ENVIRONMENTAL AND SOCIAL IMPACT STATEMENT FOR THE PROPOSED SINDILA MINI HYDROPOWER STATION IN BUNYAMWERA PARISH, SINDILA SUB-COUNTY, BUNDIBUGYO DISTRICT

UPDATED

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ABBREVIATIONS

BoQ	Bill of Quantities
CBD	Convention on Biological Diversity
CMS	Conservation of Migratory Species
DWD	Directorate of Water Development
EIA	Environmental Impact Assessment
EPC	Engineering, Procurement and Construction
BHECL	Butama Hydro Electricity Company Limited
ERA	Electricity Regulatory Authority
ERP	Emergency Response Plan
ES	Environmental Specialist
ESMP	Environmental and Social Management Plan
ESIA	Environmental and Social Impact Assessment
Ga	Giga-year, a measure of time (before the present) used in geology and palaeontology
GDP	Gross Domestic Product
GoU	Government of Uganda
GRP	Glass-fibre Reinforced Plastic
GWh	Giga Watt Hour
HH	Household
HPWR	Hemas Power PLC
HMMP	Hazardous Materials Management Plan
HS&E	Health, Safety and Environment
HSMP	Health and Safety Management Plan
IFC	International Finance Corporation
ILO	International Labour Organisation
IUCN	International Union for Conservation of Nature
kV	Kilo Volt
kWh	Kilo Watt Hour
LC	Local Council
LFMP	Labour Force Management Plan
MEMD	Ministry of Energy and Mineral Development
MSDS	Material Safety Data Sheet
MVA	Mega Volt Ampere
MW	Mega Watt
NEA	National Environmental Act
NEAP	National Environment Action Plan

NEMP	National Environment Management Policy
NFA	National Forestry Authority
O&M	Operation and Maintenance
OSH	Occupational Safety and Health
PAP	Project Affected Person
PCDP	Public Consultation and Disclosure Plan
PIA	Project Impact Area
PMT	Project Management Team
PPE	Personal Protective Equipment
PSCP	Pollutant Spill Contingency Plan
PV	Photo Voltaic
R&D	Research and Development
REA	Rural Electrification Agency
REFIT	Renewable Energy Feed in Tariff
RET	Renewable Energy Technology
SEAP	Social and Environment Action Plan
SHP	Small Hydro Power
SOE	State of Environment
SPPA	Standardised Power Purchase Agreement
TMP	Traffic Management Plan
UEB	Uganda Electricity Board
UETCL	Uganda Electricity Transmission Company Limited
UGX	Ugandan Shilling
US$	US Dollars
UWA	Uganda Wildlife Authority
WMP	Waste Management Plan

FOREWORD

The current report is an update of the ESIA report for the proposed Sindila Mini Hydropower Project (MHP) to be located on River Sindila in Sindila Sub-county, Bundibugyo District, Western Uganda.

The original ESIA report was prepared by OPEP Consult Ltd and submitted to NEMA in 2012 for approval. Although NEMA approved the project on 7th March 2013 (Certificate Number: NEMA/EIA/4395), a potential lender for the project undertook a gap analysis of the ESIA report in line with the lenders environmental and social requirements. The International Finance Corporation (IFC) Performance Standards (PS) were used as the basis for the gap analysis.

Following the analysis, the potential lender identified a number of gaps which were presented in an environmental due diligence report dated 9th June, 2014. It is upon this background, that the project proponent, Butama Hydro Electricity Company Limited, contracted Atacama Consulting, to address the gaps that had been identified.

The focus of the updated ESIA (the current report) therefore, was primarily to address the identified gaps. The integrity of the original ESIA as prepared by OPEP Consult Ltd as submitted to NEMA, remains the same.

EXECUTIVE SUMMARY

Introduction

Projections show that Uganda's electricity demand is expected to triple in the next decade assuming the current economic growth trends continue, paving way for increased investment in the country. Whilst the demand for electricity in the country is growing rapidly, electricity generation by the country's major hydropower plants cannot keep up with the increasing demand for electricity. Therefore, there is need for new sources of electricity to match the growing demand.

In order to alleviate the current energy deficit, Uganda has been embarking on projects geared towards promoting investments in the energy sector. The Uganda Electricity Generation Company Limited (UEGCL), projects that Uganda requires at least 3,800MW of power supply added to the national grid by 2015.

The Government of Uganda (GoU) has taken a policy decision to encourage the private sector to develop and operate small hydropower projects (SHP). Under this policy, SHP plants can be built and operated to serve isolated mini grids operated by the developers themselves or the output of the plants can be fed into the national electricity grid owned and operated by the Uganda Electricity Transmission Company Limited (UETCL). The Ministry of Energy and Mineral Development (MEMD) has also put in place policy initiatives targeted at alternative sources of energy such as wind, geothermal, co-generation and biomass generated electricity. These policy initiatives it is hoped will attract private sector investments as well as help enhance national energy security while contributing to employment and income generation.

In line with the above, Butama Hydro Electricity Company Limited (Ltd) proposes to set up a hydropower facility (Sindila Mini Hydro Power Project) in Sindila Sub-county, Bundibugyo District, Western Uganda with a total capacity of 5.25MW. This facility will utilise the hydropower potential of River Sindila. The power generated from the facility, amounting to approximately 25.9 GWh per year, will be sold to the Ugandan Utility, the UETCL, based on a power purchase agreement (PPA) the company shall enter into with the UETCL.

Project location

The Sindila MHP is to be located in the middle reaches of River Sindila in the villages of Kyebumba, Ntuma and Kabwe in Bunyamwera Parish, Sindila sub-county, Bughendera County in Bundibugyo District (Figure 1). All the civil engineering structures will be located within two Local Council (LC) I areas (Ntuma and Kabwe) of Sindila sub-county. The proposed weir (35N 0833539E, 0063773N) and the headrace channel are to be located in the Ntuma village while the forebay tank, penstock and powerhouse are to be located within the village of Kabwe. The support structures are located in Kyebumba. Table 1 indicates the proposed coordinates of key project infrastructure.

Table 1: Proposed location of key project infrastructure

Project Component	Latitude	Longitude
Weir	833539.47E	63773.152 N
Forebay	833434.94E	64368.22N
Power House	832266E	66336N

Coordinates are in WGS84, UTM 35N

The proposed project site can be accessed via the Kampala-Fort Portal Highway by taking the road to Bundibugyo and then travelling a distance of 25km to the village of Butama, south of Bundibugyo town. The proposed project area extends from 35 N 0833234E to 35N 0834864E and 0066994N to 0065538N.

Project description

The Sindila MHP is a proposed hydropower facility expected to generate 5.25MW of electricity with an annual energy output of 25.9GWh. This will involve harnessing the hydropower potential of the River Sindila at 35N 083549E, 0063788N and discharging the water through a 675m long conveyance system to the forebay tank and thereafter by a 3000m long spiral welded steel penstock pipe to the powerhouse located near River Sindila in Kabwe village. After the power generation, the water will be released back into River Sindila through a tailrace channel of 25m. The distance between the abstraction and release points in the Sindila River is approximately 3.5km.

The power generated at the Sindila MHP will be connected to the National Grid, either through (i) a new 5.7km long 100 AAAC 33kV interconnection line from the Sindila MHP to a new switching station in Busunga and construct another 1km 33kV line from Ndugutu to Sindila. Conversion of the Busunga-Bundibugyo-Fort Portal line to a double circuit 200sqmm AAAC line has also been proposed or, (ii) through a 33kV transmission line to be newly constructed from Nyahuke town (the nearest point of the existing line). The length of the transmission line is 5.7km and it follows along the reservation of the existing District Road from Nyahuke town to Bunyangule via Butama village and then along the proposed powerhouse access road.

The proposed project is in close proximity to a prospective hydropower facility - Ndugutu MHP. Ndugutu MHP is to be located on the left bank of River Ndugutu while Sindila MHP is located on the right bank of the same river both of which fall within Bunyamwera Parish, Sindila sub-county.

In the event that the project development is completed within the near term and there is overlap in construction periods for the projects -- necessary approvals will be obtained. Furthermore, if construction of the projects fall within the community areas, there could be cumulative impacts linked to unidentified effects on communities and habitats. In other words, disturbed conditions observed may have stabilised or returned to normal, but increasing numbers of construction activities undertaken sequentially or with temporal and spatial coincidence may result in cumulative adverse effects. Appropriate mitigation measures will be put in place to handle this scenario in the event it occurs.

Project components

The construction schedule for Sindila MHP is estimated to take about 18 months (540 days), with work beginning immediately following the awarding of the contract

Below are the major components that will form part of the proposed Sindila MHP – a detailed description of which is provided in Section 2.4 of this ESIS:-

- Weir;
- Intake structure;
- Desilting tank and Headrace Channel;
- Penstock pipe;
- Access roads
- Power generation plant;
- Transmission network for the mini hydro power plant; ; and
- Operators Quarters

In addition to the above, the proposed Sindila MHP associated support structures include:-

- Temporary workers' camps/contractor's camp; The construction camp which will accommodate 25 to 30 individuals at maximum design capacity and shall include: Staff quarter buildings including: dormitories, recreational areas, canteens, ablution facilities, washing areas, emergency medical facilities, storage areas, and guard rooms as required; all services for the Contractor's camp, including potable water supply, power supply, waste water treatment (kitchen and washing), sewage treatment (mainly septic tank but this will also be dependent on what is agreeable to the local authorities in the area), surface runoff treatment, and trash collection; Security fences and security personnel; All required Contractor's site offices; Local and long distance communication systems including Internet connection; All required construction plant and equipment parking/storage areas; Workshops for maintenance and repair of plant and equipment; Warehouses for storage of construction

materials and equipment; Diesel/ petrol / lubricants supply and related storage facilities; and Testing facilities;
- Temporary office;
- Employer's permanent accommodation in the main camp area (permanent staff quarters and housing);
- Workshop/stores incorporated in the powerhouse;
- Vehicle/equipment storage and parking yard;
- Stone/murram quarries, borrow pits and sand mining areas.

Access roads

The existing community roads and foot paths connecting Butama trading centre to (the earlier proposed forebay tank) proposed materials storage yard at chainage 1850m and powerhouse will be improved to permit the transport of construction material, machinery and electro mechanical equipment to the site. The footpath starting from Bunyamwera trading centre to the nursery school (35 N 833379E 65121N) will be widened and improved. From that point to chainage 1850m (earlier proposed forebay tank), an access road will be constructed to provide access to the forebay tank. The footpath starting from Butama– Bunyangule road to the proposed powerhouse will also be upgraded.

Construction materials will be carried along the proposed gravel footpath along the Penstock/Canal for construction of the Forebay, De-silt structure and Weir. This is mainly to avoid excessive excavation along steep slope areas. All existing footpaths and routes to be constructed traverse through home gardens, cultivated lands and bare lands. Details of the access roads to be developed are provided in the Table 2 below.

Table 1: Details of the access roads to be upgraded for the Sindila MHP

No	Road description	Length (m)	Road type	Width (m)	Present land use
1	Access Road to Power House	1600	Concrete paved / Rubble Paved/Gravel compacted	3	Gravel Road /Foot Path
2	Access road to Fore bay Tank	1000	Concrete Paved /Gravel compacted	3	Footpath; Bare lands; Cassava, Banana cultivated plots
Total road length		**2,600**			

Project cost and investment plan

The project cost is estimated at US$ 16.5 Million (see Table 3 below). This is proposed to be funded through 70:30 debt proportions. The developer will invest all capital required through financial close. Post-financial close equity will come in the form of preferred equity from Lereko Metier Sustainable Capital (LMSC) and Acumen Fund. Debt will come from either the Overseas Private Investment Corporation (OPIC) or FMO. Therefore, the external debt component of US$ 11.55 Million will be infused by these institutions and international banks. Thus, the proposed equity investment for this project will be approximately US$ 4.95 Million.

Table 3: Proposed equity investment for the Sindila MHP

Source of Finance	Amount (Million US$)	%
Equity	4.95	30

Long term debt	11.55	70
Total	16.5	100

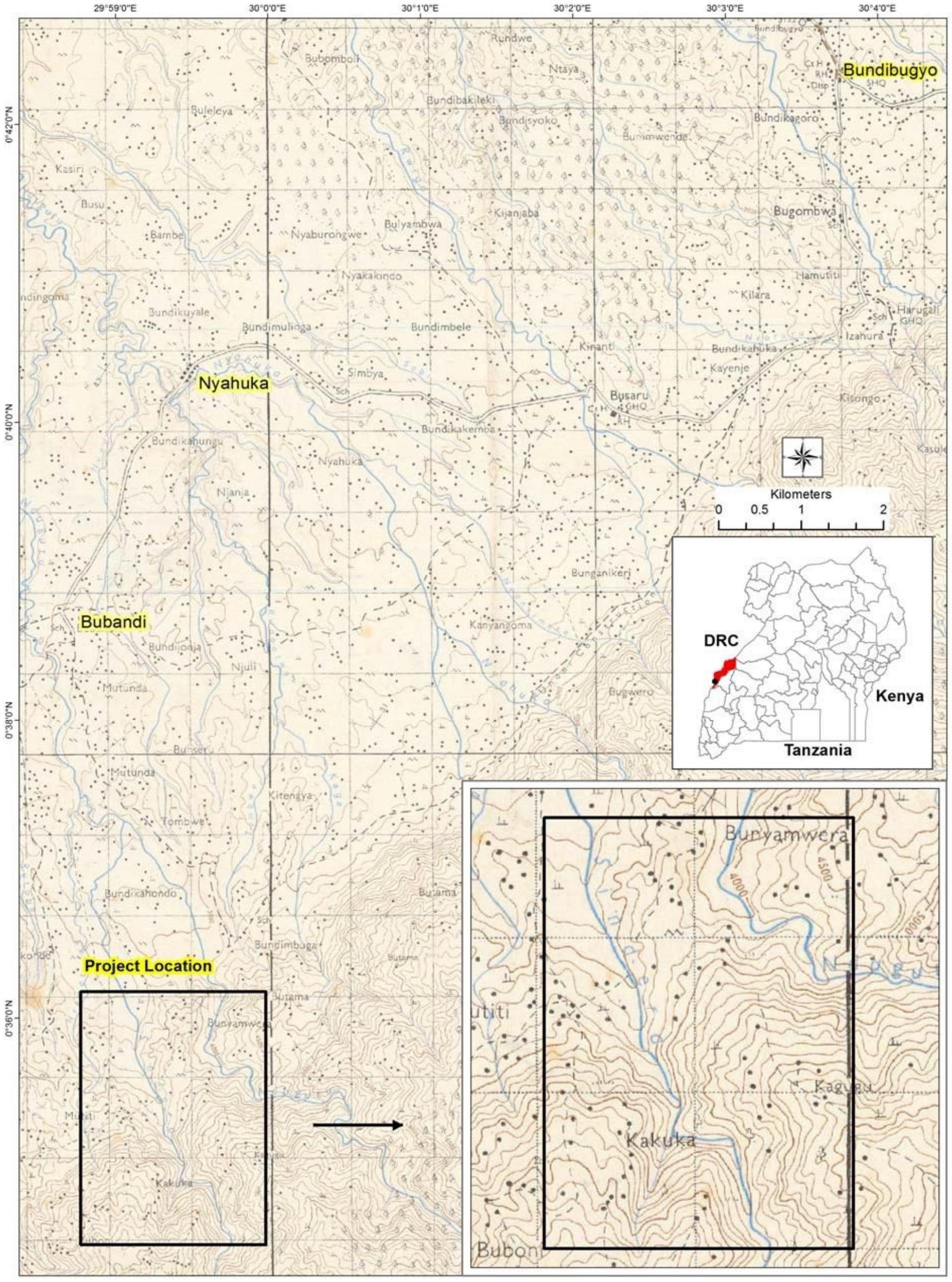


Figure 1: Project Location

Need for ESIA

The Third Schedule of the National Environmental Act of Uganda (NEA) Cap 153 specifies that, any development that involves dams, rivers and water resources (including storage dams, barrages and weirs) or electrical infrastructure (including electricity generation stations, electrical transmission lines and electrical substations) requires an EIS to be submitted by the developer, which is to be approved by the National Environment Management Authority (NEMA).

Several activities will be undertaken during the construction of the proposed Sindila MHP and will involve among others, the following:

- Construction of basic hydropower structures which include the Weir, Headrace channel, Forebay Tank, Penstock and powerhouse;
- Acquisition of the right of way and way leaves for the power line;
- Survey and mapping of the electricity transmission routes; and
- Construction of access roads among others.

The above mentioned activities will give rise to environmental and social impacts, both negative and positive. Impacts such as restriction on land use, landscape impairment and visual amenity, and habitat encroachment that could affect flora and fauna, water resource contamination, and social disruption are likely to result from the implementation of the project. Therefore, proper identification, quantification and mitigation of potential impacts associated with the project are crucial prior to implementation.

Objectives of the ESIA

The purpose of the ESIA was to ensure that project activities under consideration are environmentally and socially sound and sustainable.

The specific objectives of the ESIA are therefore to:

- Assimilate baseline data and information relating to the physical, biological and social environment in and around the proposed project site;
- Have a series of dialogues with the Lead Agencies, local communities/households living in and around the proposed project site as well as other stakeholders of the project to obtain their views;
- Assess the potential environmental impacts that might emanate from the construction as well as operation phases of the proposed project;
- Formulate the necessary counter measures against the potential adverse impacts so as to minimise the possible negative impacts due to project implementation;
- Propose an Environmental and Social Management Plan (ESMP) to guide the implementation of mitigatory measures and monitoring throughout the implementation of the project and contribute to the overall process of project monitoring and auditing. This will enable the project developer to take timely action to prevent negative environmental and social impacts before they become irreversible; and
- Prepare the ESIA report, which will properly address all the items specified in the Terms of Reference (ToR) approved by NEMA.

Scope of the ESIA

This ESIA report covers all the activities (construction and operation phases) of the proposed Sindila MHP as described in detail in Section 2 that follows. These include construction of project infrastructure (key of these are; the weir, headrace canal, forebay, penstock, powerhouse and the associated access roads) and installation of the power generation equipment. Butama Hydro Electricity Company Ltd will liaise with the relevant Lead Agencies for all activities not assessed in this ESIA where necessary, to obtain the necessary approvals before such activities are carried out.

It is important to note that the current report is an update of the ESIS report that was prepared by OPEP consult in 2012 and approved by NEMA on 7th March, 2013 (Certificate Number: NEMA/EIA/4395). Although NEMA approved the project based on the ESIS that was submitted in 2012, a potential lender for the project undertook a gap analysis in line with its environmental and social requirements. The International Finance Corporation (IFC) Performance Standards (PS) were used as the basis for the gap analysis.

Following the gap analysis, a number of gaps were identified which were presented in an Environmental Due Diligence report dated 9th June 2014. It is upon this background, that the project proponent – Butama Hydro Electricity Company Ltd, contracted Atacama Consulting, to address the gaps that were identified following the analysis. To ensure that all the gaps are fully addressed, a checklist in the form of a detailed concordance table has been prepared and is presented in Annexure 4 of this updated ESIS indicating how the identified gaps have been addressed. The focus of the ESIS update was primarily on addressing identified gaps and therefore the integrity of the original ESIS as prepared by OPEP Consult, submitted to, and approved by NEMA, remains the same.

Approach and methodology

The ESIA preparation process was guided by the EIA guidelines for Uganda of 1997 that outline the EIA process in Uganda. It is worth noting that this process was further refined by the IFC Performance Standards as part of updating the original ESIA by Atacama Consulting.

Some of the key methodologies that were deployed as part of the ESIA process included:-

- Stakeholder consultations and engagement which were undertaken in accordance with NEMA guidelines for seeking opinions and views on the environmental aspects of projects. In this regard, prior to and/or during preparation of this ESIA, there were three key steps within the overall stakeholder consultation and engagement process: identifying and notifying stakeholders of the proposed Sindila MHP and the ESIA; holding meetings (formal and informal); and making provision for stakeholders to provide their comments and concerns. Key stakeholders consulted including comments made and the respective responses are presented in Annexure 5 of this ESIS;

- Site visits to the proposed project area were undertaken by the consultancy team with additional visits for the ESIA update process undertaken in May 2014. During the site visits, data including but not limited to the following was collected: vegetation, fauna, topography, land use, socio-economic profile (demographic characteristics, land tenure and settlement pattern, economic profile, health services, water and sanitation, education, governance and public administration, employment status and cultural heritage), and soils/geology. Specific site visits addressing the biological and physical environment involved walking through the proposed project area and collecting baseline data through observation, photography, collection of samples and laboratory analyses. Sample stations and other features of concern in the proposed project area were marked and recorded using a hand held Global Positioning System (GPS) unit. Methodologies were developed for the different study variables and these are presented in the environmental and social baseline description (Section 4 of this ESIS) together with their results.

- Various methods and techniques were applied in impact identification, prediction and evaluation. The team, with the help of the relevant stakeholders, identified and analysed potential impacts linking these with specific project activities and phases. The first task was to consider both positive and negative impacts of the project and a number of tools were applied during the identification and assessment of impacts. The detailed methodology used to assess impacts is discussed in Section 6 of this ESIS.

- Literature review: Key among the reviewed documents that were deemed to be pertinent to the study included but were not limited to: Bundibugyo District Local Government (2010/2011 – 2014/2015) Development Plan; Sindila sub-county Development Plan(2010/2011 – 2014/2015); National Environment Act (NEA), Chapter 153; The National Environmental Impact assessment (EIA) Regulations S.I. No. 13/1998; Environmental Impact Assessment Guidelines for the Energy Sector, 2004; Renewable Energy Policy, 2002; Uganda Renewable Energy Feed- in - Tariff (REFIT), Approved Guidelines For 2011-2012, Electricity Regulatory

Authority; Statistical Abstract June, 2011, Uganda Bureau of Statistics; Pre-Feasibility Study Report, Sindila MHP, 2011; and IFC Performance Standards, 2012.

Policy and Legal Framework

Section 3 of this ESIS presents a summary of the laws, regulations, policies, standards and guidelines relevant to the environmental and social management of the proposed Sindila MHP. Also identified in this section, are the agencies, departments and institutions responsible for the monitoring and enforcement of the legal requirements specified herein.

Baseline Environment

Location

The proposed Sindila Mini Hydropower project (MHP) is to be located in the middle reaches of River Sindila in the villages of Kyebumba, Ntuma and Kabwe in Bunyamwera Parish, Sindila sub-county, Bughendera County in Bundibugyo District (see Figure 1). All the civil engineering structures will be located within two Local Council (LC) I areas (Ntuma and Kabwe) of Sindila sub-county. The proposed weir (35N 0833539E, 0063773N) and the headrace channel are to be located in the Ntuma village while the forebay tank, penstock and powerhouse are to be located within the village of Kabwe. The support structures are located in Kyebumba (see Table 1 above).

Of particular relevance with regards to the proposed Sindila MHP, is the fact that, although the entire project will be located in a community area, the proposed project (weir) will be located 430m North West of the RMNP, gazetted in 1991 and was recognised as a United Nations Educational, Scientific and Cultural Organisation (UNESCO) World Heritage site in 1994 and a Ramsar site in 2008.

Physical Environment

Climate and Air

Rainfall
Precipitation in the Rwenzori Mountains occurs primarily during two pronounced seasons from March to May and August to November as demonstrated by the average monthly rainfall at Bundibugyo rainfall station. The March-May rainy season receives 31% of annual rainfall while the August-November season receives 48%, meaning that the two rainy seasons are responsible for 80% of the annual rainfall amount. There is also a strong orographic effect exerted by topography on rainfall. Mean annual rainfall at Bundibugyo is about 1350mm but it can be as high as 2300mm or higher in the mountains.

Temperature
Maximum temperature varies from 24.2^{o}C in November to 29.2^{o}C in March. Minimum temperature varies from 13.2^{o}C in December to 15.1^{o}C in March.

Humidity
Relative humidity varies from 59% in March to 86% in November.

Wind speed
Average wind speed is 6.2km/h.

Air quality
The proposed project area can be described as generally rural with interfaces of natural vegetation, cultivated lands and lands under fallow. The area is largely vegetated and there are no major industrial developments. The primary sources of air emissions in the area would be automobiles (vehicles and motor cycles) although the number of automobiles going up the steep poorly maintained road is relatively low and therefore most of the area has to be accessed on foot. The air quality at the proposed project site is therefore considered to be generally good as the level of Greenhouse gases generating equipment is negligible.

Noise

Baseline noise levels of the proposed project area were determined during the February 2012 survey. These were firmed up with further noise assessment during the May 2014 survey, using an

American National Standards Institute (ANSI) S4 compliant digital direct reading Multi-Function CEM DT- 8820 Environment Meter. This equipment has an active range of 35-100 decibels (dB), with low frequencies ranging from 35-64dB, and high frequency levels ranging from 65dB to100dB.

Noise levels were recorded at the proposed project components locations and other ambient background noise measurement points were selected based on proximity of the sensitive receptors to the location of the proposed project components. With the exception of parts of the headrace canal and the proposed weir site location which fall within a forested area, all other proposed project components fall within areas with some settlements and none of them fall within a commercial area. The baseline noise levels within the proposed project area were therefore assessed based on the maximum permissible noise levels for residential areas which are set at 50 dB (A).

Based on the results, some of the average noise levels recorded at the proposed project components and selected sites were within permissible limits for residential areas as provided for in the National Environment (Noise Standard and Control) Regulations of 2003, which set the maximum limit as 50dB(A) during the day. The exceptions were the average noise levels recorded at sensitive receptor sites along the headrace canal (homestead), the powerhouse access road, Kabwe nursery school along the penstock path, a sensitive receptor along the penstock path (homestead), forebay tank, and sensitive receptor along the headrace canal. These noise levels were largely influenced by sound from bird and insects calls and background conversations from the nearby community.

Hydrology

Catchment characteristics

River Sindila originates at an altitude of 3810m.a.s.l from the Rwenzori ranges and drains northwest into River Semliki. In its travel downstream, it descends by about 2400m over a distance of approximately 12.5km. The average bed slope of the river is 16.3%.

The land cover within the catchment is composed of montane forests and heath moss forests. Higher up, towards the peaks, the woodlands gradually thin down to Afro – Alpine vegetation.

Drainage pattern

River Sindila flows in a north easterly direction from the Rwenzori Mountain Ranges towards the Congo Border. The catchment has a near oval shape with a maximum length (in the direction of flow) of 10km and a maximum width of 3.6km. The catchment area upstream of the proposed MHP is 38.6 km^2. The catchment elevation varies between 1,525m.a.s.l at to about 3,821m.a.s.l with an average of 2,769m.a.s.l.

Flow analysis

The long term mean daily flow at the proposed site is 1.47m^3/s with a standard deviation of 1.38m^3/s. The modelled minimum flow was 0.02m^3/s while the maximum flow was 27.1m^3/s. The monthly flow varied between 0.1 Million Cubic Metres (MCM) and 12.9 MCM with an average of 3.9 MCM. The annual flow varied between 33.9 MCM and 69.2 MCM with an average of 46.3 MCM.

In terms of total monthly cumulative flows, the mean monthly flow varies between 1.2 MCM in August and 6.7 MCM in November. Another peak flow of 6.2 MCM is experienced in May while February experiences a second flow minima of 1.5 MCM.

Environmental Flow

In line with the Tennant method , which prescribes that minimum flows at any time of the year must be 10% of mean annual discharge, below which fish habitat and recreational value will be severely degraded, the suggested environmental flow of 10% of mean flow for River Sindila is equivalent to, (10%*1.47) = 0.147m^3/s (147l/s) – refer to hydrology study report in Annexure 10. It should however be noted that this percentage of the mean is highly susceptible to a relatively small number of unobserved high flows. This suggests that the mean is subject to substantial uncertainty. By comparison, if one applied a 10% of the median flow (1.06m^3/s), derived from recent hydrological studies which is a more reliable figure and less susceptible to outliers, one would reach a suggested environmental flow of (10%*1.06) = 0.106m^3/s (106l/s).Therefore, at least 0.106m^3/s should be

allowed to pass through at all times to maintain the 3.5km riverine section. The Abstraction Permit (BUN 501010/ISWMDW 2013) issued by the Directorate of Water Development (DWD) dated 10th December 2013, stipulates EF for the Sindila MHP as 40l/s. The mandatory minimum, as included in the Abstraction Permit issued by DWD has to be met. In general, the project needs to adequately allow for environmental flows enough to, maintain river flow conditions, support the livelihood of people, sustain both the terrestrial and aquatic ecosystems and recharge groundwater and aquifers.

According to Section 4.2.2.6 (Aquatic Biodiversity), during the May 2014 survey, three fish of the same species (*Labeo forskalii*) were caught from River Sindila. Other aquatic biodiversity identified in the samples collected from River Sindila included four taxonomic groups (Blue-greens, Greens, flagellates and Diatoms) of phytoplankton, two taxonomic groups (i.e. rotifers, and crustaceans) of zooplanktons and seven taxonomic groups (orders) of benthic macro-invertebrates (i.e. *Odonata, Plecoptera, Diptera,* Mollusca*, Coleoptera, Nemouridae* and *Conchostraca*).

Therefore, based on the above, the highest aquatic water requirement in River Sindila between the proposed weir and the powerhouse is for the fish species, *Labeo forskalii*, which use the river as a breeding and nursery ground as a potamodromous fish. Potamodromous fishes are known to migrate during the peak rainy season for their spawning, feeding and to nursery grounds. The migratory fish habitat in a lotic river, include; rocks, boulders and aquatic vegetation in the river fringes. Therefore, the determined environmental flow ($1.06m^3/s$) should be maintained, especially during the rainy seasons for the maintenance of the fish habitats for the migration of *Labeo forskalii* in River Sindila.

In addition to the above, it is important to note that the main source of drinking water and that for other domestic purposes in the Project's Area of Influence (PAI) is River Sindila. The estimated average daily water abstraction by communities at the water collection points (Nyamuchimba, Mabondo, Kiralho Point, Ekyamularo and Ekyamugisa) between the weir and the powerhouse is approximately $0.0218m^3/s$. The community water requirement is relatively low ($0.0218m^3/s$) and falls within the determined environmental flow for the bypass section of River Sindila ($0.147m^3/s$). Furthermore, River Sindila is joined by a perennial stream (Ntuma) below coordinate 833433E 64378N, UTM 35 (see Section 4.1.4.2 of this updated ESIS). Ntuma stream contributes to the flow of water in River Sindila all year round.

Water quality

During the February 2012 survey, three water samples were collected from a number of sampling points to ascertain the river system health based on a number of parameters. The samples included; Sample Reference S1 from the proposed weir location; Sample Reference S2 from the point where the proposed spillway canal joints river Nyamuchimba; and Sample Reference S3 from the proposed powerhouse location. Following on, during the May 2014 ESIA update, two more samples were collected from streams in the project impact area, namely; Sample Reference S4 coordinates (UTM 35 833433E 64378N) from Ntuma stream (located along the proposed headrace canal) and Sample Reference S5 coordinates (UTM 35 833110E 67098N) from a Sindila stream (located along the access road to the proposed power house).

For each sampling site, the surface water samples were collected from approximately 0.5m below the water surface in clean labelled 250ml pyrex glass bottles. In the field, the water samples were kept in a cooler containing dry ice and later transferred within 24 hours for analysis at the National Water and Sewerage Corporation (NWSC) laboratory in Bugolobi, Kampala.

The results of the water quality laboratory analysis indicate that the water quality parameters of the samples collected at the selected sites were within the recommended national potable water standards except for the following physical parameters for selected samples: apparent colour, total suspended solids and bacteriological parameters: fecal coliforms and E. coli.

- Results of samples S1 and S2 were within the maximum permissible level for apparent colour but samples S3, S4 and S5 exceeded the maximum permissible level for apparent colour set by the national standard for potable water (15 TCU – True colour unit). The deviation from the permissible level for samples collected was S3 (21 TCU), S4 (64 TCU) and S5 (96 TCU). The cause of the deviation from the standard can be attributed to the function of runoff/drainage point within and around the project area. This is primarily due to water contamination in the process of water harvesting and agriculture (through cropland soil erosion when the soils along the slopes are loosened).

- Related to the apparent colour strength in the water samples, total suspended solids for samples S1 (1mg/l), S4 (12mg/l) and S5 (6mg/l) also exceeded the maximum permissible level set by the national standards for portable water.

- Water samples collected at S1 (60 CFU/100ml), S3 (10 CFU/100ml), S4 (168 CFU/100ml) and S5 (210 CFU/100ml) comprised of high levels of faecal coliforms above the permissible limit set by the national standard for portable water. E. coli were also evident in S3 (5 CFU/100ml). The high levels of faecal coliforms and E. coli in these water samples can be attributed to watering of animals which deposit dung in the River and open defecation along River Sindila.

Geology, Geomorphology and Soils

Geology

The project area is covered with undifferentiated gneisses. The proposed project site's general lithology consists of granitized or high-medium grade metamorphic formations. The undifferentiated gneisses including elements of partly granitised and metamorphic formations are present in this region, showing the general foliation of east-west with southward dipping.

General strike and dip direction of exposed bed rock around the weir and intake location is $120^0/30^0$. The riverbed is covered by Alluvium deposits, which are 0.2-0.5m boulders mixed with gravelly sand (the thickness of this layer is <2m).

At the headrace canal section of 0+3450+390, a hard, massive rock escarpment was identified and at 0+720, about 20m wide and 5-7m deep, a gulley with hard slightly weathered rock exposed at both abutments. At the proposed desilting tank location, bedrock is exposed, with thin (<1m) residual clay overburden along the gulley path that leads to the river. The forebay will be located on flat land covered by sandy clay material of residual origin, exhibiting hard characteristics, and the thickness of this layer is <2.5m.

A number of landslide scars were identified along the penstock path and piers will be located in stable positions in order to avoid landslide areas. The upper section of the area is largely covered with overburden residual soil with 0.3 – 0.6m of organic silt, over fine to medium-grained sand to 1.3m, over stiff to hard, low to non-plastic silt.

At the proposed powerhouse location, alluvium deposits of silty fine sand material were encountered and thickness of this material layer is >3m. The groundwater table is around 3m below the exiting ground level. Sandy material exhibits medium dense characteristics.

More detailed discussions on the geology of the project location are contained in the project geology and geotechnical report (Annexure 12 of this updated ESIS) as well as the updated geotechnical memo dated September 2014.

Geomorphology

The area is characterised by ridge and valley morphology and the main River Sindila runs along a 5-10m wide V- shaped deep valley towards a north-westerly direction. The slope on both the left and right banks of the river is very steep to moderately steep. The main ridge runs parallel to the river and a number of small streams run perpendicular to the main valley. The bottom part of the main river flows on a rocky bed bounded by rock escarpment.

Soils

The soils in the project area and specifically at the proposed project site locations are as follows:

- At Weir site: About fifteen metres from the right bank along the weir axis, alluvium deposits of rounded gravely sand with 0.5-1.0m diameter rock boulders were present. This layer penetrates about 1m depth evident from surrounding rock exposes.
- Along the Headrace canal: The section of the headrace canal is characterised by hard slightly weathered to fresh rock exposures. These rock exposures are moderately to highly jointed and detached and exhibit a high possibility of rock falls during excavation.
- Along the Spillway: Spillway location is mainly covered by gravelly clay of residual origin and hard rock is encountered at about 1.5m depth.

- At the Forebay: The proposed forebay area is mainly covered by residual clay material which consists of gravely clay. Thickness of this material layer is more than 1.7m.
- Powerhouse: The powerhouse location is covered by alluvium deposits and the test pit data shows penetration of this layer deeper than 2.6m.

Soil quality

A composite soil sample was collected from a soil profile test pit, which was dug at the centre of the proposed support structures (will house project stores, a parking area, and waste management facilities) and on soil profile was described. The composite soil sample was taken to the Uganda Directorate of Government Analytical Laboratory and analysed for the following parameters: moisture content, arsenic, barium, cadmium, calcium, chromium, lead, manganese, mercury, nickel, zinc, nitrogen (total), phosphorous (total), total organic carbon, percentage composition of sand, clay and silt, texture, Extractable Petroleum Hydrocarbons (EPHs) and Poly Aromatic Hydrocarbons (PAHs). Although Uganda soil regulatory limits have been established; National Environment (Minimum Standards for Management of Soil Quality) Regulations, 2001), they do not state the regulatory limits for the specific soil parameters. Therefore, the United States Environmental Protection Agency (USEPA) regulatory limits for the specific soil parameters that were being analysed were used as a basis for comparison.

The soil analytical results indicate that the measured parameters are within the USEPA regulatory limits and that the soil was devoid of any form of contamination in relation to the measured parameters. These results establish background levels for these parameters at the proposed support structure location.

Seismic analysis

The proposed Sindila MHP area lies in the earthquake prone zone within the western arm of the East African Rift System (EARS) - one of the tectonic features that are most associated with the seismicity of Uganda.

The project Area lies in highest Seismic Energy zone (red-orange) of potential earthquakes of magnitude greater than 6.8, and highest seismic hazard considering a radius of 20 to 50km from major seismic source zones. Within a radius of 20 to 50km, the following major earthquakes occurred: (i) on 2nd October 1929, Location (0.4° N 30° E) Toro earthquake in the western rift measuring 5.9, (ii) 20th March 1966 Location (0.84° N 29.9° E) Toro earthquake measuring 6.7, and (iii) on 5th February 1994, Location (0.59° N 30.03° E) Kisomoro-Toro earthquake measuring 6.2.

Biological Environment

Vegetation

The immediate impact zone of the project comprises mostly of manmade habitats and therefore the floral diversity was found to be low. A total number of 77 predominant plant species were recorded during the first field survey (February, 2012) within the study area. The majority of the plant species recorded were trees (31 species) followed by herbs (25 species), shrubs (11) and climbers (10). Riverside vegetation, the only natural habitat present in the area had the highest number of species compared to the other vegetation that was observed. None of the recorded plant species were unique or restricted to the area. Furthermore, none of the species were listed as globally threatened (IUCN, 2012).

Provided in Section 4.2.1 of this ESIS, are the detailed descriptions of the vegetation (i) at the proposed weir site, (ii) along the proposed headrace canal, (iii) at the proposed forebay tank, (iv) along the penstock path, (v) at the proposed powerhouse location, and (vi) along the proposed access roads.

Fauna

Mammals

Only a few species of mammals were observed during the survey. Large mammals such as *Papio cynocephalus* (Yellow baboon), and *Phacochoerus aethiopicus* (Warthog) were not recorded at the proposed project site during the survey but were said to be present in the riverine forest area. According to the local community members these mammals do come to the village transiently.

Discussions held with the Uganda Wildlife Authority (UWA) officials and the Bundibugyo District Forestry Officer during the ESIA update on 31st May, 2014, revealed the presence of the Olive baboon (*Papio anubis*), the Blue monkey (*Cercopithecus mitis stuhlmanni*) and the Angolan colobus (*Colobus angolensis rwenzorii*). The Angolan colobus monkey is a sub-species endemic to the Rwenzori Mountains.

Community members also mentioned these three primate species as crop raiders. This is unavoidable as fields are planted up to the park boundary.

Groups of larger monkeys such as the Olive baboon may have home ranges of 4-5km^2 and thus could easily arrive in community fields on ridges at lower elevations. Home ranges of Blue monkeys may average 2-3km^2, so those arriving in fields well away from park boundaries are probably local groups living outside the park.

Avifauna

Out of the 51 species of birds recorded during the first survey by OPEP Consult in February 2012 in the area, 34 species were recorded in the various circular plots while the remaining species were observed opportunistically along the transects. The bird species that were encountered most frequently include species such as *Pycnonotus barbatus* (Common bulbul), *Colius striatus* (Speckled mouse bird), *Prinia subflava* (Tawny-flanked prinia), *Passer griseus* (Grey-headed sparrow), *Serinus citrinelloides* (African citril). Some bird species such as *Corvus albus* (Pied crow), *Motacilla aguimp* (African pied wagtail) were also encountered around human habitations.

All the bird species in the project area are listed as of Least Concern according to the IUCN Red list.

Butterflies

Twenty species of butterflies were observed during the first survey by OPEP Consult in February 2012. Out of these *Neptis saclava* (Small Spotted Sailor), *Acraea johnstoni* (Johnston's Acraea), *Aceaea pharsalus*, *Papilio demodocus* (Citrus Butterfly), *Amauris tartarea* (Monk), *Leptosia alcesta* (African Wood White), *Junonia oenone* (Dark Blue Pansy), *Eurema hecabe* (Common Grass Yellow) and *Pseudargynnis hegemone* (False Fritiliary) were the most commonly encountered species. These species were observed in almost all the habitats and most frequently within disturbed open vegetation. However, species such as *Papilio dardanus* (Mocker swallowtail), *Danus chrysippus* (African monarch) *Papilio phorcas* (Green-banded swallowtail), *Papilio nireus* (Narrow green-banded swallowtail) were only recorded in forested areas.

Herpetofauna

Only 9 species of herpertiles were observed during the first survey by OPEP Consult in February 2012 at the project site. These included; two amphibian and seven reptile species. This could be attributed to the fact that most of the project activities take place in human modified habitats that are subjected to constant change. Therefore, only species that can easily adapt to such a changing habitat could be observed.

No reptile species of conservation concern were identified. The conservation status of amphibians in Uganda is generally unknown because of data deficiency. However, according to the IUCN Red List Category, the amphibians recorded during the study are of least conservation concern.

Aquatic Biodiversity

Aquatic biodiversity assessments were carried out on 30th May, 2014. Sampling was done at selected locations before and after the proposed weir and power-house locations in River Sindila. Samples were collected to establish the aquatic biodiversity of the river in terms of fish, phytoplankton, zooplankton, and macro invertebrates (benthos).

Fish

At least 16 fish species (six families) occur in the Rwenzori Mountains, and their distribution is mainly limited by altitude (Busulwa, 1998). Many indigenous fish species are present at an altitude of between 900 and 1,700m.a.s.l. The most common are cyprinids such as *Varicorhinus rwenzorii, Barbus alluaudi, B. somereni, B. perince* and *B. apleurogramma*. Other species include the catfish, which swims against the fast flowing rivers of the mountain, *Amphilius jacksonii*, the swamp catfish *Clarias alluaudi*, and three species of Cyprinodontidae and various Haplochromine at the very lowest locations. Cyprinid (large Barbus) species are the only species that extend above 1,500m.a.s.l. The

proposed Sindila MHP will be located between altitude 1563.5m.a.s.l (weir) and 11120m.a.s.l (powerhouse) along River Sindila (see Section 2.4.1 of this ESIS). The proposed project altitudinal range therefore, falls within the altitudinal habitat range (900 - 1700m.a.s.l) of some fish species found in the rivers of Rwenzori Mountain, the habitats of which need to be maintained.

Although the aquatic surveys undertaken during the previous ESIA did not find any fish species in the river which was later confirmed by the local people then, during the May 2014 survey, three fish of the same species (*Labeo forskalii*), were caught from River Sindila. One fish was caught in the minnow trap set before the proposed power-house site (UTM Zone 35N, Arc 1960, 0833132, 0064664) and two from the trap set downstream (UTM Zone 35N, Arc 1960, 0833137, 0064653) after the proposed powerhouse location. No fish catches were recorded from the traps set close to proposed site for the weir. The low fish abundance and diversity observed could be seasonal and bears significance to the ecological functions of this river as a breeding and nursery ground for the identified fish species. The species (*Labeo forskalii*) have one breeding season a year that is closely linked to peak flows, and they rely on increased flow as a cue for migration and maturation. They are also vulnerable to changes in the timing of high flow events that are inappropriate to their breeding seasonality and for the needs of drifting larvae. The absence of fish during the February 2012 survey could be attributed to the low peak flows during the month of February in Bundibugyo.

Even though no fish catches were recorded at the location of the weir, it is important to note that the assessment was conducted for a short duration and cannot be used to confirm presence of fish at different altitudes. In addition to the short assessment duration, IUCN categorised the species *Labeo forskalii* as Data Deficient for North and East Africa due to a lack of information on its distribution, abundance and threats (http://www.iucnredlist.org/details/181762/0). Based on this categorization, it would be unfounded to conclude on the altitudinal range in which this fish species migrate in River Sindila. However, some publications (Tamatamah, 2009) indicate that species in the genus Labeo migrate to small and large mountainous streams and do well in sediment-rich rocky biotopes in middle and lower sections of large rivers. During migration, they use the mouth and broad pectoral fins to climb damp surfaces of barrier rocks and weirs. These features help explain their wide altitudinal occurrences in river basins of Lake Victoria. However, note that the altitudinal range of the Lake Victoria Rivers is different from that of the rivers in the Rwenzori Mountains.

It is also important to note that *Labeo forskalii* is under heavy fishing pressure in Uganda, although consultations held with the local community members in the proposed Sindila MHP area acknowledged no fishing of the species on the river. This species is currently considered as a species of least conservation concern (IUCN, 2013).

Due to limited data on *Labeo forskalii* altitudinal range in the rivers of Mt Rwenzori, the fact that members of the genus Labeo can climb damp surfaces of barriers rocks and weirs, and that some Cyprinid *(a wider family where the Genus Labeo falls)* fishes can be found in altitudinal ranges above 1500m.a.s.l, *Labeo forskalii* may be expected to migrate upstream of the proposed location. It is therefore recommended that construction of the weir should take considerations of contiguous water pathways that must allow migrant fish to access their breeding areas in the river upstream of the weir.

Phytoplankton

Four taxonomic groups (Blue-greens, Greens, flagellates and Diatoms) constituted the algal community in River Sindila. A number of phytoplankton cells per mililitre were recorded from the samples collected with *Oscillatoria* species dominating the blue greens, *Spirogyra* dominating the greens, and *Uroglena* dominating the flagellates. There were no diatom *species* recorded at all sites sampled along River Sindila.

In terms of species abundance for the river, greens were more abundant (4-20 cells/ml) followed by the blue greens (4-15 cells/ml), and flagellates (2-3 cells/ml). Overall, diatom species richness and diversity appeared to be low and this is likely to be attributed to the higher turbulence and the low water temperatures (about 15 °c) for River Sindila. The dominance of *Oscillatoria* species among the blue green is an indication of high organic loads from the catchment this therefore indicates deteriorating water quality conditions at the sampled sites. The phytoplankton species recorded are similar to most of those found in Ugandan fresh water bodies especially Lake Victoria where extensive research has been done regarding the phytoplankton/algal communities.

Zooplankton

Two taxonomic groups (i.e. rotifers, and crustaceans) were found in River Sindila for all the samples collected. No copepods and cladocerans were found during the study. The diversity and abundance of rotifers at the sites where sampling was done is a characteristic of habitats that support fish.

Macro invertebrates

Seven major taxonomic groups (orders) of benthic macro-invertebrates were identified from River Sindila (i.e. *Odonata, Plecoptera, Diptera,* Mollusca*, Coleoptera, Nemouridae* and *Conchostraca*). Most of the identified macro-invertebrate organisms are associated with the lotic conditions with behavioural and morphological structures that assist them withstand the existing conditions in the fast flowing waters.

Dragon flies and bivalves dominated the macro-invertebrates found in samples collected from River Sindila.

Ephemeroptera and *Trichoptera* were not found in any of the samples collected from the river, an indicator of poor water quality since their occasional occurrence, or near absence, can indicate pollution problems or minimal disturbance of their habitat. This was also indicated by the high prevalence of chironomids, which are good indicators of deteriorating water quality.

Socio-economic Environment

The proposed project's area of influence (PAI) is defined to include the villages of Ntuma (where the weir and the headrace canal will be located) and Kabwe (where the forebay, penstock, and powerhouse are to be located) in Bunyamwera Parish and also the villages of Mutiti, Kakuka, Buboni and Bihya in Kakuka Parish (located on the left bank of the Sindila river) where people depend on the river as their main source of water. All the villages are located in the Sindila Sub-county.

Assessment methodology

In order to adequately assess the socio-economic baseline, both qualitative and quantitative methods were used.

A socio-economic matrix was first developed which included listing of all the relevant stakeholders and key parameters for consideration in the proposed project area. Data collection was undertaken at the household level as well as communities/settlements and other relevant aggregations as identified in the matrix. Techniques that were used in data collection include:

- Secondary data collection at both local and national levels;
- Focus Group Discussions (FDGs): These were mainly used to collect qualitative data through an interactive group setting in which consultees gave their opinions, perceptions and attitudes towards the project;
- Key informant interviews: These interviews were conducted with key individuals, resource persons and opinion leaders in the project area. The interviews were conducted in person;
- Structured interviews and questionnaires: In these interviews, the same questions were asked in the same order using questionnaires so as to provide systematic analysis and comparisons. This was mainly applicable to consultees that were able to read and write.
- Photography: photographs of importance and concerns on current situation of the various sites, stakeholder meetings and the surrounding physical, biotic and social environment were taken using digital cameras to record empirical evidence;
- Mapping: data was captured using GPS and maps processed using GIS to identify the existing status of physical features, geology and soil, drainage vegetation and land use, and infrastructure.

Location and Administrative structures

Bundibugyo District is located at coordinates 00 43N, 30 04E. The district is bordered by Ntoroko District to the north east, Kibaale District to the east, Kabarole District to the south, and the Democratic Republic of Congo (DRC) to the west and north. The geographic boundaries of the district are: the River Semliki to the west, the Rwenzori Mountains to the East and Lake Albert to the North.

As with other districts in the country, Bundibugyo is divided into administrative zones - two counties, Bwamba and Bughendera and thirteen sub-counties, one Town Councils and one Town Board. At the lower levels, there are 83 Parishes with 559 villages.

The leadership structure of the district also consists of several levels; with the Local Council (L.C) V at district level, L.C.IV at county level, L.CIII at sub-county level, L.CII at parish level and L.CI at village level. The technical aspects are handled by different departments at the district and sub-counties headed by professionals in the respective fields (Bundibugyo District Local Government, 2011).

Sindila sub-county was created in 2009 by curving out a section from the Ndugutu sub-county. The sub-county is located approximately 25km from the District Capital Bundibugyo and is about 70km^2 in extent. The sub-county is made up of 35 villages and 5 parishes. The eastern part of the sub-county is very mountainous with steep terrain and River Sindila is the main water way that runs through the sub-county and, is the primary water source for the majority of the people living in the sub-county.

Demographic Characteristics

Population

The PAI falls within Bunyamwera Parish, which has a total population of 5,282 in 755 households, calculated at an average size of seven (7) members per household. Bunyamwera Parish when compared with other rural Parishes in Sindila Sub-county, has a relatively higher population. The more mountainous Parishes such as Nkulanga and Nyankonda have a relatively low population compared to Bunyamwera Parish. The entire population in the PAI can be classified as rural.

According to the socioeconomic census survey of September 2014, the total number of Project Affected Persons (PAPs) is 411 of whom 91.2% (375) are in Bunyamwera and 9.8% (36) are in Nukurunga Parish. Out of the 411 PAPs, 215 were male, while 196 were female. 177 out of the 411 PAPs were children below the age of 18 years - most of these children were in Bunyamwera Parish (164) as compared to Nkuranga (13).

The total number of affected households is 107 and most of the households are in Bunyamwera parish (90%) as compared to Nkuranga Parish (10%). Most of the PAP households had a household size of 1-2 (36% and 3-4 person (30%). Relatively less PAP households had 5-6 persons (20%) and more than 6 persons (14%). The mean household size is 3.8.

Most of the household heads were male (87%) with near proportions in the different project affected areas; Nkuranga (100%) and Bunyamwera Parish (85%) and most of the household heads were married (74%), while 18% were single and 8% were widowed.

Tribes and Ethnicity

Bundibugyo District comprises of six tribes: Bamba, Babwisi, Bakonjo, Babutoku, Batwa and Batooro (Bundibugyo District Statistical Abstract, 2012/2013). These tribes are found in two counties of Bwamba and Bughendera County respectively. The ethnic groups in Bundibugyo are stipulated as follows: majority being Bamba and Babwisi (mainly in Bwamba County), Bakonzo (mainly in Bughendera county). The other groups are Batwa, Babutoku and Batooro.

According to socioeconomic census survey of September 2014, the affected persons in the PAI belong primarily to the variant of Bukonzo tribe and speak Lukonzo. Bakonzo fall within the broad Bantu category and very few PAPs were reported as belonging to the Bamba tribe.

The people in the PAI closely identify with their Bakonzo tribe and most socio-cultural interactions are defined by the customs and traditions of the tribe.

Religion

The people in the PAI belong to various denominations. 94.79% of the survey respondents were protestants.

Education levels

According to the socioeconomic census survey conducted in the PAI in September 2014, literacy and education levels among the PAP household members indicated that most of the household heads could read and write in any language; easily (56%) and with difficulty (16.8%). Nearly a third of the household heads could not read and write at all (28%).

Over half of the household heads attained primary level education (57%) while 17% had never attended formal education at all - indicating relatively low levels of education. Only 18.7% had attained some level of tertiary education.

Most of the children in the PAP households attended government aided primary schools (74%). Few attended private schools. The level of service of primary school education facilities attended by children from PAP households was perceived as poor (57%) and average (7.4%). Few PAP households perceived the primary schools performance as good (23.4%) and very good (13 %%).

Nearly half of the household heads did not posses any other functional skill other than farming (49%). Other functional skills possessed by household heads indicate that 12% possessed carpentry skills, 11% had brick making skills, 13% had art and craft skills, 5.6% were also hunters and 4.7% were causal masons around the community. The same pattern was observed for all the PAP members.

Health status

The Sub-county is served by one Government Health Centre III located in Kakuka parish. According to the Sindila Sub-county five year development plan for the period 2010/11-2014/15, people from neighbouring DRC also use this health centre for treatment. The health centre has a clinical officer, a registered nurse, a midwife, an enrolled nurse, two nursing assistants, two support staff and two security personnel. In addition to this health centre, there are three privately owned drug shops/clinics in the Sub-county, which are run by semi/unqualified staff. There is no clinic or drug shop in the PAI.

Common diseases in the Sindila Sub-County are Malaria, Cholera, Typhoid, Cough and HIV/AIDS.

The socioeconomic census survey results of September 2014 revealed that the pre-dominant health conditions suffered among the PAPs were: malaria (62%) with near trends between the project affected areas, Bunyamwera (61%) and Nukuranga (64%).

The levels of reported HIV/AIDS known cases within the households were generally low (1%). However, ulcers (5.6%), polio (3.7%) and TB (3.7%) were relatively higher as compared to the other health conditions (other than malaria) reported in the households.

Water and Sanitation

Water

According to the BIDP baseline survey conducted in 2005, the main source of portable water in Bundibugyo District was rivers. The other prominent water sources in the district included piped water supplies, unprotected sources, and protected springs.

Most of the PAP households used unprotected water sources like rivers and streams (98%). Few PAPs down the valleys had alternative protected water sources. PAP households in Bunyamwera did not have access to a protected water source at all. The rivers (Sindila and Ndugutu) appear to be the main water sources used. The relatively high level of diarrhoea and typhoid observed during the socio-economic census survey is associated with unsafe water sources. Some households walked for over 5kms to the nearest water source (21%).

The main source of drinking water and that used for other domestic purposes, in the PAI is the Sindila River. People have to walk a distance of between 250m to 4km to reach the river. The two schools in the PAI, Kaghughu Primary School and the Bundikohondo Primary School, also do not have a water source and thus the students have to fetch water from this river.

Sanitation

Almost 96% the households in the PAI have either permanent or temporary latrines. Only 4% of the households do not have this facility. Even though 96% of the households in the project area had latrines, a walk through the village revealed several incidences of open defecation in bushes and along community footpaths.

Housing in the PAI

The quality of housing stock in the PAI is of a generally poor status and that is the situation in Sindila Sub-county and in most of Bundibugyo.

In the PAI, over 90.9 % of the houses have less than four rooms and 9% of the houses have over five rooms. While 71.5% of the houses have corrugated iron sheet roofs, 28.5% are grass thatched. The vast majority of the houses (95%) are built of clay walls and this is the traditional way of constructing walls. A small number of houses (4.5%) have walls constructed of cement and bricks.

Transport

The PAI is linked via Fort portal-Congo main road and through a District feeder road traversing through Busaru sub-county to Sindila sub-county. Within Sindila sub-county there are several community access roads which are generally in a pretty dilapidated condition (and some may become impassable especially during the heavy rain season.

Within the PAI there is only one community access road, 1.5km in length, linking Kaghughu Primary School to the Bunyangule - Butama community access road. Most of the travel within the PAI is along footpaths over the hilly terrain.

In addition to the road network, there is also an airstrip in Bundibugyo located about 20km from the PAI and 5km from Bundibugyo town.

Settlement and land use

Settlement

The settlements in the Sindila sub-county and the PAI are 100% rural. The settlement pattern indicates two distinct varieties. First, is the cluster of houses located in a single location and the second is the scattered distribution of individual houses separately and in isolation with Bunyamwera Trading Centre being the only example of the former in the PAI. All other houses in the sub-county fall into the latter category.

The Butama Trading Centre, which also has a fairly large periodic market every Sunday, is the closest main commercial centre to the PAI. It is located in the adjacent Ndugutu sub-county and the distance to the centre varies from 500m from the closest houses to over 4km from the houses located on the furthest corners of the PAI. As there are no motorable roads within the PAI, most people travel on foot to this centre. Every Sunday, almost all the villagers in the PAI and other surrounding villages bring their produce to Butama for trade and to get their cassava ground.

Land use

The land use in the PAI falls into the following categories:

1. Agricultural land: This is the dominant type of land use in the area and the crops grown include, maize, cassava, banana, beans, onions, and other vegetables and fruits. Cash crops such as cocoa, coffee and vanilla are also grown within the PIA.
2. Built structures: These include the houses and the immediate compound area where the kitchen and latrine are located. Other structures include; the schools, churches and other common buildings.
3. Infrastructure: Only foot paths were found in the PAI which is entirely located in a hilly terrain with steep slopes. An existing motorable track from the Butama-Sindila road to the Kaghughu Primary School, a distance of about 1km is in very dilapidated condition negotiable only by a four wheel drive vehicle.

Land tenure

The existing land tenure systems in Uganda and within the PAI, which systems of tenure have evolved under different socio-economic settings include; customary, leasehold and freehold tenure.

Results from the September 2014 socio-economic census survey indicated that over 70.59% of the families bought their land from the other villagers and in some cases from their parents and other relations. According to the Uganda National land tenure system, land bought from customary owners without official land titles is still considered under the customary tenure system. Therefore, all the land within the PAI is considered customarily owned - the most widespread and the oldest tenure in the area. Under this tenure, the rights of land are regulated by the local customs. The people of the present generation inherit land from the previous generation. The system has led to increasing fragmentation of land and in turn to inefficiency in agricultural production.

Sources of energy

There is no electricity in the PAI or in the Butama Trading Centre. Communities in the PAI depend on firewood for their energy needs. A few families use kerosene for night lighting and others have no form of night lighting at all.

Economic activities and employment

The September 2014 socio-economic census survey found that employment in the PAI is mainly agro-based - very few PAP households had regular employment (33.6%) and transfers (13.1%) as sources of income indicating that the household economy was largely agrarian.

Majority of the sampled families (84.39%) are categorized as subsistence farmers and a few people are employed in the service sector. The employment opportunities in the PAI are thus fundamentally natural resources based. Regular salary earning households in the entire sample accounted for 5.2% of the population. Most of the PAP household heads were engaged in subsistence farming as the primary employment (68%), Few were own account workers/business holders (10%) and relatively fewer were regular paid public workers (5%). The major source of income for most of the PAPs was subsistence farming, crop framing (98%) and livestock farming (66%).

The socio economic census survey also indicated that land remains the critical livelihood asset in the project area, as other alternative livelihood options are very few.

Poverty

The Five Year Development Plan (2010/11-2014/15) for Sindila sub-county states that most people in the sub-county still live below the poverty line mainly due to dependence on subsistence farming which makes the people's income very unpredictable. The insecurity that occurred in the region since 1977 due to insurgency has further aggravated the problem of poverty.

The poor community members have been engaging in subsistence farming, which has led to soil degradation mainly in the hilly areas. Coupled with the level of investment in soil conservation, little has been done to address the problem. As a result, the levels of agricultural production are dropping and further increasing poverty within the community.

Agriculture

Agriculture is the backbone of the Sindila sub-county and it employs the majority of the people. It also defines their livelihood and life style. The daily life of a person in the PAI very largely revolves around the agricultural plot attending to various activities depending on the crop calendar.

The principle food crops grown in the PAI include maize, cassava, mattock, beans. Cocoa, coffee and vanilla are the principle cash crops grown in the area.

The sizes of agricultural plots vary from 1 acre to over 15 acres. However, the majority of the farmers (87.3%) own less than 5 acres in extent. Less intensive agricultural practices coupled with smaller plots have kept the agricultural production at low levels affecting the overall quality of life of the people in the PAI. On the other hand, the smaller number of people who own large plots of land do not cultivate all of the land a good part remains underutilized.

Livestock production

Livestock farming is a dominant activity in Bundibugyo district as well as Sindila sub-county. The main animals raised are goats, chicken, cattle and pigs.

Results from the socio-economic census indicate that goats are raised by over 85% of the households and this is primarily due to the fact that goats are considered a measure of wealth in this area. In contrast only about 3% of the households raise cattle.

Archaeological Cultural property

Archaeological sites

The proposed project falls within the Albertine graben, which has a number of archaeological and historic sites of national heritage importance, besides the unique physical resources of the rift valley, Rwenzori Mountains, national parks and lakes, all of which are important tourist attractions (NEMA, 2009).

The closest sites to the project area include: "*Amabere ga Nyinamwiru*" natural site (approximately 103km from the project area) and Sempaya Hot Spring (approximately 83km from the project area). All these sites are located along the Fort Portal – Bundibugyo road.

Cultural property

Notable about the project area is the history, culture and beliefs of the Bakonzo, which is closely woven around the Rwenzori Mountain. The mountain especially within the RMNP is also an important source of resources to the communities around it such as the Bakonzo, who live on the slopes of the mountain. The resources include; smilax and acalypha (for basket making), medicinal plants, mushrooms, water, honey, fibres from tree bark, bamboo stems and sheath.

Other major cultural sites in Bundibugyo District fall within community areas and include:

- Kikyo, in Buhundo parish, owned by a chieftain,
- Buthatsimbwa, a soft ground used for rain making and health;
- Kyomukama, found in Bupomboli Parish used by the ridge leaders;
- Kakuka, a huge tree visited in order to control famine, to perform rituals for peace, to control diseases and epidemics, and cleansing of the land; and
- Ikondere site found in Bupomboli Parish, Kitsimba village and on the Bupomboli ridge.

Of the major cultural sites in Bundibugyo District listed above, the PAI is closest to Kakuka cultural site, which is located in Kakuka parish (1.5km to the park boundary) – Sindila Sub-county.

In addition to Kakuka cultural site, communities use the proposed weir location as a cultural site for spiritual and healing rituals. The mini falls are believed to possess power for healing diseases and cleansing of spirits.

Potential impacts

The following have been identified as the particularly relevant potential impacts associated with the proposed Sindila MHP (Table 4). A complete discussion of the impact assessment is provided in Section 6 of this Project Brief.

Table 4: Impact rating after mitigation for the proposed Sindila MHP

Impact	Phase	Impact severity after mitigation
Impact on Rwenzori Mountain National Park	Construction	Minor (4)
	Operations	Minor (4)
Loss of land/land take	Construction	Minor (4)
Loss of crops and property	Construction	Minor (4)
Increased rate of soil erosion	Construction	Moderate (8)
Soil Contamination	Construction	Minor (4)
Increased disease vector populations as a result of changes in water ecology	Operations	Minor (4)
Increased traffic	Construction	Moderate (8)
Impacts on vegetation	Construction	Minor (3)

Impact	Phase	Impact severity after mitigation
Impact on fauna	Construction	Minor (4)
	Operation	Minor (4)
Increased poaching during construction	Construction	Minor (4)
Impacts on surface water quality	Construction	Minor (3)
	Operations	Minor (3)
Sedimentation and siltation of downstream water sources	Construction	Moderate (6)
Impact on downstream river flows and community water sources	Operations	Minor (4)
Impact on migration of fish upstream of the weir	Operations	Moderate (8)
Impact on cultural resources	Construction	Minor (4)
Segregation and differential rewards	Construction	Minor (4)
Increased spread of sexually transmitted diseases and other communicable diseases	Construction	Minor (4)
Physical resettlement of people and associated impacts	Construction	Moderate (8)
Vehicular and other equipment emissions	Construction	Minor (4)
Increased dust levels (particulate matter)	Construction	Moderate (8)
Noise effect and vibrations on local communities	Construction	Minor (4)
	Operations	Minor (4)
Poor Sanitation due to poor domestic waste management	Construction	Minor (3)
Effects of blasting	Construction	Moderate (8)
Greenhouse Gas Emissions	Construction	Minor (4)
Introduction of invasive plant species	Construction	Moderate (8)
Increased Pressure on the social service sector	Construction	Minor (4)
	Operation	Minor (4)

Unplanned/contingency impacts

Non-routine events and unplanned impacts (also known as Contingency Impacts), have also been considered in this report. These include:

- Earthquakes
- Landslides
- Floods
- Failure hazards (Dam break)
- Accidents
- Susceptibility of the project to climate change

Cumulative impacts

Cumulative impacts are changes to the environment that are caused by an action in combination with other past, present and future human actions. Specifically, Cumulative Impact Assessments (CIA) are typically expected to:

- Assess impacts over a larger (i.e. “regional") area that may cross jurisdictional boundaries (includes impacts due to natural perturbations affecting environmental components and human actions);
- Assess impacts during a longer period of time into the past and future;

- Consider impacts on Valued Ecosystem Components (VECs) due to interactions with other actions, and not just the impacts of the single action under review;
- Include other past, existing and future (e.g., reasonably foreseeable) actions; and
- Evaluate significance in consideration of other than just local, direct impacts.

Of particular relevance during the cumulative impact assessment of the proposed Sindila MHP is the fact that, based on current planning, the proposed project is to be located along River Sindila in close proximity to another proposed hydropower facility - the Ndugutu MHP. Ndugutu MHP is to be located on the left bank of River Ndugutu while Sindila MHP is located on the right bank of the Sindila river both of which fall within Bunyamwera Parish, Sindila sub-county.

Cumulative impacts are not necessarily that much different from the impacts of a single project, in fact, they may be the same. According to Butama Hydro Electricity Company Ltd, based on current planning, the construction schedule for Sindila MHP is planned to last 540 days. Even if each of the potential impacts is of relatively short duration and limited spatial extent in the immediate vicinity of the proposed project site, construction of more than one project at a time may raise the severity of the impacts. If the necessary approvals are obtained and the construction phases of both projects occur simultaneously in the project area specifically for those parts of the project falling within the community areas, there could be cumulative impacts linked to unidentified effects on communities and habitats. In other words, disturbed conditions observed may have stabilised or returned to normal, but increasing numbers of construction activities undertaken sequentially or with temporal and spatial coincidence may result in cumulative adverse effects. It is therefore imperative that appropriate mitigation measures be put in place to handle this scenario.

Environmental management

The assessment process reported in this updated ESIA report has identified the need for project-specific mitigation measures to ensure that the proposed Sindila MHP is implemented with minimum adverse environmental and social impacts. These are presented for the construction and operation phases separately in Section 8 (Environmental and Social Management and Monitoring Plan) of this report.

1. INTRODUCTION

Butama Hydro Electricity Company Limited (Ltd) proposes to set up a hydropower facility (Sindila Mini Hydro Power Project) in Sindila Sub-county, Bundibugyo District, Western Uganda with a total capacity of 5.25MW. This facility will utilise the hydropower potential of River Sindila. The power generated from the facility, amounting to approximately 25.9 GWh per year, will be sold to the Ugandan Utility, the Uganda Electricity Transmission Company Limited (UETCL), based on a power purchase agreement (PPA) the company shall enter into with the UETCL.

1.1 BACKGROUND

Uganda is endowed with a vast degree of energy resources (both renewable and non-renewable). Renewable energy resources include; plentiful biomass supplies, extensive hydrological resources, favourable solar energy conditions and large quantities of biomass residues from agricultural production, among others. With the exception of biomass, Uganda utilises only a small fraction of its renewable energy resource potential. Biomass, principally fuel wood and charcoal, is in quantity terms, the most utilised energy resource in Uganda. Wood fuel (firewood and charcoal) on both non-commercial and commercial basis constitutes about 93% of energy consumed in the country (National Development Plan (2010/11 –2014/2015). The total renewable water resources of the country are estimated at 66km³/yr, (39km³/yr internal renewable resources and 27km³/yr external), which comprise inflow from Lake Victoria (25km³/yr), as well as inflow via Lake Edward and Lake Albert from the Democratic Republic of Congo (DRC) (Uganda National Water Development Report, 2005). Figure 1.1 below indicates the major water resources in Uganda.

Figure 1.1 Uganda's Water resources

The vast hydroelectric power potential however is largely under-utilised. Projections show that Uganda's electricity demand is expected to triple in the next decade assuming the current economic growth trends continue, paving way for increased investment in the country. Whilst the demand for electricity in the country is growing rapidly, electricity generation by the country's major hydropower

plants cannot keep up with the increasing demand for electricity. Therefore, there is need for new sources of electricity to match the growing demand.

To overcome this challenge, the Government of Uganda (GoU) has taken a policy decision to encourage the private sector to develop and operate small hydropower projects (SHP). Under this policy, SHP plants can be built and operated to serve isolated mini grids operated by the developers themselves or the output of the plants can be fed into the national electricity grid owned and operated by the Uganda Electricity Transmission Company Limited (UETCL).

1.2 Project location

Sindila MHP is to be located in the middle reaches of River Sindila in the villages of Kyebumba, Ntuma and Kabwe in Bunyamwera Parish, Sindila Sub-county, Bughendera County in Bundibugyo District (See Figure 1.2). The entire civil engineering infrastructure will be located within two LCI areas (Ntuma and Kabwe) of Sindila Sub-county: The proposed weir (35N 0833539, 0063773) and the headrace channel are to be located in the Ntuma village, while the forebay tank, penstock and powerhouse are to be located within Kabwe village.

1.3 The project

On April 01, 2011, the Electricity Regulatory Authority (ERA) granted a feasibility study permit (Permit No: 2011/28) (see Annexure 1) to Butama Hydro Electricity Company Ltd to evaluate the proposed Sindila MHP. The generated power from the facility, amounting to approximately 25.9GWh per year, shall be sold to the Ugandan Utility, the Uganda Electricity Transmission Company Limited (UETCL), based on a power purchase agreement the company shall enter into with the UETCL.

The points of diversion of water from the River Sindila and the point of re-entry of the water back into the river are shown in Table 1.1.

Table 1.1 Location of Sindila MHP

Project Component	Latitude	Longitude
Weir	833539.47E	63773.152 N
Forebay	833434.94E	64368.22N
Power House	832266E	66336N
Tail water discharge point	833223.55E	66325.18N

Coordinates are in WGS84, UTM 35N

1.4 Project justification

Compared to other countries, Uganda's per capita energy consumption remains among the lowest despite the fact that the country has enormous potential for hydropower and other renewable energy sources. The Uganda Energy Profile published by the Uganda Investment Authority (UIA) states that, "*the rate of Uganda's electrification is among the lowest in the world with limited access to grid electricity standing at 5% in urban areas of the country and less than 2% of the rural population. In effect this translates to about 200,000 customers connected to the grid with the annual growth rate estimated at about 6%.*"

Over the past decade, the country has suffered from unreliable power supply coupled with high tariff rates, electricity losses and low access to power, because the impressive economic growth rates that the country has enjoyed (an average of 6.5%) of the 1990s was not matched with investments in the power sector and demand outstripped supply. The Electricity Regulatory Authority (ERA) has identified lack of investment in the sector as a major contributor to the power shortages. Economists and analysts point out that Uganda's power crisis erodes about 1.5% of the country's Gross Domestic Product (GDP), (New vision, 2011-02-24).

In order to alleviate the current energy deficit, Uganda has been embarking on projects geared towards promoting investments in the energy sector. The Uganda Electricity Generation Company Limited (UEGCL), projects that Uganda requires at least 3,800MW of power supply added to the

national grid by 2015. Implementation of major power projects such as the Bujagali Hydropower project and the proposed 750MW Karuma Hydropower project, will contribute immensely towards alleviating the country's energy deficit. UEGCL also has plans to boost power output through the construction of other major hydropower stations including; Ayago (600MW) and Isimba (188MW), among others North (300MW), Ayago South (200MW), and Kalagala (450MW) between 2012 and 2020.

The Ministry of Energy and Mineral Development (MEMD) has also put in place policy initiatives targeted at alternative sources of energy such as wind, geothermal, co-generation and biomass generated electricity. These policy initiatives it is hoped will attract private sector investments as well as help enhance national energy security while contributing to employment and income generation.

The proposed Sindila MHP is a renewable energy project and will result in a reduction of anthropogenic emissions of greenhouse gases by displacing an equivalent amount of electricity that would otherwise have been generated by thermal power plants that are currently used as a short-to-medium term measure to address the country's energy deficit. Based on the emission factor for Uganda's electrical power system published by the United Nations Framework Convention on Climate Change (UNFCCC), the annual emissions reduction due to the proposed project is estimated at 50,000 tonnes of carbon dioxide equivalent (CO) and is therefore eligible to attract carbon finance under the Clean Development Mechanism (CDM) of the Kyoto protocol for emissions reductions. The above mentioned factors largely contribute to the justification of the project when considered from the country's socio-economic transformation perspective.

1.5 Environmental Impact Assessment of the Sindila MHP

The National Environment Management Authority (NEMA) and various lenders have their own nomenclature for EIA documentation and for purposes of this project the term Environmental Impact Assessment (EIA) is considered to be synonymous with the different terms used by various entities.

Considering Principle 1 of the Equator Principles, the project is classified as a Category B Project due to the limited adverse social and environmental impacts associated with it.

1.5.1. Need for EIA

The Third Schedule of the National Environmental Act of Uganda (NEA) Cap 153 specifies that, any development that involves dams, rivers and water resources (including storage dams, barrages and weirs) or electrical infrastructure (including electricity generation stations, electrical transmission lines and electrical substations) requires an EIS to be submitted by the developer, which is to be approved by the National Environment Management Authority (NEMA).

Several activities will be undertaken during the construction of the proposed Sindila MHP and will involve among others, the following:

- Construction of basic hydropower structures which include the Weir, Headrace channel, Forebay Tank, Penstock and powerhouse;
- Acquisition of the right of way and wayleaves for the power line;
- Survey and mapping of the electricity transmission routes; and
- Construction of access roads among others.

The above mentioned activities will give rise to environmental and social impacts, both negative and positive. Impacts such as restriction on land use, landscape impairment and visual amenity, and habitat encroachment that could affect flora and fauna, water resource contamination, and social disruption are likely to result from the implementation of the project. Therefore, proper identification, quantification and mitigation of potential impacts associated with the project are crucial prior to implementation.

1.5.2. Objectives of the ESIA

The purpose of the ESIA was to ensure that project activities under consideration are environmentally and socially sound and sustainable.

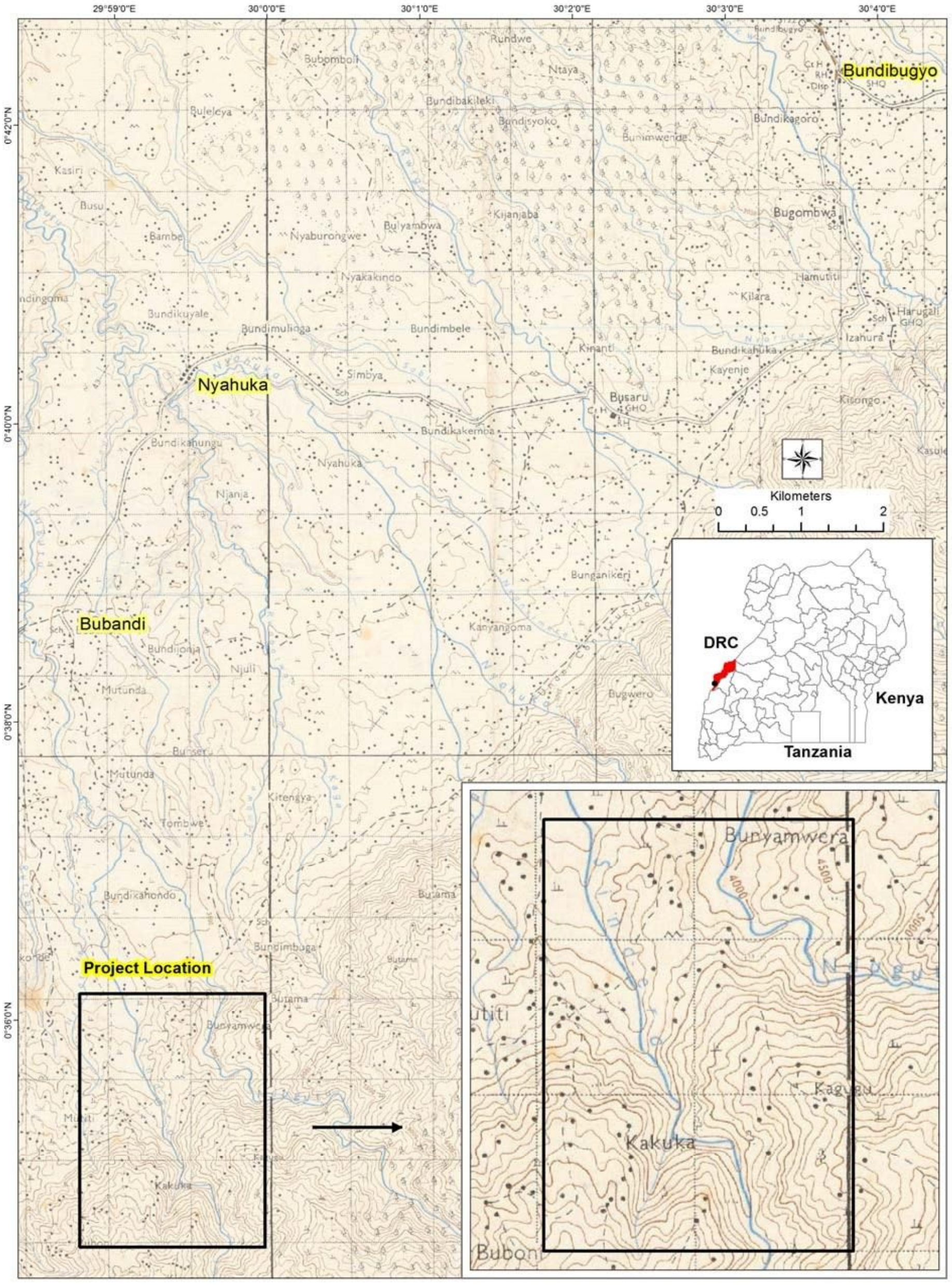


Figure 1.2: Project Location

The specific objectives of the ESIA are therefore to:

- Assimilate baseline data and information relating to the physical, biological and social environment in and around the proposed project site;
- Have a series of dialogues with the Lead Agencies, local communities/households living in and around the proposed project site as well as other stakeholders of the project to obtain their views;
- Assess the potential environmental impacts that might emanate from the construction as well as operation phases of the proposed project;
- Formulate the necessary counter measures against the potential adverse impacts so as to minimise the possible negative impacts due to project implementation;
- Propose an Environmental and Social Management Plan (ESMP) to guide the implementation of mitigatory measures and monitoring throughout the implementation of the project and contribute to the overall process of project monitoring and auditing. This will enable the project developer to take timely action to prevent negative environmental and social impacts before they become irreversible; and
- Prepare the ESIA report, which will properly address all the items specified in the Terms of Reference (ToR) approved by NEMA.

1.5.3. The EIA process

As part of the feasibility study, a scoping exercise was carried out and an Environmental Scoping Report (ESR) was prepared for the proposed project. The purpose of ESR was to make specific recommendations to elaborate on in the ESIA which would be carried out subsequently - the ToR for the ESIA were prepared based on the outcome of the scoping exercise. The ToR that were approved by NEMA on 1st December 2012 (Refer to Annexure 2 of this ESIS for the NEMA ToR approval) served as the guiding document for the consultants to conduct the ESIA in compliance with Government of Uganda (GoU) and international donor requirements.

The ESIA comprised of detailed on-site field assessments of the project site to identify the current social and ecological resources and species present with particular reference to the identification of environmentally sensitive areas. The possibilities of adverse impacts resulting from the implementation of the proposed development were assessed with respect to fauna, floral and other ecological resources associated with the site and where deemed necessary, mitigation plans were developed.

1.5.4. ESIA Report

As stipulated in the TOR approved by the NEMA (Refer to Annexure 2 of this ESIS for the NEMA TOR approval), this ESIA report (the Environmental and Social Impact Statement (ESIS)) comprises of ten major chapters and a number of Annexures, which provide supportive information to the main text.

The executive summary is a brief, non-technical justification of the proposed project that provides the reader with an appreciation of the salient features of the proposed project including the alternatives considered, existing environment (baseline), key environmental impacts, and measures to mitigate impacts, the monitoring programme and conclusions. A tabulated summary of the significant impacts and the proposed mitigatory measures are also presented.

This ESIA report is organised into 10 main chapters, namely;

Chapter 1: Introduction
Chapter 2: Project Description
Chapter 3: Policy, Legal and Institutional framework
Chapter 4: Baseline Environment
Chapter 5: Analysis of project Alternatives
Chapter 6: Impact Identification and management
Chapter 7: Public consultation and disclosure
Chapter 8: Social and Environmental Action Framework which comprises;
(a) Environmental Management Plan
(b) Environmental Mitigation plan
(c) Health and Safety Management Plan (HSMP);

(d) Traffic Management Plan (TMP);
(e) Waste Management Plan (WMP);
(f) Labour Force Management Plan (LFMP);
(g) Pollutant Spill Contingency Plan (IPSCP);
(h) Hazardous Materials Management Plan (HMMP);
(i) Emergency Response Plan (ERP);
(j) Stakeholder Engagement Plan (SEP);
(k) Dam Break Analysis and Action Plan; and
(l) Environmental Monitoring Programme (EMP).

Chapter 9: Conclusion and summary of recommendations
Chapter 10: References
Chapter 11: Annexures

1.5.5. Scope of this ESIA

This ESIA report covers all the activities (construction and operation phases) of the proposed Sindila MHP as described in detail in Section 2 that follows. These include construction of project infrastructure (key of these are; the weir, headrace canal, forebay, penstock, powerhouse and the associated access roads) and installation of the power generation equipment. Butama Hydro Electricity Company Ltd will liaise with the relevant Lead Agencies for all activities not assessed in this ESIA where necessary, to obtain the necessary approvals before such activities are carried out.

It is important to note that the current report is an update of the ESIS report that was prepared by OPEP consult in 2012 and approved by NEMA on 7th March, 2013 (Certificate Number: NEMA/EIA/4395). Although NEMA approved the project based on the ESIS that was submitted in 2012, (refer to Annexure 3 for the NEMA issued EIA Certificate of Approval), a potential lender for the project undertook a gap analysis in line with its environmental and social requirements. The International Finance Corporation (IFC) Performance Standards (PS) were used as the basis for the gap analysis.

Following the gap analysis, a number of gaps were identified which were presented in an Environmental Due Diligence report dated 9th June 2014. It is upon this background, that the project proponent – Butama Hydro Electricity Company Ltd, contracted Atacama Consulting, to address the gaps that were identified following the analysis. To ensure that all the gaps are fully addressed, a checklist in the form of a detailed concordance table has been prepared and is presented in Annexure 4 indicating how the identified gaps have been addressed. The focus of the ESIS update was primarily on addressing identified gaps and therefore the integrity of the original ESIS as prepared by OPEP Consult, submitted to, and approved by NEMA, remains the same.

1.5.6. Approach and Methodology

The ESIA preparation process was guided by the EIA guidelines for Uganda of 1997 that outline the EIA process in Uganda (Figure 1.3). It is worth noting that this process was further refined by the IFC Performance Standards as part of updating the original ESIA by Atacama Consulting.

Some of the key methodologies that were deployed as part of the ESIA process include the following;

1.5.6.1. Stakeholder Consultations

Stakeholder consultation and engagement for the proposed project was undertaken in accordance with NEMA guidelines for seeking opinions and views on the environmental aspects of projects. In this regard, prior to and/or during preparation of this ESIA, there were three key steps within the overall stakeholder consultation and engagement process:

- Identifying and notifying stakeholders of the proposed Sindila MHP and the ESIA;
- Holding meetings (formal and informal); and
- Making provision for stakeholders to provide their comments and concerns.

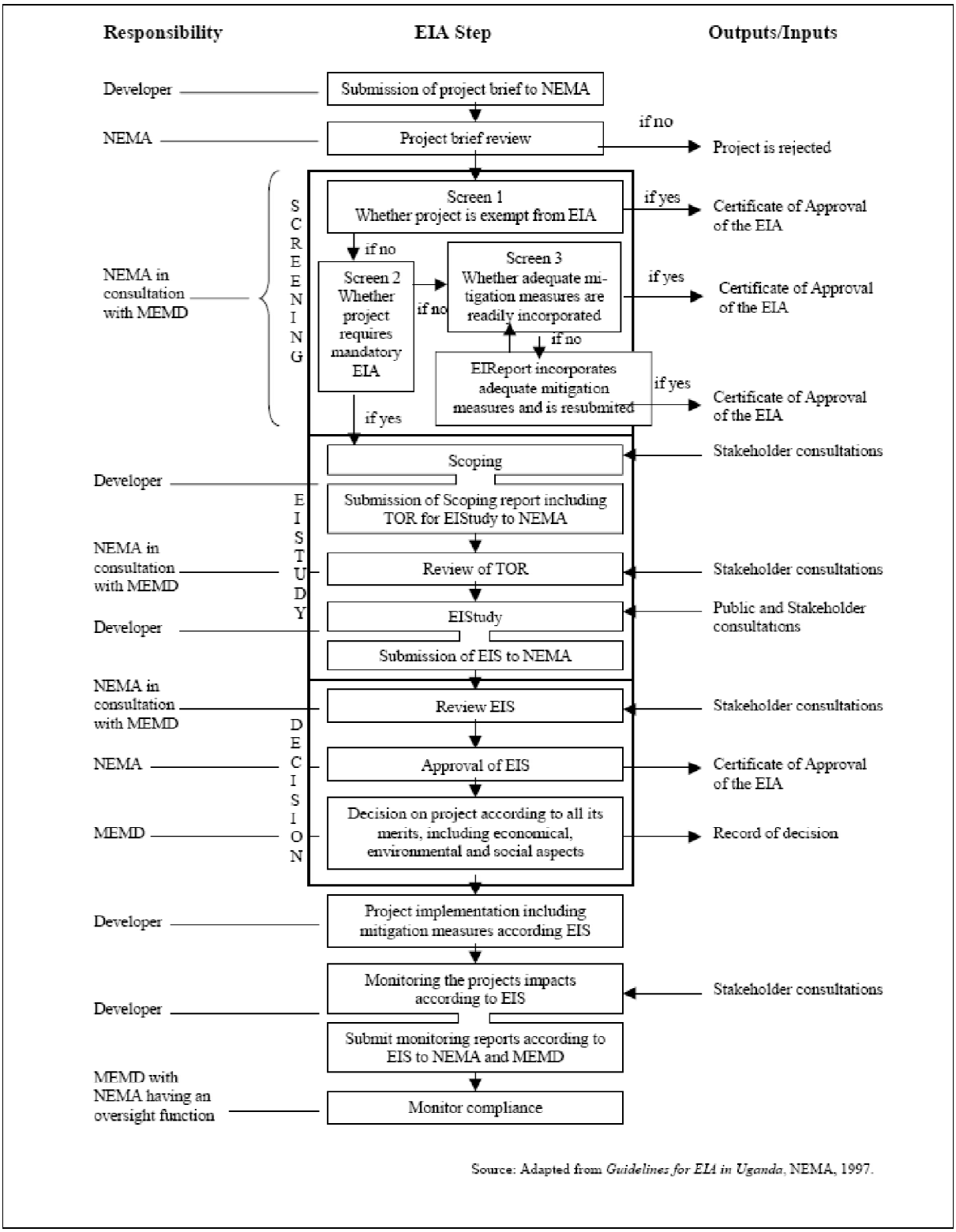


Figure 1.3: EIA process in Uganda

Key stakeholders consulted included (comments made and the respective responses are presented in Annexure 5 of this ESIA):-

- Ministry of Energy and Mineral Development(MEMD);
- Uganda Electricity Transmission Company Ltd (UETCL);
- Rural Electrification Agency (REA);
- Electricity Regulatory Authority(ERA);
- Directorate of Water Resources Management (DWRM);
- Occupational Safety and Health Department of the Ministry of Gender, Labour and Social Development;
- Department of Museums and Monuments;
- Uganda Wildlife Authority(UWA);
- Bundibugyo District Chief Administrative Officer (CAO);
- Bundibugyo District Environment Officer (DEO);
- Bundibugyo District Local Government (Chairperson LC-V)
- Bundibugyo District Community Development Officer (CDO);
- Sindila sub-county LC- III Chairperson;
- Bundibugyo Town Local Government (District Engineer); and
- Community members in the Project's Area of Influence (PAI)

1.5.6.2. Field Visits

Site visits to the proposed project area were undertaken by the consultancy team with additional visits for the ESIA update process undertaken in May 2014. Table 1.2 indicates the specific dates on which each of the proposed project components were visited during the ESIA update exercise.

Table 1.2: Specific dates on which the respective project components were visited during the ESIA update

Proposed project components	Date visited
Proposed weir site	30th May 2014
Proposed forebay tank site	29th may 2014
Proposed power house	30th May 2014

During the site visits, data including but not limited to the following was collected: vegetation, fauna, topography, land use, socio-economic profile (demographic characteristics, land tenure and settlement pattern, economic profile, health services, water and sanitation, education, governance and public administration, employment status and cultural heritage), and soils/geology.

Specific site visits addressing the biological and physical environment involved walking through the proposed project area and collecting baseline data through observation, photography, collection of samples and laboratory analyses.

Sample stations and other features of concern in the proposed project area were marked and recorded using a hand held Global Positioning System (GPS) unit. Methodologies were developed for the different study variables and these are presented in the environmental and social baseline description (Section 4 of this ESIA) together with their results.

1.5.6.3. Impact Prediction and Evaluation

Various methods and techniques were applied in impact identification, prediction and evaluation. The team, with the help of the relevant stakeholders, identified and analysed potential impacts linking these with specific project activities and phases.

The first task was to consider both positive and negative impacts of the project and a number of tools were applied during the identification and assessment of impacts.

The detailed methodology used to assess impacts is discussed in Section 6 of this report.

1.5.6.4. Literature Review

Key among the reviewed documents that were deemed to be pertinent to the study included:

- Bundibugyo District Local Government (2010/2011 – 2014/2015) Development Plan;
- Sindila sub-county Development Plan(2010/2011 – 2014/2015);
- National Environment Act (NEA), Chapter 153;
- The National Environmental Impact assessment (EIA) Regulations S.I. No. 13/1998;
- Environmental Impact Assessment Guidelines for the Energy Sector, 2004;
- Renewable Energy Policy, 2002;
- Uganda Renewable Energy Feed- in - Tariff (REFIT), Approved Guidelines For 2011-2012, Electricity Regulatory Authority;
- Statistical Abstract June, 2011, Uganda Bureau of Statistics;
- Pre-Feasibility Study Report, Sindila MHP, 2011; and
- IFC Performance Standards, 2012.

2. PROJECT DESCRIPTION

This Section of the report describes the proposed project, and identifies the locations of the various project components, as well as a description of the various project components and arrangements for the provision of services to and on the site.

The Sindila MHP is a proposed hydropower facility expected to generate 5.25MW of electricity with an annual energy output of 25.9 GWh. This will involve harnessing the hydropower potential of the River Sindila at 35N 833539E, 63773N and discharging the water through a 675m long conveyance system to the forebay tank and thereafter by a 3000m long spiral welded steel penstock pipe to the powerhouse located near River Sindila in Kabwe village. After the power generation, the water will be released back into River Sindila through a tailrace channel of 25m. The distance between the abstraction and release points in the Sindila River is approximately 3.5km.

The power generated at the Sindila MHP will be connected to the National Grid, either through (i) a new 5.7km long 100 AAAC 33kV interconnection line from the Sindila MHP to a new switching station in Busunga and construct another 1km 33kV line from Ndugutu to Sindila. Conversion of the Busunga-Bundibugyo-Fort Portal line to a double circuit 200sqmm AAAC line has also been proposed or, (ii) through a 33kV transmission line to be newly constructed from Nyahuke town (the nearest point of the existing line). The length of the transmission line is 5.7km and it follows along the reservation of the existing District Road from Nyahuke town to Bunyangule via Butama village and then along the proposed powerhouse access road.

2.1. Project Location

The proposed Sindila Mini Hydropower project (MHP) is to be located in the middle reaches of River Sindila in the villages of Kyebumba, Ntuma and Kabwe in Bunyamwera Parish, Sindila sub-county, Bughendera County in Bundibugyo District. All the civil engineering structures will be located within two Local Council (LC) I areas (Ntuma and Kabwe) of Sindila sub-county. The proposed weir (35N 0833539E, 0063773N) and the headrace channel are to be located in the Ntuma village while the forebay tank, penstock and powerhouse are to be located within the village of Kabwe. The support structures are located in Kyebumba. Table 2.1 indicates the proposed coordinates of key project infrastructure.

Table 2.1 Proposed location of key project infrastructure

Project Component	Latitude	Longitude
Weir	833539.47E	63773.152 N
Forebay	833434.94E	64368.22N
Power House	832266E	66336N
Tail water discharge point	833223.55E	66325.18N

Coordinates are in WGS84, UTM 35N

The proposed project site can be accessed via the Kampala-Fort Portal Highway by taking the road to Bundibugyo and then travelling a distance of 25km to the village of Butama, south of Bundibugyo town (also refer to Section 2.4.3 below). The proposed project area extends from 35 N 0833234E to 35N 0834864E and 0066994N to 0065538N. Figure 2.1 provides the bird's eye view of the project area from a Google image.

A simplified Project Layout is given in Figure 2.2.

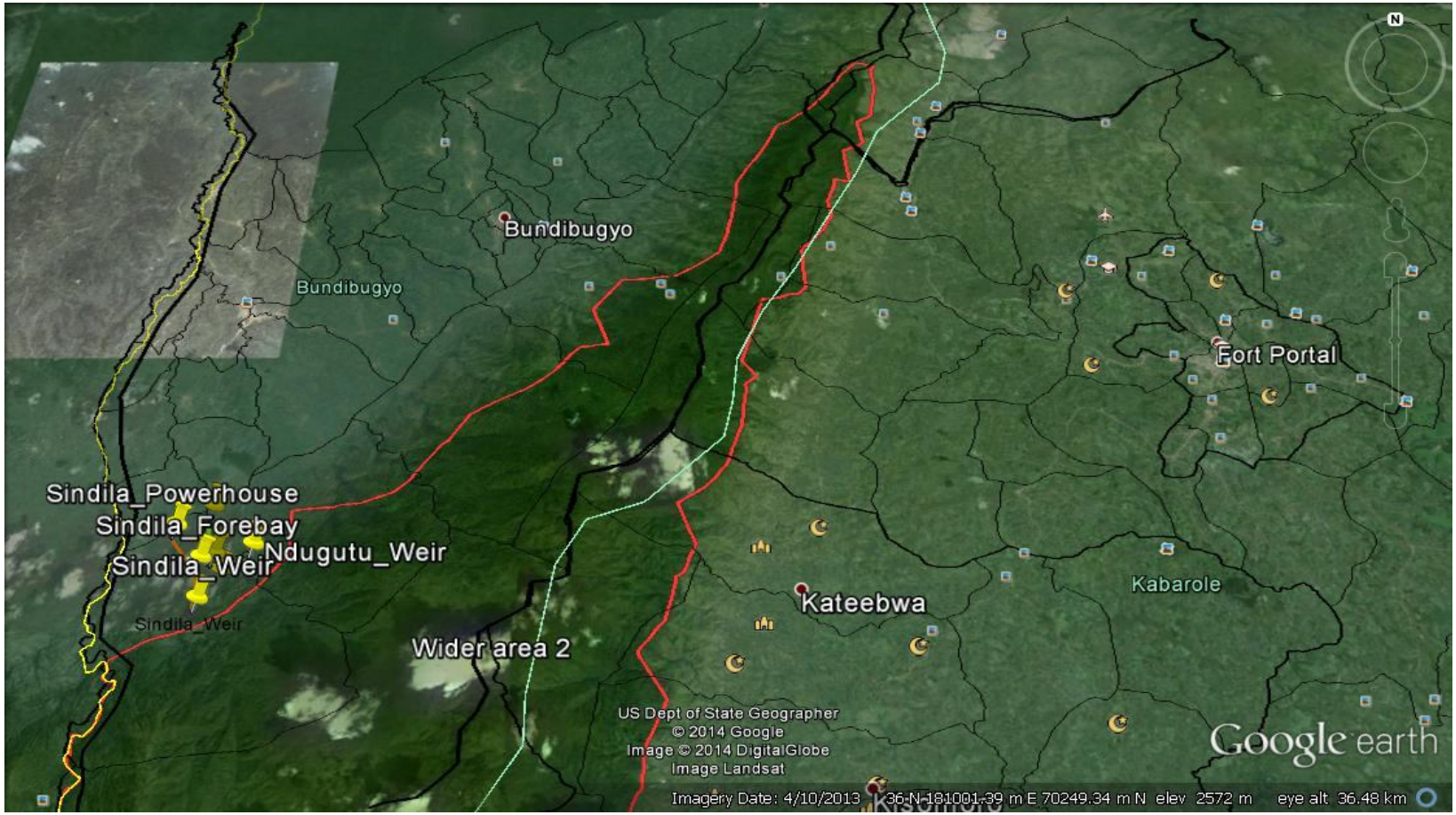


Figure 2.1 Bird's eye view of the proposed Sindila MHP project area from a Google image

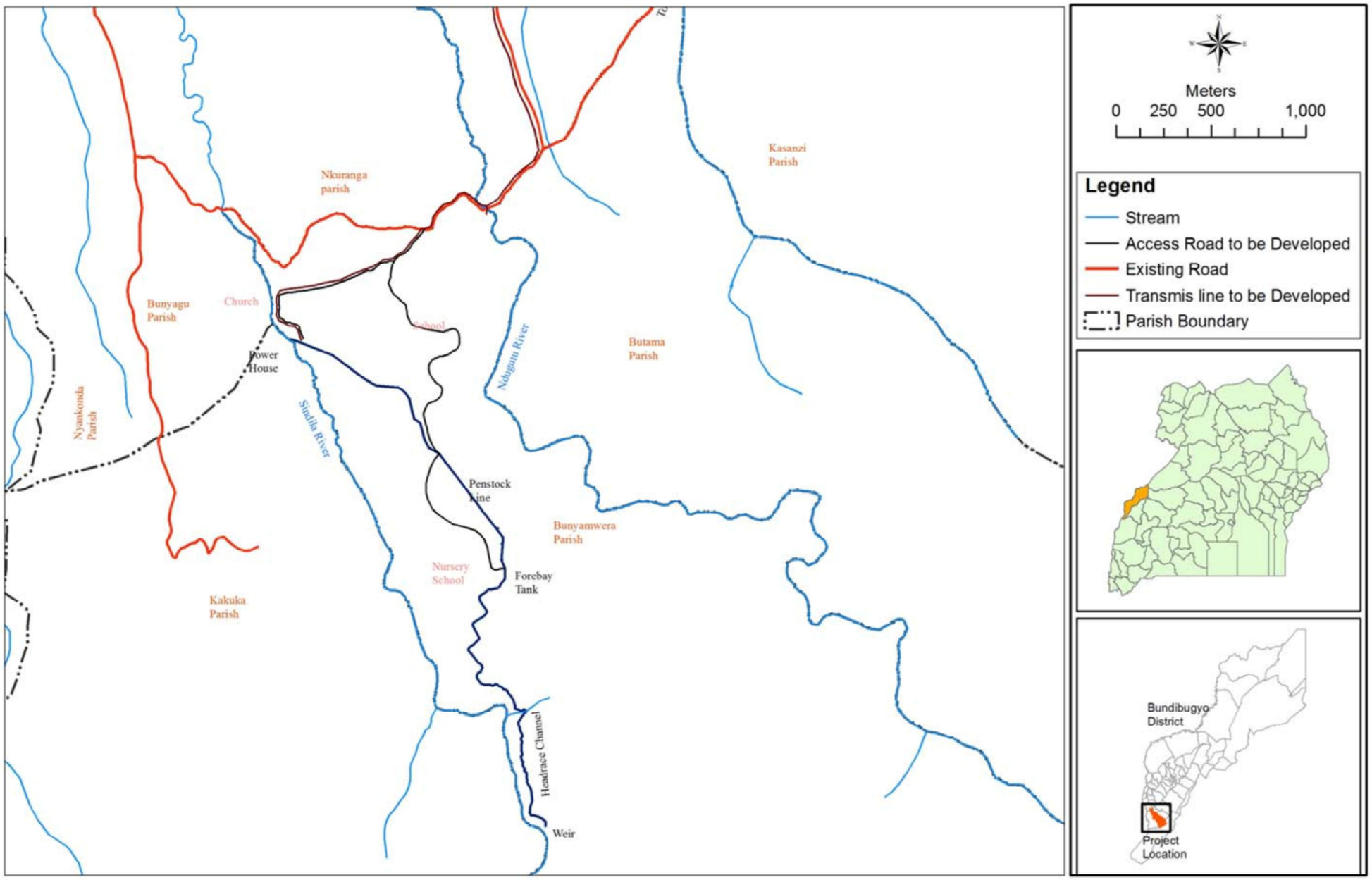


Figure 2.2 Simplified Project Layout

Energy generation potential from the proposed Sindila MHP

The estimated annual energy generation is summarised below:

Estimated annual energy	(GWh)
Two pelton	25.9
One pelton	25.45

2.2. Acquisition of permits/ approvals

Prior to the commencement of the construction phase of the project, a number of permits and approvals will have to be secured to ensure legal compliance and foster cooperation and harmony among the different stakeholders. The key permits and approvals that are relevant to the proposed Sindila MHP are presented in Table 2.2.

Table 2.2: Requisite permits and approvals for the Sindila MHP

Necessary permit/ approval	Responsible agency	Current status
Feasibility study permit	Electricity Regulatory Authority (ERA).	Client has applied for a Generation License but was deferred. ERA has told the Client an extension is not required; rather they need to reapply for the Generation License by December 2014.
Construction permit	Directorate of Water Development (DWD), Ministry of Water and Environment.	AVAILABLE (BUN501208/ 1CPHDW 2013)
Surface water abstraction permit	Directorate of Water Development (DWD), Ministry of Water and Environment.	AVAILABLE (BUN501010/ 1SWMDW 2013)
EIA Certificate of approval	National Environment Management Authority (NEMA).	AVAILABLE (NEMA/EIA/4395)
Waiver to excavate, drill, tunnel or disturb the river bed	National Environment Management Authority (NEMA)	Pending
Divert or block any river from its normal course	National Environment Management Authority (NEMA)	Pending

Necessary permit/ approval	Responsible agency	Current status
Construction and registration of workplaces	Department of Occupational Health and Safety	Pending
License for River dredging	Ministry of Water and Environment	Pending
License for extraction of stone/aggregate and murram materials	Department of Geological Survey and Mines	Pending
Use, storage and disposal of explosives	Ministry of Internal Affairs	Pending
Use of explosives in blasting of rocks	Ministry of Internal Affairs	Pending
Waste discharge permit	National Environment Management Authority	Pending
Storage of petroleum products	Department of Petroleum	Pending
Wetlands, River Banks and Lake Shores Management Permit	NEMA	AVAILABLE (NEMA/RB/LS/WT/328)

It is important to note that the permits/ approvals considered here are those required to enable implementation of the proposed project as described in this section. Any alterations, future developments or other associated structures that are not covered by this ESIA and associated NEMA EIA project approval Certificate (Certificate Number: NEMA/EIA/4395 may require a separate assessment and approvals as the lead agencies may determine, in line with the national Laws of Uganda.

2.3. Project Components

Below are the major components that will be part of the proposed Sindila MHP:-

- Weir;
- Intake structure;
- Desilting tank and Headrace Channel;
- Penstock pipe;
- Access roads
- Power generation plant;
- Transmission network for the mini hydro power plant; and
- Operators Quarters

Description of project components

2.3.1.1. Weir and Intake Structure

As the project is a run-off-the-river type, the weir is proposed to divert water from River Sindila, which will result in the minimum storage required for regulating purposes. Orientation and the location were finalized by considering rock outcrops. The weir at the selected downstream location will have a maximum height of 2.5m and a Mass gravity type of shape in reinforced cement concrete is proposed. Given below are the basic dimensions.

Weir dimensions

Coordinates	35N 833539.47E, 63773.152N, (Coordinates are in WGS84, UTM 35 N)
Type	Mass Concrete Gravity
Height	2.5m
Length	9.4m
Weir crest level	1563.5m.a.s.l

A side intake is proposed as this will minimize silt and trash entry into the headrace canal. The intake will be an open channel of reinforced concrete, and will be a 2.5m high excluding 0.2m free board - it has a curved entrance flushed with the upstream surface of weir. The weir comprises of a silt ejector at the bottom, with dimensions of 0.5m x 0.5m. It also provides an un-gated opening for uninterrupted environmental flow release. Details of diversion weir with a section along its axis are given in Annexure 6.

The resulting inundation area due to the weir will be minimal because the weir area is in a gorge. The ponding area will be extending only about 15m upstream along the river. The pond operating level is 1,563.5m.a.s.l and the maximum area of inundation would be 300m^2. The submergence area will remain within the river banks which comprises of rock outcrops and as such, the reservoir does not significantly alter the natural environment of the river. The ponding area dimensions are given below.

Length along the river	About 12.5m
Pond area	About 300m^2
Pond operating level	1563.5m.a.sl

2.3.1.2. Headrace canal

A headrace water diversion canal of approximately 675m in length which includes the desilting tank will be extending from the weir and will generally run along a contour to the forebay. The design flow of the project is 1.7m^3/s, which would be conveyed by means of a 1.35m x 1.15m canal. The bed slope of the canal is selected as 1.8m/1000m to maintain the flow velocity at around 1.5m/s to prevent the channel wall from erosion and to economize the section.

A considerable section of the channel will be a cut and cover section in areas where the terrain is steep. The remaining length of the canal will be open (open headrace canal). This approach will minimise the geological risks associated with the channel section and minimise environmental impact as well. Locations of stream crossing points were identified for design of under passes. Few

sections requiring special design considerations were identified and are summarized below. Typical details of headrace canal are given in Annexure 6.

Chainage (m)	Special feature in the location	Type of all sections
0+345-0+390	Hard, massive rock escarpment	Foundation can be placed after forming rock edge by blasting and with some anchor supports

2.3.1.3. De-silting tank

The De-silting tank will be made out of Reinforced Cement Concrete with dimensions of 34m (length) x 2.75m (width) x 3.2m (depth) and will be constructed at a chainage of 1+825m. The grade of the concrete is C25 (20mm). A vertical steel gate will be installed in the de-silting tank to flush the accumulated sediments at regular intervals. The outlet will be directed back to the river through a sedimentation pit. Location of the de-silting tank and typical details are given in Annexure 6.

De-silting tank dimensions

Type	Open R/F Concrete Rectangular Channel
Length	34m
Width	2.75 m
Height	3.2m

2.3.1.4. Forebay tank and Spillway Structure

The Forebay tank is designed to maintain the minimum of 2 minute storage and avoid any air entering into the penstock pipe. The forebay tank is a reinforced concrete structure, located on the slightly sloped land at the end of the canal, and will have a de-silting section. This consists of a sloped bed for easy ejection of silt, a spillway to spill excess water and a trash rack. A Vertical steel gate is provided to flush any sediment deposited in the forebay tank. The spill way will be constructed from the forebay tank to the river through the improved and protected natural valley (dry steam) to avoid any undesirable erosion.

Forebay tank dimensions

Length	19m
Width	3.5m
Depth	5.5m

2.3.1.5. Penstock

The penstock is 3,000m in length and 1 min diameter. Internal / external surfaces are painted with marine paint after sand blasting. Expansion joints as well as slide blocks will be provided at required locations. A vent pipe will be installed just below the bell mouth intake of the penstock. The penstock will be subjected to a non - destructive test and a pressure test after installation and before commission. Concrete anchor blocks will be provided where there are locations of change in vertical

/ horizontal angles (at every bend). These anchor blocks are designed considering allowable bearing capacity of 125kN/m^2 and are constructed with C20 concrete with 20% pumps at middle, and C25 (20mm) structural concrete with reinforcement skin mesh at the outer surface. The concrete piers with RCC core will be constructed at all straight sections of the penstock. The penstock will be strapped with steel straps onto these supports.

It is proposed that the Sindila MHP, shares a common penstock path with another neighbouring proposed mini hydropower project, the Ndugutu MHP for this part of the penstock line, so as to reduce the cost of anchor blocks and slide supports.

Penstock dimensions

Length Along Penstock (m)	Gross Head at Section End (m)	Cumulative Length Along Penstock (m)	Pipe outer diameter (mm)	Pipe Thickness (mm)
876	104	876	1,000	10
371	147	1,247	1,000	12
365	191	1,612	1,000	14
363	235	1,975	1,000	16
450	266	2,425	900	16
175	308	2,600	800 x 2	16
100	359	2,700	700 x2	16
300	388	3,000	600 x2	16

2.3.1.6. Powerhouse

The powerhouse will be constructed at the right bank of the river and the approximate size of the powerhouse will be 12m x 6m. The structural components such as floor slabs and columns will be constructed using concrete. The powerhouse roof will be supported using steel frames and covered with Zinc-Aluminium sheeting materials and the powerhouse has been designed in order to be located above the high flood level of the river. It will accommodate two horizontal axis Pelton turbines, generators, governors, electrical switch gear and panels, have an area for repairs and lifting arrangements for the machinery, storage space for spares and equipment for maintenance of the civil works. However, the dimensions and the levels of the powerhouse structure will be based on the Electrical and Mechanical equipment and will be finalized after the selection of these.

Powerhouse dimensions

GPS coordinates	35N 0832266E, 0066336N (Coordinates are in WGS84, UTM 35 N)
Stories	One
Length	20m
Width	6m
Type of turbine	Pelton
No. of units	2
Rated speed	600 rpm

2.3.1.7. Tailrace canal

A tailrace channel will be built to convey the released water from the turbines back into the river. Discharges from the turbine will be directed to a channel with a cross section of 3.0m x 4.2m and released to the river with a wider cross section. Since the power station is located closer to the river, the total length of the tailrace channel is about 25m.The basic tailrace canal dimensions Are as follows:

Tailrace canal dimensions

Total length	25m
Width	4.2m
Height	3.0m

2.3.1.8. Transmission line

The generation voltage of the power plant will be 6.6kV; this will be stepped up to 33kV through 6 MVA 6.6kV to 33kV three phase transformers. Generated power will be evacuated to the National grid via the proposed 33kV single circuit wooden pole transmission line. The Rural Electrification Agency (REA) proposed the selected transmission line for the Sindila MHP. Two options for the evacuation of the power generated at by Sindila project were considered (see Section 2 above). After evaluating both options, the most technically and practically feasible option is as follows: The Sindila MHP is to be connected with a new approximately 5.7km long 33kV 100AAAC line which is to be constructed from the Sindila switchyard to a new switching station at Busunga trading centre near the Uganda-Democratic Republic of Congo border (See Annexure 7: Summary of Power evacuation report). An updated power evacuation report has been provided separately with a detailed analysis of the options above.

2.3.1.9. Electro-Mechanical (EM) Plant

The EM plant will be selected based on the available head and flow, and on utilizing the maximum possible energy from the resource at minimum cost. Based on the available site parameters, the best EM plant option seems to be Jet Pelton turbines coupled with vertical shaft synchronous generators.

Access roads

2.3.1.10. Existing access roads

The existing community roads and foot paths connecting Butama trading centre to (the earlier proposed forebay tank) proposed materials storage yard at chainage 1850m and powerhouse will be improved to permit the transport of construction material, machinery and electro mechanical equipment to the site. The footpath starting from Bunyamwera trading centre to the nursery school (35 N 833379E 65121N) (see Plate 2.1) will be widened and improved. From that point to chainage 1850m (earlier proposed forebay tank), an access road will be constructed to provide access to the forebay tank. The footpath starting from Butama– Bunyangule road (see Plate 2.1 below) to the proposed powerhouse will also be upgraded. Construction materials will be carried along the proposed gravel footpath along the Penstock/Canal for construction of the Forebay, De-silt structure and Weir. This is mainly to avoid excessive excavation along steep slope areas. All existing footpaths and routes to be constructed traverse through home gardens, cultivated lands and bare lands. The land required for the widening of the access roads has been identified and the owners and the extents of the lands have also been identified through surveys. Routes of these access

roads are shown in Annexure 6 while land details are given in Annexure 8. Details of the access roads to be developed are given in the Table 2.3 below;

Table 2.3 Details of the access roads to be upgraded

No	Road description	Length (m)	Road type	Width (m)	Present land use
1	Access Road to Power House	1600	Concrete paved / Rubble Paved/Gravel compacted	3	Gravel Road /Foot Path
2	Access road to Fore bay Tank	1000	Concrete Paved /Gravel compacted	3	Footpath; Bare lands; Cassava, Banana cultivated plots
Total road length		**2,600**			

Foot path to Bunyamwera trading centre
Coordinates: 35 N 832910E, 66920N
Altitude: 1120 m

Existing route to Sindila power house
Coordinates: 35 N 832295 E, 066862 N

Altitude: 1089m

Plate 2.1 Existing access roads to forebay and powerhouse

2.3.1.11. Proposed project access roads

A causeway across River Ndugutu will be constructed to connect the right bank (Butama Trading centre) to the left bank (location of project infrastructure). A typical drawing of such a causeway is provided in Annexure 6.

2.4. Construction camps

The developer will appoint a contractor to construct the proposed Sindila MHP and associated support structures. It will entirely be the responsibility of the appointed Contractor to provide and maintain, throughout the construction period, the facilities necessary for the construction of the works, including:

- All required temporary workers' camps and associated infrastructure (water supply, power supply, canteens, emergency medical facilities, sewage system and wastewater treatment and waste handling facilities etc.);
- All required Contractor's offices;
- Local and long distance communication systems including Internet connection;
- All required construction plant and equipment;
- Workshops for maintenance and repair of the plant and equipment;
- Stock yards / warehouses / silos for storage of construction materials and equipment;
- Diesel/ petrol / lubricants supply and related storage facilities; and
- Testing facilities for construction materials.

The appointed contractor will however perform their duties in accordance with the developer's requirements as detailed in Sections 2.4.1 to 2.4.6 that follow.

2.4.1. Temporary construction (worker's) camp

The Contractor shall be responsible for the design, construction, maintenance, and dismantling of:

(a) A temporary construction/workers' camp; and
(b) Associated services/facilities, for the Contractor's staff and Contractor's Equipment.

The Employer (Butama Hydro Electricity Company Ltd) will provide bare land to the Contractor rent free for the duration of the project as a designated location for the construction camp within the vicinity of the proposed Sindila MHP footprint.

The designated location is approximately one hectare in size. The designated land will be shared between the Contractor's camp and the Employer's camp. Final coordinates will be given by Butama Hydroelectricity Company.

The Contractor may have access to the bare land two months prior to the commencement date. No later than two months after issuance of the taking-over Certificate, the Contractor shall remove everything from the camp site and return the land to bare land in a condition as close to that prior to construction of the temporary camp.

It is the entire responsibility of the Contractor to provide and maintain the temporary construction camp, facilities, and services necessary during the construction period.

The construction camp which will accommodate 25 to 30 individuals at maximum design capacity and shall include (also refer to Annexure 6 for an example of the campsite design drawings):

- Staff quarter buildings including: dormitories, recreational areas, canteens, ablution facilities, washing areas, emergency medical facilities, storage areas, and guard rooms as required;
- All services for the Contractor's camp, including potable water supply, power supply, waste water treatment (kitchen and washing), sewage treatment (mainly septic tank but this will also be dependent on what is agreeable to the local authorities in the area), surface runoff treatment, and trash collection;
- Security fences and security personnel;

- All required Contractor's site offices;
- Local and long distance communication systems including Internet connection;
- All required construction plant and equipment parking/storage areas;
- Workshops for maintenance and repair of plant and equipment;
- Warehouses for storage of construction materials and equipment;
- Diesel/ petrol / lubricants supply and related storage facilities; and
- Testing facilities.

2.4.2. Temporary office

The Contractor shall provide a temporary office for the Employer, located in the Contractor's main camp area (see Section 2.4.1 above).

The office layout shall be approved by the Employer prior to an order being placed. The Employer's site office shall comprise of units to make up the following:

- Office Space (capacity 4 people);
- Conference Room (capacity 8 people);
- Pantry;
- Toilets connected to the site sewerage system;
- Unisex: 1 wash basin, 1 toilet; and
- Storage space (lockable/no window).

The office units shall be stacked no more than two floors high, in a practical configuration on a suitable base, approved by the Employer. There shall be sufficient entrances/exits and fire exits, to the approval of the Employer and local and national health and safety requirements.

All rooms shall be air conditioned. All floors shall have a vinyl floor covering.

The Contractor shall provide, install and maintain all services i.e. electricity (230V), air conditioning, telephones, full time unlimited internet, plumbing etc. to the approval of the Employer. The building shall have covered outdoor terrace on three sizes with a minimum width of 4 meters.

The office space shall consist of four work stations; each work station shall have a twin general purpose outlet (GPO) 230V electric supply, a telephone jack and a computer local area network (LAN) point. One direct line for the telephone PABX system shall be provided to the office for the exclusive use of the Employer.

The Contractor shall supply all stationery for the duration of the project to the Employer.

The Contractor shall supply, install and maintain a fire suppression system within the offices to the Employer's and national health and safety standards approval. This system shall include fire extinguishers and detectors complete with alarms panels and a minimum of two external visual and audible alarms.

The office shall be capable of being made secure when not in use to the approval of the Employer.

The Contractor shall provide and maintain an area outside of the Employer's offices that can be used for parking up to three vehicles, with adequate space to manoeuvre the vehicles.

Office furniture and equipment shall be provided by the Contractor. A minimum acceptable level of furnishing shall be a desk and chair for each work station and suitable table that can accommodate 8 chairs in the conference room also capable of displaying an A_0 size drawing.

2.4.3. Employer's permanent accommodation in the main camp area (Permanent staff quarters and housing)

The Contractor shall supply, install and maintain accommodation as specified herein below, located in the Contractor's main camp area (see Section 2.4.5 above). The accommodation (Figure 2.4) shall be of good international standard. The building shall remain after completion of the project for the Employer's maintenance staff.

The accommodation facilities shall include:

- Bachelors living quarters for engineers and senior foremen, including:
    - Four individual bedrooms, size 4 x 6m, each with its own bathroom;
    - Bedroom furniture, inclusive of a bed, night stand, wardrobes, chest of draws and dressing table to the approval of the Employer;
    - Common living room area of 40m^2 minimum inclusive of four lounge chairs, occasional table and bookshelf; and
    - A kitchen with cooking top, oven, storage shelving refrigerator, ventilation system dining table and four chairs.

There shall be sufficient entrances/exits and fire exits, to the approval of the Employer and to meet national health and safety standards.

All bedrooms and living rooms shall be air conditioned. All floors shall have vinyl flooring or similar material.

Each bedroom shall have a twin switch GPO 230 V electric supply. All living rooms shall have a suitable number of twin switch GPO 230 V electric supply, a telephone point and a television jack for satellite dish. Each bedroom will be fitted with a 37" flat screen.

The Contractor shall provide, install and maintain all services i.e. electricity (230V), air conditioning, telephones, plumbing etc. to the accommodation to the approval of the Employer and in accordance with the local and national statutes.

The accommodation shall be capable of being made secure when not in use to the approval of the Employer.

The Contractor shall supply, install and maintain a fire suppression system within the accommodations to the Employer's and national health and safety standards approval. This system shall include fire extinguishers and detectors complete with alarms panels and a minimum of two external visual and audible alarms.

The Contractor shall supply, install and maintain a suitable lightning conductor to the Employer's accommodation in accordance with local and national regulations.

All furniture and equipment for the Employer's accommodations shall be provided by the Contractor and approved by the Employer.

The building shall have a covered outdoor terrace with mosquito net minimum width of 5m in the length of the building. The terrace shall be equipped with dining table and chairs for 6 people and lounge chairs for 6 people.

The building shall be constructed of bricks with cement plaster on external and internal walls. The roof shall be constructed of steel trusses and corrugated iron sheets.

Butama Hydro Electricity Company Ltd to provide plans for the sanitation facilities.

Figure 2.3 Illustration/example of the possible employer's permanent accommodation in the main camp area[1]

2.4.4. Workshop/stores incorporated in the powerhouse

The Contractor shall construct a Workshop and Stores room within the powerhouse (Figure 2.5). The room shall have lockable steel doors and windows. An area of approximately 0.2 hectares has been designated for this purpose. Final coordinates will be given by Butama Hydroelectricity Company Pvt Ltd.

The function of the workshop is to provide a minimum working space of 5m by 5m, and be equipped with perimeter heavy duty lockable storage units for small tools and small spare parts. There shall be ample electrical outlets.

The location shall provide convenient and level access to the loading bay so that heavy items can be unloaded by the overhead travelling crane and manually wheeled into the workshop.

[1] Note: The illustration provided here is simply indicative for purposes of this ESIA.

Figure 2.4 Illustration/example of the possible powerhouse in which the workshop/stores will be incorporated[2]

2.4.5. Vehicle/equipment storage and parking yard

The vehicle/equipment storage and parking yard for the Sindila MHP will be located within the contractor's camp (see Section 2.4.5 above). The vehicle/equipment storage and parking yard will have a size of 150m by 80m. The yard is expected to be the base for a fleet of standard vehicles and equipment during the construction phase of the Sindila MHP, characteristic of the anticipated project works and will provide for vehicle parking and turning of large vehicles during normal construction activities. It is anticipated that the following types of vehicles and equipment will be required (also refer to Section 2.5.2 below):

- One large crane for handling goods within the storage yard;
- Trucks of various sizes - some fitted with Hiab or Atlas-type hoists for unloading materials and equipment;
- Mobile cranes;
- Tractors with winches;
- Cable stringing pullers;
- Pilot line winders;
- Cable stringing tensioners;
- Cable reel carriers;
- Truck/trailer mounted water tanks;
- 4-wheel drive vehicles;
- Compressors with pneumatic equipment such as rock drills;
- Concrete mixers;
- Graders, excavators, compactors; and
- Diesel generators.

[2] Note: The illustration provided here is simply indicative for purposes of this ESIA.

As already mentioned in Section 2.4.5 above, the contractor will be responsible for the design, construction, maintenance and dismantling of all structures/ developments within the construction camp including the vehicle / equipment storage and parking yard.

At a minimum, the following activities will be carried out during the construction of the vehicle/ equipment storage and parking yard.

- The area of the vehicle/equipment storage and parking yard will be cleared of vegetation, stripped of topsoil, and levelled and compacted to provide a good working surface.
- Stripped topsoil will be temporarily stockpiled to the side of the parking yard within the fire break zone for reuse during site restoration.
- The site will be constructed with imported and compacted murram (see Section 2.4.10. below), designed to form a hard, durable surface ready for associated equipment.
- A fire break will be maintained outside the vehicle/equipment storage and parking yard perimeter. In this zone, grass and bushes will be cut back to near ground level, but the roots will not be removed. Trees will remain in place. Topsoil from stripping of the yard will be stored within this area.

The vehicle/equipment storage and parking yard will also serve as a muster station and staging area for vehicles and equipment in case of an emergency.

2.4.6. Stone/ murram quarries, burrow pits and sand mining areas

It is the developer's intention that:

- Murram will be sourced from existing and approved local quarries within or near Bundibugyo District; and
- Only approved quarries will be used.

It is assumed that these will most likely be existing production centres that are not limited to supplying Butama Hydro Electricity Company Ltd and it is assumed that the necessary assessments for these quarries have already been conducted by their respective operators. Assessments of these quarry areas therefore do not form part of the current ESIA. Thus, this support component will not be assessed further in this ESIA.

2.5. Workforce Requirements

The construction and operation of the Sindila MHP will require a number of employees including Engineers, Electricians, Supervisors, Accounts Clerks, Masons, Carpenters, Bar Benders, Riggers, Labourers and Security Personnel etc (see Table 2.4 below). Depending on the availability of the human resources in the surrounding areas, all semi-skilled and unskilled employment opportunities, where possible, will exclusively be provided to the people of nearby villages.

Table 2.4 Work force requirement for the Sindila MHP

Job category	Construction phase	Operation phase
Managers	1	1
Civil Engineers	2	
Mechanical Engineers	1	1

Job category	Construction phase	Operation phase
Electrical Engineers	1	1
Environmental & Safety Officer	1	
Technical officers / Supervisors	4	1
Technicians / Powerhouse operators	1	8
Account Assistants	1	1
Skilled Labourers (Masons, Carpenters, Bar benders, Riggers etc.)	40	2
Un-skilled Labourers, Helpers	120	10
Office and stores staff	2	
Security Personnel	5	4
Total	**179**	**29**

2.5.1. Training for powerhouse personnel

Experienced O&M staff are difficult to find for hydropower installations in remote areas. To secure necessary staff, it is necessary in such cases, to train personnel with the required educational background and technical capability. However, in addition to training, such staff will require work experience, best obtained from working on similar power plants. Experience cannot be substituted with education for most of the routine jobs related to the operation of hydropower plants. There is also the possibility of highly educated personnel finding their work tedious and looking for alternatives. Hence the prospect of recruiting raw personnel and providing more intensive training is more attractive. Acceptable operational experience can be obtained through secondment to the operational teams of similar power installations. Maintenance staff will receive valuable experience if suitable secondment to the manufacturers and acceptable training can be arranged, preferably as part of the equipment supply contract. The process of recruiting operational and maintenance staff will start early in the implementation phase, preferably a couple of months before the commencement of plant installation. The ideal situation will be to have all potential operational staff actively participating in the installation of plant and equipment.

2.5.2. Required equipment/machinery

Key equipment that will be used in the development of the proposed project is presented in Table 2.5.

Table 2.5 Machinery and Equipment to be used

Structure/Activity	Machinery / Equipment to be used	Number of Items
Land preparation, access road construction	Motor Grader	02
	6T Roller	02
	10T Tipper	02
	Water Bowser	03
Construction of civil structures such as dam, Powerhouse, buildings etc.	Excavator	03
	Dumpers	02
	Grouting Machine	01
	Concrete Mixer	01
	Concrete Pumping Machine	01
	Backhoe	02
	Dewatering Pumps	05
	Air Compressor	02
	Jack Hammer	02
General	Diesel Generators	05
	Welding Plants	10

2.5.3. Construction schedule

The length of time from the awarding of the construction contract to the commissioning of the power plant is estimated to be approximately eighteen months (540 days), with work beginning immediately following contract award. The construction schedule is given below (Table 2.6)

Preparatory activities will involve mobilization, land acquisition, construction of access roads and quarters etc. The major activities, such as construction of the headrace canal and penstock path will begin in the 1st year of the construction period. The powerhouse construction and transmission line erection will commence in the 2nd year of the construction period. Structures such as the weir, forebay tank and de-silting tank will be constructed in the middle of the construction schedule. Within 1 week of the commissioning period, the turbines and generators will be ready for power generation.

2.5.4. Sources of construction materials and equipment

Materials such as sand, cement, aggregate metal and reinforcement steel will be obtained locally from existing and approved local suppliers within or near Bundibugyo district. The project developer will liaise with the district local governments in the identification of quarry sites for use. It is the project developer's intention that only approved quarries be used and since these will most likely be existing production centres that are not limited to supplying Butama Hydro Electricity Company Ltd,

assessments of these quarry areas do not form part of the current ESIA. It is assumed that assessments for existing quarries have already been conducted by their respective operators.

Other construction materials, such as rubble and filling material, will be sourced from local approved suppliers as well as from the excavation site.

Table 2.6: Construction Schedule

Contract	Schedule (months from start date)									
	0-2	2-4	4-6	6-8	8-10	10-12	12-14	14-16	16-17	17-18
Access roads										
Civil										
HMEC materials										
HMEC installation										
EMEC supply										
EMEC installation										
Testing and commissioning										

2.5.5. Wastes and spoils handling facilities

The Sindila MHP will generate wastes of various types (both biodegradable and non-biodegradable) mainly during the construction phase. Such wastes may include stones, sand, steel (metallic bars), insulators and other construction materials. Organic wastes such as foodstuffs and human waste will also be generated at construction camps as will plastic wastes such as mineral water bottles, polythene bags, jerry cans, cups, plates and other plastic accessories.

Waste will also be generated from demolition of built up structures. Such waste may include iron sheets, timber, poles, nails, doors, windows, tiles, bricks, concrete and firewood among others.

All the waste generated will be managed in accordance with the Waste Management Plan (WMP) presented in Section 8.1.1.3 of this ESIA.

As a matter of fact, waste generated from the proposed activities will follow the waste management hierarchy as outlined below:

- Reduction;
- Reuse;
- Recycling;
- Recovery;
- Treatment; and
- Responsible disposal.

No waste will be disposed of in sensitive environments e.g. in water bodies, and the Contractor will, where applicable, obtain all necessary approvals before disposing of any waste.

2.5.6. Safety and Health

2.5.6.1. Occupational health and safety training

A site tour will be undertaken before the commencement of any work.

A personal protective equipment (PPE) policy will be enforced at the site throughout in line with the requirements of the Sindila MHP Health Safety and Environment (HSE) Management Plan - Section 8.1.1.1 below.

A high hygiene standard will be maintained within the housekeeping, catering, food, water and waste processing areas.

All personnel involved in work execution or supervision will have the appropriate qualifications and accreditations and will be properly trained in the appropriate HSE risk management. Particular attention will be paid to delivering comprehensive training to all newcomers; periodic refreshment to all staff at pre-determined frequency; checking competency as needed; and the renewal of accreditations before expiry dates are reached. Butama Hydro Electricity Company Ltd will be notified immediately of all accidents, incidents, near misses, equipment damage or leaks/spills which may occur.

2.5.6.2. Emergency Preparedness and Response

A bridging document will be put in place prior to the start of the proposed activities in order to ensure that the Emergency Response Plan (ERP) is as per the contractor's procedure and in compliance with Butama Hydro Electricity Company Ltd's ERP, procedures and standards, as presented in Section 8.1.1.8 below.

2.6. Operation and Maintenance

The Operation and Maintenance (O&M) of hydropower plants can be organised in many ways. The organisation depends on how the owner/developer is organised, with regards to locality, available resources and local infrastructure. The general technological standard in the region and the area where the hydropower plant is established also influences the organisational arrangements. The tendency in developed countries, is towards automation and remote control power-plant operation. In places where labour costs are relatively low and technical resources and local infrastructure are found wanting, a large workforce is preferred to man less complicated and automated plants.

The O&M arrangement depends to a great extent on the financial viability and profitability of the plant (i.e. the cost of EM plant vs. cost of maintenance). Since this is a high cost and high revenue generating project, the proposed plant is very advanced with a high level of automation, to ensure proper plant operation and minimum downtime. However, the open headrace system is less complicated but more cumbersome in that, the cleaning will be manually done, as will the operation of the head-works gates and other controllers, and therefore, a workforce shall be required for the maintenance and operation of the head-works system. This is especially true for the maintenance of the hydraulic system and for functions like silt and trash removal. These tasks do not justify installation of intricate automated systems, and can be reliably carried out with manual labour.

Furthermore, the organisational set up will make allowances for the local situation, overall local resources, availability of public services, local traditions and proximity to the owner's organisation and public utility resources.

The main requirement in the O&M planning for this project is the necessity to integrate the O&M structure with the infrastructure available to the project developer, and the close proximity of the village and the local community. The other factor in O&M planning will be integrating the overall structure with the O&M plan for all projects proposed to be set up by the developer. The concept of a competent management team, where a skilled and competent O&M team consisting of experienced personnel in Civil, Mechanical and Electrical sectors man several plants under one O&M umbrella, will be borne in mind. This aspect will justify appointment of high caliber personnel, with previous hydropower plant experience, on a permanent basis.

A major advantage of this kind of project is the relatively simple and straight forward monitoring required. Due to the intrinsic simplicity of the production process, a daily reporting procedure will provide total overview of the project's operational performance to the owners.

Daily performance analysis considering yield received versus power generation can be carried out and any variation from the expected power generation can be instantly identified. This could have been due to several reasons, among which are:

- Plant shut down due to power failure;
- Plant trip off due to protection relay activation;
- Plant closure due to blockage of hydraulic head-works due to silting;
- Plant shut down due to blockage of trash racks;
- Electro-mechanical plant breakdown;
- Riot/Strike shutdown; and
- Faulty meter readings.

It will be the duty of the plant superintendent to include these as comments in the daily report, and also corrective measures and major implications if there are any. This data will then be used to compile monthly progress reports based on rainfall, stream flow and energy generation. This report will also provide a cash flow statement including a detailed account of extraordinary expenditure occurring during the relevant period. This will at maximum, be a four page document, which will be very straight forward and easy for the directors to assess with minimum effort.

2.6.1. Operations and Maintenance structure

The operation and maintenance team will be mainly divided into two sections.

- Administrative; and
- Production.

2.6.2. Administrative team

The administrative team will oversee the efficient functioning of the project and make all decisions related to the proper operation and maintenance of the project, and will comprise of the following personnel:

- Managing Director;
- Finance Director;
- Technical Director; and
- Administration Director.

The Managing Director will have overall responsibility over the project.

The Finance Director will be in charge of all financial activities related to the project, including preparation of invoices for payments and collection of payments, payment of all operations and maintenance (O&M) expenses and staff salaries, settlement of debts and payment of dividends to shareholders.

The Technical Director will be responsible for the proper technical operation of the power plant. Technical assistance will also be provided by the consultant engineers who will make periodic visits to the site as and when required, and recommend appropriate measures for improved technical project performance. The consultant engineers will include:

- A Consultant Electrical Engineer;

- A Consultant Mechanical Engineer; and
- A Consultant Civil Engineer.

The Administration Director will have overall responsibility over the production staff. The production staff will constitute of the following personnel:

2.6.3. Training for powerhouse personnel

Experienced O&M staff are difficult to find for hydropower installations in remote areas. To secure necessary staff, there is a need to train personnel with the required educational background and technical capability. However, in addition to training, such staff will require work experience, best obtained from working on similar power plants. Experience cannot be substituted by education for most of the routine jobs related to the operation of hydropower plants. There is also the possibility of highly educated personnel finding their work tedious and looking for alternatives. Hence, the prospect of recruiting raw personnel and providing more intensive training is more attractive. Acceptable operational experience can be obtained through secondment to the operational teams of similar power installations. Maintenance staff will receive valuable experience if suitable secondment to the manufacturers and acceptable training can be arranged, preferably as part of the equipment supply contract. The process of recruiting operational and maintenance staff will start early in the implementation phase, preferably a couple of months before the commencement of plant installation. The ideal situation will be to have all potential operational staff actively participating in the installation of the plant and equipment.

2.7. Decommissioning

It is anticipated that the hydropower station facilities will be continuously maintained and repaired, and will be operated for several decades. Because of their long useable life, the circumstances under which they might ultimately be decommissioned are difficult to foresee at this stage. Thus, only a site construction decommissioning approach can be considered at this stage in the study. As a result, the practical decommissioning will for now involve the following:

- Restoration of sites through levelling and re-vegetation measures;
- Removal of obsolete equipment and associated equipment parts;
- Demobilisation and return of imported labour force after the project;
- Grievance management mechanisms with the host communities before site closure;
- Repairs of damaged roads and restoration of access routes and route deviations; and
- Removal of construction debris and unused materials.

2.8. Project cost and investment plan

The project cost is estimated at US$ 16.5 Million (see Table 2.7 below). This is proposed to be funded through 70:30 debt proportions. The developer will invest all capital required through financial close. Post-financial close equity will come in the form of preferred equity from Lereko Metier Sustainable Capital (LMSC) and Acumen Fund. Debt will come from either the Overseas Private Investment Corporation (OPIC) or FMO. Therefore, the external debt component of US$ 10 Million will be infused by these institutions and international banks. Thus, the proposed equity investment for this project will be approximately US$ 4.95 Million.

Table 2.7 Proposed equity investment for the Sindila MHP

Source of Finance	Amount (Million US$)	%
Equity	4.95	30
Long term debt	11.6	70
Total	**16.5**	**100**

3. POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

This Section discusses the policy, legal and institutional framework within which the proposed Sindila MHP is expected to operate. Relevant National/Local and International/Development partner environmental safeguard requirements, policies, legislations and guidelines are discussed along with relevant international environmental agreements and conventions.

3.1. Relevant National Policies and Guidelines

The Policy framework is critical in planning and implementation of development projects. The national policies and guidelines applicable to the proposed Sindila MHP for which a detailed discussion of the relevance of each to the proposed project is provided in Table 3.1. These include:

- Power Sector Strategic Plan;
- The National Energy Policy, 2002;
- Renewable Energy Policy, 2007;
- The National Environment Management Policy, 1994;
- National Water Policy;
- The National Industrial Policy, 2008;
- The National Wetlands policy 1995
- Vision 2025;
- Vision 2040;
- The National Gender Policy, 1997;
- National Policy on HIV/AIDS; and
- Occupational Health and Safety Policy.

3.2. Relevant Local Policies and Guidelines

The local policies and guidelines applicable to the proposed Sindila MHP for which a detailed discussion of the relevance of each to the proposed project is provided in Table 3.1 and these include:

- Sindila sub-county development plan 2010/11-2014/15; and
- Bundibugyo District Local Government Statistical abstract.

3.3. Relevant National Legislation

Provided in Table 3.2 is the environmental and social legislation applicable to the proposed Sindila MHP including but not limited to:-

- The Constitution of the Republic of Uganda, 1995;
- National Environment Act, Cap 153;
- The Electricity Act, Cap 145;
- The Land Act, Cap 227;
- The Land Amendment Act, 2010*;
- The Uganda Wildlife Act, Cap 200;
- The Water Act, Cap 152;
- The Investment Code, Cap 92
- The Fisheries Act, Cap 197;
- The National Forestry and Tree Planting Act, 2003;
- The Historical and Monuments Act, 1967;
- The Occupational Safety and Health Act, 2006;
- The Public Health Act, Cap 281;
- The Employment Act, 2006;
- The Worker's Compensation Act, Cap 225;
- The Local Governments Act, Cap 243;

- The Traffic and Road Safety Act, 1998;
- The River Act, Cap 357;
- The Mining Act, Cap 148;
- The Physical Planning Act, Cap 281;
- The Explosives Act, Cap 305; and
- Labour Unions Act, 2006

Other Regulations that deem consideration, as far as the proposed Sindila MHP is concerned are:

- Environmental Impact Assessment Regulations, 1998;
- The National Environment (Conduct and Certification of Environmental Practitioners) Regulations, 2001;
- National Environment (Audit) Regulations, No. 12 of 2006;
- The National Environment (Standards for Discharge of Effluent into Water or on Land) Regulations, 1999;
- The National Environment (Waste Management) Regulations, 1999;
- The National Environment (Wetlands, River banks and Lake shores Management) Regulations, 2001;
- The National Environment (Minimum Standards for Management of Soil Quality) Regulations, 2001;
- The National Environment (Noise Standards and Control) Regulations, 2003;
- The National Environment (Management of Ozone Depleting Substances and Products) Regulations, 2001;
- The Water Resources Regulations, 1998;
- Water (Waste Discharge) Regulations, No. 32 of 1998;
- The Electricity (Primary Grid Code) Regulations, 2003; and
- The Electricity (Tariff Grid Code) Regulations, 2003.

3.4. International Conventions and Agreements

Uganda has an obligation to abide by the terms of the international agreements that it has ratified or acceded to relating to the environment. The agreements of potential relevance to the proposed Sindila MHP for which a detailed discussion of the relevance of each to the proposed project is provided in Table 3.3 include:

- The Ramsar Convention on wetlands of international importance;
- The convention concerning the protection of the world cultural and natural heritage (World Heritage Convention) – UNESCO;
- The Convention on Biological Diversity (CBD) – United Nations;
- The African Convention on the conservation of nature and natural resources – Organisation of African Union(OAU);
- The Convention for the protection of the ozone layer and its Montreal Protocol;
- The Convention on the control of trans-boundary movements of hazardous wastes and their disposal (Basel Convention); and
- The Bamako Convention on the ban of the import into Africa and the control of trans-boundary movement and management of hazardous wastes within Africa – OAU;

3.5. International Policies

This updated ESIA has been prepared in line with relevant international policies and guidelines detailed below.

Development partner policies

Development partners or their agencies fund most development projects in developing countries, Uganda inclusive. Most development partners require the World Bank (WB), International Finance

Corporation (IFC) or African Development Bank (AfDB) guidelines as a basis for funding development projects. Therefore, the Sindila ESIA addresses the WB and IFC social and environmental safeguard policies.

The following World Bank operational guidelines and procedures are relevant to the Sindila MHP:-

(a) World Bank Operational Policies

The operational policies provide the basis on which the World Bank screens proposed projects to determine the appropriate extent and type of environmental assessment to be undertaken. The World Bank classifies proposed projects as class a, b, c or f1 depending on the type, location, sensitivity, and scale of the project and the nature and magnitude of its potential environmental impacts. The project sponsor is responsible for any environmental due diligence required by the safeguard policies.

There are ten 'safeguard policies' that the bank regards as critical to ensuring identification, minimisation and mitigation of potential social and environmental impacts of development projects, they are;

- Environmental Assessment;
- Physical Cultural Property;
- Projects in Disputed Areas;
- Forests;
- Indigenous Peoples;
- Projects involving International Waters;
- Involuntary Resettlement;
- Natural habitats;
- Pest management; and
- Safety of Dams.

The discussion below presents the safeguard policies relevant to the proposed Sindila MHP. Safeguard policies on disputed areas, Forests, Pest Management and Indigenous people are not discussed since the project does not trigger such policies.

OP 4.37 - Safety of dams

The safeguard policy on dams states that, for the life of any dam, the owner is responsible for ensuring that appropriate measures are taken and sufficient resources provided for the safety of the dam, irrespective of its funding sources or construction status. Because there are serious consequences if a dam does not function properly or fails, the World Bank is concerned about the safety of new dams it finances and existing dams on which a Bank-financed project is directly dependent. The World Bank also requires that the borrower adopts and implements certain dam safety measures for the design, bid tendering, construction, operation, and maintenance of the dam and associated works.

The Bank distinguishes between small and large dams;

a) Small dams are normally less than 15 metres in height. This category includes, for example, farm ponds, local silt retention dams, and low embankment tanks.
b) Large dams are 15 metres or more in height. Dams that are between 10 and 15 metres in height are treated as large dams if they present special design complexities for example, an unusually large flood-handling requirement, location in a zone of high seismicity, foundations that are complex and difficult to prepare, or retention of toxic materials.

Dams under 10 metres in height are treated as large dams if they are expected to become large dams during the operation of the facility. For small dams, generic dam safety measures designed by

qualified engineers are usually adequate. For large dams, the Bank requires certain guidelines to be met. The Sindila MHP is regarded as a small dam because the proposed dam height will be 1.35 metres.

OP 4.01 - Environmental Assessment

This is the umbrella policy for the World Bank's safeguard policies and requires an environmental impact assessment to be carried out before implementation of category A projects. Category A projects are those that are likely to have significant adverse impacts and irreversible environmental impacts. Conversely, category B projects are those with limited impacts that can be mitigated, and require an initial environmental evaluation or project appraisal document with an EMP covering all negative impacts. The proposed Sindila MHP falls under category B projects, and hence the need to prepare an Environmental and Social Impact Assessment.

OP 4.12 - Involuntary resettlement

This is the guiding policy when a project results in involuntary resettlement. OP 4.12 describes the detail and elements that a resettlement plan should include. These include objectives, potential impacts, socio-economic studies, legal and institutional framework, eligibility, valuation and compensation for losses, resettlement measures, relocation planning, community participation, and grievance redress procedures, implementation schedule, costs and budgets, and monitoring and evaluation. This report conforms to the WB policy requirement on contents and structure. Elaborated below are sections relevant to the Sindila MHP.

WB OP 4.12.(6a) requires an institution of measures to ensure that displaced persons are (i) informed about their options and rights, (ii) consulted on, offered choices and provided with technically and economically feasible resettlement alternatives, and (iii) provided prompt and effective compensation at full replacement costs.

WB OP 4.12(8) requires that particular attention be paid to the needs of vulnerable groups among those displaced such as those below the poverty line, the landless, the elderly, women and children, indigenous peoples, and ethnic minorities.

WB.OP 4.12 (13a) stipulates that any displaced persons and their communities and any host communities receiving them should be provided with timely and relevant information, consulted on resettlement options and offered opportunities to participate in planning, implementing and monitoring resettlement.

WB OP 4.12 (12a) states that payment of cash compensation for lost assets may be appropriate where livelihoods are land-based but the land taken for the project is a small fraction (less than 20%) of the affected asset and the residual is economically viable.

WB OP 4.12 paragraphs (6b & c) state that in case of physical relocation, displaced persons are provided with;

- Assistance (such as moving allowances) during relocation;
- Residential housing, or housing sites, or as required, agricultural sites for which a combination of productive potential, location advantage, and other factors are equivalent to the advantages of the old site;
- Support after displacement, for a transition period, based on a reasonable estimate of the time likely to be needed to restore their livelihood and standards of living; and
- Development assistance in addition to compensation measures such as land preparation, credit facilities, training, or job opportunities.

WB OP 4.12 paragraph 13(a) requires that appropriate and accessible grievance mechanisms are established to sort out any issues arising. These frameworks will be relevant in mitigating adverse socio-economic impacts associated with the proposed Sindila MHP.

OP 4.04 - Natural habitats

This policy guideline requires infrastructure development to take into account the conservation of biodiversity, as well as the numerous environmental services and products which natural habitats provide to human society. OP 4.04 prohibits projects, which would lead to significant loss or degradation of any critical natural habitats, whose definition includes those natural habitats, which are legally protected, officially proposed for protection, or unprotected but known to have high conservation value.

OP 4.11 - Cultural property

This policy provides guidelines for the preservation of cultural property and seeks to avoid their elimination, otherwise mitigation activities should be undertaken to limit the adverse impacts as far as possible.

Details of these and other World Bank guidelines can be obtained from the Bank website site, www.worldbank.org.

In addition to all the above World Bank Guidelines, IFC's Environmental Health and Safety General Guidelines as well as Performance Standards on Social and Environmental Sustainability which include the following will be followed and adhered to where applicable:

Performance Standard 1: Social and Environmental Assessment and Management Systems
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
Performance Standard 8: Cultural Heritage

The relevance of the key IFC Performance Standards has been discussed in Table 3.4 below.

(b) Equator Principals

The Equator Principles (EP) are a set of environmental and social benchmarks for managing environmental and social issues in development project finance globally. The Equator Principles apply to all project financings globally with total project capital costs of US$10 million or more, and across all industry sectors. In addition, while the Principles are not intended to be applied retroactively, and apply to all project financings covering expansion or upgrade of an existing facility where changes in scale or scope may create significant environmental and/or social impacts.

Principle 1: Review and Categorisation
Principle 2: Social and Environmental Assessment
Principle 3: Applicable Social and Environmental Standards
Principle 4: Action Plan and Management System
Principle 5: Consultation and Disclosure
Principle 6: Grievance Mechanism
Principle 7: Independent Review
Principle 8: Covenants
Principle 9: Independent Monitoring and Reporting
Principle 10: EPFI Reporting

(c) The World Bank group Environmental, Health and Safety guidelines of 2007

The Environmental, Health, and Safety (EHS) guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP). These general EHS guidelines are designed to be used together with the relevant industry sector EHS guidelines which provide guidance to users on EHS issues in specific industry sectors. These guidelines emphasise and spell out key parameters to consider under environmental, occupational health and safety, community health and safety, construction and decommissioning aspects. Therefore the construction and decommissioning of the proposed hydropower project will be undertaken with due consideration to these guidelines. The World Bank group Environmental, Health and Safety guidelines of 2007 shall apply to this project and will be referred to during project implementation and monitoring.

Table 3.1: National Policies applicable to the proposed Sindila MHP

Legislation	Key provisions/requirements	Relevance to the proposed Sindila MHP
National Policies		
Power Sector Strategic Plan	The strategic plan paved way to have a liberalized, decentralized Energy Industry which resulted in the formulation of the: Uganda Electricity Generation Company Limited (UEGCL) that took ownership and operation of generation assets; Uganda Electricity Transmission Company Limited (UETCL) that took ownership and operation of transmission assets; Uganda Electricity Distribution Company Limited (UEDCL) that took ownership and operation of distribution assets and customer services.	The implementation of the proposed Sindila MHP will contribute to the liberalization of the energy industry.
The National Energy Policy, 2002	Outlines the objectives of the energy sector in Uganda, which includes among others, the requirement to manage energy related environmental impacts.	The proponent should ensure that the environmental impacts are handled in line with the policy.
Renewable Energy Policy, 2007	The overall goal of this Policy is to increase the use of modern renewable energy, so that its proportionate use increases from the current 4% to 61% of the total energy consumption by the year 2017.	The proposed Sindila MHP is aimed at contributing to Uganda's energy goals by contributing an annual energy output of 25.9 GWh to the national grid.
The National Environment Management Policy, 1994	Provides for sustainable economic and social development through a number of strategies that include Environmental and Social Impact Assessment.	Through this ESIA, the project planning is ensuring that all the environmental and social impacts anticipated from the proposed project are assessed and duly mitigated during project implementation so as to safeguard the integrity of the environmental and social components of the project area
The National Water Policy, 1999	The objective of the policy is to provide guidance on development 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 needs, with full participation of all stakeholders and mindful of the needs of future generations.	Through this ESIA, project planning should ensure that community water sources within and in the vicinity of the project area are protected.
The National Industrial Policy, 2008	One of the core objectives of this policy is exploiting and developing natural domestic resource-based industries and promoting competitive industries that use local raw materials.	The proposed Sindila MHP is aimed at developing Uganda's energy sector which encompasses the hydro power industry.
The National Wetlands Policy, 1995	This Policy aims at promoting the conservation of Uganda's wetlands in order to sustain their ecological, social and economic functions for the present and future generations.	The activities pertaining to Sindila MHP will be carried out in line with the goals of this Policy.
Vision 2025	This is a set of goals that the Uganda government set to achieve for the common good and economic development of the country by the year 2025. The goals cover political, economic, social, environmental, and cultural aspects of life. Key in the environmental goal is the desire by Ugandans to have a sustainable socio-economic development matched with environmental quality and ecosystem resilience. In order to achieve a sustainable socio-economic development, government has prioritised industrialisation (value addition) as the key factor. To this end, rural electrification program was established to catalyse the socio-economic development of the rural areas of the country.	The proposed Sindila MHP will go a long way in meeting this vision for the people of Bundibugyo and the surrounding regions of Uganda.
Vision 2040	This is centred on harnessing opportunities, improving competitiveness and strengthening the fundamentals for transformation of Uganda as a nation. In this Vision, it is noted that Uganda has abundant fresh water resources that provide numerous opportunities which can foster faster socio-economic transformation. These opportunities include but are not limited to; irrigation, livestock rearing, and hydropower generation. To generate affordable electricity, the government will steer the development of all the hydropower potential which is estimated at 4,500 MW. This will include small, mini and large hydropower plants.	The proposed Sindila MHP is an opportunity enshrined under the water resources sector of Vision 2040. It is therefore in line with Uganda's Vision 2040 goals for the energy and water resources sectors.
The National Gender Policy, 1997	The aim of the Policy is to guide and direct at all levels, the planning, resource allocation and implementation of development programmes with a gender perspective. The National Gender Policy forms a legal framework and mandate for every stakeholder to address the gender	The proposed Sindila MHP will be established and operated in consideration of the National Gender Policy guidelines.

Legislation	Key provisions/requirements	Relevance to the proposed Sindila MHP
	imbalances within their respective sectors. Its overall goal 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 in Uganda in particular, the women.	
National Policy on HIV/AIDS	The National Policy on HIV/AIDS covers all workers and prospective workers, all employers and prospective employers from the public and private sectors both formal and informal. The policy spells out the key principles underlying its implementation namely: non-discrimination; confidentiality; HIV testing; greater involvement of people living with HIV/AIDS; promotion of prevention; treatment, care and support; and gender concerns in the work place. The goal is to provide a framework for prevention of further spread of HIV and mitigation of the socio-economic impact of HIV/AIDS within places of work in Uganda.	The workers who will be employed by the Sindila MHP should be treated in a fair manner regardless of their health status in line with the goals of this policy.
Occupational Health and Safety Policy	The policy seeks to: • Provide and maintain a healthy working environment; • Institutionalise OHS in the power sector; and • Contribute towards safeguarding the physical environment. The OHS Policy Statement is guided by the Constitution of the Republic of Uganda (1995) and other global, national and sectoral regulations and policies. The policy statement also takes into consideration, 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 promotes the safeguarding of workers' health and safety in the work place as pertains to the proposed Sindila MHP.
Local Policies and Plans		
Rwenzori Mountain National Park Management Plan	According to UWA, the Rwenzori Mountain National Park Management Plan is currently being reviewed and therefore the provisions of the former plan would be null and void here, as certain issues might have vastly changed. Therefore, for the proposed project it will be important to liaise closely with UWA during planning and implementation, to ensure that the intent of the emerging management plan is reflected.	The proposed Sindila MHP particularly the weir site is 430m northwest of the Rwenzori Mountain National Park boundary. Therefore activities pertaining to the proposed project need to be in line with the requirements of the Rwenzori Mountain National Park Management Plan.
Sindila sub-county Development Plan (2010/11-2014/15)	This is a planning document developed at the sub-county level and is geared towards accelerating development in the sub-county in an environmentally sound and sustainable manner.	The proposed Sindila MHP to be undertaken in Sindila sub-county will need to take into consideration the strategies contained in this development plan. In addition, the project proponent should work in liaison with the Sindila sub-county particularly for any updates in the sub-county development plan.

Table 3.2: National legislation applicable to the proposed Sindila Mini Hydropower project

Legislation	Key requirements	Relevance to proposed Sindila MHP
The Constitution of the Republic of Uganda, 1995	The Constitution requires the Government of Uganda to promote sustainable development and public awareness of the need to manage, promote and protect the rational use of natural resources in a balanced and sustainable manner for the present and future generations. Articles 39 and 17(f) provide for the right to a clean and healthy environment, and the duty to maintain such an environment.	The measures to ensure that care is taken to protect natural resources from degradation are presented in this document. The integrity of the general environment needs to be protected in line with the provisions of the Constitution of the Republic of Uganda, 1995.
The National Environment Act, Cap 153,1995	The Third Schedule of the Act lists projects to be considered for Environmental and Social Impact Assessment (ESIA). The schedule specifies that any development that involves electrical infrastructure including (electrical generation stations; electrical transmission lines; electrical substations and pumped-storage schemes) must be subjected to an environmental impact assessment.	The project as described in Section 2 falls in the category of projects which require Environmental and Social Impact Assessment (ESIA). It is therefore on the above basis that an ESIA for the proposed Sindila MHP was conducted.
The Electricity Act, Cap 145	The Electricity Act, Cap 145 provides for the need to protect the environment during consideration, development and operation of electricity supply projects. The Act, established the Electricity Regulatory Authority (ERA) as a statutory body mandated to regulate all aspects of the electricity industry in Uganda. Section 10 of this Act clearly defines ERA's mandate as a regulator. Section 50 (2) makes it a condition to follow procedures laid down in the National Environment Act, Cap 153, 1995 during removal of installations considered inappropriate for further operations of the plant/activity. Furthermore, Section 68 of the Electricity Act, 1999 outlines procedures and conduct of the licensee during placement and maintenance of any electricity supply lines in, over or upon any land. Subsection (3) requires the licensee to make as little damage as possible to land and to the environment and should ensure prompt payment of fair and adequate compensation to all interested persons for any damage or loss sustained by the placement and maintenance of any electricity supply lines in, over or upon any land. The Act, 1999 gives adequate guidelines for the conduct of a licensee and recognises the need to make good any damage and notice to those who may be affected by the project activities.	The proposed Sindila MHP ESIA adequately covers these provisions. The mitigation measures for foreseeable impacts are detailed in the EMP (Section 8.1).
The Land Act, Cap 227	The Land Act Cap 227 provides for the tenure, ownership and management of land. Section 41 (7) provides conditions for the acquisition of land. Section 45 states that any use of land shall conform to the provision of the Town and Country Planning Act, Cap 30, 1951 and any other applicable laws. Section 59 lists the functions of the District Land Board, which include compiling a list of rates of compensation payable in respect of crops, buildings of a non-permanent nature and anything else that may be prescribed and review every year the list of rates of compensation.	The land on which the proposed Sindila MHP is to be developed should be acquired in line with the requirements of this Act. In addition, any compensation payments that need to be made should also conform to the District Land Board rates for the current financial year.
Land Amendment Act (2010)	This is an Act to amend the Land Act (1998) in order to enhance the security of occupancy of lawful and bonafide occupants on registered land in accordance with Article 237 of the Constitution, and for related matters. According to the Land Amendment Act (2010) a lawful or bona fide occupant shall not be evicted from registered land except upon an order of eviction issued by a court and only for non-payment of the annual nominal ground rent. A Court shall, before making an order of eviction under this section, take into consideration the matters specified in Section 32(1). When making an order for eviction, the Court shall state in the order, the date, being not less than six months after the date of the order, by which the person to be evicted shall vacate the land and may grant any other order as to expenses, damages, compensation or any other matter as the court thinks fit. Section 59 of the principal Act (Land Act, Cap 227) is amended by inserting immediately after subsection (1) the following—"(la) where a board enters into or undertakes or concludes any such transaction or allocates land in contravention of subsection (l) (a), the transaction shall be void."	The proponent will carry out all compensations in line with the provisions of this Act and with consultation of the Bundibugyo District Land Board.

Legislation	Key requirements	Relevance to proposed Sindila MHP
The Uganda Wildlife Act, Cap 200	The main objective of the Uganda Wildlife Act, Cap 200 is to protect wildlife resources and enable derivation of benefits. The need for sustainable management of wildlife resources is captured within the framework of effective planning and stakeholder participation. The Act allows local community involvement and opens up wildlife management to the non-governmental/private sector by making it possible for the private sector to manage protected areas / wildlife and provide services.	The proposed weir site will be located 430 m north west of the Rwenzori Mountain National Park boundary therefore this Act is quite relevant and its provisions should be complied with.
The Water Act, Cap 152	The Act provides for the use, protection and management of water resources and supply in Uganda. One of the objectives of the Water Act Cap 152 is to control pollution and promote safe water storage, treatment, discharge and disposal of waste which may pollute water or otherwise harm the environment and human health. This Act provides for and regulates supply of water to the public. It seeks to protect the water as a resource. Under Section 34, any person who pollutes, or causes risk of pollution by any foul liquid, gas or other noxious matter to enter into a waterworks shall be liable on conviction to a fine. The Act is enforced by a number of agencies in the Ministry of Water and Environment. It is also an Act to provide for the use and management of water resources and supply; to provide for the constitution of water and sewerage authorities; and to facilitate the devolution of water supply and sewerage undertakings. An objective relevant to the proposed project is "to allow for the orderly development and use of water resources for purposes other than domestic use, such as the watering of stock, irrigation and agriculture, industrial, commercial and mining uses, the generation of hydroelectric or geothermal energy, navigation, fishing, preservation of flora and fauna and recreation in ways which minimise harmful effects to the environment." As stipulated in Section 18, no person shall construct or operate any works unless authorised to do so, in accordance with the Act. A person wishing to construct any works or to take and use water may apply to the director in the prescribed form for a permit to do so. This section further provides for conditions under which the permit may be granted. According to subsection (5) (c), the director may grant the permit on conditions that he or she may think fit; and the conditions may require the person to whom the permit is granted, to make compensation to affected person(s). Section 20 has provisions for the standard conditions under which a holder of a permit should use a water resource.	Waste management during the implementation of the proposed Sindila Mini Hydropower project should demonstrate that (i) no waste comes into contact with water; (ii) no waste is discharged directly or indirectly into a water body and (iii) no water is polluted in any other way or by any other substance due to activities related to the proposed project.
The Investment Code, Cap 92	Requires an investor to take necessary steps to ensure that the operations of his or her business enterprise do not cause injury to the ecology or environment (Section 18 2 (d)).	Potential impacts associated with the proposed Sindila MHP project, specifically those that have the potential of compromising the functioning of natural ecological or environmental systems, have been identified in this ESIA and appropriate mitigation measures proposed (Section 6).
The National Forestry and Tree Planting Act, 2003.	The Act furnishes the legal provisions for conservation, sustainable management and development of forests for the benefit of the people of Uganda and also provides for the declaration of forest reserves for the purpose of protection and production of forests and forest produce. The Act guarantees the sustainable use of forest resources and enhancement of the productive capacity of forests and furnishes the provisions for the promotion of tree planting and to consolidate the law relating to the forest sector and trade in forest produces etc. This Act repealed the Forest Act, Cap 147 and the Timber (Export) Act, Cap 151 and related matters and also established the National Forest Authority (NFA).	The proposed Sindila MHPP should be implemented in a way that the forest reserves are protected.
The Historical and Monuments Act, 1967	The Act provides for the preservation and protection of historical monuments and objects of archaeological, paleontological, ethnographical and traditional interest. Currently, this law has been placed under review by the Commissioner for Antiquities and Museums. Under this Act, the line minister may cause any of the aforesaid objects to be declared as preserved objects. The Act prohibits any person from carrying out activities on or in relation to any object declared	Whereas there were no sites of archaeological, paleontological, ethnographical, historical and traditional significance identified within the proposed project area, chance findings may be encountered. The developer is urged to exercise due diligence where historical property is discovered in any way during construction of the proposed project and other related activities. In this respect, a physical-cultural specialist should be on site to monitor excavation for the water channel (Canal) and other related hydropower plant structures.

Legislation	Key requirements	Relevance to proposed Sindila MHP
	to be preserved or protected. Section 10 of this Act spells out the procedures and requirements to declare and inspect newly discovered sites that may have archaeological, paleontological, ethnographical, historical and traditional significance for purposes of protection.	Project planning should ensure that all reasonable measures are taken to protect any objects encountered during the implementation proposed Sindila MHP that may be of archaeological, paleontological, ethnographical, historical or traditional interest and that, all work ceases at the proposed project area, should such objects be encountered - the findings of which need to be reported to the Department of Monuments and Museums within 14 days.
The Occupational Safety and Health Act, 2006	This Act consolidates, harmonises and updates the law relating to occupational safety and repeals the Factories Act of 1964. It makes provisions for the health, safety, welfare and appropriate training of persons employed in workplaces. Under Section 13 (b), it requires employers to ensure as far as reasonably practicable that the working environment is kept free from any hazard due to pollution. Section 40(2) states that a person shall, not less than one month before he or she begins to occupy any premises as a workplace, serve on the Commissioner, a notice with the particulars prescribed in Schedule 3. Sections 45-55 of the Act make provisions for the health, safety, welfare and appropriate training of persons employed in work places. Management of workplaces have to ensure safety and health of employees and equipment through provision of safety and health measures, appropriate machine guarding, personal protective equipment (PPE) like respirators, overalls and gloves. The Act emphasises work place managers to compel all workers comply and use the PPE in order to fulfil the provisions of this Act. Section 46 of the Act requires that every factory be kept in a clean state, including floors, walls, workrooms and ceiling or top of rooms. Furthermore Section 47 (2) states that a factory shall not, while work is carried out, be so overcrowded so as to cause risk of injury. Section 47(4) provides for ventilation and circulation of fresh air in each workroom.	Project planning should ensure that the necessary measures to ensure the safety and health of both Sindila MHP personnel and local communities within the project areas are put in place. The proponent will need to apply for Registration of a Workplace permit in accordance with the Act.
Public Health Act, Cap 281	Section 5 provides the local authorities with administrative powers to safeguard and promote public health. Section 105 imposes a duty on the local authority to take measures to prevent any pollution dangerous to the health of any water supply that the public has a right to use for drinking or domestic purposes. Section 7 of the Public Health Act Cap 281 provides local authorities with administrative powers to take all lawful, necessary and reasonable practicable measures for preventing the occurrence of, or for dealing with any outbreak of, any infectious communicable or preventable disease in order to safeguard and promote the public health. Section 105 of this Act imposes a duty on the local authority to take measures to prevent any pollution that is dangerous to health to enter any water supply that the public has a right to use for drinking or domestic purposes. The Act also addresses the location of waste disposal facilities such as solid waste skips and septic tanks in relation to settlements and food points.	During the construction and operation of the proposed Sindila MHP some activities may lead to contamination of the water supplies or spread of communicable diseases. Appropriate mitigation measures have been suggested in the EMP Section 8.1.
The Employment Act, 2006	The Act seeks to harmonise the relationship between employees and employers and to protect workers interests and welfare and safeguard their occupational health and safety.	The proponent should ensure that labour practices as well as those of any sub-contractors employed for the proposed Sindila MHP in terms of recruitment, contracting, deployment, remuneration, management and compensation of workers, are in line with this legal statutory instrument. In addition, the proponent should note that under this Act, labour officers from the Ministry of Gender, Labour and Social Development are empowered to inspect the working conditions of the workers during the implementation of the proposed project so as to ascertain the rights of the workers and to ensure that their provisions are provided for as well as their welfare.
Workers' Compensation Act Cap 225	This Act provides for compensation to workers for injuries suffered and scheduled diseases incurred in the course of their employment. Section 3 (1), states that, "If personal injury by accident arises out of a worker's employment, the injured worker's employer shall be liable to pay compensation in accordance with this Act." Section 18 (1) states that, "Subject to sub-sections (2) and (3), every employer shall insure and keep himself or herself insured in respect of any liability which he or she might incur under this Act to any worker employed by him or her.	The proponent should ensure that it is insured by a recognised insurer and that workers are protected and duly compensated in occurrence of any injuries and diseases incurred in the course of their employment during the implementation of the proposed Sindila MHP and in accordance with this Act.

Legislation	Key requirements	Relevance to proposed Sindila MHP
	Section 22 (1) elaborates the duty of the employer towards contractors or subcontractors. Where a person awards a contract or subcontract to an employer for the execution of any piece of work, that person shall be liable to pay to any worker employed in the execution of the contract or subcontract by the employer any compensation under this Act as if that person had been directly employed by that person. The Workers Compensation Act, 2000 provides for the provision of financial compensation for work related injury or illness. Section 28 of this Act 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 the twenty-four 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 claims 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." The Act further stipulates, "If on the hearing of an application for compensation in terms of subsection (I) of this Section the court is satisfied on the evidence that the allegations in the certificate are correct, the workman or his dependants, as the case may be, shall be entitled to compensation under this Act as if the contracting of disease were an injury by accident arising out of and in the course of the workman's employment." The provision of personal protective equipment (PPE) to employees which minimizes accidents and injuries is emphasised.	
The Local Government Act, Cap 243	The Act provides for the decentralised governance and devolution of central government functions, powers and services to local governments that have their own political and administrative set-ups. Under Section 9, local governments shall be the highest political authority within their area of jurisdiction and shall have legislative and executive powers to be exercised in accordance with the Constitution and this Act. The local governments are responsible for the protection of the environment at the district level; this therefore implies that local governments shall be consulted on projects located within their jurisdiction and on matters that affect the environment. The Act establishes a form of government based on the district as the main unit of administration. Sections 34-45 of the Act give legislative and planning powers to the districts. Districts are also enjoined to plan for the conservation of the environment within their local areas and the District Environmental Committees established under Section 15 of the National Environment Act Cap 153 are supposed to guide the district authorities in that regard.	Bundibugyo District, in which the proposed Sindila MHP project is proposed to be undertaken, has the responsibility of ensuring that the environment in the district is protected. The district has a District Environment Officer (DEO) who spearheads environmental issues. The project proponent should plan for consultations to be held with Bundibugyo District Local Government prior to undertaking the proposed project. The construction and operation works of the Sindila MHP will therefore be carried in close consultation with the Bundibugyo Local Government authorities.
The Traffic and Road Safety Act, 1998	This Act provides for among other things the use of a motor vehicle trailer or engineering plant on any road, need for the registration of all motor vehicles, the need for obtaining driving permits, the requirement to comply with road signs and speed limits, the procedure to be followed at the time of an accident, the need for the employer to keep record of drivers etc.	The proponent should ensure that all motor vehicle usage is conducted in line with this Act during implementation of the proposed Sindila MHP.
The Rivers Act, Cap 357	Section 4 of this Act requires that any dredging in a river be licensed. It states that it shall not be lawful to dredge in any river without a license from the Minister, which shall be in Form A of the Second Schedule of the Act. Section 6(1) stipulates that the Regulations set forth in the Third Schedule of this Act shall be endorsed on every license to dredge.	The proponent should acquire the dredging licence before the implementation of the proposed Sindila MHP and all river related activities should be carried in accordance with the provisions of this Act.
Physical Panning Act, Cap 281	The Physical Planning Act, 2011 establishes district and urban physical planning committees. It provides for making and approval of physical development plans and applications for development. Section 37 of the Act 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".	Bundibugyo District Local Government has jurisdiction over areas in and around the proposed Sindila MHP site and therefore has regulatory control to ensure that this project conforms to local physical planning requirements. The project proponent should ensure the proposed project designs are approved by the Bundibugyo District Physical Planner.
The Explosives Act, Cap 305	This Act requires that: No person shall manufacture any unauthorised explosive unless it is manufactured solely for	The explosive, dynamite, that will be used during the implementation of the Sindila MHP will have to be handled in line with the requirements of this Act.

Legislation	Key requirements	Relevance to proposed Sindila MHP
	the purpose of chemical experiment and not for sale, and in quantities not exceeding one pound in weight at any one time, or five pounds in all; or it is manufactured solely for practical trial as an explosive, and not for sale, and in such quantities and under such conditions (Section 3); No person shall manufacture any authorised explosive in any place other than an explosives factory (Section 4); No person shall keep, store or be in possession of any unauthorised explosive unless it has been manufactured under the Act and does not exceed five pounds in weight (Section 5); No person shall keep, store or be in possession of any authorised explosive in or on any premises other than an explosives factory or explosives magazine, unless the explosive is kept for private use, and not for sale or other disposal, and in accordance with rules or for use in the construction of any railway, road or other public work, in quantities not exceeding five thousand pounds in weight and is stored in a temporary magazine approved by an inspector and under conditions prescribed in writing by an inspector (Section 6); No person, other than the manufacturer, shall sell, deal in or dispose of, any explosive unless he or she is in possession of a licence granted under this Act by the engineer (Section 7); No person shall import into or export from Uganda, or cause to be imported into or exported from Uganda, any authorised explosive, unless he or she has obtained a permit issued (Section 9); and No person shall use or cause to be used blasting materials unless he or she is in possession of a permit issued under the authority of an inspector (Section 10).	
Labour Unions Act, 2006	This is an Act to regulate the establishment, registration and management of labour unions. Section 3 makes provision for employees' rights to organise themselves in any labour union. Section 4 stipulates that an employer shall not interfere with, restrain or coerce an employee in the exercise of his or her rights guaranteed under this Act. He shall not interfere with the formation of a labour union or with the administration of a registered organisation.	The proposed Sindila MHP will be implemented in line with this Act.
The National Environmental Impact Assessment Regulations, 1998	The Regulations have been gazetted in terms of Section 108 of Part V of the National Environmental Statute of 1995. The Regulations deal with (among other things) preparation and review process of the environmental impact statement; conditions for approval of a project; post assessment of environmental audit including self auditing and mitigation measures and provides schedules for the following; Issues to be considered in making environmental impact assessment; Certificate of approval of Environmental Impact Assessment; and Fees. The Environmental Impact Assessment Regulations, 1998 provide for implementation of the NEA. These regulations require that all projects listed in the third schedule of the NEA be subjected to an impact assessment before implementation. Electrical infrastructure is identified as a category iii listed activity requiring a full ESIA. The ESIA process goes through three major stages: screening, the ESIA study, and decision-making.	The EIA for the proposed Sindila MHP has complied with EIA Regulations throughout its assessment and submission process.
National Environment (Conduct and Certification of Environmental Practitioners) Regulations, 2003	Section 16 (1) of these Regulations require that no person shall conduct an EIA or carry out any activity relating to the conduct of an environmental impact study or environmental audit as provided for under the Act, unless that person has been duly certified and registered in accordance with these Regulations. The Regulations set out the procedures of the application for certification and the code of practice and professional ethics. The practitioners have to pay prescribed fees (Fourth Schedule) before they can be fully registered.	This is a relevant provision meant to professionalise the ESIA practice in the country so that the findings of an ESIA study are authoritatively used in decision-making. The ESIA has been undertaken through duly registered practitioners in keeping with the Regulations.
National Environment (Audit) Regulations, No. 12 of 2006	The Audit Regulations operationalise Section 3 (3) c of the National Environment Act, Cap 153 in which it is a requirement for ongoing activities which are likely to have environmental impacts to be subjected to an environmental audit in accordance with Section 22 of the Act. The Regulation also operationalises the Environmental Impact Assessment Regulation, in which it is a requirement to follow up projects that carried out an EIA with an Audit at least three years after the commencement of the project.	Audits shall be carried out once the project commences in line with this Act and in line with the EIA Certificate of Approval conditions.
The National Environment (Waste Management)	These Regulations require that: Waste generation is minimised by adoption of Cleaner Production methods; Wastes are disposed of in such a way that they do not contaminate water, soil, and air or	Waste management practices should ensure that wastes generated when conducting the proposed Sindila MHP are handled in accordance with the requirements of these regulations, from generation to disposal.

Legislation	Key requirements	Relevance to proposed Sindila MHP
Regulations, 1999	impact public health. This is in relation to on-site storage, haulage and final disposal; and Waste haulage and disposal should be undertaken by licensed entities.	
The National Environment (Wetlands, River Banks and Lake Shores Management) Regulations, 2000	These regulations provide for the management of wetlands, river banks and lake shores. Regulation 17 (1) states that every landowner, occupier or user who is adjacent or contiguous with a wetland shall have a duty to prevent the degradation or destruction of the wetland and shall maintain the ecological and other functions of the wetland. Section 12 (1) of the regulations provides that 'subject to the provisions of these regulations, a person shall not carry out any activity in a wetland without a permit issued by the Executive Director (of NEMA). Section 23 (1) (a) of the regulations requires a person who intends to 'use, erect, reconstruct, place, alter, extend, remove or demolish any structure or part of any structure in, under, or over the river bank or lake shore;' to make an application to the NEMA for environment impact assessment before any such activity takes place.	The proposed project will involve diversion of River Sindila through a canal and a penstock for about 3.5 km to generate electricity at the proposed powerhouse. For the intended project to comply with this Regulation, the developer is required to secure a Wetlands, River Banks and Lake Shores Management Permit from NEMA and Directorate of Water Development (DWD) before construction of the proposed powerhouse and its accessories. However, this ESIA adequately covers the provisions of Section 23 (1) (a) and will serve the purpose for the application of a permit.
The National Environment (Minimum Standards for Management of Soil Quality) Regulations, 2001	These Regulations emphasise the need to: maintain and restore the minimum soil quality standards as well as enhance the inherent productivity of the soil in the long term; maintain minimum standards for the management of the soil for specified agricultural practices; follow the criteria and procedures for the measurement and determination of soil and apply the prescribed measures and guidelines for soil management.	Project planning and execution should ensure that the quality of the soils within the proposed project area is not compromised, and if it is, that it is restored to as close to its original state as possible.
National Environment (Noise Standards and Control) Regulations, 2003	The purpose of these Regulations is to ensure the maintenance of a healthy environment for all people in Uganda, the tranquillity of their surroundings and their psychological well-being by regulating noise levels, and generally, to elevate the standard of living of the people by:- Prescribing the maximum permissible noise levels from a facility or activity to which a person may be exposed, and; Providing for the control of noise and for mitigation measures for the reduction of noise.	Project planning and execution should ensure that any noise generated as a result of the proposed project activities does not exceed permissible noise levels e.g. by using the best practicable means to ensure that the emission of noise from equipment to be used during the construction phase of the Sindila MHPP does not exceed the permissible noise levels.
The National Environment (Management of Ozone Depleting Substances and Products) Regulations, 2001	The objectives of these Regulations are to— (a) Regulate the production, trade and use of controlled substances and products; (b) Provide a system of data collection that will facilitate compliance with relevant reporting requirements under the Protocol; (c) Promote the use of ozone friendly substances, products, equipment and technology; and (d) Ensure the elimination of substances and products that deplete the ozone layer. Section 4 of this Regulation states that, "No person shall import or export a controlled substance or product listed in the First and Second Schedules, without a license issued by the Executive Director." Section 5 further states that, "A person intending to import or export a controlled substance or product shall apply to the Executive Director for a license in the application set out in Form A and B respectively in the Third Schedule." Controlled substances according to the Second Schedule of this Regulation include Hydrobromo fluorocarbons (HBFCs), and Chloro florocarbons (CFCs).	The proposed Sindila MHP should be carried out with respect to the guidelines in this Regulation.
The Water Resources Regulations, 1998	Under this Regulation, the developer has to apply for a water, drilling and or construction permit. This is stipulated in Section 3 (1) (b) which has provisions for application for a water permit. A person who wishes to construct, own, occupy or control any works on, or adjacent to the land referred to in Regulation 10 (where there is a weir, dam, tank or other work capable of diverting or impounding an inflow of more than 400 m^3 in any period of 24 hours); may apply to the Director for a water permit. Section 16 (3) (a) has provisions for a drilling permit. It states that, "A person who wishes to construct any works for the purpose of, impounding, damming, diverting or conveying any surface water, whether or not on or adjacent to a waterway may apply to the Director for a construction permit in Form F1 of the Sixth Schedule". Section 23 specifies conditions which a holder of a construction permit shall adhere to. Subsection (1) states that, "A holder of a construction permit shall, within ninety days of completion of any works, provide the Director with a construction completion report in respect of those works which report shall,	The proponent posses a construction permit from the Directorate of Water Resources Management. (BUN501208/ 1CPHDW 2013). Proposed project activities will be carried in accordance with the guidelines in this Regulation.

Legislation	Key requirements	Relevance to proposed Sindila MHP
	Be in a form specified, in writing, by the Director; Include plans and drawings of all works as constructed; and Contain such other information as the Director may, in writing, specify or require".	
Water (Waste Discharge) Regulations, No. 32 of 1998;	These Regulations regulate the discharge of effluent or wastewater on land or into the aquatic environment. NEMA sets standards for the discharge of such substances in consultation with the lead agency. A person who wishes to discharge such substances in the prohibited environment must obtain a permit from the Directorate of Water Resources Management (DWRM).	The proponent must obtain a permit from the Directorate of Water Resources Management (DWRM) for the discharge of effluent or wastewater.
The Electricity (Primary Grid Code) Regulations, 2003; and	The Code contains rules and procedures for the efficient management (generation, transmission and distribution) of the electric supply industry in Uganda, taking into account a wide range of operational conditions that are likely to be encountered under normal and exceptional circumstances. This Code is administered by the Uganda Grid Code Committee (the "Committee") which is empowered by the Electricity Regulatory Authority ("ERA") under Section 14 of the Act, while ERA is empowered to make final decisions on amendments of this Code in consultation with the Committee. One of the general requirements under this Regulation is the requirement of safety under all circumstances, including the prevention of personal injury.	The project developer should therefore ensure safety of all employees and communities in the vicinity of the site to avoid injury and all project related activities should be carried with guidance from these Regulations.

Table 3.3 International conventions and agreements applicable to the proposed Sindila Mini Hydropower Project

Treaty, Convention, Agreement	Subject/ key requirement	Ratified	Relevance to the proposed Sindila MHP
The Ramsar Convention on wetlands of international importance	Convention on Wetlands of International Importance especially as Waterfowl Habitats. The Convention's mission is "the conservation and wise use of all wetlands through local and national actions and international cooperation, as a contribution towards achieving sustainable development throughout the world". The convention was ratified by Uganda at a time when the country's first Ramsar site at Lake George was designated. Uganda now has 12 Ramsar sites (http://ramsar.wetlands.org). The Ramsar Convention has produced guidelines on impact assessment for proposed projects in Ramsar sites. These guidelines are based on the Convention on Biological Diversity's (CBD) guidelines for biodiversity-inclusive impact assessment, with additional Ramsar-specific annotations (Ramsar Convention Secretariat, 2010b).	4/3/1988	The proponent should consider the Ramsar Convention guidelines on impact assessment for the proposed Sindila MHP and ensure that project activities do not affect the integrity of wetlands in and within vicinity of the project area.
The convention concerning the protection of the world cultural and natural heritage (World Heritage Convention) – UNESCO	Uganda has ratified the Convention concerning the Protection of the World Cultural and Natural Heritage (World Heritage Convention). Two sites in Uganda feature on the World Heritage List: Bwindi Impenetrable National Park and Rwenzori Mountains National Park.		Project planning and implementation should ensure and be carried out in way that the integrity of the neighbouring World Heritage Site (Rwenzori Mountains National Park) is maintained, better yet enhanced.
Convention on Biological Diversity (Rio Declaration), 1992	Its objectives are to conserve biological diversity, promote the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilisation of genetic resources, including by appropriate access to genetic resources and by appropriate transfer of relevant technologies, taking into account all rights over those resources and to technologies, and by appropriate funding (Article 1).	8/9/1993	Project planning should ensure that biodiversity of the proposed project area is protected when implementing the proposed project.
African Convention on the Conservation of Nature and Natural Resources	Uganda has ratified the African Convention on the Conservation of Nature and Natural Resources (1968), signed the Protocol Agreement on the Conservation of Common Natural Resources (1982).		Project planning should ensure that conservation of nature and natural resources tantamount during the implementation of the proposed Sindila MHP project.
Montreal Protocol, 1987	The Montreal Protocol on Substances that Deplete the Ozone Layer. Requires parties to: Comply with the Ozone Depleting Substances(ODS) freeze and phase-out; and Ban ODS trade with non-Parties to the Protocol.	15/9/1988	The proponent should minimise release of emissions that have the potential of depleting the ozone layer.
Basel Convention,1989	This Convention is based on the control of trans-boundary movements of hazardous wastes and their disposal. It requires that hazardous wastes and other wastes be accompanied by a movement document from the point at which a transboundary movement commences to the point of disposal. The objective is to protect human health and the environment against the adverse effects of hazardous wastes.	11/3/1999	Implementation of the proposed project will be carried out in accordance with the guidelines of this Convention, particularly handling and transportation of hazardous wastes.
Bamako Convetion,1991	This Convention was aimed at the Ban of the Import into Africa and the Control of Transboundary Movement and Management of Hazardous Wastes within Africa. It requires party states to use legal, administrative and other measures to prevent the import of hazardous waste into Africa from non-contracting parties. Import of hazardous waste from non-contracting parties is an illegal and criminal act (Art 4.1) Each Party is required to ensure that persons managing hazardous wastes take all actions necessary to prevent pollution arising from the management of such wastes and to minimise the impacts of such waste in the event of pollution occurring (Art 4.3).	1/10/1998	Implementation of the proposed project will be carried out in accordance with the guidelines of this Convention, particularly handling and transportation of hazardous wastes.

Table 3.4 IFC Performance Standards applicable to the proposed Sindila Mini Hydropower project

IFC Performance Standards	Relevance to the proposed Sindila MHP
IFC Performance Standard 1	The proponent has conducted an Environmental and Social Impact Assessment (ESIA) of the proposed Sindila MHP in an integrated manner to include key aspects such as; • Accurate Project description, including alternatives; • Appropriate social and environmental baseline data; • Consideration of all relevant social and environmental risks and impacts in the Project's area of influence during construction and operation; and • Appropriate stakeholder engagement through disclosure of the Project-related information and consultation on matters that directly affect stakeholders.
IFC Performance Standard 4	Proposed labour and working conditions need to have considered the requirements of this PS.
IFC Performance Standard 3	The Sindila MHP needs to comply with national environmental laws related to pollution, wastes, hazardous materials, resource use and greenhouse gas (GHG) emissions. The proponent will also consider the performance levels and measures in relevant technical guidance in the World Bank Group EHS Guidelines
IFC Performance Standard 4	The proponent needs to have evaluated risks and impacts to the health, safety and resources of the affected communities during all project stages and established appropriate measures favouring prevention and avoidance. Necessary measures to prevent major accidents and limit their consequences in major accident prevention / emergency preparedness policy and management system including internal and external emergency plan have been identified.
IFC Performance Standard 5	The proposed Sindila MHP, during project planning, need to demonstrated that it has avoided, and when avoidance is not possible, minimised physical and economic displacement. All relevant information has been disclosed, and informed participation of affected persons has been done.
IFC Performance Standard 6	The proponent has evaluated risks and impacts to biodiversity, ecosystem services and sustainable management of living natural resources during all project stages (construction and operation phases) and established measures as part of an appropriate mitigation hierarchy. A due diligence regarding natural habitats, critical habitats, legally protected and internationally recognised areas and invasive alien species, including establishment of measures as part of an appropriate mitigation hierarchy has also been carried out.
IFC Performance Standard 7	Not applicable to this project as there are no indigenous peoples in the proposed project area.
IFC Performance Standard 8	During update of the ESIA the proponent evaluated cultural heritage and the affected communities were consulted regarding any significant impacts to cultural heritage. Mitigation measures are also to be implemented in accordance with national regulations and best international practice.

4. BASELINE ENVIRONMENTAL CONDITIONS

4.1. PHYSICAL ENVIRONMENT

4.1.1. Climate and Air quality

Climate

The general climate of the area is controlled by movement of air masses associated with the inter-tropical convergence zone (ITCZ) which results in a bimodal precipitation variation with wetter periods from March-May and from August-November, separated by relatively drier periods. Unlike typical monsoon climates that are derived from a reversal of wind currents from the northeast in January to the southwest in July, a north-south reversal in East Africa causes the heavy rains to occur in April and October (Taylor *et al*. 2007).

Temperature

Temperature varies over a small range (Figure 4.1). Maximum temperature varies from 24.2ºC in November to 29.2ºC in March. Minimum temperature varies from 13.2ºC in December to 15.1ºC in March. Relative humidity varies from 59% in March to 86% in November. Average wind speed is 6.2 km/h.

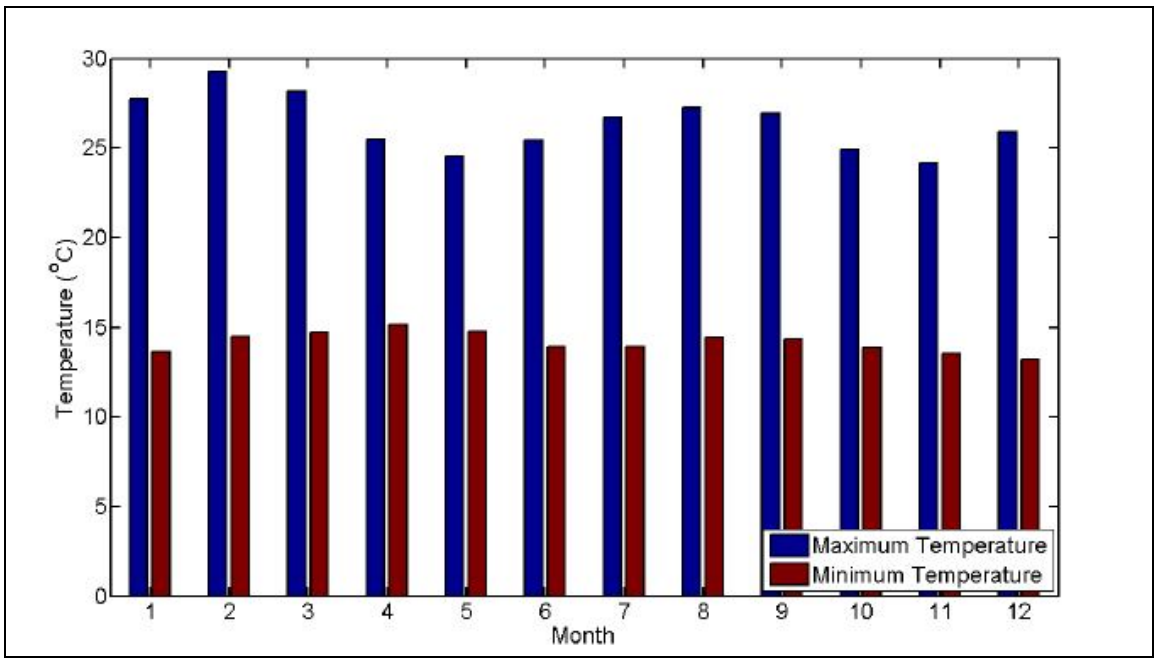


Figure 4.1: Temperature variation

Rainfall

Precipitation in the Rwenzori Mountains occurs primarily during two pronounced seasons from March to May and August to November as demonstrated by the average monthly rainfall at Bundibugyo rainfall station (Figure 4.2). The March-May rainy season receives 31% of annual rainfall while the August-November season receives 48%, meaning that the two rainy seasons are responsible for 80% of the annual rainfall amount. There is also a strong orographic effect exerted by topography on rainfall. Mean annual rainfall at Bundibugyo is about 1350mm but it can be as high as 2300 mm higher in the mountains (Figure 4.2).

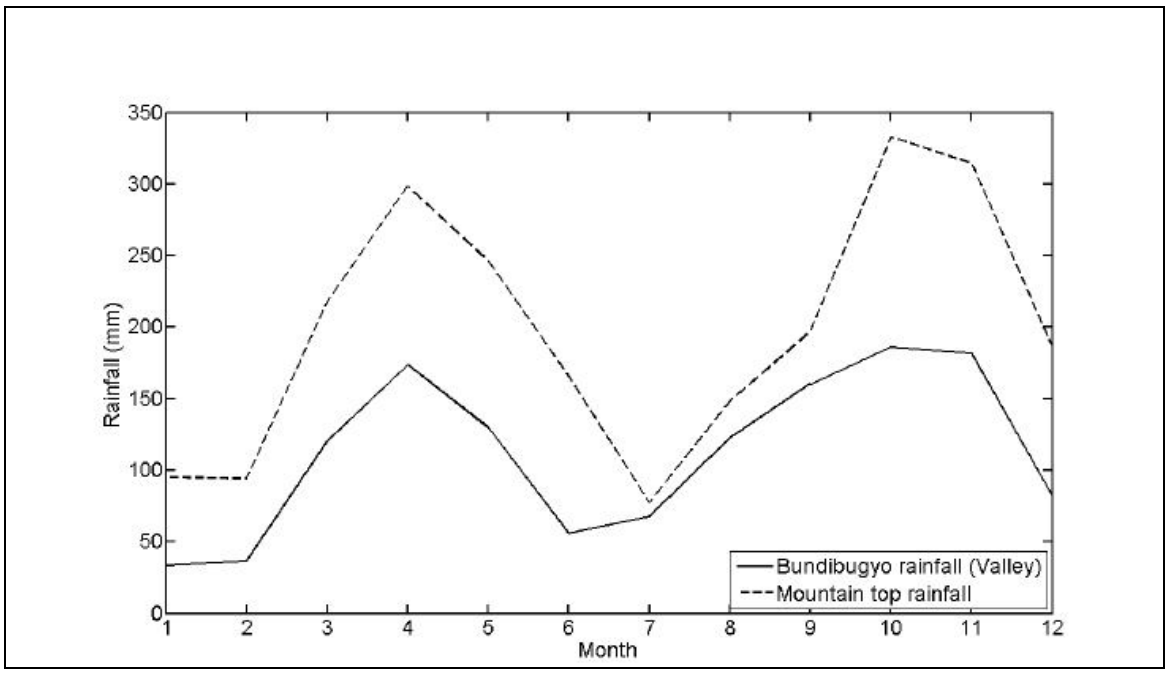


Figure 4.2: Sindila Rainfall variation

Rainfall gauging has only recently[1] (2012) started within the central high Rwenzori massif. There are no a records from the National Meteorological services that track rainfall in the Rwenzori mountains above 2500m.a.s.l. The only historical measurements of precipitation within the core alpine areas of the Rwenzori Mountains were collected by Osmaston (2006). Mean annual precipitation at four locations from 1951 to 1954 similarly showed pronounced variations with altitude. From the base of the mountains around 1250m.a.s.l, precipitation was observed to increase with rising elevation from 1150 mm per annum to a maximum annual precipitation of 2600 mm per annum recorded at 3290m.a.s.l in the Heath-moss forest zone. Above this, precipitation decreased to 2000 mm per annum at Lake Bujuku in the Afro alpine zone within the Central Rwenzori Massif (Figure 4.3).

Air quality

The proposed project area can be described as generally rural with interfaces of natural vegetation, cultivated lands and lands under fallow. The area is largely vegetated and there are no major industrial developments. The primary sources of air emissions in the area would be automobiles (vehicles and motor cycles) although the number of automobiles going up the steep poorly maintained road is relatively low and therefore most of the area has to be accessed on foot. The air quality at the proposed project site is therefore considered to be generally good as the level of Greenhouse gases generating equipment is negligible.

[1] Rainfall Gauges have been recently installed by the Uganda Wildlife Authority and Africa Nyamwamba Ltd, a private Developer of the Nyamwamba Hydropower Project at heights above 3000m

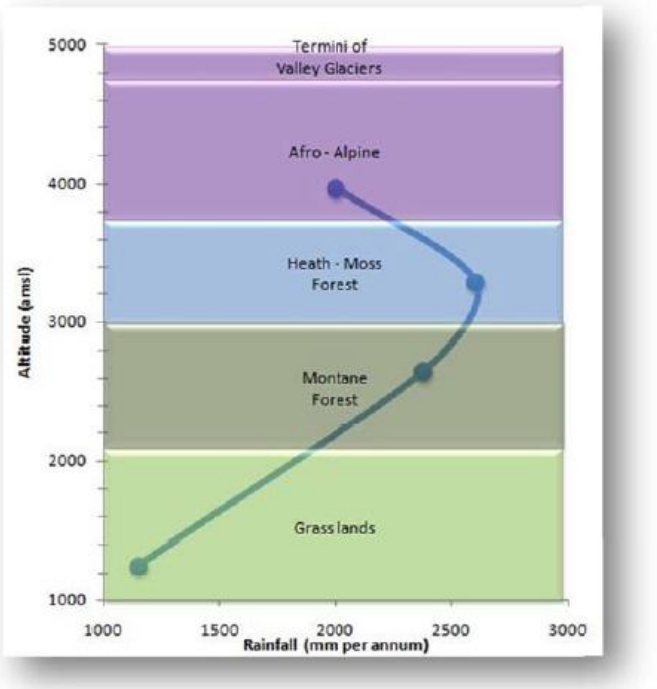


Figure 4.3: Plot of trends in observed precipitation with altitude in the Rwenzori Mountains.

4.1.2. Noise

Baseline noise levels of the proposed project area were determined during the February 2012 survey. These were firmed up with further noise assessment during the May 2014 survey, using an American National Standards Institute (ANSI) S4 compliant digital direct reading Multi-Function CEM DT- 8820 Environment Meter. This equipment has an active range of 35-100 decibels (dB), with low frequencies ranging from 35-64dB, and high frequency levels ranging from 65dB to100dB.

Noise levels were recorded at the proposed project components locations and other ambient background noise measurement points were selected based on proximity of the sensitive receptors to the location of the proposed project components. Records of the minimum and maximum noise levels were taken and the average calculated.

A summary of the ambient noise level measurements at each proposed project component and selected sites is presented in Table 4.1. The specific details of each of the noise measurements including; (i) the specific dates on which the noise measurements were recorded, (ii) the specific times when noise measurements were recorded, (iii) the specific coordinates at which noise measurements were taken including coordinates for sensitive receptor sites in relation to the proposed project components, (iv) the anthropogenic factors that may have influenced the noise levels recorded (e.g. bird calls, local community conversations, etc.) are provided in Annexure 9 of this ESIA.

Table 4.1 Average noise levels determined in the project area

Full name of the feature/area	Coordinates	Average dB(A)	Description/comment
Proposed Weir site	See Table 2.1 above H:1565m.a.s.l	61	The proposed point where the weir will be constructed is in a forested area, maximum noise was influenced by the river flow, noise from birds, cicadas and other insects.
Sensitive receptor along the headrace canal (Homestead)	E:0833220 N:0064536 H:1518m.a.s.l	44.2	The major sources of noise were insects and birds.
Sensitive receptor along the headrace canal (Homestead)	E: 0833219 N:0064666 H:1535m.a.s.l	63.3	The maximum noise levels were mainly influenced by the echo of the waterfalls, birds and insects.
Sensitive receptor along the headrace canal (Homestead)	E: 0833253 N:0064830 H:1548m.a.s.l	43.7	Echoes from River Sindila, insects and birds were the major sources of noise
Sensitive receptor along the headrace canal (Homestead)	E: 0833216 N:0064702 H:1547m.a.s.l	39.9	River Sindila echoes, insects and birds were the noise sources
Proposed Forebay tank site	See Table 2.1 above H:1505m.a.s.l	58.0	Noise levels were influenced by people's conversations and bird and insects calls.
Sensitive receptor near the forebay (nursery school)	E:0833279 N:0065121 H:1493m.a.s.l	49.0	Noise levels were influenced by people's conversations and bird and insects calls.
Sensitive receptor along the Penstock (Homestead)	E:0833301 N:0065204 H:1484m.a.s.l	54.6	Noise levels were influenced by conversations from people, and bird and insects calls.
Sensitive receptor (Kabwe nursery school) along the penstock	E:0832791 N:0066084 H:1241m.a.s.l	56.7	Noise levels were influenced by conversations from people

Full name of the feature/area	Coordinates	Average dB(A)	Description/comment
Sensitive receptors (Homesteads) along the proposed penstock area	E:0833042 N:0065711 H:1276m.a.s.l	42.7	Sounds from insects, conversations from people, bleating of goats were the major sources of noise
Sensitive receptor along the penstock (Homestead)	E:0832829 N:0065918 H:1256m.a.s.l	42.6	Echoes from river Sindila, insects and bird calls
Proposed powerhouse location	See Table 2.1 above H:1120m.a.s.l	46.0	Maximum noise levels were influenced by sounds from birds and insects calls and conversation from the nearby community.
Powerhouse access road	E:832295 N:066862 H:1089m.a.s.l	57.7	The highest noise level is influenced by insects and birds' calls and people's conversations
Sensitive receptor along the powerhouse access road (Homestead)	E:832451 N:067000 H:1106m.a.s.l	56.7	Maximum noise levels are influenced by calls from birds and insects, and background conversations by members of the local community
Proposed camp site location	E:832231 N:66365 H:1121m.a.s.l	51.35	Background conversation from the neighbouring homesteads influenced the maximum noise levels.

With the exception of parts of the headrace canal and the proposed weir site location which fall within a forested area, all other proposed project components fall within areas with some settlements and none of them fall within a commercial area. The baseline noise levels within the proposed project area were therefore assessed based on the maximum permissible noise levels for residential areas which are set at 50 dB (A).

Based on the results presented in Table 4.1, some of the average noise levels recorded at the proposed project components and selected sites were within permissible limits for residential areas as provided for in the National Environment (Noise Standard and Control) Regulations of 2003, which set the maximum limit as 50dB(A) during the day. The exceptions were the average noise levels recorded at sensitive receptor sites along the headrace canal (homestead), the powerhouse access road, Kabwe nursery school along the penstock path, a sensitive receptor along the penstock path (homestead), forebay tank, and sensitive receptor along the headrace canal. These noise levels were largely influenced by sound from bird and insects calls and background conversations from the nearby community.

4.1.3. Hydrology

In order to assess the hydro-electric power potential of River Sindila, there was need to analyse its catchment characteristics and the discharge patterns including its low and high flows. The results of this analysis therefore constitute an important input into the design process of the proposed hydro-electricity facility and provide an indication of its safe capacity and hydrological reliability.

4.1.3.1. Catchment characteristics

River Sindila originates at an altitude of 3810m.a.s.l from the Rwenzori ranges and drains northwest into River Semliki. In its travel downstream, it descends by about 2400m over a distance of approximately 12.5km. The average bed slope of the river is 16.3% and the bed profile of River Sindila is as presented in Figure 4.4.

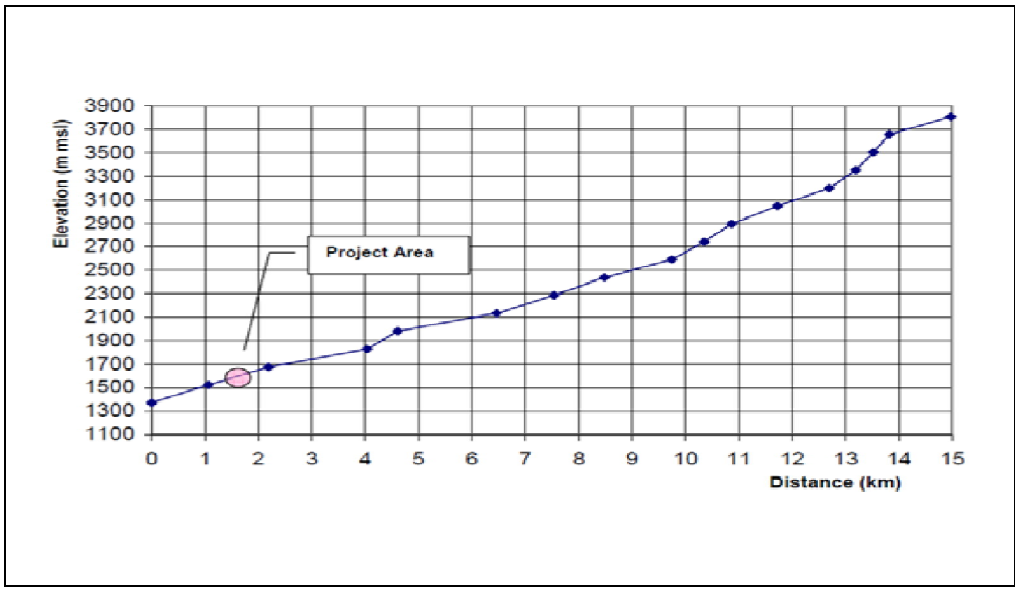


Figure 4.4: Bed profile of River Sindila

The land cover within the catchment is composed of montane forests and heath moss forests. Higher up, towards the peaks, the woodlands gradually thin down to Afro – Alpine vegetation (Figure 4.5).

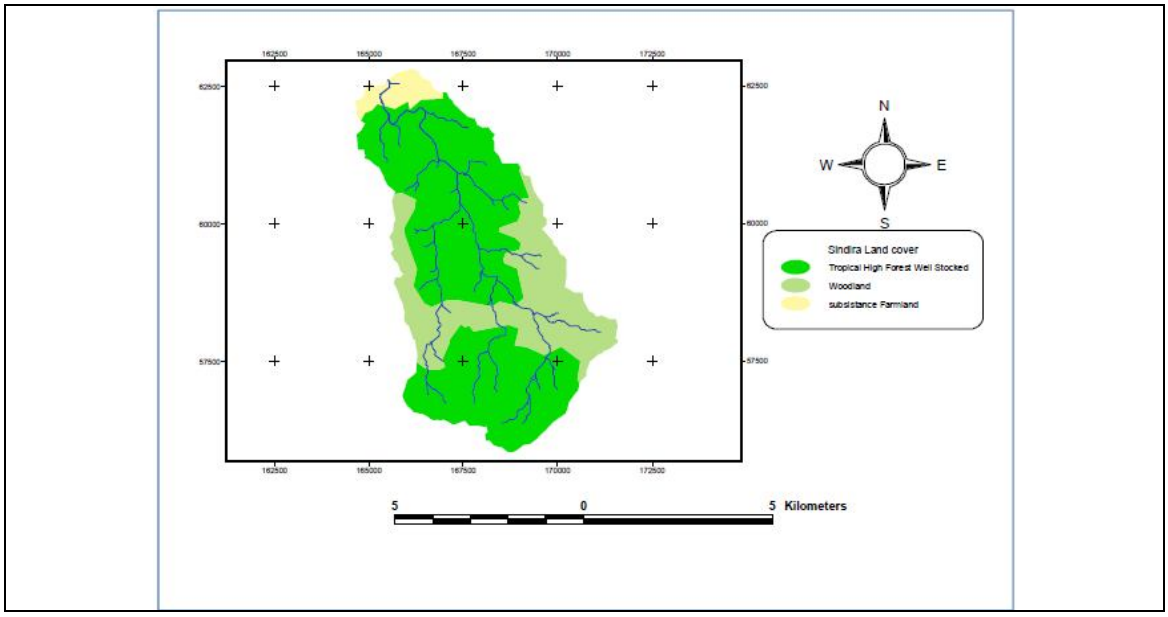


Figure 4.5: Vegetation cover of River Sindila MHP catchment

4.1.3.2. Drainage Pattern of the Area

River Sindila flows in a north easterly direction from the Rwenzori Mountain Ranges towards the Congo Border. The catchment has a near oval shape with a maximum length (in the direction of flow) of 10 km and a maximum width of 3.6km. The catchment area upstream of the proposed MHP is 38.6 km^2. The catchment elevation varies between 1,525m.a.s.l at to about 3,821m.a.s.l with an average of 2,769m.a.s.l.

4.1.3.3. Flow analysis for River Sindila

Like most rivers that flow off the western slopes of the Rwenzori mountain range towards the DRC and River Semliki, River Sindila is ungauged. Therefore, there was no basis to establish a linear relationship between River Sindila and the gauged rivers that flow off the eastern slopes of the Rwenzoris (such as Rwimi, Mubuku and Nyamwamba). Therefore, the approach that was adopted was to carry out hydrological modelling using available climate data and catchment characteristics. The SWAT model (http://swat.tamu.edu) was used for flow generation. Data for running the model was collected from various sources, including Uganda's Department of Meteorology for rainfall and other climate data as well as various internet sources for elevation (DEMs), land use, geology and soil data. Statistical analysis was then carried out on the modelled flow to estimate the different hydrological parameters.

Based on the SWAT modelling results (Annexure 10), the long term mean daily flow at the proposed site is 1.47 m^3/s with a standard deviation of 1.38m^3/s. The modelled minimum flow was 0.02m^3/s while the maximum flow was 27.1m^3/s. The monthly flow varied between 0.1 Million Cubic Metres (MCM) and 12.9 MCM with an average of 3.9 MCM. The annual flow varied between 33.9 MCM and 69.2 MCM with an average of 46.3 MCM.

In terms of total monthly cumulative flows, the mean monthly flow varies between 1.2 MCM in August and 6.7 MCM in November. Another peak flow of 6.2 MCM is experienced in May while February experiences a second flow minima of 1.5 MCM.

4.1.3.4. Ecological / Environmental Flow

Environmental Flows (EF) are the flows of water (in terms of quality, quantity and timing) in rivers that are necessary to maintain aquatic ecosystems, in other words, a flow regime in the river

capable of sustaining a complex set of aquatic habitats and ecosystem processes. Through implementation of an environmental flow, a proposed project can achieve a flow regime, or pattern, that provides for human uses and maintains the essential processes required to support a healthy river ecosystem. However, the environmental flow does not necessarily require restoring the natural, pristine flow patterns that would occur outside of a proposed project, but is rather intended to generate a broad set of values and benefits from the river.

The process for determining or estimating EF is termed Environmental Flow Assessment (EFA) and there are more than 200 techniques suggested in literature for achieving this. EFA techniques determine the volume and temporal distribution of EF. The difficulty of estimation of EF values lies in the lack of understanding of the relationship between river flow and the multiple components of river ecology and the scarcity of data concerning these relationships. For example, required river flow conditions are available only for a target fish species in a given river basin and this information is very specific and not applicable under different circumstances. Different types of flows with different amounts of discharge are due to dry and wet seasons. According to Brown (2003), flows in rivers are generally needed for various purposes such as to:

- Maintain river flow conditions such as flow velocity, water depth and acceptable turbidity levels, making it possible for the river to purify itself (dilution of effluents and waste water);
- Maintain low flows, which support the livelihood of the people (who use the river as a source of drinking water, washing, bathing, fishing, recreation and tourism, etc);
- Sustain both terrestrial and aquatic ecosystems. For example, low flow provides water to wild animals, maintains soil-moisture along the river-banks, etc. Small floods stimulate spawning in fish and allow passage for migratory fish and germination of seeds along river-banks. Large floods deposit nutrients on the banks and distribute seeds; and
- Recharge groundwater and aquifers by large floods, which maintain the perennial nature of rivers acting as a source of water during the dry season. Furthermore, large floods flush sediments and natural obstructions in the river course and maintain a sufficiently deep channel for navigation.

Tharme (2003) recorded 207 different methods for calculating EF within 44 countries. Broadly, these can be divided into four categories:

(a) Hydrological Index Methods (or rule of thumb, threshold, or standard setting, desktop methods, or flow duration curve methods) - primarily use hydrological data (historical monthly or daily flow records) for making flow recommendations for maintaining river health at designated level.

(b) Habitat Discharge Methods (hydraulic rating or habitat rating methods) - use changes in simple hydraulic variables (e.g. wetted perimeter) across a single river cross-section as surrogate for habitat factors limiting to target biota.

(c) Habitat Simulation Methods - Assess flows on basis of modelling of quantity and suitability of physical habitat available to target species under different flow regimes (integrated hydrological, hydraulic and biological response data).

(d) Holistic Approaches - identify important flow events for all major components of river, model relationships between flow and ecological, geomorphological and social responses, and use an interdisciplinary team approach to establish recommended flow regime/implications of flow scenarios (bottom-up or top-down).

The simplest, typically desktop EFA hydrological methodologies, rely primarily on the use of hydrological data, usually in the form of naturalised, historical monthly or daily flow records, for making environmental flow recommendations. They are often referred to as fixed-percentage or look-up table methodologies, where a set proportion of flow, often termed the minimum flow (Cavendish and Duncan, 1986; Milhous *et al*., 1989), represents the environmental flow intended to maintain the freshwater fishery, other highlighted ecological features, or river health at some acceptable level, usually on an annual, seasonal or monthly basis.

Reiser *et al*. (1989a) highlighted the Tennant (Montana) method as the most commonly applied hydrological methodology worldwide. Although superficially a standard-setting approach, the method, developed in the United States by Tennant (1976) and the US Fish and Wildlife Service, differs from many other hydrological methodologies in that considerable collection of field habitat, hydraulic and biological data was involved in its development. It comprises a table linking different percentages of average or mean annual flow to different categories of river condition, on a seasonal basis, as the recommended minimum flows.

The Tennant method is very simplistic and is a quick and easy-to-understand method of determining habitat and recreational suitability of stream habitat. The method is based on the assumption that flows that are satisfactory for the needs of fish and other aquatic biota will also be sufficient for maintaining recreational and aesthetic qualities. Based upon empirical relationships and observations, Tennant suggests that minimum flows at any time of the year must be 10% of mean annual discharge. Below the 10% threshold, fish habitat and recreational value will be severely degraded.

In line with the Tennant method, the suggested environmental flow of 10% of mean flow for River Sindila is equivalent to, (10%*1.47) = 0.147m^3/s (147l/s). It should however be noted that this percentage of the mean is highly susceptible to a relatively small number of unobserved high flows. This suggests that the mean is subject to substantial uncertainty. By comparison, if one applied a 10% of the median flow (1.06m^3/s), derived from recent hydrological studies which is a more reliable figure and less susceptible to outliers, one would reach a suggested environmental flow of (10%*1.06) = 0.106m^3/s (106l/s). The Abstraction Permit (BUN 501010/ISWMDW 2013) issued by the Directorate of Water Development (DWD) dated 10th December 2013, stipulates EF for the Sindila MHP as 40l/s. The mandatory minimum, as included in the Abstraction Permit issued by DWD has to be met. In general, the project needs to adequately allow for environmental flows enough to, maintain river flow conditions, support the livelihood of people, sustain both the terrestrial and aquatic ecosystems and recharge groundwater and aquifers.

According to Section 4.2.2.6 below (Aquatic Biodiversity), during the May 2014 survey, three fish of the same species (*Labeo forskalii*) were caught from River Sindila. Other aquatic biodiversity identified in the samples collected from River Sindila included four taxonomic groups (Blue-greens, Greens, flagellates and Diatoms) of phytoplankton, two taxonomic groups (i.e. rotifers, and crustaceans) of zooplanktons and seven taxonomic groups (orders) of benthic macro-invertebrates (i.e. *Odonata, Plecoptera, Diptera,* Mollusca*, Coleoptera, Nemouridae* and *Conchostraca*).

Therefore, based on the above, the highest aquatic water requirement in River Sindila between the proposed weir and the powerhouse is for the fish species, *Labeo forskalii*, which use the river as a breeding and nursery ground as a potamodromous fish. Potamodromous fishes are known to migrate during the peak rainy season for their spawning, feeding and to nursery grounds. The migratory fish habitat in a lotic river, include; rocks, boulders and aquatic vegetation in the river fringes. Therefore, the determined environmental flow (1.06m^3/s) should be maintained, especially during the rainy seasons for the maintenance of the fish habitats for the migration of *Labeo forskalii* in River Sindila.

In addition to the above, it is important to note that the main source of drinking water and that for other domestic purposes in the Project's Area of Influence (PAI) is River Sindila (see Section 4.3 below). The estimated average daily water abstraction by communities at the water collection points (Nyamuchimba, Mabondo, Kiralho Point, Ekyamularo and Ekyamugisa) between the weir and the powerhouse is approximately 0.0218m^3/s. The community water requirement is relatively low (0.0218m^3/s) and falls within the determined environmental flow for the bypass section of River Sindila (0.106m^3/s). Furthermore, River Sindila is joined by a perennial stream (Ntuma) below coordinate 833433E 64378N, UTM 35 (see Section 4.1.4.2 below). Ntuma stream contributes to the flow of water in River Sindila all year round.

4.1.3.5. Water quality

Surface water sampling was undertaken to ascertain the river system health based on a number of parameters.

During the February 2012 survey, three water samples were collected from a number of sampling points. . The samples included;

Sample Reference S1 from the proposed weir location;
Sample Reference S2 from the point where the proposed spillway canal joints river Nyamuchimba; and Sample Reference S3 from the proposed powerhouse location.

During the May 2014 ESIA update, two more samples were collected from streams in the project impact area, namely;

Sample Reference S4 coordinates (UTM 35 833433E 64378N) from Ntuma stream; and

(1) Sample Reference S5 coordinates (UTM 35 833110E 67098N) from a Sindila stream.

Sindila stream is located along the access road to the proposed power house. It is a man-made stream diverted from River Sindila for purposes of easing access to water for domestic needs in Kyebumba village whilst Ntuma stream is located along the proposed headrace canal. Ultimately, these water samples were also collected based on whether they fell within the potential pollution pathway within the proposed project area.

For each sampling site, the surface water samples were collected from approximately 0.5m below the water surface in clean labelled 250ml Pyrex glass bottles. In the field, the water samples were kept in a cooler containing dry ice and later transferred within 24 hours for analysis at the National Water and Sewerage Corporation (NWSC) laboratory in Bugolobi, Kampala. The water quality results are presented in Table 4.2.

Table 4.2 Water Quality analysis results

Parameter	Unit	Sample					Maximum Permissible Level for Potable water
		S1	S2	S3	S4	S5	
pH at ºC		7.6	7.74	7.83	7.22	7.06	6.5 – 8.5
Turbidity,	NTU	1.603	1.41	1.49	8.0	7.3	10.0
Electrical Conductivity	µs/cm	111	112	117	151	177	2500
Colour: apparent	PtCo	10	8	21	64	96	15
Total Dissolved Solids	mg/L	71	72	75	83	97	1200
Biochemical Oxygen Demand (BOD) at 20ºC	mg/L	11	7.1	9.6	0.8	1.4	Not Specified 4*
Chemical Oxygen Demand (COD)	mg/L	37	18	24	4	7	Not Specified
Total Suspended Solids (TSS)	mg/L	1	0	0	12	6	0
Oil and Grease	mg/L	-	-	-	<0.1	<0.1	0.01
Alkalinity: total as $CaCO_3$	mg/L	44	44	48	82	86	500
Hardness: total as $CaCO_3$	mg/L	52	48	52	54	72	500
Calcium: Ca^{2+}	mg/L	36.8	22.4	48	-	-	75
Magnesium: Mg^{2+}	mg/L	4.8	2.9	4.8	-	-	50
Bi-Carbonate: as $CaCO_3$	mg/L	44	44	48	-	-	500

Parameter	Unit	Sample					Maximum Permissible Level for Potable
Chloride: Cl^-	mg/L	1	1	4	1.5	2.0	500
Fluoride: F	mg/L	0	0.03	0.073	-	-	1.5
Iron: total	mg/L	0.042	0.03	0.48	0.307	1.170	1
Sulphate: SO_4^{2-}	mg/L	7	4	8	1	1	200
Nitrate – N	mg/L	0.00	0.00	0.03	0.03	0.03	5.0
Faecal Coliforms	CFU/ 100ml	60	0	10	168	210	10
Escherichia Coli (E-Coli)	CFU/ 100ml	0	0	5	-	-	0

The results of the water quality laboratory analysis (see Annexure 11) indicate that the water quality parameters of the samples collected at the selected sites were within the recommended national potable water standards except for the following physical parameters for selected samples (refer to Table 4.2): apparent colour, total suspended solids and bacteriological parameters: faecal coliforms and E. coli.

- Results of samples S1 and S2 were within the maximum permissible level for apparent colour but samples S3, S4 and S5 exceeded the maximum permissible level for apparent colour set by the national standard for potable water (15 TCU – True colour unit). The deviation from the permissible level for samples collected was S3 (21 TCU), S4 (64 TCU) and S5 (96 TCU). The cause of the deviation from the standard can be attributed to the function of runoff/drainage point within and around the project area. This is primarily due to water contamination in the process of water harvesting and agriculture (through cropland soil erosion when the soils along the slopes are loosened).

- Related to the apparent colour strength in the water samples, total suspended solids for samples S1 (1mg/l), S4 (12mg/l) and S5 (6mg/l) also exceeded the maximum permissible level set by the national standards for portable water.

- Water samples collected at S1 (60 CFU/100ml), S3 (10 CFU/100ml), S4 (168 CFU/100ml) and S5 (210 CFU/100ml) comprised of high levels of faecal coliforms above the permissible limit set by the national standard for portable water. E. coli were also evident in S3 (5 CFU/100ml). The high levels of faecal coliforms and E. coli in these water samples can be attributed to watering of animals which deposit dung in the River and open defecation along River Sindila.

4.1.4. Geology, Geomorphology and Soils

4.1.4.1. Geology

According to the geological studies (Kisolo, A and Barifaij, E-2008), two-thirds (2/3) of Uganda is underlined with Precambrian rocks. Archiean rocks are exposed in the south east regions of the country while three major Proterozonic belts underlie central and west Uganda namely; the Buganda -Toro metasediments, Karagwe-Ankolian (Kiberan) belt and Pan African rocks. The East African Rift System (EARS) and the south and south eastern side of the Rwenzori Mountains are tertiary to recent sediments and volcanics.

The Rwenzori Mountains, in close proximity to the project area comprise of ancient basement complex Precambrian rocks. The Precambrian rocks are again divided for the purpose of description into; (a) wholly granitized formation, (b) Partly granitized formation, (c) Non-granitized formation, and other rocks. The partly granitized formation again can be classified into four groups: Madi Series, Karagwe-Ankolian System, Buganda-Toro System and Nyanzian System. The entire Rwenzori mountain area is covered by the rocks of the Buganda-Toro System having an age of 2.0 – 1.8 Ga (Kisolo, A and Barifaij, E-2008).

Rwenzori Mountain is associated with the process of formation of the Rift valley. The rocks that form the mountains were extruded from the surrounding plains during the formation of the western rift valley (Howard, 1991), producing soils of low fertility, except on parts of the northern ridge where volcanic ash from the Fort Portal plateau was deposited. The present form of the Rift Valley is due to movements during early Pleistocenic times; however, the original lines of crystal weakness along which these faults developed, were initiated in Precambrian times. In the immediate vicinity of the faults, the rocks are highly sheared and altered by the enormous forces involved in the rift movement. The up-thrust mass of the Rwenzori is the most remarkable product of rift movement, where the block is estimated to have been elevated by as much as 3,000m.a.s.l.

The project area is covered with undifferentiated gneisses. The proposed project site's general lithology consists of granitized or high-medium grade metamorphic formations. The undifferentiated gneisses including elements of partly granitised and metamorphic formations are present in this region, showing the general foliation of east-west with southward dipping.

General strike and dip direction of exposed bed rock around the weir and intake location is $120^0/30^0$. The riverbed is covered by Alluvium deposits, which are 0.2-0.5m boulders mixed with gravelly sand (the thickness of this layer is <2m).

At the headrace canal section of 0+3450+390, a hard, massive rock escarpment was identified and at 0+720, about 20m wide and 5-7m deep, a gulley with hard slightly weathered rock exposed at both abutments. At the proposed desilting tank location, bedrock is exposed, with thin (<1m) residual clay overburden along the gulley path that leads to the river. The forebay will be located on flat land covered by sandy clay material of residual origin, exhibiting hard characteristics, and the thickness of this layer is <2.5m.

A number of landslide scars were identified along the penstock path and piers will be located in stable positions in order to avoid landslide areas. The upper section of the area is largely covered with overburden residual soil with 0.3 – 0.6m of organic silt, over fine to medium-grained sand to 1.3m, over stiff to hard, low to non-plastic silt.

At the proposed powerhouse location, alluvium deposits of silty fine sand material were encountered and thickness of this material layer is >3m. The groundwater table is around 3m below the exiting ground level. Sandy material exhibits medium dense characteristics.

More detailed discussions on the geology of the project location are contained in the project geotechnical report (Annexure 12).

4.1.4.2. Geomorphology

The area is characterised by ridge and valley morphology and the main River Sindila runs along a 5-10m wide V- shaped deep valley towards a north-westerly direction. The slope on both the left and right banks of the river is very steep to moderately steep . The main ridge runs parallel to the river and a numbers of small streams run perpendicular to the main valley. The bottom part of the main river flows on a rocky bed bounded by rock escarpment.

4.1.4.3. Soils

The soils in the project area and specifically at the proposed project site locations are as follows:

At Weir site
About fifteen metres from the right bank along the weir axis, alluvium deposits of rounded gravely sand with 0.5-1.0m diameter rock boulders were present. This layer penetrates about 1m depth evident from surrounding rock exposes.

Along the Headrace canal
The section of the headrace canal is characterised by hard slightly weathered to fresh rock exposures. These rock exposures are moderately to highly jointed and detached and exhibit a

high possibility of rock falls during excavation.

Along the Spillway
Spillway location is mainly covered by gravelly clay of residual origin and hard rock is encountered at about 1.5m depth.

At the Forebay
The proposed forebay area is mainly covered by residual clay material which consists of gravely clay. Thickness of this material layer is more than 1.7m.

Powerhouse
The powerhouse location is covered by alluvium deposits and the test pit data shows penetration of this layer deeper than 2.6m.

In order to ascertain the baseline soil quality around the project location, one strategic location - location of the proposed project support structures, was selected for sampling. The location of the support structures will house project stores, a parking area, and waste management facilities, which are possible sources of soil contamination. No soil samples were taken from location of other project structures, as these pose minimal risk to soil contamination.

A composite soil sample was collected from a soil profile test pit, which was dug at the centre of the proposed support structures location (Plate 4.1). One soil profile was described, the details of which are provided in the section that follows and their physical, chemical and biological properties determined. The point of soil profile description was geo-referenced.

Coordinates: 832231E, 66365N, (WGS 84, UTM 35)
A horizon, 0 to 40 cm, red (5Y 2.5/1), loamy sand, granules, common roots, very soft.
B horizon, 40-70cm, brown (10YR 6/4), sand/silt, and well sorted, no roots, coarse structure.

Plate 4.1: Soil profile pit at the centre of proposed support structures location

The composite soil sample was taken to the Uganda Directorate of Government Analytical Laboratory and analysed for the following parameters: moisture content, arsenic, barium, cadmium, calcium, chromium, lead, manganese, mercury, nickel, zinc, nitrogen (total), phosphorous (total), total organic carbon, percentage composition of sand, clay and silt, texture, Extractable Petroleum Hydrocarbons (EPHs) and Poly Aromatic Hydrocarbons (PAHs) - refer to Annexure 13 for the laboratory analytical results.

Although Uganda soil regulatory limits have been established; National Environment (Minimum Standards for Management of Soil Quality) Regulations, 2001), they do not state the regulatory limits for the specific soil parameters. Therefore, the United States Environmental Protection Agency (USEPA) regulatory limits for the specific soil parameters that were being analysed, were used as a basis for comparison.

Soil Analytical Results
The analytical results are presented in Table 4.3 below.

Table 4.3 Soil quality analytical results

Parameter	Result	Limits/ Authority
Centre of support structures location: Coordinates: 832231E, 66365N, (WGS 84, UTM 35)		
PH	6.8	6.0-8.0
Arsenic (mg/kg)	≤0.01*	5.0 max
Barium (mg/kg)	2.2	100.0 max
Cadmium (mg/kg)	0.04	1.0 max
Calcium (mg/kg)	28.7	Not indicated
Chromium Total (mg/kg)	1.2	5.0 max
Chromium VI (MG/KG)	0.02	5.0 max
Lead (mg/kg)	≤0.001*	5.0 max
Manganese (mg/kg)	0.4	1.0 max
Mercury (mg/kg)	≤0.01*	0.2 max
Nickel (mg/kg)	1.4	20.0 max
Silver (mg/kg)	0.3	5.0 Max
Zinc (mg/kg)	2.4	250.0 max
Nitrate (mg/kg)	3.2	Not indicated
Phosphorus, Total (mg/kg)	9.8	Not indicated
Sulphate (mg/kg)	24.4	Not indicated
TOC	9.2	Not applicable
EPHs (% W/W)	0	Not indicated
PAH (MG/KG)	< 0.01*	90.0 max

*Below detection limit.

The soil analytical results indicate that the measured parameters are within the United States EPA regulatory limits and that the soil was devoid of any form of contamination in relation to the measured parameters. These results establish background levels for these parameters at the proposed support structure location.

4.1.4.4. Seismic analysis

The Eastern African Rift System (EARS) is one of the tectonic features that are most associated with the seismicity of Uganda. Among others are the Katonga fault break which starts from the foot hills of Rwenzori Block Mountains, traverses L. Victoria and connects to the Kavirondo Gulf in south western Kenya and the Speke Gulf South of Lake Victoria in Tanzania; the Aswa shear zone that starts from Nimule at the Sudan-Uganda border and joins Mt. Elgon on the Eastern border.

The proposed Sindila MHP project area lies in the earthquake prone zone within the western arm of the East African Rift System (EARS). Table 4.4 indicates some of the destructive earthquakes experienced in Uganda.

The Project Area lies in highest Seismic Energy zone (red-orange) of potential earthquakes of magnitude greater than 6.8, and highest seismic hazard considering a radius of 20 to 50km from major seismic source zones (Figure 4.6). Within a radius of 20 to 50 km, the following major earthquakes occurred: (i) on 2nd October 1929, Location (0.4° N 30° E) Toro earthquake in the western rift measuring 5.9, (ii) 20th March 1966 Location (0.84° N 29.9° E) Toro earthquake measuring 6.7, and (iii) on 5th February 1994, Location (0.59° N 30.03° E) Kisomoro-Toro earthquake measuring 6.2, claiming lives of 8 people and causing destruction of property worth $ 61 million. However, moderate earthquakes continue to be felt often in the country.

The seismic hazard for the whole region has been simplified and presented in Figure 4.7 below. The information provided in the figure shows that the proposed project lies within a very seismically active area and ranks number 1 in the whole country based on the historical records of seismic risk prone areas.

The results of return period for various magnitudes of earthquakes are shown in Figure 4.8. Earthquake reoccurrences in this study can be analysed in four groups. There are those earthquakes that are more likely to return after a short period of less than 5 years (Ms ≤ 3.8). The second group of earthquakes fall in Ms ≤ 5.7, and these are more likely to re-occur in 10 ± 5.0 years. A third category of earthquakes includes events of magnitude Ms ≥ 6.0, and show return periods of 50 to 85 years. The fourth group of earthquakes have a magnitude Ms ≥ 6.8, and are likely to re-occur in over 85 years.

According to this data, the proposed area is situated in a seismically active zone and therefore vulnerable. However, it should be noted that no part of the country is earthquake free and we cannot rule out occurrence of the future big earthquakes, so for structural design purposes in any part of Uganda, a characteristic earthquake of magnitude 7.5 and above should be taken into account. This would therefore propose a return period of at least 150 years from this date since the availability of information on the past big earthquakes in the proposed project area is scarcely available.

Table 4.4 Destructive Earthquakes in Uganda

Date	Epicenter	Magnitude	Socio-economic losses due to Earthquakes
09 July 1912	Kitgum, close to Aswa shear zone	6.7	Partial destruction of buildings in Northern Uganda.
02 October 1929	Toro, Western Rift	5.9	Change of water color in hot springs, landslides.
18 March 1945	Sembabule, (40 km North of Masaka town) close to Katonga shear zone	6.0	Entebbe seismograph put out of order, 5 people dead and destruction of some buildings.
20 March 1966	Toro, Western Rift	6.6	150 people dead and over 1,300 injuries, loss 0f property worth US$1million.
07 September 1990	Lake Victoria, near Kampala	5.0	Destroyed semi-permanent buildings.
09 October 1991	Butiaba Port, Lake Albert, Western Rift.	5.3	Destroyed semi-permanent buildings.
05 February 1994	Kisomoro, Toro, Western Rift	6.2	8 people dead, destruction of property worth US$61 million (2.4% of GDP in 1994).

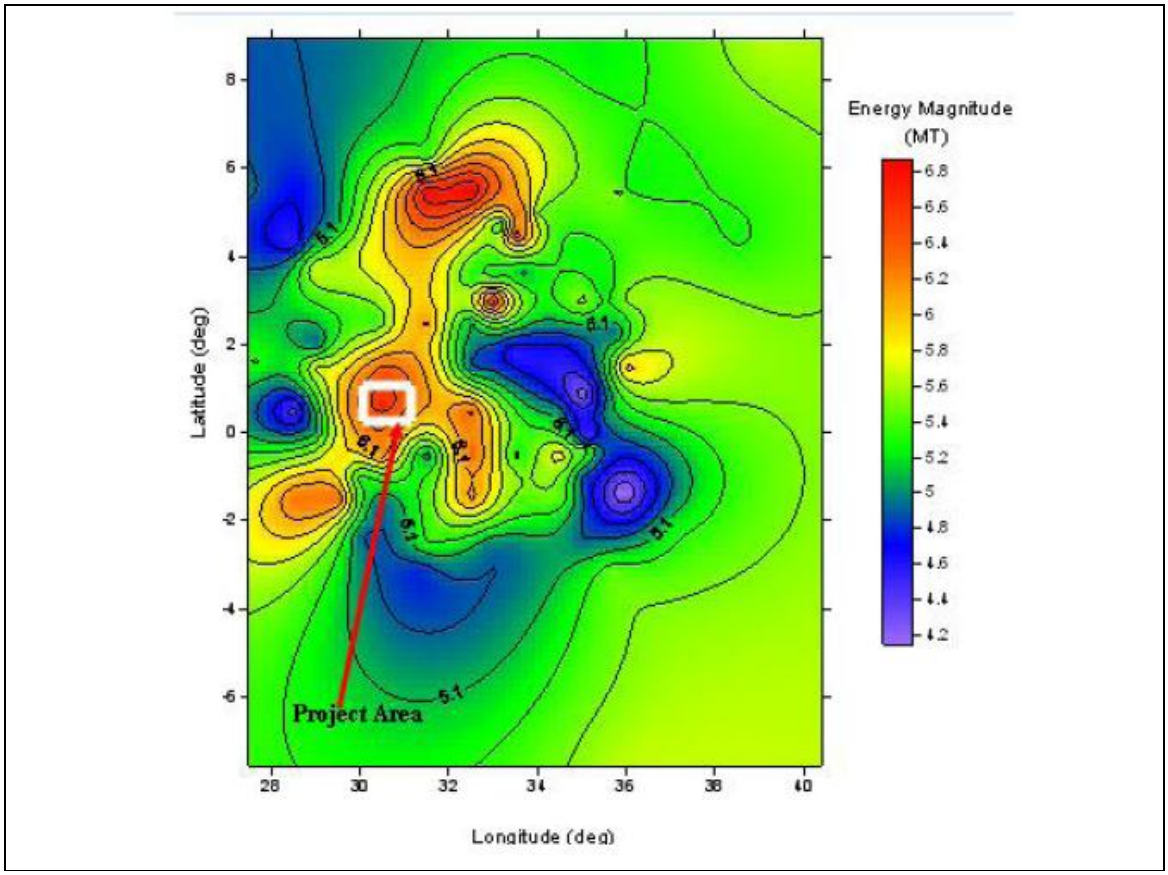


Figure 4.6 Seismicity for the Rwenzori region

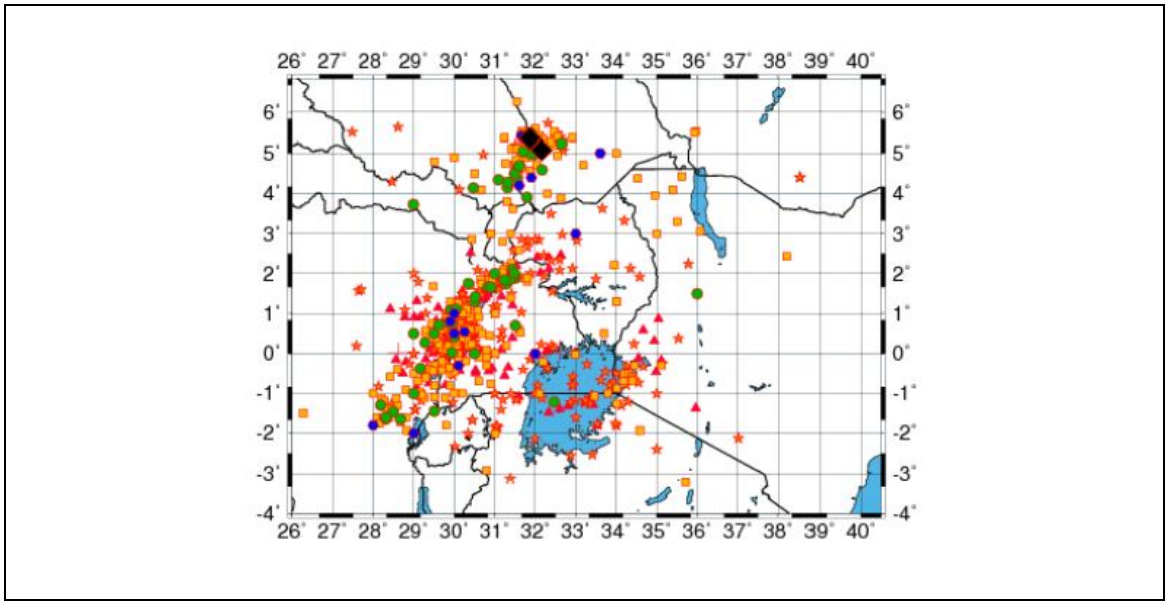
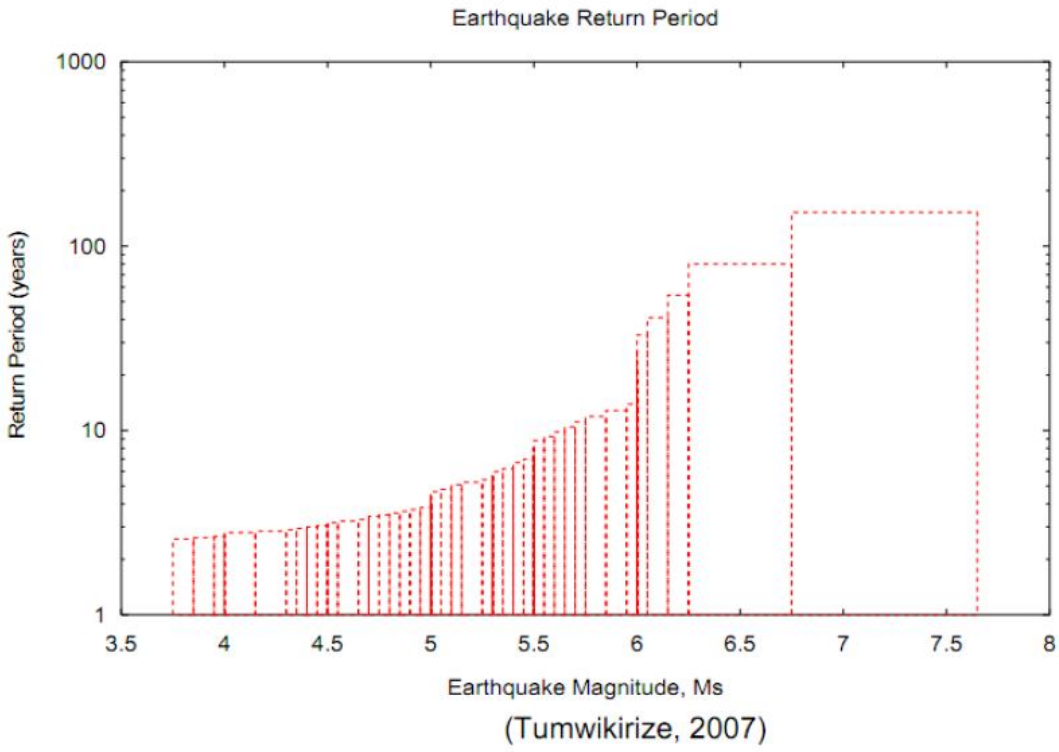


Figure 4.7 Earthquake magnitudes

1.0 ≤ Ms ≤ 1.9 red cross; 2.0 ≤ Ms ≤ 2.9 red triangle; 3.0 ≤ Ms ≤ 3.9 red star; 4.0 ≤ Ms ≤ 4.9 orange square; 5.0 ≤ Ms ≤ 5.9 green circle; 6.0 ≤ Ms ≤ 6.9 blue hexagon; 7.0 ≤ Ms ≤ 7.9 black diamond symbols (Tumwikirize 2007).



Earthquake Return Period computed from Uganda Earthquake catalogue. Note that earthquakes magnitudes can be characterised by their return periods of (Tr) ≤ 5 years, Tr ≤ 10 years, Tr ≤ 20 years, Tr ≤ 50 years, Tr ≤ 85 years Tr ≤ 100 years, and return period of over 100 years. Note that as the earthquake magnitude increases, the Return Period becomes large. Thus big earthquakes take a long time to return which may not fall in life span of humans (Tumwikirize 2007).

Figure 4.8 The earthquake return period for Uganda

4.2. BIOLOGICAL ENVIRONMENT

4.2.1. Vegetation

Two transects comprising a total of eight (8) quadrants were randomly selected for vegetation sampling in the respective sampling areas at the proposed project site. The transects contained different vegetation mosaics. Nested quadrants were laid alternately along the transect lines, spaced out at intervals of between 20m to 50m. Herbs were sampled in a 2m x 2m quadrant, while shrubs and lianas were sampled in a 15m x 15m, and trees in 25m x 25m quadrants. All herbs, lianas, shrubs and trees encountered rooted in the quadrant were recorded respectively. Tree diameters at breast height (Dbh) were measured and recorded in diameter classes of Dbh ≥2.5-9.90cm, Dbh ≥10-29.9cm, 30-49.9cm and 50cm+. Diameter ≥ 50cm classes are grouped in one class because their numbers are always low.

The same sampling methodology was used in both the forested area (the proposed weir and the headrace canal sections) and in the community area (community/open land) outside the park boundary. In the community area, the survey focused on two categories of plants: trees and under storey vegetation, since the vegetation in this area has been highly modified by human activities such as subsistence farming.

Although the plots revealed very reasonable data on the distribution, diversity, and abundance of the various plant stratum according to the land use types in the area, a cumulative list was compiled from both the plots, and opportunistic encounters that were recorded as they were encountered along the transects in the study area.

Considering that the proposed project (weir) will be located 430m North West of the RMNP, the significance of the park has been included in the of baseline assessment for the proposed Sindila MHP in Section 4.2.2.

4.2.1.1. Flora of the Rwenzori Mountain National Park

Considering that the proposed project (weir) will be located 430m North West of the RMNP, which is known for a diversity of vegetation, an overview of the park vegetation from a study conducted by the Wildlife Conservation Society (WCS) focusing on the Albertine Rift region in 2000 is presented in this section. This study aimed at surveying all the major forest blocks in the Albertine Rift region of which Rwenzori Mountain was among them. Part of this study was conducted in the northern part of the park at a location in the vicinity of Harugali, which is approximately 15km from the proposed project site. According to the study, 500 species of plants (herbs, lianas, trees, shrubs) were recorded in RMNP, of which twenty two are Albertine Rift Endemics, while nine are Threatened according to the International Union for the Conservation of Nature (IUCN) red list. The total number of plant species known in RMNP is 796, forty-one (41) of which are Albertine Rift Endemics and eleven are Threatened according to the IUCN red list.

Rwenzori Mountains is most species rich at lower altitudes in the forest but was species poor where bamboo dominated in the southwest and northeast of the park. At the survey site in the vicinity of Harugali, which is approximately 15km from the proposed project site, 139 plant species were recorded, four of which were Albertine Rift Endemics.

4.2.1.2. Flora of the project area

The immediate impact zone of the project comprises mostly of manmade habitats and therefore the floral diversity was found to be low. A total number of 77 predominant plant species were recorded during the first field survey (February, 2012) within the study area. The number of species per major life form is summarised in Table 4.5. The majority of the plant species recorded were trees (31 species) followed by herbs (25 species), shrubs (11) and climbers (10) (Table 4.5 and Annexure 14). Riverside vegetation, the only natural habitat present in the area had the highest number of species compared to the other vegetation that was observed. None of the recorded plant species were unique or restricted to the area. Furthermore, none of the species were listed as globally threatened (IUCN, 2012).

Table 4.5: Number of species per major life form recorded in the proposed project area during the first survey in February 2012

Plant Type	Total Species	Endemic	Native	Introduced	Threatened
Tree	31	-	24	7	-
Shrub	11	-	10	1	-
Herb	25	-	14	11	-
Climber or Creeper	10	-	10	0	-
Total	**77**	**0**	**58**	0	**0**

4.2.1.2.1. Vegetation at the proposed Weir Site

Riverside vegetation present in the upstream and downstream areas of the proposed weir site was highly disturbed by human activities and therefore, can be classified as disturbed riverine vegetation. Some of the plant species observed in this habitat include; *Ensete ventricosum* (Wild banana), *Rhaphidophora africana*, *Brillantaisia cicatricosa*, *Pouzolzia parasitica*, *Vernonia myriantha*, *Anubias* sp., *Ficus* spp. (Fig trees), *Trema orientalis* (Pigeonwood), *Rauvolfia caffra* (Quinine tree), *ittosporum viridiflorum* (Cheesewood), *Albizia grandibracteata* (Large-leaved Albizia), *Celtis durandii* (Stinkwood), *Harungana madagascariensis* (Orange-milk tree), *Maesa lanceolata* (Maesa), *Markhamia lutea* (Markhamia), *Monodora myristica* (Calabash nutmeg), *Polyscias fulva* (Parasol tree), *Spathodea campanulata* (African tulip tree), *Tabernaemontana stapfiana* (Wild magnolia), *Vepris nobilis* (White ironwood), *Acanthus pubescens* (Pink-flowered acanthus), *Microglossa pyrifolia* (Microglossa), *Solanecio mannii* (Solanecio), *Impatiens* spp. (Balsams). No endemic, rare or endangered plant species were recorded in the river or along the within the riverine vegetation. A detailed list of plant species observed during the field survey in the riverine vegetation up and downstream from the proposed weir site location of River Sindila is provided in Annexure 14.

4.2.1.2.2. Vegetation along the proposed headrace canal

The proposed headrace canal will pass through a number of floristic habitats such as disturbed riverside vegetation, abandoned lands, and cultivated lands. The first section of the headrace canal from the weir is located in a riverine forest. Thereafter, the canal passes through abandoned and cultivated lands. The forest vegetation observed along the head race canal comprises of the same species that were listed in the previous section for the vegetation seen in and around the weir site location.

The cultivated land observed along the path of the headrace canal comprised of a mixture of arable crops such as *Zea mays* (Maize), *Manihot esculenta* (Cassava) and *Phaseolus vulgaris* (Bean). In addition, Banana (*Musa paradisiaca, Musa sapientum*) and Coffee (*Coffea Arabica* and *Coffea canepohora*) strands were found along the proposed headrace canal site. Other than cultivated species, herbaceous species such as *Ageratum conyzoides*, *Bidens pilosa*, *Oxalis* spp., *Galinsoga parviflora*, *Pteridium aquilinum* were observed in the cultivated land. Vegetation in the land that was not under cultivation were dominated by species such as *Cymbopogon nardus*, *Pennisetum purpureum*, *Pteridium aquilinum*, *Ageratum conyzoides*, *Bidens pilosa*, *Galinsoga parviflora*, *Maesa lanceolata*. No endemic, rare or endangered flora species were recorded along the headrace canal path. A detailed list of plant species observed along the proposed headrace canal section is listed in Annexure 14.

4.2.1.2.3. Vegetation at the proposed Forebay tank

The vegetation here mainly consisted of crop species that included *Zea mays* (Maize), *Manihot esculenta* (Cassava) and Banana (*Musa paradisiaca, Musa sapientum*). In addition to the cultivated species, *Ageratum conyzoides*, *Bidens pilosa*, *Achyranthes aspera* and *Galinsoga parviflora* were observed commonly at this site. No endemic, rare or endangered flora species were recorded. A detailed list of plant species observed is shown in Annexure 14.

4.2.1.2.4. Vegetation along the Penstock path

The dominant plants observed in this section which mainly comprised of uncultivated land included species such as, *Ageratum conyzoides*, *Bidens pilosa*, *Achyranthes aspera*, *Pennisetum purpureum*, *Pteridium aquilinum*, *Gynura psuedochina*, *Galinsoga parviflora*, *Maesa lanceolata*, *Elaeis guineensis* (Oil Palm), *Senna spectabilis*. The vegetation in the home gardens was dominated by cultivated plant species such as Avocado (*Persea americana*), Mango (*Mangifera indica*), Moringa (*Moringa oleifera*), Coffee (*Coffea Arabica* and *Coffea canepohora*), Banana (*Musa paradisiaca, Musa sapientum*), Papaya (*Carica papaya*), Asparagus (*Asparagus racemosus*), Guava (*Psidium guajava*), Cocoa (*Theobroma cacao*), Maize (*Zea mays*), Cassava (*Manihot esculenta*) and Jack Fruit (*Artocarpus heterophyllus*). In addition, species such as Neem (*Azadirachta indica*), *Markhamia lutea*, *Thevetia thevetioides*, *Elaeis guineensis* (Oil Palm), *Ficus* spp. (Fig trees), *Senna spectabilis*, *Solanum macranthum* were also observed in the home gardens.

The hedges of the home gardens comprised either of *Euphorbia tirucalli* or Yellow oleander (*Thevetia peruviana*) stands. No endemic, rare or endangered plant species were observed along the penstock section. A detailed list of plant species observed in the habitats along the penstock path during the field survey is listed in Annexure 14.

4.2.1.2.5. Vegetation at the proposed Powerhouse location

The proposed powerhouse will be located in a mixed cultivated land that contains banana (*Musa paradisiaca, Musa sapientum*), Cassava (*Manihot esculenta*) and Maize (*Zea mays*). The other plant species observed include, *Ageratum conyzoides*, *Bidens pilosa, Galinsoga parviflora* and *Erythrina abyssinica*.

No endemic, rare or endangered plant species were observed at the site. A detailed list of plant species observed at the proposed power-house site during the field survey is presented in Annexure 14.

4.2.1.2.6. Vegetation along the proposed Access Roads

The vegetation here consisted of mainly coffee trees, Maize (*Zea mays*) and grasses. Other crops included cassava (*Manihot esculenta*) and Beans (*Phaseolus vulgaris*).

No endemic, rare or endangered plant species were observed.

4.2.2. Significance of Mount Rwenzori National Park

The Mount Rwenzori National Park lies in Western Uganda along the Uganda – Congo border and falls within the administrative boundaries of Bundibugyo, Kabarole, and Kasese districts. The Rwenzori Mountains was gazetted as a forest reserve in 1941.The reserve was then designated as the Rwenzori Mountains National Park in 1991 and recognised as a United Nations Educational, Scientific and Cultural Organisation (UNESCO) World Heritage site in 1994, and a Ramsar site in 2008.

Mount Rwenzori national park UNESCO World Heritage site

The inclusion of the Mount Rwenzori National Park on the list of UNESCO World Heritage sites was due to its conformity with two of the ten selection criteria[3], - Criteria VII and X.

Criterion VII considers an area, which contains superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance (http://whc.unesco.org/en/criteria/).

The Rwenzoris are the legendary "Mountains of the Moon", a reflection of the mist-shrouded mountains of this rugged massif that tower almost 4,000m above the Albertine Rift Valley, making them visible from great distances. These mountains offer a unique and pristine landscape of alpine vegetation studded with charismatic giant lobelias, groundsels, and heathers which have been called "Africa's botanical big game". The combination of spectacular snow-capped peaks, glaciers, V-shaped valleys, fast flowing rivers with magnificent waterfalls, clear blue lakes and unique flora contributes to the area's exceptional natural beauty. (http://whc.unesco.org/en/list/684)

Criterion X considers an area which contains the most important and significant natural habitats for in-situ conservation of biological diversity, including those containing threatened species of outstanding universal value from the point of view of science or conservation (http://whc.unesco.org/en/criteria/).

Because of their altitudinal range and the nearly constant temperatures, humidity and high isolation, the Rwenzori Mountains support the richest montane flora in Africa. There is an outstanding range of species, many of which are endemic to the Albertine Rift and bizarre in appearance. The natural vegetation has been classified as belonging to five distinct zones, determined largely by altitude and aspect. The higher altitude zones, covered by heath and Afro-alpine moorland, extend from around 3,500m to the snow line and represent the rarest vegetation types on the African continent.

Significant species include the giant heathers, groundsels, lobelias and other endemics. In terms of fauna, the Rwenzoris have been recognised as an Important Bird Area with 217 bird species recorded to date, a number expected to increase as the park becomes better surveyed. Among these, 17 bird species are endemic to the park. The forest zone at 1800m contains a diversity of birds that include the Rwenzori Turaco, Barred long tailed Cuckoo, Long eared owl, Handsome Francolin, Cinnamon chested bee eater, Archer's Robin-chant, White Starred Robin, Rwenzori Batis, Montane Sooty Boubou, Lagden's bush shrike, slender billed starling, Blue headed sunbird, Golden winged sunbird, strange weaver and several varieties of Barbets. The montane forests are also a home to threatened species such as the African forest elephant, eastern chimpanzee and l'Hoest's monkey. The endangered Rwenzori black-fronted or red duiker, believed to be a much localised sub-species or possibly a separate species, appears to be restricted to the Park. (http://whc.unesco.org/en/list/684).

The Mount Rwenzori National Park provides stunning views of glacier and snow-capped mountains just a few kilometres from the equator, where it is contiguous with the Virunga National Park in the Democratic Republic of Congo (DRC). Having the third highest mountain peak in Africa, Margherita peak at 5,109m (after Mount Kilimanjaro and Mount Kenya), the park includes a much larger alpine area, covering an area of 99,600ha of which 70% lies at over 2,500m in height.

The Rwenzori Mountains form a vital water catchment for all the places around it and most of the rivers. The rivers running down the mountain range feed the economically important lakes, Edward and George. The multitude of fast flowing rivers, magnificent waterfalls and stratified vegetation make the property exceptionally scenic and beautiful.

[3] To be included on the World Heritage List, sites must be of outstanding universal value and meet at least one out of ten selection criteria.

Mount Rwenzori national park Ramsar site

The designation of the Mount Rwenzori National Park Ramsar site stems from its recognition by a geographer, Ptolemy, in AD 300 who referred to it as the *Linus Montae* (Mountains of the Moon). The entire Afro-alpine ecosystem (between 1,600 and 5,100m.a.s.l) is unique; with the contribution of high rainfall and melting of snow peaks, various wetland types are present such as peat lands, freshwater lakes and tundra, among others. The mountains are known to support 21 species of small mammals, including the endemic and vulnerable Rwenzori Shrew. Other species of global conservation concern include L'Hoest's Monkey, Horseshoe bat, African elephant, chimpanzee and Rockefeller's Sunbird. With the distribution of fish varying with altitude, several indigenous fish species are found within the site, with the most common Cyprinid species including; *Barbus alluaudi, B. somereni, B. perince* and *Varicorhinus rwenzorii* (Hilde *et al*, 2009).

4.2.3. Fauna

Fauna of the Rwenzori

The Rwenzoris are renowned for species of conservation concern. The park has 54 Albertine Rift endemics, which include 18 species of mammals, 21 species of birds, 9 species of reptiles and 6 species of amphibians. Five species are endangered, 14 are threatened and four have restricted range. The endangered species include the Rwenzori duiker (*Cephalophus rubidus*), montane squirrel (*Heliosciurus ruwenzorii*), Chimpanzee (Pan *troglodytes*), African elephant (*Loxodonta africana*) and Rwenzori range frog (*Africana ruwenzorii*). Four species have restricted range. These are Rwenzori/Kivu climbing mouse (*Dendromus kivu*), the Rwenzori Duiker (*Cephalophus rubidus*), *Bradypodion xenorhium* and the Uganda clawed frog (*Xenopus ruwenzorii*).

The Rwenzori supports one of the most important bird communities in Uganda, with a total of 217 species having been recorded. (UNESCO World Heritage Centre website: (http://whc.unesco.org/en/list/684). Whilst this represents only a moderate level of species richness, the forest harbours many rare, threatened and endemic species. The amphibians show high altitudinal stratification in terms of diversity and richness. Two species of horned chameleons occur in the forest zone. Two species of snakes have been recorded below an altitude of 2440masl.

Fauna of the project area

4.2.3.1. Mammals of the project area

The presence and numbers of mammals were surveyed along line transects using the following methods:

- *Direct enumeration*; All mammals that were seen were identified to species level and the numbers of each species counted;
- *Identification of footprints and/or dung or calls*; Footprints and dung of large and medium-sized herbivores and carnivores are easily recognisable; footprints provide a relative index of the number of animals that use each specific site; and
- Local people were also consulted as a valuable source of information. Some local people informed the study about the availability of some species of mammals.

Only a few species of mammals were observed during the survey (Table 4.6). Large mammals such as *Papio cynocephalus* (Yellow baboon), and *Phacochoerus aethiopicus* (Warthog) were not recorded at the proposed project site during the survey but were said to be present in the riverine forest area. According to the villagers these mammals do come to the village transiently.

Discussions held with Uganda Wildlife Authority officials and the Bundibugyo District Forestry Officer during the ESIA update on 31st May, 2014, revealed the presence of the Olive baboon (*Papio anubis*), the Blue monkey (*Cercopithecus mitis stuhlmanni*) and the Angolan colobus

(*Colobus angolensis rwenzorii*). The Angolan colobus monkey is a sub-species endemic to the Rwenzori Mountains.

Community members also mentioned these three primate species as crop raiders. This is unavoidable as fields are planted up to the park boundary.

Groups of larger monkeys such as the Olive baboon may have home ranges of 4-5km^2 and thus could easily arrive in community fields on ridges at lower elevations. Home ranges of Blue monkeys may average 2-3km^2, so those arriving in fields well away from park boundaries are probably local groups living outside the park.

Table 4.6 Mammals recorded during the first survey (February 2012) in the project area

Common name	Scientific name	Family	Conservation Status
Dwarf mongoose	*Helog*le undulate	Herpestidae	LC
Crested porcupine	*Hystrix cristata*	Hystricidae	LC
African hare	*Lepus capensis*	Leporidae	LC
Rock hyrax	*Heterohyrax brucei*	Procaavidae	LC

4.2.3.2. Birds of the project area

Timed Species Counts (TSC's) were used to assess the relative abundance (Pomeroy & Dranzoa, 1997; Freeman *et al*, 2003) of birds within the 2km radius of the proposed project area and access roads. Four 500m long line transects were established for each campus direction. Counts along each transect lasted for 30 minutes and birds were rank-ordered according to the 5 minute recording periods within the 30 minute TSC.

For each transect, species were scored six if seen in the first 5 minutes of the count and five when seen between 5-10 minutes and so on until the last ten minutes where species would be allocated a score of one. The main assumption was that, the most abundant species are supposed to be seen sooner than the scarce ones. The TSC's were supplemented with opportunistic observations. Most of the birds were identified in the field although occasional reference was made to the Stevenson and Fanshawe (2002) field guide.

In order to ease analysis and produce a more distinct pattern, birds were further categorised using different criteria as shown in Table 4.7.

Timed species counts were conducted during the first survey, February 2012 along established transects.

Table 4.7 Categories of birds at the proposed project area

Main Category	Sub category with codes		Descriptions
Forest birds	FF	Forest specialists	Forest interior birds
	F	Forest generalists	Normally breed in the forest or fragments but may occur outside the forest
	F	Forest visitors	Non-forest birds
Aerial	AA	Aerial feeders	Species feeding on the wing
Water birds	W	Water specialist	Restricted to wetlands or open water
	W	Water generalist	Often found near water
Grassland	G	Grassland specialist	Characteristic of open grasslands
	G	Grassland	May be found in grassland habitats but also able to

Main Category	Sub category with codes		Descriptions
		generalist	utilise woodland and forested habitats.
Migrants	A	Afro tropical	Species migrating within Africa
	P	Palaearctic	Species breeding in Europe or Asia
	Ap	Afro-Palaearctic	Species with both Palaearctic and Afro tropical populations
Red Data List	CR	Critically endangered	Extremely high risk of extinction in the wild
	R-VU	Regionally vulnerable	High risk of endangerment in the wild
	EN	Endangered	High risk of extinction in the wild
	R-NT	Regionally near-threatened	Could become endangered in the region
	LC	Least concern	Large species range and not threatened
	R-RR	Regionally restricted	Species with the greater part of its distribution in East Africa

Out of the 51 species of birds recorded during the first survey by OPEP Consult in February 2012 in the area, 34 species were recorded in the various circular plots while the remaining species were observed opportunistically along the transects. The bird species that were encountered most frequently include species such as *Pycnonotus barbatus* (Common bulbul), *Colius striatus* (Speckled mouse bird), *Prinia subflava* (Tawny-flanked prinia), *Passer griseus* (Grey-headed sparrow), *Serinus citrinelloides* (African citril). Some bird species such as *Corvus albus* (Pied crow), *Motacilla aguimp* (African pied wagtail) were also encountered around human habitations.
Refer to Annexure 15 for the complete list of bird species encountered in the project area.

All the bird species in the project area are listed as of Least Concern according to the IUCN Red list.

4.2.3.4. Butterflies of the project area

The butterflies of the project area were assessed using the sweep netting method. This method involves passing a sweep net through the different habitats using alternate backhand and forehand strokes along selected transect lines. The trapped specimens were later identified using a number of standard field guides, keys as well as collections at the Zoology Museum, Makerere University. Preliminary identifications of common and familiar species were also done in the field.
Twenty species of butterflies were observed during the first survey by OPEP Consult dated February 2012. Out of these *Neptis saclava* (Small Spotted Sailor), *Acraea johnstoni* (Johnston's Acraea), *Aceaea pharsalus*, *Papilio demodocus* (Citrus Butterfly), *Amauris tartarea* (Monk), *Leptosia alcesta* (African Wood White), *Junonia oenone* (Dark Blue Pansy), *Eurema hecabe* (Common Grass Yellow) and *Pseudargynnis hegemone* (False Fritiliary) were the most commonly encountered species.

These species were observed in almost all the habitats and most frequently within disturbed open vegetation. However, species such as *Papilio dardanus* (Mocker swallowtail), *Danus chrysippus* (African monarch) *Papilio phorcas* (Green-banded swallowtail), *Papilio nireus* (Narrow green-banded swallowtail) were only recorded in forested areas. Refer to Annexure 16 for the complete list of butterflies and other insect species encountered in the project area.

4.2.3.5 Herpeto-fauna of the project area

The Visual Encounter Surveys (VES) method, which involves walking through a study area or habitats for a prescribed time systematically searching for reptiles and amphibians, was used along the riverine ecosystems of River Sindila; and along the subsidiary streams joining River

Sindila. The method is commonly used to determine the species richness of an area, to compile a species list and to estimate relative abundances of species within an assemblage.

Opportunistic encounters was the other method used during the herpeto-fauna survey and it involved recording any amphibian or reptilian species encountered anywhere and at any time within the project area, or brought in/ reported by local people. Opportunistic searches were used to maximise the number of species encountered in the project area.
Local people were also consulted as a valuable source of information to further inform the study about the availability of some species of reptiles and amphibians.

Only 9 species of herpertiles were observed during the first survey by OPEP Consult dated February 2012 at the project site. These included; two amphibian and seven reptile species (Table 4.8). This could be attributed to the fact that most of the project activities take place in human modified habitats that are subjected to constant change. Therefore, only species that can easily adapt to such a changing habitat could be observed.

Table 4.8 Herpeto-fauna species encountered in the project area

Common name	Scientific name	Family	Conservation Status
Eastern Groove-crowned Bullfrog	*Hoplobatrachus occipitalis*	Ranidae	LC
Toad	*Bufo funereus* Sombre	Bufonidae	LC
Brook's Gecko	*Hemidactylus brooki*	Gekkonidae	LC
Tropical house gecko	*Hemidactylus mabouia*	Gekkonidae	LC
Striped skink	*Mabuya striata*	Scinicidae	LC
Blue-headed tree Agama	*Acanthocercus atricollis*	Agamidae	LC
Jackson's Tree Snake	*Thrasops Jacksoni*	Colubridae	LC
Rhinoceros Viper	*Bitis nasicornis*	Viperidae	LC
Great Lakes Bush Viper	*Atheris nitschei*	Viperidae	LC

No reptile species of conservation concern were identified. The conservation status of amphibians in Uganda is generally unknown because of data deficiency. However, according to the IUCN Red List Category, the amphibians recorded during the study are of least conservation concern.

4.2.3.6. Aquatic Biodiversity of the project area

Aquatic biodiversity assessments were carried out on 30th May, 2014. Sampling was done at selected locations before and after the proposed weir and power-house locations in River Sindila. Samples were collected to establish the aquatic biodiversity of the river in terms of fish, phytoplankton, zooplankton, and macro invertebrates (benthos).

Fish

Unlike most assessments where gill nets are used for fish sampling, Minnow fish traps had to be used in this study. This is because gill nets could not be used due to the rocky bottom and fast flowing nature of water in River Sindila, and therefore Minnow fish traps which are also easy to use and can be setup in the small pools along the river channel were used.

Sampling for fish was undertaken at three sites within the River Sindila (one before and the other after the proposed power-house location and the third site was downstream of the proposed weir site). Site selection was based on the suitability of the location to accommodate setting up of the minnow traps and preference was also given to areas with relatively stable waters (pools), covered with macrophytes.

At each sampling site, two fish traps were set at opposite sides of the river. One and half hours were spent at each fish sampling site. The fish that were caught were preserved in 10% formalin for examination at the Makerere University Biological Department laboratory.

In the laboratory, the specimens were identified to species level with the help of Greenwood (1966). Measurement of total length (TL), standard length (SL) and weight of each specimen were undertaken using a ruler (calibrated in centimeters) and sensitive weighing balance (calibrated in grams) respectively.

Results

At least 16 fish species (six families) occur in the Rwenzori Mountains, and their distribution is mainly limited by altitude (Busulwa, 1998). Many indigenous fish species are present at an altitude of between 900 and 1,700m.a.s.l. The most common are cyprinids such as *Varicorhinus rwenzorii, Barbus alluaudi, B. somereni, B. perince* and *B. apleurogramma*. Other species include the catfish, which swims against the fast flowing rivers of the mountain, *Amphilius jacksonii*, the swamp catfish *Clarias alluaudi*, and three species of Cyprinodontidae and various Haplochromine at the very lowest locations. Cyprinid (large Barbus) species are the only species that extend above 1,500m.a.s.l. The proposed Sindila MHP will be located between altitude 1563.5m.a.s.l (weir) and 11120m.a.s.l (powerhouse) along River Sindila (see Section 2.4.1 of this ESIS). The proposed project altitudinal range therefore, falls within the altitudinal habitat range (900 - 1700m.a.s.l) of some fish species found in the rivers of Rwenzori Mountain, the habitats of which need to be maintained.

Although the aquatic surveys undertaken during the previous ESIA did not find any fish species in the river which was later confirmed by the local people then, during the May 2014 survey, three fish of the same species (*Labeo forskalii*), were caught from River Sindila. One fish was caught in the minnow trap set before the proposed power-house site (UTM Zone 35N, Arc 1960, 0833132, 0064664) and two from the trap set downstream (UTM Zone 35N, Arc 1960, 0833137, 0064653) after the proposed powerhouse location. The fish that were caught varied in size (see Table 4.9), the biggest recorded (8.55g, 9.5cm total length and 7.5cm standard length) was caught downstream before the proposed Sindila power house location. No fish catches were recorded from the traps set close to proposed site for the weir. No fish catches were recorded from the traps set close to proposed site for the weir.

The low fish abundance and diversity observed could be seasonal and bears significance to the ecological functions of this river as a breeding and nursery ground for the identified fish species. The species (*Labeo forskalii*) have one breeding season a year that is closely linked to peak flows, and they rely on increased flow as a cue for migration and maturation. They are also vulnerable to changes in the timing of high flow events that are inappropriate to their breeding seasonality and for the needs of drifting larvae. The absence of fish during the February 2012 survey could be attributed to the low peak flows during the month of February in Bundibugyo (Figure 4.9).

Even though no fish catches were recorded at the location of the weir, it is important to note that the assessment was conducted for a short duration and cannot be used to confirm presence of fish at different altitudes. In addition to the short assessment duration, IUCN categorised the species *Labeo forskalii* as Data Deficient for North and East Africa due to a lack of information on its distribution, abundance and threats (http://www.iucnredlist.org/details/181762/0). Based on this categorization, it would be unfounded to conclude on the altitudinal range in which this fish species migrate in River Sindila. However, some publications (Tamatamah, 2009) indicate that

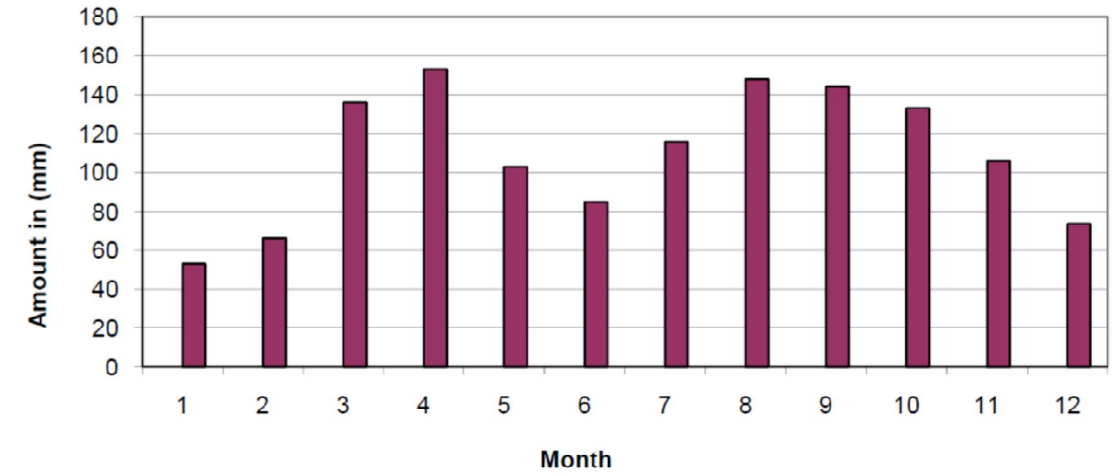
species in the genus Labeo migrate to small and large mountainous streams and do well in sediment-rich rocky biotopes in middle and lower sections of large rivers. During migration, they use the mouth and broad pectoral fins to climb damp surfaces of barrier rocks and weirs. These features help explain their wide altitudinal occurrences in river basins of Lake Victoria. However, note that the altitudinal range of the Lake Victoria Rivers is different from that of the rivers in the Rwenzori Mountains.

It is also important to note that *Labeo forskalii* is under heavy fishing pressure in Uganda, although consultations held with the local community members in the proposed Sindila MHP area acknowledged no fishing of the species on the river. This species is currently considered as a species of least conservation concern (IUCN, 2013).

Due to limited data on *Labeo forskalii* altitudinal range in the rivers of Mt Rwenzori, the fact that members of the genus Labeo can climb damp surfaces of barriers rocks and weirs, and that some Cyprinid *(a wider family where the Genus Labeo falls)* fishes can be found in altitudinal ranges above 1500m.a.s.l, *Labeo forskalii* may be expected to migrate upstream of the proposed location. It is therefore recommended that construction of the weir should take considerations of contiguous water pathways that must allow migrant fish to access their breeding areas in the river upstream of the weir.

Table 4.9 Size variation of fish (*Labeo forskalii*) caught from River Sindila

Sampling sites	Sampling equipment	Number of fish caught	Weight (grams)	Total length (cm)	Standard length (cm)
Before the Sindila power house (UTM Zone 35N, Arc 1960, 0833132, 0064664)	Minnow trap 1	1	8.55	9.5	7.5
	Minnow trap 2	-	-	-	-
After the Sindila powerhouse (UTM Zone 35N, Arc 1960, 0833137, 0064653)	Minnow trap 1	1	7.11	8.8	7.0
	Minnow trap 2	1	3.52	6.5	5.5



Source: Department of Meteorology

Figure 4.9 Mean Monthly Rainfall Totals for Bundibugyo

Phytoplankton

Water samples for the determination of phytoplankton composition and abundance were collected using a Schindler sampler. Samples were collected from areas where water was still and then placed into clean sample bottles for laboratory analysis. 0.2ml of iodine was added to preserve the colour and the phytoplankton cells.

In the laboratory, sub-samples of 2.5ml were allowed to settle for three hours prior to analysis using an inverted microscope at a magnification of X400, following methods for quantitative assessment of phytoplankton in freshwater (Hotzel and Croome, 1999, Olrik *et al.*, 1998, Findlay and Kiing, 1979).

Four taxonomic groups (Blue-greens, Greens, flagellates and Diatoms) constituted the algal community in River Sindila. A number of phytoplankton cells per mililitre were recorded from the samples collected (Table 4.10) with *Oscillatoria* species dominating the blue greens, *Spirogyra* dominating the greens, and *Uroglena* dominating the flagellates. There were no diatom *species* recorded at all sites sampled along River Sindila.

In terms of species abundance for the river, greens were more abundant (4-20 cells/ml) followed by the blue greens (4-15 cells/ml), and flagellates (2-3 cells/ml). Overall, diatom species richness and diversity appeared to be low and this is likely to be attributed to the higher turbulence and the low water temperatures (about 15 °c) for River Sindila. The dominance of *Oscillatoria* species among the blue green is an indication of high organic loads from the catchment this therefore indicates deteriorating water quality conditions at the sampled sites. The phytoplankton species recorded are similar to most of those found in Ugandan fresh water bodies especially Lake Victoria where extensive research has been done regarding the phytoplankton/algal communities.

Table 4.10 Phytoplankton diversity and abundance in River Sindila

Sampling site	Taxon	Species	Number of cells/ml
Sindila river near the weir (UTM Zone 35N, Arc 1960, 0833134,	**Blue greens**	*Oscillatoria*	10
		Anabaena	2

Sampling site	Taxon	Species	Number of cells/ml
0064670)		*Calothrix*	4
	Greens	*Zygema*	5
		Microspora	2
		Spirogyra	8
		Cladophora	4
		Desmidium	4
	Flagellates	*Phacus*	2
		Uroglena	3
Sindila river near the power house **(**UTM Zone 35N, Arc 1960, 0833195, 0067239**)**	**Blue greens**	*Oscillatoria*	5
		Anabaena	8
		Cladophora	2
	Greens	*Microspora*	6
		Ulothrix	8
		Spirogyra	12
		Cladophora	7

Zooplankton

Samples were collected using a 5-litre Schindler sampler and a total of 10 litres (two hauls) were taken, concentrated through a 53μm sieve and preserved with 4% formalin mixed with sucrose to prevent ballooning of cladocerans.

As part of the laboratory analysis process, samples were washed with distilled water over a 53μm sieve to remove the fixative, and diluted. This depended on the concentration of organisms on each sample. Sub-samples of 1ml, 2ml, and 5ml were taken with a wide bore automatic pipette from a well-agitated sample to ensure homogeneous distribution of organisms. Each sub-sample was mounted on a counting chamber and examined under an inverted microscope at both X100 and X400 magnification for taxonomic analysis and counting respectively. Species identification was done using published keys (Rutner-Kolisko, 1974 and Brooks, 1957).

Two taxonomic groups (i.e. rotifers, and crustaceans) were found in River Sindila for all the samples collected (Table 4.11). No copepods and cladocerans were found during the study. The diversity and abundance of rotifers at the sites where sampling was done is a characteristic of habitats that support fish.

Table 4.11 Zooplankton diversity in River Sindila

Sampling site	Taxon	Species	Number of organism/litre
Sindila weir	**Rotifers**	*Branchionus*	6
		Proales	2
		Keratella	2
		Ascomorpha	4
		Lecane	8
	Crustaceans	*Ostracod*	1
		Cyclop	3
		Bosmina	2
River Sindila power house (UTM Zone 35N, Arc 1960, 0833137, 0064653)	**Rotifers**	*Trichocerca*	*8*
		Proales	*2*
		Ascomorphopha	*7*
		Polyarthra	*4*
		Lecane bulla	*2*
	Crustaceans	-	

Macro-aquatic invertebrates

Sampling of benthic invertebrates was undertaken by collecting three 1m² samples per site using a standard 0.33m wide square frame benthos net fitted with a 500µm mesh net. Macro invertebrates were collected from the riffles of the river under assessment because of their boulder-to-gravel bottoms. The location of each placement of the benthos net was in a random fashion; however, sample collection was started at the furthest location downstream to locations upstream.

Processing of field samples was conducted in the laboratory. However, prior to processing, samples were drained of water, placed into appropriate sealed plastic bags and fixed in 95% ethanol. The residual water produced by the sample caused a final concentration of about 70% ethanol necessary for the fixation of macro invertebrates.

In the laboratory, samples were placed on a plastic sorting plate, macro invertebrates were sorted out from sediments and organic materials with the help of a hand lens and pair of forceps. Macro invertebrates were placed into groups of similar-looking organisms with the help of

benthos identification keys. Individual macro invertebrates from each group were identified to the order and species levels and information recorded on the data sheet.

Seven major taxonomic groups (orders) of benthic macro-invertebrates were identified from River Sindila (i.e. *Odonata, Plecoptera, Diptera,* Mollusca*, Coleoptera, Nemouridae* and *Conchostraca*). Most of the identified macro-invertebrate organisms are associated with the lotic conditions with behavioural and morphological structures that assist them withstand the existing conditions in the fast flowing waters.
Dragon flies and bivalves dominated the macro-invertebrates found in samples collected from River Sindila (Table 4.12).

Ephemeroptera and *Trichoptera* were not found in any of the samples collected from the river, an indicator of poor water quality since their occasional occurrence, or near absence, can indicate pollution problems or minimal disturbance of their habitat. This was also indicated by the high prevalence of chironomids, which are good indicators of deteriorating water quality.

Table 4.12 Macro invertebrates found in River Sindila

Sampling site	Order	Species	Numbers of invertebrates observed/m²
Sindila before power house (UTM Zone 35N, Arc 1960, 0833132, 0064664)	*Nemouridae*	*Leuctra hippopus*	7
	Odonata	*Dragon flies*	10
	Plecoptera	*Dinocras*	4
	Diptera	*Chironomidae*	10
Sindila after power house (UTM Zone 35N, Arc 1960, 0833137, 0064653)	*Conchostraca*	*Shrimps*	2
	Diptera	*Chironomids*	6
Sindila next to the weir	Mollusca	*Bivalves*	30
	Odonata	*Dragon fly*	2
	Diptera	*Chironomidae*	1

4.3. BASELINE SOCIO-ECONOMIC ENVIRONMENT

The project's area of influence (PAI) is defined to include the villages of Ntuma (where the weir and the headrace canal are to be located) and Kabwe (where the forebay, penstock, and powerhouse are to be located) and Kyebumba (where the support structures are located) in Bunyamwera Parish and also the villages of Mutiti, Kakuka, Buboni and Bihya in Kakuka Parish (located on the left bank of the River Sindila where people are dependent on the river as the sole source of water). All the villages are located in Sindila sub-county.

Assessment methodology

In order to adequately assess the socio-economic baseline, both qualitative and quantitative methods were used.

A socio-economic matrix was first developed which included listing of all the relevant stakeholders and key parameters for consideration in the proposed project area. Data collection was undertaken at the household level as well as communities/settlements and other relevant aggregations as identified in the matrix. Techniques that were used in data collection include:

- Secondary data collection at both local and national levels;
- Focus Group Discussions (FDGs): These were mainly used to collect qualitative data through an interactive group setting in which consultees gave their opinions, perceptions and attitudes towards the project;
- Key informant interviews: These interviews were conducted with key individuals, resource persons and opinion leaders in the project area. The interviews were conducted in person;
- Structured interviews and questionnaires: In these interviews, the same questions were asked in the same order using questionnaires so as to provide systematic analysis and comparisons. This was mainly applicable to consultees that were able to read and write.
- Photography: photographs of importance and concern on the current situation of the various sites, stakeholder meetings and the surrounding physical, biotic and social environment were taken using digital cameras to record empirical evidence;
- Mapping: data was captured using GPS and maps processed using GIS to identify the existing status of physical features, geology and soil, drainage vegetation and land use, and infrastructure.

4.3.1. Location and Administrative structures

Bundibugyo District is located at coordinates 00 43N, 30 04E. The District is bordered by the districts of Kibale to the Northeast, Kabarole to the East and Southeast and by the Democratic Republic of Congo (DRC) to the west. To the north, it shares a boundary with Ntoroko district.

As with other districts in the country, Bundibugyo is divided into administrative zones - two counties, Bwamba and Bughendera, and thirteen sub-counties, one town council and one town board. At the lower levels, there are 83 parishes with 559 villages.

The leadership structure of the district also consists of several levels; with the Local Council (L.C) V at district level, L.C.IV at county level, L.CIII at sub-county level, L.CII at parish level and L.CI at village level. The technical aspects are handled by different departments at the district and sub-counties headed by professionals in the respective fields (Bundibugyo District Local Government, 2011).

Sindila sub-county was created in 2009 by curving out a section from the Ndugutu sub-county. The sub-county is located approximately 25km from the District Capital Bundibugyo and is about 70km^2 in extent. The sub-county is made up of 35 villages and 5 parishes. The eastern part of the sub-county is very mountainous with steep terrain and River Sindila is the main water way that runs through the sub-county and, is the primary water source for the majority of the people living in the sub-county.

4.3.2. Demographic characteristics

Population

According to the 2002 housing and population census, Bundibugyo district had a total population of 158,909 people of whom 76,112 (47.9%) were males and 82,797 (52.1%) were females. The

2002 census report indicated that the household population was distributed within 56,426 households, of which 4.7% households were headed by females and 14.6% headed by children.

According to the approved Bundibugyo District Development Plan for the period 2010/11-2014/15, the total population of Sindila Sub-county is estimated at 19,733 of which 10,221 are females and 9,512 are males. The total number of households in the Sub-county is 2,819 with an average size of (7) seven members per household (HH) (Table 4.13).

Table 4.13 Population demographics of Sindila Sub County

Sub County	Parishes	Villages	Male	Female	Total	Number of households
Sindila	5	35	9,512	10,221	19,733	2819

Table 4.14 presents the demographic status of the different Parishes in Sindila Sub County.

Table 4.14: Demographic characteristics of parishes in Sindila Sub-county

Parish	Males	Females	Total	Number of HH	Average Size of HH
Kakuka	2794	2901	5695	814	7
Bunyangule	1823	1957	3780	540	7
Bunyamwera	2531	2751	5282	755	7
Nkulanga	608	749	1357	194	7
Nyankonda	825	875	1700	243	7
Total	**8581**	**9233**	**17814**	**2545**	**7**

The PAI falls within Bunyamwera Parish, which has a total population of 5,282 in 755 households calculated at an average size of seven (7) members per household. Bunyamwera Parish when compared with other rural Parishes in Sindila Sub-county, has a relatively higher population. The more mountainous Parishes such as Nkulanga and Nyankonda have a relatively low population compared to Bunyamwera Parish. The entire population in the PAI can be classified as rural.

According to the socioeconomic census survey of September 2014 as included in the updated project RAP (September 2014), the total number of Project Affected Persons (PAPs) is 411 of whom 91.2% (375) are in Bunyamwera and 9.8% (36) are in Nukurunga Parish. Out of the 411 PAPs, 215 were male, while 196 were female. 177 out of the 411 PAPs were children below the age of 18 years - most of these children were in Bunyamwera Parish (164) as compared to Nkuranga (13).

The total number of affected households is 107 and most of the households are in Bunyamwera parish (90%) as compared to Nkuranga Parish (10%). Most of the PAP households had a household size of 1-2 (36%) and 3-4 persons (30%). Relatively less PAP households had 5-6 persons (20%) and more than 6 persons (14%). The mean household size is 3.8.

Ethnicity

Bundibugyo District comprises of six tribes - Bamba, Babwisi, Bakonjo, Babutoku, Batwa and Batooro (Bundibugyo District Statistical Abstract, 2012/2013). These tribes are found in the two counties of Bwamba and Bughendera. The ethnic groups in Bundibugyo are stipulated as follows: majority being Bamba and Babwisi (mainly in Bwamba County) and Bakonzo (mainly in Bughendera county). The other groups are; Batwa, Babutoku and Batooro. These ethnic groups have clan leaders and elders who manage the affairs of their tribes at different forums.

Based on the socioeconomic census survey of September 2014, the affected persons in the PAI belong primarily to the variant of Bukonzo tribe (Table 4.15) and speak the Lukonzo language. Bakonzo fall within the broad Bantu category and very few PAPs were reported as belonging to the Bamba tribe.

The people in the PAI closely identify with their Bakonzo tribe, and most socio-cultural interactions are defined by the customs and traditions of the tribe.

Table 4.15 Tribal identities in the PAI

Tribe	Project Affected Area (Freq)			Project Affected Area (Percentage)		
	Bunyamwera	Nkurunga	Total	Bunyamwera	Nkurunga	Total
Bakonjo	91	8	99	100.0	72.7	97.1
Bamba	0	3	3	0.0	27.3	2.9
Total	91	11	102	100.0	100.0	100.0

Religion

Based on the socio-economic census survey, the most predominant religious denomination are the Anglicans accounting for 83.71% followed by Seventh Day Adventists at 14.4%, while the Islamic and Catholic faiths constitute 0.9% each.

4.3.3. Education and literacy

Education

According to the 2012/2013 Bundibugyo District statistical abstract, the district had 119 primary schools, fifteen (15) of which were privately owned and 104 were government aided. The district was also served by fourteen (14) secondary schools, six (6) of which were privately owned and eight (8) schools government owned. The district also had three (3) three tertiary institutions, one (1) of which was privately owned. 45,582 pupils were enrolled in primary schools in the district, in secondary schools and 361 were enrolled in tertiary institutions. At primary education level, girl enrolment constituted 47.5% of the total pupil enrolment.

During the 2012 socio-economic survey of the PAI, there were only seven (7) primary schools in Sindila Sub-county, and one government aided secondary school. There were no tertiary institutions in Sindila Sub-county. Of the seven primary schools in the sub-county, only two primary schools - Kaghughu Primary School and the Bundikahondo Primary School fall within the PAI.

The total number of students attending primary school in Sindila Sub-county was 3,000 pupils of which 1,425 (47.5%) were males and 1,575 (52.5%) were females. The total number of educational institutions and school enrolment in the project Sub-county is provided in Table 4.16.

Table 4.2: **Educational Institutions in Sindila Sub-county**

School	School enrolment		
	Male	Female	Total
Bunyangule Primary	312	373	685
Nyankonda Primary	211	240	451
Bundikahondo Primary	195	212	407
Mutiti Primary	220	223	443

School	School enrolment		
	Male	Female	Total
Busanza Primary	286	314	600
Kaghughu Primary	201	213	414
Total	**1425**	**1575**	**3000**

Most of the children in the PAP households attended government aided primary schools (74%) – Table 4.17. The level of service of primary school education facilities attended by children from PAP households was perceived as poor (57%) and average (7.4%). Few PAP households perceived the primary schools performance as good (23.4%) and very good (13 %%) – Table 4.17.

Table 4.3:Type of primary school attended by children from PAP households and attitude about performance

	Project Affected Area				Attitude about Service	
	BNW	NKR	Total	Percentage	Attitude	(%)
Ownership/Type of School Attended						
Public Government	70	9	79	74	Very Good	13
Private	19	1	20	19	Good	23.4
Community	2	1	3	2.0	Average	7.4
NGO/Religious	1	0	1	1.0	Bad	57.4
Others	4	0	4	4.0	DK	5
Total	96	11	107	100.0		100.0

BNW* Bunyamwera
NKR* Nkurunga
DK* Do not Know

Half of the PAPs households reported that their children travelled less than 1km daily to the nearest primary schools attended (50%), Others reported their children travelled between 1-5km (31.6%) while the rest reported children travelling more than 5kms daily to attend the nearest primary school – Table 4.18.

Table 4.4: Distance travelled by PAP household children to attend the nearest primary school

Distance to primary school attended	Project Affected Area			Percentage
	BNW	NKR	Total	
<=1km	53	0	53	50
over 1 km – 2.5km	17	10	27	25
over 2.5 km – 5km	5	1	6	5.6
over 5 km – 20km	17	0	17	16
DK	4	0	4	3.8
Total	96	11	107	100.0

BNW* Bunyamwera
NKR* Nkurunga
DK* Do not Know

With regards to secondary school education, the September 2014 socioeconomic census survey revealed that majority of the children in the PAP households attended government aided secondary schools (82%) – Table 4.19. The level of performance of secondary school education facilities attended by children from PAP households was perceived as poor (16%) and average (42%). Few PAP households perceived the secondary schools performance as good (23.3%) and very good (7.4%) – Table 4.19.

Table 4.5:Type of Secondary School attended by Children from PAPs Households and Performance

	Project Affected Area				Attitude about Service	
	BNW	NKR	Total	Percentage	Attitude	(%)
Ownership/Type of School Attended					**DK**	**11.2**
Public Government	79	9	88	82.2	Very Good	7.4
Private	7	0	7	6.5	Good	23.3
Community	1	0	1	2.0	Average	42
Others	9	2	11	10.2	Bad	16
Total	79	9	88	100.0	Total	100.0

BNW* Bunyamwera
NKR* Nkurunga
DK* Do not Know

There are no nearby secondary schools in the project affected area and students always travel long distances to the secondary schools – see Table 4.20 below.

Table 4.20: Distance travelled by PAP household children to nearest Secondary School attended

	Project Affected Area			Percentage
Distance to Primary School Attended	**BNW**	**NKR**	**Total**	
<=1km	1	0	1	1.0
over 1 km – 2.5km	14	0	14	13.1
over 2.5 km – 5km	43	8	51	47.6
over 5 km – 20km	25	1	26	24.3
Over 20Km	3	1	4	3.7
DK	10	1	11	10.3
Total	96	11	107	100.0

BNW* Bunyamwera
NKR* Nkurunga
DK* Do not Know

Literacy

Based on the socioeconomic census survey conducted in the PAI in September 2014, most of the household heads could read and write in any language; easily (56%) and with difficulty (16.8%). Nearly a third of the household heads could not read and write at all (28%) – Table 4.21. In addition, over half of the PAP household heads attained primary level education (57%) while 17% had never attended formal education at all - indicating relatively low levels of education. Only 18.7% had attained some level of tertiary education (Table 4.21).

Table 4.21: Literacy and Educational attainment of PAP Household Heads

Literacy Level	Project Affected Area (Freq)			Project Affected Area (Percentage)			All PAPs (freq)
	BNW	NKR	Total	BNW	NKR	Total	
Can Read and Write easily	55	5	60	57.3	45.5	56.1	215
Can Read and Write with difficulty	18	0	18	18.8	0.0	16.8	85
Can't Read/DK	23	6	29	23.9	54.5	28.1	111
Total	96	11	107	100.0	100.0	100.0	411
Highest Education Attained	BNW	NKR	Total	BNW	NKR	Total	
Never attended school	14	4	18	14.6	36.4	16.8	
Kindergarten	15	1	16	15.6	9.1	15.0	
Lower primary (p1-4)	31	0	31	32.3	0.0	29.0	
Upper primary (p5-7)	13	1	14	13.5	9.1	13.1	
O Level	15	2	17	15.6	18.2	15.9	
A Level	1	0	1	1.0	0.0	0.9	
University Degree	1	1	2	1.0	9.1	1.9	
DK	6	2	8	6.3	18.2	7.5	
Total	96	11	107	100.0	100.0	100.0	

BNW* Bunyamwera
NKR* Nkurunga
DK* Do not Know

Nearly half of the PAP household heads did not possess any other functional skill other than farming (49%). However, of those that possessed other functional skills, 12% possessed carpentry skills, 11% had brick making skill, 13% had art and craft skills, 5.6% were also hunters and 4.7% were causal masons around the community (Table 4.22).

Table 4.6: Other functional skills possessed by PAP Household Heads

Skills	Project Affected Area (Freq)			Project Affected Area (%)			All PAPs (Freq)
	BNW	NKR	Total	BNW	NKR	Total	
Carpentry	12	1	13	12.5	9.1	12.1	21
Construction	3	2	5	3.1	18.2	4.7	12
Brick making	10	2	12	10.4	18.2	11.2	21
Lumberjack	1	0	1	1.0	0.0	0.9	1
Mechanic	1	0	1	1.0	0.0	0.9	1
Welding & Ironworks	1	0	1	1.0	0.0	0.9	5
Fishnet Weaver	1	0	1	1.0	0.0	0.9	1
Arts & Crafts	14	0	14	14.6	0.0	13.1	35
Canoe & boat makers	1	0	1	1.0	0.0	0.9	6
Hunter	3	3	6	3.1	27.3	5.6	7
None	49	3	52	51.0	27.3	48.6	301

	Project Affected Area (Freq)			Project Affected Area (%)			All PAPs (Freq)
Skills	BNW	NKR	Total	BNW	NKR	Total	
Total	96	11	107	100.0	100.0	100.0	411

BNW* Bunyamwera
NKR* Nkurunga

4.3.4. Health status

Health services

According to the 2012/2013 Bundibugyo District statistical abstract, the district had 1 hospital, 31 health centres, 8 clinics and 42 drug shops. The hospital and health centres were government-aided while clinics and drug shops were privately owned.

Sindila Sub-county itself is served by one Government Health Centre III located in Kakuka parish and according to the Sindila Sub-county five year development plan for the period 2010/11-2014/15, people from the neighbouring DRC also use this health centre for treatment. The health centre has a clinical officer, a registered nurse, a midwife, an enrolled nurse, two nursing assistants, two support staff and two security personnel.

In addition to this health centre, there are three privately owned drug shops/clinics in the Sub-county, which are run by semi/unqualified staff. There is no clinic or drug shop in the PAI.

During the September 2014 socio-economic census survey, it was ascertained that most of the PAP households attended government health facilities (65%) with fewer attending private and community health facilities. The level of performance of health facilities used by PAP households was perceived as very good (37%), good (20%) and average (18.7%). Few PAP households perceived the Health facility performance as poor (15%) and very good (7.4%).

Diseases

According to the 2005 BIDP survey, malaria was the major cause of illness in Bundibugyo District. The official prevalence of malaria in the district was reported at 47.5% in 2005. Respiratory infection (21.5%) was the second cause of illness followed by diarrhoea at 6.9%.

Common diseases in the Sindila Sub-County are: Malaria, Cholera, Typhoid, Cough and HIV/AIDS. The causes of prevalence of malaria and HIV/AIDS in the Sub-county as described in the Sindila Sub-county development plan are tabulated in Table 4.23.

Table 4.7: **Causes of diseases in Sindila Sub-county**

Disease	Causes
Malaria	Availability of breeding places for mosquitoes
	Non-utilization of mosquito nets
	Non-availability of mosquito spraying facilities
HIV/AIDS	Promiscuity
	Peer pressure
	Low income levels
	Unsafe blood transfusion
	Unsafe sexual behaviour
	Insecurity
	Conservativeness about sexual practices such as polygamy

The Sub-county development plan further identifies the following as the main challenges in tackling HIV/AIDS in Sindila Sub-county:

- Inadequate funding for HIV/AIDS programmes;
- Limited use of condoms due to cultural beliefs
- Lack of after testing support services;
- Poverty among the community;
- Drunkenness especially during alcohol promotion days and local market days that increase promiscuity;
- Less inclination towards testing HIV/AIDS (stigma);
- Rural urban migration;
- High illiteracy rates;
- Divorce and inheritance of widows; and
- Early marriage, defilement and rape.

The socioeconomic census survey of September 2014 revealed that the pre-dominant health condition suffered among the PAP household members was malaria (62%) with near trends between the project affected areas, Bunyamwera (61%) and Nukuranga (64%).

The levels of reported HIV/AIDS known cases within the households were generally low (1%). However, ulcers (5.6%), polio (3.7%) and TB (3.7%) were relatively higher as compared to the other health conditions (other than malaria) reported in the households (Table 4.24).

Table 4.8: PAP Household Wellbeing and Health Status

Health condition suffered (past month)	Project Affected Area (Freq)			Project Affected Area (Percentage)			All PAPs
	BNW	NKR	Total	BNW	NKR	Total	
Surgery/ operation	5	0	5	5.2	0.0	4.7	5
HIV/AIDS	1	0	1	1.0	0.0	0.9	2
Asthma	2	0	2	2.1	0.0	1.9	12
Ulcer	6	0	6	6.3	0.0	5.6	2
Backache	2	0	2	2.1	0.0	1.9	1
Malaria	59	7	66	61.5	63.6	61.7	250
Polio	1	3	4	1.0	27.3	3.7	13
People with disabilities	1	0	1	1.0	0.0	0.9	1
TB	3	1	4	3.1	9.1	3.7	2
Trachoma	1	0	1	1.0	0.0	0.9	12
Typhoid	1	0	1	1.0	0.0	0.9	3
Worms	1	0	1	1.0	0.0	0.9	9
Wounds	1	0	1	1.0	0.0	0.9	13
Others	12	0	12	12.5	0.0	11.2	4
Total	96	11	107	100.0	100.0	100.0	411

BNW* Bunyamwera
NKR* Nkurunga

4.3.5. Water and Sanitation

Water

According to the BIDP Baseline survey conducted in 2005, the main source of portable water in Bundibugyo District was rivers. The other prominent water sources in the district included piped water supplies, unprotected sources, and protected springs.

The main source of drinking water and that for other domestic purposes in the project area is the Sindila River. People have to walk a distance of between 250m to 4km to reach the river. The two schools in the PAI - Kaghughu Primary School and the Bundikohondo Primary School also do not have a water source and thus the students have to fetch water from the river. In general people have to devote a considerable amount of their time to fetching water (see Plate 4.2) and it may take anywhere between 30 minutes to 2 hours.

Plate 4.2: Community members fetching water from River Sindila

Most of the PAP households used unprotected water sources like rivers and streams (98%). Few PAPs down the valleys had alternative protected water sources. PAP households in Bunyamwera did not have access to a protected water source at all. The rivers (Sindila and Ndugutu) appear to be the main water sources used. The relatively high level of diarrhoea and typhoid observed during the socio-economic census is probably also associated with unsafe water sources. Some PAP households walk for over 5kms to the nearest water source (21%) – Table 4.25.

Table 4.9: Access to water sources

Distance to water source	Bunyamwer	Nkurunga	Total	Percentage
<=1km	47	4	51	47.6
over 1 km – 2.5km	22	6	28	26
over 2.5 km – 5km	4	0	4	3.7
over 5 km – 20km	21	1	22	20.6
over 20 km	2	0	2	1.9
Total	96	11	107	100.0

Sanitation
Almost 96% the households in the project impact area have either permanent or temporary latrines. Only 4% of the households do not have this facility. Even though 96% of the households in the project area had latrines, a walk through the village revealed several incidences of open defecation in bushes and along community footpaths.

4.3.6. Housing in the PAI

The quality of housing stock in the PAI is of a generally poor status as is the situation in Sindila Sub-county and in most of Bundibugyo.

Based on the results of the previous (2012) household survey, majority of the houses in the PAI (95%) are built of clay (95%) - the traditional way of constructing walls. A small number of houses (5%) have walls constructed of cement and bricks.

The roofing materials used in the construction of the houses in the PAI are corrugated iron sheet roofs (71.5%) and 28.5% are grass thatched.

Over 90.9 % of the houses in the PAI have less than four rooms.

4.3.7. Transport

The district can be accessed by road and air transport. The total road network in Bundibugyo district covers 123.8km of District feeder roads and 144.5km of community access roads. The PAI is linked via Fort portal-Congo main road and through a District Feeder Road traversing through Busaru sub-county to Ndugutu and Sindila sub-counties. Within Sindila sub-county there are several community access roads as given in Table 4.26 below. These community roads are generally in a pretty dilapidated condition (Plate 4.3) and some may become impassable especially during the heavy rain season. Within the PAI there is only one community access road of 1.5km linking Kaghughu Primary School to the Bunyangule - Butama community access road. Most of the travel within the PAI is along footpaths over the hilly terrain.

The PAI is linked via the Bundibugyo – Lamia road through a district feeder road traversing through Bubandi to Ndugutu and Sindila Sub-counties. Within Sindila Sub-County, several community access roads exist (Table 4.26).

Table 4.26: Community access roads within Ndugutu and Sindila Sub Counties

Road Name	Location/Sub-county	Length (km)
Bunyangule – Butama	Ndugutu - Sindila	7.0
Nyankonda – Busunga	Sindila - Bubandi	6.0
Kaghughu – Bunyangule	Sindila	5.0
Bunyangule – Kyebumba-Mutiti	Sindila	4.0

The major aim for establishing community roads in villages is to link the communities living on the mountain slopes with those in the low lands, and to extend social services such as education, health, and administration to communities within the mountainous terrain.

Within the PAI, there is only one motorable track 1.5km in length linking Kaghughu primary school to Butama trading centre (off the Bunyangule – Butama access road as presented in Table 4.26 above). Majority of the people within the PAI however walk along footpaths over the hilly terrain (Plate 4.3).

Plate 4.3: Footpaths and community access road in Sindila Sub-county

Table 4.26 Community Roads within Ndugutu and Sindila sub-counties

Road Name	Location/Sub-county	Length (km)
Bunyangule – Butama	Ndugutu - Sindila	7.0
Nyankonda - Busunga	Sindila - Bubandi	6.0
Kaghughu - Bunyangule	Sindila	5.0
Bunyangule – Kyebumba-Mutiti	Sindila	4.0

In addition to the road network, there is also an airstrip in Bundibugyo (http://en.wikipedia.org/wiki/Bundibugyo_Airport) located about 20km from the PAI and 5km from Bundibugyo town.

Although Bundibugyo district is well endowed with a network of open water bodies compared to other Districts in the region; it has rivers, streams, swamps and a lake in the north, none of the rivers is dedicated for transport except, on Lake Albert located in the northern part of the district. There is no water transport in the Sindila sub-county as it is primarily a mountainous region without any major lakes.

4.3.8. Gender equality

The gender situation in Sindila Sub-county mirrors that of the District. The Sindila Sub-county five year development plan for the period 2010/11-2014/15 provides a vivid description of the status of women in the sub county as follows:

The picture at the Sindila Sub-county regarding gender is very similar to that of the District. The Sindila sub-county Five Year Development Plan (2010/11-2014/15) provides a vivid description of the status of women. In this plan it is stated that, "*The economic status of women in the sub-county is still poor since women manage but do not own resources at home. Most of the work at home is done by women and yet they are never involved in planning and budgeting at home. Women are involved in food production at home than men but do not own land on which food is produced. Women do not inherit property from their parents.*"

The same report identifies the following causes for the prevalence of gender imbalance in the sub county.

- Inadequate mobilization and sensitization on gender
- Early marriages and pregnancies
- Negative attitudes towards women with disabilities
- Geographical status of the sub-county making it difficult to go to hard to reach areas.

Out of the 411 PAPs, 215 were male, while 196 were female.

4.3.9. Sources of energy

Although grid electricity has been extended to Bundibugyo district, only 5 of 13 Sub-counties had access to the national grid in 2008. This is according to the 2008 statistical abstract for the district. At the time of formulating the abstract, 0.2% of the households had access to electricity leaving the majority depending on firewood and charcoal for cooking.

There is no electricity in the PAI or in the Butama Trading Centre. Communities in the PAI depend on firewood for their energy needs. A few families use kerosene for night lighting and others have no form of night lighting at all.

4.3.10. Settlement

In 2002, only 7% of the total district population was reported to be living in the urban areas of Bundibugyo district, making it primarily a rural district. This was lower than the national average of 12% of the population living in urban areas of Uganda at the time. In 2011, the percentage of urban population in Bundibugyo increased slightly. Bundibugyo thus ranked among nine districts whose population living in urban areas was about 10% of the total population.

The settlements in the Sindila Sub-county and the PAI are 100% rural. The settlement pattern indicates two distinct varieties i.e. clustered and scattered settlement patterns.

Bunyamwera Trading Centre (see Plate 4.4) is the only example of a clustered settlement in the PAI. All other houses in the Sub-county fall into the scattered settlement category.

Plate 4.4: Bunyamwera Trading Centre

Butama Trading Centre, located on the right bank of River Ndugutu operates a fairly large weekly market on Sundays, and is the closest main commercial centre near the PAI. Butama Trading Centre is located in Ndugutu Sub-county in close proximity to Sindila Sub-county.

4.3.11. Land use

Bundibugyo District has a total area coverage estimated at 821km^2. Of this area, open waters, swamps and rivers cover 210km^2 while 450km^2 is covered by mountains, forests, national parks (Semliki and Mt. Rwenzori) and forest reserves, and 161km^2 is used for settlement and cultivation.

About 59% of the district land area is gazetted as forest reserve as well as a protected area. The terrain is largely hilly especially in Bwamba and Bughendera Counties where cultivation activities take place and soil erosion is immense. The PAI is located entirely within Bughendera County.

The land use in the PAI falls into the following few categories:

1. Agricultural land: This is the dominant type of land use in the area and the crops grown include, maize, cassava, banana, beans, onions, and other vegetables and fruits. Cash crops such as cocoa, coffee and vanilla are also grown within the PAI.
2. Built structures: These include the houses and the immediate compound area where the kitchen and latrine are located. Other structures include; the schools, churches and other common buildings.
3. Infrastructure: Only footpaths were found in the PAI which is entirely located in a hilly terrain with steep slopes. An existing motorable track from the Butama-Sindila road to the Kaghugha Primary School, a distance of about 1km is in very dilapidated condition negotiable only by a four wheel drive (4WD) vehicle.

4.3.12. Land tenure

The existing land tenure systems in Uganda and within the PAI are:

1. Customary
2. Lease hold
3. Freehold

These systems of tenure have evolved under different socio-economic settings.

Customary tenure

This is the most widespread and the oldest tenure in the area. Under this tenure, the rights of land are regulated by the local customs. The people of the present generation inherit land from the previous generation. The father of the family divides his land, and gives it out to all children with the male in the family getting the biggest share with the main house. The system has led to increasing fragmentation of land and in turn to inefficiency in the agricultural production.

Leasehold tenure

This is tenure granted for a specified period for payment of rent conferred by the state or private individual. The land commission or urban authority grants this tenure system. In the PAI, the leasehold tenure is not very common as the majority of people own land under customary tenure.

Free hold tenure

This is full private ownership and is free of any obligations to the state other than payment of taxes, and observance of land use controls imposed in the public interest.

Within Sindila Sub-county, the distribution of land between households is relatively even. Only few families are landless. Although women are by far the main contributors (>70%) to the

cultivation of fields, they are generally denied land ownership. It is common for widows and their children to be left without the capacity to make a living because the family of the deceased takes ownership of land.

Results from the September 2014 socio-economic survey indicated that over 70.59% of the households bought their land from the other villagers and in some cases from their parents and other relations. According to the Uganda National land tenure system, land bought from customary owners without official land titles is still considered under the customary tenure system. Therefore, all the land within the PAI is considered customarily owned.

4.3.13. Economic activities and employment

Agriculture is the main income earner for households in Bundibugyo District. The district is divided into 3 food economy zones[4]. These include the highland zone, the lowland agricultural zone, and the mixed cattle – cultivation zone.

Bananas, beans, cocoa, coffee, palm oil and vanilla are specially grown in all the food economy zones. Cassava is predominately grown in the highland and lowland zones whereas, sweet potatoes and groundnuts are common in the lowland zone.

Many households rely on crop and livestock sales as their main source of income. Maize, cassava and beans are actively traded in the cattle keeping and fishing zone, and cocoa as well as oil palm in the highland and lowland zones.

The zoning phenomena emerged with an aim of creating and maintaining economic viability of the agriculture industry in the district. It was also created to preserve and increase agricultural production based on the available agro-ecological environment and infrastructure, and creation of domestic markets in the district. The zones are anticipated to improve external market access, effectively give access to technologies, advisory and other support services to farmers and use of natural resources sustainably.

At the level of the Sindila sub-county, over 90% of the HHs are engaged in agriculture. Of this, 95% are engaged in subsistence agriculture and only 5% are engaged in commercial agriculture, growing cash crops (see Plate 4.5).

Sindila sub-county Development Plan (2010/11-2014/15) identifies the following to be the major challenges in agriculture.

- Land fragmentation
- Poor techniques of production
- Cultural attachments
- Conservatism
- Inadequate resources to afford farm implements
- Unfavourable terrain
- Higher percentage of involvement of women in agriculture
- Land degradation due to cutting of trees
- Pests and diseases especially banana bacterial wilt disease

As subsistence farmers, people in the PAI do not generate sufficient income significantly beyond the level of daily survival. The income from cash crops is used to buy household consumables. The males in the family use a large sum of income obtained from agriculture for alcohol consumption. Although the actual share of the income cannot be verified, in some households the amount used for alcohol consumption is almost 50% of the total income from agriculture. Thus, the level of savings amongst the farming community is extremely low and this

[4] A food economy is a geographical area where the majorities of households obtain food and income through similar or a combination of means.

has prevented investment in agricultural modernisation. Poverty is a ubiquitous phenomenon in the entire PAI.

Plate 4.5: Agricultural Land in the Project area

4.3.14. Livelihood activities and income

Based on the socio economic census survey of September 2014, most of the PAP household heads were engaged in subsistence farming as the primary employment (68%) – Table 4.27. Few were own account workers/business owners (10%) and relatively fewer were regular paid public workers (5%).

The socio economic census survey as indicated that land remains the critical livelihood asset in this project affected area; as other alternative livelihood options are very few.

Table 4.10 Primary Activity engaged in by PAP household heads

Activity Engaged in						
Primary Activity	**BNW**	**NKR**	**Total**	**BNW**	**NKR**	**Total**
Going to school	0	1	1	0.0	9.1	0.9
Subsistence farming	66	7	73	68.8	63.6	68.2
Regular paid public post	4	1	5	4.2	9.1	4.7
Own account worker	11	0	11	11.5	0.0	10.3
Don't know	2	0	2	2.1	0.0	1.9
None	13	2	15	13.5	18.2	14.0
Total	96	11	107	100.0	100.0	100.0

BNW* Bunyamwera
NKR* Nkurunga

The major source of income for the most of PAPs was subsistence farming (crop framing) (98%) and livestock farming (66%) with near proportions between the project affected areas – Table 4.28. Very few PAPs households had regular employment (33.6%) and transfers (13.1%) as sources of income indicating that the household economy was largely agrarian.

Table 4.28 PAPs Household Sources of Income

	Project Affected Area (Freq)			**Project Affected Area (Percentage)**		
	BNW	**NKR**	**Total**	**BNW**	**NKR**	**Total**
Sources of income						
Enterprise	33	3	36	34.4	27.3	33.6
Employment	6	0	6	6.3	0.0	5.6
Crop farming	94	11	105	97.9	100.0	98.1
Livestock farming	63	8	71	65.6	72.7	66.4
Transfers	13	1	14	13.5	9.1	13.1
Others	27	0	27	28.1	0.0	25.2

BNW* Bunyamwera
NKR* Nkurunga

The socioeconomic census survey 2014 revealed the most of the PAP households earned less that 1,000,000 shillings per month (92.5%). All households with more than 1,000,000 shillings monthly income were from Bunyamwera Parish. The relative levels of income by parish are indicated in Table 4.29. The relatively low level of income is reflective of a largely subsistence household economy in the project affected area.

Table 4.29 PAP Households Levels of Income

Monthly Income	Project Affected Area (Freq)			Project Affected Area (Percentage)		
	BNW	NKR	Total	BNW	NKR	Total
15000-100000	14	0	14	14.6	0.0	13.1
100001-200000	14	1	15	14.6	9.1	14.0
200001-300000	15	3	18	15.6	27.3	16.8
300001-400000	9	0	9	9.4	0.0	8.4
400001-500000	10	0	10	10.4	0.0	9.3
500001-600000	9	1	10	9.4	9.1	9.3
600001-700000	6	1	7	6.3	9.1	6.5
700001-800000	5	1	6	5.2	9.1	5.6
800001-900000	5	3	8	5.2	27.3	7.5
900001-1000000	1	1	2	1.0	9.1	1.9
>1m	8	0	8	8.3	0.0	7.5
Total	96	11	107	100.0	100.0	100.0

BNW* Bunyamwera
NKR* Nkurunga

4.3.15. Poverty

The Uganda participatory poverty assessment survey has indicated many ways in which people perceive poverty. According to Ministry of Finance, Planning and Economic Development (MFPED)2000, poverty has many dimensions including low incomes and consumption, physical insecurity, poor health, low levels of education, disempowerment, a heavy burden of work or unemployment, and isolation (physical and social) and finally environmental degradation. All these can be identified through the high poverty level in the Bundibugyo District, Sindila sub-county and also the PAI.

The Five Year Development Plan (2010/11-2014/15) for Sindila sub-county states that most people in the sub county still live below the poverty line and it further states that it is mainly due to dependence on subsistence farming which makes the people's income very unpredictable. The insecurity that occurred in the region since 1977 due to insurgency has further aggravated the problem of poverty.

The poor community members have been engaging in subsistence farming, which has led to soil degradation mainly in the hilly areas. Coupled with the level of investment in soil conservation, little has been done to address the problem. As a result, the levels of agricultural production are dropping and further increasing poverty within the community.

4.3.16. Archaeological and Cultural property

Archaeology

The proposed project falls within the Albertine graben, which has a number of archaeological and historic sites of national heritage importance, besides the unique physical resources of the rift valley, Rwenzori Mountains, national parks and lakes, all of which are important tourist attractions (NEMA, 2009).

The closest sites to the project area include: "*Amabere ga Nyinamwiru*" natural site (approximately 103km from the project area) and Sempaya Hot Spring (approximately 83km from the project area). All these sites are located along the Fort Portal – Bundibugyo road.

Cultural property

Although no archaeological sites were identified in the project area, notable about the project area is the history, culture and beliefs of the Bakonzo, which is closely woven around the Rwenzori Mountain. It is believed that prior to 1941, the Rwenzori Mountain did not have clearly marked boundaries and during that time, the mountains were managed and controlled by local communities (Masereka, 1996). The Rwenzori Mountain people, for centuries, depended on the mountain resources, regarding the mountain as a gift of nature (Stacey, 1996). Resource use in the mountain was influenced by beliefs. These beliefs included totems, taboos and beliefs associated with gods and spirits of the mountain.

The Rwenzori Mountain had always been important to the livelihoods and culture of the local communities, until the area's elevation to park status in 1991, which disenfranchised local people by making access illegal (McCall, 1996). The mountain especially within the RMNP is also an important source of resources to the communities around it such as the Bakonzo, who live on the slopes of the mountain. The resources include; smilax and acalypha (for basket making), medicinal plants, mushrooms, water, honey, fibres from tree bark, bamboo stems and sheath. Since declaration of the mountain as a national park, sacred places in the park have been abandoned. However, communities have a Memoranda of Understanding with the park authorities (Uganda Wildlife Authority) to access some of these sites in the park in exchange for conservation of park resources.

Other major cultural sites in Bundibugyo District fall within community areas and include:

- Kikyo, in Buhundo parish, owned by a chieftain,
- Buthatsimbwa, a soft ground used for rain making and health;
- Kyomukama, found in Bupomboli Parish used by the ridge leaders;
- Kakuka, a huge tree visited in order to control famine, to perform rituals for peace, to control diseases and epidemics, and cleansing of the land; and
- Ikondere site found in Bupomboli Parish, Kitsimba village and on the Bupomboli ridge.

Of the major cultural sites in Bundibugyo District listed above, the PAI is closest to Kakuka cultural site, which is located in Kakuka parish (1.5km to the park boundary) – Sindila Sub-county.

In addition to Kakuka cultural site, communities use the proposed weir location as a cultural site for spiritual and healing rituals. The mini falls are believed to possess power for healing diseases and cleansing of spirits.

5. ANALYSIS OF PROJECT ALTERNATIVES

In accordance with current ESIA good practice and as one of the NEMA requirements for the EIA process in Uganda, it is appropriate for the ESIA to investigate alternatives to a proposed project.

This section outlines various alternatives that have been considered to project design or implementation, focusing on the environmental and social implications. This section aims at establishing whether there are reasonable alternatives, which could be pursued to meet the project's objectives with less impact on the environment and thee society, and if there are, to explain what other factors determined the choice of proposal.

Two types of alternatives exist: Fundamental Alternatives and Incremental Alternatives.

Fundamental Alternatives are projects that are completely different from the proposed project and usually involve a different type of methodology on the proposed site, or a different location for the proposed project.

Incremental Alternatives are modifications or variations to the design of a project that provide different options to reduce or minimize environmental impacts.

Alternatives are "different means of meeting the general purpose and requirements of the project" which includes alternatives to:

- The property on which or location where it is proposed to undertake the project;
- The type of project to be undertaken;
- The design or layout of the project;
- The technology to be used in the project; and
- The operational aspects of the project.

5.1. Fundamental alternatives

5.1.1. A different type of project

Besides hydroelectricity, there are several other energy resource options which include biomass, geothermal, wind energy, solar energy, biogas and, oil and gas. These energy resources are assessed below.

Biomass

Biomass comprises firewood, charcoal and agricultural residues; and it plays a very significant role in Uganda's energy scenario constituting 93 percent of total energy consumed in the country. Total biomass demand for households in the year 2006 was estimated at 22 million metric tonnes. The cottage industries account for about 20 percent of total biomass use (about 5.5 million metric tonnes), which brings the total biomass demand to about 27.7 million metric tonnes.

Of the total biomass demand options in Uganda, firewood is the main source of energy for small and medium scale industries and commercial activities including bakeries, tea drying, tobacco curing, lime, brick making, fish smoking, and so on (MEMD, 2006a). For instance, for every kilo gram of processed tea, 1kg of wood is required equivalent to about 20 million metric tonnes of wood consumed annually by the tea processing industry alone (MEMD, 2005a). This is the most environmentally sensitive activity that is functioning and threatening Uganda today.

Geothermal energy

Geothermal energy is heat from within the earth. It is produced through trapping steam released by hot rocks with water reservoirs about 4,000 miles below the earth surface, which is used to

power turbines. Uganda has an estimated geothermal potential of 450MW concentrated in Katwe, Kikorongo, Buranga and Kibiro all in the Western Rift valley (BCSE, 2003).

Geothermal is considered a clean energy source; however, the lack of a geothermal policy in Uganda has hindered the development of the renewable energy in the country (Ralph, 2013). In addition, although several studies have been conducted on the resource base of geothermal energy, this information has not been appropriately stored for retrieval or processed.

Wind Energy

Wind speed is moderate in most areas of Uganda. The average wind speed in low heights (less than 10m) may generally range from 2m/sec to 4m/sec. In some areas with complex terrain, the wind may speed up due to slopes of hills, escarpments and tunnelling effect. Based on wind data collected by Meteorology Department for a period of three years, it was concluded that the wind energy resource in Uganda is sufficient for small-scale electricity generation (MEMD 2006a). Recent studies also confirm that electricity generation through wind is still feasible, especially for small industries or in rural areas where target for windmill is in the range of 2.5 KV to 10 KV.

Solar Energy

Uganda is endowed with plenty of sunshine giving an average solar radiation of about 4.5kWh/m^2/day. This level of insolation is quite favourable for all solar technology applications (MEMD 2002). Existing solar data clearly show that the solar energy resource in Uganda is high throughout the year. Development of such studies is important for the Ugandan's future. However, the capital investment is significantly high for the development of solar energy in Uganda.

Biogas

Biogas is generated from decaying organic matter. In recent years, municipal and on farm biodegradable waste have been considered the most reliable sources of waste for generation of biogas.

Municipal waste in Uganda is generally composed of wet nitrogen and such materials that include organic waste from households, a few industrial wastes i.e. (slaughterhouses, food industry), agro waste manure and straw. These materials can be converted into biogas for cooking and lighting at a domestic level. In 2011, the Kampala City Council Authority (KCCA) commissioned the 'Design of Landfill Gas Recovery and Utilization Project'. The study estimated electricity generation potential of about 3MW and an average CO_2 emission reduction potential of 40,000tonnes per year for 9 years (MEMD, 2012).

For on farm/household generation of biogas, smaller technologies that do not require many costs in construction have been introduced to boost its adoption to poor communities.
Biogas has so far been spread to five districts across Uganda. These include Mpigi, Kabarole, Iganga, Tororo and Mbale. Some communities practicing zero grazing have successfully adopted the technology and maintenance skills.

However, there is limited technical and institutional capacity in both the public and private sector to implement and manage biogas investments especially for rural areas, and much less at municipal level. For instance, in the rural areas, there are few public and private sector personnel involved in this energy business. Lack of skills by public and private actors to address the roles, needs and decision making differences for women and men, hinders increased participation and benefits, which would have resulted from appropriate biogas energy interventions.

Oil and gas

Uganda is highly vulnerable to oil price shocks as it imports almost all of its 7,000 bbl/d (1,100 m^3/d) of oil (2004 figure) from the Kenyan refinery in Mombasa. The imported oil is mainly used to power automobiles; however, urban centres and industries that require a constant supply of power substitute hydropower with petrol generators during power cuts and/or during load shedding but this is rather costly.

With the discovery of oil in Uganda, there was a proposed early petroleum production and building of an oil refinery to refine the oil in the country by 2013. Nonetheless, this has not come on line yet, as the industry is still in the exploration phase. Therefore, oil and gas as an energy resource for the country is currently not economically feasible.

The proposals to generate electricity from alternative sources to feed the national grid are not economically justifiable as long as exploitable potential hydropower sources are available. This gives hydropower a potential edge over the other alternative technologies based on economics and efficiency. The alternatives technologies and energy options were reviewed in order of satisfying the requirements of Equator Principle 2b.

5.1.2 Process Alternative Energy Option

The Project can be replaced by a coal-fired or thermal power plant of 5.25 MW. Economic analysis of the thermal power alternative indicates that construction of the Sindila MHP is a less expensive power generation option. Further the project provides a sustainable energy option using renewable natural resources which is in line with Equator Principle 2g. Currently, alternative renewable energy supplies such as wind, solar, and biogas cannot compete commercially with coal-fired or hydropower generation. Increasing the coal-fired generation capacity will have significant negative environmental impacts due to the total increase in emissions.

The proposed building of an oil refinery to refine the recently discovered oil reserve in the country has not come up until now. The alternatives technologies and energy options were concerned in view of satisfying the requirements of Equator Principle 2b.

5.1.3. A different location

Butama hydro electricity company Ltd, the developer for Sindila MHP project has an overall objective of adding 25.9GWh of estimated annual energy to the national grid. This objective can be achieved with River Sindila. The results of hydrological and geological studies confirmed that River Sindila was adequate for a design flow of 1.7m^3/s and hence the estimated annual energy of 25.9GWh. Without any other project utilising the waters of River Sindila for Hydropower generation, the alternative of undertaking the proposed Sindila MHP at a different location other than River Sindila is not a feasible alternative.

According to the bed profile of River Sindila, a gradient of 5,200ft can be obtained at the current weir location yet beyond the selected weir point, two weirs would be required which is not cost effective.

The location of the forebay tank and spill way structure was selected considering the stability of the site and the suitability of the nearby natural dry valley to be used as the spill way. However, this location is on a fairly steep slope and thus stability of the location was verified through geotechnical investigations and analysis.
The proposed power house location was selected to optimize the head observed during the contour survey. Further downstream from powerhouse where water would be released back into the river is a bathing point hence limited disturbance to the social activity. The trace of the penstock line was selected to minimize the cut and fill sections and minimize the disturbance to the slopes and existing houses and buildings.

From the social context, the current project layout was based on the fact that the area has a low population density which reduces on the direct or negative impacts of the physical resettlement to the affected communities,

5.2. Incremental alternatives

Incremental alternatives are modifications or variations to the design of a project that provide different options to reduce or minimise environmental impacts. Several project alternatives were considered so that there is maximum economic benefit to the nation and optimal resource utilization while keeping environmental impacts within acceptable range. Financial viability of the

projects was also considered in the analysis. Based on the engineering surveys and hydrology study, the following two project alternatives were identified:

- The design and layout of the activity (see Section 5.3.1)
- The Alternative configurations and technologies (see Section 5.3.2); and
- The no-action alternative is discussed in Section 5.4.

5.2.1. The Design and layout alternatives

Alternative 1 – Single Power Plant

A single power plant with estimated capacity of 7.3MW (Table 5.1) can be developed using water resources of both River Ndugutu and River Sindila. However, optimum heads of two locations cannot be utilized as channel paths should be in a common contour line for this option. This option leads to under utilization of natural resources.

Table 5.1 Estimated capacity of a Single Power Plant

River	Net Head (m)	Design Flow (m^3/s)	Estimated Capacity (MW)
Ndugutu and Sindila	307	2.8	7.3

Under this option, water from both rivers will be diverted and will be released into one river (River Ndugutu) at a point several kilometers above the point at which both rivers converge. This will result into a trans-basin diversion for River Sindila for about 8km, which will have serious environmental and social effects.

Alternative 2 – Two Power Plants

Two power plants with capacities of 5.0MW and 5.25MW can be developed while using optimum heads of two locations and avoiding trans-basin diversion which is required under Alternative 1. Optimum heads of two locations can be utilized as there is no requirement to build channel on a common contour line.

This would give more than 2.25MW additional capacity while giving about 9GWh annual energy to the national grid. However, there will be incremental cost such as two forebay tanks, two penstocks lines and two power houses with additional turbines, generators and other electromechanical components required for this option.

The main project parameters under this option are as follows in Table 5.2.

Table 5.2 Main project parameters under this option

River	Net Head (m)	Design Flow (m^3/s)	Estimated Capacity (MW)
Ndugutu	340	1.7	5.0
Sindila	370	1.7	5.25
Ndugutu and Sindila			10.25

A higher design flow is required if two independent projects are to be developed when compared to a single project using waters of both rivers. This is because, financially for two projects to be viable, a higher amount of energy is required to be generated to compensate for the additional capital expenditure that will be required for two power houses, penstock lines, fore-bay tanks and additional electromechanical equipment. The developer takes a risk in this approach, as the design flow is set for a lower exceedence level in the flow duration curve (FDC) compared to a more conservative approach of fixing a design flow on a higher exceedence of the FDC.

Furthermore, the alternative of two power plants was revised to cater for financial as well as the economical benefits;

Option 1:

This option requires a long concrete channel (approx.1,900 meters) to carry the water from the intake up to the forebay tank and a shorter penstock (approx.1,750 meters) up to the forebay tank. In this design, the cost of civil works will be marginally lower than the option 2 below as the cost of concrete channel will be lower than steel penstock. A spill way of approximately 200 meters in length was designed. However, constraints or difficulties would be encountered during construction of headrace canal due to the steep terrain.

Option 2:
In order to mitigate constrains described above, the length of the headrace canal is to be shortened hence positioning the forebay and desilting tanks closer to the intake point. Locating the forebay tank near to the intake as well as to the stream eliminates the need for a separate spill way. The spilling water from the forebay tank will be directed to an existing stream which will carry the water up to the River Sindila. The length of the headrace canal will be 650 meters. A considerable section of the canal will be a cut and cover section in area where the terrain is steep. The rest of the length will be an open channel. This approach will minimise the geological risks associated with the canal section and minimise environmental impact as well. The rest of the conveyance will be a steel penstock approximately 3,000 meters in length and 1 m in diameter up to the power house. The penstock will be supported by concrete anchor blocks at every bend and all straight section will be supported on concrete piers.

Comparison of Annual Energy Generation

Based on the hydrology and head measurements, the estimated energy for above two alternatives is as follows in Table 5.3 below.

Table 5.3 Estimated energy for two alternatives

Name of River	**Estimated annual energy**
Alternative-1 Single power plant	
Sindila/Ndugutu	39
Alternative-2 Two power plants	
Ndugutu	22
Sindila	25
Total	47

It is presumed that the proposal to develop two projects is attractive as it would give more than 2.25MW additional capacity and about 9GWh of energy per annum. This also means saving USD 1.5 million annually in foreign exchange for the country, if the same quantum of energy is to be generated from a thermal power plant.
Based on the studies of two alternative designs; Single power plant and two separate projects, the environmental, social and economic consequences are summarized and presented in Table 5.4.

Table 5.4 Comparison of two alternatives (1) Single project (2) Two separate projects

Parameter	**Alternative 1**		**Alternative 2**	
Feature of structure	2 weir and 1 powerhouse		2 weirs and 2 powerhouses	
River diversion	Trans basin		Run-of-the -river	
Length of river affected	Sindila	8km	Sindila	4km
	Ndugutu	4km	Ndugutu	4km
Ecological impact	High due to trans basin diversion		Low	
Social impact	High due to trans basin diversion		Low	
Resettlement	Number of houses need to be relocated		No resettlement involved	
Installed Capacity	7.3MW		10.5MW combined	
Energy generation	39GWh / annum		48GWh / annum	

Alternative configurations and technologies

Alternatives include different weir alignments, heights, method technologies, distance of conveyance and setting of the powerhouse and tailrace. These key parameters are commonly used in optimization. A layout of project components on the right bank of the river was eliminated at the pre-feasibility study stage in consideration of issues related to the terrain, geology, access and socio-economic concerns.

Alternative configurations of diversion structure

Several alternatives were considered in selecting the weir site. All these alternatives were studied on economic and environmental basis and the alternative with least disturbance to the present environmental conditions was selected.

In selecting the height of the weir, various alternatives were studied and ultimately it was decided to maintain the weir height in such a manner that the resulting pond will be confined to a small area whereby the impact on riverine vegetation is minimized. The length of the spillway section was selected taking in to consideration the fact that the 100 year return period flood could be discharged easily.

Water conveyance mechanism

The following three alternatives for the water conveyance mechanism were considered viz, open rectangular channel, steel pipe and GRP pipe. The comparison of unit cost of those alternatives is given in Table 5.5.

Table 5.5 Comparison of alternative methods of water conveyance

Parameter	Open channel	Steel pipe	GRP pipe
Head loss due to friction	Low	High	Moderate
Corrosiveness	Low	High	Low
Ease of Transportation	High	Low	Low
Ease of construction	Moderate	High	High
Construction time	High	Low	Low
Environmental considerations	Moderate	Low	Low
Safety concerns	High	Low	Low
Maintenance requirement	High	Low	Low
Unit cost	Low	High	High

The open channel is considered as the most conventional option. Individual short pier foundations and concrete block foundations on detached rock blocks were proposed to minimize the risk of failures on steep slopes.

Machine selection with alternatives

Based on hydrology study and head of the project, the most appropriate type of turbine is pelton. There is no alternative to be considered for this type of project.

The hydrology report (Annexure 10) shows a good base flow and the flow variation is not significant during the year. Pelton turbines also have higher efficiency even at low flows. Furthermore, having two pelton turbines for the power plant does not provide a significant advantage over energy harness. One pelton turbine option is the most suitable for this power plant.

5.3. No action alternative

The no-project scenario will mean the status quo of the area remains and no occurrence of adverse impacts as well as positive impacts posed by the project implementation.

By adding 5.25MW (25.9GWh) to the National Grid annually, the proposed project will contribute to the country's renewable energy policy targets. In the absence of the Sindila MHP, an equivalent amount of energy has to be obtained from other means, most likely by thermal power options. These not only absorb foreign currency but also adversely impact on the environment. Both thermal alternatives – oil fired and coal fired – would result in emissions of CO_2, SO_x, NO_x and particulates.

Under the do-nothing alternative, the disparity between the minimum and maximum daily power demand will continue to increase. The continued increase in the base-load demand for the grid will increase the frequency and duration of power outages and load shedding. This will impact economic development of the area and hinder poverty reduction efforts. The no project option will have the forgone costs and benefits including;

- The targeted consumers will forgo improved electricity supply
- Generation of employment opportunities through expansion of business activities that would have been spurred by availability of electric power will not occur
- The rural electrification programme will suffer
- Electricity deficit in Uganda will still be experienced
- Increased pressure in the use of biomass as a source of energy

In this context, in order to alleviate the current energy deficit, Uganda has been embarking on projects geared towards promoting investments in the energy sector. The Uganda Electricity Generation Company Limited (UEGCL), projects that Uganda requires at least 3800MW of power supply added to the national grid by 2015. Implementation of power projects such as the proposed 25.9GWh Sindila Mini Hydropower project, will contribute immensely towards alleviating the country's energy deficit therefore the selection of "No action" alternative is not a wise option.

The decision to develop the proposed Sindila MHP plant is a good investment in terms of economic development. It is important and a timely intervention as it contributes to increasing the country's alternative environmental friendly power demand and also supports the call for renewable energy alternatives worldwide.

The proposals to generate electricity from alternative sources to feed the national grid are not economically justifiable as long as exploitable potential hydropower sources are available. This gives hydropower a potential edge over the other alternative technologies on the basis of economics and efficiency.

6. PROJECT IMPACT IDENTIFICATION AND MANAGEMENT

This section describes the methodology by which potential project-related impacts are assessed, and then presents the results of the assessment and the mitigation measures that have been developed as a result of the assessment process.

6.1. Assessment methodology

6.1.1. Impact description

A potential impact is both a description of the planned project activities and their effects on the environmental or social receptors. Relevant impact characteristics include:

- Adverse or beneficial;
- Direct or indirect;
- Short, medium, or long-term in duration; and permanent or temporary;
- Local, regional or global scale affect; including trans-boundary (neighbouring countries); and
- Cumulative (such an impact results from the aggregated effect of more than one project occurring at the same time, or the aggregated effect of sequential projects. A cumulative impact is “the impact on the environment which results from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions”).

The relative intensity of the impact can be assessed by these characteristics. The sensitivity of the environmental and social receptors was determined by specialists by ranking the components of the baseline data collected during the ESIA.

6.1.2. Impact severity for planned project activities

The impact severity was determined by evaluating the intensity of the impact and the sensitivity of the environmental and social receptors, which is largely subjective but based on the professional judgement of the entire team of specialists.

This methodology requires assigning of numerical descriptors to the impact intensity, as well as the environmental and social receptors, for each potential impact. The numerical descriptors are 1, 2, 3, or 4; which are equivalent to very low, low, medium or high. The impact severity is then calculated as the product of the two numerical descriptors, which is equivalent to negligible, minor, moderate or major, as indicated in Table 6.1. This is a semi-qualitative method designed to provide a broad ranking of the different potential impacts of a project.

6.1.3. Impacts of unplanned events (or contingencies)

Impacts associated with unplanned events (or contingencies), such as vehicle accidents, floods or landslides, are difficult to assess within the framework outlined above, because:

- The frequency of unplanned events is usually low, since operational procedures are designed to minimise the risk of an occurrence;
- The intensity of these impacts is difficult to quantify, since there is a wide range of possible events (i.e. the impact intensity is highly variable); and
- Unplanned events that may result in a severe environmental or social impact usually result in high financial, social and political liabilities and costs for the developer. Therefore, the project has substantial built-in controls to avoid such occurrences. The probability of unplanned events (contingencies) occurring should always be low so they are not assessed in the impact assessment, whereas expected potential impacts are assessed.

Nevertheless the potential levels of consequence to environmental and social receptors of unplanned impacts (or contingencies), should such an event occur, are addressed in Section 6.4 (Unplanned or Contingency Impacts).

6.1.4. Mitigation and residual significance

The potential impacts are assessed for severity and mitigation measures are designed to reduce this impact severity. The impact severity is then re-assessed, assuming application of the mitigation measures, to derive the 'residual' impact severity.

Table 6.1: Determination of impact severity

			Sensitivity of receptor			
			Very low	Low	Medium	High
			1	2	3	4
Intensity of impact	Very low	1	1 Negligible	2 Minor	3 Minor	4 Minor
	Low	2	2 Minor	4 Minor	6 Moderate	8 Moderate
	Medium	3	3 Minor	6 Moderate	9 Moderate	12 Major
	High	4	4 Minor	8 Moderate	12 Major	16 Major

6.2. Positive impacts of the proposed Sindila MHP

The proposed Sindila MHP will have a number of socio-economic benefits. These include:-

6.2.1. Increased revenue to the government

The electricity that will be generated by the proposed Sindila MHP will generate revenue for the district and the country in general in the form of Value Added Tax (VAT) on electricity, levy on transmission of bulk purchases of electricity, license fees and royalties, among others.

6.2.2. Alternative source of energy

According to the Uganda Bureau of Statistics, National Household Survey Report, 2009/2010, wood fuel is the most common source of fuel for cooking in Uganda. This survey ascertained that 95% of the households surveyed still used wood fuel (wood and charcoal) as the main source of energy for cooking. Firewood was most commonly used by the rural households (86%) whereas charcoal was commonly used by urban households (70%).

Baseline survey results revealed that the rural populations in the proposed project area solely depend on fuel wood as a source of energy without any complement. The proposed project is anticipated to produce 5.25MW of electricity which will complement fuel wood in the project area as well as other districts, in so doing reducing reliance on fuel wood.

6.2.3. Increasing the electricity supply to the national grid/reduction of Carbon Emissions

The proposed project is anticipated to improve electricity supply to the people within the Bundibugyo district, Kasese District, FortPortal and the neighbouring areas, in particular, Sindila Sub-county which currently does not have electricity and where the proposed Sindila MHP is to be located.

The proposed project is estimated to generate 5.25MW of hydro-electric power. 25.9GWh of electricity will therefore be added to the Ugandan National Grid annually worth US$ 2.68 million. This is expected to boost rural community access to electricity which is still less than 10% country wide, and thereby boosting economic development given the role that access to electricity plays in socio-economic transformation. Equally of importance will be the fact the energy generated will go a long way towards replacing the current non-sustainable energy production alternatives whose GHG emissions or carbon footprint is rather high.

This positive impact will be realised during the operations phase of the project.

6.2.4. Creation of employment opportunities

The project is anticipated to create employment opportunities for both skilled and unskilled labour, Table 2.4 (Section 2.5 above, Workforce requirements). Skilled personnel will be employed as Managers, Supervisors, Engineers, Architects, Surveyors, and in other technical positions whereas unskilled labourers will be employed as support staff and perform non-technical tasks. During the construction of the dam (weir), diversion canal, power house, upgrading of the access road and other construction activities, 179 people are expected to be recruited as workers. In addition, most of the casual labourers will be hired from the local area and this will benefit the local communities greatly thus boosting their incomes. The income accruing from such activities will have an effect on their standards of living thereby boosting household incomes.

6.2.5. Improvement in social services

Roads in the area are in poor condition and transport links are poorly developed. Schools and health facilities are insufficient, poorly staffed and poorly equipped. Currently there are no motorable roads beyond the Kaghughu Primary School.

The proposed project will directly or indirectly benefit local communities and increase service delivery, as it has the potential to lead to the establishment and improvement of some social services in the project area such as feeder roads. A causeway across River Sindila will be constructed to provide access to the Bunyangule area. The footpath starting from Bunyamwera trading centre to the nursery school (35N 833379E, 65121N) will be widened and improved. From that point to the forebay tank, an access road (1 km long) will be constructed to provide access to the forebay tank. The footpath starting from Butama – Bunyangule road to the proposed powerhouse (1.6km) will also be upgraded. These roads will also have to be maintained in order to be used for future operations and maintenance works.

6.3. Negative impacts of the proposed Sindila MHP and proposed mitigation measures

The potential negative impacts associated with the Sindila MHP are presented in the sections below, together with the proposed mitigation measures suggested for the respective impacts.

6.3.1. Impact on Rwenzori Mountain National Park, World Heritage Site and Ramsar Site

The analysis of the potential project impact discussed in this section is related to the possibility that during the implementation of the proposed project activities, the integrity of RMNP will be compromised.

The baseline information is presented in Section 4.1, 4.2.1 and 4.2.2.

According to this baseline information, the proposed Sindila MHP will be located 430m North West of the RMNP boundary, which was gazetted in 1991 and was recognised as a United Nations Educational, Scientific and Cultural Organisation (UNESCO) World Heritage site in 1994 and a Ramsar site in 2008. The total number of plant species known to occur in the RMNP is 796, forty-one of which are Rare and eleven are in the IUCN Threatened category Plumptre *et.al.* (2012). According to the same survey, within the vicinity of Harugali which is approximately 15km from the project site, 139 plant species were recorded, four of which were Albertine Rift Endemics.

There are 54 Albertine Rift endemics fauna species, which include 18 species of mammals, 21 species of birds, nine species of reptiles and 6 species of amphibians. Five species are endangered, 14 are threatened and four have restricted range. The Olive baboon (*Papio anubis*), the Blue monkey (*Cercopithecus mitis stuhlmanni*) and the Angolan colobus (*Colobus angolensis rwenzorii*) occasionally visit the project area from the national park. The Angolan colobus monkey is a subspecies endemic to the Rwenzori Mountains.

Potential causes of impacts on the neighbouring RMNP were identified and analysed on a case by case basis. These were then used to discuss the possibility that the integrity of the park will be compromised as a result of the proposed project activities.

Construction phase

During the construction phase of the project; the project will require 179 employees (section 2.5) including Engineers, Electricians, Supervisors, Accounts Clerks, Masons, Carpenters, Bar Benders, Riggers, Labourers and Security Personnel to mention but a few, over a period of 540days.

The project will improve a road network of 1.6km and 1km from the bridge at R. Ndugutu to the proposed powerhouse and forebay respectively, which will be used by project workers and community members in the PAI. The high rate of human population growth due to the project and concomitant needs for agricultural and grazing land, fuel wood, timber, game meat, plant foods and other natural resources, combined with development in areas surrounding the park, will exert increasingly heavy tolls on the integrity of the RMNP through improved access to the park resources, despite its national and international designations and cooperative programs with communities.

The most likely impacts of the Sindila MHP on the RMNP during the construction phase will be due to continued and potentially increased deforestation outside the park boundaries and encroachment into the national park not only by local communities, but also by any project-associated in-migration of people into the project area.

The largest mammal species appear to have already been extirpated from the far northern part of RMNP closest to the project area, according to the wildlife survey by Plumptre *et.al*. 2012; however, the Angolan colobus monkey, a sub-species endemic to the Rwenzori Mountains, still exists in this section of the park.

The impact will also possibly be extended to the four Albertine Rift Endemic species of plants recorded in the RMNP by Plumptre *et.al*. (2012). Thus, existing animal and plant populations are vulnerable to further reduction in numbers resulting from human disturbance due to the following:

- Intensified deforestation on the periphery/interior of the RMNP to access timber for construction by the local community, with probable consequential habitat loss, micro-climate change, and increased area of “edge effect” on the boundary;
- Increased agricultural production near the RMNP boundary due to improved road access and easier transport of crops with potential increase in crop raiding and human/wildlife conflicts;
- Increased collection of resources in RMNP by people with Resource Use Agreements to sell/supply to workers/migrants;

- Use of improved existing roads, paths, and project access roads to enable transport of people to and wild products out of, the RMNP;
- Increased hunting/trapping of wild animals near/in the RMNP to provide meat for project workers and new migrants to the area; and
- Inability of UWA to effectively manage and monitor the RMNP sector near the project area and offer community-based programs due to lack of funding.

The intensity of the impact is low and the sensitivity of the receptor is high resulting in a moderate impact severity before mitigations.

Proposed mitigation measures:

- Develop adaptive land use management and monitoring plans for the area adjacent to the RMNP and within the 3km Integrated Use Zone with RMNP staff, District Environment officer, District Forestry officer, NGOs, and community representatives;
- Sensitise communities, workers, and migrants to avoid further damage to RMNP;
- Work with the District Agriculture Officer, Soil Conservation Committee, and community representatives to avoid planting near/on the boundary of the RMNP, improve agricultural practices, and engage in terracing and other means of soil restoration to encourage farming near villages;
- Work with the RMNP staff and UWA rangers to enable more extensive monitoring of people legally harvesting resources in RMNP;
- Work with District Officers, UWA and community leaders to develop and implement a road and vehicle monitoring strategy to address transport of resources from the RMNP;
- Work with UWA and the RMNP staff to increase park boundary patrols and monitor wildlife poaching activities;
- Develop a financing mechanism based on Payment for Ecosystem Services (i.e. water) that would provide an option to raise additional funds for conservation and support to community livelihoods programs.

With the implementation of the above mitigation measures, the residual impact severity will reduce to minor.

Operations phase

At this stage, only 29 employees will be required for the operation and maintenance of the Sindila MHP, compared to the 179 employees required for the construction phase. However, due to the improved road network, the project area will be easily accessible for trade and commerce by community members and in-migrants as a result of the project development. Therefore, as is the case during the construction phase, there will be:

- Increased agricultural production near the RMNP boundary due to improved road access and easier transport of crops with potential increase in crop raiding and human/wildlife conflicts;
- Increased collection of resources in the RMNP by people with Resource Use Agreements to sell/supply to traders/migrants; and
- Use of improved existing roads, paths, and project access roads to enable transport of people to, and wild products out of, the RMNP.

The intensity of the impact is very low and the sensitivity of the receptor is high resulting in a minor impact severity before mitigations.

Proposed mitigation measures:

Mitigation measures for the operations phase are similar to those described for the construction phase above.

With the implementation of the above mitigation measures, the residual impact severity will remain minor.

6.3.2. Loss of land / Land take

The analysis of the potential impact discussed in this section is based on the fact that land will be acquired during the implementation of the proposed project activities.

Relevant baseline information is presented in Section 4.3.11 (Land use) and Section 4.3.12 (Land tenure). The baseline information indicates that land ownership in the project area is mainly customary and agriculture is the main form of land use in the area. Other than the weir and a section of the headrace canal which lie in a forested area, other structures are located in an area characterised by homesteads amidst cultivated farmlands and other infrastructure such as schools, with some sections of the proposed access roads being on existing footpaths.

This impact will be applicable to the construction phase only since it is assumed that no more land will be needed thereafter.

Construction phase

The construction of the Sindila MHP will necessitate the acquisition of land for both permanent and temporary activities. Permanent land take will result from the construction of the reservoir (weir) and related infrastructure such as, the headrace canal, penstock, forebay and powerhouse.

To access the site during project construction and operation, it will be necessary to upgrade, including widening, the existing road network as well as construct new access roads to the project infrastructure, these activities will further lead to permanent loss of land to the project.

There will be temporary land take due to the construction of a workers' camp. All the land required for construction of project structures and infrastructure is owned by the local community under the customary land tenure system.

This impact will lead to temporary or permanent abandonment of activities such as farming that are being carried out within the project footprint. In particular, loss of arable land is likely to threaten the food security of the local communities since subsistence agriculture is their major source of livelihood, with the directly affected people being the most hit.

The intensity of this impact is low and the sensitivity of the receptor is high resulting in a moderate impact severity before mitigations.

Proposed mitigation measures:

- The developer (Butama Hydro Electricity Company Ltd) must work with local council committees, Sub-county committees, and the District land board, CAO, RDC, politicians and other local leaders to sensitise PAPs on the intentions of land acquisition. This must be done prior to project implementation to give people sufficient time for planning and proper assessment;
- The Developer must develop a thorough Resettlement Action Plan (RAP) and implement this plan in accordance with the Ugandan laws and donor agency guidelines such as World Bank Group and its Safeguard Policies;
- Land surveying and property Valuation must be undertaken by competent authorities such as Certified Valuers and Land Surveyors. Negotiations with land and property owners should be in compliance with local market prices and government rates so as to establish rational figures for compensation and subsequent resettlement of the affected persons;
- The PAPs should be individually notified about the compensation amount(s) to be paid and the proposed form of compensation e.g. land for land, cash etc. They may then

accept or refuse the compensation proposed depending on the damages incurred, and also state there preferred form of compensation e.g. cash; and
- The project footprint should be limited to only that which is required i.e. the minimum possible.

With the implementation of the above mitigation measures, the impact severity will reduce to minor.

Operations phase
Impacts associated with the loss of land are anticipated to be particularly relevant during the construction phase only. As such, no assessment was done for the potential for loss of land/land take in the operations phase.

6.3.3. Loss of crops and property

The analysis of the impact discussed in this section is related to the possibility that existing crops will need to be cleared for the construction of the project components listed in Section 2.4 above. Baseline information indicates that the project is located in the community area, the main economic activity on this land is agriculture and crops grown include; coffee, bananas, yams, matooke and fruit trees like avocado and pawpaws although the weir and a section of the headrace canal fall within a forested area with neither settlement nor agricultural gardens. Houses and other infrastructure can also be found in the alignment of the proposed project structures.

This impact will be applicable to the construction phase only since no more land will be needed thereafter.

Construction phase
The project will lead to loss of crops and other properties falling within the project footprint due to the acquisition of land for construction of part of the headrace canal, the forebay, the penstock path, powerhouse and the access roads to these sites. Several structures were observed at the proposed project site. During the excavation and construction works there is a possibility that excavated materials, construction material and rock chippings will slide and damage property.
Loss of crops threatens food security and can impact on livelihoods of the local community.

The intensity of this impact is low and the sensitivity of the receptor is high resulting in a moderate impact severity before mitigations.

Proposed mitigation measures:
- A comprehensive property impact survey should be conducted which should indicate all affected properties within the right of way (ROW), their owners and the replacement costs. Valuation of such property should be conducted by experienced and registered valuers in association with the district land board and local leaders;
- Separate land surveys should be carried out for the permanent and temporarily affected land. All forms of compensation pertinent to loss of land should be conducted in line with the provisions of the Land Act 1998 (as amended in 2010);
- A comprehensive Resettlement Action Plan (RAP) should be prepared to ensure that PAPs are appropriately compensated and resettled;
- Prior to compensating the affected persons, adequate community sensitisation meetings should be carried out to ensure that the PAPs are aware of the entire program including visitation schedule per village, parish and/or Sub-county and how each PAP will be contacted and approached for payment;
- Prior to the compensation process, the PAPs should be individually notified about the compensation amount to be paid and the proposed form of compensation e.g. land for land, cash etc. The PAPs may accept or refuse the compensation proposed depending on their expectations and damages incurred; and

- The project footprint should be limited to only that which is required i.e. the minimum possible.

With the implementation of the above mitigation measures, the impact severity will reduce to minor.

Operations phase

Impacts associated with the loss of crops and property are anticipated to be particularly relevant during the construction phase only. As such, no assessment was done for the potential for loss of crops and property in the operations phase.

6.3.4. Increased rate of soil erosion

The analysis of the potential project impact discussed in this section is related to the possibility that during the implementation of the proposed project activities, there will be increased soil erosion within the project area.
The baseline information is presented in Section 4.1.4 (Geology, Geomorphology and soils).

According to this baseline information, the proposed Sindila MHP is to be located on very steep to moderately steep (80^0- 45^0) slopes on both the left and right banks. The surface soils in PAI include; overburden residual soil with 0.3 – 0.6m of organic silt, over fine to medium-grained sand to 1.3m, over stiff to hard, low to non-plastic silt along the penstock path (these soils are prone to soil erosion), hard slightly weathered to fresh rock exposures along the headrace canal and residual clay material that consists gravely clay at the forebay location. The PAI is therefore generally prone to high runoff rates given the steepness and can be easily eroded given the nature of the soils.

Potential causes of increase in soil erosion were identified and analysed on a case by case basis. These were then used to discuss the likely increase in soil erosion as a result of the proposed project activities.

Construction phase

During the construction phase of the project, a range of earthworks and construction activities are anticipated. These will entail construction of project features namely: access roads, powerhouse, forebay, penstock excavations, headrace canal and the intake weir. The construction phase will also involve establishment of support structures (construction camps, workers camp, temporary offices, permanent staff quarters, vehicle equipment storage and parking yard). Most of these works will involve activities such as surface levelling, vegetation removal/clearance, embankment construction and stabilisation works, which have the potential of exposing the land surface to the elements of erosion.

Considering the hilly nature of the proposed project area (Weir is at an altitude (above mean sea level) of 1563.5m, forebay at 1530m, and powerhouse at 1127m, and the characteristic erodible soils in the project area (silty fine sand material), this impact will be highly noticeable in the downstream areas where homesteads could be swept by rolling soils and rock particulates.

The intensity of this impact is medium and the sensitivity of the receptor is high resulting in a major impact severity before mitigations.

Proposed mitigation measures:

- Disposal of cut soil and all the debris trapped by the sediment traps will be undertaken outside wetlands, road reserves and fragile ecosystems (the riverine forest section) under the direction of the Resident Engineer who will approve disposal sites in collaboration with the local authorities. Such debris, for example, if it happens to be good murram can be used to back fill potholes and stabilise the proposed access road to the powerhouse.

- There will be controlled clearance of vegetation and this will be limited to only sections that are required for the access and installation of the project infrastructure;
- An efficient drainage system will be incorporated in the project design to ensure that storm water especially along the access roads to the powerhouse and forebay and along the headrace canal is efficiently and effectively controlled;
- Where possible, construction activities will not take place during heavy rains;
- Disturbed areas will be rehabilitated using a suitable indigenous cover grass. These grass species will be planted along the drainage channels to reduce the scouring effect of water;
- Affected areas will be re-vegetated to prevent soil erosion. Suitable plants e.g. trees, and grass planted along the access roads to the powerhouse and forebay and along the headrace canal will be managed and maintained by dedicated committees established by Butama Hydro Electricity Company Ltd;.
- As a long term strategy of mitigating project impacts resulting from vegetation clearance, combating soil erosion along the river and the Ntuma stream, mitigating climate change impacts and protecting and preserving the water catchment from excessive depletion and degradation, Butama Hydro Electricity Company Ltd will institute a long term tree planting program along the river banks (both upstream and downstream of R. Sindila). The developer will also initiate and/or support projects aimed at contributing to the wider protection of the river catchment against degradation and depletion.

With the implementation of the above mitigation measures, the residual impact severity will reduce to moderate.

Operations phase

This phase is characterised by activities that involve monitoring site visits and running of the hydropower station. Although the proposed plant will run on a highly automated system, the open headrace system will involve manual cleaning and so will the operation of the head works gates and other controllers.

This however, does not have the potential of increasing the rate of soil erosion. Therefore, this impact is considered insignificant during this phase. However, the drainage system and other mitigation measures as listed above will need to be monitored and maintained to ensure continuous storm water management and effectiveness.

6.3.5. Soil contamination

The analysis of the potential project impact discussed in this section is related to the possibility that during the implementation of project activities, poor waste management, and oil/fuel and chemical leaks will contaminate the soil, thus affecting its quality.

Relevant baseline information is presented in Section 4.1.4.3 (Soils) and Section 4.3.11 (Land use). The soils are of good quality since the soil analytical results of the samples taken from the proposed construction camp location indicate that the assessed parameters were within the United States EPA regulatory limits.

Sources of hazardous chemicals that may temporarily contaminate the soils were identified and analysed on a case by case basis. These were then used to discuss the likely decline in the soil quality that might be happen as a result of the project activities. Accidental large scale spillages that may impact soil quality have been considered in the contingency/unplanned impacts (Section 6.4 below) and are therefore not assessed here.

Construction phase

Pollution of soil may result from discharge of fuel, chemicals and construction material spillage onto soil. Biodegradable and non-biodegradable wastes will be generated during the construction

phase. These will include stones, sand, steel (metallic bars), insulators and other construction materials. Plastic wastes such as mineral water bottles, polythene bags, jerry cans, and other plastic accessories may be generated at the camps and work centres. Organic wastes such as food stuff and human waste will also be generated at the camps and work centres. Oil and fuel leaks might occur from vehicles, equipment and machinery used during construction. These wastes, if not well managed, have the potential to contaminate the surrounding soil and alter both its chemical and physical properties thus affecting its productivity.

The soils at the site are mainly used for agricultural purposes hence soil quality is of particular relevance.

The intensity of this impact is low and the sensitivity of the receptor is high resulting in a moderate impact severity before mitigations.

Proposed mitigation measures:

- Butama Hydro Electricity Company Ltd will ensure that all wastes generated during construction activities such as conductors, steel and metallic bars, insulators and other accessories are collected and disposed of appropriately at designated sites;
- All organic waste generated at labour campsites such as food stuffs shall be collected and transported by a licensed waste collection entity to designated landfills/dumping sites within the project area;
- All plastic waste generated (at campsites and in the course of undertaking works) such as mineral water bottles, polythene bags, jerrycans, will be collected preferably in mobile vans and handed over to a licensed waste collector or re-used;
- Fueling will be carefully undertaken at designated and well maintained fuelling centres;
- The waste management hierarchy will be followed during the construction phase. According to this hierarchy, source reduction of waste will be the first option and disposal of unavoidable waste as option of the last resort;
- Undertake routine preventive maintenance of motorised equipment to avoid any fuel leakage and spills;
- Storage of fuels and oils should be undertaken in a manner that does not allow leakage to the soil as the fuel can readily infiltrate the soils polluting the soils, ground and surface water; and
- Collect and dispose of all waste generated from project activities in accordance with local district guidelines, National Environment (Waste Management) Regulations 1999 and international best practice.

With implementation of the above mitigation measures, the residual impact severity will reduce to minor.

Operations phase

Hydropower operation activities in this phase are highly automated. However, activities such as manual cleaning of the open headrace system, operation of the headworks gates and other controllers will be carried out. Furthermore, maintenance of the hydraulic system and functions like silt and trash removal will also occur. All these will involve generation of biodegradable and or non-biodegradable waste such as oils. Spillage could also occur from overall maintenance of machinery, equipment and vehicles at the hydropower plant. However, the use of hazardous materials during operations is limited to fuels and lubricants of the equipment/machinery. No disposal of these substances is planned.

Domestic and sanitary waste will also be generated (because 29 people will be employed during this phase) and this includes foodstuffs, plastics, paper and human waste – however it is assumed that at this stage, permanent waste management facilities will have been established for the project. As such, no assessment is made for the impact on soil quality in the operations

phase. Nevertheless, in addition to the mitigation measures suggested for the construction phase above, the following is recommended during operations.

Proposed mitigation measures:

- All the waste collected from the headrace system at the time of cleaning will be disposed of appropriately at designated waste disposal sites – during flushing of the sedimentation tank, sediments will be flushed back into the river where they came from.

6.3.6 Increased disease vector populations as a result of changes in water ecology

The analysis of the potential project impact discussed in this section is related to the possibility that during the development of the proposed Sindila MHP, there will be an increase in disease vector populations as a result of changes in river ecology.

Relevant baseline information is presented in Section 4.3.4 (Health status).

Baseline information indicates that the most common diseases treated in Sindila Sub-county are Malaria and typhoid at 59% and 13% of the population respectively. Both of these diseases are associated with vectors that breed in water.

The potential increase in disease vector populations as a result of changes in water ecology is assessed in the section below.

This impact is applicable to the operations phase only since there will be no permanent changes in water ecology during construction.

Operations phase

Construction of the flow diversion weir across the river has the potential of altering the river ecology. The impoundment is relatively small considering the height of weir. However, the possibility of increasing disease vector populations because of this impoundment cannot be ruled out.

In light of the above, a permanent change in water flows in River Sindila and the creation of the reservoir/weir could influence disease incidences in the local region through creation of suitable habitats/favourable conditions for the breeding of some disease vectors and pathogens, specifically for diseases such as malaria and typhoid. The decreased stream flow rate in the river, both upstream and downstream, resulting from the diversion of water flow into the channel is expected to increase the incidence and breeding places for vectors that transmit malaria, typhoid, urinary and intestinal bilharzia.

This is particularly likely to affect children, and other users of the river. Treatment for these diseases is relatively simple, although it is crucial to seek medical attention immediately. If left untreated, serious disabilities or even death can occur. However, the proposed project area already has inadequate health facilities and timely treatment of vector-borne diseases is likely to be a challenge.

The intensity of this impact is low and the sensitivity of the receptor is high resulting in a moderate impact severity before mitigations.

Proposed mitigation measures:

- Safe supply of potable water, and water purification education will be undertaken to address threats of intestinal and guinea worms;
- The project will have a health program in place geared towards community protection. This can include sensitisation of the local community members and encouraging them to use mosquito nets. Where possible, Butama Hydro Electricity Company Ltd could

also assist in the provision of mosquito nets to the local people as part of Corporate Social Responsibility (CSR).

With implementation of the above mitigation measures, the residual impact severity will reduce to minor.

6.3.7. Increased traffic

The analysis of the potential project impact discussed in this section is related to the fact that during the implementation of project activities, traffic in the area will increase as a result of project related vehicular movements associated with the transportation of project related materials and equipment that will be brought into the project area.

Relevant baseline information is presented in Section 2.5.2 (Required Equipment/machinery) and Section 4.3.7 (Transport).

According to this information, machinery to be used includes motor graders, rollers, tippers and water bowsers. The PAI is 25km away from the District headquarters and is linked via the Fort portal-Congo main road and through a district feeder road traversing through Busaru Sub-county to Ndugutu and Sindila Sub-counties. Within the PAI, there is only one community access road of 1.5km linking Kaghughu Primary school to the Bunyangule - Butama community access road. Most of the travel within the PAI is along footpaths over the hilly terrain.

The anticipated level of traffic as a result of project activities was determined and analysed on a case by case basis. This was then used to discuss the likely increase in traffic in the area. Professional judgment of the consultants, an understanding of the communities and experience from similar projects was used to assess increase in traffic from the current baseline as a result of the project activities.

Construction phase

Although the current traffic level on the road network within the project area is low, the additional traffic will be noticeable to the local community members and is likely to interfere with their regular movements through closure or diversion of roads during construction of the access roads. During the construction phase, a 1.6km access road from the left bank of R. Ndugutu to the proposed powerhouse will be upgraded while 1km of the footpath from the left bank of R. Ndugutu to the proposed forebay will be widened and upgraded to a community road to ease access to the project site. A causeway will be constructed across River Ndugutu to connect the right bank to the left bank in order to easily access the right bank of River Sindila. The increased volume of traffic to the site may also increase the potential for accidents especially along the roads in the community leading to and from the proposed project site. However, the potential for accidents is discussed in Section 6.4 below under contingency impacts. Furthermore, increased traffic and transportation of heavy loads may damage the existing roads leaving them in a worse state.

The intensity of this impact is low and the sensitivity of the receptor is high resulting in a moderate impact severity before mitigations.

Proposed mitigation measures:

- Use well maintained and serviced vehicles to maintain efficiency;
- Prohibit off-road driving. The use of vehicle horns should be reserved for safety considerations and not used as a common communication method;
- Travel in convoys and at designated times to decrease the risk of accidents and traffic nuisance to the community;
- Journey-specific risk assessments which will include the identification of potentially sensitive receptors along the access routes will be conducted. For significant traffic movements, including transport of construction materials to site, any affected

communities/residents along the route should be sensitised, and wherever possible, attempts made to undertake the traffic movements at the least busy times of day;

- When travelling in community areas, speed limits on transportation routes will be 40km/h for light vehicles and 30km/h for heavy vehicles;
- Only approved drivers will be allowed to operate vehicles;
- Materials should wherever possible be preferentially sourced locally in a manner that reduces environmental and social impacts (e.g. transport distances) and maximises local economic development opportunities;
- All roads should have clear and visible signage especially in community areas, around schools and hospitals to minimise the risk of accidents;
- Each construction site should have a traffic controller or signal person to monitor and direct traffic flow;
- All staff will undergo the Butama Hydro Electricity Company Ltd's induction process which includes rules for safe driving, including speed limits in community areas. All recruited drivers will be able to read;
- The number of vehicles that will be used will be kept to a minimum all the time;
- Where possible, the selected routes for use during the construction phase will avoid densely populated communities; and
- The construction equipment will be kept on site until the construction is complete.

With implementation of these mitigation measures, the residual impact severity will reduce to minor.

Operations phase

At this stage, the increment in traffic levels will be low and consist of less heavy duty vehicles i.e. the construction activities will have been completed and therefore traffic will mainly consist of light vehicles transporting operations and maintenance workers to and from the site.

This impact has therefore been considered insignificant for Sindila and has not been assessed further.

6.3.8. Impacts on vegetation

The analysis of the impact discussed in this section is related to the possibility that existing vegetation will need to be cleared for the construction of the project components detailed in Section 2.4) above. This will, result not only in the loss of vegetation cover within the project footprint, but potentially rare or endangered plants with a high conservation value.

Project activities which may cause the loss of vegetation were identified. These activities were evaluated to determine the likely extent to which vegetation will be lost. Professional judgment of the consultants and experience from similar projects was used to assess changes in vegetation from the current baseline as a result of project activities. Reference was also made to the conservation status of the vegetation and flora species that would need to be cleared.

Relevant baseline information is presented in Section 4.2.1(Vegetation).

This impact is applicable to the construction phase only, since no additional vegetation is anticipated to be cleared in the operations phase.

Construction phase

The vegetation structure where the Sindila MHP is to be located is comprised of a number of floristic habitats such as riverside vegetation, abandoned lands, forest plantations, small streams and streamside vegetation. It includes trees, shrubby, herby and weedy plant species. A section of the headrace canal and the intake weir are to be located within a riverine natural forest. No plant species, identified as globally or locally threatened were observed in this section of the project footprint.

To a great extent, the vegetation within the project footprint has been highly modified by human activities with a number of crop gardens present. It is likely therefore, that the vegetation within the project area, with the exception of the weir and parts of the headrace canal would still be lost during the cultivation of crops even if the proposed Sindila MHP was not developed.

Since part of the project infrastructure (a section of headrace canal and intake weir) is located within riverine forest, the vegetation within it is considered to be highly sensitive. However, given the small footprint of the project that will fall within the riverine forest (see section 2.4.1 Description of project components) for the dimensions of these structures), with the rest of the project infrastructure falling within community land where cultivation is the main land use practice, the overall sensitivity of the receptor (vegetation) is considered to be medium.

The intensity of this impact is low and the sensitivity of the receptor is medium resulting in a moderate impact severity before mitigations.

Proposed mitigation measures:

- Following the construction phase, the affected areas will be restored and only indigenous vegetation replanted. Intentional restoration using exotic plant species will be avoided;
- Prevent vegetation trampling by restricting access to the site along a designated route. Movement of equipment (vehicles, contractors and the entire construction crew) will be limited to the designated access roads – off-road driving will be prohibited;
- The site clearing exercise will be controlled and limited to only that which is required for the project components. Workers will be prohibited from removing vegetation outside clearing marked areas of intervention;
- The contractor will avoid locating temporary project infrastructure such as, access roads, quarries, construction camps, storage areas, in sensitive ecosystems (the riverine forest at the weir and part of the headrace) which systems will be clearly delineated with stakes or flagging to prevent unintentional impacts to these ecosystems;
- Carry out a pre-ground-break survey at the start of construction works to ensure that environmental conditions have remained the same as the baseline conditions presented in this ESIS. Allowance will be made for the translocation of sensitive species or the realignment of the working area to avoid causing disturbance to sensitive micro-habitats encountered during earth movement;
- Areas for biodiversity offsets should be identified and vegetation planted to replace the one that will be lost to the project. This includes supporting afforestation activities within the project area and beyond; and
- Movement of equipment (vehicles, contractors and the entire construction crew) must follow designated pathways or agreed upon access routes.

With implementation of the above mitigation measures, the residual impact severity will reduce to minor.

6.3.9. Impact on fauna

The analysis of the impact discussed in this section is related to the possibility that the project could potentially lead to loss of fauna within the project area. This is closely related to vegetation impacts since removal of vegetation will lead to destruction of microhabitat and fragmentation of habitats. Similarly, noise and vibrations within the proposed Sindila MHP area generated due to vehicle movement and construction related activities are likely to hinder/ interfere with free movement of wild fauna.

Project activities which may impact on fauna were identified. These activities were evaluated to determine the likely extent to which fauna will be affected. Professional judgment of the consultants and experience from similar projects was used to assess changes in fauna from the current baseline as a result of project activities. Reference was also made to the conservation status of the fauna species that would likely be affected.

Relevant baseline information presented in Section 4.2.3 (Fauna), indicates that the wild fauna existing in this project area include mammals; Dwarf mangoose (*Helogle undulate*), Crested porcupine (*Hystrix cristata*), African hare (*Lepus capensis*) and the Rock hyrax (*Heterohyrax brucei*). Discussions held with Uganda Wildlife Authority officials and the Bundibugyo District Forestry Officer during the ESIA update on 31st May, 2014, revealed the presence of the Olive baboon (*Papio anubis*), the Blue monkey (*Cercopithecus mitis stuhlmanni*) and the Angolan colobus (*Colobus angolensis rwenzorii*). The Angolan colobus monkey is a sub-species endemic to the Rwenzori Mountain. The domestic fauna includes; sheep, goats and dogs.

Construction phase

Construction activities will involve vegetation clearance, excavations and levelling of the project footprint area (access road, intake weir, headrace channel, forebay, penstock, powerhouse and worker's camp). All these activities will be carried out, to a great extent, in a highly disturbed area and noise will be generated which may disrupt the fauna within the project area.

The proposed project will be located 430m North West of the RMNP boundary, and because the project area (weir site and a part of the headrace canal) is connected to the park by a corridor of a natural riverine forest, some fauna from the park are likely to come into the project area. As stated in section 4.2.3.1 (Fauna of the Rwenzori), the park is well known for a number of fauna including the African elephant. At the park survey site in the Harugali vicinity, the following species were observed: Blue monkey, Red-tailed monkey, Angolan colobus, and the Chimpanzee. The Angolan colobus, an endemic sub-species, is classified as Vulnerable and was also reported to stray into the project area. The Chimpanzee is an Endangered sub-species.

Noise can affect an animal's physiology and behavior, and if it becomes a chronic stress, noise can be injurious to an animal's energy budget, reproductive success and long-term survival Radle (2007). Depending on the characteristics of the noise and the species, the reaction of a particular animal could range from mild annoyance to panic and escape behavior.

Taking into account the fact that the project construction activities will last 540 days, the fauna in riverine natural forest are likely to be disturbed. The project construction phase will limit the free movement of fauna within this area.

Although the other project structures (forebay, penstock, powerhouse, transmission line, and support structures) will be located in community areas with only domestic animals such as goats and dogs, the riverine forest at the location of the weir and part of the headrace canal is an important fauna micro habitat.

The intensity of this impact is low and the sensitivity of the receptor is high resulting in a moderate impact severity before mitigations.

Proposed mitigation measures:

- Use well maintained and serviced equipment that generates low noise levels;
- Unnecessary noise from the construction workers (such as loud vocalisations and music) will be prohibited;
- National noise regulations as stipulated in the National Environment (Noise Standards and Control) Regulations, 2003 will be adhered to;
- Idling of vehicles and machinery will be prohibited unless necessary;
- Off-road driving will be prohibited. The use of vehicle horns will be reserved for safety considerations, and not used as a common communication method;
- Equipment will be operated with all noise-reducing components (hoods, screens) in the correct position;
- During construction, habitat disturbance should be minimised by restricting the project activities to only the maximum area required;
- Unnecessary cutting of vegetation should be avoided;

- To minimise death of fauna, vegetation clearance should always be undertaken first, as this scares away most of the fauna, as opposed to direct use of graders to clear routes for access road construction, or direct dumping of construction materials and excavated soils; and
- The construction crew should be encouraged and sensitised not to harass amphibians and reptiles.

With implementation of these mitigation measures, the residual impact severity will reduce to minor.

Operations phase

Compared to the construction phase above, activities during the operations phase will be of a low magnitude i.e. the operations phase essentially will involve running and maintenance of the hydropower project.

However, terrestrial fauna within the project footprint may also be killed while using the access road and as a result of drowning in the open headrace channel.

The intensity of this impact is very low and the sensitivity of the receptor is high resulting in minor impact severity before mitigations.

Proposed mitigation measures:

- Monitor operation activities at the open headrace; and

- The headrace should preferably be buried, and the vegetation above it restored. However, periodic monitoring should take place (at least quarterly) to ensure that tree species that have the potential of destructing the headrace are not allowed to grow. This also reduces the risks to animal safety;

With implementation of the above mitigation measures, the residual impact severity will remain minor.

6.3.10. Increased poaching during construction

The analysis of the impact discussed in this section is related to the possibility that the project could potentially lead to increased poaching within the neighbouring Rwenzori Mountains National Park.

Project activities which may lead to increased poaching were identified. These activities were evaluated to determine the likely extent to which fauna will be affected. Professional judgment of the consultants and experience from similar projects was used to assess changes in fauna from the current baseline as a result of project activities. Reference was also made to the conservation status of the fauna species that would likely be affected.

Construction phase

During construction, wildlife will be vulnerable to heightened poaching for a number of reasons.

Access roads will be constructed to link to the respective project infrastructure and these will be used by project workers and community members in the PAI.

Given the proximity of the project location to the RMNP, the upgraded site access roads will potentially lead to incursions into the national park, possibly exacerbating poaching activities. Loss of habitat in the impounded area could also cause displaced animals to seek refuge in other areas making them vulnerable to hunting related activities.

The intensity of this impact is low and the sensitivity of the receptor is high resulting in a moderate impact severity before mitigations.

Proposed mitigation measures:

- Incorporate wildlife awareness training programmes into the RAP, to address possible pressures on wildlife in resettlement host areas;
- Consider impacts on habitats and wildlife when identifying suitable sites and manage movements to minimise impacts during construction;
- Minimise riverbed and shoreline disturbance by for example, restricting construction activities and access by workers to susceptible areas that could contribute to sediment loading;
- Implement education programmes for construction workers on, *inter alia*: respect for wildlife and vegetation, avoidance of fires and accidental damage, and generally restricting the footprint of the construction camp and work areas to that which is required;
- Prohibit development of unnecessary spur roads off main access roads, to limit land degradation and habitat disturbance;
- Develop "good construction environmental management" protocols to reduce potential impacts on vegetation and wildlife. The protocols should also cover site working practices, noise management, avoidance of spills, maintenance of pollution control measures such as oil separators, and a dust management plan; and
- Replant or take measures to encourage re-colonisation by native vegetation in disturbed or degraded areas immediately following construction.

With implementation of these mitigation measures, the residual impact severity will reduce to minor.

Operations phase

Compared to the construction phase above, activities during the operations phase will be of a low magnitude i.e. the operations phase essentially will involve running and maintenance of the hydropower project. This will, especially the flow of water, depend on the natural conditions after the water has been directed into the headrace at the intake weir.

The number of crew to be involved during this phase (29) is minimal and it is assumed displaced animals will have moved further into the National Park.

Therefore, this impact is considered to be insignificant during this phase and has not been assessed further.

6.3.11. Impacts on surface water quality

The analysis of potential project impacts discussed in this section is related to the possibility that during the implementation of the proposed project, transportation of contaminants from the project site by natural flow (in the case of a spill), or by storm water to surface water bodies may occur and negatively impact surface water quality.

Baseline environmental conditions are presented in Section 4.1.3. (Water quality).

The results of the water quality laboratory analysis indicate that the water quality parameters of the samples collected at the selected sites are within the recommended national potable water standards except for the following physical parameters for selected samples; apparent colour, total suspended solids and bacteriological parameters: fecal coliforms and E. coli.

The potential for the planned hydropower project activities to further degrade the water quality of the river within the project is assessed below.

Sources of potential surface water contaminants were identified and analysed on a case by case basis. These were then used to discuss the likely surface water contamination as a result of the

hydropower project activities. Reference was also made to relevant national legislation including the National Environment (Wetlands, River Banks and Lake Shores Management) Regulations, as contained in the National Environment Act Cap 153 as well as the Water Act Cap 152.

Accidental large scale spillages have been considered in the contingency/unplanned impacts (Section 6.4 below) and are therefore not assessed here.

Construction phase

Noticeable sources of water contaminants during the construction phase include minor (small scale) spillage of fuels, lubricants and other toxic materials such as sulfuric acid used in equipment and machinery. Discharge of silt laden runoff and the disposal of waste and wastewater from the worker's camp.

In addition to the above, materials such as oil, diesel fuel, concrete additives, and solvents are likely to be stored and used at the construction sites and lay down areas and in construction vehicles and equipment. Storage and handling of these materials could lead to spills on site, along roads and in surrounding areas.

Contaminated run-off from spill sites could adversely affect soils and vegetation and if it reaches the river, would have an adverse impact on water quality. The extent of this impact will vary depending 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.

During the construction of the weir, channel deepening and widening is likely to result into increased turbidity and change the colour of the River Sindila water. In addition, the materials used in the establishment of the weir such as cement may result in increased concentration of ions such as calcium, silicon, aluminum, iron and sulfates to levels above the recommended national limits for (untreated) potable water available for water consumers.

Inappropriate disposal of waste and wastewater from the camp site also has the potential to have negative effects on water quality. Waste generated from the proposed construction camp site could also have a negative impact on water quality. However, the extent of this potential impact will also vary depending on the location of discharge points and the dilution/mixing regime possible in the receiving waters.

Impacts on the water body downstream will include; reduction in dissolved oxygen levels, nutrient loading causing increased algal growth, and the spread of pathogenic disease vectors. Uncontrolled discharge of waste would have a moderate adverse effect on water quality but this can be mitigated if appropriate measures are put in place.

River Sindila is fast flowing and the release of contaminants into the river, therefore will further degrade the water quality, which is already fairly poor.

The intensity of this impact is low and the sensitivity of the receptor is medium resulting in moderate impact severity before mitigations.

Proposed mitigation measures:

- Detailed design of spillways to manage the temperature and oxygenation of releases to the river including preventing anoxic discharges;
- Design of reservoir shoreline to minimise adverse impacts from drawdown on neighbouring land uses;
- Install treatment facilities and/or oil/water separators to remove oil and grease from drainage water prior to discharge to adjacent water courses;
- Install wastewater treatment facilities to treat wastewater from the project campsite and other construction facilities; a site construction waste and wastewater management plan will be designed and implemented in order to minimise environmental damage from construction activities. This will include regular refresher training sessions for construction

workers as pertains to safe and proper storage, handling, use, cleanup, and disposal of oils, fuels and other chemicals and the implementation of a comprehensive spill response plan including equipment and training;
- The construction vehicles and equipment will be regularly maintained from a recognised garage off-site thus minimising the potential for leakages;
- Secondary containment measures in areas where fuels, oils, lubricants and construction materials such as cement are stored and loaded or unloaded, including fueling points will be installed;
- In case of oil pollution, sedimentation and siltation, the contractor should halt construction activities immediately and recover the pollutant before it reaches the receiving water sources. In addition, the contractor should avoid washing construction equipment at the water pump or transfer station to avert pollution of receiving water sources;
- Design and install a septic tank system for human sanitary purposes at the campsite;
- Provide disposal facilities for wastes at the campsite and properly allocate the dumping site;
- Undertake regular water quality monitoring in the reservoir, and water body downstream to include dissolved oxygen, nutrients (N & P), pesticides, exchangeable ions and nuisance plants; and
- During weir construction, cuttings and residual mud generated during the channel deepening and widening process will be dried, stored and handled in appropriately bounded or under-lined areas and re-used for other project infrastructure.

With implementation of the above mitigation measures, the residual impact severity will reduce to minor.

Operations phase

The sources of surface water contaminants during the operations phase will be from the maintenance activities of the project infrastructure like the intake weir, headrace, forebay, penstock and powerhouse. In addition, the installed equipment such as the welded steel-piped penstock and turbines may slowly dissolve in the water. Of special concern are the turbines, which will be constantly turned by moving water. Turbines and the penstock will be made of steel, which does not oxidize easily in water, however the steel wears with time.

In addition, noticeable sources of water contaminants during the operations phase include minor (small scale) spillage of fuels, lubricants and other toxic materials from operation and maintenance vehicles and the disposal of waste and wastewater from the worker's camp. The number of persons proposed for employment by the project during the operations phase will be 29, compared to the construction phase where 179 persons will be employed.

The intensity of this impact is very low and the sensitivity of the receptor is medium resulting in a minor impact severity before mitigations.

Proposed mitigation measures:

- The project infrastructure such as the weir, penstock and the turbines which will be in contact with water will either be made out of insoluble material or coated with insoluble material;
- Regular and routine monitoring and maintenance will be undertaken to ensure that all project equipment is in good working order at all times;
- A site operation waste and wastewater management aimed at minimising environmental damage from operations and maintenance activities, will be developed and implemented. This will include regular refresher training sessions for operations and maintenance workers as pertains to safe and proper storage, handling, use, cleanup, and disposal of oils, fuels and other chemicals and the implementation of a comprehensive spill response plan including equipment and training; and
- The operations vehicles will be regularly maintained from a recognised garage off-site thus minimising the potential for leakages.

With implementation of the above mitigation measures, the residual impact severity will remain minor.

6.3.12. Sedimentation and siltation of downstream water sources

The analysis of the potential project impact discussed in this section is based on the possibility that during the implementation of the proposed Sindila MHP activities, organic matter and other soil components will be released into the river and streams within the project area and cause sedimentation and siltation downstream.

Baseline information is presented in Section 4.1.3. (Water quality).

The results of the water quality laboratory analysis indicate that the water quality parameters of the samples collected at the selected sites are within the recommended national potable water standards except for the following physical parameters for selected samples; apparent colour, total suspended solids and bacteriological parameters: faecal coliforms and E. coli.

Potential sources of water sediments were identified and analysed on a case by case for each of the project phases. These were then used to discuss the likely increase in river sedimentation and siltation downstream that will be attributed to implementation of the proposed project Sindila MHP. Reference was also made to relevant national legislation including the National Environment (Wetlands, River Banks and Lake Shores Management) Regulations as contained in the National Environment Act Cap 153 and the Water Act Cap 152.

Large scale sedimentation and siltation such as that resulting from landslides has been considered under contingency/unplanned impacts (Section 6.4 below) and is therefore not assessed here.

Construction phase

Construction activities will include clearing of vegetation, stream crossings, operation of large equipment and equipment lay down which all have the potential to result in soil disturbance at the construction sites, potentially resulting in soil erosion, degradation of affected areas and hence sedimentation of the water courses.

The project is located on steep slopes (weir; 1563.5m.a.s.l, forebay; 1530m.a.s.l and powerhouse; 1220m.a.s.l) that are highly susceptible to erosion. Project structures such as the access road to the powerhouse will be constructed across the Sindila stream hence rendering them susceptible to stream siltation and sedimentation. The susceptibility of the location to soil erosion, coupled with the already poor quality of the water from River Sindila and the nearby streams, already indicate a high occurrence of sedimentation and siltation in the river. The soil disturbance during establishment of the proposed project infrastructure will therefore increase the impervious surface area in the project area, in so doing, increasing surface runoff velocity and thus resulting in possible sedimentation and siltation of downstream water sources.

The intensity of this impact is medium and the sensitivity of the receptor is medium resulting in a moderate impact severity before mitigations.

Proposed mitigation measures:

- Install soil erosion control structures at all construction sites;
- Install and regularly empty, sediment traps in surface drains, along roads and construction areas.
- To prevent sedimentation of streams during construction of the diversion channel, the contractor should construct metallic barriers (sediment traps) along the diversion channel (between the channel and the river) such as hard gauge iron sheets to prevent and/or arrest any falling debris, soil or rocks from reaching the river;

- Proper design for storm water drainage facilities and maintenance during the construction phase are critical for mitigation;
- Construction during heavy rains should be avoided as much as is possible as water logged soils are easily eroded;
- Disposal of cut top soil should be undertaken outside fragile ecosystems and water sources downstream, under the direction of the resident engineer who should approve disposal sites; and
- Following completion of construction works, top soil removed and stockpiled should be used in restoration; vegetation native to the area will be re-established to ensure stabilisation of project area and its surroundings.

With implementation of the above mitigation measures, the residual impact severity will remain moderate.

Operations phase

There are no noticeable sources of sedimentation materials during the operations phase. Therefore, this impact is considered insignificant during the operations phase, and has therefore not been assessed further.

6.3.13. Impact on downstream river flows and community water sources

The analysis of the potential project impact discussed in this section is based on the fact that during the implementation of the proposed project activities, a portion of water will be diverted from its normal course for use in power generation which will result in a reduction in the downstream river flow and therefore, the amount of water available for community water use along the river downstream.

Baseline information is provided in Sections 4.3.5 (Water and sanitation). The local community uses the water downstream for bathing, fishing and other domestic purposes. The results of a hydrological study (see Annexure 10 for hydrology report) indicate that there will be fluctuations in the overall range of water levels experienced under average flow conditions in the river.

Causes of reduction in the flow rate/intermittent flows were identified and analysed on a case by case basis. These were then used to discuss the likely reduction in the flow rate/intermittent flows that will be attributed to the proposed project.

Construction phase

No water will be diverted during the construction phase. This impact is therefore not applicable to the construction phase, and has therefore not been assessed further.

Operations phase

During the operations phase, water will be regulated at the weir, diverted through the intake structure to the headrace for use in the generation of power. This will result in a fluctuation in the volume of water left to continue flowing normally through the existing watercourse particularly for the section between the intake weir and powerhouse.

The design flow for Sindila MHP will be 1.7 m^3/s(Section 2 above). According to Section 4.1.3, the long term mean daily flow at the proposed site is 0.147 m^3/s with a minimum flow of 0.02m^3/s and a maximum flow of 27.1 m^3/s.

Abstraction of water from River Sindila for power generation will therefore reduce the amount of water available for the water users especially during the minimum river flows (0.02m^3/s) experienced in the dry season. This has the potential to impact on the aquatic biodiversity within the river and community water users around the river. However, according to Section 2.4.1.1 (Weir and Intake structure), the weir will be designed to include an un-gated opening for uninterrupted environmental flow release for downstream users as well as the supporting

ecosystem(flora and fauna) along the river up to tailrace end. The un-gated opening will allow a flow of 0.106m^3/s (see Section 4.1.3).

It is important to note that the calculated environmental flow is higher than the modelled minimum flow for River Sindila. However, River Sindila is joined by Ntuma, a perennial stream at coordinates (UTM 35, 833433E 64378N) a few metres downstream of the weir. Ntuma stream together with River Sindila, will provide a sustainable flow required for flora, fauna and community water needs for River Sindila.

Baseline information in Section 4.2.3.6 above (aquatic biodiversity of the project area), indicates that River Sindila on which the proposed Sindila MHP is to be located, consists of a variety of aquatic biodiversity including fish, phytoplankton, zooplankton and macro-invertebrates.

The highest aquatic water requirement in River Sindila between the proposed weir and the powerhouse is for the fish species, *Labeo forskalii*, which use the river as a breeding and nursery ground as a potamodromous fish. Potamodromous fishes are known to migrate during the peak rainy season for their spawning, feeding and to nursery grounds. The migratory fish habitat in a lotic river, include; rocks, boulders and aquatic vegetation in the river fringes. Therefore, the determined environmental flow (1.06m^3/s) should be maintained, especially during the rainy seasons for the maintenance of the fish habitats for the migration of *Labeo forskalii* in River Sindila. This fish species will therefore not be affected by the low river flows between the weir and the tailrace as a result of abstraction for power generation and river seasonality, since members of this species mainly embark on migration during peak flows.

In addition to the above, it is important to note that River Sindila is also the main source of drinking water, water for bathing, washing clothes and other domestic chores in the PAI. Along River Sindila there are five water collection points located downstream of the diversion point and before the tailrace which include; Nyamuchimba, Mabondo, Kiralho point, Ekyamulamo and Ekyamugisa at which the people of Sindila community collect water for domestic use. The average daily community water abstraction at these points is approximately 0.0218 l/s between the weir and the powerhouse. The community water requirement is relatively low (0.0218m^3/s) and falls within the determined environmental flow that will be left in the river to sustain fauna, flora and cater for community water needs. Furthermore, River Sindila is joined by a perennial stream (Ntuma) below coordinate 833433E 64378N, UTM 35 (see Section 4.1.4.2 below). Ntuma stream contributes to the flow of water in River Sindila all year round.

It is also important to note that the project will provide water collection points along the headrace canal. These points will be located where the headrace canal crosses existing community footpaths to the river. Therefore, community members will no longer need to go all the way to the river to fetch water. However, only one water collection point (Nyamuchimba) will be located along the headrace canal. The communities on the left bank and along other collection points along the right bank (Mabondo, Kiralho and Ekyamularo) will still fetch water from the river.

The intensity of this impact is low and the sensitivity of the receptor is high resulting in a moderate impact severity before mitigations.

Proposed mitigation measures:

- Maintain at all times, and more especially during critical low flow periods, the stipulated minimum flow (0.147 m^3/s) in the river section between the intake works and point of return of flow to the main River Sindila for purposes of in stream water use, as included in the water abstraction permit issued by the Directorate of Water Development (DWD) on 10th December 2013;
- Manage operations to avoid rapid fluctuations in downstream flow;
- Provide an alternative water source for example by constructing protected springs for the community members whose water sources will be affected; and
- There should be periodic monitoring of water flow between the weir and powerhouse and downstream of the powerhouse.

With implementation of these mitigation measures, the residual impact severity will be reduced to minor.

6.3.14. Impact on fish migration upstream of the weir

The analysis of the impact discussed in this section is based on the fact that during the implementation of the proposed Sindila MHP activities, an intake weir will be constructed across the river. Construction of the weir across the river will create a barrier effect that will impede fish migration upstream of the weir.

Relevant baseline information is presented in Section 4.2.3.6 (aquatic biodiversity of the project area). According to baseline information three fish of the same species (*Labeo forskalii*) were caught from River Sindila during the assessment in May 2014. One fish was caught in the minnow trap set before the proposed powerhouse location (UTM Zone 35N, Arc 1960, 0833132, 0064664) and two from the trap set downstream after the proposed powerhouse location (UTM Zone 35N, Arc 1960, 0833137, 0064653). No fish catches were recorded from the traps set close to proposed weir location.

Project activities, which may affect fish migration, were identified. These activities were evaluated to determine the likely extent to which fish will be affected. Professional judgment of the consultants and experience from similar projects was used to assess the impact on fish migration as a result of construction of the weir across the river.

Construction phase

During the construction phase, the intake weir will be constructed across River Sindila to divert water through the headrace for use in the generation of power. However, during this time there will be no barrier (weir) to fish migration. Therefore the impact is only applicable to the operations phase.

Operations phase

During the operations phase, the weir will exist across River Sindila which is a potential barrier to fish migration. Mature fish migrate upstream to spawn while young fish migrate downstream.

Even though traps set close to the proposed weir location had no fish, migration of fish upstream of this location cannot be ruled out. Labeo are generally longitudinal migrants that move within the main river channel or up and down tributaries as juveniles seek riffle/rapid habitats and adults inhabit both riffles and pools. They require relatively high dissolved oxygen levels (second to riffle guilds) and as such they are sensitive to reductions in water quality and may locally disappear under eutrophic conditions or when their river is dammed and prevents migration. In breeding seasons, the genus Labeo migrates upstream in numbers to breed in clear running waters in rocky substrates. During migration they use the mouth and broad pectoral fins to climb damp surfaces of barrier rocks and weirs. However as discussed under Section 6.3.13 above, this fish species will not be affected by low river flows between the weir and the tailrace as a result of abstraction for power generation and river seasonality, since members of this species mainly embark on migration during peak flows.

The intensity of this impact is medium and the sensitivity of the receptor is high resulting in a moderate impact severity

Proposed mitigation measures:

- The intake weir should be designed to include rock ramp fish ways made of large rocks, and timber to create pools and small falls that mimic natural structures suitable for the species (*Labeo forskalii)* found in River Sindila; and

- Maintain major peaks in the river's flow level that occur at a given recurrence interval to provide cue for spawning migrant fishes such as Labeo to start upstream spawning migration.

With implementation of these mitigation measures, the residual impact severity will be reduced to moderate.

6.3.15. Impacts on cultural resources

The analysis of the potential project impact described in this section is based on the possibility that during the implementation of the proposed Sindila MHP, resources such as cultural or sacred sites as their cultural practices may be impacted on.

It is worth noting that no archaeological sites were encountered in the project area. However, the project is located on the slopes of Rwenzori Mountain on which some of the people in the project area (the Bakonzo) have some degree of cultural attachment. It is also located 430m North West from RMNP, which is an important resource for the community.

The impact of the proposed Sindila MHP project on the above mentioned cultural resources is assessed below for each of the phases.

Construction phase

During construction activities, excavations will be carried out within the project footprint. These excavations are likely to result in destruction of any artifacts if any, that may be located within the project footprint. Also cultural practices of the construction team might 'water down' the traditional cultural practices of people in the area.

During the construction phase, this impact will be highly noticeable if the majority of the construction crew are from outside the project area, freely interact with the local community members, attach less value and de-campaign some of the traditional cultural practices and make attempts to promote their own culture. However, the majority of the construction crew from outside the proposed project area will be housed in the workers camp with their movements controlled or restricted.

The intensity of this impact is low and the sensitivity of the receptor is high resulting in a moderate impact severity.

Proposed mitigation measures:

- Before commencement of the construction works, the contractor will be taken on a guided tour of the site to get acquainted with the physical cultural resources;
- Butama Hydro Electricity Company Ltd and its contractors will exercise care so as not to damage any artifacts or fossils uncovered during excavation operations and will provide such cooperation and assistance as may be necessary to preserve the findings for removal or other disposition;
- A "Chance find" procedure will be developed and used during the construction phase;
- All the construction team members will be inducted upon arrival at the work camp. Among other issues, respect for the local traditional cultures will be emphasised; and
- All the foreign construction team members will be accommodated at the workers camp and their movements controlled to avoid any negative influence on local community cultural practices.

With the implementation of the above mitigation measures, the residual impact severity will remain moderate.

Operations phase

No earthworks are planned on new areas during the operations phase, therefore it is envisaged that no more cultural sites – especially those that are buried will be affected during this phase.

In addition to the above, the operation and maintenance team will consist of few personnel – 29 in number including; Manager(1), Mechanical engineer(1),Electrical Engineer(1) (1), Supervisor (1), Account Assistants(1), Powerhouse Operators (8), Skilled Labourers (2), Unskilled Labourers(10) and Security personnel (4).

Therefore, during the operations phase, in light of the fact that no further excavations will be undertaken and given the small number of employees from outside the project area that might influence the local culture, this impact is considered insignificant and has therefore not been assessed further. Nevertheless, the following mitigation measure is proposed.

Proposed mitigation measures:

- All the operations team members will be inducted prior to the commencement of the operations phase. Among other issues, respect for traditional culture will be emphasised.

6.3.16. Segregation and differential rewards

The analysis of the potential impact discussed in this section is related to the possibility that during the development of the proposed Sindila MHP, there may be unfair remuneration of some employees. The potential for segregation and a differential reward system to occur is assessed below.

Construction phase

The construction phase will employ both locals, and personnel from outside the area for the different jobs available (179 in total).

There are often concerns that local workers who often form the bulk of the casual/manual labour workforce tend to be underpaid, when compared to other workers from outside the handling the same tasks. If not mitigated, this is likely to lead to social antagonism between the locals and workers from outside the area.

The intensity of this impact is very low and the sensitivity of the receptor is high, resulting in a minor impact severity before mitigations.

Proposed mitigation measures:

- Butama Hydro Electricity company Ltd's contractor(s) employment activities will be monitored on a regular basis throughout the construction phase, including number of jobs created by employment type (skilled/semi-skilled/unskilled), number of jobs by gender, employment type and geographical area; total man hours and wages paid, by employment type, gender and geographical area; and rate of employee turnover by gender and area;
- Butama Hydro Electricity company Ltd's contractor(s) will be encouraged to pay a "living wage" to all workers; and
- The participation of local community members will be maximised during the construction phase. Unskilled labour will be recruited exclusively from directly affected communities, and semi-skilled labour will be recruited preferentially from such communities, provided that they have the requisite skills, competence and desired experience.

With implementation of these mitigation measures, the residual impact severity will remain minor.

Operations phase

The cause of this impact will be the same as that described under the construction phase above. However, at this stage, majority of the employees will be skilled although few in number given the highly technical nature of the work.

Despite the above, compared to the construction phase, this impact is considered insignificant during the operations phase and has therefore not been assessed further.

6.3.17. Increased spread of sexually transmitted diseases and other communicable diseases

The analysis of the potential impact discussed in this section is related to the possibility that during the development of the proposed Sindila MHP, there may be increased spread of sexually transmitted diseases. The potential for increased spread of sexually transmitted diseases to occur is assessed below.

Construction phase

Physical and social interactions between the construction workers and locals may negatively impact on public health. Usually, activities such as that which is proposed, are often associated with an increase in the spread of sexually transmitted infections (STI), and HIV/AIDS in particular - a major development challenge in the country, as a result of the socialisation between the locals and workers, and boosted prostitution.

However, for the Sindila MHP, the construction workers from outside the area will be accommodated at the workers camps and their movements controlled.

The intensity of this impact is low and the sensitivity of the receptor is high resulting in a moderate impact severity before mitigations.

Proposed mitigation measures:

- Special specifications in the contract documents should stipulate the need for HIV/AIDS Awareness and sensitisation campaigns. The HIV/AIDs awareness trainer will be expected to collaborate with local NGOs, CBOs and District Health Officers for sustainability and integration of activities into the existing structures of the local health institutions;
- Ensure that the workers camp and construction areas are open only to formal employees;
- Provide the workforce with access to primary health care onsite, insecticide-treated mosquito nets, prescriptions, prophylactics and condoms, and basic testing for TB, STDs and HIV/AIDS;
- Engage an NGO to prepare community institutions for any influx of in-migrants (for example, by developing by-laws and community policing systems for larger numbers of in-migrants);
- Support local healthcare facilities through training of local healthcare professionals, regular supply of medical supplies and up to date equipment;
- Establish a community health programme including providing support to existing or new local programmes such as mother and child nutrition, community health awareness, HIV/AIDS awareness, hygiene and immunisation, malaria control measures (indoor spraying of insecticides, personal protection measures, and control of mosquito larvae), and local Voluntary Counselling and Testing (VCT) programmes.
- Butama Hydro Electricity Company Ltd and its subcontractors will put in place an STI and HIV/AIDS awareness campaign and services for the construction crew to promote safe sex practices and other control measures in order to reduce this anticipated negative outcome;
- Workers with the exception of local workers, who will return to their homes, will be housed in the workers camp and will have access to health services like HIV/AIDs counseling; and

- All workers will be inducted in relevant codes of conduct that minimise exposure to risky life styles including unsafe sex practices.

With implementation of these mitigation measures, the residual impact severity will reduce to minor.

Operations phase

During the operations phase, there will be very few people on site for operation and maintenance purposes. It is assumed however, that by this stage, the local community members will have already been sensitised during the construction phase and thus aware of the dangers of unsafe sexual practices including the necessary prevention measures. Therefore, this impact is considered to be insignificant during this phase and has not been assessed further.

6.3.18. Physical resettlement of people and associated impacts

The analysis of the potential project impact discussed in this section is related to the fact that during the implementation of project activities, the human settlements within the proposed project footprint might have to be relocated/ resettled to another place to pave way for project activities.

The baseline information indicates that besides the weir and a part of the headrace canal (approximately 400m), which are entirely located in a riverine forest with no settlements; the other project components are located along community roads and footpaths as well as scattered households.

The settlement pattern within the project impact area was explored and analysed. The settlements within the project footprint that will be affected by the proposed project were established. This was then used to discuss the possibility of the need for relocation/resettlement and associated nuisance impacts as a result of the project. Knowledge of the communities, the requirements of the proposed project and experience from similar projects was used to assess the need for resettlement as a result of the proposed project activities.

This impact is applicable to the construction phase only, as it is assumed that no other land will need to be acquired during the operations phase.

Construction phase

The proposed project will result in the need for resettlement of some homesteads within the project footprint for the establishment of project structures. In addition, some of the homesteads on the lower side of project footprint might have to be resettled to avoid the effects noise from the powerhouse during the operations phase. The nearest homestead to the proposed powerhouse is located at 35N 0832269E 0066335N (39m downstream).

According to the Updated Resettlement Action Plan (September, 2014), the total number of the affected persons is about 411, according to the land survey report of September 2014 they are 22 households out of 107 who will lose more than 20 percent of their land and 5 households will lose 100% of their land see Annexure 1. Due to the change of the project design no household to be physically displaced by the project activities, those household whose properties were included in the valuation and land survey report as to be physically displaced households basing on the initial design of the project will be given a disturbance allowance and compensate land for land if avoidance of their properties is not possible.

Physical resettlement of homesteads has far reaching impacts. In addition to relocation to a newplace, especially if people are resettled into different communities that are reasonably far away from their original area of residence. This can result in the breakdown of existing social networks, loss of access to cultural and social centres and increased vulnerability of the relocated homesteads especially if the new areas have fewer opportunities than the former.

Due to the typical rural nature of the proposed project area and the fact that many local community members own portions of land in different locations within the larger project area the physically displaced homesteads will be accommodated within their local communities unless some particular homestead heads prefer moving to a different area. The affected homesteads in this case will mainly incur the inconveniences of relocation provided all the assets on the affected land, are properly valued and compensation made in a timely manner.

All the households to be resettled will be resettled on their land elsewhere, so no new locations have been identified by the project to resettle the affected persons (Updated Resettlement and Action Plan, September 2014)

The intensity of this impact is medium and the sensitivity of the receptor is high resulting in major impact severity before mitigations

Proposed mitigation measures:

- Butama Hydro Electricity Company Ltd will develop a thorough Re-settlement Action Plan (RAP) and implement this plan in accordance with the Ugandan laws and donor agency guidelines such as World Bank Group and its Safeguard Policies;
- A comprehensive RAP should be conducted before the commencement of the construction phase for the proposed Sindila MHP;
- Where physical displacement is necessary, the developer will agree compensation with the affected person(s) and in accordance with District rates and guidance;
- Following agreement with regards to compensation, any required economic and physical displacement must take place prior to construction phase;
- Limit the project activities to the footprint of the required area;
- A grievance mechanism will be in place to ensure that grievances from displaced persons are handled carefully and in a manner that promotes confidence and trust;
- The affected communities should be fully sensitized and the homesteads to be resettled given options before the commencement of the construction phase;
- Land surveying and property Valuation will be undertaken by competent authorities such as Certified Valuers and Land Surveyors. Negotiations with land and property owners will be in compliance with local market prices and government rates so as to establish rational figures for compensation and subsequent resettlement of the affected persons;
- The PAPs will be individually notified about the compensation amount to be paid. They may then accept or refuse the compensation proposed depending on the damages incurred; and
- The number of PAPs to be physically resettled will be minimised. Where possible, the project designs especially alignment of the access roads will be slightly altered to avoid homesteads.

With implementation of the above mitigation measures, the residual impact severity will be reduced to minor.

Operations phase

All the activities that require resettlement of homesteads will occur during the construction phase. Therefore, this impact will not occur during the operations phase and has not been assessed further.

6.3.19. Vehicular and other equipment emissions

Operation of equipment and machinery such vehicles will produce emissions, which could impact on the ambient air quality.

The baseline ambient air quality (Section 4.1.1 - Climate and Air) in the larger part of the proposed project area is that of an unindustrialised and typical rural area, characterised by good air quality. There are no major industrial developments in the area.

Sources of emissions were identified and analysed on a case-by-case basis. These were then used to discuss the likely quantity and quality of emissions that will be produced. The professional judgment of the consultants and experience from similar projects was used to determine if there would be significant air quality degradation from the current baseline as a result of the project activities. Where applicable, reference is made to the national environment (draft air quality standards) regulations for Uganda (2006) (Table 6.2).

Table 6.2: Regulatory air quality standards for selected gases

Pollutant	Averaging time for ambient air	Standard for ambient air
Carbon dioxide (CO_2)	8hr	9.0ppm
Carbon monoxide (CO)	8hr	9.0ppm
Hydrocarbons	24hr	$5mgm^{-3}$
Nitrogen dioxides (NO_2)	24hr	0.10ppm
Smoke	Not to exceed 5 minutes in any 1hr	Ringlemann scale No.2 or 40% observed at 6m or more
Soot	24hr	$500\mu g/Nm^{-3}$
Sulphur dioxide (SO_2)	24hr	$0.15ppm^{-3}$
Sulphur trioxide (SO_3)	24hr	$200\mu g/Nm^{-3}$

Note: ppm= parts per million; "N" in $\mu g/Nm^{-3}$ standards for normal atmospheric conditions of pressure and temperature (25^{o}C and 1 atmosphere).

Source: Draft national air quality standards and regulations (2006).

Construction phase

The most significant sources of gaseous emissions are expected to be from operation of vehicles and equipment.

With regards to the construction equipment, as described in Section 2.5.2 above, the construction equipment will include:

- Loader Backhoes;
- Dump Trucks;
- Vibrator Roller;
- Water Bowser;
- Excavator;
- Dumpers;
- Mechanical Winch;
- Dump Trucks;
- Diesel Generators;
- Dewatering Pumps
- Jack Hammer;
- Welding Plants;
- Air Compressor; and
- Concrete mixers.

The gaseous emissions caused by the project based on the above listed equipment, are expected to include CO_2, NO_2, SO_2, and volatile organic compounds since most of the construction equipment and machinery will be powered by diesel engines.

Significant receptors in as far as any changes in ambient air quality are concerned will be the local community members settled within the proposed project area. It is also important to note that, gaseous emissions are not restricted to the emission sources; they can spread to a wider area as determined by the direction of wind.

Emissions associated with Sindila MHP are not expected to noticeably alter air quality or cause concentrations that exceed the national environment (draft air quality standards) regulations for Uganda, based on past experience of similar construction site activities; and the lack of other significant cumulative impacts from vehicles, other projects, or wildfires.

With regards to the access roads, emission impacts will be attenuated, since they are spread out along the road, as opposed to being concentrated at one location at the site.

Continuous and long-term exposure to air pollution can damage human and animal health, especially from respiratory related infections. Such health complications are not anticipated due to the non-continuous nature of the emissions.

The intensity of the impact is low and the sensitivity of the receptor is high resulting in a moderate impact severity before mitigations.

Proposed mitigation measures:

- Vehicles and machinery will be fitted with appropriate exhaust systems and devices;
- Efforts will be made to use fuel-efficient and low emissions machinery and vehicles, which will be serviced regularly and in accordance to the manufacturers' specifications to maintain efficiency;
- All emission-producing equipment will be operated only when necessary and unnecessary idling of equipment will be avoided;
- A grievance mechanism will be put in place to address air quality grievances from local stakeholders; and
- Journey management will be undertaken in order to ensure that only the necessary trips required for the construction activities are made.

With implementation of the above mitigation measures, the residual impact severity will reduce to minor.

Operations phase

During the operations phase, emissions will be restricted to light vehicles transporting operation and maintenance crew to and from site. These emissions are considered insignificant and have therefore not been assessed further.

6.3.20. Increased dust levels (particulate matter)

Dust will be generated during construction activities, and may:

- Temporarily hinder visibility for workers and local communities;
- Cover vegetation surfaces including crops in the surroundings, in so doing slowing down the rate of photosynthesis and affecting the quality of forage for animals; and
- Affect respiratory health of workers and potentially local community members.

Relevant baseline information (Section 4.1.1 Climate and Air) indicates that the proposed project area can be described as generally rural with interfaces of natural vegetation, cultivated lands and lands under fallow. The area is largely vegetated and therefore the dust nuisance in Sindila Sub-county is insignificant. Transport in the PAI is mainly by foot along community access roads and footpaths with low dust levels.

Potential sources of dust were identified and analysed on a case by case basis. These were then used to discuss the likely quantity and extent of the dust that will be generated. Uganda does not have regulatory guidelines for dust generation. Therefore, the professional judgment of the consultants and experience from similar projects was used to determine if there would be significant degradation of baseline conditions as a result of the proposed project activities.

Construction phase

Construction activities will result in dust emissions as a result of vegetation clearance at the proposed project site for establishment of the different infrastructure components and along the access road routes (1.6km and 1km long to the powerhouse to the forebay respectively). Dust will also be generated during the transportation of required construction materials from the different source points to the construction sites.

Although the intake weir and approximately 400m of headrace are located within a riverine forest area, where there are no settlements, the rest of the project infrastructure falls within community land mainly used for agriculture and settlement. Dust emissions at the proposed project site and majorly along the roads that will be used to access the sites during construction of the Sindila MHP, are likely to pose a nuisance to local community members along these roads.

The intensity of the impact is medium and the sensitivity of the receptor is high resulting in a major impact severity before mitigations.

Proposed mitigation measures:

- All unpaved haul roads will be continuously watered by watering trucks or constant misting, so that surfaces remain damp at all times when in use during construction. The Contractor will make provisions to have an adequate amount of water and appropriate equipment to disperse water onsite at all times;
- Gravel cover shall be applied to unpaved surfaces which are regularly used;
- All truck loads that enter or leave the site will be covered and if required, rumble grids will be installed at site exit points to minimise dust along community roads;
- Clearing of land will be carried out systematically - with clearing restricted to only the required areas so as to minimise disturbed and exposed areas;
- Stockpiles of construction materials will be shielded from wind using bins and monitored daily during the construction phase. In addition, they will be located away from public and residential areas;
- All vehicle movements will be subject to risk assessment (which therefore allows for the incorporation of project-specific controls) and all drivers will be inducted in health, safety and social and environmental issues;
- A speed limit of 40km/h for light vehicles and 30km/h for heavy vehicles will be maintained on routes used to access the construction sites;
- Community awareness and sensitisation about the proposed project will be created prior to construction activities so that community members become more vigilant and are aware of what to expect in terms of potential nuisances; and
- A grievance mechanism will be put in place to address grievances from local communities.

With implementation of the above mitigation measures, the residual impact severity will reduce to moderate.

Operations phase

The likely increment in dust levels during the operations phase will be insignificant since during this phase, emissions will be restricted to light vehicles transporting the operation and maintenance crew to and from site. This impact has therefore not been assessed further.

6.3.21. Noise effect and vibrations on local communities

Noise will be generated from project activities and could become a nuisance to the local stakeholders within the vicinity of the project site at nearby human settlements and the larger community area neighbouring the Sindila MHP.

Relevant baseline information is presented in Section 4.1.2 (Baseline noise conditions) and Section 4.3.10 (Settlement).

According to baseline information, the average noise levels at the selected sensitive receptors were within permissible limits for residential areas as provided for in the National Environment (Noise Standard and Control) Regulations of 2003, which sets the maximum limit as 50dB(A) during the day, with the exception of the average noise levels for homesteads along the powerhouse access road, Kabwe nursery school along the penstock path, homestead along the penstock path and a homestead along the headrace canal. These noise levels were largely influenced by sound from birds and insects calls and conversation from the nearby community.

According to Section 4.3.10 (Settlement), the settlement in the Sindila Sub-county and the PAI is 100% rural. The settlement pattern indicates two distinct categories i.e. clustered and scattered settlement patterns. Besides the weir and part of the headrace canal which are located in a riverine forest with no settlements; project components like the forebay, penstock, the powerhouse and access roads are located in community areas characterised by gardens, fallow land settlements. These settlements are likely to be affected by noise generated from the project activities.

Baseline noise levels at the proposed project site were determined. The baseline noise levels were then used to assess the likely increase in noise levels as a result of the proposed project activities.

Construction phase

The major sources of noise and vibration during the construction of the Sindila MHP will be mainly from moving vehicles, operation of construction equipment, and noise generated by the construction workforce. Some of these noise sources are continuous, while others are punctual, like breaking of soil by construction equipment.

The maximum noise level recorded was 73.3 dB(A), and the minimum was 71.1dB(A) at the proposed weir location. Most of the average noise levels at the nearby sensitive receptors were within the permissible limits set for residential areas as provided for in the National Environment (Noise Standard and Control) Regulations of 2003.

Reference was made to the maximum permissible noise levels for construction sites and accelerating vehicles (see Table 6.3).

Table 6.3:Maximum permissible noise levels for construction sites and accelerating vehicles

Facility	Maximum Permissible Noise levels dB(A)	
	Day*	Night*
Construction Sites		
(i) Hospitals, schools, institutions of higher learning, homes for the disabled etc.	60	50
(ii) Buildings other than those prescribed in paragraph (i) above	75	65
(iii) Industrial	85	65

Facility	Maximum Permissible Noise levels dB(A)	
	Day*	Night*
Accelerating Vehicles		
4. Vehicles intended for carriage of goods and having a maximum mass exceeding 3.5 tonnes		
a) With an engine power of less than 75KW	81	
b) With an engine power of not less than 75Kw but less than 150KW	83	
c) With an engine power of not less than 150KW	84	

The letters "A" following the abbreviation "dB" designate a frequency-response function that filters the sounds that are picked up by the microphone in the sound level meter. (A) is used to measure hearing risk and for compliance with OSHA regulations that specify permissible noise exposures in terms of a time-weighted average sound level or daily noise dose.

Time Frame (The time frame takes into consideration human activity).

Day: 6.00a.m-10.00 p.m., Night: 10.00p.m- 6.00 a.m.

Source: Environmental Legislation of Uganda Handbook (2003).

The noise created at the sites during construction is not expected to noticeably alter baseline noise levels, but it is possible that some events may result in noise levels that exceed the maximum permissible noise levels for construction sites (see Table 6.3 above) as set out by the national environment (noise standards and control) regulations of 2003. Noise levels generated will be more disturbing if construction activities take place at night. However, based on current planning this is not envisaged.

In addition, noise along the proposed total 2.6km long access roads will be generated by project vehicles during its construction and during the transportation of equipment and other required materials to the site. The noise created along the access road during the construction phase will alter baseline noise levels but it is unlikely that noise levels will exceed the maximum permissible noise levels for construction sites. In addition, unlike the noise associated with site activities, the noise generated during construction of the access road will not be continuous and/or stationary and is therefore not considered particularly relevant, nevertheless noise mitigation measures have been suggested for the access road below as well.

It is important to note however, that, noise levels generated tend to reduce exponentially with increasing distance from the source, and therefore irrespective of the sensitivity of the receptor, it is the intensity of the impact that influences the severity of the noise impact.

The intensity of the impact is low and the sensitivity of the receptor is high resulting in a moderate impact severity before mitigations.

Proposed mitigation measures:

- Prior notice will be given to the local community members to keep them informed of what will take place. Where necessary, they will be advised to avoid some sections at certain times of the construction phase for safety reasons;

- Noise events will be scheduled for appropriate times of the day to avoid disturbance of any programmed community gatherings;
- Construction activities will be limited to only day time hours;
- Community awareness of the project activities and schedules will be created to enable community members plan accordingly;
- Unnecessary noise from the construction crew (such as loud vocalisations and music) will be prohibited;
- Adherence to national noise regulations as stipulated in the National Environment (Noise Standards and Control) Regulations (2003) will be ensured;
- A grievance mechanism will be established to enable local people express their concerns;
- Noise monitoring will be undertaken within the area and at nearby sensitive receptor sites during construction;
- Use of well maintained and serviced equipment that generates low noise levels;
- Prohibit idling of machinery including vehicles, unless necessary;
- Prohibit off-road driving;
- The use of horns should be reserved for safety considerations, and not used as a common communication method;
- Acoustic insulation (e.g. screens or bunds) will be deployed when necessary, especially on compressors, when possible. Equipment will be operated with all noise-reducing components (hoods, screens) in the correct position; and
- Noisy equipment will be sited with regard to or away from sensitive receptors whenever possible.

With implementation of the above mitigation measures, the residual impact severity will reduce to minor.

Operations phase

Noise emissions and vibrations during the operations phase will be from the installed machinery at the powerhouse and operation and maintenance vehicles. However, the powerhouse will be insulated and access to these structures will be restricted thus preventing exposure of the community members to the noise emitted.

The intensity of the impact is very low and the sensitivity of the receptor is high resulting in a minor impact severity before mitigation.

Proposed mitigation measures:

- The powerhouse shelter will be insulated to minimise the level of noise emitted;
- A reasonable safety perimeter will be established around the powerhouse where access by community members will be highly restricted. By so doing, the emitted noise levels from the powerhouse will not reach the community members; and
- Only monitoring site visits necessary for proper running of the hydropower project will be conducted.

With implementation of the above mitigation measures, the residual impact will remain minor.

6.3.22. Poor sanitation due to poor domestic waste management

The analysis of the potential project impact discussed in this section is related to the possibility that during the implementation of project activities, wastes generated may be poorly handled and disposed of.

The potential for the waste generated during project activities to be poorly handled and result into further decline in the sanitation levels within the project area is assessed in the section below.

Construction phase

Domestic wastes that may include food waste, food packaging and materials brought to site by construction workers among others, will be generated during the construction. If not properly handled, they may turn out to be a sanitation hazard as well as attract vermin such as rodents. This is particularly vital for the weir location and a section of the headrace canal which are located in the Riverine forest as plastic wastes may affect the health of the ecosystem. In the community area, plastic wastes may also affect the health of livestock if ingested. The impact will be of a direct nature.

The intensity of this impact is low and the sensitivity of the receptor is medium resulting in a moderate impact severity before mitigations.

Proposed mitigation measures:

- Butama Hydro Electricity Company Ltd should ensure that all waste will be removed from site and transported by a licensed waste carrier for proper disposal. Biodegradable and non-biodegradable wastes will be properly segregated during collection;
- All organic waste generated at labour campsites such as food stuffs shall be collected and transported by the contractor to designated landfills/composting sites within the project area;
- All plastic waste generated at campsites and in the course of undertaking works such as mineral water bottles, polythene bags, jerrycans, should be collected in mobile vans and adequately disposed of and some reused were possible;
- All waste generated from demolition of built up structures should be sorted (biodegradable, non-biodegradable, Metals, Glasses) by the contractor and disposed of appropriately at designated waste disposal sites;
- A mobile toilet for use by the construction personnel will be in place at the construction sites and the work camps, and emptied regularly by a licensed waste contractor;
- Anti-vermin safeguards (such as covering bins with lids) will be put in place; and
- During activities, the first priority will be to reduce, re-use and recycle waste in preference to disposal.

With implementation of these mitigation measures, the residual impact severity will reduce to minor.

Operations phase

The cause of poor sanitation due to domestic waste during the operations phase will be the same as that discussed under the construction phase above. However, during the operations phase, there will be very few people on site. During this phase it is envisaged that project waste management infrastructure will be in place. The impact during this phase is considered insignificant and is therefore not assessed further.

6.3.23. Effects of blasting

The analysis of the potential project impact discussed in this section is related to the possibility that during the development of the proposed Sindila MHP, the local community and animals will be affected as a result of blasting activities.

Construction phase

Controlled blasting of rocks will be conducted during construction of the weir and diversion canal and this is anticipated to have a negative impact on both animals and human beings. The animals including birds, however, are most likely to be displaced from the surrounding area due to sudden noise caused by blasting. The impact of blasting is more significant and disturbing if it comes as a shock or unexpected by the receptor (this refers to human beings).

The intensity of the impact is medium and the sensitivity of the receptor is high resulting in a major impact severity before mitigations.

Proposed mitigation measures:

- The day, time, hour and the minute at which the actual blasting will be conducted must be communicated to all the surrounding communities. All the people surrounding the project site especially those in Ntuma village must know the routine of blasting. The developer must work with the local leaders and properly plan for the blasting of rocks. People must know that a blast is pending such that they make arrangements to overcome any shock and avert accidents;
- Uncoordinated and haphazard blasting will not be tolerated. A properly agreed upon blasting time table should be developed and Butama Hydro Electric Company Ltd should stick to it; and
- As a precautionary measure, sirens must be sounded prior to blasting in order to prepare/forewarn the community. The timing and interpretations of these sirens should be agreed upon by the developer and the community. Activities in the camp site and other project sites should be halted at least 30 minutes to the actual explosion to prevent accidents.

With the implementation of the above mitigation measures the residual impact severity will reduce to moderate.

Operations phase

No blasting is expected during the operations phase of the Sindila MHP therefore this impact has not been assessed further.

6.3.24. Greenhouse Gas Emissions

Recent studies have suggested that the emission of greenhouse gases (GHG) from reservoirs due to rotting vegetation and carbon inflows from the catchment may be a significant source of GHG emissions.

Greenhouse gases (carbon dioxide and methane) are released into the atmosphere from reservoirs that flood forests and other biomass, either slowly (as flooded organic matter decomposes) or rapidly (if the forest is cut and burned before reservoir filling). Reservoir releases of carbon dioxide and methane are thought to contribute an estimated 7% of the global warming impact of all human activities.

The magnitude of the predicted climate change impact of this project depends on three factors: the amount of biomass that is inundated by the reservoir, the total surface area of the reservoir, and the flux rate. Provided that vegetation is at least partially cleared prior to inundation, GHG emissions will be relatively low, given that the surface area of the reservoir is not large in comparison to other man-made reservoirs in Africa.

This impact is applicable to the operations phase only since no flooding is expected during the constructed phase.

Operations phase

Construction of the flow diversion weir across the river has the potential of altering the river ecology. When the course of water is changed the surrounding areas may get flooded. The large quantities of water collected due to the flood emit a lot if GHG like carbon dioxide. The emissions are due to rotting vegetation and carbon inflows from the catchment.

The intensity of this impact is very low and the sensitivity of the receptor is high, resulting in a minor impact severity before mitigations.

Proposed mitigation measures:

- Consider selected clearance of vegetation prior to filling the reservoir.

With the implementation of the above mitigation measures, the residual impact severity will remain minor.

6.3.25. Introduction of invasive plant species

The forested area where the proposed weir and a section of the headrace canal are located is relatively 'undisturbed' and therefore prone to invasive plant species. Similarly, although other sections of the proposed project areas are currently under cultivation and settlement and therefore 'disturbed' and already prone to invasive plant species, some invasive plant species may be accidentally introduced in the area.

Baseline information is presented in Section 4.2.1 (Vegetation). The baseline information indicates that during the February 2012 site visit, none of the floral species identified within the project area is invasive.

The potential for project activities to introduce and/or increase invasive plant species in the project area is assessed in the section below.

Assessment approach

Project activities that are likely to result in the introduction and/or increase in the number and density of invasive plant species were identified. All plant species encountered were checked to determine if they are invasive. This list was used to evaluate the likely introduction and/or increase in the number and density of invasive plant species. Professional judgment of the consultants and experience from similar projects was used to assess the likely introduction and/or increase in the number and density of invasive plant species from the current baseline as a result of the project activities. Literature on the common invasive plant species of Uganda and the project area in particular was also reviewed.

Construction phase

The use of murram obtained from elsewhere in Bundibugyo district to construct the site may result in the introduction of invasive plant species.

Construction equipment that is not properly cleaned and sterilized has the potential to transport seeds of invasive species from other parts of Uganda or if imported into Uganda, other parts of the world. There are a variety of carriers of exotics ranging from a boot sole to the back-hoe.

In addition to the above, loss of indigenous vegetation especially in the riverine forest section may lead to introduction of invasive species of plants.

Invasive plant species have the potential of spreading quickly and inhibiting the growth of native vegetation reducing plant species diversity. Inhibition of crop growths in the surrounding cultivated lands could result in lowering crop yield in the area.

The intensity of this impact is medium and sensitivity of the receptor is high, resulting in a major impact severity before mitigations.

Proposed mitigation measures:

- Potential quarry locations for murram will first be inspected for the presence of invasive species and if any are found, these sources will not be excavated[5]

[5]However, there is still potential for the soils to have seeds of these invasives.

- Invasive species will be monitored and if they appear along the access road or at the site will be recorded and reported to the Bundibugyo District Local Government to allow further management of the species.
- Murram and subsoil will be sourced from licensed (by NEMA/Bundibugyo Local Government) sources according to a set of contractual environmental and social procedures

With the application of the above mitigation measures, the residual impact severity will reduce to moderate.

Operations phase
Impacts associated with the invasive plant species are anticipated to be significant during the construction phase only. As such, no assessment is made for this impact in the operations phase. However the equipment that will be brought in during the operations phase needs to be subjected to the applicable mitigation measures as recommended for the construction phase.

6.3.26. Increased Pressure on the social service sector

The analysis of the potential project impact discussed in this section is related to the possibility that during the implementation of project activities, the local social service sector will be overwhelmed by the presence of project employees who may be in need of these services.

Relevant baseline information is presented in sections 4.3.4 and 4.3.5 (health status, water and sanitation respectively). The baseline information indicates that the available social services in the proposed project area are already strained. The nearest health unit to Sindila sub-county is Kakuka Health centre III which is located 6Km away from the project area.

The people of Sindila Sub-county depend on River Sindila for potable water. There is a high prevalence of infectious and communicable diseases and HIV/AIDS is a health and development challenge with visible social and economic effects on the community.

The potential for project employees to exert further pressure on the social service sector is assessed in the section below.

Assessment approach
The number and type of employees to participate in the implementation of project activities was identified and analysed. Their accommodation during project activities and access to social services was also assessed. This was then used to discuss the likely increase in pressure on the social service sector as a result of the project activities. Knowledge of the communities and experience from similar projects was used to assess the increase in pressure on the social service sector from the baseline as a result of the project activities.

Construction phase
If the project leads to in-migration, it will increase pressure on the already strained social service infrastructure like housing, health, water sources and sanitation facilities in the area when people move into the community in anticipation of employment opportunities. In addition, this project is one of many that are being implemented in the region.

The intensity of this impact is low and the sensitivity of the receptor is high resulting in a moderate impact severity before mitigations.

Proposed mitigation measures:
Workers during the construction phase with the exception of local workers who will return to their homes in the local communities, will be housed in the temporary workers' camp or local guest houses (for workers from outside the region) and will have access to the necessary social service amenities like health, water and sanitation facilities

With the implementation of the above mitigation measures, the residual impact severity will reduce to minor.

Operations phase
The cause of increase in pressure on the social service sector during the operations phase will be the same as that discussed under the construction phase above. However, only a small workforce will be required during the operations phase as compared to the construction phase.

The intensity of this impact is very low and the sensitivity of the receptor is high resulting in a minor impact severity before mitigations.

Proposed mitigation measures:
The mitigation measures implemented during the operations phase are the same as those applied during the construction phase, listed above.

With the implementation of the above mitigation measures, the residual impact severity will remain minor.

6.4. Unplanned (contingency) impacts of the proposed Sindila MHP

Non routine events and unplanned impacts (also known as Contingency Impacts), have also been considered in this updated ESIA. These include events such as:-

- Earthquakes; (Section 6.4.1)
- Landslides (Section 6.4.2);
- Floods (Section 6.4.3);
- Failure hazards (Dam break) (Section 6.4.4);
- Accidents (Section 6.4.5); and
- Susceptibility of the project to climate change linked to the above (Section 6.4.6).

Impacts associated with unplanned events (or contingencies), including aspects such as vehicle accidents, are difficult to assess within the framework outlined above, because:

- The frequency of unplanned events is usually low, since operational procedures are designed to minimize the risk of an occurrence;
- The intensity of these impacts is difficult to quantify, since there is a wide range of possible events (i.e. the impact intensity is highly variable); and
- Unplanned events that may result in a severe environmental or social impact usually result in high financial, social and political liabilities and costs for the developer. Therefore, the project has substantial built-in controls to avoid such occurrences. The probability of unplanned events (contingencies) occurring should always be low, although these are identified, they are not assessed in the impact assessment, whereas expected potential impacts are assessed.

The project, which is described in Section 2 of this ESIS, is designed to prevent undesirable events.

The identified contingency impacts can occur at any time of the project lifespan and, therefore, they have not been apportioned to either the construction or operations phase. The main goal is to have in place enough preventive measures to avoid them throughout the proposed project lifespan.

6.4.1. Earthquakes

Bundibugyo district is prone to earthquakes, and the last significant incidence occurred in 1995. In the 1980s, the district experienced earthquakes which caused some destruction - the earthquake occurred on a very large scale of 4 Kilo Newton out of 7 Kilo Newton. Any

development project therefore, should take into consideration seismic risk in the design of the project.

The Sindila MHP is to be located within a zone of high micro earthquake activity (Tumwikirize 2007). However, only a small number of earthquakes are actually higher than 3 on the Richter scale. Nevertheless, it is imperative that measures are taken into consideration during design and construction works to avoid hazards associated with earthquakes.

Proposed mitigation measures:

- Simulations and modelling of earth quakes should be undertaken by the contractor and an emergency preparedness plan should be designed; and
- Incorporate ground acceleration into the design to adequately safeguard the structures from earthquake disaster.

6.4.2. Landslides and obstruction of pathways

Generally, the Mount Rwenzori area in which Bundibugyo district is located, is prone to landslides. A number of landslide scars were identified along the penstock path and piers will be located in stable positions avoiding landslide areas. The upper section of the area is largely covered with overburden residual soil with 0.3 – 0.6m of organic silt over fine to medium-grained sand (1.3m), over stiff to hard, low to non-plastic silt.

Landslides majorly result from the cumulative effect of many interrelated factors, including underlying geology, geomorphology (landforms and processes that create them), hydrology, weather/climate, slope modifications and deforestation. Landslides may be "triggered" by earthquakes, blasting, freeze-thaw, slope modifications, with the most common trigger being high levels of precipitation. Slope modification is a major contributing factor to slope instability.

Construction works such as creation of access roads, construction of the dam and movement of heavy machinery on steep slopes, may weaken the surrounding soils causing a landslide.

The heaps of soil (overburden) at the construction sites and/or due to earth works could also sway in form of a landslide causing accidents and blocking community routes in the low lying areas if not well managed when opening the surface with graders.

Landslides lead to significant environmental damage including soil and forest loss, sedimentation of streams, rivers and lakes, increased erosion and habitat destruction.

Proposed mitigation measures:

- During the construction phase, the slopes, which are prone to landslides should be cut to attain stable angles of natural repose which retain the soils;
- The resultant slopes should be reinforced with gabion boxes and other geo materials;
- The cut benches should be planted with vegetation preferably, a mixture of grass and trees to help bind soil;
- An appropriate and sufficient number of drainage structures such as culverts and other drainage systems should be put in place;
- Establish a notification system for identified landslide hazard areas;
- A program of public education that emphasises the key aspect of landslide mitigation should be developed in order to provide information on triggering mechanisms; and
- Wherever possible, construct interconnected roads to access project facilities.

6.4.3. Floods

Steep slopes are associated with high velocity storm water run-off and erosion. Such slopes, when improperly developed, can significantly increase the amount and velocity of storm water. This run-off can cause unexpected flooding, severe erosion, and water course degradation.

Increases in water velocity and volume also result in soil being carried down the slopes and into streams causing siltation and damage to aquatic life and habitats.

Flood risks may occur at the weir due to malfunctioning or dam failure, at the forebay, if the spillway discharge channels are not properly directed and in the river floodplain which extends below the powerhouse.

Proposed mitigation measures:

- Minimise cut and fill on steep slopes;
- Re-vegetate slopes;
- Encourage ground cover with deeper roots;
- Include swales and depressions in landscaping to store runoff;
- Respect natural contours so that the construction e.g. of the access roads follows natural contours and avoids natural drainage areas, as these areas are likely to be flooded and cause runoff to be displaced to other sites downstream; and
- Construct project access roads parallel to the contour of the land to minimise erosion and reduce the runoff rate more effectively.

6.4.4. Failure hazards (Dam breaks)

Failure due to poor construction or other causes can be catastrophic to downstream settlements and infrastructure. However, smaller dams and micro hydro facilities present less of a risk but can form continuing hazards even after being decommissioned.

Failure hazards can be due to; the use of inappropriate construction materials, imbalanced mixture or poor mixture of cement, and use of unqualified engineers employed to carry out the construction works. In addition, failure hazards can also occur due to natural disasters such as earthquakes and collapsing.

Proposed mitigation measures:

- Butama Hydro Electricity Company Ltd will recruit qualified and experienced civil and structural engineers to undertake the construction works;
- Butama Hydro Electricity Company Ltd will refer to the geotechnical report prepared for the project (see Annexure 12) to inform the design and selection of appropriate technology;
- Structural designs will be developed in accordance with the Bundibugyo District building standards. Technical consideration will be taken during construction works for example ground beam, horizontal beam and vertical beam will be considered to overcome multiple forces that may cause dam break.

6.4.5. Occupational Accidents

Accidents are by their nature incidental and are never planned. The Sindila MHP will be associated with traffic accidents along the routes that will be used to access the sites and construction and operations accidents. Construction works will involve a number of activities, operations and machinery that could injure workers. For instance, accidents to workers may occur as a result of collapsing soils during construction of the dam, while dealing with inflammable fuel and/or perceived risks from gas and fuel. Other risks may arise from moving machine parts on unguarded machines, moving construction vehicles, electrical current etc.

These may be caused by improper use of Personal Protective Equipment (PPE), mechanical faults in equipment or vehicles, health of workers, lack of team coordination, third party interference, careless driving on roads, among others. Injuries could range from those which are minor to possible loss of life.

The likelihood of accidents during the operations phase will be the same as for the construction phase. However, during the construction phase, due to the nature of activities involved as well as the equipment that will be on site during this time, it is likely that accidents during this phase of the project may be even fatal.

Potential accidents at site may include but are not limited to cuts by machinery, workers trapped and buried in an excavation owing to the collapse of the sides, workers struck and injured by falling material, workers falling from heights and electrical accidents.

Proposed mitigation measures:

- All workers, including Sub-contractors and casual labourers, will undergo an Environment, Health and Safety (EHS) induction before commencing work on site, which will include a full briefing on site safety and rules;
- Personnel will only undertake tasks for which they are trained/qualified and a formal ' permit to work' system will be in place;
- Routine toolbox talks will be conducted on different topics for all workers prior to the start of the construction phase;
- All accidents, near misses and incidents will be recorded and such records maintained as part of a health and safety management programme;
- The required PPE will be provided and will be worn by personnel;
- All the mitigation measures for regulating increased traffic discussed in Section 6.3.7 above are also relevant for the management of this impact;
- Local community members will be requested to suspend their activities within the project footprint during the construction phase. This is mainly for their safety; and
- A detailed construction schedule with associated activities will be developed and communicated to all affected individuals.

6.4.6. Susceptibility to climate change

A changing climate has major implications for the safety and performance of hydropower projects. Increases in the severity and frequency of droughts would reduce the capacity for hydropower production, and may increase reservoir sedimentation. This will, however, only happen over the very long term. In addition, increased floods have the potential to threaten dam/weir safety.

Proposed mitigation measures:

- The design parameters will include provision for the worst possible maximum flood event (PMF) that may occur over a number of years; and
- The issue of seasonality was considered when designing the project to ensure that power is generated throughout the year.

6.5. Cumulative impacts

Cumulative impacts are changes to the environment that are caused by an action in combination with other past, present and future human actions.

Specifically, Cumulative Impact Assessments (CIA) are typically expected to:

- Assess impacts over a larger (i.e. "regional") area that may cross jurisdictional boundaries (includes impacts due to natural perturbations affecting environmental components and human actions);
- Assess impacts during a longer period of time into the past and future;
- Consider impacts on Valued Ecosystem Components (VECs) due to interactions with other actions, and not just the impacts of the single action under review;
- Include other past, existing and future (e.g., reasonably foreseeable) actions; and
- Evaluate significance in consideration of other than just local, direct impacts.

Of particular relevance during the cumulative impact assessment of the proposed project is the fact that the proposed project is to be located along River Sindila in close proximity to the proposed Ndugutu Mini Hydropower Project. Ndugutu MHP is to be located on the left bank of R. Ndugutu while Sindila MHP is located on the right bank of R. Sindila both of which fall within Bunyamwera Parish, Sindila sub-county.

Cumulative impacts are not necessarily that much different from the impacts of a single project, in fact, they may be the same. According to Butama Hydro Electricity Company Ltd, based on current planning, the construction schedule for Sindila MHP is planned to last 540 days. Even if each of the potential impacts is of relatively short duration and limited spatial extent in the immediate vicinity of the proposed project site, construction of more than one project at a time may raise the severity of the impacts. If the construction phases of both projects occur simultaneously in the project area specifically for those parts of the project falling in the community areas, there could be cumulative impacts linked to unidentified effects on communities and habitats. In other words, disturbed conditions observed may have stabilised or returned to normal, but increasing numbers of construction activities undertaken sequentially or with temporal and spatial coincidence may result in cumulative adverse effects. It is therefore imperative that appropriate mitigation measures be put in place to prevent this from happening.

6.6. Summary of impacts

Based on the above description, Table 6.4 shows a summary of project impacts and their respective rating before and after mitigation.

Table 6.4 Summary of impacts attributed to the proposed Sindila MHP

Impact	Phase	Before mitigation			After mitigation		
		Intensity	Sensitivity	Severity	Intensity	Sensitivity	Severity
Impact on Rwenzori Mountain National Park, World Heritage Site and Ramsar Site	Construction	Low (2)	High (4)	**Moderate (8)**	Very Low (1)	High (4)	**Minor (4)**
	Operations	Very low (1)	High (4)	**Minor (4)**	Very low (1)	High (4)	**Minor (4)**
Loss of land/land take	Construction	Low (2)	High (4)	**Moderate (8)**	Very low (1)	High (4)	**Minor (4)**
	Operation	Not applicable					
Impact on crops and property	Construction	Low (2)	High (4)	**Moderate (8)**	Very low (1)	High (4)	**Minor (4)**
	Operation	Not applicable					
Increased rate of soil erosion	Construction	Medium (3)	High (4)	**Major (12)**	Low (2)	High (4)	**Moderate (8)**
	Operations	Not assessed further					
Soil Contamination	Construction	Low (2)	High (4)	**Moderate (8)**	Very low (1)	High (4)	**Minor (4)**
	Operations	Not assessed further					
Increased disease vector populations as a result of changes in water ecology	Construction	Not applicable					
	Operations	Low (2)	High (4)	**Moderate (8)**	Very Low (1)	High (4)	**Minor (4)**
Increased traffic	Construction	Low (2)	High (4)	**Moderate (8)**	Very Low (1)	High (4)	**Minor (4)**

Impact	Phase	Before mitigation			After mitigation		
		Intensity	Sensitivity	Severity	Intensity	Sensitivity	Severity
	Operations	Not assessed further					
Impacts on vegetation	Construction	Low (2)	Medium (3)	**Moderate (6)**	Very Low (1)	Medium (3)	**Minor (3)**
	Operations	Not applicable					
Impact on fauna	Construction	Low (2)	High (4)	**Moderate (8)**	Very Low (1)	High (4)	**Minor (4)**
	Operations	Very low (1)	High (4)	**Minor (4)**	Very low (1)	High (4)	**Minor (4)**
Increased poaching during construction	Construction	Low (2)	High (4)	**Moderate (8)**	Very low (1)	High (4)	**Minor (4)**
	Operations	Not assessed further					
Impacts on surface water quality	Construction	Low (2)	Medium (3)	**Moderate (6)**	Very Low (1)	Medium (3)	**Minor (3)**
	Operations	Very low (1)	Medium (3)	**Minor (3)**	Very Low (1)	Medium (3)	**Minor (3)**
Sedimentation and siltation of downstream water sources	Construction	Medium (3)	Medium (3)	**Moderate (9)**	Low (2)	Medium (3)	**Moderate (6)**
	Operations	Not assessed further					
Impact on downstream river flows and community water sources	Construction	Not assessed further					
	Operations	Low (2)	High (4)	**Moderate (8)**	Very Low (1)	High (4)	**Minor (4)**
Impact on migration of fish	Construction	Not assessed further					

Impact	Phase	Before mitigation			After mitigation		
		Intensity	Sensitivity	Severity	Intensity	Sensitivity	Severity
upstream of the weir	Operations	Medium (3)	High (4)	**Major (12)**	Low (2)	High (4)	**Moderate (8)**
Impact on cultural resources	Construction	Low (2)	High (4)	**Moderate (8)**	Very Low (1)	High (4)	**Minor (4)**
	Operations	Not assessed further					
Segregation and differential rewards	Construction	Very Low (1)	High (4)	**Minor (4)**	Very Low (1)	High (4)	**Minor (4)**
	Operations	Not assessed further					
Increased spread of sexually transmitted diseases and other communicable diseases	Construction	Low (2)	High (4)	**Moderate (8)**	Very Low (1)	High (4)	**Minor (4)**
	Operations	Not assessed further					
Physical resettlement of people and associated impacts	Construction	Medium (3)	High (4)	**Major (12)**	Low (2)	High (4)	**Moderate (8)**
	Operations	Not assessed further					
Vehicular and other equipment emissions	Construction	Low (2)	High (4)	**Moderate (8)**	Very low (1)	High (4)	**Minor (4)**
	Operations	Not assessed further					
Increased dust levels (particulate matter)	Construction	Medium (3)	High (4)	**Major (12)**	Low (2)	High (4)	**Moderate (8)**
	Operations	Not assessed further					
Noise effect and vibrations on local communities	Construction	Low (2)	High (4)	**Moderate (8)**	Very low (1)	High (4)	**Minor (4)**

Impact	Phase	Before mitigation			After mitigation		
		Intensity	Sensitivity	Severity	Intensity	Sensitivity	Severity
	Operations	Very low (1)	High (4)	**Minor (4)**	Very low (1)	High (4)	**Minor (4)**
Poor Sanitation due to poor domestic waste management	Construction	Low (2)	Medium (3)	**Moderate (6)**	Very low (1)	Medium (3)	**Minor (3)**
	Operations	Not assessed further					
Effects of blasting	Construction	Medium (3)	High (4)	**Major (12)**	Low (2)	High (4)	**Moderate (8)**
	Operations	Not assessed further					
Greenhouse Gas Emissions	Construction	Not assessed further					
	Operations	Very low (1)	High (4)	**Minor (4)**	Very low (1)	High (4)	**Minor (4)**
Introduction of invasive plant species	Construction	Medium (3)	High (4)	**Major (12)**	Medium (3)	Medium (3)	**Moderate (9)**
	Operations	Not assessed further					
Pressure on the social service sector	Construction	Low (2)	High (4)	**Moderate (8)**	Low (2)	Medium (3)	**Moderate (6)**
	Operations	Very low (1)	High (4)	**Minor (4)**	Very low (1)	Medium (3)	**Minor (3)**

7. PUBLIC CONSULTATION AND DISCLOSURE

7.1. Introduction

This Section presents a summary of the views and concerns expressed by project stakeholders during the public disclosure and stakeholder consultation process undertaken during the ESIA process. The objectives of the public disclosure and stakeholder consultation process were;

- To provide stakeholders with an overview of the proposed project activities, as well as an understanding of the Project activities and the process during the implementation phase; and
- To identify and document the views, concerns and expectations of affected communities, political and cultural leaders, non-governmental organizations, and government agencies relating to the proposed project activities.

In order to gather the views and concerns of the people likely to be affected by the development of the proposed project and incorporate them in the planning and implementation process of the project, consultations were conducted with relevant stakeholders, including potential beneficiaries, affected groups, Civil Society Organizations (CSOs) and the local authorities, district officials and officials from relevant specialized institutions as required by the World Bank and Government of Uganda.

7.2. Stakeholder Analysis

The stakeholder analysis can be defined as the process of determining the stakeholders who will be affected directly or indirectly, positively or negatively by the proposed project and who can contribute to, or hinder its success. It is necessary to keep all stakeholders informed during project implementation so as to accord their support and advice. A stakeholder analysis was undertaken for the Sindila MHP in order to identify the relevant stakeholders.

Stakeholders are individuals, groups and entities that are affected by a development activity either directly or indirectly, or those that may exert either positive or negative influence on the project. Those that are directly affected are known as, primary stakeholders whilst those that are affected indirectly, are known as secondary stakeholders. A number of key stakeholders were involved in the consultations component of the ESIA baseline study.

Consultations were carried out with four groups of stakeholders, namely;

- Directly affected persons
- Indirectly affected persons
- Government Agencies and;
- NGOs

7.3. Stakeholder Engagement

Stakeholder engagement refers to a process of sharing information and knowledge related to the project activities, seeking to understand and respond to the affected people's concerns and build relationships based on collaboration. At this stage the developer/developer's representative keeps everyone involved, motivated and updated about the project activities, ensuring that there is a shared understanding of meaning and minimising the opportunity for rumours and gossip.

Stakeholder engagement involved a participatory approach in which the developer representative described the planned, pre, during and post-construction activities and informed the stakeholders about the key issues as well the schedule of activities. During this process stakeholders were given an opportunity to respond by asking questions or making comments about planned project activities.

According to IFC PS 1 requirements, Stakeholder engagement is an ongoing process that may involve, in varying degrees, stakeholder analysis and planning, disclosure and dissemination of information, consultation and participation, grievance mechanism, and ongoing reporting to Affected Communities.

7.4. Stakeholder Consultations

In order to ensure that the interests of the community, the PAPs and the public at various levels, are addressed and incorporated into the design of the project, a consultative-participatory approach was adopted to shed more light on the project sub-components, implementation activities, and to explain the likely impacts from the project. During that process, formal and informal consultations were undertaken with the central government, Bundibugyo District, sub-county and village-level government officials.

To ensure consistency with IFC PS 1, which requires “effective community engagement through disclosure of Project related information and consultation with local communities on matters that directly affect them,” village-level consultation meetings were held. Formal consultations were also conducted which included village and household-level surveys and group discussions, village-level presentations and planned meetings with local and central government officials. The stakeholders consulted during the consultation process for the Sindila MHP include the following;

- National Environment Management Authority (NEMA);
- Ministry of Energy and Mineral Development(MEMD);
- Uganda wildlife Authority(UWA);
- Uganda Electricity Transmission Company Ltd (UETCL);
- Rural Electrification Agency (REA);
- Electricity Regulatory Authority(ERA);
- Directorate of Water Resources Management (DWRM);
- Gender Department , Ministry of Gender , Labour and Social Development;
- Department of Museums and Monuments;
- Bundibugyo District Chief Administrative Officer (CAO);
- Bundibugyo District Environment Officer (DEO);
- Bundibugyo District Community Development Officer (CDO);
- Bundibugyo Town Local Government(District Engineer);
- Sindila sub-county chief;
- Bundibugyo District LC (V) Chairman;
- LC (IV) representative;
- The local community members (Ntuma, Bunyamwera, Nkuranga, Kabwe, Musalau, Kakuka, Mutiti, Kaghughu, Bunyangule, Musili and Kyebumba)

Note: Consultations with Buboni and Bihya villages (in the Project area of Influence) were not made but arrangements should be made to consult the residents in these villages.

Table 7.1 Key themes following consultations with stakeholders during preparation of the ESIA for the proposed Sindila MHP project

Key theme	Raised by	Main response from Sindila MHP
Water quality		
Assurance that the water quality for the River Sindila will not be affected by the proposed project is required.	Bundibugyo District Office Community Development Officer	The water quality cannot be affected by the proposed project except during construction. However, during the ESIA process, water samples are taken to get the base line quality for future reference
Will the volume of water in the River Sindila be greatly reduced? Will the remaining water be contaminated?	Sindila sub-county community consultation	Project adviser responded that a certain amount of water (environmental flow) must remain in the river for human use as per the recommendations by project approving agencies such as NEMA and DWRM and it will not be contaminated in any way.
The developer (Butama Hydro Electricity Company) should do enough water tests to get the baseline information and ensure that the quality is maintained throughout the implementation phase.	Bundibugyo Environment Officer	Noted
There will be water quality issues before, during and after construction. The project should not result into significant changes in water quality	UETCL(Environment officer)	Noted
Landslides		
Bundibugyo soils are prone to landslides, how will Butama Hydro Electricity Company respond to such a problem?	Bundibugyo District Office	After construction, trees will be planted along the canal to stabilize the soils and where possible, retaining walls will be constructed
The proposed project area is mountainous and therefore the soils are prone to landslides (Collapsing soils) and yet the local people use poor agricultural practices. The developer (Butama Hydro Electricity Company) should therefore sensitize the local people on better agriculture practices to ensure the sustainability of the project.	Bundibugyo Environment Officer	Noted

Key theme	Raised by	Main response from Sindila MHP
How will the company solve the problem of rolling stones during construction since our area is hilly? What will be the width of the proposed access roads?	Sindila sub-county community consultation	The contractor will always make sure that before any kind of excavation is done, the people downhill will be informed in advance and if the situation is serious they will be relocated until construction is finished with adequate compensation.
Compensation:		
We have seen that some access roads will be opened up; is there going to be compensation for those houses which will be affected?	Sindila sub-county community consultation	As we mentioned earlier, there will be appropriate compensation of all the property affected by the project activities. The ESIA team leader added that another study called RAP will be carried out to value the affected property in order to do appropriate compensations
Now the season is about to begin, and some of us just have small pieces of land. Suppose the canal passes through that piece of land, should we use it or we wait?	Sindila sub-county community consultation	Everybody is expected to continue using his or her land until they have been told to stop and appropriately compensated
Some of our crops were destroyed during the process of other preliminary surveys, so do you have any program for us?	Sindila sub-county community consultation	Visits to those sites will be carried out to ascertain the intensity of the damage and plan accordingly.
The district rates used to compensate people are normally 2-3 years old and hence the valuation report may not reflect the actual property rates. Butama Hydro Electricity Company needs to bring the community on board and try to sensitize them through their leaders such that their expectations are not too high.	MEMD	Noted
There will be several compensation issues due to land take. This needs to be addressed well by consulting the affected stakeholders. Does the developer have some community development projects and livelihood restoration program?	UETCL (Environment Officer)	

Key theme	Raised by	Main response from Sindila MHP
In terms of compensation, some families are female headed therefore there is a need to carry out enough consultations before compensation is done to identify issues related to property ownership as well as land tenure systems in the area.	Gender Department, Ministry of Gender, Labour and Social Development	Noted
Environmental flow		
There is a lot of tapping by different gravity flow schemes because of the nature of our water sources, so the developer (Butama Hydro Electricity Company) should take that into consideration in that their designs should cater for the existing flow scheme and also consider doing more extensions to the nearby communities.	Bundibugyo District CDO (Water and Sanitation)	Noted
There will be diversion of water from River Sindila, therefore issues related to environmental flow should be clearly addressed and permits obtained from the relevant lead agencies which allow water abstraction.	ERA UETCL (Environment Officer)	Noted
Hydrology		
Butama Hydro Electricity Company should do an in-depth study in terms of hydrology and catchment characteristics such that once power generation commences, it's sustainable economically instead of having to run one season and the other we shut down because there isn't enough water.	ERA UETCL (Environment Officer)	Noted
There is need to discuss the hydrology of River Sindila well. Hydropower needs to be designed with a high reliability of the hydrology.	DWRM	Noted
Issues of flooding if any should be handled at design level.	MEMD	Noted
Community sensitisation		

Key theme	Raised by	Main response from Sindila MHP
The proposed Sindila Mini Hydropower projects will result into the influx of outside people into the project area therefore the residents should be sensitized on how to protect their land.	Bundibugyo District CDO (Water and Sanitation)	Noted
The transmission line for evacuating the power to the grid or consumers will go through community or private land and all these can result into conflict with surrounding community if they are not well sensitized.	MEMD	Community sensitisations will be done
The illiteracy level in the area is very high in such communities, therefore the local leaders should try to sensitize the people on all the project activities that are to take place especially during the compensation process	UETCL Gender Department, Ministry of Gender, Labour and Social Development	Noted
Public consultations		
Public consultations should be carried out especially with the local community and ensure that all their concerns are addressed at planning stage.	MEMD	Noted
Archaeology		
Butama Hydro Electricity Company may need to find out if there are any historical or archaeological sites. There has to be a procedure for handling chance finds, if any.	UETCL (Environment Officer)	Butama Hydro Electricity Company developed a Chance Find Procedure for the proposed project
Cultural site		
The Karugutu fossils site although not close to the proposed Sindila mini hydropower station is among the cultural sites in the proposed project area.	Department of Museums and Monuments	Noted
Corporate and Social Responsibility:		

Key theme	Raised by	Main response from Sindila MHP
Through Butama Hydro Electricity Company's Corporate and Social Responsibility, the company may have to look into community concerns such as lighting villages in collaboration with REA, supporting education programs in the project area, building resettlement houses among others. There has to be a grievance redress mechanism to settle dispute as a result of land take and displacement of community infrastructure. Opinion leaders, NGOs should be incorporated in the grievance redress mechanism to help in dealing with difficult people among the community.	UETCL (Environment Officer) ERA	Noted
Butama Hydro Electricity Company should consider supporting schools and hospitals in the area as part of its Corporate and social responsibility.	UETCL Bundibugyo Environment Officer Gender Department, Ministry of Gender, Labour and Social Development	Noted
Earth works		
The developer needs to plan how dispose the excavated earth works. The source of aggregates should be defined and also how the sites will be restored after construction phase.	UETCL (Environment Officer) DWRM	Noted
Employment		
When will the jobs be available?	Sindila sub-county	Butama Hydro Electricity Company management is undertaking all the necessary feasibility studies as

Key theme	Raised by	Main response from Sindila MHP
	community consultation	they wait for NEMA to approve the ESIA report and thereafter, the project will commence. However, we anticipate beginning at the end of 2012.
Wildlife		
Are there no eco-tourism sites that may be affected by the proposed power plants?	UETCL (Environment Officer)	Surveys will be done to find out any eco-tourism sites and if any is present mitigation measures will be put in place to reduce the impact
The open canal will greatly affect the wildlife especially if it cuts across animal routes. Therefore Butama Hydro Electricity Company should consider fencing the canal.	ERA	
There is a national park with plenty of wild life, about 1km away from the proposed weir site.	Bundibugyo District Environment Officer	Mitigation measures will be put in place to safeguard the integrity of the park
Acquisition		
During the acquisition of property, all the procedures taken should be appropriately documented in the presence of local leaders for future reference.	Bundibugyo District CDO (Water and Sanitation) ERA	Noted
Accessibility		
Communication network between the site and the main road should be properly worked on because of the increase in traffic during the construction phase.	ERA	Noted
Noise and Vibrations		
If Butama Hydro Electricity Company is to establish any quarry in the area, some residual impacts like effects of intensive vibrations have to be considered	ERA	Noted

Key theme	Raised by	Main response from Sindila MHP
HIV/AIDS		
In conjunction with the local leaders, Butama Hydro Electricity Company should put in place regulations and code of conduct to guide the people who will be employed during construction and after construction to avoid bad habits like prostitution which are dangerous to the community	Gender Department, Ministry of Gender, Labour and Social Development	Noted
The projects should also facilitate HIV/AIDS and Gender mainstreaming activities.	Bundibugyo District CDO (Water and Sanitation)	Noted
Impacts on Biodiversity		
The Albertine region is known for high species richness and rarity therefore biodiversity issues are very important. Documentation on the biodiversity of the area in terms of flora and fauna, whether threatened, endangered rear and others needs to be looked at.	UETCL Bundibugyo Environment Officer	Biodiversity assessments will be done during the biodiversity surveys
Do the rivers have fish? This needs to be assessed and ensure that the diversions don't affect fish stocks.	UETCL (Environment Officer)	Aquatic biodiversity assessments will be carried out during the baseline surveys.
There will be issues of biodiversity loss and how will these be mitigated.	MEMD	Mitigation measures are provided in the ESIA
Design discharge		
The design discharge has always been taken when it's not sustainable. Most of the existing mini hydropower stations have been over designed.	DWRM	Noted
Trans boundary		

Key theme	Raised by	Main response from Sindila MHP
The site being close to Democratic Republic of Congo should not raise trans boundary issues.	DWRM	Noted
Community benefits resulting from the proposed project		
Will we be able to access power since it going to be produced from our area?	Sindila sub-county community consultation District Community Development Officer	The company is licensed to generate power and feed it into the national grid. If access to electricity is to be obtained, community leaders should make their requests known to REA, the government institution responsible for distributing electricity to rural areas in Uganda.

8. ENVIRONMENTAL AND SOCIAL MONITORING PLAN

Butama Hydro Electricity Company has an Environmental Management System (EMS), which governs all of its operations. As part of the EMS, a number of standard plans and operating procedures are in place, addressing environmental protection for the operations in Sindila Sub-county.

These procedures are referred to where appropriate in this ESIA, and form part of the management regime under which the proposed Sindila MHP project will be undertaken. The assessment process reported in this ESIA has identified the need for additional, specific mitigation measures to ensure that the proposed Sindila MHP project has minimum adverse environmental and social impacts.

The Environmental and Social Monitoring Plan (ESMP) for the proposed Sindila MHP project will therefore incorporate the following elements:

1. Operations wide documents; reference.
2. Project specific measures identified by the ESIA.

The specific measures to be undertaken during the mobilisation and implementation activities of the proposed Sindila MHP project are included in Table 8.1 and Table 8.2 for the construction phase and operations phase respectively. These tables also include monitoring measures designed to ensure that compliance with the plans can be checked and recorded during implementation, and assign responsibility for these actions.

Table 8.1 Construction phase Environmental and Social Monitoring Plan

Environmental/social issue	Mitigation measure	Monitoring indicator	Agency/Entity responsible for monitoring	Frequency
Pre-construction issues	Sensitisation of the local communities on the planned hydropower project in order to avoid public anxiety and speculation.	Number of sensitisation meetings held. Minutes of sensitisation meetings. Availability of a sensitisation programme.	Butama Hydro Electricity Company	Prior to construction phase
Impact on Rwenzori Mountain National Park, World Heritage Site and Ramsar Site	Develop adaptive land use management and monitoring plans for the area adjacent to the RMNP.	Availability of Land use plan	Bundibugyo District Environment officer Bundibugyo District Forestry officer NGOs Community representatives UWA	Prior to construction phase
	Sensitise communities, workers, and migrants to avoid further damage to RMNP.	Number of sensitisation meetings held. Minutes of sensitisation meetings	Bundibugyo District Environment officer UWA	Throughout the project lifecycle

Environmental/social issue	Mitigation measure	Monitoring indicator	Agency/Entity responsible for monitoring	Frequency
	Improve agricultural practices, and engage in terracing and other means of soil restoration to encourage farming near villages	Extent of terraced areas	Bundibugyo District Agriculture Officer Community representatives	Throughout the project lifecycle
	Enable more extensive monitoring of people legally harvesting resources in RMNP	Monitoring records	UWA	Throughout the project lifecycle
	Develop and implement a road and vehicle monitoring strategy to address transport of resources from the RMNP.	Availability of vehicle monitoring strategy	Bundibugyo District Local Government UWA Community leaders	Throughout the project lifecycle
	Develop a financing mechanism based on Payment for Ecosystem Services (i.e. water) that would provide an option to raise additional funds for conservation and support to community livelihoods programs	Availability of financing mechanism	Bundibugyo District Local Government Local Communities	Throughout the project lifecycle
Land take	Land acquisition and compensation should follow the established process of land acquisition in Uganda.	Compensation records and RAP monitoring reports	Bundibugyo District Local Government	Prior to land Acquisition

Environmental/social issue	Mitigation measure	Monitoring indicator	Agency/Entity responsible for monitoring	Frequency
	Land survey and valuation of the land and property for project affected persons should be undertaken by competent authorities to ensure that negotiations for land with land owners are in compliance with local market prices and government rates.			Prior to land Acquisition
	Site clearance for project components and support structures will be restricted to the required area to minimise the loss of the livelihood resources	Area covered by project components and support structures	Butama Hydro Electricity Company	Prior to construction phase
	Sensitise project affected persons (PAPs) on the intentions of land acquisition to give people sufficient time for planning and proper assessment	Sensitisation meeting minutes and stakeholder engagement plan	Butama Hydro Electricity Company Ltd Bundibugyo District Local Government Local council committees Sub-county committees Bundibugyo District Land Board	prior to implementation of the project
	Project affected persons should be individually notified about the compensation amount paid which they may accept or negotiate depending	Compensation agreements or any other documentation to prove that consensus was reached with PAPs.	Bundibugyo District Local Government Butama Hydro Electricity Company Ltd	Prior to the construction phase

Environmental/social issue	Mitigation measure	Monitoring indicator	Agency/Entity responsible for monitoring	Frequency
	on the damage to be incurred.			
	Prepare a thorough Resettlement and Community Development Action Plan and implement this plan in accordance with the Ugandan laws and donor agency guidelines such as World Bank Group and its Safeguard Policies	Resettlement and Community Development Action Plan	Butama Hydro Electricity Company Ltd Chief Government Valuer Bundibugyo District Local Government Community leaders	Prior to the project implementation
Loss of crops and property	A comprehensive property impact survey should be conducted which should indicate all affected properties within the right of way (ROW), their owners and the replacement costs. Valuation of such property should be conducted by experienced and registered Valuers in association with the district land board and local leaders	Survey strip maps and valuation reports	Bundibugyo District Local Government Butama Hydro Electricity Company Ltd	Prior to construction phase
	Separate land surveys should be carried out for the permanent and temporarily affected land. All forms of compensation pertinent to loss of land should be conducted in line with the provision of the Land Act 1998, (Cap 227)			Prior to construction phase

Environmental/social issue	Mitigation measure	Monitoring indicator	Agency/Entity responsible for monitoring	Frequency
	Prior to compensating the affected persons, adequate community sensitisation meetings should be carried out to ensure that the PAPs are aware of the entire program including visitation schedule per village, parish and/or sub-county and how each PAP will be contacted and approached for payment	Minutes of sensitiation meetings	Bundibugyo District Local Government Butama Hydro Electricity Company Ltd	Prior to construction phase
	The project footprint should be limited to only that which is required i.e. the minimum possible	Area taken up by project components	Butama Hydro Electricity Company Ltd Bundibugyo District Environment Offier	Prior to commencement of construction phase
Increased soil erosion and landslide potential	Disposal of cut soil and debris trapped by the sediment traps will be done outside road reserves and fragile ecosystems	Presence of cut soil outside road reserves, wetlands and fragile ecosystems.	Butama Hydro Electricity Company Ltd Bundibugyo District Environment Officer	Throughout the project lifecycle
	There will be controlled clearance of vegetation and this will be limited to only sections that are required for the access and installation of the project infrastructure	Areas devoid of vegetation	Butama Hydro Electricity Company Ltd Bundibugyo District Environment Officer	Construction phase
	An efficient drainage system will be incorporated in the	Existence of efficient drainage channels and number of	Butama Hydro Electricity Company Ltd	Prior to construction phase

Environmental/social issue	Mitigation measure	Monitoring indicator	Agency/Entity responsible for monitoring	Frequency
	project design to ensure that storm water especially along the access roads to the powerhouse and forebay and along the headrace canal is efficiently and effectively controlled.	culverts installed.	Bundibugyo District Engineer	
	Where possible, construction activities will not take place during heavy rains.	Project implementation Schedule.	Butama Hydro Electricity Company Ltd	Construction Phase
	Disturbed areas will be rehabilitated using a suitable indigenous cover grass. These grass species will be planted along the drainage channels to reduce the scouring effect of water.	Type of grass used for site restoration	Butama Hydro Electricity Company Ltd Bundibugyo District Environment Officer	Upon completion of construction activities
	Affected areas will be re-vegetated to prevent soil erosion. Suitable plants e.g. trees, and grass planted along the access roads to the powerhouse and forebay and along the headrace canal will be managed and maintained by dedicated committees established.	Trees and cover grass planted along access roads Existence of project Environmental monitoring team. Type of plant species	Butama Hydro Electricity Company Ltd Bundibugyo District Environment Officer	Upon completion of construction activities

Environmental/social issue	Mitigation measure	Monitoring indicator	Agency/Entity responsible for monitoring	Frequency
	Institute a long term tree planting program along the river banks (both upstream and downstream of R. Sindila), also initiate and/or support projects aimed at contributing to the wider protection of the river catchment against degradation and depletion	Presence of an afforestation program	Butama Hydro Electricity Company Ltd Bundibugyo District Environment Officer DWD	Upon completion of construction activities
Soil contamination	Ensure that all wastes generated during construction activities such as conductors, steel and metallic bars, insulators and other accessories are collected and disposed of appropriately at designated sites	Good housekeeping and general cleanliness at the construction site. Waste collection receipts	Butama Hydro Electricity Company Ltd Bundibugyo District Environment Officer NEMA certified waste collector	Construction phase
	All organic waste generated at labour campsites such as food stuffs shall be collected and transported by a licensed waste collection entity to designated landfills/dumping sites within the project area	Existence of a registered waste collector Contact with a registered waste collector	Butama Hydro Electricity Company Ltd	Prior to commencement of construction activities
	All plastic waste generated (at campsites and in the course of undertaking works) such as mineral water bottles, polythene bags, jerrycans, will be collected and disposed of safely or reused where	Waste generation inventory Waste collection records	Butama Hydro Electricity Company Ltd	Throughout the construction phase

Environmental/social issue	Mitigation measure	Monitoring indicator	Agency/Entity responsible for monitoring	Frequency
	possible			
	Fueling will be carefully undertaken at designated and well maintained fuelling centres	Designated fueling centres for equipment and machinery.	Butama Hydro Electricity Company Ltd	Construction phase
	Undertake routine maintenance of motorised equipment to avoid any fuel leakage and spills	Preventive maintenance records and schedule for all project equipment, machinery and vehicles.	Butama Hydro Electricity Company Ltd	Throughout the project lifecycle
	Storage of fuels and oils should be undertaken in a manner that does not allow leakage to the soil as the fuel can readily infiltrate the soils polluting the soils, ground and surface water	Presence of spill contingency measures	Butama Hydro Electricity Company Ltd	Throughout the project lifecycle
	Collect and dispose of all waste generated from project activities in accordance with local district guidelines, National Environment (Waste Management) Regulations 1999 and international best practice.	Waste collection and disposal records	Butama Hydro Electricity Company Ltd Bundibugyo District Environment Officer	Throughout the project lifecycle
Increased traffic	Raise awareness about road safety among vehicle drivers.	Number of road safety awareness meetings/clinics held.	Butama Hydro Electricity Company Ltd Bundibugyo District Traffic Police Department Local community leaders	During Construction Periods
	A traffic management plan will be in operation in close cooperation with Police.	Functional traffic management plan	Butama Hydro Electricity Company Ltd	Construction Phase

Environmental/social issue	Mitigation measure	Monitoring indicator	Agency/Entity responsible for monitoring	Frequency
	Speed limits will be enforced for construction vehicles involved in construction work.	Presence of road safety signage/furniture	Bundibugyo District Traffic Police Department	
	Records will be maintained for all accidents and incidents involving project vehicles	Availability of accidents and incidents register	Butama Hydro Electricity Company Ltd	Throughout the project lifecycle
	Use well maintained and serviced vehicles to maintain efficiency	Maintenance records for vehicles.	Butama Hydro Electricity Company Ltd	Throughout the project lifecycle
	Prohibit off-road driving. The use of horns should be reserved for safety considerations and not used as a common communication method	Driver traffic safety sensitsation records		Throughout the project lifecycle
	Travel in convoys and at designated times to decrease the risk of accidents and traffic nuisance to the community	Journey management/traffic plans	Butama Hydro Electricity Ltd Local community leadership	Throughout the project lifecycle
	Journey-specific risk assessments which will include the identification of potentially sensitive receptors along the access routes will be conducted. For significant traffic movements, including transport of construction materials to site, any affected communities/residents along	Journey specific risk assessment records	Butama Hydro Electricity Ltd Local community leadership	Throughout the project lifecycle

Environmental/social issue	Mitigation measure	Monitoring indicator	Agency/Entity responsible for monitoring	Frequency
	the route should be sensitised, and wherever possible, attempts made to undertake the traffic movements at the least busy times of day			
	When travelling in community areas, speed limits on transportation routes will be 40km/h for light vehicles and 30km/h for heavy vehicles;	Induction record of all project drivers with emphasis on acceptable speed limits.	Butama Hydro Electricity Company Ltd Project drivers Local leaders	Throughout the project lifecycle
	Only approved drivers will be allowed to operate vehicles	Training records of all project drivers.	Butama Hydro Electricity Company Ltd	Throughout the project lifecycle
	Materials should wherever possible be preferentially sourced locally in a manner that reduces environmental and social impacts (e.g. transport distances) and maximises local economic development opportunities	Procurement records.	Butama Hydro Electricity Ltd	Construction phase
	All roads should have clear and visible signage especially in community areas, around schools and hospitals to minimise the risk of accidents Each construction site should have a traffic controller to monitor and direct traffic flow	Presence of road signage indicating that the construction activities are in progress. Presence of a traffic controller/signal person within the project area	Butama Hydro Electricity Ltd District Engineer Local community leadership	Throughout the project lifecycle
	All staff will undergo the induction process which includes rules for safe driving, including speed limits in	Staff Induction records	Butama Hydro Electricity Company Ltd	Throughout the project lifecycle

Environmental/social issue	Mitigation measure	Monitoring indicator	Agency/Entity responsible for monitoring	Frequency
	community areas. All recruited drivers will be able to read.			
	The number of vehicles that will be used will be kept to a minimum all the time; Where possible, the selected routes for use during the construction phase will avoid densely populated communities The construction equipment will be kept on site until the construction is complete	Project vehicle fleet size and Journey management plan for selected routes. Equipment demobilisation plan	Butama Hydro Electricity Ltd Bundibugyo District Engineer Local community leadership	Throughout the project lifecycle
Impacts on vegetation	Following the construction phase, the affected areas will be restored and only indigenous vegetation replanted. Intentional restoration using exotic plant species will be avoided	Presence of native vegetation in restored areas	Butama Hydro Electricity Company Ltd Bundibugyo District Environment Officer	Upon completion of the construction activities
	Prevent vegetation trampling by restricting access to the site along a designated route. Movement of equipment (vehicles, contractors and the entire construction crew) will be limited to the designated access roads – off-road driving is prohibited	Designated access routes to the project area.	Butama Hydro Electricity Company Ltd Bundibugyo District Environment Officer	Construction phase
	The site clearing exercise will be controlled and limited to only that which is required for the project components.	Size of the area cleared for purposes of the planned project activities.	Butama Hydro Electricity Company Ltd Bundibugyo District	Construction phase

Environmental/social issue	Mitigation measure	Monitoring indicator	Agency/Entity responsible for monitoring	Frequency
	Workers will be prohibited from removing vegetation outside clearing marked areas of intervention		Environment Officer Local community Leadership	
	The contractor will avoid locating temporary project infrastructure such as, access roads, quarries, construction camps, storage areas, in sensitive ecosystems (the riverine forest at the weir and part of the headrace) which systems will be clearly delineated with stakes or flagging to prevent unintentional impacts to these ecosystems	Delineation of all sensitive ecosystems in the project area with stakes or flags. Type of site occupied by temporary infrastructure.	Butama Hydro Electricity Company Ltd Bundibugyo District Environment Officer Local community leadership	Construction phase
	Carry out a pre-ground-break survey at the start of construction works to ensure that environmental conditions have remained the same as the baseline conditions presented in this ESIS. Allowance will be made for the translocation of sensitive species or the realignment of the working area to avoid causing disturbance to sensitive micro-habitats encountered during earth movement	Pre-ground survey report. Specie translocation records	Butama Hydro Electricity Company Ltd Bundibugyo District Environment Officer	Prior to commencement of construction activities
	Areas for biodiversity offsets	Biodiversity offset program	Butama Hydro Electricity	Prior to the

Environmental/social issue	Mitigation measure	Monitoring indicator	Agency/Entity responsible for monitoring	Frequency
	should be identified and vegetation planted to replace the one that will be lost to the project. This includes supporting afforestation activities within the project area and beyond		Company Ltd Bundibugyo District Local Government Local community leadership	commencement of construction activities
Impacts on fauna	Use well maintained and serviced equipment that generates low noise levels	Equipment maintenance records and their associated noise levels	Butama Hydro Electricity Company Ltd	Throughout the project lifecycle
	Unnecessary noise from the construction workers (such as loud vocalisations and music) will be prohibited	Construction noise levels and related community complaints/grievances	Butama Hydro Electricity Company Ltd Bundibugyo District Environment Officer	Construction phase
	National noise regulations as stipulated in the National Environment (Noise Standards and Control) Regulations, 2003 will be adhered to.	Noise monitoring records.	Butama Hydro Electricity Company Ltd Bundibugyo District Environment Officer	Throughout the project lifecycle
	Idling of vehicles and machinery will be prohibited unless necessary Off-road driving will be prohibited. The use of horns will be reserved for safety considerations, and not used as a common communication method	Induction records for drivers emphasizing the need to avoid idling, off road driving and guidance on use of horns.	Butama Hydro Electricity Company Ltd Bundibugyo District Environment Officer Local community leadership	Throughout the project lifecycle

Environmental/social issue	Mitigation measure	Monitoring indicator	Agency/Entity responsible for monitoring	Frequency
	Equipment will be operated with all noise-reducing components (hoods, screens) in the correct position.	Presence of noise suppression equipment on noise sources	Butama Hydro Electricity Company Ltd Bundibugyo District Environment Officer	Throughout the project lifecycle
	Habitat disturbance should be minimised by restricting the project activities to only the maximum area required.	Extent of area occupied by project infrastructure.	Butama Hydro Electricity Company Ltd Bundibugyo District Environment Officer	During construction
	Unnecessary cutting of vegetation should be avoided	Extent of vegetation clearance	Butama Hydro Electricity Company Ltd Bundibugyo District Environment Officer	Prior to the construction phase
	To minimise death of fauna, vegetation clearance should always be undertaken first, as this scares away most of the fauna, as opposed to direct use of graders to clear routes for access road construction, or direct dumping of construction materials and excavated soils	Site clearance schedule	Butama Hydro Electricity Company Ltd	Prior to the construction phase
	The construction workers should be encouraged and sensitised not to harass amphibians and reptiles.	Biodiversity toolbox talks for construction workers	Butama Hydro Electricity Company Ltd	Throughout the project lifecycle

Environmental/social issue	Mitigation measure	Monitoring indicator	Agency/Entity responsible for monitoring	Frequency
Increased poaching during construction	Incorporate wildlife awareness training programmes into the RAP, to address possible pressures on wildlife in resettlement host areas.	Records of meetings conducted with the local communities and workers as pertains to prevention of poaching	Butama Hydro Electricity Company Ltd UWA	Prior to project implementation
	Consider impacts on habitats and wildlife when identifying suitable sites and manage movements to minimise impacts	Sightings of wild animals or their exhibits.	Butama Hydro Electricity Company Ltd UWA	During construction
	Minimise riverbed and shoreline disturbance by for example, restricting construction activities and access by workers to susceptible areas that could contribute to sediment loading.	Restricted access and activities along sediment susceptible areas	Butama Hydro Electricity Company Ltd DWD	During construction
	Implement education programmes for construction workers on, *inter alia*: respect for wildlife and vegetation, avoidance of fires and accidental damage, and generally restricting the footprint of the construction camp and work areas to that which is required	Number of sensitisation and public awareness programmes held.	Butama Hydro Electricity Company Ltd	Throughout the project lifecycle
	Prohibit development of unnecessary spur roads off main access roads, to limit land degradation and habitat disturbance	Illegal trails in the project area.	Butama Hydro Electricity Company Ltd Bundibugyo District Environment Officer	Throughout the project lifecycle
	Develop “good construction environmental management”	Environment Management Protocols in place.	Butama Hydro Electricity Company Ltd	Throughout the project lifecycle

Environmental/social issue	Mitigation measure	Monitoring indicator	Agency/Entity responsible for monitoring	Frequency
	protocols to reduce potential impacts on vegetation and wildlife. The protocols should also cover site working practices, noise management, avoidance of spills, maintenance of pollution control measures such as oil separators, and a dust management plan		Bundibugyo District Environment Officer	
	Replant or take measures to encourage re-colonisation by native vegetation in disturbed or degraded areas	Presence of planted indigenous plants in the native areas.	Butama Hydro Electricity Company Ltd Bundibugyo District Environment Officer	Following construction
	Increase park boundary patrols and monitor wildlife poaching activities.	Security patrols and wildlife monitoring records	Butama Hydro Electricity Company Ltd UWA	Throughout the project lifecycle
Impact on surface water quality	Detailed design of spillways to manage the temperature and oxygenation of releases to the river including preventing anoxic discharges	Proper design of spillways	Butama Hydro Electricity Company Ltd Bundibugyo District Water Officer, Bundibugyo District Environment Officer DWRM	Prior to construction phase
	Design of reservoir shoreline to minimise adverse impacts from drawdown on neighbouring land uses.	Shoreline design	Butama Hydro Electricity Company Ltd Bundibugyo District Engineer	Prior to construction phase

Environmental/social issue	Mitigation measure	Monitoring indicator	Agency/Entity responsible for monitoring	Frequency
			Bundibugyo District Water Officer Bundibugyo District Environment Officer DWD	
	Install treatment facilities and/or oil/water separators to remove oil and grease from drainage water prior to discharge to adjacent water courses.	Presence of oil/water separators.	Butama Hydro Electricity Company Ltd Bundibugyo District Environment Officer	Throughout the construction phase
	Install wastewater treatment facilities to treat wastewater from the project campsite and other construction facilities; a site construction waste and wastewater management plan will be designed and implemented in order to minimise environmental damage from construction activities. This will include regular refresher training sessions for construction workers as pertains to safe and proper storage, handling, use, cleanup, and disposal of oils, fuels and other chemicals and the implementation of a comprehensive spill response	Presence of waste treatment and waste segregation facilities	Butama Hydro Electricity Company Ltd District Environment Officer	Throughout the construction phase

Environmental/social issue	Mitigation measure	Monitoring indicator	Agency/Entity responsible for monitoring	Frequency
	plan including equipment and training.			
	Secondary containment measures in areas where fuels, oils, lubricants and construction materials such as cement are stored and loaded or unloaded, including filling points will be installed In case of oil pollution, sedimentation and siltation, the contractor should halt construction activities immediately and recover the pollutant before it reaches the receiving water sources. In addition, the contractor should avoid washing construction equipment at the water pump or transfer station to avert pollution of receiving water sources	Presence of secondary containment measures in areas containing hazardous materials. Oil Spill Contingency Plan in place to manage potential leaks and spills. Incidence register on site.	Butama Hydro Electricity Company Ltd District Environment Officer	Construction phase
	Provide disposal facilities for wastes at the campsite and properly allocate the dumping site	Waste segregation bins and disposal sites	Butama Hydro Electricity Company Ltd District Environment Officer	Throughout the construction phase
	Undertake regular water quality monitoring in the reservoir, and water body downstream to include dissolved oxygen, nutrients (N & P), pesticides, exchangeable ions and	Availability of water quality assessment certificates	Butama Hydro Electricity Company Ltd District Environment Officer DWD	Throughout the construction phase

Environmental/social issue	Mitigation measure	Monitoring indicator	Agency/Entity responsible for monitoring	Frequency
	nuisance plants.			
	During weir construction, cuttings and residual mud generated during the channel deepening and widening process will be dried, stored and handled in appropriately bounded or under-lined areas and re-used for other project infrastructure	Records indicating that cutting and residual muds generated during the channel deepening was re-used.	Butama Hydro Electricity Company Ltd District Environment Officer	Construction phase
Sedimentation and siltation of downstream water sources	Install soil erosion control structures at all construction sites	Presence of soil erosion control structures and gulleys	Butama Hydro Electricity Company Ltd Bundibugyo District Environment Officer Bundibugyo District Engineer DWD	Throughout the construction phase
	Install and regularly empty, sediment traps in surface drains, along roads and construction areas. To prevent sedimentation of streams during construction of the diversion channel, the contractor should construct metallic barriers (sediment traps) along the diversion channel (between the channel and the river) such as hard	Presence of soil erosion control structures. Presence of sediment traps.	Butama Hydro Electricity Company Ltd Bundibugyo District Environment Officer Bundibugyo District Engineer DWD	Construction phase

Environmental/social issue	Mitigation measure	Monitoring indicator	Agency/Entity responsible for monitoring	Frequency
	gauge iron sheets to prevent and/or arrest any falling debris, soil or rocks from reaching the river			
	Proper design for storm water drainage facilities and maintenance Construction during heavy rains will be avoided as much as is possible as water logged soils are easily eroded. Disposal of cut top soil should be undertaken outside fragile ecosystems and water sources downstream, under the direction of the resident engineer who should approve disposal sites.	Presence of storm water drainage channels Top soil disposal site selection criteria Construction schedules	Butama Hydro Electricity Company Ltd Bundibugyo District Environment Officer Bundibugyo District Engineer DWD	Construction phase
	Following completion of construction works, top soil removed and stockpiled will be used in restoration; vegetation native to the area will be re-established to ensure stabilisation of project area and its surroundings.	Site Restoration plan. A report showing source of materials used in restoration activities.	Butama Hydro Electricity Company Ltd Bundibugyo District Environment Officer	Construction phase

Environmental/social issue	Mitigation measure	Monitoring indicator	Agency/Entity responsible for monitoring	Frequency
Impact on downstream river flows and community water sources	Adherence to stipulated environmental flow stipulated by the Directorate of Water Development (DWD)	Installation of flow sluices at the intake weir. Construction monitoring reports.	DWD Bundibugyo District Water Officer Bundibugyo District Engineer Butama Hydro Electricity Company Ltd	Construction phase
	Provide an alternative water source for example by constructing protected springs for the community water members whose water sources will be affected.	Presence of alternative water source in the community.	Bundibugyo District Water Officer Bundibugyo District Environment Officer Butama Hydro Electricity Company Ltd Local community leadership	Construction phase
	There should be periodic monitoring of water flow between the weir and powerhouse and downstream of the powerhouse.	Periodic monitoring records	DWD Bundibugyo District Water Officer Butama Hydro Electricity Company Ltd	Throughout the project lifetime
	Water quality will be monitored to determine any pollutant	Water monitoring records.	Butama Hydro Electricity Company Ltd	Throughout the project implementation

Environmental/social issue	Mitigation measure	Monitoring indicator	Agency/Entity responsible for monitoring	Frequency
	trace introduced as a result of project activities.		Bundibugyo District Environment Officer	
Impact on cultural resources	Before commencement of the construction works, the contractor will be taken on a guided tour of the site to get acquainted with the physical cultural resources.	Scouting report	Butama Hydro Electricity Company Ltd Bundibugyo District Environment Officer Local Council Leaders	Prior to Construction phase
	Butama Hydro Electricity Company Ltd and its contractors will exercise care so as not to damage any artefacts or fossils uncovered during excavation operations and will provide such cooperation and assistance as may be necessary to preserve the findings for removal or other disposition.	Presence of a change finds procedure	Butama Hydro Electricity Company Ltd Department of Museums and Monuments	Throughout the construction phase
	All the construction team members will be inducted upon arrival at the work camp. Among other issues, respect for the local traditional cultures will be emphasised	Cultural Induction records	Butama Hydro Electricity Company Ltd	Throughout the construction phase
	All the foreign construction team members will be accommodated at the workers camp and their movements controlled to avoid influence on local community culture.	Category of workers residing at the worker camp and associated access controls	Butama Hydro Electricity Company Ltd Contractor	Throughout the construction phase

Environmental/social issue	Mitigation measure	Monitoring indicator	Agency/Entity responsible for monitoring	Frequency
Segregation and differential rewards	Butama Hydro Electricity company Ltd's contractor(s) employment activities will be monitored on a regular basis throughout the construction phase, including number of jobs created by employment type (skilled / semi-skilled / unskilled), number of jobs by gender, employment type and geographical area; total man hours and wages paid, by employment type, gender and geographical area; and rate of employee turnover by gender and area Butama Hydro Electricity company Ltd's contractor(s) will be encouraged to pay a "living wage" to all workers The participation of local community members will be maximised during the construction phase. Unskilled labour will be recruited exclusively from directly affected communities, and semi-skilled labour will be recruited preferentially from such communities, provided that they have the requisite qualification, competence and desired experience.	Records of recruitment of workers and how this was undertaken. Records of payment made to workers and the nature of the work activities. Absence of conflicts with regards to the payments. Absence of conflicts between the contractor and the district authorities Changes in livelihood Payment vouchers and receipts in place Agreements on mode of payments Sensitisation meetings held	Butama Hydro Electricity Company Ltd Bundibugyo District Labour Officers Contractor Bundibugyo Environment Officer Community Bundibugyo Community Development Officers	Throughout the construction period

Environmental/social issue	Mitigation measure	Monitoring indicator	Agency/Entity responsible for monitoring	Frequency
Increased risk of spread of HIV/AIDS and STI	Special specifications in the contract documents should stipulate the need for HIV/AIDS Awareness campaigns and sensitization. The HIV/AIDs awareness trainer will be expected to collaborate with local NGOs, CBOs and District Health Officers for sustainability and integration of activities into the existing structures of the local health institutions	Specifications spelled out in the contractors contract	Bundibugyo District Health Office Butama Hydro Electricity Company Ltd	Throughout the project lifecycle
	Ensure that the workers camp and construction areas are open only to formal employees	Workers camp access records	Butama Hydro Electricity Company Ltd	Throughout the project lifecycle
	Provide the workforce with access to primary healthcare onsite, insecticide-treated mosquito nets, prescriptions, prophylactics and condoms, and basic testing for TB, STDs and HIV/AIDS	A record of workforce access to health services	Butama Hydro Electricity Company Ltd	Throughout the project lifecycle
	Engage an NGO to prepare community institutions for any influx of in-migrants (for example, by developing by-laws and community policing systems for larger numbers of in-migrants)	By-laws and community policing systems in place	Butama Hydro Electricity Company Ltd Local NGOs	Throughout the project lifecycle
	Establish a community health programme including providing support to existing or new local programmes such	Number of community health programmes in place	Butama Hydro Electricity Company Ltd	Throughout the project lifecycle

Environmental/social issue	Mitigation measure	Monitoring indicator	Agency/Entity responsible for monitoring	Frequency
	as mother and child nutrition, community health awareness, HIV/AIDS awareness, hygiene and immunisation, malaria control measures (indoor spraying of insecticides, personal protection measures, and control of mosquito larvae), and local Voluntary Counselling and Testing (VCT) programmes.			
	Put in place an STI and HIV/AIDS awareness campaign and services for the construction crew to promote safe sex practices and other control measures in order to reduce this anticipated negative outcome	Number of awareness campaigns held.	Butama Hydro Electricity Company Ltd	Throughout the project lifecycle
	Workers with the exception of local workers, who will return to their homes, will be housed in the workers camp and will have access to health services like HIV/AIDs counselling	HIV/AIDs counselling services available to workers. Records of workers accommodation arrangements	Butama Hydro Electricity Company Ltd	Construction phase
	All workers will be inducted in relevant codes of conduct that minimise exposure to risky life styles including unsafe sex practices	Level of awareness among workers and the local communities, records of HIV/AIDS sensitisation in place. Induction record of all workers.	Butama Hydro Electricity Company Ltd	Throughout the project lifecycle
Physical resettlement of	Develop a thorough Re-	Evidence of RAP	Butama Hydro Electricity	Prior to commencement

Environmental/social issue	Mitigation measure	Monitoring indicator	Agency/Entity responsible for monitoring	Frequency
people and associated impacts	settlement Action Plan (RAP) and implement this plan in accordance with the Ugandan laws and donor agency guidelines such as World Bank Group and its Safeguard Policies	implementation	Company Ltd	of the construction phase
	A comprehensive RAP should be conducted before the commencement of the construction phase for the proposed project	RAP report for Sindila MHP	Butama Hydro Electricity Company Ltd	Prior to construction phase
	Following agreement with regards to compensation, any required economic and physical displacement must take place prior to construction phase	Property valuation records Compensation payment records	Butama Hydro Electricity Company Ltd	prior to construction phase
	A grievance mechanism will be in place to ensure that grievances from displaced persons are handled carefully and in a manner that promotes confidence and trust	Record of grievances handled during the different phases of the project lifecycle.	Butama Hydro Electricity Company Ltd	Throughout the project lifecycle
Vehicular and other equipment emissions	Vehicles and machinery will be fitted with appropriate exhaust systems and devices to reduce emissions Efforts will be made to use fuel-efficient and low emissions machinery and vehicles, which will be serviced regularly and in	Machinery and equipment fitted with pollution prevention equipment Equipment procurement specifications	Butama Hydro Electricity Company Ltd Bundibugyo District Environment Officer Local Council Leaders	Throughout the construction phase

Environmental/social issue	Mitigation measure	Monitoring indicator	Agency/Entity responsible for monitoring	Frequency
	accordance to the manufacturers' specifications to maintain efficiency All emission-producing equipment will be operated only when necessary, unnecessary idling of equipment will be avoided. A grievance mechanism will be put in place to address air quality grievances from local stakeholders. Journey management will be undertaken in order to ensure that only the necessary trips required for the construction activities are made.	Vehicle trip logs Vehicle speeds within the project area.		

Environmental/social issue	Mitigation measure	Monitoring indicator	Agency/Entity responsible for monitoring	Frequency
Increased dust levels (particulate matter)	All unpaved haul roads will be continuously watered by watering trucks or constant misting, so that surfaces remain damp at all times when in use during construction. Gravel cover shall be applied to unpaved surfaces which are regularly used All truck loads that enter or leave the site will be covered and if required, rumble grids will be installed at site exit points to minimise dust along community roads	Road watering regime/program Number of vehicle fitted with dust suppression covers	Butama Hydro Electricity Company Ltd Local community leadership	Construction phase.
	Clearing of land will be carried out systematically - with clearing restricted to only the required areas so as to minimise disturbed and exposed areas.	Area devoid of vegetation	Butama Hydro Electricity Company Ltd Bundibugyo District Environment Officer	Construction phase

Environmental/social issue	Mitigation measure	Monitoring indicator	Agency/Entity responsible for monitoring	Frequency
	Stockpiles of construction materials will be shielded from wind using bins and monitored daily during the construction phase. In addition, they will be located away from public and residential areas. All vehicle movements will be subject to risk assessment (which therefore allows for the incorporation of project-specific controls) and all drivers will be inducted in health, safety and social and environmental issues. A speed limit of 40km/h for light vehicles and 30km/h for heavy vehicles will be maintained on routes used to access the construction sites	Stability of Soil stockpiles Vehicular movement Risk assessment registers Speed limit signage and driving patterns in the project area	Butama Hydro Electricity Company Ltd Bundibugyo District Environment Officer	Construction phase
	Community awareness and sensitisation about the proposed project will be created prior to construction activities so that community members become more vigilant and are aware of what to expect in terms of potential nuisances	Meeting attendance registers Stakeholder engagement plan	Butama Hydro Electricity Company Ltd Bundibugyo District Community Development Officer Local community leadership	Prior to commencement of construction activities

Environmental/social issue	Mitigation measure	Monitoring indicator	Agency/Entity responsible for monitoring	Frequency
	A grievance mechanism will be put in place to address grievances from local communities	Number of grievances filed/reported	Butama Hydro Electricity Company Ltd Bundibugyo District Environment Officer Bundibugyo District Community Development Officer Local community Leaders	Construction phase
Noise effect and vibrations on local communities	Prior notice will be given to the local community members to keep them informed of what will take place. Where necessary, they will be advised to avoid some sections at certain times of the construction phase for safety reasons. Noise events will be scheduled for appropriate times of the day to avoid disturbance of any programmed community gatherings. Construction activities will be limited to only day time hours Community awareness of the project activities and schedules will be created to enable community members	Letters/Memos/local radio announcements Project formal working hours	Butama Hydro Electricity Company Ltd Local Council Leaders Department of Occupational Health and Safety Bundibugyo District Environment Officer	Throughout the construction phase

Environmental/social issue	Mitigation measure	Monitoring indicator	Agency/Entity responsible for monitoring	Frequency
	plan accordingly. Unnecessary noise from the construction crew (such as loud vocalisations and music) will be prohibited.	Noise monitoring records Health and safety awareness records		
	Noise monitoring will be undertaken within the area and at nearby sensitive receptor sites (homesteads along the penstock and the headrace canal and the nursery school next to the forebay) during construction	Noise monitoring records	Butama Hydro Electricity Company Ltd	During construction
	Use well maintained and serviced equipment that generates low noise levels, Prohibit idling of machinery including vehicles, unless necessary		Butama Hydro Electricity Company Ltd	Throughout the construction phase
	The use of horns should be reserved for safety considerations, and not used as a common communication method. Acoustic insulation (e.g. screens or bunds) will be deployed when necessary, especially on compressors, when possible. Equipment will be operated with all noise-		Butama Hydro Electricity Company Ltd	Throughout the construction phase

Environmental/social issue	Mitigation measure	Monitoring indicator	Agency/Entity responsible for monitoring	Frequency
	reducing components (hoods, screens) in the correct position; and Noisy equipment will be sited with away from sensitive receptors whenever possible			
Poor Sanitation due to poor domestic waste management	All waste generated from demolition of built up structures should be sorted (biodegradable, non-biodegradable, Metals, Glasses) by the contractor and disposed of appropriately at designated waste disposal sites.	Waste management plan developed for managing all project associated waste Presence of a registered waste collector.	Butama Hydro Electricity Company Ltd Bundibugyo District Environment Officer	During the construction phase
	A mobile toilet for use by the construction personnel will be in place at the construction sites and the work camps, and emptied regularly by a licensed waste contractor.	Presence of adequate sanitation facility	Butama Hydro Electricity Company Ltd	
	Anti-vermin safeguards (such as covering bins with lids) will be put in place.	Work place hygiene records and infrastructure	Butama Hydro Electricity Company Ltd Bundibugyo District Environment Officer	
	Waste management in line with the waste hierarchy, with source reduction being the first option and disposal the	Cleaner production practices	Butama Hydro Electricity Company Ltd Bundibugyo District	

Environmental/social issue	Mitigation measure	Monitoring indicator	Agency/Entity responsible for monitoring	Frequency
	last option		Environment Officer	
Effects of Blasting	The day, time, hour and the minute at which the actual blasting will be conducted must be communicated to all the surrounding communities. All the people surrounding the project site especially those in Ntuma village must know the routine of blasting. The developer must work with the local leaders and properly plan for the blasting of rocks. People must know that a blast is pending such that they make arrangements to overcome any shock and avert accidents. Uncoordinated and haphazard blasting will not be tolerated. A properly agreed upon blasting time table should be developed and Butama Hydro Electric Company Ltd should stick to it.	EMP for blasting; blasting schedule which has been communicated to the relevant persons and associated records Level of local community awareness of the time schedule for blasting	Butama Hydro Electricity Company Ltd Contractor Bundibugyo District Environment Officer Local community leadership	Throughout the construction phase
	As a precautionary measure, sirens must be sounded prior to blasting in order to prepare/forewarn the community. The timing and interpretations of these sirens	Presence of siren and evidence of its proper use	Butama Hydro Electricity Company Ltd Local community leadership	Throughout the construction phase

Environmental/social issue	Mitigation measure	Monitoring indicator	Agency/Entity responsible for monitoring	Frequency
	should be agreed upon by the developer and the community. Activities in the camp site and other project sites should be halted at least 30 minutes to the actual explosion to prevent accidents.			
Occupational accidents	Standard and comprehensive health and safety measures should be adhered to during the construction and operation phases of the project. Workers should be provided with Personal Protective Equipment (PPEs) and this must be used as directed. First aid services should be available on site in case of an accident. Fire extinguishers, sand and water should also be available onsite in case of fires Hazard warning signage should be posted on any storage tank at the site and outside the generator house - maintenance workers should be conversant with safety procedures.	Evidence of compliance with the requirements of the Act Safety and health measures put in place and evidence of communication of these to workers Requisite PPE provided and workers properly utilising this PPE. Evidence of First Aid Services on site e.g. First Aid Box and some personnel trained in First Aid. Fire emergency preparedness training records Work place incident register. Hazard warning signage in place and evidence that the safety procedure was	Butama Hydro Electricity Company Ltd Contractor Department of Occupational Safety Health Bundibugyo District Labour Office	Throughout the construction phase

Environmental/social issue	Mitigation measure	Monitoring indicator	Agency/Entity responsible for monitoring	Frequency
		communicated to maintenance workers and that they are conversant with it.		
Earthquakes	Simulations and modelling of earth quakes should be undertaken by the contractor and an emergency preparedness plan should be designed	Earthquake emergency preparedness plan including drills	Butama Hydro Electricity Company Ltd Ministry of Disaster Preparedness	Throughout the construction phase
	Incorporate ground acceleration into the design to adequately safeguard the structures from earthquake disaster	Dam safety documentation/records	Butama Hydro Electricity Company Ltd	Throughout the construction phase
Landslides and obstruction of pathways	During the construction phase, the slopes, which are prone to landslides should be cut to attain stable angles of natural repose which retain the soils	Field observations confirming that stable slope angles have been obtained.	Butama Hydro Electricity Company Ltd Bundibugyo District Engineer Bundibugyo District Environment Officer.	Construction phase
	The resultant slopes should be reinforced with gabion boxes and other geo materials. The cut benches should be planted with vegetation preferably, a mixture of grass and trees to help bind soil.	Presence of slope stabilisation measures	Butama Hydro Electricity Company Ltd Bundibugyo District Engineer Bundibugyo District Environment Officer	Construction phase
	An appropriate and sufficient number of drainage structures	Number of culverts and other drainage facilities put in place	Butama Hydro Electricity Company Ltd	Construction phase

Environmental/social issue	Mitigation measure	Monitoring indicator	Agency/Entity responsible for monitoring	Frequency
	such as culverts and other drainage systems should be put in place.		Bundibugyo District Engineer Bundibugyo District Environment Officer	
	Establish a notification system for identified landslide hazard areas.	Landslide early warning and evacuation system.	Butama Hydro Electricity Company Ltd Bundibugyo District Engineer Bundibugyo District Environment Officer	Construction phase
	A program of public education that emphasises the key aspect of landslide mitigation should be developed in order to provide information on triggering mechanisms.	Community sensitization records.	Butama Hydro Electricity Company Ltd Bundibugyo District Engineer Bundibugyo District Environment Officer	Construction phase
	Wherever possible, construct interconnected roads to access project facilities.	Number of roads constructed to enable access to the project facilities	Butama Hydro Electricity Company Ltd Bundibugyo District Engineer Bundibugyo District Environment Officer	Construction phase

Table 8.2: Operations phase Environmental and Social Management Plan

Environmental/social issue	Mitigation measure	Monitoring indicator	Agency/ Entity responsible for monitoring	Frequency
Soil contamination	All the waste collected from the headrace system at the time of cleaning will be disposed of appropriately at designated waste disposal sites – during flushing of the sedimentation tank, sediments will be flushed back into the river where they came from.	Agreement with a NEMA registered waste collection entity. Records of waste collection.	Butama Hydro Electricity Company Ltd District Environment Officer	During the operations.
Increased disease vector populations as a result of changes in water ecology.	Safe supply of potable water, and water purification education will be undertaken to address threats of intestinal and guinea worms.	Availability of safe portable water	Butama Hydro Electricity Company Ltd Contractor Bundibugyo District Health Officer	Throughout project implementation
	The project should have a health program in place geared towards community protection. This can include sensitisation of the local community members and encouraging them to use mosquito nets. Where possible, Butama Hydro Electricity Company Ltd could also assist in the provision of mosquito nets to the local people as part of Corporate Social Responsibility (CSR).	Evidence of community health campaign records. Availability of health awareness and training records delivered to community health workers	Butama Hydro Electricity Company Ltd Bundibugyo District and Public health Inspection office	Throughout project implementation
Impacts on fauna	Monitor operation activities at the open headrace The headrace should preferably be buried, and the vegetation above it restored.	Operation and Maintenance records.	Butama Hydro Electricity Company Ltd Environment	Throughout the project

Environmental/social issue	Mitigation measure	Monitoring indicator	Agency/ Entity responsible for monitoring	Frequency
	However, periodic monitoring should take place (at least quarterly) to ensure that tree species that have the potential of destructing the headrace are not allowed to grow. This also reduces the risks to animal safety		monitoring Officer Bundibugyo District Environment Officer	
Impacts on surface water quality	The project infrastructure such as the weir, penstock and the turbines which will be in contact with water will either be made out of insoluble material or coated with insoluble material	Equipment specifications.	Butama Hydro Electricity Company Ltd	At the procurement stage
	Regular and routine monitoring and maintenance will be undertaken to ensure that all project equipment is in good working order at all times.	Monitoring and maintenance records of project equipment.	Butama Hydro Electricity Company Ltd	Throughout
	A site operation waste and wastewater management plan in order to minimise environmental damage from operations and maintenance activities, will be developed and implemented. This will include regular refresher training sessions for operations and maintenance workers as pertains to safe and proper storage, handling, use, cleanup, and disposal of oils, fuels and other chemicals and the implementation of a comprehensive spill response plan including equipment and training	Presence of a waste and wastewater management plan. Training records of operations and maintenance staff	Butama Hydro Electricity Company Ltd Bundibugyo District Environment Officer	Prior to operations phase
	The operations vehicles will be regularly maintained from a recognised garage off-site thus minimising the potential for leakages	Maintenance records of the operations vehicles.	Butama Hydro Electricity Company Ltd	Throughout the operations phase

Environmental/social issue	Mitigation measure	Monitoring indicator	Agency/ Entity responsible for monitoring	Frequency
		List of garages where maintenance of operations vehicle takes place.		
Impact on fish migration upstream of the weir	The intake weir should be designed to include rock ramp fish ways made of large rocks, and timber to create pools and small falls that mimic natural structures suitable for the species (*Labeo forskalii)* found in River Sindila	Presence of rock ramp fish ways at the intake weir.	Butama Hydro Electricity Company Ltd Bundibugyo District Fisheries Officer Bundibugyo District Environment Officer	Operation phase
Noise effects and vibrations on local communities	The powerhouse shelter will be insulated to minimise the level of noise emitted	Acoustics at the powerhouse shelter	Butama Hydro Electricity Company Ltd	Operation phase
	A reasonable safety perimeter will be established around the powerhouse where access by community members will be highly restricted. By so doing, the emitted noise levels from the power house will not reach the community members	Presence of safety perimeter	Butama Hydro Electricity Company Ltd	Operation phase
	Only monitoring site visits necessary for proper running of the hydropower project will be conducted	Monitoring records	Butama Hydro Electricity Company Ltd	Operation phase
Impacts on aquatic ecology and biodiversity	Implement soil erosion control measures and reduce soil disturbance during construction	Soil erosion control measures installed along steep	Bundibugyo District Environment Officer	Throughout the construction phase, Onset

Environmental/social issue	Mitigation measure	Monitoring indicator	Agency/ Entity responsible for monitoring	Frequency
	activities by constructing sediment traps Install and regularly empty sediment traps in surface drains, around roads and construction areas. Proper design for storm water drainage facilities and maintenance during the construction phase are critical for mitigation. Disposal of cut spoil should be outside fragile ecosystems and water sources downstream Design and implement agreed seasonal compensation flow regime during operation.	slopes. Presence of designs for management of storm water Presence of sediment trap at the construction site Presence of river flow regime		of rain season and operation phase
Floods	Minimise cut and fill for new development on steep slopes Limit development of slopes exceeding 25% grades to permanent residential uses	Residential development at less than 25% slope	Bundibugyo District Environment Officer	Prior to construction activities
	Re-vegetate slopes along access roads.	Vegetation planted along the mountain slopes Presence of deep rooted plants		
	Include swales and depressions in landscaping to store runoff.	Presence of swales		
	Respect natural contours so that new development follows natural contours and avoids natural drainage areas as these areas are likely to be flooded and cause runoff to be	Undisturbed natural contours and drainages.		

Environmental/social issue	Mitigation measure	Monitoring indicator	Agency/ Entity responsible for monitoring	Frequency
	displaced to other sites downstream			
	Construct project access roads parallel to the contours of the land to minimize erosion and to reduce the runoff rate more effectively.	Parallel contours roads		
Dam failure hazard	Contract qualified and experienced civil engineers (contractor) for the construction works	Qualified and experienced contractor contracted for construction works	Butama Hydro Electricity Company Ltd	On recruitment of new staff
	Carry out soil test for the proposed site to determine its bearing capacity	Availability of soil bearing test	Butama Hydro Electricity Company Ltd Environment monitoring Officer	
	Proper structural designs that match with the district (Bundibugyo District Standards) and construction standards of such structures should be developed	Availability of structural designs conforming to required district and best standards	Butama Hydro Electricity Company Ltd Resident Engineer	
	Technical consideration will be taken during construction work such as ground beam, horizontal beam and vertical beam to overcome multiple forces that may cause failure hazards.	Ground beam, horizontal and vertical beam constructed for dam strength	Bundibugyo District Technical Planning Committee	
Impact on cultural resources	All the operations team members will be inducted prior to the commencement of the operations phase. Among other issues, respect for the traditional culture will be	Evidence of staff induction with emphasis on respect for	Butama Hydro Electricity Company Ltd	Prior to the start of operations

Environmental/social issue	Mitigation measure	Monitoring indicator	Agency/ Entity responsible for monitoring	Frequency
	emphasized	traditional culture	Contactor	
Greenhouse Gas Emissions	Consider selected clearance of vegetation prior to reservoir filling.	Vegetation in reservoir	Butama Hydro Electricity Company Ltd	

8.2. Other Environmental and Social Management Plans

8.2.1. General consideration

The Social and Environmental Management Plans (ESMP) proposed in Tables 8.1 and 8.2 specify the mitigation measures and monitoring actions required in order to track progress and the resulting effects on the environment, resulting from the proposed project. Also included in the ESMP are the time frames, specific responsibilities assigned and possible necessary follow-up actions required. Monitoring will commence right away and continue throughout both the construction and operations phases. An important aspect of monitoring is to assess the effectiveness of the recommended mitigation measures and where these are found lacking; other appropriate actions to mitigate against adverse effects will be undertaken.

Implementation of the measures included in the ESMP needs to be undertaken at different stages of the project facilities construction and operations phases. During the design stage, proposed mitigation measures will be incorporated in design and tender documents. The contractual agreement will also include articles to enforce environmental aspects.

Construction phase activities are mainly the responsibility of the contractor and the construction supervision consultant. The actual physical implementation works are mostly carried out at this stage.

Mitigation measures proposed for socio-economic issues such as compensation for loss of land or properties that may be damaged during the execution of the works will be handled by the Chief Government Valuer.

Environmental issues during the operations phase of the power plant shall be handled by Butama Hydro Electricity Company Ltd (the developer).

The staff of the Environmental Unit in Butama Hydro Electricity Company Ltd will acquire some specialized knowledge and skills in environmental monitoring activities for them to effectively assume this responsibility.

8.3. Health, Safety and Environmental Management Plan

Introduction

For the period during project implementation, the Sindila MHP station Contractor will develop and maintain an HS&E Management System to ensure that project activities comply with regulatory, reporting, operational and document control requirements. A comprehensive HS&E Management System will be developed by the hydropower station Contractor and will include the following components:

- The HSE&S Policy.
- HSE&S target and objectives.
- Organization and responsibilities.
- HSE&S documents and communication.
- HSE&S operation control.
- Training, awareness and competence.
- Management of change.
- Monitoring, compliance audit and corrective actions
- Management review

During the construction period, HS&E management objectives are briefly summarised as;

HS&E Policy

The Contractor will commit to achieving the required standards of health, safety, environment within its operational areas for the construction period. The Employer's needs and expectations for this period are anticipated and will be met through safe and timely operating procedures, actions and solutions that will minimize risk of accidents and harm to people and the environment.

HS&E Documentation and Communication

Documentation and records for this project shall meet the requirements of the contract. Records and documents shall ensure verification of project compliance including training, audits, inspections, incident reports, reviews, meetings, risk management studies and management of change. Where required obsolete documents will be removed or updated in line with the Document Control Procedures.

A communication policy will be developed for effective record keeping and for easy accessibility. All HS&E meetings will be recorded as formal minutes of meetings, which will be made available promptly for review by the owner. These minutes will record duration, location, attendees, agenda, key findings and agreed actions.

Communication with communities is also important with particular respect to specific issues. The official project language will be English. HS&E signage will be posted in the local language of a particular site where required.

Responsibility

The Project manager and the Construction Manager in conjunction with the Safety Coordinator will be responsible for the implementation of the HSMP while the Social and Environment Manager will have responsibility of verifying its implementation. All supervisors should be sensitised and trained on how to achieve the plan. In implementing the plan, the hydropower contractor will:

- Provide adequate resources to facilitate the implementation of the plans
- Identify hazards, assess, and control the risk
- Develop, maintain, implement safe working procedures
- Provide training, information and instruction to employees

- Implement and injury management program

Employee Responsibilities

- Employees must cooperate with the Contractor to implement the HSMP
- Employees must follow the correct work procedures
- All sub contractors either on site or at any location are required to comply with requirements of this HSMP

Safety Meetings

There will be safety meetings to review the progress of implementation of HSMP once every week, chaired by the Construction Manager. The meeting will:

- Find solutions to any safety issues unresolved during the previous meeting
- Identify problem areas and work out suggestions to resolve them
- Investigate accidents that occurred and plan ways to avoid them in the future
- Review the implementation of the safety plan
- Appraise employees on various specific needs at the work place

Training Plan

The Contractor will ensure:

- HSE Officer conducts safety awareness program for the site supervisory staff before they are deployed on site
- The safety officer will provide induction safety induction to all workers and records
- Weekly toolbox talks will be conducted as required
- Daily work instruction to the workmen will consist of hazards likely encountered while executing work and precautions to be taken.

Tool box talk

There will be weekly briefings on health and safety precautions conducted by supervisors and foremen to their respective workforce. The HSE Officer will maintain a record of the meetings for the job specific hazards and precautions to be taken. Subjects to be covered will include:

- Unsafe working conditions and safe acts noted during the previous week
- Lessons leant from the near misses, accidents if any
- Safety precautions to be taken in the coming week
- Safety systems and procedures to be followed
- Safety checklists
- Role of employees in preventing accidents

Other precautions include

- ✓ Safe use of scaffolds, ladders, power tools
- ✓ Electrical safety requirements
- ✓ Fire precautions
- ✓ Safe usage of hand tools
- ✓ Safe handling of mechanical materials
- ✓ Safety rules related to housekeeping and tidiness
- ✓ Safety access to the workplace
- ✓ Materials storage and transportation requirements
- ✓ Safety during excavation
- ✓ Working near construction equipment and machinery
- ✓ Emergency evacuation procedures

- ✓ Health hazards
- ✓ Personal Protection Equipment (PPE) use
- ✓ Working at heights
- ✓ Safety while crossing power lines
- ✓ Temporary earthing
- ✓ Guying arrangements of scaffolds
- ✓ Ageing of tools and maintenance

Insurance

The Contractor will secure liability insurance to cover for injuries and ill health to employees. This will include insurance for accidents involving vehicles and third party and building insurance. The costs covered by insurance can include sick bay, damage to plant and equipment, overtime working and temporary labour, production delays, investigation time.

Control and Use of Personal Protective Equipment

The EPC Contractor will provide the following Personal Protective Equipment (PPE) to workers:

- Head protection gear
- Goggles for eye protection.
- Muffs for hearing protection.
- Boots for foot protection.
- Gloves for hand protection.
- Mask for respiratory protection.
- Helmets
- High visibility vests.
- Life jackets.
- Heavy lift jackets.
- Shields (i.e. for grinding and welding).

PPE will be supplied free of charge to all EPC Contractor personnel on the project. The EPC Contractor will ensure that PPE is:

- Suitable for intended use.
- Clean and replaced when damaged or no longer effective.
- Properly used and maintained by personnel.

Personnel will be provided with training, information and instruction on PPE use and maintenance and will be supervised to ensure that it is used correctly. Sub-contractors shall also be required to provide appropriate PPE to their workers.

STDs, HIV/AIDS, and Welfare of Workers

Prior to the commencement of construction work, hygiene awareness will be carried out. The workers and local community residents will be sensitised on health risks associated with the HIV/AIDS pandemic. Two trained people will be made available at each site. They will be assisted by a site nurse. Enough first aid boxes should be available at site. Other requirements include:

- An emergency vehicle which will always be available at site. However, the facilities of the police department or hospital will be called in to handle major injury.
- Temporary facilities should be provided with garbage bins with lids to dispose all waste generated on site.
- The accommodation facilities of the workforce will be maintained in an acceptable hygienic condition for the convenience of workers

- Enough toilets and urinals should be installed at assigned locations on site and should be maintained clean and dry. The facilities should be contained to avoid environmental pollution.
- Safe potable drinking water will be provided on site and workers will be encouraged to drink enough water during hot weather.
- Scrap metal generated on site should be collected in scrap bins.
- Flammable wastes such as empty paint containers, insulation glue, adhesives will not be disposed in scrap bins. They will be collected and stored separately for such purposes.
- The garbage bins will be removed and disposed off at approved locations.
- A skip will be maintained on site to dispose all solid waste materials and shall be removed through authorised agencies at regular intervals.
- The drainage lines from the offices and washrooms will be connected to the existing drainage lines. Any leakage to the drainage should be attended to immediately. The septic tanks and soak pits will be used appropriately as required.
- All necessary first aid arrangements will be available on site.
- Wide awareness on safety, health and Environment should be implemented.

Treatment of Workers

- A clinic will be set up at various project sites.
- A qualified nurse will be on-site and should be provided with adequate first aid supplies to stabilise a patient until transferred offsite to a local medical facility if required.
- The Contractor will have a formal contract with a local doctor to provide any medical treatment that may be required.
- Emergency procedures and communication protocols should be in place prior to construction.

Visitors on Site

- All visitors must sign the Contractor/visitor sign-in register on entering sites.
- A performance logbook for recording all work performed on site will be on site.
- All workers will sign-in and out on each working day.
- All visitors will be given safety orientation and should be escorted at all times when on site. All sub contractors shall adhere to these procedures and will submit their training records.
- Visitors will be issued with a visitor's badge on all sites.

Work method statement

- The Contractor must complete a Work Method Statement for all works. A Work Method Statement is a document which describes the job to be carried out; steps involved, the hazards associated, and controls to be implemented to ensure that the work is completed safely.
- Permits will be given for hot work and confined work, fire equipment impairment notices and hazardous work.

Fire Protection

- The Contractor must provide up to date safety data sheet (MSDSs) for all chemicals used on site or brought onto the site and stored at the site. They must include police emergency contact details.
- The Contractor will include all chemicals that they store permanently on the site in the chemical register. The chemicals will be stored in a manner that is:
  - ✓ Secure in position from unauthorised people
  - ✓ Free from risk of falling and being knocked over
  - ✓ Away from food
  - ✓ Appropriately labelled

Scheduling of Works

When an activity included in the scope of the contract has a high risk of exposure to the public or employees, the contractor should schedule the activities outside the site's opening hours. For 24-hour sites, the contractor must arrange to complete high risk activities at off-peak times.

Project Equipment

For all equipment on site the contractor must ensure that:

- The employees to use the equipment are licensed and have competency based training.
- No electric operated equipment/tools will be used during working hours without permission.
- All equipment should be operated without risk to employees or the public.
- Equipment should be stored, operated, and maintained in accordance with the national legislation.
- Equipment should not be left unattended to and must be out of reach of children.
- Noise levels from equipment and working areas should in accordance with Ugandan noise standard.

Contractors Management

- The sub contractors should read safety guidelines, access equipment inspected by HSE officer or any other responsible person before deploying.
- She/he should get all machinery, power tools, safety appliances, access equipment inspected before deploying them.
- The entire workforce should be oriented on safety, health and environmental issues.
- Details of accidents during work should be maintained separately.

Accident, Incident, and Near Miss Investigation and Reporting

All accidents, incidences and "near-misses" shall be recorded, investigated and reported.

Effectiveness of the reporting system will be ensured by:

- An immediate notification to the Employer and Engineer.
- Investigating an incident to determine the facts and circumstances related to it and determining recommending remedial actions.
- Ensure that all personnel are aware of the reporting protocol.
- Reviewing incident/accident reports to establish trends so that appropriate remedial actions can be taken.
- Following up any corrective actions recommended.

Temporary Facilities

Hazards including fire, electric shock, and hygiene related hazards should have the following precautions:

- ✓ All electrical connections should be routed through the earth leakage circuit breaker.
- ✓ Make shift wiring will not be allowed at any site.
- ✓ The platform and walls of the pantry, where the above is located will be covered gypsum boards or steel sheets.
- ✓ Fire extinguishers are supposed to be provided in all buildings and will be inspected by the HSE officer every month to keep them in good working condition
- ✓ Disposable wastes which can cause fire will not be allowed close to fire places.
- ✓ Dustbins will be provided in the offices, stores, and rest areas to prevent employees from disposing waste materials indiscriminately.

Excavation

Hazards including falling into pits, collapse of the sides, breakage of buried service lines, should have the following precautions:

- ✓ Before excavation, necessary approval shall be taken from relevant authorities to ensure that there are no buried services in the area.
- ✓ Sides of the excavations must be sloped of casing used to a safe angle not steeper than the angle of repose of the particular soil.
- ✓ If the excavations or the earthwork is close to the foundation of any adjoining building, adequate steps should be taken to prevent damage to the existing structure.
- ✓ Every accessible part of the excavated pit, into which there is a danger of person falling, shall be suitably fenced with a barrier as close to the edge of the excavation as possible. Warning signs and lamps should also be provided along the fence, if the excavation is a public place.
- ✓ No under cutting at the side of excavation shall be allowed.
- ✓ All construction machinery used in the excavation should have reverse horns.
- ✓ Proper de-watering facilities will be ensured at site of evacuating water at the time of drilling.

Concreting

Hazards including collapse of casing while pouring concrete, persons falling off working platform, hygiene problems, and environmental threats require the following precautions:

- ✓ All workmen involved in pouring the concrete shall be required to use adequate PPE.
- ✓ Delivery hose of the concrete pump or the concrete shall be controlled properly to avoid dumping excess concrete at one location which may overload the shutter.
- ✓ Power cables of the vibrator, trowels, should not have any joint and shall be provided with industrial plugs.
- ✓ Safe handling of concrete will be ensured with trained workforce.
- ✓ Spilling of concrete will be checked and cleaning should be ensured after works.

Painting

Hazards including fire, spillage, and fall from height require the following precautions:

- ✓ Painters will use correct working platforms and scaffolds or ladders will be provided. The platforms will be inspected regularly.
- ✓ Paint cans will always be closed unless in use.
- ✓ Painters will be trained about the above hazards and ways of fire fighting in case there is a fire.
- ✓ Empty cans of paints will be collected and removed from site and disposed of correctly.
- ✓ Painters will be instructed to wash their hands before handling any eatables and will be provided with cleaning solutions, and will use gloves and masks to prevent exposure to paint and its vapours.

Scaffoldings

Hazards including collapse, electrical induction to structures, and fall of persons from height require the following precautions:

- ✓ All scaffolds will be inspected every week and records kept. If found to be defective, they will be labelled as such to caution the people not to use them.
- ✓ The height of scaffolds should be limited to 3.5m times its minimum base width.
- ✓ All workmen in the platform will be asked to get down before moving the working platform.
- ✓ Suitable approach in the form of ladders will be provided to the working platform of the scaffolds wherever required.
- ✓ Proper anchoring of scaffolds will be ensured and checked.

- ✓ Proper lighting will be provided at night.

Ladders

Hazards including collapse of ladders and fall of persons from heights require the following precautions:

- ✓ All ladders will be registered to ensure that they are inspected at regular intervals. Site made timber ladders will not be allowed on site.
- ✓ Technicians will be warned about the danger of using the top two rungs and the effect of overreaching while using ladders in the tool box meeting.
- ✓ Metallic ladders will not be used where there is a risk of electrical parts contact.
- ✓ Portable and extension ladders, if any, will have to be tied at the top and its angle of inclination will not be less than 75 degrees.

Tower Erection

Hazards including persons/material falling, failure of lifting accessories, trapping limbs, and being hit by swinging load require the following precautions:

- ✓ The foreman/supervisor should check that slings used should be of adequate capacity in configuration in which it is being used and free from defects. The crane and all lifting tackles should have a valid test certificate.
- ✓ The mobile crane should be inspected.
- ✓ The tower members loaded in the trailers/trucks will be secured to avoid movement and falling in transit. The vehicle should be checked to avoid overload.
- ✓ During erection all workers should use safety belts, helmets, and safety shoes.
- ✓ The cranes should have test certificates and operated by qualified personnel.
- ✓ Cranes should be operated when properly leveled and positioned
- ✓ In case of missing member, the incomplete tower will be indicated be red flag at offending item. All vehicles, mobile cranes will carry first aid boxes
- ✓ Towers will not be released for stringing unless properly tightened.

Conductor Stringing

Hazards including electric shock, persons/materials falling, injury to onlookers and workmen, damage to public property, require the following precautions:

- ✓ Engineer in charge will ascertain that the necessary permits have been issued and earthing bonds issued where applicable.
- ✓ All scaffolds will be securely erected and positioned to required clearances. Scaffolds will be checked for sufficient strength to withstand applied loads and earthed.
- ✓ Roadside scaffolds will be provided with warning lights and signs.
- ✓ While stringing, both tensioner and puller should be suitably earthed.
- ✓ All workmen will use adequate PPE and body harness safety belts
- ✓ Back staying of towers or conductors will be in accordance with approved techniques and checked daily.
- ✓ Jumpers will be left disconnected until conductor work of all line is complete, in order to reduce risk of accidents due to lightening strike.
- ✓ Adequate communication equipment will be available to warn stringing crew/gang about approaching storm.
- ✓ Spacing chairs will be of approved design.
- ✓ Conductors will not be left in position without adequate warning signs and lights.

- ✓ Onlookers will not be allowed to come near tensioner/puller and under moving stringing and sagging operations.
- ✓ Appropriate signaling signs and communications equipment will be used during stringing and sagging operations.
- ✓ Periodic checks on all tools will be ensured.

Power Tools

Hazards including electric shock, hit by rotating object, foreign body falling in the eye, require the following precautions:

- ✓ An identified electrician at site will check all portable power tools before releasing it to the site, and in addition make sure that the power tools are regularly inspected and a record is maintained.
- ✓ If a power tool is unsafe to use during the regular inspection, it shall be marked/tagged to that effect and returned to stores for repair and replacement.
- ✓ All power cables will be provided with industrial plug and sockets for power distribution.
- ✓ The guards provided in the power shall not be removed either by the technicians or by the maintenance electrician.
- ✓ The power tools shall be returned to the stores at the end of the day or shall be stored properly at site to prevent its damage.

Hand Tools

Hazards including tools falling, hit by sharp edges, hit by flying objects, slipping and falling due to use of worn out tools, require the following precautions:

- ✓ The storekeeper will inspect all the hand tools before issuing it out to ensure that they are in good working condition
- ✓ Defective tools should be identified with reference to broken handles, blunt edges, worn out heads, cracked parts. If found, damaged tools should be removed, returned to store, or destroyed
- ✓ Technicians will be reminded of misuse of tools in tool box meetings and the need to report tool defects
- ✓ Technicians must use goggles while carrying out chipping, hammering and similar operations
- ✓ Use of tools to perform tasks for which they are not made is prohibited

Fire Prevention and Fighting

- ✓ Smoking will not be allowed at site and power house or any other prohibited places.
- ✓ Fire extinguishers should be installed and maintained on site and stores wherever there is a potential fire hazard.
- ✓ Fire surveys will be conducted frequently on site to assess the fire load, type of prevention, and fighting plan required.
- ✓ Flammable liquids such as paints, insulation compounds should be clearly labelled and barricades provided with fireproof walls.
- ✓ All used flammable liquid containers should be collected and removed from site.
- ✓ Packaging materials should be removed on the same day from site, whenever removed from a consignment.
- ✓ Training on use of fire extinguishers shall be conducted to all employees as part of induction session and it will be repeated at the tool box meeting.

Alcohol, Intoxicants, and Non Prescribed Medicine

- ✓ Alcohol, Intoxicants, and Non Prescribed Medicine shall not be permitted on any site.
- ✓ While on job, the use of intoxicants (sedatives, tranquilizer) will not be permitted.

Housekeeping

- ✓ Smoking will not be permitted in site store and office.
- ✓ Trash containers will be kept near the rest area and workers advised to dispose lunch, soft drink, bottles in trash containers.
- ✓ All materials at site will be neatly stacked in the assigned location provided with suitable enclosures.
- ✓ Scrap generated at site will be removed on a day to day basis by the respective personnel at the end of the shift every day.
- ✓ Packaging materials, if any, shall be removed from the site immediately after opening the boxes.
- ✓ Gas cylinders shall be kept in the floors in such a way that it cannot be tipped inadvertently.
- ✓ Welding cables, power cables will be laid in such a way that they will not cause trip hazard.

8.4. Traffic Management Plan

Introduction
The Sindila MHP station Contractor's Traffic Management Plan (TMP) should include recommended practices for moving equipment and persons to, from and power site. The TMP specifies the procedures for monitoring construction-generated traffic movements, and associated environmental problems.

The TMP contains procedures for:

- ✓ Parking on site traffic movement
- ✓ Training, testing, of heavy equipment operators and drivers, including vision tests, and record training
- ✓ Use of project vehicles/buses to transport workers to reduce pressure on existing public transport.

Purpose
The scope of the TMP covers the actions to be taken by all Contractor project personnel (including Sub-contractors personnel) involved in the operation of motor vehicles and provides measures to be implemented by the Sindila MHP contractor to ensure safety of the project personnel and the public.

Responsibility
The Safety Site Coordinator will have the following responsibilities:

- ✓ Check and ensure the drivers have the right qualifications and experience
- ✓ Ensure lane closures against traffic flows which can unduly affect capacities to an unacceptable level
- ✓ Ensure works are undertaken in a safe manner by having a guide to manage traffic flows
- ✓ Make sure the project site is properly delineated at all times
- ✓ Ensure all entry and exit movements to and from traffic streams are in accordance with the requirements of safe working practices
- ✓ Ensure that a 40 km/hr speed restriction is imposed at the work site and in accordance with traffic guides
- ✓ Ensure that the traffic control layout at each work site location is detailed in the traffic control plans.

Traffic Assessment
The works will be undertaken during day from 0800 to 1700 hours. However, the lane closure will need to be maintained at all times while excavation is in place. If the traffic data indicates that the traffic volumes will exceed the recommended lane capacity requirements, work can be undertaken during periods when traffic volumes are anticipated to be lower. Drivers will also take alternative route where possible once they are aware of the potential for delays. Information related to this will be communicated to using appropriate media e.g. fm radio stations and local newspapers.

Hazard identification and risk identification
The following approach will be used for identifying and controlling hazards:

- ✓ Elimination
- ✓ Substitution
- ✓ Engineering
- ✓ Administration
- ✓ PPE

Elimination
Potential hazards associated with the interaction of road traffic such as motor vehicles, pedestrians, cyclists will be eliminated where practical by excluding such traffic from entering the work site.

Adequate road signs to warn pedestrians and motorists of construction activities and or/diversions will be in place.

Substitution
Once methods prove unfeasible, then an alternative method would be proposed to complete the work without compromising the national and international safety and work practice standards.

Engineering
Project vehicles and equipment exiting and entering work sites will be fitted with flash warning lights and hazard lights. All vehicles and construction equipment will be required to have reversing alarms for operations within the work site. Work sites and lanes will be cordoned off from traffic by the placement of cones and signage in accordance with the Uganda Traffic standards. All project vehicles and equipment will be fitted with flashing amber warning and hazard lights, and will be required to have reverse alarms.

Administration
The Contractor will issue safe working procedures for the project workers and vehicles required to enter and leave the construction site into trafficked lanes. Site induction training will take place to advise workers of the potential hazards associated with traffic environment. Traffic control plans and instruction for the setting out, maintenance and removal of signs, cones, temporary pavement markings and other traffic control devices will be prescribed. Procedures and work practices relating to the monitoring, evaluation, and review of the traffic controls will be prescribed. Communication programs and advance warning signs will be required to inform affected stakeholders of the potential hazards associated with the work site.

Personnel Protective Equipment (PPE)
All workers at the project site will be required to wear the appropriate PPE. Traffic controllers will be required to wear high visibility protective clothing and reflective vests as well as steel capped safety boots. When workers on site are required within a specific construction site, traffic controllers may be required to wear additional PPE (hard hats, ear protection, and safety glasses). Traffic controllers will be required to meet the minimum PPE requirements set out by the client prior to entering the work site.

Minimizing Air Pollution
In order to minimise the air pollution, the following measures will be followed to control exhaust emissions

- ✓ Equipment will be maintained in good running condition, no vehicles that generate excessive black smoke should be allowed
- ✓ Vehicle load restrictions will be in force to avoid excessive emissions from engine overloads
- ✓ Where practical, engines should be switched off when not in use
- ✓ Access roads shall be sprinkled with water at least five times a day in settled areas to suppress dust emissions

Procedures for Risks Assessment
- ✓ The procedure for undertaking an ongoing risk assessment will be

    - Evaluation; Each worksite will be checked by the site engineer to assess the risk prior to set out
    - Work site changes; any changes will be made by the site engineer after the risk assessment has been checked. All changes to work site will be documented in the daily diary

Monitoring of work site; the work site engineer will be responsible for monitoring the site hazards and changes to be made accordingly as per matrix. Upon completion, all access roads shall be ripped and rehabilitated.

Traffic Management Implementation
Sequence and Staging
Traffic management requirements must be observed at all times as indicated in the TMP. Details will be provided for all activities relating to installation, staging and removal of signage, lane closures and work activities. These activities will be recorded in the daily diary detailing the time at which they occur.

- ✓ Erection approach and departure advisory signage on approaches to site
- ✓ Lane closure
- ✓ Undertake and complete installation of cables
- ✓ Removal of delineation devices and reopening of closed traffic lanes
- ✓ Removal approach and departure advisory signage
- ✓ Installing road condition advisory signature

Risk Control
The contractor will eliminate all potential hazards associated with the interaction of road traffic and work site personnel through speed restrictions, lane closures and delineation devices to ensure that hazards associated with the mingling of this traffic and work will not occur. Modifying the approach signage layout and installing repeater speed zone signs will minimize potential increase in rear end crashes that may arise should the queue length of traffic on the approaches to the work site extend beyond the proposed advisory signage layout. All project vehicles and equipment will be fitted with flashing amber warning lamps and hazard lights, and will be required to have reversing alarms for operations within the project site. Work sites and lanes will be cordoned off from traffic by the placement of cones and signage in accordance with National Standards.

The following measures will be taken:

- Speed zones shall be put in place where required.
- Safe working procedures will be followed by vehicles required to enter and leave the construction site into trafficked lanes.
- Traffic control plans and instruction for the setting out, maintenance and removal of signage, cones and other traffic control devices will be prescribed. Documentation of this will be recorded in daily dairy.
- All workers will be required to wear high visibility protective clothing and reflective vests.
- Where Traffic controllers are used, they are to be relieved at two hourly intervals and are to be in two-way communication with each other for the duration of the work shift. Traffic controllers are to use night wands in conjunction with the stop/slow bat for night works.
- Site foreman and Site Safety Coordinator will be in two-way communication with each other and the traffic controllers for the duration of the work shift.

Flashing Arrow Signs
Where flashing arrow signs are required to better delineate lane tapers, these will comprise a matrix of lamps or light emitting elements in the form of an arrow that is flashed in a cyclical manner to provide advanced warning. The sign shall have a minimum dimension of 2400 mm x 1200mm. and conform to international standards. The Site Safety Coordinator/Works Supervisor shall ensure that all equipment used meets the National standards.

Temporary Signs and Delineation
Requirements for signage

All signs used shall conform to the designs and dimensions and the national and International traffic standards and codes. Prior to installation, all signs and devices shall be checked to ensure that they are in good condition and meet the following requirements:-

- *Mechanical condition* – Items that are bent, broken or have surface damage shall not be used.
- *Cleanliness* – Items will be free from accumulated dirt, road grime or other contamination
- *Colour of fluorescent signs* – Fluorescent signs whose colour has faded to a point where they have lost their daylight impact shall be replaced.
- *Retro reflectivity* – Signs for night time use whose retro reflectivity is degraded either from long use or surface damage and does not meet the national standards shall be replaced.
- *Battery Operated Devices* – shall be checked for lamp operation and battery condition. Where signs do not conform either to the requirements standards or would fail to pass any of the above checks, they shall be placed on notice from the Site Environmental Coordinator. All signs shall be positioned and erected such that they:-

  - ✓ are properly displayed and securely mounted;
  - ✓ are within the driver's line of sight;
  - ✓ cannot be obscured from view;
  - ✓ do not obscure other devices from the driver's line of sight;
  - ✓ do not become a possible hazard to workers or vehicles; and
  - ✓ do not deflect traffic into an undesirable path.

Signs will be placed clear of the travel path and erected in accordance with the installation plans. Advanced warning signs; other warning signs; Regulatory and other signs; Delineation devices such as cones shall be placed in the same sequence, i.e. those furthermost in advancement placed first. Signs and devices that are erected before are required shall be covered by a suitable opaque material.

Daily Routine Tasks and Record Keeping

The Site Safety Coordinator will ensure that all temporary signs, devices and controls are maintained at all times. To achieve this, procedures in line with the requirements outlined above will be instituted. The monitoring program shall incorporate inspections;

- Before the start of work activities on site,
- During the hours of work,
- Closing down at the end of the shift period, and
- After hours.
- A daily record of the inspections shall be kept indicating;
- When traffic controls were erected,
- When changes to controls occurred and why the changes were undertaken,
- Any significant incidents or observations associated with the traffic controls and their impacts on road users or adjacent properties.

Where an incident is observed or reported associated with the site incident reporting and investigation procedures; the incident will be instigated in accordance with the Health and Safety Management Plan.

After working hours and on non-work days the traffic management layout must be checked at least every six hours and the frequency increased if traffic management elements such as signs, bollards, traffic cones or crash barriers have been disturbed. Any disturbance of such elements must be recorded with sufficient detail to identify the elements involved and the traffic management plan restored to full effectiveness.

Delineation

For short-term lane closures operating for less than 24 hours, cones will be used for delineation. All cones will be at least 700mm in height and constructed from fluorescent orange or red material that is resilient to impact and will not damage vehicles when hit at low speed. Cones shall be designed to be stable under reasonably expected wind conditions and air turbulence from passing traffic. Cones will be inspected at intervals necessary to ensure any mis-alignment or displacement is identified and corrected prior to this causing disruption to traffic. For long term works where delineation will be required for more than 2 weeks, fixed base bollards shall be installed to ensure that the temporary median island created by the bollards remain in place for the duration they are required.

Contingency Arrangements

Road accidents or vehicle breakdown within the project area will be attended to immediately and remedial measures taken. Road works that may impact on any services requiring access to the project area will be cleared from the area as quickly as necessary. Project traffic controllers, supervisors and foreman will be equipped with mobile communications to advise and/or liaise with emergency services to ensure a prompt response will the need arise. There will be a site nurse to assist where required. The Contractor shall when necessary, advise the authorities (Police, Fire brigade and other emergency services) in the event of an emergency during the proposed works and traffic management arrangements.

Pedestrian Access

- Location of access roads/detours shall be done in consultation with the local community especially in important or sensitive environments.
- Access roads shall not traverse wetland areas.
- Pedestrian access will be restricted at times throughout the proposed works. The existing layout of the pedestrian pathway system will be such that there is no existing pedestrian crossing the site. Detours to other footpaths will be signposted.
- After consultations with the Local communities, mechanisms will be put in place to take care of persons that might use the pedestrian crossing.
- Designated walkways must be used to prevent contact with mobile project equipment such as forklifts and vehicles.

Public Transport

Public transport will be directed past the work site as part of the general traffic stream. Parking space will be secured outside the construction area. Care will be taken in deploying the traffic management devices to ensure that traffic rules are not compromised.

Traffic Flows

Accredited traffic controllers shall be called to monitor traffic in peak periods. Any drivers that do approach the project area will be able to legitimately make all manoeuvres before the construction site. The Site Safety Coordinator must call on additional traffic controllers if this situation is likely to occur regularly on weekdays.

Monitoring and Revisions

The Site Safety Coordinator will monitor driver's conduct and performance, to ensure high safety standards are maintained. Disciplinary measures, including verbal, written warnings or dismissal, will be used in the event of driving infractions. The TMP will also address construction traffic volume and the impact on local road conditions aimed at identifying required improvements and maintenance.

The Contractor will endeavour to monitor the traffic situation carefully especially during the first few days of operation to ensure that future monitoring is proper. Any minor adjustments to improve performance and safety will be made and recorded as specified. If significant issues arise, then the plan will be promptly reviewed. This includes pedestrian safety matters, detour arrangements, signage and lighting.

Public Awareness Campaign
The Contractor will undertake public awareness campaign prior to commencement of the works to advise all road users of the forthcoming works, the likely timeframe of the works and road conditions likely to be encountered. This campaign will be broad enough to reach the general motoring public and will consist of a combination of the following options:

- Erecting advance advisory signage in the form of a black and yellow temporary sign erected on the approaches to the work site 10 days prior to commencement of works indicating the type of work to be undertaken, and the time and date of the works.
- Place notices in the local newspapers and FM radio stations.
- Install variable message signs to warn traffic of possible congestion at the work area.
- Liaise with emergency services (i.e. Police, Fire brigade and other emergency Services).
- Liaise with the Ministry of Works, Housing and Communication and police where public transport is likely to be affected.
- Liaise with Local Authorities regarding local issues and possible disruption of commercial services
- Liaise, if necessary, with affected business proprietors and/or residents to make appropriate provisions.

Newspaper/Radio and Notices

A newspaper notice will be placed in popular daily newspapers and local FM radios for two consecutive weeks immediately before the commencement of given works that are likely to affect road transport.

Other requirements

Prior to the finalization of any traffic control plan, the contractor shall liaise with the Police, Ministry of Works, Housing and Communication, Local Authority and any other affected stakeholder to ensure all concerns are considered and appropriate strategies to address those concerns are embodied into the relevant traffic control plans.

Records
Daily set out and implementation of traffic control devices, lane closures and delineation as per the Traffic Control Diagram specific to the stage of works and site, shall be documented in a daily diary. Any variation to the Traffic Management Plan and/or Traffic Control Diagram shall be documented, state the nature of the variation and state the reasons why the variation was necessary.

8.5. Waste Management Plan

Purpose of the Waste Management Plan

The Contractor should strive to achieve accepted international best practice of waste handling and management. Achieving best practice means that waste generation is minimised, recycling is practiced wherever possible and that the disposal of wastes is undertaken in a responsible manner. The waste management plan has been developed based on best practice principles of cleaner production. It is a three tiered system aimed at:

- Minimising the creation of waste through efficient use of resources,
- Maximising reuse and recycling of waste materials,
- Appropriately disposing of all generated waste materials to prevent environmental harm and minimise volumes disposed to a designated area.

The disposal of waste has the potential to adversely affect the natural and physical environment and amenity values of the project. The Waste Management Plan (WMP) Plan specifies provisions for disposal, re-use or recycling and disposal of wastes including solid and hazardous waste. The scope of WMP includes actions to be taken by the Contractor (including Sub-contractors personnel) for the management and proper and safe disposal of waste materials generated by the project activities.

Specifically the purpose of the WMP is to:

- Identify the different types of waste likely to be generated by the Sindila MHP construction and operation activities.
- Define their segregation methods;
- Provide information on local waste transportation and disposal regulations and permitting requirements;
- Define responsibility for waste management handling including safe disposal; and
- Comply with environmental requirements, policies and procedures and with Environmental laws, rules and regulations applicable in Uganda regarding Waste Management.
- Establish a system of colour coded bins to segregate waste at its source.
- Develop a system whereby any new chemical that is not currently used on site is approved first by REA.
- Zero hazardous wastes disposed to landfill.

Proper waste management will be accomplished through:

- Reduction
- Reuse
- Recycling
- Recovery
- Treatment; and
- Responsible disposal

Responsibility

The Contractor should ensure the health, safety and welfare of its employees, sub-contractors, and members of the public and achieving sustainable environmental objectives at all sites. During implementation, the Contractor will be responsible for the collection, storage, treatment and transportation of all types of waste generated during the course of project activities. The Contractor will provide all the necessary planning, materials, equipment, tools and training required to ensure appropriate project waste management. For project activities in the field, all waste generated will be collected and disposed of at a recommended waste disposal site after consulting relevant authorities.

Waste Management Guidelines

The Contractor should be committed to integrated waste management and aware that consent may be required for any discharge of waste to public sewerage or storm water drainage systems. As a result the Contractor will put in place the following measures:

- Encouraging re-use of materials where possible.
- Separating re-usable and recyclable materials from non-recyclable materials prior to disposal.
- Providing adequate space on-site for storage of separated material.
- From time to time, undertaking a review of waste stream to identify the types and quantities of wastes generated.
- Monitoring waste stream to minimise unnecessary waste and to reduce the cost of oversupply and waste disposal.
- When purchasing materials and equipment, the Contractor will take into account the cost of disposing of additional or unnecessary packaging, as well as the type of packaging.
- The Contractor will purchase materials that have recyclable content where possible.
- Avoid discharging of waste to sewerage or storm water drainage systems where possible.

Waste Minimization

The Contractor's waste management plan will be in compliance with the applicable Ugandan regulations. Waste types to be generated during the project period will include:

1. Non hazardous waste: This is waste that is not hazardous and may consist of recyclable and non-recyclable components. Non hazardous waste can be a combination of putrescible and non putrescible waste materials.

2. Hazardous Waste: these are wastes which by virtue of their concentration of constituents and characteristics (such as ignitibility, corrosiveness, reactivity, toxicity, radioactivity etc.) pose a hazard to human or environmental health if improperly managed e.g. waste oil and lubricants. The Contractor will dispose of Hazardous waste in compliance with national and international requirements.

Waste Reduction and Disposal

Activities within the project can generate significant quantities of waste. The contractor will ensure that the collection, recycling, recovery, treatment and disposal of wastes have positive and no adverse effects on the environment. A reduction in waste volume will reduce the scale and intensity of those effects. Some wastes will be treated or processed so that it is no longer waste.

Waste reduction is an important means of promoting sustainable management and supports the Waste Management Plan under the National Environment (waste Management) Regulations (1999). Under regulation 5(1), a person who owns or controls a facility or premises, which generate waste, shall minimize the waste generated by adopting cleaner production methods like incorporating environmental concerns in the design and disposal of a product.

The Contractor will ensure that solid waste volumes are reduced by:

- Reduction in the volume of solid waste generated.
- Reduced consumption and reduced waste of resources.
- Reduction in environmental pollution and land contamination through better management and disposal of solid waste.
- Recovery of resources that will yield economic and social benefits to the community.
- Appropriate siting, design and management of waste management facilities.

- Practices that reduce the volume of solid waste generated and disposed of in an environmentally friendly manner should be promoted.
- Waste should be minimised where possible, or re-used or recycled.
- Encouraging community involvement and private enterprise participation in the reduction, collection and recycling of solid waste. However for the communities, this will be done in consultation with local councils.

The Contractor will ensure that any sub-contractor hired to the effect of solid waste collection, recycling, recovery, transfer, treatment and disposal operations will minimise social and environmental impacts. To achieve this, the Contractor will ensure that solid waste collection, recycling, recovery, storage, treatment and disposal activities are properly sited, designed and managed to avoid, remedy or mitigate adverse effects on the environment and amenity values. In particular negative impacts on health and safety, high quality soils, landscapes, and ecologically and culturally sensitive areas will be minimised.

Waste Management Activities

The Contractor will hire a sub-contractor to collect, treat and dispose of waste. Wastes will be collected in temporary, clearly labelled containers. Efforts will be made to recycle the wastes and only dispose of those that cannot be recycled. Waste management facilities will be appropriately designed and managed to minimise adverse effects. The effects vary with the receiving environment and type of waste. Waste containing hazardous substances can pose health and safety risks and will be dealt with as indicated in the Hazardous Waste Management Plan.

The philosophy of waste minimisation, recycling, treatment and disposal (as a last resort option) applies to each of the categories of waste that will be generated during the Interconnection Project. These include:

- Regulated or Hazardous wastes
- Food Wastes also known as putrescible waste
- Non-hazardous recyclables
- Non-hazardous non-recyclables
- Metallic wastes/scrap

The disposal options for major regulated waste streams that are likely to be generated at the project are as outlined below.

Disposal of chemical containers and leftover chemicals will be an important consideration in the granting of environmental approval. If possible the need to dispose of containers should be totally eliminated by using bulk systems (e.g. for oils, acids, reagents and detergents).

The Contractor will keep a database of all chemicals and this is used to assist in the management of chemicals on site. The database will be held in the Health and Safety Department. This system will be supplemented by regular inspections to ensure chemicals are correctly stored, labelled, transported and disposed.

<u>Oil waste</u>

The primary emphasis will also be on minimising the generation of oily waste. Strategies that will be developed to assist this process include:

- Bulk storage of lubricating, hydraulic and gear oils to eliminate the need for drums.
- The use of water-based, quick-break degreasers and detergents that effectively clean and enable oil/water separator systems to work effectively
- Storage of all oils that are being used in concrete bunded areas to minimise the potential of contaminating soil with oil.
- An effective planned maintenance system to minimise the chances of hydraulic hose rupture.

- Orderly storage of oils in stores yard i.e. no leaking drums, no storage of drums on its side, wooden pallets in good condition.

Recycling/Disposal of Waste oil

Waste oil will be removed from machinery and a mixture of hydraulic, lubrication and gear oils will be combined in waste oil tanks situated in selected bunded areas. The oil will be periodically collected by the supplying oils companies.

Oily Rags and Oil Filters

Oily rags and oil filters will be placed into labelled drums. They will be disposed off in consultation with District Environment Officer and preferably they will be taken for incineration.

Medical Waste

Medical waste that will be generated from the project or onsite treatment will be placed in labelled medical waste containers by the Medical staff. Disposal of medical waste will be via burning in an incinerator (under supervision of Medical staff at a given incinerator location).

Batteries

The Contractor will produce a limited number of used batteries each year. Efforts and negotiations will be made so that used batteries can be taken to Uganda Batteries for recycling.

Tyres

All used tyres will be collected by a designated local contractor.

Sewerage

Sewage disposal may be to a septic tank connected to a soak way pit. No sewage or any other untreated waste water will be discharged into the surrounding streams and environment. For the work force while in the field, mobile toilets will be provided. They will be emptied as soon they fill up and the contents taken to a given public wastewater treatment facility.

Food wastes will be generated from different project sites including canteens and field sites. These wastes will be put in labelled containers and disposed of to a given municipal disposal facility.

Non-Hazardous Recyclables

All non-hazardous materials with the potential for recycling will be segregated and either recycled on-site or sent off-site.

Cardboard/Paper

Cardboard and paper will be placed into labelled and colour-coded bins. As a result this material will be burned to prevent it being scattered outside of the rubbish tip.

Wood

The main source of waste wood is packing crates and pallets. Wood will be collected into bins and sold or given away to the local community.

Scrap Metal

Scrap-metal will be separated and put in labelled and colour-coded scrap metal bins and will be periodically collected by a designated local contractor who will be advised to take it for recycling (scrap for cash).

Non-Hazardous Non-Recyclables

General non-hazardous waste not suitable for recycling includes general litter and a range of plastic wrappings. These items will be placed in general refuse bins and disposed of at appropriate designated sites.

Logistics and Temporary Storage

Bins

Each work area will be equipped with a range of colour coded and labelled bins and primary segregation of rubbish will take place in the work-place as indicated in Table 8.3.

Table 8.3 Possible Rubbish Bin Colour Codes and Labeling

Color	Color name	meaning
	Green	Food Wastes (Marked FOOD WASTES ONLY)
	Yellow	Paper/Cardboard (Marked PAPER/CARDBOARD ONLY)
	Light Blue	Plastic/General Waste (MARKED PLASTIC/GENERAL WASTE ONLY)
	Orange	Medical wastes (Marked MEDICALWASTES ONLY)
	Grey	Scrap Metal (Marked METAL ONLY)
	Red	Oily Wastes including Filters (Marked OILY WASTES ONLY)
	Brown	Wood (Marked WOOD ONLY)

Primary pick-up

The Safety Department will be responsible for ensuring that bins are emptied on a regular basis and that segregated waste is taken to its appropriate location.

Removal

Waste removal will be undertaken routinely by a number of contractors and delivered to the appropriate off-site locations.

Regulatory methods

The Contractor will conform in all respects, with the national rules namely;

- Those requiring the provision of space for waste minimization and storage of recyclable materials in comprehensive residential developments.
- Those that control activities by reference to location, scale and intensity of solid waste management activities, and hours of operation.
- Rules that control the storage, use, disposal and collection of hazardous wastes and other wastes.

Information, Advocacy and Education
The Contractor will:

- Provide information to encourage, promote and support waste minimization.
- Increase public awareness of ways to reduce waste disposal and increase diversion.
- Promote waste management guidelines for non-residential activities.
- Increase public awareness of appropriate disposal of building and demolition materials.

8.6. Labour Force Management Plan

Purpose

This Labour Force Management Plan (LMFP) is to comply with the minimum Government of Uganda and International Labour Standards, which include:

- Freedom of association and collective bargaining;
- Non-discrimination and equality of opportunity;
- Freedom from child labour;
- Freedom from forced labour;
- Retrenchment of which the core requirement is to have a retrenchment plan based on consultation and non-discrimination;
- Working relations which should include documentation and communication of conditions;
- Working conditions which should comply with collective bargains or, where these are not in place, national law minimums on matters such as pay, hours, etc;
- Grievance mechanisms whereby an appropriate procedure must be in place for workers; and,
- Human resource policy where the Contractor is expected to have a human resource policy in place.

The Contractor will ensure that the management of all employees working on the Project including those who are indirectly employed:

- Complies with Ugandan law and meets the requirements of the African Development Bank Performance Standards;
- Optimises the benefits associated with construction employment; and,
- Mitigates where possible any negative impacts that might occur as a result of construction employment or subsequent retrenchment.

This LFMP seeks to achieve the above objectives through clear and manageable plans and procedures, underpinned by the explicit guiding principles detailed below. This LFMP is applicable to the direct and indirectly-employed workforce (i.e. sub-contractors), at all skill levels working on the project.

ILO Principles

Within this LFMP, nine labour standards are addressed. The first four of these are stated in the Declaration on Fundamental Principles and Rights at Work adopted by the International Labour Organization ("ILO") in 1998. Unlike an international labour convention that binds only members that ratify it, the Declaration applies automatically to all countries that have accepted the ILO Constitution. This means the Contractor should promote and realize these four fundamental standards outlined below:

- Freedom of Association and the effective recognition of the right to collective bargaining;
- Elimination of all forms of forced or compulsory labour;
- Effective abolition of child labour; and,
- Elimination of discrimination in respect of employment and occupation.

In addition to these standards, the Contractor will ensure recognition of the action points that cover five further standards based on other international conventions of the ILO and on provisions contained in regional and national law including:

- Health and safety including HIV/AIDS prevention;
- Wages to be paid in full and on time, to meet legal minima and be sufficient for basic needs;
- Paying for hourly workers, working hours to be limited, and overtime;
- No repeated casualisation to avoid meeting wages and other legal benefits; and,
- Ensuring that relevant social security regimes are applied.

Compliance with Laws
The Contractor will conform in all respects, including by the giving of all notices and the paying of all fees, with the provisions of:

- Any national or state statute, ordinance, or other law, or any regulation, or by-law of any local or other duly constituted authority in relation to the execution and completion of the project and the remedying of any defects therein; and,

- The rules and regulations of all public bodies and companies whose property or rights are affected or may be affected in any way by the project.

Responsibilities
The Contractor will be responsible for the implementation of this LFMP.

The following sections outline the principles and measures that the Contractor will take to address each of the standards and policies outlined above.

Employment
The Contractor will employ technical staff, who are skilled and experienced in their respective callings and such foremen and leading hands as are competent to give proper superintendence of the project. The skilled, semi-skilled and unskilled labour is necessary for the proper and timely fulfilling of the construction, including implementation of planned mitigation and community development measures for the project.

The Contractor will also ensure that local residents are given first priority for job opportunities for which they are qualified, before workers from outside the region are hired. Details of specific job opportunities will be released and information provided on application procedures.

Freedom of Association
The Contractor should recognize the freedom of its employees, the non-employee workers of the project, and the Contractor employees and their sub-contractors to be members of registered trade unions and to participate in collective bargaining agreements. Workers shall be allowed to establish and join work-based organizations if they wish to negotiate wages and other working conditions.

The Ugandan Labour Unions Act (2006) regulates the establishment, registration and management of labour unions and provides for other related matters. The Government of Uganda Labour Disputes (Arbitration and Settlement) Act, 2006, outlines the process for the resolution of disputes with regard to labour. ILO conventions C87-Freedom of Association and Protection of the Right to Organise 1948; C98- Right to Organise and Collective Bargaining 1949; and C135 - Workers Representatives Convention 1971 will apply.

Equality of Treatment
The ILO conventions to be applied include the C 100 - Equal Remuneration 1951; and C111 - Discrimination (Employment and Occupation 1958) conventions. Discrimination means denying someone a job or training on the basis of a factor, which does not affect their ability to perform that job for example, because they are from a particular region, ethnic group, or because they are women. In practice discrimination is often justified in terms of culture, e.g. “our women like to carry concrete”, implying they will not be considered for other jobs. Such an attitude is discriminatory if it results in limiting employment opportunities for a particular group.

The Contractor should commit to ensuring that men and women hired for work on the project receive equal rates of pay for equal types of work. They will not discriminate in its hiring and employment practices on any basis of sex, race, culture, religion, sexual orientation, or other aspect as per ILO convention.

Wages

ILO standards deal with the issue of wage protection: Protection of Wages Convention (No. 95) and Recommendation (No. 85). They also deal with protection of workers' claims in case of their employer's bankruptcy or judicial liquidation: Protection of Workers' Claims (Employer's Insolvency) Convention (No. 173) and Recommendation (No. 180). Where there is a current national minimum wage, this wage can be used as a standard. However, high inflation may mean that the rate is out of date. In this case, the rate agreed in the relevant collective agreement should be applied. If there is no such agreement, the rate used by a similar company known for good practice may be an alternative reference point. The Contractor should ensure that Wages are paid in cash, not in kind in accordance to ILO Convention (ILO conventions C131 – Minimum Wage Fixing Convention; C95 - Protection of Wages Convention 1949); The Contractor will further display notices to inform workers about their contract condition in accordance to C94 t - Labour Clauses on Public Contracts.

The Contractor will determine Wages in accordance to The Minimum Wages Advisory Boards and Wages Councils Act, Cap. 221 established by the Government of Uganda that provides for the establishment of minimum wages advisory boards and wage councils for the regulation of the remuneration and conditions of employment and employees.

Minimum Wages

The Contractor will establish rates of wages and observe conditions equitable to those established for the trade or industry where the work is carried out. In the absence of trade or industry-established rates of wages or conditions of labour, the he shall pay rates of wages and observe conditions of labour which are equitable to the general level of wages and conditions observed by other employers engaged in trades or industries similar.

Timeliness of Payment

The Minimum Wages Advisory Boards and Wages Councils Act, Cap. 221(section 10) established by the Government of Uganda establishes the timing for the payment of wages. The Contractor will pay employees promptly and regularly at the customary intervals and ensure that all employees are paid in full.

Working Hours

The Contractor will employ both salary and non-salary staff. The provisions below apply mainly to non-salary staff being paid on an hourly basis.

National law specifies the working week, – but it is usually 40 – 42 hours. Overtime should be paid above this rate according to the national legal formula. Regulations should ensure that the use of task-based/piecework do not lead to self-exploitation and workers having to spend longer hours than specified in the legislation (ILO conventions C14 – Weekly Rest (Industry) 1921, C1 - Hours of Work (Industry) 1919, also C47).

Due to the nature of the large infrastructure construction project, the Contractor employees will be required to perform overtime work. Hours of work will be compliant with the Ugandan Employment Act 2006, Section (53), and subsection (4):

Sub-section (5) states that where persons are employed in shifts, it shall be permissible to employ persons in excess of 10 hours in any one day, or 48 hours in any one week, where the average number of hours over the period of 3 weeks exceeds neither 10 hours per day nor 56 hours per week.

Where employee's are required to work overtime, and in the absence of other accommodations, they will be compensated in compliance with Section (53), subsection (8) of the Ugandan Employee Act (2006).

The Contractor will ensure that work for the project is not carried out on locally recognized days of rest and public holidays and all recognized festivals, and religious or other customs, except when work is unavoidable or previously scheduled with amenable staff. Where employees are required to work on public holidays they will be remunerated or otherwise compensated consistent with Section 54 of the Ugandan Employee Act (2006). The provisions of this paragraph shall not be applicable in the case of any work which is carried out in multiple shifts which may include night shifts.

Health and Safety
The Contractor should commit to the safety of its employees and non-employee workers at the worksite and will operate in collaboration with and to the requirements of the local health authorities.

The Contractor will comply with the Government of Uganda's Workers' Compensation Act, 2000 which outlines the compensation to workers for injuries suffered and Scheduled diseases incurred during the course of employment.

Ugandan regulations require basic protective clothing for construction including proper foot protection, overalls where needed, protective gloves, and raincoats for wet weather work.

The Contractor health and safety policies will comply with applicable provisions of the Ugandan Occupational Safety and Health Act, 2006, as well as applicable ILO clauses C155 - Occupational Health and Safety 1981; C167 – Safety and Health in Construction 1988, and ILO Code of Practice on Safety and Health in Construction 1992 which covers safety and health planning, co-ordination and compliance.

PPE
In accordance with Section 19 of the Uganda Occupational Safety and Health Act, 2006, the Contractor will provide and equip all employees with the appropriate personal protective equipment (PPE) to adequately protect them from hazards associated with their specific occupation. All PPE including protective clothing and equipment purchased for use by its employers is manufactured to such a nationally and internationally recognized standard as to ensure adequate protection against injury and accident. Any sub-contractors involved in the construction phase of the project will provide the appropriate level of PPE to their employees.

First Aid
In accordance with Section 55(1-8) of the Uganda Occupational Health and Safety Act of 2006, the Contractor will provide and maintain adequate first aid facilities appropriate to the conditions of work being undertaken for the project. Scale of first aid facilities will be related to the size of the job. In the event of a medical emergency, the Contractor will also make arrangements to evacuate injured persons to a health centre.

Measures against Insect and Pest
The Contractor is committed to taking the necessary precautions to protect all employees and non-employee workers on the worksite from insect nuisance, rats and other pests and reduce the dangers to health and the general nuisance occasioned by the same.

Epidemics
In the event of any outbreak of illness of an epidemic nature, the Contractor will comply with and carry out such regulations, orders and requirements as may be made by the Government, or the local medical or sanitary authorities, for the purpose of dealing with and overcoming the epidemic.

Burial of the Dead
The Contractor will make all necessary arrangements for the transport, to any place as required for burial, of any of his expatriate employees or members of their families who may die in Uganda. The Contractor will also assist with appropriate arrangements with regard to burial of any of its local employees who may die while engaged in work.

Accident and Injury to Workers
Except as required by Ugandan Law, the Contractor will be liable for or in respect of any damages or compensation payable to any employee from injury resulting from any act or default of the Contractor, his agents or servants.

Reporting Accidents
The Contractor will ensure any sub-contracts established with non-employee workers for the project will outline the responsibilities to report details of any accident as soon as possible after its occurrence. In the case of any fatality or serious accident, the Contractor will ensure that the sub-contractors are aware of the importance to notify immediately by the quickest available means following an accident.

Records of Safety and Health
The Contractor will maintain safety and health records and make reports concerning safety, health and welfare of persons and damage available to the appropriate authorities.

Amenities
In accordance with Section 50 of the Uganda OSHA, 2006, the Contractor will in so far as is reasonably practicable, having regard to local conditions, provide on the worksite an adequate supply of potable drinking water for the use of his employees and non-employee workers.

In accordance with Section 49 of the Uganda OSHA, 2006, the Contractor will provide and maintain adequate sanitary latrine accommodation for the use of the employees and non-employee workers for the interconnection project and shall keep the whole of the facility and latrines in a clean and sanitary condition in accordance with the requirements of the Health Authorities of the Government.

In accordance with Section 54 of the Uganda OSHA, 2006, the Contractor shall provide suitable facilities appropriately furnished for the consumption of food. With respect to expatriate workers, the Contractor shall provide and maintain such accommodation and amenities as may be considered necessary for employees or non-employee workers employed for the purposes of or in connection with the project.

Engagement of Labour
The preference is to employ local staff where possible and with the required qualifications and experience.

The Contractor will make arrangements for the engagement of expatriate labour and for the housing, health, welfare and repatriation of the same. The Contractor will be responsible for the return of expatriates to the place where they were recruited following the termination of their employment. The Contractor will comply with the applicable provisions of ILO policies regarding avoidance of forced labour.

The Contractor may from time to time employ casual / temporary labour for the project. The Contractor will keep records to include information on casual / temporary labour and intentions to avoid long term status of casual workers.

Damage to Persons and Property
The Contractor will ensure that any sub-contractor hired during the construction phase of the project is obliged under their sub-contractual agreements with the Contractor to indemnify the Contractor against all losses and claims in respect of:

- Death of or injury to any person; or,
- Loss of or damage to any property, which may arise out of or in consequence of the execution of the project and the remedying of any defects therein, and against all claims,

proceedings, damages, costs, charges and expenses whatsoever in respect thereof or in relation thereto.

Employment of Children

The ILO definition of a child is a person of 14 years of age or under. If hazardous work is involved then the minimum age is 18 years. Applicable conventions adopted by the ILO to be applied include C138 -Minimum Age 1973; and C182 - Worst Forms of Child Labour 1999.

In accordance with the Ugandan Employment Act (2006) Section 32, the Contractor will forbid the employment of anyone under the age of 18. Ugandan Law forbids the employment of any child under the age of 12 or under the age of 14 unless it is light work, does not interfere with schooling and only under the direct supervision of a person age 18 or over.

Records

The Minimum Wages Advisory Boards and Wages Councils Act, Cap. 221 (section 10) established by the Government of Uganda addresses record and notice requirements for employers where a wages regulation order applies. Section 21 of this act addresses penalties for false entries or records. Section (50) of the Ugandan Employment Act stipulates the requirement of the employer to provide pay statements.

The Contractor will keep proper records of the time worked by every employee engaged on the project irrespective of the employee's method of payment (hourly or salary), the class of work on which employed and the wages paid. The Contractor will keep proper records for every employee engaged, their gender, the class of work in which he/she is employed, whether as a casual or permanent employee, and the wages (and allowances if any), paid in accordance with Ugandan regulations. These records will be available at any time for inspection by authorized lender representative or authorised representative of the government. The Contractor will produce, if required, other records that may be necessary to provide evidence of their compliance with the requirements of this paragraph.

Grievance Mechanism

According to IFC's Performance Standard 1, if ongoing risks to, or adverse impacts on project-affected communities are anticipated, the Project Sponsor is required to "establish a grievance mechanism to receive and facilitate resolution of the affected communities' concerns and grievances about the client's environmental and social performance" (IFC, 2006). The Contractor will establish a grievance mechanism which will be is accessible to its employees, their non-employee workers or subcontractors.

Others

<u>No Alcoholic Liquor, Drugs, and Firearms</u>

The Contractor will not import, sell, give, barter or otherwise dispose of any alcoholic liquor or illegal drugs, or permit or suffer any such importation, sale, gift, barter or disposal by its employees, labour or contractors.

<u>Festivals and religious Customs</u>

In all dealings with his staff and labour, the Contractor will have due regard to all recognised festivals, days of rest and religious or other customs. It is recognized that some form of construction activities will be required during these times and will managed as described in the section on Working Hours.

<u>Disorderly Conduct</u>

The Contractor will at all times take all reasonable precautions to prevent any unlawful, riotous or disorderly conduct by or amongst his staff and labour and for the preservation of peace and protection of people and property in the neighbourhood of the project.

Illegal Hunting

To avoid illegal hunting, the Contractor will:

- Prohibit project workers from hunting bush meat during working hours or on project work sites.
- Prohibit project workers from possessing firearms, snares and other hunting equipment when on project work sites.
- Prohibit transport of bush meat on project vehicles.
- Pay workers an adequate wage so that they can buy their food without augmenting it with illegally obtained bush meat.

8.7. HIV/AIDS Policy

The ILO's Code of Practice on AIDS recognizes HIV/AIDS as a workplace issue and goes beyond raising awareness to include non-discrimination, confidentiality, care and support. UNAIDS and other agencies produce guidelines of employer good practice with regard to HIV/AIDS. The Contractor will also follow applicable Ugandan national policy on HIV/AIDS.

The Contractor will arrange for its employees to attend an HIV awareness programme provided in accordance with the SEA and UNAID guidelines by a third party organisation such as The Aids Support Organisation ("TASO"). The programme will take place during its employee's normal working hours. HIV/AIDS management programmes will be subject to the normal monitoring process of the project. Further information about the HIV awareness programme is provided below.

The Contractor will:

- Sub-contract with an Approved Service Provider to provide an HIV Awareness Programme to Employees and the Local Community;
- Give any representative of the Approved Service Provider all reasonable access to the worksite in connection with the HIV Awareness Programme;
- Instruct Employees to attend the HIV Awareness Programme in the course of their employment and during their normal working hours or any period of overtime provided for in the relevant employment contracts and uses all reasonable endeavours to ensure this instruction is followed;
- Provide suitable space for delivery of the HIV Awareness Programme; and,
- Referral to testing, counselling and advice on AIDS in compliance with UNAIDS guidelines.

The Contractor will treat HIV/AIDS the same as other life-threatening illnesses and handicaps in terms of our policies and benefits where they apply. The Contractor should not discriminate against a qualified individual with regard to job application, hiring, advancement, discharge, compensation, training, or other terms, conditions or privileges of employment.

The Contractor should recognise that an employee with HIV/AIDS or another life-threatening illness may wish to continue in as many of his/her normal pursuits as his/her illness allows, including work. The Contractor will be supportive of and make reasonable accommodation for the employee who is medically able to perform his/her job. An employee's medical information is personal and will be treated as confidential.

While accommodating employees with life-threatening diseases and other disabilities, however, The Contractor should provide a safe work environment for all employees. The Contractor should be sensitive and responsive to co-worker's concerns and will emphasize employee education:

- People with AIDS or HIV infection are entitled to the same rights, benefits and opportunities as people with other serious or life-threatening illnesses.
- Employment practices comply with local laws and regulations and/or the practices of the parent company, whichever is greater, and where applicable.
- Employment practices are based on the scientific and epidemiological evidence that people with AIDS or HIV infection do not pose a risk of transmission of the virus to co-workers through ordinary workplace contact.

- Senior management unequivocally endorses non-discriminatory employment practices and education programs or information about AIDS. The Contractor will communicate policies and practices to employees in simple, clear, and unambiguous terms.

- The contractor will provide employees with sensitive, accurate and up-to-date information about risk reduction in their personal lives.

- The contractor will protect the confidentiality of employee's medical insurance information.

- To prevent work disruption and rejection by co-workers of an employee with AIDS or HIV infection, the contractor will undertake education for all employees before such an incident occurs and as needed thereafter.

- The contractor does not require HIV screening as part of pre-employment or general workplace physical examinations.

8.8. Pollutant Spill Contingency Plan

Purpose
Pollutant Spill Contingency Plan (PSCP) has been prepared to enable the Contractor to provide procedures for proper handling of pollutants and the procedures to be taken in the event of a spill. The scope of the PSCP is to minimise the risk of spills during project construction activities as well as to provide information about equipment and materials available to undertake immediate remedial actions.

The purpose of this Contingency Plan is to establish a mechanism for mutual assistance, under which management of the Contractor employees on the project, including those who are indirectly employed will co-operate in order to co-ordinate and integrate their response to pollution incidents likely to affect the construction of the project structures.

PSCP covers the actions that will be taken by all workers in the event of an accidental release of hazardous substances, fuels or any other potentially polluting materials. These actions include:

- Materials needed to contain and clean-up spilled hazardous materials, which will be maintained on-site at all times. A material quality sufficient to contain and clean the spilled materials will be available.
- All weather sealed containers will be used to store hazardous materials. These containers will be colour coded and labelled as *Hazardous Material Spill Supplies*.
- All containers will be labelled in relation to their contents.
- Earth and/or water contaminated by the spilled hazardous materials will be secured in all weather sealed containers for transport to an approved waste receptor site.

Responsibilities
The Contractor is responsible for the implementation of the PSCP. While the Contractor shall have overall responsibility for the implementation of this plan, the Project Social and Environmental Manager will have the responsibility to verify its implementation. All supervisors will be made aware of and sensitised about this plan.

The general objective of the Plan is to organise a prompt and effective response to oil spills affecting or likely to affect the area of responsibility of the project and facilitate their co-operation in the field of oil and chemical pollution preparedness and response. The specific objectives are to:

- define areas of responsibility of the parties to the Plan;
- determine the extent of co-operation for the implementation of the Plan between the responsible authorities, at the operational level;
- specify the type of assistance which might be provided and the conditions under which it will be provided;
- divide the responsibilities and to provide for the transfer of responsibilities
- establish the principles of command and liaison, and to define the corresponding structures;
- determine in advance the financial conditions and administrative modalities related to co-operative actions in case of emergency.

Response Elements
The lead role in the implementation of the plan shall be assumed by the Contractor whose area of responsibility has been affected or is likely to be affected by a pollution incident.

For the purpose of this plan the contractor shall set up an Emergency Response Centre (ERC) manned 24 hours a day, which will be equipped with appropriate communications system and have necessary facilities to be used as the operations room of the Operational Command in case of Joint Response Operations (JRO).

Command Structure
The command structure for Joint Response Operations should consist of:

Operational Command which is responsible for overall co-ordination and control of *Joint Response Operations* and consists of taking decisions concerning response strategy and defining the tasks of various concerned parties.

Operational Control which is direct control over personnel, means units taking part in the response operations, including giving orders to specific groups of teams and units for execution of response operations, in accordance with the strategy and the tasks defined by the Operational Command.

Tactical Command which consists of directing and supervising the execution of specific tasks by teams or units on the scene. Tactical Command is exercised by the Leader of each team taking part in the response operations.

Communications Arrangements
For effective communication, record keeping and easy accessibility, English language shall be used in all communications related to the implementation of the plan. Important communications by radio or telephone should be confirmed by fax, telex or e-mail. This is to include the activation of the plan, requests for assistance, offers of assistance, estimated costs of assistance, acceptance of requests, instructions by the command for the movement and deployment of assisting units, tasks assigned to units and termination of operations.

Response to a pollution incident within the area of responsibility of the Contractor shall be conducted in accordance with the provisions of National Legislations. In order to facilitate smooth proceeding of Joint Response Operations, the Parties shall inform each other about relevant parts of their National Contingency Plan (NCP) and, in particular, those parts describing:

- national response organisation;
- likely sources of oil spills, vulnerable resources and priorities for protection;
- resources for responding to accidental pollution, available at the national level;
- rules concerning the use of dispersants; and
- logistic support available within Uganda.

Maps showing possible sources of pollution, environmentally sensitive areas, priorities for protection and areas where the use of dispersant is allowed, restricted or forbidden, will be are included in the National Contingency Plans (NCPs).

Response Strategy
Deciding upon the response strategy to be applied in each particular pollution incident and planning of specific operations shall be the responsibility of On Scene Coordinator (OSC). In taking such decision the OSC shall follow the outline given below.

- assessment of the severity of the incident,
- activation of the National Contingency Plan and notification of other Parties;
- selection of appropriate response methods;
- evaluation of available and required response resources;
- request for assistance;
- implementation of selected response methods, making use of national resources and resources from assisting Parties;

- re-assessment of the situation and making necessary modifications in response actions;
- termination of response operations;
- de-activation of the plan;
- returning equipment and other means rendered as assistance by the other Parties.

Response Operations

Response Phases

For the purpose of this Contingency Plan, pollution response operations have been divided into three distinct phases:

Phase I - Notification

Phase II - Evaluation and activation of the Plan

Phase III - Joint response operations

It is understood that according to circumstances, entire phases or parts thereof, may take place concurrently with one or more other phases.

Phase I

Notification and verification of information concerning pollution incidents shall be done, at the national level. When a major pollution incident has occurred, that is, one requiring counter-pollution resources to be mobilised, the Contractor shall inform the relevant stakeholders through their National Contact Point immediately after receiving and verifying the incident report, regardless of the need for the activation of the Plan. The relevant Operational Authority in this context is that of the Party in whose area of responsibility the incident has occurred.

Judgment must be used when there has been an incident which may cause pollution but has not yet done so. If the pollution would threaten neighbouring water bodies the responsible management authorities should be informed.

Phase II

The Contractor shall assess the pollution and determine the type and level of response required and whether or not to activate the Plan.

- inform the Operational Authorities of the other Parties, through their designated National Contact Points, who has been appointed OSC;

- activate its own Emergency Response Coordinator (ERC) who shall assume the role of Joint Emergency Response Coordinator (JERC);

- activate its own Support Team;

- through the On Scene Coordinator (OSC), with the advice of the Support Team, formulate the strategy to deal with the incident and evaluate the need for assistance from other Parties.

Phase III

The main objectives of Joint Response Operations are to stop the spillage of the pollutant from the source, to restrict its spreading and movement and to remove as much pollutant as possible. Joint Response Operations at BIP shall be conducted in accordance with the procedures described by Contractor Units team leaders.

Spill Monitoring

The monitoring of the spill and its movement and transmission of relevant reports is the responsibility of the contractor. Following the activation of the Plan this responsibility rests with SOSC, who shall take all necessary measures to ensure regular monitoring of the spill and its movement and behaviour, in order to properly assess the situation and decide on adequate response measures.

Requests for Assistance

Following the activation of the PSMP, the Party who has activated the Plan may request assistance from the other Parties, in form of;

- trained response personnel and, in particular, strike teams;
- specialised pollution combating equipment;
- pollution treatment products; and
- other means, including, in particular, self-contained units such as vessels and other equipment

Reporting

Any polluting incident presenting a potential threat shall be reported to the emergency centre as soon as possible. The exchange of information concerning pollution incidents, the Parties shall use the international pollution reporting system (POLREP); the contractor shall endeavour to transmit a POLREP, at least once a day.

Post Incident Reports will include description of the pollution incident and development of the situation; description of response measures taken; description of assistance rendered; assessment of the complete response operation; assessment of assistance rendered by others; costs incurred during the response; an estimate of environmental and economic damage; description and analysis of problems encountered in responding to the pollution incident; recommendations regarding possible improvement of existing arrangements and, in particular, provisions of the Plan.

8.9. Hazardous Materials Management Plan

Purpose
Management of hazardous materials is a great concern worldwide. As a result the Contractor has prepared a Hazardous Materials Management Plan (HMMP) whose aim is to:

- ensure safe and proper use of hazardous chemicals
- provide personnel with a program to reduce the risk of accidents involving hazardous chemicals and/or wastes
- describe the process of how the contractor will provide and maintain a safe and supportive environment for workers and those providing services for the project

The Contractor is committed to maintaining programs designed to prevent and reduce the risks on workers, visitors and the community by ensuring proper handling and disposal of hazardous materials and wastes.

Hazardous Waste
A hazardous waste is an unwanted substance that can damage the environment and pose a threat to human safety. Hazardous wastes come in many physical shapes and forms, from PCBs to battery acid, paints and solvents. They may be wastes left over from a complex manufacturing process such as making plastic or chemicals. They could be fluids used in electrical transformers. Hazardous wastes cannot be recycled, reused or safely disposed of in industrial or municipal landfills.

ILO Principles
The 77th Conference of the International Labour Organization (ILO) met in Geneva, Switzerland, in June of 1990. Highlights of the conference included the adoption of new labour standards on night work and the use of hazardous chemicals in the workplace. The International Labour Organization (ILO) welcomed the Seoul Declaration on Safety and Health at Work adopted in the world congress on Safety and Health that was held in Seoul, Republic of Korea, 2008. ILO emphasized, “The ILO, in partnership with the International Social Security Association (ISSA) and the Korean Occupational and Safety Health Agency, are determined to continue tangible progress towards reducing the number of occupational accidents and diseases”. Recognizing that improving safety and health at work has a positive impact on working conditions, productivity and economic and social development, the Declaration also emphasizes that the right to a safe and healthy working environment should be recognized as a fundamental human right. The Declaration also states that promotion of occupational safety and health and the prevention of accidents and diseases at work is a core element of the ILO’s founding mission and of the Decent Work Agenda.

Responsibilities
The Contractor is responsible for the implementation of the HMMP. All supervisors will be made aware of and sensitised to this plan.

Procedure
The Contractor should be committed to safeguarding worker rights and will implement good practice in relation to labour and working conditions of the project. The following presents the minimum requirements to ensure safe and proper use of hazardous and non-hazardous chemicals and to provide employees and non-employee workers of the project with a program to reduce the risk of accidents involving hazardous chemicals and/or wastes.

Management of Hazardous Materials

For proper management of hazardous materials the Contractor will first, determine how much hazardous waste is generated each month in order to determine how much to store and how long to store it. The following practices will be undertaken:

The Contractor will at all times maintain proper storage in compatible containers by:

- Maintaining containers in good condition.
- Prevent leaks, ruptures and accumulation of rainwater on tops of drums.
- Transferring waste to a new container in case of leakage.
- Keeping containers closed. Self-closing funnels will be used when adding waste. Wastes will not be allowed to evaporate by covering them properly.
- Making sure that wastes must be compatible with the container. For example, use high density polyurethane plastic containers for corrosive wastes.
- Making sure that incompatible wastes (e.g., acids and bases) are not put together in same container to avoid chemical reactions from taking place.

Storage of Hazardous Materials

The Contractor will ensure proper storage of hazardous materials through the following:

- Maintaining adequate aisle space between container rows to allow inspection for leaks and damages.
- Storing ignitable and reactive wastes at least 50 feet from property boundaries.
- Storing containers with incompatible wastes in separate areas.
- Minimizing inventory and use a “first-in, first-out” system to prevent the need for disposal of unused materials.
- Putting a sign indicating; “Do not discharge hazardous wastes to the ground surface or into septic tanks”.
- Managing wastes in an appropriate manner to prevent discharges to the environment by keeping containment structure valves closed.
- Keeping soiled towels in a clearly labelled, closed container.
- Storing partially used absorbents in closed, labelled containers for reuse.
- Use drip pans under leaking cars, machinery and pipes or under removed parts rather than cleaning them up with absorbents.
- Pre-cleaning parts with a squeegee, rag or wire brush. This approach helps minimize or possibly eliminate the use of hazardous solvents and prolongs the life of cleaning solutions.
- Having a contract with approved recycling services for used antifreeze, lead-acid batteries, used oil and oil filters.
- Using separate receptacles for draining used oil and antifreeze.
- Educating employees about recommended maintenance schedules and replacing fluids only when necessary.

Preventive Measures

This checklist will help in preventing the most common hazardous waste violations. The Contractor will facilitate training of the employees to reduce hazardous wastes through sensitising and training on the following list of preventive measures:

- Saving money on waste management costs.
- Reducing concerns about penalties and liability.
- Creating a safer, healthier workplace.
- Promoting positive public relations with clients, customers and the local community.
- The Project manager and supervisors must be committed to waste minimization and pass that commitment on to the employees.

- Evaluate where wastes are generated or originating from and identifying areas where changes can be made.
- Involving employees in designing and implementing pollution prevention measures.
- Reducing or eliminating solvent use by determining whether cleaning is really necessary.
- Using a multi-purpose solvent to reduce the types of hazardous waste that need to be managed.
- Substituting detergent-based solution for caustic solution when cleaning; substitute water-based cleaners for solvent cleaners.
- Considering switching to a water-based cleaner instead of using chlorinated spray cans of brake cleaner or carburettor cleaner.
- Using solvent sinks properly: using drip trays, allowing more drainage time, using filters to prolong solvent life and keep lids closed when not in use.
- Replacing solvent only when necessary.
- Using dedicated equipment to minimize cross-contamination.
- Keeping used oil and other vehicle fluids segregated from solvent wastes and carburettor cleaner.
- Storing large quantities of batteries in an isolated area with no floor drains.
- Storage area should be sealed with an acid-resistant material.
- Labeling containers clearly to prevent contamination of non-hazardous wastes.
- Leaving containers that contain explosive material open
- Keeping accurate inspection records
- Identifying and recording quantities of hazardous waste monthly.
- Use proper containers to collect and store wastes or products.
- Labeling all containers whether product or waste as to their contents.
- Keeping all hazardous waste or products containing regulated solvents closed at all times unless when actively removing from or adding to it.
- Posting emergency information near each phone.
- Develop a contingency plan for emergencies.
- Using manifests for all waste transported for disposal.

Receiving and Delivering

The Contractor will maintain a Hazardous Materials Management Plan and will also ensure delivery of all chemicals and hazardous materials in compressed gases. The Contractor will ensure that damaged materials are not delivered to the project site and no storage of damaged materials in receiving area for more than 6 hours.

Transportation

The Contractor will transport hazardous materials in accordance with Hazardous Material Transportation regulations and maintain policies and procedures for the same. Employees will also be trained in the requirements of hazardous material transportation.

Storage and Disposal

The Contractor will not purchase excessive quantities of hazardous materials but will properly store hazardous materials and chemicals. The Contractor will not dispose of hazardous materials in the drainage systems.

The Contractor will make sure that the following are followed:

- Making sure that transport and disposal facility have identification numbers.
- Use manifests for all hazardous wastes shipped off-site. Keep the manifests on-site.
- Inspecting containers at least once a week and keep a written log of container inspections.

- Keeping a record of larger spills and use this information to identify the spill prevention options that might help to reduce related impacts.
- Keeping training and inspection records for three years.
- Keeping manifests and shipping receipts for three years.
- Keeping land disposal restriction forms for three years from the date the waste was last shipped.
- Labeling every container with the type of waste and whether it is hazardous or non-hazardous or used oil.
- Including the accumulation start date (the date when waste was first placed in the drum).
- Training all employees to identify, reduce and properly handle wastes.
- Training new employees before they handle hazardous wastes.

Personnel Training
The Contractor will ensure personnel training in their area in the receiving, transportation, proper storage, handling, disposal and use of hazardous materials in accordance with the requirements of this plan.

Hazardous Materials Handling
The Contractor will:

i. Ensure that hazardous wastes they are dealing with are made public and more importantly to the District Environment Officer.
ii. Ensure that hazardous and infectious materials are labelled so that adequate instructions and standard danger symbols on them are visible, clear, and appropriate.
iii. Ensure that all people involved in transport and storage of hazardous wastes are adequately trained and protected and made aware of the dangers involved and how to mitigate them.
iv. Provide appropriate safety wear for people handling hazardous wastes in the various places of the project.
v. Treat the infected workers to stop spread of diseases and disinfect contaminated places and materials.
vi. Regular medical checkups for the staff are mandatory.
vii. Immunization against Hepatitis B and other blood borne diseases is mandatory.

The Contractor will keep District Environment Officers in the project areas informed of the methods that are used to handle, treat and dispose of all hazardous waste.

Security Measures
All chemical storage areas should be kept locked when unattended.

Hazard labeling

- The only hazard warning labels on chemical containers are those that the manufacturers/suppliers place on the containers.

- The Manufacturer/Supplier may place identification labels on some containers.
- The Manufacturer/Supplier may place Hazardous Material Identification System Labels on some containers.
- Transportation hazard Class Labels may be on containers and packages as sent by the manufacturer/supplier.
- Hazardous waste containers are labelled as specified by a given Hazardous Waste Program.

Warning Signs
Hazardous waste will have warning signs depending on the type as indicated below:

Type of Hazardous Material	Required Warning Sign
Hazardous Waste	"Danger Hazardous Waste Unauthorized Personnel Keep Out"
Compressed Gases	"Danger Compressed Gas Storage"
Flammable Liquid Storage Areas	"Danger Flammable Liquids"
Flammable Liquid Storage Cabinets	"Flammable – Keep Fire Away"
Asbestos	Danger Contains Asbestos Fibres Avoid Creating Dust Cancer and Lung Disease Hazard"

Inspections
The frequency of hazardous materials storage area inspections will be specified in the document entitled HS&E Inspections once every week and whenever there is need.

Records
Environmental Health and Safety maintain all hazardous material inspection records.

Emergency Equipment
In the case of large quantities of hazardous wastes, the Contractor will have a written plan that includes:

- Emergency response arrangements with police, fire, hospitals and emergency response contractors.
- Emergency coordinator's name, address and phone number.
- On-site emergency equipment descriptions and locations.
- Evacuation plan and routes, including a site diagram.
- Spill reporting procedures.
- Post Emergency Information
- Post the following information near every telephone:
- Fire department phone number.
- Locations of fire alarms and extinguishers.
- Locations of spill control materials.

The Contractor will ensure that this HMMP is reviewed by relevant authorities every year. Recommendations for plan compliance and improvements shall be made to the Director of Environmental Health and Safety.

Emergency Coordinator
This person must know what to do in case of fire, spill or other emergency and must be on the premises or on call 24 hours a day.

Notify local authorities
Police and fire departments and local hospitals that would respond to an emergency need to know that there are hazardous wastes on the Contractor project premises.

Disposal of Used Oils and Other Contaminants
The Contractor will ensure that Lead acid batteries that are not recycled are managed in a manner not to allow possible discharge of hazardous wastes. Engine coolant that is not recycled will be

tested prior to disposal because often it is a hazardous waste because of lead or solvent content. The Contractor will ensure that it is not discharged directly to the environment.

Because they have a low flashpoint (less than 140 degrees Fahrenheit) or may be toxic, spent parts cleaners and washers are considered hazardous wastes. Solvents become hazardous wastes because they are contaminated with heavy metals such as lead, cadmium, chromium or barium. The Contractor will ensure that spent solvents do not mix with used oil because mixing a hazardous cleaner with another substance may make the mixture hazardous. Training of employees to this effect will be a priority.

The Contractor will make sure that rags contaminated with used oil or solvents that may be hazardous waste are discharged to a publicly-owned sanitary sewer, not in storm sewer, septic tank or cesspool. Used oil that is not recycled or is rendered un-recyclable will be regulated as a hazardous waste. To avoid ground water contamination problem the Contractor will ensure that oil spilled on the ground is cleaned up immediately.

8.10. Emergency Response Plan

Overview

This emergency response plan designed and written to assist the Power Station's management, employees, local communities and outside responding agencies or stakeholders through emergency response actions at the Power Station. It is recognized that this plan alone is not "all inclusive" of the actions which occur in all emergencies, but if used properly in conjunction with emergency response training and rational decisions, it will lessen the impact of emergencies on human life, environmental and power plant property. Close cooperation with National and Local Agencies should be established and should be maintained. The emergency response plan should be compatible with their plans, actions, reporting, notifications and other requirements.

The following is a list of the types of emergencies that can occur at the Sindila hydropower facility:

- Fire
- Major electricity accident endangering many company workers, neighbouring communities and outsiders;
- Bomb threat;
- Civil disturbance;
- Hostage;
- National terrorist incident;
- Death of a company worker (depending on circumstances);
- Rape (depending on circumstances);
- Suicide;
- Shooting or stabbing;
- Widespread power outage especially at night;
- Natural disaster such as earth quake, lightening;
- Large-scale hazardous material spill;
- Major weather emergency;
- Mass casualties;
- Health epidemics;
- Laboratory explosion;
- Rapture or leak of equipment;
- Flood;
- Mobile equipment accident; and
- Any other strange occurrence.

Responsibility

Emergency response during implementation of Sindila MHP activities will be a shared responsibility between the different entities. To a minimum, they address emergency issues within their jurisdiction shown in the table below.

Entities	Area of responsibility
Butama Hydro Electricity Company Limited	Fire, Oil and Chemical Spill and leakages, Accidents and ill health, Death of a company work, Laboratory explosion.
Department of Disaster Preparedness, Office of the Prime Minister	Civil disturbance, Natural disasters, major weather emergency, health Epidemics, flood and among others.

Entities	Area of responsibility
Bundibugyo District Local Government	Fire, Oil and Chemical Spill and leakages,
Uganda Red Cross	Civil disturbance, Natural disasters, major weather emergency, health Epidemics, flood
Uganda Police	Mass causalities, suicide, rape, Hostage,, Shooting and stabbing
Uganda Defence Force	Bomb threat, National terrorism incidents, Shooting and stabbing

General emergency plan

- Find the nearest alarm and sound it;
- In case you have access to a company phone, dial **the company's emergency number** and report to security precisely where the incident has occurred;
- Evacuate to the nearest assembly point on hearing the alarm ;
- Cooperate with the evacuation wardens and follow their instructions;
- Once at the assembly point, register your presence and help identify any missing persons; and
- Do not re-enter the building or facility after an emergency evacuation until you have been instructed by the responsible emergency coordinators.

Fire emergency plan

Every employee has a role to play in fire prevention and the emergency preparedness plan. It is therefore important to comply with the following:

- Always obey no "No Smoking" signs.
- Do not allow or use open flame near flammable material or fumes.
- Know where the nearest fire extinguisher is and how to use it.
- Workers should always be warned not to tamper with fire-fighting equipment; Let them know it is there for their safety and protection.
- Used fire extinguishers should be reported in order for them to be refilled. Never return them to their location directly after use.
- All staff should be familiar with evacuation procedures.
- Know the locations of the fire alarms near the workstation.
- Know the locations of emergency exit routes and assembly points
- Participate in emergency preparedness drills.
- Do not attempt to fight fire if you are not trained.
- In case of fire, alert colleagues, emergency body (fire brigade) before attempting to fight it.

Communication Strategy

The probable emergencies have been categorized into two, internal and external. For effective communication, two communication strategies have been developed tailored to the respective recipients as described below.

Internal communication

This communication strategy will be used in communicating internal emergencies. The recipients will therefore be Butama Hydro Electricity Company Ltd employees who are most likely to comprise of unskilled, semi-skilled and skilled labour. It is most likely that most of the unskilled labour will be illiterate and will only understand the local language; however, skilled and semi-skilled labour will

have knowledge of the English language and some may actually not fully understand the local language.

A number of communication channels will be put in place and every employee taken through their operation for proper understanding. These channels will mainly be meant to notify staff of emergencies upon their occurrence and will therefore have to be timely. They will include verbal communication, use of signage and instruments like use of gongs, bells or sounding of alarms/ sirens. The employees will then assemble at a designated place for formal communication of the emergency at hand. Unless otherwise, English and Rukonjo will be the languages used for verbal communication. A record will then be noted and forwarded to higher levels in the company for further action and strategies laid, to prevent the emergency from happening again in future.

External communication
External communication will be needed for emergencies which have an impact on external individuals or where their involvement is deemed necessary to effectively handle an emergency. Due to the different classes of recipients, this strategy will further be divided into two, one for the locals and the other, for Lead Agencies including NGOs.

External communication for locals
External communication to the local people will be done through their leaders unless the emergencies directly affect them and there is need for immediate communication, in which case, informal communication channels like immediate assembling of nearby individuals will be used.

External communication to lead agency officials
These include central government agencies including the lead agencies, district officials and NGOs. This form of communication is very important because the officials involved provide guidance on the handling of emergencies and rescues in case of security emergencies.

This communication will be official and mainly in the form of writing. Only authorized Butama Hydro Electricity Company Ltd officials will make this kind of communication and a record of this will be maintained.

The exception in this strategy will be communication to security and rescue personnel in case of security emergencies. In this case, emergency contact numbers will be made available to all the employees who will use them as soon as possible.

Reporting
All accidents, incidents and near misses shall be reported, recorded and investigations carried out to ascertain their causes within the project and in the communities. Any pollution incident presenting a potential threat, shall be reported to the emergency centre as soon as possible.

Post Incident Reports will include description of the emergency and development of the situation; description of response measures taken; description of assistance rendered; assessment of the complete response operation; assessment of assistance rendered by others; costs incurred during the response; an estimate of environmental and economic damage; description and analysis of problems encountered in responding to the emergency; recommendations regarding possible improvement of existing arrangements and, in particular, provisions of the Plan.

8.11. Stakeholder Engagement Plan

Overview

Stakeholder engagement is the basis for building strong, constructive, and responsive relationships that are essential for the successful management of a project's environmental and social impacts. In line with the requirements of IFC PS 1, stakeholder engagement is an ongoing process that involves the following elements; stakeholder analysis and planning, disclosure and dissemination of information, consultation and participation, grievance mechanism and ongoing reporting to affected communities.

Purpose

- To prepare communities on potential emergency scenarios that could be caused by the project and can affect the community.
- To build a trusting relationship with the affected communities and other interested stakeholders based on a transparent and timely supply of information and open dialogue.
- To ensure effective engagement with local communities and other key stakeholders throughout all phases of the project.
- To actively build and maintain productive working relationships, based on principles of transparency, accountability, accuracy, trust, respect and mutual interests with affected communities and other stakeholders.

Stakeholder Analysis and Engagement Planning

The stakeholder analysis can be defined as the process of determining stakeholders who will be affected directly or indirectly, positively or negatively by the proposed project and who can contribute to, or hinder its success. All stakeholders need to be kept informed during project implementation so as to accord the necessary support and advice. A stakeholder engagement plan (Table 8.4) has been developed to ensure the full involvement of the proposed project site. Key stakeholders identified include but are not limited to:

- National Environment Management Authority (NEMA);
- Ministry of Energy and Mineral Development(MEMD);
- Uganda wildlife Authority(UWA);
- Uganda Electricity Transmission Company Ltd (UETCL);
- Rural Electrification Agency (REA);
- Electricity Regulatory Authority(ERA);
- Directorate of Water Resources Management (DWRM);
- Gender Department , Ministry of Gender , Labour and Social Development;
- Department of Museums and Monuments;
- Bundibugyo District Chief Administrative Officer (CAO);
- Bundibugyo District Environment Officer (DEO);
- Bundibugyo District Community Development Officer (CDO);
- Bundibugyo Town Local Government (District Engineer);
- Sindila sub-county chief;
- Bundibugyo District LC (V) Chairman;
- LC (IV) representative;
- The local community members (Sindila sub-county).

Table 8.4 Stakeholder Engagement Plan

Target Group	Tasks/Methods	Frequency	Responsibility	Project Phase
Displaced/affected Households	Compensation; Working Group Meetings; regular household visits; and monitoring the livelihoods of displaced persons.	When required and in accordance with the law.	Butama Hydro Electricity Company Ltd	Construction and operation phase
Directly and Indirectly affected Persons.	Appraise and educate Local Communities on health and safety, cultural and environmental issues related to the project. Health promotion and awareness programmes on HIV/AIDS.	Quarterly	Butama Hydro Electricity Company Ltd	All phases
Local and central government agencies	Provision of regular updates and submission of monitoring reports to relevant agencies as required. Payment of attention to the licences required for the project	As required	Butama Hydro Electricity Company Ltd	All phases
Community Consultation	Continuous consultations with the community members.	As required	Butama Hydro Electricity Company Ltd	All phases
Non-Government Organisations	Provide regular updates on the key project information	As required	Butama Hydro Electricity Company	All phases
Vulnerable groups	Identify support that may be required to ensure vulnerable people can access project benefits.	Quarterly	Butama Hydro Electricity Company Ltd	All phases

Information sharing and disclosure/ communication strategy
All the relevant stakeholders should be kept informed and up to date on issues pertaining to the project activities especially those which affect them or where they have influence (See Table 8.4 above). Information sharing and disclosure can be done in the following ways:

Public meetings with local communities: Effective community engagement is central to the successful management of risks and impacts on communities affected by the project in addition to adding value to the acceptance of the project. To ensure this, regular public meetings will be organised paying special attention to vulnerable groups like the disabled, elderly and women and their views considered in future plans.

National and Local Regulatory Authorities: Butama Hydro Electricity Company Ltd will conduct regular meetings with both national and local authorities to ensure that all are always kept well informed. Some information to some of the central agencies can be channeled through submission of monitoring reports.

Non-government Organisation (NGOs): These include environmental and social development NGOs which operating in the project area. This is necessary to prevent conflict of interests.

8.12. Dam Breakdown Analysis and Action Plan

Overview

Dams provide many benefits to our society, but floods resulting from the failure of constructed dams have also resulted in some of the most devastating disasters of the last two centuries. Development of effective emergency action plans requires accurate prediction of inundation levels and the time of flood wave arrival at a given location.

Simulation of dam break events and the resulting floods are crucial to characterizing and reducing risks associated with dam failure.

Causes of dam break

Dam failure (dam break) can result from:

- Breaching (opening formed in the dam body that causes the dam to fail, a phenomenon which causes the water concentrated behind the dam to propagate towards downstream regions)
- External force and internal erosion
- Seepage
- Piping (internal erosion). Dam break due to piping elongates the time period of high water surface level, which increases the duration of risk
- Overtopping due to insufficient spillway capacity
- Insufficient free board
- Settlement on slope slides on the upstream shells
- Liquefaction due to earthquakes
- Landslides
- Extreme storms
- Equipment malfunctions
- Structure damage
- Foundation failure
- Sabotage

Responsibility

- BHECL should recruit qualified and experienced civil engineers for the construction works of the Sindila MHP;
- BHECL should carry out soil tests for the proposed project site to determine its bearing capacity;
- Structural designs should meet the district (Bundibugyo district) standards ; and
- Technical consideration should be taken by BHECL during construction works for example ground beam, horizontal beam and vertical beam should be considered to overcome multiple forces that may cause failure hazards.

Emergency Plan

Emergency action planning has an obvious application in situations such as these. The core concern, should circumstances exist in which dam failure is possible, must be the saving of human life downstream of the dam. Given the extreme severity of the flooding which would result from dam failure and the relatively short warning times which would be possible, the only practical way of achieving this must be to move people quickly out of the path of the likely or impending flood. The central planning task, therefore, is to devise methods by which evacuation operations can be quickly and effectively carried out.

8.13. Cultural Heritage Management Plan (CHMP)

Overview

This plan describes the management of cultural sites within and/or close to the Sindila MHP proposed to be located on River Sindila in Sindila sub-county, Bundibugyo District, Western Uganda.

According to IFC Performance Standard 8, cultural heritage refers to:

- Tangible forms of cultural heritage, such as tangible moveable or immovable objects, property, sites, structures, or groups of structures, having archaeological (prehistoric), paleontological, historical, cultural, artistic, and religious values;
- Unique natural features or tangible objects that embody cultural values, such as sacred graves, rocks, lakes, and waterfalls; and
- Certain instances of intangible forms of culture that are proposed to be used for commercial purposes, such as cultural knowledge, innovations, and practices of communities embodying traditional lifestyles.

The objectives of IFC Performance Standard 8 are to preserve and protect cultural heritage by avoiding, reducing, restoring, where possible, and in some cases compensating for the adverse impacts that projects might cause to cultural heritage.

The Sindila MHP Cultural Heritage Management Plan determines and establishes the appropriate strategies, objectives, actions and management structures to safeguard the cultural heritage in the project area and balance the different needs and use of the sites in the development of the project. The plan recognises that the cultural heritage of the area may be affected by both short and long-term activities of the project. However, with careful management of the identified cultural sites and establishment of chance find procedures, it is possible to implement the project with minimum impacts on the cultural resource and substantially increase the visibility of the value and functionality of the sites even to the external communities/ world.

Purpose of the Cultural Heritage Management Plan

The objectives of the CHMP for the proposed hydropower project are to:

- Safeguard the cultural heritage value of the sites identified in the project area for community use and tourism for the current and future generations;
- Preserve the values attached to the community cultural sites whenever feasible;
- Avoid disturbance of identified cultural sites where feasible during the construction and operation phases of the project in order to maintain the cultural heritage value of the sites and enhance good working relations with the communities in the area;
- Where preservation and avoidance are not feasible, aim at minimising adverse impacts and restoration, in-situ, to ensure that the value and functionality of the sites is maintained;
- Where minimisation of loss or restoration of the value and functionality of the cultural resource in use by the project affected persons is not possible, compensation for loss of the cultural heritage and in case of spiritual sites, appeasement of the spirits to allow for the project to proceed;
- To identify any chance finds during project construction and operation, and suspend project activities until proper identification and appropriate action is taken on archaeological, paleontological, ethnographical, historical and/or of traditional interest.

Identification of the cultural sites in the project area

No cultural sites were identified in the project area.

It is important to note that a Chance Find Procedures has also been developed under this Cultural Heritage Management Plan. The procedures will be centred on any archaeological, paleontological, ethnographical, historical and/or of traditional interest resources not identified during the ESIA and that may be identified during the construction and/or operation phases of the project.

Table 8.5: Cultural Heritage Management Plan for the Sindila MHP

Action	Responsibility	Accountable party	Key performance indicator	Frequency
Provide ongoing training to all personnel to ensure that all works remain within the physical barriers of the project unless appropriate approval and/or permission is obtained from the cultural site committees. Heritage awareness training must be included in the work force induction.	Environment Control Officer; Butama Hydro Electricity Company Ltd	Bundibugyo District Community Development officer	Cultural heritage protection training module; Records of meetings and participants	Quarterly
Feedback from communities will be obtained at Cultural Heritage Site Management planning meetings that will incorporate a review of the CHMP	Environment Control Officer; Butama Hydro Electricity Company Ltd	Cultural Site Management Committee		Annually
Any unanticipated incidences will be reported in the Emergency Response Plan (Section 8.1.1.8)	Environment Control Officer; Butama Hydro Electricity Company Ltd	Cultural Site Management Committee		At occurrence
In case the cultural site falls within the project footprint, the Project Affected Persons will be allowed continued access to the site through alternatives such as alternative access routes, time and date of access, provision of health and safety equipment during access. This should be included in an agreement between Butama Hydro Electricity Company Ltd and the Cultural Site Management Committee.	Environment Control Officer; Butama Hydro Electricity Company Ltd	Sindila LC 3 Chairperson and other local council leaders	A Cultural Management Agreement	
Documentation of cultural sites activities, discoveries, communication/ grievances/ chance finds will be filled with Elgon Hydro PVT Ltd and maintained.	Environment Control Officer; Butama Hydro Electricity Company Ltd	Cultural Site Management Committees	Cultural sites management registers	At incident occurrence/ continuous

Chance Find procedures

In the context under consideration, it is improbable that chance finds will require declarations of permanent "no go" zones. At most, a temporary pause in activity at a limited locale may be required. The strategy is to rescue the material as quickly as possible.

For this section, the term "heritage resource" includes burial grounds, archaeological, paleontological, ethnographical, historical and/or items/sites of traditional interest.

For chance finds, responsible persons must be designated. This will include hierarchically:

- The Resident Engineer or foreman who is going to be most often in the field;
- The Environmental Control Officer (ECO) for the project; and
- The Project Manager probably based in Kampala.

The Resident Engineer or foreman and workers involved in excavations must been encouraged and informed of the need to watch out for potential fossil and buried archaeological material. Workers that find potential objects as defined under this procedure are to report to the Resident Engineer who, in turn, will report to the Environmental Control Officer. The ECO will inform the Bundibugyo District Administrative office and the Conservator of Antiquities - Department of Museums and Monuments.

If a chance find is encountered during the construction or operation phases of the Sindila MHP the following steps will be followed:

1. The heritage resource will be avoided and all activities in the immediate vicinity ceased/suspended;
2. The person who discovers the chance find should record the following information; excavation position (GPS coordinates), depth of find in a hole, digital image of the hole showing the vertical section and the digital image of the find;
3. The Resident Engineer of Butama Hydro Electricity Company Ltd will be notified of the discovery as soon as is feasible (not exceeding 2 days) who in turn will notify the ECO;
4. The Department of Museums and Monument of Uganda will be notified either via communicating with the Environment Control Officer via telephone or email or based on a site visit within 14 days from the time of discovery;
5. Should the [6]Conservator of Antiquities from the Department of Museums and Monuments confirm that the discovered resource falls within the heritage resource description, he/she will report the resource to the Minister of Tourism Heritage and Antiquities for preservation and protection. Rescue excavation or in-situ conservation will be proposed based on the disturbance likely to be caused by the project or in relation to cost *versa vi* value of the heritage resource;
6. Butama Hydro Electricity Company Ltd will apply for either an excavation or preservation in-situ license of the discovered resource. The feasible proposal will then be executed. In case of in-situ conservation, the site will be managed and open to the communities and tourists that access the project area;
8. All chance finds will be recorded in the Cultural Sites Management registers.

[6] The Historical Monuments Act, Chapter 46 of the Laws of Uganda, Revised Edition, 2000

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