MINISTRY OF AGRICULTURE, WATER DEVELOPMENT AND IRRIGATION

NATIONAL WATER DEVELOPMENT PROGRAMME

MALAWI RURAL WATER SUPPLY INVESTMENT PLAN:

2014-2020

APRIL 2015

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ACRONYMS

ACGF	African Catalytic Growth fund
ADB	African Development Bank
ADC	Area Development Committee
ADF	African Development Fund
AEC	Area Executive Committee
AM	Area Mechanic
AusAID	Australian Agency for International Development
AWF	African Water Facility
BCR	Benefit Cost Ratio
BH	Bore Hole
CIDA	Canadian International Development Agency
CWP	Communal Water Point
DCT	District Coordination Team
DDP	District Development Plan
DFID	Department of Finance for International Development
DSIP	District Strategy and Investment Plan
DWDO	District Water Development Office
EIB	European Investment Bank
EIRR	Economic Internal Rate of Return
EMA	Environmental Management Act
EU	European Union
FIRR	Financial Internal Rate of return
GDP	Gross Domestic Product
GFS	Gravity Fed Schemes
GoM	Government of Malawi
GVH	Group Village Head
IDA	International Development Association
IWRM	Integrated Water Resources Management
JICA	Japan International Cooperation Agency
JMP	Joint Monitoring Programme
km	kilometre
l/c/d	Litre per capita per day
LDF	Local Development Fund
l/s	Litre per second
LUO	Local Utility Operator
MCE	Metaferia Consulting Engineers
MDGs	Millennium Development Goals

MGDS	Malawi Growth and Development Strategy
M&E	Monitoring and Evaluation
MK	Malawi Kwacha
NWDP	National Water Development Programme
NGO	Non-Government Organizations
NPV	Net Present Value
NSO	National Statistical Office
OFID	OPEC International development Fund
O&M	Operation and Maintenance
PMU	Project Management Unit
SWAP	Sector Wide Approach
TA	Traditional Authority
TOR	Terms of Reference
UN	United Nations
US$ / USD	United States Dollar
WPC	Water Point Committee
VDC	Village Development Committee
VH	Village Head
VHWC	Village Health and Water Committee
VIP	Ventilated Improved Pit
VNRMC	Village Natural Resources management Committee
WASH	Water, Sanitation and Hygiene
WB	World Bank
WEMS	Water and Environment Management Services
WUA	Water User Association
WSSD	World Summit on Sustainable Development

ACKNOWLEDGMENTS

EXECUTIVE SUMMARY

INTRODUCTION

Malawi has a total population of 15.3 million in 2013 out of which 12.7 million (83%) are living in rural areasand is projected to be19.1 million by 2020. Of which 15.5 million (81%) will be living in rural area. The country is divided into three regions and 28 districts. The districts are subdivided into traditional authorities (TAs), presided over by chiefs. Each TA is composed of villages, which are the smallest administrative units, and the villages are presided over by village headmen.

The Government of Malawi through the Ministry responsible for Water Development and Irrigation has come up with policies, startegies, legislation and regulations for the sector to effectively contribute towards achieving the National Development Agenda set in the 1998 Malawi Government's Vision 2020.

Water supply and sanitation is identified as one of the nine key priority areas in the Development Strategy The key policies that lay foundation for the management and development of the water sector among others are: i) the 2005 Water Policy, ii) the 2013, National Water Resources Act, iii) the 1998 Local Governments Act, iv) the 2008 National Sanitation Policy and v) the Forestery Act.

Guided by the Vision 2020 and the MGDS' aspirations, in 2012 the Ministry responsible for Water development and Irrigation has developed the Water Sector Investment Plan extending up to the year 2030. Based on the Vision 2020 and the investment plan prepared in 2007 and 2012 the investment plan for Rural Water Supply covering the period 2014-2020 is prepare to serve both at district level and national level. The investment plan assessed issues of existing gravity fed schemes, policy and legal, institutional, socio-economic and environmental, surface water resources for existing and new schemes and groundwater based reticulated systems mainly for market centres. The investment plan is prepared based on the assessments of all the issues which are presented in several topical reports. There is also existing National 10 years Sanitation and Hygiene Investment Plan and Startegy of October 2012 prepared by the Ministry responsible for Water Development and Irrigation and has to be used in parallel and synchronization with this Rural Water supply Investment Plan.

INSTITUTIONAL FRAMEWORK

The Central Government is responsible for strategic planning, coordination, quality assurance and technical assistance systems, including collaboration efforts with donors/ NGOs and the private sector. The Ministry responsible for Water Development and Irrigation is the lead Ministry to provide overall policy direction for water services in the country. Ministries of Health, Environmental Affairs, Ministry of Finance, Ministry of Gender, Local Government and Rural Development are also involved in the sector.

The Ministry responsible for Water Development and Irrigation The Ministry is organized under five departments, of which the department of water supply and the department of sanitation have major involvement in the rural water supply and sanitation services. The water supply department has two divisions the first division is responsible for operation, maintenance and monitoring and the second is responsible for planning design. However the department is understaffed. The 2012/13 Sector Performance Report indicates that out of the total 493 established staff posts for Water and Sanitation Department only 143 were filled.

The Local Governments: The Local Governments are charged with responsibilities for the provision and management of rural water supply and sanitation services, in liaison with the ministry responsible

for water. Local Governments carry out: planning, budgeting and resource allocation, community mobilization and participation, follow up implementation by private sector and support the operation and maintenance of water services, monitoring, and reporting. However, the capacities of the Local Governments are still inadequate to undertake these tasks. District Councils do not have a revenue base to fund investment and they also don't have the funds to contribute to the operations and maintenance of existing facilities. Financing of rural water supply is restricted by the very low level of fiscal devolution.

Local Leaders: Local leaders consist of the Village Head (VH), the Group Village Head (GVH) a Traditional Authoritys (TA). Where there is strong local leadership communities are actively engaged in the implementation, operation and maintenances of water supply projects.

User Community: Users are organized in several forms to enable their full participation in planning and implementation stages through to Operation and Maintenance (O&M) of the water facilities. The Water Statute provides the legal platform for the formation of Water and Sanitation Committees, Water User Groups and Water User Association at community level that will ensure sustainability and proper management of the facilities.

Private Sector: The private sector, represent a viable resource for design, construction, operation, maintenance, training, capacity- building and commercial services

Development Partners: Malawi has received considerable support from development partners for funding the development budget including rural water supply and sanitation. The major donors include World Bank, African Development Bank, European Union, DFID, UNICEF, and ACGF. Some donors transfer funds directly to NWDP while others manage the funds on their own

Non-Governmental Organizations (NGOs): There are 46 NGOs operating in 26 districts in the rural water supply sector. They are important and effective partners of government in development and and are well-placed to raise public awareness and build capacity at the local level.

OVERVIEW OF EXISTING RURAL WATER SUPPLY SERVICES

Malawi has one of the highest levels of access to improved drinking water source and the highest level of access to improved sanitation facilities compared to other Sub Saharan Africa countries. According to the JMP 2013 report the overall access of improved water supply services for the Sub Saharan Africa was 63% while that of Malawi was 84%. The country has already met the 2015 MDGs (67%) and MGDSII (75%) targets. Whilst this is a good development, the sector however needs to make sure that these water sources are functional at any given time.

According to the DWDO figures there are over 43,157 boreholes, 10,539 shallow wells, 14,790 stand pipes and 269 protected springs making a total of 71,717, of these the functional schemes at present are 35,695 boreholes, 7,658 shallow wells, 10,730 stand pipes and 221 protected springs making a total of 54,304 (75.7%) water supply point. On the other hand the inventory of rural Gravity Fed Schemes revealed that there are currently over 13,211 standpipes for the 108 gravity schemes assessed of which only 5,737 (less than 50%) are currently functioning.

OVERVIEW OF EXISTING WATER SECTOR INVESTMENT PLANS

The 2007 Startegic and Investment plan: The 2007 Investplan was mainly focusing on: major rehabilitation and maintenance of existing malfunctioned gravity fed schemes and boreholes, to

increase access to potable water to 70% of the rural inhabitants by 2011 to realize the MDGs requirements in 2015 and full coverage by 2025, and establishment of effective management structures in all piped water schemes and recruitment of Water Monitoring Assistants

***The 2012 Water Sector Investment Plan*:** The plan was prepared to assess the level of investment required for the water and sanitation sector development in order to achieve the levels and targets to reach universal access coverage of water supply and sanitation. It also assess the institutional reform and capacity building needs in order to implement the required investment levels to achieve universal access by 2025 for water supply and 87% access to sanitation in 2030.

***Districts Strategy and Investment Plans*:** 18 districts have District Strategy and Investment Plan (DSIP) with planning horizon up to year 2015. Most districts depend on the support from NGOs and projects financed from the central government for them to implement their plans.

THE 2014-2020 PROPOSED RURAL WATER SUPPLY INVESTMENT PLAN

The 2014-2020 Rural Water Supply Investment Plan is prepared based on: findings of inventory of existing gravity fed schemes, surface and groundwater sorces assessment, policy, legal and institutional assessments, socio-economic and environmental assessments condcuted in the country and conceptual design prepared for rehabilitation, expansion and development of new surface water systems as well as possible borehole based reticulated systems. The Investment plan includes activities to be undertaken, resources and capacities required, environmental and social issues to be addressed and population to be served during the planning period.

Access Target: The targets set for access to rural water supply in Malawi are 83% by 2015, 85% by 2017 and 90% by 2020 and the targets are in line with Vision 2020, the MDGS II, the 2007 investment plan and the Malawi Water Sector Investment Program of 2012. The plan proposed to bring all the districts to the same level in terms of access to rural water supply at the end of the planning period. The additional population to be provided with water supply access is projected for each stage of the target years for each district based the water supply access and population in 2013. Accordingly the total additional population to be served by 2020 with water supply access is 3.91 million.

Water Demand: The water demand for gravity fed piped schemes and reticulated boreholes is detrmined on the basis of 36 l/c/d for CWP, 50 l/c/d for private connection. For boreholes and shallow wells for point supply 27 l/c/d will be used.

Technologies options: The main technology options that are considered for the investment plan are: protected springs, shallow wells fitted with hand pumps, boreholes fitted with hand pumps, boreholes fitted motorised, and gravity fed piped systems. **It is also assumed that for point water sources protected spring and shallow wells will serve 120 people, boreholes fitted with hand pumps will serve 250 people, boreholes fitted with submersible pumps will serve a population of not less than 1500 and**, for gravity fed and other piped systems the population served will depend on the number of water points in the system. The use of technology options such as solar, wind mill and fuel energy has to be considered in the feasibility study of specific projects. Particular attention should be paid to encourage the use of solar energy in remote rural areas as the sun shine hours is sufficient and longer although initial cost could be high but has less O&M costs.

In order to meet the 2015, 2017 and 2020 targets for the provision of rural water supply access various infrastructure development are envisaged over the years. This includes: 1) Rehabilitation and

expansion of existing borehole schemes and surface water schemes and 2) Construction of new schemes based on gravity fed surface water and on boreholes.

PROPOSED REHABILITATION, EXPANSION AND NEW SCHEMES

Rehabilitation of Existing Boreholes: Of the 7,462 boreholes reported as exisiting malfunctioning, it is assumed that about 5,593 (75%) of these boreholes could be rehabilitated. and is assumed to serve on average 200 people after rehabilitation. Accordingly a total of 1,118,600 people are expected to be served from the rehabilitated boreholes.

Rehabilitation of Existing Gravity Fed Schemes: 108 existing gravity fed schemes were assessed and evaluated if they require rehabilitation. Accordingly out of the 108 schemes the following were identifed:

i) 40 schemes that could be rehabilitated by the community and are not considered for rehabilitation under the investment plan. The poluations that will be served by these schems is estimated at 474,763.

ii) 25 schemes that require minor rehabilitation, The poluations that will be served by these schems is estimated at 207,716.

iii) 22 schemes that require major rehabilitation and The poluations that will be served by these schems is estimated 477,271.

iv) 16 schemes that require rehabilitation and expantion. The poluations that will be served by these schems is estimated at 490,250.

New Surface Water Based Schemes: A total 9 schemes for gravity fed piped schem from surface water sources and pumped schemes from Lake Malawi in 7 districts are identified for development after furher detailed feasibility study and design. The total number of population to be served from these schemes is estimated to be 218,720.

***Ground Water Sources Based New Schemes*:** New boreholes fitted with hand pumps and groundwater based reticulated systems for market centers is **IDENTIFIED AS FOLLOWS:**

a) Drilling of over 8,102 new boreholes fitted with hand pumps. The total population to be served from the new ground water based schemes is 2,065,000.

b) . Ground water source based reticulated water supply system 32 market centres are proposed with information based on detailed study and investigation. The total population to be served from the new ground water based reticulated schemes is 197,005

Capacity Building: The sector institutional framework is in place to facilitate the planning, implementation and monitoring of the water sector programmes. Emphasis should be directed at strengthening roles, capacity, co-ordination and collaboration for improved performance and results-oriented management and development of the water sector programmes at all levels. In this respect the investment plan will focus

- Supporting the Ministry responsible for Water Development and Irrigation to work with the universities and vocational training institutes to draft specific curriculum for water sector professionals and organize special crush programme to produce the required engineers, technicians and water sector practitioners.
- Supporting the district councils to develop capacity to play their role.
- Training of District Coordination Teams;

- Formation, training and capacitation of Water Users Associations and Water Point Committees;
- Developing operations and maintenance framework for WUAs;
- Strengthening of M&E systems;
- Preparation of District rural water supply investment plans;
- Strengthening and building capacity for private sector participation

Catchment Protection: Addressing catchment protection in general and environmental issues in particular entails improving the socio-economic status of beneficiary communities. Some of the major issues that are identified to be undertaken during the implementation period are:

- Studies and designs for all rehabilitation and new works must incorporate catchment and invornmental protection;
- WUAs should also monitor the catchment of their water sources and allocate resources for such activities in their budget;
- The beneficiary communities should be sensitized adequately on the importance of catchment;
- The water supply facilities for people living upstream of intake point in the catchment area should be planned together with the new gravity fed schemes.

COST ESTIMATIONS AND FINANCIAL ANALYSIS

Unit Costs: To come up with cost estimates for the different proposed schemes and facilities unit cost are established for the various infrastruactural elements and activities as follows:

- Unit costs for the proposed different technology options are derived from various contracts signed, documents used in the preparation of projects and water resources investment plan and market prices from suppliers of pipes
- Cost for environmental mitigation and catchment protection activities are estimated as percentage of the project cost and this is considered as 10%.
- Cost for study and design works for each activity and the Engineering cost is considered as 15% of the total cost of the activities to be implemented.
- Capacity building activities costs are estimated at 5% of the facilities cost.
- The cost estimations for rehabilitation and expansion works for the existing gravity schemes is prepared based on the quantification of works to be done from field assessment

Total Investment Costs: The total investment cost estmate is stablishe for the planning period of 2014 to 2020 based on the facilities to to be provided and activities to be undertaken and by applying the appropriate unit costs d. Accordingly the total investment cost required to implement the investment plan is MK 74,563,091,614.00 (equivalent to USD 186,407,729) and the average percapit cost is MK 17,277 (USD 43). Summary of the investment cost by district and target period is provided below.

All Inclusive Cost Estimates for the Planning Period from 2014 - 2020 by District

S. Nr.	District	Amount in MK			
		2014-2015	2016-2017	2018-2020	2014-2020

1	Chitipa	50,700,000	250,539,906	413,894,000	715,133,906
2	Karonga	217,040,293	332,422,133	841,698,000	1,391,160,426
3	Nkhatabay	247,536,502	868,574,711	1,103,479,000	2,219,590,213
4	Rumphi	403,439,987	292,990,574	1,186,250,000	1,882,680,561
5	Mzimba	771,459,966	1,936,516,000	1,627,652,000	4,335,627,966
6	Likoma	-	-	13,000,000	13,000,000
7	Kasungu	2,741,375,000	3,250,000,000	3,781,414,000	9,772,789,000
8	Nkhotakota	255,450,000	104,435,255	497,159,000	857,044,255
9	Ntchisi	498,568,748	638,534,000	650,000,000	1,787,102,748
10	Dowa	3,435,250,000	3,368,014,000	4,225,000,000	11,028,264,000
11	Salima	391,300,000	881,103,473	1,309,074,000	2,581,477,473
12	Lilongwe	3,187,925,000	3,487,874,000	4,550,000,000	11,225,799,000
13	Mchinji	1,138,800,000	1,911,482,845	2,080,000,000	5,130,282,845
14	Dedza	345,651,521	-	1,052,220,000	1,397,871,521
15	Ntcheu	436,396,190	775,839,713	556,634,000	1,768,869,903
16	Mangochi	114,075,000	401,486,031	2,934,074,000	3,449,635,031
17	Machinga	431,418,482	1,105,699,238	1,993,576,000	3,530,693,719
18	Zomba	194,761,910	384,387,449	402,298,000	981,447,359
19	Chiradzulu	295,425,000	-	-	295,425,000
20	Blantyre R	302,250,000	-	520,000,000	822,250,000
21	Mwanza	39,975,000	-	339,794,000	379,769,000
22	Thyolo	231,469,995	1,432,960,631	1,625,000,000	3,289,430,627
23	Mulanje	232,577,738	38,453,557	643,695,000	914,726,294
24	Phalombe	261,705,148	560,616,949	357,500,000	1,179,822,097
25	Chikwawa	205,725,000	426,261,669	507,000,000	1,138,986,669
26	Nsanje	155,025,000	-	239,369,000	394,394,000
27	Balaka	133,575,000	-	424,918,000	558,493,000
28	Neno	26,325,000	520,000,000	975,000,000	1,521,325,000
MK	**Total**	**16,745,201,481**	**22,968,192,134**	**34,849,698,000**	**74,563,091,614**
USD	**1USD = MK 400**	**41,863,004**	**57,420,480**	**87,124,245**	**186,407,729**

Source: Compiled by the Consultant for this study

FINANCIAL AND ECONOMIC ANALYSIS

Source of Fund: The Ministry responsible for Water development and Irrigation has the primary responsibility of sourcing funding for the development of rural water supply infrastructure. The Ministry should market these projects to possible financiers such as the World Bank, African Development Bank, European Investment Bank, JICA and other development partners. Government is also expected to finance projects through the annual national budget.

Non-Governmental Organisations (NGOs) are also expected to partner with Government in the provision of safe potable water in the rural areas by financing specific projects through District Assemblies.

Channeling of Funding: The funding will mainly be channeled through the National Water Development Program II (NWDPII) or through the next possible arrangement of another similar program. As the Ministry responsible for Water development and Irrigation is taking a centre stage in the development of water supply systems through the national budget the government is pursuing a devolution and decentralisation policy. The decentralisation policy has given birth to the Local Development Fund (LDF). A fully fledged LDF is supposed to take centre stage in coordinating all rural water supply investments coming to the local authority through NGOs including the operation and maintenance of all rural water systems. However, Whilst LDF has been established as a countrywide funding mechanism for all local authority public funding and services there is need to align the objectives of the MWDI and the LDF.

Tariffs: An analysis of the existing water tariffs indicates various WUAs have adopted their own tariff rates for various customer categories. The variations shows that there is a very loose and

uncoordinated relationship between the various WUAs in applying the water tariff policy and indeed there is no legislation or regulation that establishes a legal regulator of the tariff setting mechanism in water supply services including schemes managed by the WUAs'. As a result most of the WUAs are not applying water tariffs that align with the fundamental policy principle of cost recovery of operation and maintenance costs.

Financial and Economic Analysis: A financial and economic analysis has been prepared to assess the financial and economic viability of the project. Specifically the financial analysis has focused on determining the required tariff levels that fit within the Government policy of operation and maintenance cost recovery tariff for the Rural Water Supply. Caution is exercised in setting rural water supply tariff in order to safeguard the poor communities in the rural areas. In determining the financial and economic viability of the proposed projects alternative senarious and parameter such as: Ideal Cost Recovery Tariff, Operation and Maintenance Financial Internal Rate of Return (FIRR), Benefit Cost Ratio (BCR), Net Present Value (NPV), and Economic Internal Rate of Return have been analysed:

The financial analysis under the alternative scenario shows that the adjusted O&M cost recovery tariff has the most favourable indicators in form of the NPV, IRR and BCR. However this entails that the rural consumers will be paying tariffs that are significantly higher than existing tariffs. The choice is between seeking the financial viability and sustainability of the water supply schemes as opposed to the social bearing of water on the rural communities. If the major determining factor is financial viability of the project the choice on implementation of the water tariffs is between the ideal tariff which derives the 1% IRR and the tariff derived from the additional 25% O&M cost on investment.

However it is recommended that for a start the tariff derived from 12% O&M cost recovery be initially considered and gradually graduated to higher tariffs that would lead to the financial viability of the water supply schemes. Whichever tariff that is picked by the project must be implemented with substantive marketing and sensitization on the need and justification for the consumers to pay a water tariff. Sound financial management would be the key in inspiring confidence in consumers that the water tariff being proposed would be put to good use.

IMPLEMENTATION STARTEGY AND TIME FRAME

Project Management and Administration Approach by the NWDP: The Ministry responsible for Water Development and Irrigation through the Project Management Unit (PMU) of the NWDP is responsible for the implementation of rural water supply projects financed by donor partners. The PMU is spearheading the administration and management of the donor funded projects and is mainly dealing with procurement, project administration and management activities related to goods, consultants and contractors that are involved in the implementation of the project activities and delivery of goods required for the works.

PMU has so many projects and seem to be overwhelmed by large volume of works and although many are successfully implemented, there are also some delays in project planning to its implementation stage in some cases. The NWDP which is running now is about to be concluded very soon and if establishing a new one it is important to consider lessons learnt and improve the set up and performance of the PMU on the next NWDP.

Implementation Timeframe: The proposed intervention will be implemented stage by stage over the period from 2014 to 2020. Achieving the end result of the water supply system would involve, Project formulation, Project planning, Project Preparation, Project tendering andselection of contractors, Project construction, Project defects liability period, and mMentoring period. It is important that in

the process decisions be made on time and actions taken within the given time span to expedite the implementation process

Implementation Strategy: The implementation strategy for the proposed interventions will be carried out step by step and is set in such a way that different stakeholders will be involved in the implementation on the basis of the responsibilities accorded to them. It is important that each stakeholder reacts accordingly and fulfill its role in order to effectively and efficiently implement the investment plan.

RECOMMENDATIONS

The rural water supply investment plan is based on information and data provided in the different topical reports prepared for this assignment and data collected from different institutions and organizations. In the preparation of the investment plan a number of assumptions have been made which would require further verification during the feasibility study and design of the proposed activities. In order to implement the proposed facilities to meet the set targets the following recommendations are made:

- Government and donors have to allocate funds for project preparation in advance and instead of combining it with the physical implementation activities.
- MWDI of priority has to ensure the boosting of coverage and access level for the districts that are now at lower levels.
- The targets set and activities planned can only be achieved if financial resources are allocated, accordingly government and development partners must ensure that resources are allocated sufficiently and on time to meet the targets.
- The formation of the WUAs in all the gravity fed systems for the sustainable operation and maintenance of the system and management of the schemes is vital and MWDI in collaboration with the District council and District Water Development Offices must enhance and ensure that the WUAs are formed in all the GFS.
- Environmental issues regarding catchment protection and mitigation of negative environmental impacts must be given serious attention and be implemented together with the physical implementation of the facilities proposed and this must be put as part of the requirements in project preparation and implementation.
- Sustaining of the functionality of existing functional facilities and also carrying out rehabilitation works on existing schemes at community level is considered in the planning and the District Council and the DWDOs must take serious steps to ensure the community and scheme management bodies such as WUAs and scheme committees take action in this regard by providing the necessary technical support.
- From the financial analysis the ideal tariff should be the preferred option so that the schemes operate on a sustainable basis.
- The financial management structure of the WUAs must be strengthened to ensure maximum accountability of the revenues that will be collected from customers.
- A cost of capital of 12% was used in the financial model which is generally giving a negative IRR. Hence in sourcing funds for the projectat the cost of capital should be equal and or lower than 3.5%.

- A marketing strategy must be developed and implemented for communites to accept new tariff rates.
- The performance and approach in project management and construction of the NWDP need to be assessed and lessons learnt to be adopted for the next phase NWDP.

1 INTRODUCTION

1.1 GENERAL

Malawi is a landlocked country located in the southern Africa region with a total population of 15,316,860 in 2013 according to NSO out of which 12,719,692 (83%) are living in rural areas and market centers while 2,597,168 (17%) live in urban areas of which 80% live in the 4 major cities. According to the National Statistics Office (NSO) the rural population for Malawi is projected to be 15,506,787 (81%) and that of urban will be 3,597,488 (19%) by 2020.

The country is divided into three regions: the Northern, Central, and Southern Regions. There are 28 districts in the country. Six districts are in the Northern Region, nine are in the Central Region, and 13 are in the Southern Region as shown in Figure 1.1. Administratively, the districts are subdivided into traditional authorities (TAs), presided over by chiefs. Each TA is composed of villages, which are the smallest administrative units, and the villages are presided over by village headmen.

Figure 1-1: Map of Malawi Showing the Districts

Water supply and sanitation continue to be a priority in the second Malawi Growth and Development Strategy (MGDS II), and is identified as one of the nine key priority areas. The Ministry responsible for Water Development and Irrigation is mandated to provide overall policy direction for water services in the country in addition to providing water supply to the rural areas. Five Water Boards (Lilongwe, Blantyre, Northern Region, Central Region and Southern Region) provide water supply in the four cities and several towns in the country. Because of its far reaching importance, other government ministries including Ministries of Health, Environmental Affairs, Local Government and Rural Development are also involved in the sector.

The Government of Malawi (GoM) through the Ministry responsible for Water Development and Irrigation has come up with policies, legislation and regulations in order the sector to effectively contribute towards achieving the National Development Agenda set in the 1998 Malawi Government's Vision 2020 which is: "God-fearing, secure, democratically mature, environmentally sustainable, self-reliant with equal opportunities for and active participation by all, having social services, vibrant cultural and religious values and being a technologically-driven, middle-income economy by the year 2020".

This investment plan covering the period from 2014-2020 is developed in line with the principles of the Vision 2020 and the Malawi Growth and Development Strategies (MGDS II). The MGDS II covering the period 2011 – 2016 is the second medium-term national development strategy for the country and builds on the MGDS I that ended in 2011. MGDS II is a strategic reference document to be followed by all sectors and stakeholders including the water and sanitation in order to achieve the nation's goal of creating wealth through sustainable economic growth and infrastructure development. Guided by the Vision 2020 and the MGDS' aspirations, in 2012 the Ministry responsible for Water Development and Irrigation has developed the Water Sector Investment Plan extending up to the year 2030 and also the 2007 rural water supply investment plan. The 2007 rural water supply investment plan was covering the period from 2007-2015 and it had some draw backs such as identifying source of funding, implementation schedule, inclusion of catchment issues, capacity building works and also lucks harmonization of the national and district strategic investment plan and capacity of the sector. It is on these backgrounds that this investment plan was prepared and it presented the physical activities to be implemented and the financial requirements for the implementation of the planned physical activities for the period of 2014-2020.

There is also a National 10 Year Sanitation and Hygiene Investment Plan prepared in 2012 to adderss the issue of sanitation and hygiene in the country in order to meet the objectives set in the National Sanitation Policy. The objective of the Investment Plan is to quantify investment alternatives for on and off-site sanitation, solid waste disposal and drainage. The plan shall provide the infrastructural platform required for growth in the different waste generation sectors. The Sanitation investment plan has to therefore be taken into consideration in parallel or in synchronization witht eh Rural Water Supply Investment Plan during its implementation as sanitation and water supply should go hand in hand to creat impact in the livelihood of the rural population.

1.2 PREPARATION OF THE RURAL WATER SUPPLY INVEST PLAN :2014-2020

The Water Sector Investment Plan of 2012 has set the premises for the overall water sector investment plan for the country. The 2014-2020 Rural Water Supply Investment Plan in essences is an elaboration of the rural subsector of the 2012 Investment Plan.

The Rural Water Supply Investment plan is prepared based on: the findings of inventory of existing gravity fed schemes and assessment of potential surface water systems as well as groundwater potential for reticulated systems in the country as consolidated in the conceptual design prepared for rehabilitation, expansion and development of new surface water systems as well as possible borehole based reticulated systems. The Investment plan includes activities to be undertaken, resources and capacities required, environmental and social issues to be addressed, capacity, policy and legal matters to be improved and population to be served during the planning period.

The investment plan is prepared based on the information and recommendations provided in the Topical and Conceptual Design Reports prepared as part of the exercises during the process and submitted on the following topics:

- Annex I: Policy, Legal and Institutional Assessment
- Annex II: Water Resources Assessment (Surface Water and Groundwater)
- Annex III: Socio-Economic and Environmental Assessment
- Annex IV: Detailed Assessment of Existing Gravity Fed Schemes
- Annex V: Conceptual Design Report

1.3 THE INVEST PLAN REPORT

The Water Sector Investment Plan of 2012 has set the premises for the overall water sector investment plan for the country by 2030. This report presents the 2014-2020 Rural Water Supply Investment Plans which are in essences an elaboration of the rural subsector of the 2012 Investment Plan.

The Malawi Rural Water supply Investment Plan 2014-2020 report has covered major topics related to the issues considered in the plan and it is divided into twelve sections. Chapter one is the introduction and the second and third sections present the policy, legal and the institutional framework. The fourth and fifth sections present the overview of the existing rural water supply service and the review of the existing investment plans respectively. The key parameters used to determine the 2014-2020 rural water supply investment plans are presented in section six. Section seven presents list of existing schemes identified for rehabilitation by the community, minor and major rehabilitations and expansion works as part of the investment plan. The list of new piped schemes identified for constructions are presented in section eight while the overall capacity development needs and catchment protection measures are presented in section nine. Section ten presents the cost estimate and financial analysis of the investment plan. The implementation strategy and the implementation time frame are presented in section eleven. The last section is the conclusion and recommendation for the investment plan.

2 POLICY AND LEGAL FRAMEWORK

2.1 WATER POLICY, 2005

The overall policy goal of the 2005 National Water Policy is to ensure 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. It is meant to address all aspects of water including resource management, development and service delivery.

With respect to rural water services the policy's goals, objectives and guiding principles are: "to achieve sustainable provision of community owned and managed water supply and sanitation services that are equitably accessible to and used by individuals and entrepreneurs in rural communities for socio-economic development at affordable cost".

2.2 WATER RESOURCES ACT, 2013

The purpose of this Act is to provide for management, conservation, and use of water resources and for regulation of rights to use of water. It is primarily concerned with regulating the abstraction of water nationally, licensing and permits, pollution control, conservation of catchment areas and various other areas of concern.

This Act provides for the establishment of the National Water Resources Authority to replace the National Water Resources Board and paves way for the establishment of River basin authorities such as the Shire River Basin Management Authority and sub catchment management units.

The Water Resources Act also provides for permits for those intending to abstract water. There are elaborate provisions for applications for water right including detailed criteria on the grant or refusal of the said application. One of the criteria for grant is to see whether or not the proposed abstraction and use of water are consistent with the objectives of the Act and National Water Policy as well as National Water Resources Master Plan

2.3 THE LOCAL GOVERNMENT ACT, 1998

The Local Government Act of 1998 supports implementation of the Decentralization Policy by giving powers to the local authorities for planning and development of the areas under their jurisdictions. It devolves authority and relocates capacities from the centre to the local assemblies.

The Local Assemblies have responsibility to ensure sustainable management of natural resources in their jurisdiction. However, devolution of authority has been slow and implementation of programmes is constrained by human and financial resources limitations.

2.4 THE NATIONAL SANITATION POLICY, 2008

The National sanitation policy aims to all people to have access to improved sanitation where safe hygienic behavior is the norm and where the recycling of solid and liquid waste is widely practiced leading to a better life for all the people of Malawi.

2.5 THE ENVIRONMENT MANAGEMENT ACT

The Environmental Management Act was enacted to make provision for the protection and management of the environment and the conservation and sustainable utilization of natural resources. The Act defines environment as the physical factors of the surroundings of human being including land, water, atmosphere, climate, sound, odor, taste, and the biological factors of fauna and flora, and includes the cultural, social and economic aspects of human activity, the natural and the built environment.

The Act defines pollution as any direct or indirect alteration of the physical, thermal, chemical, biological, or radioactive properties of the environment caused by the discharge, emission, or deposit of waste or a pollutant into the environment in such amounts and for such duration and under such conditions as to cause an actual or potential danger to the environment.

2.6 FOREST ACT

The Forestry Act was enacted to provide for participatory forestry, forest management, forestry research, forestry education, forest industries, protection and rehabilitation of environmentally fragile areas and international co-operation in forestry and for matters incidental thereto or connected therewith. The Act does help to ensure there is good catchment management for the protection of water resources.

2.7 WATER WORKS ACT

The Water Works Act 17, 1995 mandated Regional Water Boards to run urban water supply and water borne sanitation in their respective regions. The Act also mandates the Boards to control and administer all works and all the water in such water works and shall manage the supply and distribution of such water in accordance with the Act.

2.8 DECENTRALIZATION POLICY

The National Decentralization Policy was approved by the Cabinet in October, 1998 and the policy:

- devolves administration and political authority to the district level;
- integrates governmental agencies at the district and local levels into one administrative unit, through the process of institutional integration, manpower absorption and composite budgeting and provision of funds for the decentralized services;
- diverts the centre of implementation responsibilities and transfers these to the districts;
- assigns functions and responsibilities to the various levels of government; and
- promotes popular participation in the governance and development of districts.

The policy was put in place to implement the following objectives:

a) to create a democratic environment and institutions in Malawi for governance and development; at the local level which will facilitate the participation of the grassroots in decision making;

b) to eliminate dual administrations (field administration and local government) at the district level with the aim of making public service more efficient, more economical and cost effective;

c) to promote accountability and good governance at the local level in order to help Government reduce poverty; and

d) to mobilize the masses for socio-economic development at the local level.

2.9 REGULATORY FRAMEWORK OF RURAL PIPED WATER SUPPLY

2.9.1 GENERAL

Government has decided that the supply of water to rural communities should be regulated through some instruments such as the Concession agreement, the Memorandum of Understanding and where applicable a contract between the WUA and a Local Utility Operator. In urban or market centers similar arrangement can be made except that in these areas it is more commercial than rural areas.

It is recognized that Government is responsible for construction of the rural piped water schemes for communities and afterwards it hands over the schemes to the communities to manage them and this has to be regulated through the instruments as below. As a public asset the scheme should not just be handed over to the communities without any agreement. Hence the following, as elaborated in Annex I, Policy, Legal and Institutional Assessment Topical report, are required:

2.9.2 SETTING UP OF LEGAL ENTITY

It is a requirement under the Water Resources Act that the communities must form themselves into a legal entity called Water Users Association (WUA) (properly incorporated) in order that once the Government constructs the Rural Piped Water Scheme that legal entity will manage that scheme on behalf of the communities. These legal entities must be registered with the Registrar General and affiliated/licensed with Water Resources Authority. This is to ensure that Government is dealing with a proper legal entity for the scheme for sustainable management of the scheme instead of dealing with a lot of members of the community.

2.9.3 CONCESSION AGREEMENT OR MOU

It is also a requirement that the legal entity, the WUA must enter into a concession agreement with Government for taking over of the scheme and managing it. This is because the scheme is a public asset and cannot simply be given to a community without Government asserting its ownership. The way this is done is a tripartite agreement between Government through the Ministry responsible for water development, Local Council having jurisdiction in that area and the legal entity. The concession agreement then sets out various roles and responsibilities for each of these three parties. The agreement further emphasizes that the asset remains Government asset through the Local Council.

The Local Council is given the responsibility to monitor the operation and management of the scheme to ensure the legal entity is managing the scheme in accordance with the agreement. It also gives technical and other advice to the legal entity as necessary.

The legal entity has a duty to manage the scheme, carry out maintenance of the scheme and ensure all have access to the water. It also has a duty to collect water fees from the members who are also water

users for use of the water from the scheme. It also has a duty to pay water abstraction fees to the Water Resources Authority.

The agreement prescribes the period of the concession and has termination clause as well as surrender of the scheme for breach or effluxion of time for the agreement.

2.9.4 RECRUITMENT OF LOCAL UTILITY OPERATOR

In order to ensure that the scheme is run professionally the legal entity (WUA) employs a Local Utility Operator (LUO) to manage the scheme under a management contract. The Local Utility Operator negotiates his fee with the legal entity board and the contract includes some performance targets which the LUO is supposed to achieve. He is supposed to prepare reports which after board approval are also sent to the Local Council.

2.9.5 REGULAR REVIEW MEETINGS

The agreement requires regular meetings between the three parties to review progress and whether the LUO is meeting the targets and generally to see if there is need for revision to the concession agreement or the MOU. This way Government is kept abreast of the operation and management of the schemes under WUA. The regular review meeting can be conducted biannually if resources permit if not annually depending on the conditions of the individual water supply scheme.

3 INSTITUTIONAL FRAMEWORK

3.1 CENTRAL GOVERNMENT

The Central Government is responsible for strategic planning, coordination, quality assurance and technical assistance systems, including collaboration efforts with donors/ NGOs and the private sector. Key ministries, as presented in Annex I, Policy, Legal and Institutional Assessment Topical report, involved in the realization of the sector policies and strategies and their mandates are:

a) The Ministry responsible for Water Development and Irrigation is the lead ministry for sanitation, water supply and water resources development and management;

b) The Ministry of Finance, Planning and Economic Development has the role of allocating funds, general mobilization of funding and co-ordination of donor inputs. The ministry also coordinates the national planning;

c) Ministry of Local Government has the mandate to establish, develop and facilitate the management of self-sustaining, efficient and effective decentralized government systems capable of delivering the required services to the people, in order to foster good governance and integrated social and economic development;

d) Ministry of Health has the responsibility for policy on hygiene promotion; and

e) The Ministry of Gender, Labor and Social Development is responsible for spear heading and coordinating gender responsive development and community mobilization.

3.2 MINISTRY RESPONSIBLE FOR WATER DEVELOPMENT AND IRRIGATION

The Government of Malawi through the Ministry responsible for Water Development and Irrigation is committed to providing adequate, reliable and sustainable water and sanitation services to the citizens of Malawi to meet the ever increasing demand for safe water for domestic, institutional, commercial and agricultural use, with emphasis on poor and rural communities. The Ministry responsible for Water Development and Irrigation is responsible for overseeing the development of national policies, regulations, and management of the country's water resources. As stated earlier the specific policy goal for rural water supply is to achieve sustainable provision of community-owned and managed water supply and sanitation services that are equitably accessible to and used by individuals and entrepreneurs in rural communities for socio-economic development at affordable cost.

For the execution of its mandates and responsibilities the Ministry responsible for Water Development and Irrigation is organized under five departments as shown in the organization chart in Figure. 3.1. Out of the five departments the department of water supply and the department of sanitation have major involvement in the rural water supply and sanitation services.

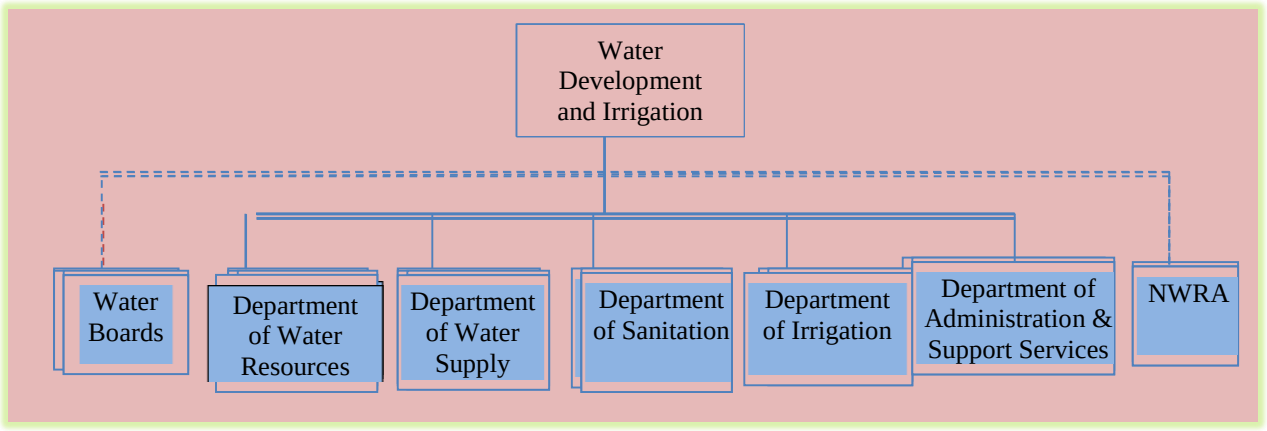

Figure 3-1: Ministry Responsible for Water Development and Irrigation

3.3 DEPARTMENT OF WATER SUPPLY

The water supply department has two divisions the first division is responsible for operation, maintenance and monitoring and the second is responsible for planning design and construction and each division has three units. The responsibility for the urban areas is limited to providing policy guidance, planning, coordination and monitoring, while in the rural areas the department is still engaged in the planning, design, implementation, operations and maintenance of some schemes. The Department has been managing water supply systems through different management arrangements. The management systems still pose great challenges. There are a number of piped water supply systems and boreholes which are not performing well mainly due to management problems apart from technical issues. The organization chart of the department with the key staffing plan is shown in Figure 3.2

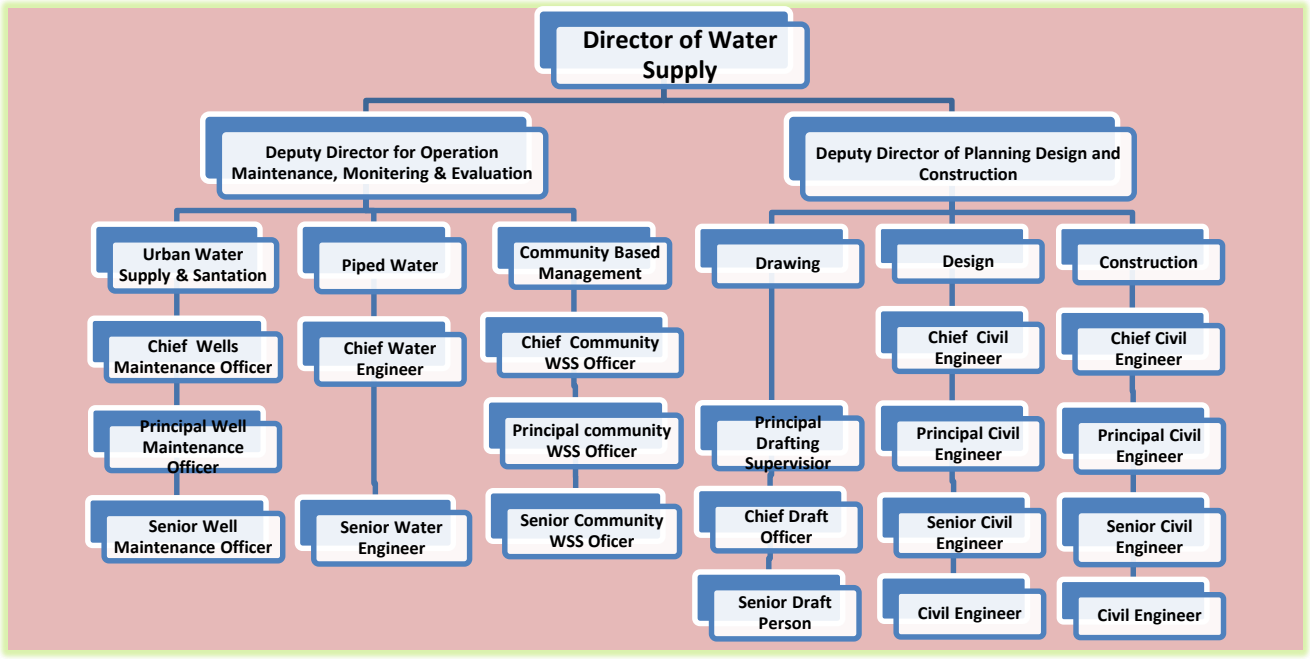

Figure 3-2: Organizational Chart of Water supply Department

The Malawi Irrigation Water and Sanitation Sector Performance Report of 2012, according to Annex I- Policy Legal and Institutional Assessment Topical report, indicates that out of the total 493 established staff posts for Water and Sanitation Department only 143 were filled. This shows a vacancy rate of 71% and the situation in 2013 is not much different from this.

3.4 LOCAL GOVERNMENTS

Under the Decentralization Policy (1998), the Local Governments (made of councilors from each ward in the district forming the District Assembly) in the districts are charged with responsibilities for the provision and management of rural water supply services, in liaison with the Ministry responsible for Water Development and Irrigation. The Local Governments' responsibilities also include the monitoring of provision of rural sanitation services and community mobilization. Water and sanitation is an integral part of the District Development Plans (DDPs) and is one of the mainstream functions of the District's Area Development Committees (ADCs), which are represented at village level by Village Development Committees (VDCs).

Local Governments carry out: planning, budgeting and resource allocation, community mobilization and participation, follow up implementation of water and sanitation services by private sector and support the WUAs and the WPCs in the operation and maintenance of water services, monitoring, and reporting of the rural water supply and sanitation activities in the district.

However, the capacities of the Local Governments are still inadequate to undertake these tasks. District Councils do not have a revenue base to fund investment and they also don't have the funds to contribute to the operations and maintenance of existing facilities. Financing of rural water supply is constrained by the very low level of fiscal devolution. Analysis of national government allocation to all districts for 2009-10 budget shows that only MK 35.2 million relates to the water sector and the bulk of this money have been used to fund operation costs.

From what is gathered during the field visit as presented in Annex I Policy, Legal and Institutional Assessment Topical report, the average budget allocated for the water and sanitation sector as recurrent and operational costs is about 1% of the District Councils budget and ranges between MK 700,000 to MK 2,100,000 per annum for the year 2013 the total for all the districts being MK40.9 million. This amount is not adequate for effective operation and maintenance even when the District Councils have staff allocated to the sector.

Nevertheless, with the assistance of donors and NGOs important progress has been made in the District Councils ability to prepare plans for the water sector. Over the last few years 17 District Councils have prepared district investment plans. Though some of these investment plans are outdated they do serve as reference document for planning future investment plans.

3.5 LOCAL LEADERS

Local leaders consist of the Village Head (VH), the Group Village Head (GVH) who is the overall leader of a group of villages, and a Traditional Authority (TA). These are "custodians of tradition" supervised by the District Commissioner in all areas of social and economic development in their areas. Some of them play pivotal role in the development of their areas. The role of local leaders at community level has been proven to be very important, where there is strong local leadership communities are actively engaged in the implementation, operation and maintenances of water supply projects.

3.6 USER COMMUNITY

The planning, implementation and sustainability of water and sanitation activities are heavily dependent on the participation of the user communities. These require an organized community to enable full participation in planning and implementation stages through to operation and maintenance (O&M) of the facilities. The Water Statute provides the legal plat form for the formation of Water and Sanitation Committees, Water User Groups and Water User Association at community level that will ensure sustainability and proper management of the facilities.

3.7 PRIVATE SECTOR

Involvement of the private sector, which is considered to represent a viable resource for design, construction, operation, maintenance, training, capacity building and commercial services, has been promoted. The private sector is also being considered for mobilizing resources and financing for sub-sector development in the on-going Water Sector Reform studies.

3.8 DEVELOPMENT PARTNERS

The country has received considerable support from development partners for funding the development budget including rural water supply and sanitation. The major donors include World Bank, African Development Bank, European Union, DFID, UNICEF, and ACGF. To date the National Water Development Programme (NWDP) Project management Unit (PMU), a programme management arm of the Ministry responsible for Water Development and Irrigation manages the majority of donor-supported projects. Some donors transfer funds directly to NWDP while others manage the funds on their own and only delegate NWDP with the administrative role - for example the WASH UNICEF project. UNICEF is involved in 16 districts in rural water supply (Kasungu, Lilongwe, Mchinji, Salima, Mzimba, Nkhatabay, Karonga, Chitipa, Blantyre, Dowa, Chiradzulu, Mangochi, Chikwawa, Nsanje, Thyolo), while JICA is involved in two districts (Mchinji, Mwanza).

3.9 NON-GOVERNMENTAL ORGANIZATIONS (NGOS)

There are 46 NGOs operating in 26 districts in the rural water supply sector. The Council for Non-Governmental Organizations in Malawi is the overall body that provides administrative functions on the operation of NGOs in the country. However, the NGOs are coordinated by different sector specific networks according to the nature of their work. All these networks have no mandate to direct to specific areas where an NGO has to operate neither do they rule on what activities that NGO has to engage in. Consequently, any NGO has the freedom to operate in any area of its choice, after agreement is reached between the NGO and the specific district, a situation which has been observed from the concentration of NGOs in few particular districts than others due to choices and preferences resulting in uncoordinated approaches.

While World Vision have the highest coverage 16 districts, Catholic Development Commission (CADECOM), Malawi Red Cross, Water Aid cover each 8 districts, the rest have an average of about 2 districts. On the other hand while Kasungu has 11 NGOs operating in the district Dedza and Likoma districts did not report any NGO operating in their respective districts. Table 3.1 below provides the list of NGOs and the districts they are involved in rural water supply

The proliferation of NGOs has an advantage that they complement government's efforts in a number of ways. It has however some disadvantages in that some NGOs engage in activities for which they do not have adequate expertise just by working on emerging issues that are likely to attract funding. In general Non-Governmental Organizations are important and effective partners of government in development. They are well-placed to raise public awareness and build capacity at the local level.

Table 3-1 : List of NGOs Working on Rural Water Supply in the Districts

No.	Name of NGO	Districts in Which the NGO is Involved	No. of Districts
1	World Vision	Dowa, Kasungu, Lilongwe, Mchinji, Ntcheu, Neno, Ntchisi, Salima, Mzimba, Nkhatabay, Balaka, Chiradzulu, Machinga, Mangochi, Zomba, Mulanje,	16
2	Catholic Development Commission (CADECOM)	Dowa, Kasungu, Mzimba, Rumphi, Karonga, Balaka, Blantyre, Phalombe	8
3	Malawi Red Cross	Kasungu, Salima, Mzimba, Karonga, Blantyre, Mangochi, Zomba, Phalombe	8
4	Water Aid	Kasungu, Nkhotakota, Salima, Rumphi, Karonga, Machinga, Chikwawa, Mulanje	8
5	Concern Universal (CU)	Dowa, Kasungu, Ntcheu, Chikwawa, Phalombe, Thyolo	6
6	Inter-Aide	Dowa, Kasungu, Lilongwe, Mchinji, Ntchisi	5
7	Action Aid	Mchinji, Rumphi, Nkhatabay, Phalombe	4
8	Livingstonia Synod Aids Program (LISAP)	Mzimba, Rumphi, Nkhatabay, Chitipa	4
9	Nkhoma Synod	Kasungu, Lilongwe, Mchinji, Nkhotakota	4
10	Plan Malawi	Kasungu, Lilongwe, Mzimba, Mulanje	4
11	Salvation Army	Ntcheu, Balaka, Machinga, Mangochi	4
12	Participatory Development Initiatives (PDI)	Nkhotakota, Ntchisi, Machinga	3
13	Adventist Development & Relief Agency (ADRA)	Salima, Mulanje	2
14	Assemblies of God Relief & Development Services (AGREDS)	Mchinji, Salima	2
15	DAPP	Chiradzulu, Thyolo	2
16	Emmanuel International	Machinga, Zomba	2
17	Gift of the Givers	Balaka, Mangochi	2
18	Goal Malawi	Chikwawa, Nsanje	2
19	Good Neighbors	Kasungu, Lilongwe	2
20	Mineral Appropriate Technology in Malawi (MATAMA)	Dowa, Ntchisi	2
21	Pump Aid	Kasungu, Mchinji	2
22	TIMMS	Chiradzulu, Zomba	2
23	Total Land Care	Mchinji, Rumphi	2
24	VALE Logistics	Machinga, Mwanza	2
25	Water for People	Rumphi, Chikwawa	2
26	Water Missions International	Lilongwe, Karonga	2
27	Water Wells for Africa	Mangochi, Zomba	2
28	Estates	Mulanje	1
29	ELDS	Karonga	1
30	Feed the Children (FTC)	Dowa	1
31	FICA/FAO	Mzimba	1
32	Islamic International Development Agency (ISIDA)	Mangochi	1
33	Islamic Relief	Machinga	1
34	Lusubilo	Karonga	1

No.	Name of NGO	Districts in Which the NGO is Involved	No. of Districts
35	Lutheran Church	Lilongwe	1
36	Matunkha/Future Vision	Rumphi	1
37	MAZIKO	Kasungu	1
38	Millennium Village Project	Zomba	1
39	Nkhoma Relief and Development (NRD)	Dowa	1
40	People Serving Girls at Risk	Blantyre	1
41	Self Help Africa	Balaka	1
42	Soldev	Karonga	1
43	Tubepoka Development Initiative (TDI)	Chitipa	1
44	Village Reach	Balaka	1
45	WESM Dwangwa	Nkhotakota	1
46	Work for Rural Health	Salima	1

4 OVERVIEW OF RURAL WATER SUPPLY SERVICES

4.1 RURAL WATER SUPPLY HISTORICAL DEVELOPMENT

The construction of boreholes and hand-dug wells, which started in the 1930's, can be considered to be the beginning of the utilization of groundwater resource in Malawi (IWRM Plan 2008-2012). In the 1960s, mainly as a result of the international water supply and sanitation decade initiative, more attention was given to the water sector and as a result more water points were provided through boreholes, shallow wells and gravity-fed piped water supply schemes in rural areas.

According to the Ministry responsible for Water Development and Irrigation there were over 86 rural gravity fed piped water supply schemes, although the number has now reached 108 schemes based on the field inventory conducted for this study as presented in Annex IV Detailed Assessment of Existing Gravity Fed Scheme Topical report, of which, a lot of them were constructed by the Ministry responsible for Water Development and irrigation or development partners since the first scheme was installed in 1968. The records for gravity fed schemes showed that about 22 schemes were constructed during 1970-79, about 34 schemes were constructed during 1980-89, about 12 schemes were constructed during 1990-99 and about 18 schemes were constructed in 2000-09. This showed that most gravity fed rural water supply schemes were constructed in the 1970s and 1980s and now require rehabilitation and replacement works.

The water sector services study of 1993/94 culminated in the development of the first phase of the National Water Development Project I (NWDP I), with the objective of supporting the implementation of the 1994 policy to ensure adequate and safe water supply services, provision of water infrastructure, and protection and management of water resources.

Parallel to the NWDP I other programs supported by different donors and partners such as African Development Bank financed Mzimba and Ntchisi Districts Integrated Rural Water Supply and Sanitation Project, the Thyolo and Phalome Districts Rural Water Supply and Sanitation Project with finance from CIDA were implemented (IWRM Plan 2008-2012).

The implementation of the NWDP I brought about some improvements in the water supply and sanitation delivery. However, some short falls remained and the National Water development Program (NWDP) has therefore been developed to address the shortcomings of NWDP (I). The NWDP and other related sector projects are being implemented to attain objectives of the Malawi Growth and Development Strategy (MGDS) and the set targets of the Millennium Development Goals.

The main objectives of the NWDP are: (i) to increase access to sustainable water supply and sanitation services for people living in cities, towns, market centers and villages; and (ii) to improve water resources management nationally. It has been designed as a 6-year (2007 – 2013) programme later on was extended up to 2015. The programme has five components namely (i) Urban Water Supply and Sanitation; (ii) Town and Market Centers Water Supply and Sanitation; (iii) Rural Water Supply and Sanitation; (iv) Water Resources Development and Management; and (v) Sector Reforms and Management and Capacity Building.

The NWDP is a multi-donor financing Programme with the total financing to-date for the program being US$354.5 million with contributions from the following development partners, apart from the Government of Malawi and the program beneficiaries:

- The International Development Association (IDA) of the World Bank (WB)

- The African Development Fund (ADF) of the African Development Bank (AfDB)
- The European Union (EU) through the African Water Facility
- The European Investment Bank (EIB)
- The OPEC Fund for International Development (OFID)
- The Netherlands Government through UNICEF
- The African Catalytic Growth Fund (ACGF) through the WB
- The Australian Aid (AusAid) through the AfDB, and
- The African Water Facility (AWF) through the AfDB

Under the NWDP the number of rural water supply facilities implemented includes drilling of boreholes as water point sources in rural areas, drilling of 13 boreholes for reticulated system in six market centers, rehabilitation of eight gravity schemes and construction of 23 new gravity schemes for the rural water supply and one market centre.

The activities under the NWDP and other rural water supply activities are mainly based on the 2007 Rural Water Supply Investment Plan. The 2007 Investment Plan covered the period from 2007 to 2025 with mainly focusing on the provision of boreholes as point sources and with little consideration of the gravity fed system and no reticulated borehole system. The Plan also relied on the 1998 census population for projections up to 2025 which had made it obsolete due to the census of 2008, a year after the plan was prepared, requiring revision with new census results regarding the actual population figure and growth rates for the year 2008. In addition a number of policy changes and incorporation of new development directions in the sector have necessitated the revision and development of new rural water supply investment plan with emphasis on gravity fed schemes and reticulated borehole systems.

4.2 PERFORMANCE OF THE WATER SUPPLY AND SANITATION SERVICES

4.2.1 GENERAL WATER SUPPLY AND SANITATION SECTOR PERFORMANCE

Malawi has one of the highest levels of access to improved drinking water source and the highest level of access to improved sanitation facilities compared to other Sub Saharan Africa countries. It has achieved this despite the country's relatively low GDP per capita. According to the JMP 2013 report the overall coverage of improved water supply services for the Sub Saharan Africa was 63% while that of Malawi was 81%. Similarly the overall coverage of improved sanitation services for the Sub Saharan Africa was 30% while that of Malawi was 53%. The country has already met the 2015 MDGs (67%) and MGDS II (75%) targets. Whilst this is a good development, the sector however needs to make sure that these water systems are functional at any given time.

According to the Malawi Water Sector Investment Plan of May 2012 one of the reasons for the comparatively good performance has been the long-term plan for developing the water supply and sanitation sector put in place by the government, and which has been largely followed, with some revisions. However, despite the relative strength of Malawi among comparator countries, there is still much room for improvement in water supply and sanitation sector.

4.2.2 RURAL WATER SUPPLY AND SANITATION SERVICES

According to the Malawi Demographic and Health Survey, 2004 and 2010 shows that the proportion of households with access to improved sanitation increased between 2004 and 2010 (See Figure 4.2. Access to flush and VIP toilets was relatively low in 2004 (1.7 percent) and increased by 0.3 percentage points from 2004 to 2010.

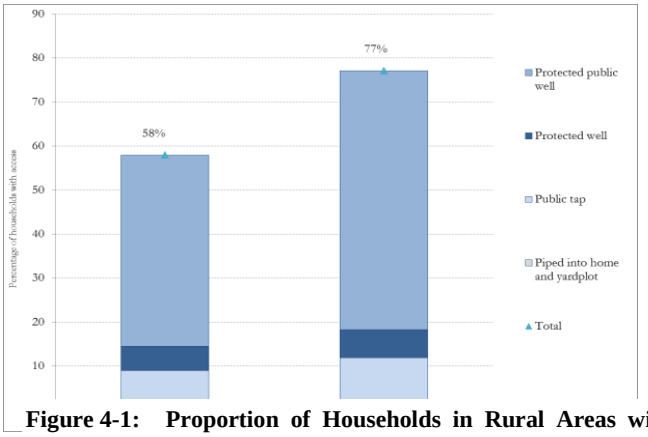

Figure 4-1: Proportion of Households in Rural Areas with Access to Improved Sanitation

Similarly, according to the Malawi Demographic and Health Survey, 2004 and 2010 depicted in the Malawi Water Sector Investment Plan of May 2012, access to improved water in rural areas increased by 33 percent from 2004 to 2010 (see Figure 4.1). Increase in access largely resulted from an increase in access to protected public wells (boreholes) from 43 percent to 59 percent (a 35 percent increase). There was also an increase in access to public taps from 7.4 percent to 10 percent (a 36 percent increase).

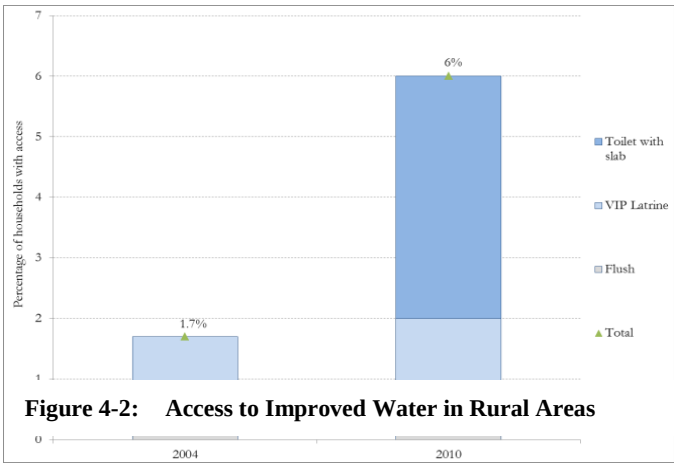

Figure 4-2: Access to Improved Water in Rural Areas

4.3 EXISTING RURAL WATER SUPPLY FACILITIES

During the process of this assignment data on existing rural water supply facilities for the 28 districts was collected from the respective District Water Development Offices. Most of the districts provided data that represent the 2012/2013 financial year ending June 2013. The rural water supply facilities are boreholes with hand pumps, stand pipes from gravity fed piped schemes and reticulated boreholes, shallow wells and protected springs.

As shown in Table 4.1 there are over 43,157 boreholes, 10,539 shallow wells, 14,790 stand pipes and 269 protected springs making a total of 71,717 water supply schemes plus quite a number of private/individual connections from gravity fed schemes and motorized boreholes serving the rural population in Malawi. Of the total number of schemes, the functional schemes at present as reported by the DWDOs and from the field inventory of existing gravity fed schemes by the consultant are 35,695 boreholes, 7,658 shallow wells, 10,730 stand pipes and 221 protected springs making a total of 54,304 water supply schemes plus a number of individual connections from the rural gravity fed schemes and reticulated boreholes. On the other hand the inventory of rural Gravity Fed Schemes revealed that there are currently over 13,211 standpipes for the 108 gravity schemes assessed of which only 5,737 CWP (less that 50%) are currently functioning the gap being private connections included in the figures from DWDOs figures.

Table 4.1 shows existing number of rural water supply points by type of technology in each district by the end of 2013. The functionality rate for each district is compiled based on the data obtained from

the respective District Water Development Offices as presented during the consultative workshops condcuted by the Ministry responsible for Water Development and Irrigation.

Table 4-1 : Existing Number of Rural Water Supply Points by Technology by District

S. Nr.	District	Total Number of Water Points					Number of Water Points that are functioning					Average Functionality rate of all schemes
		BH	Stand pipes	Shallow wells	Springs	Total	BH	Stand pipes	Shallow wells	Springs	Total	
1	Chitipa	618	567	549	30	2,185	548	227	249	22	1,446	66.2%
2	Karonga	1,142	385	1,096	-	2,623	922	0	778	-	1,700	64.8%
3	Nkhata Bay	765	430	573	-	2,068	656	239	422	-	1,644	79.5%
4	Rumphi	997	805	-	-	2,553	605	514	-	-	1,755	68.7%
5	Mzimba	2,782	1,087	1,952	-	5,635	2,269	730	1,360		4,231	75.1%
6	Likoma	5	-	6	-	41	5	0	6	-	40	97.6%
7	Kasungu	2,023	-	498	-	2,658	1,829	0	411	-	2,319	87.2%
8	Nkhotakota	1,557	650	568	15	2,664	1,208	631	471	15	1,949	73.2%
9	Ntchisi	1,083	14	236	31	1,542	853	14	128	17	1,158	75.1%
10	Dowa	1,265	-	258		1,553	1,011	0	206		1,242	80.0%
11	Salima	1,289	84	499	-	1,898	1,199	7	416	-	1,622	85.5%
12	Lilongwe	6,242	-	765	10	7,017	5,438	0	496	5	5,939	84.6%
13	Mchinji	1,239	174			1,446	1,015	61			1,126	77.9%
14	Dedza	1,392	269	934		3,041	959	140	651	-	2,054	67.5%
15	Ntcheu	2,774	589	196	99	3,715	2,256	234	196	99	2,892	77.8%
16	Mangochi	2,772	171	506		3,423	2,616	58	463	-	3,124	91.3%
17	Machinga	1,696	1,055	340		3,114	1,289	449	272		2,337	75.0%
18	Zomba	2,259	1,339	348		4,794	2,023	593	252		3,711	77.4%
19	Chiradzulu	1,499	-	131		2,113	1,094	0	111		1,555	73.6%
20	Blantyre R	2,006	-	324	29	2,731	1,593	0	207	23	2,127	77.9%
21	Mwanza	535	43	50		638	480	25	5		513	80.4%
22	Thyolo	1,305	339	283		1,965	1,104	47	261		1,597	81.3%
23	Mulanje	1,308	2,369	109	54	3,193	1,126	127	59	39	1,653	51.8%
24	Phalombe	713	1,604	23		3,185	419	859	23		2,139	67.2%
25	Chikwawa	1,221	591	84	1	1,530	939	133	63	1	1,106	72.3%
26	Nsanje	1,036	5	27		1,093	824	5	27	-	881	80.6%
27	Balaka	1,074	2,220	168		2,717	891	1230	114		1,903	70.0%
28	Neno	560	-	16		582	524	0	11		541	93.0%
	Total	**43,157**	**14,790**	**10,539**	**269**	**71,717**	**35,695**	**10,730**	**7,658**	**221**	**54,304**	**75.7%**
	Functionality rate						**82.7%**	**60.4%**	**72.7%**	**82.1%**		

Source: compiled by the Consultant based on data from each DWDO from consultative workshop

Table 4.1 also shows the functionality rate of all the schemes in each district and the average functionality rate at national level which is about 75.7% for all types of schemes. Among the districts Mulanje has the lowest (51.8%) followed by Karonga (64.8%) functionality rates which are mainly due to most stand pipes not functioning as a result of defects of intakes or distribution pipelines. Only five districts have functionality rates over 85%, Likoma district being the highest (97.6%) followed by Neno (93%) and Mangochi (91.3%) districts.

According to the MGDS II (2011-2016) the non-functionalityrate of water supply infrastructures was at 30%, although not indicated, probably by 2009 and the main causes were referred as being aging infrastructure, inadequate maintenance capacity, theft and vandalism. This means the functionality

rate has been 70% by 2009 and has now increased to 75.7% showing improvement of 5.7%. The Sector Performance Report for the period 2012/2013 financial year also showed functionality rate of 75% and this is in line with the functionality rate of 75.7% obtained from the analysis of data submitted from the DWDOs for this assignment.

4.4 ACCESS TO AND COVERAGE OF RURAL WATER SUPPLY SERVICE

According to the Monitoring and Evaluation Result Handbook by the Ministry responsible for Water development and Irrigation in 2014 coverage and access are defined as follows:

- Improved Water Coverage is the ratio of people served with improved water facilities (according to the design population of facilities) in a given area to the total number of people in that area.
- Access to Safe Water is a household having access to a safe water source if that household has access to a minimum of 27 liters of water per person per day[1,] from water source meeting the Government of Malawi Water Quality Guidelines, at a maximum one-way distance from the household of 500 m in rural areas and 200m in urban areas[1]. Further, to be considered having access to a safe water source, the maximum round-trip time for that household to collect water should be less than 30 minutes[1]. Access rates to safe water can only be determined using a combination of household surveys and water quality testing.

Based on the above definition the Improved Water Supply Coverage ratio for the total schemes and for the functional schemes can be estimated using the number of schemes and design population figures per scheme as set in the design standards of the Ministry responsible for Water Development and Irrigation provided the type of facilities are clearly identified; 250 people for boreholes and 120 people for the other safe water sources except for individual taps compared to the district population. However it has to be noted that these figures are maximum design figures for a given design horizon but not necessarily the prevailing population for that particular scheme and may give exaggerated coverage figures. This situation can be seen from the data provided in Table 4.2 below in the column 'Calculated % of Water Supply Service' where coverage and access to rural water supply service is shown for each district.

The District Water Development Offices also reported the access to water supply service in their districts. The data provided by the DWDO for each district is also depicted in Table 4.2 and it showed big difference with the calculated access to water supply in the district.

Similarly the National Statistics Office (NSO) has conducted Welfare Monitoring Survey (WMS) in the country in 2011 which included water supply service coverage. The WMS is designed to provide indicators at district level. The survey was conducted up to February 2012 to provide rapid information on selected core indicators in the population that would enable monitoring changes on a yearly basis on the progress and attainment of goals outlined such as in the Malawi Growth and Development Strategy (MGDS) II and the Millennium Development Goals (MDGs). Accordingly the survey showed that 81% of the rural households had access to improved drinking water sources.

The Ministry responsible for Water Development and Irrigation gave the national access to rural water supply facilities by about 76% of the rural population to the most conservative estimate by 2012/13.

[1]Rural Piped Water Technical Manual, Ministry of Water Development and Irrigation - Gravity Fed Water Supply

The WMS also showed access to improved water sources by district without disaggregating at urban and rural level. In order to make more realistic rural water supply coverage estimation, the data given by NSO for pipe inside dwellers, yard or plot is reduced by 70% to consider the urban portion from these type of water sources in order to estimate the rural portion (30% is considered). The percentage of access to improved drinking water sources as calculated from the WMS is also shown in Table 4.2 below.

Table 4-2: Access to Potable Water Supply in Rural Areas by District

No.	District	Projected Population	Calculated % of Water Supply Service		Reported by the DWDO	From NSO (WMS 2012)
		2013	Coverage	Access	Access	Access
1	Chitipa	188,096	182%	130%	64%	76%
2	Karonga	268,918	172%	120%	70%	89%
3	Nkhata Bay	238,923	145%	118%	74%	59%
4	Rumphi	176,648	247%	164%	70%	73%
5	Mzimba	817,205	127%	98%	81%	81%
6	Likoma	9,052	99%	87%	87%	87%
7	Kasungu	714,653	81%	72%	64%	61%
8	Nkhotakota	326,574	160%	120%	58%	93%
9	Ntchisi	257,252	127%	97%	71%	77%
10	Dowa	693,404	51%	40%	70%	54%
11	Salima	361,618	109%	97%	77%	81%
12	Lilongwe	1,384,726	119%	103%	79%	69%
13	Mchinji	523,933	64%	51%	65%	72%
14	Dedza	677,910	81%	55%	65%	89%
15	Ntcheu	524,358	154%	122%	79%	80%
16	Mangochi	885,635	87%	81%	75%	95%
17	Machinga	542,337	110%	83%	87%	66%
18	Zomba	635,216	137%	112%	80%	93%
19	Chiradzulu	306,503	146%	107%	82%	90%
20	Blantyre Rural	380,230	155%	122%	86%	84%
21	Mwanza	85,312	171%	145%	80%	84%
22	Thyolo	613,792	66%	55%	55%	73%
23	Mulanje	540,823	102%	64%	70%	89%
24	Phalombe	348,777	136%	89%	85%	98%
25	Chikwawa	494,004	69%	52%	52%	86%
26	Nsanje	244,902	109%	87%	75%	95%
27	Balaka	344,277	135%	100%	72%	88%
28	Neno	134,614	106%	99%	66%	78%
	Total	**12,719,692**	**123%**	**88%**	**81%**	**81%**

Source: compiled by the Consultant based on data from each DWDO and WMS

When calculating the coverage and access to water supply service in rural areas in each district using the total number of schemes and the number of functional schemes against design population figures, a number of factors such as actual population figure using each facility, walking distance to water source, duplication of facilities in the same areas, mix up in recording of stand pipes (communal water points) with taps (private and institutional connections) are not considered as they have impact in the

estimation of reliable percentage coverage and access to safe water supply in that particular area or in the district. This is what is reflected in the percentages shown in Table 4.2 above. For exact estimation of water users or coverage it would be important to have up-to-date inventory or count of population per facility which requires a lot of efforts and resources and cannot be made practical for the purpose of this activity.

However in reality the population accessing safe water per scheme in most cases are less than the number of population used in the design which is a reality because design population is supposed to be reached at the end of the design period. Malawi is reported to have achieved 81%2 access to safe /improved water supply to rural areas in 2012 which is higher than the target set by the MDG (67%) and MGDS (75%).

Therefore the percentage of access to water supply service for each district provided by NSO from the Welfare Monitoring Survey of 2012 is used in estimating the population that have access to improved water supply services in the process of the preparation of the estimation of population and facilities to be provided in the Rural Water Supply Investment Plan under consideration.

[2]Final Sector Performance Report 2012-2013 Financial Year

5 OVERVIEW OF WATER SECTOR INVESTMENT PLANS

5.1 THE 2007 STRATEGY AND INVESTMENT PLAN

The 2007 investment plan was prepared to assist stakeholders to direct resources equitably in the rural areas in the development of rural water supply contributing to poverty reduction and sustainable development through the achievement of the specific MDGs and WSSD targets on water and sanitation in Malawi. The targets of the 2007 investment plan were:

- Halving by 2015, the proportion of people without sustainable access to safe drinking water;
- Halving by 2015, the proportion of people without sustainable access to basic sanitation
- The Plan also details investment requirement to full coverage by 2025.

The investments provided in the plan were focusing on:

- Major rehabilitation and maintenance of existing malfunctioned gravity fed schemes and boreholes
- To increase access to potable water to 70% of the rural inhabitants by 2011 to realize the MDGs requirements in 2015 and full coverage by 2025
- Future investments to encourage catchment management as a prerequisite for any further investment in water schemes to ensure sustainable catchment management by 2011
- Establishment of effective management structures in all piped water schemes and recruitment of Water Monitoring Assistants

In estimating the population for the planning period, an annual population growth rate of 2.0% was used uniformly through the planning period (2007-2025) and this figure was on the lower side when compared to the growth rate from the 2008 census by the NSO that varied from 2.76% to 2.68% in 2015, 2.56% in 2020 and 2.41% in 2025.

The assumptions in the investment plan mainly focused on rehabilitation works and upgrading and extension works to serve more people in order to meet the MDG target without considering areas that are not served and without proper assessment of the situation on the ground.

Most of the existing gravity fed schemes were considered for expansion to meet the 2025 demands for full coverage without indicating whether the sources were adequate or not. Most of the existing schemes, from the assessment done under this assignment could not have the water sources capacity for expansion except few schemes and those that require rehabilitation works only.

In the plan 26 new piped water schemes were proposed for implementation as rural water supply sources by 2025 without considering the additional schemes required from 2020 to 2025. Most of the indicated surface water sources could not be identified and some of them are in locations where there are no forests coverage and in settlement areas. The 26 new schemes also include multipurpose dams which require investment beyond the provision for rural water supply and the probability of implementing such schemes under the rural investment plan could not be materialized as their realization was also dependent on other sectors and so far none of them were implemented.

The investment plan did not identify possible sources of funding to cover the estimated investment amounts. It did not also show implementation schedule of the physical activities and the activities regarding catchment protection, management works and capacity building apart from stating that the unit costs for the facilities cover all these costs.

Indeed the plan was prepared considering to achieve access to water supply coverage as set in the MDG and MGDS targets (MDG 67% and MGDS 75%) by 2015. The plan had achieved beyond these targets and the achievement for access to water supply now stands at 81% in rural areas of Malawi.

Hence because of the above described issues there was need to review the rural water supply investment plan considering the situation on the ground and the harmonization of the national and districts strategy and investment plan and improvement of the capacity of the sector as well as the interest of development partners in financing the sector.

5.2 THE WATER SECTOR INVESTMENT PLAN OF 2012

The Government of Malawi through the Ministry responsible for Water Development and Irrigation prepared the Malawi Water Sector Investment Plan of 2012 with support from World Bank and the Water Partnership Program. The plan was prepared to assess the level of investment required for the water and sanitation sector development in order to achieve the levels and targets of the universal access coverage of water supply and sanitation. It also assessed the institutional reform and capacity building needs in order to implement the required investment levels to achieve universal access by 2025 for water supply and sanitation in 2030.

The plan illustrated three investment scenarios with the investments needed and the outcomes and selected an investment plan that will lead to universal access to water by 2025 and 87 percent access to sanitation by 2030 and it requires a substantial increase in funds and investment in the sector. The scenarios were:

- Scenario 1, Business as usual—continuing the then current levels of expenditure which would lead to stagnating access levels and was not recommended
- Scenario 2, Full coverage for water by 2025 and 87 percent for sanitation by 2030—this scenario was considered highly cost-benefit justified. However, the investment plan entailed expenditure of more than US$700 million in the 2016-2020 period, more than US$600 million in the 2021-2025 period and more than US$700 million in the 2026-2030 period. The plan states that it is possible that such a scale up in funding and investment is out of reach
- Scenario 3, Full coverage for water by 2030, and more than 40 percent for sanitation by 2030—the plan recommended this as the minimum level Malawi could aim for. In this scenario Malawi could achieve universal access to water by 2030 and 95 percent access to improved sanitation in urban areas by 2030. Access to improved sanitation in rural areas may fall behind the Governments targets in this scenario. The plan also suggested that investment levels are lower than in the previous scenario by US$200 million over the period. Nevertheless, the plan indicated that this scenario was still ambitious, running at more than US$700 from 2016-2020, US$400 million from the 2021-2025 period, and more than US$700 from 2026-2030.

The investment plan also depicted that Malawi exceeded the Millennium Development Goal of 70 percent by 2015 and reaching close to 80 percent by 2015. Malawi has already surpassed that water

supply coverage by 2013 and is at 83 percent coverage for the nation in 2013 and is at 81 percent for the rural areas.

The plan analyses prioritization of investments among different sectors on the basis of benefits and costs and recommended the water supply and sanitation investment to be one of the top priorities. The document is mainly focusing on estimating investment required but has not indicated the number of population, type and number of schemes to be developed and have not provided the assumptions and estimates used as basis of the analysis for the different scenarios. In estimating the investment levels the following per capita costs were established and are found important:

- Development of new borehole based water point costs about USD37.00/person
- Development of gravity fed scheme costs about USD 42.00/person
- Rehabilitation of borehole water point costs USD 13.00/person and 6% of all the boreholes need rehabilitation every year.
- A borehole with submersible pumps and piped or reticulated costs about USD 70.00/person

The document stated technology options to be used and highlighted that there are concerns on the cumulative abstraction of water from boreholes which may theoretically be greater than the assessed storage of the aquifers and far in excess of the potential recharge. These concerns have lead the Government to shift its focus towards investing in surface water supply schemes although it requires more per capita investment as compared to groundwater. However the issue of possible groundwater depletion was not substantiated in the report and need to be taken cautiously as this may not be the case.

The plan encouraged the districts to decide on the type of technology to implement considering the availability of groundwater versus surface water and costs of each technology compared to additional benefits that could be available. The plan also emphasized on the establishment and design of mechanisms to provide sustainable operations and maintenance such as strengthening of Water User Associations, outsourcing to individuals to operate. It recommended capacity building at district level, strengthening the Water User Associations and the Ministry in charge for water affairs.

5.3 DISTRICTS STRATEGY AND INVESTMENT PLANS

Information from the districts showed that 18 districts have District Strategy and Investment Plan (DSIP) while the remaining 10 districts did not prepare the District Strategy and Investment Plan. Those districts that have the investment plans have varied planning period as shown in Table 5.1. It is only one district (Nkhotakota) that has revised its first DSIP and the revised one covers the period from 2013 to 2018. Most of the districts have made their planning horizon up to year 2015 which coincided with the MDG set target year to half the number of population without water supply.

As can be seen from the planning horizon the districts have not reached the end of their planning period of year 2015. Most districts, although they have DSIP, did not allocate budget for the implementation of physical activities and they relied on the support from NGOs and projects financed from the central government for them to implement their plans. In most cases the support and resources from the central government could not match with the activities planned to be implemented as in the DSIP.

Two districts, Nkhotakota and Ntchisi, updated their DSIP but when updating their plan they have not made assessments of the achievements made during the implementation of the earlier DSIP. Table 5.1 shows some aspects of the DSIP for each district that has DSIP.

Table 5-1: Assessment of Some Planning Aspects of the DSIP by District

S. Nr.	District	District Strategy & Investment Plan		Planning population		Planned achievement (%)		Present Coverage (%)
		Available	Period	2008	2015	from	To	2013
1	Chitipa	None						63.7
2	Karonga	Yes	2010-2015	269890	339907	66	83	70.4
3	Nkhata Bay[3]	Yes	2007-2015	195545	223260	67	80	74
4	Rumphi	Yes	2010-2015	172034	199435	45	75	65
5	Mzimba	Yes	2007-2015	764000	871472	65	80	81
6	Likoma	None						100
7	Kasungu	None						84
8	Nkhotakota	Yes	2013-2018	356459	381136	58	76	58
9	Ntchisi	Yes	2014-2017	276481	305589	73	86.5	71
10	Dowa[3]	Yes	2007-2015	496934	651778	61	80	70
11	Salima[3]	Yes	2007-2015	309300	449338	76	80	76.4
12	Lilongwe[3]	Yes	2007-2015	1100000	1599161	53	81	79
13	Mchinji[3]	Yes	2007-2015	425000	586000	62	80	67
14	Dedza	Yes	2009-2015	623789	741849	60	80	65
15	Ntcheu	Yes	2010-2015	471589	574585	70	85	78.8
16	Mangochi[3]	Yes	2007-2015	755040	1000144	73	80	86.7
17	Machinga	Yes	2007-2015	488996	615000	60	80	87
18	Zomba	Yes	2012-2020	583167	910000	70	98	80
19	Chiradzulu	Yes	2011-2016	425000	586000	62	80	82
20	Blantyre Rural	None						70
21	Mwanza	None						80
22	Thyolo[4]	Yes	2012-2017	593992	643836	67.4	83.7	65.4
23	Mulanje	None						73
24	Phalombe	None						69
25	Chikwawa	Yes	2008-2015	438895	473825	55	80	51.6
26	Nsanje	None						
27	Balaka	None						72.3
28	Neno	None						46

Source: compiled by the Consultant based on data from the DSIP

Major observation on the DSIP from the assessment and review of the documents are the following:

- Population figures used do not segregate the urban population in the district as the plan was supposed to cover only rural areas.
- Different figures for the same parameter were used for analysis of issues and facts. For instance different figures for population in the same year were used in estimating coverage.
- Reference years were not indicated for the different set targets in the planning

[3]The base population is from year 2006
[4]The base population is from year 2010

- Some districts have used population figures different from the NSO census figures for the year 2008.
- The number of base population and the planning year did not match (planning for 2007 while population was for 2006)

Out of the 18 districts that have got DSIP only 4 districts managed to achieve the set targets earlier than planned. On the contrary 5 districts have their coverage gone below or stagnant compared to the base coverage figure used for planning. The remaining 8 districts have made some improvement in terms of coverage but compared to the time remaining the achievements were not that much significant nor close to the set target. Zomba district has just started implementation of the activities planned in the DSIP and its plan ends by 2020 which is the same as the Rural Water Supply Investment Plan under preparation in this assignment. The disparities in the planned figures and the reported current coverage could also be as a result of lack of simple and clear methods for calculating coverage at district level. This can be seen from the calculations shown in Table 4.2 where there are over 100% coverage in some districts where as the situation on the ground is not showing such coverage as there are so many villages without access to safe drinking water supply service regardless of the functionality of the schemes.

5.4 NATIONAL 10 YEARS SANITATION AND HYGIENE INVESTMENT PLAN

There is National 10 year Sanitation and Hygiene Investment Plan prepared by the Ministry Responsible for Water Supply and Sanitation in 2012. Although it is not part of the scope of work for this assignement to assess the sanitation situation, it is appropriate to highlight the investment plant regaring sanitation as they always complement with water supply. The Investment Plan presents the investment needed in order to meet the objectives set in the National Sanitation Policy. The objective of the Investment Plan is to quantify investment alternatives for on and off-site sanitation, solid waste disposal and drainage. The plan shall provide the infrastructural platform required for growth in the different waste generation sectors.

Two investment alternatives have been analyzed in order to take into consideration the elasticity of future funding. These alternatives were identified in the Water Sector Investment Plan prepared by Castelia in 2012.

- Alternative #1: full funding available, 52% coverage by 2022, up to 87% coverage by 2030
- Alternative #2: Limited funding available: 26% coverage by 2022, up to 40% coverage by 2030

The main difference between both alternatives lies in the increase of the access rate to improved sanitation and the household will be the main actor of this development, as he will keep investing and operating the individual sanitation facilities. In order to boost this process a specific and targeted subsidy mechanism has been identified so to help the household access cheaper material for constructing individual sanitation facilities, under the condition that they use it exclusively for this purpose. This Investment Plan suggests that the responsibility of this subsidy lies at Government Level (MoWDI).

The plan is considered necessary for reaching the National Sanitation Policy and the Open Defecation Free Strategy objectives. Since the ODF objective is critical path the Investment Plan gives a special attention in considering the ODF-contributing activities as a priority. The Sanitation Investment Plan has to be used in synchronization with the RWS Investment Plan during implementation.

6 PARAMETERS OF THE 2014-2020 RURAL WATER SUPPLY INVESTMENT PLAN

6.1 THE INVESTMENT TARGETS

Considering the situation on the ground and the planning for the period from 2014-2020, the following planning targets are set to be achieved step by step during the planning period which will be leading to 95% and 100% access for rural water supply by the years 2025 and 2030 respectively. The set targets for the planning period from year 2014-2020 are in line with Vision 2020, the MGDS II, the 2007 investment plan and the Malawi Water Sector Investment Program of 2012.

- Target of 83% access coverage by 2015,
- Target of 85% access coverage by 2017,
- Target of 90% access coverage by 2020

Currently all the 28 districts do not have the same level of water supply access and that gap is assumed to be leveled out by the end of 2020. The basis for the targets is the water supply access in 2013. To arrive to the number of people to be provided with access to rural water supply, population projection for each district up to the year 2025 has been made. Based on the population projection the additional population to be provided with water supply access is projected for each stage of the target years. The details are provided in the sections below.

6.2 POPULATION PROJECTION FOR RURAL AREAS

Population projection is one of the key factors in the preparation of the rural water supply investment plan for the next 7 years (2013-2020), year 2013 being taken as the base year. The National Statistics Office based on the census of 2008 has made population projections by districts for each year up to the year 2030. The rural population projection by NSO was adjusted by the consultant by deducting the population of the 'bomas' and some major towns within the districts such as Liwonde in Machinga, Luchenza in Thyolo, Monkey Bay in Mangochi as these centres are served by water supply service from Water Boards. It is against these projected rural population that the Rural Water Supply Investment Plan from 2014-2020 is prepared. Accordingly population projection for the rural areas in each district based on NSO projections up to 2025 is shown in Table 6.1.

Table 6-1: Projected Rural Population by District

Sr. N.	District	Projected Rural Population					
		2013	2014	2015	2017	2020	2025
1	Chitipa	188,601	193,756	199,025	209,870	226,811	256,418
2	Karonga	269,634	278,203	287,018	305,417	335,082	390,374
3	Nkhata Bay	239,224	246,975	255,018	271,970	299,515	348,887
4	Rumphi	177,116	181,990	186,976	197,231	213,235	241,281
5	Mzimba	819,453	844,134	869,722	923,688	1,011,836	1,177,712
6	Likoma	9,079	9,085	9,094	9,118	9,157	9,218
7	Kasungu	716,539	744,768	774,085	836,138	938,262	1,134,466
8	Nkhotakota	327,434	337,829	348,575	371,197	408,221	478,480
9	Ntchisi	257,938	266,746	275,825	294,829	325,577	383,764
10	Dowa	695,242	726,094	757,892	824,272	930,611	1,126,657
11	Salima	362,576	373,588	384,874	408,348	446,092	516,345
12	Lilongwe	1,388,407	1,421,454	1,455,501	1,526,971	1,643,430	1,863,679
13	Mchinji	527,792	546,795	566,479	607,945	675,609	804,194
14	Dedza	679,726	695,449	711,573	745,145	799,153	899,153
15	Ntcheu	525,760	540,126	554,791	585,122	633,281	721,103
16	Mangochi	888,007	919,442	952,221	1,022,061	1,138,378	1,365,277
17	Machinga	543,792	560,683	578,246	615,535	677,468	798,172
18	Zomba	637,113	648,882	660,896	685,755	725,344	797,153
19	Chiradzulu	307,328	311,503	315,733	324,377	337,842	361,471
20	Blantyre Rural	381,242	389,906	398,835	417,453	447,177	500,572
21	Mwanza	85,539	86,872	88,212	90,912	94,969	101,495
22	Thyolo	602,920	612,974	623,449	645,778	682,808	752,502
23	Mulanje	542,279	549,267	556,392	571,216	595,132	638,884
24	Phalombe	349,712	358,541	367,699	387,185	419,849	484,211
25	Chikwawa	495,310	509,955	525,135	557,180	609,684	708,632
26	Nsanje	245,558	251,508	257,691	270,823	292,546	334,092
27	Balaka	345,199	356,385	368,012	392,627	433,097	510,516
28	Neno	134,972	141,614	148,523	163,116	186,833	230,801
Total Rural		**12,743,490**	**13,104,525**	**13,477,491**	**14,261,280**	**15,537,001**	**17,935,512**
Total Cities & other Urban		**2,574,008**	**2,701,485**	**2,833,843**	**3,113,084**	**3,568,883**	**4,425,095**
Total Malawi		**15,317,499**	**15,806,010**	**16,311,334**	**17,374,364**	**19,105,884**	**22,360,607**

Source: compiled by the Consultant based on NSO population projections

6.3 PROJECTED RURAL POPULATION AND WATER SUPPLY ACCESS FOR PLANNING

The percentage of rural population having access to water supply service in each district is shown in Table 4.2 in Section 4. The total number of rural populations having access to water supply and those that do not have access in each district is calculated for the year 2013 using the population figure and the NSO percentage from Table 4.2 and is shown in Table 6.2 as follows.

Table 6-2: Rural Population with and without Access to Water Supply in 2013 by District

No.	District	Population	%Population	Number of Population (2013)	
		2013	With Access	With Access	Without Access
1	Chitipa	188,096	79%	142,539	45,557
2	Karonga	268,918	92%	238,396	30,522
3	Nkhata Bay	238,923	63%	140,988	97,934
4	Rumphi	176,648	80%	128,388	48,260
5	Mzimba	817,205	82%	658,749	158,456
6	Likoma	9,052	87%	7,876	1,177
7	Kasungu	714,653	67%	438,869	275,785
8	Nkhotakota	326,574	93%	305,314	21,260
9	Ntchisi	257,252	81%	197,184	60,068
10	Dowa	693,404	54%	377,212	316,192
11	Salima	361,618	83%	292,079	69,539
12	Lilongwe	1,384,726	70%	953,938	430,788
13	Mchinji	523,933	75%	377,913	146,020
14	Dedza	677,910	87%	603,136	74,773
15	Ntcheu	524,358	78%	421,059	103,299
16	Mangochi	885,635	95%	841,353	44,282
17	Machinga	542,337	69%	355,448	186,889
18	Zomba	635,216	92%	593,292	41,924
19	Chiradzulu	306,503	92%	275,914	30,589
20	Blantyre Rural	380,230	85%	318,519	61,711
21	Mwanza	85,312	87%	71,688	13,624
22	Thyolo	613,792	75%	449,971	163,821
23	Mulanje	540,823	91%	480,359	60,464
24	Phalombe	348,777	98%	342,499	6,278
25	Chikwawa	494,004	90%	422,423	71,581
26	Nsanje	244,902	96%	231,898	13,004
27	Balaka	344,277	94%	302,585	41,692
28	Neno	134,614	72%	104,488	30,127
	Total	**12,719,692**	**81%**	**10,074,073**	**2,645,619**

Source: compiled by the Consultant

Similarly the number of rural population not served can be projected up to 2025 by deducting the number of population served at present (2013) as given in Table 6.2. In other words the rural population increase above the 2013 served rural population with water supply system ideally needs service in the planning period up to 2025. However this will depend on the resources and capacity available to provide 100% coverage at each stage to cope with the un-served population. Projected population in rural areas without access to water supply beyond 2013 until 2025 is given in Table 6.3.

Table 6-3: Total Rural Population and those without Access to Water Supply Beyond 2013 by District

No.	District	Population 2013			2014		2015		2020		2025	
		Total	Total with Access	Without Access	Total	Without access	Total	Without access	Total	Without access	Total	Without access
1	Chitipa	188,096	142,539	45,557	193,756	51,217	199,025	56,486	226,811	84,272	256,418	113,879
2	Karonga	268,918	238,396	30,522	278,203	39,807	287,018	48,622	335,082	96,686	390,374	151,979
3	Nkhata Bay	238,923	140,988	97,934	246,975	105,986	255,018	114,029	299,515	158,527	348,887	207,899
4	Rumphi	176,648	128,388	48,260	181,990	53,602	186,976	58,588	213,235	84,847	241,281	112,893
5	Mzimba	817,205	658,749	158,456	844,134	185,385	869,722	210,973	1,011,836	353,087	1,177,712	518,963
6	Likoma	9,052	7,876	1,177	9,085	1,210	9,094	1,219	9,157	1,281	9,218	1,342
7	Kasungu	714,653	438,869	275,785	744,768	305,899	774,085	335,216	938,262	499,394	1,134,466	695,598
8	Nkhotakota	326,574	305,314	21,260	337,829	32,515	348,575	43,260	408,221	102,907	478,480	173,166
9	Ntchisi	257,252	197,184	60,068	266,746	69,562	275,825	78,642	325,577	128,393	383,764	186,581
10	Dowa	693,404	377,212	316,192	726,094	348,882	757,892	380,680	930,611	553,399	1,126,657	749,445
11	Salima	361,618	292,079	69,539	373,588	81,509	384,874	92,795	446,092	154,013	516,345	224,266
12	Lilongwe	1,384,726	953,938	430,788	1,421,454	467,516	1,455,501	501,563	1,643,430	689,492	1,863,679	909,741
13	Mchinji	523,933	377,913	146,020	546,795	168,882	566,479	188,567	675,609	297,696	804,194	426,281
14	Dedza	677,910	603,136	74,773	695,449	92,313	711,573	108,437	799,153	196,017	899,153	296,017
15	Ntcheu	524,358	421,059	103,299	540,126	119,066	554,791	133,731	633,281	212,221	721,103	300,043
16	Mangochi	885,635	841,353	44,282	919,442	78,088	952,221	110,868	1,138,378	297,025	1,365,277	523,924
17	Machinga	542,337	355,448	186,889	560,683	205,235	578,246	222,799	677,468	322,020	798,172	442,724
18	Zomba	635,216	593,292	41,924	648,882	55,590	660,896	67,604	725,344	132,052	797,153	203,861
19	Chiradzulu	306,503	275,914	30,589	311,503	35,589	315,733	39,818	337,842	61,928	361,471	85,557
20	Blantyre Rur.	380,230	318,519	61,711	389,906	71,387	398,835	80,316	447,177	128,658	500,572	182,053
21	Mwanza	85,312	71,688	13,624	86,872	15,184	88,212	16,524	94,969	23,281	101,495	29,808
22	Thyolo	613,792	449,971	163,821	612,974	163,004	623,449	173,478	682,808	232,837	752,502	302,531
23	Mulanje	540,823	480,359	60,464	549,267	68,908	556,392	76,034	595,132	114,774	638,884	158,525
24	Phalombe	348,777	342,499	6,278	358,541	16,042	367,699	25,201	419,849	77,351	484,211	141,713
25	Chikwawa	494,004	422,423	71,581	509,955	87,533	525,135	102,712	609,684	187,261	708,632	286,209
26	Nsanje	244,902	231,898	13,004	251,508	19,611	257,691	25,793	292,546	60,649	334,092	102,195
27	Balaka	344,277	302,585	41,692	356,385	53,801	368,012	65,428	433,097	130,512	510,516	207,931
28	Neno	134,614	104,488	30,127	141,614	37,126	148,523	44,036	186,833	82,346	230,801	126,314
	Total	**12,719,692**	**10,074,073**	**2,645,619**	**13,104,525**	**3,030,452**	**13,477,491**	**3,403,418**	**15,537,001**	**5,462,928**	**17,935,512**	**7,861,438**

Source: compiled by the Consultant

6.4 WATER DEMAND FOR RURAL SETTINGS

The per capita water demand for domestic use in rural areas is given as 27 l/c/d for those using boreholes, shallow wells or protected spring sources and 36 l/c/d for people using communal standpipes from gravity schemes or from reticulated borehole system. The design for gravity fed water supply schemes under the African Development Fund financed projects in the 4 districts have used slightly different figures in the calculation of per capita demands for individual connections and institutions. Other scheme that were rehabilitated and new construction as well as the market centres financed by the AusAid have also used different figures and this is compiled as shown in Table 6.4:

Table 6-4: Per Capita Water Demands in Rural Areas

Scheme/ District	CWP	Connections		Institutions	Distribution loss
		In Yard	In House		
Machinga	36 l/c/d	50 l/c/d	70 l/c/d	30% of total demand	20% of total demand
Mulanje	36 l/c/d	50 l/c/d	50 l/c/d	20 l/c/d & 100 l/c/d for boarding schools.	20% of total demand
Zomba	36 l/c/d	50 l/c/d	70 l/c/d		20% of total demand
Chapananga	36 l/c/d	120 l/c/d	120 l/c/d	30% of total demand	10% of total demand
Katizi	36 l/c/d	50 l/c/d	50 l/c/d	20 l/c/d	
Misuku	27 l/c/d			10% of total demand	
Mvula	36 l/c/d			36 l/c/d	
Usingini	36 l/c/d			36 l/c/d	20% of total demand
Market Centres	36 l/c/d	50-70	125	20% of total demand	Max 20% of total demand

Source: compiled by the Consultant from Previous Study and Design Documents

The total water demand is determined from Table 6.4 and based on the Design Manual of the Ministry responsible for Water Development and Irrigation the design per capita water demand used are 36 l/c/d for CWP, 50 l/c/d for private connection (for yard and house connection and 20% of population) and 20% of total demand for institutions and 20% of total demand for system losses. These figures will also be used both for gravity fed piped schemes and reticulated boreholes. For boreholes and shallow wells for point supply 27 l/c/d will be used when necessary.

6.5 TARGET POPULATION IN THE PLAN

The population that need to be supplied to achieve the set targets is calculated based on the population without access to water supply service and the percentages of targets set to achieve in the given period. The target population to be provided with water supply service during the planning period by district is shown in Table 6.5.

Table 6-5: Target Population for Planning from 2013 to 2020 by District

S. Nr.	District	Population 2013			Population 2015		Population 2017		Population 2020	
		Total	Served	Access (%)	Total	Target (83%)	Total	Target (85%)	Total	Target (90%)
1	Chitipa	188,096	142,539	76%	199,025	165,191	209,870	178,390	226,811	204,130
2	Karonga	268,918	238,396	89%	287,018	238,225	305,417	259,604	335,082	301,574
3	Nkhatabay	238,923	140,988	59%	255,018	211,665	271,970	231,175	299,515	269,563
4	Rumphi	176,648	128,388	73%	186,976	155,190	197,231	167,647	213,235	191,912
5	Mzimba	817,205	658,749	81%	869,722	721,869	923,688	785,135	1,011,836	910,653
6	Likoma	9,052	7,876	87%	9,094	7,548	9,118	7,750	9,157	8,241
7	Kasungu	714,653	438,869	61%	774,085	642,490	836,138	710,717	938,262	844,436
8	Nkhotakota	326,574	305,314	93%	348,575	289,317	371,197	315,518	408,221	367,399
9	Ntchisi	257,252	197,184	77%	275,825	228,935	294,829	250,605	325,577	293,019
10	Dowa	693,404	377,212	54%	757,892	629,050	824,272	700,631	930,611	837,550
11	Salima	361,618	292,079	81%	384,874	319,445	408,348	347,096	446,092	401,483
12	Lilongwe	1,384,726	953,938	69%	1,455,501	1,208,066	1,526,971	1,297,925	1,643,430	1,479,087
13	Mchinji	523,933	377,913	72%	566,479	470,178	607,945	516,753	675,609	608,048
14	Dedza	677,910	603,136	89%	711,573	590,606	745,145	633,374	799,153	719,238
15	Ntcheu	524,358	421,059	80%	554,791	460,476	585,122	497,354	633,281	569,953
16	Mangochi	885,635	841,353	95%	952,221	790,344	1,022,061	868,752	1,138,378	1,024,540
17	Machinga	542,337	355,448	66%	578,246	479,945	615,535	523,205	677,468	609,721
18	Zomba	635,216	593,292	93%	660,896	548,544	685,755	582,892	725,344	652,810
19	Chiradzulu	306,503	275,914	90%	315,733	262,058	324,377	275,720	337,842	304,058
20	Blantyre R	380,230	318,519	84%	398,835	331,033	417,453	354,835	447,177	402,459
21	Mwanza	85,312	71,688	84%	88,212	73,216	90,912	77,275	94,969	85,472
22	Thyolo	613,792	449,971	73%	623,449	517,463	645,778	548,911	682,808	614,527
23	Mulanje	540,823	480,359	89%	556,392	461,806	571,216	485,534	595,132	535,619
24	Phalombe	348,777	342,499	98%	367,699	305,190	387,185	329,107	419,849	377,864
25	Chikwawa	494,004	422,423	86%	525,135	435,862	557,180	473,603	609,684	548,716
26	Nsanje	244,902	231,898	95%	257,691	213,883	270,823	230,199	292,546	263,292
27	Balaka	344,277	302,585	88%	368,012	305,450	392,627	333,733	433,097	389,787
28	Neno	134,614	104,488	78%	148,523	123,274	163,116	138,649	186,833	168,150
	Total	**12,719,692**	**10,074,073**	**81%**	**13,477,491**	**11,186,318**	**14,261,280**	**12,122,088**	**15,537,001**	**13,983,301**

6.6 RURAL WATER SUPPLY TECHNOLOGY OPTIONS

The main technology options that are currently in use to provide water supply service to rural areas in Malawi depending on the type of sources are:

- Protected springs –spring box for use on spot or reticulated;
- Shallow wells fitted with hand pumps of different type of which AFRIDEV is the majority followed by Malda, Indian Mark II and in few cases Rope, Elephant and Mark V hand pumps as reported by the districts during the consultative workshops;
- Boreholes fitted with hand pumps of different type of which AFRIDEV pump is the most common followed by Climax and Play hand pumps as reported by the districts during the consultative workshops;
- Boreholes fitted with solar energy (its use need to be enhanced) or fuel or electricity driven pumps to mostly supply through taps from reticulation and elevated storage tanks within institutions and small communities around the sources;

- Boreholes fitted with submersible pumps to supply market centers through communal standpipes or kiosks and domestic yard and household connections (20% of the population) from reticulation system of about 2.5 to 5 km length and storage reservoirs within the market centre; and
- Gravity fed piped systems with intake works on the source, screening tanks, treatment plant in few cases, transmission mains, reservoirs, distribution networks and stand pipes (communal water points) and taps (private connections) to households and institutions. The intakes are weir structure across the stream and in few cases dams with small to medium heights.

The districts during consultative workshops highlighted the type of technology options used in the rural water supply that are currently in use which is the same as what is described above. It is important to note that there is confusion when using the word 'tap' to mean standpipe (communal water point) and private connection tap.

6.7 DESIGN PARAMETERS USED FOR THE INVESTMENT PLAN

As stated in Annex V- Conceptual Design report the main purpose of conceptual design is to provide preliminary idea or concept of the facilities to be considered in the investment plan so that its implementation is guided based on the concepts developed regarding the type of rural water supply facilities to be promoted and to make more realistic cost estimates for the preparation of the investment required during the planning period to achieve the set target. Accordingly the following design parameters are developed in order to come up with conceptual design of water facilities for the different type of water supply sources and technology options for the purpose of preparation of the investment plan financial requirements.

- Protected springs –on spot is expected to serve on average about 120 people and it should have a minimum dry yield that can satisfy the water demand of the users at 27l/c/d and water collection time will be during day for 10 hours period. This type of source is not considered in the investment plan as this will be scarce resources to find and those identified can be handled by such as NGOs
- Shallow wells fitted with hand pumps of different type –point water source is expected to serve a maximum of 120 people at 27l/c/d water demand and it should have a minimum dry yield of 0.1l/s and water collection time will be during day for 10 hours period. This type of source is not also considered in the investment plan as this are not reliable during dry seasons and not most preferred by communities and those identified can be handled by such as NGOs.
- Boreholes fitted with hand pumps of different type –point water sources is expected to serve a maximum of 250 people (this figure is only for planning purpose) at 27l/c/d water demand and it should have a minimum dry yield of 0.2l/s and water collection time will be during day for 10 hours period. This will be considered in the investment plan to fill the gaps where gravity fed schemes or reticulated pumped schemes are not practical to implement
- Boreholes fitted with solar energy or wind mills or fuel or electricity driven pumps to mostly supply through taps from small reticulation and elevated storage tank within institutions and small communities around the sources- This may be considered for specific institutions and areas and will not form part of the major facilities in the investment plan.
- Boreholes fitted with submersible pumps powered by solar (solar powered pumps encouraged in remote areas) or wind or electricity energy to supply market centers or densely populated

rural villages through communal standpipes or kiosks and domestic yard and household connections –with reticulation system of about 5 km length (pipes of diameter 63mm and above) and 8 hours demand storage capacity on ground or elevated reservoirs within the market centre or service area assumed to serve a population of not less than 1500. The length of the transmission or distribution network can be longer or shorter depending on the number of population to be served and settlement pattern of the market center and location of the water sources and storage reservoirs.

- Gravity fed piped systems with intake works on the source, screening tanks, treatment plant with chlorination system, transmission mains, reservoirs, distribution networks and stand pipes (communal water points) and taps (private connections) to households and institutions. The size and capacity of the scheme depends on the availability of water sources and potential areas to be supplied. Water demand of 36 l/c/d for standpipe users and 20% of the total population for private connections and institutions, as given in the design criteria is considered in estimating the number of population to be served and amount of water required from a given gravity fed scheme. For the purpose of planning water sources of more than 2l/s abstraction will be considered for development as gravity scheme as those below could have higher per capita investment cost.
- Water from Lake Malawi pumped using solar or wind or electricity or fuel powered with intake works on the Lake, sump wells, pump stations for raw and clear water, treatment plant with chlorination system, transmission mains, reservoirs, distribution networks and stand pipes (communal water points) and taps (private connections) to households and institutions. The size and capacity of the scheme depends on the potential areas to be supplied as the Lake water is abundant. Water demand of 36 l/c/d for standpipe users and 20% of the total population for private connections and institutions, as given in the design criteria is considered in estimating the number of population to be served. For the purpose of planning 12l/s abstraction will be considered for development as Lake Water Pumped System.

When estimating number of population to be served from a new gravity scheme the minimum flow from a standpipe is assumed at 0.075 l/s which is assumed to serve a maximum of 120 people and then this two figures are used to calculate how many people a water source can serve depending on the minimum flow excluding environmental requirement from a source based on the findings regarding water sources as given in Annex II Water Resources Assessment Topical report. For instance if a stream has minimum flow of 2 l/s then the number of population to be served is calculated by dividing the minimum flow of the source by 0.075 l/s and then multiply by 120 which will give 3,200.00 which is equivalent to 26 standpipes or communal water points. It is also assumed that the distance between two standpipes on average would be 500m (0.5 km) and the scheme has 26 standpipes then the distribution network will have a total length of about 13 km to cover the standpipes. That means for this planning purpose an estimate of 0.5 km/standpipe distribution pipe length can be used in the analysis of gravity fed and pumped system schemes.

As mentioned above there are different types of energy sources for the pumps such as from solar system, wind, electricity from the national grid and fuel. The type of energy sources to be used can be defined after conducting proper feasibility study works and detail designs based on specific projects with comparison of costs and performance of the system.

Malawi being country with almost 12 hours of sunshine the use of solar energy driven pumps has to be encouraged. The initial cost for such energy driven facilities are believed to be on the high side but

its O&M on the contrary is on the lower side compared to electricity driven pumps. There are countries, such as Ethiopia which are at present persuing the use of clean and renewable energy for rural water supply service in remote areas where national electricity grid could not reach. The use of solar and wind energy has to be given due attention in the preparation of the feasibility study and detail designs of rural water supply proposed under this investment plan. Experience from other countries where the use of solar energy is being promoted could be of valuable to share in the process of implementation of this Investment plan.

6.8 PROPOSED INFRASTRUCTURE DEVELOPMENT

In order to meet the 2015, 2017 and 2020 targets for the provision of rural water supply access various infrastructure development are envisaged over the planning years. This includes: 1) Rehabilitation and expansion of existing borehole schemes and surface water schemes and 2) Construction of new schemes based on gravity fed surface water and on boreholes. These are described in detail in the following sections.

6.9 PROPOSED CAPACITY DEVELOPMENT AND CATCHMENT PROTECTION ACTIVITIES

Institutions which are going to implement the rural water supply investment programme have to undertake several key measures to be able to deliver expected outputs for a better and equitable water supply services in the rural areas. The sector institutional framework is in place to facilitate the planning, implementation and monitoring of the water sector programmes. Emphasis should be directed at strengthening the roles, strengthening capacity and co-ordination and collaboration for improved performance and results-oriented management and development of the water sector programmes at all levels.

Catchment protection is meant to prevent catchment degradation in Gravity-Fed Water Supply Schemes in order to ensure availability of water to the people in the scheme area. Some of the causes of catchment degradation are ignorance of individuals, negligence by households, poor service provision by institutions, poverty, high population concentration and deforestation.

Due to a combination of factors like age, catchment encroachment, neglect, inadequate management, over-extension (beyond design capacity) and vandalism, the majority of existing gravity fed schemes are functioning below capacity and are in urgent need of rehabilitation as proposed in the next section. Degradation of catchment areas is a major factor in contributing to the malfunctioning of the schemes and deteriorated water quality of the supplied water. Gravity fed schemes need to have water permit to operate their system to ensure proper withdrawal of water without conflict with other users. The capacity building and the catchment works to be undertaken are described in detail in Section 10

7 PROPOSED REHABILITATION AND EXPANSION OF EXISTING SCHEMES

7.1 REHABILITATION OF EXISTING BOREHOLES

Rehabilitation of existing borehole water points that are not properly functioning is essential in order to put back the system into functional to serve the population in that area. Although there was no detail assessment done similar to the existing gravity fed system, there are over 7,462 boreholes as reported by the districts in the consultative workshops that are not currently functioning and most of them could be rehabilitated to put them back into operation. From experience rehabilitation of all non-functional boreholes may not be possible as some could be beyond repair and for the purpose of this planning process it is assumed that 75% of these boreholes could be rehabilitated, which would be about 5,593 boreholes for possible rehabilitation. As it appears, since there are a lot of boreholes in the districts, it is assumed that a rehabilitated borehole will serve on average 200 people after rehabilitation instead of the 250 being used in the design manuals. Shallow wells and springs have to be also rehabilitated but they are not considered here as they can easily be handled by the community or the district councils. Table 7.1 shows the number of boreholes to be rehabilitated and population to be served after the rehabilitation in each district.

Table 7-1: Number of Boreholes to be Rehabilitated and Population Served by District

S. Nr.	District	Total No. of BH	No. of BH functioning	No. of BH not functioning	% of BH not functioning	No. of BH to be rehabilitated	Population to be served by rehabilitated BH
1	Chitipa	618	548	70	11%	52	10,400
2	Karonga	1,142	922	220	19%	165	33,000
3	Nkhatabay	765	656	109	14%	81	16,200
4	Rumphi	997	605	392	39%	294	58,800
5	Mzimba	2,782	2,269	513	18%	385	77,000
6	Likoma	5	5	-	0%	-	-
7	Kasungu	2,023	1,829	194	10%	145	29,000
8	Nkhotakota	1,557	1,208	349	22%	262	52,400
9	Ntchisi	1,083	853	230	21%	172	34,400
10	Dowa	1,265	1,011	254	20%	190	38,000
11	Salima	1,289	1,199	90	7%	68	13,600
12	Lilongwe	6,242	5,438	804	13%	603	120,600
13	Mchinji	1,239	1,015	224	18%	168	33,600
14	Dedza	1,392	959	433	31%	325	65,000
15	Ntcheu	2,774	2,256	518	19%	388	77,600
16	Mangochi	2,772	2,616	156	6%	117	23,400
17	Machinga	1,696	1,289	407	24%	305	61,000
18	Zomba	2,259	2,023	236	10%	177	35,400
19	Chiradzulu	1,499	1,094	405	27%	303	60,600
20	Blantyre R	2,006	1,593	413	21%	310	62,000
21	Mwanza	535	480	55	10%	41	8,200
22	Thyolo	1,305	1,104	201	15%	151	30,200
23	Mulanje	1,308	1,126	182	14%	137	27,400
24	Phalombe	713	419	294	41%	220	44,000
25	Chikwawa	1,221	939	282	23%	211	42,200
26	Nsanje	1,036	824	212	20%	159	31,800
27	Balaka	1,074	891	183	17%	137	27,400
28	Neno	560	524	36	6%	27	5,400
	Total	**43,157**	**35,695**	**7,462**	**17%**	**5,593**	**1,118,600**

Source: compiled by the Consultant based on data from each DWDO

From Table 7.1 districts with over 10% non-functionality rate have to make effort to bring down the rate below the 10%. At present 21 districts have over 10% non-functionality rate of boreholes and these districts must give priority for the rehabilitation works.

7.2 REHABILITATION OF EXISTING GRAVITY FED SCHEMES

7.2.1 GENERAL APPROACH

Rehabilitation of existing gravity fed schemes that are not properly functioning is essential in order to put back the system into functional to serve the population in that area. Schemes that require rehabilitation among the existing gravity fed system are identified based on the field assessment works as presented in Annex IV Detailed Assessment of Existing Gravity Fed Schemes. For scheme to be considered for rehabilitation it needs to satisfy the following condition:

- The status of the scheme facilities that require rehabilitation is beyond the capacity of the WUA or the community to repair it
- The scheme is not currently under any rehabilitation works
- The water source for the scheme to be rehabilitated has sufficient capacity to supply the original design population or possibility of constructing small dams to store more water
- The catchment area for the water source above the intake location is not substantially degraded or encroached.
- The scheme has no potential for expansion but just rehabilitation as expansion is considered separately.

Following the above conditions for the selection of existing schemes for rehabilitation works all the 108 existing gravity fed schemes were assessed and evaluated. In addition to the above the field observation regarding the size of the scheme and its management is also considered in certain cases to incorporate or leave a scheme for rehabilitation. Based on these conditions all the 108 gravity fed schemes are categorized into four groups as follows:

- Schemes that could be rehabilitated by the community and are not considered for rehabilitation under the investment plan– these are schemes that are functioning well, all or majority of the standpipes are functioning properly, no conditions of intake problem or that are recently under gone full rehabilitation works and those that can easily be rehabilitated by the management of the scheme without involvement of Ministry responsible for Water Development and Irrigation.
- Schemes that require minor rehabilitation – these are schemes that have minor intake problems, river crossings and where taps are functioning partially and also have not received full rehabilitation works.
- Schemes that require major rehabilitation – these are schemes that have the intakes washed away, pipelines vandalized or washed away, river crossings destroyed, all or majority of the standpipes are not working and have not under gone any rehabilitation works recently according to information from field assessment
- Schemes that require rehabilitation and at the same time can be expanded – these are schemes that require some form of rehabilitation works and also that have more water flows in their sources for more abstraction and that can be extended beyond their present capacity to serve more population.

As described in Annex III Socio-Economic and Environmental Assessment Topical report there are conflicts of interests in some water source areas as people want to use water for different uses. Such conflicts must be addressed where they exist and all section of the water user communities must be sensitized on water conservation through catchment protections. District sector offices must work hand in hand to address the issues at community level and assist the communities in the planning of water use. This situation must be considered in the feasibility studies for the implementation of the proposed rehabilitation and expansion works.

7.2.2 SCHEMES THAT CAN BE PUT INTO OPERATION BY THE COMMUNITY

Existing gravity fed schemes that could be rehabilitated by the community themselves and not included in the investment plan following the set criteria in Section 7.2.1 above and according to field assessment are about 40 out of 108 schemes and the list is shown in Table 7.2.

Table 7-2: List of Existing GFS that would be rehabilitated by the Community

District	Name of Gravity scheme	Name of water source /river	Average Estimated flow (l/s)	Intake Pipe Size & material	Year completed & rehabilitated	Number of CWPs			Number of P/ conecs	Estimated water used (l/s)
						Initial	Current	Function		
Mzimba	Msaka	Msaka & Qucho	0.5 each	covered by silt	1982 & 2000	48	0	0	0	0
Rumphi	Livingstonia	Manchewe	5	GI 80mm	1984/2011	21	0	0	320	1
Rumphi	Chitimba/Chiweta	Chizindlri	10	GI 80mm	1997	64	70	60	69	4
Rumphi	Mulowe	Thimba	10	GI 80mm	1997	64	63	49	60	3
Chitipa	Chintekwa	Chintekwa	3	GI 80mm	2004	43	46	25	2	2
Chitipa	Chinongo	Ilyalawe & Namafuwa	2	GI 50mm	2011	10	10	8	0	1
Chitipa	Kavomolo	Nakapumi	5	GI 80mm	2000/2003	31	31	16	0	2
Chitipa	Misuku	Makeye & Mtawali	2&5	GI 80mm	1983 & under rehab	73	102	102	43	5
Nkhatabay	Chikwina-Impamba	Luwawa & Manyenyezi	5 & 15	GI 80mm & 150mm	1999 & 2014 u. const.	150	74	0	0	4
Nkhatabay	Usisya	Sasasa		GI 100mm	1997	124	78	49	0	4
Nkhatabay	Kavuzi	Kavuzi	2	GI 100mm	2005	0	193	163	0	10
Nkhatabay	Ruarwe	Ruarwe			1995	16	16	16		1
Ntcheu	Kalitsiro	Linthethe	0.5	GI 80mm	1977/2009	13	22	22		1
Ntcheu	Chilobwe	Bwathaka/ Mkanda	3	GI 80mm	1975/2010	14	26	26	0	1
Dedza/ Salima	Ngodzi	Nayayigwa	5	Pvc 110mm	2001/2006	165	83	43	0	8
		Mnengedzi	3	Pvc 110mm	2001/2006		83	83	0	
Nkhotakota	Mwansambo-Kasakula	Kanyelele	10	GI 150mm	1983/under Rehab	238	372	372	0	19
Balaka	Mpira Balaka	Mpira Dam	30	GI 4X355mm	1987/1992	1850	2220	1230		111
Machinga	Mangale	Mangale	1.3	GI 50mm	2001/2013	21	19	19	20	1
		Bububu	1.5	GI 80mm	2001/2013					
Machinga	Doza	Doza	1.7	GI 80mm	2003/2013	11	15	15	20	1
Machinga	Nkala	Nkala Spring	1.6	GI 80mm	2002/2013	9	15	15	20	1
Machinga	Dala	Dala	1.5	GI 50mm	2003	0	34	34	14	2
Machinga	Naungu	Msuluzi	0.5	uPVC 80mm	2001/2013	15	28	28	20	1
Machinga	Nyambi	Makolo	1	GI 50mm	2012	0	10	10	0	1
Machinga	Kawinga	Chanyungu 2	30	GI 100mm	2013 under rehab	500	415	0	500	23
		Namianga	15	GI 100mm	2013 under rehab					
		Zumulu Lower	30	GI 100mm	2001/2013 u. rehab					
		Zumulu Upper	3	GI 100mm						
		Mchololo 1	11	GI 100mm	under rehab					
		Mchololo 2	11	GI 80mm	under rehab					
		Sambuzi	5	GI 100mm	under rehab					
Zomba	Malosa	Lifani	30	GI 150mm	2013	0	15	15	50	1

District	Name of Gravity scheme	Name of water source /river	Average Estimated flow (l/s)	Intake Pipe Size & material	Year completed & rehabilitated	Number of CWPs			Number of P/ conecs	Estimated water used (l/s)
						Initial	Current	Function		
Phalombe	Phalombe Minor	Phalombe	20	GI 100mm	2005/2014 u. rehab	100	145	0		7
Mulanje	Muloza East	Muloza	200	GI 150mm	2006/2013 u. rehab	89	150	0		8
Mulanje	Chambe T Centre	Likhubula	40	GI 100mm	2011	0	20	15	-	1
Mulanje	Mulanje S. West	Likhubala	60	GI 150mm	1989/2013 u. rehab	181	250	0		13
Mulanje	Mbewa	Likhubula	2	GI 80mm	2010	18	19	13	-	1
Mulanje	Nalipili	Linje	200	GI 150mm	1980/2013 u. rehab	271	271	0		14
Mulanje	Lichenya	Lichenya	10	GI 150mm	1982/2013 u. rehab	575	575	0	-	29
Mulanje	Mulanje West	Likhubula	60	GI 150mm	1975/2013 u. rehab	398	398	0		20
Mulanje	Namitambo	Likhumbula	60	GI 150 mm	1979 under rehab	432	448	0		22
Thyolo	Chitengo	Spring Wisikisi	No estimate	PVC 32mm	2004	0	3	3	0	0
Chikwawa	Chapananga	Mwanza	60	GI 200&150mm	1983/2014 u. rehab	500	411	3	900	23
Mwanza	Kakhome 1	Spring	1	GI 80mm	2008	15	6	6	0	0
Mwanza	Kakhome 2	Mwale	4	GI 80mm	1997		10	3	0	1
Mwanza	Thambani	Nsupe	4	GI 80mm	1997/2009	28	27	16	0	1
Nsanje	Chididi	Matekesa	1	GI 50mm	1999/2013	26	5	5	0	0
	TOTAL					**6,113**	**6,778**	**2,038**	**2,464**	

Source: Compiled by the Consultant for this assignment based on field assessment

As can be seen from Table 7.2 the 40 Gravity Fed Schemes have got about 6,778 standpipes as obtained from the field assessment out of which 4,314 standpipes were not functional. It is assumed that the Schemes Management Committees and the community themselves with some technical assistance from the DWDO can put them back into operation. Some of the standpipes that are not functional are due to the incompleteness of the on-going rehabilitation and/or construction works such as Phalombe Minor, Chapananga, etc. and they will be operational when the works are completed. When the non-functional standpipes under the category of schemes proposed to be rehabilitated by the community as described above start functioning they will supply water to an estimated population of 474,763. The functional standpipes under the schemes proposed to be rehabilitated by the community during the field assessment will supply water to a total population of 280,096.

7.2.3 SCHEMES WITH MINOR REHABILITATION WORKS

As classified above existing gravity fed schemes that require minor rehabilitation works following the set criteria in Section 7.2.1 above and according to field assessment are about 25 out of 108 schemes. These are schemes that have minor intake problems; river crossings, some taps are not functioning, and have not under gone any rehabilitation works recently or some of their components are partially rehabilitated. According to Annex II Surface Water Resources Assessment Topical report, the schemes have sufficient water source flow that can sustain the demand of the present population.

On the other hand some of the schemes have high flow of water sources lending themselves for possible expansion but they have limitations in service areas. Some of them have also rooms for provision of private connections without necessarily going under expansions works. The activities to be performed under the minor rehabilitation works are detailed in the Assessment of Existing Gravity Schemes Topical Report.

The list of existing schemes that require minor rehabilitation and proposed to be incorporated in the invest plan is shown in Table 7.3.

Table 7-3: List of Existing Gravity Fed Schemes that Require Minor Rehabilitation Works

District	Name of Gravity scheme	Name of water source /river	Average Estimated flow (l/s)	Intake Pipe Size & Material	Year completed & rehabilitated	Number of CWPs			Number of P/ connecs	Estimated water used (l/s)
						Initial	Current	Function		
Karonga	Ighembe	Ighembe	Dam	PVC 200mm	1974	36	29	0	0	1
Mzimba	Luzi	Mtaghalavu	7	GI 80mm	1975	51	76	60	3	4
Mzimba	Khosolo	Chagavuma	5	GI 2X 50mm	2008	139	150	105	105	8
Mzimba	Msese	Luwelezi	4	GI 100mm	1986/2012	32	60	42	0	3
Rumphi	Nkhamanga	Luviri	0.5	GI 150	1978	94	94	32		5
Rumphi	Nkhamanga	Lunyina	7	GI 150mm	1978	80	80	74		4
Rumphi	Nkhamanga	Kantizi	8	GI 150	2008	66	66	52		3
Rumphi	Bale	Kakwale	5	GI 80mm	1990/1993	36	68	25	4	3
Nkhata Bay	Lifutazi	Lifutazi	3	GI 80mm	1987	64	66	11	0	3
Ntchisi	Mpamila	Kachikota	0.5	GI 33mm	2010	14	14	14	0	1
		Lifuriza	0.5	GI 33mm	2010					
Ntcheu	Lizulu	Ntendezi	3	GI 80mm	1977/2009	34	57	57	0	3
Ntcheu	Ntonda	Ntchima	10	GI 80mm	1978	109	129	108	41	7
		Nzidza	3	GI 150mm	1978					
Dedza	Mvula	Mkatha	Combined discharge 10.8			73	73	0		4
		Mpopopo								
		Chideza 1								
		Chideza 2								
		Ndambiwole								
Dedza	Ngwere	Mngwere	0.8	Pvc 110mm	1976/2008	35	30	14	0	2
Machinga/Zomba	Lifani	Lifani	30	GI 150mm	1977/2013	151	231	158	150	12
Machinga	Milala	Milala	5	GI 80mm	1984/2004	146	83	47	30	4
Machinga	Chanyungu 1	Chanyungu	30	GI 80mm	2000/2009	65	85	3	55	4
Zomba	Makhwawa North	M'kanya	2	GI 150mm	1968/2013	59	80	35	2	4
Mulanje	Phwera	Phwera	2	GI 150mm	2007	46	24	10	120	2
Mulanje	Chambe Rural	Likhubula	60	GI 150mm	1979	460	132	83	-	7
Phalombe	Migowi	Namphende	150	GI150mm	1985/2004	90	197	130	378	11
Thyolo	Sankhulani	Makwasa	15	GI 100mm	2005	181	75	4	0	4
Thyolo	Limphangwi	Mining'ono	5	GI 80mm	2005	85	75	22	0	4
Thyolo	Mvumoni	Mvumoni	Flow not estimated	PVC 90mm, 63mm	2004	85	76	9	0	4
		Mtungulu		PVC 90mm, 63mm						
		Mtungulu		PVC 90mm, 63mm						
		Mapelela		PVC 90mm, 63mm						
Thyolo	Kalintulo	Ambira	Flow not estimated	PVC 32mm	2006	12	13	9	1	1
		Mayera		PVC 20mm						
	TOTAL					**2,243**	**2,063**	**1,104**	**889**	

Source: Compiled by the Consultant for this assignment based on field assessment

According to the data sown in Table 7.3 the 25 Gravity Fed Schemes have got about 2,063 standpipes as obtained from the field assessment out of which 959 standpipes were not functional. It is assumed that after the minor rehabilitation works the standpipes will be put back into operational. When the non-functional standpipes under the category of schemes recommended for minor rehabilitation works as described above start functioning they will supply water to an estimated population of 89,535. The functional standpipes under the schemes recommended for minor rehabilitation works during the field assessment supply water to a total population of 118,181. This brings the total population figure to be served from these schemes to 207,716 people to benefit.

7.2.4 PROPOSED SCHEMES FOR MAJOR REHABILITATION WORKS

As classified above existing gravity fed schemes that require major rehabilitation works, following the set criteria in Section 7.2.1 above and according to field assessment are about 22 out of 108 schemes. These are schemes that have the intakes washed away, pipelines vandalized or washed away, river crossings destroyed, all or majority of the standpipes are not working. The schemes have sufficient water sources flow that can sustain the demand of the present population. The list of existing schemes that require major rehabilitation and included in the investment plan is shown in Table 7.4.

Table 7-4: List of Existing Gravity Fed Schemes that Require Major Rehabilitation Works

District	Name of Gravity scheme	Name of water source /river	Average Estimated flow (l/s)	Intake Pipe Size & Material	Year completed & rehabilitated	Number of CWPs			Number of P/ connection	Estimated water used (l/s)
						Initial	Current	Function		
Mzimba	Champhira S	Luwelezi	15	GI 150mm	1981/2007	206	406	225	101	21
Mzimba	Champhira North	Kamwankhuku/Kabwazi	5	GI 150	1983	211	216	170	4	11
Mzimba	Luwazi	Luwazi	4	PVC 200mm	1983/1999 & 2013	72	179	128	0	9
Karonga	Chonanga	Chonanga	1	GI 50mm	1975	37	64	0	0	3
Karonga	Iponga	Iponga	4	GI 50mm	1983	37	42	0	0	2
Karonga	Lufira /Karonga	Lufira & sanyenda	100 &5	GI 200mm & 100mm	1974 & 2010	250	250	0	2	13
Chitipa	Chisenga/ Chitipa	Chisenga		GI 2X100mm	1986	204	209	50	0	10
Chitipa	Sekwa	Sekwa	0.8	GI 100mm	1997	85	84	0	0	4
Ntcheu	Dombole	Dombole	8	GI 100mm	1983	146	153	21	0	8
		Mkhande	6	GI 80mm	1983					
		Sanjika 1	3	GI 80mm	1983					
		Sanjika 2	2	GI 80mm	1983					
Ntcheu	Kasinje	Mitongwe	2	GI 80mm	1982	95	84	0	0	4
Ntcheu	Nanyangu	Makopokela	5	GI 100mm	1982	118	118	0	0	6
Mchinji	Mchinji	Lusa	5	GI 2X50mm	1975	105	103	45	0	5
		Mtenjemanja	3	GI 80mm	1975		71	16	0	4
Nkhotakota /Nkhatabay	Dwambazi	Dwambazi	10	Pvc 160mm	2000/2003	250	278	259	0	14
Salima	Chipoka	Mchololo	3	Pvc 90mm	1989/1991	84	68	7	0	3
		Mtamba	2	Pvc 63mm	1989/1991		16	0		1
Zomba	Zomba - East	Nkande /Chifunde	10 &20	2xGI 150mm	1968/2014 u. rehab	852	685	332	170	35
Zomba	Zomba West and old Chingale	Ntanagala	20	GI 100mm	1986/2013	412	452	120	60	23
		Chigumula	18	GI 100mm	1986/2013					
		Kuche	25	GI 100mm	1968/2013					
		Mtungulusi	15	GI 100mm	1984/2013					
Phalombe	Phalombe Major	Thuchila	150	2x GI150mm	1979/2005	907	879	520		44
Phalombe	Muloza East	Muloza	200	GI 150mm	2006	89	105	72	46	5
Thyolo	Didi	Mapelela	3	PVC 90mm	1995/2004	37	97	0	5	5
Chikwawa	East Bank - Mapelela	Mapelela	flow not estimated	GI 200mm	1994/2012	156	50	29	20	3
Chikwawa	East Bank - Livudzu	Mbinini / Livudzu	10	GI 100mm	1994/2008		41	35	10	2
Chikwawa	East Bank - Limphangwi	Limphangwi	20	GI 150mm	1994/2012		42	26	0	2
	TOTAL					**3,864**	**4,692**	**2,055**	**418**	

Source: Compiled by the Consultant for this assignment based on field assessment

As can be seen from Table 7.4, similar to the schemes under the minor rehabilitation category, some of the schemes under the major rehabilitation category also have high flow of water sources lending themselves for possible expansion but they have limitations in service areas. Some of them have also rooms for provision of private connections without necessarily going under expansions works. Similarly some schemes have high number of standpipes/communal water taps which has been

installed by extending the scheme beyond manageable size. The activities to be performed under the major rehabilitation works are detailed in Annex IV Assessment of Existing Gravity Schemes Topical Report.

According to data provided in Table 7.4 the 22 Gravity Fed Schemes have got about 4,692 standpipes as obtained from the field assessment out of which 2,637 standpipes (56%) were not functional. It is assumed that after the major rehabilitation works the standpipes will be put back into operational. When the non-functional standpipes under the category of schemes recommended for major rehabilitation works as described above start functioning they will supply water to an estimated population of 250,859. The functional standpipes under the schemes recommended for major rehabilitation works during the field assessment supply water to a total population of 226,412. The total population figure to be served from these schemes would then become 477,271.

7.3 EXISTING SCHEMES FOR EXPANSION

Existing Gravity Schemes were assessed for possible expansion of the system in addition to the rehabilitation works to serve more population beyond the areas that they are serving at the moment. The schemes are proposed for expansion based on the water sources availability and service areas beyond the present service areas. The water sources availability and proposed facilities to be expanded as well as rehabilitated are described below based on the findings regarding water sources as depicted in the Surface Water resources Assessment Topical Report and service areas as depicted in the Field Assessment of Existing Gravity Fed Schemes Topical Report.

7.3.1 REHABILITATION OF SCHEMES PROPOSED FOR EXPANSION

As classified above existing gravity fed schemes that can be rehabilitated as well as expanded, following the set criteria in Section 7.2.1 above and according to field assessment are about 16 out of 108 schemes. These are schemes that have high estimated yields or discharge of the rivers and streams, the amount of water being abstracted is very small as compared to the estimated discharge of the rivers and streams, have smaller number of standpipes and private connections, some of them have smaller intake pipe sizes as compared to the discharge of the rivers and streams. The schemes also have all or majority of the standpipes not functioning lending themselves for rehabilitation works in addition to the expansion works. The schemes as described in Annex II Water Resources Assessment Topical Report have sufficient water source flow that can sustain the demand of the present population and additional population to be served from the proposed increment of the standpipes and possible private connections. The list of existing schemes that require some rehabilitation works prior in parallel to expansion works is shown in Table 7.5.

Table 7-5: List of Existing GFS Proposed for Rehabilitation & Expansion Works

District	Name of Gravity scheme	Name of water source /river	Average Estimated flow (l/s)	Intake Pipe Size & Material	Year completed & rehabilitated	Number of CWPs			Number of P/ connecs	Estimated water used (l/s)
						Initial	Current	Function		
Rumphi	Hewe	Hewe	200	GI 50mm	1976	60	55	0	0	3
Rumphi	Muhuju	Muhuju	15	Pvc 110mm	1973	61	73	54	79	4

Rumphi	Ntchenachena	Lura	200	GI 80mm	1997	122	182	128	0	9
Rumphi	Ng'onga	Ng'onga	100	GI 2x80mm	1971/1996/2004	48	54	40	52	3
Chitipa	Nthalire	Choyoti & 2 BHs	40	GI 50mm	1983 & 2012	51	6	2	405	1
Chitipa	Chinunkha	Chiwula	40	GI 2X80mm & GI 80mm,50mm	1975	35	44	24	20	2
Chitipa	Ifumbo	Itongo	40	GI 32mm	1982	30	35	0	0	2
Nkhatabay	Kalwe	Kalwe	7	GI 75 mm	2007	0	3	0	0	0
Mangochi	Lingamasa	Luchichi	20	GI 150mm	1980/2004	210	153	40	0	8
		Luchichi	20	GI 100mm	1980/2004					
		Pilipili	4	GI 75mm	1983/1999 & 2013					
Mangochi	Chowe	Uzuzu 1	3	PVC 63mm	2006	0	18	18	0	1
		Uzuzu 2	3	PVC 63mm	1998					
		Liwaso	4	PVC 63mm	2013					
Machinga	Chawinga (Chagwa)	Chawinga	30	GI 80mm & PVC 90mm	1976/2007	235	120	120	304	7
Zomba	Makhwawa S	Msakambidzi	150	GI 200mm	1968/2013	67	107	91	0	5
Phalombe	Sombani	Sombani	200	GI150mm	1979	300	237	96		12
Phalombe	Sakanena	Sakanena	15	GI 80mm	2007	41	41	41		2
Mulanje	Muloza Crator	Muloza Crator	50	GI 150mm	1979	100	82	6	71	4
Chikwawa	Mbadzi	Mbadzi	10	GI 100mm	1994/2013	0	47	40	15	2
	TOTAL					**1,360**	**1,257**	**700**	**946**	

Source: Compiled by the Consultant for this assignment based on field assessment

According to the data given in Table 7.5 the 16 Gravity Fed Schemes have got about 1,257 standpipes as obtained from the field assessment out of which 557 standpipes were not functional. It is assumed that after the rehabilitation works the standpipes will be put back into operational. When the non-functional standpipes under the category of schemes recommended for rehabilitation works and expansion as described above start functioning they will supply water to an estimated population of 57,639 apart from the expansion of the schemes which is described below. The functional standpipes under the schemes recommended for rehabilitation and expansion works during the field assessment supply water to a total population of 58,811. The total population to benefit from rehabilitation of non-functional stand pipes and functional ones would then be 116,450 people.

7.3.2 PROPOSED EXPANSION COMPONENTS

The GFS listed under Table 7.5 are also proposed for expansion works. While rehabilitation is done also expansion can be combined and the components of the schemes to be expanded can be assessed in detail during detail design works in preparation for construction works. For the purpose of planning the following components are in general proposed for expansion and/or rehabilitation works.

- All the schemes that have intake pipe size less 50mm diameter will be replaced by higher diameter pipe and those that are not wide enough compared to the flow will be provided with additional intake pipes
- Intake works, screening tanks, treatment plant (sedimentation, roughing filter and slow sand filter with chlorination), additional storage reservoirs, additional length of distribution networks and additional number of standpipes
- Number of standpipes will be increased based on the design criteria set and the water resources capacity

The average estimated flow of the rivers, from Annex II Surface Water Resources Assessment and Annex IV Field Assessment of Existing Gravity Fed Schemes Topical Reports is subject to further verification and larger intake pipes could be used provided the expansion works can be done without affecting the environmental flows and area to be served is available. Table 7.6 shows list of schemes with proposed intake pipes and number of standpipes to be added.

Table 7-6: List of Proposed Intake Pipes and Number of Standpipes

District	Name of Gravity scheme	Name of water source /river	Average Estimated flow (l/s)	Intake Pipe Size & Material		Number of CWPs		Number of Private connection	Estimated water used (l/s)
				Existing	Proposed	Current	Proposed		
Rumphi	Hewe	Hewe	200	GI 50mm	Pvc 160mm	55	200	0	3
Rumphi	Muhuju	Muhuju	15	Pvc 110mm	+Pvc 100mm	73	150	79	4
Rumphi	Ntchenachena	Lura	200	GI 80mm	+Pvc 200mm	182	360	0	9
Rumphi	Ng'onga	Ng'onga	100	GI 2x80mm	+Pvc 160mm	54	200	52	3
Chitipa	Nthalire	Choyoti &2 BHs	40	GI 50mm	Pvc 160mm	6	150	405	1
Chitipa	Chinunkha	Chiwula	40	GI 3X80mm &50mm	Pvc 160mm	44	150	20	2
Chitipa	Ifumbo	Itongo	40	GI 32mm	Pvc 160mm	35	150	0	2
Nkhatabay	Kalwe	Kalwe	7	GI 75 mm	+Pvc 100mm	3	75	0	0
Mangochi	Lingamasa	Luchichi	20	GI 150mm	Have got sufficient intake pipes	153	250	0	8
		Luchichi	20	GI 100mm				0	
		Pilipili	4	GI 75mm					1
Mangochi	Chowe	Uzuzu 1	3	PVC 63mm	Have got sufficient intake pipes	18	50	304	7
		Uzuzu 2	3	PVC 63mm					
		Liwaso	4	PVC 63mm					
Machinga	Chagwa	Chagwa	30	GI 80mm & Pvc 90mm	No new intake pipe	120	150		
Zomba	Makhwawa S	Msakambidzi	150	GI 200mm	No new intake pipe	107	400	0	5
Phalombe	Sombani	Sombani	200	GI150mm	+Pvc 160mm	237	400		12
Phalombe	Sakanena	Sakanena	15	GI 80mm	+Pvc 160mm	41	150		2
Mulanje	Muloza Crator	Muloza Crator	50	GI 150mm	No new intake pipe	82	200	71	4
Chikwawa	Mbadzi	Mbadzi	10	GI 100mm	No new intake pipe	47	80	15	2
						1,257	**3,115**	**946**	

Source: Compiled by the Consultant for this assignment based on field assessment

According Table 7.6 the 16 Gravity Fed Schemes proposed for expansion will have additional 3,115 standpipes when expanded. The proposed new standpipes when completed will supply water to an estimated population of 373,800 in addition to possible private connection beneficiaries. In other words the combined rehabilitated and existing standpipes plus the new additional standpipes from the 16 gravity fed schemes will serve a total population of 490,250.

7.4 POPULATION TO BE SERVED BY EXISTING GRAVITY FED SCHEMES

After assessing and review of the proposed rehabilitation and expansions works the total number of population that can be served by the existing schemes that are proposed to be rehabilitated by the community, proposed for minor rehabilitation works, major rehabilitations works and rehabilitation/expansion works are estimated. The estimate of population to be served is made for each scheme based on the average number of household users as obtained from field assessment and given

in Annex IV Field Assessment of Existing Gravity Fed schemes Topical report and number of private connections multiplied by average number of household size obtained from NSO (5.2, 4.7 and 4.4 persons/household for Northern, Central and Southern regions respectively). Table 7.7 shows the total number of population served from the different category of schemes described above. The population figures also include population served from private connections.

Table 7-7: Estimated Population that can be served by Existing & Expanded GFS

Schemes Category with	Number of standpipes			Total Population estimated			
	Functional	Rehabilitated	Expansion	Functional	Rehabilitated	Expansion	Total
No Rehabilitation	2,038	4,314	0	280,096	474,763	0	754,859
Minor rehabilitation	1,104	959	0	118,181	89,535	0	207716
Major rehabilitation	2,055	2,637	0	226,412	250,859	0	477271
Expansion & some rehabilitation works	700	557	3,115	58,811	57,639	373,800	490250
Total	**5,897**	**8,467**	**3,115**	**683,500**	**872,796**	**373,800**	**1,930,096**

Source: Compiled by the Consultant for this assignment

8 PROPOSED NEW POTENTIAL SCHEMES

8.1 SURFACE WATER BASED POTENTIAL NEW GRAVITY FED PIPED SCHEMES

The District Water Development Offices presented possible potential surface water sources that can be developed as new gravity fed schemes. The consultant also made assessment of some potential water sources from literatures, previous study documents and from field visit to existing schemes as depicted in Annex II Water Resources Assessment Topical Report.

According to the 2007 Investment Plan for Rural Water Supply about 12 schemes were proposed for construction between years 2000-2010. Attempt was made to identify these sites to assess the situation for further consideration in this Investment Planning process. However some schemes are found not attractive such as Ntchisi North, Masanje where there are no well protected catchment areas with potential surface water source while some of the other names were difficult to locate for instance Mzimba II, Salima North West, etc. even after consultation with the DWDOs. Therefore more concentration was made on the potential sites identified in consultation with the DWDOs in the field and during the consultative workshops as given in Annex II Surface Water Resources Assessment Topical Report. Those areas that are found not attractive however can be considered to be supplied by boreholes fitted with hand pumps and can be included during the implementation of the investment plan.

The other potential sources reported in the 2007 Investment Plan were the proposed multipurpose dams. The multipurpose dams are always available for development of gravity scheme provided they are implemented. The main challenge of the multipurpose dams is that their implementation requires huge amount of resources and needs coordination of multi sector institutions. Considering this potential dams for gravity fed schemes in the short to medium term planning makes it unrealistic considering the process required to implement the dams themselves as evidenced that they were not implemented as planned for in the 2007 Investment Plan. However the multipurpose dams could be considered for development of gravity fed schemes for rural water supply at any time during this planning period if their implementation or construction is realized during this planning period. It has to be noted that this document must be considered live document subject to necessary adjustment depending on conditions as time and events unfold.

According to information from field assessment for existing gravity schemes such as Zomba East and Jali market centre revealed that communities in Jali market centre prefer to take water from the gravity scheme instead of the reticulated groundwater system. The people from the market centre break the gravity line passing by the market centre to tap water instead of using water from the reticulated groundwater system. The situation is similar for Nkhamanga GFS where most of the households from Bolero market centre are having private connection from the gravity system. The main reason for such shift is the amount of money that the users pay being very high compared to that of the GFS tariff. It is therefore important to consider this situation during the feasibility study with respect to specific sites.

8.1.1 SURFACE WATER SOURCES FOR NEW GRAVITY FED SCHEMES

The potential surface water sources identified for development as new gravity fed schemes from Annex II Surface Water Resources Assessment Topical Report are 15 schemes. In addition it is assumed that water from Lake Malawi can be pumped to higher ground and then supply villages in lower areas. Districts along the Lake shore can pilot one scheme to supply identified villages particularly large villages and market centres such as Chitimba, Nyungwe and Kaporo in Karonga although they are also indicated in the reticulated borehole systems. However at this stage it was not possible to identify the villages by specific locations and this need to be done during project preparation stage. For the details of water quantity source estimates please refer to Annex II Water Resources Assessment Topical report.

As stated in Annex II Water Resources Assessment Topical Report prepared by the Consultant Chanyungu gravity fed scheme has to be constructed as new scheme since nothing can be salvaged from the old system and there is a third spring for Chididi that can be developed as new scheme. Detailed feasibility study and design must be carried out prior to implementation of the proposed schemes as the figures indicated in Table 8.1 are preliminary assessment results. The new gravity fed schemes and the possible arrangement from Lake Malawi is listed in Table 8.1.

Table 8-1: List of Proposed New Gravity Fed Schemes

No	District	Gravity Fed Scheme	Estimated mean min monthly flow (l/s)	Environmental release (10%)	Water to be abstracted (l/s)
1	Machinga	Chanyungu (planned as new)	10	1	9
2	Nsanje	Chididi (third spring)	3	0.3	2.7
3	Nkhatabay	Kaluwe	6	0.6	5.4
4	Nkhatabay	Chingwere	9	0.9	8.1
5	Chitipa	Kayilezi	5	0.5	4.5
6	Nkhotakota	Katonda Spring	0.5	0.05	0.45
	Nkhotakota	Aerodan spring	1	0.1	0.9
7	Zomba	Lisanjala (Upper Mulumbe)	5	0.5	4.5
8	Mwanza	Mkanto	8	0.8	7.2
9	Mulanje	Kamwendo*	21	2.1	16
	Pumping from Lake Malawi to feed communities along lakeshore districts of Karonga, Rumphi, Nkhata Bay, Nkhotakota, Salima, Dedza and Mangochi. It is assumed to pump 12l/s for each district and this figure is just taken arbitrarily for planning purpose			Detail assessment is required to select service areas, estimation of population to be served& amount of water to be pumped from the lake	

* there is already design to serve population of 27,600 under the 4 districts project funded by ADF
Source: Compiled by the Consultant for this assignment

8.1.2 POPULATION TO BE SERVED

The number of population to be served is dependent on the amount of water to be abstracted and availability of areas that can allow gravity flow to the population living in that particular area. Considering the available amount of water for abstraction and the design criteria set in Section 6 the number of population (design population) for the proposed new gravity scheme is estimated and is shown in Table 8.2.

Table 8-2: Estimation of Population to Be Served by the Proposed New Gravity Fed Schemes

No	District	Gravity Fed Scheme	Population 2012	Growth Rate (NSO)	Design (2020) Population
1	Machinga	Chanyungu	9,327	3.20%	12,000
2	Nsanje	Chididi	3257	2.60%	4000
3	Nkhatabay	Kaluwe	5,550	3.30%	7,200
4	Nkhatabay	Chingwere	8,330	3.30%	10,800
5	Chitipa	Kayilezi	3,878	2.70%	4,800
6	Nkhotakota	Katonda Spring	497	3.20%	640
	Nkhotakota	Aerodan	995	3.20%	1,280
7	Zomba	Lisanjala (Upper Mulumbe)	5,505	1.90%	6,400
8	Mwanza	Mkanto	8,522	1.50%	9,600
9	Mulanje	Kamwendo*	24,890	1.30%	27,600
10	Pumping of 12l/s for each district from Lake Malawi to feed communities along the lakeshore	Karonga	14,923	3.20%	19,200
		Rumphi	15,514	2.70%	19,200
		Nkhata Bay	14,923	3.20%	19,200
		Nkhotakota	14,923	3.20%	19,200
		Salima	15,157	3.00%	19,200
		Dedza	16,006	2.30%	19,200
		Mangochi	14,468	3.60%	19,200
Total population to be served from new schemes			**176,665**		**218,720**

* there is already design to serve population of 27,600 under the 4 districts project funded by ADF
Source: Compiled by the Consultant for this assignment

8.1.3 PROPOSED INTAKE AND CAPACITY

Experience from the existing gravity fed schemes have shown that most of the intakes are weir structures constructed across the rivers or streams and for spring sources it is protection concrete box. The intake pipes are then installed together with the intake structures to direct water to the supply areas. Similar types of intake structures are therefore appropriate and recommended for the proposed new schemes.

The intake from the Lake can be different types with pipes installed in the permanent water area of the Lake to avoid water level fluctuation in the Lake. The intake structure can be a concrete mass with pipe inserted and connected to it and pipe extending to the ground into a sump for pumping to the treatment plant and then to the supply areas. The water waves have to be taken into account in the design of the intake structure and the pipe on the Lake as this may cause pipe break if not properly submerged deep enough in the water.

The intake from the springs will consist of spring box made of concrete structure to store water and guide to the pipe inserted in the spring box intake. The box has to be constructed on the eye of the spring without affecting the direction of the spring natural flow.

The intake pipes will be installed from each source to abstract water and feed the next scheme component such as the screening structure or transmission/gravity line to treatment works. It is proposed to use uPVC pipes or DCI pipes or HDPE pipes depending on the soil condition of the intake area and the pipe line route. Table 8.3 shows the type of proposed intake pipe size and material and amount of water to be abstracted from the proposed sources.

Table 8-3: Proposed Type of Intake, Pipe Size and amount of Water to Abstract

No	District	Gravity fed scheme	Intake structure	Water abstract (l/s)	Pipe size/ material
1	Machinga	Chanyungu	weir across river	8	PVC160mm
2	Nsanje	Chididi	weir across river	2.5	PVC90mm
3	Nkhatabay	Kaluwe	weir across river	4.5	PVC110mm
4	Nkhatabay	Chingwere	weir across river	6.8	PVC160mm
5	Chitipa	Kayilezi	weir across river	3	PVC110mm
6	Nkhotakota	Katonda Spring	Spring box	0.4	DCI 80mm
	Nkhotakota	Aerodan	Spring box	0.8	DCI 80mm
7	Zomba	Lisanjala (Upper Mulumbe)	weir across river	4	PVC110mm
8	Mwanza	Mkanto	weir across river	6	PVC160mm
9	Mulanje	Kamwendo*	As designed	17.3	DCI 200mm
10	Pumping of 12l/s for each district from Lake Malawi to feed communities along the lakeshore	Karonga	Submerged concrete with intake piped embedded in it	12.0	DCI 150mm
		Rumphi		12.0	
		Nkhata Bay		12.0	
		Nkhotakota		12.0	
		Salima		12.0	
		Dedza		12.0	
		Mangochi		12.0	

* there is already design to serve population of 27,600 under the 4 districts project funded by ADF
Source: Compiled by the Consultant based on Water resources Topical report

8.1.4 PROPOSED SCHEME COMPONENTS AND TECHNOLOGY OPTIONS

Potential new gravity fed schemes can have the water supply system components arranged based on different conditions such as water quality, gravity or pumped flow, full conventional treatment or simple technology treatment methods, etc. The Consultant believe that the current practiced technology options in the rural areas are sufficient and simple to operate and manage by the users and did not recommend any sophisticated treatment methods for this purpose. However this can be looked into during the detailed design depending on the quality of raw water, water abstraction methods from the source, location of the intake and supply area, etc. For the purpose of this planning exercise and with the experience from existing schemes, the components that are considered for installation on the new schemes to supply water to the intended population are categorized as follows:

- Transmission main or gravity main sizes and lengths are determined depending on the amount of flow. Length of 0.2km is assumed per flow of 1l/s for preliminary design.
- All the schemes, except the spring sources will be provided with screening tanks, treatment plant (sedimentation, roughing filter and slow sand filter). The capacity of the structures will be related to the amount of flow and a scheme with a flow of 2l/s will have $10m^2$ of sedimentation tank, $8m^2$ roughing filter and $48m^2$ slow sand filters and each unit will have double compartment depending on the size of the scheme. These units will be considered as one main package for cost calculation based on the flow given in Table 4.4.
- The schemes that obtain water from the Lake Malawi will have pumping station with electric or fuel or solar or wind mill driven pumps and water being pumped to the treatment plant. The pump station will have sump or wet well of $10m^3$ capacity, operation room of $24m^2$, 2 pumps of 12l/s capacity at 100m head, transformer of 100kw and other necessary materials
- All the schemes will have storage capacity of 33% of the amount of flow from the source to the system.

- All the schemes, except the spring sources will have chlorination system installed for gravity feeding for continuous disinfection at a rate of 2ppm (2mg/l of flow) equivalent to 0.17kg/day for a flow of 1l/s.
- All distribution pipelines will have minimum diameter of 63mm uPVC pipe and can be as large as 200mm diameter of uPVC pipe and the length is estimated using the number of CWPs (one CWP is assumed to have 0.5km distribution network).
- Private connections are assumed to serve 40% of the population while Kiosks/Communal Water Points are assumed to serve 60% of the population (one connection for 6 persons and one Kiosk/CWP for 120 people) kiosks/communal water points being located not more than 500m maximum walking distance from the house.
- Office and store building for water users association with total area of 150m^2(100m^2 for office and 50m^2 for store).

Table 8.4 shows summary of the proposed schemes components based on the above descriptions or category of schemes.

Table 8-4: Summary of Scheme Components for the New GFS

No	District	Gravity fed scheme	Flow (l/s)	Intake pipe size	Main pipe line size	Pump station	Treatment works (pkg)	Chlorination (kg/day)	Storage tank(m^3)	Distribution	No. of CWP	Private connect
1	Machinga	Chanyungu	8	P160mm	1.6km 160mm	none	5	1.4	250	43km <160mm	85	427
2	Nsanje	Chididi	2.5	90mm	0.5km 90mm	none	2	0.5	100	13km <90mm	27	133
3	Nkhatabay	Kaluwe	4.5	110mm	0.9km 110mm	none	3	0.8	150	24km <110mm	48	240
4	Nkhatabay	Chingwere	6.8	160mm	1.4km 160mm	none	4	1.2	200	36km <160mm	72	360
5	Chitipa	Kayilezi	3	110mm	0.6km 110mm	none	2	0.6	100	16km <110mm	32	160
6	Nkhotakota	Katonda Spring	0.4	80mm	0.1km 63mm	none	none	rarely	10	2km =63mm	4	21
	Nkhotakota	Aerodan	0.8	80mm	0.16km 63mm	none	none	rarely	20	4km =63mm	9	43
7	Zomba	Lisanjala (Upper Mulumbe)	4.0	110mm	0.8km 110mm	none	2	0.7	150	21km <110mm	43	213
8	Mwanza	Mkanto	6.0	160mm	1.2km 160mm	none	3	1.0	200	32km <160mm	64	320
9	Mulanje	Kamwendo	17.3	200mm	3.5km 200mm	none	9	3.0	500	92km <200mm	185	923
10	Pumping of 12l/s for each district from Lake Malawi to feed communities along the lakeshore	Karonga	12.0	150mm for each area	2.4km 160mm for each area	Yes for each area as described above	7 for each area	2.1 for each area	350 for each area	64km<160mm for each area in the district	128 for each area	640 for each area
		Rumphi	12.0									
		Nkhata Bay	12.0									
		Nkhotakota	12.0									
		Salima	12.0									
		Dedza	12.0									
		Mangochi	12.0									

Source: Compiled by the Consultant

The scheme components described above are for planning purposes and further detailed feasibility study and design must be carried out prior to implementation of the proposed schemes as the figures indicated in Table 8.4 are preliminary conceptual arrangements. Due attention should be given in the use of Solar energy for the pumping system as there is sufficient sunshine in the lakeshore area.

Site specific feasibility study and detail designs have to be carried out to determine the appropriate sizes, locations, capacities and all other requirements for the construction works including preparation of construction design drawings and contract documents. The proposed schemes in Nkhotakota Districts seem to be small but this can be verified during feasibility study and decision can be made to either consider developing or dropping them.

Special attention must be paid to the system from Lake Malawi as this may require some sophisticated components for the system and capacity to operate and maintain as rural water supply system resulting in probably higher water tariffs to sustain the operation and maintenance works. The use of solar energy driven pumps has be considred which would minimize the operation and maintenance cost thereby resulting in lower tariff to be covered by beneficiaries. The use of convention treatment system may be required to treat the water from the Lake and this must be assessed during the feasibility study.

8.1.5 POTENTIAL NEW GRAVITY FED SCHEMES PRESENTED BY THE DISTRICTS

The DWDOs were requested during the consultative workshops to come up with suggestions and proposal for new potential sites for gravity fed schemes within their respective districts. Most of the districts came up with long list of possible water sources, some listing all rivers flowing in the district, and discussed during the workshops that the consultant will further assess their list and suggest actions to be taken. Accordingly the suggested and proposed sites were studied by the consultant and recommendations were made based on the assessment of water resources from documents, maps and catchment conditions to further conduct prefeasibility studies to some of the sites. Among the potential gravity fed schemes proposed by the districts those shown in Table 8.5 are recommended for pre-feasibility study as possible potential sites.

Table 8-5: Potential New GFS Presented by DWDO & Recommended for Prefeasibility Study

No	District	Proposed GFS	Sub basin/River	Estimated Mean Min monthly sub basin unit runoff (l/s/km^2)
1	Kasungu	Kasungu North East in Nkhamenya area in TA Kaluluma	Luwelezi	1.0
2	Mchinji	GVH Kazyozyo in T.A Mkanda	Bua/Luwelezi	1.0
3	Chitipa	Matipwa	Lufira	3.3
4	Chitipa	Chilughi	Sofwe	2.1
5	Chitipa	Miwanga and	North Rukuru	5.7
6	Chitipa	North Rukuru	North Rukuru	5.7
7	Rumphi	Chiweta/Chitemba	North Rumphi	15.3
8	Rumphi	Bowe	Kantizi	2.4
9	Rumphi	Mwazisi	Luviri	2.4
10	Karonga	Mwirang'ombe	Karonga Lakeshore	3.2
11	Karonga	Kyungu	Karonga lakeshore	3.2
12	Nkhatabay	Mzenga	Nkhatabay Lakeshore	5
13	Nkhatabay	Mndola-Khoza	Nkhatabay Lakeshore	5
14	Mzimba	Kasitu river in TA Kampingo Sibande	Kasitu	1
15	Mzimba	Kasangazi river – Kampingo Sibande	Kasitu	1
16	Mzimba	Kachere River in Khosolo	Rupashe	5.7
17	Mzimba	Msambanyifwa river in Khosolo	Rupashe	5.7
18	Mzimba	Lupache River in Khosolo, Kabuwa area	Rupashe	5.7
19	Mulanje	Kamwendo	Thuchila	2.7
20	Neno	Mfundazi River in TA Dambe up to TA Mlauli	Wamkurumadzi	2.6
21	Neno	Mwetang`ombe River in TA Dambe up to TA Chekucheku	Wamkurumadzi	2.6
22	Neno	SC Symon and Wamkurumadzi also in TA Dambe up to TA Chekucheku	Wamkurumadzi	2.6
23	Thyolo	Thangazi	Kalulu Forest Reserve	2.9
24	Thyolo	Manyali	Thyolo Mountain	2.9

Source : Proposed by DWDO at Consultative workshop and compiled by the Consultant

8.2 GROUND WATER BASED SCHEMES

The groundwater based schemes are classified into two as follows:

- Boreholes fitted with hand pumps to supply water on spot.
- Boreholes drilled and fitted with submersible pumps and reticulated to supply water through private connections and kiosks

The boreholes fitted with hand pumps as stated above will serve small communities in rural areas where there are no gravity fed schemes and reticulated borehole systems are not sustainable due to costs and smaller number of users. New boreholes fitted with hand pumps will be installed and are the major source of water supply to rural areas and are provided in areas where there will be no gravity fed schemes and groundwater based reticulated systems. A borehole fitted with hand pump, apart from shallow wells fitted with hand pumps, is the basic type of scheme to be provided to supply water to rural communities where groundwater source is available without considering its financial viability.

The ground water based reticulated system can be used to supply water to market centres and even scattered settlements of rural areas. The cost of energy/power is the main concern and as a result the tariff rate which could be on higher side on the rural population whose livelihood is mainly based on agricultural produces only could not be affordable. On the other hand people living in market centre areas have different income sources such as agriculture and business and could afford higher water tariff rates. The experience so far showed that groundwater based pumped and reticulated systems is provided to market centres such as the Seven Market Centres project implemented by NWDP under the AusAid finance.

8.2.1 GROUND WATER SOURCES BASED NEW RETICULATED SCHEMES

The groundwater based new reticulated schemes are proposed mainly for market centres that are not covered by gravity schemes or water boards. The market centres for this technology options are also selected based on the availability of groundwater potential in the market centre areas as described in Annex II Water Resources Assessment Topical Report. The National Water Resources Master Plan study by CTI in the Progress Report 3 of January 2014 provided exhaustive list of market centres in the country with their water supply status. The market centres proposed to be incorporated in the investment plan for rural water supply are picked from the CTI list by superimposing the groundwater potential areas for piped system and those market centres that fit to the potential areas. In addition some market centres are also picked for possible ground water based reticulated system and these market centres would be considered in the next planning phase.

In general 74 market centres are proposed for reticulated system by superimposing on the potential aquifer areas as provided in Annex II Water Resources Assessment Topical Report. Out of the 74 market centres about 32 are proposed for ground water source based reticulated water supply system due to mainly the size of the population in the centres and current water supply condition which is mainly from boreholes fitted with hand pumps.

The 32 market centres are assessed for possibility of being supplied water from potential groundwater in each market centre area and information regarding aquifer type, borehole depth and estimated yield per borehole are also provided. Areas like Euthini and Mbalachanda in Mzimba districts have been mentioned by the district water office as areas that require borehole based reticulation system. Such centres in general fall in areas where the aquifer potential is low as compared to the demand of the areas. However this need to be investigated thoroughly during detailed study and investigation of groundwater in those particular areas to confirm the potential. In general it has to be noted that feasibility study and detail designs based on proper investigation through test drilling need to be carried out prior to start of the implementation works. Table 8.6 shows list of market centres to be provided water from groundwater with reticulated system including aquifer type and estimated depth of a borehole and average yield per borehole as depicted in Annex II Groundwater Resources Assessment Topical report.

Table 8-6: List of Market Centres Proposed for Borehole Based Reticulation System

S.No	District	Market Centre	Aquifer Type in the area	Estimated Average BH Depth (M)	Estimated Yield Per Borehole (L/S)
1	Karonga	Chitimba	Quaternary Sediment Aquifer	55	4
2	Karonga	Nyungwe	Quaternary Sediment Aquifer	55	3
3	Karonga	Kaporo	Quaternary Sediment Aquifer	50	3
4	Nkhatabay	Mzenga	Quaternary Sediment Aquifer	50	2
5	Nkhatabay	Kandeu	Quaternary Sediment Aquifer	45	4
6	Nkhatabay	Mpamba	Quaternary Sediment Aquifer	45	3
7	Rumphi	Mphompha	River Valley Sediment Aquifer	50	4
8	Mzimba	Edingeni	Weathered Basement Aquifer	40	2
9	Mzimba	Embangweni	Weathered Basement Aquifer	40	2
10	Mzimba	Kafukule	Weathered Basement Aquifer	40	2
11	Mzimba	Jenda	Weathered Basement Aquifer	40	2
12	Kasungu	Chamama	Weathered Basement Aquifer	45	3
13	Ntchisi	Malomo	Weathered Basement Aquifer	45	3
14	Dowa	Mvera	Quaternary Sediment Aquifer	50	3
15	Salima	Thavite	Quaternary Sediment Aquifer	50	3
16	Lilongwe	Namitete	Weathered Basement Aquifer	45	2
17	Mchinji	Kapiri	Weathered Basement Aquifer	45	2
18	Dedza	Mtakataka	Quaternary Sediment Aquifer	50	3
19	Dedza	Mayani	Weathered Basement Aquifer	50	2
20	Dedza	Golomoti	Quaternary Sediment Aquifer	50	3
21	Ncheu	Senzani	Weathered Basement Aquifer	50	2
22	Ncheu	Bwanje	Weathered Basement Aquifer	50	2
23	Mangochi	Malindi	Quaternary Sediment Aquifer	50	3
24	Mangochi	Chilipa	Weathered Basement Aquifer	45	2
25	Balaka	Phalula	Quaternary Sediment Aquifer	50	3
26	Balaka	Ulongwe	Quaternary Sediment Aquifer	50	3
27	Machinga	Nayuchi	Quaternary Sediment Aquifer	55	4
28	Zomba	Mayaka	Quaternary Sediment Aquifer	55	4
29	Mwanza	Thambani	Weathered Basement Aquifer	40	3
30	Thyolo	Thekerani	Quaternary Sediment Aquifer	50	3
31	Thyolo	Bvumbwe	Quaternary Sediment Aquifer	50	3
32	Nsanje	Marka	Weathered Basement Aquifer	40	2

Source: Compiled by the Consultant from Groundwater Resources Assessment Topical Report

8.2.2 POPULATION TO BE SERVED

The market centres listed in Table 8.6 are proposed to be provided by reticulated water supply system from pumped boreholes. The population of the market centres are estimated based on the NSO 2008 census and from the data given in different study documents for the year 2012 such as the Water Resources Master Plan study by CTI consultant. Projected population of the market centres is shown in Table 8.7. The number of boreholes required is also estimated for each market centre based on the yield per borehole as indicated in Table 8.6 above and in Annex II Water Resources Assessment Technical Report. Table 8.7 also shows the number of boreholes required by taking into account the 2020 design population and the per capita water demand set in Section 6.

Table 8-7: Projected Population & Proposed Number of Borehole for each Market Centres

S.No	District	Market Centre	Population			Yield /BH (l/s)	Required no. of BHs
			2012	2013	Design 2020		
1	Karonga	Chitimba	3,957	4,084	5,076	4	2
2	Karonga	Nyungwe	2,573	2,656	3,300	3	2
3	Karonga	Kaporo	4,218	4,354	5,410	3	3
4	Nkhata-Bay	Mzenga	8,710	8,985	11,250	2	7
5	Nkhata-Bay	Kandeu	1,079	1,113	1,394	4	1
6	Nkhata-Bay	Mpamba	9,228	9,519	11,919	3	5
7	Rumphi	Mphompha	4,886	5,021	6,045	4	2
8	Mzimba	Edingeni	5,503	5,665	6,995	2	5
9	Mzimba	Embangweni	5,498	5,660	6,988	2	5
10	Mzimba	Kafukule	2,500	2,574	3,178	2	3
11	Mzimba	Jenda	3,089	3,180	3,926	2	3
12	Kasungu	Chamama	7,400	7,695	10,076	3	4
13	Ntchisi	Malomo	4,200	4,346	5,581	3	2
14	Dowa	Mvera	3,968	4,151	5,420	3	2
15	Salima	Thavite	1,460	1,506	1,832	3	2
16	Lilongwe	Namitete	6,891	7,055	8,543	2	6
17	Mchinji	Kapiri	5,645	5,849	7,487	2	5
18	Dedza	Mtakataka	6,369	6,517	7,662	3	4
19	Dedza	Mayani	5,039	5,156	6,062	2	5
20	Dedza	Golomoti	6,400	6,549	7,700	3	4
21	Ncheu	Senzani	5,335	5,484	6,605	2	5
22	Ncheu	Bwanje	4,138	4,253	5,123	2	4
23	Mangochi	Malindi	6,800	7,037	9,021	3	5
24	Mangochi	Chilipa	2,108	2,181	2,797	2	2
25	Balaka	Phalula	7,291	7,522	9,437	3	5
26	Balaka	Ulongwe	5,310	5,478	6,873	3	4
27	Machinga	Nayuchi	3,200	3,298	4,109	4	2
28	Zomba	Mayaka	3,400	3,463	3,942	4	2
29	Mwanza	Thambani	4,200	4,268	4,739	3	3
30	Thyolo	Thekerani	4,087	4,150	4,700	3	3
31	Thyolo	Bvumbwe	8,800	8,936	10,120	3	5
32	Nsanje	Marka	3,030	3,102	3,695	2	3
	Total Population		**156,312**	**160,807**	**197,005**		**115**

Source: Compiled by the Consultant

Population to be served by boreholes fitted with hand pumps in each district to fill the gap of gravity fed and reticulated borehole schemes are given in Section 9.

8.2.3 PROPOSED GROUNDWATER BASED RETICULATED SCHEME COMPONENTS

For the purpose of this planning exercise and with the experience from existing schemes for market centers, the components that are considered for installation on the new borehole based reticulated schemes to supply water to the intended population will have the following components as major structures:

1. Boreholes drilled to the required depth, cased, gravel packed and developed
2. Riser pipe of GI pipe with appropriate diameter and length to be installed in each borehole. GI 65mm for 2 l/s, GI 80mm for 3-4 l/s yielding boreholes and length of 2/3 of the depth of the borehole
3. Submersible pump of required discharge and head. Head is calculated by adding 2/3 of borehole depth and additional 50 m head to storage tank on average.
4. Transmission main or gravity main sizes and lengths are determined depending on the amount of flow. Length of 0.2 km is assumed per flow of 1 l/s from experience for planning purpose
5. All the schemes will have storage capacity of 33% of the amount of flow from the source to the system.
6. All the schemes, except the spring sources will have chlorination system installed for gravity feeding for continuous disinfection at a rate of 2 ppm (2 mg/l of flow) equivalent to 0.17 kg/day for a flow of 1 l/s or 1 kg/day for 5.9 l/s flow.
7. All distribution pipelines will have minimum diameter of 63mm uPVC pipe and can be as large as 160 mm diameter of uPVC pipe and the length is estimated using the number of CWPs (one CWP is assumed to have 0.5km distribution network).
8. Private connections are assumed to serve 40% of the population while Kiosks/Communal Water Points are assumed to serve 60% of the population (one connection for 6 persons and one Kiosk/CWP for 120 people) kiosks/communal water points being located not more than 500m maximum walking distance from the house
9. Transformer, cables and poles for power supply to the borehole site and 12m^2 area of office/ control/ operation room. The use of solar energy driven pumps has be considred to minimize O&M cost thereby resulting in lower tariff to be covered by beneficiaries.
10. Office and store building for Water Users Association with total area of 150 m^2 (100 m^2 for office and 50 m^2 for store).
11. Standard fence of 150 m perimeter of brick with gate around the borehole

Since the market centers listed above have varying population figures and located in different groundwater aquifer zones the information in Table 8.6 is superimposed with Table 8.7 to determine the required number of boreholes to serve the design population of 2020. The number, size and capacity of the other water supply system components are also established based on the total water demand and the number of boreholes to be drilled for each market centre. Please note that the figures and estimations and conditions stated here are for planning purposes. Detailed study and assessment with proper design has to be made for each market centre for implementation of the water supply system. The proposed water supply system components for each market centre are provided in Table 8.8 below.

Table 8-8: Summary of Scheme Components for the New Borehole Based Reticulation Schemes

S.No	District	Market Centre	BH required	Submersible pump/BH		Riser pipe		Transmission main		Reservoir Capacity	Chlorination	Distribution		Kiosks / CWP	Private connect
			No.	Q (l/s)	Head (m)	Diam (mm)	Length (m)	Diam (mm)	Length (m)	(m^3)	(kg/day)	Diam (mm)	Length (m)	No.	No.
1	Karonga	Chitimba	2	4	86	80	46	160	1.6	200	1.4	63-160	13	25	338
2	Karonga	Nyungwe	2	3	86	65	46	110	1.2	150	1.1	63-110	8	17	220
3	Karonga	Kaporo	3	3	83	80	43	160	1.8	200	1.6	63-160	14	27	361
4	Nkhatabay	Mzenga	7	2	83	65	43	160	2.8	350	2.4	63-160	28	56	750
5	Nkhatabay	Kandeu	2	4	80	80	40	90	0.8	100	0.7	63-110	3	7	93
6	Nkhatabay	Mpamba	5	3	80	80	40	160	3.0	350	2.6	63-160	30	60	795
7	Rumphi	Mphompha	2	4	83	80	43	160	1.6	200	1.4	63-160	15	30	403
8	Mzimba	Edingeni	5	2	76	65	36	160	2.0	250	1.7	63-160	17	35	466
9	Mzimba	Embangweni	5	2	76	65	36	160	2.0	250	1.7	63-160	17	35	466
10	Mzimba	Kafukule	3	2	76	65	36	110	1.2	150	1.1	63-110	8	16	212
11	Mzimba	Jenda	3	2	76	65	36	110	1.2	150	1.1	63-110	10	20	262
12	Kasungu	Chamama	4	3	80	80	40	160	1.2	300	2.1	63-160	25	50	672
13	Ntchisi	Malomo	2	3	80	80	40	110	1.2	150	1.1	63-110	14	28	372
14	Dowa	Mvera	2	3	83	80	43	110	1.2	150	1.1	63-110	14	27	361
15	Salima	Thavite	2	3	83	80	43	110	1.2	150	1.1	63-110	5	9	122
16	Lilongwe	Namitete	6	2	80	65	40	160	2.4	300	2.1	63-160	21	43	570
17	Mchinji	Kapiri	5	2	80	65	40	160	2.0	250	1.7	63-160	19	37	499
18	Dedza	Mtakataka	4	3	83	80	43	160	2.4	300	2.1	63-160	19	38	511
19	Dedza	Mayani	5	2	83	65	43	160	2.0	250	1.7	63-160	15	30	404
20	Dedza	Golomoti	4	3	83	80	43	160	2.4	300	2.1	63-160	19	39	513
21	Ncheu	Senzani	5	2	83	65	43	160	2.0	250	1.7	63-160	17	33	440
22	Ncheu	Bwanje	4	2	83	65	43	160	1.6	200	1.4	63-160	13	26	342
23	Mangochi	Malindi	5	3	83	80	43	160	2.0	350	2.6	63-160	23	45	601
24	Mangochi	Chilipa	2	2	80	65	40	90	0.8	100	0.7	63-110	7	14	186
25	Balaka	Phalula	5	3	83	80	43	160	2.0	350	2.6	63-160	24	47	629
26	Balaka	Ulongwe	4	3	83	80	43	160	2.4	300	2.1	63-160	17	34	458
27	Machinga	Nayuchi	2	4	86	80	46	160	1.6	200	1.4	63-160	10	21	274
28	Zomba	Mayaka	2	4	86	80	46	160	1.6	200	1.4	63-160	10	20	263
29	Mwanza	Thambani	3	3	76	80	36	160	1.8	200	1.6	63-160	12	24	316
30	Thyolo	Thekerani	3	3	83	80	43	160	1.8	200	1.6	63-160	12	24	313
31	Thyolo	Bvumbwe	5	3	83	80	43	160	3.0	350	2.6	63-160	25	51	675
32	Nsanje	Marka	3	2	76	65	36	110	1.2	150	1.1	63-110	9	18	246

Source: Compiled by the Consultant

9 FACILITIES REQUIRED TO ACHIEVE TARGETS SET BY 2014-2020

9.1 INTRODUCTION

The planned and proposed schemes to be implemented during the planning period from 2014 to 2020 are identified as presented in Section 7 and 8 above. These proposed schemes are assessed if they can cover the targets set in Section 6 together with the current water supply facilities specially the existing boreholes and shallow wells fitted with hand pumps, protected springs and gravity fed schemes. The following are additional facilities to be implemented in phases during the planning period in order to achieve the set targets during the different years of the planning period.

The check list for the proposed activities for each scheme and the cost estimate is provided in the Appendix to this report. The check list will help in planning and identifying those activities that are implemented and those that are pending.

9.2 PLANNED FACILITIES TO ACHIEVE TARGETS SET BY 2015

To achieve the 2015 access of 83% it is proposed to implement during 2014 and 2015 the following:

- It is important to sustain the functionality level of all existing water supply facilities by the community and the water facilities management institutions such as WUAs
- Rehabilitation of existing 75% of the non-functional existing boreholes fitted with hand pumps
- Rehabilitation and replacement of non-functional standpipes by scheme management committees and community that are under the schemes proposed for rehabilitation works by the community with the support from the DWDO and other stakeholders
- Rehabilitation of facilities and replacement of non-functional standpipes for gravity fed schemes proposed under minor rehabilitation works
- Drilling of additional new boreholes fitted with hand pumps to fill the gaps

Some districts have already achieved the set target of 83% or above while some are very much lower than set target levels. On the other hand about 90% target rate will be achieved at national level by doing the rehabilitation works shown in Table 9.1. Therefore districts that have lower coverage rate require drilling of new boreholes to achieve the 83% target at district level in order to push them up so that the coverage would be more or less uniform at the end of the planning period, by 2020.

The activities will be implemented during the period of 2014 and 2015. Table 9.1 shows target population and schemes to be provided to achieve the 83% target by 2015.

Table 9-1: Planned Access to Water Supply by 2015 by Rehabilitation & New BH by District

S. Nr.	District	Population 2015		BH to rehabilitated		GFS taps for rehab by mgt		GFS taps for minor rehab		New BH to be drilled		To be served	
		Total	Target (83%)	No. of BH	Pop served	No. of Taps	Pop Served	No. of Taps	Pop Served	No.	Pop Served	Population	Access (%)
1	Chitipa	199,025	165,191	52	10,400	38	4,337	-	-	-	-	157,276	79%
2	Karonga	287,018	238,225	165	33,000	0	-	29	3,016	-	-	274,412	96%
3	Nkhatabay	255,018	211,665	81	16,200	133	18,070	55	4,576	20	5,000	184,834	72%
4	Rumphi	186,976	155,190	294	58,800	24	1,102	125	6,063		-	194,354	104%
5	Mzimba	869,722	721,869	385	77,000	0	-	79	5,595	50	12,500	753,844	87%
6	Likoma	9,094	7,548	0	-	0	-	-	-	-	-	7,876	87%
7	Kasungu	774,085	642,490	145	29,000	0	-	-	-	400	100,000	567,869	73%
8	Nkhotakota	348,575	289,317	262	52,400	0	-	-	-		-	357,714	103%
9	Ntchisi	275,825	228,935	172	34,400	0	-	-	-	50	12,500	244,084	88%
10	Dowa	757,892	629,050	190	38,000	0	-	-	-	500	125,000	540,212	71%
11	Salima	384,874	319,445	68	13,600	0	-	-	-	50	12,500	318,179	83%
12	Lilongwe	1,455,501	1,208,066	603	120,600	0	-	-	-	400	100,000	1,174,538	81%
13	Mchinji	566,479	470,178	168	33,600	0	-	-	-	150	37,500	449,013	79%
14	Dedza	711,573	590,606	325	65,000	40	5,076	89	10,458	-	-	683,670	96%
15	Ntcheu	554,791	460,476	388	77,600	0	-	21	3,455	-	-	502,114	91%
16	Mangochi	952,221	790,344	117	23,400	0	-	-	-	-	-	864,753	91%
17	Machinga	578,246	479,945	305	61,000	415	36,520	191	20,574	-	-	473,542	82%
18	Zomba	660,896	548,544	177	35,400	0	-	45	5,940		-	634,632	96%
19	Chiradzulu	315,733	262,058	303	60,600	0	-	-	-		-	336,514	107%
20	Blantyre R	398,835	331,033	310	62,000	0	-	-	-		-	380,519	95%
21	Mwanza	88,212	73,216	41	8,200	18	2,068	-	-		-	81,956	93%
22	Thyolo	623,449	517,463	151	30,200	0	-	195	12,720	-	-	492,891	79%
23	Mulanje	556,392	461,806	137	27,400	2103	250,026	63	11,242		-	769,026	138%
24	Phalombe	367,699	305,190	220	44,000	145	12,760	67	5,896		-	405,155	110%
25	Chikwawa	525,135	435,862	211	42,200	408	35,904	-	-		-	500,527	95%
26	Nsanje	257,691	213,883	159	31,800	0	-	-	-		-	263,698	102%
27	Balaka	368,012	305,450	137	27,400	990	108,900	-	-		-	438,885	119%
28	Neno	148,523	123,274	27	5,400	0	-	-	-	-	-	109,888	74%
	Total	**13,477,491**	**11,186,318**	**5,593**	**1,118,600**	**4,314**	**474,763**	**959**	**89,535**	**1,620**	**405,000**	**12,161,971**	**90%**
			83%									90%	

Source: Compiled by the Consultant for this study

Drilling of new boreholes fitted with hand pumps is proposed only for eight districts to bust their coverage which is very low compared to the other districts currently so that the set targets at the end of the planning period would be achieved. From Table 9.1 there are still districts below the set targets but it is assumed that the coverage for these districts will be at the same level with the planned target by the end of the planning period. This approach is followed in all the planning process of the facilities considering the distribution of resources and its utilization to be as effective as possible and value for money is achieved throughout the planning period. The number of new boreholes fitted with hand pumps seem to be on the higher side but unless emergency and tuff action is taken it would be difficult to achieve the end result which is meeting the set targets at the end of the planning period year 2020.

9.3 PLANNED FACILITIES TO ACHIEVE TARGETS SET BY 2017

To achieve the 2017 access of 85% it is proposed to implement during 2016 and 2017 the following activities:

- It is important to sustain the functionality level of all existing water supply facilities by the community and the water facilities management institutions such as WUAs

- Rehabilitation of facilities and replacement of non-functional standpipes of gravity fed schemes proposed for major rehabilitation
- Rehabilitation of facilities and replacement of non-functional standpipes for gravity fed schemes proposed under rehabilitation and expansion works
- Implementation of groundwater based reticulated water supply system for 17 market centers out of the 32 during this period
- Drilling of additional new boreholes fitted with hand pumps to fill the gaps

These activities will be implemented during the period of 2016 and 2017 after the completion of the implementation of the proposed activities for the period 2014 and 2015 described in Section 9.1. It is important that preparatory works such as feasibility study and detailed designs be prepared in advance to start the works as planned. Table 9.2 shows target population and schemes to be provided to achieve the 85% target set by the year 2017.

Table 9-2: Planned Access to Water Supply by 2017 by Rehabilitation & New BH by District

S. Nr.	District	Population 2017		BH New		Major Rehab GFS		Rehab/Expan GFS		Market Centre New			To be served	
		Total	Target (85%)	No.	Pop served	No. of Taps	Pop Served	Rehab Exist Taps	Pop served	No. Mrkt	No. of motor BH	Pop Served	Population	Access (%)
1	Chitipa	209,870	178,390	0	-	243	35,724	59	6,864	-	-	-	193,000	92%
2	Karonga	305,417	259,604	0	-	356	26,905	-	-	-	-	-	301,316	99%
3	Nkhatabay	271,970	231,175	30	7,500	0	-	3	282	3	13	24,467	216,801	80%
4	Rumphi	197,231	167,647	0	-	0	-	142	12,230	-	-	-	194,354	99%
5	Mzimba	923,688	785,135	200	50,000	278	39,281	-	-	2	8	10,189	853,314	92%
6	Likoma	9,118	7,750	0	-	0	-	-	-	-	-	-	7,876	86%
7	Kasungu	836,138	710,717	500	125,000	0	-	-	-	1	4	10,055	702,923	84%
8	Nkhotakota	371,197	315,518	0	-	19	3,126	-	-	-	-	-	360,840	97%
9	Ntchisi	294,829	250,605	80	20,000	0	-	-	-	1	2	5,475	269,559	91%
10	Dowa	824,272	700,631	500	125,000	0	-	-	-	1	2	5,486	670,698	81%
11	Salima	408,348	347,096	100	25,000	77	4,747	-	-	1	2	1,849	349,774	86%
12	Lilongwe	1,526,971	1,297,925	500	125,000	0	-	-	-	1	6	8,380	1,307,918	86%
13	Mchinji	607,945	516,753	250	62,500	113	6,815	-	-	1	5	7,476	525,804	86%
14	Dedza	745,145	633,374	0	-	0	-	-	-	-	-	-	683,670	92%
15	Ntcheu	585,122	497,354	30	7,500	334	42,347	-	-	-	-	-	551,961	94%
16	Mangochi	1,022,061	868,752	0	-	0	-	113	17,402	2	7	11,859	876,612	86%
17	Machinga	615,535	523,205	150	37,500	0	-	-	-	1	2	4,129	515,172	84%
18	Zomba	685,755	582,892	0	-	685	42,566	16	563	1	2	3,947	681,144	99%
19	Chiradzulu	324,377	275,720	0	-	0	-	-	-	-	-	-	336,514	104%
20	Blantyre R	417,453	354,835	0	-	0	-	-	-	-	-	-	380,519	91%
21	Mwanza	90,912	77,275	0	-	0	-	-	-	-	-	-	81,956	90%
22	Thyolo	645,778	548,911	150	37,500	97	8,536	-	-	2	8	14,921	553,848	86%
23	Mulanje	571,216	485,534	0	-	0	-	76	8,360	-	-	-	769,026	135%
24	Phalombe	387,185	329,107	0	-	392	34,496	141	11,167	-	-	-	439,651	114%
25	Chikwawa	557,180	473,603	50	12,500	43	6,288	7	770	-	-	-	519,314	93%
26	Nsanje	270,823	230,199	0	-	0	-	-	-	-	-	-	263,698	97%
27	Balaka	392,627	333,733	0	-	0	-	-	-	-	-	-	438,885	112%
28	Neno	163,116	138,649	80	20,000	0	-	-	-	-	-	-	129,888	80%
	Total	**14,261,280**	**12,122,088**	**2,620**	**655,000**	**2,637**	**250,829**	**557**	**57,639**	**17**	**61**	**108,232**	**13,176,033**	**92%**
			85%										92%	

Source: Compiled by the Consultant for this study

As can be seen from Table 9.2 some districts will have already achieved over the set target of 85% or above while some will very much remain lower than the set target levels by the end of 2017. On the

other hand about 92% access rate will be achieved at national level by doing the rehabilitation works and drilling of the new boreholes fitted with hand pumps as well as reticulated boreholes for seventeen market centres as shown in Table 9.2. Therefore districts that have lower access rate require drilling of more new boreholes fitted with hand pumps to achieve at least 80% and above target at district level in order to push them up so that the coverage would be 85%, which would make it more or less uniform at the end of the planning period, by 2020.

Drilling of new boreholes fitted with hand pumps is proposed for thirteen districts to bust their level of coverage which is very low compared to the other districts so that the set targets at the end of the planning period would be achieved. From Table 9.2 there are still districts below the set targets but it is assumed that the coverage for these districts will be at the same level with the set target by the end of the planning period by 2020.

9.4 PLANNED FACILITIES TO ACHIEVE TARGETS SET BY 2020

To achieve the 2020 access of 90% it is proposed to implement the following activities during 2018 and 2020:

- It is important to sustain the functionality level of all existing water supply facilities by the community and the water facilities management institutions such as WUAs
- Expansion of scheme and implementation of additional standpipes for gravity fed schemes proposed under rehabilitation and expansion works
- Implementation of the proposed new gravity fed schemes and the pumped system from Lake Malawi
- Implementation of groundwater based reticulated water supply system for 15 market centers out of the 32 during this period
- Drilling of additional new boreholes fitted with hand pumps to fill the gaps

These activities will be implemented during the period from 2018 to 2020 after the completion of the implementation of the proposed activities for the period 2016 and 2017 described in Section 9.3. It is important that preparatory works such as feasibility studies and detailed designs be prepared in advance to start the works as planned. Table 9.3 shows target population and schemes to be provided to achieve the 90% target set by the year 2020.

As can be seen from Table 9.3 all the districts will achieve the set target of 90% or above by the end of 2020. On the other hand about 95% target rate will be achieved at national level by doing the expansion works for existing gravity schemes, implementing the new proposed gravity schemes and pumped system from Lake Malawi, drilling of some new boreholes fitted with hand pumps as well as reticulated boreholes for fifteen market centres as shown in Table 9.3.

Drilling of new boreholes fitted with hand pumps is proposed for sixteen districts to bring their coverage level which is lower compared to the set targets at the end of the planning period. From Table 9.3 there would be no districts that would have their coverage level below the set targets of 90% which is the planned or set target by the end of 2020.

Table 9-3: Planned Access to Water Supply by 2020, Expansion & New Facilities by District

S. Nr.	District	Population 2020		BH New		Expansion GFS		New GFS		Market Centre New			To be served	
		Total	Target (85%)	No.	Pop served	No. of Taps	Pop Served	New Taps	Pop served	No. Mrkt	No. of motor BH	Pop Served	Population	Access (%)
1	Chitipa	226,811	204,130	0	0	450	54,000	32	4,800	-	-	-	247,063	109%
2	Karonga	335,082	301,574	0	0	-	-	128	19,200	3	7	13,759	334,275	100%
3	Nkhatabay	299,515	269,563	30	7500	75	9,000	249	37,200	-	-	-	260,881	90%
4	Rumphi	213,235	191,912	0	0	910	109,200	128	19,200	1	2	6,010	328,763	154%
5	Mzimba	1,011,836	910,653	200	50000	-	-	-	-	2	8	10,932	914,246	90%
6	Likoma	9,157	8,241	2	500	-	-	-	-	-	-	-	8,376	91%
7	Kasungu	938,262	844,436	550	137500	-	-	-	-	-	-	-	840,423	90%
8	Nkhotakota	408,221	367,399	0	0	-	-	141	21,120	-	-	-	381,960	94%
9	Ntchisi	325,577	293,019	100	25000	-	-	-	-	-	-	-	294,559	90%
10	Dowa	930,611	837,550	650	162500	-	-	-	-	-	-	-	833,198	90%
11	Salima	446,092	401,483	130	32500	-	-	128	19,200	-	-	-	401,474	90%
12	Lilongwe	1,643,430	1,479,087	700	175000	-	-	-	-	-	-	-	1,482,918	90%
13	Mchinji	675,609	608,048	320	80000	-	-	-	-	-	-	-	605,804	90%
14	Dedza	799,153	719,238	0	0	-	-	128	19,200	3	13	21,453	715,746	90%
15	Ntcheu	633,281	569,953	30	7500	-	-	-	-	2	9	11,698	573,133	91%
16	Mangochi	1,138,378	1,024,540	350	87500	300	36,000	128	19,200	-	-	-	1,019,312	90%
17	Machinga	677,468	609,721	250	62500	150	18,000	85	12,000	-	-	-	607,672	90%
18	Zomba	725,344	652,810	0	0	400	48,000	43	6,400	-	-	-	732,640	101%
19	Chiradzulu	337,842	304,058	0	0	-	-	-	-	-	-	-	336,514	100%
20	Blantyre R	447,177	402,459	80	20000	-	-	-	-	-	-	-	400,519	90%
21	Mwanza	94,969	85,472	0	0	-	-	64	9,600	1	3	4,711	96,267	101%
22	Thyolo	682,808	614,527	250	62500	-	-	-	-	-	-	-	616,348	90%
23	Mulanje	595,132	535,619	0	0	200	24,000	185	27,600	-	-	-	752,792	120%
24	Phalombe	419,849	377,864	0	0	550	66,000	-	-	-	-	-	505,651	120%
25	Chikwawa	609,684	548,716	70	17500	80	9,600	-	-	-	-	-	529,606	87%
26	Nsanje	292,546	263,292	0	0	-	-	27	4,000	1	3	3,716	271,414	93%
27	Balaka	433,097	389,787	0	0	-	-	-	-	2	9	16,350	454,135	105%
28	Neno	186,833	168,150	150	37500	-	-	-	-	-	-	-	167,388	90%
	Total	**15,537,001**	**13,983,301**	**3,862**	**965,500**	**3,115**	**373,800**	**1,465**	**218,720**	**15**	**54**	**88,630**	**14,822,683**	95%
			90%										95%	

Source: Compiled by the Consultant for this study

9.5 SUMMARY OF PLANNED ACTIVITIES TO ACHIEVE THE SET TARGETS BY 2020

The breakdowns of activities to be implemented in the planning phases are shown in Tables 9.1 to 9.3. The proposed activities for implementation during the period of 2014 to 2020 as indicated in Tables 9.1-9.3 are summarized by district level. Table 9.4 shows the summarised activities to be implemented during the planning period from 2014 to 2020.

Table 9-4: Summary of Planned Activities to Be Implemented during 2014-2020 by District

S. Nr.	District	No. of BHs to be rehabilitated	No. Taps to be rehab by Mngt	No taps under minor rehab of GFS	No. of New BH to be drilled	No. of Taps under major rehab of GFS	No. of Taps under rehab of expansion of GFS	No. of BH for market centers	No. of additional taps under expansion of exist GFS	No. of taps under new GFS
1	Chitipa	52	38	-	-	243	59	-	450	32
2	Karonga	165	-	29	-	356	-	7	-	128
3	Nkhatabay	81	133	55	80	-	3	13	75	249
4	Rumphi	294	24	125	-	-	142	2	910	128
5	Mzimba	385	-	79	450	278	-	16	-	-
6	Likoma	-	-	-	2	-	-	-	-	-
7	Kasungu	145	-	-	1,450	-	-	4	-	-
8	Nkhotakota	262	-	-	-	19	-	-	-	141
9	Ntchisi	172	-	-	230	-	-	2	-	-
10	Dowa	190	-	-	1,650	-	-	2	-	-
11	Salima	68	-	-	280	77	-	2	-	128
12	Lilongwe	603	-	-	1,600	-	-	6	-	-
13	Mchinji	168	-	-	720	113	-	5	-	-
14	Dedza	325	40	89	-	-	-	13	-	128
15	Ntcheu	388	-	21	60	334	-	9	-	-
16	Mangochi	117	-	-	350	-	113	7	300	128
17	Machinga	305	415	191	400	-	-	2	150	85
18	Zomba	177	-	45	-	685	16	2	400	43
19	Chiradzulu	303	-	-	-	-	-	-	-	-
20	Blantyre R	310	-	-	80	-	-	-	-	-
21	Mwanza	41	18	-	-	-	-	3	-	64
22	Thyolo	151	-	195	400	97	-	8	-	-
23	Mulanje	137	2,103	63	-	-	76	-	200	185
24	Phalombe	220	145	67	-	392	141	-	550	-
25	Chikwawa	211	408	-	120	43	7	-	80	-
26	Nsanje	159	-	-	-	-	-	3	-	27
27	Balaka	137	990	-	-	-	-	9	-	-
28	Neno	27	-	-	230	-	-	-	-	-
	Total	**5,593**	**4,314**	**959**	**8,102**	**2,637**	**557**	**115**	**3,115**	**1,465**

Source: Compiled by the Consultant for this study

10 CAPACITY BUILDING & CATCHMENT PROTECTION ACTIVITIES

10.1 CAPACITY BUILDING

The sector institutional framework is in place to facilitate the planning, implementation and monitoring of the water sector programmes. Emphasis should be directed at strengthening roles, capacity, co-ordination and collaboration for improved performance and results-oriented management and development of the water sector programmes at all levels.

As presented in Annex I –Policy, Legal and Institutional Assessment Topical report, many of the capacity and performance shortcomings can be ascribed to the decentralization that has taken place in particular to the understaffing of the sector institutions. Many of the on-going support activities by the stakeholders in the sector should contribute to improved implementation performance. However, additional measures may contribute to further improvements. Hence the Investment Plan will focus:

- Supporting the district councils to develop capacity to play their role under the country's Decentralisation Policy which includes management, maintenance, and oversight of Water, Sanitation and Hygiene (WASH) services to improve on sustainability of the proposed investments.
- Supporting the Ministry responsible for Water Development and Irrigation to work with the universities and vocational training institutes to draft specific curriculum for water sector professionals and organize special crush programme to produce the required engineers, technicians and water sector practitioners.
- Training of District Coordination Teams;
- Formation, training and capacitation of Water Users Associations and Water Point Committees;
- Developing operations and maintenance framework for WUAs;
- Strengthening of M&E systems;
- Preparation of District rural water supply investment plans based on the national rural water supply investment plan;
- Strengthening and building capacity for private sector participation

Considering all the above to be implemented or undertaken during the planning period, resource allowance has been made in the investment plan for capacity development, which is also reflected in the sanitation investment plan. At this stage about 5% of the total cost estimates for the rural water supply investment is incorporated in the overall cost estimation for capacity development activities with breakdown indicated in Table 10.1.

Table 10-1: Breakdown of the 5% cost by Activity

Activity	Estimated Cost % of total Cost
• Supporting the district councils to develop capacity in management, maintenance, and oversight of Water, Sanitation and Hygiene (WASH) services.	1.5%
• Training of District Coordination Teams	0.5%
• Formation, training and capacitation of Water Users Associations and Water Point Committees	2%
• Developing operations and maintenance framework for WUAs	0.5%
• Preparation of District rural water supply investment plans	0.5%

10.2 ENVIRONMENTAL MANAGEMENT AND CATCHMENT PROTECTION

10.2.1 ENVIRONMENTAL MANAGEMENT

Addressing catchment protection in general and environmental issues in particular entails improving the socio-economic status of beneficiary communities by enabling them to improve their income sources and encouraging them to undertake alternative income generating activities other than selling charcoal or raw wood through cutting of trees from forest reserves. Some of the major issues that need to be addressed as national concerns regarding catchment protection as presented in Annex III Socio-Economic and Environmental Assessment Topical report are:

- Catchment protections require awareness creation training and probably providing guidelines on the procedures to be followed in catchment protection activities at WUA or scheme level.
- Although byelaws are in place in some of the schemes they need to be enforced by the district councils, Chiefs and ADCs
- Licensed timber merchants must be controlled and monitored for proper management of the catchment and if they are operating according to the license and the appropriate Acts.
- Government must put in place in all the districts vibrant forestry and water resources extension services to train and conduct awareness campaigns to communities living close to river banks and catchment areas and communities have to be taught the right farming practices and encourage afforestation through provision of seedlings. Communities must be empowered through regular sensitizations and training to safeguard their own environment from degradation.
- It is important that Village Natural Resources Management Committees (VNRMCs) or Catchment Management Committees are established and must have Management Plans prepared by involving all segments of the community to ensure its implementation. Even people burning charcoal must be part and parcel of the preparation of the management plan to ensure that their interest is incorporated in using the forest while ensuring its sustainability.
- It is also important to update and to harmonize Forest Act of 1997, Water Resources Act of 2013, Land Acquisition Act of 1972, Wildlife Act of 1992, Water Works Act of 1995 and Environmental Act of 1996 to allow common working ground and uniform implementation of activities by each concerned sector as reported in the Socio-Economic and Environmental Impact Assessment Topical Report.

10.3 CATCHMENT PROTECTION AND ENVIRONMENTAL IMPACT FOR EXISTING SCHEMES

The NWDP has implanted water resources management in all the rural water supply projects implemented to allow for tree plantation in intake areas and some income generating activities for residents around the project catchment areas of the water sources. DCTs were encouraged to conduct law enforcement and monitoring of catchment protection activities to determine behavioural changes as described in Annex III Socio-Economic and Environmental Assessment Topical Report. And such activities must continue in larger scale for all the existing gravity fed schemes.

Studies and designs for all rehabilitation works must incorporate catchment protection activities in their reports as environmental component to be implemented with the other activities during the proposed rehabilitation works.

Water Users Association as part of the management of the water supply scheme should also monitor the catchment of their water sources to ensure sustainable supply of water from the source. WUAs must allocate some resources for such activities in their budget.

The beneficiary communities should be sensitized adequately on the importance of catchment in relation to constant supply of water to them, how the catchment can be protected and how they can contribute to the protection of the catchment. This should be done before the rehabilitation works, during and after the implementation of the rehabilitation works.

Provide water supply service to the people living upstream of intake point (in the catchment area) of gravity fed schemes so that they can have equal service as people in the downstream area and show interest in protecting the catchment. The water supply facilities should be planned together with the new gravity fed schemes.

Apart from catchment protection issues it is important that environmental mitigation measures are put in place to mitigate negative impacts as a result of construction works such as excavation works, cutting of trees for location of structures and pipeline routes, etc. This situation must be assessed in detail during the study and design stage (project preparation stage) and be implemented together with the water supply components. At this stage about 10% of the total cost estimates for the rehabilitation of the schemes is incorporated in the overall cost estimation for mitigation activities.

10.4 CATCHMENT PROTECTION AND ENVIRONMENTAL IMPACT FOR NEW SCHEMES

The proposed new gravity fed schemes and the pumped schemes from Lake Malawi as well as reticulated boreholes need to be planned by incorporating environmental issues and catchment protection activities before the construction, during and after implementation of the construction works as described under Section 8 similar to what is proposed for the rehabilitation works for existing gravity fed schemes.

According to Annex II Water Resources Assessment Topical Report the newly proposed gravity fed schemes have their intakes located in reserved or protected forest areas as listed in Table 10.2.

Table 10-2: Catchment Conditions of the New Proposed Gravity Fed Schemes

District	Proposed GFS	Origin of Intake area	Catchment condition
Machinga	Chanyungu	Liwonde forest reserve	
Nsanje	Chididi	Matandwe forest reserve	Well protected
Nkhatabay	Kaluwe	Forested hill catchment	Requires proper catchment intervention works
Nkhatabay	Chingwere	Forested hill catchment	Requires proper catchment intervention works
Chitipa	Kayilezi	Mafinga mountain Forest Reserve	Well protected
Nkhotakota	Katonda Spring		Need protection works
Nkhotakota	Aerodan		Need protection works
Zomba	Lisanjala (Upper Mulumbe)	Forested hill catchment	Under forest reserve so well protected
Mwanza	Mkanto	Forested hill catchment	Under forest reserve so well protected
Mulanje	Kamwendo*	Mulanje mountains Forest reserve	Well protected

Apart from the location and condition of the catchment and intake site area it is important that environmental mitigation measures are put in place to mitigate negative impacts as a result of construction works such as excavation works, cutting of trees for location of structures and pipeline

routes, etc. as depicted in Annex III Socio-Economic and Environmental Assessment Topical Report. This situation must be assessed in detail during the study and design stage and be implemented together with the water supply components. The situation also applies for the borehole based reticulated water supply systems proposed for implementation. At this stage about 10% of the total cost estimates for the development of the schemes is incorporated in the overall cost estimation for mitigation of negative environmental impacts and catchment protection works.

11 COST ESTIMATIONS AND FINANCIAL ANALYSIS

11.1 COST ESTIMATION FOR THE IMPLEMENTATION OF PROPOSED ACTIVITIES

11.1.1 ASSUMPTIONS FOR COST ESTIMATIONS

The proposed activities for implementation during the planning period from 2014 to 2020 are identified as presented in Sections 7 and 8 above and summarized in Section 9. The activities are planned to be implemented in three stages as follows:

Activities to be implemented during the period of 2014 and 2015 include:

- It is important to sustain the functionality level of all existing water supply facilities by the community and the water facilities management institutions such as WUAs and the costs for such activities are assumed to be covered by the community and management of the water schemes at community level.
- Rehabilitation of existing 75% of the non-functional boreholes which will result in a total of 5,593 boreholes
- Rehabilitation of non-functional standpipes by scheme management committees and community that are under the schemes proposed for rehabilitation works by water committees and community and these comprises of 40 existing gravity fed schemes with a total of 4,314 standpipes to be put back to operational and the cost is expected to be covered by the facility management committees, water point committees and district councils and support from NGOs where available.
- Rehabilitation of facilities and non-functional standpipes for gravity fed schemes proposed under minor rehabilitation works which comprises 25 existing gravity fed schemes with a total of 959 standpipes to be put operational cost to be covered by government, donor partners and NGOs.
- Drilling of additional new boreholes fitted with hand pumps to fill the gaps and this will cover a total of 1,620 boreholes fitted with hand pumps and complete structures and cost to be covered by government, donor partners and NGOs.

Activities to be implemented during the period of 2016 and 2017 include:

- It is important to sustain the functionality level of all existing water supply facilities by the community and the water facilities management institutions such as WUAs and the costs for such activities are assumed to be covered by the community and management of the water schemes at community level.
- Rehabilitation of facilities and non-functional standpipes for gravity fed schemes proposed under major rehabilitation works which comprises 22 existing gravity fed schemes with a total of 2,637 standpipes to be made operational and cost to be covered by government, donor partners and NGOs.
- Rehabilitation of facilities and non-functional standpipes for gravity fed schemes proposed under rehabilitation and expansion works which comprise of 16 existing gravity fed schemes with a total 557 standpipes to be made operational and cost to be covered by government, donor partners and NGOs.
- Implementation of borehole based reticulated water supply system for 17 market centers during this period which comprises drilling of 61 boreholes fitted with motorized pumps with reticulation systems and cost to be covered by government, donor partners and NGOs.

- Drilling of additional new boreholes fitted with hand pumps to fill the gaps and this will cover a total of 2,620 boreholes fitted with hand pumps and complete structures and cost to be covered by government, donor partners and NGOs.

Activities to be implemented during the period of 2018 and 2020 include:

- It is again important to sustain the functionality level of all existing water supply facilities by the community and the water facilities management institutions such as WUAs and the costs for such activities are assumed to be covered by the community and management of the water schemes at community level.
- Expansion of existing facilities and construction of additional standpipes for gravity fed schemes proposed under rehabilitation and expansion works which comprise of 16 existing gravity fed schemes with construction of a total of 3,115 new standpipes and cost to be covered by government, donor partners and NGOs.
- Construction of 9 new gravity fed schemes and 7 pumped schemes from Lake Malawi which comprises 1,465 new standpipes to be put operational and cost to be covered by government, donors partners and NGOs.
- Implementation of borehole based reticulated water supply system for 15 market centers out of the 32 during this period which comprises of drilling of 54 boreholes fitted with motorized pumps and with reticulation systems and cost to be covered by government, donor partners and NGOs.
- Drilling of additional new boreholes fitted with hand pumps to fill the gaps and this will cover a total of 3,862 boreholes fitted with hand pumps and complete structures and cost to be covered by government, donor partners and NGOs.

To implement the proposed activities it is important to come up with cost estimates for the different proposed schemes and facilities so that resources can be allocated and obtaining the funding can be planned accordingly.

11.1.2 DEVELOPMENT OF UNIT COSTS

Unit costs used for cost estimation of the proposed different technology options are derived from various contracts signed for gravity fed schemes and boreholes with different contractors by National Water Development Programme (NWDP), Consultants for Market centers and the 4 Districts Capacity Building Projects, market prices from suppliers of pipes and other different documents used in the preparation of projects and water resources investment plan for installation of water supply facilities. The cost for pipe lines and water storage tanks of the same capacity is assumed to be the same regardless of the source technology such as gravity fed or pumped system.

Similarly the cost for environmental mitigation and catchment protection activities are estimated as percentage of the project cost and this is considered as 10%. It however requires detailed assessment during project preparation to come up with specific cost estimates for such activities for particular scheme.

As this is an investment plan prepared based on preliminary assessments and basic assumption for different aspects, it is important to incorporate cost for study and design works for each activity and the Engineering cost is considered as 15% of the total cost of the activities to be implemented.

It is also important to enhance capacity at different levels through trainings, awareness creations, purchase of facilities needed for capacity building etc. These costs are estimated at 5% of the facilities cost.

Considering the conditions discussed above and different factors that affect the cost of installing a water supply scheme with different technology options, the following unit costs are established for the proposed scheme components based on water sources as shown in Table 11.1.

Table 11-1: Unit Cost Estimation for Installation of Scheme Components for New GFS

Sr. No	Components of proposed water source technology	Average unit cost	
		MK	USD
1	Drilling of borehole to max 60m depth, well development and testing installed with PVC casings and screen, cover slab, hand pump with accessories, apron construction with drainage and washing slab	5,000,000.00	12,500.00
2	Drilling of borehole to max 60m depth, well development and testing installed with PVC casings and screen, cover slab, well head for motorized pump installation all other incidentals	4,000,000.00	10,000.00
3	Construction of weir structure across the river, intake pipe, retaining walls and drainage for GFS from river intakes	6,000,000.00	15,000.00
4	Construction of intake concrete structure in the Lake, intake pipe installed with heavy structure to keep the pipe under water, pipe up to pump sump	10,000,000.00	25,000.00
5	Raw water sump on the Lake shore for collecting water for pumping from the lake to treatment plant	20,000,000.00	50,000.00
6	Installation of raw water pumps from the lake to treatment plant with pump station and all power supply and installation works	12,000,000.00	30,000.00
7	Installation of submersible pumps with riser pipes into boreholes with electric cable and all other incidentals for 1 borehole	10,000,000.00	25,000.00
8	Installation of clear water pumps from the Lake to storage tanks with pump station and all power supply and installation works	8,000,000.00	20,000.00
9	Construction and installation of transmission/gravity main pipe line from intake to treatment plants and to storage reservoirs with all fittings and structures of 1km length	5,000,000.00	12,500.00
10	Construction of screening tank, sedimentation basin, roughing filter and slow sand filter with all necessary fittings and structures for 2l/s system	30,000,000.00	75,000.00
11	Chlorination system for disinfection of water with chlorine mixing and dripping system all complete for 1kg/day feeding capacity	5,000,000.00	12,500.00
12	Construction of storage reservoir of capacity 100m^3 minimum with all earth works, fittings, accessories and completed for service (cost /1m^3 volume)	200,000.00	500.00
13	Construction of distribution pipe line laid for a maximum distance of 1km; pipe diameter of 63mm to 200mm uPVC pipe with all fittings, trench excavations and installation of fittings and accessories for 1km length	2,000,000.00	5,000.00
14	Construction of new standpipes with apron, washing slab and all the necessary fittings and accessories	500,000.00	1,250.00
15	Office and store buildings of 150m^2 area with all furniture and sanitary, water, electivity installed for WUA	15,000,000.00	37,500.00
16	Power supply to the pump stations and all other operational areas	15,000,000.00	37,500.00
17	Construction of control house of 40m^2 for the electrical control panels and other gadgets for boreholes and pump stations	4,500,000.00	11,250.00
18	Costs for rehabilitation of non-functional borehole fitted with hand pumps including replacement of complete hand pump as required	1,500,000.00	3,750.00

Source: Compiled by the consultant from Water and Sanitation Unit cost by Ministry Responsible and other similar projects

11.1.3 COST ESTIMATES FOR ACTIVITIES TO BE IMPLEMENTED IN 2014 AND 2015

As described above activities to be implemented during the period of 2014 and 2015 include:

- Rehabilitation of 5,593 existing boreholes
- Minor rehabilitation works on 25 existing gravity fed schemes with 959 non-functional standpipes
- Drilling of additional new 1,620 boreholes fitted with hand pumps and complete structures.

The cost for the above activities is estimated at MK 12,880,924,215.82 or equivalent to USD 32,202,310.54 and is expected to be expended in 2014 and 2015 planning period. The breakdown of the costs by activity and districts is shown in Table 11.2.

Table 11-2: Cost Estimates for Activities to Be Implemented During 2014-2015 by District

S. Nr.	District	Rehabilitation of BHs (MK)	Minor Rehab of GFS (MK)	Drilling of new BHs with Hand pumps (MK)	Total for 2014-2015(MK)	
		MK	MK	MK	MK	USD
1	Chitipa	39,000,000.00	-	-	39,000,000.00	97,500.00
2	Karonga	123,750,000.00	43,204,071.60	-	166,954,071.60	417,385.18
3	Nkhatabay	60,750,000.00	29,662,694.10	100,000,000.00	190,412,694.10	476,031.74
4	Rumphi	220,500,000.00	89,838,451.90	-	310,338,451.90	775,846.13
5	Mzimba	288,750,000.00	54,680,742.90	250,000,000.00	593,430,742.90	1,483,576.86
6	Likoma	-	-	-	-	
7	Kasungu	108,750,000.00	-	2,000,000,000.00	2,108,750,000.00	5,271,875.00
8	Nkhotakota	196,500,000.00	-	-	196,500,000.00	491,250.00
9	Ntchisi	129,000,000.00	4,514,421.60	250,000,000.00	383,514,421.60	958,786.05
10	Dowa	142,500,000.00	-	2,500,000,000.00	2,642,500,000.00	6,606,250.00
11	Salima	51,000,000.00	-	250,000,000.00	301,000,000.00	752,500.00
12	Lilongwe	452,250,000.00	-	2,000,000,000.00	2,452,250,000.00	6,130,625.00
13	Mchinji	126,000,000.00	-	750,000,000.00	876,000,000.00	2,190,000.00
14	Dedza	243,750,000.00	22,135,785.60	-	265,885,785.60	664,714.46
15	Ntcheu	291,000,000.00	44,689,376.70	-	335,689,376.70	839,223.44
16	Mangochi	87,750,000.00	-	-	87,750,000.00	219,375.00
17	Machinga	228,750,000.00	103,110,370.74	-	331,860,370.74	829,650.93
18	Zomba	132,750,000.00	17,066,853.90	-	149,816,853.90	374,542.13
19	Chiradzulu	227,250,000.00	-	-	227,250,000.00	568,125.00
20	Blantyre R	232,500,000.00	-	-	232,500,000.00	581,250.00
21	Mwanza	30,750,000.00	-	-	30,750,000.00	76,875.00
22	Thyolo	113,250,000.00	64,803,842.64	-	178,053,842.64	445,134.61
23	Mulanje	102,750,000.00	76,155,952.14	-	178,905,952.14	447,264.88
24	Phalombe	165,000,000.00	36,311,652.00	-	201,311,652.00	503,279.13
25	Chikwawa	158,250,000.00	-	-	158,250,000.00	395,625.00
26	Nsanje	119,250,000.00	-	-	119,250,000.00	298,125.00
27	Balaka	102,750,000.00	-	-	102,750,000.00	256,875.00
28	Neno	20,250,000.00	-	-	20,250,000.00	50,625.00
	Total	**4,194,750,000.00**	**586,174,215.82**	**8,100,000,000.00**	**12,880,924,215.82**	32,202,310.54
1USD=	MK 400	10,486,875.00	1,465,435.54	20,250,000.00	32,202,310.54	

Source: Compiled by the Consultant for this study

11.1.4 COST ESTIMATES FOR ACTIVITIES TO BE IMPLEMENTED IN 2016 AND 2017

As described above activities to be implemented during the period of 2016 and 2017 include:

- Major rehabilitation of facilities for 22 existing gravity fed schemes with a total of 2,637 non-functional standpipes
- Rehabilitation of facilities for 16 existing gravity fed schemes with a total 557 non-functional standpipes
- Implementation of 17 market centers by drilling 61 boreholes fitted with motorized pumps with reticulation systems
- Drilling of additional new 2,620 boreholes fitted with hand pumps and complete structures.

The cost for the above activities is estimated at MK 17,667,840,102.70 or equivalent to USD 44,169,600.60 and is expected to be expended in 2016 and 2017 planning period. The breakdown of the costs by activity and district is shown in Table 11.3.

Table 11-3: Cost Estimates for Activities to be implemented during 2016-2017 by District

S. Nr.	District	Major Rehabilitation of GFS (MK)	Rehab part of Expansion of Existing GFS	Drilling of new BHs with Hand pumps	Construction of WS for 17 Market Centers	Total for 2016-2017 (MK)	
			MK	MK	MK	MK	USD
1	Chitipa	142,474,245.00	50,248,759.95	-	-	192,723,004.95	481,807.51
2	Karonga	255,709,333.35	-	-	-	255,709,333.35	639,273.33
3	Nkhatabay	-	44,174,392.88	150,000,000.00	473,960,000.00	668,134,392.88	1,670,335.98
4	Rumphi	-	225,377,364.33	-	-	225,377,364.33	563,443.41
5	Mzimba	241,187,692.23	-	1,000,000,000.00	248,440,000.00	1,489,627,692.23	3,724,069.23
6	Likoma	-	-	-	-	-	-
7	Kasungu	-	-	2,500,000,000.00	-	2,500,000,000.00	6,250,000.00
8	Nkhotakota	80,334,811.80	-	-	-	80,334,811.80	200,837.03
9	Ntchisi	-	-	400,000,000.00	91,180,000.00	491,180,000.00	1,227,950.00
10	Dowa	-	-	2,500,000,000.00	90,780,000.00	2,590,780,000.00	6,476,950.00
11	Salima	103,191,902.10	-	500,000,000.00	74,580,000.00	677,771,902.10	1,694,429.76
12	Lilongwe	-	-	2,500,000,000.00	182,980,000.00	2,682,980,000.00	6,707,450.00
13	Mchinji	63,511,419.60	-	1,250,000,000.00	156,860,000.00	1,470,371,419.60	3,675,928.55
14	Dedza	-	-	-	-	-	-
15	Ntcheu	446,799,779.46	-	150,000,000.00	-	596,799,779.46	1,491,999.45
16	Mangochi	-	60,295,408.20	-	248,540,000.00	308,835,408.20	772,088.52
17	Machinga	-	8,617,875.00	750,000,000.00	91,920,000.00	850,537,875.00	2,126,344.69
18	Zomba	170,649,854.73	33,512,798.05	-	91,520,000.00	295,682,652.78	739,206.63
19	Chiradzulu	-	-	-	-	-	-
20	Blantyre R	-	-	-	-	-	-
21	Mwanza	-	-	-	-	-	-
22	Thyolo	57,717,408.60	-	750,000,000.00	294,560,000.00	1,102,277,408.60	2,755,693.52
23	Mulanje	-	29,579,658.88	-	-	29,579,658.88	73,949.15
24	Phalombe	391,110,840.90	40,132,966.00	-	-	431,243,806.90	1,078,109.52
25	Chikwawa	60,914,494.80	16,979,096.84	250,000,000.00	-	327,893,591.64	819,733.98
26	Nsanje	-	-	-	-	-	-
27	Balaka	-	-	-	-	-	-
28	Neno	-	-	400,000,000.00	-	400,000,000.00	1,000,000.00
	Total	**2,013,601,782.57**	**508,918,320.13**	**13,100,000,000.00**	**2,045,320,000.00**	**17,667,840,102.70**	44,169,600.26
1USD=	MK 400	5,034,004.46	1,272,295.80	32,750,000.00	5,113,300.00	44,169,600.26	

Source: Compiled by the Consultant for this study

11.1.5 COST ESTIMATES FOR ACTIVITIES TO BE IMPLEMENTED IN 2018 AND 2020

As described above activities to be implemented during the period of 2018 and 2020 include:

- Expansion of existing facilities 16 existing gravity fed schemes with construction of a total of 3,115 new standpipes
- Construction of 10 new gravity fed schemes and 7 pumped schemes from Lake Malawi with 1,465 new standpipes
- Implementation of borehole based reticulated water supply system for 15 market centers drilling 54 boreholes fitted with motorized pumps with reticulation systems
- Drilling of additional new 3,862 boreholes fitted with hand pumps and complete structures.

The cost for the above activities is estimated at MK 26,807,460,000.00 or equivalent to USD 67,018,650.00 and is expected to be expended in 2018 and 2020 planning period. The breakdown of the costs by activity and district is shown in Table 11.4.

Table 11-4: Cost Estimates for Activities to be implemented during 2018-2020 by District

S. Nr.	District	Expansion of Existing GFS Additional Taps	New GFS	Pumped system from Lake Malawi	Drilling of new BHs with Hand pumps	Construction of WS for 15 Market Centers	Total for 2018-2020	
		MK	MK	MK	MK	MK	MK	USD
1	Chitipa	225,000,000.00	93,380,000.00	-	-	-	318,380,000.00	795,950.00
2	Karonga	-	-	356,980,000.00	-	290,480,000.00	647,460,000.00	1,618,650.00
3	Nkhatabay	37,500,000.00	304,350,000.00	356,980,000.00	150,000,000.00	-	848,830,000.00	2,122,075.00
4	Rumphi	455,000,000.00	-	356,980,000.00	-	100,520,000.00	912,500,000.00	2,281,250.00
5	Mzimba	-	-	-	1,000,000,000.00	252,040,000.00	1,252,040,000.00	3,130,100.00
6	Likoma	-	-	-	10,000,000.00	-	10,000,000.00	25,000.00
7	Kasungu	-	-	-	2,750,000,000.00	158,780,000.00	2,908,780,000.00	7,271,950.00
8	Nkhotakota	-	25,450,000.00	356,980,000.00	-	-	382,430,000.00	956,075.00
9	Ntchisi	-	-	-	500,000,000.00	-	500,000,000.00	1,250,000.00
10	Dowa	-	-	-	3,250,000,000.00	-	3,250,000,000.00	8,125,000.00
11	Salima	-	-	356,980,000.00	650,000,000.00	-	1,006,980,000.00	2,517,450.00
12	Lilongwe	-	-	-	3,500,000,000.00	-	3,500,000,000.00	8,750,000.00
13	Mchinji	-	-	-	1,600,000,000.00	-	1,600,000,000.00	4,000,000.00
14	Dedza	-	-	356,980,000.00	-	452,420,000.00	809,400,000.00	2,023,500.00
15	Ntcheu	-	-	-	150,000,000.00	278,180,000.00	428,180,000.00	1,070,450.00
16	Mangochi	150,000,000.00	-	356,980,000.00	1,750,000,000.00	-	2,256,980,000.00	5,642,450.00
17	Machinga	75,000,000.00	208,520,000.00	-	1,250,000,000.00	-	1,533,520,000.00	3,833,800.00
18	Zomba	200,000,000.00	109,460,000.00	-	-	-	309,460,000.00	773,650.00
19	Chiradzulu	-	-	-	-	-	-	
20	Blantyre R	-	-	-	400,000,000.00	-	400,000,000.00	1,000,000.00
21	Mwanza	-	151,400,000.00	-	-	109,980,000.00	261,380,000.00	653,450.00
22	Thyolo	-	-	-	1,250,000,000.00	-	1,250,000,000.00	3,125,000.00
23	Mulanje	100,000,000.00	395,150,000.00	-	-	-	495,150,000.00	1,237,875.00
24	Phalombe	275,000,000.00	-	-	-	-	275,000,000.00	687,500.00
25	Chikwawa	40,000,000.00	-	-	350,000,000.00	-	390,000,000.00	975,000.00
26	Nsanje	-	87,950,000.00	-	-	96,180,000.00	184,130,000.00	460,325.00
27	Balaka	-	-	-	-	326,860,000.00	326,860,000.00	817,150.00
28	Neno	-	-	-	750,000,000.00	-	750,000,000.00	1,875,000.00
	Total	**1,557,500,000.00**	**1,375,660,000.00**	**2,498,860,000.00**	**19,310,000,000.00**	**2,065,440,000.00**	**26,807,460,000.00**	67,018,650.00
1USD	MK400	3,893,750.00	3,439,150.00	6,247,150.00	48,275,000.00	5,163,600.00	67,018,650.00	

Source: Compiled by the Consultant for this study

The cost estimations for rehabilitation and expansion works for the existing gravity fed schemes is prepared based on the quantification of works to be done from field assessment as provided in the Annex IV Assessment of Existing Gravity Fed Schemes Topical Report. The summary of cost estimates for each scheme under the proposed rehabilitation and expansions works is given in Appendix I to this report

11.1.6 SUMMARY OF COST ESTIMATES FOR ACTIVITIES TO BE IMPLEMENTED IN 2014 - 2020

The investment costs for each district and the total at national level are as shown in Tables 6.2 to 6.4 above for implementation of proposed facilities during the different planning period. The costs related to environmental (10%), engineering (15%) and capacity building (5%) are then added to the investment costs for the implementation of facilities to obtain the total investment cost. Table 11.5 shows investment costs for physical facilities, environmental, engineering and capacity building all inclusive for the planning period.

Table 11-5: All Inclusive Cost Estimates for the Planning Period from 2014 - 2020 by District

S. Nr.	District	Total Amount in				
		MK			MK	USD
		2014-2015	2016-2017	2018-2020	2014-2020	2014-2020
1	Chitipa	50,700,000	250,539,906	413,894,000	715,133,906	1,787,834.77
2	Karonga	217,040,293	332,422,133	841,698,000	1,391,160,426	3,477,901.07
3	Nkhatabay	247,536,502	868,574,711	1,103,479,000	2,219,590,213	5,548,975.53
4	Rumphi	403,439,987	292,990,574	1,186,250,000	1,882,680,561	4,706,701.40
5	Mzimba	771,459,966	1,936,516,000	1,627,652,000	4,335,627,966	10,839,069.92
6	Likoma	-	-	13,000,000	13,000,000	32,500.00
7	Kasungu	2,741,375,000	3,250,000,000	3,781,414,000	9,772,789,000	24,431,972.50
8	Nkhotakota	255,450,000	104,435,255	497,159,000	857,044,255	2,142,610.64
9	Ntchisi	498,568,748	638,534,000	650,000,000	1,787,102,748	4,467,756.87
10	Dowa	3,435,250,000	3,368,014,000	4,225,000,000	11,028,264,000	27,570,660.00
11	Salima	391,300,000	881,103,473	1,309,074,000	2,581,477,473	6,453,693.68
12	Lilongwe	3,187,925,000	3,487,874,000	4,550,000,000	11,225,799,000	28,064,497.50
13	Mchinji	1,138,800,000	1,911,482,845	2,080,000,000	5,130,282,845	12,825,707.11
14	Dedza	345,651,521	-	1,052,220,000	1,397,871,521	3,494,678.80
15	Ntcheu	436,396,190	775,839,713	556,634,000	1,768,869,903	4,422,174.76
16	Mangochi	114,075,000	401,486,031	2,934,074,000	3,449,635,031	8,624,087.58
17	Machinga	431,418,482	1,105,699,238	1,993,576,000	3,530,693,719	8,826,734.30
18	Zomba	194,761,910	384,387,449	402,298,000	981,447,359	2,453,618.40
19	Chiradzulu	295,425,000	-	-	295,425,000	738,562.50
20	Blantyre R	302,250,000	-	520,000,000	822,250,000	2,055,625.00
21	Mwanza	39,975,000	-	339,794,000	379,769,000	949,422.50
22	Thyolo	231,469,995	1,432,960,631	1,625,000,000	3,289,430,627	8,223,576.57
23	Mulanje	232,577,738	38,453,557	643,695,000	914,726,294	2,286,815.74
24	Phalombe	261,705,148	560,616,949	357,500,000	1,179,822,097	2,949,555.24
25	Chikwawa	205,725,000	426,261,669	507,000,000	1,138,986,669	2,847,466.67
26	Nsanje	155,025,000	-	239,369,000	394,394,000	985,985.00
27	Balaka	133,575,000	-	424,918,000	558,493,000	1,396,232.50
28	Neno	26,325,000	520,000,000	975,000,000	1,521,325,000	3,803,312.50
MK	**Total**	**16,745,201,481**	**22,968,192,134**	**34,849,698,000**	**74,563,091,614**	**186,407,729.04**
USD	**1USD = MK 400**	**41,863,004**	**57,420,480**	**87,124,245**	**186,407,729**	

Source: Compiled by the Consultant for this study

11.1.7 PER CAPITA INVESTMENT COSTS

The all-inclusive total investment costs for implementation of proposed facilities during the different planning period for each district and the total at national level are as shown in Tables 11.5 above. The costs are then evaluated against the population to be served and per capita cost at districts and national level are calculated as shown in Table. 11.6.

Table 11-6: Per Capita Investment Cost for the Planning Period from 2014 - 2020 by District

S. Nr.	District	Increase in population Served			Total Investment Cost (MK)			Per Capita Cost (MK)			Per Capita Cost (USD)		
		2014-2015	2016-2017	2018-2020	2014-2015	2016-2017	2018-2020	2014-2015	2016-2017	2018-2020	2014-2015	2016-2017	2018-2020
1	Chitipa	14,737	35,724	58,800	50,700,000.00	250,539,906.44	413,894,000.00	3,440.32	7,013.21	7,039.01	8.60	17.53	17.60
2	Karonga	36,016	26,904	32,959	217,040,293.08	332,422,133.36	841,698,000.00	6,026.22	12,355.86	25,537.73	15.07	30.89	63.84
3	Nkhatabay	43,846	31,967	53,700	247,536,502.33	868,574,710.74	1,103,479,000.00	5,645.59	27,170.98	20,548.96	14.11	67.93	51.37
4	Rumphi	65,966	0	134,409	403,439,987.47	292,990,573.63	1,186,250,000.00	6,115.88		8,825.67	15.29	-	22.06
5	Mzimba	95,095	99,470	60,932	771,459,965.77	1,936,515,999.90	1,627,652,000.00	8,112.52	19,468.34	26,712.60	20.28	48.67	66.78
6	Likoma	0	0	500	-	-	13,000,000.00	-	-	26,000.00	-	-	65.00
7	Kasungu	129,000	135,054	137,500	2,741,375,000.00	3,250,000,000.00	3,781,414,000.00	21,250.97	24,064.45	27,501.19	53.13	60.16	68.75
8	Nkhotakota	52,400	3,126	21,120	255,450,000.00	104,435,255.34	497,159,000.00	4,875.00	33,408.59	23,539.73	12.19	83.52	58.85
9	Ntchisi	46,900	25,475	25,000	498,568,748.08	638,534,000.00	650,000,000.00	10,630.46	25,065.12	26,000.00	26.58	62.66	65.00
10	Dowa	163,000	130,486	162,500	3,435,250,000.00	3,368,014,000.00	4,225,000,000.00	21,075.15	25,811.31	26,000.00	52.69	64.53	65.00
11	Salima	26,100	31,595	51,700	391,300,000.00	881,103,472.73	1,309,074,000.00	14,992.34	27,887.43	25,320.58	37.48	69.72	63.30
12	Lilongwe	220,600	133,380	175,000	3,187,925,000.00	3,487,874,000.00	4,550,000,000.00	14,451.16	26,149.90	26,000.00	36.13	65.37	65.00
13	Mchinji	71,100	76,791	80,000	1,138,800,000.00	1,911,482,845.48	2,080,000,000.00	16,016.88	24,892.02	26,000.00	40.04	62.23	65.00
14	Dedza	80,534	0	40,653	345,651,521.28	-	1,052,220,000.00	4,291.99	-	25,882.96	10.73	-	64.71
15	Ntcheu	81,055	49,847	19,198	436,396,189.71	775,839,713.30	556,634,000.00	5,383.95	15,564.42	28,994.37	13.46	38.91	72.49
16	Mangochi	23,400	11,859	142,700	114,075,000.00	401,486,030.66	2,934,074,000.00	4,875.00	33,854.97	20,561.14	12.19	84.64	51.40
17	Machinga	118,094	41,630	92,500	431,418,481.96	1,105,699,237.50	1,993,576,000.00	3,653.18	26,560.15	21,552.17	9.13	66.40	53.88
18	Zomba	41,340	46,512	54,400	194,761,910.07	384,387,448.61	402,298,000.00	4,711.22	8,264.26	7,395.18	11.78	20.66	18.49
19	Chiradzulu	60,600	0	0	295,425,000.00	-	-	4,875.00	-	-	12.19	-	-
20	Blantyre R	62,000	0	20,000	302,250,000.00	-	520,000,000.00	4,875.00	-	26,000.00	12.19	-	65.00
21	Mwanza	10,268	0	14,311	39,975,000.00	-	339,794,000.00	3,893.16	-	23,743.55	9.73	-	59.36
22	Thyolo	42,920	60,957	62,500	231,469,995.43	1,432,960,631.18	1,625,000,000.00	5,393.06	23,507.73	26,000.00	13.48	58.77	65.00
23	Mulanje	288,667	0	51,600	232,577,737.78	38,453,556.54	643,695,000.00	805.70	-	12,474.71	2.01	-	31.19
24	Phalombe	62,656	34,496	66,000	261,705,147.60	560,616,948.97	357,500,000.00	4,176.86	16,251.65	5,416.67	10.44	40.63	13.54
25	Chikwawa	78,104	18,787	27,100	205,725,000.00	426,261,669.13	507,000,000.00	2,633.99	22,689.18	18,708.49	6.58	56.72	46.77
26	Nsanje	31,800	0	7,716	155,025,000.00	-	239,369,000.00	4,875.00	-	31,022.42	12.19	-	77.56
27	Balaka	136,300	0	16,350	133,575,000.00	-	424,918,000.00	980.01	-	25,988.87	2.45	-	64.97
28	Neno	5,400	20,000	37,500	26,325,000.00	520,000,000.00	975,000,000.00	4,875.00	26,000.00	26,000.00	12.19	65.00	65.00
	Total	**2,087,898**	**1,014,060**	**1,646,648**	**16,745,201,480.57**	**22,968,192,133.51**	**34,849,698,000.00**	**8,020.12**	**22,649.74**	**21,164.02**	**20.05**	**56.62**	**52.91**

Source: Compiled by the Consultant for this study

11.2 SOURCE OF FUNDING AND EXISTING TARIFFS

11.2.1 SOURCE OF FUNDING FOR RURAL WATER SUPPLY

The Ministry responsible for Water Development and Irrigation has the primary responsibility of sourcing funding for the development of rural water supply infrastructure. The funding will mainly be channeled through the Ministry responsible for Water Development and Irrigation under the administration and management of the National Water Development Program II (NWDP II) or through the next possible arrangement of another similar program. Such program is expected to pull all projects both from rural water supply and Water Boards under the Ministry responsible for Water Development and Irrigation throughout the country and market these projects to possible financiers such as the World Bank, African Development Bank, European Investment Bank, JICA and other development partners. Government through the annual national budget is also expected to finance rural water supply projects particularly as it relates to drilling of boreholes fitted with hand pumps for on-source supply. Funding from development partners for rural water supply is expected to come mainly in the form of grants to Malawi Government. It has however to be noted that NWDP II program is coming to an end in the next three years..

Non-Governmental Organizations (NGOs) are also expected to partner with Government in the provision of safe potable water in the rural areas by financing specific projects through District Assemblies. It has been noted that often NGOs work directly with the District assemblies both at planning and implementation level leaving out the Ministry responsible for Water Development and Irrigation. It is therefore recommended that the Ministry responsible for Water Development and Irrigation coordinates all efforts of NGOs to ensure effective and maximum results in the sourcing and implementation of projects that have been proposed.

The Ministry responsible for Water Development and Irrigation further needs to recognize the efforts to decentralize sourcing, administration of funding for the development of services in the rural areas including water supply services through the Local Development Fund (LDF) under the Local Assemblies. Ministry responsible for Water Development and Irrigation therefore needs to clearly define a working mechanism that brings together the NGO's, LDF and the Ministry responsible for Water Development and Irrigation to avoid duplication of efforts.

11.2.2 FUNDING FOR RURAL WATER SUPPLY THROUGH LOCAL DEVELOPMENT FUND

As the Ministry responsible for Water Development and Irrigation is taking a centre stage in the development of water supply systems through the national budget, pursuing a devolution and decentralization policy is important to empower the District councils. The decentralization policy has given birth to the Local Development Fund (LDF) with the local authorities in Malawi. The LDF intends to devolve and decentralize the sourcing, administration of funding for the development of services in the rural areas including water supply services. LDF therefore is building capacity at the local level through the local assembly to design rural water supply projects, market the projects for funding, develop and manage the infrastructure once installed. A fully fledged LDF is supposed to take over the role of rural water supply development at all levels including that of designing, funding, and execution from the Ministry responsible for Water Development and Irrigation. At this point the Ministry responsible for Water Development and Irrigation is supposed to be the policy holder, advisor and regulator of the water supply services. A fully fledged LDF is supposed to take centre stage in coordinating all rural water supply investments coming to the local authority through NGOs including the operation and maintenance of all rural water systems.

It has to be noted that whilst LDF has been established as a countrywide funding mechanism for all local authority public funding and services, Ministry responsible for Water Development and Irrigation on the other had is working towards establishing a Sector Wide Approach (SWAp) a mechanism which seeks to centralize all funding mechanism for the water supply services including that of the rural water supply. An impending clash of funding methodology is looming and a reconciliation of the two is a necessity. This reconciliation must establish what intervention is more viable between the NWDP II which will graduate into a SWAp and further align the objectives of the ministry responsible for water development and irrigation and the LDF.

11.2.3 ASSESSMENT OF EXISTING RURAL WATER SUPPLY TARIFFS

An analysis of the existing water tariffs indicates various WUAs have adopted their own tariff rates for various customer categories. The water tariff graph shown below depicts a picture of tariffs for sample of WUAs across the country. The graphs show the flat rates applied per household/customer in each of the customer categories and rate per cubic meter of water volume. The variations attest to the fact that there is a very loose and uncoordinated relationship between the various WUAs in applying the water tariff policy and indeed there is no legislation or regulation that establishes a legal regulator of the tariff setting mechanism in water supply services including schemes managed by the WUAs'. As a result most of the WUAs are not applying water tariffs that align with the fundamental policy principle of cost recovery of operation and maintenance costs. The lack of capacity building in record keeping and financial management as well as reporting is manifested in the irregular and poor water tariff policy implementation as reflected in Figure 11.1 water tariff per month and 11.2 water tariff per cubic meter below.

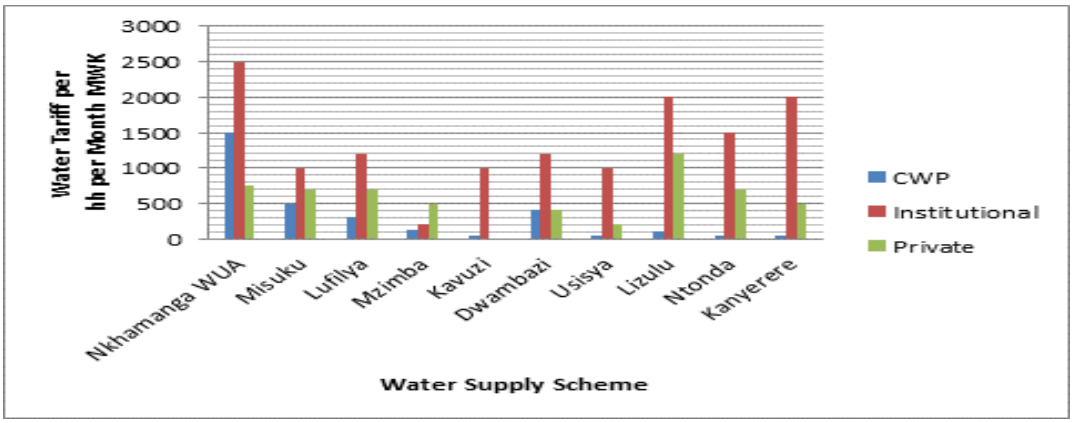

Figure 11-1: Water Tariff per Month

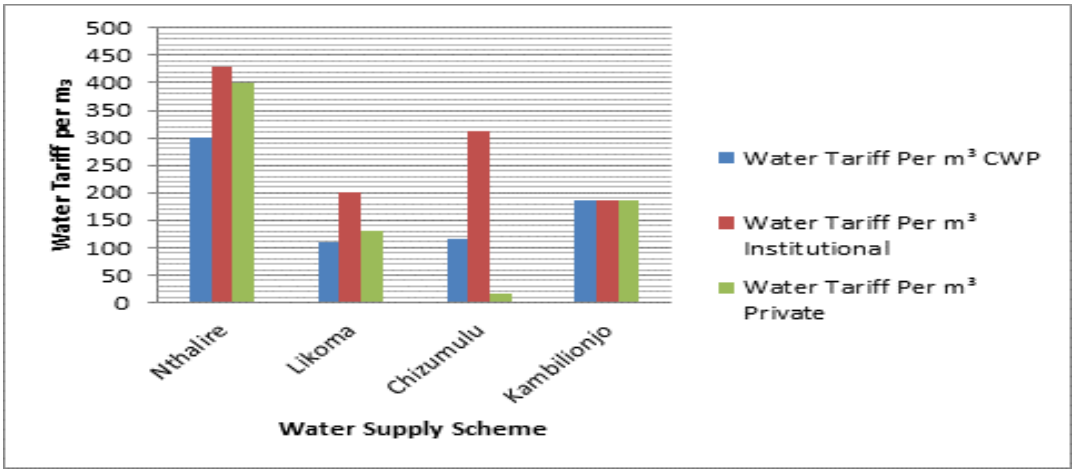

Figure 11-2: Water Tariff per m³

11.3 FINANCIAL AND ECONOMIC ANALYSIS

11.3.1 GENERAL

A financial and economic analysis has been prepared to assess the financial and economic viability of the project. Specifically the financial analysis has focused on determining the required tariff levels that fit within the Government policy of operation and maintenance cost recovery tariff for the Rural Water Supply. The guidelines for the Rural Gravity Fed Piped Water Supply Tariff define water tariff as the appropriate price a user is expected to pay for a service. As is the case the objective of this tariff is to allow the water supply scheme to generate adequate income to recover operation and maintenance costs so that the scheme is self-sustaining. The water tariff is also used as a water demand management strategy. Even though the primary objective of the water tariff is to generate adequate income, caution is always exercised in setting rural water supply tariff in order to safeguard the poor communities in the rural areas. In determining the financial and economic viability of the proposed projects, the financial and economic analysis has looked at the following key parameters:

a) Ideal Cost Recovery Tariff: Is the appropriate price that a user (household) is expected to pay at the end of the month. This amount is expected to adequately support the operation and maintenance cost of the water supply system as well as generate a positive Financial Internal Rate of Return of at least 1%.

b) Operation and Maintenance Cost Recovery Tariff: Is the appropriate price that a user (household) is expected to pay at the end of the month. This amount is expected to support the operation and maintenance cost i.e. procurement of spare parts, maintenance materials and payment of salaries and wages for the water supply operators. This amount need not generate a positive FIRR for the project.

c) Financial Internal Rate of Return (FIRR): Is an indicator that measures the financial return of the project. The derived return is often compared to the generally expected return on an investment of similar nature on the market or indeed an alternative investment.

d) Benefit Cost Ratio (BCR): Is the ration of the benefits of the project relative to its costs. A cost benefit ratio that is equal to and above 1 is generally considered favourable.

e) Net Present Value (NPV): Is the difference between the present value of the future cash flows derived from an investment and the actual investment amount. A positive NPV is an indicator that the future expected net inflows from the project are more valuable than the investment amount now. The positive NPV is an indicator of that the project is viable.

f) Economic Internal Rate of Return: Is an indicator that measures the return of the project after considering both the financial and economic benefits of the project. An EIRR that equal to or greater than 1 is considered favourable.

g) An alternative scenario which assumes an additional operational cost equivalent to 25% of the investment has been assumed to assess the tariff that is required for schemes to effectively support the operation and maintenance costs plus some minor rehabilitation and expansion works in future.

Financial and economic analysis results will help the Water Supply Schemes to plan the operations, investments and finance of the water schemes in a sustainable and affordable way.

Financial and economic analysis was done for rehabilitation and expansion of existing gravity fed schemes, the proposed new gravity fed schemes, for the Lake Malawi pumped schemes and for reticulated borehole systems. Financial and economic analysis for the proposed drilling of new boreholes to be fitted with hand pumps and rehabilitation of existing boreholes was not done on the assumption that it is not required as the community or users do not pay regular tariff for the water consumption. Maintenance of any breakdown will be made through contribution from the community as it happens and there is no operation costs involved. Provision of boreholes fitted with hand pumps is not normally based on feasibility of financial conditions.

11.3.2 FINANCIAL REQUIREMENTS FOR THE PROPOSED SCHEMES

The study has established the need for the rehabilitation, expansion and installation of new water supply systems in the various rural areas and market centers across all districts in the country. Specifically this review has proposed funding levels as highlighted in the tables that follow:

For the rehabilitation and expansion the review has proposed rehabilitation and expansion of 63 GFS which will benefit a population of 771,804 requiring an investment of MK 4,666,194,318.52 as shown in Table 11.7 below.

Table 11-7: Investment Cost for Minor, Major Rehabilitation and Expansion of Existing GFS

District	Name of GFS	No of GFS	Population				Total	Cost (MK)				
			2014-2015	2016-2017		2018-2020		2014-2015	2016-2017		2018-2020	Total
			M. Rhab	Mj. Rehab	Rexpan	Ex Taps		M. Rhab	Mj. Rehab	R & expan	Ex Taps	
Chitipa	Chisenga, Sekwa, Chitipa, Nthalire, Chinunkha, Ifumbo	6	-	54,000	35,724	6,864	96,588		225,000,000	142,474,245.00	50,248,759.95	417,723,004.95
Karonga	Ighembe, Iponga, Lufira, Chonanga, Karonga	5	3,016		26,905		29,921	43,204,071.60		255,709,333.35	44,174,392.88	343,087,797.83
Nkhatabay	Lifutazi, Dwambazi, Kalwe	3	4,576	9,000		282	13,858	29,662,694.10	37,500,000			67,162,694.10
Rumphi	Nkhamanga, Bale, Hewe, Muhuju, Ntchenachena, Ng'onga	6	6,063	109,200	-	12,230	127,493	89,838,451.90	455,000,000		225,377,364.33	770,215,816.23
Mzimba	Luzi, khosolo, Msese, Champhira S & N, Luwazi	6	5,595		39,281		44,876	54,680,742.90		241,187,692.23		295,868,435.13
Nkhotakota	Dwambazi	1	-		3,126		3,126			80,334,811.80		80,334,811.80
Ntchisi	Mpamila	1					-	4,514,421.60				4,514,421.60
Dowa							-					-
Salima	Chipoka	1			4,747		4,747			103,191,902.10		103,191,902.10
Lilongwe							-					-
Mchinji	Mchinji	1			6,815		6,815			63,511,419.60		63,511,419.60
Dedza	Mvula, Ngwere	2	10,458				10,458	22,135,785.60				22,135,785.60
Ntcheu	Lizulu, Ntonda, Dombole, Kasinje, Nanyangu	5	3,455		42,347		45,802	44,689,376.70		446,799,779.46		491,489,156.16
Mangochi	Lingamasa, Chowe	2		36,000		17,402	53,402		150,000,000		60,295,408.20	210,295,408.20
Machinga	Lifani, Milala, Chanyungu 1, Chawinga (Chagwa)	4	20,574	18,000			38,574	103,110,370.74	75,000,000		8,617,875.00	186,728,245.74
Zomba	Lifani, Makhwawa North, Zomba E, W & Old Chingale, Makwawa South	6	5,940	48,000	42,566	563	97,069	17,066,853.90	200,000,000	170,649,854.73	33,512,798.05	421,229,506.68
Thyolo	Sankhulani, Limphangwi, Mvumoni, Kalintulo, Didi	5	12,720		8,536	8,360	29,616	64,803,842.64		57,717,408.60		122,521,251.24
Mulanje	Phwera, Chambe R, Muloza Crator	3	11,242	24,000	-	11,167	46,409	76,155,952.14	100,000,000		29,579,658.88	205,735,611.02
Phalombe	Migowi, Mapelela, Livudzu, Sombani, Sakanena	5	5,896	66,000	34,496		106,392	36,311,652.00	275,000,000	391,110,840.90	40,132,966.00	742,555,458.90
Chikwawa	Mbadzi	1	-	9,600	6,288	770	16,658		40,000,000	60,914,494.80	16,979,096.84	117,893,591.64
	Total	**63**	**89,535**	**373,800**	**250,831**	**57,638**	**771,804**	**586,174,215.82**	**1,557,500,000**	**2,013,601,782.57**	**508,918,320.13**	**4,666,194,318.52**

Source: Compiled by the Consultant for this study

For the new water supply systems the review has proposed new GFS in 9 rural areas using surface water sources which will benefit a population of 84,320 requiring an investment of MK 1,375,660,000.00 as shown in Table 11.8 below.

Table 11-8: Investment Cost for New Gravity Fed Schemes

District	Name of GFS	No of GFS	Population	Investment Cost (MK)
			2020	2018-2020
Chitipa	Kayilezi	1	4,800	93,380,000.00
Nkhata Bay	Kaluwe & Chingwere	2	18,800	304,350,000.00
Nkhota kota	Katonda Spring, Aerodan	2	1,920	25,450,000.00
Machinga	Chanyangu	1	12,000	208,520,000.00
Zomba	Lisanjala (Upper Mulumbe)	1	6,400	109,460,000.00
Mwanza	Mkanto	1	9,600	151,400,000.00
Mulanje	Kamwendo	1	27,600	395,150,000.00
Nsanje	Chididi	1	4,000	87,950,000.00
Total		**10**	**85,120**	**1,375,660,000.00**

Source: Compiled by the Consultant for this study

For the new water supply systems the review has also proposed new ground water systems in 32 market centers which will benefit a population of 196,862 requiring an investment of MK 4,110,760,000.00 as shown in Table 11.9 below.

Table 11-9: Investment Cost for New Market Centers Pumped BH Schemes

District	Name of Schemes	No of BH (pumped) Sch	Population			Investment Cost (MK)		
			2017	2020	Total	2017	2020	Total
Karonga	Chitimba, Nyungwe, Kaporo	3		13,759	13,759	-	290,480,000.00	290,480,000.00
Nkhatabay	Mzenga, Kandeu, Mpamba	3	24,467	-	24,467	473,960,000.00	-	473,960,000.00
Rumphi	Mphompha	1	-	6,010	6,010	-	100,520,000.00	100,520,000.00
Mzimba	Edingeni, Embangweni, Kafukule, Jenda	4	10,189	10,932	21,121	248,440,000.00	252,040,000.00	500,480,000.00
Kasungu	Chamama	1	10,055	-	10,055	-	158,780,000.00	158,780,000.00
Ntchisi	Malomo	1	5,475	-	5,475	91,180,000.00	-	91,180,000.00
Dowa	Mvera	1	5,486	-	5,486	90,780,000.00	-	90,780,000.00
Salima	Thavite	1	1,849	-	1,849	74,580,000.00	-	74,580,000.00
Lilongwe	Namitete	1	8,380	-	8,380	182,980,000.00	-	182,980,000.00
Mchinji	Kapiri	1	7,476	-	7,476	156,860,000.00	-	156,860,000.00
Dedza	Mtakataka, Mayani, Golomoti	3	-	21,453	21,453	-	452,420,000.00	452,420,000.00
Ntcheu	Senzani, Bwanje	2		11,698	11,698		278,180,000.00	278,180,000.00
Mangochi	Malindi, Chilipa	2	11,859		11,859	248,540,000.00		248,540,000.00
Balaka	Phalula, Ulongwe	2	-	16,350	16,350	-	326,860,000.00	326,860,000.00
Machinga	Nayuchi	1	4,129	-	4,129	91,920,000.00	-	91,920,000.00
Zomba	Mayaka	1	3,947	-	3,947	91,520,000.00	-	91,520,000.00
Mwanza	Thambani	1	-	4,711	4,711	-	109,980,000.00	109,980,000.00
Thyolo	Thekerani, Bvumbwe	2	14,921	-	14,921	294,560,000.00	-	294,560,000.00
Nsanje	Marka	1	-	3,716	3,716	-	96,180,000.00	96,180,000.00
	Total	**32**	**108,233**	**88,629**	**196,862**	**2,045,320,000**	**2,065,440,000.00**	**4,110,760,000.00**

Source: Compiled by the Consultant for this study

In addition to new gravity schemes from river the review has proposed new pumped water supply system from Lake Malawi in 7 rural areas using Lake Malawi water sources which will benefit a population of 134,400 requiring an investment of MK 2,498,860,000.00 as shown in Table 11.10 below.

Table 11-10: Investment Cost for Pumped Schemes from Lake Malawi

District	Name of GFS	No of GFS	Population	Investment Cost (MK)
			2020	2018-2020
Karonga	Karonga (Lake Malawi)	1	19,200	356,980,000.00
Rumphi	Rumphi (Lake Malawi)	1	19,200	356,980,000.00
Nkhata Bay	Nkhatabay (Lake Malawi)	1	19,200	356,980,000.00
Nkhota kota	Nkhotakota (Lake Malawi)	1	19,200	356,980,000.00
Salima	Salima(Lake Malawi)	1	19,200	356,980,000.00
Dedza	Dedza(Lake Malawi)	1	19,200	356,980,000.00
Mangochi	Mangochi(Lake Malawi)	1	19,200	356,980,000.00
Total		**7**	**134,400**	**2,498,860,000.00**

Source: Compiled by the Consultant for this study

11.3.3 ASSUMPTIONS USED IN THE FINANCIAL AND ECONOMIC ANALYSIS

The financial and economic analysis has been carried out based on the following key assumptions;

a) The cost of capital has been assumed at 12%. This has been used as the discounting factor in the financial cash flows of the project in determining the IRR. The 12% is the generally accepted cost of capital for most of Government projects. The cost of capital is above London Inter-Bank Offered Rate (LIBOR) rates in order to cater for foreign exchange risk.

b) The maintenance cost of the project has been assumed at 12% of the cost of the project. This has been derived from historical trend under the existing Water User Associations.

c) Operating expenditure has been projected upwards annually by 8% representing the expected average inflation over the project life. The 8% has been assumed based on historical achieved inflation rates over the past ten years during years of economic stability.

d) The project life has been projected at 20 years. This is in line with the average expected useful life of the major assets of the project.

e) A flat operation and maintenance cost recovery tariff per household has been assumed in the base year. The base year tariff has been projected upwards by 10% representing the expected average inflation of 8% plus a margin over the project life.

f) The number of households has been derived from the population that is expected to benefit from the project in the base year. A total of 5.2, 4.7 and 4.2 individuals have been assumed per household in the north, center and southern regions respectively based on NSO census information.

g) Through sensitivity analysis, an ideal operation and maintenance cost recovery tariff has been determined seeking a minimum positive IRR of 1% which has been arbitrarily chosen as desirable and modest for rural water supply projects.

h) It has been assumed that the water supply projects being proposed will help improve the health status of households thereby improving the productivity and reduce the cost of health care. Quantifying such benefits is often difficult. In this analysis it has been assumed that the economic benefits coming from reduced cost of health care and increased productivity will invariably reduce the cost of capital of 12% used in the financial model down to 3.5%. Alternative financial and economic results have therefore been derived to show the impact of the economic benefits of the project.

11.3.4 SUSTAINABLE TARIFF FOR GRAVITY FED PIPED SCHEMES

Based on the assumptions above, a sensitivity analysis was carried out on the investment cost for the rehabilitation and expansion of GFS using a financial model that showed the results as in Table 11.11 below.

The financial analysis shows that using the base O&M cost recovery tariff and projecting it forward by 10% annually results in negative IRR and BCR that is less than 100% for all project areas under rehabilitation and expansion. The BCR results suggests that the value of the investment amount outweigh the value of the present value of future cash flows of the project given the low tariffs that have been derived based on O&M costs only. Considering these factors in isolation leads to a conclusion that the project is not financially viable and sustainable (cannot self-sustain itself after the project life due to unavailability of reserves that would cater for expansion, rehabilitation and replacement) if the base operation and maintenance cost recovery tariff is implemented and all other assumed factors used in the financial model are sustained.

The option therefore is for the project to consider applying an alternative tariff which if used in the financial model results in a positive IRR of 1% and with NPVs that are all positive as reflected in Table 11.11 under the column Ideal Tariff.

Assuming the ideal O&M cost recovery tariff is used at the base year in each of the project areas and that all other assumptions are sustained, the project is considered financially viable and must be undertaken.

It is therefore recommended that the Ideal tariff be considered as a preferred option during implementation of the proposed rehabilitation and expansion projects. In considering this, attention must be paid to the levels of willingness to pay by consumers. It is common knowledge that the rural population has low sources of income which are largely unreliable and inconsistent which impact on levels of affordability and willingness to pay for water. Targeted marketing and sensitization on the need for households to pay the ideal tariff is recommended.

Bringing on board the economic benefits of the project which invariably reduce the cost of capital from 12% to 3.5% tends to improve the IRR but the derived IRR does not cross the line from negative to positive. In the short term the project would still be considered as not viable even after incorporating the economic benefits. However in the much longer term (a period beyond the project life) the economic benefits would help the analysis results cross the line from positive IRR to positive IRR.

Despite the negative IRR based on the O&M cost recovery tariff in the base year, the project can still be considered considering the short and long term social economic benefits.

Table 11.12 is showing the impact of the enhanced economic indicators by way of reduced cost of capital. In this scenario the O&M cost recovery tariff now reflects improved IRR, NPV and BCR for all the projects though not positive.

Table 11-11: Financial Analysis Results for the Investment for Rehabilitation and Expansion of Existing GFS

				Based on O&M Cost Recovery Tariff Year 2017					Based on O&M Cost recovery that derives IRR of 1% Tariff Yr 2017			
District	**Population in 2017**	**No of HH in 2017**	**Investment Cost (MK)**	**O&M Cost based on 12% of the investment (MK)**	**Tariff MK/ House hold/ Month**	**NPV (MK)**	**IRR (%)**	**BCR (%)**	**Ideal Tariff MK/ House hold/ Month**	**NPV (MK)**	**IRR (%)**	**BCR (%)**
Chitipa	96,588	18,575	417,723,004.95	50,126,761	225	(184,252,570.02)	-12%	56%	395	26,908,313.18	1%	106%
Karonga	29,921	5,754	343,087,797.83	41,170,536	596	(115,831,945.91)	-10%	66%	988	16,918,952.86	1%	105%
Nkhata Bay	13,858	2,611	67,162,694.10	8,059,523	257	(36,770,002.83)	-13%	45%	461	2,539,862.88	1%	104%
Rumphi	127,493	24,518	770,215,816.23	92,425,898	314	(351,766,363.85)	-12%	54%	544	39,621,469.33	1%	105%
Mzimba	44876	8,630	295,868,435.13	35,504,212	343	(106,337,448.47)	-10%	64%	581	17,903,491.69	1%	106%
Ntchisi			4,514,421.60	541,731					-	-	0%	0%
Dedza	10458	2,225	22,135,785.60	2,656,294	99	(12,591,820.03)	-14%	43%	149	667,436.33	1%	103%
Ntcheu	45,802	9,745	491,489,156.16	58,978,699	504	(160,498,381.66)	-10%	67%	836	28,892,484.73	1%	106%
Nkhota-kota	3,126	665	80,334,811.80	9,640,177	1,208	(35,668,268.70)	-13%	56%	2,148	1,938,045.72	1%	102%
Salima	4,747	1,010	103,191,902.10	12,383,028	1,022	(45,816,706.47)	-13%	56%	1,817	2,489,464.03	1%	102%
Mchinji	6,815	1,450	63,511,419.60	7,621,370	438	(28,801,117.77)	-14%	55%	800	2,133,173.78	1%	103%
Machinga	38,574	9,184	186,728,245.74	22,407,389	203	(103,174,667.44)	-13%	45%	376	6,932,813.86	1%	104%
Mangochi	53,402	36,000	210,295,408.20	25,235,449	58	(260,223,781.59)	0%	24%	297	11,397,862.76	1%	105%
Zomba	97,069	23,112	421,229,506.68	50,547,541	182	(186,748,170.82)	-12%	56%	333	26,557,074.81	1%	106%
Thyolo	29,616	7,051	122,521,251.24	14,702,550	174	(56,208,286.42)	-12%	54%	309	7,216,143.72	1%	106%
Mulanje	46,409	8,391	205,735,611.02	24,688,273	245	(104,054,661.50)	-13%	49%	436	11,786,139.57	1%	106%
Phalombe	106,392	25,331	742,555,458.90	89,106,655	293	(273,968,913.64)	-11%	63%	479	23,116,184.36	1%	103%
Chikwawa	16,658	3,966	117,893,591.64	14,147,231	297	(41,347,274.43)	-10%	65%	486	5,125,298.70	1%	104%
Total	**771,804**	**188,219**	**4,666,194,318.52**			**(2,104,060,381.54)**				**232,144,212.33**		

Source: Compiled by the Consultant for this study

Table 11-12: Impact of Reduced Cost of Capital for the Investment for Rehabilitation & Expansion of Existing GFS

District	No of HH	Investment	O&M Cost Recovery Tariff Year 2017 MK/Household/Month	NPV (MK)	IRR (%)	BCR (%)
Chitipa	18,575	417,723,004.95	272.12	(129,850,426.66)	-4%	69%
Karonga	5,754	343,087,797.83	721.47	(57,346,418.07)	-2%	83%
Nkhata Bay	2,611	67,162,694.10	311.28	(29,082,126.66)	-6%	57%
Rumphi	24,518	770,215,816.23	380.11	(257,577,132.74)	-5%	67%
Mzimba	8,630	295,868,435.13	414.83	(58,262,547.50)	-3%	80%
Ntchisi		4,514,421.60				
Dedza	2,225	22,135,785.60	99.48	(10,789,825.84)	-7%	51%
Ntcheu	9,745	491,489,156.16	610.26	(74,680,119.66)	-2%	85%
Nkhota-kota	665	80,334,811.80	1,461.50	(35,584,910.49)	-6%	56%
Salima	1,010	103,191,902.10	1,236.26	(45,709,630.94)	-6%	56%
Mchinji	1,450	63,511,419.60	529.99	(28,899,519.07)	-7%	54%
Machinga	9,184	186,728,245.74	246.01	(86,813,950.54)	-6%	54%
Mangochi	36,000	210,295,408.20	70.68	(458,747,950.03)	0%	118%
Zomba	23,112	421,229,506.68	220.53	(132,532,720.45)	-4%	69%
Thyolo	7,051	122,521,251.24	210.24	(40,921,067.48)	-5%	67%
Mulanje	8,391	205,735,611.02	296.68	(82,650,466.09)	-6%	60%
Phalombe	25,331	742,555,458.90	354.69	(158,631,867.52)	-3%	79%
Chikwawa	3,966	117,893,591.64	359.67	(22,184,556.24)	-3%	81%
		4,666,194,318.52				

Source: Compiled by the Consultant for this study

11.3.5 SUSTAINABLE TARIFF FOR LAKE MALAWI PUMPED PIPED SCHEMES

Based on the assumptions above, a sensitivity analysis was carried out to determine the sustainable tariff and its associated financial and economic indicators for the new proposed schemes along Lake Malawi. Table 11.13 is showing the results from the sensitivity analysis.

The financial analysis again shows that using the base O&M cost recovery tariff and projecting it forward by 10% annually results in negative IRR of 14%and BCR of 43% for all projects. The BCR less than 100% suggests that the value of the investment amount outweigh the value of the present value of future cash flows of the project. Considering these factors in isolation leads to a conclusion that the project is not financially viable and sustainable if the base full cost recovery is implemented and all other assumed factors used in the financial model are sustained.

The option therefore is for the project to consider applying an alternative tariff which if used in the financial model results in a positive IRR of 1% and with NPVs that are all positive as reflected in Table 11.13 under the column Ideal Tariff.

Assuming the ideal full cost recovery tariff is used at the base year in each of the project areas and that all other assumptions are sustained, the project is considered financially viable and must be undertaken.

It is therefore recommended that the Ideal tariff be considered as a preferred option during implementation of the proposed new water supply schemes along the lake. In considering this, attention must be paid to the levels of willingness to pay by the beneficiaries. Targeted marketing and sensitization on the need for households to pay the ideal tariff is recommended.

Bringing on board the economic benefits of the project which invariably reduce the cost of capital from 12% to 3.5% tends to improve the IRR but the derived IRR does not cross the line from negative to positive. In the short term the project would still be considered as not viable even after incorporating the economic benefits. However in the much longer term (a period beyond the project life) the economic benefits would help the analysis results cross the line from positive IRR to positive IRR.

Table 11.14 is showing the impact of the enhanced economic indicators by way of reduced cost of capital. The O&M cost recovery tariff now reflects improved negative IRR of -7% from -14% for all projects which further strengthen the viability of the project.

Table 11-13: Financial Analysis Results for the New Pumped Scheme from Lake Malawi

					Based on O&M Cost Recovery Tariff					Based on O&M Cost recovery that derives IRR of 1%			
District	**Pumped Scheme**	**Population served 2020**	**No of HH**	**Investment (MK)**	**O&M Cost based on 12% of the investment (MK)**	**O&M Cost Recovery Tariff Year 2020 MK/Household/ Month**	**NPV (MK)**	**IRR (%)**	**BCR (%)**	**Ideal Tariff Yr 2020 MK/Household/Month**	**NPV (MK)**	**IRR (%)**	**BCR (%)**
Karonga	Lake Malawi	19,200	3,692	356,980,000.00	42,837,600.00	966.82	(203,066,111.87)	-14%	43%	1,459.90	3,934,271.55	1%	104%
Nkhota kota	Lake Malawi	19,200	4,085	356,980,000.00	42,837,600.00	873.86	(203,066,111.87)	-14%	43%	1,319.52	15,040,225.50	1%	104%
Nkhata Bay	Lake Malawi	19,200	3,692	356,980,000.00	42,837,600.00	966.82	(203,066,111.87)	-14%	43%	1,459.90	15,040,225.50	1%	104%
Mangochi	Lake Malawi	19,200	4,571	356,980,000.00	42,837,600.00	780.89	(203,066,111.87)	-14%	43%	1,179.15	15,040,225.50	1%	104%
Rumphi	Lake Malawi	19,200	3,692	356,980,000.00	42,837,600.00	966.82	(203,066,111.87)	-14%	43%	1,459.90	15,040,225.50	1%	104%
Salima	Lake Malawi	19,200	4,085	356,980,000.00	42,837,600.00	873.86	(203,066,111.87)	-14%	43%	1,319.52	15,040,225.50	1%	104%
Dedza	Lake Malawi	19,200	4,085	356,980,000.00	42,837,600.00	873.86	(203,066,111.87)	-14%	43%	1,319.52	15,040,225.50	1%	104%
		134,400		**2,498,860,000.00**			**(1,421,462,783.07)**				**94,175,624.55**		

Source: Compiled by the Consultant for this study

Table 11-14: Financial Analysis Results for New Pumped Scheme from Lake Malawi Assuming the Low Cost of Capital of 3.5%

					Based on O&M Cost Recovery Tariff			
District	**GFS Scheme**	**Population served 2020**	**No of HH**	**Investment (MK)**	**O&M Cost Recovery Tariff Year 2020 MK/Household/Month**	**NPV (MK)**	**IRR (%)**	**BCR (%)**
Karonga	Lake Malawi	19,200	3,692	356,980,000.00	966.82	(174,005,662.05)	-7%	51%
Nkhota kota	Lake Malawi	19,200	4,085	356,980,000.00	873.86	(174,005,662.05)	-7%	51%
Nkhata Bay	Lake Malawi	19,200	3,692	356,980,000.00	966.82	(174,005,662.05)	-7%	51%
Mangochi	Lake Malawi	19,200	4,571	356,980,000.00	780.89	(174,005,662.05)	-7%	51%
Rumphi	Lake Malawi	19,200	3,692	356,980,000.00	966.82	(174,005,662.05)	-7%	51%
Salima	Lake Malawi	19,200	4,085	356,980,000.00	873.86	(174,005,662.05)	-7%	51%
Dedza	Lake Malawi	19,200	4,085	356,980,000.00	873.86	(174,005,662.05)	-7%	51%
		134,400		**2,498,860,000.00**		**(1,218,039,634.34)**		

Source: Compiled by the Consultant for this study

11.3.6 SUSTAINABLE TARIFF FOR NEW GFS

Based on the assumptions above, a sensitivity analysis was carried out to determine the sustainable tariff and its associated financial and economic indicators for the new proposed GFS schemes. Table 11.15 is showing the results from the sensitivity analysis.

The financial analysis also shows that using the O&M cost recovery tariff and projecting it forward by 10% annually results in negative IRR of 14% and BCR of 43% for all projects. The BCR less than 100% suggests that the value of the investment amount outweigh the value of the present value of future cash flows of the project. Considering these factors in isolation leads to a conclusion that the project is not financially viable and sustainable if the base full cost recovery is implemented and all other assumed factors used in the financial model are sustained.

The option therefore is for the project to consider applying an alternative tariff which if used in the financial model results in a positive IRR of 1% and with NPVs that are all positive as reflected in Table 11.15 under the column Ideal Tariff.

Assuming the ideal full cost recovery tariff is used at the base year in each of the project areas and that all other assumptions are sustained, the project is considered financially viable and must be undertaken.

It is therefore recommended that the Ideal tariff be considered as a preferred option during implementation of the proposed new gravity fed water supply schemes. In considering this attention must be paid to the levels of willingness to by the beneficiaries. Likewise targeted marketing and sensitization on the need for households to pay the ideal tariff is recommended.

Bringing on board the economic benefits of the project which invariably reduce the cost of capital from 12% to 3.5% tends to improve the IRR but the derived IRR does not cross the line from negative to positive. In the short term the project would still be considered as not viable even after incorporating the economic benefits. However in the much longer term (a period beyond the project life) the economic benefits would help the analysis results cross the line from positive IRR to positive IRR.

Table 11.16 is showing the impact of the enhanced economic indicators by way of reduced cost of capital. The full cost recovery tariff now reflects improved IRR of -7% from -14%, for all projects which further strengthen the viability of the project.

Table 11-15: Financial Analysis Results for the New GFS

					Based on O&M Cost Recovery Tariff					Based on O&M Cost recovery that derives IRR of 1%			
District	**GFS Scheme**	**Population served 2020**	**No of HH**	**Investment (MK)**	**O&M Cost based on 12% of the investment (MK)**	**Tariff Year 2020 MK/Household /Month**	**NPV (MK)**	**IRR (%)**	**BCR (%)**	**Ideal Tariff Yr 2020 MK/House hold/Month**	**NPV (MK)**	**IRR (%)**	**BCR (%)**
Nkhata Bay	Kaluwe & Chingwere	18,800	3,615	304,350,000.00	36,522,000.00	841.82	(173,127,825.50)	-14%	43%	1,271.15	12,822,826.58	1%	104%
Machinga	Chanyangu	12,000	2,857	208,520,000.00	25,022,400.00	729.82	(118,615,456.46)	-14%	43%	1,102.03	8,785,332.01	1%	104%
Nkhota- Kota	Katonda Spring, Aerodan	1,920	409	25,450,000.00	3,054,000.00	622.99	(14,477,092.69)	-14%	43%	940.72	1,072,255.42	1%	104%
Chitipa	Kayilezi	4,800	923	93,380,000.00	11,205,600.00	1,011.62	(53,118,700.00)	-14%	43%	1,527.54	3,934,271.55	1%	104%
Zomba	Lisanjala (Upper Mulumbe)	6,400	1,524	109,460,000.00	13,135,200.00	718.33	(62,265,719.66)	-14%	43%	1,084.68	4,611,751.59	1%	104%
Mwanza	Mkanto	9,600	2,286	151,400,000.00	18,168,000.00	662.38	(86,123,058.26)	-14%	43%	1,000.19	6,378,761.11	1%	104%
Mulanje	Kamwendo	27,600	6,571	395,150,000.00	47,418,000.00	601.32	(224,778,906.67)	-14%	43%	907.99	16,648,397.97	1%	104%
Nsanje	Chididi	4,000	952	87,950,000.00	10,554,000.00	923.48	(50,029,874.33)	-14%	43%	1,394.45	3,705,495.64	1%	104%
	Total	**85,120**	**19,137**	**1,375,660,000.00**			**(3,625,462,199.70)**				**57,959,091.86**		

Source: Compiled by the Consultant for this study

Table 11-16: Financial Analysis Results for New GFS from Assuming the Low Cost of Capital of 3.5%

					Based on O&M Cost Recovery Tariff			
District	**GFS Scheme**	**Population served 2020**	**No of HH**	**Investment (MK)**	**Tariff Year 2020 MK/Household/Month**	**NPV (MK)**	**IRR (%)**	**BCR (%)**
Nkhata Bay	Kaluwe & Chingwere	18,800	3,615	304,350,000.00	841.82	(148,351,793.50)	-7%	51%
Machinga	Chanyangu	12,000	2,857	208,520,000.00	729.82	(101,640,597.93)	-7%	51%
Nkhota- Kota	Katonda Spring, Aerodan	1,920	409	25,450,000.00	622.99	(12,405,300.29)	-7%	51%
Chitipa	Kayilezi	4,800	923	93,380,000.00	1,011.62	(45,516,972.16)	-7%	51%
Zomba	Lisanjala (Upper Mulumbe)	6,400	1,524	109,460,000.00	718.33	(53,354,977.22)	-7%	51%
Mwanza	Mkanto	9,600	2,286	151,400,000.00	662.38	(73,798,132.20)	-7%	51%
Mulanje	Kamwendo	27,600	6,571	395,150,000.00	601.32	(192,611,175.30)	-7%	51%
Nsanje	Chididi	4,000	952	87,950,000.00	923.48	(42,870,183.14)	-7%	51%
	Total	**85,120**	**19,137**	**1,375,660,000.00**		**(670,549,131.75)**		

Source: Compiled by the Consultant for this study

11.3.7 SUSTAINABLE TARIFF FOR GROUND WATER BASED PIPED SCHEMES

Based on the assumptions above, a sensitivity analysis was carried out to determine the sustainable tariff and its associated financial and economic indicators for the new proposed ground water piped schemes in the Market Centres. Table 11.17 is showing the results from the sensitivity analysis.

The financial analysis also shows that using the base O&M cost recovery tariff and projecting it forward by 10% annually results in negative IRR of 14% and BCR of 43% for all projects. The BCR less than 100% suggests that the value of the investment amount outweigh the value of the present value of future cash flows of the project. Considering these factors in isolation leads to a conclusion that the project is not financially viable and sustainable if the base full cost recovery is implemented and all other assumed factors used in the financial model are sustained.

The option therefore is for the project to consider applying an alternative tariff which if used in the financial model results in a positive IRR of 1% and with NPVs that are all positive as reflected in Table 11.17under the column Ideal Tariff.

Assuming the ideal full cost recovery tariff is used at the base year in each of the project areas and that all other assumptions are sustained, the project is considered financially viable and must be undertaken.

It is therefore recommended that the Ideal tariff be considered as a preferred option implementation of the new water supply schemes in the Market Centres. In considering this attention must be paid to the levels of willingness to by the beneficiaries. Likewise targeted marketing and sensitization on the need for households to pay the ideal tariff is recommended.

Bringing on board the economic benefits of the project which invariably reduce the cost of capital from 12% to 3.5% tends to improve the IRR but the derived IRR does not cross the line from negative to positive. In the short term the project would still be considered as not viable even after incorporating the economic benefits. However in the much longer term (a period beyond the project life) the economic benefits would help the analysis results cross the line from positive IRR to positive IRR.

Table 11.18 is showing the impact of the enhanced economic indicators by way of reduced cost of capital. The O&M cost recovery tariff now improved IRR of -7% from 14% for all projects which further strengthen the viability of the project.

Table 11-17: Financial Analysis Results for New Schemes in Market Centres Assuming Cost of Capital of 12%

					Based on O&M Cost Recovery Tariff					Based on Ideal Tariff that derives at least 1% IRR			
District	**Market Center Scheme**	**Population served 2020**	**No of HH**	**Investment (MK)**	**O&M Cost (MK)**	**Tariff Year 2020 MK/Household /Month**	**NPV (MK)**	**IRR (%)**	**BCR (%)**	**Ideal Tariff Yr 2020 MK/Household/ Month**	**NPV (MK)**	**IRR (%)**	**BCR (%)**
Karonga	Chitimba, Nyungwe, Kaporo	13,759	2,646	290,480,000.00	34,857,600.00	1,097.82	(165,237,952.20)	-14%	43%	1,646.74	8,758,528.30	1%	103%
Nkhata Bay	Mzenga, Kandeu, Mpamba	24,467	4,705	473,960,000.00	56,875,200.00	1,007.31	(269,609,542.22)	-14%	43%	1,510.97	14,290,801.68	1%	103%
Rumphi	Mphompha	6,010	1,156	100,520,000.00	12,062,400.00	869.72	(57,180,249.78)	-14%	43%	1,304.59	3,030,870.51	1%	103%
Mzimba	Edingeni, Embangweni, Kafukule, Jenda	21,121	4,062	500,480,000.00	60,057,600.00	1,232.18	(217,979,176.46)	-12%	56%	1,959.42	26,535,403.55	1%	103%
Kasungu	Chamama	10,055	2,139	158,780,000.00	19,053,600.00	742.18	(90,321,130.71)	-14%	43%	1,113.28	4,787,521.08	1%	103%
Ntchisi	Malomo	5,475	1,165	91,180,000.00	10,941,600.00	782.73	(51,867,242.09)	-14%	43%	1,174.10	2,749,251.62	1%	103%
Dowa	Mvera	5,486	1,167	90,780,000.00	10,893,600.00	777.74	(51,639,704.28)	-14%	43%	1,166.60	2,737,190.85	1%	103%
Salima	Thavite	1,849	393	74,580,000.00	8,949,600.00	1,895.76	(42,424,423.28)	-14%	43%	2,843.64	2,248,729.83	1%	103%
Lilongwe	Namitete	8,380	1,783	182,980,000.00	21,957,600.00	1,026.26	(104,087,167.77)	-14%	43%	1,539.39	5,517,197.42	1%	103%
Mchinji	Kapiri	7,476	1,591	156,860,000.00	18,823,200.00	986.14	(89,228,949.26)	-14%	43%	1,479.22	4,729,629.40	1%	103%
Dedza	Mtakataka, Mayani, Golomoti	21,453	4,564	452,420,000.00	54,290,400.00	991.18	(257,356,631.55)	-14%	43%	1,486.77	13,641,329.43	1%	103%
Ntcheu	Senzani, Bwanje	11,698	2,489	278,180,000.00	33,381,600.00	1,117.67	(158,241,164.77)	-14%	43%	1,676.50	8,387,659.74	1%	103%
Mangochi	Malindi, Chilipa	11,859	2,824	248,540,000.00	29,824,800.00	880.23	(141,380,613.60)	-14%	43%	1,320.35	7,493,956.98	1%	103%
Balaka	Phalula, Ulongwe	16,350	3,893	326,860,000.00	39,223,200.00	839.64	(185,932,515.34)	-14%	43%	1,259.46	9,855,454.97	1%	103%
Machinga	Nayuchi	4,129	983	91,920,000.00	11,030,400.00	935.01	(52,925,612.29)	-14%	42%	1,402.51	2,771,564.04	1%	103%
Zomba	Mayaka	3,947	840	91,520,000.00	10,982,400.00	1,089.80	(52,060,649.22)	-14%	43%	1,634.70	2,759,503.27	1%	103%
Mwanza	Thambani	4,711	1,002	109,980,000.00	13,197,600.00	1,097.23	(62,561,518.81)	-14%	43%	1,645.85	3,316,107.62	1%	103%
Thyolo	Thekerani, Bvumbwe	14,921	3,175	294,560,000.00	35,347,200.00	927.84	(167,558,837.78)	-14%	43%	1,391.76	8,881,548.11	1%	103%
Nsanje	Marka	3,716	791	96,180,000.00	11,541,600.00	1,216.49	(54,711,464.62)	-14%	43%	1,824.73	2,900,011.19	1%	103%
	Total	**196,862**	**41,368**	**4,110,760,000.00**			**(2,272,304,546.02)**				**135,392,259.58**		

Source: Compiled by the Consultant for this study

Table 11-18: Financial Analysis Results for New Schemes in Market Centres based on Low Cost of Capital Derived from the Water Project

District	Market Center Scheme	Population served 2020	No of HH	Investment (MK)	O&M Cost Recovery Tariff Year 2020 MK/Household/Month	NPV (MK)	IRR (%)	BCR (%)
Karonga	Chitimba, Nyungwe, Kaporo	13,759	2,646	290,480,000.00	1,097.82	(141,591,026.70)	-7%	51%
Nkhata Bay	Mzenga, Kandeu, Mpamba	24,467	4,705	473,960,000.00	1,007.31	(231,026,173.97)	-7%	51%
Rumphi	Mphompha	6,010	1,156	100,520,000.00	869.72	(48,997,280.38)	-7%	51%
Mzimba	Edingeni, Embangweni, Kafukule, Jenda	21,121	4,062	500,480,000.00	1,232.18	(151,542,748.63)	-4%	70%
Kasungu	Chamama	10,055	2,139	158,780,000.00	742.18	(77,395,425.57)	-7%	51%
Ntchisi	Malomo	5,475	1,165	91,180,000.00	782.73	(44,444,608.28)	-7%	51%
Dowa	Mvera	5,486	1,167	90,780,000.00	777.74	(44,249,633.03)	-7%	51%
Salima	Thavite	1,849	393	74,580,000.00	1,895.76	(36,353,135.40)	-7%	51%
Lilongwe	Namitete	8,380	1,783	182,980,000.00	1,026.26	(89,191,428.21)	-7%	51%
Mchinji	Kapiri	7,476	1,591	156,860,000.00	986.14	(76,459,544.37)	-7%	51%
Dedza	Mtakataka, Mayani, Golomoti	21,453	4,564	452,420,000.00	991.18	(220,526,756.75)	-7%	51%
Ntcheu	Senzani, Bwanje	11,698	2,489	278,180,000.00	1,117.67	(135,595,537.76)	-7%	51%
Mangochi	Malindi, Chilipa	11,859	2,824	248,540,000.00	880.23	(121,147,871.72)	-7%	51%
Balaka	Phalula, Ulongwe	16,350	3,893	326,860,000.00	839.64	(159,324,025.71)	-7%	51%
Machinga	Nayuchi	4,129	983	91,920,000.00	935.01	(47,444,239.57)	-7%	48%
Zomba	Mayaka	3,947	840	91,520,000.00	1,089.80	(44,610,337.25)	-7%	51%
Mwanza	Thambani	4,711	1,002	109,980,000.00	1,097.23	(53,608,445.04)	-7%	51%
Thyolo	Thekerani, Bvumbwe	14,921	3,175	294,560,000.00	927.84	(143,579,774.25)	-7%	51%
Nsanje	Marka	3,716	791	96,180,000.00	1,216.49	(46,881,798.91)	-7%	51%
	Total	**196,862**	**41,368**	**4,110,760,000.00**		**(1,913,969,791.51)**		

Source: Compiled by the Consultant for this study

In general these projects are viable particularly when the alternative tariff is taken into consideration.

11.3.8 ALTERNATIVE SCENARIO – O&M PLUS 25% INVESTMENT COST RECOVERY

An alternative scenario which assumes an additional cost of operation and maintenance equivalent to 25% of the investment has been assumed. This has been considered to allow the proposed water supply schemes generate adequate reserves that should support minor expansion and rehabilitation in future.

The analysis shows that the based on the alternative scenario the project returns favorable and positive NPV, IRR, and BCR due to the higher O&M cost recovery tariff derived from the alternative assumptions. For Most project areas an IRR range of 23% to 59% for most has been derived. Similarly a positive BCR with a range of 254% to 301% has been determined under the alternative scenario.

The analysis therefore favors the base tariff derived from the additional cost of operational and maintenance. The question is whether consumers would be willing to pay the higher tariff bearing in mind that the project areas are in the rural areas. Table 11.19, 11.20, 11.21 and 11.22 show the ultimate tariffs for all project categories for the alternative scenario.

Table 11-19: Financial Analysis Results for the Investment for Rehab & Expan of Existing GFS with 25% Investment Cost Recovery

				Based on O&M Cost Recovery Tariff				
District	**Population in 2017**	**No of HH in 2017**	**Investment Cost (MK)**	**O&M Cost based on 37% of the investment (MK)**	**Tariff Year 2017 MK/Household/ Month**	**NPV (MK)**	**IRR (%)**	**BCR (%)**
Chitipa	96,588	18,575	417,723,004.95	154,557,512	693	793,344,111.48	36%	290%
Karonga	29,921	5,754	343,087,797.83	126,942,485	1,838	631,639,330.98	40%	284%
Nkhata Bay	13,858	2,611	67,162,694.10	24,850,197	793	133,845,733.77	32%	299%
Rumphi	127,493	24,518	770,215,816.23	284,979,852	969	1,544,492,517.85	43%	301%
Mzimba	44876	8,630	295,868,435.13	109,471,321	1,057	540,750,781.51	37%	283%
Ntchisi			4,514,421.60	1,670,336				
Dedza	10458	2,225	22,135,785.60	8,190,241	307	42,655,081.47	32%	293%
Ntcheu	45,802	9,745	491,489,156.16	181,850,988	1,555	905,891,631.79	42%	284%
Nkhota-kota	3,126	665	80,334,811.80	29,723,880	3,724	131,026,387.42	32%	263%
Salima	4,747	1,010	103,191,902.10	38,181,004	3,150	168,306,389.73	32%	263%
Mchinji	6,815	1,450	63,511,419.60	23,499,225	1,351	97,564,452.29	32%	254%
Machinga	38,574	9,184	186,728,245.74	69,089,451	627	329,637,759.04	24%	277%
Mangochi	53,402	12,715	210,295,408.20	77,809,301	510	395,913,111.38	32%	288%
Zomba	97,069	23,112	421,229,506.68	155,854,917	562	684,596,786.82	23%	263%
Thyolo	29,616	7,051	122,521,251.24	45,332,863	536	224,928,372.00	32%	284%
Mulanje	46,409	8,391	205,735,611.02	76,122,176	756	409,424,066.66	38%	299%
Phalombe	106,392	25,331	742,555,458.90	274,745,520	904	1,494,394,764.89	56%	301%
Chikwawa	16,658	3,966	117,893,591.64	43,620,629	917	235,275,184.68	59%	300%
Total	**771,804**	**164,933**	**4,666,194,318.52**			**8,763,686,463.75**		

Source: Compiled by the Consultant for this study

Table 11-20: Financial Analysis Results for the Investment for the Lake Malawi Pumped Schemes with 25% Investment Cost Recovery

					Based on O&M Cost Recovery Tariff				
District	**Pumped Scheme**	**Population served 2020**	**No of HH**	**Investment (MK)**	**O&M Cost based on 37% of the investment (MK)**	**Tariff Year 2020 MK/Household/ Month**	**NPV (MK)**	**IRR (%)**	**BCR (%)**
Karonga	Lake Malawi	19,200	3,692	356,980,000.00	132,082,600.00	2,981.03	687,891,148.62	32%	293%
Nkhota kota	Lake Malawi	19,200	4,085	356,980,000.00	132,082,600.00	2,694.39	687,891,148.62	32%	293%
Nkhata Bay	Lake Malawi	19,200	3,692	356,980,000.00	132,082,600.00	2,981.03	687,891,148.62	32%	293%
Mangochi	Lake Malawi	19,200	4,571	356,980,000.00	132,082,600.00	2,407.76	687,891,148.62	32%	293%
Rumphi	Lake Malawi	19,200	3,692	356,980,000.00	132,082,600.00	2,981.03	687,891,148.62	32%	293%
Salima	Lake Malawi	19,200	4,085	356,980,000.00	132,082,600.00	2,694.39	687,891,148.62	32%	293%
Dedza	Lake Malawi	19,200	4,085	356,980,000.00	132,082,600.00	2,694.39	687,891,148.62	32%	293%
		134,400		**2,498,860,000.00**			**4,815,238,040.35**		

Source: Compiled by the Consultant for this study

Table 11-21: Financial Analysis Results for the Investment for New GFS with 25% Investment Cost Recovery

					Based on O&M Cost Recovery Tariff				
District	**GFS Scheme**	**Population served 2020**	**No of HH**	**Investment (MK)**	**O&M Cost based on 37% of the investment (MK)**	**Tariff Year 2020 MK/Household/ Month**	**NPV (MK)**	**IRR (%)**	**BCR (%)**
Nkhata Bay	Kaluwe & Chingwere	18,800	3,615	304,350,000.00	112,609,500.00	2,595.61	586,474,511.41	32%	293%
Machinga	Chanyangu	12,000	2,857	208,520,000.00	77,152,400.00	2,250.28	401,812,601.02	32%	293%
Nkhota- Kota	Katonda Spring, Aerodan	1,920	409	25,450,000.00	9,416,500.00	1,920.90	49,041,486.17	32%	293%
Chitipa	Kayilezi	4,800	923	93,380,000.00	34,550,600.00	3,119.15	179,940,824.30	32%	293%
Zomba	Lisanjala (Upper Mulumbe)	6,400	1,524	109,460,000.00	40,500,200.00	2,214.85	210,926,564.87	32%	293%
Mwanza	Mkanto	9,600	2,286	151,400,000.00	56,018,000.00	2,042.32	291,743,850.92	32%	293%
Mulanje	Kamwendo	27,600	6,571	395,150,000.00	146,205,500.00	1,854.06	761,443,743.01	32%	293%
Nsanje	Chididi	4,000	952	87,950,000.00	32,541,500.00	2,847.38	169,477,355.93	32%	293%
	Total	**85,120**	**19,137**	**1,375,660,000.00**			**12,281,337,018.33**		

Source: Compiled by the Consultant for this study

Table 11-22: Financial Analysis Results for the New Schemes in Market centers with 25% Investment Cost Recovery

					Based on O&M Cost Recovery Tariff				
District	**Market Center Scheme**	**Population served 2020**	**No of HH**	**Investment**	**O&M Cost**	**Tariff Year 2020 MK/Household /Month**	**NPV**	**IRR (%)**	**BCR (%)**
Karonga	Chitimba, Nyungwe, Kaporo	13,759	2,646	290,480,000.00	107,477,600.00	3,384.96	559,747,383.19	32%	293%
Nkhata Bay	Mzenga, Kandeu, Mpamba	24,467	4,705	473,960,000.00	175,365,200.00	3,105.88	913,308,557.34	32%	293%
Rumphi	Mphompha	6,010	1,156	100,520,000.00	37,192,400.00	2,681.65	193,699,418.06	32%	293%
Mzimba	Edingeni, Kafukule, Embangweni, Jenda	21,121	4,062	500,480,000.00	185,177,600.00	3,799.23	939,760,312.22	35%	288%
Kasungu	Chamama	10,055	2,139	158,780,000.00	58,748,600.00	2,288.40	305,964,918.42	32%	293%
Ntchisi	Malomo	5,475	1,165	91,180,000.00	33,736,600.00	2,413.42	175,701,481.68	32%	293%
Dowa	Mvera	5,486	1,167	90,780,000.00	33,588,600.00	2,398.02	174,930,692.12	32%	293%
Salima	Thavite	1,849	93	74,580,000.00	27,594,600.00	5,845.26	143,713,714.67	32%	293%
Lilongwe	Namitete	8,380	1,783	182,980,000.00	67,702,600.00	3,164.30	352,597,687.19	32%	293%
Mchinji	Kapiri	7,476	1,591	156,860,000.00	58,038,200.00	3,040.61	302,265,128.50	32%	293%
Dedza	Mtakataka, Mayani, Golomoti	21,453	4,564	452,420,000.00	167,395,400.00	3,056.13	871,801,539.19	32%	293%
Ntcheu	Senzani, Bwanje	11,698	2,489	278,180,000.00	102,926,600.00	3,446.14	536,045,604.02	32%	293%
Mangochi	Malindi, Chilipa	11,859	2,824	248,540,000.00	91,959,800.00	2,714.05	478,930,097.14	32%	293%
Balaka	Phalula, Ulongwe	16,350	3,893	326,860,000.00	120,938,200.00	2,588.89	629,850,694.26	32%	293%
Machinga	Nayuchi	4,129	983	91,920,000.00	34,010,400.00	2,882.94	175,162,047.80	32%	291%
Zomba	Mayaka	3,947	840	91,520,000.00	33,862,400.00	3,360.22	176,356,652.81	32%	293%
Mwanza	Thambani	4,711	1,002	109,980,000.00	40,692,600.00	3,383.13	211,928,591.31	32%	293%
Thyolo	Thekerani, Bvumbwe	14,921	3,175	294,560,000.00	108,987,200.00	2,860.84	567,609,436.77	32%	293%
Nsanje	Marka	3,716	791	96,180,000.00	35,586,600.00	3,750.83	185,336,351.26	32%	293%
	Total	**196,862**	**41,368**	**4,110,760,000.00**			**7,894,710,307.98**		

Source: Compiled by the Consultant for this study

The financial analysis under the alternative scenario shows that the adjusted O&M cost recovery tariff has the most favorable indicators in form of the NPV, IRR and BCR. However this entails that the rural consumers will be paying tariffs that are significantly higher than existing tariffs. The choice is between seeking the financial viability and sustainability of the water supply schemes as opposed to the social bearing of water on the rural communities. If the major determining factor is financial viability of the project the choice on implementation of the water tariffs is between the ideal tariff which derives the 1% IRR and the tariff derived from the additional 25% O&M cost on investment.

However it is recommended that for a start the tariff derived from 12% O&M cost recovery be initially considered and gradually graduated to higher tariffs that would lead to the financial viability of the water supply schemes. Whichever tariff that is picked by the project must be implemented with substantive marketing and sensitization on the need and justification for the consumers to pay a water tariff. Sound financial management would be a key in instilling confidence in consumers that the water tariff being proposed would be put to good use.

12 IMPLEMENTATION STRATEGY AND TIME FRAME

12.1 PROJECT MANAGEMENT AND ADMINISTRATION APPROACH BY THE NWDP

The Ministry responsible for Water Development and Irrigation through the Project Management Unit (PMU) of the NWDP is responsible for the implementation of rural water supply projects financed by donor partners. The NWDP is a multi-donor financing Programme and Development Partners that have contributed to the Programme are the AfDB Group, the World Bank (IDA), the British Department for International Development (DfID) through the African Catalytic Growth Fund, the European Union and European Investment Bank, the Netherlands through UNICEF and the OPEC Fund.

The PMU is spearheading the administration and management of the donor funded projects and is mainly dealing with procurement, project administration and management activities related to goods, consultants and contractors that are involved in the implementation of the project activities and delivery of goods required for the works.

The PMU follows the procedures and manuals prepared for the different projects based on the requirements of the financier or donor as well as national and local rules and regulations of the Government of Malawi for project administration and management. The procedures and conditions provided in the contract conditions are also guiding principles or basis for project administration.

The PMU through different sections in the organization follow up the activities of the different consultants, contractors and suppliers at national level and project site level. The PMU is responsible for preparation of procurement plans, hiring of suppliers, consultants and contractors and also processing of payments to all according to the contract agreements. The PMU has project manager that coordinates the activities of the different sections under its jurisdiction and follow up implementation activities and project management through different experts assigned for this purpose. The PMU conduct progress meeting with consultants and contractors to assess their performance and also prepare progress reports for donors.

The PMU has assigned specialist staffs to perform its duties such as preparation of procurement plans, project TORs for recruitment of Consultants, evaluation of Tenders, daily follow up of performance and reporting of different projects to the Ministry responsible for Water Development and Irrigation and the donors.

PMU has so many projects and seem to be overwhelmed by large volume of works and although many are successfully implemented, there are also some delays in project planning to its implementation stage in some cases as indicated in the End Line Study and Value for Money report for ADF/AusAID financed projects prepared by MCE and WEMS in 2013. The report further indicated that implementation of some activities were delayed from the onset of the start of the projects and this was to certain extent attributed to shortage of staffing and the volume of work expected to be performed by PMU. The case of IDA/World Bank funded projects could be similar to that of the ADF/AusAID funded projects and therefore need to be assessed in detail.

The NWDP which is running now is about to be concluded very soon and if establishing a new one it is important to consider lessons learnt and improve the set up and performance of the PMU on the next NWDP. The PMU has to have sufficient qualified staff and also recruitment of qualified consultants and capable contractors must be considered. Strict adherence to contract conditions and procedures is important in the administration and management of contracts. In general there is need to conduct detailed performance assessment of the PMU in order to improve its management capacity and practice in the next NWDP if to be continued.

12.2 IMPLEMENTATION STRATEGY

12.2.1 TYPE OF ACTIVITIES PERFORMED DURING THE IMPLEMENTATION

The activities to be implemented to achieve the end result of the water supply system involves preparatory works that require a long process and communities and politicians get fed up with the process without not knowing the importance and contribution of such activities to the sustainability of the facilities. The activities to be implemented prior to startup of supplying water to the target community can be described as follows:

- Project formulation – this is the process whereby the concept of the project is initiated, potential input and out puts are set together, benefits identified and preliminary plans are put in place
- Project planning – at this stage the resources required to make project preparations are sourced, terms of references prepared and conditions or procedures of donor support established and stakeholder responsibilities defined, including the executing authority. Fulfillment of conditions set by donors' and recruitment process of consultants under gone.
- Project Preparation – at this stage the recruited consultant will be on board conducting activities according to the TOR given to it. The activities involved are feasibility study and detailed designs with preparation of tender documents. Also sensitization of the community, formulation of the necessary scheme management committees, training of the committees and the district level different implementers at grass route level. During this period the communities apply for facilities and make the required contribution and this is appraised by the district coordination team.
- Project tendering and selection of contractors – the procedure to select a contractor need to be followed from the client and donor conditions following the tender documents. This process requires advertising, selling of tender documents and preparation of tender by the bidders, evaluation of bids by the client, approval or obtaining no objection consent from donors, award, negotiation and contract signing with the winning contractor.
- Project construction - this involves mobilization by the contractor and construction of physical structures as designed during the project preparation stage. Supervision works by the consultant and the communities and district water development office is also part of this project implementation period. All completed facilities are tested and checked and handed over to users as final step to this process.
- Project defects liability period – this is the 12 months period after handing over of the facilities to the users for the contractor to correct any defects observed on any of the parts of the facilities during this period. This marks the end of the project process in general

- Mentoring period – This process is not practiced commonly in the project implementation process but it is very important to ensure sustainability of the implemented facilities that are put in place and granted by the user communities. This includes monitoring and evaluation of project performance and achievement of its targets, strengthening of the capacity of the management and operators of the facilities and empowering the role of the community in the sustainability of the schemes.

12.2.2 ROLES AND RESPONSIBILITIES OF STAKEHOLDERS

The implementation strategy for the proposed interventions will be carried out step by step and is set in such a way that different stakeholders will be involved in the implementation on the basis of the responsibilities accorded to them. The stakeholders envisaged to get involved in the implementation of the interventions are classified as follows together with their roles to play.

Table 12-1 Roles and Responsibilities of Stake holders

Name of Stakeholder	Role
Government of Malawi	• Overall strategic planning, coordination, quality assurance, collaboration with donors, and allocation of resources
Ministry responsible for Water Development and Irrigation	• Policy formulation and guidance • Ensure allocation of resources • Ensure planning and implementation of the interventions • Regulate tariffs • Coordinate collaboration and participation of stakeholders • Providing technical support • Ensure M&E system
Ministry of Finance	• Ensure sufficient allocation and proper utilization of financial resources • Facilitate and ensure availability of financial resources
Ministry of Local government	• Establish, develop and facilitate the management of self-sustaining, efficient and effective decentralized government systems
Ministry of Health	• responsible for policy on hygiene promotion
The Ministry of Gender, Labor & Social Development	• Responsible for spear heading and coordinating gender responsive development and community mobilization
Development Partners	• Provide adequate financial support • Follow up of the implementation of the interventions • Ensure proper utilization of the finance • Provide technical support
Local Governments (Districts Council)	• Oversees all development activities in the district carry out planning, budgeting and resource allocation, community mobilization and ensure their effective participation and involvement and follow up implementation, operation and maintenance of water services,
District Executive Committee	• Serves as the technical arm of the District Council and is responsible for planning, co-ordination, monitoring and evaluation of water supply and sanitation projects.
District Coordination Team	• spearheads all social aspects of water supply and sanitation activities in the district • responsible for planning community work, training extension workers and overseeing implementation of all social aspects of the project
District Water development Officer	• responsible for local level planning, coordination and support for the operation and maintenance of the systems
Village Development Committees	• Responsible for identifying needs and facilitating planning and development in local communities.

Name of Stakeholder	Role
Area Development Committees	• Responsible for development of projects in TAs and STAs and for mobilizing community resources to implement them. They also submit requests to the District Assembly (DA) for funding and monitor development initiatives.
Water User Associations	• Legal entities responsible for overseeing operation and maintenance of the schemes. • Responsible for the day to day operations of the scheme, and financial management including maintenance and expansion of the scheme over time with contractual arrangement with
Area Mechanics (AMs)	• Responsible for repair and maintenance of a cluster of water points (hand pumps) with a contractual arrangement with the water point committees (WPCs).
Village Headmen and G/Village Headmen	• Custodians of tradition supervised by the District Commissioner in all areas of social and economic development in their areas.
Water Point Committee (WPC)	• Keep records on money and water point maintenance. • Protect communal water point (CWP) against theft and vandalism. • Monitoring construction of the CWP. • Decide on how funds for maintenance of communal water point should be raised/ managed.

12.3 IMPLEMENTATION TAME FRAME

The proposed intervention will be implemented stage by stage over the period from 2014 to 2020. Activities to be implemented as stated above will be carried out following the time frame proposed as follows:

- Project formulation – the time required to prepare project formulation depends on the capacity of the client and the way the work is organized. The activities under this assignment, for preparation of investment plan for rural water supply can be considered as a project formulation which elapsed for almost 7 months. So depending on the nature of the project this might take from 1 month to 6 months on average.
- Project planning – this process requires a lot of communication, discussion, meetings, preparation of different conditions and procedures, preparation of TORs and recruitment of consultants and approvals by donors and client. Experience is showing that this period sometimes take over a year if not well organized and planned specially if the information required by donors is not well addressed. In general this process will require about 12 months on average.
- Project Preparation – this depends on the level of activities to be performed and size and complexity of the scheme as iterated in the TOR. The process involves field works, interaction with different stakeholders including community activities, office works, review and acceptance of reports by client and donors. From experience this stage consumes a lot of time due to mainly delays by different stakeholders in responding to some decisive issues to proceed to next stage. In some cases there is pressure on the consultants to speed up to compensate time lost in the project planning period which results in poor quality output for the project preparation. Again experience is showing that this period sometimes take over two year if not well organized and planned specially in responding approval and go ahead issues and coordination of community participation. In general this process will require about 18 months on average.

- Project tendering and selection of contractors – the major time consuming process is the approval procedures as this is required for each step; approval for advertisement, approval for the tender evaluation, approval for signing the contract as well as longer time for negotiation and signing of the contract. From experience this process takes about 6-8 months. In general this process will require about 6 months on average.
- Project construction - this depends on the size and complexity of the physical structures to be constructed. This can take about 8 months to 24 months and can be determined during the project preparation stage.
- Project defects liability period – this is the 12 months period after handing over of the facilities to the users and is standard for all projects
- Mentoring period – this depends on the availability of resources and capacity of the implementer and can vary from 12 months to 36 months after the defects liability period.

12.4 IMPLEMENTATION SCHEDULE

The proposed intervention will be implemented stage by stage over the period from 2014 to 2020. The time schedule for the implementation of the proposed activities during the planning stage of 2014 to 2020 is depicted in Figure 12.1.

Description of Activities	Yr 2014				Yr 2015				Yr 2016				Yr 2017				Yr 2018				Yr 2019				Yr 2020			
	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
Project Planning and preparation (study & design) works																												
Rehabilitation of existing non-functional boreholes																												
Rehab of non-functional standpipes of existing GFS by Mgnt																												
Rehab of non-functional GFS and standpipes under minor rehab																												
Drilling of additional BHs with hand pumps																												
Rehab of non-functional GFS and standpipes under major rehab																												
Rehab of non-functional GFS and standpipes under rehab& expan																												
Implement BH based reticulated system in 17 market centres																												
Drilling of additional BHs with hand pumps																												
Expansion of existing GFS & standpipes under rehab& expansion																												
Implement proposed new GFS																												
Implement pumped system from Lake Malawi																												
Implement BH based reticulated system in 15 market centres																												
Drilling of additional BHs with hand pumps																												

Figure 12-1 Implementation Schedule of Proposed Activities

13 CONCLUSIONS AND RECOMMENDATIONS

13.1 CONCLUSIONS

Malawi has already surpassed the MDG targets and the water supply coverage at present is about 81% for the rural areas. The planned target is to achieve 90% by 2020 in each district and at national level with the proposed activities to be implemented and this is taken into consideration in the Investment Plan as presented in Annex V Conceptual Design Topical Report. Detailed field assessment of existing gravity fed schemes was conducted and for new schemes data analysis and field assessment was also made to come up with new facilities to be provided. Pumping water from Lake Malawi to supply water to the villages along the Lakeshore districts and boreholes based reticulated water supply system are proposed for market centre where groundwater potential is expected to be sufficient.

The proposed technology options are those that are commonly used in place in the country and are known to many operators of the schemes. The technology options proposed, according to the opinion of the consultant are the most appropriate and practical types being used at present. The conventional treatment plants for instance rapid sand filter can be considered for the pumped system from Lake Malawi as slow sand filter would require large area and challenge in cleaning and to certain extent more expensive for large schemes. The use of energy sources like solar and wind mill apart from fuel or electricity driven pumps can also be considered in specific cases during the project preparation stage and compared to select the most appropriate options. The availability longer hours of sunshine in the country need to be utilized by installing solar energy driven pumps which has less O&M cost which is good for beneficieries in terms of less tariff which contributes to sustainability of the system.

Attempt has been made in the preparation of the investment plan to bring the water supply coverage level of the districts to the same level at the end of the planning period and all the required facilities to be implemented are proposed for each district to ensure equitable distribution of services accordingly. Government and donor partners are required to follow the plans and contribute the necessary resources to achieve the set targets.

Local Governments are charged with responsibilities for the provision and management of rural water and sanitation services, in liaison with the Ministry Responsible for Water Development and Irrigation. The District Co-ordination Team (DCT) spearheads all social and technical aspects of water supply and sanitation activities in the district. However, most districts do not have the required staff and where they are available they do not have the appropriate background and skills needed for the position. In addition the districts do not have revenue base for operations and maintenance of existing facilities and for new investment.

In general, the projects that have been proposed are critical in the socio economic development of Malawi and are in line with Government's agenda on poverty reduction. It is therefore important that Government through the Ministry Responsible for Water Development and Irrigation gives prime focus on these projects so that they are implemented within the proposed timeframe. In carrying out this project Government must pay particular attention to the recommendations made particularly as it relates to strengthening the financial management structure of WUAs, changing the social mind set of communities on water tariffs and sourcing low cost capital for the project.

13.2 RECOMMENDATIONS

The rural water supply investment plan is prepared based on information and data provided in the different topical reports prepared for this assignment and data collected from different institutions and organizations. In the preparation of the investment plan a number of assumptions have been made which would require further verification during the feasibility study and design of the proposed activities. In order to implement the proposed facilities to meet the set targets the following recommendations are made:

- From NWDP experience there were some delays in the project preparation from client as well as consultants side in completing the assignments as planed in terms of timing. This is a lesson that project preparation works should be conducted in parallel while actual implementation of some other activities is in progress and government and donors have to allocate funds for project preparation in advance and instead of combining it with the physical implementation activities.
- The water supply coverage and access in all the districts have to come to similar level as planned and Ministry Responsible for Water Development and Irrigation has to ensure the boosting of coverage and access level for the districts that are now at lower levels.
- The activities to be implemented are based on assumptions and estimates from existing secondary data and information from field assessments and feasibility study has to be carried out with all the necessary investigations prior to going into the physical implementation.
- Estimating water supply access is not straight forward and calculating coverage and/or access using the number of water points by number of people supposed to be served by a water point gives unrealistic figures which could result into incorrect coverage/access figures. The Ministry Responsible for Water Development and Irrigation has to therefore come up with better method of estimating the coverage/access by conducting research and study on the method to be used in the future.
- The targets set and activities planned can only be achieved if financial resources are allocated accordingly and government and donors must therefore ensure that resources are allocated sufficiently and on time to meet the targets.
- The formation of the WUAs in all the gravity fed systems groundwater based reticulated systems for the sustainable operation and maintenance of the system and management of the schemes is vital and Ministry Responsible for Water Development and Irrigation in collaboration with the District council and District Water Development Offices must enhance and ensure that the WUAs are formed in all the GFS and reticulated system.
- Sustaining of the functionality of existing functional facilities and also carrying out rehabilitation works on existing schemes at community level is considered in the planning and the District Council and the DWDOs must take serious steps to ensure the community and scheme management bodies such as WUAs and scheme committees take action in this regard by providing the necessary technical support.
- The use of renewable energy sources for pumps, particularly solar driven pumps in Lake water sources and borehole based reticulated systems for market centres has to be given priority in the designs and implementation.

- Environmental issues regarding catchment protection and mitigation of negative environmental impacts must be given serious attention and be implemented together with the physical implementation of the facilities proposed and this must be put as part of the requirements in project preparation and implementation.
- From the financial analysis the ideal tariff should be the preferred option so that the schemes operate on a sustainable basis.
- The financial management structure of the WUAs must be strengthened to ensure maximum accountability of the revenues that will be collected from customers.
- A cost of capital of 12% was used in the financial model which is generally giving a negative IRR. This must be taken into consideration in sourcing funds for the project. Funding for this project must be sourced preferably at a cost of capital that is equal and or lower than 3.5%.
- A marketing strategy must be developed and implemented. This strategy should focus on sensitizing communities in the project areas on the need to pay for water at the recommended tariffs. This strategy must be preceded by a survey on the willingness to pay for water.
- The performance and approach in project management and construction of the NWDP need to be assessed and lessons learnt to be adopted if NWDP and PMU are to continue.

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APPENDIX TO THE INVESTMENT PLAN

SUMMARY OF COSTS FOR ALL INVESTMENT PLAN WORKS

Type of Major Activities	MK	USD
Rehabilitation of Existing Boreholes fitted with hand pumps	4,194,750,000.00	10,486,875.00
Minor Rehabilitation works of Existing Gravity Fed Schemes	586,174,215.82	1,465,435.54
Major Rehabilitation works of Existing Gravity Fed Schemes	2,013,601,782.57	5,034,004.46
Rehabilitation and Expansion works of Existing Gravity Fed Schemes	2,066,418,320.13	5,166,045.80
New Gravity Fed schemes	1,375,660,000.00	3,439,150.00
Pumped System schemes from Lake Malawi	2,498,860,000.00	6,247,150.00
Borehole Based Reticulated Schemes for Market centres	4,110,760,000.00	10,276,900.00
New Boreholes to be Drilled and Fitted with Hand pumps	40,510,000,000.00	101,275,000.00
Total Physical works	**57,356,224,318.52**	**143,390,560.80**
Add 10% Environmental Cost	5,735,622,431.85	14,339,056.08
Add 15% Engineering Cost	8,603,433,647.78	21,508,584.12
Add 5% Capacity Building Cost	2,867,811,215.93	7,169,528.04
Total for Investment Plan	**74,563,091,614.08**	**186,407,729.04**

1USD = MK400.00

SUMMARY OF COSTS FOR REHABILITATION OF EXISTING BOREHOLES WITH HAND PUMPS

No	District Name	No. of BH to be rehab	Cost estimate	
			MK	USD
1	Chitipa	52	39,000,000.00	97,500.00
2	Karonga	165	123,750,000.00	309,375.00
3	Nkhatabay	81	60,750,000.00	151,875.00
4	Rumphi	294	220,500,000.00	551,250.00
5	Mzimba	385	288,750,000.00	721,875.00
6	Likoma	0	-	-
7	Kasungu	145	108,750,000.00	271,875.00
8	Nkhotakota	262	196,500,000.00	491,250.00
9	Ntchisi	172	129,000,000.00	322,500.00
10	Dowa	190	142,500,000.00	356,250.00
11	Salima	68	51,000,000.00	127,500.00
12	Lilongwe	603	452,250,000.00	1,130,625.00
13	Mchinji	168	126,000,000.00	315,000.00
14	Dedza	325	243,750,000.00	609,375.00
15	Ntcheu	388	291,000,000.00	727,500.00
16	Mangochi	117	87,750,000.00	219,375.00
17	Machinga	305	228,750,000.00	571,875.00
18	Zomba	177	132,750,000.00	331,875.00
19	Chiradzulu	303	227,250,000.00	568,125.00
20	Blantyre R	310	232,500,000.00	581,250.00
21	Mwanza	41	30,750,000.00	76,875.00
22	Thyolo	151	113,250,000.00	283,125.00
23	Mulanje	137	102,750,000.00	256,875.00
24	Phalombe	220	165,000,000.00	412,500.00
25	Chikwawa	211	158,250,000.00	395,625.00
26	Nsanje	159	119,250,000.00	298,125.00
27	Balaka	137	102,750,000.00	256,875.00
28	Neno	27	20,250,000.00	50,625.00
		Total	**4,194,750,000.00**	**10,486,875.00**

SUMMARY OF COSTS FOR MINOR REHABILITATION WORKS OF EXISTING GRAVITY FED SCHEMES

No.	District Name	Name of the scheme	Cost estimate	
			MK	USD
1	Chitipa	0	0	-
2	Karonga	Ighembe	43,204,071.60	108,010.18
3	Nkhatabay	Lifutazi	29,662,694.10	74,156.74
4	Rumphi	Luviri	9,710,158.50	24,275.40
		Lunyina	16,047,000.00	40,117.50
		Kantizi	30,000,430.00	75,001.08
		Bale	34,080,863.40	85,202.16
5	Mzimba	Luzi	23,887,556.10	59,718.89
		Khosolo	12,410,884.80	31,027.21
		Msese	18,382,302.00	45,955.76
6	Likoma	0	0	-
7	Kasungu	0	0	-
8	Nkhotakota	0	0	-
9	Ntchisi	Mpamila	4,514,421.60	11,286.05
10	Dowa	0	0	-
11	Salima	0	0	-
12	Lilongwe	0	0	-
13	Mchinji	0	0	-
14	Dedza	Mvula	16,338,000.00	40,845.00
		Ngwere	5,797,785.60	14,494.46
15	Ntcheu	Lizulu	7,851,168.00	19,627.92
		Ntonda	36,838,208.70	92,095.52
16	Mangochi	0	0	-
17	Machinga	Lifani	35,043,008.94	87,607.52
		Milala	34,862,205.60	87,155.51
		Chanyungu 1	33,205,156.20	83,012.89
18	Zomba	Makhwawa North	17,066,853.90	42,667.13
19	Chiradzulu	0	0	-
20	Blantyre R	0	0	-
21	Mwanza	0	0	-
22	Thyolo	Sankhulani	16,254,182.52	40,635.46
		Limphangwi	16,872,462.00	42,181.16
		Mvumoni	22,708,748.52	56,771.87
		Kalintulo	8,968,449.60	22,421.12
23	Mulanje	Phwera	31,353,337.44	78,383.34
		Chambe Rural	44,802,614.70	112,006.54
24	Phalombe	Migowi	36,311,652.00	90,779.13
25	Chikwawa	0	0	-
26	Nsanje	0	0	-
27	Balaka	0	0	-
28	Neno	0	0	-
		Total	**586,174,215.82**	**1,465,435.54**

SUMMARY OF COSTS FOR MAJOR REHABILITATION WORKS OF EXISTING GRAVITY FED SCHEMES

No.	District Name	Name of the scheme	Cost estimate	
			MK	USD
1	Chitipa	Sekwa	82,654,384.20	206,635.96
		Chisenga/ Chitipa	59,819,860.80	149,549.65
2	Karonga	Chonanga	103,872,273.75	259,680.68
		Iponga	54,950,626.80	137,376.57
		Lufira /Karonga	96,886,432.80	242,216.08
3	Nkhatabay	0	0	-
4	Rumphi	0	0	-
5	Mzimba	Champhira South	119,762,396.10	299,405.99
		Champhira North	63,960,597.00	159,901.49
		Luwazi	57,464,699.13	143,661.75
6	Likoma	0	0	-
7	Kasungu	0	0	-
8	Nkhotakota	Dwambazi	80,334,811.80	200,837.03
9	Ntchisi	0	0	-
10	Dowa	0	0	-
11	Salima	Chipoka	103,191,902.10	257,979.76
12	Lilongwe	0	0	-
13	Mchinji	Mchinji	63,511,419.60	158,778.55
14	Dedza	0	0	-
15	Ntcheu	Dombole/ Mkhande	271,816,495.20	679,541.24
		Sanjika 1 &2	8,281,472.40	20,703.68
		Kasinje	55,403,956.26	138,509.89
		Nanyangu	111,297,855.60	278,244.64
16	Mangochi	0	0	-
17	Machinga	0	0	-
18	Zomba	Zomba West and old Chingale	170,649,854.73	426,624.64
19	Chiradzulu	0	0	-
20	Blantyre R	0	0	-
21	Mwanza	0	0	-
22	Thyolo	Didi	57,717,408.60	144,293.52
23	Mulanje	0	0	-
24	Phalombe	Phlombe Major	187,616,493.00	469,041.23
		Muloza East	203,494,347.90	508,735.87
25	Chikwawa	East Bank -Mapelela	27,637,621.20	69,094.05
		East Bank -Livudzu	8,953,351.20	22,383.38
		East Bank -Limphangwi	24,323,522.40	60,808.81
26	Nsanje	0	0	-
27	Balaka	0	0	-
28	Neno	0	0	-
		Total	**2,013,601,782.57**	**5,034,004.46**

SUMMARY OF COSTS FOR REHABILITATION AND EXPANSION OF EXISTING GRAVITY FED SCHEMES

No.	District Name	Name of the scheme	Cost estimate	
			MK	USD
1	Chitipa	Nthalire	44,271,864.00	110,679.66
		Chinunkha	143,448,745.05	358,621.86
		Ifumbo	87,528,150.90	218,820.38
2	Karonga	0	0	-
3	Nkhatabay	Kalwe	81,674,392.88	204,185.98
4	Rumphi	Hewe	447,571,517.40	1,118,928.79
		Muhuju	82,113,766.80	205,284.42
		Ntchenachena	76,016,250.00	190,040.63
		Ng'onga	74,675,830.13	186,689.58
5	Mzimba	0	0	-
6	Likoma	0	0	-
7	Kasungu	0	0	-
8	Nkhotakota	0	0	-
9	Ntchisi	0	0	-
10	Dowa	0	0	-
11	Salima	0	0	-
12	Lilongwe	0	0	-
13	Mchinji	0	0	-
14	Dedza	0	0	-
15	Ntcheu	0	0	-
16	Mangochi	Lingamasa	114,940,624.20	287,351.56
		Chowe	95,354,784.00	238,386.96
17	Machinga	Chawinga liwonde (Chagwa)	83,617,875.00	209,044.69
18	Zomba	Makhwawa South	233,512,798.05	583,782.00
19	Chiradzulu	0	0	-
20	Blantyre R	0	0	-
21	Mwanza	0	0	-
22	Thyolo	0	0	-
23	Mulanje	Muloza Crator	129,579,658.88	323,949.15
24	Phalombe	Sombani	280,712,808.00	701,782.02
		Sakanena	34,420,158.00	86,050.40
25	Chikwawa	Mbadzi	56,979,096.84	142,447.74
26	Nsanje	0	0	-
27	Balaka	0	0	-
28	Neno	0	0	-
		Total	**2,066,418,320.13**	**5,166,045.80**

SUMMARY OF COSTS FOR PROPOSED NEW GRAVITY FED SCHEMES

No.	District Name	Name of the scheme	Cost estimate	
			MK	USD
1	Chitipa	Kayilezi	93,380,000.00	233,450.00
2	Karonga	0	0	-
3	Nkhatabay	Kaluwe	129,890,000.00	324,725.00
		Chingwere	174,460,000.00	436,150.00
4	Rumphi	0	0	-
5	Mzimba	0	0	-
6	Likoma	0	0	-
7	Kasungu	0	0	-
8	Nkhotakota	Katonda Spring	10,050,000.00	25,125.00
		Aerodan	15,400,000.00	38,500.00
9	Ntchisi	0	0	-
10	Dowa	0	0	-
11	Salima	0	0	-
12	Lilongwe	0	0	-
13	Mchinji	0	0	-
14	Dedza	0	0	-
15	Ntcheu	0	0	-
16	Mangochi	0	0	-
17	Machinga	Chanyungu	208,520,000.00	521,300.00
18	Zomba	Lisanjala (Upper Mulumbe)	109,460,000.00	273,650.00
19	Chiradzulu	0	0	-
20	Blantyre R	0	0	-
21	Mwanza	Mkanto	151,400,000.00	378,500.00
22	Thyolo	0	0	-
23	Mulanje	Kamwendo*	395,150,000.00	987,875.00
24	Phalombe	0	0	-
25	Chikwawa	0	0	-
26	Nsanje	Chididi	87,950,000.00	219,875.00
27	Balaka	0	0	-
28	Neno	0	0	-
		Total	**1,375,660,000.00**	**3,439,150.00**

SUMMARY OF COSTS FOR PROPOSED NEW PUMPED SCHEMES FROM LAKE MALAWI

No.	District Name	Name of the scheme	Cost estimate	
			MK	USD
1	Chitipa	0	0	-
2	Karonga	Lake Malawi	356,980,000.00	892,450.00
3	Nkhatabay	Lake Malawi	356,980,000.00	892,450.00
4	Rumphi	Lake Malawi	356,980,000.00	892,450.00
5	Mzimba	0	0	-
6	Likoma	0	0	-
7	Kasungu	0	0	-
8	Nkhotakota	Lake Malawi	356,980,000.00	892,450.00
9	Ntchisi	0	0	-
10	Dowa	0	0	-
11	Salima	Lake Malawi	356,980,000.00	892,450.00
12	Lilongwe	0	0	-
13	Mchinji	0	0	-
14	Dedza	Lake Malawi	356,980,000.00	892,450.00
15	Ntcheu	0	0	-
16	Mangochi	Lake Malawi	356,980,000.00	892,450.00
17	Machinga	0	0	-
18	Zomba	0	0	-
19	Chiradzulu	0	0	-
20	Blantyre R	0	0	-
21	Mwanza	0	0	-
22	Thyolo	0	0	-
23	Mulanje	0	0	-
24	Phalombe	0	0	-
25	Chikwawa	0	0	-
26	Nsanje	0	0	-
27	Balaka	0	0	-
28	Neno	0	0	-
		Total	**2,498,860,000.00**	**6,247,150.00**

SUMMARY OF COSTS FOR PROPOSED BOREHOLE BASED RETICULATION FOR 32 MARKET CENTRES

No.	District Name	Name of the scheme	Cost estimate	
			MK	USD
1	Chitipa	0	0	-
2	Karonga	Chitimba	82,994,285.71	207,485.71
		Nyungwe	82,994,285.71	207,485.71
		Kaporo	124,491,428.57	311,228.57
3	Nkhatabay	Mzenga	236,980,000.00	592,450.00
		Kandeu	67,708,571.43	169,271.43
		Mpamba	169,271,428.57	423,178.57
4	Rumphi	Mphompha	100,520,000.00	251,300.00
5	Mzimba	Edingeni	157,525,000.00	393,812.50
		Kafukule	94,515,000.00	236,287.50
		Embangweni	155,275,000.00	388,187.50
		Jenda	93,165,000.00	232,912.50
6	Likoma	0	0	-
7	Kasungu	Chamama	158,780,000.00	396,950.00
8	Nkhotakota	0	0	-
9	Ntchisi	Malomo	91,180,000.00	227,950.00
10	Dowa	Mvera	90,780,000.00	226,950.00
11	Salima	Thavite	74,580,000.00	186,450.00
12	Lilongwe	Namitete	182,980,000.00	457,450.00
13	Mchinji	Kapiri	156,860,000.00	392,150.00
14	Dedza	Mtakataka	139,206,153.85	348,015.38
		Mayani	174,007,692.31	435,019.23
		Golomoti	139,206,153.85	348,015.38
15	Ntcheu	Senzani	154,544,444.44	386,361.11
		Bwanje	123,635,555.56	309,088.89
16	Mangochi	Malindi	177,528,571.43	443,821.43
		Chilipa	71,011,428.57	177,528.57
17	Machinga	Nayuchi	91,920,000.00	229,800.00
18	Zomba	Mayaka	91,520,000.00	228,800.00
19	Chiradzulu	0	-	-
20	Blantyre R	0	-	-
21	Mwanza	Thambani	109,980,000.00	274,950.00
22	Thyolo	Thekerani	110,460,000.00	276,150.00
		Bvumbwe	184,100,000.00	460,250.00
23	Mulanje	0	-	-
24	Phalombe	0	-	-
25	Chikwawa	0	-	-
26	Nsanje	Marka	96,180,000.00	240,450.00
27	Balaka	Phalula	181,588,888.89	453,972.22
		Ulongwe	145,271,111.11	363,177.78
28	Neno	0	0	-
		Total	**4,110,760,000.00**	**10,276,900.00**

SUMMARY OF COSTS FOR PROPOSED DRILLING OF NEW BOREHOLES WITH HAND PUMPS

No.	District Name	No. of BH with Hanp pums	Cost estimate	
			MK	USD
1	Chitipa	0	-	-
2	Karonga	0	-	-
3	Nkhatabay	80	400,000,000.00	1,000,000.00
4	Rumphi	0	-	-
5	Mzimba	450	2,250,000,000.00	5,625,000.00
6	Likoma	2	10,000,000.00	25,000.00
7	Kasungu	1450	7,250,000,000.00	18,125,000.00
8	Nkhotakota	0	-	-
9	Ntchisi	230	1,150,000,000.00	2,875,000.00
10	Dowa	1650	8,250,000,000.00	20,625,000.00
11	Salima	280	1,400,000,000.00	3,500,000.00
12	Lilongwe	1600	8,000,000,000.00	20,000,000.00
13	Mchinji	720	3,600,000,000.00	9,000,000.00
14	Dedza	0	-	-
15	Ntcheu	60	300,000,000.00	750,000.00
16	Mangochi	350	1,750,000,000.00	4,375,000.00
17	Machinga	400	2,000,000,000.00	5,000,000.00
18	Zomba	0	-	-
19	Chiradzulu	0	-	-
20	Blantyre R	80	400,000,000.00	1,000,000.00
21	Mwanza	0	-	-
22	Thyolo	400	2,000,000,000.00	5,000,000.00
23	Mulanje	0	-	-
24	Phalombe	0	-	-
25	Chikwawa	120	600,000,000.00	1,500,000.00
26	Nsanje	0	-	-
27	Balaka	0	-	-
28	Neno	230	1,150,000,000.00	2,875,000.00
	Total	**8,102**	**40,510,000,000.00**	**101,275,000.00**

ANNEXES

THE FOLLOWING ANNEXES ARE THE TOPICAL REPORTS PRESENTED IN SEPARATE VOLUMES.

ANNEX I: POLICY, LEGAL AND INSTITUTIONAL ASSESSMENT

ANNEX I -VOLUME I – POLICY AND LEGAL ASSESSMENT

ANNEX I - VOLUME II – INSTITUTIONAL ASSESSMENT

ANNEX II: WATER RESOURCES ASSESSMENT (SURFACE WATER AND GROUNDWATER)

ANNEX II - VOLUME I - SURFACE WATER RESOURCES ASSESSMENT

ANNEX II - VOLUME II - GROUNDWATER RESOURCES ASSESSMENT

ANNEX III: SOCIO-ECONOMIC AND ENVIRONMENTAL ASSESSMENT

ANNEX IV: DETAILED ASSESSMENT OF EXISTING GRAVITY FED SCHEMES

ANNEX IV -VOLUME I – MAIN REPORT GFS ASSESSMENT

ANNEX IV – VOLUME II -COST ESTIMATES FOR REHABILITATION WORKS

ANNEX IV –VOLUME III – HISTORICAL RECORDS OF EXISTING GFS

ANNEX V: CONCEPTUAL DESIGN REPORT