No.

BASIC DESIGN STUDY REPORT
ON
THE PROJECT FOR RURAL WATER SUPPLY AND SANITATION
IN
KANO STATE
IN
THE FEDERAL REPUBLIC OF NIGERIA

JANUARY 2005

JAPAN INTERNATIONAL COOPERATION AGENCY

PACIFIC CONSULTANTS INTERNATIONAL

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PREFACE

In response to a request from the Government of the Federal Republic of Nigeria, the Government of Japan decided to conduct a basic design study on the Project for Rural Water Supply and Sanitation in Kano State and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Nigeria a study team from July 27 to September 9, 2004.

The team held discussions with the officials concerned of the Government of Nigeria, and conducted a field study at the study area. After the team returned to Japan, further studies were made. Then, a mission was sent to Nigeria in order to discuss a draft basic design, and as this result, the present report was finalized.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of the Federal Republic of Nigeria for their close cooperation extended to the teams.

January 2005

Seiji Kojima
Vice President
Japan International Cooperation Agency

January 2005

Letter of Transmittal

We are pleased to submit to you the basic design study report on the Project for Rural Water Supply and Sanitation in Kano State in the Federal Republic of Nigeria.

This study was conducted by Pacific Consultants International, under a contract to JICA, during the period from July, 2004 to January, 2005. In conducting the study, we have examined the feasibility and rationale of the project with due consideration to the present situation of Nigeria and formulated the most appropriate basic design for the project under Japan's grant aid scheme.

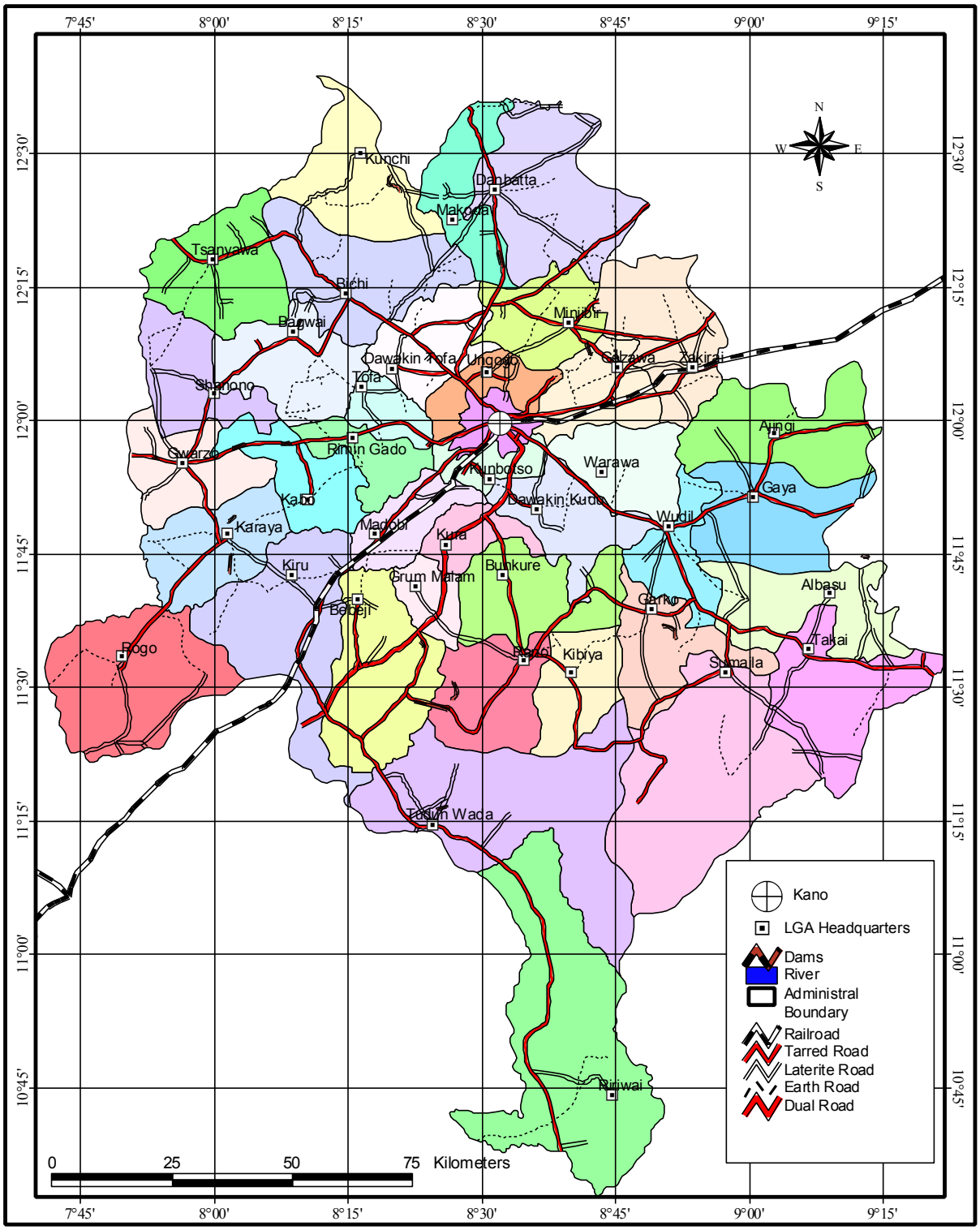
Finally, we hope that this report will contribute to further promotion of the project.

Very truly yours,

鈴村忠男

Tadao Suzumura
Project Manager,
Basic Design Study Team on
The Project for Rural Water Supply and
Sanitation in Kano State
Pacific Consultants International

Location Map of Study Area



Administrative Map of LGA in Kano State

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Abbreviations

A/P	:	Authorization to Pay
ASTM	:	American Society for Testing and Materials
B/A	:	Banking Arrangement
BS	:	British Standard
DTH	:	Down The Hole hammer
DIN	:	Deutsche Industrie -Norm
EC	:	Electric Conductivity
E/N	:	Exchange of Note
FMWR	:	Federal Ministry of Water Resources
JIS	:	Japanese Industrial Standards
JICA	:	Japan International Cooperation Agency
LGA	:	Local Government Areas
LGA Unit	:	LGA Water and Sanitation Unit
LHPM	:	Local Hand Pump Mechanic
M/D	:	Minutes of Discussion
MWRRD	:	Ministry of Water Resources and Rural Development
NEEDS	:	National Economic Empowerment and Development Strategy
NGN	:	Nigerian Nira
NPC	:	National Planning Commission
O&M	:	Operation and Maintenance
PDM	:	Project Design Matrix
PVC	:	Polyvinyl Chloride
RUWASA	:	Rural Water Supply and Sanitation Agency
T.D.S.	:	Total Dissoluble Solid
UNDP	:	United Nations Development Program
UNICEF	:	United Nations International Children’s Fund
uPVC	:	Unplastised polyvinyl Chloride
VLOM	:	Village Level Operation and Maintenance
VWESC	:	Village WATSAN Committee
WHO	:	World Health Organization
WRECA	:	Water Resources Engineering and Construction Agency

SUMMARY

Summary

The Federal Republic of Nigeria (hereinafter referred to as Nigeria) is located in Western Africa. It has an area of 924,000 km^2 and total population is 132.8 million (World Bank, 2002).

The water supply ratio in the urban areas is 81% where the rate drops to 39% in the rural areas where nearly 60% of the total population resides (WHO, 2000). Occurrence of water-borne diseases is high due to use insanitary water. For that reason, the Government of Nigeria established "National Water supply and Sanitation Policy" in 1999. It aims to supply safe drinking water for all the people by 2011.

Kano State, which is the target area, is located in the arid zones in northern part of the country. It has an area of 20,760 km^2. The population is approximately 7,929 thousand where about 80% (approx. 6,014 thousand) live in rural areas (Kano State Statististical Year Book, 2003).

The Kano State Ministry of Water Resources and Rural Development (hereinafter referred to as MWRRD) is the authority for water supply for the state, and is responsible for water administration to construction of facilities. RUWASA under the MWRRD is in charge of rural water supply service. RUWASA has constructed about 290 boreholes and 140,000 people have been provided with potable water up to now. However, the ratio of safe water supply in the rural area is 14.8 %, and is considerably low compared to the national average of 39%. Therefore, most people living in rural areas are forced to use insanitary water from streams, ponds, and hand dug wells as the water resource of domestic use.

Guinea worm was a serious water borne disease in the area. However, due to the success of the eradication campaign (extension of filter usage for drinking water) carried out from 2000 to 2002 by UNICF, Guinea worms are now hardly reported excluding some of the areas. However, the occurrence of water bone diseases such as Diarrhea, Cholera, and Dysentery are still high. The occurrence of these diseases is particularly high during the early rainy season in the months of May and June, and in the months of September to October when the dry season starts. Therefore, improvement of water supply condition is urgently needed, as a part of hygiene condition improvement.

The government of Kano state is carrying out groundwater development under the National Water supply and Sanitation Policy, where the task attached with importance. In September 2001, with the aim of strengthening the system of rural water supply and t improve hygiene conditions in the rural areas, the Government of Kano state has made a request for Japanese

Grant Aid through the Federal Ministry of Water Resources concerning the project which included procurement of drilling rigs and technical assistants for operation and maintenance of procured equipment. In response, the Japanese government carried out a basic design study in July 2004.

Japan International Cooperation Agency (hereinafter referred to as "JICA") sent a basic design study team to Nigeria to confirm the background, contents and scope of the request from 27 July to 9 September 2004. After the study team returned to Japan, it carried out further studies and completed a draft basic design report, taking into consideration the requested contents, adequacy of cooperation and suitable contents and scale of the basic plan. After compiling these contents into the Draft Final Report, the study team was again sent to Nigeria in order to discuss the draft basic design from 13 to 23 December 2004.

At the result of discussion, both sides confirmed that the project will consist of procurement of equipment necessary for groundwater development and technical assistance through "Soft Component", where the Nigerian side holds responsibility for the construction of the facilities.

The final outline of the basic design is as follows:

	Item	**Equipment and quantity**
1	Drilling Equipment	Drilling rig(1unit), Air Compressor (1unit), Drilling tools (1set), Development tools (1set)
2	Geophysical Survey Equipment	Electric Resistivity Survey Equipment (1unit)
3	Pumping Test Equipment	Submersible pump (1unit), Engine generator (1unit), Water level detector (1unit), Triangle weir (1unit)
4	O&M Equipment	Repair Tools for Drilling rig and support vehicles (compressor, water tanker, pick up car, etc.) for simple repair, maintenance, cleaning, tire replacement, puncture repair, etc. (1set)
5	Hand Pump & Tools	Hand pump & maintenance kits, Maintenance kit & Tools (1set)
6	Water Analysis Apparatus	Portable water analysis apparatus (1unit)
7	Supporting Vehicle Motorcycle	Cargo truck with crane(2unuts), Water Tanker (1unit), Pick up car(2units), Motorcycle(5units)
8	Borehole Construction Materials	Casing pipe (2,667p.c.s), Screen pipe (1,334P.C.s)
9	O/A Equipment	Personnel computer (2units), Printer (2units), UPS (2units)
10	Spare Parts for Existing Rig	Spare part for existing TH-10R type rig (1set)

The “Soft Component” of the project consists of the following two components:

- Technical Training for Construction Management (Guidance of Construction Management)
- Strengthening of O&M System for Water Supply Facility

The project, when implemented as a grant aid project, will require 39 months in total, with 30 months as facility construction period by the Nigerian side, 8 months as procurement period of equipment and material and 4.5 months for “Soft Component”. The total necessary budget for implementation of the project is estimated to be 448 million Japanese Yen (361 million Japanese Yen to be borne by Japanese side and 87 million Japanese Yen to be borne by Nigerian side.). This cost estimate is provisional and would be further examined by the Government of Japan for the approval of the Grant.

Upon the completion of this project, 240 boreholes will be constructed and 86,000 people will receive safe water. The water supply rate in the rural areas of Kano state will increase from 14.8% to 16.2%. Furthermore, RUWASA will have a new up-to-date drilling rig with good work efficiency and life of existing rigs will be prolonged. These rigs will be continuously utilized in water supply projects after this project is completed. The ability of RUWASA personnel on construction management and operation and maintenance of equipment will increase by guidance of construction management and strengthening of operation and maintenance system of water supply facilities through the “Soft Component” of this project. Furthermore, due to the support for strengthening of operation and maintenance system for water supply system, maintenance and the ability of operation and maintenance for hand pump will be improved. The system for water supply and sanitation services will be strengthened and technical knowledge and skills for these services will be improved.

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CHAPTER 1
BACKGROUND OF THE PROJECT

CHAPTER 1 BACKGROUND OF THE PROJECT

The Federal Republic of Nigeria (hereinafter referred to as Nigeria) is located in the Western Africa. It has an area of 924,000 km^2 and the total population is 132.8 million (World Bank, 2002). The water supply ratio in the urban areas is 81% whereas it is 39% in the rural areas where almost 60% of the total population lives (WHO, 2000). In the rural areas, the occurrence of water-borne diseases is common since people use contaminated water. For that reason, the Federal Ministry of Water Resources (hereinafter referred to as FMWR) established "National Water supply and Sanitation Policy" in 1999, which aims to supply safe drinking water for all the people by 2011.

Kano State is located in an arid zone in the northern part of the country and has an area of 20,760 km^2. The population of the State is 7.9 million, and 80% of the population (6 million) live in the rural areas (Kano State Statistical Year Book, 2003).

The Ministry of Water Resources and Rural Development (hereinafter referred to as MWRRD) supervises the water supply management in Kano State. It takes charge of administration, construction of facilities and promotion of water supply projects under FMWR. Also, it controls the sub-sectors such as the Rural Water Supply and Sanitation Agency (hereinafter referred to as RUWASA), the Water Resources and Engineering Construction Agency (hereinafter referred to as WRECA), and Water Board.

RUWASA is responsible for the rural water supply service. RUWASA was set up as the rural water section in WRECA in the 1980s. In 1997, RUWASA became an independent organization for rural water service supported by UNICEF and UNDP. It has constructed about 290 boreholes and 140,000 people have been provided with potable water by RUWASA since 1997.

The water supply ratio in the rural area is still considerably low: only 14.8% even counting the boreholes constructed since 1980s by the World Bank, Local Government Areas (hereinafter referred to as LGA), and private sector. It is much lower than the 39% of the average ratio in the rural areas of the whole country. Therefore, most people living in the rural areas are forced to use contaminated water from streams, ponds, and hand dug wells as the water resource for domestic use.

Guinea worm was a serious water borne disease in the area. However, new cases are not being reported today, because of successful hygiene education by UNICEF using filters for drinking water. However, the occurrence of water borne diseases such as Diarrhea, Cholera, and Dysentery are high. Especially, the occurrence is very high during the early rainy

season in the months of May and June. It is also very high in the month of September and October when the dry season starts. Therefore, improvement of water supply condition is urgently needed, as a part of hygiene condition improvement.

In such a situation, the State Government has requested for the Japanese Grant Aid for the procurement of drilling equipment for the construction of boreholes, and technical assistance for operation and maintenance of equipment through FMWR on September 2001, aiming to improve the water supply and sanitation conditions in the rural areas of the State.

In the response to this request, the Government of Japan decided to send a study team to Nigeria to confirm the background, contents and scope of the request in July 2004.

CHAPTER 2
CONTENTS OF THE PROJECT

CHAPTER 2 CONTENTS OF THE PROJECT

2-1 Basic Concept of the Project

(1) The National and State Targets and the Project Objectives

The National Policy of Nigeria were mentioned “Vision 2010”, “National Water Supply and Sanitation Policy”, and “National Economic Empowerment and Development Strategy: NEEDS”. “Vision 2010” was established in 1997, and it aims at the following goals: (1) Fulfillment of Basic Human Needs for the people (Water, Food, Health, and Education), (2) Establishment of a permanent democratic society, and (3) To become a leading country in African economy. Based on “Vision 2010”, FMWR established “National Water Supply and Sanitation Policy” in 1999 (It was revised in 2000). Also, the Federal Government established “National Economic Empowerment and Development Strategy: NEEDS” in July 2004. These policy aims to increase the water supply ratio up to 100% by 2011.

The State Government of Kano has been implementing ground water development according to “National Water Supply and Sanitation Policy”. RUWASA which takes charge of rural water supply and sanitation in Kano State, was established “The Rolling Plan 2005 to 2007” as a water supply scheme.

This project aims to procure necessary equipment for achievement of the goals of “Vision 2010”, “NEEDS”, and “RUWASA rolling plan 2005 to 2007” in the Kano State. The project will implement procurement of equipment and technology transfer of Operation and Maintenance (O&M) for the equipment under the Japanese Grant Aid system. Also, the project will carry out components such as technology transfer of construction management for efficient borehole construction and strengthening of O&M system for water supply facility for sustainable O&M.

(2) Basic Concept of the Project

1) Request for the Japanese Grant Aid

The request list of equipment and materials from Nigeria in September 2001 is as follows:

① Drilling Equipment and Tools

- Drilling rig 1 set
- Drilling tools 1 lot
- High pressure air compressor 1 set

② Supporting Vehicles for the Project

- Cargo truck with crane	1 set
- Water tank truck	2 sets
- Fuel tank truck	2 sets
- Pick up truck	4 sets
- Motorcycles	10 sets

③ Well Related Equipment

- Well development equipment	1 set
- Electrical logging instrument	1 set
- Pumping test equipment	1 set

④ Water Analysis Equipment	1 set
⑤ Resistivity Survey Equipment	1 set
⑥ Workshop Tools and Equipment	1 set
⑦ Computers	2 sets
⑧ Spare parts	1 set

⑨ Borehole Construction Materials

- Hand pumps	440 sets
- PVC Casing pipes	4,400 pcs
- PVC Screen pipes	1,600 pcs

2) Comparison between the Request and the Basic Design

The analysis result based on the comparison with the request and basic design is shown in Table 2-1.

① Procurement of equipments and materials

After reviewing the existing equipment and existing materials in RUWASA and present capacity of RUWASA, the necessary equipment and materials in this project are shown in Table 2-1.

② Technical Assistance

Regarding technical assistance for construction of boreholes by using equipment and materials procured in this project, technology transfer for drilling equipment or construction techniques will be conducted by the supplier as a part of the procurement work. Also, Japanese consultants will carry out the soft component

for the construction management and the improvement of O&M system of water supply facility, prior to the commencement of the project.

3) Basic Concepts of the Project

This project is composed of procurement of equipment/materials and soft components.

The equipment/materials procured are for drilling and construction of 240 boreholes to be implemented by Nigerian side. Technology transfer for drilling equipment or construction techniques are to be conducted by the supplier as a part of the procurement work.

The soft components will be implemented by Japanese consultants for transferring construction management technology and O&M system improvement of water supply facilities.

The expecting outputs by the project are as follows:

1. Necessary equipment and materials for the drilling and construction of boreholes will be fully provided in Kano State. Technical level of RUWASA for the construction of boreholes and O&M will be improved in Kano State.

2. The water supply and sanitation service system and the management system of RUWASA in Kano State will be strengthened.

Project Design Matrix (PDM) is shown in Table 2-2.

Table 2-1 Comparison of Equipment and Materials for the Project

Item		Original Request (September, 2001)		Basic Design	Reason of Modify
①Drilling Equipment and Tools	・Drilling Rig	Drilling capacity 6-3/4" x 150m (Hydraulic Top-Head -Drive type)	1set	Drilling capacity 300m	Drilling capacity 300m is needed to drill well depth 100m.
	・Drilling Tools	(4-3/4 drill pipe) acccessory, Mud drilling and DTH drilling tools	1lot	No modify	—
	・High pressure air compressor	Truck mounted type 10.5kg/cm^2, 20m^3/min	1set	20.5kg/cm2, 20m3/min	Adapted to maximum well depth 100m.
②Supporting Vehicles	・Cargo truck with crane	Loading capacity 5t, Crane capacity 5t	1 set	2 sets (Loading 6t, Crane 3t)	For effective use of 3 rigs including existing rigs, and implemantation of works contain 2 fuel tank truck.
	・Water tank truck	Tank capacity 6,500 l	2 sets	1set (8,000 l)	1(one) water tank truck will be able to supply water to each sits by incleasing of tank capacity.
	・Fuel tank truck	Tank capacity 8,000 l	2 sets	None	Multipurpose of fuel tank truck is low. Fuel in drum load to cargo truck.
	・Pick up truck	2,800 cc (Pick up truck)	4 sets	2sets	Available number of existing rig are 2 sets considering the rate of operation. Pick-up truck is planed for total 3 rigs including new one. Existing 1 pick-up is able to work.
	・Motorcycle	125 cc class	10 sets	5sets	Motorcycles are able to share 5 sets for 10 enlightment staffs.
③Well related Equipment	・Well development equipment	Including 7kg/cm^2, 5m3/min air compressor etc.	1 set	7kg/cm2, 8.5m3/min	Adapted to maximum well depth 100m.
	・Pumping test equipment	Submersible pump 20l /min. × 50m, Generator etc.	1 set	10l /min. × 50m	Adapted to hand pump capacity.
④Survey Equipment	・Water analysis equipment	EC meter and pHmeter, Pack test kit	1 set	No modify	—
	・Resistivity survey equipment	Prospecting depth 200m capacity	1 set	Measurable depth 100m	It is planed that average boreholes depth is 45m and maximum depth is 100m.
	・Borehole logging equipment	Measuring electrical Resistivity and S.P. to depth 100m with standard accessoriries	1 set	—	Resistivity survey equipment will be used for borehole logging by use of accessories.
⑤ Workshop Tools and equipment		Welding machine, repair tools etc.	1 set	No modify	—
⑥ Computer		Windows98 (English)、Printer	2 sets	No modify	—
⑦ Spare Parts for equipment		10% of equipment price	1 set	10% of rig price, 5% of others price	The quantity is decided on account of construction period of the ptoject 2.5 years.
⑧Borehole Construction Materials	・Hand pump	440 sets（PVC riser pipe and stainless rods）		240 sets	Suitable quantity will be procured for 240 site that selected in the Basic Design Survey.
	・Casing pipe	4,400 pcs.		2,667 pcs.	
	・Screen pipe	1,600 pcs.		1,334pcs.	
⑨ Spare Parts for existing rig		—		1set	For effective use of existing rigs

Table 2-2 Project Design Matrix (PDM) of the Rural Water Supply and Sanitation in Kano State in Federal Republic of Nigeria

Project : Rural Water Supply and Sanitation in Kano State in Federal Republic of Nigeria　　Project Duration : 2005～2008
Target Area : 240 Sites of 38 LGA in Kano State　　Target Group : Communities in the Study Area

Design Summary	Project Monitoring Indicators	Source of Indicators	External Condition
Ultimate Goal Improvement of water supply and sanitary condition in rural area of Kano State	・Ratio of increased of water supply in rural area of Kano state. ・Ratio of decreased patients with water-borne diseases in the rural areas of Kano state	・Statistical data of water supply ・Statistical data published by WHO and Ministry of Health	・Assuming no radical change of national development policy regarding rural water supply system in the country ・Assuming that any epidemic disease and others never rapidly spread over the country
Purpose 1. To keep functioning installed boreholes with appropriated maintenance in the targeted area 2-1. To establish Village Water & Environment Sanitation Committee (VWESC) in the communities of the targeted area, and 2-2. To encourage the VWESC keep managing and maintaining the relevant water supply facilities in the target area	1. Numbers of installed out of 240 boreholes in the targeted area 2-1. Numbers of established VWESCs in the target area to take care of the installed boreholes in each community. (since 240 boreholes are to be installed in all target area so that establishment of 240 VWESC in all target area is expected as ultimate purpose in this case), and 2-2. Daily participating extent of VWESC members to take part in the committees	1-1. Progress reports of construction work of RUWASA 1-2. Inventories of wells management by RUWASA 2-1. Monitoring papers by LGA Unit (Participants lists of VWESC、Resistors of payment), and 2-2. Progress Report of RUWASA	・Assuming no radical economic change in the country ・Assuming that population in the targeted areas won't drastically increase.
Outputs 1. Necessary equipment and materials for the drilling and construction of boreholes will be fully provided. Also Technical level of RUWASA for the construction of boreholes and O&M will be improved in the Kano State. 2. The water supply and sanitation service system and management system of RUWASA in the Kano State will be strengthened.	1-1. The extent of procurement materials and equipment as planned 1-2. The extent of acquiring techniques and skills for O&M management of relevant facilities by relevant engineers. 2-1. The extent of establishment of water supply and sanitation service system of RUWASA. 2-2. The extent that RUWASA staff learns techniques and acquires knowledge. 2-3. The extent of collaboration between RUWASA and LGA Unit 2-4. The extent to which collaboration activity for promotion programs for sanitary to the community by RUWAS and LGA Unit in sustainability is carried out 2-5. The extent RUWAS and LGA continuously follow up for monitoring activity.	1. Final repots of the project 2-1. Manual of RUWASA's water supply & sanitation service 2-2. Participants list and certificates of RUWASA's staff 2-3. Reports of training workshop by RUWASA staff, including text as well. 2-4. Progress reports for promotion programs for sanitary by RUWAS and LGA Unit 2-5. Monitoring reports submitted to RUWASA by LGA Unit	・Assuming that the rural water supply project of RUWASA will continue to be implemented after this study
Activities 1-1. Procurement equipments and materials of digging boreholes 1-2. Procurement equipments and materials of construction of water supply facilities 1-3. Training of digging boreholes 2-1. Technical Training for Construction Management 2-2. Strengthening of O&M System for Water Supply Facility 2-2-1 Strengthening of O&M System for Water Supply Facility collaboration between RUWAS and LGA Unit 2-2-2 Training Workshop for RUWASA staff	Inputs 〔Japanese Side〕 Equipment and materials： ・Equipment for digging wells ・Equipment for construction of water supply facilities ・Materials for community mobilization activity Human Resources： ・Engineers Project Cost： ・Procurement cost of equipment and materials ・Cost for soft component	〔Nigerian Side〕 Construction of facilities： ・Instillation of 240 boreholes Equipment and materials： ・Provision of RUWASA's equipment and cars Human Resource： ・RUWASA staff ・LGA Unit staff ・Community People receiving project benefit Project Cost： ・Labor cost of RUWASA staff ・Labor cost of LGA Unit staff ・Construction cost for water supply system ・Necessary equipment, materials, and expendable supplies ・Project management cost	・Assuming that RUWASA staff continuously work in the institution. ・Assuming that customs clearance and transport is done properly ・Assuming that soaring cost of management and maintenance won't occur.

2-2 Basic Design of the Requested Japanese Assistance

2-2-1 Design Policy

(1) Basic Policy

1) Scope of Requested Japanese Assistance

The scope of requested Japanese assistance is to procure drilling equipment and materials, soft component parts such as the technical transfer for proper operation of the equipment and sustainable O&M for effective Japanese grant aid funding. Nigerian side shall construct the facilities, while Japanese side shall procure necessary equipment and material (hand pumps, casing and screen pipes). Nigerian side shall items such as, bentonite, cement, sand and gravel, reinforcement steel bars, fuel, water, and labor expenses, which will be necessary for the construction work.

2) Site Selection

Nigerian side requested 456 sites at first; however, in regard of issues such as the capacity of the implementing agency and the storing period of equipment and material for borehole construction such as casing pipes procured in Japan, the number of sites was decided to be 240. 240 priority sites in 172 villages were selected based on the results of natural condition and social condition surveys. RUWASA side shall select the exact locations by conducting detailed electrical sounding surveys.

(2) Policy Considerations on Natural Conditions

1) Climate

Dry season in Nigeria starts from November and ends to March. The annual rainfall is between 800 and 1,000 mm in which more than 80% of rainfall is in wet season. The accessibility to reach many of the LGAs in Kano state by large-size trucks becomes worse in rainy season because of the muddy roads. Therefore, the work plan is scheduled by taking into consideration the lowered progress of borehole construction during the wet season, in regard of operation efficiency of drilling rigs and the possibility of accidents.

2) Hydrogeological Condition

The main source of the existing boreholes is the aquifers of weathered zones in the upper part of the bedrock. Since the thickness of weathered zone is rather thin and

not continuously developed, it is necessary to develop a fissure groundwater in bedrocks in some cases. Bedrock is composed of very hard granite and gneiss; therefore, the rig procured should have enough drilling capacity and allow conducting DTH method. According to the experiences of RUWASA and World Bank in the project area, average drilling length is 45 m. These conditions will be regarded in preparation of the equipment plan, and the drilling plan will be proposed.

3) Groundwater Quality

Some existing boreholes show high contents of NO_3. This is likely to be cased by contamination by domestic waste water. Reinforcement of the superficial structures such as platforms will prevent contamination of groundwater by domestic waste water. The design and construction plan will be proposed taking this into consideration.

4) Environmental Condition for the Construction of Boreholes

Since the selected sites belong to public land, there will be no problem for expropriation.

(3) Policy on Social Conditions

Many of the people in Kano State are devout Muslims. Men are mainly in charge of economic activities outside of the household. This also includes fetching water. On the other hand, women mainly take care of household activities. Such social/religious factors will be taking into account for conducting water and sanitation education and promoting peoples' participation to water environmental and sanitation committees, which are the organizations subject to O&M of the water supply facilities.

(4) Policy on Construction of Borehole by Using Existing Rigs for the Project

- RUWASA has been operating 6 drilling rigs since its establishment in 1997 and has the experience of constructing approximately 290 boreholes (1999 to Aug. 2004). The RUWASA drilling staff has been formerly stationed in WRECA and Water Board, under MWRRD and has experience in borehole drilling. The staff has the basic technical skills for drilling, and the project is judged possible with the premise that appropriate technical training is provided.

- In the project, existing rigs and equipment owned by RUWASA will be effectively used as well as new rigs to be procured.

(5) Present O&M Condition of RUWASA for Borehole Construction

- Since RUWASA doesn't posses written manuals for O&M of water supply and sanitation operations, and is not conducting educational activities for premeditated construction of water supply facilities and their O&M. Moreover, public relations on water supply facility construction towards LGAs and villages are not adequate and coordination with LGAs is not well maintained. Implementation of the plan requires solution of such management issues, and necessary support shall be provided.

- Technical support will be provided for handling and O&M of the newly procured equipment and material.

- Support for preparation of construction plans such as procedures for borehole construction, schedule management and quality control will be provided.

(6) Specification of the Equipment and Materials to be procured

- Rig shall be selected to cover both mud circulation rotary and DTH drilling methods for various geological conditions.

- Rig and compressor is to be selected by considering truck-mounted for easy accessibility and mobility.

- 4-wheel-drive type vehicles shall be selected for small trucks and crane cargo truck in regard of bad road conditions.

- Indian Mark III (VLOM type), which is the standard of RUWASA shall be selected for hand pumps.

- Plans for equipment, drilling methods and structure of boreholes matching the geological conditions shall be proposed.

- Superficial structures such as platform and drain ditch shall be designed with consideration to prevent infiltration of domestic waste water, in order to avoid influence to water quality.

(7) Drilling Method and Construction Period

- Both of mud circulation rotary and DTH methods shall be applied as drilling methods depending on geological conditions.

- Drilling schedule shall be prepared taking into account the capacity of RUWASA and low progress of borehole drilling in the rainy season due to issues such as bad access to the drilling site.

- Total project period shall be conservatively scheduled taking into account the time necessary for procurement, the capacity of RUWASA and the period for conducting the soft component.

2-2-2 Basic Plan

RUWASA has constructed a total of 159 boreholes during the 5 years from 1999 up to last year (11 to 84 boreholes annually). Since the execution of the basic design survey for this project has been realized, the implementation budget of RUWASA has vastly increased for this year. RUWASA plans to construct 162 boreholes this year, and has already completed 134 boreholes (as of August, 2004.) 24 staffs including 5 drilling crews are employed, enabling the mazimum formulation of 5 groups. Moreover, there are 8 staff comprising 2 teams for construction of superficial structures. The state government plans to assign necessary engineers for investigation and pumping test.

Therefore, the capacity of RUWASA is sufficient for the project implementation, with the premise that appropriate technical training is provided. The project will be formulated as equipment provision with the Nigerian government constructing the facilities by utilizing the equipment procured through the Japanese grant aid and those owned by RUWASA.

(1) General Plan

1) Target Site (Villages)

The target site, as shown in table 2-4, are selected based on 3 viewpoints: groundwater potential (amount and quality of groundwater, groundwater table and borehole depth), social conditions (occurrence of water borne diseases, present situation of water supply facilities: existence of water source, distance to water source, amount and quality of water, situation of water environmental and sanitation committee establishment, villagers willingness for participation and available support by LGA, etc.), and site access. 1 borehole will be constructed in each of the 240 communities located in 38 LGAs. Further investigation of the 240 sites will be carried out by RUWASA to decide exact drilling spots.

2) Unit Water Supply

RUWASA aims at supplying 30 l.p.c.d as the unit water supply, which is the standard instructed by National Water supply and Sanitation Policy. However, this project applies 20 l.p.c.d, as the unit water supply taking into account the urgency operation and putting emphasis on providing service to larger numbers of people, and also the standards of previous Japanese grant aid projects in Nigeria and the that of UNICEF, etc. Table 2-3 shows the principal data of water supply conditions adopted by relevant organizations.

Table 2-3 Unit Water Supply

Organization, etc.	Service Population	Unit Water Supply
National Water Policy	250～500	30 l.p.c.d
UNICEF	500	20 l.p.c.d
WHO	-	5～25 l.p.c.d
Japanese Grant Aid projects	450～500	15～20 l.p.c.d
RUWASA	500	30 l.p.c.d

3) Operation Hour of Hand Pump and Beneficiary Population

According to the results of interview survey for the use of existing hand pump, the average operating hours is approximately 8 to 12 hours per day in many of the communities. The operation hours is expected to be even longer in dry season. The average operation hour applied to the Japanese grant aid projects is 8 hours/day and the maximum is 10 hours/day. Therefore, 10 hours operation/day will be designed in this project in regard of the present situation. With premise that the capacity of the boreholes will be 12 liters per minute, the population to be serviced by 10 hours/day operation is estimated below.

12 liters per minute × 10 hours = 7,200 liters per day
7,200 liters per day / 20 l.p.c.d = 360 persons

The total service population will be

240 villages × 360 persons = 86,400 persons.

This is equivalent to 1.4% of the water supply ratio in the rural area of Kano state.

4) Examination of Water Sources

The water source for this project is groundwater, of which is recharged mainly by rainfall. The annual rainfall in the areas ranges between 800 and 1,000 mm. With

20 l.p.c.d as unit water supply, and the estimated beneficiary population as 360 persons, the amount of groundwater recharge largely exceeds the amount of withdraw for the 240 boreholes, as indicated below. Thus recharge of groundwater will no be regarded as a problem.

Withdraw (Q) =7,200 liters/day/borehole × 240 boreholes × 365 days
= 629 × $10^3$$m^3$ /year

Recharge from rainfall (R) = 800 mm (annual rainfall) × 1% (= Infiltration ratio to under ground*) × 20,760 × $10^6$$m^2$ （=total area of the 38LGAs）
= 171.8 × $10^6$$m^3$/year

That is, Q = 6.3 Mm^3 << R = 171.8 Mm^3 （less than 0.37%）

Note: * Infiltration ratio is hardly lower than 1% in the least case

5) Groundwater Quality of Raw Water

Water quality tests conducted in the field survey indicates several existing boreholes with high nitrate (NO_3) and/or iron (Fe). There are possibilities that Nitrate results from infiltration of domestic wastewater into the boreholes. This can be avoided by reinforcing platform and preventing infiltration of domestic wastewater into groundwater. Iron contents are within usable standards, and it can be said that water quality is generally favorable. Therefore, borehole development will not be done and the raw water will be directly used without any treatment. However, taking into account the possible localities, water quality will be confirmed through water quality tests conducted together with the pumping test.

Table 2-4 Total Evaluation of Village for Rural Water Supply Project in Kano State

No.	No. BH	ID/No	LGA	Village	Latitude	Longtitude	Population	Existing Facility	No. of Requested Well	G.P.E Points	A.E. Points	S.E. Points	T.E. Points
1	**1**	29-10	Tofa	Ung. Rimi Yangarki	11.96972	8.35889	1,029	-	1	236	4	21	**48.6**
2	**3**	7-2	Dawakin Kudu	Dabar Kwari	11.72528	8.68611	2,000	HP	2	277	5	15	**47.7**
3	**4**	10-4	T/Wada	F/Ma aji Bayan Dutse	11.32222	8.37389	1,620	-	1	282	5	14	**47.2**
4	**5**	18-6	Rogo	Sundu	11.37333	7.76056	2,940	-	1	281	5	14	**47.1**
5	**7**	35-8	Wudil	Wudil Hausawa	11.82278	8.84333	2,310	-	2	255	4	17	**46.5**
6	**8**	18-2	Rogo	Dandan	11.39222	7.83917	1,234	-	1	279	5	13	**45.9**
7	**9**	24-6	Danbatta	Dukawa (Ung. Bai)	12.58520	8.61417	1,200	-	1	291	5	11	**45.1**
8	**11**	29-6	Tofa	Jili Badawa	11.91139	8.27972	2,007	-	2	240	3	18	**45.0**
9	**12**	37-7	Takakl	K/Lafiya Duga	11.49028	9.21722	1,910	-	1	260	3	16	**45.0**
10	**13**	4-6	Kura	Butalawa C/Gari	11.80361	8.42639	897	-	1	269	4	14	**44.9**
11	**14**	18-3	Rogo	Fulatan S/Gari	11.39250	7.85611	2,350	HP	1	269	5	13	**44.9**
12	**15**	29-8	Tofa	Doka Katsalle	12.00028	8.29167	1,009	-	1	228	5	17	**44.8**
13	**16**	29-9	Tofa	Unguwar Rimi Jigawa	11.98944	8.33278	2,000	HP	1	238	5	16	**44.8**
14	**17**	11-2	Doguwa	Dokar Goma	10.76472	8.62500	1,009	HP	1	273	5	12	**44.3**
15	**18**	32-5	Albasu	Balaiya (Lahya)	11.59833	8.98556	710	-	1	263	5	13	**44.3**
16	**19**	4-1	Kura	Rugar Duka	11.80417	8.44056	1,980	-	1	261	4	14	**44.1**
17	**20**	35-7	Wudil	Kwas Kuraya	11.47083	8.78389	1,617	-	1	269	4	13	**43.9**
18	**21**	4-4	Kura	Kwario Dangama	11.83361	8.50667	1,600	-	1	247	5	14	**43.7**
19	**23**	18-5	Rogo	Rogo (Balawa)	11.55833	7.82083	2,003	-	2	247	5	14	**43.7**
20	**25**	24-4	Danbatta	"(Turawa babba)	12.46944	8.67833	2,000	-	2	297	4	10	**43.7**
21	**26**	5-1	G/Mallam	Ringimawa Galaduna	11.66694	8.41500	991	-	1	246	5	14	**43.6**
22	**28**	7-1	Dawakin Kudu	Danbagari	11.78417	8.77611	1,009	HP	2	286	4	11	**43.6**
23	**29**	29-7	Tofa	Doka Farinruwa	12.00972	8.31250	1,289	-	1	216	5	17	**43.6**
24	**32**	1-3	Rano	Gargun	11.61667	8.61500	2,010	-	3	265	5	12	**43.5**
25	**34**	13-3	Bebeji	Kadangaru	11.76389	8.13917	2,001	-	2	245	3	16	**43.5**
26	**35**	3-3	Kibiya	Kibiya Katanya	11.55944	8.74861	1,021	-	1	294	3	11	**43.4**
27	**37**	12-6	Kiru	Maidagaye	11.35389	8.21611	1,720	-	2	274	2	14	**43.4**
28	**39**	33-3	Gaya	Lautai Arewa	11.82222	8.95694	2,600	-	2	223	4	17	**43.3**
29	**40**	33-8	Gaya	Lautai Kudu	11.80361	8.96167	1,620	-	1	223	4	17	**43.3**
30	**41**	6-5	Madobi	Gora Danzogari	11.82278	8.29389	1,950	-	1	242	4	15	**43.2**
31	**43**	36-8	Garko	Sarina (Z/Barkono)	11.57861	8.88833	2,001	-	2	241	2	17	**43.1**
32	**44**	17-3	Karaye	Zango	11.83389	8.05667	911	-	1	260	2	15	**43.0**
33	**45**	1-2	Rano	Shangu	11.52056	8.59917	1,207	HP	1	269	4	12	**42.9**
34	**46**	14-2	Gwarzo	Nassarawa (Zangarma)	11.93194	7.83833	921	HP	1	229	5	15	**42.9**
35	**47**	10-5	T/Wada	Tsamiya	11.32306	8.26778	1,800	-	1	267	2	14	**42.7**
36	**48**	12-5	Kiru	GGASS Kiru	11.70611	8.14722	1,920	-	1	255	5	12	**42.5**
37	**49**	34-2	Ajingi	Fulalan (Kwari)	11.98889	8.91722	2,314	HP	1	254	1	16	**42.4**
38	**50**	2-5	Bunkure	Nariya	11.57778	8.64833	2,082	-	1	233	3	16	**42.3**
39	**51**	5-4	G/Mallam	Kargo	11.67611	8.41444	1,002	-	1	243	5	13	**42.3**
40	**52**	24-1	Danbatta	Ajumawa (F/Yamma)	12.50972	8.48028	1,500	-	1	273	4	11	**42.3**
41	**53**	28-5	Dawakin Tofa	Rumo Walawa	12.13611	8.43250	1,023	-	1	223	4	16	**42.3**
42	**54**	33-6	Gaya	Kabuga	11.93194	9.01306	1,675	-	1	273	4	11	**42.3**
43	**55**	4-3	Kura	Rjivar Kwari	11.68611	8.37194	2,001	-	1	231	5	14	**42.1**
44	**56**	5-3	G/Mallam	Kosawa Agalas	11.78417	8.45694	981	-	1	261	5	11	**42.1**
45	**57**	14-4	Gwarzo	Riji Tsauni (Katoge)	11.95083	7.90639	902	HP	1	221	5	15	**42.1**
46	**58**	35-3	Wudil	Lajawa Hurumi	11.87306	8.92500	1,928	-	1	251	3	14	**42.1**
47	**59**	35-5	Wudil	Kausani Kirikassamma	11.85278	8.89611	1,710	-	1	261	4	12	**42.1**
48	**61**	4-8	Kura	Ganun Kaya	11.76528	8.50639	2,010	-	2	250	4	13	**42.0**
49	**63**	7-5	Dawakin Kudu	Danfari	11.89194	8.53778	1,021	-	2	250	5	12	**42.0**
50	**65**	12-3	Kiru	Maraku	11.68611	8.13167	1,627	-	2	260	5	11	**42.0**
51	**66**	14-1	Gwarzo	Zangarmawa	11.95000	7.87278	764	-	1	220	5	15	**42.0**
52	**67**	5-6	G/Mallam	Galinja	11.85361	8.49667	1,320	-	1	268	4	11	**41.8**
53	**68**	18-7	Rogo	Sundu (Amasha)	11.53972	7.82028	980	-	1	268	5	10	**41.8**
54	**71**	29-4	Tofa	Lambu Baunikare	12.00083	8.35333	2,019	-	3	228	5	14	**41.8**
55	**72**	37-9	Takakl	D/Gabas	11.53917	9.22778	1,701		1	258	5	11	**41.8**
56	**73**	20-2	Ungogo	Kokarani	12.16806	8.91361	1,200	HP	1	257	5	11	**41.7**
57	**74**	29-2	Tofa	Gajida	12.07917	8.28194	1,280	-	1	237	4	14	**41.7**
58	**76**	9-1	Kumbotso	Shekar Barde Kudu	11.96972	8.53028	1,750	-	2	246	5	12	**41.6**
59	**77**	29-3	Tofa	Lambu Fanshata	12.00944	8.35278	2,100	HP	1	226	5	14	**41.6**
60	**78**	4-2	Kura	Rigar Wajc	11.82333	8.50528	1,760	-	1	245	5	12	**41.5**
61	**79**	10-6	T/Wada	Yalwa Gishirya	11.33361	8.40806	1,670	-	1	285	4	9	**41.5**
62	**80**	13-1	Bebeji	Dangora (Kyarama)	11.57889	8.14306	671	-	1	213	5	15	**41.3**
63	**81**	11-4	Doguwa	Barji	11.16694	8.54556	901	-	1	282	5	8	**41.2**
64	**83**	37-8	Takakl	K/Lafiya Dumbani	11.50000	9.17472	2,019	-	2	261	3	12	**41.1**
65	**84**	4-7	Kura	Gawo	11.84278	8.44611	789	-	1	240	3	14	**41.0**
66	**85**	6-4	Madobi	Madobi Bugurau	11.76444	8.30056	2,100	-	1	210	5	15	**41.0**
67	**86**	37-6	Takakl	Kanawa K/Tsakiya	11.45000	9.02306	2,601	-	1	260	0	15	**41.0**
68	**87**	11-1	Doguwa	Doguwar Gabas	10.74444	8.58944	920	-	1	269	4	10	**40.9**
69	**88**	10-1	T/Wada	Jeli C/Gari	11.28444	8.26417	1,560	-	1	268	2	12	**40.8**
70	**90**	1-5	Rano	Zanbur (Yado)	11.57917	8.58167	1,850	-	2	226	5	13	**40.6**
71	**91**	38-1	Sumaila	Unguwar Gara	11.30333	9.00861	1,002	-	1	266	2	12	**40.6**
72	**92**	3-7	Kibiya	Shiye Karama	11.50917	8.65694	1,002	-	1	253	5	10	**40.3**
73	**93**	25-5	Makoda	Dunawa	12.47028	8.41778	2,100	-	1	278	3	10	**40.3**
74	**94**	36-2	Garko	Gurjiya	11.65639	8.84222	2,100	HP	1	212	4	15	**40.2**
75	**95**	9-5	Kumbotso	Gaida	11.91250	8.47306	2,114	-	1	261	5	9	**40.1**
76	**96**	35-6	Wudil	Tsiburi Ung. Naggi	11.84222	8.84111	1,801	-	1	271	4	9	**40.1**
77	**97**	13-2	Bebeji	Galadimawa Dumi	11.76472	8.24417	890	-	1	210	4	15	**40.0**
78	**99**	17-1	Karaye	Makera	11.78417	7.96750	1,610	-	2	270	4	9	**40.0**
79	**101**	35-1	Wudil	Utai Kukatara	11.74556	8.88250	1,290	-	2	230	5	12	**40.0**
80	**103**	32-4	Albasu	Saya-Saya (Domawa)	11.87306	8.32806	2,351	-	2	238	3	13	**39.8**
81	**104**	9-3	Kumbotso	Bechi	11.93111	8.50083	950	-	1	266	5	8	**39.6**
82	**105**	33-4	Gaya	Muna-Muna	11.70583	9.01000	2,100	HP	1	226	4	13	**39.6**
83	**106**	3-1	Kibiya	Kadigawa	11.59722	8.73917	711	-	1	275	3	9	**39.5**
84	**109**	21-6	Bitchi	Kyalli C/G (Kyalli)	12.33389	8.18806	3,000	-	3	205	5	14	**39.5**
85	**110**	29-1	Tofa	Kalobawa Dispensary	12.02028	8.36861	1,009	-	1	225	4	13	**39.5**
86	**111**	15-2	Kabo	H/Bango Ung. Gyaroji	11.87250	8.19194	891	-	1	234	5	11	**39.4**
87	**113**	30-5	Bagwai	Kalin Maiko	12.03917	8.16611	712	-	2	244	3	12	**39.4**
88	**114**	14-3	Gwarzo	Ruzar Daudu	11.89306	8.06444	890	-	1	213	3	15	**39.3**
89	**116**	15-1	Kabo	Wutsawar Indabo	11.95083	8.17667	1,090	-	2	203	5	14	**39.3**
90	**118**	33-1	Gaya	Dangagarau Shagogo	11.84278	8.96389	3,000	-	2	223	5	12	**39.3**

No.	No. BH	ID/No	LGA	Village	Latitude	Longtitude	Population	Existing Facility	No. of Requested Well	G.P.E Points	A.E. Points	S.E. Points	T.E. Points
91	**120**	36-6	Garko	Sarina (Hurumi)	11.59750	8.92083	2,007	-	2	243	4	11	**39.3**
92	**121**	36-7	Garko	Sarina (Kurunka)	11.59750	8.92167	1,009	-	1	243	4	11	**39.3**
93	**122**	2-1	Bunkure	Madachi Juma	11.63639	8.61917	980	HP	1	242	4	11	**39.2**
94	**123**	2-6	Bunkure	Chirin (Kode)	11.65611	8.51833	1,009	-	1	222	3	14	**39.2**
95	**125**	20-3	Ungogo	Doka	12.09750	8.40167	2,600	-	2	232	5	11	**39.2**
96	**127**	27-5	Gabasawa	GGISS Zakirai	12.11667	8.88972	2,900	-	2	232	5	11	**39.2**
97	**128**	1-7	Rano	Toure	11.59722	8.59722	950	-	1	241	5	10	**39.1**
98	**129**	15-3	Kabo	Wari Tofa	11.91222	8.17833	798	-	1	211	5	13	**39.1**
99	**131**	23-2	Tsanyama	Daddarawa	12.22639	8.07417	1,700	HP	2	231	3	13	**39.1**
100	**133**	32-6	Albasu	Hure Kado Hungi	12.00972	8.32361	2,110	-	2	211	5	13	**39.1**
101	**134**	37-4	Takakl	Daushanga Randas	11.54000	9.11500	1,910	-	1	261	5	8	**39.1**
102	**135**	37-10	Takakl	Faruruwa Taranda	11.43083	9.20278	1,918		1	291	1	9	**39.1**
103	**136**	1-4	Rano	Kasuwar Dila	11.45111	8.56583	2,009	HP	1	240	3	12	**39.0**
104	**137**	6-6	Madobi	Guoa Unguwar Madaki	11.82361	8.31306	2,001	-	1	209	4	14	**38.9**
105	**139**	23-11	Tsanyama	Doray	12.37250	8.07861	1,090		2	239	5	10	**38.9**
106	**140**	24-3	Danbatta	Saidawa (C/Gari)	12.30389	8.62889	1,900	-	1	229	4	12	**38.9**
107	**141**	34-1	Ajingi	Tsma (Toranke)	12.02056	9.21889	1,230	-	1	239	4	11	**38.9**
108	**142**	28-7	Dawakin Tofa	Police Barack D/Tofa	12.09861	8.34111	1,625	-	1	238	5	10	**38.8**
109	**144**	33-2	Gaya	Bangashe	11.89250	9.01806	2,900	HP	2	218	5	12	**38.8**
110	**145**	37-1	Takakl	Takai Loko	11.57806	9.11167	1,670	-	1	257	5	8	**38.7**
111	**147**	12-2	Kiru	Kiru Dirba	11.70556	8.13444	1,617	-	2	256	5	8	**38.6**
112	**148**	3-2	Kibiya	Kuluki Katanya	11.57889	8.75556	813	HP	1	275	3	8	**38.5**
113	**150**	26-9	Gezawa	Bujawa Village	12.15556	8.74472	2,210	-	2	245	5	9	**38.5**
114	**151**	15-4	Kabo	Garo Alkalawa	11.96972	8.11944	914	-	1	184	5	15	**38.4**
115	**152**	34-4	Ajingi	Gulya	12.04000	8.95222	1,920	-	1	264	1	11	**38.4**
116	**154**	35-4	Wudil	Makadi Saikahu	11.70694	8.76944	2,211	-	2	224	3	13	**38.4**
117	**155**	36-1	Garko	Kafin Malamai	11.67611	8.88194	2,300	-	1	234	5	10	**38.4**
118	**156**	36-3	Garko	Kawo	11.66806	8.82083	2,008	-	1	214	5	12	**38.4**
119	**158**	1-6	Rano	Garabawa (Dawa)	11.55917	8.54833	1,550	-	2	203	4	14	**38.3**
120	**159**	20-7	Ungogo	Rimin Zakara	12.00972	8.44611	1,760	-	1	253	3	10	**38.3**
121	**160**	26-8	Gezawa	Musku Village	12.00889	8.76611	1,423	-	1	233	4	11	**38.3**
122	**161**	34-3	Ajingi	Fagawa	11.97083	8.88500	1,524	-	1	253	1	12	**38.3**
123	**163**	23-7	Tsanyama	Rindi	12.18722	8.01278	1,870	-	2	222	5	11	**38.2**
124	**164**	24-5	Danbatta	Sansan (D/Malamai)	12.43083	8.66278	2,000	-	1	272	3	8	**38.2**
125	**166**	16-5	Shanono	Shakogi (Sabon Gari)	12.02028	8.01722	2,009	-	2	201	4	14	**38.1**
126	**167**	27-3	Gabasawa	Unguwar Zakarai	12.22611	8.91278	1,009	-	1	261	4	8	**38.1**
127	**169**	3-5	Kibiya	Kalambu	11.43194	8.61833	9,001	-	2	260	3	9	**38.0**
128	**171**	12-4	Kiru	Bauda C/Gari	11.59750	8.19000	1,817	-	2	240	4	10	**38.0**
129	**173**	16-4	Shanono	Leni (Badumawa)	12.05861	8.10389	2,005	HP	2	240	3	11	**38.0**
130	**175**	20-4	Ungogo	Kaisuwa	12.11806	8.49833	3,200	-	2	230	4	11	**38.0**
131	**177**	31-6	Rimi Gado	Dansudu	12.00972	8.32361	1,650	-	2	210	5	12	**38.0**
132	**179**	8-6	Warawa	Imawa	11.89194	8.81694	2,500	-	2	269	2	9	**37.9**
133	**180**	15-6	Kabo	Wutsawa Titi	11.95139	8.15889	916	-	1	199	5	13	**37.9**
134	**182**	23-4	Tsanyama	Gurun Duisenguwa	12.35306	7.94972	1,900	-	2	239	4	10	**37.9**
135	**184**	35-2	Wudil	Utai Kukar babare	11.74556	8.88500	2,009	HP	2	229	4	11	**37.9**
136	**185**	8-3	Warawa	Garindaiu C/Gari	11.82778	8.82778	2,800	-	1	248	5	8	**37.8**
137	**187**	15-7	Kabo	Gude Kwalwa	11.96972	8.14889	1,718	-	2	198	5	13	**37.8**
138	**188**	28-3	Dawakin Tofa	Dawanau Sec. School	12.09778	8.41611	1,019	-	1	228	5	10	**37.8**
139	**189**	36-5	Garko	Yarka	11.59861	8.88861	1,901	-	1	238	2	12	**37.8**
140	**190**	2-3	Bunkure	Bunkure (Madugu)	11.70556	8.54056	2,001	HP	1	237	5	9	**37.7**
141	**191**	14-5	Gwarzo	Kutuma Rugar waje	11.91222	7.94361	807	-	1	237	5	9	**37.7**
142	**195**	14-8	Gwarzo	Rugar Waje (Zango)	11.93056	7.94639	2,011	-	4	247	5	8	**37.7**
143	**196**	17-6	Karaye	Tudun Kava C/Gari	11.74444	7.92889	891	-	1	267	3	8	**37.7**
144	**197**	27-6	Gabasawa	Special P/S Gabasawa	12.16722	8.90306	1,890	-	1	237	5	9	**37.7**
145	**199**	31-7	Rimi Gado	Jantsauni	11.95028	8.23861	1,700	-	2	167	4	17	**37.7**
146	**200**	38-5	Sumaila	Gajiki	11.24500	8.85778	1,009	-	1	267	3	8	**37.7**
147	**201**	9-2	Kumbotso	Gumi gawa	11.93194	8.52194	2,165	-	1	266	4	7	**37.6**
148	**202**	20-8	Ungogo	Maigaru	12.07917	8.47306	2,000	-	1	226	5	10	**37.6**
149	**203**	37-2	Takakl	Takai Kogawa	11.57861	9.11000	2,001	HP	1	256	5	7	**37.6**
150	**204**	26-3	Gezawa	Gawo Village	12.00944	8.75778	1,918	-	1	235	5	9	**37.5**
151	**205**	28-1	Dawakin Tofa	Burun Tumau	12.18611	8.41306	1,817	-	1	215	5	11	**37.5**
152	**207**	30-4	Bagwai	Rimin Bai	12.05972	8.20806	912	HP	2	225	1	14	**37.5**
153	**208**	34-6	Ajingi	Jarna ar dal	11.93194	9.01306	1,029	-	1	274	2	8	**37.4**
154	**210**	1-1	Rano	Jalabi Zango	11.65694	8.61139	1,500	-	2	222	4	11	**37.2**
155	**212**	20-5	Ungogo	Tarda Barebari	12.11750	8.52972	1,900	-	2	222	5	10	**37.2**
156	**214**	32-1	Albasu	Yaura (Kinkimaje)	11.59861	8.94639	1,928	-	2	242	5	8	**37.2**
157	**216**	19-8	Minjibur	Farawa	12.15611	8.63861	2,500	-	2	241	4	9	**37.1**
158	**218**	33-5	Gaya	Kasai Wudilawa	11.82250	8.91694	1,780	HP	2	231	5	9	**37.1**
159	**220**	33-9	Gaya	Gamoji	11.83472	9.17806	1,200	HP	2	221	5	10	**37.1**
160	**221**	37-5	Takakl	Kanwa K/Kudu	11.50111	9.15194	2,001	-	1	251	3	9	**37.1**
161	**222**	5-2	G/Mallam	Azoren Waje (U/Zango)	11.76472	8.39583	809	-	1	250	4	8	**37.0**
162	**224**	17-2	Karaye	Kaleku (Agalawa)	11.63611	7.90611	1,919	-	2	240	5	8	**37.0**
163	**226**	31-5	Rimi Gado	Unguwar Ganji	11.96944	8.25417	1,718	-	2	210	5	11	**37.0**
164	**228**	14-6	Gwarzo	Ung. Tudu (Karofi)	11.93167	7.95417	1,028	-	2	249	5	7	**36.9**
165	**230**	31-3	Rimi Gado	Yandadi	12.00861	8.40333	1,990	HP	2	209	4	12	**36.9**
166	**232**	32-3	Albasu	Saya-Saya (Digawa)	11.70556	8.98278	1,920	-	2	199	5	12	**36.9**
167	**233**	32-8	Albasu	Zangon Gala	11.61806	9.00667	761	-	1	249	4	8	**36.9**
168	**235**	36-11	Garko	Yarka (Dundu)	11.61750	8.91194	1,760		2	239	4	9	**36.9**
169	**236**	37-3	Takakl	Garfi U. Galadima	11.46972	9.15500	1,009	-	1	259	3	8	**36.9**
170	**237**	26-2	Gezawa	Tofa Village	12.00111	8.74944	2,009	-	1	238	4	9	**36.8**
171	**239**	5-5	G/Mallam	Yakasai	11.84167	8.49389	2,010	-	2	247	4	8	**36.7**
172	**240**	14-9	Gwarzo	Moda C/Gari	11.91250	7.92917	821	-	1	237	5	8	**36.7**
173	242	23-5	Tsanyama	Rigar Barde	12.16778	8.02889	1,235	-	2	227	3	11	**36.7**
174	244	31-4	Rimi Gado	Dawakin Gulu	11.87306	8.32806	2,002	-	2	237	3	10	**36.7**
175	245	2-4	Bunkure	Buran (Yamma)	11.45083	8.55250	1,081	-	1	236	2	11	**36.6**
176	246	32-7	Albasu	Hargagi (Barburawa)	11.95028	8.23861	671	-	1	176	5	14	**36.6**
177	247	10-7	T/Wada	Rufan Maigari	11.30417	8.71972	1,900	-	1	265	3	7	**36.5**
178	248	18-1	Rogo	Unguwar Dawa	11.61722	7.94361	1,002	-	1	245	2	10	**36.5**
179	249	19-14	Minjibur	Magarawa	12.26417	8.68500	1,850	-	1	215	4	11	**36.5**
180	251	30-3	Bagwai	Rimin Dako (Munkebe)	12.09806	8.24972	820	-	2	245	2	10	**36.5**

No.	No. BH	ID/No	LGA	Village	Latitude	Longtitude	Population	Existing Facility	No. of Requested Well	G.P.E Points	A.E. Points	S.E. Points	T.E. Points
181	253	31-2	Rimi Gado	Atawa	11.95083	8.24917	2,500	HP	2	164	5	15	**36.4**
182	255	6-2	Madobi	Rijardawa	11.72611	8.31111	1,550	-	2	213	4	11	**36.3**
183	257	8-7	Warawa	Bagoji	11.87333	8.80083	2,600	-	2	253	2	9	**36.3**
184	259	30-1	Bagwai	Bagwai (Rinji)	12.17556	8.13500	1,324	-	2	223	4	10	**36.3**
185	260	3-9	Kibiya	Tarai Zana	11.50028	8.67528	1,810	-	1	252	5	6	**36.2**
186	262	11-3	Doguwa	Daguwa (Doka)	10.72583	8.62083	2,301	-	2	272	5	4	**36.2**
187	264	16-2	Shanono	Kokiya (Gidan dawa)	12.00833	8.03278	2,000	-	2	191	3	14	**36.1**
188	265	27-1	Gabasawa	Dorawar Isau	12.13639	8.78694	1,630	-	1	241	4	8	**36.1**
189	267	33-10	Gaya	Bagoge	11.85306	9.00583	1,009		2	221	5	9	**36.1**
190	268	32-2	Albasu	Duja Yamma	11.67611	9.08944	1,627	-	1	230	3	10	**36.0**
191	270	33-7	Gaya	Tsurutawa Jasan	11.85278	9.00000	2,190	HP	2	220	5	9	**36.0**
192	272	36-9	Garko	Lamire (Yelde)	11.68750	8.82528	2,006	PE	2	200	4	12	**36.0**
193	274	31-1	Rimi Gado	Rimin Gado (Atawa)	11.95056	8.25472	1,020	-	2	159	4	16	**35.9**
194	276	36-10	Garko	Yarka (Kira-Kira)	11.61750	8.90806	3,001		2	239	3	9	**35.9**
195	277	7-3	Dawakin Kudu	Kode	11.85278	8.67750	1,008	-	1	248	4	7	**35.8**
196	279	7-7	Dawakin Kudu	Dilawa	11.82306	8.75194	1,210	-	2	197	5	11	**35.7**
197	281	8-1	Warawa	Ganitsuru	11.80389	8.75278	1,400	-	2	217	4	10	**35.7**
198	282	19-3	Minjibur	Kunshe	12.16722	8.61667	1,500	-	1	217	4	10	**35.7**
199	283	32-9	Albasu	Jemo	11.67639	9.15556	820	-	1	256	2	8	**35.6**
200	284	38-4	Sumaila	Siti Doguwar Dorawa	11.28417	8.81444	1,009	-	1	266	4	5	**35.6**
201	286	14-7	Gwarzo	Koyar Gesto	11.87361	7.95417	1,020	-	2	245	4	7	**35.5**
202	289	23-3	Tsanyama	Zarosi Dispensary	12.24583	7.99139	3,100	HP	3	214	3	11	**35.4**
203	290	3-4	Kibiya	Kibiya Ung. Musa	11.52056	8.66250	1,091	HP	1	243	5	6	**35.3**
204	291	38-3	Sumaila	Falali (Fita)	11.49000	9.06306	980	-	1	243	3	8	**35.3**
205	293	8-9	Warawa	Madari Audalawa	11.89278	8.75139	2,800	-	2	232	2	10	**35.2**
206	295	9-4	Kumbotso	Unguwar Duniya	11.95056	8.40444	2,131	-	2	242	5	6	**35.2**
207	297	23-9	Tsanyama	Gezama	12.28444	7.94083	1,280		2	211	5	9	**35.1**
208	298	28-2	Dawakin Tofa	Yakasai Dandalama	12.17528	8.48444	2,010	HP	1	221	5	8	**35.1**
209	300	19-7	Minjibur	Azore B/Kasuwa	12.13611	8.60556	2,500	-	2	220	4	9	**35.0**
210	301	27-4	Gabasawa	Kaki Gumawa	12.15611	8.86472	1,910	-	1	190	5	11	**35.0**
211	302	27-9	Gabasawa	Kanwa	12.05917	8.89139	1,009		1	230	4	8	**35.0**
212	303	17-7	Karaye	Kwanyawa	11.78389	7.88833	896	-	1	279	1	6	**34.9**
213	304	26-4	Gezawa	Gofaro Village	12.02000	8.74722	1,231	-	1	229	5	7	**34.9**
214	305	32-10	Albasu	Sheda	11.66667	9.00667	817	-	1	219	3	10	**34.9**
215	306	36-4	Garko	Raba	11.67639	8.82444	1,290	-	1	209	5	9	**34.9**
216	307	8-4	Warawa	Yandalla	11.83333	8.78778	1,800	HP	1	217	5	8	**34.7**
217	309	9-6	Kumbotso	Mariri (Kata)	11.95000	8.62917	2,005	-	2	227	5	7	**34.7**
218	311	23-10	Tsanyama	Yanromo	12.33417	7.94417	2,100		2	227	5	7	**34.7**
219	312	2-2	Bunkure	Bono (Kure)	11.68694	8.63306	810	-	1	246	3	7	**34.6**
220	314	8-8	Warawa	Madari C/Gari	11.91194	8.73861	2,500	-	2	256	2	7	**34.6**
221	316	16-8	Shanono	D/Bakoshi (Jammaza)	12.04000	8.02583	2,000	HP	2	196	4	11	**34.6**
222	317	26-5	Gezawa	Tsalle	12.07861	8.71111	1,521	-	1	216	4	9	**34.6**
223	318	34-5	Ajingi	Guzawa (Arewa)	11.98917	8.97083	2,019	-	1	246	1	9	**34.6**
224	320	19-4	Minjibur	Asanawa C/Gari	12.17500	8.62611	2,500	HP	2	225	5	7	**34.5**
225	321	35-9	Wudil	Achika Jama are	11.68667	8.93056	1,321	-	1	224	3	9	**34.4**
226	323	3-8	Kibiya	Shile	11.51944	8.63639	2,010	HP	2	243	3	7	**34.3**
227	325	21-1	Bichi	Makara Huta (Bichi)	12.24472	8.24611	2,000	-	2	213	5	8	**34.3**
228	326	7-4	Dawakin Kudu	Salfawa	11.83361	8.71139	911	-	1	212	5	8	**34.2**
229	327	15-5	Kabo	Masanawa	11.83444	8.23972	817	-	1	212	2	11	**34.2**
230	329	22-1	Kunchi	Fallc C/Gari	12.59722	8.27611	910	-	2	222	5	7	**34.2**
231	330	10-3	T/Wada	Fala Tsohon gari	11.33333	8.77028	1,890	-	1	271	3	4	**34.1**
232	333	16-1	Shanono	Kokiya (Kazaga)	12.00028	8.02083	2,500	HP	3	191	3	12	**34.1**
233	335	21-2	Bitchi	Buden Gari (G/Hakimi)	12.24472	8.23889	2,500	-	2	211	5	8	**34.1**
234	337	21-8	Bitchi	Rimaye R/Kau-Kau	12.28333	8.20028	4,000	-	2	211	5	8	**34.1**
235	339	23-1	Tsanyama	Kwardagwalle	12.35361	8.05167	1,020	-	2	221	4	8	**34.1**
236	341	16-7	Shanono	Shanono (Jemagu)	12.07889	7.99806	1,800	-	2	190	4	11	**34.0**
237	344	21-4	Bitchi	Daddo (C/G/Badumc)	12.18667	8.31361	2,500	-	3	239	5	5	**33.9**
238	345	25-4	Makoda	Bankaura	12.33361	8.51333	2,200	-	1	209	5	8	**33.9**
239	346	4-5	Kura	Bode	11.84167	8.47028	1,780	-	1	248	4	5	**33.8**
240	348	13-4	Bebeji	Jibga	11.70639	8.24194	2,009	-	2	208	4	9	**33.8**
241	349	20-6	Ungogo	Zangon Barebari	12.07806	8.48333	1,240	-	1	228	5	6	**33.8**
242	350	38-7	Sumaila	Larau	11.49000	9.12056	2,010		1	238	3	7	**33.8**
243	352	13-5	Bebeji	Maska (Karako)	11.59861	8.08444	2,001	-	2	237	3	7	**33.7**
244	354	19-2	Minjibur	Gandirwawa	12.17583	8.61833	3,000	-	2	217	5	7	**33.7**
245	356	23-6	Tsanyama	Harbau U/Dorawa	12.37306	8.04556	2,000	-	2	217	5	7	**33.7**
246	358	19-1	Minjibur	Gizawa C/Gari	12.15667	8.59444	2,500	-	2	226	4	7	**33.6**
247	360	30-2	Bagwai	Gadanya (Rinji)	12.09806	8.03889	617	HP	2	196	5	9	**33.6**
248	362	16-6	Shanono	Shakogi (Kurmi)	12.00000	8.01194	2,800	-	2	194	4	10	**33.4**
249	364	19-11	Minjibur	Kantamar Chiroma	12.16694	8.58056	3,750	-	2	204	4	9	**33.4**
250	366	27-7	Gabasawa	Asayaya	12.17583	8.91194	2,005	-	2	253	5	3	**33.3**
251	368	19-6	Minjibur	Sabauna	12.13694	8.59528	3,000	-	2	222	4	7	**33.2**
252	369	28-4	Dawakin Tofa	Jalunawa	12.17583	8.50306	2,123	-	1	202	5	8	**33.2**
253	370	27-8	Gabasawa	Timbau Kaurare	12.00917	8.83000	1,007		1	221	4	7	**33.1**
254	372	8-5	Warawa	Dakata	11.89194	8.75333	1,900	-	2	230	2	8	**33.0**
255	374	9-7	Kumbotso	Mariri Arewa	11.97000	8.61556	2,233	-	2	220	5	6	**33.0**
256	376	31-9	Rimi Gado	Jujin Ahmadu	11.93194	8.26667	2,100		2	190	4	10	**33.0**
257	377	10-2	T/Wada	Gardi	11.16750	8.41917	2,450	HP	1	269	3	3	**32.9**
258	379	16-11	Shanono	Alajawa (Goda)	12.02056	7.94306	1,500	HP	2	169	4	12	**32.9**
259	381	20-1	Ungogo	Kadawa	12.07833	8.45389	1,090	-	2	229	5	5	**32.9**
260	383	16-12	Shanono	Kadamu (Dankucciya)	12.13667	7.95917	1,900	-	2	208	3	9	**32.8**
261	384	19-12	Minjibur	Burasawa	12.26444	8.55972	1,700	-	1	198	4	9	**32.8**
262	385	38-6	Sumaila	Gajiki Unguwar Lemo	11.26444	8.84556	1,250	-	1	268	3	3	**32.8**
263	387	19-10	Minjibur	Kuru C/Gari	12.16722	8.53389	3,005	-	2	197	4	9	**32.7**
264	389	23-8	Tsanyama	Harbau Bojawa	12.41194	8.05278	1,760	-	2	217	3	8	**32.7**
265	391	31-8	Rimi Gado	Danlsa	11.95056	8.22611	2,000	-	2	187	5	9	**32.7**
266	392	8-10	Warawa	Ung. Jigawa Amarawa	11.91167	8.78167	2,900	-	1	236	2	7	**32.6**
267	393	25-1	Makoda	Chidari	12.39222	8.48139	2,500	HP	1	196	5	8	**32.6**
268	394	38-2	Sumaila	Unguwar Sansani	11.24583	9.00389	1,020	-	1	266	1	5	**32.6**
269	396	26-7	Gezawa	Wangara	12.03889	8.10111	3,500	-	2	195	3	10	**32.5**
270	397	8-2	Warawa	Yamai	11.84250	8.74639	1,600	-	1	194	5	8	**32.4**

No.	No. BH	ID/No	LGA	Village	Latitude	Longtitude	Population	Existing Facility	No. of Requested Well	G.P.E Points	A.E. Points	S.E. Points	T.E. Points
271	398	26-6	Gezawa	Daraudau Village	12.05861	8.70083	1,423	-	1	194	4	9	**32.4**
272	399	24-3	Danbatta	Ajumawa (M/Danya)	12.47000	8.46417	1,600	-	1	232	3	6	**32.2**
273	400	25-2	Makoda	Wailarc gara	12.26528	8.53028	1,700	-	1	192	5	8	**32.2**
274	401	26-1	Gezawa	Danja Village	12.04028	8.74639	3,450	HP	1	212	5	6	**32.2**
275	403	27-2	Gabasawa	Falali	12.13639	8.83528	2,009	-	2	212	5	6	**32.2**
276	405	16-10	Shanono	Alajawa (Dantoro)	12.09833	7.98111	1,500	-	2	191	4	9	**32.1**
277	407	15-8	Kabo	Danja Prinary School	12.00944	8.10639	1,091	-	2	157	3	13	**31.7**
278	408	12-1	Kiru	Kiru Gazan	11.70556	8.20444	650	-	1	246	5	2	**31.6**
279	409	19-5	Minjibur	Gandiwawa Asibiti	12.17556	8.61667	1,000	-	1	215	5	5	**31.5**
280	410	27-10	Gabasawa	Sharalle	12.01972	8.85861	1,870		1	234	4	4	**31.4**
281	411	3-6	Kibiya	Kibiya Ung. Ali	11.52083	8.66111	913	-	1	243	5	2	**31.3**
282	412	28-6	Dawakin Tofa	Ganduje Sec. School	12.22556	8.44944	1,920	-	1	201	3	8	**31.1**
283	413	25-3	Makoda	Gagarawa	12.30333	8.56028	1,550	-	1	219	4	5	**30.9**
284	414	30-7	Bagwai	Ragar yayya Yartola	12.09778	8.15056	172	-	1	206	4	6	**30.6**
285	415	8-11	Warawa	Danhawar Gjwa	11.97083	8.82917	1,950	-	1	214	2	7	**30.4**
286	416	21-9	Bitchi	Kau-Kau C/Gari	12.26500	8.24917	1,500	HP	1	204	4	6	**30.4**
287	417	30-6	Bagwai	G/Wanzamai	12.17556	8.13667	162	-	1	222	4	4	**30.2**
288	420	21-7	Bitchi	Yengwazo (Kyalli)	12.28417	8.15556	3,500	-	3	211	3	6	**30.1**
289	422	22-2	Kunchi	Gadaba C/Gari	12.52083	8.22667	2,009	HP	2	166	5	8	**29.6**
290	424	16-13	Shanono	Kadamu (Dorogo)	12.00000	7.97278	2,000	-	2	195	5	5	**29.5**
291	426	22-5	Kunchi	G/Sheme Rugana	12.37333	8.21361	817	-	2	167	4	8	**28.7**
292	427	6-3	Madobi	Damunawa	11.76444	8.37139	2,008	HP	1	196	3	6	**28.6**
293	429	21-3	Bitchi	Ung. Auzunawa	12.28333	8.28583	1,900	-	2	186	2	8	**28.6**
294	431	16-3	Shanono	Leni (Bakwari)	12.02083	8.11333	2,000	-	2	180	3	7	**28.0**
295	433	19-13	Minjibur	Kwarkiva C/Gari	12.24556	8.59778	2,500	-	2	190	5	4	**28.0**
296	436	21-5	Bitchi	Tinki (Kwamarawa)	12.34278	8.38722	3,500	-	3	200	0	8	**28.0**
297	438	22-4	Kunchi	G/Sheme (Kofar Gabas	12.39306	8.24139	910	HP	2	150	5	8	**28.0**
298	441	16-14	Shanono	Goron Dutse (Duka)	12.17583	7.92000	2,500	-	3	195	3	5	**27.5**
299	443	16-9	Shanono	D/Bakoshi (Gwamma)	12.05889	7.96444	2,000	-	2	164	5	6	**27.4**
300	445	22-3	Kunchi	Yandadi (Kofar gabas)	12.46944	8.24194	1,009	-	2	181	2	7	**27.1**
301	447	7-6	Dawakin Kudu	Wasawa	11.87250	8.63083	1,101	HP	2	218	3	2	**26.8**
302	448	19-9	Minjibur	Jama ar Ladan	12.17611	8.55417	1,950	-	1	176	4	5	**26.6**
		5-7	G/Mallam	Butalawa Gawo			1,009	-	1				
		6-1	Madobi	Rugar Duka (U/Kwari			1,750	-	2				
		17-4	Karaye	Kaleku (Agalawa)			890	-	1				
		17-5	Karaye	Tambawa			921	-	1				
		18-4	Rogo	Falalu Gabas			2,009	-	2				
		29-5	Tofa	Jili Darkawa			1,009	-	1				

HP:Hand Pump
PE:Pipe Extension

G.W.E. : Groundwater Potential Evaluation
A.E. : Accessbility Evaluation
S.E. : Social Evaluation
T.E : Total Evaluation

【Selections of Villages or Borehole Sites】

(1)Groundwater Potential Evaluation

1)Water Depth	**0〜100 Point**
2)Water Quality	**0〜100 Point**
3)Borehole Deoth	**0〜100 Point**
4)Yield	**0〜100 Point**

Note: The lowest value in each index. For example, if water depth varies G.L-5 m to G.L.-100 m, the former is given 100 point as the maximum evaluation and the latter is given 0 points as the minimum evaluation. Total evaluation point (TP) is summed them up. Therefore, the maximum total evaluation is 400 points.

(2)Social Condition Evaluation

1)Situation of Waterborne Bisease	**0〜10 Point**
・Rate of Waterborne Disease/Each LGA (2003, MOH)	0〜5 Point
・Rate of Waterborne Disease/Village Survey result	0〜5 Point
2)Existing Water Supply Situation	**0〜10 Point**
・Existing Water Supply Facility	0〜3.3 Point
・Distance from Water Existing Resouse	0〜3.3 Point
・Satisfaction of Water Quality	0〜3.3 Point
3)Participation of Water & Sanitation Committee and Water & Sanitation Unit of LGA support	**0〜10 Point**
・Water & Sanitation Committee(Existence or Willing)	0〜5 Point
・Supporting to Community by LGA	0〜5 Point

(3)Evaluation of Accessibility

0km〜2.0km	**5 Point**
2.0km〜5.0km	**4 Point**
5.0km〜10.0km	**3 Point**
10.0km〜15.0km	**2 Point**
15.0km以上	**1 Point**
In case of river or stream on the way	**-1 Point**

Total evaluation points (T.E.P.)> = <Groundwater Potential Evaluation Points>/10
+ <Social Condition Evaluation Points>
+ <Accessibility Points>

Breakdown of LGA

No.	LGA	Requested		Evaluation result		No.	LGA	Requested		Evaluation result	
		No. of Village	No. of Boreholes	No. of Village	No. of Boreholes			No. of Village	No. of Boreholes	No. of Village	No. of Boreholes
1	Rano	7	12	7	12	21	Bitchi	9	21	1	3
2	Bunkure	6	6	4	4	22	Kunchi	5	10	0	0
3	Kibiya	9	11	5	6	23	Tsanyama	11	23	4	8
4	Kura	8	9	7	8	24	Danbatta	6	7	5	6
5	G/Mallam	7	8	6	7	25	Makoda	5	5	1	1
6	Madobi	6	8	3	3	26	Gezawa	9	11	4	5
7	Dawakin Kudu	7	12	3	6	27	Gabasawa	10	13	3	4
8	Warawa	11	17	2	3	28	Dawakin Tofa	7	7	4	4
9	Kumbotso	7	11	4	5	29	Tofa	10	13	9	12
10	T/Wada	7	7	4	4	30	Bagwai	7	12	2	4
11	Doguwa	4	5	4	3	31	Rimin Gado	9	18	4	8
12	Kiru	6	10	5	9	32	Albasu	10	14	6	10
13	Bebeji	5	8	3	4	33	Gaya	10	17	8	13
14	Gwarzo	9	14	8	12	34	Ajingi	6	6	5	5
15	Kabo	8	11	6	8	35	Wudil	9	13	8	12
16	Shanono	14	30	2	4	36	Garko	11	16	8	11
17	Karaye	7	9	4	6	37	Takai	10	11	10	11
18	Rogo	7	9	5	6	38	Sumaila	7	7	2	2
19	Minjibur	14	23	1	2						
20	Ungogo	8	12	6	9		**Total**	**308**	**456**	**172**	**240**

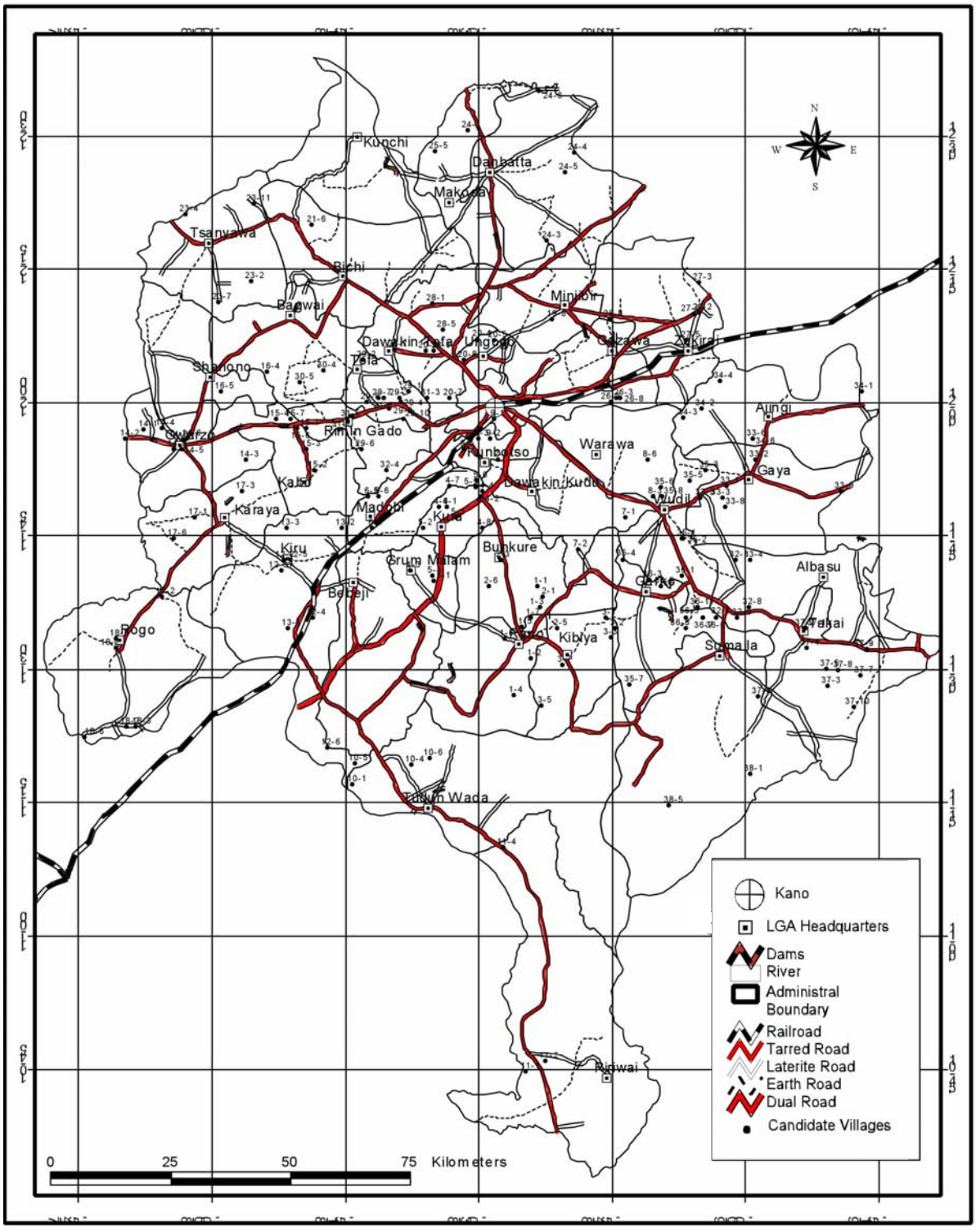


Figure 2-1 Location of Candidate Village

6) Construction of Water Supply Facility

RUWASA has responsibility for construction of facilities. The specifications of the facilities are as follows:

- Since there are no problems in terms of the size and structures of conventional platforms, and that RUWASA is well experienced with it, the conventional specifications of RUWASA (identical to that of UNICEF) will be basically applied.

- Although the drainage distance of drainage channel from the borehole is 3 m for the existing facilities constructed by RUWASA, it is recommended to have longer distances than the existing facility in regard of water contamination.

- According to the electrical sounding results, average drilling depth is inferred as between 40m and 100 m. In the western areas where groundwater development is more difficult, the drilling depth runs up to 100 m. In reference to experiences of RUWASA and materials prepared by World Bank, the average drilling depth for Kano state is approximately 45 m. Although the final decision of drilling depth for each site will be determined based on geological features and groundwater condition at the drilling stage, design depth is set as 45 m on average.

- Casing program will be decided based on the observation and level of groundwater at the drilling stage and electrical logging results.

- Drilling diameter is to be 10” for the surface layers which easily collapse and requires guide pipes, and 6” below the guide pipe end. The diameter of casing and screen pipes is to be 4”. Gravel packing in the screen portion is necessary to avoid plugging screen slits by silt.

- Cementing and sealing in the shallow extent of the borehole is necessary to prevent infiltration of contaminated water.

- Since some villages do not have drainage channels for rainwater and wastewater, and pools of water were observed near the boreholes, a soakage pit is to be installed at the end of drain to infiltrate wastewater into the ground. The size of soakage pit is 1m (width) × 1m (length) × 1m (depth), which follows the UNICEF standard.

- Installation of fences around the borehole will be instructed to prevent cattle from entering.

- Proper O&M of facility will be instructed through soft component at the implementation stage.

7) Success of Borehole Construction

According to the World Bank, out of the 1,000 boreholes constructed in the 38 LGAs of Kano state, 80% were successful. On the other hand, experience of RUWASA indicates the success rate of 90%. In expectation that RUWASA will improve its capacity for groundwater investigation through the provision of electrical sounding instrument by this project and experience of groundwater potential analysis utilizing the database of existing boreholes, the planned success rate for this project is set at 90%. The necessary quantity for consumable drilling tools and casing pipes are estimated based on this success rate.

(2) Plan of Equipment and Materials

1) Equipment and Materials

The existing rigs of RUWASA are shown Table 2-5. Though RUWASA has five secondhand rigs, many of them have been used for more than 20 years and have become superannuated. The drilling capacity is approximately 50m, and only three rigs are capable of operation.

Table 2-5 Existing Drilling Equipment in RUWASA

Name	Maker	Type/Spec.	Condition
Rig No.1	Ingersol Rand	TH-10R	Normal
Rig No.2	Ingersol Rand	TH-60	Necessary of repair
Rig No.3	HAND-ENGLAND LTD	HE-90L	Usable
Rig No.4	John Deer	M&W100	Normal
Rig No.5	John Deer	M&W100	Out of order
Compressor No1	Holman	Modified	Under Repair
Compressor No2	ATLAS COPCO/Ingersoll Rand	Modified/20bar	Under Repair
Compressor No3	Holman	32bar	On HE-90
Compressor No4	ATLAS COPCO	22bar	Usable
Compressor No5	ATLAS COPCO	22bar	Usable

The 240 new boreholes of this projects is planned to be constructed by the Nigerian side with two existing rigs (TH-10R and HE-90L, Table 2-5) and the new rig to be procured. Therefore, the procurement plan of the project consists of one drilling rig and a set of related equipment and materials.

The equipment and materials are as follows; (1) equipment for borehole construction (drilling rig, drilling tools and accessories, compressor), (2) equipment for resistivity survey (geophysical sounding instrument), (3) equipment for pumping test, (4) equipment for O&M (workshop engineering tools), (5) hand pumps relevant tools, (6) equipment for water quality analysis, (7) supporting vehicles (trucks), (8) borehole construction materials, (a) O/A Equipment and (10) spare parts for existing rigs.

Table 2-6 shows the equipment and materials to be procured, selected in regard of: the propose of use; type, number and operating condition of existing equipment; and future plan of use etc.

Table 2-6 Procured Equipment and Materials

No.	Name of Equipment	Specification/Description	Quantity	Unit
1	Drilling Rig	Type: Truck mounted rig (including standard spare parts). Top head drive type Drilling Method: Mud circulation rotary and DTH drilling methods. Capable Drilling Depth: 100 m Capable Drilling Diameter: 10-5/8" for mud drilling, 6-1/4 for DTH drilling Applicable Geology: Un-consolidated strata to hard bedrock Mobilization Method: Truck mounted. Truck Specification: 4WD	1	lot
2	Drilling Tools	Drill pipe, hammer bits, work casing and all other necessary tools for the rig above described.	1	set
3	High Pressure Compressor	Supply Air Pressure: 2.01 MPa (=20.5 kg/cm^2) or more / High pressure Supply Air Volume: 11.3 m^3/min or more. Mobilization Method: Truck mounted. Truck Specification: 4WD	1	lot
4	Cargo Truck with Crane	Load capacity: 6,000 kg or more Specification: 4WD Engine: Diesel (water cooling) Length of Carrier: 5.5m or more Crane Capacity: 2.9 tons (3 tons)	2	lot
5	Water Tank Truck	Tank Volume: 8 m^3 Truck Specification: 4WD	1	lot
6	Pick-up Truck	Cabin: Single and double for each Truck Specification: 4WD Engine: Gasoline (water cooling) Load Maximum: 1.0 ton or more (single) / 0.5 ton or more (double)	2	lots
7	Motorcycle	To be used for Community Development Officers and drilling team communication In rainy season, 4 wheel vehicles are hard to access (motor cycle is more useable). Cylinder Volume: about 100 – 125 cc	5	lots
8	Well Development Equipment	Air Compressor Supply Air Pressure: 0.7 MPa (=7.0kg/cm^2). Supply Air Volume: 8.5 m^3/min.	1	set
9	Pumping Test Equipment	Submersible motor pump: Discharge of 10 liters/min. 50 m head (=1.5 kW and 50 Hz) Engine Generator: 5 kVA or more Groundwater Level Meter: Measurable Depth of 100m	1	set
10	Water Analysis Equipment	Measurement Items: pH, DO, EC, T.D.S, Chlorides, and Water temperature	1	lot
11	Resistivity Survey Equipment	Electrical Sounding Instrument of Measurable depth: 100 m. Measuring Item: Apparent resitivity and spontaneous potential. Measurable range: 0.1 mV – 10V. Accessory: Software for interpretation Others: Applicable for logging work for 100m depth borehole (with cable and probe)	1	set
12	Workshop tools and Equipment	For simple repair, maintenance, cleaning, tire replacement, puncture repair of drilling rigs and other equipment (compressor, tank lorry, supporting vehicles, motorcycles, etc).	1	set
13	Computer	Software: Word processor and spreadsheet software Accessory: UPS of more than 10 minutes. Compatible: IBM compatible computer. Printer : Laser printer.	2	lots
14	Spare Parts for Existing Rigs	For the existing TH10R owned by RUAWASA	1	set
15	Hand Pump	Hand pump & Maintenance kit : VLOM type, Indian Mark III, which is the standard model of UNICEF and RUWASA	240	Sets
		Repair tools for hand pump: Tools used by villagers for simple repair work, and those for LGA mechanics for serious repair such as parts replacement that cannot be coped by villagers.	1	lots
16	Casing Pipe	Materials: unplasticised polyvinyl chloride Dimension: Diameter of 4", O.D. of 114.4 mm, Length of 3 m Wall thickness : 5.5 mm or more Connection: threading method	2,667	pieces
17	Screen Pipe	Materials: unplasticised polyvinyl chloride Dimension: Diameter of 4", O.D. of 114.4 mm, Length of 3 m Wall thickness : 5.5 mm or more Connection: screw type Opening Ratio: 3% or more	1,334	pieces

2) Necessity and Basis of Quantity for Equipment and Materials

① Drilling Rig

Purpose : For drilling tube wells
Basis of Quantity : Existing rigs of RUWASA only are expected to drill 55 boreholes per year. In order to conduct this project (240 boreholes during 2.5 years) and to improve the capacity of groundwater development, one new drilling rig is planned.
Deposition : Water supply and technical service department (Water supply)

② Drilling Tools

Purpose : Tools and accessories for drilling with the above rig
Basis of Quantity : The quantity of tools and accessories such as drilling rods, hammer bits and casing is planned for the minimum requirements of the above rig. Consumable material will be for 267 drillings in regard of the success rate (90%).
Deposition : Water supply and technical service department (Water supply)

③ High Pressure Air Compressor

Purpose : To supply compressed air to DTH hammer of drilling rig and remove cutting skim.
Basis of Quantity : The existing compressors cannot be shared wit the new rig. Therefore, one air compressor is planned exclusively for the DTH hammer of the procured drilling rig.
Deposition : Water supply and technical service department (Water supply)

④ Cargo Truck with Crane

Purpose : For transportation of drilling tools and materials such as casing pipes, etc.
Basis of Quantity : Original requested number is one lot for the one drilling rig to be procured. However, for construction of the planned 240 boreholes, utilization of existing rigs is also required. Therefore, 2 cargo trucks with crane are planned for transportation and of drilling equipment, fuel, etc. for the 3 drilling teams.
Deposition : Water supply and technical service department (Water supply)

⑤ Water Tank Truck (8 m^3)

Purpose : For supplying water for removing drilling slime, cooling down triton-bit and for borehole development works, etc.

Basis of Quantity : Water is indispensable for drilling, borehole development, grout work and platform construction. The maximum water volume for one drilling iste is estimated as about 7.6m^3/day. The drilling sites are distributed within 80km from RUWASA and access requires approximately 2 to 4 hours for round trip. In this regard, by installing a transportable water tank in the drilling sites, the 8m^3 water tank truck can supply water to several sites (assumption: 2 to 3 sites pre day). Thus 1 water tank truck is planned instead of the requested quantity of two.

Deposition : Water supply and technical service department (Water supply)

⑥ Pick-up Truck

Purpose : For transportation of drilling staff, small sized equipment and communication of drilling teams, office and drilling site, etc. for efficient mobilization of the drilling rig.

Basis of Quantity : Works such as siting borehole location, drilling, installing hand pump and constructing facilities are consecutive work, and a total 6 vehicles for working teams (2 vehicles x 3 teams) is required. However, it will be a rare occasion to fully utilize all 6 vehicles by all working teams at the same time. Full time requirements are the 3 vehicles used by the 3 drilling teams. Because one existing vehicle owned by RUWASA is available for use, two new vehicles are planned.

Deposition : Water supply and technical service department (Water supply)

⑦ Motorcycles

Purpose : For transportation of staff of Mobilization section and Sanitation section who take charge of community development for O&M of water supply facilities and water sanitation, and communication between RUWASA office and drilling sites.

Basis of Quantity : The project sites are 240 communities in 172 villages of 38 LGA. It is planned to use motorcycles because some sites have difficulty in access by 4 wheel vehicles during rainy season. The staff of RUWASA for community development activity can then visit more than 2 villages in the same day.

Since it is rare that all staffs of RUWASA visit villages at the same time, and that 2 staffs can visit villages with one motorcycle, 5 motorcycles are planned for the total 17 staff of RUWASA's community development members (10 members of Planning and Community Mobilization department and 7 members of Sanitation section of Water supply and technical service department in RUWASA).

Deposition : Planning and Community mobilization department (Community Mobilization)

*Shared with Water supply and technical service department (Sanitation)

⑧ Well Development Equipment

Purpose : For developing borehole for clean water and increase available withdrawal volume.

Basis of Quantity : One complete set of compressor and attachments is estimated for the new rig.

Deposition : Water supply and technical service department (Water supply)

⑨ Pumping test Equipment

Purpose : For confirmation of withdrawal volume to confirm whether drilled borehole is successful or not.

Basis of Quantity : One complete set is estimated for the new rig.

Deposition : Water supply and technical service department (Water supply)

⑩ Water Analysis Equipment

Purpose : To confirm groundwater quality and to confirm whether drilled borehole is successful or not from the viewpoint of water quality

Basis of Quantity : General items for potable water analysis will be consigned to the Water Board for testing. A portable testing set will be planned to confirm water quality at the site. The items to be tested are: pH, DO, EC, T.D.S, Chlorines, and Water temperature. One complete set will be shared by 2 pumping test teams.

Deposition : Planning and Community mobilization department (Planning)

⑪ Resistivity Survey Equipment

Purpose : For investigating geological features, depth width of the aquifer and its depth.

Basis of Quantity : In regard of maneuverability, an instrument capable to investigate the depth of 100m, and could be also used for electrical logging is planned. Additional 100m cable and sonde necessary for electrical logging is also planned as accessory. Although necessary quantity is estimated as two (2) sets, one existing set of RUWASA is available to use in the Project. Therefore, one new set of Resistivity Survey Equipment is planned.

Deposition : Planning and Community mobilization department (Planning)

⑫ Workshop Tools and Equipment

Purpose : For maintenance, checking and repair of drilling equipment and supporting vehicles.

Basis of Quantity : Maintenance (particularly maintenance, checking and repair of vehicles) is crucial for efficient utilization of the equipment. However, the RUWASA workshop has little equipment for repair, it is necessary to provide assorted tools for maintenance of equipment.

Deposition : Water supply and technical service department (Workshop)

⑬ Computer

Purpose : For preparation of inventory of more than 1,100 boreholes including existing and planned wells, management of equipment and material, making texts for social development and educational activities, and storage of water quality analysis results.

Basis of Quantity : IBM compatible computer with high generality with necessary software for spreadsheet calculation and word processing, laser printer, and UPS (capacity: 10 minutes) for the frequent power failures is planned. Necessary quantity is 2 sets: one set is planned to be used for Planning and Community mobilization department in charge of administration and management of community training section activity, and the other one is for Water supply and technical service department. These departments will be operating borehole construction and will be strongly related to this project.

Deposition : Water supply and technical service department & Planning and Community mobilization department

⑭ Spare Parts for Existing Rig

Purpose : For utilization of existing rigs and to prolong its functionality
Basis of Quantity : It is difficult to complete 240 boreholes by only using the new rig. It is necessary to use the existing 2 rigs. Therefore, at least one lot of spare parts for the existing rig (TH-10R) at the available extent is planned.
Deposition : Water supply and technical service department (Water supply)

⑮ Hand Pump

Purpose : For groundwater extraction from boreholes and for daily maintenance by village and LGA levels.
Basis of Quantity : VLOM type Indian Mark III hand pump, which is standard for UNICEF and RUWASA, repair tools for community level (used for daily maintenance) and standard tools for LGA level (used by LGA mechanics for ambulant repair and for serious repair that cannot be coped by villagers) is planned for the number of boreholes to be drilled (240sets).
Deposition : Water supply and technical service department (Water supply)

⑯ Casing Pipe

Purpose : Fore securing borehole and retaining groundwater.
Basis of Quantity : The quantity is estimated based on 90% success rate. In regard of the average borehole depth of 45 m, the average casing length will be estimated as 30 m.

Total length of casing = 30m × 240 sites / 0.9 = 8,000m
8,000m/3m = 2,667 pieces

Deposition : Water supply and technical service department (Water supply)

⑰ Screen Pipe

Purpose : For groundwater extraction from aquifer
Basis of Quantity : The quantity is estimated based on 90% success rate. In regard of the average borehole depth of 45 m, the average screen length will be estimated as 15m

Total length of screen = 15m × 240 sites / 0.9 = 4,000 m
4,000 m/3 m = 1,334 pieces

3) Specifications of Major Equipment and Materials

① Drilling Rig

The specification of the drilling rig is decided based on following requirements:

Borehole structure

The borehole is tube well type with casing and screen pipe, as shown in the basic design drawing.

Geological features

The geology of the area is consists of very hard bedrock of mainly gneiss and granite. Several to tens of meters of collapsible soft and unconsolidated strata (top soil and weathered layer) are on the surface. The rig should be capable to drill in a wide range of geological features; from soft unconsolidated strata to soft rocks, medium hard rocks and hard rocks.

Drilling method

The drilling method is DTH drilling for the bed rack layer (hard rock such as gneiss and granite) rock, and mud rotary drilling for the relatively soft layers and weathered layers near the surface.

Drilling diameter

The drilling diameter will be 10" for the relatively soft layers and strongly weathered layers near the surface (average depth up to 10m), and 6" for deeper layers. Tri-cone bits of 10-5/8" will be used for mud rotary drilling, and 6-1/4" (156mm) hammer bits will be used for DTH drilling.

Drilling depth

According to resistivity survey and past drilling experiences, boreholes with average drilling depth of boreholes are less than 50m (average of 45m) are dominant in the southeastern area, while many of those in the northwestern area exceeds the depth of 50m and up to 100m. Therefore, in regard of the hydrogeological conditions and potentials for groundwater development, the drilling capacity of the drilling rig will be set at 100m. However, in consideration of the difficult geological conditions in the northern and northwestern areas, and the necessity of groundwater development in hard rock layers, a rig with the lifting capacity over 6,000kg (equivalent to 300m depth for 4") is planned.

Truck to be mounted with rig

Load capacity: the rig generally weighs nearly 10tons in total. The truck will have the load capacity compatible to this weight.

Specification: The truck will be 4WD

② High Pressure Air Compressor

The necessary air pressure and volume is decided based on the following conditions:

Calculation of necessary air pressure

Necessary pressure of compressor is calculated by the lowest operating pressure and water head.

- Lowest operation pressure : 10.5 kgf/cm^2 (1.03 MPa)
- Water head pressure : 10.0 kg/cm^2 (0.98 MPa, maximum drilling depth of 100 m)

Necessary air pressure = Lowest operation pressure + Water head pressure = 10.5 + 10.0 = 20.5 kg/cm^2 (2.01MPa)

Calculation of necessary air volume

The necessary air volume is calculated by the following conditions:

$V = Q/A$

$A = 1/4 \times \pi \times (D^2-d^2)$

V : Flow velocity in the space between rod and drilled wall in borehole.
Q : Necessary air volume (m^3/min)
A : Space area between the rod and the wall of the borehole (m^2)
D : Borehole diameter (m)
d : Rod diameter (m)

The Flow velocity in the space between rod and drilled wall in borehole is generally from 1,200 to 1,500 m/min. The average value of 1,350 m/min is used for this calculation. Borehole diameter is 6" (0.159 m), and the Rod diameter is 4-3/4" (0.12 m). The necessary air volume (Q) is calculated as follows.

$Q= Q/A = 1{,}350 \text{ m/min} \times 1/4\pi \times (0.159^2-0.12^2) = 11.3 \text{ m}^3/\text{min}$

Thus the air compressor is planned to be a high pressure type (necessary air pressure 2.01 MPa or more) with the supply air volume of 11.3 m^3/min or more.

Truck

The air compressor requires the same mobility as the drilling rig. In regard of the bad road conditions and long distance transportation, it should be mounted on a truck.

Load capacity

The air compressor, along with accessories and reserve fuel weighs approximately 6.2tons. The truck will have the load capacity compatible to this weight.

③ Cargo Truck with Crane (for existing rig and new rig)

The cargo truck with crane is planned with the following specifications.

In regard of the weight of necessary drilling tools, casing pipes, etc., the load capacity of the cargo truck will be 6tons or more.

Specification

In regard of road conditions, driving conditions, travelling distance, weight of cargo, the cargo truck should be 4WD with high durability.

Size of Carrier

In regard of the size of the pipes, the size should be 5.5 m or more.

Crane Capacity

The load capacity of 2.9tons (nearly 3 tons) will be planned in regard of the general capacity of the trucks manufactured.

④ Water Tank Truck

The specification of the water tank truck is planned with the following specifications.

Tank volume

- Mud-drilling	: 10m × 0.0412 m^2	=	0.4 m^3
- Development	: 0.02 m^3 × 45 m × 1.5×4 hr	=	5.4 m^3
- DTH	: 0.02 m^3 × 45 m × 1.63 × 8 hr × (35/13) day	=	31.6 m^3
- Others	: 5% of the above-mentioned total	=	1.9 m^3
	Total		39.3 m^3

(=8 m^3/day with average period of 5 days)

The study area is within the range of approximately 80km radius, and takes 4 to 6.5 hours for round trip. Necessary water volume is around 8 m^3 for one day drilling work. Therefore, the water tank truck will supply water to the site 1 time per day.

Truck for water tank

In regard of the transportation distance, mobility and bad road conditions, the truck for water tank will be 4WD with high durability.

⑤ Pick-up Truck

The specification of the pick-up truck is planned with the following specifications.

Specifications

In regard of road condition, travelling distance and cargo, 4WD with high durability is planned.

Load capacity and Cabin type

In regard of construction staff transportation, and weight and type of cargo to be loaded, 1 single cabin and 1 double cabin pick-up truck is planned. The load capacity will be 0.5ton or more for double cabin and 1.0ton for single cabin.

Engine Type

In Nigeria, gasoline is cheaper than diesel. Thus gasoline type engine is planned from the economical viewpoint.

⑥ Motorcycle

Motorcycles are planned to be used for transportation of community development staff and communication between the main office and drilling sites. Motorcycles which have high mobility are necessary in regard of the difficulty of access to the sites by 4 wheel vehicles particularly in the wet season. In regard that two staffs will be on the motorcycle, the cylinder volume should be 100 – 125 cc.

⑦ Well Development Equipment

Air Compressor

In regard of the estimated maximum drilling depth of 100m, the air compressor is planned with the following dimensions:

- Air supply pressure: 7.0 kg/cm^2 or more
- Air supply volume: 8.5 m^3/min or more

⑧ Pumping Test Equipment

Submersible pump

The planned extraction from the borehole is 10 litters per minute and the maximum dynamic water level is 40m below ground level. Thus the dimension of the pump is as follows.

- Dimension: 10 L/min × 50 m × 1.5 kW × 50 Hz

Generator

In regard of the load capacity (submersible pump: 1.5 kW), 5 kVA is planned.

Groundwater Level Indicator

The indicator should be capable of measure up to the maximum drilling depth of 100m with a buzzer of a red lamp the indicator. Power should be supplied from batteries in regard of its portability, and the measure rope should be metal cable.

4) The Main Equipment and Materials Procurement Sources

The main equipment and materials will be procured from sources shown in the following Table 2-7. The procurement prices will be decided by comparing the cost estimates from these procurement sources.

Table 2-7 Procurement Sources of Main Equipment and Materials

Item		Japan	Third Country	Nigeria
Drilling Equipment and Tools	・Drilling Rig	○	○	
	・Drilling Tools	○	○	
	・High Pressure Air Compressor	○	○	
Supporting Vehicles for	・Cargo Truck with Crane	○	○	
	・Water Tank Truck	○	○	
	・Pick-up Truck	○	○	
	・Motorcycles	○	○	
Instrument and Materials	・Well Development Equipment	○	○	
	・Pumping test Equipment	○	○	
Test Equipment	・Water Analysis Equipment	○		
	・Resistivity Survey Equipment	○		
Workshop Tools and Equipment		○	○	
Computer			○	○
Materials for construction boreholes	・Hand Pump		○	○
	・Casing Pipe		○	○
	・Screen Pipe		○	○
Spare Parts for Existing Rig		○	○	

○: Available

2-2-3 Basic Design Drawing

The design plan for the basic design drawing is shown as follows:

- Figure 2-2: Standard Structure of Borehole
- Figure 2-3: Standard Structure of Platform (VOLM type) and Soakage Pit
- Figure 2-4: Standard Structure of Platform Plan

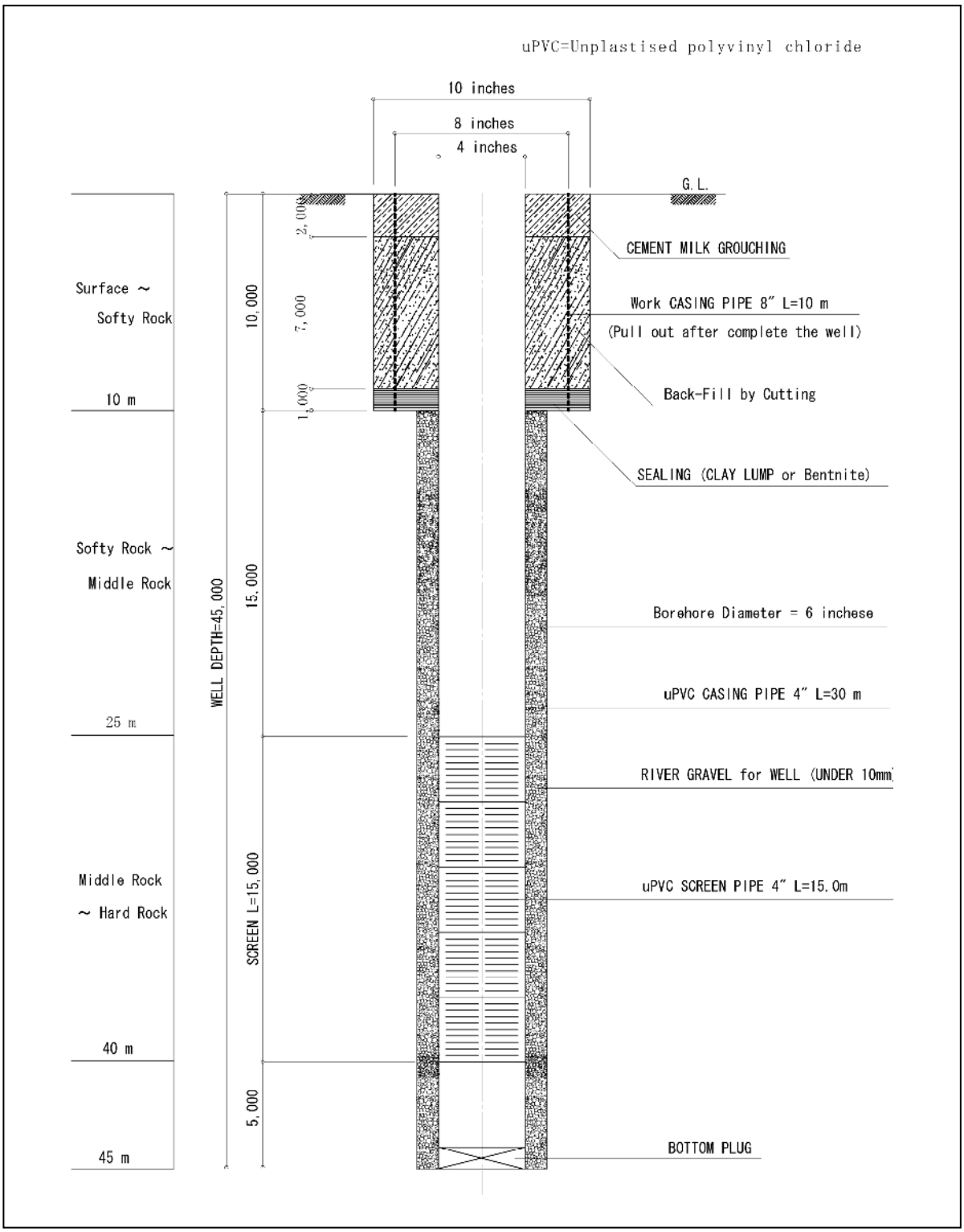


Figure 2-2 Standard Structure of Borehole

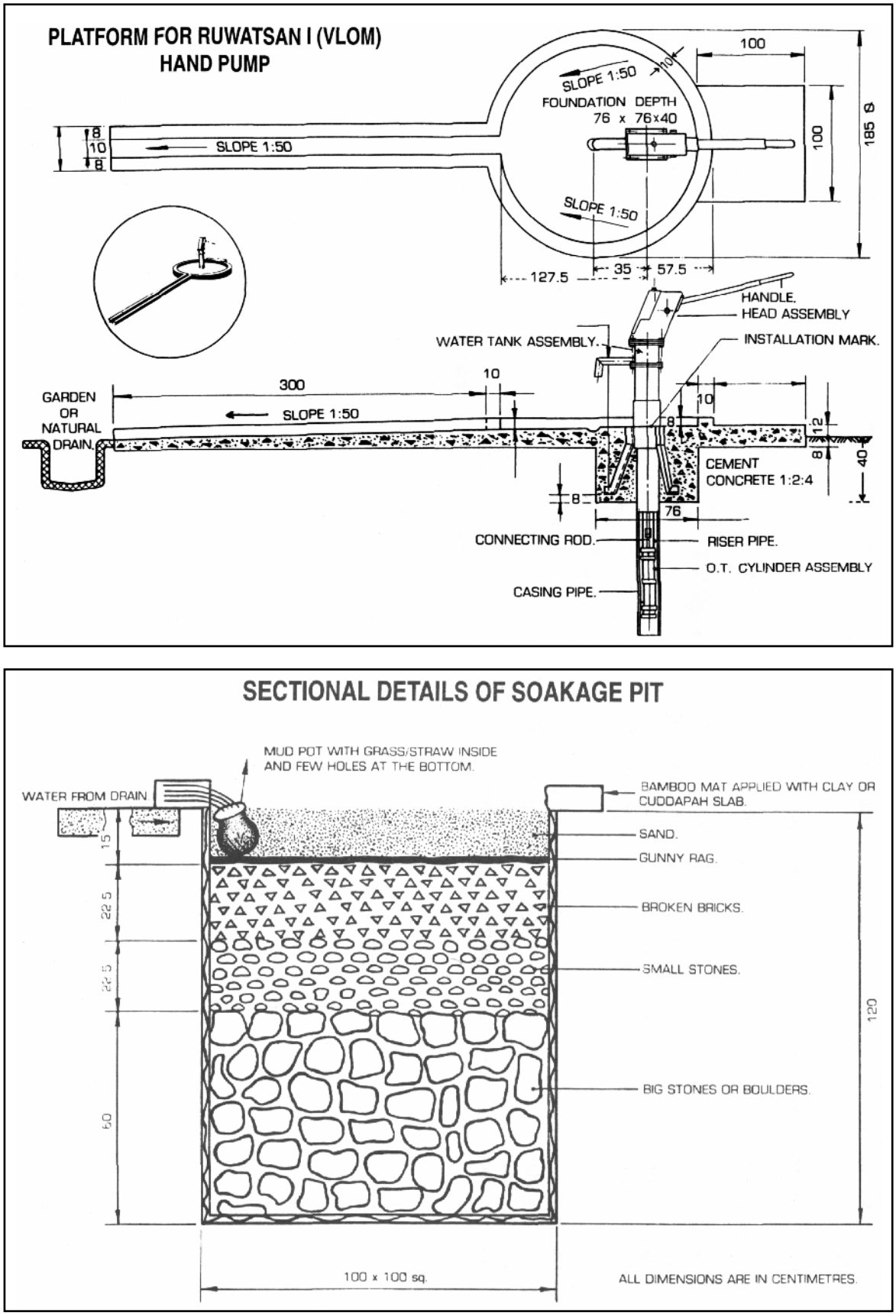


Figure 2-3 Standard Structure of Platform and Soakage Pit

Source: RUWATSAN I (VLOM) Installation & Maintenance Manual of Pumps

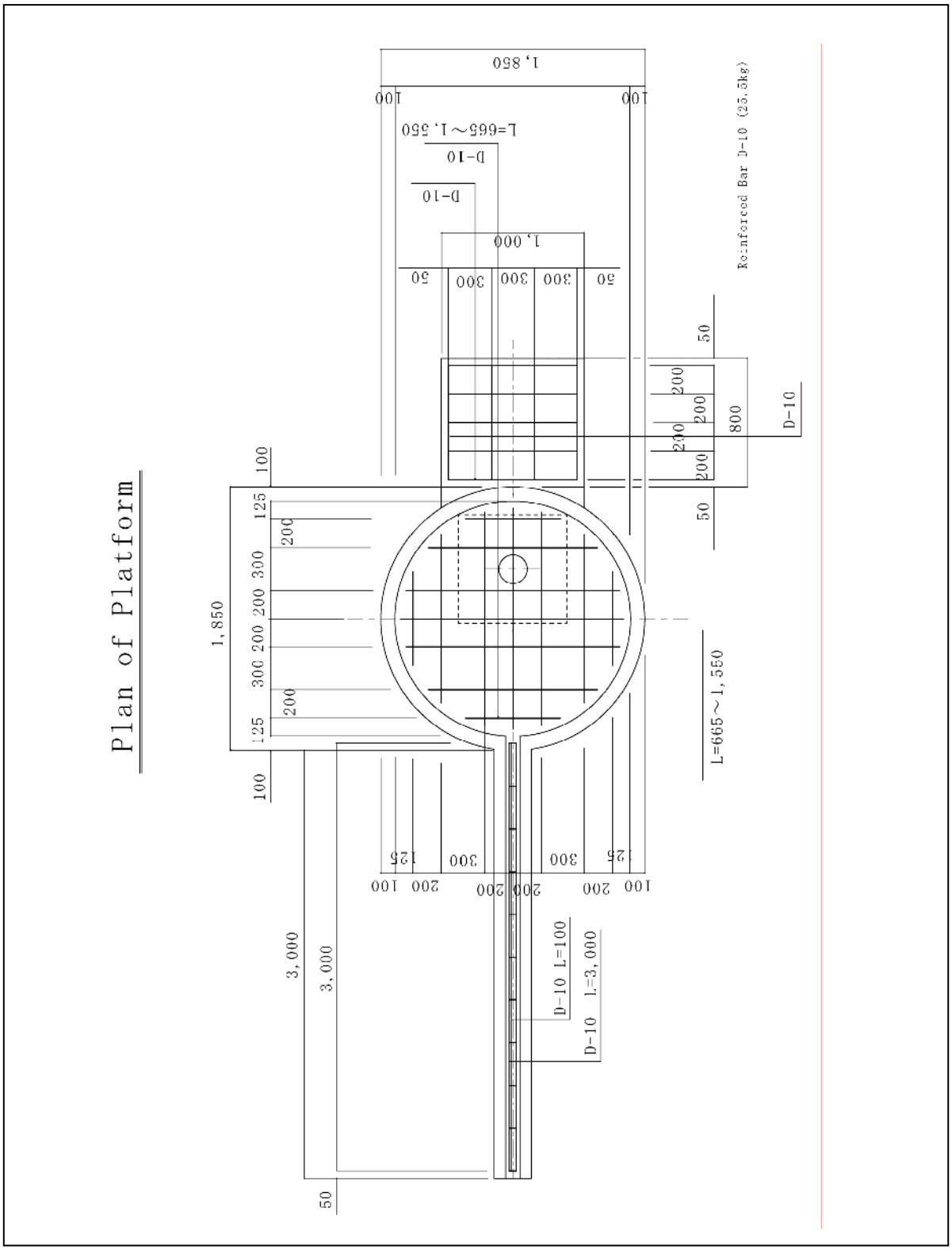


Figure 2-4 Standard Structure of Platform Plan

2-2-4 Implementation Plan

2-2-4-1 Implementation Policy

The procurement plan will be planned based on following policy:

- The Procurement plan of equipment and materials should be suited to the construction schedule of RUWASA.
- Selection of the equipment and materials should consider availability and acquisition route of spare parts and consumables, environmental conditions for use in Nigeria and the system of maintenance.
- The most advantagious procurement source of equipment and materials is to be selected from Nigeria, third countries and Japan with consideration of technical level and O&M conditions of RUWASA.
- The equipment and materials are to be selected under the international standard of BS, DIN, ASTM, JIS and etc. up to the possible extent in regard of quality control and schedule management.
- RUWASA will have responsibility for O&M of procured equipment and materials.
- Village water environmental and sanitation committees (VWESC) of each community will have responsibility for the O&M of water supply facilities.
- VWESC has responsibility for the O&M of water supply facilities.

2-2-4-2 Implementation Conditions

On procurement of equipment and materials, attention should be paid to the following points.

- Smooth custom clearance of equipment and materials, and registration of cars by the Nigerian side for inspection and commissioning for O&M of the equipment by the engineers dispatched by the supplier.
- Approval of import, customs clearance, and other works for import by Nigerian side.
- Confirmation of progress condition of transportation by Japanese supplier. Also, notice of customs clearance, receipt of equipment, and any accident after a bond period.

2-2-4-3 Scope of Works and Responsibilities

Japanese side has responsibility of work until handing over the equipment and materials to RUWASA. Nigerian side has responsibility of O&M of the equipment and materials after hand over. The Nigerian side will be also responsible for management of construction works utilizing the procured equipment and material, and O&M for water supply facility.

Japanese side shall carry out the technical transfer for quality control, construction method, and management of construction work to RUWASA through soft component. However, Japanese side does not have the responsibility of management of construction works.

The responsibility for procurement of necessary materials for construction of water supply facility shall be allocated as shown in Table 2-8.

Table 2-8 Allocation of the Procurement

Materials	Nigerian side	Japanese side
Casing pipe	―	○
Screen pipe	―	○
Hand pump	―	○
Consumable materials for drilling such as bentonite, cement, gravel, sand, steel bar and fuel	○	―

2-2-4-4 Consultant Supervision

Consultant and Contractor will execute the following procurement supervision to secure smooth execution of tendering, transportation and hand over of the equipment and materials.

Procurement Planner of Consultant

The consultant will execute the following task to secure smooth and certain hand over.

- Confirmation of the Contractor's work
- Confirmation of the procurement order for equipment and materials
- Inspection of the equipment and materials before delivering from manufacturers
- Supervision of technical transfer conducted by contractor, and handing over of manuals and documents for O&M of equipment and materials prepared by Contractor

Contractor

- Contractor shall send engineers to Nigeria for confirmation of equipment and materials when they arrive at Lagos port
- Contractor shall execute technical transfer and explanation to engineer staffs of RUWASA for operation of rig, trucks, and electrical sounding instrument, etc.

2-4-4-5 Quality Control Plan

The quality of borehole is influenced by the finishing procedure. Moreover, the poor or imperfect borehole facilities such as apron, drainage system cause a significant influence on the longevity of the boreholes. Therefore, the consultant and procurement firms will carry out the support activities as mentioned below:

(1) The consultant's person in charge of the "soft component" (before supply of equipment)

- The work shop on quality control will be carried out, and the importance of quality control will be understood by the RUWASA.
- The check list for quality control will be prepared.

(2) The procurement firm's person in charge of guidance for construction method (after supply of equipment)

- The OJT for construction method, finishing of borehole and technology of borehole construction will be carried out.
- The apron should be constructed in conformity to standard drawings, and guidance of concrete work will be carried out.
- Drainage system such as soakage pit should be constructed.

2-2-4-6 Procurement Plan

In principle, procurement plan for equipment and materials will consider the possibility of procurement from Nigeria, Japan and third countries so as to secure aftercare services and to reduce cost.

1) Rig and Drilling Tools

Rig and drilling tools are neither manufactured nor assembled in Nigeria. Thus these equipment and materials will be procured from Japan or a third country. Procurement will be done from a rig manufacturer which is capable of local aftercare service.

2) Equipment and Materials for Construction of Boreholes

- Hand Pump

  UNICEF is currently standardizing the hand pumps in Nigeria, and repairing skills are high. Acquisition of spare parts is easy, and thus the same type of product will be procured in this project. Since hand pumps are manufactured in Nigeria, and there are local importers, they will be procured from Nigeria or a third country.

- Casing and Screen Pipes

  Casing pipes and screen pipes made of un-plasticized polyvinyl chloride (uPVC) can be procured in Nigeria. Some companies are capable of producing pipes meeting international standards. Therefore, these pipes shall be procured in Nigeria

2-2-4-7 Implementation Schedule

(1) Period for Procurement of Equipment / Materials and Construction

< Procurement of Equipment and Materials >

Equipment and materials will be procured from Japan, third country and Nigeria. However, the major equipment such as drilling rig or cargo truck will be procured from Japan or third country. In case of Japan, it takes about 8 months: 6 months for manufacturing, 2 months for transportation to Kano and custom clearance at the Lagos Port. In case of third country, it takes around 7 months. For materials to be procured by RUWASA in Nigeria such as cement, bentonite, sand and gravel etc., it takes one month from markets and dealers.

< Construction of Water Supply Facility >

Two hundred and forty (240) boreholes will be drilled by two existing rigs (TH-10R and HE-90L) and one new rig. Figure 2-5 is the flow chart of the borehole construction to estimate the total construction period.

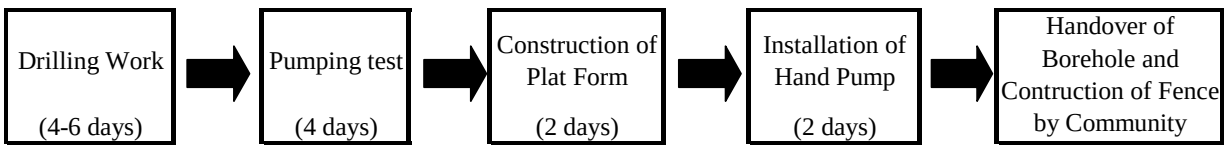


Figure 2-5 Drilling Schedule of Borehole for One Site

Drilling rig will be used for drilling work for around four to six days at each site, and approximately 60 to 90 boreholes are expected to be completed a year by new rig.

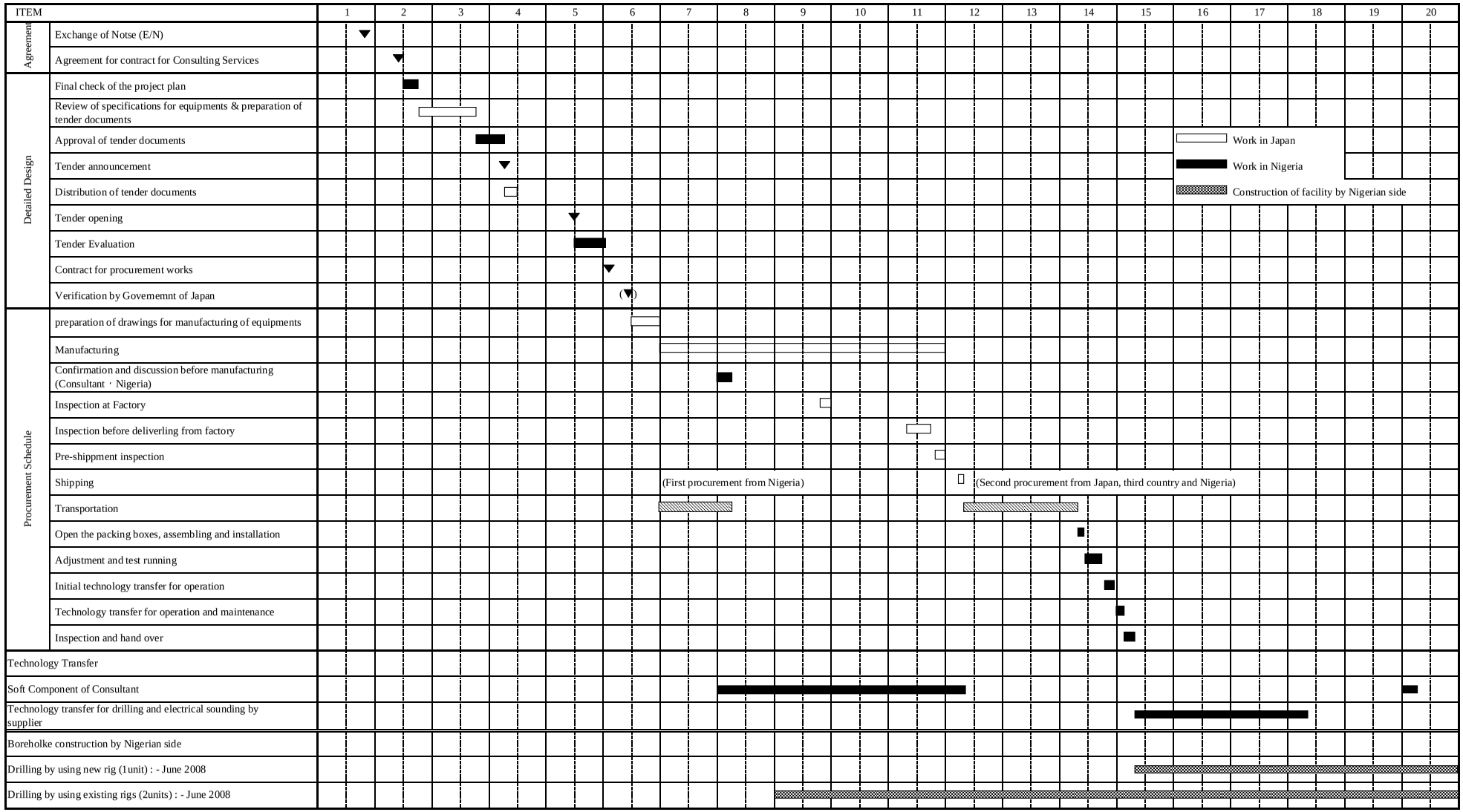
On the other hand, it is judged that capability of TH-10R and HE-90L are 60% and 30% of the new rig respectively on the basis of the actual number of boreholes drilled by RUWASA from 1997 to 2004. Assuming that 60 boreholes a year can be drilled by the new rig, the construction of 55 boreholes a year by TH-10R and HE-90L is very reasonable.

(2) Implementation Schedule in the Project

The existing two rigs and one procured rig will be used for the project. The existing rigs are planned to operate for 30 months. The procured rig will go into drilling work schedule after six months from the beginning of the drilling work. The expected borehole construction number (=N) is as follows:

N = New rig (60 boreholes/year × 2 years)
+ Existing rig-1 (60 boreholes/year × 0.6 × 2.5 years)
+ Existing rig-2 (60 boreholes/year × 0.3 × 2.5 years)
= 255 > 240 borehole

Table 2-9 Implementation Schedule (draft)



2-3 Obligation of the Government of Nigeria

The scope of works to be undertaken by the Government of Nigeria is as follows:

(1) Construction of Boreholes

Item	Nigeria
Construction work	- Mobilization of drilling rig, setting and dismantling, - Drilling, electrical logging, casing pipe installation, gravel packing, backfilling, cementing, pumping test, water quality analysis, finishing - Hand pump installation, platform construction - Necessary equipment & materials for construction such as fuel, bentonite, chemical agent, sand and gravel, reinforcement steel bar, lubricant, water, and cost of other consumables etc. - Vehicle and labor expense for construction work. - Common temporary work expense - Site expenditure, etc.
Cost	The cost for construction work and management.
Construction Period	Preparation of construction schedule. Construction completion within construction period of 2.5 years. If the construction will not be completed, Nigerian side will take up the responsibility to complete the construction.
Sitting	Prior to commencement of construction, the sitting for the 240 sites will be conducted by Nigerian side.
Quantities of construction materials	Nigeria side will be responsible for construction materials exceeding 240 sites.
The method of delivery materials	Transportation of equipment & materials from RUWASA office in Kano City to each site. Management of the equipment and materials.
Exemption of taxes	Nigeria side will prepare the necessary documents for custom clearance before arrival of the equipment and materials at Lagos port, and Nigeria side will carry out customs clearance.
Quality control and Inspection	Nigeria side will undertake the responsibility of quality control and compliance to specifications, etc.
Safety/Security measures	Responsible for any accident during construction. Anti-theft measures of the equipment and materials at the sites.
Special Attention	The progress report of the work shall report monthly to Japanese side.
Others	Improvement of access road Construction of fences around the boreholes.

(2) Others

- To provide necessary data and information for the implementation of the Project
- To secure the construction sites for the Project, and to clear, level and reclaim the prior to the commencement of the construction.
- To provide office and counterparts free of charge to Japanese consultant.
- To bear the following fees to Japanese foreign exchange bank for the banking services based on the Banking Arrangement(B/A):
  - Advising commission of Authorization to Pay (A/P), and
  - Payment commission

- To ensure prompt unloading and customs clearance of the materials and equipment procured by the Project.
- To exempt for Japanese engineers from customs duties, internal taxes and other fiscal levies which may be imposed in Nigeria with respect to the supply of products and services under the verified contracts.
- To acquire number plate register for the vehicle procured by the Project
- To maintain and use properly and effectively the facilities constructed and equipment provided under the Project.
- To bear all expenses, other than those to be borne by the Japanese Grant Aid, necessary for the execution of the Project.
- Preparation of storage, workshop, and space for vehicle in RUWASA.
- To take the measures necessary for the safety and security for the Japanese engineers.
- To provide counterparts to the soft component activities as working team, and to be participate staffs in the training work shop in RUWASA.
- To arrange "the JICA In-country training workshop" collaborated with the Project.
- To set up the pumping test team.

(3) Project Cost of the Government of Nigeria

The total cost estimated for Project implementation is approx. Japanese Yen 448 million. This cost estimate is provisional and would be further examined by the Government of Japan for the approval of the Grant. The cost to be borne by Japanese side and Nigerian side is described below, which is estimated on the basis of conditions mentioned.

1) Estimated Costs Covered by Japanese Side:

Estimated Total Project Cost		361 Million Yen
Expense Item		Estimated Cost (Million Yen)
Equipment and Materials	Drilling Rig, Compressor, Crane Cargo Truck, Water Tank Lorry, Supporting Vehicle, Motorcycles, Pumping test Equipment, Geophysical Instrument etc.	317 Million Yen
Detailed Design, Procurement Supervision and Soft Components		44 Million Yen

2) Costs Covered by Nigerian Side: NGN 104.47 million (Yen 87 million)

① Cost of Facility Construction: NGN 104 million (Yen 86 million)
② Site preparation, fence, etc: NGN 0.47 million (Yen 0.39 million)

3) Conditions for Cost Estimation

① Estimated on: September 2004
② Exchange rate: 1US $ ＝110.5Yen
1NGN＝0.83Yen
③ Execution Period: Period of detailed design, supervision and provision of equipment and materials is shown in Implementation schedule.
④ Others: The Project will be implemented in compliance with Japanese Grant Aid System.

2-4 Project Operation Plan

(1) O&M of the Drilling Equipment

< Management >

The construction of boreholes are composed of geophysical survey, drilling, pumping test, construction of superficial structures, and hand pump installation by using the equipment and materials procured by this project. RUWASA is responsible for execution of the construction works, and the equipment and materials procured are to be set up in RUWASA office. The necessary staff of RUWASA for the project is shown Table 2-10. It is judged that the present RUWASA staff number and their capacity are enough for the implementation of project.

Table 2-10 Necessary Staffs for the Implementation of the Project

Work Item	Team Component		Present Staff Nos.	Necessary Staff for the Project	Remark
1. Electrical Sounding	Geophysicist Assistant technicians	1 3	2	2 (6 workers at site)	Planning Section 2 teams
2. Drilling	Chief driller Assistant driller Mechanics Drivers	1 1 1 2	5 8 11 10	4 4 4 6	Water Supply & Technical Service Section 4 teams
3. Pumping Test	Engineer Plumber Assistant technicians	1 1 2	Drilling team is planned	4 4 8	Water supply & Technical Service Section 4 teams
4. Hand Pump Installation	Engineer Assistant technicians	1 2	2 9	2 4	Water supply & Technical Service Section 2 teams
Total	-		47	42	-

1) Geophysical Survey

An electrical sounding instrument, which is able to be used for logging work, is planned. The geophysicists of RUWASA can use computers and they have enough knowledge, although they do not have much experience in field. A similar type of instrument, the same as the existing one of RUWASA, is judged to be usable to be operated by themselves.

2) Drilling

The staff has basic knowledge of drilling technology judging by the results of basic study and the past experience. Therefore, it seems that it is possible for the staff of RUWASA to operate the new rig and drilling equipment procured in this project. However, practical and technical transfer such as mud circulation rotary drilling, guide pipe installation and removal, and DTH drilling for the staff are necessary.

3) Pumping Test

The pumping test is important to judge discharge and borehole condition. However, it has not been carried out in RUWASA, and the discharge quantity and pumping drawdown water level are judged by the driller's experience. Because that pumping test data is essential for future groundwater development planning, necessary equipment is planned to be procured.

4) Installation of Hand Pump

Installation of hand pump is being conducted by private sector and LGA staff under the supervision of RUWASA. The technical level of engineers for the installation of hand pump is enough. However, the support for operation of facility is crucial for sustainable O&M by VWESC.

< Management of Workshop and Staff >

The management for the procured equipment and materials is shown below.

- Daily and regular check of the equipment
- Maintenance and check of the equipment at site
- Maintenance and store of construction tools
- Repair for breakdown
- Management & store of the materials
- Arrangement of manuals & technical documents

Table 2-11 Staff of Workshop

Section	Staff Nos.	Contents
Management of stored materials	1	Administration and service section is responsible
Mechanics	7	Check and repair for rig, trucks and compressor. Assembling and processing simple machines
Electrician	1	Welding works
Operator for the equipment	2	Maintenance of compressor and generator, etc.

Total 11 staff in the workshop section are conducting repair, welding work and maintenance of vehicles, compressor, engine and generator. The staff of the drilling teams can maintain the equipment at site by simple daily check.

Engineers of private sectors in Kano City are available at car repair factories. RUWASA sublets complicated repairs to private sector for special equipment such as pump and hydraulics of rig. To simplify management of RUWASA and availability of outside sourcing, it is judged to be more economical that special repair works shall be sublet to private sector.

(2) O&M for Water Supply Facility

< VWESC >

The residents (users) are responsible for O&M for water supply facility after hand over. Therefore, the staff of Community Mobilization section in RUWASA will establish VWESC to residents in community. VWESC is composed of about 7 to 10 members such as Chairman, Vice Chairman, Elder, Secretary, Treasurer, and Hand Pump Mechanics selected by residents. VWESC carry out O&M of water supply facility under the supporting of LGA Unit.

According to the interview survey, most of VWESC combines the traditional self-defense committee, and they have not collected money for water regularly. The necessary cost to procure spare parts or to repair facility is by contributions, donation, and/or depends on LGA supports. It takes considerable effort to establish the method for water charge collection with one or two times payments at harvest season instead of regularly payment by residents in this agricultural rural area. VWESC should discuss and select the best method for collection, regular check, and repair facility. In addition, RUWASA staff shall consider the religious conditions in the area, and give a chance for women to participate in the hygiene education.

< Monitoring and Supporting System >

In RUWASA's water supply and sanitation service, the staff of LGA Unit will take a charge of management and support for VWESC after hand over of boreholes in the community under RUWASA. The staff that is called "Local Hand Pump Mechanic (LHPM)" of LGA Unit will visit each community regularly, and monitor the present condition of the hand pump, drainage condition, sanitation condition around borehole, and collect conditions on reserved funds for O&M of boreholes. They will also request RUWASA to hold a community workshop again if necessary. In case of the promotion of sanitation program and inspected sanitation condition in community, LGA Unit will ask for support to Health Section in LGA. (Refer to Figure 2-6 LGA Organization chart)

However, it is very rare for RUWASA staff to visit community and to confirm monitoring activity or O&M condition of water supply facility. Also, RUWASA have never held a community workshop again for collection of O&M cost, hygiene education, and technical training of daily check and maintenance based on request by LGA.

It is necessary for VWESC to monitor their activities and self-reform, and to support them regularly in order to realize sustainable O&M of boreholes. Therefore, the necessity of the activities to RUWASA and LGA for the project shall be made clear since they have not been done as mentioned above until now. In this project, this system shall be activated by the soft component.

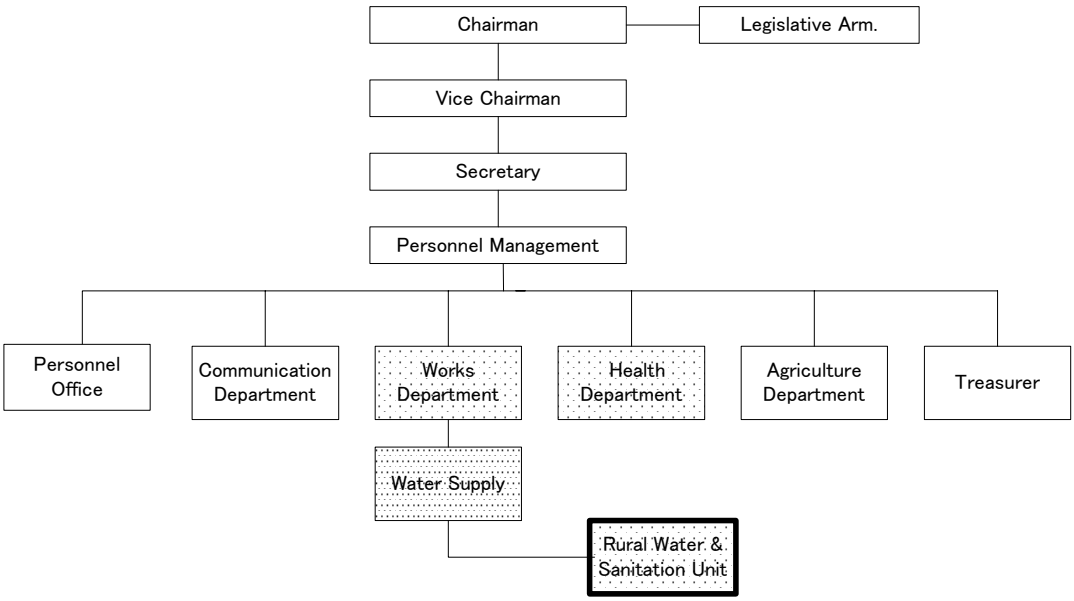


Figure 2-6 LGA Organization chart

(3) O&M Cost

1) Maintenance of Equipment

According to RUWASA's recent experiences of drilling boreholes, drilling cost for one borehole including fuel and oil is about NGN 118,500, therefore, the cost of maintenance for the equipment proposed in the Project of 240 boreholes is estimated at about NGN 11.4 million/year. The maintenance cost will be provided by the Kano State Government without trouble.

2) Maintenance of Boreholes with hand pump

The boreholes with hand pump to be constructed in the water supply and sanitation service by RUWASA is the standard type of the RUWASA office: Indian MarkⅢof VLOM type. Indian Mark III has high durability under moderate maintenance and high performance, and there is wide experience with it. However, periodic replacement for some consumable parts will be required. The residents of the community, beneficiaries of the water supply service, will bare the cost of maintenance including replacement of spare parts. Reservation, collection, and management of the cost will be carried out by the members of VWESC selected in community. Proper activity by VWESC is required for smooth maintenance such as procurement of necessary parts, periodic replacement, simple repair, etc.

The LGA Unit or RUWASA office takes a charge of rehabilitation of boreholes, which are difficult to repair, and their cost is borne by the community.

Sharing of the maintenance costs is as shown in Table 2-12, and it is necessary to have a consensus in establishing the VWESC.

Table 2-12 Sharing of the Maintenance Costs

Expense Item	RUWASA	LGA	Community	Remarks
Daily inspection and cleaning			○	
Water charge collection and management			○	
Periodic replacement of pump consumable parts		○	○	Purchase of parts, Replacement work
Repair of unexpected failure of pump	○		○	Major repair done by RUWASA, Residents bare the actual expenses
O&M of ancillary facilities			○	Provision of fence, Repair of platform, etc.
Replacement of old pump	○		○	Once in 10 years, Residents bare the actual expenses
Water quality monitoring		○	△	

○ Do the work and/or bare the cost △Partial bearing the cost

Necessary tools for repair of boreholes with hand pump will be handed over to the Hand Pump Mechanic of the VWESC. The technology required for periodic inspection and parts replacement will be transferred by Department of Planning and Community Mobilization in RUWASA. Therefore, the costs of O&M for water supply facility are purchase of replacement parts, expenses for repair, and replacement of pumps. Annual O&M cost of Indian Mark Ⅲ pump to be installed by this Project are shown in Table 2-13.

Table 2-13 Annual O&M Cost for One Borehole

No.	Item	Unit price	Quantity	Amount	Remarks
1	Replacement of spare parts	23,000	0.5	11,500	Once in 2 years
2	Maintenance kit	15,000	0.1	1,500	Once in 10 years
3	Cleaning of well	38,000	0.1	3,800	Once in 10 years
4	Hand pump, pipe replacement	97,000	0.1	9,700	Once in 10 years
Total		-	-	26,500	-

Annual O&M cost for one borehole (average number of beneficiaries of 360 persons) is estimated at NGN 26,500, which is equivalent to NGN 74 /person/year. According to the results of Social Condition Survey carried out by this Study, more than half the residents in a community with a VWESC has paid at least NGN 30 /month (NGN 360 /year). In the communities for future installation, more than 60% of them answered that NGN 30 to 50 /month will be possible to pay. According to the supplementary survey by the Study team members, some residents proposed that the payment would be made depending on the capacity, pay during the harvest period of cash crops, etc. The estimated annual O&M amount will be adequate. However, payment of water charge will be required to address accidents and serious failure of pump.

2-5 Soft Component Plan

In “Soft Component” of this project, two kinds of support are to be executed: 1) Technical Training for Construction Management (Guidance of Construction Management) and 2) Strengthening of O&M System for Water Supply Facility.

(1) Necessity of Instituting “Soft Component”

1) Technical Training for Construction Management (Guidance of Construction Management)

In this project, construction of 240 boreholes is planned in two and a half year period. The training of management, such as preparation of implementation plan for the construction as well as the strengthening of technique such as handling of equipment,

O&M of equipment, drilling technique of boreholes and capacity of supervision, is essential for effective implementation of construction by efficient utilization of equipment and materials procured in this project. Such training will enable best utilization of the limited human and financial resources of RUWASA for construction management. By construction based on planned and controlled construction period, this project will be smoothly implemented with minimized time loss due to idling, insufficiency of equipment and accidents.

Also, the maintenance situation of existing equipment in RUWASA has a repeated cycle of breakdown and repair. RUWASA has no systematic maintenance inventory (record) and there are no routine maintenance to avoid breakdown. For these reasons, breakdown of equipment occur frequently, disturbing the progress in drilling. Therefore, it is necessary to provide guidance to prepare maintenance records using a standard format and for preparing appropriate plans for maintenance and renewal for equipment. Daily maintenance and precautionary maintenance of equipment will prevent breakdown of equipment.

2) Strengthening of O&M System for Water Supply Facility

The RUWASA's system of water and sanitation service consists of: request of construction of boreholes, securing of budget for implementation, site survey (natural conditions, social conditions), construction of facility, water quality testing, and community mobilization immediately after construction. After handing over of the water supply facility to the community, VWESC are organized by residents of the community, and VWESC carries out the O&M of the facility. Staff of the LGA Unit, which belong to Works Department of LGA assist the VWESC. This system is not appropriately functioning, as it is not well understood by the Staff of RUWASA, LGAs and residents of the communities.

The causes of these problems are namely: lack of understanding on the system of water supply and sanitation service of RUWASA by many staff because they comes from other water supply sectors (WRECA, Water Board), insufficient cooperation among relevant stakeholders, insufficient management due to insufficient technical knowledge and skill of RUWASA staff, and absence of guidance training for RUWASA staff. In order to establish sustainable O&M system for water supply facilities, it is required to review the system of water supply and sanitation service by RUWASA and to strengthen the cooperation system among relevant stakeholders. Furthermore, capacity building for RUWASA staffs through practical training and chances to learn technical knowledge and techniques is needed for establishment of VWESC and community mobilization activities to be appropriately executed.

(2) Present Condition and Issues of RUWASA's Water Supply and Sanitation Service

Many of the staffs of RUWASA has recently come from other water sectors. It is necessary to further strengthen the system of O&M and water supply and sanitation service by RUWASA for effective construction of water supply facility using equipments and materials procured in this project.

The issues that should be reformed to strengthen the existing system for water supply and sanitation service of RUWASA are as follows:

① To manage the construction of water supply facility based on detail plan
② To improve workshops and management system for equipment and materials.
③ To establish a systematic management of water supply facility records.
④ To reconstruct management manual of the water supply and sanitation service and to share the scope of works by each sector in RUWASA.
⑤ To strengthen the cooperation of supporting system for water supply facility by RUWASA and LGA.
⑥ To carry out educational approach to mobilize residents in the community to recognize the importance of maintenance for water supply facility by them.
⑦ To make clear the criteria for community selection to construct water supply facilities and to monitor O&M conditions after construction.
⑧ To improve technical knowledge and techniques for O&M of water and sanitation service for the staffs of RUWASA.

(3) Target of "Soft Component"

1) Technical Training for Construction Management (Guidance of Construction Management)

① Construction of boreholes will be implemented continuously based on the construction plan.
② Sustainable supporting system for borehole construction will be established by improvement of management system for equipment and materials.
③ O&M system for water supply and sanitation services will be established by development of borehole inventory.

2) Strengthening of O&M System for Water Supply Facility

① Water supply and sanitation services by RUWASA will be implemented continuously based on the management manual.
② Educational activity toward VWESC and support for establishment of villager organizations through a cooperation between RUWASA and LGA will be implemented continuously.
③ VWESC will be established in each community for implementation of O&M of water supply facility by themselves.
④ Community selection and monitoring of O&M system based on the manual will be implemented continuously.
⑤ Capacity building of LGA staffs in water supply and sanitation sector will be conducted by RUWASA staffs.

(4) Output of "Soft Component"

The direct output of "soft component" in this project is as follows:

1) Technical Training for Construction Management
(Guidance of Construction Management)

① Construction period of borehole will be kept on the basis of the established borehole construction plan.
② Management plan for equipments and materials will be prepared.
③ Borehole inventory will be developed .

2) Strengthening of O&M System for Water Supply Facility

① Comprehensive manual for water supply and sanitation services will be prepared, and work contents will be made clear.
② Demarcation of responsibility on supporting VWESC between RUWASA and LGA will be made clear by the preparation of regulations of work management.
③ VWESC will be established in a model community and RUWASA/LGA staffs will learn know-how of community development and organization.
④ O&M manual for water supply system including criteria of community selection and implementation method of monitoring O&M system will be prepared.
⑤ RUWASA staffs will learn technical knowledge and techniques for water supply and sanitation services.

(5) Activity (Input plan) of "Soft Component"

Contents of activity

1) Technical Training for Construction Management
(Guidance of Construction Management)

Before start of construction, Japanese consultant will carry out capacity building for the staffs of Water Supply Section, Workshop Section and Monitoring Section of RUWASA for preparation of management plan for water supply system and equipment & materials with the aim of strengthening the management system.

2) Strengthening of O&M System for Water Supply Facility

① Strengthening Cooperation for O&M System of Water Supply Facility

Strengthening of management system and cooperation among RUWASA, LGA and VWESC, along with reviewing of the contents of water supply and sanitation services of RUWASA will be done with the aim of strengthening sustainable management system of water supply facilities.

② Training Workshop for RUWASA staffs

The training workshop for RUWASA staffs will be held under the planning and management by working members who were engaged in preparing the manual for water supply & sanitation services of RUWASA. Its purpose is to confirm the work contents of water supply and sanitation services and to learn technical knowledge and techniques for community mobilization and organizing of VWESC.

More detailed contents of activity are shown from next page onward.

1) Technical Training for Construction Management (Guidance of Construction Management)

Activities	Contents	Detail contents	Out put
1. Planning of borehole construction.	1-1. Scheduling of engineers and management plan for the construction 1-2. Planning of a work schedule for the construction. 1-3. Planning of safety management	① To organize a construction planning team in RUWASA ② To make a working plan for the construction ③ To share related construction work as reference, and then to make a list of quality control . ④ To make a work schedule of the construction ⑤ To make safety management plan for the construction work (see Note 1 for detail)	1. Construction period of borehole will be kept on the basis of the established borehole construction plan. 2. Management plan for equipments and materials will be prepared. 3. Borehole inventory will be constructed .
2. Maintenance planning of equipment and materials.	2-1. Planning of maintenance work	① To organize a maintenance planning team in RUWASA. ② To make a management list for maintenance work such as, working plan, list of maintenance records etc. ③ To maintain equipments and materials beforehand to avoid any accident (see Note 2 for detail)	Inputs / Equipment 1. Japanese Consultant (1person) 2. Vehicle rent: for Japanese consultant 1 vehicle x 54 days
3. Administrative procedure of borehole inventories	3-1. Preparation of borehole inventories	① To collect existing boreholes data ② To input existing borehole data into a computer.	
Facilitator: 1. Japanese Consultant (1 person) Target group: Staff of RUWASA 1. Construction planning team: Staff of Water supply section (37 persons) 2. Maintenance planning team: Staff of workshop section (11 persons) 3. Borehole inventory team records Staff of water supply section and Planning section (4 persons)	Note 1. Training for borehole construction planning (a) Explanation of outline of the project, importance of responsibility of personnel in charge and cooperation among related departments (b) Preparation of a list of the contents in the construction plan (c) Questions and answers (d) Instruction on quality, work period and safety management. (e) Advice on organization of borehole team (f) Advice on the construction period (g) Preparation of a check list of quality control (h) Sharing related constructions as examples among participants (i) Making construction plan (j) Training of data analyses 2. Training for maintenance planning of equipments and materials (a) Explaining the importance of maintenance of equipments. (b) Explaining the necessity of setting up maintenance standard and conducting regular maintenance for a certain period and daily maintenance (c) Questions and answers (d) Preparation of a digital stock list. (e) Filing of stack list and documents. Keep this file in right place that easy to handle by any staff. (f) Training of how to make a annual maintenance plan by maintenance records (g) Instruction of safety management for the construction work		

2) Strengthening of O&M System for Water Supply Facility

① Cooperation Strengthening of O&M System for Water Supply Facility

Activities	Contents	Detail contents	Output
1. Reviewing and arrangement of the Water supply and sanitation service by RUWASA	1-1. Preparing a manual for water supply and sanitation service.	① To select a LGA as model and organize a working team (see Note 1) ② To review the existing service of water supply and sanitation (see Note 2) ③ To examine the existing service of water supply and sanitation for improvement ④ To define demarcation of work among RUWASA, LGA Unit, and VWESC. ⑤ To document the water supply and sanitation service and work contents (manual, project information list etc.)	1. Contents of water supply and sanitation services will be made clear by the manual within RUWASA. 2. Demarcation of responsibility on supporting VWESC between RUWASA and LGA will be made clear by the regulations of work management. 3. VWESC will be established in a model community and RUWASA staffs will learn know-how of community organization. 4. O&M manual for water supply system including criteria of community selection and implementation method of monitoring O&M system will be prepared.
2. Strengthening of cooperation between RUWASA and LGA	2-1. Verification of role between RUWASA and LGA in the service.	① To hold a meeting with selected LGA Unit. (Introduction of the project, request of cooperation and confirmation of the Unit condition)	
	2-2. Setting up regulations for O&M of work.	① Consideration of regulation for O&M of work like request to construction, system to supply spare parts, regularly meeting, supporting to VWESC. ② Setting up regulation for O&M of work (add to manual).	
3. Organization of VWESC, and activity of community mobilization in model community (see Note 3)	3-1. Verification of work sharing (Community workshop 1)	① To select one targeted village as model community of LGA ② To introduce the water supply and sanitation service of RUWASA to the targeted community.	
	3-2. Setting up VWESC (Community workshop 2)	① To explain necessary and role of VWESC, and O&M of water supply facility. ② To select relevant members of VWESC, and preparing the member list.	
	3-3. Community mobilization for O&M cost (Community workshop 3)	① To explain O&M cost for water supply facility ② To discuss about O&M cost (cost of water charge, frequency of payment, the method of payment, the way of collecting and keeping money in the committee, etc.) ③ To make a rule for O&M cost in VWESC through workshop in the community	Inputs / Equipment 1. Japanese Consultant (1 person) 2. Vehicle rent: for Japanese consultant 1 vehicle x 63 days 1 bus x 8 days (Site trip and visit model LGA) 3. LGA Unit staffs (3 persons) Per diem: 3 x 45 days 4. Lectures (2 persons) Experts of rural water supply system (1 day) Expert of hygiene education (2 days)
	3-4. Promotion of hygiene education (Community workshop 4) (see Note 4,5)	To promote hygiene education on environment around water supply facilities and households, etc. ④ To promote hygiene education to prevent from water-borne diseases.	
	3-5. Training for maintenance and technique of water supply facility (Community workshop 5) (see Note 6)	① To explain how to cope with broken boreholes (demarcation of roles and communication system) ② To train local borehole engineers how to check and maintain boreholes (including distribution of manuals)	

Activities	Contents	Detail contents	Output
4. Clarification of criteria of site selection and procedure of monitoring	4-1. Clarifying criteria of site selection	① To examine approach of base line survey, selection of site for construction of boreholes ② To carry out the base line survey in the model community ③ To analyze the results of the base line survey and define the criteria of site selection ④ To prepare a manual of site selection	
	4-2. Procedure of monitoring	① To examine the approach of monitoring and the report format ② To conduct monitoring survey in model community (regarding VWESC, water facility, water-borne disease, population etc.) ③ To make a report on the results of the monitoring by staff of LGA ④ To understand current issues and examine improvement of problems based on monitoring report, and to prepare a manual for monitoring	
Working team: 1. Japanese consultant: Facilitator (1 person) 2. Staffs of RUWASA (8 to 10 persons) 3. Staffs of LGA Unit (3 persons) Total (14 persons) Lecturer (Adviser): 1. Staffs of UNICEF (More than 2 persons) Rural water supply system, Hygiene education	Notes: 1. Working team is composed of 10 members from selected each department in RUWASA, 3 members of model LGA Unit, and Japanese consultant (1 person) : totally 14 members. 2. Interviewees of the survey is members of VWESC constructed by RUWASA (1or 2 persons) and members of LGA Unit. 3. The staff of Planning and mobilization division and staff of LGA Unit carry out the workshop in community. 4. Promotion activities of hygiene education are carried out twice, and one of the project target encourages participation of women. 5. Experts from UNICEF participate in community workshop as advisers. 6. Training of maintenance technique is conducted to Local Hand pump mechanics and VWESC members in community of model LGA that have existing water facility constructed by RUWASA		
Target group: Staffs of RUWASA Participation: 1model LGA, 1model community			

② Training Workshop for RUWASA staff

Activities	Contents	Detail contents	Out put
1. Planning of the training agenda	1-1. Preparation of the training schedule and curriculum (see Note 1)	① To examine contents of training workshop, the curriculum and materials (see Note 2) ② To arrange availability of lecturers (see Note 3)	1. RUWASA staffs will learn technical knowledge and techniques for water supply and sanitation services
2. Preparation of contents of the training	2-1. Introduction on the project and lectures on the water supply and sanitation project to RUWASA (see Note 2)	① To explain the project, and division of work of stakeholders ② To provide basic knowledge on rural water & sanitation project ③ To provide knowledge on health and water supply management ④ To give lectures on the project (community mobilization, hygiene education, maintenance technique of boreholes, project management, water quality, potential of groundwater, etc) ⑤ To let trainees of RUWASA make a report about the whole training	Inputs / Equipment: 1. Vehicle rent: for Japanese consultant 1 vehicle x 5 days 2. Lecturers from outside of RUWASA (more than 3 persons) Expert of UNICEF (Rural water supply system) 1 day Expert of UNICEF (Hygiene education) 1 day Expert of WHO (Prevention of Water borne diseases) 1 day
Working team: 1. Japanese consultant: supporter (1 person) 2. Staffs of RUWASA (8 to 10 persons) Total (11 persons) Lecturers from out side: (more than 3) 1. Expert of UNICEF (Rural Water supply system, Hygiene education) Expert of WHO (Prevention of water borne diseases)	Notes: 1. RUWASA working team who get involved in making a manual of the water supply and sanitation project initiatively propose curriculum of the lectures in the training which the Japanese consultant suppose. 2. The training is based on the practice and lectures 3. UNICEF and WHO experts are invited as lecturers of rural water supply project and water-borne disease. 4. The working team examines contents of the training and selects lectures from RUWASA.		
Target group: Staffs of RUWASA (30 persons) Lecturers from RUWASA Planning and management of the training RUWASA working team			

Detailed Input Plan

Detailed input is shown in Table 2-14.

Table 2-14 Detailed Assignment Plan

	Supporting Item	Activities	Contents	1	2	3	4	5	6	Place	Output	Documents
Technical Training for Construction Management	Guidance for Construction Management	Preparation	Preparetion text							Japan		・Training text
		Mobilization								Mobilization		
		Planning of borehole construction	Scheduling of engineers and management plan for the construction							Kano city	・To comply with the construction period of the facility is preserved, and construction plan for borehole is prepared accordingly.	・Construction manual of boreholes & Consruction plan ・Safty control manual & Safty control plan ・Pogress Report
			Planning of a work schedule for the construction									
			Planning of safety management									
		Maintenance planning of equipments and materials									・Management plan for equipments and materials is prepared.	・Planning manual of management for equipments and materials
		Administrative procedure of borehole inventories	Preparation of borehole inventories								・Borehole inventories record is arranged.	・Manual & boreholes inventories record
	Evaluation and reporting of activities											・Final Report of activity ・Activity record, photo
Strengthening of O&M System for Water Supply Facility	Cooperation Strengthening of O&M System for Water Supply Facility	Preparation	Preparetion text							Japan		・Text for guaidance
		Mobilization								Mobilization		
		Reviewing and arrangement of the Water supply and sanitation service by RUWASA	To select a LGA as model and organize a working team							Kano city, model 1LGA, and model 1 community	・The manual for the system of water supply and sanitation service is prepared, and the contents is defined.	・Management manual for water supply and sanitation service, brochure of survice to introduce *Progress Report
			Preparing a manual for water supply and sanitation service.									
		Strengthening of cooperation between RUWASA and LGA	Verification of role between RUWASA and LGA in the service, and Setting up regulations for O&M of work.								・The regulations of management to assist VWESC by RUWASA and LGA is made, and burden sharing is defined.	・Regulations of management to assist VWESC
		Organization of VWESC, and activity of community mobilization in model community	Setting up VWESC and Community workshop for sasutainable O&M of boreholes in model community.								・ VWESC is established in a model community, at the same time, staffs of RUWASA and LGA Unit are learn the know how of community mobilization activity.	・Member list of VWESC, Rule of management for VWESC ・Maintenance manual (Community level) ・Document or poster for hygiene education or community mobilization
		Clarification of criteria of site selection and procedure of monitoring	Clarifying criteria of site selection								・The criteria for site selection is established and a way of monitoring is chosen. And those manual are prepared.	・Manual for site selection
			Procedure of monitoring									・Manual for monitoring ・Questionier for monitoring ・Report format for monitring
	Training Workshop for RUWASA staffs	Planning of the training agenda, implementation of training workshop	Preparation of the training schedule and curriculum							Kano city	・Staffs of RUWASA learn necessary knowledge and techniques for water supply and sanitation service.	・Training workshop plan ・Curriculum
			Introduction on the project and lectures on the water supply and sanitation project to RUWASA									・Paticipants list, certificate
	Evaluation and reporting of activities											・Final Report of Activities ・Activity record, photo
Evaluation	Evaluation for accomplishment of Output about Soft Conponent	Mobilization								Mobilization		
		Evaluation for accomplishment of Output								Kano city		・Final Report of Soft Conponent

Assignment Plan	Human resource		1	2	3	4	5	5	Quantity	Note
	Japanease Side	Strengthening of O&M System for Water Supply Facility : Japanese consultant (1 person)							3.0M/M	In Japan:0.23M/M In nigeria:2.77M/M
		Guidance of Construction Managemen: Japanese Consultant(1 person)							2.2M/M	In Japan:0.23M/M In Nigeria:1.97M/M
		Lecturer 1 (Taking a charge of rural water supply system, UNICEF)							2days	
		Lecturer 2 (Taking a charge of Hygiene education & community mobilization, UNICF)							3days	
		Lecturer 3 (Taking a charge of prevention water borne diseases, WHO)							1day	
	Nigerian Side	Working team for Strengthening of the system for O&M of water supply facility(13)								RUWASA(10persoms): Selected 2 staffs from Planning and Mobilization section and 1 staff from other sections. LGA(3persoms): Selected 3 staffs from LGA Works. One is staff of Water supply section. Others are Area handpum mechanics and Health care women
		Working team of construction management (52)								Water supply section, Workshop section, and Planning section: Total (52 persons)
	Vehicle		1	2	3	4	5	6	Quantity	Note
	Japanease Side	Vehicle(4WD)							73days	For Japanese consurtant
		Vehicle (Microbus)							8days	For working team
		Vehicle (Sedan)							54daus	For Japanese consurtant
	Working space, Meeting room, and others		1	2	3	4	5	6	Quantity	Note
	Nigerian Side	Working space							Abt. 4months	
		Meeting room							3days	Training Work shop(1day) Meeting with LGA(2days)
		Others								

Importance of the initiative of relevant agencies

In this project, participation of relevant agencies and their roles to conduct the soft component is shown as follows.

Actors	Roles
1. Japanese Consultants	• Planning, management, operation, reporting of soft component part • Supervising staffs of RUWASA as facilitator
2. RUWASA office/staff	• Conducting the Project under supervision of the Japanese consultant • Corresponding to stakeholders about the Project and asking for cooperation • Planning and preparation for training workshop
3. Staff of Model LGA Unit	• Supervising and managing water supply and sanitation project in LGA • Conducting community mobilization of VWESC with RUWASA • Monitoring of rural water supply and sanitation project and reporting to RUWASA • Supporting VWESC in case of boreholes get broken
4. VWESC in model community	• O&M for boreholes in community (collection of water rate and management of boreholes, regularly check, maintenance, cleaning surround of boreholes, fence, etc)
5. UNICEF staff (Rural Water supply system/Hygiene Education)	• Reviewing the contents supported by UNICEF in 1997 • Giving advice for community mobilization activities in model community • Lecturers of training workshop for RUWASA staff
6. WHO staff (Prevention of water borne disease)	• Lecturer of training workshop for RUWASA staff

(6) Assistance Item and Implementation Resource of the Project

The assistance item and implementation resource for soft component are shown as follows:

Assistance Item	Activity	Formation	Implementation Resource
1) Technical Training for Construction Management	① Guidance of Construction Management	Management assistance	Japanese Consultant
2) Strengthening of O&M System for Water Supply Facility	① Cooperation Strengthening of O&M System for Water Supply Facility	〃	〃
	② Training Workshop for RUWASA staff	〃	〃

Note: Experts from UNICEF and WHO are invited as lecturers in order to support strengthening of O&M system for water supply facility.

For procurement of new equipment and materials, the Japanese consultants in charge of the "Soft Component" supervises water supply and sanitation service for the purpose of capacity building of RUWASA.

(7) Implementation Schedule of "Soft Component" Part

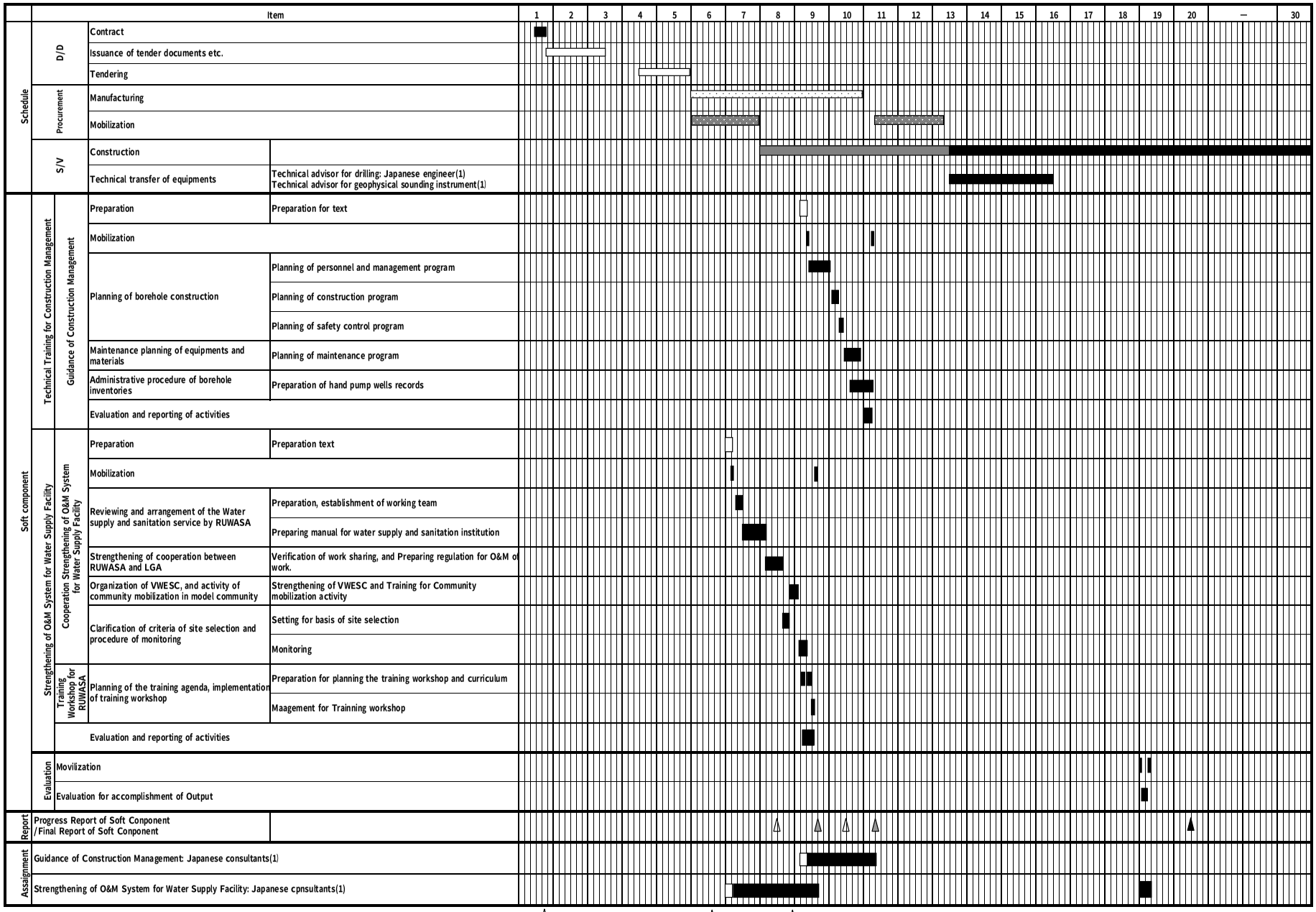
Implementation Schedule of "Soft Component" part is shown Table 2-15 in following page.

(8) Collaboration with In-Country Training Workshop by JICA Technical Assistance

To improve O&M system for water supply facility managed by residents in community, RUWASA requested In-Country Training Workshop entitled "The O&M Technique for Facility of Rural Water Supply in Kano States" as part of JICA technical assistance. The main role of "soft component" will strengthen the rural water supply and sanitation project through capacity building of RUWASA, and it is expected to effectively contribute to the project by collaboration with In-Country Training Workshop.

The main purpose of "In-Country Training Workshop" is to have the member of rural water supply and sanitation sector of LGA in Kano state. LGA staffs who work for VWESC in community will obtain the technical knowledge and techniques, as to daily maintenance of water supply facilities, good sanitation conditions in the community, prevention of groundwater contamination, maintaining better sanitary conditions for community and management of VWESC. RUWASA staffs are expected to take action for planning and management of the training workshop with knowledge and techniques learned in this project under support by UNICEF

Table 2-15 Implementation Schedule of Soft Component



CHAPTER 3

PROJECT EVALUATION AND RECOMMENDATIONS

CHAPTER 3 PROJECT EVALUATION AND RECOMMENDATIONS

3-1 Project Effect

In relation to the current status and problems, the inputs to be implemented by the Project and the effect to be obtained by the Project are shown in the following Table 3-1.

Table 3-1 Improvement Expected by Implementation of the Project

Current Status/Problems		Input by the Project	Effect by the Project
Direct Effects			
1	Most people in target communities depend on ponds and shallow wells for drinking water that are contaminated with bacteria. Therefore, there are many cases of water-borne diseases, deteriorated public health and poor sanitation conditions.	- Procurement of drilling equipment/materials and technical assistance for construction of 240 boreholes with hand pumps.	- Provide safe drinking water to 86,000 people to be covered under the project. - Current water supply rate of 14.8% of the rural area in Kano State will be improved to 16.2% in 2008 after the completion of the Project.
2	Due to the superannuation of the well drilling equipment owned by RUWASA, the wok efficiency is low. Only three out of the five drilling rigs owned by RUWASA are under operation.	- Procurement of one (1) drilling rig and supporting equipment and materials.	- RUWASA will have the drilling rig of the latest model with high drilling efficiency. The rig shall be used by RUWASA to continue the rural water supply and sanitation project after the Project is completed, and will help to improve the rural water supply rate.
3	RUWASA does not have any logging and pumping test equipment, and has to carry out the casing program depending on their experience only.	- Procurement of one (1) set of borehole logging equipment and one (1) set of pumping test equipment. - Guidance for borehole drilling technology and construction management by Japanese consultant.	- Upgrade the capability of construction management, borehole drilling expertise and equipment maintenance and management of RUWASA personnel.
4	The operation and maintenance system of borehole facilities is very unreliable due to the insufficiency of the organization of RUWASA.	- To conduct the soft component programs on the O&M of construction of borehole and equipment.	- O&M technology for construction works will be improved. - O&M technology for the equipment will be improved. - O&M ledger will be prepared. - Borehole inventory will be prepared.
5	Residents have a low awareness of O&M of borehole facilities. Relationship with O&M between communities, LGA and RUWASA is inadequate.	- To conduct the soft component programs on the O&M of borehole facilities.	- The manual for water supply and sanitation service of RUWASA will be established. - The role of works among RUWASA, LGA and community will be shared more clearly, and their mutual cooperation will be promoted and strengthened. - Technical knowledge and techniques necessary for the water supply project will be enhanced in RUWASA.
Indirect Effect			
1	Children have to draw and carry water from distant water source, sometimes even from a distance of several km away from their residences. They are forced to spend considerable time and effort to obtain water.	- Procurement of drilling equipment/materials and technical assistance for construction of 240 boreholes with hand pumps by Nigerian side.	- The average distance to carry water will be reduced than the existing condition. And the workload on children for obtaining water will be reduced.

3-2 Recommendations

In order to execute the maintenance of procured equipment and materials related to the well digging and constructed water supply facilities under the Project sustainable and smoothly, and to execute the water supply project by RUWASA efficiently, it is indispensable to consider the following aspects.

(1) Securing Budget for Water Supply Project in Kano State and Enforcement of RUWASA Organization

It will be necessary for the Kano State to secure the budget for the water supply project and for RUWASA in charge of local water supply project to maintain its organization and techniques, in order to efficiently operate the procured equipment/materials related to the well digging, to improve water supply rates in the rural area and to supply safe water to the rural areas in the Kano State.

(2) Strengthening Function of O&M for Monitoring the Water Supply Facilities

In order to use the constructed well water supply facilities for a long period, their operation and management are important factors. Therefore, cooperation between the community people, LGA and RUWASA will be required for the O&M. It is especially essential that the users establish an organization for water sanitation in the communities and the users themselves operate and maintain it on their own initiatives. RUWASA is in a position to manage it and guide them and shall establish a system by which they can continuously do periodic check of water supply facilities, guide simple repairing skills, check sanitary environment around the wells, periodically monitor water quality through LGA which directly supports the communities, make LGA properly report to RUWASA, and cope up with trouble and breakage. Since spare parts of hand pump are available from several agents in Kano City, it is easy for the local people to buy them.

(3) Establishment of Water Fee Collection System by the Community People

Once the management system of water supply facilities by the community people is established, an extra expenditure will be required for any unforeseen breakdown or obsolescence of the borehole by use of long period, flushing bore, cleaning of deposit, and so on. To cope up with such situation, it is important for VWESC to collect water fee properly and completely as well as to pay enough attention to the reserve fund and bookkeeping. Especially, accounting system must be independent and transparent to prevent embezzlement and/or misappropriations.

(4) Collaboration with UNICEF

UNICEF is the sole agency to support the rural water supply and sanitation project in Kano State. In regard to the collaboration with UNICEF on activity to enlighten the community people, a lecturer is scheduled to be dispatched for the activity of the soft component. The collaboration with UNICEF is essential for activating of the rural water supply and sanitation project in the province.

(5) Collaboration with Technical Assistance (local domestic training)

In the project, soft component on the local enlightenment activities is carried out for RUWASA. To compliment this activity, implementation of local domestic training (technical assistance) is recommendable.

Adjustments with the soft component and the implementation schedules of the construction works in Nigeria shall be considered in order to perform efficient collaboration with the soft component and the local domestic training.

APPENDICES

1. Member List of the Study Team

Appendix 1. Member List of the Study Team

〈Basic Design Study〉

	Name	Assignment	Official Position, Company
1	Mr. Yoshio FUKUDA	Team Leader	Team Director, Water and Sanitation Team, Project Management Group1, Grant Aid Management Dep., JICA
2	Mr. Tadao SUZUMURA	Chief Consultant/ Ground Water Development	Pacific Consultants International
3	Mr. Norifumi YAMAMOTO	Hydrogeology/ Geophysical Survey	Pacific Consultants International
4	Mr. Mamoru NAKAMURA	Equipment Planning/ Management of Water Supply Activities	Pacific Consultants International
5	Ms. Rumi SAWADA	Social Condition Survey/ Management for Operation & Maintenance of Facility	Pacific Consultants International
6	Mr. Manabu ATSUCHI	Cost Estimate and Procurement Planning	Pacific Consultants International

〈Explanation on Draft Final Report〉

	Name	Assignment	Official Position, Company
1	Mr. Tomohiro SEKI	Team Leader	Chief, Project Monitoring and Coordination Team, Administration and Coordination Group, Grant Aid Management Dept., JICA
2	Mr. Tadao SUZUMURA	Chief Consultant/ Water Supply Development	Pacific Consultants International
3	Ms. Rumi SAWADA	Social-condition Survey/ Management for Operation & Maintenance of facilities	Pacific Consultants International

2. Study Schedule

Appendix 2. Study Schedule 〈Basic Design Study〉

Day	Date		Team Leader (Yoshio FUKUDA)	Chief Consultant/ Ground Water Development (Tadao SUZUMURA)	Hydrogeology/ Geophysical Survey (Norifumi YAMAMOTO)	Social Condition Survey/ Management for O&M of Facility (Rumi SAWADA)	Equipment Planning/ Management of Water Supply Activities (Mamoru NAKAMURA)	Cost Estimate and Procurement Planning (Manabu Atsuchi)
1	Jul-27	Tue.	Narita-London					
2	Jul-28	Wed.	London-Abujya, Courtesy calls on Embassy of Japan, JICA Office, NPC, and FMWR					
3	Jul-29	Thu.	Discussion with FMWR, Abuja-Kano (by car)					
4	Jul-30	Fri.	Discussion with RUWASA, Courtesy calls on Kano State Ministry of Water Resources and Rural Development					
5	Jul-31	Sat.	Site Survey (Minjibir, Bichi)					
6	Aug-01	Sun.	Interview Survey to Private Drilling Campany, Date collection					
7	Aug-02	Mon.	Discussion with RUWASA					
8	Aug-03	Tue.	Discussion with RUWASA, Discussion with Kano State Ministry of Water resouse and Rural Development					
9	Aug-04	Wed.	Kano-Abuja, Meeting with FMWR		Preparation of Field Survey			
10	Aug-05	Thu.	Signing of M/D, UNICEF, Embassy of Japan, JICA office		Preparation of Site Survey			
11	Aug-06	Fri.		Kano-Abuja	Data collection of Hydrogeology	Narina-London		
12	Aug-07	Sat.		Preparation of Site Survey (Social-Condition Survey, Water Quality Analyze)	Preparation of Geophysical Survey and Water Quality Analysis	London-Abuja-Kano		
13	Aug-08	Sun.		Data Collection from UNICEF (Abuja)	Preparation of Water Quality Analysis	Preparation of Social-Condition Survey, Selection Assistants for Social-Condition Survey	Data Collection of Equipment and Materials	
14	Aug-09	Mon.		Data Collection	Data Collection	Site Survey Data Collection	Data Collection and Marcket Survey of Equipment and Materials	Marcket and Procurement Survey
15	Aug-10	Tue.						
16	Aug-11	Wed.						
17	Aug-12	Thu.		Meeting with UNICEF (Bauchi)		Interview from MOH Site Survey	Meeting with UNICEF (Bauchi)	
18	Aug-13	Fri.		Meeting with RUWASA/Team Meeting				
19	Aug-14	Sat.		Site Survey		Data Arrangement	Data Collection and Arrangement	Marcket and Procurement Survey
20	Aug-15	Sun.						
21	Aug-16	Mon.		Site Survey Data Collection	Site Survey Data Collection	Site Survey Data Collection	Data Collection and Arrangement /Site Survey	
22	Aug-17	Tue.						
23	Aug-18	Wed.						
24	Aug-19	Thu.						
25	Aug-20	Fri.		Meeting with RUWASA/Team Meeting				
26	Aug-21	Sat.		Site Survey		Data Arrangement	Data Collection and Arrangement	Arrangement of Survey Result
27	Aug-22	Sun.						
28	Aug-23	Mon.		Site Survey Data Collection	Site Survey Data Collection	Site Survey Data Collection	Data Collection and Arrangement /Site Survey	Kano-Abuja
29	Aug-24	Tue.						Aujya-London
30	Aug-25	Wed.		Data Collection and Arrangement				Narita
31	Aug-26	Thu.						
32	Aug-27	Fri.		Meeting with RUWASA/Team Meeting				
33	Aug-28	Sat.		Site Survey		Data Arrangement	Data Collection and Arrangement	
34	Aug-29	Sun.						
35	Aug-30	Mon.		Arrangement of Survey Result	Arrangement of Data and Survey Result	Site Survey Data Collection	Arrangement of Survey Result	
36	Aug-31	Tue.						
37	Sep-01	Wed.		Meeting with RUWASA				
38	Sep-02	Thu.		Arrangement of Survey Result				
39	Sep-03	Fri.		Kano-Abuja	Arrangement of Survey Result	Meeting with WHO, Arrangement of Survey Result	Kano-Abuja	
40	Sep-04	Sat.		Site Survey (Nijya State)	Arrangement of Survey Result		Site Survey (Nijya State)	
41	Sep-05	Sun.		Preparation of Meeting Reference			Arrangement of Survey Result	
42	Sep-06	Mon.		Meeting with FMWR, UNICEF	Kano-Abuja	Kano-Abujya, Meeting with UNICEF	Meeting with FMWR, UNICEF	
43	Sep-07	Tue.		Report to FMWR, Embassy of Japan, JICA Office				
44	Sep-08	Wed.		Abuja-London				
45	Sep-09	Thu.		Narita				

⟨Explanation on Draft Final Report⟩

Day	Date		Team Leader (Tomohiro SEKI)	Chief Consultant/ Ground Water Development (Tadao SUZUMURA)	Social Condition Survey/ Management for O&M of Facility (Rumi SAWADA)
1	Dec-12	Sun.	Narita-London		
2	Dec-13	Mon.	London-Abuja, Courtesy calls on Embassy of Japan, NPC, Meeting with JICA office, Courtesy calls on UNICEF, Courtesy calls and Discussion with FMWR		
3	Dec-14	Tue.	Abuja-Kano, Courtesy calls and Discussion with RUWASA, Courtesy calls on Kano State Ministry of Water Resouces and Rural Development, Kano State Govenor's House		
4	Dec-15	Wed.	Discusstion with RUWASA		
5	Dec-16	Thu.	Discussion with RUWASA, Site Survey, Discussion with RUWASA, NPC, and FMWR for M/D, Meeting with WHO, Discussion with RUWASA		
6	Dec-17	Fri.	Kano-Abuja, Meeting with JICA office		
7	Dec-18	Sat.	Team Meeting/Arrangement Documents		
8	Dec-19	Sun.	Team Meeting/Arrangement Documents		
9	Dec-20	Mon.	Signing on M/D, Report to Embassy of Japan, JICA office, Abuja-Frankfurt	Signing on M/D, Report to Embassy of Japan, JICA office	
10	Dec-21	Tue.	Furankfurt-Narita	Discussion with UNICEF	
11	Dec-22	Wed.	Narita	Abuja-London	
12	Dec-23	Thu.		London-Narita	

3. List of Parties Concerned in the Federal Republic of Nigeria

Appendix 3. List of Parties Concerned in the Federal Republic of Nigeria

〈Basic Design Study〉

National Planning Commission (NPC)

- Dr. M. Badangida Aliyu:	Permanent Secretary
- Mr. Nwozuzu Samuel:	Principal Planning Officer

Federal Ministry of Water Resources (FMWR)

- Mr. Mukutar Shagari:	Minister
- Engr. M.A.K. Abudakar:	Director of Water Supply & Quality Control
- Mr. Akinladi Aletan:	Deputy Director of Water Supply & Quality Control
- Mr. Idou Adetunji:	Assistant Director of Water Supply & Quality Control
- Mr. Gaya Usman:	Chief Science Officer of Water Supply & Quality Control

Kano State, Ministry of Water Resources and Rural Development (MWRRD)

- Mr. Salihu M. Sagir Takai:	Commissioner
- Mr. Alhaji Abdu Lawan Kofar-Mazugal:	Permanent Secretary
- Mr. Ayusu Balarabe:	Director

Kano State, Rural Water Supply and Sanitation Agency (RUWASA)

- Mr. Adamu M. Salihu:	Managing Director
- Engr. Suleiman Salisu:	Assistant General Manager of Planning & Community Mobilization Department
- Mr. Abdul Ganiyu A. Ibrahim:	Assistant General Manager of Admin. & General Department
- Mr. Balarabe I. Yazid:	Assistant General Manager of Water & Sanitation Technical Services Department
- Mr. Labaran Urale:	Monitoring Manager of Planning & Community Mobilization Department
- Mr. Babangida Sari Yandadi:	Mobilization Manager of Planning & Community Mobilization Department
- Mr. Salusu D. Jahir:	Hydrogeologist of Planning & Community Mobilization Department

Kano State, Ministry of Health

- Dr. Daiyabu Mahd: Director of Primary Health Sector
- Mr. Ubale Ibrahim Rano: Director of Planning Sector

WHO

- Dr. Hamisu Walla: Surveillance Officer

UNICEF

- Mr. Stanley R. Hall: Chief, WES Section (Abjya)
- Ms. Theresa K. Pamma: APO, GWEP (Anjya)
- Mr. Mohammed Kamfut: Project Officer (Bauchi, Zone-D Office)

Niger State, Rural Water and Sanitation (RUWATSAN)

- Mr. Hassaini Babanna: Director

Embassy of Japan

- Akira MATSUI: Ambassador Extraordinary and Plenipotentiary
- Yoshihiro MIZUTANI: First Secretary

JICA Nigeria Office

- Shigeo YAMAGATA: Resident Representative of JICA Nigeria
- Hikaru KUSAKABE: Project Formulation Advisor
- Sumiko KOGA: Project Formulation Advisor (Health Sector)
- Kiyomi KAIDA: Associate Expert of Gender Equality Team
- Mr. Bashir Ibrahim: Security Adviser (Kano)

〈Explanation on Draft Final Report〉

National Planning Commission（NPC）

- Mr. Bauchaka A. M.: Assistant Director
- Mr. Tijani Umar: Senior Administrative Officer)

Federal Ministry of Water Resouces (FMWR)

- Engr. M. A. K. Abubakar: Director of Water Supply & Quality Control
- Mr. Akinladi Aletan: Deputy Director of Water Supply & Quality Control
- Mr. Idou Adetunji: Assistant Director of Water Supply & Quality Control
- Mr. Gaya Usman: Chief Science Officer of Water Supply & Quality Control

Kano State Governor's House

- Mr. Aihaji Abdulkarim Hassan: Secretary of Kano State Government

Kano State, Ministry of Water Resources and Rural Development (MWRRD)

- Mr. Malam Salihu M. Sagir: Permanent Secretary, (Hon. Commissioner)
- Mr. M. Haruma: Permanent Secretary

Kano State, Rural Water Supply and Sanitation Agency（RUWASA）

- Mr. Adam Salihu: Managing Director
- Mr. Abdul Ganiyu A. Ibrahim: Assistant General Manager of Admin. & General Service Department
- Mr. Balarade I. Yazid: Assistant General Manager of Water Supply & Technical Services Department
- Engr. Suleiman salisu: Assistant General Manager of Planning & Community Mobilization Department
- Mr. Labaran Urale: Manager of Planning Section

UNICEF

- Engr. Stanley R. Hall: Chief of WES Section
- Ms. Theresa K. Pamma: APO, GWEP

WHO

- Dr. Hamisu Walla: Serveillance Officer

Embassy of Japan

- Akio TANAKA: Ambassador Extraordinary and Plenipotentiary
- Yoshihiro MIZUTANI: First Secretary
- Takanori YAMASHITA: First Secretary

JICA Nigeria Office

- Shigeo YAMAGATA: Resident Representative of JICA Nigeria
- Hikaru KUSAKABE: Project Formulation Advisor
- Mr. Sowunmi: Administrator
- Mr. Bashir Ibrahim: Security Advisor

4. Minutes of Discussions (M/D)

Appendix 4. Minutes of Discussions (M/D)

(1) Basic Design Study (5 August 2004)

MINUTES OF DISCUSSIONS ON THE BASIC DESIGN STUDY ON THE PROJECT FOR RURAL WATER SUPPLY AND SANITATION IN KANO STATE IN THE FEDERAL REPUBLIC OF NIGERIA

In response to the request from the Government of the Federal Republic of Nigeria (hereinafter referred to as "Nigeria"), the Government of Japan has decided to conduct a basic design study on the Project for Rural Water Supply and Sanitation in Kano State (hereinafter referred to as "the Project") and entrusted the study to the Japan International Cooperation Agency (hereinafter referred to as "JICA").

JICA sent to Nigeria the Basic Design Study Team (hereinafter referred to as "the Team"), which is headed by Mr. Yoshio Fukuda, Team Director, Water and Sanitation Team, Project Management Group I, Grant Aid Management Dept., JICA, and is scheduled to stay in the country from July 28 to September 8, 2004.

The Team held discussions with the concerned officials of the Government of Nigeria, and conducted a field survey at the project site.

In the course of the discussions and field survey, both parties have confirmed the main items of the Project as described on the attached sheets. The Team will proceed to further works and prepare the Basic Design Study Report.

Abuja, 5 August 2004

Mr. Yoshio Fukuda
Leader
Basic Design Study Team
Japan International Cooperation Agency
Japan

Engr. M. A. K. Abubakar MFR
Director
Water Supply and Water Quality
Federal Ministry of Water Resources
Federal Republic of Nigeria

Mr. Nwozuzu Samuel
Principal Planning Officer
National Planning Commission
Federal Republic of Nigeria

Mr. Adamu Salihu
Managing Director
Rural Water Supply and Sanitation Agency
Ministry of Water Resources and Rural Development
Kano State
Federal Republic of Nigeria

ATTACHMENT

1. Objective

The objective of the Project is to improve the health and living standard of the people who live in areas affected by either waterborne diseases such as guineaworm endemic etc. or serious scarcity of water in Kano State by providing potable water through the procurement of equipment related to groundwater development and construction of water supply facilities.

2. Project Sites

The Project sites requested by the Nigerian side are located at the thirty-eight (38) Local Government Areas in Kano State as shown in Annex-1.

3. Responsible and Implementing Agencies

The responsible organization of the Project is the Federal Ministry of Water Resources (FMWR).
The implementing organization of the Project is the Rural Water Supply and Sanitation Agency (RUWASA), Kano State Ministry of Water Resources and Rural Development.
The organizational charts are shown in Annex-2.

4. Items Requested by the Federal Government of Nigeria

After discussions between the Nigerian side and the Team, the items described in Annex-3.1 were finally requested by the Government of Nigeria. The Japanese side explained that in Japan's Grant Aid, equipment and materials that are for general use and able to be procured locally would be given lower priority.
As for share of materials, both sides agreed as shown in Annex-3.2 except Bentonite and High Early Strengthening Agent, the availability which the Team will examine in the Basic Design Study.
Both sides confirmed that the appropriateness of the request shall be assessed in accordance with the further studies and analysis in Japan and the final components of the Project shall be decided by the Japanese side after the assessment.

5. Japan's Grant Aid System

The Nigerian side understood Japan's Grant Aid system and the necessary measures to be taken by the Government of Nigeria as explained by the Team and described in Annex-4, for smooth implementation of the Project, on condition that the Grant Aid Assistance by the Government of Japan is extended to the Project.

6. Schedule of the Study

(1) The consultants of the Team will proceed to carry out further studies such as interviews/surveys on socio-economy, hydrogeological investigation, water quality examination, management condition of the existing machinery and equipment and so on, in Nigeria until September 8, 2004.

(2) Based on the Minutes of Discussions and technical examination of the study results, JICA will prepare a draft report in English and dispatch a mission to Nigeria in order to explain its contents to the Nigerian side towards the early November 2004.

(3) If the contents of the draft report are accepted in principle by the Nigerian side, JICA will proceed to complete the final report and send it to the Nigerian side around January 2005.

7. Other Relevant Issues

The following issues were discussed and confirmed by both sides.

(1) Responsibility of each Organization concerning the Project

The FMWR shall collaborate with National Planning Commission and other Federal bodies to facilitate the implementation of the Project in such areas as exemption from taxes and so on, while the Kano RUWASA shall take responsibility of operation and maintenance of facilities and equipment and borehole construction through mobilization of Local Government Areas.

(2) Rural Water Supply and Sanitation Strategy in Kano State

Federal Republic of Nigeria enacted "National Economic Empowerment Development Strategy Doccument" as national development plan that targets (a) access to basic requirement on water, food, health, housing and education for the nation, (b) everlasting democracy and (c) leadership of African economy.

Thus Federal Ministry of Water Resources set up "National Water Supply and Sanitation Policy 1999" to achieve 100% portable water supply for all by 2011.

RUWASA also implements construction of 11,000 bore holes to attain above-mentioned goal.

(3) Responsibilities with regard to the Construction Work

Both sides agreed that the construction work of the Project shall be executed by the Nigerian side with its full responsibility.

Furthermore, it was agreed as follows that:

--- The number of boreholes to be constructed by the Nigerian side using materials to be procured by the Japanese side would be confirmed by both sides based on the capability of Kano RUWASA, referring to the result of the hydrogeological investigation and socio-economic survey in the Basic Design Study.

However, the construction period of the Project is put in 2 (Two) years after deliveries of equipment and materials from the view points of deterioration and proper management.

--- The Japanese side shall procure necessary materials within the limitation of Japan's Grant Aid system for the construction of certain number of boreholes mentioned above.

--- The Nigerian side shall secure budget for the Project timely and submit monthly report of progress of the construction work to the Japanese side.

(4) Equipment and Materials requested for Procurement

Both sides agreed that the necessity of the equipment and materials requested by the Nigerian side as stated in Annex-3 shall be examined from the view points of purpose of use, future project plan, technical and budgetary availability for operation and maintenance, conditions of the existing equipment, etc. The type, quantity and specification of these equipment and materials shall be determined on the minimum required and the easiest operation level.

(5) Screening of Villages for Borehole Construction

The list of the candidate sites for borehole construction is shown in annex-5.

Both sides agreed that the sites of approximately 240 (Two Hundred and Forty) boreholes from the list are to be examined taking into consideration criteria below;

- number of waterborne diseases including guineaworm affected areas
- demographic condition
- assistance from Local Government Areas
- existing water facilities
- accessibility
- hydrogeological conditions
- water quality (applying WHO guidelines)
- capacity for operation and maintenance of the facilities at community level
- willingness to pay for operation and maintenance of water supply facilities by community
- absence of water projects by other donors
- sanitation and hygienic conditions

Among the criteria, emphasis would be placed on demographic condition, number of waterborne diseases including guineaworm affected areas and existing water facilities.

And drilling sites will be selected in the Basic Design Study in consideration of RUWASA's capacity.

(6) Operation and Maintenance of Facilities, Equipment and Materials

The water supply facilities constructed by the Nigerian side shall be properly operated and maintained by the respective communities and Local Government Areas with support by Kano RUWASA.

The equipment and materials requested by the Nigerian side shall be properly operated and maintained by Kano RUWASA.

(7) Budgetary Allocation for the Project by the Nigerian side

The concrete amount of budget to be born by the Nigerian side for the Project including operation and maintenance cost shall be assessed through the study and analysis in Japan.

The Nigerian side accepted that the assistance from the Japanese side shall be determined according

to the budgetary allocation by the Nigerian side.

Thus the Nigerian side gave assurance that adequate fund will be provided for the Project except for those materials to be procured by the Japanese side.

The progress of the budgetary allocation and the total project cost to be born by the Nigerian side shall be confirmed by both sides around November 2004.

(8) Storage for Construction Materials

The materials for the construction work requested by the Nigerian side would be properly stored by Kano RUWASA and the recipient Local Government Areas with support by Kano RUWASA.

The Nigerian side shall make preparation for adequate stores to keep the materials before the commencement of the Project.

Both sides agreed that the arrangement of proper storage for the materials should be confirmed around November 2004.

(9) Spare Parts for RUWASA's Drilling Rigs

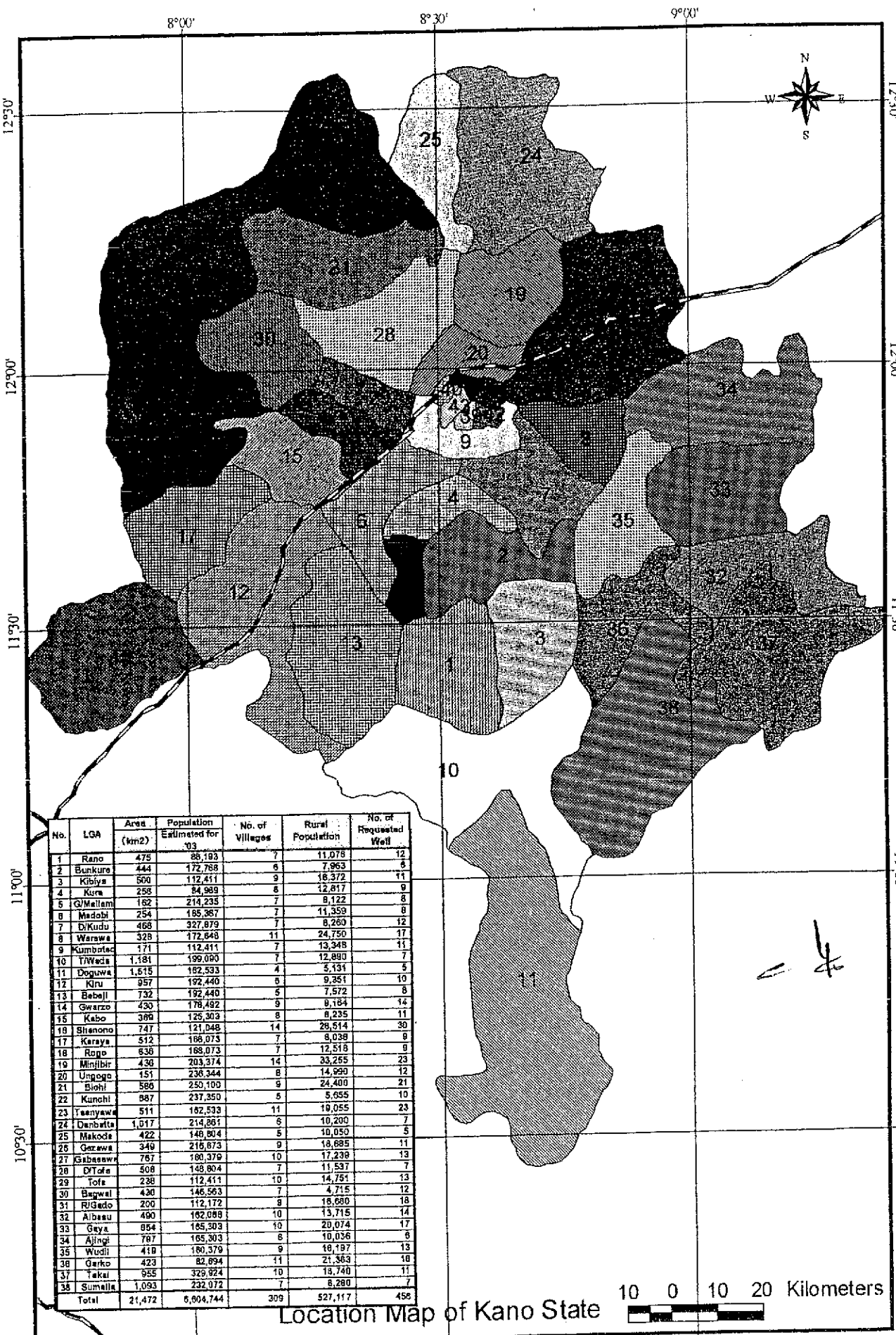
The Nigerian side requested spare parts for drilling rigs owned by RUWASA for improvement of drilling performance in the Project.

(10) Technical Assistance

The Nigerian side requested technical cooperation of dispatch of expert(s), training for staff of RUWASA, LGAs and villagers of local community in addition to technical assistance mentioned in Annex-3 for effective execution and follow-up of theProject.

(11) Safety and Security

The Nigerian side would ensure that necessary measures are taken for the safety and security of the Japanese nationals involved in the Project.



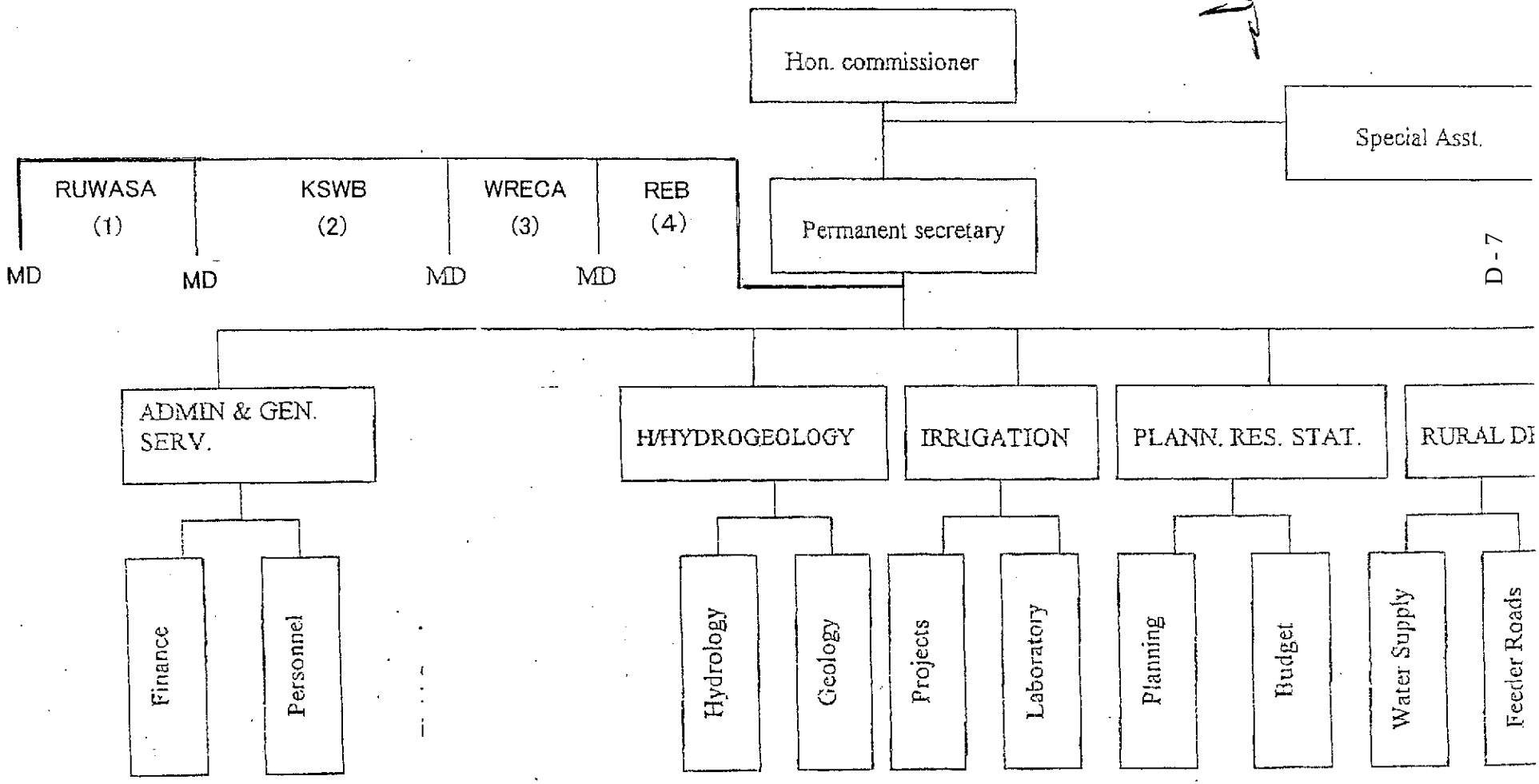
Location Map of Kano State

No.	LGA	Area (km2)	Population Estimated for '03	No. of Villages	Rural Population	No. of Requested Well
1	Rano	475	88,193	7	11,078	12
2	Bunkure	444	172,768	6	7,963	8
3	Kibiya	500	112,411	9	16,372	11
4	Kura	258	84,989	8	12,817	9
5	G/Mallam	162	214,235	7	8,122	8
6	Madobi	254	185,367	7	11,359	8
7	D/Kudu	468	327,879	7	8,260	12
8	Warawa	328	172,648	11	24,750	17
9	Kumbotso	171	112,411	7	13,348	11
10	T/Wada	1,181	199,090	7	12,890	7
11	Doguwa	1,515	182,533	4	5,131	5
12	Kiru	957	192,440	6	9,351	10
13	Bebeji	732	192,440	5	7,572	8
14	Gwarzo	430	178,492	9	9,164	14
15	Kabo	389	125,303	8	8,235	11
16	Shanono	747	121,048	14	28,514	30
17	Karaya	512	166,073	7	8,038	9
18	Rogo	638	166,073	7	12,516	9
19	Minjibir	436	203,374	14	33,255	23
20	Ungogo	151	236,344	8	14,990	12
21	Bichi	586	250,100	9	24,400	21
22	Kunchi	887	237,350	5	5,655	10
23	Tsanyawa	511	182,533	11	19,055	23
24	Danbatta	1,017	214,861	6	10,200	7
25	Makoda	422	148,804	5	10,050	5
26	Gezawa	349	215,873	9	18,685	11
27	Gabasawa	767	180,379	10	17,239	13
28	D/Tofa	508	148,804	7	11,537	7
29	Tofa	238	112,411	10	14,751	13
30	Bagwai	430	146,563	7	4,715	12
31	R/Gado	200	112,172	9	16,680	18
32	Albasu	490	162,088	10	13,715	14
33	Gaya	854	185,303	10	20,074	17
34	Ajingi	787	185,303	8	10,036	6
35	Wudil	419	180,379	9	16,197	13
36	Garko	423	82,694	11	21,363	18
37	Takai	955	329,924	10	13,740	11
38	Sumaila	1,093	232,072	7	8,280	7
	Total	21,472	6,604,744	309	527,117	456

Annex-2.1

KANO STATE

Ministry of Water Resources and Rural Development



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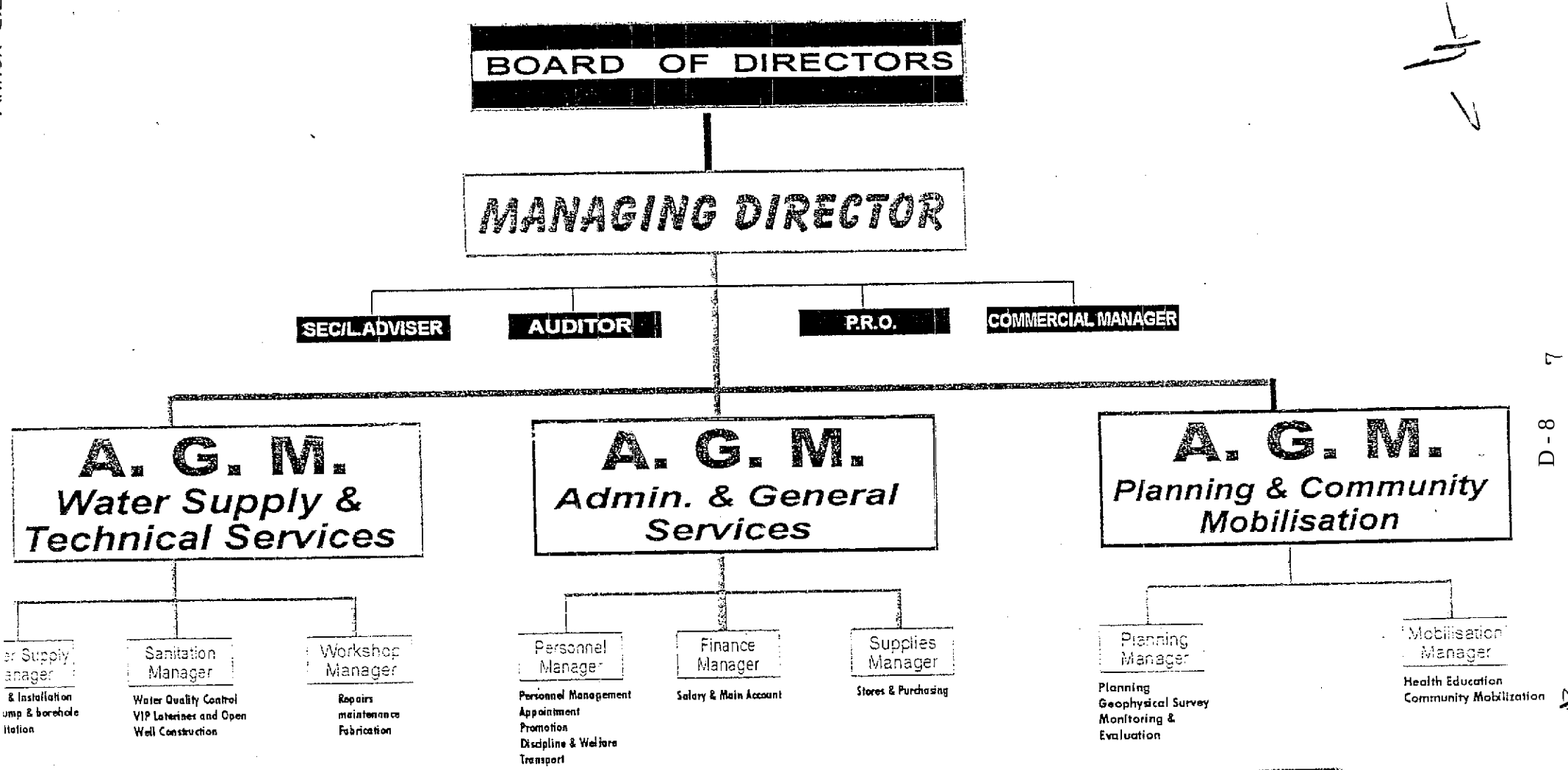
(1) Rural Water Supply and Sanitaion Agency
(2) Kano State Water Board
(3) Water Resources Engineering and Construction Agency
(4) Rural Electrification Board

Rural Water Supply & Sanitation Agency (RUWASA)

ORGANISATIONAL CHART



LOCAL GOVT. RURAL WATER & SANITATION UNITS

Water point maintenance, construction and maintenance of latrines community mobilisation Training staffing management of finances and inter sectoral coordination.

VILLAGE COMMITTEE

Mobilisation, Usage and care contributions

WATSAN COMMITTEES

Collection of Revenues
Disbursement of Revenues
Technology Adoption
Behavioural change

D-8

Equipment

1. Drilling rig(Truck mounted)	1 unit
2. Drilling tools and material	1 set
3. Air compressor	1 unit
4. Truck with crane	1 unit
5. Water tank truck	2 units
6. Oil tank truck	2 units
7. Supporting vehicle	4 units
8. Motorcycle	10 units
9. Well development tools	1 set
10. Bore hole logging tools	1 set
11. Pumping test equipment	1 set
12. Water quality analysis equipment	1 set
13. Work shop tools and equipment	1 set
14. Electric prospecting equipment	1 set
15. Computer	2 units
16. Spare parts including existing drilling rigs	

Main Materials

17. Hand pump	Necessary quantities
18. PVC casing pipe	Necessary quantities
19. PVC screen pipe	Necessary quantities

Technical assistance

Drilling skill, construction management, maintenance of bore hole, management of bore hole and so on for RUWASA, LGAs and Local communities

Annex-3.2

Share of Materials

Materials	Nigerian Side	Japanese Side
Casing pipe		O
Screen pipe		O
Centralisers		O
Bottom plug		O
Hand pump		O
Bentonite	(O)	(O)
High early strengthening agent	(O)	(O)
Foam (Blowing agent)	O	
Mud-water admixture (Polymer)	O	
Cement	O	
Reinforced bar	O	
Sand, Gravel	O	
Form	O	
Cobble stone	O	
Brick	O	
Pebble stone	O	
Boulder (Rubble stone)	O	
Fuel	O	
Lubricant	O	
Water	O	

JAPAN'S GRANT AID

1. Japan's Grant Aid System

(1) Grant Aid Procedures

1) Japan's Grant Aid Program is executed through the following procedures.

- Application (Request made by a recipient country)
- Study (Basic Design Study conducted by JICA)
- Appraisal & Approval (Appraisal by the Government of Japan and Approval by the Cabinet)
- Determination of the implementation
  (The Notes exchanged between the Governments of Japan and the recipient country)
- Implementation (Implementation of the Project)

2) Firstly, the application or request for a Grant Aid project submitted by a recipient country is examined by the Government of Japan (the Ministry of Foreign Affairs) to determine whether or not it is eligible for Grant Aid. If the request is deemed appropriate, the Government of Japan assigns JICA to conduct a study on the request.

Secondly, JICA conducts the study (Basic Design Study), using Japanese consulting firms.

Thirdly, the Government of Japan appraises the project to see whether or not it is suitable for Japan's Grant Aid Programme, based on the Basic Design Study report prepared by JICA, and the results are then submitted to the Cabinet for approval.

Fourthly, the project, once approved by the Cabinet, becomes official with the Exchange of Notes signed by the Governments of Japan and the recipient country.

Finally, for the implementation of the project, JICA assists the recipient country in such matters as preparing tenders, contracts and so on.

(2) Basic Design Study

1) Contents of the Study

The aim of the Basic Design Study (hereinafter referred to as "the Study"), conducted by JICA on a requested project (hereinafter referred to as "the Project"), is to provide a basic document necessary for the appraisal of the Project by the Government of Japan. The contents of the Study are as follows:

i) Confirmation of the background, objectives and benefits of the Project and also institutional capacity of agencies concerned of the recipient country necessary for the Project's implementation;
ii) Evaluation of the appropriateness of the Project to be implemented under the Grant Aid Scheme from a technical, social and economic points of view;
iii) Confirmation of items agreed on by both parties concerning the basic concept of the Project;
iv) Preparation of a basic design of the Project; and
v) Estimation of costs of the Project.

The contents of the original request are not necessarily approved in their initial form as the contents of the Grant Aid project. The Basic Design of the Project is confirmed considering the guidelines of Japan's Grant Aid Scheme.

The Government of Japan requests the Government of the recipient country to take whatever measures are necessary to ensure its self-reliance in the implementation of the Project. Such measures must be guaranteed even through they may fall outside of the jurisdiction of the organization in the recipient country actually implementing the Project. Therefore, the implementation of the Project is confirmed by all relevant organizations of the recipient country

through the Minutes of Discussions.

2) Selection of Consultants

For the smooth implementation of the Study, JICA uses a registered consulting firm. JICA selects a firm based on proposals submitted by interested firms. The firm selected carries out a Basic Design Study and writes a report, based upon terms of reference set by JICA.

The consultant firm used for the Study is recommended by JICA to the recipient country to also work in the Project's implementation after the Exchange of Notes, in order to maintain technical consistency and also to avoid any undue delay in implementation should the selection process be prepared.

(3) Japan's Grant Aid Scheme

1) What is Grant Aid?

The Grant Aid Program provides a recipient country with non-reimbursable funds to procure the facilities, equipment and services (engineering services and transportation of the products, etc.) for economic and social development of the country under principles in accordance with the relevant laws and regulations of Japan. Grant Aid is not supplied through the donation of materials as such.

2) Exchange of Notes (E/N)

Japan's Grant Aid is extended in accordance with the Notes exchanged by the two Governments concerned, in which the objectives of the project, period of execution, conditions and amount of the Grant Aid, etc., are confirmed.

3) "The period of the Grant" means the one fiscal year which the Cabinet approves the project for. Within the fiscal year, all procedure such as exchanging of the Notes, concluding contracts with consulting firms and contractors and final payment to them must be completed.
However, in case of delays in delivery, installation or construction due to unforeseen factors such as weather, the period of the Grant Aid can be further extended for a maximum of one fiscal year at most by mutual agreement between the two Governments.

4) Under the Grant, in principle, Japanese products and services including transport or those of the recipient country are to be purchased.

When the two Governments deem it necessary, the Grant Aid may be used for the purchase of the products or services of a third country.

However, the prime contractors, namely consulting, contracting and procurement firms, are limited to "Japanese nationals". (The term "Japanese nationals" means persons of Japanese nationality or Japanese corporations controlled by persons of Japanese nationality.)

5) Necessity of "Verification"

The Government of the recipient country or its designated authority will conclude contracts denominated in Japanese yen with Japanese nationals. Those contracts shall be verified by the Government of Japan. This "Verification" is deemed necessary to secure accountability of Japanese taxpayers.

6) Undertakings required to the Government of the recipient country

In the implementation of the Grant Aid project, the recipient country is required to undertake such necessary measures as the followings:

i) To secure land necessary for the sites of the Project and to clear, level and reclaim the land prior to commencement of the construction;

ii) To provide facilities for the distribution of electricity, water supply and drainage and other incidental facilities in and around the site;

iii) To secure buildings prior to the procurement in case the installation of the equipment;

iv) To ensure all the expenses and prompt execution for unloading, customs clearance at the port of disembarkation and internal transportation of the products purchased under the Grant Aid;

v) To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in the recipient country with respect to the supply of the products and services under the verified contracts;

vi) To accord Japanese nationals whose services may be required in connection with the supply of the products and services under the verified contracts such as facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work;

vii) "Proper Use"
The recipient country is required to maintain and use the facilities constructed and equipment purchased under the Grant Aid properly and effectively and to assign the necessary staff for this operation and maintenance as well as to bear all the expenses other than those covered by the Grant Aid.

viii) "Re-export"
The products purchased under the Grant Aid shall not be re-exported from the recipient country.

ix) Banking Arrangement (B/A)
a) The Government of the recipient country or its designated authority should open an account in the name of the Government of the recipient country in an authorized foreign exchange bank in Japan (hereinafter referred to as "the Bank"). The Government of Japan will execute the Grant Aid by making payments in Japanese yen to cover the obligations incurred by the Government of the recipient country or its designated authority under the verified contracts.
b) The payments will be made when payment requests are presented by the Bank to the Government of Japan under an Authorization to Pay (A/P) issued by the Government of recipient country or its designated authority.

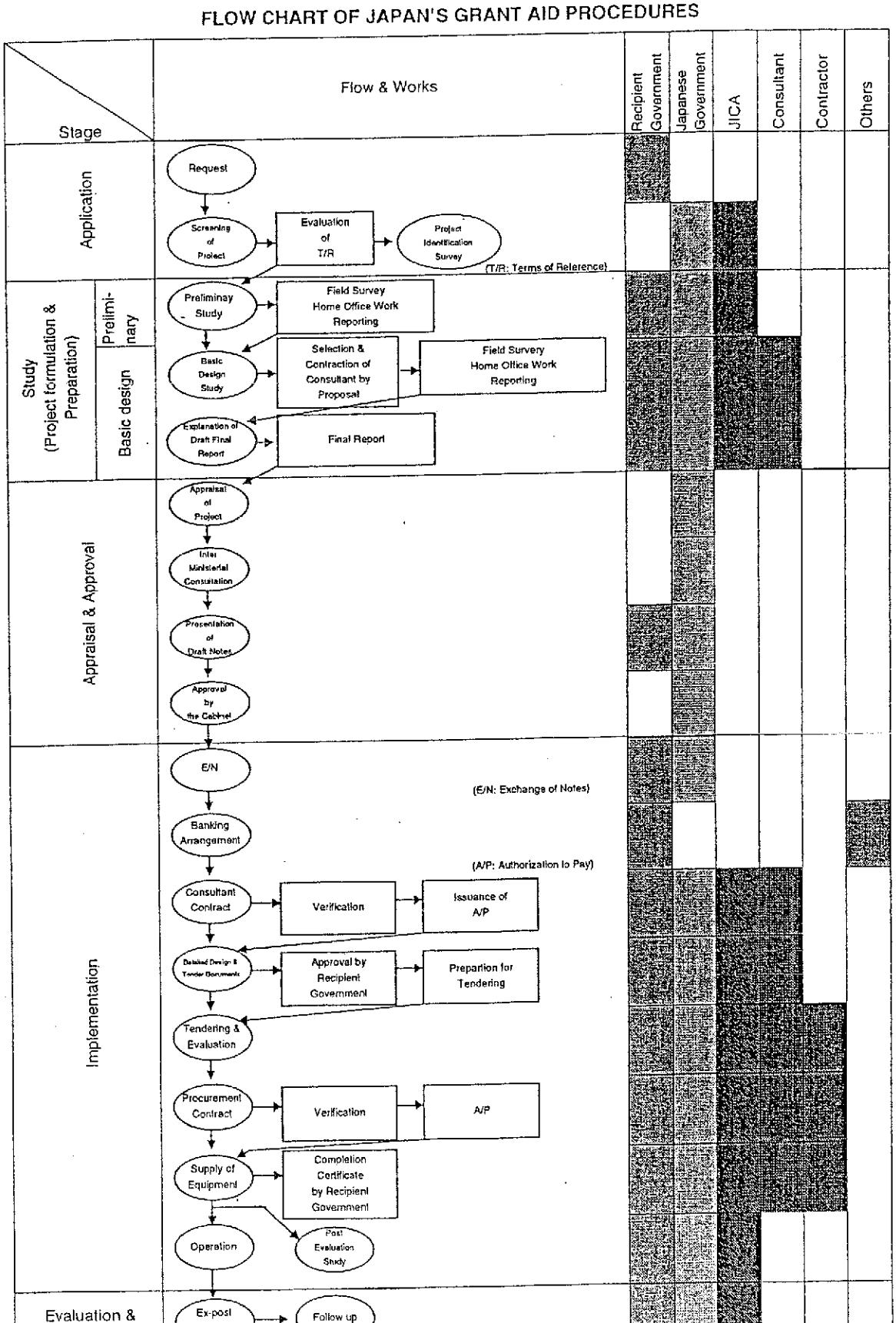
2. Grant Aid Procedure

(1) Flowchart of Japan's Grant Aid Procedures
Refer to Attachment 1.

(2) Major Undertaking to be taken by Each Government
Refer to Attachment 2.

Grant Aid Procedures

FLOW CHART OF JAPAN'S GRANT AID PROCEDURES



Major Undertakings to be taken by Each Government (Equipment)

NO	Items	To be covered by Grant Aid	To be covered by Recipient
1	To bear the following commissions to a bank of Japan for the banking services based upon the B/A		
1) Advising commission of A/P			•
2) Payment commission			•
2	To ensure prompt unloading and customs clearance at the port of disembarkation in recipient country		
1) Marine(Air) transportation of the products from Japan to the recipient country		•	
2) Tax exemption and custom clearance of the products at the port of disembarkation			•
3) Internal transportation from the port of disembarkation to the project		•	
3	To accord Japanese nationals whose services may be required in connection with the supply of the products and the services under the verified contract such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work		•
4	To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in the recipient country with respect to the supply of the products and services under the verified contract		•
5	To maintain and use properly and effectively the facilities constructed and equipment provided under the Grant Aid		•
6	To bear all the expenses, other than those to be borne by the Grant Aid, necessary for the transportation and installation of the equipment		•

Target Villages and Number of Requested Well

ID/No	LGA	Village/Ward	Population	Existing Facility	No. of Requested Well	Category	Remarks
1-1	Rano	Jalabi Zango	1,500	–	2	C	
1-2	Rano	Shangu	1,207	Handpump	1	C	
1-3	Rano	Gargun	2,010	–	3	C	
1-4	Rano	Kasuwar Dila	2,009	Handpump	1	C	
1-5	Rano	Zanbur (Yado)	1,850	–	2	C	
1-6	Rano	Garabawa (Dawa)	1,550	–	2	C	
1-7	Rano	Toure	950	–	1	C	
2-1	Bunkure	Madachi Juma	980	Handpump	1	A	
2-2	Bunkure	Bono (Kure)	810	–	1	A	
2-3	Bunkure	Bunkure (Madugu)	2,001	Handpump	1	A	
2-4	Bunkure	Buran (Yamma)	1,081	–	1	A	
2-5	Bunkure	Nariya	2,082	–	1	A	
2-6	Bunkure	Chirin (Kode)	1,009	–	1	A	
3-1	Kibiya	Kadigawa	711	–	1	A	
3-2	Kibiya	Kuluki Katanva	813	Handpump	1	A	
3-3	Kibiya	Kibiya Katanya	1,021	–	1	A	
3-4	Kibiya	Kibiya Ung. Musa	1,091	Handpump	1	A	
3-5	Kibiya	Kalambu	9,001	–	2	A	
3-6	Kibiya	Kibiya Ung. Ali	913	–	1	A	
3-7	Kibiya	Shiye Karama	1,002	–	1	A	
3-8	Kibiya	Shile	2,010	Handpump	2	A	
3-9	Kibiya	Tarai Zana	1,810	–	1	A	
4-1	Kura	Rugar Duka	1,980	–	1	A	Water diff. Area
4-2	Kura	Rigar Wajc	1,760	–	1	A	"
4-3	Kura	Rjivar Kwari	2,001	–	1	A	"
4-4	Kura	Kwario Dangama	1,600	–	1	A	"
4-5	Kura	Bode	1,780	–	1	A	"
4-6	Kura	Butalawa C/Gari	897	–	1	A	"
4-7	Kura	Gawo	789	–	1	A	"
4-8	Kura	Garun Kaya	2,010	–	2	A	
5-1	G/Mallam	Ringimawa Galaduna	991	–	1	A	
5-2	G/Mallam	Azoren Waje (U/Zango)	809	–	1	A	
5-3	G/Mallam	Kosawa Agalas	981	–	1	A	
5-4	G/Mallam	Kargo	1,002	–	1	A	
5-5	G/Mallam	Yakasai	2,010	–	2	A	
5-6	G/Mallam	Galinja	1,320	–	1	A	
5-7	G/Mallam	Butalawa Gawo	1,009	–	1	A	
6-1	Madobi	Rugar Duka (U/Kwari	1,750	–	2	C	
6-2	Madobi	Rijadawa	1,550	–	2	C	
6-3	Madobi	Damunawa	2,008	Handpump	1	C	
6-4	Madobi	Madobi Bugurau	2,100	–	1	C	
6-5	Madobi	Gora Danzogari	1,950	–	1	C	
6-6	Madobi	Guoa Unguwar Madaki	2,001	–	1	C	
7-1	Dawakin Kudu	Danbagari	1,009	Handpump	2	B	
7-2	Dawakin Kudu	Dabar Kwari	2,000	Handpump	2	B	
7-3	Dawakin Kudu	Kode	1,008	–	1	B	
7-4	Dawakin Kudu	Salfawa	911	–	1	B	
7-5	Dawakin Kudu	Danfari	1,021	–	2	B	
7-6	Dawakin Kudu	Wasawa	1,101	Handpump	2	B	
7-7	Dawakin Kudu	Dilawa	1,210	–	2	B	
8-1	Warawa	Ganitsuru	1,400	–	2	B	
8-2	Warawa	Yamai	1,600	–	1	B	
8-3	Warawa	Garindau C/Gari	2,800	–	1	B	
8-4	Warawa	Yandalla	1,800	Handpump	1	B	
8-5	Warawa	Dakata	1,900	–	2	B	
8-6	Warawa	Imawa	2,500	–	2	B	
8-7	Warawa	Bagoji	2,600	–	2	B	
8-8	Warawa	Madari C/Gari	2,500	–	2	B	
8-9	Warawa	Madari Audalawa	2,800	–	2	B	
8-10	Warawa	Ung. Jigawa Amarawa	2,900	–	1	B	
8-11	Warawa	Danhawar Gjwa	1,950	–	1	B	
9-1	Kumbotso	Shekar Barde Kudu	1,750	–	2	C	
9-2	Kumbotso	Gumi gawa	2,165	–	1	C	
9-3	Kumbotso	Bechi	950	–	1	C	
9-4	Kumbotso	Unguwar Duniya	2,131	–	2	C	
9-5	Kumbotso	Gaida	2,114	–	1	C	
9-6	Kumbotso	Mariri (Kata)	2,005	–	2	C	
9-7	Kumbotso	Mariri Arewa	2,233	–	2	C	
10-1	T/Wada	Jeli C/Gari	1,560	–	1	A	
10-2	T/Wada	Gardi	2,450	Handpump	1	A	
10-3	T/Wada	Fala Tsohon gari	1,890	–	1	A	
10-4	T/Wada	F/Ma aji Bayan Dutse	1,620	–	1	A	

Target Villages and Number of Requested Well

ID/No	LGA	Village/Ward	Population	Existing Facility	No. of Requested Well	Category	Remarks
10-5	T/Wada	Tsamiya	1,800	–	1	A	
10-6	T/Wada	Yalwa Gishirya	1,670	–	1	A	
10-7	T/Wada	Rufan Maigari	1,900	–	1	A	
11-1	Doguwa	Doguwar Gabas	920	–	1	A	
11-2	Doguwa	Dokar Goma	1,009	Handpump	1	A	
11-3	Doguwa	Daguwa (Doka)	2,301	–	2	A	
11-4	Doguwa	Barji	901	–	1	A	
12-1	Kiru	Kiru Gazan	650	–	1	A	Water diff. area
12-2	Kiru	Kiru Dirba	1,617	–	2	A	"
12-3	Kiru	Maraku	1,627	–	2	A	"
12-4	Kiru	Bauda C/Gari	1,817	–	2	A	"
12-5	Kiru	GGASS Kiru	1,920	–	1	A	"
12-6	Kiru	Maidagaye	1,720	–	2	A	
13-1	Bebeji	Dangora (Kyarama)	671	–	1	A	
13-2	Bebeji	Galadimawa Dumi	890	–	1	A	
13-3	Bebeji	Kadangaru	2,001	–	2	A	
13-4	Bebeji	Jibga	2,009	–	2	A	
13-5	Bebeji	Maska (Katako)	2,001	–	2	A	
14-1	Gezawa	Danja Village	3,450	Handpump	1	B	
14-2	Gezawa	Tofa Village	2,009	–	1	B	
14-3	Gezawa	Gawo Village	1,918	–	1	B	
14-4	Gezawa	Gofaro Village	1,231	–	1	B	
14-5	Gezawa	Tsalle	1,521	–	1	B	
14-6	Gezawa	Daraudau Village	1,423	–	1	B	
14-7	Gezawa	Wangara	3,500	–	2	B	
14-8	Gezawa	Musku Village	1,423	–	1	B	
14-9	Gezawa	Bujawa Village	2,210	–	2	B	
15-1	Kabo	Wutsawar Indabo	1,090	–	2	B	Water diff. area
15-2	Kabo	H/Bango Ung. Gyaroji	891	–	1	B	"
15-3	Kabo	Wari Tofa	798	–	1	B	"
15-4	Kabo	Garo Alkalawa	914	–	1	B	"
15-5	Kabo	Masanawa	817	–	1	B	"
15-6	Kabo	Wutsawa Titi	916	–	1	B	"
15-7	Kabo	Gude Kwalwa	1,718	–	2	B	"
15-8	Kabo	Danja Primary School	1,091	–	2	B	"
16-1	Shanono	Kokiya (Kazaga)	2,500	Handpump	3	B	Water diff. Area
16-2	Shanono	Kokiya (Gidan dawa)	2,000	–	2	B	"
16-3	Shanono	Leni (Bakwari)	2,000	–	2	B	"
16-4	Shanono	Leni (Badumawa)	2,005	Handpump	2	B	"
16-5	Shanono	Shakogi (Sabon Gari)	2,009	–	2	B	"
16-6	Shanono	Shakogi (Kurmi)	2,800	–	2	B	"
16-7	Shanono	Shanono (Jemagu)	1,800	–	2	B	"
16-8	Shanono	D/Bakoshi (Jammaza)	2,000	Handpump	2	B	"
16-9	Shanono	D/Bakoshi (Gwamma)	2,000	–	2	B	"
16-10	Shanono	Alajawa (Dantoro)	1,500	–	2	B	"
16-11	Shanono	Alajawa (Goda)	1,500	Handpump	2	B	"
16-12	Shanono	Kadamu (Dankucciya)	1,900	–	2	B	"
16-13	Shanono	Kadamu (Dorogo)	2,000	–	2	B	"
16-14	Shanono	Goron Dutse (Duka)	2,500	–	3	B	"
17-1	Karaye	Makera	1,610	–	2	A	Water diff. area
17-2	Karaye	Kaleku (Agalawa)	1,919	–	2	A	"
17-3	Karaye	Zango	911	–	1	A	"
17-4	Karaye	Kaleku (Agalawa)	890	–	1	A	"
17-5	Karaye	Tambawa	921	–	1	A	"
17-6	Karaye	Tudun Kava C/Gari	891	–	1	A	"
17-7	Karaye	Kwanyawa	896	–	1	A	"
18-1	Rogo	Unguwar Dawa	1,002	–	1	C	
18-2	Rogo	Dandan	1,234	–	1	C	
18-3	Rogo	Fulatan S/Gari	2,350	Handpump	1	C	
18-4	Rogo	Falalu Gabas	2,009	–	2	C	
18-5	Rogo	Rogo (Balawa)	2,003	–	2	C	
18-6	Rogo	Sundu	2,940	–	1	C	
18-7	Rogo	Sundu (Amasha)	980	–	1	C	
19-1	Minjibur	Gizawa C/Gari	2,500	–	2	A	Water diff. Area
19-2	Minjibur	Gandirwawa	3,000	–	2	A	"
19-3	Minjibur	Kunshe	1,500	–	1	A	"
19-4	Minjibur	Asanawa C/Gari	2,500	Handpump	2	A	"
19-5	Minjibur	Gandiwawa Asibiti	1,000	–	1	A	"
19-6	Minjibur	Sabauna	3,000	–	2	A	"
19-7	Minjibur	Azore B/Kasuwa	2,500	–	2	A	"
19-8	Minjibur	Farawa	2,500	–	2	A	"
19-9	Minjibur	Jama ar Ladan	1,950	–	1	A	"

Target Villages and Number of Requested Well

ID/No	LGA	Village/Ward	Population	Existing Facility	No. of Requested Well	Category	Remarks
19-10	Minjibur	Kuru C/Gari	3,005	–	2	A	"
19-11	Minjibur	Kantamar Chiroma	3,750	–	2	A	"
19-12	Minjibur	Burasawa	1,700	–	1	A	"
19-13	Minjibur	Kwarkiva C/Gari	2,500	–	2	A	"
19-14	Minjibur	Magarawa	1,850	–	1	A	"
20-1	Ungogo	Kadawa	1,090	–	2	C	
20-2	Ungogo	Kokarani	1,200	Handpump	1	C	
20-3	Ungogo	Doka	2,600	–	2	C	
20-4	Ungogo	Kaisuwa	3,200	–	2	C	
20-5	Ungogo	Tarda Barebari	1,900	–	2	C	
20-6	Ungogo	Zangon Barebari	1,240	–	1	C	
20-7	Ungogo	Rimin Zakara	1,760	–	1	C	
20-8	Ungogo	Maigaru	2,000	–	1	C	
21-1	Bitchi	Makara Huta (Bichi)	2,000	–	2	A	Water diff. Area
21-2	Bitchi	Buden Gari (G/Hakimi)	2,500	–	2	A	"
21-3	Bitchi	Ung. Auzunawa	1,900	–	2	A	"
21-4	Bitchi	Daddo (C/G/Badumc)	2,500	–	3	A	"
21-5	Bitchi	Tinki (Kwamarawa)	3,500	–	3	A	"
21-6	Bitchi	Kyalli C/G (Kyalli)	3,000	–	3	A	"
21-7	Bitchi	Yengwazo (Kyalli)	3,500	–	3	A	"
21-8	Bitchi	Rimaye R/Kau-Kau	4,000	–	2	A	"
21-9	Bitchi	Kau-Kau C/Gari	1,500	Handpump	1	A	
22-1	Kunchi	Fallc C/Gari	910	–	2	A	Water diff. area
22-2	Kunchi	Gadaba C/Gari	2,009	Handpump	2	A	"
22-3	Kunchi	Yandadi (Kofar gabas)	1,009	–	2	A	"
22-4	Kunchi	G/Sheme (Kofar Gabas	910	Handpump	2	A	"
22-5	Kunchi	G/Sheme Rugana	817	–	2	A	"
23-1	Tsanyama	Kwardagwalle	1,020	–	2	B	Water diffc.area
23-2	Tsanyama	Daddarawa	1,700	Handpump	2	B	"
23-3	Tsanyama	Zarosi Dispensary	3,100	Handpump	3	B	"
23-4	Tsanyama	Gurun Duisenguwa	1,900	–	2	B	"
23-5	Tsanyama	Rigar Barde	1,235	–	2	B	"
23-6	Tsanyama	Harbau U/Dorawa	2,000	–	2	B	"
23-7	Tsanyama	Rindi	1,870	–	2	B	"
23-8	Tsanyama	Harbau Bojawa	1,760	–	2	B	"
23-9	Tsanyama	Gezama	1,280		2	B	"
23-10	Tsanyama	Yanromo	2,100		2	B	"
23-11	Tsanyama	Doray	1,090		2	B	"
24-1	Danbatta	Ajumawa (F/Yamma)	1,500	–	1	A	
24-2	Danbatta	Ajumawa (M/Danya)	1,600	–	1	A	
24-3	Danbatta	Saidawa (C/Gari)	1,900	–	1	A	
24-4	Danbatta	"(Turawa babba)	2,000	–	2	A	
24-5	Danbatta	Sansan (D/Malamai)	2,000	–	1	A	
24-6	Danbatta	Dukawa (Ung. Bai)	1,200	–	1	A	
25-1	Makoda	Chidari	2,500	Handpump	1	C	
25-2	Makoda	Wailarc gara	1,700	–	1	C	
25-3	Makoda	Gagarawa	1,550	–	1	C	
25-4	Makoda	Bankaura	2,200	–	1	C	
25-5	Makoda	Dunawa	2,100	–	1	C	
26-1	Gwarzo	Zangarmawa	764	–	1	A	Water diff. area
26-2	Gwarzo	Nassarawa (Zangarma)	921	Handpump	1	A	"
26-3	Gwarzo	Ruzar Daudu	890	–	1	A	"
26-4	Gwarzo	Riji Tsauni (Katoge)	902	Handpump	1	A	"
26-5	Gwarzo	Kutuma Rugar waje	807	–	1	A	"
26-6	Gwarzo	Ung. Tudu (Karofi)	1,028	–	2	A	"
26-7	Gwarzo	Koyar Gesto	1,020	–	2	A	"
26-8	Gwarzo	Rugar Waje (Zango)	2,011	–	4	A	"
26-9	Gwarzo	Moda C/Gari	821	–	1	A	"
27-1	Gabasawa	Dorawar Isau	1,630	–	1	A	
27-2	Gabasawa	Falali	2,009	–	2	A	
27-3	Gabasawa	Unguwar Zakarai	1,009	–	1	A	
27-4	Gabasawa	Kaki Gumawa	1,910	–	1	A	
27-5	Gabasawa	GGISS Zakirai	2,900	–	2	A	
27-6	Gabasawa	Special P/S Gabasawa	1,890	–	1	A	
27-7	Gabasawa	Asayaya	2,005	–	2	A	
27-8	Gabasawa	Timbau Kaurare	1,007		1	A	
27-9	Gabasawa	Kanwa	1,009		1	A	
27-10	Gabasawa	Sharalle	1,870		1	A	
28-1	Dawakin Tofa	Burun Tumau	1,817	–	1	B	
28-2	Dawakin Tofa	Yakasai Dandalama	2,010	Handpump	1	B	
28-3	Dawakin Tofa	Dawanau Sec. School	1,019	–	1	B	
28-4	Dawakin Tofa	Jalunawa Walawa	2,123	–	1	B	

Target Villages and Number of Requested Well

ID/No	LGA	Village/Ward	Population	Existing Facility	No. of Requested Well	Category	Remarks
28-5	Dawakin Tofa	Robar Walawa	1,023	–	1	B	
28-6	Dawakin Tofa	Ganduje Sec. School	1,920	–	1	B	
28-7	Dawakin Tofa	Police Barack D/Tofa	1,625	–	1	B	
29-1	Tofa	Kalobawa Dispensary	1,009	–	1	A	Water diff. Area
29-2	Tofa	Gajida	1,280	–	1	A	"
29-3	Tofa	Lambu Fanshata	2,100	Handpump	1	A	"
29-4	Tofa	Lambu Baunikare	2,019	–	3	A	"
29-5	Tofa	Jili Darkawa	1,009	–	1	A	"
29-6	Tofa	Jili Badawa	2,007	–	2	A	"
29-7	Tofa	Doka Farinruwa	1,289	–	1	A	"
29-8	Tofa	Doka Katsalle	1,009	–	1	A	"
29-9	Tofa	Unguwar Rimi Jigawa	2,000	Handpump	1	A	"
29-10	Tofa	Ung. Rimi Yangarki	1,029	–	1	A	"
30-1	Bagwai	Bagwai (Rinji)	1,324	–	2	B	Water diff. Area
30-2	Bagwai	Gadanya (Rinji)	617	Handpump	2	B	"
30-3	Bagwai	Rimin Dako (Munkebe)	820	–	2	B	"
30-4	Bagwai	Rimin Bai	912	Handpump	2	B	"
30-5	Bagwai	Kalin Maiko	712	–	2	B	"
30-6	Bagwai	G/Wanzamai	162	–	1	B	"
30-7	Bagwai	Ragar yayya Yartola	172	–	1	B	"
31-1	Rimi Gado	Rimin Gado (Atawa)	1,020	–	2	B	Water difficult Area
31-2	Rimi Gado	Atawa	2,500	Handpump	2	B	
31-3	Rimi Gado	Yandadi	1,990	Handpump	2	B	
31-4	Rimi Gado	Dawakin Gulu	2,002	–	2	B	
31-5	Rimi Gado	Unguwar Ganji	1,718	–	2	B	
31-6	Rimi Gado	Dansudu	1,650	–	2	B	
31-7	Rimi Gado	Jantsauni	1,700	–	2	B	
31-8	Rimi Gado	Danlsa	2,000	–	2	B	
31-9	Rimi Gado	Jujin Ahmadu	2,100		2	B	
32-1	Albasu	Yaura (Kinkimaje)	1,928	–	1	B	
32-2	Albasu	Duja Yamma	1,627	–	2	B	
32-3	Albasu	Saya-Saya (Digawa)	1,920	–	2	B	
32-4	Albasu	Saya-Saya (Domawa)	2,351	–	1	B	
32-5	Albasu	Balaiya (Lahya)	710	–	2	B	
32-6	Albasu	Hure Kado Hungi	2,110	–	1	B	
32-7	Albasu	Hargagi (Barburawa)	671	–	1	B	
32-8	Albasu	Zangon Gala	761	–	1	B	
32-9	Albasu	Jemo	820	–	1	B	
32-10	Albasu	Sheda	817	–	2	B	Possible
33-1	Gaya	Dangagarau Shagogo	3,000	–	2	B	Water born
33-2	Gaya	Bangashe	2,900	Handpump	2	B	Disease area
33-3	Gaya	Lautai Arewa	2,600	–	1	B	"
33-4	Gaya	Muna-Muna	2,100	Handpump	2	B	"
33-5	Gaya	Kasai Wudilawa	1,780	Handpump	1	B	"
33-6	Gaya	Kabuga	1,675	–	2	B	"
33-7	Gaya	Tsurutawa Jasan	2,190	Handpump	1	B	"
33-8	Gaya	Laulai Kudu	1,620	–	2	B	"
33-9	Gaya	Gamoji	1,200	Handpump	2	B	"
33-10	Gaya	Bagoge	1,009		1	A	
34-1	Ajingi	Tsma (Toranke)	1,230	–	1	A	
34-2	Ajingi	Fulalan (Kwari)	2,314	Handpump	1	A	
34-3	Ajingi	Fagawa	1,524	–	1	A	
34-4	Ajingi	Gulya	1,920	–	1	A	
34-5	Ajingi	Guzawa (Arewa)	2,019	–	1	A	
34-6	Ajingi	Jama ar dal	1,029	–	2	B	Possible water
35-1	Wudil	Utai Kukatara	1,290	–	2	B	Born disease
35-2	Wudil	Utai Kukar babare	2,009	Handpump	1	B	area
35-3	Wudil	Lajawa Hurumi	1,928	–	2	B	
35-4	Wudil	Makadi Saikahu	2,211	–	1	B	
35-5	Wudil	Kausani Kirikassamma	1,710	–	1	B	
35-6	Wudil	Tsibiri Ung. Naggi	1,801	–	1	B	
35-7	Wudil	Kwas Kuraya	1,617	–	2	B	
35-8	Wudil	Wudil Hausawa	2,310	–	1	B	
35-9	Wudil	Achika Jama are	1,321	–	1	B	Water diff. Area
36-1	Garko	Kafin Malamai	2,300	–	1	B	"
36-2	Garko	Gurjiya	2,100	Handpump	1	B	"
36-3	Garko	Kawo	2,008	–	1	B	"
36-4	Garko	Raba	1,290	–	1	B	"
36-5	Garko	Yarka	1,901	–	2	B	"
36-6	Garko	Sarina (Hurumi)	2,007	–	1	B	"
36-7	Garko	Sarina (Kutunka)	1,009	–	2	B	"
36-8	Garko	Sarina (Z/Barkono)	2,001	–			

Target Villages and Number of Requested Well

ID/No	LGA	Village/Ward	Population	Existing Facility	No. of Requested Well	Category	Remarks
36-9	Garko	Lamire (Yelde)	2,006		2	B	"
36-10	Garko	Yarka (Kira-Kira)	3,001		2	B	"
36-11	Garko	Yarka (Dundu)	1,760	Pipe Extension	2	B	"
37-1	Takaki	Takai Loko	1,670	-	1	A	
37-2	Takaki	Takai Kogawa	2,001	Handpump	1	A	
37-3	Takaki	Garfi U. Galadima	1,009	-	1	A	
37-4	Takaki	Daushanga Randas	1,910	-	1	A	
37-5	Takaki	Kanwa K/Kudu	2,001	-	1	A	
37-6	Takaki	Kanawa K/Tsakiya	2,601	-	1	A	
37-7	Takaki	K/Lafiya Duga	1,910	-	1	A	
37-8	Takaki	K/Lafiya Dumbani	2,019	-	2	A	
37-9	Takaki	D/Gabas	1,701		1	A	
37-10	Takaki	Faruruwa Taranda	1,918		1	A	
38-1	Sumaila	Unguwar Gara	1,002	-	1	C	
38-2	Sumaila	Unguwar Sansani	1,020	-	1	C	
38-3	Sumaila	Falali (Fita)	980	-	1	C	
38-4	Sumaila	Siti Doguwar Dorawa	1,009	-	1	C	
38-5	Sumaila	Gajiki	1,009	-	1	C	
38-6	Sumaila	Gajiki Unguwar Lemo	1,250	-	1	C	
38-7	Sumaila	Larau	2,010		1	C	
			527,121		456		

*A: Villages requested by the residents own demand and /or responsibility
*B: Villages requested by the Public Health Center because of number of water borne demand didiseases
*C: Villages pointed by the State Government, RUWASA and /or LGA's initiative

(2) Explanation on Draft Final Report (December 20th, 2004)

MINUTES OF DISCUSSIONS
ON
THE BASIC DESIGN STUDY
ON
THE PROJECT FOR RURAL WATER SUPPLY AND SANITATION IN KANO STATE
IN
THE FEDERAL REPUBLIC OF NIGERIA
(EXPLANATION ON DRAFT FINAL REPORT)

In August 2004, Japan International Cooperation Agency (hereinafter referred to as 'JICA') dispatched a Basic Design Study Team on the Project for Rural Water Supply and Sanitation in Kano State (hereinafter referred to as "the Project") to the Federal Republic Nigeria (hereinafter referred to as 'Nigeria'), and through discussion, field survey, and technical examination of the results in Japan, JICA prepared a draft final report of the study.

In order to explain and to consult with the Nigeria side on the contents of the draft final report, JICA sent to Nigeria the Draft Final Report Explanation Team (hereinafter referred to as 'the Team'), which was headed by Mr. Tomohiro SEKI, Chief, Monitoring and Coordination Team, Administration and Coordination Group, Grant Aid Management Department, JICA, and was scheduled to stay in the country from December 13th to December 22nd, 2004.

As a result of discussion, both parties confirmed the main items described on the attached sheets.

Abuja, December 20th, 2004

Mr. Tomohiro Seki
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Japan International Cooperation Agency
Japan

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Managing Director
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Ministry of Water Resources and Rural Development
Kano State
Federal Republic of Nigeria

ATTACHMENT

1. Components of the Project

The Nigerian side agreed and accepted in principle the components of the draft final report explained by the Team. After discussions, both sides agreed that the Project would be composed of the following components when the Japanese Government finally decided to implement the Project.

- Procurement of equipment and materials listed in **Annex-I**.
- "Soft Component" which is composed with 1) Technical Training for Construction Management and 2) Strengthening of O&M System for Water Supply Facility.

2. Japan's Grant Aid scheme

The Nigerian side understands the Japan's Grant Aid Scheme and the necessary measures to be taken by the Government of Nigeria as explained by the Team and described in **Annex-4** of the Minutes of Discussions signed by both sides on August 5, 2004.

3. Schedule of the Study

JICA will complete the final report in accordance with the confirmed items and will send it to Nigeria by March 2005.

4. Other relevant issues

(1) Modification of the construction period:

Both sides agreed that the construction period of the Project modified from 2 years to 2 and half years after deliveries of the equipment and materials due to the proper construction schedule.

(2) Responsibilities of the Construction Work of the 240 Boreholes and Facility:

The Nigerian side promised that the construction work of the Project shall be executed by Nigerian side as described in ATTACHMENT 7. (3) of the Minutes of Discussions signed by both sides on August 5, 2004. The Nigerian side agreed the construction work will be done by using two existing rigs and the new rig which will be procured under the Project.

The target communities for borehole construction are listed in **Annex-II**.

(3) Budgetary Arrangement for the Implementation of the Project:

The Nigerian side explained that the budget for the construction work for the fiscal year 2005 has been approved by Kano State Government.

The Nigerian side agreed to proceed necessary budgetary allocation to cover the construction cost for after the fiscal year 2005.

(4) In-Country Training Program:

Rural Water Supply and Sanitation Agency (RUWASA) requested In-Country Training Program to JICA. RUWASA explained that the training is for village users for the sustainable operation and maintenance of facility, and the training will be carried out by collaboration with the contents of "Soft Components" of the Project. The Team explained the request will be examined after official submission through the Government of Nigeria.

Procured Equipment and Materials

Name of Equipment	Specification/Description	Quantity	
1. Drilling Rig	Type: Truck mounted rig (including standard spare parts). Top head drive type Drilling Method: Mud circulation rotary and DTH drilling methods. Capable Drilling Depth: 100 m Capable Drilling Diameter: 10-5/8" for mud drilling, 6-1/4 for DTH drilling Applicable Geology: Un-consolidated strata and hard bedrock Mobilization Method: By Truck mounted. Truck Specification: 4WD	1	unit
2. Drilling Tools	Drill pipe, hammer bits, work casing and all other necessary tools for the rig above described.	1	set
3. High Pressure Air Compressor	Supply Air Pressure: More 2.01 MPa (=20.5 kg/cm2)/ High pressure Supply Air Volume: 11.3 m3/min or more. Mobilization Method: By Truck mounted. Truck Specification: 4WD	1	unit
4.Cargo Truck with Crane	Load capacity: More than 6,000 kg or more Specification: 4WD, Diesel water cooling engine Length of Carrier: More 5.5m Crane Capacity: 2.9 tons (3 tons)	2	units
5. Water Tank Truck	Tank Volume: 8 m3 Truck Specification: 4WD	1	unit
6. Pick-up Truck	Cabin: Single and double for each Truck Specification: 4WD Engine: Gasoline type water cooling Load Maximum: More 1.0 ton (single) /More 0.5 ton (double)	2	units
7. Motorcycle	To be used for community development officers and drilling team communication In rainy season, 4 wheel vehicles are hard to access (motor cycle is more useable). Cylinder Volume: 100 – 125 cc	5	units
8. Well Development Equipment	Air Compressor Supply Air Pressure: 0.7 MPa (=7.0kg/cm2). Supply Air Volume: 8.5 m3/min.	1	set
9. Pumping Test Equipment	Submersible motor pump: Diameter of 2.5". Discharge of 10 liters/min. 50 m head (=1.5 kW and 50 Hz) Engine Generator: 5 kVA Groundwater Level Meter: Measurable Depth of 100m	1	set
10. Water Analysis Equipment	Measurement Items: pH, DO, EC, T.D.S, Chloride, and Temperature	1	unit
11. Resistivity Survey Equipment	Electrical Sounding Instrument of Measurable depth: 100 m. Measuring Item: Apparent resitivity and spontaneous potential. Measurable range: 0.1 mV – 10V. Accessory: Software for interpretation Others: Applicable for logging work for 100m depth borehole (with cable and probe)	1	unit
12. Workshop tools and Equipment	For simple repair of equipments such as compressor, tank lorry, supporting vehicles, motorcycles for puncture, replace of tires by use of chain block etc.	1	set
13. Computer	Software: Word and Excel. Accessory: UPS of more than 10 minutes. Compatible: IBM compatible computer. Printer: Laser printer.	2	sets
14. Spare Parts for Existing Rig	For the existing rigs: Depending the availability of the manufacture for TH10R	1	lot
15. Hand Pump	Hand pump & Maintenance kit : VLOM type, Indian Mark III. Tools for repair by village level and LGA leve	240 1	Sets unit
16. Casing Pipe	Materials: un-plasticised polyvinyl chloride Dimension: Diameter of 4", O.D. of 114.4 mm, Length of 3 m Wall thickness : More 5 mm Connection: threading method	2,667	pieces
17. Screen Pipe	Materials: un-plasticised polyvinyl chloride Dimension: Diameter of 4", O.D. of 114.4 mm, Length of 3 m Wall thickness : More 5mm Connection: threading method. Opening Ratio of 3% or more	1,334	pieces

Annex- II

Total Evaluation of Village for Rural Water Supply Project in Kano State

No.	No. BH	ID/No	LGA	Village	Latitude	Longtitude	Population	Existing Facility	No. of Requested Well	G.P.E Points	A.E. Points	S.E. Points	T.E. Points
1	1	29-10	Tofa	Ung. Rimi Yangarki	11.96972	8.35889	1,029	-	1	236	4	21	48.6
2	3	7-2	Dawakin Kudu	Dabar Kwari	11.72528	8.68611	2,000	HP	2	277	5	15	47.7
3	4	10-4	T/Wada	F/Ma ajo Bayan Dutse	11.32222	8.37389	1,620	-	1	282	5	14	47.2
4	5	18-6	Rogo	Sundu	11.37333	7.76056	2,940	-	1	281	5	14	47.1
5	7	35-8	Wudil	Wudil Hausawa	11.82278	8.84333	2,310	-	2	255	4	17	46.5
6	8	18-2	Rogo	Dandan	11.39222	7.83917	1,234	-	1	279	5	13	45.9
7	9	24-6	Danbatta	Dukawa (Ung. Bai)	12.58520	8.61417	1,200	-	1	291	5	11	45.1
8	11	29-6	Tofa	Jili Badawa	11.91139	8.27972	2,007	-	2	240	3	18	45.0
9	12	37-7	Takaki	K/Lafiya Duga	11.49028	9.21722	1,910	-	1	260	3	16	45.0
10	13	4-6	Kura	Butafawa C/Gari	11.80361	8.42639	897	-	1	269	4	14	44.9
11	14	18-3	Rogo	Fulatan S/Gari	11.39250	7.85611	2,350	HP	1	269	5	13	44.9
12	15	29-8	Tofa	Doka Kasalle	12.00028	8.29167	1,009	-	1	228	5	17	44.8
13	16	29-9	Tofa	Unguwar Rimi Jigawa	11.98944	8.33278	2,000	HP	1	238	5	16	44.8
14	17	11-2	Doguwa	Dokar Goma	10.76472	8.62500	1,009	HP	1	273	5	12	44.3
15	18	32-5	Albasu	Balaiya (Lahya)	11.59833	8.98556	710	-	1	263	5	13	44.3
16	19	4-1	Kura	Rugar Duka	11.80417	8.44056	1,980	-	1	261	4	14	44.1
17	20	35-7	Wudil	Kwas Kurmya	11.47083	8.78389	1,617	-	1	269	4	13	43.9
18	21	4-4	Kura	Kwanro Dangama	11.83361	8.50667	1,600	-	1	247	5	14	43.7
19	23	18-5	Rogo	Rogo (Balawa)	11.55833	7.82083	2,003	-	2	247	5	14	43.7
20	25	24-4	Danbatta	'Turawa habba)	12.46944	8.67833	2,000	-	2	297	4	10	43.7
21	26	5-1	G/Mallam	Ringimawa Galaduna	11.66694	8.41500	991	-	1	246	5	14	43.6
22	28	7-1	Dawakin Kudu	Danbagari	11.78417	8.77611	1,009	HP	2	286	4	11	43.6
23	29	29-7	Tofa	Doka Farinruwa	12.00972	8.31250	1,289	-	1	216	5	17	43.6
24	32	1-3	Rano	Gargun	11.61667	8.61500	2,010	-	3	265	5	12	43.5
25	34	13-3	Bebeji	Kadangaru	11.76389	8.13917	2,001	-	2	245	3	16	43.5
26	35	3-3	Kibiya	Kibiya Kalmya	11.55944	8.74861	1,021	-	1	294	3	11	43.4
27	37	12-6	Kiru	Maidagaye	11.35389	8.21611	1,720	-	2	274	2	14	43.4
28	39	33-3	Gaya	Lautai Arewa	11.82222	8.95694	2,600	-	2	223	4	17	43.3
29	40	33-8	Gaya	Laulai Kudu	11.80361	8.96167	1,628	-	1	223	4	17	43.3
30	41	6-5	Madobi	Gora Danzogari	11.82278	8.29389	1,950	-	1	242	4	15	43.2
31	43	36-8	Garko	Sarina (Z/Barkono)	11.57861	8.88833	2,001	-	2	241	2	17	43.1
32	44	17-3	Karaye	Zango	11.83389	8.05667	911	-	1	260	2	15	43.0
33	45	1-2	Rano	Shangu	11.52056	8.59917	1,207	HP	1	269	4	12	42.9
34	46	14-2	Gwarzo	Nassarawa (Zangarma)	11.93194	7.83833	921	HP	1	229	5	15	42.9
35	47	10-5	T/Wada	Tsamiya	11.32306	8.26778	1,800	-	1	267	2	14	42.7
36	48	12-5	Kiru	GGASS Kiru	11.70611	8.14722	1,920	-	1	255	5	12	42.5
37	49	34-2	Ajingi	Fulalan (Kwari)	11.98889	8.91722	2,314	HP	1	254	1	16	42.4
38	50	2-5	Bunkure	Nariya	11.57778	8.64833	2,082	-	1	233	3	16	42.3
39	51	5-4	G/Mallam	Kargo	11.67611	8.41444	1,002	-	1	243	5	13	42.3
40	52	24-1	Danbatta	Ajumawa (F/Yamma)	12.50972	8.48028	1,500	-	1	273	4	11	42.3
41	53	28-5	Dawakin Tofa	Rumo Walawa	12.13611	8.43250	1,023	-	1	223	4	16	42.3
42	54	33-6	Gaya	Kahuga	11.93194	9.01306	1,675	-	1	273	4	11	42.3
43	55	4-3	Kura	Rijvar Kwari	11.68611	8.37194	2,001	-	1	231	5	14	42.1
44	56	5-3	G/Mallam	Kosawa Agalas	11.78417	8.45694	981	-	1	261	5	11	42.1
45	57	14-4	Gwarzo	Riji Tsauni (Katoge)	11.95083	7.90639	902	HP	1	221	5	15	42.1
46	58	35-3	Wudil	Lajawa Hurumi	11.87306	8.92500	1,928	-	1	251	3	14	42.1
47	59	35-5	Wudil	Kausani Kirikassamma	11.85278	8.89611	1,710	-	1	261	4	12	42.1
48	61	4-8	Kura	Garun Kaya	11.76528	8.50639	2,010	-	2	250	4	13	42.0
49	63	7-5	Dawakin Kudu	Danfari	11.89194	8.53778	1,021	-	2	250	5	12	42.0
50	65	12-3	Kiru	Maraku	11.68611	8.13167	1,627	-	2	260	5	11	42.0
51	66	14-1	Gwarzo	Zangarmawa	11.95000	7.87278	764	-	1	220	5	15	42.0
52	67	5-6	G/Mallam	Galinja	11.85361	8.49667	1,320	-	1	268	4	11	41.8
53	68	18-7	Rogo	Sundu (Amasha)	11.53972	7.82028	980	-	1	268	5	10	41.8
54	71	29-4	Tofa	Lambu Baumkare	12.00083	8.35333	2,019	-	3	228	5	14	41.8
55	72	37-9	Takaki	D/Gabas	11.53917	9.22778	1,701	-	1	258	5	11	41.8
56	73	20-2	Ungogo	Kokarani	12.16806	8.91361	1,200	HP	1	257	5	11	41.7
57	74	29-2	Tofa	Gajida	12.07917	8.28194	1,280	-	1	237	4	14	41.7
58	76	9-1	Kumbotso	Shukar Barde Kudu	11.96972	8.53028	1,750	-	2	246	5	12	41.6
59	77	29-3	Tofa	Lambu Fanshata	12.00944	8.35278	2,100	HP	1	226	5	14	41.6
60	78	4-2	Kura	Rugar Waje	11.82333	8.50528	1,760	-	1	245	5	12	41.5
61	79	10-6	T/Wada	Yalwa Gishirya	11.33361	8.40806	1,670	-	1	285	4	9	41.5
62	80	13-1	Bebeji	Dangora (Kyarama)	11.57889	8.14306	671	-	1	213	5	15	41.3
63	81	11-4	Doguwa	Barji	11.16694	8.54556	901	-	1	282	5	8	41.2
64	83	37-8	Takaki	K/Lafiya Dumbani	11.50000	9.17472	2,019	-	2	361	3	12	41.1
65	84	4-7	Kura	Gawo	11.84278	8.44611	789	-	1	240	3	14	41.0
66	85	6-4	Madobi	Madobi Bugurau	11.76444	8.30056	2,100	-	1	210	5	15	41.0
67	86	37-6	Takaki	Kanawa K/Tsakiya	11.45000	9.02306	2,601	-	1	260	0	15	41.0
68	87	11-1	Doguwa	Doguwar Gabas	10.74444	8.58944	920	-	1	269	4	10	40.9
69	88	10-1	T/Wada	Jeli C/Gari	11.28444	8.26417	1,560	-	1	268	2	12	40.8
70	90	1-5	Rano	Zanbur (Yado)	11.57917	8.58167	1,850	-	2	226	5	13	40.6
71	91	38-1	Sumaila	Unguwar Gara	11.30333	9.00861	1,002	-	1	266	2	12	40.6
72	92	3-7	Kibiya	Shiye Karama	11.50917	8.65694	1,002	-	1	253	5	10	40.3
73	93	25-5	Makoda	Donawa	12.47028	8.41778	2,100	-	1	273	3	10	40.3
74	94	36-2	Garko	Gurjiya	11.65639	8.84222	2,100	HP	1	212	4	15	40.2
75	95	9-5	Kumbotso	Gaida	11.91250	8.47306	2,114	-	1	261	5	9	40.1
76	96	35-6	Wudil	Tsibiri Ung. Naggi	11.84222	8.84111	1,801	-	1	271	4	9	40.1
77	97	13-2	Bebeji	Galadimawa Dumi	11.76472	8.24417	890	-	1	210	4	15	40.0
78	99	17-1	Karaye	Makera	11.78417	7.96750	1,610	-	2	270	4	9	40.0
79	101	35-1	Wudil	Utai Kukatara	11.74556	8.88250	1,290	-	2	230	5	12	40.0
80	103	32-4	Albasu	Saya-Saya (Donawa)	11.87306	8.32806	2,351	-	2	238	3	13	39.8
81	104	9-3	Kumbotso	Beehi	11.93111	8.50083	950	-	1	266	5	8	39.6
82	105	33-4	Gaya	Muna-Muna	11.70583	9.01000	2,100	HP	1	226	4	13	39.6
83	106	3-1	Kibiya	Kadigawa	11.59722	8.73917	711	-	1	275	3	9	39.5
84	109	21-6	Bichi	Kyadi C/G (Kyadi)	12.33389	8.18806	3,000	-	3	205	5	14	39.5
85	110	29-1	Tofa	Kalohawa Dispensary	12.02028	8.36861	1,009	-	1	225	4	13	39.5
86	111	15-2	Kabo	H/Bango Ung. Gyaroji	11.87250	8.19194	891	-	1	234	5	11	39.4
87	113	30-5	Bagwai	Kalin Maiko	12.03917	8.16611	712	-	2	244	3	12	39.4
88	114	14-3	Gwarzo	Ruzar Daudu	11.89306	8.06444	890	-	1	213	3	15	39.3
89	116	15-1	Kabo	Wutsawar Indabo	11.95083	8.17667	1,090	-	2	203	5	14	39.3
90	118	33-1	Gaya	Dangagarau Shagogo	11.84278	8.96389	3,000	-	2	223	5	12	39.3

Total Evaluation of Village for Rural Water Supply Project in Kano State

No.	No. BH	ID/No	LGA	Village	Latitude	Longtitude	Population	Existing Facility	No. of Requested Well	G.P.E Points	A.E. Points	S.E. Points	T.E. Points
91	120	36-6	Garko	Sarina (Hurumi)	11.59750	8.92083	2,007	-	2	243	4	11	39.3
92	121	36-7	Garko	Sarina (Kurunka)	11.59750	8.92167	1,009	-	1	243	4	11	39.3
93	122	2-1	Bunkure	Madachi Jurna	11.63639	8.61917	980	HP	1	242	4	11	39.2
94	123	2-6	Bunkure	Chirin (Kode)	11.65611	8.51833	1,009	-	1	222	3	14	39.2
95	125	20-3	Ungogo	Doka	12.09750	8.40167	2,600	-	2	232	5	11	39.2
96	127	27-5	Gabasawa	GGHSS Zakirai	12.11667	8.88972	2,900	-	2	232	5	11	39.2
97	128	1-7	Rano	Toure	11.59722	8.59722	950	-	1	241	5	10	39.1
98	129	15-3	Kabo	Wari Tofa	11.91222	8.17833	798	-	1	211	5	13	39.1
99	131	23-2	Tsanyama	Daddarawa	12.22639	8.07417	1,700	HP	2	231	3	13	39.1
100	133	32-6	Albasu	Hure Kado Hungi	12.00972	8.32361	2,110	-	2	211	5	13	39.1
101	134	37-4	Takaki	Daushanga Ranlas	11.54000	9.11500	1,910	-	1	261	5	8	39.1
102	135	37-10	Takaki	Faruruwa Taranda	11.43083	9.20278	1,918	-	1	291	1	9	39.1
103	136	1-4	Rano	Kauuwar Dila	11.45111	8.56583	2,009	HP	1	240	3	12	39.0
104	137	6-6	Madobi	Guoa Unguwar Madaki	11.82361	8.31306	2,001	-	1	209	4	14	38.9
105	139	23-11	Tsanyama	Doray	12.37250	8.07861	1,090	-	2	239	5	10	38.9
106	140	24-3	Danbatta	Saidawa (C/Gari)	12.30389	8.62889	1,900	-	1	229	4	12	38.9
107	141	34-1	Ajingi	Tsma (Toranke)	12.02056	9.21889	1,230	-	1	239	4	11	38.9
108	142	28-7	Dawakin Tofa	Police Barack D/Tofa	12.09861	8.34111	1,625	-	1	238	5	10	38.8
109	144	33-2	Gaya	Bangashe	11.89250	9.01806	2,900	HP	2	218	5	12	38.8
110	145	37-1	Takaki	Takai Loko	11.57806	9.11167	1,670	-	1	257	5	8	38.7
111	147	12-2	Kiru	Kiru Dirba	11.70556	8.13444	1,617	-	2	256	5	8	38.6
112	148	3-2	Kibiya	Kuluki Katanya	11.57889	8.75556	813	HP	1	275	3	8	38.5
113	150	26-9	Gezawa	Bujawa Village	12.15556	8.74472	2,210	-	2	245	5	9	38.5
114	151	15-4	Kabo	Garo Alkalawa	11.96972	8.11944	914	-	1	184	5	15	38.4
115	152	34-4	Ajingi	Gulya	12.04000	8.95222	1,920	-	1	264	1	11	38.4
116	154	35-4	Wudil	Makadi Saikahu	11.70694	8.76944	2,211	-	2	224	3	13	38.4
117	155	36-1	Garko	Kafin Malamai	11.67611	8.88194	2,300	-	1	234	5	10	38.4
118	156	36-3	Garko	Kawo	11.66806	8.82083	2,008	-	1	214	5	12	38.4
119	158	1-6	Rano	Garabawa (Dawa)	11.55917	8.54833	1,550	-	2	203	4	14	38.3
120	159	20-7	Ungogo	Rimin Zakara	12.00972	8.44611	1,760	-	1	253	3	10	38.3
121	160	26-8	Gezawa	Musku Village	12.00389	8.76611	1,423	-	1	233	4	11	38.3
122	161	34-3	Ajingi	Fagawa	11.97083	8.88500	1,524	-	1	253	1	12	38.3
123	163	23-7	Tsanyama	Rindi	12.18722	8.01278	1,870	-	2	222	5	11	38.2
124	164	24-5	Danbatta	Sansan (D/Malamai)	12.43083	8.66278	2,000	-	1	272	3	8	38.2
125	166	16-5	Shanono	Shakogi (Sabon Gari)	12.02028	8.01722	2,009	-	2	201	4	14	38.1
126	167	27-3	Gabasawa	Unguwar Zakarai	12.22611	8.91278	1,009	-	1	261	4	8	38.1
127	169	3-5	Kibiya	Kalambu	11.43194	8.61833	9,001	-	2	260	3	9	38.0
128	171	12-4	Kiru	Bauda C/Gari	11.59750	8.19000	1,817	-	2	240	4	10	38.0
129	173	16-4	Shanono	Leni (Badumawa)	12.05861	8.10389	2,005	HP	2	240	3	11	38.0
130	175	20-4	Ungogo	Kaisuwa	12.11806	8.49833	3,200	-	2	230	4	11	38.0
131	177	31-6	Rimi Gado	Dansudu	12.08972	8.32361	1,650	-	2	210	5	12	38.0
132	179	8-6	Warawa	Imawa	11.89194	8.81694	2,500	-	2	269	2	9	37.9
133	180	15-6	Kabo	Wutsawa Titi	11.95139	8.15889	916	-	1	199	5	13	37.9
134	182	23-4	Tsanyama	Gurun Duisenguwa	12.35306	7.94972	1,900	-	2	239	4	10	37.9
135	184	35-2	Wudil	Utai Kukar babare	11.74556	8.88500	2,009	HP	2	229	4	11	37.9
136	185	8-3	Warawa	Garindau C/Gari	11.82278	8.82778	2,800	-	1	248	5	8	37.8
137	187	15-7	Kabo	Gude Kwaiwa	11.96972	8.14889	1,718	-	2	198	5	13	37.8
138	188	28-3	Dawakin Tofa	Dawanau Sec. School	12.09778	8.41611	1,019	-	1	228	5	10	37.8
139	189	36-5	Garko	Yarka	11.59861	8.88861	1,901	-	1	238	2	12	37.8
140	190	2-3	Bunkure	Bunkure (Madugu)	11.70556	8.54056	2,001	HP	1	237	5	9	37.7
141	191	14-5	Gwarzo	Kuluma Rugar waje	11.91222	7.94361	807	-	1	237	5	9	37.7
142	195	14-8	Gwarzo	Rugar Waje (Zango)	11.93056	7.94639	2,011	-	4	247	5	8	37.7
143	196	17-6	Karaye	Tudun Kava C/Gari	11.74444	7.92889	891	-	1	267	3	8	37.7
144	197	27-6	Gabasawa	Special P/S Gabasawa	12.16722	8.90306	1,890	-	1	237	5	9	37.7
145	199	31-7	Rimi Gado	Jantsauni	11.95028	8.23861	1,700	-	2	167	4	17	37.7
146	200	38-5	Sumaila	Gajiki	11.24500	8.85778	1,009	-	1	267	3	8	37.7
147	201	9-2	Kumbotso	Gumi gawa	11.93194	8.52194	2,165	-	1	266	4	7	37.6
148	202	20-8	Ungogo	Maigaru	12.07917	8.47306	2,000	-	1	226	5	10	37.6
149	203	37-2	Takaki	Takai Kogawa	11.57861	9.11000	2,001	HP	1	256	5	7	37.6
150	204	26-3	Gezawa	Gawo Village	12.00944	8.75778	1,918	-	1	235	5	9	37.5
151	205	28-1	Dawakin Tofa	Burun Tumau	12.18611	8.41306	1,817	-	1	215	5	11	37.5
152	207	30-4	Bagwai	Rimin Bai	12.05972	8.20806	912	HP	2	225	1	14	37.5
153	208	34-6	Ajingi	Jama ar dai	11.93194	9.01306	1,029	-	1	274	2	8	37.4
154	210	1-1	Rano	Jalabi Zango	11.65694	8.61139	1,500	-	2	222	4	11	37.2
155	212	20-5	Ungogo	Tarda Barebari	12.11750	8.52972	1,900	-	2	222	5	10	37.2
156	214	32-1	Albasu	Yaura (Kinkimaje)	11.59861	8.94639	1,928	-	2	242	5	8	37.2
157	216	19-8	Minjibir	Farawa	12.15611	8.63861	2,500	-	2	241	4	9	37.1
158	218	33-5	Gaya	Kasai Wudilawa	11.82250	8.91694	1,780	HP	2	231	5	9	37.1
159	220	33-9	Gaya	Gamoji	11.83472	9.17806	1,200	HP	2	221	5	10	37.1
160	221	37-5	Takaki	Kanwa K/Kudu	11.50111	9.15194	2,001	-	1	251	3	9	37.1
161	222	5-2	G/Mallam	Azoren Waje (U/Zango)	11.76472	8.39583	809	-	1	250	4	8	37.0
162	224	17-2	Karaye	Kaleku (Agalawa)	11.63611	7.90611	1,919	-	2	240	5	8	37.0
163	226	31-5	Rimi Gado	Unguwar Ganji	11.96944	8.25417	1,718	-	2	210	5	11	37.0
164	228	14-6	Gwarzo	Ung. Tudu (Karofi)	11.93167	7.95417	1,028	-	2	249	5	7	36.9
165	230	31-3	Rimi Gado	Yandadi	12.00861	8.40333	1,990	HP	2	209	4	12	36.9
166	232	32-3	Albasu	Saya-Saya (Digawa)	11.70556	8.98278	1,920	-	2	199	5	12	36.9
167	233	32-8	Albasu	Zangon Gala	11.61806	9.00667	761	-	1	249	4	8	36.9
168	235	36-11	Garko	Yarka (Dundu)	11.61750	8.91194	1,760	-	2	239	4	9	36.9
169	236	37-3	Takaki	Garfi U. Galadima	11.46972	9.15500	1,009	-	1	259	3	8	36.9
170	237	26-2	Gezawa	Tofa Village	12.00111	8.74944	2,009	-	1	238	4	9	36.8
171	239	5-5	G/Mallam	Yakasai	11.84167	8.49389	2,010	-	2	247	4	8	36.7
172	240	14-9	Gwarzo	Moda C/Gari	11.91250	7.92917	821	-	1	237	5	8	36.7

HP:Hand Pump
PE:Pipe Extension

G.W.E. : Groundwater Potential Evaluation
A.E. : Accessbility Evaluation
S.E. : Social Evaluation
T.E : Total Evaluation

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Reference: GHS/A/1/I/30 *Date:* 17/12/2004
04/11/1425AH

Mr. Shigei Yamagata,
The Resident Representative,
Japan International Cooperation Agency,
Nigeria Office,
P.M.B. 5090,
Wuse – Abuja.

Re: Japanese Grant Aid for Rural Water Supply and Sanitation Project in Kano State

It is my pleasure to, on behalf of Government and people of Kano State; express my profound gratitude to Japanese Grant Aid to Kano State Government in the provision of 240 complete hand pump boreholes.

Indeed, I have no doubt that the people of the State will immensely benefit from the project particularly those in areas where there is srious scarcity of water or water borne disease prone areas.

I also understand from the Minutes of Discussions and Explantion of the Draft Final Report that the drilling equipment and other accessories needed for the project are part of the assistance.

Accordingly, I would like to confirm the commitment of Kano State Government for allocating ₦75 million (Seventy five million naira only) in the year 2005 Budget to supplement the good gesture of the Japanese Government.

Accept, please the assurances of my highest esteem always.

Ibrahim Shekarau
Executive Governor, Kano State

5. Results of Geophysical Survey

Appendix 5. Results of Geophysical Survey

1. Objectives

In order to clarify the hydrogeological conditions of the target area, a total of 32 points were determined for electrical sounding in reference to existing information (data from approximately 500 drilling results by funding of World Bank in the 1980's and data from approximately 200 drillings done by RUWASA since 1997). These points are shown in Table E-1.

Table E-1 List of Electrical Sounding Spots

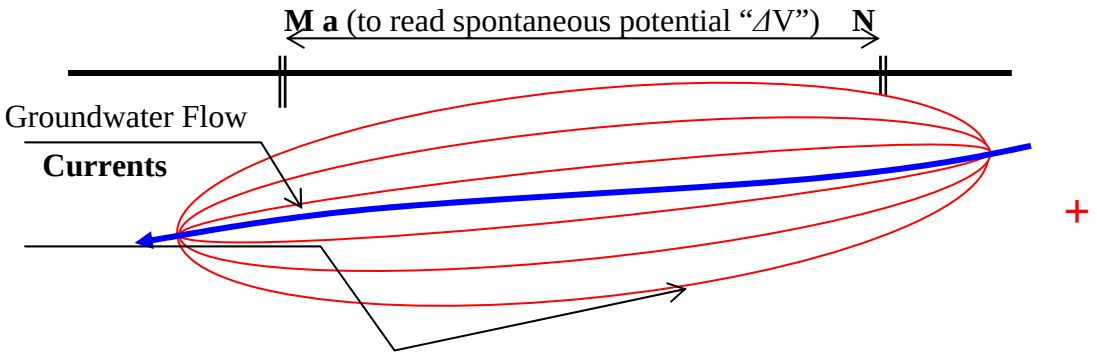
Longitude	Latitude	Nos of Electrical Sounding and Methods
11.492520	8.295290	**ES1-3** Rano LGA by Horizontal survey and Resitivity profiling by Dipole
11.492520	8.295300	**ES1-7** Rano, Toure village by Horizontal survey and Vertical Sounding
11.647639	8.904306	**ES2-2** Bunkure LGA by Vertical sounding
11.529417	8.653111	**ES3-6** Kibiya LGA by Vertical sounding
11.879306	7.973694	ES7 D/Kudu LGA by Vertical sounding
11.542810	8.441680	**ES8-8a** Warawa LGA by vertical sounding. Due to no potential by the results alternative site was re-surveyed at ES8-8b spot
11.910139	8.739444	**ES8-8b** Warawa by Vertical sounding and Resistivity profiling by Wenner method
10.395730	8.383520	ES11-3 Doguwa LGA by Horizontal survey and Vertical sounding
11.678417	8.262833	ES12-5 Kiru LGA by Vertical sounding
11.678639	8.262750	ES13-4 Bebeji LGA Resitivity profiling by Dipole method
12.048017	7.985933	ES16 Shanono LGA by Vertical soundiong
11.628778	7.885111	ES17 Karaye LGA by Vertical soundiong
11.678417	8.262833	ES18 Rogo LGA by Vertical soundiong
12.214222	8.559361	ES19 Minjibir LGA by Vertical soundiong
12.090517	8.484800	ES20 Ungogo LGA by Vertical soundiong
12.203190	7.583180	ES22-3 Kunchi LGA by Vertical soundiong
12.203190	7.583180	ES23 Tsanyama LGA by Vertical soundiong
12.420717	8.517333	ES24 Danbatta LGA by Vertical soundiong
11.583560	8.462700	**ES26-8** Gezawa LGA Horizontal survey and Vertical soundiong
11.492520	8.295290	ES28 D/Tofa LGA by Vertical soundiong
12.048517	8.272500	ES29 Tofa LGA by Vertical soundiong
12.153367	8.135983	ES30 Bagwai LGA by Vertical soundiong
11.862528	8.998444	ES32 Albasu LGA by Vertical soundiong
11.957889	9.037889	ES33a Gaya LGA by Vertical soundiong
11.647639	8.904306	**ES33b** Gaya LGA, Talatar village by Vertical soundiong and Vertical sounding
11.897083	8.926250	**ES33c** Gaya LGA, Gamarya village by Vertical soundiong
11.878167	7.972083	ES34 Ajingi LGA by Vertical soundiong
11.567139	9.107694	ES37 Takai LGA by Vertical soundiong
11.567417	9.106972	ES38 & WQ13 Sumaila LGA by Vertical soundiong
12.021167	8.555722	**ES44a**Electrical Logging at Tuduwada ward, Kano City
11.957889	9.037889	ES44b by Vertical soundiong at Tuduwada ward, Kano City

Note: Bould Numbers show the spots where RUWASA request to carry out the survey

2. Survey Method

a) Spontaneous Potential Method (SP Method)

The SP method was applied in general by an a = 40 m electrode interval where deep groundwater level is inferred, and by an a = 20 m interval for shallow groundwater levels such as in valley bottoms. It is inferred that where there is no difference in the SP value for the a = 20 m and the a = 40 m electrode separation, depth will not be properly indicated on both electrode intervals. The electrode used is highly conductive, non-polarizing copper sulfate. The copper sulfate was brought from Japan, and local materials comprising copper bars and sponge was used to complete the electrode assembly. Electrodes were set directly in the earth after the surrounding soil was dug away slightly. The direction of the 2 electrodes is very important to detect exact groundwater flow along cracks. Therefore, prior to starting the survey, a site reconnaissance was carried out with all available data, the interpretation of which was used to determine the electrode direction.



M and N: Non-polarizing electrodes
a: Electrode Intervals (m)

b) Resistivity Method for Vertical Sounding

The resistivity method used was that of electrical sounding. This method is common and very frequently used for groundwater investigations for sedimentary rock or strata. However, in non-homogeneous strata and/or in areas where very local groundwater flows occur along cracks, fissures or faults such as in igneous rock zones groundwater may be difficult to detect properly by this electrical sounding method.

The formula for Wenner and Shulumberger electrode alignment in this method is:

$$\rho a = n \times (n+1) \times a \times \pi \times \Delta V/\Delta I$$

where,

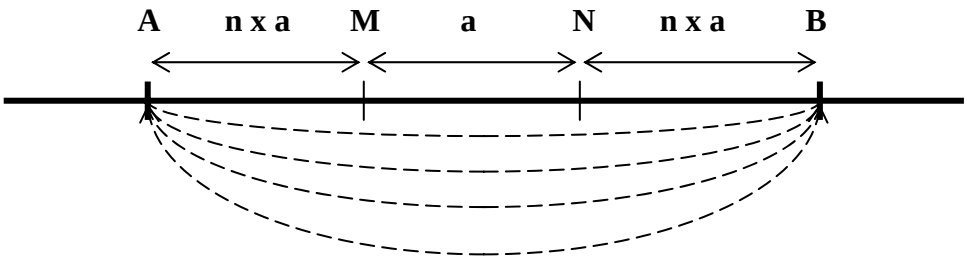
ρ*a* : Apparent Resistivity (ohm/m)

n : n = 1 when Wenner electrode alignment is applied, and n > 5 when Schulumberger alignment is applied

a : electrode interval (m)

*Δ*V : Reading of potential (mV)

*Δ*I : Reading of electrical current transmitted (mA)



A and B : Current electrodes (broken line illustrates currents)

M and N : Potential electrodes to measure mV

c) Electrical Logging by Using Electrical Sounding Instrument

The electrical logging by using the same electrical sounding instrument was conducted for the drilled hole carried out by RUWASA at Tudunwada ward in Kano City. The cable to use in the hole is arranged at site with the same electrical wire as the surface survey work. To save a time and constrained wires, 0.25m and 1.0m electrode intervals are utilized. Therefore, two kinds of resitivity value and one kind of spontaneous potential value by 1.0 m interval are measured. The result is instantly interpreted at site and informed to the drilling crew for the decision of screen location. The calculation formula for the logging is as follows:

$$\rho a = 4 \times a \times \pi \times \Delta V/\Delta I$$

The result is shown in E-13 page.

3. The Survey Results

The location of the 32 points for electrical sounding and the estimated ground water potential is indicated in Fig. E-1. The outline of electrical sounding results are shown in Table E-2, while details are shown in page E-6 to E-17. The result is utilized to reflect and interpret the borehole design standards which depend on hydrogeological conditions as shown in Table E-2 and the Fig. E-1.

Table E-2 Result of 32 Electrical Soundings

Area	LGA Nos. (ES Nos)	Hydrogeology from Electrical Sounding Results	Borehole Length (m)	Recommendable Sounding Method
South	11, 10, 1,3,13 (ES11-3, ES13-4, ES1-7, ES1-3, ES3-6)	Fresh granite bedrock is underlain with fluctuation below thin covering weathered soil layer. Aquifer is found only at the boundary between fresh granite and the soil.	(50) – **60m**	To detect most probable depression zone of the fresh rock, horizontal SP survey method is necessary. Then, 2D resistivity profile survey shall be planned.
Central	2,4,5,6,9,8,26 (ES2-2, ES44, ES26-8, ES8-8a, ES8-8b)	Younger granite is developed rather in shallow subsurface. But, G/W/L is shallow, borehole site will be found easier. Attention is required against contamination from the surface water.	Ave. **40m**	Due to high dense of villages, 2D survey may be not so easy. Horizontal and vertical survey shall be concentrated.
East	32,33,34,35,36, 37,38 (ES32, ES33a, ES33b, ES33c, ES34, ES35, ES37, ES38)	At the beginning of survey planning stage, high Cl goundwater is scared. Actually it is by contamination from high dense of housing. In palces, borehole successful condition will be varied.	**50m** – (70)m	2D survey will be important to investigate undulating condition of the boundary of fresh granite.
West	12,14,15,16,17, 18,23,29,30,31 (ES12-5, ES17, ES18, ES16, ES14, ES23, ES29, ES30)	Older granite is developed in most of places with deeper weathering ground water is in this weathered layer. Borehole collapse during drilling work is scared.	(40) – **100m**	To detect crack in older granite, horizontal survey is recommended.
North	19,20,21,22,24, 25,27,28 (ES22, ES24, ES19, ES28, ES20)	Bedrock may be develop in shallow portion. High iron contents are inferred in groundwater.	(40) – **60m**	Low potential area for groundwater development. Therefore, careful investigation is necessary.

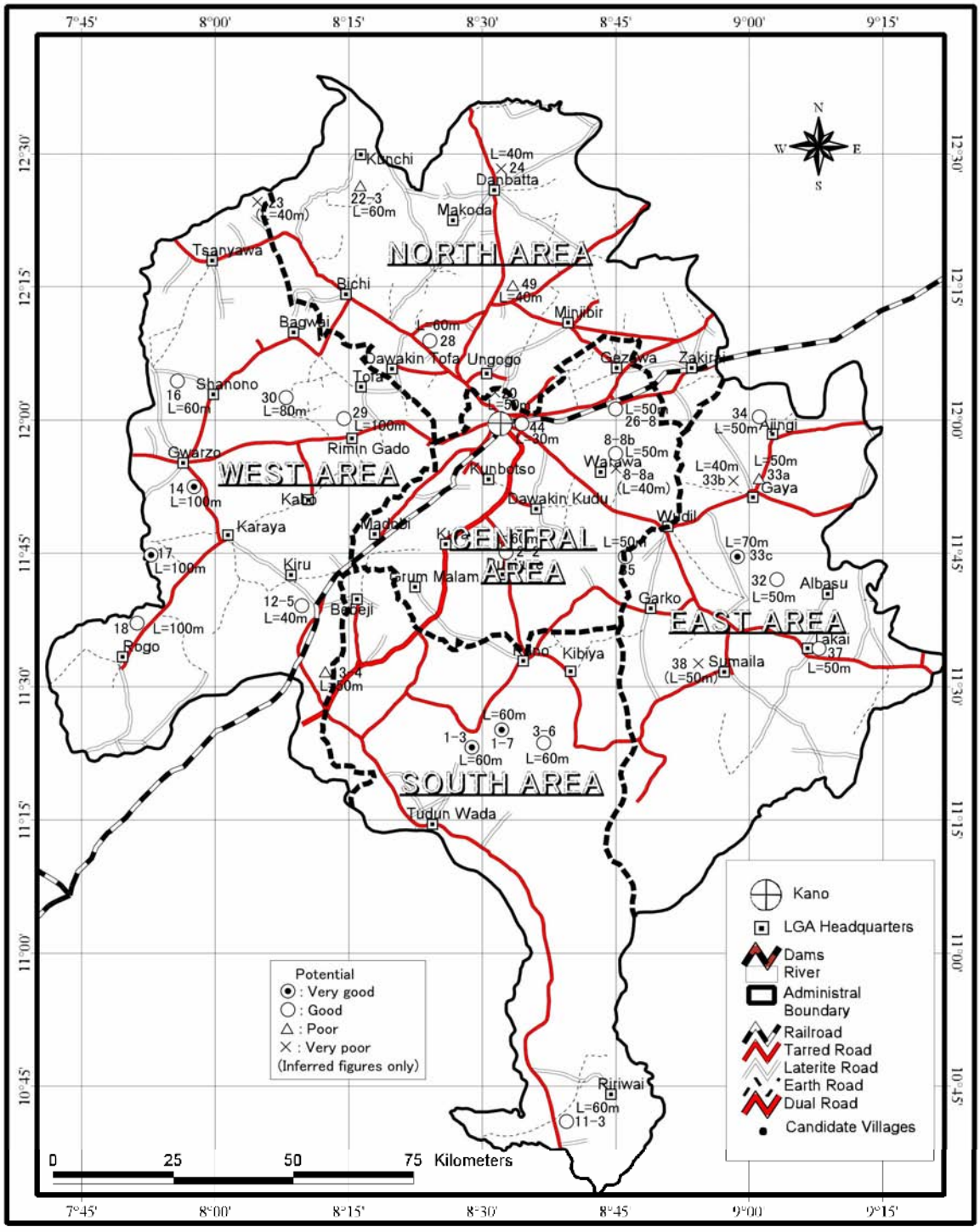
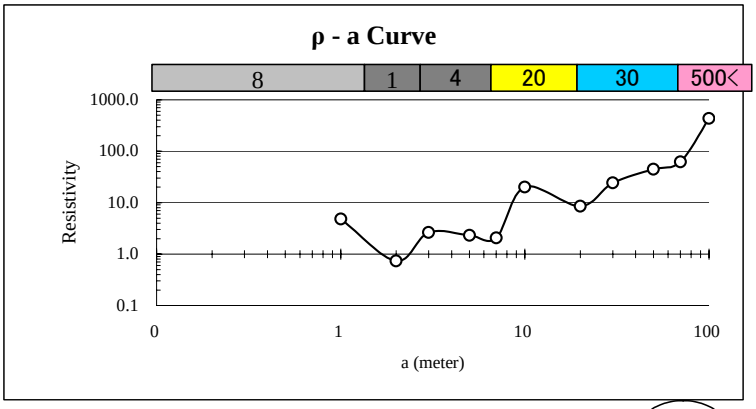


Fig. E-1 Location Map of Electric Soundings and Evaluated Potential

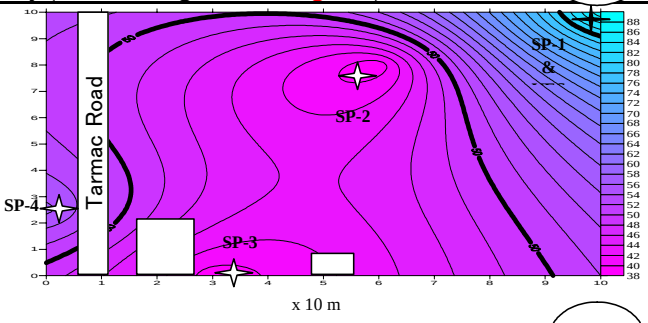
Data Sheet for WENNER Method (ES 11-3: Doguwa LGA "good") GPS27

	a (m)	Resis-tivity	mV (⊿V)	mA
1	0.5			
2	1.0	4.8	41.78	54.46
3	2.0	0.7	4.47	76.84
4	3.0	2.6	11.68	83.21
5	5.0	2.3	6.60	88.82
6	7.0	2.1	5.42	115.60
7	10.0	20.1	32.66	102.06
8	20.0	8.5	8.47	125.19
9	30.0	24.1	22.47	175.46
10	50.0	44.5	14.92	63.50
11	70.0	62.2	20.39	144.02
12	100.0	434.2	64.95	93.95



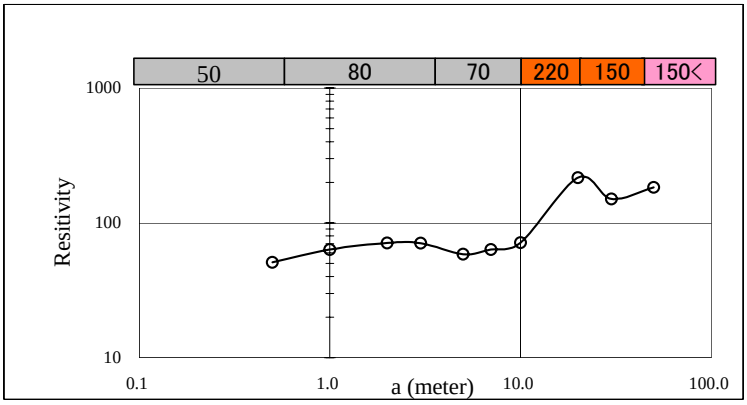
Spontaneous Potential Survey (ES 11-3: Doguwa LGA "good") GPS27

	X	Y	SP (mV)
1	**10**	**10**	**87.44**
2	6	8	38.67
3	3	0	38.87
4	0	2.5	56.62



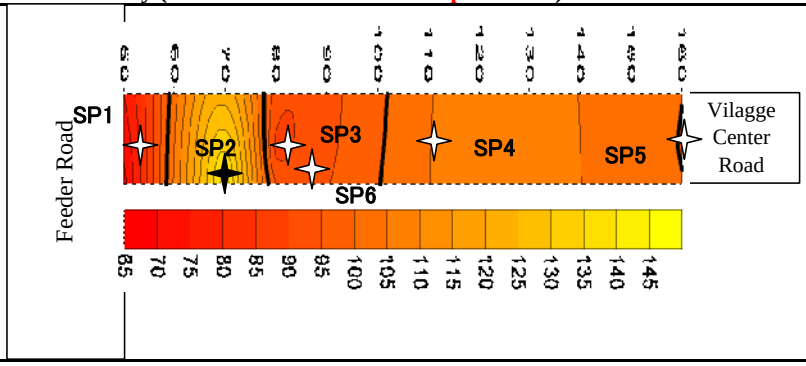
Data Sheet for WENNER Method (ES 8-8a Warawa LGA "no potential") GPS31

	a (m)	Resis-tivity	mV (⊿V)	mA
1	0.5	50.9	285.15	17.58
2	1.0	63.6	216.64	21.40
3	2.0	70.9	163.90	29.02
4	3.0	70.7	73.85	19.68
5	5.0	58.7	161.14	86.25
6	7.0	63.6	122.78	84.82
7	10.0	71.3	73.33	64.62
8	20.0	216.0	49.59	28.84
9	30.0	150.9	48.14	60.10
10	50.0	183.1	23.35	40.05
11	70.0			
12	100.0			



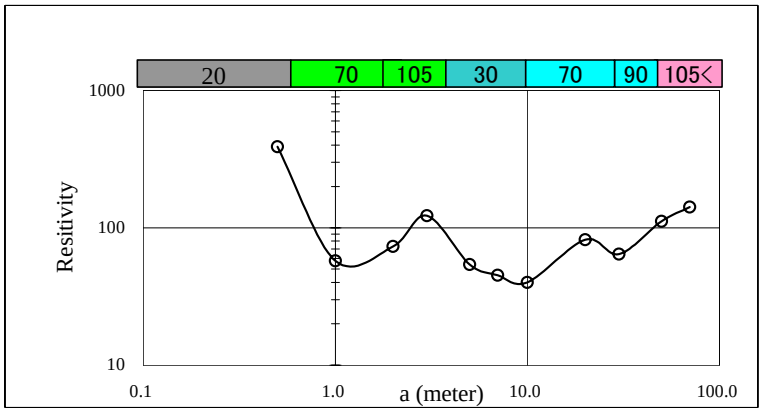
Spontaneous Potential Survey (ES 8-8a Warawa LGA "no potential") GPS31

	X	Y	SP (mV)
1	0	0	
2	3	50	68
3	**0**	**70**	**144**
4	5	80	88
5	0	120	110
6	3	160	99.8



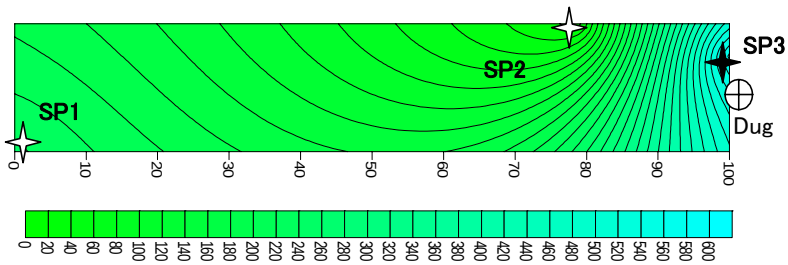
Data Sheet for WENNER Method (ES1-7 Rano LGA "very good") GPS37

	a (m)	Resis-tivity	mV (⊿V)	mA
1	0.5	388.35	17091.3	138.19
2	1.0	57.568	1116.7	121.82
3	2.0	73.249	615.9	105.60
4	3.0	122.73	1130.0	173.47
5	5.0	53.94	294.8	171.63
6	7.0	45.237	110.2	107.05
7	10.0	40.126	86.0	134.58
8	20.0	81.946	110.9	170.04
9	30.0	64.337	22.3	65.39
10	50.0	111.51	18.2	51.11
11	70.0	141.16	35.1	109.31
12	100.0			



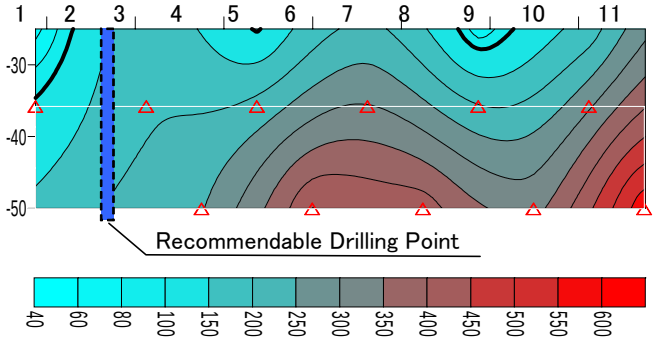
Spontaneous Potential Survey (ES 1-7 Rano LGA "very good") GPS37

	X	Y	SP (mV)
1	20	0	244
2	0	79	12
3	**5**	**100**	**586**
4			
5			
6			



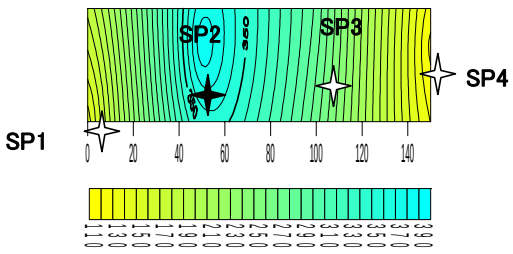
Data Sheet for Dipole Resitivity profile (ES1-3: Rano LGA "very good") GPS35

n	X	Z	Resitivity	mV	mA
1	37.5	−25	52.1	3.24	29.3
2	75	−50	246.4	6.05	46.25
1	62.5	−25	195.3	23.72	57.2
2	100	−50	451.2	7.8	32.57
1	87.5	−25	94.5	7.1	35.38
2	125	−50	427.7	8.5	37.44
1	112.5	−25	216.8	17.42	37.85
2	150	−50	331.3	4.38	24.91
1	137.5	−25	62.3	3.63	27.44
2	175	−50	589.8	12.55	40.09
1	162.5	−25	173.1	12.68	34.51



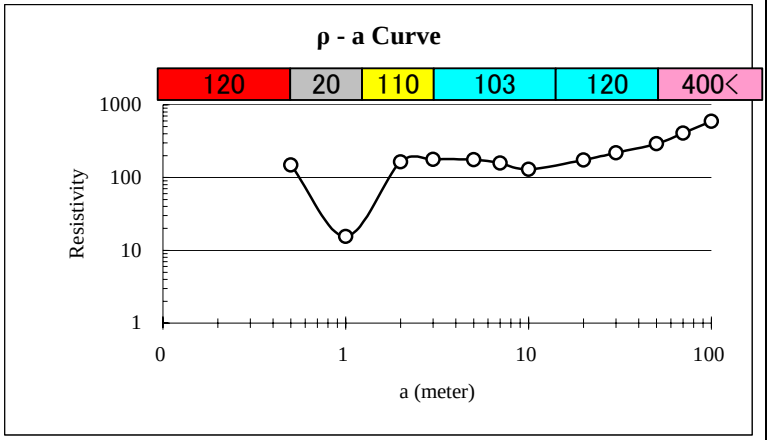
Spontaneous Potential Survey (ES 1-3, Rano LGA "very good") GPS35

	X	Y	SP (mV)
1	0	0	144
2	**50**	**10**	**390**
3	100	15	288
4	150	10	116.51
5			
6			



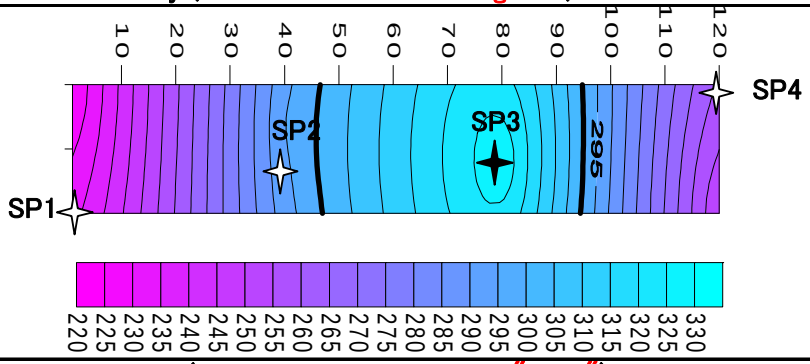
Data Sheet for WENNER Method (ES26-8: Gezawa LGA "good") GPS29

	a (m)	Resis -	mV (⊿V	mA
1	0.5	149.1	916.27	19.3
2	1	15.5	54.78	22.13
3	2	164.8	294.37	22.43
4	3	178	253.17	26.79
5	5	176	139.54	24.9
6	7	157.5	105.22	29.37
7	10	129.9	63.95	30.92
8	20	174.6	51.38	36.97
9	30	219	60.1	51.71
10	50	292	35.75	36.53
11	70	408.8	8.9	9.57
12	100	592.4	12.32	13.06



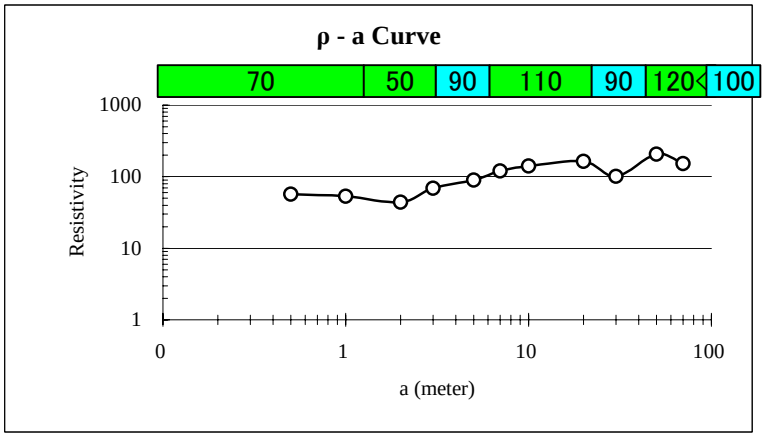
Spontaneous Potential Survey (ES 26-8 Gezawa LGA "good") GPS29

	X	Y	SP (mV)
1	0	0	225
2	3	40	295
3	6	80	229.43
4	9	120	250

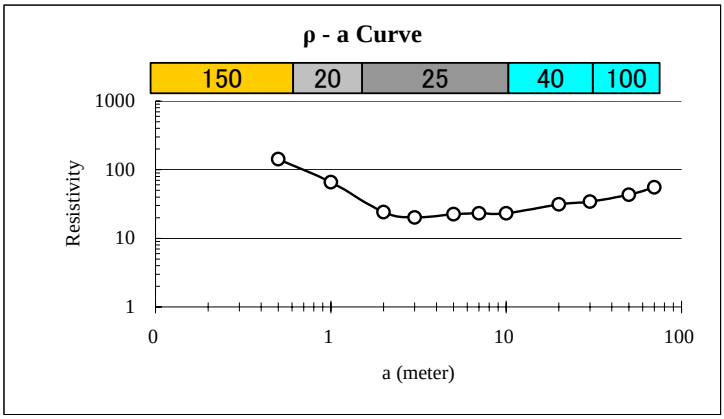


Data Sheet for WENNER Method (ES28: Dawakin Tofa LGA "good") GPS39

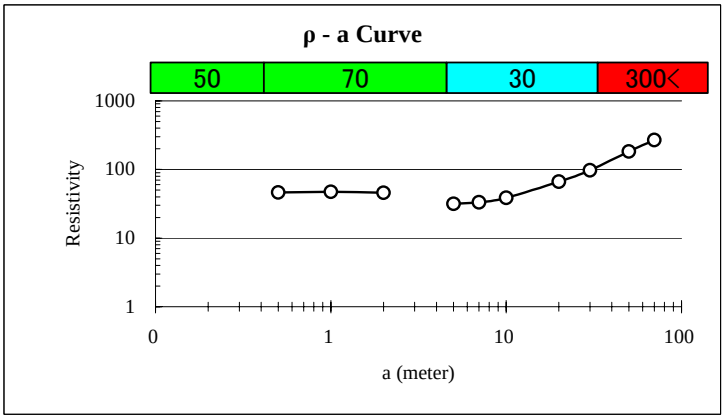
	a (m)	Resis -	mV (⊿V	mA
1	0.5	57.32	753.37	41.27
2	1	53.35	345.94	40.72
3	2	43.83	127.94	36.66
4	3	69.42	219.69	59.62
5	5	89.53	280.42	98.35
6	7	120.7	196.54	71.57
7	10	141.7	119.96	53.16
8	20	163.3	20.69	15.91
9	30	101.2	6.58	12.25
10	50	206.5	24.25	36.87
11	70	153.4	7.36	21.09
12	100			



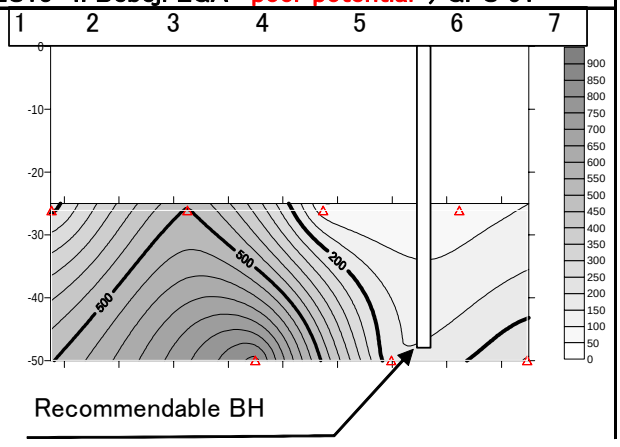
Data Sheet for WENNER Method (ES14: Gwarzo LGA "very good") GPS58					
	a (m)	Resis-tivity	mV (⊿V)	mA	
1	0.5	142.53	726.74	16.01	
2	1	65.54	190.56	18.26	
3	2	24.14	14.82	7.71	
4	3	20.10	22.68	21.26	
5	5	22.57	16.71	23.25	
6	7	23.15	9.22	17.51	
7	10	23.25	10.40	28.09	
8	20	31.46	5.55	22.16	
9	30	34.11	5.87	32.42	
10	50	43.00	2.87	20.96	
11	70	55.71	2.39	18.86	
12	100				



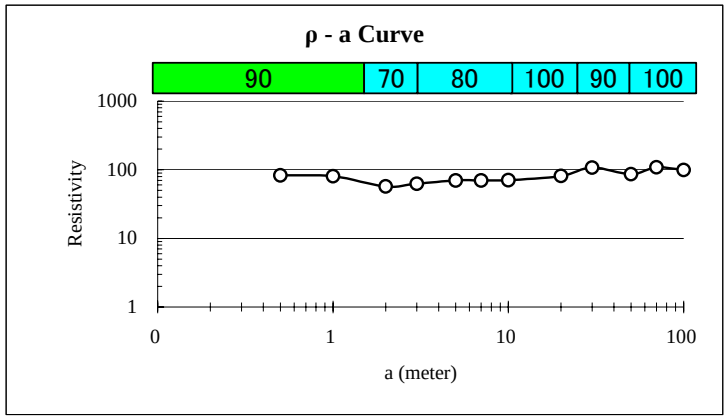
Data Sheet for WENNER Method (ES12-5, Kiru LGA "good") GPS52					
	a (m)	Resis-tivity	mV (⊿V)	mA	
1	0.5	46.23	243.22	16.52	
2	1	47.26	274.29	36.45	
3	2	45.76	121.21	33.27	
4	3				
5	5	31.48	45.71	45.60	
6	7	33.15	25.96	34.43	
7	10	38.48	39.87	65.07	
8	20	66.80	48.97	92.07	
9	30	97.68	47.26	91.15	
10	50	182.82	36.00	61.83	
11	70	267.54	35.67	58.61	
12	100				



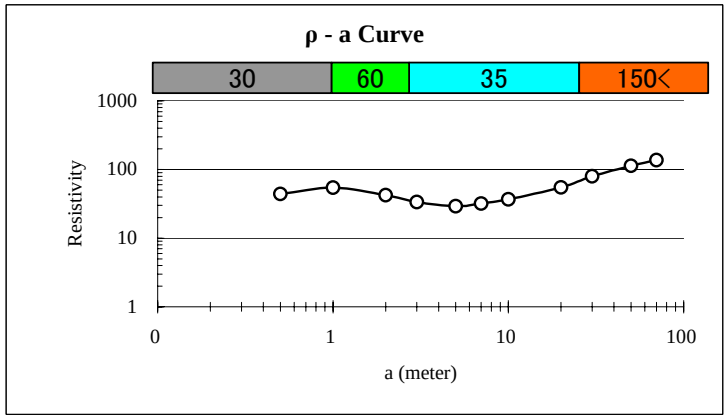
Data Sheet for Dipole Method profiling (ES13-4: Bebeji LGA "poor potential") GPS 51					
n	X	Z	Resitivity	mV	mA
1	37.5	-25	172.1	10.46	28.63
2	75	-50	870.2	9.51	20.59
1	62.5	-25	496.8	34.42	32.63
2	100	-50	156.1	2.75	33.18
1	87.5	-25	48.8	3.73	35.98
2	125	-50	256.4	3.59	26.38
1	112.5	-25	75.6	4.85	30.23



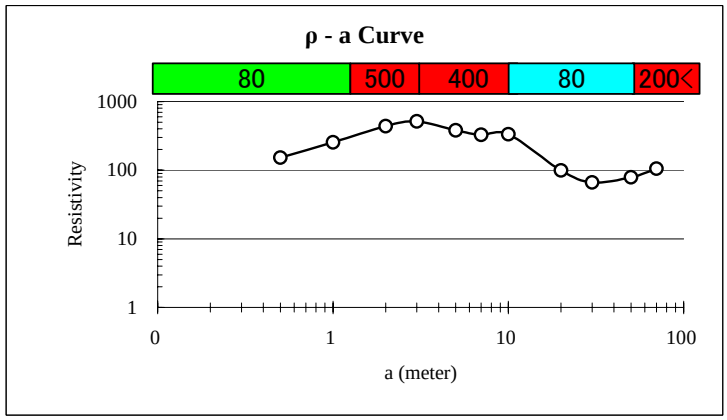
Data Sheet for WENNER Method (ES17 Karaya LGA "very good") GPS57					
	a (m)	Resis-tivity	mV (⊿V)	mA	
1	0.5	83.05	1082.00	40.91	
2	1	80.68	85.18	6.63	
3	2	57.32	123.44	27.05	
4	3	62.52	287.06	86.50	
5	5	69.98	130.49	58.55	
6	7	69.78	42.78	26.95	
7	10	70.85	49.49	43.87	
8	20	81.29	13.89	21.46	
9	30	107.79	34.14	59.67	
10	50	86.12	5.54	20.20	
11	70	108.37	7.97	32.33	
12	100	99.70	7.42	46.74	



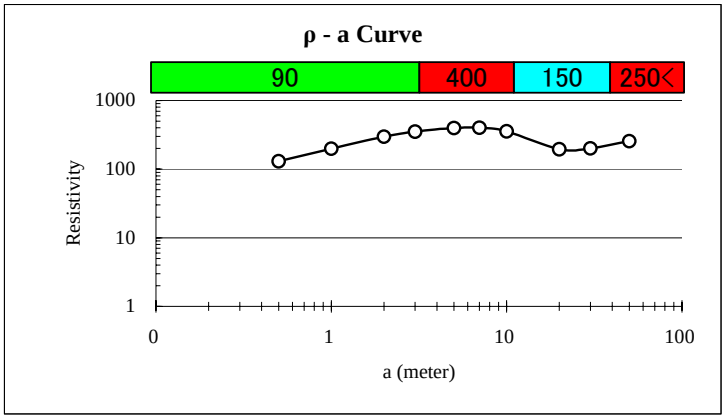
Data Sheet for WENNER Method (ES18 Rogo LGA "good") GPS53					
	a (m)	Resis-tivity	mV (⊿V)	mA	
1	0.5	44.13	979.38	69.69	
2	1	54.35	553.66	63.97	
3	2	42.47	286.30	84.66	
4	3	33.42	128.34	72.35	
5	5	29.27	75.05	80.51	
6	7	31.83	67.20	92.82	
7	10	36.79	56.44	96.34	
8	20	54.76	44.32	101.65	
9	30	79.74	53.39	126.15	
10	50	112.85	28.26	78.63	
11	70	137.09	14.66	47.01	
12	100				



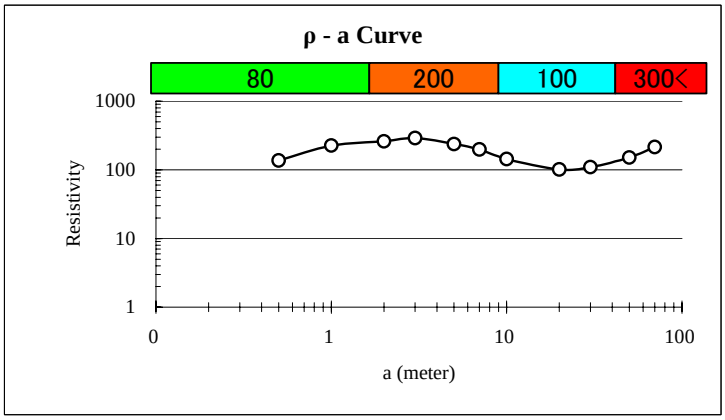
Data Sheet for WENNER Method (ES32 Albasu LGA "good") GPS65					
	a (m)	Resis-tivity	mV (⊿V)	mA	
1	0.5	153.56	1795.30	36.71	
2	1	255.01	1658.00	40.83	
3	2	439.99	1671.70	47.72	
4	3	517.88	1015.70	36.95	
5	5	380.33	611.80	50.51	
6	7	328.69	295.27	39.49	
7	10	335.71	76.55	14.32	
8	20	98.91	15.90	20.19	
9	30	66.70	11.46	32.37	
10	50	78.92	9.41	37.44	
11	70	105.00	17.03	71.30	
12	100				



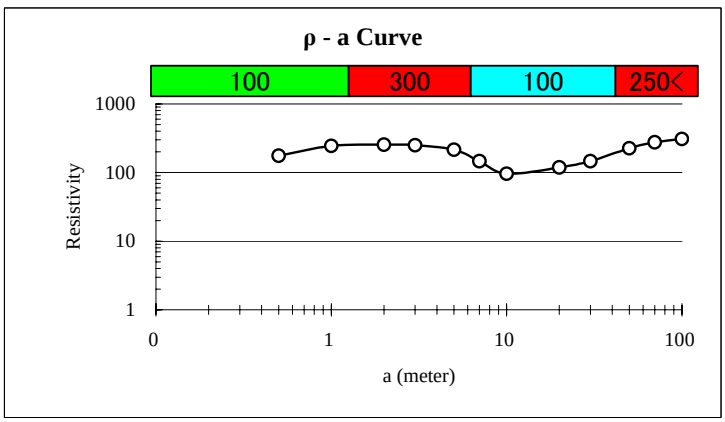
Data Sheet for WENNER Method (ES33a Gaya LGA "poor potential") GPS61				
	a (m)	Resis-tivity	mV (⊿ V)	mA
1	0.5	130.13	1198.50	28.92
2	1	197.82	831.90	26.41
3	2	295.74	762.89	32.40
4	3	350.26	841.62	45.27
5	5	395.68	435.25	34.54
6	7	402.42	307.58	33.60
7	10	357.31	269.01	47.28
8	20	193.97	57.08	36.96
9	30	201.31	33.37	31.23
10	50	254.30	35.78	44.18
11	70			
12	100			



Data Sheet for WENNER Method (ES34 Ajingi LGA "good") GPS60				
	a (m)	Resis-tivity	mV (⊿ V)	mA
1	0.5	136.41	1733.30	39.90
2	1	225.68	1095.70	30.49
3	2	261.35	982.98	47.24
4	3	290.09	429.13	27.87
5	5	238.78	334.22	43.95
6	7	198.58	73.18	16.20
7	10	143.30	63.62	27.88
8	20	101.08	26.83	33.34
9	30	109.65	12.10	20.79
10	50	152.01	7.00	14.46
11	70	216.03	5.16	10.50
12	100			

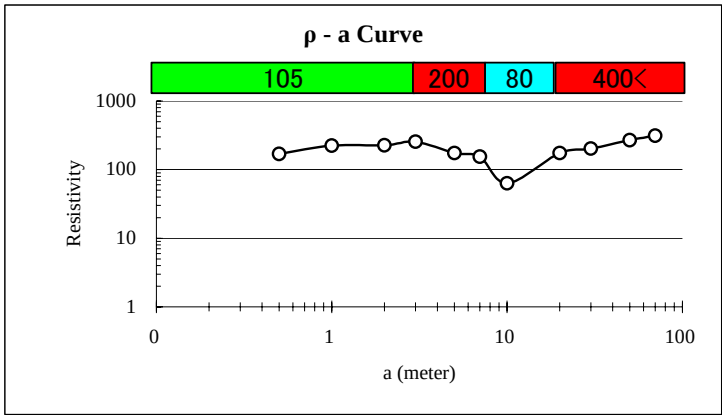


Data Sheet for WENNER Method (ES37 Takai LGA "good") GPS68				
	a (m)	Resis-tivity	mV (⊿ V)	mA
1	0.5	175.79	2241.00	40.03
2	1	246.31	965.61	24.62
3	2	254.19	629.01	31.08
4	3	250.33	662.49	49.86
5	5	215.87	331.03	48.15
6	7	147.01	106.71	31.91
7	10	96.38	89.80	58.51
8	20	118.78	40.77	43.11
9	30	146.69	39.25	50.41
10	50	225.16	75.68	105.54
11	70	276.60	14.95	23.76
12	100	307.46	0.94	1.92



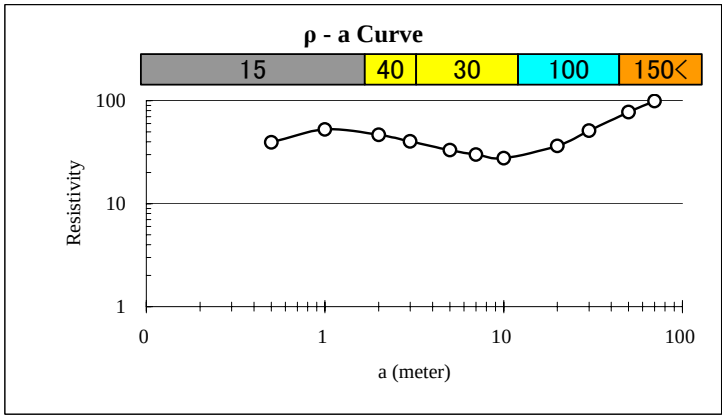
Data Sheet for WENNER Method (ES38 Sumaila LGA "very poor potential") GPS71

	a (m)	Resis-tivity	mV (⊿V)	mA
1	0.5	168.57	1049.00	19.54
2	1	224.12	531.75	14.90
3	2	226.14	413.75	22.98
4	3	254.59	255.00	18.87
5	5	174.21	124.61	22.46
6	7	154.83	78.47	22.28
7	10	63.41	31.00	30.70
8	20	174.43	65.09	46.87
9	30	203.21	20.17	18.70
10	50	268.42	24.44	28.59
11	70	310.55	16.70	23.64
12	100			



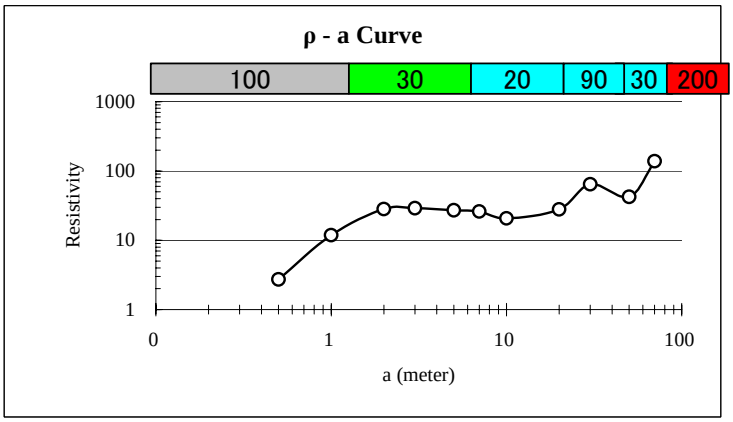
Data Sheet for WENNER Method (ES19 Minjibir LGA "poor potential") GPS73

	a (m)	Resis-tivity	mV (⊿V)	mA
1	0.5	39.38	777.66	62.01
2	1	52.63	719.92	85.90
3	2	46.51	243.31	65.70
4	3	40.36	100.03	46.69
5	5	33.12	39.57	37.52
6	7	29.98	51.12	74.96
7	10	27.60	44.39	100.99
8	20	36.40	28.27	97.55
9	30	51.09	30.13	111.11
10	50	77.41	21.83	88.55
11	70	99.01	12.55	55.72
12	100	145.42	7.03	30.36



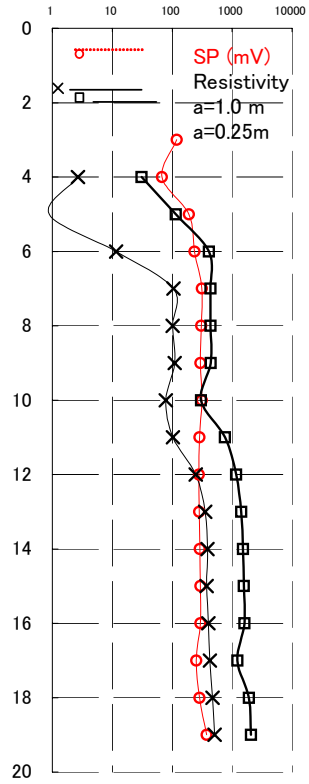
Data Sheet for WENNER Method (ES2-2 Bunkure LGA "good") GPS81

	a (m)	Resis-tivity	mV (⊿V)	mA
1	0.5	2.74	114.15	130.96
2	1	11.83	249.00	132.23
3	2	28.13	218.47	97.56
4	3	29.06	84.51	54.79
5	5	27.09	50.84	58.93
6	7	26.00	35.58	60.15
7	10	20.68	23.87	72.50
8	20	28.03	19.14	85.75
9	30	64.38	19.98	58.47
10	50	42.56	5.54	40.87
11	70	138.46	15.49	49.18
12	100			



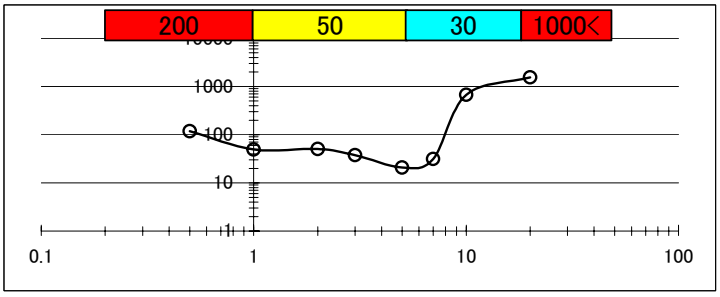
Logging Data at ES44a Tudunwada in Kano City

	1.0 m				0.25 m		
Depth (m)	SP(mV) 1m	Resiti-vity	mV (⊿V)	mA	Resitivity	mV (⊿V)	mA
0							
1							
2							
3	119.8						
4	67.9	31	352.17	143.14	3	121.71	141.54
5	190.9	116	1159.50	125.87	1	49.79	174.39
6	237.0	410	3634.00	111.27	12	410.33	111.34
7	313.3	435	3607.70	104.25	106	3567.90	106.00
8	305.3	434	3612.60	104.65	102	3549.40	109.57
9	297.0	439	3628.30	103.80	110	3622.70	103.00
10	312.9	302	3614.10	150.11	79	3457.00	138.11
11	285.2	757	3629.90	60.21	103	2015.90	61.57
12	279.0	1167	3637.00	39.14	246	3680.70	47.06
13	282.0	1411	3640.80	32.42	353	3634.10	32.29
14	289.6	1525	3642.80	30.01	390	3656.60	29.44
15	296.4	1565	3642.50	29.23	376	3674.00	30.67
16	295.2	1613	3649.40	28.41	403	3655.00	28.46
17	253.8	1226	2651.70	27.17	426	3679.50	27.15
18	285.2	1912	3646.60	23.96	470	3574.90	23.87
19	377.4	2061	3605.00	21.97	512	3583.00	21.97



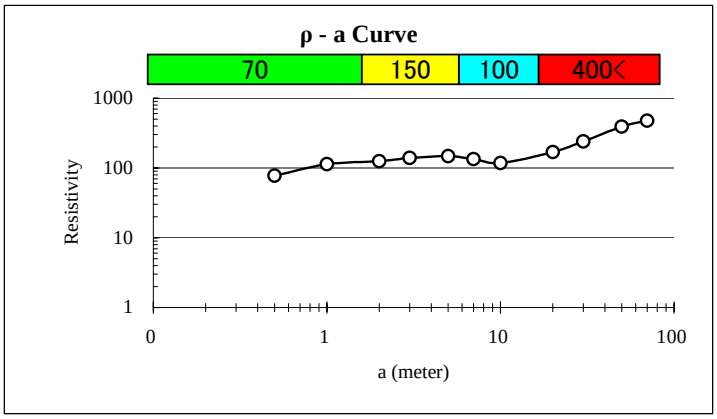
Data Sheet for WENNER Method (at ES44b Logging spot of Tudunwada in Kano City) GPS72

	a (m)	Resis-tivity	mV (⊿V)	mA
1	0.5	118.87	325.19	8.59
2	1	49.62	226.69	28.69
3	2	51.00	87.50	21.55
4	3	37.93	26.21	13.02
5	5	20.86	12.86	19.36
6	7	31.38	28.40	39.78
7	10	670.35	1078.00	100.99
8	20	1545.05	1200.00	97.55

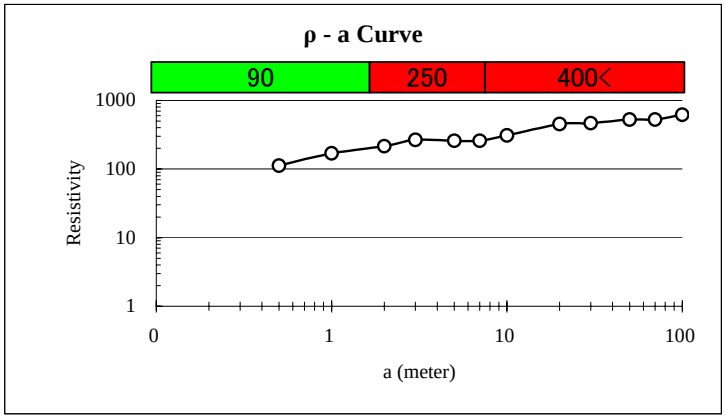


Data Sheet for WENNER Method (ES20 Ungogo LGA "very poor potential") GPS74

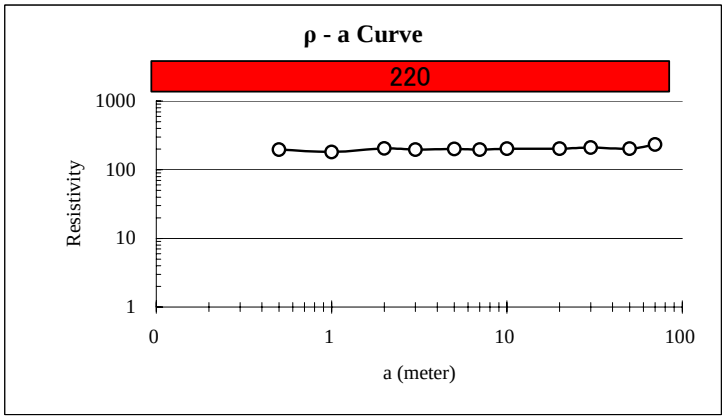
	a (m)	Resis-tivity	mV (⊿V)	mA
1	0.5	77.22	1117.50	45.44
2	1	113.22	750.01	41.60
3	2	124.91	471.51	47.41
4	3	139.92	263.06	35.42
5	5	147.20	124.93	26.65
6	7	133.98	110.94	36.40
7	10	117.81	114.45	61.01
8	20	169.77	57.19	42.31
9	30	241.34	37.61	29.36
10	50	392.07	45.40	36.36
11	70	475.94	21.35	19.72
12	100	#DIV/0!		



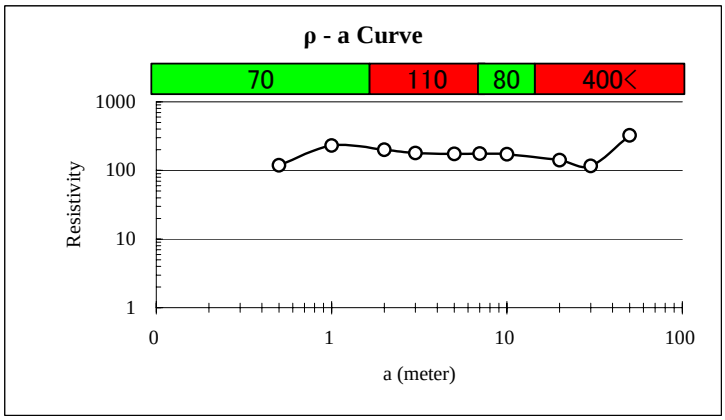
Data Sheet for WENNER Method (ES24 Danbatta LGA "no potential") GPS76				
	a (m)	Resis-tivity	mV (⊿ V)	mA
1	0.5	112.48	1134.10	31.66
2	1	169.17	699.02	25.95
3	2	214.84	593.20	34.68
4	3	264.75	119.87	8.53
5	5	257.96	55.37	6.74
6	7	258.40	95.93	16.32
7	10	309.30	49.35	10.02
8	20	453.37	25.52	7.07
9	30	467.13	27.77	11.20
10	50	523.56	23.31	13.98
11	70	523.93	8.76	7.35
12	100	620.26	14.43	14.61



Data Sheet for WENNER Method (ES29 Tofa LGA "potential by deper weathering") GPS75				
	a (m)	Resis-tivity	mV (⊿ V)	mA
1	0.5	197.25	1841.80	29.32
2	1	182.17	756.24	26.07
3	2	204.37	395.73	24.32
4	3	195.70	188.12	18.11
5	5	200.62	218.96	34.27
6	7	197.07	81.05	18.08
7	10	203.17	132.32	40.90
8	20	203.22	49.30	30.47
9	30	209.92	163.95	147.14
10	50	202.91	31.05	48.05
11	70	234.18	14.49	27.20
12	100			

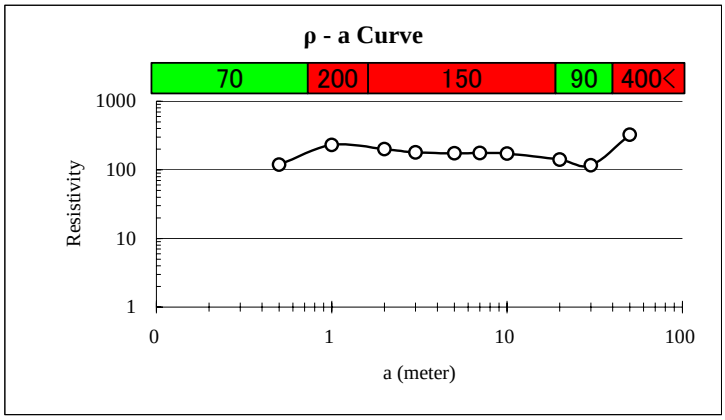


Data Sheet for WENNER Method (ES30 Bagwai LGA, "potential by deep weathering") GPS78				
	a (m)	Resis-tivity	mV (⊿ V)	mA
1	0.5	58.50	888.10	47.67
2	1	88.71	1051.00	74.40
3	2	108.83	563.72	65.06
4	3	125.38	659.24	99.06
5	5	128.02	265.06	65.01
6	7	102.19	189.01	81.31
7	10	75.50	32.57	27.09
8	20	122.03	45.85	47.19
9	30	170.17	29.87	33.07
10	50	248.23	25.40	32.13
11	70	307.13	23.44	33.55
12	100			



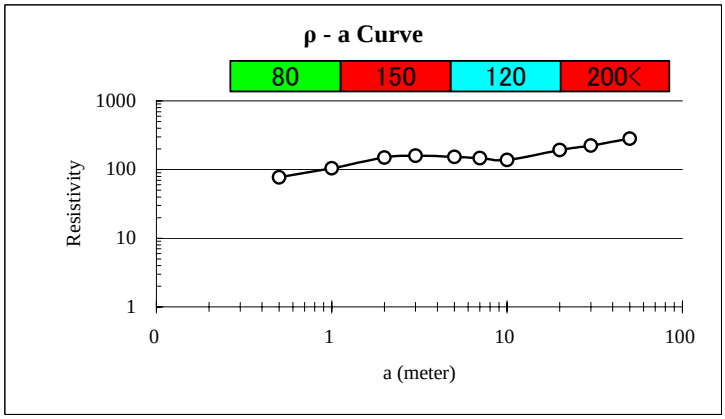
Data Sheet for WENNER Method (ES23 Tsanyama LGA, "very poor potential") GPS46

	a (m)	Resis-tivity	mV (⊿V)	mA
1	0.5	119.43	863.02	22.69
2	1	231.49	822.00	22.30
3	2	200.91	306.64	19.17
4	3	179.36	183.74	19.30
5	5	174.48	81.35	14.64
6	7	175.80	48.63	12.16
7	10	172.00	43.63	15.93
8	20	140.50	23.86	21.33
9	30	117.15	13.12	21.10
10	50	323.33	25.29	24.56
11	70			
12	100			



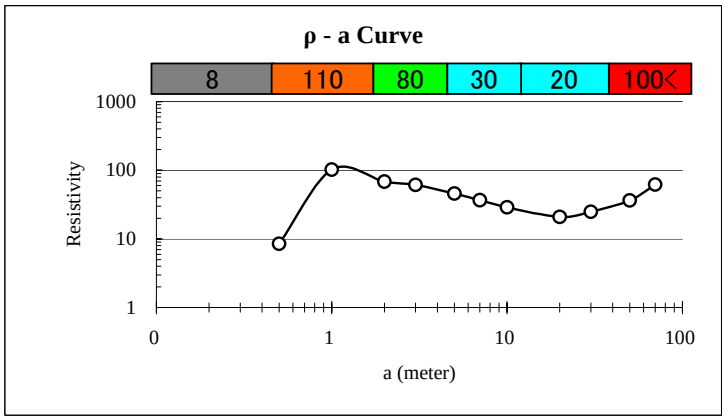
Data Sheet for WENNER Method (ES22-3 Kunchi LGA "poor potential") GPS47

	a (m)	Resis-tivity	mV (⊿V)	mA
1	0.5	77.48	437.72	17.74
2	1	104.69	391.93	23.51
3	2	149.43	196.18	16.49
4	3	159.35	164.76	19.48
5	5	153.55	160.98	32.92
6	7	146.62	173.47	52.01
7	10	138.56	74.31	33.68
8	20	192.14	95.72	62.57
9	30	223.22	34.04	28.73
10	50	282.31	27.53	30.62
11	70			
12	100			



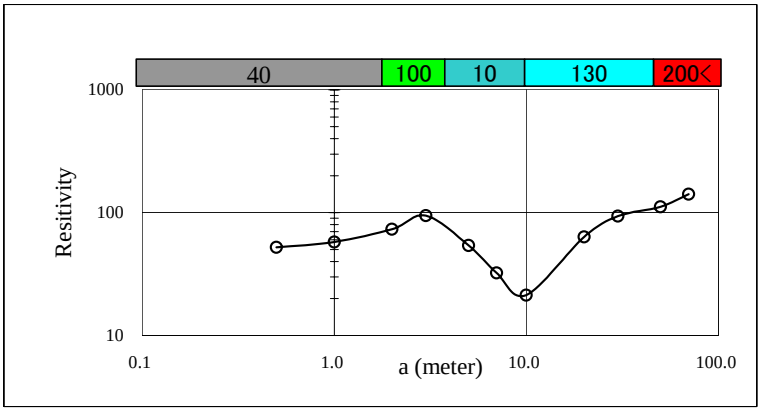
Data Sheet for WENNER Method (ES16 Shanono LGA "good potential") GPS77

	a (m)	Resis-tivity	mV (⊿V)	mA
1	0.5	8.47	117.50	43.57
2	1	102.84	709.91	43.35
3	2	68.79	276.36	50.46
4	3	61.27	158.05	48.60
5	5	45.97	84.96	58.03
6	7	36.65	42.45	50.91
7	10	28.99	21.33	46.20
8	20	20.85	8.81	53.06
9	30	24.82	10.90	82.74
10	50	36.51	7.16	61.58
11	70	61.90	14.71	104.46
12	100			



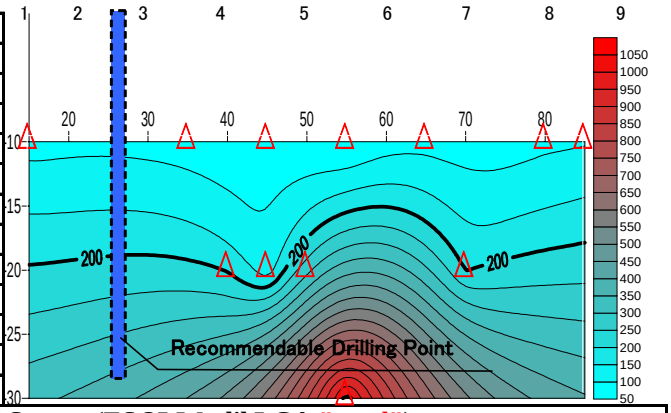
Data Sheet for WENNER Method (ES3-6 Kibiya LGA "good") GPS84

	a (m)	Resis-tivity	mV (⊿V)	mA
1	0.5	52.146	975.5	58.74
2	1.0	57.568	1116.7	121.82
3	2.0	73.249	615.9	105.60
4	3.0	94.488	870.0	173.47
5	5.0	53.94	294.8	171.63
6	7.0	32.284	110.2	150.00
7	10.0	21.335	19.1	56.31
8	20.0	63.337	110.9	220.00
9	30.0	93.488	22.3	45.00
10	50.0	111.51	18.2	51.11
11	70.0	141.16	35.1	109.31
12	100.0			



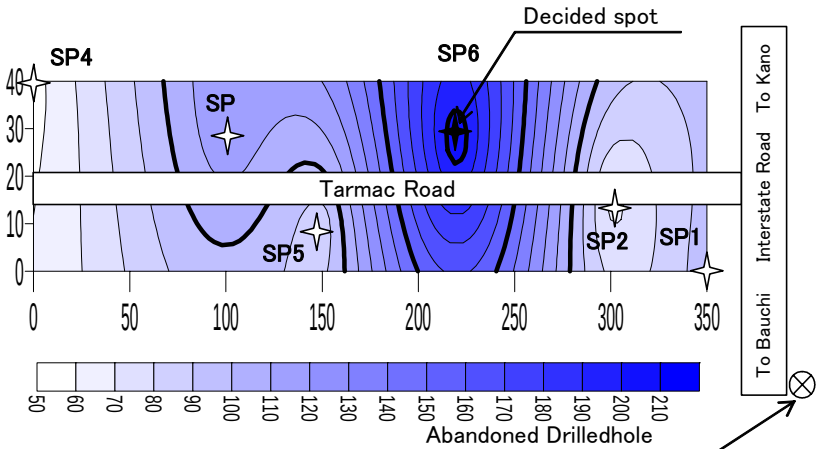
Data Sheet for Dipole Resitivity profile (ES35 Wudil LGA "good") GPS80

n	X	Z	Resitivity	mV	mA
1	15	−10	83.1	5.39	30.56
2	40	−20	197.2	5.11	48.82
3	55	−30	1022.9	3.82	17.59
1	35	−10	78.8	3.58	21.4
2	50	−20	283.6	1.77	11.76
1	55	−10	48.6	1.67	16.17
1	45	−20	122.3	3.82	14.71
1	45	−10	80.0	1.84	10.83
2	70	−20	197.9	4.48	42.65
1	65	−10	84.6	12.28	68.39
1	80	−10	90.2	7.3	38.1
1	85	−10	96.1	8.89	43.57



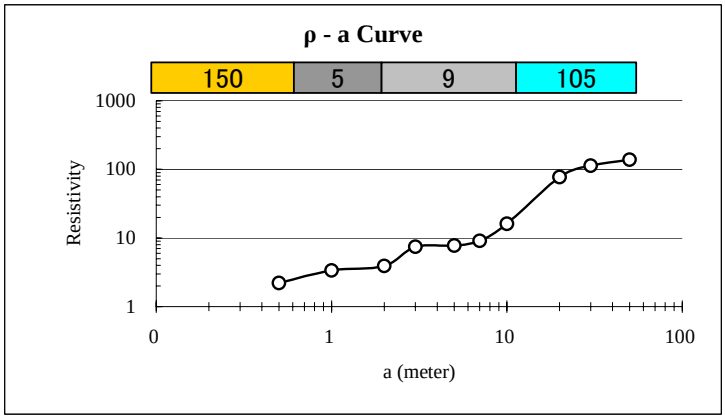
Spontaneous Potential Survey (ES 35 Wudil LGA "good")

	X	Y	SP (mV)
1	350	0	96
2	300	15	66
3	100	30	120
4	0	40	56
5	150	10	83
6	220	27	209



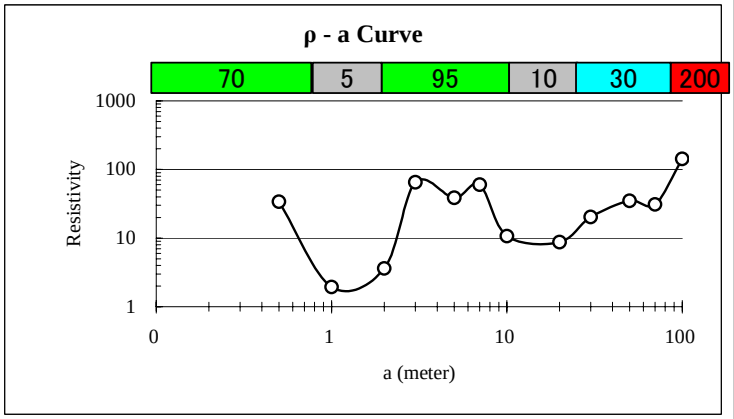
Data Sheet for WENNER Method (ES33b Gaya LGA, Talatar "very poor") GPS85

	a (m)	Resis-tivity	mV (⊿V)	mA
1	0.5	2.20	3.58	5.11
2	1	3.38	4.19	7.79
3	2	3.90	3.64	11.72
4	3	7.47	2.49	6.28
5	5	7.79	1.20	4.84
6	7	9.08	2.47	11.96
7	10	16.08	5.07	19.80
8	20	76.96	7.42	12.11
9	30	113.51	6.73	11.17
10	50	137.80	2.87	6.54
11	70			
12	100			



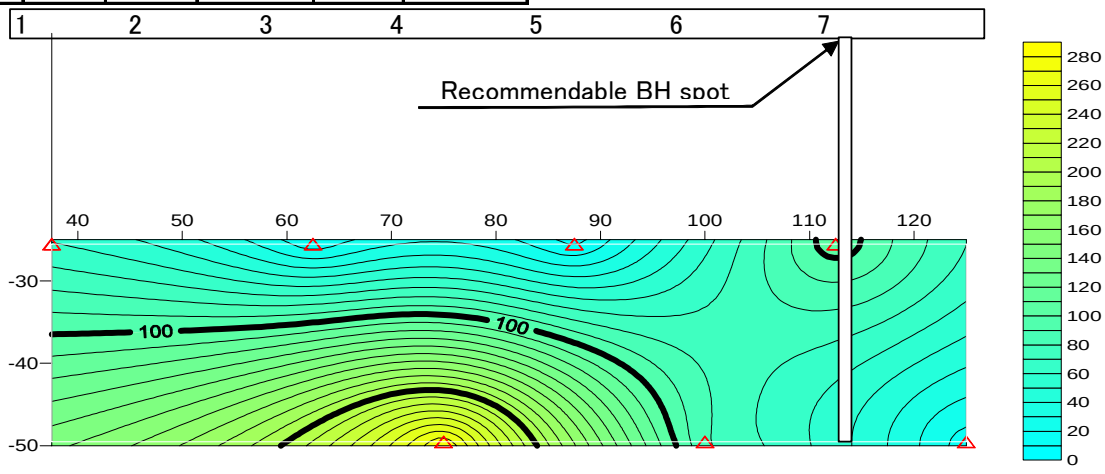
Data Sheet for WENNER Method (ES33c Gaya LGA, Gamarya "very good") GPS87

	a (m)	Resis-tivity	mV (⊿V)	mA
1	0.5	34.05	526.90	48.59
2	1	1.94	11.80	38.22
3	2	3.61	10.39	36.15
4	3	65.47	98.28	28.28
5	5	38.47	92.50	75.50
6	7	60.17	35.33	25.81
7	10	10.73	6.36	37.23
8	20	8.71	4.21	60.71
9	30	20.30	6.23	57.81
10	50	35.01	2.99	26.82
11	70	30.94	2.62	37.23
12	100	142.11	8.97	39.64



Data Sheet for WENNER Method (ES8-8b re-survey Warawa LGA "good") GPS74

n	X	Z	Resitivity	mV	mA
1	37.5	-25	59.0	1.8	14.38
2	75	-50	282.2	9.18	61.28
1	62.5	-25	9.5	3.84	190.24
2	100	-50	81.4	5.27	121.97
1	87.5	-25	4.7	1.22	123.1
2	125	-50	13.7	1.11	152.93
1	112.5	-25	108.6	22.06	95.67



6. Result of Hydrogeophysical Analysis

Appendix 6. Result of Hydrogeophysical Analysis

1. Natural Conditions

1-1 Geography

As shown in Figure F-2, the geography of the Kano state is almost flat. But, the north-eastern area is located at a lower elevation whereas the western side of the state surrounding the Kano city is located at a higher elevation. In general, the altitude of the lower area is 400m, and that of the hillside is between 600m to 700m. The highest altitude is located at the southern edge area in the state, which is about 800m. Handejia is the main river that run across the south part of Kano city from South West to North East and finally reaches Lake Chad.

1-2 Climate

The climate of most part of Kano belongs to Sudan Savanna, and southern part belongs to Guiana Savanna. As shown in Figure F-1, rainy season starts from April and ends in October and the dry season starts from November and ends in March. The southern area has more annual rainfall which is about 1,000mm, than that of north and north eastern area which is about 400mm. In the dry season, humidity is significantly low, raising a cloud dust intensively. On the contrary, climate is more moderate in the rainy season and leads to vegetation recovery.

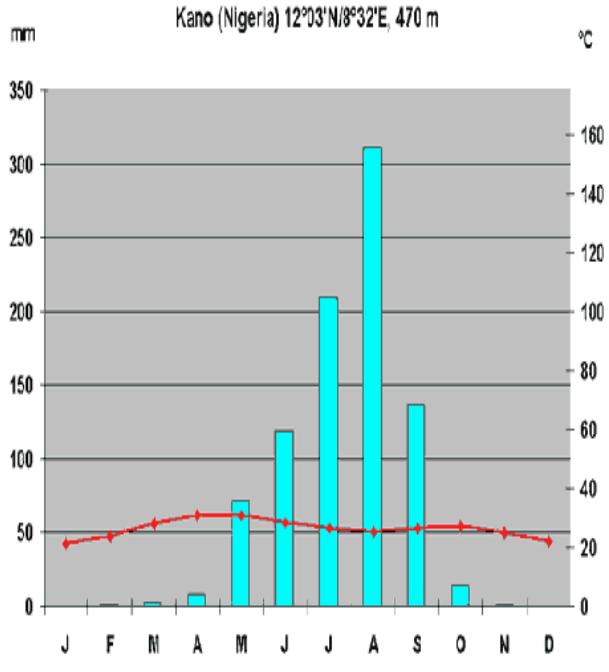


Figure F-1 Annual rainfall and temperature in Kano province

From November to February, the temperature remains about 10 ℃ and it is severely dry.

On the other hand, the highest temperature reaches to 33 ℃ in the northern edge of the state. The distance between northern edge and northeast area is only 900 km, and the forest is grown to protect desertification.

2. Geology and hydrology

Geology of Kano state consists of granite rocks that was formulated from Paleozoic era to Precambrian era and metamorphic rocks, called as basement rocks of the area.

According to the result of "The Study for Water Resources Development plan in Nigeria" conducted by JICA in 1995, Kano state was pointed as a lowest potential area in the nation, and was ranked as a difficult area to develop ground water.

According to Kano state geologic map shown as Figure F-3, red color indicates granite rocks and green color indicates metamorphic rocks. The groundwater development is considered as difficult especially in the western area of the state that consists of metamorphic rocks.

The major groundwater aquifer in Kano state is located in surface area of designative basement rock and in the border of non-designative basement rock.

In Kano state, the record of excavated well is summarized by Kano Agriculture and Rural Development Agency (KNARD) in May 1990. It includes additional data of 1733 wells which were excavated from 1982 to 1989 by the assistance of World Bank. In the present survey, there are 977 boreholes data, targeted to 38 LGA.

The data of 786 successful boreholes were picked up from the database and hydrogeologic characteristics were analyzed by GIS. The result is shown below.

- Ground Water Level: In the surrounding area of Kano city and South area, groundwater is distributed at a level of equal to or shallower than 10 m from ground level. In North area, it is distributed at a level of more than 20m below the ground level, and especially in area around Bichi , Kunchi it is distributed at a level of more than 40m below ground level (refer to Figure F-4).

- Borehole excavation depth: In the southeastern area of Kano state, shallow wells which were excavated at a depth of 50m are found more. In the north-western area, boreholes which were excavated at a depth of more than 50m, and some of them reached up to 100m, were found (refer to Figure F-5).

- Capacity of ground water discharge (yield): In the south-eastern area of Kano state, there are boreholes with an yield of 20 liters per minute. In the north-western area, the groundwater yield is lower in general and do not satisfy the success borehole standard (refer to Figure F-6).

- Electrical Conductivity: One of index to evaluate water quality is Electrical Conductivity (EC). According to the distribution of EC, north eastern area of Kano state and Rano, Kibiya, Sumaila in South area EC indicates higher values than other areas, and it can be inferred that the area has relatively worse water quality than the other area (refer to Figure F-7).

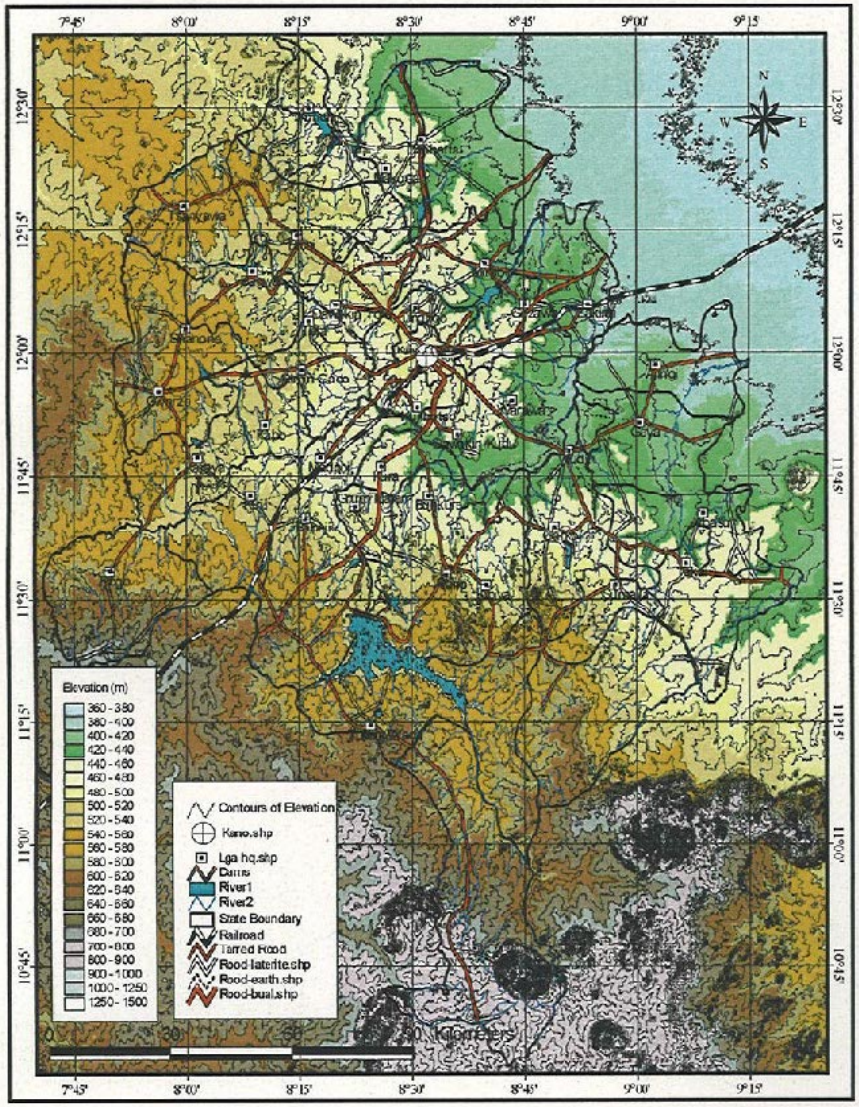


Figure F-2 Topographical Map

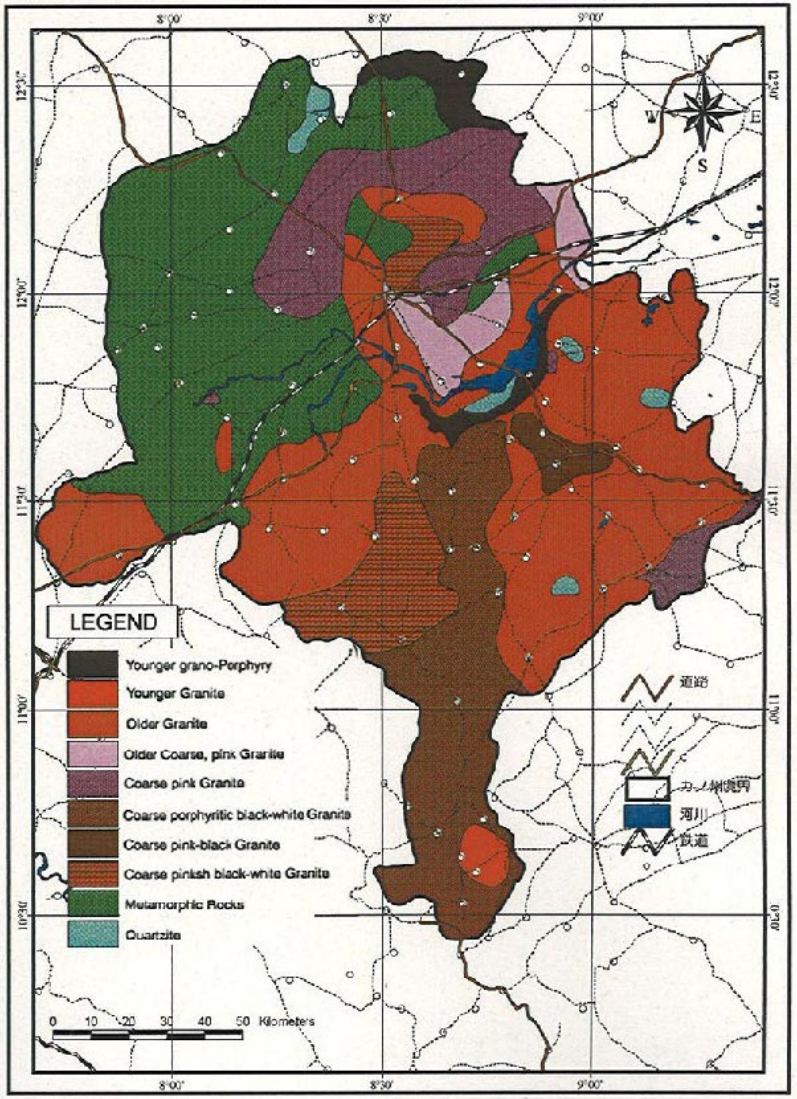


Figure F-3 Geological Map

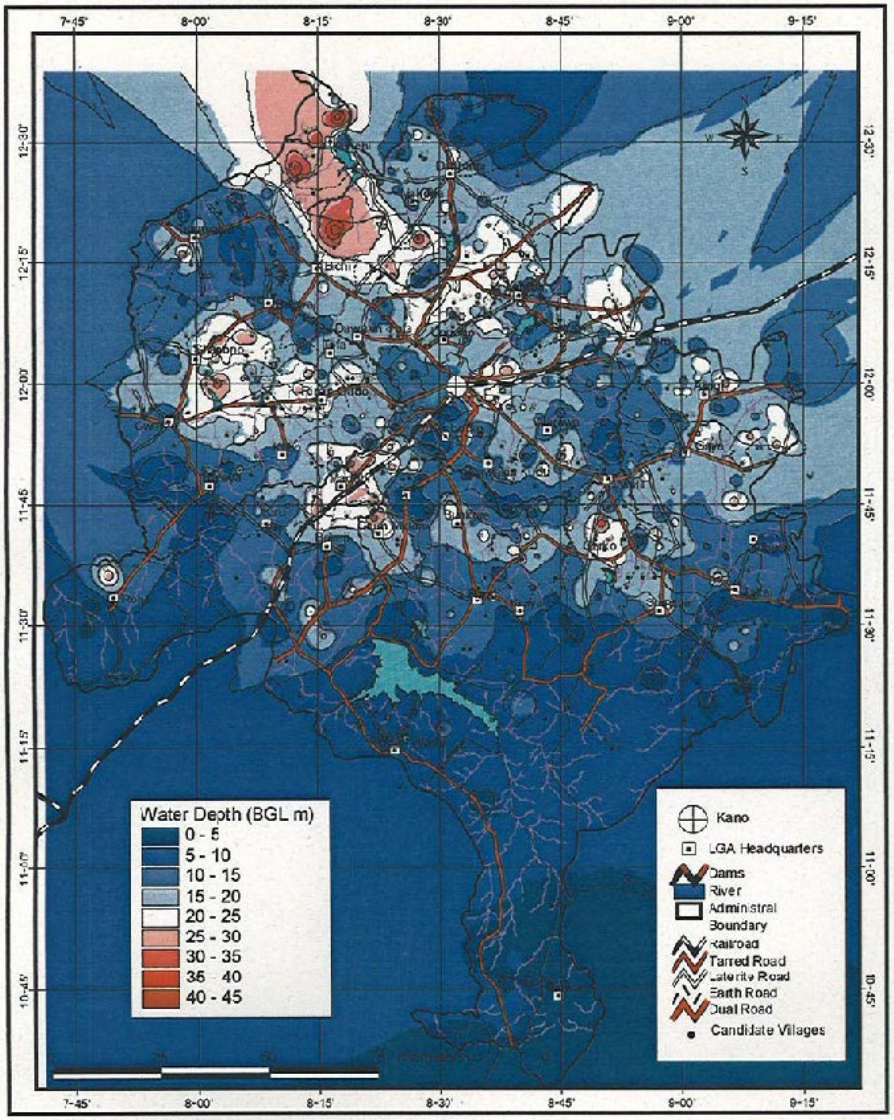


Figure F-4 Ground Water Level in Kano State

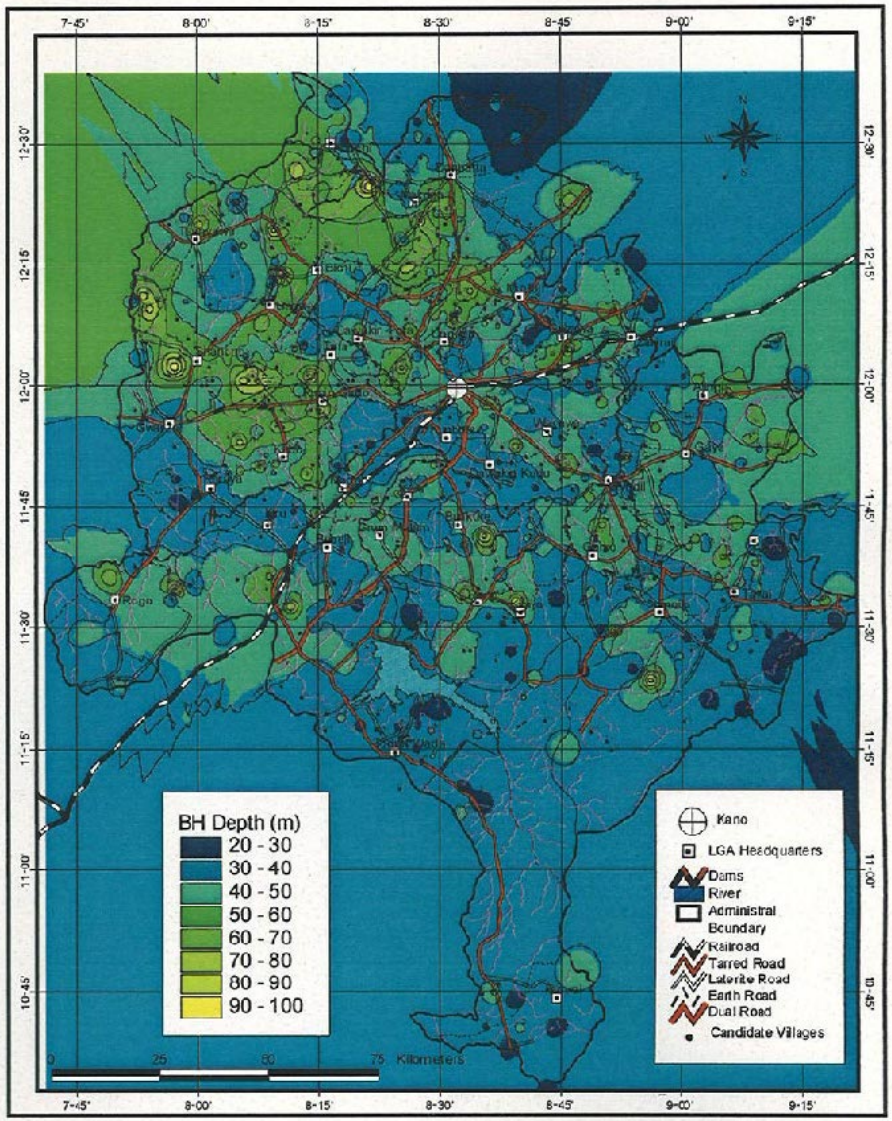


Figure F-5 Borehole Depth of Existing Boreholes in Kano State

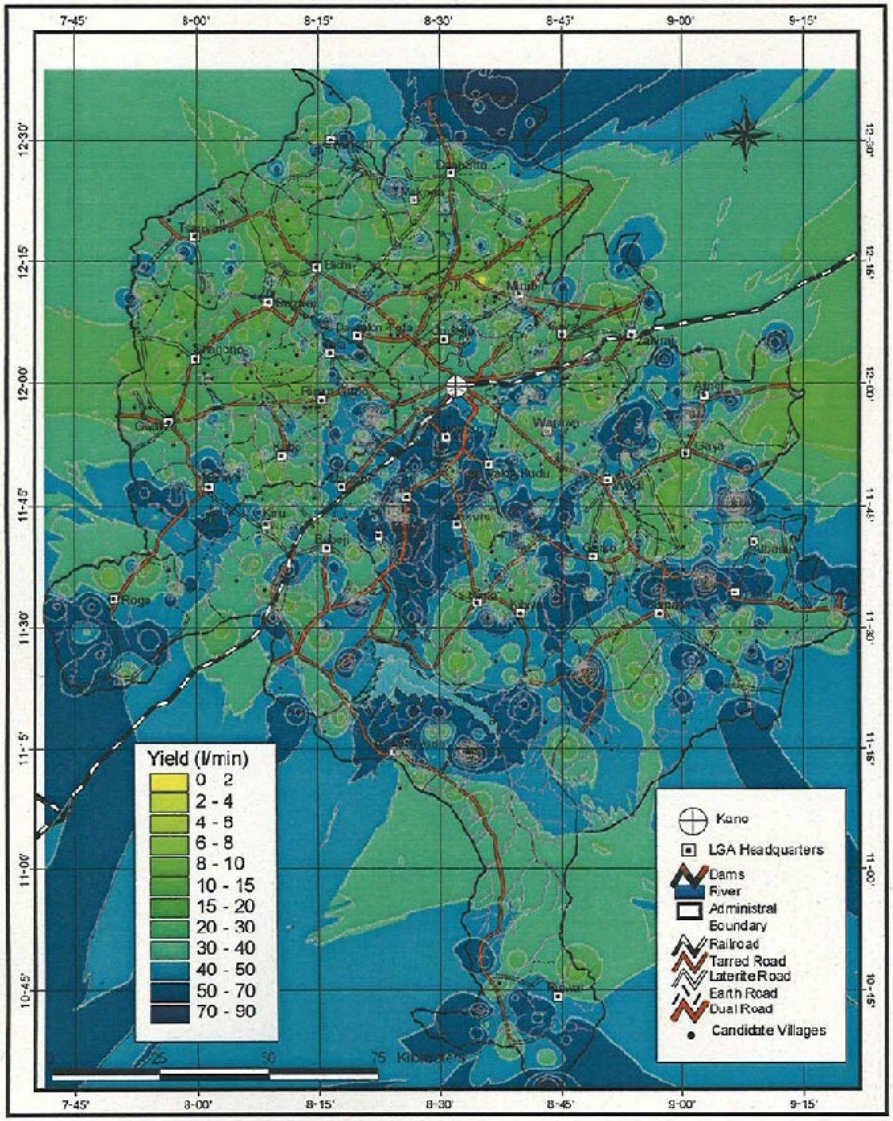


Figure F-6 Ground Water Yield in Kano State

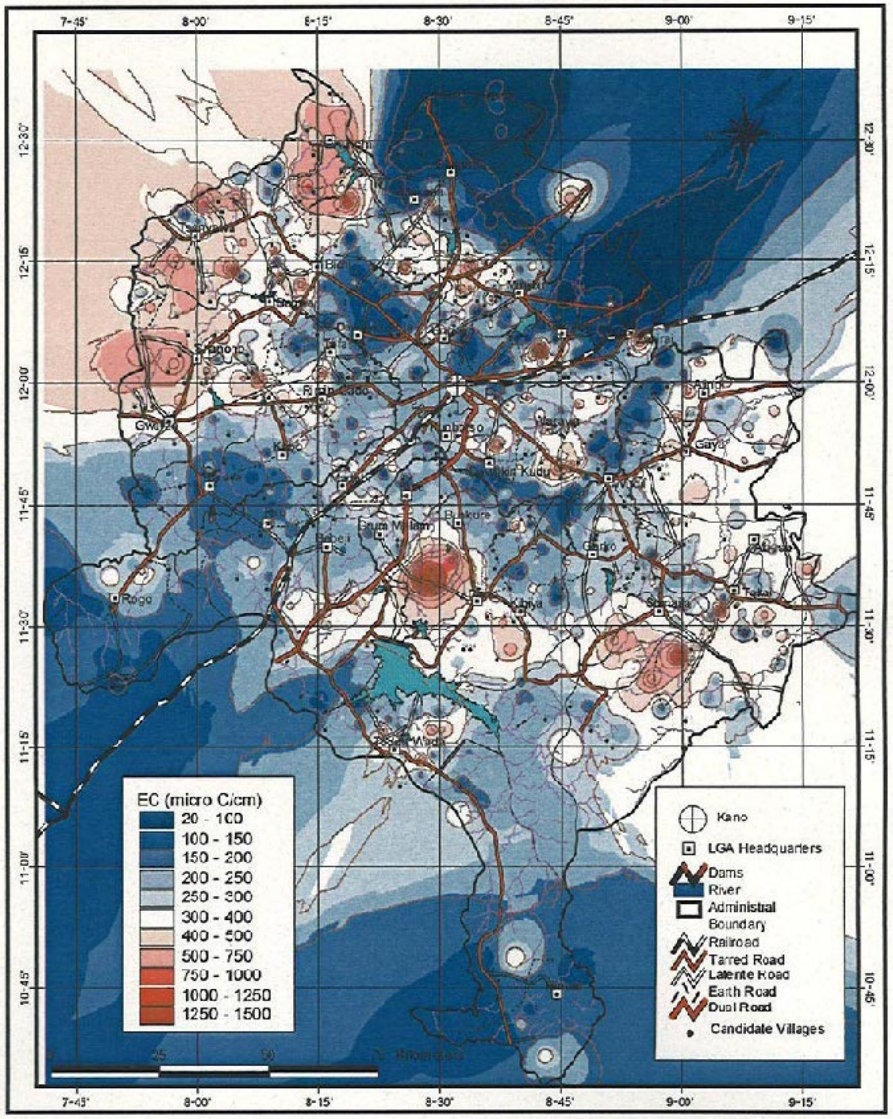
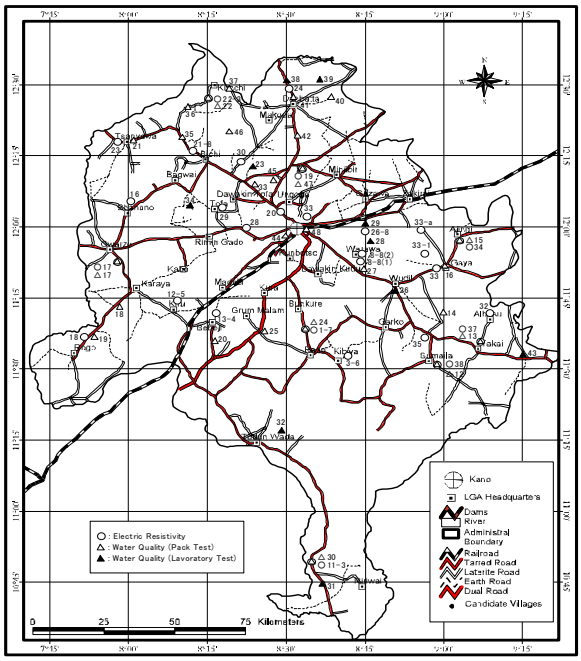


Figure F-7 Electrical Conductivity in Kano State

7. Results of Water Quality Analysis

Appendix 7. Results of Water Quality Analysis

The simplified measurements carried out in the project area and the results of water quality analysis attained from the water quality analysis organization are shown in Table G-1. The locations at which the samples were collected are shown in the figure in right side.



Location map of sampling point for water quality analysis

Simplified measurement: Pack Test was used to measure Fe, Mn, NO_3 and Cl. And simultaneously, Temperature, Electric Conductivity (EC), TDS, and salt content were measured by the simple measurement equipment (Hach Senion 5) (refer Table G-2).

The results of pack test showed that the levels of Mn and Cl were within the measurable limits, but the levels of Fe were higher than the WHO standards in many locations. Nitrate ($NO_{3),}$ which indicates the artificial contamination, was relatively a high level but was below the permissive level. The high level of NO_3 indicates the possibility of contamination of water sources. The values of Total Dissolved Solids (TDS) were below permissive level as a whole; however the TDS values were above the standard level of 1,000mg/l in some areas.

Results of laboratory analysis: 10 water samples were collected from the wells where the simplified measurements were carried out and their water quality analysis were carried out. Although heavy metals etc. which affect the human health were not found, some of the levels of Fe, Mn, Mg and turbidity did not satisfy the water quality standard. And Bacillus coli were also found in half of the locations and artificial contamination of water source were confirmed.

Table G-1 Results of Groundwater Quality Analysis in Kano State

	Sample No.	LGA Name	Longitude	Latitude	In-situ Data				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
					Temp.	EC	TDS	Salinity	Turbidity (Appearance)	Odor	Color	Temp.	pH	Phosphate	T.D.S	Manganese	Calcium	Magnesium	Chloride	Nitrate	Nitrite	Fluoride	Sulfate	Total Iron	Arsenic	Electric Conductivity	No. of Coliform
					^{0}C	µC/cm	mg/l	‰	NTU	Dilution factor	Hazen	^{0}C	-	mg /L	mg /L	mg Mn/L	mg Ca/L	mg Mg/L	mg Cl/L	mg NO_3/L	mg NO_3/L	mg F/L	mg SO4/L	mg Fe/L	mg /L	µS/cm	no/100mg
26	1		8.50472	11.47567	29.5	226	108.2	0.1	29.7	Odorless	10	27.0	6.6	ND	84	ND	14	5.48	17.77	3.1	ND	ND	12.0	0.70	ND	140	ND
28	2		8.46270	11.58355	29.5	242	116.1	0.1	6.4	Odorless	5	27.0	6.6	ND	96	ND	14	4.9	22.70	2.5	ND	ND	27.0	0.50	ND	160	12
29	3		8.45542	11.59243	29.8	180	86.1	0.1	0.7	Odorless	5	27.0	6.4	ND	89.4	ND	13	3.3	12.31	1.3	ND	ND	23.0	ND	ND	149	ND
31	4		8.26526	11.15005	27.7	50	23.3	0.0	130	Odorless	50	28.0	6.0	ND	114	ND	5	4.5	5.92	3.0	ND	ND	ND	ND	ND	190	ND
32	5		8.22146	12.09029	28.8	279	134.0	0.1	4.2	Odorless	5	28.0	7.2	ND	126	10.0	32	8.8	23.69	6.5	0.2	ND	ND	ND	ND	210	9
23	6		7.59310	12.17545	27.6	74	74.3	0.1	5.2	Odorless	5	27.0	6.6	ND	69	2.73	10	2.7	8.39	10.5	0.2	ND	ND	ND	ND	115	ND
34	7		8.11072	12.07036	29.6	630	306.0	0.3	12.6	Odorless	5	27.0	7.0	ND	126	ND	81	11.0	72.05	11.0	0.06	ND	8.0	1.20	ND	210	34
38	8		8.38037	12.33323	30.5	131	62.4	0.1	90	Odorless	50	27.0	6.4	ND	46.2	11.28	81	11.3	12.83	5.5	0.2	ND	ND	ND	ND	77	5
39	9		8.30535	12.25412	31.6	109	52.0	0.0	61.5	Odorless	30	28.0	6.3	ND	37.2	3.29	7	3.3	11.84	8.0	0.15	ND	ND	0.70	ND	62	ND
43	10		9.15271	11.32295	30.3	1,730	864.0	0.9	40	Odorless	30	27.0	6.0	ND	708	ND	18	43.8	210.23	30.0	0.16	ND	46.0	2.00	ND	1,180	4
	WHO Standards								5-25(NTU)	2	5-50	-	6.5-8.5	-	1,500	≤0.1	≤100	≤30	≤350	≤44.3	-	≤1.5	≤500	0.95		-	ND

Table G-2 Results of Groundwater Quality Analysis by Simplified Measurement

Sample No.	Longtitude	Latitude	1	2	3	4	5	6	7	8
			Fe	Mn	No3	Cl	Temp.	EC	TDS	Salinity
			mg/l	mg/l	mg/l	mg/l	^{0}C	μC/cm	mg/l	‰
1	8.08156	11.71679	<0.2	<0.5	2	<10	28.1	582.0	282	0.3
2	8.80025	11.41902	<0.2	<0.5	<1	<10	26.8	309.0	149	0.1
3	8.66301	11.52914	2	<0.5	20	<10	29.1	776.0	378	0.4
4	8.16678	11.88333	2	<0.5	1	<10	29.4	89.2	187	0.1
5	8.00167	11.78354	<0.2	<0.5	<1	<10	29.8	121.3	58	0.1
6	7.82515	11.54012	<0.2	<0.5	<1	<10	27.5	112.1	53	0.0
7	7.98336	12.03356	<0.2	<0.5	1	<10	30.5	645.0	314	0.4
12	8.57305	11.32216	3	<0.5	1	<10	-	-	-	-
13	9.06251	11.34027	3	<0.5	1	<10	-	-	-	-
14	9.08056	11.40153	3	<0.5	2	<10	-	-	-	-
15	8.59535	11.51450	5	<0.5	30	<10	-	-	-	-
16	8.59387	11.51460	3	<0.5	<1	<10	-	-	-	-
17	7.58195	11.52414	3	<0.5	20	<10	28.2	920.0	455	0.5
18	7.53057	11.37424	3	<0.5	30	<10	28.9	1258.0	621	0.6
19	7.53045	11.37405	3	<0.5	10	<10	27.7	276.0	132	0.1
20	8.15305	11.36167	5	<0.5	30	<10	28.7	344.0	1620	0.2
21	7.59310	12.17545	5	<0.5	2	<10	30.1	169.8	81	0.1
22	7.59310	12.17545	5	<0.5	15	<10	30.5	184.1	88	0.1
23	7.59310	12.17545	5	<0.5	5	<10	27.6	73.8	74	0.1
24	8.36477	11.35317	5	<0.5	5	<10	29.5	285.0	137	0.1
25	8.29528	11.49251	5	<0.5	30	<10	29.1	680.0	332	0.3
26	8.50472	11.47567	7	<0.5	<1	<10	29.5	226.0	108	0.1
27	8.42166	11.53377	2	<0.5	1	<10	29.7	89.5	42	0.0
28	8.46270	11.58355	2	<0.5	<1	<10	29.5	242.0	116	0.1
29	8.45542	11.59243	2	<0.5	1	<10	29.8	180.0	86	0.1
30	8.38353	10.39574	2	<0.5	<1	<10	28.9	13.3	6	0.0
31	8.26527	11.15005	5	<0.5	<1	<10	27.7	49.6	23	0.0
32	8.22147	12.09029	2	<0.5	<1	<10	28.8	279.0	134	0.1
33	8.11072	12.07036	2	<0.5	<1	<10	30.2	83.1	39	0.0
34	8.11072	12.07036	2	<0.5	1	<10	29.6	630.0	306	0.3
35	8.18016	12.30169	2	<0.5	<1	<10	31.8	286.0	138	0.1
36	8.18016	12.30169	2	<0.5	<1	<10	30.5	176.3	84	0.1
37	8.18016	12.30169	3	<0.5	2	<10	30.8	581.0	282	0.3
38	8.38037	12.33323	5	<0.5	1	<10	30.5	131.1	62	0.1
39	8.30535	12.25412	5	<0.5	<1	<10	31.6	109.4	52	0.0
40	8.30535	12.25412	2	<0.5	1	<10	29.1	298.0	143	0.1
41	8.30531	12.25413	2	<0.5	2	<10	30.2	62.5	29	0.0
42	9.15271	11.32298	2	<0.5	2	<10	29.1	966.0	474	0.5
43	9.15271	11.32295	3	<0.5	2	<10	30.3	1730.0	864	0.9
44	8.58059	11.36365	3	<0.5	<1	<10	29.1	319.0	154	0.1
45	8.18274	12.18069	2	<0.5	<1	<10	-	-	-	-
46	8.18276	12.18063	2	<0.5	<1	<10	-	-	-	-
47	8.18425	12.18386	2	<0.5	1	<10	-	-	-	-
48	8.33337	12.12512	2	<0.5	<1	<10	-	-	-	-
WHO Standard			0.3	0.1	50	250.0	-	-	1000	-

8. Results of Social Conditions Survey

Appendix-8 Results of Social Conditions Survey

1. Overview of the Survey

Social Conditions Survey was conducted in the project villages as shown below;

Social Conditions Survey

Survey	Method	Place & Respondents	Contents/Topics
Village Survey	Questionnaire	302 villages (1 respondent per village)	Existing water supply facilities, Health, Sanitation/hygiene, VWESC condition and O&M fee etc.
Household Survey	Questionnaire	2 households per village (1 male & 1 female)	Household economic conditions, Consciousness towards VWESC and O&M etc.
Supplementary Survey	Interview Group Discussion Observation	15 villages in 38 LGA	Existing water supply fcilities, Health, Sanitation/hygiene, VWESC conditions and O&M fee, Villagers' consciousness to participate in the activities, Social conditions, Economic conditions, Women's conditions etc.

Village survey and household survey were carried out by enumerators. They interpreted the questionnaires into the local language and recorded the respondents' answers in English.

Respondents of Village survey were village leaders and elders who knew well about their villages, since the questions included indicators of the project effects such as conditions of existing water supply facilities (type, distance, water quality, and water quantity etc.), conditions of water borne disease which residents hava frequently, problem of water supply, and establishment and activity of VWESC etc.

Household survey includes questions on economic conditions in each household, health, and sanitation/ hygiene conditions, existing water supply conditions, willingness to participate in VWESC, social conditions, women's conditions in Islamic area etc. One man and one woman were selected randomely in each village as the respondents of household survey, considering the richness and gender to reflect different ideas on issues of water, health, sanitation/hygiene, and family life.

In supplementary survey, the study team member, who was in-charge of social-conditions survey, visited 15 villages in 38 LGA, and carried out key-informant interviews to village leaders, community leaders, and women, etc. Group discussions were also held in 2 villages. Most residents in Kano state are puritanical Muslim, and

therefore, it was difficult to interview married women. Considering this situation, the interview to women was carried out through interpreter of LGA staff accompanied by their husband inside each household. Supplementary survey was conducted to understand the voice of villagers which was not included in the questionnaire. The questions in supplementary survey are as follows: importance of water in people's life, health conditions, knowledge or consciousness of health and sanitation/hygiene, idea towards VWESC, condition of water sources, and conditions of fetching water etc.

Some of the 308 project villages were consolidated after 2001. Therefore, the number of target villages turned out to be 302 upon implementation of the survey.

2. Survey Results

2.1 General Conditions of the Project Village and Life of Village

There are 44 districts in Kano state and each district is composed of villages and towns. A Village consists of several community or ward. A project village is composed of 10 to 15 communities, in average and a community is composed of 20 to 30 households. The average population of a project village is about 2,700 and female population is slightly higher than the male population. In a village, there are about 1,200 males and about 1,500 females. It is because most of the residents of Kano state are puritanical Muslim where one man can have up to 4 wives. It is common that a household in Kano state consists of a husband, 2 to 3 wives, 8 to 10 children, which sum up to10 to 30 members per household. According to household survey result, an average household consists of a husband, 2 wives, and 8 children, with a total of 12 members.

Muslim characteristics is observed in relations between from social conditions, lifestyle, water and sanitation/hygiene conditions. Houses are made of sun dried brick, straw, clay etc. and are surrounded by tall walls. Interior of a house is not seen from outside. A barn for donkey which carries burden is located near the entrance and a granary to keep foods and shed for livestock is located in the center of house. Rooms, water supply, latrine and kitchen are located facing the wall on the right and left of the entrance. Kitchen and latrine are often located near the storage of water supply.

In the project villages, 96% of the households have private latrine, mostly traditional pit type. Through supplementary survey, it was confirmed that some of the latrine was only a separated space within a room. 70% of village leaders agreed to construct a public latrine. Over 90% of them think that they can pay money for the construction of latrine if the cost is under N100 to N300. However, most of the respondents think that

a latrine should be constructed in each household by residents in consideration of the responsibility of operation and maintenance.

Most respondents wash their hands using water and soap before eating and after using latrine, since they have religious custom to wash before their prayer 5 times per day. According to the result of supplementary survey, they also clean up the house including latrine a few times per day. However, their consciousness of sanitation/hygiene is still low, since the conditions of scattered dung can be observed in front of the house, poor drainage of hand pump borehole, dirt of containers for fetching and storing water. Trainings are needed to improve their awareness on sanitation/hygiene condition.

Most residents of the project village live on farming; they cultivate crops such as sorghum, millet, and maize, and vegetables. They also rear livestock including cattle, goat, and chicken. Their average monthly income is about N15,000. In some southern areas, rice is cultivated using irrigation system. However in most of the project villages, people depends on rain water, and therefore the farmers' busiest season is the rainy season from May to September. The harvest is carried out in once a year. Villagers preserve self-sufficient grains in the granary of their house, and they earn cash by selling the surplus grain in the market. Fishery is another way of earning cash in some project villages near river or pond. Their average monthly expenditure is about N9,000. Its average breakdown is about N5,000 for food, about N2,000 for clothes, about N900 for water and sanitation/hygiene, and about N1,000 for health. They usually buy their necessaries in rural market or Kano city market.

Married women are not generally allowed to go outside of the house, and hence men are in-charge of the economic activities such as agriculture and livestock, fetching firewood, repairing house, repairing rural road, and buying necessaries. Women's activities are limited to activities inside house, such as: taking care of children, cleaning up room, washing clothes, cooking, and taking care of livestock.

It is common that men and children fetch water two times per day in morning and evening in this area. According to the result of household survey, men are in charge of fetching water by 58%. Children also fetch water before and after going to school, 52% of which are boys and 28% are girls.

Taking Charge of Fetching Water

Person of family	%
Man	58%
Woman	2%
Boy	52%
Girl	28%
Other	1%
No answer	4%

According to the hearing from women in the supplementary survey, the housekeeping are still hard work for them although women

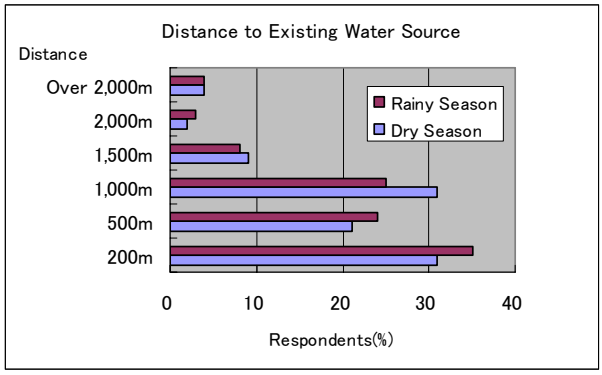
hardly fetch water. According to the result of household survey, working hour for housekeeping is on an average of 3 to 5 hours per day. However, big households need over 6 hours per day for housekeeping. For example, they wash clothes a few times (2 to 3 times) per week. They spend on an average of 2 to 3 hours for washing, and the ratio of washing in daily working hours is high. Women are in-charge of water and sanitation/hygiene through activities such as cooking, washing clothes, clean up room, and taking care of the family, although they do not have any opportunity to learn about them. Therefore, women are eager to attain education on hygiene.

2.2 Existing Water Resource and Health and Sanitation/Hygiene Conditions

Existing water resources used in village is almost the same in the rainy and dry seasons. The distance to existing water resources is from 200 to 1,000 m, this is because 40% of project village already have hand pump borehole, and over 80% of project village have private dug wells or public dug wells constructed by LGA.

Existing Water Sources

Water Sources	Ratio within Dry season (%)	Ratio within Rainy season (%)
Borehole	36%	38%
Dug well	86%	85%
Pond	10%	8%
Stream/River	8%	13%
Rain water	1%	12%



However, some residents who use water from river or pond answered that fetching distance of water is over 2 km. In supplementary survey one resident answered that he fetches water from existing hand pump borehole which is 5 km off for getting safe water. In this case, adults including married women carry the water container such as jelly can using bicycle, donkey, and two-wheeled cart because it is too heavy for children to carry.

Most residents use plastic bucket or jelly can to fetch water, and clay pot or plastic container to store water. The common size of container to fetch water is 20 to 25 litres. Residents usually wash this container when they fetch water everyday. However they hardly clean up container to store water in their house. According to the result of household survey, one household uses about 120 litres per day for their daily use. Therefore, they have to fetch water 6 times per day when they use 20 litres jelly can. Over 50% of the respondents answered that there are “no problem” about quality and quantity of existing water resources in rainy season. However, in dry season the number of respondents who answered that there are “problem” increases.

This social conditions survey was conducted in rainy season. However, in supplementary survey, water taken from existing water resources was checked by a study team member. It contained floating algae and was difficult to say as “no problem” the most common reason indicated by the people who answered “water quality is problem” was turbidness, most residents answered that they do not boil nor filter the water, and they drink directly.

Amount and Quality of Existing Water Resouces

Rainy Season	%
Good	9.9%
No problem	59.6%
Problem	26.8%

→

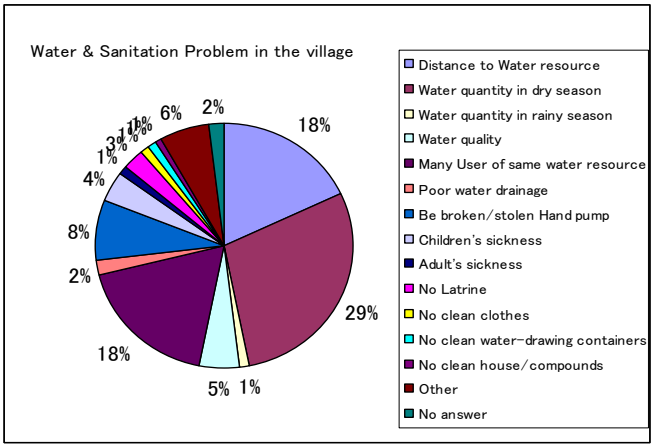
Problem	%
Amount	3.7%
Color	74.1%
Smell	9.9%
Taste	7.4%

Dry Season	%
Good	3.5%
No problem	34.3%
Problem	58.4%

→

Problem	%
Amount	38.0%
Color	69.4%
Smell	8.2%
Taste	8.2%

According to the result of village survey, most respondents answered that the biggest problem of village is water and sanitation/hygiene, and over 80% of them recognized the problem. About 50% of the respondents answered that the next problem is health. The same results were observed in the household survey. In regard to this issue, there was no difference of recognition between men and women.



Besides, through the analysis of village survey, household survey and supplementary survey, it was found that most of the residents recognize problem of water shortage or distance to water resources a serious problem through their responses such as “water quantity in dry season”, “number of people who use same water resources”, “water quantity in rainy season”, and “distance to water resources”.

Many kinds of water borne diseases such as malaria, dysentery, diarrhea, cholera, typhoid etc. were found in the project villages. Most respondents recognized that water borne diseases happen because of “unsanitary water” or “unsanitary food”. Over 50% of them recognize that “clean water”, “improvement of sanitation/hygiene condition” prevent those diseases. They also have knowledge of water treatment such as “boiling water”, “Using filter” and “using antiseptic” for their health. However, they do not actually treat the water properly because of reasons such as shortage money to buy firewood. Therefore, water borne diseases often occur. The residents demand to get safe water from near place in sustainably by constructing new water supply facility is very high.

2.3 VWESC and O&M for Borehole

About 40% of the project villages already have borehole facilities. However, only 4% of the villages have organized VWESC. Even in villages which have these kind of community organizations, most of them are not proper VWESC. They are often traditional self-help community organization is in-charge of water management or health and sanitation/hygiene activity. Very few people operate and maintain the boreholes.

Presence of VWESC

VWESC	%
Existing.	4%
Existing but not operating	16%
Will be established	47%
Never existed	29%
No answer	5%

It is uncommon to regularly collect money for O&M of boreholes. They only collect money before construction as initial contribution or when borehole is broken as repair cost. In the village where there is proper functioning of O&M, they collect N 100 to 200 as the initial contribution from resident who can pay, and the residents who can not pay money usually contribute their labor for preparation work to construct the borehole. They collect a water charge of N30 to 100 per month. The water charge is set according to the capacity of payment in each community.

Frequency of Water O&M Fee

Frequency of Payment	%
Monthly	91.6%
Weekly	0.4%
When borehole broken	3.8%
Yearly	3.8%
No answer	0.4%

The villages where VWESC was organized but not functioning is 16% of the project villages. This condition exists because most residents could not pay money for O&M of borehole, and they depend on their neighbors who has more income or on LGA to repair the borehole. Therefore their borehole has been left un-repaired for a long time. According to the result of village survey, over 50% of the respondents answered that they “can not bear the cost for O&M”.

Initial Contribution for Construction

Initial Contribution	%
Abt. N100	28.5%
Abt. N200	42.6%
Abt. N300	24.0%
Abt. N400	0.4%
Abt. N500	0.4%
Over N500	0.8%
Donate (labor, material, etc)	0.8%
Don’t know	1.1%
No answer	1.5%

Willingness to Pay O&M Fee

O&M Fee (monthly)	%
Abt. N20	9.5%
Abt. N30	19.4%
Abt. N40	28.1%
Abt. N50	28.5%
Abt. N60	0.0%
Abt. N100	3.0%
Over N100	7.6%
Donate (labor, material, etc)	1.5%
Don’t know	0.8%
No answer	1.5%

47% of the project villages answered that they don't have VWESC but they plan to organize it in order to carry out O&M of borehole facilities. Most respondents agree to pay water charge monthly. The results of village surreys indicates that the villages can afford is N100 to 300 as initial contribution and N 30 to 50 as monthly water charge.

In the supplementary survey, most residents answered that they could pay an average cost of N20 to 50 per month. In group discussion, some residents proposed that the payment should be made depending on the capacity.

O&M cost for one borehole (average number of beneficiaries: 360 persons) is estimated to be N26,500 per year. This amount is equivalent to N74/person/year, and one household (assumed to have 12 persons per one household) has to pay about N900/year. According to the result of household survey, monthly average expenditure is about N9,000 per household, Out of which water and sanitation cost in average is N900. Therefore, about N75/household/month is not impossible for the O&M cost of borehole.

However, some residents can not pay money for O&M every month. The residents have to discuss with VWESC members about amount of payment, way of payment, contribution of labor work, and payment during harvest period of cash crops, etc. In the supplementary survey, residents answered that O&M by residents with VWESC members will be possible, if they are given appropriate training by RUWASA or LGA.

The villages which do not have VWESC and do not have a plan to organize VWESC in future counts to 29% of the project villages. The ratio increases to 36% in the household survey. Most residents answered as "No money to contribute", and some residents answered as "No interest" or "Government's responsibility" as the reason. The request such as "We want to attain safe water from nearby place" is very strong. However, their ownership of water supply facility and consciousness of participation for O&M are not enough, and they tend to depend on people with a high income or on the government. In order to gradually change the consciousness of the residents and to perform sustainable O&M, it is necessary to carry out the strengthening of organization of VWESC, and continue activities such as hygiene education by RUWASA with LGA.

2.4 LGA's Assistance Condition to VWESC

Most existing boreholes in the project villages were established by LGA or State Government. Some of them were established by communities. Most of the public dug wells were established by LGA. In Kano State, O&M of borehole should be carried out

by residents of community. Therefore, in case of establishment of borehole by government, each community has to organize a VWESC. The staff of water supply sector in State government or LGA has the responsibility to support improvement of water supply and should regularly check and repair the existing borehole of communities. The staff of health sector in LGA has the responsibility to give trainings to improve the health and sanitation/hygiene condition to residents in communities.

However, according to the result of village survey, only 26% of respondents answered that they have experience of training and development activity by government staffs. 63% of respondents had no experience of any training activity. Most of these training activities were conducted by LGA.

Experience of Mobilization & Sensitization Activity

Mobilization and Sensitization Activity	%
Yes	26%
No	63%
No answer	11%

When RUWASA constructs water supply facility, daily training activity for sustainable O&M by residents is carried out by LGA. For the sustainable O&M of water supply facility, RUWASA has to conduct the training of community organized and educational activity in collaboration with LGA.

3. Summary

From three kinds of social conditions surveys, it is evident that there is “Necessity of sustainable safety water” in the project village. The social-condition survey was conducted in August during rainy season, and the existing water recourses had moderate quantity of water. However, it was difficult to say that the quality and quantity of the water was “safe water” or “no problem”. Those water resources dry up in dry season and therefore, the residents have to go to away far distances to fetch water, and it is rare that the quality and quantity of water is enough. Some communities prepare a reservoir or a tank, and buy water from the water seller in Kano city. Considering such situation, most residents recognize that "water and sanitation/hygiene" is one of the biggest problems in their community, and it is thought that the degree of water poverty of the project village is very high. Also, water borne diseases such as cholera, diarrhea, and dysentery occur frequently in the project village. Especially, the occurrence tend to be very high when amount of water runs short at the beginning of rainy season, in June, and in the beginning of dry season, in October. The residents recognized that one of causes of the diseases is “unsanitary water”, and they are now eager for safe water to be supplied stably by construction of a new water supply facility (borehole).

However, the residents have little consciousness of ownership and O&M for the water supply facilities in project village, and they tend to depend on residents with high income or the government. There are some points which should be improved about the treatment method of drinking water or hygiene and low consciousness of residents on water sanitation. Furthermore, it also became clear that LGA and State Government did not carry out enough training and development activity or hygiene education etc. to the residents. In order to achieve “Stable supply of safe water", the residents who are users must continuously operate and maintain the water supply facility.

It will take a long time to change the old consciousness of the residents and to bring new activities for O&M of borehole. Therefore, RUWASA, which is the implementing organization of the project, should understand the living conditions of the residents, and it is necessary to train the people to organize a VWESC, O&M of boreholes, and provide hygiene education etc. in cooperation with LGA.

Village Survey to village representative

Village No._____ Village name _____ LGA _____

Enumerator_____ Respondent_____ (Respondent's) Position _____

A : Basic Questions

A1. Village Population: Total_____ / male (_____), female (_____)

A2. Total number of households:_____

A3. How are people getting income mainly by?

a. Agriculture b. Livestock c. Fishery d. Sale other item e. Labor work

f. Other ( )

A4. How much of average income can people get?

N _____/month

A5. How much products do people sell per year for income?

Agricultural products :

a-1. Yam (_____ /year) a-2. Maize (_____ /year)

a-3. Beans (_____ /year) a-4. Other : _____ (_____ /year)

Livestock products :

b-1. Chicken (_____ /year) b-2. Cow (_____ /year)

b-3. Goat (_____ /year) b-4. Other : _____ (_____ /year)

Fishery products :

c-1. Fresh water fish (_____ /year) c-2. Other: _____ (_____ /year)

Main sales Item :

d-1. Charcoal (_____ /year) d-2. Other: _____ (_____ /year)

A6. How much do people spend per month?

Average: N _____ /month

A7. How much do people spend for;

a. Food: N _____ /month

b. Clothes: N_____ /month

c. Water-related issues/matters (O&M, Buy Water, Jelly can, etc) N _____ /month

d. Sanitation and hygiene-related issues/matters (latrine construction, etc) N _____ /month

e. Health-related issues/matters (medicine, hospital, etc) N _____ /month

A8. Where do people buy necessities?

a. Rural Market b. City Market c. Peddler d. Other ( )

A9. What are the problems that people in village are facing every day?

a. Water & Sanitation b. Financial problem c. Education d. Health care

e. Other ( )

A10. What kind of Water & Sanitation problem does the village have?

(Circle (○) the ones that apply. Worst 3 problems)

a. Water source is too far

b. Little water in dry season

c. Little water as resource even in rainy season

d. Water quality is bad ⇒ d-1. Smell d-2. Color d-3. Taste d-4. Other ( )

e. Too many people use the same water resource

f. Poor water drainage

g. Be broken/stolen Hand pump

h. Many children are usually sick ⇒ (Ex. : _____)

i. Many adults are usually sick ⇒ (Ex. : _____)

j. Latrine: None/Too few

k. No clean clothes

l. No clean water-drawing containers

m. No clean house/compounds

n. Other ( )

B. Questions about Health Condition

B1. What kind of diseases did your village have for the last one year?

a. Cholera b. Guinea worm c. Malaria d. Diarrhea e. Typhoid

f. Dysentery g. Other ( )

B2. What are the causes of the diseases?

a. Dirty water b. Irregular weather c. Bad people d. Unsanitary food

e. Other ( )

B3. How did people cure the diseases?

a. Self treatment b. Local doctor c. Mosque/Church d. Hospital

e. No treatment f. Other ( )

B4. How the people can prevent diseases?

a. Clean water b. Good sanitary condition c. Good medicine

d. Other ( )

B5. Where do you think the patients should be treated?

a. Hospital b. Mosque/Church c. Local clinic d. Traditional treatment

e. Specialist of water-born diseases f. Other ( )

B6. What kinds of Medical facilities are in the village? (Please write the numbers.)

a. Hospitals _____ b. Clinics _____ c. Dispensaries _____

d. Health Center _____ e. Drug Shops_____ f. Traditional Doctors_____

C. Questions about Water Supply

C1. What is the main drinking water source in rainy season?

a. Borehole b. Dug Well c. Pond d. Stream/River

e. Rain Water f. Other ( )

C2. How far is a main water source from center of village in rainy season?

a. 200m b. 500m c. 1000m d. 1500m e. 2000m

f. Over 2000m

C3. How is the water quality of main source in rainy season? If "Bad", please choose the reason.

a. Good b. OK c. Bad ⇒ 1. Water amount 2. Color 3. Smell 4. Taste

C4. What is the main drinking water source in dry season?

a. Borehole b. Dug Well c. Pond d. Stream/River

e. Rain Water f. Other ( )

C5. How far is the main water source from center of Village in dry season?

a. 200m b. 500m c. 1000m d. 1500m e. 2000m

f. Over 2000m

C6. How is the water quality of main resource in dry season?

a. Good b. OK c. Bad ⇒ 1. Water amount 2. Color 3. Smell 4. Taste

C7. What kind of facility do people use to carry the water from water source?

a. Jelly can b. Plastic Bucket/Bowl c. Clay pot d. Calabash

e. Iron Pail f. Other ( )

C8. What kind of facility do people use to store the water?

a. Drum b. Plastic Container c. Clay Pot d. Clay pots fitted with taps

e. Buckets fitted with taps f. Calabash g. Other ( )

C9. How do people treat the water before drinking?

a. Boil b. No treatment c. Other ( )

D. Questions about Water & Sanitation/Hygiene

D1. Is there household or public latrine in the Village? a. Yes b. No

D2. What type of household latrine or public use latrine is in the village?

a. Traditional Pit Latrine b. Improved Traditional Pit Latrine

d. Ventilated Improved Pit Latrine e. Other ( )

D3. How do people dispose of the excreta from the facilities?

a. Bush b. Stream/River c. Pit latrine d. Gutter

e. Court yard/House surrounding f. Other ( )

D4. Do people wash their hands after using the latrine?

a. Yes b. No

D5. What type of ownership of latrine is preferred in your village?

a. Village ownership b. Private ownership c. Private compound ownership (Group)

d. Other ( )

D6. Would you be willing to build a public latrine?

a. Yes b. No

D7. (If yes) How much would you contribute for construction of the latrine?

a. less than N100 b. less than N200 c. less than N300

d. less than N400 e. less than N500 f. over N500

D8. (If No) Why would you not support a public latrine?

a. No money to contribute b. No interest c. Former efforts

d. Government responsibility e. Other ( )

D9. Do people wash their hands before eating?

a. Yes b. No

E. Questions about Public Participation

E1. Did/Does village have VWESC (Village Water & Environment Sanitation Committee)?

a. Yes, It was organized in (When _____) and still exists.

b. Yes, It was organized in (When _____) but dose not exist now.

c. No, but it will be organized in (When _____).

d. No, it will not be organized.

E2. (If “a”) How much money does household pay as an initial contribution?

a. about N100 b. about N200 c. about N300 d. about N400

e. about N500 f. over N500 g. None h. don’t know

i. donate (labor, material, etc)

E3. (If “a”) Did/Does people pay money regularly for O&M?

a. Yes b. No

E4. (If “Yes”) How much money did/does each household pays regularly for Water cost (O&M) per month?

a. about N20 b. about N30 c. about N40 d. about N50

e. about N60 f. about N100 g. over N100 h. None

i. don’t know j. donate (labor, material, etc)

E5. (If “b”) Why does VWESC not exist?

a. No money to O&M b. No knowledge for O&M c. No service from LGA

d. Other ( )

E6. (If “c”) How much money will household pay as an initial contribution?

a. about N100 b. about N200 c. about N300 d. about N400

e. about N500 f. over N500 g. None h. don’t know

i. donate (labor, material, etc)

E7. (If “c”) How often will each household pay the water cost (O&M)?

a. Monthly b. weekly c. When boreholes brake

d. Other ( )

E8. (If “c”) How much money will each household pay regularly for Water cost (O&M) per month?

a. about N20 b. about N30 c. about N40 d. about N50

e. about N60 f. about N100 g. over N100 h. None

i. don’t know j. donate (labor, material, etc)

E9.(If “d”) Why will you not have VWESC?

a. No money to contribute b. No interest c. Former efforts

d. Government responsibility e. Other ( )

E10. (If money will be/is collected regularly) Who does/will collect the money for VWESC?

a. Village Chairman b. VWESC leader c. Accouter of VWESC

d. Other ( )

E11. (If money will be/is collected regularly) Who does/will keep the money for VWESC?

a. Village Chairman b. VWESC leader c. Accouter of VWESC

d. Other ( )

E12. Does/Did the village receive service of O&M or Sanitation/hygiene Education?

a. Yes b. No

E13. (If “Yes”) Who did/does support to Village?

a. LGA b. State Government c. NGO d. Other ( )

F. Questions about Others

F1. Do you have projects by other donor or NGO?

a. Yes b. No

F2. (If “Yes”) What kind of project?

a. Water supply & Sanitation b. Education c. Health

d. Infrastructure (Ex. Road construct) e. Other ( )

F3. (If “Yes”) Who is operation the project?

a. UNICEF b. NGO ( ) c. Other ( )

Household Survey to village residents

Village No. _____ Village name _____ LGA _____

Enumerator_____ Respondent_____ Age _____

Sex: 1. Female 2. Male

A : Basic Questions

A1. Household Composition (number):

Total_____/ Male ( ), Female ( ) / Boys ( ), Girls ( )

A2. What kind of problems does your family have?

a. Water & Sanitation b. Low Income c. Education d. Health care

e. Other ( )

A3. How are you getting income mainly by?

a. Agriculture b. Livestock c. Fishery d. Sale other item

e. Labor work f. Other ( )

A4. How much of average income can you get?

N _____/month

A5. How much product s do you sell per year for income?

Agricultural products :

a-1. Yam (_____ /year) a-2. Maize (_____ /year)

a-3. Beans (_____ /year) a-4. Other : _____ (_____ /year)

Livestock products :

b-1. Chicken (_____ /year) b-2. Cow (_____ /year)

b-3. Goat (_____ /year) b-4. Other : _____ (_____ /year)

Fishery products :

c-1. Fresh water fish (_____ /year) c-2. Other: _____ (_____ /year)

Main sales Item :

d-1. Charcoal (_____ year) d-2. Other: _____ (_____ /year)

A6. How much does your family spend per month?

Average: N _____ /month

A7. How much does your family spend for ;

a. Food: N _____ /month

b. Clothes: N_____ /month

c. Water-related issues/matters (O&M, Buy Water, Jelly can, etc) N _____ /month

d. Sanitation and hygiene-related issues/matters (latrine construction, etc) N _____ /month

e. Health-related issues/matters (medicine, hospital, etc) N _____ /month

A8. Where does your family buy necessities?

a. Rural Market b. City Market c. Peddler d. Other ( )

A9. What kind of Water & Sanitation problem does the village have?

(Circle (○) the ones that apply. Worst 3 problems)

a. Water source is too far

b. Little water in dry season

c. Little water at the souse even in rainy season

d. Water quality is bad ⇒ d-1. Smell d-2. Color d-3. Taste d-4. Other ( )

e. Too many people use the same water resource

f. Poor water drainage

g. Be broken/stolen Hand pump

h. Many children are usually sick ⇒ (Ex. : _____)

i. Many adults are usually sick ⇒ (Ex. : _____)

j. Latrines: None/Too few

k. Not clean clothes

l. Not clean water-drawing containers

m. Not clean house/compounds

n. Other ( )

B. Questions about Health Condition

B1. What kind of diseases did your family have for the last one year?

a. Cholera b. Guinea worm c. Malaria d. Diarrhea e. Typhoid

f. Dysentery g. Other ( )

B2. What are the causes of the disease?

a. Dirty water b. Irregular weather c. Bad people d. Unsanitary food

e. Other ( )

B3. How did you cure the diseases?

a. Self treatment b. Local doctor c. Mosque/Church d. Hospital

e. No treatment f. Other ( )

B4. How can you prevent diseases?

a. Clean water b. Good sanitary condition c. Good medicine

d. Other ( )

B5. Where should the patients be treated?

a. Hospital b. Mosque/Church c. Local clinic d. Traditional treatment

e. Specialist of water-born diseases f. Other ( )

C. Questions about Water Supply

C1. What is a main drinking water source in rainy season?

a. Borehole b. Dug Well c. Pond d. Stream/River

e. Rain Water f. Other ( )

C2. How far is a main water source from your house in rainy season?

a. 200m b. 500m c. 1000m d. 1500m e. 2000m

f. Over 2000m

C3. How is the water quality of main source in rainy season?

a. Good b. OK c. Bad ⇒ 1. Water amount 2. Color 3. Smell 4. Taste

C4. What is the main drinking water source in dry season?

a. Borehole b. Dug Well c. Pond d. Stream/River

e. Rain Water f. Other ( )

C5. How far is the main water source from your house in dry season?

a. 200m b. 500m c. 1000m d. 1500m e. 2000m

f. Over 2000m

C6. How is the water quality of main resource in the Dry season?

a. Good b. OK c. Bad ⇒ 1. Water amount 2. Color 3. Smell 4. Taste

C7. Who usually does fetching water for your family?

a. Males b. Female c. Boys d. Girls e. Share by Family

f. Other ( )

C8. How many liters of water does your family use per day?

a. less than 40 l b. below 80 l c. below 120 l d. below 200 l

e. below 300 l f. over 300 l

C9. What kind of facility do you use to carry the water from water source?

a. Jelly cans b. Plastic Bucket/Bowl c. Clay pot d. Calabash

e. Iron Pail f. Other ( )

C10. What kind of facility do you use to store the water?

a. Drum b. Plastic Container c. Clay Pot d. Clay pots fitted with taps

e. Buckets fitted with taps f. Calabash g. Other ( )

C11. How do you treat the water before drinking?

a. Boil b. No treat c. Other ( )

C12. How many times do you clean the water fetching facility?

a. Every day b. few times per week c. few times per month

d. never e. Other ( )

D. Questions about Water & Sanitation/Hygiene

D1. Do you have latrine in your house?

a. Yes b. No

D2. What type of latrine are you using?

a. Traditional Pit Latrine

b. Improved Traditional Pit Latrine

c. Ventilated Improved Pit Latrine

d. Other ( )

D3. How does your family dispose of the excreta from the facilities?

a. Bush b. Stream/River c. Pit latrine d. Gutter

e. Court yard/House surrounding f. Other ( )

D4. Do you wash your hands after using latrine?

a. Yes b. No

D5. What do you use to clean your hands after using the latrine?

a. Water only b. Water & leaves c. Paper & leaves

d. Water with soap e. Other ( )

D6. How many times do you usually clean your latrine?

a. Every day b. few times per week c. few times per month

d. never e. Other ( )

D7. Would you be willing to build a public latrine?

a. Yes b. No

D8. (If yes) How much would you contribute?

a. less than N100 b. less than N200

c. less than N300 d. less than N400

e. less than N500 f. over N500

D9. (If No) Why would you not support a public latrine?

a. No money to contribute

b. No interest

c. Former efforts

d. Government responsibility

e. Other ( )

D10. Do you wash your hands before eating?

a. Yes b. No

E. Questions about Public Participation

E1. Did/Does your village have VWESC (Village Water & Sanitation Environment Committee)?

a. Yes, It was organized in (When _____) and still exists.

b. Yes, It was organized in (When _____) but dose not exist now.

c. No, but it will be organized in (When _____).

d. No, it will not be organized.

E2. (If “a”) How much money do you pay as an initial contribution?

a. about N100 b. about N200 c. about N300 d. about N400

e. about N500 f. over N500 g. None h. don’t know

i. donate (labor, material, etc)

E3. (If “a”) Did/Do you pay money regularly for O&M?

a. Yes b. No

E4. (If “Yes”) How much money did/do you pay regularly for Water cost (O&M) per month?

a. about N20 b. about N30 c. about N40 d. about N50 e. about N60

f. about N100 g. over N100 h. None i. don’t know

j. donate (labor, material, etc)

E5. (If “b”) Why do you think VWESC does not exist?

a. No money to O&M b. No knowledge for O&M c. No service from LGA

d. Other ( )

E6. (If “c”) How much money will you pay as an initial contribution?

a. about N100 b. about N200 c. about N300 d. about N400

e. about N500 f. over N500 g. None h. don’t know

i. donate (labor, material, etc)

E7. (If “c”) How much money will you pay regularly for Water cost (O&M) per month?

a. about N20 b. about N30 c. about N40 d. about N50 e. about N60

f. about N100 g. over N100 h. None i. don’t know

j. donate (labor, material, etc)

E8. (If “c”) How often will you pay the water cost (O&M)?

a. Monthly b. weekly c. When boreholes brake

d. Other ( )

E9.(If “d”) Why do you think you will not need VWESC ?

a. No money to contribute b. No interest c. Former efforts

d. Government responsibility e. Other ( )

E10. (If money will be/is collected regularly) Who does/will collect the money for VWESC?

a. Village Chairman b. VWESC leader c. Accouter of VWESC

d. Other ( )

E11. (If money will be/is collected regularly) Who does/will keep the money for VWESC?

a. Village Chairman b. VWESC leader c. Accouter of VWESC

d. Other ( )

E12. Does/Did the village receive service of O&M or Sanitation / hygiene Education?

a. Yes b. No

E13. (If “Yes”) Who did/does support to Village?

a. LGA b. State Government c. NGO d. Other ( )

F. Questions about Other

(Answer only women)

F1. How many times do you spend doing housework?

a. Less than 2 hrs. b. Less than 3 hrs. c. Less than 4 hrs. d. Less than 5 hrs. e. Over 5 hrs.

F2. How often do you wash your family clothes in a week?

a. Every day b. 5 times c. 4 times d. 3 times e. 3 times f. once a week

F3. How many times do you spend doing washing clothes?

a. Less than 1 hrs. b. Less than 2 hrs. c. Less than 3 hrs. d. Less than 4 hrs. e. Over 4 hrs.

(Answer only by men)

F4. Do you help in housework?

a. Yes b. No

F5. (If “Yes”) What kind of housework?

a. Repair house b. Fetching Water c. Other ( )