**REPUBLIC OF MALAWI**
**MINISTRY OF AGRICULTURE, IRRIGATION**
**AND WATER DEVELOPMENT (MoAIWD)**

# PROJECT FOR NATIONAL WATER RESOURCES MASTER PLAN IN THE REPUBLIC OF MALAWI

# FINAL REPORT

## Volume II: Main Report

**DECEMBER 2014**

**JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)**

**CTI ENGINEERING INTERNATIONAL CO., LTD**
**ORIENTAL CONSULTANTS CO., LTD.**
**NEWJEC Inc.**

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## COMPOSITION OF FINAL REPORT

**Volume I : Summary**

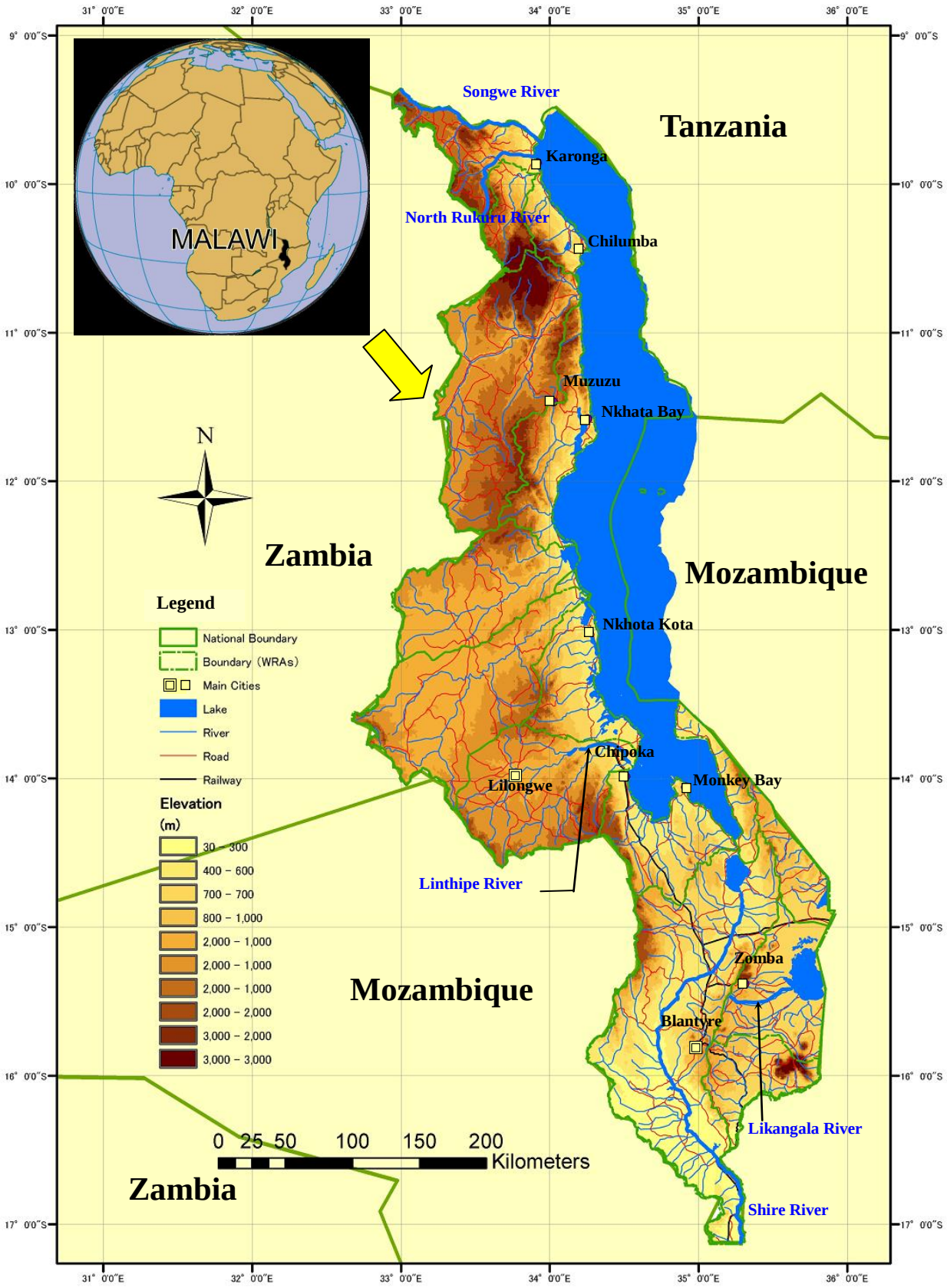
**Volume II : Main Report**

**Volume III : Data Book**

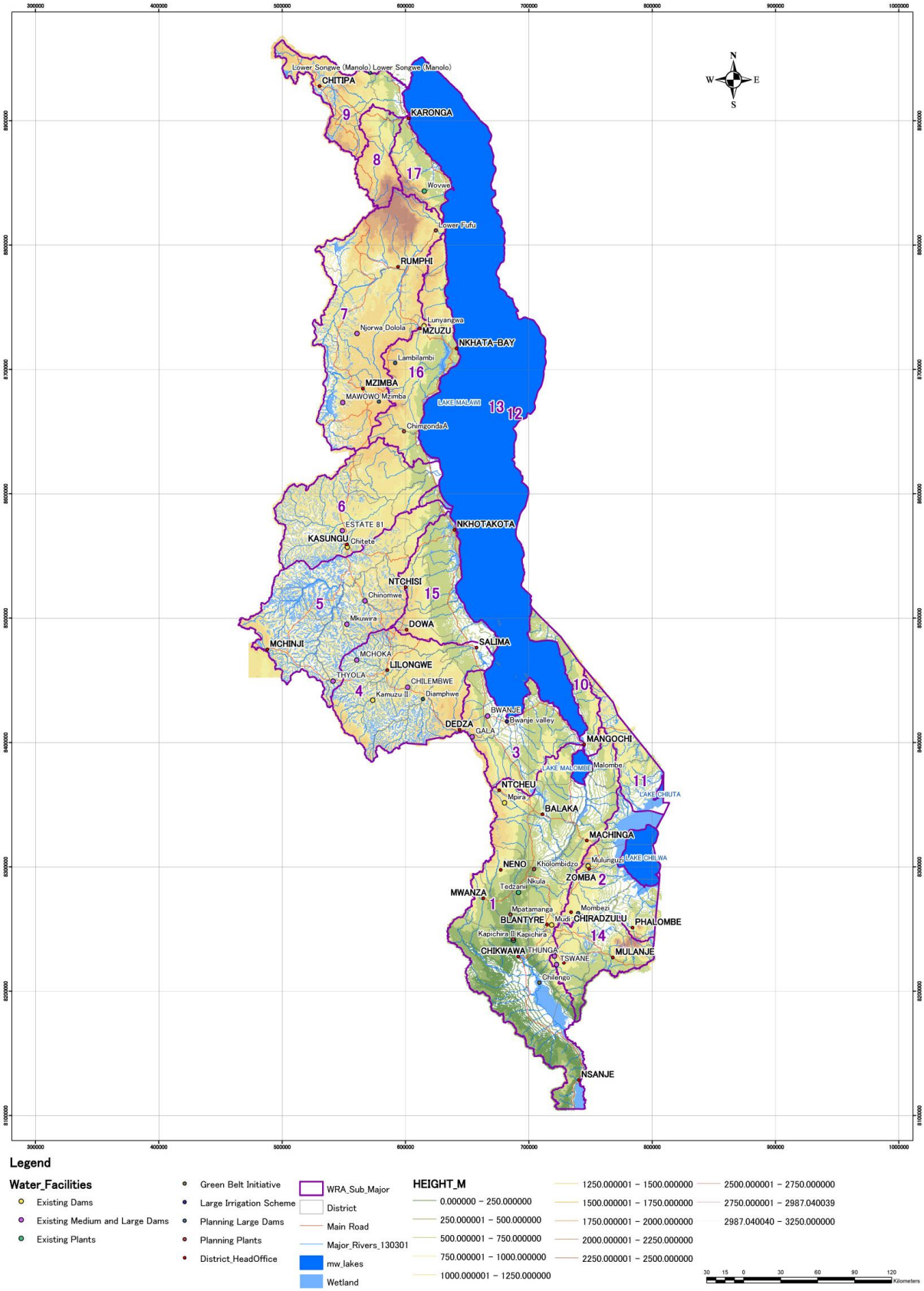
**Volume IV : Photo Book**

EXCHANGE RATE
USD1.0=MWK329=EUR 0.77=JPY84.88
December 1, 2012

# COMPOSITION OF VOLUME II: MAIN REPORT




**Location Map**

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## ACRONYMS AND ABBREVIATIONS

| | | |
|---|---|---|
| ACDF | : | Africa Catalytic Growth Fund |
| ADC | : | Area Development Committee |
| ADD | : | Agriculture Development Division |
| ADMARC | : | Agricultural Development and Marketing Corporation |
| ADP | : | Agriculture Development Programe |
| AEC | : | Area Executive Committee |
| AfDB | : | African Development Bank |
| AIDs | : | Acquired Immuno Deficiency Syndrome |
| AUSAID | : | Australian Agency for International Development |
| BCC | : | Blantyre City Council |
| BGS | : | British Geological Survey |
| BOD | : | Biochemical Oxygen Demand |
| BWB | : | Blantyre Water Board |
| CA | : | Capacity Assessment |
| CBM | : | Community-Based Management |
| CD | : | Capacity building |
| CDO | : | Community Development Officer |
| CIDA | : | Canadian International Development Aid |
| CRWB | : | Central Region Water Board |
| CSOs | : | Civil Society Organizations |
| COD | : | Chemical Oxygen Demand |
| CWP | : | Community Water Point |
| CWR | : | Crop Water Requirement |
| DAs | : | District Assembly |
| DAO | : | District Agriculture office |
| DC | : | District Committee |
| DCCMS | : | Department of Climate Change and Meteorological Services |
| DCP | : | Doppler Current Profiler |
| DCT | : | District Coordinate Team |
| D/D | : | Detail Design |
| DDC | : | District Development Committee |
| DEM | : | Digital Elevation Model |
| DHI | : | Danish Hydrological Institute |
| DEC | : | District Executive Committee |
| DPD | : | Department of Planning and Development |
| DoI | : | Department of Irrigation Services |
| DoE | : | Department of Energy Affairs, MoNREE |
| EAD | : | Environmental Affairs Department |
| EIA | : | Environmental Impact Assessment |
| EIB | : | European Investment Bank |
| EIRR | : | Economic Internal Rate of Return |
| ESCOM | : | Electricity Supply Corporation of Malawi Limited |
| EU | : | European Union |
| FAO | : | Food and Agriculture Organization of the United Nations |
| F/S | : | Feasibility Study |
| GBI | : | Green Belt Initiative |
| GDP | : | Gross Domestic Product |
| GIS | : | Geographic Information System |
| GPS | : | Global Positioning Syste |
| GWP | : | Global Water Partnership |
| ha | : | hectare |
| HA | : | Health Assistant |
| HD | : | High Density |

| | | |
|---|---|---|
| HIV | : | Human Immunodeficiency Virus |
| HPP | : | Hydropower Plant |
| HQ | : | Headquarters |
| HRPU | : | Human Resources Planning Unit |
| HSA | : | Health Surveillance Assistant |
| IDA | : | International Development Association |
| IAEA | : | International Atomic Energy Agency |
| IEE | : | Initial Environmental Examination |
| IFAD | : | Internat ional Fund for Agricultural Development |
| IPP | : | Independent Power Producer |
| IT | : | Information Technology |
| ITCZ | : | Inter Tropical Convergence Zone |
| ISD | : | Irrigation Service Division |
| IWA | : | International Water Association |
| IWRM | : | Integrated Water Resources Management |
| JICA | : | Japan International Cooperation Agency |
| JPC | : | Joint Permanent Commissions |
| JPY | : | Japanese Yen |
| JSR | : | Joint Sector Review |
| LCC | : | Lilongwe City Council |
| LD | : | Low Density |
| LWB | : | Lilongwe Water Board |
| MBS | : | Malawi Bureau of Standard |
| MCA | : | Millennium Challenge Account |
| MCC | : | Millennium Challenge Corporation |
| MD | : | Middle Density |
| MDGs | : | Millennium Development Goals |
| M&E | : | Monitoring and Evaluation |
| MDPC | : | Ministry of Development, Planning and Cooperation |
| MEGS | : | Malawi Economic Growth Strategy |
| MEIP | : | Malawi Electricity Investment Plan |
| MG | : | Malawi Government |
| MGDS | : | Malawi Growth and Development Strategy |
| MIS | : | Management Information System |
| MK | : | Malawi Kwacha |
| MoAIWD | : | Ministry of Agriculture, Irrigation and Water Development |
| MoAFS | : | Ministry of Agriculture and Food Security |
| MoEM | : | Ministry of Energy and Mine (former MoNREE) |
| MoF | : | Ministry of Finance |
| MoIWD | : | Ministry of Irrigation and Water Development |
| MoLGRD | : | Ministry of Local Government and Rural Development |
| MoNREE | : | Ministry of Natural Resources, Energy and Environment |
| MoPW | : | Ministry of Public Works |
| MoWDI | : | Ministry of Water Development and Irrigation (fomer MoAIWD) |
| MP | : | Member of Parliament |
| M/P | : | Master Plan |
| MPRS | : | Malawi Poverty Reduction Strategy |
| MPUWSP | : | Malawi Peri-Urban Water and Sanitation Project |
| MW | : | Mega Watts |
| NFRA | : | National Food Reserve Agency |
| NGO | : | Non Governmental Organization |
| NIB | : | National irrigation Board |
| NIPDS | : | National Irrigation Policy and Development Strategy |
| NRW | : | Non Revenue Water |
| NRWB | : | Northern Region Water Board |

| | | |
|---|---|---|
| NSO | : | National Statistical Office |
| NSP | : | National Sanitation Policy |
| NWDP | : | National Water Development Project or National Water Development Programme.N.B. The former is abbreviated as NWDPI and the latter NWDPII. |
| NWP | : | National Water Policy |
| NWRA | : | National Water Resources Authority |
| NWRMP | : | National Water Resources Master Plan |
| ODA | : | Official Development Aid |
| OJT | : | On-the-Job Training |
| O&M | : | Operation and Maintenance |
| OPC | : | Office of President and Cabinet |
| OPEC | : | Organization of the Petroleum Exporting Countries |
| PMU | : | Project Management Unit |
| POW | : | Plan of Work |
| PPP | : | Private Public Partnership |
| PRSP | : | Poverty Reduction Strategy Paper |
| PSB | : | Programme Steering Board |
| PSIP | : | Public Sector Investment Programme |
| PV | : | Photovoltaic |
| RE | : | Rural Electrification |
| RGF | : | Rapid Gravity Filters |
| RWBs | : | Regional Water Boards |
| SAFRIEND | : | The Southern Africa Flow Regimes from International Experimental and Network Data |
| SADC | : | Southern Africa Development Community |
| SAPP | : | Southern Africal Power Pool |
| SC | : | Steering Committee |
| SEA | : | Strategic Environmental Assessment |
| SFPDP | : | Smallholder Flood Plains Development Programmes |
| SFFRFM | : | Smallholder Farmers Fertilizer Revolving Fund of Malawi |
| SRBMP | : | Shire River Basin Management Program |
| SRWB | : | Southern Region Water Board |
| S.T.A | : | Sub Traditional Authority |
| TAs | : | Traditional Authorities |
| TNA | : | Training Needs Assessment |
| STA | : | Senior Traditional Authority |
| TAMS | : | Tippett, Abbett, McCarthy and Stratton Engineers |
| TC | : | Technical Committee |
| TCC | : | Tobacco Control Commission |
| THA | : | Traditional Housing Area |
| UNDP | : | United Nations Development Plan |
| UNICEF | : | United Nations Children’s Fund |
| US AID | : | United States Agency for International Development |
| US$ | : | United States Dollar |
| VDC | : | Village Development Committee |
| VHC | : | Village Health Committee |
| VHWC | : | Village Health and Water Committee |
| VIP | : | Ventilated Improved Pit |
| VLOM | : | Village Level Operations and Maintenance |
| WASH | : | The Water, Sanitation and Hygiene Project |
| WB | : | World Bank |
| WES | : | Water and Environmental Sanitation |
| WMA | : | Water Monitoring Assistant |
| WPCs | : | Water Point Committees |

| | | |
|---|---|---|
| WRAs | : | Water Resources Areas |
| WRB | : | Water Resources Board |
| WRD | : | Water Resource Division |
| WRF | : | Water Resources Fund |
| WRIS | : | Water Resources Investment Strategy |
| WRM | : | Water Resources Management |
| WRUs | : | Water Resources Units |
| WQEO | : | Water Quality and Environmental Officer |
| WSGPG | : | Water and Sanitation Development Partners Group |
| WUA | : | Water Users Association |
| WUP | : | Water Utility Partnership |
| WWA | : | Water Works Act |
| WWTP | : | Wastewater Treatment Plant |
| ZAMCOM | : | Zambezi Watercourse Commission |

# EXECUTIVE SUMMARY

## Background and Objectives

### Background

Average annual rainfall is about 1,000 mm in Malawi and many perennial flows exist. Generally, water resources are abundant as compared with the other African countries. Mineral resources in Malawi have hardly developed as compared with the neighboring countries. The Malawi Government aims to accomplish economic growth with the utilization of its water resources. Malawi's National Water Policy in 2005 and National Sanitation Policy in 2008 target "continuous and systematic water resources management and development" and "continuous offer of sanitary service and water supply." In the circumstances described above, appropriate approaches to the targets have to be implemented.

However, proper management and effective use of water resources have not been smoothly implemented and systematic basic information about water resources and water utilization were not updated after making the National Water-Resources Master Plan in 1986 with UNDP support. To overcome all the existing problems, the Malawi Government has considered integrating the water resources management policy based on the present water budget and water resources potential. The Malawi Government therefore tackles the renewal of the master plan as an item of primary importance. It requested assistance from the Government of Japan to establish a National Water Resources Master Plan together with the capacity building concerned.

In response to the request, the Japan International Cooperation Agency (JICA) dispatched an inquiry mission from February to March in 2011, and the Scope of Work (S/W) and the Minutes of Meeting (M/M) were signed by JICA and the Ministry of Irrigation and Water Development (MoIWD) in March 2011. The Project was commenced in March 2012, through the process of submitting the Interim Report in October 2013, and the Final Report was submitted to the MoAIWD in December 2014.

### Objectives

The objectives of the Project are: (1) to formulate the national water resources master plan (the M/P); and (2) to transfer technology and knowledge to the Malawi counterpart personnel. Through establishment of the M/P, issues on the water resources management in Malawi are to be clarified and strategies for the improvement in capability of Malawi and the appropriate directions for water resources management are proposed. Thus, related agencies in Malawi will be able to perform integrated water resources management in the future. Moreover, the technical transfer regarding data collection, analysis, management and planning, etc., will be implemented in the Project through on-the-job training (OJT), seminars, workshops and so on.

The Project Area covers the entire Malawi country with an area of 118,000 $km^2$ and a population of 13.1 million.

## Present Status surrounding the Project

### Related Organizations

The management of national water resources is primarily under the responsibility of the Ministry of Agriculture, Irrigation and Water Development (MoAIWD) for policy-making, supervision and direction in the areas of irrigation and water supply. The Ministry of Natural Resources, Energy and Environment (MoNREE) is responsible for hydropower development. The MoAIWD is the central institution to facilitate the development and management of water resources in Malawi. Its primary responsibilities are to ensure access to safe water and sanitation, the provision of safe drinking water to rural communities, water resources management, provision of irrigation scheme, and the collection as well as monitoring of hydrological data and catchment protection to support policy formulation. In addition, Water

Resources Board, local governments, and Water Boards are relevant organizations in the water resources development and management.

**Major Industries**

Agriculture is the most important sector of the Malawi economy. It employs about 80% of the total workforce, contributes over 80% to foreign exchange earnings, accounts for 39% of gross domestic product (GDP) and contributes significantly to national and household food security. The agricultural sector has two main subsectors; the smallholder subsector (contributes more than 70% to agricultural GDP), and the estate subsector (contributes less than 30% to agricultural GDP). Smallholders cultivate mainly food crops such as maize, cassava and sweet potato to meet subsistence requirements. Estates focus on high value cash crops for export such as tobacco, tea, sugar, coffee and macadamia.

**River Basins**

Malawi is divided into 17 water resource areas (WRAs) based on the river basins. Some WRAs consist of one river basin and others are composed of several small river basins. Moreover, WRAs are divided into water resource units (WRUs).

**Meteorology and Hydrology**

The climate of Malawi is categorized as sub-tropical and divided into three weather variations such as warm-wet (November to April), cool-dry winter (May to August) and hot-dry seasons (September to October). The warm-wet season is recognized as the rainy season with about 95% of annual rainfall expected. In whole Malawi, the average annual rainfall in the latest 3 decades is 971 mm, ranging between approx. 700 mm and 1,200 mm. In the rainy season, runoff yield is about 20% of rainfall depth. The annual runoff ratios of rivers in Malawi fluctuate between 0.2 and 0.3 based on the collected rainfall and discharge data in the Project.

In hydrological monitoring, 139 stations consisting of 136 MoAIWD stations and 3 Water Board stations are operational and 164 stations are closed. On the other hand, MoNREE manages meteorological monitoring. There have been about 800 rainfall stations in the 1980's, but there are only between 100 and 200 operational rainfall stations at present. Evaporation and other climatic data have been recorded at all the meteorological stations, and MoNREE manages 23 meteorological stations.

Groundwater monitoring in 2012 was carried out at only 18 boreholes out of the established 35 boreholes. Regarding water quality monitoring, there are 195 water quality monitoring points in Malawi which are classified into three categories: surface water, pollution control located at outlets of effluent sources and groundwater. Periodical monitoring for those stations is not made due to budgetary constraints.

**Evaluation on 1986 Water Resources Master Plan**

The Master Plan of 1986 (NWRMP 1986) proposed many water supply projects for both urban and rural areas. Due to the difficulty in pursuing the implementation results of numerous water supply projects proposed in the NWRMP 1986, the progress of water supply situations was examined by referring to actual and proposed service coverage of accessing improved water. An achieved service coverage ratio is 93% in 2010 to planned 65% in 2005 in urban areas, 72% in 2010 to planned 68% in 2005 in rural areas, and 75% in 2010 to planned 67% in 2005 in total. Thus the progress of actual water supply exceeds the planned figures.

NWRMP 1986 planned to increase the hydropower generation capacity of 230 MW from 178 MW in 1986 up to 408 MW until 2001. However, actual capacity increase remains at 140 MW at present.

As similar to water supply, progress of irrigation development is evaluated using a parameter of irrigation area. NWRMP 1986 planned the irrigation area from 19,400 ha in 1985 to 39,500 ha. The

actual irrigation development achieved exceeding results as 67,000 ha in 2005 and 90,600 ha in 2011.

## Existing Water Use

### Water Supply

The nationwide accessibility to safe water was 83% in 2011. Accessibility in rural areas is 81% with continuous improvement; however, the accessibility decreased from 92% in 2010 to 88% in 2011, because of failure of the water supply infrastructure and the high urban population growth rate.

### Irrigation Development

The cumulative area under irrigation for smallholder increased from 37,960 ha in 2009/10 to 42,181 ha in 2010/11. Meanwhile, the total irrigation area of the estate which mainly cultivates sugar and tea was 48,382 ha in 2010/11.

### Hydropower Generation

The installed capacity of existing hydropower is 286MW, of which 98% is generated from cascaded run-of-the-river power plants on the Shire River and the remaining 2% is on the Wovwe River.

## Basic Policy of Master Plan Formulation

### Target Year

The target year of the Master Plan for water resources development and management was set in 2035 as a long-term target, 2025 as a middle-term target and 2020 as a short-term target.

### Basic Policy for Water Resources Development and Management

To satisfy growing demand in Malawi, the key considerations for water resources development in Malawi are effective usage of; 1) effective water demand management in dry season, 2) abundant water resources in rainy season, 3) constantly abundant water resources of Lake Malawi and the Shire River.

The main countermeasures for water resources management are; 1) appropriate monitoring for hydrological data and water quality, 2) enhancement of system and capacity of relevant agencies, and 3) strengthening of basin management system based on the basin characteristics studied in the Project.

### Priority in Water Utilization

The priority order of consumptive water use is domestic water and irrigation and livestock. Regarding the environmental flow, in the Malawi there is insufficient information about the user of environmental flow such as existence of protective species. In addition, there is no guideline to estimate environmental flow in Malawi. In the circumstance, influence to the river discharge by water resources development is examined and compared with the environmental flow. As a result of the examination, a direction of management of environmental flow is suggested in the Project. In fact, monitoring and detailed investigation for the environmental flow and clarification of precious species should be done in Malawi to modify guidelines and properly control the environmental flows by river basin.

### Safety Level of Water Usage

The safety level of water resources development for consumptive uses is set at 20-yaer drought for 4 cities water supply, 10-year drought for rural towns and market centers, 5-year drought for rural villages, and 5-year drought for irrigation.

## Urban and Rural Water Supply Development Plan

### 4 Cities' Water Supply Development

The water supply plans for 4 cities were evaluated, and an implementation priority was given based on the results of existing feasibility studies and detailed designs. First priority was given to extension of existing water treatment works in Zomba, and groundwater borehole and raising of Kamuzu dam I in Lilongwe follow it as second and third priorities. The followings are planned service coverage, non-revenue water (NRW) rate, and project cost in each city in the target year of 2035. The economic internal rate of return (EIRR) ranges from 10% to 21%. They show high economic efficiency.

1. Lilongwe: Service coverage of 100%, NRW rate of 20%, Project cost of 517.1 million USD
2. Brantyre: Service coverage of 86.9%, NRW rate of 25%, Project cost of 315.4 million USD
3. Mzuzu: Service coverage of 100%, NRW rate of 20%, Project cost of 228.5 million USD
4. Zomba: Service coverage of 100%, NRW rate of 20%, Project cost of 29.2 million USD

### Rural Water Supply Development for Towns

Northern, Central and Southern Regional Water Boards (RWBs) supply domestic water to towns in Malawi. In accordance with population projection in target towns, RWBs conduct mainly rehabilitation of the existing supply networks and their extension. 7 water supply schemes in northern region, 20 in the central and 22 in the southern are planned, and their total project cost aggregates 143.3 million USD. The EIRR shows high economic efficiency of 17.3%.

### Rural Water Supply Development for Market Centers

Targeting market centers of 154 in total as a rural center, which extend 34 in northern region, 58 in the central and 62 in the southern, water supply facilities are planned by gravity-fed or borehole system in accordance with population increase and facilities' aging. Planned service coverage is set at 98% in 2035 from 73% in 2015. The total project cost aggregates 123.2 million USD, and the EIRR shows high economic efficiency of 15.1%.

### Rural Water Supply Development for Villages

Targeting villages in the rural areas, water supply facilities are planned by gravity-fed or borehole system to supply safe water to the villagers. Planned access rate is set at 98% in 2035 from 73 - 95% in 2015. The total project cost aggregates 424.2 million USD, and the EIRR was not computed due to basic human needs basis.

## Irrigation Water Supply Development Plan

### Irrigation Development Scenarios

The two development scenarios were set up: one is a realistic development at 2,500 ha/year, and the other one is a little ambitious development at 5,000 ha/year. The latter one is nearly equal to the standard development rate of SADC countries.

### Cropping Patterns and Non-structural Applications

In view of the result of initial water balance analysis, it is proved that water is still available at early stage of the dry season. Therefore, the possibility of crop diversification, such as shifting crop cultivation and application of early growing crops (early maturing varieties), are proposed for saving available water as a non-structural application. In the case annual irrigation area increases at 5,000 ha/year, the cropping modification could reduce the total cost by 34% from the normal cropping.

### Planning Concepts

Clarified was the water balance between water resources potential and irrigation water demand in two scenarios through water balance simulation by Water Resources Unit (WRU). Structural

components shall be arranged water intake facilities of weir or pump, conveyance and distribution canal system, and water distribution or storage ponds. Their suitable components shall be determined depending on the water availability and their topographic features.

**Stepwise Implementation Program of the Irrigation Development and Economic Efficiency**

Following the above concepts, the suitable irrigation development facilities were proposed by WRU, and the stepwise implementation program was proposed until 2035 by giving the priority of each WRU project considering the parameters of cost efficiency, development effects and water supply potential. The total project cost aggregates 914.9 million USD, and the EIRR shows low economic efficiency of 2.2 - 3.2% in both scenarios due to setting maize as the major crops newly planting for the development areas.

## Hydropower Development Plan

**Hydrological Evaluation Hydropower Development**

Hydropower development projects are planned by MoNREE until 2030 and some of the projects have been proceeded in accordance with the plans. Hydropower development projects are evaluated and compiled from the view point of Integrated Water Resources Management (IWRM) on the present and future conditions.

It can be said that hydropower projects in Malawi are feasible from standpoint of the water resources. Furthermore, cascaded development proposed in the master plan level study of WB1998 is more beneficial than single development. Therefore, for proceeding projects, feasibility studies and further design studies are recommended for practical hydropower development.

**Necessity of Data/Information Sharing**

Since meteorological data such as rainfall data is being observed by MoNREE, and hydrological data such as river flow data by MoAIWD, sharing these data for studies on hydropower development is very important to manage hydropower generation.

## Water Resources Management

**New Institution for Water Resources Management**

Based on the implication of the Water Resources Act enacted in 2013 and the IWRM policy, coordination of all relevant stakeholders centering on the NWRA and catchment management committees among them may be the great challenge in realizing the Malawi IWRM. The NWRA is an independent organization, but it is closely related to the MoAIWD, so that the NWRA shall have a mutual relationship with MoAIWD to exchange and share information regarding water resources management and development projects. Regarding relevant governmental agencies out of MoAIWD, the NWRA shall conduct a sector-wide coordination among them.

In near future, NWRA will monitor the hydrological data including surface water, groundwater and water quality, and will manage them. In order to smoothly transfer the existing monitoring and management works to NWRA, MoAiwd shall improve their data management system as the integrated hydrological information management system at first.

## Recommendations

Various issues were encountered in the course of survey on existing conditions and plan formulation in

the Water Resources Master Plan. Relatively abundant water resources compared with other African countries are one of a few drivers to uplift the Malawian economy in the future. These issues are not only to be overcome for future efficient water resources management but also to be essential factors for uplifting the economy. Thus the issues shall be enumerated below as recommendations.

**Institutional Strengthening of MoAIWD and Smooth Transition of its Functions to NWRA**

New Water Resources Act was enacted in 2013, and new organization of NWRA will be established in near future based on the stipulation of the Act. Through establishment of new organization, management of water right system will be empowered so that the financial base of water resources management is expected to be much more robust. Hydrological monitoring section including groundwater and water quality monitoring will move to NWRA in the near future. The smooth transition from MoAIWD and reform to agile institution is expected to be made.

Furthermore, the 28 district water offices have been mainly conducted hydrological monitoring including water level observation and discharge measurement. However, poor working conditions of the stations and shortage of staffs in the offices could be observed in the course of the survey. In order to activate the hydrological monitoring through collaboration with such local institutions or merger of them into NWRA, intensive institutional reform is indispensable with perspectives of future activation including the local institutions.

**Strengthening of Monitoring System covering Surface Water, Groundwater and Water Quality, and Sharing and Utilization of Monitored Data**

Essential is periodical groundwater table monitoring at testing wells and water quality monitoring at the designated points as well as monitoring of water level and discharge measurement, and archiving of the monitored data in a database system. Furthermore, an integrated data management system shall be established through additionally archiving of the observed data in the water-related projects.

The integrated database system will be transferred to NWRA, and NWRA shall establish the data providing system or data access system for the related agencies as well as MoAIWD. In this context, NWRA will be a data center of Malawi in hydrological and water quality so that long-lasting stagnation in this field will be solved for activating of hydrological and water quality monitoring.

**Promotion of Urban and Rural Water Supply**

The cost estimation clarified that the project costs is very huge, namely those for the four cities amounting to 1.19 billion USD, towns 140 million USD, combination of market centers and rural communities 550 million USD. Access to safe water is the minimum security to support the people living safe and comfortable in urban as well as rural areas. Official assistances should be confirmed from the World Bank, AfDB and other development partners in order to finance those project costs.

It is required to implement rehabilitation of water distribution networks to cope with the leak of water and to reduce NRW in urban areas as well as to develop new water sources. As for boreholes in rural water supply, equipment utilizing jetting method or brushing method is effective to restore their function which is deteriorated by clogging and subsoil sedimentation.

**Promotion of Irrigation Development and the Coordination with the Irrigation Master Plan by the World Bank**

Development of the water resources potential by WRU is proposed in the Irrigation Development Plan. Though the Irrigation Master Plan was started by the World Bank during the period of the JICA Project, coordination between the two projects was not necessarily conducted in satisfactory manner due to a time limitation. As JICA Project Team provided the results of water balance simulation for the World Bank Master Plan Team, which is still working in Malawi, it is expected that the Master Plan of the JICA Project will be utilized by them.

Furthermore, GBI (Green Belt Initiative) is also a national project for the irrigation. A large amount of investment is indispensable by private investors to promote cash cropping from the viewpoint of economic growth as well as supplying irrigation water to smallholders. Thus, such efforts to invite

private investment should be conducted by the whole country with arranging conditions which attract foreigners to make investment easily.

**Further Study on Environmental Flow**

Environment is one of the important users with considering the management of water resources development where environmental flow should be set for the conservation. However, its priority has to be lowered in this Master Plan because environmental factors are not specified to conserve and it may even disturb the water resources development according to a hydrological approach. It is recommended that environmental flow should be set by appropriate approach in feasibility studies on water resources development of rivers in the future, considering the survival property of specified conservation targets.

# PART I EXISTING CONDITION

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# PART I
# Chapter 1. INTRODUCTION

# CHAPTER 1. INTRODUCTION

## 1.1 Background of the Project

Average annual rainfall is about 1,000 mm in Malawi and many perennial flows exist. Generally, water resources are abundant as compared with the other African countries. Mineral resources in Malawi have hardly developed as compared with the neighboring countries. The Malawi Government aims to accomplish economic growth with the utilization of its water resources.

Water resources development and utilization to accomplish economic growth is the main part in the Malawi Growth Development Strategy (MGDS) as mentioned in the second term inaugural speech of President Bingu wa Mutharika. Malawi's National Water Policy in 2005 and National Sanitation Policy in 2008 target "continuous and systematic water resources management and development" and "continuous offer of sanitary service and water supply." In the circumstances described above, appropriate approaches to the targets have to be implemented.

However, proper management and effective use of water resources have not been smoothly implemented and systematic basic information about water resources and water utilization were not updated after making the National Water-Resources Master Plan in 1986 with UNDP support.

To overcome all the existing problems, the Malawi Government has considered integrating the water resources management policy based on the present water budget and water resources potential. The Malawi Government therefore tackles the renewal of the master plan as an item of primary importance. It requested assistance from the Government of Japan to establish a National Water Resources Master Plan together with the capacity building concerned.

In response to the request, JICA dispatched an inquiry mission from February to March in 2011 to perform a preparatory study for the master plan. The inquiry mission conducted investigations on the background of the request and its contents. It also investigated the present cooperation by other development partners, the contents of full-fledged investigation, the implementation organization in Malawi, etc. Subsequently, the Scope of Work (S/W) and the Minutes of Meeting (M/M) were signed by the Japan International Cooperation Agency (JICA) and the Ministry of Irrigation and Water Development (MoIWD) on March 4, 2011.

## 1.2 Objective of the Project

The objectives of the Project are: (1) to formulate the national water resources master plan (the M/P); and (2) to transfer technology and knowledge to the Malawi counterpart personnel.

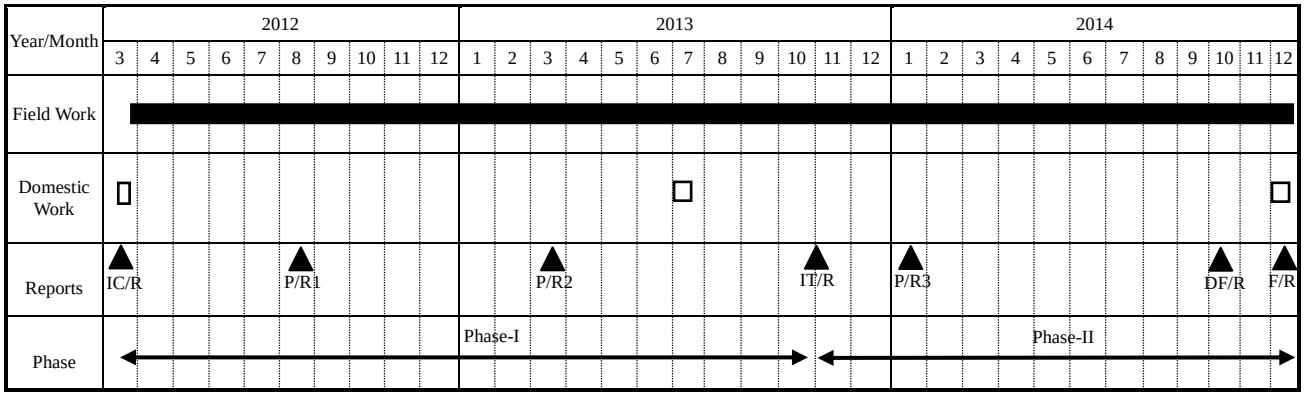
Through establishment of the M/P, issues on the water resources management in Malawi are to be clarified and strategies for the improvement in capability of Malawi and the appropriate directions for water resources management are proposed. Thus, related agencies in Malawi will be able to perform integrated water resources management in the future. Moreover, the technical transfer regarding data collection, analysis, management and planning, etc., will be implemented in the Project through on-the-job training (OJT), seminars, workshops and so on.

## 1.3 Project Area

The Project Area covers the entire Malawi country with an area of 118,000 $km^2$ and a population of 13.1 million (Source: Population and Housing Census, 2008).

## 1.4 Project Schedule

The Project is scheduled for a period of thirty months as shown in **Figure 1.4.1**. To present project progress and results during the Project, several reports will be submitted to related organizations based on the following schedule.




Legend：IC/R: Inception Report; P/R1: Progress Report 1; P/R2: Progress Report 2; P/R3: Progress Report 3, IT/R: Interim Report, DF/R: Draft Final Report; F/R: Final Report
Phase-I: Water resources assessment
Phase-II: Formulation of water resources master plan

**Figure 1.4.1 Schedule of the Project**

## 1.5 Implementation Organization of the Project

### 1.5.1 Staffing Plan

The composition of the JICA Project Team is as shown in the following **Table 1.5.1**.

**Table 1.5.1 Composition of the JICA Project Team**

| Name | Designation or Field of Specialty |
|---|---|
| Kanehiro MORISHITA | Team Leader / Water Resource Management |
| Toshihiro GOTO | Co-Team Leader / Water Resource Development |
| Hironobu KUROE | Urban Water Supply |
| Masahiro YAMAGUCHI | Rural Water Supply |
| Seiichi YAMAKAWA | Agriculture and Irrigation |
| Takao SARUHASHI | Hydro power |
| Kenji MORITA | Hydrological Monitoring |
| Masakazu MIYAGI | Hydrology/ Water Balance/ Flood Control |
| Hirokazu UEDA | Geology/ Water Quality |
| Manabu MAYA | GIS Database |
| Tomoko MIZUYORI | Capacity Development |
| Sebastian JARA | Environmental and Social Consideration |
| Makoto YAJIMA | Economic and Financial Evaluation |
| Toshiaki SATAKE | Construction Plan/ Design |

### 1.5.2 Working System

MoIWD had agreed on the Scope of Work (S/W) of the project. In 2011, however, MoIWD and the Ministry of Agriculture and Food Security were unified to form the Ministry of Agriculture, Irrigation and Water Development, which became the counterpart institution for the project. After that, in April 2012, the new ministry was separated into two ministries again, namely, the Ministry of Agriculture and Food Security and the Ministry of Water Development and Irrigation. In June 2014, they were unified again to form the Ministry of Agriculture, Irrigation and Water Development. Therefore, the Ministry of Agriculture, Irrigation and Water Development finally became the counterpart institution for the Project.

#### (1) Steering Committee

The Steering Committee (SC) established at the beginning of the project and composed of members from related organizations as shown in the following table has the following functions:

- To share information with relevant organizations on the implementation of the Project

- To provide necessary guidance and instructions to the Project Team

MoAIWD shall convene the SC at the time of reports submission and as necessary. The Principal Secretary of MoAIWD acts as the chairman of the SC.

**Table 1.5.2 Composition of the Steering Committee**

| Organization | Member |
|---|---|
| MoAIWD | Vice Chairperson, Director of Water Resource Department, MoAIWD |
| MoAIWD | Director of Water Supply Service Department, MoAIWD |
| MoAIWD | Director of Irrigation Service Department, MoAIWD |
| Water Resources Board | Representative of Water Resources Board |
| MoE | Principal Secretary of Ministry of Energy |
| Ministry of Agriculture, Irrigation and Water Development | Principal Secretary of Ministry of Agriculture and Food Security |

### (2) Technical Committee

For smooth implementation of the Project, the Technical Committee (TC) established with agreement of both sides has the following responsibilities:

- To provide the Project with necessary information on relevant technical aspect
- To share details of technical aspects of the project with relevant organizations
- To assist the Steering Committee

MoAIWD organizes the TC meetings as needed.

### (3) Organizational Framework of the Project

The following chart shows the draft of the organizational framework of the project.

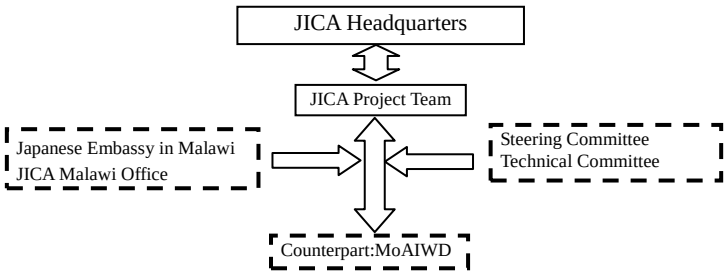



**Figure 1.5.1 Organizational Framework of the Project**

## 1.6 Status of the Project

The Project Team has conducted activities for the collection and arrangement of data and information related to water resources sectors as well as initial capacity assessment and capacity building program under the Phase I project (from March 2012 to August 2013). In September 2013, the Team prepared the interim report to summarize the result of Phase I.

# PART I

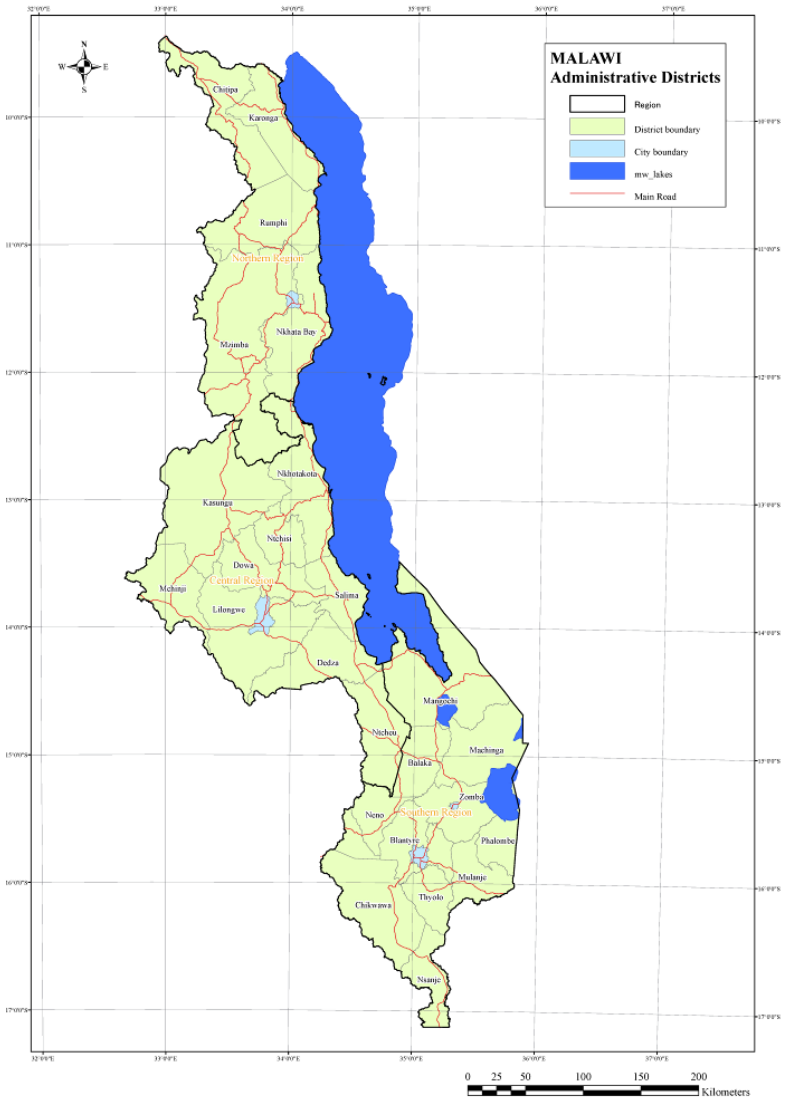
# Chapter 2. INSTITUTIONAL AND SOCIO-ECONOMIC CONDITIONS

# CHAPTER 2. INSTITUTIONAL AND SOCIO-ECONOMIC CONDITIONS

## 2.1 Administrative Setup and Boundary

The Republic of Malawi is a landlocked country in Southeast Africa which borders with Mozambique to the east, south and west, Zambia to the northwest, and Tanzania to the northeast. Parts of the border are along the lakeshore or within Lake Malawi, which separates the country from Tanzania and Mozambique. About 93.2% of its land area of 118,484 km$^2$ is situated within the Zambezi river basin and 86.1% of its population live in this basin (Water and Sanitation Sector Joint Sector Review, 2009). Malawi is a member state of the Zambezi Watercourse Commission (ZAMCOM). The population is approximately 13.1 million with the average growth rate of 2.8% (Population and Housing Census, 2008). Chichewa is the language most widely spoken all over the country, and English is the official administrative language. The four urban centers of Malawi are Lilongwe, Blantyre, Mzuzu and Zomba.

The country is composed of three regions: the northern, central and southern region. There are 28 districts below the level of region as the administrative boundary. The commercial centers like Lilongwe in Lilongwe District encounter higher population growth rates due to the growing urbanization and the influx of people looking for better economic opportunities as well as jobs. Next to Lilongwe, the districts of Mchinji, Chitipa and Karonga, which are the northern borders with Tanzania and Zambia, are seeing higher growth rates due to trading activities. Mwanza District was divided into Mwanza and Neno in 2007, which made the total number of districts 28. A map showing the district boundaries is given in **Figure 2.1.1**. Under the districts, there are the traditional authorities (TAs) whose leaders are chosen by traditional parentage, generally families. Villages in rural areas are small entities in terms of the number of people. Generally, their respective communities based on traditional rules and values chose the village chiefs. Some 80% of them live in the rural areas. A summary of the population is in **Table 2.1.1.**




Source: Project Team

**Figure 2.1.1 Administrative Districts of Malawi**

**Table 2.1.1 Administrative Districts of Malawi**

| Region | Population | | | | Area ($km^2$) |
|---|---|---|---|---|---|
| **A. SOUTHERN REGION** | **1998-1999** | **2008** | **Difference** | **Growth Rate** | |
| 1. BALAKA DISTRICT | 253,098 | 316,748 | 63,650 | 1.25 | 2,193 |
| 2. BLANTYRE DISTRICT | 809,397 | 999,491 | 190,094 | 1.23 | 2,012 |
| 3. CHIKWAWA DISTRICT | 356,682 | 438,895 | 82,213 | 1.23 | 4,775 |
| 4.CHIRADZULU DISTRICT | 236,050 | 290,946 | 54,896 | 1.23 | 767 |
| 5. MACHINGA DISTRICT | 369,614 | 488,996 | 119,382 | 1.32 | 3,771 |
| 6. MANGOCHI DISTRICT | 610,239 | 803,602 | 193,363 | 1.32 | 6,273 |
| 7. MULANJE DISTRICT | 428,322 | 525,429 | 97,107 | 1.23 | 2,056 |
| 8. MWANZA DISTRICT | 138,015 | 94,476 | -43,539 | 0.68 | 826 |
| 9. NSANJE DISTRICT | 194,924 | 238,089 | 43,165 | 1.22 | 1,942 |
| 10.PHALAMBE DISTRICT | 231,990 | 313,227 | 81,237 | 1.35 | 1,394 |
| 11. THYOLO DISTRICT | 458,976 | 587,455 | 128,479 | 1.28 | 1,715 |
| 12. ZOMBA DISTRICT | 546,661 | 670,533 | 123,872 | 1.23 | 2,580 |
| 13. NENO DISTRICT | | 108,897 | 108,897 | | 1,469 |
| **B. CENTRAL REGION** | | | | | |
| 1. DEDZA DISTRICT | 486,682 | 623,789 | 137,107 | 1.28 | 3,624 |
| 2. DOWA DISTRICT | 411,387 | 556,678 | 145,291 | 1.35 | 3,041 |
| 3. LILONGWE DISTRICT | 1,346,360 | 1,897,167 | 550,807 | 1.41 | 6,159 |
| 4. KASUNGU DISTRICT | 480,659 | 616,085 | 135,426 | 1.28 | 7,878 |
| 5. MCHINJI DISTRICT | 324,941 | 456,558 | 131,617 | 1.41 | 3,356 |
| 6.NKHOTAKOTA DISTRICT | 229,460 | 301,868 | 72,408 | 1.32 | 4,259 |
| 7. NTCHEU DISTRICT | 370,757 | 474,464 | 103,707 | 1.28 | 3,424 |
| 8. NTCHISI DISTRICT | 167,880 | 224,098 | 56,218 | 1.33 | 1,655 |
| 9. SALIMA DISTRICT | 248,214 | 340,327 | 92,113 | 1.37 | 2,196 |
| **C. NORTHERN REGION** | | | | | |
| 1. CHITIPA DISTRICT | 126,799 | 179,072 | 52,273 | 1.41 | 4,288 |
| 2. KARONGA DISTRICT | 194,572 | 272,789 | 78,217 | 1.40 | 3,355 |
| 3. LIKOMA DISTRICT | 8,074 | 10,445 | 2,371 | 1.29 | 18 |
| 4. MZIMBA DISTRICT | 610,994 | 853,305 | 242,311 | 1.40 | 10,430 |
| 5. RUMPHI DISTRICT | 128,360 | 169,112 | 40,752 | 1.32 | 4,769 |
| 6.NKHATABAY DISTRICT | 164,761 | 213,779 | 49,018 | 1.30 | 4,071 |
| TOTAL | 9,933,868 | 13,066,320 | 3,132,452 | 1.32 | 2,193 |

Source: www.districts of malawi.com
1. 1988 Malawi Census Analytical Report
2. Mwanza District Assembly District Education
3. Wikipedia, "Neno District"
4. Environmental Impact Assessment: Mozambique-Malawi Interconnection Draft
5. "2008 Population and Housing Census, Preliminary Report"
6. Institute for Security Studies

## 2.2 Present Institutional Framework of Water Resources Management

Water resources have multifunctional roles for different purposes: agriculture, industrial production, potable water for drinking and domestic use, and hydropower generation. Currently, different ministries and institutions are taking charge of respective areas of water use. The management of national water resources is primarily under the responsibility of the Ministry of Agriculture, Irrigation and Water Development for

policy-making, supervision and direction in the areas of irrigation, water supply, and water for production. The focus on the institutional involvement is therefore the Ministry of Agriculture, Irrigation and Water Development. The Ministry of Natural Resources, Energy and Environment (MoNREE) is responsible for hydropower development. There is already a master plan on energy development including hydropower produced for the MoNREE. This report focuses more on the water resources management although the plan for hydropower is not less important or neglected. **Table 2.2.1** shows the governmental bodies for the water sector.

**Table 2.2.1 Institutional Setting, Roles and Responsibilities**

| Institutions | Roles and Responsibilities |
|---|---|
| Ministry of Agriculture, Irrigation and Water Development | Monitor, regulate, investment and set policies for the water sector. |
| Ministry of Health | Sanitation and hygiene education |
| Water Resources Board | Water tariff setting, water right, license |
| Water Boards | Implement water supply services |
| Local government | Plan and coordinate water supply and sanitation services |

Source: Completion Report on the Dispatch of Expert to the Government of the Republic of Malawi in the Field of Water Resources Phase I revised by the Project Team.

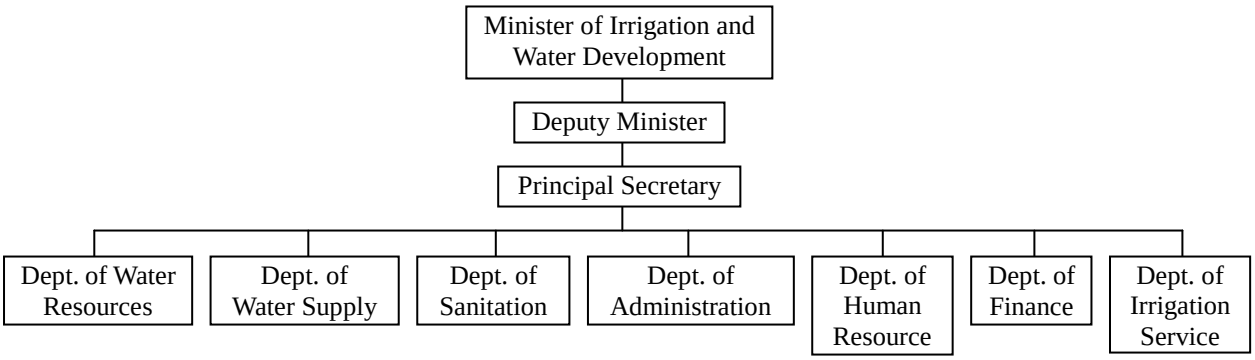
### (1) Ministry of Agriculture, Irrigation and Water Development

The MoAIWD is the central institution to facilitate the development and management of water resources in Malawi. Its primary responsibilities are to ensure access to safe water and sanitation, the provision of safe drinking water to rural communities, water resources management, provision of irrigation scheme, and the collection as well as monitoring of hydrological data and catchment protection to support policy formulation. The Ministry has four technical departments and three administrative departments as shown in **Table 2.2.2** and **Figure 2.2.1**.

**Table 2.2.2 Administrative Departments of MoWDI as of 2012**

| Departments | Sections |
|---|---|
| Department of Water Resources | Surface water, Ground water, Water quality |
| Department of Water Supply | Operation maintenance monitoring & evaluation, Planning design and construction |
| Department of Sanitation | Sanitation |
| Department of Irrigation Services | Planning design and operation, Irrigation management, Research and development, Administration |
| Department of Administration | Planning, Administration |
| Department of Human Resources | Human resources |
| Department of Finance | Finance |

Source: The Ministry of Water Development and Irrigation Organogram, 2012




Source: The Ministry of Water Development and Irrigation Organogram 2012

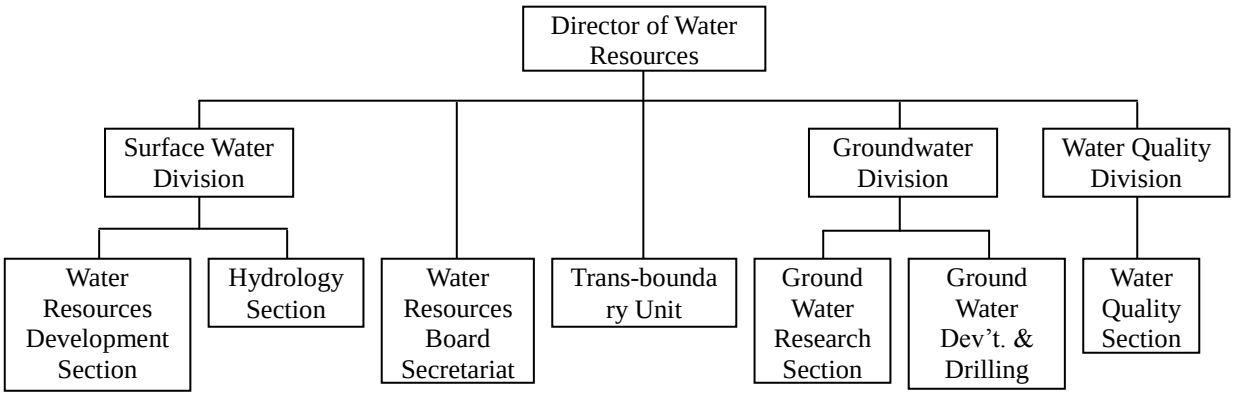
**Figure 2.2.1 Organization Chart of MoWDI as of 2012**

Responsibility of each technical department is as follows:

- Department of Water Resources: To manage and develop water resources for all sectors utilizing water in Malawi.
- Department of Water Supply: To supply safe water to local communities, and to supervise water supply and sewerage treatment in towns and urban areas through the water boards.
- Department of Sanitation: To consider and adjust policies on sanitation sector programs.
- Department of Irrigation Service: To implement various-scale irrigation schemes to increase and stabilize agricultural production.

Among the above four departments, the Department of Water Resources is the main actor in terms of water resources management. It has the roles of (i) management and development of surface water, including observation, assessment and conservation of surface water; (ii) management and development of groundwater including monitoring of groundwater; (iii) water quality monitoring, assessment and management including contamination control; (iv) management of laws and regulations on water resources; and (v) management of transboundary water resources.

The Department of Water Resources has three divisions and several sections as shown in **Figure 2.2.2**. From the viewpoint of observation and monitoring, the Hydrology Section is in charge of the management of hydrological observations on water level and discharge, the Groundwater Research Section has the responsibility of groundwater monitoring, and the Water Quality Section takes care of water quality monitoring.




Source: The Ministry of Water Development and Irrigation Organogram 2012

**Figure 2.2.2 Organizational Chart of the Department of Water Resources**

On the other hand, from the aspect of relationship between the central and regional organizations of MoAIWD, the headquarters is located in Lilongwe, the three regional water development offices are in the Northern, Central and Southern regions respectively, and district water offices are located in 28 of the districts. The role of each regional office is to provide support and role coordination among their districts. In the district water office, appropriate staff are assigned from the sector (department) of water resources, water supply and administration, depending on the requirement of each district. For example, there are no positions/posts assigned from the water resources sector including hydrological services in some districts. Besides, the Department of Irrigation Services has a different system. It has the irrigation services headquarters in Lilongwe, eight irrigation service divisions (ISDs) at the regional level, and 25 district irrigation offices. The eight ISDs will be reorganized into three ISDs in future.

As a serious issue regarding the MoAIWD organization in both central and regional level, a lot of positions/posts that are necessary to properly manage the organization are vacant mainly due to shortfall in human resources and financial constraints.

### (2) Water Resources Board

The Water Resources Board (WRB) in the Department of Water Resources under the MoAIWD is in charge of managing the water rights and abstraction fees (for water use and discharge of wastewater) for

both public and private sectors. The number of water users is recorded; however, data management for water rights is not enough condition to draw and examine actual conditions of water allocation.

### 1) Water Rights Function of WRB

WRB exercises its responsibility for the protection and control of public water, as well as conservation and use through:

- Issuance of water rights, consents and certificate of easement
- Imposition of fines and penalties
- Responding to pollution incidents
- Conflict management as regards water abstraction among users
- Regulation of the Shire River flow
- Collaboration with other stakeholders in the water and sanitation sector

The Water Resources Board has granted water rights for 911 water users as of August 2011. Water boards, private companies, farmers, investors, etc., are granted with water rights and, in some instances, a water user can hold a number of water rights. For example, the water board requested water rights for water users in its jurisdictional area. Unfortunately, the Water Resources Board keeps a record of the number of water users but not water rights due to the lack of tools and manpower. Hence, many unregistered water users, as well as records on the number of water users, might exist in the whole of Malawi.

### 2) Application Procedure for Water Rights

To obtain water rights and be able to abstract surface water, water users must go under the following procedure:

- File an application with the Chairman of the Water Resources Board.
- The Water Resources Board sends Form WRB 1 for surface water abstractions to applicant/client.
- Applicant to fill the form, using qualified and experienced engineers, and return it to the Water Resources Board together with MK3,000.00 as application fee.
- A 1:50,000 scale map is to be included indicating the grid reference of the location.
- The Water Resources Board issues the Water Rights after assessment by the Secretariat and the Board and Technical meetings held quarterly in a year.
- Then the applicant/client proceeds to abstract water.

With regard to groundwater abstraction, the procedure for water users is as follows:

- File an Application with the Chairman, Water Resources Board.
- The Water Resources Board sends Forms WRB 1A and WRB 2 for groundwater to the applicant.
- Applicant to fill the forms, using qualified and experienced engineers, and return them to the Water Resources Board together with MK3,000.00 as a non-refundable application fee.
- A 1:50,000 scale map is to be included indicating the grid reference of the location.
- The Water Resources Board issues the Water Rights after assessment by the Secretariat and the Board and Technical meetings held quarterly in a year.
- Then the applicant conducts a geophysical survey using qualified and experienced engineers and sends the results to the Water Resources Board with a copy to the Secretary for Water Development, through the Chief Hydro-geologist.
- Applicant drills boreholes using qualified contractors registered with the National Construction Industry Council of Malawi (NCIC).
- All data from drilling logs are to be documented and sent to the Water Resources Board.

To receive water rights and allowed to discharge wastewater, water users shall follow the following procedure:

- File an application with the Chairman, Water Resources Board.
- The Water Resources Board sends form to applicant.
- Applicant to fill the form, using qualified and experienced engineers, and return it to the Water Resources Board together with MK3,000.00 as application fee.
- A 1:50,000 scale map is to be included indicating the grid reference of the location.
- The Water Resources Board issues the license after assessment by the Secretariat and the Board and Technical meetings held quarterly in a year.
- After receipt of the license, the applicant can proceed with the discharge of wastewater.

#### 3) Regulations on Water Board

The Water Resources Board also controls the quantity and quality of water resources in the country so that the available water resources would be sustainable through the administration of the Water Resources Act (1966) and Waterworks Act (1995).

The Water Resources Act (1969) states that no person shall abstract, divert, dam, store public water for the purpose of irrigation, industrial, power, public, domestic (other than normal village use) or for any purpose construct or maintain any works except in accordance with water right granted or deemed to be granted under the Act.

### (3) Setting of Water Tariff

According to the Water Resources Board (WRB) of the MoAIWD, any person/organization granted with the right to abstract public water shall pay annual water right fees which is calculated based on daily fees by using the following formula:

Total Fee = (Water Rate)*[Factor A + Factor B+ Factor C]*365

"Water Rate" is the rate charged per amount of water abstracted and depends on the type of usage, and the rate is equal to MK2.50 as of July 1, 2012 (see **Table 2.2.3**). Factor A relates to water source/place, B is purpose of water use, and C is season of use (see **Table 2.2.4**). Before the application system, the water rate had been set at only MK0.5/$m^3$.

**Table 2.2.3 Unit Cost by Amount for Consumptive Use**

| Quantity of Water | Water Rate for Consumptive Use | Water Rate for Non-Consumptive Use |
|---|---|---|
| Initial 500,000 $m^3$ | MK2.50/1,000$m^3$ per day (or part thereof) | MK2.50/10,000$m^3$ per day (or part thereof) |
| Next 500,000 $m^3$ | MK2.50/500$m^3$ per day (or part thereof) | MK2.50/5,000$m^3$ per day (or part thereof) |
| In excess of 1,000,000$m^3$ | MK2.50/250$m^3$ per day (or part thereof) | MK2.50/2,500$m^3$ per day (or part thereof) |

Source: Water Resources Board

**Table 2.2.4 Water Rate Factors**

| Factor A | | Factor B | | Factor C | |
|---|---|---|---|---|---|
| Source/Place | Factor | Use of Water | | Season | Factor |
| Lake Malawi | 1.4 | Drip Irrigation | 2.0 | All year round | 1.5 |
| Upstream of Matope/L. Malombe | 1.8 | Flood Irrigation | 2.3 | Dominantly dry | 2.0 |
| M/Shire bwtn Matope & Chikawa | 1.5 | Sprinkler Irrigation | 2.2 | Rainy Season | 1.0 |
| Lower Shire below Chikwawa | 1.2 | Industrial Use | 2.6 | | |
| L.Chiuta & tributaries | 1.0 | Fisheries | 1.5 | | |
| Private storage reservoirs | 0.5 | Navigation | 1.4 | | |
| Stream into L.Malawi | 1.5 | Public Water Supply | 1.5 | | |
| Lake Chilwa | 1.0 | Domestic Water Use | 1.0 | | |
| Stream into L.Chilwa | 1.0 | Power Generation | 0.5 | | |
| Stream into Shire | 1.0 | Conservation | 0.5 | | |
| Groundwater | 1.5 | Recreation | 1.4 | | |

Source: Water Resources Board

### (4) Definition of Water Supply Coverage Area

Coverage area of water supply is defined by households having access to improved water supply within 500 m (rural area) or 200 m (urban area) with a return trip of less than 30 minutes and a daily per capita consumption of at least 27 liters[1]. The table below summarizes the progress rate of access to improved water supply in rural and urban areas (% of households).

**Table 2.2.5 Progress Rate of Access to Improved Water Supply**

| Year | Rural Areal (% of households) | Urban Area (% of households) |
|---|---|---|
| 1990 | 35% | 90% |
| 1995 | 46% | 92% |
| 2000 | 57% | 93% |
| 2005 | 68% | 94% |
| 2008 | 77% | 95% |
| 2010 | 77% | 92% |
| 2015 (MDG target) | 67% | 95% |
| 2016 (MGDS II target) | 75% | 95% |

Source: Malawi Sector Performance Report 2011

### (5) Local Government (District Council/City and Town Council)

District councils are primarily responsible for rural and urban water supply and sanitation services. In urban areas where both district and city/town councils exist, there is a demarcation of responsibility between the district council and the city/town council. The District Council looks after the operation and maintenance of rural water supply and sanitation while the city/town council looks after those of the city/town center. In districts where there is no council due to the small size of town, the district council looks after the whole district.

However, the local government elections scheduled several times to elect local representatives in recent years did not actually take place but postponed until 2014. Therefore, no council is currently in place at the district level so that the local governments are not currently fully able to plan and make decisions on water supply services in rural areas in Malawi. The district water offices under the Ministry of Agriculture, Irrigation and Water Development render technical services for operation and maintenance and implementation of construction projects. In recent years, devolution efforts have been undertaken on the Sector Wide Approach framework, whereby the Ministry of Local Government and Rural Development plays a coordinating role in devolution and decentralization efforts in the district level.

Water supply activities devolved to the district level are the following:

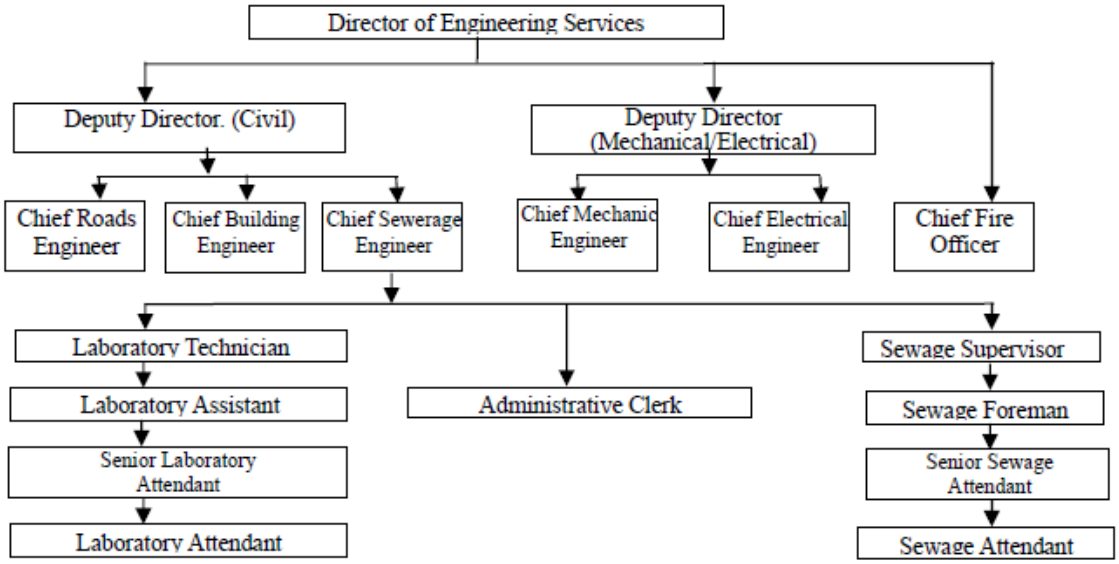
- Operation and maintenance of borehole and hand pump facilities
- Operation and maintenance as well as rehabilitation of rural piped water supply system
- Training and enhancement of community based management system of water supply facilities
- Assurance of availability of spare parts for water supply facilities

Meanwhile, the district/city councils hold the main responsibility for sewerage/sanitation services including waste removal and disposal services. (The main institutions responsible for sanitation are the MoAIWD, the District/City councils and the Ministry of Health, but the National Sanitation Policy places responsibility for sanitation under the water boards.)

The overall role of district/city councils is to achieve universal access to improved sanitation, improved health and safe hygiene behavior nationwide. In addition, the major challenge in urban areas includes indiscriminate waste disposal, environmental degradation and pollution from domestic/industrial effluent, and insufficient waste management regulations.

(Three major cities in Malawi; i.e., Lilongwe, Blantyre and Zomba cities, have public sewerage systems of the off-site system. In Mzuzu City, there are community sewerage systems only in the army and the Central Hospital. Other areas have used the on-site sanitation systems such as septic tank, pit latrine, eco-san toilet, etc.)

The organization that has jurisdiction over the sewerage service of Lilongwe City is shown in **Figure 2.2.3** as a typical example. Similarly, in other cities, the sewerage service is under the jurisdiction of the Engineering Services or the Health Department.




Source: Lilongwe City Council, 2013 / Study on Urban Development Master Plan for Lilongwe (JICA) 2010)

**Figure 2.2.3 Organizational Structure of Lilongwe City Council**

### (6) Water Boards

Five water boards have been established as parastatal organizations under the Water Works Act of 1995. Two of them, the Blantyre and Lilongwe water boards, serve the two cities and their peri-urban areas. The other three boards (Northern, Central and Southern Region water boards) were established to provide water to wide ranges of other 2 cities, towns and commercial centers. According to the Water Works Act, the boards are responsible for, among others, the promotion of sanitation services and enforcement of water works by-laws related to the construction of delivery and connection facilities of services for water supply and sanitation in declared water areas. (However, in reality, sewerage services are currently the responsibility of city assemblies.)

Coverage areas of water boards are shown in following table.

**Table 2.2.6 Coverage Area of Water Boards**

| Water Boards | Coverage Area |
|---|---|
| Lilongwe | Lilongwe city urban and peri-urban areas (3 zones - Northern, Central, Southern) |
| Blantyre | Blantyre city urban and peri-urban areas (3 zones - Kabula, Soche, Limbe) |
| Northern | Muzu city, towns and commercial centers in the northern region (5 zones - Mzuzu, Karonga, Karonga, Nkhata Bay, Mzimba, Rumphi) |
| Central | Towns and commercial centers in the central region (5 zones- Kasungu, Salima, Dedza, Mponela and Likuni) |
| Southern | Zomba city, towns and commercial centers in the southern region (5 zones - Zomba, Liwonde, Mangochi, Mulanje, Ngabu) |

Source: Project Team

Water boards are targeting the cities and towns where profitability is relatively high. On the other hand, in other rural areas (Market center: 5,000-10,000 people scale, and Villages), the MoAIWD or other development partners are constructed a water supply facility, and the residents, Water Users' Associations (WUAs) and Water Point Committees (WPCs) are responsible for the maintenance of facilities.

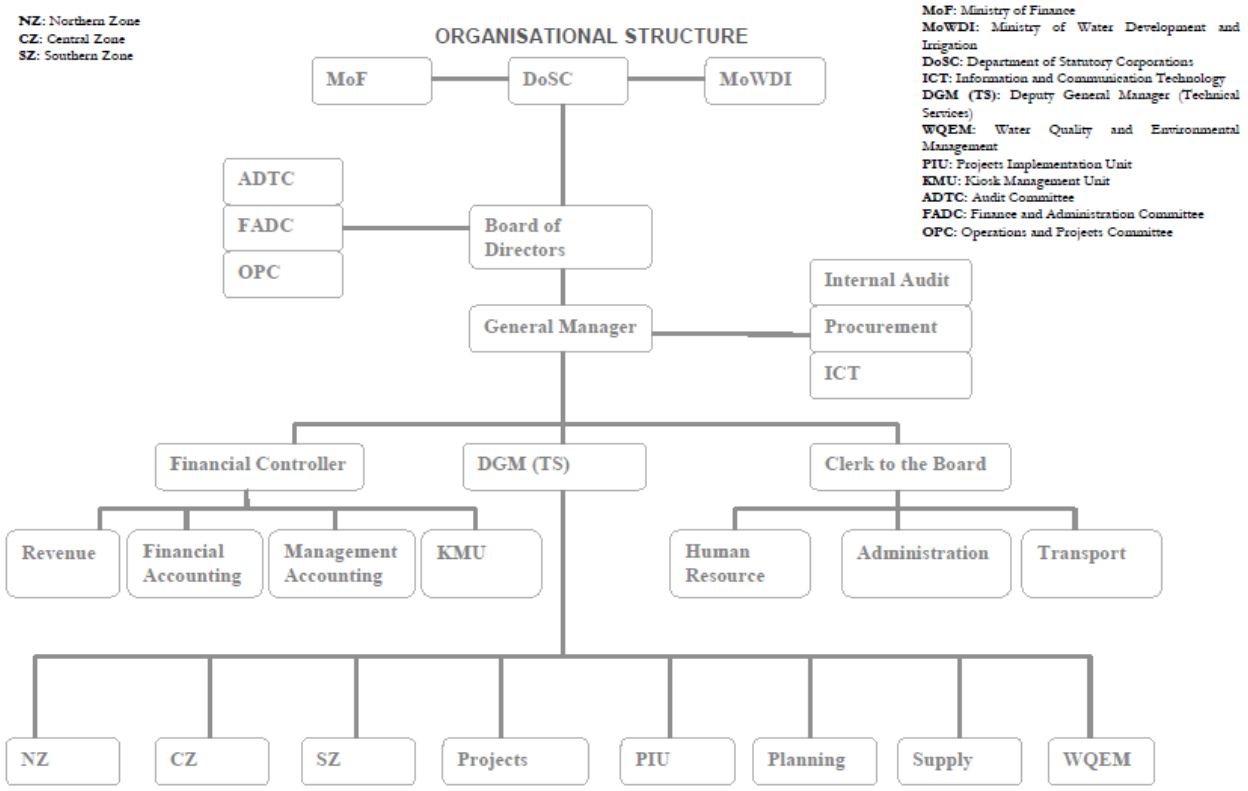
In addition to the water boards, the WASAMA (Water Services Association of Malawi) has been in existence to address common issues, etc., of tariff adjustment between water boards and GoM to make sure that these five boards are operating effectively.

The following describes the current organizational situation of two water boards that cover the water supply of two main urban cities: Lilongwe and Blantyre.

### 1) Lilongwe Water Board

The Lilongwe Water Board (LWB) was established in 1947 and it was reconstituted as a parastatal organization under the Water Works Act of 1995. The LWB is a statutory corporation mandated by the GoM to supply water to the City of Lilongwe and surrounding areas.

The organizational structure of LWB is as shown in **Figure 2.2.4**. The organization consists of the Technical Service, Finance (Financial Controller), and human resource/administration (Clerk to the Board), etc. The LWB currently has 423 employees, i.e., 12 employees per one thousand connections.




Source: Lilongwe Water Board, 2013

**Figure 2.2.4 Organizational Structure of LWB**

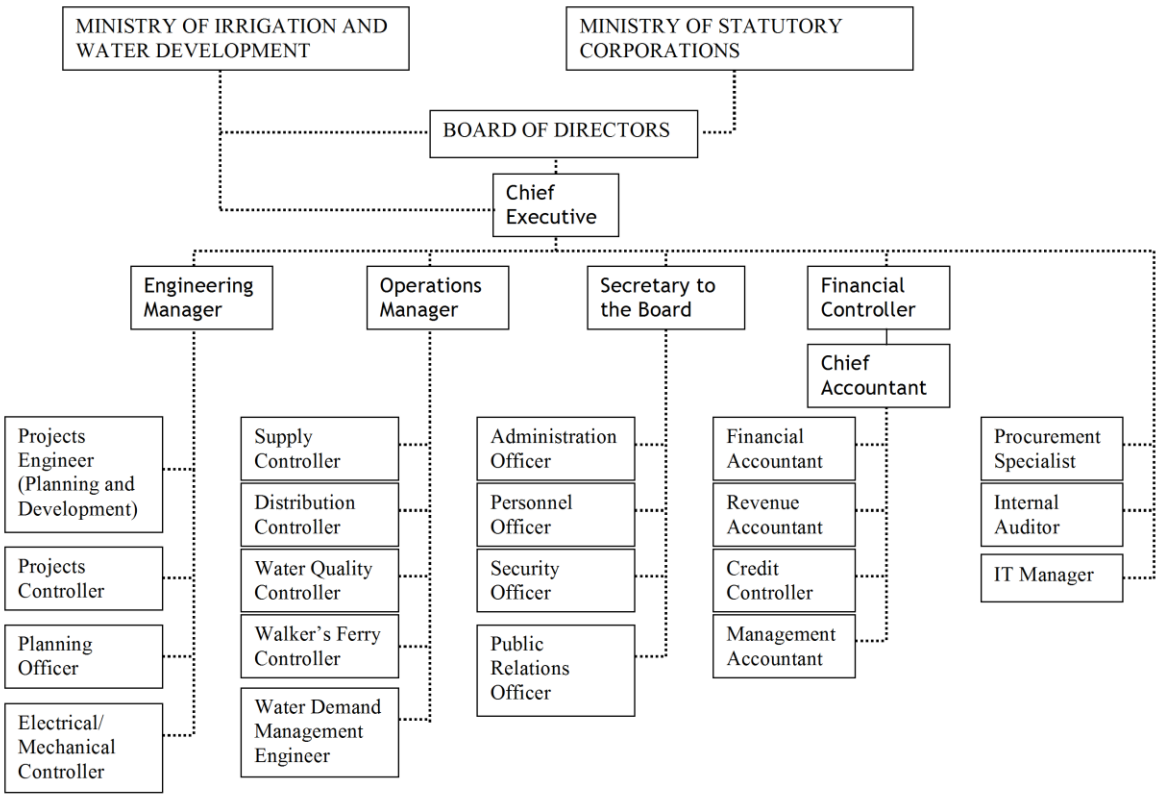
### 2) Blantyre Water Board

The original Blantyre Water Board (BWB) was established in January 1929 after the construction of the Hynde Dam Scheme, and provided the first piped water to residents of Blantyre Town in 1930. After the enactment of the Water Works Act of 1995, the BWB was reconstituted as a parastatal organization to supply potable water to Blantyre City and surrounding areas.

The organizational structure of BWB is as shown in **Figure 2.2.5**. The organization consists of Engineering, Operations, Finance (Financial Controller), and human resource/administration (Secretary to the Board), etc. The BWB currently has 554 employees, i.e., 14.7 employees per one thousand connections.

The Blantyre Water Board collaborates with the following water resources management institutions:

- The Southern Africa Development Corporation - Global Water Partnership (SADC-GWP)
- The Abidjan-based Water Utility Partnership (WUP),
- The International Water Association (IWA)
- Water Operators Partnerships for Africa based in Nairobi




Source: BWB, Business Plan for 2007 to 2015 (June, 2006)

**Figure 2.2.5 Organizational Structure of BWB**

### 3) Kiosk Management in Lilongwe

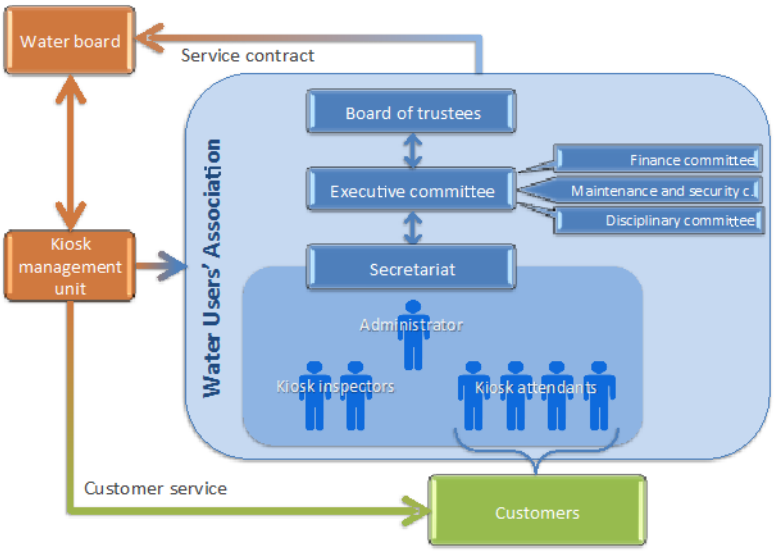
In addition to normal house connection supply, communal water points have been established by the Water Boards since the 1980s, to improve services in low-income settlements of Malawian cities. While kiosks are owned by the boards, from the start, management for many of these stand-posts was handed over to alternative providers; e.g., water committees or local leaders. However, bill payment problems arose, and in response, both water boards established kiosk management units (KMUs) and introduced water users' associations (WUAs) to manage the kiosks. (Compared to other operators, WUAs manage a much higher number of kiosks as shown in **Table 2.2.7**.)

**Table 2.2.7 Types of Operator of Water Kiosks in Blantyre and Lilongwe**

| Lilongwe | | Blantyre | |
|---|---|---|---|
| Operator | Kiosk No | Operator | Kiosk No |
| LWB | 106 | BWB | 25 |
| Private individuals | 90 | Private individuals | >21 |
| CBOs | 10 | Water committees | >100 |
| WUAs | 303 | WUAs | 159 |
| Total | 566 | Total | 315 |

Source: Malawi Sector Performance Report 2011

This WUA management structure by KMUs has been criticized as top-heavy and costly. However, WUAs achieve reasonably good kiosk management and cost recovery. The local community management "self-regulation" of the water kiosk management is delivering regular bill payment, reasonable cost recovery and reduction of arrears, adequate kiosk maintenance and relatively low reselling prices.




Source: Malawi Sector Performance Report 2011

**Figure 2.2.6 WUA Management Structure by KMU**

## 2.3 National Development Policies and Legislation

### 2.3.1 National Water Development Programme

The National Water Development Programme (NWDP) started in 1994 in MoAIWD as a focal point for the Ministry and development partners to facilitate a smooth engagement into the water sector, which is now run as the NWDPII from 2007 to 2015. The Programme Management Unit (PMU) in the MoAIWD manages NWDPII. The NWDPII is functioning as a focal programme in MoAIWD to streamline interventions and development partner funds into a coherent effort to increase access to sustainable water supply and sanitation services for both rural and urban population as well as production and commercial purposes. It also aims at improving water resources management at the national level. The overall intention of the program is as summarized below.

Sector Goal

To ensure sustainable provision of adequate quantity and quality of water and adequate sanitation services to the whole population of Malawi.

Long Term Outcome

Healthier population with easier access to improved water supply and sanitation

Performance Indicators

1. Water coverage and access to sanitation to meet national targets

2. Incidence of death in Under 5's from waterborne diseases by 2025

The National Water Development Programme (NWDP) has four components:

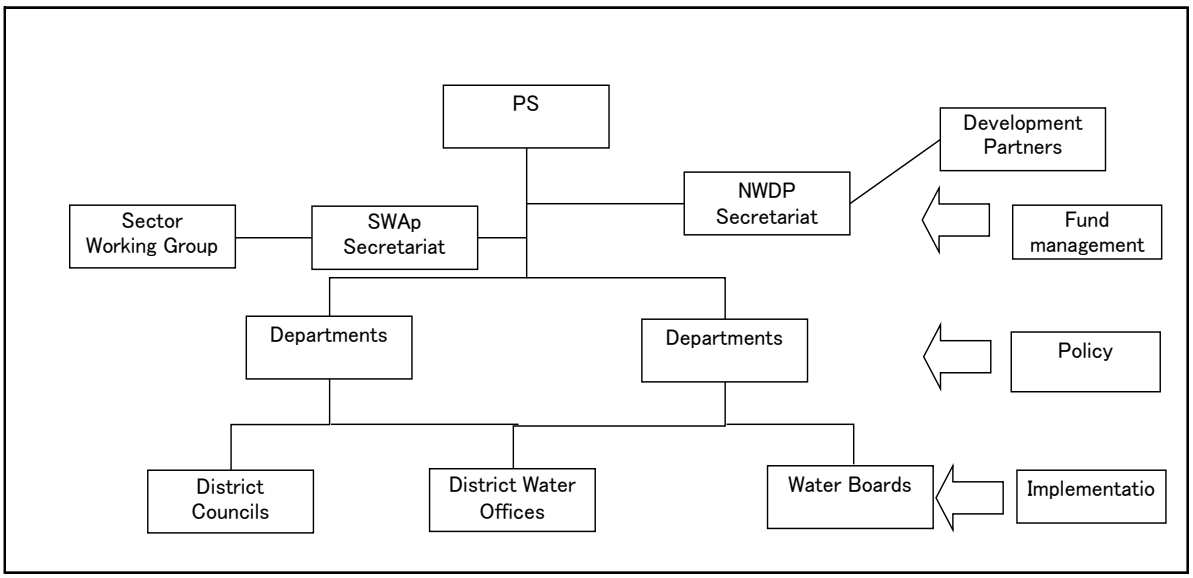
- Urban Water Supply and Sanitation
- Town, Market Centre and Rural Piped and Point Water Supply and Sanitation
- Water Resources Management
- Program Management and Capacity Building

Currently, AfDB, the World Bank, Australia, EU and other various development partners are participating in the program to assist MoAIWD in project interventions and policy guidance in a coherent and streamlined assistance for the water sector. However, from the onset, NWDP is a temporal solution for development of the water sector and expected to terminate in 2015. Since the capacity of the Ministry to administer policy implementation is still rather weak, a more viable institutional solution for its future direction is needed. In

this context, the Sector Wide Approach (SWAp) is being prepared to support a single policy and expenditures on the water sector development under the government leadership.

### 2.3.2 Sector Wide Approach (SWAp)

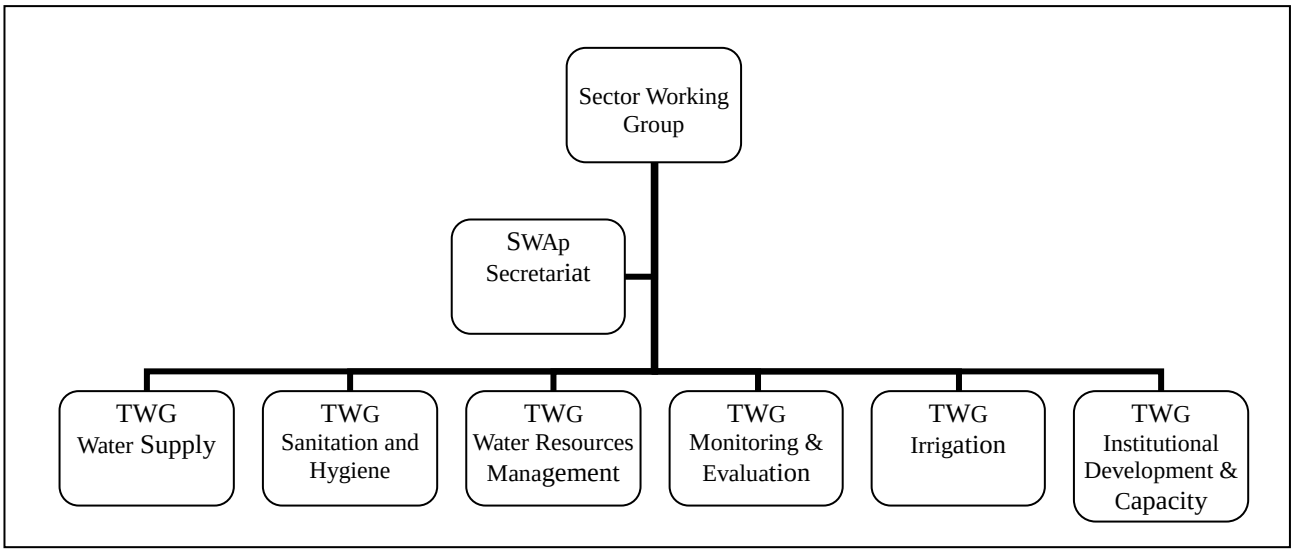
For the water sector, NWDPII is to terminate in 2015. From the onset, it was agreed that NWDP is a temporal solution to coordinate funding and project implementation engagements and hence a longer term structure has been sought. The concept of sector wide approach (SWAp) has been widely promoted in all sectors. In the same token, for the water sector, the Sector Wide Approach (SWAp) has been proposed for future direction and preparatory activities to form a SWAp system have been undertaken. The system aims to give more reliance on government procedures to disburse and account for all funds. However, a viable institutional structure has not yet been agreed upon among stakeholders in the Ministries and development partners and it is still under consideration. It is suggestive that a key functional structure to liaise the Ministry with development partners and investors needs to be put in place but such institutional function is still not finalized as to how and who are going to work within it. The current institutional structure of the water sector under the MoAIWD is shown in **Figure 2.3.1**.




Source: Project Team

**Figure 2.3.1 Institutional Structure of Water Resources Management under MoAIWD**

Under the SWAp structure, a sector working group (SWG) is set with six technical working groups (TWGs) to discuss policy directions, work on specific challenges and undertake policy implementation activities in each technical domain. The members of the TWGs are composed of government officials, development partner agencies, and NGOs. Except for the government officials from the ministry, membership is rather voluntary and if there is an interested party, it can ask the TWG to be a member. The technical working groups discuss policy directions to facilitate implementation of undertakings that they have agreed to achieve. Currently, however, the technical working groups discuss issues with sporadic commitment without having concrete implementation agreements so that decisions that are made in the meetings are not effectively implemented. The SWAp Secretariat is currently set up with three parttime officers in charge of the Planning, Monitoring and Evaluation Section of the Department of Administration to administer the clerical and administrative work. This is a weak administrative support unit to underpin SWAp to work sustainably. **Figure 2.3.2** illustrates the structure of TWGs.




Source: Project Team

**Figure 2.3.2 Water Sector Technical Working Group**

## Table 2.3.1 Management Structure of the Water Sector Wide Approach 1/4

| TWG | Items | Contents |
|---|---|---|
| Water for Production/ Irrigation | Specific Objectives | ・ Provide policy direction and guidance e for the sub-sector<br>・ Promote integrated development of irrigation schemes in a sustainable manner<br>・ Enhance agricultural production and productivity in line with the Greenbelt Initiative<br>・ Enhance collaboration amongst key stakeholders in mobilization and harmonization of water based investments<br>・ Promote generation of hydro power |
| | Golden Indicators | ・ Area under irrigation increased from 90,000 hectares to 200,000 hectares by 2016<br>・ Number of fish-ponds constructed and stocked increased from 6,500 to 7,500 by 2016<br>・ Amount of hydropower (electricity) generated increased |
| | Activities | ・ Consider programs of work, work plans and budgets that are developed in the subsector before submission to SWGs<br>・ Review and develop policies, strategies and regulations for adoption of the SWG in the subsector<br>・ Develop guidelines and best practices for improved water productivity and submit to SWG for adoption<br>・ Consider subsector performance report before adoption of the SWGs<br>・ Provide professional advice on subsector policies, strategies and regulations to the SWGs<br>・ Recommend to SWG establishment of Technical Committees or Task Forces on priority areas a s required<br>・ Analyze and recommend Water for Production technologies to be adopted by SWG |
| Institutional Development And Capacity Building | Specific Objectives | ・ Ensure the institutional framework at central, regional and local levels to implement the Public Sector Reform Management Programme (PSRDMP)<br>・ Ensure adequate capacity in the national system at all levels to support implemention of SWAp programes and processes<br>・ Ensure there is effective collaboration and partnership amongst SWAp stakeholders<br>・ Promote information sharing among SWAp stakeholder<br>・ Facilitate implementation of sector reform and establish appropriate institutional framework for effective operationalization |
| | Golden Indicators | ・ The percentage of cooperating partners that have agreed to SWAp financing, procurement and reporting mechanisms<br>・ The percentage of funding from cooperating partners that is going through SWAp financing mechanisms to reach 100%<br>・ Reduce overall sector vacancy rate<br>・ Increase operational funding to district water offices |
| | Activities | ・ Analyze fiduciary arrangements in the country and recommend a fiduciary framework or financing arrangements between government and the cooperating partners on funding and reporting to the SWAp<br>・ Consider and recommend strategies to be adopted by the SWG to address the human resource gap<br>・ Consider and recommend strategies to be adopted by SWG to address the skills and other resources gaps at central, regional and district levels<br>・ Develop a communication strategy and recommend for its adoption and implementation<br>・ Consider financial and human resource performance reports before adoption of the SWG<br>・ Coordinate the development of a sector governance strategy and program<br>・ Provide professional advice to SWG on governance strategy and program<br>・ Recommend establishment of technical committee or task force on priority areas as required<br>・ Analyze and recommend resolutions to issue emerging in the subsector for SWG consideration<br>・ Coordinate the development and implementation of an appropriate institutional framework and requisite capacity strategy to support routine work functions of all implementing agencies<br>・ Coordinate preparation of a consolidated sector budget and financial reports reflecting all on-going development partner funded activities and programs in the sector, whether funded through direct support, pool funding etc.<br>・ Coordinate development and implementation of a coherent capacity development strategy based on a needs assessment and functional review<br>・ Coordinate consolidation of performance reports based on joint monitoring indicators<br>・ Coordinate joint planning nd implementation of cross-cutting issues such as gender mainstreaming, environment and climate change within the sector or through collaboration with other sectors<br>・ Follow-up on issues relevant to the TWG that are raised in either SWG and identify those issues within the TWGs that may need to be taken for higher level discussions |

Source: Terms of Reference for the Water Sector Wide Approach (SWAp), June 2014

## Table 2.3.1 Management Structure of the Water Sector Wide Approach 2/4

| TWG | Items | Contents |
|---|---|---|
| Water Supply | Specific Objectives | ・Advocate effective and efficient development, management and utilization of water supply systems<br>・Facilitate the development of strategic water supply infrastructure in order to continually increase water supply coverage and access<br>・Encourage public and private partnership in investment and management for water supply services<br>・Promote appropriate management structures for water supply services that ensures the sustainability of the systems<br>・Ensure enhanced coordination among stakeholders in the sub-sector<br>・Promote attainment of financial sustainability through cost recovery |
| | Golden Indicators | **Urban Water Supply**<br>・Water supply coverage in the urban areas increased from 74% of 2008 to 79% by 2012 and 85% by 2016<br>・Non-Revenue Water (NRW) under Blantyre City reduced by 14% by 2012 and 21% by 2015 and Lilongwe City reduced by 5% by 2012 and 7% by 2016<br>・Revenue collection efficiency in the urban areas increased from 60% of 2007 to 70% by 2012 and 98% by 2016<br>**Town and Market Centres**<br>・Coverage of potable water supply increased from 75% as of 2007 to 80% by 2016<br>**Rural Water Supply**<br>・Water supply coverage rate increased from 64% as of 2008 to 80% by 2016<br>・The proportion of non-functional improved water points reduced from 30% as of 2007 to 25% by 2016 |
| | Activities | **Urban Water Supply**<br>・Promote installation and replacement of water meters in Blantyre and Lilongwe City to reduce NRW<br>・Encourage water boards to collect all arrears and bring all customers to current billing system<br>・Facilitate the collection of arrears from debtors particularly in the major cities of Blantyre and Lilongwe<br>・Monitor the reduction of the backlog of new connections in urban areas<br>**Town and Market Centers**<br>・Support water boards to construct, rehabilitate and extend some town and market center water supply systems<br>・Ensure the establishment and empowerment of Water Users Associations<br>・Facilitate capacity building for Local Assemblies and WUAs for management of Market Center Water Supply<br>・Monitor the review, update and harmonize policies and regulations<br>・Support the development and update investment plan<br>**Rural Water Supply**<br>・Ensure improved sector coordination and develop capacity to manage Rural Water Supply services<br>・Encourage the participation of water users in catchment protection and water conservation activities<br>・Monitor the establishment of GIS and MIS at National and District level for effective planning, implementation, operation, maintenance, monitoring and evaluation of water supply services |
| Monitoring and Evaluation | Specific Objectives | ・Coordinate and provide advice on the process of putting in place a sector wide management information system<br>・Coordinate capacity building for data collection and management under the M&E framework<br>・Monitor performance of other all sub-sectors including WASH an Irrigation programs<br>・Lead processes for the harmonization of definition of indicators for the irrigation, water and sanitation sector<br>・Ensure that program assessments/evaluations are done, that best practices and lessons learned are published or disseminated and that their use is promoted<br>・Work with the Institutional Development and Capacity Building (ID&CB) subsector to promote the use of academic research, social studies and other learning materials<br>・Ensure that M&E frameworks and systems are in line with national, regional and international development agendas (e.g. MGDSII, MDGs) |
| | Golden Indicators | ・Existence of a complete sector performance report that include performance reports for all 6 sub-sectors comparing progress against goals<br>・M&E system for the sector put in place by 2014 |

Source: Terms of Reference for the Water Sector Wide Approach (SWAp), June 2014

## Table 2.3.1 Management Structure of the Water Sector Wide Approach 3/4

| TWG | Items | Contents |
|---|---|---|
| Monitoring and Evaluation | Activities | ・Coordinate the development and utilization of a sector Monitoring and Evaluation Framework and sector indicator definitions<br>・Coordinate preparation and analysis of sector performance reports against the joint monitoring indicators before consideration of SWG<br>・Coordinate the review of sector programs including WASH and Irrigation programs to ensure alignment with national, regional, and international policy objectives<br>・Coordinate Irrigation, water and sanitation sector program (WASH and Irrigation) survey evaluation and research<br>・Coordinate dissemination to all stakeholders of recommended lessons learned and best practices<br>・Facilitate the process of collecting and disseminating academic, social study and other learning materials from different stakeholders<br>・Review sub-sector implementation progress of subsector projects.<br>・Recommend to be SWG on establishment of Systems Task Forces on priority areas as need may be<br>・Consider national program, work plans and budgets for M&E subsector<br>・Analyze and recommend resolutions to issues emerging in the subsector |
| Water Resources | Specific Objectives | ・Provide accurate and reliable information on the condition and trend of the country's water resources for economic and social development<br>・Plan, develop and manage the utilization of surface water and groundwater resources in the country<br>・Ensure water availability of acceptable quality for all the needs in Malawi and equitable allocation and apportionment of water resources to all sectors for socio-economic production and services<br>・Promote sustainable and integrated water resources management and development at national, regional and catchment level<br>・Support implementation of international conventions, riparian and regional agreements without compromising the country's integrity, security and sovereignty<br>・Rationalize and prioritize the investment requirements for implementation<br>・Facilitate institutionalization of a rapid water related disaster warning system in the ministry<br>・Assist with the establishment and implementation of proper technologies in Rainwater harvesting and small scale water resources development |
| | Golden Indicators | ・Three (3) water resources monitoring networks established and rehabilitated by 2016<br>・Rainwater harvesting activities streamlined in the sector's mandate by 2016<br>・Water storage capacity of the available/accessible water resources increased by 5% by 2016 |
| | Activities | ・Coordinate the development and review of the Water Resources Sub-sector Investment Strategy<br>・Coordinate the review and alignment of the sub-sector activities towards the goals of the MGDS, MDGs and all approved policy documents related to the water resources<br>・Provide professional advice to the SWG on water resources subsector issues related to policies, strategies, programs budget and regulations<br>・Coordinate a review of policies, regulations and guidelines in the water resources sub-sector and recommending to the SWG<br>・Review designs, rehabilitation and construction of water resource management infrastructure. This is one of the activities which will be undertaken by the infrastructure and equipment TWG<br>・Coordinate the development and periodical update of the water resources management logical framework to capture the full reach of sub-sector objective and activities in the short-term to medium-term<br>・Analyze and review periodic subsector performance reports (Annual Implementation Plan) and budget against set priorities and agreed golden indicators<br>・Review subsector implementation progress of subsector projects. This is another activity which will be undertaken by the Infrastructure and Equipment TWG<br>・Recommend to the SWG on establishment of System Task Forces on priority areas<br>・Consider national program of work, work plan and budget for the water resources subsector<br>・Consider guidelines and best practices for improved water resource management<br>・Analyze and recommend to SWG water resource management system technologies<br>・Analyze and recommend resolutions to issues emerging in the subsector |

Source: Terms of Reference for the Water Sector Wide Approach (SWAp), June 2014

## Table 2.3.1 Management Structure of the Water Sector Wide Approach 4/4

| TWG | Items | Contents |
|---|---|---|
| Sanitation and Hygiene | Specific Objectives | ・Identify the overall contribution that the pillar can make to poverty reduction and the development of the country<br>・Identify all factors including policies, legislation, stakeholders and challenges that affect pillars<br>・Review and propose revisions to the existing existing policies, legislation and implementation plans<br>・Prepare the framework for streamlining and coordinating the work of stakeholders in the pillar<br>・State the investment requirements in the short, medium and long term for the development of the pillar to attain the target contribution to poverty reduction<br>・Identify and prioritize the investment requirements for implementation for the period up to 2015<br>・Develop and implement the monitoring and evaluation framework and mechanisms of the pillar's performance<br>・Review and strengthen IEC materials for sanitation and hygiene<br>・Conduct impact studies to demonstrate the contribution of sanitation and hygiene to economic growth and poverty reduction<br>・Develop national institutional framework for sanitation and hygiene<br>・Identify function and strengthen capacities of the water sector authorities |
| | Golden Indicators | ・Reduce open defecation from 6% in 2008 to 2 % by 2016<br>・Increased access to improved sanitation from 65% to 75% of the urban inhabitants by 2016<br>・Increased access to improved sanitation from 46% to 60% of the rural inhabitants by 2016<br>・Increased access to improved sanitation from 46% to 65% of the town and market centers inhabitants by 2016 |
| | Activities | ・Facilitate the carrying out of a situation analysis and the development of a subsector strategic and investment plans<br>・Facilitate the review and/or development legal documents which will be upport the rolling out of the National Sanitation Policy 2008<br>・Facilitate the establishment and effective operation a coordinating mechanism for all the stakeholders within the subsector<br>・Facilitate the establishment and maintenance of a Management Information System (MIS) and an efficient and effective Monitoring and Evaluation (M&E) system with their appropriate supporting databases<br>・Facilitate the preparations, existence and effective use of Information and Communication materials for civic education and awareness campaigns<br>・Facilitate the reduction of open defecation and encourage people to move up the sanitation ladder<br>・Facilitate and support capacity building activities for professional and technical staff<br>・Identify and recommend technologies and methods of making water safe at point of use<br>・Hold regular meetings to guide the Department of Sanitation and Hygiene Promotions issues<br>・Facilitate development of technical guidelines and training materials on sanitation and hygiene<br>・Undertaking research on current developments and practices in the fields of sanitation and hygiene<br>・Identify and recommend financing schemes for various sanitation and hygiene interventions develop guidelines on emergency sanitation and hygiene and advocate for preparedness and build capacity for implementation<br>・Prepare a compendium of sanitation and hygiene financing best practices<br>・Conduct annual subsector performance review<br>・Undertaking study tours to learn and appreciate other experiences and the best practices in sanitation and hygiene promotion within and outside the region |

Source: Terms of Reference for the Water Sector Wide Approach (SWAp), June 2014

Within the SWAp framework, Joint Sector Review meetings have been organized every year since 2008, to review the works undertaken in the previous year and to plan undertakings for the coming year. In the JSR, technical working groups present their activities in the previous year and assess whether or not the agreed undertakings have been achieved. Also new target undertakings for the next year are agreed. So far, these activities show poor results. In the year 2011, one out of seven agreed undertakings was achieved.

Although the Ministry and development partners have been discussing to formulate a sustainable and functional institutional arrangement, there is no agreement yet as to a viable institutional arrangement to launch SWAp officially for the water sector. There is a common understanding among the Ministry and development partners with regard to the challenges that need to be solved in order for SWAp to be fully functional. Three major issues that have been raised during the JSR are:

- Sector Investment Plan
- Fiduciary system issue
- Devolution planning

The progress of these issues is explained below.

**(1) Sector Investment Plan**

The need for a sector investment plan was suggested at the Joint Sector Review in 2008. It was then pointed out that there is no sector investment plan to decide on which sector and to what degree is the investment for the coming decisive period in future. Therefore, to meet this need of making a plan for investment into the water sector, the task was undertaken in 2011 and a sector investment plan was formulated for the period 2015 to 2030. The suggested key investment areas were safe water supply, water and sanitation improvement in schools, improvement of water boards so that the utility becomes self-financing, and institutional changes to improve the performance of water boards, district councils and the Ministry. The plan forecasts its improvement and the financial viability in three different scenarios by 2030. These suggest that Malawi needs an investment on those areas of over USD140 million annually to meet challenging targets to improve its water supply and sanitation coverage rates. The investment in schools would improve not only hygiene and sanitation of learners, but also school outcomes. Bulk water supply at larger cities such as Lilongwe, Blantyre, Mzuzu and Mzimba would have economic rates of return of over 10 percent, which are keys to secure the fast growing cities living conditions and economic productivities to avoid unhygienic living environments and waterborne diseases in townships. In recent years, for example, cholera outbreaks have been reported in such areas due to failure of safe and stable water supply. In the case of Blantyre, the option suggested so far has to be reevaluated to avert solo reliance on intake of water from the Shire River.

Prioritizing water supply makes sense in terms of net benefit, since the net benefit on water supply is estimated to be very high per dollar of investment. USD14 for rural water and USD10 for urban water were calculated as net benefits per dollar of investment respectively. When funding constraints are taken into consideration, water supply should be placed in priority as the net investment benefits in rural and urban sanitation are estimated to be USD9 and USD4 per dollar of investment. Although these investments are relevant to social and economic development, investment in water supply will produce more net benefits. This is a matter of comparison and choices on which the selection of policies needs to be well thought and coordinated to make the right combination of interventions.

**(2) Fiduciary System Issue**

Among the Ministry and development partners, as well as other stakeholders, a financial scheme which is seen as the key issue to implement the SWAp framework is yet to be agreed. A well thought financial management system has to be put in place for the SWAp to work, an accounting and auditing system has to be designed, and a system to manage influx of development partner funds and sector budget have yet to be agreed both within the Ministry and development partners. Presently, different development partners offer financial and technical cooperation in different forms such as project based funding, multilateral project funding, co-financing and basket funding. For the SWAp to be implemented, a

basket fund is preferred by the Ministry and some development partners but not by some other stakeholders such as Japan.

It is foreseen that the process of reaching an agreement on the fiduciary issue as to what fund management framework is to be in place will still take an indefinite period of time. To reach an agreement, a credible institutional system and capacity has to be agreed, established and demonstrated to assure investors and development partners that the invested funds will be utilized rightfully for the intended purpose. Without this process, the SWAp would largely be dysfunctional and to pursue its establishment is not recommended.

#### (3) Devolution Planning

Within the SWAp framework, the devolution process is promoted in the rural water sector to make the sector respond more quickly to the needs as well as to be financially and technically more effective. The activities devolved to district councils include rural water supply and hygiene and sanitation components to effectively implement projects and render services to the rural communities at the district level. The responsibility of keeping track and assistance to the rural water is sought to be transferred to the district councils. The district council officers still need to upgrade their skills to be able to undertake activities to coordinate, plan, monitor and facilitate the entire process. The process will still take time since the capacity of district councils is still largely insufficient for such activities as planning interventions, implementation, monitoring and evaluation. The water boards are also expected to be more self-financing with less subsidized projects. These, however, still need time and steps since the improvement of collection of water fees faces strong resistance from the water users, especially due to the inflating economic trends that put severe financial pressure on the people of Malawi at large.

The policy making and administrative capacity of the Ministry also requires upgrading to make the SWAp run on its own. The annual Joint Sector Review meetings, which started in 2008, are still organized in a development partner driven manner. Invitation to the meetings is given to very wide audiences so that participants to the meeting are not necessarily well aware of the issues being discussed. A more focused discussion with a clear mandate to each participant as well as a well-functioning management is desirable to make the review meeting activities more concrete and fruitful.

### 2.3.3 Policies, Strategies and Acts

Currently the legislations and regulations related to water resources management are in place as **Table 2.3.2** shows. Some of the related legislations and regulations are elaborated in the following sections.

**Table 2.3.2 Related Legislations and Regulations on Water Resources Management**

| Year | Legislations and Regulations |
|---|---|
| 1969 | Water Resources Act |
| 1995 | Water Works Act |
| 1996 | Environmental Management Act |
| 1997 | Fisheries Conservation and Management Act |
| 1998 | Malawi Vision 2020 |
| | Forestry Act |
| | Local Government Act |
| | Decentralization Policy |
| | National Land Policy |
| 2000 | Millennium Development Goals (MDGs)<br>Water Resources Management Policy and Strategies<br>National Irrigation Policy and Development Strategy (MoAI)<br>National Gender Policy<br>Protocol on Shared Watercourse for the SADC Region |
| 2001 | Irrigation Act<br>National Fisheries and Aquaculture Policy |
| 2002 | Malawi Poverty Reduction Strategic Paper (PRSP)<br>Land Policy Act<br>Malawi Energy Strategy |
| 2003 | MoWD Strategic Plan (2003-2006) |
| 2004 | National Environmental Policy<br>Malawi Energy Policy |
| 2005 | Malawi Growth and Development Strategy (2006-2011)<br>National Water Policy (a revision of the previous policy formulated in 1994) |
| 2006 | Final Draft of Sanitation Policy of MoIWD<br>MoIWD Strategic Plan (2006-2011) |
| 2007 | Malawi Development Assistance Strategy (2006-2011) (MoF) |
| 2008 | National Sanitation Policy<br>Draft Water Resources Bill |
| 2009/10 | National Irrigation Policy<br>New Water Resources Act (draft)<br>National Water Resources Authority (draft)<br>Revised MGDs (January 2010) |
| 2013 | New Water Resources Act |

Source: Project Team

### (1) Malawi Vision 2020

In this strategic policy document, it is stated that Malawi envisions a long-term aspiration of becoming an environmentally sustainable middle-income economy by the year 2020. The effort to produce this document started in 1996. The conceptual framework for developing the vision is adapted from the National Long-Term Perspective Studies (NLTPS) approach formulated by the African Futures Group in Abidjan.

This document notes a shift of approach of economic and development strategies. The economy of Malawi prior to this document was primarily dependent on natural comparative advantage. The process of drawing this long-term vision helped the country to realize and comprehend the importance of taking strategic approaches to all social and economic sectors to create competitive advantage to underpin significant economic growth and to support people in Malawi.

In terms of the water sector, the importance was noted to enhance protection of water resources and catchment area management. It also realizes that there are threats of depletion of water resources due to deforestation, drought conditions, and poor management of water supply systems. It also outlines strategic options to prevent pollution of water, conserve catchment areas and improve water supply systems, as follows:

- Designing proper waste disposal systems;

- Dredging and rehabilitating existing dams;
- Constructing multipurpose dams;
- Proper management of catchment areas and the river banks;
- Constructing silt traps; and
- Using new water harvesting techniques.

In conjunction with the water resources management, deforestation and land degradation are also seen as challenges for Malawi to take actions for improvement.

### (2) The Malawi Growth and Development Strategy II (MGDS II)

This is a strategic policy tool to attain the goals in the medium term spelt out in Malawi Vision 2020. Strategies to tackle challenges in key sectors and areas are formulated and steps outlined. Following the successful implementation of MGDS from 2006 to 2011, the Government of Malawi has set forth with the implementation of MGDS II for the term from 2011 to 2016. MGDS II aims to continue reducing poverty through sustainable economic growth and infrastructure development, identifying nine key priority areas and six thematic areas to work on. Green Belt Irrigation and Water Development is one of the identified key priority areas.

Access to safe and potable water is one key goal in water development strategy. In recent years, various efforts were made to improve access to potable water. MGDS II states that total water supply coverage has increased from 58 percent in 2004 to 76 percent in 2009. In rural areas, 58 percent in 2004 was improved from 64 percent in 2008. However, despite these achievements, there are considerable challenges urging the country to tackle in the water sector. These include such challenges as relatively low access to potable water in the rural areas, aging infrastructure, inadequate maintenance capacity, theft and vandalism resulting in more than 30 percent non-functionality of the infrastructure.

In view of the growing industrial and commercial development, water is seen as a multipurpose resource to produce power, to source irrigation and to meet the domestic daily demand. These increasing demands in different fields have conflicting interests in usage of water; therefore, the efficient use of water resources is deemed to be a key important issue. However, the institutional framework is frequently altered and different plans are laid so that monitoring of the progress needs a concerted effort among the relevant stakeholders.

### (3) Malawi Poverty Reduction Strategy Paper (MPRSP)

There are four strategic pillars. The first one emphasizes promotion of sustainable pro-poor growth. A major shift of approach for poverty reduction is noted in this turning point strategy paper. The poor is not seen as a burden of the recipient end of the growth of trickle-down effect but the active production entities. The role of the government as well as development partners herewith is to create conducive environment for the poor to be able to work on gaining better income.

In this philosophy, the overall goal of the MPRS is set to achieve "sustainable poverty reduction through socio-economic and political empowerment of the poor." It moves away from seeing the poor as helpless victims of poverty in need of hand-outs and as passive recipients of trickle-down growth. Instead, the poor are seen as masters of their own destinies. Government and development partners' role is to create the conditions whereby the poor can reduce their own poverty. This change in philosophy is reflected across the MPRS.

### (4) Malawi Economic Growth Strategy (MEGS)

Malawi Economic Growth Strategy (MEGS) was formulated in view of narrowing the policy gaps that were observed with MPRSP and the reality. In 2004 the Ministry of Economic Planning and Development (MoEPD) worked on the production of MEGS in cooperation with the private and other relevant partners. In this strategy, business sectors are focused to draw strategies to facilitate public and private investment. The agriculture sector accounts nearly 40% of GDP. The manufacturing sector is about 11%. The products are mainly agro-products. The agro-sector will remain the main economic strategic area for Malawi and the effective usage of water will be a key issue.

### (5) National Water Policy (2005)

The National Water Policy was revised in 2005 and 2007 to clarify the issues that were in some part vague in the previous version and set clear objectives to work on. This policy document was produced in conjunction with a number of challenges that the water and sanitation sector is facing and conservation and management of water resources as well as operation and maintenance of facilities. These conceptual ventures include putting in place of mechanisms such as Integrated Water Resources Management (IWRM) and Community-Based Management (CBM). In this policy document, 13 water related sectors are covered, which are: Water Resources Management and Development, Water Quality and Pollution Control, Urban, Peri-Urban and Market Centers Water Services, Rural Water Services, Agriculture Services, Irrigation Services, Navigation Services, Fisheries, Hydropower Generation, Eco-Tourism and Recreation, Forestry, Disaster Management, Policy Monitoring and Evaluation. These set out specific objectives and strategies for each sector for the future development. **Table 2.3.2** shows related legislations and regulations.

### (6) National Sanitation Policy

Preparatory works of the National Sanitation Policy started in 2007 supported by the Canadian International Development Agency with inputs from the main stakeholders including various government ministries, local governments (District and City assemblies), UNICEF, the water boards, and civil society. The National Sanitation Policy was adopted by the Cabinet in October 2008. The overall policy goal is to promote improved sanitation and safe hygiene practices for improved health and socioeconomic development for the people of Malawi. The overall policy objective is to achieve universal access to improved sanitation, and safe hygiene practices while ensuring sustainable environmental management for the economic growth. In concrete terms, the policy is composed of five themes as enumerated below. The implementation of sanitation/hygiene activities prescribes that it requires a multi-sector and coordinated integrated approach involving many stakeholders including the ministries.

- Sanitation and Hygiene Promotion at National Level;
- Sanitation and Hygiene in Rural Areas;
- Sanitation and Hygiene Promotion and Delivery of Services in Cities, Municipalities, Towns, Market Centers and Peri-Urban Areas;
- Sanitation and Hygiene Promotion and Delivery in Schools; and
- Sanitation and Hygiene Promotion and Delivery in Health Care Facilities.

(In the third theme of the above, "To transfer management of sewerage systems and works to the Water Boards in line with the 1995 Water Works Act" is prescribed as one strategy.)

Also, the following specific strategies have been used for monitoring and evaluating activities:

- Develop procedures for monitoring and evaluation of policy investment plans;
- Conduct quarterly, mid-year, and annual reviews of the specific activities of the investment plans; and
- Conduct periodic surveys to assess the impact of program implemented under the investment plans for this policy.

### (7) Water Works Act (No. 17 of 1995)

This act provides for the establishment of Water Board's water-areas and for administration of such water-areas for the development, operation and maintenance of waterworks and waterborne sewerage sanitation in Malawi and for matters incidental thereto or connected therewith (in Part XII, Repeals and Savings).

In Part II, the power of the Board shall include the power to levy and enforce payment of rates in accordance with the Act, and power to engage in research or investigation in connection with water supply and waterborne sewerage sanitation either alone or by arrangement or in conjunction with other

persons. The water-area of the Board is declared by the Minister from time to time, and the boundaries can be altered, amended, reduced or extended. In addition, the Board has control and administration of all waterworks and all water in such waterworks and the management of supply and distribution of such water in accordance with the Act in the water-areas, except the rural water supply areas. Based on this Act, five water boards such as Blantyre, Lilongwe, The Northern Region, the Central Region and the Southern Region Water Boards were established.

In Part IV, water service connections for people in the service area are shown. In Part V, Operation of Waterborne Sewerage Sanitation, the construction and maintenance of public sewer and waterborne sewerage disposal works are also the responsibility of the Boards.

### 2.3.4 International Treaties on Water Resources

The water resources in Malawi are bordering with the neighboring countries as international lakes and rivers. They include Lake Malawi, Lake Chilwa, Lake Chiuta, and the Shire, Ruo and Songwe rivers. The trans- and cross boundary watercourses are potential sources of friction, since the neighboring countries share the catchment areas, but no actual conflict has arisen for discussion up to date. Generally, the political relation with its neighboring countries such as Tanzania and Mozambique are amicable and no party wants to have conflict on the watercourses. At present, the development potential of a hydropower plant is under consideration for the Ruo River, but there is no institutional framework set up to take further steps with the neighboring Mozambique so that both governments have not made concrete plans to make use of the resources. There are a few international conventions and agreements that Malawi has ratified for mutual cooperation with member states.

#### (1) Protocol on Shared Watercourses (2000)

Malawi has ratified the Protocol on Shared Watercourses (2000) within the framework of the Southern African Development Community (SADC) with 14 member states: Angola, Botswana, the Democratic Republic of Congo, Lesotho, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Swaziland, Tanzania, Zambia and Zimbabwe. This is the first regional convention to regulate common utilization and management of the resources of watercourse systems shared by member states in the SADC region. The watercourse systems include both ground and surface waters in the form of sea, lake, river or aquifer. The aim of this convention is to facilitate mutual cooperation and communication among concerned member states. It specifies procedures to apply in case of negotiations caused by potential interventions or conflicts.

Some of the key principles agreed among member states are:

- To ensure that interventions are consistent with the sustainable development and harmonization of socio-economic policies;
- To recognize the right of water use within its territory for agricultural, domestic, industrial, navigational and environmental uses;
- To maintain a proper balance between resource development to improve living standard of people and conservation and enhancement of the environment;
- To exchange available information and data on the hydrological, hydro-geological, and water quality meteorological and environmental conditions; and
- To consult each other on the possible effects of planned measures, adverse effects, on the conditions of shared watercourses.

#### (2) Zambezi Watercourse Commission (2004)

This agreement has been ratified by eight member states sharing the borders with Zambezi River to facilitate mutual cooperation for the management of the Zambezi Watercourse recognizing the significance of the Zambezi Watercourse as a major water resource in the region, as well as the need to conserve, protect and sustainably utilize the resources of the Zambezi Watercourse. The size of Zambezi basin is as shown in **Table 2.3.3**. The area of Malawi in the Basin is small in nominal term since the country is small; however, to look at the percentage, 93% is falling within the basin. Also

86.1% of the population out of the total national population is living within the basin. Therefore, the influence of interventions or natural impact from the Zambezi River is significant.

**Table 2.3.3 Area of Zambezi Basin**

| Country | Total Area (sq. km) | Area in Basin (sq. km) | Territory falling in Basin (%) | 2002 Total National Population (a) | Population living in Basin (b) | Population in Basin (%) |
|---|---|---|---|---|---|---|
| Angola | 1,246,700 | 145,000 | 12 | 14,000,000 | 518,000 | 3.7 |
| Botswana | 582,000 | 84,000 | 14 | 1,736,000 | 13,888 | 0.8 |
| Malawi | 118,000 | 110,390 | 93 | 11500000* | 9,901,500 | 86.1 |
| Mozambique | 802,000 | 140,000 | 18 | 18,100,000 | 3,472,200 | 19.2 |
| Namibia | 824,000 | 24,000 | 3 | 1,830,000 | 67,710 | 3.7 |
| Tanzania | 945,000 | 27,000 | 3 | 33,600,000 | 1,344,000 | 4.0 |
| Zambia | 753,000 | 540,000 | 72 | 10700000** | 7,511,400 | 70.2 |
| Zimbabwe | 391,000 | 251,410 | 64 | 11,630,000 | 8,385,230 | 72.1 |
| Total | 5,661,700 | 1,321,800 | | 103,096,000 | 31,753,568 | 30.8 |

Mid-year 2003
**2004 mid-year projection
Sources: Chenje, M (ed), State of the Environment Zambezi Basin 2000, SADC/IUCN/ZRA/SARDC, Maseru/Lusaka/Harare, 2000
a. SADC website (www.sadc.int)
b. Adapted from SADC website figures (a)

## 2.4 Demographic Characteristics

### 2.4.1 Information Source regarding Demographic Characteristics

The National Statistical Office (NSO) is the main government department responsible for the collection and dissemination of official statistics under the 1967 Statistics Act. As for demographic information, the NSO releases the "Population and Housing Census" in every 10 years (most recent census was released in year 2008) and the "Malawi Democratic and Health Survey" in 2004 and 2010.

In addition, based on the Census 2008, the NSO published the "Malawi Population Projection" which describes the projected results for the period from 2008 to 2050 for the national projections and from 2008 to 2030 for the district projections. Moreover, based on the population projection document, the "Malawi Population Data Sheet 2012" was also issued by the NSO, figuring out the condition of demographic characteristics in 2012.

The demographic characteristics of Malawi are explained in Section 2.4 based on the following documents published by the NSO:

- Population and Housing Census 2008 (Census 2008);
- Malawi Democratic and Health Survey 2010 (DHS 2010);
- Malawi Population Data Sheet 2012; and
- Population Projections in Malawi.

### 2.4.2 Major Historical Demographic Conditions

According to the DHS 2010, population censuses were conducted in 1945, 1966, 1977, 1987, 1998, and 2008 after World War II. **Table 2.4.1** shows historical changes of demographic condition of Malawi between 1966 and 2008 based on the decennial censuses.

**Table 2.4.1 Historical Change of Demographic Conditions of Malawi**

| Indicators | Census 1966 | | Census 1977 | Census 1987 | Census 1998 | Census 2008 |
|---|---|---|---|---|---|---|
| Population | 4,039,583 | | 5,547,460 | 7,988,507 | 9,933,868 | 13,077,160 |
| Intercensal growth rate | 3.3 | | 2.9 | 3.7 | 2.0 | 2.8 |
| Density (pop/sq.km) | 43 | | 59 | 85 | 105 | 139 |
| Percentage of urban population | 5.0 | | 8.5 | 10.7 | 14.0 | 15.3 |
| Sex ratio | 90.0 | | 93.0 | 94.0 | 96.0 | 94.7 |
| Crude birth rate | not available | | 48.3 | 41.2 | 37.9 | 39.5 |
| Crude death rate | not available | | 25.0 | 14.1 | 21.1 | 10.4 |
| -Male | not available | | 39.2 | 41.4 | 40.0 | 48.3 |
| -Female | not available | | 42.4 | 44.6 | 44.0 | 51.4 |

Source: DHS 2010, Note: Sex ratio is defined as the number of males per 100 females.

### (1) Population Size and Growth Rate

The series of censuses figured that population increased by more than 300% to about 13 million in 2008 from 1966 (about 4 million) and by more than 130% from 1998 (about 10 million). The intercensal population growth rate is 2.8 percent per year for the decade between 1998 and 2008 and it seems that there is a general increase in annual population growth rate. However, the lowest rate appeared between 1987 and 1998, which seems to be due to the influx of Mozambique refugees in 1990 as shown in the Census 2008.

### (2) Population Density

Population density increased from 105 persons per sq. km in 1998 to 139 persons per sq. km in 2008; therefore, Malawi is said to be one of the most densely populated countries in the world. According to the DHS 2010, Malawi adopted the National Population Policy in 1994, aiming to scale back population growth to a level compatible with Malawi's social and economic goals (OPC, 1994) in consideration of improvement to family planning and health care, increment of school enrolment, etc.

### (3) Spatial Population Distribution

In these two decades, the southern region has the highest population followed by the central region. The percentages against total population in 2008 are 45%, 42% and 13% in the southern region, the central region and the northern region respectively. The capital city of Lilongwe is located in the central region and the secondary city of Blantyre is situated in the southern region.

**Table 2.4.2 Spatial Population Distribution in Malawi**

| Region | 1987 | 1998 | 2008 |
|---|---|---|---|
| Northern Region | 911,787 (11.4%) | 1,233,560 (12.4%) | 1,708,930 (13.1%) |
| Central Region | 3,110,986 (38.9%) | 4,066,340 (40.9%) | 5,510,195 (42.1%) |
| Southern Region | 3,965,734 (49.6.%) | 4,633,968 (46.6%) | 5,858,035 (44.8%) |

Source: Census 2008; (%): percentage against total population

### (4) Urban Population

There are four cities in Malawi; namely, Mzuzu City in the northern region, Lilongwe City in the central region, and the Zomba and Blantyre cities in the southern region. Census 2008 shows a general increment in urban population rate.

According to Census 2008, the four cities of Lilongwe, Blantyre, Zomba and Mzuzu have high population figures. Lilongwe City has the highest population of 674,448; Blantyre City, 661,256; Mzuzu City, 133,968; and Zomba City, 88,314. In addition, Lilongwe rural has the highest population of 1,230,834 and Likoma district has the lowest population of only 10,414.

### (5) Nationality and Religion

Census 2008 states that foreign population is 51,554 representing less than one percent of the total population. Of the foreign population, Mozambicans hold 37 percent followed by Zambians with 11 percent. There are two major religions in Malawi. One is the Christian the percentage of which is 83% and the other is Muslim, which is 13 percent of the total population. **Table 2.4.3** shows the population distribution by religion.

**Table 2.4.3 Population Distribution by Religion**

| Religion | 1998 | 2008 |
|---|---|---|
| Christian | 79.9 | 82.7 |
| Muslim | 12.8 | 13.0 |
| Other | 3.1 | 1.9 |
| None | 4.3 | 2.5 |
| Total | 100 | 100 |

Source: Census 2008

## 2.4.3 Population Projection

NSO projects population by the Cohort Component Method, which can calculate the future size of population, taking into account the effects of mortality, fertility and migration.

The projected country population in 2050 is not mentioned in Population Projection in Malawi. Only the projected district population up to 2030 is mentioned in it. The population of each district between 2031 and 2035 was calculated by using the growth ratio of total population.

### (1) Estimated Population for Year 2011, 2025, 2035

The total number of people was estimated as 14.4 million in 2011 and 30.3 million in 2035 in the Population Projection in Malawi. The population distribution by region is summarized in **Table 2.4.4**. (Details are given in **Section 5.3**)

**Table 2.4.4 Estimated Population for Year 2011, 2025, 2035**

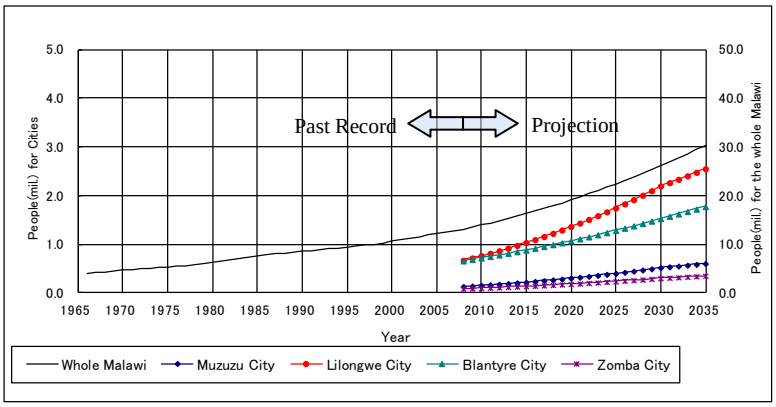
(mil. person)

| Items | 2008 | 2011 | 2025 | 2035 |
|---|---|---|---|---|
| Total | 13,077,160 | 14,388,550 | 22,358,190 | 30,296,833 |
| North Region | 1,7108,930 | 1,891,579 | 3,003,745 | 4,086,546 |
| Central Region | 5,510,195 | 6,145,539 | 9,952,421 | 13,654,484 |
| South Region | 5,858,035 | 6,351,432 | 9,402,024 | 12,555,803 |

Source: Population Projection in Malawi and Census 2008

### (2) Projection in National and District Levels

The populations projected by NSO for the national level and the major large cities (Mzuzu, Lilongwe, Blantyre and Zomba Cities) are as plotted in **Figure 2.4.1**.



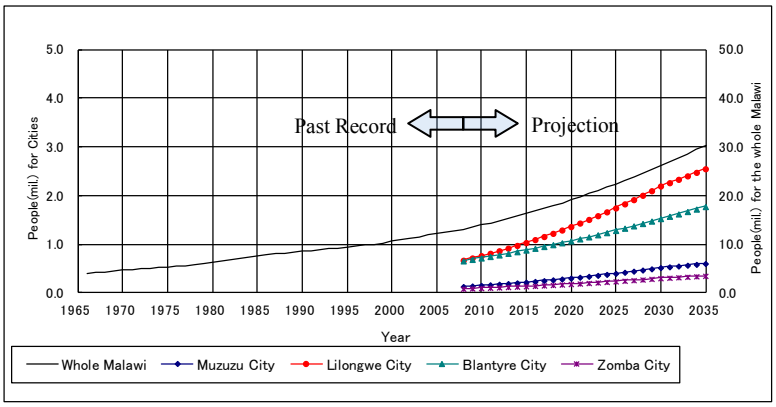

Source: Project Team

**Figure 2.4.1 Projected Population Growth for Malawi and Major Cities**

## 2.5 Land Use

The most recent land use map was established in 1993 interpreting the satellite images taken in 1990/91 through the satellite remote sensing project "Forest Resource Mapping and Biomass Assessment for Malawi, 1993" under the Ministry of Forestry and Natural Resources. The land use map is shown in **Figure 2.5.1**.

According to the map, agricultural land use dominates 48.8% of the whole Malawi (including low density agricultural area) followed by the forest area (22.4%) and the water surface area (20.5%), while Build-up area is interpreted as only 0.2% of the whole Malawi. The land cover classes, which are generally in accordance with Malawi nationally standards, were interpreted into 8 main classifications with 25 detail classifications. The land use classifications and land use ratio are shown in **Table 2.5.1**.




Source: Project Team

**Figure 2.4.1 Projected Population Growth for Malawi and Major Cities**

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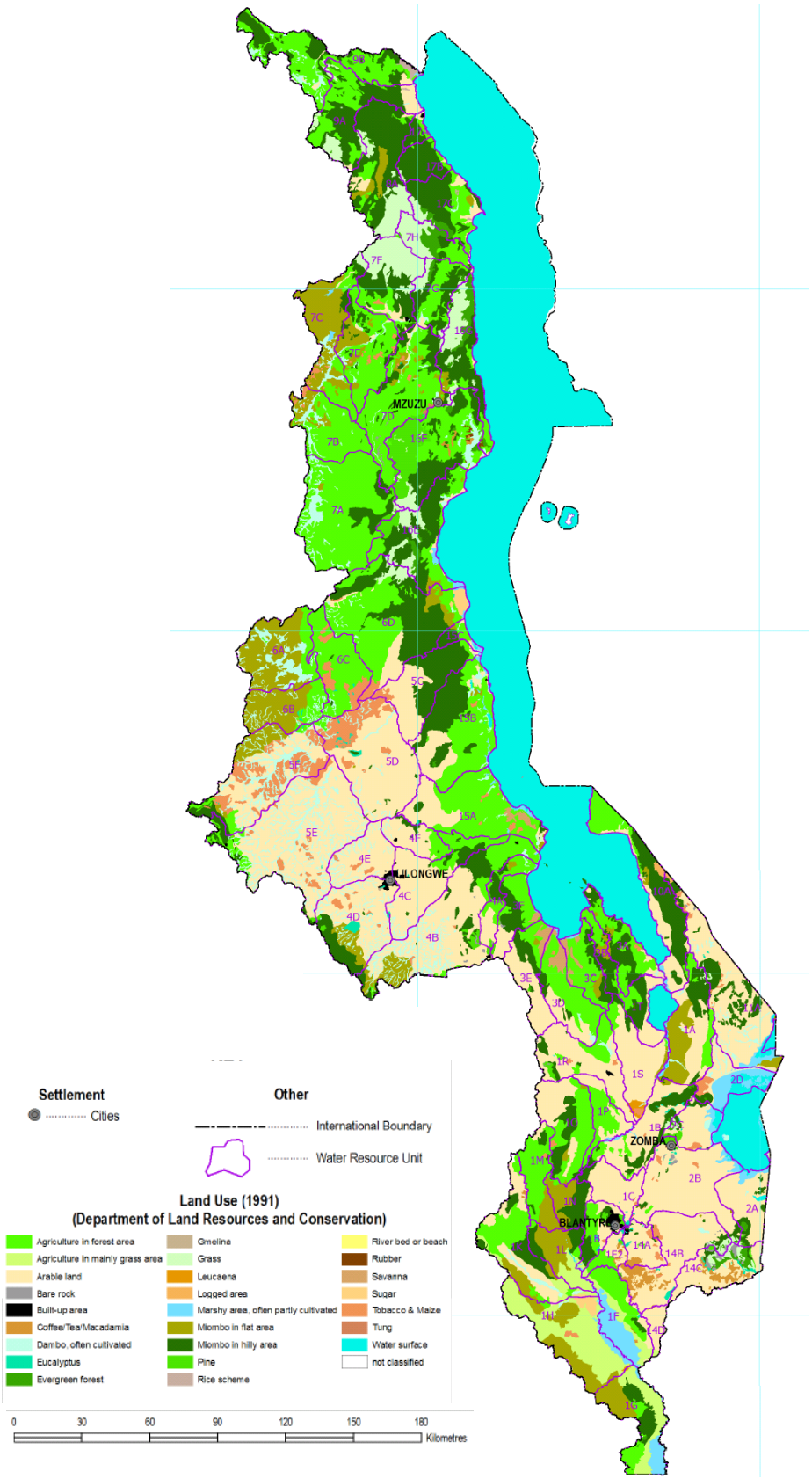
**Table 2.5.1 Land Use Classifications and Land Use Ratio and Area**

| Class 1 | | | Class 2 | | | Class 3 | | |
|---|---|---|---|---|---|---|---|---|
| Classification | Area | | Classification | Area | | Classification | Area | |
| | (ha) | (%) | | (ha) | (%) | | (ha) | (%) |
| Forest (less than 20% open land) | 2,642,823.7 | 22.36 | Evergreen | 82615.8 | 0.70 | Evergreen | 82,615.8 | 0.70 |
| | | | Brachystegia | 2,418,961.1 | 20.46 | Brachystegia in hill area | 1,685,853.0 | 14.26 |
| | | | | | | Brachystegia in flat area | 733,108.1 | 6.20 |
| | | | Plantation | 136,429.4 | 1.15 | Eucalyptus | 24,042.7 | 0.20 |
| | | | | | | Gmelina | 721.9 | 0.01 |
| | | | | | | Pine | 107,289.7 | 0.91 |
| | | | | | | Rubber | 2,665.0 | 0.02 |
| | | | | | | Tung | 1,710.1 | 0.01 |
| | | | Logged | 4,817.4 | 0.04 | Logged | 4,817.4 | 0.04 |
| Open natural vegetation | 764,788.6 | 6.47 | Grass | 310,900.9 | 2.63 | Grass | 310,900.9 | 2.63 |
| | | | Dambo (often cultivated) | 414,729.2 | 3.51 | Dambo (often cultivated) | 414,729.2 | 3.51 |
| | | | Savana | 39,158.5 | 0.33 | Savana | 39,158.5 | 0.33 |
| Extensive agriculture (20-70% cultivated land) | 2,668,193.9 | 22.57 | Agriculture in forest area | 2,432,907.0 | 20.58 | Agriculture in forest area | 2,432,907.0 | 20.58 |
| | | | Agriculture in mainly grass area | 235,286.9 | 1.99 | Agriculture in mainly grass area | 235,286.9 | 1.99 |
| Intensive agriculture (more than 70% cultivated land) | 3,105,542.2 | 26.27 | Arable | 2,782,977.0 | 23.54 | Arable | 2,782,977.0 | 23.54 |
| | | | Plantation | 316,029.0 | 2.67 | Coffee/Tea/Macadamia | 44,332.1 | 0.37 |
| | | | | | | Sugar | 20,622.7 | 0.17 |
| | | | | | | Tobacco/Maize | 244,459.5 | 2.07 |
| | | | | | | Leucena | 6,614.7 | 0.06 |
| | | | Rice Scheme | 6,536.2 | 0.06 | Rice Scheme | 6,536.2 | 0.06 |
| Marshy area or swamp (often partly cultivated) | 177,095.1 | 1.50 | Marshy area or swamp (often partly cultivated) | 177,095.1 | 1.50 | Marshy area or swamp (often partly cultivated) | 177,095.1 | 1.50 |
| Non-vegetated land | 16,084.9 | 0.14 | Bare rock | 15,620.5 | 0.13 | Bare rock | 15,620.5 | 0.13 |
| | | | River bed or beach | 464.4 | 0.00 | River bed or beach | 464.4 | 0.00 |
| Build-Up | 22,442.9 | 0.19 | Built-Up | 22,442.9 | 0.19 | Build-Up | 22,442.9 | 0.19 |
| Water surface | 2,422,779.0 | 20.49 | Water surface | 2,422,779.0 | 20.49 | Water surface | 2,422,779.0 | 20.49 |
| Unclassed | 2,182.4 | 0.02 | Unclassified | 2,182.4 | 0.02 | Unclassed | 2,182.4 | 0.02 |
| Total Area | 11,821,932.7 ha | | | | | | | |

Source: Forest Resource Mapping and Biomass Assessment for Malawi, 1993

So far, the land use map has not been renewed extensively from 1993; however, some projects may be modified using recent satellite images. For instance, in the study "Linthipe and the Lingadzi River System Study, Central Region River Basin (2012), European Commission Humanitarian Aid Department," land use conditions between year 1991 and recent year was compared as summarized in **Table 2.5.2** in accordance with FAO's legendary structures, i.e., land use cover classification system (LCCS). Incidentally, in river basins with about 874,300 ha of catchment area, the built-up area increased 3 times of the 1990 condition (0.6% to 1.7%) and forest and forest plantations had a decreasing tendency (10.2% to 9.0%).




Source: Department of Land Resource and Conservation, MoAFS

**Figure 2.5.1 Land Use Map of Malawi**

**Table 2.5.2 Land Cover Change in the Linthipe and Lingadzi River Basin**

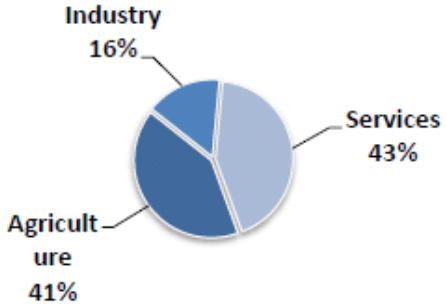
| Classification | Area 1990 (ha) | Area 1990 (%) | Area 2009 (ha) | Area 2009 (%) |
|---|---|---|---|---|
| Built-up | 5,361.8 | 0.61 | 14,938.1 | 1.71 |
| Burnt area | 11,072.4 | 1.27 | 14,856.7 | 1.70 |
| Cropland fertile soil | 332,064.2 | 37.98 | 299,093.1 | 34.21 |
| Cropland infertile soil | 101,600.1 | 11.62 | 99,829.9 | 11.42 |
| Forest | 81,237.7 | 9.29 | 73,421.7 | 8.40 |
| Forest Plantation | 7,812.3 | 0.89 | 5,617.1 | 0.64 |
| Open shrubs/Grassland | 147,824.9 | 16.91 | 167,890.3 | 19.20 |
| Shrubland | 102,801.0 | 11.76 | 96,539.5 | 11.04 |
| River | 389.8 | 0.04 | 575.4 | 0.07 |
| Riverine vegetation | 83,764.1 | 9.58 | 101,046.2 | 11.56 |
| Waterbody | 368.7 | 0.04 | 443.6 | 0.05 |

Source: Linthipe and Lingadzi River System Study, Central Region River Basin (2012)

## 2.6 Industries

### 2.6.1 General Condition

According to the Interim Country Strategy Paper (AfDB, 2011), Malawi's GDP at 2000 constant prices was estimated at USD2.7 billion in 2009. Among them, the industry sector with 16% of GDP in 2009 grew at an average of 6.9% between 2007 and 2009 (In 2010 the sector grew by 21.3%). About half of industrial production originated in food, beverages, tobacco, textiles, clothing and leather goods. Labor force of industry and services accounts for 10% of the total population as of 2003.




Source: AfDB Statistic Department

**Figure 2.6.1 GDP by Sector of Malawi (2009)**

### 2.6.2 Growth of Industries

The expansion of the industry sector came from mining and construction sectors where growth was estimated to have risen from an average of 7.9% for both sectors between 2007 and 2009 to 19.9% and 52.3% in 2010 respectively. Electricity, gas and water posted an average growth rate of 4.7% between 2007 and 2009. In 2010 the utilities sector grew by 6.7%. Despite the growth, the utilities sector performance remains poor, resulting in a slowdown in manufacturing growth from an annual average of 7.1% between 2007 and 2009 to 6.2% in 2010[2].

**Table 2.6.1 Growth Rate of the Industrial Sector in Malawi**

| Items | 2007-2009 | 2009-2010 |
|---|---|---|
| Mining | 7.9% | 19.9% |
| Construction | | 52.3% |
| Electricity, gas and water | 4.7% | 6.7% |
| Manufacture | 7.1% | 6.2% |

Source: AfDB Statistic Department

### 2.6.3 Condition of Industrial Sectors

The majority of Malawi's industrial activity comes from manufacturing, a sector that in 2000 generated around 14 percent of GDP. Malawian manufacturing is carried out by about 100 companies involved in agricultural product processing (food, beverage, and tobacco), textiles, clothing, and footwear production.

The mining sector is not completely developed in Malawi but has huge scope for future expansion. As of 2008, the mining sector largely focused on industrial minerals consumed locally. Unfortunately, Malawi has no precious metals; however, ruby mining began in the mid-1990's and deposits of bauxite, asbestos, graphite, uranium, titanium, etc., were explored.

Malawi has no known oil or gas reserves and, consequently, no upstream oil industry. The downstream oil industry is wholly dependent on refined petroleum products imported from neighboring countries. Many foreign companies have operations in the downstream oil sector of the country. Approximately 74% of the total production is consumed for local energy needs and the remaining is exported to trade partners.

Textiles and clothing make up the bulk of Malawian industrial product exports. All the country's top ten export products are agricultural commodities and 14 percent of the manufacturing products are exported, while Tobacco alone accounted for 64 percent of the country's export earnings in 2008 (Ministry Development Planning and Cooperation, 2009). From this, it can be inferred that most of the industrial products are consumed in the domestic market.

Regarding the industrial water use, the industries having large uses are generally supposed to have their own source of water independent from the water supply system of the water boards. With the exclusion of these industries, the industrial water demand for the relatively modest industries including commercial demand was 17% of the total demand in Lilongwe City and 25% of the total demand in Blantyre City in 2008.

## 2.7 Agriculture, Livestock and Fishery

### 2.7.1 Agriculture

Agriculture is the most important sector of the Malawi economy. It employs about 80 percent of the total workforce, contributes over 80 percent to foreign exchange earnings, accounts for 39 percent of gross domestic product (GDP) and contributes significantly to national and household food security. The agricultural sector has two main subsectors; the smallholder subsector (contributes more than 70 percent to agricultural GDP), and the estate subsector (contributes less than 30 percent to agricultural GDP). Smallholders cultivate mainly food crops such as maize (the main starchy staple), cassava and sweet potato to meet subsistence requirements. Estates focus on high value cash crops for export such as tobacco, tea, sugar, coffee and macadamia. Smallholder farmers cultivate small and fragmented landholdings under customary land tenure with yields lower than in the estate sector.

#### (1) ASWAp and MGDS

Since Malawi's independence, development resources, strategies and policies have heavily biased towards agricultural development. Malawi has benefited from substantial development partner programs over many years but, until very recently, has suffered from chronic food insecurity at both household and national levels. Agricultural exports have remained undiversified, with little value added. The Malawi Government (GOM) agreed with development partners to formulate the Agriculture Sector Wide Approach (ASWAp) as a means for achieving the agricultural growth and poverty reduction goals of the Malawi Growth and Development Strategy (MGDS). The MGDS has targeted agriculture as the driver of economic growth and recognizes that food security is a prerequisite for economic growth and wealth creation. The ASWAp, therefore, offers a strategy for supporting priority activities in the agricultural sector in order to increase agricultural productivity to make Malawi a hunger free nation, enable people access nutritious foods and increase the contribution of agro-processing to economic growth.

The ASWAp is unique in that it is a program led by the Malawi Government. It also envisages a single comprehensive program and budget framework; has a formalized process for better development partner coordination and harmonization of investment and alignment of funding arrangements between

GoM and development partners; promotes increased use of local procedures for program design, implementation, financial management, planning and monitoring.

It is essential to note that the ASWAp is being implemented against a background of various challenges, particularly, high poverty among rural people, food insecurity and malnutrition, low agricultural incomes, limited GoM financial resources, extensive land degradation, underdeveloped irrigation system, rampant deforestation, adverse effects of climate change, low agricultural growth rates (currently at an average of 3% annually), underdeveloped supporting infrastructure (road and telecommunication networks), development partner-led program, un-harmonized priorities for investment by GoM and development partners, uncoordinated funding to projects, un-harmonized systems for program implementation, low levels of technology utilization, weak research and extension services, low capacities to implement program effectively, HIV/AIDS pandemic and finally, gender disparities. **Table 2.7.1** shows the key priority areas and expected outcomes as articulated in the MGDS. It is evident that food production and income generation from agricultural activities are key in achieving food security through own production and/or incomes realized from sales of agricultural outputs. Such agricultural activities need to ensure that natural resources are used in a sustainable manner.

**Table 2.7.1 Key Priorities for Agriculture, Food Security and Irrigation in the MGDS**

| Key Priority Area | Long and Medium Term Goals | Expected Outcome |
|---|---|---|
| Agriculture and Food Security | • Increase agriculture productivity.<br>• No food shortages even in times of disasters (e.g. drought and floods).<br>• Increased exports of food staples.<br>• Increase the contribution of agro - processing to economic growth, move up the value chain in key crops, and increase exportation of agro - processed products.<br>• To open up the linkages to the sea. | • Increased value added to agricultural products by rural farmers and orient smallholder sub competitiveness.<br>• Food is available in sufficient quantities and qualities and supplied through domestic production or imports;<br>• All Malawians have at all times physical and economic access to sufficient nutritious food required for leading a healthy and active life.<br>• Increased contribution of agro-processing to GDP.<br>• An active inland network in local and international shipping that facilitates trade and tourism in a safe manner. |
| Irrigation and Water Development | • To ensure that water resources are well protected and managed to meet agricultural, domestic and industrial demands. | • Increased agricultural land under irrigation.<br>• Reduced dependence on rain-fed agriculture.<br>• Basic water requirements of every Malawian are met while the country's natural ecosystem is enhanced.<br>• Household access to safe water within 500m. |
| Integrated Rural Development | • To promote the growth and development of rural growth centers. | • Broad-based wealth creation amongst all citizens.<br>• Reduced negative consequences of rural urban migration |

Source: GOM (2006)

### (2) Greenbelt Initiative (GBI)

Malawi has depended on rain-fed agriculture to achieve food security, increased income and ensure sustainable socio-economic growth and development. Over-dependence on rain-fed agriculture has led to low agricultural production and productivity due to weather shocks and natural disasters (unreliable rainfall patterns, erratic rains, dry spells, pest and diseases, droughts, floods, etc.). Malawi is endowed with a variety of natural resources which include vast expanses of water systems and soils. The water systems cover over 21% of the country's territorial area. The Government of Malawi has therefore formulated the Greenbelt Initiative (GBI) aimed at using the available water resources to increase production, productivity, incomes and food security at both household and national levels for economic

growth and development. The initiative has the potential to transform Malawi from a predominantly consuming and importing country to a producing and exporting country.

### 1) Rationale of the GBI

The Malawi Government has been implementing various policies and interventions aimed at improving agricultural production, productivity and food and nutrition security. One such intervention is the Farm Input Subsidy Programme which has been very successful. The GBI therefore aims at consolidating the gains made from these interventions by intensifying irrigation farming, livestock development and fisheries development among others. The Initiative aims at using the available abundant water resources for irrigation farming thereby hedge against the effects of climate change on food and nutrition security.

### 2) Objectives of the GBI

The overall goal for GBI is the creation of wealth through increased agricultural production and productivity, enterprise development and increased exports. The specific objectives of the GBI are to: Increase production and productivity of crops, livestock and fisheries; Increase access to social infrastructure and support services; Increase agricultural exports and foreign exchange earnings; Promote diversification of crop and livestock enterprises; Increase household incomes; Improve value chain linkages and operations; Increase private sector participation in agricultural production; Add value through processing of raw materials; Reduce rural-urban migration; and Improve people's access to water for various uses.

### 3) Program Outputs

The program will achieve the following outputs: Increased area under sustainable irrigation farming using the available abundant water resources in the country from 90,000 ha to 1,000,000 ha; Increased productivity of crops (from the current 25% to 50%), livestock and fisheries; Increased agricultural exports and foreign exchange earnings; Increased crop, livestock and fisheries diversification; Improved value chain linkages and operations; Increased private sector participation in agricultural production; Improved access to social infrastructure and support services; Increased smallholder income levels and employment opportunities; Improved access to water for various uses; and Existing rural growth centers rehabilitated and new ones established.

### 4) Program Outcomes

The intended Initiative outcomes include: reduction in poverty levels among the farming communities; improved export led economic growth; improved social development; increased employment opportunities; improved food and nutritional security; and reduced rural-urban migration.

### 5) Components of the GBI

The GBI will have seven major components: Crops, Livestock and Fisheries Development, Infrastructure Development and Rehabilitation; Land Administration; Environmental Management; Technology Development and Dissemination; Institutional Development and Capacity Building; and Agro-Processing and Marketing Development.

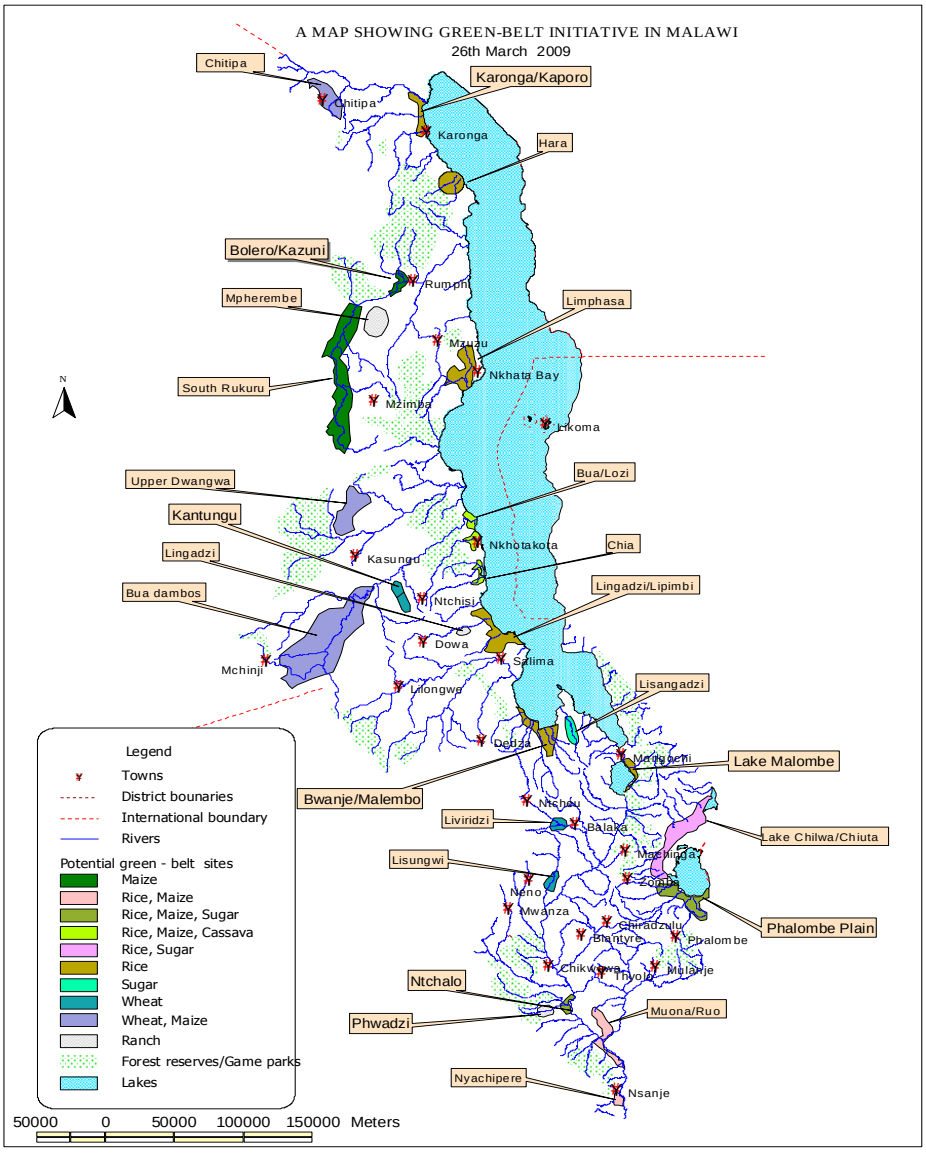
### 6) Implementation Arrangement

The GBI is a multi-sector initiative requiring a cross section of expertise and various players in the implementation of the Initiative activities. The program will be implemented with the participation of the beneficiaries to ensure that there is ownership which will contribute to make the program sustainable. The program will have two implementation arrangements focusing on smallholder and commercial farmers. For proper implementation of the Initiative activities, different structures will be put in place to coordinate activities at various levels. These include: National Steering

Committee (NSC), National Consultative Group (NCG), National Technical Committee, National GBI Secretariat, District Assembly Steering Committee and District Assembly Technical Committee. Under the Initiative, smallholder farmers, private investment and public private partnerships will be promoted.

### 7) Financing of the GBI

Funds for the GBI will come from government, development partners and private sectors. The government will engage development partners to support the GBI in line with the principles of the Paris Declaration. Development partners will be free to choose the components of the GBI that they wish to support. Private sector financing will constitute direct investment in the selected GBI sites and through Public-Private-Partnership (PPP) arrangements. GBI project areas are as shown in **Figure 2.7.1.**




Source: Project Team

**Figure 2.7.1 Location Map of Greenbelt Initiative Programs in Malawi**

### (3) Irrigation Policy and Laws

The following are the existing irrigation legislations in Malawi:

- Irrigation Act, 2001
- National Irrigation Policy and Development Strategy (NIPDS), 2011

#### 1) Irrigation Act of 2001

The Irrigation Act of 2001 has been legislated for the sustainable development and management of irrigation, protection of the environment from irrigation related degradations, establishment of the National Irrigation Board and for matters connected therewith or incidental thereto. The Act consists of the following parts:

- Part I - Preliminary Provisions
- Part II - National Irrigation Policy and Development Strategy
- Part III - Establishment of the Malawi Irrigation Board
- Part IV - Functions and Powers of the Board
- Part V - The Secretariat of the Board
- Part VI - Irrigation Fund
- Part VII - Local Community Participation
- Part VIII -Registration of Irrigation Consultants
- Part IX - Offence and Penalties
- Part X - Miscellaneous Provisions

#### 2) National Irrigation Policy and Development Strategy

The National Irrigation Policy and Development Strategy was formulated in 2011 to provide a clear statement of the Government's aspirations for the irrigation sector as provided in the Malawi Growth and Development Strategy (MGDS) and to highlight the strategy for attaining irrigation development objectives.

The occurrence of droughts and their effect on agricultural production have resulted in increased emphasis on irrigation development. The role of the government in irrigation development and management is that of a facilitator in a market oriented economy. Current high population growth rates demand much more of irrigated agriculture than in the past and Malawi needs to realize a major growth in both agricultural production and export earnings to meet the needs of the expanding population and at the same time provide for some improvement in per capita food consumption. Considering the relatively limited land and water resources in the country, irrigation could provide a significant technical means to increase agricultural output.

Sustainable irrigation development can be achieved within a policy framework which reflects national development policy hence the need for a clear and comprehensive policy to guide irrigation development in Malawi. There is also a need to view irrigation in the broad context of national development so that it contributes to the socio-economic advancement of the population. Irrigation must also fit into a strategy of sustainable and environmentally appropriate natural resources development and management.

### 2.7.2 Livestock

Dairy farming is a highly profitable sector in agriculture and is expected as one of the important income sources for farmers in Malawi. Tobacco production, which is also considered as a high profitable sector in agriculture, has a tendency of declining of its market price; therefore, some farmers resort to dairy farming instead of tobacco production.

Poultry, goats, cattle and pigs are the main types of livestock. In the Central and Northern regions, livestock production is mainly associated with smallholders, while in the Lower Shire valley, large herds of cattle are

found associated with milk/meat production industries in Blantyre. The current statistics on livestock population at the district level for 2011/12 was provided by the Livestock Department of MoAFS, as shown in **Table 2.7.2**. The Livestock Department also provided the data on livestock population at the district level for 2010/11 except those of Kasung ADD and Shire Valley ADD.

**Table 2.7.2 Major Livestock Population in Districts of Malawi**

| ADD | District | Goats | Sheep | Pigs | Chicken | Cattle |
|---|---|---|---|---|---|---|
| KASUNGU | Kasungu | 251,922 | 17,362 | 123,721 | 1,402,988 | 67,381 |
| | | - | - | - | - | - |
| | Ntchisi | 117,414 | 7,676 | 52,097 | 347,777 | 22,596 |
| | | - | - | - | - | - |
| | Dowa | 354,468 | 14,471 | 143,293 | 1,027,337 | 43,271 |
| | | - | - | - | - | - |
| | Mchinji | 223,811 | 12,820 | 181,369 | 1,401,868 | 75,072 |
| | | - | - | - | - | - |
| KARONGA | Chitipa | 46,275 | 4,371 | 52,542 | 445,601 | 57,753 |
| | | 43,686 | 4,382 | 39,447 | 880,555 | 56,208 |
| | Karonga | 40,176 | 2,933 | 65,917 | 1,244,868 | 97,404 |
| | | 34,994 | 2,870 | 77,727 | 1,111,721 | 93,379 |
| MZUZU | Mzimba | 223,482 | 13,205 | 84,506 | 1,480,346 | 184,563 |
| | | 202,996 | 11,585 | 102,957 | 1,371,300 | 177,109 |
| | Rumphi | 37,590 | 4,338 | 15,593 | 325,543 | 15,347 |
| | | 36,210 | 4,368 | 20,092 | 275,706 | 15,970 |
| | Nkhatabay | 28,953 | 2,272 | 13,393 | 513,403 | 9,310 |
| | | 28,134 | 2,129 | 15,654 | 478,768 | 9,402 |
| | Likoma | - | - | 221 | 12,695 | 60 |
| | | 270,613 | | 121 | 12,656 | 43 |
| MACHINGA | Machinga | 131,505 | 19,938 | 8,140 | 562,910 | 11,537 |
| | | 123,718 | 21,242 | 7,523 | 467,013 | 11,506 |
| | Mangochi | 418,570 | 26,165 | 18,170 | 1,137,172 | 21,910 |
| | | 356,040 | 20,300 | 16,247 | 5,666,812 | 22,063 |
| | Zomba | 225,106 | 25,583 | 168,897 | 1,154,697 | 19,876 |
| | | 206,045 | 20,043 | 143,907 | 1,127,112 | 18,131 |
| | Balaka | 204,476 | 16,323 | 54,715 | 2,022,911 | 16,839 |
| | | 178,252 | 15,246 | 47,220 | 1,242,630 | 15,189 |
| BLANTYRE | Mwanza | 60,292 | 412 | 71,950 | 709,977 | 4,287 |
| | | 38,462 | 312 | 65,656 | 577,167 | 3,689 |
| | Neno | 77,280 | 2,664 | 22,219 | 822,864 | 30,161 |
| | | 68,162 | 2,888 | 27,007 | 726,082 | 25,067 |
| | Blantyre | 109,551 | 8,013 | 149,569 | 11,999,329 | 30,501 |
| | | 98,419 | 6,915 | 121,794 | 7,686,980 | 28,068 |
| | Chiradzulu | 205,266 | 1,651 | 227,892 | 1,902,001 | 15,140 |
| | | 166,692 | 1,309 | 151,335 | 1,476,565 | 13,219 |
| | Phalombe | 123,932 | 1,596 | 77,268 | 631,416 | 21,571 |
| | | 93,461 | 1,751 | 61,984 | 584,227 | 18,351 |
| | Mulanje | 246,101 | 1,587 | 154,108 | 164,344 | 21,266 |
| | | 217,951 | 1,337 | 135,220 | 1,492,820 | 19,524 |
| | Thyolo | 239,731 | 370 | 161,684 | 2,836,380 | 20,136 |
| | | 205,435 | 475 | 119,744 | 2,684,304 | 17,671 |
| SALIMA | Salima | 165,542 | 6,477 | 28,149 | 545,874 | 22,601 |
| | | 144,987 | 6,180 | 23,703 | 550,318 | 21,304 |
| | Nkhotakota | 65,708 | 17,509 | 7,438 | 574,799 | 8,293 |
| | | 63,702 | 16,367 | 22,977 | 1,116,911 | 8,044 |
| LILONGWE | Lilongwe | 581,315 | 15,785 | 188,418 | 20,063,459 | 146,336 |
| | | 560,042 | 15,183 | 169,037 | 12,567,172 | 84,368 |
| | Dedza | 226,542 | 8,890 | 231,679 | 1,123,472 | 108,888 |
| | | 212,826 | 8,423 | 51,504 | 996,058 | 48,023 |
| | Ntcheu | 213,060 | 3,164 | 220,016 | 1,876,620 | 61,341 |
| | | 190,222 | 3,039 | 227,171 | 1,926,923 | 62,208 |
| SHIRE VALLEY | *Chikhwawa | 198,520 | 5,369 | 71,063 | 486,612 | 122,699 |
| | | - | - | - | - | - |
| | *Nsanje | 129,706 | 1,196 | 42,232 | 30,1984 | 36,240 |
| | | - | - | - | - | - |

Source: Livestock Department, MoAFS: Figures in the upper row of districts denote livestock population in 2011/12; those in the lower row denote the population in 2010/11.

### 2.7.3 Fisheries

The importance of the fisheries sector that comprises capture fisheries, aquaculture and aquarium trade in Malawi's economy is widely recognized. Fish contributes substantially to the economy as it directly employs nearly 60,000 people in fishing while over 450,000 people are engaged in fish processing, fish marketing, boat building and engine repair. Furthermore, nearly 1.6 million people in lakeshore communities are supported by the fishing industry. With 24% of the surface area of the country covered by water, both large- and small-scale capture fisheries contribute to food security and the poverty reduction goal of the Government of Malawi (GoM) as highlighted in the Malawi Growth and Development Strategy (MGDS) and the Agricultural Sector-wide approach (ASWAp). The fisheries resources contribute over 60% of animal protein in the national diet of Malawians. The sector remains one of the few economic activities along the shores of Lake Malawi that generates surplus.

The fisheries sector has been in great decline from the 1990's to 2005. Recent catch figures for the past three years show an upward trend with an annual production level of over 90,000 tons, over 60% being Usipa (*Engraulicypris sardella*) which was not being recorded in the past. With the exclusion of Usipa the downward trend still prevails. While Chambo stocks had been declining in the late 1990's and early 2000's (up to 3,000 tons annually) current trends indicate an increase of up to about 7,000 tons annually.

## 2.8 Legal and Institutional Aspects on Environmental and Social Considerations

All proposed projects by the Project Team will go through an initial environmental examination (IEE) in order to identify at an early stage potential impacts of the projects on the natural and social environment. In addition mitigation measures will be proposed for the adverse impacts. The result of the IEE will be taken into account in the preparation of the Environmental Impact Assessment (EIA) which is a more detailed study conducted in case of the feasibility stage of the proposed projects.

### 2.8.1 Laws and Regulations related to Environment in Malawi

The table below summarizes the main legislations in Malawi that relate to Environment.

**Table 2.8.1 Main Legislations related to the Environment in Malawi (1/4)**

| Legislation | Main Content |
|---|---|
| **Law and Legislation on Environmental Impact Assessment (EIA)** | |
| Environmental Management Act (EMA), 1996 | Contain provisions for the protection and management of the environment and the conservation and sustainable utilization of natural resources. |
| Guidelines for EIA, 1997 | Provides guidance on the conduct EIA for all types of development projects |
| EIA Guidelines for Irrigation and Drainage Projects, 2002 | Provides guidance on how to deal specifically with the environmental impact assessment of new irrigation and drainage projects. |
| Guidelines for Environmental Management System and Environmental Auditing for Irrigation and Drainage Operations, 2002 | Provides assistance on the preparation of an environmental management system for an existing irrigation and drainage schemes and for undertaking environmental audits of the scheme's activities. |
| EIA Guidelines for Mining Projects, 2002 | Provides guidance in dealing specifically with the environmental impact assessment of mining projects. |
| Guidelines for Environmental Management System and Environmental Auditing for Mining Operations, 2002 | Provides assistance on the preparation of an environmental management system for an existing mine operation and for undertaking environmental audits of the mine's activities. |
| EIA Guidelines for Sanitation Projects, 2002 | Provies guidance in dealing specifically with the environmental impact assessment of new sanitation projects. |

Source: Project Team

**Table 2.8.1 Main Legislations related to the Environment in Malawi (2/4)**

| Legislation | Main Content |
|---|---|
| Guidelines for Environmental Management System and Environmental Auditing for Sanitary Operations, 2002 | Provides assistance on preparing environmental management system for existing sanitation operation and for undertaking environmental audits of the operation's activities. |
| EIA Guidelines for Waste Management Projects, 2002 | Gives guidance to deal specifically with the environmental impact assessment of waste management projects. |
| **Law and Legislation on Environmental Management** | |
| The Water Resources Bill (approval pending by the President) | Has provisions on the management, conservation, use and control of water resources, on the acquisition and regulation of water rights, etc. This Bill was approved by the Parliament in 2012 and it is pending approval by the President of Malawi. |
| The Water Resources Act, 1969. | Has provisions on the control, conservation, apportionment and use of water resources of Malawi |
| Water Work Act, 1995 | Has legal provisions on water supply and sanitation services. Water Boards are constituted and operate under the terms of this Act. As for sanitation, Part III, Section 20 of this Act states that Water Boards have the power to install and operate waterborne sewerage sanitation schemes within the water-area. In addition, Part V, Section 26(1) states that Water Boards may construct and maintain a public sewer and construct waterborne sewage disposal works. |
| Local Government Act, 1998 | It states that for environmental protection, the city councils may establish, maintain and manage services for the collection and removal and treatment of solid and liquid waste. Currently there is an institutional conflict between the City Councils and Water Boards in terms of responsibility for sanitation in the urban areas. |
| Water Policy, 2005 | The overall policy goal is sustainable management and utilization of water resources, in order to provide water of acceptable quality and of sufficient quantities, and ensure availability of efficient and effective water and sanitation services that satisfy the basic requirements of every Malawian and for the enhancement of the country's natural ecosystems. |
| Blantyre Water Works Act | Administration of Blantyre water area and water board. |
| Lilongwe Water Board Act | Administration of Lilongwe water area and water board. |
| Water Resources (water pollution control) Regulations G.N. 39/1997 | Has provisions for the discharge of effluent into public water systems with the consent of the Minister. The regulation also states that the approval of the Minister to build a septic tank or pit-latrine within a distance of 220 yards from a borehole or to build any septic tank with a capacity of 5,000 gallons or more is needed. |
| Water Resources (controlled water areas) (Ndirande–Mudi dam controlled water area) Order* | Has provisions for the sound management of the Ndirande-Mudi Dam water catchment area in order to promote its conservation from pollution and siltation. The controlled water area includes part of Mudi catchment in the Ndirande Mountain Forest Reserve. An Authority (Ndirande-Mudi Catchment Management Committee) was established for the management which requires a license for any activity inside the area that may affect the water resource. The Order also states that through agreement the Authority may co-manage the forest reserve or plantation pursuant to Sections 25 and 36 of the Forestry Act. |
| The National Forest Policy, 1996 | The goal of the National Forest Policy is to sustain the contribution of the national forest resources to the quality of life in the country by conserving the resources for the benefit of the nation. |
| The Forest Act, 1997 | Has provisions on the sound management of forests. Among these provisions exists the protection of fragile areas such as steep slopes, river banks, water catchment and the conservation and enhancement of biodiversity. |
| The National Parks and Wildlife Act, 1992 | Has provisions on the establishment of national parks, preservation of animals, vegetation and objects of special interest in parks. |
| Game Act | Has provisions on the reservation and control of game in controlled areas and game reserves |
| Fisheries Conservation and Management Act, 1997. | Has provision on the regulation, conservation and management of fisheries in Malawi |
| Fisheries Policy, 2001 | The policy goal is to maximize the sustainable yield of fishes from the national waters of Malawi and man-made water bodies. |
| National Irrigation Policy and Development Strategy, 2000 | Main Objectives are: a) to promote poverty reduction by targeting resources to small farmers for irrigation development, and b) to increase food production and enhance food security through irrigation. |

Source: Project Team

**Table 2.8.1 Main Legislation in Malawi that relates to Environment (3/4)**

| Legislation | Main Content |
|---|---|
| Noxious Weeds Act | Eradication of noxious weeds |
| Special Crops Act | Controls development and marketing of crops, flue-cured tobacco, cashew nuts, cotton, groundnuts, and tea. |
| Tobacco Act | Production, manufacture and marketing of tobacco. |
| Cotton Act | Production, marketing and processing of cotton. |
| Fertilizers, Farm Feeds and Remedies Act | Registration of fertilizers, farm seeds, etc. |
| Mines and Minerals Act | Regulates the exploration and mining of minerals for protection of the environment and natural resources. |
| The Land Act, 1965 and its amendments of 2004 | Land use and management |
| Local Government (Urban Areas) Act | Powers to acquire land and by-laws on agriculture, forestry, health, sanitation and water supply in urban areas |
| The National Environmental Policy, 2004 | The overall policy goal is the promotion of sustainable social and economic development through the sound management of environment and natural resources |
| National Sanitation Policy, 2008 | The overall policy goal is to promote improved sanitation and safe hygiene practices for improved health and socioeconomic development. |
| Road Traffic Act | Road traffic and vehicles |
| Town and Country Planning Act | Planning and properties management |
| Factories Act | Regulation of employment conditions, health, welfare and safety in the work place |
| Industrial Development Act | Controls the orderly development and promotion of industries |
| Public Health Act | Preservation of public health: prevention of infectious diseases, sanitation and housing, sewerage and drainage |
| **Environmental Standards** | |
| Industrial effluents- Tolerance limits for discharge into inland surface waters, MS 539, 2002 | It specifies values of parameters for discharge of industrial effluents into inland surface water in order to protect the aquatic environment from pollution |
| Tolerance limits for domestic/sewage effluents discharge into inland surface waters, MS 691, 2005 | It specifies values of parameters for discharge of domestic effluents into inland surface water in order to protect the aquatic environment from pollution |
| Effluent treatment plants-Operating conditions, MS 732, 2005 | It specifies the operating condition for an effluent treatment plant and defines the units to be employed in any treatment. |
| Borehole and shallow well water quality-Specification, MS 733, 2005 | It specifies requirements for untreated or raw groundwater in boreholes and shallow wells suitable for human consumption and all usual domestic purposes |
| Drinking water- Specification, MS 214, 2005 | It specifies values of parameters for treated drinking water distributed by water boards and other water authorities in urban and semi-urban areas |
| Drinking water quality-control and surveillance of water in public supply networks, MS 678, 2005 | It defines the control and surveillance of water in public supply networks. It also indicates the frequency and the type of analysis required |
| Acoustics – Noise Pollution – Tolerance Limits, MS 173, 2005 | It prescribes maximum allowable noise limits in industrial, commercial, residential and silence zones areas. It also lays down sound level requirements for indoors of non-industrial buildings |
| Acoustics- Recommended practice for the design of low-noise workplaces containing machinery, Part 1 - Noise Control Strategies, MS 712-1, 2005 | It outlines strategies in dealing with noise problems in existing and planned workplaces. |
| Acoustics- Recommended practice for the design of low-noise workplaces containing machinery, Part 2 - Noise Control Measures, MS 712-2, 2005 | It deals with the technical aspects of noise control in workplaces |
| Hazardous waste-Management, classification and disposal - Code of practice. MS 719, 2005 | It provides guidelines for classification, transportation, treatment and disposal of hazardous waste |
| Plastic products - Guidelines for safe management and disposal, MS 713, 2005 | It outlines general guidance on the identification, environmentally sound management of plastic wastes and their disposal |
| Solid waste-handling, transportation and disposal-Code of practice, MS 59, 2002 | It prescribes the recommended procedure for the handling, transportation and disposal of solid waste to ensure safety of operatives, passers-by, animal and the environment |
| Solid waste disposal sites, guidelines for design-Code of practice, MS 730, 2005 | It prescribes guidelines for design of solid waste disposal sites taking the form of landfill, land treatment and incineration facilities |
| Solid waste disposal sites, guidelines for safe management - Code of practice, MS 731, 2005 | It prescribes guidelines for safe management of solid waste disposal sites in the form of landfills, land treatment and incineration facilities |
| Water quality-Sampling, Part 1: guidance on the design of sampling program and sampling techniques, MS 682-1, 2002 | This part sets out general principles for, and provides guidance on, the design of sampling program and sampling techniques for all aspects of sampling water (including wastewater, sludge, effluents and bottom deposits) |

Source: Project Team

**Table 2.8.1 Main Legislation in Malawi that relates to Environment (4/4)**

| Legislation | Main Content |
|---|---|
| Water quality-sampling, Part 4: Guidance on sampling from lakes, natural and man-made MS 682-1, 2002 | It provides detailed principles to be applied to the design of sampling program, sampling techniques and the handling and preservation of samples of water from natural and man-made lakes. |
| Water quality-Sampling, Part 6: guidance on sampling of rivers and streams, MS 682-6, 2002 | It sets out the principles to be applied to the design of sampling program, sampling techniques and the handling of water samples from rivers and streams for physical and chemical assessment. |

*The Ndirande-Mudi Catchment which covers an area of 890 hectares was gazetted in 2008 as a water controlled area and since then Blantyre Water Board through the Ndirande-Mudi Catchment Management Committee has been reclaiming the land from the encroachers and the reclaimed land has been re-afforested with trees (Source: Webpage of Blantyre Water Board, **http://www.bwb.mw/env.php**)
Source: Project Team

### 2.8.2 Land Tenure System in Malawi

#### (1) General

There are 3 categories of land tenure in Malawi:

- Public Lands: composed by all land occupied, used or acquired by the Government
- Private Lands: refers to all land owned, held or occupied under a freehold or leasehold lease hold title or certificate of claim which is registered as private land under the Registered Land Act (Cap 58:01).
- Customary Lands: refers to all land held or occupied or used under customary law. This category has the concept that the land in a village belongs to the community.

#### (2) Land Acquisition and Resettlement

The existing legal framework for land acquisition is as follows:

##### 1) Constitution of Malawi

- Article 28 guarantees freedom to own property and prohibits arbitrary deprivation of property
- Article 44 empowers Government to acquire land for public utility and makes provision for adequate notification and appropriate compensation and reserves the right for the aggrieved party to appeal to a court of law

##### 2) Related Laws

- Land Acquisition Act (Cap. 58:04): An Act that empowers Government to acquire land for a public purpose. It makes provision for the manner of acquisition and assessment of compensation.
- Malawi National Land Policy: it stipulates fair compensation at market value to property owners for all classifications of land (whether held under customary land tenure or leasehold) in case such land is acquired for public infrastructure.
- Land Act: the act guarantees landholders with appropriate compensation in the event of disturbance or loss, or damage of assets and interests, on the land. The act also provides procedures of acquisition of one classification of land to another. The process begins with appropriate notification of the existing lessee of the land.
- Public Roads Act (Cap. 69:02): An Act that makes provisions for acquisition of land for construction or diversions of public roads. It is more specific in that it defines how compensation is assessed. Public roads are classified into main roads, secondary roads, tertiary roads, branch roads and estate roads. The Act is more specific in that it makes provision for assessment of compensation generally and for surface rights, compensation for land which becomes public land, matters to be taken into consideration in assessing compensation for alienated land, claims for compensation and appeal to the High Court;

- Town and Country Planning Act (Cap. 23:01): An Act that empowers Government to acquire land on behalf of local authorities for planning purposes where the rights of the owner of land will be divested, appropriate compensation is paid. The Act empowers Government to acquire land either compulsorily or by agreement for planning or development control purposes. The mode of acquisition is subject to the Constitution and compensation is assessed in accordance with the Land Acquisition Act.

### 2.8.3 Environmental Impact Assessment

#### (1) General

The Environmental Impact Assessment in Malawi is governed by the Environmental Management Act of 1996 and the Guidelines for Environmental Impact Assessment of 1997 and it is mandatory for all projects that are considered potentials to affect the Environment. Such study must include all the impacts to be generated by the implementation of the project and the mitigation proposal for the negative impacts.

A developer shall, before implementing any project for which an environmental impact assessment is required, submit to the Director of Environmental Affairs, a project brief with the following subjects:

(a) The description of the project;

(b) The activities that shall be undertaken in the implementation of the project;

(c) The likely impact of those activities on the environment;

(d) The number of people to be employed for purposes of implementing the project;

(e) The segment or segments of the environment likely to be affected in the implementation of the project;

(f) Such other matters as the Director may in writing require from the developer or any other person who the Director reasonably believes has information relating to the project.

When the Director considers that sufficient information was given in the project brief, he shall request in writing to the developer the preparation of the EIA according to the guidelines.

An Environmental Impact Assessment shall include a least the following subjects as stated in the above Act:

(a) A detailed description of the project and the activities to be undertaken to implement the project;

(b) The description of the segment or segments of the environment likely to be affected by the project and the means for identifying, monitoring and assessing the environmental effects of the project;

(c) The description of the technology, method or process to be used in the implementation of the project and of any available alternative technology, method or process and the reasons for not employing the alternative technology, method or process;

(d) The reasons for selecting the proposed site of the project as opposed to any other available alternative site;

(e) A detailed description of the likely impact the project may have on the environment and the direct, indirect, cumulative, short-term and long-term effects on the environment of the project;

(f) An identification and description of measures proposed for eliminating, reducing or mitigating any anticipated adverse effects of the project on the environment;

(g) An indication of whether the environment of any other country or of areas beyond the limits of national jurisdiction is or are likely to be affected by the project and the measures to be taken to minimize any damage to the environment;

(h) An outline of gaps, deficiencies and the adverse environmental concerns arising from the

environmental impact assessment and from the compilation of the environmental impact assessment report;

(i) A concise description of the method used by the developer to compile the information required under this section.

**(2) Projects Covered by EIA**

According to the Guidelines for Environmental Impact Assessment, 1997, the list of prescribed projects for EIA is classified into two categories, those projects that require an EIA (List A named also mandatory List) and projects that may require an EIA (List B). In the **Annex 2.8.1-1** and **Annex 2.8.1-2** are presented those lists.

**(3) Environmentally-sensitive areas in Malawi**

The EIA Guidelines of 1997 describes the list of Sensitive Areas in Malawi as follows:

- National parks
- Wetlands
- Productive agricultural land
- Important archaeological, historical and cultural sites
- Areas protected under legislation
- Areas containing rare or endangered flora or fauna
- Areas containing unique or outstanding scenery
- Mountains or developments on or near steep hill-slopes
- Dry tropical forests (e.g. Brachystegia woodlands)
- Development near Lake Malawi or its beaches
- Development providing important resources for vulnerable groups such as fishing communities along the lake-shore
- Development near high population concentrations or industrial activities where further development could create significant environmental problems
- Prime ground-water recharge areas of importance for surface run off of water

**(4) Project Screening Criteria**

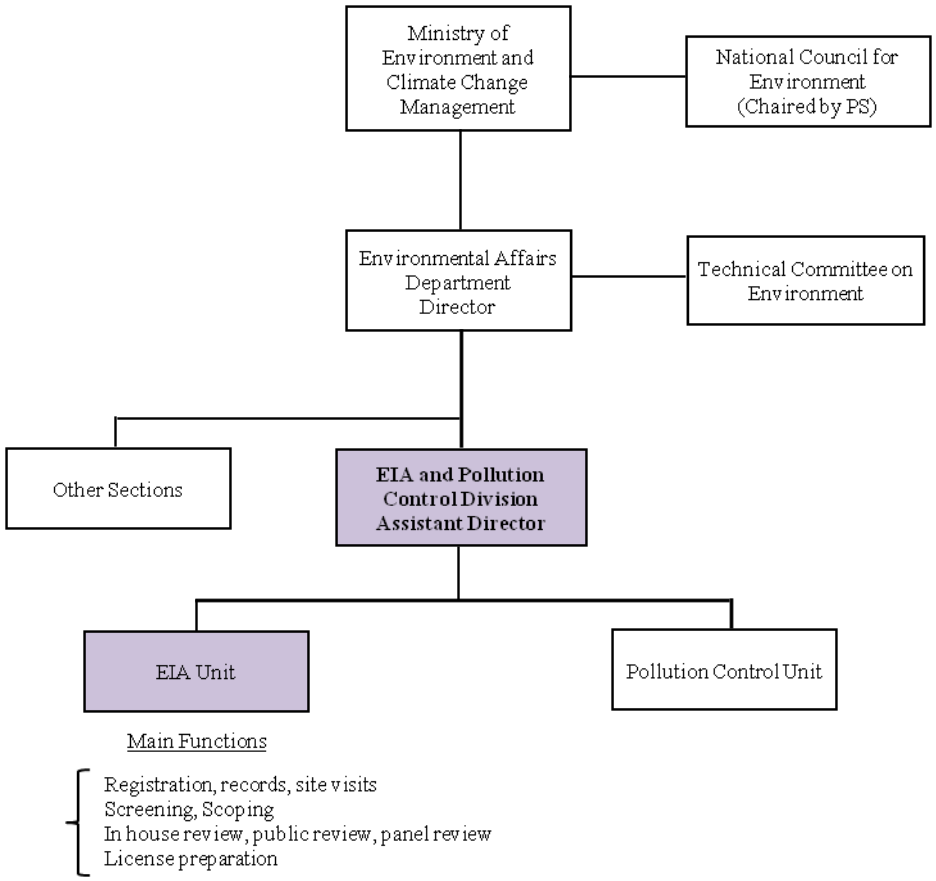
The Project Brief is reviewed by EAD utilizing screening criteria contained in the Guidelines for Environmental Impact Assessment, 1997. If the prescribed project meets the conditions stipulated in the screening criteria, no further compliance with EIA requirement is necessary. The screening criteria are described in the **Annex 2.8.1-3.**

**(5) Existence of Sectoral Guidelines**

So far, Malawi had prepared Sectoral Guidelines for Irrigation, Mining, Sanitation and Waste Management. However, still is lacking the preparation of the Sectoral Guideline for Water Resources Development which has direct relation to the Project.

**(6) Outline of the Organization in charge of EIA**

The Environmental Affairs Department (EAD) through its Environmental Impact Assessment and Pollution Control Division is in charge of EIA studies in Malawi. The bellow **Figure 2.8.1** shows the flowchart of the Organization and the main functions of EIA Unit.




Source: MoNREE

**Figure 2.8.1 Organizational Structure for EIA Study as of 2012**

### (7) Procedure for EIA

The current procedure for conducting EIA in Malawi starts with the submission of the outline of the project by the developer to EAD. Then, the EAD confirms whether the project is prescribed or not under the Environmental Management Act, if not, no further action concerning EIA requirements need to be undertaken; if yes, then a Project Brief must be submitted to EAD with the payment of MK 50,000 in concept of review fee.

When the Director of EAD receives the Project Brief, he refers it to the Technical Committee on Environment (TCE) established under Section 16 of EMA for its revision. The TCE assess whether the project needs or not the EIA study utilizing the project screening criteria (see **Annex 2.8.1-3**) and then recommends the course of action to the Director of EAD. The Director then determines whether or not an EIA is required and inform to the developer.

If EIA is required, then the Terms of Reference (TOR) for EIA study must be prepared in order to scope the issues to be covered in the Study. This TOR could be prepared by EAD on base of the Project Brief presented by the Developer or the Developer can prepare it in consultation with EAD to be presented conjointly with the Project Brief. In the last case, the timing process become shorter and EAD only make some few adjustments to approve the TOR.

Once the TOR by EAD is approved, the execution of the EIA Study is started.

Public consultation is mandatory during the EIA study implementation. The developer must meet the stakeholders to inform them about the project and to get their views on it.

When the draft EIA report is completed, the proponent must submit it to EAD for review. The review is made through the following mechanism:

- In-house review consists of report analysis by officers of EAD assisted by members of TCE. If the project is complicated and beyond the expertise of the TCE, independent experts are engaged to provide comments based on their area of expertise.
- Public review; it is made for specific projects where the people can access the document and give comments within a period of 14 days.
- If considered necessary, the Director EAD can call for a public hearing on the EIA to solicit direct comments from the people who may be affected by the project.

When the reviews are completed, the developer makes corrections or addition, if any, in the preparation of the draft final report which again is reviewed by TCE until a satisfactory report is produced. TCE may recommend to the Director of EAD to consider sending the report to NCE for their consideration of approval. The result of the review may arrive to the three types of conclusions:

- The project must be redesigned to reduce negative impacts or to enhance positive impacts. The EIA report must be redone
- The project is rejected since it is considered that will cause significant and irreparable injury to the environment
- The project is approved since it is considered that it will not cause significant injury to the environment. In this case, the Director of EAD issues a certificate and the terms and conditions of the approval upon payment of an EIA fee of 0.003 times the total project cost in MK, but not exceeding 3 million MK. This EIA fee will be used by EAD to monitor the implementation of the environmental management plan of the project presented in the EIA study.

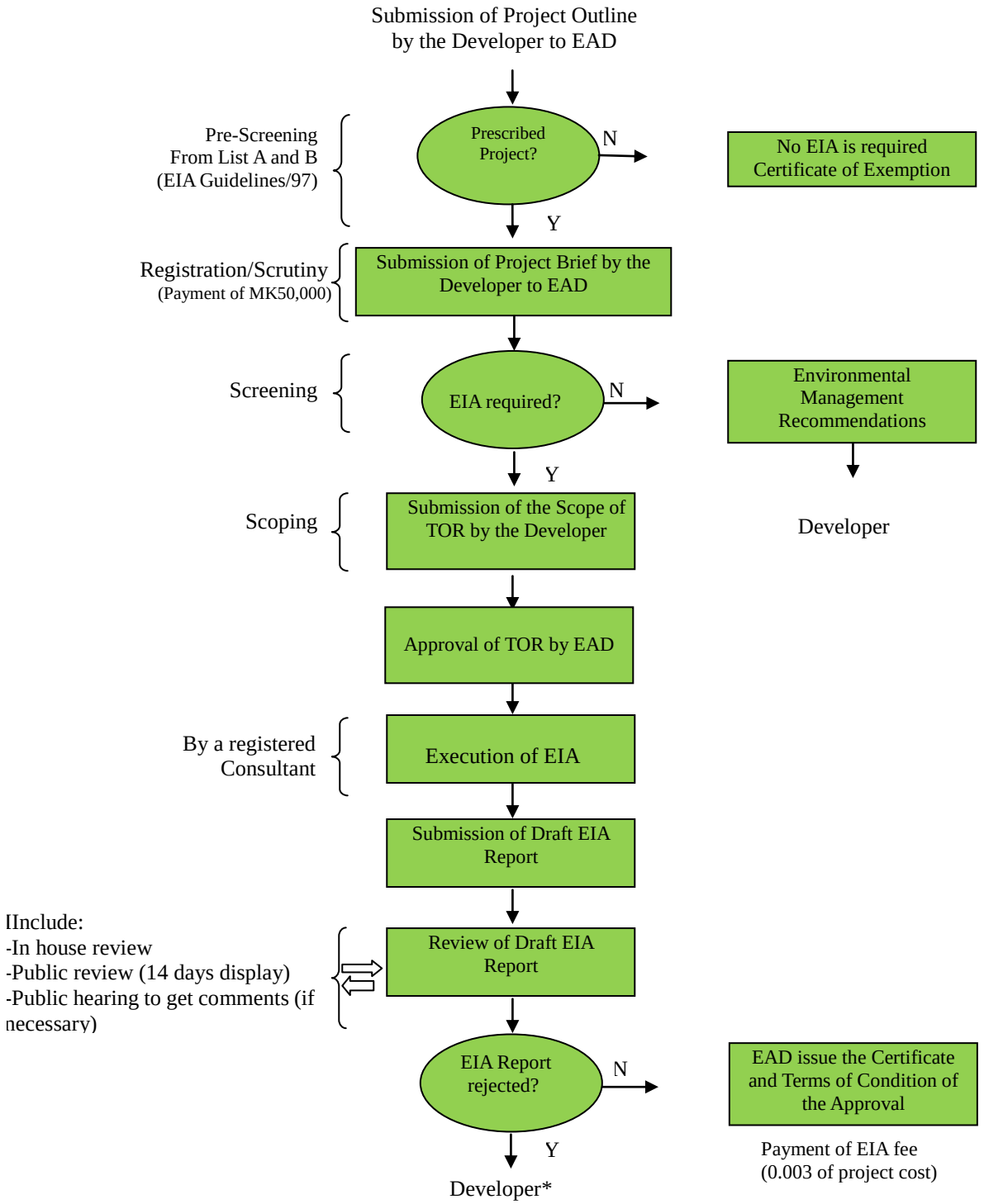
Once the EIA Report is approved by EAD, the developer must seek, depending on the nature of the project, the approval of the project by the other licensing authorities such as the Water Resources Board, the City Councils, etc., as summarized in the table below.

**Table 2.8.2 Other Licenses Required for Project Implementation**

| License or Permit | Act or Regulation Applied | Licensor |
|---|---|---|
| License for water use, abstraction or building dams | Water Resources Act, Cap. 72.03 | Water Resources Board |
| License for effluent discharge to control pollution | Effluent must comply with MBS* | Water Resources Board |
| License for Fish Farming | Fisheries Conservation and Management Act, Cap 66.05 | Fisheries Dept. |
| License for localization | Local Government Act | City Councils |
| License for Mining | Mines and Mineral Act | Department of Mines |

*Malawi Bureau of Standards
Source: MoNREE

If the project is approved by the other relevant licensing authorities, then the Director of EAD will request the TCE to develop and implement a government audit program to ensure the project complies with the result of EIA process. **Figure 2.8.2** shows the EIA process flowchart in Malawi.




* The Developer may appeal to the Environmental Appeal Tribunal if not satisfied with the decision
Source: MoNREE

**Figure 2.8.2 EIA Process Flowchart**

As for the timeframe for conducting EIA studies on the sector of water resource development, the tentative schedule is shown in **Table 2.8.3**.

**Table 2.8.3 Tentative Schedule for EIA Execution on Water Resources Development in Malawi**

| Months | | 1 | | | | 2 | | | | 3 | | | | 4 | | | | 5 | | | | 6 | | | | 7 | | | | 8 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Weeks | | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| Nº | Activities | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | Submission of Project outline to licencing authority | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | EAD determines whether the project is prescribed or not. If yes, the developer must prepare Project brief | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | Submission of Project Brief to EAD | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | EAD determines whether EIA is or not required (screening)(15 days) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | If EIA is required,TOR for EIA Study must be prepared by the developer in consultation with EAD (scoping) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | Execution of EIA including Public Consultation | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | Submission of Draft EIA Report to EAD | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | Review of Draft EIA Report by EAD/TCE (50 days) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8.1 | In house review (by EAD staff and TCE members) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8.2 | Public Review (14 days display) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8.3 | Panel Review and public hearing (if necessary) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9 | Developer prepare the draft Final Report based on comments from EAD/TCE/licencing authorities | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10 | Review of draft Final EIA Report by EAD and TCE members (25 days) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Developer prepare the Final Report and submitt to DEA | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 11 | Approval of Final EIA Report by EAD | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Source: MoNREE

***Refferences for Chapter 2***

[1] Malawi Sector Performance Report 2011
[2] Interim Country Strategy Paper (AfDB, 2011)

# PART I

# Chapter 3. NATURAL CONDITIONS

# CHAPTER 3. NATURAL CONDITIONS

## 3.1 River Basins

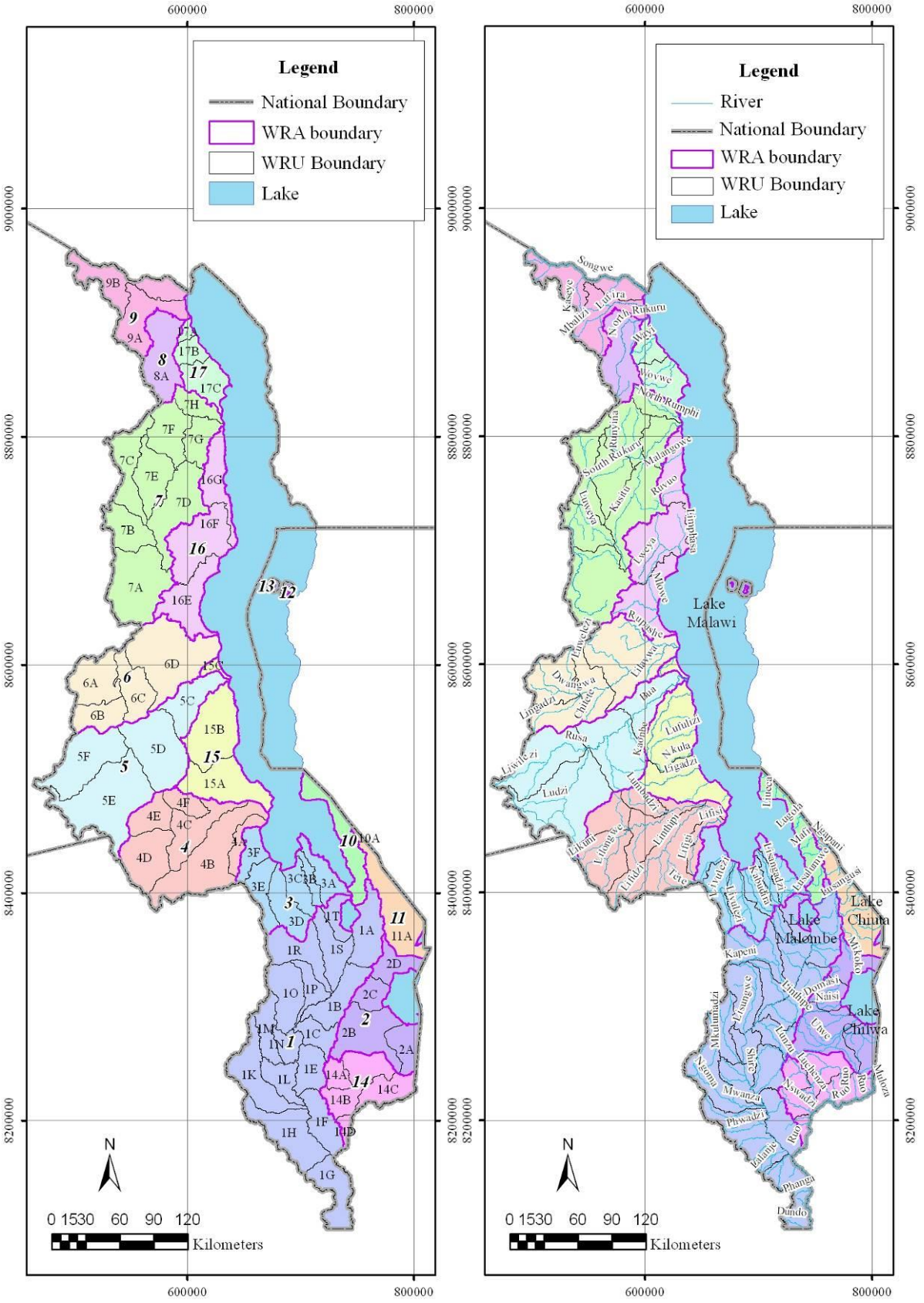
Malawi is divided into 17 water resource areas (WRAs) based on the river basins as shown in **Table 3.1.1**. Some WRAs consist of one river basin and others are composed of several small river basins. Moreover, WRAs are divided into water resource units (WRUs) as shown in **Table 3.1.2**, which presents a list of main rivers, lakeshore rivers and the major tributaries in the WRUs selected in consideration of the existing or previously existing hydrological stations. Boundaries of WRAs and WRUs, as well as river systems and lakes, are as shown in **Figure 3.1.1**.

Fifteen (15) of the 17 WRAs excluding WRA-2 (Lake Chilwa) and WRA-11 (Lake Chiuta) belong to the river basins of tributaries of the Zambezi International River, which include the Lake Malawi Basin and the Shire River Basin of the only outflow river from Lake Malawi. The total basin area of the 15 WRAs is about 87 thousand km$^2$, or 93% of the total basin area of Malawi. Except WRA-1 (Shire) and WRA-14 (Ruo), all rivers of the other 13 WRAs flow into Lake Malawi.

**Table 3.1.1 List of WRAs and WRUs in Malawi**

| WRAs (Water Resources Areas) | | WRUs (Water Resources Units) | | Catchment Area [i] (km$^2$) | Catchment Area [ii] (km$^2$) |
|---|---|---|---|---|---|
| No. | Name | Qty. of Units | Name of Unit | | |
| 1 | Shire | 16 | A to T | 18,910.6 | 18,945 |
| 2 | Lake Chilwa | 4 | A to D | 4,567.6 | 4,981 |
| 3 | South West Lakeshore | 6 | A to F | 4,997.8 | 4,958 |
| 4 | Linthipe | 6 | A to F | 8,884.8 | 8,641 |
| 5 | Bua | 4 | C to F | 10,658.1 | 10,654 |
| 6 | Dwangwa | 4 | A to D | 7,750.5 | 7,768 |
| 7 | South Rukuru/North Rumphi | 8 | A to H | 12,719.2 | 12,705 |
| 8 | North Rukuru | 1 | A | 2,088.3 | 2,091 |
| 9 | Songwe/Lufira | 2 | A to B | 3,729.7 | 3,680 |
| 10 | South East Lakeshore | 1 | A | 1,658.7 | 1,540 |
| 11 | Lake Chiuta | 1 | A | 2,442.7 | 2,462 |
| 12 | Likoma Island | 1 | - | 17.3 | 18.7 |
| 13 | Chizumulu Island | 1 | - | 3.3 | 3.3 |
| 14 | Ruo | 4 | A to D | 3,518.9 | 3,494 |
| 15 | Nkhota-kota Lakeshore | 3 | A to C | 4,819.2 | 4,949 |
| 16 | Nkhata-Bay Lakeshore | 3 | E to G | 5,532.7 | 5,458 |
| 17 | Karonga Lakeshore | 3 | A to C | 1,945.1 | 1,928 |
| | | | **Total (Continental Area)** | **94,244.6** | **94,276** |
| | | | **Total Lake Area** | **23,855.8** | **24,208** |
| | | | **Total Area** | **118,100.4** | **118,484** |

[i] GIS data of MoAIWD; [ii] Area in the National Water Resources Master Plan (1986)[1]
Source: Project Team




Source: Project Team

**Figure 3.1.1 WRAs & WRUs and Rivers & Lakes**

## Table 3.1.2 List of Major Rivers in WRAs/WRUs

| WRAs | | WRU | Catchment Area [i] ($km^2$) | Catchment Area [ii] ($km^2$) | Rivers |
|---|---|---|---|---|---|
| No. | Name | | | | |
| 1 | Shire | 1A | 1,546.2 | 1,632 | Kambewe, Lingamadzi, Masanje, Mwalasi, Nangondo, Shire |
| | | 1B | 1,360.4 | 1,374 | Kaloti, Likwemu, Likwenu, Linjisi, Lisanjala, Shire |
| | | 1C | 735.2 | 753 | Lirangwe, Lunzu, Shire |
| | | 1E | 958.0 | 946 | Chimwankhunda, Likhubula, Mudi, Mwamphazi, Naperi, Shire |
| | | 1F | 1,185.3 | 1,160 | Mapelera, Milore, Nkhate, Ruo, Shire, Thangadzi East |
| | | 1G | 1,466.5 | 1,460 | Dande, Dundo, Nyachipere, Nyamadzere, Nyaphambere, Phanga, Shire, Thangadzi |
| | | 1H | 2,117.9 | 2,110 | Chidyamanga, Lalanje, Mafume, Namikalango, Namitalala, Nkombedzi wa Fodya, Phwadzi, Shire |
| | | 1K | 1,843.8 | 1,790 | Mwanza, Ngoma, Shire |
| | | 1L | 851.4 | 861 | Mwambezi, Shire |
| | | 1M | 880.2 | 870 | Mkulumadzi |
| | | 1N | 573.4 | 550 | Shire |
| | | 1O | 1,483.5 | 1,440 | Lisungwe, Mwetang'ombe, Shire |
| | | 1P | 657.4 | 674 | Mlunguzi, Shire |
| | | 1R | 1,501.7 | 1,570 | Chizungulire, Kapeni, Liwawadzi, Marko, Mpamadzi, Mpira, Rivi Rivi |
| | | 1S | 1,178.2 | 1,230 | Chimwalira, Mwaye, Ngande, Nkasi, Shire |
| | | 1T | 571.4 | 525 | Shire |
| 2 | Lake Chilwa | 2A | 942.6 | 980 | Khongoloni, Mabongo, Migowi, Sombani |
| | | 2B | 2,083.1 | 2,050 | Chagwa, Likangala, Mombezi, Mulunguzi, Mulunguzi West, Namadzi, Phalombe, Sunuzi, Thondwe, Utwe |
| | | 2C | 682.7 | 898 | Domasi, Lingoni, Naisi, Songani |
| | | 2D | 859.2 | 1,053 | Mikoko, Naminga |
| 3 | South West Lakeshore | 3A | 909.8 | 895 | Nakundu, Namingundi, Nasenga, Shire |
| | | 3B | 386.0 | 364 | Lisangadzi |
| | | 3C | 784.1 | 813 | Gonde, Kabudira, Najkholokolo, Nankholokolo |
| | | 3D | 1,175.8 | 1,010 | Bwanje, Liwadzi, Mtemankhokwe, Nanyangu |
| | | 3E | 992.8 | 1,080 | Livulezi, Nadzipokwe, Naminkokwe, Nkhande, Ralitsa |
| | | 3F | 749.3 | 796 | Nadzipula, Nakaingwa |
| 4 | Linthipe | 4A | 576.7 | 463 | Lifisi |
| | | 4B | 3,274.3 | 3,190 | Diampwe, Lifidzi, Lilongwe, Linthipe, Msunduzi, Tete |
| | | 4C | 1,614.7 | 1,572 | Lilongwe, Nanjiri |
| | | 4D | 1,849.4 | 1,854 | Chaulongwe, Katete, Likuni, Lilongwe |
| | | 4E | 953.2 | 937 | Lingadzi, Mteza |
| | | 4F | 616.5 | 625 | Lumbadzi |
| 5 | Bua | 5C | 1,438.8 | 1,388 | Bua |
| | | 5D | 2,732.6 | 2,770 | Bua, Kasangadzi, Mphelele, Mtiti |
| | | 5E | 3,935.2 | 3,916 | Bua, Ludzi, Namitete, Tete |
| | | 5F | 2,551.6 | 2,580 | Liwilezi, Rusa |
| 6 | Dwangwa | 6A | 1,670.3 | 1,690 | Dwangwa, Liziwazi, Mchenda |
| | | 6B | 1,075.2 | 1,066 | Lingadzi |
| | | 6C | 1,320.6 | 1,287 | Chitete, Dwangwa, Kafyololoka, Mpasadzi |
| | | 6D | 3,684.4 | 3,725 | Dwangwa, Lilavwa, Luwelezi, Milenje, Pwazi, Rupashe |
| 7 | South Rukuru/North Rumphi | 7A | 2,943.9 | 2,897 | Mzimba, South Rukuru |
| | | 7B | 1,247.2 | 1,302 | Kapembere, Luwewya, Luweya, South Rukuru |
| | | 7C | 1,646.9 | 1,648 | Luwewe, South Rukuru |
| | | 7D | 2,268.6 | 2,258 | Kasitu, Lunyangwa, Lusangazi |
| | | 7E | 1,463.6 | 1,456 | South Rukuru |
| | | 7F | 1,488.9 | 1,482 | South Rukuru, Luviri, Runyina, South Rumphi |
| | | 7G | 956.8 | 950 | Luviri, Muhuju, South Rukuru |
| | | 7H | 703.2 | 712 | Kaziwiziwi, North Rumphi |
| 8 | North Rukuru | 8A | 2,088.3 | 2,091 | Mibanga, Mwesia, North Rukuru |
| 9 | Songwe/Lufira | 9A | 1,745.8 | 1,790 | Chambo, Kalenje, Lufira, Mbalizi, Sekwa |
| | | 9B | 1,983.9 | 1,890 | Hanga, Ipenza, Kaseye, Kyungu, Makeye, Songwe, Yamba |
| 10 | South East Lakeshore | 10A | 1,658.7 | 1,540 | Lilole, Liueca, Lugola, Lusalumwe, Mafi, Mbwasi, Nsinje |

| WRAs | | WRU | Catchment Area [i] ($km^2$) | Catchment Area [ii] ($km^2$) | Rivers |
|---|---|---|---|---|---|
| No. | Name | | | | |
| 11 | Lake Chiuta | 11A | 2,442.7 | 2,462 | Chitundu, Laurere, Lifune, Luchima, Lusangusi, Masongola, Mpili, Ngapani, Nyenyesi, Sankhwi |
| 14 | Ruo | 14A | 502.2 | 513 | Chisombezi, Luchenza, Namadzi, Nansadi |
| | | 14B | 1,726.3 | 1,645 | Chisawani, Kwakwasi, Likulezi, Namlenga, Nswadzi, Thuchil;a |
| | | 14C | 1,045.2 | 1,066 | Chapaluka, Lichenya, Likabula, Lujeri, Muloza, Ruo, Tangusi |
| | | 14D | 245.3 | 270 | Chinyenyedi, Lisule, Ruo |
| 15 | Nkhota-kota Lakeshore | 15A | 2,152.0 | 2,293 | Chirua, Lingadzi, Namanda |
| | | 15B | 2,459.2 | 2,458 | Kaombe, Likoa, Lufulizi, Mbambara, Nkula |
| | | 15C | 208.0 | 198 | Liwaladzi |
| 16 | Nkhata-Bay Lakeshore | 16E | 1,838.6 | 1,770 | Dwambadzi, Kawiya, Luwawa, Mazembe, Mkoma, Mlowe |
| | | 16F | 2,374.1 | 2,346 | Chikangawa, Kajilirwe, Kakwewa, Kalungulu, Kalwe, Limphasa, Luchelemu, Luweya |
| | | 16G | 1,320.1 | 1,342 | Chiwisi, Malangowe, Ruvuo |
| 17 | Karonga Lakeshore | 17A | 182.6 | 178 | Lwasha |
| | | 17B | 541.9 | 556 | Wayi |
| | | 17C | 1,220.6 | 1,194 | Hara, Nyungwe, Wovwe |

Note: [i] GIS data of MoAIWD, [ii] Area in the National Water Resources Master Plan (1986)
Source: Project Team

### (1) Lakes[1]

There are four major lakes in Malawi as shown in **Table 3.1.3**. Among them, Lake Malawi is the third biggest freshwater lake in Africa and the eighth all over the world. Its water surface area is about 29 thousand $km^2$ and its catchment area spreads to around 98 thousand $km^2$ consisting of 64 thousand $km^2$ in Malawi, 27 thousand $km^2$ in Tanzania and the rests in Mozambique. The lake is 570km in length and 16-80km in width, and the total volume is about 8 thousand $km^3$. The mean lake level is about 474m above mean sea level. Lake Malawi has quite an important role not only from the viewpoint of water resources but also national tourism, transportation and fishery industries in Malawi.

Lake Chilwa basin is enclosed with many rivers and streams draining to the lake and has its own WRA, the WRA-2. Total catchment area of the lake is about 8 thousand $km^2$ of which around 60% lies in Malawi and the rests in Mozambique. Lake Chilwa lies in a depression and is surrounded by large swamps and a seasonally inundated grassland. The water is highly saline and the lake is shallow with a maximum depth of about 5m. In 1968 the lake area reduced to 200-300$km^2$ and in 1978 it may have exceeded 1,500$km^2$, while there is some suggestion that the lake may have dried up from 1895 to 1915.

Lake Chiuta basin comprises the WRA-11. The basin embraces all streams draining northeastward out of Malawi into Mozambique, either directly or through Lake Chiuta. Lake Chiuta straddles the Malawi-Mozambique border, and except in dry years the lakes form a single water body connected by a swamp formed by the "delta" of the Lifune River. In very dry years, the swamp dries sufficiently to cause discontinuity between the lakes. Its water surface area is about 100$km^2$ including around 40$km^2$ in Mozambique, and the water depth is about 5m.

Lake Malombe is located in WRA-1 and the Shire River flows into and out of Lake Malombe. Its water level is relatively shallow with average depth of 4m and is largely controlled by the Kamuzu barrage at Liwonde. The water surface area is about 300$km^2$ and spread 30km long by 15km wide.

**Table 3.1.3 List of Major Lakes in Malawi**

| No. | Name | Area [i] ($km^2$) | Area [ii] ($km^2$) |
|---|---|---|---|
| 1 | Lake Chilwa | 1,124.5 | 683 |
| 2 | Lake Chiuta | 60.3 | 60 |
| 3 | Lake Malombe | 311.8 | 303 |
| 4 | Lake Malawi | 22,359.2 (29,203.0[iii]) | 23,162 (28,760[iii]) |
| | **Total** | 23,855.8 | 24,208 |

[i] GIS data of MoAIWD, [ii] Area in National Water Resources Master Plan (1986),
[iii] including area in Mozambique
Source: Project Team

## 3.2 Topography

The most important geomorphic feature of Malawi is that The Great Rift Valley extends across Malawi from north to south and the depressed rift forms Lake Malawi which is the third largest lake on the African Continent. Shire River flows to the south from the lake. The geomorphic feature is classified into the four divisions mentioned below.

### (1) Lowland in the Rift Valley

The lowland areas are under approximately 600 meters in elevation and correspond to the lakeshore of Lake Malawi (WRA-3, the western area of WRA-15, 16 and 17) and floodplain areas of the Shire River (a large part of WRA-1). In the floodplain areas, marshy meadows named "Dambo" are distributed. They are flooded in the rainy season.

### (2) Escarpment

The escarpment areas comprise steep slopes between highland and lowland on the west side of Lake Malawi and both banks of the Shire valley. In the northern district, mountain areas have 2,000 to 2,500m in elevation neighboring Lake Malawi, and these areas form remarkable scarps (corresponding to the north-west margin of WRA-7 and 16).

Large rivers form the outlet on the highland (for example, Lilongwe River in WRA-4, Bua River in WRA-5, Dowangwa River in WRA-6, etc.) and these branched rivers flow to the lake across the escarpment areas eroding the ground surface continuously and thus bedrock outcrops are well exposed on the slope surface. The subsoil is generally thin, and vegetation is relatively poor compared to the highland and lowland areas.

### (3) Highland

The highland areas of 900 to 1,400m in elevation comprise a great part of the land area of Malawi except Lake Malawi. The geomorphology shows gentle ground undulations and the subsoil is composed of laterites in which basement rocks have decomposed to red clay. These places in which the relatively thick laterites are underlain tend to form the "Dambo" area.

### (4) Mountains

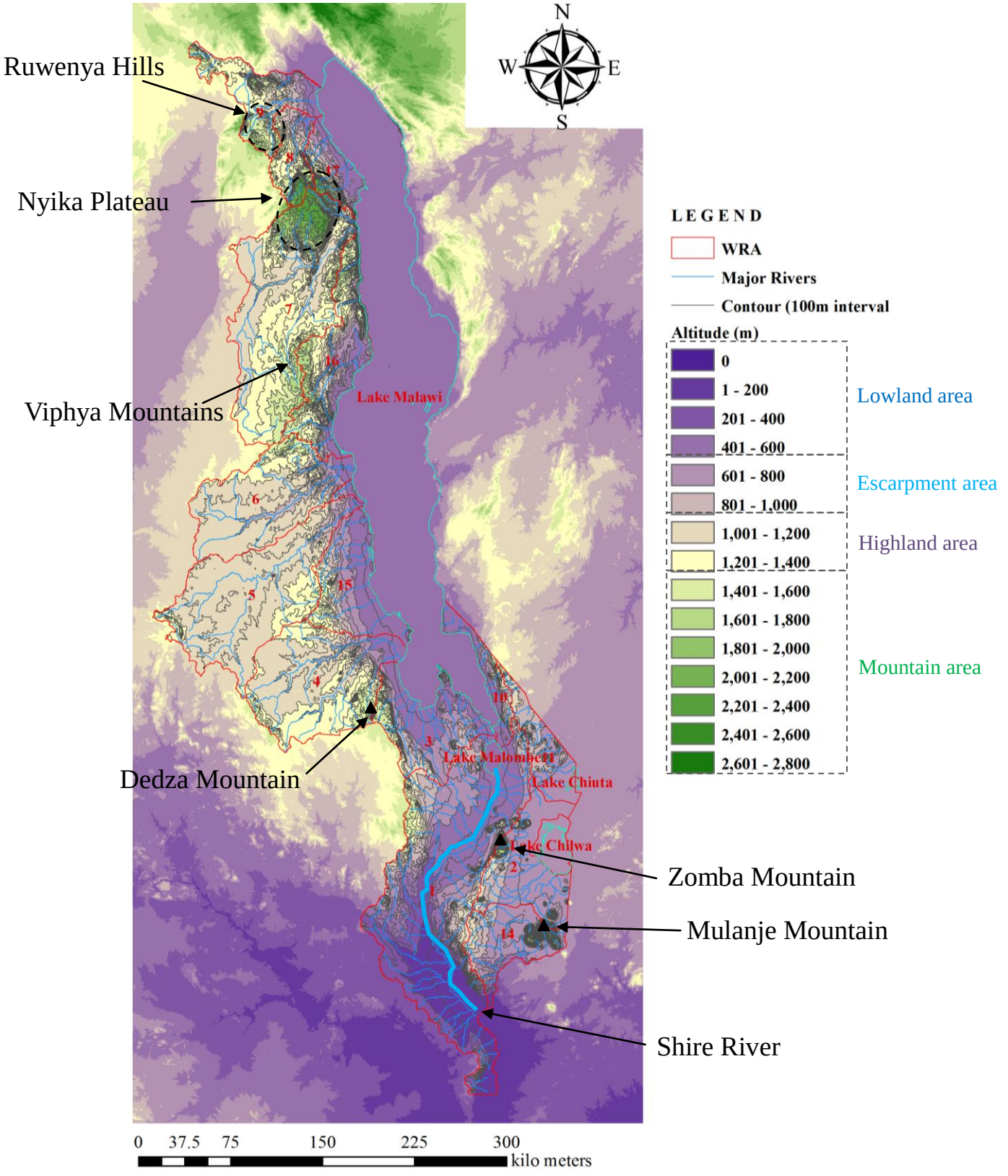
In the northern district, mountain ranges which have elevations of 1,400 to 2,500m such as the Ruwenya Hills in WRA-9 and Niyaka Plateau in Northern WRA-7, the Viphya Mountains which comprise a great watershed between WRA-7 and WRA-16 are orientated north to south. In highland areas of the middle to southern district, the mountains of over 2,000m high tend to exist in isolation. Representative mountains are the Dedza Mountain located in WRA-4 which is 2,198m high, the Zomba Mountain located in WRA-2 which is 2,098m high, and the Mulanje Mountain located in WRA-14 which is 3,000m high. The mountains mentioned above are generally constituted of massive igneous rocks. Residual soils or weathered rocks are very thin and vegetation is poorly growing.

The geomorphic features of each WRA are tabulated in **Table 3.2.1**.

**Table 3.2.1 Geomorphic Features of WRAs**

| WRA | Topo-Division | Descriptions |
|---|---|---|
| 1 | Lowland | The area comprising the watershed of the Shire River is the lowest elevation area of WRAs. Water discharged from Lake Malawi flows through Lake Malombe into the Shire River, and enormous tributaries from tops of Great Rift Valley join into the Shire River. |
| 2 | Low to Highland | The area is located at higher elevation than the watershed of the Shire River (approx. 600m). Plain area widely expand in the center of Lake Chilwa and some rivers converge into the lake. The pleao-lake shore sediments might accumulate thickly under the plain. |
| 3 | Mainly Lowland | Most parts of the area form the lakeshore nearby the southern part of Lake Malawi. The western part of this area comprises the steep escarpment. |
| 4 | Mainly Highland | Long rivers such as the Lilongwe River, the Linthipe River, the Namitete River, the Dwangwa River, etc., flow across the area, incise the escarpment area, and finally reach the Lake Malawi. The highland area consists of gentle hills. Dambos widely spread on the highland. |
| 5 | | |
| 6 | | |
| 7 | Highland and Mountain | Viphya Mountains rims the east edge of the area, and Niyaka Plateau locates at the north edge.the Rikuru River, and the Kasitu River meander through valleys surrounded by the high mountains. The Luwewe River which is a tributary of Rikuru River is surrounded by a wide Dambo on the western area. |
| 8 | Highland, Mountain, Escarpment and Lowland | High plateau (Nyika Plateau) and mountains (Ruwenya hills) over 1,500m comprise surrounded edges of areas. Highland plains are distributed between mountains in relatively narrow areas. Most of the areas consist of exposed rock ground. The ground surface has remarkable undulation and poor vegetation. |
| 9 | | |
| 10 | Low land and Escarpment | The area forms the lakeshore nearby the eastern part of Lake Malawi. |
| 11 | Low to Highland | The area forms the east banks of Great Rift Valley and comprises gentle hills ranging from 600 to 800m in elevation. Lake Chiuta is located on the edge of eastern area. |
| 14 | Low to Highland | Mulanje Mountain with heights of 3,000m is located at the eastern area. Flat plain of approx. 600m high expands from the foot of the mountain. |
| 15 | Lowland and Escarpment | The area forms the west slope of Great Rift Valley. The escarpment area is remarkably incised by various sizes of rivers, streams and gullies, thus the area has large undulations. |
| 16 | Lowland and Escarpment | The area forms the west slope of Great Rift Valley. Top of the slope corresponds to Viphya Mountains. Long rivers in the area flow parallel to the foot of the mountains. Geological faults or fractures extending south to north control the river channels. |
| 17 | Lowland and Escarpment | Niyaka Plateau rims the west edge of the area. Linear hills controlled by geological faults or fractures develop on the escarpment area. |

Source: Project Team




Source: Project Team

**Figure 3.2.1 Elevation Colored Map All Over Malawi**

## 3.3 Hydrogeology

### 3.3.1 Outline of Geology

Large parts of the highland areas of Malawi are underlain by crystalline metamorphic complex belonging to the Mozambique Tectonic Belt. These rock bodies are comprised of mainly gneiss, schist, quartzite and granulate of Pre-Cambria to Early Paleozoic age. On the highland areas, these fresh rocks are overlaid thickly with decomposed materials and these outcrops are rarely visible on the surface. On the escarpment areas, the fresh rock bodies can be observed well due to constant incising by rivers or gullies.

Igneous rocks composed of Dolerite, Basalt, Gabbro and Granite are scattered on various districts in Malawi. Almost all of these rocks are magmatic intrusions occurred during Jurassic to Cretaceous age, and mainly form mountain areas due to larger resistance against erosion and weathering than metamorphic rocks.

Karro sedimentary sequences deposited in Permian to Triassic age are distributed as small outcrops in the northern and southern areas of Malawi. These sedimentary rocks are constituted of sandstone, shale, red mudstone and coal bed. Rocks in the sequence are well cemented by calcite and indurate. The basal boundary of the Karro sequence is not exposed in any distribution area; however, the thickness has been estimated as exceeding 3,500m in accordance with past geological survey.

On the lowland areas, basement rocks are thickly covered by Quaternary alluvium deposits composed of unconsolidated clay, silt, sand and gravel. These sedimentary faces reflect transitions of the past river channels, and are highly variable in vertical succession and lateral extent.

Geological information of Malawi is published as geological maps, associated bulletins, etc., by the Geological Survey Department located at Zomba (see **Table 3.3.1)**. For instance, **Figure 3.3.1** shows a general geological map at a scale of 1:1,000,000 which was issued in 1966 [2].

**Table 3.3.1 List of Published Geological Issues in Malawi**

| Publications regarding Geology | Scale | Date Issued | Number of Publications |
|---|---|---|---|
| Geological Map of All Malawi | 1:1,000,000 | 1966 | 1 |
| Geological Map of All Malawi | 1:100,000 | 1969 | 24 |
| Local Geological Map | - | 1969 | 24 |
| Bulletins annexed Local Geological Map | 1:50,000 | 1965 | 48 |
| Topographic Map of Malawi | 1:100,000 | 1976 | 24 |
| Hydro-geological Reconnaissance Map | 1:250,000 | 1987 | 11 |
| Mineral Resources and Occurrences | 1:1,000,000 | 1990 | 1 |

Source: Project Team

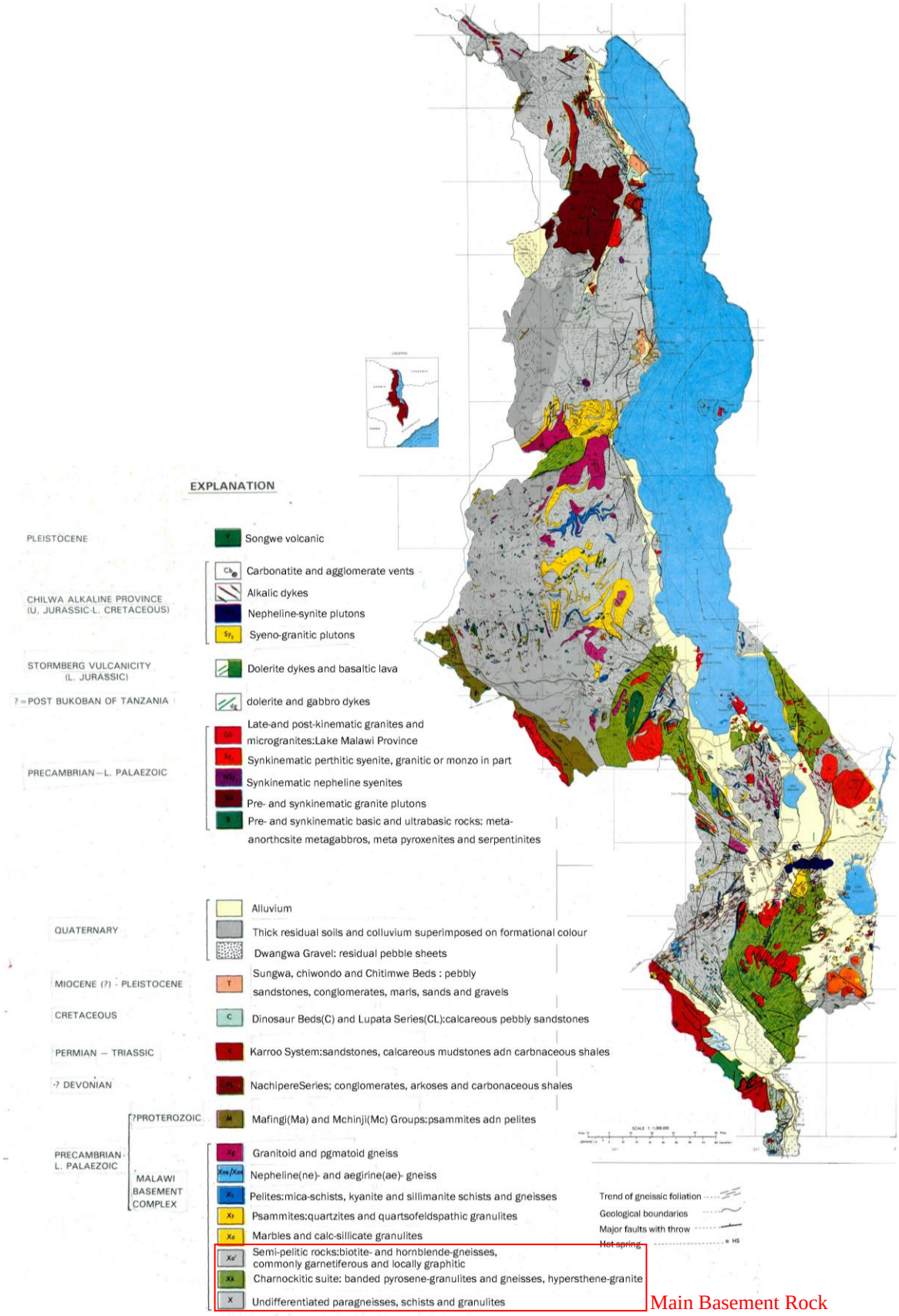
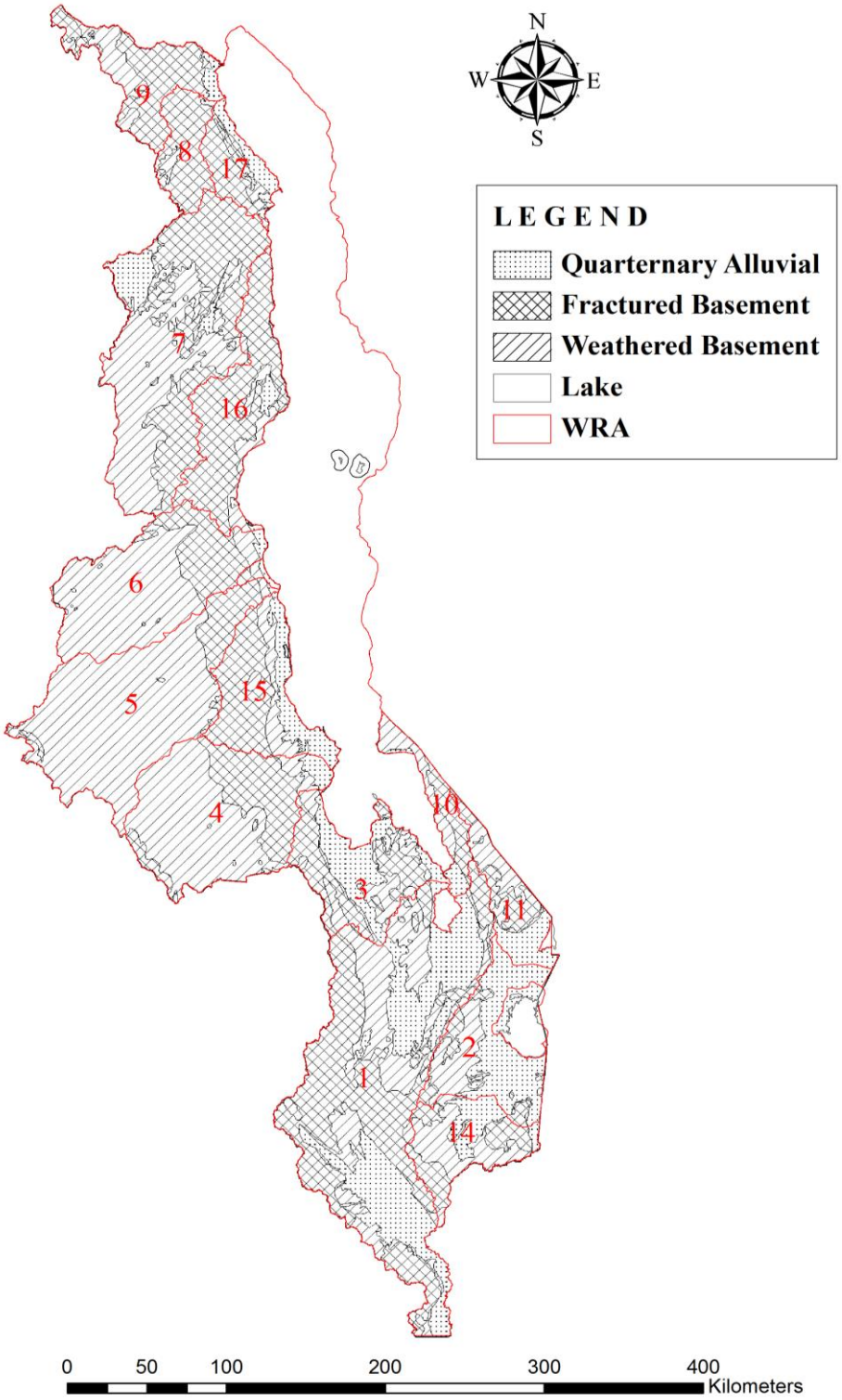



**Figure 3.3.1 General Geological Map of Malawi [1]**

### 3.3.2 Aquifer

According to geological conditions on ground surface, three categories of aquifer have been broadly identified: Weathered Basement (WB), Fractured Basement (FB), and Quaternary Alluvial (QA). These distributions in Malawi are shown in **Figure 3.3.2**, and the characters of each aquifer type are summarized as follows.




Source: Project Team

**Figure 3.3.2 Distribution Map of Aquifers in Malawi**

### (1) Weathered Basement Aquifers

Weathered Basement aquifer is the best developed on the highland areas and the most important source of rural water supply in Malawi. Typical structure of the aquifer is shown in **Figure 3.3.3**. According to existing borehole records, the weathered zone is divided into 3 layers: the laterite layer which is composed of mainly red clay or completely weathered silt; the saprolite layer which is composed of quartzitic clayey sand or heavily weathered fine to coarse sand; and medium weathered layer in which rock mass is separated into fragments or small blocks by groundwater infiltrating into joints of rock.

Subsurface consisting of laterite layers tend to be indurate on relatively better drained areas, so that the indurate clayey materials have poor permeability and porosity. Relatively thicker clayey layers tend to prevent water infiltration into deep portions in underground and form "Dambo" areas on the surface.

Weathered zone basically gets coarser grained materials in proportion of depth. The medium weathered layer is considered the best water yield as weathered basement aquifer, and the occurrence depth is estimated to be between 15 and 30 meters in general. However, the aquifer thickness or the occurrence depth is very variable due to topographic conditions. On the escarpment areas, rejuvenated rivers have actively eroded the ground surface, and thus weathered zone tends to be reduced in comparison to the highland areas. On the mountain areas, distributions of good aquifers are not expected because fresh bedrocks expose on the surface and weathered layers are very thin if underlain.

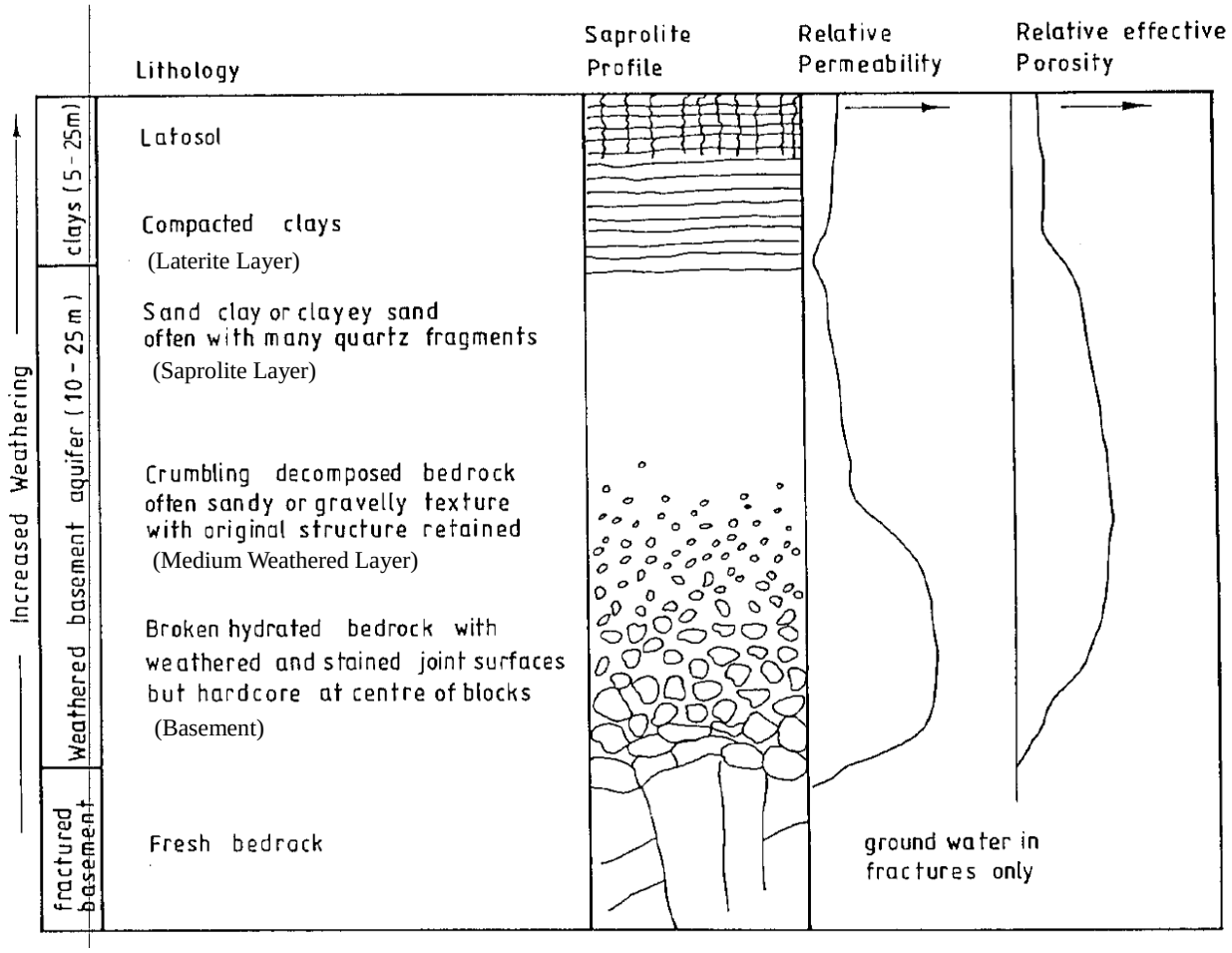



**Figure 3.3.3 Typical Model of Weathered Basement Aquifer** [2]

The characteristics of weathered basement profiles also differ on geological conditions (see **Table 3.3.2**). Weathering is the decomposition of bedrocks which can take place by both chemical and physical processes in which the weathering rate is greatly controlled by joint spacing, lithofacies, mineral component, and agglomeration degree of rock mass. For instance, Quartzite is comprised of quartz in large parts and its rock has strong resistivity against chemical weathering, and thus the rock mass hardly

forms weathered zone and does not yield groundwater so much. Dolerite and Basalt which are magmatic intrusion and eruption are rich in mafic minerals such as iron, magnesium and aluminum. These compounds tend to react with oxygen and acidic water more rapidly than silicate minerals and alter to clayey products in weathering process. Therefore, the weathered zone is dominated with fine grained products which is difficult to be infiltrated from surface water. Schist, which is a kind of metamorphic stone, develops foliation in its rock body prior to joints. The lithoface appear like fish-skin in the fresh condition and tend to become fine grained materials by weathering, thus Schist also hardly makes good permeable aquifers. Gneiss and granite contain abundant quartz and also have feldspars and a few mafic minerals for cementing in a specific proportion. Furthermore, vertical joints corresponding to seepage path develop well in these rock bodies. Hence, these rocks tend to be blocky separated by weathering and are expected to make good permeable aquifers.

As mentioned above, the water yield potential of weathered basement aquifer depends largely on the parent rock compositions and conditions. Therefore, evaluation of the groundwater potential of aquifers requires the distribution maps of parent rocks, depth of impermeable fresh rocks and hydraulic parameters led by borehole information.

**Table 3.3.2 Weathering Profiles of Metamorphic and Igneous Basement** [3]

| Parent Rock | Texture of Aquifer | Jointing | Weathering Products | Depth of Weathering | Water Bearing Capacity |
|---|---|---|---|---|---|
| Gneiss | Coarse grained | Moderate | Clay minerals, Quartz persists | Moderate to deep | Good |
| Schists | Foliated | Cleavage | Clay minerals | Deep | Poor |
| Quartzite | Fine-coarse grained | Strong | Mechanically weathered Quartizite | Shallow | Poor to very good |
| Granite & Granodirite | Coarse grained | Strong | Clay minerals, Quartz and some mica persists | Deep | Good |
| Syenite | Coarse grained | Moderate | Clay minerals | Moderate | Poor |
| Gabbro | Coarse grained | Little | Clay minerals | Moderate | Poor |
| Dolerite | Fine grained | Strong | Clay minerals and iron oxides | Moderate to deep | Poor |
| Basalt | Fine grained | Strong | Clay minerals and iron oxides | Moderate to deep | Poor |

### (2) Fractured Basement Aquifer

The fresh bedrocks underlying the weathered zone have joints as seepage path and storage but its groundwater resource potential is negligible. However, extensively fractured zones are expected to be available water storage. These fractured zones are overlain thickly by subsurface and weathered materials and so unclear on the highland areas. Thus electrical prospecting has to be carried out to trace the continuation and the scale.

The Karro sedimentary sequences which are a sort of basement rocks were thought to be thicker than 3,500m underground, but the strata are generally cemented by calcite which has resulted in a considerable reduction in primary porosity and permeability. According to the past borehole records, a specific sandstone layer not weathered had larger storage compared to other kinds of basement rock. The good aquifer properties are possibly caused by the extent of secondary fissuring, enlargement of joints and clearances between the bedding planes. Some localities rich in groundwater yields are recognized in the distribution areas of Karro sedimentary sequences, but these aquifers are thought difficult to apply Darcy's Law[1].

### (3) Alluvial Aquifer

Alluvial sequences generally have good permeability, porosity and storage capacity due to thickness and un-consolidation. These aquifers are important groundwater sources vied with the weathered basement aquifers in Malawi. The alluvial aquifers are underlain thickly on the lowland areas in the vicinity of Lake Malawi and Shire River, and highly variable faces both in vertical sequence and lateral extent. The borehole records in which detailed stratum faces are mentioned are further fewer than the records bundled into "Alluvial deposits", and thus it is very difficult to grasp the three-dimensional distributions of each stratum based on the borehole records. In the alluvial areas, the geometry of the basins of alluvial sequences is not well understood because many of the past boreholes did not penetrate up to the underlying basement throughout the alluvial unit. According to some records of the boreholes which penetrate to the bedrock, the thickness of the alluvial sediments in the lakeshore areas appears to generally increase towards Lake Malawi from toes of the escarpment area. On the other hand, the Upper Shire valley has thickness of alluvium 40 to 80 meters deep in the center of the valley. In the Lower Shire valley, the thickness of alluvium varies from zero to over 150 meters[1].

The alluvial sequences are constituted of clay, silt, sand and gravel. It is clear that thickness of sand layer is a very significant factor in many localities with rich amount of water yield. In particular, buried river channel and the lakeshore deposits produce the largest amount of groundwater because these deposits usually are dominated by coarse grained sand sorted well. The clay or silt sequences tend to be confined and not well infiltrated because of being too fine particle (i.e., the sediments surrounding the Lake Chilwa appear to be dominantly very fine-grained[1]). Unfortunately, it is thought that clay or silt materials dominate the alluvial sequences overall; therefore, drilling boreholes on the alluvial distribution areas do not always lead to high yield of groundwater.

**Table 3.3.3 Summary of Aquifer Characteristics**

| Aquifer Class | Geological Conditions | Hydraulic Characteristics | Expected Water Yield |
|---|---|---|---|
| Weathered Basement | • Subsurface: Laterite comprised of indurate clay.<br>• Upper Weathered Zone: Decomposed basement comprised of clayey sand mixing gravels.<br>• Lower Weathered Zone (The most permeable zone): Separated blocks of basement due to weathering.<br>• The thickness generally ranges from 15 to 30m, but remarkably varies at localities | Groundwater is basically transmitted as laminar flow along blocks in lower weathered zone. In case that laterite layer overlays on weathered zone, presence of groundwater would not be expected because fine materials preclude recharge from infiltrating rainfall. The permeability depends on weathering degree in the most part but also source rock of basement in some little. | Weathered aquifers have very large potential of groundwater development and these are the most widely spread in Malawi; however, the water yield is relatively low at a single borehole. |
| Fractured Basement | Discontinuous planes such as joints, cracks, fractures, and geological faults in all basement rock-mass. | Groundwater cannot flow into massive rock body, but can flow only along discontinuous planes. Laminar flow theory does not apply to fractured basement because of random flow. Groundwater capacity depends on density of joint development and joint clearance. | Generally low. |
| Quaternary Alluvial | • Lakeshore sediments<br>• River channel deposits<br>• Alluvial fan or Colluvium at toe of mountains or escarpments<br>• Sediments mentioned above are comprised of clay, silt, sand and gravel, but gradation patterns are largely different at localities.<br>• The thickness generally ranges from 40 to 80m. | Groundwater is basically transmitted as laminar flow between particles. Permeability of the aquifer depends on particle size. Coarser particles tend to be higher permeable. | Yield of coarse sediments such as river channel deposit are expected to be high. On the other hand, clayey sediments have poor potential of groundwater yield. |

Source: Project Team