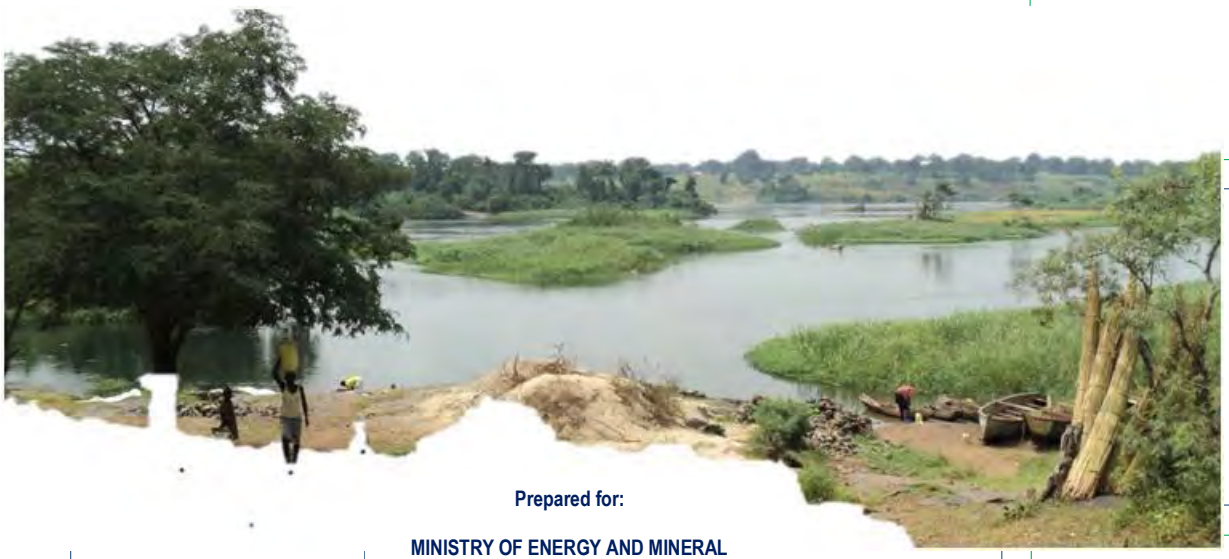
Final Report

MINISTRY OF ENERGY AND MINERAL DEVELOPMENT

Environmental Impact Assessment

For proposed the Isimba Hydropower Plant and Reservoir



Prepared for:

MINISTRY OF ENERGY AND MINERAL DEVELOPMENT
Amber House,
Plot 29/33 Kampala, Uganda

Prepared by:

AWE Environmental Engineers
(EIA Partnership of AIR WATER EARTH-AWE)
27 Binayomba Road, Bugolobi P.O.
Box 22428, Kampala, UGANDA Tel:
041-4268466
Email: mail@awe-engineers.com
Web: www.awe-engineers.com

On behalf of:

KAGGA & PARTNERS LTD
Consulting Engineers
2 Bandali Close Bugolobi
P. O. Box 6583, Kampala Uganda
T: +256 414 220279 / 256 414 223692
E: mail@kaggapartners.com
W: www.kaggapartners.com

FITCHNER GmbH & Co. KG
Sarweystrasse 3
70191 Stuttgart, Germany
T: +49 (0)711 89 95 - 0
E: info@fichtner.de
W: www. fichtner.de

NORPLAN
Nedre Skøyen vei 2
0276 Oslo, Norway
T: +47 21 58 50 00
E: norplan@norplan.com

APRIL 2014

MINISTRY OF ENERGY AND MINERAL DEVELOPMENT

Environmental Impact Assessment for the Proposed Isimba Hydropower Plant

Dam location:

Districts Involved	Dam Site:
Kayunga Kamuli Jinja	Left bank Right bank Right bank reservoir

Cover photograph: Proposed Isimba HPP location in Nampanyi Village on left bank of Victoria Nile in Kayunga District. This will also be the starting point of the 42 km 132 kV transmission line that will traverse districts of Kayunga and Buikwe from proposed Isimba dam site to Bujagali power station.

Document Control

Client: Ministry of Energy & Mineral Development			**Project No:**	
Project Name: Environmental Impact Assessment for Isimba Hydropower Plant				
Report Title: Environmental Impact Assessment for the proposed Isimba Hydropower Plant.			**Date:** April, 2014 **Report. No.:**2014/128/MEMD	
Revision	**Description**	**Originator**	**Reviewed**	**Signed off:**
		VO, OBD, RK, JK,	TP, IK	LK
Preparation of this report has been undertaken within agreed terms of reference using all reasonable skill and care. The consultant accepts no responsibility or legal liability arising from unauthorized use by third parties of data or professional opinions herein contained.			Distribution ☐ Official ■ Public ☐ Confidential	

UEGCL contacts for public interface.

www.uegcl.com
info@uegcl.co.ug
+256-434 120891

Consultants

Lead consultants:

Eng. Lammeck KAJUBI; PE.
BSc. Eng. (1.1 Hons), MEng. Sc(Env)(UQ-Australia), MUIPE, MASAE (USA).
Registered Professional Environmental Engineer (PE)- UGANDA
Registered EIA Practitioner
Environmental Engineer & Team Leader.

.....

Herbert Mpagi KALIBBALA, PhD.
BSc. Eng. (Civ)(Mak), MScEng. (Env) (Mak), PhD, GMUIPE
Registered EIA Practitioner
Civil/Infrastructure Engineer.

.....

Pamela TASHOBYA KWOLEKWA
BA (MAK), MSc (Dev. Mgt.)
Registered EIA Practitioner
Socio-development Specialist

.....

Faith MUGERWA BA
(MAK), MA (Soc)
Registered EIA Practitioner
Sociologist

.....

Isa KABENGE, PhD.
Registered EIA Practitioner
Water Resources Engineer/ GIS specialist

.....

David Ben OYEN
Registered EIA Practitioner
Environmental Engineer

.....

Contributing consultants:

Dr. Robert KITYO, PhD.
Ecologist - Fauna
Dr. James KALEMA, PhD.
Ecologist - Flora

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ACRONYMS AND MEASURES

Acronyms:

AP:	Angle Point(s)
CFR:	Central Forest Reserve
CO_2:	Carbon dioxide
dBA:	Decibel (on scale "A": a measure of sound level as heard by a human ear)
EIA:	Environmental Impact Assessment
ERA:	Electricity Regulatory Authority
ESMP:	Environmental and Social Management Plan
HFO:	Heavy Fuel Oil
HPP:	Hydropower Project
HV:	High Voltage
IPP:	Independent Power Producer(s)
LC:	Local Council
MEMD:	Ministry of Energy and Mineral Development
NDP:	National Development Plan
NEMA:	National Environment Management Authority
NOx:	Oxides of Nitrogen
OHS:	Occupational Health and Safety
PAP:	Project-Affected Person(s)
PPP:	Public Private Partnership
RAP:	Resettlement Action Plan
REA:	Rural Electrification Agency
SIA:	Social Impact Assessment
STD:	Sexually Transmitted Disease
UETCL:	Uganda Electricity Transmission Company Limited
UEGCL:	Uganda Electricity Generation Company Limited

Measures and units:

A:	Ampere (a unit of current)
g:	Gram
Ha:	Hectare (10 000 square metres)
kph:	Kilometre per hour
km:	Kilometre (1 000 metres)
kV:	Kilovolt(1000 volt)
kVA:	Kilovolt-ampere (1000 volt-ampere)
kWh:	Kilowatt-hour (1000 watt-hour)
m:	Metres
MVA:	Mega volt-ampere (10^6 volt-ampere)
MWh:	Megawatt-hour (10^6 watt-hour)
MW:	Megawatt (10^6 watt)

EXECUTIVE SUMMARY

A. Introduction

The period between 2003 and 2007 is remarkable in the history of Uganda's electricity sector because of a prolonged drought which affected operations of the Owen Falls Dam, then the country's main source of electricity. Impaired hydrology led to substantial decline in electricity generation resulting into a supply deficit of up to 210 MW, causing 24-hour load shedding. Acute shortage of electricity supply negatively impacted the gross domestic product (GDP), dropping at the rate of 1.5% per annum. In spite of the decline in generation, demand for electricity continued to grow, widening the gap and peak demand reached 380 MW.

The Ministry of Energy and Mineral Development (MEMD) in 2006 prepared a plan to meet the shortfall in electricity supply in the short, medium and long terms. The broad objective was not only to provide adequate and reliable power supply, but to also anticipate new electricity demand ahead instead of the old approach of chasing demand forecasts. The short-term measures involved procurement of thermal generation to provide temporary relief. About 150MW of additional thermal power plants were installed at Lugogo, Mutundwe and Kiira sub-stations to provide relief to the consumers. The Government also procured the 50 MW Namanve Jacobsen Heavy Fuel thermal plant. However, the stop-gap measures were at a cost. Power became expensive, forcing the Government to subsidise up to $9.5million every month despite increase in the end-user tariffs. The introduction of thermal power generation in the energy mix was combined with aggressive energy loss reduction strategy and an energy efficiency/ demand side management. To improve energy efficiency, the 800,000 energy-saving bulbs were procured at a cost of $1.2million and distributed freely to households and about 30 MW were saved under this demand-side intervention. The MEMD also carried out energy audits in various industries, commercial buildings and institutions to improve their energy management practices.

The medium-term strategy involved the development of the 250 MW Bujagali Hydropower Project on River Nile. Construction work of this project started in May 2007, and the plant was fully commissioned in July 2012.The Bujagali project doubled the electricity supply, reducing load-shedding and replacing expensive thermal power generation. The plant was commissioned on unit-by-unit basis in response to energy ministry's strategic decision to replace the expensive thermal power generation at the earliest date and minimize load shedding. The other medium-term measure was to promote construction of small hydropower plants around the country. A number of small hydro power projects have already been completed and commissioned.

In September 2012, Nyagak Hydropower Plant of capacity 3.5 MW was commissioned, and this supplies the off-grid West Nile region. Other plants commissioned recently and delivering power to the national grid are:

- 18 MW Mpanga small hydro power station (Commissioned in 2011)
- 13 MW Bugoye small hydropower station (Commissioned in 2009)
- 10 MW Mubuku III mini-hydro station(Commissioned in 2008)
- 9 MW Buseruka hydropower plant renamed Kabalega Hydropower Plant (Commissioned in January 2013)
- 6.5 MW Ishasha mini-hydropower station (Commissioned in 2011)

It is estimated that there are over 50 small hydropower sites around the country, which can generate a total of 200 MW to supplement bigger projects on River Nile.

Uganda Government is now focused on construction of the 180 MW Isimba Hydro Power Project and 600 MW Karuma Hydro Power Project which will be a major addition to the national hydropower pool.

B. Policy, Legal and Institutional Framework

The legislative, regulatory and policy context in which the proposed Isimba Hydropower Project should comply are discussed along with IFC performance standards, international conventions to which Uganda is party and guidelines of World Commission on Dams (WCD). The policies include: The National Environment Management Policy, 1994, The Energy Policy, 2002, National Development Plan, 2010, Wetlands Policy, 1995, Uganda's Vision 2040, National Gender Policy (1997), The Forestry Policy, 2001, HIV/AIDS Policy 1992, Occupational Health and Safety (OHS)

Policy 2006, Renewable Energy Policy, 2007, Master Plan Study on Hydropower Development in Uganda, 2011, National water policy 1999, The Fisheries Policy, 2004, and Wildlife Policy, 1999.

The legislative framework to be complied with includes: Constitution of the Republic of Uganda, 1995, National Environment Act, Cap 153 1995, Land Act, Cap 227 1998, Electricity Act, Cap 145 1999, Physical planning act, 2011, Public Health Act, Cap 281 1964, Occupational Safety and Health Act, 2006, National Environment (Wetlands, River Banks and Lakeshores management) Regulations, 2000, National Environment (Noise Standards and Control) Regulations, 2003, National Environment (Minimum Standards for Management of Soil Quality) Regulations, 2001, Water Act, Cap 152, 1997, National Environment (Waste Management) Regulations, 1999, The Mining Act, Cap. 148, 2003, Workers' Compensation Act (2000), and the Local Governments Act, Cap. 243.

The Regulations that have to be complied with include: Environmental Impact Assessment Regulations, 1998, National Forestry and Tree Planting Act, 2003, Petroleum Supply Act, 2003, Uganda Wildlife Act, Cap. 2000, Draft National Air Quality Standards, 2006, Road Act, Cap.358, Investment Code Act, Cap. 92, National Environment (Standards for Discharge of Effluent into Water or on Land) Regulations, 1999, Employment Act, 2006, and Historical and Monuments Act, 1967.

Uganda is party to several global and regional environment and conventions and agreements as described below and they have to be complied with and this include: *The Convention on Biological Diversity (CBD), The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), and Protocol Agreement on Conservation of Common Natural Resources (1982).*

The Institutional Framework that is in place for the project works includes: National Environmental Management Authority, NEMA, Environmental Liaison Units in Ministries, Ministry of Energy and Mineral Development, MEMD, Electricity Regulatory Authority, ERA, Uganda Electricity Transmission Company and Generation Company Limited, Local Government Administration Structures, The Ministry of Gender, Labour & Social Development, MGLSD and National Forestry Authority, NFA, and Uganda Wildlife Authority (UWA) and Rural Electrification Agency, REA and Ministry of Tourism, Wildlife and Antiques, and Ministry of Water and Environment.

There are also prior undertakings by the Government of Uganda (GoU) under Article 3, Section 3.06 (a) of the Indemnity agreement and engagement between the government and the World Bank.

C. Description of the Project

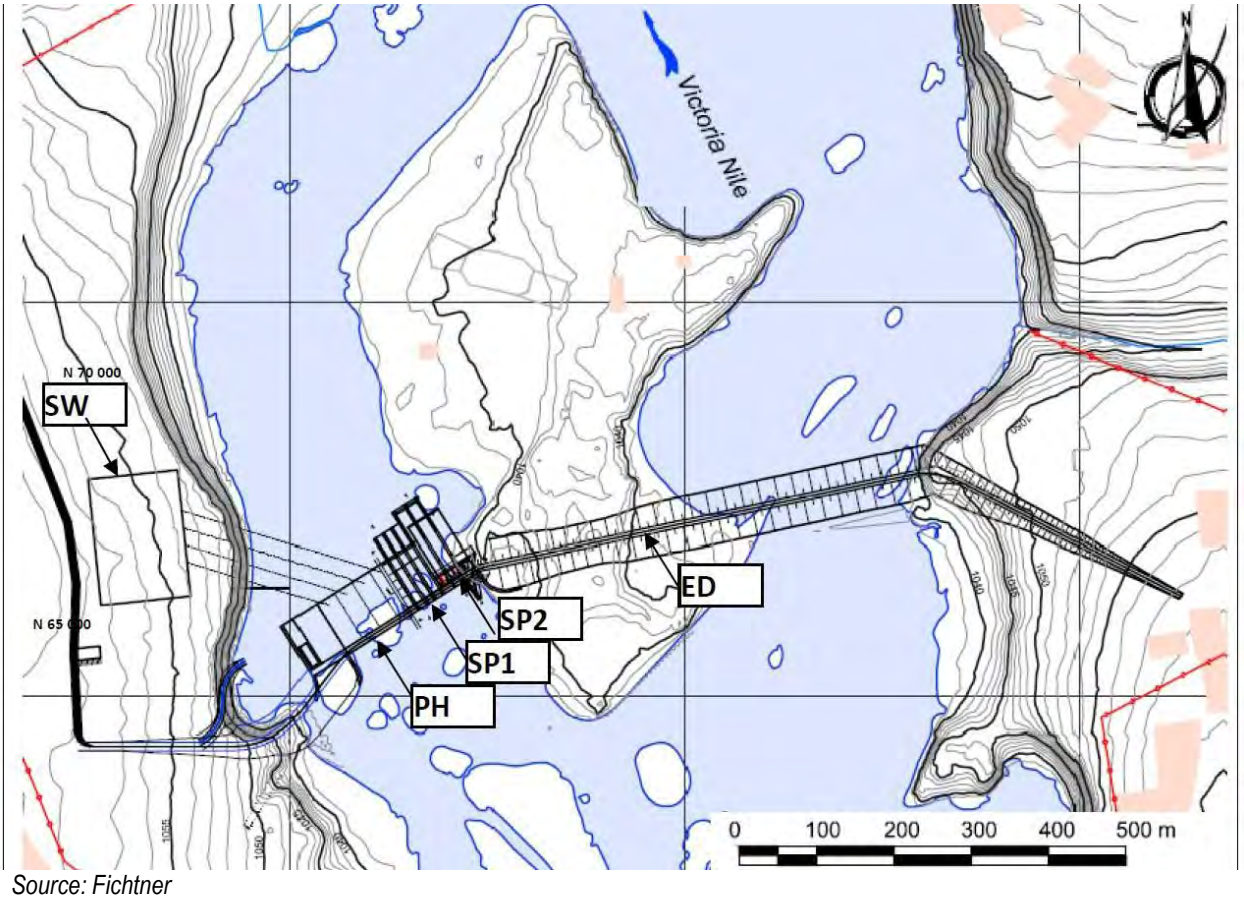
Nature of dam structure

Due to a relatively low water head available, the power station will have its powerhouse structure embedded in the overall water retaining structure. This offers the most convenient and cost-effective option. The power station will comprise of Kaplan turbines which provide for easier maintenance since similar units are installed at Bujagali HPP and

Nalubaale HPP (formerly Owen Falls Dam). A rockfill dam with central clay core was selected for the structure of power station. This choice was based on abundant availability of good rock material and clay in the vicinity of project site.

Layout

The powerhouse and spillways will be located in the left river channel. The layout of the Isimba Hydro Power Project main structures is presented in Figure 0-1.



Source: Fichtner

Figure 0-1: Layout of Isimba HPP

From Figure 0-1, the outdoor switchyard will be on the left bank and connected to the powerhouse with four overhead lines. To provide adequate space at the erection bay and enable easy access, the bay will be located west of the powerhouse and main access road will lead to this location.

Powerhouse

The powerhouse structure will be monolithic with the intake, turbine block and outlet to be casted as integral parts of the powerhouse. Water will enter each intake through a double entrance protected by trash screens. Each intake could be isolated from the reservoir by hydraulic servo-assisted fast closing guard gates. For inspection and maintenance purposes manually operated bulkhead gates upstream of the trash racks are provided. Downstream of the guard gates, the double waterway passages merge into a single section leading to the turbine spiral case. The waterway entrances are shaped to minimize hydraulic losses. Similarly to the intake, the outlet works was designed with due attention to provide for efficient operation of the turbines. It is intended to have steel-lined draft tubes immediately below the turbine runner. Each draft tube will be further divided into two channels that discharge water to the Tail water. At the end, the draft tubes shall be equipped with the bulk head gates to enable their closure for inspection and maintenance. Depending on the actual geological conditions, if necessary the tailrace channel immediately downstream of the draft tube outlets will be lined with concrete or some other measure for protecting the channel against erosion may be adopted.

Hydro mechanical and electrical equipment will be placed within the powerhouse itself. Downstream of the turbine units, three floors are envisaged for placement of all necessary equipment. Only transformers are intended to be located on the outside platform at an elevation of 1045 m above sea level (ASL). This should enable easy evacuation of energy towards the substation over one short overhead line. The control building will be located at the west end of the erection bay within the powerhouse and will contain enough space for all administrative/ office(s), controlling and equipment rooms.

Spillways

Main data for the selected spillway gates are presented in Table 0-1.

Table 0-1: Main characteristics of the spillways

Selection	Units	Lower radial gates	Upper radial gates	Flap gates
Width	m	9.5	14	11
Gate height	m	10.5	10.5	2.5
Number of gates	unit	3	2	2
Sill level	m ASL	1029	1044.5	1052.5
Top of gate	m ASL	1039.65	105.55	10.55
Capacity of each gate	m^3/s	923	1105	196

The intake pond has an area of about 20 km^2 and the maximum flood level of the reservoir at an elevation of 1055 m ASL would be reached within 2 hours if the power plant has stopped and the inflow is 1375 m^3/s (capacity of upstream power plant).

The spillway was designed using the following criteria:

- Pass the 1000-year flood with the reservoir level not exceeding the elevation of the top of the dam body.
- No risk of cavitation at the design flood.
- Pass the maximum reservoir level with limited increase of the reservoir level, that is, not overtopping the embankment dams.

The spillway structures will comprise of:

- Three submerged radial gates for flood spilling, diversion during construction and for flushing of sediments accumulating in the reservoir.
- Two radial gates located above ogee crest spillways with a downstream plunge pool.
- Two flap gates located within each of the upper radial gates having the purpose of diverting floating debris during normal operation of the power plant.

Electrical Equipment

a) Generators

The generators will be vertical shaft, synchronous units each directly coupled to a Kaplan turbine. Key data about the generators is:

- Number of units 4
- Capacity 53 MVA
- Power 45.8 MW
- Cos Ø 0.85
- Voltage 12 – 15 kV
- Rotational speed 88.2 rpm.

The generators will be indirect water cooled closed air-circulation by “rim ventilation” with a multiple air to water heat exchangers mounted on the stator frame.

b) Main Transformers

The step-up transformers from the generated voltage to transmission line voltage (132kV), will be of three phase, air

cooled type, main characteristics are;

- Voltage 132 kV
- Capacity 53 MVA

Isimba Substation

The substation shall be of double busbar type with two line bays, 4 Transformer bays, 1 bus coupler and 2 future bays, one control building and necessary access roads, pavement and drainage system.

Isimba 132 kV substation will comprise of 1 (one) double busbar system 132 kV outdoor, steel work and busbar, lattice type, busbar conductors as follows:

Power and Energy Production

From available net head and discharge, the installed plant power capacity will be 183.2 MW based on the following information:

- Normal operating level in headwater: 1054.5 m ASL
- Tail water level, 4 units in operation: 1039.1 m ASL
- Gross Head: 15.4 m
- Net Head (assumed losses 0.3 m): 15.1 m
- Discharge 1 turbine: 343.75 m^3/s
- Discharge 4 turbines: 1375 m^3/s
- Assumed overall plant efficiency: 0.90
- Installed capacity, 4 turbines: 4 x 45.8 MW = 183.2 MW

C. Methodology

A rapid scoping assessment was undertaken at the beginning of the study. This exercise involved consultation with the client, design consultant, key stakeholders and local affected communities. The exercise helped the assessment team define the spatial and contextual scope of the study. Participation of the public at an early stage in the Environmental Impact Assessment (EIA) process was adopted to inform stakeholders of the proposed project and provide them with an opportunity to raise and incorporate potential concerns into the study. The scoping study entailed an initial and broad assessment of the project, policies, regulations and baseline data. The activities included geographical coverage, stakeholder meetings (interested and affected parties), foreseeing of significant impacts (within the areas of study) and determining the levels of detailed investigation requirements in each particular impact study. The scoping exercise also involved the review of literature and a number of field visits that generated the spatial dimensions of the project. Upon approval of terms of reference developed during scoping study, a full EIA study was commenced the findings of which are presented in this report.

D. Predicted Environment Impacts

The project will entail a temporary reduced flow downstream especially during dam filling operation of the power plant. This will potentially affect water quality, riverbank vegetation, birds and other aquatic life. Identified positive social impacts of the Isimba Hydropower Project include employment opportunities for local people during the construction period and upgrading of the road infrastructure in the project area. It is estimated that during its construction period, about 1500-2000 workers will be hired over 4-5 year construction period.

Biophysical impacts identified were found to be either small or minimal with the exception of the potential impact on Kalagala Offset area through encroachment and poaching and the islands in the river that will submerged. There was no bird or plant species, identified as a globally or locally threatened species according to IUCN classification. Implementation of the project is considered unlikely to affect fish migration because no migrating species were

encountered in the river during fish surveys in the project affected area. A summary of the predicted negative environmental impacts and their mitigation recommendations are presented in Table 0-2.

Table 0-2: Summary of proposed project impacts and mitigation measures

Impact	Mitigation/ Monitoring measures
Temporary land-take	As a requirement of the contract, temporary land take areas will be reinstated to pre-project condition. The ultimate decision as to the final uses for this land will rest with Uganda Land Commission.
Permanent land-take	▪ The project will provide due compensation to affected landowners to enable replacement of lost land. ▪ The project will guide displaced persons to identify resettlement areas of similar agricultural potential or productivity based on national soil productivity maps.
Impact on agriculture	▪ The project will provide due compensation to affected landowners to enable replacement of lost land. ▪ The project will guide displaced persons to identify resettlement areas of similar agricultural potential or productivity based on national soil productivity maps.
Impacts on Water environment, Reservoir water quality, New water environment sedimentation and erosion	▪ No digging or grubbing will be done during clearance of the reservoir. ▪ It is suggested that a sediment management plan should be designed. ▪ Regular evacuation of the deposited sediment with use of the planned bottom outlet will be performed almost every year in order to prolong the lifetime of the reservoir. ▪ Site drainage systems will include sedimentation basins. ▪ Water quality downstream will be monitored visually on a daily basis and samples taken and analysed on periodic basis. In practice catchment management in the future will have a significant influence on mitigation of these impacts. If intensive agricultural development and deforestation occur these could provide the reservoir with an increased sedimentation, nutrient supply of phosphorus and nitrogen pushing the reservoir into a higher eutrophic state. In the absence of catchment management there is therefore a moderate risk of adverse levels of eutrophication in the reservoir.
Downstream Impacts ▪ Short-term impacts on river levels during reservoir filling ▪ Long-term impacts on downstream river morphology and water quality ▪ Long-term impacts on river levels during operation	▪ The reach immediately downstream of the dam may experience some erosion, but it should be possible to control this through energy dissipaters at the dam. Further regulation of flow downstream may be considered at a later date; this would require additional assessment of the potential environmental and social impacts. ▪ These impacts could be mitigated in part by introduction of a compensation flow regime to achieve a flow pattern closer to the seasonal variation in natural flow conditions although it would not be possible to achieve a degree of seasonal variation of the same order as that occurring naturally. A smaller degree of variation could be achieved by varying power generation from the dam. These mitigation measures could be more accurately defined after better evaluation of seasonally inundated areas. This mitigation might involve use of small weirs to regulate flow and mimic natural local flooding regimes. Further study should be carried out during final, detailed design, including comparison of satellite imagery from the wet and dry seasons.
Effects of the reservoir on water resources	▪ Construction water should be stored on site to avoid direct surface water abstraction. ▪ Standard good construction site management practices will mitigate this effect.
Water pollution risks during construction Long term risks to water quality	▪ There will be provision for secure storage of substances such as oil, diesel fuel, concrete additives or solvents, including interceptors and sumps in case of spillage. ▪ There will be provision for pollutant spill response plans (including provision of training and equipment)

Impact	Mitigation/ Monitoring measures
	▪ The contractor will be required to treat all waste streams before discharge into water. ▪ The contractor will be contractually required to implement management measures, which will minimise the risk of a significant release of chemicals into the environment. With effective management and implementation of waste and wastewater management systems, the significance of this impact during the operation phase will be minor.
Effects on air quality	▪ Project vehicles will have a restricted speed limit of 40 kph through settlements and trading centres to minimise road dust. ▪ No work will be undertaken unless the required personal protective equipment has been provided and is being worn. ▪ During dry conditions, access roads will be wetted or treated with a biodegradable (e.g. lignin-based) road sealing product to prevent dust generation; ▪ Batching plant, conveyors, etc.will be suitably contained to minimise offsite dust; ▪ Trucks containing friable material will be covered if using public highways; and, ▪ A maintenance programme for plant and vehicles will be implemented, to ensure emissions of particulates, SO_2 and NO_2 are minimised.
Effects of noise	▪ Project vehicles will have a restricted speed limit of 40 kph through settlements and trading centres to minimise noise. ▪ Line construction workers will be provided with appropriate safety gear for protection against excessive noise. ▪ Noisy equipment like generators will be sited with regard to the presence of sensitive receptors whenever possible. Acoustic insulation (e.g. screens or bunds) will be used around noisy equipment. ▪ Regular care and maintenance of vehicles and equipment will be undertaken to ensure emissions of both noise are controlled.
Impacts on ecology and biodiversity Impacts on aquatic ecology; Impacts on terrestrial habitats; Impacts on wildlife; Temporary effects during construction; Secondary effects from movements of people; and	▪ Minimise riverbed and shoreline disturbance (e.g. restricting access of construction activities and workers to susceptible areas that could contribute to sediment loading); ▪ Develop "good construction environmental management" protocols to reduce effects on vegetation, noise management , avoidance of spills, maintenance of pollution control measures such as oil separators, and a dust management plan; ▪ Reduce the biomass that will be flooded by clearing most of the vegetation and the commercial salvage of forest products; and ▪ Implement 'nuisance' plant monitoring programme for the reservoir; ▪ Design the operational plan for the Isimba hydroelectric plant to ensure that reservoir drawdown is managed to optimise native vegetative growth in littoral zone. ▪ Design to have short periods of impoundment ▪ Develop a catchment management programme to prevent further sediment loading from upstream reach; and ▪ Design and develop a de-silting programme for the reservoir ▪ Prohibit development of unnecessary spur roads off main access roads, to limit land degradation and habitat disturbance; ▪ Replant or take measures to encourage re-colonisation by native vegetation in disturbed or denuded areas immediately following construction. ▪ Avoid or minimize unnecessary vegetation clearing. ▪ Provide for rescue of rare or distressed animals and strategic fire management; ▪ Selectively harvest tall trees (above 30m in height) within the inundation area prior to impoundment to force tree-dwelling wildlife to migrate from the area prior to flooding; ▪ Begin reservoir inundation after the dry season once hibernating animals have emerged; ▪ Locate all associated structures, temporary and permanent construction-related sites (e.g. construction camp, borrow pits) as far as possible within the zone of inundation, and in already disturbed habitat locations to minimise habitat loss and human/wildlife

Impact	Mitigation/ Monitoring measures
	interactions; ▪ Restoration of the site after construction should enable re-establishment of suitable habitats. ▪ Implement education programmes for construction workers on, inter alia: respect for wildlife and vegetation, avoidance of fires and accidental damage to property. ▪ Minimise the footprint of the construction camp and work areas.
Impact on Kalagala Offset area	Provided support to the on-going implementation of the Kalagala Offset management plan 2009-2018
Waste management and impact on soil quality	▪ Workers will be sensitised about responsible litter control and waste management practices. ▪ All waste generated at a given construction location will be collected in appropriate containers and disposed of as required by NEMA guidelines. ▪ Closure of camps and equipment yards will ensure no waste is left behind and contaminated areas on sites are properly remediated. ▪ Fuel transport and storage facilities will be licensed by the Petroleum Supply Department in MEMD. Such licensure requires use of bunded fuel storage, ensuring measures for spill and fire control.

A summary of monitoring plan is provided in Table 0-3.

E. Conclusions

The proposed Isimba Hydropower Project poses a number of positive impacts such as generation of hydro-electric energy to the national grid which will support national economic development; and construction of roads in local communities. A number of negative impacts have also been identified including loss of agricultural land, displacement of people, influx of people, loss of biodiversity and impact on water quality. Mitigations are proposed including compensation, resettlement (if necessary) and development of infrastructure facilities including upgrading of roads. It is expected that, over all, there will be less impacts from this development or the project. The proposed project does not have irreversible environmental impacts and mitigation measures proposed in the EIA report if implemented may eliminate or minimize these negative effects.

F. Recommendations

The project should collaborate with local governments and the lead agencies (Directorate of Water Resources Management (DWRM), Electricity Regulatory Authority (ERA), Uganda Wildlife Authority (UWA), National Forestry Authority (NFA), National Environment Management Authority (NEMA) and other relevant District or Local councils) during implementation of the recommended mitigation measures.

Sensitization should be done especially during project construction to minimize social impacts, undue expectations and other effects including accidents and poaching. It is recommended that whenever possible workers should be recruited from the local communities, especially in non-skilled positions. This would avoid in-migration of non-native persons into the project area and associated socio-environmental impacts.

Table 0-3: Environmental Management and Monitoring Plan

	Issue to Monitor	Indicator(s)	Data collection and Reporting			Use of data		Training or orientation required
			Who collects ****Timeframe**	**Who checks, Counter-checks**	**Method(s), Tools** ****Cost (UgShs)**	**Who acts,** ****Action**	**Referral (if action cannot be taken)**	
1	LEVEL OF OCCUPATIONAL SAFETY OF CONSTRUCTION WORKERS	Provision of personal protective gear to workers throughout the construction period Presence of First Aid Kits on site throughout the construction period	Site Supervisor **Throughout construction period	Site engineer UEGCL's site agent	Visual observation **Protective gear – USD 65,000 **First Aid Kits – UDS 20,000 **Fire extinguishers – USD 45,000	Site engineer ** Ensure stringent construction supervision. ** Provide personal protection gear	Contractor's Project Manager UEGCL's Project Manager	Importance and effective use of protective gear Use of First-Aid Kit
2	EXCESSIVE STRIPPING OF VEGETATION ALONG T/LINE ROUTE, CANAL, PENSTOCK, ACCESS ROADS AND POWERHOUSE SITES	Wide areas stripped of vegetation on site Dust plumes from cleared areas	Site Supervisor **During site preparation	Site Engineer UEGCL's site agent NFA, NEMA, District Environment Officer (DEO)	Visual observation. **Facilitation – USD 80,000	Site engineer ** Ensure that only areas to be constructed on are stripped of vegetative cover	UEGCL's Project Manager District Environment Officer	Provide key site personnel with mitigation measures of this EIA report
3	RESPONSIBLE CONSTRUCTION WASTE	Improper construction waste management practices observed on site throughout	Site foremen	Site supervisor NEMA, District	Visual Inspection	Site Engineer ** Provide	UEGCL's site agent/ supervising	Possible problems of improper waste management.

	Issue to Monitor	Indicator(s)	Data collection and Reporting			Use of data		Training or orientation required
			Who collects ****Timeframe**	**Who checks, Counter-checks**	**Method(s), Tools** ****Cost (UgShs)**	**Who acts,** ****Action**	**Referral (if action cannot be taken)**	
	MANAGEMENT	construction of the power station. Containers for construction waste collection provided.	**Throughout construction period.	Environment Officers (DEO).	**Provided for in above monthly monitoring cost for 5 years, Facilitation – USD 100,000	containers for construction waste collection and storage.	engineer.	Costs incurred from wasted material.
4	WATER CONTAMINATION	Excessive deposition of gravel in swamp at tower foundation sites. Waste dumped in watercourses.	Site supervisor **Throughout the construction period.	Site Engineer NEMA, District Environment Officer (DEO), Wetlands Management Department (WMD). WRMD	Visual inspection **Facilitation – USD 100,000 for 5 year's monitoring by WMD of T/line and proposed hydropower facility along the river and through swamps.	Contractor ** Minimise deposition of gravel, limiting quantities to the bare necessary.	UEGCL's Project Manager.	--

	Issue to Monitor	Indicator(s)	Data collection and Reporting			Use of data		Training or orientation required
			Who collects ****Timeframe**	**Who checks, Counter-checks**	**Method(s), Tools** ****Cost (UgShs)**	**Who acts,** ****Action**	**Referral (if action cannot be taken)**	
5	WASTE MANAGEMENT DURING MAINTENANCE WORK	All waste is properly collected stored and transported offsite.	UEGCL **Throughout project life.	UEGCL NEMA, District Environment Officer (DEO).	Visual inspection.	UEGCL. **Ensure contractors do not litter sites during maintenance	District Environment Officer.	Importance of proper solid waste management. Methods of waste handling.
6	NOISE AND AIR QUALITY IMPACTS	Community complaints about excessive noise or dust emissions.	Local leaders **Throughout project construction.	Project Manager	Visual observation. Measurement of dust and noise are complainant receptors **USD 40,000: one time purchase of noise meter and dust meter for environmental monitoring and implementation of mitigations.	UEGCL ** Ensure contractor complies with noise and dust control measures in EIA.	--	None

	Issue to Monitor	Indicator(s)	Data collection and Reporting			Use of data		Training or orientation required
			Who collects ****Timeframe**	**Who checks, Counter-checks**	**Method(s), Tools** ****Cost (UgShs)**	**Who acts,** ****Action**	**Referral (if action cannot be taken)**	
7	KALAGALA OFFSET AREA	Depletion in quality and quantity of water resources in catchment area. Wide areas stripped of vegetation on site Waste dumped in watercourses.	UEGCL **Throughout project life.	WRMD NFA, NEMA, District Environment Officer (DEO)	Visual inspection **Facilitation – USD 400,000 for 5 year's monitoring by WMD of catchment area.	UEGCL. ** Support to the Kalagala Offset Management Plan		None
	Total cost (USD)				**850,000**			

1 INTRODUCTION

1.1 OVERVIEW AND HISTORICAL PERSPECTIVE OF UGANDA'S POWER SECTOR

1.1.1 Historical Perspective

The period between 2003 and 2007 is remarkable in the history of Uganda's sector for electricity because of a prolonged drought which affected operations of the Owen Falls Dam, then the country's main source of electricity. Impaired hydrology led to substantial decline in electricity generation resulting into a supply deficit of up to 210 MW, causing 24-hour load shedding. Acute electricity supply shortage negatively impacted the gross domestic product (GDP), dropping at a rate of 1.5% per annum. In spite of the decline in generation, demand for electricity continued to grow, widening the gap and peak demand reached 380MW.

The Ministry of Energy and Mineral Development (MEMD) in 2006 prepared a plan to meet the shortfall in supply of electricity in the short, medium and long terms. The broad objective was not only to provide adequate and reliable power supply, but to also anticipate new electricity demand ahead instead of the old approach of chasing demand forecasts. The short-term measures involved procurement of thermal generation to provide temporary relief. About 150 MW of additional thermal power plants were installed at Lugogo, Mutundwe and Kiira sub-stations to provide relief to the consumers. In addition to these, the Government also procured the 50MW Namanve Jacobsen Heavy Fuel Thermal Plant. However, the stop-gap measures were at a cost. Power became expensive, forcing the Government to subsidise up to $9.5million every month despite increase in the end-user tariffs. The introduction of thermal power generation in the energy mix was combined with aggressive energy loss reduction strategy and an energy efficiency/ demand side management. To improve energy efficiency, 800,000 energy-saving bulbs were procured at a cost of $1.2million and distributed freely to households leading to saving of about 30 MW under this demand-side intervention. The ministry also carried out energy audits in various industries, commercial buildings and institutions to improve their energy management practices.

The medium-term strategy involved the development of the 250 MW Bujagali Hydropower Project on River Nile. Construction work of this project started in May 2007 and the plant was fully commissioned in July 2012.This project doubled the electricity supply, reducing load-shedding and replacing expensive thermal power generation. The plant was commissioned on unit-by-unit basis in response to energy ministry's strategic decision to replace the expensive thermal power generation at the earliest date and minimize load shedding. The other medium-term measure was to promote construction of small hydropower plants around the country, a number of which have already been completed and commissioned.

In September 2012, Nyagak Hydropower Plant with a capacity of 3.5 MW was commissioned, and this supplies the off-grid West Nile region. Other plants commissioned recently and delivering power to the national grid are:

- 18MW Mpanga small hydro power station (Commissioned in 2011)
- 13MW Bugoye small hydropower station (Commissioned in 2009)
- 10MW Mubuku III mini-hydro station (Commissioned in 2008)
- 9 MW Buseruka hydropower plant renamed Kabalega Hydropower Plant (Commissioned in January 2013)
- 6.5 MW Ishasha mini-hydropower station (Commissioned in 2011)

It is estimated that there are over 50 small hydropower sites around the country, which can generate a total of 200 MW to supplement the bigger projects on River Nile.

Uganda Government is now focused on construction of the 180 MW Isimba and 600 MW Karuma Hydropower Projects which will be a major addition to the national hydropower pool.

1.1.2 Reform in the Energy Sector

Uganda carried out reforms in the electricity sector that resulted into the unbundling of Uganda Electricity Board (UEB) into generation, transmission and distribution entities. The reforms have subsequently defined institutional, legal and policy framework, as well as the market structure. In the pre-reform era, Government assumed total control of the energy sector. This resulted in the creation of public enterprises for reasons that kept shifting depending on the regime that was making the policy. The electricity sector was thus dominated by UEB, a state-owned and controlled body which managed generation, transmission and distribution of electricity in the country as well as planning for future expansion. From 1971 to 1986 Uganda's economy was marred by economic crises resulting from extreme political instability. During that period, real GDP per capita fell by a quarter, and by 1987 most productive sectors, including the electricity sector, nearly failed. Electricity production had fallen from 150 MW in 1963 to 60 MW (Mawejje et al. 2012)[1].

In 1997, Uganda Government formulated a strategic plan and energy policy for transforming the power sector into a financially-viable electricity industry with the following objectives:

- Making the power sector financially viable and able to perform without subsidies from the budget and moving to cost reflective tariffs.
- Increasing the sector's efficiency.
- Improving the sector's commercial performance.
- Meeting the growing demand for electricity and increasing coverage.
- Improving the reliability and quality of electricity supply.
- Attracting private investment.

The Electricity Act was enacted in 1999 and this provided for the establishment of an independent regulator. The regulator would be responsible for setting tariffs and other charges, issuing licences for generation, distribution and transmission, regulating the quality of services and technical standards in addition to enforcing compliance.

In 2001, the assets, liability and operations of the UEB were transferred to separate limited liability companies for generation, transmission and distribution. The successor companies were registered in accordance with the Companies' Act under the names: Uganda Electricity Distribution Company Limited (UEDCL), Uganda Electricity Transmission Company Limited (UETCL) and Uganda Electricity Generation Company (UEGCL).

- UEDCL owns the electricity supply infrastructure operating at 33 kV and below. Its assets were leased to UMEME in 2005 under a 20-year concession.
- UETCL owns and operates the grid connected electricity supply infrastructure operating above 33kV. It is the only company responsible for buying power in bulk from generators and selling it to distribution companies.
- UEGCL is mandated to establish, acquire, maintain and operate electricity generation facilities and to promote research and development in the electricity generation sector.

The Electricity Act also set up a Rural Electrification Fund to promote rural electrification. The fund is administered by the Rural Electrification Agency (REA). The Act also established a tribunal to handle any electricity dispute.

By licensing of independent power producers, competition was introduced, which has attracted a number of private sector-led investments in the electricity sector. This has increased electricity supply enough to meet the current demand. The current installed electricity capacity is 800 MW compared to 150 MW Uganda used to

[1]Mawejje. J, Munyambonera. E, Bategeka. L, 2012: Uganda's electricity sector reforms and institutional restructuring Economic Policy Research Centre.

produce in the 1960s. Under the rural electrification programme, the Government has put emphasis on connecting electricity to district headquarters, productive centres like factories and trading centres and social services such as health centres, educational institutions and water supply points.

1.1.3 Performance of the Energy Sector and Uganda's Energy Mix

According to the Energy Sector Performance Report 2011-2012, the country's installed generation capacity is currently 818.5 MW after the full commissioning of the 250 MW Bujagali HPP and Electromax's 32 MW. Large hydropower generation accounts for 630 MW while smaller hydropower plants account for 41.5 MW, with 26 MW generated through co-generation using biomass at sugar factories[1]. However, the current dependable capacity is about 650 MW. The actual peak demand is in the order of 487 MW and the country experiences no power shortages for the moment. Operating power stations in the country currently supplying power to the grid are shown in Table 1.

Table 1: Power stations currently supplying power to the grid and their capacities

Type of generation	Installed capacity	Current generation	Remarks
Large Hydropower	603 MW	200 MW	180 MW(Nalubaale HPP)
			200 MW (Kiira HPP)
		250 MW	250 MW (Bujagali HPP)
Mini Hydropower	56.5 MW	23.5 MW	Bugoye-13 MW, Mpanga -18 MW, Ishasa 6.5 MW, KCCL-10.5 MW, Kilembe Mines-5MW, Nyagaka I -3.5 MW
HFO Thermal plants	100 MW	48	50 MW (Electromax)
		50	50 MW (Jacobsen-Namanve)
Diesel Generators	2.5 MW	2.5 MW	0.75 MW(Moroto)
			0.75 MW (Adjumani)
			0.75 MW (Moyo)
			0.25 MW (Kalangala)
Biomass power	29.5 MW	8	Kakira (22 MW)but 12 MW to grid
			Kinyara (7.5 MW)but 5 MW to grid
Total	**818.5 MW**	**558.5 MW**	

Source: MEMD 2012: Energy & Mineral Sector Performance Report 2011-2012, p13.

Uganda's consumption of energy is very low and is characterised by:

- Total energy consumption: 10,149,936 Tonnes of Oil Equivalent (TOE).
- The energy consumption per capita was 341.6 kilogram of Oil Equivalent (kgOE); and commercial consumption per capita was 28.9 kgOE.
- Traditional fuels (fuel wood and charcoal) are the predominant source of energy for people's livelihood.

Uganda consumes roughly 27,000 barrels of oil per day. The country's import bill on petroleum products is estimated at USD 2 billion annually. Petroleum products are imported primarily through Kenya and Tanzania via trucks. Biomass (fuel wood and charcoal) remains the predominant source of energy for livelihoods in Uganda[2] and about 90 percent of the population relies on these fuels for energy consumption. The country also relies on limited hydropower capacity.

1.1.4 Challenges in Energy Sector

Notable challenges, however, are: increasing power supply, reducing power losses and providing power at affordable tariffs. Local banks are unwilling to undertake long-term lending to power projects. There is also lack of

[1] MEMD 2012: Energy & Mineral Sector Performance Report 2011-2012, p13.
[2] Okure, M. 2011: Status of Liquefied Petroleum Gas in the Energy Mix of Uganda", Makerere University, Uganda.

ready projects with accomplished feasibility studies. There has been difficulty in bringing all stakeholders on board to embrace the power sector reforms and constraints in fuel supply inhibit thermal power generation. Regarding accessing electricity, the major constraint is the inability, mainly of the rural and peri-urban dwellers, to afford connection costs.

Despite the above challenges, generally a lot has been achieved in the electricity sector in the last 50 years and addition of Isimba power station to the national generation pool will consolidate these achievements.

1.2 PROJECT BACKGROUND

1.2.1 Project Description

Isimba Power Station is to be constructed on the Victoria Nile, downstream of Bujagali Power Station. The contract for feasibility studies and design was awarded to a consortium of engineering firms FICHTNER and NORPLAN in association with KAGGA & PARTNERS a Ugandan engineering consulting practice. The latter is responsible for managing the preparation of EIA, SIA and resettlement plan of the project.

Power to be generated by Isimba hydropower dam would considerably increase the nation's installed capacity of a renewable and cheaper energy supply. Without this project, 180 MW of electrical supply would be forfeited on the national grid. This would mean continued power scarcity and increased load shedding when supply is outstripped by demand. Isimba HPP is in line with Uganda Government's continued pursuit for sufficient power supply to match present and foreseeable future national demand.

According to Uganda's National Environment Act Cap 153, Section 10(a, b and c, i.e. electrical generation stations, transmission lines and substations respectively), the proposed project is categorized among —Third ScheduleII developments for which EIA is mandatory.

Additionally, World Bank/IFC classifies proposed developments into four categories (A, B, C, and FI) depending on the type, location, sensitivity and scale of the project and nature and magnitude of its potential environmental impacts. These categories are explained below:

Box 1: Project categorisation for environmental assessment

Category A: have high risk and likely to have significant adverse environmental impacts that are sensitive, diverse, or unprecedented.
Category B: have modest risk and will have potential adverse environmental impacts on human populations or environmentally important areas--including wetlands, forests, grasslands, and other natural habitats but are less adverse than of Category A projects.
Category C: are likely to have minimal or no adverse environmental impacts. For these, no detailed EIA is necessary.
Category FI: if it involves investment of IFC funds through a financial intermediary, in subprojects that may result in adverse environmental impacts. In addition, in some capital markets projects, IFC funds are not targeted to specific subprojects but the financial institution has operations which may have adverse environmental impacts.

Based on above categorization Isimba HPP is classified as "Category A" project and therefore subject to full Environmental and Social Impact Assessment in spite of similar other HPP developments e.g. Kiira, Nalubaale, Bujagali power stations near (upstream) of proposed project site.

Isimba hydropower project will comprise a powerhouse, a reservoir, 132 kV transmission line and associated substations. However EIA for the transmission line was prepared and submitted to the client as a separate document.

1.2.2 Project Relation to the National Development Plan (NDP) (2010/11 - 2014/15)

The NDP recognises that limited access and use of energy significantly slows down economic and social transformation (NDP, Sec 6.3 'Energy Sector', p149)[1]. Uganda has one of the lowest electricity consumption per capita in the world estimated at 69.5 kWh per capita in 2009. This is significantly lower than Africa's average of 578 kWh per capita and the World's average of 2,752 kWh per capita (NDP, Line 388, p149). It compares poorly with Kenya and Ghana that are 2.3 and 3.6 times better, respectively. The consumption per capita is about 55 times lower than that of Malaysia (3,668 kWh per capita) and 123 times lower than Korea's 8,502 kWh per capita. The low energy consumption per capita in Uganda has largely contributed to slow economic transformation by limiting industrialisation and is a major factor affecting the country's investment competitiveness. Energy exploitation pattern is such that biomass accounts for 92 percent of total energy consumed while fossil fuels account for 7 percent and electricity only 1 percent. Most of the biomass energy is from wood consumed in the form of charcoal and firewood. This consumption is not sustainable because it heavily relies on non-renewable energy that is costly, untimely, limited and has environmental effects.

The current energy supply levels cannot support heavy industries like steel mills, textile mills and aluminium processing plants. This is partly attributed to little investment in the power generation for over 40 years since commissioning of Nalubaale dam. The policy of supplying electricity to meet the demand within the economy has also partly contributed to low prioritisation of the energy sector subsequently limiting investment. Power is a prerequisite for investment not the opposite. It is an indispensable parameter in attracting investments.

In order to create a favourable investment climate and attract heavy investments in the industry sector, there is need for policy reform to ensure sufficient electricity generation capacity is created. Given the current levels of electricity generation, there is need for radical and drastic action to step up electricity supply to drive the economy to the indicators compared to middle income countries like Malaysia and Korea. Capacity requirements to raise power consumption from 75 kWh per capita (2010) to 674 kWh by 2015 subsequently to 3,670 kWh per capita by 2040 are indicated in Table 2. The fact that the current installed capacity (Year 2013) is less than 900 MW and should rise to 3885 MW in Year 2015 fortifies the urgency of investment in power generation stations.

Table 2: Electricity generation projections to meet NDP targets

Year	2010	2015	2020	2025	2030	2035	2040
Consumption (kWh/capita)	75	674	1273	1872	2470	3069	3668
Capacity (MW)	425	3885	8601	14670	22222	31252	41738

Source: NDP 2010, Line 389, p151

During the NDP period (2010/11 - 2014/15), Government's investment priorities will include physical infrastructure development mainly in energy, railway, waterways and air transport; human resources development in areas of education, health, water and sanitation; facilitating availability and access to critical production inputs especially in agriculture and industry; and promotion of science and innovation. Clearly, the NDP's development approach intertwines economic growth and poverty eradication. Energy is therefore a key driver in achieving NDP objectives. Indeed strategic pillars for increasing stock and improving quality of public physical infrastructure in the energy sector, according to NDP (Ref. Table 4.4, p46) include:

- Improving national power generation capacity.
- Expanding power grid and improving transmission and distribution infrastructure in the country

The NDP (Ref. Sec 6.3.2, p152) recognises limited generation capacity as a key constraint to performance of Uganda's energy sector and therefore advocates for formulation of a public-private partnerships (PPP) framework

[1]*Republic of Uganda, National Development Plan, (2010/11 - 2014/15)*

to increase private sector involvement in the energy sector (Ref. Line 397, Objective 5, p154). It is planned that Isimba HPP will be developed as a PPP and this is in line with aspirations of the NDP to involve the private sector in financing development of energy projects.

1.2.3 Project Relation to Uganda Vision 2040

On April 18, 2013, Uganda launched the Vision 2040 plan – a 30 year strategy aimed at propelling Uganda from a lower to a middle income economy. Uganda Vision 2040 builds on the progress that has been made in addressing the strategic bottlenecks that have constrained Uganda's socio-economic development since her independence.

Uganda Vision 2040 recognises energy and in particular electricity as a key driver of socio-economic transformation noting that for Uganda to shift from a peasantry to industrialized and urban society, it must be propelled by electricity as a form of modern energy. To achieve the targets of Vision 2040, Uganda will develop and generate modern energy to drive the industry and services sector. It is estimated that Uganda will require 41738 MW by year 2040 thus increasing its electricity consumption per capita to 3,668 kWh. Furthermore, the access to the national grid must significantly increase to 80 percent. Uganda will fully exploit its hydro power potential by developing large and small hydro power plants (Uganda Vision 2040, Sec 4.2.3 Energy, p46)[1] and therefore development of Isimba HPP is contiguous with this Vision's aspirations.

1.3 OBJECTIVE OF THE EIA

The EIA aimed at assessing potential environmental impacts of developing and operating the Isimba HPP and propose mitigation recommendations.

The study aimed at:

- Conducting baseline environmental and social investigations at the proposed powerhouse site and area to be inundated by the reservoir to form a basis for project impact analysis;
- Conducting consultations with relevant stakeholders, including potentially affected persons, to obtain their views and suggestions regarding the environmental and social impacts of the proposed project;
- Proposing mitigation measures to address potential negative impacts; and
- Preparing an EIA report incorporating results of environmental analysis.

Specifically, the focus of the EIA study was on:

- Flora and fauna;
- Drainage and water resources;
- Landscape and visual amenity;
- Land use and agriculture;
- Natural forested areas (loss and biodiversity considerations);
- Property, settlements and community facilities;
- Health and safety impacts; and
- Induced development resulting from project implementation;
- Noise and air quality, if any.

[1]National Planning Authority (N PA) 2012, Uganda Vision 2040

2 POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

2.1 INTRODUCTION

This section provides the legislative, regulatory and policy context in which the proposed Isimba Hydropower Project should comply. National regulations are discussed along with IFC performance standards, international conventions to which Uganda is party and guidelines of World Commission on Dams (WCD).

2.2 POLICY FRAMEWORK

2.2.1 The National Environment Management Policy, 1994

The overall goal of this policy is promotion of sustainable economic and social development mindful of the needs of future generations and EIA is one of the vital tools it considers necessary to ensure environmental quality and resource productivity on long-term basis. The policy calls for integration of environmental concerns into development policies, plans and projects at national, district and local levels. Hence, the policy requires that projects likely to have significant adverse ecological or social impacts undertake an EIA before their implementation. This is also reaffirmed in the National Environment Act (Cap 153) that makes EIA a legal requirement for "Third Schedule" projects. According to Uganda's National Environment Act Cap 153, Section10(a, b and c), i.e. electrical generation stations, transmission lines and substations, respectively, the proposed transmissionis categorized among "Third Schedule" hence necessitating this EIA study.

Interpretation: This policy is relevant to the Project as it requires that an EIA is conducted prior to project implementation.

2.2.2 The Energy Policy, 2002

The policy goal is to meet energy needs of Uganda's population for social and economic development in an environmentally sustainable manner. The policy recognizes linkages between the energy sector and other sectors such as economy, environment, water resources, agriculture, forestry, industry, health, transport, education, decentralization and land use. Hence at the sectoral level, the policy strengthens provisions of the National Environment Management Policy (1994) that emphasises need for environmental impact assessment. This policy recognises the energy sector as potentially having more significant environmental impacts than most other economic sectors. Since energy development and environmental damage are related, the policy recognises need to mitigate both physical and social environmental impacts of energy projects.

Objective (5) of the policy aims at managing energy-related environmental impacts and it states that the Government will ensure that environmental considerations are given priority by energy suppliers and users to protect the environment and monitor compliance with environmental protection guidelines. To meet these objectives, Government is required to:

- Promote the use of alternative sources of energy and technologies that are environmentally friendly.
- Sensitise energy suppliers and users about environmental issues associated with energy.
- Work towards the establishment and acceptance of broad targets for the reduction of energy-related emissions that are harmful to the environment and energy users.
- Promote efficient utilisation of energy resources.

In pursuit of those objectives, Uganda government will construct Isimba HPP to increase the proportion of renewable energy in the nation's mix. By undertaking this EIA, Government commits to ensuring that environmental issues are given priority consideration during project development.

Interpretation: The Project is consistent with this policy in so far as it seeks to increase access to hydro-electricity, a source of renewable energy; and an EIA has been conducted prior to implementation as required.

2.2.3 National Development Plan, 2010

In February 2010, Government of Uganda finalized a new five-year National Development Plan (NDP) spanning Financial Year 2011-2015 and this took from achievements of the *Poverty Eradication Action Plan* (PEAP) that was being implemented up to 2008. The NDP's main theme is "Growth, Employment and Socio-Economic Transformation for Prosperity," marking a broadening of the country's development strategy from poverty reduction to structural transformation with the aim to raise growth and living standards. The NDP is the first in a series of six plans intended to transform Uganda over 30 years into a modern and prosperous nation.

The NDP recognises that limited access and use of energy significantly slows down economic and social transformation. The low energy consumption per capita in Uganda has largely contributed to the slow economic transformation by limiting industrialisation as well as value addition. It's one major factor that impacted on the country's competitiveness over the last decade. The energy exploitation and consumption patterns reflect that the country is still in infancy stages of energy application in production processes. The exploitation pattern is such that biomass accounts for 92 percent of total energy consumed while fossil fuels account for 7 percent and electricity only 1 percent. To improve this situation, NDP devised two strategies below:

Strategy 1: Construct large hydropower plants and thermal power plants through public and private investments.

i) Complete Bujagali hydropower dam construction. This is expected to increase power generation capacity by 250 MW.
ii) Construct Karuma hydropower plant to generate 700 MW.
iii) Study, design and construct Ayago hydro power plant to generate 700 MW.
iv) Study, design and construct Orianga hydro power plant to generate 400 MW.
v) Construct Isimba hydro power dam.
vi) Build a thermal power Plant (700 MW as part of the refinery) to utilize Uganda's oil resources.
vii) Design and construct solar thermal plants to generate 200 MW.
viii) Study, design and build geothermal plants to generate 100 MW.
ix) Increase the co-generation capacity to 150 MW from wood and garbage.

Strategy 2: Develop mini hydro power plants to generate 150 MW.

i) Construct Muzizi, Kikagati, Nshongyenzi, Waki and other mini hydropower projects.
ii) Complete the construction of Mpanga, Kabalega and Nyagak minihydro power plants.

Interpretation: The Project is consistent with the NDP's Strategy 1 to enhance economic and social transformation. It considers Isimba HPP among priority large hydropower stations to be developed.

2.2.4 Wetlands Policy, 1995

The national policy on conservation and management of wetlands aims at curtailing loss of these resources and ensuring that their benefits are equitably distributed to all people of Uganda. The wetlands policy calls for:

- Sustainable use to ensure that benefits of wetlands are maintained for the foreseeable future;
- Environmentally sound management of wetlands to ensure that other aspects of the environment are not adversely affected;
- Equitable distribution of wetland benefits;
- Application of environmental impact assessment procedures on all activities to be carried out in a

wetland to ensure that wetland development is well planned and managed.

In order to operationalize the policy and to provide a legal framework for its implementation, wetland related issues have been adequately incorporated into the National Environmental Act, Cap 153. To minimise population centres and associated resettlement cost, the proposed dam is aligned along fringes of stretches of swamps any of which are seasonal and have been modified by farming activities.

Interpretation: This policy is relevant to the Project since there exist swamps within the project area especially in the villages of Kiteredde and Nakakandwa in Kayunga District and villages of Bupiina, Lwanyama and Nabukidi in Kamuli District.

2.2.5 Uganda's Vision 2040

In 'Vision 2040' Uganda Government set goals to achieve by the year 2040 ranging from political, economic, social, energy and environment. With respect to environmental goals, the government aspired to have sustainable social-economic development that ensures environmental quality and preservation of the ecosystem. Vision 2040 recognises energy as a key driver of the economic development and notes that for Uganda to shift from a peasantry to an industrialized and urban society, it must be propelled by electricity as a form of modern energy. It estimates that Uganda will require 41,738 MW of electricity by year 2040 thus increasing its electricity consumption per capita to 3,668 kWh. Furthermore the access to the national grid must significantly increase to 80 percent. To this end, Uganda will fully exploit its hydropower potential by developing large and small Hydropower plants including Isimba, Ayago, Karuma, Kalagala and Murchison Bay besides other renewable sources of energy such as wind, solar and bio-gas. To reduce the energy deficit, in the long-term Government would invest in development of nuclear power from uranium deposits in the country. Vision 2040 notes that to improve access and availability of electricity to the rural and urban areas, especially to economic zones and other productive areas, new transmission lines to evacuate power will be built and rural electrification programmes accelerated.

Interpretation: Therefore the proposed Isimba HPP is in line with aspirations of Vision 2040.

2.2.6 National Gender Policy (1997)

The overall goal of this policy is to mainstream gender concerns in the national development process in order to improve the social, legal/ civic, political, economic and cultural conditions of the people of Uganda, particularly women. Thus, in the context of the power sector, this policy aims to redress imbalances which arise from existing gender inequalities and promotes participation of both women and men in all stages of energy project cycle, equal access to, and control over significant economic resources and benefits.

This policy would especially apply to recruitment of dam construction labour where women should have equal opportunity as men for available jobs. This policy also requires provision of a working environment that is conducive to women as well as for men in addition to gender-disaggregated impacts and vulnerabilities.

Interpretation: This policy would especially apply to recruitment of construction labour for Isimba HPP where women should have equal opportunity as men for available jobs. This policy also requires provision of a work environment that is safe and conducive to women as is for men considering gender-disaggregated differences and vulnerabilities. This, for example, applies to onsite worker's sanitation facilities where women should have separate facilities from men's.

2.2.7 The Forestry Policy, 2001

The forest policy puts an emphasis on the ecological and socio-economic importance of protecting the country's forest resources. Implementation of the policy is a responsibility of the National Forestry Authority (NFA), which also provides guidelines for management of forest reserves, community forests and private forests. The Forest

Policy entails provisions for safeguarding and conservation of forests so as to ensure sufficient supplies of forest products, protect water resources, soils, fauna and flora. The policy also mandates government with a responsibility to control unsustainable forest exploitation practices.

This policy is also important in light of the fact that the proposed hydropower dam will affect 1.8 km^2 (8.2%) of Kalagala Forest Reserve, 1.3 km^2 (0.13%) of Mabira Management Area and 0.168 km^2 (2.8%) of the Nile Bank Central Forest Reserve.

Interpretation: This policy potentially has relevance to the Project because it provides for protection of Kalagala forest reserve that will be affected by the project.

2.2.8 HIV/AIDS Policy 1992

In Uganda current effort to combat HIV/AIDS is characterized by a policy of openness by Government and this has, to a large extent, been emulated by civil society, political and social institutions, and workplaces. HIV/AIDS is recognized by Ministry of Health as a considerable risk in construction of infrastructure projects and it (together with the ministry responsible for labour) encourages employers to develop in-house HIV/AIDS policies, provide awareness and prevention measures to workers and avoid discriminating against workers or living with or affected by HIV/AIDS. To ensure HIV/AIDS is addressed in the workplace, the policy encourages employee awareness and education on HIV/AIDS. To protect the infected and affected persons from discrimination, employers are required to keep personal medical records confidential. Employees living with, or affected by, HIV infection and AIDS, and those who have any related concerns, are encouraged to contact any confidant within the organization to discuss their concerns and obtain information. It is anticipated that during line construction, there may be an influx of people into the project area possibly resulting into sexual fraternisation and a risk of HIV/AIDS spread. These requirements are expected to be fulfilled by the dam construction contractors or their subcontractors.

Interpretation: The requirements of this policy are expected to be fulfilled by the Isimba HPP construction contractors or their subcontractors, especially in regard to having an in-house HIV Policy, worker sensitisation and provision of free condoms. This policy is relevant to the project if implementation of proposed Isimba HPP construction leads to in-migration into the project area by people seeking construction jobs and indulging in prostitution or irresponsible sexual fraternisation associated with HIV/AIDS risk.

2.2.9 Occupational Health and Safety (OHS) Policy 2006

This policy seeks to:

- Provide and maintain a healthy working environment
- Institutionalize OHS in the power-sector policies, programs and plans
- Contribute towards safeguarding the physical environment

The OHS Policy Statement is guided by the Constitution of the Republic of Uganda and other global, national and sectoral regulations and policies. The Statement also takes into recognition of the Energy Policy and the Health Sector Strategic Plan, all of which aim to improve the quality of life for all Ugandans in their living and working environment. This policy will be especially relevant for OHS of power plant construction crews and subsequently, maintenance personnel. This also will have relevance in mitigation measures that protect the public from health and safety impacts as a result of project construction and subsequent operation and maintenance activities.

Interpretation: This policy will be especially relevant for OHS of Isimba HPP construction crews and subsequently, maintenance personnel. The policy will also have relevance in mitigation measures that protect the public from health and safety impacts as a result of project construction and subsequent operation and maintenance activities.

2.2.10 Renewable Energy Policy, 2007

The overall objective of the Renewable Energy Policy is to diversify energy supply sources and technologies in Uganda. In particular, the policy goal is to increase the use of renewable energy from 4% (in 2007) to 61% of the total energy consumption by 2017 and the largest proportion of this will evidently be contributed by hydropower stations. Additionally, in January 2011, MEMD announced one of the most sophisticated, Feed-in Tariff Program in Africa. A feed-in tariff is a policy mechanism designed to accelerate investment in renewable energy technologies by offering long-term contracts to renewable energy producers based on the cost of generation of each technology. The national feed-in tariffs aimed to offer cost-based compensation to renewable energy producers, providing price certainty and long-term contracts that help finance renewable energy investments. The Uganda program specifies capacity caps for each renewable energy technology by year and this provides clear policy guidance on how much the country wants of which renewable technology.

Interpretation: Hydropower is Uganda's most prevalent renewable energy resource and increasing its play in the nation's energy mix is concordance with this Policy. Therefore development of Isimba hydropower station conforms to the broad objectives of this policy.

2.2.11 Master Plan Study on Hydropower Development in Uganda, 2011

The "Hydro Power Master Plan" from December 2010 presented an integrated hydropower development of Victoria Nile River. Based on the estimated daily load pattern with peak demand in the evening hours and no significant variations on weekly and monthly basis, daily peaking power production is allocated to the power plants on the upper reach of Victoria Nile (up to Kyoga Lake). This was mainly due to the natural regulating effect of the Kyoga Lake for the peaking operation discharges from the upstream projects. On the other hand base load is recommended for the projects downstream of Kyoga Lake that mainly have much larger installed capacities. Isimba HPP therefore can utilise water released from Bujagali hydro power station and provide for partial balancing of the daily peak load based on its own limitations in reservoir elevation and size.

The study included prioritization of potential hydropower sites based on consideration of technical, environmental, economic and financial aspects for the development in the period of 15 years as well as the optimal scale, basic layout and the framework of development. The study also aimed at implementation of necessary power supply plan that would support economic growth in the Republic of Uganda as well as the East African region. Development of Isimba HPP is in line with this Master Plan.

Interpretation: Development of Isimba HPP is in line with recommendations of this Master Plan.

2.2.12 National water policy 1999

The goal of this policy is to provide guidance on development and management of the water resources of Uganda in an integrated and sustainable manner, so as to secure and provide water of adequate quantity and quality for all social and economic needs, with full participation of all stakeholders and mindful of the needs of future generations. The policy aims to:

- Promote rational use of water.
- Control pollution and promote the safe storage, treatment and disposal of waste, which could pollute water and impact public health.

Interpretation: This policy is relevant to the Project since it requires rational use of water from River Nile and avoidance of contamination of water course.

2.2.13 The Fisheries Policy, 2004

Policy Area No. 8 (The environment and fisheries) seeks to ensure that adverse environmental impacts on

fisheries are minimized including pollution of watercourses by industrial and infrastructural development.

Interpretation: River Nile has been identified to be a prolific habit for fisheries; this policy is relevant to the projectsince a dam across the river can influence changes in fisheries resources and species diversity both upstream and downstream of the dam. Baseline surveys encountered fish species, for example, Mormyruskannume (Elephant Snout) that swim upstream for breeding.

2.2.14 Wildlife Policy, 1999

This policy aims to conserve in perpetuity the rich biological diversity and natural habitats of Uganda in a manner that accommodates national development needs, well-being of its people and the global community. It also recognizes poaching as a major challenge to conserving wildlife in Uganda.

Interpretation: This policy is relevant to the Project since the proposed Isimba HPP will affect 1.8 km^2 (8.2%) of Kalagala Forest Reserve, 1.3 km^2 (0.13%) of Mabira Management Area and 0.168 km^2 (2.8%) of the Nile Bank Central Forest Reserve with notable population of primates.

2.3 LEGAL FRAMEWORK

2.3.1 Constitution of the Republic of Uganda, 1995

The 1995 Constitution restored all private land tenure regimes (which had previously been abolished under the Land Reform Decree, 1975). It divested the state and the Uganda Land Commission of radical title to land that was expropriated in 1975, and vested it directly in the citizens of Uganda. The constitution provides for, inter alia:

- The right of every Ugandan to a clean and healthy environment (Article 39);
- The responsibility of government to enact laws that protect and preserve the environment from degradation and to hold in trust for the people of Uganda such natural assets as lakes, rivers, wetlands, game reserves and national parks [Article 237(2)];
- The right of every Ugandan to fair and adequate compensation in instances of land acquisition.

The Constitution provides that every person has a right to own property and that no person shall be compulsorily deprived of property or any interest in or right over property without prompt payment of fair and adequate compensation, prior to the taking of possession or acquisition of the property.

On land tenure regimes and transfer of land, the Constitution prescribes tenure regimes in accordance with rights and interests held in land. Article 237 of the Constitution, 1995, vests land in the citizens of Uganda and identifies four land tenure systems, namely: *customary*, *freehold*, *mailo* and *leasehold*. Understanding these systems (detailed in section 4 of the Land Act, 1998) is vital for compensation of households to be affected by the project. These tenure systems are outlined below:

a) Customary tenure

In this tenure, land is owned in perpetuity and tenure is governed by rules generally accepted as binding and authoritative by the class of persons to which it applies (that is, “customary regime is not governed by written law”). Customary occupants are occupant of former public land, and occupy the land by virtue of their customary rights; they have proprietary interest in the land and are entitled to certificates of customary ownership. Certificates for customary ownership are issued by the District Land Board, through application to the Parish Land Committee.

b) Freehold tenure

This tenure derives its legality from the Constitution. It involves the holding of land in perpetuity or for a period

less than fixed by a condition and enables the holder to exercise, subject to the law, full powers of ownership.

c) Leasehold tenure

Lease tenure is created either by contract or by operation of the law. It is a form of tenure under which the landlord or lessor grants the tenant or lessee exclusive possession of the land, usually for a defined period and in return for a rental fee. The tenant has security of tenure and a proprietary interest in the land.The Constitution and the Land Act also protect "rights of spouses and children" with regard to land transactions. The head of household must acquire the consent of spouse and children prior to any sale of land on which the family ordinarily resides.

d) Mailo land tenure

The Mailo land tenure system is a feudal ownership introduced in Buganda by the British in 1900 under the Buganda Agreement. "Mailo" is a Luganda word for "mile" as the original grants under the agreement were measured in square miles. Prior to the 1975 Land Reform Decree, Mailo land was owned in perpetuity by individuals and by the Kabaka (hereditary King). Since no section of the proposed line traverses Buganda region, this type of tenure does not apply to the project.

These tenure systems will be important during resettlement planning. Detail of land take and compensation were addressed in the line project resettlement action plan (RAP) and social impact assessment report (SIA).

2.3.2 National Environment Act, Cap 153 1995

The specific legislation that deals with environmental impact assessments (EIA) in Uganda is the National Environment Act (NEA), Cap 153. NEMA was created under NEA and mandated with the responsibility to oversee, coordinate and supervise environmental management activities in Uganda. Third Schedule of the National Environment Act, Cap 153 (*Section 10(a), (b), (c): "Electrical infrastructure including electricity transmission lines and substations.")* requires this project to undertake an EIA.

The Act provides for various strategies and tools for environment management, which also include EIA (Section 19) for projects likely to have significant impacts on the environment. NEMA sets multimedia environmental standards (Sections 24 - 32) to prevent contamination of air, water and soil resources. Section 36 entrusts NEMA, lead agencies and the district environment committee with powers to protect quality of watercourses, permanent or seasonal from human activities that could adversely affect them. Section 56 prohibits discharge of hazardous substances like chemicals, oil, etc. into the environment except in accordance with guidelines prescribed by NEMA. NEMA will also be responsible for approval of the project EIA and prescribing compliance conditions during project implementation.

All the foregoing sections of the Act are relevant for preservation of the natural environmental in the hydropower project area both during construction and operation of the project.

2.3.3 Land Act, Cap 227 1998

The Land Act is an essential legal tool for the proposed project in so far as there are squatters who lay claim to land that is legally supposed to be owned by the project.

Largely, the Act addresses four issues namely, *holding*, *control*, *management* and *dispute resolution*. As regards tenure, the Act repeats in Section 3, provisions of Article 237 of the Constitution which vests all land in the citizens of Uganda, to be held under *customary*, *freehold*, *mailo* and *leasehold* tenure systems. It then defines the incidence of each tenure regime (section 4); provides mechanisms of acquisition of certificates of customary ownership (sections 5 - 9); the conversion of customary tenure to freehold (sections 10 - 15), or collective management of land held under customary law (sections 16 - 27); the protection of the rights of women, children and persons with disability (sections 28); the conversion of leasehold into freehold (section 29) and the security of

tenure for 'tenants by occupancy' (sections 30 - 39).

Provisions regarding land administration (referred to in the Act as "management") are adequately detailed. The Act creates a series of land administration institutions consisting of *Parish Land Committees*, *District Land Boards* and *Uganda Land Commission* (ULC). Each of these entities is largely autonomous of one another and is entrusted with functions that range from the holding of lands not subject to private ownership, management of land thus held, processing applications for various grants and certificates, registration and transfer of interest in land (sections 47 - 74).

The Land Act provides for a decentralized system to resolve land disputes in Uganda (sections 75 - 90) through establishment of Land Tribunals at all levels of local government and that they should first arbitrate land disputes before resorting to legal courts of law. No other organ, except informal traditional authority mediators (section 89) will henceforth have jurisdiction over land disputes (section 98). Thus the Act favours local landowners by advancing a process that is localized and free from costs or formalities associated with formal judicial courts.

The Act provides procedures to follow during the acquisition of land for public interest and provides for the "prompt payment of fair and adequate compensation" prior to taking possession of land. This Act mandates local governments to protect natural resources in interest of public good. For the proposed Isimba HPP, example of these resources comprises natural forests, streams and wetlands.

Under the Land fund, there is a provision for resettling persons who have been rendered land-less by Government action. For energy development projects in general, the developer will have to source funds for resettlement or compensation.

2.3.4 Electricity Act, Cap 145 1999

Enactment of the Electricity Act, 1999 paved way for liberalisation of Uganda's energy sector, allowing the establishment and operations of independent power producers. This Act liberalized the power sector breaking up Uganda Electricity Board that had monopoly for power generation, transmission and distribution, into three companies responsible for generation (UEGCL), transmission (UETCL) and distribution (UEDCL) of electric power in Uganda. The Act also authorised licensing of independent power producers (IPP), to generate, distribute and sell power. This Act created the Electricity Regulatory Authority ("*the Authority*" in this Act), an independent body responsible for regulating the electricity sector in Uganda and licensing private investors. The Authority retains power to award licenses for power generation; promote efficiency, economy and safety on the part of licensees and the efficient and safe use of electricity. This ensures that the design and operation of generation, transmission and distribution by licensees will have efficiency built in and approved standards.

Section 29(2)(f) and Section 33(1)(g) require that any entity desirous of securing a license to establish a power generation facility provides reports of studies undertaken to assess impact of the project on electricity supply, socioeconomics, cultural heritage, environment, natural resources and wildlife.

Section 68 of the Act provides guidelines for the placement of electricity supply lines on land, stating that a developer shall as much as possible minimise damage to the environment and shall ensure prompt payment of fair and adequate compensation to all interested persons for any damage or loss sustained by construction of electricity supply infrastructure. Section 69 of the Act requires a developer or licensee who intends to enter land under the management or control of the Uganda Land Commission or a District Land Board, to give 30 days' notice to the Uganda Land Commission or a District Land Board, stating the nature and extent of the acts intended to be undertaken.

Further, the Act under section (49) (2) requires, when necessary, decommissioning (removal of installations) of the project to be done in accordance with the National environmental Act and prevailing applicable standards
Section 75 provides for royalties payable to local authorities as per excerpts below:

(7) The holder of a license for hydropower generation shall pay to the district local government in which his or her generating station, including any dam or reservoir, is situated a royalty agreed upon by the licensee and the district local government, in consultation with the authority.

(8) Where the licensee and the district local government fail to agree upon the royalty, the authority shall determine the royalty to be paid to the district local government by the licensee.

(9) Where the generating station is situated in more than one district local government area, the royalty paid under subsection (7) shall be shared proportionately among the district local governments.

Interpretation: The Electricity Act is relevant to the Project in so far as Section 29(2)(f) and Section 33(1)(g) require that before establishing a power generation station assessment of impact of the project on socioeconomics, cultural heritage, environment, natural resources and wildlife should be undertaken. In practice, from the project point of view, it is expected that ERA will endorse the project and support its activities to the extent that those activities are consistent with its mandate.

2.3.5 Physical planning act, 2011

This Act replaced the Town and Country Planning Act, Cap 246 which was enacted in 1951 and revised in 1964 but is now inconsistent with contemporary government system in Uganda. The 1951 Act was enacted to regulate and operate in a centralised system of governance where physical planning was carried out at national level through the Town and Country Planning Board. Implementation of the Act was supervised by local governments, especially the urban local governments.

Uganda has since gone through many social, political and economic changes. For example, promulgation of the 1995 Constitution established a decentralised system of governance which divulged powers and functions including physical planning, finance and execution of projects from the central government to local governments. This therefore created a need to enact a physical planning legislation which is consistent with this Constitutional requirement. The Physical Planning Act, 2011 establishes district and urban physical planning committees, provides for making and approval of physical development plans and applications for development.

Section 37 of The Physical Planning Act, 2011 requires an EIA permit for developments before they are implemented, stating:

> *"Where a development application related to matters that require an environmental impact assessment, the approving authority may grant preliminary approval subject to the applicant obtaining an EIA certificate in accordance with the National Environment Act".*

Kayunga and Kamuli District Local Governments have jurisdiction over areas along the proposed hydropower dam and therefore have regulatory control to ensure that this project conforms to local physical planning requirements.

2.3.6 Public Health Act, Cap 281 1964

This Act provides local authorities with administrative powers to take all *lawful*, *necessary* and *reasonable* measures to prevent the occurrence or deal with any outbreak or prevalence of any infectious communicable or preventable disease and to safeguard and promote the public health. The Act mandates local authorities (Section 103) to prevent pollution of watercourses in interest of public good.

Interpretation: This Act is applicable to onsite management of construction waste, sewage and domestic waste during construction and or operation of the power station to prevent environmental contamination leading to public health impacts.

2.3.7 Occupational Safety and Health Act, 2006

The Act requires employers to provide and maintain safe working conditions, and to take measures to protect workers and the public from risks and dangers of their works, at his or her own cost (Section 13). Employers with more than 20 workers should prepare and often revise a written policy with respect to safety and health of workers (Section 14). Every workplace must be kept in a clean state, free from effluent arising from any drains and sanitary facilities (Section 46). The contractor therefore is obliged to provide employers with washing facilities, First Aid, facilities for meals and safe access to workplaces. This Act was discussed in the project's SIA.

This Act provides local authorities with administrative powers to take all *lawful*, *necessary* and *reasonable* measures to prevent the occurrence or deal with any outbreak or prevalence of any infectious communicable or preventable disease and to safeguard and promote the public health. The Act mandates local authorities (Section 103) to prevent pollution of watercourses in interest of public good.

Interpretation: This Act is applicable to onsite management of construction waste, sewage and domestic waste during construction and or operation of the power station to prevent environmental contamination leading to public health impacts.

2.3.8 National Environment (Wetlands, River Banks and Lakeshores management) Regulations, 2000

These regulations provide principles for sustainable use and conservation of wetlands, riverbanks and lakeshores. Relevance of these regulations to the EIA study is embedded in the following requirements:

- EIA is mandatory for all major activities on riverbanks and lakeshores,
- Measures should be put in place for protection of riverbanks and lakeshores such as prevention of soil erosion, siltation and water pollution.
- Acquisition of the necessary permits such as the water abstraction permit.

Interpretation: These regulations are relevant to the Project since the power station will be built across River Nile and reservoir will submerge some seasonal streams and marshes; hence there is potential for activities to cause siltation and sedimentation.

2.3.9 National Environment (Noise Standards and Control) Regulations, 2003

Section 7 of these regulations requires that no person shall emit noise in excess of permissible noise levels, unless permitted by a license issued under these Regulations. Section 8 imparts responsibility onto noise generators to use the best practicable means to ensure that noise does not exceed permissible noise levels. At construction sites corresponding limits are 75 dBA and 65 dBA for day and night time levels respectively[1].

Table 3: Regulatory noise limits

Facility	Noise limits dB (A) (Leq)	
	Day*	Night*
Construction sites	75	65
Residential areas	55	45
*Time frame: Day 6.00 a.m. -10.00 p.m.; Night 10.00 p.m. - 6.00 a.m.		

Source: The National Environment (Noise Standards and Control) Regulations, 2003.

Interpretation: These regulations are relevant to the Project if construction activities and operation generate noise above permitted levels.

[1]Time frame: Day 6.00a.m -10.00 p.m.; Night 10.00 p.m. - 6.00 a.m.

2.3.10 National Environment (Minimum Standards for Management of Soil Quality) Regulations, 2001

Section 12 of this Act requires compliance with prescribed measures and guidelines for soil conservation for the particular topography, drainage and farming systems, contravention of which constitutes an offence.

Interpretation: The regulations will be relevant in regard to prevention of contamination of land covered by the project infrastructure. The regulations will apply to waste disposal practices of contractors during construction, operation repair and maintenance. These regulations are also relevant to the Project, since development will require construction activities in areas prone to soil erosion due to unstable slopes (slopes > 10%).

2.3.11 Water Act, Cap 152 1997

It is envisaged that water will be required for project construction activities and consumption by construction crew. Abstraction of water will be regulated by this Act. According to Section 6 of the Act, no person acquires any rights to use water or to construct or operate any works unless authorized under Part II of the Act. Thus, unless a person is an occupier of land on which surface water exists, water may not be used for any purpose without the approval of an authority. The general rights to use surface water are limited to domestic use and fire fighting, indicating the importance attached to water supply for domestic purposes. Section 18 states that a person is not allowed constructing or operating any works unless he has a permit granted for that purpose by the Director, Directorate of Water Development (DWD). Construction is defined to include alteration, improvement, maintenance and repair.

Section 31 (1) of the Water Act stipulates that it is an offence for a person to pollute water through discharge of waste into watercourses. In conformity with this law, the spillage of petroleum products, disposal of overburden, litter or construction waste should be avoided during project construction and operation or maintenance activities.

Interpretation: This Act is relevant to the Project as the proposed project infrastructure will be constructed on a watercourse that in some locations is used by local people for domestic water supply and fishing. During project development, a water abstraction permit will be required to abstract water from River Nile.

2.3.12 National Environment (Waste Management) Regulations, 1999

These regulations require waste disposal in a way that would not contaminate water, soil, and air or impact public health. According to the regulations, waste haulage and disposal should be done by licensed entities. These Regulations will apply to:

- All categories of hazardous and non-hazardous waste;
- Storage and disposal of construction waste.

Interpretation: The regulations will relate to overall waste management of the project as wastes will be generated by both construction and maintenance activities.

The regulations, which will relate to overall waste management during line construction, promote minimise waste generation by:

- *Eliminating use of toxic raw materials;*
- *Reducing toxic emissions and wastes;*
- *Recovering and reuse of waste wherever possible.*

2.3.13 The Mining Act, Cap. 148 2003

Stone quarry sites and gravel borrow pits will be necessary for materials needed to construct the power project and applicable licenses shall be obtained from the Commissioner of the Geological Survey and Mines. The Mining

Act of 2003 regulates mining developments including set up of new quarries and/or sandpits. Relevant environmental studies required for this license application are described in Part XI. The extraction of stone/aggregate and murram materials will be undertaken in line with the provisions of this Act. Issues of restoration of the sites after extraction of murram will be of key importance after construction of the proposed project.

Interpretation: This Act will apply to the project's contractors who will be required to obtain license for extraction of stone/ aggregate and murram materials required for dam construction.

2.3.14 Workers' Compensation Act (2000)

Section 28 of The Workers' Compensation Act (2000) states that:

- Where a medical practitioner grants a certificate that a worker is suffering from a scheduled disease causing disablement or that the death of a workman was caused by any scheduled disease; and,
- The disease was due to the nature of the worker's employment and was contracted within 24 months immediately previous to the date of such disablement or death, the worker or, if he or she is deceased, his or her dependants shall be entitled to claim and to receive compensation under this Act as if such disablement or death had been caused by an accident arising out of and in the course of his or her employment.

Interpretation: This Act is relevant to the Project as large labour will be employed for construction and Operation/ Maintenance activities. Provision of personal protective equipment (PPE) to employees is required to minimise accidents and injuries. Contractors must ensure that workers constructing the proposed project have safety gear to ensure compliance with this Act.

2.3.15 Local Governments Act, Cap 243

This Act provides for decentralized governance and devolution of central government functions, powers and services to local governments that have own political and administrative structures. Districts have powers to oversee implementation of development activities under supervision of their relevant departments such as environment, lands and water resources. According to Section 9 of the Act, a local government is the highest political and administrative authority in its area of jurisdiction and shall exercise both legislative and executive powers in accordance with the Constitution.

Interpretation: This Act is relevant to the Project as all District Local Governments covered by the project infrastructure will be stakeholders and will have jurisdiction over implementation of the Project. Accordingly, Kamuli and Kayunga District Local Governments will have key responsibilities for environmental monitoring during construction of the project.

2.3.16 Environmental Impact Assessment Regulations, 1998

The regulations require a detailed study to determine possible environmental impacts and mitigation measures. The guidelines require that the EIA process should be participatory engaging the general public and stakeholders in consultations or to inform them and obtain their views about the proposed development during the EIA.

Interpretation: Conduct of this environmental assessment in compliance with requirements of these regulations.

2.3.17 National Forestry and Tree Planting Act, 2003

This legislation regulates access and use of forest resources in Uganda. Section 38 provides that a person intending to undertake a project or an activity which may, or is likely to have significant impact on forests shall undertake an EIA. This policy is important since the hydropower dam will affect 1.8 km^2 (8.2%) of Kalagala Forest Reserve, 1.3 km^2 (0.13%) of Mabira Management Area and 0.168 km^2 (2.8%) of the Nile Bank Central Forest Reserve.

Interpretation: This Act has relevance to the Project as there is potential for the loss of forest trees.

2.3.18 Petroleum Supply Act, 2003

Over the construction period, the contractor will require considerable fuel (petrol and diesel) supplies to be stored at the construction camp or equipment yard for use by motorised equipment and power generators. The Petroleum Supply Act of 2003 provides for supervision and monitoring transportation, supply, storage and distribution of petroleum products. Among other provisions, the Act provides for safety and protection of public health and the environment in petroleum supply operations. According to the Act, fuel storage for construction projects must be licensed.

Interpretation: This Act has relevance to the Project as it requires consideration for safety and protection of public health and the environment in petroleum storage and transfer operations.

2.3.19 Uganda Wildlife Act, Cap 2000

This Act defines wildlife as any wild plant or animal of a species native to Uganda. The Act entrusts ownership of wild animals and plants with the government for the benefit of Ugandan people, a responsibility executed by Uganda Wildlife Authority (UWA). Sections of the Act specifically dealing with the project development activities include:

Section 15: Environmental impact assessment; (1) Any developer desiring to undertake any project which may have a significant effect on any wildlife species or community shall undertake an environmental impact assessment in accordance with the National Environment Act, (2) The authority shall perform all the functions required of a lead agency for purposes of an environmental impact assessment under the National Environment Act, and any regulations made under the National Environment Act.

Section 21: General offences in wildlife conservation areas: Unless provided for by this Act, any person who in any wildlife conservation area unlawfully; (a) hunts, takes, kills, injures or disturbs any wild plant or animal or any domestic animal; (b) takes, destroys, damages or defaces any object of geomorphological, archaeological, historical, cultural or scientific interest, or any structure lawfully placed or constructed; (c) starts or maintains a fire without lawful authority; commits an offence.

Interpretation: This Act is relevant to the Project as development activities will take place in areas where infrastructure and workers may affect wildlife due to proximity of project site to Kalagala Offset area. A notable requirement of this Act is avoidance of any hunting and poaching either during project construction or its operation.

2.3.20 Draft National Air Quality Standards, 2006

Construction operations will generate dust and exhaust emissions, mainly from motorised equipment. The draft national air quality standards provide the following regulatory limits for various emissions as presented in Table 4.

Table 4: Draft regulatory air quality limits

Pollutant	Averaging time for ambient air	Standard for ambient air
Carbon dioxide (CO_2)	8 hrs	9.0ppm
Carbon monoxide (CO)	8 hrs	9.0ppm
Hydrocarbons	24 hrs	$5mgm^{-3}$
Nitrogen oxides (NO_x)	24 hrs 1 year arithmetic mean	0.10 ppm
Smoke	Not to exceed 5 minutes in any one hour	Ringlemann Scale No.2 or 40% observed at 6m or more
Soot	24 hrs	500 µg/Nm-3

Pollutant	Averaging time for ambient air	Standard for ambient air
Sulphur dioxide (SO_2)	24 hrs	0.15 ppm
Sulphur trioxide (SO_3)	24 hrs	200 µg/Nm-3

Source: Draft National air quality standards, 2006. Note: ppm=parts per million, "N' in µg/Nm^{-3} connotes normal atmospheric conditions of pressure and temperature (25^{0}C and 1 atmosphere).

Interpretation: These standards are relevant considering that project construction will require motorised machinery powered by diesel engines hence generating pollutants such as CO_2, NO_x, SO_x and particulates are expected to be emitted. Road dust will also be generated during both road construction and material/ equipment transport.

2.3.21 Road Act, Cap 358

The Road Act (Cap 358 of the Laws of Uganda) provides for maintenance of roads by empowering the Minister of Works and Transport and respective local governments. The need for Government to maintain basic control over developments along the road is to ensure that basic necessities of maintaining road geometry and engineering needs such as sight lines, horizontal curvatures, sight distances and road safety considerations are in place. Consequently, town council would have authority over town roads where as district roads are governed by the district local government.

Interpretation: This Act applies to construction of proposed roads meant to enable access to the project site. The fact that these roads will remain important transport infrastructure in the local community necessitates conformity to requirements of this Act.

2.3.22 Investment Code Act, Cap 92

Section 18(2) (d) of the Act requires a project proponent to take necessary steps to ensure that development and operation of an investment project do not cause adverse ecological and socio-economic impacts.

Interpretation: This Act applies requires not only investors taking necessary care toward environmental protection but also compliance with relevant laws applicable to substance of health of natural environment. This EIA is the first step toward compliance of the proposed development to t requirements of this Act.

2.3.23 National Environment (Standards for Discharge of Effluent into Water or on Land) Regulations,1999

Section 6 (2) details maximum permissible limits for 54 regulated contaminants, which must not be exceeded before effluent is discharged into water or on land. A few commonly regulated parameters in sewage and wash/ oily effluent from a construction site are indicated in Table 5.

Table 5: National discharge standards for selected pollutants

Parameter	National discharge standards
BOD_5 (mg/l)	50
Suspended solids (mg/l)	100
Faucal coliforms	10,000 counts/ 100ml
Chlorine residual (mg/l)	1 mg/l
pH	6-8
Phenols (µg/l)	0.2 mg/l
Oil and grease (mg/l)	10 mg/l
Total Phosphorus (mg/l)	10 mg/l
Temperature	20-35^{o}C

Source: The National Environment (Standards for Discharge of Effluent into Water or on Land) Regulations, 1999.

Interpretation: These regulations are particularly important for treatment and disposal of effluent from the construction site and workers' camp.

2.3.24 Employment Act, 2006

Employment Act, 2006 (which repeals Employment Act Cap 219 enacted in 2000) is the principal legislation that harmonises relationships between employees and employers, protect workers interests and welfare and safeguards their occupational health and safety through:

- Prohibiting forced labour, discrimination and sexual harassment at workplaces (Part II; Part IV).
- Providing for labour inspection by the relevant ministry (Part III).
- Stipulating rights and duties in employment including weekly rest, working hours, annual leave, maternity and paternity leaves, sick pay, etc. (Part VI).
- Continuity of employment i.e. continuous service, seasonal employment, etc (Part VIII).

Interpretation: For the 4-5 years of project construction (and subsequent operation and maintenance), this Actwill govern management of labour force hired by the contractor (during construction) and the power station (operation phase) in regard to their occupational safety.

2.3.25 Historical and Monuments Act, 1967

This Act provides for preservation and protection of historical monuments and objects of archaeological, paleontological, ethnographical and traditional interest. The Act prohibits any person from carrying out activities on or in relation to any object declared to be preserved or protected. Section 10 of this Act spells out procedures and requirement to declare "chance finds" that may have archaeological, paleontological, ethnographical, historical and traditional significance for preservation.

Interpretation: This Act requires that any chance finds encountered during project construction shall be preserved by the Department of Monuments and Museum in the Ministry of Tourism, Wildlife and Heritage.

2.3.26 International Agreements

Uganda is party to several global and regional environment and conventions and agreements as described below:

- ***The Convention on Biological Diversity (CBD):*** A major objective of which is in-situ and ex-situ conservation of biological diversity. Parties to this convention are required to undertake ESIA for projects likely to have significant adverse effects on biodiversity and are required to develop national plans and programmes for the conservation and sustainable use of biodiversity.

- ***The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES):*** This convention seeks to ensure that international trade in species of wild fauna and flora does not threaten their survival in wilderness. Species on the CITES lists are considered of conservation concern. This Convention would be relevant to prevention of poaching of Wildlife in Kalagala offset area.

- ***Protocol Agreement on Conservation of Common Natural Resources (1982):*** Uganda also signed the Protocol Agreement on Conservation of Common Natural Resources (1982). Lake Albert is a common watercourse shared between Uganda and Democratic Republic of Congo (DRC) therefore its protection from contamination during dam construction.

Interpretation: The development of Isimba HPP will have an obligation to avoid impacts that may violate the above conventions in respect to protection f Lake Albert, a common lake and avoidance of wildlife poaching.

2.4 INSTITUTIONAL FRAMEWORK

2.4.1 National Environmental Management Authority, NEMA

The National Environmental Act provides for establishment of NEMA as the principal agency responsible for coordination, monitoring and supervision of environmental conservation activities. NEMA is under the Ministry of Water and Environment (MWE) but has a cross-sectoral mandate to oversee the conduct of EIA through issuance of EIA guidelines, regulations and registration of practitioners. It reviews and approves environmental impact statements (EIS) in consultation with any relevant lead agencies.

NEMA's enforcement branch is the department of Monitoring and Compliance. They are responsible for ensuring that enterprises comply with the various environmental regulations and standards. NEMA has appointed environmental inspectors whose powers and duties are spelled out in Section 81 of the National Environmental Act and can include stopping any activity which pollutes the environment. The environmental inspector may also issue an improvement notice requiring an operator of any activity to cease any activities deleterious to the environment which are contrary to the Act. NEMA has power; to prosecute environmental offenders and offences committed under the National Environment Act may earn the offender fines and prison sentences. NEMA works with District Environment Offices and Local Environment Committees at local government level, which undertake inspection, monitoring and compliance enforcement on its behalf.

Interpretation: NEMA will review and approve the EIA prepared for this Project.

2.4.2 Environmental Liaison Units in Ministries

NEMA is linked to sectoral lead agencies, private organisations and educational institutions through Environmental Liaison Units (ELUs). ELUs are charged with implementation of environmental programmes and integration of environmental concerns in sectoral policies, laws, regulations and programs. Consequently, they monitor investment programmes at their respective sectoral levels.

Interpretation: Relevant ELU's are stakeholders in the Project and will have input in to the EIA process.

2.4.3 Ministry of Energy and Mineral Development, MEMD

The Ministry is responsible for the energy sector, dealing specifically with policy formulation, policy implementation and monitoring. In 1999, following approval by cabinet of the Power Sector Reform and Privatization Strategy and enactment of new electricity law (The Electricity Act, 1999), Electricity Regulatory Authority (ERA) was established to regulate the energy sector. Thus, while the MEMD formulates policy, ERA is charged with the mandate of regulating the energy sector, independent of the Ministry.

Interpretation: Implementation of the Project will be by UEGCL which is overseen by MEMD.

2.4.4 Electricity Regulatory Authority, ERA

The Electricity Regulatory Authority (ERA) is a statutory body established in accordance with the Electricity Act of 1999 (CAP 145) as an agency of the Ministry of Energy and Mineral Development. The mandate of the ERA is "to provide for the generation, transmission, distribution, sale and use of electricity" in Uganda; to guide the liberalization of the electricity industry; and to manage licensing, rates, safety and other matters concerning the electricity industry. The main functions of ERA include:

- Issuing licenses for generation, transmission, distribution, of electricity processing applications for investors in the energy sector;
- Enforcement of requirement under the Act to ensure compliance with regulations;
- Establishing tariffs, reviewing, and approving rates of investment in the electricity sector;
- Advising the minister regarding the need for electricity projects; and
- Developing and enforcement of energy standards.
- ERA will ensure that, the operations costing of energy from the planned project will be in accordance with its set standards and tariffs.

Interpretation: ERA will license this project for its development and operation.

2.4.5 Uganda Electricity Transmission Company and Generation Company Limited

Uganda Electricity Transmission Company Limited (UETCL) and Uganda Electricity Generation Company Limited (UEGCL) are Public Limited Companies which were incorporated in March 2001 as a result of the power sector reform and liberalization policy that unbundled Uganda Electricity Board (UEB) into successor companies. The Companies operate under policy guidance of the Ministry of Energy and Mineral Development. UETCL's mission is to dispatch, transmit quality and reliable bulk power in a viable and efficient manner; be an efficient and commercially focused single buyer actor and; mitigate emergency power situations in Uganda. The mandate of UETCL is to develop and implement national strategic plan as the appointed "Single Buyer Actor" in the power market. UETCL operational licenses require it to:

- Operate its Operation of High Voltage Transmission Grid (HVTG) facilities in compliance with the Grid code that involves promoting and developing policies and programs to achieve high level quality and reliable HVTG services in accordance with the Electricity Act.
- Operate the national power system with the objective of dispatching available electricity to meet load requirements at the lowest cost for customer service, maintaining system integrity and reliability.
- Purchase power to provide continuous and economic supply of electricity to meet the load requirement for customers served directly or indirectly from HVTG facilities at lowest reasonable cost.
- Import and export electricity power to neighbouring countries pursuant to the terms of the agreement(s) for such international power transactions.

It is the mandate of UETCL to transmit power to and from different substations in the national grid and in this regard, UETCL will evacuate power from Isimba HPP through the proposed transmission line. UEGCL's mission is "To efficiently generate electricity, effectively monitor electricity generation concessions and trade in bulk quality, safe and reliable power at competitive rates in a sustainable manner for accelerating economic development". UEGCL's objectives include:

- To oversee the efficient production of electricity power in the country.
- To monitor the effects of electricity generation on the environment and develop appropriate policies in line with International Standards.
- To engage in research and consultancy so as to contribute to the development of the energy sector.
- To develop the organisation to enable it fulfil and deliver on its mandate and project a positive image.
- Disaster preparedness.

Interpretation: UETCL will construct the 220 kV-transmission line that will evacuate power from the power house to Bujagali substation and its operation and maintenance will be done by UETCL.

2.4.6 Local Government Administration Structures

The Local Governments Act, Cap 243 provides for decentralised governance and devolution of central

government functions, powers and services to local governments that have their own political and administrative structures. Districts have powers to oversee implementation of development activities under supervision of their relevant departments such as environment, lands and water resources. District and Local Council administration of Kayunga and Kamuli would be vital in implementation of the project by mobilising political goodwill and sensitizing local communities. Local administration leaders e.g. District Environmental Officers (DEO) will also play role in environmental monitoring associated with project construction and operation.

Interpretation: District and Local Council administrations are stakeholders in the Project and will have input in to the EIA process as well as subsequent monitoring. For example DEOs will review the project EIA and provide guidance about local conditions to NEMA prior to approval decision.

2.4.7 The Ministry of Gender, Labour & Social Development, MGLSD

The Ministry of Gender, Labour & Social Development (MGLSD) is responsible for coordinating social development in Uganda. In collaboration with other stakeholders, MGLSD is responsible for inspecting state of occupational safety, labour relations, community empowerment, protection and promotion of rights and obligations of vulnerable groups for social protection and gender-responsive development.

Interpretation: MGLSD is a stakeholder in the Project and will be responsible for inspecting the project for compliance with occupational health and safety regulations, national labour laws and gender equity.

2.4.8 National Forestry Authority, NFA

The National Forestry and Tree Planting Act of 2003 created NFA as semi-autonomous body responsible for management of central forest reserves. NFA divided the country into sectors and manages forest reserves through its sector managers. This institution is responsible for protection of forests reserves in Uganda, with the stated goals of maintaining an integrated forest sector that achieves sustainable increases in the economic, social, and environmental benefits from forests and trees by all the people of Uganda especially the poor and vulnerable. The NFA provides direction and guidance on all aspects of a Project that potentially impact on Uganda's forest resources.

Interpretation: NFA is a stakeholder in the Project and will have input in to the EIA process, especially in regard to management of natural forests in the project area (Kalagala Offset area).

2.4.9 Uganda Wildlife Authority (UWA)

The Uganda Wildlife Authority (UWA) was established under the Uganda Wildlife Act, Cap. 200. The main function of the UWA is to ensure sustainable management of wildlife in conservation areas by coordinating, monitoring and supervising wildlife management issues. UWA can manage wildlife (wild plant and wild animals native to Uganda) in both protected and unprotected areas. The UWA provides direction and guidance on all aspects of a project that potentially impact Uganda's wildlife and exert jurisdiction in Kalagala Offset area which is found upstream of the proposed dam site.

Interpretation: UWA is an important stakeholder in the Project especially for protection of wildlife in the project area.

2.4.10 Rural Electrification Agency, REA

REA is a government agency responsible for promoting rural electrification by moving of our population from use of traditional energy sources (e.g. firewood and other basic forms of biomass) to the adoption of modern energy services (e.g. electricity, petroleum fuels, bio-fuels and improved stoves). REA is charged with the following key responsibilities:

a) Undertake basic planning and preparation of projects in line with the Indicative Rural Electrification Master Plan (IREMP) and as determined by the Rural Electrification Board.

b) Implement Government's priority rural electrification projects for public funding as determined by the Board. c) Generate and provide information relating to investment opportunities, costs and benefits of rural electrification and available technical and financial support facilities to all stakeholders.
d) Recommend to the Rural Electrification Board the most efficient use of the Rural Electrification Fund (REF) for promotion of Rural Electrification Programme as set by Government policy.
e) Process applications for financial support from the REF.
f) Build and maintain a national database on rural electrification projects in Uganda.
g) Prepare for the Board an annual status report on the Rural Electrification Programme indicating progress, challenges and obstacles, and identifying options for mitigating the obstacles.

Interpretation: REA has on-going rural electrification programs in areas near the project site and is considering including villages comprised in the project area if 33 kV connectivity is provided for in design of Isimba HPP 220 kV substation so as to enable supply of power to local consumers.

2.4.11 Ministry of Tourism, Wildlife and Heritage

In this ministry d found the Department of Monuments and Museums mandated to protect, promote and present the cultural and natural heritage of Uganda through collection, conservation, study and information dissemination for enjoyment and education.

The department's key functions are:

a) Research about natural and cultural heritage
b) Conservation and maintenance of important physical cultural Resources or Heritage Collections.
c) Provision of professional knowledge and information on the archaeology and palaeontology of Uganda d) Publication of research findings in appropriate publications
e) Exhibition and interpretation of specimens for public study and enjoyment
f) Monitoring implementation policies and strategies of historical and cultural heritage conservation and development.
g) Development of strategies for community participation in cultural heritage.
h) Promote public awareness about cultural and natural heritage through formal and informal education. i) Provide technical guidelines to the private investors

Interpretation: This Ministry will be responsible for preservation of any chance finds encountered during project implementation.

2.4.12 Ministry of Water and Environment

The Ministry of Water and Environment (MWE) has the responsibility for setting national policies and standards, managing and regulating water resources and determining priorities for water development and management.

It also monitors and evaluates sector development programmes to keep track of their performance, efficiency and effectiveness in service delivery. MWE has three directorates:

a) Directorate of Water Resources Management (DWRM);
b) Directorate of Water Development (DWD); and
c) Directorate of Environmental Affairs (DEA).

The Directorate of Water Resource Management (WRMD) is responsible for water resources panning and regulation; monitoring and assessment and water quality management. WRMD has the following key functions:

i) **Water Quality Management** in all Uganda's water bodies

ii) **Management of international and transboundary water resource management** promote transboundary regional cooperation for equitable and reasonable utilisation of shared water resources. Specific roles are:

- Transboundary water resources management policy formulation, reviews, implementation and advice,
- Regional coordination of transboundary projects and programmes,
- Transboundary water resources management MIS and monitoring, and evaluation of transboundary projects and programmes, and
- Raising awareness, capacity and confidence-building as well as capacity-building on transboundary water resources management issues.

Lake Albert is a shared lake (between Uganda and DRC) and thus its management is a mandate of WRMD. iii)

Regulation and use of water resources in Uganda

Anybody abstraction of water from a lake, river or underground using a motorized pump; discharging wastewater into the environment; drilling for water; or construction of dams and other structures on water bodies is required to apply for a water permit according to the Water Act. These permits are issued by WRMD.

The Directorate of Water Development (DWD) is responsible for urban water supply, water for production, rural water supply and urban water regulation.

The Directorate of Environmental Affairs (DEA) comprises:

- ***Climate Change Unit (CCU)***, whose main objective is to strengthen Uganda's implementation of the United Nations Framework Convention on Climate Change (UNFCCC) and its Kyoto Protocol (KP).
- ***Environment Support Services (ESS);***
- ***Forest Sector Support Department (FSSD)*** that promotes efficient and effective governance of the forestry sector.
- ***Metrology Department*** that monitors weather and climate, exchange data/information and products and issue advisories to the nation.
- ***Wetlands Management Department*** (WMD) which protects wetland resources in Uganda.

MWE also oversees autonomous agencies namely NFA and NEMA.

Interpretation: Overall, this Ministry is responsible for environmental and water resources management in Uganda. MWE is also responsible for ensuring good catchment health of River Nile.

2.5 INTERNATIONAL BEST PRACTICE

This EIA has been conducted to conform to regulations and standards of the GoU and the safeguard policies of IFC, the Wold Bank Branch that lends to the private Sector.

2.5.1 International Finance Corporation (IFC)

The IFC has operates a set of Performance Standards on Social and Environmental Sustainability (in force from July 2006). These Standards replace the prior safeguard policies and will be used to evaluate any project seeking funding through the IFC. The Equator Principles[1] have been revised to adhere to the new IFC Performance Standards (but do not reference the Sustainability Policy). The Performance Standards are listed in Box 2 below and ones likely to be triggered by the project indicated by "√" symbol.

Performance Standard 1 (see Box 3 below) underscores the importance of managing social and environmental

performance throughout the life of a project. It identifies the need for an effective social and environmental management system that is dynamic and continuous, 'involving communication between the client, its workers, and the local communities directly affected by the communities'. It requires 'thorough assessment of potential social and environmental impacts and risks from the early stages of project development and provides order and consistency for mitigating and managing these on an on-going basis' [1].

Box 2: IFC Performance Standards

- Performance Standard 1: Social and Environmental Assessment and Management √;
- Performance Standard 2: Labour and Working Conditions √;
- Performance Standard 3: Pollution Prevention and Abatement √;
- Performance Standard 4: Community Health, Safety and Security√;
- Performance Standard 5: Land Acquisition and Involuntary Resettlement√;
- Performance Standard 6: Biodiversity Conservation and Sustainable Natural Resource Management√;
- Performance Standard 7: Indigenous Peoples X;
- Performance Standard 8: Cultural heritage √.

Box 3: Objectives of Performance Standard 1

- To identify and assess social and environmental impacts, both adverse and beneficial, in the projects area of influence.
- To avoid, or where avoidance is not possible, minimise, mitigate, or compensate for adverse impacts on workers, affected communities, and the environment.
- To ensure that affected communities are appropriately engaged on issues that could potentially affect them.
- To promote improved social and environmental performance or companies through the effective use of management systems.

IFC Performance Standards reinforce the importance of effective community engagement through disclosure of project-related information and consultation with local communities on matters that directly affect them. Through the Performance Standards (particularly Performance Standard 1), IFC requires clients to engage with affected communities through disclosure of information, consultation and informed participation, in a manner commensurate with the risks to and impacts on the affected communities.

IFC is committed to putting into practice processes of community engagement that ensure the "free, prior, and informed consultation of affected communities, leading to broad community support [2]for the project"[3].

2.5.2 Comparison of the IFC Performance Standards and the World Bank Safeguards

All key principles of the World Bank Operation Policies have been incorporated into the new IFC Performance Standards. There are, however, some slight differences between the guidelines, the most relevant of which are outlined in Table 6.

Table 6: Comparison of IFC Performance Standards and World Bank Safeguards

Performance Standard 1: Social and Environmental Assessment and Management System	World Bank Operational Policies
▪ Goes beyond assessment to address implementation through the use of a social and environmental management system	▪ OP 4.01 mostly focuses on assessment only
▪ Broader scope of assessment with broader geographic and time horizon; third party actions	▪ No equivalent requirement in OP 4.01
▪ Requires more comprehensive and on-going information disclosure and consultation with affected communities for all projects at a level commensurate with the project's risks and impacts.	▪ OP 4.01 requires consultation for all Category A projects, and as appropriate, Category B projects.

▪ Requires free, prior and informed consultation and informed participation of affected communities for projects with significant impacts on them. In addition, IFC's Sustainability Policy requires that IFC will verify broad community support for the project within the affected communities.	▪ No equivalent requirement in OP 4.01
▪ Requires clients to establish a grievance mechanism	▪ No equivalent requirement in OP 4.01
▪ Clients must disclose the Action Plan to affected communities, provide them with periodic reports on its implementation and disclose any updated measures and actions to address issues of concern to affected communities.	▪ OP 4.01 has no disclosure requirements beyond assessment.
▪ Documentation and processes are driven by risks and impacts, not project categorisation.	▪ Driven by project categorisation.
▪ Requires an on-going and iterative consultation process throughout the life of the project.	▪ A requirement to consult "at least twice" during the assessment process
▪ All trans-boundary impacts are considered as part of the assessment process.	▪ International Waterways (OP 7.50) deals with transboundary issues.
▪ Alternatives analysis will be focused on alternatives to avoid adverse impacts. No requirement to compare the "without project" situation.	▪ Requirement to compare the "without project" situation.

2.5.3 Guidelines of the World Commission of Dams (WCD)

WCD was created by World Bank & IUCN in May 1998 in response to growing opposition to large dams. International Commission on Large Dams (ICOLD) defines a large dam as one with a height of 15 m or more from the foundation. If dams are between 5-15 m high and have a reservoir of more than 3 million cubic metres, they are also classified as large dams. Using this definition, Isimba HPP is a large dam. Therefore, the 10 WCD recommendations below will need to be useful for implementation of the project:

i) Development needs and objectives should be clearly formulated through an open and participatory process, before various project options are identified.
ii) A balanced and comprehensive assessment of all options should be conducted, giving social and environmental aspects the same significance as technical, economic and financial factors.
iii) Before a decision is taken to build a new dam, outstanding social and environmental issues from existing dams should be addressed, and the benefits from existing projects should be maximized.
iv) All stakeholders should have the opportunity for informed participation in decision-making processes related to large dams through stakeholder fora. Public acceptance of all key decisions should be demonstrated. Decisions affecting indigenous peoples should be taken with their free, prior and informed consent.
v) The project should provide entitlements to affected people to improve their livelihoods and ensure that they receive the priority share of project benefits (beyond compensation for their losses). Affected people include communities living downstream of dams and those affected by dam-related infrastructure such as transmission lines and irrigation canals.
vi) Affected people should be able to negotiate mutually agreed and legally enforceable agreements to ensure the implementation of mitigation, resettlement and development entitlements.
vii) The project should be selected based on a basin-wide assessment of the river ecosystem and an attempt to avoid significant impacts on threatened and endangered species.
viii) Mechanisms to ensure compliance with regulations and negotiated agreements should be developed and budgeted for, compliance mechanisms should be established, and compliance should be subject to independent review.
ix) A dam should not be constructed on a shared river if other riparian States raise an objection that is upheld by an independent panel.

[1]A financial industry benchmark for determining, assessing and managing social & environmental risk in project financing

[1]IFC (2006). Guidance Note 1.Social and Environmental Assessment and Management Systems; World Bank Group.

[2]Broad community support is a collection of expressions by the affected communities, through individuals or their recognised representatives, in support of the project. There may be broad support even if some individuals or groups object to the project.

[3]IFC Policy on Social and Environmental Sustainability (paragraph 20).

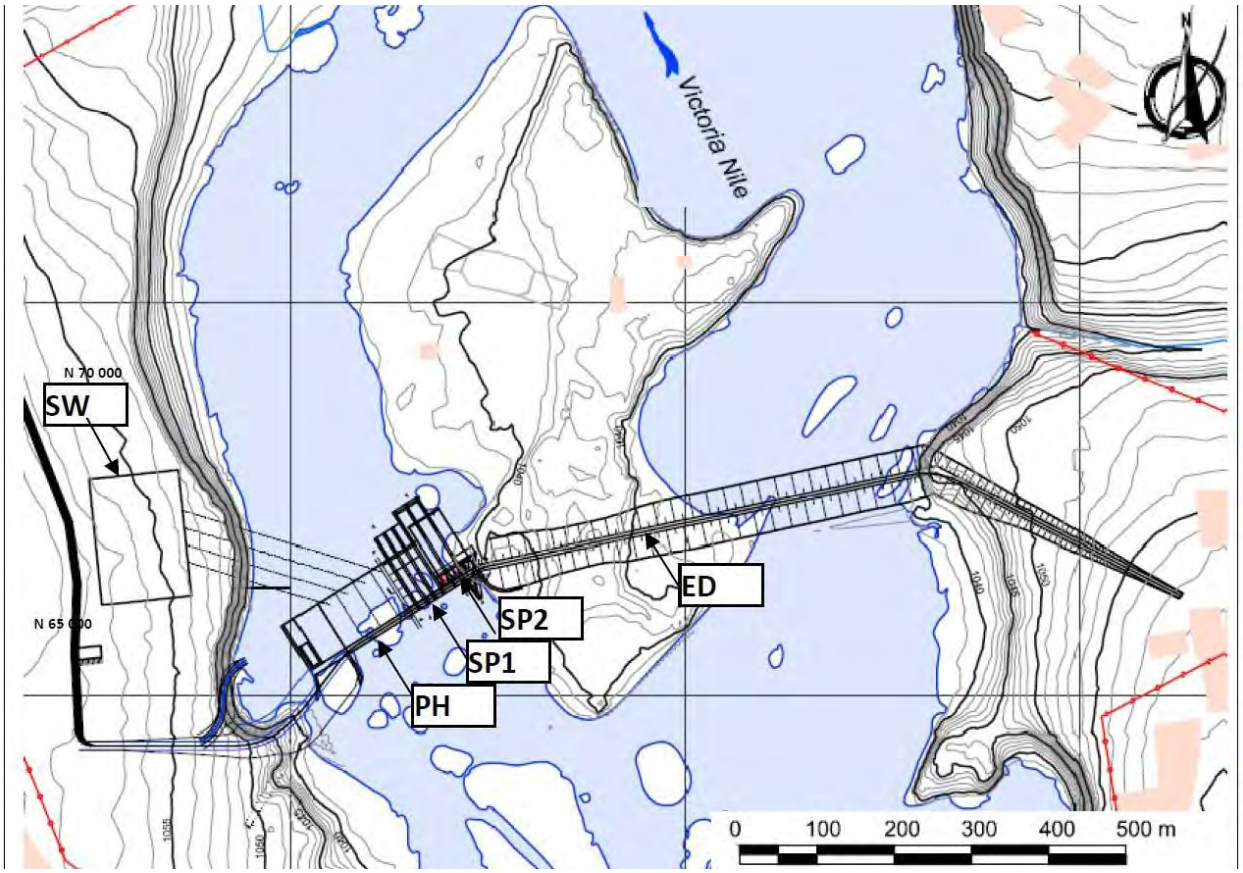
3 PROJECT DESCRIPTION

3.1 NATURE OF DAM STRUCTURE

Due to a relatively low water head available, the power station will have its powerhouse structure embedded in the overall water retaining structure. This offers the most convenient and cost-effective option. The power station will comprise of Kaplan turbines which provide for easier maintenance since similar units are installed at Bujagali HPP and Nalubaale HPP (formerly Owen Falls Dam). A rockfill dam with central clay core was selected for power station's structure. This choice was based on abundant availability of good rock material and clay in the vicinity of project site.

3.2 LAYOUT

The layout of the Isimba hydropower project main structures is presented in Figure 1. The powerhouse and spillways will be located in the left river channel.



Source:
Fichtner

Figure 1 Layout of Isimba HPP

From the Figure 1, the outdoor switchyard will be on the left bank and connected to the powerhouse with four overhead lines. To provide adequate space at the erection bay and enable easy access, the bay will be located west of the powerhouse and main access road will lead to this location.

3.3 POWERHOUSE

The powerhouse structure will be monolithic with the intake, turbine block and outlet to be casted as integral parts of

the powerhouse. Water will enter each intake through a double entrance protected by trash screens. Each intake is designed to be isolated from the reservoir by hydraulic serv0-assisted fast closing guard gates.

For inspection and maintenance purposes, manually operated bulkhead gates upstream of the trash racks are provided. Downstream of the guard gates, the double waterway passages merge into a single section leading to the turbine spiral case. The waterway entrances are shaped to minimize hydraulic losses. Similarly to the intake, the outlet works is designed with due attention to provide for the efficient operation of the turbines. It is intended to have steel-lined draft tubes immediately below the turbine runner. Each draft tube will be further divided into two channels that discharge water to the Tail water. At the end, the draft tubes shall be equipped with the bulk head gates to enable their closure for inspection and maintenance. Depending on the actual geological conditions, if necessary, the tailrace channel immediately downstream of the draft tube outlets will be lined with concrete or some other measure for protection against erosion may be adopted.

Hydro mechanical and electrical equipment will be placed within the powerhouse itself. Downstream of the turbine units, three floors are envisaged for placement of all necessary equipment. Only transformers are intended to be located on the outside platform at elevation 1045 m ASL. This should enable easy evacuation of energy toward the substation over one short overhead line. The control building will be located at the west end of the erection bay within the powerhouse. The control building shall contain enough space for all administrative, control and equipment rooms and offices.

3.4 SPILLWAYS

Design characteristics of the selected spillway gates are presented in Table 7.

Table 7: Main characteristics of the spillways

Selection	Units	Lower radial gates	Upper radial gates	Flap gates
Width	m	9.5	14	11
Gate height	m	10.5	10.5	2.5
Number of gates	unit	3	2	2
Sill level	m ASL	1029	1044.5	1052.5
Top of gate	m ASL	1039.65	105.55	10.55
Capacity of each gate	m^3/s	923	1105	196

The intake pond has an area of about 20 km^2 and the maximum flood level of the reservoir at an elevation of 1055 m ASL, would be reached within 2 hours if the power plant has stopped and the inflow is 1375 m^3/s (capacity of upstream power plant).

The spillway was designed using the following criteria:

- Pass the 1000-year flood with the reservoir level not exceeding the elevation of the top of the dam body.
- No risk of cavitation at the design flood.
- Pass the maximum reservoir level with limited increase of the reservoir level, i.e. not overtopping the embankment dams.

The spillway structures will comprise of:

- Three submerged radial gates for flood spilling, diversion during construction and for flushing of sediments accumulating in the reservoir
- Two radial gates located above ogee crest spillways with a downstream plunge pool.
- Two flap gates located within each of the upper radial gates having the purpose of diverting floating debris during normal operation of the power plant.

3.5 ELECTRICAL EQUIPMENT

3.5.1 Generators

The generators will be vertical shaft, synchronous units each directly coupled to a Kaplan turbine. Key data about the generators is:

- Number of units 4
- Capacity 53 MVA
- Power 45.8 MW
- Cos Ø 0.85
- Voltage 12 – 15 kV
- Rotational speed 88.2 rpm.

The generators will be indirect water cooled closed air-circulation by "rim ventilation" and a multiple air to water heat exchangers mounted on the stator frame.

3.5.2 Main Transformers

The step-up transformers from the generator voltage to transmission line voltage (132kV), will be of three phase, air cooled type. Main characteristics are:

- Voltage 132 kV
- Capacity 53 MVA

3.6 ISIMBA SUBSTATION

The substation shall have double busbar type with two line bays, 4 Transformer bays, 1 bus coupler and 2 future bays, one control building and necessary access roads, pavement and drainage system.

Isimba 132 kV-substation will comprise of one (1) double busbar system 132 kV outdoor, steel work and busbar, lattice type, busbar conductors as follows:

One (1) busbar coupler consisting of:

- One (1) set SF6 circuit breaker,
- Two (2) sets of disconnector with 1 (one) earthing switch,
- Three (3) multi-core current transformers.

Two (2) busbar measuring bay consisting of

- Six (6) voltage transformer.
- Two (2) sets of disconnector with earthing switch

Two (2) line bays consisting each of:

- One (1) set SF6 circuit breakers
- One (1) set of double busbar disconnectors with one (1) earthing switch,
- One (1) set of disconnector with two (2) earthing switches,
- Three (3) multi-core current transformers,
- Three (3) voltage transformers,

- Three (3) lightning arresters

Four (4) transformer bays with:

- One (1) set SF6 circuit breaker,
- One (1) set of double busbar disconnectors with one (1) earthing switch,
- One (1) earthing switch,
- Three (3) multi-core current transformers,
- Three (3) voltage transformer,
- Three (3) lightning arresters

In addition to the above following is included in the equipment of the Isimba Substation: the auxiliary power system, power and control cables, earthing system, power and lightning installation control and monitoring equipment, protection equipment and telecommunication system.

3.7 POWER AND ENERGY PRODUCTION

From available net head and discharge, the installed plant power capacity will be 183.2 MW based on the following information:

- Normal operating level in headwater: 1054.5 m ASL
- Tailwater level, 4 units in operation: 1039.1 m ASL
- Gross Head: 15.4 m
- Net Head (assumed losses 0.3 m): 15.1 m
- Discharge 1 turbine: 343.75 m^3/s
- Discharge 4 turbines: 1375 m^3/s
- Assumed overall plant efficiency: 0.90
- Installed capacity, 4 turbines: 4 x 45.8 MW = 183.2 MW

3.8 TRANSMISSION LINE DESIGN, 132KV

The transmission line from Bujagali to Isimba shall be designed for 132 kV voltage level for the following reasons:

- The 132 kV voltage level offers easy grid extensions to: the north, Kayunga and Kamuli Districts in the future.
- Although the 132 kV transmission line itself is more expensive than a 220 kV one, the overall costs for 132 kV substation and 132 kV transmission line are less compared with overall costs of substation and line both at 220 kV level.
- Electro-technical equipment of Bujagali and Isimba Substations would be similar and this will provide for easier operation and maintenance during emergency cases, procurement of spare parts, etc.
- The 180MW will be a peak load only and transmission losses during the majority of the operation will be significantly less than for these peak load.

The minimum design requirements from the point of view of the electrical system and other general data are indicated in Table 8.

Table 8: Electrical system data

Characteristic	Design requirement
Nominal voltage	132 kV
Maximum operating voltage	145 kV
Power frequency	50 Hz
Basic insulation level design BIL (lightning impulse)	650 kVpeak

Short duration power frequency withstand voltage	275 kVr.m.s.
System highest 3-phase short-circuit current level	31.5 kA
Transmission capacity of one circuit (n-1)	212MVA

4 EIA METHODOLOGY

4.1 INTRODUCTION

This chapter describes the broad principles of methodology and scope of the EIA indicating the approach that was used to identify, evaluate and recommend mitigation measures for environmental impacts.

The approach employed for collection of the information necessary for this study and impact assessment included desk based literature reviews and field survey of the main sites in the project area. The main sites surveyed were the actual Dam site around Nampaanyi, the big island (Koova) in the river and Bugumira and the areas that were preliminarily marked as potentially liable to flooding.

4.2 PHYSICAL ENVIRONMENT

4.2.1 Data Sources

This Environmental Assessment (EA) has examined baseline environmental data for both the left (Kayunga side) and right (Kamuli side) banks of the Victoria Nile, as identified during the alternatives assessment. This data has been compiled from a range of primary, secondary and tertiary sources. Primary data was collected by the consultant's survey teams and methods used varied depending on the nature of the data to be collected. However, standardised, defensible data collection methodologies were used throughout the study to ensure that high quality primary data was collected.

Secondary data was relied upon in development of this EIA. Many studies have been conducted on the ecosystems and biodiversity of central Uganda and where possible, existing information has been used to maximise the efficiency of the EIA process. Only when critical gaps in the body of existing secondary data were identified was effort expended in collecting primary data.

4.2.2 FieldSurveys

a) Air quality

Airborne particulate measurements were made during March 2013 at sensitive receptor sites on both banks and the surrounding areas of the proposed dam site (Figure 2). Ambient Total Suspended Particulates (TSP) readings were taken in these areas using a pre-calibrated Casella Microdust® dust/aerosol monitor then mounted on a tripod 1-1.5m above ground level. The equipment was zero checked daily, and following an initial adjustment at the start of the survey the zero calibration was found to be stable. Measurements were made over five (5) minutes sampling periods. The integrated average reading was observed to stabilise within a few minutes at all locations, so the five-minutes average was considered to be a representative spot reading.

b) Ambient noise

Ambient noise readings were taken at sites (Figure 2) along the River banks of the proposed Hydro power dam site on both sides using a Casella CEL-621C2 sound level meter which was calibrated and mounted on a tripod 1.0-1.5m above ground level. Between 3 and 4 readings were taken at each site at varying locations. Background noise was monitored at 30 sec intervals over a ten (10) minute period at each site. For each reading an instantaneous sound pressure level reading was recorded (LA) and an equivalent continuous A-weighted sound pressure level reading for the preceding 30 seconds (LAeq).

CASELLA MicroDust used to measure dust (TSP)

Instrument used: CASELLA CEL-621C2/K1 Integrating 1/3 Octave Band Sound Level Meter (Class 2) used for noise measurement

c) Surface water quality

The proposed Isimba HPP site is located in Nampaanyi village on the left bank and in Bulangira Busoke village on the right bank. Water samples were taken from each of the banks at several points (Figure 3) both upstream and downstream of the proposed dam site. Two sets of samples were taken for laboratory analysis at the National Water & Sewerage Corporation (NWSC) laboratory; one for bacteriological quality and the second one for physic-chemical analysis (see results in Appendix A). Microbiology samples were collected in sterilised bottles obtained from National Water &Sewerage Corporation (NWSC). During sample collection, onsite measurements were carried out and included pH, temperature, dissolved oxygen, conductivity/ total dissolved solids (TDS), salinity and oxidation-reduction potential. Onsite measurements were carried using the HANNA HI 9828 multi-parameter water quality meter.

Photo 1: Onsite water quality measurements on the Victoria Nile at Nampanyi Village using the multi-parameter field water meter (HANNA HI 9828)

d) Soil

Specific sites for soil sampling were earmarked in both the Kayunga District side and Kamuli District side of the River Nile which runs through the project area (Figure 4 and Figure 5). For correct classification and understanding of the soils of the project area, soil profile description method was employed and the soil properties of all the horizons up to the parent material were described. This method involved exposing a profile by digging a 1.5 m^2 area test pit with a depth of up to the parent material. The test pits were strategically sited to

represent the areas within the water sheds that immediately contribute runoff to the project area. Within a 3km radius 3 pits were dug - 2 pits close to the River bank and 1 in the periphery but in between the 2 so as to depict a triangular shape. For each of the horizons in the profile, soil properties described, included; depth of the horizon, boundary regularity and sharpness, moisture status, colour, texture, structure (degree of structural development and the shapes of the different soil peds), consistence, porosity, compactness, presence of fauna, drainage, roots distribution and size with their quantifying adjectives such as shape, nature, health and age. In addition, details of the vegetation, slope gradient and susceptibility to erodibility around the sample area were recorded.

Representative soils samples were taken within the horizons of the soil profile and delivered to the laboratory for analysis. The mehlich-3 extractable method was used to analyze for the soil minerals including phosphorus, potassium calcium and so on. Soil water extract was used to provide the pH and electrical conductivity with respective probes. Nitrogen was determined using the Kjeldah method. The organic matter on the collected samples was determined following the Walkley-Black method. Soil texture was determined by the Bouycous (hydrometer) method while the textural triangle was used to identify the textural classes. Other soil properties analysed included: pH, total nitrogen, organic matter, organic carbon, available phosphorus, exchangeable bases (sodium, potassium, calcium and magnesium), texture determination (percentages of sand, silt and clay), particle size distribution, trace elements (zinc, copper, iron and manganese) and salinity.

Additionally, with the help of a core sampler, cores were used to take samples from the respective horizons for bulky density determination. For some of the parameters such as texture, laboratory analyses provided a check for the conclusions drawn during in-situ investigations.

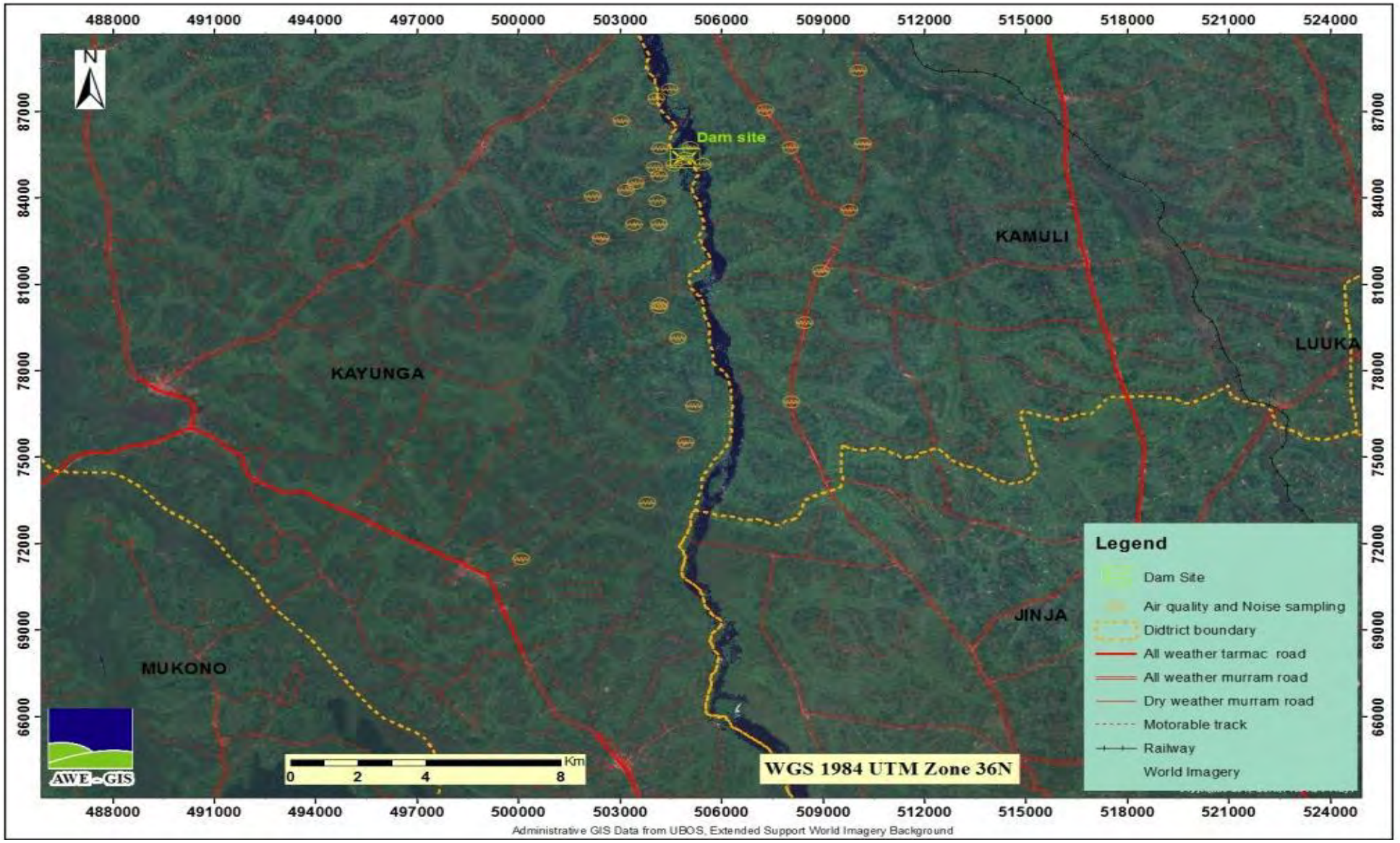

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Figure 2 Air quality and noise sample points in the project area

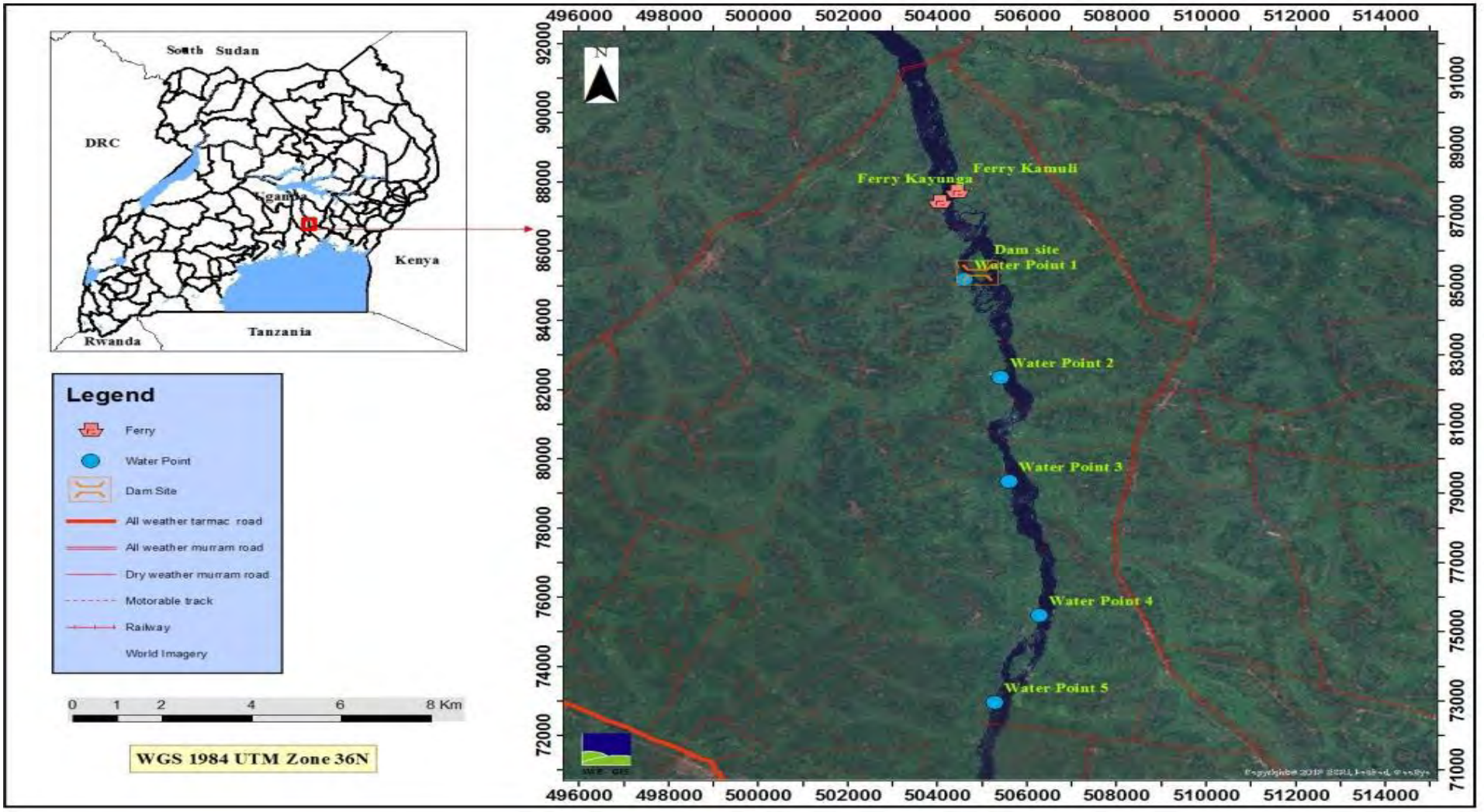


Figure 3 Map of water sampling points in the project area

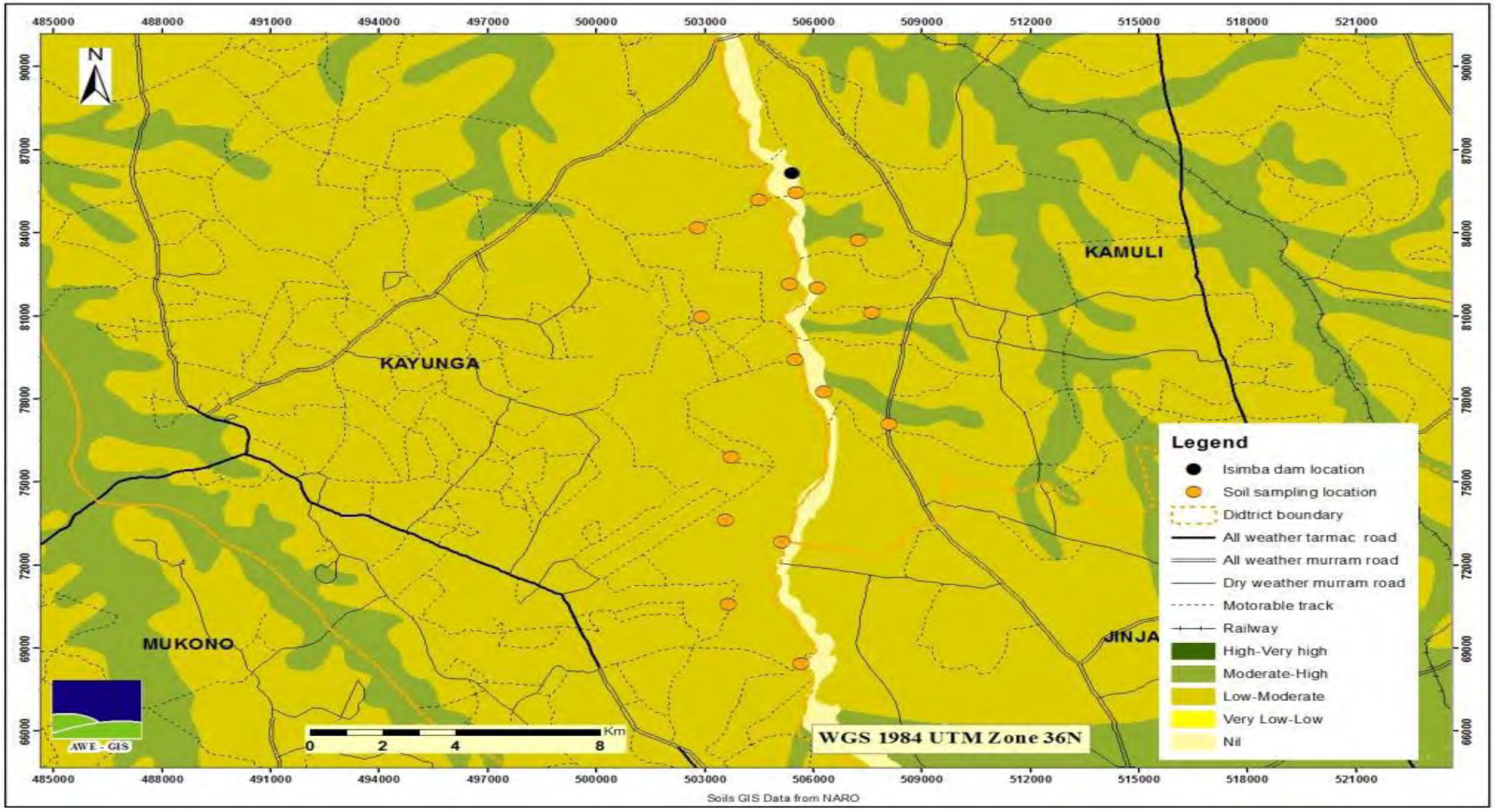


Figure 4 Map of soil and soil productive in the project and soil sampling locations

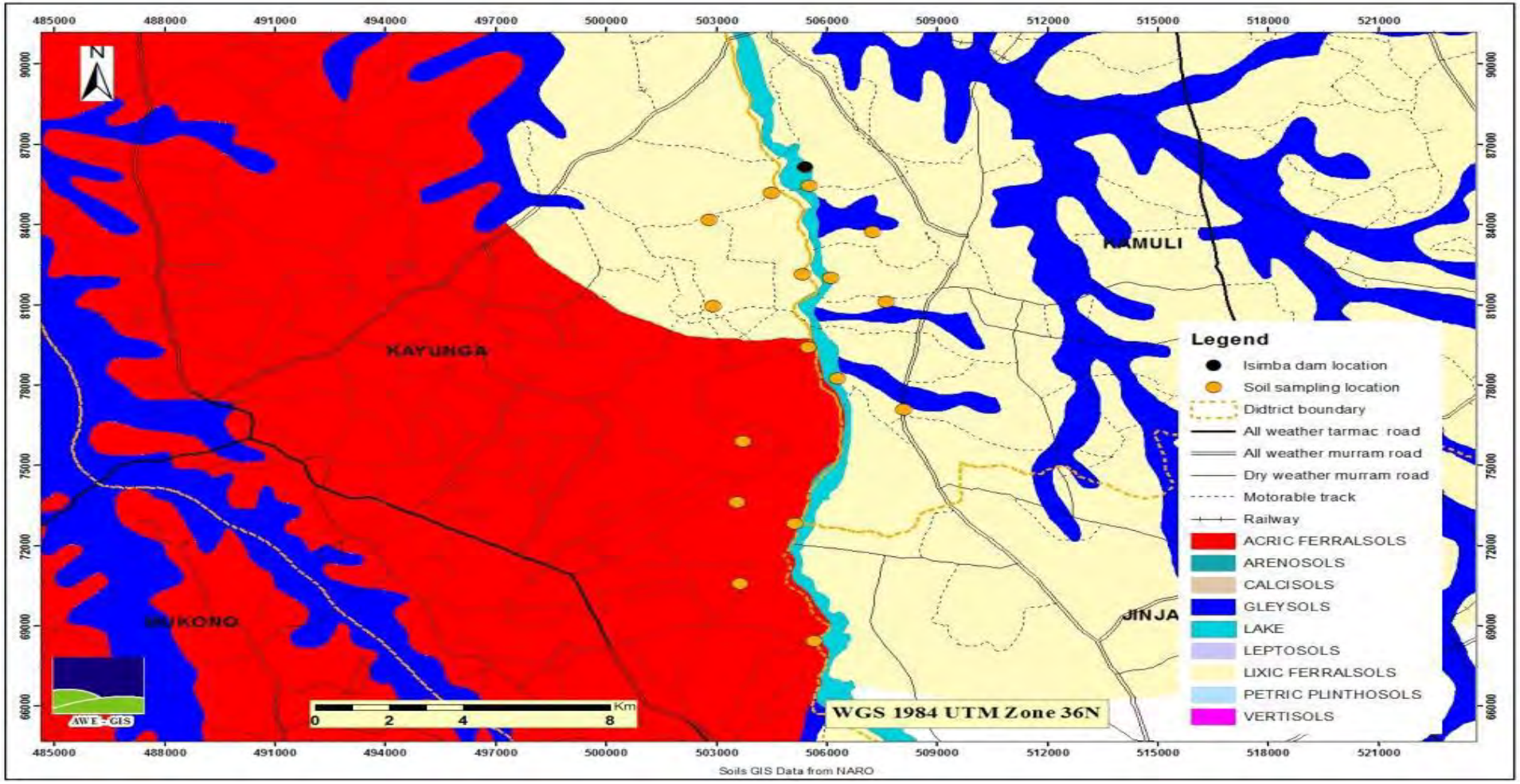


Figure 5 Map of soil types in the project and soil sampling locations

4.3 BIOLOGICAL ENVIRONMENT

The approach employed for collection of the information necessary for this study and impact assessment included desk based literature reviews and field survey of the main sites in the project area. The main sites surveyed were the actual Dam site around Nampaanyi, the big island (Koova) in the river and Bugumira and the areas that were preliminarily marked as potentially liable to flooding.

The Direct Impact Zones where they will be direct and on-site effects on the bio-physical environment in the project area were identified from both the field surveys and background information. These include the dam site, and areas believed to be most susceptible to the anticipated flooding already mapped. Inevitable removal of vegetation is anticipated, thus destruction and degradation of natural habitat for flora and all biodiversity. On the other hand, Indirect Impact Zones are those that are likely to suffer only secondary effects from the activities of the dam construction. These are hence off-site impacts. The part of the river downstream area stands a high likelihood of being affected in this manner. Effects arising from soil erosion and possible subsequent siltation can cause such indirect impact, but less so for vegetation. However, if there is any pollution arising from the activities, the aquatic flora and other biodiversity are bound to be affected negatively.

4.3.1 Literature Reviews

The desk-based studies of the area were undertaken prior to the field visit. This helped to get acquaintance with the ecology, biodiversity and landscape features of the general area. The readily accessible existing sources of information about the general area were sought. Information relevant to vegetation and flora studies including soils and geology and their conservation status was reviewed. The purpose was to identify beforehand, any unique, threatened, rare and other cases of conservation concern species and habitats known to occur in and around the area of the proposed dam activities. A range of information required for the assessment of possible impacts on vegetation and flora was gathered.

Vegetation classifications previously made by Langdale-Brown et al. (1964) were reviewed to provide an overview of the likely potential natural vegetation and habitats present within the study area. The relative extent of coverage and variation of vegetation types identified during the reviews, together with available satellite images were used to identify survey sites for the field surveys. Most of the area was under subsistence cultivation. Some natural habitats included wetlands, wooded grasslands and riparian wooded environments.

4.3.2 Field Surveys

The field survey was conducted in March 2013. The information gathered during the literature survey was used to ground-truth, and also collect further site-specific information on habitat types and quality, species presence and landscape features. Features of the landscape including the dominant habitats and species of conservation concern were recorded. Global Positioning System (GPS) units were used to mark the survey points and all other points of interest. The field surveys also provided site specific survey data on the presence, abundance and distribution of individual species across the survey area.

4.3.3 Vegetation and Flora Sampling

Survey sites were selected for sampling to represent coverage of the habitats identified within the survey area during the review process. The objectives of the flora surveys were to describe and assess:

- the existing land cover and vegetation in the project area,
- the possible impacts of the project on the land cover and vegetation, and
- the relevant mitigation measures to be integrated in the design and operation of the Isimba Hydropower Project.

At each survey site, the main plant communities, which are partly explained by topographical and soil variations (Currie 1991), were identified. Sampling was then undertaken, following variation in plant communities. At each sampling point, all species of plants present were identified and recorded. The taxonomy of each plant was done at family, genus and species (and in a few instances sub species or variety) levels. The life form of each plant was recorded as Tree, Shrub, Vine, Herbaceous Climber, Grass or Herb. The relative abundance of the plant species was assessed using the DAFOR scale where D=Dominant; A=Abundant; F=Frequent; O=Occasional; R=Rare, which is a quick though subjective method of assessing relative abundance (Kent & Coker 1992).

Habitats believed to be unique and important within a given survey site were sampled as azonal areas. This sampling regime optimizes capture of as wide a range of the vegetation types and species (Gillison& Brewer 1985, Økland 1990, Wessels et al. 1998, de Blois et al. 2002) in the area as possible. The plants that could not easily be identified in the field were collected as vouchers for subsequent identification at the Makerere University Herbarium (MHU).

The general vegetation type in each of the selected sites was characterized. This characterization was based on the floristic and landscape features observed in the different habitat types. Dominant species of plants in the woody and herbaceous layers were identified and used for the purpose. The general terrain and proximity to the River Nile and streams were noted.

The *species richness* of each survey vegetation type was the summation of all species recorded from all the survey sites (Magurran 2004) described by the vegetation type. In order to estimate the relative abundance of a species over the total area surveyed, a species was assigned a score of 5 for D, 4 for A, 3 for F, 2 for O and 1 for R in each of the surveyed sites where it occurred. For each species, these scores were summed up across all the sample points where the species occurred. The species with the highest figure of relative abundance had the highest relative abundance. Relative frequency was assessed from the total number of sites a species was recorded in.

Severity, extent of impact, and final evaluation of impact assessment followed a step-by-step approach. First, a "value", as judged from the baseline situation, for that specific issue or theme within the project area, giving a ranking from "low" to "high". The value was based on established conservation criteria as well as indications of regional and local importance. Accordingly, sites with the following attributes were assessed as high value:

- Presence of IUCN globally threatened species
- Range-restricted species
- High woody biomass
- Provision of critical ecosystem services e.g. watershed protection, buffer zones against siltation
- Rare habitats e.g. those with high ecological fragility such as groundwater areas supporting localized wetland flora
- Presence of large mature trees as seed sources for natural regeneration

4.3.4 Fauna Sampling

4.3.4.1 Insects (Butterflies and dragon flies)

The butterfly and dragonfly fauna of the target areas were sampled through the systematic use of sweep net at each point location. Random sweeping within the areas (rapid biodiversity assessment) that involved combing through a defined area and catching and identifying every species encountered was employed. Opportunistic observations were included to help build the species list. Several habitat types were sampled as summarized in Table 9.

Each of the butterfly species was assigned to one of the ecological categories as described by Davenport (1996). The major categories considered in this study are forest dependent species (F), forest edge/woodland species (f),

open habitat species (O), widespread species (W), migratory species (M), and wetland species (S). The habitat preferences for the dragonflies were also assessed.

Table 9: Summary of the different areas sampled and the nature of land-use

Site Number	Site Name	Land use(s)
1	Bugumira	wetland /gardens
2	Big Island	forested/wetland/cultivation
3	Small Island near Nampanyi	cultivation/rocks
4	Nampanyi shoreline	cultivation
5	Lwanyama,Nabukidi, Bupiniina	mixed habitat
6	Kiterede, Kireku, Nakakandwa	heavily cultivated
7	Budoda	gardens and wetland
8	Bukwenya-Kirindi	mainly coffee gardens

4.3.4.2 Mammals

The surveys for mammals were largely based on looking for mammalian signs (faecal samples or prints), the occasional actual sighting and interviews with the local people. The surveys were mainly centred in the areas listed in Table 10.

Table 10: Locations in which the mammal surveys were conducted

Village	Northing	Easting
Kasega	36N505162	E76458
	36N505152	E76443
	36N505272	E76267
	36N505379	E76268
	36N506027	E75479
Kirunda	36N506245	E75482
Nsima	36N505211	E72957
Wabilongo	36N504435	E71232
	36N505749	E85223
	36N505575	E85198
Bugumira	36N505415	E85186
Bukyatifu	36N508104	E83755
	36N506311	E81936
Bukasa	36N506087	E81548
	36N506040	E81197
	36N505987	E81162
Isimba	36N505576	E80468
Lwanyama	36N506086	E79709
Namalumba	36N506533	E75291

4.3.4.3 Fish

The investigation area for this assessment was a defined watercourse occurring as the centreline of the proposed project. The potential impacts of the proposed Hydro Power Project on downstream and upstream watercourses, aquatic habitats and biota were considered.

Field observations and investigations of aquatic habitats and fisheries at the site and along the flood stretch were made (Figure 6). At each landing site visited assessments were made of water quality, flow and colour and morphological features (substratum, width-depth ratio, bank stability). Characteristics of the riparian zone recorded included in stream and riparian vegetation, width, nature and whether or not vegetation overhangs the bank of the river. The location of each observation site was recorded using a hand-held GPS unit and the site photographed. Other features, such as barriers to fish movement, the extent and type of disturbance of each site were recorded.

Fish species present in river along the proposed project area were considered good indicators of aquatic health that could be assessed in an efficient and cost effective manner. Fish sampling was done using:

- Two gillnets; one made up of 10 gill-nets of graded mesh sizes in approximately 12.5 mm increments from 1" (inch) to 8" (inch) and local's 4" for five hours,
- Cast net at each location.
- Long line fishing using baited hooks

The gill nets were set near the shoreline (inshore) in series and the cast net thrown 10m (offshore). The fish were sorted and separated into various taxa, measured and weighed.

4.4 IMPACT SIGNIFICANCE

Three stages were utilised to establish significance of impacts as follows:

a) *Impact severity*: how severe is the impact (negligible, low, medium, and high). The severity of an impact is a function of a range of considerations including:

- impact magnitude;
- impact extent;
- impact duration; and
- receptor sensitivity.

b) *Likelihood of occurrence*: how likely is the impact to occur (none, low medium and high); and
c) *Identification of the impact significance*, which is the product of a combination of the above two variables.

The process for combining the severity of the impact with the likelihood of the impact is shown as a matrix below.

Matrix 1: Derivation of impact significance

Impact Severity	Impact Likelihood			
	None	Low	Medium	High
Negligible	Negligible	Negligible	Negligible	Negligible
Low	Negligible	Negligible	Negligible – Minor	Minor
Medium	Negligible	Minor	Minor – Moderate	Moderate
High	Minor	Moderate	Major	Major

4.5 MITIGATION OF ENVIRONMENTAL IMPACTS

Mitigation measures were designed in order to avoid, reduce, mitigate, or compensate for adverse environmental and social impacts and inform the Environmental and Social Management Plan (Chapter 8). A detailed impact analysis is provided in Chapter 7.

Figure 6 Fish survey locations in the project area.

4.6 CONSULTATION AND DISCLOSURE

Stakeholder consultation and disclosure are essential for acceptance and ownership of the proposed project. Relevant and adequate project information was provided to stakeholders to enable them understand project risks, impacts and opportunities. Stakeholder consultation aimed at:

- Generating good understanding of the project;
- Understanding local expectations of the project;
- Characterising potential environmental, socio-economic impacts;
- Developing effective mitigation recommendations.

4.7 APPROACH FOR STAKEHOLDER CONSULTATION

The following techniques were used to conduct consultations:

- Interviews with local administration (district administration and local LC leaders);
- Consultation with local communities to be affected by the dam reservoir;
- Focus group discussions and formal meetings;
- Organisation of workshops.

5 BASELINE CONDITIONS

In this section, a description of baseline environmental conditions of the proposed Isimba HPP is presented. This information is limited to only environmental (Physical and Biological) conditions as the social-economic baseline is discussed in a stand-alone social impact assessment (SIA) report. The baseline is based on observations and measurements taken from both the right and left banks that lie in Kayunga and Kamuli districts, respectively, review of available secondary information and stakeholder consultation.

5.1 PROJECT DISTRICTS' ADMINISTRATIVE BOUNDARIES

5.1.1 Kayunga District

Curved out of Mukono, Kayunga District came into existence through the merging of Bbale and Ntenjeru counties in the year 2000. It has an area of 1742 km^2 and is bordered by Apac to the North, Jinja to the East, Luweero to the West and Mukono to the South. The district is divided into two counties of Ntenjeru and Bbaale, eight sub-counties, one town council.

5.1.2 Kamuli District

Kamuli District is located in southeastern Uganda and borders River Nile and Kayunga District in the west, Jinja District in the South, Luuka District in the east and Buyende District in the north. The District has a total land area of 3,443.62 km^2 and 835.12 km^2 (23%) of water. It is composed of three counties namely: Budiope, Bugabula and Buzaaya; 17 lower local councils (Sub-counties); one Town council and 1284 villages.

5.1.3 Jinja District

Jinja District is located in south-eastern Uganda, approximately 54 miles (87 km), by road, east of Kampala bordering the Districts of Iganga and Kamuli in the North, Mukono in the south-west, Kayunga in the West, Mayuge in the East and Lake Victoria in the south. It lies between latitudes 0° 25' 28N and longitudes 33° 12' 15E. It has an altitude of 1167 m ASL. It has a total land area of 767.8 km^2 of which 65.8 km^2 is covered by water. Jinja Municipality is the largest metropolitan area in Jinja District and is considered the capital of the Kingdom of Busoga. The district comprises of two counties – Butembe and Kagoma; composed of 7 sub-counties; one municipality comprising of 3 divisions and three town councils (Buwenge, Bugembe and Kakira). There are 46 parishes with 381 villages.

5.2 PHYSICAL ENVIRONMENT

5.2.1 Climate

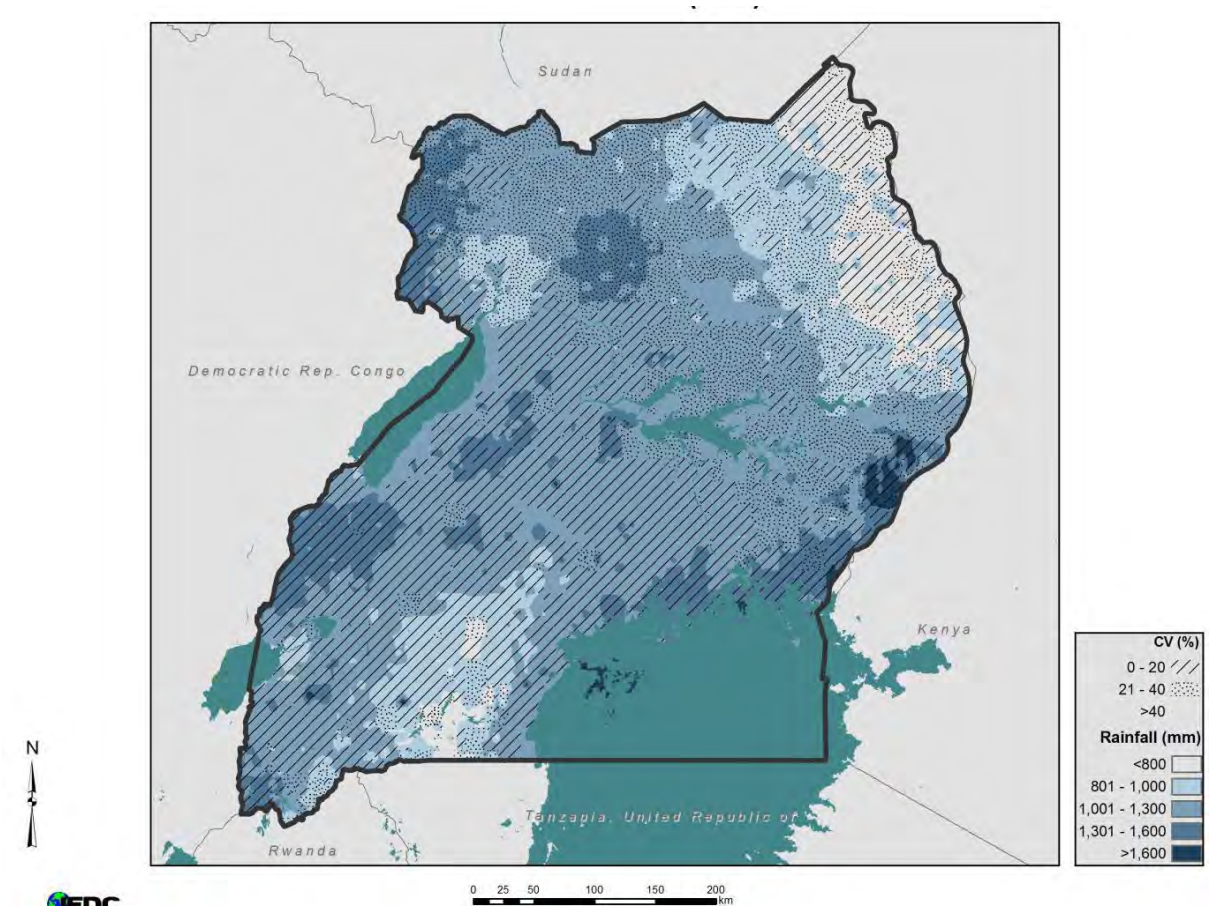
Kayunga District lies at an altitude ranging between 1000 to 1200 m ASL with an average rainfall of 1000 mm - 1200 mm per year while Kamuli has annual average rainfall is 1350 mm. The two districts lie in the same rainfall zone as indicated in Figure 7. Both districts experience a bimodal type of rainfall with peaks in March – June and August – November. Their temperatures range from 19˚ C to 25 ˚C.

5.2.2 Water Resources and Supply

Kayunga District is bordered by River Nile in the East and Lake Kyoga in the North. It is generally flat with no remarkable hills and drained by River Ssezibwa wetland towards Lake Kyoga. Swamp reclamation exists especially along River Ssezibwa in Namatogonya, Lukonda, Kamusabi and Nakyesa villages in Kayonza Sub County. Swamps have been reclaimed for various reasons including grazing animals, cultivation, settlement and setting up processing plants. For example all the maize mills in Bukolooto and coffee factories in Kayunga Town Council are situated in swamps (Kayunga District DDP, 2011)

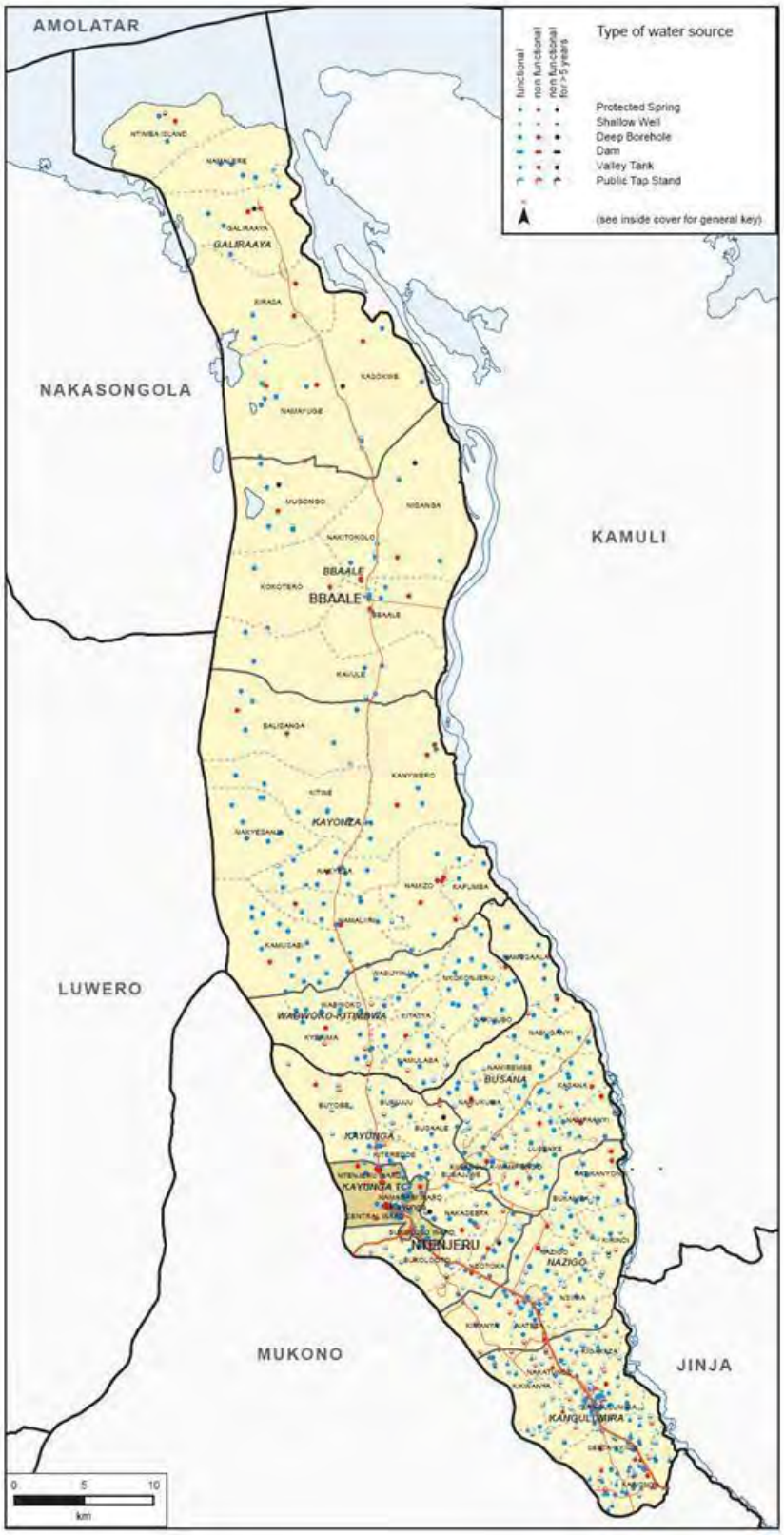
Kamuli District is also bordered by Lake Kyoga in the North, the only major water resource in the district. Kamuli District has two critical wetlands and these included Kiko and Nalwekomba wetlands. Wetlands form one of the most important, yet threatened ecosystems in the district. The major threats to wetlands include: paddy rice cultivation, sugarcane growing, sand mining and bush burning during dry season.

Distribution of water resources and water supply points in Kayunga and Kamuli Districts is presented in Figure 8 and Figure 9, respectively.



Source: IFDC (www.amitsa.org)

Figure 7 Distribution of annual rainfall in Uganda



Source: Water supply atlas 2010

Figure 8 Distribution of water resources and supply points in Kayunga District

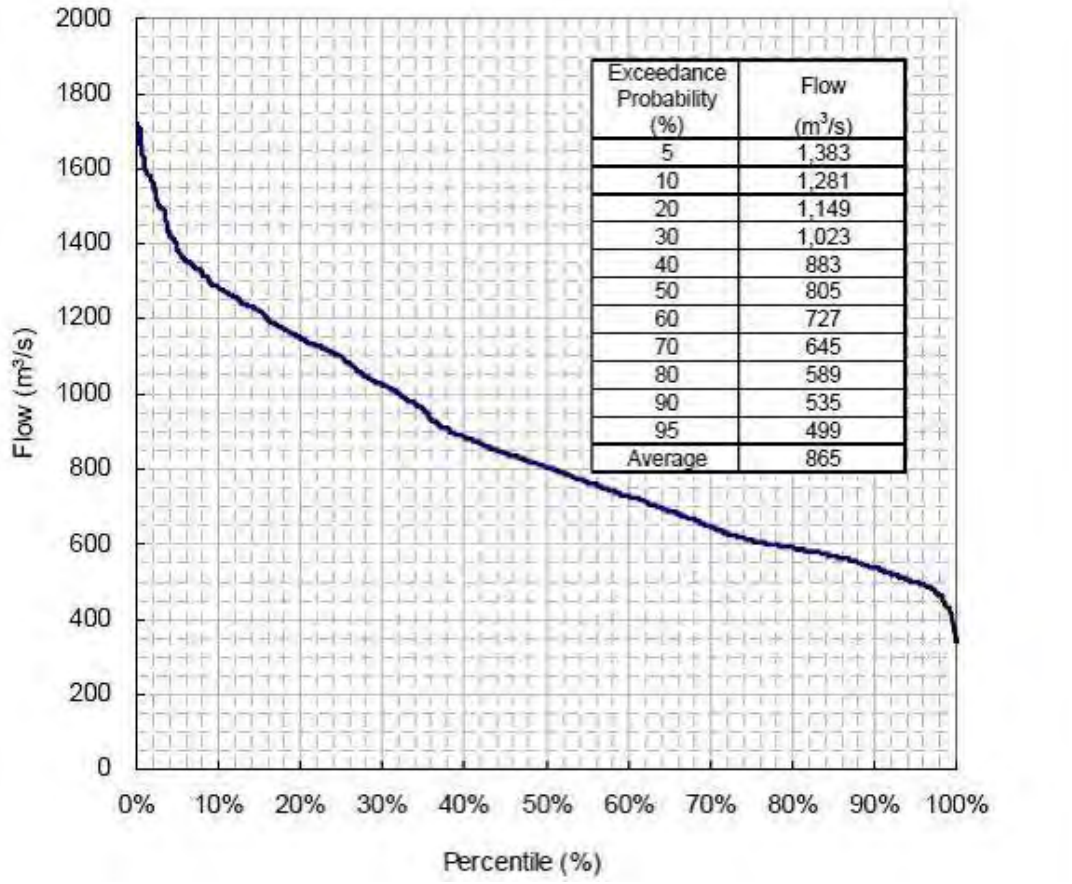
Source: Water supply atlas 2010

Figure 9 Distribution of water resources and supply points in Kamuli District

5.2.2.1 Victoria Nile Hydrology

Water flow arriving at the Isimba hydropower station will be controlled by discharges from Lake Victoria at the Nalubaale, Kiira and Bujagali dams, all located upstream of the proposed dam site. Prior to construction of Nalubaale dam, the outflow from Lake Victoria was regulated naturally at Ripon Falls. Since 1954 (when Nalubaale Power Station was completed), the water outflow has been constrained to mimic natural outflows from the lake using a rating curve that correlates flow at the source of River Nile with water level in the Lake (Figure 10).

The average outflow from the Lake during the period 1900 - 1961 was approximately 1600 m^3/s, whilst the average flow in the year 1961 was approximately 1200 m^3/s. For most of the 1990s, the outflow levelled at approximately 1000 m^3/s but between 1997 and 1998, it rose significantly. During the time of site investigation in 1998, the water level in Lake Victoria was approximately 1134.5 m ASL and by 2005 it had reduced to approximately 1133.5 m ASL.



Exceedance Probability (%)	Flow (m^3/s)
5	1,383
10	1,281
20	1,149
30	1,023
40	883
50	805
60	727
70	645
80	589
90	535
95	499
Average	865

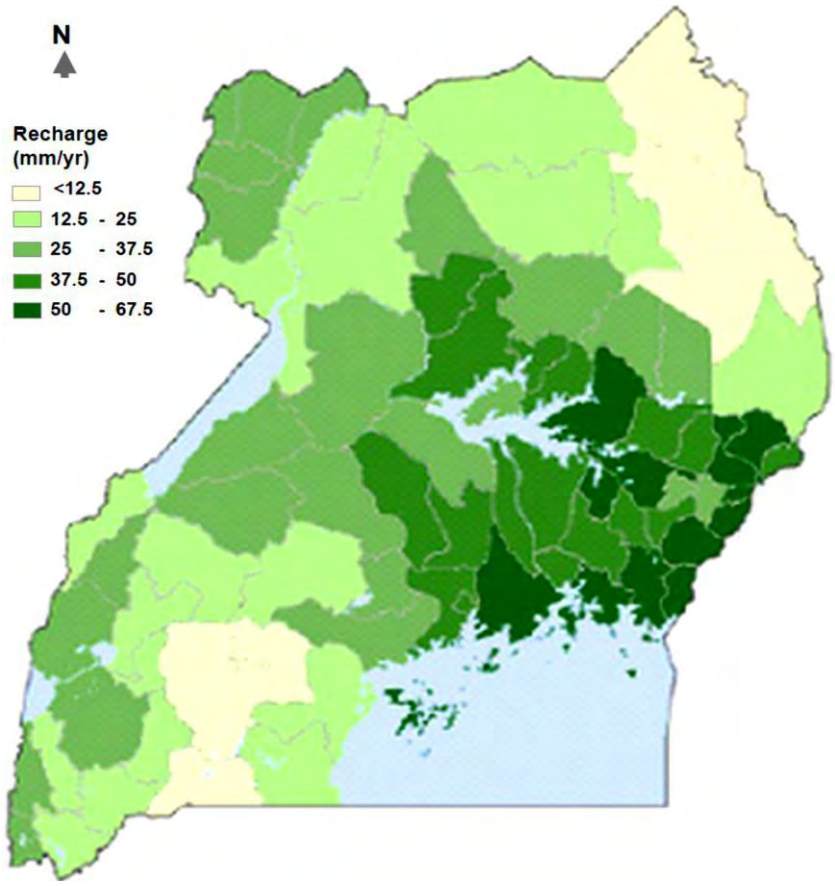
Figure 10 Lake Victoria Outflow duration curve (1896 -2008) at Mbulamuti (JICA 2010)

5.2.2.2 Groundwater

Due to the nature of the basement rocks, the aquifers have limited hydrological connectivity and rely on positive recharge from rainfall. The surface soils are reasonably well-drained although during heavy rains, the soil becomes saturated and local ponding occurs. Although seasonal rainfall is relatively high, the groundwater levels are generally depressed with water surfacing close to the relatively impermeable bedrock, which is approximately at river level (Knight Piésold, 1998). Higher groundwater levels are encountered locally which is probably related to perched water tables associated with locally well-developed lateritic soils, unusually shallow fresh rock or lenses of more clayey residual soils. The districts lie within one of the groundwater rich areas in Uganda with an estimated recharge of 37.6 - 60 mm per year (Figure 11).

5.2.3 Soil

Residual soils are present on either banks of the River Nile with lateritic duracrusts encountered in parts. The residual soils are overlain by slightly organic topsoil. Within the river valley, alluvial materials are encountered, including alluvial deposits on Koova Island.



Source: NEMA, 2010

Figure 11 Estimated sustainable available ground water by district

5.2.4 Topography and Geology

Kayunga District lies between 1000 and 1200 m ASL. It is generally flat with no remarkable hills and part of it is a wetland (Ssezibwa), towards Lake Kyoga in the Northern part. Kamuli District has a number of hills but most notably is the Kagulu hills which are revered as the ancestral home for the old chiefs of the former Busoga district (Kamuli District, 2011). The other parts of Kamuli District are low land areas covered with swamps and bordered by River Nile.

The regional geology is composed of the Precambrian Gneiss Complex with the Isimba project area located on the Kampala granitoid (Figure 12). The Kampala granitoid is comprised of igneous rocks in part metamorphosed.

The geology of the dam site is characterized by granitic gneisses with ridges of amphibolite rock trending approximately north-east to south-west across the site. Amphibolitic rocks are more resistant to weathering and protrude as ridges within the river banks and Koova Island. The amphibolite ridges also account for smaller islands and rapids within the river channel. Between the amphibolite ridges, the granitic gneiss is rarely exposed at the ground surface. A tropical weathering profile penetrates the granitic gneiss to varying depths, with residual soils encountered at the ground surface.

5.2.5 Landscape / Aesthetics

In terms of scenic quality, the farmland surrounding the river in the project area is attractive but not visually exceptional. The river, rapids and forested islands, however, are important elements increasing the diversity and visual qualities of the landscape in this area.

Photo 2: Cultivated land along the river bank

Photo 3: River rapids and forested island to be submerged

A number of borrow pits and quarry sites such as Wakisi, Wakikona village, Wakisi Sub-County in Buikwe District, Bukunguluin Busana Sub-County in Kayunga District, Namalembe - Kibibi Outcrop in Namalembe village, Kibibi Parish in Budondo Sub-county in Jinja District and Mpumwire Site in Namagera Parish in Jinja Districtamong others where identified during geotechnical studies. Therefore which ever site is used will need to be restored to their original landscape state after construction.

5.3 BIOLOGICAL ENVIRONMENT

5.3.1 Human Activity and Conservation

The vegetation cover in Kayunga District is predominantly savannah with short grasses and thorny bushes. There are two forest reserves Nazigo and Bbaale. Swampy vegetation is also traced along River Ssezibwa. While Kamuli District is mainly covered with savannah vegetation with scattered remains of the equatorial forest covers which have been depleted over time.

The human population density in this area is among the highest in central Uganda with Kayunga and Kamuli Districts having 210 and 117 people per km^2, respectively (Statistical Abstract, 2012). As a result, most of the natural vegetation in the project area has been cleared for cultivation. Cultivation and fishing are the main traditional sources of livelihood. A large quantity of fuel wood is needed in order to preserve the fish. Consequently, extensive tree felling and bush burning are common in many places, exposing soils to erosion. These activities are presumed to have contributed to environmental degradation and loss of natural vegetation.

5.3.2 Fish

The studies on the fisheries of the Upper Victoria Nile carried out by the Fisheries Resources Research Institute (FIRRI) have identified that some species of migratory fish exist in the river. However, there is no evidence from the FIRRI studies, or from other published sources, that these populations are obligatorily migratory; are required to migrate for breeding or other purposes (Bujagali- SEA report 2006). Given that similar fish species are found on either side of the barrier, it indicates that the dam has presented minimal adverse effect on fish population structure and size. Basing on the fact that there is no proven research and publication on the existence of obligatory migratory fish species in Victoria Nile, and also the existence of Owen Falls dam (50 years) without significant fish population structure and composition differences on either side of the dam, the fish ladder is not necessary as suggested by NEMA (Bujagali- SEA report 2006). It should be noted that barriers to upstream fish migration between the Victoria Nile and Lake Victoria currently exist in the form of the Bujagali dam and a series of relatively small rapids exist in the upstream of the Victoria Nile, and are likely to have represented a barrier to downstream fish migration, leaving only open connection between fisheries of Victoria Nile and Lake Kyoga.

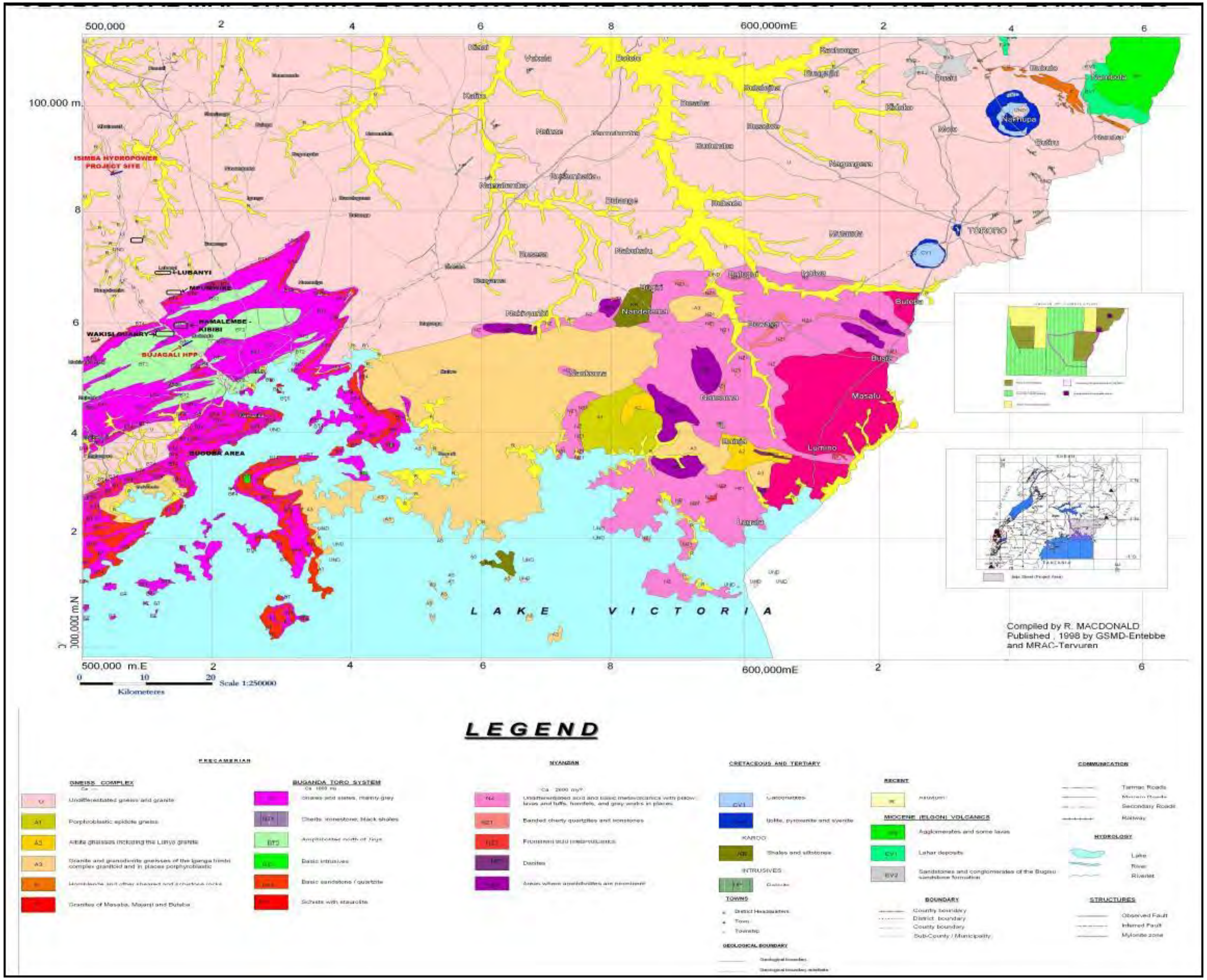


Figure 12 Geological map showing location and regional geology

The original fisheries of Lakes Victoria and Kyoga and the Victoria Nile were similar in nature. The Lakes originally had a diverse fish fauna. They had a multi-species fishery comprising of about 14 taxa of which two tilapiine species, (*Oreochromisesculentus* and *O. variabilis*), were the most important. These two species are endemic to the Victoria and Kyoga Lake Basins. The rivers of the Victoria and Kyoga Lake basins supported important fisheries of *Labeovictorianus* and *Barbusaltianalis*. Other important species included the cat fishes (*Bagrusdocmac* and *Clariasgariepinus*), *Protopterusaethiopicus, Schilbeintermedius, Synodontis species, Mormyrids and haplochromine cichlids* (Goudswaard et al., 2002).

The Victoria Nile originally had a very rich fish fauna dominated by riverine species. These included nine *Barbus* species (*B. altianalis, B. bynni, B. amphigramma, B. paludinosis, B. somereni, B. cercops, B. yongei, B. magdalenae, B. apleurogramma),* seven *Mormyrid* species (*Mormyrusmacrocephalus, Momyruskannume, Petrocephaluscatastoma, Marcuseniusnigricanus, Marcuseniusgrahami, Gnathonemusvictoriae, Gnathonemus-longibarbis*), *Labeovictorianus, Garajohnstonii, Rastrineobolaargentea, Alestes(Brycynus) jacksonii, Alestes (Brycynus) sedler, Bagrusdocmac, Schilbeintermedius, Clariasgariepinus, Clariascarsonii, Synodontisvictoriae, Synodontisafrofischeri, Amphiliusjacksonii, Clariallabespetricola, Oreochromisesculentus , Oreochromis) variabilis* and *Rastrineobolaargentea* (Greenwood, 1958). Of these species*, Labeovictorianus, B. altianalis* and *Mormyrids* were commercially the most important species. Some of the riverine species, namely *B. altianalis, S. intermedius, L. victorianus* and *Mormyrids*, migrate up rivers to spawn but return to the lake after spawning and the young grow in the lake (Ocheing, 1990).

In the 1950s and 1960s, Nile perch and three tilapiine species; *Oreochromisniloticus, Oreochromisleucostictus* and *Tilapia zillii* were introduced into Lake Victoria and Lake Kyoga to supplement the stock of native *Oreochromis*species, which had declined due to overfishing. The introduced species, *L. niloticus* and *O. niloticus,* boosted the catches in the 1970s, especially at the estuary of the Victoria Nile into Lake Kyoga. This was again followed by a decline in catch due to destructive methods of fishing (Ogutu-Ohway, 1990).

The original multispecies fishery, based mostly on *cichlids* (*Haplochromines, Tilapias*), *cyprinids* (*Barbus, Labeo*, *Rastrineobola*) and *siluroids* (*Bagrus, Clarias, Synodontis, Schilbe*), has changed dramatically to one based on three species: the *cyprinids*, *Rastrineobolaargenrea* (Pellegrin), and the introduced *L. niloticus* and *Oreochromisniloticus* (Achieng, 1990). This shift is mainly attributed to the piscivorous nature of *L. niloticus*, preying the smaller fish species, and competition for resources presented by the invasive *O. niloticus*. This led to the disappearance of the Victoria tilapias (*Oreochromisesculentus*and *O. variabilis*) from the catches of the estuarine fishery.

5.4 SITE SPECIFIC BASELINE

5.4.1 Water Quality

On-site water quality measurements indicated good baseline river water quality. The average concentration of dissolved oxygen (DO) was 5.69 ppm which is above the minimum level of 2.00 ppm that stresses most species of fish. The minimum DO concentration recorded was 4.64 ppm which is still way above the limit. The pH-value ranged from 6.85 to 6.87 which indicate a good environment for aquatic organisms expected in the area. The water quality measurements indicated a water resource with limited pollution (Table 11, Appendix A). However, project development activities may lead to deterioration of the river water quality hence impacting negatively the aquatic environment, drinking water supply and recreational activities downstream of Isimba HPP project site.

Table 11: Results of in-situ water quality measurements taken from the left bank in Kayunga district

Sampling Point	Village Name	Coordinates	Dissolved Oxygen (DO) (ppm)	% DO	Temperature (˚C)	pH	pHmV	Electrical Conductivity (EC) (µS/cm)	EC[a] (µS/cm-)	Oxidation-reduction potential (ORP)	Salinity	Totaldissolved solids (ppt)	Resistivity (MΩcm)
Water point 1(at proposed dam location)	Nampaanyi	0504609E, 0085192N	4.86	68	26.44	6.86	-0.6	111	114	6.5	0.05	56	0.009
Water point 2 (upstream of dam location)	Kiteredde	0505418E, 0082359N	4.64	66.5	27.48	6.85	-.0.1	80	83	16.2	0.04	40	0.0126
Water point 3 (upstream of dam location)	Buddoda	0505608E, 0079342N	6.25	88.5	26.89	6.86	-.0.5	84	87	69.2	0.04	42	0.012
Water point 4 (upstream of dam location)	Nakakonge	0506274E, 0075480N	6.92	98.7	27.28	6.86	-.0.4	80	83	105.5	0.04	40	0.0125
Water point 5 (upstream of dam location)	Nsiima	0505287E, 0072953N	6.72	94.3	26.51	6.86	-.0.2	81	84	105.1	0.04	41	0.0123
Water point 6 (upstream of dam location)	Kitambuza	0505759E, 0068453N	5.56	79.1	27.16	6.87	-.0.8	83	87	13.1	0.04	42	0.012
Kasana Ferry (downstream of dam location)	Kasana	0505419E, 0082359N	4.9	68.9	26.58	6.86	-.0.7	79	82	-6.0	0.04	40	0.0126

5.4.2 Soil Quality

Productivity: The soils in the project area are generally fertile especially the top soil (horizon A) where most crops grow. However, in some properties for example N and O.M, the levels are slightly below the critical values in the lower horizons. The soil pH is moderately acidic and this favours a wide range of crops with the exception of tea. Available phosphorus is limiting in the project area. The exchangeable bases (calcium, magnesium and potassium) are above the critical levels in all the horizons. The trace elements (iron, manganese, copper and zinc) and sodium are in the recommended levels for crop production and non-toxic levels respectively. The soil texture ranges from sandy clay to sandy clay loam with some areas dominated with clay soils. Sandy clay and sandy clay loams support a wider range of crops because of their good soil properties including water retention, prevention of nutrient leaching and allow proper root development.

Erodibility: The soils within the project area have large diameter particle sizes above the 100 µm that is considered fragile to erosion. The soils also exhibit perfect drainage and reasonable clay content. Throughout the project area, bulky density is averagely above 1.33 g/cm^3 (range 1.37 – 1.77 g/cm^3) which enhances the cohesion forces between the soil particles. Thus erodibility due to rain drop impact may be insignificant especially where there is vegetation cover. However, the shearing action of intensive runoff, especially in the sloping areas towards the river banks with less vegetation cover and mainly characterised with cultivation, may cause serious erosion. In addition, since most of the soils from the project area are weak in terms of the degree of structure development, constant flooding and high velocity runoff from the sloping areas towards the river may lead to silting. Soil characteristics in the project area are shown in Tables 12 - 14.

Table 12: Soil characteristics in the project area

Pits	Surrounding Conditions	Northing	Easting	Elevation (m)	Horizons	Depth (cm)	Boundary regularity	Boundary sharpness	Moisture Status	Colour	Texture	Structure (DSD)*	Structure (Shape of aggregates)	Consistence	Porosity	Compactness	Drainage	Fauna	Roots (qty)	Roots (size)	Roots (shape)	Roots (nature)	Roots (health)	Roots (age)	Special features
1 Kayunga	Garden (coffee) next to homestead	0504483	0085206	1051	A	0 -16	Irregular	Gradual	Dry	Dusky red	Sandy loam	Weakly developed	Granular	Loose	Porous	Loose	Perfect	-	Rare	Small	Free growing	Fibrous	Alive and Strong	Young	Parent material very near (50cm)
					B	16 -50	Smooth	Clear	Dry	Reddish brown	Sandy clay loam	Weakly developed	Crumb/ Granular	Hard	Porous	Compact	Perfect	-	Rare	Small	Free growing	Fibrous	Alive and Strong	Young	
					C	50 & below	-	-	-	-	Bed Rock	-	-	-	-	-	-	-	-	-	-	-	-	-	
2 Kayunga	Garden under fallow (Cassava) in a Swampy area towards R. Nile	0505337	0082166	1053	A	0 -40	Smooth	Clear	Moist	Bluish black	Clay	Strong	Granular	Very firm	Very fine porous	Very compact	Imperfect	Ants	Few	Small	Free growing	Rhizomatous	Alive and Strong	Young	
					B	40 - 70	Smooth	Gradual	Moist	Light bluish grey	Gravel/Sandy	Weakly developed	Single grain	Friable	Very porous	Loose	Imperfect	-	Rare	Small	Free growing	Fibrous	Alive and Strong	Young	
					C	70 & below	-	-	Wet	Light bluish grey	Sandy	Weakly developed	Sandy	Friable	Very porous	Loose	Imperfect	-	-	-	Free growing	-	-	-	
3 Kayunga	Garden under fallow (Cassava)	0505501	0079441	1056	A	0 - 10	Smooth	Clear	Moist	Dusky red	Clay loam	Weakly developed	Granular	Loose	Porous	Loose	Perfect	-	Few	Small & Medium	Free growing	Rhizomatous & fibrous	Alive	Young	
					B	10 & below	-	-	Moist	Dusky red	Sandy	Weakly developed	Single grain	Loose	Very porous	Loose	Imperfect	-	Rare	Small	Free growing	Fibrous	Alive and Strong	Young	
4 Kayunga	Land under fallow	0502789	0084202	1072	A	0 - 33	Smooth	Clear	Slightly moist	Reddish black	Sandy	Weakly developed	Granular	Firm	Fine porous	Loose	Perfect	-	Abundant	Small & Medium	Free growing	Rhizomatous & fibrous	Alive and Strong	Young	
					B	33 - 73	Irregular	Gradual	Slightly moist	Red	Gravel/Sandy	Strongly developed	Granular	Very firm	Porous	Compact	Imperfect	-	Rare	Small	Free growing	Fibrous	Alive and Strong	Young	
					C	73 & below	-	-	Slightly moist	Red	Gravel/Sandy	Strongly developed	Granular	Very firm	Porous	Compact	Imperfect	-	-	-	-	-	-	-	
5 Kayunga	Garden (Banana, Coffee & Cassava)	0502900	0080967	1072	A	0 - 27	Smooth	Clear	Slightly moist	Very dusky red	Loam	Weakly developed	Granular	Friable	Porous	Loose	Perfect	-	Abundant	Small Medium & Large	Free growing	Woody Fibrous & Rhizomatous	Alive and Strong	Young	
					B	27 - 56	Irregular	Gradual	Slightly moist	Red	Gravel /Sandy	Weakly developed	Single grains	Firm	Very porous	Compact	Imperfect	-	Frequent	Small	Free growing	Fibrous	Alive and Strong	Young	
					C	56 & below	-	-	Slightly moist	Dark Red	Gravel /Sandy	Weakly developed	Single grains	Firm	Porous	Compact	Imperfect	-	Few	Small	Free growing	Fibrous	Alive and Strong	Young	
6 Kayunga	Garden (Banana, Coffee & Cassava)	0503724	0075912	1088	A	0 - 23	Wavy	Clear	Moist	Dark reddish grey	Clay loam	Weakly developed	Granular	Loose	Porous	Loose	Perfect	Millipedes	Abundant	Small Medium	Free growing	Rhizomatous & Fibrous	Alive and Strong	Young	
					B	23 - 40	Irregular	Diffuse	Moist	Dark red	Clay	Weakly developed	Granular	Firm	Fine porous	Loose	Imperfect	-	Few	Small	Free growing	Fibrous	Alive and Strong	Young	
					C	40 - 90	Smooth	Clear	Moist	Red	Clay	Weakly developed	Granular	Firm	Porous	Loose	Imperfect	-	-	-	-	-	-	-	
					D	90 & below	-	-	Moist	Red	Sandy	Weakly developed	Granular	Very firm	Fine porous	Compact	Imperfect	-	-	-	-	-	-	-	
7 Kayunga	Grazing land				A	0 - 30	Smooth	Clear	Slightly moist	Greenish grey	Clay loam	Weakly developed	Granular	Loose	Fine porous	Loose	Perfect	-	Few	Small	Free growing	Rhizomatous	Alive and Strong	Young	
					B	30 - 60	Irregular	Gradual	Moist	Dark greenish grey	Clay	Strongly developed	Whole peds	Firm	Very fine porous	Loose	Imperfect	Bio graders (Kisokomi)	-	-	-	-	-	-	

Pits	Surrounding Conditions	Northing	Easting	Elevation (m)	Horizons	Depth (cm)	Boundary regularity	Boundary sharpness	Moisture Status	Colour	Texture	Structure (DSD)*	Structure (Shape of aggregates)	Consistence	Porosity	Compactness	Drainage	Fauna	Roots (qty)	Roots (size)	Roots (shape)	Roots (nature)	Roots (health)	Roots (age)	Special features
					C	60 - 114	Smooth	Clear	Moist	Greenish grey	Clay	Strongly developed	Whole peds	Firm	Very fine porous	Loose	Imperfect	-	-	-	-	-	-	-	
					D	114 & below	-	-	Moist	Greenish grey	Gravel/Sandy	Weakly developed	Single grains	Loose	Very porous	Loose	Imperfect	-	-	-	-	-	-	-	
8 Kayunga	Garden (Banana, Cassava) signs of runoff	0505127	0072850	1056	A	0 - 49	Smooth	Clear	Moist	Reddish black	Sandy	Weakly developed	Granular & Crumb	Loose	Fine porous	Loose	Imperfect	Ants	Frequent	Medium small	Free growing	Woody, Rhizomatous Fibrous	Alive and Strong	Young	
					B	49 - 120	Smooth	Clear	Moist	Yellowish red	Sandy	Weakly developed	Granular	Loose	Porous	Loose	Imperfect	-	Rare	Small	Free growing	Fibrous	Alive and Strong	Young	
					C	120 & below	-	Clear	Moist	Light red	Gravel	Weakly developed	Single grain	Loose	Porous	Friable	Imperfect	-	Rare	Large medium small	Free growing	Woody & fibrous	Alive and Strong	Young	
9 Kayunga	Garden (Potatoes)	0505654	0068456	1088	A	0 - 20	Smooth	Clear	Moist	Reddish black	Loam	Weakly developed	Granular	Loose	Porous	Loose	Perfect	-	Frequent	Small	Free growing	Rhizomatous Fibrous	Alive and Strong	Young	
					B	20 - 63	Irregular	Gradual	Moist	Red	Clay	Weakly developed	Granular	Firm	Fine porous	Compact	Imperfect	-	Frequent	Small	Free growing	Fibrous	Alive and Strong	Young	
					C	63 & below	-	-	Moist	Red	Clay	Weakly developed	Granular	Loose	Porous	Loose	Perfect	-	Few	Small	Free growing	Fibrous	Alive and Strong	Young	
10 Kayunga	Land under fallow	0503634	0070605	1100	A	0 - 30	Smooth	Clear	Moist	Reddish brown	Sandy clay loam	Weakly developed	Granular	Loose	Porous	Loose	Perfect	Ants	Abundant	Large medium small	Free growing	Woody Fibrous	Alive and Strong	Young	
					B	30 - 80	Irregular	Gradual	Moist	Red	Clay	Weakly developed	Granular	Firm	Fine porous	Compact	Imperfect	Ants	Few	Small	Free growing	Fibrous	Alive and Strong	Young	-
					C	80 & below	-	-	Moist	Red	Clay loam	Weakly developed	Granular	Loose	Porous	Loose	Perfect	-	Few	Medium small	Free growing	Fibrous	Alive and Strong	Young	
11 Kayunga	Garden (Cassava & Banana) flat land	0503554	0073636	1084	A	0 - 30	Irregular	Gradual	Slightly moist	Dark red	Clay loam	Weakly developed	Granular/ Crumb	Loose	Porous	Lose	Perfect	-	Abundant	Small	Free growing	Rhizomatous Fibrous	Alive and Strong	Young	
					B	30 - 75	Irregular	Diffuse	Slightly moist	Red	Clay loam	Strongly developed	Granular/Crumb	Firm	Fine porous	Compact	Perfect	-	Few	Small	Free growing	Fibrous	Alive and Strong	Young	-
					C	75 & below	-	-	Slightly moist	Red	Clay loam	Weakly developed	Granular	Loose	Fine porous	Loose	Perfect	Termites centipedes	Rare	Small	Free growing	Fibrous	Alive and Strong	Young	
1 Kamuli	Garden (Maize, Beans)	0505515	0085474	1039	A	0 - 50	Irregular	Clear	Wet	Black	Clay	Weakly developed	Granular	Sticky	Porous	Loose	Perfect	Ants	Frequent	Small	Free growing	Rhizomatous Fibrous	Alive and Strong	Young	Presence of a gravel layer in the transition layer between the first and two horizons
					B	50 - 65	Smooth	Clear	Wet	-	Stony layer	-	Gritty	-	Very porous	-	Imperfect	-	Few	Small	Free growing	Fibrous	Alive and Strong	Young	
					C	65 - 130	Smooth	Clear	Wet	Reddish grey	Clay	Strongly developed	Whole peds	Very sticky	Very fine porous	Compact	Imperfect	-	Rare	Small	Free growing	Fibrous	Alive and Strong	Young	
					D	130 & below	-	-	Wet	Light reddish grey	Clay	Weakly developed	Whole peds	Extremely sticky	Very fine porous	Very compact	Imperfect	-	-	-	-	-	-	-	
2 Kamuli	Grazing land	0507250	0083750	984	A	0 - 20	Irregular	Clear	Wet	Black	Loam	Weakly developed	Granular	Sticky	Porous	Loose	Perfect	Centipedes/ millipedes	Few	Small	Free growing	Fibrous	Alive and Strong	Young	
					B	20 - 75	Smooth	Diffuse	Wet	Reddish brown	Sandy clay loam	Weakly developed	Granular	Very sticky	Porous	Loose	Perfect	-	Few	Small	Free growing	Fibrous	Alive and Strong	Young	

Pits	Surrounding Conditions	Northing	Easting	Elevation (m)	Horizons	Depth (cm)	Boundary regularity	Boundary sharpness	Moisture Status	Colour	Texture	Structure (DSD)*	Structure (Shape of aggregates)	Consistence	Porosity	Compactness	Drainage	Fauna	Roots (qty)	Roots (size)	Roots (shape)	Roots (nature)	Roots (health)	Roots (age)	Special features
					C	75 & below	-	-	Wet	Greyish White	Gravel	Weakly developed	Single grain	Sticky	Porous	Compact	Imperfect	-	-	-	-	-	-	-	
3 Kamuli	Garden (Maize, Cassava, beans, Coffee)	0506113	0082030	1068	A	0 - 28	Irregular	Gradual	Moist	Dark reddish brown	Loam	Weakly developed	Granular	Loose	Porous	Loose	Perfect	Ants	Few	Small	Free growing	Fibrous	Alive and Strong	Young	
					B	28 - 63	Irregular	Diffuse	Moist	Dark red	Clay	Weakly developed	Granular	Loose	Porous	Loose	Perfect	Termites	Few	Small	Free growing	Fibrous	Alive and Strong	Young	-
					C	63 & below	-	-	Moist	Dark red	Clay	Weakly developed	Granular	Loose	Porous	Loose	Perfect	-	-	-	-	-	-	-	
4 Kamuli	Garden (Banana, Coffee, Maize)	0507600	0081125	1053	A	0 - 30	Smooth	Clear	Moist	Reddish black	Clay loam	Weakly developed	Granular	Loose	Fine porous	Loose	Perfect	Bio graders	Frequent	Medium Small	Free growing	Woody Fibrous	Alive and Strong	Young	
					B	30 - 70	Irregular	Gradual	Moist	Red	Clay	Weakly developed	Granular	Friable	Porous	Loose	Perfect	-	Few	Small	Free growing	Fibrous	Alive and Strong	Young	-
					C	70 & below	-	-	Moist	Red	Clay loam	Weakly developed	Granular	Firm	Fine porous	Compact	Perfect	-	Rare	Small	Free growing	Fibrous	Alive and Strong	Young	
5 Kamuli	Garden (Sugar cane, Banana, Maize, Cassava)	0506291	0078274	1057	A	0 - 30	Smooth	Clear	Moist	Reddish brown	Clay	Weakly developed	Granular	Loose	Fine porous	Loose	Perfect	-	Few	Large medium small	Free growing	Woody Rhizomatous Fibrous	Alive and Strong	Young	
					B	30 - 90	Irregular	Diffuse	Moist	Brown	Clay	Weakly developed	Granular	Loose	Fine porous	Loose	Perfect	-	Rare	Small	Free growing	Fibrous	Alive and Strong	Young	
					C	90 & below	-	-	Moist	Brown	Clay	Weakly developed	Granular	Firm	Fine porous	Compact	Perfect	-	-	-	-	-	-	-	
6 Kamuli	Garden (Maize, Sugarcane) in a swampy area	0508100	0077100	1056	A	0 - 24	Smooth	Clear	Wet	Black	Clay loam	Weakly developed	Granular	Sticky	Porous	Loose	Perfect	-	Few	Small	Free growing	Rhizomatous Fibrous	Alive and Strong	Young	
					B	24 - 90	Irregular	Gradual	Wet	Weak red	Clay	Strongly developed	Whole peds	Very sticky	Porous	Loose	Imperfect	-	Rare	Small	Free growing	Fibrous	Alive and Strong	Young	-
					C	90 & below	-	-	Wet	Reddish grey	Clay	Strongly developed	Whole peds	Very sticky	Porous	Loose	Imperfect	-	-	-	-	-	-	-	
7 Kamuli	Garden (Maize, Beans, Banana, potatoes)	0506570	0075223	1071	A	0 - 40	Irregular	Clear	Moist	Black	Sandy	Weakly developed	Granular	Loose	Fine porous	Friable	Imperfect	-	Abundant	Small	Free growing	Fibrous	Alive and Strong	Young	
					B	40 - 100	Irregular	Diffuse	Moist	Light brown	Sandy clay loam	Weakly developed	Granular	Compact	Fine porous	Friable	Imperfect	Termites	Few	Small	Free growing	Fibrous	Alive and Strong	Young	-
					C	100 - below	-	-	Moist	Brown	Sandy clay loam	Weakly developed	Granular	Friable	Fine porous	Loose	Imperfect	-	Rare	Small	Free growing	Fibrous	Alive and Strong	Young	
8 Kamuli	Garden (Maize)	0505478	0072037	1083	A	0 - 37	Smooth	Clear	Moist	Reddish brown	Clay loam	Weakly developed	Granular	Loose	Porous	Loose	Perfect	Cockroach	Few	Small	Free growing	Fibrous	Alive and Strong	Young	
					B	37 - 106	Irregular	Diffuse	Moist	Red	Clay	Weakly developed	Granular	Firm	Fine Porous	Compact	Perfect	-	Rare	Small	Free growing	Fibrous	Alive and Strong	Young	
					C	106 - 155	Smooth	Clear	Moist	Red	Clay	Weakly developed	Granular	Loose	Porous	Loose	Perfect	-	-	-	-	-	-	-	-
					D	Bed Rock	-	-	-	-	Bed Rock	-	-	-	-	-	-	-	-	-	-	-	-	-	
9 Kamuli	Forest reserve (Pine trees)	0506378	0069441	1086	A	0 - 40	Smooth	Clear	Moist	Reddish brown	Loam	Weakly developed	Granular	Loose	Porous	Loose	Perfect	-	Few	Small	Free growing	Rhizomatous Fibrous	Alive and Strong	Young	-

Pits	Surrounding Conditions	Northing	Easting	Elevation (m)	Horizons	Depth (cm)	Boundary regularity	Boundary sharpness	Moisture Status	Colour	Texture	Structure (DSD)*	Structure of (Shape aggregates)	Consistence	Porosity	Compactness	Drainage	Fauna	Roots (qty)	Roots (size)	Roots (shape)	Roots (nature)	Roots (health)	Roots (age)	Special features
					B	40 - 80	Smooth	Clear	Moist	Red	Clay	Weakly developed	Granular	Firm	Fine porous	Compact	Perfect	Termites	Rare	Small	Free growing	Fibrous	Alive and Strong	Young	
					C	80 - 90	Smooth	Clear	Moist	-	Gravel/stony	Weakly developed	Stony	-	Very porous	-	Imperfect	-	-	-	-	-	-	-	
					D	90 & below	-	-	Moist	Red	Clay with grits	Weakly developed	Granular	Firm	Very fine Porous	Very compact	Imperfect	Earthworms	-	-	-	-	-	-	
10 Kamuli	Garden (Maize, Banana, Potatoes)	0507600	0071000	1100	A	0 - 30	Irregular	Clear	Wet	Reddish brown	Loam	Weakly developed	Granular	Sticky	Porous	Loose	Perfect	-	Few	Small	Free growing	Rhizomatous Fibrous	Alive and Strong	Young	
					B	30 - 90	Irregular	Diffuse	Wet	Red	Clay	Weakly developed	Granular Crumb	Very sticky	Fine porous	Compact	Perfect	-	-	-	-	-	-	-	-
					C	90 & below	-	-	Wet	Red	Clay	Weakly developed	Granular	Very sticky	Fine porous	Loose	Perfect	-	-	-	-	-	-	-	
11 Kamuli	Garden (Banana, Coffee)	0508219	0073714	1107	A	0 - 26	Smooth	Clear	Moist	Reddish brown	Clay loam	Weakly developed	Granular	Loose	Porous	Loose	Perfect	-	Few	Large medium small	Free growing	Woody, Rhizomatous Fibrous	Alive and Strong	Young	
					B	26 - 100	Irregular	Diffuse	Moist	Red	Clay	Weakly developed	Granular	Firm	Fine porous	Compact	Perfect	Termites	Frequent	Small	Free growing	Rhizomatous Fibrous	Alive and Strong	Young	
					C	100 - 150	Smooth	Clear	Moist	Red	Clay loam	Weakly developed	Sub-Angular	Loose	Fine porous	Loose	Perfect	-	Few	Small	Free growing	Fibrous	Alive and Strong	Young	
					D	Bed Rock	-	-	-	-	Bed Rock	-	-	-	-	-	-	-	-	-	-	-	-	-	

Table 13: Physical-chemical properties of the soil surveyed in the project area

Lab No.	Client's reference	Horizon	pH	Electrical Conductivity µS/cm	Salinity ppt	O.M %age	Nitrogen %age	Phosphorus mg/kg	Calcium mg/kg	Magnesium mg/kg	Potassium mg/kg	Sodium mg/kg	Iron mg/kg	Manganese mg/kg	Copper mg/kg	Zinc mg/kg	Sand %age	Clay %age	Silt %age	Bulk Density g/cm3	Textural class
S/13/1181	Pit 1	HA	6.0	20.7	0	2.8	0.16	13.06	1207.7	370.4	262.6	<0.01	80.8	126.3	35.0	3.5	65.7	29.0	5.3	1.37	Sandy clay loam
S/13/1182	Pit 2	HA	6.5	19.6	0	4.2	0.23	53.98	2630.8	1097.4	341.8	<0.01	157.7	81.1	47.5	6.3	55.7	35.0	9.3	1.49	Sandy clay
S/13/1183	Pit 3	HA	6.4	19.5	0	4.4	0.22	54.38	1784.6	312.0	70.4	<0.01	144.9	137.1	55.0	6.3	45.7	35.0	19.3	1.45	Sandy clay
S/13/1184	Pit 4	HA	6.3	19.2	0	3.6	0.20	7.34	1592.3	407.6	145.3	<0.01	178.2	221.1	57.5	21.0	59.7	35.0	5.3	1.52	Sandy clay
S/13/1185	Pit 5	HA	6.4	19.1	0	3.6	0.20	4.61	1688.5	572.1	289.1	<0.01	116.7	281.3	42.5	14.6	51.7	35.0	13.3	1.35	Sandy clay
S/13/1186	Pit 6	HA	6.6	19.3	0	4.1	0.21	8.29	1996.2	598.6	80.7	<0.01	165.4	328.7	50.0	21.0	39.7	51.0	9.3	1.38	Clay
S/13/1187	Pit 7	HA	6.1	18.6	0	3.7	0.20	2.02	1784.6	842.7	42.1	<0.01	242.2	96.2	62.5	22.9	65.7	21.0	13.3	1.56	Sandy clay loam
S/13/1188	Pit 8	HA	6.2	18.7	0	4.5	0.23	22.88	1938.5	444.7	51.5	<0.01	216.6	147.8	30.0	19.2	63.7	27.0	9.3	1.29	Sandy clay loam
S/13/1189	Pit 9	HA	6.2	18.4	0	3.8	0.20	17.43	1573.1	418.2	308.0	<0.01	137.2	249.0	30.0	22.0	59.7	29.0	11.3	1.24	Sandy clay loam
S/13/1190	Pit 10	HA	6.5	18.2	0	4.3	0.22	28.34	2188.5	476.5	285.6	<0.01	50.1	309.3	65.0	34.9	49.7	41.0	9.3	1.27	Clay
S/13/1191	Pit 11	HA	5.4	18.3	0	2.2	0.13	5.84	1111.5	343.9	163.7	<0.01	91.1	259.8	30.0	36.7	31.7	61.0	7.3	1.49	Clay
S/13/1213	Pit 1	HB	5.8	19.6	0	2.5	0.13	8.90	1126.5	320.6	189.8	<0.01	70.6	100.9	30.6	3.8	65.7	29.0	5.3	1.35	Sandy clay loam
S/13/1192	Pit 2	HB	4.9	18.2	0	1.9	0.13	0.52	1323.1	227.1	82.5	<0.01	152.6	89.7	50.0	39.5	49.7	41.0	9.3	1.62	Clay
S/13/1193	Pit 3	HB	6.1	18.8	0	1.1	0.11	2.97	1400.0	672.9	101.0	<0.01	34.7	132.8	50.0	29.4	75.7	15.0	9.3	1.63	Sandy loam
S/13/1194	Pit 4	HB	5.7	19.0	0	1.2	0.10	5.97	650.0	312.0	161.7	<0.01	121.8	180.1	42.5	23.8	67.7	29.0	3.3	1.59	Sandy clay loam
S/13/1195	Pit 5	HB	5.5	18.9	0	1.6	0.12	0.79	765.4	349.2	406.2	<0.01	162.8	208.1	85.0	23.8	65.7	29.0	5.3	1.48	Sandy clay loam
S/13/1196	Pit 6	HB	5.8	19.1	0	1.7	0.12	1.47	1053.8	439.4	130.0	<0.01	126.9	290.0	65.0	23.8	29.7	61.0	9.3	1.46	Clay
S/13/1197	Pit 7	HB	5.8	19.6	0	1.3	0.10	trace	1034.6	1782.0	210.6	<0.01	211.5	162.9	52.5	22.9	55.7	33.0	11.3	1.81	Sandy clay loam
S/13/1198	Pit 8	HB	5.4	19.6	0	1.6	0.12	41.97	1150.0	795.0	221.1	<0.01	191.0	188.8	85.0	27.5	53.7	35.0	11.3	1.45	Sandy clay
S/13/1199	Pit 9	HB	4.7	19.8	0	1.5	0.12	6.52	784.6	253.7	109.0	<0.01	196.1	137.1	75.0	5.3	45.7	47.0	7.3	1.61	Clay
S/13/1200	Pit 10	HB	5.5	19.7	0	1.8	0.12	14.16	900.0	174.1	147.5	<0.01	214.1	218.9	47.5	0.7	39.7	55.0	5.3	1.45	Clay
S/13/1201	Pit 11	HB	5.5	19.7	0	1.6	0.12	0.65	803.8	237.7	95.8	<0.01	126.9	279.2	52.5	11.8	33.7	61.0	5.3	1.44	Clay
S/13/1202	Pit 2	HC	6.7	19.6	0	0.8	0.09	0.65	1092.3	391.6	118.6	<0.01	167.9	173.7	57.5	23.8	85.7	7.0	7.3	1.63	Loamy sand
S/13/1203	Pit 4	HC	5.8	19.2	0	1.3	0.11	6.11	900.0	179.4	147.3	<0.01	60.3	208.1	95.0	4.4	69.7	23.0	7.3	1.77	Sandy clay loam
S/13/1204	Pit 5	HC	5.2	19.0	0	1.4	0.12	0.65	861.5	136.9	243.8	<0.01	114.1	31.6	40.0	3.5	65.7	31.0	3.3	1.56	Sandy clay loam
S/13/1205	Pit 6	HC	5.8	18.9	0	1.1	0.10	trace	1053.8	285.5	46.2	<0.01	103.9	124.2	75.0	16.4	33.7	57.0	9.3	1.53	Clay
S/13/1206	Pit 7	HC	6.4	18.6	0	1.2	0.11	1.20	938.5	2344.5	158.0	<0.01	55.2	40.2	62.5	4.4	47.7	37.0	15.3	1.76	Sandy clay
S/13/1207	Pit 8	HC	5.8	18.4	0	1.2	0.10	1.34	1380.8	609.2	295.0	<0.01	119.3	72.5	55.0	7.2	63.7	29.0	7.3	1.66	Sandy clay loam
S/13/1208	Pit 9	HC	4.7	18.5	0	1.9	0.13	5.97	611.5	211.2	161.3	<0.01	119.3	44.5	90.0	9.0	47.7	47.0	5.3	1.53	Clay
S/13/1209	Pit 10	HC	5.6	18.6	0	1.7	0.12	0.52	688.5	168.8	219.3	<0.01	93.6	27.3	30.0	10.9	33.7	63.0	3.3	1.48	Clay
S/13/1212	Pit 11	HC	5.7	19.4	0	0.9	0.08	0.79	765.4	142.2	212.4	<0.01	121.8	126.3	40.0	16.4	29.7	63.0	7.3	1.45	Clay
S/13/1210	Pit 6	HD	5.9	18.6	0	0.6	0.08	trace	880.8	190.0	289.6	<0.01	114.1	109.1	37.5	11.8	39.7	43.0	17.3	1.46	Clay
S/13/1211	Pit 7	HD	6.2	18.9	0	0.5	0.08	4.20	1380.8	1697.1	295.0	<0.01	155.1	44.5	35.0	10.9	67.7	27.0	5.3	1.74	Sandy clay loam
Critical values			**5.2**			**3.0**	**0.20**	**<90**	**350.0**	**100.0**	**150.0**		**50.0**	**20.0**	**5.0**	**20.0**					
Sufficient levels			**5.2-7.0**	**<200**		**6.0**	**0.30**	**90-230**	**2000.0**	**600.0**	**500**										

Table 14: Particle size distribution soils surveyed in the project area

Lab no	Particulars	Percentage	Particle size	Lab no	Particulars	Percentage	Particle size	Lab no	Particulars	Percentage	Particle size
S/13/1181	Pit 1 HA	42.6	2mm-250um	S/13/1182	Pit 2 HA	63.8	2mm-250um	S/13/1183	Pit 3 HA	56.6	2mm-250um
		16.2	250-180um			11.2	250-180um			11.2	250-180um
		37.8	180-63um			24.4	180-63um			30	180-63um
		3.4	<63um			0.6	<63um			2.2	<63um
S/13/1213	Pit 1 HB	40.6	2mm-250um	S/13/1192	Pit 2 HB	53.4	2mm-250um	S/13/1193	Pit 3 HB	68	2mm-250um
		18.2	250-180um			15.6	250-180um			11.6	250-180um
		39.8	180-63um			29.6	180-63um			18.6	180-63um
		1.4	<63um			1.4	<63um			1.8	<63um
				S/13/1202	Pit 2 HC	63.2	2mm-250um				
						12.2	250-180um				
						23.8	180-63um				
						0.8	<63um				
S/13/1184	Pit 4 HA	45.8	2mm-250um	S/13/1185	Pit 5 HA	51.4	2mm-250um	S/13/1186	Pit 6 HA	45.4	2mm-250um
		16	250-180um			15	250-180um			15.6	250-180um
		35.8	180-63um			30.6	180-63um			35.8	180-63um
		2.4	<63um			3	<63um			3.2	<63um
S/13/1194	Pit 4 HB	66.2	2mm-250um	S/13/1195	Pit 5 HB	63.6	2mm-250um	S/13/1196	Pit 6 HB	51.2	2mm-250um
		9.8	250-180um			11.4	250-180um			13.2	250-180um
		23	180-63um			23.8	180-63um			34.2	180-63um
		1	<63um			1.2	<63um			1.4	<63um
S/13/1203	Pit 4 HC	64.0	2mm-250um	S/13/1204	Pit 5 HC	57.8	2mm-250um	S/13/1205	Pit 6 HC	49.40	2mm-250um
		8.8	250-180um			10.8	250-180um			14.40	250-180um
		26.4	180-63um			30.8	180-63um			34.00	180-63um
		0.8	<63um			0.6	<63um			2.20	<63um
								S/13/1210	Pit 6 HD	37.00	2mm-250um
										19.60	250-180um
										42.40	180-63um
										1.00	<63um
S/13/1187	Pit 7 HA	51.4	2mm-250um	S/13/1188	Pit 8 HA	55.4	2mm-250um	S/13/1189	Pit 9 HA	35.4	2mm-250um
		12.6	250-180um			11.6	250-180um			17.8	250-180um
		35.8	180-63um			32.4	180-63um			44.2	180-63um
		0.2	<63um			0.6	<63um			2.6	<63um
S/13/1197	Pit 7 HB	68	2mm-250um	S/13/1198	Pit 8 HB	67.4	2mm-250um	S/13/1199	Pit 9 HB	47.4	2mm-250um
		9.2	250-180um			8.8	250-180um			14.0	250-180um
		22.8	180-63um			23.4	180-63um			36.6	180-63um
		0	<63um			0.4	<63um			2.0	<63um
S/13/1206	Pit 7 HC	65.60	2mm-250um	S/13/1207	Pit 8 HC	77.80	2mm-250um	S/13/1208	Pit 9 HC	33.60	2mm-250um
		9.80	250-180um			5.80	250-180um			16.20	250-180um
		24.40	180-63um			16.20	180-63um			48.40	180-63um
		0.20	<63um			0.20	<63um			1.80	<63um

Lab no	Particulars	Percentage	Particle size	Lab no	Particulars	Percentage	Particle size	Lab no	Particulars	Percentage	Particle size
S/13/1211	Pit 7 HC	73.40	2mm-250um								
		9.00	250-180um								
		17.20	180-63um								
		0.40	<63um								
S/13/1190	Pit 10 HA	44.4	2mm-250um	S/13/1191	Pit 11 HA	54.8	2mm-250um				
		16.6	250-180um			13	250-180um				
		37.2	180-63um			29	180-63um				
		1.8	<63um			3.2	<63um				
S/13/1200	Pit 10 HB	56.6	2mm-250um	S/13/1201	Pit 11 HB	49.0	2mm-250um				
		12.0	250-180um			14.4	250-180um				
		30.0	180-63um			34.2	180-63um				
		1.4	<63um			2.4	<63um				
S/13/1209	Pit 10 HC	36.40	2mm-250um	S/13/1212	Pit 11 HC	47.00	2mm-250um				
		16.80	250-180um			16.60	250-180um				
		44.00	180-63um			34.20	180-63um				
		2.80	<63um			2.20	<63um				

5.4.3 Noise

With the exception of highlighted sections with noise levels above required national standards for day time limits, the other baseline noise measurements indicate a relatively quiescent environment currently devoid of sources of high noise pollution (Table 15 & Table 16). National noise regulations require that the maximum permissible noise levels for mixed residential with some commercial and entertainment are 55 dBA during the day and 45 dBA at night.

Table 15: Baseline noise levels on left bank of the dam site Kamuli District

Location	Time and date	5 minute Recorded sound pressure values (dBA)					Description/ Notes
		LAeq	L10	L50	L90	Lmax	
504448E, 87755N	30-APR-13 9:31	56.5	59.0	52.5	43	82.4	Ferry landing site; Human conversion
507278E, 87041N	30-APR-13 10:12	47.4	49	47	44.5	59.7	Izanyiro Trading centre; Human conversion, bicycle & motorcycle movement
510052E, 88413N	30-APR-13 10:21	52.0	53.5	46	42.5	73.3	Human conversation
509775E, 83581N	30-APR-13 12:45	54.7	49.5	43	38	70.6	Human conversation, bicycle and motorcycle movement
510181E, 85898N	30-APR-13 10:16	50.5	55.5	49	44	74.9	Human conversation
508033E, 85743N	30-APR-13 11:45	52.4	53	45	41.5	71.2	Human conversation & bicycle movement
505435E, 85178N	30-APR-13 12:49	48.2	51	44	39	69.2	Human conversation, bicycle and motorcycle movement
508055E, 76919N	30-APR-13 12:55	52.6	54.0	47.3	43.0	66.6	Human conversation, bicycle and motorcycle movement
508460E, 79673N	30-APR-13 13:03	61.9	65.6	51.3	42.7	75.9	Human conversation, bicycle and motorcycle movement
508926E, 81473N	30-APR-13 13:17	45.9	47.0	41.5	39.0	59.9	Human conversation

Table 16: Baseline noise levels on left bank of the dam site Kayunga District

Location	Time and date	5 minute Recorded sound pressure values (dBA)				Description/ Notes
		LAeq	L50	L90	Lmax	
504050E, 87447N	3/15/2013 11:04	50.6	47	52	61.3	A ferry landing site in Kasana Village; Human conversion and bulldozer operating in distance
503036E, 86682N	3/15/2013 11:25	50.2	40.5	37	69.1	Kasana LC 1 Trading centre; Human conversion, bicycle and motorcycle movement
504156E, 85719N	3/15/2013 11:49	55.3	39.5	41	57.5	Human conversation
504023E, 85070N	3/15/2013 12:18	42.5	47	42	54.7	Human conversation and waterfalls in distance
504588E, 85156N	3/15/2013 12:37	57.2	51	47.5	70.5	Human conversation
504913E, 85376N	3/15/2013 13:03	48.2	55.5	47.5	59.7	Birds singing on Koova Island for proposed Dam location
504139E, 84773N	3/15/2013 13:40	48	43	38.5	65.6	Human conversation, bicycle and motorcycle movement
503463E, 84507N	3/15/2013 13:54	52.6	47.3	43	66.6	Human conversation, bicycle and motorcycle movement at Nampanyi Mosque

Location	Time and date	5 minute Recorded sound pressure values (dBA)				Description/ Notes
		LAeq	L50	L90	Lmax	
502194E, 84073N	3/15/2013 14:14	61.9	51	42.5	75.7	Pupils in Playground at Nampanyi Primary School
503161E, 84282N	3/15/2013 14:37	45.9	41.5	39	59.9	Birds Singing at Pentecostal church Village
504082E, 83915N	3/15/2013 15:01	56.7	55	48.5	71.7	Human conversation, bicycle and motorcycle movement
504141E, 83090N	3/15/2013 15:08	54.2	52	47.5	62.1	Children playing in class at Nakakandwa CU Primary School
505077E, 85764N	3/16/2013 15:19	42.9	39.5	36.5	56.3	Birds singing & human conversation on Koova Island for proposed Dam location
503390E, 83092N	3/18/2013 15:01	46.6	43	39.5	63.5	Children playing in class at Nakakandwa RC Primary School
502417E, 82608N	3/21/2013 9:38	55.9	49	44	66.6	Human conversation & bicycle movement in Kireku Trading Centre
504699E, 79134N	3/21/2013 14:34	46	43	39.5	58.3	Human conversation at Calvary Chapel Budooda
504931E, 75517N	3/24/2013 10:16	63.3	46	40	74.2	Human conversation and motorcycle movement in Kirindi Trading centre
504152E, 80196N	3/24/2013 11:03	64.7	58.5	52	78.1	Human conversation in Kiwuba Trading centre
505176E, 76787N	3/24/2013 10:59	42.4	52	41	67.2	Human conversation in Kasega Trading centre
503804E, 73431N	3/24/2013 11:18	56.9	47	41	71.1	School children in playground at Exodus Primary school
500076E, 71470N	3/25/2013 13:03	57.4	51.4	47.8	72.5	Human conversation & motorcycle movement at Nazigo Demonstration school

Limit corresponds to land-use zoning (Mixed Residential (with some commercial and entertainment): Day time limit 55 dBA; Night time 45 dBA) as per National Environment (Noise Standards and Control) Regulations, 2003.

At all receptor points where noise measurements were done, noise levels conformed to the national limit of 55 dBA (day-time) and 45 dBA for residential dwellings in "*general environment*: *Mixed residential (with some commercial and entertainment*) with exception of most trading centres where day time noise recorded exceeded 55 dBA day time limit with the maximum measurement of 64.7 dBA in Kiwuba Trading Centre in Kayunga District.

PART 1 - Regulations 6(1): Maximum Permissible Noise Levels for General Environment

Facility	NOISE LIMITS dB (A) (Leq)	
	Day	Night
A. Any building used as hospital, convalescence home, home for the aged, sanatorium and institutes of higher learning, conference rooms, public library, environmental or recreational sites.	45	35
B. Residential buildings	50	35
C. Mixed residential (with some commercial and entertainment).	55	45
D. Residential + industry or small scale production + commerce.	60	50
E. Industrial	70	60

Source: National Environment (Noise Standards and Control) Regulations, 2003, first Schedule, Part 1, pg 300

5.4.4 Air Quality

No industrial sources of air emissions were encountered in the project area. A few trading centres had more motor traffic than rural areas but these were not associated with significant air quality effects different from that manifested in larger towns elsewhere in Uganda. Unpaved roads did not generate notable dust due to the low traffic volumes in rural areas around the project area. Air quality along the line route can therefore be categorised as nearly pristine due to absence of notable emission sources.

The project will involve activities that will create significant amounts of harmful atmospheric pollutants such as oxides of nitrogen and sulphur. Thus, there will be copious emissions of noxious air pollutants, other than from diesel engines and vehicle raised dust.

Agricultural activities such as tillage can generate considerable quantities of particulate matter. The burning of wood for cooking and brick making, and the burning of crop residues contributes to ambient particulate and nitrogen dioxide concentrations. The levels of traffic currently in the project area also contribute to these background total suspended particulates concentrations and noxious air pollutants. Measurements at all points did not find any detectable levels of CO_2, H_2, SOx, H_2S, NH_3, CO, nor CLO_2. The levels of other air quality parameters quantified including total suspended particulates (TSP) are presented in Table 17 and Table 18.

Table 17: Baseline air quality levels in project area and at identified receptors in Kayunga District

Location	Date and time	5 min TSP mean µg/m³	LEL	NOx	Description/ Notes
504050E, 87447N	3/15/2013 11:04	38	3	0	A ferry landing site in Kasana Village
503036E, 86682N	3/15/2013 11:25	36	4	0	Kasana LC 1 Trading centre
504156E, 85719N	3/15/2013 11:49	34	5	1	Settlements
504023E, 85070N	3/15/2013 12:18	35	5	0	Settlements
504588E, 85156N	3/15/2013 12:37	34	5	1	Landing site
504913E, 85376N	3/15/2013 13:03	37	3	0	Gardens on Koova Island for proposed Dam location
504139E, 84773N	3/15/2013 13:40	36	2	0	Settlements
503463E, 84507N	3/15/2013 13:54	39	5	0	Nampanyi Mosque
502194E, 84073N	3/15/2013 14:14	46	4	0	Nampanyi Primary School
503161E, 84282N	3/15/2013 14:37	38	3	0	Pentecostal church Village
504082E, 83915N	3/15/2013 15:01	83	5	1	Settlements
504141E, 83090N	3/15/2013 15:08	47	3	0	Nakakandwa CU Primary School
505077E, 85764N	3/16/2013 15:19	41	4	0	Settlement on Koova Island proposed Dam location
503390E, 83092N	3/18/2013 15:01	43	4	0	Nakakandwa RC Primary School
502417E, 82608N	3/21/2013 9:38	71	6	1	Kireku Trading Centre
504699E, 79134N	3/21/2013 14:34	43	5	2	Calvary Chapel Budooda
504931E, 75517N	3/24/2013 10:16	83	6	1	Kirindi Trading centre
504152E, 80196N	3/24/2013 11:03	72	6	1	Kiwuba Trading centre
504175E, 80319N	3/24/2013 10:59	65	5	0	Nakatooke Primary School
505176E, 76787N	3/24/2013 11:18	49	4	0	Kasega Trading centre
503804E, 73431N	3/25/2013 13:03	42	4	0	Exodus Primary school
500076E, 71470N	3/25/2013 17:18	78	6	1	Nazigo Demonstration school

Table 18: Baseline air quality levels in project area and at identified receptors in Kamuli District

Location	Date and Time	5 min TSP mean (µg/m^3)	LEL	NOx	Description/ Notes
504448E, 87755N	30-APR-13 09:31	38	2	0	Ferry landing site in Bulangira Village
507278E, 87041N	30-APR-13 10:12	36	2	0	Izanyiro Trading centre
510052E, 88413N	30-APR-13 10:21	39	4	0	Settlements
509775E, 83581N	30-APR-13 12:45	37	5	1	Settlements
510181E, 85898N	30-APR-13 10:16	36	4	1	Near Nawantale Primary School & Church
508033E, 85743N	30-APR-13 11:45	46	5	0	Gardens and scattered settlements.
505435E, 85178	30-APR-13 12:49	44	6	1	Sand mining & landing site along to river bank
508055E, 76919N	30-APR-13 12:55	56	4	0	Nankandulo Primary School
508460E, 79673N	30-APR-13 13:03	48	3	0	Lwanyama Primary School
508926E, 81473N	30-APR-13 13:17	67	4	2	Kisozi SDA Primary School

The draft Air Quality Standards for Uganda (2006) set out ambient air quality standards for specific pollutants. The standard for dust (total suspended particulates) is a limit of 300 µg/m^3 averaged over a 24 hour period. The ambient dust levels at all project sites were well below the proposed Ugandan national standard as seen in Table 17 and Table 18. Therefore background air quality in the project area is generally good with respect to TSP.

5.4.5 Biological Environment

5.4.5.1 Flora

A total of 199 plant species in 134 genera and 49 families were recorded at the surveyed project area (Appendix B). The richness of wild species was not high because much of the area had been converted or degraded to variable levels. The relative frequency of the different life forms by number of species is presented in Figure 13. Most species were herbs followed by trees and grasses. Climbers, both herbaceous and woody were least frequent. The woody species altogether contributed 33.17 percent by species richness as compared to 66.82 percent of the non-woody species.

The DAFOR scale used was transformed to estimate the relative abundance of the species. This procedure gives a good picture about relative abundance of species. Accordingly, the commonest species (most frequent) were *Leersiahexandra*, *Ageratum conyzoides* and *Triumfettamacrophylla*. The most abundant were *Leersiahexandra*, *Echinochloapyramidalis* and *Triumfettamacrophylla*, all of which are typically wetland species. A total of 43 species were quite uncommon in the project area sites, recorded only once, and in each of the sites rated as Rare (R) on the DAFOR scale. These include *Dracaena steudneri*, a species commonly used for medicinal purposes, and *Ricinuscommunis*, an invasive species.

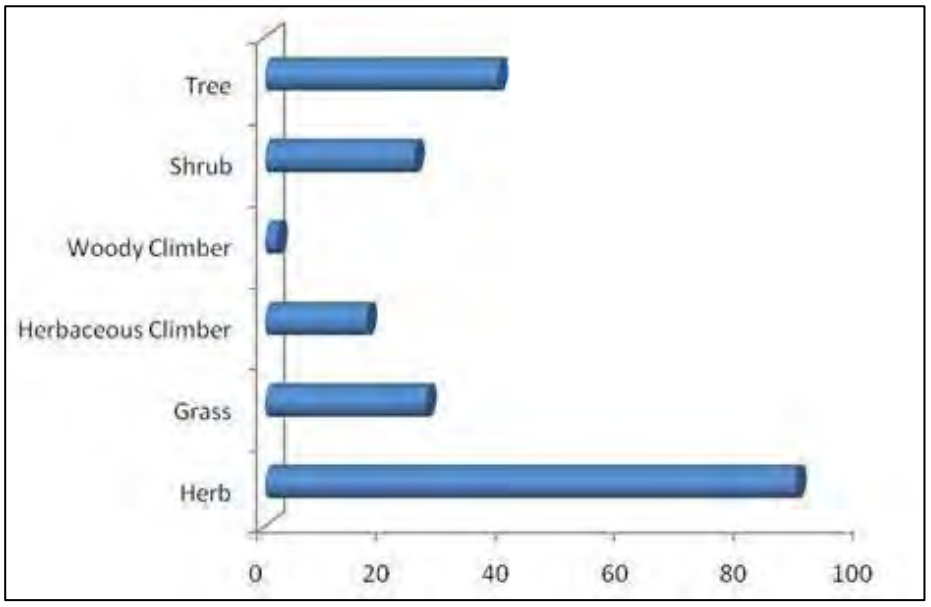


Figure 13 Distribution of plant species by life form in the project area

Table 19: The top ten most abundant and frequent plant species in the surveyed project area

Rank	Abundance	Relative Frequency
1	*Leersiahexandra*	*Leersiahexandra*
2	*Echinochloapyramidalis*	*Ageratum conyzoides*
3	*Triumfettamacrophylla*	*Triumfettamacrophylla*
4	*Acacia polyacantha.*	*Acacia polyacantha*
5	*Cyperus dives*	*Bidenspilosa*
6	*Melantherascandes*	*Cyperus dives*
7	*Phragmitesmauritianus*	*Miliciaexcelsa*
8	*Eichhorniacrassipes*	*Phragmitesmauritianus*
9	*Miliciaexcelsa*	*Vernoniaamygdalina*
10	*Alchorneacordifolia*	*Achyranthesaspera*

5.4.5.2 Species of conservation concern

The direct impact areas do not harbour many globally and nationally threatened species of plants. Only two species of conservation concern in the sense of endemism, threat in IUCN context or rarity were recorded. These are *Miliciaexcelsa* and *Suddiasagittifolia*. *Miliciaexcelsa* is listed because of commercial logging and use for timber, especially for quality indoor and outdoor furniture, firewood and charcoal. It is steadily getting rarer in Uganda now, although Kalema & Beentje (2012) have assessed it as globally Least Concern owing to its wide distribution. In the surveyed project area, scattered individual trees were found growing in cultivated areas, presumably having been spared by the farmers. They were recorded at 36 N 504920 85237, 36 N 505084 80665, 36 N 505072 80689, 36 N 505561 7946636 N 506182 76615, 36 N 505285 73038, 36 N 505620 85180, 36 N 505425 85438, 36 N 505473 85414, 36 N 505471 85319, 36 N 505599 85007, 36 N 506270 81626, 36 N 505721 80534 and 36 N 505799 80824.

Suddiasagittifolia is typically a wetland species growing in water at the extreme edge of the River Nile. This species is restricted in distribution, known only from the Nile in Uganda as the southernmost limit of its geographical range (Kalema 2005) to the Sudds of South Sudan (Renvoize et al. 1984). It was only recorded at 36 N 504624 85144, Nampaanyi village. The National Forestry Authority (NFA) list of 'Reserve Species' includes *Markhamialutea*, which was recorded. This was among the 20 most abundant and common species in the survey area. *Markhamialutea* is therefore protected from exploitation and threat to its habitats.

5.4.5.3 Invasive species

These species are invasive aliens recorded at the project area, with a potential to spread further in the project area once there is disturbance (Cronk & Fuller, 1995) even though they are still uncommon in the project area. The species are all a result of introduction in Uganda, with a large potential to suppress the indigenous species of plants (Cronk & Fuller, 2001; Global Invasive Species Programme, 2003) and included:

i) *Eichhorniacrassipes* (Water Hyacinth) is one of the most notorious invasive species that has been recorded in the fresh waters of Uganda and beyond (Johnstonne & Githongo, 1997; Howard & Matindi, 2003). It was recorded from 36 N 504683 85197, 36 N 505424 82343, 36 N 505599 79378, among others. It could proliferate with increased soil erosion and the resultant sedimentation of the river that are likely to occur due to vegetation removal in some project areas.
ii) *Broussonetiapapyrifera* is another highly invasive species which spread and covered vast parts of the Mabira Forest Reserve ecosystem. It does appear to flourish in gaps or open areas. It was evident in some areas along the Nile where there was evident disturbance due to cultivation. It was recorded mainly from 36 N 504920 85237.
iii) *Mimosa pigra* is a moist ground invasive shrub capable of covering large parts of wetlands once disturbances are chronic. It proliferates as grazing intensifies. *Mimosa pigra* is invading many wetlands in Uganda including Sio-Siteko (Kalema 2008), Lutembe, Mabamba, Nabugabo, Bisina, Nakuwa wetlands (Kalema 2005), all of which are now Ramsar Sites except Sio-Siteko. Wetland systems in some of the protected areas have also been invaded by *M. pigra*, thus: Lake Mburo, Murchison Falls and Queen Elizabeth National Parks, as well as Ajai, Kyambura and Semliki Wildlife Reserves (Kalema 2005). Some of the areas it was recorded from are 36 N 505172 82327, 36 N 506317 81607 and 36 N 505937 81148.
iv) *Lantana camara* invades areas that are drier than *M. pigra*. Both species thrive with disturbance (Cronk & Fuller, 2001). Its presence makes the indigenous flora in any given area susceptible to suppression effects (Cronk & Fuller, 2001; Global Invasive Species Programme, 2003). It was recorded from 36 N 508189 83838 and 36 N 504731 84942.
v) *Pistiastratiotes* was recorded from 36 N 504683 85197
vi) *Ricinuscommunis* (Castor Oil Plant) - recorded from 36 N 504937 85294 on the big island; it is a species favouring well lit conditions and survives with human disturbance

5.4.5.4 Butterflies and dragon flies

A total of 39 species of butterflies (Figure 14) and 9 species of dragonflies (Figure 15) were encountered within the project area. The wetland areas around Bugumira were the richest in the species recorded while Bukwenya - Kirindi area that mainly comprised of coffee gardens was the least in term of species richness.

Most of the sites were mainly home gardens, some starting as close as the river itself and in several areas, there were visible signs of soil erosion.

The big Island (Koova) that was fairly forested with a mix of other habitat types registered the highest number of draglfy species. Only one species, *Brachythemisleucosticta* was found in all the eight sites surveyed, the others were mainly found in three or less sites.

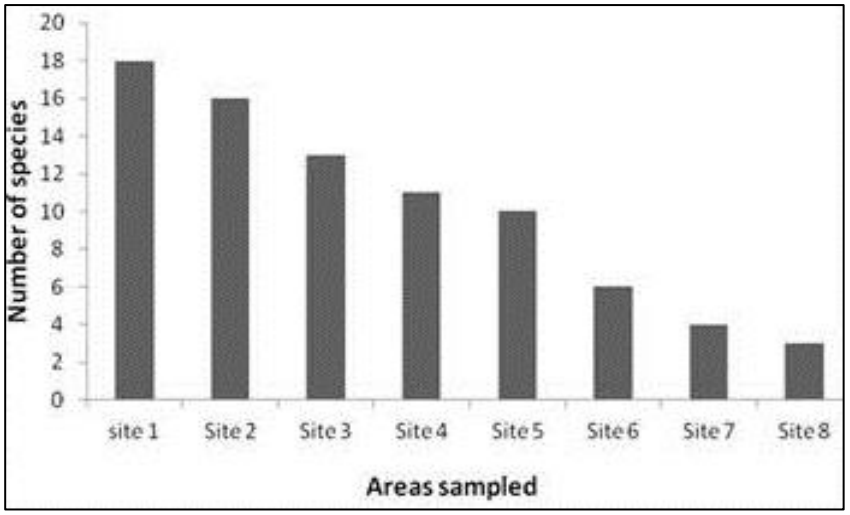


Figure 14: Number of butterfly species in different areas sampled within the proposed project area.

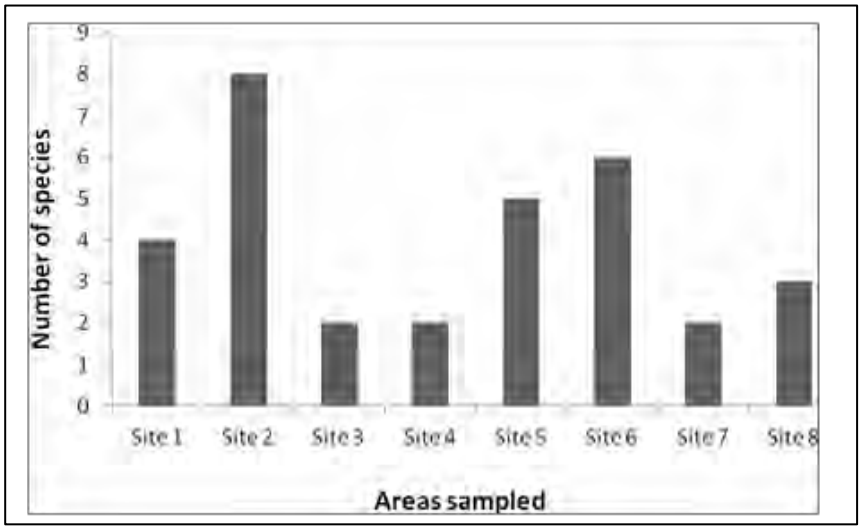


Figure 15: Dragonfly species numbers in different areas sampled within the proposed project area.

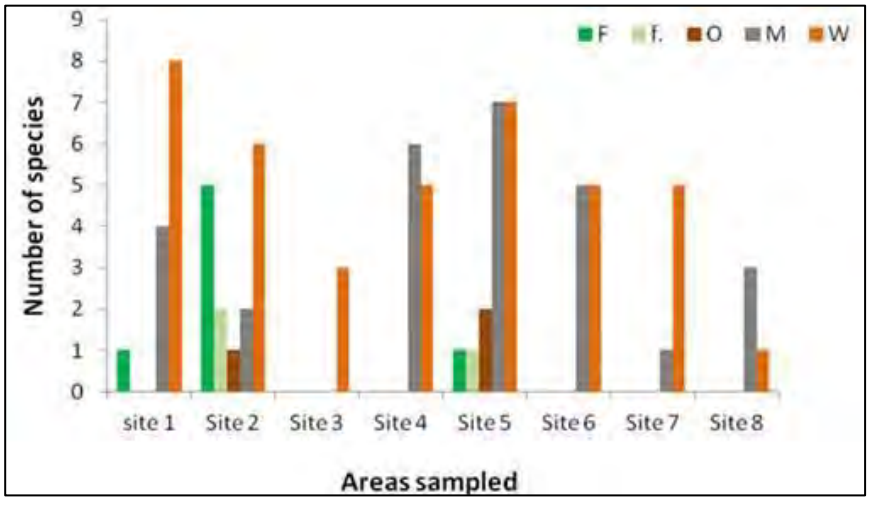


Figure 16 Distribution of different butterfly ecotypes within the different sampled sites

The small Island near Nampanyi only had the migrant species. The area was very open with cassava gardens and rocks. For Kiterede, Kireku, Nakakandwa, Budoda and Bukwenya-Kirindi areas, only migrant and widespread species were encountered. No IUCN redlist species of butterflies have been recorded in the project areas, although some forest specialist species were present.

A total of seven forest dependent butterfly species were recorded in the project areas (Figure 17), although the majority of species were widespread and migrant species; three forest edge/woodland species were recorded in these areas, but no swamp/wetland species were encountered.

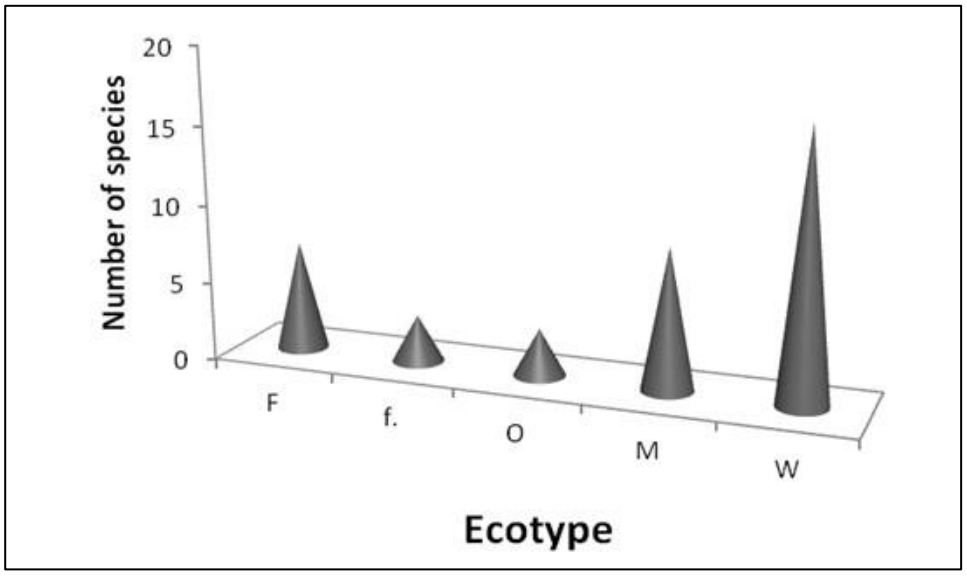


Figure 17: Distribution of combined buttefly ecotypes within the project areas.

Adult butterflies are not a pest however their larval stage (caterpillar) are a pest and destroy food crops or ornamental plants. Complete defoliation may result from severe attacks. Among the species present in the Isimba areas are:

***Sweet potato butterfly, Acraeaacerata (Lepidoptera: Nymphalidae)*:** The sweet potato butterfly is a pest in East and Central Africa. It is an important production constraint in some localities. Outbreaks are sporadic and seasonal and usually occur at the beginning of the dry season.

Citrus swallowtail, Papiliodemodocus (Lepidoptera: Papilionidae): This is a large swallowtail butterfly common to sub-Saharan Africa. It is a pest species, the caterpillar feeding on citrus trees. These can become major pest in case of an outbreak causing massive damages to citrus plantations.

African Swallowtail, Papiliodardanus (Lepidoptera: Papilionidae): It is an extremely variable butterfly from the Afro-tropical ecozone. It is a master of Batesian mimicry. The larvae feed on several members of the Rutaceae including citrus, thus a major outbreak can result into an epidemic with massive losses of the citrus plants.

Acraeaalicia (Lepidoptera, Nymphaidae): It is found across several African countries and its habitat consists of mountain forests and farmlands. The larvae feed on several plants including the members of the family *passifloraceae*, of which the common passion fruit is one. They can become major pest in case of an outbreak of populations.

5.4.5.5 Mammals

Most of the potentially project affected area is no longer prime habitat for mammalian diversity conservation. A few species, however, still live there but it is unlikely that they are in large numbers. Mammal species encountered in the project area are shown in Table 20.

In total, evidence for 21 species of mammals were recorded, comprising of 3 species of primates, 8 species of carnivores, 1 species of Pangolins, 3 species of *Artiodactyles* and 5 species of the order *Rodentia*. The level of richness ranged from as low as two species for areas that were heavily settled and cultivated to as many as 15 species for areas that still have some fair amount of natural vegetation cover.

The majority of mammals that were recorded are fairly wide spread species and none of which has any part of the project area as the core area of its country distribution. For majority of the species, the record of their presence was from interviews and a few from actual sighting or faecal remains. This foregoing observation would suggest that they occur at very low densities. The Vervet monkey *Cercopithecusaethiops* which were seen with higher frequency are considered a vermin and like the other two species of *cercopithecine* primates recorded raid crops and cause loss of yield for the local people.

However, among the species recorded, two deserve particular mention simply because they are tightly dependent on the water:-

- *Lutramaculicollis* (Spotted-necked Otter) is considered by IUCN (2012) as a species of Least Concern but with an observation that their global population is of a decreasing trend.
- *Hippopotamus amphibius* (Hippopotamus) is classified by IUCN (2012) as Vulnerable also with an observation that the global population is decreasing

These two species were reported in several of the areas visited but no large schools of Hippos were observed in any river section. For mammals, none of the potentially project affected area has a significant concentration of mammal species that would adversely be affected by the HPP project.

Table 20: Mammal records reported in the various locations within the Isimba HPP project area

Site (→)	**Kasega**				**Kirunda**		**Nsima**	**Wabilongo**	**Bugumira**		
Coordinates (→)	**36N0505162**	**36N0505152**	**36N0505272**	**36N0505379**	**36N0506027**	**36N0506245**	**36N0505211**	**36N0504435**	**36N0505749**	**36N0505575**	**36N0505415**
	E0076458	**E0076443**	**E0076267**	**E0076268**	**E0075479**	**E0075482**	**E0072957**	**E0071232**	**E0085223**	**E0085198**	**E0085186**
Species name (↓)											
Grey-cheeked Mangabey*Lophocebusalbigena*					p						
Red-tailed monkey *Cercopithecusascanius*		p				p	p	p			
Vervet monkey *Cercopithecusaethiops*					p		p	p	p	p	
Poto*Perodicticuspotto*										p	
Serval cat *Felisserval*	p					p					
Spot necked Otter *Lutramaculicollis*	p					p	p			p	
Large Grey Mongoose *Herpestes ichneumon*	p		p			p	p	p	p	p	p
Side tripped Jackal *Canisadustus*	p	p	p		p	p	p	p	p	p	
Leopard *Pantherapardus*		p					p	p	p	p	p
Serverline Genet *Gennetaservalina*	p			p		p	p			p	
Banded Mongoose *Mungosmungo*	p		p	p		p	p	p		p	
Serval cat *Felisserval*							p	p			
Tree Pangolin *Manistricupsis*										p	
Hippo *Hippopotamus amphibius*							previous		occasional	p	p
Bushbuck *Tragelaphusscriptus*											
Common Duiker *Sylivicapragrimmia*	p		p			p	p			p	
Giant rat *Cricetomysgambianus*	p				p		p		p	p	
Cane rat *Thryonomysgregorianus*	p			p		p	p		p	p	
Stripped ground Squirrel *Xeruserythropus*	p				p	p	p	p	p	p	
Crested Porcupine *Hystrixcristata*						p				p	
Gambian Sun Squirrel *Heliosciurusgambianus*	p					p	p		p	p	
Total	**11**	**3**	**4**	**3**	**5**	**12**	**15**	**8**	**9**	**16**	**3**

5.4.5.6 Birds

Fourteen waterbird species were recorded along the River Nile, and some of these also occurred in the wetlands. No less than four of these are regionally-listed, with the African Darter being rated as Vulnerable. Replacing the rapids along the rives with a lake will reduce the value of the river to a few species (such as Rock Pratincole, which although likely to occur in small numbers, was not actually seen) but others, including African Fish eagle and various species of kingfishers, will benefit from the larger expanse of water, if suitably managed.

The land areas support a wide variety of land-bird species, as expected for these areas from wider surveys (Nalwanga, 2011; Nalwanga et al, 2012). Despite previous surveys (mainly of the route of the transmission route) having recorded well over a hundred land-birds, a further 18 were added this time; conversely, 56 of those recorded along the transmission route were not recorded in the Isimba HPP project area. These differences were partly due to the relatively short times spent in each area (10 counts, 10 hours for the transmission line; 14 counts, 9.5 hours around Isimba).

Of the three main habitat types – near to and at the river, wetlands and farmlands – the farmlands had the largest number of species (Table 21), but that is partly because most time was spent in this habitat. No birds of global conservation concern were recorded (the time was short, but there is no evidence that species of global concern would be likely to occur, except as occasional migrants). However, there were several species of regional importance, particularly in the wetlands.

The presence of many trees, including some large ones near to the river, accounts for the presence of birds associated with forests, even though no actual forest occurred in the area. Similarly, the river itself and the damp valleys with areas of wetland attracted a number of waterbirds. Other specialists included a few birds characteristic of grasslands but rather few aerial feeders (swifts and swallows). Palearctic migrants (either winter visitors of birds ion passage) were few, but there were rather more Afrotropical migrants.

Table 21: Number of species of birds recorded in the main habitat types

			Near river	Valley wetlands	Farmlands
Habitat categories	Forest specialist	FF	1	3	1
	Forest generalist	F	6	12	7
	Other 'tree birds'	f	19	20	16
	Wetland specialist	W	10	7	6
	Wetland visitor	w	8	9	9
	Grassland specialists	G	6	5	4
	Aerial feeders	AG	2	1	2
Migrants	Palearctic	P	2	2	2
	Afrotropical	A	5	7	5
Regional Red data	Vulnerable	R-VU	0	1	0
	Non-threatened	R-NT	1	4	1
	Regional responsibility	R-RR	1	2	0
Total time in habitats (h)			2.0	3.5	4.0
Total species in habitat			62	49	74

Overall, the bird fauna was typical of much of southern Uganda, where smallholder farms are the predominant form of land use (Nalwanga, 2011). The number of species and their variety are notable and any developments

in the area will inevitably mean a loss of several habitats, and of the species that depend upon them. However, the widespread nature of these habitats means that the loss cannot be considered as too serious.

The most important habitat is the River Nile itself, which has a good variety of waterbirds. With good design and management, the retained lake will also support most of the species recorded, particularly if there are islands with minimal or no human activity. The surrounding countryside, like that along most of the Tx route, is fairly actively farmed, but the remaining trees, especially the native trees, are of particular importance. If the reserved land above high water level is of sufficient size, it could be allowed to regenerate to natural forest (with enrichment planting to speed the process). This will benefit many bird species, as well as reducing soil erosion and enhancing the landscape.

5.4.5.7 Fish

a) Itanda (Upstream Flood Area)

This point is located in Kamuli District, approximately 1 km below Itanda falls and 2 km upstream the end of the flood area resulting from dam construction and about 18 km from the proposed dam site. It is expected to offer refuge to organisms escaping rising water levels in the flood area. It is a small bay with high loose vegetated banks; inshore is shallow with sand and rocky bottom, clear slow flowing water with visible fingerlings swimming about. The shoreline is covered with a 2 m strip of macrophytes consisting of:

- Floating forms: *Eichhorniacrassipes* and *Potulacaoleracea,* and
- Emergent forms: *Cynodondactylon.*

Offshore, 3 m, is deep with fast flowing water (main river bed). The majority of the catchment is a planted forest (Nile bank forest) and rest is nature vegetation. The location is used as:

- River sand mining site (main activity)
- Cattle watering site
- Source of water for domestic use
- Fishing site (one person was reported to carry out fishing at this location)

The location is a good feeding, breeding and spawning ground for species. A total of three fish species were sampled at the location. *Oreochromisniloticus* were the most abundant while *Latesniloticus* was as abundant as *Barbusaltinalis*.

b) Nakatto Landing

This point is located in Kamuli District, approximately 14 Km from the proposed dam site and within the flood area. It is expected to have raised water level and extended shoreline during dam and reservoir construction. The location has slightly raised vegetated shoreline with gently slope catchment area, with spring water flowing into the river. The riparian zone is about 1m thick and composed of an emergent form *C. dactylon*. On left side, stands a makeshift observation shelter constructed by 'whites', beyond it 2 m the sloping bank is cleared exposing red soils. On the right side the catchment area is covered natural vegetation comprising of *Pennnisetumpurpureum* and climbers of *Ipomea* genus and other shrub forms. Inshore water is shallow with sandy bottom. Offshore about 4 m is the main river bed with deep and fast flowing water. The location is used as:

- Water transport crossing point between the Kayunga and Kamuli districts.
- Source of water for domestic use.
- Cattle watering point
- Fish landing site

The location is a good feeding, breeding and spawning ground for species. A total of four fish species were sampled at the location. *Oreochromisniloticus* was abundant as *Barbusaltianalis* and *Bagrusdocmak* while *Mormyruskannume* was also recorded (Table 22).

c) Nsiima landing site

This point is located in Kayunga district; approximately 14 Km from the proposed dam site and within the flood area. It is expected to have raised water level and extended shoreline during dam and reservoir construction. The location has general levelling vegetated shoreline with farmland within 5 m reach. The shoreline is covered thin macrophytes comprising of *C. dactylon* and *P. oleracea*. Inshore water is shallow, clear with visible fingerlings swimming about and nibbling at the sandy and rocky bottom. Offshore about 2 m lies a semi-permanent floating mat ('island') of 5 m width made up of *P. oleracea* and *C. dactylon*. The main river water is deep and fast flowing. Most of the catchment is natural vegetation. On a tree, about 12 m downstream, a stationed eagle was sited (probably a fishing eagle). The location is used as:

- Water transport crossing point between the Kayunga and Kamuli districts.
- Fishing landing site (small scale)

The location is a good feeding, breeding and spawning ground for species. A total of three fish species were sampled at the location. *Oreochromisniloticus* and *Rastrineobolaargentea* were the most abundant while *Haplochromine spp* were also recorded (Table 22).

d) Nakatooke landing site

This point is located in Kayunga District, approximately 6 km from the proposed dam site and within the flood area. It is expected to have raised water level and extended shoreline during dam and reservoir construction. The location has general levelling vegetated shoreline with raised rocky catchment with sparse vegetation, within 15 m reach on the right side. The riparian zone (2 m width) is covered vegetation comprising of *C. dactylon* and *Bolboschoenusglaucus*. Inshore water is shallow, clear with visible fingerlings swimming about over a sandy bottom. Offshore about 4 m is the main river bed with deep and fast flowing water. In the catchment area on right side (10 m) small scale rock excavation takes place. The location is used as:

- Water transport crossing point between the Kayunga and Kamuli districts.
- Fishing landing site (small scale)
- Source of water for domestic use.

The location is a good feeding, breeding and spawning ground for species. A total of six fish species were sampled at the location. *Oreochromisniloticus* and *Rastrineobolaargentea* were the most abundant while *Latesniloticus,* was as abundant as Tilapia *zillii*, *Sarotherodongalilaeus* and *Haplochromine spp* (Table 22).

e) Isimba landing site

This point is located in Kamuli District, approximately 6 km from the proposed dam site and within the flood area. It is expected to have raised water level and extended shoreline during dam and reservoir construction. The location has slightly raised vegetated shoreline with levelled and grassed sandy bank top. The riparian zone (2 m width) is covered vegetation comprising of *C. dactylon* and *E. crassipes*. Inshore water is shallow, clear with visible fingerlings swimming about over a sandy bottom. Most of the catchment is covered with natural vegetation (simple grass). On the grassed bank top are heaps of sand and a *Mangiferaindica* tree. Offshore about 4 m is the main river bed with deep and fast flowing water. The location is used as:

- Water transport crossing point between the Kayunga and Kamuli districts.
- Source of water for domestic use.

- River sand depot

The location is a good feeding, breeding and spawning ground for species. A total of four fish species were sampled at the location. *Oreochromisniloticus*, *Rastrineobolaargentea, Latesniloticus* and *Haplochromine spp* (Table 22).

f) Nampanyi

This point is located in Kayunga District, at proposed dam site. It is expected to have raised water level and extended shoreline during dam and reservoir construction. The location has slightly raised rocky shoreline with gently sloping banks that recede into the catchment. Most of the catchment has been cleared for agriculture and settlement. Inshore water (upstream) is shallow, clear and relatively slow. Upstream, approximately 7m, the river is divided into three channels by two islands. The island on the right side is mainly a mat of *C. dactylon* and *P. oleracea*. The second island left is permanent (approx. 0.2 ha) farmland used rice growing mainly. Downstream is Isimba falls and a small immediately below with sheltered water and riparian zone composed of *C. dactylon* and *E. crassipes*. The location is used as:

- Water transport crossing point between the Kayunga and Kamuli districts.
- Source of water for domestic use.

The location is a good feeding, breeding and spawning ground for species. A total of four fish species were sampled at the location. *Oreochromisniloticus, Haplochromine spp* and *Rastrineobolaargentea* were the most abundant while *Sarotherodongalilaeus* was recorded (Table 22).

g) Zanyiro

This point is located in Kamuli District, 2 km downstream proposed dam site. It is expected to have reduced water level and receded shoreline during dam and reservoir construction. The location has slightly raised rocky shoreline with gently sloping banks that recede into the catchment. The catchment was cored with natural vegetation, most of herbaceous tall shrubs- *Pennistumpurpureum* with associated climbers and they were over hanging the banks. Inshore water is deep, clear and fast flowing. Upstream, approximately 1.5 km the river is divided into two channels by an island. The location is not particular gazetted, chosen a reference point below the dam site.

The location is a good feeding, breeding and spawning ground for species. A total of eight fish species were sampled at the location. *Oreochromisniloticus* were the most abundant followed by *Latesniloticus*, *Barbusaltianalis*, *Bagrusdocmak* and *Mormyruskannume. Clariasgariepinus* was also recorded (Table 22).

Table 22: Fish Species and their families caught within project area

Family	Fish Species
Cichlidae	*Tilapia zillii*
	Oreochromisniloticus
	Oreochromisleucostictus
	Sarotherodongalilaeus
	Haplochromine species
Centropomidae	*Latesniloticus*
Cyprinidae	*Barbusaltianalis*
	Rastrineobolaargentea

Family	Fish Species
Bagridae	*Bagrusdocmak*
Mormyridae	*Mormyruskannume*
	Mormyrus species
Clariidae	*Clariasgariepinus*
Total 6	**Total 12**

Species abundance: *Oreochromisniloticus* were the most abundant, followed by *Rastrineobolsargentea, Hoplochrominespp, Latesniloticus, Barbusaltianalis, Oreochromisleucostictus*, *Bagrusdocmak*, *Mormyruskannume* and the least abundant were *Tilapia zilli*, and *lariasgariepinus* where only two individuals of each w recorded.

Table 23: Fish Species at selected points

	T. zillii	*O. niloticus*	*O. leucostictus*	*S. galilaeus*	*H. spp*	*L. niloticus*	*B. altianalis*	*R. argentea*	*B. docmak*	*M. kannume*	*C.gariepinus*
Zanyiro	1	6	1	1	0	2	2	0	2	2	1
Nampanyi	0	3	1	1	3	0	0	3	0	0	0
Isimba	0	2	0	0	2	2	0	2	0	0	0
Nakattoke	1	3	1	1	1	1	0	3	0	0	0
Nsiima	0	0	2	3	0	0	0	3	0	1	1
Nakatto	0	2	0	0	0	0	2	0	2	1	0
Itanda	0	2	0	0	1	1	1	0	0	0	0

Note: The detailed biological assessment report is provided in Appendix B.

6 RESULTS OF STAKEHOLDER CONSULTATION

Consultations were conducted with stakeholders to introduce the project, its potential benefits and impacts as well as addressing any concerns raised. Issues raised are summarized in Box 4 but were mostly related to social-economic conditions and environmental conservation. A list of stakeholders consulted and their responses are presented in Appendix C.

The stakeholder analysis showed in Table 24 belongs to the key entities in this project.

Table 24: Stakeholder analysis

Category	Stakeholder	Primary	Secondary	Interests in the Project
Central Government	MEMD	√		MEMD is the Project proponent, beneficiary of financing for the proposed Isimba Hydro power plant project and EIA during implementation. Its key interest would be to construct a Hydro Power Plant that generates 180 MW that feed into the national and regional grids. It is also responsible for resource mobilization, distribution and implementation of compensation and resettlement. MEMD is responsible to provide policy guidelines in the development of the energy and mineral sector.UETCL is directly under policy oversight of MEMD and is therefore a secondary stakeholder.
	UEGCL	√		Uganda Electricity Generation Company Limited is responsible for generation of electricity at the Isimba Hydro power Dam; thus having a direct role in implementation of this project, hence Primary stakeholder status.
	UETCL		√	UETCL's key interest would be to develop a transmission infrastructure that evacuates power from the IsimbaHydro-power dam site feeding into the national and regional grids. UETCL is also a service provider; ensuring power is evacuated to substations to be distributed to the communities by separate power distribution companies, hence assuming a secondary role.
	REA		√	REA is responsible for undertaking basic planning and preparation of projects in line with the Indicative Rural Electrification Master Plan (IREMP) and as determined by the Rural Electrification Board as eligible for support. REA functions mostly dwell on generating and providing information relating

Category	Stakeholder	Primary	Secondary	Interests in the Project
				to investment opportunities, costs and benefits of rural electrification and available technical and financial support facilities to all stakeholders.
	MLHUD	√		The Chief Government Valuer in MLHUD approves property valuation. Additionally, property or cadastral survey report is approved by the Commissioner for Surveys & Mapping in MLHUD, which is therefore a primary stakeholder since the project will displace many people.
	MGLSD		√	MGSLD is a secondary stakeholder and will be interested primarily in labour conditions during dam construction and the entire project development: ▪ Community Rehabilitation Programme for the Disabled (CBR), ▪ Functional Adult Literacy Programme (FAL), ▪ Support to AIDS Orphans and Other Vulnerable Children (PCY), ▪ Elimination of Child Labour.
	DWD- Water Resources Management Department	√		Managing water resources in the context of extreme events, mitigating the effects of extreme water-related events, information generation and dissemination. Support regional, sub-regional and capacities for data collection and processing and for planning, research, monitoring, assessment and enforcement.
	NAFIRRI		√	NAFIRRI is mandated to carry out fish stock assessment, the monitoring programme in all major water bodies in Uganda.
	MTWA	√		The Ministry of Tourism, Wildlife and Antiquities'(MTWA) mandate is to formulate and implement policies, strategies, plans and programs that promote tourism, wildlife and cultural heritage conservation for socio-economic development and transformation of country. The ministry is a primary stakeholder because some eco-tourism sites will be affected by the project.
Local Government	Kayunga District	√		The left bank is situated in Kayunga District so the District officials will mobilize and manage communities in the affected areas since they have jurisdiction over them. They will also participate in managing and monitoring social impacts, mitigations and

Category	Stakeholder	Primary	Secondary	Interests in the Project
				resettlement activities and grievances at the local levels. Though all these roles are major they act as service providers making them primary stakeholders.
	Kamuli District	√		The Right bank is situated in Kamuli District so the District officials will mobilize and manage communities in the affected areas since they have jurisdiction over them. They will also participate in managing and monitoring social impacts, mitigations and resettlement activities and grievances at the local levels. Though all these roles are major they act as service providers making them primary stakeholders.
Funding agencies	(Currently unknown)		√	Implementation of this project will be through PPP arrangement but private sector partners may be funded by financing agencies. As a funding agency, hence hold "secondary" stakeholder status.
Communities	Communities and PAPs	√		Communities will derive direct benefit from project development (construction jobs) and operation (more reliable power supply) immediately in some cases and in future for other communities within project areas.
NGOs	Auxiliary Foundation		√	NGOs are usually engaged as "external monitors" of RAP implementation and success of resettlement programs. Therefore their interests are regarded secondary in the project.
Tourism Agencies	UTB		√	Uganda Tourism Board as an umbrella for the tourism agencies in Uganda will have some of its member agencies operating along Victoria Nile affected thus affecting them too. They will therefore be considered a secondary stakeholder.
	Kayak The Nile (U) Ltd	√		They generate revenue for the Central Government by bringing in tourists to view River Nile and will therefore be affected once the dam is in place, hence considering them as Primary stakeholders.
	Nile Rivers Explorers	√		They generate revenue for the Central Government by bringing in tourists to view River Nile and will therefore be affected once the dam is in place, hence considering them as Primary stakeholders.

Category	Stakeholder	Primary	Secondary	Interests in the Project
	Nalubaale Rafting	√		They generate revenue for the Central Government by bringing in tourists to view River Nile and will therefore be affected once the dam is in place, hence considering them as Primary stakeholders.
	Hairy Lemon Island	√		They generate revenue for the Central Government by bringing in tourists to view River Nile and will therefore be affected once the dam is in place, hence considering them as Primary stakeholders.

Consultations were conducted with stakeholders to introduce the project, its potential benefits and impacts as well as addressing any concerns raised. Issues raised are summarized in Box 1 but were mostly related to social-economic conditions and environmental conservation. A detail list of stakeholders consulted, their responses and questions are presented in Appendix C.

Box 4: Key findings from stakeholder consultation

a) Project implementation

Common stakeholder queries and concerns were:

- *How long will the project development take because this is useful for entrepreneurs who may wish to develop services that support project development?*
- *All HEP developments seem to be concentrating on River Nile, What effects will the development have on other planned projects along the Nile?*
- *Incase many dams are constructed on River Nile, won't there be a backwash effect in future creating floods in Jinja District?*
- *What considerations were taken to choose the best location of the dam and what were the alternatives?*
- *Is there a way the MAAIF can link with MEMD to reduce the decay of biomass that would by flooded to generate GHG*
- *Back flooding may affect others areas that were not in the plan. How will the project ensure that the same volume of water flows down to downstream communities?*
- *Will the district get electricity from the project and how long will the Isimba HPP be on the grid?*
- *Kalagala Offset management plan (KOMP) exists and since Isimba HPP is part of Kalagala Offset area, It should be integrated in the KOMP.*
- *The proposed project if implemented may damage the already existing roads; therefore effort should be made to maintain all existing access roads or better still improve on them.*
- *Which are the actual homesteads to be affected by the project? How soon will valuation data of affected PAPs be given to district officials in charge?*
- *The reservoir extent needs to be clear because approximately 14km of the River stretch which will be covered by the reservoir will inundate white water rafting and completely shut down tourism and knock off effects in some districts.*

b) Land

- *Who gives consent on surveying affected land? Is it the land owners or squatter?*
- *Where will the PAPs whose land is going to be affected be resettled? Is there enough land?*

c) Timely, equitable compensation

- *The compensation rates set by the District Land Board should be revised so that the PAPs are fairly compensated.*
- *Most government projects get problems during the compensation stage especially if given in instalments. Will compensation be done in instalments?*
- *Are squatters on the affected land compensated?*
- *Will the government compensate PAPs with no land tittles because most of the people in Kamuli District do not own Land titles?*

- *Is "good will" of an economic facility compensated?*

d) Employment:

- *Will the proposed project consider employment for the locals?*
- *When employing workers for the project, won't the contractors consider academic qualifications and bribes?*

e) Tourism:

- *What are the immediate tourism resources to be affected by the project?*
- *How will people whose livelihood depends on tourism services be compensated (for example Kayaking instructors)?*
- *Won't the reservoir affect Kalagala offset and Itanda falls?*
- *Won't all tourist attraction be eliminated by the project?*

g) Grievances:

- *In case of any grievances, where will the offices be located?*
- *There are repercussions of a dam after it has been built. People employed by the project end up contributing to crime after the project ends. What measures have been put in place for such cases?*

h) Benefits:

- *Kisozi Sub-County sees less than 10 % benefit from the project, therefore request that as much as design is already done, the project should set up facilities such as schools, health centers or roads as a cooperate social responsibility.*
- *Is there a plan for revenue/project benefit sharing with stakeholders?*
- *The community desired to have a bridge to connect to Kamuli and Kayunga, Is it possible?*

i) Stakeholder Consultations:

- *Residents of Nampanyi village alleged not having been sensitized enough. Complaints were received by RDC Kayunga District where people refused to sign consent forms of property surveyors because of fear of taking away their land.*
- *The project team should have a development communication specialist who will prepare people for eventualities likely to take place for example loss of jobs after construction.*
- *The project team should include a Natural Resources Economist on the list to do the cost-benefit analysis.*
- *Long term effects such as effects on vibrations due to the project should be addressed to communities. There is need to engage with the CDOs to be involved in sensitization.*
- *Some technical personnel such as Community Development Officers (CDOs) should be involved when sensitizing communities.*

j) Kalagala Offset:

- *Mabira Management Area and Kalagala offset if affected by the project should be compensated.*
- *The project should provide a good monitoring plan for Kalagala offset. MOWE developed a good monitoring plan; the project can look at their plan and borrow best practices.*

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7 POTENTIAL IMPACTS AND MITIGATION MEASURES

Analysis in sections below is limited to environmental impacts of construction, operation and decommissioning of the proposed Hydropower plant since social impacts (such as employment, income to suppliers of line construction materials and equipment, etc.) were assessed and documented in a separate Social Impact Assessment (SIA) report.

Hydro-power plants characteristically generate impacts such as land take, clearing of vegetation from sites, construction of access roads, reservoir level fluctuations, soil erosion and sedimentation filling as construction and operation-related impacts. The plant construction phase is the period when most environment changes will occur. Impacts of the project are discussed in sections below. The implications of permanent and temporary land take on ecology, communities and features of cultural heritage are discussed.

7.1 EFFECTS ON LAND

7.1.1 Temporary Land-take

During construction, land will be occupied temporarily and will be required for the project components such as:

- Access road;
- Workers' camps;
- Temporary work area;
- Stockpile area.

The sites for most these will be determined by the contractor but the main workers' camp will be near most likely the proposed plant site in Nampanyi villages.

Further land may be occupied by informal migration of people into the area stimulated by the construction activity and the long term availability of water, but it is not possible to estimate the location or area of land take at the present time, or to determine whether this will result in establishment of permanent new communities. The extent and duration of impact will be determined by policies implemented to manage these population movements.

Uganda Land Commission (ULC) on behalf of UEGCL will have a leasehold title to the area of land encompassed by the Setting Out Points (SOP) boundaries on both banks for a period of five years. At the end of this leasehold period, the 'radical title' not taken by the permanent works may be handed over to the original land owners.

Project phase when impact will occur	Construction	Operation
	√	

Impact significance

The likelihood of this impact is ***high*** because some of this land is currently being used for agriculture. Impact severity is considered ***medium*** and significance Moderate because this means a decrease in land that is being used for food production and also forest reserve land might be affected. Therefore significance is ***moderate***.

Negative Impact (-)		**Impact Likelihood**			
		None	**Low**	**Medium**	**High**
Impact Severity	**Negligible**	Negligible	Negligible	Negligible	Negligible
	Low	Negligible	Negligible	Negligible – Minor	Minor
	Medium	Negligible	Minor	Minor - Moderate	Moderate
	High	Minor	Moderate	Major	Major

Mitigation measures

As a requirement of the contract, temporary land take areas will be reinstated to pre-project condition. The ultimate decision as to the final uses for this land will rest with ULC.

7.1.2 Permanent Land-take

A total area of 2867.6 acres of permanent land will be required for the reservoir and hydropower plant facilities and this will include:

- land on the Right bank;
- land on the Left bank; and
- land of islands that will be inundated.

As mentioned above, this land will be compensated before project commencement. It will be demarcated, to prevent encroachment or unauthorised access and use. This land will be transferred from its previous owners to the Uganda Land Commission (ULC), which holds a freehold title in respect thereof.

Project phase when impact will occur	Construction	Operation
	√	√

Impact significance

The likelihood of this impact occurring is ***high*** because land will be lost to the hydropower plant and reservoir. Impact severity is ***medium*** since most of it is agricultural land with low environmental sensitivity. Therefore significance is ***moderate***.

Negative Impact (-)		Impact Likelihood			
		None	**Low**	**Medium**	**High**
Impact Severity	**Negligible**	Negligible	Negligible	Negligible	Negligible
	Low	Negligible	Negligible	Negligible – Minor	Minor
	Medium	Negligible	Minor	Minor - Moderate	Moderate
	High	Minor	Moderate	Major	Major

Mitigation measures

Even though most of the land to be lost is of low environmental sensitivity, there exist fragile areas upstream including islands and river banks to be inundated, some of which form part of the Kalagala Offset area. Scaling up implementation of some aspects of the sustainable management plan of the Kalagala Offset is proposed for the Isimba HPP as area as a way of compensating for ecological value of lost land. These include catchment afforestation, and restoration of degraded areas.

The flooded area of the Nile Bank CFR will be compensated with an equivalent planted area. Prior to inundation, biological baseline studies will be undertaken in liaison with UWA prior to relocation of affected species on the islands.

7.1.3 Terrestrial Ecology

Several small and large islands such as Damba and Koova Islands will be submerged by Isimba HPP reservoir. Inundation will result in the loss of terrestrial vegetation, habitats and in some cases, displacement of inhabitants. Only two flora species of conservation concern in the sense of endemism, threat in IUCN context or rarity were recorded in the project affected area. These are *Miliciaexcelsa* and *Suddiasagittifolia*. *Miliciaexcelsa* is listed because of commercial logging and use for timber, especially for quality indoor and outdoor furniture, firewood

and charcoal.

Project phase when impact will occur	Construction	Operation
	√	√

Impact significance

The likelihood of this impact occurring is ***high*** because inundation of the small islands is certain. Severity is ***medium*** because there are two plant species of conservation concern but no critical habitats for threatened terrestrial species on islands and river banks that will be submerged. Therefore significance is ***moderate***.

Negative Impact (-)		Impact Likelihood			
		None	**Low**	**Medium**	**High**
Impact Severity	**Negligible**	Negligible	Negligible	Negligible	Negligible
	Low	Negligible	Negligible	Negligible – Minor	Minor
	Medium	Negligible	Minor	Minor - Moderate	Moderate
	High	Minor	Moderate	Major	Major

Mitigation measures

- The land tenure in the project for Kayanga, Kamuli and Jinja is public land and the islands to be submerged are on public land owned by government but any inhabitants thereon will be compensated for their crops or structures. On the riverbanks, land owners will also be compensated for land and developments thereon.
- Restore the disturbed areas immediately after the operations. The natural regeneration process will then take place so that the disturbed areas may be re-vegetated with natural vegetation immediately after the construction activities.
- Care should be taken to ensure that the construction and related activities are restricted only to the target areas so that others may not be disturbed. Unnecessary habitat loss and/or alteration should be avoided
- Sensitization of all the entire construction team, including the foremen and supervisors should be done to enhance their awareness about environmental matters. This will enhance minimize environmental damage, and impact on the habitat. This awareness drive should be carried out before commencement of operations in the area.
- The environmental management and monitoring plan as well as the impact mitigation measures proposed in the ESIA should be closely followed and adhered to and supervised to ensure compliance. The relevant offices of NEMA, District Environment Office, Wetlands Management Department and any others of relevance, should play a leading and active role to this end.

7.1.4 Impact on Kalagala Offset Area

Kalagala Offset Area measuring a total of 22 km^2 was created to ensure good environmental management of Mabira ecosystem for purposes of "counterbalancing or making up for" the negative effects caused by Bujagali dam on the environment, as stipulated in the Indemnity Agreement (No. B-0130-UG) signed between Government of Uganda and World Bank/ IDA in 2007.

The indemnity agreement commitments include:

i)Set aside the Kalagala falls site exclusively to protect the natural habitat and environmental and spiritual values in conformity with sound environmental and social standards

ii)Carry out tourism development activities at Kalagala falls site in conformity with sound social and environmental standards

iii) Not to develop power generation that could adversely affect the ability to maintain Kalagala falls.

iv) Conserve through a sustainable management program and budget, the present ecosystem of Mabira Central Forest Reserve, Kalagala Central Forest Reserve and the Nile Bank Central Forest Reserve.

Subsequently, Kalagala Offset Sustainable Management Plan (SMP) was developed in 2009 and was to be implemented over a 10 year period (2009-2018).

The Indemnity Agreement committed Kalagala offset to include Kalagala and Itanda Falls and associated waters and islands, Mabira Forest, Kalagala Falls and Nile Bank CFRs. However, using the ecosystem approach, the SMP took into account the following additional components necessary to achieve the obligations of Kalagala Offset:

- Water catchment following the drainage (hydrology) directly feeding into the Nile system within or near Kalagala and Itanda Falls area,
- Natural assets and ecosystems whose ecological, social and economic functions impact on the integrity of Kalagala and Itanda Falls area or get impacted on by existence of Kalagala and Itanda Falls;
- Natural and modified production systems extending 3-5 km either side of the Nile River (mainly river bank, adjacent land and infrastructure) stretching between 0.45° and 0.75° north and people therein;
- Cultural assets whose values are associated with Kalagala and Itanda Falls.

The SMP is currently being implemented by the Ministry of Water and Environment together with various Government Lead Agencies and this largely addresses items i, ii, and iv, in the idemnity agreement.

It was noted and identified during field surveys that the section of the Nile Bank CFR area of the Offset to be affected by Isimba HPP is currently encroached with subsistence cultivation. Nonetheless, responsible conservation measures and conformity to guidelines of Kalagala Offset SMP are essential.

Photo 4: River Nile Bank CFR part of Kalagala Offset Area cultivated with maize.

Mitigation measures

The SMP will be scaled up or integrated in the implementation of the Isimba HPP area, to limit the anticipated impacts

on the Kalagala Offset and its environs, and the impacts of the Isimba HPP on its environs. The interventions for Isimba HPP include:

- Enhancement of the natural habitat, environmental and spiritual/Cultural values within the project area and the environs shall be carried out (catchment afforestation, replacement of the portion of the kalagala offset area that is to be affected by Isimba reservoir, etc);

- Promotion of social – economic and environmentally sound eco – tourism activities (Livelihood restoration, infrastructure development including access roads and landing sites, promotion of Kalagala, Itanda and Isimba as tourism destinations, promotion of alternative tourism experiences including boat rides on the reservoir, development of the Isimba eco-tourism plan etc) shall be carried out;

- Promotion of the conservation of the ecological and social economic values of the surrounding ecosystems.

- Integration of the pertinent activities of the Kalagala off set into the social and economic development aspirations of the people in adjacent landscape (establishment of a cultural centre, value addition to natural resources and agricultural products, community civic education, improved safe water supply etc to be elaborated in the Community Development Action Plan).

- Harnessing the institutional capabilities for ensuring cost effective implementation of the Isimba Environment and Social Management Plan (Government Departments, Local Governments, NGOs, CBOs, Private Sector, Academic Institutions, Development Partners, etc. to be involved in project monitoring).

7.2 EFFECTS ON WATER

7.2.1 Hydrology and Hydrogeology

a) Downstream flows during construction and reservoir filling

Outside the immediate diversion area, the flow of River Nile during Isimba dam construction will remain governed by the operating regime of Nalubaale, Kiira and Bujagali dams. The diversion works at Isimba are not expected to have any significant effect on river flows outside the immediate construction area. Diversion of the west channel of Nile River at Koova Island into the east channel during the first stage of construction will result in higher water levels and increased flow velocities in the east channel. Water depth will increase by up to 6 m along the non-diverted (east) channel alongside Koova Island; the 'backwater' effect is expected to extend up to about 500 m upstream. Some localised scouring and erosion, and possibly some downcutting of the riverbed, are anticipated.

Project phase when impact will occur	Construction	Operation
	√	

Impact significance

The likelihood of this impact occurring is ***low*** because the flow of River Nile during dam construction will remain governed by the operating regime of Nalubaale, Kiira and Bujagali power stations. Impact severity is considered ***medium*** because some localised scouring and erosion, and possibly some down-cutting of the riverbed. Therefore, significance is ***negligible – minor***.

Negative Impact (-)		Impact Likelihood			
		None	Low	Medium	High
Impact Severity	Negligible	Negligible	Negligible	Negligible	Negligible
	Low	Negligible	Negligible	Negligible – Minor	Minor
	Medium	Negligible	Minor	Minor - Moderate	Moderate
	High	Minor	Moderate	Major	Major

Impact management

On completion of the dam and power station, the reservoir will be filled in such a way that no more than 5 percent of the instantaneous flow downstream of Bujagali dam is retained in the Isimba reservoir. Therefore, during the filling period the Minimum Residual Flow (MRF) downstream of the Isimba Dam will not be less than 95 percent of the flow downstream of Bujagali power station. Although the reservoir could in theory be completely filled in about one day, the on-going checks of dam and riverbank stability will mean that the reservoir is filled slowly, and in a staged manner, over a period of several weeks. Thus, changes in the discharge downstream of Isimba power station during filling are likely to be imperceptible.

Prior to start of reservoir filling, the communities upstream and with activities and settlements in the reservoir area will be informed to vacate, to avoid being affected by the rising waters and resulting loose slopes. This will be done through various media, including radio, TV and flyers.

b) Reservoir level fluctuation during operation

Once complete the plant will be operated to provide a relatively steady production of electricity. As a result of the considerable variation of inflow into the reservoir from Lake Victoria and the variation in discharge from Bujagali HPP, Nalubaale HPP and Kiira HPP upstream of Isimba HPP, this will result in fluctuation in water levels in the reservoir of Isimba HPP. The effect of a standard operating regime (continuous energy expenditure of 180MW) has been simulated over a period of 40 years using historic flow data.

Other hydrological effects during dam operation include:

- Changes in shoreline
- Downstream flow regime during operation
- Lake Victoria levels
- Groundwater levels

Filling and long term operation of the reservoir will have a significant effect on downstream flows in the Victoria Nile. River flow regimes (*i.e.* the seasonal and inter-annual variation in flow and flow volumes) control many physical aspects of river form and processes, including water levels, sediment transport and nutrient exchange. Changes in flow regime can therefore have significant impacts on riverine habitats and water users.

It is also likely that local groundwater sources will be utilized for both construction purposes (*e.g.*to supplement process waters) and to supply potable water to the construction camps. Although the quantity of groundwater used is unlikely to be significant in comparison to the available resource, there may be localized impacts where the drawdown caused by project boreholes affects groundwater levels in adjacent community wells.

The same impact may occur if dewatering is carried out as part of foundation construction. These impacts can be avoided by the careful siting of project boreholes during the detailed design phase to avoid conflict with local village water supplies, and the regular monitoring of selected wells to assess whether impacts are occurring.

Project phase when impact will occur	Construction	Operation
	√	√

Impact significance

The likelihood of this impact occurring is ***low*** becauseCurrent best practice dictates that dams should provide for release of "compensation flows" that address both in-stream requirements and flood releases designed to overtop and supply floodplains and deltas.Impact severity is considered ***medium*** therefore, significance is ***negligible – minor***.

Negative Impact (-)		Impact Likelihood			
		None	Low	Medium	High
Impact Severity	Negligible	Negligible	Negligible	Negligible	Negligible
	Low	Negligible	Negligible	Negligible – Minor	Minor
	Medium	Negligible	Minor	Minor - Moderate	Moderate
	High	Minor	Moderate	Major	Major

Impact management

- Compensation flows should be designed to contribute as far as possible towards downstream ecological and livelihood objectives, rather than simply releasing a constant quantity of water.
- Ensure that there is adequate design and construction site management measures in place.

7.2.2 Water Quality

a) Suspended solids during construction

The main impact on water quality during the construction phase is anticipated to arise from inputs of suspended matter to the river as a result of coffer dam construction and erosion of the banks of the river channels by the higher velocity flows during diversion. Suspended matter in the river could have two main effects downstream of the site. The first is siltation in areas remote from the site, particularly in areas of shallow gradient and on the inside of bends, where flow velocity is low. This may have some impacts on navigation and fishing activity, although these are expected to be insignificant due to the high volume of water that flows down the River Nile. Of greater concern are the potential adverse impacts of suspended matter on aquatic life downstream, and on fish species in particular. Suspended particles can clog fish gills, and at high levels cause death by suffocation, although the dose-response varies greatly amongst fish species. Regardless, it is generally difficult to maintain a freshwater fishery in water with long-term suspended solids concentration exceeding 80-100 mg/l (Alabaster & Lloyd, 1982). In general, fish species of the Nile are expected to be relatively tolerant of suspended matter as there are existing high silt loads during wet seasons, and they are expected to demonstrate avoidance behaviour.

Project phase when impact will occur	Construction	Operation
	√	

Impact significance

The likelihood of this impact occurring is ***high*** because while sedimentation can be controlled during construction, it will not be completely avoidable since the banks, especially where cultivation is done are prone to erosion during dam construction. Impact severity is, however, ***medium*** considering the large discharge (flow) of the River Nile which would quickly flush to disperse the sediment. Therefore, significance is ***moderate***.

Negative Impact (-)		Impact Likelihood			
		None	Low	Medium	High
Impact Severity	Negligible	Negligible	Negligible	Negligible	Negligible
	Low	Negligible	Negligible	Negligible – Minor	Minor
	Medium	Negligible	Minor	Minor - Moderate	Moderate
	High	Minor	Moderate	Major	Major

Mitigation measures

Mitigation measures to be undertaken include:

- No digging or grubbing will be done during clearance of the reservoir.
- Site drainage systems will include sedimentation basins.
- Water quality downstream will be monitored on a monthly basis, with samples taken and analysed for all forms of contaminants.

b) Discharge of pollutants into the river during construction

Possible sources of contaminants from the site would be process water such as flow from concrete batching plant, wash water, etc.; and surface water and seepage water run-off from site. There is also a risk of contamination of the river by accidental spills or discharges of construction-related chemicals such as oil, diesel fuel, concrete additives or solvents.

Project phase when impact will occur	Construction
	√

Impact significance

Impact severity is ***high*** and the extent of impact will depend on the size, frequency and timing of spills in relation to flow conditions in the receiving waters and the nature of the materials involved including their toxicity and possible for bio-magnification or bioaccumulation. The risk of water pollution for these sources can be reduced by adopting protective measures to prevent spills and putting in place suitable spill response plans to be implemented in the event of accidents occurring. Suitable measures to collect treat and dispose of chemical wastes will also be required. With these good construction site practices the likelihood of the impact occurring is ***low***. Therefore, the impact significance is ***moderate.***

Negative Impact (-)		Impact Likelihood			
		None	Low	Medium	High
Impact Severity	Negligible	Negligible	Negligible	Negligible	Negligible
	Low	Negligible	Negligible	Negligible – Minor	Minor
	Medium	Negligible	Minor	Minor - Moderate	Moderate
	High	Minor	Moderate	Major	Major

Mitigation/ monitoring measures

- There will be provision for secure storage of substances such as oil, diesel fuel, concrete additives or solvents, including interceptors and sumps in case of spillage.
- There will be provision for pollutant spill response plans (including provision of training and equipment)
- The contractor will be required to treat his effluent before discharge into water with a discharge permit.

- The contractor will be contractually required to implement management measures, which will minimise the risk of a significant release of chemicals into the environment.

c) Water quality and eutrophication of the reservoir

Eutrophication is a process by which concentrations of nutrients (primarily nitrogen and phosphorus) in a body of water become elevated. This process can be natural or induced by human activities. Human activities leading to eutrophication include runoff of fertiliser applied to agricultural fields and discharge of effluent containing organic wastes such as sewage, or food processing plant waste, or phosphate containing detergents.

High concentrations of nutrients combined with high temperatures, can result in "blooms" of aquatic vegetation, particularly microscopic algae. In highly eutrophic waters, algal blooms can cause de-oxygenation of water resulting in fish mortality, bad odour or colour and difficulties in treating the water for drinking purposes.

It is not anticipated that the hydropower development alone will cause the upstream nutrient load to increase. As NEMA effluent quality standards are now in force, discharge of nutrients into the Upper Victoria Nile should decrease from current levels. Therefore, the risk of future development making this stretch of the Victoria Nile more susceptible to eutrophication should be reduced. In the longer term, water quality conditions in the reservoir will be influenced by the accumulation of nutrients, particularly nitrogen and phosphorus, contained in the influent waters such as from agricultural fields and other upstream activities.

Project phase when impact will occur	Construction	Operation
	√	√

Impact significance

The extent of these impacts will be determined by the detailed characteristics of the reservoir, including its circulatory patterns, temperature profile and water chemistry. However, based on anecdotal evidence from Nalubaale reservoir it is understood that organic decomposition is unlikely to have a major influence on the water quality conditions in the reservoir. Therefore the likelihood of the impact occurring is ***medium*** while the impact severity is ***medium***. Thus significance of the impact is rated to be of ***minor to moderate.***

Negative Impact (-)		**Impact Likelihood**			
		None	**Low**	**Medium**	**High**
Impact Severity	**Negligible**	Negligible	Negligible	Negligible	Negligible
	Low	Negligible	Negligible	Negligible – Minor	Minor
	Medium	Negligible	Minor	Minor - Moderate	Moderate
	High	Minor	Moderate	Major	Major

Mitigation/ monitoring measures:

In practice catchment management in the future will have a significant influence on mitigation of these impacts. If intensive agricultural development and deforestation occur, these could provide the reservoir with an increased nutrient supply of phosphorus and nitrogen pushing the small reservoir into a higher eutrophic state. If there is no careful catchment management interventions there will therefore be a moderate risk of eutrophication in the reservoir.

d) Impacts on aquatic ecology and fisheries

Potential effects on fish species of commercial and conservation importance are discussed in this section. The potential impacts of the proposed Isimba project on fish resources in the River Nile arise through a number of direct and indirect mechanisms:

i) Effects on water quality:

- Increased suspended sediment (and decreased transparency) downstream of the site during construction;
- Decreased suspended sediment (and increased transparency) in the reservoir during operation;
- Potential for increased nutrients (eutrophication) in the reservoir due to increased retention time; and,
- Potential for dissolved oxygen depletion in the reservoir due to reduced turbulence.

ii) Effects on invertebrate prey species:

- Change in habitat availability on the basis of water depth, flow velocity and diurnal water level fluctuations.

iii) Effects on macrophyte species:

- Change in macrophyte cover and species composition on the basis of water depth, transparency, flow velocity and diurnal water level fluctuations.

iv) Effects on juvenile life stages (including prey species):

- Change in food availability (phytoplankton and invertebrates);
- Change in habitat availability on the basis of water depth, flow velocity, diurnal water level fluctuations and effects on macrophyte species; and,
- Change in feeding efficiency due to changes in transparency of the water column.

v) Effects on feeding and spawning habitat:

- Changes in availability of habitat on the basis of water depth, water transparency, flow velocity and water level fluctuations.

The importance of each of the potential changes outlined above is assessed in Table 25 for the reaches above (Itanda falls to Isimba Hydropower Site) and below Isimba falls during operation of the facility, and for downstream reaches during construction. In summary, the major changes that will occur during construction and operation of the hydropower facility include increase in suspended sediment concentrations downstream during construction and changes in habitat type within the impounded reach to a habitat more representative of that currently found at Zanyiro, 2 km downstream of the site.

Project phase when impact will occur	Construction	Operation
	√	√

Impact significance

The likelihood of this impact occurring is ***high.*** Impact severity is ***medium*** considering that there is minimal fisheries in the river stretch. Therefore, significance is ***moderate***.

Negative Impact (-)		**Impact Likelihood**			
		None	**Low**	**Medium**	**High**
Impact Severity	**Negligible**	Negligible	Negligible	Negligible	Negligible
	Low	Negligible	Negligible	Negligible – Minor	Minor
	Medium	Negligible	Minor	Minor - Moderate	Moderate
	High	Minor	Moderate	Major	Major

Mitigation measures

Impacts on fish and mitigation actions are provided in Table 25.

Table 25: Impacts on fish

Issue	Location	Mitigation measure	Net effect	Monitoring/ follow-up
Detrimental effect on fish populations	Upstream and downstream	Re-stocking programmes to be carried out in the reservoir or if necessary establish healthy populations of desirable species.	Expected increase in productivity of the fishery in the reservoir and no significant effect expected on fisheries downstream of the reservoir.	Conduct fisheries surveys post-construction; upstream and downstream
Damage to aquatic organisms through entrainment and passage through the turbines	Reservoir	Instillation of fish screens before water intake to reduce rate of entrainment by fish.	Fish deaths caused by entrainment will be reduced.	During initial operation, inspection of materials removed from fish screens will be done to determine the success of the management measure. The results this management programme will determine if additional management measures are required.
Change in available offish habitats for some species	Reservoir	Creation of new habitat (fast-flowing water) for some species; *Rastrineobolaargentae* and *Latesniloticus*, as part of the quarry and river bank restoration.	The project will result in minor changes to the balance between populations of certain fish species upstream and downstream of the dam.	Success of rehabilitation will be monitored

7.3 EFFECTS ON AIR QUALITY

Measurements of airborne particulates, nitrogen dioxide and sulphur dioxide indicate that ambient air pollution levels at the site are relatively low (Section 5.4.4). During construction there will be potential for deterioration in local air quality due to generation of suspended particulates from construction of project roads, blasting, excavation and quarrying, vehicle movements and mechanical handling. These are outlined below.

a) Traffic generated dust

During construction, generation of dust along off-site access routes during importation of construction materials and staff travel is of concern, particularly during the dry season periods of June to August and December to February. Murram or gravel roads can generate large plumes of airborne particulates during dry weather.

b) Dust from other sources

Wind-borne dust emissions depend upon wind speed and turbulence, the physical condition of the surface and size range of the dust present. If the latter factors are constant, then there will be a threshold wind speed at which dust begins to be removed from the surface and entrained in the airflow. For example, threshold wind speeds are 3 to 6 m/s for disturbed soils of less than 50 percent clay and low pebble cover, 6 to 10 m/s for bare clay soils and 20 to 30 m/s for undisturbed sandy soils having a crust or fine gravel cover. However the wind speed rarely exceeds 5.6 m/s and is never above 8.2 m/s. Thus, wind erosion is unlikely to be a significant impact at the site.

Mechanical handling of construction materials such as unloading, loading and the formation of stockpiles or overburden storage mounds provides the energy required to suspend in the atmosphere a proportion of the material having an appropriate particle size range. Aggregate crushing and grading has a high potential for dust

emissions unless the plant is suitably enclosed. Blasting operations release dust emissions, but these are not likely to be significant in the context of emissions from the materials handling processes.

c) Greenhouse gases

Recent research indicates that, in addition to emissions from construction machinery, reservoirs can emit greenhouse gases (GHGs) as a result of decomposition of organic material caught in the impoundment. The World Commission on Dams (2000) report concludes that precise assessments of emissions are important in selecting climate friendly options, and particularly if hydropower projects seek to benefit from any form of carbon credit. Although Uganda is a signatory to the 1992 Convention on Climatic Change, it does not currently have a system of carbon permitting or trading.

Project phase when impact will occur	Construction	Operation
	√	

Impact significance

The likelihood of this impact occurring is ***high.*** Impact severity is ***medium*** considering that there is no large fisheries in the river stretch.

Negative Impact (-)		Impact Likelihood			
		None	**Low**	**Medium**	**High**
Impact Severity	**Negligible**	Negligible	Negligible	Negligible	Negligible
	Low	Negligible	Negligible	Negligible – Minor	Minor
	Medium	Negligible	Minor	Minor - Moderate	Moderate
	High	Minor	Moderate	Major	Major

Mitigation measures

- Stockpiles of friable material will be grassed in order to prevent erosion (and sediment run-off to the river during wet weather);
- During dry conditions, access roads will be wetted or treated with a biodegradable (e.g. lignin-based) road sealing product to prevent dust generation;
- Batching plant, conveyors, etc. to be suitably contained to minimise offsite dust;
- Trucks containing friable material will be covered if using public highways; and,
- A maintenance programme for plant and vehicles will be implemented, to ensure emissions of particulates, SO_2 and NO_2 are minimised.

7.4 EFFECTS OF NOISE

During dam construction, regulatory noise levels could temporarily be exceeded due to operation of project traffic and equipment. Project construction traffic will generate noise, exhaust emissions and road dust. Road dust would affect roadside retail shops, markets and dwellings, especially in trading centres. It is also noted that noise impacts will occur during transportation of materials to dam site. All the foregoing are negative impacts and ones associated with dam operation are long-term while construction phase effects are temporary and reversible because they cease upon completion of construction activities. Dam maintenance and traffic is not expected to cause noticeable noise pollution.

Project phase when impact will occur	Construction	Operation
	√	√

Impact significance

The likelihood of this impact occurring is ***high*** if the power dam is constructed. If project vehicles are restricted to a speed limit of 40 km/h through trading centres and communities, impact severity will be ***medium*** and therefore significance is predicted to be ***moderate***.

Negative Impact (-)		Impact Likelihood			
		None	Low	Medium	High
Impact Severity	Negligible	Negligible	Negligible	Negligible	Negligible
	Low	Negligible	Negligible	Negligible – Minor	Minor
	Medium	Negligible	Minor	Minor - Moderate	Moderate
	High	Minor	Moderate	Major	Major

Mitigation measures

- Project vehicles will have a restricted speed limit of 40 km/h through settlements and trading centres to minimise noise.
- Construction workers will be provided appropriate safety gear for protection against excessive noise.
- Noisy equipment like onsite power generators will be sited with regard to the presence of sensitive receptors whenever possible. Acoustic insulation (e.g. screens or bunds) will be used around noisy equipment.
- Regular care and maintenance of vehicles and equipment will be undertaken to ensure emissions of both noise are controlled.

7.5 AESTHETIC

The aesthetics of the Victoria Nile at the dam location will be altered by presence of the power station. Aesthetics of the Victoria Nile upstream of the dam will be changed due to the new reservoir; islands that currently exist in this stretch of the river will be submerged. Flow in the reservoir will be noticeably reduced from that in the existing river. Construction activities and physical presence of the dam on the river will therefore have some impacts on the landscape and visual qualities within the project area. Some scenic rapids, islands and forested river banks will be inundated by the project. However, the main attraction, Kalagala Falls, will not be affected by any project activity.

The lack of outstanding/ exceptional visual qualities in the project area reduces the anticipated impacts of the project..

Project phase when impact will occur	Construction	Operation
	√	√

Impact significance

The ***l***ikelihood of visual impact occurring is ***high*** when the power dam is constructed. Impact severity is considered ***medium*** and significance ***moderate*** since the power dam would be considered by many local communities (except tourists) to be a sign of national economic development.

Negative Impact (-)		Impact Likelihood			
		None	Low	Medium	High
Impact Severity	Negligible	Negligible	Negligible	Negligible	Negligible
	Low	Negligible	Negligible	Negligible – Minor	Minor
	Medium	Negligible	Minor	Minor - Moderate	Moderate
	High	Minor	Moderate	Major	Major

Mitigation measures

- The construction sites will be restored after removal of temporary structures, including workers camps, batching plant, access roads, etc.
- Material source points including rock and sand quarries will as will be restored
- The river banks and protection zone will be planted with grass and some trees, with emphasis on indignous species

7.6 WASTE MANAGEMENT AND IMPACT ON SOIL QUALITY

During dam construction, waste will be generated including packaging waste (paper, polyethene sheets, and wood pallets), metal scrap, wire cuttings, wooden planks, polyethene sheets, PET water bottles and waste oil from construction equipment or vehicles. Waste generation would also occur during closure of workers camp (if contractor will use one), equipment yard and dam decommissioning. Specifically for workers camp and equipment yard, remnant waste and contaminated areas would pose a short to medium-term risk to soil quality. A key likely contaminant is spilt fuel or waste oil from vehicles and motorised equipment such as power generators. Once improperly disposed of, waste could contaminate soil at dam construction sites. Although this impact will commonly be localised to dam site and camp area (if any) if due caution and pollution prevention measures are not considered. Comparatively, lesser waste quantities hence contamination is anticipated during plant maintenance.

Fuel storage and dispensing areas and equipment yard can also be a source of soil contamination during plant construction and decommissioning.

Project phase when impact will occur	Construction	Operation	Decommissioning
	√	√	√

Impact significance

The likelihood of this impact occurring is ***medium*** based on experience with other dam construction projects and when workers are sensitised about responsible litter control practices. Impact severity will be ***medium*** and therefore significance is predicted to be ***minor-moderate***.

Soil contamination will be ***short-term*** only manifesting during construction (and decommissioning) phases of the hydropower facility but ***reversible*** when these activities are completed. Contamination would be ***localised*** in spatial extent, limited to spots where waste is inappropriately dumped or incidental fuel or oil spills occur along access roads or at the storage area.

Negative Impact (-)		Impact Likelihood			
		None	**Low**	**Medium**	**High**
Impact Severity	**Negligible**	Negligible	Negligible	Negligible	Negligible
	Low	Negligible	Negligible	Negligible – Minor	Minor
	Medium	Negligible	Minor	Minor - Moderate	Moderate
	High	Minor	Moderate	Major	Major

Mitigation measures

- The contractor will be required to develop and implement a waste management plan, and Hazardous waste management plan
- A centralized waste collection area will be designated, and approval sought from relevant authorities, including NEMA and the District Local Governments

- Workers will be sensitised about responsible litter control and waste management practices.
- All waste generated at a given construction location will be collected in appropriate containers and disposed of as required by NEMA guidelines.
- Closure of camps and equipment yards will ensure no waste is left behind and contaminated areas on sites are properly remediated.
- Fuel transport and storage facilities will be licensed by the Petroleum Supply Department in MEMD. Such licensure requires use of bunded fuel storage, ensuring measures for spill and fire control.
- Ensure that contractors that handle and transport waste are licensed/ certified waste handlers by NEMA.
- During the construction phase, collection and transportation of waste will be undertaken by licenced firms as per provisions in the national Environment (Waste Management) Regulations of 1999.
- The contractor to ensure fuel storage and dispensing facilities have construction permits and storage and dispensing licences issued by MEMD

7.7 IMPACTS OF BLASTING

Construction activities will require large volumes of aggregate for the dam alignment and powerhouse. The materials will be sought, mined and transported from within the project site or neighbourhood. The use of explosives is expected, with anticipated impacts being noise generation, vibrations, impacts of fly rocks and misfires including injuries and destruction of property, dust emissions, and social disruption, and safety of workers on site.

Impact significance

The likelihood of impacts of rock quarrying occurring are high if no mitigation measures are put in place. The intensity will be high especially during the peak period of excavations and construction works considering the volumes required. The receptors are considered medium sensitive considering there are scattered settlements within the blasting impact zone estimated at 3km, water based activities including fishing, fetching of water for domestic use, boat transport, fish landing sites, and agricultural activities. The impact significance is therefore moderate.

Mitigation measures

- *The EPC contractor will be required to have in place blasting procedures approved by the Supervising Consultant and UEGCL. The procedures should highlight the technology and mitigation measures during blasting, and include:*
    - *Safe storage, transportation and use of explosives to be addressed by the contractor, including relevant permits (for storage, transportation) and licences for import and for blasters as required in the Explosives Act*
    - *The requirement for a baseline: the physical structures within 3km radius will be mapped out and status documented by the EPC Contractor prior to start of blasting activities;*
    - *There should be no houses or developments within a radius of 500m of the blasting area. This zone should be acquired or evacuated prior to blasting;*
    - *The communities and workers should be sensitized on the effects of blasting and actions required on their part during rock blasting;*
    - *A grievance procedure will be established composed of the EPC Contractor, the Supervising Consultant, UEGCL, MEMD and Local Authorities to review and address complaints arising from rock blasting activities;*
    - *Blasting schedules will be communicated in advance to the local communities and leaders*

- *Prior to actual blasting, sirens will be sounded to warn local communities and workers to move to safe areas, and adequate time provided to evacuate.*
- *Site specific procedures for drilling and blasting, including appropriate safety and adjacent structure stability monitoring protocols will be prepared by the EPC Contractor and approved by the appropriate government agency*
- *Provision of appropriate PPE for the workers to prevent exposure to noise due to blasting*
- *Instrumental monitoring of noise, seismic vibrations and air quality (particulate matter) within and outside site to a radius of 2km will be undertaken by the EPC Contractor. The Contractor to ensure adequate resources are in place for this purpose.*

The table below summarizes the Impact of Blasting and how it will be handled during construction

Issue	**Location**	**Mitigation measure**	**Net effect**	**Monitoring/follow up**
Effects of Noise				
Nuisance blasting noise to adjacent receptors	Villages adjoining the construction site, particularly Nampanyi village and Bulangira-Bukose	Implement noise management measures as specified in the EPC Contractor's Action Plan. In addition the following practices may be adhered to: • All internal combustion equipment will have properly functioning silencers or mufflers; • Landowners in the vicinity to be notified about the construction schedule and activities, including blasting, as required; • Noise generating activities that take place near residential or sensitive institutional Receptors will be restricted to the period between 0600 and 2200 h, which is defined as 'daytime' in the Ugandan noise standards; • The EPC Contractor will comply with standards derived	Transitory short-term nuisance noise effects, primarily during daytime	Liaison by the EPC Contractor with adjacent residents and landowners to identify nuisance noise issues and resolve complaints. Instrumental monitoring of noise outside site the site boundary. Monthly Environmental Inspection report to be completed

		from Ugandan national noise standards. If necessary, measures to be taken to reduce noise emissions from the site will include provision of screens or bunds to absorb noise and deflect it away from receptors. A change management process will be used to modify operations, as necessary, to address noise issues. These measures will include identification of the equipment of process(es) causing exceedance of the standard, and proposed abatement options, including: • Relocation of equipment; • Provision of screens, bunds, casings or temporary building to deflect or absorb The EPC Contractor will develop an appropriate blast notification protocol as part of its Blasting Procedure.		Information provided and reviewed after every 12 months.
Effects on air				
Impairment of air quality from nuisance dust	Construction area, transport routes	Short-term, localized effects on air quality, primarily in relation to fugitive dust		Daily inspection by the EPC Contractor of construction areas for excessive nuisance dust. Instrumental monitoring of particulates outside site Boundary. EPC Contractor to maintain records of complaints on air quality, and follow-up corrective

				measures.
Vibration	Villages adjoining the construction site, particularly Nampanyi village and Bulangira-bukose	Design a comprehensive blasting procedure to guide all the blasting processes throughout the project cycle. Community sensitization on the blasting procedure Safe blasting distance ranges, Provision of appropriate PPE for the workers to prevent exposure to noise due to blasting Contractor shall obtain expert services to determine the safe vibration limits unless specified by the regulations. Contractor shall carry out vibration measurements on regular basis and ensure that recommended vibration levels are not exceeded. Contractor shall also submit reports of vibration measurements to the Client within one week of receipt of such test results with his proposals for vibration reduction measures if required.	Throughout project life span, during the day time	Liaison by the EPC Contractor with adjacent residents and Land owners to identify nuisance noise issues and resolve complaints. Instrumental monitoring of noise outside site Boundary. Monthly Environmental Inspection report to be completed
Flying debris	Villages adjoining the construction site, particularly Nampanyi village and bulangira-bukose the	Blasting shall be conducted in a controlled manner in accordance with Ugandan	Throughout the project life span during the day time	Liaison with the EPC contractor, community vigilance, UEGCL/MEMD and other stakeholders

	site and the river media	explosives regulations Adopt controlled blasting techniques where possible to prevent rock chips been sprayed into river area		who might want to use such information.

8 ENVIRONMENTAL MANAGEMENT & MONITORING PLAN

This Chapter presents Construction and Operational Environmental Management Plans developed for the Isimba Hydropower Plant Project. These constitute the primary instrument for management of the Project's environmental performance.

An Environmental Management Plan (EMP) is a stand-alone document which outlines mitigation measures, accountability, monitoring and institutional arrangements for environmental management of the Project. The EMP also provides information on environmental decisions which need to be made during the design, construction and operation phases of the Project. It provides key performance indicators for evaluating efficiency of mitigation and management measures and suggests actions that need to be taken to achieve the desired Project outcomes.

Monitoring is necessary to avoid negative effects during construction and operation of the proposed project and achieve sustained environmental compliance. Details of the recommended environmental monitoring plan (EMMP) are presented in Table 26below. Since social impacts were assessed and documented in a separate study (Social Impact Assessment) focus of the EMP is limited to only environmental impacts.

In the EMP, the proposed timeframe for monitoring every environmental issue or impact is given in the same cell as the individual to collect monitoring information. The estimated cost (for both the monitoring process and corrective measures) is given in the same cell as the proposed method/tool(s) to be used. However, since some of the mitigation measures are to be executed during the construction phase, the contractor will have to incorporate exact cost estimates into the construction financial proposal.

All project personnel have a responsibility for their own environmental performance and compliance with the direction of the EMP and national environmental legislation.

There will be also a need to provide environmental awareness and training to all project personnel and contractor staff. The objective of the environmental awareness and training is to provide personnel working on the Project with:

- An understanding of what their responsibilities are as outlined in the EMP;
- A means of developing a culture of compliance with the Project environmental requirements; and
- A means to improve the environmental awareness of the workforce through the education of Project field personnel.

The management and monitoring actions proposed to avoid or minimise impacts during construction and operation of the Isimba Hydropower Project were identified and detailed in Chapter 7 of this EIA. This chapter presents the framework for implementing the management and monitoring requirements within the framework for an Environmental Management and Monitoring Plan (EMMP) that will be developed for the project.

The EMMP framework presented herein addresses the following key components:

- Environmental management policies and systems;
- Mitigation plans, procedures, and programmes;
- Monitoring activities;
- Implementation schedules and cost estimates; and,
- Plans for integrating the EMMP within the overall development plan for the project.

8.1 ENVIRONMENTAL MANAGEMENT

UEGCL is the implementing agency on behalf of MEMD who is the developer of the project on behalf of GoU, and will have overall responsibility for design and building of the Hydropower Facility and will own and will own and operate the hydropower plant. As Project Sponsor, the ultimate responsibility for the project's compliance with Ugandan and international lender legislation and guidelines for environmental performance will lie with UEGCL. However, day-to-day responsibility for implementing environmental and social mitigation, compensation and monitoring actions will in many cases be devolved to the construction Contractor.

The specific means by which Environmental Management will occur during the construction phase will be finalised upon appointment of the Contractor. However, it is possible to outline UEGCL's planned environmental management team structure, and means for implementing actions by the supervising consultant. It is also possible to outline the general environmental management framework under which the Contractor will be required to operate. While specific methods which are envisaged will be used by the Contractor to carry out its responsibilities may also be provided (and are, below), it must be recognized that specific implementation methods are likely to be modified by the Contractor on appointment. A Change Management System is therefore proposed, by which such changes will be documented and if necessary, input sought from NEMA and international lenders, prior to being implemented. Note that all modifications will require approval from the Supervising Consultant.

The EMP will address both the construction and operational phases of the hydropower facility up to the decommissioning phase. As such, the EMP is intended to be a living document, to be updated and revised as appropriate.

In adopting their environmental policies, both UEGCL and the Contractor will communicate their principles and intentions to each employee, as well as the nature of their individual environmental responsibilities. Where appropriate, staff training will be undertaken to ensure employees' continued environmental performance.

A significant percentage of the unskilled labour force during the construction phase is expected to originate from villages within the project area. The Contractor will implement a Local Training Programme that is intended to provide local unskilled, unemployed persons the skills necessary to be hired to work on the hydropower project. As part of the contract, the EPC contractor is committed to the creation and implementation of programmes to reduce the probability of occurrence of deleterious environmental incidents. Contingency plans will be developed for dealing with such adverse incidents, if they occur.

The EPC Contractor will expect the same level of environmental performance from its agents, suppliers, and sub-contractors and will stipulate this in any legally binding agreements it enters with these parties. These measures will include those specified in the Contract. Thus the Contractor will be under contractual obligation to UEGCL and the Supervising Consultant to implement the aspects of the EMP that apply to it, and to ensure compliance by its own subcontractors. UEGCL and the Contractor will ensure that appropriate corporate resources, personnel and reporting and accountability systems, are in place for the successful implementation of the EMP. They will, on a continuing basis, review the objectives of the EMP as well as the company's success in achieving them. Where objectives are not being achieved, corrective action will be taken. The EMP objectives will also be modified over the life of the project, as appropriate, to reflect changing environmental laws, regulations, standards, and technologies.

8.2 RELATIONSHIP OF THE EMP TO OTHER PROJECT PLANS

The EMP is an umbrella plan that is comprised of several components that are to be integrated and implemented by UEGCL and the Contractor with regard to the Isimba Hydropower Plant. These components are shown in Figure 18.

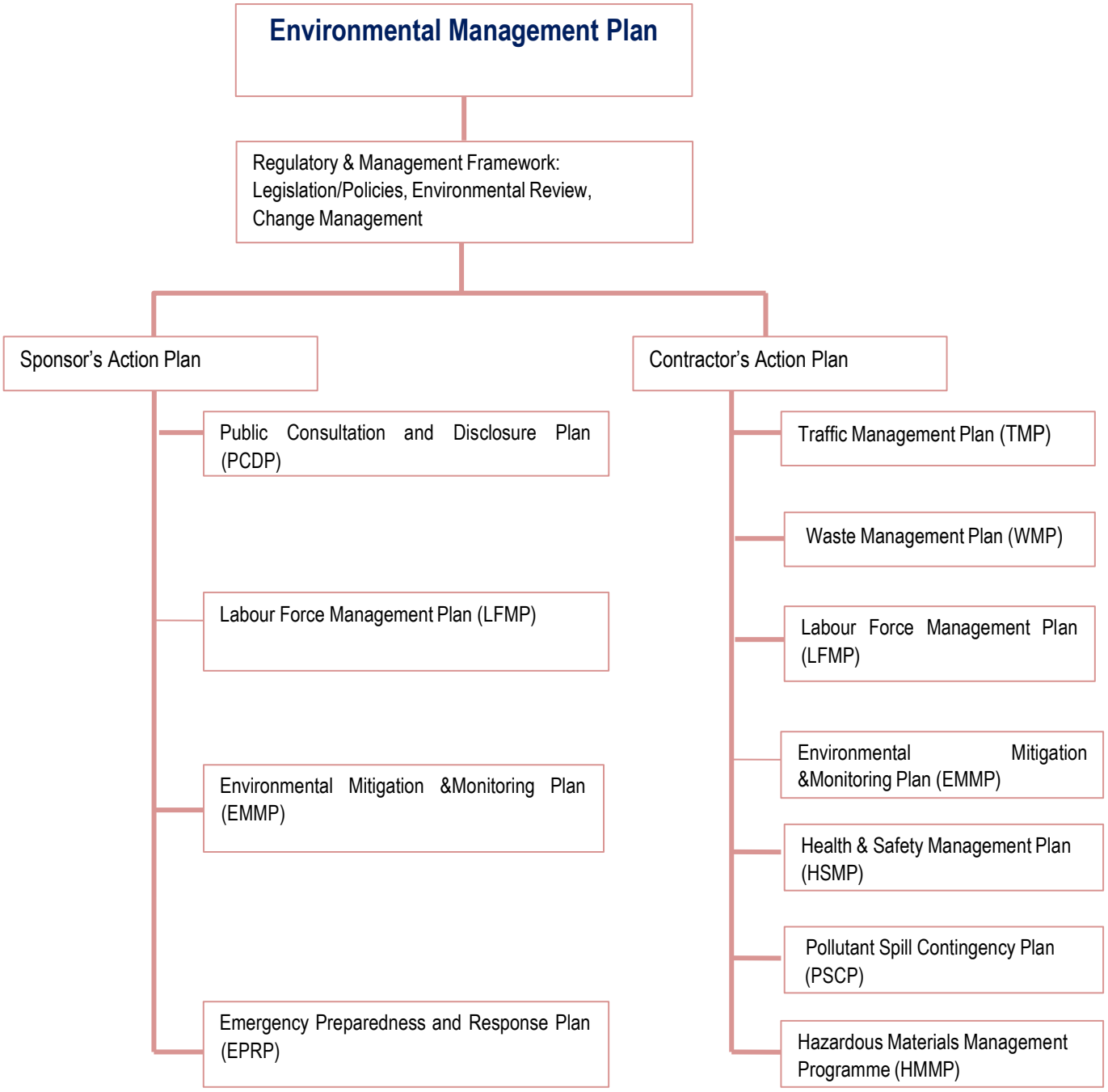

Figure 18: EMP Component Plans

8.3 SPONSOR'S ACTION PLANS

UEGCL will compile a project-specific set of Action Plans, outlining the company's undertakings in its capacity as project sponsor. These Action Plans will be completed before mobilisation of the Contractor on site. This section outlines the component Action Plans that have been, or will be, generated.

8.3.1 Regulatory and Management Framework

This introductory section to the EMP will include relevant policies, regulations, procedures arising from government agencies, lender policies and international treaties, such as those outlined in Chapter 2 of this EIA. Thus, it will contain all of the relevant policies and guidelines to be observed to reduce environmental (including social and economic) impacts of the project. It will also set out the proposed Management Framework, which will be based upon this Section 8 of the EIA report.

The Management Framework will include a Change Management process, whereby proposed changes to environmental management procedures are reviewed and assessed prior to being implemented, and a comprehensive register of such changes is kept. Further detail on the Change Management process is provided in Section below.

This section will also include procedures for version control of the document, as individual sections are likely to be amended during the life of the document, and it is important that all copies of the document are up-to-date.

8.3.2 Public Consultation and Disclosure Plan (PCDP)

A PCDP has been developed in order to bring continuity to the consultation and disclosure process. The PCDP and the results generated by it to date have been used to guide the impact assessment and mitigation measures outlined in Chapter 7.

The Contractor will have a role in the consultation and disclosure process during construction, particularly with regard to disclosure of information in relation to construction scheduling, traffic management, public health and safety, and the results of environmental monitoring. Any changes to environmental management procedures arising from the PCDP process will be incorporated into the Sponsor's and/or the Contractor's Action Plan, as appropriate.

8.3.3 Labour Force Management Plan (LFMP)

In order to safeguard workers' rights and implement good practice in relation to labour and working conditions, UEGCL guide the EPC Contractor in developing a Labour Force Management Plan. This will contain the human resource policies and procedures to be put in place, and also the commitments required of the contractor and its sub-contractors in relation to human resource management and compliance with labour standards during the construction phase

The LFMP will contain requirements in relation to policies and procedures on:

- Human resources policy and information provision to workers;
- Respect for collective agreements and provision of reasonable working conditions;
- Freedom of association and collective bargaining;
- Non-discrimination and equal opportunity;
- Retrenchment;
- Grievance mechanisms;
- Child labour and forced labour;
- Health and safety;
- Non-employee workers;
- Supply chains; and,
- Labour standards-related ToR for contractor, and subcontractors, including security personnel.

The LFMP will also include an assessment of risk arising from the deployment of security personnel at its site/s, and methods for training these personnel in appropriate use of force, conduct, and compliance with relevant laws. It will also include a grievance mechanism, which will allow the affected community to express concerns about the security arrangements and the conduct of security personnel. The grievance mechanism will include a mechanism for assessing the credibility of allegations, investigation of credible allegations of unlawful or abusive acts, corrective actions and documentation and (where appropriate) reporting of such incidents.

8.3.4 Emergency Response and Preparedness Plan (EPRP)

UEGCL will prepare an EPRP, which will assess the risks and impacts from project activities, set out the methods for dealing with emergencies arising during both construction and operation, and particularly those with potential

effects on the neighbouring and wider communities, i.e. persons not directly involved with the project. The EPRP will also set out the means by which these measures will be communicated to affected communities in a culturally appropriate manner.

8.3.5 Environmental Mitigation & Monitoring Plan (EMMP)

This plan will comprise the specific mitigation and monitoring actions that will be implemented by UEGCL in order to mitigate the effects of the project on the biophysical environment. As such, the EMMP will include environmental actions related to:

- Groundwater;
- Surface water flows;
- Water quality;
- Habitats;
- Ecosystems;
- Fish stocks and fisheries livelihoods;
- Unplanned but predictable developments such as the influx of workers to the project area;
- Disease vectors; and,
- Seismic/ vibrations.

8.4 CONTRACTOR'S ACTION PLANS

The controlling documents for all of the Contractor's activities (including environmental responsibilities) will be its Action Plans. These Contractor's Action Plans are conceptual, and the EPC contractor develop more detail into a stand-alone Action Plan which will be complementary to the Sponsor's Action Plan, but will form a component of the overall EMP for the project. The Contractor's Action Plan will be comprised of a set of method statements covering all critical construction and environmental management tasks. The key components of the Contractor's Action Plan are outlined in the following sections.

8.4.1 Traffic/Access Management Plan (TMP)

The Contractor will produce a Traffic Management Plan (TMP) that contains appropriate strategies for moving materials and persons to, from and within construction areas, including abnormal loads. It will also contain provisions for management of connection points between site access roads and the main public highways, and for any upgrading work to be carried out. Specific traffic management measures will include, but not be limited to, those provided in Chapter 7 of this EIA Report. The TMP will also specify the procedures for monitoring construction-generated traffic movements, and associated environmental problems.

8.4.2 Waste Management Plan (WMP)

Waste management during construction of the proposed HPP is a responsibility of the contractor, who should develop a Waste Management Plan to be the project's guiding document on waste management. The Contractor will develop a Waste Management Plan (WMP) for dealing with construction waste specifying provisions for disposal, re-use or recycling of solid waste, hazardous waste, foul and process water. Specific waste management measures will include, but not be limited to, those provided in Chapter 7 of this EIA Report.

8.4.3 Pollutant Spill Contingency Plan (PSCP)

The Contractor will produce a Pollutant Spill Contingency Plan, which will set out the procedures for proper handling of potential pollutants and procedures to be taken in the event of a pollutant spill. It will also specify equipment procurement and training of construction personnel. Specific pollution management measures will include, but not be limited to, actions provided in Chapter 7 of this EIA Report.

8.4.4 Contractor's Labour Force Management Plan

The contractor will ensure that labour standards are respected during the project, as set out in the contractor ToR. Under the contractor LFMP, the contractor will take into account the capacity of sub-contractors to achieve sound labour management in its assessment of potential sub-contractors.

The contractor will ensure a contractual commitment on the part of labour providers to comply with all relevant aspects of Ugandan national labour law, including the establishment of formal employment relationships with labourers, ensuring legal protection on form and frequency of pay, working hours.

Under the Contractor's LFMP, the contractor will:

- Commit, where requested, to provide a copy of employment registers and records including details of hours/overtime worked, wages paid and the employment status of workers, both those employed directly and indirectly;
- Assume primary responsibility for day-to-day monitoring of the implementation of labour standards requirements placed by project financiers on the Project
- Proposer (UEGCL) and thereby designate a manager who is responsible for ensuring labour and health and safety legislation is complied with, both in the direct and indirectly employed workforce (namely, sub-contracted labour);
- Provide or ensure that training is carried out on health and safety issues with regard to all workers, direct and indirectly employed;
- Put in place a mechanism for checking the age of workers;
- Carry out risk assessments in relation to all employees who are under the age of 18;
- Put in place a worker grievance mechanism and details of any complaints lodged under the procedure in the last year;
- Undertake to inform UEGCL and thereafter the project financiers of all serious accidents that take place in relation to the project; and,
- Provide UEGCL and thereafter the project financiers with sample copies of payslips for direct and sub-contracted workers indicating payment of wages and social security contributions.

8.4.5 Hazardous Materials Management Programme

A Hazardous Materials Management Programme will be prepared to comply with the Ugandan standards and relevant IFC and WB Environmental, Health and Safety Guidelines. This will set out the methods for screening the characteristics and threshold quantities of hazardous materials, managing the risks associated with their transportation, storage, use and disposal, and for informing the potentially affected community (if relevant).

8.4.6 Health and Safety Management Plan

A Health and Safety Management plan will be prepared that address all Ugandan Health and Safety Standards, as well as the Health and Safety guidelines of the international lenders (such as the IFC June 2003 Occupational Health & Safety Guidelines), including:

- Workplace noise;
- Workplace air quality;
- Electrical safety in the workplace;
- Working at height;
- Working in confined spaces;
- Handling hazardous substances;
- General workplace health and safety; and,
- Personnel training.

The procedures will include internal incident tracking and a corrective action programme to prevent recurrence of any incidents that may occur. The Contractor will be responsible and accountable for the actions of its company and employees. These responsibilities will be incorporated into the contract documents consistent with the recommendations of the EMP.

8.4.7 Contractor's Environmental Mitigation and Monitoring Plan (EMMP)

Within this plan, the Contractor will specify the 'biophysical' mitigation and monitoring measures to be implemented in relation to construction of the hydropower facility.

The monitoring component of the EMMP will identify:

- Environmental issues;
- Parameters to be monitored;
- Monitoring methodology including locations, equipment, frequency, etc;
- Threshold limits that trigger corrective action;
- Reporting procedures; and,
- Responsibility for monitoring

The Contractor will monitor the parameters set out in the EMMP to ensure that the performance of the Works complies with the threshold limits which trigger intervention, including relevant Ugandan standards (e.g. noise limits) and performance standards of key lender and internal corporate performance standards.

8.5 IMPLEMENTATION OF THE ENVIRONMENTAL ACTION PLAN

This section outlines the commitments of UEGCL and the Contractor in relation to the staff resources, team structures and reporting lines required to implement the EMP. It also outlines the system for internal and external reporting and auditing in relation to environmental matters, and the proposed Change Management system that will be used to assess and manage the environmental impacts of future changes in project scope.

8.5.1 UEGCL's Commitments and Resourcing

In order to discharge its commitments with respect to management of biophysical impacts of the project, UEGCL will designate a suitably qualified Project Manager, with support from a team of Environmental, Social and Helth and Safety specialist staff. This team, working together with the Supervising Consultant will be:

- Point of contact for the Contractor's Site Project Manager and HSE Officer;
- Ensuring that all environmental protection procedures are followed as planned;
- Review and approval of the Environmental components of the Construction Contractor's Project Plan
- Auditing the CEMMP;
- Liaison with members of the public, local organizations and governmental and non-governmental organizations;
- Liaison with other businesses potentially affected by the project; and, Reporting results of mitigation and monitoring activities to NEMA, the lenders and other applicable parties.

UEGCL's Project Manager and Specialist staff involved in HSE Monitoring, together the Supervising Consultant team, will be provided with sufficient support staff and facilities to ensure environmental commitments to be discharged appropriately. The Environmental Manager and his team will be members of the overall Implementation Team for the project. The planned structure for the overall Implementation Team is outlined in figure below.

Biophysical impacts and mitigation activities fall into two broad areas: the construction environment and the operational environment. HSE Officers will be appointed to deal with each of these. Construction environment issues are those short-term issues arising directly from construction activities, e.g. traffic, noise, air quality and waste issues,. The site HSE Officers will be responsible for management of long-term and non-construction related issues

including fisheries and agriculture.

The Social or Community Liaison Officer will be responsible for implementing the ongoing stakeholder engagement and consultation and resultant EMP development requirements during project construction and operation.

8.5.2 Contractor's Commitments and Resourcing

The Contractor will designate an appropriately experienced and qualified Site Health, Safety and Environmental Officers, and Social and Community Liaison Officers, who will be responsible for implementation of the measures set out in the Contractor's EMMP. The key responsibilities will include the following:

- Ensuring that all environmental protection procedures are followed;
- Co-ordination of environmental monitoring of site-related activities required to discharge the Contractor's obligations;
- Liaison with and reporting to Contractor Project Manager, who will in turn report to the UEGCL Project Manager and the Supervising Consultant;
- The monitoring of hazardous substances on-site to ensure that the possibility of accidental release is minimized;
- Ensuring, where appropriate, that monitoring equipment required for the execution of the obligations of the Contractor are calibrated and maintained as required;
- Promoting on-site environmental and safety awareness;
- Liaison with other businesses and industry; and,
- Maintaining an Environmental Management System.

There may be occasions where the Contractor considers that outside bodies are required for specialist monitoring, training or consultation purposes. UEGCL will be responsible for contacting any external parties, while the HSEO shall co-ordinate any site-related monitoring conducted by those outside bodies and all monitoring results provided to the Contractor shall be reported directly to the Project Manager and Supervising Consultant.

The proposed structure of the Contractor's Environmental Department (to be headed by the HSEO) is outlined in Figure 18. The Environmental Field Inspectors will be appointed during the mobilization phase, and will be local staff with relevant environmental/engineering experience, who are fluent in local languages. The number of field inspectors may be adjusted upwards according to the environmental issues on-site.

The HSEO will have overall responsibility for the activities of the Contractor's Environmental department. On a day - to-day basis the emphasis of his work will be upon liaison with UEGCL's and Supervising consultant Team, and with relevant authorities, local residents and NGOs on environmental issues (i.e. external liaison). The responsibility for day-to-day management of the field team will be devolved to the Environmental Field Co-ordinator. The field team will comprise Field Inspectors, supported by drivers and labourers. The Field Inspectors will maintain a permanent presence onsite, carrying out routine checks of operating procedures and environmental monitoring as specified in Chapter 7.

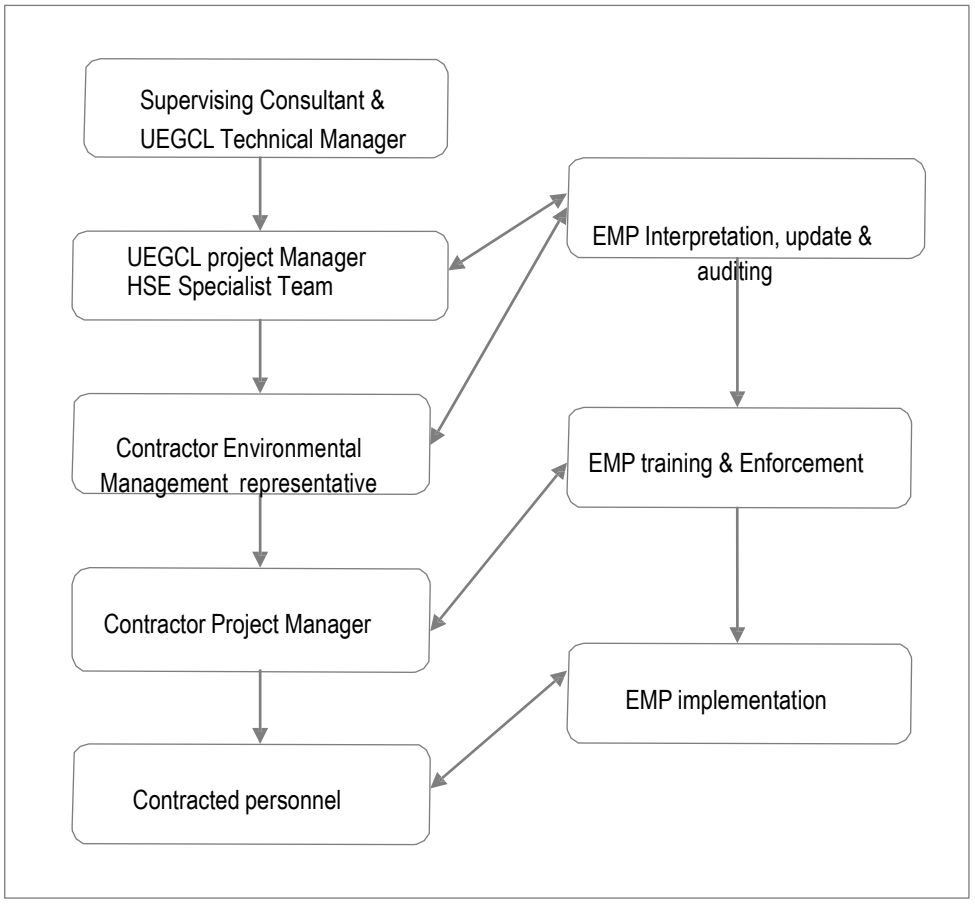

Figure 18: Implementation Team Structure

8.5.3 Reporting Lines and Decision-Making

Reporting the results of environmental monitoring allows the responsible agencies to identify if any mitigation measure is not being effective and will enable corrective action to be taken. During construction, UEGCL will have the ultimate responsibility to ensure environmental reporting procedures are being undertaken.

The monitoring programme described in Chapter 7 and the EMMPs requires recurrent and ad hoc inspections and surveys for different parameters. A set of pro forma report documents will be drawn up and used by the UEGCL and Supervising Consultant HSE Team for recording the findings of these, and if necessary, reporting any exceptions to NEMA and project lenders. These documents may be inspected and/or audited by NEMA and project lenders from time to time, in accordance with the above statute.

On a monthly basis, the Contractor HSEO will provide the UEGCL and the Supervising Consultant with a report containing monitoring results (and a summary of these), a synopsis of environmental issues encountered, and the efficacy of solutions to these issues.

UEGCL and the Supervising Consultant will develop quarterly and annual environmental reports suitable for submission to NEMA (as a requirement of the Ugandan Environmental Impact Assessment Regulations) and to other stakeholders as appropriate. This will provide an opportunity for NEMA and stakeholders to comment both on the impacts of the project itself and the efficacy of the EMP. Where necessary, the EMP will be updated

All monitoring and reporting documents will be kept on file for the life of the project, and will not be disposed of without permission from NEMA.

8.5.4 Environmental Auditing and Reporting

Auditing of the environmental compliance of the project will be carried out at two levels: internal and external. UEGCL will carry out annual internal audits of its compliance with the requirements of the EMP, and any other environmental requirements, such as those imposed by NEMA and/or the international lenders. UEGCL/ MEMD may chose to employ external consultants to undertake annual environmental audits.

External audits of the Contractor's environmental compliance will be carried by UEGCL, and potentially by representatives of NEMA and the international lenders.

It is a requirement of NEMA that annual environmental reports ('self-auditing') be submitted for review. UEGCL together with MEMD will consult with NEMA to determine any additional mitigation measures or monitoring that is considered to be required.

Self-audit reports will be compiled from internal and external audits carried out by both UEGCL and the Contractor. It should be noted that the EIA Regulations and the National Environment (Audit) Regulations require the names and qualifications of persons carrying out 'self-auditing' to be approved by the Executive Director of NEMA, and for these persons to be duly certified by NEMA before commencing work.

In addition to these formal, annual, reports, the Contractor will be required to report quarterly to UEGCL on the implementation of its EMP. UEGCL will use this information and its own to compile quarterly reports for the overall project.

8.5.5 Social and Environmental Oversight

The project will have on-going accountability to, and will be monitored by, both the lenders and NEMA (the latter via the District Environmental Officers for Kayunga, Kamuli and Jinja, and other lead agencies such as MWE through DWRM, DWD and Department of Environment Affairs; Department of Occupational Health and safety; Ministry of Tourism, Wildlife and Antiquities.

To ensure that issues are identified early, and resolved in an equitable fashion, MEMD will engage a Supervising Consultant with competence in design, construction, HSE, hydro-power social impacts and dam safety.

8.6 RESPONSIBILITIES AND COSTS FOR ENVIRONMENTAL MITIGATION MEASURES

Table 23 below outlines the overall package of environmental mitigation measures that will be implemented in relation to the Isimba HPP (as outlined in detail in Chapter 7). The table also assigns general responsibilities for implementing each group of mitigation measures. A detailed implementation schedule will be developed once the Contractor is selected, and it will be submitted as an EIA update.

Table 26: Environmental Management and Monitoring Plan

	Issue to Monitor	Indicator(s)	Data collection and Reporting			Use of data		Training or orientation required
			Who collects ****Timeframe**	**Who checks, Counter-checks**	**Method(s), Tools** ****Cost (UgShs)**	**Who acts,** ****Action**	**Referral (if action cannot be taken)**	
1	LEVEL OF OCCUPATIONAL SAFETY OF CONSTRUCTION WORKERS	Provision of personal protective gear to workers throughout the construction period Presence of First Aid Kits on site throughout the construction period	Site Supervisor **Throughout construction period	Site engineer UEGCL's site agent	Visual observation **Protective gear – USD 65,000 **First Aid Kits – UDS 20,000 **Fire extinguishers – USD 45,000	Site engineer ** Ensure stringent construction supervision. ** Provide personal protection gear	Contractor's Project Manager UEGCL's Project Manager	Importance and effective use of protective gear Use of First-Aid Kit
2	EXCESSIVE STRIPPING OF VEGETATION ALONG T/LINE ROUTE, CANAL, PENSTOCK, ACCESS ROADS AND POWERHOUSE SITES	Wide areas stripped of vegetation on site Dust plumes from cleared areas	Site Supervisor **During site preparation	Site Engineer UEGCL's site agent NFA, NEMA, District Environment Officer (DEO)	Visual observation. **Facilitation – USD 80,000	Site engineer ** Ensure that only areas to be constructed on are stripped of vegetative cover	UEGCL's Project Manager District Environment Officer	Provide key site personnel with mitigation measures of this EIA report
3	RESPONSIBLE CONSTRUCTION	Improper construction waste management practices observed on	Site foremen	Site supervisor	Visual Inspection	Site Engineer	UEGCL's site agent/	Possible problems of improper waste

	Issue to Monitor	Indicator(s)	Data collection and Reporting			Use of data		Training or orientation required
			Who collects ****Timeframe**	**Who checks, Counter-checks**	**Method(s), Tools** ****Cost (UgShs)**	**Who acts,** ****Action**	**Referral (if action cannot be taken)**	
	WASTE MANAGEMENT	site throughout construction of the power station. Containers for construction waste collection provided.	**Throughout construction period.	NEMA, District Environment Officers (DEO).	**Provided for in above monthly monitoring cost for 5 years, Facilitation – USD 100,000	** Provide containers for construction waste collection and storage.	supervising engineer.	management. Costs incurred from wasted material.
4	WATER CONTAMINATION	Excessive deposition of gravel in swamp at tower foundation sites. Waste dumped in watercourses.	Site supervisor **Throughout the construction period.	Site Engineer NEMA, District Environment Officer (DEO), Wetlands Management Department (WMD). WRMD	Visual inspection **Facilitation – USD 100,000 for 5 year's monitoring by WMD of T/line and proposed hydropower facility along the river and through swamps.	Contractor ** Minimise deposition of gravel, limiting quantities to the bare necessary.	UEGCL's Project Manager.	--

	Issue to Monitor	Indicator(s)	Data collection and Reporting			Use of data		Training or orientation required
			Who collects ****Timeframe**	**Who checks, Counter-checks**	**Method(s), Tools** ****Cost (UgShs)**	**Who acts,** ****Action**	**Referral (if action cannot be taken)**	
5	WASTE MANAGEMENT DURING MAINTENANCE WORK	All waste is properly collected stored and transported offsite.	UEGCL **Throughout project life.	UEGCL NEMA, District Environment Officer (DEO).	Visual inspection.	UEGCL. **Ensure contractors do not litter sites during maintenance	District Environment Officer.	Importance of proper solid waste management. Methods of waste handling.
6	NOISE AND AIR QUALITY IMPACTS	Community complaints about excessive noise or dust emissions.	Local leaders **Throughout project construction.	Project Manager	Visual observation. Measurement of dust and noise are complainant receptors **USD 40,000: one time purchase of noise meter and dust meter for environmental monitoring and implementation of mitigations.	UEGCL ** Ensure contractor complies with noise and dust control measures in EIA.	--	None
7	KALAGALA OFFSET	Depletion in quality	UEGCL	WRMD	Visual	UEGCL.		None

	Issue to Monitor	Indicator(s)	Data collection and Reporting			Use of data		Training or orientation required
			Who collects **Timeframe	Who checks, Counter-checks	Method(s), Tools **Cost (UgShs)	Who acts, **Action	Referral (if action cannot be taken)	
	AREA	and quantity of water resources in catchment area. Wide areas stripped of vegetation on site Waste dumped in watercourses.	**Throughout project life.	NFA, NEMA, District Environment Officer (DEO)	inspection **Facilitation – USD 400,000 for 5 year's monitoring by WMD of catchment area.	** Support to the Kalagala Offset Management Plan		
	Total cost (USD)				**850,000**			

8.7 RESPONSIBILITIES FOR ENVIRONMENTAL MONITORING MEASURES

Chapter 7 of this EIA Report outlines the monitoring requirements for the project. An Environmental Management and Monitoring Plan (EMMP) will be developed as part of the EMP that details the specific procedures to be carried out. The EMMP will also assign responsibilities for each monitoring activity, and specify the parties who are capable of carrying out the monitoring, on behalf of the responsible body.

It should be noted that, consistent with the strategy of integrating environmental protection and mitigation activities into the Contractor's Scope of Work, the specifications for many of the construction-related monitoring activities were included in the bid package upon which the Contractor is developing its base rates. Therefore it is not possible to present a detailed accounting of all the monies devoted to the project's environmental monitoring activities during the construction phase.

8.8 INSTITUTIONAL STRENGTHENING

This section outlines the framework that UEGCL will adopt for ensuring that the third party institutions that are assigned responsibilities under the EMP have the capacity to discharge these responsibilities.

The approach that will be taken by UEGCL will be guided by the following principles:

- Any capacity to be developed within Ugandan institutions for dealing with or monitoring environmental impacts of the Isimba project should be transferable, such that it can be used in relation to other projects or plans; and,
- Where appropriate, institutional strengthening should be integrated with existing programmes being planned or implemented by the institutions themselves, or by national or international organisations such as NGOs, lenders and aid agencies.

Several governmental agencies at both the local and national levels will be responsible for on-going monitoring of construction and operational conditions and activities. In general, UEGCL will consult with the applicable agencies to establish the extent of each agency's 'in house' capability for managing such activities, and identify any shortfalls.

The general process to be followed to establish institutional strengthening needs is as follows:

- Discuss the mandate and monitoring responsibilities of each agency, and develop a monitoring plan that will include details of procedures, equipment requirements and staff requirements;
- Establish the Agency's 'in house' capability for managing such activities, and identify any shortfalls;
- Develop, in consultation with the Agency, a plan for meeting these shortfalls;
- Assist the Agency to implement a specific capacity building plan, taking into account other capacity building programmes being planned or implemented by government or international organisations; and,
- Monitor the effectiveness of institutional strengthening measures, and carry out any further measures as required.

Preliminary information about the institutional strengthening needs of the key government agencies involved, based on preliminary consultations during the SEA process, is outlined below.

8.8.1 District Environmental Offices

DEOs in Kayunga and Kamuli reported that they have sufficiently qualified senior staff to deal with environmental aspects of the project. However, as considerable field visits, on-site presenceand consultation with residents may be required during the construction and operation phases, the Contractor will engage its own HSE staf with the DEOs undertaking their mandatory oversight role.

UEGCL will consult further with the DEOs to ascertain their specific needs and capabilities.

8.8.2 Health Centres

Through consultations, AWE has confirmed that the existing health centres in the project affected area of the hydropower plant are inadequate to meet required needs of the communities. The project will have to enhance existing health centres: Busaana Health Centre III and Bukamba Health Centre II in Kayunga District and Kiyunga Health Centre II and Nakandulo Health Centre IV in Kamuli District and Lumuli Health Centre II. Measures proposed to support these centres will be set out in the Community Development Action Plan, which is a component of the EMP. It is also proposed that the contractor provides adequate health services for its employees on site.

8.8.3 National Forestry Authority, NFA

The NFA offices in Kayunga, Kamuli and Jinja have reported that they have adequate numbers and expertise of staff to advise on conservation of forest areas associated with the project specifically the Kalagala Offset area which includes forested islands, Mabira Forest, Kalagala Falls and Nile Bank CFRs. However, the NFA expects the developer to meet the cost of restoring borrow areas, river banks with indigenous vegetation. The cost for these has been incorporated into the cost estimates presented herein.

8.8.4 District Agriculture and Natural Resources Offices

The District Agricultural Officers in Kayunga and Kamuli run extension services covering their respective left and right banks. Of particular importance for the project are the erosion control and catchment management programmes operating in this area that will be able to assist the project. In the longer term, the Department will be able to advise on land restoration, possible use of irrigation, and methods for increasing income-generating activities. An appropriate means for enabling the delivery agricultural extension services would be a Memorandum of Understanding between the District, the sub county, and the project Sponsor.

8.8.5 National Environmental Management Authority, NEMA

NEMA has a dedicated Environmental Impact Assessment group, which has full capability to assess EIAs, and to monitor the compliance of projects with environmental regulations. No strengthening of its capabilities will be required in order to oversee the environmental aspects of Isimba HPP. NEMA will also coordinate quarterly monitoring by an Environmental Monitoring team composed of representative from various lead agencies listed in section 8.5.5 above.

8.8.6 Uganda Wildlife Authority, UWA

The Uganda Wildlife Authority may be required to monitor the effects of the project on wildlife in Kalagala Offset area which includes Kalagala and Itanda Falls and associated waters and islands, Mabira Forest, Kalagala Falls and Nile Bank CFRs. UWA has sufficient capacity to carry out these tasks. However, the client will consult further with UWA to ascertain the exact capabilities of the UWA to monitor project activities and administer its responsibilities in the Kalagala offset area.

9 ANALYSIS OF PROJECT ALTERNATIVES

9.1 INTRODUCTION

The purpose of this chapter is to present and compare the different alternatives that have been considered for the layout of the Isimba HPP. The analysis concludes with selection of the most favourable alternative, which is then described in detail.

9.2 ALTERNATIVE DAM SITE LOCATIONS

The position of the Simba Falls, as given in the Master Plan by Kennedy & Donkin, was used to locate the potential project site. Having in mind the position of the Kalagala Falls as upstream boundary and location of the Kyoga Lake as downstream boundary it was quite straight forward to conclude that the range of possible locations for the development of the Isimba HPP is quite limited.

Investigation of the morphology of the Victoria Nile showed that most of the water head is concentrated in the first several kilometres downstream of the Kalagala Falls. Nevertheless, up to the location of the Simba Falls, it is estimated that the river has an approximate slope of0.05%. Having in mind very limited total head available between the Kalagala Falls and Kyoga Lake, it is concluded to consider the location of the Simba Falls as the most upstream feasible location for the Isimba HPP and investigate further possibilities at the locations downstream of the Simba Falls.

On the other hand, some 9km downstream of the Simba Falls, upstream of the gauging station Mbulamuti, it is observed that the river section widens significantly. Having in mind increase in economic costs caused by larger amounts of material for the closure of the wider river sections as well as correspondingly higher costs for the river diversion in contrary to the very limited additional water head from this section up to the Kyoga Lake, the Mbulamuti section is adopted as the most downstream feasible location.

Finally in the river reach of about 9km between the Simba Falls and Mbulamuti section, four alternative locations for the river closure (dam) have been identified. Due to very small river slope as well as very gentle morphology of the area, the alternatives with the separated location of the dam and powerhouse for the purpose of the creation of additional water head on turbines have not been considered. Furthermore it is considered that the power plant embedded in the dam structure is most probably the most economical option. This is supported by the generally good geological conditions that should provide for the foundation of such structure within the river bed.

Four identified alternative dam locations: D1, D2, D3, D4 that offer some advantages for the development of the HPP are given in the Figure 20 below. More detailed positions as well as the cross sections for each dam location are given in Annex 5 of the feasibility study for the development of Isimba HPP and associated transmission line and sub-station, Volume II a, hydropower plant main report. The sites D1 to D4 are numbered from upstream towards downstream.

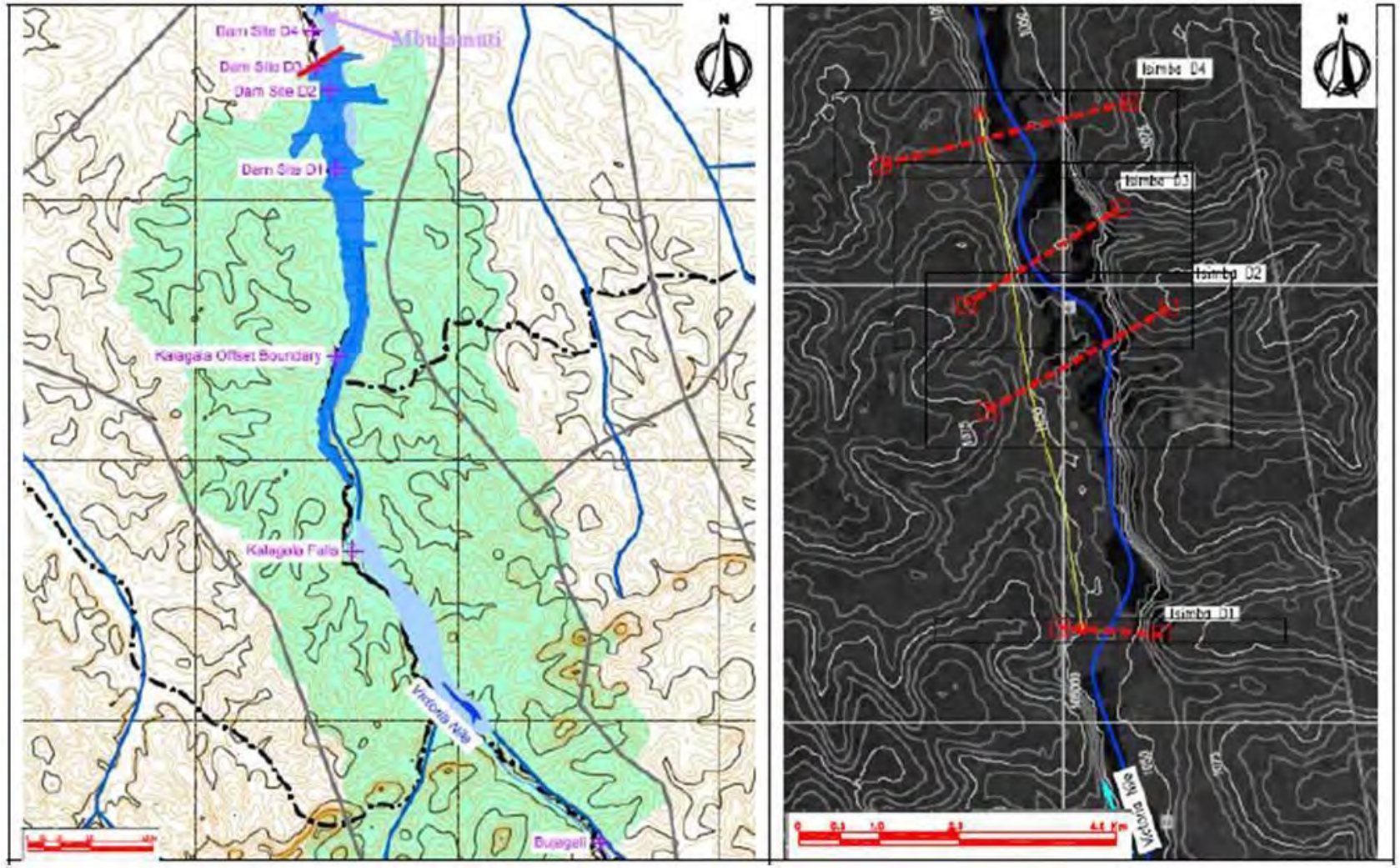

Figure 20 The four alternative dam locations: D1, D2, D3, D4

9.3 RANKING OF ALTERNATIVES ACCORDING TO INDIVIDUAL CRITERIA

9.3.1 Geological Criteria

Anticipated suitability for the development of the hydro power project and construction of hydraulic structures at alternative dam site locations has been evaluated on basis of existing information and data/ observations made during site visits. For each issue/subject and alternative a score has been assigned according to the table below. Our general impression of the geology is that all dam sites are feasible from a geological point of view.

Table 27: Ranking scores assigned to anticipated geological suitability/impacts

-4	-3	-2	-1	0	1	2	3	4
Very large negative	Large negative	Moderate negative	Low negative	Insignificant	Low Positive	Moderate Positive	Large Positive	Very large positive

The main geological parameters of importance for the HPP development are then evaluated as follows.

Table 28: Anticipated magnitude and ranking of impacts at each site alternative

Geological conditions	Site			
	D1	D2	D3	D4
Foundation conditions in river	2	2	3	2
Foundation conditions at left abutment	2	2	2	1
Foundation conditions at right abutment	2	2	1	2
Characteristic of basic geological features (consistent or variable)	2	1	2	2
Orientation and direction of basic geological features (suitable or not)	-1	1	1	1
Permeability characteristics	-1	-1	1	1
Rock availability as construction material	0	0	0	0
Width of river channel	1	-1	-1	-2
Availability of islands for coffering	2	1	2	1
Overall ranking	**9**	**7**	**11**	**6**

As it can be seen from the above Table 28 the general geological conditions at all four site are quite similar and any of the alternatives seems suitable for the development of HPP. Nevertheless, alternative site D3 is slightly better than the others. This is mainly due to the general impression of solid rock foundation in the river and at the abutments as well as due to the existence of consistent amphibolite with closed joints and no dominant direction of the structures in rock mass. In addition, since for all 4 sites the same rock quarry is assumed as the most suitable material source and there is general prevalence of the clay material in the area, there are no significant differences between the sites from this point of view.

Finally, in addition to the overall ranking of the alternatives, in order to be able to compare different criteria such as environmental, geological and power production or economic costs between each other, the achieved ranking has been converted into the “scores”. Score presents the performance of some alternative on a scale from 0 to 100 percent for selected criteria as discussed below

9.3.2 Socio-environmental Criteria

Anticipated magnitude of impacts on human, biological and physical environment has been evaluated on basis of existing information and data/ observations made during site visits (including informal consultations with project affected people). For each issue/subject and alternative a score has been as shown in Table 29.

Table 29: Ranking scores assigned to magnitude of impacts

-4	-3	-2	-1	0	1	2	3	4
Very large negative	large negative	Moderate negative	Low negative	Insignificant	Low Positive	Moderate Positive	Large Positive	Very large positive

For each site, socio-environmental scoring is shown in *Table 30*.

Table 30: Anticipated magnitude and ranking of impacts at each site alternative

Socio-environmental impact	Site			
	D1	D2	D3	D4
Land take	-2	-3	-3	-4
Impact on physical cultural resources/ cultural heritage	-1	-1	-1	-2
Terrestrial flora	-1	-1	-1	-1
Terrestrial fauna	-1	-1	-1	-1
Fish	-3	-2	-2	-1
Protected areas	0	0	0	0
Tourism impacts	-2	-2	-2	-2
Visual impact	-1	-1.5	-1.5	-2
Water quality	-1	-1.5	-1.5	-2
Erosion and landslide risk	-1	-1.5	-1.5	-2
Overall ranking	**-13**	**-14.5**	**-14.5**	**-17**

From impact ranking, it is apparent that site D4has the most negative socio-environmental impact (score -17) and therefore least favorable. Based on ranking presented above, site D1 is most ideal dam location (score -13) ranking better than D2 and D3 which appear to equal magnitude of impacts.

9.3.3 Economic Evaluation

Based on the above given preliminary project dimensions and estimated total project costs at each alternative dam site location, preliminary economical parameters are obtained. For each parameter a score has been assigned according to *Table 31*.

Table 31: Ranking scores assigned to magnitude of impacts

-4	-3	-2	-1	0	1	2	3	4
Very large negative	large negative	Moderate negative	Low negative	Insignificant	Low Positive	Moderate Positive	Large Positive	Very large positive

Based on the above ranking the parameters of importance for the power production and economic costs of the project are evaluated as follows.

Table 32: Anticipated magnitude and ranking of impacts at each site alternative

Power production and economic cost	Site			
	D1	D2	D3	D4
Hydrological input and reservoir area	-1	0	0	1
Annual power production	0	1	2	3
Total cost	0	-2	-1	-3
Generation cost / internal rate of return	2	0	3	1
Overall ranking	**1**	**-1**	**4**	**2**

As it can be seen the alternative D3 ranked the best according to the combined evaluation of power production and economic criteria. Although it does not provide the most energy, the ratio between the benefits from the power production and the costs in the development of the HPP is the best for this alternative.

Notwithstanding the above it has to be recognised, that the sole purpose of these analyses was comparison of the alternative dam locations between each other. Therefore, only the relative relationship between different alternatives is important. It is considered that the accuracy of the here used data is sufficient for the here done

comparison. Nevertheless, above given on power production and economic costs are subject to be changed during further course of the study.

9.4 OVERALL EVALUATION OF ALTERNATIVE DAM SITES

9.4.1 General

In the following paragraphs the main findings about the identified dam site alternatives are summarized and final recommendation for the selection of one alternative site is made. This recommendation is based on the above given individual assessment of the performance of the each site alternatives that is in the following combined into an overall assessment using the multi criteria evaluation techniques.

9.4.2 Analysis of the Alternative Dam Sites

Since all dam sites are located within some 5km there is no significant differences between the sites according to the hydrological or sedimentation input. The main difference from this point of view is available water head. Nevertheless, since the differences in water head are relatively small, the capacity of each alternative in terms of energy production is mainly limited with the available river discharges.

In general there are no geological observations which strongly favour or disfavour any of the proposed dam axes. Except for distinct weakness-zones / faults, the rock mass is generally slightly weathered, and exposes sound and strong quality. Orientation of jointing relative to dam axes could differentiate on the permeability across dam axes for different localities, but it is premature to conclude on this based on the preliminary investigations. Nevertheless, the site D3 left slightly better impression than the other three sites.

From the environmental point of view the distinctions between the sites are also not very large. Nevertheless, the largest negative socio-environmental impacts are allocated to the siteD4 and the smallest to the D1. Sites D2 and D3 ranged the same, in the middle between the previous two. This is mainly based on the extent of the inundated area and corresponding effects on the environmental and socio impacts. As far as the flora and fauna are concerned as well as cultural and heritage values no major problem for the development of the HPP at any of the sites are identified.

Finally, the alternative sites have been compared in terms of the power production possibilities and economic costs. For the identification of the available head for power production, maximum reservoir elevation and the same maximum discharge as for Bujagali HPP were assumed.

Due to the highest available head the alternative D4 ranked as the best in terms of overall power production. On the other side, quite wide river cross section at this site reflected in relatively high economic costs that largely hindered this alternative. In terms of the specific beneficial value considering the possibly obtained benefits in comparison to the invested costs, the alternative D3 preformed the best. This alternative provides more power production then the alternatives D1 and D2 with comparatively smaller additional investment costs.

As it can be seen from above alternative D3 scores the best in two of three predefined criteria, namely power production/economic costs and geological/morphological.

9.4.3 Identification of Alternative Reservoir Elevations

Considering the above illustrated interference following three alternative solutions for the reservoir levels are identified:

- Reservoir restricted up to the first rapid downstream of Kalagala Falls (Level at 1055 m ASL)
- Reservoir restricted up to the northern border of the Nile Bank Central Forest Reserve (Level at 1048 m ASL)
- Reservoir restricted up to the northern border of Kalagala Offset Area (Level at 1043 m ASL)

Each of the above alternatives is graphically presented in Figure 21. It is to be noted that here given levels are the maximum reservoir levels for the maximum probable flood. Furthermore, none of the alternatives endangers the high environmental and socio value of the Kalagala Falls as well as its potential for possible further development of the hydro power.

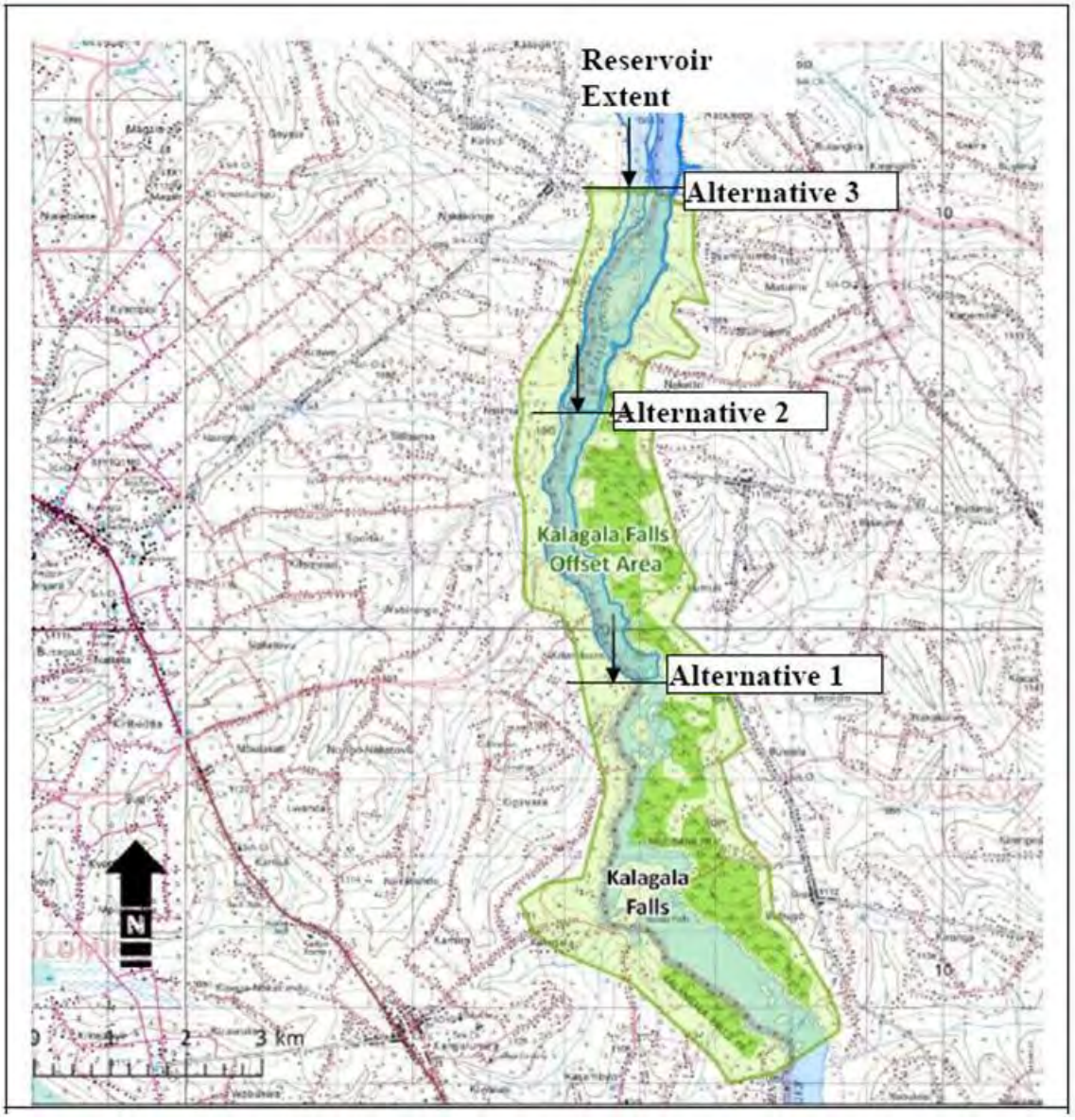

Figure 21: Reservoir level alternatives

As already said, with Alternative 1 the reservoir would be limited to the first rapids downstream of the Kalagala Falls that is about 2 km downstream from the Kalagala Falls itself. This corresponds to the existing power development documentation. With Alternative 2 the reservoir would be restricted up to the northern border of the Nile Bank Central Forest Reserve. The boundaries of the Nile Bank CFR are defined on Page 29 of the Kalagala Offset Sustainable Management Plan (2010-2019) as at 0°35' and 0°40' North and 33°00' and 33°02' East. Therefore the reservoir ends about 7 km downstream airline of the Kalagala Falls.

With Alternative 3 the reservoir would be restricted up to the northern border of Kalagala Offset Area as approximately given in the Map of the Kalagala Offset Area from the Indemnity Agreement. The reservoir ends about 10km downstream airline of the Kalagala Falls. In the following, the feasibility in terms of power production, economic viability and socio-environmental impacts of the above identified alternatives will be given. Having in

mind that the techno-economical evaluation of any alternative have to be done for a very specific costs, such as costs of land acquisition, equipment costs, construction costs, and that the socio and environmental impacts request for even more complex evaluation of the impacts at the site, the aim and scope of the work here was restricted as to provide for the relative comparison among identified alternatives. These evaluations are based on the available data as well as on the Consultants experience from other similar project but are not meant to be used for any other purpose than above stated.

9.5 RESULTS OF THE EVALUATION OF ALTERNATIVE RESERVOIR LEVELS (1, 2 AND 3)

9.5.1 Economic Analysis

Based on the evaluation of potential reservoir level alternatives according to the technical, socio-economic and environmental criteria, an overall assessment of the best compromise solution is made in the following. Firstly an economic evaluation of the alternatives based on the evaluation of all projects costs and benefits reduced to the net present value is done and one alternative is recommended. In order to include the environmental and social impacts into this analysis, where possible, monetary values are assigned to the impacts as well. The results of the calculations are shown in the tables below. Table 33 shows the results of the evaluation where the alternative generation is assumed to be thermal generation based on imported fuel (HFO) while Table 34 shows the results of the evaluation where the alternative generation is assumed to be hydropower.

Table 33: Results of the economic evaluation (alternative generation based on imported fuel)

	Alt 2 versus Alt 3	Alt 1 versus Alt 2	Alt 1 versus Alt 3
NPV (10%) USD million	267	398	680
EIRR	43.5	45.5	44.9
Benefit/Cost ratio (10%)	3	3.5	3.5

In the case where lost generation from a smaller development of Isimba HPP is compared to thermal generation based on imported fuel (HFO) Alternative 2 gives far better economic merits than Alternative 3. The net present value (NPV) is USD 267 million (at 10 % discount rate) and the economic internal rate of return (EIRR) is 43.5 %.The benefit-cost ratio is calculated to be 3.0.

Alternative 1 gives also far better economic merits than Alternative 2, as the value of increased power generation outweighs the costs in form of increased investments and lost income from tourism. The net present value is in this case calculated to USD 398 million (at 10 % discount rate) and the economic internal rate of return to 45.5 percent. The benefit-cost ratio is calculated to be 3.5.

When comparing Alternative 1 to Alternative 3 the net present value is USD 680 million (at 10 % discount rate) and the economic internal rate of return almost 45 percent. The benefit-cost ratio is calculated to be 3.5.

Table 34: Results of the economic evaluation (alternative hydropower generation)

	Alt 2 versus Alt 3	Alt 1 versus Alt 2	Alt 1 versus Alt 3
NPV (10%) USD million	28	62	106
EIRR	16.1	19.3	18.7
Benefit/Cost ratio (10%)	1.2	1.4	1.3

Also in the case where lost generation from a smaller development of Isimba HPP is compared to alternative hydropower generation has Alternative 2 better economic merits than Alternative 3. The net present value is in this case calculated to USD 28 million (at 10 %discount rate) and the economic internal rate of return to 16 percent. The benefit-cost ratio is calculated to be 1.2.

When comparing Alternative 1 to Alternative 2, the higher power generation more than outweighs the costs in form of higher investment costs and lost income from tourism. The net present value is in this case USD 62

million (at 10 % discount rate) and the economic internal rate of return 19 percent. The benefit-cost ratio is calculated to be 1.4.

When comparing Alternative 1 to Alternative 3 the much higher power generation more than pays for the increased costs of Alternative 1. The net present value is in this case USD 106million (at 10 % discount rate) and the economic internal rate of return almost 19 percent. The benefit-cost ratio is calculated to be 1.3. Based on economic evaluation Alternative 1 is a better choice for development than Alternative 2 and Alternative 3.

9.5.2 Environmental criteria

As next criteria the environmental impacts are evaluated as well. Only the impacts in which important differences are identified in the previous chapter are analysed here. The results are summarized in the Table 35. Important to note is that only the parameters for which an important difference in impacts of the reservoir alternatives has been previously identified are selected and evaluated here.

Table 35: Environmental evaluation of alternative reservoir elevations

Socio-environmental impact	Site		
	Alternative 1	Alternative 2	Alternative 3
Landscape / visual impact	-2	-1	0
Terrestrial flora and fauna	-1	-1	0
Fish and bird species	-1	0	0
Protected areas	-2	-1	0
Overall ranking	**-6**	**-3**	**0**

As it can be seen, according to the environmental criteria Alternative 3 clearly prevails over the other two. This is to be expected due to its much smaller reservoir and inundation area. Nevertheless, it is important to note that there were no environmental factors identified that would exclude any of the alternatives.

9.5.3 Socio-economic criteria

The evaluation of the annual energy generation, investment costs, costs of alternative energy production as well as costs of displaced households, loss of land and loss of tourism income have been brought here to a common numerical values (using ranking method). These are presented in Table 36.

Table 36: Socio-economic evaluation of alternative reservoir elevations

Socio-environmental impact	Site		
	Alternative 1	Alternative 2	Alternative 3
Annual energy generation	4	0	-4
Investment cost	-2	-1	0
Cost of alternative energy generation	4	0	-4
Cost of displaced households	-3	-2	-1
Cost of land take	-3	-2	-1
Loss of tourism revenue	-3	-2	0
Fisheries	2	1	0
Overall ranking	**-1**	**-6**	**-10**

It can be seen that in overall performance Alternative 1 still prevail over Alternatives 2 and 3.This is simply due to the important benefits of the energy production and prevention of currently high costs on alternative energy generation. In comparison with the loss of land for households, agriculture and tourism income on the national scale the above two are still much more important. It can be concluded that in the weighted score Alternative 1 scores highest and is be preferred option.

10 DECOMMISSIONING

At end of the useful life of the project (probably 50-60 years) it would be decommissioned based on prevailing technologies and regulatory requirements which are not known with certainty at this point. It is also noted that catastrophic failure, such as caused by a major earthquake, could necessitate earlier than "end of project life" decommissioning.

Section 50 of the Electricity Act, Cap 145 provides requirements for removal of installations, as follows:

> *50. (1) The licensee shall, on the expiry of the license, remove at his or her own expense and to the satisfaction of the Authority, all installations considered by the Authority as inappropriate for further operations.*
> *(2) The removal of installations under subsection (1) shall be in accordance with the National Environment Act, Cap 153 and any other relevant law.*

Section 51 provides for reporting accidents, stating:

> *51. (1) A licensee shall send to the Authority notice of any accident which has occurred in any part of the licensee's works or transmission lines, together with notice of any loss of life or serious personal injury occasioned by any such accident.*
> *(2) A licensee who fails to send notice to the Authority under subsection (1) as soon as possible after the occurrence of the accident has become known to him or her commits an offence.*

Outline below gives measures and steps to be followed in decommissioning the power plant with the aim to ensure that there is no residual environmental impact.

a) Holding discussions with stakeholders

This should be done to obtain views and expectations about entire process and compliance requirements.

b) Developing a removal and restoration plan

This should detail which project facilities will remain and which will be removed. Ideally this should be undertaken with inclusion of stakeholder views. The plan should provide for removal and transfer of any non-native species from the reservoir.

c) Getting regulatory approval

Approval will be necessary from ERA or electricity regulator of the time for the power plant to be shut down and facilities removed. NEMA or environmental regulator of the time will ensure that all regulatory compliances are fulfilled.

d) Beginning the work

This should start with planning engineering removal of all facilities. Deconstruction drawings should be developed to support the area of potential effect document. A complete walk-through of facilities to determine accessibility and environmental effects is essential before any removal works.

It may be necessary to break the project down into manageable parts, and create a document describing key sensitivities. This "area of potential effect" document should be used as the primary source for description and detail on how the facilities would be removed.

A removal schedule should also be developed. This schedule should coordinate removal activities to allow safe operations.

e) Shutting down the powerhouse

Once plant is shut down and full stream flow was restored, removal of power plant structures should commence.

f) Removing appurtenant structures

Removal of the substation, unless connected to other generation stations or interconnected to another transmission line, should also be part of the decommissioning plan.

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Appendix A: PHYSIO-CHEMICAL WATER RESULTS

NATIONAL WATER AND SEWERAGE CORPORATION
CENTRAL LABORATORY - BUGOLOBI.
P.O.BOX 7053 KAMPALA.
Tel: 257548, 341144. Fax: 256 41 255441
E-Mail: waterquality@nwsc.co.ug

CERTIFICATE OF ANALYSIS

CLIENT: Air Water Earth (AWE)

Serial No: INV/2013/128-1

Sample Source: Water, River Isimba; Isimba Hydro Power Project

Sampled by: Client

Date Sample Received: 21-03-2013

Date of Report: 22-04-2013

Table of Analytical Results

Parameters	Units	Source: Water Point 1	National Standards for potable water.
WS Sample Nr	--	K896/13/C/B	
Temperature	^{o}C	23.9	Not Specified
pH	--	7.56	6.5 – 8.5
Turbidity	NTU	2.0	10.0
Total Suspended Solids	mg/L	0	0.0
Hardness: total as $CaCO_3$	mg/L	56	500
Calcium: Ca^{++}	mg/L	6.4	75
Magnesium: Mg^{++}	mg/L	9.6	50
Total iron	mg/L	0.061	1.0
Ammonia – N	mg/L	0.00	1.0
Nitrate – N	mg/L	0.04	5.0
Nitrite – N	mg/L	0.02	0.2
Chloride: Cl^-	mg/L	1.5	500
Fluoride: F^-	mg/L	0.47	1.5
Sulphate	mg/L	1	200
BOD	mg/L	7.3	Not Specified
COD	mg/L	18	Not Specified
Oil & Grease	mg/L	<1.0	1.0
Chlorophyll-a	µg/L	16	Not Specified
Total coliforms	CFU/100mL	70	10
Faecal coliforms	CFU/100mL	8	0

Remarks:
The sample showed satisfactory physio-chemical characteristics but with less-satisfactory bacteriological properties, which failed to meet the National Standards for potable water quality.

NATIONAL WATER AND SEWERAGE CORPORATION
22 APR 2013
THE CENTRAL LABORATORY

Lance E. Okwerede
PRINCIPAL QC OFFICER

Chritstopher Kanyesigye
QUALITY CONTROL MANAGER

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CENTRAL LABORATORY - BUGOLOBI.
P.O.BOX 7053 KAMPALA.
Tel: 257548, 341144. Fax: 256 41 255441
E-Mail: waterquality@nwsc.co.ug

CERTIFICATE OF ANALYSIS

CLIENT: Air Water Earth (AWE)

Serial No: INV/2013/128-2

Sample Source: Water, River Isimba; Isimba Hydro Power Project

Sampled by: Client

Date Sample Received: 21-03-2013

Date of Report: 22-04-2013

Table of Analytical Results

Parameters	Units	Source: Water Point 2	National Standards for potable water.
WS Sample Nr	--	K897/13/C/B	
Temperature	^{O}C	23.4	Not Specified
pH	--	7.44	6.5 – 8.5
Turbidity	NTU	2.0	10.0
Total Suspended Solids	mg/L	1	0.0
Hardness: total as $CaCO_3$	mg/L	64	500
Calcium: Ca^{++}	mg/L	6.4	75
Magnesium: Mg^{++}	mg/L	11.5	50
Total iron	mg/L	0.119	1.0
Ammonia – N	mg/L	0.00	1.0
Nitrate – N	mg/L	0.04	5.0
Nitrite – N	mg/L	0.03	0.2
Chloride: Cl^-	mg/L	1.0	500
Fluoride: F^-	mg/L	0.36	1.5
Sulphate	mg/L	1	200
BOD	mg/L	4.2	Not Specified
COD	mg/L	18	Not Specified
Oil & Grease	mg/L	<1.0	1.0
Chlorophyll-a	µg/L	19	Not Specified
Total coliforms	CFU/100mL	88	10
Faecal coliforms	CFU/100mL	11	0

Remarks:
The sample showed satisfactory physio-chemical characteristics but with less-satisfactory bacteriological properties, which failed to meet the National Standards for potable water quality.

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THE CENTRAL LABORATORY

Lance E. Okwerede
PRINCIPAL QC OFFICER

Christopher Kanyesigye
QUALITY CONTROL MANAGER

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CENTRAL LABORATORY - BUGOLOBI.
P.O.BOX 7053 KAMPALA.
Tel: 257548, 341144. Fax: 256 41 255441
E-Mail: waterquality@nwsc.co.ug

CERTIFICATE OF ANALYSIS

CLIENT: Air Water Earth (AWE)

Serial No: INV/2013/128-3

Sample Source: Water, River Isimba; Isimba Hydro Power Project

Sampled by: Client

Date Sample Received: 21-03-2013

Date of Report: 22-04-2013

Table of Analytical Results

Parameters	Units	Source: Water Point 3	National Standards for potable water.
WS Sample Nr	--	**K898/13/C/B**	
Temperature	^{o}C	23.7	**Not Specified**
pH	--	7.51	**6.5 – 8.5**
Turbidity	NTU	3.0	**10.0**
Total Suspended Solids	mg/L	1	**0.0**
Hardness: total as $CaCO_3$	mg/L	52	**500**
Calcium: Ca^{++}	mg/L	8.0	**75**
Magnesium: Mg^{++}	mg/L	7.7	**50**
Total iron	mg/L	0.081	**1.0**
Ammonia – N	mg/L	0.00	**1.0**
Nitrate – N	mg/L	0.04	**5.0**
Nitrite – N	mg/L	0.02	**0.2**
Chloride: Cl^{-}	mg/L	1.0	**500**
Fluoride: F^{-}	mg/L	0.44	**1.5**
Sulphate	mg/L	1	**200**
BOD	mg/L	5.4	**Not Specified**
COD	mg/L	15	**Not Specified**
Oil & Grease	mg/L	<1.0	**1.0**
Chlorophyll-a	µg/L	15	**Not Specified**
Total coliforms	CFU/100mL	91	**10**
Faecal coliforms	CFU/100mL	10	**0**

Remarks:
The sample showed satisfactory physio-chemical characteristics but with less-satisfactory bacteriological properties, which failed to meet the National Standards for potable water quality.

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Lance E. Okwerede
PRINCIPAL QC OFFICER

Christopher Kanyesigye
QUALITY CONTROL MANAGER

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NATIONAL WATER AND SEWERAGE CORPORATION

CENTRAL LABORATORY - BUGOLOBI.
P.O.BOX 7053 KAMPALA.
Tel: 257548, 341144. Fax: 256 41 255441
E-Mail: waterquality@nwsc.co.ug

CERTIFICATE OF ANALYSIS

CLIENT: Air Water Earth (AWE)

Serial No: INV/2013/128-4

Sample Source: Water, River Isimba; Isimba Hydro Power Project

Sampled by: Client

Date Sample Received: 21-03-2013

Date of Report: 22-04-2013

Table of Analytical Results

Parameters	Units	Source: Water Point 4	National Standards for potable water.
WS Sample Nr	--	K899/13/C/B	
Temperature	^{O}C	23.3	Not Specified
pH	--	7.47	6.5 – 8.5
Turbidity	NTU	3.8	10.0
Total Suspended Solids	mg/L	1	0.0
Hardness: total as $CaCO_3$	mg/L	56	500
Calcium: Ca^{++}	mg/L	8.0	75
Magnesium: Mg^{++}	mg/L	8.6	50
Total iron	mg/L	0.068	1.0
Ammonia – N	mg/L	0.00	1.0
Nitrate – N	mg/L	0.04	5.0
Nitrite – N	mg/L	0.02	0.2
Chloride: Cl^-	mg/L	0.5	500
Fluoride: F^-	mg/L	0.41	1.5
Sulphate	mg/L	1	200
BOD	mg/L	6.5	Not Specified
COD	mg/L	19	Not Specified
Oil & Grease	mg/L	<1.0	1.0
Chlorophyll-a	µg/L	21	Not Specified
Total coliforms	CFU/100mL	106	10
Faecal coliforms	CFU/100mL	13	0

Remarks:
The sample showed satisfactory physio-chemical characteristics but with less-satisfactory bacteriological properties, which failed to meet the National Standards for potable water quality.

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22 APR 2013
THE CENTRAL LABORATORY

Lance E. Okwerede
PRINCIPAL QC OFFICER

Christopher Kanyesigye
QUALITY CONTROL MANAGER

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NATIONAL WATER AND SEWERAGE CORPORATION

CENTRAL LABORATORY - BUGOLOBI.
P.O.BOX 7053 KAMPALA.
Tel: 257548, 341144. Fax: 256 41 255441
E-Mail: waterquality@nwsc.co.ug

CERTIFICATE OF ANALYSIS

CLIENT: Air Water Earth (AWE)

Serial No: INV/2013/128-5

Sample Source: Water, River Isimba; Isimba Hydro Power Project

Sampled by: Client

Date Sample Received: 21-03-2013

Date of Report: 22-04-2013

Table of Analytical Results

Parameters	Units	Source: Water Point 5	National Standards for potable water.
WS Sample Nr	--	**K900/13/C/B**	
Temperature	^{o}C	23.8	**Not Specified**
pH	--	7.48	**6.5 – 8.5**
Turbidity	NTU	1.8	**10.0**
Total Suspended Solids	mg/L	0	**0.0**
Hardness: total as $CaCO_3$	mg/L	48	**500**
Calcium: Ca^{++}	mg/L	8.0	**75**
Magnesium: Mg^{++}	mg/L	6.7	**50**
Total iron	mg/L	0.075	**1.0**
Ammonia – N	mg/L	0.00	**1.0**
Nitrate – N	mg/L	0.09	**5.0**
Nitrite – N	mg/L	0.06	**0.2**
Chloride: Cl^{-}	mg/L	1.0	**500**
Fluoride: F^{-}	mg/L	0.46	**1.5**
Sulphate	mg/L	1	**200**
BOD	mg/L	8.1	**Not Specified**
COD	mg/L	21	**Not Specified**
Oil & Grease	mg/L	<1.0	**1.0**
Chlorophyll-a	µg/L	20	**Not Specified**
Total coliforms	CFU/100mL	129	**10**
Faecal coliforms	CFU/100mL	19	**0**

Remarks:
The sample showed satisfactory physio-chemical characteristics but with less-satisfactory bacteriological properties, which failed to meet the National Standards for potable water quality.

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THE CENTRAL LABORATORY

Lance E. Okwerede
PRINCIPAL QC OFFICER

Christopher Kanyesigye
QUALITY CONTROL MANAGER

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NATIONAL WATER AND SEWERAGE CORPORATION

CENTRAL LABORATORY - BUGOLOBI.
P.O.BOX 7053 KAMPALA.
Tel: 257548, 341144. Fax: 256 41 255441
E-Mail: waterquality@nwsc.co.ug

CERTIFICATE OF ANALYSIS

CLIENT: Air Water Earth (AWE)

Serial No: INV/2013/128-7

Sample Source: Water, River Isimba; Isimba Hydro Power Project

Sampled by: Client

Date Sample Received: 21-03-2013

Date of Report: 22-04-2013

Table of Analytical Results

Parameters	Units	Source: Kasana Ferry crossing Water point	National Standards for potable water.
WS Sample Nr	--	**K902/13/C/B**	
Temperature	^{o}C	24.0	**Not Specified**
pH	--	7.32	**6.5 – 8.5**
Turbidity	NTU	2.2	**10.0**
Total Suspended Solids	mg/L	1	**0.0**
Hardness: total as $CaCO_3$	mg/L	40	**500**
Calcium: Ca^{++}	mg/L	11.2	**75**
Magnesium: Mg^{++}	mg/L	2.9	**50**
Total iron	mg/L	1.563	**1.0**
Ammonia – N	mg/L	0.00	**1.0**
Nitrate – N	mg/L	0.05	**5.0**
Nitrite – N	mg/L	0.02	**0.2**
Chloride: Cl^{-}	mg/L	1.0	**500**
Fluoride: F^{-}	mg/L	0.48	**1.5**
Sulphate	mg/L	1	**200**
BOD	mg/L	4.7	**Not Specified**
COD	mg/L	16	**Not Specified**
Oil & Grease	mg/L	<1.0	**1.0**
Chlorophyll-a	µg/L	23	**Not Specified**
Total coliforms	CFU/100mL	140	**10**
Faecal coliforms	CFU/100mL	36	**0**

Remarks:
The sample showed satisfactory physio-chemical characteristics but with less-satisfactory bacteriological properties, which failed to meet the National Standards for potable water quality.

NATIONAL WATER AND SEWERAGE CORPORATION
22 APR 2013
THE CENTRAL LABORATORY

Lance E. Okwerede
PRINCIPAL QC OFFICER

Christopher Kanyesigye
QUALITY CONTROL MANAGER

NB: The NWSC certificate of analysis by no means constitutes a permit to any person or undertaking to conduct business

MINISTRY OF ENERGY AND MINERAL DEVELOPMENT

ISIMBA HYDROPOWER PROJECT - STAKEHOLDER WORKSHOP ON THE ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

By

FICHTNER GMBH & CO.KG / NORPLAN / KAGGA / AWE / AES

Date: 13 December 2012

Venue: CRESTED CRANE HOTEL, JINJA

ATTENDANCE LIST

NO.	NAME / ~~ORGANISATION~~	ORGN / DESIGNATION	TELEPHONE CONTACT	EMAIL ADDRESS	SIGNATURE
1.	DIANA KAKWERA	MINISTRY OF TRADE, INDUSTRY & COOPERATIVES	0789923686	dkakwera@mtic.go.ug kakwedia@yahoo.com	
2.	JAMIE SIMPSON	KAYAK THE NILE (U) LTD	0791880322	INFO@KAYAKTHENILE.COM	
3.	OLUKA PETER	NILE RIVER EXPLORERS	0772470314	raff@Raftafrica.com	
4.	EGESA DAVID	KAYAK THE NILE	0782947432	davidkayak@hotmail	
5.	KALISMARTA ASHIRAF	NALUBAALE RAFTING		Will@nalubaaleRafting	
6.	OYAA. N. AWUA.	R.D.C - KAMULI GA.	0782649143	—	
7.	KATUBI LAMMECK	AIR WATER EARTH	0782564[illegible]	mail@[illegible]engineers.com	
8.	Oyen Ben David	Air Water Earth	0772196033	d.oyen@awe-engineers.com	
9.	Faith Mugenya	Air water Earth	0782716542	f.mugenya@awe.engineers.com	
10.	YIGA JOSEPH F	OSHD/MGLSD	0772423390	yjflavian@yahoo.co.uk	

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NO.	NAME / ORGANISATION	ORGN / DESIGNATION	TELEPHONE CONTACT	EMAIL ADDRESS	SIGNATURE
11.	NELLIE BAGGYA	UGANDA MANUFACTURERS ASSOCIATION (UMA)	0782-673797	umaregionaloffice@gmail.com	
12.	ARIHO JULIUS	M&E SPEC.	0782-306100	arijol@yahoo.com	
13.	MAGGA APOLLO	Chairperson LC III Wakisi s/c	0774983300		
14.	SSEWANYANA KIGANDA	DISTRICT BUILDING Comm. Dev't OFFICER	0712887815	Kigandasam@yahoo.co.uk	
15.	Pamela Tasiobya	AWE / Sociologist	0772515917	pkwolekwa@yahoo.com	
16.	Kago Alex Isaac	P.P / Kyabo Burkwe Sub.	0772451932		
17.	Natal Natal	DRIVER	0717100862		
18.	NAHONE RUTH	KAKISI SUBCOUNTY CDO	0752624188	ruthnahone2@yahoo.com	
19.	NYESONIGA MATAYO	LC III c/m BUSATANA	0772868343		
20.	MUBIRU ROBERT	Kayunga HG	0772390529	agasuza@yahoo.com	
21.					

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NO.	~~ORGANISATION~~ NAME	ORGN/DESIGNATION	TELEPHONE CONTACT	EMAIL ADDRESS	SIGNATURE
22.	KIYIMBA ITEMIRY	C.D.O IWAKISI S/C	0783136633	KIAKISI	
23.	SSEKIOLEKO SOLOMON	UTB Research Officer	0782042223	SsekioleksSolomon@yahoo.com	
24.	WAISWA FRED	LAND OFFICER/JINJA	0776633331	Weiswayefe@yahoo.Com	
25.	NAKIRI JAZIRA KYAZZE	ENVIRONMENT OFFICER BUIKWE	0712271728	Njaziro@gmail.com	
26.	MARTIN OKUMU	UNCCI HEAD OF COMM. DEPT.	0750788100 0752626103	communications@chamberuganda.com	
27.	OJAA. N. ANNA	R.D.C- KAJUNGA	0782649143		
28.	OCAMGIU FRANCIS J	UEGCL	0776237749	focamgiu@uegcl.co.ug	
29.	KALISMARTZ ASHIRAF	NALUBALE RAFTING	07826388938	Will@nalubaleRafting.com	
30.	MENE KAGGA	KAGGA	0701-272-460	mene.kagga@kaggapartners.com	
31.	ANNE KOMUGISA	KAGGA & PARTNERS	0712-865036	admin@kaggapartners.com	
32.	SEGANE KENNETH. N.	KAGGA & PARTNERS	0775-449840	Ksegane@yahoo.co.uk	

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NO.	NAME ~~ORGANISATION~~	ORG /DESIGNATION	TELEPHONE CONTACT	EMAIL ADDRESS	SIGNATURE
33.	Leo Mmerewoma	Kamuli - DGDO	0772614540	mmerez@yahoo.com	[signature]
34.	Kateeba Godfrey	Kamuli D-CAO	0772-496926	gkateeba@yahoo.co.uk	[signature]
35.	KINTU JOHN	KAMULI CDO	0753036190		[signature]
36.	KYONDA MOSES	c/p LCIII Kisozi	0772 963127 0752 963127	Kyondamoses12@gmail.com	[signature]
37.	Ogwal Joseph	SPO/SA VETC	0772 605550	joseph.ogwal@...	[signature]
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43.					

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NO.	~~ORGANISATION~~ NAME	ORGN/ DESIGNATION	TELEPHONE CONTACT	EMAIL ADDRESS	SIGNATURE
44.	UEGCL	Environment Officer	0776237749	focanjuo@uegcl.co.ug	
45.	UEGCL	Sen. Specialist	0776240684	mofim@uegcl.co.ug	
46.	UEGCL	Socio logist	0712184026	abwowe@uegcl.co.ug	
47.	OFFICE OF THE PRESIDENT	D - RDC KAMULI	0776766634	elyashmabazi@yahoo.com	
48.	UEGCL	Environment Officer	0712696473	fasiimwe@uegcl.co.ug	
49.	Paul Ferguson	Hairy lemon Island	0752 828 338	hairylemonugandaa@gmail.com	
50.	TIBEIHAKA A.C - NAM	C/P LC3 Bududo S/C	0782417260	tibeivan@yahoo.co.uk	
51.	NAKIRYA LYDIA	CDO/ KAMUNGA	0752202417		
52.	Namisi Faridath	SCDO Kayunga	0782499257	namisiif@gmail.com	
53.	Ocima Geoffrey	DP Planner Kayunga	0774-666-013	ocimageoffrey100@yahoo.com	
54.					

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NO.	NAME ~~ORGANISATION~~	ORGN DESIGNATION	TELEPHONE CONTACT	EMAIL ADDRESS	SIGNATURE
77.	Walusimbi Andrew	Bailiffs of Court	0772436971		
78.	Milando Grace	DE-Kamuli	0725791858	jmilando@yahoo.com	
79.	Isabinye Robert	SEO - Kamuli	0772361135	alupar@yahoo.com	
80.	Herbert Owle	ES-REA	0772620044	howle@rea.or.ug	
81.	TAMUBULA OLIVIA	CAO - JINJA	UTB084399	oliviatamubula@yahoo.com	
82.					
83.					
84.					
85.					
86.					
87.					

Stakeholder consultation record:

Name of agency/stakeholder/community:	KAYUNGA DISTRICT HEAD OFFICE (ADMINISTRATION)				
Purpose of consultation (*tick appropriate box*):	Scoping:		ESIA:	✓	
	Sensitisation:		RAP:	✓	
	Environmental Audit:		Other (specify):		
Date: 13th - Dec - 2012.					
Project name: ISIMBA HYDRO POWER PROJECT					
Proponent:					

	Name of person/ official met:	Designation	Contact (Tel/email)	Sign/ initial
1	LUTALO-KAMYA JAMIL	Sec works/tech Councillor LCS Busaana S/C	0772930620 0755310973	[illegible]
2	SETTI MADINA	Chairperson production Technical services	0772978514	Setti M
3	[illegible]	Dist clerk [illegible]	0773349998	[illegible]
4	Mukonyi Suza[illegible]	District Councillor	0754680882	[illegible]
5	Muwanga Kisalita	" "	0772621357	[illegible]
6	KARA GODFREY M	DISTRICT COUNCILLOR (NAZIGO S/C)	0752582738	[illegible]
7	OYAA N. ALOIA	R.D.C.	0782641143	[illegible]
8	SIMPEWI RAMADHAN	INSPECTOR OF SCHOOLS	0772544468	[illegible]
9	YIGA CHARLES	DISTRICT FISHERIES OFFICER	0772981626	[illegible]
10	Lukande Paul Rogers	District Internal Auditor	0774021617	[illegible]
11	AWI CHAMPLAIN	SIS	0752934281	[illegible]

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Stakeholder consultation record:

Name of agency/stakeholder/community:	KAYUNGA DISTRICT HEAD OFFICE (ADMINISTRATION)				
Purpose of consultation (*tick appropriate box*):	Scoping:	☐		ESIA:	☑
	Sensitisation:	☐		RAP:	☑
	Environmental Audit:	☐		Other (specify):	
Date: 17- Dec - 2012					
Project name: Isimba Hydro Power Project					
Proponent:					

	Name of person/ official met:	Designation	Contact (Tel/email)	Sign/ initial
22	Kagolo Peterson	Subcounty Chief Busaana	0772304443 petersonkagolo2009@yahoo.com	
23	Nyondwa Geoffrey	for CAO County Nazigo	0772844772	
24	Kirene A. Kelly	Kayunga	0782871861	
25	WESONGA MATHYO	LC III C/M KUSAANA	0772883443	
26	SSEBAGGALA HENRY W.	Assistant CAO	0782089639 dsphuet@gmail.com	
27	MABONGA GODFREY	CLERK TO THE COUNCIL	0772601233/0701	
28	Joseph Ocima	DWEP	0772-86v99c	
29	Kigongo David	WBS TV / PRESS	0784108426 / 0702664059	
30	NAKIMULI EDWARDS	DISTRICT C'MAN	0772.668712	
31	NAKIGALANDA ROSE	DISTRICT C'MAN	0776939817	NAKIGALANDA

Name of agency/stakeholder/community:	KAYUNGA DISTRICT HEAD OFFICE (ADMINISTRATION)				
Purpose of consultation (*tick appropriate box*):	**Scoping:**			**ESIA:**	✓
	Sensitisation:			**RAP:**	✓
	Environmental Audit:			**Other (specify):**	
Date:	12th Dec - 2012.				
Project name:	ISIMBA HYDRO POWER PROJECT				
Proponent:					

	Name of person/ official met:	Designation	Contact (Tel/email)	Sign/ initial
✓12.	Dr. David Mugabi	District Prodn officer	0772[0701 453164 dmugabis@gmail.com	
13.	MASAMBU JOHN	DISO KAYUNGA	0772615683	
14.	Ojambo B. Moses	News Reporter cbs	0772662963	
15.	Samuel K Mukasa	District Commercial Officer	0772-460513	
16.	Ouma Geoffrey	District physical planner	0774-666-013.	
17.	SSEBOWA DICKSON	District HR	0782-421790	
18.	Mulumba Nathan	S.A Busana	0772687352	
19.	Kagolo Sarah	Asst Coull	0772937168	S.C.
20.	Nyemanya Godfrey	Sec for production & Natural Resources	0772853164	
21.	BASAHIZA FESTUS	Environment officer	0777-425372	

Stakeholder consultation record:

Name of agency/stakeholder/community: Meeting at Kamuli District Hq					
Purpose of consultation (*tick appropriate box*):	**Scoping:**			**ESIA:**	x
	Sensitisation:	x		**RAP:**	x
	Environmental Audit:			**Other (specify):**	
Date: 30/10/2012					
Project name: Isimba Hydropower Project					
Proponent: M.EMD					

Name of person	TITLE Village name	Contact	Sign/ initial
Kateeba Godfrey	D-CAO - Kamuli DLG.	0772-496926	
Saeed A. Baghoth	DWO, Kamuli DLG	0791606251	
Bamwole Samuel	Ag. District c/person	0782-507710	
Asiimwe Tracksen	RDC - Kamuli	0772895278	
WATEO EPU	Information officer	0712529669	
Mukiibi Moffat	for P.P.O	0751681341	
Mulondo Grace	Ag DE	0772579188	
Banafama Robert	District Planner	0772624995	
Richard Musenero	District Production officer	0772595819	
Gabula Nadiope-A.	Sen. Finance officer	0772665138	
Isabinye Robert	S. environment officer	0772361135	

Stakeholder consultation record:

Name of agency/stakeholder/community:	Meeting at Kamuli Hq				
Purpose of consultation (*tick appropriate box*):	**Scoping:**			**ESIA:**	x
	Sensitisation:	x		**RAP:**	x
	Environmental Audit:			**Other (specify):**	
Date:	30/10/2012				
Project name:	Isimba Hydropower Project				
Proponent:	MoEMD				

Name of person	TITLE / Village name	Contact	Sign/ initial
Leo Muverewone	KDLG	0772614540	mmerezeyahwiera
WEYALE ANDREW	ACAO KDLG	0704783515	
ISANGA JOSEPH	FORESTER KDLG	0752-553340	
BIJJUMBUKE FRED	PHY-PLANNER-KDLG	0752396682	