No.

INTERNAL DRAINAGE BASIN WATER OFFICE
MINISTRY OF WATER
THE UNITED REPUBLIC OF TANZANIA

THE STUDY ON THE GROUNDWATER RESOURCES DEVELOPMENT AND MANAGEMENT IN THE INTERNAL DRAINAGE BASIN IN THE UNITED REPUBLIC OF TANZANIA

FINAL REPORT

MAIN REPORT

FEBRUARY 2008

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

OYO INTERNATIONAL CORPORATION
KOKUSAI KOGYO CO. LTD.

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Exchange rate on Jan. 2008 is US$ 1.00 = Tanzanian Shilling Tsh 1,108.83 = Japanese Yen ¥ 114.21

PREFACE

In response to a request from the Government of the United Republic of Tanzania, the Government of Japan decided to conduct "The Study on the Groundwater Resources Development and Management in the Internal Drainage Basin in the United Republic of Tanzania" and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA selected and dispatched a study team composed of OYO International Corporation (OYO) and Kokusai Kogyo Co., Ltd., headed by Mr. Norifumi YAMAMOTO of OYO to Tanzania between September 2005 and December 2007. In addition, JICA set up an advisory committee in order to examine the study from specialist and technical points of view.

The study team held discussions with the officials concerned of the Government of the United Republic of Tanzania, and conducted field surveys in the study area. Upon returning to Japan, the team conducted further studies and prepared this final report.

I hope that this report will contribute to a promotion of further steps and to the enhancement of friendly relationship between our two countries.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of the United Republic of Tanzania for their close cooperation extended to the team.

February 2008

Ariyuki MATSUMOTO
Vice President
Japan International Cooperation Agency

THE GROUNDWATER RESOURCES DEVELOPMENT AND MANAGEMENT IN THE INTERNAL DRAINAGE BASIN IN THE UNITED REPUBLIC OF TANZANIA

February 2008

Mr. Ariyuki MATSUMOTO
Vice President
Japan International Cooperation Agency

LETTER OF TRANSMITTAL

Dear Sir,

We are pleased to submit the final report entitled "The Study on the Groundwater Development and Management in the Internal Drainage Basin in the United Republic of Tanzania". The Study Team has prepared this report in accordance with the contract between Japan International Cooperation Agency and OYO International Corporation in association with Kokusai Kogyo Co. Ltd.

The Study Team has examined the present conditions related to natural and socio-economic aspects of the Internal Drainage Basin, formulated hydrogeological map and assessed groundwater development potentiality for the future plan.

The report consists of the Summary, Main Report, Supporting Report, GIS Figure Book and Data Book. The Supporting Report includes details of the Study by study-item-wise or expert-wise approach. The Main Report is made considering a storyline of the study results. The Summary summarizes the Main Report as a whole. GIS Figure Book contains major maps which were formulated through the Study including hydrogeological map, groundwater potential evaluation maps and so on. Finally, the Data Book contains all basic data and drawings used in the Study.

All the members of the Study Team wish to express grateful acknowledgements to Japan International Cooperation Agency (JICA), Ministry of Foreign Affair, and also to Tanzanian officials and individuals for their assistance extended to the Study Team. The Study Team sincerely hopes that the results of the study will contribute to the proper development and management of groundwater resources in IDB, and that amicable relation of both countries will be promoted further by this occasion.

Yours faithfully,

Norifumi YAMAMOTO
Team Leader

EXECUTIVE SUMMARY

1. Background of the Study

The Internal Drainage Basin (hereinafter referred to as "IDB") is situated in the north-eastern part of the country. IDB is the second largest basin in Tanzania, which extends over 6 regions (Arusha, Shinyanga, Manyara, Dodoma, Singida, and Tabora) with a nominal area of 153,800km^2. The annual precipitation in almost the whole IDB ranges from 600mm to 900mm with annual evapotranspiration rate of over 2,000mm. Since it is known that the minimum annual precipitation for corn growth is 600mm, the water resources condition in IDB is considerably severe.

Moreover, there are water quality problems in IDB caused by its natural characteristics, especially the internal drainage system which leads to accumulation of inorganic salts or materials hazardous to health, such as fluoride in surface water and groundwater. In water resources development, groundwater development is an urgent issue in particular to provide adequate safe and reliable water supply under such circumstances. However, there are constraints in the planning and execution of water supply, because there is no integrated management of data and information related to the existing water supply facilities, hydrology, geomorphology, hydrogeology, water quality, socio-economy, etc.

Location Map of IDB

The Internal Drainage Basin Water Office (IDBWO) was established on 29th October 2004 to manage water resources in a comprehensive manner. However, the office has not been fully functioning due to lack of budget, equipment, human resources and so on.

2. Objectives of the Study

Under the above-mentioned circumstances, this Study was formulated and conducted in order to evaluate groundwater development potential and identify water contamination areas for planning of drinking water supply projects in IDB. Major objectives of the Study are as follows.

- To formulate hydrogeological map with necessary information for development and management plan of water resources and water supply for IDB.
- To develop the capability of counterpart personnel of Ministry of Water and other authorities concerned in the course of the Study.

3. General Description of the Study Area

3.1 Definition of IDB

The accurate boundary of IDB was redefined by analyzing data of Digital Elevation Model (DEM) by SRTM Shuttle Rader Topography Mission (SRTM). Based on the analysis, the area of Tanzanian part of IDB was found to be 143,100 km^2, which had been estimated at 153,800 km^2 previously.

3.2 Administrative Setting

Since the definition of IDB boundary is based on the hydrological condition for watershed management or river basin management, it is different from the existing administrative boundaries. IDB is covered by the parts of six regions whose related administrative organizations consist of 24 districts and 3 municipalities. Total villages and population within IDB were estimated at more than 1,650 and more than 4.5 million respectively.

3.3 Meteorology and Hydrology

The climatic type of IDB mainly belongs to “Tropical Savannah”. The season of IDB is divided into the dry season from June to October and rainy season from November to May. The average annual rainfall in most parts of IDB ranges from 600 to 900 mm/year; but the north-eastern part of IDB near the border of Kenya comes to more than 1,000 mm/year. IDB can be subdivided into nine sub-basements or sub-catchments. Almost all of the rivers in IDB are seasonal rivers which flow from December to July, but they are completely dried up as for the rest. All river water drains into lakes and swamps of varying size within IDB.

3.4 Geomorphology & Geology

Geomorphologic and geological features of IDB are closely related to “East African Rift System (EARS)”. The Eastern Rift of EARS: namely, “Gregory Rift” is running north and south, and its tectonic movement formed Lake Natron, Lake Eyasi, Lake Manyara and so on. Geology of IDB consists of three typical types of geology: i) Granitic rocks and Metamorphic rocks in Precambrian, ii) Volcanic rocks in Tertiary to Quaternary, and iii) Sediments in Neogene to Holocene distributed around Bahi Swamp and Wembere Swamp. Volcanic landforms such as Mt. Kilimanjaro and Ngorongoro Crater, which can be seen in the north-eastern part of IDB, were also built up by EARS. There are many faults caused by EARS in IDB, which are regarded as the noteworthy geological structure for groundwater exploration

3.5 Socio-economic Conditions

The socio-economic conditions in IDB can be summarized as the following according to the existing statistical data for districts in six regions.

- In IDB, which occupies 15% of the nation, there reside about 450,000 people, and 90% of them live in rural areas.
- Roughly half of the GDP in IDB is contributed by agricultural sector. The major food products

of them are maize, sorghum and rice, and the major cash crops are coffee, cotton, and cigarette.

- Rough breakdown of the livestock is: cattle (50%), goat (30%), and sheep (15%).
- The pavement ratio in IDB is 3%, which is much less than the national average of 12.2% and the electrification ratio is only 5%.
- The water supply coverage is 37.5%, which is much lower than the national average of 53.1%
- Due to lack of water resources, only 30% of the cultivated lands and irrigated areas are utilized.

The following is the result of village surveys conducted in order to understand the socio-economic conditions of the rural regions in IDB.

- The average annual household income of villages in IDB is 920,000 Tsh, and the expenditures for water and health are 5% and 3% of the income, respectively.
- For water supply, villagers prefer a traditional hand-dug well, which is cheap and easy to fetch water from, without regard of safety and stability of water.
- Water-supply issues in villages include not only distance to water sources but also poor performance of water supply facility, which causes a long waiting time to fetch water.
- Villagers understand the importance of their investment on construction and maintenance of new water facilities. However, they do not understand the idea of water-right fees very well.

4. Water Quality Analysis and Fluoride Problems

4.1 Water Quality Analysis

Simplified water quality tests were carried out at 264 points in the rainy season and at 317 points in the dry season. Laboratory tests of water quality were carried out at 157 points (139 points for existing water sources and 18 points for test drilling wells). From the results of comprehensive analysis based on the results of them, the following features of water quality in IDB were found.

- Many of the lakes in the study area are shallow lakes with the maximum water depth of 3m or less and many are alkaline lakes with extremely high concentration of fluoride in the water.
- As for surface water in the study area, high fluoride concentration in the rivers, dams and ponds was observed in Shinyanga Region (the average: 2.4 mg/l) and that in springs was observed in Arusha Region (the average: 2.6 mg/l).
- As for groundwater in the study area, the highest fluoride concentration in the shallow groundwater was observed in Arusha Region (the average: 3.0 mg/l) and the highest fluoride concentration in the deep groundwater was observed in Shinyanga Region (the average: 4.1 mg/l).
- The seasonal change of Fluoride and Electric Conductivity in water sources in the study area shows that the concentration increases slightly in the dry season.
- According to the results of the analysis by hexa-diagrams and trilinear diagrams, some of the fluoride-rich water sources in IDB have high concentration of alkaline bicarbonate ($NaHCO_3$)

and others are rich in alkaline non-carbonate (NaCl), and the water sources of alkaline bicarbonate ($NaHCO_3$) type tend to have longer residence times and higher fluoride concentration than those of alkaline non-carbonate (NaCl) type.

- The elution of fluoride from the volcanic strata and the effect (infiltration)of fluoride from the alkaline lakes are considered as a possible supply source of fluoride to the water sources in the study area.

4.2 Fluoride Problems

Overall condition of fluoride problems in IDB was checked by dental fluorosis survey.

- Dental fluorosis survey was conducted for 2,912 children of 96 villages in IDB. According to the result of this survey, 85.4％of the children had at least one tooth with more than moderate degree of dental fluorosis (Thylstrup-Fejerskov Index (TFI) >4).
- Obvious influence of dental fluorosis extends to the northern part of IDB covered by the younger volcanic rocks. The influence is also recognized around Shinyanga and Singida areas covered by granitic bedrocks with pegmatite.
- On an average of TFI by Regions in IDB, Arusha showed the worst score: TFI 4.3, Dodoma the best score: TFI 1.8 and Singida was TFI 3.4.
- Results of dental fluorosis analysis in IDB somewhat imply relationship between fluoride concentration of drinking water and dental fluorosis (TFI). However, it cannot be necessarily concluded that fluoride in the groundwater causes fluorosis, because it is considered that Magadi containing high concentration of fluoride may have more severe impact on fluorosis.
- There are several ways to remove fluoride technically from water, but it is actually not preferred to adopt them in consideration of the current socio-economic conditions of the rural areas in IDB. Awareness campaign of fluoride problems, guidance to better water sources with less fluoride concentration and discouraging consumption of Magadi as temporary measures are needed in terms of impact or risk management before full-scale countermeasure against fluorosis.

5. Organizational Conditions and Capacity Development Program

In Tanzania, water resources development and management are carried out based on the National Water Policy 2002 (NAWAPO), which introduced the concept of Integrated Water Resources Management (IWRM). Since IDBWO was newly established two years after NAWAPO, the office was not well functioning at the beginning of the Study. Therefore, capacity development programs consisting of upskilling programs and organization strengthening program were executed to raise the performance level of IDBWO.

6. Hydrogeology and Water Balance Analysis

6.1 Hydrogeology

Hydrogeological conditions in IDB were analyzed based on the water resources management database for IDB, which consists of existing data and the results of geophysical survey, test borehole drilling survey, water quality survey, satellite image analysis, socio-economic survey and so on. Groundwater productivity was evaluated based on the distribution of static water level, bedrock depth and well yield, and flow direction of groundwater. Areas with high productivity groundwater are located 1) along the fault system related on the Great Rift Valley, 2) around the volcanic mountains, 3) in the vicinity of boundary between granitic rocks and metamorphic rocks. High productivity is also expected in a fissure type of aquifer in granitic rocks. On the other hand, the areas covered by sediments have low groundwater productivity because of the accumulated fine materials. These results were assembled into the hydrogeological map.

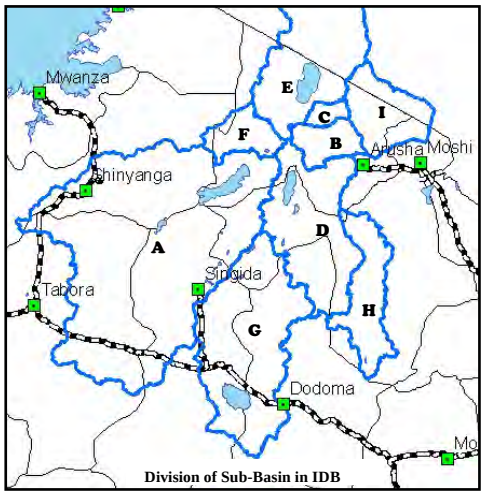
6.2 Water Balance Analysis

Water balance and groundwater recharge in each sub-basin were analyzed with meteorological, hydrological, and remote sensing data. Three kinds of water balance analyses were conducted: a) firstly, monthly macro water balance in each sub-basins in the IDB (minimum analysis unit: sub-basin), b) secondly, the analysis concentrated on grasping the distribution of the infiltration potential in each sub-basin in the rainy season (minimum analysis unit of 75 m/pixel) and c) thirdly, the analysis applied to the sub-basin G to obtain more detailed distribution of the infiltration potential under consideration of surface water runoff during rainy and dry season (minimum analysis unit of 75m/pixel). The results are as follows.

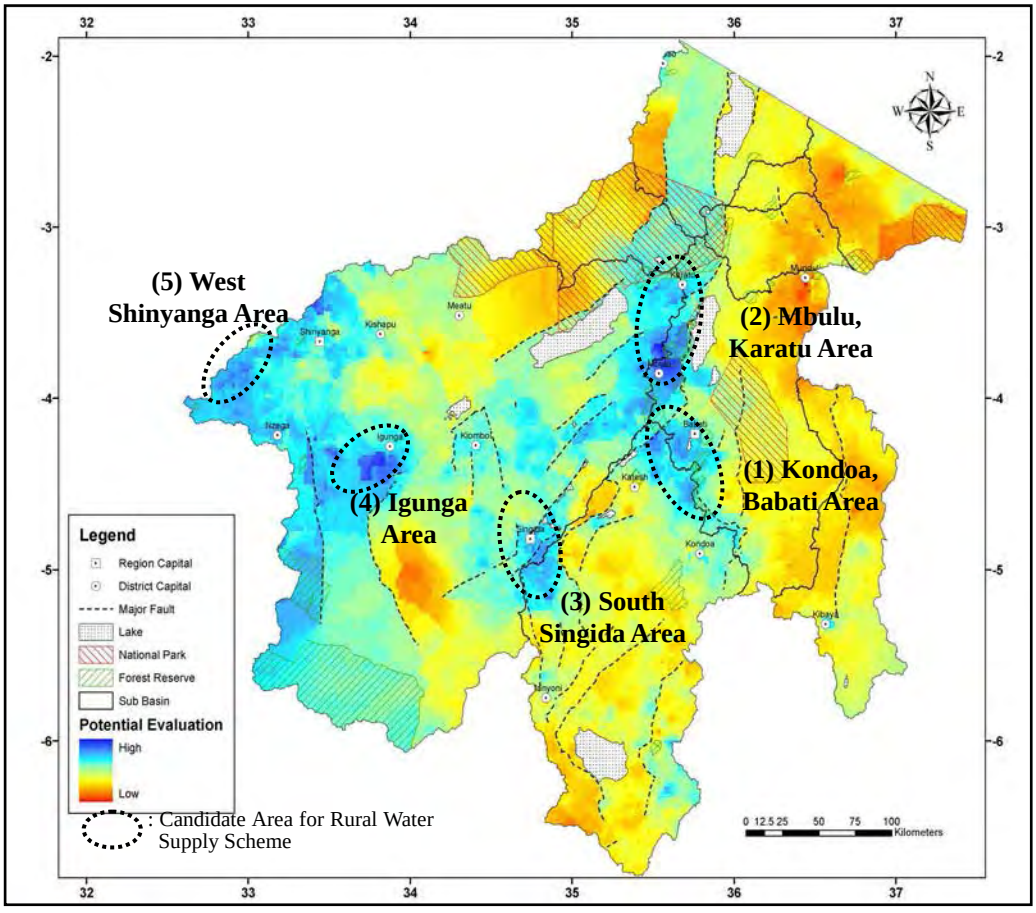
- Possible infiltration during the dry season is almost “zero” in IDB.
- Annual possible infiltration (per unit area) in IDB is higher in the northern area than that in the southern area and the monthly infiltration in the northern area is unevenly distributed in April during the rainy season. However, the monthly infiltration in the southern area during the rainy season is rather stable.
- There are high precipitation and high possible infiltration areas in and around Lake Eyasi and Lake Manyara.
- There are areas with stable monthly infiltrations but not so much in and around Tabora region.
- The runoff in the sub-basin G is around 2% to 11% during the rainy season.
- The infiltration in the sub-basin G is higher in the northeast area than in the southwest area.

7. Groundwater Potential Evaluation

Groundwater potential evaluation map was completed stakeholder friendly. Since one of the main purposes of this study is to evaluate groundwater potential in IDB from hydrogeological and hydrological points of view, high potential areas in IDB can be easily distinguished. Synthetic analysis with groundwater potential evaluation and social conditions with population density and rural water supply ratio indicate that five areas: i) Kondoa/Babati area, ii) Karatu/Mbulu area, iii) South Singida town area, iv) Igunga area and v) West Shinyanga area, have relatively high potentiality for rural water supply scheme.



Sub-basins in IDB



Groundwater Potential Evaluation and Candidate Areas for Rural Water Supply Scheme

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ABBREVIATION

ADM	Administrative
As	Arsenic (mg/L)
B.H.	Borehole
BWB	Basin Water Board
BWO	Basin Water Office
C/P	Counter Part
CDP	Capacity Development Program
CFI	Community Fluorosis Index
DB	Database
DBMS	Database Management System
DC	District Council
DDCA	Drilling and Dam Construction Agency
DEM	Digital Elevation Model
DWE	District Water Engineer
DWL	Dynamic Water Level (m)
EA	Enumeration Area
EC	Electric Conductivity (mS/m)
ETM	Enhanced Thematic Mapper
F	Fluoride (mg/L)
Fe	Iron (mg/L)
GDP	Gross Domestic Product
GIS	Geographic Information System
GPS	Global Positioning System
GTZ	Deutsche Gesellschaft fur Technische Zusammenarbeit
IDB	Internal Drainage Basin
IDBWO	Internal Drainage Basin Water Office
IFAD	International Fund for Agricultural Development
IWRM	Integrated Water Resources Management
JICA	Japan International Cooperation Agency
LANDSAT	Land sensing Satellite
MC	Municipality Council
Mn	Manganese (mg/L)
MoF	Ministry of Finance
MoLD	Ministry of Livestock Development
MoW	Ministry of Water
MoWLD	Ministry of Water and Livestock Development
MS	Microsoft
MWE	Municipal Water Engineer
NBS	National Bureau of Statistics
NGO	Non Government Organization
NH_4	Ammonia Ion (mg/L)
NO_3	Nitrate Ion (mg/L)
NSGRP	National Strategy for Growth and Reduction of Poverty

O&M	Operation & Maintenance
OJT	On the Job Training
ORP	Oxidation Reduction Potential (mV)
OSP	Organization Strengthening Program
OST	Organization Strengthening Team
PMO-RALG	Prime Minister's Office - Regional Administration and Local Government
PRSP	Poverty Reduction Strategy Paper
RAS	Regional Administrative Secretariat
RCU	Regional Consultancy Unit
RWE	Regional Water Engineer
RWSSP	Rural Water Supply and Sanitation Programme
S	Sulphate Ion (mg/L)
SAVI	Soil Adjusted Vegetation Index
SEMA	Sustainable Environment Management Action
SMD	Surveys and Mapping Division
SRTM	Shuttle Rader Topography Mission
SWL	Static Water Level (m)
TANESCO	Tanzania Electric Supply Company
TAZARA	Tanzania and Zambia Railways
TDS	Total Dissolved Solid
TFI	Thylstrup and Fejerskov Index
TOR	Terms of Reference
TPDC	Tanzanian Petroleum Development Corporation
TPTC	Tanzanian Posts and Telecommunication
TRC	Tanzania Railways Corporation
TTCL	Tanzanian Telecommunication Company Ltd.
TWA	Technical Water Advisor
UNCSD	United Nations Commission on Sustainable Development
UNCTAD	United Nations Conference on Trade and Development
UTM	Universal Transverse Mercator
VEO	Village Executive Officer
VES	Vertical Electrical Sounding
VSW	Vegetation-Soil-Water
WFP	World Food Program
WGS	World Geodetic System
WHO	World Health Organization
WRD	Water Resources Division
WUA	Water User Association
WUC	Water User Committee
WUG	Water User Group

Chapter 1
Introduction

CHAPTER 1 INTRODUCTION

1.1 Background of the Study

The Internal Drainage Basin (hereinafter referred to as "IDB") is situated in the north-eastern part of the country (Refer to Figure 1-1, 2). IDB is the second largest basin in Tanzania as shown in Table 1-1, which extends over 6 regions (Arusha, Shinyanga, Manyara, Dodoma, Singida, and Tabora) with a nominal area of 153,800 km^2. The total population in IDB is approximately 4.5 million. The annual precipitation in almost whole IDB ranges from 600mm to 900mm with annual evapotranspiration rate of over 2,000mm.

Since it is stated that the limiting values of annual precipitation for corn growing is 600mm, the water resources condition in IDB is considerably severe. Moreover, there are water quality problems in IDB caused by its natural characteristics, especially the internal drainage system which leads to accumulation of inorganic salts or materials hazardous to health, such as fluorides in surface water and groundwater.

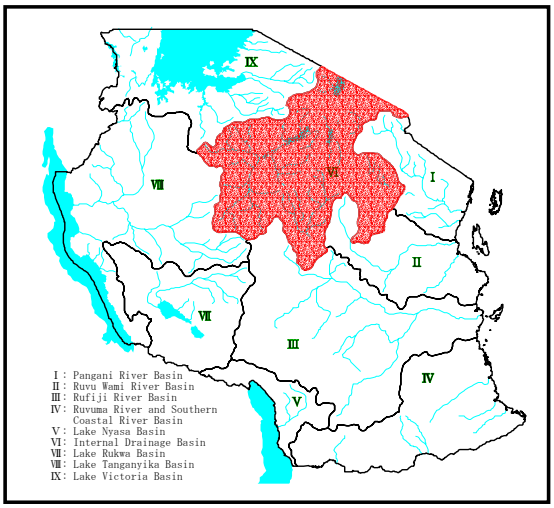

Figure 1-1 Nine River Basins in Tanzania

Table 1-1 Area of Basins

No.	Basin	Area (km^2)
I	Pangani	56,300
II	Wami/Ruvu	72,930
III	Rufiji	177,420
IV	Ruvma/Southern Coast	103,720
V	Lake Nyasa	75,230
VI	Internal Drainage	153,800
VII	Lake Rukwa	81,180
VIII	Lake Tanganyka	137,900
IX	Lake Victoria	79,570

: Study Area

Water resources development, particularly groundwater development is an urgent issue to provide adequate safe and reliable water supply under such circumstances. However, there are constraints in the planning and execution of water supply, since there is no integrated management of data and information related to existing water supply facilities, hydrology, geomorphology, hydrogeology, water quality, socio-economy etc. The Internal Drainage Basin Water Office (hereinafter referred to as IDBWO) was established on 29th October 2004 to manage water resources in a comprehensive manner. However, IDBWO has not been functioning fully because it was newly established based on the new policy: Water Policy 2002 and the new concept: Integrated Water Resources Management.

1.2 Objectives of the Study

Under the above-mentioned circumstances, this Study was formulated and conducted in order to evaluate groundwater development potential and identify water contamination areas for planning of drinking water supply projects in IDB. Major objectives of the Study are as follow.

- To formulate hydrogeological map with necessary information for development and management plan of water resources and water supply for the Internal Drainage Basin,
- To develop the capability of counterpart personnel of Ministry of Water and other authorities concerned in the course of the Study.

1.3 The Study Area

The study area is located in the north-eastern part of Tanzania as shown in Figure 1-2; it covers a whole IDB: 143,100km^2 or 16.4 percentage of the country. The detailed administrative boundaries related to IDB are illustrated in Figure1-3.

Figure 1-2 Location Map of the Internal Drainage Basin

1.4 Implementation of the Study

The Internal Drainage Basin Water Office (hereinafter referred to as "IDBWO"), the Ministry of Water (MoW), has been assigned as the counterpart organization from the Government of Tanzania, while the Japan International Cooperation Agency (JICA) has been assigned as the official responsible agency for the implementation of the technical cooperation program from the Government of Japan. The Study has been conducted by the Japanese Study Team, comprised of members of OYO International Corporation and Kokusai Kogyo Co., Ltd officially retained by JICA for the Study in collaboration with the counterpart staffs of Tanzania.

1.5 Study Schedule

The Study is scheduled to be completed in a period of approximately 28 months between the late September 2005 and the late December 2007 through six stages of work as mentioned below.

(1) 1st Work in Japan (Sep. 2005)
(2) 1st Field Survey (Oct. 2005 - Dec. 2005)
(3) 2nd Field Survey (Jan. 2006 - Mar. 2006)
(4) 3rd Field Survey (Jun. 2006 - Mar. 2007)
(5) 4th.Field Survey (May. 2007 - Nov.2007
(6) 2nd Work in Japan (Nov.2007 – Dec.2007)

Total schedule of the Study is shown in Figure 1-4.

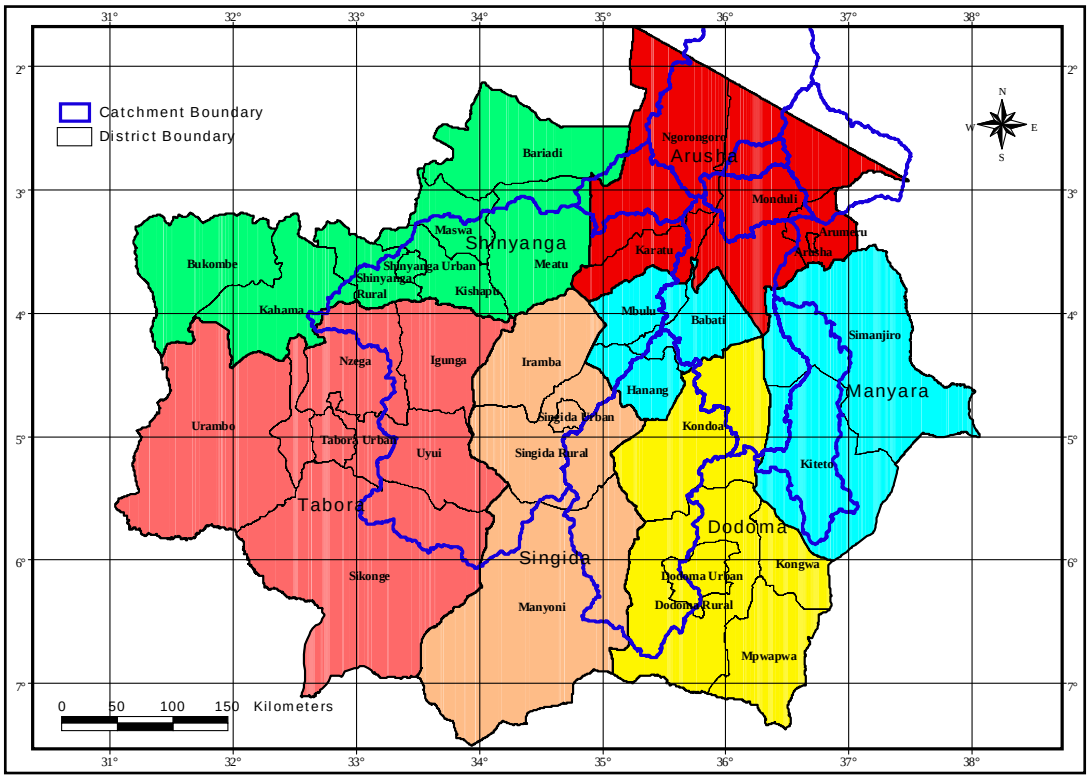

Figure 1-3 Related Regions and Districts of IDB

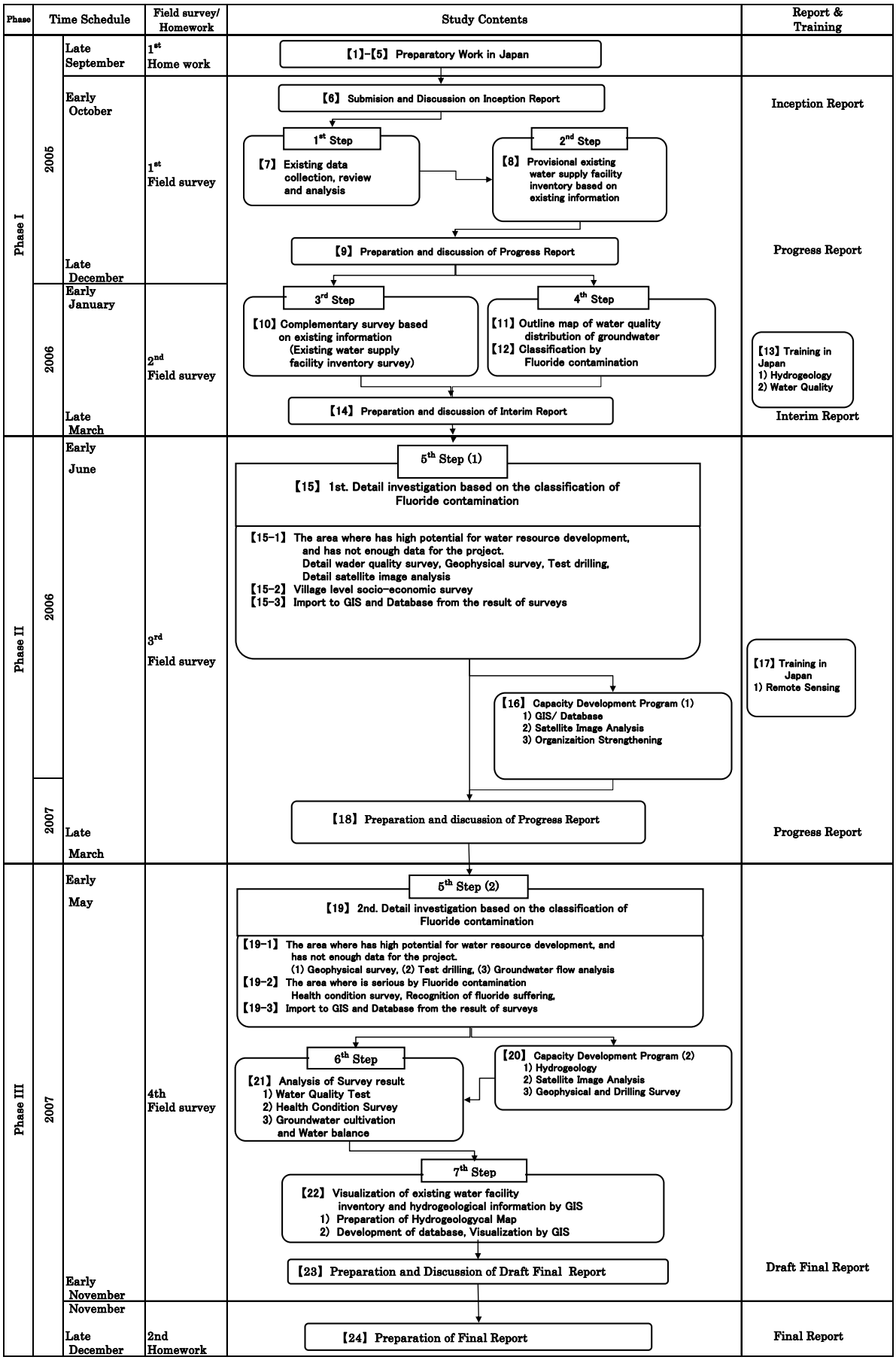

Figure 1-4 Flow Chart of the Study

1.6 Member List of the Study

The members involved in the Study and the Steering Committee for the Study are listed in Table1-2, and 1-3.

Table 1-2 Member List of the Study

Name	Assignment
<JICA>	
Mr. Hidetake AOKI	Staff / JICA Headquarters
Mr. Daigo KOGA	Assistance Resident Representative
<JICA Study Team>	
Mr. Norifumi YAMAMOTO	Team Leader
Mr. Shinichi ISEKI	Deputy Team Leader / Hydrogeologist (1)
Mr. Shigeaki MATSUO	Hydrogeologist (2) / Remote Sensing Expert
Mr. Masamichi HARAGUCI	GIS / Database Expert
Dr. Takayoshi KURATA	Water Quality Specialist
Mr. Ichiro TANAKA	Hydrologist
Mr. Jun MATSUO	Geophysicist / Test Drilling Supervisor
Ms. Rumi SAWADA	Socio-economist
Dr. Lillian D. MINJA	Health Survey Supervisor
Mr. Shinya KAWADA	Environment Consideration Expert
Mr. Takashi HARA	Coordinator
<C/P Staff>	
Mr. J.S.Nasari	Team Leader
Mr. A.H. Bwanguzo	Deputy Team Leader
Mr. N. M.Mgozi	Hydrogeologist / Remote Sensing Expert
Mr. K. Mpanda	G.I.S. Data Expert
Mr. F. Saroni	Water Quality Specialist
Mr. Y. Hema	Hydrologist
Mr. G. Lyatuu	Geophysicist / Test Drilling Supervisor
Mr. Sebastian Mundia	Socio-economist
Mr. Joseph Seni	Health Survey Supervisor
Mr. Richard Masao	Environment Consideration Expert

Table 1-3 Member List of the Steering Committee

Name	Position
<Ministry of Water (MoW)>	
Mr. Washington Mutayoba	Director, Water Resources Division (WRD)
Dr. Hassani J. Mjengera	Director, Water Laboratories
Mr. Lister R.E. Kongola	Assistant Director, WRD
Ms. Elder Mcharo	Principal Hydrogeologist, WRD
<Internal Drainage Basin Water Office (IDBWO)>	
Mr. Joseph S. Nasari	Basin Water Officer (former)
Mr. Ahmed M. H. Bwanguzo	Principal Hydrogeologist
Mr. Festo Saroni	Senior Technician - Water Quality
Ms. Paulina Duki	Personal Secretary
<Arusha Region>	
Mr. Paul M. Nginita	Representative of Technical Advisor - Water (TAW, Regional Secretariat (RS))
<Manyara Region>	
Mr. Shadrack Shoo	TAW (RS)
<Shinyanga Region>	
Mr. M. N.Mgozi	Representative of TAW(RS)
<Singida Region>	
Mr. Alphouce J. Mchome	Representative of TAW (RS)
Mr. A. A. Kusenha	Manyoni District Water Engineer
<Dodoma Region>	
Mr. Robert Mganga	Representative of Kondoa District Water Engineer

1.7 Composition of the Reports

The following reports have been submitted to the Tanzanian side during the study period.

- Inception Report: 25 copies
- Progress Report (I): 10 copies
- Interim Report: 25 copies
- Progress Report (II): 10 copies
- Draft Final Report: Main Report 25 copies, and GIS Figure Book 4 copies.
- Final Report: Main Report 50 copies, Supporting Report 10 copies, Summary 50 copies, GIS Figure Book 10 copies, and Data Book 10 copies.

The Main Report of the final report presents the summarized results of all the studies. Detailed study results are described in the Supporting Report and Data Book. GIS Figure Book contains major maps, which were formulated through the Study including hydrogeological map, groundwater potential evaluation maps and so on.