SOIL PROFILE INVESTIGATION TO DETERMINE THE DEPTH OF WATER TABLE AT DEKINA

BY

SAMUEL O. OBAKA
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CERTIFICATION

I certify that this work was carried out by SAMUEL O. OBAKA in the Department of Agric Engineering. Federal University of Technology, Minna.

....

MRS. Z. D. OSUNDE **Date**
(Project Supervisor)

....

Engr (Dr. M. G. Yisa) **Date**
(Head of Department Agric. Engineering)

....

Prof. J. O Adeniyi **Date**
(Dean post Graduate School)

DECLARATION

I hereby declare that the project work is an original concept wholly carried out by me, under the supervision of MRS. Z. D. OSUNDE Agric. Engineering, Federal University of Technology, Minna.

....

SAMUEL O. OBAKA

DEDICATION

To God be the glory for the great thing he has done.

The work is humbly dedicated to the Almighty God the creator of heaven and the earth and my family especially my wife Mrs. Elizabeth Obaka.

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ACKNOWLEDGEMENT

I whole heartedly wish to expressed my profound gratitude to His Excellency the Lord Jesus Christ for giving me grace and privilege to attain this high.

My indebtedness to MRS. Z. D. OSUNDE my project supervisor who through patience and sisterly advice made this work what it has turned out to be. I also thank her so much for relentlessly reading my manuscripts several times and offering useful correction and advice. As a result of her guidance and objective criticisms and suggestion I have been able to achieve more mature and scholarly perspectives.

In the same vein I will thank Dr.M.G. Yisa the head of department school of Agric Engineering, also my appreciation goes to Engr. N.A Egharevba the course coordinator, my warmest greeting goes to Dr. D. Adgidzi for his professional advice and encouragement given through out the course period.

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for their moral support, encouragement given to me during this period including my beloved brother Mr. Kevin S. Obaka for his love. My greatest appreciation goes to the Geologist who assisted me in carrying out the geological survey of the area Mr. Kayode Ayodele.

I am indebted to all my colleagues and fellow in the struggle, who sees the struggle not as a one man affair, I mean people like Suleman, Gwaya, Elizabeth, Jiya and the host of others.

I will not conclude without mentioning Dr. Adewumi for his love and professional advice.

This, I have only attempted to remember them for what they have done. I pray that god will certainly reciprocate their kindly gesture toward me in Jesus Name (Amen).

ABSTRACT

Investigation on soil profile to determine the depth of water table was carried out at Ologba, Udaba and Olowa of Dekina in Dekina Local Government Area of Kogi State. Physical properties determined include moisture content. Climatological data of this area were also collected from (ADP) Agric. Development project Ayangba, Water quality and quantity was also determine, from experiment carried out the depth at which a bore hole will have to be drilled to get the desired quality and quantity to satisfy WHO standard for the study area is between 60m end 150m depth, this can be used as a guide line for bore hole drilling in Ologba, Udaba and Olowa of Dekina Area.

CHAPTER ONE

INTRODUCTION

The purpose of the survey was to provide information on the soil profile to determine the depth of water table.

The area suggested for investigation occupied 60 hectares in the Derived savanna zone of northern Nigeria. It is centred around 7° 25'N and 7° 17E lying along Ayangba Shintaku Road.

The area is shown in map I. Administratively. Dekina is a local Government Area, which is in the middle belt of Nigeria in Kogi State. The area is characterised by low and high variable rainfall.

The distribution of water to this community is of great asset.

A water well is a hole in the earth down to supply water excavated for the purpose of bringing ground water to the surface.

GROUND WATER AND AQUIFER

The outer part of the earth crust is normally porous to greater or lesser depths. This zone is called the zone of rock fracture, the pores or opening in this zone if lithosphere may be partly or completely filled with water. The upper strata where openings are completely filled with water is called zone of saturation. Formation of strata within the zone of saturation below the ground surface from which ground water can be obtained for beneficial use is called Aquifer.

The pore spaces of aquifer where water exist is expressed as percentage of void space to the total volume of the mass.

This ground water reservoir or water bearing formation known as Aquifer are permeable geological formation that permit appreciable amount of water to move through them. The portion of the rock or soil not occupied by the solid material may be occupied by ground water.

These spaces are known as voids, interstices, or pore space.

Water enter a ground water reservoir from natural to artificial recharge. It flow out under the action of gravity and is extracted by wells.

The water in a well penetrating an Aquifer does not in general rise above phreatic level, water table is the upper surface of the zone of saturation. At the water table the water in the pore of the Aquifer is at atmospheric pressure. The hydraulic pressure at any level within a water table aquifer is equal to the depth from the water table to the point and is referred to as hydraulic head.

1.1.1 LOCATION OF STUDY AREA AND LIMITATION

The site of project is 27km from Ayigba. Dekina is Local Government Head Quarter and latitude 7° 25N and LONGITUDE 6° 17E, lying astride the Olowa at a point 16km east-south or Ayigba on the main Lokoja Shintaku Road.

The area is shown in the map. Administratively the area is included in Igala Division. The area suggested for the investigation occupied some area in the derived savanna zone of Northern Nigeria.

The scope of this investigation covered only Dekina area with the view of determining.

- Topographic map of the study area
- Determination of moisture content
- Soil analysis of the study area
- Climatic condition of the area
- Ground water table and it depth

1.2 AIM AND OBJECTIVE

To determine the depth of water table at the project site

To access the quality and quantity of water in the area.

To determine some soil physical properties related to the area

CHAPTER TWO

LITERATURE REVIEW

GEOLOGICAL FORMATION

The Geographical location of Kogi State, the state is divided into two distinct geographical zones, the eastern and western zones.

Dekina area of Kogi State is in the eastern side of Kogi State, it is lying mainly to the south of the middle belt.

Each geological formation exhibits different topographical, hydrological, and soil features which are highly influential in determining existing settlement distribution.

The location of these various formations is depicted in Appendix A which is adapted from De sward and casey.

The survey area Dekina is situated at the fresh water sand stones, known as the false Bedded sand stones formation and consist of some 300m of medium to coarse-grained cross-bedded sand stones with subordinate white and pale Grey shale bands.

The wet season starts by late March and end in October an average of eight months. The remaining months from November to February covers the dry season.

Adefolalu (1986) in his contribution explained that during the wet season every where get wet, the rivers streams filled up to their paves and in some cases over flouring their banks. This can lead to flood for lack of good water drainage and water channel for easy water flow.

Ojo (1977) show that variability in Nigeria reveal that a part from the rainfall amount other measure of precipitation effectiveness, similarly, Den mad et-al (1980) carried an experiment to determine the effect of soil moisture content.

Doorenbous and pruitt (1977) examine soil water balance application in irrigation scheduling and Oldeman and Frere (1982) describe methods of calculating the soil water balance with particular reference to humid regions of south east Asia.

For many years Oxfam` and other agencies involved in relent medical aid and development work in many parts of the world have been acutely aware of the health problem created by an inadequate water supply.

Oxfam in his relief work over sea has repeatedly be called upon to initiate or assist with water supply schemes to alleviate human privation and suffering.

2.1.2. WATER RESOURCES

Water is vital to life and development in all parts of the world, the paramount influence of water in domestic uses in generals and crop production is fairly well established. Water infact appears to be the most important natural limiting factor in the world food/ production e.g domestic, industry, institution and Agriculture.

Water availability depends on water balance a deference between intake and out flow for much of Agriculture.

It is evident therefore that water as an environmental variable has receive major attention in the global need to increase in all department of production.

Water requirement has been defined as the quantity of water required for Agriculture, Industrials use in a good period of time for its normal purpose it is provided for.

This also include consumption use of water by the crop and other unavoidable losses associated with the delivery and application of water in the field.

2.1.3 THE FUNCTION OF WATER: Generally

i. Water is used domestically

ii. Water is used for plant

iii. Water is used in the industry

iv. Water brings plant nutrient element into plant available form

v. Water carrieds dissolved oxygen into the soil

vi. Water keeps soil from getting too hot or two cold especially in temperate region.

2.1.4 HYDROLOGICAL CYCLE

Long ago Solomon observed that all streams flow into the sea yet the sea is not full, Although the streams are still flowing. (Ecclesiastes 1:7). The explanation for these Enigma is well know to day to the role played by evaporation and precipitation, this is far from obvious.

Water evaporated from the ocean and is transported over the continents by moving air masses when this moisture bearing air is cooled to its dew points temperature, forming foq or cloud. The cooling occurs when the moist is lifted to a higher elevations.

Since air pressure decrease with elevation, the air expands as it is lifted and cooled in accordance with the ideal gas law.

PV/T = pressure

V = Volume

T = Temperature.

About two thirds (2/3) of the precipitation that fall to the land surface is returned to the atmosphere by evapqration from water surface, soil and vegetation through plants transpiration. The remaining third of the precipitation returns ultimately to the ocean through surface or underground channels. The hydrological cycle is depicted.

2.1.5 PRECIPTATION:

This includes all water that falls from the atmosphere to the earth's surface.

2.1.6 GROUND WATER:

Is the tension free continuous mass of water below the soil surface. It fills all the pores of the material in which its occures. The surface of the ground water is called the ground water table. It can be found by drilling a hole in the soil and observing the surface level of the water that will fill up the hole. In some cases two or more ground water level exist above each other, where extensive layers of impervious materials occurs.

The upper ground water masses are called perched ground.

During the wet season the level of the spring is high is high and sink during the dry season. The capillary fringe of ground water is held by the soil under tension and it ~~therefore~~ soil moisture and not ground water. By capillary fringe is meant the water in the layer of soil or subsoil water enters due to capillary rise.

The direct value of ground water to plants depends on whether roots can reach the capillary fringe.

Whether this be the case or not this is determined by the depth of the water table, the rate and extent of capillary rise, the aeration of the soil and the nature of the crops.

2.6.1 MOISTURE CONTENT

Measurement of water stored in soil and capacity of soil to store water are very important. Some soils produce crops despite the lapse of many days and some-times weeks between periods of rainfall is evidence of their capacity to store available water, since all growing plants required water continuously.

In irrigation region the capacity of soil to store available water for the use of crops is of special importance and interest because the depth of water to apply in each irrigation, and the interval between irrigation are both influenced by storage capacity of the soil.

It is important to find the available water capacity for different soil i.e the field capacity less the moisture content at the permanent welting point (vangum orson glen (1980).

How ever for the purpose of this work gravimetric method was used. Moisture content can be calculated by expressing it as percentage of dry weight as given below.

$$W = \frac{Ww - wd}{Wd} \times \frac{100}{1} \qquad \text{.................2.2}$$

Where Ww = wet weight of soil

Wd = Dry weight of soil

Nd = Moisture content expressed as percentage of dry weight.

2.6.2. WATER HOLDING CAPACITY

The moisture content of a sample of soil is usually defined as the amount of water lost out of soil when dried at 106^{oC}, expressed either as the weight of water per unit weight of dry soil. Multiply by 100.

About half a soil's volume is pore space, which is occupied by varying the amount of air and water, depending on how wet the soil is. Water is held in the pore spaces in the form of films adhering to the soil particle the small pores in the soil are called micro pores.

The larger ones are macropores, this do not hold well because the water films become too thin to adhere well to the surrounding soil particle it is not worthy that drainage takes place within macropores.

2.6.3 PERMEABILITY

Permeability is defined as the readiness with which a soil transmit fluids, a high permeability is essential for teaching down the excessive soil or removal of sodium (Na) released by the application.

2.6:4 BULK DENSITY:

The dry bulk density of soil is defined as the

ratio of the mass of dried particles to the total volume of soil

Ds $$Ds = \frac{MS}{Vt} \qquad 2.4$$

Where

Ds = Bulk Density

Ms = Mass of dried soil

Vt = Total volume

The term dry bulk density and apparent specific gravity are often used synonymously where as the term specific gravity Denotes a dimensionless quantity, bulk density is expressed in grams. Per cm^3.

The apparent specific gravity is influenced by the structure, texture and compactness of the soil. It is an important soil physical property considering its influence on the water holding capacity of soils and its hydraulic conductivity. For instance, when the bulk density of medium to fine textured sub-soils exceeds about 1.7g/cc, the hydraulic conductivity values will be so low that drainage may become difficult.

Total (wet) bulk density is the mass of moist soil per unit Volume.

$$Dbt = \frac{Mt}{Vt} \qquad 2.8$$

Where Mt = Total mass of soil

Vt = Total volume of soil

2.6.5 POROSITY

This is defined as the ratio of the pores to the total soil volume

$$N = \frac{Va + Vw}{Vt} = \frac{Va + Vw}{Va + Vw + Vs} \qquad 2.9$$

Porosity is an index of the relative volume of pores. It is influenced by the textural and structural characteristic of the soil. Michael (1980). The porosity of sandy soils usually ranges from 35 to 50 percentage (%), while that clay soils from 40to 60 percent (%)

The more finely divided soil particles, the greater the porosity.

2.6.6 PHYSICAL HYDROLOGY AND WATER STORAGE

The infiltration capacity of a soil depends on the availability of water porosity, the regulative cover as well as the intensity of rainfall.

All loose permeable soil has a higher infiltration capacity than a compacted clayed soil.

A higher intensity rainfall tends to clog the soil intensity with finer particles through impact action and therefore tends to reduce the rate of infiltration, Grass and other vegetation cover reduces the impact of rain drops on the soil and therefore enhance its infiltration capacity of the ground changes continuously during a rain storm until saturation is reached.

The infiltration rate is normally equal to the intensity of rainfall or both being less than the infiltration capacity. However as saturation is approached the infiltration rate reduces. The excess of rainfall over the infiltration water accumulates and begin to flew as surface run off.

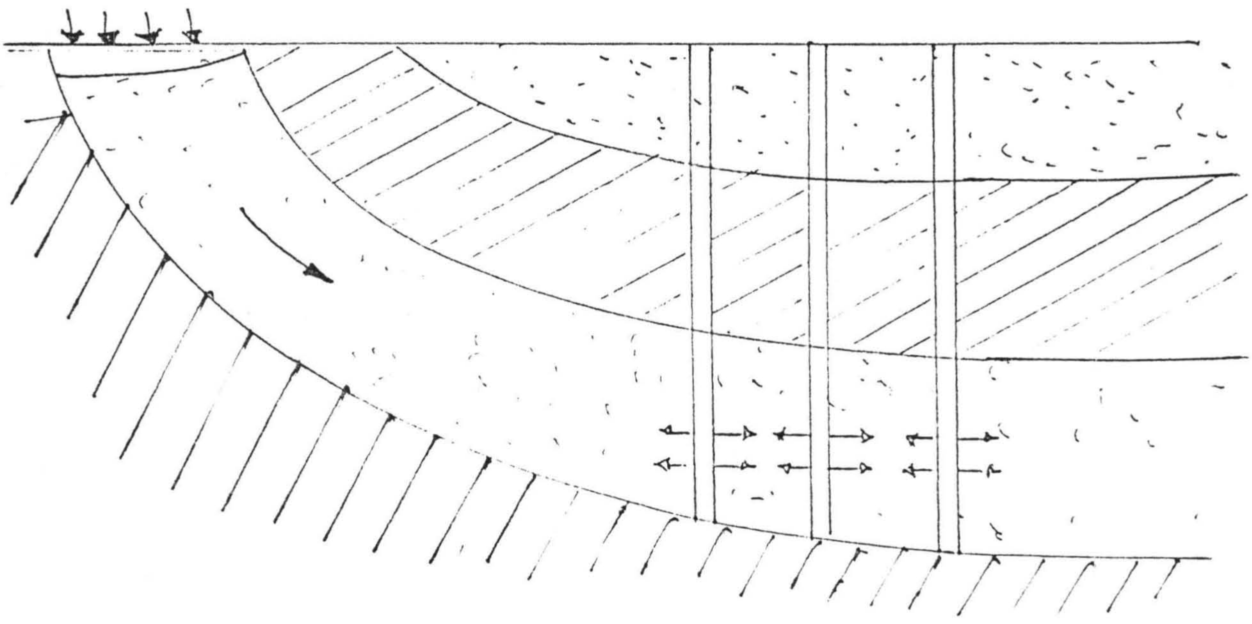
2.6.7 GROUND WATER

Ground water is the water benearth the soil surface where voids in the soil are substantially filled with water.

Upward movement of ground water by capillary from the water table into the root zone can be major source of water for plant growth.

The outer part of the earth crust is normally pores to greater or lesser depths. This zone is called the zone of rock fracture. The pores or openings in this zone in lithosphere may be partly or completely filled with water.

a Hydrogeologic Crosssection



b Pressure distribution

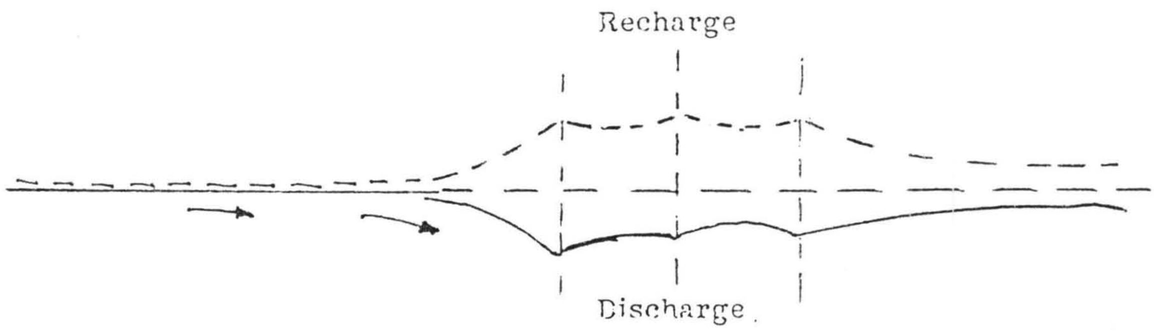


Fig 1. Showing the Recharge and Discharge of confiued aquifer

2.7.3 HYDRAULIC CONDUCTIVITY

Permeabilitya and conductivity are frequently used inter changeably. The characteristics that determines how fast air and water moves through a soil is know as permeability. The rate water moves through a soil is determined by the least permeable horizon.

The permeability of a soil is defined as the velocity of flow caused by a unit gradient, and this is an important point of difference between permeability and infiltration. Permeability is influenced by most physical properties, for unsaturated soils the moisture contents is one of the dominant factors influencing permeability.

Darcy's experiment showed that the flow of water through a column of saturated sand is proportional to the difference in hydraulic head at the ends of the column, and inversely proportional to the length of the column.

This known as darcy's law expressed as $V = K \frac{(h1 - h2)}{L}$ 2.10

Where V = velocity of flow m/day

K = hydraulic conductivity depending upon the properties of the sand and the liquid m/day

(h1-h2) = difference in hydraulic head, (m).

L = distance along the flow path between the point h1 and h2 (m) hydraulic head (h1-h2) divided by the distance and along, the flow path fluid flow is the hydraulic gradient (I) V = Ki 2.11

Often the quantity of flow may be of greater interest than the velocity. Hence in terms of quantity of flow darcy's law may be expressed as follows

Q = av = Kia 2.12

Where Q= volume of water discharge in saturated length of time usually expressed as m^3/day

A = cross-sectional area through which water moves m^2

2.7.4 INFILTRATION

The rate at which water can enter soil when not limited by the rate of supply is measured in the field with water either pounded on the surface or filling on it as artificial or natural rain at a rate sufficient to cause run off. It is expressed in (m/s)

FACTORS AFFECTING INFILTRATION ARE:

The movement of water into the soil by infiltration may be limited by restriction to the flows of water through the soil profile. The major factor affecting the infiltration of water into the soil are;

i. The initial moisture content

ii. Condition of soil surface

iii. Hydraulic conductivity of the soil, profile, texture porosity and etc.

2.7.5 PHYSICAL PROPERTIES OF SOIL

The soils of the area are derived either directly or indirectly from the weathering products of predominantly coarse, grained sandstones and consist of red, very strongly acid sands to sandy clay loams, red, shallow laterite ironstone.

For plant to growth in any soil the air, water and soil particle must be in the right proportion for every cm of soil that is expected to support plant life must be:

i. Open enough to permit the right amount of rain water or irrigation water to enter the soil, but not so excessively open as to allow loss of water and plant nutrients by deep percolation.

ii. Well enough aerated to permit all plant root cells to obtain oxygen at all times.

iii. The soil must have retention property as to retain the moisture in it. Supply crop roots with all needed water.

2.7.6 WATER REQUIREMENT FOR COMMUNITY

The estimation of the water requirement for community is one of basic steps when planning water supply to any community.

Water requirement may be defined as the quantity of water needed by a community for domestic, industrial, agricultural use.

CHAPTER THREE

MATERIAL AND METHODS

3.0 The project site:- Dekina the project site is a local government area head quarter, the project was carried out in three community of Dekina namely Ologba, Udaba and Olowa all in Dekina Local Government area of Kogi State.

3.1.0 FIELD EXPERIMENT

MATERIAL

The materials used were cutlass, hammer, electric wire, current electrode and potential electrode of 200m and 50m respectively, electrode rod and Mcohmeter. The area of water depth determination was cleared with cutlass at both side of the instrument to about 200m each as to prevent field obstacle during survey.

3.2.0 DETERMINATION OF THE DEPTH OF WATER TABLE

Field experimeter:- The Mcohmeter was placed in position, the current and potential electrode wire were connected to the Mcohmeter, the dry cell battery which is the power source was fixed into the Mcohmeter, the current and potential electrode has 2 points, which are the electrode spacing.

The instrument was operated, the current goes through point A to the ground by 1-meter depth, the reading comes out through B, and it was recorded.

The current electrode was moved by 2m at both sides, the instrument was operated to get the reading at 2m depth to the ground.

This procedure continued till 6m distance, at this point the instrument was operated to get the reading at 6m depth.

At 6m depth the potential electrode distance was changed from 0.5m to 1m. The reading was also taken at 6m after this change.

The current electrode was moved to 7m distance and the reading recorded.

This procedure continued until 150m distance, the reading for 150m depth was taken.

During the field experiment the reading is always high when the current comes in contact with hard formation e.g like rock, but when it comes in contact with water bearing formation the reading will be low.

To get the accurate true reading which is the apparent resistivity the field reading is to be multiply by the Geometric factor.

$$K = \frac{(AB)^2}{2} - \frac{(MN)^2)}{2} 3.1415$$

Where K is the Geometric factor

AB = distance between current electrode

MN = distance between potential electrode

Generally is called electrode spacing.

$\frac{V}{I}$ This is the field record

Where V = Voltage

I = Current

Pa = KR, $R = \frac{V}{I}$

Where Pa = Apparent Resistivity

K = Geometric factor

R = Field reading

V = Voltage

I = Current

The data obtained from the field are tabulated in the tables 8,9,10 on page 46, 49, and 52.

The Apparent resistivity curves are presented in the fig. 1,2, and 3 on page 43, 46, and 49 these have been plotted on log-log scale of apparent resistivity versus current electrode spacing.

The resistivity curves were interpreted, the maximum electrode spacing for the profile of this project are 104m for Ologba 170m for Udaba 88, for Olowa could be seen on page 57, 58, and 59.

It is well known that the resistivity of a formation largely depends on the moisture content and on the physical and chemical properties of the saturating water.

The equipment used for this field work was the versatile Mcohmeter. The Apparent resistivity which is the normal quantity determined from the field measurement is not a physical constant, but reflects the distribution of the true resistivities in the subsurface and depends on the spatial configuration of the measuring system.

The schlumbeger arrangement was the one employed in the present study.

Apparent resistivities were obtained from field resistance value as per the equation above.

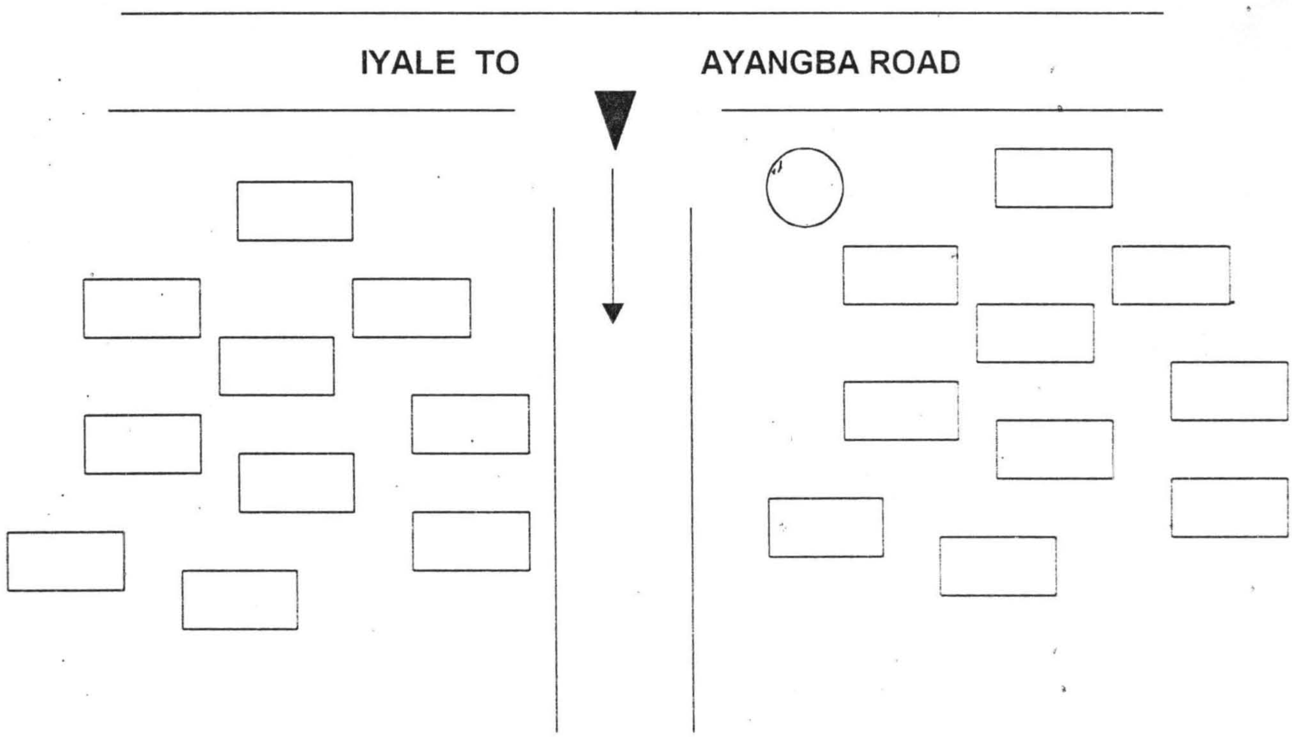


Fig. 3 THE LAYOUT OF OLOGBA – DEKINA PROJECT SITE NO.1

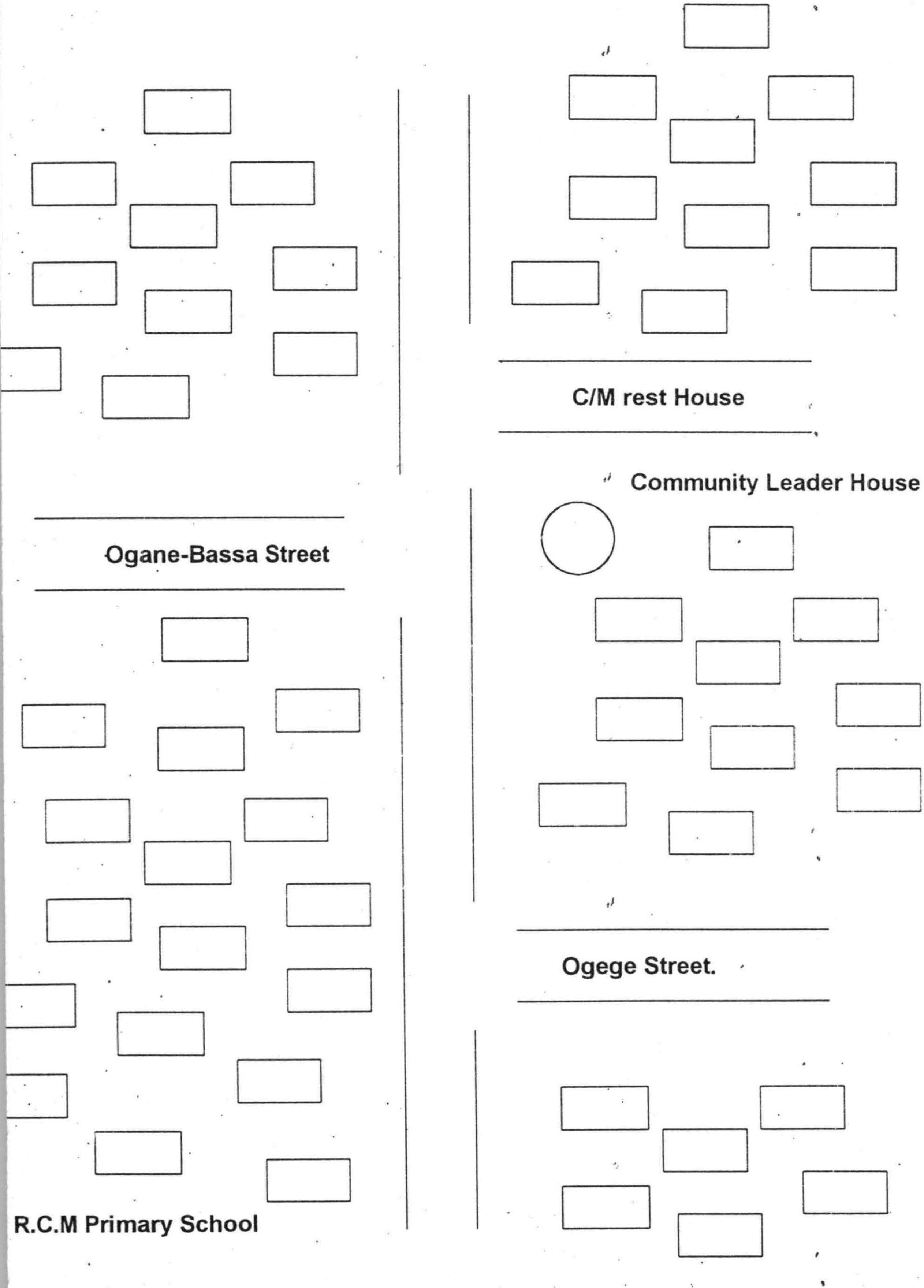


Fig. 4 THE LAYOUT OF UDABA DEKINA PROJECT SITE NO. 2

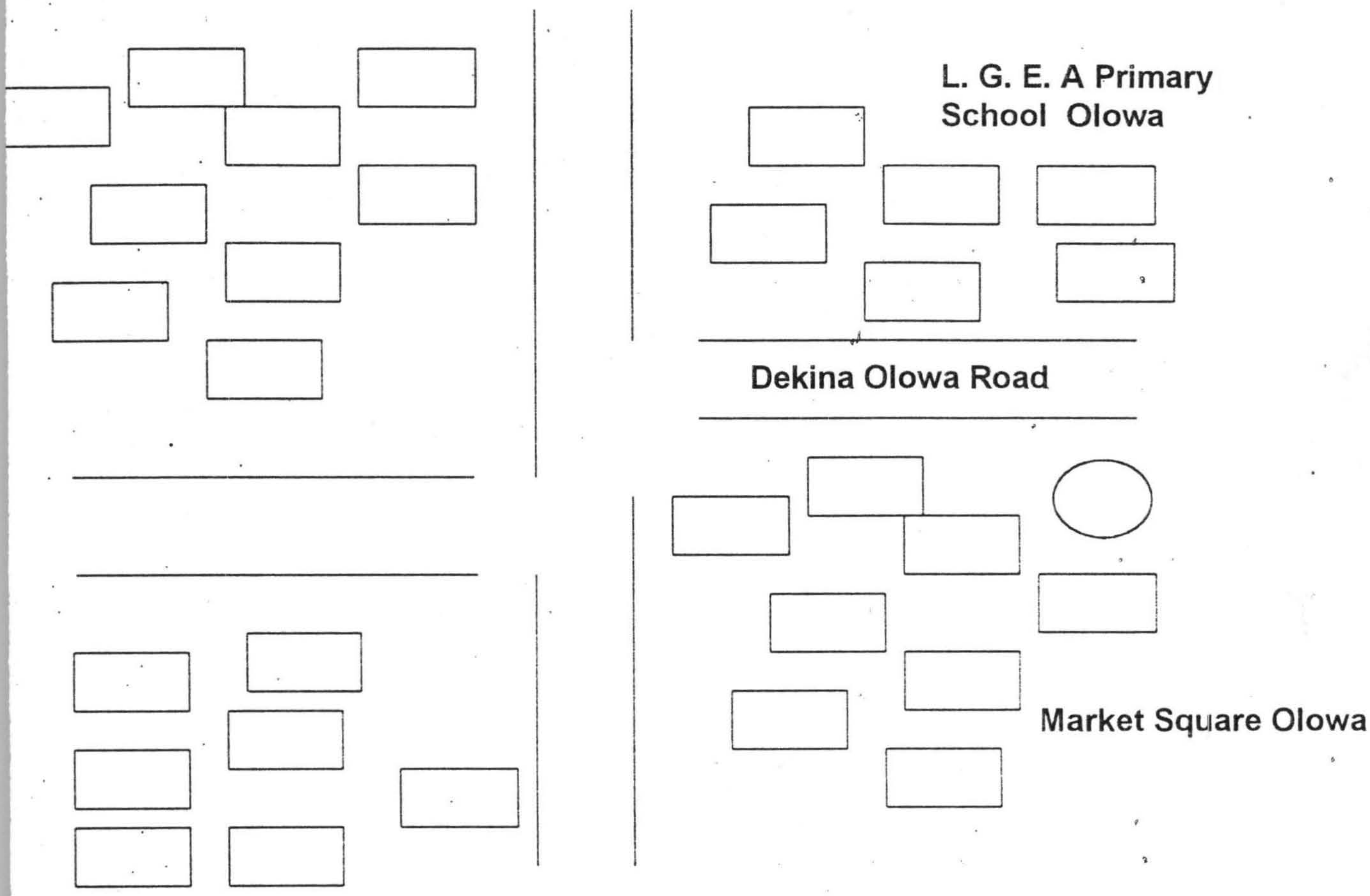


Fig. 5 THE LAYOUT OF OLOWA DEKINA PROJECT SITE NO.3

3.2 LABORATORY EXPERIMENT

DETERMINATION OF MOISTURE CONTENT

The core sample which is 5.8cm in diameter and 6m high are placed on the soil (0-15)cm and pushed down by tapping gently with a bracer and mallet until the core is completely filled with soil, it is then gently removed by placing a cutlass under the core sampler so as to prevent the soil in the core from falling off.

This cores were then placed in cool place the same procedure was followed for all the other points with in (0-15)cm depth.

From (15-30)cm and (30-45)cm drilling hand auger was used to get the soil sample at Ologba, Udaba and Olowa as showed in figure 9 on page 60.

All the sample were taken gently in a container and taken to the labouratory where an electric weighing machine was used to weight the container and the soil-sample.

This container were clearly labeled to distinguish the samples depth and location.

The cans containing the soil were placed in the oven for 24 hours at the temperature of 106^{oC}. After 24 hours the oven is switched off and opened for the can and the soil sample to cool.

The sample is reweigh after oven dry. The moisture content is calculated.

Below is the formular for calculating moisture content.

$$W = \frac{Ww - Wd}{Wd - Wc} \times 100\% \qquad 2.1$$

Where Ww = wt of container plus moist soil

Wd = Wt of container plus dry soil

Wc = wt of container

w = moisture contents

Bulk density: The dry bulk density of soil is defined as the ratio of the mass of dried particles to the total volume of soil.

$$Ds = \frac{Ms}{Vt} \qquad 2.2$$

Where Ds = dry bulk density

Ms = mass of dry soil

Vt = total volume.

These term dry bulk density and apparent specific gravity are often used synonymously, the bulk density is expressed in gramms per a unit volume.

The apparent specific gravity is influenced by the structure, texture and compactness of the soil. It is an important soil physical property considering its influence on the water holding capacity of the soils and its Hydraulic conductivity.

For instance when the bulk density of medium to fine textured subsoils exceeds about 1.7g/cm the hydraulic conductivity values will be so low that drainage may be come difficult.

Wet bulk density

$$Dbt = \frac{mt}{Vt} = \frac{ms + mw}{Vt}$$

Where mt = total mass of soil

Vt = total volume of soil

POROSITY: This can be defined as the ratio of the pore to the total volume of the soil.

$$n = \frac{Va + Vw}{Vt}$$

Where n = porosity

Va = volume of air

Vw = volume of water

Vt = total volume of soil

Porosity is an index of the relative volume of pores. It is influenced by the textured and structural characteristie of the soil. Michael (1980). The porosity of sandy soil usually ranges from 35 to 50 percent, while that of clay soil ranges from 40 to 60 percent. That is to say the more finely divided soil particles are the greater the porosity.

TABLE 1 SUMMARY OF RAIN FALL DATA OF DEKINA FROM 1984 – 2000, SOURCE ADP AYANGBA

YR/MONTH	JAN.	FEB	MAR.	APRIL	MAY	JUNE	JULY	AUG.	SEP	OCT.	NOV.	DEC.	TOTAL
1984	0.0	0.0	4.0	4.7	22.6	138.5	282.4	390.4	323.2	94.7	0.0	0.0	1256.4
1985	0.0	0.0	17.4	204.8	262.33	131.7	377.2	242.9	121.9	121.9	4.6	0.0	1484.73
1986	0.0	0.0	15.4	16.2	130.3	196.1	262.7	422.3	135.5	148.7	7.6	0.0	1334.8
1987	0.0	0.0	61.2	17.3	141.7	250.6	214.8	185.6	148.1	93.3	0.0	0.0	1112.6
1988	0.0	0.0	61.2	17.3	137.3	250.6	233.0	249.7	176.6	61.0	0.0	0.0	1186.7
1989	0.0	0.0	57.8	20.3	137.3	190.0	139.0	302.4	276.7	47.7	0.0	0.0	1171.2
1990	0.0	0.0	39.6	15.4	36.0	183.3	251.7	243.0	315.8	83.8	19.6	0.0	1188.2
1991	0.0	0.0	13.5	44.6	104.5	83.0	143.7	238.5	94.6	100.1	0.0	0.0	822.8
1992	0.0	0.0	0.0	0.0	81.5	132.0	218.3	350.1	403.6	33.1	0.0	0.0	1218.6
1993	0.0	0.0	5.0	49.5	765.0	193.7	193.7	248.7	202.0	79.0	0.0	0.0	1736.6
1994	0.0	0.0	0.0	177.2	225.0	80.5	256.3	185.8	145.6	110.5	0.0	0.0	1181.9
1995	0.0	0.0	0.0	114.5	335.0	180.1	192.9	268.5	190.8	33.9	0.0	0.0	1315.7
1996	0.0	0.0	1.3	158.2	176.8	162.9	196.4	231.5	230.3	46.6	32.9	0.0	1241.9
1997	0.0	0.0	0.0	0.04	174.4	170.5	189.7	271.1	178.3	63.3	0.0	0.0	1047.3
1998	0.0	0.0	7.3	72.5	144.4	239.0	142.5	367.2	261.3	208.1	0.0	0.0	1442.3
1999	0.0	0.0	0.0	100.5	123.3	144.5	153.2	409.0	185.7	135.5	23.6	0.0	1275.3
2000	0.0	0.0	0.0	48.6	164.7	225.0	259.7	257.0	191.1	127.9	0.0	0.0	1274.0
MEAN			16.4	124.89	186.0	173.6	215.13	286.09	210.6	93.5	5.2	0.0	

TABLE 2 DEKINA 1995

Month	Rain fall total (mm)	Cumulative total (mm)	Max oc temp.	Min oc temp.	R/H %
January	0.0	0.0	34	18	66
February	0.0	0.0	37	18	46
March	0.0	0.0	40	24	66
April	38.9	38.9	37	24	69
May	171.9	210.9	34	24	80
June	151.4	362.2	32	23	84
July	75.8	438.0	32	23	85
August	425.7	863.7	31	23	84
September	194.0	1057.7	31	23	85
October	102.1	1159.8	33	23	81
November	0.0	1159.8	34	19	69
December	0.0	1159.8	43	15	55

Climatological Dept of (ADP) Agric Development, Dekina

TABLE 3 DEKINA 1996

Month	Rain fall total (mm)	Cumulative total (mm)	Max oc temp.	Min oc temp.	R/H %
January	0.0	0.0	34	15	50
February	0.0	0.0	36	17	40
March	22.9	22.9	39	24	69
April	43.8	66.7	38	26	69
May	92.3	159.0	35	24	75
June	128.7	287.7	33	24	81
July	236.7	524.4	32	23	84
August	307.5	984.1	31	23	85
September	152.2	984.1	32	23	85
October	105.6	1089.7	33	23	81
November	12.3	1102.0	35	19	67
December	0.0	1102.0	35	17	69

Climatological Dept. of Agric Development project Ayangba of Dekina

TABLE:4 1997

Month	Rain fall total (mm)	Cumulative total (mm)	Max oc temp.	Min oc temp.	R/H %
January	0.0	0.0	35	15	50
February	18.9	18.9	37	21	40
March	0.0	18.9	38	24	69
April	12.6	31.5	39	25	69
May	2.0	33.5	33	24	75
June	190.7	224.2	30	23	81
July	201.8	426.0	29	23	84
August	326.1	752.1	31	13	85
September	170.5	922.6	31	22	85
October	41.3	963.9	33	18	81
November	0.0	963.9	36	19	67
December	0.0	963.9	34	17	69

Climatological Dept of Agric Development Project Ayanba of Dekina.

TABLE 5 DEKINA 1998

Month	Rain fall total (mm)	Cumulative total (mm)	Max oc temp.	Min oc temp.	R/H %
January	0.0	0.0	34	16	32
February	0.0	0.0	38	19	69
March	64.9	64.9	37	24	72
April	53.9	118.8	37	24	72
May	129.3	248.1	32	23	81
June	219.0	527.3	31	21	97
July	219.0	746.3	22	24	81
August	227.2	973.5	32	23	77
September	145.7	119.2	29	2	86
October	135.4	1254.8	35	23	81
November	7.2	1261.8	36	20	66
December	0.0	1261.8	35	17	54

Climatological Dept of Agric. Development project Ayabgba of Dekina.

TABLE 6 DEKINA 1999

Month	Rain fall total (mm)	Cumulative total (mm)	Max oc temp.	Min oc temp.	R/H %
January	0.0	0.0	40	24	65
February	0.0	0.0	39	24	29
March	0.0	0.0	41	27	58
April	67.1	67.1	34	24	82
May	213.2	270.3	34	27	85
June	75.5	345.8	32	24	77
July	239.7	585.5	32	24	88
August	145.5	631.0	28	24	86
September	153.7	784.7	31	23	84
October	103.0	887.7	34	24	77
November	0.0	887.7	36	17	73
December	0.0	887.7	36	16	62

Climatological Dept of Agric Development Project Ayangba of Dekina.

TABLE 7 DEKINA 2000

Month	Rain fall total (mm)	Cumulative total (mm)	Max oc temp.	Min oc temp.	R/H %
January	0.0	0.0	35	17	54
February	2.8	2.8	27	20	57
March	0.8	3.6	58	25	58
April	112.1	115.7	37	24	72
May	135.5	251.1	34	23	73
June	196.8	447.9	32	23	85
July	264.1	712.0	31	23	87
August	194.5	906.5	30	23	86
September	153.7	1060.2	31	23	88
October	98.0	1158.2	33	23	85
November	0.0	1158.2	35	21	72
December	0.0	1158.2	34	24	72

Climatological Dept of Agric. Development Project Ayangba of Dekina.

CHAPTER FOUR

4.0 RESULT AND DISCUSSION

The results obtained from the field experiment, laboratory experiment, computation are presented in this chapter.

1. The result from the geophysical survey carried out to determined the depth of water table is shown on Table 8,9 and 10.

From the geo electric layer met layer (1) has an apparent resistively of 62.8ohm and a thickness of 6m of topsoil containing laterite.

Layer (2) has an apparent resistivity of 88.7ohm and thickness of 6m to 36m containing ferruginous sandstone.

Layer (3) (4) (5) are sandy materials with apparent resistivity of 176.2, 264.25 and 222.4 ohm, having the thickness of (36m – 96m), (96m-104m) (104m-165m) respectively.

The fig.6, 7, and 8 shows the lithological profile of Ologba, Udaba and Olowa in Dekina Local Government respectively.

This data were collected from Kogi State geological survey department of Ministry of land and survey Lokoja.
There is Pitched Aquifer from 2m to 7.2m depth, while the major aquifer is below the dry sand of 60m depth containing white sand stone sandy and fine coarse sand. To get the

desired quality and quantity of water in the study area is between 60m to 150m deep.

2. **Rainfall Data Collection**

The rainfall data from 1995 to the year 2000 were collected from Agric Development Project Ayigba this is shown on tables 2,3,4,5,6 and 7.

It shows that majorly that the rainfall on set is April, we have max rainfall in August and cessation period of rainfall in October.

3. **Laboratory Test:**

Laboratory test carried out to determine the moisture content of the project site is shown on table 10.

This result shows that moisture content has a relationship with water table.

The increase in depth to the soil the higher the weight of the soil sample, and the greater the moisture content.

The increase you go to the soil the more moisture you get in the soil.

This is an indication that the further you go to the soil the closer one gets to the water table.

5. **Bulk density and dry density:**

It was observed that the bulk density decreases as the increase in depth to the soil. The same applied to the dry bulk density, this could be seen in table 11.

CHEMICAL ANALYSIS

A sample of water was taken from existing borehole at Udaba of 2 litres quantity. This sample of water was tested at Kogi water board at Lokoja.

Water quality standard gives an information about suitability of water for public supply. In essence the water for consumption is expected to meet minimum level of standard guidelines as possible for protection of public health.

Base on this the drinking water standard established by (WHO) World Health organisation is compared with the result of the test carried out. Below is the table of the result.

S/NO	PARAMETER	MEASURED VALUE	WHO NPL	REMARK
1	PH	7.9	6.5 –8.5	
2.	Apparent colour Hazen	10	15 Hazen	
3.	Turbidity (NTU)	1.8	5 NTU	
4.	Suspended solid	13.3	25	
5.	Conductivity (US/Con)	607	-	
6.	Bicarbonate (Alkaline) (mgt)	46.0	2509/L	
7.	Total Hardness (mgt/L)	74.0	250 mg/L	
8.	Salinity as Nad (mg/L)	8.25	200 mg/L	
9.	Iron (mg/L)	0.08	0.1 mg/L	
10.	Calcium (mg/L)	15.48	75 mg/L	
11.	Magnesium (mg/L)	8.25	30 mg/L	
12	Chloride (mg/L)	5.10	200 mg/L	
13.	Nitrate (mg/L)	5.25	20 mg/L	Source Kogi State Water Board

The above comparison shows that the sample of water tested meet the requirement of the WHO, since the amount of the parameter present in the water is not above WHO requirement. Substance that would have posed health harzard are very low and water nutrients required for body growth are well available.

<u>**VERTICAL ELECTRICAL SOUNDING DATA ENTRY FORM**</u>

PROJECT: **GEO- PHYSICAL SURVEY**

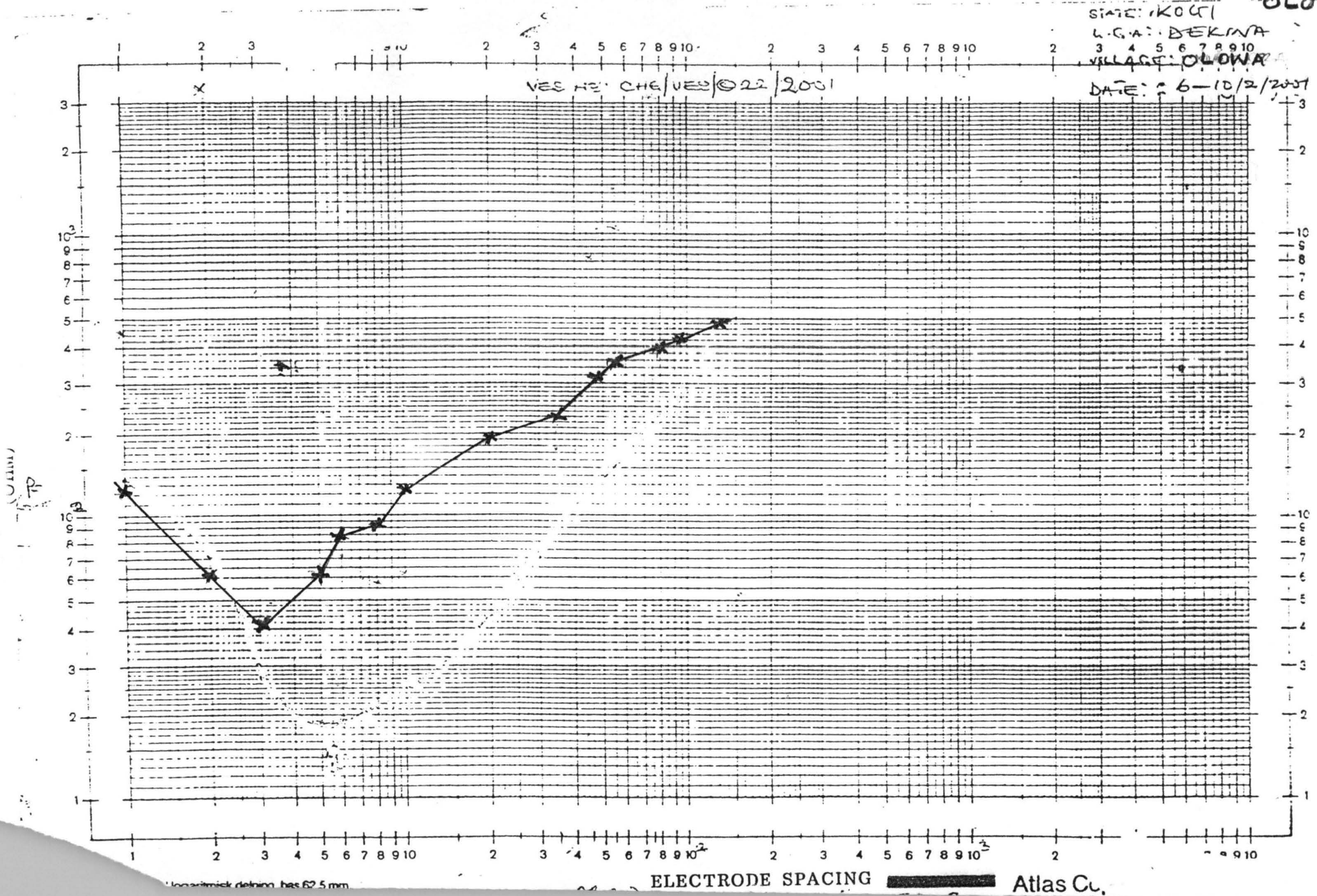
LOCALITY: **OLOWA/ DEKINA** L. G. A **DEKINA** KOGI STATE

EQUIPMENT: **MC-OHMETER** VES NO...............ELEVATION:....................

AZIMUTH: ....SURVEYED BY:.................DATE:.................

TABLE 8

Electrode Spacing (M)		**Geometric Factor (K)**	**Resistivity (R)**	**Apparent Resistivity (a)**	**Comment**	**Geo-Electric Layer**
AB/2	MN/2		(Ohms)	(0hms (m)		
1	0.05	2.36	61.66	145.52		
2.	0.50	11.8	5.122	60.44		
3.	0.50	27.8	1.484	41.25		
5.	0.50	112.0	0.571	63.952	67.4ohm	
6	0.5	55.0	0.442	24.31		
6	1.00	99	0.883	87.42		
8	1.00	156	0.579	90.32		
10	1.00	58.90	0.438	25.798		
10	2.50	137	1.136	155.63		
15	2.50	247	0.571	141.03		
20	2.50	562	0.352	197.82	185.6ohm	
35	2.50	1001	0.248	248.248		
35	7.50	323	0.188	60.724		
45	7.50	512	0.613	313.856	242.6ohm	
55	7.50	742	0.476	353.19		
75	7.50	1014	0.388	393.4	393.4ohm	
96	15.0	1329	0.324	430.59	435.3ohm	
126	15.0	647	0.745	482.01		
165	15.0	225	1.240	279		
215	15.0	1024	1.400	14336		
200	15.0	1244	1.600	1990.4		


OLOW
STATE: KOGI
L.G.A: DEKINA
VILLAGE: OLOWA
DATE: 6-10/2/2001
VES NO: CHE/VES/022/2001
ρ (Ohm)
ELECTRODE SPACING
Atlas Co.
Logaritmisk delning, bas 62,5 mm

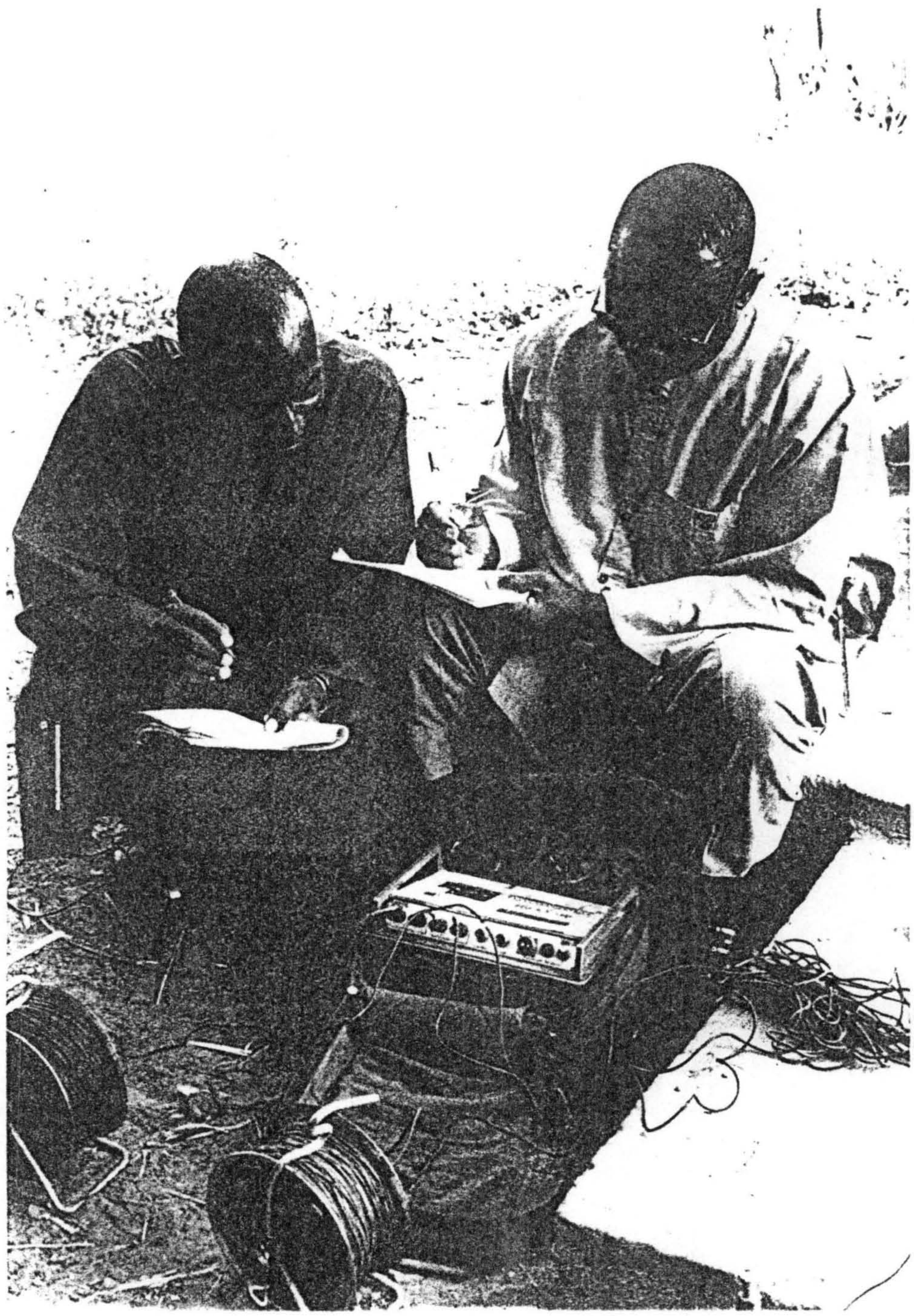


Plate 1: A Pictorial View of the project Site taking reading of the depth of the water table from the MC-Ohmeter. At Olowa.

VERTICAL ELECTRICAL SOUNDING DATA ENTRY FORM

PROJECT: **GEO - PHYSICAL SURVEY**

LOCALITY: **OLOGBA/ DEKINA** L. G. A **DEKINA** KOGI STATE

EQUIPMENT: **MC-OHMETER** VES NO................ELEVATION:.....................

AZIMUTH: ....SURVEYED BY:..................DATE:..................

TABLE 9

Electrode Spacing (M)		Geometric Factor (K)	Resistivity (R)	Apparent Resistivity (a)	Comment	Geo-Electric Layer
AB/2	MN/2		(Ohms)	(Ohms (m)		
1	0.05	2.36	54.12	127.72		
2.	0.50	11.8	7.817	92.24		
3.	0.50	27.8	2.377	65.37	62.8ohm	
5.	0.50	77.8	0.610	47.46		
6	0.5	112	0.398	44.58		
6	1.00	55	0.901	49.56		
8	1.00	99	0.455	45.05		
10	1.00	156	0.285	44.5		
10	2.50	58.90	0.863	50.83	88.7ohm	
15	2.50	137	0.443	60.69		
20	2.50	247	0.440	108.68		
35	2.50	562	0.303	170.29		
35	7.50	1001	0.180	180.18		
45	7.50	323	0.123	39.73		
55	7.50	512	0.356	182.3	170.2ohm	
75	7.50	742	0.293	217.4		
96	15.0	1014	0.238	241.3		
126	15.0	1429	0.201	287.2	264.25ohm	
165	15.0	647	0.179	115.8	222.4ohm	
215	15.0	225	0.170	38.25		
200	15.0	1024	0.168	172.03		

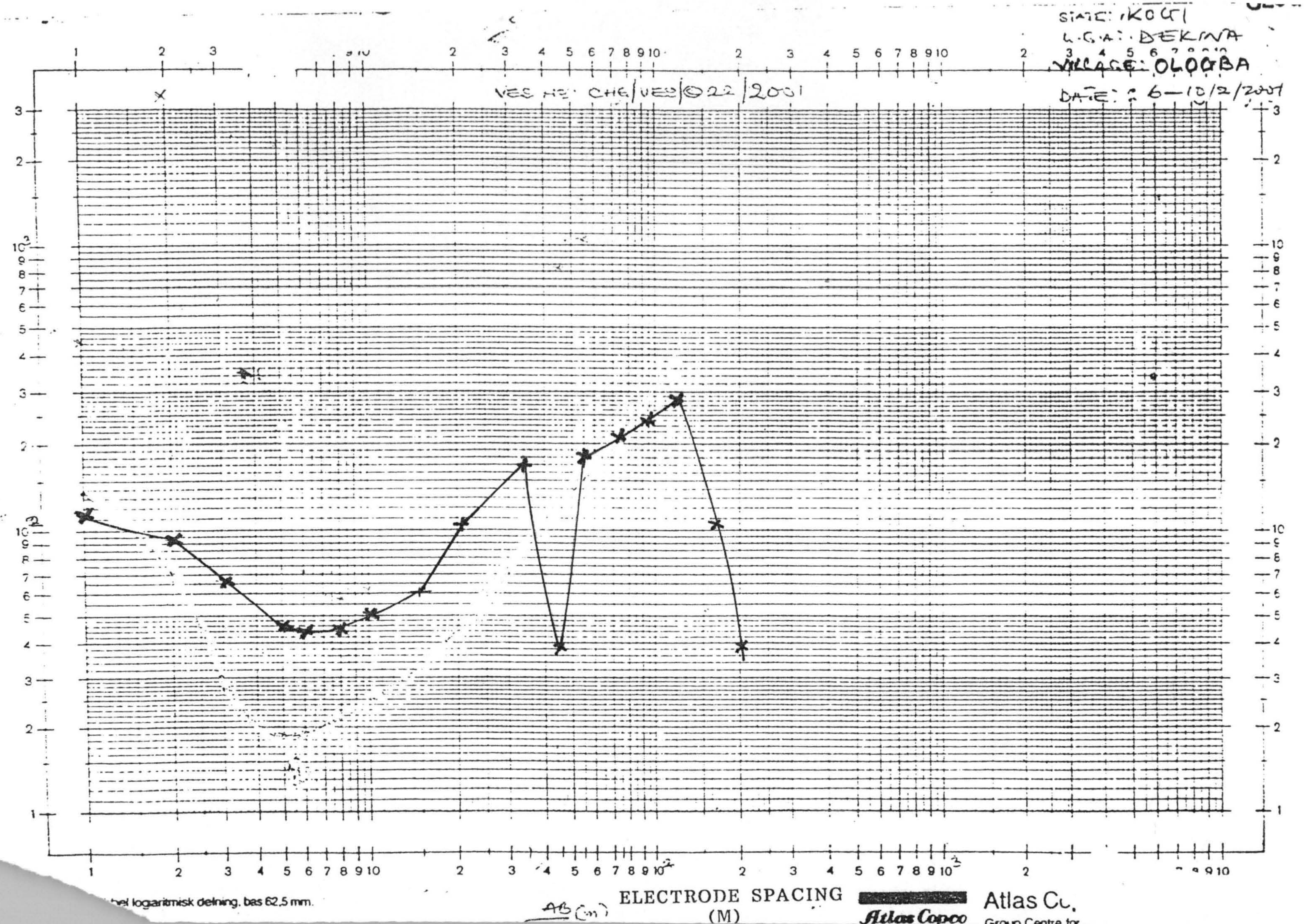

STATE: KOGI
L.G.A: DEKINA
VILLAGE: OLOGBA
DATE: 6—10/2/2001
VES NO: CHE/VES/022/2001
ELECTRODE SPACING
(M)
AB (m)
...bel logaritmisk delning, bas 62,5 mm.
Atlas Copco
Atlas C...
Group Centre for

Plate 2 A Pictorial View of the project Site taking reading of the depth of the water table from the MC-Ohmeter. At Ologba.

VERTICAL ELECTRICAL SOUNDING DATA ENTRY FORM

PROJECT: **GEO - PHYSICAL SURVEY**

LOCALITY: **UDABA/ DEKINA** L. G. A **DEKINA** KOGI STATE

EQUIPMENT: **MC-OHMETER** VES NO……………ELEVATION:…………………

AZIMUTH: ……………………..SURVEYED BY:………………DATE:………………

TABLE 10

Electrode Spacing (M)		Geometric Factor (K)	Resistivity (R)	Apparent Resistivity (a) (KR)	Comment	Geo-Electric Layer
AB/2	MN/2		(Ohms)	(0hms (m)		
1	0.5	2.36	187	441.32		
2.	0.5	11.8	15.4	181.72		
3.	0.5	27.8	22.1	607.75		
5.	0.5	77.8	31.0	2411.8		
6	0.5	112	6.5	728	466.4ohm	
6	1.00	55	3.1	170.5		
8	1.00	99	0.596	59.004		
10	1.00	156	0.409	63.804		
10	2.50	58.90	0.90	53.01		
15	2.50	137	0.44	60.28	67.4ohm	
20	2.50	247	0.36	88.92		
35	2.50	56.2	3.14	176.48		
35	2.50	100	4.56	456.0	491.8ohm	
45	7.50	323	2.61	843.03		
55	7.50	512	2.00	1024		
75	7.50	742	1.90	1409.8	1318.3ohm	
96	7.50	1014	1.50	1521.0		
126	15.0	1629	0.906	1475.87		
165	15.0	647	0.792	512.424		
215	15.0	825	0.584	481.8		
200	15.0	1025	0.228	233.7		

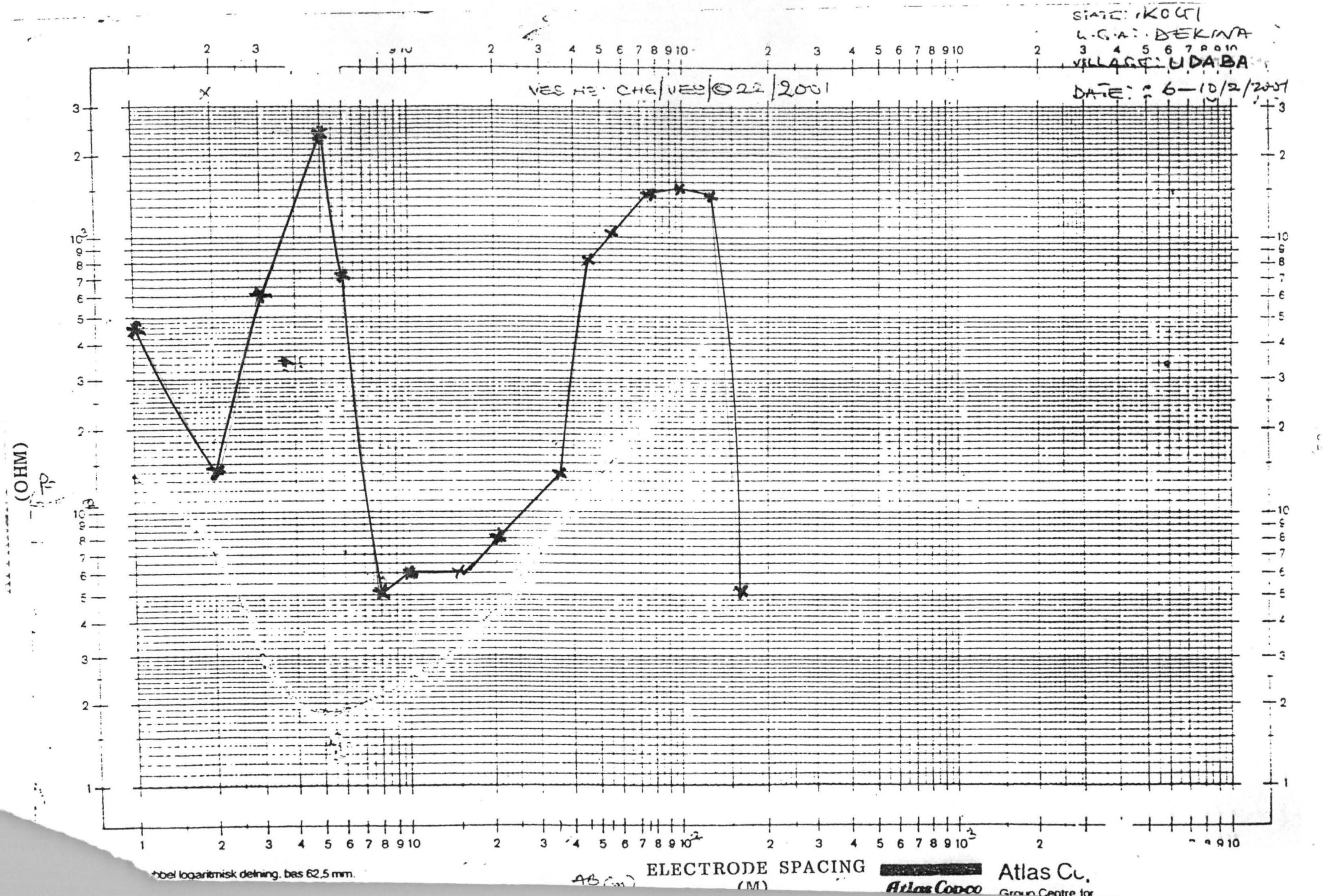

STATE: KOGI
L.G.A: DEKINA
VILLAGE: UDABA
DATE: 6–10/2/2001
VES NO: CHE/VES/022/2001
(OHM)
ELECTRODE SPACING
(M)
AB (m)
dobbel logaritmisk delning, bas 62,5 mm.
Atlas Copco
Atlas Co.
Group Centre for

Plate 3. A Pictorial View of the project Site taking reading of the depth of water table from the MC-Ohmeter. At Udaba.

4.2.0 COMPUTATION OF MOISTURE CONTENT

$$W = \frac{Ww - Wd}{Wd} \times 100\% \qquad 2.1$$

Where Ww = Wt of wet soil sample

Wd = Wt of dry soil sample

W = moisture content

From moisture content table

At depth (0-15)cm

Wt of wet soil = 351.38g

Wt of dry soil = 344.2g

$$W = \frac{(351.38 - 344.2)g}{344.2} \times 100$$

W = - 2.08%

At (15 – 30)cm depth

Wt of wet soil = 322.85

Wt of dry soil = 307.85

$$W = \frac{322.85 - 307.85}{307.85} \times 100$$

W = 4.87%

At (30 – 45)cm depth

Wt of wet soil = 400g

Wt of dry soil = 360g

$$W = \frac{400 - 360}{360} \times 100$$

w = 11.1%

4.3.0 BULK DENSITY COMPUTATION

Wet bulk density

At (0.15) depth

Ds = Ms 2.2

Wt of wet soil = 315.38g

Total vol = 158.52cm3

Ds = 351.38 = 2.21gkm3

At (15 – 30)cm depth

Wet Ds = 400.0 0.113g/cm

3554.75

4.4.0 DRY BULK DENSITY

At (0 – 15)cm

Wt of dry soil = 344.2g

Vt total volume soil = 158.52cm3

$\frac{\text{Wt of soil}}{\text{Total vol}}$ 2.3 $\frac{\text{Wt of soil}}{\text{Total vol}} = \frac{344.2}{158.52}$

Dry Ds = 2.17g/cm3

At (15 – 30)cm depth

Wt of dry soil = 307.85

Vt total volume V soil = 2356.5

Dry Ds = $\frac{\text{Wt of dry soil}}{\text{Total vol}} = \frac{307.85}{2356.5}$ = 0.13068/cm3 at (30 – 45)cm depth

Wt of dry soil = 360g

Total volume of soil = 3534.75

Dry Sc = Wt of dry soil / Total volume

$$= \frac{360}{3534.75} = 0.1018g/cm$$

4.5.0 **POROSITY COMPUTATION**

2.4

At (0 – 15) $n = \frac{Va + Vw}{Vt}$

$$n = \frac{8.38}{158.52} = 0.053$$

at (15 – 30)cm depth

$$n = \frac{4.89}{2356.5} = 0.0021$$

The values is dimensionless.

TABLE 11 MOISTURE CONTENT, BULK DENSITY, AND POROSITY OF OLOGBA, UDABA AND OLOWA OF DEKINA AREA.

LOCATION	DEPTH (CM)	WT OF Wet Soil Samples (g)			Wt of dry soil samples (g)			Moisture Content (%)			Mean of Moisture Content %	Wet bulk density (g/cm3)			Dry bulk density (g/cm3)		
		1	2	3	1	2	3	1	2	3		1	2	3	1	2	3
At Ologba	0-15	351.35	350.4	350.0	344.2	346.3	347.0	2.08	1.18	1.4	1.55	2.21	2.210	2.22	2.17	2.18	2.19
	15-30	322.85	323.0	322.4	307.85	306.0	307.9	4.87	5.55	4.71	5.04	0.14	0.137	0.137	0.130	0.129	0.131
	30-45	400.0	398.0	401.0	360.0	360.0	361.0	11.1	10.6	11.08	10.9	0.112	0.112	0.114	0.102	0.1018	0.102
At Udaba	0-15	330.40	332.0	331.5	323.4	324.0	323.6	2.16	2.47	2.44	2.35	2.1	2.09	2.09	2.04	2.04	2.041
	15-30	352.30	349.80	353.0	337.33	335.8	336.0	4.45	4.17	5.05	4.55	0.149	0.148	0.15	0.143	0.142	0.143
	30-45	360.03	359.25	361.0	320.03	322.0	321.5	12.49	11.56	12.29	12.11	0.102	0.1016	0.102	0.091	0.091	0.092
At Olowa	0-15	339.49	340.20	338.80	329.49	331.2	328.8	3.03	2.72	3.04	2.93	2.14	2.15	2.137	2.07	2.09	2.07
	15-30	355.0	356.2	352.4	340.5	339.21	336.4	4.25	8.01	4.75	5.670	0.151	0.151	0.149	0.144	0.144	0.103
	30-45	404.0	400.5	402.8	364.0	360.05	362.8	10.9	11.23	11.0	11.04	0.114	0.113	0.114	0.102	0.102	0.103

Volume of core sample = VT - $\pi \frac{d^2 L}{4} = \pi \frac{(5.8)^2 \times 6}{4}$ = $158.52cm^3$

Diameter of drilling auger = 10cm

Volume at 30cm depth - $VT = \pi \frac{d^2 \times L}{4} = \pi \frac{(10)^2 \times 30}{4}$ = $2356.5cm^3$

Volume at 45cm depth = $VT = \pi \frac{d^2 L}{4} = \pi \underline{(10)^2 \times 45}$ = $3534.75cm^3$

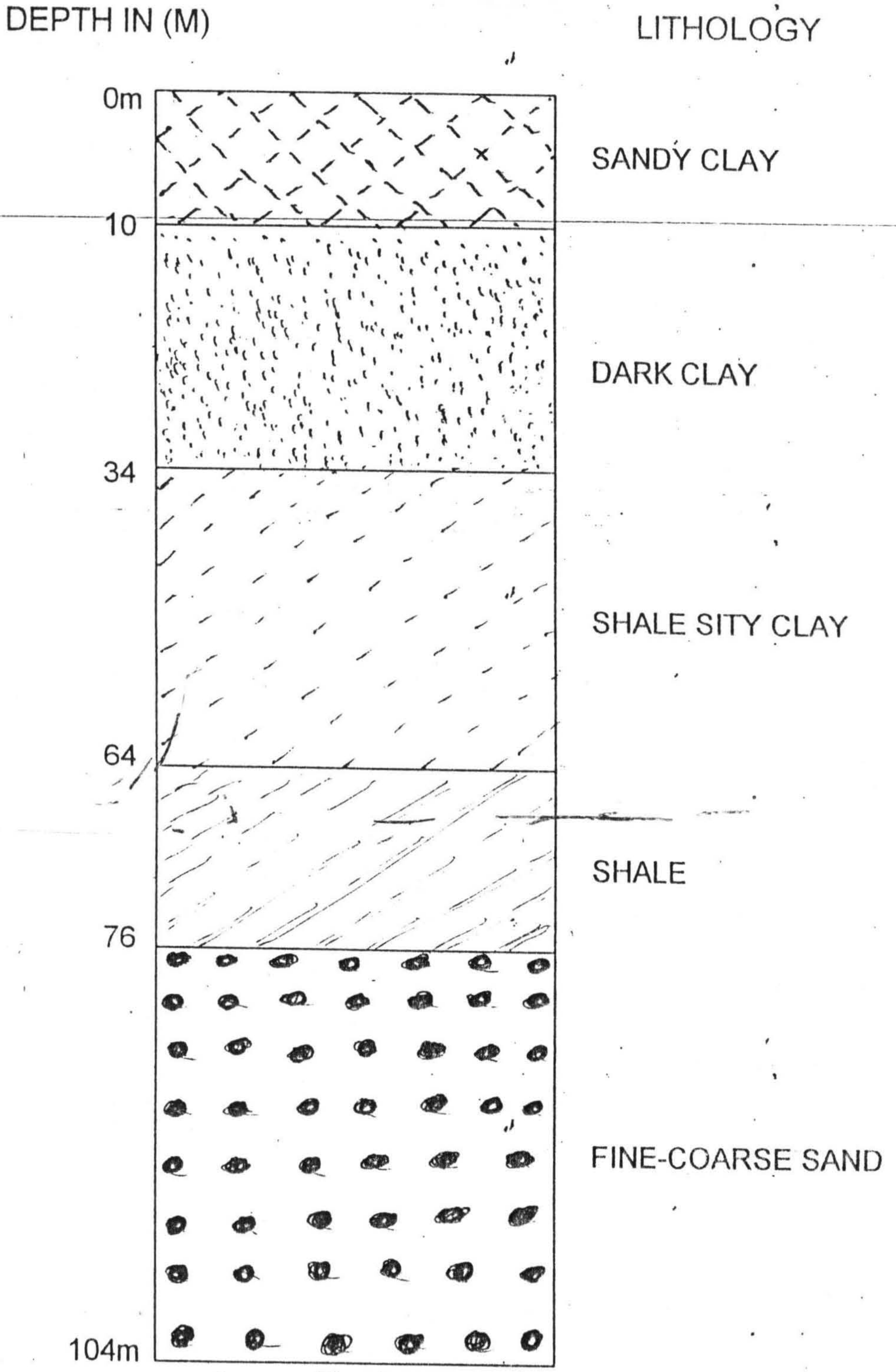


Fig. 6

FIG. 6: SHOWS LITHOLOICAL PROFILE OF OLOGBA OF DEKINA

Source Kogi State Geological survey department ministry of land and survey Lokoja.

CHAPTER THREE

MATERIAL AND METHODS

3.0 The project site:- Dekina the project site is a local government area head quarter, the project was carried out in three community of Dekina namely Ologba, Udaba and Olowa all in Dekina Local Government area of Kogi State.

3.1.0 FIELD EXPERIMENT

MATERIAL

The materials used were cutlass, hammer, electric wire, current electrode and potential electrode of 200m and 50m respectively, electrode rod and Mcohmeter. The area of water depth determination was cleared with cutlass at both side of the instrument to about 200m each as to prevent field obstacle during survey.

3.2.0 DETERMINATION OF THE DEPTH OF WATER TABLE

Field experimeter:- The Mcohmeter was placed in position, the current and potential electrode wire were connected to the Mcohmeter, the dry cell battery which is the power source was fixed into the Mcohmeter, the current and potential electrode has 2 points, which are the electrode spacing.

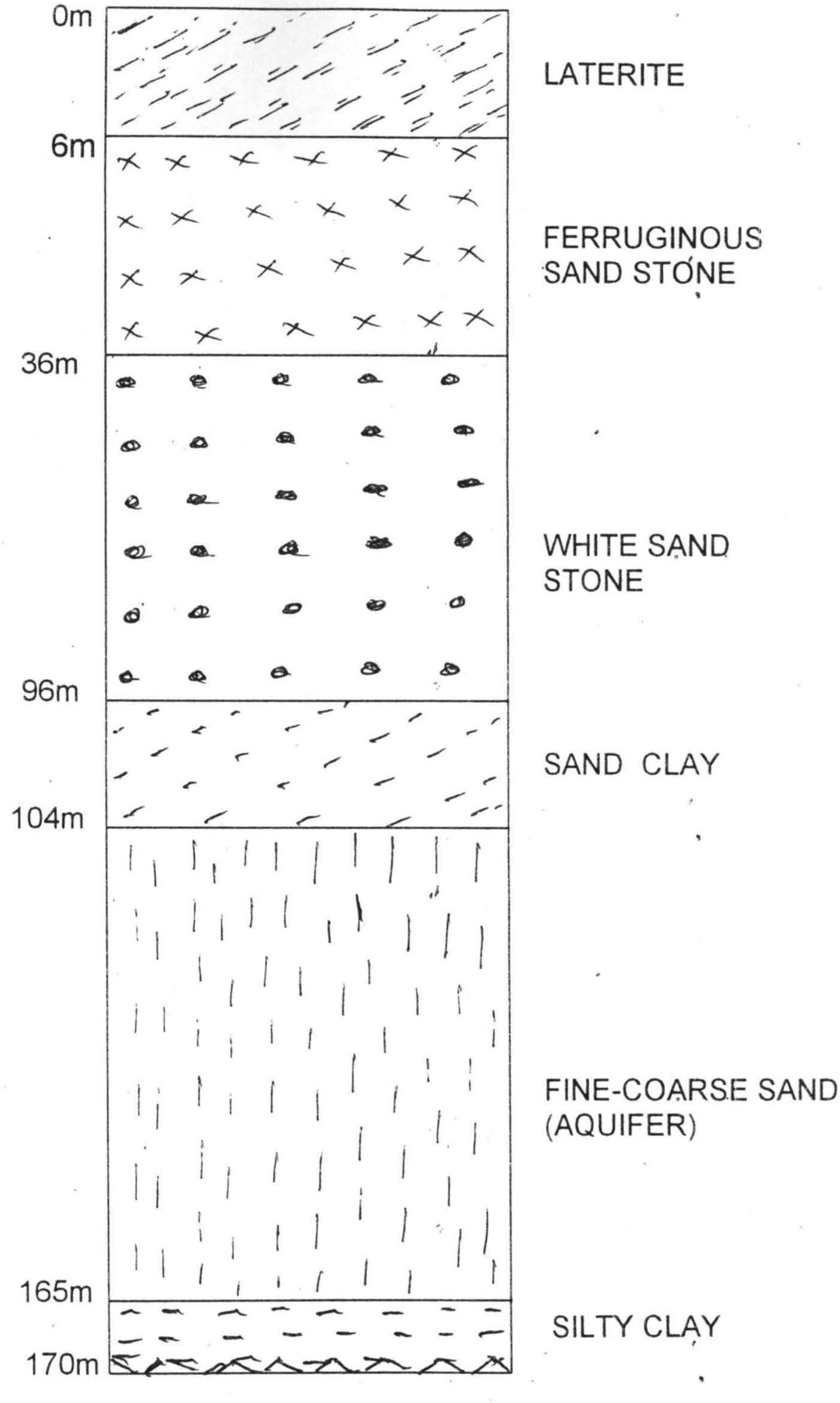


Fig. 7

FIG. 7: SHOWS LITOLOGICAL PROFILE OF UDABA DEKINA

Source: Kogi State Geological survey department ministry of land and survey lokoja.

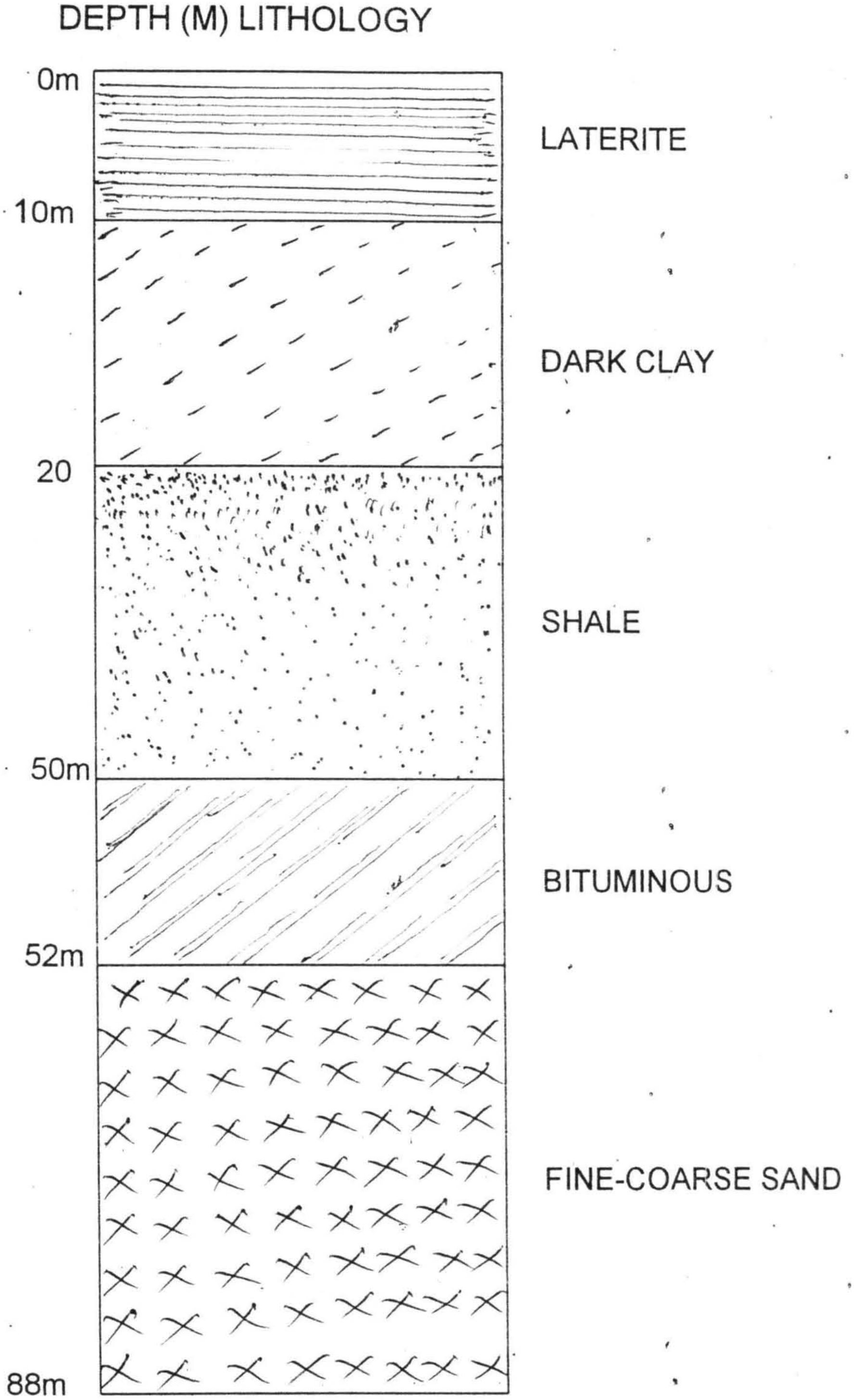


Fig. 8

FIG. 8: SHOWS LITHOLOGICAL PROFILE OF OLOWA DEKINA

Source Kogi State Geological Survey Department ministry of Land and Survey Lokoja

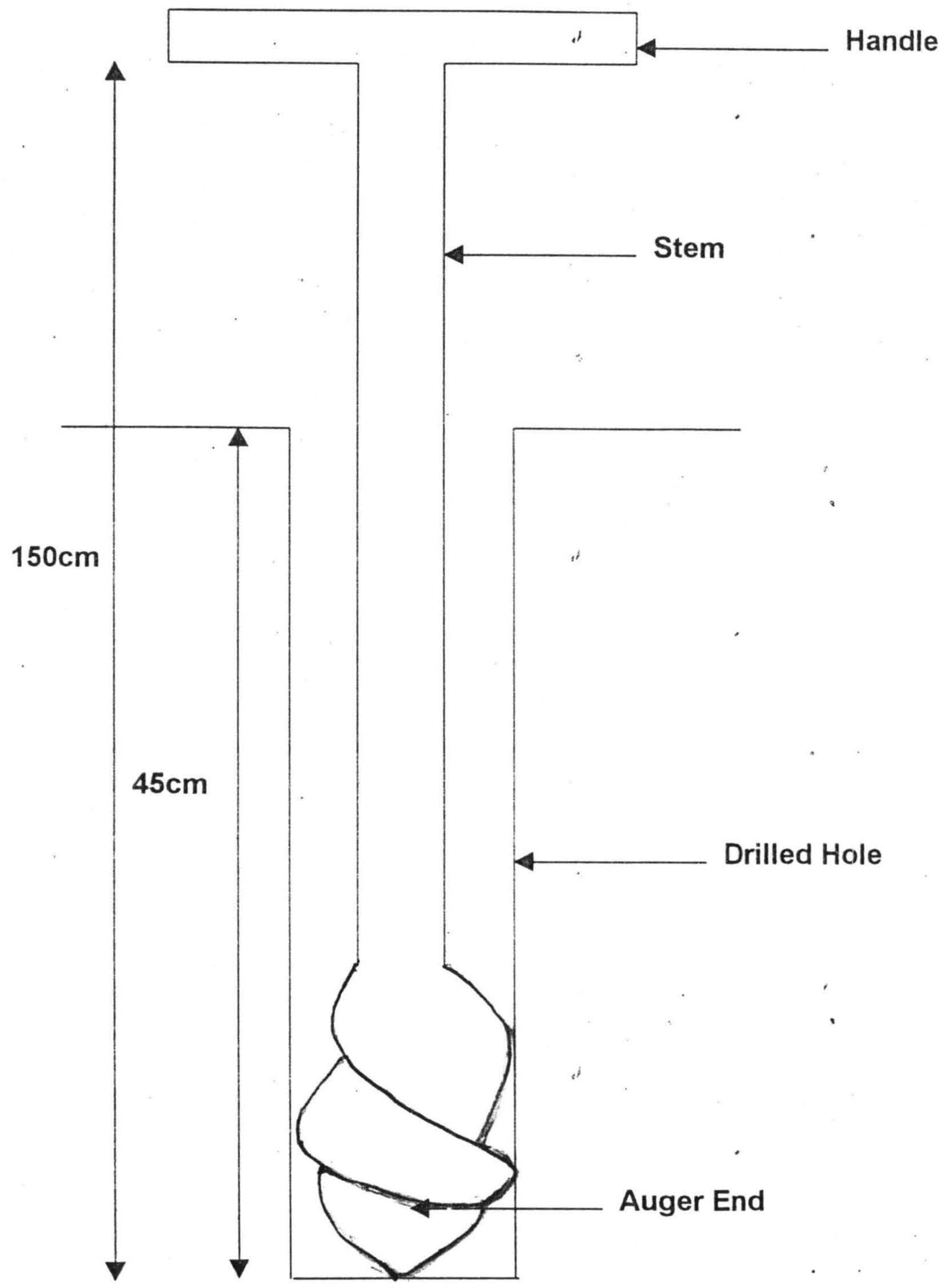


Fig. 9 HAND DRIVEN AUGER USE TO DRILL SOIL SAMPLES

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATION

5.1.0 CONCLUSION

After surveying the study area it was discovered that the depth at which the bore-hole have to be drilled to get the desired quality and quantity of water in the study area is between 60m and 150m deep.

This could be used as guide line for any driller coming to drill a bore hole in the area.

The soil sample collected from the field were taken to laboratory for moisture content determination. This was done, the bulk density and porosity were computed.

The climatological data to get the rainfall between 1984 to 2000, were collected from Agric Development Project Ayangba in Dekina Local Government Area.

The soil profile of the area was collected from state geological department.

2 litres sample of water was collected from existing bore hole and taken to Lokoja Kogi State Water board lab to test for quality and quantity of water.

5.2.0 RECOMMENDATION

There is need to always carry out Geo-physical survey before embacking on any bore hole drilling project as this help to prevent waste of time, money and resources.

The investigation has shown that one has to drill between 60m to 150m deep to be able to get the needed water for the community.

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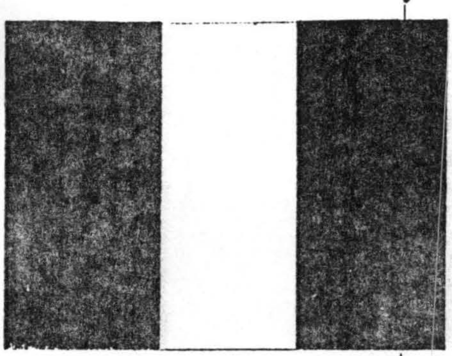
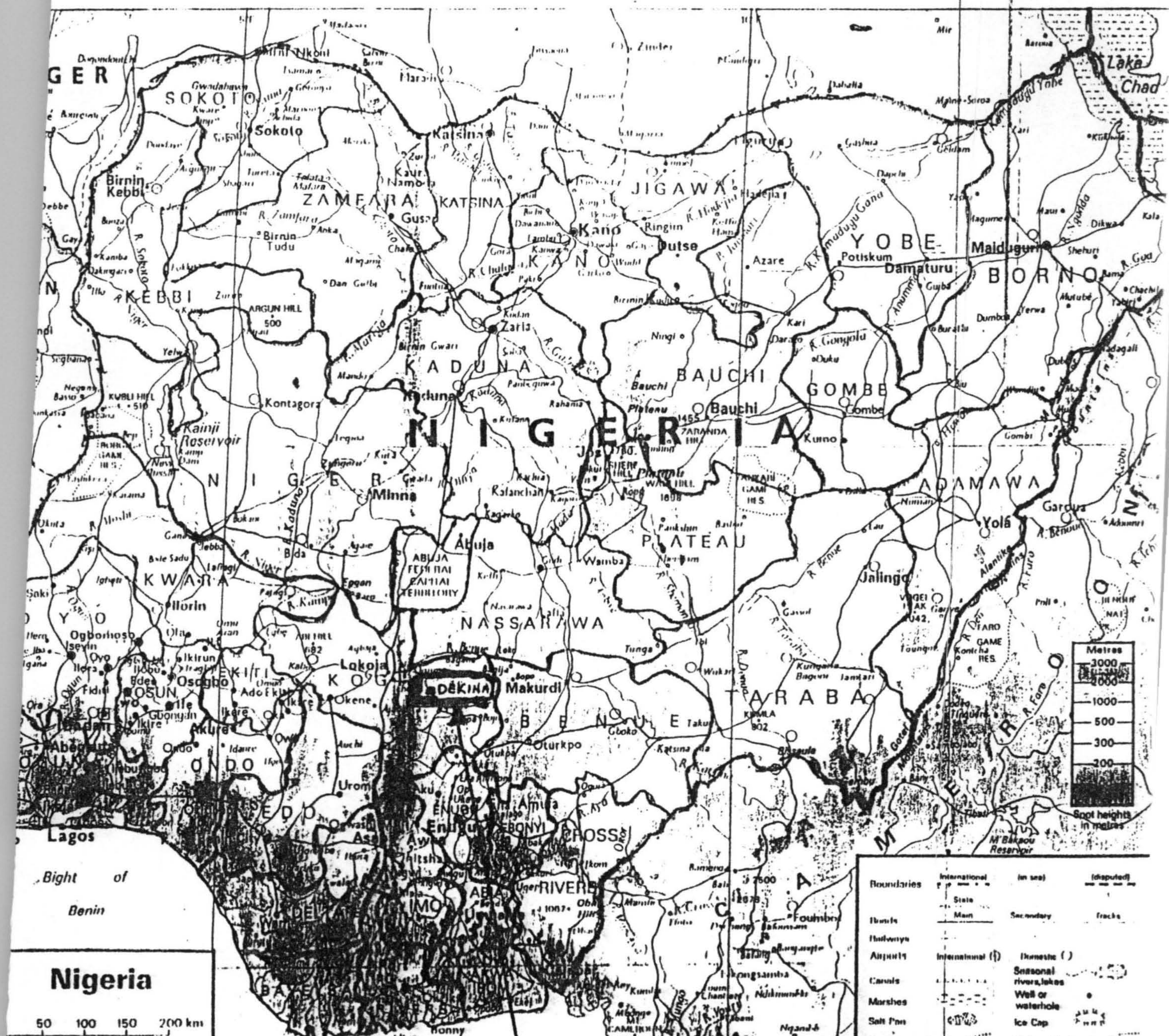
MAP OF NIGERIA

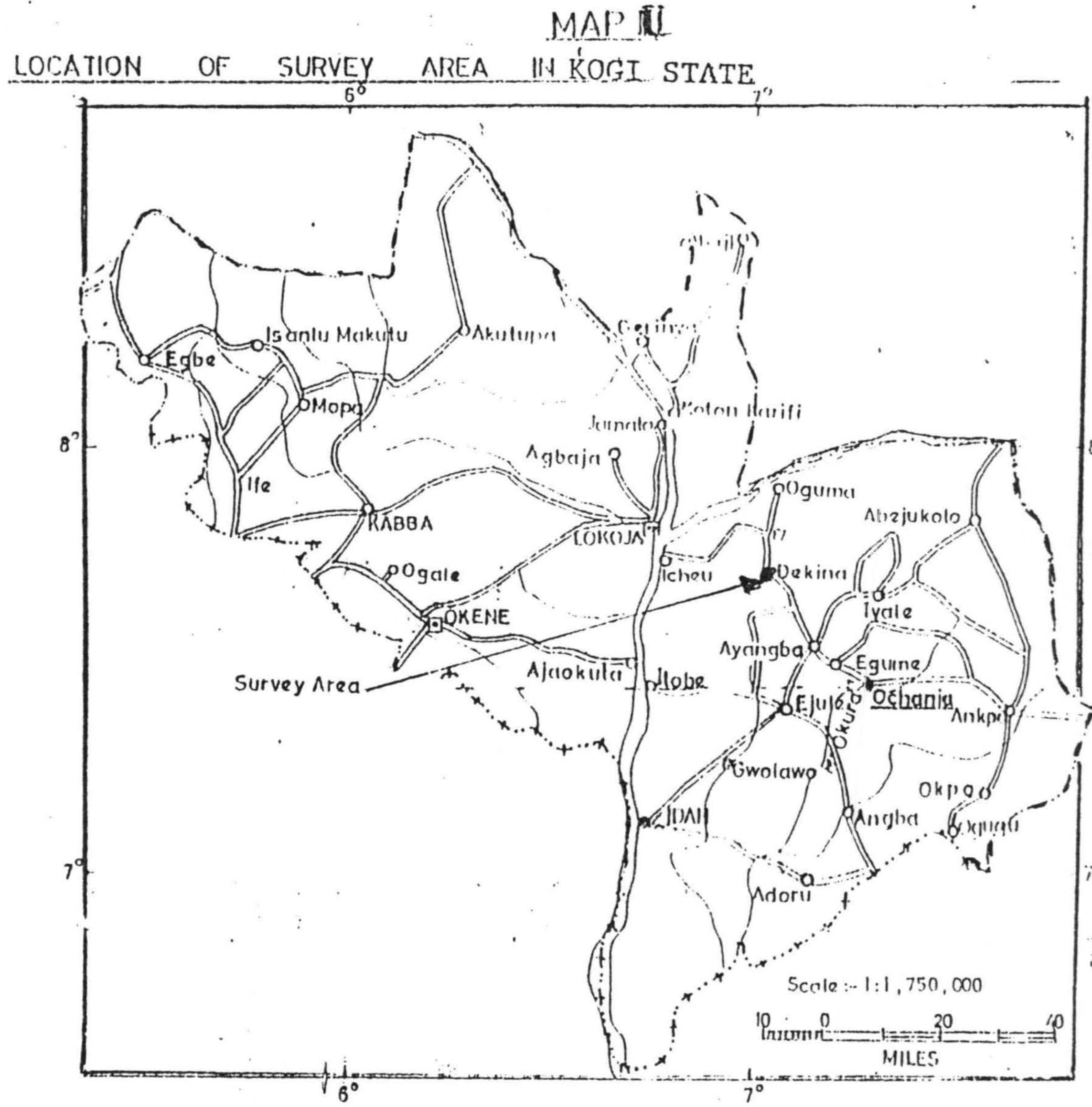
36 States and the
Federal Capital Territory.





SURVEY AREA

APPENDIX A2


MAP II
LOCATION OF SURVEY AREA IN KOGI STATE
6°
7°
8°
Isanlu Makutu
Akutupa
Egbe
Mopa
Ife
KABBA
Agbaja
Oguma
Abejukolo
LOKOJA
Icheu
Dekina
Ogale
OKENE
Iyale
Ayangba
Egume
Survey Area
Ajaokuta
Itobe
Ejule
Ochanja
Ankpa
Gwolawo
Okpo
Angba
IDAH
Adoru
Scale :- 1:1,750,000
10
0
20
40
MILES

APPENDIX A3

MAP III

MAP OF DEKINA LOCAL GOVERNMENT AREA
(KOGI STATE)