PREPARATORY SURVEY
ON
THE PROJECT FOR IMPROVEMENT OF RURAL WATER SUPPLY
IN
THE FEDERAL REPUBLIC OF NIGERIA

FINAL REPORT

FEBRUARY 2011

JAPAN INTERNATIONAL COOPERATION AGENCY

YACHIYO ENGINEERING CO., LTD.

GED
JR
11 - 046

PREPARATORY SURVEY
ON
THE PROJECT FOR IMPROVEMENT OF RURAL WATER SUPPLY
IN
THE FEDERAL REPUBLIC OF NIGERIA

FINAL REPORT

FEBRUARY 2011

JAPAN INTERNATIONAL COOPERATION AGENCY

YACHIYO ENGINEERING CO., LTD.

PREFACE

Japan International Cooperation Agency (JICA) decided to conduct the preparatory survey on the project for Improvement of Rural Water Supply in the Federal Republic of Nigeria, and organized a survey team headed by Hiroshi Nakamura of Yachiyo Engineering Co., Ltd. between June, 2010 to February, 2011.

The survey team held a series of discussions with the officials concerned of the Government of Nigeria, and conducted a field investigations. As a result of further studies in Japan, 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.

Finally, 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 survey team.

February, 2011

Shinya Ejima
Director General,
Global Environment Department
Japan International Cooperation Agency

SUMMARY

Summary

① Overview of Country

The Federal Republic of Nigeria (hereinafter called Nigeria) faces the Gulf of Guinea in the central West Africa and borders Niger, Chad, Cameroon and Benin, having a population of 140 million (2007, according to the National Census Data) and an area of 923,700 km^2 .The GDP per capita of Nigeria is US$ 2,133(IMF,2007). Nigeria was one of the most productive agricultural countries in Africa exporting a wide variety of farm products. However, following the discovery of petroleum in the latter part of the 1960s, it adopted an economic structure dependent on oil revenues. Moreover, due to repeated civil strife and coups surrounding the petroleum reserves, the domestic political situation has remained unstable and little progress has been made on mitigating poverty and developing infrastructure.

② Background of Project

The Government of Nigeria formulated "National Economic Empowerment and Development Strategy: NEEDS" in May 2004, which is regarded as Poverty Reduction Strategy Paper. It stressed development of various sectors in order to become one of the most developed 20 countries of the world by 2020 through economic development. Water supply sector is raised as a priority sector, and it is eventually intended to supply safe water to all the people by 2011. However, the ratio of people with access to safe water declined from 49% in 1990 to 48% in 2004 due to population increase, etc. The ratio is especially low in rural areas at 31% compared to 68% in the cities in 2004. There is an urgent need to secure safe water supply because many people drink surface water and puddle water with risk of water-borne diseases. With above background, Government of Nigeria requested Grant Aid Project of Japan. The requested project consists of procurement of equipment and materials for borehole drilling for thirteen states.

③ Summary of Survey and Content of the Project

Responding to the request by the Government of Nigeria, the Government of Japan dispatched the Preparatory Survey Team form 13th June 2010 to 7th July 2010 for implementation of the field survey in ten candidates States excluding three States with security problem. During the field survey, JICA Survey Team examined the content, necessity and appropriateness of implementation of the Grant Aid Project. After the first filed survey in Nigeria, JICA Survey team went back to Japan and selected the prioritized states based on the result of the analysis on the data and information collected in the filed survey.

JICA dispatched the Preparatory Survey Team again to Nigeria from 7th August to 24th September 2010. Japanese side and Nigerian side agreed on the five prioritized States; Kebbi, Niger, Taraba, Ondo and Enugu. After the agreement, JICA Survey Team implemented the second filed survey in the five prioritized States.

After the second field survey in Nigeria, the JICA Survey Team analyzed the collected data and information in Japan and examined necessity, appropriateness, social and economic efficiency of the Project. As results of analysis, JICA Survey Team complied Draft Final Report. JICA Survey Team was dispatched to Nigeria form 8th January to 16th January 2011 to explain draft Final Report to Nigerian side. Based on the discussion between Japanese side and Nigerian side in the meeting above, the Final Report was completed.

Content of the Project consists of provision of i) equipment for borehole construction, ii) materials for construction of water supply facilities and iii) soft component. It was confirmed by Japanese side and Nigerian side that Nigerian side would construct water supply facilities including siting of borehole drilling points.

Outline of equipment and materials to be procured is shown in Table-1, which was proposed based on discussion between Japanese side and Nigerian side.

Table-1 Outline of Equipment and Materials for Procurement

	Contents of Equipment and Materials	Quantity	
1.	Drilling Equipment		
(1)	Drilling rig	Kebbi :1 Niger :1 Taraba :1 Ondo :1 Enugu :1	unit
(2)	High pressure air compressor		
(3)	Cargo truck with crane		
2.	Survey Equipment		
(1)	Geophysical survey equipment	Kebbi :1 Niger :1 Taraba :1 Ondo :1 Enugu :1	unit
(2)	Water analysis equipment		
(3)	Pumping test equipment		
3.	Borehole Construction Materials		
(1)	Hand pump	Kebbi :100 Niger :100 Taraba :100 Ondo :100 Enugu :100	Set
(2)	Community level mechanic tool		
(3)	LGA level mechanic tools	Kebbi :14 Niger :24 Taraba :15 Ondo :18 Enugu : 9	Set
(4)	PVC casing pipe & screen pipe	Kebbi :100 Niger :100 Taraba :100 Ondo :100 Enugu :100	Set
(5)	Drilling fluid	Kebbi :100 Niger :100 Taraba :100 Ondo :100 Enugu :100	Set

Soft component will be implemented for two activities below:

- Technical support for formulation of borehole construction plan, data management and equipment maintenance.
- Technical support for strengthening of operation and maintenance system of rural water supply facilities.

④ Project implementation schedule and rough cost estimate

Responsible Organization of the Project is the Federal Ministry of Water Resources (FMWR), and the Implementing Agencies are RUWASSA/WATSAN Project of the five target States (Kerbbi, Niger, Taraba, Ondo and Enugu). Necessary period for the Project implementation by Japan's Grant Aid is estimated 24 months for procurement of equipment and materials (including 6 months for implementation of soft component) and 24 months for construction of water supply facilities by Nigerian side, namely 48 month in total. The Project cost by Nigerian side is 0.319 billion Nigerian Naira. This estimated amount does not mean upper limit of provision in Exchange of Note (E/N).

Main obligation of Nigerian side is construction of water supply facilities including siting of borehole drilling points by implementation of geophysical survey. Budget for implementation of rural water supply project must be secured, and the Implementing Agencies must be maintained with sufficient capability in institutional and technical aspects, in order to increase water supply coverage for providing rural residents with safe water in the target States, using procured equipment and materials

by the Project.

⑤ Appropriateness of the Project

500 water supply facilities with hand pump boreholes will be constructed in two years after the procurement of equipment and materials by the Project, and safe water will be provided to 132,000 persons in the Project area from the constructed boreholes.

Continuously, the Implementing Agencies of the five target States will continue borehole construction using the procured equipment and materials after completion of 500 boreholes. The Implementing Agencies will complete 750 boreholes between three and five year after the procurement of the equipment and material, providing 198,000 rural residents with safe water.

Furthermore, capability the Implementing Agencies will be improved by the implementation of soft component by the Project for i) formulation of borehole construction plan, data management and equipment maintenance and ii) strengthening of operation and management system of water supply facilities. As a result of the soft component by the Project, staff of the Implementing Agencies will be able to manage borehole construction work more effectively and complete borehole inventory for effective use. And skill for equipment maintenance will be improved. Furthermore, residents of the target communities will be able to operate and maintain water supply facilities with the support from the Implementing Agency.

It is expected that outbreak of water born disease such as diarrhea, cholera and dysentery will be reduced by the provision of safe water by the Project. Moreover, water supply facilities constructed in the Project will relieve the residents of the communities from heavy work for water collection.

Implementation of the requested Grant Aid Project of Japan is judged to be appropriate because the Project is expected to provide great deal of benefits to residents of the Project area as mentioned above.

Matters below must be taken into account for effective implementation of the water supply project in the target 5 States, with sustainable and smooth maintenance of the procured equipment and water supply facilities constructed in the Project.

- Securing of budget for rural water supply project and strengthening of the Implementation Agencies of the 5 target States in technical and institutional aspects.
- Strengthening of operation and maintenance system of borehole water supply facilities.
- Cooperation with activities of National Water Resources Institute.

Contents

Preface
Summary
Contents
Location Maps
List of Figures & Tables
Abbreviations

Chapter 1 Background of the Project 1-1
1-1 Background of the Project 1-1
1-2 Natural Condition of Project Area 1-1
1-3 Social Condition 1-7
1-3-1 Questionnaire Survey 1-7
1-3-2 Interview Survey 1-11

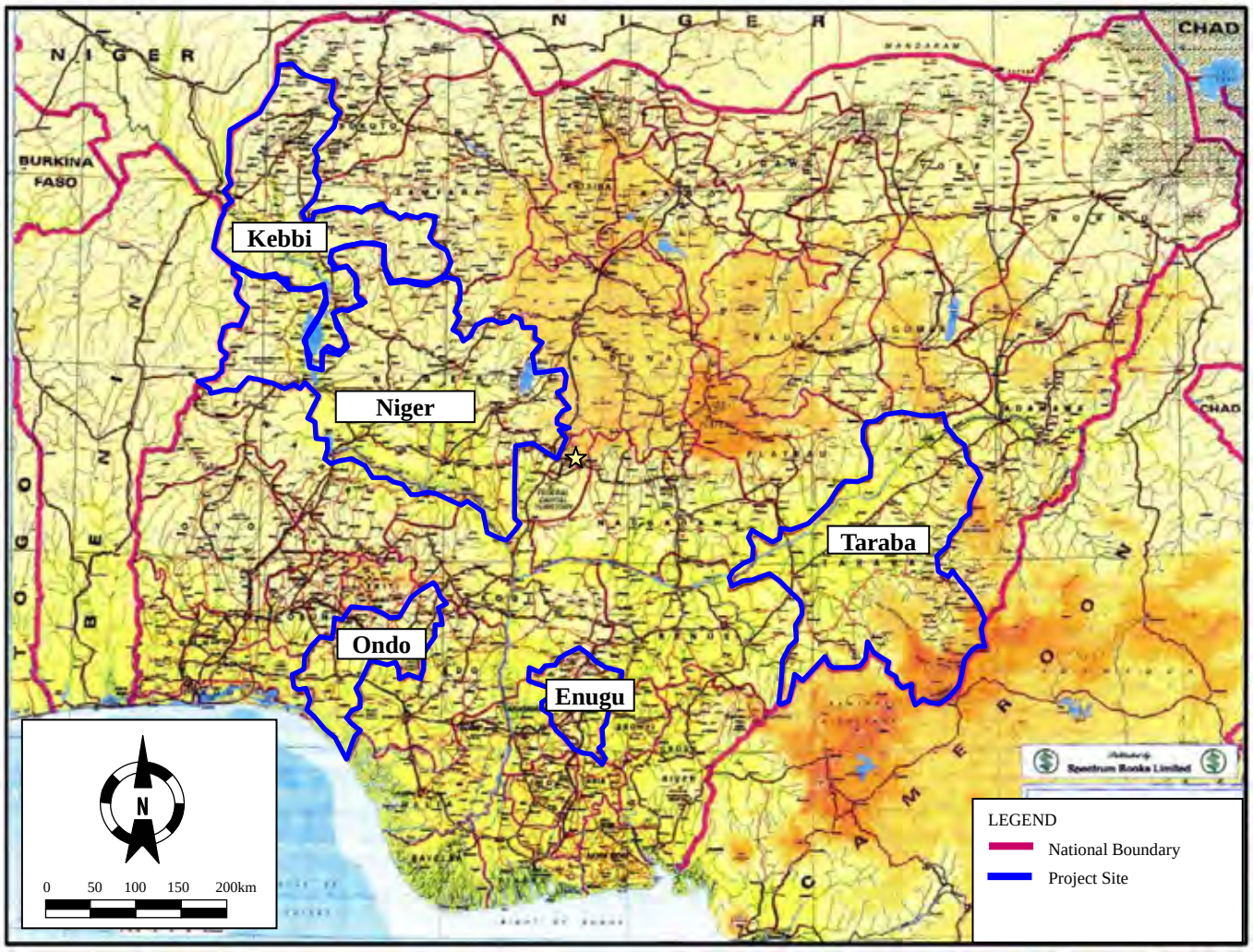
Chapter 2 Concept of the Project 2-1
2-1 Basic Concept of the Project 2-1
2-2 Outline Design of the Japanese Assistance 2-1
2-2-1 Design Policy 2-5
2-2-2 Basic Plan (Equipment Plan) 2-8
2-2-2-1 Overall Plan 2-8
2-2-2-2 Equipment Plan 2-27
2-2-3 Outline Design Drawing 2-38
2-2-4 Implementation Plan 2-39
2-2-4-1 Implementation Policy 2-39
2-2-4-2 Implementation Conditions 2-40
2-2-4-3 Scope of Work 2-40
2-2-4-4 Consultant Supervision 2-40
2-2-4-5 Quality Control Plan 2-41
2-2-4-6 Procurement Plan 2-42
2-2-4-7 Operational Guidance Plan 2-42
2-2-4-8 Soft Component (Technical Assistance) Plan 2-43
2-2-4-9 Implementation Schedule 2-52
2-3 Obligations of Recipient Country 2-54
2-4 Project Operation Plan 2-56
2-4-1 Operation and Maintenance of Borehole Drilling Equipment 2-56
2-4-2 Operation and Maintenance of Water Supply Facilities 2-59
2-5 Project Cost Estimation 2-59

2-5-1 Initial Cost Estimation ····· 2-59
2-5-2 Operation and Maintenance Cost ····· 2-60
2-5-2-1 Maintenance Cost of Procured Equipment and Materials ····· 2-60
2-5-2-2 Maintenance Cost of Water Supply Facilities ····· 2-60
2-6 Other Relevant Issues ····· 2-62

Chapter 3 Project Evaluation ····· 3-1
3-1 Recomendation ····· 3-1
3-1-1 Precondition for the Project Implementation ····· 3-1
3-1-2 Precondition and Important Assumption of Overall Project Goal ····· 3-1
3-2 Project Evaluation ····· 3-2
3-2-1 Appropriateness of the Project ····· 3-2
3-2-2 Effectiveness ····· 3-3
3-2-3 Conclusion ····· 3-5

[Appendices]

1. Member List of the Study Team
2. Study Schedule
3. List of Parties Concerned in the Recipient Country
4. Minutes of Discussions
5. Soft Component (Technical Assistance) Plan
6. Other Relevant Data
7. References



Location Map

List of Figures and Tables

[Table]

Table 1-1 Rough Estimation of Groundwater Potential of Target Aquifer in Kebbi State ····· 1-4

Table 1-2 Groundwater Level, Production Yield and Borehole Successful Rate of the Target Aquifer in Kebbi State ····· 1-4

Table 1-3 Rough Estimation of Groundwater Potential of Target Aquifer in Niger State ····· 1-4

Table 1-4 Groundwater Level, Production Yield and Borehole Successful Rate of the Target Aquifer in Niger State ····· 1-5

Table 1-5 Rough Estimation of Groundwater Potential of Target Aquifer in Taraba State ····· 1-5

Table 1-6 Groundwater Level, Production Yield and Borehole Successful Rate of the Target Aquifer in Taraba State ····· 1-5

Table 1-7 Rough Estimation of Groundwater Potential of Target Aquifer in Ondo State ····· 1-6

Table 1-8 Groundwater Level, Production Yield and Borehole Successful Rate of the Target Aquifer in Ondo State ····· 1-6

Table 1-9 Outline Estimation of Groundwater Reserves of Target Aquifer in Enugu State ····· 1-6

Table 1-10 Groundwater Level, Production Yield and Borehole Successful Rate of the Target Aquifer in Enugu State ····· 1-7

Table 1-11 Number of the Target LGAs and Communities ····· 1-8

Table 1-12 Basic Data of the Prioritized States ····· 1-8

Table 1-13 Total Population of the Target Communities ····· 1-8

Table 1-14 Major Problems Identified by the People in the Target Communities ····· 1-9

Table 1-15 Current Condition of Hand Pump Boreholes ····· 1-9

Table 1-16 Current Condition of Motorized Pump Boreholes ····· 1-9

Table 1-17 Access to Safe Water, Water Consumption and Distance to Source of Drinking Water ····· 1-9

Table 1-18 Access to Basic Sanitation Facilities ····· 1-10

Table 1-19 Major Problems on Water Supply in Rural Communities Identified by the Communities ····· 1-10

Table 1-20 Community-based Organizations for O & M of Water and Sanitation Facilities ··· 1-10

Table 1-21 LGAs and Communities for the Interview Survey ····· 1-11

Table 2-1 Development Plan for Rural Water Supply of 5 Target States (2009-2017) ····· 2-1

Table 2-2 Procured Equipment and Materials ····· 2-2

Table 2-3 Project Design Matrix (PDM) ····· 2-3

Table 2-4 Number of Drilling Team in Implementing Agencies ····· 2-7

Table 2-5 Number of Borehole Drilled by the Implementing Agencies for Past Five Years ···· 2-9

Table 2-6 Number of Borehole Drilled by Existing Rig before Kano Project (1999-2004) ··· 2-10

Table 2-7 Number of Boreholes Drilled by Procured Rig (2007-2009) ····· 2-10

Table 2-8 Three Hydrogeological Criteria for Use of Hand Pump at Borehole ····· 2-10

Table 2-9 Hydrogeological Condition of Target States (120 Prioritized Communities in Each State) 2-11
Table 2-10 Comprehensive Evaluation of Number of Boreholes to be drilled for Two Years 2-12
Table 2-11 Target Communities (Enugu) 2-13
Table 2-12 Target Communities (Ondo) 2-15
Table 2-13 Target Communities (Taraba) 2-17
Table 2-14 Target Communities (Kebbi) 2-19
Table 2-15 Target Communities (Niger) 2-21
Table 2-16 Design Standards on Water Supply Unit 2-23
Table 2-17 Borehole Yield and Groundwater Recharge of Each State (after Development of Hand Pump Borehole by the Project) 2-24
Table 2-18 Water Quality Inspection Items 2-25
Table 2-19 Design Drilling Depth and Design Screen Length of Each State 2-26
Table 2-20 Well Drilling Successful Rate of Each State 2-27
Table 2-21 Procured Equipment and Materials 2-28
Table 2-22 Area of Facilities and Yard of the Implementing Agencies (m^2) 2-29
Table 2-23 Number of Boreholes for Estimate of Consumable Material 2-30
Table 2-24 Situation of Existing Crane Truck of the Implementing Agencies 2-30
Table 2-25 Current Situation of Pumping Test by the Implementing Agencies 2-31
Table 2-26 Effective Use of Electric and Electro-magnetic Survey 2-32
Table 2-27 The Existing Geophysical survey Equipment of the Implementing Agencies 2-32
Table 2-28 Number of Hand Pumps and Tools for Repair 2-33
Table 2-29 Number of Casings and Screens to be procured 2-33
Table 2-30 Rock Type of Aquifer to be drilled in Target States 2-34
Table 2-31 Drilling Depth of Target States 2-34
Table 2-32 Specification of Pipes 2-36
Table 2-33 Procurement Sources of Main Equipment and Materials 2-37
Table 2-34 Allocation of the Responsibility for Procurement 2-40
Table 2-35 Target Staff for Soft Components Activities (Borehole Construction Plan, Data Management and Equipment Maintenance) 2-46
Table 2-36 Staff for Soft Components Activities 2-46
Table 2-37 Contents of Soft Components Activities 2-47
Table 2-38 Detailed Assignment Plan of Soft Components for Technical Training for Formulation of Construction Plan, Data Management and Equipment Maintenance 2-49
Table 2-39 Detailed Assignment Plan of Soft Components for Strengthening of Operation and Management System for Water Supply Activities 2-50
Table 2-40 Implementation Item and Resources for Soft Components 2-51
Table 2-41 Soft Components Implementation Schedule (Draft) 2-52

Table 2-42 Implementation Schedule (Draft) 2-53
Table 2-43 Construction Schedule 2-53
Table 2-44 Work Schedule of Borehole Drilling 2-54
Table 2-45 Responsibility of Nigerian Side on Water Supply Facilities 2-55
Table 2-46 Necessary Staff for the Implementation of the Project 2-56
Table 2-47 Staff of Workshop in the Implementing Agencies 2-58
Table 2-48 Equipment for Maintenance and Repair of the Implementing Agencies 2-58
Table 2-49 Allocation of Roles in Operation and Maintenance of Hand Pump Borehole 2-59
Table 2-50 Cost for Construction of Borehole Facilities by the Implementing Agencies 2-60
Table 2-51 Annual cost for Maintenance for Procured Equipment 2-60
Table 2-52 Annual Maintenance cost of Hand Pump Borehole 2-61
Table 2-53 Cost for Maintenance and Ability to Pay of Individual Families in Communities for Water Supply Facilities 2-61
Table 3-1 Number of Water Supply Facilities Constructed by the Project 3-3
Table 3-2 Number of Population Supplied with Safe Water by the Project 3-3
Table 3-3 Qualitative Output by the Project 3-4

[Figure]

Figure 2-1 Location of Target Communities in Enugu State 2-14
Figure 2-2 Location of Target Communities in Ondo State 2-16
Figure 2-3 Location of Target Communities in Taraba State 2-18
Figure 2-4 Location of Target Communities in Kebbi State 2-20
Figure 2-5 Location of Target Communities in Niger State 2-22
Figure 2-6 Standard Structure of Borehole 2-38
Figure 2-7 Hand Pump Platform 2-39
Figure 2-8 Soakage Pit 2-39

Abbreviation

ASTM	American Society for Testing and Materials
CBO	Community based Organization
DO	Dissolved Oxygen
DTH	Down The Hole Hammer
EC	Electric Conductivity
E/N	Exchange of Note
FMWR	Federal Ministry of Water Resources
G.L.	Ground Level
GNP	Gross Domestic Product）
JICA	Japan International Cooperation Agency
LG	Local Government
LGA	Local Government Areas
M/D	Minutes of Discussion
MDG	Millennium Development Goal
MWR	Ministry of Water Resources
NEEDS	National Economic Empowerment and Development Strategy
NGN	Nigerian Naira
NPC	National Planning Commission
NWRI	National Water Resources Institute
OJT	On-the-Job Training
O&M	Operation and Maintenance
PHCN	Power Holding Community of Nigeria
PVC	Polyvinyl Chloride
RUWASSA	Rural Water Supply and Sanitation Agency
UNICEF	United Nations International Children’s Fund
uPVC	Unpracticed polyvinyl Chloride
VLOM	Village Level Operation and Maintenance
WASHCOM	Water, Sanitation and Hygiene Committee
WATSAN Project	Water and Sanitation Project
WHO	World Health Organization

CHAPTER 1

BACKGROUND OF THE PROJECT

Chapter 1 Background of the Project

1-1 Background of the Project

The Federal Republic of Nigeria (hereinafter called Nigeria) faces the Gulf of Guinea in the central West Africa and borders Niger, Chad, Cameroon and Benin, having a population of 140 million (2007, according to the National Census Data) and an area of 923,700 km^2 .The GDP per capita of Nigeria is US$ 2,133 (IMF, 2007). Nigeria was one of the most productive agricultural countries in Africa exporting a wide variety of farm products. However, following the discovery of petroleum in the latter part of the 1960s, it adopted an economic structure dependent on oil revenues. Moreover, due to repeated civil strife and coups surrounding the petroleum reserves, the domestic political situation has remained unstable and little progress has been made on mitigating poverty and developing infrastructure.

Against such a background the Government of Nigeria formulated "National Economic Empowerment and Development Strategy: NEEDS" in May 2004, which is regarded as Poverty Reduction Strategy Paper. It stressed development of various sectors in order to realize economic development to be one of the most developed 20 countries of the world by 2020. Water supply sector is raised as a priority sector, and it is eventually intended to supply safe water to all the people by 2011 according to "National Rural Water Supply and Sanitation Programme".

Within above goal for rural water supply (supplied population of no more than 5,000), it is intended to secure 30ℓ of water supply per person per day, to keep water carrying distances less than 250 m and to provide water supply points for every 250 to 500 people. However, the ratio of people with access to safe water declined from 49% in 1990 to 48% in 2004 due to population increase, etc. The ratio is especially low in rural areas at 31% compared to 68% in the cities in 2004. There is an urgent need to secure safe water supply because many people drink surface water and puddle water with risk of water-borne diseases.

In these circumstances, the Government of Nigeria requested the Government of Japan to provide grant aid for the procurement of borehole drilling equipment for thirteen States in July 2009. ODA task force of Nigerian side proposed five States (Nassarawa, Niger, Zamfara, Taraba and Ondo State) in course of selection of candidate States from thirteen States. After selection of above 5 States, JICA Survey Team again examined ten States excluding three States with public security problem, considering appropriateness and necessity for implementation of the grant aid project. As a result of the examination, five States, Enugu, Ondo, Taraba, Kebbi and Niger were selected as prioritized States, and Japanese side and Nigerian side agreed on the final selection above. Preparatory survey was conducted to perform outline design to formulate project implementation plan and estimate rough cost of the Project for 5 prioritised States.

1-2 Natural Condition of Project Area

(1) Meteorology, Geography and Geology

1) Kebbi State

The Kebbi State belongs to the savanna climate, and the rainy season and the dry season are clear. The rainy season is from May to October, and the dry season is from November to April. Between December and March, it hardly rains with mean monthly precipitation of almost 0mm, though the annual mean precipitation is 835mm. The annual average minimum temperature is 22.2^{o}C, and the annual average maximum temperature is 34.7^{o}C.

As for geographical feature, Niger River flows from northwest to southeast in the state, and the lowlands have been formed along the river. In the north half of the state, the low hill like tableland has been formed in the northeast, and the riverside lowlands spread out along Sokoto River in northwest. In the southern and the central part of the State, the hilly landform with gentle undulation has been formed, and inselbergs remain sporadically in hilly areas in the southeast and the southwest part of the state.

As for geology, in the Basement Complex, gneiss is distributed in large area and the schist and granite

is distributed in narrow area. In the Cretaceous, the argillaceous strata with intercalated sandstone layers are predominant in the lower part of the Cretaceous, and sandstone strata become thick in the upper part of the Cretaceous. In the Tertiary, the argillaceous strata are predominant in the lower part of the Tertiary, and the sandstone layers are intercalated in the upper part of the Tertiary. The alluvial deposit of Quaternary is distributed over the lowlands along big rivers such as Niger River and Sokoto River, with the small thickness of the deposit.

It is presumed that the aquifer consist of i) the weathered and fractured part of the Basement Complex, ii) the sandstone and the fractured part of the Cretaceous, and iii) the sandstone layers of the Tertiary. The fractured part of the rock might have been formed along the faults in Basement Complex, geological boundary and tectonic zone.

2) Niger State

The Niger State belongs to the tropical savanna climate. The rainy season and the dry season are clear. The rainy season is from April to October. The dry season is from November to March. Between November and March, it hardly rains with mean precipitation of almost 0mm, though the annual mean precipitation is 1550mm. The annual average minimum temperature is 22.8 ^{o}C, and the annual average maximum temperature is 32.5 ^{o}C.

As for geographical feature, hilly landform with gentle undulation showing inselbergs in some places is characteristic in the area. Niger River flows toward southeast from the Kainji dam along the southern state boundary. Large lowlands have been formed along the river. Moreover, the tributaries such as Kontagora river and Kaduna river etc. flow from northeast to southwest. Lowlands has been formed along these tributaries.

As for geology, in Basement Complex, gneiss is distributed in large area, and granite and schist are also distributed in large area. Sandstone is predominant in the Cretaceous. The alluvial deposit of the Quaternary is distributed relatively wide over the lowlands along rivers besides Niger River and Kaduna River.

It is presumed that the aquifer has been formed in i) the weathered part and the fractured part of the Basement Complex, and ii) the sandstone and the fractured part of the Cretaceous. The fractured part might have been formed along the faults of the Basement Complex, geological boundary and tectonic zone.

In addition, the alluvial deposits are distributed with thickness of 10m or less. To develop groundwater of the alluvial, both the alluvium and the aquifer below the alluvium should be developed together, since the alluvial deposit is too small to be development alone.

3) Taraba State

The Taraba State belongs to the tropical savanna climate. The rainy season and the dry season are clear. The rainy season is from May to October. The dry season is from November to April. Between December and February, it hardly rains with the mean precipitation of almost 0mm, though the annual mean precipitation is 959mm. The annual average minimum temperature is 23.0^{o}C, and the annual average maximum temperature is 32.7^{o}C.

As for geographical feature, Benue River flows from northeast to southwest in the northwest part of the state. Large lowlands are distributed along the river. Terraces and low hills are distributed in the north and south of the lowland. There are mountains in the south of the Benue River. The Mambila Mountains and Gotel Mountains are located in the southeast of the state, which include the highest peak of 2418m.

As for geology, in the Basement Complex, gneiss is distributed in large area and schist is distributed in narrow area. In the Cretaceous, sandstone and calcic strata are predominant in the lower part of the Cretaceous. Shale strata are intercalated within the Cretaceous in the central part. Shale with intercalated limestone is distributed in the upper part of the Cretaceous. The alluvium deposit of the Quaternary is distributed over the lowlands along Benue River.

It is presumed that the aquifer has been formed in i) the weathered part and the fractured part of Basement Complex, and ii) the sandstone and the fractured part of the Cretaceous. The fractured part

might have been formed in the faults in Basement Complex, geological boundary and old tectonic zone. Moreover, such a geological condition is presumed that groundwater is stored within the sandstone in the bottom of the syncline structure.

In addition, the alluvial deposits are presumed to have thickness of 10m or less. To develop the groundwater of the alluvial deposit, both the alluvial deposit and the aquifers below the alluvial deposit should development together, since the alluvial deposit is too small to be developed alone.

4) Ondo State

The Ondo State belongs to the tropical savanna climate. The rainy season and the dry season are clear. The rainy season is from February to November. The dry season is from December to January. It hardly rains with mean monthly precipitation of 0mm in January. The annual mean precipitation is 1579mm. The annual average minimum temperature is 21.3 ^{o}C, and the annual average maximum temperature is 31.1 ^{o}C.

Geographical feature is low hill with undulation in the north half of the state. 50km-wide coastal plain spreads in the south part beyond low hill area. There is no large-sized river in the state.

As for geology, the Basement Complex is distributed in low hill area, and gneiss is predominant of the Basement Complex. Granite and schist is distributed in narrow area. Quartzite is seen in the north-western part of the state. Cretaceous formation is distributed in narrow area between low hill and coastal plain. Shale is distributed in the lower part of the formation, and sandstone strata increase its distribution in upper part of the formation. In the Tertiary, argillaceous strata are predominant, and sandstone and limestone layers are intercalated within the argillaceous strata. Quaternary deposit is distributed over coastal plain with sand stratum as main deposit.

It is presumed that the aquifer has been formed in i) the weathered part and fractured part of the Basement Complex, ii) the sandstone and fractured part of the Cretaceous, iii) sandstone of the Tertiary, and iv) sand-strata of the Quaternary. Remarkable faults and old tectonic zones, etc. of the inside of Basement Complex or geology boundary are not recognized.

5) Enugu State

The Enugu State belongs to the tropical savanna climate. The rainy season and the dry season are clear. The rainy season is from April to October. The dry season is from November to March. Between December and February, it rains about 10mm. The annual mean precipitation is 1189mm. The annual average minimum temperature is 22.2 ^{o}C, and the annual average maximum temperature is 34.2 ^{o}C.

As for Geographical feature, there is a watershed ridge of low hill in the center of the state. In the west of the state, many small tributaries flow into the lowland along Niger River. There is no large-scale river in the state, and such rivers are not suitable for river development.

As for geology, the Cretaceous is widely distributed over the central to eastern part of the state. The Tertiary is distributed over the northwest to the east of the state. The Quaternary is distributed in small area over the easternmost and the westernmost of the state. In the Cretaceous, shale superior strata are distributed in the lower part of the Cretaceous, and sandstone superior strata are distributed in the upper part of the Cretaceous. Argillaceous strata are predominant in the Tertiary, and sandstone and limestone are intercalated within argillaceous strata.

As for the geological structure, there is an anticlinal axis extending northeast to southwest inclining southeast in Aninri LGA. Since the whole state is located in the north-western wing of the anticline structure, every stratum inclines to northwest direction. Although sandstone with large thickness has formed good aquifers in the central hills and the western part of the state, the groundwater level is as deep as 100 to 200m from the ground surface. Therefore, the sandstone is not suitable for development of hand-pump boreholes. In the area from the center to eastern part of the state, the development of hand-pump boreholes is limited to the intercalated sandstone within the shale.

(2) Hydrogeology and Groundwater Potential

1) Kebbi State

In the Kebbi State, the target aquifer for water production consists of the Basement Complex (40%), the Cretaceous sedimentary (25%) and the Tertiary sedimentary (35%) in terms of distribution area.

The groundwater potential of the target aquifer is estimated as shown in Table 1-1.

Table1- 1 Estimation of Groundwater Potential of Target Aquifer in Kebbi State

Aquifer	Distribution Percentage (%)	Distribution Area (km^2)	Thickness of Aquifer (m)	Efficient Porosity (%)	G.W. Potential (Mil.m^3)
Tertiary Sedimentary	35	12,880	15	15	38,640
Cretaceous Sedimentary	25	9,200	20	10	18,400
Basement Complex	40	14,720	15	5	11,040
Total	100	36,800	—	—	68,080

The groundwater potential of the target aquifer in the site is presumed to be 68,080x10^6m^3. It is much larger than borehole production yield (32.7x10^6m^3/year) after the hand-pump boreholes development by the Project. Moreover, the groundwater recharge is presumed to be 307.3x10^6m^3/year (Refer to Table 2-17), and the ratio of borehole production yield to the groundwater recharge is only 10.7%. It is clear that the groundwater potential is sufficient for the groundwater development by the hand-pump boreholes in the Project.

The groundwater level, yield and borehole successful rate are analysed as shown in Table 1-2, which is based on the existing borehole completion records and reports or interview survey to RUWASSA and others.

Table1- 2 Groundwater Level, Production Yield and Borehole Successful Rate of the Target Aquifer in Kebbi State

Aquifer	Groundwater Level (m)	Production Yield (L/sec)	Drilling Success Rate (%)
Tertiary Sedimentary Rock Strata	5-10	1.1-1.5	65-70
Cretaceous Sedimentary Rock Strata	6-11	0.8-1.2	80-85
Basement Complex	5-10	0.6-1.0	80-85

Judging from the groundwater level, production yield and borehole successful rate shown above, hand-pump borehole construction of the Project has enough potential.

2) Niger State

In the Niger State, the target aquifer for water production consists of Basement Complex (55%) and the Cretaceous sedimentary rock (45%) in general. The groundwater potential of the target aquifer in the state is estimated as shown in Table 1-3.

Table1- 3 Estimation of Groundwater Potential of Target Aquifer in Niger State

Aquifer	Distribution Percentage (%)	Distribution Area (km^2)	Thickness of Aquifer (m)	Efficient Porosity (%)	G.W. Potential (Mil.m^3)
Cretaceous Sedimentary Rock Strata	45	34,363	20	10	68,727
Basement Complex	55	42,000	15	5	31,500
Total	100	76,363	—	—	100,226

The groundwater potential of the target aquifer in the state is presumed to be 100,226x10^6m^3. It is larger than borehole production yield (25.9x10^6m^3/year) after the hand-pump borehole development by this project. Moreover, the groundwater recharge is presumed to be 1,183.6x10^6m^3/year (Refer to Table 2-17), and ratio of the borehole production yield to the groundwater recharge is only 2.2%. It is clear that the groundwater potential is sufficient for the development of the hand-pump boreholes construction by the Project.

The groundwater level, yield and borehole successful rate were analysed as shown in Table 1-4, which is based on the existing borehole completion records and reports or interview survey to RUWASSA and others.

Table1- 4 Groundwater Level, Production Yield and Borehole Successful Rate of the Target Aquifer in Niger State

Aquifer	Groundwater Level (m)	Production Yield (L/sec)	Borehole Successful Rate (%)
Cretaceous Sedimentary Rock Strata	7-11	0.5-0.9	70-75
Basement Complex	5-10	0.6-1.0	70-80

Judging from the groundwater level, production yield and borehole successful rate shown above, hand-pump borehole construction of the Project has enough potential.

3) Taraba State

In the Taraba State, the target aquifer for water production consists of Basement Complex (65%), the Cretaceous sedimentary rock (35%) in general. The groundwater potential of the target aquifer in the state is estimated as shown in Table 1-5.

Table1- 5 Estimation of Groundwater Potential of Target Aquifer in Taraba State

Aquifer	Distribution Percentage (%)	Distribution Area (km^2)	Thickness of Aquifer (m)	Efficient Porosity (%)	G.W. Potential ($Mil.m^3$)
Cretaceous Sedimentary Rock Strata	35	19,066	15	10	28,598
Basement Complex	65	35,407	15	5	26,556
Total	100	54,473	—	—	55,154

The groundwater potential of the target aquifer in the state is presumed to be $55,154x10^6m^3$. It is larger than the of borehole production yield ($9.4x10^6m^3$/year) after the hand-pump borehole development by the project. Moreover, the amount of groundwater recharge is presumed to be $522.4x10^6m^3$/year (Refer to Table 2-17), and ratio of the borehole production yield to the groundwater recharge is only 1.8%. It is clear that the groundwater potential is sufficient for the development of the hand-pump boreholes construction in the Project.

The groundwater level, yield and borehole successful rate were analysed as shown in Table 1-6, which is based on the existing borehole completion records and reports or interview survey to RUWASSA and others.

Table1- 6 Groundwater Level, Production Yield and Drilling Success Rate of the Target Aquifer in Taraba State

Aquifer	Groundwater Level (m)	Production Yield (L/sec)	Borehole Successful Rate (%)
Cretaceous Sedimentary Rock Strata	2-6	0.3-0.7	70-85
Basement Complex	3-7	0.3-0.7	60-75

Judging from the groundwater level, production yield and borehole successful rate shown above, hand-pump borehole construction of the Project has enough potential.

4) Ondo State

In the Ondo State, the target aquifer for water production consists of Basement Complex (70%), the Cretaceous and Tertiary sedimentary rock (10%) and the Quaternary deposit (20%) in general. The groundwater potential of the target aquifer was estimated as shown in Table 1-7.

Table1- 7 Estimation of Groundwater Potential of Target Aquifer in Ondo State

Aquifer	Distribution Percentage (%)	Distribution Area (km^2)	Thickness of Aquifer (m)	Efficient Porosity (%)	G.W. Potential (Mil.m^3)
Cretaceous Sedimentary Rock Strata	20	3,100	25	25	19,375
Tertiary Sedimentary Rock Strata	5	775	20	20	3,100
Cretaceous Sedimentary Rock Strata	5	775	15	10	1,163
Basement Complex	70	10,850	15	5	8,138
Total	100	15,500	—	—	12,400

The groundwater reserves capacity of the target aquifer in the state is presumed to be 12,400x10^6m^3. It is larger than the borehole production yield (17.1x10^6m^3 /year) after the hand-pump borehole development by this project. Moreover, the amount of groundwater recharge is presumed to be 244.7x10^6m^3/year (Refer to Table 2-17), and ration of the borehole production yield to the groundwater recharge is only 7.0%. It is clear that the groundwater potential is sufficient for the development of the hand-pump boreholes construction in the Project.
The groundwater level, yield and borehole successful rate were analysed as shown in Table 1-8, which is based on the existing borehole completion records and reports or interview survey to WATSAN Project and others.

Table1- 8 Groundwater Level, Production Yield and Borehole Successful Rate of the Target Aquifer in Ondo State

Aquifer	Groundwater Level (m)	Production Yield (L/sec)	Borehole Successful Rate (%)
Quaternary Deposit	12-18	1.5-2.5	50
Tertiary Sedimentary Rock Strata	5-10	0.8-1.2	60-70
Cretaceous Sedimentary Rock Strata	3-8	0.7-1.1	60-80
Basement Complex	12-18	1.5-2.5	50

Judging from the groundwater level, production yield and borehole successful rate shown above, hand-pump borehole construction of the Project has enough potential.

5) Enugu State

In the Enugu State, the target aquifer for water production consists of the Cretaceous sedimentary rock strata (shale superior strata) (50%), the Cretaceous sedimentary rock strata (sandstone superior strata) (40%), and the Tertiary sedimentary rock strata (10%) in general. The groundwater potential of the target aquifer in the state is estimated as shown in Table 1-9.

Table1- 9 Estimation of Groundwater Reserves of Target Aquifer in Enugu State

Aquifer	Distribution Percentage (%)	Distribution Area (km^2)	Thickness of Aquifer (m)	Efficient Porosity (%)	G.W. Potential (Mil.m^3)
Tertiary Sedimentary Rock Strata (Sandstone Superior Strata)	10	716	25	20	3,581
Cretaceous Sedimentary Rock Strata (Sandstone Superior Strata)	40	2,864	50	10	14,322
Cretaceous Sedimentary Rock Strata (Shale Superior Strata)	50	3,581	10	10	3,581
Total	100	7,161	—	—	21,483

The groundwater potential of the target aquifer in the state is presumed to be 21,483x$10^6$$m^3$ on the whole, including 3,581x$10^6$$m^3$ in the Cretaceous sedimentary rock strata (shale superior strata), which will be the target aquifer of the hand-pump boreholes development. It is larger than the borehole production yield (24.2x$10^6$$m^3$/year) after the hand-pump borehole development by this Project. Moreover, the amount of groundwater recharge is presumed to be 85.1x$10^6$$m^3$/year (Refer to Table 2-17), and ratio of the borehole production yield to the groundwater recharge is 28.5%. Although groundwater has been developed in Enugu state more than other states, it is clear that the groundwater potential is still sufficient for the development of the hand-pump boreholes in the Project.

The groundwater level, yield and borehole successful rate were analysed as shown in Table 1-10, which is based on the existing borehole completion records and reports or interview survey to RUWASSA and others.

Table1- 10 Groundwater Level, Production Yield and Borehole Successful Rate of the Target Aquifer in Enugu State

Aquifer	Groundwater Level (m)	Production Yield (L/sec)	Borehole Successful Rate (%)
Tertiary Sedimentary Rock Strata (Sandstone Superior Strata)	80-100	(20-25)	(80-85)
Cretaceous Sedimentary Rock Strata (Sandstone Superior Strata)	100-120	(17-21)	(80-85)
Cretaceous Sedimentary Rock Strata (Shale Superior Strata)	1-8	0.8-1.7	60-80

Remarks; ( ) shows motorized borehole data.

Since the groundwater level is deep in the Tertiary sedimentary rock (sandstone superior strata) and the Cretaceous sedimentary rock (sandstone superior strata), the Tertiary and the Cretaceous are not suitable for the development of hand-pump boreholes. In the hand-pump boreholes development, the Cretaceous sedimentary rocks (shale superior strata) turn into the target aquifer. Although, from the groundwater level, production yield and borehole successful rate, it is judged that the hand-pump borehole construction of the plan is possible enough. Since the sandstone intercalated in the upper part of the shale superior strata might have small thickness, borehole successful rate of the sandstone may be low.

1-3 Social Condition

The Government of Nigeria announced MDG that safe water access rate would be 75% by 2015. However, population that can access to safer water decreased between 1990 and 2006. Therefore, it is expected that water supply coverage will be far from the goal under the current trend of water supply coverage. Improvement of water supply condition is urgent problem in the target five States. Especially, water supply coverage in rural area is considerably lower than that in the urban area in the five target states. There are some reasons of low coverage rate. It is one important reason that residents in the rural communities are not aware of importance of safe water supply. Rural residents must realize importance of safe water supply and maintain water supply facilities by their own effort, in order to secure sustainable operation and maintenance of rural water supply facilities. Social condition survey was performed by the JICA Survey Team in the five target states to know current water supply condition and awareness of the communities' residents on water supply. Social condition survey was performed by means of questionnaire and interview. Social condition of the Project area is described below.

1-3-1 Questionnaire Survey

(1) Objectives of the Survey

- To obtain data and information related to water and sanitation conditions in the selected communities in order to confirm appropriateness as target sites of the Project in terms of social condition.

- To clarify the current problems of operation and maintenance (O & M) for rural water supply facilities at community level and to offer recommendations for sustainability of the water supply facilities.

(2) Methodology of the Survey

The Survey was carried out by means of Questionnaire targeting about 120 communities for each prioritized state which are proposed by RUWASSA and WATSAN Project. In parallel with the Survey, interview survey was done for some selected communities.

(3) Contents of the Survey

- a. General Information
- b. Water Supply Condition
- c. Condition on Sanitation and Hygiene
- d. Operation and Maintenance of Water Supply Facilities in Rural Communities

(4) Survey Results

1) Number of Answers Collected

A response rate of the Questionnaire was almost 100 %.

Table1- 11 Number of the Target LGAs and Communities

	Kebbi	Niger	Taraba	Ondo	Enugu	**Total**
LGA	14	24	15	18	9	**80**
Community	119	121	120	119	120	**599**
(Response Rate)	(99%)	(100%)	(100%)	(99%)	(100%)	**(≒100%)**

2) Outline of the Survey Results

2-1) Basic Data

Table1- 12 Basic Data of the Prioritized States

	State	Geopolitical Zone	No. of LG	Total Population	Total Land Area (Km^2)	Population Density (persons/ Km^2)
1	Kebbi	North West	21	3,238	37,698	86
2	Niger	North Central	25	3,950	65,874	60
3	Taraba	North East	17	2,294	61,368	37
4	Ondo	South West	18	3,460	14,798	233
5	Enugu	South East	17	3,257	8,088	403
	Total		**98**	**16,199**	**187,826**	**87**

Source：Kebbi State：Statistical Year Book 2007, Kebbi State of Nigeria
Niger State：Ministry of Finance & Economic Planning, Niger State
Taraba State：2006 Population and Housing Census, Population and Housing Tables, Taraba State
Ondo State：Socio-Economic Indicators, 2009 Edition, Department of Research and Statistics, Ministry of Economic Planning and Budget
Enugu State：National Bureau of Statistics

2-2) Total Population of the Target Communities

It is expected that whole or a part of the following people in the target communities would have direct or indirect impacts as a result of the Project.

Table1- 13 Total Population of the Target Communities

State	a. Target LGA	b. No. of Target Communities	c. Total Target Population	d. Ratio of Target Population to Total LGA Population
1. Kebbi	14	119	525,294 (4,447)	16%
2. Niger	24	121	472,159(3,968)	12%
3. Taraba	15	120	298,820 (2,490)	13%
4. Ondo	18	119	474,269 (4,019)	14%
5. Enugu	9	120	1,779,137 (15,471)	55%
Total	**80**	**599**	**3,549,679 (5,926)**	**22%**

Note) ( ) shows average population of one Target LGA.
(Source：Questionnaire Survey)

2-3) Major Problems in the Target Communities

The Survey identified that among the ranking of the major problems that affect rural households water problem is the topmost priority for all the target communities.

Table1- 14 Major Problems Identified by the People in the Target Communities

Problem	1. Kebbi State	2. Niger State	3. Taraba State	4. Ondo State	5. Enugu State
a. Water	**93%**	**98%**	**100%**	**97%**	**92%**
b. Electricity	24%	21%	7%	55%	14%
c. Poverty	55%	31%	20%	38%	48%
d. Health Care	34%	50%	66%	59%	59%
e. Roads	34%	60%	43%	69%	37%
f. Fertilizer	20%	7%	20%	15%	5%
g. Education	21%	23%	35%	19%	19%
h. Latrine	30%	10%	13%	51%	16%
i. Others	0%	0%	0%	6%	4%

（Source：Questionnaire Survey）

2-4) Water Supply Facilities

The Survey result showed that many boreholes equipped with hand pump as well as motorized pump are out of service at any one time.

Table1- 15 Current Condition of Hand Pump Boreholes

	Kebbi	Niger	Taraba	Ondo	Enugu	**Total**
a. Functioning	131	43	86	51	29	**340**
b. Un-functioning	132	64	66	45	30	**337**
(Operating Rate: a/a+b)	50%	40%	57%	53%	49%	**50%**

（Source：Questionnaire Survey）

Table1- 16 Current Condition of Motorized Pump Boreholes

	Kebbi	Niger	Taraba	Ondo	Enugu	**Total**
a. Functioning	53	51	5	20	6	**135**
b. Un-functioning	35	4	10	50	12	**111**
(Operating Rate: a/a+b)	60%	93%	33%	29%	33%	**55%**

（Source：Questionnaire Survey）

2-5) Access to Safe Water, Water Consumption Per Capita Per Day and Distance to Source of Drinking Water

Access to Safe Water[note)] is 14% to 24%, Water Consumption per Capita per Day is 21ℓ to 29ℓ and Distance to Source of Drinking Water is 302m to 495m as indicated in table below. It is likely that data on access to safe water and water consumption contain water other than the safe one, according to result of the Interview survey.

Table1- 17 Access to Safe Water, Water Consumption and Distance to Source of Drinking Water

State	Access to Safe Water (%)	Water Consumption Per Capita Per Day (ℓ)	Mean Distance to Source of Drinking Water (m)
1. Kebbi	24	29	302
2. Niger	19	28	383
3. Taraba	18	24	495
4. Ondo	17	21	357
5. Enugu	14	21	410

Note) Safe water means groundwater form boreholes and protected hand dug wells. Access to Safer Water (%) is defined as water supply coverage (%) by boreholes and protected hand dug wells.

（Source：Questionnaire Survey）

2-6) Access to Basic Sanitation

Many people live without any toilets or with traditional latrines. Lack of access to improved sanitation facilities coupled with insufficient water supply facilities are main causes of water- and excrement-relate diseases like diarrhoea.

Table1- 18 Access to Basic Sanitation Facilities

State	Access to Basic Sanitation Facilities (%)
1. Kebbi	25
2. Niger	22
3. Taraba	17
4. Ondo	21
5. Enugu	24

（Source：Questionnaire Survey）

2-7) Major Problems of Rural Water Supply Facilities

The major problems related to water supply facilities are a shortage of safe water, followed by a time consuming for water collection and a long distance to source of drinking water from premises.

Table1- 19 Major Problems on Water Supply in Rural Communities Identified by the Communities

	Major Problem	Kebbi	Niger	Taraba	Ondo	Enugu	Average
1	Distance to Source of Drinking Water	34%	27%	21%	39%	25%	29%
2	Shortage of Safe Water	23%	45%	45%	34%	29%	35%
3	Water Quality	13%	12%	23%	18%	14%	16%
4	Water Collection Time	21%	26%	50%	35%	34%	33%
5	Breakdown of Hand Pump Borehole	52%	20%	22%	10%	8%	22%
6	Unhygienic Condition at Water Collection Place	8%	1%	10%	6%	0%	5%
7	O & M for Water Supply	27%	5%	14%	16%	8%	14%
8	Financial Difficulties for O & M	27%	14%	10%	15%	8%	15%
9	Other Problems	1%	7%	13%	1%	16%	8%

Note) Multiple answers were allowed.
（Source：Questionnaire Survey）

2-8) Operation and Maintenance of Water Supply Facilities by the Community-based Organizations

1) Current Situation of Structuring

Table1- 20 Community-based Organizations For O & M of Water and Sanitation Facilities

	WASHCOM	Water Committee	Other Types of CBO	None（including Unknown）
1. Kebbi	15 (13%)	39 (33%)	30 (25%).	35 (29%)
2. Niger	6 (5%)	31 (26%)	3 (2%)	81 (67%)
3. Taraba	55 (46%)	5 (13%)	1 (0%)	49 (41%)
4. Ondo	8 (7%)	12 (10%)	19 (16%)	80 (67%)
5. Enugu	14 (12%)	17 (14%)	2 (2%)	87 (72%)
Total	**98（16%）**	**114（19%）**	**55（10%）**	**332（55%）**

（Source：Questionnaire Survey）

2) Current Situation on Inspection and Minor Repair

The Survey showed the following condition.

a. Frequency

More than one-third of the target communities implements inspection and repair one or two times a year. Besides, about one-third of the total communities implements inspection and repair more than three times a year.

b. Authorities of Inspection and Repair

More than half the numbers of the target communities take primary responsibility for inspection and repair at community level, among others such as LGA, RUWASSA, WATSAN Project, private companies, donors.

c. Cost

Cost for inspection and minor repair ranges from 19,000 to 45,000 NGN per repair. The average cost is 30,000 NGN.

1-3-2 Interview Survey

An outline for the result of the Interview survey is as follows.

- The interview survey was carried out for 34 communities in 18 LGAs selected by RUWASSA/WATSAN Project in the target five states, as listed in table below.

Table1- 21 LGAs and Communities for the Interview Survey

		Kebbi State	Niger State	Taraba State	Ondo State	Enugu State
1	LGA	1. Kalgo	1. Paikolo	1. Zing	1. Akure North	1. Nkanu East
		2. Argungu	2. Katcha	2. Lau	2. Ose	2. Awgu
		3. Jega	3. Magama	3. Gassol	3. Akoko South West	3. Uzo-uwani
			4. Bosso	4. Bali	4. Akoko North	
2	Community	***(1. Kalgo-2)***	***(1. Paikolo-3)***	***(1. Zing-2)***	***(1. Akure North-2)***	***(1. Nkanu East-2)***
		Ubqandawaki	Kwata/Baidna	Jagmpo	Adewolo Camp.	Ihuokpara
		Asarara	Baidna	Lappo	Imafon	Obodo Uvuru
		(2. Argungu-2)	Busi	***(2. Lau-2)***	***(2. Ose-2)***	***(2. Awgu-3)***
		Yamama	***(2. Katcha-2)***	Msheli	Ute	Ugboha Imama Mgbowo
		Kwakwashe	Edotsu Badeggi	Yusa'B'Wuro Munyawa	Ijagba	Ohaja
		(3. Jega-2)	Fuyaka Katcha	***(3. Gassol-2)***	***(3. Akoko South West-***	Amoli
		Tsirairai	***(3. Magama-2)***	Garin Abba	Etioro Akoko	***(3. Uzo-uwani-1)***
		Bakabi	Majinga	Chul	***(4. Akoko North-1)***	Ogurugu
			Maraa	***(4. Bali-2)***	Enusu (Amo) Akoko	
			(4. Bosso-1)	Mayokam		
			Pyata	Jatau		

- Except for Enugu state, population of the communities are less than 5,000. Agriculture and cattle raising constitute the primary sectors of the economy. The survey reveals that there are small-scale local trades in some communities.
- Except for some communities in Ondo and Enugu states in which one or two boreholes are available for rural water supply, communities that have sufficient access to safe water are nil.
- Water consumption per capita per day is less than 20 litres in the most communities, with some exception which exceeds 20 litres.
- Many inhabitants in the communities have been suffering from water-born diseases like diarrhoea in every year. Endemic of guinea warm has not been reported in the past few years.
- Women and children bear the greatest burden of collecting water in most communities.
- “Shortage of safe water”, “time consuming for water collection” and “distance to source of drinking water from premises” are major common problems for all the communities.
- About one-fifth of the communities have particular community-based organizations for O & M of water and sanitation facilities. There are some other communities that have self-help organizations which provide O & M management related to water supply facilities, although they are not so adequate.

The interview survey reveals that all of inhabitants of the community has strong wish to participate in operation and maintenance of water supply facilities. It also reveals that the ability to pay, the average amounts to which individual families are able to bear for operation and maintenance, is 150 – 200 NGN per month.

CHAPTER 2

CONCEPT OF THE PROJECT

Chapter 2 Contents of the Project

2-1 Basic Concept of the Project

(1) Superior Targets

The superior national development plans to the Project are Millennium Development Goal (2008 to 2015) and Vision 2020. These national plans aim at improvement of living standard of Nigerian people by economic development in middle to long term.

As for water supply, the National Water Supply and Sanitation Policy (1999) aims to raise the water coverage rate gradually to 60% by 2005, 80% by 2008 and supply safe water to every residents of Nigeria by 2011. On the other hand, the National Rural Water Supply and Sanitation Programme (A Strategic Framework) aims to raise the water coverage rate to 75% by 2015 and 100% by 2025. Following above national policy, Government of Nigeria is trying to improve water coverage rate of rural area.

(2) Project Targets

Responding to the national policy, the Implementing Agency of the five target States have borehole construction plan for rural water supply for coming eight years (2010-2017).

Table 2- 1 Development Plan for Rural Water Supply of 5 Target States (2010-2017)

State	Borehole drilling plan		Target water coverage rate in 2017 (%)
	Hand pump	Motorised	
Kebbi	410	200	52
Niger	650	240	60
Taraba	490	80	35
Ondo	690	195	70
Enugu	250	403	57

Planned water supply coverage rate shown in Table 2-1 is lower than national goal. The planned coverage in Table 2-1 is based on financial and technical capacity, such as number of boreholes drilled by the target 5 States in recent years. The planned coverage ratio in Table 2-1 is more realistic than the national goal which already showed big difference from actual water supply coverage. The equipments and materials procured by the Project are indispensable for implementation of the projects by the five target States.

The Project aims to provide equipment and materials for borehole construction and technical support for operation and maintenance of equipment over an appropriate scope as a grant aid undertaking of the Government of Japan in order to contribute to the realization of construction plans for the rural water supply.

In order to realize the plans, the Project aims to drill 100 hand pump boreholes in each target State, total of 500 boreholes in 5 target States, over two years using the procured equipment, and these facilities will benefit a population of approximately 132,000.

The procured drilling rigs will be used continuously for construction of water supply facilities by the Implementing Agencies of 5 target States. It is expected that 150 boreholes by each State, 750 boreholes in total, will be constructed during 2015 to 2017, benefiting a population of approximately 198,000 in the five target States.

2-2 Outline Design of the Japanese Assistance

The Project is composed of equipment and materials procurement and the soft components.

Equipment and materials for the drilling and construction of boreholes will be procured and used for the construction work of 500 boreholes in total for five target States by the Nigerian side. After the 500 drilling work, the Nigerian side will continue drilling work using the procured equipment. The summary of the outline design is shown in Table 2-2.

Table 2- 2 Procured Equipment and Materials

	Contents of Equipment and Materials	Quantity	
1.	Drilling Equipment		
(1)	Drilling rig	Kebbi:1 Niger :1 Taraba:1 Ondo :1 Enugu :1	unit
(2)	High pressure air compressor		
(3)	Cargo truck with crane		
2.	Survey Equipment		
(1)	Geophysical survey equipment	Kebbi:1 Niger :1 Taraba:1 Ondo :1 Enugu :1	Set
(2)	Water analysis equipment		
(3)	Pumping test equipment		
3.	Borehole Construction Materials		
(1)	Hand pump	Kebbi:100 Niger :100 Taraba:100 Ondo :100 Enugu :100	Set
(2)	Community level mechanic tool		
(3)	LGA level mechanic tools	Kebbi:14 Niger :24 Taraba:15 Ondo :18 Enugu : 9	Set
(4)	PVC casing pipe & screen pipe	For number of boreholes below in each State Kebbi:100 Niger :100 Taraba:100 Ondo :100 Enugu :100	Set
(5)	Drilling Fluid	Kebbi:100 Niger :100 Taraba:100 Ondo :100 Enugu :100	Set

The Japanese consultant will take the initiative in implementing the soft components, which will comprise the implementation of technical training for i) formulation of construction plan, data management and equipment maintenance, and ii) strengthening of the operation and maintenance system for the water supply facilities.

The following outputs are anticipated as a result of the above Project activities.

① The equipment to construct water supply facilities with boreholes will be made available in five target States.
② Implementation and organizational setup of the water supply and sanitation of the Implementing Agency in five target States will be reinforced.

Project Design Matrix (PDM) for the Project is shown in Table 2-3.

Table 2- 3　Project Design Matrix（PDM）

Project：Project for Improvement of Rural Water Supply in Federal Republic of Nigeria
Project Duration：2 years
Target Area：100 sites for each of five target States: Kebbi, Niger, Taraba, Ondo and Enugu.
Target Group：Communities in the Project Area

Design Summary	Project Monitoring Indicators	Source of Indicators	External Conditions
［Ultimate Goal］ • Improvement of water supply and sanitation condition in rural areas in Kebbi, Niger, Taraba, Ondo and Enugu State.	• Water coverage ratio will be increased in rural areas of Kebbi, Niger, Taraba, Ondo and Enugu State. • Number of patients with water-borne diseases will decrease in the rural areas of Kebbi, Niger, Taraba, Ondo and Enugu State.	• Statistical data of water supply coverage by State Ministry of Water Resources and the Implementing Agencies • Statistical data on water-borne diseases by Ministry of Health and LGs.	• There is no change in the national policy about rural water supply. • The health education and activities for health improvement will be continued.
［Purpose］ • Water supply facilities will be constructed in the Project area. • Community organization will be established for sustainable used of water supply facilities in the project area.	• Water supply facilities will be constructed and water supply conditions of communities will be improved. • WASHCOM will be established in the target communities. • Assuming that each borehole provides 30ℓ of water for 264 people per day, safe water will be supplied to approximately 330,000 people over five years. • Water collection work load of women and children will be reduced.	• Monitoring report on pumping, community population, water supply coverage, daily pumping hours, etc. • Interview survey to communities residents on water drawing load.	• There is no radical economic change in the country. • Population of the Project area will not increase immediately.
［Outputs］ • Necessary equipment and materials for the drilling and construction of boreholes will be provided to the Implementing Agencies. • The project implementation and institutional management of the Implementing Agencies will be strengthened. • WASHCOM in the communities will be strengthened.	• The extent of equipment and materials procurement as planned. • The number of borehole construction by the Nigerian side. • The number of established WASHCOM in the target communities	• The shipping document of equipments • The delivery of goods/receipts of equipments • Construction record, etc. • Progress report of the Project • Monitoring record by the LGs submitted to the Implementing Agencies	• Manpower and cost for operation and maintenance of equipment will be secured by Nigerian side. • The organization and cost for project implementation will be secured by Nigerian side.

Design Summary	Project Monitoring Indicators	Source of Indicators	External Conditions
[Activities] <Japanese Side> • Procurement of equipments and materials for borehole construction • OJT on operation and maintenance of the above-mentioned equipment and materials. • Procurement of materials for construction of 100 boreholes for Kebbi, Niger, Taraba, Ondo and Enugu State. • Technical support for formulation of facilities construction plan, data management and equipment maintenance (soft components) • Technical support for strengthening of O/M system of water supply facilities (soft components) <Nigerian Side> • Construction of 100 hand pump boreholes in Kebbi, Niger, Taraba, Ondo and Enugu State. • O/M of water supply facilities by communities	**[Inputs]** (Japanese Side) • Equipment for drilling and survey equipment: Drilling rigs, high pressure air compressor, survey equipment (geophysical survey equipment, water quality analysis, pumping test) • Materials for borehole construction: Casing, screen, hand pump, etc. • Technical assistance by soft components (Nigerian Side) • Securing of construction sites, personnel and budget for construction. • Construction of 500 boreholes with hand pump (Kebbi:100, Niger:100, Taraba:100, Ondo:100, Enugu;100) over two years • Sustainable groundwater development following completion of the Project • Sustainable education and support to communities for operation and maintenance of water supply facilities.		• Intensive inflation and fluctuation of exchange rate do not occur during the Project implementation. • Remarkable natural disaster does not occur, and the security situation does not change during the Project implementation. • Staff of the Implementing Agencies given technical transfer by the Project will continue their work.

2-2-1 Design Policy

(1) Basic Policy

The basic policy of the Project is described below.

1) Scope of the cooperation

- Considering the effective realization of the Japan's Grant Aid, the scope of the Project shall cover the following: ① procurement of drilling machines and other borehole construction equipment and materials, ② technical training by means of OJT by the supplier regarding the operation and handling of the procured equipment and materials, ③ soft components by the consultant to support i) formulation of construction plan, data arrangement and equipment maintenance, ii) strengthening of operation and maintenance system for water supply facilities.
- The Implementing Agencies will construct the borehole facilities in two years using equipment and materials (hand pumps, casing and screen pipes etc.) supplied by the Japanese side. The Implementing Agencies will continue construction of the borehole facilities using the procured equipment continuously after completion of the Project.
- Drilling chemicals such as bentonite and mud control chemicals will be procured by the Japanese side. The Nigerian side will bear the cost of, cement, gravel, reinforcing bars, fuel, water, other borehole construction materials and labor.

2) Site selection

- The borehole construction period shall be set at two years in consideration of the possible storage time for borehole construction materials such as casing pipes etc. procured by the Japanese side.
- As for the construction work for the first two years, the Implementing Agency of each State proposed construction of 120 boreholes. Responding to this proposal, JICA Survey Team examined appropriateness of the proposed 120 sites based on the construction capacity of the Implementing Agencies, hydrogeological condition and social condition of the proposed sites. Based on the examination, the JICA Survey Team finally concluded that 100 boreholes should be constructed by each Implementing Agency.
- Implementing Agencies will determine prioritised 100 borehole drilling sites in each State based on result of geophysical sounding. Remaining 20 borehole sites in each State will be considered as additional points.

(2) Concept regarding Natural Conditions

1) As for the amount of rainfall of target 5 States, it is relatively smaller in the States of the northern part of the country, such as 835mm in Kebbi State. On the other hand, it is bigger in the States of the southern part of the country, such as 1,579mm in Ondo State. The target five States are classified into tropical savannah climate, and the dry season and the rainy season are clear. The rainy season is from April/May to October, and the monthly rainfall is the highest between July and September, usually in August, about 220mm to 410mm in the target States of the northern part of the country. In the target States of the southern part of the country, there are two peaks of monthly rainfall, June/July and September/October, with the maximum mean monthly rainfall of 200mm to 340mm.

The main roads of each State are paved with good maintenance, so that the passing trouble will hardly happen even in the rainy season. However, many local roads away from main roads to target communities are un-paved. The road condition will become bad in the rainy season which will cause the bad influence to vehicular traffic. Access to a drilling site for the construction work may be difficult in heavy rainy season. Therefore, the borehole construction plan shall be formulated in consideration of the access condition to the drilling site.

2) The aquifer of the Project areas consists of i) the sand stratum of the Quaternary deposit, ii) the sandstone layer intercalated within the clay and the shale formation of the Tertiary sedimentary rock, iii) the sandstone superior formation of the Cretaceous sedimentary rock, iv) the sandstone layer

intercalated within the shale superior formation of the Cretaceous sedimentary rock and v) the weathered zone or fissured zone of the Basement Complex.

Therefore, the borehole drilling plan and borehole structure shall be drawn up in consideration of the various hydrogeological conditions.

3) The average yield of boreholes is 0.9ℓ/sec. in Kebbi State, 0.8ℓ/sec. in Niger State, 0.5ℓ/sec. in Taraba State, 1.1ℓ/sec. in Ondo State and 1.2ℓ/sec. in Enugu State. The borehole yield in Taraba State is smaller than those of the other States.

In order to increase borehole yield, methods below should be tried: i) to perform exploratory survey in detail prior to drilling work, ii) to drill borehole deeper than usual to explore aquifer condition. It is effective to locate screen properly based on the result of geophysical borehole logging.

4) It is reported that there are some areas where concentration of iron, nitric acid, fluorine, salt, etc. of groundwater exceed water quality standard, though such areas are limited. The water quality analysis must be carried out at the time of pumping test. If water quality does not satisfy requirement of water quality standard, it is necessary to judge carefully the eligibility of the groundwater as drinking purpose.

(3) Concept regarding Social Conditions

An examination of the social condition identified the following water supply conditions and prospects in most target communities:

(a) Absolute lack of access to safe water;
(b) A great amount of time is consumed for collecting water due to a long distance to sources of drinking water in addition to the limited number of water sources;
(c) Slow progress in improvement of access to basic sanitation (toilets) causes a routine occurrence of water- and excreta-related diseases under unhygienic sanitation conditions; and
(d) People have intention to own, operate and maintain the hand-pump boreholes on their own responsibilities.

Bearing the facts mentioned above in mind, the following policies related to social condition shall be considered for the outline design:

1) Selection of the target communities in consideration of effectiveness of the Project
Some communities have one or more water sources available as an alternative to groundwater. On the other hand, there are other communities depending substantially only on development of groundwater. The Nigerian side should select the final target communities in which a water scheme of the Project is sited. In selection of the final target communities, priority should be taken into account for such communities with the strong need for hand-pump boreholes, as this prioritization will accelerate an increase of effectiveness of the Project.

2) Sustainable Operation and Maintenance by Community-based Organization
A community-based organization is critical for operation and maintenance (O & M) of the boreholes after completion. O & M shall include an undertaking to make small repairs on hand-pumps. This will require responsibilities for communities to bear financial obligation and/or labor service.
To ensure a sustainable O & M by community-based organization based on the self-help sprit, the detail design shall consider the technical and financial capacities of the inhabitants in the target communities.

(4) Concept regarding the Construction Situation and Utilization of Local Constructors, Equipment and Materials

The Implementing Agencies have boreholes drilling teams and geophysical sounding teams with enough numbers of personnel for borehole construction work. There are more than one drilling team without drilling machine (see Table 2-4). In the past, one drilling team operated one drilling machine. However, in recent years available number of drilling rigs has been reduced because of breakdown of the rigs. As a result, number of drilling team has exceeded number of drilling rigs in each Implementing Agency. However, one drilling machine is being operated by more than two drilling

teams in rotation, and no drilling team is out of drilling work. Therefore, drilling machines to be procured by this Project will be operated by drilling teams currently active. The existing drilling teams have enough experience and skill for drilling work, and they can implement this Project with a little basic technical transfer on handling of drilling rigs. Therefore, Implementing Agencies of the target 5 States will construct borehole facilities using procured equipment and materials in this Project.

There are several private drilling companies in the target States. The Implementing Agencies of the target State can drill boreholes with higher technical capacity than the private companies, so that it is not necessary to employ private drilling companies for the Project.

Table 2- 4 Number of Drilling Team in Implementing Agencies

State	Number of drilling rigs currently being operated	Number of drilling teams currently active	Number of drilling team available for operating newly procured drilling rig
Kebbi	1	2	1
Niger	2 note-1)	3	1
Taraba	2 note-2)	3	1
Ondo	0	2	2
Enugu	1	3	2

Note-1) One of two existing drilling rigs was manufactured in 1987. It is not expected for this rig to be operated in good condition.

Note-2) One of two existing rigs is mainly operated. The other one is small rig without high capacity.

In utilization of the local material in the Project, items below will be considered.

- In order to secure quality of construction, equipment and materials shall be selected from products that comply with international standards as much as possible.
- In consideration of service and maintenance, major items of equipment such as drilling rigs and vehicles shall be purchased from makers that can readily supply spare parts.
- Borehole construction materials such as hand pump, casing and screen shall be procured in Nigeria. Indian Mark III, which is promoted by the Federal Government as standard hand pump type for Village Level Operation and Maintenance (VLOM), shall be selected.

(5) Concept regarding the Operation and Maintenance Capacity of the Implementing Agencies

1) Construction Plan

The Implementing Agencies of each State have responsibility to complete 100 borehole facilities within two years. This construction work needs effective management. Judging from drilling experience and achievement of each Implementing Agencies, it is not difficult for the Implementing Agencies to drill 100 boreholes in 2 years. However, there is a possibility that they can not complete 100 boreholes in case where borehole construction work is not efficiently managed by them. Before borehole construction work starts, overall construction plan for 100 boreholes drilling for 2 years shall be formulated in the soft component by the Project. Most important working schedule of overall construction will be carefully selected, and management plan will be proposed. Following such management plans, the Implementing Agencies will be able to complete 100 borehole facilities for 2 years.

2) Maintenance of equipment by Implementing Agencies

The Implementing Agencies do not have maintenance manual for equipment. They have record of maintenance, which is simple memorandum without detail description by regular format. Drilling work in the field is frequently stopped due to breakdown of drilling rig, which is not regularly maintained and repaired. This will cause delay of drilling works. To improve such situation, formulation of regulation within the agencies and manual for maintenance of equipment are necessary. Further more, formulation of record format for check sheet of equipment maintenance will promote daily maintenance and preventive work. This will be implemented in the soft components.

3) Compiling of well inventory

The Implementing Agencies keep many reports on drilling. However, information and data of the

reports are not yet compiled into borehole inventory and can not be efficiently utilized. Borehole inventory is indispensable for formulation of borehole construction plan. The Implementing Agencies are going to formulate borehole inventory using computer data base, which needs technical support by the soft components.

4) Support for operation and maintenance of rural water supply facilities
The Implementing Agencies of the target States use manual compiled by UNICEF for operation and maintenance of rural water supply facilities. The contents of this manual are too comprehensive for the communities to understand. Natural conditions of the target States is different from each other, and current condition and issues on water supply is also different from State to State. Manual by UNICEF does not reflect such differences. Therefore, it is necessary to compile new manual which reflect real situation of water supply condition of each State.

(6) Concept regarding the Grading of Equipment

- The capable drilling depth of the rigs shall be set in consideration of the depth of aquifer and the static water level.
- Truck-mounted rig and compressor shall be selected to ensure easy accessibility and mobility.
- 4-wheel-drive vehicles shall be selected for crane cargo trucks in consideration of bad road conditions.
- Indian Mark III (VLOM), which is promoted by the Federal Government as standard hand pump type, shall be selected.
- Borehole structure, drilling methods and equipment plans for drilling which meet the local geological conditions shall be proposed.
- Platform structures such as concrete pad, drainage ditches and soakage pits shall be designed in consideration of preventing infiltration of domestic waste water, in order to avoid adverse impact on water quality.

(7) Concept regarding Drilling Works and Procurement Methods and Work Period

- As Pre-Cambrian hard basement rocks and sedimentary rocks are distributed widely in the target States, basement rocks and sedimentary rocks are hard in deep part of the ground. However, the rocks are soft in the shallow part of the ground and likely to collapse during drilling work. Therefore, the casing program and drilling method shall be chosen in consideration of the rock condition.
- Both mud circulation rotary drilling and DTH drilling methods shall be applied as the drilling method depending on geological conditions.
- Drilling schedule shall be prepared taking into account the past drilling achievement by the Implementing Agencies. It should be carefully noticed that efficiency of drilling work will be reduced in the rainy season due to deterioration of accessibility to the sites and so forth.
- The total Project period shall be scheduled taking into account the time necessary for procurement, the capacity of the Implementing Agencies for project implementation and the period for the soft components.

2-2-2 Basic Plan (Equipment Plan)

2-2-2-1 Overall Plan

The Implementing Agencies of the target States drilled many boreholes in the past and currently have sufficient project implementation capacity as organizations responsible for rural waters supply. On the other hand, their drilling work in recent year is reducing due to deterioration of drilling rigs. It makes less efficient use of manpower of drilling section of the Implementing Agencies. The biggest issue of the Implementing Agencies is deterioration of drilling rigs. By solving this problem, capacity of the Implementing Agencies will be fully utilized. Procurement of drilling equipment and materials by the Project will improve technical and organizational capacity of the Implementing Agencies. Consequently, the function of the Implementing Agencies will be strengthened as responsible organizations for rural water supply,

This Project should be implemented for the procurement of equipment and materials, whereas the Nigerian side will execute the construction of facilities using the equipment and materials procured

under the Project and those currently owned by the Implementing Agencies.

(1) Target Communities

Target communities were selected for procurement of materials for borehole construction in this Project. Target communities were selected based on three criteria below:

a) Drilling capacity of the Implementing Agencies
b) Hydrogeological condition
c) Social condition

Drilling capacity of the Implementing Agencies was evaluated from result of the field survey to the Implementing Agencies. On the other hand, prioritized communities were listed up for evaluation of hydrogeological condition and social condition. The Implementing Agencies submitted to JICA Survey Team the list of prioritized communities for drilling boreholes for two years. List of the prioritized communities are shown in Table 2-11 to Table 2-15, and location of the prioritized communities are shown in Figure 2-1 to 2-5.

Number of the prioritized communities submitted by State was around 120 because it is not realistic to drill more than 120 boreholes for two years by each State. Target communities were examined based on criteria mentioned above, and the result of the examination is explained below.

1) Drilling Capacity of the Implementing Agencies
Number of boreholes to be drilled for two years depends on drilling capacity of the Implementing Agencies and geological condition of the target communities. The number of boreholes drilled by the Implementing Agencies for the past five years is shown in Table 2-5.

Table 2- 5 Number of Boreholes Drilled by the Implementing Agencies for Past Five Years

State	Average number of boreholes drilled in 1 year (per drilling rig)	Maximum number of boreholes drilled in 1 year (per drilling rig)	Geology
Kebbi	30	57	Aquifer is mainly basement rock, though it is sedimentary rocks in some area.
Niger	12[1)]	60	
Taraba	31	62	
Ondo	33	54	
Enugu	24	36	Aquifer Sedimentary rock

Note) The Implementing Agency of Niger State did not drill borehole between 2006 and 2009 due to lack of drilling rig available. But they drilled 60 boreholes in 7 months in 2010. This is why their drilling achievement is only 12 boreholes per year in average for the last 5 years.

As shown in Table 2-2, the Implementing Agencies drilled 12 to 33 boreholes per year in average using 1 drilling rig and 54 to 62 boreholes per year at maximum, for the past 5 years. Matters below must be noticed in interpretation of number of boreholes in Table 2-5.

- Drilling rigs of the Implementing Agencies are already old, and drilling capacity of the rigs is low.
- Number of boreholes to be drilled by the Implementing Agencies depends on dimension of projects for rural water supply by the State Government and donors.
- The States Government or donors can decide whether the drilling work will be undertaken by the Implementing Agency or private drilling companies in the Project.

Therefore number of boreholes shown in Table 2-5 indicate not only drilling capacity of the Implementing Agencies but also other factors explained above. An example of Kano Project (2007) gives suggestion in order to assess number of boreholes to be drilled by the Implementing Agencies using newly procured drilling rigs by the Project. Number of boreholes drilled before Kano Project is shown in Table 2-6, and those after Kano Project are shown in Table 2-7.

Table 2- 6 Number of Borehole Drilled by Existing Rig before Kano Project (1999～2004)

Average number of boreholes drilled per 1 rigs per year	Maximum number of boreholes drilled per 1 rig per year
19	42

Table 2- 7 Number of Boreholes Drilled by Procured Rig during Kano Project (2007～2009)

Year	2007	2008	2009	Average
Number of boreholes drilled by Procured rig	47	80	38	55

As shown in Table 2-7, the number of boreholes drilled in Kano Project (from 2007 to 2009) is much larger than those before Kino Project (from 1999 to 2004). During three years in Kino Project, 55 boreholes per year were drilled in average. In consideration of example of Kano Project, adequate number of boreholes to be drilled by the Implementing Agencies was assessed based on matters bellow.

- Drilling capacity of the Implementing Agencies should not be assessed based on average number of boreholes drilled per year but the maximum number of boreholes drilled per year shown in Table 2-5.
- According to Table 2-5, most of the Implementing Agencies drilled more than 50 boreholes per year.
- Kano RUWASSA drilled less than 19 boreholes per year in average before Kano Project. However, they drilled more than 50 boreholes per year during Kano project using newly procured rig.

Consequently, it is concluded that the Implementing Agencies can drill 50 boreholes per year using newly procured rig by the Project. The Implementing Agencies have enough capacity to drill more than 50 boreholes per year. However, there are unpredictable factor in drilling work, so that 50 boreholes per year should be their target of drilling. Therefore, it is concluded that the each Implementation Agencies should drill 100 boreholes for two years.

2) Hydrogeological Condition

Hand pump will be used for boreholes in the Project. Three conditions mentioned in Table 2-8 must be satisfied for use of hand pump.

Table 2- 8 Three hydrogeological Criteria for Use of Hand Pump at borehole

Condition	Content
Groundwater level must be higher than 40m below the ground surface	This condition is for use of Indian Mark III, which is common hand pump in Nigeria. The Federal Ministry of Water Resources is promoting standardization of Indian Mark III as hand pump for village level operation and maintenance (VLOM). Generally speaking, it becomes harder for women and children to pump up groundwater from a borehole as groundwater level become deeper. Groundwater level of 40m below the ground surface is limit for them to pump up groundwater using Indian Mark III.
Yield from boreholes must be more than 7 m^3/day	The Implementing Agenises adopt 11 ℓ/minute as standard yield form a borehole with hand pump. Total yield of 7m^3/day can be possible in 12 hours operation of hand pump with pumping rate of 11 ℓ/minute. Therefore, potential yield of borehole must be more than 7m^3/day.
Boreholes successful rate to satisfy above 2 conditions must be more than 60%	The Implementing Agencies do not have clear criteria for successful rate of boreholes. Practically they give up drilling borehole in community after they drilled 2 to 3 boreholes without groundwater. Successful rate of 50％ is proposed by JICA Guidline[Note)].

Note) Guideline on Basic Design for Groundwater development for Japans Grant Aid Project (1997)

The result of hydrogeological survey on 120 prioritized communities is shown in Table 2-9. As shown in Table 2-9, the groundwater level is higher than 40m below the ground surface in most of the Project area of the target States, except some area in Enugu State. On the other hand, there is no problem on potential yield and successful rate of boreholes in the entire Project area. Therefore, most of 120 communities prioritized by the Implementing Agencies meet hydrogeological condition except some communities of Enugu State.

Table 2- 9 Hydrogeological Condition of Target States
(120 Prioritized Communities in Each State)

State	Aquifer	Groundwater level	Yield	Successful rate	Water quality
		GL-m	m^3/day		
Kebbi	Tertiary sedimentary rock	7.2	47	65～85%	Almost good
	Cretaceous sedimentary rock	8.0	36		Good
	Pre-Cambrian basementrock	7.6	29		Good
Niger	Cretaceous sedimentary rock	9.0	25	70～80%	Almost good
	Pre-Cambrian basementrock	7.0	29		Almost good
Taraba	Cretaceous sedimentary rock	4.3	18	70～85%	Almost good
	Pre-Cambrian basementrock	4.7	18		Almost good
Ondo	Quaternary sediment	15.0	72	50～80%	Almost good
	Tertiary/Cretaceous sedimentary rock	6.7	36		Almost good
	Pre-Cambrian basementrock	5.1	32		Good
Enugu	Tertiary shale/Cretaceous sandstone	91.0	830	60～85%	Almost good
	Cretaceous Ajalli sandstone	110.0	680		Almost good
	Awgu shale, Cretaceous Asta shale/Awgu shale	6.0	36		Almost good
	Cretaceous Awgu shale	5.0	54		Almost good

3) Social Condition

a) Clarification of Effectiveness for Construction of Boreholes

The data of the social condition survey indicate that construction of hand-pump boreholes in most target communities selected by the Nigerian side are basically appropriate for the Project since almost all the target communities have been suffering from the lack of access to safe water under different conditions. As an example, there are some communities with a number of water sources as an alternative to hand-pump boreholes such as motorized boreholes. However, their actual water supply conditions are poorer than the water coverage rates indicated by the results of the social condition survey. One of the backgrounds for this situation is that there are many non-functional boreholes without repairs for years in all the selected States.

Conclusions of the social condition survey have clarified the appropriateness of the target communities in the five selected States as proposed, with the following comments that would greatly increase the effectiveness of the Project.

i) The Nigerian side should give consideration to the different conditions of water supply among the communities in the project implementation stage;
ii) Based on the consideration as above, a high priority among the target communities should be given for those with an absolute necessity of constructing hand-pump boreholes; and
iii) Coincidently, for increasing the effectiveness of the Project as a whole, further it is necessary to take an appropriate action promptly for reactivation of the non-functional but repairable boreholes.

b) Sustainable Operation and Maintenance by the Community-based Organization

The communities should have responsibilities for operation and maintenance (O & M) of the facilities after completion, in collaboration with LGs and the Implementing Agencies. For example, they have to manage minor repairs including purchase and replacement of spare parts for hand-pumps in cases where the troubles are repairable at community level of operation and maintenance (VLOM).

It is apparent by the results of the social condition survey that through the community-based organizations, the people have shown their strong positive intention and hope for possession, operation and maintenance of their facilities by themselves. Further, they also revealed their intention to pay for the purpose of O & M. According to the survey, the affordable contribution for O & M in monetary term was within a range of 100s to 1,000s NGN per month per household. On the other hand, it must be noted that it is not small task for the people in communities to meet with the monetary obligations at all times since their cash income sources are neither ample nor stable all the year round.

From the above, it could be concluded that

i) All the target communities have acceptability and potential that may be developed to

sustainable O & M of the completed facilities; and

ii) Said O & M will be achieved only when appropriate considerations are given to the capacities of the target communities-based organizations (WASHCOM etc.) in terms of technical and financial aspects.

4) Comprehensive Evaluation

Number of community where borehole can be drilled for two years was decided based on criteria mentioned above (seen Table 2-10).

Table 2- 10 Comprehensive Evaluation of Number of Boreholes to be drilled for Two Years

(Unit：Number of Boreholes)

State	①Capacity of Implementing Agencies	Prioritized communities		Evaluation (Minimum of ① to ③)
		① Hydrogeological Condition	③ Social Condition	
Kebbi	100	120	123	100
Niger	100	120	120	100
Taraba	100	120	120	100
Ondo	100	120	120	100
Enugu	100	110	120	100

As shown in Table 2-10, most critical condition for decision of number of boreholes to be drilled for two years is capacity of the Implementing Agencies. Matters below must be noticed to interpret this result.

- The Implementing Agencies has enough drilling capacity to drill more than 100 boreholes in two years, as they announced. However, their responsibility for drilling in two year should be kept 100 boreholes because there will be unpredictable natural factor to delay drilling works.
- Each Implementing Agency has the list of prioritized communities of more than 200 communities. From the list, they selected and submitted to JICA Survey Team around 120 prioritized communities with highest emergency. The JICA Survey Team examined the proposed communities and concluded that entire community are lacking in water supply facilities and eligible for target of the Project. The Implementing Agencies will select most urgent 100 communities from 120 prioritised communities for drilling boreholes in the Project Implementation Stage. As for the selection of the 100 communities, Japanese expert will make assistance to the Implementing Agencies through the soft components activities for technical training for formulation of borehole construction plan within the Project.

Table 2- 11 Target Communities (Enugu)

No.	LGA	Community	No.	LGA	Community
1	ANINRI	Aneke Oji Mpu	61	ANINRI	Aneke Oji Mpu
2		Okomegbgo Mpu	62		Okomegbgo Mpu
3		Okpanku	63		Okpanku
4		Ekoli	64		Ekoli
5		Ukete Oduma	65		Ukete Oduma
6	AWGU	Uhueze Nenwe	66		Uhueze Nenwe
7		Emudo Nenwe	67		Emudo Nenwe
8		Amorji Nenwe	68		Amorji Nenwe
9		Owelli Uzam	69		Owelli Uzam
10		Amabor Owelli	70	AWGU	Amabor Owelli
11		Enugu Owelli	71		Enugu Owelli
12		Ibite Agbudu	72		Ibite Agbudu
13		Enugu Agu Enuguato Ihe	73		Enugu Agu Enuguato Ihe
14		Umuogodo Ihe	74		Umuogodo Ihe
15		Amata Ituku	75		Amata Ituku
16		Umuonyiba Ituku	76		Umuonyiba Ituku
17		Ogbaku	77		Ogbaku
18		Ugboha Imama Mgbowo	78		Ugboha Imama Mgbowo
19		Obodo Ikoro Ezioha	79		Obodo Ikoro Ezioha
20		Amokpo	80	ENUGU EAST	Amokpo
21		Mbulu Owehe	81		Mbulu Owehe
22	ENUGU EAST	Ogbeke	82		Ogbeke
23		Mbulu Njodo	83		Mbulu Njodo
24		Mbulu Awulu	84		Mbulu Awulu
25		Obeagu	85	ENUGU SOUTH	Obeagu
26	ENUGU SOUTH	Obeagu Uno	86		Obeagu Uno
27		Jioto	87		Jioto
28		Akwuke Awkunanaw	88		Akwuke Awkunanaw
29		Ikem Umaram	89	ISIUZO	Ikem Umaram
30	ISIUZO	Aguudele Mbu	90		Aguudele Mbu
31		Emeora Neke	91		Emeora Neke
32		Akpani Neke	92		Akpani Neke
33		Abor Ishiala	93		Abor Ishiala
34	NKANU EAST	Amaechi Idodo	94	NKANU EAST	Amaechi Idodo
35		Mburubu	95		Mburubu
36		Umuawulu Agu Unateze	96		Umuawulu Agu Unateze
37		Amuofia Amagu Nara	97		Amuofia Amagu Nara
38		Enuogu Nkerefi	98		Enuogu Nkerefi
39		Umuene Nomeh	99		Umuene Nomeh
40		Isigwe Ugbawka	100		Isigwe Ugbawka
41		Imama Amafor Ugbawka	101		Imama Amafor Ugbawka
42		Umuatugbuoma Akegbe	102	NKANU WEST	Umuatugbuoma Akegbe
43		Orjiagu	103		Orjiagu
44	NKANU WEST	Okorouba Ozalla	104		Okorouba Ozalla
45		Obe Uno	105		Obe Uno
46		Eziokwe Amuri	106		Eziokwe Amuri
47		Amankanu Amuri	107		Amankanu Amuri
48		Mgbogodo Agbani	108		Mgbogodo Agbani
49		Obinagu Uno Akpugo	109		Obinagu Uno Akpugo
50		Ihunekwuagu Akpugo	110		Ihunekwuagu Akpugo
51		Ogonoeji Ndi Uno Akpugo	111		Ogonoeji Ndi Uno Akpugo
52		Agbaede Akpugo	112		Agbaede Akpugo
53		Obollo Afor	113	UDENU	Obollo Afor
54	UDENU	Amalla	114		Amalla
55		Egali Amalla	115		Egali Amalla
56		Obollo Etiti	116		Obollo Etiti
57		Iheakpu Obollo	117		Iheakpu Obollo
58	UZO-UWANI	Ogbosu Umuluokpa	118	UZO UWANI	Ogbosu Umuluokpa
59		Adada	119		Adada
60		Nkume	120		Nkume

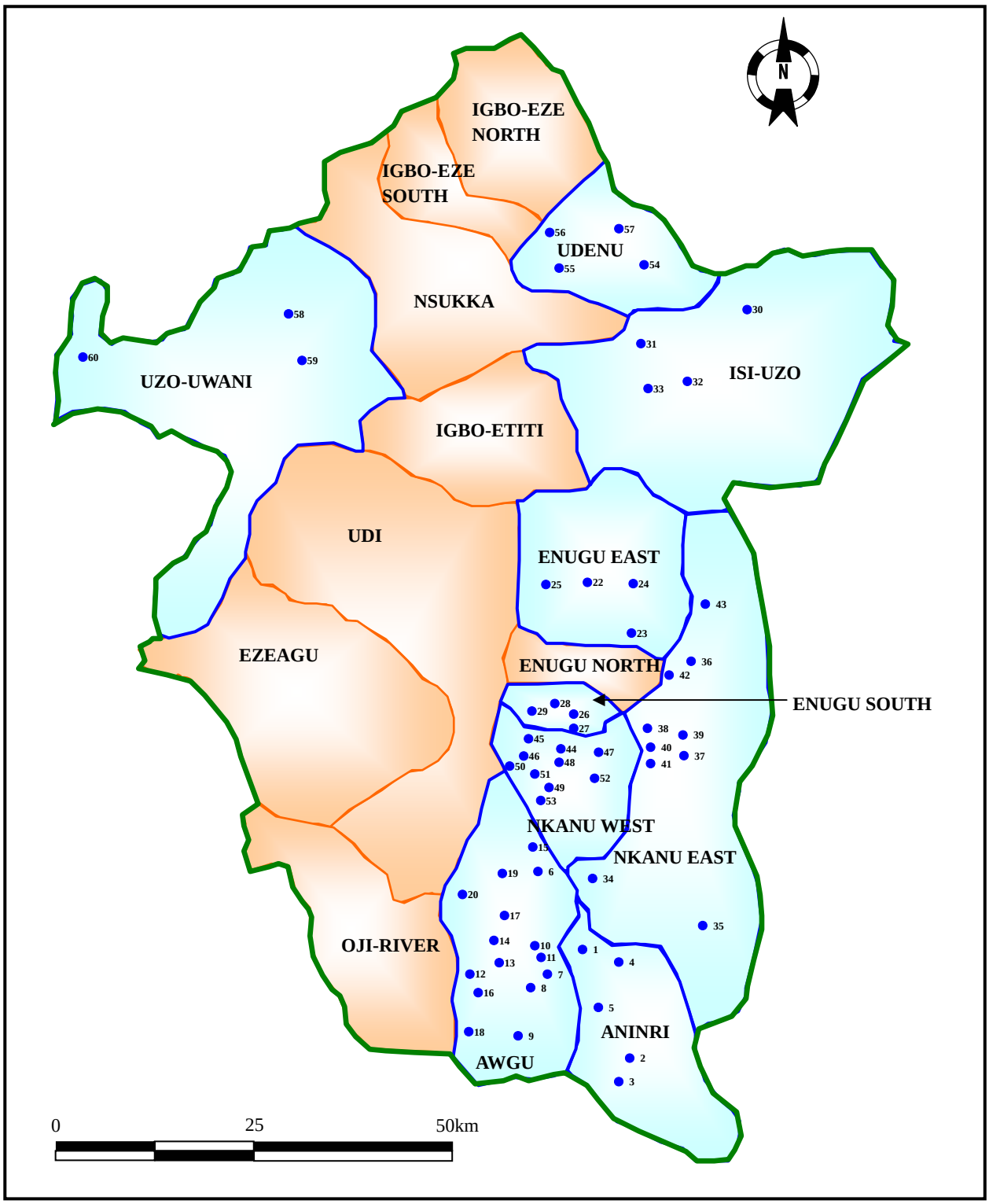


Figure 2- 1 Location of Target Communities in Enugu State

Table 2- 12 Target Communities (Ondo)

No.	LGA	Community	No.	LGA	Community
1	Akoko North-West	Arigidi Iye Road	61	Ondo West	Ajegunle
2		Afin Akoko	62		Laje 1
3		Eso Ibaram	63		Lokuakwa
4		Erusu Akoko	64		Kajola
5		Uro Akoko	65		Adewole Camp
6		Iludotun Akoko	66	Akure North	Imafo
7		Ese-Akoko	67		Adeyeye Camp,
8		Iyani Akoko	68		Ayede Ilado
9		Iye-Akoko	69		Araromi Igoba
10		Oyagi Ikaramu	70		Odo-Eku
11	Akoko South-West	Akowonjo	71		Odudu
12		Etioro -Akoko	72		Igunsin
13		Supare-Camp	73		Araromi
14		Okia-Akoko	74		Ibitoye Irese Road
15		Simerin-Akoko	75	Akure South	Akarakiri Camp, Aule
16		Ayegunle	76		Ise Oluwa Abusoro
17		Ose-Oba	77		Prayer Centre, Adofure
18		Odole-Ibaka	78		Ipinsa
19	Akoko South-East	Oyara Akoko	79		Ita-Oniyan
20		Gbede-Ipe Akoko	80		Ijigba Zone D
21		Iseu-Epinmi Akoko	81		Aseigbo
22		Sosan Isale	82	Idanre	Itaolorun
23		Sosan Oke	83		Apefon
24		Izo-Igboro	84		Asoko
25		Ayetoro Oke-Ifira	85		Aponmu Lona
26		Eti-Ose	86		Obamutula Camp
27		Ilegbe Ipe	87		ijaniyi Camp
28		Ipe Gen. Hospital	88		Ala-Goke (Near Ala)
29	Akoko North-East	Oke-Ima Akoko	89		Omifufun Camp
30		Ugbe-Akoko	90		Owode-Kajola
31		Akunnu-Akoko	91	Ile-Oluji /Okeigbo	Igbo Eledumare
32		Iyedu -Ikakumo	92		Kokowu
33		Auga-Akoko	93		Leegun
34		Ise-Akoko	94		Lipanu
35		Iboropa	95		Malintedo
36	Ose	Iwoye Afo	96	Ilaje	Igboegunrin
37		Ute	97		Atijere
38		Idogun	98		Itebunkunmi
39		Ijagba	99		Kurugbene
40	Owo	Kajola Camp	100		Ilebe
41		Ago Pannu (After Uso)	101	Okitipupa	Iju-Oke Oko
42		Sasere Camp	102		Abusoro
43		Adanigbo	103		Odofin
44		Aba Aladie (Uwase Road)	104		Ode-Aye (By Tunji & Tunji)
45		Ipenmen	105		Gbotalota
46		Oladokun Camp	106		Oni Tea
47		Bolorunduro	107	Odigbo	Orita Odigbo
48	Ondo East	Atamo	108		Adegbiji kajola
49		Mobire	109		Onipetesi
50		Oludasa	110		Koseru
51		Soko camp	111		Sabomi
52		Fagbo	112	Ese-Odo	Igbekebo
53		Ibuji	113		Igbobini
54	Ifedore	Isaru	114		Kiribo
55		Lari Camp (Aaye)	115		Agadagba Obon
56		Ajebamidele	116		Iju-Osun
57		Erigi	117	Irele	Lonla
58		Ogho	118		Iyansan
59	Ondo West	Orunbato	119		Atoranse
60		Erinla	120		Omi

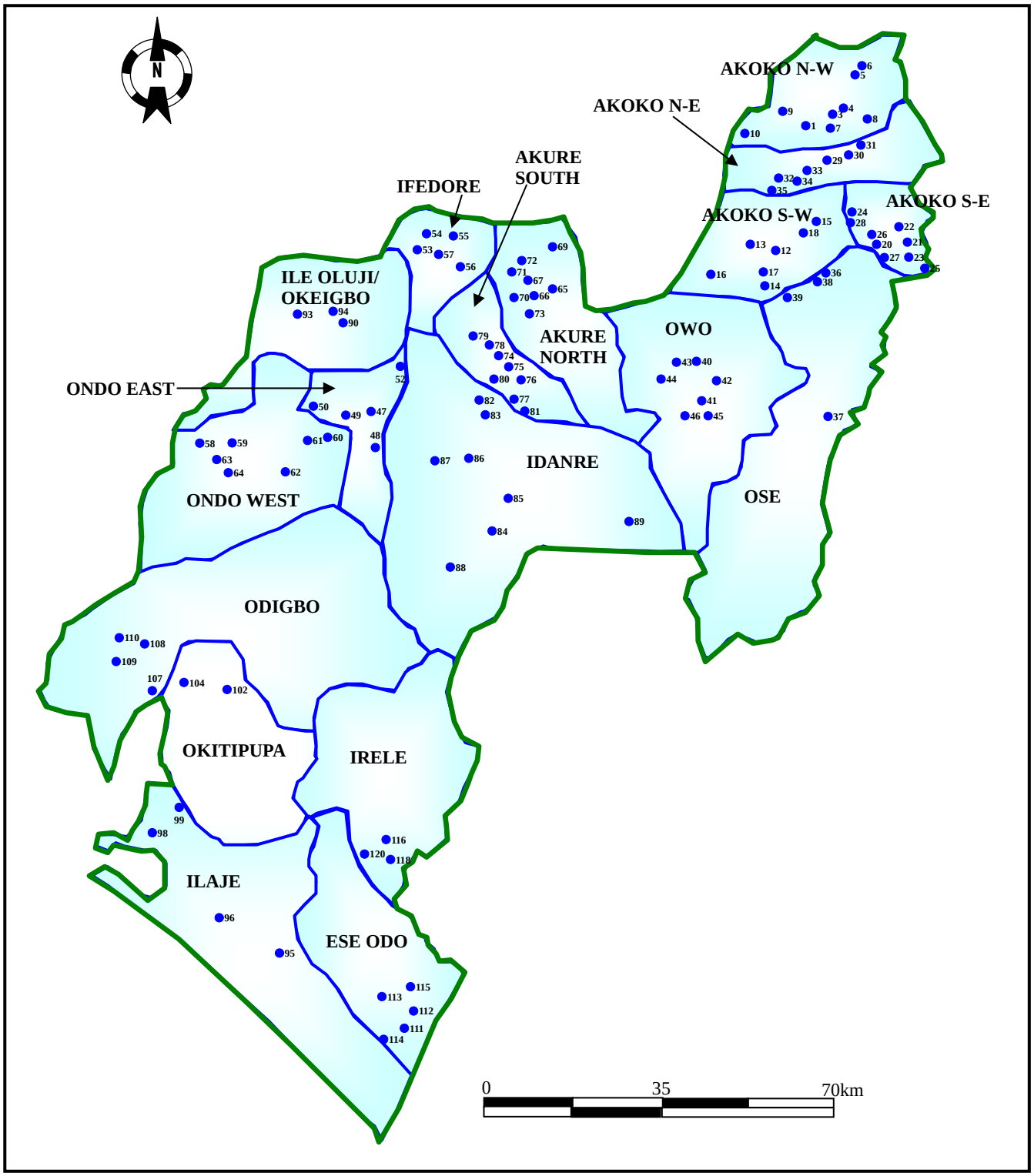


Figure 2- 2 Location of Target Communities in Ondo State

Table 2- 13 Target Communities (Taraba)

No.	LGA	Community	No.	LGA	Community
1	Ardo Kola LGA	Mayo Renewo II	61		Sabongari Jen
2		Lanko	62		Bangai
3		Mallum I	63		Mararraba Jen
4		Wuro Tapari	64		Wuro Lancha
5		Jauvo Manjor	65	Kurmi LGA	Ambwe
6		Pampetel	66		Abonbia
7		Garin Baka	67		Gidan Mallam
8		Garim Kadiri	68		Bente
9	Bali LGA	Borno - Borno	69		Kafai Ndaforo
10		Mile Tara	70		Gatere
11		Nyanli	71		Sabongida Akwanweh
12		Garim Sabon Dale	72		Nyido
13		Kungana	73	Lau LGA	Yussa B
14		Jatau	74		Misheli
15		Mayo - Kam	75		Minda
16		Yamata Manda	76		Bujun Kasuwa
17	Donga LGA	Tachapa	77		Sabongida Abbare
18		Wasaji	78		Wuro Ladde
19		Ruwan Sanyi	79		Kara Mukel
20		Lafiya Bibinu	80		Apawa Kasuwa
21		Gankwe Assen	81	Takum LGA	Tati
22		Gbundu	82		Kapiye
23		Rugan Fulani	83		Fete
24		Kabawa	84		Manya
25	Gashaka LGA	Bodel	85		Tampa
26		Abba Dogo	86		Tati Kumbu
27		Nyabar	87		Mbiya
28		Balewa	88		Kpafikun
29		Abaku	89	Ussa LGA	Kwesati
30		Kufai	90		Kusansang
31		Gamen	91		Rikwentom
32		Goje	92		Kutuko
33	Gassol LGA	Garin Abba	93		Rikwen Rika
34		Chul	94		Fikyu Ndukwe
35		Yola Bodewa	95		Kpakiya
36		Gunduma	96		Lumbu Sabongida
37		Gwiwan Kogi	97	Wukari LGA	Arufu
38		Sabon Gida Takai	98		Chinkai
39		Kwararafa	99		Nukambo
40		Dinya	100		Nolo Alamani
41	Ibi LGA	Nwoyo II	101		Kente
42		Bakyu	102		Ndo Yola
43		Gidan Mande	103		Nwuko
44		Kauyen Danwazam	104		Sondi
45		kanyen Audu Jukun	105	Yorro	Mabang
46		Agwan Jibu	106		gadalasheke
47		Muti	107		Panyala CRCN
48		Gindan Urpav	108		Nyalapa
49	Jalingo LGA	Yelwa	109		Boh Muka
50		jekunnuhou	110		Mazang Kopo
51		Kpanti Napu	111		Dazang Pupule
52		Janbanbu	112		Dilla
53		Yawai II	113	Zing	Lappo
54		Bashin	114		Janganpo
55		Murbai	115		Zandi
56		Jauro Shawo	116		Bubong
57	Karim Lamido	Zoh makra	117		Dinding
58		Nayi	118		Mazara
59		Garin Kode	119		Bushanki
60		Jen Petel	120		Bansi

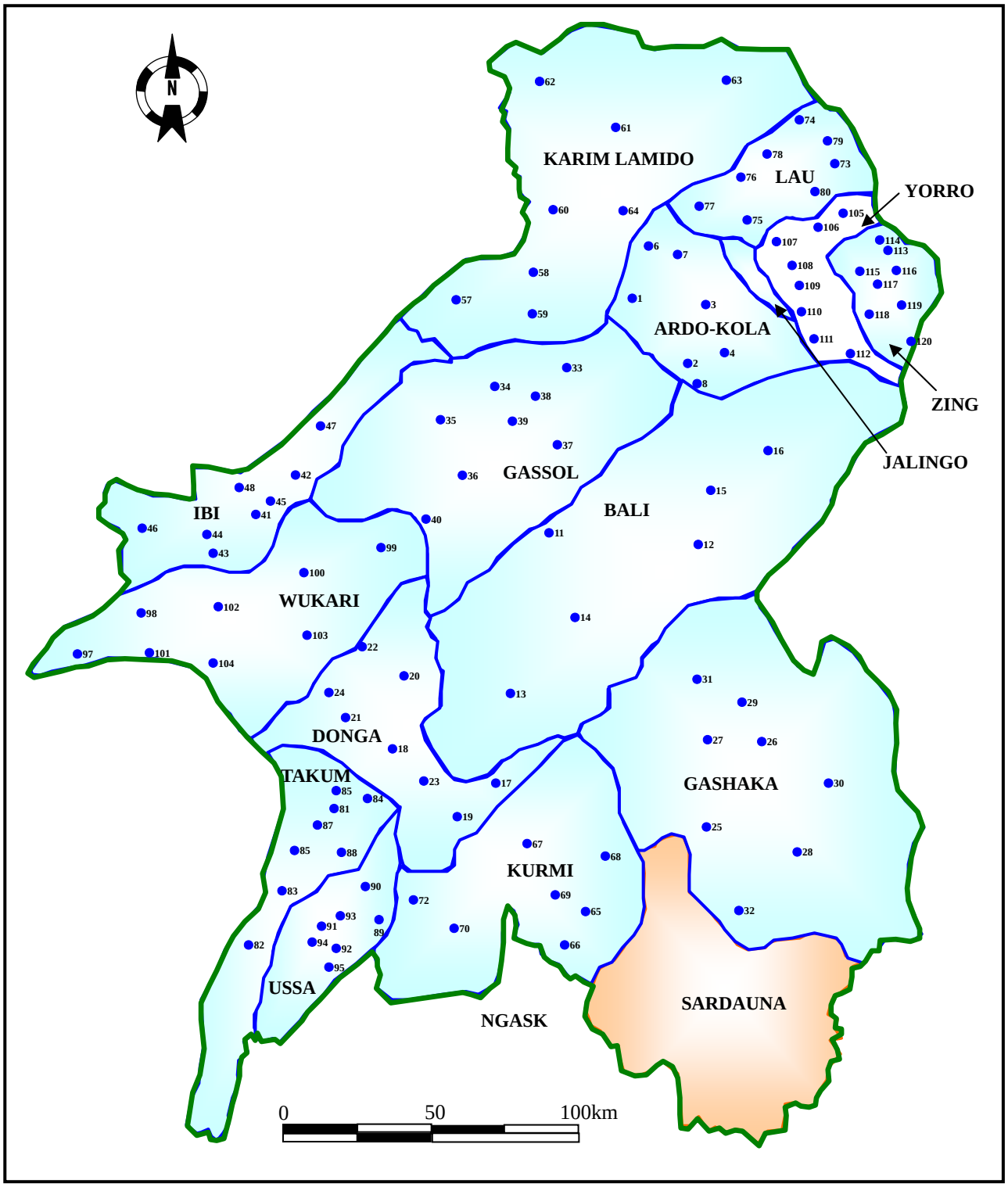


Figure 2- 3 Location of Target Communities in Taraba State

Table 2- 14 Target Communities (Kebbi)

No.	LGA	Community	No.	LGA	Community
1	Arewa	Amagoro 1	63	Jega	Basaura
2		Chibika	64		Yarga
3		Tago	65		Nassarawa
4		Gigane	66		Gindi
5		Fawangu	67		Kimba
6		Bui	68		Tsirarrai
7		Yeldu	69		Bahabi
8		Jantulu	70	Maiyama	Kawara
9		Amogoro 2	71		Ruwan Fili
10	Augie	Kwaido	72		Andarai
11		Dundaye	73		Saran Dosa
12		Tiggi	74		Dogon Daji
13		Bubuce	75		Sambawa
14		Bayewa	76		Mayalo
15		Mera	77		Mungadi
16		Augie	78	Ngaski	Lorfa
17	Argungu	Bere	79		Garin Baka
18		Kamfani	80		Kwangu
19		Bayan Tanki	81		Kambuwa
20		Tungar Alkasim	82		Sakaba
21		Kan Iyaka	83		Ngaski
22		Yamama	84		Libata
23		Karakwashe	85		Tungar Kadi
24		Tungar Marina	86	Suru	Aljannare
25		Alwasa	87		Giro
26		Fonkonsarki	88		Shangilu
27	Bagudo	Tuga	89		Shima
28		Kaliel	90		Kwaifa
29		Kende	91		Gwafidi
30		Kwasara	92		Lafiya
31		Sabongari Illo	93	Kalgo	Ubandawaki
32		Maje	94		Asarawa
33		Lolo	95		Kwartagi Kokani
34		Tsamiya	96		Runtuwa Bagga
35		Gwamba	97		Bakoshi
36	Bunza	Tilli	98		Bangar Wurigauri
37		Zogirma	99		Wurigauri
38		Raha	100		Kokani
29		Maidahimi	101		Ungwar Bawace
40		Balu	102		Erga Hausawa
41		Yarma	103	Shanga	Raha
42		Kanzana	104		Dugu
43		Hilima	105		Gironmassa
44		Matseri	106		Arabu Lafiya
45		Sabon Birni	107		Shanga
46	Danko/ Wasagu	Amburkele	108	Zuru	Balaure
47		Berboro	109		Bulum Bakwoshi
48		Erga	110		Bulum Shipkawu
49		Ilbo	111		Isgana
50		Elbere	112		Issingiri
51		Musuru	113		Kiri
52		Rade	114		Tungar Rimi
53		Tangaram	115		Udungu
54		Tunburku	116		Ungwar Bala
55		Ayu	117		Tungar Bezere
56		Marina	118	Aleiro	Sabiyal
57		Kyabu	119		Kashin Zama
58		Kellen Kassa	120		Aliero
59		Isrange	121		Rafin Bauna
60		Dungar Danwari	122		Jiga
61		Kwanfe	123		Jiga Sala
62		Kele			

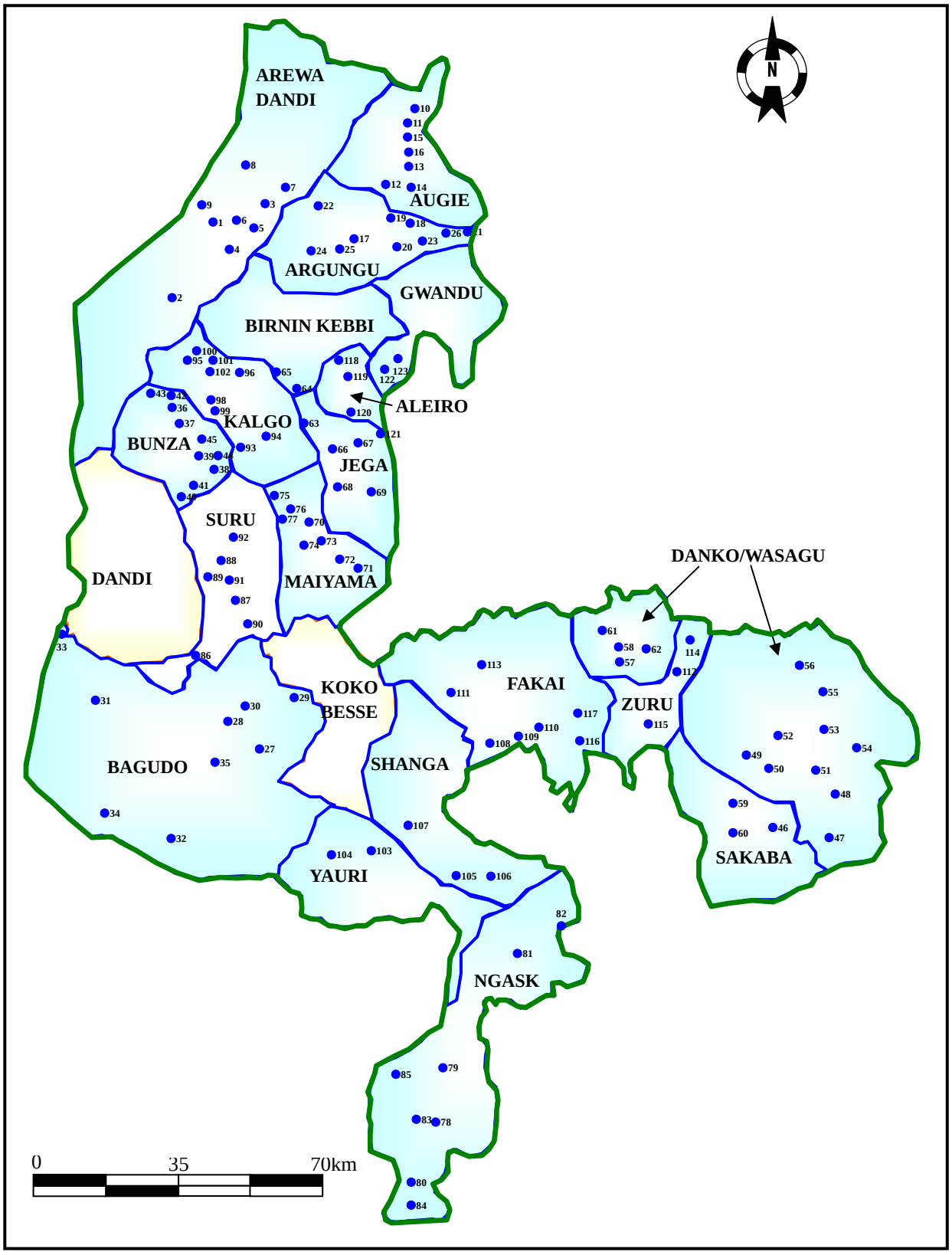


Figure 2- 4 Location of Target Communities in Kebbi State

Table 2- 15 Target Communities (Niger)

No.	LGA	Community	No.	LGA	Community
1	Lavun	Dogo	66	Bosso	Tungan Masenja
2		Tsawuni	67		Gbata
3		Sabon Madina	68		Jita
4		Kpatagi/Jikanagi	69		Ingiri
5	Gbako	Tsadzafu	70		Sharuwauna
6		Emiladan	71	Borgu	Tamanai
7		Kawo	72		Leshigbe
8		Picifugi	73		Yangba
9	Bida	Masaba "A"	74		Dogogari
10		Maiyaki Ndajiya	75	Mashegu	Malmo
11		Masaga "A"	76		Patiko Makeri
12		Massarafu	77		Baban Rami
13	Kontagora	Tudun Wadan Ibanga	78		Mashegu
14		Ugulu	79		Koso Nunawa
15		Ganawa	80		Acwikogi
16		Maikomo	81		Babagi
17	Agaie	Zhima	82	Shiroro	Talawyi
18		Emisheshi	83		Zari
19		Ekogi	84		Galadima Kogo
20		Wuna Woro Kota	85		Dnaknala Erena
21		Egina	86		Ebbeknma
22	Lapai	Gawa	87		Guita Gbayi
23		Bwaje	88	Gurara	Shako
24		Ganamadi	89		Kabo
25		Giro	90		Boyi Madaki
26	Mokwa	Kusogi	91		Toll Gate
27		Bokani	92		Yagopi
28		Rabba	93		Ngagre
29		Muwo	94		Gufana
30	Paikoro	Wakili Tungan Mallan	95		Dagibbe
31		Jita	96		Furushe
32		Dunkule/Nikuchi	97	Edati	Kusodu
33		Bwafiyi Ang・Magari	98		Yagbidin
34		Salema	99		Monturawa
40	Mariga	Gulbin Boka	100		Kusodu
41	Munya	Tsohon Gari Sarkin Pawa	101		Gbangban
42		Gbakodna(Dangunu)	102	Rafi	Ung. alhaji Idi Adidi
43		Kupkan (Fuka)	103		Ung. Asharmu Gizo
44		Unguwan Kadara (Guni)	104		Ung. Danigi
45		Gbaraga (Gini)	105		Ung. Danlami Tegina
46	Agwara	Kashini Wara Ung Hawkuri	106		Ung. Ibrahim mai Baba
47		Papiri	35	Magama	Dusai, Klbobi, Masteri,Faradok
48		Suteku Wkra Ung Bobu Gan	36		Sigikaneanin Bobi
49		Galla	37		Faradiia
50		Kokoli Wara Ung Ganu	38		Dusai/Mahoro
51	Tafa	Nassarawan Iku	39		Matseri
52		Itah Gbauti	107		Maraa
53		Ung. Gbagyi Luma Wesi	108		Mara'a
54		Tungan Tsauni	109		Mashuwa
55		Tungam Makama Iku Wara	110		Matalangu
56	Suleja	Barikin Niadaua	111		Majinga
57		Rafin Santi Ung Pada	112	Wushishi	Tangwggi
58		Gangaren Panganu	113		Yelwa
59		Madaua Sabon Gari (Newste	114		Sabon Gari Tudun Wada
60		Tundam Shagata	115		Erena
61	Rijau	Ung. G.R.A Rijau Town	116		Akare Cheji
62		Ung. Gazuma Shambo	117	Katcha	Bashi Mugu
63		Ung. Fada Jeda	118		Kolo Gbako
64		Tunga Mallam Tsoho	119		Mansatali Gbako
65		Ungwa Rataya Guem	120		Shidagba

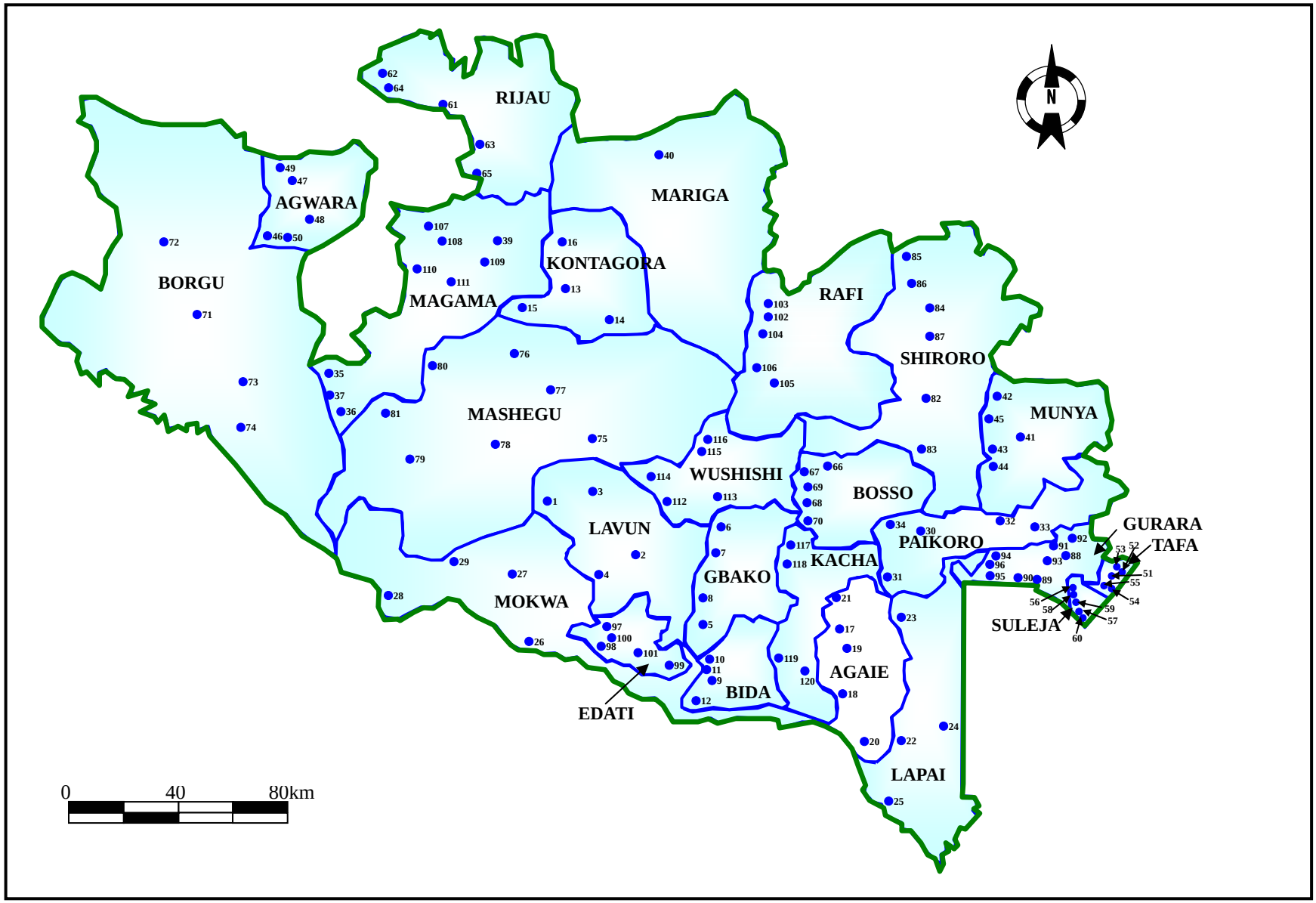


Figure 2- 5 Location of Target Communities in Niger State

(2) Water Supply Units and Beneficiaries Population

According to the "National Rural Water Supply and Sanitation Programme, A Strategic Framework (2004)", one borehole should supply water to communities of between 250 to 500 populations, and 30 ℓ per person per day should be provided, with a maximum water carrying distance of 250 meters. Water quality from borehole must meet requirement stipulated in Water Quality Standard of Nigeria.

The JICA Survey Team discussed with the Implementing Agencies on water supply units based on above national policy, design standard of the Implementing Agencies and JICA guideline. As result of the discussion, JICA Survey Team and the Implementing Agencies agreed water supply units as shown Table 2-16.

Table 2- 16 Design Standard on Water Supply Unit

Item	Content	Back data
Water supply rate	30 ℓ/person/day	National goal for rural water supply
Pumping rate from borehole	11ℓ/minute	Design standard of the Implementing Agencies
Operation hours of hand pump	12hours/day	Result of survey
Daily pumping rate from hand pump	11ℓ/×12hours=7,920ℓ/day	Calculated from above
Beneficiaries population of one borehole with hand pump	7,920ℓ/day ÷ 30ℓ/person/day = 264 persons	Calculated from above

Beneficiaries' population by the Project was calculated below.

Beneficiary's population by borehole construction for two years after procurement of equipment and materials in one State

= Number of boreholes drilled for two years x population supplied with water from one borehole with hand pump
= 100 boreholes × 264 person =26,400 persons

Therefore Beneficiary's population of five target States are;

26,400 × 5 States = 132,000 persons

132,000 persons in total will be benefited by borehole construction for two years after procurement of the Project.

(3) Examination of Water Sources

Amount of the groundwater to be extracted form boreholes constructed by the Project was estimated, and appropriateness of groundwater development of the above amount was analysed in terms of water balance as shown below:

a) It must be confirmed that groundwater recharge is much bigger than groundwater extraction.
b) Groundwater will be extracted from deep aquifer through boreholes. Amount of the groundwater recharge to deep aquifer is estimated using formula below:

Amount of groundwater recharge =
The amount of mean-rainfall ×area ×recharge rate

Rate of recharge can be estimated 5% or more according to the result of the existing JICA Study[1]. However, recharge rate should be assumed 1% for the Project area for the sake of safe estimation.

c) Total borehole yield was estimated by formula below:

Total borehole yield =
Yield of existing boreholes + Yield of newly drilled boreholes by the Project

Moreover, yield of existing boreholes was estimated by formula below:

Yield of existing borehole =

[1] According to the Study on National Water Resources Master Plan (JICA, 1995), average annual groundwater recharge was assessed as more than 5% of annual precipitation in entire country.

Yield of hand pump boreholes + Yield of motorized pump boreholes

In formula above, solar powered pump is included in motorized pump.

d) Borehole yield was assumed as below;

The yield of one hand pump borehole = 6, 600ℓ/day
The yield of one motorized pump borehole =15, 000ℓ/day (refer to above (3))

However, in Enugu State, groundwater of 400m^3/day per borehole is currently being pumped up. The boreholes have diameter of 12" and depth of 200 to 300m, and installed with large-sized submergible motor pumps. Geology of the aquifer of the boreholes is the Cretaceous sandstone superior formation. It is considered that yield of the motorized pump boreholes is 400, 000ℓ / day.

The result of analysis is shown in Table 2-17. The amount of groundwater recharge is much larger than the total borehole yield including yield of hand pump boreholes to be construed by the Project. Therefore, it can be concluded that implementation of the groundwater development by the Project is possible in each target State in terms of water balance.

Table 2- 17 Borehole Yield and Groundwater Recharge of Each State (after Development of Hand Pump Borehole by the Project)

Item		Unit	Kebbi State	Niger State	Taraba State	Ondo State	Enugu State
Groundwater Recharge	Mean Annual Rein Fall	mm	835	1,550	959	1,579	1,189
	Area	km^2	36,800	76,363	54,473	15,500	7,161
	Recharge Rate	%	1.0	1.0	1.0	1.0	1.0
	Ground Water Recharge	X10^{6}m^3/year	307.280	1,183.627	522.396	244.745	85.144
Deep Borehole Yield	No. of Existing Hand Pump Borehole	No.	2,153	2,560	859	674	301
	Existing Hand Pump Borehole Yield per day	ℓ/ day	6,600	6,600	6,600	6,600	6,600
	Existing Hand Pump Borehole Yield per year	m^3/ year	5,186,577	6,167,040	2,069,331	1,623,666	725,109
	No. of Existing Motorized Pump Borehole	No.	498	355	128	631	159
	Existing Motorized Pump Borehole Yield per day	ℓ/ day	150,000	150,000	150,000	150,000	400,000
	Existing Motorized Pump Borehole Yield per year	m^3/ year	27,265,500	19,436,250	7,008,000	34,547,250	23,214,000
	No. of New Hand Pump Borehole	No.	120	120	120	120	120
	New Hand Pump Borehole Yield per Day	ℓ/ day	6,600	6,600	6,600	6,600	6,600
	New Hand Pump Borehole Yield per Year	m^3/ year	289,080	289,080	289,080	289,080	289,080
	Total Deep Borehole Yield	X10^{6}m^3/ year	32.741	25.892	9.366	36.460	24.228
Percentage of Total Deep Borehole Yield to Ground Water Recharge		%	10.7	2.2	1.8	14.9	28.5

1) Kebbi State

In Kebbi State, the amount of groundwater recharge is 307,280x10^{6}m^3/year, and the total borehole yield after the Project (for two years) is 32,741× 10^{6}m^3/year. Therefore, the total borehole yield is only 10.7% of the amount of groundwater recharge.

In addition, groundwater development by boreholes installed with hand pumps, motorized pumps and solar pumps is rapidly progressing by the State Water Supply Department using State budget in recent years. New information on borehole number and total yield on above mentioned groundwater development is taken into account in this water balance analysis.

2) Niger State

In Niger State, the amount of groundwater recharge is 1,183,627 × 10^{6}m^3/year, and the total borehole yield after the Project (for two years) is 25.892 × 10^{6}m^3/year. The total borehole yield is only 2.2% of amount of groundwater recharge.

3) Taraba State

In Taraba State, the amount of groundwater recharge is 522,396 × 10^{6}m^3/year, and the total borehole yield after the Project (for two years) is 9,366 × 10^{6}m^3/year. The total boreholes yield is only 1.8% of the amount of groundwater recharge.

4) Ondo State

In Ondo State, the amount of groundwater recharge is 244,745 × $10^6 m^3$/year, and the total borehole yield after the Project (for two years) is 17,057 × $10^6 m^3$/year. The total borehole yield is only 7.0% of the amount of groundwater recharge.

5) Enugu State

In Enugu State, the amount of groundwater recharge is 85,144 × $10^6 m^3$/year, and the total borehole yield after the Project (for two years) is 24,228 × $10^6 m^3$/year. The total borehole yield is only 28.5% of the amount of groundwater recharge.

Ratio of total borehole yield against the amount of groundwater recharge is higher in Enugu State than the other States. This is because large amount of groundwater is being pumped up from deep aquifer of the Cretaceous sandstone superior formation through the boreholes which are much deeper than those of the other States.

Although there are many private boreholes in Enugu State aiming at selling groundwater, the data of the private boreholes are not investigated in this Survey and not included in the analysis of water balance.

The aquifer for groundwater development by the Project is not Cretaceous sandstone superior formation above mentioned but the Cretaceous shale superior formation. These two aquifers are distributed in different area. Moreover, the total amount of borehole yield by the Project is very small compared with the current yield from sandstone superior formation area. In order to implement sustainable groundwater development in the whole Enugu State from now on, groundwater development and management plan should be formulated based on the result of water balance analysis on area of sandstone superior formation where groundwater development is currently advancing.

(4) Raw Water Quality

Water quality analysis is conducted by the Implementing Agencies or private laboratories in each State. Water quality standard is based on NSDWQ or WHO guideline.

Water quality was analysed in the filed Survey using pack testing kits. Target water sources of the filed Survey were mainly boreholes and hand dug wells. According to the survey results, groundwater of some water sources did not satisfy waters quality standard in iron/fluorine and nitric acid/colon bacilli. Iron and fluorine originates from geology, and nitric acid and colon bacilli originate from living environment. In contrast to the result mentioned above, according to the Implementing Agencies, nitric acid and colon bacilli have not yet been detected by them so far, though high concentration of iron, manganese and fluorine exceeding the standard levels was detected in the past. It seems that groundwater quality is deteriorating as time goes by. The nitric acid and colon bacilli, which originated from contaminants such as farm chemicals and excrement from livestock, may be infiltrating into the ground or directly flowing into water sources. Such condition will happen because the water sources facilities are already old and deteriorated with lack of maintenance. Therefore, water quality analysis should be performed at least on items as listed in Table 2-18 (NSDWQ water quality standards).

Table 2- 18 Water Quality Inspection Items

No.	Item	Water quality standard (NSDWQ)	No.	Item	Water quality standard (NSDWQ)
1	Water temperature	No standard	6	Iron	0.3mg/ℓ
2	Colour, Taste, Odor	No standard	7	Manganese	0.2mg/ℓ
3	pH	6.8 - 8.5	8	Fluorine	1.5mg/ℓ
4	Electrical conductivity	1000us/cm	9	Nitrates	50mg/ℓ
5	Turbidity	5NTU	10	Colon bacilli	0cfu/mℓ

(5) Facility Construction

Facility construction will be carried out by the Implementing Agencies of each State. The specification for the construction is as follows.

- Since there are no problems in terms of the size and structures of conventional platforms, and staff

of the Implementing Agencies are well experienced with them. Therefore, the conventional specifications of the Implementing Agencies (identical to those of UNICEF) will be applied in principle.

- Although the distance of drainage channels from the boreholes is 3m for existing facilities constructed under the Implementing Agencies, it is recommended that the distance should be longer than those of the existing facilities in consideration of water contamination.
- The design drilling depth and the design screen length of each State is set up as shown in Table 2-19.

Table 2- 19 Design Drilling Depth and Design Screen Length of Each State

Item	Kebbi State	Niger State	Taraba State	Ondo State	Enugu State
Design drilling depth (m)	45	51	42	51	57
Design screen Length (m)	9	9	9	12	18

1) Kebbi State
The average drilling depth of the existing boreholes in target LGAs is between 35m and 59m, providing enough amount of groundwater for requirement. Therefore, the design drilling depth is set to 45m in the average. Screen length of the existing boreholes is between 3m and 12m, mainly 6 to 9m. So the design screen length is set to 9m.

2) Niger State
The average drilling depth of the existing boreholes in target LGAs is between 37m and 66m, providing enough groundwater for requirement. The design drilling depth is set to 51m in the average. The screen length of the existing boreholes is between 3m and 18m, mainly 9m with maximum length of 30m. So the design screen length is set to 9m.

3) Taraba State
The average drilling depth of the existing boreholes in target LGAs is between 23m and 40m, with lower yield than other States. The design drilling depth is set to 42m. The screen length is between 0m and 30m. In many cases, deep part of boreholes is open hole without casing because the rock is very hard. The design screen length is set to 9m referring to the example of the existing boreholes in the other States with the same lithological condition.

4) Ondo State
The average drilling depth of the existing boreholes in target LGAs is between 57m and 69m. Most boreholes were installed with motorized pump, and the yield of the boreholes is larger than other States. The drilling depth of the hand pump boreholes, which were drilled by the State Ministry of Community Development and Cooperative Services, is between 30m and 40m to obtain required yield. The design drilling depth is set to 51m, taking into consideration that the drilling depth becomes deeper in case of sedimentary deposit and sedimentary rock. The screen length of the existing boreholes is 6m to 15m, mainly 12m, with the maximum length of 30m. So the design screen length is set to 12m.

5) Enugu State
The average drilling depth of the existing boreholes in target LGAs is between 49m and 56m. The sandstone layer intercalated within the Cretaceous shale superior formation is the main aquifer, which included the Asata Nkporo shale group with low yield. The design drilling depth is set to 57m. The screen length of the existing boreholes is between 6m and 36m, mainly 18m. So the design screen length is set to 18m.

- The casing program will be decided based on the groundwater level during drilling work and electrical logging results.
- Drilling diameter is to be 10″ for the surface layer, which is prone to collapse and requires installation of guide pipes, and 6″ below the guide pipe end. The diameter of casing and screen pipes will be 4″. Gravel packing in the screen portion is necessary to avoid plugging of screen slits.
- Cementing and sealing in the shallow part of the borehole is necessary to prevent infiltration of

contaminated water.

- Since some communities do not have drainage channels for rainwater and wastewater, and pools of water were observed around the boreholes. Therefore, a soakage pit is to be installed at the end of drain to make wastewater infiltrate into the ground. The size of soakage pit is 1m (width) × 1m (length) × 1m (depth) in line with the UNICEF standard.
- Installation of fences around the borehole will be instructed to prevent cattle from entering borehole areas.
- Proper operation and maintenance of facilities will be instructed through the soft components during the implementation stage of the Project.

(6) Successful Rate of Borehole

The borehole successful rate of each State is shown in Table 2-20.

Table 2- 20 Borehole Successful Rate of Each State (unit: %)

Item	Sub-Item	Kebbi State	Niger State	Taraba State	Ondo State	Enugu State
Geology	Quaternary	-	-	-	50	-
	Tertiary	65-70	-	-	60-70	(80-85)
	Cretaceous	80-85	70-75	70-85	60-70	-
	Cretaceous (Sandstone Superior Formation)	-	-	-	-	(80-85)
	Cretaceous (Shale Superior Formation)	-	-	-	-	60-80
	Basement Rock	80-85	70-80	60-75	60-80	-
Target LGA	Range	65-85	70-80	65-85	50-80	60-80
	Average	75	75	70	70	70

Notes: ( ) shows motorized pump well.
The numerical value of the table is mainly based on information by the Implementing Agencies.

The design borehole successful rate is set to 75% in Kebbi State, 75% in Niger State, 70% in Taraba State, 70% in Ondo State and 70% in Enugu State as shown in Table 2-17.

Electrical survey is usually performed before drilling work. Especially private company is keen to perform geophysical survey (electric survey) in each State. In the Taraba State, the geophysical survey section of the Implementing Agency performs the geophysical survey positively, and is extending their activities even to the neighbouring State of Adamawa. It is not easy to raise successful rate higher than the present one by only implementation of geophysical survey. However, in order to maintain the present successful rate, it is necessary to carry out geophysical survey (especially vertical electrical survey) in detail more than now. The area which is easy for groundwater development has already been fully developed. To the contrary, only the area which is difficult for groundwater development will be future target. Successful rate of boreholes will fall in such area.

In Ondo State and Enugu State, private drilling companies are performing geophysical borehole logging to determine the screen location before screen installation, especially in sedimentary rock area. The Implementing Agencies also need sets of geophysical borehole logging equipment.

2-2-2-2 Equipment Plan

(1) Procurement Equipment

Table 2-21 shows the equipment and materials to be procured, taking into account the capacity of the Implementing Agencies, the purpose of equipment use, the types/quantities/operating conditions of the existing equipment and future plans of drilling, etc.

The Implementing Agencies constructed many water supply facilities in the past as organization responsible for rural water supply. Furthermore, they have enough manpower and techniques for drilling boreholes. On the other hand, their equipment for drilling borehole is already old and deteriorated, which cause many problem in project implementation. Therefore, provision of equipment and materials by the Project will contribute to promotion of project implementation for rural water

supply.

There are some difference in number of technician and drilling equipment among the Implementing Agencies. On the other hand, there is a little difference in number of boreholes that were drilled in recent years by each Implementing Agency. Considering matter above, it is judged that drilling capacity of each Implementing Agency is almost same. Therefore, procurement of one drilling rig and one set of supporting equipment will be planned for each Implementing Agency.

Table 2- 21 Procured Equipment and Materials

No.	Name of Equipment	Specification/Description	Unit	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 : Not less than 100m Capable Drilling Diameter : Mud Drilling : 10 - 5/8″ DTH : 6 - 1/4″ Capable Geology :Alluvial deposit to hard rock Mobilization Method: Truck mounted. Truck Specification : 4 × 4 or 6 × 4 (2 axis drives))	Lot	Kebbi:1 Niger :1 Taraba:1 Ondo:1 Enugu :1
2	Drilling Tools and consumable materials	[Drilling Tools] Drill pipe, hammer bits, work casing and all other necessary tools for the rig above described. [Consumable Materials] Drilling Chemicals (Bentonite, CMC and foam)	Set	Kebbi:1 Niger :1 Taraba:1 Ondo:1 Enugu :1
3	High Pressure Air Compressor	Supply Air Pressure : More than 2.01MPa (=20.5kg/cm^2) Supply Air Volume: 11.3m^3/min or more. Mobilization Method : Truck mounted Truck Specification : 4 × 4 or 6 × 4 (2 axis drives))	Lot	Kebbi:1 Niger :1 Taraba:1 Ondo:1 Enugu :1
4	Cargo Truck with Crane	Load Capacity : 6.0tons or more Specification : 4 × 4 or 6 × 4 (2 axis drives)) Engine : Diesel (water cooling) Carrier Length: 6.0m or more Crane Capacity : 2.9tons	Lot	Kebbi:1 Niger :1 Taraba:1 Ondo:1 Enugu :1
5	Pumping Test Equipment	Submersible motor pump : Discharge of 30ℓ/min × 70m head (1.5kW/50Hz) Engine Generator : 5kVA or more Groundwater Level Indicator : Measurable depth of 100m	Set	Kebbi:1 Niger :1 Taraba:1 Ondo:1 Enugu :1
6	Water Analysis Equipment	Measurement Items : pH, DO, EC, T.D.S. and Water temperature	Lot	Kebbi:1 Niger :1 Taraba:1 Ondo:1 Enugu :1
7	Geophysical Survey Equipment	[Electric survey] Electrical Sounding Instrument : Measurable depth of 100m Measuring Item : Apparent resistivity and spontaneous potential Measurable range : 0.1mV～10V Accessory : Software for analysis Others : Applicable for logging work for 100m depth borehole (with cable and probe) [Electro-magnetic survey] Slingram method Measurable depth of 40 to 60m Measuring Item : Apparent resistivity Accessory : Software for analysis	Lot	Kebbi:1 Niger :1 Taraba:1 Ondo:1 Enugu :1

No.	Name of Equipment	Specification/Description	Unit	Quantity
8	Hand Pump and Tools	India Mark III, which is VLOM type and standard type of UNICEF and the Implementing Agencies	Lot	Kebbi :100 Niger :100 Taraba:100 Ondo :100 Enugu :100
		Repair tools for hand pump : Tools used by villagers for simple repair work	Set	Kebbi :100 Niger :100 Taraba:100 Ondo :100 Enugu :100
		Repair tools for hand pump : Tools used by LGA mechanics for serious repair such as replacement of pump parts	Set	Kebbi :14 Niger :24 Taraba:15 Ondo :18 Enugu :9
9	Casing Pipe	Materials : uPVC (Un-plasticized polyvinyl chloride) Dimension : ϕ 4″ ,O.D.114.4mm, Length 3.0m Wall thickness : 5.5mm or more Connection : Threading method	Set	For number of boreholes below Kebbi :100 Niger :100 Taraba:100 Ondo :100 Enugu :100
10	Screen Pipe	Materials : uPVC (Un-plasticized polyvinyl chloride) Dimension : ϕ 4″ , O.D.114.4mm, Length 3.0m Wall thickness : 5.5mm or more Connection : Threading method Screen type : Slit type (0.8-1.0mm in width) Opening Ratio : 3% or more	Set	For number of boreholes below Kebbi :100 Niger :100 Taraba:100 Ondo :100 Enugu :100
11	Drilling Fluid	Bentonite : Montmorillonite of #250-Powder Polymer: CMC (CARBOXY METHYL CELLULOSE) Forming agent: Anion based surfactant	Set	Kebbi :100 Niger :100 Taraba:100 Ondo :100 Enugu :100

(2) Necessity of the Equipment for Procurement and Basis for Quantities

1) Drilling rig

Purpose

The Implementing Agencies will use drilling rigs for boreholes construction.

Necessity and Basis of Quantity

Each Implementing Agency has drilling plan of 100 boreholes for 2 years using the procured equipment and materials. One drilling rig for each Implementing Agency, 5 rigs in total, are planned. The yard area (m^3) of each Implementing Agency is shown in Table2-22. As shown in Table 2-22, there is enough safekeeping space for equipment in each Implementing Agency

Table 2- 22 Area of Facilities and Yard of the Implementing Agencies (m^2)

	Kebbi	Niger	Taraba	Ondo	Enugu
Office	250	1,000	300	400	1,000
Workshop	100	1,000	200	300	100
Yard	2,500	5,000	2,500	2,500	3,000
Storehouse	280/50 (2 houses)	1,000/800 (2 houses)	200/72 (2 houses)	1,500 (2 houses)	1,200 (2 houses)

The drilling teams of the Implementing Agencies have enough experiences and achievements in recent years. They can implement the Project with a little technical training on operation of newly procured rigs.

2) Drilling tools and accessories

Purpose

Drilling tools and accessories are used for drilling work with the above rigs.

Necessity and Basis of Quantity

The quantity of tools and accessories such as drilling pipes, hammer bits and work casing etc. shall be the minimum amount required to drill 100 boreholes for 2 years by each Implementing Agency using the procured rig. The quantity of consumable materials shall be calculated taking into account successful rate of boreholes as described below. Calculated result is shown in Table 2-23.

Number of boreholes for estimation of consumable materials
= Number of boreholes to be completed for two years ÷ borehole successful rate

Table 2- 23 Number of Boreholes for Estimation of Consumable Material

State	Number of boreholes to be completed for two years	Borehole successful rate (%)	Number of boreholes for estimation of consumable materials
Kebbi	100	75	134
Niger	100	75	134
Taraba	100	70	143
Ondo	100	70	143
Enugu	100	70	143

3) High pressure air compressor

Purpose

High pressure air compressors supply compressed air to DTH hammer of drilling rig for high speed up-down movement of the hammer and removing cutting rocks out of borehole.

Necessity and Basis of Quantity

The existing compressors of the Implementing Agencies cannot be shared with the new drilling rig. Therefore, the procurement of new air compressors is planned. One new compressor will be procured coupling with one procured drilling rig to each Implementing Agency.

4) Cargo truck with crane

Purpose

Cargo truck with crane will transport drilling tools and materials such as casing pipes, etc.

Necessity and Basis of Quantity

Situation of the existing crane truck of each Implementing Agency is shown in Table 2-24. Crane trucks of each Implementing Agency are broken and impossible to be repaired. Therefore, procurement of one crane truck is planned coupling with one procured drilling rig.

Table 2- 24 Situation of Existing Crane Truck of the Implementing Agencies

State	Maker	Condition	Provision Year
Kebbi	TATA , India	Truck is broken and impossible to be repaired due to lack of spare part	1995
Niger	TATA, India	Truck is broken and impossible to be repaired due to lack of spare part	1995
Taraba	None	-	-
Ondo	TATA, India	Truck is broken and impossible to be repaired due to lack of spare part	1992
Enugu	TADANO, Nissan diesel	Truck is broken and impossible to be repaired due to lack of spare part	1996

Crane trucks will transport, set up drilling accessories/tools such as drill pipes/hammer bits/casings and hoist up casings/screens. Procurement of one crane truck for each Implementing Agency is planed.

5) Pumping test equipment

Purpose

Pumping test equipment is used to confirm potential yield of drilled borehole to judge whether the borehole is successful or not.

Necessity and Basis of Quantity

Currently each Implementing Agency does not conduct pumping test because their equipment for pumping test are broken or they do not have the equipment. Current situation of pumping test by the Implementing Agencies is shown in Table 2-25.

Table 2- 25 Current Situation of Pumping Test by the Implementing Agencies

State	Situation of pumping test implementation
Kebbi	Equipment of pumping test provided by UNICEF in 1995 is broken and not in use since 2008
Niger	Equipment of pumping test provided by JICA in 1991 is broken and not in use since 2000
Taraba	There is no equipment for pumping test.
Ondo	Equipment of pumping test provided by UNICEF in 1992 is broken and not in use since 2008
Enugu	Equipment of pumping test provided by JICA in 1988 is broken and not in use since 2009

Usually drilling team of the Implementing Agency judges whether borehole is successful or not by observing i) groundwater flow into a borehole from aquifer during drilling work or ii) borehole yield during development work. However, above method is too simple for them to judge precisely. Generally in the Project area, there are isolated small groundwater body called as “perched groundwater”. Drillers sometimes mistake perched groundwater for the regional groundwater body and complete boreholes to pump up groundwater from the perched groundwater. Such boreholes will soon dry up. To prevent such misunderstanding, pumping test must be conducted to judge whether pumping is possible for a long period of time or not. Pumping test is indispensable for completion of borehole, so that procurement of pumping test equipment is planned.

6) Water analysis equipment

Purpose

Water analysis equipment is used to confirm groundwater quality to judge whether drilled borehole is successful or not from viewpoint of water quality

Necessity and Basis of Quantity

The Implementing Agencies take water sample from boreholes after drilling work and analyse water quality in laboratory to judge whether groundwater of borehole is suitable for drinking. They analyse water quality with old instruments, which were provided by UNICEF in early 1990s. However, currently water quality analysis is performed insufficiently, because equipment is too old for operation, and chemical agent is out of stock. Considering current situation above, water quality information by the proposed equipment is useful, though items to be observed by the equipment are limited and do not give full information on possibility of groundwater for drinking purpose.

The proposed water analysis equipment has advantage of giving outline of water quality during drilling work or immediate after completion of borehole at drilling site. It is possible to stop drilling work on the way if borehole is judged to be unsuccessful based on result of water quality test with the proposed water analysis equipment.

Thus water analysis equipment will contribute to borehole construction work. Procurement of one set of water analysis equipment is planned to each Implementing Agency. Items to be measured by the equipment are as follows.

a) pH, b) Dissolved oxygen, c) Electric conductivity, d) Total dissolved solid, e) Water temperature

7) Geophysical Survey Equipment

Purpose

Geophysical Survey Equipment is used for investigating geological condition, such as horizontal distribution, depth and thickness of the aquifer.

Necessity and Basis of Quantity

Electric and electro-magnetic survey is suitable as geophysical survey to know groundwater development potential. Weathered zone of the Pre-Cambrian basement rock usually forms aquifer in the Project area. Distribution of the weathered zone can be detected by electric and electro-magnetic survey which can identify difference in electric resistivity between the weathered rock zone and the fresh rock zone. Based on above principle, most promising drilling points can be detected. Electric and

electro-magnetic survey will contribute to increasing borehole successful rate. Effective use of electric and electro-magnetic survey is summarized in Table 2-26.

Table 2- 26 Effective Use of Electric and Electro-Magnetic Survey

Item	Electro-magnetic survey (2 loop method)	Electric survey
Advantage	Horizontal distribution of aquifer can be detected based on electro-magnetic characteristic of aquifer. This method is suitable for horizontal survey.	Vertical distribution of aquifer can be detected based on electric characteristic of aquifer. This method is suitable for vertical survey.
Information from sounding result	Site where aquifer has maximum thickness.	Vertical geological structure of Aquifer in detail
Combination use of electro-magnetic survey and electric survey	At first, site where aquifer has maximum thickness can be detected by electro-magnetic survey. Then, vertical geological structure of aquifer can be detected in detail by electric survey to design borehole structure.	

Electro-magnetic survey and electric survey have different advantage as explained in Table 2-26. Combination use of both methods will improve survey accuracy, leading to higher borehole successful rate. Current situation of the existing geophysical survey equipment of each Implementing Agency is shown in Table 2-27.

Table 2- 27 Existing Geophysical Survey Equipment of the Implementing Agencies

State	Electric survey			Electric borehole logging		
	equipment	Condition	year	equipment	condition	Provision Year
Kebbi	ABEM	Too old for operation	1995	None	-	1995
Niger	GEOTRON MODEL G41	Good condition	2009	Geologer	Too old and broken for operation	2009
Taraba	Terameter SAS300	Bad condition due to frequent breakdown	2000	None	-	2000
Ondo	MacOhom	Too old and broken for operation	1992	None	-	1992
Enugu	ABEM	Too old for operation	1988	Geologer	Too old and broken for operation	1988

Most of electric survey equipment of the Implementing Agencies was provided by UNICEF in the 1990s, and the equipment is already old and easily becomes out of order. Some equipment is completely broken and impossible to be repaired. That equipment is old type, and accuracy of measurement with the equipment is low. Accuracy of geological interpretation of the survey result is also low employing analogue analysis method. On the other hand, the latest geophysical survey equipment is excellent in operation, and accuracy of interpretation is high with computer software for numerical analysis. Therefore, procurement of one electric survey equipment is planned for each Implementing Agency.

There is electric survey equipment with good condition in the Implementing Agency of Niger State as shown in Table 2-27. However, this equipment is exclusively used by the existing geophysical survey team that always work together with the existing drilling team. Therefore, procurement of one set of geophysical survey equipment is planned for the Implementing Agency of Niger State. There are experienced geophysical survey teams in each Implementing Agency. Therefore, the procured geophysical equipment can be used effectively and maintained by them.

8) Hand Pump and Tools

Purpose

Hand Pump is used for groundwater extraction from boreholes, and tools are used for daily maintenance by community and LGs levels.

Necessity and Basis of Quantity

Procurement of hand pumps and repair tools at community level, used for daily maintenance, are planned for 100 boreholes to be drilled by each Implementing Agency for two years.

The repair tools will be planned at both community level and LG level. As for the community level,

the tools will be used by communities for daily maintenance work and repair. On the other hand, as to LG level, the tools will be used by LG mechanics for mobile repairs, especially serious repairs that cannot be handled by villagers.

Number of tools at community level corresponds to number of hand pumps. On the other hand, number of tools at LG level corresponds to number of LGAs in target States.

Table 2- 28 Number of Hand Pumps and Tools for Repair

State	Number of hand pumps	Tools for repair	
		Community level	LG level
Kebbi	100	100	14
Niger	100	100	24
Taraba	100	100	15
Ondo	100	100	18
Enugu	100	100	9
Total	500	500	79

9) Casing pipe

Purpose

Casing pipe is necessary for retaining borehole.

Screen pipe is necessary for allowing groundwater to flow into boreholes, preventing sand and silt of aquifer from flowing into boreholes.

Necessity and Basis of Quantity

Planned number of casings and screens is shown in Table 2-29.

Table 2- 29 Number of Casings and Screens to be procured

State	Number of borehole	Average length of borehole (m)	Casing (m)		Screen (m)	
			Length of casing per one borehole	Total length of casings	Length of screen per one borehole	Total length of screen
Kebbi	100	45	36	3,600	9	900
Niger	100	51	42	4,200	9	900
Taraba	100	42	33	3,300	9	900
Ondo	100	51	39	3,900	12	1,200
Enugu	100	57	39	3,900	18	1,800
Total	500	-	-	18,900	-	5,700

Note) Length of casings and pipes will be longer than those shown above considering damage rate (10%) during stock.

(3) Specifications of Major Equipment and Materials

1) Borehole Drilling Equipment

a) Drilling Rig

The specifications of the drilling rig are defined based on the following requirements:

① Drilling method

b) Rock type of aquifer of the five target States is shown in Table 2-30. Both Pre-Cambrian basement rocks and sedimentary rocks are distributed in 4 States out of 5 target States except Enugu State. Only sedimentary rocks are distributed in Enugu State.

Table 2- 30 Rock Type of Aquifer to be Drilled in Target States

State	Rock type for drilling
Kebbi	Pre-Cambrian basement rocks
	Sedimentary rocks(Cretaceous, Tertiary)
Niger	Pre-Cambrian basement rocks
	Sedimentary rocks(Cretaceous)
Taraba	Pre-Cambrian basement rocks
	Sedimentary rocks(Cretaceous)
Ondo	Pre-Cambrian basement rocks
	Sedimentary rocks(Cretaceous, Tertiary)
Enugu	Sedimentary rocks(Cretaceous, Tertiary)

Drilling method depends on rock type as explained below:

Pre-Cambrian basement rocks

Fresh part of the basement rocks is generally very hard. However, weathered basement rocks with characteristics of sand and gravel usually form aquifer. In this case, drilling method by DTH hammer with high compressed air should be employed. However, in case of soft ground near the ground surface where DTH hammer method is not effective, rotary drilling method with circulating mud should be employed.

Sedimentary Rocks

Sedimentary rocks are not as hard as Pre-Cambrian basement rocks. Drilling method by DTH hammer should be employed in case of hard sedimentary rocks. On the other hand, rotary drilling method with mud circulation should be employed in case of soft ground near the ground surface.

① Drilling diameter

The drilling diameter shall be 10" for the weathered rocks near the ground surface, and 6" for deeper rocks. The weathered rocks near the ground surface need 10" drilling because such rocks are likely to collapse and needs installation of guide pipe with 8” diameter.

Tri-cone bits of 10-5/8" shall be used for mud rotary drilling near the ground surface, and afterward, 6-1/4" hammer bits shall be used for DTH drilling.

② Drilling depth

The average and maximum borehole depth of the target States is shown in Table 2-31. As shown in Table 2-31, the maximum drilling depth in each target State is almost same between 71 and 100m. Therefore, the drilling rig is planned to have drilling capacity of more than 100m for each State.

Table 2- 31 Drilling Depth of Target States

State	Average drilling depth(m)	Maximum drilling depth (m)
Kebbi	45	72
Niger	50	71
Taraba	40	76
Ondo	50	100
Enugu	55	80

③ Truck mounted with rig

Federal and State roads are mainly paved with tar and being kept good condition for driving. However, the local roads away from main roads are not in good condition. The local road is usually unpaved and rough. Normal vehicles cannot run on the local road in rainy season because the roads become too muddy for driving. Accordingly, 4-wheel-drive (4×4 or 6×4) vehicles shall be adopted.

c) High Pressure Air Compressor

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

① Calculation of necessary air pressure

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

- Minimum operating pressure : 10.5 kg/cm^2 (1.03MPa)
- Water head pressure : 10.0 kg/cm^2 (0.98MPa : maximum drilling depth of 100m)
  Necessary air pressure = Lowest operation pressure + Water head pressure
  = 10.5+10.0 = 20.5 kg/cm^2 (2.01MPa)

② Calculation of necessary air volume

The necessary air volume is calculated by using the following formula.

The necessary air volume（Q）＝ Flow velocity in the space between rod and drilled wall in borehole (V) × Space between the rod and the wall of the borehole (A)

Where:

- Flow velocity in the space between rod and drilled wall in borehole (V):
  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 in the Project.
- Space between the rod and the wall of the borehole (A)
  $=1/4\times\pi\times\{(\text{Borehole diameter})^2-(\text{Rod diameter})^2\}$
- Borehole diameter : 6"(=0.159m)
- Rod diameter : 4-3/4"(=0.121m)

Therefore,

The necessary air volume（Q）＝ Flow velocity in the space between rod and drilled wall in borehole (V)×Space between the rod and the wall of the borehole(A)

$= 1{,}350\text{m/min}\times1/4\times\pi\times\{(0.159)^2-(0.121)^2\} = 11.3\text{m}^3/\text{min}$

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

③ Truck

The air compressor requires the same mobility as the drilling rig because the air compressor and drilling rig are always operated together. Therefore the drive form is planned as 4-wheel-drive type (4×4 or 6×4), the same as the drilling rig.

d) Cargo Truck with Crane (drilling support vehicle)

① Specifications

Considering road conditions, driving conditions, travelling distance and weight of cargo, the cargo truck shall be 4-wheel-drive type (4×4 or 6×4) with high durability.

② Load capacity

Considering the weight of necessary drilling tools and casing pipes, etc., the load capacity of the cargo truck shall be no less than 6 tons.

③ Crane Capacity

The load capacity of 2.9 tons (nearly 3 tons) shall be planned in consideration of weight of drilling tools and the general capacity of the trucks manufactured.

e) Pumping test equipment

① Submersible pump

The planned amount of extraction from the borehole is 11ℓ per minute with the maximum dynamic water level of around 40m below ground level. Information on maximum yield lager than planned yield of borehole is also necessary for pumping test. Thus the specification of the submersible pump shall be established as follows.

- Specification：30ℓ/minutes×70m×1.5kW×50Hz

② Generator
Considering the load capacity (submersible pump: 1.5kW), 5kVA is planned.

③ Groundwater Level Indicator
The indicator shall be capable of measuring up to the maximum drilling depth of 100m.

f) Water analysis equipment
Potable water analysis equipment shall be planned to confirm water quality on site. The items to be tested are: pH, dissolved oxygen (DO), electric conductivity (EC), total dissolved solid (TDS), chlorines, and water temperature.

g) Geophysical Survey Equipment
Electric survey equipment and electro-magnetic survey equipment shall be planned. Considering maximum depth of boreholes in the Project area, electric survey equipment shall have the same maximum detectable depth of 100m. On the other hand, electro-magnetic survey will be conducted before implementation of electric survey to detect horizontal distribution of weathered zone of the rocks. Consequently, electro-magnetic survey equipment needs detectable depth of 40 to 60m.

Electric survey equipment shall be usable not only for sounding on the ground surface but also for electrical borehole logging with an additional 100m cable and sonde.

h) Hand Pump and Tools
Indian Mark III (VLOM type), which is the standard hand pump type promoted by the federal government, shall be selected. Maintenance of Indian Mark III is much easier than hand pumps of other types because check valve and plunger can be replaced without lifting up of riser pipes in case of Indian Mark III. Foreign donors such as UNICEF, UNDP and WB also recommend use of Indian Mark III.

Corrosion of hand pump is taking place due to groundwater quality at some sites in the Project area. To prevent corrosion of hand pump, cylinder and connecting rod should be made of stainless steel, and riser pipes should be made of uPVC.

i) Casing and screen pipe
Based on on-site borehole survey and the marketing research, the specifications of each pipe are as follows.

Table 2- 32 Specification of Pipes

Item	Content
Casing pipe	Materials：uPVC (Un-plasticized polyvinyl chloride) Dimension：φ4″,O.D.114.4mm, Length 3.0m Wall thickness：5.5mm or more Connection：Threading method
Screen pipe	Materials：uPVC (Un-plasticized polyvinyl chloride) Dimension：φ4″,O.D.114.4mm, Length 3.0m Wall thickness：5.5mm or more Connection：Threading method Screen type：Slit type (0.8-1.0mm in width) Opening Ratio：3％ or more

j) Drilling fluid

Drilling Fluid will be used to support borehole wall and remove drilled cuttings out of borehole. Three types of drilling fluid will be procured as below:

i) Bentonite : Montmorillonite of #250-Powder
ii) Polymer : CMC (Carboxy Methyl Cellulose)
iii) Forming agent : Anion based surfactant

(4) Main Equipment and Materials Procurement Sources

The main equipment and materials shall be procured from the sources as shown in Table 2-33. The procurement prices shall be decided by comparing the cost estimates from these procurement sources.

Table 2- 33 Procurement Sources of Main Equipment and Materials

Item		Supply classification			Means
		Japan	Nigeria	Third Country	
Drilling Equipment and Tools	Drilling Rig	●			These items are not produced in Nigeria. Therefore, they shall be procured from Japan.
	Drilling Tools	●			
	High Pressure Air Compressor	●			
Supporting Vehicle	Cargo Truck with Crane	●			
Relevant equipment	Pumping Test Equipment	●			
Survey Equipment	Water Analysis Equipment	●			
	Geophysical Survey Equipment	●			
Materials for boreholes construction	Hand Pump		●		These items are produced in Nigeria. It is planned to procure in Nigeria.
	Casing Pipe		●		
	Screen Pipe		●		
	Drilling fluid		●		

2-2-3 Outline Design Drawings

The design drawings for the Outline Design are as follows:

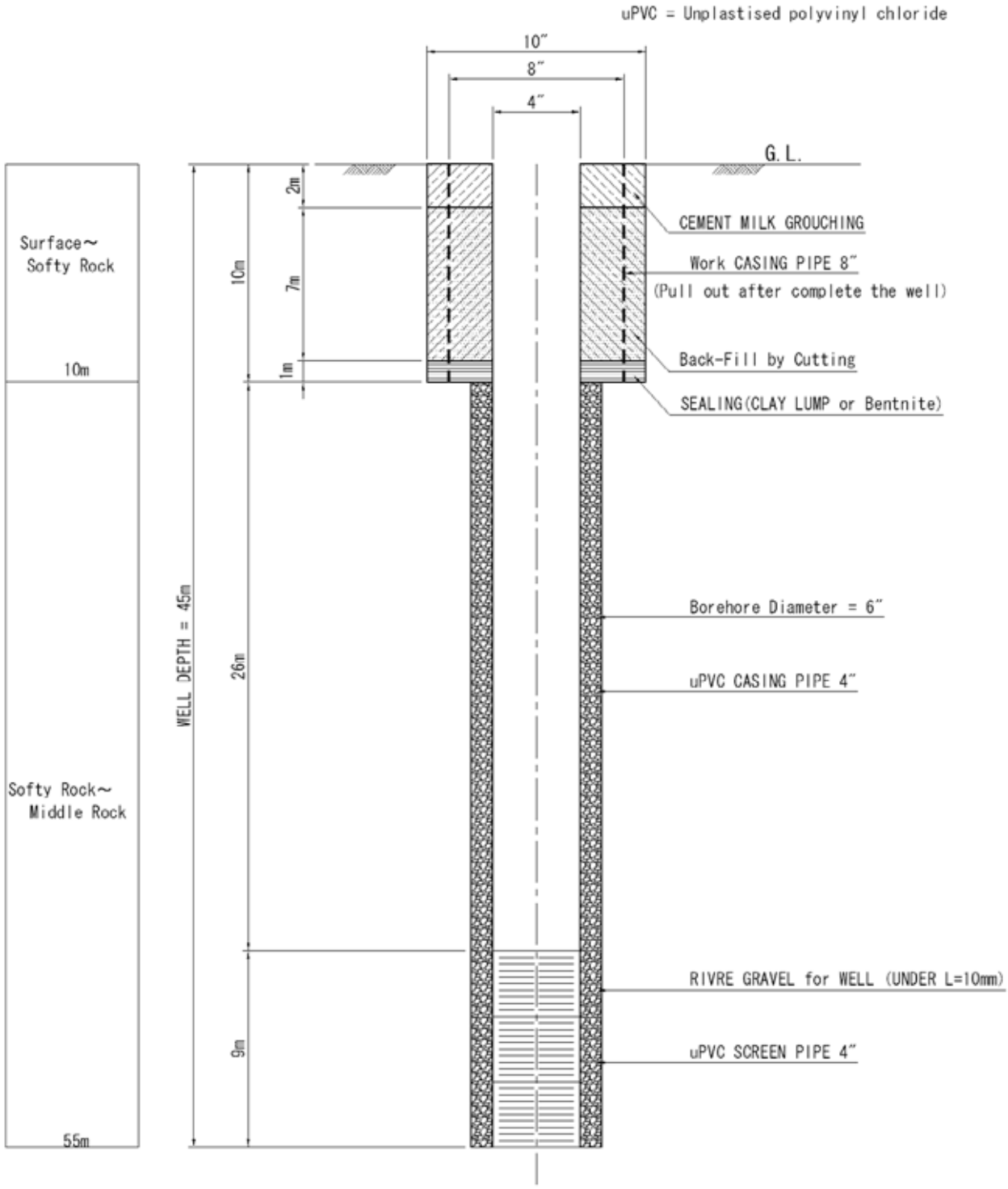


Figure 2- 6 Standard Structure of Borehole

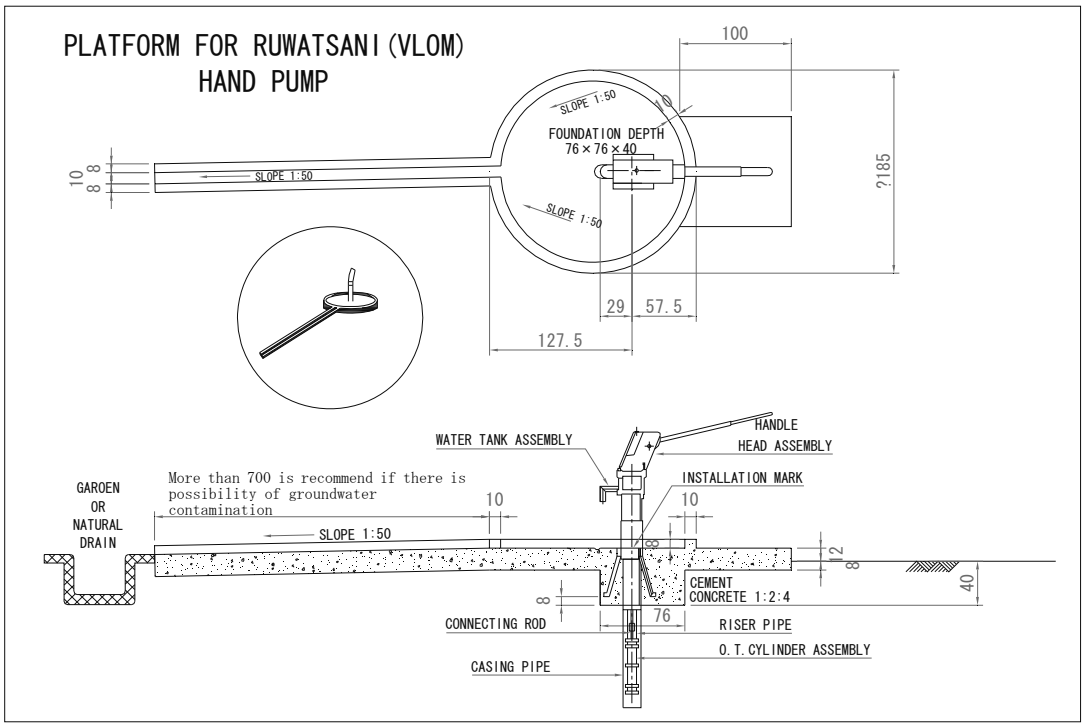


Figure2- 7 Hand Pump Platform

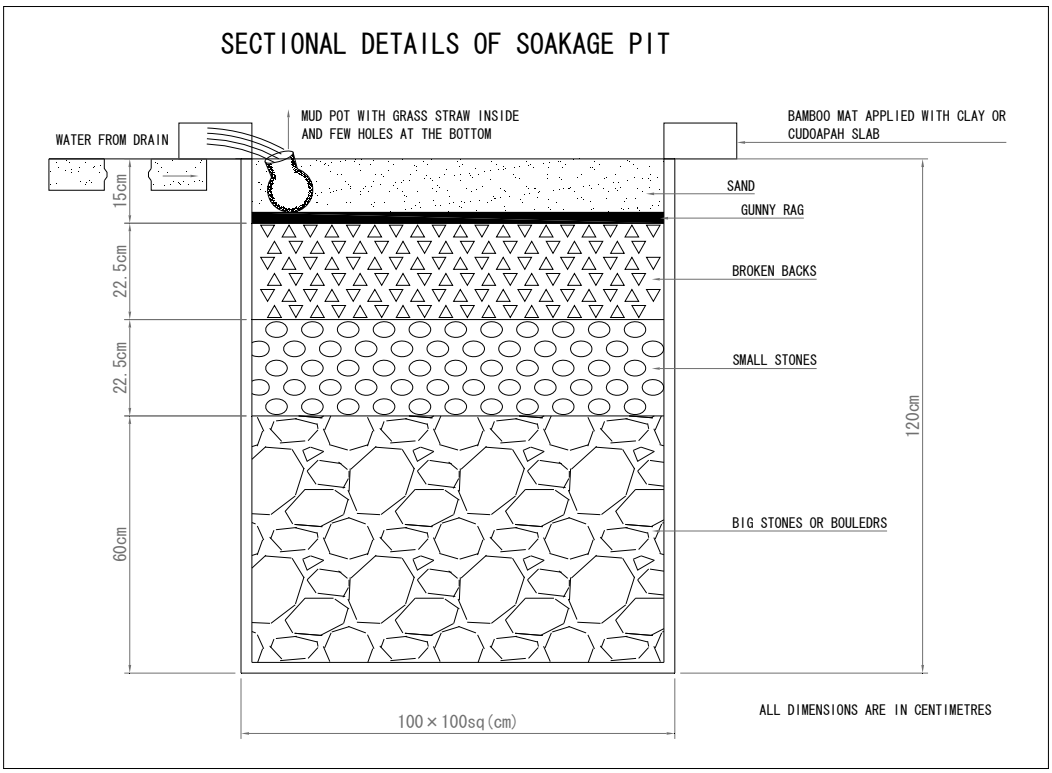


Figure2- 8 Soakage Pit

2-2-4 Implementation Plan

2-2-4-1 Implementation Policy

The procurement plan shall be formulated based on the following policy.

1) The procurement plan of equipment and materials shall be coordinated with the construction schedule of the Implementing Agencies.

2) The equipment and materials shall be selected considering supply sources of spare parts and consumables, operation environment and maintenance system.
3) The most advantageous equipment and materials for Nigerian side shall be selected in Nigeria and in Japan, in consideration of technical levels and operation and maintenance conditions of the Implementing Agencies.
4) The equipment and materials shall be selected under the international standards of BS, DIN, ASTM, and JIS and so on, considering easier quality control and schedule management in the construction of boreholes. However, materials that have been approved under local standards shall be included in the procurement scope.
5) The Implementing Agencies shall have the responsibility for the operation and maintenance of procured equipment and materials.
6) Each community shall have the responsibility for the operation and maintenance of boreholes to be constructed with the procured equipment and materials.

2-2-4-2 Implementation Condition

With regard to the procurement of equipment and materials, the following points shall be fully considered.

1) Inspection, operation and maintenance of the equipment by the engineers dispatched by the Supplier.
2) Approval of import and customs clearance, other trade procedures and registration of vehicles by the Nigerian side.
3) Transportation conditions by the Supplier, customs clearance and handover, and any troubles during and after storage.
4) Conditions regarding complicated procedures at the port of unloading (Lagos) in Nigeria.

2-2-4-3 Scope of Works

The Japanese side shall have responsibility for the procured equipment and materials until handing over them to the Implementing Agencies. The Nigerian side shall have responsibility for i) operation and maintenance of equipment and materials after handover, ii) management of construction works using the equipment and materials, and iii) operation and maintenance of the completed water supply facilities.

The Japanese side shall carry out technical transfer to the Implementing Agencies, concerning quality control, construction method, schedule management and progress management through implementation of the soft components. However, the Japanese side shall not be responsible for supervising the construction works. The responsibility for procurement of necessary materials for construction of water supply facilities shall be allocated as shown in Table 2-34.

Table 2- 34 Allocation of the Responsibility for Procurement

Materials	Nigerian side	Japanese side
Casing pipe		○
Screen pipe		○
Hand pump		○
Drilling fluid such as bentonites and other drilling chemicals (CMC etc.)		○
Consumable materials for drilling and construction such as cement, gravel, sand, steel bars and fuel	○	

2-2-4-4 Consultant Supervision

Consultant and Contractor shall collaborate and execute the following procurement supervision to secure the smooth implementation of tendering, design, procurement, manufacturing, transportation, delivery and installation, etc. of the equipment and materials.

1) Consultant (Procurement Supervisor)
   - Preliminary discussions with contractors

- Checking of approval documents etc.
- Confirmation of the ordering contents
- Inspection and checking at the factory
- Pre-shipping inspection
- Checking and witnessing of the handover of equipment and materials
- Checking of technical transfer (OJT), user manuals and maintenance manuals, etc. provided by the Contractor

2) Contractor
- Dispatch of procurement supervisors to Nigeria for checking of equipment and materials when they arrive at Lagos port
- Contractor shall give explanations to the engineering staffs of the Implementing Agencies concerning the operation and use of rigs, trucks, and geophysical survey equipment, etc.

2-2-4-5 Quality Control Plan

The quality control plan for the Project is described below in reference to schedule control and quality control.

(1) Schedule control

As this the Grant Aid Project consists of only the procurement of equipment and materials, the Equipment Supplier shall be requested to manage manufacturing process of equipment in the factory. Consequently in principle, process control shall be based on the factory management by the Supplier (Suppliers). Meanwhile, the Consultant shall check progress of manufacturing based on reports submitted by the Supplier and shall issue warnings etc. if necessary. The following work is planned as the Consultant's process control.

① The Consultant shall establish a necessary and sufficient project implementation schedule, in consideration of the project period to be appropriate for the Grant Aid Project and necessary for the manufacturing of the equipment. Based on above project period, the Consultant shall prepare a project schedule sheet, which will be a part of contract document for the equipment supply.
② At the time of the tender, the Consultant shall check that the schedule proposed by the bidders is appropriate for completion of the Project within the project period.
③ The Consultant shall check the progress of the work by comparing the actual progress made by the Equipment Supplier with the planned schedule.
④ When the work progress of the Equipment Supplier falls significantly behind the planned schedule, the Consultant shall issue a warning to the Equipment Supplier to restore delayed work progress to the planned schedule. Moreover, the Consultant shall examine and propose measures to maintain the planned schedule where necessary.

The equipment to be procured by the Project shall be manufactured at factories. Accordingly, the quality of such equipment shall, in principle, be controlled by the Equipment Supplier, and the Consultant shall verify the equipment quality based on the results of performance test etc. at the time of completion. In addition, the Consultant shall conduct the following works related to the quality control.

① The Consultant shall indicate the equipment specifications in the tender documents based on the result of the Outline Design.
② The Consultant shall verify that the equipment proposed by the bidders at the time of the tender meets the specifications set in the relevant tender documents.
③ When necessary, the Consultant shall check the specifications of the equipment, which is too detailed to be stipulated by the Consultant, by means of checking the approved documents etc. from the Equipment Supplier.
④ The Consultant shall confirm the quality of the equipment prior to its shipment by witnessing the quality inspection at the time of completion of manufacturing equipment at the factory, and/or reviewing reports on the inspection results etc. The Consultant shall instruct the Equipment Supplier to adjust the manufactured equipment where necessary.

(2) Quality control of the borehole construction

In Nigeria, the National Water Resources Institute is compiling the "Draft National Code of Practice for Borehole Drilling in Nigeria" for quality control of borehole construction. This is applied to quality control of the borehole construction in this Project.

2-2-4-6 Procurement Plan

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

1) Drilling rig and related tools

Drilling rigs are neither manufactured nor assembled in Nigeria. Therefore, drilling rigs and related tools shall be procured from Japan. The procurement shall be done from a rig manufacturer which is capable of providing local aftercare service.

2) Equipment and Materials for Construction of Boreholes

- Hand Pumps

In Nigeria, the Federal Government is currently standardizing hand pump, and they recommend Indian Mark III as standard type, which is called RUWATSAN-1. Foreign donors such as UNICEF, UNDP and WB also promote use of Indian Mark III, and thus the same type of product shall be procured in this Project. Hand pumps are manufactured in Nigeria, and there are local importers, leading to easy acquisition of spare parts. Therefore, hand pumps will be procured in Nigeria.

- 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 that meet international standards. Therefore, these pipes shall be procured in Nigeria

- Drilling Fluid

Drilling fluid such as montmorillonite, CMC and forming agent can be procured in Nigeria. There is no problem in their quality. Therefore, drilling fluid shall be procured in Nigeria.

2-2-4-7 Operational Guidance Plan

Drilling engineers of Nigerian side have enough experiences and skill for drilling. However, they have not yet operated the same drilling rigs which will be procured in the Project. Even though manufacturers of the rigs and tools are different, generally speaking basic mechanical composition and operation method of the drilling rigs and tools is almost same. However, there are a little difference in specification among the equipment and tools of the different manufacturers. Therefore, careful initial technical training is necessary for drilling engineers of Nigerian side at the beginning of operating rigs and tools for sustainable use of them. Two types of technical training are necessary for drilling engineers of Nigerian side to master how to operate the newly procured rigs for short period of time. This technical training shall be implemented by drilling engineers of Japanese side who are familiar to operation of the drilling rigs and tools that will be procured by the Project.

<u>Technical training for initial handling</u>

Drilling engineers of Japanese side shall give technical training to drilling engineers of Nigerian side. This technical training will give basic knowledge and skill such as fundamental mechanical structure and capacity of equipment, layout of meters and indicators of operation panel, procedure of operation, maintenance and repair of equipment and so on.

<u>Technical training for operation</u>

Drilling engineer will encounter many problems during drilling work in the field which would not be resolved by only the knowledge on the initial operation method. To overcome such problems, drilling engineers of both Nigerian side and Japanese side shall drill three boreholes together in the field in each target State. Through this experience, drilling engineers of Nigerian side will master practical

drilling skill at the site.

Technical training shall be implemented for i) drilling equipment, and ii) survey equipment, with necessary smallest input and period.

2-2-4-8 Soft Components (Technical Assistance) Plan

There would be no problem regarding the intention of the Implementing Agencies to operate and maintain the equipment and materials procured by the Project. As well as above mentioned, local resident in communities would have the willingness to operate and maintain the water supply facilities constructed with the equipment and materials of the Project. To support the Implementing Agencies and the local residents, technical transfer of the following two items shall be implemented under the soft components of the Project.

① Technical training for formulation of borehole construction plan, data management and equipment maintenance
② Technical training for strengthening of operation and maintenance system for water supply facilities

The above soft components shall be kept to a minimum in terms of scale. Concerning the implementation method, the Japanese consultant shall conduct overall supervision and guidance, while the local consultant shall be responsible for some of the activities. The soft components will be completed before the handover of the procured equipment and materials to Nigerian side.

(1) Necessity for Introduction of the Soft Components

1) Technical training for formulation of borehole construction plan, data management and equipment maintenance

In the Project, construction of 100 boreholes by each Implementing Agency is planned over two years. To achieve this goal, technical support to Nigerian side is necessary in two items below for effective implementation of the Project using procured equipment and materials.

i) Strengthening of the technical capacity regarding handling of equipment and drilling skill
ii) Technical training for formulation of borehole construction plan, data management and equipment maintenance

As for item i) mentioned above, the Supplier shall be responsible for this training. On the other hand, Consultant shall be responsible for item ii) mentioned above through implementation of soft components. Such training will contribute for the effective utilization of the limited human and financial resources of the Implementing Agencies. Through the facilities construction controlled by carefully formulated plan for borehole construction, the Project will be smoothly implemented with minimum period, which will enable the Project effect to be realized satisfactorily.

The Implementing Agencies do not have the existing drilling record. Effective drilling plan can not be formulated without the existing data. Furthermore, regarding the maintenance situation of existing equipment in the Implementing Agencies, there are repetitive breakdowns and repairs. They do not conduct daily check and systematic maintenance/repair of equipment to prevent breakdowns. For these reasons, equipment is apt to break down frequently, disturbing the progress of drilling work. As a result, the Implementing Agencies can not complete number of boreholes as they planned initially.

To improve the condition mentioned above, support for strengthening of data management and formulation of plan for equipment maintenance is necessary. This support shall be implemented for each Implementing Agency.

2) Technical training for strengthening of operation and maintenance system for water supply facilities

Rural water supply and sanitation service of the Implementing Agencies is conducted following the steps below:

Request of construction of boreholes
↓
Securing of budget for implementation
↓
Site survey (natural conditions, social conditions)
↓
Establishment of community organization (WASHCOM)
↓
Construction of water supply facilities
↓
Water quality analysis
↓
Community mobilization immediately after construction

The Implementing Agencies completes water supply facilities, and they hand over them to communities. After the hand over, WASHCOM is organized by residents of the community and carries out the operation and maintenance of the water supply facility. The WASH Unit, which belongs to Water Supply Department of LG, assists WASHCOM.

However, cooperation among the Implementing Agency, LGs and community are not sufficient. Especially staff of LGs, who should play main role in the cooperation, has a little knowledge and skill, even though they have repeatedly received training for coordination. As a result, communities can not implement sustainable operation and maintenance of water supply facilities.

The Implementing Agencies use manual compiled by UNICEF for community training. However, content of the manual is for introduction of general method for community participatory training, which is not reflecting the actual situation of rural water supply of the Project area. New manual which is easier for the communities to understand and reflecting the current situation of rural water supply is necessary. Compiling of above manual is useful for daily maintenance of the facilities because currently there is not such practical manual for communities.

Supporting system for LGs and communities by the Implementing Agencies shall be established to strengthen relationship among relevant stakeholders, so that establishment of community organization and mobilization activities shall be promoted. For this purpose, capacity development of the staff of the Implementing Agencies shall be implemented by technical transfer though implementation of soft components of the Project.

(2) Soft Components Targets

Targets of Soft Components are as follows.

1) Technical training for formulation of construction plan, data management and equipment management
   - Borehole construction will be implemented continuously based on the construction plan.
   - Borehole inventory will be established.
   - Proper borehole structure will be designed in order to prevent groundwater contamination.
   - Equipment maintenance plan will be formulated including plan to introduce new workshop equipment for maintenance and repair.

2) Technical training for strengthening of operation and maintenance system for water supply facilities

- The coordination system and contents of operation and maintenance work on water supply facilities among the Implementing Agency, LGs and communities will be made clear. Based on that, new manual will be established to clarify their responsibilities.
- For technical training, model communities will be selected from the target communities, and WASHCOM will be established in model communities.
- Staff of the Implementing Agency will perform technical training for staff of LGs.
- The Implementing Agency and LGs will guide the communities to establish WAHCOM in the model communities, and perform educational activities toward communities with close cooperation of the Implementing Agency and LGs.
- The Implementing Agency and LGs will compile the manual for organizing and managing WASHCOM.

(3) Outputs of the Soft Components

The direct outputs of the soft components in the Project will be as follows.

1) Technical training for formulation of construction plan, data management and equipment management

- Borehole construction will be implemented following the plan, and construction period will be made shorter.
- Borehole management will be strengthened based on borehole inventory.
- Borehole structure will be improved, and groundwater contamination will be prevented.
- Function of workshop will be improved, and maintenance of equipment will be strengthened.

2) Technical training for strengthening of operation and maintenance system for water supply facilities

- Work content of the Implementing Agency to support operation and maintenance of water supply facilities by communities will be made clear, and work coordination will be improved.
- Cooperation between the Implementing Agency and LGs will be strengthened, and they will continuously support WASHCOM.
- Staff of the Implementing Agency and LGs will learn skill to establish community organization and perform educational support through activities in the model communities.
- WASHCOM will be established in each community.
- Operation and maintenance of water supply facilities will be implemented continuously according to the management manual.

(4) Soft Components Activities

<u>Contents of Activities</u>

The supporting activities will consist of the following two items.

1) Technical training for formulation of borehole construction plan, data management and equipment maintenance

Before commencement of borehole construction, the Japanese consultant will provide technical support on formulation of borehole construction plans, data management and equipment maintenance for the staff of the Implementing Agencies as shown in Table 2-35.

Table 2- 35 Target Staff for Soft Components Activities
(Borehole Construction Plan, Data Management and Equipment Maintenance)

	Item \ State	Kebbi	Niger	Taraba	Ondo	Enugu
(1)	Formulation of Borehole construction plan	Workshop Department of RUWASSA	Water Supply Department of RUWASSA	Water Supply Department of RUWASSA	Water Supply Department of WATSAN Project	Water Supply Department of RUWASSA
(2)	Data management	Water Supply Department of RUWASSA	Water Supply Department of RUWASSA	Water Supply Department of RUWASSA	Water Supply Department of WATSAN Project	Water Supply Department of RUWASSA
(3)	Equipment management	Workshop Department of RUWASSA	Workshop Department of RUWASSA	Maintenance Department of RUWASSA	Workshop Department of WATSAN Project	Workshop Department of RUWASSA

2) Strengthening of operation and maintenance system for water supply facilities

Before commencement of borehole construction, the Japanese consultant will provide technical support on strengthening of operation and maintenance system for water supply facilities for the target staff shown in Table 2-36.

Table 2- 36 Staff for Soft Components Activities
(Strengthening of Operation and Maintenance System for Water Supply Facilities)

	Item \ State	Kebbi	Niger	Taraba	Ondo	Enugu
(1)	Strengthening of operation and maintenance system for water supply facilities	Community Mobilization Department of RUWASSA	Community Mobilization /Hygiene Education Department of RUWASSA	Community Mobilization /Hygiene Education Promotion Department of RUWASSA	Community Mobilization /Hygiene Education Department of WATSAN Project	Community Mobilization /Hygiene Education Department of RUWASSA

Table 2- 37 Contents of Soft Components Activities

1) Technical Training for Formulation of Construction plan, Data Management and Equipment Maintenance (to the Implementing Agencies of five target States)

Activities	Contents	Detail contents	Output
1.Formulation of borehole construction plan	1-1. Designing of Borehole structure 1-2. Formulation of mobilization plan and construction plan 1-3. Formulation of construction management plan. 1-3. Formulation of safety management plan	① To organize a construction planning team in the Implementing Agency. ② To design borehole structure ③ To formulate construction plan ④ To introduce related construction work as example, and to make a check list for quality control ⑤ To formulate construction management plan ⑥ To formulate safety management plan （see Note 1 for detail）	1. Borehole structure will be designed suitable for geological condition. 2. Borehole construction plan will be formulated to shorten construction period 3. Borehole inventory will be constructed 4. Plan for equipment maintenance will be formulated including plan to introduce workshop equipment.
2.Management of borehole data	2-1. Preparation of borehole inventories	①To collect existing boreholes data and create data-input format ②To input existing borehole data into data-base. （see Note 2 for detail）	Inputs / Equipment <Japanese side> a) Japanese Consultant (1 person) Local Consultant (1 person) b) Rental car for Japanese consultant: 213 days c) Preparation of documents: 1 set
3. Equipment maintenance	3-1. Formulation of equipment management plan 3-2. Compiling of manual for equipment maintenance. 3-3. Formulation of workshop equipment plan	① To organize a team for equipment management planning in the Implementing Agency. ② To formulate equipment maintenance plan ③ To formulate plan for introduction of workshop equipment ④ To compile manuals and check sheets	<Nigerian side> a) Staff of the Implementing Agencies: 4 to 20 members from each sate.

<Working Team: each State>
(1) Facilitator
a) Japanese Consultant (1 person)
b) Local Consultant (1person)

(2) Target group : Staff of the Implementing Agencies
a) Construction Planning team: Water supply section, 4 persons
b) Borehole inventory team: Water supply section, 4 persons
c) Equipment management team: Workshop section, 4 persons

Note
1.Training for formulation of borehole construction plan
(a) Explanation of outline of the Project, importance of responsibility of staff in charge and cooperation among related departments
(b) Preparation of a list of the contents in the construction plan
(d) Instruction on quality management, construction management and safety management
(e) Advise for establishing borehole construction planning team
(f) Proposal for construction plan
(g) Preparation of check sheets
(h) Introduction of the example of the related constructions works
(i) Formulation of construction plan

2.Training for borehole data management
(a) Explanation on the importance of data management
(b) Understanding on current situation and problem in data management
(e) Preparation of format for borehole inventory
(f) Confirmation of method for borehole data management at the implementation stage

3. Training for equipment maintenance
(a) Preparation of list of content of equipment maintenance plan
(b) Preparation of list of content of introducing plan for workshop equipment
(c) Formulation of equipment maintenance plan
(d) Formulation of plan for introducing workshop equipment
(e) Compiling of manuals and check sheets

2) Strengthening of Operation and Management System for Water Supply Facility (to the Implementing Agencies of five target States)

Activities	Contents	Detail contents	Out put
1. Improvement of supporting system for operation and maintenance of water supply facilities by communities	1-1. Confirmation of operation and maintenance of water supply facilities	① To understand current situation of operation and maintenance of water supply facilities ② To clarify work on operation and management of water supply facilities ③ To define demarcation of responsibility among 3 tiers: the Implementing Agency－LGs－WASHCOM	1. Activities for operation and maintenance of water supply will be made clear, and coordination for above activities will be strengthened. 2. Management rule to support WAHCOM will be complied by the Implementing Agency and LGs, and demarcation of duty for support will be made clear. 3. Demarcation of responsibility on supporting WASHCOM between the Implementing Agency and LGs will be made clear by the regulations of work management. 3. WASHCOM will be established in a model community, and staff of the Implementing Agency will learn know-how to organize community and educate them. 4. O&M manual for water supply facilities will be compiled, and method to monitor O&M will be prepared.
2. Strengthening of cooperation between the Implementing Agency and LGs	2-1. Confirmation of responsibility between the Implementing Agency and LGs.	① To select model community and establish working team (see Note-1) ② To hold a meeting with selected LG Units to confirm demarcation of responsibility	
	2-2. Formulation of regulations for O&M	① Discussion on content of rule to support WAHCOM by establishing system to solve immediate breakdown of facilities, to supply spare parts and to open regular meeting ② Compiling of the rule on O/M work	
3. Organising WASHCOM and education for communities (see Note 2)	3-1. Confirmation of work demarcation	① To select one community from model LGA as model community ② To explain work demarcation among the Implementing Agency－LG－WASHCOM	
	3-2. Establishment of WASHCOM	① To explain necessity and responsibility of WASHCOM and importance of O&M of water supply facility by community. ② To select members of WASHCOM, and prepare the member list	
	3-3. Promotion of O&M cost collection	① To open community workshop ② To explain necessity of O&M cost for water supply facility ③ To discuss about O&M cost (amount of water charge, frequency of payment, the method of payment, the way of collecting and keeping money, etc.) ④ To make management rule of WAHCOM including payment of water charge	Inputs / Equipment <Japanese side> a) Japanese Consultant (1 person) b) Rental car for Japanese consultant : 153 days 3. Preparation of documents: 1 set <Nigerian side> a) Staff of the Implementing Agency: 4 members. b) LGs Unit member: 4 persons c) Vehicle for transportation of above staff.
	3-4. Promotion of water supply and hygiene education（see Note 3）	① To promote hygiene education on environment around water supply facilities and households, etc ② To perform educational activities to prevent water born disease	
	3-5. Training for maintenance and repair of water supply facility (see Note 4)	① To explain how to repair broken boreholes (demarcation of responsibility and communication system with LG) ② To train technician in community for repairing hand pump and distribute manuals for repair	
<Working team: each State> a) Japanese consultant: Facilitator (1 person) b) Staff of the Implementing Agency :4 persons each State c) Staff of LGs WASH Unit :2 persons d) Adviser: Expert of UNICEF (Rural water supply system, Hygiene education) e) Participation : 1 model LGA, 1 model community	Notes: 1. Working team is composed of i) 4 members from responsible department of the Implementing Agency, ii) 2 members of model LG Unit, and iii) Japanese consultant (1 person) : 7 members in total. Japanese consultant will act as facilitator, and Working group will perform main activities. Expert of UNICEF will participate in the activities as adviser. 2. Staff of the Implementing Agency will perform various activities together with staff of LG Unit. 3. Hygiene education will be carried out twice. One of them will aim at only women as target. 4. Training of hand pump repair will be conducted for local hand pump mechanics and WASHCOM of model community, where there is the existing water facilities constructed by the Implementing Agency		

Table 2- 38 Detailed Assignment Plan of Soft Components for Technical Training for Formulation of Construction Plan, Data Management and Equipment Maintenance

Target	Activity	Content	Detailed Content	Place	Output	Documents
Preparation		Preparation of text	・Preparation of text and plan for activities(15days)	Japan		・Training text(activity and data)
Mobilization		Mobilization	・Narita-Abuja(2days) ・Discussion with FMWE and JICA(2days)			
Soft component for Enugu	Formulation of borehole construction Plan	Organizing of borehole construction planning team	・Abuja→Enugu(1day) ・Organizing of borehole construction planning team, and explanation of activities (2days)			
		・Designing of borehole design ・Mobilization plan and construction plan	・Designing of borehole structure (3days) ・Formulation of construction plan, quality control, procedure of construction work, question and answer and compiling of construction plan (6 days)	Enugu	・Borehole construction plan to shorten construction period will be formulated	・Borehole structure ・Mobilization plan and construction plan ・Construction management plan ・Safety control plan/safety manual
		Construction management plan	・Explanation of construction management plan, priority of construction order, compiling of construction management plan (5dasy)			
		Safety plan (with assistance of local consultant)	・Lecture on safety control with safety manual(1days) ・Instruction of safety management in construction site and compiling of safety plan (2days)			
	Management of borehole data	Borehole inventory (with assistance of local consultant)	・Collection of borehole data (2days) ・Compiling of format for borehole inventory (2days) ・Data input into borehole inventory (by local consultant)		・ Borehole inventory will be compiled	・Borehole inventory
	Equipment maintenance plan	・Equipment maintenance plan (with assistance of local consultant) ・Workshop equipment introducing plan	・Organization of equipment maintenance planning team (1day) ・Formulation of equipment maintenance plan (4days) ・Formulation of workshop equipment introducing plan (4days) ・Compiling of manuals and check sheets (2days)		・ Equipment maintenance plan will be formulated	・ Equipment maintenance plan/equipment maintenance manual (check sheet of equipment) ・ Introducing plan of workshop equipment
	Preparation of report		・Compiling of final report of soft component (2days)			・ Final Report for the implementing Agencies ・ Record of training, photographs
Soft component for Ondo	Formulation of borehole construction Plan	Organizing of borehole construction planning team	・Abuja→Enugu(1day) ・Organizing of borehole construction planning team, and explanation of activities (2days)			
		・Designing of borehole design ・Mobilization plan and construction plan	・Designing of borehole structure (3days) ・Formulation of construction plan, quality control, procedure of construction work, question and answer and compiling of construction plan (6 days)	Acure	・Borehole construction plan to shorten construction period will be formulated	・Borehole structure ・Mobilization plan and construction plan ・Construction management plan ・Safety control plan/safety manual
		Construction management plan	・Explanation of construction management plan, priority of construction order, compiling of construction management plan (5dasy)			
		Safety plan (with assistance of local consultant)	・Lecture on safety control with safety manual(1days) ・Instruction of safety management in construction site and compiling of safety plan (2days)			
	Management of borehole data	Borehole inventory (with assistance of local consultant)	・Collection of borehole data (2days) ・Compiling of format for borehole inventory (2days) ・Data input into borehole inventory (by local consultant)		・ Borehole inventory will be compiled	・Borehole inventory
	Equipment maintenance plan	・Equipment maintenance plan (with assistance of local consultant) ・Workshop equipment introducing plan	・Organization of equipment maintenance planning team (1day) ・Formulation of equipment maintenance plan (4days) ・Formulation of workshop equipment introducing plan (4days) ・Compiling of manuals and check sheets (2days)		・ Equipment maintenance plan will be formulated	・ Equipment maintenance plan/equipment maintenance manual (check sheet of equipment) ・ Introducing plan of workshop equipment
	Preparation of report		・Compiling of final report of soft component (2days)			・ Final Report for the implementing Agencies ・ Record of training, photographs
Soft component for Taraba	Formulation of borehole construction Plan	Organizing of borehole construction planning team	・Abuja→Enugu(1day) ・Organizing of borehole construction planning team, and explanation of activities (2days)			
		・Designing of borehole design ・Mobilization plan and construction plan	・Designing of borehole structure (3days) ・Formulation of construction plan, quality control, procedure of construction work, question and answer and compiling of construction plan (6 days)		・Borehole construction plan to shorten construction period will be formulated	・Borehole structure ・Mobilization plan and construction plan ・Construction management plan ・Safety control plan/safety manual
		Construction management plan	・Explanation of construction management plan, priority of construction order, compiling of construction management plan (5dasy)			
		Safety plan (with assistance of local consultant)	・Lecture on safety control with safety manual(1days) ・Instruction of safety management in construction site and compiling of safety plan (2days)			
	Management of borehole data	Borehole inventory (with assistance of local consultant)	・Collection of borehole data (2days) ・Compiling of format for borehole inventory (2days) ・Data input into borehole inventory (by local consultant)	Jalingo	・ Borehole inventory will be compiled	・Borehole inventory
	Equipment maintenance plan	・Equipment maintenance plan (with assistance of local consultant) ・Workshop equipment introducing plan	・Organization of equipment maintenance planning team (1day) ・Formulation of equipment maintenance plan (4days) ・Formulation of workshop equipment introducing plan (4days) ・Compiling of manuals and check sheets (2days)		・ Equipment maintenance plan will be formulated	・ Equipment maintenance plan/equipment maintenance manual (check sheet of equipment) ・ Introducing plan of workshop equipment
	Preparation of report		・Compiling of final report of soft component (2days)			・ Final Report for the implementing Agencies ・ Record of training, photographs
	Mobilization		・Taraba－Abuja(2days) ・Dissuasion with FMWR and JICA(2days) ・Abuja-Narita(2days)			
Soft component forKebbi	Formulation of borehole construction Plan	Organizing of borehole construction planning team	・Abuja→Enugu(1day) ・Organizing of borehole construction planning team, and explanation of activities (2days)			
		・Designing of borehole design ・Mobilization plan and construction plan	・Designing of borehole structure (3days) ・Formulation of construction plan, quality control, procedure of construction work, question and answer and compiling of construction plan (6 days)		・Borehole construction plan to shorten construction period will be formulated	・Borehole structure ・Mobilization plan and construction plan ・Construction management plan ・Safety control plan/safety manual
		Construction management plan	・Explanation of construction management plan, priority of construction order, compiling of construction management plan (5dasy)			
		Safety plan (with assistance of local consultant)	・Lecture on safety control with safety manual(1days) ・Instruction of safety management in construction site and compiling of safety plan (2days)	Kebbi		
	Management of borehole data	Borehole inventory (with assistance of local consultant)	・Collection of borehole data (2days) ・Compiling of format for borehole inventory (2days) ・Data input into borehole inventory (by local consultant)		・ Borehole inventory will be compiled	・Borehole inventory
	Equipment maintenance plan	・Equipment maintenance plan (with assistance of local consultant) ・Workshop equipment introducing plan	・Organization of equipment maintenance planning team (1day) ・Formulation of equipment maintenance plan (4days) ・Formulation of workshop equipment introducing plan (4days) ・Compiling of manuals and check sheets (2days)		・ Equipment maintenance plan will be formulated	・ Equipment maintenance plan/equipment maintenance manual (check sheet of equipment) ・ Introducing plan of workshop equipment
	Preparation of report		・Compiling of final report of soft component (2days)			・ Final Report for the implementing Agencies ・ Record of training, photographs
Soft component forNiger	Formulation of borehole construction Plan	Organizing of borehole construction planning team	・Abuja→Enugu(1day) ・Organizing of borehole construction planning team, and explanation of activities (2days)			
		・Designing of borehole design ・Mobilization plan and construction plan	・Designing of borehole structure (3days) ・Formulation of construction plan, quality control, procedure of construction work, question and answer and compiling of construction plan (6 days)		・Borehole construction plan to shorten construction period will be formulated	・Borehole structure ・Mobilization plan and construction plan ・Construction management plan ・Safety control plan/safety manual
		Construction management plan	・Explanation of construction management plan, priority of construction order, compiling of construction management plan (5dasy)			
		Safety plan (with assistance of local consultant)	・Lecture on safety control with safety manual(1days) ・Instruction of safety management in construction site and compiling of safety plan (2days)	Minna		
	Management of borehole data	Borehole inventory (with assistance of local consultant)	・Collection of borehole data (2days) ・Compiling of format for borehole inventory (2days) ・Data input into borehole inventory (by local consultant)		・ Borehole inventory will be compiled	・Borehole inventory
	Equipment maintenance plan	・Equipment maintenance plan (with assistance of local consultant) ・Workshop equipment introducing plan	・Organization of equipment maintenance planning team (1day) ・Formulation of equipment maintenance plan (4days) ・Formulation of workshop equipment introducing plan (4days) ・Compiling of manuals and check sheets (2days)		・ Equipment maintenance plan will be formulated	・ Equipment maintenance plan/equipment maintenance manual (check sheet of equipment) ・ Introducing plan of workshop equipment
	Preparation of report		・Compiling of final report of soft component (2days)			・ Final Report for the implementing Agencies ・ Record of training, photographs
	Mobilization		・Niger－Abuja(2days) ・Dissuasion with FMWR and JICA(2days) ・Abuja-Narita(2days)			
Evaluation	Evaluation of accomplishment of output of soft component	Traveling	・Narita－Abuja (2days) ・Dissuasion with FMWR and JICA (2days) ・Abuja-Narita (2days)	Mobilization		
		Evaluation of accomplishment of output of soft component	Interview survey to relevant organization, site inspection, interview survey to the Implementing Agencies and evaluation of accomplishment of soft component (20days)	five states		Final report of soft component (JICA)

Assignment plan				Quantity	Note
	Human resources				
	Japanese side	Technical training for construction plan, data management and equipment management-1 (Japanese consultant)		5.09M/M	in Japan :0.23M/M (7days) in Nigeria :5.09M/M (118days+28days=146days)
		Technical training for construction plan, data management and equipment management-2 (Japanese consultant)		2.93M/M	in Japan :0.23M/M (7days) in Nigeria :2.70M/M 81days)
		Technical training for construction plan, data management and equipment maintenance (Japanese consultant)(Local consultant)		20days	
	Nigerian side	Working team for construction plan, data management and equipment maintenance (4 to 8 members)			Drilling team and hydrogeological survey team: 4 to 6 members
	Vehicle			Quantity	Note
	Japanese side	Vehicle(4WD)	For Technical training for construction plan, data management and equipment management-1		
		Vehicle(4WD)	For Technical training for construction plan, data management and equipment management-2	130days	191 days (Training of soft component)＋24days(Evaluation)=215 days for Japanes
	Working room, meeting room and others			Quantity	Note
	Nigerian side	Working room		4 months	
		Meeting room		5days	LGA meting：3dasy
		others (transport if necessary)			

Table 2- 39 Detailed Assignment Plan of Soft Components for Strengthening of Operation and Management System for Water Supply Activities

Target	Activity	Content	Detailed Content	1	2	3	4	Place	Output	Documents
Preparation		Preparation of text	・Preparation of text and plan for activities(15days)					Japan		Training test (Activities and data)
Mobilization			・Narita-Abuja(2days) ・Discussion with FMWE and JICA(2days)					Mobilization		
Soft component for Enugu	Improvement of supporting system for operation and maintenance of water supply facilities by communities	Establishment of working team	・Abuja- Enugu(1day) ・Selection of model community and establishment of working team(2days)					Enugu		
		Confirmation of supporting system for operation and maintenance	・Arrangement of existing boreholes data and information on LGAs (1day) ・Examination of existing system for operation and maintenance for water supply facilities and problems to be solved (2 days) ・Arrangement of work demarcation of operation and maintenance of water supply facilities (3days) ・Compiling of work content of stakeholders (2days)						Operation and management system for water supply facilities will be improved and work content will be made clear	Management rule to support WASHCOM
	Strengthening of cooperation between the Implementing Agency and LGs	Confirmation of work demarcation and compiling of management rules	・Discussion with model LGs Unit(2days) ・Examination of management rule (2days) ・Compiling of management rule (3days)						Management rules for supporting WASHCOM by the Implementing Agency and LGs will be formulated and work demarcation will be verified.	
	Organizing WASHCOM and education for communities	Organizing of WASHCOM and educational activities for communities	・Preparation of educational activities for communities(1days) ・Explanation of work content by community, establishment of WASHCOM and examination of cost for operation and maintenance (2days) ・Hygiene education (men and women separately)(1day) ・Distribution and explanation of manual for repair and inspection of water supply facilities(2days) ・Discussion of problems to be solved in activities (1day)						WASHCOM will be established in model community, and staff of the Implementing Agency and LGs Unit will learn know-how to organize and educate community	・Member list of WASHCOM and management rule of WASHCOM ・Manual for hand pump maintenance ・Record on hygiene education and other educational activities
	Compiling of report		Compiling of final report of soft component (4 days)						WASHCOM will be established in model community, and staff of the Implementing Agency and LGs Unit will learn know-how to organize and educate community	・ Final Report for the implementing Agencies ・ Record of training, photographs
Soft component forOndo	Improvement of supporting system for operation and maintenance of water supply facilities by communities	Establishment of working team	・Abuja- Enugu(1day) ・Selection of model community and establishment of working team(2days)					Acure		
		Confirmation of supporting system for operation and maintenance	・Arrangement of existing boreholes data and information on LGAs (1day) ・Examination of existing system for operation and maintenance for water supply facilities and problems to be solved (2 days) ・Arrangement of work demarcation of operation and maintenance of water supply facilities (3days) ・Compiling of work content of stakeholders (2days)						Operation and management system for water supply facilities will be improved and work content will be made clear	Management rule to support WASHCOM
	Strengthening of cooperation between the Implementing Agency and LGs	Confirmation of work demarcation and compiling of management rules	・Discussion with model LGs Unit(2days) ・Examination of management rule (2days) ・Compiling of management rule (3days)						Management rules for supporting WASHCOM by the Implementing Agency and LGs will be formulated and work demarcation will be verified.	
	Organizing WASHCOM and education for communities	Organizing of WASHCOM and educational activities for communities	・Preparation of educational activities for communities(1days) ・Explanation of work content by community, establishment of WASHCOM and examination of cost for operation and maintenance (2days) ・Hygiene education (men and women separately)(1day) ・Distribution and explanation of manual for repair and inspection of water supply facilities(2days) ・Discussion of problems to be solved in activities (1day)						WASHCOM will be established in model community, and staff of the Implementing Agency and LGs Unit will learn know-how to organize and educate community	・Member list of WASH COM and management rule of WASH COM ・Manual for hand pump maintenance ・Record on hygiene education and other educational activities
	Compiling of report		Compiling of final report of soft component (4 days)						WASHCOM will be established in model community, and staff of the Implementing Agency and LGs Unit will learn know-how to organize and educate community	・ Final Report for the implementing Agencies ・ Record of training, photographs
Soft component forTaraba	Improvement of supporting system for operation and maintenance of water supply facilities by communities	Establishment of working team	・Abuja- Enugu(1day) ・Selection of model community and establishment of working team(2days)					Jalingo		
		Confirmation of supporting system for operation and maintenance	・Arrangement of existing boreholes data and information on LGAs (1day) ・Examination of existing system for operation and maintenance for water supply facilities and problems to be solved (2 days) ・Arrangement of work demarcation of operation and maintenance of water supply facilities (3days) ・Compiling of work content of stakeholders (2days)						Operation and management system for water supply facilities will be improved and work content will be made clear	Management rule to support WASHCOM
	Strengthening of cooperation between the Implementing Agency and LGs	Confirmation of work demarcation and compiling of management rules	・Discussion with model LGs Unit(2days) ・Examination of management rule (2days) ・Compiling of management rule (3days)						Management rules for supporting WASHCOM by the Implementing Agency and LGs will be formulated and work demarcation will be verified.	
	Organizing WASHCOM and education for communities	Organizing of WASHCOM and educational activities for communities	・Preparation of educational activities for communities(1days) ・Explanation of work content by community, establishment of WASHCOM and examination of cost for operation and maintenance (2days) ・Hygiene education (men and women separately)(1day) ・Distribution and explanation of manual for repair and inspection of water supply facilities(2days) ・Discussion of problems to be solved in activities (1day)						WASHCOM will be established in model community, and staff of the Implementing Agency and LGs Unit will learn know-how to organize and educate community	・Member list of WASHCOM and management rule of WASHCOM ・Manual for hand pump maintenance ・Record on hygiene education and other educational activities
	Compiling of report		Compiling of final report of soft component (4 days)						WASHCOM will be established in model community, and staff of the Implementing Agency and LGs Unit will learn know-how to organize and educate community	・ Final Report for the implementing Agencies ・ Record of training, photographs
	Mobilization		・Niger－Abuja (1day) ・Disscussion in Abuja(MWR、JICA)(2days) ・Abuja-Narita(3days)							
Soft component forKebbi	Improvement of supporting system for operation and maintenance of water supply facilities by communities	Establishment of working team	・Abuja- Enugu(1day) ・Selection of model community and establishment of working team(2days)					Kebbi		
		Confirmation of supporting system for operation and maintenance	・Arrangement of existing boreholes data and information on LGAs (1day) ・Examination of existing system for operation and maintenance for water supply facilities and problems to be solved (2 days) ・Arrangement of work demarcation of operation and maintenance of water supply facilities (3days) ・Compiling of work content of stakeholders (2days)						Operation and management system for water supply facilities will be improved and work content will be made clear	Management rule to support WASHCOM
	Strengthening of cooperation between the Implementing Agency and LGs	Confirmation of work demarcation and compiling of management rules	・Discussion with model LGs Unit(2days) ・Examination of management rule (2days) ・Compiling of management rule (3days)						Management rules for supporting WASHCOM by the Implementing Agency and LGs will be formulated and work demarcation will be verified.	
	Organizing WASHCOM and education for communities	Organizing of WASHCOM and educational activities for communities	・Preparation of educational activities for communities(1days) ・Explanation of work content by community, establishment of WASHCOM and examination of cost for operation and maintenance (2days) ・Hygiene education (men and women separately)(1day) ・Distribution and explanation of manual for repair and inspection of water supply facilities(2days) ・Discussion of problems to be solved in activities (1day)						WASHCOM will be established in model community, and staff of the Implementing Agency and LGs Unit will learn know-how to organize and educate community	・Member list of WASHCOM and management rule of WASHCOM ・Manual for hand pump maintenance ・Record on hygiene education and other educational activities
	Compiling of report		Compiling of final report of soft component (4 days)						WASHCOM will be established in model community, and staff of the Implementing Agency and LGs Unit will learn know-how to organize and educate community	・ Final Report for the implementing Agencies ・ Record of training, photographs
Soft component forNiger	Improvement of supporting system for operation and maintenance of water supply facilities by communities	Establishment of working team	・Abuja- Enugu(1day) ・Selection of model community and establishment of working team(2days)					Niger		
		Confirmation of supporting system for operation and maintenance	・Arrangement of existing boreholes data and information on LGAs (1day) ・Examination of existing system for operation and maintenance for water supply facilities and problems to be solved (2 days) ・Arrangement of work demarcation of operation and maintenance of water supply facilities (3days) ・Compiling of work content of stakeholders (2days)						Operation and management system for water supply facilities will be improved and work content will be made clear	Management rule to support WASHCOM
	Strengthening of cooperation between the Implementing Agency and LGs	Confirmation of work demarcation and compiling of management rules	・Discussion with model LGs Unit(2days) ・Examination of management rule (2days) ・Compiling of management rule (3days)						Management rules for supporting WASHCOM by the Implementing Agency and LGs will be formulated and work demarcation will be verified.	
	Organizing WASHCOM and education for communities	Organizing of WASHCOM and educational activities for communities	・Preparation of educational activities for communities(1days) ・Explanation of work content by community, establishment of WASHCOM and examination of cost for operation and maintenance (2days) ・Hygiene education (men and women separately)(1day) ・Distribution and explanation of manual for repair and inspection of water supply facilities(2days) ・Discussion of problems to be solved in activities (1day)						WASCOM will be established in model community, and staff of the Implementing Agency and LGs Unit will learn know-how to organize and educate community	・Member list of WASHCOM and management rule of WASHCOM ・Manual for hand pump maintenance ・Record on hygiene education and other educational activities
	Compiling of report		Compiling of final report of soft component (4 days)						WASCOM will be eastablished in model commnity, and staff of the Implementing Agency and LGs Unit will learn know-how to organize and educate community	・ Final Report for the implementing Agencies ・ Record of training, photographs
	Mobilization		・Niger－Abuja (1day) ・Disscussion in Abuja(MWR、JICA)(2days) ・Abuja-Narita(3days)							

Assignment plan

Human resources			1	2	3	4	Quantity	Note
Japanese side	strengthening of Operation and Management of Water Supply Facilities-1(Japanese consultant)						3.36M/M	in Japan: 0.23M/M (7days) in Nigeria: 3.13M/M (94days)
Japanese side	strengthening of Operation and Management of Water Supply Facilities-2(Japanese consultant)						2.39M/M	in Japan: 0.23M/M (7days) in Nigeria: 2.16M/M (65days)
Nigerian side	Working team for Strengthening of Operation and Management of Water Supply Facilities (around 6persons)							The Implementing Agencies:4 persons from each target state LAG:2 persons from each target state(hand pump mechanic:1person、member from hygiene section: 1pesrson)
Nigerian side	Advisor from UNICEF						10 days	Expert of UNICEF
Vehicle			1	2	3	4	Quantity	Note
Japanese side	Vehicle(4WD)	For Technical training for construction plan, data management and equipment management-1						
Japanese side	Vehicle(4WD)	For Technical training for construction plan, data management and equipment management-2					147days	Japanese Consultant
Working room, meeting room and others			1	2	3	4	Quantity	Note
Nigerian side	Working room						5 months	
Nigerian side	Meeting room						5 days	LGA meeting: 3days
Nigerian side	others (transport if necessary)							

(5) Procurement of Implementation Resources for the Soft Components Activities

The support items and methods of procurement for implementation resources for the soft components in the Project are indicated as below.

Table 2- 40 Implementation Item and Resources for Soft Components

Assistance Item	Condition of resource	Implementation Resource
1)Technical training for formulation of borehole construction plan, data management, equipment maintenance	Engineer who knows i) hydrogeology of the Project area, ii) capacity of the Implementing Agencies and iii) content of the procured equipment. Additionally, he/she is requested to have capability : • to formulate borehole drilling plan • to compile borehole inventory • to formulate plan for maintaining and repairing equipment	It is difficult to find suitable local consultant resources in Nigeria. Therefore, Japanese consultant will implement requested activities. A part of activities will be carried out by local consultant resource.
2)Technical training for strengthening of O&M system for water supply facilities	Engineer who knows problem in water supply system in the Project area. Additionally, he/she is requested to have capability : • to improve supporting system for communities • to perform organizing WAHCOM and educational activities for communities.	As same as above, Japanese consultant will implement requested activities.

1) The Japanese consultant and local consultant will implement the technical training for formulation of borehole construction plan, data management and equipment maintenance for the target staff of the Implementing Agencies, that is staff of the drilling section and hydrogeological section of Water Supply Department and Workshop Department (see Table 2-35). Main contents of technical training are, i) formulation of borehole construction plan, ii) data management and iii) equipment maintenance, with purpose of promoting effective construction work using equipment and materials procured by the Project. Part of training will be implemented by the local consultants.

2) The Japanese consultant and local consultant will implement training for strengthening of operation and maintenance system for water supply facilities to the target staff of the Implementing Agencies who has responsibility for community mobilization and education (see Table 2-36). Main contents of the training are i) strengthening of system for operation and maintenance of water supply facilities, ii) strengthening of cooperation between the Implementing Agencies and LGs, and iii) establishment of community organization (WASHCOM) and implementation of educational activates for communities.

(6) Soft Components Implementation Process

The soft components will be implemented before the commencement of borehole construction. The assistance will be conducted in the areas of i) technical training for formulation of borehole construction plan, data management and equipment maintenance, and ii) strengthening of operation and maintenance system for water supply facilities. The soft components will be implemented avoiding Ramadan period, so that most target staff of the Implementing Agencies can participate in the soft components. Implementation schedule of the soft components is shown in Table 2-41.

It is planned to start the soft components at nine months after the conclusion of the consultant agreement and continue activities of the soft components for around seven months. The degree of achievement of the overall soft components outputs will be evaluated at the end, which will take half a month. This activity will start approximately two months after completion of the soft components activities. When implementing the soft components, local consultants shall be utilized, and the most rational training method shall be adopted with a view to minimizing involvement of Japanese engineers.

Table 2- 41 Soft Components Implementation Schedule

Japanese consultants (Japan)
Japanese consultant (Nigeria)
( )Working days

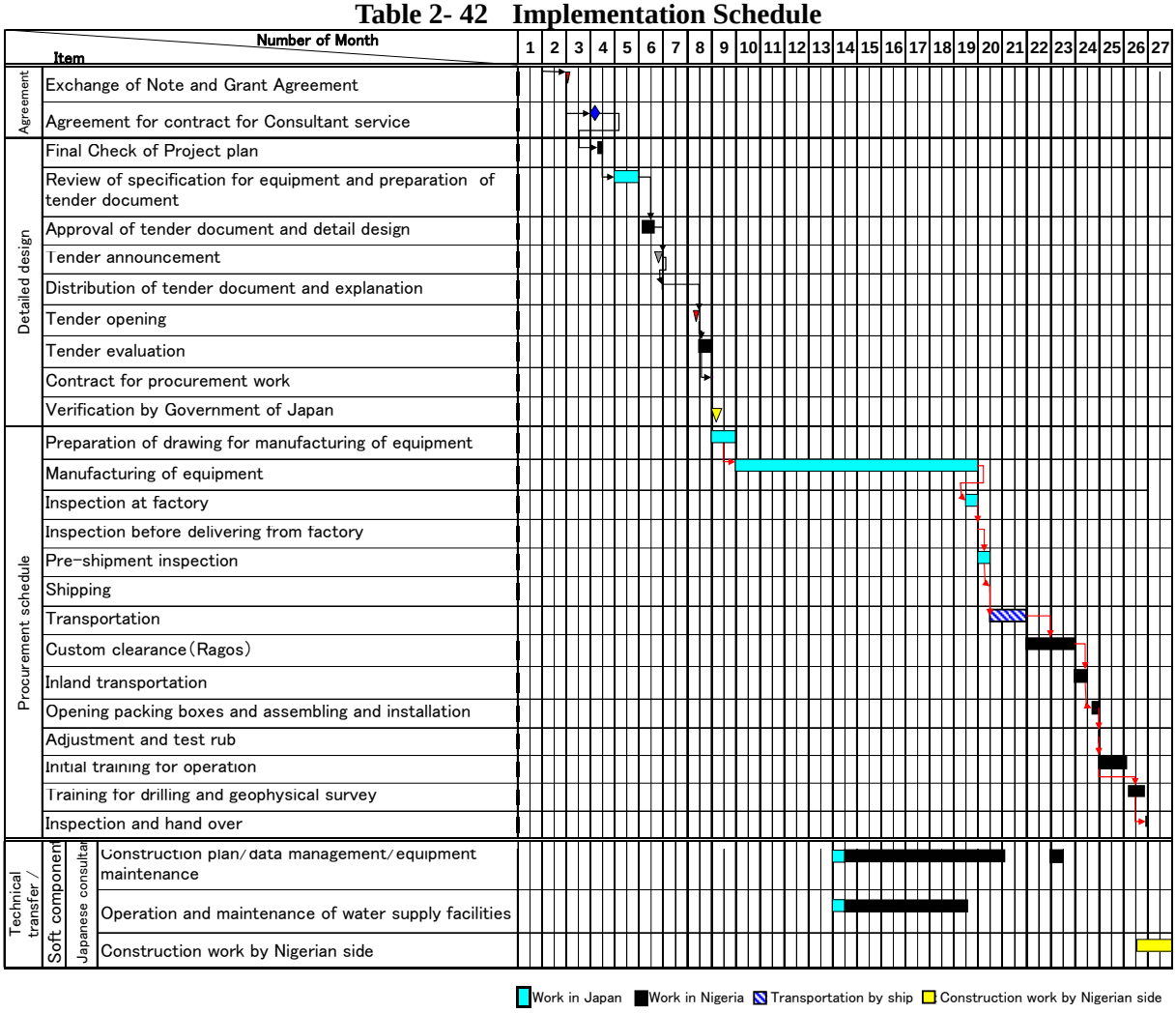
Activity	Expert	1	2	3	4	5	6	Traveling	Japanese consultants Nigeria	Japanese consultants Japan	
①Formulation of borehole construction plan, data management and equipment maintenance	Japanese consultant -1	Text compiling (7days)								7	
		Traveling (Tokyo -Abuja, meeting with FMWR) (3days)						1	3		
		Formulation of borehole construction plan, data management and equipment maintenance (Enug) (35days)							35		
			Report compiling (2days)						2		
			Formulation of borehole construction plan, data management and equipment maintenance (Ondo) (35days)						35		
				Report compiling (2days)					2		
				Formulation of borehole construction plan, data management and equipment maintenance (Taraba) (35days)					35		
					Report compiling (2days)				2		
					Traveling (Taraba-Abuja, meeting with FMWR, Abuja－Tokyo) (4 days)				4		
	Japanese consultant -2	Text compiling (7days)								7	
		Traveling (Tokyo -Abuja, meeting with FMWR) (3days)						1	3		
		Formulation of borehole construction plan, data management and equipment maintenance (Kebbi) (35days)							35		
			Traveling (Tokyo -Abuja, meeting with FMWR) (3days)						2		
			Formulation of borehole construction plan, data management and equipment maintenance (Niger) (35days)						35		
				Report compiling (2days)					2		
				Traveling (Niger-Abuja, meeting with FMWR, Abuja－Tokyo) (4 days)					4		
								2	**199**	**14**	Total
②Operation and maintenance of water supply facilities	Japanese consultant -3	Text compiling (7days)								7	
		Traveling (Tokyo -Abuja, meeting with FMWR) (3days)						1	3		
		Operation and maintenance of water supply facilities (Enug)(27 days)							27		
			Report compiling (2days)						2		
			Operation and maintenance of water supply facilities (Ondo)(27 days)						27		
				Report compiling (2days)					2		
				Operation and maintenance of water supply facilities (Taraba)(27 days)					27		
					Report compiling (2days)				2		
					Traveling (Taraba-Abuja, meeting with FMWR, Abuja－Tokyo) (4 days)				4		
	Japanese consultant -4	Text compiling (7days)								7	
		Traveling (Tokyo -Abuja, meeting with FMWR) (3days)						1	3		
		Operation and maintenance of water supply facilities (Kebbi)(27 days)							27		
			Report compiling (2days)						2		
			Operation and maintenance of water supply facilities (Niger)(27 days)						27		
				Report compiling (2days)					2		
				Traveling Niger-Abuja, meeting with FMWR, Abuja－Tokyo) (4 days)					4		
								2	**159**	**14**	Total
Evaluation of activities	Japanese consultant -1				Traveling (Tokyo -Abuja, meeting with FMWR/JICA/NWRI) (4days)			1	4		
						Evaluation of activities (20 days)			20		
					Traveling (Niger-Abuja, meeting with FMWR, Abuja－Tokyo) (4 days)				4		
								1	**28**		Total
								5	**386**	**28**	Grand total

2-2-4-9 Implementation Schedule

(1) Project period

The equipment and materials will be procured from Japan or Nigeria. If procuring from Japan, it will require approximately 22 to 23 months in total after Consultant Agreement, comprising 10 months for manufacturing the equipment (drilling rigs), 6 months for transportation including customs clearance, and 6 to 7 months for other activities. Implementation schedule (draft) is shown in Table 2-42.

Table 2- 42 Implementation Schedule



(2) Construction schedule

The newly procured rigs will be used to drill 100 boreholes in each target State, 500 boreholes in total, for two years after procurement by the Project. The standard construction schedule for one borehole construction is shown in Table 2-43 and 2-44.

Table 2- 43 Construction Schedule

Working schedule	Necessary days	Working team responsible for activities
1) Drilling work	4 to 6 days	Drilling team
2) Pumping test	4 days	Pumping test team
3) Construction of borehole head facilities • Platform construction • Hand pump installation	 • 2 days • 4 to 6 days	Facilities construction team
4) Handover and fence installation(by residents)	1 day	Facilities construction team and community

As shown in Table 2-43, drilling team is responsible for only drilling boreholes. Other construction work such as pumping test and construction of platform will be implemented by the other working teams.

Table 2- 44 Work Schedule of Borehole Drilling

Work	Day	Hour	Mon. 1	Thu. 2	Wed. 3	Thu. 4	Fri. 5	Sat. 6	San. 7	Note
Mobilization	0.5	5								
10-5/8"tricon drilling (0 to10m) and installation of work casing	1	10								Drilling speed is 10m/day
6/1/4"air hammer drilling (10 to 50m) and well development	2.5	25								Drilling speed is 20m/day (last 0.5day for contingency)
Electric logging	0.2	4								Electric logging to decide location of screen
Installation of casing/screen and gravel pack	0.3	6								
Withdrawal of work casing	0.1	2								
Cementing against contamination	0.1	2								
Preparation for shifting to the next site	0.3	6								
Move to the next site	1	10								After drilling, a team for pumping test will come to the site. After pumping test, a team for construction of platform will come to the site.
Day off	1									
Total	7									

Note) Length of borehole is 40m to 50m. Working time is from 8:00 to 19:00 for 10 hours a day.

It will take 4 to 6 days to drill one borehole. Number of boreholes that can be drilled in one year is estimated below, considering available working period of 10 months except heavy rainy season.

10 months × 30 days ÷ (4 to 6 days for one borehole) = 50 to 75 boreholes

100 boreholes can be drilled for two years under the assumption of drilling pace of 50 boreholes per year, which include enough time to spare. However, more than 100 boreholes must be drilled for two years if successful rate (70%) of boreholes is considered. In this case, countermeasures below should be taken.

- In case of unsuccessful borehole, work items after electric logging in Table 2-44 will be cancelled, and drilling team will shift to the next drilling point. Therefore, only 3 days or less will be wasted for drilling of unsuccessful borehole.
- Order of communities for drilling work should be carefully planned following the borehole construction plan, which will be formulated before the Project implementation. In this plan, it should be considered that drilling work should be carried out even in heavy rainy season at communities located near the main road with good access by drilling rig. Such a plan will accelerate drilling pace to be more than 50 boreholes per year.
- Borehole construction plan will be formulated by soft components of the Project. Drilling pace will be accelerated by the result of the soft components.

2-3 Obligations of the Recipient Country

The scope of works of the Japanese side in the Project covers the procurement of equipment and materials for construction of water supply facilities and technical support via the soft components. Both Governments have agreed that the Nigerian side will take responsibility for the construction of water supply facilities including the selection of sites. The specific scope of works of the Nigerian side is indicated below.

(1) Construction of Borehole Facilities

Responsibility of Nigerian side on water supply facilities is shown in Table 2-45.

Table 2- 45 Responsibility of Nigerian Side on Water Supply Facilities

Item	Obligations of Nigerian Side
Borehole construction work	・ Mobilization of drilling rig, setting and dismantling. ・ Drilling, electrical logging, casing pipe installation, gravel packing, backfilling, cementing, pumping test, water quality analysis, borehole development. ・ Hand pump installation, platform construction. ・ Necessary equipment & materials for construction such as fuel, 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.
Borehole construction cost	・ The cost for construction work and management.
Construction period	・ Preparation of construction schedule. ・ Completion of 100 boreholes in each target State, 500 boreholes in total of 5 target States within the period of two years. If the construction will not be completed within 2 years, Nigerian side will take up the responsibility to complete the construction. After that, continuous construction for 3 years.
Siting	・ Prior to commencement of construction work, the siting of the drilling points will be conducted by Nigerian side.
Quantities of construction materials	Nigeria side will be responsible for preparation of additional construction materials such as PVC casing & screen and hand pumps, if they complete more then 100 boreholes in each target State within 2 years.
The method of delivery materials	・ Transportation of equipment and materials from headquarters' office of each Implementing Agency to each drilling site. ・ Management of the equipment and materials.
Exemption of taxes	Nigeria side will prepare the necessary documents for exemption of taxes before arrival of the equipment and materials at Lagos Port, and Nigeria side will carry out exemption of taxes.
Quality control and Inspection	Nigeria side will undertake the responsibility of quality control of construction work of water supply facilities and compliance to specifications, etc.
Safety/ Security measures	・ Responsible for any accident during construction work. ・ Anti-theft measures of the equipment and materials at the sites.
Special attention	・ The progress report of the construction work shall be submitted monthly to Japanese side.
Others	・ Improvement of access roads. ・ 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 them prior to the commencement of the construction work.
- To provide office and counterparts free of charge to Japanese consultant.
- To bear the fees in accordance with the Banking Arrangement (B/A) and the Authorization to Pay (A/P).
- To ensure prompt unloading and customs clearance of the materials and equipment procured by the Project on arrival in Nigeria.
- To exempt Japanese officials 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 Project.
- To acquire number plate registration for the vehicles procured in the Project.
- To maintain and use properly and effectively both the procured equipment and the constructed facilities under the Project.

- To secure storehouse and workshop to keep equipment and materials procured by the Project and to secure enough parking spaces for rig/vehicles by the Project.
- To take the measures necessary for the safety and security of the Japanese engineers.
- To provide counterparts for the soft components activities as a working team, and to participate in the training workshop.

For improvement of the rural water supply coverage to provide safe water to residents in rural areas by effective use and operation of the drilling equipment procured by the Project, it is necessary for the Government of the target States to secure the budget for rural water supply and to sustain the organizational and technical capability of the Implementing Agencies, which are in charge of the rural water supply.

2-4 Project Operation Plan

2-4-1 Operation and Maintenance of Borehole Drilling Equipment

(1) Management

The construction procedure of boreholes using the equipment to be procured in this Project is composed of: geophysical survey → drilling → pumping test → construction of platform and hand pump installation. The Implementing Agencies are responsible for the implementation of these construction works. The procured equipment and materials are to be set up in offices of the Implementing Agencies. The necessary staff for the operation and maintenance of these equipment and materials, which is shown in Table 2-46, can be assigned from the present staff of the Implementing Agencies.

Table 2- 46 Necessary Staff for the Implementation of the Project

	Work contents	Team component		No. of present staff	Necessary staff for the Project	Remark
Kebbi	① Geophysical survey	Geophysicist	2	7	2	Survey Team of Water Supply Department
	② Drilling	Chief driller Assistant driller Mechanical engineer Driver	1 1 1 2	9	5	Workshop Department
	③ Pumping test	Engineer Assistant	1 1	7	2	Pumping Test Team of Water Supply Department
	④ Hand pump Installation	Engineer Assistant	1 2	4	3	Water Supply Department Pump Installation Team
Niger	① Geophysical survey	Geophysicist Assistant Driver	1 2 1	4	4	Water Supply Department Survey Team
	② Drilling	Chief driller Assistant driller Mechanical engineer Driver	1 3 1 3		8	Drilling Team of Water Supply Department
	③ Pumping test	Engineer Assistant	1 1	2	2	Pumping Test Team of Water Supply Department
	④ Hand pump Installation	Engineer Assistant Driver	1 3 1	5	4	Pump Installation Team of Workshop Department
Taraba	① Geophysical survey	Geophysicist Assistant Driver	1 2 1	4	4	Survey Team of Water Supply Department
	② Drilling	Chief driller Assistant driller Mechanical engineer Labour/Driver	2 3 1 2	25	8	Drilling Team of Water Supply Department
	③ Pumping test	Engineer Assistant Plumber	1 2 1	4	2	Pumping Test Team of Water Supply Department
	④ Hand pump Installation	Engineer Assistant	1 2	3	4	Pump Installation Team of Workshop Department

	Work contents	Team component		No. of present staff	Necessary staff for the Project	Remark
Ondo	① Geophysical survey	Geophysicist Geologist	2 2	10	6	Survey Team of Water Supply Department
	② Drilling	Chief driller Assistant driller Civil engineer Geologist Mechanical engineer Labour/Driver	1 2 1 1 1 2	16	8	Drilling Team of Water Supply Department
	③ Pumping test	Geologist Assistant Electric Engineer Plumber	2 2 1 1	6	6	Pumping Test Team of Water Supply Department
	④ Hand pump Installation	Engineer Assistant mason Carpenter	1 2 1 1	5	5	Pump Installation Team of Workshop Department
Enugu	① Geophysical survey	Geophysicist Assistant	1 2	3	3	Survey Team of Water Supply Department
	② Drilling	Chief driller Assistant driller Mechanical engineer Labour/Driver	2 3 1 2	25	8	Drilling Team of Water Supply Department
	③ Pumping test	Engineer Assistant Plumber	1 2 1	16	5	Pumping Test Team of Water Supply Department
	④ Hand pump Installation	Engineer Assistant Mason Carpenter	1 2 1 1	16	5	Pump Installation Team of Workshop Department

① Geophysical survey equipment

Procurement of electric survey equipment and electro-magnetic survey equipment are planed. The electric survey equipment can be used for both sounding on the ground and borehole logging work. The existing geophysical survey equipments of the Implementing Agencies were offered by Japan and UNICEF in the 1980s to 1990s. After its procurement, the Implementing Agencies established geophysical survey teams. The geophysical survey teams are still continuing their activities though the procured equipment is already old and prone to breaking down.

The staff of the geophysical survey team of the Implementing Agencies has basic knowledge in geophysical survey and enough experience in the field. Consequently, it is considered that they can perform electric sounding and electro-magnetic survey with equipment procured by the Project. However, it will be necessary to make up for their lack of experience in i) operation of new equipment and ii) analysis using computer software, through technical transfer.

② Borehole drilling

The drilling engineers in the Implementing Agencies are considered to have basic drilling skill according to the results of the field survey to the Implementing Agencies. Therefore, the staff of the Implementing Agencies will be able to operate the new drilling rigs and tools procured in the Project. However, technical training will be necessary regarding mud circulation rotary drilling, guide pipe installation/removal and DTH drilling, using the new drilling rig.

③ Hand pump installation

The engineers of the Implementing Agencies are considered to possess enough experience and ability to install hand pumps. However, regarding the maintenance of water supply facilities after construction, technical support should be provided under the soft components in order to realize sustainable operation and maintenance by WASHCOM.

(2) Maintenance System

The scope of maintenance work for drilling equipment, support vehicles and geophysical survey instruments, etc. to be procured in the Project is as follows.

- Daily and regular inspection of the equipment
- Maintenance, inspection and repair of the equipment in the construction sites
- Maintenance and storage of construction tools
- Repair of breakdowns
- Management and inventory control of the materials
- Keeping of manuals and technical documents

The geophysical survey team and the water quality section of the Water Supply Department in the Implementing Agencies shall be responsible for the maintenance of the geophysical survey equipment and water analysis equipment, whereas Workshop or Maintenance Department shall be in charge of the other procured equipment and materials. As shown in Table 2-47, the Department responsible for maintenance and repair of equipment in the Implementing Agencies have personnel capable of conducting simple vehicle repairs, welding work, and maintenance of compressor engines and generators, etc. After procurement of equipment by the Project, the Implementing Agencies will own more equipment than before, so that they need more maintenance work than now. In order to handle the extra maintenance work, training for maintenance will be implemented for the Implementing Agencies within the soft component by the Project.

Table 2- 47 Staff of Workshop in the Implementing Agencies

Section	Kebbi	Niger	Taraba	Ondo	Enugu	Content
Staff for management of stored materials	1	3	5	2	2	Safekeeping of the procured material (Hand pump, PVC casing, screen).
Mechanics	2	8	4	4	5	• Check and repair for drilling rig, trucks and compressors. • Assembling and processing simple machines.
Electrician	1	3	1	3	4	Welding works and electricity-related repair.
Plumber and welder	0	8	4	5	6	Pipe processing, plumbing and welding.

Equipment for maintenance and repair currently owned by the Implementing Agencies are shown in Table 2-48. As shown in Table 2-48, the Implementing Agencies have almost same type of equipment. Some equipment is too old and broken and can not be used any more. In case of the Implementing Agency of Taraba State, they have workshop vehicle with equipment for maintenance and repair, and they can conduct maintenance work in the drilling site.

Table 2- 48 Equipment for Maintenance and Repair of the Implementing Agencies

Kebbi	Niger	Taraba	Ondo	Enugu	Condition
Lathe machine	Pressing machine	Welding machine and generator	Lathe machine	Complete set of spanners and pipe wrench	Some equipment is too old and broken and can not be used.
Pressing machine	Electric saw	Pressing machine	Metal drilling machine	Jack	
Metal cutting machine	Grinding machine	Pipe master machine	Welding machine	Welding machine	
Grinding machine	Metal drilling machine	Ventor lifter	Power hark saw	Hydraulic jack	
Metal drilling machine	Welding machine	Electric motor	Pressing machine	Pressing machine	
—	Fork lift	—	Grinding machine	Mobile crane gantry	

2-4-2 Operation and Maintenance of Water Supply Facilities

Communities are required to perform daily checks and minor repairs of boreholes and to bear costs. A maintenance kit will be provided to each borehole when the boreholes are handed over to the communities. The Implementing Agencies and LGs will assist members of WASHCOM in instructing how to maintain a hand pump by explaining the function of each parts, replacement of consumable parts and technical skills for repairs. This will enable communities to maintain and repair hand pump by themselves.

It is necessary for WASHCOM to collect a certain amount of money from residents in the community and deposit the money for the operation and maintenance of water supply facilities. It is expected to accumulate sufficient funds to repair a hand pump as soon as it is broken. Therefore, the Implementing Agencies and LGs will provide training including collection and management of water charge.

"The National Rural Water Supply and Sanitation Programme: A Strategic Framework" stipulates the demarcation among Implementing Agencies－LGs－communities in operation and maintenance of boreholes as shown in Table 2-49.

Table 2- 49 Allocation of Roles in Operation and Maintenance of Hand Pump Borehole

Work content		Implementing Agency	LG	Community	Remarks
Daily check & cleaning				○	－
Collection and management of cost for operation and maintenance				○	－
Replacement of consumable parts and minor repairs	Repair work	(○)	(○)	○	－
	Cost burden		(○)	○	
Major repairs beyond the capability of community	Repair work	○	○		"The Strategic Framework" proposes that major repairs beyond the capability of communities should be undertaken by the private sector, and the costs of the repair should be borne by the community. In reality, however, there are many cases where the Implementing Agencies and LGs repair major breakdowns and bear the cost of the entire repair.
	Cost burden	(○)	(○)	(○)	
Operation and maintenance of platform	Repair work	(○)	(○)	○	Repair of platforms (basement, drain ditch and soakage pit) or installation of fences.
	Cost burden		(○)	○	

Actually, allocation of responsibility among stakeholders in operation and maintenance of water supply facilities is not always same as that proposed by "National Strategic Framework". It is recommended to act in a flexible manner with consultations of stakeholders. However, the participation and involvement of communities will be encouraged to gradually realize allocation of responsibility proposed in "National Strategic Framework".

2-5 Project Cost Estimation

2-5-1 Initial Cost Estimation

(1) Cost for Equipment Procurement of Japanese Side

This section is closed due to the confidentiality.

(2) Cost Burden of the Nigerian side

Cost burden of Nigerian side is shown in Table 2-50. Japanese side will bear cost burden to procure equipment and materials for borehole construction, and Nigerian side will bear cost burden to construct boreholes. As shown in Table 2-50, cost of drilling is different state by state. Furthermore, drilling cost in the first 2 years after the procurement of equipment is different form drilling cost of the next 3 years after the first 2 years.

The each implementing Agency will construct 100 borehole facilities using the procured equipment and materials in 2 years after procurement. Total amount of cost for it is 167 million NGN.

On the other hand, for the next 3 years after the first 2 years, each Implementing Agency will drill 150 boreholes in the next 3 years using the procured equipment following their development plan. Total amount of cost for above drilling is 474 Million NGN. Even after above period, the Implementing Agencies can continue drilling boreholes using the procured equipment.

Table 2- 50 Cost for Construction of Borehole Facilities by the Implementing Agencies

period	Content	Kebbi	Niger	Taraba	Ondo	Enugu	Total
2 years after procurement	Cost for 1 borehole (NGN)	160,000	230,000	250,000	630,000	400,000	
	Total number of boreholes	100	100	100	100	100	500
	Total cost for drilling (×Million NGN)	16	23	25	63	40	167
Next 3 years after the first 2 years	Cost for 1 borehole (NGN)	440,000	550,000	560,000	910,000	690,000	
	Total number of boreholes	150	150	150	150	150	750
	Total cost for drilling (×Million NGN)	66	83	84	137	104	474

2-5-2 Operation and Maintenance Cost

2-5-2-1 Maintenance Cost of Procured Equipment and Materials

The maintenance cost for the procured equipment and materials is shown in Table 2-51.

Table 2- 51 Annual Cost for Maintenance for Procured Equipment (for one State)

Name of equipment	Annual cost (NGN)	Contents of the maintenance
Drilling rig	2,590,000	Implementation of the maintenance services for every 10 boreholes (engine oil exchange, filter replacement, gear oil exchange), tire replacement (twice a year)
High pressure air compressor	2,599,800	
Cargo truck with crane	1,704,000	
Pumping test equipment	563,200	Generator maintenance servicing (engine oil exchange), pumping pipe replacement
Geophysical survey equipment	520,000	Main body maintenance servicing
Total	7,977,000	-

According to the results of the field survey to the five target Implementing Agencies, the average maintenance cost of procured drilling equipment will be about 7.9 million NGN/year for each Implementing Agency, that is 39.5 million NGN/year in total for five Implementing Agencies. Therefore, the maintenance cost of procured equipment for construction of the planned boreholes will be 79 million NGN in two years. This maintenance cost will be contributed by the State Governments of the Project area.

2-5-2-2 Maintenance Cost of Water Supply Facilities

The hand pumps to be provided by the Project are Indian Mark III, which is adopted by the Federal Government as standard type hand pump for village level operation and maintenance (VLOM). The Implementing Agencies have constructed many boreholes in the past with the Indian Mark III hand pumps.

Communities are expected to perform daily checks and minor repairs as well as bear the cost of maintenance. The necessary operation and maintenance cost of Indian Mark III is summarized in Table 2-52. Currently, communities are required to bear the cost of only “A” in Table 2-52, while the cost of “B” is borne by the Implementing Agencies or LGs. However, it sometimes takes long time to repair hand pump due to lack of budget or delay of response of the Implementing Agencies and LGs. Furthermore, newly drilled boreholes by the Project will require more maintenance work by Implementing Agencies and LGs, and they will not be able to response timely. Therefore, it is proposed that communities should collect and reserve necessary money to bear the cost of minor

repairs, while major repairs and replacement are carried out by LGs and the Implementing Agencies.

Table 2- 52 Annual Maintenance Cost of Hand Pump Borehole

(Unit: Naira)

Content		① Unit Price	Frequency	② Frequency per year	Required money per year (①×②)
A	Maintenance kit	50,000	Once every five years	0.2	10,000
	Replacement of spare parts	50,000	Once every two years	0.5	25,000
	A Total				35,000
B	Borehole flushing	60,000	Once every ten years	0.1	8,000
	Major repairs（replacement of hand pump or pipe etc）	110,000	Once every five years	0.2	30,000
	B Total				38,000
	A+B Total				73,000

Note) Cost of hand pump maintenance and repair is different among five target States. Cost shown above is average cost of five target States.

As shown in Table 2-52, the annual cost of operation and maintenance of a facilities is estimated to be NGN 73,000 (“A”+”B” in Table 2-52). Therefore, the total cost for the operation and maintenance of the water supply facilities will amount to 73 million NGN for two years of the Project.

However, communities can bear cost of only “A” in Table 2-52, which is 35,000NGN. Cost for maintenance for water supply facilities and ability to pay of individual families in the target communities are shown in Table 2-53.

Table 2- 53 Cost for Maintenance and Ability to Pay of Individual Families in Communities for Water Supply Facilities

Annual cost for maintenance	① Annual cost for maintenance ② Number of beneficiaries per borehole ③ Maintenance cost per person（①/②）	35,000 NGN/year 264 persons 132 NGN/year
Amount of ability to pay	④ Amount of ability to pay per household ⑤ Average number per household ⑥ Amount of ability to pay per person（④/⑤）	150～200 NGN/month＝1,800～2,400 NGN/year 15 persons 120～160 NGN/year
Average income	⑦ Average income per household ⑧ Average number per household ⑨ Income per person（⑦/⑧）	18,000 NGN/month＝216,000 NGN/year 15 person 14,400 NGN/year
% of Cost of income	③/⑨	0.9%

As shown in Table 2-53, 132 NGN per person per year is necessary for maintenance of water supply facilities. This amount is almost same level as ability to pay revealed by the residents in the target communities, which is equivalent to 120 to 160 NGN per person per year. This analysed result can conclude that it is possible for the communities to bear the technical responsibility based on the water charge to be collected.

Besides, as shown in Table 2-53, average income of one household in the target community is estimated 18,000 NGN/year. Consequently, maintenance cost per person per year account for 0.9% of annual income per person. It is generally said that water charge is affordable if it is less than 3% of income. In case of the Project area, it is possible for residents of community to pay water charge according to the ability to pay because it is less than 3 % of income. However, care below need to be taken to ensure the above mentioned among residents in communities.

- Amount of water charge depends on whether it is a fixed rate for all households or adjusted according to the number of people per household.
- Amount of income shown in Table 2-53 is average one, and there are some households with smaller income than the average. Not every household can afford to pay water charge as discussed above.

2-6 Other Relevant Issue

(1) Exemption of Taxes

Regarding the procedure that needs to be followed by the Nigerian side to secure exemption of taxes for the equipment and materials by the Project, the contractor needs to submit an application form to the Federal Ministry of Water Resources (FMWR), and this is processed through the National Planning Commission (NPC) before approval is granted by the Ministry of Finance. Careful attention will be required to ensure that delays in the granting of exemption do not impact the progress of the Project.

(2) Others

An issue of concern in the Project implementation is delay in unloading and custom clearance of the procured equipment and materials upon arrival in Nigeria. In the past grant aid projects for Nigeria by Japan, delay in the unloading and customs clearance stage greatly impacted the implementation schedule of the projects. In order to prevent above problem and ensure the smooth passage of equipment and materials through customs, it will be important to make sure that the necessary procedures are taken by Nigerian side in advance.

CHAPTER 3

PROJECT EVALUATION

Chapter 3 Project Evaluation

3-1 Recommendation

This Project constitutes a part of the Overall Project aiming at improvement of rural water supply and hygiene condition as shown below.

The Project

Equipment and materials for construction of water supply facilities will be procured by Japanese side, and Nigerian side will construct 500 boreholes water supply facilities in 2 years using the procured equipments and materials.

Overall Project Plan

Following the Project of the first two years, Nigerian side will continue drilling work of 750 boreholes in subsequent three years. Even after above 3 years' construction period, Nigerian side will continue construction work using the procured equipments, to achieve the improvement of the rural water supply and the hygiene condition, which is superior goal of the Overall Project.

The precondition for implementation of both the Project and the Overall Project is as follows. Mattes below are recommended to be implemented by Nigerian side for achievement of the goal of both the Project and the Overall Project.

3-1-1 Precondition for the Project Implementation

Nigerian side will drill 500 boreholes in 2 years after procurement of equipment and materials by the Project. Activities below are required to Nigerian side as precondition for achievement of the Project.

- To secure the technical staff who will construct water supply facilities using the procured equipment and materials.
- To procures equipment and materials necessary for implementation of the Project which will not be included in the equipment and material to be procured by Japanese side.
- To select optimum drilling points in the target communities and secure construction sites for water supply facilities.
- To secure budget for construction of 500 borehole water supply facilities in 2 years.
- To secures budget and manpower for maintenance of the procured equipment and materials.
- To establish WASHCOM in the target communities before construction of boreholes water supply facilities for operation and maintenance of the facilities by rural communities.

The details of content above are descried in Table 2-45.

3-1-2 Precondition and Important Assumption for Achievement of Overall Project Goal

The precondition and the external conditions are described below for achievement of the Overall Project goal by construction of water supply facilities after the first 2 years' construction work mentioned above.

(1) Securing of budget for rural water supply project and maintaining of institutional and technical capability of the Implementing Agencies of the 5 target States

Budget for rural water supply project must be secured, and institutional and technical capability of the Implementing Agencies must be maintained for effective use of the procured equipment and materials by the Project.

(2) Strengthening of operation and maintenance system of water supply facilities and establishment of monitoring system

Residents of the communities have to operate and maintain water supply facilities properly by their own effort to use the facilities for long period of time. For this purpose, operation and maintenance system must be strengthened with cooperation among the Implementing Agencies, LGs and communities. It is indispensable for communities to establish WASHCOM to operate and maintain water supply facilities by themselves. The Implementing Agencies has obligation to assist

WASHCOM by technical training for communities on regular check, repair and water quality test of the water supply facilities. It is also important to establish monitoring system for WASHCOM to report regularly on condition of water supply facilities to the Implementing Agencies.

(3) Collection of Water Charge by WASHCOM

Urgent expenditure will be necessary for hand pump repair, borehole cleaning and removal of sand and silt from boreholes during the use of water supply facilities in long period of time. For such case, WASHCOM has to collect water charge from community and keep it with treasurers' report. Especially, accounting of the collected money must be transparent.

(4) Collaboration with National Water Resources Institute

Soft component will be implemented by the Project for i) formulation of borehole construction plan, data management and equipment maintenance and ii) strengthening of operation and management system of rural water supply facilities. To compensate the training of the soft component, it is expected to collaborate with training by the National Water Resources Institute (NWRI). To achieve goal of the Overall Project, the Implementing Agencies should receive technical training in NWRI.

(5) Coordination by the Implementing Agencies in Rural Water Supply Projects

It is expected that the Implementing Agencies of the target States will be improved in terms of capability of project coordination by the Project, and they will be able to coordinate implementation of many project by the other responsible organizations such as the State Government, MDG offices and foreign donors (JICA and UNICEF and etc.).

3-2 Project Evaluation

3-2-1 Appropriateness of the Project

This project is judged to be appropriate as Japan's Grant Aid Project as explained below:

(1) Beneficiaries

Rural residents of low income group are target of this Project. The Project will benefit a large number of the target group of 132,000 people.

(2) Urgency

Rural residents in the Project area drink dirty water and suffer from water born diseases such as diarrhea, cholera and dysentery. Safe water provision to the rural residents is urgent.

(3) Capability of maintenance

The Implementing Agencies of the five target States has enough experience and capability for operation and maintenance of drilling rigs in institutional and technical aspects. Therefore, it is concluded that they can operate and maintain the drilling rigs to be procured by the Project. Borehole water supply facilities with hand pump will be constructed by Nigerian side using procured equipment and material. Maintenance of the water supply facilities is so simple that the residents of the target communities can do it.

(4) Relation between the Project and Superior Plan

The goal of the Project is consistent with the National Plan (long term rural water supply plan) and will contribute to achievement of the national goal.

(5) Monetary profit from the Project

Project for rural water supply are categorized into activity to satisfy basic human need, which can not expect monetary profit in the Project area. Water supply facilities will be handed over to rural residents after completion of the facilities and managed by the communities. Such projects are suitable for Japans Grant Aid Project.

(6) Environmental Consideration

Amount of groundwater extracted from aquifer is much smaller than groundwater potential in the

Project area. Therefore, negative impact to groundwater environment is not expected by implementation of the Project.

(7) Feasibility of Implementation of the Project by Japan's Grant Aid Scheme

There were several similar projects for rural water supply by Japan's Grant Aid in the past in Oyo Kano, Yobe, Bauchi and Katsina State in Nigeria. Additionally, there were many projects for the other sector of Nigeria by Japan's Grant Aid Scheme in the past. The Federal Ministry of Water Resources can assist implementation of this Project for the five target states based on their experience of the past similar projects, regarding i) responsibility of Nigerian side during the procurement stage, ii) countermeasures to delay in construction work, iii) countermeasures to machinery trouble and breakdown of the procured equipment and vi) timely and regular report to Japanese side on progress of construction work. Judging from the above experience, this Project can be implemented without any difficulties in accordance with Japan's Grant Aid Scheme.

3-2-2 Effectiveness

Items listed in Table 3-1 are expected as output of the Project.

(1) Quantitative output

Number of water supply facilities and number of population supplied with safe water will be increased by implementation of the Project as shown in Table 3-1 and Table 3-2.

Table 3-1 Number of Water Supply Facilities Constructed by the Project

Index		Number of water supply facilities constructed by the Project	
		Baseline in 2010	2014
Number of Boreholes drilled by the Project	Kebbi	0	100
	Niger	0	100
	Tarava	0	100
	Ondo	0	100
	Enugu	0	100
	Total	0	500

Table 3-2 Number of Population Supplied with Safe Water by the Project

Index		Number of population supplied with water by the Project	
		Baseline in 2010	2014
Number of population supplied with safe water by the project	Kebbi	0	26,400
	Niger	0	26,400
	Tarava	0	26,400
	Ondo	0	26,400
	Enugu	0	26,400
	Total	0	132,000

(2) Qualitative output

Qualitative output by the implementation of the Project is listed in Table 3-3.

Table 3-3 Qualitative Output by the Project

Current situation and problems	Measures by the Project (Requested Japanese Assistance)	Effects by the Project and degree of improvement
(1) Improvement of hygiene condition		
Rural residents in the Project area depend on ponds and shallow wells for drinking water, and water supply and hygiene condition is extremely poor leading to frequent outbreak of water born diseases such as diarrhea, cholera and dysentery.	Equipment and materials will be procured with technical support for construction of 500 borehole water supply facilities with hand pumps for 5 target Sates.	• Provision of safe water will decrease the number of persons suffering from water born diseases. • Resident in the Project area will be relieved from heavy work for water collection.
(2) Improvement of technical capability of the Implementing Agencies		
Drilling rigs of the Implementing Agencies are so old that they break down frequently, causing delay in borehole construction in the Project area.	Each of the five target state will be provided with one set of drilling rig, high pressure air compressor and track with crane, etc.	The procured newest drilling rigs with high capacity will be used continuously to promote construction works for rural water supply development.
Borehole successful rate is low due to insufficient implementation of geophysical survey.	Each of the five target state will be provided with one set of geophysical survey equipment (one electric survey equipment with borehole logging function, and one electro-magnetic survey equipment)	Capability of the Implementing Agencies will be improved to raise borehole successful rate.
The implementing agencies can not judge the available yield of borehole due to luck of pumping test equipment.	Each of the five target state will be provided with one set of pumping test equipment.	Capability to judge successful borehole of the Implementing Agencies will be improved.
The Implementing Agencies do not have borehole construction plan, boreholes inventory and equipment maintenance plan.	Soft component will be implemented by the Project for training on formulation of borehole construction plan, data management and equipment maintenance.	• Capability to formulate construction plan of the Implementing Agencies will be improved. • Borehole inventory will be compiled. • Capability of equipment maintenance of the Implementing Agencies will be improved.
(3) Improvement of O&M of water supply facilities by Community		
Rural residents are not fully aware of necessity of operation and maintenance of water supply facilities. Cooperation among the Implementing Agency, LGs and communities is not fully functioned.	Soft component will be implemented for strengthening of operation and maintenance system of water supply facilities.	• Demarcation of responsibility among the Implementing Agencies, LGs and communities will be made clear, and cooperation among them will be strengthened. • Condition of operation and maintenance of water supply facilities will be improved.
(4) Improvement of coordination system of rural water supply project		
There are several organizations implementing rural water supply project, such as the Implementing Agencies, foreign donors, State Governments and MDG office. Hence, arrangement for demarcation of project implementation among above organizations is necessary.	Capability of project coordination of the Implementing Agency will be improved by the Project.	The Implementing Agencies will properly coordinate rural water supply projects by the other organizations, leading to effective implementation of rural water supply projects.
(5) Compensation of activities by private drilling companies		
The Implementing Agencies supervise drilling work of private companies. Technical level of the supervision depends on technical level of the Implementing Agencies.	Provision of drilling rigs will improve drilling capability of the Implementing Agencies.	Capability of the Implementing Agencies to supervise private drilling companies will be strengthened.

Current situation and problems	Measures by the Project (Requested Japanese Assistance)	Effects by the Project and degree of improvement
It is difficult for private drilling companies to do their works in area far from town and with low borehole successful rate	Provision of drilling rigs will promote drilling work by the Implementing Agencies.	Drilling work will be promoted by the Implementing Agencies in the area far from town or with low borehole successful rate.
Drilling work by the private drilling companies is sometimes too rapid to complete boreholes with high quality.		Borehole with high quality will be constructed by the Implementing Agencies with higher drilling capability than private companies.
Drilling price of private companies is more expensive than that of the Implementing Agencies.		Borehole price of the Implementing Agencies is less expensive than that of the private companies. Consequently, communities can order borehole construction to the Implementing Agencies using their own budget.

3-2-3 Conclusion

The proposed Project is expected to have many benefits as explained above. Therefore, it is concluded that the proposed Project should be implemented by Japans Grant Aid scheme, which would contribute to improvement of water supply and hygiene condition of poor people in the rural area of the five target States of the Project. Furthermore, there are no problems in implementation of the Project because Nigerian side can secure manpower with enough technique for drilling work and enough budget for project implementation. The Project will be finally implemented smoothly and effectively with the other necessary conditions that will be fulfilled by Nigerian side.

Appendices

Appendices 1 Member List of the Sturdy Team

(1) The First Survey

Name	Responsibility	Position
Mr. KUTSUNA	Team Leader	Adviser of Consultant Contract Division I, Procurement Department, JICA
Dr. YOSHIDA	Expert of rural water supply	Visiting Senior Advisor (Water Resources and Disaster Management), JICA
Mr. INOUE	Project Coordinator	Water Resources Management Division 2, Water Resources and Disaster Management Group, Global Environment Department, JICA
Mr. NAKAMURA	Project Manager / Groundwater development Planning	Yachiyo Engineering Co., Ltd.
Mr. OURA	Hydrogeology/geophysical survey -1	Yachiyo Engineering Co., Ltd.
Dr. FUKUTSUKA	Hydrogeology/geophysical survey -2	Yachiyo Engineering Co., Ltd.
Mr. YAMAZAKI	Social condition survey / Management for operation and maintenance of Facilities-1	Yachiyo Engineering Co., Ltd.
Ms. MATSUBARA	Social condition survey / Management for operation and maintenance of Facilities-2	Yachiyo Engineering Co., Ltd.
Mr. IKEDA	Equipment and Procurement planning / Cost estimation	Geotechnos Co., Ltd.

(2) The Second Survey

Name	Responsibility	Position
Dr. YOSHIDA	Team Leader	Visiting Senior Advisor (Water Resources and Disaster Management), JICA
Mr. MATSUZAKI	Project Coordinator	Water Resources Management Division 2, Water Resources and Disaster Management Group, Global Environment Department, JICA
Mr. NAKAMURA	Project Manager / Groundwater development Planning	Yachiyo Engineering Co., Ltd.
Mr. OURA	Hydrogeology/geophysical survey -1	Yachiyo Engineering Co., Ltd.
Dr. FUKUTSUKA	Hydrogeology/geophysical survey -2	Yachiyo Engineering Co., Ltd.
Mr. YAMAZAKI	Social condition survey / Management for operation and maintenance of Facilities-1	Yachiyo Engineering Co., Ltd.
Mr. IKEDA	Equipment and Procurement planning / Cost estimation	Geotechnos Co., Ltd.

(3) The Third Survey

Name	Responsibility	Position
Dr. YOSHIDA	Team Leader	Visiting Senior Advisor (Water Resources and Disaster Management), JICA
Mr. SAHARA	Project Coordinator	Water Resources Management Division 2, Water Resources and Disaster Management Group, Global Environment Department, JICA
Mr. NAKAMURA	Project Manager / Groundwater development Planning	Yachiyo Engineering Co., Ltd.
Mr. YAMAZAKI	Social condition survey / Management for operation and maintenance of Facilities-1	Yachiyo Engineering Co., Ltd.
Mr. IKEDA	Equipment and Procurement planning / Cost estimation	Geotechnos Co., Ltd.

Appendices 2 Study Schedule

(1) The First Survey

			Official Member			Consultant Team Member					
Day	Date		**Mr.Kutsuna (Team Leader)**	**Dr.Yoshida (Rural Water Supply)**	**Mr.Inoue (Project Management)**	**Mr.Nakamura Chief Consultant/Ground -water Development Planning)**	**Mr.Oura Hydrogeology/Geop hysical Survey 1)**	**Dr.Fukutsuka Hydrogeology/Geop hysical Survey 2)**	**Ms.Matsubara (Social Condition Survey /Managememt for O/M of facilities 2)**	**Mr.Yamazaki (Social Condition Survey /Management for O/M of Facilities 1)**	**Mr.Ikeda (Equipment and Procurement Planning/ Cost Estimation)**
1	13-Jun	Sun	Narita-London								
2	14-Jun	Mon	04:35 (BA083) ->Abuja, 09:00 JICA Nigeria Office, 11:00 EoJ, 14:00 NPC, 15:00 FMWR, Abuja								
3	15-Jun	Tue	9:00 Discussion with EU, 11:00 Discussion with FMWR, @Abuja				07:00 Abuja -> 17:00 Birnin Kebbi (10h), @Birnin Kebbi			07:00 Abuja -> 10:30 Lokoja (3.5h), 11:00 Discussion with, WES Kogi, @Lokoja	
4	16-Jun	Wed	8:00 Abuja - 10:30 Lafia (2.5h), 11:00 Discussion with RUWASA Nassarawa, Site Survey, Lafia				09:00 Discussion with RUWASA Kebbi, Site Survey, @Birnin Kebbi			09:00 Discussion with WES Kogi, Site Survey, @Lokoja	
5	17-Jun	Thu	9:00 Discussion with RUWASA Nassarawa, 12:00 Lafia - 14:30 Abuja- 16:30, @Minna				07:00 Birnin Kebbi -> 10:30 Gusau (3.5), 11:00 Discussion with RUWASA Zamfara, @Gusau			07:00 Lokoja -> 12:00 Ado-Ekiti (5h) 13:00 Discussion with WATSAN Ekiti,	
6	18-Jun	Fri	9:00 Discussion with RUWASA Niger, Site Survey, @Minna				09:00 Discussion with RUWASA Zamfara, Site Survey, @Gusau			09:00 Discussion with WATSAN Ekiti, Site survey, 15:30 Ado-Ekiti -> 17:00	
7	19-Jun	Sat	10:00 Minna - 12:00 Abuja (2h), Data arrangement, @Abuja				07:00 Gusau -> 11:00 Kaduna, Discussion with Experts of the RWSSC, 14:00 Kaduna -> 17:00 Abuja			Data arrangement, @Akure	
8	20-Jun	Sun	Data arrangement, @Abuja				07:00 Abuja -> Lafia -> Shendam -> Wukari -> 17:00 Jalingo, @Jalingo			Data arrangement @Akure	
9	21-Jun	Mon	7:00 Abuja - 10:00 Kaduna (3h), C/C to NWRI, 15:00 Kaduna -> 18:00 Abuja, @Abuja				09:00 Discussion with RWESA Taraba, Site Survey, @Jalingo			09:00 Discussion with RUWASA Ondo, Site Survey, @ Akure	
10	22-Jun	Tue	10:00 Discussion with UNICEF, 14:00 Discussion with FMWR, @Abuja				09:00 Discussion with RWESA Taraba, 14:00 Jalingo -> 17:30 Gombe (3.5), @Gombe			07:00 Akure -> 17:30 Enugu (10.5h), @Enugu	
11	23-Jun	Wed	10:00 Signing of M/D, 14:00 Report to JICA Nigeria Office, 16:00 Report to EoJ, @Abuja				09:00 Discussion with WATSAN Gombe, Site Survey, @Gombe			09:00 Discussion with RUWASA Enugu, Site Survey, @Enugu	
12	24-Jun	Thu	08:45 Abuja (BA082) - London			Data arrangement, @Abuja	07:00 Gombe -> 14:30 Abuja (7.5h), or Gombe -> Yola (by Car), Yola -> Abuja (by Air), @Abuja			07:00 Enugu -> 15:00 Abuja (8h), @Abuja	
13	25-Jun	Fri	London -> Narita			Meeting within Team, @Abuja					
14	26-Jun	Sat				Data arrangement, @Abuja					
15	27-Jun	Sun				Data arrangement, @Abuja					
16	28-Jun	Mon				Analysis of survey result, @Abuja					
17	29-Jun	Tue				Discuss with JICA, EoJ, @Abuja					
18	30-Jun	Wed				Discuss with FMWR, @Abuja					
19	1-Jul	Thu				Discuss with FMWR, @Abuja, Report Drafting, @Abuja					
20	2-Jul	Fri				Report to JICA, Report to EoJ, @Abuja					
21	3-Jul	Sat				Abuja - London (by air)					
22	4-Jul	Sun				London - Narita (by air)					

(2) The Second Survey

			Official Member		Consultant Member				
Day	Date		**Dr.Yoshida (Team Leader)**	**Mr.Matsuzaki (Project Management)**	**Mr.Nakamura (Chief Consultant/Ground-water Development Planning)**	**Mr.Oura (Hydrogeology/Geo-physical Survey 1)**	**Dr.Fukutsuka Hydrogeology/Geo-physical Survey 2)**	**Mr.Yamazaki (Social Condition Survey /Management for O/M of Facilities 1)**	**Mr.Ikeda (Equipment and Procurement Planning/ Cost Estimation)**
1	7-Aug	Sat	Narita → Frankfrut		Narita →London, London → Abuja				
2	8-Aug	Sun	**Frankfurt → Abuja**		**Abuja (BA83, 4:35)**	Narita → Londonr, Londo →		**Narita → Londonr, Londo**	
3	9-Aug	Mon	Courtesy call on JICA Nigeria Office, EOJ, NPC, Discussion with FMWR			**Abuja (BA83, 4:35)**		**Abuja (BA83, 4:35)**	
4	10-Aug	Tue	Signing of M/D, 14:00 Report to JICA Nigeria Office, 16:00 Report to EoJ, @Abuja→			**Abuja → Birnin Kebbi, @Birnin Kebbi**	Narita - Londonr, Londo - Abuja	**Abija → Birnin Kebbi (bay car), @Birnin Kebbi**	
5	11-Aug	Wed	Report to JICA Nigeria Office, 16:00 Report to EoJ, @Abuja		**Abuja → Birnin Kebbi (by car),** @Birnin Kebbi	Hydrogeological and existing well survey,@Birnin Kebbi	**Abuja (BA83, 4:35), Abuja → Birnin Kebbi (by car), @Birnin Kebbi**	Field survey for O/M of facilities, @Birnin Kebbi	Field survey (equipment an d material), @Birnin Kebbi
6	12-Aug	Thu	Abuja→London	Abuja→Franjfurt	Capacity of RUWASA for well construction and O/M, @Birnin Kebbi	Hydrogeological and existing well survey, @Birnin Kebbi		Field survey for O/M of facilities, @Birnin Kebbi	Field survey (equipment an d material), @Birnin Kebbi
7	13-Aug	Fri	London	Frankfurt→	Water sector development plan, @Birnin Kebbi	Hydrogeological and existing well survey, @Birnin Kebbi		Field survey for O/M of facilities, @Birnin Kebbi	Market and procurement, @Birnin Kebbi
8	14-Aug	Sat	London→Uganda	→Narita	Facilities construction plan, @Birnin Kebbi	Hydrogeological and existing well survey, @Birnin Kebbi		Field survey for O/M of facilities, @Birnin Kebbi	Market and procurement, @Birnin Kebbi
9	15-Aug	Sun			Data arrangement, @Birnin Kebbi				
10	16-Aug	Mon			Discussion with RUWASSA, **Birnin Kebbi → Minna (by car)**				
11	17-Aug	Tue			Organization and budget of RUWASSA, Acutual result of well construction., @Minna	Hydrogeological and existing well survey, @Minna		Field survey for O/M of facilities, @Minna	Field survey (equipment an d material), @Minna
12	18-Aug	Wed			Capacity of RUWASSA for well construction and O/M, @Minna	Hydrogeological and existing well survey, @Minna		Field survey for O/M of facilities, @Minna	Field survey (equipment an d material), @Minna
13	19-Aug	Thu			Water sector development plan, @Minna	Hydrogeological and existing well survey, @Minna		Field survey for O/M of facilities, @Minna	Market and procurement, @Minna
14	20-Aug	Fri			Disscusion with RUWASSA, **Minna →Abuja (by car), @Abuja**				
15	21-Aug	Sat			Data arrangement, @Abuja				
16	22-Aug	Sun			**Abuja-Jalingo (by car), @Jalingo**				
17	23-Aug	Mon			Organization and budget of RUWASSA, Acutual result of well construction., @Jalingo	Hydrogeological and existing well survey, @Jalingo		Field survey for O/M of facilities, @Jalingo	Field survey (equipment an d material), @Jalingo
18	24-Aug	Tue			Capacity of RUWASA for well construction and O/M, @Jalingo	Hydrogeological and existing well survey, @Jalingo		Field survey for O/M of facilities, @Jalingo	Field survey (equipment an d material), @Jalingo
19	25-Aug	Wed			Water sector development plan, @Jalingo	Hydrogeological and existing well survey, @Jalingo		Field survey for O/M of facilities, @Jalingo	Market and procurement, @Jalingo
20	26-Aug	Thu			Facilities construction plan, @Jalingo	Hydrogeological and existing well survey, @Jalingo		Field survey for O/M of facilities	Market and procurement, @Jalingo
21	27-Aug	Fri			Data arrangement, @Jalingo			Data arrangement, @Jalingo	Data arrangement, @Jalingo
22	28-Aug	Sat			Discussion with RUWASSA, @Jalingo				
23	29-Aug	Sun			**Jalingo → Enugu (by car),** Discussion with RUWASSA, @Enugu				
24	30-Aug	Mon			Organization and budget of RUWASSA, Acutual result of well construction, @Enugu.	Hydrogeological and existing well survey, @Enugu		Field survey for O/M of facilities, @Enugu	Field survey (equipment an d material), @Enugu
25	31-Aug	Tue			Capacity of RUWASA for well construction and O/M, @Enugu	Hydrogeological and existing well survey, @Enugu		Field survey for O/M of facilities, @Enugu	Field survey (equipment an d material), @Enugu
26	1-Sep	Wed			Water sector development plan, @Enugu	Hydrogeological and existing well survey, @Enugu		Field survey for O/M of facilities, @Enugu	Market and procurement, @Enugu
27	2-Sep	Thu			Facilities construction plan, @Enugu	Hydrogeological and existing well survey, @Enugu		Field survey for O/M of facilities	Market and procurement, @Enugu
28	3-Sep	Fri			Data arrangement, @Enugu	Data arrangement, @Enugu		Data arrangement, @Enugu	Data arrangement, @Enugu
29	4-Sep	Sat			Discussion with RUWASSA, @Enugu				
30	5-Sep	Sun			**Enugu → Akure (by car),** Discussion with RUWASSA, @Akure				
31	6-Sep	Mon			Organization and budget of RUWASSA, Acutual result of well construction, @Akure	Hydrogeological and existing well survey, @Akure		Field survey for O/M of facilities, @Akure	Field survey (equipment an d material), @Akure
32	7-Sep	Tue			Capacity of RUWASSA for well construction and O/M, @Akure	Hydrogeological and existing well survey, @Akure		Field survey for O/M of facilities, @Akure	Field survey (equipment an d material), @Akure
33	8-Sep	Wed			Water sector development plan, @Akure	Hydrogeological and existing well survey, @Akure		Field survey for O/M of facilities, @Akure	Market and procurement, @Akure
34	9-Sep	Thu			Facilities construction plan, @Akure	Hydrogeological and existing well survey, @Akure		Field survey for O/M of facilities	Market and procurement, @Akure
35	10-Sep	Fri			Data arrangement, @Akure	Data arrangement, @Akure		Data arrangement, @Akure	
36	11-Sep	Sat			**Akure → Abuja (by car), @Abuja**				
37	12-Sep	Sun			Data arrangement, @Abuja				
38	13-Sep	Mon			**Abuja → Kano (by car),** @Kano	Compiling field report, @Abuja		**Abuja → Kano (by car),** @Kano	
39	14-Sep	Tue			Discussion with RUWASSA,@Kano	Compiling field report, @Abuja		Discussion with RUWASSA,@Kano	
40	15-Sep	Wed			**Kano→ Abuja (by car),** @Abuja	Compiling field report, @Abuja		**Kano→ Abuja (by car),** @Abuja	
41	16-Sep	Thu			Compiling field report, @Abuja	Compiling field report, @Abuja		Compiling field report, @Abuja	
42	17-Sep	Fri			Compiling field report, @Abuja	**Abuja → London (BA82, 8:45)**		Compiling field report, @Abuja	**Abuja → London (BA82,8:45)**
43	18-Sep	Sat			Compiling field report, @Abuja	London → Narita		Compiling field report, @Abuja	London → Narita
44	19-Sep	Sun			Compiling field report, @Abuja			Compiling field report, @Abuja	
45	20-Sep	Mon			Reporting to FMWR, @Abuja			Reporting to FMWR, @Abuja	
46	21-Sep	Tue			Reporting to FMWR, @Abuja			Reporting to FMWR, @Abuja	
47	22-Sep	Wed			Reporting to JICA Nigeria Offic and EOJ, @Abuja			**Abuja → London (BA82, 8:45)**	
48	23-Sep	Thu			**Abuja → London (BA82, 8:45)**			London → Narita	
49	24-Sep	Fri			London → Narita				

(3) The Third Survey

			Official Team		Consultan Team		
Day	Date		**Dr.Yoshida (Team Leader)**	**Mr.Sahara (Project Management)**	**Mr.Nakamura (Chief Consultant/Ground-water Development Planning)**	**Mr.Yamazaki (Social Condition Survey /Management for O/M of Facilities 1)**	**Mr.Ikeda (Equipment and Procurement Planning/ Cost Estimation)**
1	8-Jan	Sat	Narita →London, London → Abuja				
2	9-Jan	Sun	Abuja				
3	10-Jan	Mon	Courtesy call on JICA Nigeria Office, EOJ, NPC, Discussion with Niger State				
4	11-Jan	Tue	Discussion with Enugu and Ondo State				
5	12-Jan	Wed	Discussion with Taraba and Kebbi State				
6	13-Jan	Thu	Report to EOJ and JICA Nigeria office, Signature to M/D				
7	14-Jan	Fri	Abuja→Londo→		Participaion in Seminor		
8	15-Jan	Sat			Abuja→Londo→		
9	16-Jan	Sun			→ Tokyo		

Appendices 3 List of Parties Concerned in the Recipient Country

(Basic Design Study)

Institution/Organization	Name
Federal Ministry of Water Resources / FMWR	
Minister	Mr. Chief Obadiah Sumi
Permanent Sectretary	Amb(Dr). Godknows Boladei Igalii
Special Adviser to the Honorable Minister	Mr. Michael Magaji
Deputy Director of Rural Water Supply	Engr. B.M. Tahir
Assistant Director of Rural Water Supply	Mr. Adetunji Idow
Principal Technical Officer	Mr. Kassim Bello
Hydrogeologist	Mr. Ogbonna Kenneth Emeka
National Planning Commission / NPC	
Director of Department of International Cooperation	Mrs. L. D. Bagaiya
Acting Director, Department of International Cooperation	Mr. B.O.Akpanyung
Assistant Chief Planning Officer of Department of International Cooperation	Mr. U.S. Nwozuzu
National Water Resources Institute	
Head, Continuing Education Division & Coordinator, Rural Water Supply & Sanitation Center	Dr. Martin O. Eduvie
Kebbi State Ministry of Water Resources	
Hon. Commissioner	Mr. Hussaini Abdullahi Raha
Permanent Secretary	Mr. Haliru Sarki
Kebbi RUWASSA	
Programme Manager	Dr. Umar Baraya
H. O. D., Workshop Department	Mr. Umaru Aliyu Gwandangaji
H. O. D., Planning Department	Mr. Aminu Galadima
H. O. D., Store Department	Mr. Ibrahim Tilli
H. O. D., Sanitation Department	Mr. Isah B. Ngaski
H. O. D., Mobilization Department	Mr. Bello Bagudu Diggi
H. O. D., Water Supply Department	Mr. Abdullahi Kwazo
D. F. S., Finance Department	Mr. Kabiru Bako
Niger State Ministry of Water Resources	
Hon. Commissioner	Dr. Isah Y. Vatsa
Niger RUWASSA	
Ag. General Manager	Mr. Ibrahim Isah
Auditor	Mr. Emmanuel S. Thomas
HOD, omm, Mobilization	Mr. Fatima M. Koro
DA/sec. Board	Mr. Abdulkadir Usman

Institution/Organization	Name
Workshop Manager	Mr. Aliyu Tauheed
HOD. Water supply/Hydrogeologist	Mr. Isah M.Dadi
HOD. Sanitation	Mr. Joseph Ahmadu
Hdrogeologist	Mr. Abubakar Sadiq Idris
Taraba State Ministry of Water Resources and Rural Development	
Honorable Commissioner	Mr. Samuel Madaki Usman
Permanent Secretary	Mr. Manu Jaio Gangumi
Secretary	Mr. Boyinga M. Sanda
ACAO	Mr. Hassan Ismaila Agwaru
Geologist	Mr. Oyouwa Eddis
Taraba RUWASSA	
Programme Manager	Mr. Isiyaka E. Bashir
Programme Secretary	Mr. Adi Andesaba
Programme Auditor	Mr. Aminu H. Mafindi
Prog. Accountant	Mr. Sabo M. Sambo
Dir. Engineering Services	Mr. Danfulani A. Pana
Dir. Planning Research &	Mr. Ibrahim Dantsoho
DCD	Mr. Obadiah Galadima
Dir. Urban Water Supply	Mr. Sylvester P. Godwin
Director Sanitation	Mr. Auta Ahmed
Dir. LGA/WES	Mr. Baba Hammajulde
Director Electrical	Mr. D. A. Bashir
Ag. Workshop Manager	Mr. Hassan Tukura
ADRWS	Mr. Danjuma S. Tsokwa
Secretary	Mr. Boyinga M. Sanda
ACAO	Mr. Hassan Ismaila Agwaru
PMEO	Mr. J.R. Tafida
HEO	Mr. E.A. Ben
Ondo State Ministry of Special Duties	
Honorable Commissioner	Mr. Niran-Sule Akinniyi
Perm. Secretary	Mr. Pastor Adigun
Ondo WATSAN Project	
Ag. General Manager	Mr. J. O. Akindutire
Chairman	Engr. Gbenga Akinnagbe
DFA	Mr. E. O. Akinbobla
HM	Mr. Pastor Adelusi S. O.
D. Water Supply	Engr. Oladimeji E. R.
Workshop Engr.	Engr. T. Akindoyin

Institution/Organization	Name
HPME	Mr. Adejoro B. O.
Dir. Sanitation	Mr. Ogunleye J. B.
Dep. Dir. Sanitation	Mr. Abegunde J. O.
Dept. Comm/HyEd.	Mr. Akande F. I.
HCM/HE	Mrs. Fabolude
Geologist	Mr. Ogedengbe C.
Enugu State	
Executive Governor	Mr. Sullivan Iheanacho Chime
Enugu Ministry of Water Resources	
Honorable Commissioner	Mr. Emecca ANI
Enugu RUWASA	
Deputy Director Off.	Mr.Amatanweze Cosmas N
Deputy Director Off., Commercial Dept.	Mr. Obi Anselem
Deputy Director Off., Finance and Accounts Dept.	Mr. Offor Edwin A.
Chief Planning Off., Planning Monitoring and Evaluation Dept.	Mr. Okpara R. A.
Deputy Director, Planning Monitoring and Evaluation Dept.	Mr. Ugwu Patrick
Technologist Microbiologist, Water Quality Unit	Mr. Nwobodo C.
Deputy Director Engr. Sanitation Dept	Mr. Ude Sunday N.
Hydro geologist I, Water Supply Dept.	Mr. Ajose O. A.
Higher Works Supt., Hand pump Installation and Maintenance Unit	Mr. Nnadi Jude
Asst Chief Work Supt., Workshop Unit	Mr. Chikelu Raphael
Embassy of Japan in Nigeria	
First Secretary (Economic Cooperation)	Mr. Jun Nishizawa
First Secretary (Economic Cooperation)	Nobuto Watanabe
Researcher/Adviser (Economic cooperation)	Masako Watanabe
JICA Nigeria Office	
Resident Representative of JICA Nigeria	Mr. Sumi Yoshitaka
Assistant Resident Representative	Mr. Fujie Ken
Project Officer	Mr.Masuda Yoshiro

(Explanation on Draft Final Report)

Institution/Organization	Name
Federal Ministry of Water Resources / FMWR	
Deputy Director of Rural Water Supply	Engr. B.M. Tahir
Assistant Director of Rural Water Supply	Mr. Adetungi Idow
Principal Technical Officer	Mr. Kassim BELLO
Hydrogeologist	Mr. Ogbonna Kenneth Emeka
Water Engr. 2	Mr. Adewale B.Z.
SEO	Mr. Alakoko R. A
National Planning Commission / NPC	
Director of Department of International Cooperation	Mrs. L. D. Bagaiya
Acting Director, Department of International Cooperation	Mr. B.O.Akpanyung
Assistant Chief Planning Officer of Department of International Cooperation	Mr. U.S. Nwozuzu
CPO	Mr. Onu, G.S
Kebbi State Ministry of Water Resources	
Honorable Commissioner	Mr. Alhaji Hussaini Abdullahi Raha
Kebbi RUWASSA	
Programme Manager	Dr. Umar Baraya
Niger State Ministry of Water Resources	
Honorable Commissioner, Ministry of Water Resources and Rural Development, Niger State	Dr. Isah Yahaya Vatsa
Niger RUWASSA	
Board Chairman	Mr. Abdulkadir Usman
Ag. General Manger	Mr. Abubakar Sadiq Idris
HOD. Water supply/Hydrogeologist	Mr. Isah M. Dadi
Fmr. Ag. General Manager	Mr. Ibrahim Isah
Taraba State Ministry of Water Resources and Rural Development	
Honorable Commissioner, Ministry of Water Resources and Rural Development, Taraba State	Mr. Samuel Madaki Usman
State Con. Adviser	Engr. Kiziro Ambogdi
Taraba RUWASSA	
Programme Manager	Mr. Isiyaka E. Bashir
Ondo State Ministry of Special Duties	
Honorable Commissioner	Mr. Niran-Sule Akinniyi
Perm. Secretary	Mr. Pastor Adigun
Ondo WATSAN Project	
Chairman	Engr. Gbenga Akinnagbe
General Manager	Mr. Akindutire Jones O.

Institution/Organization	Name
Director, Water Supply	Engr. Oladimeji Emmanuel R.
Enugu State Ministry of Water Resources	
Honorable Commissioner	Mr. Emecca ANI
Enugu RUWASSA	
Managing Director	Mr. Micheal Cole Oguamah
Embassy of Japan in Nigeria	
Ambassador	Mr. Toshitsugu Uesawa
First Secretary (Economic Cooperation)	Mr. Nobuto Watanabe
JICA Nigeria Office	
Resident Representative of JICA Nigeria	Mr. Sumi Yoshitaka
Assistant Resident Representative	Mr. Fujie Ken
Project Officer	Mr. Masuda Yoshiro

Appendices 4 The First Minute of Discussion

MINUTES OF DISCUSSIONS
ON
THE PREPARATORY SURVEY
ON
THE PROJECT FOR IMPROVEMENT OF RURAL WATER SUPPLY
IN
THE FEDERAL REPUBLIC OF NIGERIA

In response to the request from the Government of Nigeria (hereinafter referred to as "Nigeria"), the Government of Japan (hereinafter referred to as "Japan") decided to conduct a Preparatory Survey (hereinafter referred to as "the Survey") on the Project for Improvement of Rural Water Supply (hereinafter referred to as "the Project") and entrusted the Study to the Japan International Cooperation Agency (hereinafter referred to as "JICA").

JICA sent the Preparatory Survey Team (hereinafter referred to as "the Team") to Nigeria, which is headed by Mr. Hiroyuki KUTSUNA, Advisor of Contract Div.1, Procurement Dept. of JICA, and Consulting Team is scheduled to stay in the country from 14th June 2010 to 3rd July 2010.

The Team held series of discussions with the Nigerian officials concerned and conducted a field survey in the Project area.

In the course of discussions and field survey, both parties have confirmed the main items described in the attached sheets. The Team will proceed for further works and prepare the Preparatory Study Report.

Abuja, 23rd June 2010

Mr. Hiroyuki KUTSUNA
Leader
Preparatory Survey Team
Japan International Cooperation Agency

Engr. B. M. Tahir
Acting Director
Department of Water Supply, Quality
Control and Inspectorate
Federal Ministry of Water Resources
Federal Republic of Nigeria

Witnessed by

Mrs. L.D. Bagaiya
Director
Department of International Cooperation
National Planning Commission
Federal Republic of Nigeria

ATTACHMENT

1. Objective of the Project
The objective of the Project is to provide drilling rigs and other equipment for improving drinking water services.

2. Project Site
Several States will be selected from 10 States listed below considering criteria in Paragraph 8-1.
Candidate States: Nassarawa, Niger, Kebbi, Zamfara, Taraba, Gombe, Kogi, Ekiti, Ondo, Enugu

3 Responsible and Implementing Agency
The Responsible Agency is Federal Ministry of Water Resources (FMWR). The Implementing Agencies in the implementing stage are RUWASA or WATSAN of the selected states.

4. Objective of the Preparatory Survey Phase
The Team explained that the objective of the Survey is collecting information for the selection of the States and confirmation of the appropriateness of the requested components. If some of the components are found feasible as a result of the Survey, JICA will continue the Survey for the detailed design of the Project. Thus, the enforcement of the project is not guaranteed by Japanese side during the Survey Phase. Nigerian side understood that.

5. Items requested by the Government of Nigeria
After discussions with the Team, the items described in Annex-1 were finally requested by each State. JICA will assess the appropriateness of the request and will recommend to the Government of Japan for approval after the Study.

6. Japan's Grant Aid Scheme
6-1. The Nigerian side understood the Japan's Grant Aid Scheme explained by the Team, as described in Annex-2 and 3.
6-2. The Nigerian side promised to take the necessary measures, as described in Annex-3, for smooth implementation of the Project, as a condition for the Japanese Grant Aid to be implemented.
6-3. The Nigerian side promised to arrange necessary personnel and appropriate budget for the water supply facilities development plan in the selected States.
6-4. JICA will report to the Nigerian side if there are any other undertakings based on the result of this survey.

7. Schedule of the Survey
7-1. Consultant members will proceed with studies in Nigeria till 3rd July 2010.
7-2. JICA will send the second Preparatory Survey Team for the detailed design of the Project based on the result of the selection of the States.
7-3. JICA will prepare the draft report in English and dispatch another mission in order to explain its contents around the Mid of March 2011.
7-4. In case the contents of the report is accepted in principle by the Government of Nigeria, JICA will complete the final report and send it to the Government of Nigeria around June 2011.

8. Other relevant issues

8-1. Criteria for the Selection

(1) Existing equipment

States which do not have enough number of working Equipment should have priorities.

(2)Capacity of the implementing agencies

States which have implementing agencies with enough

- Capacity for operation and maintenance of the equipment,
- Existing water supply facilities,
- Capacity for water supply facilities development planning,
- Numbers of skilled personnel, and
- Ability to guide communities.

(3)Hydrogeological conditions and water quality

States which are suitable for water supply with hand pump facilities and have enough underground water resources and good water quality have priorities.

(4) Condition of the target communities

States with communities which have enough ability to maintain water supply facilities have priorities.

(5) Peace and order

States must be safe enough for implementing the Project including Soft Components.

(6) Regional Balance

Regional Balance should be considered if many States are qualified..

(7)Others

Any other criteria considered to be necessary should be taken into account.

8-2. Operation and Maintenance of the Facilities

The Japanese side will propose necessary storage, operation and maintenance plan based on the result of the Survey. The Nigerian side agreed to take any necessary measures including arrangement of the personnel and the allocation for necessary budget to keep the equipment in response to Japanese proposal.

8-3. Overlapping with Other Project

The Nigerian side explained that this project would not be overlapped with any other project extended by the other donor agencies, NGO.

8-4. Necessity of the Soft Components

Both sides confirmed the necessity of the Soft Components for improving the knowledge and techniques of the Nigerian counterparts in two fields.

(1)Planning and continuous management of the water supply facilities development

(2)Management, operation and maintenance of water supply facilities

8-5. Target Year

The Japanese side explained that the target year of the Project is 2012, and the equipment provided shall be utilized to water supply facilities development for the next five years.

Annex-1 Contents of the Requested Equipment and Materials
Annex-2 Japan's Grant Aid Scheme
Annex-3 Flow Chart of Japan's Grant Aid Procedures
Annex-4 Undertakings by the Government of the Recipient Country

H.K. Omnie 21/10

Annex-1

Contents of the Requested Equipment and Materials

		State	Zamfara	Nassarawa	Taraba	Ondo	Niger	Enugu	Kogi	Ekiti	Gombe	Kebbi
No.	Content	unit	Quantity									
1. Drilling equipment												
1-1	Drilling rig	unit	2	2	2	2	2	2	2	1	1	2
1-2	Drilling tools and accessories	L.S.	1	1	1	1	1	1	1	1	1	1
1-3	Truck mounted high pressure air compressor	unit	2	2	2	2	2	2	2	1	1	2
1-4	Cargo truck with crane	unit	2	2	2	2	2	2	2	1	1	2
1-5	Mobile water tanker	unit	2	2	1	1	3	2	3	3	1	2
2. Survey equipment												
2-1	Geophysical survey equipment	set	2	2	2	1	2	2	1	2	1	2
2-2	Personal computer and GIS software	set	8	20	3	5	10	8	10	10	-	20
3. Borehole construction materials												
3-1	Hand pump	L.S.	1	1	1	1	1	1	1	1	1	1
3-2	PVC casing pipes and screen pipes	L.S.	1	1	1	1	1	1	1	1	1	1
3-3	Village and LGA level mechanic tools	L.S.	1	1	1	1	1	1	1	1	1	1
3-4	Water treatment chemicals	L.S.	1	1	1	1	1	1	1	1	1	1
4. Soft component												
4-1	Training of officers and staff	L.S.	1	-	-	1	1	1	1	1	-	-

H.K. Ammi

Annex-2

JAPAN'S GRANT AID

The Government of Japan (hereinafter referred to as "the GOJ") is implementing the organizational reforms to improve the quality of ODA operations, and as a part of this realignment, a new JICA law was entered into effect on October 1, 2008. Based on this law and the decision of the GOJ, JICA has become the executing agency of the Grant Aid for General Projects, for Fisheries and for Cultural Cooperation, etc.

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

1. Grant Aid Procedures

The Japanese Grant Aid is supplied through following procedures:

- Preparatory Survey
  - The Survey conducted by JICA
- Appraisal &Approval
  - Appraisal by the GOJ and JICA, and Approval by the Japanese Cabinet
- Authority for Determining Implementation
  - The Notes exchanged between the GOJ and a recipient country
- Grant Agreement (hereinafter referred to as "the G/A")
  - Agreement concluded between JICA and a recipient country
- Implementation
  - Implementation of the Project on the basis of the G/A

2. Preparatory Survey

(1) Contents of the Survey

The aim of the preparatory Survey is to provide a basic document necessary for the appraisal of the Project made by the GOJ and JICA. The contents of the Survey are as follows:

- Confirmation of the background, objectives, and benefits of the Project and also institutional capacity of relevant agencies of the recipient country necessary for the implementation of the Project.
- Evaluation of the appropriateness of the Project to be implemented under the Grant Aid Scheme from a technical, financial, social and economic point of view.
- Confirmation of items agreed between both parties concerning the basic concept of the

H.K

Project.

- Preparation of an outline design of the Project.
- Estimation of costs of the Project.

The contents of the original request by the recipient country are not necessarily approved in their initial form as the contents of the Grant Aid project. The Outline Design of the Project is confirmed based on the guidelines of the Japan's Grant Aid scheme.

JICA requests the Government of the recipient country to take whatever measures necessary to achieve its self-reliance in the implementation of the Project. Such measures must be guaranteed even though they may fall outside of the jurisdiction of the organization of the recipient country which actually implements the Project. Therefore, the implementation of the Project is confirmed by all relevant organizations of the recipient country based on the Minutes of Discussions.

(2) Selection of Consultants

For smooth implementation of the Survey, JICA employs (a) registered consulting firm(s). JICA selects (a) firm(s) based on proposals submitted by interested firms.

(3) Result of the Survey

JICA reviews the Report on the results of the Survey and recommends the GOJ to appraise the implementation of the Project after confirming the appropriateness of the Project.

3. Japan's Grant Aid Scheme

(1) The E/N and the G/A

After the Project is approved by the Cabinet of Japan, the Exchange of Notes(hereinafter referred to as "the E/N") will be singed between the GOJ and the Government of the recipient country to make a pledge for assistance, which is followed by the conclusion of the G/A between JICA and the Government of the recipient country to define the necessary articles to implement the Project, such as payment conditions, responsibilities of the Government of the recipient country, and procurement conditions.

(2) Selection of Consultants

In order to maintain technical consistency, the consulting firm(s) which conducted the Survey will be recommended by JICA to the recipient country to continue to work on the Project's implementation after the E/N and G/A.

H.K. Omnia

(9) Authorization to Pay (A/P)

The Government of the recipient country should bear an advising commission of an Authorization to Pay and payment commissions paid to the Bank.

(10) Social and Environmental Considerations

A recipient country must carefully consider social and environmental impacts by the Project and must comply with the environmental regulations of the recipient country and JICA socio-environmental guidelines.

H. K. Amin

(3) Eligible source country

Under the Japanese Grant Aid, in principle, Japanese products and services including transport or those of the recipient country are to be purchased. When JICA and the Government of the recipient country or its designated authority 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, constructing and procurement firms, and the prime consulting firm are limited to "Japanese nationals".

(4) 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 JICA. This "Verification" is deemed necessary to fulfill accountability to Japanese taxpayers.

(5) Major undertakings to be taken by 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 Annex-4.

(6) "Proper Use"

The Government of the recipient country is required to maintain and use properly and effectively the facilities constructed and the equipment purchased under the Grant Aid, to assign staff necessary for this operation and maintenance and to bear all the expenses other than those covered by the Grant Aid.

(7) "Export and Re-export"

The products purchased under the Grant Aid should not be exported or re-exported from the recipient country.

(8) Banking Arrangements (B/A)

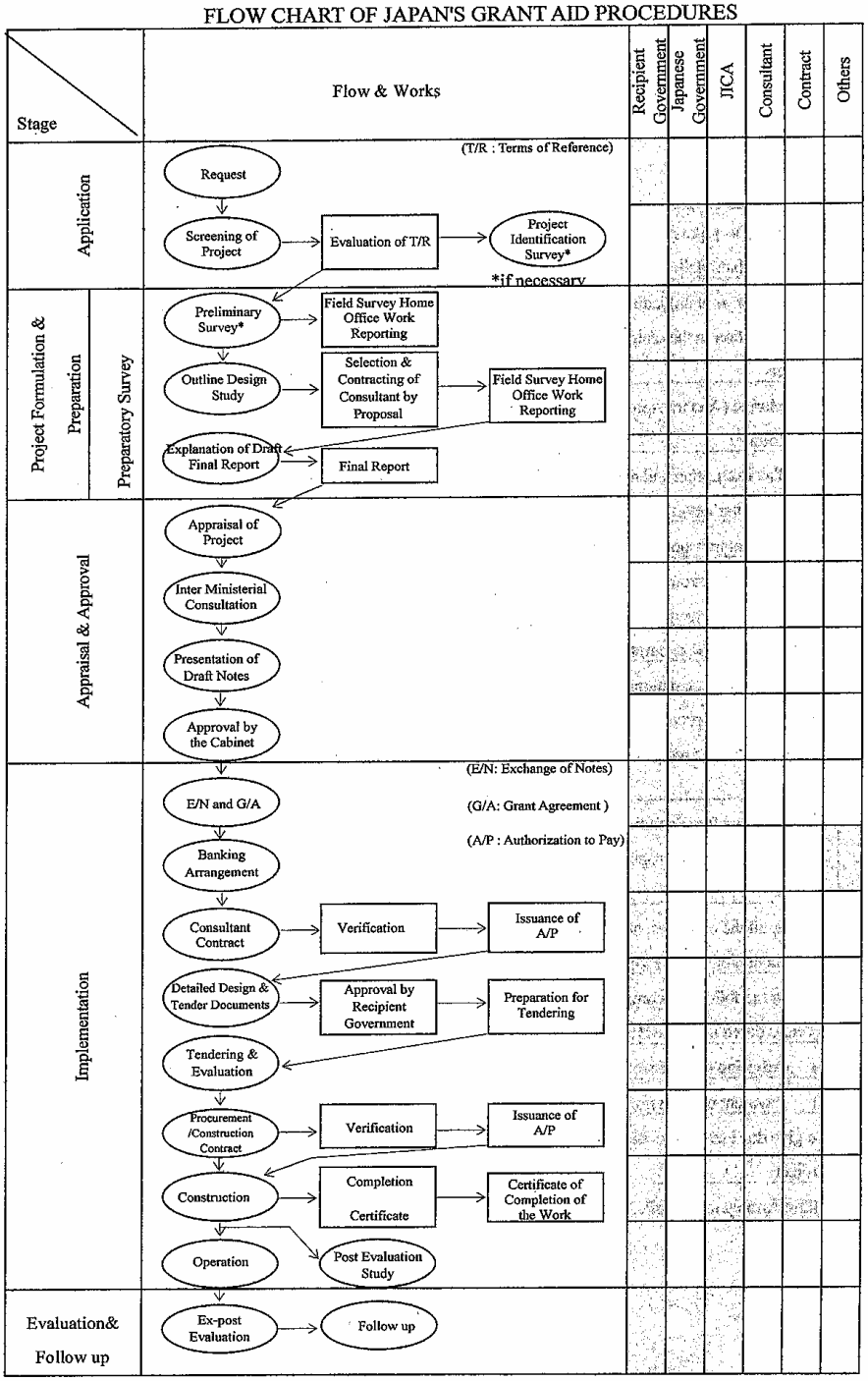
a) The Government of the recipient country or its designated authority should open an account under the name of the Government of the recipient country in a bank in Japan (hereinafter referred to as "the Bank"). JICA will execute the Grant Aid by making payments in Japanese yen to cover the obligations 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 JICA under an Authorization to Pay (A/P) issued by the Government of the recipient country or its designated authority.

H.K.

Annex-3

FLOW CHART OF JAPAN'S GRANT AID PROCEDURES



H.K.

Annex-4A

Major Undertakings to be taken by Each Government (Construction)

No.	Items	To be covered by Grant Aid	To be covered by Recipient Side
1	to secure [a lot] /[lots] of land necessary for the implementation of the Project and to clear the [site]/[sites];		●
2	To ensure prompt unloading and customs clearance of the products at ports of disembarkation in the recipient country and to assist internal transportation of the products		
	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 site	(●)	(●)
3	To ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the recipient country with respect to the purchase of the products and the services be exempted		●
4	To accord Japanese nationals whose services may be required in connection with the supply of the products and the services such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work		●
5	To ensure that [the Facilities and the products]/[the Facilities]/ [the products] be maintained and used properly and effectively for the implementation of the Project		●
6	To bear all the expenses, other than those covered by the Grant, necessary for the implementation of the Project		●
7	To bear the following commissions paid to the Japanese bank for banking services based upon the B/A		
	1) Advising commission of A/P		●
	2) Payment commission		●
8	To give due environmental and social consideration in the implementation of the Project.		●

(B/A: Banking Arrangement, A/P: Authorization to pay)

H.K. Amin

Annex-4B

Major Undertakings to be taken by Each Government (Equipment)

No.	Items	To be covered by Grant Aid	To be covered by Recipient Side
1	To ensure prompt unloading and customs clearance of the products at ports of disembarkation in the recipient country and to assist internal transportation of the products		
	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 site	(●)	(●)
2	To ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the recipient country with respect to the purchase of the products and the services be exempted		●
3	To accord Japanese nationals whose services may be required in connection with the supply of the products and the services such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work		●
4	To ensure that [the Facilities and the products]/[the Facilities]/ [the products] be maintained and used properly and effectively for the implementation of the Project		●
5	To bear all the expenses, other than those covered by the Grant, necessary for the implementation of the Project		●
6	To bear the following commissions paid to the Japanese bank for banking services based upon the B/A		
	1) Advising commission of A/P		●
	2) Payment commission		●
7	To give due environmental and social consideration in the implementation of the Project.		●

(B/A: Banking Arrangement, A/P: Authorization to pay)

H.K. Amin

Appendices 4(2) The Second Minute of Discussion

MINUTES OF DISCUSSIONS
ON
THE PREPARATORY SURVEY
ON
THE PROJECT FOR IMPROVEMENT OF RURAL WATER SUPPLY
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 (hereinafter referred to as "Japan") decided to conduct a Preparatory Survey (hereinafter referred to as "the Survey") on the Project for Improvement of Rural Water Supply (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 Preparatory Survey Team (hereinafter referred to as "the Team"), which is headed by Dr. Katsuhito YOSHIDA, Visiting Senior Advisor of JICA, and is scheduled to stay in the country from 8th August 2010 to 22nd September 2010.

As a result of discussions, both parties have confirmed the main items described in the attachment, while other items are in accordance with Minutes of Discussions (hereinafter referred to as "M/D") dated June 23rd 2010. The Team will proceed to further works and prepare the Basic Design Study Report.

Abuja, 12th August 2010

Dr. Katsuhito YOSHIDA
Leader
Preparatory Survey Team
Japan International Cooperation Agency

Eng. B. M. Tahir
Acting Director
Department of Water Supply, Quality
Control and Inspectorate
Federal Ministry of Water Resources
Federal Republic of Nigeria

Witnessed by

Mr. B. O. Akpanyung
Acting Director
Department of International Cooperation
National Planning Commission
Federal Republic of Nigeria

ATTACHMENT

1. Selection of the Project Sites

In accordance with the criteria stated in M/D dated June 23rd 2010, prioritizing of candidate states were determined and top 5 states were selected as the Project sites.

Two analysis methods (weighted summation analysis and concordance analysis) were employed for the prioritizing. Different weight factor (case-1 to case-6) was given to both methods. As a result, (i) Enugu, (ii) Ondo, (iii) Taraba, (iv) Kebbi, (v) Niger state were selected as top priority 5 states.

2. Schedule of the Survey

2-1. Consultant members will proceed to further studies in Nigeria till 22nd September 2010.

2-2. JICA will prepare the draft final report in English and dispatch another mission in order to explain its contents from 4th to 6th of January 2011.

2-3. In case of that the contents of the report is accepted in principle by the Government of Nigeria, JICA will complete the final report and send it to the Government of Nigeria around February 2011.

2-4. The Project will be divided into 2 years of 2011 and 2012.

3. Security Clearance

If security situations in the Project sites are not favorable, the Team will take proper measures in consultation with JICA office and the Embassy of Japan. The Nigerian side promised to assist them.

Appendices 4(3) The Third Minute of Discussion

MINUTES OF DISCUSSIONS
ON
THE PREPARATORY SURVEY
ON
THE PROJECT FOR IMPROVEMENT OF RURAL WATER SUPPLY
IN
THE FEDERAL REPUBLIC OF NIGERIA

In June and August 2010, the Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched a Preparatory Survey Team on the Project for Improvement of Rural Water Supply in The Federal Republic of Nigeria (herein after referred to as "Nigeria") and through discussion, field survey, and technical examination of the result in Japan, JICA prepared a draft final report of the study.

In order to explain and consult the Nigerian side on the components of the draft final report, JICA dispatched to Nigeria the Draft Report Explanation Team (hereinafter referred to as "the Team"), which was headed by Dr. Katsuhito Yoshida, Visiting Advisor of JICA, from January 9th to January 14th 2011.

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

Abuja, 13th January 2011

Dr. Katsuhito YOSHIDA
Leader
Preparatory Survey Team
Japan International Cooperation Agency

13-01-11
Eng. B. M. Tahir
Acting Director
Department of Water Supply
Federal Ministry of Water Resources
Federal Republic of Nigeria

Mr. Sullivan Iheanacho Chime
The Governer of Enugu State
Enugu State
Federal Republic of Nigeria

Alhaji Hussaini Abdullahi Raha
Honourable Commissioner
Ministry of Water Resources and
Rural Development
Kebbi State
Federal Republic of Nigeria

(1)

13/1/2011

Dr. Isah Yahaya Vatsa
Honourable Commissioner
Ministry of Water Resources
Niger State
Federal Republic of Nigeria

13/1/11

Engr. Gbenga Akinnagbe
Executive Chairman
WATSAN
Ondo State
Federal Republic of Nigeria
Witnessed by

Mr. Samuel Madaki Usman
Honourable Commissioner
Ministry of Water Resources and
Rural Development
Taraba State
Federal Republic of Nigeria

Mr. B. O. Akpanyung
Acting Director
Department of International Cooperation
National Planning Commission
Federal Republic of Nigeria

(2)

ATTACHMENT

1. Component of the Draft Report

The Nigerian side agreed and accepted in principle the components of the draft report explained by the Team.

2. Japans Grant Aid Scheme

The Nigerian side understood the scheme of Japan's Grant Aid and would implement the necessary measures of the Nigerian side as explained by the Team and described in ATTACHEMENT of the First Minutes of Discussion signed by both sides on 23rd June 2010.

3. Project Sites

In accordance with the Second Minutes of Discussion signed by both sides on 12th August 2010, five states, (i) Enugu, (2) Ondo, (iii) Taraba, (iv) Kebbi, (v) Niger states, were selected as the target states of the Project

4. Schedule of the Study

JICA will complete the final report in accordance with the confirmed items and send it to the Nigerian side by end of March, 2011.

5. Other Relevant Issues

The following issues were discussed and confirmed by both sides.

(1) Components of the Project

Both sides agreed that the Project would be composed of following components.

- Procurement of equipments and materials listed in Annex-1.
- "Soft component" which is composed of 1) technical training for construction planning, data management and equipment maintenance and 2) strengthening of management, operation and maintenance for water supply facilities.

Both sides also agreed that draft technical specification of the equipments listed in Annex-1 is strictly confidential and should never be duplicated or released to other parties.

Further, the Nigerian side noted that, in addition to the equipments listed in Annex-1, it needs equipments such as support vehicles, water tankers and fishing tools to construct boreholes. The Team agreed that these equipments are necessary for borehole construction, but stated that these equipments can be procured within Nigeria and the procurements of these are the responsibility of the Nigerian side for successful implementation.

(2) Project Cost Estimate and Budgetary Arrangement

The Team explained to the Nigerian side the estimated project cost as attached in Annex-2. Both

sides confirmed that this estimated cost was provisional and would be examined further by the Government of Japan for its final approval.

The Nigerian side reconfirmed to secure necessary counterpart budget for the project timely and adequately to cover the required amount of the cost, as confirmed in the First minutes.

Furthermore, both sides confirmed that this estimated project cost is strictly confidential, and should never be duplicated or released to other parties.

(3) Rural Water Supply Plan in Five Target States.

Five target states have confirmed the construction plan of rural water supply facilities, which is shown in Annex-3. Kebbi state RUWASSA shall aim at constructing 610 boreholes by 2017, Niger state RUWASSA shall aim at constructing 890 boreholes by 2017, Taraba state RUWASSA shall aim at constructing 570 boreholes by 2017, Ondo state WATSAN Project shall aim at constructing 885 boreholes by 2017 and Enugu state RUWASSA shall aim at constructing 653 boreholes by 2017.

Both sides confirmed that the procured equipments and materials would be utilized to attain the goals mentioned above.

(4) Responsibilities of the Borehole Construction Works

The Nigerian side promised that borehole construction works shall be executed by Nigerian side as described in Annex-4A of the First minutes. In the borehole construction, the Nigerian side shall be responsible for the procurement of the necessary equipments, materials and labors which will not be procured by the Japanese side in the Project.

The Team explained the result of the survey for the selection of prioritized boreholes to be constructed by using the procured equipments and materials and both sides agreed that one hundred (100) boreholes would be constructed in each target state from prioritized communities listed in Annex-3, by the Nigerian side within two years after the completion of procurement.

Both sides agreed that, in case that the Nigerian side has unavoidable reasons such as dry holes at the target communities, the alternative communities will be selected from the prioritized communities in Annex-3.

After the above mentioned construction of 100 boreholes in each state (500 boreholes in five states), Nigerian side agreed that the Implementation Agencies shall continue to operate and maintain the drilling rigs and other equipments procured in the Project, in order to attain the goals mentioned in the plan in Annex-4.

(5) Progress Report on the Borehole Construction

The Nigerian side promised that the Implementation Agency in each target state shall submit 1) monthly reports on progress of the 100 borehole construction and 2) quarterly reports on the progress other borehole construction after the completion of 100 borehole construction, to JICA Nigeria office and Federal Ministry of Water Resources (FMWR) by using the format of progress report shown in Annex-5.

(6) Other undertakings of Nigerian Side

The Team explained to the Nigerian side its undertakings as listed in Annex-6, and stressed that there shall be continuous support, facilitation and implementation by the Nigerian side at all times, as agreed in this Minutes of Discussions. The Nigerian side understood this issue and agreed to execute them at all times in a timely manner.

The Nigerian side agreed that FMWR shall take necessary measures to facilitate project implementation, such as exemption of Value Added Tax, custom duties, and any other taxes and fiscal levy charges in Nigeria arising from the Project activities, collaborating with National Planning Commission (NPC) and other Federal bodies.

Both sides confirmed that the procured equipments and materials for construction should be kept in adequate storage and the Implementation Agencies shall be responsible for the operation and maintenance. Both sides confirmed that equipments and materials shall be stored in a warehouse in the premises of the headquarters office of the Implementation Agencies of the target states.

(7) Capacity Development of Counterpart Staffs

Both sides recognized that continuous technical trainings for the concerned staffs are necessary to complete the planned constructions by using the procured equipments. The Nigerian side agreed to make best effort to enhance the capacity of the concerned technicians and engineers and expressed its willingness to make use of the training courses at the Rural Water Supply and Sanitation Center for Capacity Development (RWSSC) in the National Water Resources Institute (NWRI).

(8) Safety and Security

The Nigerian side will ensure that all necessary measures shall be taken for the safety and security of the Japanese nationals involved in the Project.

Annex-1 List of Procured Equipment and Material
Annex-2 Cost estimate of the Project
Annex-3 Target Communities Village for Borehole Construction
Annex-4 Rural Water Supply Plan in Target States
Annex-5 Format of Monthly Progress Report for Borehole Construction
Annex-6 Undertakings of Nigerian Side

End

Confidential

Annex-1

List of Procured Equipment and Material

No.	Name of Equipment	Specification/Description	Unit	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 : Not less than 100m Capable Drilling Diameter : Mud Drilling : 10 - 5/8″ DTH : 6 - 1/4″ Capable Geology :Alluvial deposit to hard rock Mobilization Method: Truck mounted. Truck Specification : 4 x 4 or 6 x 4 (2 axis drives)	Lot	Kebbi :1 Niger :1 Taraba :1 Ondo :1 Enugu :1
2	Drilling Tools and Consumable Materials	[Drilling Tools] Drill pipe, hammer bits, work casing and all other necessary tools for the rig above described. [Consumable Materials] Drilling Chemicals (Bentonite, CMC and foam)	Set	Kebbi :1 Niger :1 Taraba :1 Ondo :1 Enugu :1
3	High Pressure Air Compressor	Supply Air Pressure : More than 2.01MPa (=20.5kg/cm^2) Supply Air Volume: 11.3m^3/min or more. Mobilization Method : Truck mounted Truck Specification : 4 x 4 or 6 x 4 (2 axis drives)	Lot	Kebbi :1 Niger :1 Taraba :1 Ondo :1 Enugu :1
4	Cargo Truck with Crane	Load Capacity : 6.0tons or more Specification : 4 x 4 or 6 x 4 (2 axis drives) Engine : Diesel water cooling Carrier Length: 6.0m or more Crane Capacity : 2.9tons	Lot	Kebbi :1 Niger :1 Taraba :1 Ondo :1 Enugu :1
5	Pumping Test Equipment	Submersible motor pump : Discharge of 30Lit./min x 70m head (1.5kW/50Hz) Engine Generator : 5kVA or more Groundwater Level Indicator : Measurable depth of 100m	Set	Kebbi :1 Niger :1 Taraba :1 Ondo :1 Enugu :1
6	Water Analysis Equipment	Measurement Items : pH, DO, EC, T.D.S. and Water temperature	Lot	Kebbi :1 Niger :1 Taraba :1 Ondo :1 Enugu :1
7	Geophysical Survey Equipment	[Electric survey] Electrical Sounding Instrument : Measurable depth of 100m Measuring Item : Apparent resistivity and spontaneous potential Measurable range : 0.1mV～10V Accessory : Software for analysis Others : Applicable for logging work for 100m depth borehole (with cable and probe) [Electro-magnetic survey] Slingram method Measurable depth of 40 to 60m Measuring Item : Apparent resistivity Accessory : Software for analysis	Lot	Kebbi :1 Niger :1 Taraba :1 Ondo :1 Enugu :1

No.	Name of Equipment	Specification/Description	Unit	Quantity
8	Hand Pump and Tools	India Mark III, which is VLOM type and standard type of UNICEF and the Implementing Agencies	Lot	Kebbi :100 Niger :100 Taraba :100 Ondo :100 Enugu :100
		Repair tools for hand pump : Tools used by villagers for simple repair work	Set	Kebbi :100 Niger :100 Taraba :100 Ondo :100 Enugu :100
		Repair tools for hand pump : Tools used by LGA mechanics for serious repair such as replacement of pump parts	Set	Kebbi :14 Niger :24 Taraba :15 Ondo :18 Enugu :9
9	Casing Pipe	Materials : uPVC (Un-plasticized polyvinyl chloride) Dimension : $\phi 4''$,O.D.114.4mm, Length 3.0m Wall thickness : 5.5mm or more Connection : Threading method	Piece	For number of boreholes below Kebbi :100 Niger :100 Taraba :100 Ondo :100 Enugu :100
10	Screen Pipe	Materials : uPVC (Un-plasticized polyvinyl chloride) Dimension : $\phi 4''$, O.D.114.4mm, Length 3.0m Wall thickness : 5.5mm or more Connection : Threading method Screen type : Slit type (0.8-1.0mm in width) Opening Ratio : 3% or more	Piece	For number of boreholes below Kebbi :100 Niger :100 Taraba :100 Ondo :100 Enugu :100

Confidential

Annex-2

Cost estimate of the Project

(1) Cost for Equipment Procurement of Japanese Side

This section is closed due to confidentiality.

(2) Cost Burden of the Nigerian side

Cost burden of Nigerian aside is shown in Table 2-2. Japanese side will bear cost burden to procure equipment and materials for borehole construction, and Nigerian side will bear cost burden to construct boreholes. As shown in Table 2-2, cost of drilling is different state by state. Furthermore, drilling cost in the first 2 years after the procurement of equipment is different form drilling cost in 3 years after the first 2 years.

The each implementing Agency will construct 100 borehole facilities using the procured equipment and materials for 2 years after procurement. Total amount of cost for it is 167 million NGN.

On the other hand, for 3 years after the first 2 years, the Implementing Agencies will drill 50 boreholes every year using the procured equipment following their development plan. Total amount of cost for it is 474 Million NGN. Even after above period, the Implementing Agencies can continue drilling boreholes using the procured equipment.

Table 2-2 Cost for Construction of Borehole Facilities by the Implementing Agencies

period	Content	Kebbi	Niger	Taraba	Ondo	Enugu	Total
2 years after procurement	Cost for 1 borehole (NGN)	160,000	230,000	250,000	630,000	400,000	
	Total number of boreholes	100	100	100	100	100	500
	Total cost for drilling (×Million NGN)	16	23	25	63	40	167
3 years after the first 2 years	Cost for 1 borehole (NGN)	440,000	550,000	560,000	910,000	690,000	
	Total number of boreholes	150	150	150	150	150	750
	Total cost for drilling (×Million NGN)	66	83	84	137	104	474

Note) The above costs do not include any future price escalation. For the purpose of estimating actual cost in the future, it is necessary to consider economic factors that affect the estimation.

Calculation Conditions

a) Estimation point: September 2010
b) Exchange rates: 1US$=90.90 yen
1NGN=0.596 yen
c) Procurement period: Single fiscal year
d) Others: The Project shall be implemented according to the grant aid scheme.

(3) Operations and Maintenance Cost

(1) Maintenance Cost of Procured Equipment and Materials

The maintenance for the procured equipment and materials shall be carried out based on the plan as shown in Table 2-3.

Table 2-3 Annual cost for maintenance for procured equipment

Type of equipment	Annual cost (NGN)	Contents of the maintenance
Drilling rig	2,590,000	Implementation of the maintenance services for every 10 boreholes (engine oil exchange, filter replacement, gear oil exchange), tire replacement (twice a year)
High pressure air compressor	2,599,800	
Cargo truck with crane	1,704,000	
Pumping test equipment	563,200	Generator maintenance servicing (engine oil exchange), pumping pipe replacement
Geophysical survey equipment	520,000	Main body maintenance servicing
Total	7,977,000	

According to the results of the field study and the fact-finding survey at the five Implementing Agencies, the average maintenance cost of this new procured drilling equipment will be about 8.0 million NGN per year for each Implementing Agency, thus 40 million NGN per year in total for five Implementing Agencies. Therefore, the maintenance cost of procured equipment for constructing the planed boreholes will be 80 million NGN in two years. This maintenance cost will be contributed by the State Governments of the five Implementation Agencies.

(4) Maintenance Cost of Water Supply Facilities

The hand pumps to be provided by the Project are Indian Mark III, which is adopted by the Federal Government as standard type hand pump for village level operation and maintenance (VLOM). The Implementing Agencies have constructed many boreholes with the Indian Mark III hand pumps.

Communities are expected to perform daily checks and minor repairs as well as bear the cost of maintenance. The necessary operation and maintenance cost of Indian Mark III is summarized in Table 2-4. Currently, communities are required to bear the cost of only "A" in Table 2-4, while the cost of "B" is borne by the Implementing Agencies or LGs. It sometimes takes long time to repair hand pump due to lack of budget or delay of response of the Implementing Agencies and LGs. Furthermore, newly drilled boreholes by the Project will require more maintenance work by Implementing Agencies and LGs, and they will not be able to response timely. Therefore, it is proposed that communities should collect and reserve necessary money to bear the cost of minor repairs, while major repairs and replacement are carried out by LGs and the Implementing Agencies.

Table 2-4 Annual Maintenance Cost of Hand Pump Borehole

(Unit: Naira)

	Content	Unit Price	Frequency	Quantity	Required money per year
A	Maintenance kit	50,000	Once every five years	0.2	10,000
	Replacement of spare parts	50,000	Once every two years	0.5	25,000
	A Total				35,000
B	Borehole flushing	60,000	Once every ten years	0.1	8,000
	Major repairs (replacement of hand pump or pipe etc)	110,000	Once every five years	0.2	30,000
	B Total				38,000
	A+B Total				73,000

Note) Cost of hand pump maintenance and repair is different among five target States. Cost shown above is average cost of five target States.

As shown in Table 2-4, the annual cost of operation and maintenance of a hand pump is estimated to be NGN 73,000 ("A"+"B" in Table 2-4). However, community's responsibility is limited to "A" in Table 2-4, which is 35,000NGN. Cost for maintenance for water supply facilities and ability to pay of individual families in the target communities are shown in Table 2-5.

Table 2-5 Cost for Maintenance and Ability to Pay of Individual Families in Communities for Water Supply Facilities

Annual cost for maintenance	① Annual cost for maintenance ② Number of beneficiaries per borehole ③ Maintenance cost per person (①／②)	35,000 NGN/year 264 persons 132 NGN/year
Amount of willingness to pay	④ Amount of ability to pay per household ⑤ Average number per household ⑥ Amount of ability to pay per person (④／⑤)	150～200 NGN/month＝1,800～2,400 NGN/year 15 persons 120～160 NGN/year
Average income	⑦ Average income per household ⑧ Average number per household ⑨ Income per person (⑦／⑧)	18,000 NGN/month=216,000 NGN/year 15 person 14,400 NGN/year
% of Cost of income	③/⑨	0.9%

As shown in Table 2-5, 132 NGN per person per year is necessary for maintenance of water supply facilities. This amount is almost same level as ability to pay revealed by the residents in the target communities, which is equivalent to 120 to 160 NGN per person per year. This analyzed result can conclude that it is possible for the communities to bear the technical responsibility based on the water charge to be collected.

Besides, as shown in Table 2-5, average income of one household in the target community is estimated 18,000 NGN/year. Consequently, maintenance cost per person per year account for 0.9% of annual income per person. It is generally said that water charge is affordable if it is less than 3% of income. In case of the Project area, it is possible for residents of community to pay water charge according to the ability to pay because it is less than 3 % of income. However, care below need to be taken to ensure the above mentioned among residents in communities.

- Amount of water charge depends on whether it is a fixed rate for all households or adjusted according to the number of people per household.
- Amount of income shown in Table 2-5 is average one, and there are some households with smaller income than the average. Not every household can afford to pay water charge as discussed above.

Target Communities for Borehole Construction

Table 3-1 Target Communities for Borehole Construction in Kebbi State

No.	LGA	Community	No.	LGA	Community
1	Arewa	Amagoro 1	63	Jega	Basaura
2		Chibika	64		Yarga
3		Tago	65		Nassarawa
4		Gigane	66		Gindi
5		Fawangu	67		Kimba
6		Bui	68		Tsirarrai
7		Yeldu	69		Bahabi
8		Jantulu	70	Maiyama	Kawara
9		Amogoro 2	71		Ruwan Fili
10	Augie	Kwaido	72		Andarai
11		Dundaye	73		Saran Dosa
12		Tiggi	74		Dogon Daji
13		Bubuce	75		Sambawa
14		Bayewa	76		Mayalo
15		Mera	77		Mungadi
16		Augie	78	Ngaski	Lorfa
17	Argungu	Bere	79		Garin Baka
18		Kamfani	80		Kwangu
19		Bayan Tanki	81		Kambuwa
20		Tungar Alkasim	82		Sakaba
21		Kan lyaka	83		Ngaski
22		Yamama	84		Libata
23		Karakwashe	85		Tungar Kadi
24		Tungar Marina	86	Suru	Aljannare
25		Alwasa	87		Giro
26		Fonkonsarki	88		Shangilu
27	Bagudo	Tuga	89		Shima
28		Kaliel	90		Kwaifa
29		Kende	91		Gwafidi
30		Kwasara	92		Lafiya
31		Sabongari Illo	93	Kalgo	Ubandawaki
32		Maje	94		Asarawa
33		Lolo	95		Kwartagi Kokani
34		Tsamiya	96		Runtuwa Bagga
35		Gwamba	97		Bakoshi
36	Bunza	Tilli	98		Bangar Wurigauri
37		Zogirma	99		Wurigauri
38		Raha	100		Kokani
29		Maidahimi	101		Ungwar Bawace
40		Balu	102		Erga Hausawa
41		Yarma	103	Shanga	Raha
42		Kanzana	104		Dugu
43		Hilima	105		Gironmassa
44		Matseri	106		Arabu Lafiya
45		Sabon Birni	107		Shanga
46	Danko/ Wasagu	Amburkele	108	Zuru	Balaure
47		Berboro	109		Bulum Bakwoshi
48		Erga	110		Bulum Shipkawu
49		Ilbo	111		Isgana
50		Elbere	112		Issingiri
51		Musuru	113		Kiri
52		Rade	114		Tungar Rimi
53		Tangaram	115		Udungu
54		Tunburku	116		Ungwar Bala
55		Ayu	117		Tungar Bezere
56		Marina	118	Aleiro	Sabiyal
57		Kyabu	119		Kashin Zama
58		Kellen Kassa	120		Aliero
59		Israngе	121		Rafin Bauna
60		Dungar Danwari	122		Jiga
61		Kwanfe	123		Jiga Sala
62		Kele			

Figure3-1 Location of Target Communities in Kebbi State

(12)

Table 3-2 Target Communities for Borehole Construction in Niger State

No.	LGA	Community	No.	LGA	Community
1	Lavun	Dogo	66	Bosso	Tungan Masenja
2		Tsawuni	67		Gbata
3		Sabon Madina	68		Jita
4		Kpatagi/Jikanagi	69		Ingiri
5	Gbako	Tsadzafu	70		Sharuwauna
6		Emiladan	71	Borgu	Tamanai
7		Kawo	72		Leshigbe
8		Picifugi	73		Yangba
9	Bida	Masaba "A"	74		Dogogari
10		Maiyaki Ndajiya	75	Mashegu	Malmo
11		Masaga "A"	76		Patiko Makeri
12		Massarafu	77		Baban Rami
13	Kontagora	Tudun Wadan Ibanga	78		Mashegu
14		Ugulu	79		Koso Nunawa
15		Ganawa	80		Acwikogi
16		Maikomo	81		Babagi
17	Agaie	Zhima	82	Shiroro	Talawyi
18		Emisheshi	83		Zari
19		Ekogi	84		Galadima Kogo
20		Wuna Woro Kota	85		Dnaknala Erena
21		Egina	86		Ebbeknma
22	Lapai	Gawa	87		Guita Gbayi
23		Bwaje	88	Gurara	Shako
24		Ganamadi	89		Kabo
25		Giro	90		Boyi Madaki
26	Mokwa	Kusogi	91		Toll Gate
27		Bokani	92		Yagopi
28		Rabba	93		Ngagre
29		Muwo	94		Gufana
30	Paikoro	Wakili Tungan Mallan	95		Dagibbe
31		Jita	96		Furushe
32		Dunkule/Nikuchi	97	Edati	Kusodu
33		Bwafiyi Ang·Magari	98		Yagbidin
34		Salema	99		Monturawa
40	Mariga	Gulbin Boka	100		Kusodu
41	Munya	Tsohon Gari Sarkin Pawa	101		Gbangban
42		Gbakodna(Dangunu)	102	Rafi	Ung. alhaji Idi Adidi
43		Kupkan (Fuka)	103		Ung. Asharmu Gizo
44		Unguwan Kadara (Guni)	104		Ung. Danigi
45		Gbaraga (Gini)	105		Ung. Danlami Tegina
46	Agwara	Kashini Wara Ung Hawkuri	106		Ung. Ibrahim mai Baba
47		Papiri	35	Magama	Dusai, Klbobi, Masteri,Faradol
48		Suteku Wkra Ung Bobu Gar	36		Sigikancanin Bobi
49		Galla	37		Faradiia
50		Kokoli Wara Ung Ganu	38		Dusai/Mahoro
51	Tafa	Nassarawan Iku	39		Matseri
52		Itah Gbauti	107		Maraa
53		Ung. Gbagyi Luma Wesi	108		Mara'a
54		Tungan Tsauni	109		Mashuwa
55		Tungam Makama Iku Wara	110		Matalangu
56	Suleja	Barikin Niadaua	111		Majinga
57		Rafin Santi Ung Pada	112	Wushishi	Tangwggi
58		Gangaren Panganu	113		Yelwa
59		Madaua Sabon Gari (Newste	114		Sabon Gari Tudun Wada
60		Tundam Shagata	115		Erena
61	Rijau	Ung. G.R.A Rijau Town	116		Akare Cheji
62		Ung. Gazuma Shambo	117	Katcha	Bashi Mugu
63		Ung. Fada Jeda	118		Kolo Gbako
64		Tunga Mallam Tsoho	119		Mansatali Gbako
65		Ungwa Rataya Guem	120		Shidagba

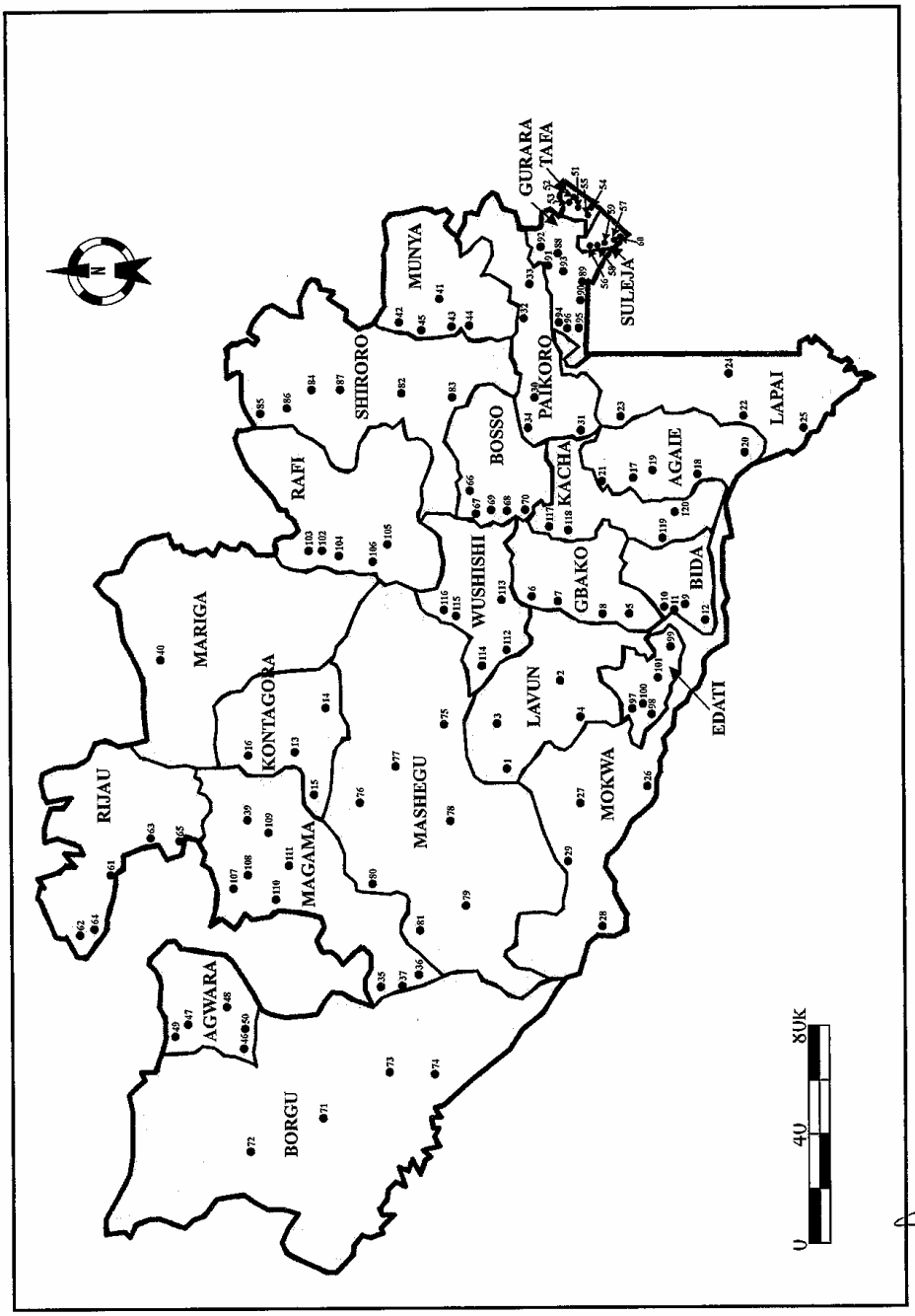


Figure 3-2 Location of Target Communities in Niger State

(14)

Table 3-3 Target Communities in Taraba State

No.	LGA	Community	No.	LGA	Community
1	Ardo Kola LGA	Mayo Renewo II	61		Sabongari Jen
2		Lanko	62		Bangai
3		Mallum I	63		Mararraba Jen
4		Wuro Tapari	64		Wuro Lancha
5		Jauvo Manjor	65	Kurmi LGA	Ambwe
6		Pampetel	66		Abonbia
7		Garin Baka	67		Gidan Mallam
8		Garim Kadiri	68		Bente
9	Bali LGA	Borno - Borno	69		Kafai Ndaforo
10		Mile Tara	70		Gatere
11		Nyanli	71		Sabongida Akwanweh
12		Garim Sabon Dale	72		Nyido
13		Kungana	73	Lau LGA	Yussa B
14		Jatau	74		Misheli
15		Mayo - Kam	75		Minda
16		Yamata Manda	76		Bujun Kasuwa
17	Donga LGA	Tachapa	77		Sabongida Abbare
18		Wasaji	78		Wuro Ladde
19		Ruwan Sanyi	79		Kara Mukel
20		Lafiya Bibinu	80		Apawa Kasuwa
21		Gankwe Assen	81	Takum LGA	Tati
22		Gbundu	82		Kapiye
23		Rugan Fulani	83		Fete
24		Kabawa	84		Manya
25	Gashaka LGA	Bodel	85		Tampa
26		Abba Dogo	86		Tati Kumbu
27		Nyabar	87		Mbiya
28		Balewa	88		Kpafikun
29		Abaku	89	Ussa LGA	Kwesati
30		Kufai	90		Kusansang
31		Gamen	91		Rikwentom
32		Goje	92		Kutuko
33	Gassol LGA	Garin Abba	93		Rikwen Rika
34		Chul	94		Fikyu Ndukwe
35		Yola Bodewa	95		Kpakiya
36		Gunduma	96		Lumbu Sabongida
37		Gwiwan Kogi	97	Wukari LGA	Arufu
38		Sabon Gida Takai	98		Chinkai
39		Kwararafa	99		Nukambo
40		Dinya	100		Nolo Alamani
41	Ibi LGA	Nwoyo II	101		Kente
42		Bakyu	102		Ndo Yola
43		Gidan Mande	103		Nwuko
44		Kauyen Danwazam	104		Sondi
45		kanyen Audu Jukun	105	Yorro	Mabang
46		Agwan Jibu	106		gadalasheke
47		Muti	107		Panyala CRCN
48		Gindan Urpav	108		Nyalapa
49	Jalingo LGA	Yelwa	109		Boh Muka
50		jekunnuhou	110		Mazang Kopo
51		Kpanti Napu	111		Dazang Pupule
52		Janbanbu	112		Dilla
53		Yawai II	113	Zing	Lappo
54		Bashin	114		Janganpo
55		Murbai	115		Zandi
56		Jauro Shawo	116		Bubong
57	Karim Lamido	Zoh makra	117		Dinding
58		Nayi	118		Mazara
59		Garin Kode	119		Bushanki
60		Jen Petel	120		Bansi

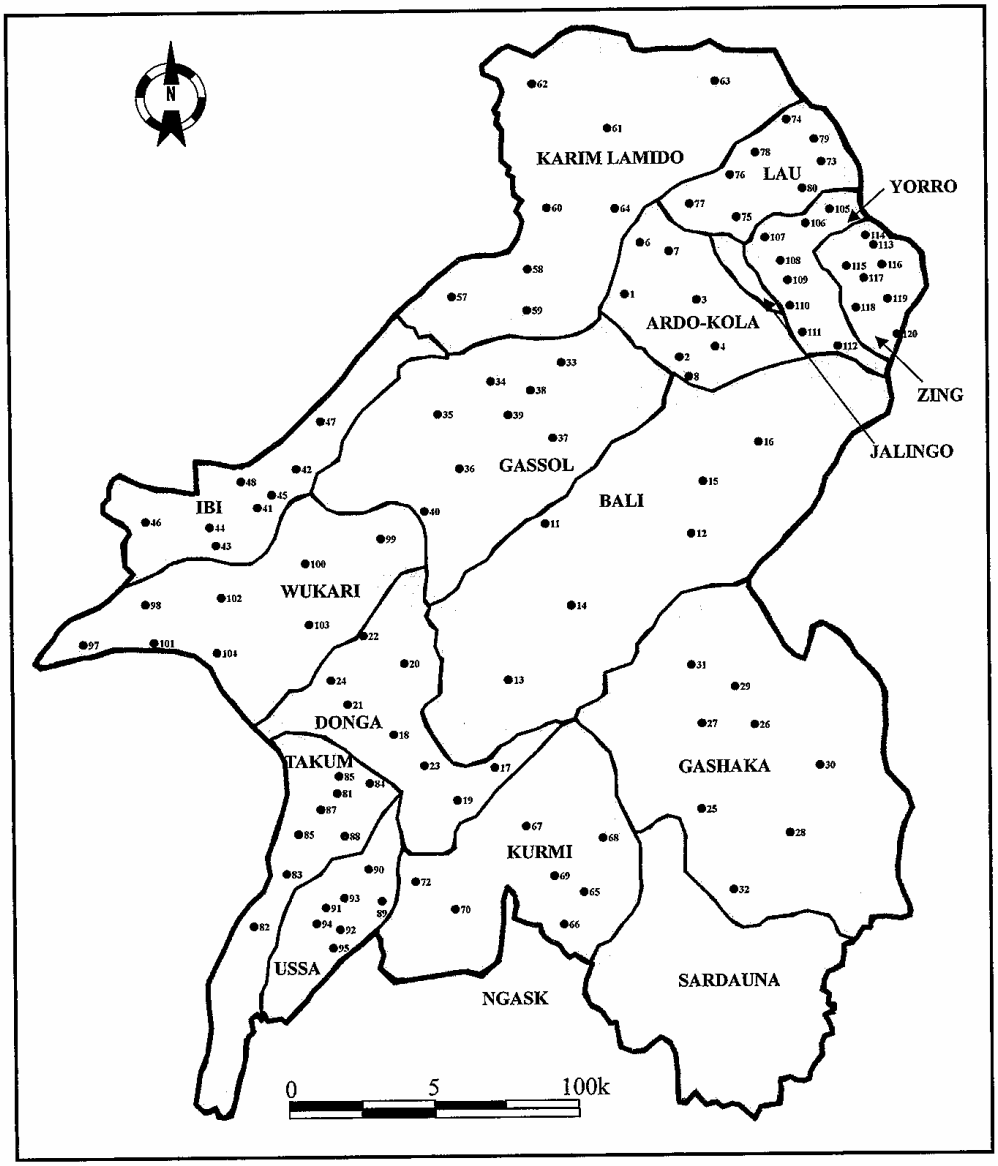


Figure3-3 Location of Target Communities in Taraba State

Table 3-4 Target Communities for Borehole Construction in Ondo State

No.	LGA	Community	No.	LGA	Community
1	Akoko North-West	Arigidi Iye Road	61	Ondo West	Ajegunle
2		Afin Akoko	62		Laje 1
3		Eso Ibaram	63		Lokuakwa
4		Erusu Akoko	64		Kajola
5		Uro Akoko	65		Adewole Camp
6		Iludotun Akoko	66	Akure North	Imafo
7		Ese-Akoko	67		Adeyeye Camp,
8		Iyani Akoko	68		Ayede Ilado
9		Iye-Akoko	69		Araromi Igoba
10		Oyagi Ikaramu	70		Odo-Eku
11	Akoko South-West	Akowonjo	71		Odudu
12		Etioro -Akoko	72		Igunsin
13		Supare-Camp	73		Araromi
14		Okia-Akoko	74		Ibitoye Irese Road
15		Simerin-Akoko	75	Akure South	Akarakiri Camp, Aule
16		Ayegunle	76		Ise Oluwa Abusoro
17		Ose-Oba	77		Prayer Centre, Adofure
18		Odole-Ibaka	78		Ipinsa
19	Akoko South-East	Oyara Akoko	79		Ita-Oniyan
20		Gbede-Ipe Akoko	80		Ijigba Zone D
21		Iseu-Epinmi Akoko	81		Aseigbo
22		Sosan Isale	82	Idanre	Itaolorun
23		Sosan Oke	83		Apefon
24		Izo-Igboro	84		Asoko
25		Ayetoro Oke-Ifira	85		Aponmu Lona
26		Eti-Ose	86		Obamutula Camp
27		Ilegbe Ipe	87		ijaniyi Camp
28		Ipe Gen. Hospital	88		Ala-Goke (Near Ala)
29	Akoko North-East	Oke-Ima Akoko	89		Omifufun Camp
30		Ugbe-Akoko	90		Owode-Kajola
31		Akunnu-Akoko	91	Ile-Oluji	Igbo Eledumare
32		Iyedu -Ikakumo	92	/Okeigbo	Kokowu
33		Auga-Akoko	93		Leegun
34		Ise-Akoko	94		Lipanu
35		Iboropa	95		Malintedo
36	Ose	Iwoye Afo	96	Ilaje	Igboegunrin
37		Ute	97		Atijere
38		Idogun	98		Itebunkunmi
39		Ijagba	99		Kurugbene
40	Owo	Kajola Camp	100		Ilebe
41		Ago Pannu (After Uso)	101	Okitipupa	Iju-Oke Oko
42		Sasere Camp	102		Abusoro
43		Adanigbo	103		Odofin
44		Aba Aladie (Uwase Road)	104		Ode-Aye (By Tunji & Tunji)
45		Ipenmen	105		Gbotalota
46		Oladokun Camp	106		Oni Tea
47		Bolorunduro	107	Odigbo	Orita Odigbo
48	Ondo East	Atamo	108		Adegbiji kajola
49		Mobire	109		Onipetesi
50		Oludasa	110		Koseru
51		Soko camp	111		Sabomi
52		Fagbo	112	Ese-Odo	Igbekebo
53		Ibuji	113		Igbobini
54	Ifedore	Isaru	114		Kiribo
55		Lari Camp (Aaye)	115		Agadagba Obon
56		Ajebamidele	116		Iju-Osun
57		Erigi	117	Irele	Lonla
58		Ogho	118		Iyansan
59	Ondo West	Orunbato	119		Atoranse
60		Erinla	120		Omi

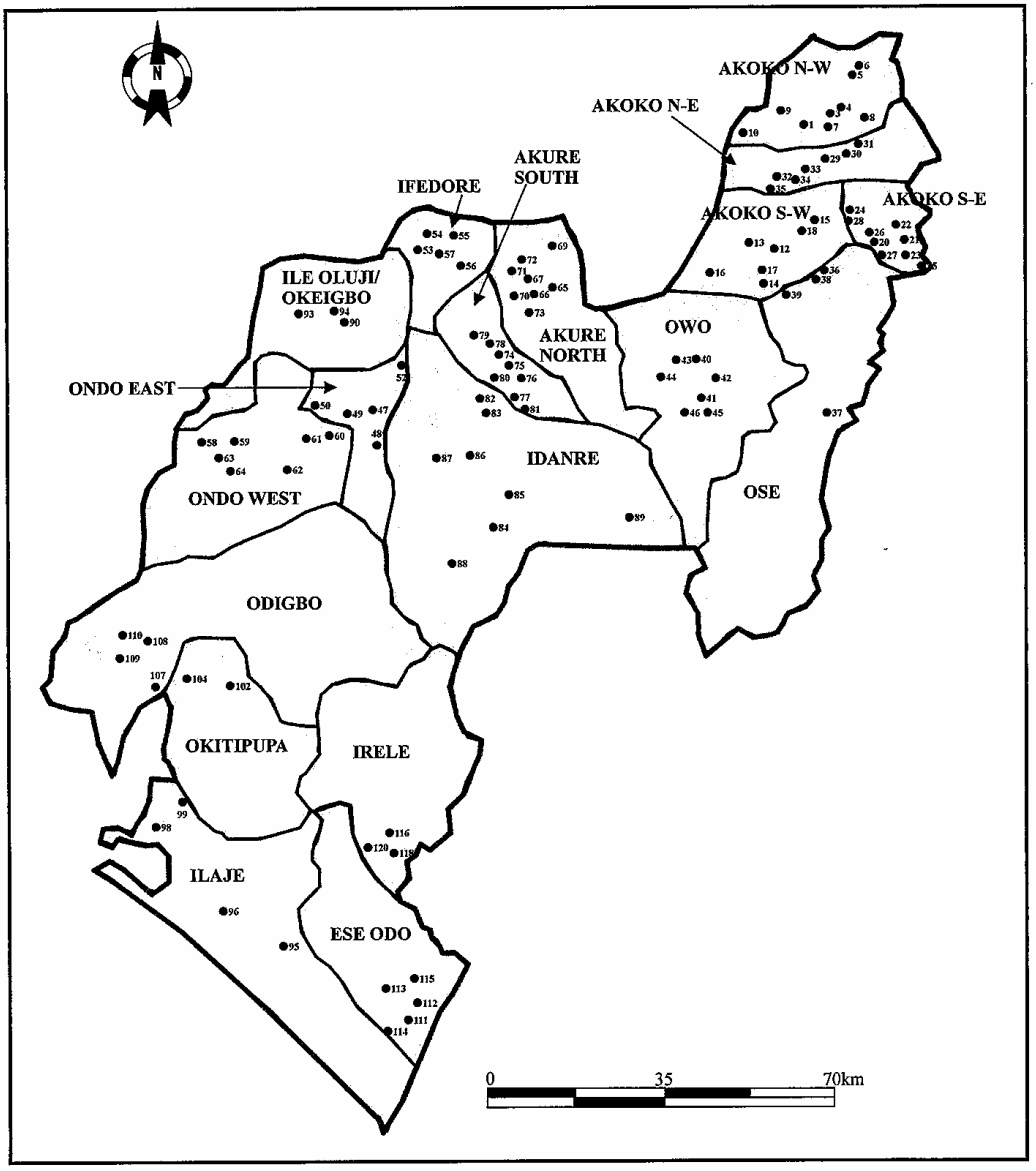


Figure3-4 Location of Target Communities in Ondo State

Table 3-5 Target Communities for Borehole Construction in Enugu State

No.	LGA	Community	No.	LGA	Community
1	ANINRI	Aneke Oji Mpu	61	ANINRI	Aneke Oji Mpu
2		Okomegbgo Mpu	62		Okomegbgo Mpu
3		Okpanku	63		Okpanku
4		Ekoli	64		Ekoli
5		Ukete Oduma	65		Ukete Oduma
6	AWGU	Uhueze Nenwe	66		Uhueze Nenwe
7		Emudo Nenwe	67		Emudo Nenwe
8		Amorji Nenwe	68		Amorji Nenwe
9		Owelli Uzam	69		Owelli Uzam
10		Amabor Owelli	70	AWGU	Amabor Owelli
11		Enugu Owelli	71		Enugu Owelli
12		Ibite Agbudu	72		Ibite Agbudu
13		Enugu Agu Enuguato Ihe	73		Enugu Agu Enuguato Ihe
14		Umuogodo Ihe	74		Umuogodo Ihe
15		Amata Ituku	75		Amata Ituku
16		Umuonyiba Ituku	76		Umuonyiba Ituku
17		Ogbaku	77		Ogbaku
18		Ugboha Imama Mgbowo	78		Ugboha Imama Mgbowo
19		Obodo Ikoro Ezioha	79		Obodo Ikoro Ezioha
20		Amokpo	80	ENUGU EAST	Amokpo
21		Mbulu Owehe	81		Mbulu Owehe
22	ENUGU EAST	Ogbeke	82		Ogbeke
23		Mbulu Njodo	83		Mbulu Njodo
24		Mbulu Awulu	84		Mbulu Awulu
25		Obeagu	85	ENUGU SOUTH	Obeagu
26	ENUGU SOUTH	Obeagu Uno	86		Obeagu Uno
27		Jioto	87		Jioto
28		Akwuke Awkunanaw	88		Akwuke Awkunanaw
29		Ikem Umaram	89	ISIUZO	Ikem Umaram
30	ISIUZO	Aguudele Mbu	90		Aguudele Mbu
31		Emeora Neke	91		Emeora Neke
32		Akpani Neke	92		Akpani Neke
33		Abor Ishiala	93		Abor Ishiala
34	NKANU EAST	Amaechi Idodo	94	NKANU EAST	Amaechi Idodo
35		Mburubu	95		Mburubu
36		Umuawulu Agu Unateze	96		Umuawulu Agu Unateze
37		Amuofia Amagu Nara	97		Amuofia Amagu Nara
38		Enuogu Nkerefi	98		Enuogu Nkerefi
39		Umuene Nomeh	99		Umuene Nomeh
40		Isigwe Ugbawka	100		Isigwe Ugbawka
41		Imama Amafor Ugbawka	101		Imama Amafor Ugbawka
42		Umuatugbuoma Akegbe	102	NKANU WEST	Umuatugbuoma Akegbe
43		Orjiagu	103		Orjiagu
44	NKANU WEST	Okorouba Ozalla	104		Okorouba Ozalla
45		Obe Uno	105		Obe Uno
46		Eziokwe Amuri	106		Eziokwe Amuri
47		Amankanu Amuri	107		Amankanu Amuri
48		Mgbogodo Agbani	108		Mgbogodo Agbani
49		Obinagu Uno Akpugo	109		Obinagu Uno Akpugo
50		Ihunekwuagu Akpugo	110		Ihunekwuagu Akpugo
51		Ogonoeji Ndi Uno Akpugo	111		Ogonoeji Ndi Uno Akpugo
52		Agbaede Akpugo	112		Agbaede Akpugo
53		Obollo Afor	113	UDENU	Obollo Afor
54	UDENU	Amalla	114		Amalla
55		Egali Amalla	115		Egali Amalla
56		Obollo Etiti	116		Obollo Etiti
57		Iheakpu Obollo	117		Iheakpu Obollo
58	UZO-UWANI	Ogbosu Umuluokpa	118	UZO UWANI	Ogbosu Umuluokpa
59		Adada	119		Adada
60		Nkume	120		Nkume

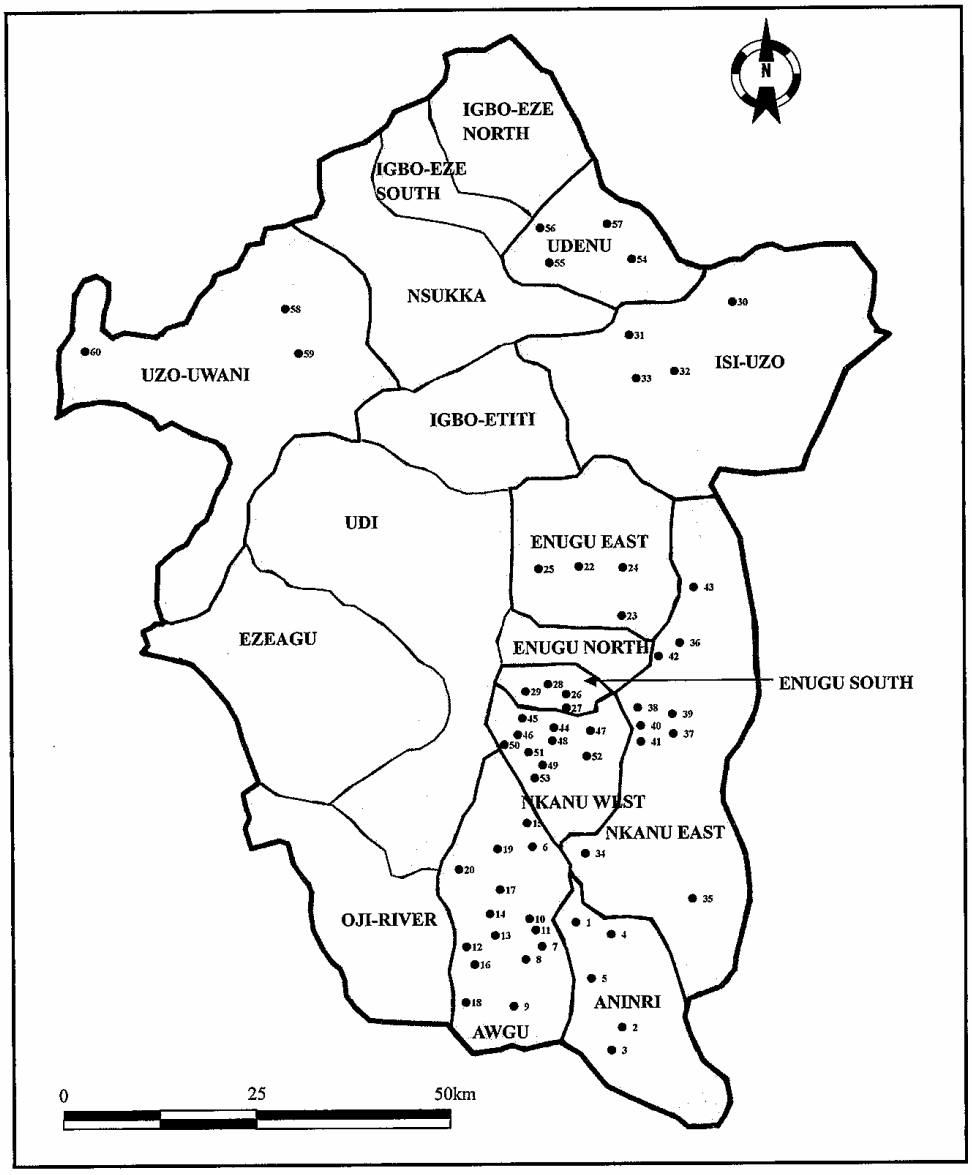


Figure3-5 Location of Target Communities in Enugu State

(20)

Rural Water Supply Plan in Target States

Table 4-1 Rural Water Supply Plan in Kebbi State

Year	Borehole construction				No of beneficiaries from improved capacity	Cumulative population of those with access	Total projected rural population	Coverage (%)
	Hand pump		Motor pump	Total				
	by JICA Rig	by other rig and private companies	by other rig and private companies					
2009						1,151,805	2,879,512	40%
2010		20	25	45	80,280	1,232,085	2,961,002	42%
2011		20	25	45	80,280	1,312,365	3,044,799	43%
2012		20	25	45	80,280	1,392,645	3,130,966	44%
2013	50	20	25	95	93,480	1,486,125	3,219,573	46%
2014	50	20	25	95	93,480	1,579,605	3,310,687	48%
2015	50	20	25	95	93,480	1,673,085	3,404,379	49%
2016	50	20	25	95	93,480	1,766,565	3,500,723	50%
2017	50	20	25	95	93,480	1,860,045	3,599,793	52%
Total	250	160	200	610	-	-	-	-

Table 4-2 Rural Water Supply Plan in Niger State

Year	Borehole construction				No of beneficiaries from improved capacity	Cumulative population of those with access	Total projected rural population	Coverage (%)
	Hand pump		Motor pump	Total				
	by JICA Rig	by other rig and private companies	by other rig and private companies					
2009						1,312,340	2,916,312	45%
2010		50	30	80	103,200	1,415,540	2,998,843	47%
2011		50	30	80	103,200	1,518,740	3,083,711	49%
2012		50	30	80	103,200	1,621,940	3,170,980	51%
2013	50	50	30	130	116,400	1,738,340	3,260,718	53%
2014	50	50	30	130	116,400	1,854,740	3,352,997	55%
2015	50	50	30	130	116,400	1,971,140	3,447,886	57%
2016	50	50	30	130	116,400	2,087,540	3,545,462	59%
2017	50	50	30	130	116,400	2,203,940	3,645,798	60%
Total	250	400	240	890	-	-	-	-

Table 4-3 Rural Water Supply Plan in Taraba State

Year	Borehole construction				No of beneficiaries from improved capacity	Cumulative population of those with access	Total projected rural population	Coverage (%)
	Hand pump		Motor pump	Total				
	by JICA Rig	by other rig and private companies	by other rig and private companies					
2009						497,576	1,990,304	25%
2010		30	10	40	37,920	535,496	2,046,630	26%
2011		30	10	40	37,920	573,416	2,104,550	27%
2012		30	10	40	37,920	611,336	2,164,108	28%
2013	50	30	10	90	51,120	662,456	2,225,353	30%
2014	50	30	10	90	51,120	713,576	2,288,330	31%
2015	50	30	10	90	51,120	764,696	2,353,090	32%
2016	50	30	10	90	51,120	815,816	2,419,682	34%
2017	50	30	10	90	51,120	866,936	2,488,159	35%
Total	250	240	80	570	-	-	-	-

Table 4-4 Rural Water Supply Plan in Ondo State

Year	Borehole construction				No of beneficiaries from improved capacity	Cumulative population of those with access	Total projected rural population	Coverage (%)
	Hand pump		Motor pump	Total				
	by JICA Rig	by other rig and private companies	by other rig and private companies					
2009						1,828,811	2,902,875	63%
2010		20	10	30	35,280	1,864,091	2,994,606	62%
2011		60	30	90	105,840	1,969,931	3,089,235	64%
2012		60	30	90	105,840	2,075,771	3,186,855	65%
2013	50	60	25	135	104,040	2,179,811	3,287,560	66%
2014	50	60	25	135	104,040	2,283,851	3,391,447	67%
2015	50	60	25	135	104,040	2,387,891	3,498,617	68%
2016	50	60	25	135	104,040	2,491,931	3,609,173	69%
2017	50	60	25	135	104,040	2,595,971	3,723,223	70%
Total	250	440	195	885	-	-	-	-

Table 4-5 Rural Water Supply Plan in Enugu State

Year	Borehole construction				No of beneficiaries from improved capacity	Cumulative population of those with access	Total projected rural population	Coverage (%)
	Hand pump		Motor pump	Total				
	by JICA Rig	by other rig and private companies	by other rig and private companies					
2009						1,349,328	3,569,650	38%
2010			126	126	378,000	1,727,328	3,682,451	47%
2011			58	58	174,000	1,901,328	3,798,816	50%
2012			69	69	207,000	2,108,328	3,918,859	54%
2013	50		30	80	103,200	2,211,528	4,042,695	55%
2014	50		30	80	103,200	2,314,728	4,170,444	56%
2015	50		30	80	103,200	2,417,928	4,302,230	56%
2016	50		30	80	103,200	2,521,128	4,438,180	57%
2017	50		30	80	103,200	2,624,328	4,578,427	57%
Total	250	0	403	653	-	-	-	-

Annex-5

Format of Monthly Progress Report for Borehole Construction

ID	LGA	Community	Date	Depth (m)	Screen Position (m)	Yield (l/min)	S.W.L. (m)	Pump Depth (m)	WASHCOM mobilized

Monthly/Cumulative - Total

Month	Number of Borehole Drilled	Number of Pumps Installed	Successful	Unsuccessful	Depth (m)	Casings (m)	
						Blind	Screen

Undertakings of Nigerian Side

The scope of works of the Japanese side in the Project covers the procurement of equipment and materials for construction of water supply facilities and technical support via the soft components. Both Governments have agreed that the Nigerian side will take responsibility for the construction of water supply facilities including the selection of sites. The specific scope of works of the Nigerian side is as indicated below.

(1) Construction of Borehole Facilities

Responsibility of Nigerian side on water supply facilities is shown in Table 6-1.

Table 6- 1 Responsibility of Nigerian side on Water Supply Facilities

Item	Obligations of Nigerian Side
Borehole construction work	• Mobilization of drilling rig, setting and dismantling. • Drilling, electrical logging, casing pipe installation, gravel packing, backfilling, cementing, pumping test, water quality analysis, borehole development. • Hand pump installation, platform construction. • Necessary equipment & materials for construction such as fuel, 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.
Borehole construction cost	• The cost for construction work and management.
Construction period	• Preparation of construction schedule. • Completion of 100 boreholes in each target State, 500 boreholes in total of 5 target States within the period of two years. If the construction will not be completed, Nigerian side will take up the responsibility to complete the construction. After that, continuous construction for 3 years.
Siting	• Prior to commencement of construction work, the sitting for the drilling points will be conducted by Nigerian side.
Quantities of construction materials	Nigeria side will be responsible for preparation of additional construction materials such as PVC casing & screen and hand pumps, if they complete more then 100 boreholes in each target State for 2 years.
The method of materials delivery	• Transportation of equipment and materials from headquarters' office of each Implementing Agency to each drilling site. • Management of the equipment and materials.
Exemption of taxes	Nigeria side will prepare the necessary documents for exemption of taxes before arrival of the equipment and materials at Lagos Port, and Nigeria side will carry out exemption of taxes.
Quality control and Inspection	Nigeria side will undertake the responsibility of quality control of construction work of water supply facilities and compliance to specifications, etc.
Safety/ Security measures	• Responsible for any accident during construction work. • Anti-theft measures of the equipment and materials at the sites.
Special attention	• The progress report of the construction work shall be submitted monthly to Japanese side.
Others	• Improvement of access roads. • 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 them prior to the commencement of the construction work.
- To provide office and counterparts free of charge to Japanese consultant.

PREPARATORY SURVEY

ON

THE PROJECT

FOR

IMPROVEMERNT OF RURAL WATER SUPPLY

IN

THE FEDERAL REPUBLIC OF NIGERIA

SOFT COMPONENT PLAN

February 2011

JAPAN INTERNATIONAL COOPERATION AGENCY

YACHIYO ENGINEERING CO., LTD.

Contents

1. Background of Planning for Soft Component 1
2. Necessity for Introduction of the Soft Components 3
3. Soft Components Targets 5
4. Outputs of the Soft Components 5
5. Confirmation of Output and Achievement of Soft Component 6
6. Soft Components Activities 7
7. Procurement of Implementation Resources for the Soft Components Activities 12
8. Soft Components Implementation Process 12
9. Output of Activities 15
10. Rough Cost Estimate of Implementation of Soft Component 15
11. Obligation of Nigerian Side 15

1 Background of Planning for Soft Component

1.1 Background of Project

(1) Background of Request

The Federal Republic of Nigeria (hereinafter called Nigeria) faces the Gulf of Guinea in the central West Africa and borders Niger, Chad, Cameroon and Benin, having a population of 140 million (2007, according to the National Census Data) and an area of 923,700 km^2 .The GDP of Nigeria is US$ 2,133 per capita. Nigeria was one of the most productive agricultural countries in Africa exporting a wide variety of farm products. However, following the discovery of petroleum in the latter part of the 1960s, it adopted an economic structure dependent on oil revenues. Moreover, due to repeated civil strife and coups surrounding the petroleum reserves, the domestic political situation has remained unstable and little progress has been made on mitigating poverty and developing infrastructure.

Against such a background the Government of Nigeria formulated "National Economic Empowerment and Development Strategy: NEEDS" in May 2004. It stressed development of various sectors in order to realize economic development to be one of the most developed 20 countries of the world. Water supply sector is raised as a priority sector, and it is eventually intended to supply safe water to all citizens by 2011 according to "National Rural Water Supply and Sanitation Programme".

Within above goal for rural water supply (supplied population of no more than 5,000), it is intended to secure 30ℓ of water supply per person per day, to keep water carrying distances less than 250 m and to provide water supply points for every 250~500 people. However, the ratio of people with access to safe water declined from 49% in 1990 to 48% in 2004 due to population increase etc. The ratio is especially low in rural areas at 31% compared to 68% in the cities in 2004. There is an urgent need to secure safe water supply because many people drink surface water and puddles with risk of water-borne diseases.

In these circumstances, the Government of Nigeria requested the Government of Japan to provide Grant Aid for the procurement of borehole drilling equipment for thirteen States. ODA task force of Nigerian side selected five States (Nassarawa, Niger, Zamfara, Taraba and Ondo State) in course of selection of candidate States from thirteen States. After selection of above 5 States, JICA Survey Team again examined ten States excluding three States with public security problem, considering appropriateness and necessity for implementation of the Grant Aid Project. As result of the examination, five States, Enugu, Ondo, Taraba, Kebbi and Niger were selected as prioritized States, and Japanese side and Nigerian side agreed on the above five States. Preparatory survey was conducted to perform outline design to formulate project implementation plan and estimate rough cost of the Project for 5 prioritised States.

(2) Basic Concept of Project

This Project constitutes a part of the Overall Project aiming at improvement of rural water supply and hygiene condition of the Project area as shown below.

<u>The Project</u>

Equipment and materials for construction of water supply facilities will be procured by Japanese side, and Nigerian side will construct 500 boreholes water supply facilities in two years using the procured equipments and materials.

<u>Overall Project Plan</u>

Following the above Project of the first two years, Nigerian side will continue drilling work of 750 boreholes in subsequent three years. Even after above construction period, Nigerian side will continue construction work using the procured equipments, to achieve the improvement of the rural water supply and the hygiene condition, which is superior goal of the Overall Project.

In addition to the procurement of equipment and materials, the Project will provide technical training for operation of the equipments and materials. Moreover, technical support for i) formulation of borehole construction plan, data management and equipments maintenance and ii) strengthening of operation and maintenance system for water supply facilities will be implemented. The list of the

equipment and material to be procured by the Project is shown in Table 1-1.

Table 1-1 Procured Equipment and Materials

No.	Name of Equipment	Specification/Description	Unit	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 : Not less than 100m Capable Drilling Diameter : Mud Drilling : 10 - 5/8″ DTH : 6 - 1/4″ Capable Geology :Alluvial deposit to hard rock Mobilization Method: Truck mounted. Truck Specification : 4 × 4 or 6 × 4 (2 axis drives))	Lot	Kebbi :1 Niger :1 Taraba :1 Ondo :1 Enugu :1
2	Drilling Tools and consumable materials	[Drilling Tools] Drill pipe, hammer bits, work casing and all other necessary tools for the rig above described. [Consumable Materials] Drilling Chemicals (Bentonite, CMC and foam)	Set	Kebbi :1 Niger :1 Taraba :1 Ondo :1 Enugu :1
3	High Pressure Air Compressor	Supply Air Pressure : More than 2.01MPa (=20.5kg/cm^2) Supply Air Volume: 11.3m^3/min or more. Mobilization Method : Truck mounted Truck Specification : 4 × 4 or 6 × 4 (2 axis drives))	Lot	Kebbi :1 Niger :1 Taraba :1 Ondo :1 Enugu :1
4	Cargo Truck with Crane	Load Capacity : 6.0tons or more Specification : 4 × 4 or 6 × 4 (2 axis drives)) Engine : Diesel (water cooling) Carrier Length: 6.0m or more Crane Capacity : 2.9tons	Lot	Kebbi :1 Niger :1 Taraba :1 Ondo :1 Enugu :1
5	Pumping Test Equipment	Submersible motor pump : Discharge of 30ℓ/min × 70m head (1.5kW/50Hz) Engine Generator : 5kVA or more Groundwater Level Indicator : Measurable depth of 100m	Set	Kebbi :1 Niger :1 Taraba :1 Ondo :1 Enugu :1
6	Water Analysis Equipment	Measurement Items : pH, DO, EC, T.D.S. and Water temperature	Lot	Kebbi :1 Niger :1 Taraba :1 Ondo :1 Enugu :1
7	Geophysical Survey Equipment	[Electric survey] Electrical Sounding Instrument : Measurable depth of 100m Measuring Item : Apparent resistivity and spontaneous potential Measurable range : 0.1mV～10V Accessory : Software for analysis Others : Applicable for logging work for 100m depth borehole (with cable and probe) [Electro-magnetic survey] Slingram method Measurable depth of 40 to 60m Measuring Item : Apparent resistivity Accessory : Software for analysis	Lot	Kebbi :1 Niger :1 Taraba :1 Ondo :1 Enugu :1
8	Hand Pump and Tools	India Mark III, which is VLOM type and standard type of UNICEF and the Implementing Agencies	Lot	Kebbi :100 Niger :100 Taraba :100 Ondo :100 Enugu :100
		Repair tools for hand pump : Tools used by villagers for simple repair work	Set	Kebbi :100 Niger :100 Taraba :100 Ondo :100 Enugu :100
		Repair tools for hand pump : Tools used by LGA mechanics for serious repair such as replacement of pump parts	Set	Kebbi :14 Niger :24

No.	Name of Equipment	Specification/Description	Unit	Quantity
				Taraba :15 Ondo :18 Enugu :9
9	Casing Pipe	Materials : uPVC (Un-plasticised polyvinyl chloride) Dimension : φ4″,O.D.114.4mm, Length 3.0m Wall thickness : 5.5mm or more Connection : Threading method	Piece	For number of boreholes below Kebbi :100 Niger :100 Taraba :100 Ondo :100 Enugu :100
10	Screen Pipe	Materials : uPVC (Un-plasticised polyvinyl chloride) Dimension : φ4″, O.D.114.4mm, Length 3.0m Wall thickness : 5.5mm or more Connection : Threading method Screen type : Slit type (0.8-1.0mm in width) Opening Ratio : 3% or more	Piece	For number of boreholes below Kebbi :100 Niger :100 Taraba :100 Ondo :100 Enugu :100
11	Drilling Fluid	Bentonite : Montmorillonite of #250-Powder Polymer : CMC (CARBOXY METHYL CELLULOSE) Forming agent: Anion based surfactant	Set	Kebbi :100 Niger :100 Taraba :100 Ondo :100 Enugu :100

(3) Current situation of water supply and problems to be solved in target 5 states

The Implementing Agencies take responsibility of rural water supply project under Ministry of Water Resources of State[1]. Project management capability of the Implementing Agencies of the target States must be strengthened and improved for effective construction of rural water supply facilities using equipment and materials procured in the Project. Problems to be improved are as follows:

① The Implementing Agencies do not formulate effective plan for smooth construction work of water supply facilities.
② The Implementing Agencies do not compile and manage records of construction work and the constructed facilities.
③ The Implementing Agencies do not maintain equipment and materials efficiently. Workshop can not fulfil its function due to luck of workshop materials.
④ Cooperation between the Implementing Agencies and LGs is not enough to support maintenance of rural water supply facilities.
⑤ Residents in communities are lacking in willingness to operate and maintain water supply facilities with self-help effort.
⑥ Activity to monitor operation and maintenance of rural water supply facilities is not implemented properly by the Implementing Agencies and LGs after completion of water supply facilities.
⑦ Staff of the Implementing Agencies does not have enough knowledge and skill on operation and maintenance of water supply and hygiene project, and they have little opportunity to learn it.

2 Necessity for Introduction of the Soft Components

There would be no problem regarding the intention of the Implementing Agencies to operate and maintain the equipment and materials procured by the Project. As well as above mentioned, local resident in communities would have the willingness to operate and maintain the water supply facilities constructed with the equipment and materials of the Project. To support the Implementing Agencies and the local residents, technical transfer of the following two items shall be implemented under the soft components of the Project.

① Technical training for formulation of borehole construction plan, data management and

[1] The implementing Agency of Kebbi, Niger, Taraba and Enugu State is established under the Ministry of Water Resources of the State. However, the implementing Agency of Ondo State is under Ministry of Special Duties

equipment maintenance

② Technical training for strengthening of operation and maintenance system for water supply facilities

The above soft components shall be kept to a minimum in terms of scale. Concerning the implementation method, the Japanese consultant shall conduct overall supervision and guidance, while the local consultant shall be responsible for some of the activities. The soft components will be completed before the handover of the procured equipment and materials to Nigerian side.

1) Technical training for formulation of borehole construction plan, data management and equipment maintenance

In the Project, construction of 100 boreholes by each Implementing Agency is planned in two years. To achieve this goal, technical support to Nigerian side is necessary in two items below for effective implementation of the Project using procured equipment and materials.

i) Strengthening of the technical capacity such as handling of equipment and drilling skill
ii) Technical training for formulation of borehole construction plan, data management and equipment maintenance

As for item i) mentioned above, the Supplier shall be responsible for this training. On the other hand, Consultant shall be responsible for item ii) mentioned above through implementation of soft components. Such training will contribute for the effective utilization of the limited human and financial resources of the Implementing Agencies. Through the facilities construction controlled by carefully formulated plan for borehole construction, the Project will be smoothly implemented with minimum period, which will enable the Project effect to be realized satisfactorily.

The Implementing Agencies do not have the existing drilling record. Effective drilling plan can not be formulated without the existing data. Furthermore, regarding the maintenance situation of existing equipment in the Implementing Agencies, there are repetitive breakdowns and repairs. They do not conduct daily check and not have systematic maintenance/repair of equipment to prevent breakdowns. For these reasons, equipment is apt to break down frequently, disturbing the progress of drilling work. As a result, the Implementing Agencies can not complete number of boreholes as they planned initially.

To improve the condition mentioned above, support for strengthening of data management and formulation of plan for equipment maintenance is necessary. This support shall be implemented for each Implementing Agency.

2) Technical training for strengthening of operation and maintenance system for water supply facilities

Construction, operation and maintenance of rural water supply facilities will be implemented with collaboration among the Implementing Agency, local governments and rural communities as shown in Figure 2-1.

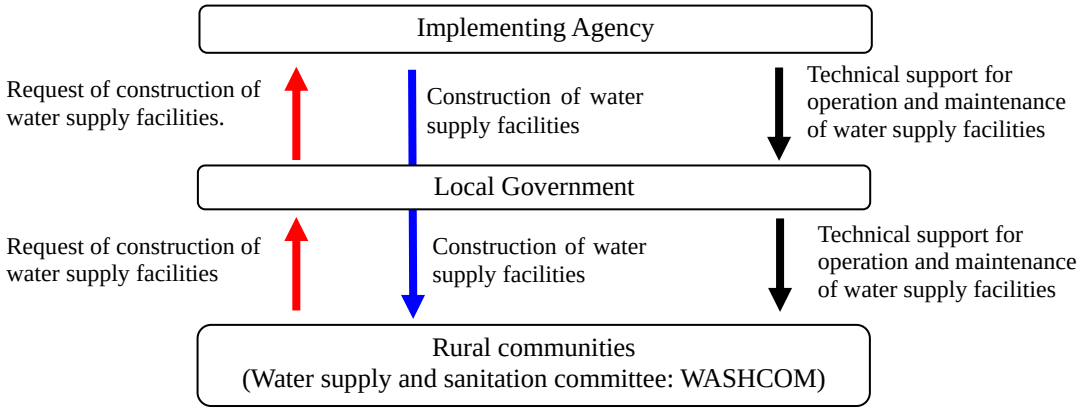


Figure2-1 Relation among Stakeholders on Construction, Operation and Maintenance of Water Supply Facilities

Rural water supply and sanitation service of the Implementing Agencies is conducted following the steps below:

Request of construction of boreholes
↓
Securing of budget for implementation
↓
Site survey (natural conditions, social conditions)
↓
Establishment of community organization (WASHCOM)
↓
Construction of water supply facilities
↓
Water quality analysis
↓
Community mobilization immediately after construction

The Implementing Agencies completes water supply facilities, and they hand over them to communities. After the hand over, WASHCOM is organized by residents of the community, and carries out the operation and maintenance of the water supply facility. The LG WASH Unit, which belongs to Water Supply Department of LG, assists WASHCOM.

However, cooperation among the Implementing Agency, LGs and community are not sufficient. Especially staff of LGs, who should play main role in the cooperation, has a little knowledge and skill, even though they have repeatedly received training for coordination. As a result, communities can not implement sustainable operation and maintenance of water supply facilities.

The Implementing Agencies use manual compiled by UNICEF for community training. However, content of the manual is for introduction of general method for community participatory training, which is not reflecting the actual situation of rural water supply of the Project area. New manual which is easier for the communities to understand and reflecting the current situation of rural water supply is necessary. Compiling of above manual is useful for daily maintenance of the facilities because currently there is not such practical manual for communities.

Supporting system for LGs and communities by the Implementing Agencies shall be established to strengthen relationship among relevant stakeholders, so that establishment of community organization and mobilization activities shall be promoted. For this purpose, capacity development of the staff of the Implementing Agencies shall be implemented by technical transfer though implementation of soft components of the Project.

3 Soft Components Targets

Targets of Soft Components are as follows.

1) Technical training for formulation of construction plan, data management and equipment maintenance

a) Formulation of construction plan

In order to complete 500 boreholes in two years using equipment and materials procured by the Project, an efficient borehole construction plan is required, and the plan will be formulated in by a soft component of the Project. Since the groundwater contamination is taking place in the Project area, designing of the borehole structure for preventing the groundwater contamination is urgently required. Soft component of the project will deal with this problem.

b) Data management

It is necessary to compile and save the borehole data into borehole inventory to make the data utilizable, in order to formulate borehole construction plan and manage the existing boreholes. Borehole inventory will be compiled in the soft component of the Project to make best use of the data.

c) Formulation of equipments maintenance plan.

Maintenance of the equipments is indispensable, in order to construct water supply facilities continuously using the procured equipments. Equipment management plan will be formulated in soft component of the Project including the plan for introducing workshop equipment.

2) Technical training for strengthening of operation and maintenance system of water supply facilities

a) Clarification of work content

Ambiguous demarcation of responsibilities is one of the main reasons of insufficient cooperation among the Implementing Agency, LGs and communities. To improve the situation, demarcation of their responsibilities must be clarified with compiling management manual.

b) Selection of model community and technical assistance

The model community will be selected for technical transfer, and a water supply and hygiene committee (WASHCOM) will be established.

Staff of the Implementing Agency will perform technical training for staff of local government to support communities by using the model community and the model WASHCOM as model case. The staff of the Implementing Agencies and local government will learn how to cooperate themselves and how to establish and educate the WASHCOM through training in model case.

c) Compiling of manual to establish and manage WASHCOM

The staff of the Implementing Agency and the LG will analyse the result of the above-mentioned training, and compile manual for establishment and management of WASHCOM.

4 Outputs of the Soft Components

The direct outputs of the soft components in the Project will be as follows.

1) Technical training for formulation of construction plan, data management and equipment management
   - Borehole construction work will follow the plan, and borehole construction period will be made shorter.
   - Borehole management will be strengthened based on borehole inventory.
   - Borehole structure will be improved, and groundwater contamination will be prevented.
   - Function of workshop will be improved, and maintenance of equipment will be strengthened.

2) Technical training for strengthening of operation and maintenance system for water supply facilities
   - Work content of the Implementing Agency to support operation and maintenance of water supply facilities by communities will be made clear, and work coordination will be improved.
   - Cooperation between the Implementing Agency and LGs will be strengthened, and they will continuously support WASHCOM.
   - Staff of the Implementing Agency and LGs will learn skill to establish community

organization and perform educational support through activities in the model communities.

- WASHCOM will be established in each community.
- Operation and maintenance of water supply facilities will be implemented continuously according to the management manual.

5 Confirmation of Output and Achievement of Soft Component

Items for confirmation of output and achievement of the soft component are shown in Table 5-1 and Table 5-2. The current situation to be improved with the activities of the soft component will be made clear through listening survey. The content of activities will be carefully examined to get the best outputs within limited period of time. The consultants in charge of the soft component will confirm and evaluate the output and achievement of the activities at the end of the softy component, and will submit the report on the activities to the Nigerian side.

Table 5- 1 Items for Confirmation of Output and Achievement of Formulation of boreholes construction plan, data management and equipment maintenance

Activity	Output （at the end of soft component）	Method for confirmation
1. Formulation of borehole construction plan	• Borehole structure will be designed to fit the geological condition • Borehole construction plan will be formulated to shorten construction period.	• To confirm designed borehole structure and its appropriateness • To confirm borehole construction plan (construction plan, management plan, mobilization plan, safety plan and their appropriateness)
2.Borehole data management	Borehole inventory will be compiled	To confirm complied borehole inventory and its appropriateness.
3.Equipment maintenance	Equipment maintenance plan will be formulated, and plan to introduce workshop-equipment will be formulated	To confirm equipment maintenance plan and workshop-equipment introducing plan, and their appropriateness.

Table 5- 2 Items for Confirmation of Output and Achievement of Strengthening of Operation and Maintenance of Water Supply facilities

Activity	Output （at the end of soft component）	Method for confirmation
1. Improvement of supporting system for operation and maintenance of water supply facilities.	Activities for operation and maintenance of water supply will be made clear, and coordination for above activities will be strengthened.	• To confirm appropriateness of operation and management system of water supply facilities. • To conform appropriateness of the content of activities
2. Strengthening of cooperation between WATSAN Project and LGs.	Management rule to support WAHCOM will be complied by the Implementing Agency and LGs, and demarcation of duty for support will be made clear.	To confirm the compiled management rule and its appropriateness.
3. Organising WASHCOM and education for communities.	WASHCOM will be established in a model community, and staff of the Implementing Agency will learn know-how to organize community and educate them.	• To confirm establishment of WASHCON of model communities. • To confirm records on establishment of WASHCOM and educational activities by the Implementing Agencies and Model LG and their appropriateness.

The Implementing Agencies has obligation to report monthly to Japanese side and FMWR on progress of facilities' construction after procurement of equipment and materials. Japanese side will confirm the output and degree of the achievement of the soft component with reports from Nigerian side on condition of i) borehole inventory, ii) equipment maintenance, iii) supporting to communities and iv) monitoring of communities' response etc.

6 Soft Components Activities

The supporting activities will consist of the following two items.

1) Technical training for formulation of borehole construction plan, data management and equipment management

Before commencement of borehole construction, the Japanese consultant will provide technical support on formulation of borehole construction plans, data management and equipment management for the staff of the Implementing Agencies (see Table 6-1).

Table 6- 1 Target Staff for Soft Components Activities

(Borehole Construction Plan, Data Management and Equipment Maintenance)

	State / Item	Kebbi	Niger	Taraba	Ondo	Enugu
(1)	Formulation of Borehole construction plan	Workshop Department of RUWASSA	Water Supply Department of RUWASSA	Water Supply Department of RUWASSA	Water Supply Department of WATSAN Project	Water Supply Department of RUWASSA
(2)	Data management	Water Supply Department of RUWASSA	Water Supply Department of RUWASSA	Water Supply Department of RUWASSA	Water Supply Department of WATSAN Project	Water Supply Department of RUWASSA
(3)	Equipment management	Workshop Department of RUWASSA	Workshop Department of RUWASSA	Maintenance Department of RUWASSA	Workshop Department of WATSAN Project	Workshop Department of RUWASSA

2) Strengthening of operation and maintenance system for water supply facilities

Before commencement of borehole construction, the Japanese consultant will provide technical support on strengthening of operation and maintenance system for water supply facilities (see Table 6-2).

Table 6- 2 Staff for Soft Components Activities

(Strengthening of Operation and Maintenance System for Water Supply Facilities)

	State / Item	Kebbi	Niger	Taraba	Ondo	Enugu
(1)	Strengthening of operation and maintenance system for water supply facilities	Community Mobilization Department of RUWASSA	Community Mobilization /Hygiene Education Department of RUWASSA	Community Mobilization /Hygiene Education Promotion Department of RUWASSA	Community Mobilization /Hygiene Education Department of WATSAN Project	Community Mobilization /Hygiene Education Department of RUWASSA

Detailed assignment plan is shown in Table 6-3 and Table 6-4, and man power and equipment and materials for implementation of soft component is shown in Table 6-5 and Table 6-6.

Table 6- 3 Contents of Soft Components Activities (1/2)

Technical Training for Formulation of Construction plan, Data Management and Equipment Maintenance (to the Implementing Agencies of five target States Project)

Activities	Contents	Detail contents	Output
1.Formulation of borehole construction plan	1-1. Designing of Borehole structure 1-2. Formulation of mobilization plan and construction plan 1-3. Formulation of construction management plan. 1-3. Formulation of safety management plan	① To organize a construction planning team in the Implementing Agency. ② To design borehole structure ③ To formulate construction plan ④ To introduce related construction work as example, and to make a check list for quality control ⑤ To formulate construction management plan ⑥ To formulate safety management plan （see Note 1 for detail）	1. Borehole structure will be designed suitable for geological condition. 2. Borehole construction plan will be formulated to shorten construction period 3. Borehole inventory will be constructed 4. Plan for equipment maintenance will be formulated including plan to introduce workshop equipment.
2.Management of borehole data	2-1. Preparation of borehole inventories	①To collect existing boreholes data and create data-input format ②To input existing borehole data into data-base. （see Note 2 for detail）	Inputs / Equipment <Japanese side> a) Japanese Consultant (1 person) Local Consultant (1 person) b) Rental car for Japanese consultant: 213 days c) Preparation of documents: 1 set
3. Equipment maintenance	3-1. Formulation of equipment management plan 3-2. Compiling of manual for equipment maintenance. 3-3. Formulation of workshop equipment plan	① To organize a team for equipment management planning in the Implementing Agency. ② To formulate equipment maintenance plan ③ To formulate plan for introduction of workshop equipment ④ To compile manuals and check sheets	<Nigerian side> a) Staff of the Implementing Agencies: 4 to 20 members from each sate.
<Working Team: each State> (1) Facilitator a) Japanese Consultant (1 person) b) Local Consultant (1person) (2) Target group : Staff of the Implementing Agencies a) Construction Planning team: Water supply section, 4 persons b) Borehole inventory team: Water supply section, 4 persons c) Equipment management team: Workshop section, 4 persons	Note 1.Training for formulation of borehole construction plan (a) Explanation of outline of the Project, importance of responsibility of staff in charge and cooperation among related departments (b) Preparation of a list of the contents in the construction plan (d) Instruction on quality management, construction management and safety management (e) Advise for establishing borehole construction planning team (f) Proposal for construction plan (g) Preparation of check sheets (h) Introduction of the example of the related constructions works (i) Formulation of construction plan	2.Training for borehole data management (a) Explanation on the importance of data management (b) Understanding on current situation and problem in data management Project (e) Preparation of format for borehole inventory (f) Confirmation of method for borehole data management at the implementation stage 3. Training for equipment maintenance (a) Preparation of list of content of equipment maintenance plan (b) Preparation of list of content of introducing plan for workshop equipment (c) Formulation of equipment maintenance plan (d) Formulation of plan for introducing workshop equipment (e) Compiling of manuals and check sheets		

Table 6- 4 Contents of Soft Components Activities (2/2)

Strengthening of Operation and Management System for Water Supply Facility Project (to the Implementing Agencies of five target States)

Activities	Contents	Detail contents	Out put
1. Improvement of supporting system for operation and maintenance of water supply facilities	1-1. Confirmation of operation and maintenance of water supply facilities	① To understand current situation of operation and maintenance of water supply facilities ② To clarify work on operation and management of water supply facilities Project ③ To define demarcation of responsibility among 3 tiers: the Implementing Agency－LGs－Unit WASHCOM	1. Activities for operation and maintenance of water supply will be made clear, and coordination for above activities will be strengthened. 2. Management rule to support WAHCOM will be complied by the Implementing Agency and LGs, and demarcation of duty for support will be made clear. 3. WASHCOM will be established in a model community, and staff of the Implementing Agency will learn know-how to organize community and educate them. 4. O&M manual for water supply facilities will be compiled, and method to monitor O&M will be prepared.
2. Strengthening of cooperation between WATSAN Project and LGA 2. Strengthening of cooperation between the Implementing Agency and LGs	2-1. Confirmation of responsibility between the Implementing Agency and LGs.	① To select model community and establish working team (see Note-1) ② To hold a meeting with selected LG Units to confirm demarcation of responsibility	
	2-2. Formulation of regulations for O&M	① Discussion on content of rule to support WAHCOM by establishing system to solve immediate breakdown of facilities, to supply spare parts and to open regular meeting ② Compiling of the rule on O/M work	
3. Organising WASHCOM and education for communities (see Note 2)	3-1. Confirmation of work demarcation	① To select one community from model LGA as model community ② To explain work demarcation among the Implementing Agency－LGs －WASHCOM	
	3-2. Establishment of WASHCOM	① To explain necessity and responsibility of WASHCOM and importance of O&M of water supply facility by community ② To select members of WASHCOM, and prepare the member list	
	3-3. Promotion of O&M cost collection	① To open community workshop ② To explain necessity of O&M cost for water supply facility ③ To discuss about O&M cost (amount of water charge, frequency of payment, the method of payment, the way of collecting and keeping money, etc.) ④ To make management rule of WAHCOM including payment of water charge	Inputs / Equipment <Japanese side> a) Japanese Consultant (11 person) b) Rental car for Japanese consultant : 153 days 3. Preparation of documents: 1 set <Nigerian side> a) Staff of the Implementing Agency: 4 members. b) LGs Unit member: 4 persons c) Vehicle for transportation of above staff.
	3-4. Promotion of water supply and hygiene education（see Note 3）	① To promote hygiene education on environment around water supply facilities and households, etc ② To perform educational activities to prevent water born disease	
	3-5. Training for maintenance and repair of water supply facility (see Note 4)	① To explain how to repair broken boreholes (demarcation of responsibility and communication system with LG) ② To train technician in community for repairing hand pump and distribute manuals for repair	
<Working team: each State> a) Japanese consultant: Facilitator (1 person) b) Staffs of the Implementing Agency :4 persons each State c) Staff of LGs WASH Unit :2 persons d) Adviser: Expert of UNICEF (Rural water supply system, Hygiene education) e) Participation：1 model LGA, 1 model community	Notes: 1. Working team is composed of i) 4 members from responsible department of the Implementing Project, ii) 2 members of model LG Unit, and iii) Japanese consultant (1 person) : 7 members in total. Japanese consultant will act as facilitator, and Working group will perform main activities. Expert of UNICEF will participate in the activities as adviser. 2. is Staff of the Implementing Agency will perform various activities together with staff of LG Unit 3. Hygiene education will be carried out twice. One of them will aim at only women as target. 4. Training of hand pump repair will be conducted for local hand pump mechanics and WASHCOM of model community, where there is the existing water facilities constructed by the Implementing Agency.		

Table 6-5 Detailed Assignment Plan of Soft Components for Technical Training for Formulation of Construction Plan, Data Management and Equipment Maintenance

Target	Activity	Content	Detailed Content	1	2	3	4	5	6	Place	Output	Documents
Preparation		Preparation of text	・Preparation of text and plan for activities(15days)							Japan		・Training text(activity and data)
Mobilization		Mobilization	・Narita-Abuja(2days) ・Discussion with FMWE and JICA(2days)									
Soft component for Enugu	Formulation of borehole construction Plan	Organizing of borehole construction planning team	・Abuja→Enugu(1day) ・Organizing of borehole construction planning team, and explanation of activities (2days)									
		・Designing of borehole design ・Mobilization plan and construction plan	・Designing of borehole structure (3days) ・Formulation of construction plan, quality control, procedure of construction work, question and answer and compiling of construction plan (6 days)							Enugu	・Borehole construction plan to shorten construction period will be formulated	・Borehole structure ・Mobilization plan and construction plan ・Construction management plan ・Safety control plan/safety manual
		Construction management plan	・Explanation of construction management plan, priority of construction order, compiling of construction management plan (5dasy)									
		Safety plan (with assistance of local consultant)	・Lecture on safety control with safety manual(1days) ・Instruction of safety management in construction site and compiling of safety plan (2days)									
	Management of borehole data	Borehole inventory (with assistance of local consultant)	・Collection of borehole data (2days) ・Compiling of format for borehole inventory (2days) ・Data input into borehole inventory (by local consultant)								・ Borehole inventory will be compiled	・Borehole inventory
	Equipment maintenance plan	・Equipment maintenance plan (with assistance of local consultant) ・Workshop equipment introducing plan	・Organization of equipment maintenance planning team (1day) ・Formulation of equipment maintenance plan (4days) ・Formulation of workshop equipment introducing plan (4days) ・Compiling of manuals and check sheets (2days)								・ Equipment maintenance plan will be formulated	・ Equipment maintenance plan/equipment maintenance manual (check sheet of equipment) ・ Introducing plan of workshop equipment
	Preparation of report		・Compiling of final report of soft component (2days)									・ Final Report for the implementing Agencies ・ Record of training, photographs
Soft component for Ondo	Formulation of borehole construction Plan	Organizing of borehole construction planning team	・Abuja→Enugu(1day) ・Organizing of borehole construction planning team, and explanation of activities (2days)									
		・Designing of borehole design ・Mobilization plan and construction plan	・Designing of borehole structure (3days) ・Formulation of construction plan, quality control, procedure of construction work, question and answer and compiling of construction plan (6 days)							Acure	・Borehole construction plan to shorten construction period will be formulated	・Borehole structure ・Mobilization plan and construction plan ・Construction management plan ・Safety control plan/safety manual
		Construction management plan	・Explanation of construction management plan, priority of construction order, compiling of construction management plan (5dasy)									
		Safety plan (with assistance of local consultant)	・Lecture on safety control with safety manual(1days) ・Instruction of safety management in construction site and compiling of safety plan (2days)									
	Management of borehole data	Borehole inventory (with assistance of local consultant)	・Collection of borehole data (2days) ・Compiling of format for borehole inventory (2days) ・Data input into borehole inventory (by local consultant)								・ Borehole inventory will be compiled	・Borehole inventory
	Equipment maintenance plan	・Equipment maintenance plan (with assistance of local consultant) ・Workshop equipment introducing plan	・Organization of equipment maintenance planning team (1day) ・Formulation of equipment maintenance plan (4days) ・Formulation of workshop equipment introducing plan (4days) ・Compiling of manuals and check sheets (2days)								・ Equipment maintenance plan will be formulated	・ Equipment maintenance plan/equipment maintenance manual (check sheet of equipment) ・ Introducing plan of workshop equipment
	Preparation of report		・Compiling of final report of soft component (2days)									・ Final Report for the implementing Agencies ・ Record of training, photographs
Soft component for Taraba	Formulation of borehole construction Plan	Organizing of borehole construction planning team	・Abuja→Enugu(1day) ・Organizing of borehole construction planning team, and explanation of activities (2days)									
		・Designing of borehole design ・Mobilization plan and construction plan	・Designing of borehole structure (3days) ・Formulation of construction plan, quality control, procedure of construction work, question and answer and compiling of construction plan (6 days)								・Borehole construction plan to shorten construction period will be formulated	・Borehole structure ・Mobilization plan and construction plan ・Construction management plan ・Safety control plan/safety manual
		Construction management plan	・Explanation of construction management plan, priority of construction order, compiling of construction management plan (5dasy)									
		Safety plan (with assistance of local consultant)	・Lecture on safety control with safety manual(1days) ・Instruction of safety management in construction site and compiling of safety plan (2days)									
	Management of borehole data	Borehole inventory (with assistance of local consultant)	・Collection of borehole data (2days) ・Compiling of format for borehole inventory (2days) ・Data input into borehole inventory (by local consultant)							Jalingo	・ Borehole inventory will be compiled	・Borehole inventory
	Equipment maintenance plan	・Equipment maintenance plan (with assistance of local consultant) ・Workshop equipment introducing plan	・Organization of equipment maintenance planning team (1day) ・Formulation of equipment maintenance plan (4days) ・Formulation of workshop equipment introducing plan (4days) ・Compiling of manuals and check sheets (2days)								・ Equipment maintenance plan will be formulated	・ Equipment maintenance plan/equipment maintenance manual (check sheet of equipment) ・ Introducing plan of workshop equipment
	Preparation of report		・Compiling of final report of soft component (2days)									・ Final Report for the implementing Agencies ・ Record of training, photographs
	Mobilization		・Taraba－Abuja(2days) ・Dissuasion with FMWR and JICA(2days) ・Abuja-Narita(2days)									
Soft component forKebbi	Formulation of borehole construction Plan	Organizing of borehole construction planning team	・Abuja→Enugu(1day) ・Organizing of borehole construction planning team, and explanation of activities (2days)									
		・Designing of borehole design ・Mobilization plan and construction plan	・Designing of borehole structure (3days) ・Formulation of construction plan, quality control, procedure of construction work, question and answer and compiling of construction plan (6 days)								・Borehole construction plan to shorten construction period will be formulated	・Borehole structure ・Mobilization plan and construction plan ・Construction management plan ・Safety control plan/safety manual
		Construction management plan	・Explanation of construction management plan, priority of construction order, compiling of construction management plan (5dasy)									
		Safety plan (with assistance of local consultant)	・Lecture on safety control with safety manual(1days) ・Instruction of safety management in construction site and compiling of safety plan (2days)							Kebbi		
	Management of borehole data	Borehole inventory (with assistance of local consultant)	・Collection of borehole data (2days) ・Compiling of format for borehole inventory (2days) ・Data input into borehole inventory (by local consultant)								・ Borehole inventory will be compiled	・Borehole inventory
	Equipment maintenance plan	・Equipment maintenance plan (with assistance of local consultant) ・Workshop equipment introducing plan	・Organization of equipment maintenance planning team (1day) ・Formulation of equipment maintenance plan (4days) ・Formulation of workshop equipment introducing plan (4days) ・Compiling of manuals and check sheets (2days)								・ Equipment maintenance plan will be formulated	・ Equipment maintenance plan/equipment maintenance manual (check sheet of equipment) ・ Introducing plan of workshop equipment
	Preparation of report		・Compiling of final report of soft component (2days)									・ Final Report for the implementing Agencies ・ Record of training, photographs
Soft component forNiger	Formulation of borehole construction Plan	Organizing of borehole construction planning team	・Abuja→Enugu(1day) ・Organizing of borehole construction planning team, and explanation of activities (2days)									
		・Designing of borehole design ・Mobilization plan and construction plan	・Designing of borehole structure (3days) ・Formulation of construction plan, quality control, procedure of construction work, question and answer and compiling of construction plan (6 days)							Minna	・Borehole construction plan to shorten construction period will be formulated	・Borehole structure ・Mobilization plan and construction plan ・Construction management plan ・Safety control plan/safety manual
		Construction management plan	・Explanation of construction management plan, priority of construction order, compiling of construction management plan (5dasy)									
		Safety plan (with assistance of local consultant)	・Lecture on safety control with safety manual(1days) ・Instruction of safety management in construction site and compiling of safety plan (2days)									
	Management of borehole data	Borehole inventory (with assistance of local consultant)	・Collection of borehole data (2days) ・Compiling of format for borehole inventory (2days) ・Data input into borehole inventory (by local consultant)								・ Borehole inventory will be compiled	・Borehole inventory
	Equipment maintenance plan	・Equipment maintenance plan (with assistance of local consultant) ・Workshop equipment introducing plan	・Organization of equipment maintenance planning team (1day) ・Formulation of equipment maintenance plan (4days) ・Formulation of workshop equipment introducing plan (4days) ・Compiling of manuals and check sheets (2days)								・ Equipment maintenance plan will be formulated	・ Equipment maintenance plan/equipment maintenance manual (check sheet of equipment) ・ Introducing plan of workshop equipment
	Preparation of report		・Compiling of final report of soft component (2days)									・ Final Report for the implementing Agencies ・ Record of training, photographs
	Mobilization		・Niger－Abuja(2days) ・Dissuasion with FMWR and JICA(2days) ・Abuja-Narita(2days)									
Evaluation: Evaluation of accomplishment of output of soft component	Traveling		・Narita－Abuja (2days) ・Dissuasion with FMWR and JICA (2days) ・Abuja-Narita (2days)							Mobilization		
	Evaluation of accomplishment of output of soft component		Interview survey to relevant organization, site inspection, interview survey to the Implementing Agencies and evaluation of accomplishment of soft component (20days)							five states		Final report of soft component (JICA)

Assignment plan	Human resources		1	2	3	4	5	8	Quantity	Note
Japanese side	Technical training for construction plan, data management and equipment management-1 (Japanese consultant)								5.09M/M	in Japan :0.23M/M (7days) in Nigeria :5.09M/M (118days+28days=146days)
Japanese side	Technical training for construction plan, data management and equipment management-2 (Japanese consultant)								2.93M/M	in Japan :0.23M/M (7days) in Nigeria :2.70M/M 81days)
Japanese side	Technical training for construction plan, data management and equipment maintenance (Japanese consultant)(Local consultant)								20days	
Nigerian side	Working team for construction plan, data management and equipment maintenance (4 to 8 members)									Drilling team and hydrogeological survey team: 4 to 6 members
Vehicle			**1**	**2**	**3**	**4**	**5**	**8**	**Quantity**	**Note**
Japanese side	Vehicle(4WD)	For Technical training for construction plan, data management and equipment management-1								
Japanese side	Vehicle(4WD)	For Technical training for construction plan, data management and equipment management-2							130days	191 days (Training of soft component)＋24days(Evaluation)=215 days for Japanes
Working room, meeting room and others			**1**	**2**	**3**	**4**	**5**	**8**	**Quantity**	**Note**
Nigerian side	Working room								4 months	
Nigerian side	Meeting room								5days	LGA meting:3dasy
Nigerian side	others (transport if necessary)									

Table 6-6 Detailed Assignment Plan of Soft Components for Strengthening of Operation and Maintenance System for Water Supply

Target	Activity	Content	Detailed Content	Place	Output	Documents
Preparation		Preparation of text	・Preparation of text and plan for activities(15days)	Japan		Training test (Activities and data)
Mobilization			・Narita-Abuja(2days) ・Discussion with FMWE and JICA(2days)	Mobilization		
Soft component for Enugu	Improvement of supporting system for operation and maintenance of water supply facilities by communities	Establishment of working team	・Abuja- Enugu(1day) ・Selection of model community and establishment of working team(2days)	Enugu		
		Confirmation of supporting system for operation and maintenance	・Arrangement of existing boreholes data and information on LGAs (1day) ・Examination of existing system for operation and maintenance for water supply facilities and problems to be solved (2 days) ・Arrangement of work demarcation of operation and maintenance of water supply facilities (3days) ・Compiling of work content of stakeholders (2days)		Operation and management system for water supply facilities will be improved and work content will be made clear	Management rule to support WASHCOM
	Strengthening of cooperation between the Implementing Agency and LGs	Confirmation of work demarcation and compiling of management rules	・Discussion with model LGs Unit(2days) ・Examination of management rule (2days) ・Compiling of management rule (3days)		Management rules for supporting WASHCOM by the Implementing Agency and LGs will be formulated and work demarcation will be verified.	
	Organizing WASHCOM and education for communities	Organizing of WASHCOM and educational activities for communities	・Preparation of educational activities for communities(1days) ・Explanation of work content by community, establishment of WASHCOM and examination of cost for operation and maintenance (2days) ・Hygiene education (men and women separately)(1day) ・Distribution and explanation of manual for repair and inspection of water supply facilities(2days) ・Discussion of problems to be solved in activities (1day)		WASHCOM will be established in model community, and staff of the Implementing Agency and LGs Unit will learn know-how to organize and educate community	・Member list of WASHCOM and management rule of WASHCOM ・Manual for hand pump maintenance ・Record on hygiene education and other educational activities
	Compiling of report		Compiling of final report of soft component (4 days)		WASHCOM will be established in model community, and staff of the Implementing Agency and LGs Unit will learn know-how to organize and educate community	・ Final Report for the implementing Agencies ・ Record of training, photographs
Soft component forOndo	Improvement of supporting system for operation and maintenance of water supply facilities by communities	Establishment of working team	・Abuja- Enugu(1day) ・Selection of model community and establishment of working team(2days)	Acure		
		Confirmation of supporting system for operation and maintenance	・Arrangement of existing boreholes data and information on LGAs (1day) ・Examination of existing system for operation and maintenance for water supply facilities and problems to be solved (2 days) ・Arrangement of work demarcation of operation and maintenance of water supply facilities (3days) ・Compiling of work content of stakeholders (2days)		Operation and management system for water supply facilities will be improved and work content will be made clear	Management rule to support WASHCOM
	Strengthening of cooperation between the Implementing Agency and LGs	Confirmation of work demarcation and compiling of management rules	・Discussion with model LGs Unit(2days) ・Examination of management rule (2days) ・Compiling of management rule (3days)		Management rules for supporting WASHCOM by the Implementing Agency and LGs will be formulated and work demarcation will be verified.	
	Organizing WASHCOM and education for communities	Organizing of WASHCOM and educational activities for communities	・Preparation of educational activities for communities(1days) ・Explanation of work content by community, establishment of WASHCOM and examination of cost for operation and maintenance (2days) ・Hygiene education (men and women separately)(1day) ・Distribution and explanation of manual for repair and inspection of water supply facilities(2days) ・Discussion of problems to be solved in activities (1day)		WASHCOM will be established in model community, and staff of the Implementing Agency and LGs Unit will learn know-how to organize and educate community	・Member list of WASH COM and management rule of WASH COM ・Manual for hand pump maintenance ・Record on hygiene education and other educational activities
	Compiling of report		Compiling of final report of soft component (4 days)		WASHCOM will be established in model community, and staff of the Implementing Agency and LGs Unit will learn know-how to organize and educate community	・ Final Report for the implementing Agencies ・ Record of training, photographs
Soft component forTaraba	Improvement of supporting system for operation and maintenance of water supply facilities by communities	Establishment of working team	・Abuja- Enugu(1day) ・Selection of model community and establishment of working team(2days)	Jalingo		
		Confirmation of supporting system for operation and maintenance	・Arrangement of existing boreholes data and information on LGAs (1day) ・Examination of existing system for operation and maintenance for water supply facilities and problems to be solved (2 days) ・Arrangement of work demarcation of operation and maintenance of water supply facilities (3days) ・Compiling of work content of stakeholders (2days)		Operation and management system for water supply facilities will be improved and work content will be made clear	Management rule to support WASHCOM
	Strengthening of cooperation between the Implementing Agency and LGs	Confirmation of work demarcation and compiling of management rules	・Discussion with model LGs Unit(2days) ・Examination of management rule (2days) ・Compiling of management rule (3days)		Management rules for supporting WASHCOM by the Implementing Agency and LGs will be formulated and work demarcation will be verified.	
	Organizing WASHCOM and education for communities	Organizing of WASHCOM and educational activities for communities	・Preparation of educational activities for communities(1days) ・Explanation of work content by community, establishment of WASHCOM and examination of cost for operation and maintenance (2days) ・Hygiene education (men and women separately)(1day) ・Distribution and explanation of manual for repair and inspection of water supply facilities(2days) ・Discussion of problems to be solved in activities (1day)		WASHCOM will be established in model community, and staff of the Implementing Agency and LGs Unit will learn know-how to organize and educate community	・Member list of WASHCOM and management rule of WASHCOM ・Manual for hand pump maintenance ・Record on hygiene education and other educational activities
	Compiling of report		Compiling of final report of soft component (4 days)		WASHCOM will be established in model community, and staff of the Implementing Agency and LGs Unit will learn know-how to organize and educate community	・ Final Report for the implementing Agencies ・ Record of training, photographs
	Mobilization		・Niger－Abuja (1day) ・Disscussion in Abuja(MWR、JICA)(2days) ・Abuja-Narita(3days)			
Soft component forKebbi	Improvement of supporting system for operation and maintenance of water supply facilities by communities	Establishment of working team	・Abuja- Enugu(1day) ・Selection of model community and establishment of working team(2days)	Kebbi		
		Confirmation of supporting system for operation and maintenance	・Arrangement of existing boreholes data and information on LGAs (1day) ・Examination of existing system for operation and maintenance for water supply facilities and problems to be solved (2 days) ・Arrangement of work demarcation of operation and maintenance of water supply facilities (3days) ・Compiling of work content of stakeholders (2days)		Operation and management system for water supply facilities will be improved and work content will be made clear	Management rule to support WASHCOM
	Strengthening of cooperation between the Implementing Agency and LGs	Confirmation of work demarcation and compiling of management rules	・Discussion with model LGs Unit(2days) ・Examination of management rule (2days) ・Compiling of management rule (3days)		Management rules for supporting WASHCOM by the Implementing Agency and LGs will be formulated and work demarcation will be verified.	
	Organizing WASHCOM and education for communities	Organizing of WASHCOM and educational activities for communities	・Preparation of educational activities for communities(1days) ・Explanation of work content by community, establishment of WASHCOM and examination of cost for operation and maintenance (2days) ・Hygiene education (men and women separately)(1day) ・Distribution and explanation of manual for repair and inspection of water supply facilities(2days) ・Discussion of problems to be solved in activities (1day)		WASHCOM will be established in model community, and staff of the Implementing Agency and LGs Unit will learn know-how to organize and educate community	・Member list of WASHCOM and management rule of WASHCOM ・Manual for hand pump maintenance ・Record on hygiene education and other educational activities
	Compiling of report		Compiling of final report of soft component (4 days)		WASHCOM will be established in model community, and staff of the Implementing Agency and LGs Unit will learn know-how to organize and educate community	・ Final Report for the implementing Agencies ・ Record of training, photographs
Soft component forNiger	Improvement of supporting system for operation and maintenance of water supply facilities by communities	Establishment of working team	・Abuja- Enugu(1day) ・Selection of model community and establishment of working team(2days)	Niger		
		Confirmation of supporting system for operation and maintenance	・Arrangement of existing boreholes data and information on LGAs (1day) ・Examination of existing system for operation and maintenance for water supply facilities and problems to be solved (2 days) ・Arrangement of work demarcation of operation and maintenance of water supply facilities (3days) ・Compiling of work content of stakeholders (2days)		Operation and management system for water supply facilities will be improved and work content will be made clear	Management rule to support WASHCOM
	Strengthening of cooperation between the Implementing Agency and LGs	Confirmation of work demarcation and compiling of management rules	・Discussion with model LGs Unit(2days) ・Examination of management rule (2days) ・Compiling of management rule (3days)		Management rules for supporting WASHCOM by the Implementing Agency and LGs will be formulated and work demarcation will be verified.	
	Organizing WASHCOM and education for communities	Organizing of WASHCOM and educational activities for communities	・Preparation of educational activities for communities(1days) ・Explanation of work content by community, establishment of WASHCOM and examination of cost for operation and maintenance (2days) ・Hygiene education (men and women separately)(1day) ・Distribution and explanation of manual for repair and inspection of water supply facilities(2days) ・Discussion of problems to be solved in activities (1day)		WASCOM will be established in model community, and staff of the Implementing Agency and LGs Unit will learn know-how to organize and educate community	・Member list of WASHCOM and management rule of WASHCOM ・Manual for hand pump maintenance ・Record on hygiene education and other educational activities
	Compiling of report		Compiling of final report of soft component (4 days)		WASCOM will be eastablished in model commnity, and staff of the Implementing Agency and LGs Unit will learn know-how to organize and educate community	・ Final Report for the implementing Agencies ・ Record of training, photographs
	Mobilization		・Niger－Abuja (1day) ・Disscussion in Abuja(MWR、JICA)(2days) ・Abuja-Narita(3days)			

Facilities

Assignment plan

Human resources			Quantity	Note
Japanese side	strengthening of Operation and Management of Water Supply Facilities-1(Japanese consultant)		3.36M/M	in Japan: 0.23M/M (7days) in Nigeria: 3.13M/M (94days)
	strengthening of Operation and Management of Water Supply Facilities-2(Japanese consultant)		2.39M/M	in Japan: 0.23M/M (7days) in Nigeria: 2.16M/M (65days)
Nigerian side	Working team for Strengthening of Operation and Management of Water Supply Facilities (around 6persons)			The Implementing Agencies:4 persons from each target state LAG:2 persons from each target state(hand pump mechanic:1person、member from hygiene section: 1pesrson)
	Advisor from UNICEF		10 days	Expert of UNICEF
Vehicle			**Quantity**	**Note**
Japanese side	Vehicle(4WD)	For Technical training for construction plan, data management and equipment management-1		
	Vehicle(4WD)	For Technical training for construction plan, data management and equipment management-2	147days	Japanese Consultant
Working room, meeting room and others			**Quantity**	**Note**
Nigerian side	Working room		5 months	
	Meeting room		5 days	LGA meeting: 3days
	others (transport if necessary)			

7 Procurement of Implementation Resources for the Soft Components Activities

The support items and methods of procurement for implementation resources for the soft components in the Project are indicated as below.

Table 7-1 Implementation Item and Resources for Soft Components

Assistance Item	Condition of resource	Implementation Resource
1)Technical training for formulation of borehole construction plan, data management, equipment maintenance	Person in charge is required the knowledge on i) the hydrogeology of the target of 5 states, ii) the capability of the target group and iii) the contents of the procured equipments. **<Well drilling plan>** Formulation of borehole constriction plan is required for effective drilling. For this plan, person in charge needs knowledge and experience on i) selection of borehole drilling point and drilling technique, ii) borehole construction management and iii) technique on pumping test. **<Data management>** The person in charge needs the knowledge on the i) hydrogeology, ii) content of borehole inventory and iii) structure of data-base. **<Equipments maintenance plan>** Person in charge needs the knowledge on i) the specification and basic structure and ii) maintenance and repair method of drilling rigs. **<Facilitator>** Person in charge needs skill for managing meeting and capability of communication to educate the target group.	It is difficult to find out the local resource that can satisfy the requirement. Therefore, Japanese consultants will perform direct support for Nigerian side. The local consultants will take one part of the activities because the required activities cover wide filed of the support.
2)Technical training for strengthening of O&M system for water supply facilities	The person in charge needs understanding of problem in operation and maintenance of water supply facilities in the 5 target states and following knowledge and technology. **<Strengthening of supporting system>** Person in charge needs knowledge on organization, function and capability of the Implementing Agency to find out their problem to be improved. Moreover, the person needs to know demarcation of responsibility among the Implementing Agency, local government and communities in rural water supply project. **<Establishment of WASCOM and educational activities >** The person in charge needs full knowledge on the organization and role of the WASHCOM to find their problem and method to improve it. The person needs knowledge and experience on implementation of i) maintenance of water supply facilities, ii) water charge collection and its management, iii) water quality management and iv) monitoring method. **<Facilitator>** Person in charge needs skill for managing meeting and capability of communication to educate the target group.	It is difficult to find out the local resources that can satisfy the requirement. Therefore, Japanese consultant s will perform direct support for Nigerian side. The UNICEF expert with enough experience will take one part of the activities because the required activities cover wide filed of the support.

1) The Japanese consultant and local consultant will implement the technical training for formulation of borehole construction plan, data management and equipment maintenance for the staff of the Implementing Agencies. The target group is staff of the drilling section and hydrogeological section of Water Supply Department and Workshop Department. Main contents of technical training are, i) formulation of borehole construction plan, ii) data management and iii) equipment maintenance, with purpose of promoting effective construction work using the equipment and materials procured by the Project. Part of training will be implemented by the local consultants.

2) The Japanese consultant and local consultant will implement training for strengthening of operation and maintenance system for water supply facilities to the staff of the Implementing Agencies who has responsibility for community mobilization and education. Main contents of the training are i) strengthening of operation and maintenance system of water supply facilities, ii) strengthening of cooperation between the Implementing Agencies and LGs, and iii) establishment of community organization (WASHCOM) and implementation of educational activates for communities.

8 Soft Components Implementation Process

The soft components will be implemented before the commencement of borehole construction. The assistance will be conducted in the areas of i) technical training for formulation of borehole construction plan, data management and equipment maintenance, and ii) strengthening of operation and maintenance system for water supply facilities. The soft components will be implemented avoiding Ramadan period, so that most staff of the Implementing Agencies can participate in the soft components. Implementation schedule of the soft components is shown in Table 8-1.

It is planned to start the soft components from nine months after the conclusion of the consultant agreement and continue activities of the soft components for around seven months. The degree of achievement of the overall soft components outputs will be evaluated at the end, which will take half a month. This activity will start approximately two months after completion of the soft components activities. When implementing the soft components, local consultants shall be utilized, and the most rational training method shall be adopted with a view to minimizing involvement of Japanese engineers.

Table 8-1 shows the implementation schedule of the soft components.

Table 8-1 Content of Soft Component and Implementation Schedule

	Content	Consultant	Period to start	Duration of activities (month)	
				In Japan	In Nigeria
①	Technical training for formulation of borehole construction plan, data management, equipment management	Consultant-1	9 months after Conclusion of Consultant agreement	0.23	3.93
		Consultant-2		0.23	2.70
②	Technical training for strengthening of O&M system for water supply facilities	Consultant-3		0.23	3.13
		Consultant-4		0.23	2.16
③	Confirmation of achievement	Consultant-1	2 months after completion of activities of the soft component	-	0.93

Soft Components Implementation Schedule is shown in Table 8-2.

Table 8- 2 Soft Components Implementation Schedule

Japanese consultants (Japan)
Japanese consultant (Nigeria)
( )Working days

Activity	Expert	1	2	3	4	5	6	Traveling	Japanese consultants Nigeria	Japanese consultants Japan	
①Formulation of borehole construction plan, data management and equipment maintenance	Japanese consultant -1	Text compiling (7days)								7	
		Traveling (Tokyo -Abuja, meeting with FMWR) (3days)						1	3		
		Formulation of borehole construction plan, data management and equipment maintenance (Enug) (35days)							35		
			Report compiling (2days)						2		
			Formulation of borehole construction plan, data management and equipment maintenance (Ondo) (35days)						35		
				Report compiling (2days)					2		
				Formulation of borehole construction plan, data management and equipment maintenance (Taraba) (35days)					35		
					Report compiling (2days)				2		
					Traveling (Taraba-Abuja, meeting with FMWR, Abuja－Tokyo) (4 days)				4		
	Japanese consultant -2	Text compiling (7days)								7	
		Traveling (Tokyo -Abuja, meeting with FMWR) (3days)						1	3		
		Formulation of borehole construction plan, data management and equipment maintenance (Kebbi) (35days)							35		
			Traveling (Tokyo -Abuja, meeting with FMWR) (3days)						2		
			Formulation of borehole construction plan, data management and equipment maintenance (Niger) (35days)						35		
				Report compiling (2days)					2		
				Traveling (Niger-Abuja, meeting with FMWR, Abuja－Tokyo) (4 days)					4		
								2	**199**	**14**	Total
②Operation and maintenance of water supply facilities	Japanese consultant -3	Text compiling (7days)								7	
		Traveling (Tokyo -Abuja, meeting with FMWR) (3days)						1	3		
		Operation and maintenance of water supply facilities (Enug)(27 days)							27		
			Report compiling (2days)						2		
			Operation and maintenance of water supply facilities (Ondo)(27 days)						27		
				Report compiling (2days)					2		
				Operation and maintenance of water supply facilities (Taraba)(27 days)					27		
					Report compiling (2days)				2		
					Traveling (Taraba-Abuja, meeting with FMWR, Abuja－Tokyo) (4 days)				4		
	Japanese consultant -4	Text compiling (7days)								7	
		Traveling (Tokyo -Abuja, meeting with FMWR) (3days)						1	3		
		Operation and maintenance of water supply facilities (Kebbi)(27 days)							27		
			Report compiling (2days)						2		
			Operation and maintenance of water supply facilities (Niger)(27 days)						27		
				Report compiling (2days)					2		
				Traveling Niger-Abuja, meeting with FMWR, Abuja－Tokyo) (4 days)					4		
								2	**159**	**14**	Total
Evaluation of activities	Japanese consultant -1				Traveling (Tokyo -Abuja, meeting with FMWR/JICA/NWRI) (4days)			1	4		
						Evaluation of activities (20 days)			20		
					Traveling (Niger-Abuja, meeting with FMWR, Abuja－Tokyo) (4 days)				4		
								1	**28**		Total
								5	**386**	**28**	Grand total

9 Output of Activities

Table 9-1 shows result and output of activities of soft component

Table 9-1 Result and Output of Activities of Soft Component

Item	Activity	Result	Output and Compiled document	
			Nigerian side	Japanese side
① Formulation of borehole construction plan/ data management/ equipment maintenance	a) Formulation of borehole construction plan b) Management of borehole data c) Equipment maintenance	a) Borehole structure will be designed suitable for geological condition. b) Borehole construction plan will be formulated to shorten construction period c) Borehole inventory will be constructed d) Plan for equipment maintenance will be formulated including plan to introduce workshop equipment.	・Drawing of borehole structure ・Manual for borehole construction /Borehole construction plan ・Manual for safety management /Safety management plan ・Manual for borehole inventory/format of borehole inventory ・Manual for equipment maintenance/ Equipment maintenance plan	・Test（Activity plan, materials and etc.） ・Final Report ・Completion Report to JICA
② Strengthening of operation and maintenance system of rural water supply facilities	a) Improvement of supporting system for operation and maintenance of water supply facilities b) Strengthening of cooperation between RUWASSA and LGA c) Organising WASHCOM and education for communities	a) Activities for operation and maintenance of water supply will be made clear, and coordination for above activities will be strengthened. b) Management rule to support WAHCOM will be complied by the Implementing Agency and LGs, and demarcation of duty for support will be made clear. c) WASHCOM will be established in a model community, and staff of the Implementing Agency will learn know-how to organize community and educate them. d) O&M manual for water supply facilities will be compiled, and method to monitor O&M will be prepared.	・Management rules on water supply facilities ・Member list of WASHCOM and rule of WASHCOM ・Records on hygiene education and other educational activities. ・Manual for hand pump repair	・Test（Activity plan, materials and etc.） ・Final Report ・Completion Report to JICA

The Completion Report will be compiled and submitted to JICA with other documents after evaluation of the output and the achievement of activities of the soft component. The evaluation will be carried out after completion of activities for 1) formulation of borehole construction plan, data management and equipment maintenance, ii) strengthening of operation and maintenance system of water supply facilities.

10 Rough Cost Estimate of Implementation of Soft Component

Rough cost estimate of soft component is ¥41 million.

11 Obligation of Nigerian Side

For the achievement of soft component goal, it is continuously required that the staff of the target 5 states, who received training through the soft component, will apply the result of the training into their daily works. The Nigerian side is requested to perform responsibilities below for smooth implementation of the soft component.

(1) Common matter

- Before the commencement of the soft component activity, the Implementing Agency will select staff that will receive training to establish trainee team as target group based on the soft component plan.
- The Implementing Agency will adjust working duties of the target group to make them concentrate on the soft component activities during the soft component period.
- The Implementing Agency will prepare the hall, conference room and workshop for soft component activities.
- The target group will formulate various plans and compile many manuals by their own efforts as a result of the training of the soft component activities
- The Implementing Agency will assist the target group to fulfil their responsibilities mentioned above.

(2) Strengthening of formulation of construction plan, data management and equipment maintenance

- The soft component requires effective works within short period of time because this soft component includes wide range of activities such as designing of borehole structure, formulation of construction plan, compiling of borehole inventory and formulation of equipment maintenance plan.
- The target group of the soft component should challenge the activities with strong sense of purpose preparing for the activities by reading soft component plan carefully and analysing problems to be tackled.
- The target group should analyse and arrange the existing borehole construction plan, borehole inventory and equipment maintenance plan. And they will submit above documents to the trainers of the soft component. The activity will begin dealing with these documents as starting points.
- The implementing Agency will prepare vehicles for staff in case of going to drilling sits
- A part of activities will be assigned to the local consultants. The Implementing Agency is requested to provide information to Japanese side on local consultant that can perform part of the training.

(3) Strengthening of operation and maintenance system of water supply facilities

- The Implementing Agency will select model LGA and community from the target communities of the Project before commencement of the soft component.
- The Implementing Agency will request participation to soft component activities of the model LGs and community after careful explanation on the activities.
- The Implementing Agency will prepare vehicles for staff in case of visiting model LGs and communities for implementation of site activities.
- A part of training is planed to assign UNICEF experts. The Implementing Agency is requested to provide the Japanese side the information concerning UNICEF office and their expert.

Table 11-1 shows possibility, problems and countermeasures in implementation of activities by the staff of the Implementing Agencies / LGs and residents of the communities after completion of the soft component.

Table 11-1 Possibility, Problem and Measures in implementation of Soft Component

Sustainable Activity	Possibility	Problem	Measures
Staff of the Implementing Agency will continue borehole construction work following construction plan.	Possible	・ Lack of fund ・ Retire and removal of staff ・ Sudden accident during construction work ・ Bad weather	・ The Implementing Agency will report monthly to Japanese side on progress of construction work. ・ Japanese side will request countermeasures by Nigerian side if necessary.
The staff of the implementing Agency will compile borehole inventory and will continue data management	Possible	・ Lack of fund ・ Removal of trained staff ・ Break down and robbery of computer	・ Format of borehole inventory will be proposed for easy data input and management ・ The implementing Agency will report monthly condition of data management to Japanese side. ・ Japanese side will request countermeasures by Nigerian side if necessary.
The staff of the Implementing Agency will follow the rule for management work and will continue supporting WASHCOM.	Possible	・ Lack of fund ・ Retire and removal of staff in large scale ・ Missing of documents on management rule ・ Removal of trained staff	・ The Implementing Agency will report regularly their activities to Japanese side. ・ Japanese side will request countermeasures by Nigerian side if necessary.
The staff of the Implementing Agency and LG Unit will collaborate in continuous support of WASHCOM and educational activities	Possible	・ Lack of fund ・ Retire and removal of staff in large scale ・ Non cooperation from LG Unit ・ Communities refusal for support	・ The Implementing Agency will report regularly their activities to Japanese side. ・ The State Government will request cooperation of LGs if necessary. ・ Japanese side will request countermeasures by Nigerian side if necessary.
Member of WASHCOM established in each community will continue operation and maintenance of water supply facilities	Possible	・ The Implementing Agency and LGs do not support communities. ・ Communities can not understand content of activities for waters supply and hygiene project ・ WASHCOM is broken up ・ Resident of communities do not pay cost for operation and maintenance of water supply facilities	・ LGs will implement monitoring activities and will report monthly to the Implementing Agency. ・ The implementing Agency LGs and community will have meeting to resolve the problems.

Appendices 6 (1) Result of Field Survey of Existing Wells

Table (1) Survey Result

No.	State	Date	Well No.	L.G.A.	Community	Area Geology	Easting	Northing	Year	Provider	Type	Casing	Equipmwnt	Diameter	Total Depth (m)	S.W.L (GL-m)	Temp. (℃)	pH	E.C. (mS/m)	$D.O_2$ (mg/l)	Turbidty (NTU)	Appea-rance	Mn (mg/l)	Fe (mg/l)	N (mg/l)	NH_4 (mg/l)	F (mg/l)	Coli-forms
1	Kebbi	2010/8/12	Kebbi-01	Danko Wasagu	Wasagu	Basement	E 5° 30' 0.2"	N 11° 23' 24.1"	1980	Community	Dug Well	Concrete	Draw	1.5m	12.00	2.00	27.0	7.1	46.8	3.2	16	Cloudy	0.0	0.0	50	0.2	0.0	Y (10)
2	Kebbi	2010/8/12	Kebbi-02	Danko Wasagu	Wasagu	Basement	E 5° 30' 8.3"	N 11° 23' 29.5"	1995	UNISEF	Drilled Well		Hand Pomp	4inch	37.00	1.30	24.5	7.3	28.0	2.9	2	Clean	0.0	0.0	30	0.0	0.0	Y (3)
3	Kebbi	2010/8/13	Kebbi-03	Arewa Dandi	Amagoro	Tertiary	E 3° 53' 39.2"	N 12° 40' 57.4"	1984	Community	Dug Well	Nothing	Draw	1.2m	20.00	18.00	28.0	5.9	5.6	4.4	56	Cloudy	0.0	0.2	15	0.3	0.0	Y (8)
4	Kebbi	2010/8/13	Kebbi-04	Arewa Dandi	Tago	Tertiary	E 4° 13' 47.4"	N 12° 44' 40.2"	1977	Community	Dug Well	Nothing	Draw	1.2m	20.00	22.00	30.0	5.7	5.4	3.3	13	Cloudy	0.0	0.0	3	0.3	0.0	Y (18)
5	Kebbi	2010/8/14	Kebbi-05	Bagudo	Sakejiki	Cretaceous	E 4° 11' 17.6"	N 11° 22' 52.1"	1985	Community	Dug Well	Concrete	Draw	1.2m	3.40	4.00	27.1	6.9	23.5	4.1	175	Dirty	0.0	0.3	2	0.2	0.0	Y (13)
6	Kebbi	2010/8/14	-	Bagudo	Sakejiki	Cretaceous	E 4° 11' 12.6"	N 11° 22' 53.6"	2009	SMWR	Drilled Well	PVC	-	4inch	12.00	-	-	-	-	-	-	-	-	-	-	-	-	-
7	Kebbi	2010/8/14	Kebbi-06	Bagudo	Sakejiki	Cretaceous	E 4° 11' 14.2"	N 11° 22' 50.3"	1986	LGA	Dug Well	Concrete	Draw	1.4m	3.75	3.68	28.2	7.2	27.2	3.5	2	Clean	0.0	0.0	45	0.5	0.0	Y (15)
8	Kebbi	2010/8/14	Kebbi-07	Bagudo	Sabo Gondani	Cretaceous	E 4° 9' 57.9"	N 11° 20' 5.6"	1998	LGA	Dug Well	Nothing	Draw	1.0m	8.80	7.85	31.5	5.4	9.1	4.0	21	Clean	0.0	0.2	20	0.2	0.0	Y (13)
9	Kebbi	2010/8/14	Kebbi-08	Bagudo	Gondane	Cretaceous	E 4° 9' 36.7"	N 11° 19' 53.8"	2000	FMWR	Drilled Well	-	Hand Pump	6inch	57.00	4.00	29.5	5.9	11.9	1.7	0	Clean	0.0	0.0	45	0.5	0.2	Y (3)
10	Kebbi	2010/8/14	Kebbi-09	Bagudo	Gondane	Cretaceous	E 4° 9' 33.7"	N 11° 19' 55.5"	1998	LGA	Dug Well	Concrete	Draw	1.3m	5.70	3.65	30.8	6.8	95.5	1.9	47	Cloudy, Dirty	0.0	0.2	50	0.5	0.2	Y (15)
11	Kebbi	2010/8/14	Kebbi-10	Bagudo	Nasaraw a	Cretaceous	E 4° 15' 4.8"	N 11° 24' 50.1"	2007	Community	Dug Well	Concrete	Draw	0.8m	3.00	2.20	28.5	7.2	31.7	2.7	1	Clean	0.0	0.0	20	0.5	0.0	Y (8)
12	Kebbi	2010/8/14	Kebbi-11	Bagudo	Nasaraw a	Cretaceous	E 4° 15' 6.1"	N 11° 24' 50.7"	1998	LGA	Drilled Well	PVC	Hand Pump	-	15.00	-	30.5	5.9	14.7	2.6	1	Clean	0.0	2.0	45	0.5	0.6	N (0)
13	Kebbi	2010/8/14	-	Bagudo	Nasara	Cretaceous	E 4° 15' 5.6"	N 11° 24' 47.5"	2001	FMWR	Drilled Well	-	Moter Pump	6inch	48.00	-	-	-	-	-	-	-	-	-	-	-	-	-
14	Kebbi	2010/8/14	Kebbi-12	Bunza	Garadi	Tertiary	E 4° 3' 24.4"	N 12° 5' 24.4"	1970	LGA	Dug Well	Nothing	Draw	1.5m	5.15	4.56	30.2	6.9	56.9	3.3	2	Clean	0.0	0.0	45	0.5	0.0	Y (11)
15	Kebbi	2010/8/14	Kebbi-13	Bunza	Garadi	Tertiary	E 4° 3' 25.5"	N 12° 5' 27.9"	1984	VNDP	Drilled Well	PVC	Hand Pump	4inch	72.00	-	30.9	7.2	103.3	2.1	1	Clean	0.0	0.2	0	0.5	1.5	N (0)
16	Kebbi	2010/8/14	-	Bunza	Garadi	Tertiary	E 4° 3' 19.5"	N 12° 5' 34.1"	2008	SMWR	Drilled Well	-	Solar Power	6inch	64.00	12.00	-	-	-	-	-	-	-	-	-	-	-	-
17	Niger	2010/8/17	Niger-1	Paikoko	Baindai Kwata	Basement	E 6° 51' 53.2"	N 9° 24' 4.6"	-	-	pit	-	Draw	1.5m	1.00	0.00	31.8	6.5	5.5	4.9	42	Dirty	0.0	0.0	10	0.5	0.2	Y (4)
18	Niger	2010/8/17	Niger-2	Paikoko	Baindai Kwata	Basement	E 6° 53' 21.5"	N 9° 24' 0"	1992	UNISEF	Drilled Well	PVC	Hand Pump	4inch	30.00	-	29.3	7.0	83.9	2.9	10	Clean	0.0	0.5	50	0.2	0.2	N (0)
19	Niger	2010/8/17	Niger-3	Paikoko	Bussi	Basement	E 6° 39' 36.5"	N 9° 28' 28.4"	-	-	stream	-	Draw	(wide: 5m)	(dep: 0.2m)	0.50	30.3	6.5	6.9	4.7	35	Cloudy	0.5	0.2	1	0.2	0.4	Y (5)
20	Niger	2010/8/17	Niger-4	Paikoko	Bussi	Basement	E 6° 39' 11.7"	N 9° 28' 1.8"	-	-	stream	-	Draw	(wide: 5m)	(dep: 0.2m)	0.50	30.2	6.0	4.8	4.9	33	Cloudy	0.5	0.2	2	0.2	0.4	Y (9)
21	Niger	2010/8/18	Niger-5	Katcha	Edotsu Baaeggi	Cretaceous	E 6° 9' 22.2"	N 9° 3' 14.3"	1967	LGA	Dug Well	Block	Draw	1.2m	16.95	7.00	30.3	4.9	88.5	4.6	8	Clean	0.0	0.2	50	0.2	0.0	Y (15)
22	Niger	2010/8/18	Niger-6	Katcha	Edotsu Baaeggi	Cretaceous	E 6° 9' 21.6"	N 9° 3' 12.8"	-	Community	Dug Well	Nothing	Draw	0.8m	10.30	7.00	31.0	5.3	11.3	3.7	35	Dirty	0.0	0.2	20	0.2	0.4	Y (17)
23	Niger	2010/8/18	-	Katcha	Fuyaka	Cretaceous	E 6° 18' 32.2"	N 8° 50' 50.3"	1991	State	Drilled Well	PVC	Hand Pump	4inch	40.0	-	-	-	-	-	-	-	-	-	-	-	-	-
24	Niger	2010/8/18	-	Katcha	Fuyaka	Cretaceous	E 6° 18' 32.0"	N 8° 50' 50.0"	1994	State	Drilled Well	PVC	Hand Pump	4inch	30.0	-	-	-	-	-	-	-	-	-	-	-	-	-
25	Niger	2010/8/18	-	Katcha	Fuyaka	Cretaceous	E 6° 18' 37.0"	N 8° 50' 46.7"	2000	LGA	Drilled Well	PVC	Hand Pump	4inch	21.00	-	-	-	-	-	-	-	-	-	-	-	-	-
26	Niger	2010/8/18	Niger-7	Katcha	Fuyaka	Cretaceous	E 6° 18' 29.2"	N 8° 50' 37.1"	-	-	Pond	-	Draw	$10*10m^2$	2.00	2.00	33.0	6.5	9.9	8.0	49	Cloudy	0.0	2.0	1	0.5	0..4	Y (20)
27	Niger	2010/8/18	-	AGAIE	Gbogun	Cretaceous	E 6° 19' 8.9"	N 8° 51' 6.9"	1995	State	Drilled Well	PVC	Hand Pump	4inch	36.00	-	-	-	-	-	-	-	-	-	-	-	-	-
28	Niger	2010/8/18	-	AGAIE	Gbogun	Cretaceous	E 6° 19' 9.0"	N 8° 51' 6.6"	1965	State	Dug Well	Block	Draw	1.3m	6.30	7.30	-	-	-	-	-	-	-	-	-	-	-	-
29	Niger	2010/8/18	Niger-8	AGAIE	Fuyaka	Cretaceous	E 6° 19' 58.1"	N 8° 51' 45.5"	2010	State	Drilled Well	PVC	Hand Pump	4inch	30.00	-	32.3	7.0	26.7	1.8	16	Cloudy	0.0	0.0	50	10.0	0.8	Y (6)
30	Niger	2010/8/18	-	AGAIE	Agaie	Cretaceous	E 6° 18' 39.4"	N 9° 0' 29.3"	-	Private	Drilled Well	PVC	Hand Pump	4inch	35.00	-	-	-	-	-	-	-	-	-	-	-	-	-
31	Niger	2010/8/19	Niger-9	Magama	Majanga Maginga	Cretaceous	E 5° 1' 54.4"	N 10° 20' 36.6"	1980	Private	Dug Well	Nothing	Draw	0.8m	10.40	4.00	31.4	4.9	3.9	2.3	0	Clean	0.0	0.2	20	0.2	0.0	Y (1)
32	Niger	2010/8/19	Niger-10	Magama	Maraa	Basement	E 5° 5' 50.6"	N 10° 25' 42.3"	2008	Community	Dug Well	Nothing	Draw	0.8m	8.10	1.05	29.5	5.0	8.6	2.9	25	Brownish	0.0	0.2	10	0.2	0.2	Y (6)
33	Niger	2010/8/19	Niger-11	Magama	Uccu	Basement	E 5° 7' 0.1"	N 10° 27' 40.6"	1983	UNISEF	Drilled Well	PVC	Hand Pump	4inch	24.00	-	30.8	6.6	22.5	1.6	9	Clean	0.0	0.2	0	0.2	0.2	Y (6)
34	Niger	2010/8/20	Niger-12	Bosso	Pyata	Basement	E 6° 31' 44.1"	N 9° 4' 58.8"	1980	State	Drilled Well	PVC	Hand Pump	4inch	24.00	-	27.2	5.9	7.8	2.4	11	Clean	0.0	5.0	10	0.5	0.8	N (0)
35	Niger	2010/8/20	Niger-13	Bosso	Pyata	Basement	E 6° 31' 43.7"	N 9° 41' 36.0"	2001	State	Dug Well	Block	Draw	0.8	5.43	2.74	27.9	6.4	11.4	4.1	6	Cloudy	0.0	0.2	20	0.5	0.2	Y (5)
36	Niger	2010/8/20	Niger-14	Bosso	Zhikuchi	Basement	E 6° 30' 11.3"	N 9° 4' 17.0"	1990	State	Drilled Well	PVC	Hand Pump	4inch	24.00	-	28.4	6.5	52.7	4.2	6	Clean	0.0	0.0	50	0.2	1.5	Y (1)

Table (2) Survey Result

No.	State	Date	Well No.	L.G.A.	Community	Area Geology	Easting	Northing	Year	Provider	Type	Casing	Equipmwnt	Diameter	Total Depth (m)	S.W.L (GL-m)	Temp. (℃)	pH	E.C. (mS/m)	$D.O_2$ (mg/l)	Turbidty (NTU)	Appea-rance	Mn (mg/l)	Fe (mg/l)	N (mg/l)	NH_4 (mg/l)	F (mg/l)	Coli-forms
37	Niger	2010/8/20	Niger-15	Bosso	Gbaiko	Basement	E 6° 30' 9.6"	N 9° 38' 27.2"	1999	Community	Dug Well	Concrete	Draw	1.25	9.20	7.15	28.9	7.3	43.8	4.6	94	Cloudy	0.0	0.2	20	1.0	0.4	N (0)
38	Niger	2010/8/20	Niger-16	Bosso	Zhikuchi	Basement	E 6° 28' 47.9"	N 9° 34' 16.1"	2005	Personal	Drilled Well	PVC	Hand Pump	4inch	21.00	-	30.0	5.6	36.3	3.4	4	Clean	0.0	0.2	50	0.2	0.0	Y (1)
39	Taraba	2010/8/23	Taraba-01	Zing	Jagampo	Basement	E 11° 46' 27.5"	N 9° 1' 39.6"	-	-	Pond	-	Draw	4*5m	1.0	0.50	31.9	6.1	3.3	5.4	240	Dirty	0.0	1.0	0	0.5	0.0	Y (8)
40	Taraba	2010/8/23	Taraba-02	Zing	Gwangwang	Basement	E 11° 48' 46.4"	N 8° 58' 14.6"	1983	Community	Dug Well	Concrete	Draw	1.3m	3.9	0.90	27.3	7.0	10.6	4.1	469	Dirty	0.0	0.2	5	0.5	0.2	Y (10)
41	Taraba	2010/8/23	Taraba-03	Jalingo	Mile-Six	Basement	E 11° 23' 3.3"	N 8° 57' 16.4"	1997	State	Drilled Well	PVC	Hand Pump	4inch	30.0	3.00	30.1	6.6	36.5	2.9	2	Clean	0.0	0.0	20	1.0	8.0	Y (4)
42	Taraba	2010/8/23	Taraba-04	Jalingo	Ung Tado	Basement	E 11° 20' 4.5"	N 8° 55' 46.1"	2008	MDG	Drilled Well	PVC	Hand Pump	4inch	24.0	2.50	29.0	5.3	25.3	2.8	5	Clean	0.0	0.5	50	0.5	0.8	Y (1)
43	Taraba	2010/8/24	Taraba-05	Lau	Mishili	Sed./Base.	E 11° 38' 21.8"	N 9° 12' 14.1"	2005	LGA	Drilled Well	PVC	Hand Pump	4inch	24.0	3.00	29.5	6.9	35.0	2.8	27	Cloudy/Brown	0.0	0.5	50	0.2	1.0	Y (4)
44	Taraba	2010/8/24	-	Lau	Mishili	Sed./Base.	E 11° 38' 32.6"	N 9° 12' 7.5"	1998	FMWR	Drilled Well	PVC	Hand Pump	4inch	18.0	-	-	-	-	-	-	-	-	-	-	-	-	-
45	Taraba	2010/8/24	-	Lau	Mishili	Sed./Base.	E 11° 38' 35.1"	N 9° 12' 9.8"	1996	FMWR	Drilled Well	PVC	Moter Pump	6inch	-	(No Water)	-	-	-	-	-	-	-	-	-	-	-	-
46	Taraba	2010/8/24	Taraba-06	Lau	Wuro Miiinyaw	Sed./Base.	E 11° 28' 21.7"	N 9° 8' 39.6"	1993	Individual	Dug Well	Concrete	Draw	1.1m	4.31	3.45	28.7	6.3	22.7	3.8	5	Cloudy	0.0	0.0	20	0.5	0.2	Y (1)
47	Taraba	2010/8/24	Taraba-07	Lau	Yusa Vil.	Sedimentary	E 11° 28' 33.6"	N 9° 9' 52.2"	2008	MDG	Drilled Well	PVC	Hand Pump	4inch	30.0	3.00	30.0	6.2	21.3	2.5	6	Clean	0.0	0.0	5	0.5	0.0	Y (3)
48	Taraba	2010/8/24	Taraba-08	Lau	Yusa Vil.	Sedimentary	E 11° 28' 32.9"	N 9° 10' 36.4"	2002	FMWR	Drilled Well	PVC	Hand Pump	4inch	30.0	3.00	30.1	6.2	27.4	1.4	8	Clean	0.0	0.0	5	0.5	0.5	Y (8)
49	Taraba	2010/8/24	Taraba-09	Lau	Jim Luri	Basement	E 11° 26' 29.2"	N 9° 4' 10.1"	2006	UNISEF	Drilled Well	PVC	Hand Pump	4inch	30.00	2.50	30.5	6.6	40.6	2.0	0	Clean	0.0	0.0	2	0.2	1.0	Y (9)
50	Taraba	2010/8/25	Taraba-10	Gassol	Garin Abba	Cretaceous	E 10° 53' 45.5"	N 8° 43' 52.2"	2001	Individual	Dug Well	PVC	Draw	0.65m	6.50	0.70	28.7	5.7	19.6	4.6	0	Clean	0.0	0.0	50	0.5	0.0	Y (4)
51	Taraba	2010/8/25	Taraba-11	Gassol	LGA Office	Cretaceous	E 10° 47' 1.9"	N 8° 38' 47.9"	1998	LGA	Drilled Well	PVC	Hand Pump	4inch	45.00	-	30.7	5.2	4.3	3.1	1	Clean	0.0	0.0	0	0.2	0.0	Y (5)
52	Taraba	2010/8/25	Taraba-12	Gassol	Chull	Cretaceous	E 10° 45' 33.3"	N 8° 31' 27.5"	1981	Community	Dug Well	-	Draw	1m	10.23	8.57	29.6	6.5	65.7	2.1	2	Slightly-Cloudy	0.0	0.0	50	0.2	0.0	Y (23)
53	Taraba	2010/8/25	Taraba-13	Wucari	Mahanga	Cretaceous	E 10° 9' 23.9"	N 8° 10' 46.3"	2006	FMWR	Drilled Well	PVC	Hand Pump	4inch	18.00	3.00	31.4	6.7	56.9	1.6	89	Yellowish	0.0	15.0	0	0.2	0.8	Y (2)
54	Taraba	2010/8/25	Taraba-14	Gassol	Mahanga	Cretaceous	E 10° 9' 24.2"	N 8° 10' 46.1"	1980	State	Dug Well	Concrete	Draw	1.2m	13.58	5.05	30.1	5.8	54.8	2.5	6	Clean	0.0	0.0	50	0.2	0.0	Y (29)
55	Taraba	2010/8/25	Taraba-15	Wucari	Gidan Idi	Cretaceous	E 9° 57' 42.7"	N 7° 59' 17.0"	2009	MDG	Drilled Well	PVC	Hand Pump	4inch	30.00	3.00	30.3	6.1	24.9	2.3	5	Clean	0.0	0.2	20	0.2	0.0	Y (4)
56	Taraba	2010/8/25	Taraba-16	Wucari	Gidan Idi	Cretaceous	E 9° 57' 42.1"	N 7° 59' 17.5"	1983	LGA	Dug Well	Concrete	Draw	1.2m	10.00	7.30	29.3	6.3	68.9	2.9	4	Clean	0.0	0.0	50	0.5	0.0	Y (28)
57	Taraba	2010/8/25	-	Wucari	Gidan Idi	Cretaceous	E 9° 57' 41.2"	N 7° 59' 16.9"	2007	FMWR	Drilled Well	PVC	Solar Motor P.	6inch	42.0	3.00	-	-	-	-	-	-	-	-	-	-	-	-
58	Taraba	2010/8/25	-	Wucari	Gidan Idi	Cretaceous	E 9° 57' 39.3"	N 7° 59' 4.3"	2007	World Bank	Drilled Well	PVC	Motor Pump	6inch	30.0	2.50	-	-	-	-	-	-	-	-	-	-	-	-
59	Taraba	2010/8/26	Taraba-17	Bali	Mayo Kam	Basement	E 11° 3' 4.0"	N 8° 14' 25.7"	2007	MDG	Drilled Well	PVC	Hand Pump	4inch	24.00	3.80	28.9	6.0	49.8	2.0	3	Clean	0.0	2.0	5	0.2	1.5	Y (15)
60	Taraba	2010/8/26	Taraba-18	Bali	Mayo Kam	Basement	E 11° 3' 4.0"	N 8° 14' 20.6"	1979	State	Dug Well	Concrete	Draw	1.25m	7.65	4.24	28.4	5.8	30.0	3.1	22	Yellowish	0.0	0.0	45	0.5	0.2	Y (23)
61	Taraba	2010/8/26	Taraba-19	Bali	Mayo Kam	Basement	E 11° 3' 5.8"	N 8° 14' 57.9"	1983	FMWR	Drilled Well	PVC	Hand Pump	4inch (in 6inch)	51.00	2.00	29.2	6.7	80.2	1.9	6	Clean	0.0	0.0	50	0.2	1.5	N (0)
62	Taraba	2010/8/26	Taraba-20	Bali	Jatou	Basement	E 10° 39' 12.0"	N 7° 54' 15.4"	2003	LGA	Drilled Well	PVC	Hand Pump	4inch	30.00	2.00	29.6	6.3	62.2	2.0	8	Clean	0.0	5.0	50	0.5	0.8	Y (17)
63	Taraba	2010/8/26	Taraba-21	Bali	Jatou	Basement	E 10° 39' 11.7"	N 7° 54' 11.6"	1980	Individual	Dug Well	Blocks	Draw	0.6m	5.34	2.15	28.5	6.7	74.1	2.2	4	Clean	0.0	0.0	45	0.2	0.2	Y (14)
64	Taraba	2010/8/26	-	Bali	Jatou	Basement	E 10° 39' 11.6"	N 7° 54' 24.7"	2008	State	Drilled Well	PVC	Motor Pump	6inch	30.00	1.80	-	-	-	-	-	-	-	-	-	-	-	-
65	Taraba	2010/8/26	Taraba-22	Gashaka	Gayam	Basement	E 11° 13' 47.8"	N 7° 48' 7.3"	1980	State	Drilled Well	PVC	Hand Pump	4inch (in 6inch)	24.00	2.50	29.7	5.7	15.4	2.7	8	Clean	0.0	0.0	10	1.0	0.8	Y (1)
66	Taraba	2010/8/26	Taraba-23	Gashaka	Jantari	Basement	E 11° 22' 13.1"	N 7° 48' 8.7"	2008	State	Drilled Well	PVC	Solar Motor P.	5inch	27.00	3.00	28.9	5.9	12.5	3.5	5	Clean	0.0	0.0	5	0.2	0.8	Y (22)
67	Taraba	2010/8/26	Taraba-24	Gashaka	Jantari	Basement	E 11° 22' 8.3"	N 7° 48' 7.3"	1978	State	Dug Well	Concrete	Draw	1.2m	8.55	7.92	28.4	5.1	5.9	2.8	10	Clean	0.0	0.0	10	0.0	0.0	Y (10)
68	Enugu	2010/8/30	Enugu-01	Nkanu-East	Ihuokpara	Cretaceous	E 7° 39' 25.5"	N 6° 18' 23.7"	1993	Personal	Dug Well	Nothing	Draw	1m	12.50	1.00	29.1	6.1	38.8	2.1	5	Clean	0.0	0.0	50	0.2	0.0	Y (38)
69	Enugu	2010/8/30	Enugu-02	Nkanu-East	Ihuokpara	Cretaceous	E 7° 39' 20.1"	N 6° 17' 76.3"	2002	RUWASSA	Drilled Well	PVC	Hand Pump	4inch	60.00	5.00	29.3	5.8	43.5	1.5	3	Clean	0.5	1.0	0	0.2	0.0	Y (2)
70	Enugu	2010/8/30	Enugu-03	Nkanu-East	Ihuokpara	Cretaceous	E 7° 39' 17.6"	N 6° 17' 65.4"	-	-	Stream	-	Draw	wide=3m	0.2～0.5m	-	27.0	6.1	2.9	4.9	16	Cloudy	0.0	1.0	0	0.2	0.0	Y (23)
71	Enugu	2010/8/30	Enugu-04	Nkanu-East	Obodoquuru	Cretaceous	E 7° 39' 12.9"	N 6° 21' 21.5"	1972	Personal	Dug Well	Nothing	Draw	0.9m	19.87	2.30	28.7	5.1	4.0	1.9	8	Clear	0.0	0.0	1	1.0	0.0	Y (14)
72	Enugu	2010/8/30	Enugu-04	Nkanu-East	Obodoquuru	Cretaceous	E 7° 39' 12.5"	N 6° 21' 20.2"	2009?	RUWASSA	Drilled Well	PVC	Hand Pump	4inch	35.00	2.00	-	-	-	-	-	-	-	-	-	-	-	-
73	Enugu	2010/8/31	Enugu-05	Awgu	Ugboha Imama	Cretaceous	E 7° 29' 39.3"	N 6° 6' 24.1"	2004	RUWASSA	Drilled Well	PVC	Hand Pump	4inch	40.00	-	28.3	5.1	4.3	2.5	0	Clean	0.0	0.0	1	0.2	0.0	N (0)

※Colored…NG(NSDWQ)

Table (3) Survey Result

No.	State	Date	Well No.	L.G.A.	Community	Area Geology	Easting	Northing	Year	Provider	Type	Casing	Equipmwnt	Diameter	Total Depth (m)	S.W.L (GL-m)	Temp. (℃)	pH	E.C. (mS/m)	$D.O_2$ (mg/l)	Turbidty (NTU)	Appea-rance	Mn (mg/l)	Fe (mg/l)	N (mg/l)	NH_4 (mg/l)	F (mg/l)	Coli-forms
74	Enugu	2010/8/31	Enugu-06	Awgu	Imama Mgbowo	Cretaceous	E 7° 29' 31.5"	N 6° 6' 23.5"	2005	Private	Dug Well	Nothing	Draw	1.2	4.30	2.00	28.2	4.9	7.8	1.7	24.0	Cloudy	0.0	0.0	1.0	0.1	0.0	Y (12)
75	Enugu	2010/8/31	-	Awgu	Imama Mgbowo	Cretaceous	E 7° 30' 9.3"	N 6° 6' 12.6"	2004	RUWASSA	Drilled Well	PVC	Hand Pump	4inch	35.00	-	-	-	-	-	-	-	-	-	-	-	-	-
76	Enugu	2010/8/31	-	Awgu	Nvonvo Dam	Cretaceous	E 7° 28' 59.3"	N 6° 6' 1.2"	2005	FMWR	Dam	-	-	W150m×L300m	-	-	-	-	-	-	-	-	-	-	-	-	-	-
77	Enugu	2010/8/31	E-7	Awgu	Ohaja Primary	Cretaceous	E 7° 29' 23.1"	N 6° 4' 23.5"	2004	RUWASSA	Drilled Well	PVC	Hand Pump	4inch	40.00	-	29.5	5.2	3.3	1.2	33	Cloudy	0.0	2.0	0	0.2	0.8	Y (19)
78	Enugu	2010/8/31	E-8	Aninri	Mpu Amokofia	Cretaceous	E 7° 37' 52.9"	N 6° 0' 3.3"	2004	RUWASSA	Drilled Well	PVC	Hand Pump	4inch	40.00	10.00	29.1	7.0	196.0	1.9	7	Clean	0.0	0.5	0	5.0	1.0	N (0)
79	Enugu	2010/8/31	E-9	Aninri	Okomigbo Mpu	Cretaceous	E 7° 38' 16.0"	N 5° 59' 41.5"	2004	RUWASSA	Drilled Well	PVC	Hand Pump	4inch	40.00	10.00	30.0	6.5	199.0	1.4	6	Clean	0.0	2.0	0	2.0	0.0	Y (1)
80	Enugu	2010/8/31	E-10	Awgu	Amoli	Cretaceous	E 7° 25' 53.3"	N 6° 11' 22.9"	2008	Private	Dug Well	Nothing	Draw	1.2m	10.65	2.65	28.0	6.4	45.0	1.8	10	Cloudy	0.0	0.0	2	0.0	0.0	Y (1)
81	Enugu	2010/8/31	-	Awgu	Amoli	Cretaceous	E 7° 25' 52.7"	N 6° 11' 28.2"	2004	RUWASSA	Drilled Well	PVC	Hand Pump	4inch	35.00	3.00	-	-	-	-	-	-	-	-	-	-	-	-
82	Enugu	2010/9/1	E-10	Uzo-Uwani	Ogurugu	Tertiary	E 6° 56' 56.3"	N 6° 47' 11.8"	2004	RUWASSA	Drilled Well	PVC	Hand Pump	4inch	30.00	-	30.2	5.5	24.2	1.5	1	Clean	0.0	0.0	50	0.2	0.0	Y (-)
83	Enugu	2010/9/1	-	Uzo-Uwani	Ogurugu	Tertiary	E 6° 56' 50.1"	N 6° 47' 09.7"	2004	RUWASSA	Drilled Well	PVC	Hand Pump	4inch	30.00	3.00	-	-	-	-	-	-	-	-	-	-	-	-
84	Enugu	2010/9/2	-	Udi	Ebe	Cretaceous	E 7° 22' 41.4"	N 6° 29' 19.5"	1995	State	Drilled Well	Steel	Motor Pump	0.3m	215.00	-	-	-	-	-	-	-	-	-	-	-	-	-
85	Enugu	2010/9/2	Enugu-11	Udi	Umabi	Cretaceous	E 7° 22' 37.9"	N 6° 17' 22.7"	1987	State	Drilled Well	Steel	Motor Pump	0.3m	215.00	-	27.7	6.5	6.6	1.9	(147)※	(Colored)※	0.0	(10.0)※	0	0.0	0.8	N (0)
86	Enugu	2010/9/2	E-12	Enug-East	Ezza Onuogba	Cretaceous	E 7° 36' 48.3"	N 6° 29' 13.2"	2008	RUWASSA	Drilled Well	PVC	Hand Pump	4inch	35.00	-	27.9	5.3	4.1	1.1	27	Colored (Iron)	0.0	5.0	0	0.5	0.0	Y (10)
87	Ondo	2010/9/6	O-1	Akure-North	Adewole Camp	Basement	E 5° 17' 15.4"	N 7° 10' 26.2"	2000	Community	Drilled Well	PVC	Hand Pump	4inch	45.00	10.00	27.9	5.7	33.7	1.7	18	Yellowsih	0.0	5.0	50	0.5	0.8	N (0)
88	Ondo	2010/9/6	O-2	Akure-North	Imafon	Basement	E 5° 15' 27.8"	N 7° 12' 35.4"	2006	MDG	Drilled Well	PVC	Hand Pump	4inch	30.00	6.00	27.1	5.7	29.8	1.9	7	Clean	0.0	5.0	50	0.5	1.0	Y (3)
89	Ondo	2010/9/7	O-3	Ilaje	Igbokoga	Tertiary	E 4° 48' 7.4"	N 6° 21' 52.3"	2005	Personal	Dug Well	Concrete	Draw	0.8m	1.41	0.37	27.0	5.7	26.8	1.2	2	Yellowsih	0.0	2.0	0	0.5	0.0	Y (29)
90	Ondo	2010/9/7	O-4	Okitipupa	Tikolo Ilesanmi	Tertiary	E 4° 47' 3.0"	N 6° 30' 47.0"	2000	Personal	Drilled Well	PVC	Motor Pump	4inch	30.00	2.50	27.5	4.9	18.5	3.1	3	Clean	0.0	0.0	45	0.0	0.0	Y (1)
91	Ondo	2010/9/7	O-5	Irele	Irele	Tertiary	E 4° 52' 0.0"	N 6° 28' 34.2"	2004	LGA	Drilled Well	PVC	Motor Pump	4inch	70.00	7.10	26.6	4.3	4.5	3.3	5	Clean	0.0	0.0	10	0.0	0.0	Y (2)
92	Ondo	2010/9/7	O-6	Ese-Odo	Igbekebo	Tertiary	E 4° 51' 53.6"	N 6° 21' 21.9"	2000	Personal	Drilled Well	PVC	Motor Pump	6inch	70.00	6.20	26.5	4.6	1.8	3.2	6	Clean	0.0	0.0	1	0.0	0.0	Y (2)
93	Ondo	2010/9/8	O-7	Ose	Ijagba	Cretaceous	E 5° 45' 13.6"	N 6° 51' 21.1"	2005	EU	Drilled Well	PVC	Motor Pump	6inch	60.00	15.00	26.0	6.1	4.4	3.9	7	Clean	0.0	0.0	2	0.2	0.0	N (0)
94	Ondo	2010/9/8	O-8	Ose	Ijagba	Cretaceous	E 5° 45' 18.6"	N 6° 51' 38.6"	1987	FGN	Drilled Well	PVC	Hand Pump	4inch	40.00	15.20	27.8	5.4	10.0	1.8	4	Clean	0.0	10.0	0	0.2	1.5	N (0)
95	Ondo	2010/9/8	-	Ose	Ijagba	Cretaceous	E 5° 45' 38.8"	N 6° 50' 57.5"	2008	FGN	Drilled Well	PVC	Motor Pump	5inch	50.00	16.00	-	-	-	-	-	-	-	-	-	-	-	-
96	Ondo	2010/9/8	O-10	Ose	Ute	Sed./Base.	E 5° 36' 10.7"	N 6° 51' 0.7"	2007	STATE	Drilled Well	PVC	Hand Pump	4inch	40.00	10.20	29.1	5.6	45.0	3.3	7	Clean	0.0	0.0	50	0.2	0.0	Y (1)
97	Ondo	2010/9/8	-	Ose	Ute	Sed./Base.	E 5° 36' 10.7"	N 6° 51' 1.4"	2006	STATE	Drilled Well	PVC	Solor Motor P.	6inch	70.00	9.90	-	-	-	-	-	-	-	-	-	-	-	-
98	Ondo	2010/9/8	-	Ose	Ute	Sed./Base.	E 5° 36' 6.9"	N 6° 51' 16.0"	-	-	Stream	-	Draw	(wide=3~4m)	0.5m	-	26.2	6.3	3.1	2.8	2	Cloudy	0.0	1.0	1	0.0	0.0	Y (23)
99	Ondo	2010/9/9	Ondo-13	Akoko-SW	Etioro-Akoko	Basement	E 5° 43' 24.8"	N 7° 26' 22.2"	2003	STATE	Drilled Well	PVC	Hand Pump	4inch	45.00	4.00	26.8	6.0	55.1	1.4	7	Clean	0.0	0.0	45	0.2	0.4	N (0)
100	Ondo	2010/9/8	Ondo-14	Akoko-SW	Etioro-Akoko	Basement	E 5° 43' 21.9"	N 7° 26' 16.1"	2002	Personal	Dug Well	Concrete	Draw	0.8m	0.50	6.14	27.5	6.4	50.2	1.9	5	Clean	0.0	0.0	45	0.5	0.0	Y (9)
101	Ondo	2010/9/9	-	Akoko-SW	Etioro-Akoko	Basement	E 5° 43' 24.9"	N 7° 26' 29.6"	2006	STATE	Drilled Well	PVC	Solor Motor P.	4inch	70.00	1.80	-	-	-	-	-	-	-	-	-	-	-	-
102	Ondo	2010/9/9	Ondo-16	Akoko-NW	Erusu-Okega	Basement	E 5° 48' 53.0"	N 7° 35' 13.1"	2005	STATE	Drilled Well	PVC	Solor Motor P.	6inch	36.60	-	28.5	6.4	53.2	3.0	7	Clean	0.0	0.0	45	0.0	0.0	Y (0)
103	Ondo	2010/9/9	Ondo-17	Akoko-NW	Erusu-Amo	Basement	E 5° 49' 13.1"	N 7° 35' 16.4"	1996	STATE	Drilled Well	PVC	Hand Pump	4inch	30.00	-	29.0	6.4	65.9	1.3	8	Clean	0	0	45	0.2	0.8	N (0)
104	Ondo	2010/9/9	Ondo-18	Akoko-NW	Erusu-Okega	Basement	E 5° 49' 14.2"	N 7° 35' 18.6"	-	Personal	Dug Well	Block	Draw	6inch	7.84	0.51	28.0	7.0	84.8	2.8	6	Clean	0.0	0.0	50	0.2	0.8	Y (7)

※Colored…NG(NSDWQ)

Appendices 6 (2) Meteorological data

(1) Mean Monthly Rainfall of Target States

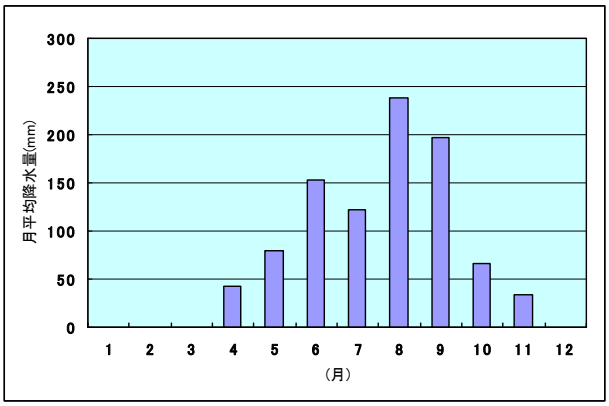


Figure 6.2-1 Mean Monthly Rainfall of Kebbi State

(Birnin Kenbbi, 2007～2009, Institute of

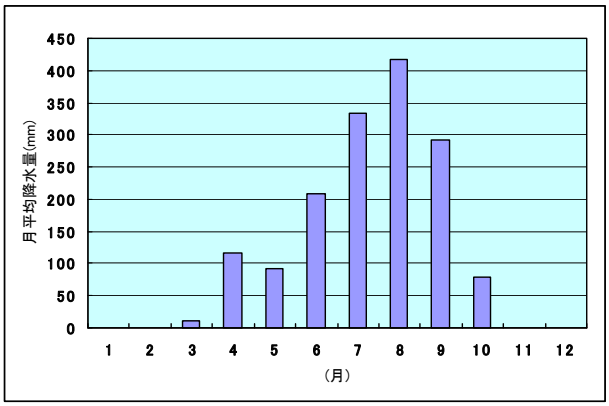


Figure 6.2-2 Mean Monthly Rainfall of Niger State

(Minna, 1999～2001, State statistics Data 2004)

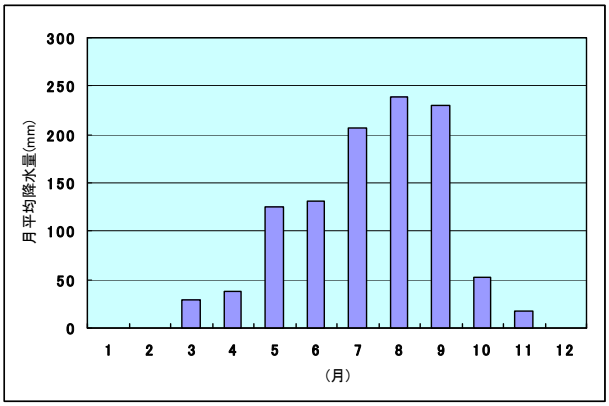


Figure 6.2-3 Mean Monthly Rainfall of Taraba State

(Gassor LGA, 2000～2008, Lower Benue River

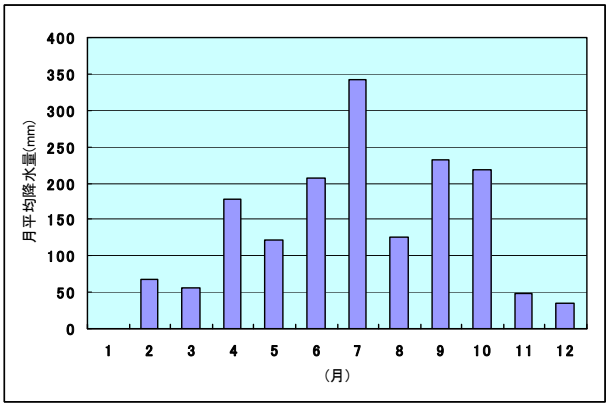


Figure 6.2--4 Mean Monthly Rainfall of Ondo State

(Akure, 2006～2009, State Ministry of

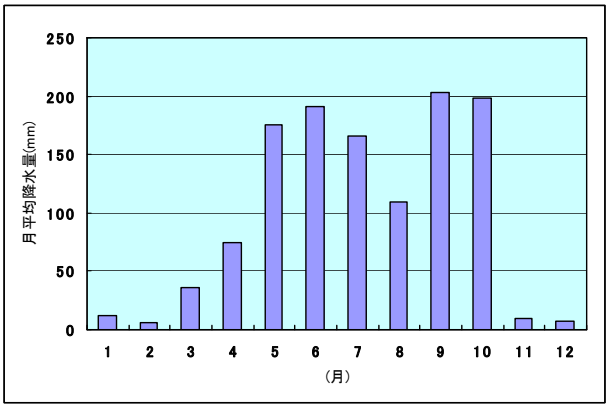


Figure 6.2-5 Mean Monthly Rainfall of Enugu State

(Enugu, 2004～2006, State statistics Data)

Appendices 6 (3) Geological Data

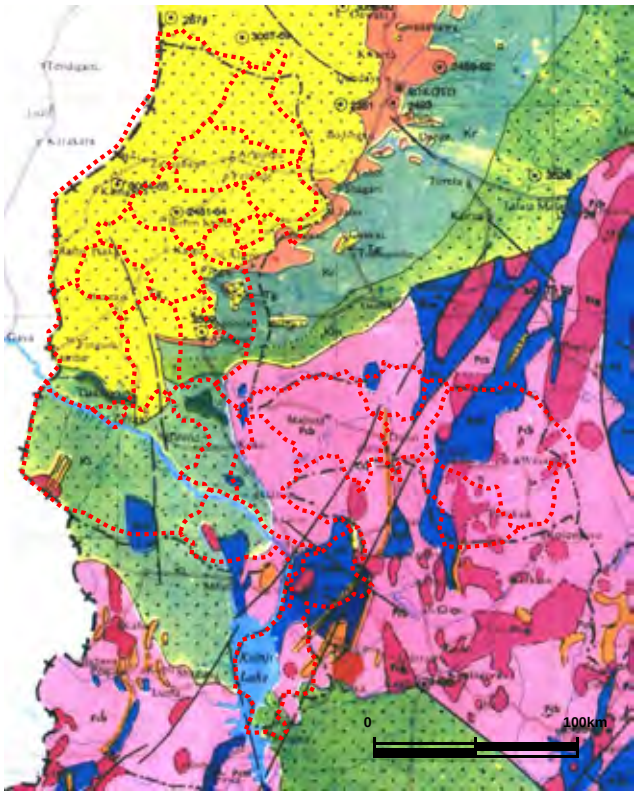


Table 6.3-1 Geological Classification in Kebbi State

Geological Age	Geological Classification	Lithological Component
Quaternary	Alluvial Deposit	Sand, Gravel, Clay, etc.
Tertiary	Gwandu Formation Sokoto Group	Clay, Sandstone (Grits), etc. Clay, Shall, etc.
Cretaceous	Rima Group Illo Formation Gundumi Formation	Sandstone, Mudstone, partly Limestone, etc. Pisolitic claystone, Sandstone (Grits), partly Pebble congromerate, etc. Claystone, Sandstone (Grits), partly Pebble congromerate, etc.
Precambrian	Basement Rock - Old Granite - Basement Complex	 Granitode Migmatite, Gneiss, Schist, etc.

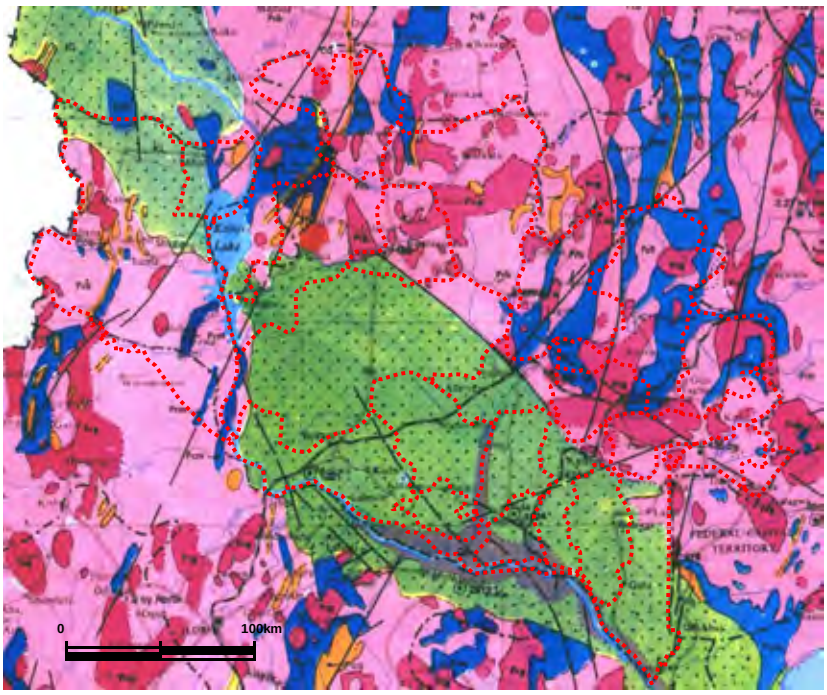


Table 6.3-2 Geological Classification in Niger State

Geological Age	Geological Classification	Lithological Component
Quaternary	Alluvial Deposit	Sand, Gravel, Clay, etc.
Cretaceous	Nupe Sandstone	Felspathic sandstone, Siltstone, etc,
Precambrian	Basement Rock - Old Granite - Basement Complex	 Granitode Migmatite, Gneiss, Schist, etc.

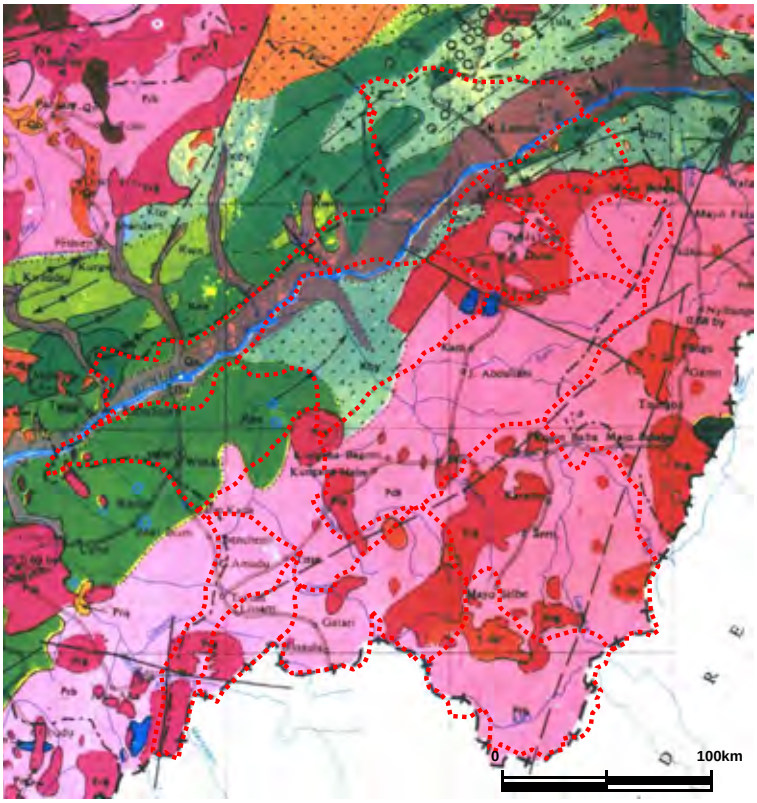
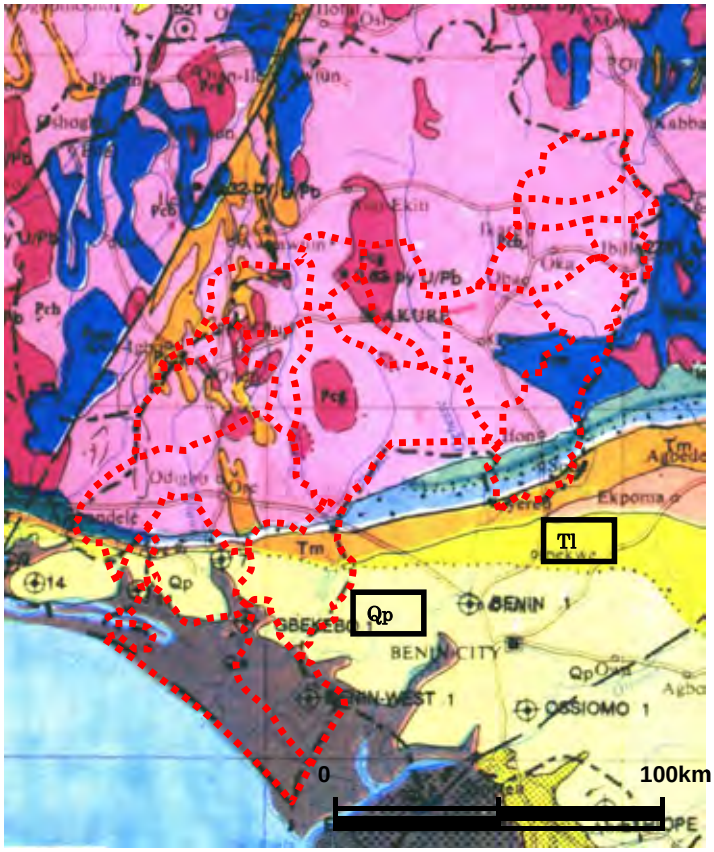


Table 6.3-3 Geological Classification in Taraba State

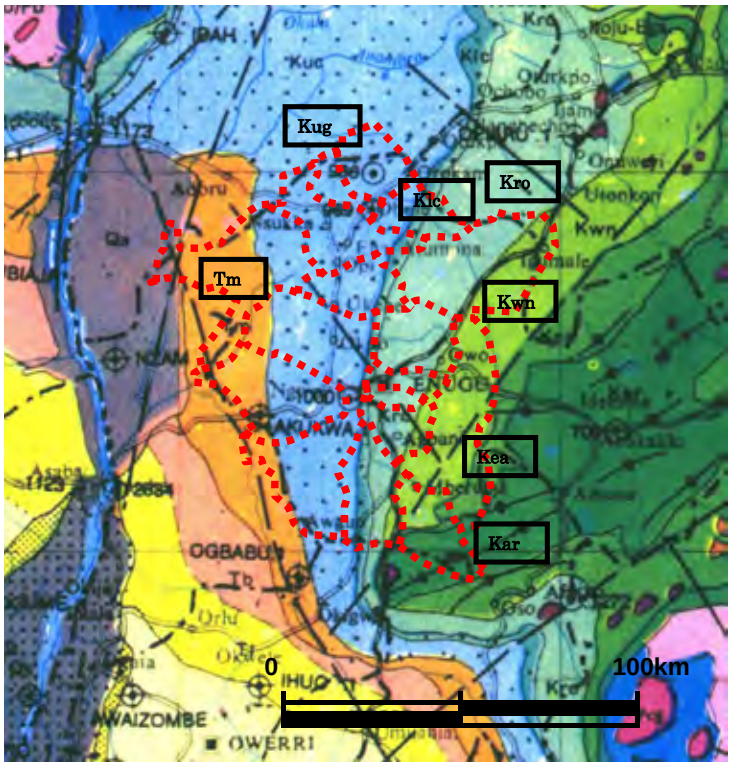
Geological Age	Geological Classification	Lithological Component
Quaternary	Alluvial Deposit	Sand, Gravel, Clay, etc.
Cretaceous	Marine Facis Ize Aku Shale Group Bima-Yola Formation	Shale, Limestone, etc. Black shale, Siltstone, etc. Felspathicsandstone, Sandy claystone, Shale, Calcareous sandstone, Marly limestone, etc.
Precambrian	Basement Rock - Old Granite - Basement Complex	 Granitode Migmatite, Gneiss, Schist, etc.



Qp; Coastal Plains Sand
Tl; Lignite Formation
Tm; Imo Clay Shale Group
Kuc; Falsebeded Sandstones & Upper Coal Measures
Kb; Abeokuta Formation
Kro; Asata Nkporo Shale Group
Bs; Basement Rocks

Table 6.3-4 Geological Classification in Ondo State

Geological Age	Geological Classification	Lithological Component
Quaternary	Alluvial Deposit Costal plain Sand Deposit	Sand, Gravel, Clay, etc. Sand, Clay, etc.
Tertiary	Lignite Formation Bende Ameki Group Imo Clay Shale Group	Clay, Sandstone, Lignite, Shale, etc. Clay, Clayey sandstone, Shale, etc. Clay, Shale, Partly limestone, etc.
Cretaceous	Falsebedded Sandstone & Upper Coal Mesures Asata Nkporo Shale Group	Falsebeded sandstone, Coal, Shale, etc. Shale, Mudstone, etc.
Precambrian	Basement Rock - Old Granite - Basement Complex	 Granitode Migmatite, Gneiss, Schist, etc.



Tm; Imo Clay Shale Group
Kuc; Falsebeded Sandstones and Upper Coal Measures
Klc; Lower Coal Measures
Kro; Asata Nkporo Shale Group
Kwn; Awgu Ndeaboh Shale Group
Kea; Eze Aku Shale Group
Kar; Asu River Group

Table 6.3-5 Geological Classification in Enugu State

Geological Age	Geological Classification	Lithological Component
Quaternary	Alluvial Deposit	Sand, Gravel, Clay, etc.
Tertiary	Imo Clay Shale Group	Clay, Shale, Partly limestone, etc.
Cretaceous	Falsebedded Sandstone & Upper Coal Measures	Falsebeded sandstone, Coal, Shale, etc.
	Lower Coal Measures	Coal, Sandstone, Shale, etc.
	Asata Nkporo Shale Group	Shale, Mudstone, etc.
	Awgu Ndeaboh Shale Group	Shale, Limestone, etc.
	Eze Aku Shale Group	Black shale, siltstone, etc.
	Asu River Group	Shale, Limestone, etc.

Appendices 7 Collected Data

State	No.	Name of data	Format of data		
			Photo	Digital	Paper
Kebbi	K-1	RUWASSA_Drilling Record	○		
Kebbi	K-2	SMWR_Water Quality Record	○		
Kebbi	K-3	Statistical Year Book 2007	○		
Niger	N-1	RUWASSA_Drilling Record	○		
Niger	N-2	WaterBoard_Report	○		
Niger	N-3	RUWASSA_WaterQuality	○		
Niger	N-4	Statistics Year Book 2004	○		
Niger	N-5	Population 2006	○		
Niger	N-6	Rainfall Data	○		
Taraba	T-1	RUWASSA_Drilling Record	○		
Taraba	T-2	RUWASSA_VES Report	○		
Taraba	T-3	RUWASSA_Water Quarity Record	○		○
Taraba	T-4	MDG_Drilling Record	○		
Taraba	T-5	Taraba Statistics Data	○		
Taraba	T-6	Ground Water Study & Development Nigeria	○		
Ondo	O-1	WATSAN_Drilling Record	○		
Ondo	O-2	WATSAN_Statistics Data		○	
Ondo	O-3	WATSAN_BOREHOLE INVENTORY		○	
Ondo	O-4	WATSAN_Geophysical Survey Report	○		
Ondo	O-5	WATSAN_Watwr Quality Record			○
Ondo	O-6	Meteorological Data	○		
Enugu	E-1	RUWASSA_Drilling Record Data Base	○		
Enugu	E-2	RUWASSA_Drilling Record	○		
Enugu	E-3	RUWASSA_Water Quality Record			○
Enugu	E-4	RUWASSA_Geophysical Survey Report	○		
Enugu	E-5	Statistical Year Book 2001-2006	○		

※1：Photo＝Data taken photo by member of the Survey Team。
※2：Digital data＝Data provided in digital format from Nigerian side（virus check completed）。
※3：Paper ＝Data provided with printed papers by Nigerian side