Rural Water Supply Network

Cost-effective Boreholes (CEB) Flagship

Cost-Effective Boreholes in Nigeria No.1

The Drilling Environment and Establishing a Drillers Association in Nigeria

Summary Report

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Executive Summary

The Rural Water Supply Network (RWSN) is committed to extending and improving access to sustainable rural water supply in sub-Saharan Africa. The Cost-Effective Boreholes (CEB) flagship of RWSN aims for policies to be adopted and practices followed, which bring about cost effective borehole provision in Africa. A key aspect of this is developing and strengthening the private sector drilling industry.

RWSN, with support from the Water and Sanitation Programme of the World Bank (WSP-AF) is supporting the formation of a Nigerian Drillers Association. This report provides an overview of the Nigerian drilling environment and sets out the first stage of the process of establishing the association. The work, which was undertaken between July and October 2007, comprised extensive discussions with a wide range of stakeholders, a literature review and workshop to agree on the name, objectives and way forward for a Nigerian Drillers Association.

Nigeria has a population of 140 million people, of which about 50% live in rural areas. It occupies an area of 924,000 km^2 and comprises 36 States and 774 Local Governments. Crude oil accounts for 95% of foreign exchange earnings. According to the UNDP Human Development Report 2006, Nigeria is rated 159^{th} out of 177 countries in the Human Development Index. The Gross Domestic Product per capita is $1,154; life expectancy is 43.4 years and adult literacy 67%. According to the UNICEF's 2006 Report Card on Water and Sanitation, 48% of the population have access to improved drinking water sources and improved sanitation is 44%.

The relief in Nigeria varies from the lowlands, from less than 5m above sea level (asl) to the high plateau of 300m asl. The climate is tropical and characterised by a rainy and dry season. Vegetation follows rainfall patterns and consists of savannah grasslands, high forests, freshwater swamps and mangroves. The rock types in Nigeria can be divided into the three broad groups: of basement complex rocks (which incorporate many isolated minor aquifers where weathered); consolidated sediments (containing only minor aquifers); and unconsolidated sediments (which constitute viable aquifers in the sandy horizons).

Prior to colonisation and up to independence, most groundwater abstraction was from unlined hand dug wells. In 1947, a cable tool rig constructed the first rural boreholes. The first major drilling programme was undertaken between 1956 and 1962. Several foreign drilling operators entered the country from independence in 1960 right through the Water and Sanitation Decade. The Nigerian economy went into recession in the mid-1980s, and although many expatriate firms found it difficult to operate, there was already a crop of trained Nigerian drillers in place. There have been 14 key water supply initiatives since the establishment of several institutions to manage the water resources of Nigeria in 1976/77. It is estimated that there are currently 1,000 borehole-drilling companies in the country, 300 of which have already been incorporated into a preliminary drillers' database.

Borehole drillers in Nigeria face numerous constraints including third party involvement in drilling contracts, small contract packages, long distances between contract locations, lack of credit facilities, difficulty in obtaining spares and consumables, clients not following contract procedure, poor access and problems with geophysical surveys. Although a study carried out in 1989 recommended that the most sensible approach to strengthen the drilling industry is the establishment of a drilling association there was no response to this call.

Extensive discussions with stakeholders and a workshop held in August 2007 have led to an agreement to establish a Nigerian Drillers Association. Objectives have been defined, the process of registration is ongoing and an inauguration committee has been established. It is planned to hold an inauguration meeting in early 2008.

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List of Abbreviations

ADP	Agricultural Development Programme
CAC	Corporate Affairs Commission
CEB	Cost Effective Boreholes
COMEG	Council of Mining Engineers and Geoscientists
DFID	Department for International Development
DFRRI	Department for Food, Roads and Rural Infrastructure
EEC	European Economic Community
ESA	External Support Agencies
FGN	Federal Government Nigeria
FMOH	Federal Ministry of Health
GSN	Geological Survey of Nigeria
HT	Hand pump Technology
JICA	Japan International Cooperation Agency
LGA	Local Government Authority
NAH	Nigerian Association of Hydrogeologist
NEEDS	National Economic Empowerment Development Strategy
NIWASA	Nigeria Water and Sanitation Association
NMGS	Nigeria Mining and Geosciences Society
O&M	Operation and Maintenance
OPEC	Organisation of Petroleum Exporting Countries
RWSN	Rural Water Supply Network
SH	Sustainable hand pumps
SS	Self Supply
TOR	Terms of Reference
UNICEF	United Nations Children's Fund
WSP	Water and Sanitation Programme of the World Bank

1 Introduction

The Rural Water Supply Network (RWSN) is committed to extending and improving access to sustainable rural water supply in sub-Saharan Africa. It is estimated that about 35,000 boreholes per annum need to be drilled in sub-Saharan Africa to meet the Millennium Development Goals for water supply. For full coverage by 2050, inclusive of the demand for industrial supply and irrigation about 50,000 boreholes per annum are required[1]. This poses a great challenge to the drilling sector in Africa and there is urgent need for reliable and cost effective drilling services.

The Cost-Effective Boreholes (CEB) flagship of RWSN is aimed at policies be adopted and practices followed, which bring about cost effective borehole provision in Africa. Developing and strengthening the private sector drilling industry is a key aspect of the CEB flagship.

In order to develop and strengthen the drilling industry in Nigeria, RWSN, with support from the Water and Sanitation Programme (WSP) of the World Bank has facilitated a brief study of the drilling environment and is assisting in the formation of a drillers association in Nigeria. The immediate objective of the assignment was to facilitate the establishment of the drillers association in Nigeria. The intention is that within 5 to 10 years the association would have set up professional standards and quality assurance procedures to enable drillers to work in a professional manner and enable contractors to access and utilise cost-effective drilling equipment.

This report provides an overview of the Nigerian drilling environment, summarises the experience of borehole drilling in Nigeria and provides the formation process and status of the Nigerian Drillers Association.

Dotun Adekile, a Nigerian consultant and member of the RWSN working group on Cost-Effective Boreholes, undertook the work summarised in this report between June and October 2007. The methodology comprised an extensive literature review, interviews and discussions with a cross-section of over 50 stakeholders (drilling contractors, rig manufacture representatives, associations, Government, donors and relevant institutions in the six states of Kano, Plateau, Oyo, Lagos, Rivers and Kaduna as well as Federal Capital Abuja, and a one day workshop attended by 38 key stakeholders in water well drilling in Nigeria.

From the outset there was great enthusiasm for the proposed association amongst the people interviewed and the consensus was that it was long overdue.

2 The Nigerian Drilling Environment

2.1 Political and administrative structure

Nigeria became a nation in 1914 with the amalgamation of the protectorates of southern and northern Nigeria by the British colonial government, which previously had been administered as two different entities. It gained independence in 1960.

The country occupies an area of 924,000 km2 between latitudes $4^{o}1'$ N and $13^{o}9'$ N and longitudes 2^{o} 2' E and 14^{o} 30' E. It shares borders with 4 countries: the Republic of Niger to the

[1] Based on Joint Monitoring Programme (JMP 2004) data on 412 million people served in 2004: MDG of 701 million people served in 2015 and full coverage of 1625 million served. Assumption made that 37.5% of people served with a hand pump (300 people per pump) and 12.5% will be served with a mechanized borehole (2000 people per system). Assuming 3% of existing boreholes per year have to be re-drilled annually.

north, the Republics of Chad and Cameroon to the east and Benin Republic to the west. The country is bounded to the south by the Atlantic Ocean and a coastline. which measures approximately 800 km.

Figure 1 Map of Nigeria showing the 36 states and Abuja (Federal Capital Territory)

At independence the country adopted a federal constitution and a 3-tier Government structure i.e. Federal, State and Local Government. There are presently 36 States and 774 Local Governments constituting the federation, with 250 ethnic groups. Figure 1 shows the 36 states of the country. According to the 2006 census figures the population of the country is 140 million. Approximately half of the population live in rural areas (FMWR 2004).

2.2 Socio economic indicators

Crude oil accounts for 95% of the foreign exchange earnings of the country. Nigeria has an estimated proven reserve of 32 billion barrels of crude oil and is the 6th largest producer in OPEC. In spite of the huge earnings from the sale of the crude oil the country remains essentially poor with inadequate infrastructure. According to the UNDP Human Development Report 2006 the country is rated 159th out of 177 countries on the human development index. The Gross Domestic Product per capita is $1,154 whilst life expectancy is put at 43.4 years and adult literacy is 67%.

The main economic activities in the rural areas are agriculture and livestock rearing with about two thirds of the population engaged in small-holdings. Rural communities in the context of water and sanitation sector in Nigeria have a population of less than 5000 and usually do not

have electricity, piped water or tarred roads. The national standard for water consumption in the rural areas is 30 litres per day per person (FMWR, 2004).

According to the Report Card on Water and Sanitation (UNICEF, 2006), coverage of improved drinking water sources is 48% and access to improved sanitation is put at 44%.

The inadequacy of water supply and improved sanitation and services is manifested in the prevalence of water and sanitation related diseases. Diarrhoea is the second cause of infant mortality after malaria and the third cause of under-five mortality. The prevalence of diarrhoea is higher in the rural than urban areas and in the northern zones than in the southern. An estimated 150,000 to 200,000 diarrhoea related deaths occur among children below 5 annually (FMWR, 2004).

The National Economic Empowerment and Development Strategy (NEEDS), Nigeria's poverty reduction strategy paper, recognises that water supply and sanitation are central to many aspects of human development – health, education, urban and rural development. The National Water Supply and Sanitation Programme proposes a strategy for the water supply and sanitation sector in four sub sectors; urban, small towns, rural areas, and water resources management. For rural areas government's focus is on increasing the water supply coverage to 60% by 2007 with a three pronged approach of rehabilitation, expansion and construction of low cost rural water schemes. The strategy includes sharing of ownership and management by communities and Local Governments with the communities taking charge of ownership (NEEDS, 2005).

2.3 Physical terrain

2.3.1 Relief

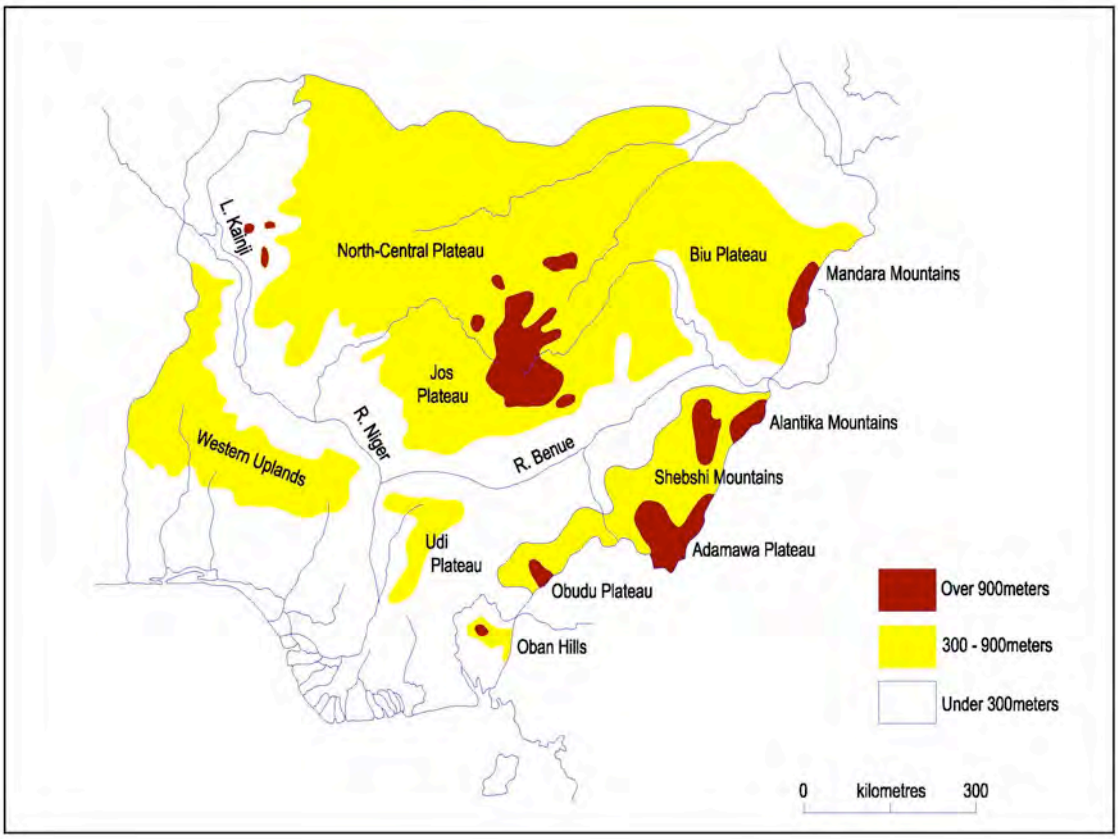
The relief of the country consists of the high plateaux where the land is generally over 300 m above sea level, and the lowlands, which can be less than 5 m above sea level in the coastal areas (figure 2). The highlands are dissected into three blocks by the three trunks of the Niger-Benue river system:

- the Central Plateaux in the north
- the Eastern and North eastern highland in the east
- the Western uplands in the west

The lowlands lie in the basins of the major rivers and are classified as follows

- the Sokoto plains in the north west
- the Niger-Benue trough in the middle belt
- the Chad basin in the north east
- the Central Lowlands of western Nigeria
- the Lowlands of Cross River Plain in south eastern Nigeria
- the Coastal margins and swamps which lie adjacent to the sea

Figure 2 Relief Map of Nigeria (Iloeje, 1996)



2.3.2 Climate

The climate is tropical with two distinct seasons – the rainy season from around April to October and the dry season from November to March. The rainfall is controlled by the latitudinal pressure belts which generate the southwest and northeast trade winds. The zone of convergence where the two meet moves north and south depending on which trade wind gains ground on the other. The location of the zone determines the climate of the region.

The country is divided into three climatic zones

- the Sahel region in the north (on the southern fringes of the Sahara Desert),
- the Savannah in the middle belt
- the Tropical rain forest in the south.

The zone of convergence of the southwest and northwest trade winds marks the approximate boundary of the Tropical rain forest and the Sahel region and the Savannah represents the transition zone between the two extremes.

The Sahel is characterised by a mean annual rainfall of 75 mm and rainy days of 60-40 northwards. The Savannah has a mean annual rainfall of 1000-1250 mm with rainy days of 80-60 days northwards. In the Tropical rain forest the mean annual rainfall is 1250 mm to over 4000 mm and the number of rainy days is 80-120 southwards (Offodile, 2002:422).

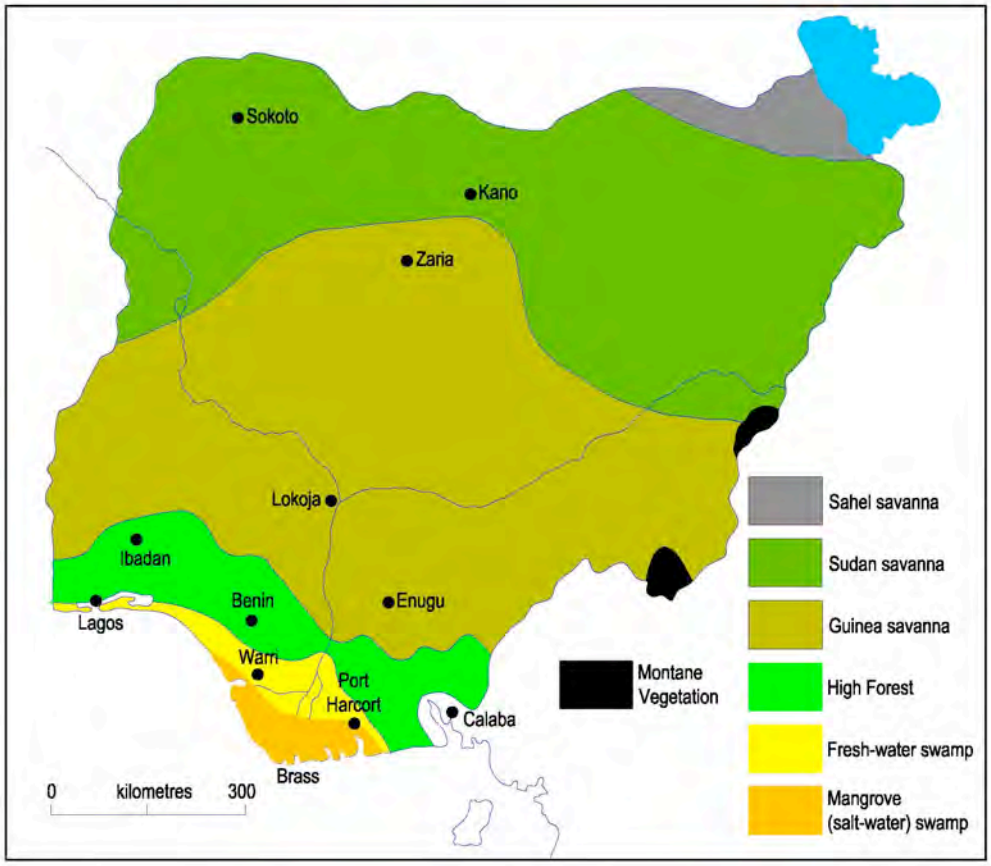
A rainfall deficit occurs approximately every 10 years in the West African sub region and resulted in the drought of 1973 which devastated most of northern Nigeria. It re-occurred to some extent between 1983 and1985 (Hazell and Barker, 1995).

2.3.3 Vegetation

The vegetation follows the rainfall pattern. It consists of the Sahel savannah grassland in the arid north, which consists of short grass, 0.5 -1.0m high interspersed with sand dunes.

The Sudan Savannah occupies most of northern Nigeria in places where the rainfall is between 65 mm and 1000 mm and consists of grassland, 1.5 to 2 m high interspersed with some stunted trees (See figure 3).

Figure 3 Vegetation Map of Nigeria (Iloeje 1996)



The Guinea savanna is the broadest vegetation zone in Nigeria and occupies half of its area. It occupies the areas where the rainfall is between 1000 and 1500 mm per annum. It consists of tall grasses and some trees, which gives it the appearance of a park and for this reason is some times referred to as parkland savanna.

The Tropical rain forest comprises the swamps of the coastal strip where the soil is permanently water logged and the vegetation consists of a tangled mass of mangrove plants and the high forest area where the top canopy can be as high as 60 m.

2.3.4 Drainage

The relief influences the drainage pattern. The rivers in southern Nigeria are arranged in almost parallel north-south direction because the land slopes to the south whilst the rivers in the north radiate from the Central Plateau and flow in all directions. There are five major hydrological basins – the Niger, Benue, Chad, Cross River and South Atlantic drainage basins.

The Niger rises on the Futa Jalon Plateau in Guinea, and traces its course at first northwards to Mali before turning southwards into Niger and Nigeria and emptying into the Atlantic Ocean.

The Benue is a tributary of the Niger and like the latter rises outside the country in the Cameroon highlands and flows southwest to empty into the Niger at Lokoja. It is navigable almost through its entire course in the country.

Five rivers flow into Lake Chad, three of which are in Nigeria – the Yedseram, Yobe and Hadejia. Lake Chad occupies an area of about 10,000 square kilometres but is rather shallow, usually not more than 1.2 m in the dry season. This is because the rivers that feed it are also shallow and flow sluggishly in arid, sandy country and thus lose much of their water by percolation and evaporation. The lake itself is on the fringe of the Sahara Desert and much of its surface is exposed to the sun so that water is lost from it by evaporation, percolation and sand encroachment. It is feared that the lake will eventually dry up.

The rivers of the Southern Atlantic drainage basin rise from the edge of the plateau and flow southwards in the direction of the slope of the sea. In western Nigeria this plateau edge is represented by the southern margin of the basement complex rocks which outcrop at the Western Uplands. In the east it is the crest of the Udi Plateau.

The Cross river also rises outside the country in Cameroon descending 1200 m over a stretch of 30 to 60 km to enter Nigeria at Ikom from where it flows in a low gradient into the Atlantic. It is separated from the South Atlantic Drainage Basin by the crest of the Udi Plateau

2.4 Geology

The geology of the country spans the Precambrian, Palaeozoic, Mesozoic, Tertiary and Quaternary times (see figure 4).

The rock types can be divided into three broad groups as set out below.

Basement Complex Rocks are mainly granitic in composition and in different stages of metamorphism. They are found in the higher parts of Nigeria. They comprise Precambrian gneisses, migmatites, schists, phyllites and quartzites. There are also Older and Younger Granites. The Younger Granites are intrusive masses, confined mainly to the Jos Plateau area whilst the older granites are batholitic and are disperse.

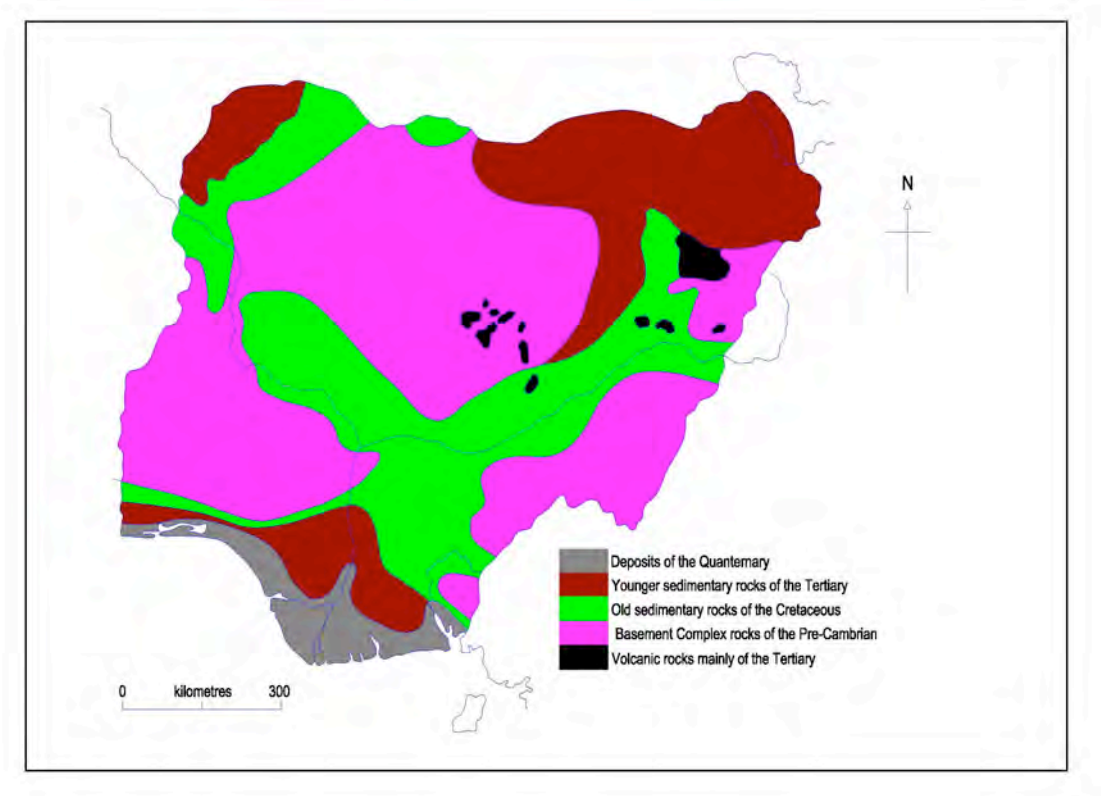
The Basement Complex also includes metasediments and volcanic rocks of different ages. About 55 % of the country is underlain by the Basement Complex. This includes the entire area of Kaduna, Kano, Katsina, Bauchi, Plateau, Oyo, Oshun and Ekiti States and parts of Zamfara, Adamawa and Kwara and Taraba States.

Consolidated sediments were laid down in Cretaceous seas. They comprise limestones, shales, sandstones and mudstones. They are usually gently inclined, locally fractured and gently folded. They cover about 20% of the country. This includes most of Sokoto State, the northern parts of Katsina State, the Niger-Benue trough and the south eastern parts of the country.

Unconsolidated sediments are mainly loose sands and clays deposited in the Tertiary. They occupy about 25% of the country and are to be found in Sokoto, Borno, Yobe, Jigawa States

and most of southern Nigeria. The unconsolidated sediments also include the Quaternary deposits laid down along the floodplains and deltas of rivers and the wind blown sediments of northern Nigeria.

Figure 4 Geology of Nigeria (Iloeje, 1996)



2.5 Groundwater

2.5.1 Occurrence

Nigeria has a long history of ground water studies. Raeburn and Jones published the results of the first regional hydrogeological studies in the country in 1934 in their account of The Geology and Water Supply of the Chad Basin (GSN Bulletin 15). Some of the earlier works include

- Geology and Hydrology of Gombe by J.H. Thompson (1956). Records of the Geological Survey of Nigeria
- Pressure water in Chad Formation of Borno and Dikwa Emirates by W. Barber (1965). Geological Survey of Nigeria Bulletin No. 35
- The Distribution and Chemical Quality of Groundwater in Northern Nigeria by J.W. du Preeze and W. Barber (1965). Geological Survey of Nigeria Bulletin No. 36
- Groundwater in the Eastern Region of Nigeria by J.R.T. Hazell (1960). Geological Survey Report 5198
- Groundwater Resources of Western Nigeria by J.D. Carter (Undated). Geological Report 1185

- Aquifers in the Sokoto Basin, North Western Nigeria with a Description of the General Hydrogeology of the Region by Henry R. Anderson and William Ogilbee (1973). Geological Survey Water Supply Paper 1757

These, and others are listed in the Reference list and Bibliography.

Recent accounts are mainly consultancy reports reviewing state or local hydrogeology for various projects. The reports of the drilling accounts of several World Bank funded Agricultural Development Programme (ADP) rural water supply projects provide a lot information on the ground water resources of the project areas. The ADP projects which were carried out in present day Bauchi, Gombe, Jigawa, Kaduna, Kano, Katsina, Kebbi, Kwara, Sokoto and Zamfara probably generated logs of about 8000 boreholes. Also the consultants' reports of the investigation of the irrigation potential of shallow alluvial aquifers in most of the northern states for the ADPs provide excellent information on the ground water resources of the floodplains.

Matthew Offodile in Ground Water Study and Development in Nigeria, first published in 1992, revised in 2002 attempted a synthesis of existing knowledge on the ground water resources of the country. He recognised the interplay between rainfall, climate and geology and described the ground water resources of the country according to the river basins. He highlighted the recurring droughts and the southward movement of the Sahel and its effects on ground water recharge. He attributed the phenomenon to the global climate change. He also discussed the issues of poor quality ground water, contamination and over abstraction in some parts of the country.

The crystalline Basement Complex rocks in the fresh state possess no primary inter-granular porosity and therefore do not hold water but where weathered or fractured they incorporate many isolated minor aquifers. Much of the weathered mantle, which developed in the Tertiary has survived to present times and in areas of fracturing where the mantle is thicker than average there is sufficient storage for domestic and rural community requirements. The aquifers are very often the only source of water close to rural settlements but have to be located using a combination of remote sensing, geological analysis and geophysical survey.

In most cases during exploration, sites for successful boreholes are located within reach of the nominated villages. Depth of drilling hardly exceeds 60 m. Borehole yield is of the order of 1 m^3/hour and a hand pump will provide a basic supply for about 300 people. Thousands of boreholes have been drilled in the country to provide rural water supply from the aquifers.

The consolidated sediments contain only minor aquifers. As a result of repeated episodes of folding the rocks have been compacted and cemented and all primary porosity lost. Ground water is stored in fractures and in the weathered mantle overlying the rocks. Due to the small particle size of the weathering product the permeability is limited. Borehole yields are in the range 0.5 to 1.2 m^3/hour and borehole depth of about 10 - 60 m. Exploration of the aquifers is similar to that on the basement complex.

The sandy horizons of the **unconsolidated sediments** constitute viable aquifers, usually confined and have been exploited by borehole sources for industrial, municipal and private water supply for more than half a century in the major population centres of Lagos, Benin, Port Harcourt, Maiduguri and Sokoto. Where the water level and the sands occur at reasonable depths they have been utilised for hand pump supplies.

In the Lagos area there are two major aquifers systems, the Tertiary Coastal Plains Sands aquifers and the Cretaceous Abeokuta Formation aquifers. The former is encountered at about 60-100 m depth and the yield is of the order of 50-100 m^3/hr. The Coastal Plains Sands Formation stretches across the southern part of the country from the west to the east. The Abeokuta Formation is encountered at a depth of about 800 m in the Lagos area. It constitutes a prolific aquifer and yield of the order 300m^3/ hour are possible but the great depth at which it

occurs, means it is only utilised by the big industries. The water also tends to be hot, about $80^{O}C$.

2.5.2 Ground water quality

The quality of the ground water in the country is generally good. Only in some areas are iron, nitrate and fluoride concentration above WHO standards. In about 20% of the country the ground water has low pH (<6.5) and the water is very corrosive which affects the choice of borehole lining material. In about 40% of the country the water is moderately corrosive with pH of 6.5-6.8 and in the remaining 40% of Nigeria the pH is higher and the water is not corrosive (FMWR, 2004).

The ground water in some areas underlain by the consolidated sediments of the Benue trough tends to be high in dissolved solids. Around Awe and Keana in Nassarawa State and in Abakaliki in Ebonyi State the ground water is saline rendering it unusable. Also most of the shallow aquifers of the coastal belt are prone to saline invasion from sea water.

2.5.3 Ground water mining

Cases of ground water mining caused by over-abstraction have been reported in Lagos and Maiduguri. Table 1 shows the different rates of decline measured by several workers in the Lagos area. The water level decline has not resulted in the dewatering of the aquifer and it remains confined. It however created flow reversals leading to saline intrusion into boreholes at the coast (Parkman Consultants, 1996). Ground water level measurements carried out by the author in 2006 in the Ikeja area of Lagos indicated that the water level was the same as recorded in 1996.

In Maiduguri, several of the artesian boreholes in the Chad Formation aquifers have lost their head and are no more free-flowing. It has been suggested that the aquifers have no recharge routes and more exploitation will lead to further decline of the water level.

Table 1 Estimated lowering of ground water levels

Source	Estimated lowering of ground water level
Kampsax – Kruger	Between 1970 and 1975 decline = 1-1.5 m in Ilupeju and Ikeja predominantly from industrial abstraction. 230 boreholes in operation
Onwuka and Adekile	By 1986 annual decline of 2.2, 2.0 and 1.6 m in Ikeja, Agege and Iganmu
Scanwater	By 1978 reported annual decline of 2 m since 1967 in Agege
Coode Blizzard	By 1996 GWL stabilisation in Ikeja and Isolo with <25% public supply boreholes functioning and most factories operating at <50% capacity

3 Experience of Borehole Drilling in Nigeria

3.1 The Early Years

Prior to colonisation and up to independence most of the ground water abstraction was from unlined hand dug wells. Between 1930 and 1933 the Geological Survey of Nigeria experimented and perfected the 1.2 m diameter lined dug well which became the standard for Anglophone and Francophone West Africa.

In 1947 the Public Works Department took over the construction of rural water supplies. A cable tool rig was purchased and the first rural boreholes were constructed. Rotary water drilling by a contractor, Balakhany Chad, a British company began in 1951 mainly for townships. The first major water supply drilling programme was between 1956 and 1962 when 280 boreholes were drilled in the north-eastern part of the country to explore the artesian aquifers of the Chad basin. Government drillers and Balakhany Chad carried out the drilling. Balakhany Chad dominated the sector for several years with some competition from another British company, George Stow and an Israeli Company, Nigeria Water Resources and Engineering Company. Between independence and the beginning of the Water and Sanitation Decade in 1980 several other operators came into the country from Italy, Germany, Britain and Greece.

During the Water and Sanitation Decade others came in from China, Japan and Canada through the international competitive bidding of the World Bank supported ADPs. Through the ADPs about 8000 boreholes fitted with hand pumps were drilled in the northern parts of the country. All the companies employed and trained Nigerians as rig operators, mechanics, welders and drivers. The FGN/UNICEF Water and Environmental Sanitation Programme also assisted some state governments with geophysical and drilling equipment. Thus in the mid 80s when the Nigerian economy went into a recession and the expatriate drilling firms found it difficult to operate and had to close down, there was already a crop of trained Nigerian drillers. Some of the companies left their equipment on lease to their local employees. Some of the employees who were laid off set up their own companies such that by 1996 when the government embarked on another large scale borehole drilling programme under the Petroleum Trust Fund, 800 prequalification applications were received from which 167 contractors were appointed. Only 3 were foreign companies.

3.2 The Water and Sanitation Decade Onwards

The drought of the early seventies prompted the Federal Government to set up several institutions to manage the water resources of the country. These institutions include the Federal Ministry of Water Resources 1976, the River Basin Development Authorities (RBDA) 1976, and the National Water Resources Institute (NWRI) 1977. The Ministry has the responsibility to formulate policies and give advice. RBDAs have the responsibility for providing water for domestic use to the communities and for irrigation. The Institute has the responsibility for manpower training and research.

There have been 14 key water supply initiatives involving borehole drilling by the Federal Government and External Support Agencies since the establishment of the institutions. According to FMWR (2004) these are:

- National Borehole Programme
- Department of Food, Roads and Rural Infrastructure RUWATSAN Programme
- FGN/UNICEF Water and Environmental Sanitation Programme
- UNDP – World Bank Rusafiya Project
- Water Supply Projects of the Agricultural Development Programmes
- Drought Relief Water Supply Programme
- National Water Rehabilitation Project
- Federal Ministry of Health/UNICEF/ Fund-In-Trust (FIT) Water Supply and Sanitation Project
- European Economic Community Middle Belt Rural Water Supply Project

- Petroleum Trust Fund (PTF) Water Supply Project
- DFID Water and Sanitation Project in Benue State
- JICA intervention in some guinea worm endemic states
- Improved National Access to Water Supply and Sanitation
- The Federal Rural Water Supply Project

Apart from the interventions listed above, the various State and Local Governments have also been carrying out borehole drilling programs. Although ground water supply is used for public supply in some of the urban centres such as Port Harcourt, Calabar, Maiduguri, Yola and Lagos, a majority of the drilling programmes are for domestic and rural water supply.

At present the following public institutions are actively involved in the award of borehole contracts

- Federal Ministry of Water Resources
- The River Basin Development Authorities
- The State Water Boards
- State Ministries of Water Resources
- The Local Government Authorities (LGAs)
- UNICEF
- WaterAid
- Other NGOs and Faith Based Organisations such as the Roman Catholic Church and the Evangelical Church of West Africa
- The oil companies – Chevron Nigeria Limited, Shell Petroleum Development Corporation of Nigeria

A major problem plaguing the rural water supply sector is that there is hardly any coordination between the different levels and organs of Government carrying out drilling in Nigeria and there is no focused national rural water supply programme. This creates duplication and despite all the previous efforts, the country still records less than 50% access to safe water.

In the past, several public institutions had their own drilling equipment and carried out their drilling programs but most of these rigs were badly maintained and vandalised and the practice discontinued. They also suffered from constraints imposed by conforming to civil service conditions. Adenle and Beale (1989) recommended the privatisation of the public drilling agencies. However because of their inadequacies most of the public drilling agencies eventually went defunct.

Nearly all the drilling in the country is presently being contracted out to the private sector. Thus with the large population to be served there is a demand for drilling contractors in Nigeria. Apart from opportunities provided by government programmes, there is also the demand from the private sector – industrialists, farmers, house-owners. However the drilling contractor is constrained by several factors (as outlined in section 3.7) and not able to operate at his utmost capacity.

3.3 Drilling Companies in Nigeria

The author estimates that there are up to 1000 drilling companies operating in the country. In Kano city alone they number over a hundred. In 1998 during the Petroleum Trust Fund

supported National Rural Water Supply Project about 800 prequalification applications were received for the drilling contracts. However the majority of the drilling companies do not have any equipment. Of the estimated 400 drilling companies in the country in the 1989 study, Adenle and Beale identified only 25 competent and committed local drilling companies. In the present exercise, the compilation of the drillers' directory had recorded about 300 drilling companies by September 2007 and was still continuing.

The drilling contractors can be classified into three categories:

- Organised drilling contractors with equipment and a management structure
- Artisan drillers engaged in manual drilling or using locally fabricated rigs
- Contractors with some interest in drilling but no equipment whatsoever

The equipment used by the organised drilling sector is of several makes and comes from all over the world (eg China, England, Germany, Japan, India, South Africa, USA, Thailand). In some cases the equipment is the one left behind in the 80s by the expatriate companies when they left, and is now old and breakdowns are frequent. With such a diversity of origin of equipment it is difficult for the local suppliers to stock spares to meet the different brands. Unfortunately only a handful of drilling companies have offshore backup. Thus, for the majority of companies, procurement of spares is difficult and repairs take a long time creating considerable idle time.

PVC casing and screen used in hand pump fitted boreholes are manufactured locally. Muntunci Pipes in Kaduna have a reputation for the quality of their products and are patronised by many of the organisations in the north. Steel casing and screens are imported by the oil industry and are also available for the water supply sector.

There are several hand pump manufacturers in the country but hand pumps are still being imported. Practitioners expressed the opinion that the imported pumps are cheaper and of better quality than the locally manufactured pumps. Submersible pumps are all imported but are readily available.

Drilling chemicals are also imported. Drillers complain that some of the chemicals are adulterated locally and the poor quality chemicals result in borehole collapse.

In many of the major cities there are welders and machinists fabricating augers and washboring equipment, which are used by the hand drillers. Some also fabricate drilling rigs which are mounted on small four wheel drive and pick up vehicles used for shallow well drilling.

3.4 Constraints facing the Nigerian driller

Apart from the constraints to the industry mentioned above, consultation with the drillers and discussion at the workshop enabled the following to be identified as some of the challenges facing the industry:

Third party involvement in drilling contracts: Contracts are often awarded to non-professional practitioners often as political patronage. The middle-men then subcontract to the drilling contractor. This lowers the profit margin and sometimes compromises technical standards.

Small Contract Packages: Drilling contracts are packaged as 1 or 2 boreholes. It is rare to find a contract of more than 10 boreholes. This makes planning and cash flow difficult. The drillers find it difficult to purchase spares and consumables in bulk. It also creates a lot of idle time between contracts and the whole industry does not benefit from the economies of scale.

However as would be seen in section 3.5 the trend is changing and bigger contract packages are being awarded.

Long distances between contract locations: As a result of the small contract packages, drillers have to travel long distances from one contract location to the other. For instance a driller mobilised from Kaduna to drill a single borehole in Yobe state, a distance of 500 km and then travelled another 600 km to Adamawa State to drill another borehole.

Lack of credit facility: Starting capital is usually from personal savings and loans from relatives. It is difficult for the smaller operators to get access to a loan facility from the bank.

Difficulty in obtaining spares and consumables: Getting consumables like hammer and bits when work is in progress is often difficult and frustrating. Having to import spares leads to idle time and with the fluctuating exchange rate profit is eroded.

In the north-eastern part of the country there is a perennial shortage of fuel and lubricants and price fluctuation could be as much as 20 times the official price. Clients often will not agree to a variation in contract price due to the fluctuation.

Clients not following contract procedure: Sometimes the contractor is asked to go beyond the scope of works without adequate compensation e.g. a borehole is designed to terminate at 60 m but the client insists on the contractor proceeding to 100 m depth without agreeing to a variation in price.

High turnover of personnel: It is difficult to retain trained personnel. There is a high turn over of staff with personnel looking for better employment and poaching from competitors.

As a result of the high turnover of staff the contractors find that they are continuously employing and training novices, a time consuming process. Most of them are not aware of the 3 month drilling program run by NWRI although the adequacy of the curriculum to meet the demand has to be determined.

Poor access: Because of the poor infrastructure in some of the rural areas, access to some drilling sites can be tortuous. A driller narrated how it took him 4 days to gain access to a site, 2 days to drill the borehole and 5 days to get back onto the nearest tarmac road.

Responsibility for geophysical survey: Unlike in the early days of drilling, particularly on the World Bank financed ADP rural water supply contracts when the client employed a specialist to carry out geophysics to site the boreholes, the present trend is to leave the responsibility of locating boreholes to the drilling contractor and he does not get paid for dry holes.

Geophysical and hydrogeological surveys are often inserted as item 1 on the drilling contract bill of quantities. Whereas the surveys should have been carried out prior to the drilling and the borehole designed based on the results.

3.5 Tendering Procedures and Costs

The cost of borehole provision in sub-Saharan Africa is higher than in other places. The current borehole pricing mechanism needs to be reviewed to see the possibilities for cost reduction and using the savings for a greater coverage. Examples of pricing mechanisms used in some institutions in Nigeria are provided below as a guide in the proposed drilling study.

Most of the public institutions i.e. FMWR, RBDAs, State Governments and UNICEF involved in the award of borehole drilling contracts tend to follow the same award procedure i.e.

- Prequalification of contractors
- Verification of prequalification submission

- Short-listing of contractors
- Submission and evaluation of tenders
- Contract award

Contracts in the Federal and State Ministries and RBDAs also undergo "due process" verification by the Ministry of Finance to ensure that the contracts are within budgetary provisions and are appropriately priced.

The different agencies however have different prices for the different categories of boreholes. For each contract an engineer's estimate is prepared which is based on the unit cost of supply of materials, equipment and labour with some percentage (30-45%) allowed for profit and overheads. Where tender prices are much higher than the engineer's estimate the client negotiates with the contractors to bring the price closer to the estimate. Prices of current borehole contracts awarded by FMWR, UNICEF and Kaduna State Government are provided Boxes 1, 2 and 3.

Preliminary analysis indicates that prices for a borehole fitted with a hand pump range considerably (US$ 4,700 to US $ 11,700). More information on completed well records, contract sums and borehole groupings is required to fully analyse these apparent differences.

Box 1 Federal Ministry of Water Resources (FMWR) Borehole Costs

FMWR is currently carrying out the drilling of 250 boreholes spread all over the country under the Federal Rural Water Supply and Sanitation Programme. The boreholes are of 5 designs and depth ranges depending on the geology and terrain. The price at which the contract is awarded based on the engineers estimate and the lowest bids received are shown below:

Type of borehole	Cost/borehole in US$
PVC lined, 60 m depth fitted with hand pump	11,700
Steel lined, 75 m depth fitted with motorised pump	61,560
Steel lined, 150 m depth fitted with motorised pump	83,280
Steel lined, 300 m depth fitted with motorised pump	112,421
Steel lined, 600 m depth fitted with motorised pump	197,656

The prices quoted are the agreed ceiling. There is a bill of quantities and the contractor is paid for actual measured quantities of work item. The government supplies the hand pumps. The prices for the motorised schemes are inclusive of drilling, pump, generator and overhead tank supply and installation.

Box 2 UNICEF/WaterAid Nigeria Borehole Costs

UNICEF drilling programmes are supported by funds from the EC and DFID. Contract tendering is carried out by the UNICEF field offices. In the past year UNICEF awarded contracts for 1200 boreholes and plan to do the same in 2007/2008. The boreholes are fitted with hand pumps except in school locations where they are fitted with solar power driven pumps. Pumps are supplied by UNICEF and installed by the contractor. Borehole contract price varies between $4700 and $5500. The contractor is not given any advance payment but paid on completion of each hole. Although this is much lower than the FMWR cost for boreholes of similar design, the Chief, Water, Sanitation and Hygiene section of UNICEF feels that the cost is still too high and will look at ways of reducing it. WaterAid are working in partnership UNICEF and they follow the same contract award procedure and pricing mechanism.

Box 3 Ministry of Water Resources, Kaduna State, Borehole Costs

Under the Kaduna State Economic Empowerment Programme the State Ministry has a 4-year rolling plan to drill 6000 rural water supply boreholes in the state starting from 2004. In the current year contracts have been awarded for 221 boreholes fitted with hand pumps. The boreholes are priced at $7420 per borehole inclusive of pump supply and installation

3.6 Insights into the Ten Elements of Cost Effective Borehole Provision

The 2005 RWSN Cost-Effective Boreholes Study in Ethiopia, identified ten elements that should be considered in order to assure cost-effective borehole provision (Table 2). Current practices in the Nigerial drilling sector are reviewed in line with these ten elements.

Table 2 Ten elements for Cost-effective Borehole Provision

1. Boreholes should be ***designed and constructed*** to fit their purpose in terms of diameter, depth, casing and screen.
2. Smaller and less costly ***rigs*** should be utilized to provide boreholes that are fit for their designed purpose.
3. Contracts should be ***packaged*** for multiple boreholes in close proximity and for boreholes with similar geology.
4. ***Knowledge of hydrogeology*** should be improved and appropriate ***siting*** practices utilized.
5. ***Test pumping*** requirements should be matched to borehole purpose while taking into account the importance of data to improve the understanding of hydrogeology and water resources.
6. High quality, timely construction ***supervision*** should be emphasized.
7. Rigorous evaluation of ***ground water resources*** should be undertaken and information made readily available.
8. ***O&M procedures*** to ensure the sustainability of pumped groundwater sources should be established
9. ***Private contractors should be supported*** regarding importation, local manufacture, taxation, workflow and to professionalize.
10. ***Communications networks*** should be improved and the ***management skills*** of public and private sectors enhanced.

3.6.1 Borehole design

The concept of designing boreholes to fit their purpose has generally been accepted. The various agencies design their boreholes to fit the terrain and the anticipated yield from the boreholes. As mentioned in section 4, FMWR have five different designs depending on the terrain and the expected yield. The Basement Complex boreholes are drilled to a maximum of 60 m (average is 35 m) and lined with 110 mm diameter PVC casing and screen and fitted with a hand pump. The others are steel lined to various depths depending on the knowledge of the aquifer depth horizon and the known yield.

3.6.2 Appropriate rigs

The concept of cost effective borehole provision by use of appropriate technology rigs is not new in the country. Water Surveys (Nigeria) Limited in their report of the Investigation of Shallow Aquifers for Lowland Irrigation in Bauchi State in 1986 recommended the use of light appropriate technology rigs to reduce the cost of borehole provision (Box 4). Subsequently several of the ADPs in northern Nigeria acquired such light rigs. In recent times also the Ingersoll Rand TH 60s which used to be very popular with drillers in the 80s are gradually giving way to smaller rigs such as the PAT 301, particularly amongst those working on the Basement Complex.

Box 4 A call for Appropriate Rigs

'It is often asked why boreholes are so expensive in Nigeria. One major factor is the high cost of rigs and the expertise needed to run them properly. Big sophisticated drilling rigs perform well in developed countries, where skilled personnel operate from near home and spare parts can be ordered by phone and fitted in hours. In such countries the half a million dollars invested can be recovered in a reasonable time.

Given a big contract and the need to complete it speedily, big rigs and expert drillers are appropriate to quick development programmes.

But in the long run continuity of borehole development, especially in the rural areas will be by local commercial contractors. We submit that for his type of modest, sustained operation, high tech rigs are a grievous and costly mistake and there are recent examples of contractors getting into difficulties this way.

In most of Bauchi state, rural boreholes do not need a big rig, and irrigation boreholes nowhere need a big rig. Also if urgency is not paramount such boreholes do not need high tech rigs. Smaller rigs are very much cheaper and simple rigs need less expert operation – so boreholes are much cheaper'.

Investigation of Shallow Aquifers for Lowland Irrigation In Bauchi State (1986)

Water Surveys Nigeria Limited/Bauchi State Agricultural Development Project

Manufacturers of small appropriate rigs like PAT- Drill of Thailand and Boart Longyear of South Africa have representatives in the country and are promoting the use of the rigs. In most of the big cities there are machinists who fabricate small drilling rigs which are used by artisan drillers for domestic boreholes.

Also there are several manual drilling operators in the country, using a combination of augering and washboring to drill boreholes. Manual drilling has probably been going on for over a hundred years in the country. There are accounts in the literature of the Banka drill (driven by the weight of about 4 men standing on a rotary platform) used for mineral exploration on the Jos tin field and later adopted for water supply boreholes and of hand operated percussion drilling in the 1940s.

In the 1990s following a World Bank initiative to develop the shallow alluvial aquifers along river floodplains for irrigation thousands of tubewells were drilled manually or by low technology equipment into the alluvial aquifers in the northern parts of the country. Presently in every major town where an aquifer can be reached within 50 m depth there is a group of manual drillers. In the south west of the country they have organised themselves into an artisan drillers association. Since the cost of the manually drilled boreholes is so much lower than the machine drilled holes, the manual drillers have the potential to contribute to meeting the MDGs for water supply. Considering that manual drilling is possible in about two thirds of the terrain of the country the potential should be harnessed.

3.6.3 Contract Packaging

The state and local government contracts by their very nature are localised to their areas of administration and therefore there is usually not much distance between contract locations except for a state like Adamawa where locations can be up to 400 km apart.

On the current **Kaduna State rural water supply project**, the 221 boreholes were awarded to 8 drilling contractors. The number of boreholes per contract varies between 9 and 75 boreholes depending on the capacity of the drilling contractors.

On the **UNICEF project**, the number of boreholes per contract varies between 20 and 30 boreholes. On the FMWR project, the hand pump borehole contract packages vary between the 6 and 9 boreholes. However of the 213 contracts awarded only 22 are for hand pumps fitted boreholes, the rest are motorised schemes. The motorised schemes are for deep boreholes and only one borehole is given to each contractor.

3.6.4 Compilation of Hydrogeology Information

The Federal Ministry has an on-going project to produce the hydrogeological map of the country. The initial data gathering has been completed and is being compiled and will be made available to the general public.

Borehole siting procedure is a combination of geological reconnaissance and geophysical surveying. In unconsolidated sediments, not much geophysics is carried out except in areas of suspected saline intrusion. On the Basement Complex and consolidated sediments geological reconnaissance is followed by resistivity depth sounding. Not many outfits have the electromagnetic metering equipment which is usually used for a quick geophysical reconnaissance to locate possible fracture zones on the crystalline terrain and consolidated sediments.

3.6.5 Pumping test matched to borehole purpose

Pumping tests have been matched to the purpose of the borehole for several years. As a result of the moderate yield of boreholes on the Basement Complex and the capacity of a hand pump, the duration of pumping test is usually between 2 to 6 hours pumping and 6 hours of recovery monitoring. On the other hand because of the high potential of the sedimentary aquifers and the need to install motorised boreholes for greater yield the duration of pumping test is usually 24 hours of pumping and 24 hours of recovery monitoring.

3.6.6 Supervision of borehole drilling

FMWR employs consultants to supervise its contract. Kaduna State Ministry of Water Resources realising that they do not have enough competent staff to supervise their drilling programmes

recently engaged the National Water Resources Institute to carry out a training program for their staff to be able to carry out the supervision.

3.6.7 Rigorous evaluation of ground water resources

FMWR's effort in compiling the database of hydrogeological information and producing a hydrogeological map of the country is a positive development in this direction. Also from the drilling programmes information continues to accrue on the ground water resources of the country. The present knowledge of the ground water resources of the country is better than 30 years ago although a lot of useful data is lost through uncontrolled drilling exercises. Some concerted effort by FMWR, ESAs, universities, research institutions and the private sector is required to evaluate and document the ground water resources of the country.

3.6.8 O&M procedures to ensure the sustainability of pumped ground water

The National Rural Water Supply and Sanitation Strategy stipulates that O&M are the responsibilities of the communities. The FMWR contracts and other agencies specify the training of the communities in the operation and maintenance of the facilities during the execution of the contract. However in many cases the training is ineffective as many of the facilities break down shortly after construction and remain in a state of disrepair. A study of the APD boreholes carried out in 1995 found that 30% of boreholes were not working.

3.6.9 Support to the private drilling contractor regarding importation, local manufacture, taxation, workflow and professionalizing

There are not many manifest cases of support to the drilling sector in this respect. This is one of the issues which the proposed drillers association is set to improve upon.

WaterAid signed an agreement with a private drilling contractor to manage a rig that was brought in for a project, after the completion of the project. The arrangement has been very successful, improving the capacity of the driller, at the same time achieving the objectives of WaterAid and their local partner (RWSN, 2006). The model is one that needs to be studied and if possible replicated.

3.6.10 Improving networking, communication and management skill in both public and private sectors

Communication amongst entrepreneur and between the private sector and the public requires improvement as their roles complement each other. This again is one of the issues that the proposed drillers' association will focus on.

4 The Nigeria Drillers Association

4.1 Overview

Adenle and Beale (1989) identified many of the constraints outlined in chapter 3. The authors conclude, "*the most sensible approach to strengthen the drilling industry is the formation of a National Drillers Association*."

For several years there was no response to the call for the formation of the drillers association in Nigeria. Although there were relevant organisations such as the Nigeria Water and Sanitation Association and the Nigeria Water Supply Association their objectives were not specific to drilling. With support from WSP and RWSN the process of establishing the drillers association has reached an advanced stage. There has been broad consultation with practitioners in the

sector and the consensus is that the association is highly welcome. A workshop was held in Abuja in August 2007 to agree on the name of the association and its objectives. The objectives are geared towards professionalizing the industry and tackling the identified constraints. An inaugural committee was selected and it is planned that the association should have its inaugural meeting in February 2008.

4.2 Opportunities and Constraints to the formation of an Association

From the outset of this work in July 2007, there was generally great enthusiasm and support amongst the drillers for the proposed association. The consensus was that it is long overdue and most of the people interviewed were prepared to join and support the association. The UNICEF WASH Chief and the WaterAid Country Representative indicated their willingness to provide whatever support is required towards the formation of the association. Other opportunities and strengths of the initiative were identified as follows:

The large number of drilling companies. The large number of drilling companies occasioned by the large population and landmass creates an opportunity for forming an association. It is presently estimated that there are up to 500 companies in the country.

Previous efforts and existing associations. Several people in the industry have perceived the need for and advantages of an association over the years and some attempts have been made to form one. The most successful of these efforts is the Nigeria Water and Sanitation Association (NIWASA), which was formed in 1983 as a response to the demands of the Water and Sanitation Decade. It is a well-established association and its membership spans drilling, water and sewerage treatment, storage tank, pipe and sanitary ware manufacturers. They hold seminars and exhibitions and publish a quarterly journal of very high quality. NIWASA membership is spread over 4 zones in the country and comprises professionals in the fields of engineering, geo-science, chemistry, drilling, drilling equipment, water treatment, and storage tank manufacturing.

The limitation of the association is that it does not cater solely for the interest of drillers although the drillers constitute the majority. Of the118 members 70 are drilling contractors. Also 80% of its membership is drawn from the Lagos area and more than half of the rest are based in the southern part of the country. Thus the spread of the association is not national.

The members of the association who were drilling contractors welcomed the initiative to form a Nigeria Drillers Association although some thought that this new association should be part of NIWASA.

National Water Supply Association. This is mostly a government driven initiative. The members are the federal and state government water supply agencies. They also encourage private sector practitioners to join the association. The president has on the past two occasions been the incumbent director of Water Supply and Quality Control in the Federal Ministry of Water Resources.

Borehole Drillers Association Kano-Jigawa States. The drillers operating in the contiguous states of Kano and Jigawa, most of who are based in Kano city have for some years formed themselves into an association. They ran into a hitch when they tried to register the association in 2003 with the Corporate Affairs Commission. They were advised to constitute themselves into a more national outfit.

Their aim is to professionalize the registered body by sponsoring a bill into the Kano and Jigawa States Houses of Assembly to recognise the members as the qualified drillers in the two states and the only ones eligible for drilling contracts in the 2 states. There are about 100 members and they presently hold meetings under the auspices of the Nigerian Mining and Geosciences

Society (NMGS) as their secretary is the local chairperson of the NMGS. They are very enthusiastic about the new initiative as they see it as a possible means of achieving their aims.

The Low Technology Drillers Association of Nigeria. This is an initiative being promoted by some drillers in the south western part of Nigeria, specifically in Ibadan city of Oyo state. They are a group that are described as artisan drillers by the conventional drillers. They include hand drillers as well as drillers using locally fabricated drilling rigs mentioned in section 3.6.2. Some of these drillers are considered opportunistic and unscrupulous by the consumers and give a bad reputation to the profession. Other drillers in this category felt the need for a body that can regulate the activities of the drillers, develop capacity, and sanction erring members and build confidence in the consumer, which is in line with the objectives of the new initiative. They are still in the process of registering with the corporate affairs commission.

The efforts of the Federal Ministry of Agriculture and Water Resources. The ministry has been organising a series of seminars for drillers and groundwater consultants in different parts of the country to build the capacity in groundwater data collection and reporting during the Phase II of the Federal Rural Water Supply Programme. The workshops have brought drillers working in the different parts of the country together, allowing for interaction and networking. The list of the participants at the workshops is helping in the compilation of the drillers' directory.

The different initiatives show that there is a realisation and need for an association and with some external support a viable association can be developed.

However, the land mass and population of the country which are considered an opportunity also constitute constraints. Some of the major problems confronting drillers are local to their environment. Potential members may not accept that a national body could tackle the problems effectively. It may also be difficult to get people from far flung places to attend meetings regularly. A way to overcome this is to form a national body for the formulation of policies, standards and liaison with the federal government agencies and to form state chapters of the association to represent the interest of the members at the local level.

Another constraint is the stratification of the drilling operators into conventional and low technology drillers. It is doubtful if one body can represent the interest of the two. The low technology drillers have a poor reputation particularly in the southern part of the country and there are conventional drillers who would not want to associate with them. As one of the aims of the new association is to professionalize the drilling sector its joining requirement will aim to keep out the charlatans.

4.3 Outcomes of the Initial Workshop

4.3.1 Overview

As part of the process of establishing the drillers association a workshop was held on the 23rd of August 2007 and attended by 38 key stakeholders including the Federal Ministry of Agriculture and Water Resources, UNICEF, WaterAid, National Water Resources Institute, the Nigeria Water and Sanitation Association and several drilling companies. The aims of the workshop were to agree on:

- Name of the association
- Objectives of the association
- Membership requirements
- Set up an inauguration committee
- Action plans leading to the registration of the association

The workshop comprised three presentations as follows: the need for a drillers association; two decades of the Nigeria Water and Sanitation Association (NIWASA); Kano/Jigwa Drillers Association. This was followed by plenary discussions, group discussions.

The discussions were lively and a lot of enthusiasm displayed for the proposed association. The consensus was that the association would help in overcoming the constraints of the industry and in meeting the challenges of the Millennium Development Goals for water supply. The association should be established and an inauguration committee selected to oversee the registration. The committee will look in more detail at the outcomes of the workshop, fine tune them, develop the constitution of the association, appoint the trustees, for registration with the Corporate Affairs Commission. After registration the committee will call an inaugural meeting of the association.

4.3.2 Association Name, Relationship with Existing Associations and Membership Requirements

The name, Nigeria Drillers Association had been found to be acceptable at the Corporate Affairs Commission. In the course of the searching the Commission's database, it was found that a body called Borehole Drillers Association of Nigeria with a Lagos address had been registered in 1992 but none of the drillers interviewed had ever heard of it.

In the group discussions, the name *Water Well Drillers Association of Nigeria* was put forward. The *Water Well* is to distinguish it from other drillers in the oil and mining sectors. However, others expressed concern that the inclusion of *Water Well* in the name may be misconstrued as an association of open hand dug well diggers. It was agreed that the inauguration committee would discuss this further.

It was suggested by the NIWASA president that there was no need for a new association and that the association remains under the umbrella of NIWASA. However a consensus was reached that NIWASA's coverage was very broad and not specific to drilling and it had over the years not been able to overcome the constraints of the industry hence the need for a specific drillers association.

The new association will affiliate with existing associations. It will register as a corporate member of NIWASA, NAH and NMGS as well as abide with the rules of COMEG.

There will be two types of membership: individual membership and corporate membership. For individual membership the applicant must have a minimum of 2 years in the drilling industry and must be recommended by 2 members of the association.

A corporate member must be registered with the Corporate Affairs Commission, recommended by two members and must have a COMEG registered geoscientist on its management team.

State chapters are to be registered where there are enough members to tackle local challenges.

4.3.3 Objectives

The following objectives were agreed upon as well as mechanisms to achieve them:

Professionalizing the drilling profession. The association should operate under the rules of the Council of Mining Engineers and Geosciences (COMEG), which is the recognised body for regulating activities of the mineral extraction industry in the country. It should encourage its members to register with other relevant professional bodies such as NIWASA, NAH, NMGS.

Advancing the expertise of borehole drilling in the country. The association will conduct seminars and workshops to develop the professional capacity of the members and support existing training institutions such as the National Water Resources Institute, Kaduna.

Promoting the adoption of cost effective borehole practices. Members should aim at standardising on types of equipment used in the country. This will streamline the required spares and make them readily available. The association will liaise with government agencies responsible for borehole contracts to ensure that boreholes are designed to fit their purpose. Members should purchase cost effective equipment suitable for the geological terrain of the areas of their main operation.

Promoting the responsible development and use of groundwater. Government should be advised that there is need for legislation to regulate activities in the drilling sector such as laws requiring permission to be issued before any drilling is carried out. This will facilitate proper record keeping, groundwater monitoring and prevent indiscriminate borehole siting and provide information for future development.

Furthering groundwater awareness and protection. The association will form partnership with local and state governments to enlighten the public on groundwater vulnerability, why abandoned boreholes should be sealed and why boreholes proximal to petrol stations and other potential sites of pollutions should be closely monitored.

Using advocacy to encourage government and consumers to use registered association members. The association should create an awareness of its existence within government circles, international donor community and other consumers. Once standards are set and the drilling industry professionalized it is a matter of time before government and consumers realise that they are better served by the members of the association.

Serve members by creating a community for the dissemination of information. The association will engage in continuous professional development of its members by publishing journals and conducting seminars on latest developments in the industry.

Development of a code of conduct for members and sanctioning of erring members. The code of conduct will ensure the exercise of professionalism within the confines of the existing knowledge of and facilities in the borehole drilling business by members. Thus a member engaged in any work shall in discharging his responsibilities uphold and enhance the honour and integrity of the profession. He shall at all time act in a judicious manner and with full regards to the code of practice of the profession in accordance with the rules laid down in the code of conduct and ethics. His honesty of purpose must always be transparent and must therefore as far as possible act only within the confines of his area of discipline. He must at all time act with utmost impartiality bearing in mind that his profession carries with it a great responsibility to the public

4.3.4 Identification of constraints and challenges

The group agreed with the constraints identified (section 3.4). Lack of hydrogeological data was identified as a major constraint and actions to overcome the constraints were suggested.

Small contract packages: The drillers association should be formed and should use advocacy to persuade agencies responsible for borehole contracts to provide larger drilling contract packages so that the industry can benefit from the economies of scale and thereby achieve growth, and effective service delivery.

Lack of transparency in contract award: The members of the drillers association should maintain their professionalism and integrity. Accepting projects from third parties should be discouraged.

Lack of credit facility: This relates to small contract packages. Larger contracts will give the drillers a higher credit rating with their bankers.

Difficulty in obtaining spares and consumables: Standardisation and streamlining of equipment types should reduce the difficulty in obtaining spares. International donors and NGOs should be approached to form partnerships with the association to assist in procuring the right type of equipment, tools and consumables through credit facilities and leases.

Clients not following contract procedure: Drillers and the drilling association should insist on the proper procedures even if it involves arbitration and litigation.

High turnover of personnel: Members of the association should provide adequate remuneration, develop capacity building scheme for their employees and insist on a reference from previous employers.

Long distances between contract location: The drillers association will facilitate the identification of credible drillers at different locations in the country and promote collaboration between members. Contracts could then be sublet to local drillers where the location is not favourable to the main contractor.

Responsibility for geophysical survey: The group agreed that the responsibility for geophysical survey lies with the drilling contractor. Even where the client has carried out a survey, the driller is advised to carry out another one, even if only as a second opinion.

Lack of hydrogeological database: The representative of the Federal Ministry of Agriculture and Water Resources informed the group that the ministry is developing a database that would be available to the general public.

Poor quality of drilling chemicals in the country: This should be brought to the notice of the Standards Organisation of Nigeria

A shortage of maintenance personnel: The association will support existing training facilities to promote the training of maintenance personnel.

4.3.5 Inauguration Committee

Twelve members were selected from different locations in the country to give as much national outlook as possible to the inauguration committee.

4.3.6 Action Plan

The following action plan was developed to see the association through to its inaugural meeting.

No.	Action	Responsible persons	Time Frame
1	Preparation of workshop report	Dotun Adekile	31.08.07
2	Circulate summary workshop report to participants	Dotun Adekile	15.09.07
3	Preparation of Draft constitution	Nura Akali Yusuf and Martin Eduvie	30.09.07

No.	Action	Responsible persons	Time Frame
4	Circulate Draft Constitution	Nura Akali Yusuf and Martin Eduvie	15.09.07
5	Meeting of the interim committee to ratify the objectives of the association and the constitution	Interim Committee members	16-17.10.07
6	Submission of registration papers with the CAC	Interim Committee	22.10.07
7	Inaugural meeting of the Association and election of Officers	Interim Committee	February 2008

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