Mchinji Water Supply and Sanitation

Consolidated Feasibility Report

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CRIDF

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In preparing this document CRIDF can confirm that it has followed CRIDF's internal general procedures, including appropriate CRIDF generic scope of work and that it has undergone appropriate quality assurance (QA) and quality control (QC) procedures as detailed in CRIDF's QA manual. Furthermore, CRIDF can confirm the applicable specific internal process and procedures have been followed including:

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Disclaimer

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List of Acronyms

Acronym	Long-Form
AIDS	Acquired Immune Deficiency Syndrome
BCR	Benefit-Cost Ratio
CBA	Cost-Benefit Analysis
CDC	Centres for Disease Control and Prevention
CRIDF	Climate Resilient Infrastructure Development Facility
CRWB	Central Region Water Board
DFID	Department for International Development
EAD	Environmental Affairs Department (Malawi)
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
ERR	Economic Rate of Return
ENPV	Economic Net Present Value
EWSC	Eastern Water and Sewerage Company
FGD	Focus Group Discussion
FIRR	Financial Internal Rate of Return
FNPV	Financial Net Present Value
GESI	Gender Equality and Social Inclusion
GBP	Great British Pound
HIV	Human Immune Deficiency Virus
IDSR	Integrated Disease Surveillance and Response
KII	Key Informant Interview

Acronym	Long-Form
MDC	Mchinji District Council
MOIWD	Ministry of Irrigation and Water Development
MRA	Malawi Revenue Authority
MWK	Malawian Kwacha
NGO	Non-Governmental Organisation
NRW	Non-Revenue Water
NSO	National Statistics Office
OECD	Organisation for Economic Co-operation and Development
O&M	Operation and Maintenance
SADC	Southern African Development Community
SCF	Standard Conversion Factor
SIWI	Stockholm International Water Institute
NWSCO	National Water and Sanitation Council
USD	US Dollar
VAT	Value Added Tax
WASH	Water Supply, Sanitation and Hygiene
WHO	Work Health Organisation
WSP	Water and Sanitation Program
WTP	Willingness to Pay
WUA	Water Users Association
ZMW	Zambian Kwacha

Section 0: Executive Summary

Access to reliable and safe water supply and sanitation facilities at border towns in the SADC region has emerged as a major challenge that requires urgent action to ensure continued activities at these strategic centres. The Climate Resilient Infrastructure Development Facility (CRIDF), DFID's innovative water infrastructure programme for southern Africa, has to date proceeded with studies in 5 of the 12 Zambian border towns (Kazungula, Mwami (Chipata)/Mchinji, Chanida, Siavonga and Chirundu).

The CRIDF interventions provide the entry point and platform for CRIDF to engage with, support and influence key SADC interventions, river basin organisations and national stakeholders. It is envisaged that through CRIDF, the inhabitants of the SADC region will benefit from climate-resilient water infrastructure thereby enhancing sustainability and cooperation amongst the stakeholder.

This report is a summary of the feasibility study undertaken to provide improvements to the existing water supply and sanitation infrastructure at the Mchinji Border Post, Malawi. The Mchinji border serves as a crossing point between Zambia and Mwami (Chipata) in Zambia.

Mchinji Border Town is an important international border on the Ncala transport corridor (Great East Road).

The high volume of traffic has brought people looking for opportunities to Mchinji, which has developed in a haphazard way, placing the existing services under pressure. The pressure on services has increased the risk of waterborne diseases in Mchinji Border Town and the possibility of cross border infection. This is exacerbated by the high transient cross border population that spends time in and passing through Mchniji while completing the cross border formalities.

The population of Mchinji Border Town is estimated to currently be 1,521 people, growing to 2,547 by 2031. The residential population is enlarged on a daily basis by the transient cross border population, which is currently estimated as 100 people per day, growing to 208 people by 2031.

Mchinji residents clearly expressed their dissatisfaction with the current water supply and sanitation services. The existing water supply infrastructure comprises one handpump operated borehole and hand-dug wells (protected and unprotected). The majority of the residents have pit latrines, but the border crossing population are only serviced by very unhygienic improved pit latrines. The cross border population often uses resident households at a fee, but this has in the past lead to conflict.

The Feasibility Study has identified the lack of a reliable water system as a constraint to growth and improvement of hygienic conditions. Reviewing the alternatives, it is recommended that a water supply system comprising boreholes, storage and distribution, be provided. Initially the distribution will be on the basis of entry level technology, i.e. kiosk, however the system should allow for the upgrade to yard or house connections.

In terms of sanitation intervention, the construction of a Communal Ablution Block (CAB), mainly for the border traffic is proposed. In addition to toilet services, the CAB should include showers and laundry facilities.

The estimated capital investment for the proposed project is £392,000. Due to the size and nature of the project, there is no benefit in phasing the project.

The project brings a number of high resilience benefits to the project recipients especially in relation to governance and livelihoods, gender and health. The review also identified a number of risks in relation to the associated infrastructure and risk-mitigating actions which if implemented will improve the resilience of the project itself to climate change risks.

The project is not expected to have significant environmental impact, as it is mainly within the urban area, which is already severely degraded. The project could actually be used to enhance certain environmental challenges, like improved sanitation by making Mchinji an open defecation free zone. An Environmental Impact Assessment (EIA) will be required, in accordance with the Environmental Management Act, but this is expected to be limited to and Environmental Project Brief (EPB). The approval of the EIA is expected to be the only permit required before proceeding with construction. The CRWB will need to secure land title of the proposed borehole sites, storage tank sites, kiosk and ablution block sites.

The financial appraisal assesses the project's financial cash-flows (revenues and expenditures) over the life of the project to determine the profitability of an investment in the project. This is done from the perspective of the Central Region Water Board (CRWB), who will be the effective project owner. The costs included in the financial appraisal are the capital investment costs and annual O&M costs. Revenue streams are expected to flow from households who access water either from a household connection or communal access point, businesses, and consumers who use the proposed ablution facilities.

The results of the appraisal indicate that the project as a standalone entity is not financially viable: at a 6% discount rate the FNPV is – GBP 316,713; and the FIRR (-5%) is below the discount rate. These results show that the revenues generated by the project infrastructure are not sufficient to cover the full investment cost over the project life. In terms of the financial sustainability of the project infrastructure however, the projected operational cost-recovery of the infrastructure is positive. Annual operational cash-flows (annual revenues less annual O&M costs) have a positive FNPV of GBP 79,005 and a BCR of 1.35, indicating that over the project life, cost recovery for CRWB is positive.

The economic appraisal component of the CBA assesses a wider spectrum of costs and benefits relative to that of the financial appraisal. Both quantitative and qualitative costs and benefits are included to provide a holistic view of the expected net socio-economic impact of the project. The costs considered are the capital and O&M costs adjusted by the relevant conversion factors in order to account market distortions in their financial prices. The benefits considered quantitatively are the incremental positive impacts on the health of residents and border patrons, and the time savings to households and businesses due to the implementation of the project. Additionally, the longer term impact of the project as an enabler of economic development is discussed qualitatively, along with the expected climate resilience impacts.

The results of the quantitative economic appraisal indicate that the project is economically desirable at both a 3.5% and 10% discount rate, with positive ENPVs and an ERR which is higher than both discount rates. The ENPV is GBP 252,431 at a 3.5% discount rate, with a BCR of 1.51.

The financial appraisal indicates that the project is operationally sustainable. Annual revenues generated exceed the annual operation and maintenance requirements of the infrastructure over the project life. Domestic demand, O&M costs, and water supply coverage are however critical to the operational sustainability of the infrastructure.

From an institutional perspective, there is moderate to low risk with respect to this project. Partly this is because the size is relatively small and partly because CRWB, though it has its challenges, has demonstrated significant institutional capacity over the years. There are admittedly concerns regarding the ongoing financial viability of the utility. In general however CRWB has demonstrated a trend over a number of years of gradually gaining institutional and financial strength, clearly evident in the increase in the number of metered connections. In view of the concerns, some consideration should perhaps be given to initiatives that further strengthen CRWB's viability, in addition to delivering a high quality and sustainable project at Mchinji.

It is therefore recommended that this project should proceed, either through CRIDF support by taking the project to Financial Closure or for CRIDF to support the CRWB with obtaining grant funding for the project. Furthermore, since CRIDF is already supporting water supply and sanitation infrastructure across the border in Mwami (Chipata), there is potential Value for Money (VfM) aspects to increase the scale of the project and undertake the Mwami and Mchinji projects as one project. This is already the justification of combining the Mwami and Chanida projects, which are similar border towns with similar infrastructure, but separated by over 100 km.

Section 1: Introduction

CRIDF Background

The Climate Resilient Infrastructure Development Facility (CRIDF) is DFID's innovative water infrastructure programme for southern Africa. Working to deliver sustainable small-scale infrastructure across 11 SADC countries, the demand-driven programme focuses on water services, water resource management, and water for livelihoods, fostering sustainable development of the region's water resources and addressing the water, food and energy nexus.

CRIDF prepares small-scale water infrastructure projects and facilitates access to finance for the implementation of these projects. Such interventions provide the entry point and platform for CRIDF to engage with, support and influence key SADC interventions, river basin organisations and national stakeholders. Activities are selected according to a set of CRIDF principles to ensure that investments align with strategic objectives that have been developed specifically for each SADC river basin.

The Mchinji Feasibility Study has been undertaken by CRIDF, as delegated by the UK Government Department for International Development (DFID) on behalf of the Government of the Malawi, in particular the Central Region Water Board (CRWB).

SADC Zambia Border Towns Project

Access to reliable and safe water supply and quality functional sanitation facilities at border towns in the Southern African Development Community (SADC) region has emerged as a major challenge and threat that needs urgent redress to assure continued and uninterrupted activities at these strategic centres. Inadequate levels of water access and sanitation facilities can result in water borne disease transmission across borders, which can lead to severed relations amongst neighbouring states and eventually impede trade, tourism and other commercial and social activities within the entire sub-region. Inadequate water supply especially can also become prevalent due to adverse unexpected changes in the climate evidenced by low rainfall, lowered water table levels, drying rivers, streams, wells, boreholes and springs.

The 12 Towns Water and Sanitation Project, first identified in studies by the *Gesellschaft fur Internationale Zusammenarbeit GmbH* (GIZ) seven years ago, aims to provide sustainable and equitable access to safe water and adequate sanitation to a prioritised 12 border towns in Zambia. Various entities continued to cite the project in the intervening years, and the SADC Regional Water Infrastructure Investment Conference held in Maseru (Lesotho) in September 2011 identified it as a priority project.

The 12 Towns

- Kazungula-Kasane (Zambia-Botswana)
- Chirundu-Chirundu (Zambia-Zimbabwe)
- Luangwa-Zumbo-Kanyemba (Zambia-Mozambique-Zimbabwe)
- Chanje-Maluera (Zambia-Mozambique)
- Chipata (Mwami)-Mchinji (Zambia-Malawi)
- Nakonde-Tunduma (Zambia-Tanzania)
- Mpulungu-Kasanga-Mutungu (Zambia-Tanzania-DRC)
- Nchelenge-Kilwa (Zambia-DRC)
- Kalabo-Mussuma (Zambia-Angola)
- Kasumbalesa-Kasumbulesa (Zambia-DRC)
- Chavuma-Caripande (Zambia-Angola)
- Sesheke-Katima Mulilo (Zambia-Namibia)

This Project is of key regional importance, as it links directly with initiatives to facilitate regional trade and investment, by upgrading basic facilities at the entry points of Zambia located along strategic trade and transport routes, this including the COMESA-EAC-SADC Tripartite Trade and Transport Facilitation Programme envisaged to improve regional tourism and reduce the incidence of cross-border waterborne diseases. This regional Programme is geared at:

- **Market integration**: the removal of tariff and non-tariff barriers and implementation of trade facilitation measures;
- **Infrastructure development**: concentrating on improving the region's infrastructure so as to improve the efficiency of regional trade flows and transport network (road, rail, water and air and including ICT and energy);
- **Industrial development:** to improve productive capacity and competitiveness and programmes that can take advantage of improvements in market integration and infrastructure development.

Mchinji Border Town

Mchinji Border Town, which borders with Mwami (Chipata) in Zambia, is a key border crossing on the Great East Road – linking Lusaka with the Nacala Port. Mchinji Border Town is situated on the Malawi-Zambia Border and it is about 110 km from Lilongwe City, the capital of Malawi. It is a location for an entry and exit dry port as such its dominant economic activities are import and export activities such as clearing of goods and immigration.

Mchinji Border Town is in the Central Region of Malawi, and located at geographic co-ordinate 13°45'11"S and 32°47'57"E. The Mchinji Border Town is at the Mchinji / Mwami (Chipata) Border Post, which is about 12 km north west of Mchinji (Malawi) and 21 km south east of the Chipata (Zambia). **Figure 1** below shows the location of Mchinji Border Town.

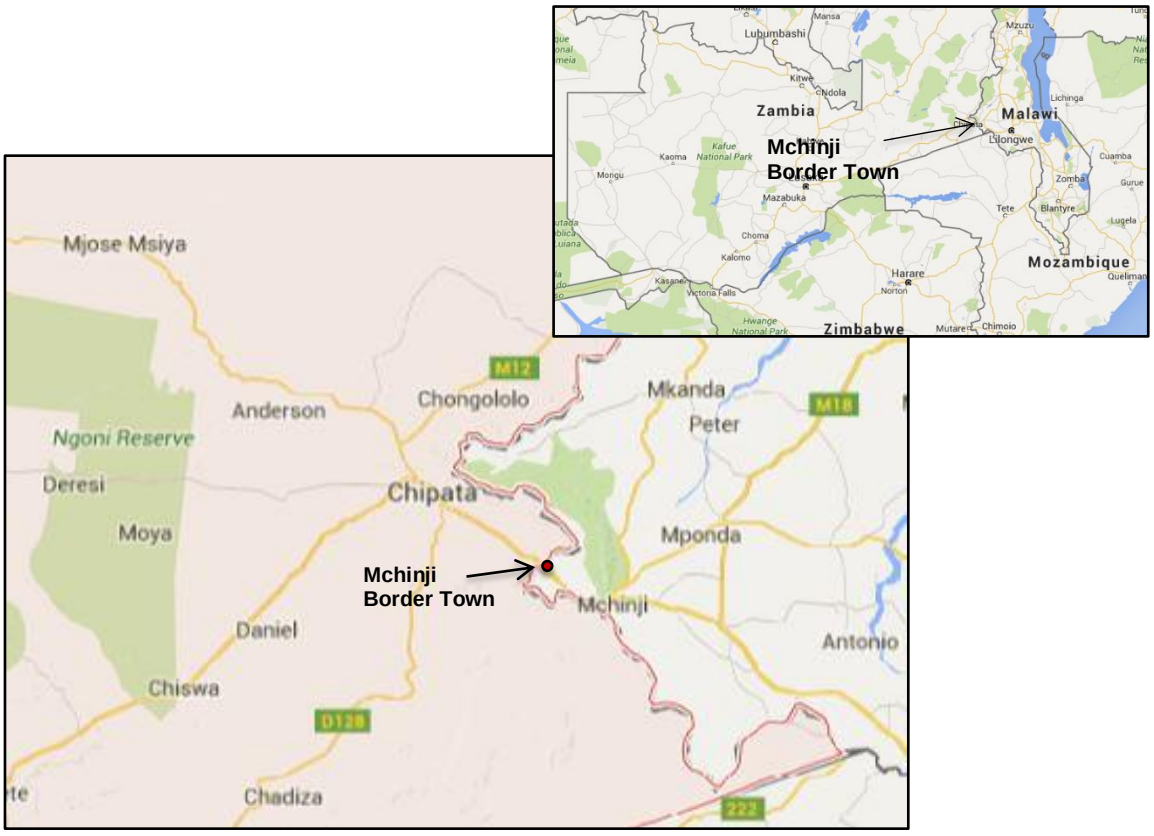

Figure 1 Locality Map

The population of Mchinji Border Town area is currently estimated at about 1,521 people, but estimated to grow to 2,547 within 15 years. The border post is open 24 hours for non-commercial traffic and 12 hours for commercial traffic. Average cross border traffic volume is 30 heavy articulated trucks and 20 passenger vehicles per day, which translates to about 100 additional people (growing to 208 by 2031). Socio-Economic activity comprises of: border civil-servants, clearing agents, cross border traders, small shop and bar owners, money changers, casual labour to assist travellers, truckers, marketers, and border taxis. Housing at the border post comprises of Immigration and Customs housing units, which are well built and have waterborne sanitation facilities. Mchinji border area has no common water supply system. The existing small water supply scheme is owned by the Malawi Revenue Authority (MRA) and only supplies MRA Offices and staff houses.

The community residing at the border post faces severe challenges to access their daily water needs from a single hand-pump operated borehole located within the community. Truck drivers and other border users have no public ablution facilities despite them often having to overnight at the border post whilst awaiting clearance. The drivers resort to using private household ablutions for a fee, a state of affairs that is not desirable.

This is similar to the situation on the Zambian side of the border at Mwami. Potentially the problems that will arise due to water deficiency on one side of the border will affect the other, as the two locations are located

directly adjacent to each other. Following study tours by the officials from Eastern Water and Sewerage Company (EWSC) of Zambia and members of Central Region Water Board (CWRB) of Malawi, it was realised that both utilities were investigating the possibility of implementing WSS projects at the Mwami / Mchinji border post. EWSC informed CRWB of the support they were receiving from CRIDF for the improvement of water supply and sanitation facilities at the Mwami border post resulting the water utilities consolidating their efforts to implement the projects.

The objective of the Feasibility Study is to address the relevant social, technical, economic/financial, institutional and environmental viability of the scheme at Mchinji. The findings and recommendations of this appraisal will allow the project to be integrated operationally into the existing CRWB infrastructure, which will reduce the risk of fractional investments.

Implementing the Mwami / Mchinji projects together provides good Value for Money (VfM) efficiencies – in terms of logistical cost, time savings and shared knowledge between the two projects as the same team will be used across both towns. The scope of works for the projects are very similar.

The Mwami / Mchinji border post is on a major transport corridor – Nacala Corridor (The Great East Road) and therefore the project supports the regional COMESA-EAC-SADC Tripartite Trade and Transport Facilitation Programme, supporting the regional agenda.

The success of the project will demonstrate commitment, through provision of improved water infrastructure, to facilitate free flowing trade and cooperation between states in this case Zimbabwe, Zambia, Malawi, Mozambique, Botswana, Angola and Tanzania because the Great East route is a key border crossing on the Great North Road which different trucks going to countries mentioned above use. The project will also lead to increased institutional knowledge.

Mchinji project, once successfully implemented, will provide sustainable, climate resilient and equitable access to a safe water supply and appropriate sanitation for the beneficiaries, largely the vulnerable and poor. This will improve livelihoods, human well-being, socio-economic development and reduce the incidence of waterborne diseases and pollution.

This report is divided into the following key sections:

- Section 1 – Introduction (this section)
- Section 2 – Socio-Economic Assessment, including Gender Equality and Social Inclusion (GESI)
- Section 3 - Technical Assessment, including Climate Change Risk Assessment (CCRA)
- Section 4 – Environmental Assessment
- Section 5 – Financial and Economic Assessment
- Section 6 – Institutional Assessment
- Section 7 – Risk Assessment
- Section 8 – Conclusions and Recommendations

Section 2: Socio-Economic Assessment

Introduction

One of the key components in developing a water supply and sanitation project in Malawi, is the social assessment which establishes full stakeholder engagement, buy in and involvement of all relevant government agencies, local authorities, Non-Governmental Organisations (NGO), local leadership and user constituent in the area of project influence. CRIDF understands that early engagement provides valuable opportunity to influence public perceptions and set a positive tone with stakeholders, despite the many uncertainties and unknowns. It is also an opportunity to help generate ideas and alternative solutions on early design questions.

This report presents a brief socio economic and gender assessment profile of the Mchinji border town as regards, settlement patterns, sources of livelihood, access to services, water security and employment opportunities. The report reveals public perception of the existing and proposed water supply and sanitation services. It also presents some of the predicted project social impacts and associated mitigation measures to ensure social sustainability. Lastly, possible community engagement in the management of proposed project interventions has been recommended.

Included as part of the Socio-Economic Assessment is a Gender Equality and Social Inclusion (GESI) assessment, that details gender and vulnerable beneficiary aspects and outlines some of the key project actions that would ensure GESI integration.

The socio economic and gender assessment contains information obtained through literature review, Focused Group discussion (FGDs) and interpersonal interviews with public and private sector personnel and the border area community. The fieldwork was undertaken during May 2016.

Project Area Socio-Economic Context

Project Area Description

Location

Mchinji is one of the nine districts in the Central Region of Malawi bordering Kasungu district in the north, Lilongwe capital city to the east, Zambia to the west and Mozambique to the south. The district urban centre is located along the main road (M12) that connects Lilongwe through the border area to Chipata district in Zambia. It is about 110 kilometres away from Lilongwe City and 12 km from Mchinji Town. According to the 2008 census Mchinji Town had an estimated population of 456,558 and was projected to be at 569,085 by 2014.

The project area locally known as Kaombe village, but termed as Mchinji border area / Mchinji border town in this report, is located 12 km from the Mchinji urban and administrative centre. It is the main entry point between Malawi and Zambian urban centres.

Project Area Settlement Pattern

The border area is a relatively small area consisting of the border post where MRA and immigration offices are located within 200 metres from the Mwami (Chipata) border post. The rest of the area extending from the border post along the M12 is a chain of shops, restaurants and other business premises. Behind the business premises are housing dwellings that extend to a farming area. The dwelling structures can be classified as peri urban and rural housing as they are characterised by communal water points with no water borne sanitation. Typical housing structures were mainly made of treated bricks, with majority of them not plastered and roofed with corrugated roofing sheets. **Figure 2** shows a typical dwelling and shops found in the border area.

Figure 2 Example of Housing Structures in Mchinji Border Area

The border area has an estimated head count of 1,521 people and using the average households size of 4.7 persons per household[1], it could be estimated that there are about 324 households. The permanent population primarily consist of local indigenous tribes found in the area with a number of tenants who have found an opportunity of making a livelihood at the border area. The rest of the population are commuter public workers who stay in Mchinji urban centre, travellers and truckers (on short term stay).

Land Tenure System and Ownership

The border area is still under traditional leadership of the overall Chief represented by a senior headman known as Mfumu Tikoliwe, who is also represented by the Kaombe village headman, the immediate local

[1] National Statistical Office of Malawi, Housing and Population Census, 2008

traditional contact in the border area. The traditional leadership is responsible for land allocation and the project implementers will have to give due recognition. At present, indigenous settler families who are selling pieces of land to other settlers from different parts of Malawi own much of the land around the border area. Mchinji District Council (MDC) does not have presence in the area resulting in haphazard uncontrolled land use.

Employment and Income Generating Opportunities

Besides the border post activities, which present an urban setup, the rest of the residential and business area presents a rural setting with minimal economic activities. The main activities therefore can be categorized under the following headings.

Agricultural activities

Agriculture is the main source of income in Mchinji district. Over 90% of the population in the district depends solely on agriculture for their income, employment and house hold food security. Agricultural production in the district is done at two levels namely smallholder and estate levels[2].

Information obtained from the FGD revealed that the majority of the residents of Kaombe village own smallholdings located beyond the residential areas, where subsistence agricultural activities take place. Crops grown include maize, vegetables, groundnuts, beans, and so on. These are grown for household consumption and for sale to cover household requirements such as health, transportation and education. Other agricultural activities include livestock rearing of small animals like chickens, goats and pigs. A few own cattle although it is not kept within the border area.

Business and Trading

The M12 road frontage is lined by business premises including restaurants, barbershops, salons, shops and stalls where groceries, hardware, clothes, charcoal, grain and mealie meal are sold. Other enterprises included secluded bars and carpentry stands. Within the housing area and along the inner roads some landlords have leased out part of their land to entrepreneurs who have established more shops and stalls.

Although there were no apparent guest houses, some house owners offer a range of services including renting out rooms, showers and toilets particularly to the travelling public. Other enterprises include taxi businesses, although typically the taxi drivers and owners reside in the Mchinji urban centre. There were a relatively small number of transit traders engaged in cross border trading between the two countries. Despite the availability of opaque beer produced by brewing companies on the market, some elderly women still brew traditional opaque beer that provides reasonable income in their households. **Figure 3** is photo of traditional opaque beer under preparation.

[2] Mchinji District Council, (2015). State of the Environment Report, Draft

Notably, business activities such as hawking, money changing, casual labour assisting travellers and bicycle transportation were more highly visible on the Mwami border area (Zambian side of border) than on the Mchinji border are (Malawian side).

Figure 3 Local Opaque Beer Brewing

Formal employment

The majority of the formally employed are public workers from the MRA, Immigration and Customs, and the Malawian Police departments. These however are a commuter population who reside in Mchinji urban centre.

Infrastructure and Social Services

This section is a brief discussion on the infrastructure and services including, health, education, and energy available in the project area. Being the main thematic aspect of this project, water supply and sanitation has been included in a dedicated section.

Health Services

The proposed Project area is served by the Mchinji district hospital, which is located within the urban centre, about 12 kilometres from the project area. In addition the Malawi health system operates 'Village Clinics' for Children below the age of 5 years. These clinics are managed by Community Health Assistants and the project area has one of these clinics in the nearby Tikoliwe village.

According to information from the District Health Statistics office, the leading causes of morbidity in Mchinji District include malaria, non-bloody diarrhoea and acute respiratory infections. Among the under five children, malaria was reported to be the leading cause of morbidity with 225% in 2010, 225% in 2011 and 66% in 2012; seconded by acute respiratory Infections with 60% in 2010, 57% in 2011 and 31.3% in 2012[3]. The Ministry of Health has several strategies aimed at improving the health status of the people, one of which is the Integrated Disease Surveillance and Response (IDSR). The aim of IDSR is to improve the ability of districts to detect and respond to diseases that cause high morbidity, mortality and disability in the

[3] District State of the Environment and Outlook Report, Mchinji District Council. Undated but post 2012

district catchment area. Included amongst the priority diseases and conditions for IDSR are cholera, diarrhea with bloody (dysentery), HIV and AIDS, bilharzia, malaria and so on.

Education

Saint Dominic is the nearest primary school utilised by children within the border area. Those that qualify to secondary level have the opportunity to enrol in the available 27 secondary schools in the district. However, as reported in the State of Environment Report of 2015, secondary education by both boys and girls is affected by limited school places and payment of school fees, which results in dropouts. Pregnancies amongst girls in some areas are another contributing factor for school dropouts. The only challenge revealed by women in the FGD as regards primary schooling in the project area was the distance to school for the younger children, whose parents are forced to enrol them at a later age. This delay and distance to school leads to resistance to go to school and poor performance amongst the learners.

Energy

The 2008 census documented several sources of energy for cooking that included firewood, paraffin, electricity, gas, straw and charcoal. The most common source of cooking fuel was firewood (87%), followed by charcoal (8.5%), electricity (2.3%) and paraffin (1.2%). The border area is connected to the national grid and the border post and some business and residential dwellings are connected to the national grid. The majority of the housing units are not connected to the grid, with the households using firewood for cooking and candles and batteries for lighting.

Existing Water Supply and Sanitation

The following sections provide a brief description of the available water supply and sanitation systems serving different user groups in the border area. Further information of the existing water supply and sanitation system is provided in the Technical Assessment section.

Water Supply and Sanitation Services - Border Post, Truckers and Travellers

The Malawi Revenue Authority (MRA) has provided its own water supply and sanitation services. The premise system is supplied with water from a borehole and overhead tank. Due to availability of water the building has an onsite water borne sanitation using septic tanks. At the moment, fee paying improved VIPs have been constructed at the border post for travellers. Despite the presence of toilets some travellers practice open urination and defecation. Given the absence of showers and laundry facilities, most travellers use household latrines and showers at a fee.

MRA is responsible for operation and maintenance of the available water supply and sanitation infrastructure.

Water Supply and Sanitation Services - Households

The residential area is serviced by one borehole equipped with a hand pump, and by protected and unprotected wells. There was no clarity on the organisation that had developed the borehole. Pump Aid one of the NGOs involved in the water supply and sanitation sector developed a number of hand dug wells in the area. **Figure 4** shows examples of the different types of wells provided. These hand dug wells service 10 to 15 households that are responsible for maintenance.

Households utilising the hand pump contribute between MK 200 to MK500 for operation and maintenance. Similarly households drawing water from protected wells contribute funds for maintenance of the well and for replacement the rope and buckets. Households in close proximity to streams and wetlands draw water from unprotected hand dug wells.

The principal mode of sanitation in the project area is largely ordinary unlined pit latrines, which account for 94% of existing facilities with VIPs at 6%. In addition, local restaurants and guest room owners have adopted makeshift wash hand stations to try and improve hygiene for their customers.

Figure 4 Type 1 Communal Hand Dug Well Type 2 Communal Hand Dug Well

Public Perceptions of Existing Water Supply and Sanitation Services

Perceptions of Existing Water Supply Facilities and Services

During FGDs and other interpersonal interviews, respondents expressed varying levels of satisfaction with the available water supply and sanitation services and facilities. Their perceptions are categorised into broad themes of quantity, quality, reliability, tariffs, distance and technology. In general there was a positive perception of the current water supply and sanitation from the MRA and other public employees who utilise the piped water supply and waterborne sewerage system. However, positive and negative perceptions from the public and local residents are explained in detail below.

Quantity

The current water supply and sanitation system within the MRA building was perceived to be adequate. Households and the travelling public were faced with major challenges. Although drinking water supply and toilets were available for use by travellers, the poor condition of the toilet and lack of showers and laundry facilities are a serious challenge.

Residents using communal water points reported that water quantity was a problem in the dry season when they are forced to limit the quantities drawn by each household. This in turns forces some of them to use alternative water sources.

Quality

As regards quality, the community expressed satisfaction with the quality of water from the borehole though this is not supported by bacteriological evidence. There is no water quality testing conducted as the borehole belongs to the community that is not capable of undertaking such tasks. The community expressed dissatisfaction with the quality of water from both protected and unprotected hand dug wells. Women complained of possible contamination from the pit latrines.

Reliability

Residents presented a negative perception of water supply reliability. They complained of the inadequate water points, which resulted in queues during peak hours. As earlier indicated some hand dug wells dry up in the dry season, forcing members to draw water from either unsafe water sources or queue up at the one borehole water point.

Distance

The community had no problems with distance as water points were within a reasonable walking distance. It was reported that distance emerged as a challenge when the hand dug wells dry up and households on the southern side of the settlement are compelled to cross over to the other side to draw water from the one borehole water point.

Water Tariffs

Community members themselves set the current water tariffs and there was due consideration of the household circumstances. Therefore there were no complaints, and in most instances payments were only made when there is a breakdown or need for a new rope and bucket arises.

Water Facilities

Women utilising the water point supplied by a borehole were content with the water facility although they had to manually operate the hand pump. This was usually difficulty for the aged, disabled and children. Those

drawing from protected hand dug wells were not content as they were concerned with issues of quality and the effort applied to draw water. In general all the women preferred piped water supply with yard connections.

Perceptions of Existing Sanitation Facilities and Services

The following are some of the major perceptions as regards sanitation technology in the project area.

Flush Toilets

These were available in the MRA building and were not a problem as they are the most desired by the public workers.

Ordinary Pit latrines

Ordinary unlined pit latrines were highly prevalent in the residential area. Truckers and other travellers also utilised similar facilities. Although these are managed and operated by MRA they were not desired both by the users and the managers. Women and other people interviewed perceived this technology as the worst technology contributing to unsanitary conditions around the border area. Women complained of the unsanitary conditions near the border area where it was suspected that the general public particularly the travellers were practising open urination and defecation. They complained of the inconvenience of digging pits around the premises. Other complaints included odours and flies.

Public Perceptions of the Proposed Water Supply and Sanitation Facilities

It was evident that the water supply and sanitation for both truckers and travellers and the local community was unsatisfactory. The absence of Mchinji District Council and the Central Region Water Board (CRWB) presence was one of the contributing factors for underdeveloped water supply and sanitation services in the proposed project area. Although the border area did not appear to be too busy, the need for these services would not only be determined by the population size but by the need to safe guard health of the travellers and local population that would have other benefits such as good reputation, attraction of other investment opportunities and enhanced regional trade.

Based on the issues described by the stakeholders in the project area, the following typical improvements would be applicable.

Water Supply Improvements

- Development of a borehole water supply to cater for the current and future water demand;
- Storage tank to cater for peak day water demand;
- Kiosks to distribute the water, catering for low cost access to water;
- In order to enhance the commercial operation of the service, each kiosk should be equipped with shelving and a hatch counter.

- Provision of a water supply system, where individual connections could be made on application and payment by the household.

Sanitation Improvements

Support in the area of sanitation is only targeted at the plight of truckers and other travellers crossing the border post who have undesirable limited sanitation facilities. This can be achieved through the construction of a public ablution facility. The facility would consist of toilets, shower and laundry facilities, which will be separate for males and females, designed to cater for up to 200 travellers (catering for 2031 daily average). It has been proposed that the facility should be under delegated management. Travellers would pay for use of ablution facilities, as a cost recovery measure to finance operation and maintenance and payment for water charges.

Public Perceptions of the Proposed Water Supply Technology

The women and other respondents provided with information on the proposed water supply and sanitation expressed satisfaction with the proposed project. Women in the FGD recommended that the kiosks should be evenly located to cater for households on each side of the M12. They further proposed that kiosks should only be a start-up level of service. Some of the advantages of the kiosks expressed was:

- the ease in which water could be drawn, as the kiosks would be equipped with taps;
- the idea of having a vendor to manage the water point was recommended as this would reduce the number of conflicts that emerge due to crowding at the water point.

Despites these advantages nearly all the women preferred yard connections, which offer more privacy and control on the consumption. The system should therefore be able to cater for a higher level of service, paid for by the homeowner, as finances allow.

Public Perceptions of the Proposed SanitationTechnology

The proposal to construct an ablution block was underscored by the MRA Deputy Commissioner and the women of the community who all felt that the existing services were an embarrassment. There was no objection to the type of infrastructure.

The women in the FGDs recommended that, local residents should be encouraged to construct environmentally friendly and hygienic sanitation facilities, such as VIPs or waterborne toilets.

Positive and Negative Socio-Economic Impacts of the Proposed Project

Typical water and sanitation projects inevitably produce both positive and negative impacts. The direct socio-economic benefits of the project include the net results of improved livelihoods through health improvements, increased productivity, and improved community resilience to climate change. Positive impacts include modernised sanitation infrastructure, potential for greening the area that would improve the

aesthetic environment of the area. Some of the critical impacts with accompanying enhancement and mitigation measures are as follows:

Positive impacts

Increased Population

An increase in population will result in both positive and negative impacts. A combination of improved water supply and trade will attract more business people, and settlers to the area. Relocation of MRA and other public workers will lead to an emergence of middle cost housing. This will create employment and demand for services provided by the local residents.

Urbanisation

As indicated above relocation of more public workers will be accompanied by other urban services such as modern supermarkets, organised commuter transportation, upgraded lodges and guesthouses. Therefore provision of water network will enable households to pay for household or yard connections. Those that can afford would be able to upgrade their sanitation facilities to water borne. This will give a modern outlook to the area.

Reduced vulnerability to poor health

Provision of sanitary facilities for the truckers and travelling public will assist in reducing their vulnerability to waterborne diseases. This will reduce on the emotional stress of searching for hygienic sanitary facilities. In particular women travellers would be able to conduct their menstrual hygiene management without fear of exposure to related health problems.

Improved Health for households

Improvements in water supply infrastructure, would translate into increased water quantities of high quality. Higher quantities of water will enable household members to maintain cleanliness and hygiene, which will result in reduced waterborne disease. In relation to quality, communities will be assured of quality water, as the CRWB would conduct periodic quality analysis and ensure that water users receive treated water.

Increased Productivity

Improved health will have a positive impact on productivity in whichever occupation one is involved in, as there will be less absenteeism from tasks. Larger reliable quantities of water will enable residents to engage in productivity tasks such as backyard gardening, block making, managing restaurants and hair salons more efficiently. These enterprises assist households to earn incomes that are used for other household requirements.

Time saving

This is particularly important for households that draw water from hand pumps and wells where time is spent on queuing up and waking up at awkward hours. Reliable water supplies will result in time savings, as women will be able to draw water at reasonable times and use the time saved for other household and productivity activities. Women involved in enterprises outside the home are usually disrupted by erratic water supplies as they give priority to water thereby delaying or abandoning their productive activities. This results in reduced household incomes.

Negative Impacts

Water wastage

There is a likelihood of water wastage in households through leakage and inefficient practices such as watering lawns, car washing leaking taps and so on. There is also a possibility of water loses through the main reticulation system. These loses can be mitigated by installing meters in each premise including kiosks. This measure should be coupled with customer sensitisation on demand management. Promoting water use efficiency would benefit the company, as they would generate adequate revenue to cover operational costs for them to deliver a good service.

Vandalism

The border area is likely to emerge as an urban area as the population increases. More people from different parts of the Malawi, Zambia and Mozambique could flock to the area, taking with them other urban vices, such as theft and vandalism that would impact negatively on trade and local residents. In relation to water supply, vandalism impacts negatively on the provision of safe water due to contamination of water through infiltration and breakdowns. The CRWB should therefore be alert and use vandal proof materials. Vandalism can also be minimised through community sensitisation.

Generation of solid waste

Management of solid waste is cardinal as indiscriminate disposal increases chances of contamination of water in the event of leakages. The mandate of waste collection and disposal lies with the Mchinji District Council who is not present at the border area. In this light Mchinji District Council should establish a sustainable waste collection, and ban the current waste disposal practice of using pits and burning that is undesirable for an area that is frequented by travelers.

Community Engagement for the Proposed Project

The CRWB has been responsible for water supply and has established approaches, guidelines and structures for urban and peri urban supplies. Therefore the company will have to use its well-elaborated approaches in delivering water in different contexts. In order to improve management of piped water supply

systems in market and other communities with communal piped water systems, the Ministry of Irrigation and Water Development (MOIWD) has adopted the concept of Water Users Association (WUA). The CRWB has through the Ministry developed guidelines for establishment of WUAs[4].

Management of Individual piped reticulation

In areas where individual connections (such as the MRA building, houses and business premises) are provided the Board should ensure that all the connections are metered and charged according to consumption as stipulated in their tariff systems. The Board should be responsible for maintenance of main lines, however any maintenance after the meter within the premises would be are individual's responsibility. However, leakages after the meter should be detected and monitored to avoid contamination.

Management of Water supply and Ablution for Travellers

Management of the water supply and sanitation facility for travellers should be sub contracted to a private company that would ensure cost recovery and high hygiene standards.

Management of Communal Water Points

The CRWB should adopt the WUA concept to manage the kiosks. Depending on the discussions with the users, the WUA could hire a vendor who would take up all the responsibilities as stipulated in the guidelines for the establishment of WUA's.

Gender, Equality and Social Inclusion

Introduction

The purpose of this section of the report is to analyse the existing Gender Equality and Social Inclusion (GESI) issues, with a specific focus on the following elements:

- Outlining community development issues including employment and income generating opportunities, and address the water and sanitation needs of women and girls, and the vulnerable;
- Description of the expected changes in the quality of life to women and girls, and the vulnerable including the poor as a result of the project activities.

In order to determine how the benefits would accrue to the mentioned beneficiaries there shall be an illustration of how inclusive the project outcomes are likely to be.

Information provided in this section was obtained through field Focus Group Discussions (FGD) with women, girls and men in Mchinji border area, in addition to information from secondary sources.

[4] Government of Malawi, (2009), Market Centre and Rural Piped Water Supply and Sanitation Programme: Guidelines for Establishment of Water Users Association In Malawi

CRIDF recognizes that gender equality and social inclusion is of central concern in water services, water resources management and other productive activities, therefore adopting a gender and social sensitive approach improves the project impact, performance and sustainability. This is particularly important in the southern African region where rural and peri urban poverty levels in most parts are relatively high and respective populations are dependent on water and land resources. Furthermore, like elsewhere in the developing countries, women and girls are typically responsible for fetching water for both domestic and productive use. Therefore giving a voice, choice, and control to women and girls on water, land and other natural resources is of key concern to CRIDF.

At the country level Malawi has exhaustive focus on gender equality issues and has enacted legislation and other policy, legal and institutional frameworks for addressing gender equality in all developmental activities.

Policy, Legal and Institutional Framework for Gender Equality and Social Inclusion in Malawi

Gender issues are an integral part of the overall national development agenda of the Government of Malawi. Of significance is the Constitution as supreme law of the land that has captured the spirit of the CEDAW and other relevant international legal instruments on gender equality. Government has created an enabling legal environment for the promotion of gender equality and women empowerment through the enactment of the following gender specific and gender related laws that are guided by international human rights treaties. These include The Constitution of the Republic of Malawi (1994); The Prevention of Domestic Violence (GBV) Act 2006; The Child Care (Justice and Protection) Act, 2010; The Deceased Estates Act (Wills, Inheritance and Protection) Act, 2011, The Gender Equality Act, 2013 and the National Gender Policy 2011. Further Malawi has ratified key international legal instruments, which include the Convention on the Elimination of Discrimination against Women (CEDAW), the African Union Women's Protocol, the SADC Protocol on Gender and Development, the Beijing Declaration and the Beijing Platform for Action.

The Gender Equality Act 2012 is aimed at promoting gender equality and equal integration of men and women in all functions of society, prohibiting and providing redress for sex discrimination, harmful practices, sexual harassment and providing for public awareness and promotion of gender equality. The Human Rights Commission is responsible for enforcing provisions of the Act (Government of the Republic of Malawi 2012).

The purpose of the National Gender Policy 2011 is to mainstream gender in the national development process to enhance participation of women and men, girls and boys for sustainable and equitable development for poverty eradication (Government of the Republic of Malawi 2011).

Further the Ministry of Irrigation and Water Development has provided guidelines for formation of Water User Associations (WUA) in 2009. Within the guidelines addressing issues of gender, environment and HIV / Aids are singled as one of the functions of the Communal Water Point Committee (CWPC).

Context Gender Equality Social Inclusion issues at Mchinji Border Area

Gender Inequality

Some researchers report that despite the exhaustive legal, policy and institutional frameworks aimed at gender equality, there are existing inequalities. The unequal status of women in Malawi is shaped by the inter-locking factors of general poverty, discriminatory treatment in the family and public life and a vulnerability to HIV/AIDS. Both matrilineal and patrilineal systems operate in Malawi's ethnic groups and it is reported that both systems perpetuate discrimination against women in the family with respect to control over resources. Women in Malawi generally fair worse than their male counter-parts on most social and economic indicators including wage equality, political participation, secondary and tertiary education enrolment and literacy. However, Malawi has achieved gender parity with respect to primary school enrolments, which indicates an improvement in attitudes towards girls' education.

Notably, women reported that they expected the men folk to support them financially, as it was their responsibility culturally.

Existing Support Programmes for Women

Women in the FGD revealed that besides the Ministry of Education and Ministry of Health, there were no other public sector departments in the project area. Women complained of neglect and deprivation of income generating activities that were taking place in other parts of Malawi. This has contributed to the poverty levels amongst the community, especially women.

Vulnerability of residents

There are two main incapacitating situations that expose the Mchinji residents particularly women to hardships, these are the lack of support to deal with drivers of poverty and the lack of adequate good quality water supply and poor sanitation. The main source of safe drinking water is the one hand pump, while the other sources include protected and unprotected hand dug wells that are exposed to contamination. In addition nearly all the households utilise ordinary unlined pit latrines that are a source of groundwater contamination. Below are pictures of hand-dug wells provided by Pumps Aid.

Associated Gender Equality Social Inclusion Challenges

The existing water supply and sanitation situation has given rise to GESI challenges.

Poor Water supply and Sanitation facilities for travellers

There is a critical problem of sanitation, which exposes both males and females travellers to health problems. In particular male truckers who are quite often marooned at the border for different reasons are forced to pay for available makeshift bathing and toilet facilities amongst households. Local residents complained of the poor sanitary conditions in the open areas near the border that are used for open

urination and defecation. These conditions also expose passing local residents, especially children to health risks.

Furthermore women in transit face challenges with menstrual hygiene management as they at times require water for changing, showering and disposing of their sanitary towels. Poor and inappropriate sanitary facilities therefore cause stress amongst female members.

Inadequate Safe Water Supply

The major complaint by the women, who are the primary collectors of water, was the inadequacy of water in the dry season when the hand dug wells dry up. Women spend many hours queuing for water. Households using the hand pump are forced to regulate the amount of water drawn by each household to ensure equal distribution. Those that draw from hand dug wells give each other turns to allow the well to recharge. These limitations lead to reduced water quantities in the households. Unsafe water and limited supplies leads to poor hygiene and exposure to waterborne and other health problems. The time spent drawing water deprives the women of the opportunity to undertake other productive activities. Further resulting illnesses place stress on women who typically have the obligation of taking care of the sick in the household.

Impact of water supply facilities on the elderly

Given the types of water supply facilities such as the hand pump and hand dug wells, elderly women complained of the inability to pump and pull buckets from the well. Therefore the technology is inappropriate to the elderly and weaker members who have to rely on other able bodied members of the household. This presents a problem to households inhabited by the elderly.

Exposure to Accidents and other Risks

The hand pump is located on one side of the M12 road. Therefore the inhabitants on the other side of the road rely on hand dug wells that dry up in the dry season. Women are at such times are exposed to accidents as they have to cross the M12 highway.

Unfavourable Sanitation Technology

The Mchinji Project area residents are highly aware of the dangers of poor sanitation. Women therefore complained of the inappropriateness of the ordinary pit latrines although these are widely used in the project area. These present a number of nuisances including contamination of ground water, odours, flies and were cited as the major source of water borne diseases. Furthermore, households with smaller plots complained of inadequate space for digging latrines, which need replacement from time to time.

Social exclusion of Different Social Groups

Improved and ordinary latrines are built with squat holes. Specific members of households such as pregnant women, the aged, the sick and children are faced with challenges when using squat holes due to their

physiology. Therefore, selection of sanitation technology should be based on the needs and usability of special social groups in the households.

Expected changes in the quality of life of Project Area Beneficiaries

The project is expected to produce specific outputs that will result into specific outcomes that will not only impact the lives of women, girls and the poor but also all residents and travellers in both border areas. Some of the positive aspects are discussed.

Increased safe water Supply

Expansion and modernisation of the current water supply infrastructure will translate into increased quantities of water. Provision of kiosks would relieve the local population of the burden of fetching water from unsafe water sources and they would be able to draw water with ease. Further adequate safe water supply would contribute to improved hygiene and ultimately to the health of the household members.

Improved water supply and sanitation for the travelling community

Provision of an ablution block would promote the reputation of the border post and ease the burden of searching for sanitary facilities. Sanitary conditions around the border post would eliminate exposure to health risks amongst both the travelling and local population. Further the possible threat of insecurity posed by allowing strangers in households would be reduced. This enables household members to live in harmony and have the freedom to engage in their various activities without fear.

Wealth Creation Opportunity

Given that the hand dug wells provide water sources, local communities would still retain the wells and use them for other productive activities such as gardening, block making, beer brewing and so on. These activities would contribute substantial incomes given the limited employment opportunities in the area. Those owning makeshift guesthouses would be able to renovate their houses and attract more clients. Furthermore adequate water supplies would promote initiation of greening projects that would contribute to the aesthetics of the area thereby attracting potential investors.

Recommended Actions for Gender Equality and Social Inclusion

In order to support gender equality and social inclusion in the project the following actions should be considered at different stages of project development and implementation.

Management of Participatory Infrastructure Development

The CRWB should utilise their well-elaborated approaches of delivering water in different contexts to ensure sustainable services. Mchinji border area has characteristics of commercial, high-density and rural areas.

Project design stage

During feasibility views of women (as primary collectors of water) over their preferred technology were solicited. As regards water supply infrastructure majority of the women preferred yard connections as opposed to communal water points. In order to cater for the poor, kiosks were also the most preferred infrastructure. However given the level of economic activities it was proposed that kiosks would be the initial service level. Therefore project implementers should provide residents with options of house and yard connections and kiosks.

Sites for kiosks

Project implementers should be aware of critical factors to consider when siting kiosks. Some of the issues to consider include the following. Kiosks should not be located in close proximity to bars, markets, bus stations and other congested public places. They should be located in sites that would provide privacy and dignity to women as they draw water. Due consideration should be made to employ women as vendors or managers of the water points.

Support for Sanitation

Although the proposed project is limited to supporting water supply and sanitation for the travelling community, some form of support could be mobilised for household sanitation. In some countries like Zambia the private sector is actively being used to finance sanitation through micro finance. CRIDF could assist respective local authorities to negotiate for a sanitation micro financing facility so that household sanitation is fully integrated in the project. Local authorities should be encouraged to formulate sanitation by–laws that would coerce households to adopt appropriate and safe sanitation facilities.

Management of Communal Water Points

The CRWB operates communal standpipes in Mchinji urban, a system that is well accepted by residents. The Board can extend the system of management using the lessons learnt in other areas to ensure effective management. For instance a vendor who can take over overall management is more preferable to management by a committee.

Once an ablution block is constructe, a management contract can be negotiated with a private sanitation company. The private company would be responsible for operation and maintenance of the facility. Services should be provided at a fee and these fees should be used to maintain the facility to ensure high hygienic standards.

GESI Summary Tables

The GESI assessment is summarised within the tables attached in **Annex A**:

- **Annex A1**: GESI Analytical Checklist

- **Annex A2**: GESI Action Plan

Population

Various population data sources were consulted to estimate the population of the Mchinji Border Post, including the 2008 Malawian Population and Housing Census, Malawi Revenue Authority (MRA) transit data, and the Environmental Health Technician (EHT). In addition to this, the number of households was counted using aerial photography (Google Earth imagery).

Current Population Estimate

The last published population and housing census in Malawi was undertaken in 2008. From the Census report, key population statistics for Central Region under which the project area falls are summarised below:

- Population growth rate over the period 2000 - 2008 — 3.5% per annum
- Vehicle traffic — 5% per annum
- Household size (Central Region / Mchinji) — 4.7 persons per household

Data from the Water Point Committee participants and the District Environmental Health Office indicated that there are currently over 300 households. This figure was confirmed through aerial photography house count. Using the 2008 Census household size the population was estimated at 1,521 people.

As a border post, Mchinji also has a transient population, which due to delays at the border post, place a demand on the water and sanitation infrastructure of the town. On average, about 100 people (transients) pass through the border post daily. For the purposes of this report, it is assumed that the number of border crossings will grow by 5% per annum, which is equivalent to the target cited in the 2008 Malawian Population and Housing Census – Mchinji District.

Population projections have been categorised based on the observed trend in the development of housing in the project area, which indicates housing floor areas ranging from averages of 50 m^2 (low cost) to 180 m^2 (high cost), where the communities are predominantly low cost (peri-urban or rural) houses, **Figure 5**. The current split of residential categories is shown in

Table 1.

Table 1 Residential categories for Mchinji Border Post

Category	Connection Category	Percentage in Category	Percentage of Total
High Cost (180 m^2)	House	0%	0%
Low Cost (50 m^2)	House	0 %	0%

Low Cost / Peri-urban or rural housing	Communal	100 %	100%

Based on the residential categories in

Table 1, the breakdown of population per category is given in

Table 2.

Table 2 Total number of exiting housing plots and current population

	Total No of Stands	Total Population
High Cost (180 m²)	0	0
Low Cost (50 m²)	0	0
Low Cost / Peri-urban or rural housing	324	1,521
Sub Total	**324**	**1,521**
Transient		100
Total Population		**1,621**

Figure 5 Low cost or rural housing units at Mchinji Border Post

Future Population Size and Split

The following assumptions were used to calculate the projected future population:

- 2008 Census growth rate of 3.5% and average household size of 4.7 people
- 5% Growth rate for border crossing traffic
- 15 year design horizon

Based on these assumptions, the projected population is shown in **Table 3**:

Table 3 Project Population

Category	2016	2031
High Cost (180 m²)	0	102
Medium Cost	0	153
Low Cost (50 m²) connections	0	2,292
Low Cost/Peri-urban or communal kiosk	1,521	0
Transient	100	208
Total	**1621**	**2,755**

The current and projected population, split by category, is summarised in

Table 4.

Table 4 Current and projected population by residential area and housing cost category

Residential Zone	Current Category Population			2031 Category Population			
	High Cost	**Low Cost**	**Low Cost Rural**	**High Cost**	**Medium Cost**	**Low Cost**	**Low Cost Rural**
High Cost (180 m²)				102			
Medium Cost					153		
Low Cost (50 m²)						2,292	
Low Cost / Peri-urban or rural housing			1,521				
Sub Total			**1,521**	**102**	**153**	**2,292**	
Transient Community		100				208	
Sub Total		**100**	**1,521**	**102**	**153**	**2,500**	
Total	**1,621**			**2,755**			

The above table shows an estimated total projected population of 2,755 people in 2031.

Conclusion

MRA and the community expressed dissatisfaction with the current sanitation services for travelers and were interested in being part of the CRWB water reticulation system. Similarly the local community was not satisfied with the current water supply due to limited quantities and poor quality, especially for those using hand dug wells. Women expressed concern over the current situation and preferred yard connections and kiosks as compared to the current technology.

Section 3: Technical Assessment

General Description of the Project Site

The Mchinji Border post area is bounded by hilly terrain prevalent on the southern and western flanks. It lies close to the foot of a hill located on the western side (the eastern range of hills is approximately 1 km away). One natural feature located in close proximity to the border post is Kachebere stream, which is approximately 1 km away in a south easterly direction. The stream is not a perennial stream.

The prime activity at Mchinji is the border crossing for pedestrians, domestic and commercial vehicular traffic from either Malawi into or in transit through Zambia and vice versa. These activities have given rise to the establishment of small business enterprises such as trading stores, restaurants, and entertainment venues, all of which serve the locally residing and travelling populace.

The spatial structure of the border post is spontaneous, with no distinct elements of land use and development structure in the area. Apart from the main road, the interconnecting road network and layout of housing developments is haphazard. The general planning structure is therefore not conducive to the efficient and cost-effective provision of public utility services. Low cost housing and traditional dwelling homesteads are intermingled, thus complicating the supply of water and disposal of generated wastewater, i.e. the selection of an appropriate level of service in the provision of public utilities for the various areas of the township and villages.

The Google Earth image of the central part of Mchinji in **Figure 6** illustrates the spontaneous planning structure of the border town. Typically, there is no network of planned road services to provide a spatial skeleton for the location of water supply and wastewater networks.

The Mchinji Border Post area is on the Malawian side of the Zambia (Mwami) / Malawi Border. Therefore the Mchinji Water Supply and Sanitation project can be viewed as an extension of the Mwami (Chipata) Water Supply and Sanitation project, even though the infrastructure will be kept separated for reasons of system management and revenue collection.

Safe drinking water is scarce as there are few reliable access points (shallow wells) from which water for domestic use can be sourced.

Figure 6 Central Part of Mchinji

Existing Water Supply and Sanitation Infrastructure

The estimated 1,521 people at the Mchinji Border Post area do not have adequate water supply or sanitation services. The situation is exacerbated by the travelling public who are total unserved in terms of water and sanitation, other than unacceptable facilities at the border post. This is a recipe for enteric and hygiene related disease outbreaks. Being a border town, such outbreaks may easily be transmitted to the bordering country.

Water Supply Infrastructure

Mchinji border relies on shallow wells (some are protected) for water supply (**Figure 7**). There is one borehole that services the population in the centre of the market (**Figure 8)**, while the Malawi Revenue Authority (MRA) has its own borehole and overhead tank servicing the Border post building (**Figure 9** and **Figure 10)**. There is a standpipe accessible to transit population with free drinking water and bathing water at a fee.

Figure 7 Protected Well

Figure 8 Borehole Handpump

Figure 9 MRA Borehole and Elevated Tank

Figure 10 Standpipe at MRA Tank

A few households, especially those belonging to the lower income population in the community have not managed to protect wells and resort to fetching safe drinking water from neighbours' protected wells and use water sourced from their unprotected wells for washing, bathing and gardening only.

The water sources are inadequate especially for those drawing from the communal wells and the borehole in the market. Though the market borehole is a high yielding borehole and does not fail to satisfy the demand in the dry season, the waiting period to collect water at the only "safe" drinking water source increases as most shallow wells are dry and everyone converges at the borehole at peak hours.

Sanitation Infrastructure

The principal mode of sanitation in the project area consist mainly of pit latrines which account for 94% of existing pit latrine facilities (**Figure 11**) and 6% are VIPs. A water borne system is accessible only within the Immigration department at the Mchinji border post. In addition, local restaurant and lodge owners have adopted makeshift wash hand stations to try and improve hygiene for their customers (**Figure 12**).

Figure 11 Pit Latrine Top Structure

Figure 12 Makeshift Handwashing

Of particular concern, is the plight of travellers crossing the border post who do not have designated safe sanitation. At the moment, fee paying VIPs and bath facilities have been constructed at the border post for travellers as shown in **Figure 13** and **Figure 14**.

Figure 13 VIP at Border Post

Figure 14 VIP at Border Post

From the FGDs held on 17th May 2016, two issues were voiced out concerning truckers as follows:

- Truckers have a challenge with bathing and laundry when they are delayed at the border. This forces them to seek toilet facilities from nearby homes.
- Whereas during day time the marooned truckers may seek toilets from nearby homes, at night, they sometimes use nearby areas which are just along the roads. This poses a health risk to both the residents as well as travellers including the truckers themselves.

There are no excreta management services provided by the local authority in this area, leaving all issues related to excreta treatment and disposal as a matter to be handled by residents themselves and individual institutions. Due to the lack of a clear excreta management service, the travelling public is inconvenienced and where excretion is done indiscriminately, the community public health is put at risk. Furthermore children are sometimes required to go and draw water in order to provide the “bathing services” to truckers which can have negative impacts, like school attendance by these children.

Water Demand

Development

Field inspections and interviews revealed that demand projections for the area will be derived using a “mixed development” approach due to the variation in customer types. One category will access water from public communal water points housed in small kiosk buildings whilst another category will require standpipe and “in-house” connection that will facilitate provision for fixtures that include a water borne closet, wash basins, and shower or bath tub. The field survey also revealed that several households were constructed without in-house facilities due to the non-availability of a direct household water connection.

The proposed system is in a fast expanding residential area. It is therefore important that the area where the water source is located to supply the project is secured on title. Adequate land should be secured to cater for future expansions beyond the project’s life span and reduce the risk of contamination of the well field. As a way of safeguarding water quality, it will be imperative that no developments are allowed within this area as his may compromise the water quality. No farming activities should also be permitted in the vicinity of the well field sites to avoid contamination with agro-chemicals. Currently, the land falls within the jurisdiction of paramount Chief, however the land should preferably be on title and under the jurisdiction of the local authority or CRWB, who both currently have very little presence in the area.

Current and projected water demand

The CRWB maintains a block based consumer category system that has been used as a guideline in selecting suitable consumption rates for the various consumer categories at the border post. The water demand consumption rates in

Table 5 have been adopted for use in the estimation of water demand.

Table 5 Typical average per capita consumption

Category	Average per capita consumption litre/capita /day
High Cost	100
Medium Cost	75
Low Cost	40
Low cost – communal (Peri-Urban / Rural) and Transient Consumers	25

The definitions of the various categories according to the national standards are as follows:

- High Cost Houses (HC): Low density housing with consumption in excess of 30 cubic meters per month with multiple taps, more than one Water Closet (W.C) and water borne sanitation;
- Medium Cost Houses (MC): Medium density housing with consumption from of 4 cubic meters up to 30 cubic meters per month with multiple taps, one or more W.C and water borne sanitation;

- Low Cost Houses (LC): High density housing with consumption less than 4 cubic meters with reduced number of taps, one W.C and water borne sanitation; and
- Peri-urban or Rural Housing: Housing with communal or shared standpipe or one tap in a plot with no water borne sanitation (i.e. uses latrines as a means of excreta disposal), or communal water points (kiosks)

Currently there are only Low Cost Housing units in Mchinji. However it is expected that there will be growth in the Higha and Medium Cost Housing units, especially due to the development of housing by the MRA.

The estimated population and expected development of the Mchinji border area is given in

Table 4. In addition to the water demand of the households, allowance has been made for the additional water demand from restaurants and admin / commercial.

Using the per capita rates, in conjunction with population projections, the current and future water demand for each consumer category in each residential area was estimated. The results are summarised in

Table 6.

Table 6 Estimated Water Demand by category for the main development areas

Residential Zone	Current Water Demand (m^3/d)			2031 Water Demand (m^3/d)		
	High Cost	Medium Cost	Low Cost	High Cost	Medium Cost	Low Cost
High Cost (180 m^2)	0.0	0.0	0.0	10.2	0.0	0.0
Medium Cost	0.0	0.0	0.0	0.0	11.5	0.0
Low Cost (50 m^2)	0.0	0.0	0.0	0.0	0.0	91.7
Low Cost / Peri-urban or rural housing	0.0	0.0	38.0	0.0	0.0	0.0
Sub Total	**0.0**	**0.0**	**38.0**	**10.2**	**11.5**	**91.7**
Transient Community	0.0	0.0	2.0	0.0	0.0	5.2
Restaurant/Admin	0.0	0.0	10.0	0.0	20.8	0.0
Total	**0**	**0**	**12.0**	**0.0**	**20.8**	**5.2**
	50.0			**139.4**		

The above shows a projected average water demand of **139.4 m^3/d** by the year 2031.

Water Source Assessment

The following objectives guided this component of the technical assessment, namely:

(i) Conduct a rapid water resources assessment (quantity and quality for both surface and groundwater) to determine sustainable source of water for the Project;

(ii) Recommend mitigation measures for the water pollution if it exists;

(iii) Assess any water use entitlements required to ensure regulatory compliance – including permits or general authorizations needed for abstraction.

General Physiography of Mchinji Border Post Town

Mchinji Border Town lies at an altitude of approximately 1300 m amsl. The area is generally flat but interrupted by hills in the northwest, southwest, southeast and east. Taking a SW-NE traverse line, the land slopes from 1390 m amsl from the top of the hill to 1270 mamsl in the dambo. There is therefore a 120 m drop in elevation from a highest point on a hill located in the southwest to a lowest point in a dambo (shallow wetland) located in the northeast of the project area.

Two river channels are distinguished in close proximity to the site: one in the south, and the other in the east. The river channel in the south flows from the west towards the east before discharging into the dambo, while that in the east flows from the south towards the northeast. The headwaters of the dambo are located southeast of Mchinji Border Town. The dambo occupies the southeast and northeast side of the project area. The river channel on the eastern side of Mchinji Border Post Town forms the eastern boundary of the dambo, despite the river rising from within the dambo just southeast of Mchinji Border Town (see **Figure** 15).

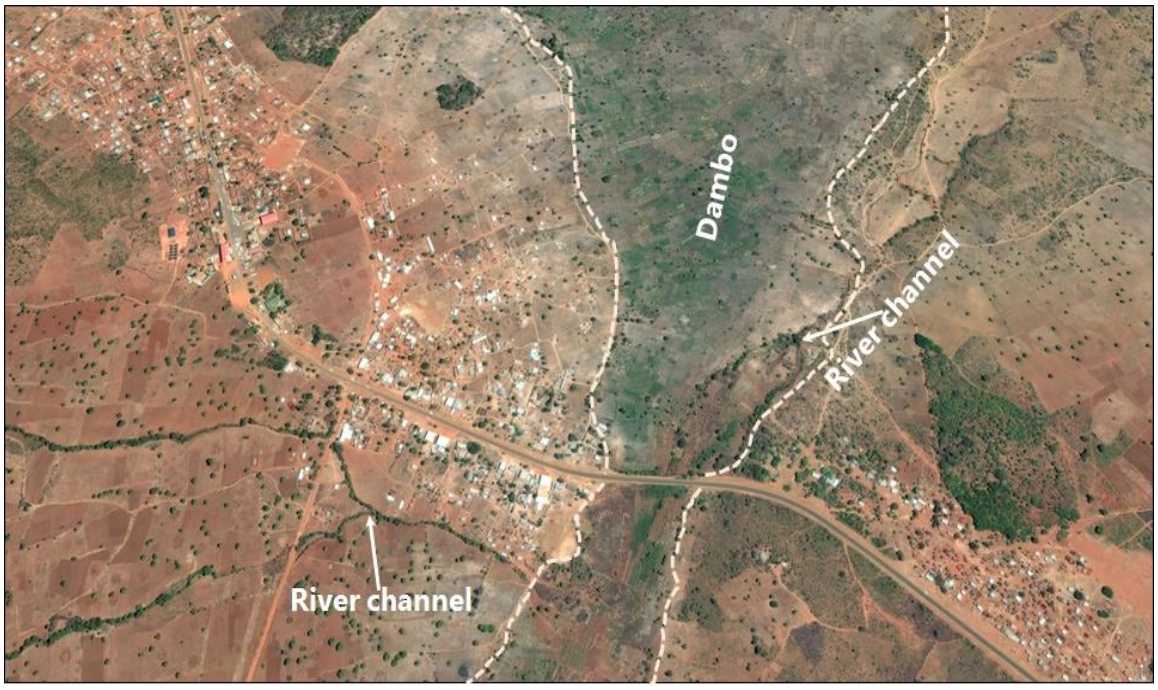

Figure 15 General physiography of Mchinji Border Post Town

Land - use and Geology

The land at Mchinji Border Post Town is predominantly traditional / customary. Therefore, traditional leadership allocates the land to their subjects and almost all the land in and around the Mchinji Border Town is owned by individual households. Apart from the land where houses and other structures such as shops, storage sheds, and similar are constructed, all other land is used as agricultural land. Dambo farming is

commonly practiced by local communities in and around Mchinji Border Town. As a result, the dambo which occupies the larger part of the project area is cultivated for various crops.

Due to the proximity, the geology of Mwami Border Post Town was used. This, nonetheless, fitted very well with some of the major geological formations observed around the Mchinji Border Town. For example, the belt of dambo alluvium located east and northeast of Mwami Border Town was also observed in Malawi, particularly east and northeast of Mchinji Border Town. Consequently, it was concluded that the geology of the two areas are similar.

Regionally, the geology of Mchinji Border Town is part of the Basement Complex of the Chipata area consisting of complexly folded, polymetamorphosed rocks - intruded by granites, syenites and basic rocks (GRZ, 1974)5. The Basement units include the Lutembwe River granulites of cordierite- or hornblende-granulite subfacies and a biotite gneiss unit of the almandine-amphibolite facies in which occur a wide variety of gneisses and migmatites (GRZ, 1974).

Locally, Mchinji Border Town sits on three geological formations, namely: Porphyritic biotite or biotite-amphibole granite; Granulite (undifferentiated (H), with spinel (sp), sillimanite (H1), garnet (H2), hypersthene (h)), and River and dambo alluvium, lateritic soil, sandy and clayey soil.

Possible Water Sources

Two possible water source types were investigated namely surface and groundwater. In principle, both surface and groundwater resources are available in and around the Mchinji Border Town.

The presence of surface water sources is signified through the presence of river channels. Two river channels are found in the project area, one located in the south of the project area and running west to east, and the other one that is located in the east of the project area and flowing from the south to the northeast (see **Figure 15**). Nevertheless, the yields from these two rivers are not substantial enough to provide sustainable water supplies to the Mchinji Border Post Town.

There were no flows observed in the river channel located to the south of the project area although there were clear indications that the river flowed during the rainy season. On the contrary, some flows were observed on the river that was located in the east of Mchinji Border Town but these flows were so low, not to warrant any considerations as a source water supply to the project area.

Further from the project area, in the vicinity of Kachebere is the Kachebere stream – see **Figure 16** (approximately 4 km to the south east of the border). The stream is also seasonal and there was no flow at the time of the site visit by the feasibility team. The potential for surface water is therefore very limited. Consequently, the demand cannot be met and this option cannot be viably pursued.

[5] GRZ (1974) *'The Geology of the Chipata Area: Explanation of Degree Sheet 1332, SE Quarter, Report No. 41'*, Geological Survey of Zambia, The Government Printer, Lusaka

Figure 16 Location of Kachebere Stream

A summary of the water source options is presented in

Table 7.

Table 7 Water Source Options Matrix

Option and Ranking	Option Description	Benefits	Key Issues
Option 1 (Boreholes)	• Drill boreholes within the service area • Transfer water (distance less than 1 km) from borehole to reservoirs to be installed on hill adjacent to the well fields • Chlorinate the water • Distribute water from overhead reservoirs to the Mchinji settlement directly below the reservoir location • Access to water through individual metered household connections and communal access points called kiosks manned by vendors contracted by CRWB	• Potential drilling sites available • Power readily available within service area • Treatment process not complex • Regulated usage which minimises wastage	• Traditional leadership to be engaged so as to give an undertaking to avail land where drilling can be effected • Tariffs are set by CRWB • Community participation through vendors and Community Committees, which enhances ownership • Access by all is assured which will positively impact sanitation and general hygiene levels
Option 2 (From streams e.g. Kachebere	• Extract surface water from the Stream point 4 km from Mchinji Border post	• Water source unreliable	• More expensive option as much more infrastructure is required • More manpower

Option and Ranking	Option Description	Benefits	Key Issues
stream)	• Construction of a water treatment plant that can effect coagulation, flocculation, sedimentation, filtration, chlorination • Construct a 4 km high pressure pumping main to Mchinji including high lift centrifugal pumps		required for operations and general security for the transmission line • Higher energy costs due to very long pumping distances • Water source not sustainable throughout the year – therefore not an option.

Groundwater Resources

In the absence of sustainable yields from surface water bodies – low river flows attenuated by seasonal variations – groundwater was considered as the only possible option for the water supply to the project area.

A number of boreholes were observed around the Mchinji Border Town. Although no information on the yields of various boreholes was available, a borehole located at the Immigration Offices is equipped with an electrical submersible pump and continuously provides water for all the border post facilities. This, therefore, showed that groundwater yields around the project area could be substantial enough to provide long term sustainable water supplies to the border post town. This conclusion was further supported by the information provided by the Malawi Central Region Water Board that revealed yields of 9 l/s from a borehole drilled about 3 km east of the project area (Makwenda, 2016)[6].

It has to be noted that specific norms guide borehole construction in Malawi. For example gravel packing is provided all around the casing. In addition, if high yields are expected larger casing diameters of more than 160 mm are recommended so that more flexibility and optimization in pump sizing can be attained (Makwenda, 2016).

Potential Sites for Locating Boreholes for the Mchinji Border Post Town Water Supply Project

A technical assessment to investigate suitability of the Mchinji Border Town for groundwater production was undertaken from Wednesday, May 18th 2016 to Saturday, May 21st 2016. Fundamental to this technical assessment was the identification of locations or sites with high potential for groundwater occurrences, capable of providing adequate quantities of groundwater to sustain continuous water supply to Mchinji Border Post Town. The boreholes were sited primarily on *Porphyritic biotite or biotite-amphibole granite* as well as on *dambo alluvium*.

The locations for drilling the boreholes to supply water to Mchinji were sited using two geophysics methods, namely electromagnetic and resistivity methods. Electromagnetic (EM) technique was used to primarily

[6] Personal communications with Mr. John Makwenda, Projects Manager, Malawi Central Region Water Board

pinpoint areas of high conductivity were resistivity technique, vertical electrical sounding (VES) technique was applied. Because of the time constraints, three locations were selected on EM traverses line where VES were executed. The equipment used in the VES was the Geotron and the Schlumberger electrode array.

Underground geological materials were investigated up to 100 m depth. Data obtained from the investigations were analysed and actual resistivity on each of the eight points computed. The two-layer master curves were used for the qualitative analysis of the data and the IPI2Win computer programme was used in processing the data obtained from the Geotron. The programme was jointly developed at Moscow State University and Geoscan-M Limited and it generates a 1D interpreted data of geological formation along a single profile.

Three sites were investigated using VES technique as possible locations for drilling boreholes to supply water to Mchinji Border Post Town and these are BH001, BH002 and BH003. All the sites investigated were located in the eastern side of the project area - see **Figure 17** and **Table 8**.

Table 8 Coordinates of sited points

Location code	Eastings	Southings
BH001 (MJI)	32°48'11"E	13°45'11"S
BH002 (MJI)	32°48'11"E	13°45'06"S
BH003 (MJI)	32°48'11"E	13°45'21"S

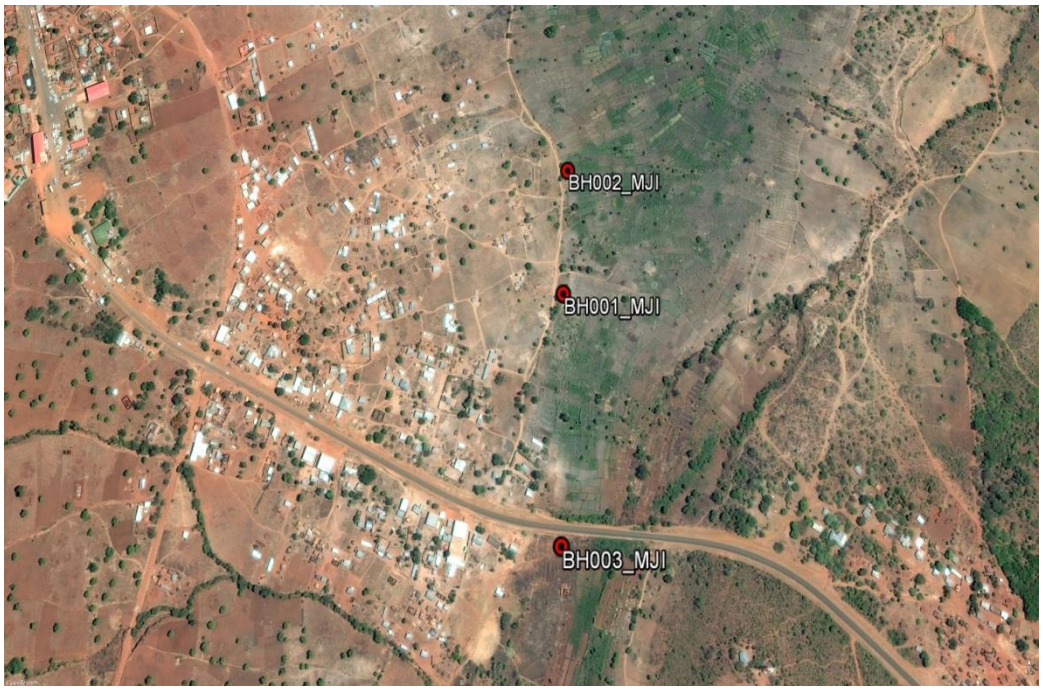

Figure 17 Position of Investigated Boreholes

BH001 (MJI)

BH001 (MJI) was sited along the dambo. The site is located approximately at 1281 m amsl.

Two geological layers were apparent from the investigations. The resistivity of the first geological layer was higher than the resistivity of the second geological layer, i.e. $\rho_1 > \rho_2$.

Table 9 and **Figure 18** are the computed resistivity of the geological layers underlying site BH001 (MJI) as interpreted using the IPI2Win from the field data of apparent resistivity (Measured data in **Annex B**).

Table 9 Resistivity of BH001 (MJI)

Layer	Resistivity (Ωm)	Thickness (m)
Layer 1	147.5	10
Layer 2	61.92	Infinitely thick

The resistivity of the second layer (Layer 2) was computed as 61.92 Ωm and this layer starts from 10 m below ground level and it is infinitely thick. This resistivity indicates a highly weathered geological formation, which provides a very high likelihood of intercepting groundwater in Layer 2. Overall curve fitting error was 0.0345 percent.

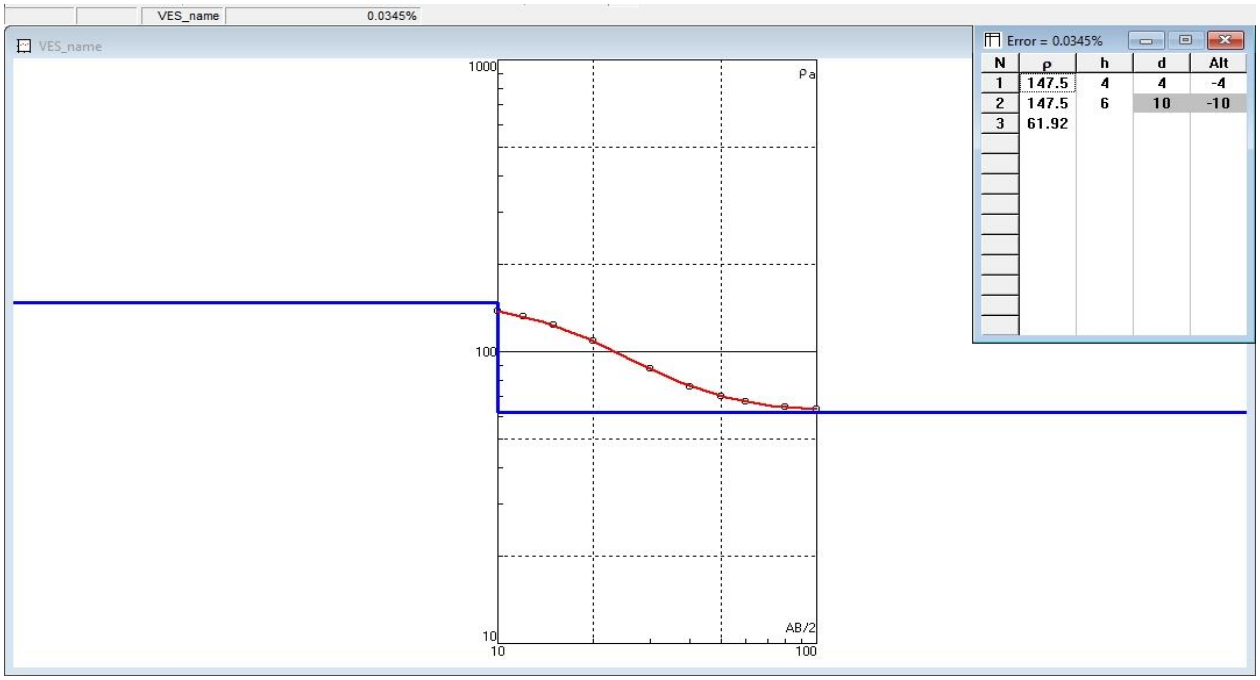

Figure 18 Resistivity interpretation at site BH001 (MJI)

Therefore, it is proposed that BH001 (MJI) be drilled to 100 m using a 12 inch diameter down-the-hole hammer (DTH). The drilled hole should be cased from top to bottom with the 8 inch diameter casing pipes fitted with a sump at the bottom. 1 mm diameter screens should be used at points of groundwater strikes.

Furthermore, suitable gravel pack – especially alluvial sands of at least 1.5 mm diameter thick should be used. The gravel pack should form a 4 inch diameter annulus and should cover at least 20 m thickness from the end of the last screen casings.

As an identification mark, a tree stalk was used as peg, painted with green oil paint from the top so as to increase its visibility to the drillers.

BH002 (MJI)

BH002 (MJI) is located some 164 m north of BH001 (MJI) also along the edge of the dambo. It is approximately 1282 m amsl.

Three geological layers were identified from the investigations on site BH002 (MJI). The VES data showed that resistivity of the first geological layer was lower than the resistivity of the second geological layer. Similarly, the resistivity of the second geological layer was lower than that of the third layer. Therefore, the conductance properties of the first geological layer were better than those of the second and third layers. As a result, the resistivity of the geological formation on the second site (BH002 (MJI)) was represented by the model, thus: $\rho_1 \rho_2 \rho_3$.

Table 10 gives the resistivity of the geological layers on site BH002 (MJI) as computed from the apparent resistivity (Measured data in **Annex B**).

Table 10 Resistivity of BH002 (MJI)

Layer	Resistivity (Ωm)	Thickness (m)
Layer 1	501.8	10
Layer 2	680.5	4
Layer 3	1356.5	Infinitely thick

The potential of intercepting groundwater on this site is relatively low to very poor. The resistivity of all three layers on BH002 (MJI) indicated geological formations with very low conductance properties. Therefore, this site should not be drilled.

BH003 (MJI)

BH003 (MJI) is located some 290 m southwest of BH002 (MJI). The site lies at an altitude of approximately 1287 m amsl. Two geological layers were visible from the investigations. The resistivity of the first geological layer was higher than that of the second geological layer, i.e. $\rho_1 \rho_2$. The first layer was almost 30 m in thickness while the second layer was infinitely thick.

Table 11 is the computed resistivity of the geological layers underlying site BH003 (MJI) as interpreted using the IPI2Win from the field data of apparent resistivity (Measured data in **Annex B**).

Table 11 Resistivity of BH003 (MJI)

Layer	Resistivity (Ωm)	Thickness (m)
Layer 1	175	25.6
Layer 2	30	Infinitely thick

The potential to intercept groundwater resources in BH003 (MJI) is comparatively high. The low resistivity of Layer 2 is indicative of high conductance resulting from a highly weathered regoriths. Therefore, BH003 (MJI) possesses very good potential for groundwater supply.

BH003 (MJI) should be drilled and packed to the same proposed specification as BH001 (MJI), i.e. to 100 m using a 12 inch diameter down-the-hole hammer (DTH), with an 8 inch diameter casing pipes fitted with screens and suitable gravel pack.

The borehole has been marked with a green painted tree stalk.

Recommended Drilling Site and Borehole Construction

Both BH001 (MJI) and BH003 (MJI) are good sites with very good potential to intercept groundwater resources. It is recommended that BH003 (MJI) should be drilled first before proceeding on to drill BH001 (MJI).

Based on expected yields from boreholes in this region, is likely that more than two boreholes will be necessary to supply the water demand. It is therefore recommended that additional sites should be investigated to the south of BH003 (MJI) position, at least 80 m away from BH003 (MJI).

All the borehole sites should be secured by the Central Region Water Board in readiness for drilling works. This, therefore, means that Central Region Water Board would have to go into negotiations with private landowners to secure the pieces of land where the two boreholes are likely to be drilled. It is recommended that at least 16 m² (4 m x 4 m) of land be negotiated by the Central Region Water Board on each site for the construction of the pump infrastructure as well as a buffer for the water supply borehole.

Drilling should be by down-the-hole hammer (DTH) and drilling diameter of 12 inches or 304.8 mm up to 100 m end-of-hole (EoH). The drilled borehole should be lined with PVC casings of 8 inches or 203.2 mm diameter from top to bottom. A bottom plug or end cap should be installed and secured to the casings. Two types of PVC casings would be installed, namely solid and screen casings. Screen casings would be installed over sections of groundwater saturation and sections where water strikes are intercepted. Furthermore, the hole has to be gravel packed with preferably alluvium sands of grain size ranging between 1.5 mm and 2 mm diameter. The overall annular diameter of the borehole would be at least 4 inch or 102 mm in thickness. The aperture sizes of the screens should be 1 mm and of equal width and length.

Well Development and Aquifer Hydraulic Tests

Drilled boreholes would be developed prior to performing the pumping test (aquifer hydraulic test). Therefore, aquifer yields would only be determined upon completion of the aquifer hydraulic test. All boreholes would be developed using air lifting and surging. Once the boreholes are adequately developed

and the groundwater clear of any noticeable suspended solid matter, aquifer hydraulic testing (pumping tests) should then be undertaken.

Aquifer hydraulic tests would be undertaken through two tests, namely: Step-drawdown test (SDT) and Constant Rate Test (CRT). Three steps would constitute the SDT. Each of these steps would be for 1 hour and thereafter the aquifer should be allowed to recover to its static water level (SWL) after the end of the third step. The aquifer would be pumped at not less than 1 l/s for 1 hour during the 1st step of the SDT. Consequent steps in the SDT would have incremental pumping rates of 100 percent for the 2nd step and 200 percent for the 3rd step, relative to the pumping rates used in the 1st step of the SDT.

The Constant Rate (discharge) Test (CRT) would then be performed on the aquifer. The suitable pumping rate for the CRT would be determined upon analysing the aquifer behaviour after the SDT. The CRT would be for a minimum of 12 hours.

Although aquifer yields would only be determined after under taking the aquifer hydraulic tests, it is, nevertheless, recommended that initial aquifer yields be estimated during the drilling using a 90 degrees v-notch weir. The v-notch weir should be installed at an appropriate distance downstream the flow of water to avoid errors that may arise as the result of turbulence. This initial yield of the borehole would be used to determine the most suitable pumping rate for the aquifer hydraulic test.

Groundwater samples would be collected during the CRT aquifer hydraulic tests and preferably during the last hour of the test. The collected groundwater samples would then be analysed at the laboratory for water physical chemistry parameters as well as bacteriological parameters.

Water Supply System Design

Project Objectives and Justification

The main objective of this project is to improve the water supply and sanitation status of the project area in order that waterborne and other water related hygiene diseases are prevented. This is an important project for Mchinji border as it will lead to improved socioeconomic status of the community. The hygiene levels of both the community as well as the travelling public will be improved due to this project.

Description of the proposed water supply system

The water supply system will have three distinct components namely:

- Water source - boreholes;
- Storage facilities; and
- Distribution system.

There is currently no piped supply to the community at Mchinji or any other acceptable form of service except one communal handpump operated borehole in the centre of the market.

Details of the proposed borehole water source has been elaborated on in the preceding sections. For the purposes of the Feasibility Study, an additional borehole has been sited to the south of BH003 (MJI), shown as BH2 on the network layout drawings.

Design criteria

The following design criteria was used for the feasibility design:

- Elevated storage volume – 1 x average daily demand
- Pipe sizes – Peak hourly demand (3 x average daily demand)
- Supply (boreholes) – Peak daily demand (1.5 x average daily demand)

Two simple distribution networks, based on different storage reservoir locations, but both comprising a gravity mains from the reservoir and a main stem which runs along the main road to feed the south eastern and south western parts of the border post were considered.

- **Option 1:** Comprises 1.5 km pumping main which runs along the main road to a high level storage located on a hill to the west of the border post. The main disadvantage of this option is that the pumping main (which is generally associated with high pressures) is long, which will increase the pipeline cost due to the higher pressure class pipe **(Figure 19)**.
- **Option 2:** Comprises 1.2 km pumping main which runs from the proposed well fields and crosses the stream to a high level storage located on the Kachebere hills to the south of the border post. The main advantage of this option is the reduced pumping main length, which will ultimately reduce the pipeline costs **(Figure 20).**

Due to the proximity of the boreholes to the Kachebere hills, i.e. to the east of the border, Option 2 had the lowest construction cost and therefore was assessed for the purposes of this report.

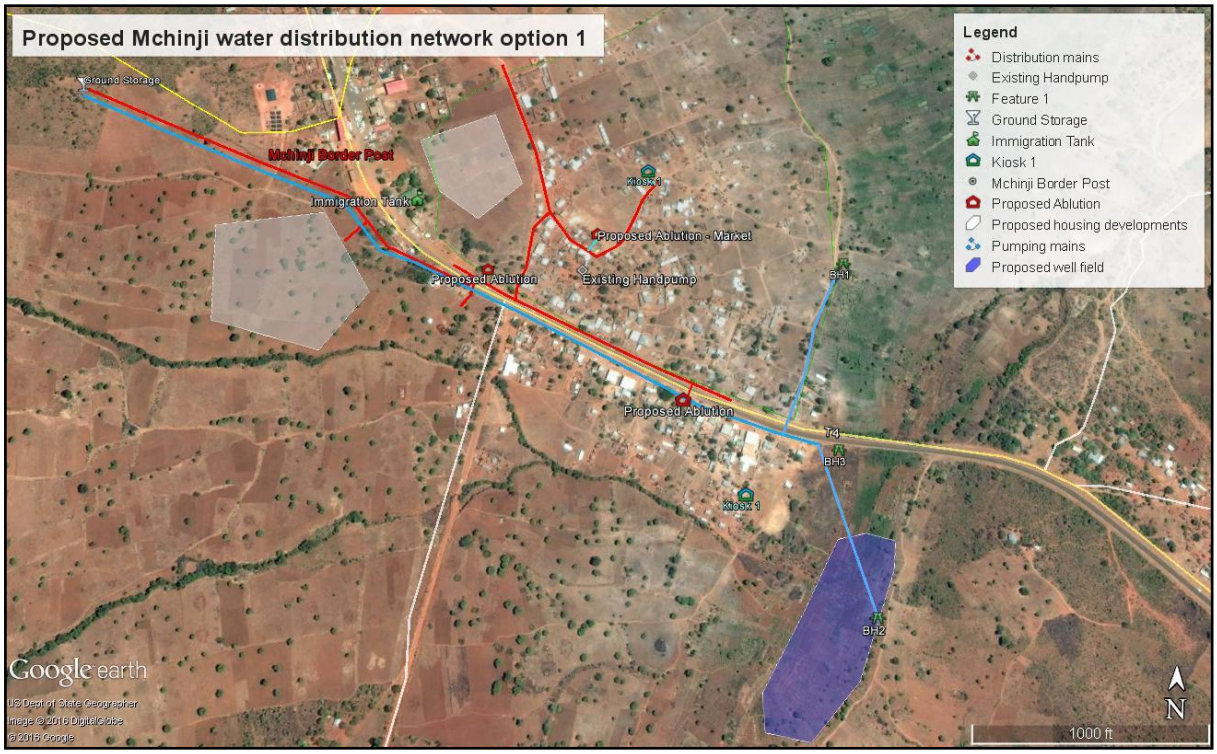

Figure 19 Proposed Mchinji Border Post Distribution Network Option 1

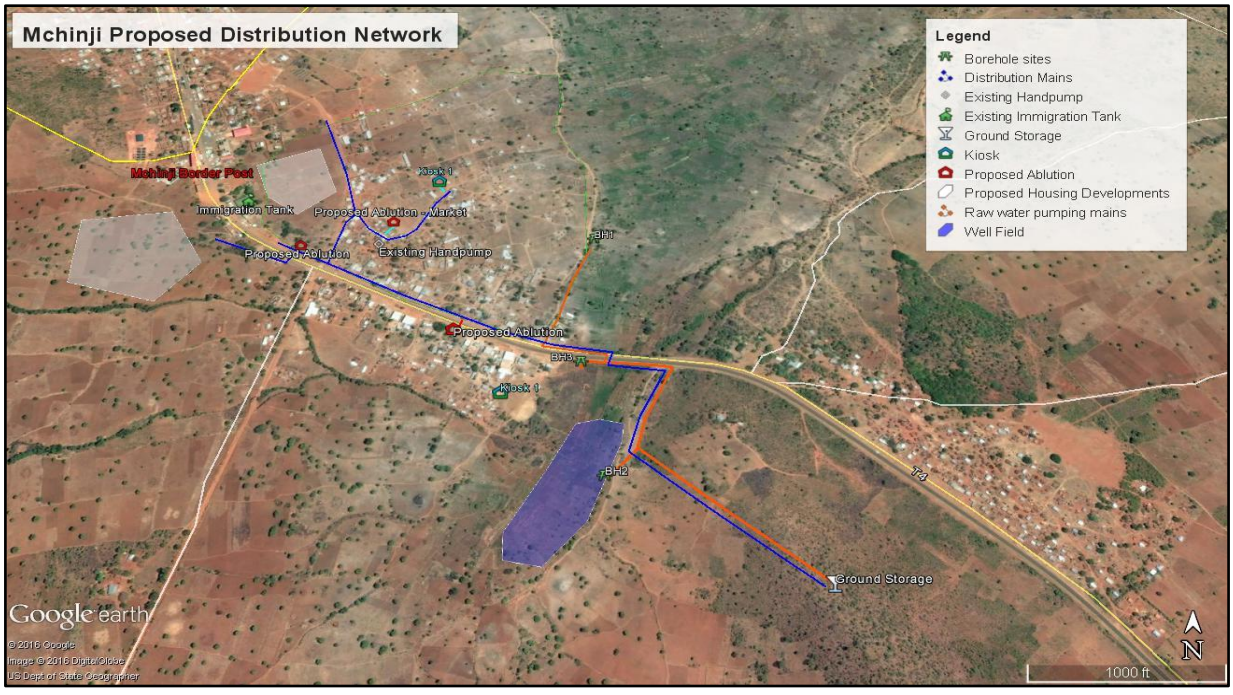

Figure 20 Proposed Mchinji Border Post Distribution Network Option 2

A secondary mains branches into the central Mchinji to supply the commercial, proposed Immigration houses and residential properties to the south west. Another secondary mains branches to the south western parts to supply the area and the proposed MRA hosing development. The layout of the proposed network is shown in **Figure 20**.

A total of two water kiosks located as shown in **Figure 20** will be provided to cater for consumers from Low Cost Housing to gain access to water, while individual connections will be made on application.

Four demand Zones have been identified, one around each kiosk (2 of) and the two new proposed housing developments (MRA and Immigration). Average water demand in each of the four demand zones has been estimated on the basis of the total number of buildings in each zone, pro rata the total water demand for the year 2031.

Peak day and peak hourly demand for each centre was then computed by multiplying average daily demand for year 2031 by 1.5 and 3 respectively. The results for the 2031 peak water demand are summarised in **Table 12**.

Table 12 Mchinji peak water demand by demand centre for year 2031

	Peak Hour		Peak day (16 h)	
Zones	m3/day	m3/h	m3/day	m3/h
1	118	7.4	89.6	5.6
2	91	5.7	68.8	4.3
MRA	21	1.3	14.4	0.9
Immigration	46	2.9	35.2	2.2
Total		**17.3**		**13.0**

The network has been designed to cater for future housing developments through infills and densification of residential houses. It will serve as a nucleus within which new developments will occur, thus discouraging expansion of housing developments to unserviced areas.

Borehole Development

An assessment of required raw water supply, with an assumed potential safe yield of 3.6 – 5.4 m^3/hr (1 to 1.5 l/s). It is proposed to develop borehole water supply to cater for water demand up to 2031 as follows:

- Peak day water demand at 2031 (16 h) = 13 m^3/hr
- No of boreholes required to cater for the demand = 13 / 3.6 = 3.6
  = 13 / 5.4 = 2.4
- It is expected that a total of three boreholes drilled at locations in the south east of the border post, across the highway will be adequate to cater for peak day water demand. The final number will need to be confirmed by yield testing the boreholes.

Based on an aquifer Specific Capacity of 0.056 l/s/m the total drawdown required to produce 1 l/s is estimated at 20 m. Assuming water table depths in the region of approximately 30 m, the boreholes will require to be drilled up to at least 50 m and sited at least 80 m apart. All the boreholes operating together will deliver in excess of the peak day demand.

Pumping system

It is proposed to pump water from the three boreholes by means of 3 kW electrically submersible pumps, through short 50 mm diameter class 16 uPVC pipelines into a 1,177 m long, 75mm diameter, Class 9 uPVC pipeline, from where it will be delivered to a high level distribution reservoir.

The results of the network analysis of the raw water pumping system showing node pressures and pipe diameters are illustrated in **Figure 21**.

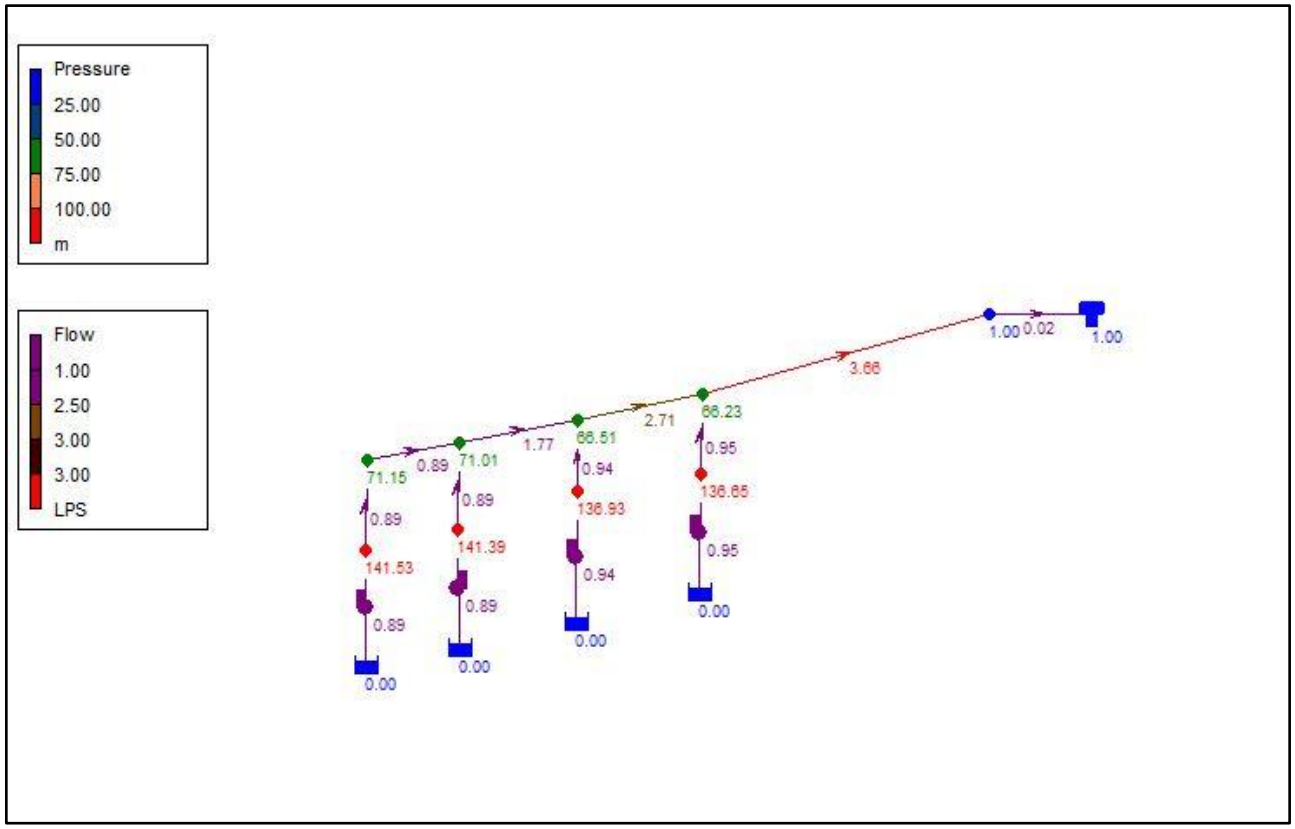

Figure 21 Results of Mchinji border post raw water pumping network analysis

Storage Reservoir

It is proposed to construct a 139 m^3 ground steel reservoir at a high level location shown in **Figure 20** to cater for 24 h storage requirements, based on the 2031 average water demand.

Distribution Mains

Water will gravitate from the storage reservoir into a distribution network, designed to cater for peak hourly demand. The layout of the network will promote densification of housing developments by utilising infills as people seek to locate their homes within serviced areas. Based on the estimated projected water demand, the distribution network will cater for growth within the existing infill areas up to 2031.

Components of the proposed network, shown in **Figure 22**, are as follows:

- 1,340 m long, 110 mm diameter class 6 gravity mains pipeline which terminates at a bifurcation in the vicinity of the border along the main road.
- A 260 m long main stem branching almost parallel to the main road comprising of 90 mm diameter Class 6 uPVC
- A 160 m long 50 mm diameter branch line feeding the lager demand Zone Mchinji Central and Kiosk No 1.
- A 265 m long 50 mm diameter branch line feeding the Immigration housing development zone.
- A 50 m long 50 mm diameter stem branching perpendicular to the main road feeding the MRA housing development zone.

The layout of the distribution mains is shown on the Google Earth image **Figure 20.**

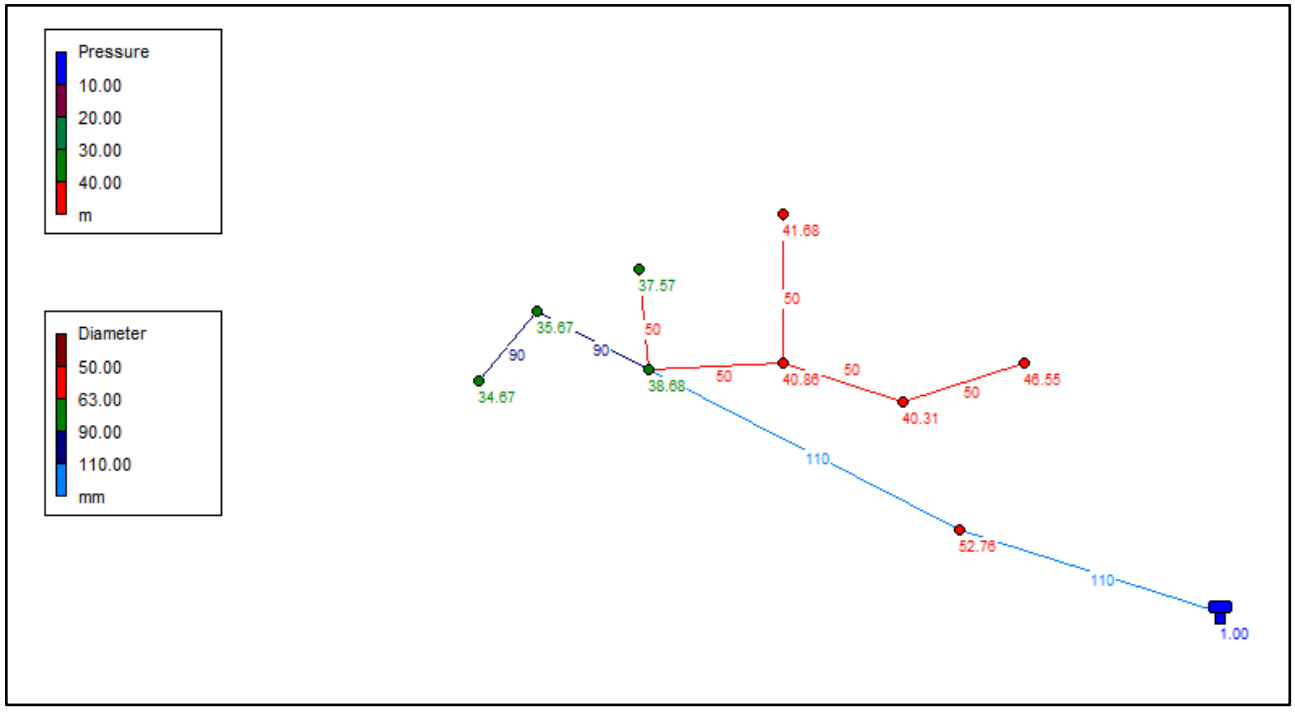

Figure 22 Results of Mchinji border post distribution network analysis

Water Kiosks

It is proposed to construct two water kiosks for the sale of water to unconnected households. The distribution of the kiosks is show in **Figure 20**. Each kiosk will be directly connected to the network, with provisions for the metering of water used. In order to enhance the commercial operation of the service, each Kiosk will be equipped with shelving and a hatch counter.

Sanitation

Proposed Sanitation Intervention

It is proposed to construct a public ablution facility for use by travellers crossing the border at the border post. The ablution block will consist of toilets, shower and laundry facilities, which will be separate for males and females, designed to cater for a maximum of 200 travellers (catering for 2031 daily average). Sewage treatment will be by means of a septic tank, designed to be emptied every 3 years. The sludge will be discharged into sewage ponds located at the closest town with sewage treatment facilities, such as the district capital, Mchinji Town.

The facility will be under delegated management. Charges will be levied for the use of ablution facilities by travellers, as a cost recovery measure to fund cleaning and water supply services.

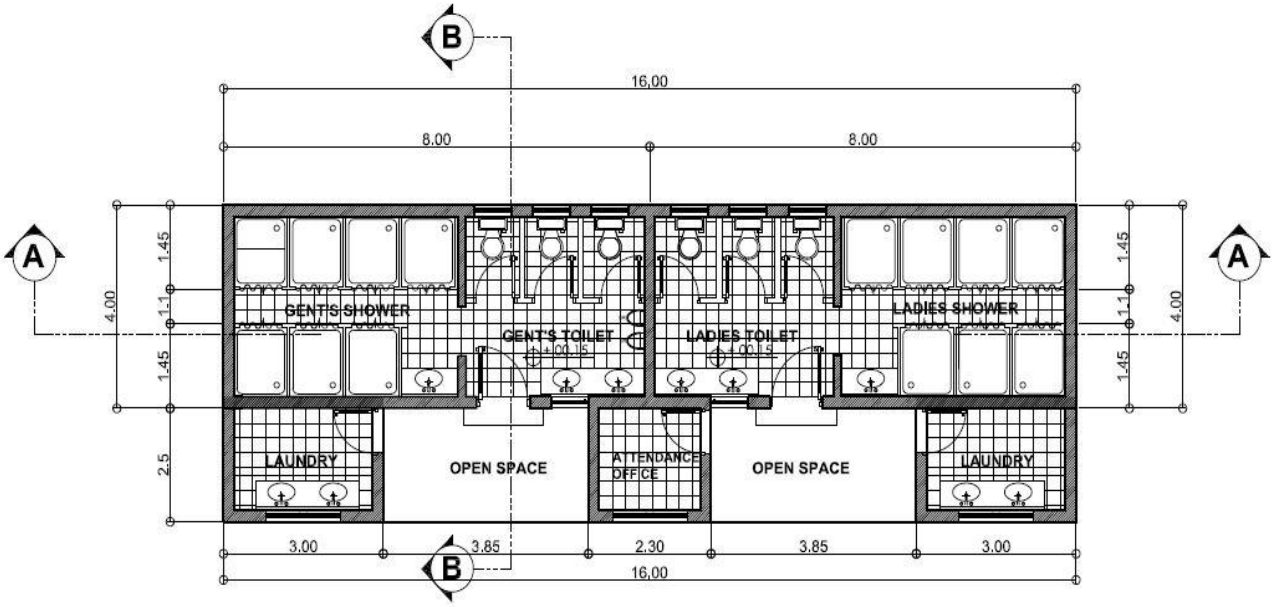

Figure 23 Proposed layout of ablution block at Mchinji Border Post

Proposed Operations and Maintenance Management Sanitation Facility

As the facility will fall under CRWB, who are only responsible for the water supply in the area, they may wish to appoint a vendor to run the facility on their behalf. CRWB will install a water meter at the facility and will bill the vendor for the volume of water consumed.

In addition, the facility will need to have an operations and maintenance plan in place to attend to the daily maintenance and cleaning requirements as well as desludging when the septic tank fills up. It is therefore important that provision of these services is sustainable for the facility to operate to the satisfaction of the would-be users.

The vendor should provide attendant/attendants to be collecting the user fees as well as to clean the facilities on a daily basis. The funds raised should be managed in such a way that in three and half years, there should be enough funds in the coffers to enable desludging of the facility.

The operations for the facility will fall in the CRWB peri-urban services section

Key Attributes and Operational Features;

i) The appointed vendor (Water Usage Association) sets up a tariff for usage of the facility within the parameters of CRWB as the regulator and collects the GROSS from the customers through the attendant at the facility.

ii) The vendor is responsible for the cost of electricity and CRWB water consumption tariff payment.

iii) The vendor provides the security requirements to guard the very strategic installations on the area network such as pumps and electrical starter panels

iv) The vendor is responsible for all maintenance interventions required on the infrastructure. The maintenance artisans are employed from the community.

v) The WUA (Water Usage Association) builds up a usage tariff in collaboration with CRWB and pays for volume of water consumed only to CRWB.

vi) The WUA MUST HAVE membership of females living within the community as per “WUA Formation Guidelines 2009”.

Climate Change Risk Assessment (CCRA)

Scope of Review

The scope of this Climate Resilience Risk Assessment (CCRA) review includes the following project components and outcomes.

Climate risk screening on the following project components:

- Groundwater abstraction using boreholes
- Storage Reservoir
- Distribution network

Identification of resilience benefits of the following project outcomes:

- Provision of a reliable water supply system
- Provision of water and sanitation facility for the cross border population (communal ablution building)

Climate Vulnerability Mapping and Tool Indicators

Table 13 presents the level of the climate vulnerability indicators for the Chirundu Water Supply project area according to the climate vulnerability assessment tool. For some indicators a range is presented, which

reflects the differences in vulnerability amongst sites. Further guidance on the meaning of the indicators is presented in **Annex B3**.

Table 13 Climate Vulnerability Indicators (from website[7])

Indicator	Outcome
Future risks to people	5. Moderate High
Water risk under climate change	5. High
Climate change pressure	4. High
Baseline risks to people	3. Medium
Resilient population	4. High
Population density	656 (people per km2)
Household and community resilience Groundwater stress	0.57 Moderately more resilient
Groundwater stress	No data
Upstream storage	No major reservoirs
Drought severity	2. Low to Medium (20-30)
Flood FREQ MINM	
Seasonal variability	5. Extremely High (>1.33)
Inter-annual variability	3. Medium to High (0.5 to 0.75)
Baseline Water Stress	1. Low (<10%)
CRIDF Basin	ZAMBEZI

The project area faces extremely high seasonal variability, with flood occurrence and drought severity medium to high risks. In addition to these factors regulatory and reputation risk is extremely high risks that could have an impact on the ability to supply services to the beneficiaries.

The development of a reliable supply through improving the abstraction system, the capacity of treatment and the reticulation will enhance inherent climate resilience of the community and surrounding area and allow for effective water services for the poor given the current level of climate change.

Regional Climate Projections

The project falls within Region 1 (refer Annex C), and the expected impacts associated with this region are presented in **Table 14**.

Table 14 Climate Projections for Project Area

7 The CRIDF Climate Vulnerability Assessment is available online at: http://geoservergisweb2.hrwallingford.co.uk/CRIDF/CCVmap.htm

Climate change trend / parameter	Impacts	
	By 2025	By 2055
Precipitation variability	Continuing trend of seasonal and interannual variability in precipitation. A transition zone between areas where the annual rainfall is more likely to increase (to the north) and more likely to decrease (to the south). Any changes are most likely (but not definitively) in the range −10% to +10%. The possibility of increased rainfall rises with higher emissions.	Continuing trend of seasonal and interannual variability in precipitation, decreased winter rainfall and increased aridity, in combination with wind gustiness, drying out of seasonal wetlands/pans and ephemeral rivers. Variability in particular at boundary with southernmost extent of intertropical convergence zone (ITCZ). A transition zone between areas where the annual rainfall is more likely to increase (to the north) and more likely to decrease (to the south). Any changes are most likely (but not definitively) in the range −10% to +10%. The possibility of decreased rainfall is higher than around 2025. Water supply is challenged by increased temperatures (and associated evaporation), and more erratic rainfall patterns, leading to vulnerability of perennial river systems and decreased level of the groundwater table.
Temperature variability	Continuing trend of increased mean annual air temperature (MAAT). Likely increase of MAAT by 0.5ºC to 1.5°C, but lower/higher values cannot be excluded; some increase in length of warm spells and reduced frequency of cold periods.	Continuing trend of increased MAAT, aridity trend will reinforce decreased humidity especially under more erratic seasonal precipitation regimes; increased heatwaves; increased thunderstorm activity, heatwaves. Likely increase of MAAT by 0.5ºC to 3.0°C, but lower/higher values not excluded; almost certain increase in length of warm spells and reduced frequency of cold periods.
Extreme events	More erratic precipitation and temperature regimes, resulting in some likely increase in extreme flood/drought events.	More erratic precipitation and temperature regimes, resulting in an increased likelihood of extreme flood/drought events, both in severity and duration. This will have a multiplier effect in increasing vulnerabilities to other risk events and thus result in wider likely impacts.
Agriculture	Food insecurity arising from	Increased overall drying trend and decreased winter

Climate change trend / parameter	Impacts	
	By 2025	By 2055
	political instability across the region and challenges to both food production and supply, climatic instability.	rains result in decreased food production in total and land surface degradation and soil erosion due to increased aridity and soil moisture loss. Deforestation and loss of biodiversity an increasing issue. Aridification and spread of sand dunes in Sahelian areas. Rain-fed agriculture will be likely less reliable in many areas and irrigated agriculture will become more significant, but this poses problems for famers' access to technology, investment and training (including provision of GM seeds).
Health	Pockets of different disease types as a result of site-specific water/air/pollution, amplified by incorrect water, agricultural and land management practices, and mining wastes. Low nutrition/health in some areas due to food insecurity.	Widespread health effects due to food/water insecurity, availability of potable water, water contamination by runoff, and low water quality due to biological diseases, pollution/sewage runoff into rivers, wastewater and groundwater contamination due to poor sanitation in informal settlements and due to industries such as mining.

CCRA Results

Climate Risks

The project comprises of a number of physical infrastructure components, that were identified and screened at a high level against a series of relevant climatic threats for the area such as flooding, drought and fire. A summary of the outcome of the process in terms of climate risks is presented in

Table 15 along with a series of risk management options.

Table 15 Climate Risk Matrix

Project component	Flood	Drought	Fire	Risk mitigation options
Provision of a reliable water supply system	**Low**: Flooding is unlikely to impact water distribution network	**Medium**: Prolonged drought can reduce recharge rate of groundwater aquifers and volumes of sustainable yield	**Low**: Fire is unlikely to impact water distribution network	The boreholes will be positioned in the best geo-hydrological are to improve the sustainable borehole yield. Boreholes will also be drilled to a deeper level, if this will improve the long term drought resilience.
Provision of water and sanitation facility for the cross border population (communal ablution building)	**Medium**: Flooding could damage the communal ablution building and could also flood the septic tank.	**Low**: Drought is unlikely to impact the communal ablution buildings.	**Medium**: Fire could destroy the communal ablution building.	The design of the communal ablution building will need to take flooding and fire into account, in terms of selection of materials, positioning away from flammable materials / bushes / trees and flood resistance of the septic tank.

Resilience benefits

The project delivers a series of outcomes that enhance the resilience of project recipients to climate change. An overview of the project's outcomes along with a list of resilience benefits that the project delivers are presented in the 'Climate Resilience Benefits Matrix' attached in **Annex B2**.

Conclusions

The CCRA shows that the project brings a number of high resilience benefits to the project recipients especially in relation to governance and livelihoods, gender and health. The review also identified a number

of risks in relation to the associated infrastructure and risk-mitigating actions which if implemented will improve the resilience of the project itself to climate change risks.

Flood -The existing flood risk in the area is medium to high and is likely to intensify with future climate change impacts. The infrastructure that is at risk of flooding should be designed to firstly manage stormwater run-off and secondly minimise the impact of flooding.

Drought - Drought is a known and recurrent issue in the area and is likely to intensify with climate change. This could impact water abstractions in the area and this in turn could have systemic implications for the water supply of the project area. Selection of borehole sites and the drilling of boreholes should address this aspect during construction.

Recommendations

The project should address the specific future changes in precipitation due to climate change as projected by climate models. Furthermore institutional strengthening of the water and sewerage supply company, which can address long terms aspects like water conservation, demand management and reduction of non-revenue water, could influence the volume of water required to supply the town. Climate projections should be shared and discussed with local stakeholders by the project team to explore future and alternative risk mitigation options.

Cost Estimates

Capital Costs

Cost estimates for the above proposed works were undertaken based on the preliminary technical assessment outlined above. It is assumed that the expected borehole yields from the development of the aquifer south east of the border post will be realised (Option 2). There will be a need to confirm these yields through yield testing after drilling of the boreholes.

A summary of preliminary cost estimate is given in **Table 16**.

Table 16 Cost Estimate

	US$	£ (£1 = $1.345)
Pipe Materials	27,200	20,200
Civil Works	73,200	54,400
Fencing	5,200	3,800
Pumps and Motors	42,400	31,500
Boreholes	28,000	20,800
Power Lines	18,800	13,900
Reservoirs	68,300	50,700

	US$	£ (£1 = $1.345)
Pipe Fittings	22,600	16,800
Ablution Blocks	40,600	30,200
Kiosk	11,800	8,800
Preliminary and General	101,400	75,400
Sub Total	**439,400**	**326,700**
Add 20% contingencies	87,900	65,300
TOTAL PROJECT COST	**527,300**	**392,000**

Operation and Maintenance Plan

The overriding objective is to deliver improved, reliable and sustainable services to Mchinji Border Town.

It is widely recognised that Operation and Maintenance (O&M) services are essential for providing long term reliable services. Therefore neglect of this discipline will lead to inefficient and poor services, a reduced life of capital assets and loss or reduction of revenue. Integral to achieving adequate O&M is an efficient and cost effective O&M Plan, implemented by CRWB.

CRWB is currently not involved in the O&M of the Mchinji Border Post, but due to the proximity of the area to Mchinji Town will be managed and operated from the CRWB operation in Mchinji. This ensures an overarching efficiency and economy by sharing resources and expertise. It is envisaged that only a limited CRWB presence will be required to operate the new Mchinji water supply and sanitation system. The operations will be based on kiosks and communal ablution blocks, using an outsourced individual vendor model. The maintenance will be done from Mchinji, utilising existing maintenance staff.

The Institutional Assessment highlights that there is currently not a satisfactory O&M Plan in place. CRWB should be assisted with preparing such a plan.

The O&M Plan can be used as a tool to manage the activities of the entire O&M department, which can assist in planning, allocation of adequate O&M budget, continuous improvement of procedures and identification of recurring problems.

Annual Operation and Maintenance Costs

Operation costs for the water supply infrastructure include electricity to pump water from the boreholes, chlorine to treat the water, however excludes labour to man the kiosks and ablution block. The operation costs for the ablution block include electricity costs of running the building, cleaning materials, labour and regular desludging.

O&M costs for this type of project would be in the order of 4 or 5% of the capital costs annually, or about £18,140.

Project Implementation

Construction Options

The existing layout at Mchinji border area demands that the infrastructure to service the area be constructed in one single phase since the project area comprising mainly of dwelling houses is located parallel alongside the main trunk road. Construction in phases will not be cost effective due to the relatively small size of the project area. The main water supply lines will be constructed alongside the main road to service the existing and proposed developments and provision will be made for any developer to connect to the main distribution lines for an individual connection and also for the public access points (kiosks).

Options Summary

The technical assessment of the Mchinji project reviewed a number of options by which the project could be implemented. The technical options related to five components of the infrastructure design – water supply, pump infrastructure, water storage, and the distribution network and sanitation intervention.

Water supply

The project area has no perennial surface water bodies in its immediate vicinity, therefore surface water resources were not considered as a sustainable option to meet the water supply requirements of the proposed intervention.

Groundwater was identified as the most feasible water source. A rapid assessment of the potential of the ground water resources of the area was conducted using both historical and collected data. Technical staff from the CRWB were consulted on the ground water potential and availability in the area based on their previously documented experiences with boreholes in the area. It should be possible to draw sufficient water from the operation of three to four boreholes to meet future water demand from the community.

Pump infrastructure

Boreholes require water pumps to be able to draw the water from the ground as well as transport it along the network of pipes or to the water storage tanks. There are various types of pumps, with varying fuel inputs required. The main options explored were petrol/diesel or electricity. Solar powered pumps will be considered when the borehole yields are known, at which stage the higher capital cost and complexity can be assessed.

The proposed solution makes use of electrical pumps due to the fact that there is electricity in the town already and thus it would be relatively easy to access this power source for the pumps. Additionally, electricity would be a cheaper fuel source than petrol or diesel for the proposed infrastructure. The downside of using electricity to pump water would be that the pumps would not work in the case of a power cut. This is accounted for in the design pump operating time and at least 24 h water use storage in the system and also through shorter pumping time during the day.

Water storage

Water storage is necessary to account for variability in water demand from the population, as well as in situations where there is a breakdown with the borehole pumps or distribution system. While there are various options for water storage, such as dams or reservoirs, only water storage tanks were considered appropriate in the proposed design. This is because the design requires only a limited amount of water stored at each point in time and the water is required for drinking and needs to be kept disinfected, there the construction of a dam is inappropriate and would be an over-investment. It is proposed that a 138 m^3 steel reservoir is constructed to cater for 24 h storage requirements, based on the 2031 average water demand.

In addition, two sites (namely Kachebere hills and an unnamed hill west of the border post), where identified for ground water storage. The preferred site, Kachebere hills have been assessed and explored in this report because :

- The unnamed hill site is further away from the potential well field and results in higher costs to construct the pumping mains.
- There is no power line in direct proximity to the site, resulting in higher power infrastructure capital costs.

Distribution network

The distribution network of pipes for Mchinji consists of various sizes of PVC pipes. PVC piping is assumed to be the appropriate technical option due to the fact that they are durable (up to 100 years) as well as the fact that they are easy to install. This network has been simplified in the current design of the project in order to limit capital costs. It is proposed that high-cost households pay for their own household connections to the water supply, but that the water distribution system caters for such developments.

Sanitation

For this project only provision of a sanitation facility for the daily transitory population (border crossing population) will be provided. All households will be responsible for the provision of their own on-site disposal of wastewater, using either a septic tank or VIP (depending on water supply connection and affordability). Support for on-site sanitation systems can be provided in terms of reviewing or providing standard designs for the CRWB to provide households wishing to construct sanitation infrastructure.

Conclusion

The preferred technical solution recommended in this report is thus to sink three new boreholes which connect to a steel water storage tank. A simple network comprising one spine main has been developed for the project area. This will supply individual connections on application and a total of two water kiosks.

The proposed water supply component of the project includes the following infrastructure:

- The sinking and equipping three boreholes
- The supply and installation of main line to boreholes, with distribution network

- The supply and construction of a water tank together with required fittings
- The construction of two water kiosks
- The construction of a sanitation facility for cross border population.

Section 4: Environmental and CCRA Assessment

Approach and Methodology

To describe the existing environment and legal requirements and undertake the ESR appropriate standard methodologies were used as follows:

- Literature / Desk Study
- Data Collection
- Stakeholder Interviews
- Data Analysis

Literature / Desk Study

A desk study was undertaken to review the available data, documents and literature for information relevant to the study. References used are listed in **Annex C1**. The activity involved collecting and analysing literature from publications, documents and the internet:

- Collect and documented data on all aspects of the project;
- Review in detail any existing studies on the project area related to the project;
- Review of environmental and other relevant legislation, environmental and social quantitative and/or qualitative surveys/studies;
- Review of technical documents related to the field of water supply and sanitation; and
- Study the Malawi environmental laws, regulations and guidelines.

Data Collection

Field trips and surveys were conducted by the study team at the site and surroundings to gather information on the existing environment like geophysical, fauna, flora, and socio-economic aspects relevant to the environmental study.

Stakeholder Interviews

Key Stakeholders were identified and informants were consulted on various aspects concerned with water supply and sanitation in the project area.

The consultation process methodology used was a one-on-one interview with the identified stakeholders. These stakeholders represented key government institutions which were selected based on their direct dealing with the proposed project development, others for being authorities that offer building permits. Also some of the stakeholders are from the local community institutions and individual persons.

Following the above consultation it was found that most of those consulted welcomed the proposed project, however there was concern raised by residential neighbours for the following:

- Water pollution of ground water from the pit latrines, which could compromise the water quality.
- The reduction of water for the gardens located in the proposed well field, gardeners were worried commercial pumping for water supply could deplete the water springing out in the area.
- Relocation of fields and displacement of some properties were the infrastructure will be located, like borehole, storage tanks Kiosks and network.

Field surveys involved drives and walks within the project area especially along and around the site. Focus areas were around proposed sites earmarked for laying of pipes, construction of water tanks, kiosks and areas with potential to accommodate well fields.

Observations on the proximity of existing structures to location of proposed infrastructure as well as activities within the area that may be impacted upon by project activities were made. These observations assisted in identifying 'hot spots' with respect to envisaged project impacts. As it is anticipated that the project will make use of groundwater and impact surface water,

Data analysis

Data analysis involved synthesizing the information collected from interviews, documents, interviews and others to come up with the significance of the anticipated impacts.

Analysis of Legislation

The main legislation reviewed, dealing with this project, was the Environmental Management Act, Water Works Act, Water Resources Act, Country and Town Planning Act and the Public Health Acts. Key policy document were the National Environmental Policy and Malawi Environmental Outlook Report for 2010.

Central Region Water Board of Malawi has been supported by CRIDF to undertake a feasibility study for the construction of a water supply and sanitation system at Mchinji border post. Part of this study is an environmental screening and evaluation of the planned Water Supply and Sanitation project at Mchinji border post, in Mchinji District of Central Province Malawi.

This environmental screening report is being prepared to evaluate the proposed water and sanitation project and its potential impacts and identify the environmental assessment requirements, in compliance to national environmental objectives as set out in the Environment Management Act, No 23 of 1996 (EMA) and the National EIA guidelines of Malawi which outlines the EIA process to be followed and provides for the enabling legislation to ensure compliance with the EIA requirements.

The EMA sets the tone for environmental assessments for projects. This EIA provisions in the Environment Management Act (EMA) are found in Sections 24, 25, 26, 27, 29 and 63, 69 and 76.

Section 24 specifies the criteria for projects which may require an Environmental Impact Assessment. The EIA process to be followed is set out in the EIA Guidelines (EAD, 1997), shown as a flow diagram in Annex C2, in relation to the relevant project phase. These guidelines for undertaking EIAs under the act were published to assist developers in the screening process. Sector specific guidelines were also promulgated, which included water and sanitation.

In terms of the EIA Guidelines there are three sets of criteria against which proposed projects are evaluated. These are as follows:

i) Criteria where an EIA is mandatory (List A, Appendix B of the EIA Guidelines, EAD, 1997);
ii) Criteria where an EIA may be required (List B, Appendix B of the EIA Guidelines, EAD, 1997); and
iii) General project criteria (Appendix D of the EIA Guidelines, EAD, 1997).

Based on discussions with CRWB indications were that the Mchinji water supply and sanitation project would only require a project brief, based on their past experience in similar projects. However, a review of the Guidelines shows the Mchinji water supply and sanitation project falls within the following criteria given below:

A3: WATER RESOURCES DEVELOPMENT

1. ***"*Construction, or expansion of, ground water utilisation projects where the utilisation will be greater than 15 1/s or where the well is 60 m or deeper". *Depending on the actual well development this may not apply as most wells yields are lower than 15 l/s i.e. 5-9l/s but will be up to the depth of 100 meter.***

A4: INFRASTRUCTURE PROJECTS

3. **Any new sewerage outfall to a receiving water body or location of sewerage systems or septic tanks within 1 km of a water body**. *The nearest stream from Mchinji project site is located at the bridge near where BH003 is proposed to be located and the septic tanks are likely to be located at the border where current pit latrines are located. The distance here could just be about 1km estimated from Google Earth map in* **Figure 24**.

4. **Construction or expansion of septic tanks servicing more than 100 people or 20 homes or which receive more than 100 cubic metres per day of waste water**. *This number of people is just at the threshold but the amount of wastewater to be generated based on the Mwami design figure is twice with 200 people and a volume of 1300 l/d which is well below the 100 cubic meters or 100,000 l/d.*

B: LIST OF PROJECTS FOR WHICH EIA MAY BE REQUIRED

Water supply projects. This covers all types of water supply projects including the Mchinji project

Therefore, based on this screening analysis the Mchinji water supply and sanitation project will fall in list B projects which may require an EPB. In which case, an EPB needs to be prepared according to the regulation for a decision by the EAD director. The Director upon receiving the EPB might decide that 'NO EIA' will be required and thus only request for an EMP to be submitted; which is most likely for such a small project.

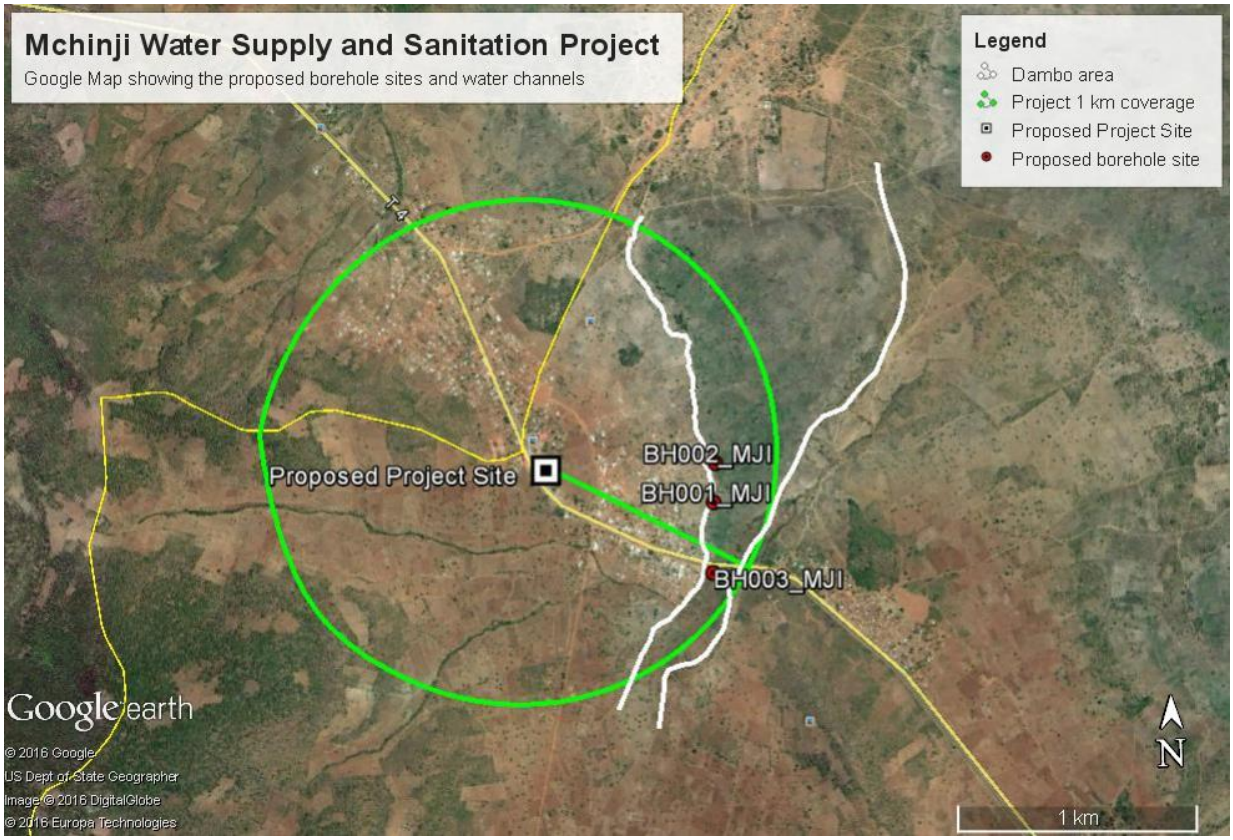

Figure 24 Project Radius

The Guidelines requires a Project Brief to be prepared stating in a concise manner:

- the description of the project;
- the activities that shall be undertaken in the implementation of the project;
- the likely impact of those activities on the environment;
- the number of people to be employed for purposes of implementing the project;
- the segment or segments of the environment likely to be affected in the implementation of the project;
- Such other matters as the Director may in writing require from the developer or any other person who the Director reasonably believes has information relating to the project.

Upon submission of the EPB, the Director would then decide whether an EIA should be conducted based on careful examination of the Project Brief. The Director may consider that further information is required to be stated in the Project Brief before an environmental impact assessment is conducted. The Director shall require the developer, in writing, to provide, such further information, as necessary.

Table 17 Other Acts reviewed and their key provisions

Act, Regulation or Byelaw	Key Aspects Requirements	Implementing Agency
Water Resources Act CAP72.03	Water Right Permit is required to use and/or abstract water, build dams	Water Resources Board: Water Abstraction Control Sub-committee
Water works Act no. 17 of 1995	Creation of water boards and provide for Water supply to urban areas and peri urban areas	Water Board
Environmental Management Act	Provides for EIAs, Pollution control and Waste management permits and licenses	EAD
Public Health Act	Control of environmental and communicable diseases	MOH

Malawi is in the process of developing its own emission and water quality standards. To date the standards as shown in **Table 18** have been developed by the Malawi Bureau of Standards (MBS). In addition, the MBS has developed Codes of Practice for a range of environmental management and pollution control activities, including: disposal of surplus pesticides and associated toxic waste, the design and management of solid waste disposal sites, and the operation of effluent treatment plants.

Table 18 MBS Emission and Water Quality Standards

Document / Standard Number	Title
13.020.10	The ISO14000 series on environmental management has been adopted
MS539:2002	Industrial effluents - tolerance limits for discharge into inland surface waters
MS691:2005	Tolerance limits for domestic sewage effluents discharged into inland surface waters
MS214:2005	Drinking water – specification
MS173:2005	Noise pollution – tolerance limits
MS326:2004	Incinerators – standard performance requirement for incineration plants for the destruction of hospital waste

Other requirements

During the construction, all construction materials such as sand, gravel and aggregates, will be obtained from existing approved borrow pits and quarries in Mchinji and surrounding districts.

Project Activities

The Mchinji water supply and sanitation project will involve a number of activities that are discussed under two phrases (construction and operational stages).

Activities during the preparation stage

For both water and sanitation systems, the only anticipated activity during the preparation phase is mobilization involving securing of camp sites (if these will be required) for workers and storage facilities for materials.

Activities during the construction stage

For the water supply system, activities during the construction phase will include the following:

- Setting out according to the design
- Grubbing and site clearing
- Borehole drilling and equipping at the coordinates in

Table 19 GPS coordinates of borehole sites, including noise measurements

BH Site	Easting (E)	Southing (S)	**Noise levels (dB)**
BH001 (MJI)	32°48'11"E	13°45'11"S	52.0
BH002 (MJI)	32°48'11"E	13°45'06"S	50.7
BH003 (MJI)	32°48'11"E	13°45'21"S	45-52 No traffic 72-84 with traffic passing by

- Transportation of equipment and materials (e.g. pipes and pumps)
- Construction of the distribution system, which will involve lying of pipes. This will require excavations which may require blasting where pipe route passes through rocky areas;
- Construction of the storage facilities;
- Construction of pumping stations.
- Haulage of waste from construction sites
- Use of hydrocarbons including fuel and oils for transportation vehicles, plant and machinery
- Construction of camp sites
- Employment of required labour force

For the sanitation part, activities will include:

- Setting out according to the design;
- Grubbing and site clearing;
- Trenching; and
- Transportation of building materials (i.e. blocks, cement, fittings etc.)

Activities during the operation stage

For the water supply systems, activities during the operation phase will be confined to water abstraction from the boreholes, treatment (chlorination) and distribution.

For the sanitation component, the only major activity in this phase will be the daily cleaning of the ablution block and periodical desludging of the sludge from the septic tank every three years.

Raw Materials

The project's life cycle will comprise the construction and operation phases. The raw and other materials and waste products for each of these phases are presented below.

Construction Phase

During the construction phase, the following will be the raw materials:-

- Water supply pipes of varying sizes;
- Plumbing fittings for the sanitation facility;
- Building construction materials for the toilet (e.g. cement, sand, blocks, roofing materials, etc.);
- Fuel;
- Pumps; and
- Steel for construction of storage facility

The expected waste products in this phase will mainly include rubble and excess spoil from construction activities.

Operational Phase

Raw materials in the operation phase will mainly the water treatment chemicals (chlorine). No waste products are expected from the water supply system. For the sanitation system, no raw materials are anticipated in the operation phase. Sludge will be the only waste product.

Products and by products

The envisaged products from this project include an adequate water supply system satisfying the needs of both the residents and the travelling public and an ablution block which will respond to the needs of the travelling public.

Analysis of Alternatives

The analysis of alternatives mainly considered the proposed project water source, borehole facilities location, and water supply and sanitation technological options.

Water source

Two possible water source types were investigated namely surface water and groundwater.

Use of surface Water

Surface water is available in the Kachebere stream during the rainy season, but this stream is relatively far more the project area, about 4 km. Furthermore the treatment will be expensive and may need a lot of chemicals for disinfection as the surface water is contaminated.

Use of Groundwater

The area hydrogeology is mainly in alluvial and basement aquifers which can be drilled and be developed to supply the project with adequate water.

The water quality testing for deep boreholes in the area (see **Annex C3**) show good quality water can be abstracted and will require very little disinfection to prevent contamination from the network infrastructure. This option was found to be suitable as it supplies the community with adequate portable water. Further, groundwater is considered by some experts to be probably the cheapest and safest potable water source (Foster, 1986).

Location of Boreholes Sites

The locations for drilling the boreholes to supply water to Mchinji were sited using two geophysics methods, namely electromagnetic and resistivity methods. The position of the identified sites are shown on **Figure 17** with co-ordinates in **Table 19**. These boreholes show the best potential to provide sufficient yield to meet the water demand of the community.

Technological options

The analysis of technology options considered the following for water supply and sanitation respectively:

Water supply

- **Use of communal hand pumps on boreholes**

  This option was not adequate and suitable for high cost and medium cost housing developing in the area with septic tanks and closet flash toilets. Unsustainable as there is high wastage and service not metered user fees cannot cover operational costs.

- **Conventional network with household connection for those who could afford and public kiosks as a starting water supply level**

  This option is more sustainable as it ensures each water user pays for the types of service received.

- **Do nothing**

  This option means continuing with inadequate water supply which will deteriorate as the township grows. The system continues with a wasteful and unsustainable water supply delivery for a the growing urban community. Water borne water washed and oral – route diseases escalates.

Sanitation

- **ECOSAN Toilets**

  Use an Ecological Sanitation (ECOSAN) toilet were found to be too expensive and has both technological in terms of maintenance and social challenges as most people view them negatively.

- **Use of flush toilets and ablution Block connected to sewer network and final treatment in convectional sewerage plants**

  This option is the best from an environment point of view, but requires massive investments as it is capital intensive and needs government commitment and intervention, as it is typically too expensive for the community to afford. Further, presence of treatment plant nearby would make it cheaper for septic tanks desludging services to the community.

- **Continued use of current toilets and septic tanks for the community; and for the trucker's ablution block**

  Sludge emptying of the septic tanks done in a hygienic manner and then taken to licenced waste treatment facilities closest to the area. This option was found to be more attractive as it has low initial project costs, as there is no network and sewage pond construction costs. However, the township community will continue to pay heavy price for desludging and having it taken for treatment.

- **The Zero alternative for sanitation considered doing nothing and continuing with status quo, with escalating contamination from faecal matter**

  This option was found to be unacceptable as current situation result in ground water contamination and spread of water borne disease epidemics; pit empting is done in a non-dignified way where no PPE is used and the sludge is left in the environment or buried in a pit dug near the toilet which result in ground water contamination posing a health hazard.

Geophysical Environment

Topography

Mchinji District lies between 1,200 and 1,829 meters above sea level. It has two terrains, the hilly western part and the plain consisting mostly of arable land. The hilly western part consists of Mchinji mountain ranges with gentle slopes that are 1,600 – 830 meters above sea level. Almost all rivers found in the district

originate from these hills. The remaining part, which forms the biggest part of the district, lies within a plain of mostly arable land, dambos and waterways which drain the plains into Bua and Rusa rivers.

Geology

The geological setting of Malawi is mainly characterized by crystalline metamorphic and igneous rocks of Pre-Cambrian to lower Palaeozoic age. This is referred to as the basement complex that covers approximately 70% of Malawi's landscape and supplying water to about 60% of the population[8].

Hydrology

Drainage

Most of the urban areas of Malawi depend on surface water while the rural section of the country depends on the use of ground water, mostly shallow wells. Mchinji gets its water from the mountains. Borehole have become more common in recent years, with the Malawian Government and private organisation initiatives. This has offered cleaner water that is both less contaminated and safer for the users[8]. Urban areas in Malawi depend much on surface water for potable water use, however this water flow originate from base flow in hills and mountains[9].

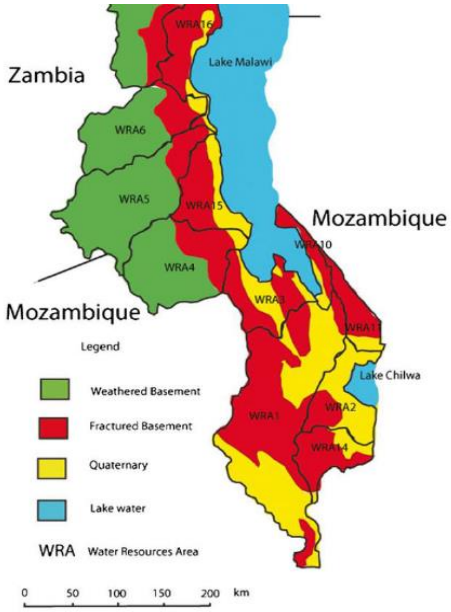

Figure 25 Geology and Water Resource Areas (WRA) of Malawi[8]

[8] Mapoma H. W. T. and Xie X. (2014). Basement and alluvial aquifers of Malawi: An overview of groundwater quality and policies. African Journal of Environmental Science and Technology, Vol. 8(3), pp. 190-202.
[9] Ngongondo, C.S, (2006). An analysis of long-term rainfall variability, trends and groundwater availability in the Mulunguzi river catchment area, Zomba mountain, Southern Malawi. Quaternary International.

Hydrogeology

The major lithological units of the basement aquifer complex are syenitic granites, charconoctic and ultra-basic gneisses, schistis, granulalite and quartzites. Large inselberg of these rocks rises above the plateau as a result of This basement is divided into weathered and fractured basement aquifers (**Figure 25**). Besides basement complex, the quaternary alluvial aquifer exists in Malawi[8].

The low land valley areas to the north and north east of the township was characterised by grey to dark sand loams and the whole valley is covered with gardens as the water from the hills come out in springs year round.

Climate

In terms of climate, Malawi's seasons are influenced by the migration of the Inter-Tropical Convergence Zone (ITCZ). However, climatic conditions are complex due to the wide topographic variation and the influence of Lake Malawi. Much higher rainfall is experienced in uplands as compared to low lands.

Mchinji is situated in the hilly areas of the district and is generally cool and wet with mean temperatures ranging from 17 ^{o}C to 19 ^{o}C per annum. Lowest temperatures are experienced in June while higher temperatures are registered during the months of October and November. In contrast, the plains are generally warm and dry with mean temperatures varying from 19 ^{o}C to 21 ^{o}C. Like most districts in Malawi, Mchinji has two seasons. The dry season runs from May to October while the wet/rainy season runs from November to April. The hilly areas receive average rainfalls of between 1,000 mm and 1230 mm per annum. The plains receive less rainfall, generally ranging from 80 mm to 1,030 mm per annum. The District has experienced significant climatic changes in the last nine years. Rains have been erratic, with the northern and eastern parts of the district experiencing serious droughts. Consequently, most communities consistently experience shortage of water for drinking, livestock production and crop production.

Air Quality and Noise levels

The Mchinji border post site has no industries and though along the main road has relatively low traffic about 100 trucks/vehicle pass through the border a day and does not experience any air pollution incidents.

Air quality

The project site is devoid of industrial activities hence there is no industry related air pollution. For areas located away from the highway, traffic volume is low hence pollution due to emissions from motor vehicles is also low and insignificant. However, along the road, motor vehicles emissions normally results from the combustion of petrol and diesel fuels. Pollutants from these sources include hydrocarbons (HCs) and Benzopyrene, Particulate Matter (PM), Carbon Monoxide (CO), Oxides of Sulphur (SO_X) and Oxides of Nitrogen (NO_X).

Indoor air pollution resulting from the use of charcoal and other wood fuels obviously affects residents especially in areas where charcoal and wood are the main sources of energy. Almost all rural type of housing units in the area are not connected to electricity and are therefore susceptible to this type of

pollution. The fuels emit PM, HCs, CO, SO_X and NO_X. The effects of prolonged exposure to these emissions on humans are Acute Respiratory Infections (ARIs).

Noise Measurements

During the field survey, noise levels were measured at the border and sites for the proposed boreholes and kiosks. Noise levels were mainly influenced by trucks movements ranging between 52.7-60dB during truck movement along the road and average 40-56dB when there is no truck movement at 10 m from the road.

Ecology

Fauna

Being a heavily settled peri urban village the area has no large mammals present, except for small animals like rodents, monkeys, squirrels, rabbits, duikers and an isolated impala**.** From observation:

- **Amphibian** like frogs and monitor lizard
- **Reptiles** like common snakes like house snakes, gecko and common lizards.
- **Insects** noticed during site visits are; butterflies, grasshoppers, termites and soldier ants.
- **Avifauna**, common birds' fond in and near settlement areas like, wabbler, quelea, crows, pigeons, francolin, guinea fowl .Common Bulbul, and House Sparrow

Floral

Forest resources in Mchinji are found in protected areas (forest reserves), on customary land (Village Forest Areas, woodlots, graveyards and farms) and a few plantations. Forest reserves are usually found on or at the foot of mountains and hills whilst forests on customary land exist in open access areas, hills, along riverine and on moderate gentle slopes. In Mchinji, forests in protected areas (forest reserves) cover an estimated area of 21,385 ha (9.6 % of the total land area) while in customary land, forests cover an estimated area of 16,073 ha (7.13 % of the total land area). The total forest cover for Mchinji is 38,115 ha, constituting 17.13 % of the total land cover for Mchinji.

Forests in Mchinji can easily be identified as patches of trees growing in graveyards, communal forest areas and individual woodlots, scattered and clustered trees on farms, shrubs and reeds/grass along riverine and degraded natural forests and on hills demarcated as Village Forest Areas. The most common species found in these forests include Burkea africana (Mkalati), Pterocarpus angolensis (Mlombwa), Bauhimia thonningii (Chitimbe, Mshawa), Terminalia sericea (Naphini), Brachystegia floribunda (Tsamba), Pericopsis angolensis (Muwanga) and Syzygium cordatum (Katope, normally found at river sources and along river banks).

Protected Forest Areas

There are two gazetted forest reserves in Mchinji, namely Mchinji Forest Reserve and Thyolasanu Forest Reserve. Thyolasanu is part of Dzalanyama Range that extends in Mchinji. Government through the Forestry Department is responsible for managing forest resources in forest reserves.

Table 20 Forest reserves in Mchinji

Forest Reserve	Year Gazetted	Hectares	Estimated Intact Percentage
Mchinji Forest Reserve	1924	19,166	**70.0%**
Thyolasanu	1922	2,219	**50.0%**

Source: GOM

Environmental Analysis

This section presents the environmental impacts expected from the proposed project. The impacts were assessed from the changes likely to be brought about by the project activities on baseline environmental and social conditions. The impacts are discussed under separate headings for positive and negative impacts. At the end of the section, all the impacts discussed are summarised in **Table 23** (Impacts common to water and sanitation projects), **Table 24** (Water project impacts) and **Table 25** (Sanitation project impacts).

Positive Socio-economic impacts

Employment opportunities

The execution of the projects will require employment of different professionals and casuals at all the different phases of the project. Firstly, there will be creation of job opportunities to the consultants. After the designs, a contractor will be engaged who will employ people for the various aspects of the construction works. The employment may also provide skills and work experience that can lead to long term employment.

Increased revenue base for the water utility (CRW*B*)

Implementation of the water supply and sanitation projects will result in increased revenue base for the utility. Revenue will be generated from fees for using the ablution block as well as from water tariffs.

Positive Environmental impacts

There are no anticipated positive environmental impacts common to both projects

Negative Socio-economic impacts

Destruction of fields either temporarily or permanently

Construction works, especially if carried out during the rainy season may lead to destruction of fields. This is especially the case for sites where boreholes, tanks and pipe routes will be located.

Impacts associated with worker campsite

Campsites are associated with a number of impacts. Firstly, if constructed from poor quality materials, they may be an aesthetic hazard. If inappropriately sited, the camps may disrupt the local communities and lead to pollution of water sources. They may also pose health hazards to workers if not properly drained especially where the excreta disposal facilities are on-site like pit latrines as the storm water may flood the area leading to excreta and storm water mixing. This can lead to pollution of both surface and ground water sources. Lastly, if left standing after the construction works, the campsites may serve as hiding places for people involved in illicit activities.

Temporary disruption of pedestrian and traffic movement

During construction, there will be excavations and earthworks along the roads and within the residential area. Where the pipes cut across the roads, it will be necessary to close the road. This may disrupt pedestrian and traffic flow. In cases where the pipe trenches are dug in front of households, access to these properties will be restricted.

Increased child labour

The proposed water supply and sanitation projects may lead to contracted construction workers sometimes subcontracting under-aged children to work for them which may lead to adverse effects on the minors like injuries, sexual and physical abuse, and school absenteeism.

Damage/disruption to adjacent services

The project may result in damage or disruption of adjacent services. Although the area has limited services, there are possibilities of excavation works damaging telephone lines and the optic fibre cables which in most cases are buried underground. Therefore, excavation activities may lead to damage and consequently, disruption of some services.

Disruption and/or destruction of sites having archaeological or historical values

Construction activities in this project can lead to disruption and/or destruction of sites having archaeological or historical value. This is especially so for activities involving excavations. However, most of the proposed works in this project are within the already developed area.

Spread of sexually transmitted disease by migrant workforce

During the construction phase, there will be an increase in employment opportunities directly and indirectly arising from these projects. Firstly, standards of living for people who will be employed by the project will be raised due to income mostly in form of wages. Secondly, some people will be forced to relocate from their normal places of residence. This situation may potentially result in casual sexual behaviour among workers and between workers and the inhabitants of the surrounding communities. This may lead to increased incidences of sexually transmitted diseases and HIV/AIDS infections.

Noise and vibrations arising from construction activities

During construction, noise may be caused by the operation of construction equipment, installation of equipment and machinery, and transportation of equipment, materials and people. Noise often causes discomfort, pain and noise-induced hearing loss. Similarly, vibrations will arise from machinery and equipment that will be used in construction works. Vibrations may be excessive for borehole drilling activities as well as where explosives may also be used (like in cases where the proposed pipes pass through rocky areas where excavations may only be possible through the use of explosives). Vibrations can damage buildings (e.g. causing cracks especially to weak structures like the ones that dominate the project site), affect vibration-sensitive machinery or equipment, disturb, annoy and affect person's ability to work.

Risks arising from blasting activities

The construction of the proposed water supply and sanitation infrastructure may require blasting (i.e. in rocky areas) which may involve the use of explosives to excavate the rocks. The risks associated with blasting include fly-rock, splinters and debris which may injure community members, construction workers and animals. Damage to buildings, trees and other objects may occur. Blasting also causes vibrations whose effects have been discussed in the preceding section. Damage to property can lead to litigations and delays in execution of work.

Explosives left undetonated at a blast site may injure or kill people especially children. Explosives which are dropped on the ground or left undetonated in the ground can also result in chemicals leaching into ground and surface water.

The noise associated with blasting can startle people in the neighbourhood as well as cause impacts have already been discussed. Noise caused by blasting can lead to death especially for people suffering from hypertension. Blasting can also cause dust accumulation. The magnitude of all the blasting related impacts depends on the closeness of the blasting activities to the communities.

Injury or/and loss of life

During the construction phase, accidents may occur resulting in injuries, disability and loss of life. Accidents may involve employees working on the project, motorists and pedestrians and in some cases trespassers.

Danger of people and traffic falling into excavated trenches

In most areas where construction will take place, disruption of pedestrian and traffic movements will occur. Lying of pipes requires trenching. The trenches have the potential of increasing accidents; either pedestrians or traffic can fall into them. This impact will be higher in busier areas like the area just around the border where pedestrian and traffic movement is more.

Danger of excavation related accidents like trench collapse

Trenches for water supply pipes and septic tank and soakaway may result in accidents. During deep excavations, if no appropriate safety measures are taken, there is a danger that the trenches can collapse. This may result in injuries and fatalities.

Danger arising from use of access equipment such as ladders and scaffolds

During construction of some infrastructure like the storage and distribution water tanks and the ablution block, people will be required to work off ground. This will make the use of ladders and scaffolds unavoidable. This will result in danger of workers falling from heights which can result in injuries and fatalities.

Traffic safety

Construction activities will lead to increased traffic movement in the area resulting from transportation of the work force as well as materials that will be required. This may lead to increased road traffic related accidents in the project area.

Occupation Health and safety

Over-exertion, and ergonomic injuries and illnesses, slips and falls, fall of materials or tools are some of the accidents expected on construction sites like the water supply and sanitation sites. Vehicle traffic and use of lifting equipment in the movement of machinery and materials on a construction site may pose temporary hazards. Confined spaces and excavations which are associated with pipe laying also pose occupational health and safety hazards such as suffocation for anyone who accidently falls in. Construction sites may pose a risk of exposure to dust, chemicals, hazardous or flammable materials, and wastes in a combination of liquid, solid, or gaseous forms.

Community health and safety

General site hazards include risks that may arise from inadvertent or intentional trespassing, including potential contact with hazardous materials, contaminated soils and other environmental media, buildings that are vacant or under construction, or excavations and structures which may pose falling and entrapment hazards.

Explosion and fire from fuel storage

The proposed project will require the use of petroleum products. It may also require on-site storage and handling of fuel. This will pose a risk of explosion and fires as the liquid is flammable.

Negative Environmental Impacts

Soil compaction from construction vehicles and equipment

Movement of vehicles and plant equipment during construction will compact the soil thereby changing its characteristics. This may result in reduced vegetation growth and groundwater recharge.

Soil erosion from clearing of vegetation and movement of soil

Construction activities will inevitably result in soil loosening and movement (e.g. excavations that will be required in digging trenches for the pipes). Loosened soil including slopes and stockpiles of earth material may easily be eroded by wind, rain, surface runoff, water and movement of vehicles and equipment. Excessive erosion may lead to destruction of roads and may lead to problems with water quality of receiving water bodies which in this case is the Dambo and nearest river channels. This silt may eventually end up in the dams on the river located downstream where it would accelerate the silting of the dams.

Contamination of soils by petroleum products

Construction activities for the proposed project will involve the use of machinery and equipment that will use petroleum products (mainly diesel). In case of leakages or spillages, the products have the potential to contaminate the soil. It is also expected that there will be fuel storage tanks at camp sites to be used for storage of fuel that will be required by the construction vehicles and equipment. There may be leakages or spillages especially during the delivery of the petroleum products. This can result in the pollution of the soil.

Land degradation from disposal of waste

During construction works, solid waste will be generated which if not properly managed can accumulate within the project sites. This has the potential of adversely changing the aesthetic appearance of the surrounding areas and can pollute the soil and water resources.

Mixing of topsoil with subsoil during excavations and back filling thereby reversing the soil profile

Where excavations are carried out, during back-filling there can be mixing of topsoil with subsoil. Where care is not exercised, there may be a complete reversal in the soil profile where the top soil goes in at the bottom and the subsoil ends up on top. This will negatively affect regeneration of vegetation where required.

Increased dust and air pollution

Construction activities in this project will require use of vehicles and machinery. This will result in air pollution in form of dust and exhaust fumes which are major negative impacts expected during this project phase. The primary causes of emissions are contact of construction machinery with bare soil and movement of construction vehicles on unpaved roads. Sources of emissions are exhaust fumes. Exposure to air pollution is associated with numerous effects on human health, including pulmonary, cardiac, vascular, and neurological impairments. Air pollutants such as ozone and nitrogen oxides from vehicles also have harmful effects on natural ecosystems. They can kill plants and trees by destroying their leaves, and can kill animals, especially fish in highly polluted rivers.

Contamination of ground/surface water from petroleum products

Construction activities may pose the potential for release of petroleum-based products during their storage, transfer, or use in equipment. Released products have the potential to contaminate ground and surface water. The pollution will be in form of hydrocarbons and other pollutants usually associated with petroleum products. Hydrocarbons can affect water and consequently soil and plants, which may put the health of the public at risk.

Destruction of vegetation due to construction activities

The construction/installation of water supply and sanitation systems require clearing of vegetation which may disturb the scenic beauty of the areas. Trees and woodlands may be disturbed, the project is a developed area, and hence minimal vegetation disturbance is expected.

Classification and Significance of impacts

The impacts discussed are summarised in **Table 23** (Impacts common to water and sanitation projects), **Table 24** (Water project impacts) and **Table 25** (Sanitation project impacts). The significance of impacts has been determined by combining the perceived frequency of occurrence of the source of the impact, the duration, severity, and spatial extent of the impact and the sensitivity of the area being impacted upon. The analysis was also aided by using information presented in

Table 21, which explains the terms used in the impact ranking and

Table 22, which provides the significance rating scale.

The summary of impacts provides additional information on whether the impact is direct, indirect, reversible, irreversible and/or cumulative. Their significance with respect to the design of the water supply and sanitation components is also discussed.

Table 21 Criterion and classification of impacts

Impact Criterion	Effect On Environment	Classification Of Effect	
		Expression	Effect Description
Positive or negative	Will impact be positive or negative?	Positive	A positive impact
		Negative	A negative impact
Likelihood of occurring	What certainty of occurrence is associated with impact?	Unlikely	Probably will not occur
		May occur	Small chance that it will occur
		Possible	Significant chance that it will occur
		Certain	Will occur
Duration	What timeframe or period is effect to be felt or last?	Short-term	Will last up to end construction activity
		Medium-term	Will last as long as operational activity
		Long-term	Will last beyond project operation
		Permanent	Will last a lifetime
Timing	At what stage will the impact occur or be felt?	Immediately	Will occur upon starting project activities
		Near future	Will occur during project operation
		Distant future	Will occur beyond project operation
Severity	How severe will the impact be?	Slight	Little impact
		Moderate	Moderate impact
		severe	High impact
		Very severe	Very high impact
Spatial extent	What is the real extent or coverage of impact?	Localised	Impact will be felt at localised scale covering a few hectares
		Study area	Impact will be felt within project area including immediate environment
		Regional	Impact will be felt at district or provincial level
		National	Impact will be felt at country level
		International	Impact will be felt beyond national boundaries
Nature	What type of impact is it?	Direct	Arsing as a direct result of the activity
		Induced	Arising indirectly as a result of an activity
		Cumulative	Arising due to compounding of several minor impacts
Overall rating	How important is impact in Project design?	Insignificant	Impact not substantial, needs no mitigation/enhancement
		Minor	Impact of little importance, needs limited mitigation/enhancement
		Moderate	Impact has influence and requires mitigating/enhancing
		Significant	Impact of great importance, mitigation/enhancement a must

Table 22 Description of Significance Ratings

Significance Rating	Description	Score Range
Insignificant	This refers to an impact with acceptable effects for which mitigation is desirable but not essential. The impact by itself is insufficient to prevent project approval. Effects from these impacts do not go beyond medium term	4 to 7
Moderate	Impacts for which mitigation measures are required though impact cannot prevent project approval. The impacts can extend up to long term	8 to 11
Significant	This is a serious impact which, if not mitigated, may prevent project approval (if negative). These impacts can result in major and usually long-term effects to the environment	12 to 14
Very Significant	This is a very serious impact which if negative may, by itself, be sufficient to prevent project implementation. This type of impact results in permanent change and usually have no mitigation measures	15 to 17

Table 23 Impacts common to both the water supply and sanitation projects

Item	Potential Impact	Phase	Likelihood of Occurrence	Effect					Total Score	Overall Impact Rating
				Duration	Timing	Severity/ Benefit	Extent	Nature		
Positive Socio-economic Impacts										
1	Employment opportunities	Construction	Certainly	Short term	Immediately	Very beneficial	National	Direct	14	Significant
2	Increased revenue base for the water utility (CRWB)	Operation	Certainly	Long term	Near future	Beneficial	Regional	Induced	12	Significant
Positive Environmental Impacts										
1	None									
Negative Socioeconomic Impacts										
1	Destruction of fields either temporarily or permanently	Construction	Possible	Short term	Immediately	Slightly	Localised	Direct	8	Moderate
2	Impacts associated with worker campsite	Construction	Possible	Short term	Immediately	Slightly	Localised	Direct	8	Moderate
3	Temporary disruption of pedestrian and traffic movement	Construction	Possible	Short term	Immediately	Moderate	Localised	Direct	12	Significant
4	Increased child labour	Construction	May occur	Short term	Immediately	Moderate	Study area	Induced	8	Moderate
5	Damage/disruption to adjacent services	Construction	Possible	Short term	Immediately	Severe	National/ International	Direct	12	Significant

Item	Potential Impact	Phase	Likelihood of Occurrence	Effect					Total Score	Overall Impact Rating
				Duration	Timing	Severity/ Benefit	Extent	Nature		
6	Disruption and/or destruction of sites having archaeological or historical values	Construction	May occur	Permanent	Immediately	Moderate	National	Direct	12	Significant
7	Spread of sexually transmitted disease by migrant workforce	Construction	Possible	Short term to Permanent	Immediately	Severe	National	Induced	14	Significant
8	Noise and vibrations arising from construction activities	Construction	Certain	Short term	Immediately	Moderate	Study area	Direct	12	Significant
9	Risks arising from blasting activities	Construction	Possible	Short term	Immediately	Moderate	Study area	Direct	12	Significant
10	Injury or/and loss of life	Construction	May Occur	Short term to Permanent	Immediately	Severe	Study area	Induced	15	Very significant
11	Danger of people and traffic falling into excavated trenches	Construction	May occur	Short term	Immediately	Severe	Localised	Direct	12	Significant
12	Danger of excavation related accidents like trench collapse	Construction	May occur	Short term	Immediately	Severe	Localised	Direct	12	Significant
13	Danger arising from use of access	Construction	May occur	Short term	Immediately	Severe	Localised	Direct	13	Significant

Item	Potential Impact	Phase	Likelihood of Occurrence	Effect					Total Score	Overall Impact Rating
				Duration	Timing	Severity/ Benefit	Extent	Nature		
	equipment such as ladders and scaffolds									
14	Traffic safety	Construction	Possible	Short term	Immediately	Severe	Study area	Induced	13	Significant
15	Occupation Health and safety	Construction	Certain	Short term to Permanent	Immediately	Severe	Study area	Direct/Induced	14	Significant
16	Community health and safety	Construction	Certain	Short term to Permanent	Immediately	Severe	Study area	Induced	12	Significant
17	Explosion and fire from fuel storage	Construction	May Occur	Short term	Immediately	Severe	Localised	Direct	8	Moderate
Negative Environmental Impacts										
1	Soil compaction from construction vehicles and equipment	Construction	Possible	Short term	Immediately	Slight	Localised	Direct	7	Insignificant
2	Soil erosion from clearing of vegetation and movement of soil	Construction	Possible	Short term	Immediately	Moderate	Study area	Direct	12	Significant
3	Contamination of soils by petroleum products	Construction	May occur	Short term	Immediately	Severe	Study area	Direct	12	Significant
4	Land degradation	Construction	May occur	Short to	Immediately	moderate	Study area	Induced	8	Moderate

Item	Potential Impact	Phase	Likelihood of Occurrence	Effect					Total Score	Overall Impact Rating
				Duration	Timing	Severity/ Benefit	Extent	Nature		
	from disposal of waste			long term						
5	Mixing of topsoil with subsoil during excavations and back filling thereby reversing the soil profile	Construction	May occur	Long term	Immediately	Slight	Localised	Direct	7	Insignificant
6	Increased dust and air pollution	Construction	Certain	Short term	Immediately	Moderate	Localised	Direct	12	Significant
7	Contamination of ground/surface water from petroleum products	Construction	May occur	Short term	Immediately	Moderate	Study area	Direct	11	Moderate
8	Destruction of vegetation due to construction activities	Construction	Certain	Short to long term	Immediately	Slight	Localised	Direct	7	Insignificant

Table 24 Impacts specific to the water supply project

Item	Potential Impact	Phase	Likelihood Of Occurrence	Effect					Total Score	Overall Impact Rating
				Duration	Timing	Severity/ benefit	Extent	Nature		
Positive Socio-economic Impacts										
1	Improved water supply to the project area	Operational	Certain	Long term	Near future	Very beneficial	Localised	Direct	16	Very Significant
2	Change in quality of life and increase in self-esteem in communities due to improved services	Operational	Certain	Long term	Near future	Very beneficial	Study area	Cumulative	15	Very Significant
3	Improved quality of life due to associated health benefits from water availability like changes in personal hygiene	Operational	Certain	Long term	Near future	Very beneficial	Study area	Cumulative	15	Very Significant
4	Increased property values due to improved water supply services	Operational	Certain	Long term	Near future	Very beneficial	Localised	Cumulative	14	Significant
5	Potential for industrial growth in the district due to availability of water	Operational	Possible	Long term	Near future	Very beneficial	Study area	Induced	14	Significant

Item	Potential Impact	Phase	Likelihood Of Occurrence	Effect					Total Score	Overall Impact Rating
				Duration	Timing	Severity/ benefit	Extent	Nature		
Positive Environmental Impacts										
1	None									
Negative Socio-economic Impacts										
1	Displacement and relocation	Construction	May occur	Short term	Immediately	moderate	Localised	Induced	9	Moderate
2	Temporary displacement of people and disruption of business to pave way for construction works of water supply infrastructure	Construction	May occur	Short term	Immediately	moderate	Localised	Induced	8	Moderate
3	Displacement of tenants due to increased rentals arising from improved water supply services	Operational	May occur	Long term	Near future	Moderate	Localised	Induced / cumulative	9	Moderate
6	Storage, handling and use of disinfection chemicals in water treatment facilities	Operation	Possible	Long term	Near future	Severe	Localised	Direct	11	Moderate
Negative Environmental Impacts										

Item	Potential Impact	Phase	Likelihood Of Occurrence	Effect					Total Score	Overall Impact Rating
				Duration	Timing	Severity/ benefit	Extent	Nature		
1	Reduction in ground water due to increased abstraction	Operation	Possible	Long term	Near future	Very severe	Study area	Direct	15	Very Significant

Table 25 Impacts specific to the sanitation project

Item	Potential Impact	Phase	Likelihood of Occurrence	Effect					Total Score	Overall Impact Rating
				Duration	Timing	Severity/ benefit	Extent	Nature		
Positive Socio-economic Impacts										
1	Improved access to sanitation facilities by the travelling public and truckers	Operational	Certain	Long term	Near future	Very beneficial	International	Direct	15	Very Significant
2	Improved quality of life for the travelling public due to improved sanitation	Operational	Certain	Long term	Near future	Very beneficial	International	Direct / cumulative	15	Very Significant
3	Improved productivity due to anticipated disease burden reduction arising from provision of	Operational	Possible	Long term	Near future	Very beneficial	Study area	Direct / cumulative	14	Significant

Item	Potential Impact	Phase	Likelihood of Occurrence	Effect					Total Score	Overall Impact Rating
				Duration	Timing	Severity/ benefit	Extent	Nature		
	sanitation services									
Positive Environmental Impacts										
1	Improved environmental aesthetics (i.e. odours and sight) due to reduced indiscriminate defecation	Operational	Certain	Long term	Near future	Very beneficial	Localised	Direct / cumulative	15	Very Significant
2	Reduced excreta related contamination from indiscriminate defecation	Operational	Certain	Long term	Near future	Very beneficial	Localised	Direct / cumulative	15	Very Significant
Negative Socio-economic Impacts										
1	Nuisance and public health hazards from overflows from the septic tank	Operational	May occur	Long term	Near future	Severe	Localised	Induced	12	Significant
Negative Environmental Impacts										
1	Soil contamination from sludge spillages during transportation and inappropriate disposal	Operational	May occur	Long term	Near future	Severe	Localised	Direct / cumulative	11	Moderate

Item	Potential Impact	Phase	Likelihood of Occurrence	Effect					Total Score	Overall Impact Rating
				Duration	Timing	Severity/ benefit	Extent	Nature		
2	Contamination of water resources from inappropriate sludge storage, transportation and disposal	Operational	May occur	Long term	Near future	Severe	Localised	Direct / cumulative	11	Moderate

Conclusion

This Environmental screening objectively assessed and evaluated impacts that may arise as a consequence of implementing the proposed project by MLGH/CRWB in Mchinji at Mchinji Border. In-depth analysis of the project and anticipated impacts revealed the following key findings:

- Proposed projects will mainly be located in an already developed residential areas;
- Due to the openness of the areas, it is unlikely that the projects will trigger involuntary displacement;
- Most of the anticipated negative impacts are confined to the construction phase and all of them will be adequately mitigated; and
- Implementation of the projects will result in very significant socioeconomic and environmental benefits to both the residents and the travelling public including truckers.

Based on the level of detail and depth of the study, all envisaged negative environmental and socio-economic impacts have been fully addressed.

From the screening analysis the Mchinji Water supply and sanitation Project will have to undertake an EPB for the submission to EAD for a decision to determine whether the project requires;

- No further environmental evaluation
- Only an EMP; or
- A full EIA

The preliminary environmental evaluation shows concerns relating to relocation or loss of property towards areas where infrastructure will be constructed, however this will be minimal. Secondly, concerns about the depletion of groundwater due to pumping from the dambo area where there are many agricultural farms located.

Section 5: Financial and Economic Assessment

Introduction

The Financial and Economic Assessment aims to determine the financial and economic feasibility of the project as designed. Cost-Benefit Analysis (CBA) is the tool used for this assessment. CBA is a framework for appraising the viability of capital projects by weighing up financial flows, as well as the implicit and explicit positive and negative socio-economic impacts of the investment.

As such, the use of the project CBA is to show both the commercial and social imperatives of project. The CBA is also an invaluable tool for informing and guiding project development so that the project design maximises both the commercial and social imperative of project. In this respect, the project has been redesigned based on the outcomes of a previous CBA which found that despite the clear socio-economic justification for the project, the previous design was highly unlikely to be financially sustainable.

Approach to the CBA

This report outlines the Cost-Benefit Analysis (CBA) assessment, which forms an input to the feasibility study of the Mchinji project. The CBA aims to determine the financial and economic feasibility of the project as presently designed. CBA is a framework for appraising the viability of capital projects by weighing up financial flows, as well as the explicit and implicit positive and negative socio-economic impacts of the investment. As such, the use of the project CBA is to provide an evidence base for the commercial and social rationale of the project. The CBA is also a tool for informing and guiding project development in order for the project design to maximise both the commercial and social imperatives of the project.

It is anticipated that a project of this nature is unlikely to attract private-sector investors due to limited returns and the risks associated with water supply; however, its broader public-good nature is likely to increase the welfare of the population significantly. CBA is a useful approach in demonstrating this as it is able to weigh up future project costs and benefits in a present value approach, thus helping to give direction as to whether the project is desirable and should be implemented.

The main elements of this report includes the core **assumptions** to the CBA, followed by the **financial appraisal** which looks at the financial flows (expenditures and revenues) over the life of the project, to calculate the Financial Net Present Value (FNPV) of the investment, Financial Internal Rate of Return (FIRR) on the project investment, and Financial Benefit-Cost Ratio (FBCR). The **economic appraisal** then assesses a wider spectrum of costs and benefits compared to the case of pure profit determination of the financial appraisal. The outcome of the quantitative economic appraisal includes the Economic Net Present Value (ENPV), Economic Rate of Return (ERR), and Economic Benefit-Cost Ratio (EBCR) of the project. In addition to these quantitative indicators, a description of the qualitative economic impacts serves to inform an understanding of the expected net socio-economic impact of the project to society.

Based on the results of the financial and economic appraisals, and drawing on a broader understanding of the context, institutional arrangements, and prevailing local socio-economic conditions, a **sustainability analysis**

provides an assessment of the on-going financial and economic sustainability of the project, primarily from the perspective of the affordability of the project to the local community. Lastly a high-level **risk assessment** serves to highlight the key risks to the financial and economic viability of the project and discusses associated recommendations for risk mitigation arrangements, before final conclusions and recommendations of the CBA are put forward.

Key CBA Assumptions

The CBA analysis is premised on a number of key input assumptions. The assumptions are drawn from the technical report, observations by the project team in the project area, and peer-reviewed publications/international benchmarks. The tables below provide the detail of the assumptions that frame the CBA analysis. The details underlying these assumptions are provided in **Annex D**.

Table 26 Financial assumptions

Item	Assumption
Financial Discount Rate	6%[10]
Exchange Rate	MWK1.00 = GBP 0.0010[11]
O&M Costs	5% of capital costs[12]
Constant Versus Current Prices	All prices are given in constant 2016 terms

Source: CRIDF CBA

Table 27 Revenue generating assumptions

Item	Assumption
Number of households (2016)	324[13]
Household size	4.7[14]
Population size	1,521
Annual population growth	3.5%[15]
Current proportion of household types[16]	• High-cost: 0% • Medium cost: 0% • Low cost: 0%

[10] A real interest rate of 6% is calculated as the nominal interest rate over the period 2012 – 2016 minus the inflation rate over the same period. The nominal interest rate over this period is 21% (see http://data.worldbank.org/indicator/FP.CPI.TOTL.ZG/countries/MW?display=default) and the inflation rate is 27% (see http://www.tradingeconomics.com/malawi/interest-rate)
[11] Oanda Currency Converter. Online: https://www.oanda.com/currency/converter/ [accessed 14 June 2016]
[12] A rate of 5% is suggested by the Swiss Resource Centre for Development (2008), as sufficient for a water supply system. See SKAT (2008). Operation and Maintenance of Rural Water Supplies. Online: www.rural-water-supply.net/_ressources/documents/default/208.pdf
[13] CRIDF (2016) Mchinji Feasibility Report
[14] Ibid.
[15] Ibid.
[16] Ibid.

Item	Assumption	
	• Low cost (kiosk): 100%	
Per capita water consumption	• High-cost: 100 litres/capita/day • Medium cost: 75 litres/capita/day • Low cost: 40 litres/capita/day • Low cost (kiosk): 25 litres/capita/day	
Number of businesses (2016)	• 100	
Domestic water tariffs[17]	*m^3*	*GBP/m^3*
	0 – 4	Flat rate: 0.7
	5 – 30	0.17
	30+	0.18
	Kiosk	0.09
Commercial water tariffs[18]	0 – 4	Flat rate: 5.85
	5 - 30	0.69
	30+	0.82
Service charges (per month)	*GBP/m^3*	
High-cost	0.13	
Medium-cost	0.35	
Low-cost	0.35	
Commercial	2.92	
Meter rental	0.31	
Individual	3.06	
Commercial		
Ablution tariffs (GBP)[19]	Toilet (per entry)	0.13
	Shower/laundry (per entry)	0.33
Number of truck passengers per day	50[20]	
Number of other passengers per day	30	
Annual growth in truck traffic	5%[21]	
Non-revenue water	20%[22]	

Source: CRIDF CBA

[17] Approved CRWB Tariffs (2016). Online: http://www.crwb.org.mw/tarrifs.html
[18] Approved CRWB Tariffs (2016). Online: http://www.crwb.org.mw/tarrifs.html
[19] Based on current payments in the informal market in Mwami
[20] CRIDF (2016) Mchinji Feasibility Report
[21] http://www.afdb.org/fileadmin/uploads/afdb/Documents/Multinational__Malawi-Zambia__-_Nacala_Road_Corridor_Development_Project_-_Phase_IV_-_Appraisal_Report.pdf
[22] KII with CRWB in Mchinji Town indicated that current NRW is between 20% and 25%. Given that this is a new scheme; it is not expected that NRW will be more significant than this

Table 28 Economic assumptions

Factor	Discount/conversion factor	
Social Discount Factors	3.5%	10%
Tradable goods	0.8	
Unskilled labour	0.75[23]	
Skilled labour	1.00	
Non-tradable goods	1.00	

Source: CRIDF CBA

The CBA is carried out within the context of a with- and without-project basis, and hence includes only incremental values for the costs and benefit inputs. This is in an effort to include only the incremental costs and benefits of the project, including variables such as time spent collecting water in the current system versus time spent in the new system. In terms of the financial appraisal, the current system does not have any formal operations and maintenance costs; although the community is responsible for the repair of the hand-pumps should they break. Hence, the O&M costs are included in their entirety. Revenues from water tariffs are also included in their entirety as households are currently not connected to a water supply. In terms of the sanitation facilities at the border, the costs and benefits are also included in their entirety as there is no such facility at present.

In the economic appraisal, incremental values are important in calculating the health and time savings. Both health and time savings are expected to increase due to the proposed project, however these benefits are unlikely to be the full health and time savings. In other words, it is unlikely that the project will result in all water-related health concerns being addressed, while there will still be some residual time spent by rural households in collecting water from kiosks. The incremental benefits will be discussed in more detail in the Economic Appraisal below.

Options Appraisal

The project has been designed to account for the current needs of the town – increasing water supply and sanitation, catering for a large border population, town residents and businesses – as well as for the significant increase in the town's population over the next 15 years.

Table 29 Population and household projections for Mchinji Border Town

Item	2016	2021	2026	2031
Population	1,521	1,806	2,146	2,548
Border patrons per day	100	128	163	208

Source: CRIDF CBA

[23]According to the Asian Development Bank, unskilled labour typically has a conversion factor of between 0.5 to 0.75 in labour surplus economies. Asian Development Bank (2011). Financial / Economic Analysis and Shadow Pricing. Online: http://www.adb.org/sites/default/files/page/149401/financial-economic-analysis-shadow-pricing-mar2012.pdf

The technical assessment of the Mchinji project reviewed a number of options by which the project could be implemented. The technical options related to four components of the infrastructure design – water supply, pump infrastructure and water storage. These are covered in detail in the Technical report and the summary recommendations are presented below:

Water supply

Groundwater was identified as the most feasible water source for the project due to limited surface water availability in the area. A rapid assessment of the potential of the ground water resources of the area was conducted using both historical and collected data, with an assumed potential safe yield of 3.6 m^3/hr. At this yield, three boreholes would thus be necessary to meet the demand figures of the 2031 population.

Pump infrastructure

The proposed solution makes use of electrical pumps due to the fact that there is electricity in the town already and thus it would be relatively easy to access this power source for the pumps. Solar and diesel were excluded as technical design options due to cost.

Water storage

Water storage is necessary to account for variability in water demand from the population, as well as in situations where there is a breakdown with the boreholes or borehole pumps. It is proposed that a 139 m^3 steel reservoir is constructed to cater for 24 hours of storage requirements based on the 2031 average water demand. A site in the Kachebere hills, south east of the border post, has been identified for water storage.

The preferred technical solution recommended is thus to sink three new boreholes which connect to a steel water storage tank. A simple network comprising one ring main has been developed for the project area. This will supply individual connections on application and a total of two water kiosks. The proposed water supply component of the project includes the following infrastructure:

- The sinking and equipping three boreholes
- The supply and installation of main line to boreholes, with distribution network
- The supply and construction of water tank together with required fittings
- The construction of two water kiosks

Financial Appraisal

The purpose of the financial appraisal is to identify the financial return to the project investment and the operational sustainability of the infrastructure. The financial appraisal is conducted from the perspective of the Central Region Water Board (CRWB), who will be the project owner, and will be responsible for the operation and maintenance of the infrastructure. CRWB will also be the direct recipient of the water tariffs and charges.

The costs considered in the financial appraisal include the capital investment for the water and sanitation infrastructure, and the operation and maintenance cost of the system. The revenue considered includes the

expected water tariffs that will be charged to domestic customers, commercial users and the border patrons. Assessing the financial return of the project over its lifespan against the capital and operational costs yields a financial return to the project. The following indicators represent the key outputs of the financial appraisal:

- Financial Net Present Value – the discounted flow of expected investment and operating costs deducted from expected return
- Financial Internal Rate of Return – the financial return on the project. The financial rate of return should be above the cost of capital (discount rate)
- Financial Net Benefit Cost Ratio – the ratio of the present value of the returns on the project set against the project's costs.

Importantly, should the project not be financially viable on its own, the financial appraisal will set out the amount of subsidisation the project will require to make it financially viable and sustainable. The project's costs and revenues are set out below, before the financial appraisal results are outlined.

Project Costs

The total project investment for both the water supply and sanitation components of the design amounts to GBP 392,000 (see **Table 16** – Section 3: Technical Assessment). Large cost items include reservoirs (GBP 48,100) and civil works (GBP 51,500). Project costs are driven by the significantly low current level of water infrastructure in the town, along with the informal layout of the town. Training of CRWB and the project beneficiaries has also been excluded from the final project cost, posing a risk to successful implementation and operation of the scheme. This is discussed in more detail under Project Risks.

Annual Operation and Maintenance Costs

O&M costs for the scheme are separated into those for the water supply and those of the ablution block.

O&M costs for the water supply are estimated to be close to 5% of the capital costs annually and assumed to be constant across the project life span as inflation is excluded from the financial appraisal.[24]

The Technical Assessment section suggests that since the ablution facility will fall under CRWB, who are only responsible for the water supply in the area, they may wish to appoint a vendor to run the facility on their behalf. CRWB will install a water meter at the facility and will bill the vendor for the volume of water consumed. In line with sanitation facilities operated in other CRIDF-focus project sites (such as Chirundu), it is assumed that CRWB would take 80% of the revenues of the facility, and that the additional 20% would be used to pay for the operator of the facility. In this way, the effective O&M costs of the facility would be 20% of annual revenue, equating to GBP 1,297 in the first year of the project's implementation and increasing to GBP 2,569 by its 15th year. Increasing O&M costs would be the result of additional traffic through the facility which would increase the need the inputs such as cleaning materials, as well as account for higher maintenance costs with an aging infrastructure. Refer to **Table 30** for CAPEX and O&M Cost Phasing.

[24] Discussions with Project Director confirmed the estimate of 5% of CapEx for O&M costs of such a system

Table 30 Capital and O&M Cost Phasing (GBP)

Year	CAPEX	O&M	O&M Ablution Facility	Year	O&M	O&M Ablution Facility
0	391,391					
1		18,140	1,297	11	18,140	2,113
2		18,140	1,362	12	18,140	2,219
3		18,140	1,430	13	18,140	2,330
4		18,140	1,502	14	18,140	2,447
5		18,140	1,577	15	18,140	2,569
6		18,140	1,656	16	18,140	2,569
7		18,140	1,739	17	18,140	2,569
8		18,140	1,826	18	18,140	2,569
9		18,140	1,917	19	18,140	2,569
10		18,140	2,013	20	18,140	2,569

It is envisaged that the ablution block is operated by an outsourced company where the operating entity keeps 20% of the revenue and absorbs the costs of the facilities on-going maintenance. CRWB would be responsible for capital costs of the project, administration of the tariffs charged at the facility and other high-level management functions, whereas the day-to-day administration of the facility would be managed by the outsourced company. The cost of large upgrades to the system would be borne by the water utility, but are not included in the financial appraisal as the useful life of the facility is limited to 20 years and these costs are not expected to occur in this time period. See below for a discussion on the project time frame.

Project Time Frame

The technical design is based on projected population water demand in the 15th year of the project. It accounts for current population needs, as well as growth in population, including a movement toward in-house water connections and a growing border population. To align with the other border town projects, including Kazungula, Chirundu, Mwami and Chanida, the estimated lifespan of the infrastructure is assumed to be 20 years. In order to ensure that the CBA does not inflate project benefits beyond those designed for, the approach taken in this CBA is to assume the beneficiaries stay constant from the 15th year of the project until

the 20th year of the project, thus not requiring additional design capacity. Incremental project costs and benefits are included in the same way as the first 15 years of the project, but are held constant for the last five years of its lifespan.

This approach indicates that after 20 years the proposed infrastructure will have no further benefit, and ensures comparison between projects in this suite of CRIDF work can be compared. An alternative approach would have been to include a residual value for the infrastructure equal to the NPV of its future net revenues, discounted to its 15th year of implementation. Given that this approach was not followed in the other CBAs, it was decided that the former approach would be the most suitable.

Keeping the project design population at that of its 15th year of implementation accounts for the fact that the infrastructure will serve as seed infrastructure to CRWB, i.e. that the water utility will be able develop the CRIDF interventions as population grows and their capacity in the town is expanded.[25]

Revenues

Revenue streams are expected to flow from the three groups of users. These will be discussed separately below:

- Households, including high, medium, low costs households, as well as those that access water from communal kiosks
- Businesses, and
- Border patrons.

Households

The revenue analysis for household use is based on estimations of water demand by high, medium, low cost and kiosk users and the corresponding tariffs charged per usage. Tariff rates are based on the CRWB 2016 approved block rates for the Central province, and vary from low cost per unit charges at low levels of consumption and then escalate to higher charges at higher levels of consumption. Mapping demand over the project's lifespan is derived from population growth figures and the evolution of consumption patterns between communal water kiosks and household connections.

Based on information gathered during site visits, and from input from the Technical Report, it is assumed that out of the current population, 100% of households are considered low cost, accessing water at communal water points. This includes the businesses operating in the town. Over time, however, it is expected that the number of high, medium and low cost households accessing water through in-house or yard connections will increase as the town develops. This will only be possible through the proposed intervention, as the current system does not allow for household connections.

[25] Discussions with Activity Lead suggest that we should provide a baseline level of infrastructure so as to enable CRWB's operation in the town

Table 31 Proportion of household types over time (% of total number of households)

Household type	2016	2021	2026	2031	2036
High Cost	0%	3%	4%	4%	4%
Medium Cost	0%	3%	6%	6%	6%
Low Cost - Connection	0%	34%	65%	90%	90%
Low Cost - Kiosk	100%	60%	25%	0%	0%
Total	**100**%	**100**%	**100**%	**100**%	**100**%

Each of these groups of users have varying levels of daily water consumption, as demonstrated in **Table 5**. In-line with the Technical Assessment section, these proportions are assumed to stay constant throughout the 20-year life-span of the project.

Additionally, there are small revenue components associated with service charges and meter rental collected by the water utility, calculated as the monthly payment for these services and multiplied by 12 months.[26] No service charge is included for water kiosks.

Ablution facility

An additional revenue source is created through the construction and operation of the proposed ablution facility. This facility is expected to operate similarly to those proposed in Mwami, where patrons pay a fee for the use of the facility. Based on the prices currently charged in the informal market for these services in Mwami (ZWM2 for the use of the toilet and ZMW 5 for the use of shower/laundry facilities respectively) and conservatively assumes that 20% of border patrons use the facility. The proposed operational scheme sees the outsourcing of their operation to a private party who keeps 20% of the total revenue and provides staffing and daily operation of the system. CRWB will collect the additional revenue and provide water to the facility, as well as long-term O&M. Only the revenue collected by CRWB is included in the financial appraisal below.

Commercial users

Site visits indicated that there are currently approximately 100 small businesses operating in Mchinji, largely comprised of restaurants, bars and small stores that service the border patrons. At present, all businesses in Mchinji access water through the communal hand pump which poses significant constraints on their ability to operate commercially. A large amount of time is spent collecting water, and business that service border patrons have to make do with buckets as hand-washing facilities and pit latrines for toilets.

Under the proposed scheme, businesses are expected to grow in line with growth in the border traffic in the town at 5% annually, and will be able to connect their businesses to the water supply system through in-house connections. They will be charged those tariffs associated with commercial users, and it is assumed that they

[26] See Key Assumptions for a breakdown of these charges.

will require 100 litres per day.[27] Additionally, there are small revenue components associated with service charges and meter rental collected by the water utility, calculated as the monthly payment for these services and multiplied by 12 months.[28]

Table 32 Projected incremental revenue from water tariffs (GBP)

Revenue category	Year 0	Year 5	Year 10	Year 15	Year 20
High-cost (metered access)	0	322	511	606	606
Medium cost (metered access)	0	242	574	682	682
Low cost (metered access)	0	1 461	3 318	5,457	5,457
Low cost (kiosk)	0	891	441	-	-
Commercial	0	213	213	90	90
Service charges	0	1,600	3,749	5,329	5,329
Meter rentals	0	10,463	13,354	17,043	17,043
Non-Revenue Water	-	20%	20%	20%	20%
Ablution facility	0	6,308	8,051	10,275	10,275
Total	**0**	**19,421**	**26,733**	**35,162**	**35,162**

Source: CRIDF CBA

Non-revenue water (NRW) is assumed to be 20% for the proposed design.[29] The project is dependent on the revenue that is derived from these ablution facilities, providing approximately 29% of revenue to the scheme by the 15th year of operation. This is an important finding as the ablution facilities make up a small component of the capital investment requirements but provides an important source of revenue to CRWB. Separate schemes for the water supply component of the project and the ablution facility are discussed in the section that follows.

Financial Appraisal Results

A financial appraisal of the project was carried out on two scenarios, one being the scenario where the water supply and ablution facilities are separated into two schemes, and the second being that the full project's bankability is calculated. This approach demonstrates the financial feasibility of the water supply scheme should CRWB not take ownership of the ablution facility, as could be the case if they decide it does not fall within their mandate. On the other hand, grouping the infrastructure options, shows the overall bankability of the project, particularly since the intention is to seek project funding to cover all components of the infrastructure.

[27] CRIDF (2016) Mchinji Feasibility Report
[28] See Key Assumptions for a breakdown of these charges.
[29] KII, site visit 2016 suggested that NRW was between 20% and 25% in Mchinji town, and given that this project proposes new infrastructure it is assumed that NRW should be lower than in areas with established infrastructure

Water supply scheme only

Table 33 Financial Appraisal Results (Scenario 1 – Water Supply)

Indicator	Results (6% discount rate)
FNPV (GBP)	-383,952
FIRR (%)	-12%
FBCR	0.33
N/K Ratio	0.50

Source: CRIDF CBA

The results of the appraisal indicate that the water supply components of the project are not financially viable: at a 6% discount rate the FNPV is negative GBP 383,952; and the FIRR (-12%) is below the discount rate. These results show that the revenues generated by the project infrastructure are not sufficient to cover the full investment cost over the project life. This is not surprising, given that water and sanitation provision is largely a public good and that current tariff design in Malawi does not account for full cost recovery. High levels of NRW, aging infrastructure and low tariffs pose challenges to Malawi's ability to recover its costs of water supply and sanitation.[30]

CRWB is mandated to provide services that are safe, desirable, and affordable to consumers while also ensuring that the institutional and commercial system is capable of actually recovering costs.[31] These often conflicting goals have significant economic implications and have led to the implementation of tariffs which cannot account for cost recovery.[32] Tariffs are the most common way of recovering costs, but with goals beyond those of raising revenues to cover all or part of costs, these are not sufficient throughout Malawi to do so. Tariffs are, instead, set below full cost recovery for historical and political reasons, and subsidies are relied on to cover the shortfall in revenues. AICD (2008) indicates that central government is responsible for these costs in Malawi, although there is some decentralised responsibility at the regional and local government level.[33]

[30] USAID (2010) Malawi Water and Sanitation profile. Online: http://www.washplus.org/sites/default/files/malawi2010.pdf
[31] AICD (2008) Cost Recovery, Equity, and Efficiency in Water Tariffs: Evidence from African Utilities. Online: http://www.infrastructureafrica.org/system/files/WP7_Watertariffs.pdf
[32] Ibid.
[33] Ibid.

Ablution facility only

Table 34 Financial Appraisal Results (Scenario 1 – Ablution)

Indicator	Results (6% discount rate)
FNPV (GBP)	59,886
FIRR (%)	22%
FBCR	3.09
N/K Ratio	3.09

Source: CRIDF CBA

The results of the appraisal of the ablution facility alone indicates that the facility is financially viable: at a 6% discount rate the FNPV is GBP 59,886; and the FIRR is 22%. These results show that the revenues generated by the ablution facility are sufficient to cover its capital cost, which is relatively small at GBP 28,600, as well as on-going operations and maintenance costs. The ablution facility is a revenue generating component of the entire scheme even when O&M costs are expected to be 20% of revenue.

Scenario 2

Water supply and ablution facility combined

Table 35 Financial appraisal results (Scenario 2 – Combined)

Indicator	Results (6% discount rate)
FNPV (GBP)	-316,713
FIRR (%)	-5%
FBCR	0.51
N/K Ratio	0.79

Source: CRIDF CBA

The results of the appraisal with the combined water supply and sanitation components show a marginally more financially viable project that those of the water supply component alone. However, the project still displays unviable returns to cover the upfront infrastructure costs. At a discount rate of 6%, the FNPV is - GBP 316,713; the FIRR of -5% is below the discount rate; and the FBCR (0.51) is below 1. These results show that the revenues generated by the project are not sufficient to cover the full investment costs over the project life. This has important implications for the funding of the project, which will be discussed below under Funding Scenarios.

In terms of its ongoing financial sustainability, the projected operational cost-recovery of the infrastructure is positive. Net cash-flows (annual revenues less annual O&M costs) have a positive FNPV of GBP 79,009, implying that CRWB will be able to recover its yearly operational costs and make a small return. This is substantiated by the BCR of the ongoing cash-flows of 1.35.

The 'Financial Appraisal' table in **Annex D1** contains a full summary of the financial appraisal. This has important implications for the funding of the project, which will be discussed below under Funding Scenarios.

Funding Scenarios

The project's financial results indicate that private sector funding will be unavailable as a source of finance. Concessional finance (e.g. interest-free loans) paid back over the life of the project are also not feasible given the significant capital costs relative to revenues from tariff collection. The project will therefore require grant funding to proceed. However, should external financing for the required initial capital investment be accessed, the project infrastructure will be operationally sustainable.

Table 36 indicates the financial return on the project investment when varying degrees of external grant funding are leveraged. An external grant for the entire capital investment results in a stronger financial outlook, with an IRR of 7%, but because this is lower than the discount rate of 10% the FNPV still remains negative.

Table 36 Project Funding Scenarios

Description	FNPV (GBP)	FIRR (%)
Full grant funding	53,221	11%
Break-even investment	335,083	6%

Source: CRIDF CBA

These project scenarios demonstrate a weak financial outlook for the project relative to the costs. The project is not financially 'bankable', meaning it does not deliver high enough risk-adjusted returns to attract private-sector equity or debt. This is not unique to this project – all middle and low-income countries face challenges at providing bankable water supply projects. Not only do they often lack project-development resources, but their governments also may not be able to afford the funding commitments required or cannot offer sufficient guarantees to mitigate the perceived risk of the project.[34] However, in the case that grant funding is accessed to cover the upfront costs of the project, the project demonstrates positive financial returns, as well as providing a sustainable means of providing water supply to an increasingly important border town in Malawi – with long run operational revenues higher than operational costs.

Sensitivity Analysis

A sensitivity analysis is an important way to analyse whether the key input assumptions for the project have a material impact on its outcomes, particularly those of its overall viability. The objective is to identify the factors that have the biggest impact on the project's sustainability and returns. The sensitivity assessment looks at

[34] Development Finance (2016) How to plug the gap in water investments. Online: http://alliance4water.org/resources/Development-Finance-03.pdf

the main factors that could impact the project's costs, as well as the factors affecting the project's revenue generation.

The project's operational sustainability is impacted by the significant upfront costs, leading to a poor overall financial outlook. Increasing the upfront costs and O&M costs of the project by 10% sees a material impact on the project's NPV from -GBP 316,713 to -GBP 377, 001. The associated change in the FIRR is from -5% to -7%. This is a resultant change of higher proportions than the change in the costs themselves.

Decreasing the capital costs and their associated O&M costs by 10% results in an increase of the NPV from -GBP 316,713 to - GBP 256,426, associated with a significant change in the FIRR from -5% to -3%. However, decrease in capital costs of 50% is needed to elicit a positive NPV (GBP 45,009, with an FIRR of 8% and BCR of 1.28)

While capital costs play a role in determining the overall financial viability of the project, it is also necessary to do a sensitivity analysis on the operational sustainability of the project. This is particularly the case for project's which are funded by an external source but which will need to rely on operational sustainability for their on-going success. In the case of Mchinji, a sensitivity analysis was carried out on the operational flows of the proposed intervention in isolation of the capital costs. Looking only at the operational costs (O&M costs) and revenues of the project, two variables investigated in this report are the population of the town, as well as the border patrons.

Table 37 Sensitivity Analysis – Cost Parameters (GBP)

Parameter	Change	FNPV before change	FNPV after change	BCR before change	BCR after change
Increase in population	+10%	79,009	87,499	1.35	1.39
Decrease in population	-10%	79,009	70,518	1.35	1.32
Increase in border traffic	+10%	79,009	88,371	1.35	1.39
Decrease in border traffic	-10%	79,009	69,647	1.35	1.31

Source: CRIDF CBA

From **Table 37** it is evident that border traffic numbers play a larger role in determining the operational outcomes of the project than population figures. Future work on the project should ensure that traffic estimates figures are accurate. However, a variance of 10% does not pose a risk to the operational sustainability of the scheme for either variables, with a BCR significantly higher than 1 in both cases.

Economic Appraisal

The economic appraisal is conducted from the perspective of the economy as a whole to assess whether the project will have a net positive socio-economic impact. As such, the economic appraisal assesses project costs and benefits beyond financial returns alone, and aims to do so at prices equal to their real value to society rather than financial / market prices.

Project Costs

It is necessary to convert financial prices into economic prices. This removes any market distortions (such as taxes or import duties) and presents the true capital cost of the project to Malawian society. In many cases, market prices do not reflect the opportunity cost of inputs and outputs and items in the financial analysis must therefore be adjusted. The methodology used in the economic analysis thus applies 'conversion factors' to market prices to correct for market distortions and attain relevant 'shadow prices' of inputs and outputs.

If a conversion factor is less than one it indicates that the true value of that price is less than its market price, and vice versa. An example would be an imported product which is subject to exchange rate commissions and VAT. These are transfers within the economy and not true indications of value – hence they should be removed from its market price. If a market price is higher than 1, it indicates that the true value of that price is higher than its associated market value, such as due to government subsidies.

Capital Costs

Through a discussion with the technical logistics team, it was noted that most of the inputs for the construction of the project and supply of associated materials, machinery, and equipment during construction and operations of the infrastructure can be sourced locally. A conversion factor of 20% was thus applied to the capital costs of the project to remove import duties from any costs in the economic analysis, along with the proportion of low-skilled labour included in these costs. VAT, as discussed above, is removed from the economic costs of the infrastructure, while preliminaries and general costs are kept at their financial prices as these relate to non-tradable goods.

Table 38 Conversion Factors for Capital Costs (GBP)

Item	Financial price	Conversion factor	Economic price
Pipe Materials	20,200	0.8	16,160
Civil Works	54,400	0.8	43,520
Fencing	3,800	0.8	3,040
Pumps and Motors	31,500	0.8	25,200
Boreholes	20,800	0.8	16,640
Power Lines	13,900	0.8	11,120
Reservoirs	50,700	0.8	40,560
Pipe Fittings	16,800	0.8	13,440
Ablution Blocks	30,200	0.8	24,160

Item	Financial price	Conversion factor	Economic price
Kiosk	8,800	0.8	7,040
Preliminary and General	75,400	0.8	60,320
TOTAL PROJECT COST	**326,500**	**0.8**	**261,200**

The overall conversion factor is calculated as 0.8 for the project.

Capital Costs

In order to calculate the economic O&M costs, the O&M percentage of 5% applied in the financial appraisal is applied on the economic costs of the project and based on the assumption that the above discussion of imported goods applies to O&M costs. A further conversion is undertaken to account for the proportion of low-skilled labour in on-going operation and maintenance of the system, as is described below.

Price of labour

The cost of labour is included in the financial analysis in both the construction of the project and during its operation. This is the financial price of labour and estimated at market rates. In the economic analysis, however, it is necessary to consider the social opportunity costs of labour; that is, to be aware that market prices for labour may not reflect its true value. This is done by looking at the alternative use of labour in the absence of the project and valuing the substitute used for labour, what is known as the 'shadow wage'.

Two assumptions are therefore made given the project's context. Firstly, the price of high-skilled labour is understood to reflect its true value given the shortage of readily available skills in the country. Secondly, the opportunity cost of low-skilled labour is likely to be lower than that of the market wage. Not only might there not be another job available, but it is likely that workers will be willing to work for a wage that is lower than the market wage, if given a choice between being unemployed and accepting a lower paying job. Therefore, in cases with involuntary unemployment, the shadow wage will be lower than the financial wage. In line with the Asian Development bank's guideline for the conversion factor for low-skilled labour in labour surplus countries, a conversion factor of 75% is applied.[35] This high discount factor accounts for the high levels of formal unemployment in Mchinji and presenting a conservative value of the opportunity cost of low-skilled labour. The higher the conversion factor, the lower the opportunity cost of low-skilled labour.

The conversion of low-skilled labour is used in estimating the economic benefits of the project, as will be described in the section below (Economic Benefits), as well as the value of project costs.

In terms of the operations and maintenance of the proposed design, a further conversion of financial costs is applied. O&M costs are proportioned between various components, as presented in Table 44 below, and the conversion factor for unskilled labour is applied.

[35] Asian Development Bank (2011). Financial / Economic Analysis and Shadow Pricing. Online: http://www.adb.org/sites/default/files/page/149401/financial-economic-analysis-shadow-pricing-mar2012.pdf

Table 39 Economic O&M costs

Item	Proportion of Cost	Conversion factor
Fuel costs	6%	1
Chemical costs	11%	1
Electricity costs	12%	1
Maintenance costs	23%	1
Lab costs	6%	1
Staff costs	38%	0.75
Other costs	4%	1

Source: CRIDF CBA

The final annual economic cost of the project is estimated to be GBP 16,416, approximately 9% lower than that of the financial O&M cost.

Economic Benefits

The economic benefits of the Mchinji water supply and sanitation project include impacts that can be quantified into monetary terms as well as those which can only be captured qualitatively. The CBA aims to capture both the quantitative and qualitative benefits which stem from the project.

Quantitative Benefits

Financial revenues do not represent the true value of water supply and sanitation infrastructure to the town of Mchinji for a number of reasons, as discussed above, but including the fact that water is not priced according to its scarcity value but is rather assigned a tariff which accounts for the human rights-to-water and affordability concerns. Essentially, the tariffs charged for water in Malawi do not reflect the full associated costs of providing sustainable services.

The real value of water supply and sanitation is commonly estimated through an estimation of the maximum willingness to pay (WTP) of consumers for the service rather than the market tariff. WTP includes the full benefit of water and sanitation to a consumer – in terms of health, time savings, productivity, preference of supply, etc. It is usually assessed through stated preference (contingent valuation) methodologies, which can be resource intensive and misleading where there is significant asymmetry of information.

In this economic appraisal (in lieu of a WTP survey and analysis), the following expected project benefits are assigned a monetary value in order to estimate the real (economic) value of the project:

- Health benefits
- Time savings

Health improvements associated with water supply and sanitation

The World Health Organisation (WHO) (2004) asserts that 1.8 million people die every year from diarrhoeal diseases; 90% of which are children under five, mostly in developing countries. The proposed interventions for Mchinji will directly and indirectly contribute to the reduction of a range of water and sanitation related diseases, such as cholera, dysentery and trachoma. Exposure to diarrhoea-causing agents is frequently related to the use of contaminated water and to unhygienic practices in the preparation of food and disposal of excreta.[36] The water and Sanitation Progam (WSP) estimates that 5.2 million Malawians use unsanitary or shared latrines, and 1.4 million have no latrine at all and defecate in the open.[37]

Mchinji border town suffers from a number of water and sanitation-related challenges. These include inadequate water supply to the current population. Additionally, the town does not have a sewerage system, and residents rely on pit latrines, most of which are not improved. These sanitation practices, coupled with a lack of water supply and a large, mostly unserviced border population, have resulted in a tenuous situation in which outbreaks of diarrhoea are common.[38]

There are a high number of cholera cases reported at the District Hospital, along with a prevalence of other water-related illnesses, especially bloody and non-bloody diarrhoea. In a KII with a senior member of staff at the hospital, it was mentioned that this year they have had 11 cases of cholera, three of which resulted in death. This is particularly worrying for the district and is evidence of significant WASH challenges in the area. There have been over 200 cases of typhoid reported at the hospital this year (January to June).[39]

The World Bank Water and Sanitation Program (WSP) has calculated the economic costs of poor sanitation in Malawi and found poor water supply, sanitation and hygiene (WASH) cost the country USD57 million annually.[40] This cost includes health impacts of poor water supply and sanitation, the cost of premature death due to illness caused by diarrhoea and the cost of productivity losses while sick or accessing health care. Inflating this value to current prices using the average inflation rate of 21% between 2005 until 2016[41], the per capita cost of inadequate water supply and sanitation is estimated to be GBP 8.20 per person per year.

This economic cost estimate of poor sanitation is used as a basis to estimate the health benefits (or avoided cost) of the project. WHO and SIWI finding that improved water supply can decrease diarrhoea morbidity by up to 25%; and hygiene interventions and drinking water quality can reduce the number of diarrhoeal cases by up to 45% and 39% respectively.[42] Moreover, more expensive interventions such as the implementation of

[36] Central Statistics Office (CSO), Ministry of Health (MOH), Tropical Diseases Research Centre (TDRC), University of Zambia, and Macro International Inc. (2009) "Zambia Demographic and Health Survey 2007", CSO & Macro International Inc., Calverton, Maryland, USA
[37]WSP (2012) Economic Impacts of Poor Sanitation in Africa. Online: https://www.wsp.org/sites/wsp.org/files/publications/WSP-ESI-Malawi.pdf
[38] KII, site visit 2016
[39] KII, site visit 2016
[40] WSP (2012) Economic Impacts of Poor Sanitation in Africa. Online: https://www.wsp.org/sites/wsp.org/files/publications/WSP-ESI-Malawi.pdf
[41]The nominal interest rate over this period is 21% (see http://data.worldbank.org/indicator/FP.CPI.TOTL.ZG/countries/MW?display=default) and the inflation rate is 27% (see http://www.tradingeconomics.com/malawi/interest-rate)
[42] WHO & SIWI, "Making Water a Part of Economic Development", Government of Norway & Sweden as input into Commission on Sustainable Development (CSD) (2004-2005)

advanced types of technologies such as regulated in-house piped water (as planned in the project), can lead to an average global reduction in diarrhoeal cases by around 70%.[43] The proportion of health costs avoided due to the implementation of the proposed design is assumed to be 45%.

Table 40 Health savings (GBP)

Annual value of health savings	2016	2021	2026	2031	2036
Health savings	0	17,147	21,294	26,476	26,476

While the health benefits estimated in this CBA are calculated on the quantifiable health savings due to the proposed intervention, it is expected that they are significantly less than the full cost to society. This is because they ignore a number of benefits that are difficult to quantify and monetise. These are listed below:

- The cost of reduced long-term cognitive development which is a result of early childhood diarrhoea and associated under-nutrition, stunting and wasting;
- The cost of funerals, which are borne directly by households and are particularly significant in African culture. A study in South Africa found that on average, households spend the equivalent of year's total expenditure on food and groceries on funerals;
- The cost of epidemic outbreaks. An epidemic outbreak of cholera would pose a severe cost to the economy due to productivity losses, premature death, diversion of expenditure to health, and losses in trade and tourism;
- Increasingly poor health due to climate change impacts, namely more frequent occurrences of drought, rainfall variability and temperature increases.

Time savings

At present, all residents within Mchinji, including the 100 businesses currently operating in the town, fetch water either from one communal hand-pump or unprotected wells. KII indicate that at communal water points slow yields and a limited supply of water result in long queues. Fetching water is predominantly a woman and children's role in Mchinji and long waiting periods are spent queuing at hand-pumps. The community asserted that households spend an average of an hour fetching a 20 litre bucket of water.[44] Given that time has an opportunity cost, a benefit value can be placed on the amount of time saved in the town due to the intervention.

As this CBA includes only the incremental benefits of the project, only the additional savings brought about from the proposed intervention are included. In the current system, low-cost unmetered households collect water from communal stand pipes, whereas in the new system they will collect water from kiosks. Metered households are expected to have the larger time savings of the two dwelling types due to the fact the entire

[43] Ibid.
[44] CRIDF (2016) Mchinji Outline Business Case

time that was spent on fetching water is now avoided due to household water connections. They will no longer have to travel to fetch water nor wait for slow yielding hand pumps.

Time savings through the new system are expected to occur for households graduating to household connections, assumed to be a savings of 100% of the time used in the absence of the proposed intervention, low-cost households who connect to the water system through yard connections, assumed to save 80% of the time spent collecting water in the absence of the intervention, as well as those households who continue to rely on communal water points to due to a more reliable, and larger quantity, of water provided. Given that the proposed scheme sees the construction of two water kiosks, as opposed to one hand-pump currently, time savings are assumed to be 50% for these households.

The monetary value of time savings can be calculated as the opportunity cost of the time spent fetching water. The economic value of one hour saved is expected to be less than the minimum wage per hour in the community due to the high levels of unemployment in the town, especially for women who are usually tasked with water collection for the household.

Time savings under this period of time are estimated in the following way:

- Assuming no new households could be connected to the water supply in the absence of the intervention due to capacity constraints, the total time taken to fetch water per additional household was calculated as the journey time (assumed to be one hour per trip) multiplied by the number of households fetching water
- Dividing this figure by the number of work hours in the day (8 hours) gives an indication of the work-value of this time
- This time is then assigned its opportunity cost, being the minimum wage in the town (estimated to be MWK 687 per day[45]) and discounted in line with the low-skilled conversion factor discussed above
- To get the annual opportunity cost of time, this figure is then multiplied by 240 working days in the year

The combined time savings is valued at GBP 18,426 in the first year of the project. Time savings is assumed to grow proportionally to the size of the population and the proportional change in types of households (see **Table 41** for a breakdown of these changes). Refer to the 'Time and Health Benefits' table in **Annex D2** for a detailed breakdown of these calculations.

Table 41 Time savings (GBP)

Annual value of time savings	2016	2021	2026	2031	2036
High Cost	0	789	1,249	1,483	1,483
Medium Cost	0	789	1,873	2,225	2,225
Low Cost - Connection	0	7,150	16,235	26,698	26,698
Low Cost - Kiosk	0	7,886	3,903	-	-

[45] Wage Indicator (2016) Minimum Wages in Malawi with effect from 01-01-2016. Online: http://www.wageindicator.org/main/salary/minimum-wage/malawi

Annual value of time savings	2016	2021	2026	2031	2036
Businesses	0	8,057	10,283	13,124	13,124
Total time savings	**0**	**24,671**	**33,543**	**43,530**	**43,530**

Source: CRIDF CBA

Quantitative results

The results of the quantitative economic appraisal, as summarised in the table below, indicate that the project is economically desirable at both a 3.5% and 10% discount rate, with positive ENPVs and an ERR which is higher than both discount rates.

Table 42 Economic appraisal results

Indicator	3.5 % discount rate	10 % discount rate
ENPV (GBP)	252,431	9,633
ERR (%)	10.5%	10.5%
EBCR	1.51	1.02

Source: CRIDF CBA

Sensitivity Analysis

Two important factors in the estimation of economic benefits are: the length of time taken to fetch water and the percentage of diarrhoea-related illness cases avoided due to the intervention. The impact of these assumptions is investigated in Table 48 below.

Table 43 Economic Sensitivity Analysis (GBP, 3.5% SDR)

Parameter	Change	ENPV before change	ENPV after change	BCR before change	BCR after change
Increase in time taken to collect water	+10%	252,431	297,784	1.51	1.60
Decrease time taken to collect water	-10%	252,431	207,078	1.51	1.42
Increase in ability to reduce incidence of diarrhoea-related cases	+10%	252,431	281,833	1.51	1.57
Decrease in ability to reduce incidence of diarrhoea-related cases	-10%	252,431	223,029	1.51	1.45

Source: CRIDF CBA

Changing the impact of the intervention on the number of water-related health incidents in Mchinji has a proportionally smaller impact on the economic results of the project than time savings. However, the project is not significantly affected by changes in either, and maintains its strong economic justification.

Qualitative Project Benefits

While the economic appraisal above aims to capture the main components of the economic benefits of the project, it is likely that they are an understatement of the true value of the water and sanitation services supplied by the project. Thus, the qualitative description of the full spectrum of benefits is an important aspect of this economic analysis. The likely qualitative economic benefits associated with improved water and sanitation includes: positive impacts on gender equality, educational outcomes, economic development, and regional dividends. In particular, economic development, regional dividends and climate resilience are particularly important to Mchinji and are discussed below.

Economic Development

The extent and speed of infrastructure expansion and economic development in Mchinji will be contingent on the supporting water supply and sanitation infrastructure. Water supply and sanitation is an enabling factor to economic activity, by expanding the productive capacity of the economy – both by increasing resources, and enhancing the productivity of existing resources.[46]

Similarly, the growth potential of new enterprises in all sectors of the economy will depend on water supply and sanitation as a factor of production. Such opportunities for new enterprises include those in trading, the provision of roadside services, salaried workers, government officials and the general public. The increase in local economic activity will in turn result in an increase in tax revenues for local government.

In the above context, the economic value of the project consists of both direct and indirect impacts on economic development. Direct value added is the value generated directly in the operations of the infrastructure through the consumptive use of the water resources – in the first 'round' of expenditure. First round expenditure however induces another round of expenditure and value-add in other sectors of the economy, and further rounds after that may follow. These 'backward linkages' create a multiplier effect, so that the overall impact is larger than the direct value add alone.

The magnitude of the multiplier effect of water and sanitation investments on national income have been estimated by Krop et. al (2008)[47] and WHO & SIWI (2005).[48] Krop et. al (2008) find that the long term multiplier effect of water and sanitation investment on GDP is roughly 6.35 times the original investment – that is, for every GBP 1.00 investment in water and sewer infrastructure increases private output (GDP) in the long term by GBP 6.35. This estimate was developed through the review of over 300 economic studies. The WHO

[46] Krop, R.A., Hernick, C. & Frantz, C. (2008) "Local Government Investment in Water and Sewer Infrastructure: Adding Value to the National Economy", US Conference of Mayors, Mayors Water Council Washington, DC
[47] Ibid.
[48] WHO & SIWI, "Making Water a Part of Economic Development", Govt Norway & Sweden as input into Commission on Sustainable Development (CSD) (2004-2005)

and SIWI have estimated a multiplier of 3.33; however, this multiplier is specific to the effect of investment in household access to safe water supply on GDP only, excluding sewerage systems.

Both Krop et al and WHO & SIWI stress that their economic multiplier estimates for water and sanitation infrastructure vary geographically and by past investment – that is, if public water and sanitation infrastructure is adequate and of high quality, rates of return on further investment will be lower than it would be if infrastructure were inadequate[49] - the greatest economic benefits will be felt in countries with the greatest water challenges.[50]

Regional Dividends

Mchinji holds a strategic position on the trade route between Zambia and Zambia and has been identified for its strategic importunate to both Zambia and the SADC region in general. A total of 50 trucks pass through the border town each day, carrying a variety of commodities between the two countries. This substantial number of vehicles is expected to increase as trade within SADC grows. The number of truck drivers passing through the border depends on the amount of time that it takes to cross the border, as well as a range of other amenities available to them while they wait. Water supply and sanitation infrastructure is one of these basic and fundamental amenities.

Improved water supply and sanitation will enable increased and smoother regional connectivity, trade and ultimately regional integration. With a high standard of basic infrastructure, Mchinji will remain a primary conduit for traffic crossing from Malawi to Zambia. Without water supply and sanitation improvements, truck drivers will continue putting strain on the town's already limited water supplies. The fact that the town is a border means that the chance of these epidemics spreading throughout the region is significant.

Climate Resilience

The compounding pressures of growing populations, increasing number of border patrons and climate change, which sees a decrease in the average rainfall to the area while simultaneously more variable rainfall, suggests the urgent need for better water infrastructure.[51]

According to the CRIDF (2016) Draft Feasibility Study, providing a reliable source of water to the Mchinji community provides resilience to changes in climatic conditions. Generally, wastage of water is identified as one major factor that exacerbates water shortages in unplanned supply areas. The design, operational and maintenance procedures incorporate water saving features:

- All water access points will be metered and the water consumed will be levied and paid for proportional to the volume of water consumed

[49] Krop, R.A., Hernick, C. & Frantz, C. (2008) "Local Government Investment in Water and Sewer Infrastructure: Adding Value to the National Economy", US Conference of Mayors, Mayors Water Council Washington, DC
[50] WHO & SIWI, "Making Water a Part of Economic Development", Govt Norway & Sweden as input into Commission on Sustainable Development (CSD) (2004-2005)
[51] CEEPA (2006). The economic impacts of climate change on agriculture in Zambia. http://www.ceepa.co.za/uploads/files/POLICY%20NOTE%2027.pdf [2015, July 14]

- The quality of fixtures used for the network will be durable and robust to minimise malfunction and unnecessary water loss

Importantly, it should be required that CRWB staff should undergo training on operation and maintenance procedures with emphasis on aspects such as water balances, water demand management, climate change and water restrictions for the successful implementation and operation of the scheme. A budget is not included for this training in the programme, and it is hoped that such training may come from CRWB head office, however this identified as a project risk and discussed later under the section Project Risks.

Sustainability Analysis

The economic appraisal shows that the project is justified from a socio-economic perspective. The financial appraisal shows that with external funding support for capital investment costs, there is adequate cash flow to maintain operations at the assumed current tariff levels. The remaining issue for a sustainability analysis is to assess the affordability of the project for its intended beneficiaries. The analysis assesses the affordability of the current tariff levels that will be charged for the services provided in the Mchinji project, based on the average monthly income of the population.[52]

Benchmarks are a useful source of affordability standards for water and sanitation services. Hutton (2012)[53] finds that in Africa, the affordability index for the monthly spend of median households on water is around 2.8% of monthly income, and for poor households connected to public water supply can easily reach 7.5%. International agencies have provided their own affordability thresholds – UNDP (3%), World Bank (5%), OECD unofficial (4%), and African Development Bank (5%).

The average monthly household spend on water is calculated per household type, shown in **Table 44**.

Table 44 Average monthly household consumption (m^3)

Household type	Average monthly water consumption (m^3)	Proportion of minimum wage
High cost	14	11%
Medium cost	11	8%
Low cost	6	5%
Kiosk	4	3%

Using the minimum age used in calculating time savings (MWK 687 per day), communal access households are expected to spend roughly 3% of their household budget, assuming that only one household member works, on water per month. For high-cost households, this equates to roughly 11% of their monthly wage, assuming only one member of the household works. At the current assumed income levels, the tariffs appear

[52] We have assumed that tariffs will remain fixed at 2016 prices
[53] Hutton, G. (2012) Monitoring affordability of water and sanitation services after 2015: Review of global indicator options", PhD – A paper submitted to the United Nations Office of the High Commission for Human Rights, http://www.wssinfo.org/fileadmin/user_upload/resources/END-WASH-Affordability-Review.pdf

to be affordable for both rural and high cost households. Comparing these with the benchmarks outlined above, the project will be affordable to the Mchinji population.

As discussed in the Financial Appraisal section above, tariffs for border patrons are based on current charges in the informal market for water and sanitation services. They thus represent sufficient willingness to pay for the water supply and sanitation services proposed in the project design.

Conclusions and Recommendations

The summary of the financial and economic assessment is provided in

Table 45.

Table 45 Summary Table

Budget		
Capital investment	£391,391	
Beneficiaries		
Direct beneficiaries	1,521	
Indirect beneficiary households	The indirect beneficiary population includes the significant transitory population passing through Mchinji, estimated to be 100 people per day. As the project infrastructure includes ablution facilities for this population, they are included as indirect beneficiary households.	
Assumed number of people per household	4.7	
Analysis timeframe	20 years (although catering for a design population over 15 years)	
Financial appraisal performance indicators (6% Discount Rate)		
Financial Net Present Value (FNPV)	-£316,713	
Financial Internal Rate of Return (FIRR)	-5%	
Financial Benefit Cost Ratio (FBCR)	0.51	
Economic appraisal performance indicators		
	(3.5% SDR)	**(10% SDR)**
Economic Net Present Value (ENPV)	£252,431	£9,633
Economic Rate of Return (ERR)	10.5%	10.5%
Economic Benefit-Cost Ratio (EBCR)	1.51	1.02
Sustainability		

In isolation, the project is not financially viable due to its capital cost and would require grant funding. However, the project has strong operational sustainability, suggesting that should a grant be sourced, the scheme will be able to generate sufficient revenues to cover its on-going operations and maintenance.

Using the minimum age used in calculating time savings (Malawian Kwacha (MWK) 687 per day), communal access households are expected to spend roughly 3% of their household budget, assuming that only one household member works, on water per month. For high-cost households, this equates to roughly 11% of their monthly wage, assuming only one member of the household works. At the current assumed income levels, the tariffs appear to be affordable for both rural and high cost households. Comparing these with the benchmarks outlined above, the project will be affordable to the Mchinji population.

The sanitation facilities' tariffs are based on the current prices that border patrons face at the ablution facility at the border. Basing the tariffs on those applied in the market suggest that there will be sufficient willingness to pay for these services and that in reality it may be possible to charge higher tariffs for the same services offered through a formal and more efficient system. However, if tariffs remain at current levels, the project is still operationally sustainable.

Sustainability of the project relies strongly on revenue generating parameters such as the current population figures and the expected population growth rate and number of border patrons passing through the town. Sustainability also relies on the on-going cost parameters of the project, including the operation and maintenance costs of the proposed intervention. As these are calculated as a percentage of the total capital expenditure on the project, the percentage assigned to these costs as well as the total cost of the immediate investment are both important variables in determining financial viability as well as operational sustainability. Changes in these parameters are discussed in more detail under the sensitivity analysis.

Source: CRIDF CBA

- There is an overwhelming economic justification for the project, as indicated by the quantitative results of the economic appraisal in conjunction with the qualitative benefits arguments. In the short term, the provision of WASH infrastructure is fundamental to basic human needs. In the medium and longer term, WASH infrastructure will be catalytic to economic development and enhancing trade facilitation at a local (community) level, as well as for Malawi and the SADC region. The project is expected to result in significant improvements to the health of Mchinji residents, as well as border patrons, along with time savings, both of which indicate that the project should be implemented.
- The project alone is not commercially viable – the revenue generated by the project is not sufficient to cover the investment cost over the project life. This is not uncommon for water and sanitation projects of this scale, given that such projects are fundamentally providing a public good. Traditional financing is therefore not appropriate to this project; grant funding is required to cover the capital investment.
- The financial appraisal indicates that the project is operationally sustainable. Annual revenues generated exceed the annual operation and maintenance requirements of the infrastructure over the project life. Domestic demand, O&M costs, and water supply coverage are however critical to the operational sustainability of the infrastructure. As such, should these parameters vary significantly over time, CRWB must adjust the investments as appropriate.

Section 6: Institutional Assessment

Introduction

The purpose of this section of the report is to address the institutional component of the Mchinji Water Supply Project and in particular, the implications for the organisation responsible for management of this element once it is completed, namely the Central Region Water Board (CRWB). Of particular emphasis is the sustainability of the current and future institutional arrangements. The information in this section is a summarised version of the "Mchinji WSS – Strategic Institutional Assessment"[54], which is high level and primarily a desk study.

Legal and Policy Context

The key pieces of legislation and policy that impinge upon the water sector in Malawi is provided in **Table 46**.

Table 46 Relevant Policies and Laws for the Water Sector

Relevant Laws	Relevant Policies/ Manuals
Corrupt Practices Act, 1995	CRWB Accounting Manual, 2014
Employment Act, 2000	Environmental policy,1996
Environmental Management Act, 1996	Gender Policy, 2004
Forestry Act, 1997	National HIV & AIDS Policy, 2003
Labour Relations Act, 2000	National Water Policy, 2005
Local Government Act, 1998	Sanitation Policy, 2008
Occupational Safety, Health and Welfare Act, 1997	Water resources policy, 2013
Public Audit Act, 2003	
Public Finance Management Act, 2003	
Public Health Act, 1948	
Public Procurement Act, 2003	
Waterworks Act, 1995	
Water Resources Management Act, 2013	

In the context of this project, the most important are the Waterworks Act and the National Water Policy, which are contextualised below.

[54] CRIDF, Wilson, A. (2016). Mchinji WSS – Strategic Institutional Assessment

The Waterworks Act

The Waterworks Act[55] (WWA) provides for "the establishment of Water Boards, water areas, for the administration of such water areas, for the development, operation and maintenance of waterworks and waterborne sewerage sanitation systems in Malawi and for matters incidental thereto or connected therewith". Its content addresses the membership, powers and duties of Water Boards, the powers of the boards, services and supply of water, operation of waterborne sewerage, financial provisions, inquiries, dealing with offences, and by-laws (amongst other things).

It is clear from the WWA that the water boards are established as commercial organisations and the Act gives them the framework to act effectively in a commercial manner. It also sets out the fact that they are only responsible for urban areas, though the definitions of the intermediate peri-urban areas are often problematic in a number of countries.

The WWA defines that the CEO of the organisation is appointed by the Board and is responsible to the Board. The Board may; "make, construct and maintain all such works as are necessary and convenient for the purpose of creating, maintaining and extending waterworks for supplying water for domestic, public and business purposes, for the extinction of destructive fires, for cleansing streets, lanes, gutters and sewers and for all other purposes for which water and waterworks are supplied or applicable."[56]

The WWA also makes it lawful for a Board to suspend, withhold or diminish the supply of water for a range of circumstances, including insufficient supply or if there is a default in payment. Anyone within 100 metres of the Board's infrastructure can make application for a water supply. Any supply that is over 100 metres distant can also be supplied however this is only on specific terms and conditions.

The Board may, within its area and subject to prior approval of the Minister: "construct and maintain a public sewer", and "construct waterborne sewerage disposal works on any customary land or public land or land acquired or lawfully appropriated for the purpose."[57]

On the financial side, the Board is permitted to make levies on an annual basis and to inspect the premises receiving a water supply. In addition, the Board can make levies based on the quantity of water utilised. This also allows for different tariffs to be utilised for different types of customers and quantities of water. With respect to finances, the Minister may; "make rules prescribing the manner in which the Board shall make and submit estimates of its revenue and accounts, expenditure and revenue and capital accounts, provided for the submission by the Board of annual statements of account, and prescribing the financial year in respect of which estimates shall be made in the accounts submitted."[58]

The WWA defines offences and related fines. These include unlawful and negligent damage to waterworks, wastage of water and interfering with meters.

[55] "Waterworks Act No 17 of 1995", Government of Malawi
[56] "Waterworks Act No 17 of 1995", Government of Malawi
[57] Ibid
[58] Ibid

The WWA also sets out various by-laws addressing a range of issues including the supply of water to all premises, regulation of waterborne sewerage and other types of pollution, misuse or waste of water, the method and manner in which water may be taken from public standpipes, application forms for connections, regulation of fishing and regulation of sailing or boating.

The National Water Policy

The National Water Policy covers both water resources and water services although its primary emphasis is on water resources. It sets out policies, goals, objectives and guiding principles and addresses water resources management and development, water quality and pollution control, water utilisation, disaster management, policy monitoring and evaluation and institutional roles and linkages. When the policy was framed it was noted that whilst Malawi has more than adequate water resources, there was a lack of infrastructure that has been installed to optimise this. Additional challenges included high population growth, increased demand for industrial and municipal use, agriculture, irrigation, hydropower and other uses. The Vision set out in the policy is "Water and Sanitation for All, Always" and it was stated at the time that this vision was "based on the country's central policy of poverty reduction and economic prosperity and the fact that water is potentially the engine for social and economic development in Malawi"[59]. "This Vision endeavours to ensure that every Malawian has equitable rights to water and sanitation services for sustainable socio-economic development and enhancement of the country's natural ecosystems"[60]. It also sets out an overall Policy Goal as follows: "The overall national water policy goal is sustainable management and utilisation of water resources, in order to provide water of acceptable quality and of sufficient quantities, and ensure availability of effective and efficient water and sanitation services that satisfy the basic requirements of every Malawian and for the enhancement of the country's natural ecosystems" Specific policy goals are then set out for the following:

- Water resources management and development
- Water quality and pollution control
- Urban, peri-urban and market-centres water services
- Rural water services
- Agricultural services
- Irrigation services
- Navigation services
- Fisheries
- Hydropower generation
- Ecotourism and recreation
- Forestry
- Disaster management
- Policy monitoring and evaluation.

[59] "National Water Policy", Malawi Government. 2005
[60] Ibid

It also set out overall policy objectives and guiding principles. With respect to water services specifically, key policy objectives[61] include to;

- "Ensure that all persons have convenient access to sufficient quantities of water of acceptable quality and the associated water related public health and sanitation services at any time and within convenient distance";
- "Promote water and sanitation services pricing and charging systems but recognise water as both a social and economic good in order to institute cost recovery principles, promote user-friendly technologies to enable easy access to water and sanitation services by all manner of people".

Then in the guiding principles[62]:

- "All people shall have access to potable water and sanitation services to reduce the incidence of water-related diseases."
- "The water services shall be provided using appropriate, cost-effective technology that is sustainable in urban water services and for the rural areas technology shall conform to the VLOM concept."
- "Water development programmes shall be based on demand responses and demand-driven approaches, beneficiary participation and empowerment."
- "All water facilities shall be registered using a numbering system developed and adopted by the Ministry responsible for Water Affairs. The information shall be digitised."

Under "Water Utilisation", there are specific objectives set out for urban, peri-urban and market centres water services. These address issues such as; the need for effective and efficient management, development and utilisation, strengthening water pollution control, to encourage Public Private Partnership and to promote and develop appropriate management arrangements. Specific strategies include promotion of water conservation and catchment protection, incorporating local government and communities in the planning and development, regular rehabilitation of existing infrastructure, promoting community-based approaches, strengthening and supporting water utilities, establishment of proactive institutional and governance arrangements and promoting and instituting economically sensitive opportunities to encourage participation of small-scale water and sanitation service providers.

Institutional Arrangements

The Ministry for Agriculture, Irrigation and Water Development (MAIWD) is the key policy-making and oversight institution in the sector but was reportedly "considered functionally weak with frequently vacant district posts and a generally low institutional capacity to implement national water and sanitation policies"[63]. As the MAIWD is the nominal "sector leader" this is something of a concern.

The Water Boards are responsible for water services in the urban areas. In the rural areas Local Government is responsible for planning and coordination of water supply and sanitation. Malawi is undertaking a

[61] "National Water Policy", Malawi Government. 2005
[62] Ibid
[63] "Malawi Water and Sanitation Profile", USAID, March 2010

decentralisation process via the Ministry of Local Government. In urban areas there is an overlap between the District Authorities and the Water Boards in terms of the responsibility for sanitation. The USAID Water and Sanitation Profile reported that "monitoring and evaluation capacity is lacking in terms of sector status and performance"[64] and this is no doubt because the regulatory environment is weak. The same paper indicates that access to water supply may be understated (or overstated) because the unplanned peri-urban settlements are not accurately accounted for.

The Water Boards in Blantyre and Lilongwe have reportedly "struggled with weak governance and poor operational and financial performance"[65]. This is common with many utilities throughout Southern Africa that have struggled, in general, to fully cover operating costs through user-charges. As a result, there is insufficient funding available for a range of other functions such as refurbishment and capital investment. Interestingly also it is stated that "all Water Boards require capacity-building, restructuring, investment planning and capital (including new source development)"[66] though admittedly this source is somewhat out-of-date (circa 2008). Also highlighted was the need for increased customer focus, efficiency improvements and support in reaching low-income consumers. Apparently the use of waterborne sewerage systems is negligible, even in Blantyre and Lilongwe.

In the Malawi Sector Performance Report of 2011, it was reported that all the Water Boards have increased their water production, although the growth in water production has not kept pace with the urban population growth[67]. In addition, non-revenue water was commented upon as being of specific concern with the figures at that time ranging from some 26% to 47%. The recommendations from the Sector Report highlighted the need for continuous improvements by the Water Boards and to facilitate this there was a need for additional organisational and financial autonomy in order for them to move towards self-funding status. Also highlighted was the need for government institutions to pay their water bills. The need for a comprehensive strategy to serve the urban poor was also emphasised.

Historically donors have played a major role in terms of supporting the water sector in Malawi, particularly with respect to the capital available for new infrastructure and refurbishment. Major players have included the World Bank. European Union, UNICEF and AfDB.

The private sector implements projects, provides services, invests and utilises water resources however they have to operate under poor regulatory mechanisms. NGOs and civil society initiate and implement projects, and undertake public awareness and advocacy activities. Beneficiaries demand services and are involved in planning, construction supervision, operation and maintenance, and management of the facilities.

Since the establishment of the Regional Water Boards, there has been general improvement in the management of information on water availability use and management. The basic reason behind this state of affairs is because they have to maintain quality data which is important for making demand projections. The information from these water utilities is readily available and can be regarded reliable, consistent and accessible however caution needs to be taken for those schemes under the jurisdiction of the Water Supply

[64] Ibid
[65] Ibid
[66] Ibid
[67] "Malawi Sector Performance Report 2011", MAIWD. April 23, 2012

Branch of the Ministry of Irrigation and Water Development and those that have been handed over to communities to run by nongovernmental organisations.

Abstraction volumes by water utilities are available including those quantities that are sold to Water Users Associations (WUAs) since these are metered. This information can be regarded as reliable as the traded volumes are based on profit margins between the water utilities and the WUAs.

The Regional Water Boards inherited very old and inefficient water supply facilities from the District Water Supply Fund under the Ministry responsible for water affairs. Consequently high pressures cause pipes to burst leading to high water losses. Faulty meters and illegal water connections compound the problem further. Water losses are further experienced in public institutions where there are no incentives among the individuals concerned to minimize the use of water or to minimize water leakage by replacing faulty water appliances since they are not responsible for water bills but the institution. In the urban areas served by these Water Boards, the average amount of water lost or not accounted for ranges from 20 per cent to about 30 per cent of the total amount supplied while losses of up to 51 per cent have been reported by some Water Boards. Nonetheless, there has been improvement in information collection lately on water use and management in all the Water Boards which is also generally reliable.

At a local level, in terms of community interaction, significant use has been made of Water User Associations. These mechanisms are responsible for the management of water kiosks and communal water taps. They purchase bulk water from the utilities and sell to consumers at a profit, thereby offloading some of the responsibilities of the water utilities in the peri-urban areas. The fact that there are formal agreements in place between the two parties has reportedly assisted to reduce water losses.

Sector Performance

A sector performance comparison of Malawi, Kenya and Zambia between 1990 and 2010[68], is given in **Table 47**. This highlights that the Malawian water sector has performed very well, in spite of its many challenges. Malawi's performance in rural water and sanitation supply has been particularly impressive. Note the numbers represent percentage population having access.

Table 47 Comparative Water Sector Performance

	Access to improved sanitation RURAL 1990 – 2010	Access to improved sanitation URBAN 1990 – 2010	Access to improved water RURAL 1990 – 2010	Access to improved water URBAN 1990 – 2010
Malawi	41% - 57%	50% - 51%	33% - 77%	90% - 95%
Zambia	36% - 43%	62% - 59%	23% - 46%	89% - 87%
Kenya	27% - 32%	24% - 27%	32% - 52%	91% - 83%

[68] JMP 2010 World Progress Report

In the Sector Performance Report of 2011, it was noted that Malawi is water-stressed with some sources estimating that it could become a water-scarce country with less than 1000 m^3 of fresh water available per capita per year by 2015. “The majority of the demand is for competing agricultural uses rather than domestic use, making the development of effective integrated water resource management critical. Under the Vision 2020 medium economic growth scenario, the national total demand for water increases significantly (to) over 70% of the available surface water resource.”[69]

It was noted that while the MDG target of 80% was achieved in 2007 there appeared to have been little progress since then, and in fact a 6% decline in urban-dweller access was recorded since 2007. This is likely due to population growth as well as the urbanisation phenomenon. It is not clear what the progress has been since 2011 in terms of extending access. As is normally the case, the situation for sanitation was significantly worse, with approximately 50% having access. It was also noted in the Sector Report that all Water Boards have increased their water production although the growth has not kept pace with urban population growth.

Overview of the Central Region Water Board

The Central Region Water Board is one of five regional Water Boards, which cover the whole of Malawi. Two of the Water Boards, Lilongwe and Blantyre, are focussed on water services in their respective cities, while the other three Water Boards, Norther, Central and Southern, are more regional in nature and address the towns and market-centres throughout their areas of supply. The water boards do not address the rural areas.

The Central Region Water Board is the smallest in terms of the numbers of connections, and in terms of water production. It had 16 880 connections in 2011[70].

The economy of the CRWB area is largely agriculturally-based although there is some degree of tourism specifically within the area of Lake Malawi.

Governance

The Central Region Water Board is a statutory corporation established in 1997 under the Water Works Act, 1995 and is responsible to the Ministry of Agriculture, Irrigation and Water Development (MAIWD).

The Water Board is governed by a Board of Directors, appointed by the Ministry biennially. The Minister’s powers extend to appointing alternate members to the Board where nominated Board members are unable to attend any specific Board meeting.

The Act specifies that the Board should include a representative of local authorities (who should also nominate the Chairman), and eleven additional members, five of whom should represent the specific interests of ratepayers in the Board’s service area, the Secretaries for Health and for Education. Four additional members are appointed at the discretion of the Minister[71]. It is uncertain whether or not gender equity targets are in place and/or applied.

[69] “Malawi Sector Performance Report 2011”, MAIWD. April 23, 2012
[70] “Malawi Sector Performance Report”, MAIWD, April 23, 2012
[71] Government of Malawi (1995) Water Works Act of 1995

As at 30 June 2015, the Board consisted of a Chairman (assumed to represent local authorities), five ordinary members (assumed to be representatives of ratepayers from within the Board's service area), and four ex officio members comprised of the Secretaries for (i) Irrigation and Water Development; (ii) Local Government and Rural Development; and (iii) Treasury as well as the Comptroller of Statutory Corporations[72]

The Board is expected to ensure adherence to a five-year performance contract established via a corporate charter between the Board and the Malawian Government. The charter is intended to set out the duties and responsibilities of the Board to ensure that the CRWB achieves Key Performance Indicators for management and delivery, whilst the Malawian Government undertakes to "promote the continuing development of the Board as a successful business that is efficient, effective and economic in the discharge of its functions"[73].

Based on the Act, the CRWB has a clear mandate which requires it to provide water and sewage services in urban and peri-urban areas as well as market centres and small towns within the Central Region. Based on this, the core business of the Water Board currently is the provision of potable water for urban households, institutions and commercial consumption within eight of the nine districts located within the Central Region (Dedza, Dowa, Kasungu, Mchinji, Nkhotakota, Ntcheu, Ntchisi, and Salima). In doing so, it manages, operates and maintains the supply and distribution of water (abstracted from surface and ground water) and associated water works and infrastructure within the area. It does not, currently, provide waterborne sanitation services.

The CRWB provides services at twenty-two schemes across five zones throughout the central region which run across districts in some instances, or incorporates more than one district in other instances. These zones are (i) Kasungu (Mchinji, Kasungu, and Kochilira-Kamwendo); (ii) Mponela (Mponela, Ntchisi, Madisi and Dowa); (iii) Dedza (Dedza, Dedza Secondary School, Bembeke, Linthipe and Ntcheu); (iv) Salima (Salima, Senga-Bay also called Salima Lakeshore, Chipoka, Nkhota-kota, Lifuwu and Dwangwa; and (v) Mitundu (Mitundu and Bunda)[74].

Although the main office of the Water Board is situated in Lilongwe, it is not required to provide services to the city itself which is being supplied by Lilongwe Water Board[75].

While local authorities are held responsible for delivery to rural areas of Malawi, there is some diffusion of institutional mandates, roles and responsibilities within the rural context. This has led to the need for the CRWB to step in and offer support in respect of rural schemes within the parameters of available capacity.[76]

The list of directors holding office during the financial year ended 30 June 2015 were as follows:

- Eng. David Mzandu — Chairman
- Mr Wapona Kita — Member
- Mr John Kandulu (up to August 2015) — Member
- T/A Kachindamoto — Member
- Mrs Gloria Msosa — Member

[72] CRWB (2015) Strategic Business Development Plan 2015 -2020
[73] Government of Malawi (1995) Water Works Act of 1995
[74] Central Region Water Board Website at http://crwb.org.mw/
[75] Government of Malawi (1995) Water Works Act of 1995
[76] Personal Communication??

- Mrs Margret Nandolo Member
- The Secretary for Irrigation and Water Development Ex-official member
- The Secretary for Local Government and Rural Development Ex-official member
- The Comptroller of Statutory Corporation Ex-official member
- The Secretary to Treasury Ex-official member

Organisational Strategy

Vision

"Excellence in provision of potable water and water-borne sanitation services".

Mission

"To develop, operate, maintain and provide reliable water and water-borne sanitation services in an efficient, effective and sustainable manner in the interest of customers and other stakeholders".

Strategic Objectives

- **Financial** - To achieve financial sustainability and independence, with adequate financial reserves to initiate and fund projects of a capital nature, required for maintaining water supply and sanitation services provision effectiveness and growth.
- **Growth** - To expand services within existing schemes and to un-served areas in order for the Water Board to grow and reduce the risk associated with the existing customer profile.
- **Customer Focus** - To provide a high level of service to meet the needs of its consumers.
- **Operational** - To provide high quality and reliable supply of potable water to consumers in a cost effective and efficient manner.
- **Human Resource** - To develop appropriately skilled and motivated staff, who are able to provide effective and efficient services to the Board and its customers.
- **Environmental** - To manage the abstraction of water resources, disposal of water-borne sewage and the protection of catchment areas in partnership with local communities using sound environmental policies and practices.

External Strategic Challenges/Risks[77]

- ESCOM power outages;
- Delayed payment of water bills by customers;
- Natural disasters like drought, floods, earthquakes, etc;
- Deteriorating yields of raw water sources;
- Land and water sources encroachment;
- Unfavourable political /economic environment;
- Possible failure or delay of major projects; and

[77] "Strategic Business Development Plan 2015 - 2020", Central Region Water Board, November 2015

- Government bureaucracy manifested in delayed approvals, etc.

Internal Strategic Challenges/Risks

- Inadequate capacities of water supply infrastructure;
- Fraud, bribery and corruption;
- Possible failure or delay of major projects;
- Ageing of water infrastructure;
- Ineffective contracts management;
- Mis-procurements;
- Inadequate project management skills;
- Inadequate human resources; and
- Inadequate management information systems

The most challenging thing about strategy is not the development of the strategic plan but the implementation thereof. This is often where strategic planning succeeds or fails and speaks to the concept of "strategic management" as opposed to strategic planning. A key part of this is action plans/workplans to support the high level strategic plan that spell out the critical aspects such as "*what?*, *how much?*, *by when?* and *who?"*.

CRWB have reasonably comprehensive documentation in this regard. Tables highlighting targets and performance, for example, are illustrated in **Table 48**. There is also evidence within the relevant documentation that this is at least reviewed annually (. Ideally implementation plans should also be discussed by top management on a regular basis, perhaps every one to two months with a major review annually.

Table 48 Strategic Outcomes and Targets[78]

	Strategic outcomes	Strategic targets
1	Increased water supply coverage	1.1 Increase annual production levels from 7 million cubic meters to 10.0 million cubic meters by 2020
		1.2 Extend water supply pipe network length by 528 km by 2020
		1.3 Expand services within existing schemes and un-served areas by 12,850 new water connections by 2020
		1.4 Establish two (2) new water service schemes by 2020
2	Quality and reliable water supply and water borne sanitation services that meet customer demand	2.1 95% of treated water samples contain zero coliform (WHO & MS guidelines)
		2.2 Provide water services in all schemes 22hrs/day by 2020.
		2.3Continuously protect the environment in the water areas
3	Improved organizational	3.1 Implement 2014 Functional Review recommendations

[78] Ibid

	Strategic outcomes	Strategic targets
	performance	3.2 Develop and implement a Strategic Human Resource Plan by June, 2016
		3.3 Review and implement conducive Terms and Conditions of Service by 2018
		3.4 Develop and implement a Performance Management System [PMS] annually
		3.5 Review transport and fleet management policy by Dec, 2015.
		3.6 Develop and implement Corporate Monitoring and Evaluation system by Dec, 2015
		3.7 Establish an integrated corporate information and communication management system by 2020
		3.8 Develop and implement a Quality Management System (QMS) aligned to ISO 9000 by December, 2016
		3.9 Develop and implement an Environmental Management System (EMS) aligned to ISO 14000 by June, 2017
		3.10 Review and implement an effective procurement system by 2019
4	Sustainable revenue generation and collection	4.1 Increase in sales volume by 5% annually
		4.2 90% sales collection efficiency achieved by July 2016 and maintained annually
		4.3 60 days creditors payment period achieved by 2017
		4.4 Pilot pre-paid water meters by June, 2016
		4.5 Pilot outsourced meter reading by June, 2016
		4.6 Improve Return on Capital Employed to 5% by 2019
		4.7 Improve return on Revenue/Sales to 20% annually
5	Improved the corporate image	5.1 Establish customer service units in all schemes by June, 2020
		5.2 Enhance public relations by December, 2020
		5.3 Construct and renovate office buildings and accessories by 2017
		5.4 Enhancement of Audit services

Table 49 Summary of Performance at the end of 2014/15[79]

Parameter	Unit	Quantity
Population	No	261,876
Population served	No	181,524

[79] Integrated Strategic and Implementation Plan 2014 – 2019, CRWB

Coverage	%	69
Number of Connections	No	19,161
Production	m^3	6,463,567
Sales	m^3	4,907,471
Unaccounted for Water	%	24
Chlorine usage	kg	13,724
Specific chlorine usage	mg/l	2
Coagulant usage	kg	18,736
Power Consumption	kWh	2,676,848
Power Usage	kWh/m^3	0.4

Financial

The total CRWB revenue for 2014/2015 was approximately 2,016 million Malawian Kwacha (MWK), which is equivalent to USD 2.85 million. This translated into an operating profit of MWK 253 million and a small net profit of MWK 38 million. The operating income increased dramatically compared to the 2013/14 year, with a figure of 48% recorded. This was largely due to drastic tariff increases approved by the Minister (MAIWD) and not an increase in the volume of water sold. Operating expenditure increased almost commensurately by 40%. It would appear that this was largely due to four reasons:

- A process of "salary normalisation/equalisation" across all of the water boards.
- Increase in electricity tariffs
- Increased depreciation
- Increases in the cost of chemicals and other key materials

Salaries, wages and benefits represent 35% of expenditure, which is a reasonable ratio. Administration and general expenses at 30%, which is slightly on the high side, though it is not clear how this is defined/calculated.

It is notable that CRWB recorded a depreciation amount of MWK 167 million in 2014/15. This is a best practice approach and is certainly not standard practice amongst utilities in southern Africa. This amount also showed a significant increase from 2013/14, in line with an increased capital expenditure in 2014/15.

CRWB's current ratio for 2015 is 1.05, which is within the acceptable norm of 1.0 to 1.5.

The financial performance of CRWB over the last four years is summarised in **Table 50**.[80] This demonstrates a huge growth in revenue over this period but once again this appears to be mainly as a result of increases in tariffs as sales volume has only increased marginally in the last five years. Operating income and net profit also show improving trends during this time, as does the current ratio.

Table 50 Financial Performance over the Last Four Years (Audited)

[80] "End of Year Review for the Financial Year Ending 30 June 2015", Central Region Water Board

Financial Performance Targets	2014/15	2013/14	2012/13	2010/12
Total Revenue (MK)	2,016,109,000	1,405,091,000	1,320,962,000	875,687,000
Change in Revenue	43%	6%	51%	20%
Total Expenditure (MK)	1,875,672,000	1,310,721,000	1,259,207,000	860,894,000
Change in Expenditure	43%	4%	46%	31%
Earnings before interest and tax (MK)	140,437,000	94,370,000	6,1755,000	14,793,000
Net profit/(loss) after tax (MK)	(166,291,000)	202,353,000	54,441,000	7,338,000
Return (Net profit) on Total Assets (%)	54	2.7	1.1	0.3
Current Ratio	1.05	0.97	0.75	0.62
Profit (Net) Margin/Return (%)	-8.25	14.4	4.1	0.84
Debt collection days	87	137	118	100
Compliance with approved budget (%)	93	90	100	100
Utilisation of allocated funds (%)	98	97	98	97

Tariffs

The tariff schedule trend and projection are showing very high annual increases, 20% or more, in tariffs between 2015/16 up to at least 2019/20. These are all at 20% or more. It is not clear at this stage whether this approach has been approved by MAIWD or whether these projections reflect only the proposals of CRWB.

The tariffs are structured on a stepwise basis, which is a best practice approach. The first step is often known as the “lifeline tariff” step as it is subsidised in many southern African countries. This is not the case however in Malawi (though this may reflect the significantly higher administrative costs often inherent in running communal systems such as water kiosks). Also apparent is that the tariffs for institutional and commercial customers are much higher and hence subsidise domestic users. It is debatable whether this is the ideal approach, though it is common practice.

Revenue Management

The increasing trend in the numbers of customers is shown in

Table 51.

Table 51 Numbers of Customers (Active Connections)

Water Board	2006/07	2007/08	2008/09	2009/10	2010/11
Northern (NRWB)	18,236	22,160	26,474	29,566	31,765
Central (CRWB)	12,540	13,378	14,407	15,766	16,880
Southern (SRWB)	-	-	-	-	-
Blantyre (BWB)	35,470	37,613	38,968	37,741	40,000
Lilongwe (LWB)	28,881	30,740	33,845	36,822	39,626

Source of data: Water Board reports.

The figure for debtors' days showed a declining trend from 93 in 2010/11 to 137 in 2013/14 however this improved dramatically in 2014/15 to 87 days. Interviews with senior CRWB staff have indicated that the biggest challenge in terms of revenue collection is with state facilities/institutions. Apparently the reason for the big improvement in 2014/15 was due to a major payment of arrears by the State.

It is apparent that there is a big demand for private connections with CRWB installing an additional 4 163 in 2014/15 alone. Not only do these provide a higher level of service but they will also result in improved sales figures for CRWB. It was reported that there is some degree of consumer resistance to the CRWB connection tariff however subsidy schemes have apparently been very successful.

A common problem with many utilities in Southern Africa is unmetered connections. It is not clear to what extent this is a problem for CRWB.

Operation and Maintenance Costs

In 2011 the "Operational Ratio" for CRWB was reported to be 0.82[81], whereas the ideal figure should be closer to 0.5. It is assumed that this figure has improved somewhat since that time however the method used for the calculation is not clear.

Expenditure on electricity, plant and vehicles and chemicals were at 11%, 9% and 2% respectively. As is common with most, if not all, southern African countries, the reliability of electricity was reported to be a major operating problem for CRWB. The use of electricity appears to be a key indicator with a target of 0.4 kW/m^3 being set[82].

Organisational design and human resources

Management Structure

By virtue of its status as a statutory institution, the CRWB has prescribed organisational autonomy. While the internal management function of the CRWB resides with its Board of Directors, as well as its Senior Management, it is dependent on the Minister (Agriculture, Irrigation and Water Development) for approval of

[81] "Malawi Sector Performance Report 2011: Irrigation, Water and Sanitation", Ministry of Agriculture, Irrigation and Water Development
[82] "End of Year Review for the Financial Year Ending 30 June 2015", Central Region Water Board

its business plans that guides it in conducting its own affairs and meet its mandated responsibilities. It is therefore free to make decisions within the context of its Organisational Strategy and associated business plans. This includes organisational aspects such as internal institutional policy, institutional planning and associated budgets, pay and incentives and control and deployment of personnel.

The Water Board is managed by the Chief Executive Officer and has two main directorates namely that of Technical Services and Finance and Administration. Both Finance and Administration and Technical Services are headed by a Director. A separate Management Services Division has been established which provides home to four functional management support focus areas related to Information Technology, Environmental Services, Internal Audit Services and Procurement.

Management Functioning

The most recent revision of the CRWB Business Plan[83] demonstrates that management has the ability to fully operationalize fundamental components of delivery. Elements of underachievement have been identified and incorporated as part of a structured and appropriate action plan. The fact that the Business Planning process has taken on board actions that speak of foresight and the need to address essential components of functioning such as asset management, routine maintenance, cost recovery and customer care speaks of fundamental understanding of the business and what is required, as well as management capacity within the Organisation.

There has been well thought through and structured translation of the Organisational Strategy into the institutional management procedures and processes of the Board, as well as its organisational structures and outputs. The CRWB has indicated that it will ensure comprehensive monitoring of annual outputs and targets via strategically aligned Performance Management Plans and Budgets (PMBPs)[84].

The CRWB has shown performance levels that are – for the most part - equivalent to the other Water Boards when measured against headline and other water indicators set by the Ministry[85].

Non-Revenue Water (NRW) serves a headline indicator for the Ministry as it is deemed to be “one of the best means of assessing Water Board or utility efficiency, in terms of reducing leaks and achieving higher percentages of water bills paid. So by reducing NRW it means more water is available to be sold to customers and increased revenues are achieved”[86]. The CRWB has 26% NRW, versus the Northern Water Board at 33%, the Southern Water Board at 28%, the Blantyre Water Board at 47% and the Lilongwe Water Board at 36% (against a Ministry benchmark of 25%).

The World Bank points out that all regional water boards (including the CRWB) demonstrate relatively poor financial performance and demonstrate “moderately satisfactory” performance across a number of

[83] CRWB (2015) Strategic Business Development Plan 2015 -2020
[84] Ibid
[85] Ministry of Agriculture, Irrigation and Water Development (2012) Sector Performance Report 2011: Malawi Irrigation, Water and Sanitation
[86] Ibid

assessment criteria[87]. The Bank does not differentiate the performance of each of the regional water boards, instead stating that performance was more or less similar across the three Boards (with some variation up or down depending on indicator). The following key strengths were identified for the CRWB (as part of the group) by the Bank. The water boards[88]:

- Demonstrated a commitment to achieving the development objectives of the infrastructure services project. This commitment was "demonstrated through the ability to overcome the challenges of design and implementation of a wide range of activities scattered across" various market centres in various growth corridors;
- Demonstrated fiduciary responsibility, including ensuring compliance with financial management requirements and procedures, good governance, provision of counterpart funding, compliance with procurement as well as covenant requirements as well as through the provision of counterpart funding as agreed;
- Collaborated with other implementing entities in a number of instances to ensure the successful coordination of activities across and between sectors;
- Built constructive relationships with stakeholders, including the Bank itself and the Ministry of Economic Planning and Development;
- Ensured adequate reporting to stakeholders;
- Ensured that adequate transition arrangements for routine operation and maintenance of the infrastructure, realised via the project investments, were in place.[89].

In addition to the above, the following aspects speak of accountable management functioning[90]:

- The Business Plan is closely aligned with the Organisational Strategy, yet is directly linked in to previous experience, a review of past progress, a strategic analysis of the internal as well as external environment, including the specific constraints posed thereby, as well as the requirements set by the various applicable regulations. In addition, the process to develop the Business Plan was supported by an inclusive consultation process;
- The CRWB appears to understand the need to ensure a constructive customer orientation. A Customer Services Charter has been put in place which includes customer service standards and procedures on customer complaints, new water connections, disconnections and reconnections. The Business Plan makes provision for the introduction of Water User Committees (WUCs – also known as Water User Associations) in a number of towns within the region to act as an "administrative bridge between CRWB and the community"[91]. interactive processes to understand and meet customer requirements and associated mechanisms for regular interaction and communication. A Customer Management System has been put in place to promote an improved customer service interface;

[87] World Bank (2013) Implementation Completion and Results Report (IDA-H2420) on a Grant to the Republic of Malawi for an Infrastructure Services Project (Report No: ICR2467)
[88] Ibid
[89] World Bank (2013) Implementation Completion and Results Report (IDA-H2420) on a Grant to the Republic of Malawi for an Infrastructure Services Project (Report No: ICR2467)
[90] CRWB (2015) Strategic Business Development Plan 2015 -2020
[91] Ibid

- The CRWB has systems in place to ensure that operational and procedural controls are effective. As far as can be ascertained, most if not all of the major sections and divisions of the Board have a documented policy and procedure manual in place to guide operations in line with Board requirements. At the same time, the Business Plan notes that a number of policies and associated procedural systems will need to be developed or require revision (e.g. those related to ISO compliance systems);
- The importance of ensuring that Board initiates the supply of sanitation services is understood and has been included as a strategic focus area within the Business Plan;
- Revenue collection is seen as an important prerequisite for ongoing functioning and the Board has taken on board the need to ensure improved management of non-payment and delayed payment, in particular in respect of government institutions;
- Non-Revenue Water is understood to be a priority focus area, and mechanisms have been introduced to improve infrastructure maintenance, metering and leak responsiveness.

Based on the initial review of management capacity as described above, as well as implementation at operational level, it may be concluded that the Board demonstrates solid management functioning.

Organisational Structure

The Organisational Structure shows a clear and coherent alignment with the Organisational Strategy, including aspects of subsidiarity. In addition, the organisational development and human resources requirements described in the Business Plan align with the operational realities of the Board, including that there is an understanding of the associated key skills sets that will be required.

The Technical Services Directorate is comprised of separate divisions for (i) Planning, (ii) Plant and Maintenance, and (iii) Construction and Distribution, each manned by an Engineer with the qualifications and experience required for oversight. In addition, there is a Project Implementation Unit with its own manager, as well as a Division providing zonal oversight, which makes provision for three zone managers to be employed.

The Finance and Administration Directorate is composed of divisions for (i) Human Resources, (ii) Management Accounting, (iii) Revenue Accounting, and for (iv) Administration and Public Relations. Each division is headed by a manager.

The management support sections related to Information Technology, Environmental Services, Internal Audit Services and Procurement Management under the Management Services Division are managed by 'officers' who appear to be appointed at professional management level.

Staffing Numbers

The CRWB reported having a staff complement of 332 people at the start of the 2015 planning year[92]. The following Pie Chart sets out the Staff numbers per functional section.[93]

[92] CRWB (2015) Strategic Business Development Plan 2015 -2020
[93] Ibid

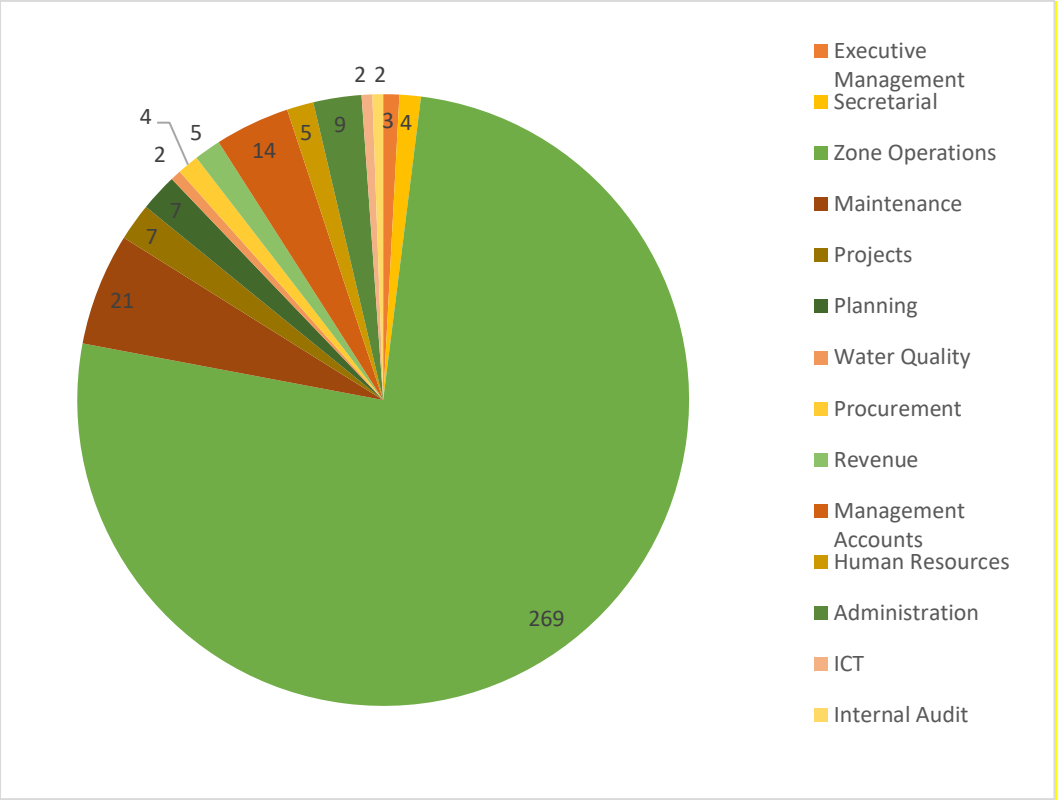

Figure 26 Staff per Section

Staff to Connection Ratio

The current staff to connection ratio could not be calculated, but the CRWB intention is to improve this ratio to 15 per 1,000 connections by 2017[94].

CRWB Organogram

The current CRWB Organogram is attached in **Annex E1**.

Staff turnover

From various reports and discussions, it appears that the CRWB shows stability in respect of staff turnover. The Business Plan reports that the Board has managed to keep the turnover figure at a maximum of 1%[95].

[94] Integrated Strategic and Implementation Plan: 2014 – 2019
[95] CRWB (2015) Strategic Business Development Plan 2015 -2020

Human Resources Management

A brief overview of the existing human resources management arrangements as well as systems and processes described in the Business Plan allow the following inferences to be drawn[96]:

- There is a well inculcated point of departure that appears to value the Board's human resources base. This is borne out by the fact that the SWOT Analysis identifies the Board's employees as a particular strength of the Organisation. It sees motivated, committed and appropriately skilled personnel as a fundamental prerequisite for becoming and "efficient, effective and sustainable organisation."
- The HR Division is expected to be staffed by an experienced HR Manager, although the position is currently vacant;
- It appears that workforce data and information are routinely collected and used for HR planning, including for periodic staff projections. Key staffing information is available and reports regularly prepared and, apparently, shared with management;
- The Business Plan states that a Strategic Human Resources Plan will be developed for implementation and will address aspects related to strategic recruitment and retention of competent personnel as well as succession planning "within the framework of sound administrative policies and guidelines;
- There appear to be policies, mechanisms, and practices based on a comprehensive Performance Management System in place or being put in place to ensure performance appraisal and management, including performance based incentives;
- From available evidence it is clear that there are comprehensive job descriptions, standards and performance expectations in place, and that this includes a statement relating to the minimum academic and skill requirement for specific posts.

Training Programmes

It is clear that there is an understanding of the need for training and capacity building of personnel. This is deemed to form the foundation for improving work related competencies as important components of job specific proficiency and the associated optimal utilization of personnel. As well, to ensure that skills sets are continuously upgraded in order to ensure adaptation to ongoing changes in the technology environment.

The Business Plan identifies a number of specific training initiatives that are required. These are:

- Water quality testing;
- Laboratory functioning and procedures;
- Meter reading;
- Zonal water testing;
- Customer services and support.

[96] Ibid

It is not known how this component is practically addressed within the workplace, including if and how training needs assessments are undertaken and the manner in which staff training is assessed in order to ensure that competency outcomes are aligned with the specific objectives for current and future organisational needs.

Decentralised Service Delivery

The CRWB uses Zonal Centers as a directed approach to ensuring decentralised capacity related to technical issues, meter reading and maintenance as well as collection of payment. From available information, deployment of human resources is largely centered around premises attached to water schemes (mainly gravity fed). These centers allow the Board to provide a dedicated resource base closer to area of operation in smaller towns and market centres.

It provides services at twenty-two schemes across five zones throughout the central region. The zones have not been based on district related zones and, therefore, runs across districts in some instances, or incorporates more than one district in other instances. These zones are (i) Kasungu (Mchinji, Kasungu, and Kochilira-Kamwendo); (ii) Mponela (Mponela, Ntchisi, Madisi and Dowa); (iii) Dedza (Dedza, Dedza Secondary School, Bembeke, Linthipe and Ntcheu); (iv) Salima (Salima, Senga-Bay also called Salima Lakeshore, Chipoka, Nkhota-kota, Lifuwu and Dwangwa; and (v) Mitundu (Mitundu and Bunda). The CRWB offers decentralised services to each of the zones to allow "timely decisions and flexibility in tackling issues specific for their zones" [97].

Due to the size and nature of its operations, the CRWB provides a human resources complement at scheme level as well as in respect of the various zones. Based on the Board's Organogram, the following dedicated Zonal staff can be identified.

Table 52 Staff of the Various Zones

POSITIONS	NUMBERS
Scheme Managers	9
Zone Accountants	4
Bylaw Inspectors	6
Electricians	5
Account Assistants	4
Billing Clerks	4
Stores Clerks	6
Cashiers	11
Purchasing Assistants	4

[97] Central Region Water Board Website at http://crwb.org.mw/

POSITIONS	NUMBERS
Plumbers	22
Assistant Plumbers	2
Plant Operators	114
Plant Servants	10
Security Supervisors	11
Drivers	14
Messengers	12
Skilled Labourers	7

The Board has indicated that, in addition to building new offices at the Chipoka and Dwangwa schemes, it will ensure the renovation of scheme offices at other schemes to ensure proper off-site workplaces for members of staff. In addition, it is the intention of the CRWB to establish and staff Water Quality Zonal Offices to ensure that it is able to meet key objectives of its mandate.

It is uncertain how it will establish and manage its obligations related to sanitation services delivery on a decentralised basis.

The CRWBs intention to establish Water User Committees (WUCs), also termed Water User Associations, in a number of zonal towns where it is responsible for supplying water is a significant initiative aimed at ensuring a more coherent institutional arrangement for decentralised services delivery to zones. The CRWB has indicated that it is the intention that such "WUCs (will) act as an administrative bridge between CRWB and the community."[98]

Mchinji Town and Border Post

Mchinji Boma or town (previously known as Fort Manning) lies in the Mchinji District and is 12 km east of the border to Zambia (Mwami) and some 110 km from Lilongwe[99]. The District, one of nine districts within the Central Regional Water Board area of jurisdiction, forms part of the CRWB Kasungu Zone decentralised service centre.

The WES Network Study further notes that Mchinji Water Department has shown serious staff capacity deficits, including that there was a need to second a Health Department official to act as a District Water Officer for a period of time between 2010 and 2012 until an appropriate candidate could be appointed.[100]

At the time of the study in 2012/2013, the WES Network found that the Department had four technical staff consisting of the District Water Officer and three monitoring assistants as opposed to the requisite 11 staff

[98] CRWB (2015) Strategic Business Development Plan 2015 -2020
[99] https://cisemw.wordpress.com/2012/11/05/mchinji-district-where-we-are/
[100] Ibid

members. The Mchinji District Water Department has an extensive mandate that includes the following, inter alia[101]:

- Provide support to each Traditional Authority (TA) in its area through the allocation of a dedicated monitoring assistant;
- Actively support and assist communities in the District to both plan as well as manage their water supply;
- Participate - as key role-players – in the District Coordination Team (DCT) which deals with all water related issues within the District;
- Prepares development plans;
- Undertakes all District water related administrative functions, including keeping records and inventory of rural water supplies and water resources management (a task that is to be extended quite extensively based on sector reforms related to IWRM and ground water management); and
- Provides direct assistance to communities in the District through WASH sensitization, training and management of new infrastructure development.

As the District Council has not appointed Sanitation Officers, the District Water Officer is required to fulfil this function as well[102].

The CWRB has a dedicated number of staff members at its Mchinji Works, which includes plant operators, a security supervisor, skilled labourers as well as plant 'servants'. It appears that, logically, these individuals would be situated at or close to the Mchinji Works itself. It is not certain how many individuals are currently employed at local level. While the CRWB Organogram indicates that there are dedicated posts for scheme managers, zone accountants and inspectors, it is not clear whether or not these staff members are situated in Lilongwe itself or are deployed in the field[103].

Asset Management

CRWB produced 7,464 Megalitres of water in 2014/15 which was a 5% increase over the previous year. This represents on average an output of approximately 20 Megalitres a day. The increase in supply was primarily due to new capital expenditure projects at Kasungu, Mitundu, Kochilira-Kamwendo, Mponela, Lithipa and Salima Lake Shore Schemes. These were all part of the National Water Development Programme.

The current non-revenue water was reported to be 27%, which is a slightly poorer performance than what has been achieved by CRWB in the past. Historically CRWB has been the best-performing of the Water Boards in Malawi in this regard (see

[101] Mchinji District Coordinating Team and UNICEF (2010) Mchinji Water Atlas 2008 A Status Report on Rural Water – Based on the District Management Information System for Rural Water Supply, Sanitation and Hygiene

[102] Water and Environmental Sanitation Network (WES Network) March (2013) Water Sector: A Marginalised Priority – Declining Levels of Financing in the Water, Sanitation and Hygiene (WASH) Sector in Malawi 2012/2013. Water Supply and Sanitation Sector Budget Analysis.

[103] CRWB (undated) Organogram.

Table 53).

Table 53: Non-Revenue Water (Headline indicator)

	2006/07	2007/08	2008/09	2009/10	2010/11
Northern	36%	33%	30%	28%	33%
Central	22%	24%	25%	24%	26%
Southern	-	-	-	31%	28%
Blantyre	53%	45%	49%	48%	47%
Lilongwe	28%	30%	36%	36%	36%

CRWB experienced significant operational challenges during 2014/15. In particular, a number of key water sources were under significant stress, though whether this is due to the drought or increase in demand is not clear. It was also reported that there was unprecedented Escom power supply outages in all schemes. The CRWB undertook significant remedial measures to address drought and power related problems in areas such as Kasungu, Mponela, Salima Lake Shore and Kochilira- Kamwendo. These are all surface-water schemes, while additional work was also undertaken to enhance groundwater sources.

It is a generic problem in Malawi that water resources infrastructure in general is underdeveloped. Malawi as a whole has plentiful water resources but it is the infrastructure to develop these, such as dams and related infrastructure that is underdeveloped. In addition, most of the water resources in Malawi require some degree of pumping to access and clearly this is nearly always the case with groundwater sources. This means once again that CRWB is reliant on power supplies, which are not completely reliable.

CRWB has 22 Schemes in total and the maintenance section is responsible for installing, servicing and repairing the waterworks assets related to these. This includes treatment works, pumps, motors, electrical switchgear, reservoirs and associated infrastructure. Property maintenance, on the other hand, has been transferred to the Admin Office and this includes maintenance of offices and related buildings as well as institutional houses. It was reported that most of this was done in-house apart from specialist functions that were outsourced.

Water Quality Management

In terms of the clarification processes CRWB uses two chemicals, namely Algaefloc 19S and aluminium sulphate. CRWB reported significant problems with the Dowa scheme in terms of high levels of turbidity. This is because the scheme extracts raw water from the Mganji River.

In terms of disinfection, CRWB exclusively uses granular HTH to disinfect and clarify water in all its schemes. HTH is a very practical material in terms of storage and transportation, however it is not always effective in terms of being able to manage dosing and the associated process control. This can result in wastage and/or unreliable results.

In terms of water quality monitoring, it was reported that levels of chlorine were monitored on a daily basis. CRWB has a quality control section which is based at the Kasungu Scheme and this has an overall oversight function in terms of water quality management. They monitor both raw water samples and treated water samples for chemical and microbiological safety, in terms of the standards set by the Malawian Bureau of Standards and the World Health Organisation Guidelines on Drinking Water. Monitoring of raw water was

effected by some 21 samples during the year that were subjected to full bacteriological and chemical analysis, so as to assess levels of pollution and raw water quality. Generally these were considered to be acceptable although some schemes experienced high levels of iron and manganese, and others high turbidity during the rainy season.

On the treated water side, it was reported that all units within CRWB schemes monitored free residual chlorine at established sampling points. Other critical parameters monitored included turbidity, pH and bacteriology. During the year, samples exceeded acceptable limits on colour and turbidity in Bembeke, Dwanga and Ntcheu. It was reported that this was due to problems with the raw water source.

It is notable that the CRWB is active in terms of work on catchment management and protection in order to protect its raw water sources. It is not common for water utilities to be active in this arena though it has obvious implications and potential benefits. From this point of view it is certainly laudable. This work included reforestation of selected catchments, in the Kasungu-Chitete Dam buffer zone, Mtenjamanga, Chimwankhuku and Kochilira-Kamwendo, in the Mchinji, Dwanga and Bembeke's-Natchilambo Stream. This work also included land-preparation, planting new woodlots and managing some old plantations. A total of almost 17 000 new tree seedlings were planted, adding to the existing almost 60 000 trees; a total area of 141 ha was addressed. The CRWB are also active in the production of seedlings and related nurseries producing a number of indigenous species.

Infrastructure Coverage

There is currently no piped water supply to the community as a whole at Mchinji Border, apart from the small scheme installed by MRA. Apparently this is also somewhat unreliable.

With regard to sanitation, the author does not currently have the relevant statistics however unimproved pit latrines are likely to be the norm, with perhaps a small number of VIPs and on-site water borne systems respectively. Of particular concern, is the plight of travellers crossing the border post who do not have designated safe sanitation.

The problem with unimproved pit latrines is that they have limited facilities for odour and fly control. In addition, few are likely to have hand-washing facilities at the toilet.

Operations and Asset Management

Perusal of CRWB's reference documents would appear to indicate that it has sufficient operational and asset management capacity for its normal operations, although specific reference is not made to asset registers or specific asset management plans per town and surrounds. There is clearly recognition of the importance of good quality operation and maintenance and the need for regular refurbishment of key assets, though the formal discipline of asset management (with all of its concurrent benefits) may still be in its infancy.

Historically CRWB has performed better on NRW than the other water boards in Malawi. For most of the last 5 years their NRW figure has been of the order of 25%, though this increased slightly to 27% in 2014/15. It was

reported that this was due to “frequent pipe bursts, old tank leakages, illegal connections, possible metering inaccuracies” and various “NWDP II project activities”[104]. At this stage the author is not aware if CRWB have a formal NRW strategy (or dedicated NRW staff). NRW is not an easy thing to reduce meaningfully and in general requires a long-term commitment, dedicated resources and a multifaceted strategy.

CRWB is reliant on a mix of surface water and groundwater schemes. To some extent these require different types of skills that need to be mastered by operational staff. Typically groundwater requires less onerous treatment processes but maintenance of the borehole and related pumping equipment and over pumping is often a threat if proper monitoring is not undertaken. It is of note also that difficult hydro-geological conditions are present in some parts of CRWB’s area of supply.

At this point the author does not have information on the treatment facilities that CRWB is responsible for and it may be that these are quite simple in nature. Poor or weak process control is a common problem with treatment facilities for many utilities. Improvements in this area will mean that plant operators (or process controllers) will have “real time” understanding of how the treatment process in proceeding through each step of the process. It will require investments in key instrumentation but some of this is “off the shelf” and need not be very expensive. It will also require investments in training for the operators. The net result will be an optimised treatment process which will almost certainly result in less expenditure on chemicals (and even power) and also a much more reliable and safer end product.

A very important part of best practice asset management is planned maintenance. This is a typical area where weaker utilities fall down as maintenance tends to be governed more by crisis management than a more measured and planned approach. At this stage the author is not aware of CRWB’s approach to this issue. It should be emphasised however that a planned maintenance approach is essential if levels of reliability and customer service are to be improved on a sustainable basis. It can also certainly be argued that in a situation where there is a lot of aged infrastructure, as is the case here, then a major planned maintenance programme is even more important to try and keep the agreed infrastructure operational. Planned maintenance can also lead to reduced costs because it results in enhanced effectiveness.

It is clear that CRWB are in something of an expansion phase in terms of not only new schemes but also upgraded and refurbished schemes. The same applies to new connections with a massive increase in 2014/15. This is all well and good as it should lead to improved levels of service and higher sales. It is important to emphasise however that there should be a commensurate increase in staffing, operating budgets, spares, vehicles and other relevant equipment. In addition, asset registers and asset management practices need to be improved/upgraded to capture and manage the new assets.

Though CRWB has the general capability to manage the operations and maintenance, it is suggested that an assessment should be made of its asset management systems and the data they contain. This should verify, for instance, the level of detail in their asset register and whether it contains descriptions of the condition of each asset, its maintenance needs and history, its remaining useful life, its replacement value and whether each has been allocated a unique identifying code.

[104] “End of Year Review for the Financial Year Ending 30 June, 2015”, CRWB

It is also important that the CRWB staff that shall oversee the operations should undergo training on operation and maintenance procedures with emphasis on aspects such as water balances, water restrictions, response times, wear and tear, stocking of critical replacement parts and septic tank construction. This should have a strong on-site emphasis. CRWB should also have the ability to respond rapidly to emergencies and to stock critical replacement parts at this location.

Existing Mchinji Town Scheme

The CRWB Mchinji Water Supply Scheme serves approximately 2,400 customers and has a conventional water treatment facility. Water supply to customers within Mchinji Boma was improved as part of the Malawi District Water Supply Phase III (DWS III) project (jointly funded by the African Development Bank (AfDB) and the Government of Malawi), which supported the provision of individual metered connections to urban residents where this could be afforded, as well standpipes for poorer residents.

Up until fairly recently, the Mchinji Waterworks was served by the Chimwankhuku and Mtenjemanga streams, with an average water production of 1,600 m^3 per day.[105]. Changes in the average annual rainfall volume and associated falls in the average production from these two sources to just over 1,400 m^3, necessitated the construction of a 'run-of-the-river' concrete intake for the Scheme from the Ludzi Stream during 2013[106], which increased daily yield to just over 1,700 m^3. This initiative was internally funded by the CRWB.

An additional project to ensure improved water supply services to the Mchinji Water Supply Scheme has been budgeted for by the CRWB under its Long-Term Capital Investment Plan. The proposed project will involve the design and installation of an additional intake area on the Bua River as well as the establishment of a Pump house and transmission main to the Mchinji Water Treatment Plant[107].

Despite attempts to ensure adequate supply for Mchinji, intermittent water shortages are experienced, mainly during the dry seasons. Although the CRWB has ascribed such shortages specifically to poor rainfall, the Mchinji District Water Officer, Mr. Chilim'madzi, has indicated the belief that the reduced water flow has resulted from blockages along the pipeline. An additional factor identified as causing a significant negative impact on water availability has been said to relate to pipes being broken along the line in order to access water for agricultural purposes[108].

In addition to water quantity issues, a Piped Water Assessment undertaken by the Malawian community-based Organisation Kalondolondo[109] aimed at assessing CRWB related services delivery, inter alia. In addition to unhappiness with the CRWB about the intermittent water supply, the Study identified significant

[105] Mchinji District Coordinating Team and UNICEF (2010) Mchinji Water Atlas 2008 A Status Report on Rural Water – Based on the District Management Information System for Rural Water Supply, Sanitation and Hygiene.
[106] http://www.water-technology.net/projects/malawi/
[107] CRWB (2015) Strategic Business Development Plan 2015 -2020
[108] Malawi News Agency – Lilongwe (September 2015) Mchinji to Face Critical Water Shortage accessed at http://allafrica.com/stories/201509140594.htm
[109] The Kalondolondo Project is a community-based monitoring and evaluation programme aimed at assessing service delivery and is funded by Plan International Malawi CONGOma and Action Aid.

dissatisfaction amongst residents of Mchinji town as well as from more rural areas in the district with regard to the CRWB service delivery[110]:

- Inefficient customer care (not defined in greater detail);
- Poor water quality (described as comprised of strong chlorine odours and debris in the water);
- The high cost of water which had severe financial implications for institutions such as the Mchinji District Hospital as well as for residents.

During September 2015, a meeting was held between district based representatives, including the District Council, traditional leaders and various other stakeholders and the CRWB, aimed at sensitizing the residents of Mchinji to the water situation. Mr. Mitumba, Public relations Officer for the Board, described the water availability situation as an "impending crisis", including that "This dry season, residents will experience low water pressure or no water at all" that would require water rationing.[111]

Residents were further informed that the CRWB had appointed a contractor to sink a borehole close to the existing water intake or mains to allow supplementation of the supply. Unfortunately, this initiative had failed to deliver significant yield due to the low water table[112].

In line with the CRWB's intention to establish Water User Committees (WUCs) in some of the water supply towns to act as an administrative bridge between the CRWB and the community, Mr. Mitumba advised the residents of Mchinji to form a committee which would liaise between the water board and residents. He indicated that the committee would also be expected to help in identifying additional water sources. In this regard, a representative from the Mchinji District Council recommended that such a Water User Committee should consult with the Water Users Committee as well as government in the district to identify potential additional water sources, including potentially being able to tap into the gravity-fed water scheme used by the Mchinji CCAP Mission Orphanage.[113.] Subsequent to this meeting, an undated Press Release from the CRWB confirmed that a consultation process had been initiated to "to tap water from a perennial river from where Mchinji Mission abstracts water some eleven Km away from Mchinji Boma along the Mchinji-Mkanda road".[114]

Service Quality

There is no independent regulator in place for water services in Malawi and therefore assessments of the quality of service from CRWB has to be reliant on other sources. These inevitably tend to be less comprehensive in nature and more sporadic. **Table 54** from the Sector Performance Report gives a very high level indication of level of service for the country as a whole.

[110] Malawi News (August 2015) Mchinji Residents express dissatisfaction over intermittent water supply accessed at http://www.manaonline.gov.mw/index.php/business/item/3395-mchinji-residents-express-dissatisfaction-over-intermittent-water-supply
[111] Ibid
[112] Malawi News (August 2015) Mchinji Residents express dissatisfaction over intermittent water supply accessed at http://www.manaonline.gov.mw/index.php/business/item/3395-mchinji-residents-express-dissatisfaction-over-intermittent-water-supply
[113] Malawi News (August 2015) Mchinji Residents express dissatisfaction over intermittent water supply accessed at http://www.manaonline.gov.mw/index.php/business/item/3395-mchinji-residents-express-dissatisfaction-over-intermittent-water-supply
[114] CRWB (undated) Press Release – Water Supply Situation in CRWB Water Areas.

Table 54 Summary of Headline Indicators

Performance themes and headline indicators		Performance trends (see notes)					Target details
		2006	2007	2008	2009	2010	
1	% of people within 500 metres (rural) and 200 metres (urban) of an improved water source* (disaggregated rural and urban)	75	81	80	80	79	**National** • MGDS I: 80% access within 500m by 2011 from 66.5% baseline
		73	79	77	78	77	**Rural** • MDG: 67% by 2015 • MGDS II: 75% for rural inhabitants and 75% for town and market inhabitants by 2016 • JSR: 75% by 2011, 85% by 2015
		94	98	94	94	92	**Urban** • MDG: 95% by 2015 • MGDS II: 80% access for urban and peri-urban inhabitants by 2016
2	% of people whose average total time to collect drinking water is less than 30 minutes (disaggregated rural and urban)					57	**National** • n/a
						54	**Rural** • n/a
						76	**Urban** • n/a
3	Equity Standard deviation of district access to safe water	10.16	10.24	8.89	10.97	14.9%	• To be determined

- Data for headline indicator 1 is obtained on an annual basis by NSO surveys (DHS and WMS), but only assuming that the responding household accesses water within the design range.
- Data for headline indicator 2 has been measured from the DHS 2010.

Obviously these figures are national and not for CRWB, nevertheless they do show a somewhat declining trend in terms of access for the urban context. The same report gives an analysis of functionality of schemes across Malawi on a sample basis and the figures for schemes in the CRWB region are illustrated in **Table 55**.

Table 55 Functionality of Gravity-piped Water Schemes in Malawi (2011) - Central Region

District	No of taps	Total operational	%
Salima	249	48	19
KK/ Ntchisi	238	0	0
Ntcheu	558	208	37
Dedza	10	10	100
KK/ NB	250	385	154
Mchinji	160	13	8
Total	**1465**	**664**	**45**

These figures are from 2011 and may have changed significantly since that period, nevertheless if they are accurate, then they are a worrying trend.

CRWB have set out a series of performance indicators which they are targeting to achieve over the next five years. In the absence of an independent regulator this is a very good approach and should allow the organisation to not only improve its level of service but if the level of reporting is credible and timeous, then it will allow external players such as Government, customers and other stakeholders, to be able to assess the performance of CRWB with some confidence. The performance indicators are included in **Annex E2**.

Five specific target areas have been identified namely water quality, installation of water connections, response to customer queries, continuity of supply, and customer satisfaction rating. What is unclear at this stage is how the indicators would be measured on a regular and accurate basis. An example of this would be response time to customer queries, which can potentially require quite an extensive system of monitoring and reporting, particularly if it includes telephonic queries. Examples of indicators, which are not specifically customer service orientated but would definitely have an impact include that for production growth, non-revenue water, pipe breaks and collection efficiency.

As was noted earlier, from an institutional perspective, Water User Associations have a key role to play in terms of the operation of water kiosk systems and community based systems. Clearly community engagement and participation in this type of scheme, particularly in the peri-urban context, is critical.

Services Coverage at Mchinji Border

There are currently no water services carried out by CRWB, nor are there pit and septic tank emptying services of any kind operating at Mchinji Border.

Water Quality at Mchinji

If the water resource at Mchinji border is to be borehole based it should be recognised that the potential for groundwater contamination is probably high. Tests undertaken by CRIDF on the Mwami side of the border found that nitrates were slightly elevated in one sample, and coliforms (total and faecal) were present in another sample.

Emphasis should be placed on Technical Study findings in relation to protection of the water resource area: [115]

"Protect land on which the well field is situated by legal title. In addition, it should be ensured that there are no developments allowed within the protected area to prevent possible contamination, which can emanate from latrine or septic tank effluents, poor solid waste practices, gardening or crop production using agro-chemicals all of which can compromise water quality and impact negatively on overall project sustainability."

Conclusions and Recommendations

Conclusions

The Mchinji Border project is small and can probably be implemented relatively easily as a kind of extension of the project on the Mwami side. The results of the technical feasibility are not yet known however it is likely that they will be positive, particularly when one considers the wider economic trade implications.

From an institutional prescriptive, the author is of the view that there is moderate to low institutional risk with respect to this project. Partly this is because its size is relatively small and partly because CRWB, though it has its challenges, has demonstrated a reasonable degree of institutional capacity over the years. There are certainly areas where CRWB can improves its performance, notably in areas such as the development of water resources infrastructure, the provision of sanitation, asset management and water quality management. In general however CRWB has demonstrated a trend over a number of years of gradually gaining institutional and financial strength. In view of the concerns, some consideration should perhaps be given to initiatives that further strengthen CRWB's institutional capacity, in addition to delivering high quality and sustainable projects at Mwami and Mchinji. CRIDF could consider an advocacy/facilitating role in this regard.

The location of this project is also clearly of a strategic nature with potentially positive spin offs in terms of enhanced commerce, trade and tourism. This can only benefit the local population and also, by extension, CRWB itself.

Recommendations

As part of the financial close out phase and before commencement of the formal project, these draft institutional strengthening proposals should be workshopped with CRWB and thereafter refined.

Institutional Arrangements

- Refine and confirm the institutional model for Mchinji – its slightly remote location may necessitate more creative options like outsourcing so as to manage operational costs.
- Liaise with other key institutions so as to align planning and effective implementation of the project
- Identify private operators for ablution blocks (if relevant) and put in place supply/service contracts.

[115] CRIDF, Chipata [Mwami] Technical Feasibility Report, December 2015

Governance

- Lobby with the Malawian Government regarding the need to increase the legal and financial autonomy of water boards.
- Lobby with the Malawian Government regarding improving the skill sets and hence fiduciary capacity of the Board of the CRWB.
- Identify appropriate training for board regarding fiduciary responsibilities and conduct these courses.

Strategic Management

- Consider review of the strategic plan to place greater emphasis on strategic challenges and opportunities such as water resource development, sanitation, the use of PPPs and outsourcing, learning from other Southern African utilities, improving capital maintenance, sustainable supply options to low income areas and the need for greater legal and financial autonomy.
- Potentially use these two new schemes to test new best practice approaches in areas like NRW, planned maintenance and outsourcing.
- Investigate options of using local residents and entrepreneurs to perform outsourced functions, both to contain costs but also to foster community relations.
- In view of the strategic and international implications; consider giving the operation and maintenance of these schemes some degree of higher priority.

Financial Management

- If possible, create a separate (ring fenced) profit centre for the new scheme
- Provide guidelines to private operators regarding tariffs (if relevant)
- Implement programmes to replace old and defective meters (this is a broader initiative designed to enhance CRWB's sustainability).
- Consider outsourcing to collect CRWB's large outstanding debt (this is a broader initiative designed to enhance CRWB's sustainability)

Organisational Design and Human Recourses

- Review CRWB organogram to determine optimum arrangements to manage the new scheme. Implement changes as necessary.
- Undertake training of staff that will be responsible for operation of the new scheme.

Asset and Operational Management

- Put in place SOPs for the new scheme
- Put in place system to carry out water balance on a monthly basis
- If relevant, monitor ablution block septic tanks and empty when required
- Populate IAR with information on 2 new schemes

- Develop planned maintenance schedule
- Develop IAMP (broader initiative to strengthen CRWB)
- Develop and implement a Water Safety Plan

Service Quality

- Ensure Mchinji Border is added to CRWB's (water quality) compliance monitoring programme
- Engage actively with local communities (and WUA) during planning and implementation process
- Undertake public awareness campaigns
- Design and undertake programme to promote safe sanitation in Mchinji Border
- Promote the use of private connections in Mchinji Border
- Consider option of additional (commercial) ablution blocks for tourists
- Consider use of mobile phone technology to enhance payment and customer experience

Implementation Plan

To provide practical effect to the Institutional Assessment recommendations an implementation plan with short term, medium term and long term proposals is included in **Annex E3**.

Section 7: Risk Assessment

A detailed assessment of the risks for the Mchinji border water supply and sanitation project was undertaken to assess the potential risks that could inhibit project implementation. The assessment has been effected from two particular fronts, namely, inherent risks and external risks which are out of the project team's control.

The sensitivity analysis on the financial and economic project aspects indicated that none of the core project parameters are critical to the financial and economic feasibility of the projects.

A high level risk analysis is outlined in **Table 56**, reflecting possible technical, financial and operational risks that might impact on the project's viability.

Table 56 Risk Assessment Matrix

Risk	Extent of control over the risk identified	Risk Assessment		Summary risk mitigation strategies
		Probability	Impact	
1. Technical				
A lack of understanding of the requirements of the project	CRIDF has fully consulted all the key stakeholders on all ambiguous and potentially contentious issues	Low	High. Increased costs and inadequate service	• Involvement and consulting of all key stakeholders at all stages of the project formulation process. • Recognition of the roles and responsibilities of each stakeholder in the process
Varying the scope and or project objectives	CRIDF has closely collaborated with all the Stakeholders.	Low	High. Increased costs, delays and reduced service levels.	• Clearly outline the objectives, scope and expected outputs and outcomes to all the stakeholders some of whom communicate the same to the beneficiaries.
Groundwater availability (or scarcity)	CRIDF has consulted Department of Environment, Water Affairs and CRWB with regard to ground water yields within the project	Low	High. Can lead to increase in costs and delays	• Do a pump test on the groundwater yield of each proposed borehole and make sure that monthly abstraction does not rise above the recommended level • Continue to monitor groundwater yield from each

Risk	Extent of control over the risk identified	Risk Assessment		Summary risk mitigation strategies
		Probability	Impact	
	area of Mchinji			proposed borehole and be aware of the dangers of unsustainable yield • Embark on a public awareness campaign if residents are using more water than the system is designed to cater for in order to control demand pressures
Groundwater contamination	CRWB to acquire title to land where the boreholes are to be located	High	Can compromise the entire water supply installation	• No housing or commercial developments within the protected area • No indiscriminate dumping of household and industrial waste within or in close proximity to the protected area • Conduct awareness campaigns for all stakeholder groups
Unregulated consumption and wastage of water	The designs for the installations have incorporated mechanisms that deter wastage and unregulated use.	High	High. Can render the entire installation to be unviable and ultimately unsustainable	• Install meters at all water access points • Specify proven good quality fittings that are not easily susceptible to wear and tear • Institute a well refined preventive maintenance programme that includes a public awareness campaign on the scourges of vandalism, adverse effects of using poor fixtures and optimal use of water
Denial of construction permits	Planning permission will be sought through CRWB and their shareholder Mchinji Council who	Low	High. Project would not proceed	• Involvement of CRWB during the design process • Adherence to national standards and specifications

Risk	Extent of control over the risk identified	Risk Assessment		Summary risk mitigation strategies
		Probability	Impact	
	have jurisdiction over Mchinji border. A drilling permit will be sought from the Council if they institute these measures before commencement of the project			
Operation and Maintenance	CRWB have a running operations unit that currently maintains network infrastructure for its operations in all the towns in Central Region	Low	Low. CRWB has demonstrable experience in operating and maintaining much larger operations than that required at Mchinji border	• Augment existing operations and maintenance activities of CRWB through this project
2. Financial				
Domestic Demand	Population may not grow as predicted. This will impact revenues generated by the project and thus its operational sustainability. O&M costs will then be serviced by small number of persons which will challenge the affordability or cost recovery of the intervention.		Medium	• Ensure adequate collaboration with the District Council before project implementation. • Stress the importance of town planning in collaboration meetings. • Ensure detailed designs are based on realistic projections of current and future water demand.

Risk	Extent of control over the risk identified	Risk Assessment		Summary risk mitigation strategies
		Probability	Impact	
	Additionally, if Mchinji's development happens outside of the proposed design, this will mean that the target population will not be served by the infrastructure. In turn this will result in the socio-economic benefits and financial revenues of the project not being realised.			
Water kiosk demand	Rural households unable or not willing to pay for consumption at kiosks due to the fact that until now they only pay when a hand-pump needs repair	Low	Medium	• Involve the community from the beginning and raise awareness on need to pay for the service. Involve the District Council in this. Devise strategies to encourage and assist with costs of connections • Stress the benefits of using safe water (that which is treated) over water from unprotected wells and the wetland area • A lack of budget for community awareness is identified as a significant risk to the project's successful implementation
Vandalism of the system	Limited control over this aspect, as it is a police function. Providing security would impact the	Low	Medium	• Facilitate establishment of community water supply committee(s) • Promote community education, awareness campaigns and

Risk	Extent of control over the risk identified	Risk Assessment		Summary risk mitigation strategies
		Probability	Impact	
	sustainability. However the area is currently not subject to vandalism.			promotion of social capital
Sanitation facilities - Border patrons unwilling to pay for ablution facility	CRWB has control over this aspect. By providing a clean facility at a reasonable charge, the border patrons will be encouraged to use the facilities. Alternatively punitive measures can be considered.	Low	Medium	• Base tariffs charged in the ablution block on those charged in the informal market for water supply and sanitation as these represent observed willingness to pay in this market. • Keep ablution facilities functional and clean so that border patrons continue to value its services
Inadequate O&M invested by CRWB	The CRWB has control over this aspect and adequate O&M investment will lead to continued revenue streams.	Low	Medium	• CRWB to commit to deploy adequate and appropriate staff on site and regular supervision and oversight visits by senior staff • Include CRWB training and capacity building during project management

Section 8: Conclusions and Recommendations

Mchinji Border Town is an important international border between Zamia and Malawi on the Ncala transport corridor (Great East Road).

The high volume of traffic has brought people looking for opportunities to Mchinji, which has developed in a haphazard way, placing the existing services under pressure. The pressure on services has increased the risk of waterborne diseases in Mchinji Border Town and the possibility of cross border infection. This is exacerbated by the high transient cross border population that spends time in and passing through Mchniji while completing the cross border formalities.

The population of Mchinji Border Town is estimated to currently be 1,521 people, growing to 2,547 by 2031. The residential population is enlarged on a daily basis by the transient cross border population, which is currently estimated as 100 people per day, growing to 208 people by 2031.

Mchinji residents clearly expressed their dissatisfaction with the current water supply and sanitation services. The existing water supply infrastructure comprises one handpump operated borehole and hand-dug wells (protected and unprotected). The majority of the residents have pit latrines, but the border crossing population are only serviced by very unhygienic improved pit latrines. The cross border population often uses resident households at a fee, but this has in the past lead to conflict.

The Feasibility Study has identified the lack of a reliable water system as a constraint to growth and improvement of hygienic conditions. Reviewing the alternatives, it is recommended that a water supply system comprising boreholes, storage and distribution, be provided. Initially the distribution will be on the basis of entry level technology, i.e. kiosk, however the system should allow for the upgrade to yard or house connections.

In terms of sanitation intervention, the construction of a Communal Ablution Block (CAB), mainly for the border traffic is proposed. In addition to toilet services, the CAB should include showers and laundry facilities.

The estimated capital investment for the proposed project is £392,000. Due to the size and nature of the project, there is no benefit in phasing the project.

The project brings a number of high resilience benefits to the project recipients especially in relation to governance and livelihoods, gender and health. The review also identified a number of risks in relation to the associated infrastructure and risk-mitigating actions which if implemented will improve the resilience of the project itself to climate change risks.

The project is not expected to have significant environmental impact, as it is mainly within the urban area, which is already severely degraded. The project could actually be used to enhance certain environmental challenges, like improved sanitation by making Mchinji an open defecation free zone. An Environmental Impact Assessment (EIA) will be required, in accordance with the Environmental Management Act, but this is expected to be limited to and Environmental Project Brief (EPB). The approval of the EIA is expected to be the only permit required before proceeding with construction. The CRWB will need to secure land title of the proposed borehole sites, storage tank sites, kiosk and ablution block sites.

There is economic justification for the project, as indicated by the quantitative results of the economic appraisal in conjunction with the qualitative benefits arguments. In the short term the provision of WASH infrastructure is fundamental to basic human needs; in the medium and longer term, WASH infrastructure will be catalytic to economic development at a local (community) level, as well as for Malawi and the SADC region. The project is expected to result in significant improvements to the health of Mchinji residents, as well as border patrons, along with time savings and ecological improvements, all of which indicate that the project should be implemented.

The project alone however is not commercially viable – the revenue generated by the project is not sufficient to cover the investment cost over the project life. This is neither surprising nor uncommon for water and sanitation projects of this scale, given that such projects are fundamentally providing a public good. Traditional financing is therefore not appropriate to this project; long term developmental/concessional loans, grant or subsidised funding are required to cover the capital investment.

The financial appraisal indicates that the project is operationally sustainable. Annual revenues generated exceed the annual operation and maintenance requirements of the infrastructure over the project life. Domestic demand, O&M costs, and water supply coverage are however critical to the operational sustainability of the infrastructure.

From an institutional perspective, there is moderate to low risk with respect to this project. Partly this is because the size is relatively small and partly because CRWB, though it has its challenges, has demonstrated significant institutional capacity over the years. There are admittedly concerns regarding the ongoing financial viability of the utility. In general however CRWB has demonstrated a trend over a number of years of gradually gaining institutional and financial strength, clearly evident in the increase in the number of metered connections. In view of the concerns, some consideration should perhaps be given to initiatives that further strengthen CRWB's viability, in addition to delivering a high quality and sustainable project at Mchinji.

It is therefore recommended that this project should proceed, either through CRIDF support by taking the project to Financial Closure or for CRIDF to support the CRWB with obtaining grant funding for the project. Furthermore, since CRIDF is already supporting water supply and sanitation infrastructure across the border in Mwami (Chipata), there is potential Value for Money (VfM) aspects to increase the scale of the project and undertake the Mwami and Mchinji projects as one project. This is already the justification of combining the Mwami and Chanida projects, which are similar border towns with similar infrastructure, but separated by over 100 km.

Annex A: GESI Tables

Annex A1: GESI Analytical Checklist

Annex A2: GESI Action Plan

Annex B: Technical Assessment

Annex B1: VES Field Investigation Data

Annex B2: GESI Action Plan

Annex C: Environmental Attachments

Annex C1: References

Annex C2: EIA Flow Chart

Annex C3: Water Quality Results

Annex C4: List of Prescribed Projects

Annex D: Cost Benefit Analysis

Annex D1: Assumptions

Annex D2: CBA Tables

Annex E: Institutional Assessment

Annex E1: CRWB Organogram

Annex E2: CRWB Planned Key Performance Indicators

Annex E3: Implementation Plan

Annex F: Minutes of Meetings

Minutes of Meeting held at Central Region Water Board Head Office in Lilongwe

Date: Monday 18th April, 2016

Time: 15hrs

1. **In Attendance**

Name	Position	Email Address	Phone Number
Gifton D. Sageme	Acting Chief Executive Officer/ Director of Technical Services	giftsageme@yahoo.com gsageme@crwb.org.mw	+265888 344191 +265999 615619
Ernest G. Mtawali	Director of Finance and Administration	emtawali@yahoo.co.uk emtawali@crwb.org.mw	+265888 863992
Zephelino Z. Mitumba	Public Relations and Administration Manager	zephelino@gmail.com zephelinomitumba@yahoo.co.uk zmitumba@crwb.org.mw	+265888 517769 +265888 823198
Jessy Sinda	Corporate Planning Manager	chipwailaj@gmail.com	+265999 190938
John Makwenda	Projects Manager	jmakwenda@crwb.org.mw jmakwenda@yahoo.com	+265996 707535 +265999 310498
Alex Chambo	Operations Manager	achambo@crwb.org.mw adgc62@gmail.com	+265995077000
Leonard Magara	Chief Engineer / Deputy Team Leader CRIDF	Leonard.Magara@cridf.com	+27 342 3819 +27822256926
Ian Nzali Banda	CRIDF Activity Lead, Zambia	iannzalibanda@gmail.com	+260977474755 +260955885865

2. Opening Remarks

The meeting was opened by the Acting Chief Executive Officer (CEO) of the Central Region Water Board (CRWB), Mr Gifton Sageme (GS). All were welcomed to the meeting called primarily to discuss the way forward on the proposed interventions for water supply and sanitation improvements at Mchinji Border post located at the boundary between Malawi and Zambia.

The Acting CEO asked Dr. Ian Banda (IB), Activity Lead, Zambia to start the deliberations by giving a brief overview on the current status.

3. The Proposed Project Overview

The CRIDF Chief Engineer Mr. Leonard Magara (LM) gave a brief overview on CRIDF activities currently on going in SADC Countries and explained that CRIDF may provide assistance for Project Design and Preparation; provide funds for construction especially where there is a potential for cross border benefits and assist State Owned Enterprises to acquire funding from potential financiers.

LM further explained that:

i) the current phase of CRIDF would expire on 31st March, 2017 and therefore all projects under implementation would have to be completed by then with no exception.

ii) that CRIDF would be able to fund the proposed interventions requested by CWRB at Mchinji Border post as the project scope was in conformity with CRIDF's criteria of providing support to projects that have a "pro-poor focus" and has a cross border benefit element

iii) the budget for the Mchinji project was estimated to be in the range between US $ 400,000 to 450,000.

4. Implementation Modalities

i) LM outlined that it was a CRIDF requirement that all projects under consideration be subjected to a scoping study; pre- and full feasibility; full detailed design prior to the physical implementation (construction) phase

ii) Due to time limitations, however, it was suggested by CRIDF (LM) that a team to undertake the pre-construction activities be built around the Zambian team that undertook the same for the Mwami Border post with support from CRWB. This proposal was accepted by CRWB

iii) CRIDF indicated that due to the existence of certain restrictions and conditionalities on funds disbursement of DFID-funded projects to Malawi could not be done through a governmental agency. CRWB confirmed acceptance of this condition.

iv) Against the fact that the project need be complete by March, 2017, and that not much work had been done on the Malawi side, the meeting explored various implementation modalities. It was considered practical to fund construction of Mchinji Border works through the procurement of one singular construction contract encompassing both Mwami and Mchinji Border posts. This would be through Eastern Water and Sewerage Company (EWSC) of Zambia. This proposal was accepted by CRWB, subject to approval from the Board and the parent government ministry.

v) CRWB indicated that they would immediately embark on a consultative process to establish on any regulatory requirements currently in force that would need to be complied with

vi) CRIDF advised that CRWB would have to facilitate smooth passage of construction equipment, materials and labour between the 2 border posts to assure smooth un-impeded construction activities

vii) CRWB indicated that they had already informed the Board of Directors on the proposed project and that they would consult the Malawi Government on the issue of "funds movement" and also acquire endorsement within 2 to 3 weeks

viii) CRIDF proposed that a "Tripartite Agreement" which would outline key issues such as roles, responsibilities, tender evaluation procedures, standards and quality be entered into between CRWB, CRIDF and EWSC

ix) CRWB requested that CRIDF avail a project proposal approval. CRIDF advised that the proposal document would be availed once CRWB makes an official request to CRIDF. CWRB advised that the request would be made by close of business on 19th April, 2016

5. Way Forward and Closure

    1. Mr Sageme, concluded that in the view of CRWB, '***it is that (contracting it through EWSC) or nothing. We will make sure to convince the Malawi Government to seriously consider the arrangement once the CRIDF approval has been received!'***
    2. ***CRIDF will consult with EWSC if there were any challenges in 'joint contracting'***
    3. ***The team mobilized for working on Mwami will work with CRWB engineers to avoid losing time on mobilization and 'cridfying' a new team***
    4. ***CRIDF undertook to prepare the tender documents so the BoQs for Zambia will be distinct from Malawi works. This will facilitate association of a main Contractor with Malawian sub-contractors. Malawi requires all contractors to be registered/licensed with their Construction Council.***
    5. ***All consultations and Final decision to be made no later than 10 May, 2016.***

There being no further business, the meeting was closed by GS at 1630hrs.

Signed:

G.D. Sageme L. Magara I.N. Banda

Meeting with Eastern Water and Sewerage Company Ltd - Minutes of Meeting held at Protea Hotel in Chipata

Date: Monday 18 April 2016

Time: 20hrs

1. In Attendance

Name	Position	Email Address	Phone Number
Lytone Kanowa	Managing Director	Lytone.kanowa@ewsc.co.zm	+260977429268
Leonard Magara	Chief Engineer and Deputy Team Leader CRIDF	Leonard.Magara@cridf.com	+27822256926
Ian Nzali Banda	CRIDF Activity Lead, Zambia	iannzalibanda@gmail.com	+260977474755 +260955885865

2. Joint Project Implementation with CWRB

The CRIDF Chief Engineer Mr Leonard Magara (LM) summarised the key points of discussion at the meeting that was held in Lilongwe at the Central Region Water Board (CRWB) offices on the proposed interventions at Mwami and Mchinji Border posts as follows.

x) That due to time limitations the team to undertake the pre-construction activities be built around the Zambian team that undertook the same for the Mwami Border post with support from CRWB and that this proposal was accepted by CRWB

xi) That due to the existence of certain restrictions and conditionalities on funds disbursement of DFID funded projects to Malawi it would be practical that the contracting for the proposed works be done as one singular project encompassing both sides namely Mwami and Mchinji Border posts through Eastern Water and Sewerage Company (EWSC) of Zambia and that this proposal was accepted by CRWB

xii) CRIDF proposed that a "Tripartite Agreement" which shall outline key issues such as roles, responsibilities, tender evaluation procedures, standards and quality be entered into by CRWB, CRIDF and EWSC

LK advised that EWSC had no objection to the three proposals

3. Procurement Modalities

LM indicated that CRIDF had consulted on the procurement modalities regulations for water utilities in Zambia and that these would be adhered to.

(LEONARD CAN YOU CLARIFY THIS POINT !!!) i.e. THE PROPOSED PROCUREMENT PROCESS

Way Forward and Closure

There being no further business, the meeting was closed by GS at 1630hrs.

Ian Nzali Banda

Secretary to the Meeting