Affirmative Investigation for

KHOLOMBIDZO HYDROPOWER PROJECT - Malawi

Site visit:

November/December 2014

DISCLAIMER

This report was prepared by USAID E3 Bureau technical staff. The recommendations expressed in this publication represent the views of USAID Washington and USAID/Malawi technical staff—with contributions from the U.S. Department of State and U.S. Department of Treasury— who conducted the affirmative investigation and were involved in various stages of field work and report development. As a technical assessment, the recommendations do not necessarily reflect the final policy views of the U.S. Agency for International Development, or the U. S. Government, on this assistance proposal.

All affirmative investigations are available online in the IFI/Title XIII Reports to Congress and Affirmative Investigation Reports Database at: http://gemini.info.usaid.gov/egat/envcomp/mdb.php

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LIST OF ACRONYMS

AfDB	African Development Bank
ESCOM	Electricity Supply Corporation of Malawi
ESIA/EIA	Environmental and Social Impact Assessment
ESSP	World Bank Energy Sector Support Program
GDP	Gross Domestic Product
GoM	Government of Malawi
HDI	Human Development Index
HPP	Hydropower Project
IFIA	International Financial Institutions Act
JICA	Japan International Cooperation Agency
km	Kilometer
MCC	Millennium Challenge Corporation
MDB	Multilateral development bank
MoNREE	Ministry of Natural Resources, Energy and Environment
MW	Megawatt
OS1	Operational Safeguard, Environmental and Social Assessment
OS2	Operational Safeguard, Involuntary Resettlement
OS3	Operational Safeguard, Biodiversity, Renewable Resources and Ecosystem Services
PID	Project Information Document
ROR	Run-of-river
SRBMP	Shire River Basin Management Program
TOR	Terms of Reference
USAID	United States Agency for International Development
USAID E3	USAID's Bureau for Economic Growth, Education, and Environment
USc/kWh	United States cent per kilowatt hour
WB	World Bank

EXECUTIVE SUMMARY

The International Financial Institutions Act (IFIA), Title XIII, Section 1303(a)(1), requires USAID to review multilateral development bank (MDB) project proposals to determine whether the proposals will contribute to the sustainable development of the borrowing country. Section 1303(a)(3) of the IFIA requires an affirmative investigation for assistance proposals that are "particularly likely to have substantial adverse impacts." Projects subject to an affirmative investigation are identified based on reviews that look for potential impacts on "the environment, natural resources, public health and indigenous peoples."

USAID determined that the Kholombidzo Hydropower Project (HPP) project, located on the middle Shire River in Malawi, required an affirmative investigation. USAID visited the proposed project site and met with stakeholders in November/December 2014. The African Development Bank (AfDB) is financing the project's feasibility study and the Environmental and Social Impact Assessment (ESIA).

USAID's Bureau for Economic Growth, Education, and Environment (E3) led the investigation, in consultation with the Department of Treasury, the Department of State, and other relevant federal agencies. USAID conducted this site visit early in the project preparation process prior, to initiation of the project's feasibility study and ESIA.

The objective of this affirmative investigation report is to:

- Summarize information collected on the potential environmental and social impacts of the Kholombidzo HPP;
- Provide specific recommendations on the Terms of Reference (TOR) for the feasibility study and ESIA, which serve to determine and address potentially significant impacts, including recommendations for mitigation measures or project alternatives, if feasible;
- Provide general recommendations for supporting environmentally and socially sustainable hydropower development in Malawi; and
- Convey this information to the general public and other interested parties.

Project Purpose, Need and Development Objectives

The proposed Kholombidzo HPP has been identified in earlier studies as a potential least cost option for expanding Malawi's power generation system and increasing access to electricity in rural communities. This project is a priority in the Government of Malawi's (GoM) recently launched Economic Recovery Plan. The proposed HPP, estimated to produce 140-280 MW, is located in the middle Shire River Basin, on the Shire River, approximately 50 km downstream of the Kamuzu Barrage. The African Development Bank approved financing of the project's feasibility study in 2013.

Summary of Key Findings and Recommendations

The boxes below provide an overview of key findings and recommendations intended to strengthen the ESIA and project design by minimizing environmental and social impacts and increasing the project's likelihood of success. Based on site visits, stakeholder discussions and available documentation, additional environmental and social recommendations are provided to help the GoM to develop the hydropower capacity in a sustainable manner, while diversifying its other renewable energy sources.

Environment and Natural Resources

Findings: Hydropower development on the Shire River provides 90 percent of Malawi's power generating capacity. The Shire River originates from the outflows of the third largest lake in Africa, Lake Malawi. Most catchment areas within the Shire River Basin are considered severely degraded, with the exception of two which are rated as moderately degraded. These catchments are intensely cultivated, using poor land management systems. Continued degradation of the catchments is contributing to increased siltation, flooding and a prevalence of invasive aquatic plants, all of which negatively impact water resources, aquatic life, and hydropower generation.

Specific Environmental Recommendations for the TOR for the ESIA:

- Collect adequate baseline data on aquatic species. This should include mapping the temporal distribution, the relative abundance and population status of fish species; critical habitats for life stage timing: microhabitat characteristics: habitat connectivity and lower trophic levels. This will inform the environmental flow analysis as part of the AfDB Operational Safeguard, Environmental and Social Assessment (OS1) and Operational Safeguard, Biodiversity, Renewable Resources and Ecosystem Services (OS3) requiring that the ESIA use appropriate methodologies.
- Include the alternative of "no action" and comparative analysis of alternative means to achieving the development objectives of the proposal and other project specific components (e.g., location, design) based on technical, social, environmental and economic risks and benefits as part of successfully meeting the intent of AfDB OS1.
- Include a cumulative impacts assessment as part of the alternatives analysis, encompassing the spatial (geographic) and temporal (time) scope and include data on: the status of natural, cultural, social, or economic resources and systems; data that characterize important environmental or social stress factors; and data on environmental and socioeconomic trends. AfDB does not explicitly state when in the process to conduct a cumulative impacts assessment. However, best practices include a cumulative impact assessment as part of the alternatives analysis.
- Include an assessment of direct, indirect and cumulative impacts of associated facilities. AfDB does not explicitly state when in the process to conduct an assessment of associated facilities nor does it define scope of impact coverage.
- Include an assessment of the potential impacts of climate change on water levels in Lake Malawi and subsequent impact on the project. The assessment should consider scenario building exercises for any future flow regime, including the predicted change in condition of the river ecosystem, as described, based on data collected. This recommendation supports AfDB's screening of projects for climate change risk.
- Include an assessment of the catchment area to inform the development of a watershed management plan.

General Environmental Recommendations to Support Sustainable Energy Development

- Conduct a comprehensive sectoral assessment to evaluate the impacts of hydropower projects on fisheries and other aquatic species, and sediment and nutrient flow in the Shire River and downstream ecosystems, such as the Elephant Marsh.
- Establish a water allocation budget for the entire basin that takes into account environmental flows and the demand by all stakeholders on natural ecosystems, such as the Elephant Marsh.
- Support a transboundary effort to collect and analyze data, monitor Lake Malawi tributary characteristics and model water balance – including rainfall, discharge and offtake in the Lake Malawi Basin –to determine the potential cumulative impacts of watershed development on lake levels and subsequent outflow to the Shire River.
- Ensure inclusion of all stakeholders on a more interactive basis such as the Electricity Supply Corporation of Malawi (ESCOM) and project-affected communities.

Project-Affected People

Findings: The Kholombidzo HPP is expected to result in involuntary resettlement, either through physical and/or economic displacement, as a result of flooding for the development of a reservoir and construction of a weir, power plant, and associated facilities (e.g., transmission and distribution lines). Along the Shire River, the cultural practices are matriarchal in which the land, along with any structures (e.g., houses) belongs to the maternal side of the family. People's livelihoods are based primarily on rain-fed or some treadle pump irrigation systems and recession agriculture. The potentially affected people fish the Shire River for subsistence and also sell any surplus fish. The Shire River is their source of water for both drinking and domestic uses. There has been a shortage of rain which has resulted in delayed planting of crops and reduction in the water table. Currently, the potentially affected people are food insecure.

Specific Social Recommendations for the TOR of the ESIA:

- Develop a timeframe and process for early engagement with potential project-affected communities and mechanism for consultation, participation and broad community support. Develop benchmark indicators for determining success in meeting AfDB Operational Safeguard Involuntary Resettlement (OS2) objectives (e.g., meaningful consultation, opportunities for comment, and mechanisms for including comments into the process).
- As a component of resettlement planning, design a process and mechanism for sharing of benefits with the project-affected community.
- Provide a mechanism for project-affected communities to obtain independent (objective) technical, legal, financial and social support.
- Collect adequate demographic, social and economic data for the ESIA to support an evaluation of impacts on community and household-level economies/livelihoods and on public health to inform the Resettlement Action Plan.

General Social Recommendations:

- Develop a National Resettlement Policy with supporting legislation (including standards for compliance and monitoring and a verification process to guide all resettlement in Malawi in a uniform and equitable manner.
- Develop guidance for public participation, consultation, and information disclosure and ensure that community participation is part of the consultation process, and not only at the chief consultation level.
- Reform the land law to include formal recognition of unregistered customary tenure.

This Report is divided into the following sections:

1. PURPOSE AND SCOPE OF THE AFFIRMATIVE INVESTIGATION

The International Financial Institutions Act (IFIA), Title XIII, Section 1303(a)(1), requires USAID to review multilateral development bank (MDB) project proposals to determine whether the proposals will contribute to sustainable development.

Section 1303(a)(3) of the IFIA requires that an affirmative investigation be undertaken for assistance proposals that are particularly likely to have substantial adverse impacts.[1] Projects subject to an affirmative investigation (AI) are identified based on consideration of their potential impacts on "the environment, natural resources, public health and indigenous peoples." USAID's Bureau for Economic Growth, Education, and Environment (E3) leads the investigation in consultation with the Department of Treasury, the Department of State, and other relevant federal agencies.

USAID determined that an affirmative investigation of the Kholomidzo Hydropower Project (HPP) was warranted. The African Development Bank (AfDB) is financing the project's feasibility study and the ESIA. A site visit was conducted in November/December 2014. The objective of this affirmative investigation report is to:

- Summarize information collected on the potential environmental and social impacts of the Kholombidzo HPP;
- Provide specific recommendations on the TOR for the feasibility study and ESIA as a means for determining and addressing potentially significant impacts, and including mitigation measures or project alternatives, if feasible;
- Provide general recommendations for supporting environmentally and socially sustainable energy development in Malawi; and
- Convey this information to the general public and other interested parties.

Anticipated Outcome

The timing of this affirmative investigation is early in the process of project development, which enables the gathering of information so that the U.S. Government (USG) gains a better understanding of the various environmental and social issues associated with this project. This allows USAID to provide feedback and recommendations to the respective government ministries and AfDB staff to improve the project's social and environmental components during development of the project.

2. METHODOLOGY USED FOR THE AFFIRMATIVE INVESTIGATION

The methodology for this affirmative investigation is a three-step process involving information/data collection, analysis, and development of recommendations. In determining the potential adverse environmental and social impacts, the affirmative investigation gathered information on the following:

- Potential adverse impacts, including data found in literature and through semi-structured interviews with stakeholders and project-affected communities;
- Cumulative impacts of the proposed project combined with existing and reasonably foreseeable future investments in the area; and

[1] Section 1303(a)(3) of the International Financial Institutions Act

- Impacts caused by associated facilities (i.e., new or additional works or infrastructure important for an MDB-financed project to function).

2.1 DOCUMENT REVIEW

Documents related to the Malawi hydropower sector, specific projects and scientific articles were reviewed (see References section). This report is not comprehensive and only includes information available through December 2014. Activities and circumstances may have changed since that time.

At the time of the affirmative investigation, publicly available documentation was limited, as the consultants hired to work on Kholombidzo HPP had only recently been selected and studies had not been initiated. A copy of the Terms of Reference (TOR) for the Kholombidzo HPP feasibility study was provided to USAID. All other project documents publicly available on the bank sites were reviewed.

2.2 FIELD VISIT

As part of the affirmative investigation, in November/December 2014, USAID/Washington staff, accompanied by U.S. Department of Treasury, U.S. Department of State, and USAID/Malawi staff, conducted a visit to the proposed sites and surrounding areas of the Kholombidzo HPP. The team also visited areas in the lower and upper Shire River Basin. The World Bank is supporting a prefeasibility study for the Mpatamanga hydropower project, which is 100 km below the Kholombidzo HPP site. Although this project was not part of the official affirmative investigation, the team took the opportunity to visit the proposed area given its proximity to Kholombidzo HPP. The team did not consult villages located upstream of the Mpatamanga hydropower project because information on the project was not sufficient to determine the potential scale of environmental and social impacts.

The team met with various Government of Malawi (GoM) ministries, World Bank and AfDB representatives, and communities in proximity to the Kholombidzo HPP. Other stakeholders in the lower Shire River Basin were consulted to get a better understanding of the environmental and social issues in that region.

During the field visit, the team interviewed stakeholders using a semi-structured format intended to allow stakeholders to provide additional information that naturally flowed from the discussion. The scope of the questions was based on the subject area expertise of the organizations, entities, and individuals interviewed.

The meetings were conducted in mixed groups of men and women. When needed, the USAID Mission staff translated the meetings from Chichewa to English.

The comments in this report reflect the views of those interviewed. USAID has not substantiated these views. In all cases, the name and affiliation of stakeholders is protected.

3. BACKGROUND AND DEVELOPMENT CONTEXT

3.1. PROJECT TECHNICAL ASSISTANCE

The proposed Kholombidzo HPP had been identified in earlier studies as a potential least-cost option for the expansion of the power generation system and increasing access to electricity by rural communities. The AfDB approved financing for the GoM to conduct a feasibility assessment of the proposed Kholombidzo HPP in 2013. The AfDB approved the financing after the original design was revised to a lower dam height (to be determined, instead of a 75 m-high dam) producing 140-280 MW in the dry/rainy seasons, instead of the initially proposed 160-370 MW.[2]

3.2. PROJECT PURPOSE, NEED, AND DEVELOPMENT OBJECTIVES

To critically address the prevailing and projected power requirements for the country, while at the same time ensuring that the system's reliability is improved, the GoM has developed a number of proposals, one of which is conducting a feasibility study for the development of the Kholombidzo HPP. Previous studies have identified this project as a potential least-cost option for the expansion of the power generation system and increasing access to electricity by rural communities. The GoM's recently launched Economic Recovery Plan lists the Kholombidzo HPP as a priority.

3.3. BACKGROUND ON DEVELOPMENT IN THE AREA

Malawi is a landlocked country with a total area of 118,480 km^2, and is traversed from north to south by the Rift Valley. The population is about 16.36 million, and based on 2010 data, the rural population is estimated at 80 percent of the total (Trading Economics 2015). Although agriculture is the main economic activity, there is increasing interest in developing the mining sector given the rare earth and other minerals located in the country.

The United Nation's 2014 Human Development Index (HDI) is a summary measure for assessing long-term progress in three basic dimensions of human development: a long and healthy life, access to knowledge and a decent standard of living. Malawi's HDI value for 2013 was 0.414, which puts the country in the low human development category, placing it at 174 out of 187 countries and territories (UNDP Human Development Report, 2014).

The Government of Malawi's Growth and Development Strategy (MGDS II, 2011-2016), aims to create wealth and reduce poverty through sustainable economic development and infrastructure development. The MGDS II identifies six broad thematic areas including infrastructure development. There are five sub-themes under infrastructure development, namely: energy; transport; water development; information and communication; and housing and urban development. Infrastructure is considered a key component for creating an enabling environment for private sector driven growth and provision of timely and quality social services. The country faces a number of challenges such as inadequate energy generation and supply. As a result, energy, together with transport and water development, has been identified as key priority areas within the infrastructure thematic area. The GoM is increasing the focus on generation, transmission and distribution of electricity and promoting other energy sources, besides hydropower, with the aim of improving service delivery and increasing outputs in the economy.

Agriculture

Agriculture is the backbone of the economy, contributing about 36 percent to Gross Domestic Product (GDP), 87 percent of the total employment, and supplying more than 65 percent of the industrial sector's raw materials (i.e., processed tobacco and tea products) (Chipofya et al. 2012, FAO 2013). It also provides 64 percent of the total income of rural people and contributes to more than 90 percent of the foreign exchange earnings, with tobacco accounting for 60 percent (African Economic Outlook 2014). The major food crops are maize, sorghum, millet, cassava, sweet potatoes, bananas, rice, beans and groundnuts. Approximately 70,000 hectares (ha) of land have

[2] This project was initially under consideration for World Bank financing, but it was dropped from consideration when studies showed that the proposed dam could flood the region upstream as far as Liwonde, inundating Kamuzu Barrage, flooding approximately 250 km^2 of land, and likely requiring the resettlement of 8,000 people.

been developed for sugar cane, smallholder rice schemes, and tobacco estates. Of this, more than 20,000 ha are being used for commercial farming in the Lower Shire River Valley and lakeshore.

Land is a scarce commodity in Malawi and areas suitable for agriculture are used extensively in the Lake Malawi and Shire River catchment. Around the southeastern shores of Lake Malawi and along the Shire River, rain-fed cropping is undertaken on plots approximately two ha in size. Recession agriculture is also practiced along lake and river banks. Irrigated agriculture is concentrated in the Lower Shire River Valley with the most significant schemes in the large estates at Nchalo and Alumenda (which total 12,000 ha). Traditional cultivation occurs on approximately 50,000 ha. The majority of people in the Basin depend on rain-fed agriculture and, as a result of recurrent droughts, food security is seriously impacted (GoM Shire River Final ESIA 2013).

Energy

The power sector in Malawi is characterized by capacity deficit and unreliability of power supply, low access, a financially-constrained utility, and a weak enabling environment to attract private investment (AfDB 2013). The current energy demand is estimated at 350 MW, while available capacity is about 277 MW. It is projected that demand will be 598 MW in 2015, 874 MW in 2020, 1,193 MW in 2025 and 1,597 MW in 2030 (AfDB 2013).

National electricity access level is between 7-8 percent, rural electricity and urban access levels are about one percent and 20 percent, respectively (GoM Concept Paper 2011). The level of rural electrification has remained static over the last 16+ years. In rural Malawi, firewood is the main fuel source, whereas charcoal is the common fuel in urban areas – even for households with access to electricity for cooking and heating. Rapid urbanization of 6.3 percent per year is contributing to high consumption of charcoal. Consequently, charcoal has a large domestic market in Malawi with a value estimated at about $40 million, slightly less than the value of tea and accounting for about 0.5 percent of the country's GDP (Kambewa et al. 2007). The tobacco industry is one of the major consumers of firewood in Malawi for curing certain types of tobacco or for hanging and drying. Brick curing is second only to tobacco curing as a contributor to deforestation. Burnt bricks, which are the most common construction material for buildings, are produced in kilns using an inefficient process that requires a significant amount of firewood (Kaunda and Mtalo2013).

Hydropower Development

The Electricity Supply Corporation of Malawi (ESCOM) is a vertically-integrated, government-owned electric utility that generates, transmits, and distributes electric power to about 203,000 customers. Nearly 95 percent of electricity in Malawi is supplied by a cascade of four interconnected run-of-river hydropower plants (with limited reservoir storage) located in the middle section of the Shire River and a mini-hydropower plant on the Wovwe River. Sixty percent of the hydropower capacity is more than 30 years old, and the remaining 40 percent became operational within the past 15 years (MCC Final Report 2011). Changes in power demand scenarios within the past ten years, coupled with significant environmental degradation, has drastically impacted the operation and efficiency of the existing hydropower generation facilities on the Shire River.

The flow of water for power generation in the Shire River is partially regulated by controlling the flow through Kamuzu Barrage. The Kamuzu Barrage is 156 m long with 14 radial steel gates and a 6.6 m carriage way providing a bridge across the river. It was constructed as part of the hydroelectric scheme and was commissioned in 1965 to regulate the flow of the Shire River to ensure adequate water supply for the Nkula Falls hydropower facility (Liabunya 2007). Kamuzu's capacity to regulate flow is limited because increasing the level of Lake Malawi by as little as only a few centimeters can flood communities and agriculture, and droughts have caused Lake Malawi to recede upstream, leaving Kamuzu and the Shire River dry.

Prior to 1993, most of the medium to large river sub-basins had river gauging stations which provided information on water flows. However, from1993 until about 2009, there was no regular river flow monitoring. The lack of data on water levels and flows for the past two decades resulted in an inability to conclusively establish an estimate on the trends of river flows in recent years. To gather this data going forward, the GoM has launched a project called "Establishment of Water Monitoring Systems" to re-install hydrometric equipment at strategic points along various river systems (GoM Shire River Final ESIA 2013).

The untapped, technically-proven hydropower potential for large scale electricity generation is about 2,000 MW (GoM Concept Paper 2011). ESCOM's programs to expand hydropower generation and access to electricity include the following planned projects:

- Construction of an additional 64 MW of installed capacity through the Kapichira II project on the Shire River to increase the total installed capacity to 347 MW;
- Purchase of about 300 MW from Mozambique (Cahora-Bassa Hydroelectric Power Station) by means of grid interconnection;
- Construction of a multipurpose dam along the Songwe River Basin, with a planned installed capacity of 342 MW of generation capacity;
- Construction of the Lower Fufu hydropower site on South Rukuru River and, through a connector, the North Rumphi River flows, for a generation capacity range of 90-180 MW;
- Rehabilitation of the existing hydropower plants along the Shire River to improve on their generation efficiency and availability;
- Construction of the Kholombidzo HPP, located in the middle Shire River Basin, on the Shire River, with an estimated generation capacity range from 140-280 MW; and
- Construction of the Mpatamanga HPP, located in the middle Shire River Basin, on the Shire River, approximately 100 km downstream of the Kholombidzo HPP with a generation capacity ranging from 100-150 MW.

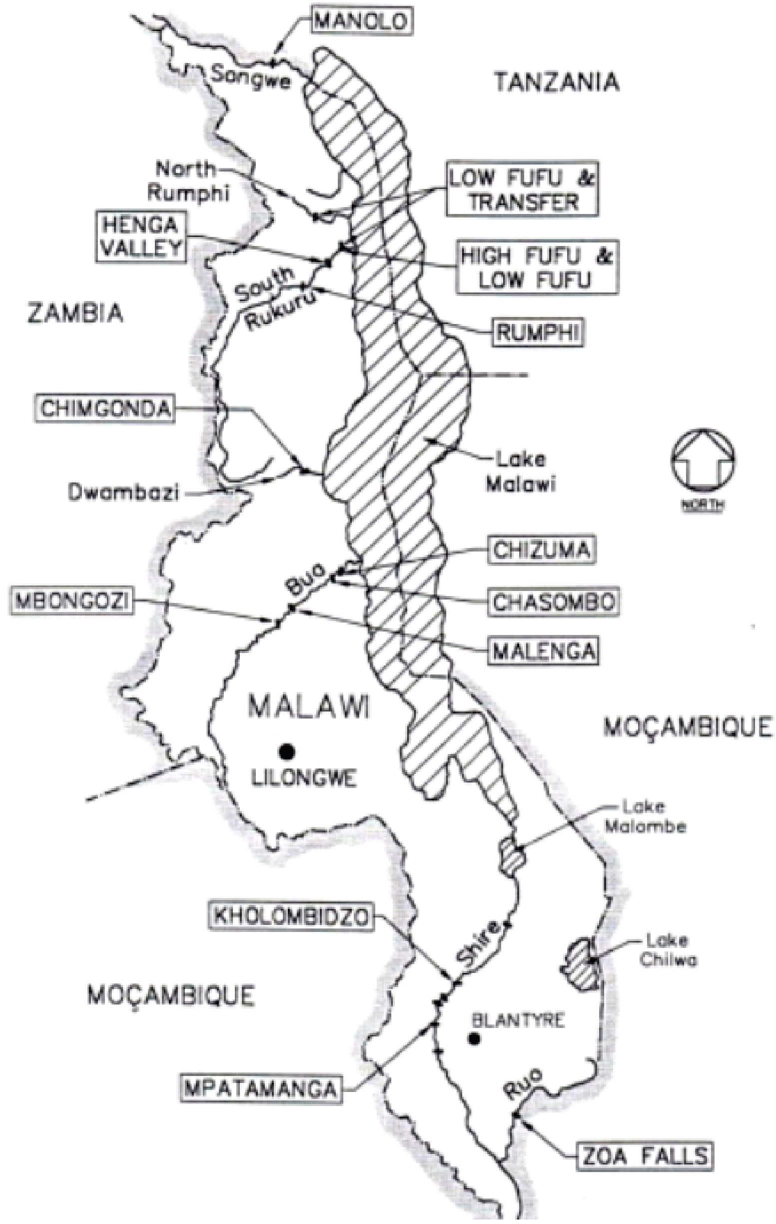

Figure 1. Untapped Hydro Resources of Malawi, including Kholombidzo HPP (shown at the bottom).
Source: http://nrec.mn/data/uploads/Nom%20setguul%20xicheel/Water/badrakh%20china/MALAWI.pdf

The World Bank's Energy Sector Support Program (ESSP) is providing financing for prefeasibility and feasibility studies for the development of an additional 200-380 MW of new hydropower generation capacity. The studies include Lower Fufu and Mpatamanga, mentioned above, and one site with less than 50 MW potential capacity on the Dwambazi River (Chimgonda). The Lower Fufu is a high-head (over 300 m) run-of-river hydropower project. The financing includes full project engineering design, comprehensive economic analysis, an ESIA and a Resettlement Action Plan. Mpatamanga is a medium head (50-60 m) storage reservoir. The financing is for a pre-feasibility assessment which will include an integrated technical and economic assessment plus a preliminary ESIA. The WB project will finance feasibility studies for the Chimgonda hydropower project, which has a potential generation capacity of 20-50 MW. The WB ESSP Project Appraisal Document states that the "social and environmental assessments are expected to indicate that no major adverse social and environmental impacts would be expected from the eventual development of these sites" (World Bank 2011). This project will provide capacity support on environmental and social safeguard issues for ESCOM and the Ministry of Natural Resources, Energy, and Environment (MoNREE) Environmental and Social Management Units.

While diversifying electrical generating capacity by developing hydropower facilities on the Lower Fufu, Chimgonda, and on the northern tributaries of Lake Malawi would reduce reliance on hydropower on the Middle Shire, this would not increase the sector's resilience to climate change. Lake Malawi, its tributaries, and the Shire are all part of the same hydrologic basin, such that droughts affecting power production on Lake Malawi's tributaries will also tend to affect power production on the Shire River. Additional hydropower on the northern rivers would provide more generation capacity, but cannot be viewed as protection against climate change. Actual diversification will require alternative energy sources.

The Millennium Challenge Corporation's (MCC) Compact[3] includes three components in support of Malawi's energy sector: Infrastructure Development, Power Sector Reform, and Environmental and Natural Resource Management. The Infrastructure Development component will include the rehabilitation of Nkula A hydropower plant and technical assistance and capacity building for the sector's key institutions. It is expected that by the end of the Compact Term, the Infrastructure Development component, together with the Government's commitment to complete construction of Kapichira II, will result in increases in generation capacity (from 286 MW to approximately 356 MW).

Alternative Renewable Energy Sources

There is good potential for geothermal, solar and wind resources, but they have not been assessed to industry standards (World Bank Energy Sector Support Project 2011, MCC Final Report 2011). Below is a brief review of renewable energy sources available to Malawi.

Solar radiation provides a strong potential renewable energy resource to serve the growing electrification needs of Malawi. The Department of Meteorological Services has collected estimates of average daily solar radiation, average cloud cover, and hours of bright sunlight at 23 locations across the country. Nearly all sites received annual average radiation above 5.5 kWh/m^2 per day, although actual available solar resources will likely be less than the average (MCC Final Report 2011). These values are roughly comparable to the average daily radiation values for the southwestern United States (Gilman et al. 2009). At present, Malawi has little installed photovoltaic (PV) capacity. However, in 2013, the Japanese Government handed over the solar generating equipment that had been installed at Kamuzu International Airport in Lilongwe. This project, "Introduction of Clean Energy by Solar Electricity Generation," was implemented from September 2012 to August 2013 under supervision of the Japan International Cooperation Agency (JICA) in Malawi. The equipment will generate the maximum of 830 kilowatts of electricity which is enough to supply power to the airport including nearby staff residences. The surplus electricity generated is being provided to the country's grid (JICA 2013).

The Department of Meteorological Services has also collected wind speed data at 2 meters height from 26 locations and average wind speed at 10 meters for 4 of the 26 sites. Wind speed collected at a height of 10 meters is appropriate for calculating estimates of wind power production from smaller distributed wind installations. Utility-scale wind turbines have hub heights measuring 50 meters and above, so the current measurements are not sufficient for estimating the project output of a utility-scale installation (MCC Final Report 2011).

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[3] The Millennium Challenge Corporation (MCC) signed a $350 million Compact with the GoM to provide support to Malawi's energy sector. (2011)

Since Malawi is located at the southern end of the East African Rift, there is good potential for geothermal generation capacity. Only Kenya and Ethiopia have developed commercial geothermal power generation (130 MW and 7 MW, respectively). One study estimates that the East African Rift could support between 2,500 MW and 6,500 MW of geothermal generation capacity (Omenda 2009). Various estimates of Malawi's geothermal energy potential vary from less than 100 MW to 400 MW, with 20 sites identified as of 2011 (MCC Final Report 2011).

Similar to competing interests for water allocation for hydropower projects, both solar and wind generation facilities will be competing with industrial agriculture, mining and other industries for available land.

The World Bank's Energy Sector Support Program is providing specialized technical assistance, including studies, to accelerate the exploitation of renewable energy resources. The program is financing a wind power resource study, using primary data from anemometers (and other hardware) installed at key locations. Additionally, the World Bank program is supporting a preliminary assessment of geothermal capacity and opportunities to expand bagasse-fuelled cogeneration capacity from significant sugar production operations (WB ESSP 2011).

Non-renewable Energy Sources

The GoM is actively considering the construction of coal-fired power plants given that the country has enough mine-mouth coal reserves to support coal-fired power generation facilities. Malawi has two main coal fields, one in the south and one in the north.[4] The northern mine field is considered of higher quality and has greater reserves. Additionally, Mozambique is building a rail line through Malawi to ship coal to the coast and some stakeholders see this as an opportunity for development of a coal-fired power plant associated with the rail line.

Transmission and Distribution

ESCOM operates the national electricity grid. The transmission network comprises 1,250 km of wood pole lines and 815 km of steel tower lines. These lines transmit bulk power at 66kV and 132kV, and feed power to more than 70 transformers at 39 substations in the country. ESCOM"s transmission network has suffered from many years of under-investment and, as a result, the system is mostly outdated. The system is characterized by heavily-loaded transmission lines and transformers, resulting in frequent failures especially during the rainy season. Due to the growing economy, the demand for electricity has risen over the past few years without corresponding investments in systems. As a result, overloading and bottlenecks are evident in many parts of the transmission system. System losses have risen beyond 20 percent (MCC Final Report 2011).

Under the MCC Infrastructure Development component, selected transmission lines and more than two dozen substations will be upgraded. For example, a new 400kV transmission line from Phombeya to Lilongwe (the new Nkhoma Substation) will be constructed with a new supervisory control and data acquisition (SCADA) system. The 400kV line will greatly improve ESCOM's ability to supply Lilongwe's electricity needs. The 400kV Mozambique – Malawi interconnection will link Hydro Cahora-Bassa and the proposed coal-fired Moatize Plant to Phombeya Substation, and extend to Mozambique. MCC expects that at the end of its Compact, the network throughput capacity will increase from 260 MW to approximately 410 MW, and distribution capacity will increase from 868 Mega Volt Amp (MVA) to approximately 1,078 MVA, along with a reduction of total system losses from 20-25 percent to 18 percent (MCC Final Report 2011).

The World Bank is financing a study for the Western Backbone line from Lilongwe (Nkhoma Substation) to Songwe – the site of the proposed Songwe River Hydropower Project. The study also covers the Lilongwe to Mchinji leg, which will result in connecting the Malawi system to the Zambia

[4] Livingstonia, North Rukuru , Ngana , Lufira and Nthalire coal fields are well known among the located 13 coalfields of the north. Lengwe and Mwabvi coalfields are located in the southern lower Shire valley.

system. Additionally, a number of transmission lines are planned to supply various proposed mining investments[5] (ESCOM ISP 2013).

Stakeholder comments on development context, energy and hydropower:

During discussions with donors and GoM officials, a number of general and specific issues were raised. Below provides a summary of stakeholder comments.

Donors said that the GoM recognizes the need to diversify its energy sources. There is serious and credible private sector interest in developing coal, solar and hydropower facilities. At this point, there are no discussions about developing large scale wind farms, due to land constraints. Two solar photovoltaic arrays (PVAs) (20-40 MW) are being explored, of which one would have storage. Although the initial investment in solar and wind is currently higher than hydropower and coal, over time the costs will be cheaper. This cost trend has been shown in other countries where the government policy is driving renewable investment.

The GoM has not had any experience in interacting with the private sector. Therefore, the GoM will need a strategy and the tools to address tariff issues and negotiations with private investors on the Power Purchase Agreements. At this point, the pricing tariff is low, currently at 10 cents/KW, and needs to be raised to 12 cents by 2017 to be cost reflective. The GoM is theoretically subsidizing energy costs because of ESCOM's revenue shortfall. The tariffs need to be cost-reflective to attract private sector investment since the conditions are present for renewables, but the tariffs are not high enough.

Donors are addressing voltage quality issues through several ongoing programs, such as the MCC programs.

As donors understand, the development of coal-fired power plants is still under study and currently at the Ministry of Finance for review.

GoM officials covered a variety of topics ranging from donor support to power distribution to ensuring that environmental concerns are integrated into the projects.

Donors are supporting studies to determine potential development of solar and wind resources. To develop additional renewable energy sources, it will be important to have serious investors. At this point, most of the discussions have been with the "middle men" so there has been limited to no follow-up. Land for solar and wind farms is scarce because of high population density and dependency on agriculture. The GoM is trying to promote more solar projects; however, there is not much interest, possibly because the initial investment is high.

The Malawi Energy Regulatory Authority provides recommendations for feed-in tariffs for solar, wind and hydropower. These recommendations need to be incorporated into GoM policy. The longer it takes to incorporate these recommendations, the more irrelevant they become as cheaper technology and increased competition drive the costs down. The feed-in tariffs will need to be reflective of lower costs.

Currently, the price of thermal (coal) is higher than the price of hydropower. However, the GoM is desperate to have electricity, so thermal will likely be part of the answer. There is GoM interest in developing a 1000 MW coal-fired plant in close proximity to the Kholombidzo HPP to take

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[5] For example, a 220kV line is planned should the heavy mineral sands (a class of ore deposit which is an important source of rare earth elements etc.) project take off and ESCOM be requested to supply power for the smelter. An extension of another transmission line to the proposed mines at Phalombe and Mulanje is planned.

advantage of the rail line that is being built through Malawi to export coal from Mozambique and the Shire River for cooling.

The Water Resources Department controls the operation of the Kamuzu Barrage – thus the operation of all hydropower facilities on the Shire River – and coordinates releases with downstream users. There is a potential for conflict over water usage for hydropower versus usage for agricultural irrigation.

The GoM recognizes that transmission lines need to be upgraded and able to interconnect with neighboring countries. A consultant is undertaking a feasibility study of the transmission spur to Zambia for a 350 kV interconnector. The MCC and WB are supporting new transmission lines.

The Department of Environmental Affairs is responsible for ensuring that environmental concerns are integrated into the project from its earliest stages through mitigation and monitoring.

The GoM raised the Songwe River as an example of good international cooperation between Tanzania and Malawi to jointly manage the Songwe Basin Authority and development on the river. Cooperation between the two countries in the Basin has been ongoing for over 10 years.

GoM engineers noted the need to diversify their electrical generating capacity to mitigate the impact of droughts and climate change by building Lower Fufu, Chimgonda, and other hydropower facilities on the northern tributaries of Lake Malawi.

Below are the latest details, provided by GoM stakeholders, on a range of hydropower projects under development or in operation.

- Lower Fufu HPP (150 MW) - The tributary this project is on is not affected by weeds and it is expected to be a bankable project in the near future.
- Songwe River HPP (342 MW) - This project initially started as a means to stabilize the Songwe River banks between Tanzania and Malawi. The current plans are to build two dams, each with ~150 MW capacity and divide the power between both countries.
- Mpatamanga HPP (100-150 MW) - This project will be assessed in two phases prior to making a final decision to construct. The first phase is the preliminary feasibility assessment, which will be carried out by a German consultant. The second phase is the detailed assessment, to be carried out by a different contractor. The German consultant will assist in drafting the TOR for this phase. It is expected that the first phase will take 8-9 months and the second phase about 18 months.
- Kholombidzo HPP (140-280 MW) - The consultant has been identified and GoM is waiting for final written approval from AfDB before starting the feasibility studies.
- Kapichira HPP (64 MW) - Additional measures have been taken to reduce the amount of weeds being caught in the intake system.
- Rehabilitation of, and raising Kamuzu Barrage, which regulates water flow to the Shire River hydropower cascade.

3.4. COUNTRY/SECTOR BACKGROUND

3.4.1 General Environmental Context

The Shire River Basin, considered part of the Zambezi Basin, lies in the southern part of the East African Great Rift Valley and is defined from the outflow of Lake Malawi to the south at Nsanje. The Basin is the fourth largest in Africa and derives the majority of its flow from the third largest lake in Africa, resulting in complex climate response dynamics. The Shire River Basin is divided into three sections – upper, middle and lower.

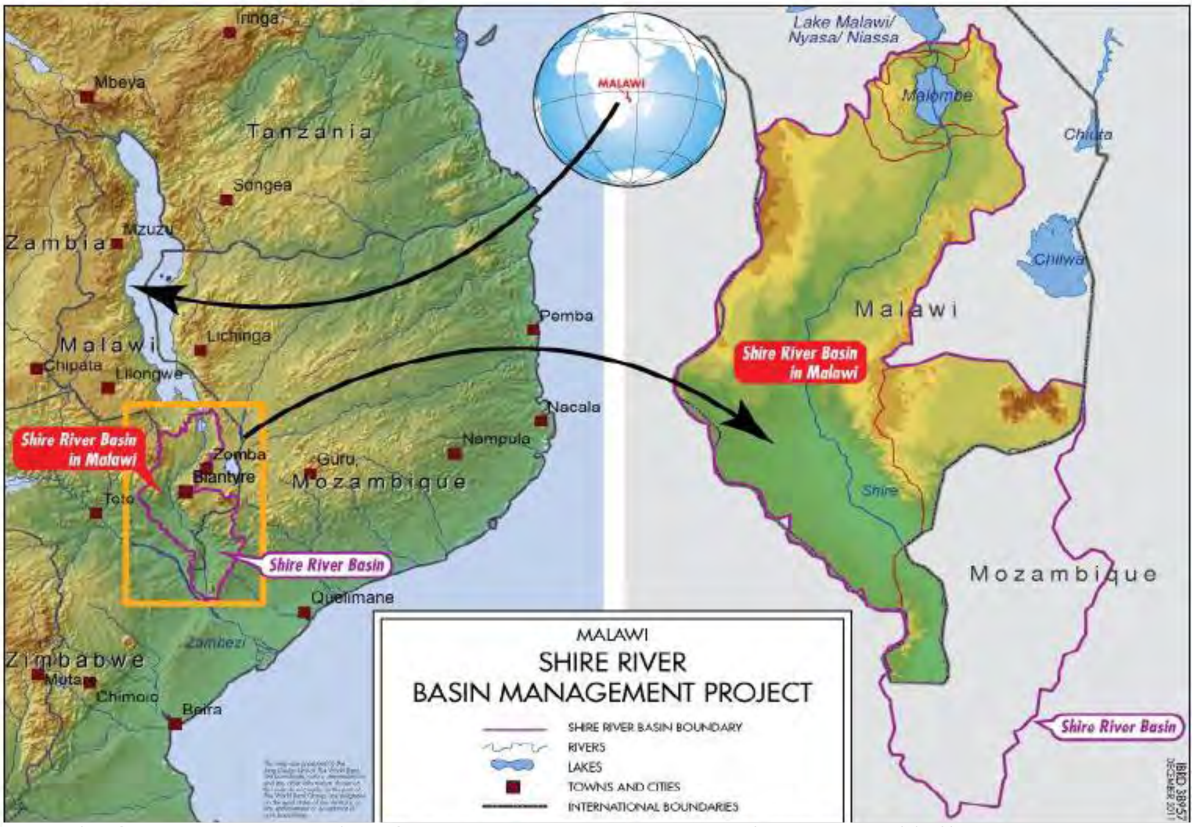

Figure 2. Geographic Extent of the Shire River Management Project (World Bank 2012)

Upper Shire River: This section is a stretch of approximately 130 km between its outlet at the southeast arm of Lake Malawi (Samama) to Matope with a total bed drop of 15 m including a 1.5 m drop from Mangochi to Liwonde (Shela 2000). The river flows across a submerged sand bar about 4 km to the north of Mangochi town at an altitude of 468 m above sea level. As a result, the mouth of the river from Lake Malawi is higher, which is a concern during times of low water levels in Lake Malawi, resulting in limited to no water flow into the Shire River (GoM Upgraded Kamuzu ESIA 2013).

Approximately 15 km downstream of Lake Malawi, the river enters into Lake Malombe, a shallow lake with an area of about 450 km^2 and depth range of 5 to 7 m. Lake Malombe is perceived to be an ox-bow lake formed due to the swelling of the Shire River. The lake therefore has similar characteristics to those of the southern part of Lake Malawi's aquatic ecology and also a high level of fish biodiversity and genetic variation (GoM Upgraded Kamuzu ESIA 2013).

Middle Shire River: This section covers a distance of about 80 km starting from Matope to Chikhwawa. The middle Shire is characterized by a narrow valley with a river drop of 384 m through 80 km of gorges and cataracts, thus creating the potential for hydropower production. The stream density in this section is high due to drainage of the Kirk Ranges and Shire Highlands.

Lower Shire River: This section is divided into the following three ecosystems: flood plain and wetlands, lagoon and riverine areas. The Lower Shire (starts from the Kapichira Falls (Chikhwawa) to the end of Ndindi Marsh on the border with Mozambique. It is one of the 17 major floodplains in Africa, covering an area of more than 820 km^2 of wetlands at peak floods. The wetland area of the Lower Shire valley covers an area of about 650 km^2 (GoM Upgraded Kamuzu ESIA 2013). After flowing for about 32 km from Kapichira Falls, the Shire River forms the seasonally flooded Elephant Marsh. This area covers approximately 500 km^2, with a catchment area of 7,200 km^2. This region consists of numerous rivers and streams originating from both west and east hills and ranges. The

Elephant Marsh is bound by the alluvial floodplain of the river on the east and by the Thyolo Escarpment on the west. The average elevation of the marsh is 200 m and consists of highly bifurcated channels between 1.5 and 100 m wide and rarely deeper than 4 m.

Figure 3. Lower Shire River Basin - Elephant Marsh

Fisheries: Lake Malawi has the largest number of fish species found in a single lake in the world, with more than 400 identified fish species and more than 200 endemic to the lake. It is likely that more than 50 fish species are in the Shire River system (Mongabay 2003). A recent field survey, conducted in support of the WB Shire River Basin Management Program, recorded about 40 species of which the majority were cichlids. The field survey did not record riverine species (Cyprinids), with the exception of a few specimens of *Opsaridium microcephalus*, *Barbus paludinosus* and *Barbus litamba* identified at the Kamuzu barrage from fishers. These fish are believed to be illegally caught from the protected Liwonde National Park. No specimen of *Opsaridium microlepis* (Mpasa) was recorded from the Shire River, highlighting the increasing scarcity of this commercial IUCN Red Listed species. However it is likely that some fish species were under-sampled or entirely missed in the field survey due to limitations in efficiency and selectivity inherent in fishing gears used for the collection efforts (GoM Shire River Final ESIA 2013).

The fish fauna of the Upper and Lower Shire River are separated by natural geographic barriers (waterfalls) downstream of the Kamuzu Barrage. As a result, fish species are very distinct and endemic to each geographical area.

Upper Shire: Most of the fish species in the Upper Shire are also found in the southeast arm of Lake Malawi and Lake Malombe, probably due to migration. From the outflow of Lake Malawi to Lake Malombe, the Shire River flows through a relatively flat area without any obstruction. The natural barriers to fish migration in the river are the waterfalls at Nkula downstream to Kapichira Falls (GoM Upgraded Kamuzu ESIA 2013). The distance from the Kamuzu Barrage to the waterfalls at Nkula is about 80 km. The gates at the Kamuzu Barrage, when fully open, are not an impediment to fish migration. Therefore, fishermen catch a great deal of migrating fish at the barrage using scoop and cast nets when the gates are open.

Apart from the Chambo (tilapia), which have significantly declined in recent years, the *Opsaridium microlepis* (Mpasa), the most commercially sought-after riverine species in Malawi, is on the verge of extinction in Malawian natural waters. This is due to multiple factors such as use of destructive fishing methods, e.g., river/stream blocking when fish are migrating for breeding; degradation of the riverine environment due to catchment destruction, e.g., by farming and use of chemicals; as well as siltation and, in extreme cases, drying of rivers and streams under natural climatic conditions. Although Mpasa has been fished out in nearly all rivers and streams in Malawi, there appear to be some remnants in Liwonde National Park, where it is still found in abundance (GoM Upgraded Kamuzu ESIA, 2013).

Middle Shire: The Kapichira Falls in Chikhwawa district and the Middle Shire rapids are physical and ecological barriers to the upstream migration of the Lower Zambezi fauna. Thus, fish cannot migrate from the Lower Shire to the Middle Shire because of the gorges and waterfalls. This is why species from the Lower Shire, such as *Oreochromis mossambicus,* are endemic to the Lower Shire and the Zambezi River (GoM Shire River Final ESIA 2013). Based on available literature, there is limited information on fish species in the middle Shire.

Lower Shire: The Lower Shire River sustains an important river-floodplain fishery (where fish production is highly dependent on the quantity and quality of annual flooding regime) contributing about 11 percent of total fish landings in the country. This fishery is mainly subsistence in nature, and pursued almost exclusively using dugout canoes from numerous permanent and temporary traditional fishing villages. There are small-scale commercial operations which provide livelihoods for about 4,000 people as gear owners or fishing crew members. The fish fauna is essentially of Zambezi River Basin origin. More than 60 species are caught in this fishery, but only three, Mlamba (*Clarias gariepinus*), Chikano (*Clarias ngamensis*) and Mphende (*Oreochromis mossambicus*) are of commercial importance. These three species comprise 90 percent of the total fish catch. In the Lower Shire, the general observation is that most of the fish species breed intensively during the rainy season, although some species breed throughout the year (GoM Upgraded Kamuzu ESIA 2013).

3.4.2 Biodiversity

Upper Shire: All three sections of the Shire Basin are home to a variety of endangered flora and fauna. The Upper Shire Basin, which includes Mangochi Forest Reserve and Liwonde National Park, is home to many of Malawi's endangered tree species – including Redwood and Mahogany Bean (GoM Shire River Final ESIA 2013).

Middle Shire: Due to the absence of wildlife protected areas within the Middle Shire River basin, no records of wildlife are available. However, the presence of hippos and crocodiles are reported. The main reason cited for lack of proper population estimates of wildlife species is navigation challenges caused by cataracts on the Shire River (GoM Shire River Final ESIA 2013).

Lower Shire: The lower-middle and lower Shire basin still support extensive woodlands – mostly under forest reserve, wildlife reserve and national park status. Most of the wildlife found in the Lower Shire River Basin is confined to protected areas (Lengwe National Park, Majete Wildlife and to some extent Mwabvi Wildlife Reserve). Lengwe National Park was originally established to conserve the northernmost population of Nyala Antelope, whose sporadic range extends from Natal in South Africa, through eastern Zimbabwe and central Mozambique, to the southern end of Malawi. In addition to the Nyala, other rare, endangered and endemic mammal species include Livingstoni Suni (Neotragus moschatus) with a restricted range in Lengwe, elephant shrew (Rhynchocyon cirnei shirensis, a subspecies of checkered elephant shrew endemic to Malawi), Nchima monkey

(Cercopithecus albogularis), and Sable Antelope (Hippotragus niger). Numbers of most animal species in the park are generally declining, mainly due to wire-snare poaching.

The critically-endangered Black Rhino (*Diceroa bicornia*) has been re-introduced into both Liwonde National Park and Majete Wildlife Reserve in an effort to restore the ecological integrity of these two protected areas.

There are seven Important Bird Areas (listed by Birdlife International) in the basin. All of these are classified as threatened to some extent:

- Mangochi Forest Reserve;
- Liwonde National Park (Lilian's Lovebird and Brown-breasted Barbet);
- Liwonde Hill Forest Reserve (Thyolo Alethe, Green-headed Oriole);
- Mulanje Mountain Forest Reserve (considered most important single center of terrestrial endemism in Malawi);
- Thyolo tea estates (remnant forests important for White-winged Apalis, Green-headed Oriole);
- Thyolo Mountain Forest Reserve (forest has been destroyed with loss of Afromontane species); and
- Lengwe National Park.

3.4.3 Climate Change

Malawi is recognized as one of the countries in Africa vulnerable to negative impacts of climate change based on the increased frequency and magnitude of extreme weather events, and low adaptive capacity. During the last two decades, the Shire River Basin has experienced significant changes in weather patterns – from severe droughts in 1991-1992 to extreme flooding events in 2000-2001. The general weather pattern is changing, with the climate becoming warmer and the duration and onset of seasons changing – the onset of rains occurs in December and ends before April (Shela 2000).

General Circulation Module (GCM) projections of future climate indicate the mean annual temperature is projected to increase by 1.1-3.0° C by the 2060s. All projections indicate substantial increases in the frequency of days and nights that are considered "hot," and decreases in the frequency of days and nights that are considered "cold" in current climate. Projections of mean rainfall do not indicate substantial changes in annual rainfall. Seasonally, the projections tend toward decreases in dry season rainfall and increases in wet season rainfall. The models consistently project increases in the proportion of rainfall that falls in heavy events in the annual average under the higher emissions scenarios. Malawi's climate can be strongly influenced by ENSO (El Nino Southern Oscillation), thus contributing to uncertainty in climate projections for this region (McSweeney et al. 2012).

Although Lake Malawi is the third largest lake in Africa, of the approximately 68 km^2 of water that enters the lake annually, only about 16 percent flows out the Shire River, with the remainder being evaporated directly from the lake surface. The dominance of precipitation and evaporation in the lake's hydrological cycle means that it is also very susceptible to changes in climate. A small increase in the precipitation: evaporation ratio can result in flooding, as occurred in 1979-1980, whereas a small decrease in the ratio can result in the basin being closed with no outflow, as occurred between 1915 and 1937 (Bootsma and Jorgensen 2006; Shela 2000a).

3.4.4 River Basin Planning/Strategic Environmental Assessments:

Freshwater ecosystems provide a range of goods and services that underpin economic development. Maintaining freshwater ecosystems can be regarded as maintaining natural infrastructure, equivalent to constructing and maintaining the built infrastructure that provides technological services for society. River basin planning is the starting point for sustaining these ecosystems, balancing a range of competing economic, social and ecological goals. Therefore, it is important that there is a good understanding of the interactions and relationships between hydrological, ecological, social and economic systems operating in a specific river basin.

Recognizing the importance of river basin management, the World Bank is financing the first phase of a three phase (12-15 years) Shire River Basin Management Project (SRBMP). To inform the design of the SRBMP, the World Bank conducted a Strategic Environmental and Social Assessment for the basin which concluded that many of the challenges in the basin were due to insufficient attention to the environmental dynamics, rapid population growth, uncoordinated development planning without adequate environmental and social safeguards, and the need to strengthen relevant institutions to manage development within the basin (GoM Shire River Final ESIA 2013).

The main development objective of the SRBMP is to increase the sustainability of social, economic and environmental benefits by developing and managing the resources in the Shire River Basin. The SRBMP has three components: 1) Shire River Basin Planning – to lay the foundation for a more integrated investment planning and modernized system of operations for the Shire River Basin; 2) Catchment Management – to rehabilitate targeted catchments within the basin, to manage erosion and improve livelihoods in the basin; and 3) water-related infrastructure – to develop critical infrastructure to improve the regulation of Shire River Flows and strengthen climate resilience. The project aims to assist approximately 430,000 people within the basin through integrated catchment rehabilitation activities, improved water management, and flood mitigation.

Under the SRBMP, there are plans for studies of the ecology, hydrology and natural resource exploitation of the Elephant Marsh in the Lower Shire valley. Participatory management planning is underway to establish community wetland management aimed at enhancing the value of the area for environmental services – particularly flood attenuation, livelihoods and biodiversity conservation. The plans also include a proposal to designate the Elephant Marsh as a Ramsar Site[6] (RAMSAR 2015).

The primary selection criterion for identifying catchments for SRBMP activities was reducing sedimentation impacting downstream hydropower facilities in the Shire River Basin. The increase in sedimentation in the tributaries of the Shire River is also a concern because it contributes to the changing of the river course, and bed elevation. The catchment sizes range from 25,000 to 40,000 ha which allows for comprehensive coverage and monitoring of measurable changes in sediment loads at the furthest point downstream (WB Shire River PAD 2012). The following catchments were identified for management activities:

- Upper Lisungwi (Ntcheu district) 25,781 ha; 53.2 percent (high soil loss);
- Upper Wamkulumadzi (Neno district) 33,257 ha; 46.5 percent (high soil loss);
- Escarpment area upstream of Kapichira Falls (Blantyre district) 33,126 ha; 62.7 percent (high soil loss); and
- Chingale area (Zomba and Mangochi districts) 40,752 ha; 39.7 percent (high soil loss).

[6] Ramsar Convention (Convention on Wetlands) is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources.

3.4.5 General Social Context

Between sixty-five and eighty percent of land in Malawi is customary land, defined as land falling within the jurisdiction of a recognized traditional authority and which is held, occupied or used under customary law. The 1995 Constitution of the Republic of Malawi mandates that no person shall be arbitrarily deprived of property; however, the state can expropriate land for public utility construction when the state has given adequate notification and provided appropriate compensation. Compensation paid is based on the open market value of the land and any improvements. The Land Acquisition Act sets forth the procedural protections guaranteed by the Constitution when land is to be acquired by the government, individuals, or developers. Valuation of assets such as buildings, trees, fruit trees, crops, and vegetables are provided for in the Public Roads Act and the Town and Country Planning Act. The Ministry of Land and Natural Resources has established compensation schedules for agricultural produce, physical assets, and trees, each with its own methods of valuation. The methods are dated and suffer from undervaluation of assets and underpayment of compensation to affected persons (USAID Malawi - Property Rights and Resource Governance Profile).

Malawi does not have a national resettlement policy or specific legislation but has a number of different laws that are applied when communities are resettled as a result of infrastructure projects. Resettlement and compensation is reflected in the National Land Policy. A recent assessment by Catholic Commission for Justice and Peace revealed a number of significant gaps in the Malawi governance framework for dealing with mining-related displacement, resettlement and compensation. Some of their findings include: insecurity of customary tenure (e.g., rights and privileges held under customary law are not formally recognized for compulsory acquisition; local customary law not taken into account); and inadequate legal guarantees for participation, sharing of benefits and dispute resolution and discretionary compensation. Although this assessment focused on the mining sector, it sheds light on key issues involved with involuntary resettlement (Catholic Commission for Justice and Peace 2014).

World Bank-funded projects that require land-acquisition and resettlement, the WB safeguard requirements exceed Malawi's legal requirements. Unlike Malawi requirements, the World Bank projects consider a broad range of land occupants as holding land rights that must be compensated, value all type of land tenure equally, compensate people for illegally-built structures, provide land as a preferred option over compensation for all classes of landholdings (including urban), and provide more extensive relocation assistance. However, the value of international guidelines is only as effective as the supporting national frameworks, legislation, and institutional capacity to facilitate and implement these guidelines (Catholic Commission for Justice and Peace 2014).

Overview of Donors and GoM Officials' Comments on Social Issues:
During discussions with donors and GoM stakeholders, a number of general and specific issues were raised. Below provides a summary of stakeholder comments on social issues.

Since there is no National Resettlement Policy with defined standards, the current practice of negotiations is approached in a piecemeal fashion. There is no regulatory framework/guidance for conducting inclusive public participation/consultations and for addressing compensation issues raised by communities. There are no consistent approaches applied to land acquisition, resettlement, and addressing the concerns for project-affected communities. These issues are dealt with on a project-by-project basis and are dependent upon the project sponsor. This ad hoc approach to participation and compensation has caused confusion and conflict, with communities viewing compensation as insufficient and inadequate. For example, if land being claimed is part of a river buffer or riparian zone, which is the interface between land and a river or stream, it is considered public and no compensation is paid regardless of the use of the land, e.g., recession agriculture.

Resettlement is not encouraged, unless it is the last resort since there is no available land to secure replacement land. When resettlement occurs, the Regional Commissioner for Lands, District Commissioner and villages are asked to approve any resettlement plan. The Regional Commissioner is responsible for assessing the affected property.

It was recommended that not only a National Resettlement Policy be developed but also that sociologists be involved in the resettlement process to address concerns of people subjected to resettlement and whose livelihoods are dependent on the land.

3.5. KHOLOMBIDZO HPP LOCATION AND GENERAL ENVIRONMENTAL CONTEXT

The Kholombidzo HPP is located in the middle Shire River Basin, on the Shire River, approximately 50 km downstream of the Kamuzu Barrage. If constructed, this project, would become the first hydropower facility in the Shire River hydropower cascade.

3.6. PROJECT PROPONENT AND PARTNER ACTIVITIES

Malawi Ministry of Energy

- The implementing agency is the Ministry of Energy.

African Development Bank

- The AfDB is financing the feasibility studies for Kholombidzo HPP.

The last AfDB intervention in Malawi in the energy sector was approved in 1993 to finance the Kapichira Hydroelectric power plant (64 MW). Prior to that, other investments included Tedzani Falls hydropower facility (20 MW, 1969), Nkula/Lilongwe transmission line and Nkula B hydroelectric facility (60 MW). The AfDB subsequently financed the construction of the Nkula/Lilongwe Transmission Line in 1975 and Nkula B Hydroelectric Project (60 MW) in 1977. In 1980, the AfDB also financed a rural electrification project which connected a total of 3,400 rural consumers at the time.

Figure 4. Kholombidzo Falls.

3.7. STATUS OF THE FEASIBILITY STUDY AND ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

The feasibility study for the development of the Kholombidzo HPP was approved for financing by an AfDB grant to the GoM in March 2013. At the time of USAID's site visit, the GoM had selected the contractor and was waiting for written approval from AfDB before moving forward. The proposed Kholombidzo HPP Feasibility Study will update the previous screening studies undertaken from 1985 to 1998, as well as use the information from the Integrated Water Resources Development Plan for both Lake Malawi and the Shire River System to confirm the optimal location and layout for the power plant. The contractor will produce a full bankable feasibility study and preliminary designs for the optimal layout that could be used in sourcing financing for project implementation (AfDB 2013). The feasibility study is expected to cover the following areas:

- Compilation and initial review of previous documents and data;
- Hydrology – assessment of the hydrological parameters for the project based on available database and verification of the quality of available data;
- Topography – Preparation of digital maps for the whole project area, which should be checked by ground surveys;
- Geology – Conducting detailed geological investigations;
- Power Simulation – Carrying out energy production simulation, for different reservoir volumes and for different discharge rates;
- Project Layout – Proposing optimum power house and dam layout with the aim of utilizing the power potential of the site;
- Load Forecast – Reviewing and updating the load forecast;
- Multipurpose use of the dam – Verification of whether the dam can also be used for water supply purposes;
- ESIA and Resettlement Action Plan (RAP) – Conducted as a part of the feasibility study and will identify climate change impacts of developing the project and how such impacts can be mitigated (AfDB 2013);
- Transmission System –Selection of optimum voltage and optimum connection point with the national grid; and
- Assessment of the options of a multipurpose use dam with water supply for Blantyre and surrounding areas.

Figure 5. Fishing below Kholombidzo Falls.

4: EVALUATION OF PROJECT SUSTAINABILITY

4.1 ENVIRONMENT – FINDINGS AND RECOMMENDATIONS

4.1.1 Findings from Literature Reviewed

Impacts of Environmental Constraints on Hydropower Generation
The main environmental challenges facing hydropower generation include sufficient water supply, sedimentation, floods, and aquatic weeds. With the exception of Wovwe HPP, the remainder of Malawi's hydropower facilities are run-of-river with various capacities of live storage on the Shire River. Power generation is seriously impacted by environmental degradation and variations in rainfall resulting in both drought and flood conditions, in addition to competing interests over water allocation. Climate change predictions forecast that although there will be no substantial changes in annual rainfall there will be seasonal impacts with decreases in the dry season and increases in the rainy season rainfall patterns. Thus, impacts on hydropower facilities could worsen over time unless appropriately mitigated. A reduction of 10-12 percent in power generation has been reported due to sedimentation, invasive aquatic plants and reduced water flow. There have also been occasions where extensive flooding has negatively impacted hydropower facilities (Kaunda and Mtalo 2013).

Catchment degradation
The vast majority (90 percent) of Malawi's power generating capacity is located in the Middle Shire Basin, and is fed in part from the Malombe East and Malombe West catchments of the Upper Shire watershed. Complementing the WB Shire River Basin Management Plan, the MCC program is focusing on improving the Upper Shire watershed.

With the exception of two catchments within the Shire River Basin, which are rated as moderately degraded, the rest are considered severely degraded. These catchments are intensely cultivated, using poor land management systems. Continuing degradation of the catchments is contributing to increased siltation, flooding and prevalence of invasive aquatic plants, which negatively impacts water resources, aquatic life, hydropower generation and water transport. Catchment degradation has affected ground water recharge, which affects rural communities who rely on shallow wells and boreholes with average yields of 1-2 liters/second. Some communities have confirmed that groundwater levels in the upper Shire are significantly lower than 10 years ago (GoM Shire River ESIA 2013).

Between 1990 and 2010, forest cover in Malawi declined from 41 percent to 34 percent (Mauambeta et el. 2010). Forest cover in the catchment has decreased from 61 percent (1973) to 29 percent (2010) and currently most of the remaining forest cover is in the form of protected areas that cover 27 percent of the catchment. The data show that the biggest change from forest to agriculture occurred in the Rift Valley escarpment, where just one percent of the forest cover remains from 1973 levels (MCC ENRM Action Plan for the Upper Shire Basin 2011). Much of the south has little remaining forest to convert to agriculture, with the Shire Valley losing 25 percent of its forest to temporary cultivation and 15 percent to permanent agriculture between 1991 and 2010. (IALUO Climate Smart Landscapes)

Changes in land use have also impacted the hydrological regimes of rivers and lake levels. One study assessing the impact of land use and deforestation reported that water levels in Lake Malawi increased due to runoff, and concluded that if the catchment vegetation or forest cover had not decreased from 64 percent in 1967 to 51 percent in the early 1990s, lake levels would have been one meter lower than observed in the 1992 southern African drought (Shela 2000a).

Due to severe land degradation in the Shire River catchment area, hydropower facilities have to manage high sedimentation rates. Sedimentation of the reservoirs has reduced water storage capacity. For example, at one point the Nkula hydropower reservoir had only 30 percent of its live storage available, resulting in unplanned resources spent on procuring a dredger and carrying out dredging operations. In July 2003, Kapichira hydropower station was almost rendered out of service when its intake reservoir was silted up to 70 percent. Today it is estimated that 60 percent of the reservoir is silted, reducing live storage. Sedimentation has decreased the live storage capacity and increased the rate of turbine erosion thereby increasing maintenance costs and reducing the design life of the plant (Kaunda and Mtalo 2013).

Aquatic weeds (primarily water hyacinths, hippo grass) are major debris sources that must be removed from the water at intakes before water is conveyed to the turbines. Accumulation of weeds at the intakes can cause vacuum pressure in the water conveyance system and cause the turbines to trip, which could result in the collapse of the conveyance system. [7] Since 2001, hydropower generation has been disrupted almost every year in the rainy season due to aquatic weeds. Similar to sedimentation, repair of damaged parts such as screens and valves and removal of the weeds increases the operational costs. The costs of controlling the weeds are very high – in 2009, nearly $370,000 was spent on managing weeds at Kamuzu Barrage, not considering costs due to weed removal at the intakes (Kaunda and Mtalo, 2013). At the Kamuzu Barrage, it was reported that, on average, approximately 135 tons of weeds (mainly water hyacinth) were removed daily (GoM Upgraded Kamuzu ESIA 2013). The World Bank financed project to upgrade the Kamuzu Barrage will include the construction of a floating steel boom upstream of the barrage to control floating weeds.

An assessment has estimated that the proportion of load losses that may reasonably be attributable to sedimentation, siltation and weed infestation as a result of catchment degradation account for some 38 percent of total annual load losses from Nkula, Tedzani and Kapichira Power Stations. The total cost in terms of ESCOM revenues lost may be some MK 237 million or $1.58 million a year, equivalent to one fifth of actual annual revenues earned. It has also been estimated that electricity consumers lose close to MK 37.5 million or $ 0.25 million a year due to the need to substitute electricity during power outages, and through replacing equipment which has broken down as a result of power surges (MCC ENRM Action Plan for the Upper Shire Basin 2011). In 2009, GoM and ESCOM spent nearly $1 million on silt and weed management on the three hydropower facilities and the total revenue lost as a result of machine unavailability at all three stations was estimated to be an additional to $1.2 million. For a generating system of 278 MW installed capacity, this translates to a direct loss of $3.6/kW of installed capacity as a result of environmental degradation, and an indirect loss of $4.3/kW of installed capacity through loss of revenue collection. In 2010, economic loss due to power outages was around 2 percent of Malawi's GDP (Foster and Shkaratan 2010).

Droughts

Existing hydropower facilities on the Shire River are designed for a firm water flow of 170 m^3/s and flow below this amount reduces the generating capacity (Shela 2000). Lake levels have been monitored since 1896, although the quality of the data is questionable since there were no regular gauging stations on the lake at that time. Between1915-1935, the water levels in Lake Malawi dropped to their lowest level of 469.94 m above sea level and outflow into the Shire River ceased (Shela 2000). This was initially due to drought but then the condition continued over a period of time due to the build-up of sand bars and vegetative material blocking the outlet. As a result of high water levels in 1935-1937, the water was able to breach the sand bars and vegetative debris, which opened the mouth of the river and allowed for resumption of flow. Since hydropower facilities were developed on the Shire River, droughts have negatively affected electricity generation. Droughts

[7] Refers to the penstock

from 1992-1998 reduced water levels and electricity generation. In 1995, the outflow from the lake measured at Kamuzu Barrage was 129 m^3/s, far below the required design flow of 170 m^3/s for power production (GoM ESIA Upgraded Kamuzu Barrage 2013). In 2004 and 2005, water flow was again reduced, impacting power generation (WB Shire River Basin Management Program 2010).

Floods

Floods can cause significant damage to hydropower facilities in addition to other infrastructure (e.g., bridges, roads). During the period of 1978 - 1986, a record rise in lake levels at 1.83 m during the 1978/79 wet season was recorded resulting in severe flooding that seriously affected hydropower generation (Shela 2000). In December 2001, Tedzani power stations I and II were completely offline due to damage of the intake screens caused by debris and water force resulting in the loss of 40 MW. Both stations were brought back on line in 2008. It cost ESCOM almost $22 million to rehabilitate the facilities (Gondwe 2010). In March 2003, Nkulu B hydropower facility was completely flooded, due to a faulty penstock valve during a flooding event. It took about five months to rehabilitate this facility.

Competing Water Allocation

Malawi is a water-stressed country with total renewable water resources per capita less than 1400 m^3 – worse than Botswana and Namibia – as a result of the imbalance in the spatial and seasonal distribution of surface water. Relatively few areas in Malawi have abundant water resources available throughout the year, with most areas experiencing seasonal fluctuations or perpetual year-to-year water scarcity with pronounced shortages during the dry season. Unreliable dry season flows have been exacerbated by deforestation and land use practices. This has resulted in intense competition for water resource allocation priorities.

Agriculture is the largest consumer of water. It has been estimated that, starting in 2012, there will be a 0.25 percent per year decline in water availability for hydropower due to other competing interests – agriculture, industry and households. The competing interests over water allocation between hydropower and industrial agriculture were raised several times during the site visit. The Ministry of Energy has proposed another HPP project below Kapichira Phase I on the Shire River, but this project is uncertain due to large scale irrigation interests in the Lower Shire Valley and demand for reservoir water to supply a proposed irrigation canal.

Transboundary cooperation

The catchment area of Lake Malawi is estimated at 6,590 km^2 and is shared by Malawi, Tanzania and Mozambique. The total inflow to the lake is estimated at 920 m^3/s of which 400 m^3/s comes from Malawi, 486 m^3/s from Tanzania, and about 40 m^3/s from Mozambique. This corresponds to approximately 35 percent of the catchment within Tanzania and 7 percent within Mozambique. Land use within Tanzania may have a disproportionate effect on the lake since the annual rainfall is greater at the northern end of the lake, with the river inputs therefore being greater (Bootsma and Jorgensen 2006).

The Songwe River forms the boundary between Malawi and Tanzania. The Songwe River, together with the Ruhuhu River in Tanzania, contributes about 53 percent of the water going into the Lake Malawi system. The Songwe River catchment has been identified as an area of critical importance since it has been found to deposit large amounts of sediment into the lake. About 55 percent of the catchment area falls within Tanzania, while 45 percent of the area falls within Malawi, with a substantial part of the catchment in Ileje and Chitipa Districts (Chiuta and Johnson 2010).

Environmental Elements Of Run Of River/River Diversion Hydropower Projects

Run-of-River (RoR)/River Diversion hydropower projects[8] are considered to be less detrimental than storage dams, mainly due to the smaller reservoir "headpond" and consequently the reduced number of people who have to be resettled as a consequence of a large storage reservoir. The "diversion reach"[9] associated with reduced river flows can vary in length. Similar to storage dams, significant infrastructure is required for RoR/River Diversion including:

- A dam to create a small reservoir (known as a headpond);
- A pipeline or tunnel (headrace or penstock) that can be several kilometers long to deliver water from the headpond to the turbines;
- A powerhouse building to house the generators;
- A tailrace channel through which the diverted water is returned to the river;
- Access roads to the headpond and powerhouse;
- Transmission lines from the powerhouse to the nearest grid transmission line; and
- In some cases, an electrical substation.

There is an increasing trend to develop cascades of RoR/River Diversion HPP within a river basin to capture as much energy potential as possible. The impacts of RoR/River Diversion projects on terrestrial and aquatic habitats can be significant, although the focus of assessments is primarily on the aquatic impacts. Aquatic impacts can be separated into: 1) effects at and above the dam and 2) effects in the diversion reach and potentially below the tailrace channel. Potential impacts above the dam include:

- Increasing water level variability and alterations to riparian vegetation[10] and useable habitat for aquatic and terrestrial species;
- Conversion of riffle habitat[11] to run habitat; and
- Fish impingement and entrainment at the intake.

Impacts below the dam will extend throughout the diversion reach and potentially further if sediment regimes, large woody debris movement, nutrient flow and food chains are affected. Usually the focus of impacts of the diversion reach is in determining the environmental flow; seldom is the focus on other aspects, such as riverine forest. Typical impacts below the dam include alterations to velocity, depth, temperature, flow variability and sediment movement. These affect the quality, quantity and type of habitat available, impacting many ecosystem components, such as nutrient dynamics. Even in reaches where fish are not present, sufficient water is required to maintain the benthic invertebrate community 'drift' as potential food in the downstream reaches (Douglas 2007).

Environmental Flows

The term "environmental flow" is defined as the quantity, timing, and quality of water flows required to sustain freshwater and estuarine ecosystems and the human livelihoods and well-being that depend on these ecosystems (The Brisbane Declaration 2007). Environmental flow science has progressed to the point where scientists warn that maintaining minimum low flows is necessary but

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[8] Electricity is generated by diverting a large proportion (up to 95 percent) of a river's flow into a tunnel or pipeline to power turbines before returning the water to the river further downstream.

[9] Diversion reach is the section of river between the dam and the powerhouse where the water has been diverted.

[10] Plant communities and species that are influenced and sustained by the presence of nearby water. Riparian vegetation stabilizes, shades and provides structure and nutrients to the aquatic habitat it surrounds. It also supports wildlife diversity and serves as a corridor for wildlife movement. Riparian areas are known to be biodiverse and important features in a landscape.

[11] A riffle is a short, relatively shallow and coarse-bedded length of stream over which the stream flows at slower velocity but a higher turbulence than it normally does in comparison to a pool.

insufficient to maintain healthy river ecosystems[12] and that a naturally variable pattern of water flow is needed to sustain biodiversity and the ecosystem services provided by rivers (Krchnak, Richter, and Thomas 2009).

A river's flow regime exerts a major influence on nearly all the physical and biological processes within it, shaping the ecosystem. The flow regime affects the regeneration of riparian vegetation, recession agriculture, and aspects of water quality including temperature and concentration of nutrients and toxins. The Shire River is characterized by wide, seasonal fluctuation of flow.

While not always possible, a minimum 20-year continuous record should form the baseline for determining environmental flows since records of this length will more accurately reflect natural variation in annual, daily, and seasonal flow. This baseline data can enable new dams to be designed with physical provisions for adjusting releases and accommodating future changes in values for managing the river (Krchnak, Richter, and Thomas 2009). There are a number of methods that have been developed, each with their own advantages and disadvantages, to guide collection of baseline data when determining ecological/environmental flows to incorporate into the EIA analysis (Dyson et al., 2003; Richter et al., 2011).

AfDB safeguard policy[13] requires that the ESIA use appropriate methodologies to address the issue of environmental flows according to best practice, including the recommendations of the World Commission of Dams. The borrower is expected to conduct a participatory water needs audit to determine, in consultation with relevant stakeholders who depend on the river flows for various needs, the minimum baseline ecological flow requirements. Additionally, environmental flow analysis is carried out, to the extent feasible, in the context of river basin planning, so that the basin's entire water balance is the framework in which environmental flows are determined.

Environmental flow and climate change

Malawi is recognized as one of the vulnerable countries in Africa to negative impacts of global climate change. Changes in river flow due to climate change depend on a number of variables including changes in the volume, timing and intensity of precipitation and snowmelt. Changes in temperature, solar radiation, atmospheric humidity, and wind speed also affect potential evaporation from the land surface and water bodies. Transpiration from plants can also either slightly offset any increase in rainfall or further exaggerate the effect of decreased rainfall (IPCC WGII, 2007). Since climate change predictions forecast that while there will be substantial changes in annual rainfall, there will also be seasonal impacts with decreases in the dry season and increases in the rainy season rainfall patterns. These changes have the potential to impact operations of hydropower projects and thus, environmental flows.

Key Components of the environmental section of the ESIA include:

General environmental data

Key to a sound ESIA is the collection of sufficient baseline data and subsequent analysis to identify avoidance and mitigation measures designed to reduce potential impacts. Appropriate baseline data, gathered over a sufficient period of time to note seasonal variation, is required to assess the scope

[12] A healthy river is one that has maintained its ecosystem integrity, and thus the capacity to maintain its structure and function, as well as to support biota and dependent communities, including human communities. River health assessments, often undertaken as part of routine, ongoing monitoring program, measure the condition of a waterway using a series of predefined indicators and reference values. Indicators commonly used include physical and chemical parameters (such dissolved oxygen, pH, conductivity), biota (for example the number, richness or diversity of fish, macroinvertebrate or algal populations, as well as riparian vegetation), hydrology (often with reference to changes to the natural flow pattern) and physical form (measures relating to the structure and form of the river channel).

[13] OS 3 - Biodiversity, Renewable Resources and Ecosystem Services

of impacts, to identify prevention and/or mitigation measures and to later verify the effectiveness of the proposed mitigation measures. Annex II provides examples of the types of baseline data that should be collected. Clear explanation of the criteria used to determine impact magnitude and significance should be provided in the ESIA.

The selection of study sites is critical for collection and mapping efforts. Improperly located sites may not provide the data required. Transect sites should be located in habitats important to species of interest. Properly set-up and geo-referenced transect sites will enable and facilitate monitoring and determination of pre-post project impacts (Lewis et al. 2004, State of Oregon 1995).

Alternatives Analysis
The AfDB safeguard policy[14] does not appear to provide a definition or a process for evaluating alternatives to the proposed project. However, AfDB's safeguard policy requires that alternatives be considered in the ESIA, as part of the mitigation hierarchy and in the project design where, in relation to resettlement, it mandates "finding other alternatives that can reasonably replace the project" (AfDB ISS 2013).

The alternatives analysis is considered the core of the ESIA as it presents the environmental and social impacts of the proposal and the alternatives in comparative form, thus defining the issues and providing a clear basis for choice among options by the decision-maker and the public. The ESIA alternatives analysis includes the alternative of "no action" and a comparison of alternatives according to ESIA practices based on technical, social, environmental and economic risks and benefits. Generally it is also important to incorporate a cumulative effects analysis into the development of alternatives for the ESIA. This analysis is also intended to look beyond location or design issues to consider alternate means of achieving the development objectives of the project.

Associated facilities
The AfDB safeguard policy includes the assessment of associated facilities as part of the area of influence in the ESIA. The policy defines related or associated facilities as those dependent on the project that are not funded by the project and that would not have been implemented if the project did not exist (AfDB ISS 2013).

Environmental and social impacts of associated facilities can be as serious as those from the MDB-financed component. Although recognizing that associated facilities may be funded, owned, constructed and operated separately, it is still important to ensure that a quality ESIA is undertaken with proposed avoidance and mitigation measures.

Cumulative Impacts Assessment
The AfDB safeguard policy defines cumulative impacts as "impacts on areas and resources that result from the proposed project, in addition to impacts from other existing or planned developments, including from any associated facilities, regardless of which entity undertakes those actions. Cumulative impacts can result from individually minor but collectively significant actions that take place over a period of time" (AfDB ISS 2013).

The process of analyzing cumulative effects can be thought of as enhancing the traditional components of an ESIA: (1) scoping; (2) describing the affected environment; and (3) determining the environmental consequences. Generally it is also critical to incorporate cumulative effects analysis into the development of alternatives for the ESIA. Only by re-evaluating and modifying alternatives in light of the projected cumulative effects can adverse consequences be effectively avoided or

[14] http://www.afdb.org/fileadmin/uploads/afdb/Documents/Policy-Documents/December_2013_-_AfDB%E2%80%99S_Integrated_Safeguards_System__-_Policy_Statement_and_Operational_Safeguards.pdf

minimized. Considering cumulative effects is also essential to developing appropriate mitigation and monitoring its effectiveness. Both environmental and social aspects of cumulative impacts need to be assessed. The AfDB does not appear to have defined "planned developments" but reasonably foreseeable future actions should be considered as part of planned actions. IFC Good Practice Handbook on Cumulative Impacts uses the terminology "reasonably anticipated" and "reasonably planned" when discussing scope.

A cumulative impacts assessment should cover the spatial (geographic) and temporal (time) scope appropriate for the project, utilizing data on the status of natural, cultural, social, or economic resources and systems and data that characterize important environmental or social stress factors; and data on environmental and socioeconomic trends. The scope should include associated infrastructure (roads, transmission lines) and other development activities which need to be addressed to avoid significant watershed-level impacts. Individual sponsors should use their best efforts to engage other developers, governments, and other stakeholders in acknowledging the cumulative impacts and risks and in designing coherent management strategies to mitigate them.

4.1.2 USAID Recommendations

Specific Environmental Recommendations for the TOR of the EIA:

- Collect adequate baseline data on aquatic species which should include: mapping the temporal distribution, relative abundance and population status of fish species; critical habitats for life stage timing; microhabitat characteristics; habitat connectivity and lower trophic levels to inform the environmental flow analysis as part of the AfDB Operational Safeguard, Biodiversity, Renewable Resources and Ecosystem Services (OS3) requiring that the ESIA use appropriate methodologies.
- Include the alternative of "no action" and comparisons of alternative means for achieving the development objectives of the proposal, including other renewable energy sources and other project specific components (e.g., location, design) based on technical, social, environmental and economic risks and benefits as part of successfully meeting AfDB OS1.
- Include a cumulative impacts assessment encompassing the spatial (geographic) and temporal (time) scope and include data on: the status of natural, cultural, social, or economic resources and systems; data that characterize important environmental or social stress factors; and data on environmental and socioeconomic trends. AfDB does not explicitly state when in the process to conduct a cumulative impacts assessment.
- Include an assessment of direct, indirect and cumulative impacts of associated facilities. AfDB does not explicitly state when in the process to conduct an assessment of associated facilities and the scope of impact coverage.
- Include an assessment of the potential impacts of climate change on water levels in Lake Malawi and subsequent impacts on the project. The assessment should consider scenario building exercises for any future flow regime, including the predicted change in condition of the river ecosystem, as described, based on data collected. This recommendation supports AfDB's screening of projects for climate change risk.
- Include an assessment of the catchment area to inform the development of a watershed management plan.

General Environmental Recommendations to Support Sustainable Energy Development

- Conduct a comprehensive sectoral assessment study to evaluate the impacts of hydropower projects on fisheries and other aquatic species, and sediment and nutrient flow in the Shire River and downstream ecosystems, such as the Elephant Marsh.
- Conduct a water allocation budget for the entire basin that takes into account environmental flows and the demand by all stakeholders on natural ecosystems, such as the Elephant Marsh.

- Support a multinational effort to collect and analyze data, monitor Lake Malawi tributary characteristics and model water balance – including rainfall, discharge and offtake in the Lake Malawi Basin to be able to determine the potential cumulative impacts of watershed development on lake levels and subsequent outflow to the Shire River.
- Ensure inclusion of all stakeholders on a more interactive basis such as ESCOM and project-affected communities.

4.2 SOCIAL – FINDINGS AND RECOMMENDATIONS

4.2.1 Findings from Literature Reviewed

Resettlement of Project Affected Communities

The Kholombidzo HPP is expected to result in involuntary resettlement either through physical and/or economic displacement. Experts in the field of involuntary resettlement highlight that despite more than 20 years of efforts to improve involuntary resettlement, livelihoods are not always improved. This may be partly attributable to the perception of involuntary resettlement activities as ancillary and temporary in comparison to the project. As a project "component," resettlement activities do not receive robust due diligence, including the detailed economic and financial analyses and budgets that they would receive if the resettlement were carried out as a self-standing project. World Bank (1996) research concluded,"cost analysis and financial planning for resettlement is often inadequate and financial obligations unclear."

Current practices lean heavily on cost-benefit analysis, which is a tool that weighs costs and benefits at the project level and usually does not explore the distribution of costs or benefits among project stakeholders. When the distribution of losses and gains are not appropriately taken into account, public resources can be invested in a way that benefits predominately one segment of the population, while the costs are disproportionately borne by disadvantaged communities (Cernea, 2008).

A four-stage process for achieving successful involuntary resettlement has been developed based on World Bank research and a statistical analysis of resettlement outcomes from 50 large globally distributed dam projects. The process requires livelihood improvement rather than restoration of previous living standards, participatory options assessment involving all stakeholders, development opportunities for resettled peoples, and project benefit sharing"(Scudder, 2012).

AfDB's Operational Safeguard 2 (OS 2) on involuntary resettlement states that project-affected people are to be "treated fairly, equitably, and in a socially and culturally sensitive manner; that they receive compensation and resettlement assistance so that their standards of living, income-earning capacity, production levels and overall means of livelihood are improved; and that they share in the benefits of the project that involves their resettlement." AfDB OS 2 requires consultation, participation and broad community support including the following elements:

- Appropriate notice to all potentially affected persons that resettlement is being considered and that there will be public hearings on the proposed plans and alternatives;
- Effective advance dissemination by the authorities of relevant information, including land records and proposed comprehensive resettlement plans specifically addressing efforts to protect vulnerable groups;
- A reasonable time period for public review of, comments on, and/or objection to any options of the proposed plan; and
- Public hearings that provide affected persons and/or their legally designated representatives with opportunities to challenge the resettlement design and process, and/or to present and discuss alternative proposals and articulate their views and development priorities.

OS 2 states that a "comprehensive socioeconomic survey-in line with international standards for social and economic baseline studies as agreed to in the environmental and social assessment process - including a population census and an inventory of assets (including natural assets upon which the affected people may depend for a portion of their livelihoods)" needs to be completed. The survey is intended to identify the people who will be displaced by the project; all the relevant characteristics of those people, including conditions of vulnerability; and the magnitude of the expected physical and economic displacement. This will include collection of gender and age-disaggregated information pertaining to the economic, social and cultural conditions of the affected population. It contains various official materials (maps, numerical records, special reports, research and knowledge pieces, etc.), records of interviews with stakeholders about their preferences, supply chain due diligence material, and a protocol to fill any gaps in data and ancillary information. It also identifies opportunities to improve community welfare.

4.2.2 Stakeholder Comments

Donors/GoM*:*
A summary of stakeholder comments on land and compensation issues by donors and GoM officials is provided below:

- The national land acquisition policy is outdated and there is need to provide technical assistance to develop a national resettlement policy.
- Resettlement and compensation processes should take into account cultural practices. Along the Shire River, cultural practices follow the matrilineal system[15] in which land belongs to the maternal side of the family, along with any physical structures (e.g., house). Most farming is done by women and loss of livelihoods is a key concern where women, orphans and older people are resettled from the area where their social safety net is in place. In a matrilineal system, when the woman marries, the husband moves into the wife's village and occupies her house. Under this condition, the challenge is who and how to compensate. Culturally, compensation should go to the wife. Joint compensation for both male/female members of the household is not culturally appropriate and makes the woman culturally more vulnerable. Given the matriarchal structure, men and village chiefs need to be educated to help women take a bigger leadership role in community decisions.
- There is unequal knowledge between stakeholders and sponsors of the proposed projects, resulting in unequal negotiating power. Technical assistance for projects is far removed from the people. Implementers need to be able to identify conflicts of interests between various levels of stakeholders. It is important to not only consult community at large, but also to consult all potentially affected persons as they likely will have different perspectives.

Communities:
Communities in the project area provided their views on the proposed development.

Discussions were conducted with a village chief and community located near the Kholombidzo proposed dam site. There are three sub-villages in this area and more than 2,300 residents. The community has been aware of plans to build Kholombidzo HPP since 1999, and has seen ESCOM vehicles visiting various sites. However, ESCOM representatives had not come to their village to discuss the project. Peoples' livelihoods are based primarily on rain-fed, some treadle pump irrigation systems and recession agriculture. They have received fertilizer and seeds from the farm input subsidy program and also extension services. The Shire River provides fish for subsistence, and any surplus fish are sold. About seven fish species are caught, of which chambo seems the dominant species. Fish appear to be migratory, as local households reported that they fish mainly during the

[15] Under the matrilineal system, land is handed down through the female line. The husband generally loses rights to use the household land in the event of divorce or his wife's death. Tenure security is lowest for men in matrilineal system and for women under patrilineal system.

rainy season. Community members said that the fish catch has been declining, with specific reference to the chambo. Some members suggested that it was the shortage of rain. They are able to catch fish up to the Nkulu dam, which has a slightly better fishery than the stretch of river by their village. The Shire River is their source of water for both drinking and domestic uses. The communities have boreholes, but some are not functioning due to declining water level or mechanical failure.

There has been a shortage of rain which has resulted in delayed planting of crops and reduction in the water table. Currently, the village is food insecure. Rainfall is unpredictable and seems to be delayed every year – it starts late and ends early.

Community members view jobs, access to electricity in their village, a school and a health center as positive aspects of the project. For example, the current health center is very far away and difficult to get to.

The following are community recommendations, if the project is developed:

- ESCOM should organize a community meeting to inform everyone about the proposed project. If the community needs to be resettled, they will need time and money to find appropriate land, since land is so scarce. Villagers stated that if this is not provided, households will have nowhere to go.
- If ESCOM does develop the project, the community needs to know how much land will be used, and how many people will be displaced at the earliest stages.

Within the last year, the Chinese company building the rail line to transport Mozambican coal through Malawi, which is located close to their village, visited the community and told them about the potential coal-fired power plant.

4.2.3 USAID Recommendations

USAID makes the following recommendations with the goal of improving hydropower sector development strategies and implementation.

Specific Social Recommendations for the TOR EIA:

- Develop a timeframe and process for early engagement with potential project-affected communities and mechanism for consultation, participation and broad community support. Develop benchmark indicators for determining success in meeting AfDB OS2 involuntary resettlement objectives (e.g., meaningful consultation; opportunities for comment and mechanisms for including comments into the process).
- As a component of resettlement planning, design a process and mechanism for sharing of project benefits with the project affected community.[16]
- Provide a mechanism for project-affected communities to obtain independent (objective) technical, legal, financial and social support.
- Collect adequate demographic, social and economic data for the ESIA to support an evaluation of impacts on community and household-level economies/livelihoods and public health, to inform the Resettlement Action Plan.

General Social Recommendations:

- A National Resettlement Policy with supporting legislation (including standards for compliance and monitoring and a verification process) should be developed to guide all resettlement in Malawi in a uniform and equitable manner.

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[16] Nepal's Chilime HPP is an example where project-affected communities were provided ongoing sharing of benefits of the HPP.

- Guidance should be developed for public participation, consultation, and information disclosure and ensure that community participation is part of the consultation process, and not only at the level of the chief.
- The land law should be reformed to include formal recognition of unregistered customary tenure.

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7: ANNEXES

ANNEX I

Government of Malawi:
The electricity sector falls under the responsibility of the Ministry of Energy (MoE), which is in charge of sector policy formulation and regulation as well as overseeing planning, investment, and development of the power sector. The MoE is also responsible for issuing licenses for electricity generation, transmission and distribution. The Department of Electricity Development (DoED) supports the MoE in these areas as well as in technical issues related to hydropower and electricity.

The Electricity Supply Corporation of Malawi (ESCOM) is a vertically-integrated, government-owned electric utility that generates, transmits and distributes electric power to about 203,000 customers. ESCOM owns and operates all of the formal generation capacity in the country. ESCOM also operates the national electricity grid. The transmission network comprises 1250 km of wood pole lines and 815 km of steel tower lines. These lines transmit bulk power at 66kV and 132kV, and feed power to over 70 transformers located at 39 substations in the country. In 2000-2001, ESCOM was functionally restructured into three business units, namely Generation, Transmission and Distribution. Under Distribution, there were three geographical regions: Southern Electricity Supply, Central Electricity Supply and Northern Electricity Supply. The Power Sector Reform Strategy (PSRS), approved by the Government of Malawi in 2003, provided for the unbundling of ESCOM and private sector participation via long term concessions in transmission and distribution and entry of Independent Power Producers (IPPs) for new generation capacity.

As part of the operationalization of the 2004 energy sector legislation, the Malawi Energy Regulatory Authority (MERA) is now operational. A board and small secretariat are now in place. MERA‟s role includes, inter alia: (i) reviewing tariff applications from ESCOM and recommending tariff changes to GoM; (ii) granting licenses for generation and distribution operators; (iii) arbitrating commercial disputes that arise under the 2004 energy legislation. As a regulator, MERA is also tasked with assisting the Ministry of Environmental Affairs in monitoring the ESMP during implementation. MERA has an Environment Section but will consult with the Ministry of Environmental Affairs if there is a problem.

The Environmental Affairs Department, under the Ministry of Natural Resources, Energy and Environment, was established to exercise general supervision and co-ordination over all matters relating to the environment. The department is the principal instrument of the government in the implementation of all policies relating to the environment and natural resources. Essentially the department provides environmental stewardship and enforces the environmental mandate through various approaches and strategies. It promotes conservation, sustainable use, and protection of the environment and natural resources in line with the principles of sustainable development, as articulated in Agenda 21 of the Rio Convention, Johannesburg Plan of Implementation, Millennium Development Goals, and Malawi’s Growth and Development Strategy (MGDS).

ANNEX II

Examples of the types of baseline data that should be collected, using standard data collection techniques, include the following:

- Baseline data on the biodiversity in the project area and its area of influence relevant: to its local, regional, national, and international importance; its use by local communities; and population structure and dynamics;
- Distribution, richness, and diversity of habitats[17] and ecosystems including connectivity/fragmentation, carrying capacity, and functional analysis;
- Maps of the temporal distribution, relative abundance, and population status of fish species;
- Maps of the critical habitats for life stage timing -- spawning, incubation, migration, and active rearing;
- Maps of microhabitat characteristics (e.g., depth, velocity, substrate, cover);
- Maps of habitat connectivity (e.g., flow regime, channel morphology[18] and characteristics) at discrete intervals to the mouth of the river;
- Hydrological studies and flow assessments. Test and refine the hypotheses about the relationships between environmental flows and the important river processes and conditions;
- Water quality parameters (e.g., dissolved oxygen, pH, temperature, total suspended solids, total organic carbon,[19] phosphorus, nitrogen) collected in a temporally and spatially structured manner. Where reservoirs will inundate vegetation, water quality issues include mercury methylation and subsequent bioaccumulation;
- Mapping lower trophic levels (periphyton, macrophytes, invertebrates). Lower trophic level species are key components of stream productive capacity and are an important component of fish diets. It may be necessary to sample lower trophic levels to be able to evaluate the effects of flow change on productivity at both low and high trophic levels; and
- Assessing wildlife hunting and fishing pressures and impact of construction workers on natural resources (wildlife, wood).

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[17] The purpose of fish habitat assessment is to describe the abundance and distribution of fish habitats and whether previous land and water uses have affected the habitats.

[18] This requires an understanding of fine and coarse sediment supply sources, transport mechanisms and deposition. The interaction between sediment, flow and setting determines characteristic features of the channel (shape – width-depth ratio, thalweg location, bars; stability – lateral instability, avulsions; bed forms – riffles, boulder riffles, etc.)

[19] This is a critical water quality characteristic, given that it drives the energy balance and food chains in aquatic ecosystems.

Based on the review of the project's TOR, USAID provides the following recommendation subcomponents with the goal of strengthening the ESIA:

Environmental Recommendation Subcomponents:

Recommendation 1 subcomponents:

- Gather baseline data over a sufficient period of time to capture seasonal variation;
- Collect baseline data on ecosystem services important to local peoples and the region;
- Map and monitor distributions of critical species;
- Provide in the ESIA a clear explanation of the criteria used to determine impact magnitude and significance; and
- Conduct a comprehensive environmental flows assessment to specify flow requirements needed to maintain ecosystem services prior to project design phase.

Recommendation 2 subcomponents:

- Identify various alternative approaches to achieve the development objective of the project;
- Provide a comparison of the environmental losses and gains associated with the various alternatives, together with the social, technical and economic costs and benefits, to provide a balanced and full picture for each alternative;
- Rigorously explore and objectively evaluate all reasonable alternatives, as well as those other alternatives;
- In addition to alternative means to achieve the development objective, include project specific demand, activity, location, process, input and mitigation alternatives; and
- Incorporate in the no-action alternative the cumulative effects of past activities and accurately depict the condition of the environment.

Recommendation 3 subcomponents:

- As part of the alternatives analysis, identify which resources or ecosystem components of concern might be affected by the proposed action or its alternatives within the project area. Once these resources have been identified, consider the ecological requirements needed to sustain the resources.
- Evaluate the degree of degradation from the environmental reference point (i.e., natural ecosystem condition) that has resulted from past actions. This would allow one to compare the impacts of various alternatives relative to existing conditions as well as identify changes critical to maintaining or restoring the desired, sustainable condition.
- Consider cumulative effects as an important means for developing appropriate mitigation measures and monitoring their effectiveness.
- Evaluate resource impact zones and the life cycle of effects rather than projects, to properly bound the cumulative effects analysis.

Recommendation 4 subcomponents:

- Identify and examine in the ESIA the facilities associated with the project, including those not financed by the MDB. The one likely type of associated facility would be transmission lines.

Recommendation 5 subcomponents:

- Collect baseline data on water uses and requirements for plants, animals and humans; water availability; environmental flows; and the hydrologic cycle;
- Model future impacts of climate change scenarios; and
- Use modeling outputs to inform feasibility analysis of hydropower projects in the near and long-term.