherd Rock
25 – 35 m	Hard Rock
35 – 40 m	Fracture Rock
40 – 55 m	Hard Rock
55 – 60 m	Fracture Rock
60 m >	Hard Rock



Descriptions of Layers:

From – To (meter)	Descriptions
0 - 3 m	Clay
3 – 20 m	Highly Weatherd Rock
20 – 30 m	Hard Rock
30 – 33 m	Fracture Rock
33 – 60 m	Hard Rock
60 – 75 m	Fracture Rock
75 m >	Hard Rock

Recommendations:

After analyzing and interpreting the data, we concluded the following:

- ✓ It is recommended to drill the first point (VES1) according to the above mentioned coordinates to the depth ±65 meters.
- ✓ It is recommended to use the air drilling method (Hammer).
- ✓ Based on the geological formations in the area and the ground water recharge as, as well previous studies, the water quantity will be required after pumping test.

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