



Bujagali Energy Limited

Bujagali Hydropower Project Social and Environmental Assessment Main Report

Prepared by

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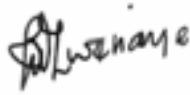
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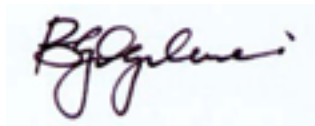
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Appendix J	Community Development Action Plan (CDAP)

Glossary

µg	Microgram
µS	Micro Siemens
AC	Asphaltic concrete
AESNP	AES Nile Power
AFD	Agence Francaise de Developpement
AfDB	African Development Bank
AMSL	Above Mean Sea Level
APRAP	Assessment of Past Resettlement Activities and Action Plan
ASTM	American Standard for Testing of Materials
BDSP	Bujagali Dam Safety Panel
BEL	Bujagali Energy Limited
CDAP	Community Development Action Plan
CFR	Central Forest Reserve
CIO	Community Information Officer
CMO	Change Management Objectives
CPMP	Cultural Property Management Plan
D/s	Downstream
DAO	District Agricultural Officer
dBLAeq	Energy Equivalent Sound Level in Decibels, A-weighted
DCS	Distributed Control System
DEG	Deutsche Investitions und Entwicklungsgesellschaft mbH
DEO	District Environmental Officer
DFID	Department for International
DHO	District Health Officer
DLB	District Land Board
DMU	Dispensary and Maternity Unit
DWD	Directorate of Water Development
EA	Environmental Assessment
EAP	Environmental Action Plan
EH&S	Environmental, Health and Safety
EIB	European Investment Bank
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EMMP	Environmental Mitigation & Monitoring Plan
EPC	Engineer, Procure, Construct
ERA	Electricity Regulatory Authority
ERP	Environmental Review Panel
EU	European Union
FAO	Food and Agriculture Organisation (of United Nations)
FD	Forest Department
FIRRI	Fisheries Resources Research Institute (formerly known as
Fisheries	Research Institute)
FSL	Full Supply Level

GDP	Gross Domestic Product
GoU	Government of Uganda
GWh	GigaWatt hours
H&SMP	Health and Safety Management Plan
HEP	Hydro-Electric Power Department
HPP	Hydropower Project
HVAC	Heating, Ventilation and Air Conditioning
IA	Impact Assessment
IBRD	International Bank of Reconstruction and Development
ICSID	International Centre for Settlement of Investment Disputes)
IDA	International Development Association
IFC	International Finance Corporation
IFIs	International Financial Institutions
IP	Interconnection Project
IUCN	International Union for the Conservation of Nature
JITDA	Jinja Tourism Development Association
LAC	Limits of Acceptable Change
LC	Local Council (ranging from RDC Resident District Commissioner LC1 [village] to LC5 [district])
RUWASA	Rural Water and Sanitation
LFMP	Labour Force Management Plan
LFRP	Local Forest Reserve Project
LV	Low Voltage
LVFO	Lake Victoria Fisheries Organisation
m AMSL	Metres Above Mean Sea Level
MDE	Maximum Design Earthquake
MFL	Maximum Flood Level
MFNP	Murchison Falls National Park
MIGA	Multilateral Investment Guarantee Agency
MoH	Ministry of Health
MOL	Minimum Operating Level Environmental Mitigation Plan
MRF	Minimum Residual Flow
MSL	Mean Sea Level
MTWA	Ministry of Tourism, Wildlife and Antiquities
MUIENR	Makerere University Institute of Environment and Natural Resources
MW	Megawatt
NAFIRRI	National Fisheries Resources Research Institute
NARO	National Agriculture Research Organisation
NEA	National Environment Act
NEMA	National Environment Management Authority
NFA	National Forestry Authority
NGO	Non-Governmental Organisation
NRE	Nile River Explorers Ltd.
NTU	Nephelometric Turbidity Units

NWSC	National Water and Sewerage Corporation
ODs	Operational Directives
OPD	Out-Patient Department
OPs	Operational Policies
OPSD	Operational Private Sector
PAP	Project-Affected Person
PCDP	Public Consultation and Disclosure Plan
PM10	Dust with an aerodynamic diameter of less than 10 microns (μm)
PoE	Panel of Experts
PPA	Power Purchase Agreement
PPAH	Pollution Prevention and Abatement Handbook
ppb	Parts Per Billion
PPS	Policy and Performance Standards
PSCP	Pollutant Spill Contingency Plan
PSOC	Private Sector Operation Committee
Q	Water flow in m^3/sec
RAP	Resettlement Action Plan
RCDAP	Resettlement and Community Development Action Plan
REA	Rural Electrification Authority
SEA	Social and Environmental Assessment
SEAP	Social and Environmental Action Plan
SEO	Site Environmental Officer
SOP	Setting-out Point Development (UK)
SR	Social Responsibility
STD	Sexually-transmitted disease
TASO	The Aids Support Organisation
TCU	True Colour Unit
TMP	Traffic Management Plan
ToRs	Terms of Reference
TSC	Timed Species Count
TSS	Total Suspended Solids
UEB	Uganda Electricity Board
UEGCL	Ugandan Electricity Generation Company Limited
UEMoP	UEB Transmission System Environmental Monitoring Plan
UEMP	UEB Transmission System
UETCL	Uganda Electricity and Transmission Company Limited
UIA	Uganda Investment Authority
ULC	Ugandan Land Commission
UMA	Uganda Manufacturers Association
UNBS	Uganda National Bureau of Standards
UNCCI	Uganda National Chamber of Commerce and Industry
UGX	Ugandan Shillings
USD	United States Dollars
UTB	Uganda Tourism Board
UWA	Uganda Wildlife Authority

VCU	Vector Control Unit
WB	World Bank
WCD	World Commission on Dams
WMP	Waste Management Plan
WRAP	Water Resources Assessment Programme
WWR	White water rafting

1.0 Introduction

1.1 Project SEA History

The Bujagali Hydropower Project (hereinafter “Project” or “HPP”) is a proposed 250 MW hydropower facility on the Victoria Nile near Jinja, in the Republic of Uganda. It is located at Dumbbell Island, approximately 8 km downstream and north of the existing Nalubaale and Kiira hydroelectric facilities that are located at the outlet of Lake Victoria, as shown on Figure 1.1. The Project sponsor is Bujagali Energy Limited (BEL), a project-specific partnership of SG Bujagali Holdings Ltd. (a wholly owned affiliate of Sithe Global Power, LLC) and IPS Limited (Kenya).

The Project is closely associated with Uganda Electricity Transmission Company Ltd.’s (UETCL) Bujagali Interconnect Project (IP), which comprises the transmission system infrastructure needed to interconnect the HPP with the national grid.

Development of the HPP and IP as a single integrated project was first initiated by AES Nile Power Ltd., (AESNP) in the late 1990’s. Among other things, AESNP prepared Social and Environmental Assessment (SEA) documentation that was approved by the Government of Uganda’s National Environmental Management Authority (NEMA) in 1999/2001, and by the World Bank (WB), International Finance Corporation (IFC) and African Development Bank (AfDB) Boards in December 2001.

In 2003 AESNP withdrew from the Project, leading the Government of Uganda (GoU) to initiate an international bidding process for the HPP aspects of the project. BEL was selected as the preferred bidder and entered into a power purchase agreement and an implementation agreement with the GoU.

The approvals by the Boards of the International Financial Institutions (IFIs) involved in financing AESNP’s project, and the permits issued by NEMA to AESNP for construction and operation of the facilities are no longer valid. Thus, BEL was required to prepare new SEA documentation and submit it for approvals. This report constitutes the required SEA Documentation for the HPP. It has been prepared to address the requirements of NEMA, the World Bank Group, and other lenders including the African Development Bank (AfDB) and the European Investment Bank (EIB). A separate SEA is being prepared by UETCL for the IP.

Many of these entities listed above have their own nomenclature for SEA documentation including “Environmental Impact Assessment”, “Environmental Impact Statement”, “Environmental and Social Impact Assessment”, and “Social and Environmental Assessment”. For the purposes of this project the term Social and Environmental Assessment, or SEA, is considered to be synonymous with the different terms used by NEMA and the various lenders.

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Figure 1.1 Location of the Bujagali Project

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BEL has based its preparation of this SEA broadly on the guidance provided in “A Common Framework for Environmental Assessment – A Good Practice Note” (Multilateral Finance Institutions Working Group on Environment, 2005). For this SEA assignment, BEL has appointed a consulting team led by R. J. Burnside International Limited of Canada (Consultant) to conduct and oversee the SEA tasks, manage the SEA process on behalf of BEL, and author the SEA documentation.

1.2 Brief Project Description

The hydropower facility will consist of a power station housing up to 5 X 50 MW Kaplan turbines with an associated 28 m high earth-filled dam and spillway works. The project will require 125 ha of land take (45 ha for the project facilities themselves and 80 ha of newly inundated area adjacent to the Victoria Nile River) and 113 ha of land take for the project’s ancillary facilities (concrete batching plant, roads, cofferdams, rock quarries and stockpile areas).

The dam will impound a reservoir extending back to the tailrace areas of the Nalubaale (previously known as Owen Falls) and Kiira (previously known as Owen Falls Extension) Hydropower facilities (see inset of Figure 1.1). The reservoir waters will be contained within the steeply incised banks of the Victoria Nile between Dumbbell Island and Owen Falls, thereby minimising the amount of newly inundated land. The general configuration of the hydropower facility and the land to be inundated immediately upstream of the facility is shown in Figure 1.2.

In order to interconnect the HPP with the National Grid, UECTL is developing the Bujagali Interconnection Project. The IP will be constructed, owned, and operated by UECTL. The IP constitutes an “associated facility” for the Bujagali HPP according to the IFC’s definition of “Area of Influence” (IFC Performance Standard 1, 2006). UECTL has contracted BEL to assist with the development of the IP, including the SEA documentation required for that project.

1.3 Project Schedule

BEL was awarded the HPP on April 20, 2005 following an international tendering process. Following negotiations, BEL and the GoU signed a power purchase agreement, paving the way for BEL to begin work on the approvals and financing for the project. The expected project schedule is as follows:

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Figure 1.2 General Project Layout

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Milestone	Timing
Submit SEA to NEMA	Q4 2006
Select EPC Contractor	Q2 2007
Receive Approval from NEMA/Complete Financing	Q2 2007
Start Construction	Q2 2007
Construction Completed/Start Operations	Q1 2011

1.4 SEA Process

The contents of this SEA report are designed to meet requirements of the GoU as well as the policies and guidelines of the various IFIs that are expected to finance the project.

This SEA Report is comprised of the following two volumes:

- Bujagali Hydropower Executive Summary;
- Bujagali Hydropower Project SEA Report; and
- Bujagali Hydropower Project SEA Technical Appendices.

A similar two volume report is being prepared by UETCL for the IP.

A key aspect of the approach undertaken by BEL for the Bujagali HPP has been to conduct the SEA according to terms of reference (ToRs) that were approved by GoU (NEMA), and reviewed with IFI representatives, project affected peoples, NGOs and the general public. The SEA ToR for the HPP is reproduced in Appendix A.1. A comparable SEA TOR for the IP is available in Appendix A.1 of the IP Technical Appendices.

The main SEA work for the hydropower facility commenced in early 2006 including ecological fieldwork, social surveys and consultations with relevant review agencies and potentially affected people.

Following this introduction, the contents of this SEA are as follows:

- Chapter 2 describes the legislative, regulatory, and policy requirements for the project;
- Chapter 3 describes the baseline conditions in the area of the hydropower facility from both an environmental and socio-economic perspective;
- Chapter 4 provides an alternatives analysis and project description;
- Chapter 5 describes the proposed project, including its construction and operation activities;
- Chapter 6 describes the public consultation and disclosure programme undertaken for the project;
- Chapter 7 provides impact identification, management and monitoring; and,

- Chapter 8 summarises the Social and Environmental Action Plan (SEAP), which is provided as a separate, stand-alone report.

A more detailed breakdown of the contents of each of these chapters can be seen in the Table of Contents in the front of this report. In addition, a volume of Technical Appendices form part of this SEA.

1.5 SEA Consultant Team

The experts that contributed to this SEA Report are as listed in Table 1.2.

Table 1.2: List of Experts

Name	Representing	Role / Area Covered on Study
Robert Turland*	Dillon Consulting Limited	SEA Project Manager
Patrick Mwesigye*	Enviro and Industrial Consult (U) Ltd.	In Country SEA Team Leader
Brett Ogilvie*	Tonkin & Taylor International Ltd.	SEA Specialist/Natural Resources Team Leader
Fred Giovannetti*	Independent Consultant	Socio-Economic Team Leader and Resettlement Specialist
Lee Doran	Ecological Writings # 1, Inc.	Senior SEA Advisor
Peter Somers	R. J. Burnside International Limited	SEA Specialist
Rui DeCarvalho	R. J. Burnside International Limited	SEA Reviewer
Robert Rowland	R. J. Burnside International Limited	SEA Specialist
Jennifer Burnham	R. J. Burnside International Limited	SEA Coordinator
John S. Balirwa Jonna Kamanyi	National Fisheries Resources Research Institute (NAFIRRI)	Aquatic Ecology / Fisheries
Derek E. Pomeroy Robert Kityo Paul Ssagawa	Makerere University Institute of Environmental and Natural Resources	Terrestrial Ecology
Don McKinnon	Dillon Consulting Limited	Public Consultation / Stakeholder Engagement
Florence Nangendo	Independent Consultant	Social Science Research Team / Resettlement Action Plan Auditor
Eddie Mutesa	UETCL / Bujagali Implementation Unit	Resettlement, Community Development
Thomas Kasule	UETCL / Bujagali Implementation Unit	Resettlement, Community Development
Jim Fletcher	Fletcher Associates	Tourism Impact Assessment

Name	Representing	Role / Area Covered on Study
Zbigniew R. Matus	MWH Global	Hydropower Engineering
Steve Gibbons	Ergon Associates	Labour

* NEMA Registration for the specialists, who comprise the core SEA team, is provided as Appendix A.2.

1.6 External Advisors

A Witness NGO, InterAid Uganda, was retained to provide independent advice to UETCL and BEL on the SEA process, focussing on the consultation activities and on the resettlement related activities. InterAid conducted the following tasks in their role as witness NGO:

- Witnessed topographical surveys along the proposed transmission line route;
- Witnessed on a sample basis, identification of stakeholders, including co-owners as per Ugandan laws (child land owners, spouses etc);
- Witnessed information meetings with the affected communities;
- Witnessed, on a sample basis, valuation of properties;
- Witnessed, on a sample basis socio-economic surveys; and,
- Developed and coordinated a grievance procedure, whereby PAPs had the ability to lodge a grievance related to the land acquisition and resettlement survey activities and process.

InterAid completed event reports after each meeting and submitted monthly Assessment Reports to BEL/UETCL. A final report was provided to BEL/UETCL at the end of the Witness' assignment related with the survey exercise.

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2.0 SEA Regulatory Requirements

The purpose of this section is to set out the legislative, regulatory, and policy context in which the Bujagali HPP is being proposed and with which the project must comply.

2.1 Ugandan Requirements

2.1.1 Constitution of Uganda

There are a number of legislative and regulatory instruments in Uganda that deal with environmental management in both general and specific terms, and which are relevant to the Bujagali HPP. The most important of these instruments is the Constitution of the Republic of Uganda (1995), which is the supreme law in Uganda. The Constitution of Uganda provides for, inter alia:

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

2.1.2 The National Environment Act

The specific legislation that deals with environmental impact assessments (EIA) in Uganda is the National Environment Act (NEA), Cap 153. NEMA was created under NEA and mandated with the responsibility to oversee, coordinate and supervise environmental management in Uganda.

The Third schedule of the NEA 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 EIA. Thus, an EIA is required for the HPP. The EIA is to be prepared in accordance with the EIA Guidelines (1997) and the EIA Regulations (1998) for Uganda, as provided by NEMA. The EIA process is identified as having three major stages, namely screening, EIA and decision-making, as shown on Figure 2.1.

Part V (I) of the same Act further provides for the setting of environmental standards. These include standards for air quality, water quality, discharge of effluent into

water, control of noise and soil quality. The National Environment (Standards for Discharge

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Figure 2.1 EIA Process Flowchart for Uganda

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of Effluent into Water or on Land) Regulations (1999), The National Environment (Wetlands, Riverbanks, and Lake Shores Management) Regulations (1999), Minimum Standards for Management of Soil Quality Regulations (2001) and National Environment (Noise Standards and Control) Regulations (2003) are in place.

Other regulations that have been developed under the NEA include the National Environment (Waste Management) Regulations (1999), the National Environment (Conduct and Certification of Environmental Practitioners) Regulations (2003), and the National Environment (Control of Public Smoking) Regulations (2004). NEMA is also contemplating air quality emission standards at the time of writing this report (Aryamanya-Mugisha, pers. comm., 2006).

Of particular relevance to the planning of the project are the following regulations:

- *The National Environment (Conduct and Certification of Environmental Practitioners) Regulations 2003* - applies to all persons certified and registered under the regulations as Environmental Practitioners, and corporate persons and partnerships registered under the regulations to co-ordinate individually registered persons to conduct environmental impact assessments or environmental audits.
- Section 16 (1) of this regulation requires 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.
- *The National Environment (Wetlands, River Banks and Lake Shores Management), 2000* – provides for the protections of all river banks and lake shores for the common good of the citizens of Uganda. The regulations limit national or local governments from leasing or alienating any river bank or lake shore. The regulation requires resources on the river banks and lake shores be utilised in a sustainable manner and requires special measures for protection against soil erosion, siltation and water pollution. The regulation requires each local government to enact by-laws (as appropriate) for the identification of river banks and lake shores within their jurisdiction, which are at risk from environmental degradations and by-laws to promote soil conservation measures including: bundling; terracing; mulching; tree planting or agro-forestry; grassing; soil engineering, compaction and placement of fills; zoning and planning; gabions; and, control of livestock grazing.

- This regulation includes application forms for a permit to undertake activities in the 100 m strip, such as tree planting. Thus, BEL will be required to submit such application in advance of any tree planting or restoration activities that are planned within the 100 m riparian strip of the Victoria Nile River within the project area.

Apart from the NEA, the following additional statutes and regulations of the GoU apply to the ESA work done for the Bujagali HPP:

- *The Water Act, Cap. 152* - provides for the management of water in Uganda and is under the mandate of Directorate of Water Development (DWD) in the Ministry of Water, Lands and Environment. Under section 107, the Water (Waste Discharge) Regulations (1998); the Water Supply Regulations (1999) and the Sewerage Regulations (1999) have been put in place to operationalise the Act and are aimed at minimising pollution of public waters by developers and other users.
- *The Rivers Act, Cap. 347* – sets out that, amongst others things, a dredging license for dredging activities is required in certain rivers, including in the Nile.
- *The Electricity Act, 1999* – A generation license for the Bujagali HPP will need to be secured from the Electricity Regulatory Authority (ERA). Application for this license must address social and environmental matters.
- *The Public Health Act, CAP 281* - provides local authorities with administrative powers to take all lawful, necessary and reasonable measures to prevent the occurrence of, or deal with any outbreak or prevalence of, any infectious communicable or preventable disease to safeguard and promote the public health and to exercise the powers and perform the duties in respect of public health.
- *The Land Act (1998)* – provides, amongst other things, for the Government or local government to acquire land in accordance with the provisions of the Constitution. The Land Regulations (2004) have been put in place to operationalise the Land Act. The Regulations provide details on how matters such as application for Certification of Occupancy, converting leasehold into freehold system, formation of Community Land Associations, procedures for paying annual ground rent by bona fide occupants to landlords, etc.
- *The Fish Act, CAP 197 and the Fish (Beach Management) Rules, 2003* – The Fish Act makes provision for the control of fishing, the conservation of fish, the purchase, sale, marketing and processing of fish and other issues related to fish. The Fish (Beach Management) Rules No. 35 2003 delegates legal authority to local people for fisheries planning and management. Fisheries stakeholders may join together to form legally empowered groups known as Beach Management Units (BMUs) that are formed from a diverse cross section of the local community.

- *The Occupational Safety and Health Act, 2006* – consolidates, harmonises and updates the law relating to occupational safety and health and repeals the Factories Act. It makes provisions for the health, safety, welfare and appropriate training of persons employed in work places (including at hydropower dams).
- Additional labour laws relevant to employment, industrial relations and workers' conditions are set out in the *Employment Act (2000)* and Employment Regulations (1977), the *Workers' Compensation Act (2000)*, the Labour Unions Act (2006) and Labour Disputes (Arbitration and Settlement) Act (2006). The relevant sections of the labour laws and regulations address such matters as:
 - Appointment of Inspectors;
 - General Duties, Obligations and Responsibilities of Employees;
 - General Duties of Employers and Self-Employed;
 - Registration of Workplaces;
 - Health and Welfare;
 - General Safety Requirements;
 - Fire Preparedness;
 - Handling of hazardous materials;
 - Machinery, Plant and Equipment;
 - Occupational Diseases;
 - First-Aid;
 - Dispute Resolutions and Settlement;
 - Collective Agreements; and,
 - Registration of Labour Unions.

The Uganda Wildlife Act, Cap 200 and the *National Forestry and Tree Planting Act, 2003*, which set up the Uganda Wildlife Authority (UWA) and the National Forestry Authority (NFA), respectively, are also significant to the SEA work on the Bujagali HPP.

2.2 Requirements of International Financial Institutions

The following provides a summary of the environmental and social requirements of the key IFIs who will be involved in this project, expected to include:

- International Finance Corporation;
- World Bank;
- Multilateral Investment Guarantee Agency (MIGA);
- African Development Bank;
- European Investment Bank; and,
- Deutsche Investitions und Entwicklungsgesellschaft mbH.

Each IFI has environmental and social review requirements that must be complied with as a condition of financing.

2.2.1 IFC and its Performance Standards

The IFC is a member of the World Bank Group (WBG), headquartered in Washington, D.C., and is the private sector financing arm of the WBG. IFC's Environment and Social Development Department is tasked with evaluating, appraising and monitoring the environmental and social impacts of proposed and existing IFC projects. Compliance with IFC's social and environmental framework is a requirement for project sponsors.

The IFC recently completed an integrated review process to update its former Safeguard Policies into a new policy framework that came into effect on April 30, 2006. It includes:

- Policy and Performance Standards on Social and Environmental Sustainability;
- Policy on Disclosure of Information; and,
- Environmental, Health and Safety (EHS) Guidelines (in process).

The IFC Sustainability Policy identifies IFC's roles and responsibilities in ensuring project performance in partnership with project sponsors. The Performance Standards clarify what is expected of project sponsors, and detail requirements that project sponsors will be required to fulfil in order to receive and retain IFC support.

There are eight performance standards, as follows:

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

The IFC's Disclosure Policy outlines IFC's commitments and responsibility to disclose information about itself as an institution. Public disclosure requirements for clients are found in the proposed Performance Standards (IFC, 2006) to encourage project sponsors to initiate early and ongoing engagement with the community/communities that are affected by a project.

In relation to environmental, health and safety, IFC currently uses two sets of guidelines for its projects:

- The environmental, health and safety guidelines contained in the *Pollution, Prevention and Abatement Handbook (PPAH)* (World Bank, 1998); and,
- Additional environmental, health and safety guidelines that IFC has prepared since 1993 and for which there are no parallel guidelines in the PPAH.

These guidelines are specific to particular industries, sectors, or types of project. There are, at present, none available for the construction of dams. Where no sector specific guideline exists for a particular project, the World Bank *General Environmental Guidelines* and the IFC's *Occupational Health and Safety Guideline* are applied, with modifications as necessary to suit the project. The guidelines that apply to the project are discussed in further detail in Section 2.4.

Additional publications that the IFC has produced to assist project sponsors in the environmental and social review of their projects include the following:

- Guidance Notes for each Performance Standard;
- Environmental and social review procedure (internal);
- Good practice publications;
- Manual for implementing Environmental Management Systems; and,
- Policies and guidelines glossary.

Additional information on IFC's social and environmental requirements can be found on www.ifc.org.

2.2.2 World Bank Safeguard Policies

The WBG includes two development institutions owned by 184 member countries – the International Bank for Reconstruction and Development (IBRD) and the International Development Association (IDA). The IBRD focuses on middle income and creditworthy poor countries, while IDA focuses on the poorest countries in the world. In addition to the IBRD and IDA, three other institutions are members of the WBG: the IFC (see previous section), the Multilateral Investment Guarantee Agency, or MIGA (see following section) and the International Centre for Settlement of Investment Disputes (ICSID). The following discussion applies to IBRD and IDA.

The operations of IDA and IBRD members are guided by a comprehensive set of environmental and social policies and procedures dealing with the Bank's development objectives and goals, the instruments for pursuing them, and the project sponsor requirements for Bank-financed operations. These policies and guidelines, known as Operational Policies (OPs), are set out in the Bank's Operational Manual. The OPs are focused statements that follow from the Bank's Articles of Agreement, general conditions, and Bank policies specifically approved by the Board. The

Manual also addresses procedures, good practice and advice on implementation of policies.

Within the overall set of OPs, the Bank has identified ten key policies critical to ensuring that potentially adverse environmental and social impacts are identified, minimised, and mitigated. These ten are known as the "Safeguard Policies" and include:

- Environmental Assessment (EA);
- Cultural Property;
- Disputed Areas;
- Forests;
- Indigenous Peoples;
- International Waterways;
- Involuntary Resettlement;
- Natural Habitats;
- Pest Management; and,
- Safety of Dams.

The Bank undertakes screening of each proposed project to determine the appropriate extent and type of EA to be undertaken. Depending on the type, location, sensitivity, and scale of the project and the nature and magnitude of its potential environmental impacts, the Bank will classify the proposed project into one of four categories (A, B, C, and FI). The project sponsor is responsible for any environmental due diligence required by the Safeguard Policies, with general advice provided by Bank staff. Further details of the Bank's environmental and social Safeguard Policies can be viewed at www.worldbank.org.

The World Bank has an Inspection Panel that was established by the Executive Directors of the International Bank for Reconstruction and Development (IBRD) and the International Development Association (IDA) on September 22, 1993. Its primary purpose is to address the concerns of the people who may be affected by Bank projects and to ensure that the Bank adheres to its operational policies and procedures during the design, preparation and implementation phases of its projects. The Inspection Panel consists of three members who are appointed by the Board for non-renewable periods of five years.

On July 27, 2001, the Inspection Panel received a Request for Inspection dated July 25, 2001 related to the Uganda Third Power Project, Fourth Power Project, and Proposed Bujagali Hydropower Project (2001) The Request was submitted by the National Association of Professional Environmentalists (NAPE) and Save the Bujagali Crusade (SBC), as well as other local organizations and individuals. It claims that the failures and omissions of the International Development Association in the design, appraisal, and implementation of these Projects have materially

affected their rights and interests and are likely to jeopardize their future social, cultural, and environmental security.

The Inspection Panel accepted the request, carried out its work and distributed its Investigation Report on May 29, 2002. On June 7, 2002, the World Bank distributed its “Management Report and Recommendation in Response to the Inspection Panel Investigation Report” for consideration by World Bank Executive Directors on June 17, 2002.

Additional details and documentation on the Inspection Panel review and findings, as well as the Management Response are available on the Inspection Panel’s website here:

<http://web.worldbank.org/WBSITE/EXTERNAL/EXTINSPECTIONPANEL/0,,contentMDK:20228304~pagePK:64129751~piPK:64128378~theSitePK:380794,00.html>

2.2.3 MIGA Safeguard Policies

MIGA, a member of the World Bank Group, addresses concerns about investment environments and perceptions of political risk in developing countries by providing three key services:

- Political risk insurance for foreign investments;
- Technical assistance to improve investment climates and promote investment opportunities; and,
- Dispute mediation services, to remove possible obstacles to future investment.

MIGA’s environmental and disclosure policies are derived from WB policies. They are a tool for identifying risks, reducing development costs, and improving project sustainability. Their application benefits affected communities and helps preserve the environment. MIGA’s Issue-Specific Safeguard Policies include:

- Natural Habitats;
- Forestry;
- Pest Management;
- Dam Safety;
- Projects on International Waterways;
- Involuntary Resettlement;
- Indigenous Peoples; and,
- Physical Cultural Resources.

During the underwriting of a project, MIGA identifies the policies and guidelines that are applicable to a project. Projects are expected to comply with the applicable policies and guidelines, as well as applicable local, national, and international laws. Considerations include:

- Environmental Assessment Policy;
- Disclosure Policy;
- Environmental and Social Review Procedures;
- Stakeholder Comments – 1999;
- Environmental Guidelines;
- Interim Issue-specific Safeguard Policies;
- Available Category A Environmental Impact Assessments;
- World Bank Note on Alcoholic Beverages; and,
- IFC/MIGA Office of Compliance and Ombudsman.

Further information is available on MIGA's website: www.miga.org

2.2.4 African Development Bank and its Relevant Policies

The AfDB Group is a regional multilateral development finance institution established in 1964 and comprised of 77 member countries from Africa, North and South America, Europe and Asia. The AfDB is headquartered in Abidjan, Côte d'Ivoire, but has temporary offices in Tunis.

The AfDB policy on environmentally sustainable development in Africa is described in the 2004 Bank Group Policy on the Environment. The new policy acknowledges the need to preserve and enhance ecological capital to sustain and enrich economic growth in Africa. The main goals of the new policy are to:

- Promote a long-term view and perspective of economic and social development;
- Reverse, where possible, and halt the impoverishment process in Africa by enhancing the access of the poor to environmental resources;
- Help Regional Member Countries to build their human capacity and sensitise policymakers on environmental issues and bring about institutional changes to achieve sustainable development; and,
- Reinforce the existing partnerships with international institutions and network also with regional and sub regional organisations to coordinate interventions in environmental sustainable development.

Two procedural guidelines central to the new Policy on the Environment were completed in 2004, namely the Strategic Impact Assessment Guidelines (SIA) and the Integrated Environmental and Social Assessment Guidelines (IESA). The SIA is a systematic process of evaluating the environmental consequences of any proposed policy or programme, as well as a tool for assessing social and environmental sustainability of policy-based lending, structural adjustment, and sector investment lending. The IESA Guidelines are designed to ensure the inclusion of environmental and social issues in Bank projects throughout the project cycle. These provide guidelines for sector-specific issues and impacts that should be taken into account during the preparation and assessment phases of a project. Of relevance to the

Bujagali HPP is the AfDB's sector-specific Hydropower Production – Appendix 8 and Dams and Reservoirs – Appendix 9 guidelines. The companion documents to the IESA Guidelines are the Environmental and Social Assessment Procedures for African Development Bank's Public Sector Operations (2001) and the Environmental Review Procedures for Private Sector Operations of the African Development Bank. These documents provide the procedural process by which public and private sector sponsored projects are categorised and assessed.

More information on the AfDB's environmental and social requirements can be viewed at www.afdb.org.

2.2.5 European Investment Bank and its Relevant Policies

The European Investment Bank (EIB) is the financing institution of the European Union (EU). The task of the EIB is to contribute towards the integration, balanced development and economic and social cohesion of the Member Countries. Outside the Union, the EIB implements the financial components of agreements concluded under European development aid and cooperation policies. The EIB is based in Luxembourg.

The EIB grants loans mainly from the proceeds of its borrowings. Outside the EU, EIB financing operations are conducted principally from the Bank's own resources but also, under mandate, from Union or Member States' budgetary resources.

Following the conclusions of the Lisbon European Council in March 2000, the Board of Governors decided to set up the "EIB Group," consisting of the EIB and the European Investment Fund.

As the EU's policy-driven bank, all projects selected by the EIB have to be acceptable to, and consistent with, EU environmental policies and law. The EIB environmental policies and procedures are set out in the EIB Environmental Procedures document. The EIB internal environmental oversight is provided by:

- Technical experts from the EIB Project Directorate;
- An Environmental Unit (ENVU) that develops and monitors the application of the EIB environmental policy and procedures;
- The Environmental Assessment Group (ENVAG) that assures quality and consistency of EA throughout the project cycle; and,
- The Environmental Steering Committee (ENVSC) that is responsible for addressing strategic environmental issues and risk assessment.

A "Preliminary Opinion for Appraisal Authorisation" on a proposed project is conducted based on classifications and criteria outlined in the EU Environmental Impact Assessment (EIA) Directive, 85/337/EEC, as amended by 97/11/EC.

Following completion of the appropriate level of assessment by the project sponsor,

the EIB Projects Directorate will issue an “Appraisal Report” summarising the assessment team’s findings and recommendations. All EIB projects are subject to a general environmental loan covenant to ensure appropriate compliance. It is EIB practice to publish the SEA for a project alike the Bujagali HPP on the EIB website at least 60 days before Board presentation.

In June 2006, EIB signed the “European Principles for the Environment” with four other of the main European-based multilateral financial institutions. A dedicated website (www.eib.org/epe) provides complete details. Other public documents describing the general approach of the Bank to social and environmental safeguards include its “Environmental Statement” (2004); “The EIB and its Contribution to Sustainable Development” (2002); and, “The EIB Project Cycle” (2001).

More information on the EIB’s environmental and social requirements can be viewed at www.eib.org.

2.2.6 DEG and its Relevant Policies

DEG promotes private enterprise in developing and transition countries providing long-term capital for private enterprises investing in those countries. DEG requires project enterprises to achieve the relevant national and international standards, using the Environmental and Social Policies and Guidelines of the World Bank Group as a benchmark. From time to time the Conventions of the International Labour Organisation (ILO) and the Guideline on the Social Compatibility of DEG Business Operations will be adopted. More information on DEG’s environmental and social requirements can be viewed at www.deginvest.de.

2.2.7 Equator Principles

The Equator Principles are a voluntary set of guidelines developed by leading financial institutions around the globe for managing environmental and social issues in their project finance lending. They were originally based on the environmental and social safeguard policies of the IFC.

On June 4, 2003, ten international banks adopted the Equator Principles for project finance in emerging markets on projects with a capital cost of USD 50 million or more. Since that time, a number of additional financial institutions have made the same commitment, bringing the total number of Equator Principles institutions to about 40.

In July, 2006, a majority of the 40 Equator Principle signatories adopted a revised set of the Principles to reflect the April 2006 revision of IFC’s social and environmental framework. The updated Equator Principles apply globally and to all sectors and were revised to:

- Apply to all project financings with capital costs above 10 million (USD) (threshold lowered from 50 million (USD));
- Also apply to project finance advisory activities;
- Specifically cover upgrades or expansions of existing projects where the additional environmental or social impacts are significant;
- Streamline application to countries with existing high standards for environmental and social issues;
- Require each signatory to report on the progress and performance of Equator Principles' implementation on an annual basis; and,
- Adopt stronger and better social and environmental standards, including more robust public consultation requirements.

Complete information on the revised Equator Principles is available at: www.equator-principles.com

2.3 Concordance Analysis of Lender Policy Requirements

Table 2.1 provides an overview of the environmental and social safeguard policy requirements applicable to the HPP, along with a brief statement regarding the status of the project and the prime locations where the requirements are address in the SEA, as applicable. Policies of the following IFI's are included in the table: WB (IDA), MIGA, IFC and the AfDB. The EIB approach is equivalent to the "Equator Principles (2003)" adopted by a number of commercial banks and based on IFC guidelines. The EIB subscribes to these principles when working outside of the EU (EIB Environmental Statement, 2004). DEG benchmarks are the Environmental and Social Policies and Guidelines of the World Bank Group. For Equator Principle Financial Institutions (EPFIs) that may be involved in the project, EPFI Principle 3 "Applicable Social and Environmental Standards" applies. Specifically EPFI Principle 3 states that "for projects located in non-OECD countries and those located in OCED countries not designated as High-income, as defined by the World Bank Development Indicators Database, the Assessment will refer to the then applicable IFC Performance Standards and the then applicable Industry Specific EHS Guidelines (EHS Guidelines). The Assessment will establish to a participating EPFI's satisfaction the projects overall compliance with, or justified deviation from, the respective Performance Standards and EHS Guidelines". Table 2.1 addresses the policies of the WB (IDA), MIGA, AfDB, and the Performance Standards of IFC. Industry specific environmental, health and safety standards and guidelines are addressed in Sections 2.4 and 7.2.3 of this Report.

Table 2.1: Hydropower SEA Regulatory Requirements - Concordance Table

Agency/Requirement	SEA Status: • SEA Report Section Where Addressed
<ul style="list-style-type: none"> • WB (IDA) OP 4.01 - Environmental Assessment (EA). • IFC Performance Standard 1 – Social and Environmental Assessment and Management Systems. • MIGA Environmental Assessment Policies. • AfDB Integrated Environmental and Social Assessment Guidelines. 	<p>Complies:</p> <ul style="list-style-type: none"> • The social and environmental assessment that has been completed by BEL for the project is documented herein. BEL has developed, and is committed to further developing, appropriate management programmes, organisational capacity, training, community engagement, monitoring and reporting.
<ul style="list-style-type: none"> • WB (IDA) OP 4.04 - Natural Habitats. • IFC Performance Standard 6 – Biodiversity Conservation and Sustainable Natural Resource Management. 	<p>Complies:</p> <ul style="list-style-type: none"> • See sections 7.5.2, 7.5.3 and 7.5.7. The project involves conversion of riverine and terrestrial habitat to hydropower facility and run of the river impoundment. Ongoing investigations are directed at establishing and maintaining an ecologically similar protected area (Kalagala Offset), which the project sponsor has agreed to in principle. In compliance with the policy, the overall local, regional and national benefits derived from the project substantially outweigh the environmental costs. BEL is committed to mitigation measures that have been included to minimise and offset habitat loss.
<ul style="list-style-type: none"> • WB (IDA) OP 4.09 - Pest Management 	<p>Complies:</p> <ul style="list-style-type: none"> • See section 7.5.10. BEL is committed to controlling pests including water borne disease vectors by a combination of environmental design (avoid creating vector breeding habitat), mechanical control (i.e., bed nets), use of medications and prophylaxes, and limited use of approved, non-persistent pesticides (e.g., pyrethrum sprays).

Agency/Requirement	SEA Status: • SEA Report Section Where Addressed
<ul style="list-style-type: none"> • WB (IDA) OP 4.10 - Indigenous Peoples. • IFC Performance Standard 7 – Indigenous Peoples. 	<p>Not Applicable:</p> <ul style="list-style-type: none"> • The World Bank Group has confirmed no indigenous peoples as defined by the World Bank Group are considered to be resident in the project area.
<ul style="list-style-type: none"> • WB (IDA) OP 4.11 – Cultural Property. • IFC Performance Standard 8 – Cultural Heritage. 	<p>Complies:</p> <ul style="list-style-type: none"> • See section 7.5.9. Cultural properties potential within the area to be inundated or areas otherwise affected during construction have been identified. BEL has provisions in place on how the discovery of unknown artefacts (if any are found before or after construction commences) will be managed.
<ul style="list-style-type: none"> • WB (IDA) OP 4.12 - Involuntary Resettlement. • IFC Performance Standard 5 – Land Acquisition and Involuntary Resettlement. • AfDB Policy on Resettlement and Involuntary Displacement. 	<p>Complies:</p> <ul style="list-style-type: none"> • See section 7.5.1. BEL has completed an Assessment of Past Resettlement Activities and Action Plans have been prepared to ensure those affected are not worse off as a result of the Project.
<ul style="list-style-type: none"> • WB (IDA) OP 4.36 – Forests. 	<p>Not Applicable:</p> <ul style="list-style-type: none"> • The project does not involve forestry sector activities, other than small scale clearing of wooded vegetation in the areas to be inundated, or otherwise needed for construction.
<ul style="list-style-type: none"> • WB (IDA) OP 4.37 - Safety of Dams. 	<p>Complies:</p> <ul style="list-style-type: none"> • See section 7.5.10.2. A dam safety panel will be appointed by BEL.
<ul style="list-style-type: none"> • WB (IDA) OP 7.50 - Projects in International Waterways. 	<p>Complies:</p> <ul style="list-style-type: none"> • See section 7.2.2. Notifications were issued to the riparian countries by BEL, both upstream and downstream, in 2006 (Appendices B.2 and B3). No county has expressed an objection.
<ul style="list-style-type: none"> • WB (IDA) OP 7.60 - Projects in Disputed Areas. 	<p>Not Applicable:</p> <ul style="list-style-type: none"> • The Project is not situated in a disputed area.

Agency/Requirement	SEA Status: • SEA Report Section Where Addressed
<ul style="list-style-type: none"> • IFC Performance Standard 2 – Labour and Working Conditions. 	Complies: <ul style="list-style-type: none"> • See section 7.5.10.3 and 7.5.14 BEL is committed to complying with labour and working conditions requirements as set out in the PS and will require corresponding compliance of its contractors and sub-contractors.
<ul style="list-style-type: none"> • IFC Performance Standard 3 – Pollution Prevention and Abatement. 	Complies: <ul style="list-style-type: none"> • See section 2.3 and 7.2.3. BEL will comply with the relevant country and lender environmental performance and EH&S standards and guidelines.
<ul style="list-style-type: none"> • IFC Performance Standard 4 – Community Health, Safety and Security. 	Complies: <ul style="list-style-type: none"> • See section 5.2.13 and 7.5.10. BEL will take appropriate steps to reduce worker and the general public's exposure to vector borne diseases, STDs and construction and operation related safety hazards. An Emergency Preparedness and Response Plan will be prepared prior to project operations (see section 8.3.6). BEL will develop appropriate security hiring, training and enforcement protocols in line with local regulations and the requirements of IFC PS. 4.
<ul style="list-style-type: none"> • Disclosure of Information Policy (IFC) and WB OP 4.01. 	Complies: <ul style="list-style-type: none"> • See chapter 6.0. Information about the project has been made available locally and nationally in Uganda by BEL. Information disclosure has been carried out in English and in the local languages, as appropriate.

2.4 Environmental Performance Requirements Concordance Analysis

In order to demonstrate the current status of the Bujagali HPP with respect to the environmental standards and guidelines of the World Bank Group (WBG) and the Government of Uganda (GoU), a concordance analysis has been undertaken. The following standards, regulations and guidelines were consulted as being applicable to the HPP:

- The Government of Uganda Occupational Safety and Health Act, 2006;

- The Government of Uganda National Environment (Standards for Discharge of Effluent into Water or on Land), Regulations, 1999;
- The Government of Uganda National Environment (Standards for Maximum Permissible Noise Levels), Regulations, 2003;
- World Bank Group's General Environmental Guidelines (July, 1998);
- World Bank Group's Monitoring Guidelines (July, 1998);
- IFC's Environmental, Health and Safety Guidelines for Construction Materials Plants (July 1, 1998);
- IFC's Environmental, Health and Safety Guidelines for Polychlorinated Biphenyls (PCBs) (July 1, 1998);
- IFC's Environmental, Health and Safety Guidelines for Hazardous Materials Management Guidelines (December, 2001); and,
- IFC's Environmental and Social Guidelines for Occupational Health and Safety (June, 2003).

World Bank/IFC guidelines indicate that projects should meet the more stringent values between the in-country environmental standards and those set out in the WBG guidelines. The concordance analysis, presented in Table 2.2 below, summarises the applicable WBG environmental performance guidelines, in tabular format, and compares them side-by-side with the equivalent GoU requirements. For each parameter or consideration required, the column labelled "Project Applicable Requirement" lists the most stringent requirement that the project must comply with.

Table 2.2: Summary of World Bank Group and Government of Uganda's Environmental Standards and Guidelines Applicable to the Proposed Bujagali HPP

Parameter	WBG Guidelines ¹	GOU Standard ²	Project Standard or Requirement
Air Emissions			
Air emissions – dust control measures for materials handling and storage	² Equipment related to material handling and storage (such as conveyor systems, silos and all transfer points) should be covered and equipped with dust collectors.	None stated	Equipment related to material handling and storage (such as conveyor systems, silos and all transfer points) should be covered and equipped with dust collectors.
Ambient Air Quality			
Ground level concentrations of particulate matter (PM)	¹ Annual arithmetic mean < 50 µg/m ³ (at plant boundary) Maximum 24 hour average: 70 µg/m ³ (95 % of the time), at plant boundary.	Maximum 24-hour average: 300 µg/m ³	Annual arithmetic mean < 50 µg/m ³ (at plant boundary) Maximum 24 hour average: 70 µg/m ³ (95 % of the time, at plant boundary).
Workplace Air Quality			
Workplace air quality: monitoring	^{2,3} Periodic monitoring of workplace air contaminants relative to worker tasks and plant operations is required. Workplace air quality monitoring equipment should be well maintained. ⁴ Ventilation systems should be provided and appropriately maintained to control work area temperatures and humidity. HVAC and industrial cooling systems shall be operated in a manner to prevent growth/spread of disease agents.	None stated	Periodic monitoring of workplace air quality should be conducted for air contaminants relevant to employee tasks and the plant's operations.

¹ Numbers preceding the requirements indicates the specific WBG guideline that apply, as follows:

- 1 WBG General Environmental Guidelines (July, 1998).
- 2 IFC's Environmental, Health and Safety Guidelines for Construction Materials Plants (July, 1998)
- 3 IFC's Hazardous Materials Management Guidelines (December, 2001).
- 4 IFC Environmental Guidelines for Occupational Health and Safety (July 24, 2003).

² Numbers preceding the requirements indicates the specific GoU Regulations that apply, as follows:

- 5 The Government of Uganda Guidelines for Environmental Impact Assessment in Uganda, 1997.
- 6 The Government of Uganda Occupational Safety and Health Act, 2006.
- 7 The Government of Uganda National Environment (Standards for Discharge of Effluent into Water or on Land), Regulations, 1999.
- 8 The Government of Uganda National Environment (Standards for Maximum Permissible Noise Levels), Regulations, 2003.

Parameter	WBG Guidelines ¹	GOU Standard ²	Project Standard or Requirement
Workplace air quality: maintenance of protective equipment	<p>² Ventilation, air contaminant control equipment, protective respiratory equipment and air quality monitoring equipment should be well-maintained.</p> <p>⁴ Air inlet filters must be kept clean and free of dust and micro-organisms.</p>	⁶ Where mechanical means of ventilation are used they shall not be regarded as satisfactory unless they provide a supply of air that adequately removes odour and contamination of the atmosphere that arises from human occupation of the room.	Ventilation, air contaminant control equipment, protective respiratory equipment and air quality monitoring equipment should be well-maintained.
Workplace air quality: use of protective respiratory equipment	<p>² Protective respiratory equipment must be used by employees when the exposure level for welding fumes, solvents and other materials present in the workplace exceed the following threshold limit values (TLVs): Asbestos (all forms, >5 mm length): 0.5 fibers/cm³ Coal dusts (<5% SiO₂): 2 mg/m³ Coal dusts (>5% SiO₂): 0.1 mg/m³ Gypsum (Calcium Sulfate): 10 mg/m³ Mineral Wool Fibre: 10 mg/m³ Particulate (Inert or Nuisance Dusts) 10 mg/m³ Portland Cement: 10 mg/m³ Silica/Crystalline Quartz: 0.1 mg/m³ .</p> <p>⁴ The employer shall identify and provide appropriate PPE that will offer adequate protection to workers, co-workers and occasional visitors without incurring unnecessary inconvenience.</p>	⁵ Annexes 4 and 5 of NEMA EIA Guidelines set out generic checklists for determining project effects on occupational health and safety, but provide no specific standards or guidelines for workplace air quality.	Protective respiratory equipment must be used by employees when the exposure level for welding fumes, solvents and other materials present in the workplace exceed the following threshold limit values (TLVs): Asbestos (all forms, >5 mm length): 0.5 fibers/cm ³ Coal dusts (<5% SiO ₂): 2 mg/m ³ Coal dusts (>5% SiO ₂): 0.1 mg/m ³ Gypsum (Calcium Sulfate): 10 mg/m ³ Mineral Wool Fibre: 10 mg/m ³ Particulate (Inert or Nuisance Dusts) 10 mg/m ³ Portland Cement: 10 mg/m ³ Silica/Crystalline Quartz: 0.1 mg/m ³ .
Limits for Liquid Effluents (process wastewater, domestic sewage and contaminated storm water discharged to surface waters)			
pH	^{1,2} 6 to 9	⁷ 6 to 8	6 to 8
BOD	¹ 50 mg/l , ² 50 mg/l	⁷ 50 mg/l	50 mg/l
COD	¹ 250 mg/	⁷ 100 mg/l	100 mg/l
Oil & Grease	¹ 10 mg/l , ² 10 mg/l	⁷ 10 mg/l	10 mg/l
Total Suspended Solids	¹ 50 mg/l , ² 50 mg/l	⁷ 100 mg/l	50 mg/l
Heavy Metals (Total)	¹ 10 mg/	⁷ None stated	10 mg/l
Arsenic	¹ 0.1 mg/l	⁷ 0.2 mg/l	0.1 mg/l
Cadmium	¹ 0.1 mg/l	⁷ 0.1 mg/l	0.1 mg/l
Chromium – Hexavalent	¹ 0.1 mg/l	⁷ 0.05 mg/l	0.05 mg/l
Chromium – Total	¹ 0.5 mg/l	⁷ 1.0mg/l	0.5 mg/l
Copper	¹ 0.5 mg/l	⁷ 1.0mg/l	0.5 mg/l
Iron	¹ 3.50 mg/l	⁷ 10.0 mg/l	3.50 mg/l
Lead	¹ 0.1 mg/l	⁷ 0.1 mg/l	0.1 mg/l

Parameter	WBG Guidelines ¹	GOU Standard ²	Project Standard or Requirement
Mercury	¹ 0.01 mg/l	⁷ 0.01 mg/l	0.01 mg/l
Nickel	¹ 0.5 mg/l	⁷ 1.0 mg/l	0.5 mg/l
Selenium	¹ 0.1 mg/l	⁷ 1.0 mg/l	0.1 mg/l
Silver	¹ 0.5 mg/l	⁷ 0.5 mg/l	0.5 mg/l
Zinc	¹ 2.0 mg/l	⁷ 5.0 mg/l	2.0 mg/l
Cyanide – free	¹ 0.1 mg/l	⁷ 0.1 mg/l	0.1 mg/l
Cyanide – Total	¹ 1.0 mg/l	None stated	1.0 mg/l
Ammonia	¹ 10 mg/l	⁷ 10 mg/l	10 mg/l
Fluoride	¹ 20 mg/l	None stated	20 mg/l
Chlorine – Total residual	¹ 0.2 mg/l	⁷ 1.0 mg/l	0.2 mg/l
Phenols	¹ 0.5 mg/l	⁷ 0.2 mg/l	0.2 mg/l
Phosphorous	¹ 2.0 mg/l	⁷ 5.0 mg/l	2.0 mg/l
Sulfide	¹ 1.0 mg/l	⁷ 1.0 mg/l	1.0 mg/l
Coliform bacteria	¹ <400 MPN/100 ml	⁷ 10,000 counts/100 ml	<400 MPN/100 ml
Temperature increase (measured either at the end of the initial dilution and mixing zone, or, if this not defined, 1,000m from the point of discharge).	<3°C	⁷ Discharge temperature = 20-35°C	<3°C increase, with discharge temperature in range 20-35°C
Pesticides, dioxins, furans and other toxicants such as polynuclear aromatic hydrocarbons.	¹ Either 100 times the WHO guidelines for drinking water or 0.05 mg/l.	Various	Either 100 times the WHO guidelines for drinking water or 0.05 mg/l.
Other pollutants not specified above.	¹ As specified by WBG on an <i>ad hoc</i> basis	N/A	No values specified by WBG

Parameter	WBG Guidelines ¹	GOU Standard ²	Project Standard or Requirement
<i>Environmental Management Considerations for Hazardous Materials and Wastes</i>			
Hazardous material handling and storage: Storage and labelling	<p>¹ All ignitable, reactive, flammable, radioactive, corrosive and toxic materials must be stored in clearly labelled containers or vessels.</p> <p>² All hazardous (reactive, flammable, radioactive, corrosive and toxic) materials must be stored in clearly labelled containers or vessels</p> <p>³ Hazardous materials must be packaged in a manner that keeps them from interacting with each other or with the environment or from being tampered with, either purposefully or otherwise. Packaging labels must comply with standards acceptable to IFC. Unless otherwise specified by national regulations, it should contain the corresponding UN number preceded by the letter “UN” on each package.</p> <p>⁴ All chemicals and hazardous materials present are labelled and marked according to national and internationally recognised requirements and standards. International Chemical Safety Cards (ICSC), Material Safety Data Sheets (MSDS) or equivalent data/information in an easily understood language must be readily available to exposed workers and first aid personnel. The employer must ensure adequate and competent supervision of the work, work practices and the appropriate use of PPE.</p>	<p>⁶ An employer shall ensure that the packages of a hazardous chemical delivered to a workplace are labelled and that the appropriate chemical safety data sheet is delivered to the workplace.</p>	All hazardous (reactive, flammable, radioactive, corrosive and toxic) materials must be stored in clearly labelled containers or vessels.

Parameter	WBG Guidelines ¹	GOU Standard ²	Project Standard or Requirement
Hazardous material handling and storage: local/international standards	<p>^{1,2} Must be in accordance with local regulations or international standards and appropriate to their hazard characteristics.</p> <p>³ Unless otherwise specified by national regulations, the package should contain the corresponding UN number preceded by the letter “UN” on each package.</p> <p>⁴ All chemicals and hazardous materials present are labelled and marked according to national and internationally recognised requirements and standards.</p>	⁵ Annexes 4 and 5 of NEMA EIA Guidelines set out generic checklists for considering effects of a project’s hazardous materials management, but provide no specific standards or guidelines for hazardous materials management.	Must be in accordance with local regulations or international standards and appropriate to their hazard characteristics.
Hazardous material handling and storage: spill containment	<p>^{1,2} Storage and liquid impoundment areas for fuels, raw and in-process materials, solvents, wastes, and finished products should be designed with secondary containment (e.g. dykes and berms) to prevent spills and the contamination of soil, groundwater and surface waters.</p> <p>³ The sponsor must produce an Emergency Preparedness and Response Plan.</p> <p>⁴ Organisations that produce handle, store, transport and dispose of hazardous materials shall fulfil the requirements of the IFC Hazardous Materials Management Guidelines.</p>		Storage and liquid impoundment areas for fuels, raw and in-process materials, solvents, wastes, and finished products should be designed with secondary containment (e.g. dikes, berms) to prevent spills and the contamination of soil, groundwater and surface waters.

Parameter	WBG Guidelines ¹	GOU Standard ²	Project Standard or Requirement
Hazardous materials handling and storage: fire prevention systems	<p>^{1,2} Fire prevention systems and secondary containment should be provided for storage facilities, where necessary or required by regulations, to prevent fires or the release of hazardous materials to the environment.</p> <p>³ Project companies must design, construct and operate all buildings and plants financed by IFC in full compliance with local building codes, local fire department regulations, local/legal insurance requirements and in accordance with internationally accepted life and fire safety standards.</p> <p>⁴ The workplace must be equipped with fire detectors, alarm systems and fire fighting equipment. Fire and emergency alarms systems shall be audible and visible.</p>	Not stated	Fire prevention systems and secondary containment should be provided for storage facilities, where necessary or required by regulations, to prevent fires or the release of hazardous materials to the environment.
Hazardous materials and wastes: asbestos	<p>¹ New installations of manufactured products should not contain unbonded asbestos fibres.</p> <p>² Processes, equipment, materials and products involving the use or potential release to the environment of asbestos or asbestos containing materials (ACMs) should not be installed.</p>	Not stated	Processes, equipment, materials and products involving the use or potential release to the environment of asbestos or asbestos containing materials (ACMs) should not be installed.
Hazardous materials and wastes: chromates	^{1,2} Formulations containing chromates should not be used in water treatment processes.	Not stated	Formulations containing chromates should not be used in water treatment processes.
Hazardous materials and wastes: PCBs	^{1,2} Transformers or equipment containing polychlorinated biphenyls (PCBs) or PCB-contaminated oil should not be installed.	Not stated	Transformers or equipment containing polychlorinated biphenyls (PCBs) or PCB-contaminated oil should not be installed.
Hazardous materials and wastes: ozone depleting substances	^{1,2} No systems or processes are to be installed using chlorofluorocarbons (CFCs), halons, 1,1,1-trichloroethane, carbon tetrachloride, methyl bromide, or hydrobromofluorocarbons (HBFCs) unless it can be shown that no alternative exists.	Not stated	Processes, equipment and central cooling systems involving the use or potential release to the environment of chlorofluorocarbons (CFCs), including halon, should not be installed.

Parameter	WBG Guidelines ¹	GOU Standard ²	Project Standard or Requirement
<i>Solid Wastes</i>			
Solid wastes: recycling/reclamation	^{1,2} Solid waste materials are to be recycled or reclaimed where possible.	⁵ Annexes 4 and 5 of NEMA EIA Guidelines set out generic checklists for considering effects of a project's solid waste management, but provide no specific standards or guidelines for solid waste recycling/reclamation.	Solid waste materials are to be recycled or reclaimed where possible.
Solid wastes: disposal	^{1,2} If recycling or reclamation is not practical, solid wastes must be disposed of in an environmentally acceptable manner and in compliance with local laws and regulations. ⁴ Places of work, traffic routes and passageways shall be kept free from waste and spillage, regularly cleaned and maintained.	⁵ Annexes 4 and 5 of NEMA EIA Guidelines set out generic checklists for considering effects of a project's solid waste management, but provide no specific standards or guidelines for solid waste management.	If recycling or reclamation is not practical, solid wastes must be disposed of in an environmentally acceptable manner and in compliance with local laws and regulations.
Solid and liquid wastes: hazardous materials	^{1,2} All hazardous materials, process residues, solvents, oils, and sludges from raw water, process wastewater and domestic sewage treatment systems must be disposed of in a manner to prevent the contamination of soil, groundwater and surface waters. ³ Where appropriate disposal options are not available, the EA process for the project must address appropriate alternatives for the handling and disposal of hazardous waste and propose a reasonable solution for handling and disposing of hazardous waste.	⁵ Annexes 4 and 5 of NEMA EIA Guidelines set out generic checklists for considering effects of a project's hazardous materials management, but provide no specific standards or guidelines for hazardous materials management.	All hazardous materials, process residues, solvents, oils, and sludges from raw water, process wastewater and domestic sewage treatment systems must be disposed of in a manner to prevent the contamination of soil, groundwater and surface waters.

Parameter	WBG Guidelines ¹	GOU Standard ²	Project Standard or Requirement
Ambient Noise			
Ambient Noise – Construction period	⁴ No employee may be exposed to a noise level greater than 85 db (A) for duration of more than 8 hrs per day. In addition no unprotected ear should be exposed to a peak sound pressure level (instantaneous) of more than 140 dBC. The use of hearing protection must be actively enforced when Laeq,8h reached 85 dB(A), the peak sound levels 140 dB(C) or the L _{max,fast} 110dB(A).	⁸ 75 dBLAeq daytime 65 dBLAeq night time	75 dBLAeq daytime 65 dBLAeq night time.
Ambient Noise – Operational Period	¹ 55 dB(A) in the day and 45 dB(A) in the night in residential/ institutional or educational areas; 70 dB(A) in the day or night in industrial or commercial areas; or a maximum increase in background levels of 3 dB(A). ² Noise levels at receptors outside the project property boundary should not exceed 75 dB(A) during the day time and 70dB(A) during the night time.	⁸ 75 dBLAeq daytime 65 dBLAeq night time	55 dB(A) in the day and 45 dB(A) in the night in residential/ institutional or educational areas; 70 dB(A) in the day or night in industrial or commercial areas; or a maximum increase in background levels of 3 dB(A).
Workplace Noise			
Workplace noise: control measures	² Feasible administrative and engineering controls, including sound-insulated equipment and control rooms should be employed to reduce the average noise level in normal work areas.	None stated	Feasible administrative and engineering controls, including sound-insulated equipment and control rooms should be employed to reduce the average noise level in normal work areas.
Workplace noise: plant maintenance	² Plant equipment should be well maintained to minimise noise levels.	None stated	Plant equipment should be well maintained to minimise noise levels.
Workplace noise	² Personnel must use hearing protection when exposed to noise levels above 85 dBA. ⁴ No employee may be exposed to a noise level greater than 85 db (A) for a duration of more than 8 hrs per day. In addition no unprotected ear should be exposed to a peak sound pressure level (instantaneous) of more than 140 dBC. The use of hearing protection must be actively enforced when Laeq,8h reached 85 dB(A), the peak sound levels 140 dB(C) or the L _{max,fast} 110dB(A).	⁸ Factory/Workshops 85 dB(A) Factory/Workshop compound 75 dB(A)	Personnel must use hearing protection when exposed to noise levels above 85 dBA.

Parameter	WBG Guidelines ¹	GOU Standard ²	Project Standard or Requirement
Work in Confined Spaces			
Work in confined spaces: dangerous gases and lack of oxygen	<p>² Prior to entry and occupancy, all confined spaces (e.g. tanks, sumps, vessels, sewers, excavations) must be tested for the presence of toxic, flammable and explosive gases or vapours, and for the lack of oxygen.</p> <p>⁴ Unavoidable confined spaces shall, to the extent possible, be provided with permanent safety measures for venting, monitoring and rescue operations. The area adjoining an access to a confined space shall provide ample room for emergency and rescue operations.</p>	⁶ All practical steps are taken to remove any fumes and, unless it is ascertained by a suitable test the space is free from dangerous fumes and the person wears a belt to which there is a securely fastened rope of which a person outside holds the free end.	Prior to entry and occupancy, all confined spaces (e.g. tanks, sumps, vessels, sewers, excavations) must be tested for the presence of toxic, flammable and explosive gases or vapours, and for the lack of oxygen.
Work in confined spaces: ventilation	<p>² Adequate ventilation must be provided before entry and during occupancy of these spaces.</p> <p>⁴ Unavoidable confined spaces shall, to the extent possible, be provided with permanent safety measures for venting, monitoring and rescue operations.</p>	None stated	Adequate ventilation must be provided before entry and during occupancy of these spaces.
Work in confined spaces: use of respirators	<p>² Personnel must use air-supplied respirators when working in confined spaces which may become contaminated or deficient in oxygen during the period of occupancy.</p> <p>⁴ Unavoidable confined spaces shall, to the extent possible, be provided with permanent safety measures for venting, monitoring and rescue operations.</p>	⁶ A person shall not enter the confined space for any purpose unless the person entering wears a suitable breathing apparatus.	Personnel must use air-supplied respirators when working in confined spaces which may become contaminated or deficient in oxygen during the period of occupancy.
Work in confined spaces: requirement for observers/assistants	<p>² Observers/assistants must be stationed outside of confined spaces to provide emergency assistance, if necessary, to personnel working inside these areas.</p> <p>⁴ The area adjoining an access to a confined space shall provide ample room for emergency and rescue operations.</p>	⁶ There shall be provided and maintained in every confined work place a sufficient number of workers trained in the practice of using breathing and reviving apparatus, belts and ropes and in the methods of restoring respiration and who shall be readily accessible.	Observers/assistants must be stationed outside of confined spaces to provide emergency assistance, if necessary, to personnel working inside these areas.

Parameter	WBG Guidelines ¹	GOU Standard ²	Project Standard or Requirement
Quarry Reclamation			
Preparation and implementation of a Quarry Reclamation Plan	² The plan should include reclamation of settling ponds, and abandoned access roads and campsites. The reclamation plan should ensure that the land is restored, to the extent practical and feasible, to conditions capable of supporting prior land use, or uses that are equivalent.	Annexes 4 and 5 of NEMA EIA Guidelines set out generic checklists for determining project effects, including those caused by aggregate operations, but provide no specific guidance for managing impacts of pits and quarries.	The plan should include reclamation of settling ponds, and abandoned access roads and campsites. The reclamation plan should ensure that the land is restored, to the extent practical and feasible, to conditions capable of supporting prior land use, or uses that are equivalent.
Quarry reclamation plan – effects on water resources	² The reclamation plan should ensure that significant adverse effects on adjacent water resources are prevented or remedied.	Annexes 4 and 5 of NEMA EIA Guidelines set out generic checklists for determining project effects, including those to water resources, but provide no specific guidance for managing impacts of quarries on water resources.	The reclamation plan should ensure that significant adverse effects on adjacent water resources are prevented or remedied.
Quarry reclamation plan – components of plan	² The plan should have the following components: i) conserve, stockpile, and use topsoil and overburden for reclamation ii) recontour slopes of more than 30% to minimise erosion and runoff iii) plant native vegetation to prevent erosion and encourage self-sustaining development of a productive ecosystem iv) schedule and budget for pre-and post-abandonment reclamation activities.	None stated	The plan should have the following components: i) conserve, stockpile, and use topsoil and overburden for reclamation ii) recontour slopes of more than 30% to minimise erosion and runoff iii) plant native vegetation to prevent erosion and encourage self-sustaining development of a productive ecosystem iv) schedule and budget for pre-and post-abandonment reclamation activities.
Quarry reclamation plan – final grading	² The final grading for the quarry closure should ensure that stormwater run-off does not accumulate and become stagnant, potentially contaminating surface waters.	None stated	The final grading for the quarry closure should ensure that stormwater run-off does not accumulate and become stagnant, potentially contaminating surface waters.

Parameter	WBG Guidelines ¹	GOU Standard ²	Project Standard or Requirement
Health and Safety			
Health – General: sanitary facilities	<p>² Sanitary facilities should be well equipped with supplies (e.g., protective creams) and employees should be encouraged to wash frequently, particularly those exposed to dust, chemicals or pathogens.</p> <p>³ All employees working with hazmats should be provided with suitable Personal Protective Equipment (PPE), emergency eyewash and shower stations, ventilation systems, sanitary facilities, pre employment and scheduled periodic medical examinations. Periodic monitoring of workplace air contaminants relative to worker tasks and plant operations is required. Workplace air quality monitoring equipment should be well maintained.</p> <p>⁴ Facilities must include locker rooms, an adequate number of toilets with wash basins, and a room dedicated for eating. Water supplied to areas of food preparation or for the purpose of personal hygiene must meet drinking water quality standards.</p>	<p>⁶In any building where work is carried out sufficient and suitable sanitary conveniences shall be provided, maintained and kept clean.</p>	<p>Sanitary facilities should be well equipped with supplies (e.g., protective creams) and employees should be encouraged to wash frequently, particularly those exposed to dust, chemicals or pathogens.</p>
Health – General: workplace ventilation	<p>^{2,4} Ventilation systems should be provided and appropriately maintained to control work area temperatures and humidity. HVAC and industrial cooling systems shall be operated in a manner to prevent growth/spread of disease agents.</p> <p>³ All employees working with hazmats should be provided with suitable PPE, emergency eyewash and shower stations, ventilation systems, sanitary facilities, pre employment and scheduled periodic medical examinations. Periodic monitoring of workplace air contaminants relative to worker tasks and plant operations is required. Workplace air quality monitoring equipment should be well maintained.</p>	<p>⁶There shall be an effective and suitable system for securing and maintaining the circulation of fresh air in each room.</p>	<p>Ventilation systems should be provided and appropriately maintained to control work area temperatures and humidity.</p>

Parameter	WBG Guidelines ¹	GOU Standard ²	Project Standard or Requirement
Health – General: work in high temperature/humidity	<p>² Personnel required to work in areas of high temperature and/or humidity should be allowed to take frequent breaks away from these areas.</p> <p>⁴ The employer shall maintain indoor temperatures that are reasonable and appropriate for the type of work. Risks of heat or cold related stress must be adequately addressed and feasible control measures implemented for work in adverse environments.. A fresh drinking water supply should be conveniently available for workers.</p>	⁶ A suitable room temperature shall be secured for workers in buildings, having regard in any workplace, to the number of workers, the ventilation and air movement, the air humidity and temperature of the surroundings.	Personnel working in areas of high temperature and/or humidity should be allowed to take frequent breaks away from these areas.
Health – General: medical examinations	<p>² Pre-employment and periodic medical examinations should be conducted for all personnel, and specific surveillance programmes instituted for personnel potentially exposed to toxic or radioactive substances.</p> <p>³ All employees working with hazmats should be provided with suitable PPE, emergency eyewash and shower stations, ventilation systems, sanitary facilities, pre employment and scheduled periodic medical examinations.</p> <p>⁴ When extraordinary protective measures are required, the employer shall provide appropriate and relevant health surveillance to workers prior to first exposure and at regular intervals thereafter.</p>	⁶ The Minister may require a medical supervision or medical examination of a person or any class of persons employed where in any workplace there may be risk of injury to the health of the workers in the workplace as a result of any process or from any substance used or handled.	Pre-employment and periodic medical examinations should be conducted for all personnel, and specific surveillance programmes instituted for personnel potentially exposed to toxic or toxic or radioactive substances.
Safety – General: prevention of mechanical injuries	<p>² Shield guards or guard railings should be installed at all belts, pulleys, gears and other moving parts.</p> <p>⁴ Floors should be level, even and non-skid. Heavy oscillating, rotating or alternating equipment should be located in dedicated buildings or structurally isolated sections. Appropriate shields, guards or railings must be installed and maintained to eliminate human contact with moving parts or hot and cold items.</p>	⁶ Every dangerous part of any machinery, other than a prime mover and transmission machinery shall be securely fenced unless it is in a position or of such construction that it safe for every person employed or working on the premises as it would be if it were securely fenced.	Shield guards or guard railings should be installed and maintained to eliminate human contact with moving parts, or hot or cold items.

Parameter	WBG Guidelines ¹	GOU Standard ²	Project Standard or Requirement
Safety – General: prevention of falling injuries	<p>² Elevated platforms and walkways, and stairways and ramps should be equipped with handrails, toe boards and non-slip surfaces.</p> <p>⁴ Hand, knee and foot railings must be installed on stairs, fixed ladders, platforms, permanent and interim floor openings, loading bays, ramps etc. Openings must be sealed by gates or removable chains. Covers if feasible shall be installed to protect against falling items.</p>	<p>⁶The staircases on premises inside and outside a building shall have handrails and guard rails which, shall be properly maintained at all times.</p>	Elevated platforms and walkways, and stairways and ramps should be equipped with handrails, toe boards and non-slip surfaces.
Safety – General: prevention of electrocution by electrical equipment	<p>² Electrical equipment should be grounded, well insulated and conform to applicable codes.</p> <p>⁴ Electrical installations must be designed, constructed and maintained to eliminate fire or explosion hazards and risks to employees.</p>	<p>⁶All electrical apparatus, fittings and conductors shall be sufficient in size and power for the work they are meant for and shall be constructed, installed, protected worked and maintained to prevent danger, as far as is reasonably practical.</p>	Electrical equipment should be grounded, well insulated and conform to applicable codes.
Safety – General: protection from dust and hazardous materials	<p>² Personnel should use special footwear, masks and clothing for work in areas with high dust levels or contaminated with hazardous materials.</p> <p>⁴ Precautions must be taken to keep the risk of exposure as low as possible. Work processes, engineering and administrative control measures must be designed, maintained and operated to avoid or minimise the release of hazardous substances to the working environment. The employer must ensure adequate and competent supervision of the work, work practices and the appropriate use of PPE.</p>	<p>⁶In a case where toxic materials or substances are manufactured, handled, used or stored the Commissioner may serve upon an occupier or employer, a notice requiring him or her to provide additional bathing facilities including showers, where practical; arrange for periodical medical examinations and, provide additional protective clothing.</p>	Personnel should use special footwear, masks and clothing for work in areas with high dust levels or contaminated with hazardous materials.

Parameter	WBG Guidelines ¹	GOU Standard ²	Project Standard or Requirement
Safety – General: high temperature materials	<p>² For work near molten or high temperature materials, employees should be provided with non-slip footwear, gloves, safety glasses, helmets, face protection, leggings and other necessary protective equipment.</p> <p>⁴ Appropriate shields, guards or railings must be installed and maintained to eliminate human contact with moving parts or hot and cold items.</p>	None stated	For work near molten or high temperature materials, employees should be provided with non-slip footwear, gloves, safety glasses, helmets, face protection, leggings and other necessary protective equipment.
Safety – General: eye protection	<p>² Eye protection should be worn by personnel when in areas where there is a risk of flying chips or sparks, or where intense light is generated.</p> <p>⁴ The employer shall identify and provide appropriate personal protective equipment (PPE) that will offer adequate protection to the worker, co-workers and occasional visitors without incurring unnecessary inconvenience.</p>	⁶ In the case of any processes suitable goggles or effective screens shall be provided, to protect the eyes of the persons employed in the process.	Eye protection should be worn by personnel when in areas where there is a risk of flying chips or sparks, or where intense light is generated.
Safety – General: protection from dangerous materials	<p>² Personnel should wear protective clothing and goggles when in areas where corrosive, reactive, ignitable or toxic materials are stored or processed.</p> <p>³ Procedures should be produced for the use of hazmats during each operation phase including initial start-up, normal operations, temporary operations, emergency shutdown, emergency operations, normal shutdown, and start up following a normal or emergency shutdown or major change.</p> <p>⁴ The employer shall identify and provide appropriate PPE that will offer adequate protection to the worker, co-workers and occasional visitors without incurring unnecessary inconvenience.</p>	⁶ Where any process carried out in a workplace is likely to cause bodily injury which cannot be prevented by other means, every worker involved in that process, who is liable to bodily injury shall be provided with suitable and appropriate PPE and clothing to prevent him or her from risk or injury.	Personnel should wear protective clothing and goggles when in areas where corrosive, reactive, ignitable or toxic materials are stored or processed.

Parameter	WBG Guidelines ¹	GOU Standard ²	Project Standard or Requirement
Safety – General: eyewashes.	<p>² Emergency eyewash and showers should be installed in areas containing corrosive materials.</p> <p>³ All employees working with hazmats should be provided with suitable PPE, emergency eyewash and shower stations, ventilation systems, sanitary facilities, pre employment and scheduled periodic medical examinations.</p> <p>⁴ Eye wash stations and/or emergency showers shall be provided close to all workstations where the recommended first aid is immediate flushing with water.</p>	<p>⁶Where dangerous or corrosive liquids are used there shall be provided and maintained for use in the case of emergency sufficient and suitable means of flushing or irrigating the eyes conveniently located and clearly indicated by a distinctive sign which is clearly visible at all times.</p>	Emergency eyewash and showers should be installed in areas containing corrosive materials.
Safety – General: safety programme. The workplace must be equipped with fire detectors, alarm systems and fire fighting equipment. Fire and emergency alarms systems shall be audible and visible.	<p>² A safety programme should be established for construction and maintenance work.</p> <p>³ All employees working with hazmats should be provided with suitable PPE, emergency eyewash and shower stations, ventilation systems, sanitary facilities, pre employment and scheduled periodic medical examinations. Periodic monitoring of workplace air contaminants relative to worker tasks and plant operations is required. Workplace air quality monitoring equipment should be well maintained.</p> <p>⁴ The employer is responsible for planning, implementing and monitoring programmes and systems required to ensure OHS on its premises.</p>	<p>⁶It is the responsibility of an employer to take as far as is reasonably practical all measures for the protection of his or her workers and the general public from the dangerous aspects of an employers undertaking at his or her cost.</p>	A safety programme should be established for construction and maintenance work.

Parameter	WBG Guidelines ¹	GOU Standard ²	Project Standard or Requirement
Safety – General: fire prevention and fire safety programme	<p>² A fire prevention and fire safety programme should be implemented and include regular drills.</p> <p>³ Project companies must design construct and operate all buildings and plants financed by IFC in full compliance with local building codes, local fire department regulations, local/legal insurance requirements and in accordance with internationally accepted life and fire safety standards.</p> <p>⁴ The workplace must be equipped with fire detectors, alarm systems and fire fighting equipment. Fire and emergency alarms systems shall be audible and visible.</p>	<p>⁶ All premises shall have means of escape from fire for workers as may be reasonably be required in the circumstance and in determining what is required by way of escape.</p>	<p>A fire prevention and fire safety programme should be implemented and include regular drills.</p>
Site Drinking Water	<p>⁴ Water supplied to areas of food preparation or for the purpose of personal hygiene must meet drinking water quality standards.</p>	<p>⁶ An adequate supply of wholesome drinking water shall be provided and maintained at suitable points in a workplace, conveniently accessible to all workers.</p>	<p>When sponsors are responsible for the project's drinking water supply, they should use drinking water standards published by the World Health Organisation in "Guidelines for Drinking Water Quality, Health Criteria and the Supporting Information".</p>

Parameter	WBG Guidelines ¹	GOU Standard ²	Project Standard or Requirement
Training			
Training: harmful materials	<p>² Employees should be trained on the hazards, precautions and procedures for the safe storage, handling and use of all potentially harmful materials relevant to each employee's task and work area.</p> <p>³ All employees working with hazmats should be trained in hazard identification, safe operating procedures, appropriate materials handling procedures special hazard unique to their job.</p> <p>⁴ The employer shall ensure that workers prior to commencement of new assignments have received adequate training and information enabling them to understand the hazards of the work and to protect their health from hazardous ambient factors that may be present. The training must adequately cover: a) knowledge of materials, equipment and tools; b) known hazards in the operations and how they are controlled; c) potential risks to health; d) precautions to prevent exposure, and; e) hygiene requirement; f) wearing and the use of protective equipment and clothing; and g) appropriate response to operation extremes, incidents and accidents.</p>	<p>⁶The provision of adequate and appropriate information, instructions, supervision and training necessary to ensure as far as is reasonably practical, the safety and health of the employees, and that the application and use of occupational safety and health measures, taking into account the functions and capabilities of different categories of workers in an undertaking.</p>	<p>Employees should be trained on the hazards, precautions and procedures for the safe storage, handling and use of all potentially harmful materials relevant to each employee's task and work area.</p>

Parameter	WBG Guidelines ¹	GOU Standard ²	Project Standard or Requirement
Training: Material Safety Data Sheets	<p>² Training should incorporate information from the Material Safety Data Sheets (MSDSs) for potentially harmful materials, which can be obtained from the supplier(s) of the chemicals being used.</p> <p>³ Training should incorporate information from MSDSs for hazmats being handled. The sponsor must produce an Emergency Preparedness and Response Plan.</p> <p>⁴ The employer shall ensure that workers prior to commencement of new assignments have received adequate training and information enabling them to understand the hazards of the work and to protect their health from hazardous ambient factors that may be present. The training must adequately cover: a) knowledge of materials, equipment and tools; b) known hazards in the operations and how they are controlled; c) potential risks to health; d) precautions to prevent exposure, and; e) hygiene requirement; f) wearing and the use of protective equipment and clothing; and g) appropriate response to operation extremes, incidents and accidents.</p>	<p>⁶The provision of adequate and appropriate information, instructions, supervision and training necessary to ensure as far as is reasonably practical, the safety and health of the employees, and that the application and use of occupational safety and health measures, taking into account the functions and capabilities of different categories of workers in an undertaking.</p>	<p>Training should incorporate information from the MSDSs for potentially harmful materials, which can be obtained from the supplier(s) of the chemicals being used.</p>

Parameter	WBG Guidelines ¹	GOU Standard ²	Project Standard or Requirement
Training: environmental health and safety	<p>² Personnel should be trained in environmental, health and safety matters including accident prevention, safe lifting practices, the use of MSDSs, safe chemical handling practices, and proper control and maintenance of equipment and facilities.</p> <p>³ Training should incorporate information from MSDSs for hazmats being handled. The sponsor must produce an Emergency Preparedness and Response Plan.</p> <p>⁴ The employer shall ensure that workers prior to commencement of new assignments have received adequate training and information enabling them to understand the hazards of the work and to protect their health from hazardous ambient factors that may be present. The training must adequately cover: a) knowledge of materials, equipment and tools; b) known hazards in the operations and how they are controlled; c) potential risks to health; d) precautions to prevent exposure, and; e) hygiene requirement; f) wearing and the use of protective equipment and clothing; and g) appropriate response to operation extremes, incidents and accidents.</p>	<p>⁶The provision of adequate and appropriate information, instructions, supervision and training necessary to ensure as far as is reasonably practical, the safety and health of the employees, and that the application and use of occupational safety and health measures, taking into account the functions and capabilities of different categories of workers in an undertaking.</p>	<p>Personnel should be trained in environmental, health and safety matters including accident prevention, safe lifting practices, the use of MSDSs, safe chemical handling practices, and proper control and maintenance of equipment and facilities.</p>

Parameter	WBG Guidelines ¹	GOU Standard ²	Project Standard or Requirement
Training: emergency response	<p>² Training should also include emergency response, including the location and proper use of emergency equipment, use of personal protective equipment, procedures for raising the alarm and notifying emergency response teams, including local and regional hospitals, and proper response actions for each foreseeable emergency situation.</p> <p>³ The sponsor must produce an Emergency Preparedness and Response Plan.</p> <p>⁴ The employer shall ensure that workers prior to commencement of new assignments have received adequate training and information enabling them to understand the hazards of the work and to protect their health from hazardous ambient factors that may be present. The training must adequately cover: g) appropriate response to operation extremes incidents and accidents.</p>	<p>⁶The provision of adequate and appropriate information, instructions, supervision and training necessary to ensure as far as is reasonably practical, the safety and health of the employees, and that the application and use of occupational safety and health measures, taking into account the functions and capabilities of different categories of workers in an undertaking.</p>	<p>Training should also include emergency response, including the location and proper use of emergency equipment, use of personal protective equipment, procedures for raising the alarm and notifying emergency response teams, including local and regional hospitals, and proper response actions for each foreseeable emergency situation.</p>

Parameter	WBG Guidelines ¹	GOU Standard ²	Project Standard or Requirement
Record Keeping and Reporting			
Environmental/ occupational health and safety records and reporting.	<p>¹ The project sponsor is required to maintain a record of air emissions, effluents, and hazardous wastes sent off site, as well as significant environmental events such as spills, fires, and other emergencies that may have an impact on the environment. The information should be reviewed and evaluated to improve the effectiveness of the environmental protection plan.</p> <p>² The sponsor should maintain records of significant environmental matters, including monitoring data, accidents and occupational illnesses, and spills, fires and other emergencies. This information should be reviewed and evaluated to improve the effectiveness of the environmental, health and safety programme. An annual summary of the above information should be provided to IFC.</p> <p>³ Measuring and monitoring records must be made available to employees handling hazmats and their representatives as appropriate. Records should be kept for IFC review and reports on hazmat management should be submitted regularly to IFC – at least one a year as part of the sponsors Annual Monitoring Report (AMR).</p> <p>⁴ An annual report adequately presenting performance and achievements in regard to OHS shall be submitted to IFC. Employee monitoring data (originals) must be saved for a period of 5 years of longer if required by national regulations.</p>	<p>⁶ There shall be kept available for inspection in every workplace, in the prescribed form, a General Register. The General Register and any other register or record shall be preserved and kept available for at least five years or such other period as may be prescribed for any other class or description of register or record after the date of the last entry in the register or record.</p>	<p>The sponsor should maintain records of significant environmental matters, including monitoring data, accidents and occupational illnesses, and spills, fires and other emergencies. This information should be reviewed and evaluated to improve the effectiveness of the environmental, health and safety programme. An annual summary of the above information should be provided to IFC.</p>

3.0 Existing Environmental and Social Conditions

3.1 Project Setting

The Bujagali HPP is located on the Victoria Nile in south-eastern Uganda. The Victoria Nile drains Lake Victoria, Africa's largest lake and the second largest Lake in the World. The Lake is considered to be the source of the Nile, since the Victoria Nile is the start of the longest branch of the Nile, which is known as the White Nile.

The Lake lies within an elevated plateau in the western part of Africa's Great Rift Valley, and straddles the equator. The location of the HPP itself is about 1,100 m above sea level and a few degrees north of the equator.

The discharge of Lake Victoria was dammed in 1954 by construction of the Owen Falls Hydro Project, and which was recently renamed as the Nalubaale Hydro Dam. In 2000, a second hydro facility, originally known as the Owen Falls Extension and later renamed Kiira, was installed next to the Nalubaale Dam in a canal excavated for that purpose. The Bujagali HPP would be located about 8 km downstream of the Nalubaale/Kiira facilities.

The Nile in this area is located within a deeply incised, steeply sloped valley, and drops in a series of rapids. In recent years the rapids in the area affected by the HPP, as well rapids further downstream have been used for commercial white-water rafting. The river is also used for small scale artisanal fisheries by local villagers, and its many islands and rapids hold cultural/religious values for some local persons and communities.

Jinja town, located on the east side of the river near Nalubaale is the closest large community. The city developed starting in the 50's when power for industry became available from the Owen Falls project. Kampala, Uganda's largest city is located about 70 km to the west.

The majority of the study area for the Bujagali hydropower facility is rural, with estate and small-scale or subsistence agriculture being the predominant land uses. Agricultural activity is primarily a labour-intensive, intercropping system with both cash and subsistence crops following the seasonal changes. The main cash crops are coffee and sugar cane, coupled with more recent cropping of vanilla. Subsistence food crops include bananas, cassava, sweet potatoes, maize, beans, millet, and yams.

The Nile is the historic dividing line between the closely related Bantu Basoga Kingdom on the east bank and the Baganda Kingdom on the west bank. The Baganda is the largest of the 16 ethnic groups in Uganda. The Basoga are the third largest. The World Bank Group does not consider either group in the area to be indigenous.

Amongst these people, many still practice traditional religions, although they are often practiced in tandem with Christianity and Islam.

3.2 Project Area of Influence

The IFC's Performance Standard 1 (April 30 2006) specifies that risks and impacts associated with a project will be analyzed in the context of the project's area of influence. Table 3.1 summarises the area of influence for the HPP according to the definition provided by IFC, including areas affected by: (i) the primary project site, (ii) associated facilities; (iii) cumulative effects, and (iv) unplanned but predictable developments. Effects on primary project site are addressed in the HPP SEA Report, while effects on associated facilities are addressed in the SEA Report being prepared for the Interconnection Project. Cumulative impacts and the effects of unplanned but predictable developments are addressed, where relevant, in the Hydropower Project SEA documents.

Table 3.1: Bujagali Hydropower Project Area of Influence

Primary Project Sites (Hydropower Project SEA Report)
1. Land/water areas for dam, its facilities & reservoir
2. Land for resettlers' houses & livelihoods, as specified, for # 1 (above)
3. Resettlers' houses, if any
4. Off-site facilities (quarries, storage, waste disposal, access roads), if any
5. Air quality & noise effects radii (off-site)
6. Upstream water areas (below Nalubaale/Kiira; mainly in Bujagali reservoir) & users
7. Downstream water regime (water quality & flows)
8. Communities (including host communities) as specified in PCDP
9. Stakeholder groups (including vulnerable groups) as identified in PCDP
10. Project personnel when off-site in project vicinity/region
Associated Facilities (Interconnection Project SEA Report)
11. Land for these Transmission line wayleaves: i) dam site to Tororo cut-off (x2); ii) dam switchyard to Kawanda substation site; iii) Kawanda substation site to Mutundwe substation
12. Land for resettlers' houses & livelihoods, as specified in RAP documentation
13. Resettlers' houses, if any, for # 11 (above)
14 Off-site facilities (construction camps, quarries, storage, waste disposal, access roads), as specified
15. Air quality, EMF & noise effects radii (off-site)
16. Change in downstream water regime (water quality & flows), if any
17. Communities (including host communities) as specified in PCDP
18. Stakeholder groups (including vulnerable groups) as identified in PCDP
19. Project personnel when off-site in project vicinity/region

Cumulative Impacts (Hydropower Project SEA Report)
20. Other hydropower dams (Nalubaale (Owens Falls), Kiira (Owens Falls Extension), Karuma, Kalagala, & their associated transmission facilities)
21. Other electricity sources (thermal, geothermal, small and medium hydro, & their associated transmission facilities)
22. Other infrastructure (roads, T-lines not associated with # 20 and 21 (above), rural electrification etc.)
23. Other initiatives (Kalagala-Itanda offset, natural areas, parks, reserves, etc.)
Unplanned but Predictable Developments (Hydropower SEA Report)
24. Project ‘followers’ offering various goods & services
25. Construction “boom & bust” (local & regional economic effects)

3.3 Land Conditions

3.3.1 Topography, Geology and Soils

The Lake Victoria basin, in which the Bujagali Hydropower Facility is located, is predominantly lowland interspersed with remnants of upland surface. The region is characterised by a pattern of low but often steep hills, which are generally highest towards the south, closer to Lake Victoria. The general elevation of the land gradually decreases northwards. Altitude ranges from 1,100 -1,300 m MASL. Abundant fluvial deposits overlie the broad valleys.

Most of Lake Victoria’s basin relief is developed on a pre-Cambrian array of metamorphosed sedimentary rocks and intrusive igneous rocks (Kendall, 1969). The dominant lithology exposed in the Nile channel at the project site is amphibolitic and doleritic rocks interbanded to varying degrees with foliated metasediments, shales, phyllitic shales, and schists (Knight Piésold, 1998).

Soils in the area of the project site are characterised by heavy loamy soils, locally referred to as Nakabango soils, which are rich in nutrients and vary between 15 and 100 cm in depth. A variety of clays, ferrisol (i.e., red) and sandy loamy soils are also common in the valley of the Victoria Nile on well-defined but shallow alluvium beds (JDA, 1997). Gully erosion, caused by human access to the river for washing and collection of drinking water, has been observed at several locations in the project area. Soil erosion is a problem in agricultural areas and is being addressed by an extension service.

Intense tropical weathering has taken place leaving a gently undulating landscape into which the Victoria Nile has been incised. As a result the river channel of the Nile often lies along fresh (unweathered) rock interface. The river valley consists of a combination of steep slopes and relatively flat river terraces.

The Nile channel between the Nalubaale dam and Dumbbell Island is characterised by resistant intrusive igneous rocks that are responsible for the formation of the numerous rapids, water falls and islands. The steep riverbanks of the Victoria Nile within the study area typically extend to around 20 m above river level, with slopes varying between 20° and 40°.

3.3.2 Landscape/Aesthetics

Within the project area, the Victoria Nile River varies in width from 200 to 600 m and drops approximately 20 m in a series of rapids. The rapids flow around groups of rocky islands, which became intensively farmed in the late 1990s in anticipation of receiving compensation from AESNP. Views of the Victoria Nile in the project area are shown in Figure 3.1.

The piedmont plateau above the river is characterised almost entirely by farming and intercropping of timber and fruit trees, field and horticultural crops, in small plots and gardens. This has created a landscape of fairly dense vegetation from ground-level up to medium height trees with the occasional taller tree rising above. While the lines of view within this landscape type are fairly short, the landscape opens up where there are plantations of field crops such as maize. The landscapes offer longer views towards the Nile, but the River, due to its steep banks, is not easily visible until the valley crest is reached. The riverbed, characterised by large boulders with no sand deposits, presents a dramatic contrast to the intensively farmed plains above it. The slopes often support a cover of crops and trees.

In terms of scenic quality, the farmland within the project area is attractive but unexceptional. The river, rapids and islands, however, have high scenic quality and interest. Bujagali Falls, which is actually a series of rapids as opposed to a falls, is a second order tourism site (first order sites include National Parks and Game Reserves). Views of the rapids are provided in Figure 3.1.

3.3.3 Seismicity

The project area is located in a region with relatively low seismic activity, midway between the eastern and western sections of the African Rift System, which have high levels of seismic activity. The project area is sufficiently distant from the rift zone that ground motions at the dam site arising from typical seismic events will be insignificant (Knight Piésold, 1998). A closer potential seismogenic source follows the regional Rwenzori fold belt, which extends from the west to east rift systems through the north end of Lake Victoria. This zone, known as the Katonga Break, is the location of moderate levels of seismicity with a surface wave magnitude (M_s) of up to M_s6 (Knight Piésold, 1998). In 1991, Acres International conducted a seismic hazard analysis for the Kiira Dam project. Given the proximity of the Kiira Dam to the

Figure 3.1 Bujagali Falls and the Surrounding Landscape

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proposed Bujagali Hydropower Facility, the earthquake-induced ground accelerations are likely to be similar at both sites (Knight Piésold, 1998).

Acres evaluated the seismic hazard and ground motion design parameters based on deterministic and probabilistic methods. The deterministic analysis found a maximum credible earthquake (MCE) to be an M 7.5 event on the Katonga Break, approximately 50 km south of the site, which will produce a Peak Ground Acceleration (PGA) of 0.2 g and 0.3 g for rock and soil foundations respectively. The probabilistic analysis determined a low probability of occurrence on the Katonga Break (PGA of 0.175 g), with a slightly higher figure for the 200 km radius area (PGA of 0.27 g). This PGA determination was based on an extremely low probability of exceedance (0.0001). Based on its findings, Acres recommended that:

- The Bujagali Project be classified as a moderate potential risk development; and,
- The Project be designed to withstand the Maximum Design Earthquake (MDE) levels and Operating Basis Earthquake levels.

For feasibility design, and given the moderate hazard rating of the area, pseudostatic methods of analysis have been carried out using the MDE ground motion design values, as given in Table 3.2.

Table 3.2: Recommended Maximum Design Earthquake (MDE) Values

Condition	Design Acceleration (g)	
	Horizontal	Vertical
Rock Foundation	0.15	0.10
Soil Foundation	0.22	0.15
Non-Critical Slopes	0.18	0.12

Note: Maximum Design Earthquake (MDE) is the maximum credible event that the dam and associated structures must survive without a failure (defined as loss of life or catastrophic failure in the water retaining capabilities of the dam). However, the dam and its associated structures may sustain substantial damage that is repairable.

Source: Knight Piésold, 1998.

The above values represent a conservative estimation of the likely ground motions at the site arising from earthquake activity in the region.

The Bujagali Dam Safety Panel accepted the seismicity analysis undertaken by Acres and Knight Piésold (Bujagali Dam Safety Panel, 2000).

As recommended by Knight Piésold (1998), further seismic hazard analysis will be undertaken by the EPC Contractor during the final design phase in order to define the MCE event and to determine the applicability of the attenuation relationships assumed above. During the final design, the EPC Contractor will undertake the following:

- Data collection of recorded seismic events;
- Assessment of seismic risk levels;
- Seismic analysis by probabilistic and deterministic methods; and,
- Verification of Operating Basis Earthquake (OBE) and Maximum Design Earthquake (MDE) design.

3.4 Water Conditions

3.4.1 Victoria Nile Hydrology

Water flow arriving at the Bujagali Hydropower Facility will be controlled by discharges from Lake Victoria at the Nalubaale and Kiira dams, located 8 km upstream of the proposed dam site. Prior to the construction of the Nalubaale dam the outflow from Lake Victoria was regulated naturally at Ripon Falls. Since 1954 (when the Nalubaale dam was completed), water flow from the Lake has been constrained to mimic the natural outflows from the lake using a rating curve that correlates the flow of the Nile at the source with Lake Victoria to the water level in the Lake. The rating curve shown as Figure 3.2 has become known as the “Agreed Curve”.

This curve was based initially on the relationship between the natural outflows of the Victoria Nile River and the levels of Lake Victoria before the construction of the Nalubaale dam. Since the issue of long-term flow of the Victoria Nile is of major importance to the planning and operation of the Bujagali HPP, historic and projected water levels for Lake Victoria are of prime concern. One hundred and six years of hydrology data exist for Lake Victoria. Due to unusual heavy rains lake levels rose between 1961 and 1964 outside the range of the water levels contemplated for the Agreed Curve. Since that period, the Agreed Curve has been extended and the hydrology of Lake Victoria basin and the natural outflow at the Nalubaale dam have been studied extensively (e.g. ACRES, 1991; Sutcliffe & Parks, 1999; Tate *et al.*, 2004; WREM, 2005).

In the period 1900-1960, Net Basin Supply (NBS) of water to the Lake Victoria Basin fluctuated between annual average values of -500 to 2000 m³/s. However, for three consecutive years (1961-1963 inclusive), heavy rainfall in the basin caused the NBS to exceed 2,200 m³/s, resulting in an increase in both the water level in Lake Victoria and the annual average outflow (Figure 3.3).

Figure 3.2 Lake Victoria Outflows: Agreed Curve

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Figure 3.3 Lake Victoria Hydrology, 1900-2005

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Historic outflows from Lake Victoria reflect the historic patterns in NBS. The average outflow from Lake Victoria during the period 1900-1961 was approximately 660 m³/s, whilst the average flow in the period 1961-1990 was approximately 1,200 m³/s. For most of the 1990s the outflow levelled at approximately 1,000 m³/s, but in 1997-98, it rose significantly. During the time of site investigation in 1998, the water level in Lake Victoria was approximately 1,134.5 m above mean sea level, and by 2005 it was approximately 1,133.5 m above mean sea level.

Over the last few years there has been considerable debate regarding the correct relationship to use for the control of water flow from Lake Victoria into the Victoria Nile. Acres, in particular, has proposed the introduction of an alternative rating curve for Ripon Falls. No international agreement regarding this issue has been reached to date, although the Institute of Hydrology has concluded that the periods of high flow are not representative of the long-term average flow (Knight Piésold, 1998 and 1998b), and more recent studies (e.g. Mason, 2006) support this. BEL has decided to use the more conservative and long-standing Agreed Curve in its design for the Bujagali HPP.

3.4.2 Groundwater

Due to the nature of the basement rocks, the aquifers have limited hydrological connectivity and rely on positive recharge from rainfall. The surface soils are reasonably well-drained although during heavy rains, the soil becomes saturated and local ponding occurs.

Although seasonal rainfall is relatively high, the groundwater levels are generally depressed with water surfaces close to the relatively impermeable bedrock, which is approximately at river level (Knight Piésold, 1998). Higher groundwater levels are encountered locally which is probably related to perched water tables associated with locally well-developed lateritic soils, unusually shallow fresh rock or lenses of more clayey residual soils.

3.4.3 Water Quality

Consultations with NEMA, the Directorate of Water Development, Makerere University and the National Fisheries Resources Research Institute (NAFIRRI) in Jinja indicated that no routine monitoring or research programmes exist from which long-term baseline water quality data for the Bujagali area may be obtained.

FIRRI carried out quarterly baseline surveys of water quality, aquatic ecology and fisheries in the Upper Victoria Nile in 2000 and one further survey in April 2006. Surveys were carried out at four sites: 6 km upstream, and 1, 24 and 65 km downstream of Dumbbell Island. Summary data from the 2000 surveys are included

in Table 3.3. Full results are reported in FIRRI (2000a to 2000d) and NAFIRRI (2006). The NAFIRRI (2006) report is included in Appendix C.1.

**Table 3.3: Water Quality Data for Four Sites on the Upper Victoria Nile, Feb-Nov 2000
 (Minimum and Maximum Values from 10-30 Samples)**

Determinand	6 km Upstream Dumbbell Island	1 km Downstream Dumbbell Island	24 km Downstream Dumbbell Island	65 km Downstream Dumbbell Island
Dissolved oxygen (mg/l)	4.1-10.2	4.8-8.8	6.1-10.7	5.4-8.4
Conductivity (µS/cm)	94.9-130	95-145	95-125	95.5-129
Temperature (°C)	24.7-26.6	24.7-26.0	24.9-26.7	25.3-26.6
pH	5.7-8.7	6.8-8.6	5.5-8.9	6.2-8.5
Secchi disk transparency (m)	0.6-2.2	1.4-2.3	1.2-2.7	1.2-3.8
SRP (µg/l)	0-44.6	0-51	7.6-56.6	5.8-68.8
TP (µg/l)	6-161	25-85	60-118	65-240
NO ₃ -N (µg/l)	0-129	38-153	85-178	107-252
NH ₃ N (µg/l)	0-138	0-178	0-130	0-138
TN (µg/l)	61-834	76-3575	216-3459	226-5154
Chlorophyll <i>a</i> (µg/l)	2-54	8-25	1-24	1-64
SS (mg/l)	0-10	0-3	0-10	0-2
Oil & grease (mg/l)	0.1-3.2	0.2-2.8	0.22-2.6	0.23-2.8
Data presented as range of values from four surveys between February and November 2000				

Source: NAFIRRI (2000a-2000d). µS = microSiemens µg = micrograms

Nitrogen and phosphorus appear to be roughly in balance from the point of view of nutrient limitation of algal growth (assuming a TN:TP ratio of 10:1 indicates a balance, which is a commonly-used indicator). Although the chemical status of the waters at the source of the Nile remained relatively stable between 1961 and 1988, mean chlorophyll *a* concentration (an index of algal biomass) has increased from 12.5 µg/l in 1961 to 46.7 µg/l in 1990-91 (Crul, 1993). This indicates a tendency towards eutrophication, and is likely to have been caused by increased anthropogenic inputs of nutrients into the lake, with possible import of nutrients in the form of water hyacinth plants blown across Lake Victoria on the prevailing (southerly/south-easterly) wind. According to OECD (1982), the phosphorus and chlorophyll concentrations outlined above indicate mesotrophic status.

Most nutrients had highest concentrations during the rainy seasons (April and November surveys), which would cause nutrient-rich run-off to flow into the upper Nile. Dissolved oxygen concentrations were always in excess of 5.0 mg/l, indicating good oxygen conditions for fish (Alabaster and Lloyd, 1982) and other aquatic animals.

Water quality during the April 2006 survey was very similar to the corresponding survey in April 2000 indicating that the historical data is representative of the existing conditions.

Quality data for borehole water from the east and west banks of the Nile near the project area were collected as part of the Rural Water and Sanitation (RUWASA) project. Example data from Namizi (East Bank) and Baizo, Wakisi (West Bank) boreholes are presented in Table 3.4.

Table 3.4: Groundwater Quality

Determinand	Namizi Borehole (East Bank)	Wakisi Borehole (West Bank)	Uganda Drinking Water Standards
Fe (total)	0.16	0.14	0.3
Mn+	0.24	-	0.1
Ca++	37.93	57.25	75
Mg++	17.00	34.01	50
F	0.85	0.0	1.0
SO ₄ =	28.0	-	200
Nitrate-nitrogen	0.0	0.80	45.0
Nitrite-nitrogen	0.00	0.006	3.0
Orthophosphate	1.10	1.0	-
Alkalinity	104	376	-
Conductivity (mS/m)	480.0	832.0	-
Turbidity (NTU)	35.0	2.0	10.0
Hardness (as CaCO ₃)	164.6	282.84	500
Data collected during RUWASA project; supplied by DWD Entebbe and NEMA Concentrations in mg/l unless stated.			

Comparison with the proposed drinking water quality standards in Table 3.4 shows that both boreholes easily achieve the drinking water quality standards for nitrates, nitrites and total hardness, although turbidity of water from the Namizi borehole exceeds the drinking water standard of five Nephelometric Turbidity Units (NTU) by three times. Despite reports from residents that the groundwater has a metallic taste, the above metal concentrations are less than the World Health Organisation (1993) guidelines for drinking water quality.

3.5 Atmospheric Conditions

3.5.1 Climate

The northern region of Lake Victoria has an equatorial type of climate. Two rainy seasons can be distinguished from March-May and October-November. Most of Uganda receives between 1,000 and 1,500 mm precipitation per year (SPIDER International, 1996). The long-term average monthly rainfall and evaporation for Entebbe (located approximately 25 km southwest of Kampala) are given in Table 3.5.

Table 3.5: Average Monthly Rainfall and Evaporation at Entebbe

Month	J	F	M	A	M	J	J	A	S	O	N	D	Total
Rainfall(mm)	100	86	141	280	257	98	65	91	87	108	146	126	1585
Evaporation(mm)	148	156	173	170	148	126	129	134	143	163	144	142	1778

Source: Crul (1993)

Mean daily temperature varies between 22°C in July and 24°C in February. The mean minimum varies from 17°C in April, with mean maximum varying from 26°C in June to 35°C in February. The average relative humidity at 08:30 hours ranges from 76 percent in December to 87 percent in July. At 14:30 hours, average relative humidity is 53 percent in January and 68 percent in May (Bitarakwate *et al.*, 1967).

Wind speed and direction data have been obtained from the Department of Meteorology for their Jinja Kimaka meteorological station. The data covered the period January 1999 to June 2000. Measurements were made four times a day at 06:00, 09:00, 12:00 and 15:00 hours. The most recent full year, July 1999 to June 2000, was analysed. Detailed data are included in Appendix C.2.

The local meteorology is characterised by a very high frequency of southerly winds. Prevailing southerly winds occur for over 30 percent of the year. Winds from the west-northwest to the east are very infrequent.

Wind speeds between 5 to 7 knots occur most frequently, and between 7 and 9 knots half as often. Southerly winds in these speed ranges occur for over 20 percent of the

year. This is also the only direction from which higher winds (9+ knots) arise to any significant extent.

Given the recorded conditions at Jinja, wind erosion of exposed ground is unlikely to be a significant source of airborne dust. Dust generated by mechanical disturbance of soil most probably would affect an area limited to the north and northwest of the source.

3.5.2 Ambient Noise

Sample measurements of the existing noise conditions were conducted near representative residential areas in the vicinity of the dam works and quarry areas as part of the AESNP EIA. Land use has not changed significantly and therefore these data are considered representative of current conditions. The summary results of the 10-minute measurements, at locations A to F as shown in Figure 3.4, are given in Table 3.6.

The table gives the date and start time of each measurement, the L_{A90} level (background level exceeded for 90 percent of the measurement period), the L_{A1} level (that exceeded for 1 percent of the period – approximating to the typical highest level) and the L_{Aeq} (energy equivalent) level. The final column indicates the primary noise sources contributing to the measured levels, as recorded by field staff during the instrumental measurement.

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Figure 3.4 Air Quality and Noise Sampling Sites

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Table 3.6: Measured Ambient Noise Levels, 2000

Site	Date	Start Time	LA90	LA1	LAeq	Primary noise source
A	16.12.00	13.17	35.8	48.8	40.6	River, birds, goats & children
	15.12.00	16.03	40.7	53.7	44.9	River, birds, crickets & goats
	16.12.00	19.50	44.2	51.2	46.0	River & crickets
	15.12.00	20.27	45.2	47.2	45.8	River & crickets
B	14.12.00	16.00	32.7	48.7	39.8	Birds & children
	13.12.00	17.12	28.2	48.2	42.6	Birds & children
	13.12.00	19.44	46.7	59.2	56.4	Crickets, distant river & children
	14.12.00	19.59	39.7	48.7	42.7	Crickets & river
	14.12.00	00.00	43.7	46.2	44.6	Crickets & river
	13.12.00	00.26	35.7	38.7	36.8	Crickets & river
C	14.12.00	15.23	38.2	54.7	43.8	River, birds & crickets
	13.12.00	16.10	38.2	54.2	43.2	River, birds & cockerel
	13.12.00	19.19	46.7	48.7	47.2	River, birds & crickets
	14.12.00	19.20	47.2	51.2	48.3	River, crickets & pedestrians talking
	14.12.00	23.37	46.2	48.2	46.6	River & crickets
	13.12.00	00.03	47.2	50.2	48.4	River & crickets
D	14.12.00	14.38	34.7	52.2	41.8	Intermittent thunder, birds & traffic
	14.12.00	15.00	34.7	49.7	41.6	Thunder, birds, traffic & baby
	13.12.00	15.20	33.2	51.2	41.3	Birds & distant domestic noise
	13.12.00	18.58	51.2	55.7	53.7	Crickets, traffic & children
	14.12.00	19.40	43.2	50.7	45.9	Crickets, children, river & baby
	14.12.00	23.18	38.7	44.2	40.5	Crickets & river
	13.12.00	23.41	39.7	45.7	42.1	Crickets, dog, river & distant traffic
E	16.12.00	12.31	33.7	50.2	40.9	River, birds, goats & distant voices
	15.12.00	15.11	35.2	51.2	41.0	Trees rustling, river, birds & goats
	16.12.00	19.17	59.7	62.7	60.5	River, crickets, goats & children
	15.12.00	19.56	54.7	58.2	56.6	River, crickets & children banging
F	14.12.00	16.51	34.7	46.7	39.1	Birds, leaves rustling, distant music & river
	13.12.00	18.13	35.7	52.7	43.2	Birds, river & children
	13.12.00	20.15	45.2	47.7	45.9	River & crickets
	14.12.00	20.30	44.2	49.7	46.7	River & crickets
	14.12.00	00.40	42.2	45.2	43.2	River & crickets
	13.12.00	01.05	43.7	47.2	45.0	River, birds & crickets

Source: AESNP, 2001

In general, the measured noise levels are representative of typical rural areas. Existing noise levels at Site A (Namizi) were typically in the low to mid 40s dBL_{Aeq}, due primarily to the noise from the river and insects. These levels would therefore be approximately constant through the day and night.

Daytime levels at Site B (Kikubamutwe) were typically in the low 40s dBL_{Aeq}, reducing to the mid 30s dBL_{Aeq} at night. The importance of the river and wildlife as the main noise sources is evident from the last column in Table 3.6, as is the influence of local children.

Site C (outlying area of Malindi), overlooking and being influenced by the noise from the river, had levels approximating to the mid to upper 40s dBL_{Aeq}. These levels were effectively independent of the time of day. Site D (area of Malindi more remote from the river, but closer to the main road) had more variable noise levels due to human activities. Daytime levels varied from the low 40s to mid 50s dBL_{Aeq}, reducing at night to the low 40s dBL_{Aeq}.

Noise levels at Site E (Kyabirwa) were influenced by the noise from the river, being about 40 dBL_{Aeq}. The noise effect of children playing is evident from Table 3.6.

Site F (representative of scattered properties in Buloba) noise levels were typically in the low to mid 40s dBL_{Aeq}, with the noise from the river and insects persisting into the night-time period.

3.5.3 Air Quality

The proposed dam does not involve an asphalt core, as was proposed by AESNP. Therefore, an asphalt batching plant shall not be needed. Thus, there will be no significant emissions of air pollutants, other than vehicle raised dust. Nonetheless, the following information on air quality is provided.

There are no historic background air quality data available regarding the ambient concentrations of nitrogen dioxide, sulphur dioxide and particulate matter in the project area. Agricultural activities such as tillage, can generate considerable quantities of particulate matter. The burning of wood for cooking and brick making, and the burning of crop residues contributes to ambient particulate and nitrogen dioxide concentrations. The levels of traffic currently in the area will also be a contribution to these background pollutant concentrations. The main source of sulphur dioxide is likely to be vehicles powered by diesel engines. Transport related dust in the air is likely to be greatest near the main road on the east bank, which is constructed with murram, than on the west bank where the main road is sealed, or near the local paths and trails where traffic is mainly via bicycles.

3.5.3.1 Airborne Particulates

Airborne particulate measurements were made in the area during December 2000, using a TSI 8520 Dustrak direct reading light scattering monitor. Monitoring locations were the same as for noise measurements, with an additional site (Site G)

near the proposed intersection of the west bank site access road with the Jinja-Kayunga highway. The monitor was equipped with a PM₁₀ sampling inlet. The dust measured therefore has a mean aerodynamic diameter of less than 10 µm. The equipment was zero checked daily, and following an initial adjustment at the start of the survey the zero calibration was found to be stable.

Measurements were made over ten minute sampling periods. The integrated average reading was observed to stabilise within a few minutes at all locations, so the ten-minute average was considered to be a representative spot reading. The results of the particulate monitoring are shown in Table 3.7.

Table 3.7: Airborne Particulate (PM₁₀) Concentrations in the Project Area (10 min average)

Site	Location	Date	Time	PM ₁₀ (µg/m ³)
A	Namizi	15/12/00	16:03	68
		16/12/00	13:35	59
B	Kikubamutwe	13/12/00	17:30	180
		14/12/00	16:00	42
C	Malindi (river)	13/12/00	16:35	157
		14/12/00	15:36	41
D	Malindi (road)	13/12/00	15:35	205
		14/12/00	14:50	92
E	Kyabira	15/12/00	15:30	65
		16/12/00	12:45	72
F	Buloba	13/12/00	18:13	207
		14/12/00	17:16	40
G	Roadside	16/12/00	14:15	79

The second readings at sites B, C, D and F followed a light shower earlier on December 14, 2000, and consequently these results are all lower than those obtained the previous day.

The draft of the Proposed Environmental Air Quality Standards for Uganda (October 2006) sets out ambient air quality standards for specific pollutants. The standard for dust (total suspended particulates) is a limit of 300 µg/m³ averaged over a 24 hour period. The ambient dust levels at all sites were well below the proposed Ugandan national standard during the survey period.

3.5.3.2 Sulphur Dioxide and Nitrogen Dioxide

Passive sampling tubes were used for monitoring sulphur dioxide and nitrogen dioxide at the above locations over a period of approximately three weeks in December 2000-January 2001. These tubes were exposed on-site so that the target gas diffused along the tube to an absorbent substance fixed at the sealed end of the tube.

The tubes were closed at the end of the sampling period and the subsequent laboratory analyses determined the average concentration of the pollutant during the sampling period. Duplicate tubes were deployed at each location.

The results for the diffusion tube survey are shown in Table 3.8. The results show good agreement between the replicated samples at each location, with the possible exception of the result for site F, replicate 1, which appears to be questionable given the low levels at all the other sites. It is, however, only 10 percent of the proposed ambient air quality standard for Uganda.

Table 3.8: Nitrogen Dioxide and Sulphur Dioxide Concentrations ($\mu\text{g}/\text{m}^3$) in the Project Site

Site	Location	Replicate	Start date	End date	NO ₂	SO ₂
A	Namizi	1	15/12/00	3/1/01	Trace	2
		2	15/12/00	3/1/01	2	2
B	Kikubamutwe	1	13/12/00	3/1/01	4	2
		2	13/12/00	3/1/01	8	Tube lost
C	Malindi (river)	1	13/12/00	3/1/01	3	2
		2	13/12/00	3/1/01	4	2
D	Malindi (road)	1	13/12/00	3/1/01	6	2
		2	13/12/00	3/1/01	6	2
E	Kyabira	1	15/12/00	3/1/01	4	4
		2	15/12/00	3/1/01	4	<2
F	Buloba	1	13/12/00	3/1/01	19	3
		2	13/12/00	3/1/01	4	2
G	Roadside	1	14/12/00	3/1/01	5	2
		2	14/12/00	3/1/01	7	4

The results indicate that baseline nitrogen dioxide concentrations within the study area are very low in the context of the 100 ppb ($190 \mu\text{g}/\text{m}^3$) 24 hour arithmetic mean concentration specified in the draft Proposed Environmental Air Quality Standards for Uganda.

The results for sulphur dioxide are also very low in the context of the 150 ppb ($400 \mu\text{g}/\text{m}^3$) 24 hour average concentration specified in the draft Proposed Environmental Air Quality Standards for Uganda.

These results confirm that existing air quality is very good.

3.6 Biological Conditions

3.6.1 Terrestrial Flora

The lands in the project area are generally composed of intensive settlement and agriculture. The vegetation in Naminya, Kikubamutwe and Malindi generally forms an agro-ecosystem with bananas, coffee, maize and vanilla as the main crops. Grasses and other vegetation has quickly filled in the portions of project area that were fenced following implementation of the resettlement programme by AESNP in 2002.

The remnant natural vegetation is characterised as moist semi-deciduous forests (*Celtis-Chrysophyllum*), commonly referenced as vegetation type D1 (Langdale-Brown et al., 1964). The youngest stages of D1 are usually dominated by *Albizia* spp., with a shrub layer of *Teclea nobilis*, though on the shallow soils *Celtis africana*, *Diospyros abyssinica* and *Antiaris toxicaria* are more abundant. D1 vegetation is prevalent in the Mabira Central Forest Reserve (CFR) approximately 7 km west of the proposed hydropower facility. It is also represented on some of the islands in the River Nile where natural forest areas still remain.

Botanists from the Makerere Institute of Environment and Natural Resources (MUIENR) completed botanical inventories of the project area in July-August 1998 and March-April 2006, in order to produce a representative species checklist of flora and to evaluate its importance. Surveys were carried out in Naminya, Namizi, Bujagali campsite and islands, Malindi and Kikubamutwe to identify both wild and domestic plant species. A single transect line method was used along the riverbank. This method was suitable because the herb and shrub-dominated strip of vegetation along the river edge is narrow, ranging from 1 to 4 m wide. The remainder of the project area, within 1 km of the river is cultivated, except for a swampy depression to the north-west of the site. Refer to Appendix C.3 for detailed listings of species recorded. Figure 3.5 shows the location of the study sites.

The sample sites were selected based on the changes that will take place during and after embankment construction. Particular attention was focused on species of conservation concern, e.g. rare species. The water level is expected to rise in all of the sample sites; therefore plants on the present water's edge will be submerged. This will lead to the loss of non-aquatic and some semi-aquatic plants. In Kikubamutwe, locations have been identified as sites for a machinery operation area, borrow pits, waste disposal and stockpiling, while the southern end of Dumbbell Island will be inundated after reservoir filling (refer to Section 4.4 and Chapter 5).

In the 1998 survey, a total of 121 species were identified from the five sample sites. None of the species recorded is globally endangered or threatened (Baillie et al 2004). In 1967 Bitarakwate *et al.* surveyed trees in the area, including the islands in the River Nile, and recorded species of the following genera: *Holoptelea*; *Celtis*;

Morus; *Dombeya*; *Warburgia*; and *Blighia*. In the 1998 survey, no trees of these genera were represented. It is most probable that they were destroyed during clearance for cultivation.

The 2006 vegetation survey results are presented in full in Appendix C.3. This survey identified 298 species in total. The most common tree species recorded included *Markhamia lutea*, *Albizia grandibracteata*, *Broussonetia papyrifera*, *Maesopsis eminii* and *Milicia excelsa*. These species occurred in at least eight of the ten sites surveyed. *M. excelsa* (Mvule) is categorised as Low Risk/ Near Threatened by the IUCN (2004). Other restricted range species include *Ficus cordata* and *Ficus ottonifolia*. These have been recorded in only one floral region out of the four that occur in Uganda. Twenty exotic (non-native) species were recorded of which the notoriously invasive *B. papyrifera* (paper mulberry) and *Lantana camara* were most common. These species have a high light demand and their abundance reflects the general absence of tree cover in the project area.

Figure 3.5 Terrestrial Ecology Study Sites

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Namizi and Bujagali on the East bank of the Hydro area are predominantly under agricultural land use with *Coffea robusta* (coffee), *Musa sapientum* (banana), *Zea mays* (maize) and *Ipomoea batatas* (sweet potato) as the main crops. Large sections of the Kikubamutwe and Naminya areas on the west bank are dominated by the invasive exotics *B. papyrifera* and *L. camara*. These species also dominate the eastern river bank. Scattered trees in the river bank areas include *Artocarpus heterophyllus* (jackfruit tree), *M. lutea*, *Ficus exasperata*, *Ficus mucosa*, *M. excelsa*, *Spathodea companulata*, *A. grandibracteata*, *Albizia coriaria*, *Artocarpus heterophyllus*, and *Trema orientalis*. Shrub species in the riverbank areas include *Vernonia amygdalina*, *Flueggea virosa* and herbaceous vegetation is dominated by *Commelina Africana*, *Bidens pilosa*, *Ageratum conyzoides*, *Digitaria abyssinica*, *Conyza floribunda*, *Syschoriste radicans* and *Imperata cylindrical*.

Along the riverbank, vegetation primarily consists of aquatic free-floating plant species such as: *Echnocroa pyramidalis*; *Voscia cupsidata*; *Cyperus dubius*; *Polia mannii*; *Paspalidium* spp.; *Pistia stratiotes*; *Eichhornia crassipes* (water hyacinth); and semi-aquatic plants such as: *Ficus glumosa*; *Archornea cordifolia*; and *Cyphostema adenocaulis*. The invasive climbers of *Ipomoea* spp. and *Broussonetia papyrifera* can be seen along the river, both on the islands and the banks, with profuse young regeneration from seeds or root suckers. Remnants of the original vegetation still found on the banks of the Nile include: *Milicia excelsa*; *Antiaris toxicaria*; *Maesopsis eminii*; *Celtis africana*; *Grewia trichocarpa*; *Trichilia prieuviana*; *Albizia coriaria*; *A. grandibracteata*; and *Markhamia lutea*.

The Dumbbell Island periphery is dominated by *B. papyrifera* and *L. camara* with inner areas having natural vegetation. The characteristic species include *Tapura fischeri*, *Alchornea cordifolia*, *Argemonea macrophylla*, *Drypetes gerrardii*, *Albizia coriaria*, *Albizia grandibracteata*, *Artocarpus heterophyllus*, *Manilkara obovata*, *Cola gigantea*, *Sterculia dawei*, *Chaetacme aristata*, *Urera trinervis* and *Lantana camara*. Dominant trees found on the Bujagali Falls islands include *Broussonetia papyrifera*, *Pseudospondias microcarpa* and *Ficus ovata*. The latter two trees provided roosting areas for bats during the 1998 surveys, but no bats were seen during the 2006 surveys.

As stated above, most of the project area including the islands contains little native vegetation due to intensive agricultural activities. The main crops grown in the area are coffee, maize, sorghum, cassava, sweet potatoes, cabbages, yams, sugar cane and vanilla. Fruits include bananas, mangoes, jackfruit, avocados and pineapples. Eucalyptus (*Eucalyptus grandis*) is planted for building poles and firewood in Naminya, Malindi and Namizi. The weeds in agricultural areas (some of which are used for medicinal purposes) include woody and non-woody plants as shown in Table 3.9.

Table 3.9: Weeds in the Agricultural Areas Around the Proposed Hydropower Facility

Woody (trees and shrubs)	<i>Cassia floribunda</i> , <i>Ficus glumosa</i> , <i>F. exasperate</i> , <i>F. natalensis</i> , <i>Grewia trichocarpa</i> , <i>Markhamia lutea</i> , <i>Mimosa pigra</i> , <i>Vernonia amydagalena</i>
Non-woody (herbs)	<i>Commelina benghalensis</i> , <i>C. Africana</i> , <i>Bidens pilosa</i> , <i>Panicum maximum</i>

Source: WS Atkins, 1999

3.6.2 Fauna

3.6.2.1 Land Birds

Birds have often been used as an indicator group to represent fauna, as they are easy to see and identify (ICBP, 1992). Since species vary enormously in their habits and requirements, the presence of particular species can be used to categorise the habitat. This approach was used in the ecological assessment of the Bujagali project site.

The habitat found within the project area is broadly similar to most of the lakeshore zone of southern Uganda, which is extremely well-known ornithologically (Carswell, 1986).

Birds were studied at three sites within the project area in July – August 1998 and again in March 2006 (Appendix C.3). Two of these sites will be lost to construction, one on each side of the river at the embankment site, referred to as Embankment East and Embankment West. The third site was on the east bank near Bujagali Falls. All of these areas are essentially agricultural, with smallholdings predominating. Trees are common in most of the area with many of them being planted. *Ficus* and *Markhamia lutea* are commonly planted species (Anderson, 1994). At the Bujagali site there are several hectares without trees. These lands are grassy and heavily grazed. The northern part of the Embankment East site also has several hectares without trees as the land is farmed. Such habitats are widespread in this part of Uganda.

A simple jack-knife method (Krebs, 1989) allowed an estimate to be made of the total numbers of species recorded at a site, based on an infinite number of counts. For the three sites separately, this estimate was about 63 species, whilst combining the data for all three resulted in an estimate of about 92 (Table 3.10).

Table 3.10: Summary of Timed Species Count (TSC) Data for Birds

	Embankment West	Embankment East	Bujagali	Overall
Mean number of species per hour	24.4	22.8	23.8	23.7
Jack-knife estimate of total species	65	63	63	92

Source: WS Atkins, 1999

The full results of the 1998 bird survey are given in Appendix C.3. In summary, a total of 77 species were recorded, as compared to a figure of about 550 for the Kampala area including water birds and migrants (Carswell, 1986). During the field survey there were few migrants since most arrive later in the year. For comparison, the current list for the whole of Uganda is about 1,010 species (Carswell, 1986). Results for the three sites were generally similar, with the same few species being most common in all of them. The sites were also similar in the numbers of species recorded per hour, with the figure of around 23 being fairly typical for moist agricultural areas (in the most species-rich habitats, scores may reach 50).

None of the species recorded are globally endangered or threatened. However, four of the species recorded are listed as sensitive in East Africa (Bennun *et al.*, in press). The Brown Snake Eagle (*Circaetus cinereus*) is considered to be *Near-Threatened*, due to habitat loss. The African Marsh Harrier (*Circus Ranivoris*) is ranked as *Vulnerable*. The Grey-capped Warbler (*Eminia lepida*) and Red-chested Sunbird (*Nectarinia erythroceria*) are listed as *Regionally Restricted*, because they are largely confined to East Africa, where however they are common.

Full results of the March 2006 survey are presented in Appendix C.3 and summarised below. In interpreting the differences between 1998 and 2006, two things are important. Firstly, the 1998 visits were in August, a comparatively dry time, whereas there had been widespread rains before the 2006 visits. Secondly, migrant birds, especially those from the Palearctic region (which is mainly Europe and northern Asia), would only just be beginning to arrive in August, the time of the 1998 surveys, but most will not have left by March, the month of the 2006 counts.

For the three sites counted in both years, 108 species were recorded (out of 140 for all sites in both years). Of these, 61 were found in both years, whilst 16 were only recorded in 1998 and 31 only in 2006. The increase in species numbers between years, from 77 to 92, can as already indicated, be largely attributed to there being virtually no migrants in 1998, whilst the rather higher scores for many species in 2006 are partly a result of wetter weather increasing the birds' activity levels. The fencing of part of the west bank, leading to the formation of dense thickets has also allowed some species, new to the area, to be added to the list. Examples are the Little

Greenbul and Snowy-headed Robin Chat. Thus, overall, the differences between the two years are easily explained in terms of seasons and the new enclosure.

The lands lost to development of the Bujagali dam are not considered significant habitat for any of the above bird species, since it represents an extremely small fraction of an extensive agricultural landscape.

3.6.2.2 Aquatic Birds

Several kilometres of the Nile were surveyed for aquatic birds from vantage points along the banks, during 1998 and 2006 (see Figure 3.5). Visits were also made to a pond situated at the eastern end of the proposed dam, in what was apparently a former watercourse of the Nile.

In 1998, seventeen species were recorded (see Appendix C.3 for survey results). None of the species recorded were globally endangered or threatened. However, three of the species recorded are regionally-listed (Bennun *et al.*, in press). The Darter (*Anhinga rufa*) and White-collared Pratincole (*Glareola nordmanni*) are ranked *Vulnerable* and the Grey Heron (*Ardea cinerea*) is considered *Near-Threatened*. The number of Darters in the area was higher than in all but a few localities in Uganda (they are very rare now on Lake Victoria: Dr. J. Arinaitwe, East Africa Natural History Society, pers. comm., July 1998). They are seriously affected by fishing, often becoming entangled in nets and drowning. The White-collared Pratincole also has a limited distribution in Uganda. It is only common in Murchison Falls National Park.

Numbers of species of birds were generally higher in 2006, partly because of the presence of Palearctic migrants, and partly because the wet season increases the food supply for many species.

Of sites in the dam area, east and west banks had similar total numbers of species, as well as species of various specialities. No *globally-threatened* species were recorded, but several species of regional interest were present. However, their populations within the HPP area are a negligible proportion of the population of the species as a whole, so that construction of the dam will not affect them significantly.

None of the species recorded are confined to rapid-flowing rivers. Several birds, such as the Fish Eagle, may increase as a lake replaces the rapids. Many of the larger water birds roost on trees, especially on islands in the river. There are presently enough trees for them to do this, but further deforestation may be to their disadvantage. As is already being seen in the fenced area on the west bank, reforestation that will occur as part of the project may be to the advantage of such species.

3.6.2.3 Mammals

A survey of the mammal species inhabiting the project area was undertaken by MUIENR in March 2006. Survey methods included observations, trapping around the proposed dam site, setting mist nets for bats and interviews with local people. Results of the mammal survey are included in Appendix C.3. A total of six groups of mammals were recorded in the area of which small mammals (mainly rodents) comprised the largest proportion. Larger mammals, such as elephants, antelopes etc, are absent from the area. Northern Savanna multi-mammate rats (*Mastomys hildebrandtii*), Eastern brush furred rats (*Lophuromys flavopunctatus*) and Common brush furred rats (*Lophuromys sikapusi*) were the most commonly trapped small mammals in the river bank areas.

Although not identified in the 2006 survey, Straw coloured fruit bats (*Eidolon helvum*) have previously inhabited the Bujagali Islands. Their presence on the islands is limited due to the lack of large tree habitat.

Although not specifically surveyed, other animals were reported by local people as being within the project area and included: the Red-tailed Monkey (*Cercopithecus ascanius*); the Mole-rat (*Tachyoryctes ruddi*); and the Monitor lizard (*Veranus niloticus*). None of these species have been listed as sensitive in East Africa. Faunal observations were also augmented through conversations with a number of local farmers who commented that the Red-tailed Monkey and the Mole-rat are pests, the latter being especially troublesome in root crops. Spot-necked Otters, (*Lutra maculicollis*) were reported by local people as being quite common in the river, although none were seen during the field visits. This species is listed as Least Concern on the IUCN's Red List of Threatened Species (2004).

In many parts of Uganda, the bushpig (*Potamochoerus porcus*) is also a problem, but the destruction of much of the forest in the project area and vicinity has led to the disappearance of bushpigs. Hippopotami, (*H. amphibious*) and crocodile (*Crocodylus niloticus*) have also disappeared in the last 10-20 years, the latter due to shooting by local residents (WS Atkins, 1999). Monitor lizards remain common, some exceeding a metre in length.

3.6.2.4 Species of Conservation Importance

Of the species recorded to still occur in the area only the African Spot Necked Otter *Lutra maculicollis* is listed by IUCN as Least Concern. No species are listed by IUCN as Critically Endangered or Endangered. The main threats to Spot-necked Otters are considered to be siltation due to erosion near the source of rivers, cultivation of bank side habitats, indiscriminate bushfires, competition for fish and hunting. The use of new nylon fishing nets has also been reported as causing the death of otters, which become tangled in them and drown. The local fisherman may

also kill otters, wrongly believing them to represent a threat to their fish stocks, as otters only take small fish and are not very numerous anyway³.

Although faced with such a diversity of threats, this species is however still widespread in many of Uganda's large fresh water bodies of which the Victoria Nile only happens to be a small part. It is not likely either that damming the Nile will result in significant negative impacts on its survival.

3.6.3 Aquatic Ecology

Data on phytoplankton, macrophytes, invertebrates and fish in the River Nile near the project site were originally collected in four quarterly surveys carried out during 2000 (FIRRI 2000a to 2000d). A further survey was carried out in April 2006, to assess whether there had been any significant changes in baseline conditions since 2000 (NAFIRRI, 2006). These surveys examined four sites: 6 km upstream and 1, 24 and 65 km downstream of Dumbbell Island. Refer to Figure 3.6 for location of the survey sites.

The summary below refers principally to the results of the 2000 survey. Where the 2006 survey identified significant changes since 2000, these are identified and discussed below.

3.6.3.1 Phytoplankton

The Cyanophyceae (blue-green algae/cyanobacteria) were the dominant and most diverse class in all quarters at all transects. The key indicative species were *Microcystis*, *Anabaena*, *Cylindrospermopsis* and *Planktolyngbya*. The degree of Cyanophyte dominance in the investigated area ranged from 49 to 78 percent of cell counts with the highest counts being registered during the wet seasons (second and fourth quarters). Chlorophyceae (green-algae) were the next most dominant class accounting for 12 to 27 percent of counts in the four quarters, represented mainly by *Ankistrodesmus* and *Scenedesmus*. The Bacillariophyceae (diatoms) were less common, with *Nitzschia* the most abundant genus in the class.

Other much less abundant groups occurring in the transects were the Cryptophyta, Peridineae and Euglenophyta. The significance of phytoplankton to the fisheries is in terms of food for zooplankton and juvenile fishes. Most juvenile tilapia stomachs contained the more common phytoplankton (Cyanophyceae, Chlorophyceae, Bacillariophyceae).

In Lake Victoria at least, the dominance of blue-green algae is indicative of eutrophic conditions due to nutrient inputs (Hecky & Bugenyi, 1989). Unlike Lake Victoria,

³ http://www.amblonyx.com/otter/maculicollis/otter_conserve.htm & <http://www.redlist.org/search/details.php?species=12420>

Figure 3.6 Aquatic Flora and Fauna Survey Sites used in FIRRI Surveys

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algal biomass is not light-limited, as indicated by secchi disk transparency. However, the seasonally varying nutrient levels do clearly point to increased agricultural run-off during the wet season, which appears to influence phytoplankton biomass as indicated by chlorophyll concentration.

3.6.3.2 Macrophytes

In 2000, 82 aquatic macrophyte species (70 percent of them obligate aquatic macrophytes, i.e. euhydrophytes) were identified within the study area. In general, the macrophytes could be separated out into four major categories. These were (in descending order of importance, by area covered):

- Emergent species (e.g. papyrus, reeds);
- Floating and related forms (water hyacinth, Nile cabbage);
- Semi-terrestrial species (the paper mulberry tree, *Broussonetia papyrifera*, shrubs – *Alcornia* and herbaceous species – *Melanthera*, *Ipomoea*, *Commellina*); and,
- Submerged species (*Ceratophyllum*, *Vallisneria*, *Potamogeton* and *Najas*).

Macrophyte species diversity tended to increase with distance downstream. The relatively higher impact of human activities (cultivation and grazing along river banks and on islands) appeared to have a negative effect on macrophyte development.

In general, seasonal effects over the four quarters were reflected in the changing cover type ratings. However, in all the quarters, the two upstream transects were dominated by hippo grass and water hyacinth, which together accounted for about 60 percent of the vegetation along the riverbanks. Terrestrial plant species (e.g. the trees, shrubs, crops, climbers) were also present along the riverbank.

Water hyacinth (*Eichhornia crassipes*), regardless of its apparent reduction and control by weevil introduction, remains a significant concern in the Victoria Nile. Although *E. crassipes* had an average cover rating of “Abundant”, at the three upstream sites, the NAFIRRI team reported a general decline in the height and vigour of individual plants due to infestation of the weevil. The weed appeared healthy and free of weevil damage in the furthest downstream (Namasagali/Bunyamira) transect.

The April 2000 survey revealed a total of 46 macrophyte species in comparison to 41 species during April 2006. In 2000, the three upstream transects had 24, 21 and 26 macrophyte species in contrast to 6, 15 and 13 species respectively during 2006. However, Transect 4 had four times more species in 2006 than in 2000 survey (9 species). However, the dominance patterns, characterised by *Vossia cuspidata* (hippo grass) and *Eichhornia crassipes* (Water hyacinth), were the same during the two surveys.

3.6.3.3 Micro-invertebrates (zooplankton)

Three taxonomic groups (Copepoda, Cladocera, Rotifera) dominate the zooplankton. By pooling the broad range of sites sampled in each transect, results indicated that total zooplankton densities decreased downstream. Copepods such as the cyclopoid *Mesocyclops* and *Thermocyclops*, followed by rotifers (e.g. *Asplanchna*, *Brachionus* and *Euclanis*) registered the highest area densities (100 individuals/m³).

It would have been expected that on the basis of a fast current, upstream sites would support lower zooplankton densities and diversity. However, similar to density, the highest diversity (12-17 zooplankton taxa) was recorded in the upstream transects 1 and 2. The observed distribution-density patterns probably reflected habitat structure of the sampled locations, especially those associated with sheltered habitats in embayments, and a diverse vegetation fringe. Such habitat diversity associated with topographical features of the riverbanks was higher than that observed in the downstream transect (Transect 4), even though the flow here may have been more uniform.

Cyclopoid copepods and rotifers were consistently the most diverse groups throughout the study. The zooplankton species composition observed during the survey is subject to seasonal changes as has been evident in samples from the four surveys. Low species composition observed during the first quarter survey contrasted markedly with high diversity during the third quarter. In the latter phase, large-bodied organisms such as *Mesocyclops* spp. and *Daphnia lumholtzi* occurred, which were not encountered at other times. In addition, a seasonal regime of abundance is also evident; with high densities of organisms during the first and second quarters when species diversity was relatively low compared to the third and fourth quarter.

3.6.3.4 Macro-Invertebrates

Macro-invertebrates are a vital component in food webs of aquatic ecosystems. As elements of the detritus food chain, they break down dead organic matter into inorganic forms thereby reducing the rate of accumulation of materials at the bottom. They are a major link between primary producers and consumers. Macro-invertebrates also serve as food for fish. The higher the abundance and diversity of macro-invertebrates, the greater the variety of niches available for fish, and the less the inter- and intra-specific competition for food resources. In Lake Victoria at least, Corbet (1961) observed that all fish in the lake basin, including rivers, feed on invertebrates at some stage in their life cycles. As a result, the fisheries are dependent on the abundance and diversity of the macro-invertebrates as they comprise a major food source for fish.

There were no clear trends in invertebrate diversity and abundance from upstream to downstream, nor apparent seasonal pattern. Consequently, the changes in species

diversity and abundance may largely have been due to life cycle processes as opposed to external conditions.

This dominance of benthic macro-invertebrates in the Upper Victoria Nile is similar to that of Lakes Victoria and Kyoga. The introduction of the Nile perch resulted in the decimation of molluscivorous fish, which allowed molluscs to flourish. The orders: Diptera (flies), Trichoptera (caddis flies), Gastropoda (snails) and Bivalvia (bivalve molluscs) had the highest number of genera represented throughout the four sampling periods. However, their abundance and diversity were not seasonally or spatially related. The molluscs were the most diverse group of macro-invertebrates and consisted of 10 and 8 genera during quarters 3 and 4, respectively.

Several species were abundant throughout all four surveys. *Bellamya* sp. (Gastropoda) recorded the greatest species density (3,233 individuals/m²) and consistently recorded the highest density for all the four surveys. Other abundant species included the mayfly *Ephemerella* and the bivalves *Corbicula* sp. and *Caelatura* sp. Among the Diptera the key taxa were the midge *Chironomus* and *Povilla*.

The April 2000 and April 2006 surveys showed similar lack of longitudinal patterns of micro-invertebrate species richness.

3.6.4 Fisheries

Data from the ecological aspects of the fisheries surveys are reported and discussed herewith. Data on the ‘socioeconomic’ aspects of the fishery are reported separately in Section 3.7.4.4.

3.6.4.1 Historical and Present Status of Ugandan Fish Populations

Scientific, English equivalent and Vernacular equivalent names for commonly-encountered fish species in Uganda are given in Table 3.11.

Table 3.11: Scientific, English and Vernacular Equivalent Names of Commonly-Encountered Fish Species in Uganda

Scientific name	English Equivalent(s)	Vernacular Equivalent(s)
<i>Lates niloticus</i>	Nile perch	Mputa, sangara
<i>Oreochromis niloticus</i>	Nile tilapia	Ngege
<i>Oreochromis leucostictus</i>	Tilapia	Ngege
<i>Tilapia zillii</i>	Tilapia, redbelly tilapia	Kajansi
<i>Bagrus docmac</i>	Catfish	Semutundu
<i>Clarias gariepinus</i>	Mudfish, sharp-toothed catfish, North African catfish	Male
<i>Schilbe intermedius</i>	Silver catfish, makriel, butter catfish, silver barbel	Nzere
<i>Protopterus aethiopicus</i>	Lungfish	Mamba
<i>Rastrineobola argentea</i>	Minnow	Mukene/Omena/Dagaa
Haplochromines	Cichlids	Nkeje/Mbipi
<i>Barbus altianalis</i>	Barbel, Ripon barbel	Kisinja
Hydrocynus	Tiger fish	Ngassa
Alestes/Brycinus (includes <i>B. jacksonii</i>)	Victoria Robber	Ngara / Nsoga
<i>Labeo victorianus</i>		Ningu
<i>Marcusenius</i> (=Gnathonemus) <i>victoriae</i>	Victoria Stonebasher	Kisoma/Bobo
Mormyrids (e.g. <i>Mormyrus kannume</i>)	Elephantsnout fish	Kasulu
<i>Synodontis afrofischeri</i>	Catfish, Fischer's Victoria squeaker	Nkolongo

Tilapiines, which include *Oreochromis niloticus* and *Tilapia zillii*, are the most commercially important and widely distributed fish species in Uganda. *O. niloticus* has been introduced to virtually all the water bodies including Lakes Victoria and Kyoga and the Koki Lakes. The species is normally restricted to shallow inshore waters. It feeds on phytoplankton and bottom detritus but occasionally ingests crustaceans, insect larvae and zooplankton, and spawns in shallow inshore areas over sand bottoms. *T. zillii* was originally present only in Lake Albert, but has been widely translocated to other water systems and stocked in ponds as an aquaculture species. It is found in shallow marginal waters with water lilies. It feeds on higher plants but can also ingest bottom deposits.

Before the introduction of Nile perch, *B. docmac* (Kisinja) was widespread in Lake Victoria in both shallow and deep waters but is now very rare in Lake Victoria and is virtually absent in Lakes Kyoga and Nabugabo. However, stocks of *B. docmac* are present especially in rocky areas along the Victoria Nile and form a major component

of the fish catches in the area immediately above the Nalubaale dam. They feed mostly on insect larvae, crustaceans and small fishes, especially haplochromines. They breed in wave-washed rocky shores but juveniles have also been recovered from rivers, rocky shores and sand beaches.

The haplochromines (Nkejje/Mbipi) comprise a group of small fishes, which together with the tilapiines belong to the family Cichlidae. They occur in virtually all water bodies in Uganda including rivers. They were the most abundant fish species in Lakes Victoria and Kyoga but were depleted following introduction and establishment of Nile perch in these water bodies.

At least 17 species of *Barbus* (Kisinja) have been reported in Uganda of which nine have been reported along the Victoria Nile (Greenwood, 1962). The species are mainly found in shallow inshore waters associated with river systems, where they feed on molluscs, aquatic vegetation and fishes (especially haplochromines) and breed in flooded rivers and streams.

Major changes have taken place in the fisheries of Lakes Victoria and Kyoga since development of their fisheries started at the turn of the 20th century. Stocks of the commercially important native species declined likely due to overfishing. Nile perch and introduced tilapiine species first appeared in Lakes Victoria and Kyoga in the late 1950s, and are thought to have been introduced to improve stocks of declining native species (Megapesca, 1997). The introduced fishes spread from the main lakes to the Victoria Nile and form an important component of the commercial fishery of the Victoria Nile.

The introduction of piscivorous ('fish-eating') Nile perch led to a reduction in the stocks and diversity of smaller prey species such as haplochromines. With the removal of smaller fish, consumption of phytoplankton (microscopic algae) and detritus was reduced, and this, along with increased nutrient inputs, has been identified as a potential cause of enhanced eutrophication (Gophen *et al.*, 1995), although water quality data from the Upper Victoria Nile indicate this is not a significant problem (see Section 3.4.3 – Water Quality).

Recent studies by scientists at Fisheries Resources Research Institute (FIRRI), now the National Fisheries Resources Research Institute (NAFIRRI) (Dr. R. Ogutu-Ohwayo, FIRRI, pers. comm., 2000) indicate that some of the native riverine fish species, especially *Labeo victorianus*, *Barbus altianalis* and some Mormyrids, have started to recover in Lake Kyoga following over-fishing of the Nile perch. These fishes have been caught near the opening of the Victoria Nile into Lake Kyoga, which indicates that they are recolonising the lake from the river.

3.6.4.2 Historical Status of Victoria Nile Fish Populations

The original fisheries of Lakes Victoria and Kyoga and the Victoria Nile were similar in nature. In all three water bodies, two tilapiine species, *Oreochromis esculentus* and *O. variabilis*, formed the most important components of the commercial catches. Other important species included the cat fishes, *Bagrus docmac* and *Clarias gariepinus*, the lung fish *Protopterus aethiopicus*, *Barbus altianalis*, *Schilbe intermedius*, *Synodontis species*, *Labeo victorianus*, Mormyrids, haplochromine cichlids and *Rastrineobola argentea* (Mukene).

The Victoria Nile originally had a very rich fish fauna dominated by riverine species. These included nine *Barbus* (Kisinja) species (*B. altianalis* Radcliff, *B. bynni*, *B. amphigramma*, *B. paludinosus*, *B. somereni*, *B. cercops*, *B. yongei*, *B. magdalanae*, *B. apleurogramma*), seven Mormyrid species (Kasulu) (*Mormyrus macrocephalus*, *Momyrus kannume*, *Petrocephalus catostoma*, *Marcusenius nigricanus*, *Marcusenius grahami*, *Gnathonemus victoriae*, *Gnathonemus longibarbis*), *Labeo victorianus*, *Gara johnstonii*, *Rastrineobola argentea*, *Alestes*(=*Bricynus*) *jacksonii*, *Alestes* (= *Bricynus*) *sedler*, *Bagrus docmac*, *Schilbe intermedius*, *Clarias gariepinus*, *Clarias carsonii*, *Synodontis victoriae*, *Synodontis afrofischeri*, *Amphilius jacksonii*, *Clariallabes petricola*, *Oreochromis esculentus* and *Oreochromis* (Nyasalapia) *variabilis* (Greenwood, 1958). Of these species, *Labeo victorianus*, *B. altianalis* and Mormyrids were commercially the most important species. Some of the riverine species, namely *B. altianalis*, *S. intermedius*, *L. victorianus* and Mormyrids, migrate up rivers to spawn but return to the lake after spawning and the young grow in the lake.

Apart from limited fish species interruption created near the source of the Nile at the Nalubaale dam, the historical changes in fisheries for Victoria Nile have been the added fishery of the introduced species into Lake Kyoga of Nile perch (*Lates niloticus*), Nile tilapia (*Oreochromis niloticus*) and to a lesser extent *Tilapia zillii*. The first two species boosted the catches in the 1970s, especially at the estuary of the Victoria Nile into Lake Kyoga. This was followed by a decline in catch due to destructive methods of fishing. The Nile Tilapia fishery is now starting to recover. *Rastrineobola argentea*, previously exploited in Lake Victoria, is offering an alternative fishery around Kyankole and Bukungu but it is not extensively exploited on the Victoria Nile between the proposed hydropower facility site and Kyankole.

As in Lake Victoria and Lake Kyoga, the Victoria tilapias (*Oreochromis esculentus* and *O. variabilis*) have virtually disappeared from the catches of the estuarine fishery, although shallow areas of the Nile provide refuges for these species.

Before the construction of the Nalubaale dam, the then Ripon Falls were famous for sport fishery (FIRRI, 2000). With the establishment of the Nalubaale dam this sport declined. It has been in the process of being gradually revived at the rapids at

Bujagali and Kalagala based on *Barbus* and the Nile perch (FIRRI, 2000), though this was not confirmed during the 1999-2000 field surveys undertaken by FIRRI, when no sport fishing was recorded at any of the survey sites.

3.6.4.3 Present Status of Barriers to Fish

It should be noted that a barrier to upstream fish migration between the Victoria Nile and Lake Victoria currently exists in the form of the Nalubaale dam. Presently, the only open connection is between the fisheries of Lake Kyoga and the Victoria Nile. Although there are anecdotal reports that Ripon Falls represented a barrier to fish migration prior to construction of the Nalubaale dam, there are no published reports of this being the case. The photograph in Figure 3.7, taken prior to construction of the Nalubaale Dam, indicates a series of relatively small rapids (in the context of the larger rapids downstream) existed in the uppermost 2 km of the Victoria Nile, but these are unlikely to have represented a barrier to downstream fish migration.

The studies on the fisheries of the Upper Victoria Nile carried out by the FIRRI have identified that some species of migratory fish exist in the river. However, there is no evidence from the FIRRI studies, or from other published sources, that these populations are obligatorily migratory (i.e. are required to migrate for breeding or other purposes). This is borne out by the fact that viable populations exist in the Victoria Nile despite the presence of the Nalubaale dam for approximately the last 50 years. For species that require headwater habitats in which to spawn, it is likely that tributary streams flowing directly into the Victoria Nile are now more important, rather than tributaries flowing into Lake Victoria, which would have been accessible prior to construction of the Nalubaale dam.

In 2001, NEMA sought advice from FIRRI on the necessity for a fish ladder or similar structure to allow passage of fish from one side of the Bujagali dam to the other. FIRRI's advice (Appendix G.5) was that there is an existing barrier to fish migration at Owen Falls/Nalubaale, and that similar fish species assemblages are found on either side of this dam, indicating that the dam has had little adverse effect on fish populations. It concluded that a fish ladder was not scientifically justifiable, particularly because the existing dam is only 8 km upstream of Bujagali.

3.6.4.4 Present Status of Victoria Nile Fish Populations

Fish surveys of the Nile system in Uganda conducted since 1987, indicate that the Victoria Nile is still dominated by many species that were once a major fishery of Lakes Victoria and Kyoga, prior to the introduction of Nile perch. Balirwa (1990) identified three types of fish ecosystems in the area, which favoured individual species. These comprised:

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Figure 3.7 The Source of the River Nile Prior to Construction of Nalubaale Dam

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- The fully lacustrine ecosystem with fish species adapted to lake conditions e.g. tilapias *Oreochromis esculentus* and *O. niloticus*, *Gnathonemus longibarbis* and other Mormyrids;
- The riverine ecosystem, having those fish species adapted to river conditions e.g. *Barbus johnstonii*, *Amphililius jacksoni* and *Labeo victorianus*; and,
- The riverine lacustrine ecosystem for migratory species between the Lakes Victoria, Kyoga and River Nile. These are known locally as ‘male’ (*Clarias gariepinus* and *C. carsonii*), Semutundu (*Bagrus docmac*) and Mputa (*Lates niloticus*).

Littoral zones of shallow swampy fringes and marginal vegetation of *Nyphea* are dominated by *B. apleurogramma* and most of the small *Barbus* species, *Marcusenius nigracans*, *Gnathonemus* (= *Marcusenius*) *victoriae* and *Alestes sadleri*, *Labeo victorianus* and Tilapiines. Turbulent waters and washed rocky grounds are dominated by *Gara jacksonii*, *Pterocephalus catastoma*, *Rastrineobola argentea*, *Lates niloticus*, *Barbus altianalis*, *B. bayanii* and *Ampilius jacksonii*. Deep rocky bottom areas are dominated by *Gnathonemus longibarbis* while the shallow, sandy bottom areas are dominated by *Gnathonemus victoriae* and *Gnathonemus longibarbis*.

The FIRRI study (summarised in FIRRI, 2001) concludes that there are six keystone species of importance to fisheries (bullets 1-6 below), and an additional three that are important from a conservation perspective (bullets 7-9 below).

- *Barbus altianalis* (Ripon barbek)
- *Mormyrus kannume* (elephant snout fish)
- *Bagrus docmak* (catfish)
- *Lates niloticus* (Nile perch)
- *Oreochromis niloticus* (Nile tilapia)
- *Rastrineobola argentea* (minnow)
- ‘Mbipi’ haplochromines
- *Synodontis* spp. (catfish)
- *Mormyrus macrocephalus*

Of the species deemed to be of conservation importance, the ‘mbipi’ haplochromines were identified due to recent impacts by Nile perch predation. The *Synodontis* and *Mormyrus* species were identified due to their migration upstream from Lake Kyoga to the Namasagali area for spawning.

The same keystone species (*Mormyrus kannume*, *Barbus altianalis*, *Lates niloticus* – Nile Perch) were encountered in 2006 as were encountered in 2000.

Table 3.12 summarises the key ecological features of the nine keystone fish species in the Upper Victoria Nile, in terms of habitat and food preferences and reproductive

ecology. It can be seen that the majority of these species are classified as lacustrine-riverine, i.e. able to inhabit both lake and river environments. This is likely due to the variety of micro-habitats offered by this section of the river – from deep, slow-flowing, backwaters and ‘pond’ areas with silty sediment, through to the rapids where soft sediment has been stripped away and the substrate is rocky.

Table 3.12: Ecological Characteristics of Important Fish Species in the Upper Victoria Nile

Species	Habitat Preference	Feeding Characteristics	Reproductive Characteristics
<i>Lates niloticus</i> (Nile perch)	Lacustrine – riverine – juveniles in riverine macrophyte beds, adults generally mid-channel. Co-evolved with Nile tilapia (Ogutu-Ohwayo, 1994)	Adults prey on fish (<i>Rastrineobola argentea</i> , Tilapiines and juvenile Nile perch) while invertebrates prey primarily on the shrimp <i>Caradina</i> . Able to switch between fish and invertebrate prey (Ogutu-Ohwayo, 1985, 1990)	Scatters eggs in open water and on substrate in open water.
<i>Oreochromis niloticus</i> (Nile tilapia)	Lacustrine – riverine. Widespread in river and lake environment. Juveniles prefer shallow, slow-flowing water over hard substrate. Co-evolved with Nile perch.	Omnivorous: phytoplankton and a wide Range of benthic invertebrates	Spawns in firm sand in water from 0.6 to 2 m deep in lakes. Males set up and defend territory which are visited by the females. Eggs are shed in batches in shallow nest and fertilised by male. Females solely involved in broodcare.
Mormyrids e.g. <i>Mormyrus kannume</i> , <i>M. macrocephalus</i>	Riverine – range of feeding grounds (soft-hard bottoms, plus submerged vegetation). Smaller individuals prefer slow-flowing reaches and embayments.	Solitary, nocturnal: feeds mainly on benthic invertebrates (primarily chironomids, chaoborids, Ephemeroptera, Trichoptera and molluscs)	Anadromous: spawn in flooded swamp pools associated with lower reaches of rivers (Corbet, 1961; Okedi, 1970).
<i>Clarias gariepinus</i>	Lacustrine – riverine. Benthopelagic – widely tolerant of extreme environmental conditions	Omnivorous: plankton, snails, fish, Plants, fruit.	Spawns during rainy season in flooded deltas. Migrates laterally into floodplains and retreats to main river channel or lake basin soon after.
<i>Tilapia zillii</i>	Lacustrine. Prefers shallow, vegetated areas and are common in marginal vegetation. Juveniles often found in seasonal floodplains.	Omnivorous – mainly epiphyton and plants with some insects from soft bottom sediments.	Spawns in lake bottoms with pebbles or sand and abundant vegetation. Lays adhesive eggs on the substratum which are guarded by both parents. Reported to deposit and guard eggs in shallow nest. Produces up to 1000 eggs

Species	Habitat Preference	Feeding Characteristics	Reproductive Characteristics
<i>Synodontis</i> spp.	Lacustrine – riverine. Rarely grows larger than 15 cm.	Omnivorous – switching between fish, plant material & insects. Chironomid larvae important.	
<i>Barbus altianalis</i>	Lacustrine – riverine. Juveniles prefer slow flowing areas with marginal vegetation. Adults prefer rocky areas with fast currents.	Primarily insects, some small fish (especially haplochromines)	Breed in floodplains of rivers and streams
<i>Bagrus docmac</i>	Lacustrine-riverine, benthopelagic – widespread in E African Rift lakes, R Nile and elsewhere, in shallow and deep water (0-80 m depth).	Feeds on crustaceans, molluscs, fish and some debris and vegetable matter.	
<i>Rastrineobola argentea</i>	Riverine. Juveniles prefer river banks and associated macrophyte beds. Adults prefer turbulent waters with hard substrate. Schooling behaviour enables it to evade Nile perch and Nile tilapia.	Primarily insects and shrimps (e.g. <i>Caradina</i>)	Spawns year-round, but June-July is peak spawning time.
<i>'Mbipi'</i> <i>haplochromines</i>	Several species in Lake Victoria and the Victoria Nile. Benthopelagic – generally in rocky habitats. Adversely impacted by Nile perch predation.	Exploits a wide variety of food resources (Fryer & Iles, 1972, Seehausen <i>et al.</i> , 1998)	Many species are mouthbrooders.

Source: Fishbase Database (www.fishbase.org) unless stated otherwise.

3.6.4.5 Species of Conservation Importance

Fish species of conservation importance are described below. As set out in Chapter 7, the HPP is not expected to have a deleterious effect on these species.

Although not found in the area of the proposed Bujagali reservoir, one fish species found in the region is listed by IUCN as Critically Endangered (CR B1ab(iii)+2ab(iii)) under version 3.1 of the Red List Categories and Criteria. This species is the haplochromine fish *Neochromis simotes*. It has been categorised as such because its estimated extent of occurrence is less than 100 km², and its estimated extent of occupancy is less than 10 km². This was based upon the work of Seehausen *et al.* (1988), who reported that this species has only been recorded at Ripon Falls (upstream of the Nalubaale Dam) and Kakindu, approximately 50 km downstream of Dumbbell Island. However, the study by FIRRI (2000) found this species at Kirindi (approximately 25 km downstream of Dumbbell Island). A further study by WS Atkins/FIRRI (2001) recovered several further specimens of this species at Kirindi, and also at Mbulamuti, approximately 40 km downstream of Dumbbell Island. These studies have extended the known range of occupancy of this species to a length of the Victoria Nile, which is at least 60 km long.

Two further fish species found in the Victoria Nile are listed as Endangered. These are the ‘Victoria Robber’ *Brycinus* (= *Alestes*) *jacksonii*, known locally as Nsoga, and the ‘Victoria Stonebasher’ *Marcusenius* (= *Gnathonemus*) *victoriae*, which is known locally as Kisoma or Bobo. Both species are found throughout the Lake Victoria basin, in Kenya, Tanzania, Rwanda and Burundi as well as Uganda, with their principal habitat being bays around the edges of Lake Victoria and other, smaller, lakes. The main threats to these species are competition and predation from introduced species (principally Nile Perch), water pollution, habitat loss and (in the case of *M. victoriae*) fisheries exploitation.

3.6.5 Tropical Disease Vectors

This section pertains solely to observances of tropical disease vectors within the Nile in the area of the proposed impoundment. Tropical disease statistics and control mechanisms are discussed in Sections 3.43 and 7.3.1.3, respectively.

3.6.5.1 Schistosomiasis

Schistosomiasis (also known as Bilharzia) is the disease caused by a blood born fluke (trematode) of the genus *Schistosoma*. Adult schistosome worms live in a mammalian host (e.g. humans) and the intermediate hosts are snails. Snails transmitting schistosomiasis are normally found in the margins of pools or slow-flowing streams where they browse on algal growths, on plants, decaying leaves etc. Most species are confined to the shallow margins, down to a depth of about 1.5 m.

Human schistosomiasis occurs in two forms in Uganda. Urinary schistosomiasis (caused by *Schistosoma haematobium*) is transmitted by members of the *Bulinus* (*Physopsis*) group of snails and was formerly common in many areas. Intestinal schistosomiasis (caused by *Schistosoma mansoni*) is transmitted by snails belonging to the genus *Biomphalaria*, and is now much more common than *S. haematobium*.

According to Mr. N. Kabatereine (August, 1998), Vector Control Division, Ministry of Health, there are three species of *Biomphalaria* present in the area:

- *Biomphalaria choanomphala* is unusual in that it is a deep water form, living in Lake Victoria on gravel and soft sedimentary rock down to a depth of 2-3 m. It is known to be a host and is probably responsible for most transmissions among fishing communities along the lake shore, including Jinja;
- *B. sudanica* occurs in permanent or semi-permanent swamps, and is particularly common along the shore line and in papyrus swamps on the edge of Lake Victoria near Jinja. It is a possible host but its local importance is not clear; and,
- *B. pfeifferi* is common in dams and slow-flowing rivers and is a very efficient vector. In 1998 it was found in the two ponds east of the proposed dam.

Qualitative sampling of snails and other aquatic macroinvertebrates at a number of sites along the river in 1998 did not yield a single specimen of *Biomphalaria*. It may have been present, but in very low numbers and restricted areas. However, a survey of the pond off the eastern side of the northern end of Dumbbell Island immediately yielded rather large shells of the vector. This is due to the preference of this vector for stagnant or slow-flowing water (Mandahl-Barth, 1954). The snail deposits its eggs on leaves of aquatic plants such the Nile cabbage (*Pistia stratiotes*) and sometimes also on stones, branches or even shells of other snails. The Nile cabbage in the pond provides a more favourable habitat for the snail than the river, which is fast-flowing.

Snail surveys in 2006 (NAFIRRI, 2006) showed that non-vector snails were more prevalent than vector snails. Of the vector snails collected, only two individuals were infectious i.e. shed cercaria. One, a *Biomphalaria* was from Kalange and the other was *Bulinus* from Kikubamutwe. Shedding of cercaria by *Bulinus* snails may be indicative of transmission of *S. haematobium*, which causes urinary schistosomiasis. However, this could not be confirmed as cercaria were preserved immediately upon collection, and a parasitologist requires live cercariae to confirm the species. This is

considered by vector control staff to be only of academic interest, as there is no clinical evidence of *S. haematobium* causing urinary schistosomiasis in Uganda (Dr. G. Baayenda, Jinja District Vector Control Officer, September 2006).

Human infection data are presented in Section 3.7.3.

3.6.5.2 Occurrence of *Bulinus* in the Project Area

Bulinus spp. were common in the area during the 1998 survey and found in moderate numbers in the 2006 survey. They are probably of little importance since urinary schistosomiasis is not known to occur in the project area.

In more general terms, *Biomphalaria spp.* occur more frequently in established water bodies while *Bulinus spp.* are better able to colonise new water bodies. Surface water temperature in the shallow area of Lake Victoria near Jinja is in the range of 24-26°C (Crul, 1993). Temperature data for the river in the vicinity of the proposed embankment are not available but are unlikely to be significantly different. These figures are within the range for the optimum multiplication of both *Biomphalaria* and *Bulinus* species so that any snails that are able to establish themselves in the reservoir are likely to multiply rapidly.

It is not practical to attempt to control snails along the shore of Lake Victoria and control is not practiced routinely in the area.

3.6.5.3 Malaria Vectors

Malaria is a leading cause of morbidity and mortality in Uganda. Female mosquitoes belonging to the genus *Anopheles* are the vectors. *Plasmodium falciparum* is the most virulent form of malaria, causing about 96 percent of cases while *P. ovale* is responsible for about 4 percent (Vector Control Unit and Ministry of Health, pers. Com., August 1998; www.malariasite.com). Malaria transmission is perennial but there is some evidence of seasonality.

Anopheles gambiae and *A. funestus* are important vectors in Uganda. *A. gambiae* is the most efficient vector. Both it and *A. funestus* feed almost exclusively on humans. *A. gambiae* bites throughout the night, the number of bites rising steadily to a peak shortly before dawn. *A. funestus* bites in particularly large numbers just before dawn. *A. funestus* numbers are at a maximum in the dry season while *A. gambiae* numbers reach a maximum immediately after the rains.

A. gambiae has a relatively high survival rate which together with its preference for human blood results in about 5 percent of females being infective, compared with infection rates of about 0.1 percent in other species. Other species may be

present in greater numbers than *A. gambiae* however, thus compensating to some extent for lower infection rates.

According to Mr. M. Okia, a Senior Entomologist at the Malaria Control Unit in Entebbe (pers. Com. August, 1998), the principal vector is *Anopheles funestus*, with *A. gambiae* and *A. moucheti* being of secondary importance. This is somewhat unusual, as *A. gambiae* is generally considered the most important vector in East Africa. While *A. pharoensis* also occurs, it is not known to be a vector.

In the vicinity of the Bujagali project area *A. funestus* breeds in areas of grassy swamp along the edge of Victoria Lake. *A. gambiae* breeds in sunlit, shallow pools, footprints etc. while *A. moucheti* breeds in areas with a good growth of grass and is more important along the banks of the Nile.

3.6.5.4 Other Mosquitoes

Culecine mosquitoes (especially *Culex quinquefasciatus*) are very common in the area and are a considerable biting nuisance. There is a possible association between *Mansonia* mosquitoes and water hyacinth, but they are more closely associated with Nile cabbage (*Pistia*). *Pistia* occurs in the Lake but is not common in the Jinja area. It is also present in the fishponds on the east bank of the Nile at Namizi near the embankment site.

3.6.5.5 Onchocerciasis (River Blindness) Vectors

The blood-sucking flies, *Simulium damnosum*, transmit river blindness. These flies breed in well-oxygenated, rapidly flowing water. In the past, suitable breeding sites occurred at many points in the Nile between the Nalubaale dam and Lake Kyoga. Breeding was widespread and human infection common. Control measures were initiated in about 1950. Regular applications of DDT were initially targeted against adults by aerial application and spraying along the banks and subsequently against larvae by application into the river itself. Larval control was achieved at a dose rate of 0.1-0.5 ppm. Treatment had a short-term adverse effect on aquatic organisms but these quickly recovered. Adult flies regularly re-invaded the river but in steadily declining numbers and were finally eradicated around 1975 (McCrae, 1977; Ayele & Walsh, 1991).

Surveys conducted by WS Atkins (1998) demonstrated the presence of other non-vector *Simulium* species (*S. alcocki* and *S. medusaeforme*) in the river, the adults of which are thought to feed on birds and cattle.

3.6.5.6 Trypanosomiasis (Sleeping Sickness) Vectors

Two morphologically identical organisms, *Trypanosoma gambiense* and *T. rhodesiense* cause human trypanosomiasis. The diseases they cause in man are

similar, with *T. rhodesiense* causing more acute diseases. Death will occur in untreated cases in six to nine months. There is historical evidence that the geographical distribution of the two species overlap in south east Uganda, although *T. rhodesiense* is now the dominant (perhaps only) species present (Consultations with Vector Control Unit and Ministry of Health, August 1998; WHO Fact Sheet No 259 Revised August 2006) A broadly similar infection is a serious disease of livestock, particularly cattle, in many parts of Africa.

Trypanosomiasis is transmitted by tsetse flies (*Glossina*), both sexes of which suck blood. The tsetse fly is riverine and inhabits the vegetation along the banks of rivers and lakes (Gordon and Lavoipierre, 1976). A female tsetse fly ovulates one egg at a time. This is retained in the “uterus”, which hatches into a larva. It then undergoes three moults before emerging from the adult female. The female selects a soft place for larviposition to ensure the larva can borrow within the shortest possible time. This type of shelter is essential to maintain the right degree of humidity until emergence. Such places include tree shelters, bushes, beneath rocks, fallen logs, and even tree cavities above ground level (Gordon and Lavoipierre, 1976). Many of these favourable habitats exist in the project area, particularly in the remnant natural vegetation on some islands. *Lantana camara* bushes have been found to be responsible for the widespread occurrence of sleeping sickness in the Busoga region because they provide ideal conditions for sheltering and larviposition (T. Kangwagye, August 1998).

3.6.6 Protected Areas

Protected areas within the vicinity of the project are shown in Figure 3.5.

3.6.6.1 Jinja Wildlife Sanctuary

The Jinja Wildlife Sanctuary (formerly the Jinja Animal Sanctuary) is partly situated within the project area, namely the portion of the Nile River between the Nalubaale dam and Bujagali Falls, including the riverbanks (width of the banks not defined in the legislation). Refer to Figure 3.5 for the location of the sanctuary. This sanctuary was established under Legal Notice 110 of 1953 for the protection of all animals except fish (Government of Uganda, 1953; GoU, 1962; GoU, 1996). Activities prohibited in the wildlife sanctuary, unless mitigation measures are provided, include:

- Hunting, trapping or killing of any animal species including birds and insects;
- Destruction of any animal habitat e.g. felling of trees where birds and insects may nest, clearing vegetation (grass, bushes, trees etc. where animals live and feed), draining of water as in pools or ponds where frogs, toads, lizards, etc. live and feed;
- Submersion of island patches within the Nile or the banks of the Nile where animals live, nest, breed or feed; and,

- Collecting/capture of live animals or parts of animals dead or alive (e.g. eggs, feathers, nests, bones, teeth, skins, etc.) for any purpose (UWA, pers. Comm., 2000).

Although no current inventory exists for the sanctuary, it is considered to have several bird species, reptiles and a diversity of insects (UWA, pers. Comm., 2000). When the Sanctuary was established, there were hippopotami in this section of the river. However, the last one was killed a few years ago (Director, Field Operations, Uganda Wildlife Authority, pers. comm., 2001). Management policies to date have centred around providing information to the local populace on the area's biodiversity. If activities are undertaken during the construction and operation of the project that are in contravention of the legislation, mitigation measures must be identified in the project's EIA and be implemented (E Buhanga, UWA, 2006). Mitigation measures are proposed, which are based upon restoration of native vegetation on former agricultural lands on the remaining Bujagali Islands and the reservoir margins. These are set out in Chapter 7 of this report.

3.6.6.2 Forest Reserves

The national forest estate comprises 721 Forest Reserves encompassing 71 percent of Uganda's 94 recognised vegetation communities across the forest and savannah zones of the country, totalling 15,000 km² (Forest Department, 1999).

Forests in Uganda are classified as:

- (a) central forest reserves;
- (b) local forest reserves;
- (c) community forests;
- (d) private forests; and
- (e) forests forming part of a wildlife conservation area declared under the Uganda Wildlife Act, Cap 200.

Central and local forest reserves are held in trust by the national government or local government (respectively) for the people. These authorities are required to protect forest reserves for ecological, forestry and tourism purposes for the common good of the citizens of Uganda.

Responsibility and authority for protection and management of Central Forest Reserves (CFRs) is devolved to the National Forestry Authority (NFA), which was formerly the Forest Department. Management powers are vested in the NFA by the National Forestry and Tree Planting Act 1993, which states that (*inter alia*):

“a forest reserve shall not be put under any use other than in accordance with the management plan”, and

“A management plan shall -

- (a) contain a description of all matters relating to the forest, the forest produce and the use currently being made of the forest produce;*
- (b) state the type of activities to be carried out in the forest;*
- (c) state the management objectives of the forest;*
- (d) state the measures to be taken for the sustainable management of the forest, and, except in the case of a private forest, the involvement of local communities in the management of the resources;*
- (e) state the resources likely to be available to enable the management plan to be executed; and,*
- (f) contain any other information as the Minister may prescribe.*

A management plan made under this section is binding on all persons having dealings with or interests in the forest.”

The 65 principal forest reserves within Uganda were ranked in terms of their biological importance (out of a total of 721 forests countrywide) (Forest Department, 1999). Management of nature conservation in the 65 principal CFRs is done under the Forest Nature Conservation Master Plan (NFA, 2002).

Kimaka CFR, the only CFR in close vicinity of the project area, is not one of the principal forests. Mabira CFR is situated approximately 7 km west of the proposed hydropower facility site, while Namavundu CFR is located approximately 8.4 km north-northwest of the proposed hydropower facility site. Further details on the Kimaka CFR are provided below.

Kimaka CFR

Kimaka CFR is located approximately 3 km downstream of the Nalubaale dam and 4.4 km upstream of the proposed Bujagali hydropower facility, to the east of the Nile River. The closest that the forest reserve comes to the river's edge is approximately 450 m (0.45 km). This CFR was first gazetted under the Forest Reserves (Declaration) Order, 1964 as a Central Forest Reserve measuring approximately 0.466 km². Under the Forest Reserves Declaration order, 1968, it remained a CFR.

Kimaka CFR is a 47 ha Plantation Forest which until 2005 was managed by the Forest Department/NFA under the Peri-urban Plantation Project (Director of Field Operations, pers. Comm., 2000). This was a project funded by NORAD whose aim was to increase the production of poles and fuel wood to meet the demands of the local population and the nearby urban centres. The CFR is currently managed by the NFA under the *Forest Management Plan for Nile Bank, Namavundu, Kalagala Falls and Kimaka Forest Reserves for the period July 2005 to June 2015* (NFA, 2005).

Forty-two of the 47 ha have been allocated to private tree planters. The private planters are granted permits by the NFA, which supervises them from seedling planting, right through management of the trees, up to harvesting. The planting is done under five-year renewable permits. The remaining 5 ha are still directly under the NFA but are managed for similar uses to the privately allocated portions of the CFR.

The forest is dominated by eucalyptus trees used mainly for fuel, building, and electricity transmission poles. Biodiversity within the forest reserve is low due to the dominance of eucalyptus plantations.

3.7 Socio-Economic Conditions

3.7.1 Administrative Boundaries and Local Governance

Uganda is divided into 77 districts, which under the centralised system of government are responsible for the general administration of individual districts. Districts are further divided into counties, sub-counties, parishes and villages. At each level the area is run by elected local councils (LC5 at District level to LC1 at village level) who are responsible for local policy formulation, resolving local conflicts and providing orderly leadership at the grass roots level. Districts, sub-counties and villages generally play the most important role in local government.

In the project area, the River Nile forms the boundary between Jinja District on the east bank and Mukono District on the west bank. Within Jinja District the area directly affected by the project lies within Budondo Sub-county (LC3) within which lie the villages (LC1) of Kyabirwa, Ivunamba, Bujagali and Namizi. Within Mukono District the area directly affected lies in Wakisi sub-county within which lie the villages of Naminya, Buloba, Malindi and Kikubamutwe. Administrative areas are shown on Figure 3.8.

3.7.2 Land-Use and Settlement Patterns

3.7.2.1 History of Development

The history of development in the area can be summarised in a number of stages:

- The pre-colonial period before 1900;
- The colonial period, 1900 to 1962;
- Independence, 1962 to 1971;

Figure 3.8 Socio Economic Features

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- Political instability, 1971 to 1985; and,
- Recovery, 1986 to the present day.

In the pre-colonial period both river banks were settled but the Budondo Sub-County (on the east bank) was particularly densely populated being the heart of Busoga land. In the second half of the 19th century, however, the population decreased due to a sleeping sickness epidemic. The west bank was less severely affected.

During the colonial period the east bank was repopulated and there was extensive settlement and clearing of forest. On the west bank extensive areas of forest were cleared following the eradication of the mbwa fly in 1952. Settlers came from all parts of Uganda, particularly the south-eastern part of the country, as well as from other East African countries. As a result both banks have a very heterogeneous population. The best land was cleared first and cash crops were planted, particularly cotton. Bush vegetation was left in swampy areas and on the dry hills. Later coffee was planted and cassava, sweet potatoes and groundnuts introduced as subsistence food crops. Jinja town grew rapidly in the 1950s and '60s in the wake of the construction of the Nalubaale hydroelectric dam.

After Independence, coffee was developed as the main cash crop. Jinja continued to expand and became a marketing centre and industrial base. The area was relatively prosperous.

However, with the onset of political instability there was economic collapse. Jinja town was adversely affected, particularly due to the expulsion of the Asian population, which formed much of the merchant class. Cotton was eliminated due to a fall in world market prices and an indiscriminate marketing policy towards peasants. People were afraid of accumulating wealth and reverted to subsistence agriculture.

Since the return of political stability in 1985, population pressure in the area has increased. Swamps were drained and the subdivision of land intensified. Plots were divided into long strips stretching from the roads to the hills or swamps to include both fertile and poorer quality land. Virtually the entire area is now cultivated and very little forest remains. There have been a number of rehabilitation projects in the industry, energy and transport sectors and Jinja has expanded, providing both market and employment opportunities. Linkages between the town and the rural areas have increased.

3.7.2.2 Demographic Conditions

National Trends

The 2002 population census indicated that Uganda had a total population of 24.4 million with an estimated annual growth of some 3.3 percent per annum between 1991 and 2002. The Statistics Department projected in 2002 that the population in the year 2005 would reach 26.7 million (Government of Uganda, Statistical Abstract, 2002).

In 2002, approximately 49 percent of the population was under the age of 15 years. Approximately 88 percent of the population was living in the rural areas with 12 percent in towns and cities. Average population density was 124 persons per square kilometre, or slightly more than one person per hectare.

Local Trends

Demographic data at the district level was obtained from the 2002 census (GoU, 2002). The total populations of Jinja and Mukono Districts in 2002 were 387,573 and 785,393, respectively, with population in Mukono District presumably having dropped from 824,606 in the 1991 census as a result of the creation of Wakiso District. The growth rates of the population in the two districts were 2.5 percent and 2.6 percent per annum respectively between 1991 and 2002, which was below the national average of 3.3 percent per annum.

The population of both districts was 49 percent male and 51 percent female for Jinja District; 50 percent male and 50 percent female for Mukono District. In Mukono District 49 percent of the population was under the age of 15 while in Jinja District the proportion was 46 percent. In Mukono District 82.8 percent of the population lived in rural areas whilst in Jinja District the proportion is only 77.9 percent due to the presence of the Jinja urban area, Uganda's second largest urban centre.

Literacy and Educational Attainment

The 2002 census indicates that 73.4 percent of the population over 10 years of age is literate in Jinja District, whilst in Mukono it is 79 percent. In both districts it is higher than the national average of 68 percent. All of these percentages are 10-15 percentage points higher than in the 1991 census. The proportion of the population over the age of six who have never attended school is 13.2 percent in Jinja District and 13 percent in Mukono compared to a national average of 32 percent. The proportion of the population between the ages of six and twelve who have attended primary school is 90.6 percent in Jinja District and 89 percent in Mukono compared to a national average of 83 percent. In conclusion, standards of education in the study area are generally higher than at the national level, particularly in Jinja District.

Overall literacy rate was 68 percent for persons aged 10 years and above, with 76 percent male and 61 percent female.

Economically Active Population

The proportion of economically active population (defined as between 10 and 64 years) is higher in Jinja District (53 percent) than in Mukono (29 percent), and both are lower than the national average (60.5 percent). These trends relate closely to the trends in educational enrolment described above.

The proportion of economically active population engaged in agriculture is 43 percent in Jinja District compared to 53 percent in Mukono and 71 percent nationally. In Jinja, the proportion of the population in the sales and service sector is 0.9 percent, with 54.6 percent professionals, semi-professionals and administrators. Whereas in Mukono, it is 18.7 percent. Agriculture still remains the dominant sector with 77 percent followed by sales and services 8 percent.

Within the project-affected area, 46 percent of affected people are primarily involved in agriculture, while 16 percent are involved in business, 15 percent are students, 4 percent are fishermen and 4 percent are bicycle or taxi drivers (AESNP Resettlement Action Plan, 2001).

3.7.2.3 Settlement Patterns

The town of Jinja, which is the second largest town in Uganda and is the administrative centre for Jinja District, dominates the project area. It is an industrial centre containing paper, textile, beer, plastics, flour milling, food processing, leather and other industries. It has a substantial commercial centre providing hotel, business and social services for a wide hinterland. It also functions as a tourist base for visitors to the source of the Nile and the Bujagali Falls and acts as a marketing centre for agricultural produce from the surrounding area. The town has a strategic location on the main route from the Democratic Republic of Congo through Kampala to Nairobi and Mombasa in Kenya, which also gives it a significant trading function. On the western bank is the satellite centre of Njeru, which contains a number of industrial and service activities.

On the east bank, settlement is concentrated along the main road from Jinja to Kamuli. From Buwenda northwards the road is murrum. At Ivunamba the main road turns in a north-easterly direction and access to the project area is via a complex network of tracks of varying width and quality (Figure 3.8). A road has recently been constructed from Ivunamba to give access to Kyabirwa Falls. The main tracks extend from Ivunamba due west to the Bujagali Falls, and north to Kyabirwa and Namizi. Settlement is generally along the tracks but is more dispersed and evenly distributed than on the west bank. The villages of Kyabirwa, Namizi and Buyala are clearly

defined by pronounced valleys. Ivunamba is a sizeable trading centre in the area with a number of grocery shops, butchers, tailors, workshops, restaurants and market stalls. To the north of these urban areas the land use and settlement pattern changes to one that is rural in character.

On the west bank, settlement is concentrated along the main Jinja -Kayunga road. There is almost continual linear development along this road through the project area. Between the main road and the river there are a number of minor roads and tracks giving access to clusters of homesteads within the villages of Nkokonjeru, Naminya, Buloba, Malindi and Kikubamutwe. Settlement is generally on higher land. Refer to Figure 3.8.

There is little permanent settlement on the islands but a number of temporary shelters are used whilst farmers are cultivating the land. Access is provided by canoe from both riverbanks.

3.7.2.4 Housing and Infrastructure

Housing in the rural areas is constructed mainly in family compounds. Buildings are either ‘temporary’ (built with traditional materials), ‘semi-permanent’ (with traditional walls and corrugated iron roofs) or ‘permanent’ (with brick or concrete walls). The majority of housing is owner occupied.

Water is obtained from the river and from boreholes, wells and springs. A piped water supply system is under construction on the east bank along the main road, as an extension to the Jinja public water supply scheme. Sanitation is normally via pit latrines.

Charcoal is generally used for cooking and kerosene for lighting, although car batteries are used to power some electrical appliances. As part of a rural electrification programme under the financing of JICA, a 33 kV line was constructed along the main roads on both banks in 2000 - 2001.

There are six primary schools in the project area with buildings and facilities in generally poor condition. A notable exception is the Namizi school, which was re-furnished by AESNP. Secondary schooling is provided in Jinja town. There are no significant recreation facilities for local people in the area, other than the Bujagali picnic site. There are no fixed line telecommunication, postal services or police services in the rural areas.

3.7.3 Public Health

3.7.3.1 Availability of Health Services in the Project Area

Two local health centres serve the population of the project area. On the west bank of the Nile, approximately 20 km from Jinja, is the Wakisi Health Centre IV. On the east bank of the project area, approximately 15 km north of Jinja, is Budondo Health Centre IV. Further Level II health centres exist at the Naminya resettlement village on the west bank and Ivunamba on the east bank. All of these rural health units refer difficult cases and emergencies to Jinja Hospital, which is a general hospital with a full complement of medical, surgical, laboratory, radiological and other diagnostic and treatment services.

The Naminya and Ivunamba Level II health centres are being improved as part of BEL's Community Development Action Plan, as discussed in more detail in Section 8.8.6.

3.7.3.2 National and Local Health Indicator Statistics

Table 3.13 gives basic health statistics for Jinja and Mukono Districts in comparison to Uganda national figures. Jinja District ranks better than Mukono District in all categories of health except for the number of hospitals/capita. Both districts rank higher than the national averages in all categories of health except for Mukono District's percentage of the population situated within a 5 km radius of a health facility (44.3 percent in Mukono District versus 49.0 percent nationally and 94.1 percent in Jinja District).

Table 3.13: Health Profile for Jinja District, Mukono District and Uganda, (2002)

Health Category	Jinja District	Mukono District	Uganda
Population (2002) Census	387,573	795,393	24,442,084
Population (per km ²)	587	256	124
Fertility and mortality rates			
Total Fertility rate	6.2	7	6.9
Infant Mortality Rate/1000	77	80	83
Child Mortality Rate /1000	115	152	n/a
Health facilities and inpatients Beds			
Hospitals	3	4	104
Health Units	65	47	2971
Total Beds	859	950	25,628
Population within 5 km radius of health facility (%)	94.1	44.3	49.0
Deployment of Trained Health personnel	712	681	16,866

Source: Statistics Abstract, 2002, Republic of Uganda & District Planning Offices (Jinja and Mukono)

National Morbidity Patterns

Table 3.14 shows the top ten outpatient diagnoses for 1997-2001 for all ages from 22 reporting districts in Uganda.

Table 3.14: Proportional Morbidity for the Ten Major Causes of Illness in Out-Patients Departments (%) 1997-2001 Excluding HIV/AIDS in all Districts

Diagnosis	1997	1998	1999	2000	2001
Malaria	28.5	32.2	31.6	33.9	39.1
ARI-Not Pneumonia	14.1	13.8	13.4	13	16.3
Intestinal Worms	9	8.4	8.5	8	8.1
Diarrhoea	7.1	6.3	6.4	6.5	4.9
Trauma (Injuries and Wounds)	6.6	6.5	5.8	5.6	4.8
ARI- Pneumonia	8.1	6.4	6.1	5.6	3
Skin Diseases	4.7	4	3.9	3.5	3
Eye Diseases	3.8	2.7	2.7	2.5	1.9
Anaemia	2.1	2.3	2.4	2.2	2
Ear Diseases	1.5	1.5	1.6	1.5	1
Other	14.5	15.9	17.6	17.8	15.9
Total	100	100	100	100	100

Source: Resource Centre Ministry of Health Kampala

Morbidity Pattern in the Project Area

Morbidity data for 2005-2006 were obtained from recorded outpatient diagnoses in the health institutions of the project area. Disease incidence patterns were similar at all health facilities. The Out-Patient Department (OPD) statistics for most frequent diagnoses in Jinja and Mukono Districts are presented in Tables 3.15 and 3.16. Malaria is the most common diagnosed disease in all categories of outpatients, followed by acute respiratory infections (excluding pneumonia), intestinal worms, and diarrhoea.

Specific data for the Wakisi (west bank – Mukono District) and Budondo (east bank – Jinja District) health centres are presented in Tables 3.17 and 3.18.

Table 3.15: Outpatients Diagnoses for Jinja District 2005-2006

Diagnoses	Under five years old		Five years and above		All ages	
	Number	% of all	Number	% of all	Number	% of all
Malaria	120,960	42.5	153,390	26.8	274,350	32.1
ARI-Not Pneumonia	44,106	15.5	59,758	10.4	103,774	12.9
Diarrhoea	22,172	7.8	15,106	2.6	37,188	4.3
Intestinal Worms	19,138	6.7	128,218	22.4	147,413	17.2
ARI- Pneumonia	17,436	6.1	9,226	1.6	26,662	3.8
Skin Diseases	11,719	3.9	16,814	2.9	28,533	3.3
Anaemia	11,142	1.9	12,185	2.1	23,327	2.7
Eye Diseases	5,606	1.7	17,466	3.0	23,086	2.7
Trauma (Injuries and Wounds)	4,899	1.68	6,102	1.1	11,001	1.3
Ear Diseases	4,787	1.6	8,925	1.5	13,712	1.6

Source: Directorate of Health Jinja District

Table 3.16: Outpatients Diagnoses for Mukono District July 2005 – June 2006

Diagnoses	Under five years old		Five years and above		All ages	
	Number	% of all	Number	% of all	Number	% of all
Malaria	90,831	39	143,957	61	234,788	53.2
ARI-Not Pneumonia	29,376	39	45,575	61	74,951	17.0
Diarrhoea	1,685	51	1,645	49	3,330	0.8
Intestinal Worms	13,510	34	13,172	66	40,245	9.1
ARI- Pneumonia	14,860	40	21,973	60	36,819	8.3
Skin Diseases	7,083	35	13,172	65	20,255	4.6
Anaemia	2,808	47	4,357	53	8,165	1.8
Eye Diseases	2,970	26	8,647	74	11,617	2.6
Trauma (Injuries and Wounds)	2,842	25	8,449	75	11,291	2.5
Schistosomiasis	6	2	284	98	290	0.1

Source: Directorate of Health Mukono District

Table 3.17: Outpatients Diagnoses for Wakisi Health Centre June 2006

Diagnoses	Under five years old		Five years and above		All ages	
	Number	% of all	Number	% of all	Number	% of all
Malaria	2054	43	20700	57	4754	62.0
ARI-Not Pneumonia	387	26	1082	74	1469	19.2
Diarrhoea	0	0	0	0	0	0.0
Intestinal Worms	35	22	119	77	154	2.0
ARI- Pneumonia	67	40	101	60	168	2.2
Skin Diseases	12	40	316	60	528	6.9
Anaemia	26	81	6	19	32	0.4
Eye Diseases	21	21	178	79	99	1.3
Trauma (Injuries and Wounds)	49	16	61	84	310	4.0
Ear Diseases	30	19	124	81	154	2.0
Schistosomiasis	1	33	2	67	3	0.0

Source: Directorate of Health Mukono District (Annual report)

Table 3.18: Outpatients Diagnoses for Budondo Health Centre 2005-2006

Diagnoses	Under five years old		Five years and above		All ages	
	Number	% of all	Number	% of all	Number	% of all
Malaria	1,380	37.4	2,688	32	4,068	33.7
ARI-Not Pneumonia	540	14.6	1,476	17.6	2,016	16.7
Diarrhoea	182	4.9	552	6.6	734	6.1
Intestinal Worms	192	5.2	588	7.0	780	6.5
ARI- Pneumonia	301	8.2	144	1.7	445	3.7
Skin Diseases	132	3.6	204	2.4	336	2.8
Eye Diseases	120	3.3	143	1.7	263	2.2
Trauma (Injuries and Wounds)	216	5.9	84	1.0	300	2.5
Ear Diseases	22	0.6	93	1.1	115	1.0
Gastro intestinal disease	281	7.6	96	1.1	377	3.1
Totals	3,366	91.3	6,068	72.2	9,434	78.3

Source: Directorate of Health Jinja District

3.7.3.3 HIV/AIDS - Background

A health facility inventory in the Ministry of health revealed that HIV/AIDs related diseases occupied 55 percent of hospital beds. HIV/AIDs related illnesses were said to account for over 50 percent of all hospital admissions.

HIV Prevalence and Trends

Uganda is one of the least urbanised countries in Africa, with over 80 percent of the population living in rural areas. About 40 percent of the population is below 15 years of age. In an estimated total population of 24 million, 1,050,555 million people living in Uganda are estimated to have HIV/AIDS. About 120,000 have developed AIDS. Nearly 80 percent of those infected with HIV are between the ages of 15-45 years, the most economically productive age group. Adolescent girls between 15-19 years are 4-6 times more vulnerable than their male age mates. Children have felt a gruesome impact. About 2 million children of less than 18 years are orphans with one or both parents dead. They experience orphan hood at an age when parental guidance and socialisation is most desirable. The quality of care, education, nutrition and socialisation among these children is often poor.

Data from HIV sentinel surveillance sites that have been declining over the last decade have begun to demonstrate a tendency towards stabilisation. The 2001 antenatal HIV infection rates across all the sites both urban and rural have significant overlap of the confidence intervals with those of 2000, indicating that the prevalence rates are not statistically significantly different from each other.

The overall antenatal prevalence rate in 2001 was 6.5 percent, closely comparing with 6.1 percent in 2000. The rates for urban and rural sites in 2001 were 8.8 percent and 4.2 percent respectively compared with 8.7 percent and 4.2 percent in 2000. New HIV cases in 2001 were estimated at 99,031; adults at 89,128 and children at 9,903. Female adult cases were at 49,092 and males at 40,533.

A cumulative total of 60,173 AIDS cases (Children and adults); had been reported to the Ministry of Health AIDS Control Programme surveillance units by December 2001, up from 55,861 in 1999. Of these 55,707 (92.5 percent) were adults and 4,466 (7.5 percent) were children aged 12 years and below. Of the total with sex recorded, 24,368 (44.9 percent) were males and 29,879 (55.1 percent) females. The overall mean age for adults with AIDS was 30.9 years.

Table 3.19: Cumulative Reported Cases of AIDS cases (1983-2001)

Year	No. of cases	Cumulative Reported Cases per Year
1983	17	17
1984	11	28
1985/86	882	910
1987	2,914	3,824
1988	3,425	7,249
1989	6,090	13,339
1990	6,616	19,955
1991	10,235	30,190
1992	6,362	36,552
1993	4,641	41, 193
1994	4,927	46,120
1995	2,191	48,312
1996	3,032	51,344
1997	1,962	53,306
1998	1,406	54,712
1999	1,149	55,861
2000	2,303	58,165
2001	2,008	60,173

Source: Uganda AIDS Commission (HIV/ AIDS Epidemic prevalence and Impact)

The total overall estimated number of people living with HIV/AIDS at the end of December 2000 was 1,107,644, down from 1,438,000 in 1999. Of these, 996,880 were adults and 110,880 children under 15 years. Aggregated by sex, 543,753 were women and 453,127 males. Uganda's cumulative number of AIDS deaths since the beginning of the epidemic is estimated at 947,552 (December 2001), up by 100,000 from 848,492 in 2000.

Of these, 852,797 were adults and 94,755 children. Adult female deaths were estimated at 427,153 and males at 425,644. With high numbers of AIDS-related deaths, Uganda records the highest proportion of AIDS orphans in the whole world. Paediatric AIDS case management and reporting remains a big challenge in care and support programmes in Uganda.

The overall mean age for children with AIDS was 2.3 years (December 2001), with no significant difference in the mean ages of males and females. The most common means of transmission of HIV (84 percent) still remains unprotected sex with an infected person. The high numbers of children living with HIV at the end of 2000 is evidence that mother to child transmission is a challenge.

In spite of the declines in HIV prevalence, the infection rates are still high. There is need for more concerted efforts to further reduce the prevalence and incidence rates and improve on existing HIV prevention and control strategies with more innovations.

Behavioural surveillance is increasingly becoming a major component of the surveillance systems for HIV/AIDS in the country, especially in the light of the declining HIV infection trends. Based on the baseline data included in the 1997 report and the subsequent reports made from population based KABP surveys it has been noted that there is a delay in age at which young people were engaging in sex, increase in condom use and reduction in non-regular (casual) sexual relationships.

The government has conducted repeat population based KABP surveys in most of the districts. Significant observations from these surveys included: very high levels of awareness, increase in levels of knowledge of protection from HIV/AIDS, increase in condom use and condom use in non-regular partnerships, and the sustainability of the increased age at first sex.

Local HIV/ AIDS Statistics

Three major AIDS Service Organisations exist within the project area, namely: The AIDS Service Organisation (TASO), AIDS Information Centre (AIC) and St Francis Health Care. These all network with the existing health units of Budondo health centre on the east bank and Wakisi health centre on the west bank. HIV/AIDS statistics for the project area are summarised in Tables 3.20 and 3.21 below.

Table 3.20: HIV/ AIDS OPD Diagnoses, Project Area 2002

Sector	Number
All out patients, Jinja District (11 months)	443,806
Jinja Hospital (year 2005)	372
Budondo Health Centre (year 2005)	37
Wakisi Health Centre (year 2005)	20
Naminya Health Centre	No HIV/AIDS services so far

Source: Directorate of Health Services Jinja and Mukono Districts

Table 3.21: Cumulative HIV/AIDS Cases Per Year

Year	2000	2001	2002	2003	2004	2005
Jinja Hospital	97	141	128	180	212	372
Budondo Health Centre	17	26	24	31	29	37

Source: Directorate of Health Services Jinja District

3.7.3.4 Tropical Diseases

Schistosomiasis

Intestinal infection due to *Schistosoma mansoni* is the only form infecting man found in the general area of the project. Surveys carried out using Lot Quality Assurance Sampling (LQAS) techniques (Brooker *et al.*, 2005) indicate infection rates of around 50 percent of population within the project-affected area, and in communities downstream of the project site.

Surveys of *Schistosoma* infection rates in the project-affected villages, carried out as part of the fisheries and aquatic ecology survey (NAFIRRI, 2006, see Appendix C.1) also showed infection rates of around 50 percent of the population.

Under the National Bilharzia and Worm Control programme, infections are treated with praziquantel, which is also effective against intestinal worms. Schools and communities are treated in sub-counties where prevalence is >50 percent. Where prevalence is between 20 and 50 percent, treatment concentrates on school-aged children only. In areas where prevalence is below 20 percent drugs are provided to the local health facilities for the treatment of any presentable cases. Schools and communities in the Jinja District area of the project have been subjected to praziquantel treatment. The fact that prevalence remains at around 50 percent of the population indicates that there are high rates of re-infection following this treatment.

Malaria

In Jinja District, Out-Patient diagnoses for malaria for the year 2005 - 2006 were 120,960 for under five year olds and 153,390 for persons over 5 years old, representing approximately 32 percent of all outpatients diagnoses. Corresponding figures for Mukono district are 90,831 for under 5 years and 143,959 for over five year olds representing approximately 53 percent of out patients diagnoses. In the country as a whole, malaria is responsible for about 30 percent of all hospital attendances and is listed first in the top ten causes of mortality in all age groups under 16 years, and second only to HIV/AIDS as a cause of death in those over 16 (Ministry of Health, 1994).

Today, malaria is responsible for more illness and death than any other single disease in Uganda. While those with low immunity- pregnant women, children under five years and people living with HIV/AIDS- are particularly vulnerable, all people living in Uganda are at risk of being infected with malaria parasites and suffering from resulting illness.

In most parts of Uganda, temperature and rainfall are sufficient to allow a stable, year round (perennial) malaria transmission at high levels with relatively little seasonal variability. Only in the high altitude areas in the southwest, west and east is malaria transmission generally low, with more pronounced seasonality, and the occurrence of epidemics.

Significant progress has been made in the fight against malaria through the improvement of health system performance and increased public knowledge about malaria. The fight against malaria is part of the overall effort of the Government of Uganda to improve health, as documented in the Health Sector Strategic Plan. This effort is multi-sectoral and involves a broad partnership, which forms the Roll Back Malaria Country Partnership. Policies and strategies for the key interventions for malaria control are detailed in the Uganda Malaria Control Policy (1998) and the more recent Uganda Malaria Control Strategic Plan (2001/2-2004/5) The main intervention strategies implemented in Uganda are; case management, vector control, epidemic preparedness and response(s), and intermittent preventive treatment during pregnancy.

Malaria is endemic in 95 percent of Uganda. The remaining 5 percent are epidemic-prone areas in the highlands of the southwest and east. A 1995 Burden of Disease study indicated that 15.4 percent of life years lost to premature death were due to malaria. A recent MOH information update on malaria in Uganda (2000) reported that malaria accounted for 25-40 percent of outpatient visits in 1992/3, 27-51 percent in 1998 and 29-50 percent in 1999. A household survey conducted by the Uganda Bureau of Statistics in 1999/2003 showed that Ugandans were reporting more illness than they were in 1992 and particularly more malaria. 28 percent of those

interviewed, reported illness in the 30 days preceding the survey and 56 percent of them stated malaria/fever as the cause of that illness. According to a study in the four districts of Jinja, Mukono, Arua and Mbarara by Commercial Marketing Strategies in 2000, awareness about malaria in general is high (99 percent) with 70.6 percent of the people getting the malaria messages from the radios. However, knowledge on recognition of disease, which is critical in case management, was still very low. Only 34 percent linked fever to malaria, 18 percent associated malaria with cold, 14.5 percent associated malaria with headaches, 11.7 percent mentioned joint pains, and 10.6 percent body weakness. Malaria was mainly considered a problem of children (75 percent). These findings are in agreement with the KAP study of 1999 in seven districts by the Centre for Basic Research (CBR) sponsored by MOH.

In 2001, baseline surveys were undertaken in the districts of Apac, Tororo, Mubende and Kabale representing the four epidemiological strata of malaria in Uganda, with the aim of getting baseline indicators for monitoring and evaluating RBM impact in Uganda. The study found that malaria continues to be the most serious public health problem in Uganda. Children under five and pregnant women bear the greatest burden of the disease and within these groups the poorest are most vulnerable. According to the baseline survey, morbidity attributed to malaria in children aged less than 5 years presenting to outpatients was 44.4 percent, while for those above 5 years it was 41.6 percent and 2 for all ages 38.8 percent. This is in agreement with the health unit OPD findings.

Mortality attributed to malaria in inpatients was 42.9 percent in the under 5-year-old and 25.1 percent in those 5 years and above. The case fatality rate in children under 5 was 4.05 percent and 2.18 percent for those above 5 years. The proportion of fever/uncomplicated malaria correctly managed at health facilities in all age groups was 27.6 percent. Among those admitted with severe malaria aged less than 5 years, 38.9 percent were correctly managed. Insecticide treated nets were available in 17.6 percent of the households surveyed but only 9.8 percent were appropriately treated with insecticide. The percentage of children under 5 years whose caretaker sought treatment within 24 hours is low at 7.3 percent, and when they did so the first action in 47.6 percent was self-medication, while 24.6 percent went to a health facility. The Crude Death Rate in the under 5 years was 78.04 per 1000 live births. This is comparable to the preliminary findings of the Uganda Demographic and Health Survey (UDHS) in 2006.

In the one epidemic-prone district included in the baseline survey, epidemics were detected more than 2 weeks after onset but were appropriately managed. One study in Hoima in the late 1990s showed that 62.1 percent of pregnant women had *Plasmodium falciparum* parasitaemia. Pregnant women in Uganda are at high risk of contracting malaria with complications that include maternal anaemia and, in severe cases, maternal death, abortion, stillbirths, premature delivery, perinatal anaemia and low birth weight children.

In another KAP study, by Commercial Market Strategies 2000, only 10 percent of the respondents perceived malaria as a problem during pregnancy. Further still, health facility records don't provide for malaria cases during pregnancy as a separate category. As a result the consequences of malaria in pregnancy remain masked. There is urgent need to protect women and the unborn children from the effects of malaria during pregnancy. Efforts to promote Intermittent Presumptive Treatment (IPT) of pregnant mothers have just started.

The incidence of epidemics has increased in the highland regions in recent years. Uganda experienced malaria epidemics in 1992, 1994, 1997/8 and in 2000/1. The most affected districts were Kabale, Rukungiri and Kisoro. A total of fourteen districts do experience epidemics, which occur almost every two years, with a wave starting at the southern end and moving northwards. In these districts all age groups are at equal risk of catching and dying of malaria. This cycle of epidemics seems to suggest an epidemiological transition from lower to higher malaria endemicity that may be associated with recent climatic changes. Until a new state of equilibrium is established, these areas are likely to experience repeated epidemics and therefore there is need to prepare for them adequately. District capacity for implementing an integrated epidemic preparedness and response plan has been built. It will need maintenance, support and upgrading over time.

In Uganda, all the four malaria parasites exist. Unfortunately, over 95 percent of the cases are due to *Plasmodium falciparum*, which is responsible for severe malaria. Furthermore, *P.falciparum* strains have developed resistance to chloroquine and sulphadoxinepyrimethamine (SP) the commonest antimalarial drugs; and resistance to chloroquine and SP continues to rise. Currently, the national average resistance to chloroquine is estimated at 30 percent while that to SP is 10 percent. Consequently, the Ministry of Health and its partners have initiated the process to change first line antimalarial drugs and a national consensus has been reached.

Formerly the treatment for uncomplicated malaria was chloroquine alone as first line drug, with either SP or amodiaquine as second line drug. This has been changed to chloroquine plus SP combination therapy as first line drugs, and quinine as second line. Quinine remains the recommended drug for severe malaria.

The burden of malaria in Uganda is further aggravated by the presence of very efficient malaria vectors. The *Anopheles gambiae* complex breeds in temporary, small water bodies that can be found anywhere in the country; more so during the rainy season. The *A. funestus* mosquito, also a common vector, breeds in stable, large water bodies, which are also widely spread over the country. These two vectors also have differences in some of their behaviours, which may complicate preventive approaches and aggravate the disease's burden.

The Malaria Control Strategic Plan is an instrument of the Government's commitment and determination to address the malaria problem in Uganda in a sustainable manner. The plan is a complement to the broader five-year Health Sector Strategic Plan of the MOH and the Poverty Eradication Action Plan where malaria features as a high priority health and poverty issue.

The Health Sector Strategic Plan sets specific targets that reflect the targets set by the African heads of state in April 2000 in the 'Abuja Declaration' and the objectives of Roll Back Malaria Country Partnership, set out in 1998. The targets are:

- To increase from 30 percent to 60 percent the proportion of the population that receive effective treatment for malaria within 24 hours of the onset of symptoms;
- 60 percent of pregnant women to receive protection against malaria through intermittent presumptive treatment with SP;
- To increase from 5 percent to 50 percent the proportion of children under 5 protected by insecticide treated bednets (ITNs); and,
- To reduce malaria case fatality at hospital level from 5 percent to 3 percent.

Implementation of malaria control in Uganda is guided by the principles of equity of access, country ownership, partnerships, health sector reform, integration into primary health care and use of cost-effective evidence based interventions. The principal intervention strategies are case management, intermittent presumptive treatment during pregnancy, vector control, and epidemic prevention preparedness and response. These intervention strategies will be supported by enabling strategies including advocacy, information, education and communication (IEC) and social mobilisation; human resource development; systems strengthening; technical support; surveillance and operational research; and management and supervision. Successful implementation of these strategies and achievement of these targets will require a strong partnership between all stakeholders at all levels. This includes families, communities, public and private sector service providers, and policy makers throughout the government, development partners, NGOs and the private sector.

Because malaria is hyperendemic among the local population, the level of immunity is correspondingly high. The principal risk of serious consequences of infection therefore lies with expatriates and any workers coming from non-malaria areas. Studies on chloroquine resistance are being carried out at Walukuba Health centre.

Due to financial constraints, residual insecticides for house spraying are in short supply. Boarding schools are treated routinely with permethrin. Ideally the schools should take responsibility, but are unable to do so for financial reasons. People are willing to use ITNs to control mosquitoes, but at a retail price of UGX 10,000-15,000 each, the nets are not affordable for the majority of the population. In addition nets require re-treatment every two washes or six months, at a cost of UGX 1,500 per treatment (G Baayenda, Jinja District Vector Control Officer, pers. comm., September 2006). General advice given to communities by District Vector Control

staff includes screening houses against mosquitoes and closing windows before dark. More recently, long-lasting bed nets have been developed with longevity reported up to 5 years before re-treatment. The Centre for Disease Control is currently testing long lasting ITNs in Kenya and Atlanta⁴.

Onchocerciasis (River Blindness)

River blindness is common in sixteen districts in western Uganda and in Mbale in south-eastern Uganda. The National Onchocerciasis Control Programme was set up by the Ministry of Health (MoH) in 1996 who formulated a national plan for the control of the infection within 15-20 years (Mutabazi & Duke, 1998). The drug ivermectin (Mectizan® Merck & Co., Inc.) is being distributed through the community to 'at risk' populations.

Surveys of the local population in 1991 revealed only two or three cases of river blindness, all imported from other areas, and none of which were in young people. Surveys conducted by the Senior Entomologist, Vector Control Division, MoH and the Divisional Vector Control Officer, Mukono found no *Simulium damnosum* flies. Furthermore, no tourists visiting the area reported bites (bites are painful and easily noticed). It was therefore concluded that *Simulium damnosum* is no longer present in the area, that onchocerciasis is no longer being transmitted, and that it is unlikely the disease will re-establish itself in the area. (Ndyomugenyi, 1998; and pers. Comm.).

No incidences of infection been recorded by the two District Health Directorates in recent years.

Trypanosomiasis (Sleeping Sickness)

In former times there were a number of serious outbreaks of human trypanosomiasis in the Busoga region. The principal vector is the tsetse fly *Glossina fuscipes*. Flies were found to breed extensively around villages and in areas where the plant *Lantana camara* is prolific. An active control programme was instituted in the early 1990s, which involved active case finding and passive surveillance, combined with fly control, initially by aerial spraying along the Nile and use of pyramidal traps treated with deltamethrin insecticide (Glossinex) at 300 mg active ingredient per trap. Traps were distributed at an average of 10 traps per km² (District Veterinary Control Officer, Jinja, pers. comm. 1998).

Infections were reduced by 96 percent over four years and by 2000 the point was reached where only nine or ten new cases of sleeping sickness occurred in a year in a population of about 300,000, and tsetse flies were no longer a problem. Traps are still

⁴ http://www.cdc.gov/malaria/control_prevention/vector_control.htm#itn

used, essentially to monitor the occurrence of flies (including other related blood-sucking species).

On a national basis, sleeping sickness remains a public health problem, spreading north from south-eastern Uganda to the present day. Surveillance and treatment centres have been maintained in the affected areas of north-western and south-eastern Uganda. Efforts to intensify tsetse fly trapping are being undertaken.

Animal trypanosomiasis occurs in the area (Acting District Veterinary Officer, Jinja). Active and passive surveillance is undertaken routinely. Positive cases are treated with dimazine aceturate to clear parasites and animals are also protected by routine treatment with Samorin®. Infections in cattle and goats at one time were high but are now down to about 5 percent in cattle and 3 percent in goats.

Rift Valley Fever

A surveillance operation was set up in the Mbale area following the Rift Valley Fever outbreak along the Tana River in Kenya. Particular attention was given to the area along the Uganda-Kenya border and to population movements. Mosquitoes have been collected, and blood samples taken from humans and livestock on both sides of the border. These have been analysed by the Centre for Disease Control in Atlanta, United States. There have been no positive reports (Virologist, Uganda Virus Research Institute, and Senior Entomologist, Vector Control Division, MoH, pers. comm. 1998).

3.7.3.5 Ebola Fever

As a result of outbreaks of Ebola fever in 2000/2001 in three communities within Uganda (Gulu, approximately 304 km northwest of Jinja; Masindi, approximately 174 km west of Jinja; and Mbarara, approximately 234 km southwest of Jinja), the Uganda National Task Force for the Control of Viral Hemorrhagic Fevers was set up in October 2000 to control/oversee such emergencies. This programme has been extended to the sub-county level and communities at large. The main task for the district is surveillance. All main hospitals in each district within the country have been equipped with protective materials in case of an emergency or suspected cases. Suspected cases are to be reported through the District Director of Health Services to the Ministry of Health, who will then send in a team to investigate the issue. A protocol has been established on how positive cases are to be handled.

3.7.4 Economic Activities

3.7.4.1 National Trends

Uganda's economy is predominantly agricultural with over 90 percent of the population dependent on subsistence farming and agro-based industries. Coffee, tea

and fish are the major earners of Uganda's foreign exchange, with the country being self-sufficient in food.

From 1962 to 1970 Uganda had a flourishing economy with a Gross Domestic Product (GDP) growth rate of 5 percent per annum compared to a population growth rate of 2.6 percent per annum. This resulted in an average growth of about 2.4 percent per capita income annually. Between 1971 and 1985 the period of military dictatorship and civil unrest seriously affected the growth of the economy and the country's capacity to provide social services such as education and health care. During this time it is estimated that real GDP per capita declined by over 40 percent. The formal sector of the economy became heavily regulated while the informal and non-monetary sectors increased substantially.

Since 1986 the Government has been implementing an economic reform and rehabilitation programme that has been supported by a large number of multilateral and bilateral donors. This programme has steadily assisted in: the removal of structural problems that constrain growth; creating an enabling environment for private initiatives; and, bringing about fiscal discipline, prudent monetary management and a stable exchange rate. These measures have resulted in a sustained economic recovery since 1987 with economic growth averaging 5.8 percent and growth in per capita income averaging over 2.5 percent annually.

Agriculture continues to be the lead sector contributing over 50 percent of the GDP, employing 80 percent of the labour force and accounting for more than 90 percent of commodity exports. The share of the manufacturing sector in GDP is still relatively small at about 5 percent and is mainly based on agro-based industries such as sugar, tea, coffee and tobacco, as well as import substitution sectors producing consumer goods, largely for the domestic market.

Since 1986, fundamental economic factors, which had previously crippled the economy, have been redressed. These include: reverse migration of skilled workers; return of expropriated Asian properties to their former owners who have returned to the county to revive their businesses; and, creating stable conditions for attracting private capital inflows. Other measures have included: government policy commitment on import and export liberalisation; foreign exchange liberalisation; privatisation of public enterprises; improvements in fiscal administration; financial and public sector reform; decentralisation of public administration to the districts; and, increased empowerment of women and other disadvantaged groups.

In economic terms, these developments have substantially enhanced the country's credibility in economic management. The result has been that scarce resources, which in the 1970s and early 1980s relocated to less productive non-tradable sectors, have shifted to higher productive sectors like manufacturing, exports and tourism. Other activities which have benefited from these favourable conditions are the increased

production of non-traditional commodities like simsim, oil, seeds, flowers, various types of vegetables and other horticultural products, both for domestic and export markets. Economic productivity is therefore increasing and inflation is low.

3.7.4.2 Local Economy

Introduction

Information on the operation of the local economy in the project area was obtained from two main sources: a baseline socio-economic survey of PAPs undertaken during 1999 by WS Atkins; and, a report undertaken by ACDI-VOCA in April 2000 for AESNP. The information collected for the PAPs remains relevant as the baseline for the resettlement programme. Information about the region in general as taken from the ACDI-VOCA is considered relevant for the level of detail needed for this SEA.

Occupations

The baseline survey indicated that 46 percent of households are primarily peasant farmers. While the vast majority of people in the area undertake some farming, a significant number of people are involved in other occupations. These include business / trade, fishing, and bicycle taxi driving.

Incomes

According to agricultural statistics from the Jinja District Agricultural Office, the average sustainable land holding in the District is 0.8 ha per compound/household, with a net annual income of UGX 3.7 million or USD 2,300 per compound/household. Based on an average of 8.4 persons per household in the project area (WS Atkins, 1998), the average annual agricultural income per individual is USD 270.

The baseline socio-economic survey indicated that the average annual income per hectare from farming is UGX 31.62 million (USD19,760), which is 8.5 times higher than the district DAO figures. The difference in estimates could be attributed to:

- Project-affected persons exaggerated their incomes in expectation of compensation;
- PAPs could have confused gross income with net income; and,
- Productivity within the project area may be higher than in the remainder of the district.

The average annual household income from fishing, according to the baseline survey is UGX 527,400 (USD 350). As with agricultural income, the reported income from fishing may have been exaggerated in anticipation of possible compensation for loss of income.

Average income per household from business activities or formal sector employment, according to the baseline survey, is UGX 3.481 m (USD 2,700). Other sources of income include rents and social benefits. The total average annual income per household in the project area is estimated at approximately UGX 8 m or USD 5,360. However, income is not distributed evenly among households in the project area.

Poverty Assessment

The ACDI-VOCA study included a poverty assessment based on a ‘simple wealth ranking’ technique. This resulted in a categorisation of households into rich, not-so-poor, poor, and very poor. Each category is accorded distinct characteristics based on ownership of property and ability to meet the necessities of life. For example the rich are characterised as:

- Having over 30 acres (12 hectares) of land;
- Owning ten cattle or more;
- Having children in boarding schools;
- Having a vehicle;
- Owning a permanent house; and/or,
- Owning a business.

The very poor are characterised as:

- Sleeping on banana fibre mats;
- Beggars;
- Having grass thatched huts with old iron sheet roofs that leak;
- Having poor nutrition in the family;
- Producing many children;
- Having divorced parents;
- During illness, relying on neighbours only to help; and/or,
- Squatters, who do not own land.

Out of 50 randomly selected households three were classed as rich (6 percent), nineteen as not-so-poor (38 percent), eighteen as poor (36 percent) and ten as very poor (20 percent).

Expenditures, Savings and Credit

The important categories of expenditure are education, food/household essentials, health care, farming, taxes, transport, credit and home building. The costs that are considered to impose hardships on a family are, in general order of importance:

- Education, acquiring land and health services;
- Marriage, death and transport requirements;

- Acquiring a household and having a first born child; and,
- Paying taxes and hosting visitors.

People are able to save during the productive seasons of May to July and September to December. However savings are inadequate to address needs during the lean months of January to March when incomes are low and expenditures high.

Any savings are normally used to cover anticipated costs. If more unexpected financial burdens, e.g., a death, occur during a period when income is high, the expense may be manageable but if it occurs during a low income period these costs may have a very negative impact on the household. In such cases, routine needs such as school fees or even money for food may be sacrificed.

Affordable and reliable opportunities for saving and obtaining credit are limited. About 10 percent of households have a bank account. Micro-Finance institutions are currently not playing an important role in the area. About a third of all households are in debt with the average debt being UGX 850,000 (USD 565). Borrowing mainly takes place from friends and relatives rather than financial institutions.

3.7.4.3 Agriculture

Farming Systems

Agriculture is practised as a labour intensive, intercropping system with both cash crops and subsistence crops. The main cash crops grown today are coffee and some sugar cane whilst there has recently been extensive planting of vanilla. The main subsistence food crops grown are bananas, cassava, sweet potatoes, maize, beans, groundnuts, cocoyam, millet, sorghum, peas, simsim, and yams. A range of horticultural crops is grown throughout the year including tomatoes, onions, cabbages, pepper, eggplants and carrots.

Trees are planted for a wide range of reasons including: to demarcate plots; provide shade and windbreaks; to provide a source of fuel and building materials; to produce fruit for sale and household consumption; to provide fodder; and, to improve soil moisture and fertility. The main fruit trees are jackfruit, avocado, mango, oranges and pawpaw. Other trees include muvule (*Chlorophora excelsa*), mugaire, musambya (*Markhamia platycalyx* or *Macadanua lutea*), *Eucalyptus spp.*, musisi (*Aesopsis emini*) and *Leucaena spp.*

Few livestock are kept due primarily to a shortage of grazing land although wealthier families on larger plots tend to keep livestock. A few cattle are kept for milk although yields are low. Goats, turkeys and poultry are the main livestock kept, along with some pigs.

During the initial consultations in 1998 the District Agricultural Officer stated the average size of agricultural holdings as 0.8 ha. Since that time there has been considerable plot sub-division in anticipation of the hydroelectric facility being constructed and landowners receiving compensation for their land.

There is a clear subdivision of responsibilities between men and women with regard to farming. Women are responsible for food supply including planting, weeding, harvesting, collection of firewood and the preparation of meals as well as childcare, fetching water and household tasks. They generally do more work than men who are responsible for cash income including cash crops, trading and providing income from other activities. They also clear the land and are responsible for building houses and looking after trees and animals. Despite the hard work, women generally do not own family land but merely have access to it. This has inhibited women's economic advancement by blocking avenues to credit schemes.

Current Problems and Issues

Land is being subdivided and production is being intensified. The number of plots into which a holding was traditionally subdivided was usually proportional to the size of the holding because the largest families tended to have the largest holdings. Over the last few years this pattern has changed and subdivision is now accelerating partly in anticipation of greater compensation from the Bujagali hydropower facility project.

In his study of Budondo sub-county, Anderson (1994) considers the smaller holdings to be not only poorer but also less environmentally sustainable. He considers a holding of less than 0.5 ha to be below the threshold to support an average family. He concludes that continued subdivision is a threat to future economic sustainability and that other sources of income are required to support the population of the area.

Other problems and constraints to production include:

- Steep slopes, intense rainfall and soil types susceptible to soil erosion;
- Low capital base and high costs of inputs;
- Pests and plant diseases, especially in coffee and bananas;
- Mechanisation not possible due to topography;
- Lack of business planning and management skills;
- Low prices for crops;
- High transport costs and poor roads that become impassable during the rainy season; and,
- Lack of a co-operative approach, which could assist in bulk purchase of inputs, value added to crops and/or access to more lucrative markets.

3.7.4.4 Fisheries

Importance of Fisheries in Uganda

Fisheries are very important in Uganda's national economy and are based on the extensive and varied aquatic system that covers about 20 percent of the country's surface area. This system comprises five major lakes (Victoria, Albert, Kyoga, Edward and George) and 160 small lakes in addition to rivers and swamps. Fish is still the cheapest source of high quality animal protein in Uganda and provides over 50 percent of animal protein consumption. Fish is a major source of income especially for the rural poor, and this industry contributes greatly to poverty eradication. Fish is an important export commodity: it is estimated that in 1996 USD 45 million were earned from fish exports, putting it next to coffee in export earnings (GoU statistics, 1998).

The Ugandan fish export industry took a severe blow when importation by the EU countries was banned in March 1999 (on the grounds of hygiene, sanitation and the presence of pesticides in fishing waters). However, the EU resumed importation in August 2000. The main entry points in Europe are Holland, Germany and Belgium in the north, and Greece in the south. Along with Spain, these countries represent the main EU consumer markets.

Virtually all fish produced in Uganda is from natural water bodies. The quantity of fish harvested in Ugandan waters increased from about 175,000 tonnes in 1985 to 276,000 tonnes in 1993, before declining to 213,000 tonnes in 1994 and remaining at about this level since then. The initial increase is attributed to increased catches of Nile perch following its establishment in Lake Victoria. A breakdown of fish catch by water body is provided in Table 3.22. It can be seen that Lakes Victoria and Kyoga provided 87 percent of the total Ugandan fish catch during the period 1990-1997, and that the whole Ugandan Nile system provided only 1.2 percent of the catch.

Table 3.22: Fish Catch by Water Body 1990-1997 (x1000 Metric Tonnes)

Water Body	1990	1991	1992	1993	1994	1995	1996	1997	Mean
L. Victoria	119.9	124.7	129.7	134.9	103.0	103.0	106.4	106.8	117.8
L. Kyoga	94.9	98.7	102.6	106.7	80.2	80.2	80.6	80.1	86.5
L. Albert	19.5	20.2	21.6	21.8	16.4	16.4	21.9	19.1	19.0
L. Edward, L. George & Kazinga Channel	5.5	5.7	5.9	6.4	5.2	5.2	4.8	6.4	5.7
R. Nile	1.4	1.5	1.5	1.6	4.8	4.7	4.6	3.4	2.8
Other waters	4.0	4.1	4.2	4.6	3.7	3.7	3.7	3.7	4.0
Total	245.2	254.9	265.5	276	213.3	213.2	222	219.5	235.8

Source: Uganda Fisheries Department, cited in UNEP (1999).

Importance of Riverine Fisheries and Historical Perspective

As shown in the table above, the River Nile produced only 1.1 percent of the mean annual Ugandan fish catch during the period 1990-1997. There are few rivers in Uganda that support commercial fisheries apart from the Nile system, which includes the Victoria Nile, Albert Nile, Aswa, Semuliki and Kagera Rivers. However, these large rivers offer ecological conditions for lacustrine, riverine and the riverine-lacustrine species.

Other than the Albert Nile, riverine fisheries in most of Uganda are largely at subsistence level with fish being caught mainly for domestic consumption. However, commercial fisheries may be significant at the river mouth. For instance, there are large landings at Kyankole near Bukungu on Lake Kyoga where the Victoria Nile flows into Lake Kyoga.

Methods of Fishing

Artisanal fishing communities that depend on it as their source of food and livelihood dominate the fishery of the Victoria Nile. The fishing craft consist of planked canoes and, to a lesser degree, dugouts. The boats are V-shaped modified Ssesse types, paddled with oars since very few people on Victoria Nile can afford to purchase outboard motors. Perhaps not surprisingly, fishing activity is greatest in the reaches of the Nile that are remote from large sets of rapids, e.g. between Bujagali and Kalagala Falls (Transect 2), and in the Namasagali area (Transect 4).

The fishing gear used consist of gill nets ranging from 2" to 8" stretch mesh size, seine nets and hooks and cast nets. Gill nets are the most commonly-used fishing gear, although yield data indicate that long-lines are more effective.

Different fishing methods are used depending on the target species. Gill nets are set in shallow marginal waters or left to drift. Long lines target *Lates niloticus*, *Protopterus spp* and *Clarias spp*, while traps and basket fishing are exclusively used in shallow waters to catch *Proteopterus*, *Clarias* and other slow-water fish species.

Fisheries on some of the rivers in Uganda have declined due to use of destructive fishing gear and practices. These include use of small mesh gill nets that crop immature fish, beach seines and traps, especially at the mouths of rivers. For instance, the fishery of *Labeo victorianus* which formed the most important riverine fishery on the rivers of the Victoria lake basin, has been destroyed due to intensive gill netting and basket trapping at the mouths of rivers at the time when fish migrate from lake to river to breed. Other species like *Barbus spp.* and *Alestes spp.* have been similarly affected.

Commercially-Important Species

The contribution of the 13 most commercially-important species to the total Ugandan fish catch, and to the catch of the River Nile, is shown in Table 3.23.

Table 3.23: Relative Importance of Fish Species in Total Ugandan Catch and River Nile Catch, 1994

Species	Contribution to total Ugandan Fishery (%)	Nile Fishery (x1000 metric tonnes)	Contribution to Nile Fishery (%)
<i>Tilapiines</i>	36.29	107.3	29.3
<i>Nile perch</i>	45.94	54.3	14.9
<i>Rastrineobola argentea</i>	5.61	0	0
<i>Bagrus docmac</i>	1.98	33	9.0
<i>Clarias gariepinus</i>	0.88	47	12.9
<i>Protopterus aethiopicus</i>	2.95	0	0
<i>Barbus altianalis</i>	0.37	27.7	7.6
<i>Hydrocynus spp.</i>	4.22	0	0
<i>Mormyrids</i>	0.70	0	0
<i>Alestes spp.</i>	1.02	55	15.1
<i>Labeo victoriae</i>	0.01	27.1	7.4
<i>Synodontis afrofishcheri</i>	0.01	13.5	3.7
Total	99.98	364.9	99.9

Source: UNEP, 1999

Fisheries of the Upper Victoria Nile

Four quarterly surveys carried out by FIRRI (now NAFIRRI) during 2000 (summarised in Appendix C.1) indicate that the most important commercial fish species in the Upper Victoria Nile are the introduced Nile perch and Nile tilapia. The other main commercially-important species are *Mormyrus kannume*, *Gnathonemus longibarbis*, *Barbus altianalis*, *Bagrus docmac* and *Tilapia zillii*. Six of these species are included in the list of keystone species as identified during the FIRRI studies, and previously described.

The fishery in the upper 65 km of the Victoria Nile supports 50-90 boats and approximately 150-200 full time jobs, depending on the season. Table 3.24 indicates that in monetary terms, the value of the fishery is estimated at between UGX 4.02 million/month (April 2000) and UGX 10.66 million/month (July-August 2000), with the lower figures being largely attributable to part-time fishermen returning to the fields to work during the rainy season. At an exchange rate of UGX 1500: USD 1,

this equates to total revenue of between USD 2680 in April 2000 and USD 7106 in July-August. Using the conservative (upper limit) figure of 150 full time jobs, this equates to an annual income per full time person in fishery-related employment of approximately USD 400.

Table 3.24: Summary Data for Fisheries Revenue From The Upper Victoria Nile

Location	Total February 2000 Revenue (million UGX)	Total April 2000 Revenue (million UGX)	Total July-August 2000 (million UGX)	Total November 2000 (million UGX)
Transect 1: Kalange to Makwanzi	2.37	1.72	2.31	1.49
Transect 2: Buyala to Kikubamutwe	4.58	0.47	7.93	3.28
Transect 3: Matumu to Kirindi	0.22	0.09	0	0
Transect 4: Namasagali to Bunyamira	0.88	1.74	0.42	2.80
Total	8.05	4.02	10.66	7.57

Data from NAFIRRI 2000a; 2000b; 2000c; 2000d

Fishing effort in terms of active fishing canoes showed no major change from the April 2000 counts (50 fishing canoes in 2000 vs. 51 fishing canoes in 2006) for all the four transects sampled. However, in terms of type of canoes used, there was a 57 percent increase in the more robust Sseese type of craft and a 39 percent decrease in the active dugout type of fishing canoe. The April 2006 survey also revealed an increase in the number of fishers from 89 during 2000 to 128 during 2006. Similarly, there was an increase in the number of fish traders from 12 to 47 (a 74 percent increase) by the April 2006 survey. Major species targeted in both surveys were *Mormyrus kannume* and *Oreochromis niloticus* (especially in Transect 1), *Rastrineobola argentea* and *Lates niloticus* (especially in Transect 2) and *Barbus altianalis* (especially in Transect 3). The increasing importance of *R. argentea* and Haplochromines in commercial catches of April 2006 was noticeable, and is due to the use of new techniques, e.g. night fishing with lights to attract these smaller fish species. The main fishing gears used were the same in both periods. These were multifilament gill nets, cast nets and hooks (longline and angling) with mosquito seines targeting *Rastrineobola* and Haplochromines. There was increased angling (from 34.8 percent in April 2000 to 40.5 percent during April 2006) and use of gill nets (from 21.7 percent in 2000 to 31 percent during 2006) in the active canoes but no major changes in hook size (10-14) nor gill net mesh size (3"-5) were noticeable.

The total monthly yield from the four transects was much higher in April 2006 (16,816 kg valued at 12million UGX.) compared to April 2000 (7,969 kg valued at

UGX. 4 million) in 2000, however the 2006 figure is heavily influenced by the report from the owner of a single canoe at Transect 2, that he catches up to 300 kg per day of *R. argentea*, thereby single-handedly accounting for more than 80 percent of the total fish catch in the surveyed transects. This statistic must be viewed with caution, and if omitted from the analysis, the overall fish catch in 2006 is similar to that in 2000.

The commercial fishing gears were the same as in 2000, i.e. multifilament gill nets, hooks, cast nets and mosquito nets.

It should be noted that the Uganda Fisheries Master Plan Study (Ministry of Agriculture, Animal Industry and Fisheries) states that average income for full-time fishermen in Uganda is *circa* USD 280 or UGX 350,000 per annum, which accords well with the estimate for the Bujagali area of USD 400 per annum.

3.7.5 Tourism

The site of the Bujagali hydropower facility is approximately 8 km downstream of the “source of the Nile” (i.e. where Lake Victoria empties into the Victoria Nile). Due to the history and scenic topography of the area, it is attractive to tourists, especially to white water rafters who come to take advantage of the sequence of rapids on the upper reaches of the Victoria Nile.

3.7.5.1 White Water Rafting Operations

The Government of Uganda, via the Uganda Tourist Board, supports the development and operation of white water rafting (WWR) in Uganda. The current Government policy is one of product and market diversification, in which eco-tourism (including WWR) is a priority. Aulo (1999) reports that the three main eco-tourism destinations in Uganda are the western mountains (for gorilla viewing), Murchison Falls National Park and the “source of the Nile” area. Interviews held with the Minister of Tourism, Trade and Industry and the Resident District Commissioner in 1998 (Duncan Garrick International Ltd., 1998) and in 2006 indicated that the administration of Jinja District and the Government of Uganda acknowledge the value and positive impacts of WWR, but recognise the need for increased power generation.

A detailed analysis of the WWR industry is provided in Appendix C.4 to this SEA, and this is summarised below.

Four companies currently operate WWR excursions at Bujagali: Adrift, Nile River Explorers (NRE), Equator Rafting and Nalubaale Rafting. The rapids on which Adrift base their one-day WWR excursions, and the class assigned to each set of rapids is given in Table 3.25, and are shown on Figure 3.9. The HPP site is located between the rapids known as Ugly Sisters/Sibling Rivalry/Surf City, and Big Brother/Silverback. The one-day excursions offered by the other three companies use

the same rapids as those used by Adrift. These companies also market a two-day trip, which starts above Bujagali Falls and extends to the Malalu area. Rapids are classified based on the degree of danger and 'thrill', on a scale of 1 to 6, with Grade 6 being a vertical drop and unsafe for commercial rafting operations. Locations of the rapids are shown in black text on Figure 3.9. Three of the 'Big Four' Grade 5 rapids (considered the most thrilling) are downstream of the Dumbbell Island dam site and thus will not be affected by the HPP.

Table 3.25: Rapids Used by Adrift Rafting for Their One and Two Day Rafting Trips

1 / 2 Day Trips	Name	Class
Day One	Bujagali	4
..	Easy Rider	3
..	Total Gunga/G.Spot	5
..	Ugly Sisters/Sibling Rivalry/Surf City	3
	Bujagali HPP Site	
..	Big Brother/Silverback	5
..	Point Break	3
..	Overtime	5
..	Retrospect	4
..	Bubugo/Super Hole	3
..	Itanda/Bad Place	6/5
Day Two	Novocaine	5
..	Vengeance	4
..	Hair of the Dog	4
..	Kulu Shaker	4
..	Nile Special	4
..	Malalu	4
(Future Extension)	Weleba	3

Source: AESNP 2001 EIA Report with updates by C. McCleay (Adrift Rafting), 2006

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Figure 3.9 Location of Rapids used by White Water Rafterers and Kayakers

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Interviews conducted with rafters suggest that many white water rafters are primarily adventure and overland tourists. In such cases, Jinja represents a convenient stopping point for tours, where WWR is available as an optional activity.

Adrift (Uganda) Ltd

Adrift was the first company to operate white water rafting in Uganda, commencing operations in 1996. Adrift was and still is based in Kampala, and brings the majority of its clients to Bujagali on a one-day excursion from Kampala. In mid 2003, Adrift opened the 'Nile High Club' which is a campsite with dormitory (and more recently a few thatched bandas) a bar/restaurant and 44m bungee jump located on a 32 m cliff-top site overlooking the Nile, adjacent to the Jinja Nile Resort (Figure 3.8).

Adrift originally launched their rafts from the riverside recreation site beside Bujagali Falls and paid a commission to an entrepreneur who held a lease for the site from the District Council. This arrangement continued until they entered a business partnership with the Kenyan Mada Hotels group, who own the Jinja Nile Resort and extensive cliff top landholdings adjacent to their hotel, upon which the 'Nile High Club' is now located and below which their rafts are now launched.

Having their base in Kampala has always meant that Adrift generated their market from amongst Kampala based ex-pats and other Ugandan based NGO employees as well as some travellers staying in Kampala as opposed to the overland truck based market. This market mix has changed a little with the building of the 'Nile High Club' and thus the availability of an accommodation base by the Nile, but reportedly, some 90 percent of their rafters still originate from Kampala sources.

Adrift offers several rafting options, one day, two day, family rafting etc., but 90 percent of their clients take the one day trip which currently costs USD 95 per person. In 1998 Adrift pushed their rafting rates up from USD 65 to USD 95 (NRE at that time left theirs at USD 65) per person and it appeared that their market position enabled them to sustain this, however rates fell back to USD 65 in the difficult years but began their recovery around 2003/4. It is estimated that Adrift took around 4,000 clients rafting during 2005, putting it in second place behind the current market leaders NRE. It is likely that the entry of the fourth rafting company, Nalubaale, run by a former Adrift employee, may have been partly responsible for this loss of market share.

Adrift as a company has developed from being simply a white water rafting experience provider to a much more broadly based travel company offering in addition, gorilla trekking, mountain climbing, wildlife safaris and outdoor management development programmes for companies, NGO's, school groups etc. They have recently been awarded a concession from the National Forestry Authority

to operate a high quality eco-tourism Lodge on Kalagala Island, within the Kalagala – Itanda Offset area, which will involve an investment of USD 1 million in association with international partners and thus continues the diversification of their business from its white water rafting origins.

Table 3.26 below provides summary information on Adrift's client numbers and estimated revenues between 1996 and 2006.

Table 3.26: WR Summary of Adrift (U) Ltd Operations, 1996-2006

Critiera	1996	1997	1998	1999	2000	2005-2006
No. of Clients/Year	490	3315	2776*	7000	7000	4,000
Trip Fee	N/A	N/A	USD 95	USD 95	USD 95	USD95
Estimated Income in USD	N/A	USD 250,000	USD 265,000	USD 700,000	USD 700,000	USD 380,000
Description of Trips	N/A	N/A	Full day, Bujagali to Itanda, 12 rapids over 25 km	Full day, Bujagali to Itanda, 12 rapids over 25 km	Full day, Bujagali to Itanda, 12 rapids over 25 km	Full day, Bujagali to Itanda, 12 rapids over 25 km
Average No. of Clients/Day	N/A	24	24	18	18	11
No. of Boats in Operation	N/A	7	7	7	7	N/A
No. of People Employed	N/A	8 ex-pats, 50 local	8 ex-pats, 50 local	6 ex-pats, 80 local	6 ex-pats, 80 local	10 expat, 30 local
Performance of Business/ Constraints	N/A	N/A	N/A	Stable. Foreign tourists fear for safety due to Bwindi massacre	Had started to pick up but Ebola epidemic kept business to 1999 levels. Still fear of insecurity within country	Now 3 competitors

* Total to end of July.

Source: Adrift (U) Ltd., personal communication with M. Barnett ,1998 Mehul Kanani, General Manager, 2001, Cam McLeay, 2006.

Nile River Explorers Ltd (NRE)

Nile River Explorers (NRE) was the second rafting company to operate on the Victoria Nile, commencing operations early in 1997. The company was set up by Jon Dahl, a Zimbabwean white water rafting expert with experience developing the sport on the river Zambezi in Zimbabwe and perhaps not surprisingly, he decided to locate his rafting base and backpacker lodge in Jinja rather than in Kampala. Offering camping, dormitory and double room accommodation options, the Explorers Backpackers Hostel in Jinja became the most popular budget accommodation in Jinja before NRE and Equator Rafting both opened similar budget accommodation facilities at Bujagali whereupon staying by the river became the preferred option.

NRE's market focus was and is different from that of Adrift. The base at Jinja made it the natural stop for the overland truck based traveller market and this sector has dominated NRE's business although not to the extent that the Kampala based market dominates Adrift's business. NRE indicates that around 60 percent of their clients are sourced through the overland truck sector and that some 40 percent therefore come through various Kampala or other Ugandan based organisations, travel agencies, expats or NGO's.

The Explorers Campsite at Bujagali is located on the cliff top overlooking the Bujagali Falls and although it originally offered a bar/restaurant, camping and dormitory accommodation, in the last few years this has been supplemented with bandas, and luxury safari style tented camp facilities, a swimming pool and an a la carte style restaurant. This has enabled higher-value markets to be attracted from Kampala and overseas and provides the overland truck passenger with an option to trade-up from the campsite as a 'treat'. The overland truck market stays three nights at the campsite which gives the travellers time to engage in a greater variety of activities, including a day devoted to working with local NGO's assisting with community based projects such as renovating school buildings or similar.

NRE have always launched their rafts from a river bank site close to the Owen Falls Dam, some kilometres upstream from where Adrift enter the river, in order to give their clients more practice and familiarity on the raft and in the water before they decide to proceed to the rapids. Like Adrift, they also offer a range of rafting options, 1 day, 2 days, family trips etc. but once again it is the 1 day option which accounts for the large majority of rafting trips. One-day rafting trips cost USD 95 per person, the same as Adrift, although historically, NRE prices were lower than Adrift prices. Estimates of the number of rafters handled during 2005 suggest a figure of around 5,000, which would make NRE the leading rafting company with Adrift in second place.

NRE provided comprehensive statistics on customer numbers and expenditure for its operations in 1999, 2000 and 2006 but was unable to do so for its first 2 years of

operation (1997 to 1998). Table 3.27 provides a summary of the company's operations for the period 1997 to 2006.

Table 3.27: Summary of NRE Operations, 1997-2006

Criteria	1997	1998	1999	2000	2005-2006
No. of Clients/Year	Estimated at 15-20% less than Adrift	Estimated at 15-20% less than Adrift	2,637	2,988	5,000
Trip Fee	N/A	USD 65	USD 65	USD 65	USD 95
Estimated Income in USD	N/A	N/A	N/A	N/A	380,000
Description of main trips			5 hour trips from base of Nalubale to Kibbi, 8 rapids over 18 km	5 hour trips from base of Nalubaale to Kibibi, 8 rapids over 18 km	Day trip from upstream of Bujagali to Itanda – 26 km
Average No. of Clients/Day	N/A	10	13	13	9
Number of Boats in Operation	3	3	5	5	N/A
Number of People Employed	N/A	7 ex-pats, 2 full-time local staff	4 ex-pats, 25 locals	4 ex-pats, 25 locals	10 ex-pats, 40 locals
Performance of Business			Stable	Good growth over previous year, esp. during festive seasons	Has grown to be joint or even sole market leader
Additional Activities: Kayaking school – Village walks				Average of 40 students/month, USD 40 / lesson 50 persons/mth USD 5 /person	Same as 1999

Source: John Dahl, Director of Nile River Explorers, personal communication in 1998 , 2001, 2006.

Equator Rafting

Equator rafting was originally established as a joint venture between Mick Barnett, a former employee of Adrift Rafting, and the Speke Hotels Group in early 2001. Mick Barnett had apparently secured a lease for the Bujagali Falls tourism site and proposed the development of a new rafting company and campsite based at the site.

The partnership and performance of Equator was very successful for a while but the partnership broke up and Speke Hotel's management of the company without the involvement of a rafting specialist appears to have resulted in a decline in operational performance.

The Speke Camp, however, appears to be more successful. It has a location immediately beside the Bujagali Falls and the site doubles as a visitor recreation and picnic site as well as a campsite and rafting base. A large, open-sided and thatch roofed bar/restaurant has a prominent location by the Falls while the campsite, dormitories, kitchen, toilets, showers and other facilities are located to the rear of the site but give a poor impression and sense of neglect.

All visitors to the site are charged for entry, UGX 2,000 for a Ugandan, UGX 3,000 for a non-Ugandan and UGX 500 for a child while vehicles are charged at an additional UGX 1,000. Visitors can either bring their own food at no extra charge or use the bar/restaurant on site. Revenues from the operation of the site as a visitor picnic/recreation site alone are understood to be around UGX 130 million (some USD 72,000) and this suggests annual visitor numbers of between 50,000 to 60,000.

Equator, who launch their rafts from their own campsite upstream of the Bujagali Falls, offer the same rafting options as Adrift and NRE and again find that the one day trip is the most popular choice. Their market is dominated by Kampala sourced/based ex-pats, NGO's and visitors and this is assisted by the Speke Hotels Group owning several prominent hotels in both Kampala and Entebbe. Formerly, rafting rates were the same as Adrift and NRE (USD 95 per person last year) but as of early 2006 Equator had dropped its price to USD 75 per person. This is a significant decision and is probably related to the poor performance of the rafting business which is understood to have carried only 600 to 700 clients during 2005 and continues to operate weakly.

Nalubale Rafting

Nalubale Rafting was started in mid-2005 by Ian Baillie a white water rafting specialist who formerly worked with Adrift Rafting. He is the owner of a carpentry business and opening the rafting company was his second business start-up. Both businesses are based in Kampala but the practical rafting operation operates out of rented premises in Jinja town but has no campsite or related facilities. Kampala is the source of his clientele which is a reflection of his experience with Adrift Rafting who generate most of their rafting business through Kampala based ex-pats, NGOs and other organisations.

At present, Nalubale only operates on weekends and while it offers a range of rafting trips like the other rafting companies, the majority of trips are one day in length and cost USD 95. The company employs eight people in Jinja, including three ex-pats and is easily the smallest of the four rafting businesses. It is estimated that they carried around 200 – 300 clients during the six months in which the business operated in 2005.

3.7.5.2 WWR Operational Summary

Table 3.28 below provides summary data on the four WWR companies that currently have operations on the Upper Victoria Nile.

Table 3.28: Summary Operational Characteristics of the Rafting Companies

Company	Company Started	Market Mix	Most Popular Rafting Trip	Rafting Trip Fee (USD)	Number of Staff	Rafter Nos. in 2005 (estimate)
Adrift	Mid 1996	90% NGO / Kampala 10% Truckers	1 Day Trip (90% of clients)	95	40 F/T (10 ex-pat, 30 local)	4,000
NRE	Early 1997	40% NGO / Kampala 60% Truckers	1 Day Trip (95% of clients)	95	50 F/T (10 ex-pat, 40 local)	5,000
Equator	Early 2001	95% NGO / Kampala 5% Truckers	1 Day Trip (95% of clients)	75	35 F/T (10 ex-pat, 25 local)	600 - 700
Nalubaale	Mid 2005	100% NGO / Kampala	1 Day Trip (100% of clients)	95	8 F/T (3 ex-pat, 5 local)	200 – 300 (6 months)

Source: Interviews with Rafting Companies and Mrs Sarah Muwanguzi (Itanda LC1 Representative)

3.7.5.3 Quantification of Demand - WWR Market in Uganda

It was estimated that the total demand in 1998 was in the range 7000-8000 persons per annum, which includes the clients of Adrift and Nile River Explorers. The total gross direct value of WWR was therefore in the range of USD 600,000-650,000 at 1997/98 prices (Duncan Garrick, 1998). By 2000, the amount of gross revenue generated by fees paid by rafters was estimated as USD 486,000, based on 6,000 rafters per year, with 35 percent paying USD 65 for a half-day trip and 65 percent paying USD 90 for a full-day trip (AESNP, 2001).

Research carried out in 2006 as part of this SEA (Appendix C.4) indicates that total rafter numbers are approximately 10,000 per year, with Adrift and NRE each carrying 4,000-5,000 per year, and 800 to 1,000 per year being carried by Equator and Nalubaale combined. The cautionary note from the Duncan Garrick (1998) study stating that rapid growth in rafting numbers may not necessarily continue into the future, appears to be correct, at least for the eight years since that study was carried out.

3.7.5.4 Non WWR Tourism Activities

The Jinja and the upper Victoria Nile area are also the location of several “action-type” tourism operations other than WWR and kayaking. These include:

- All terrain vehicle(s);
- Horse riding;
- Birdwatching;
- Bungee jumping; and,
- Ecotourism (mainly in Makira Forest).

3.7.6 Transportation

3.7.6.1 Roads

The existing road system within the project area is shown on Figure 3.8 and schematically on Figure 3.10. A main trunk road links Kampala with Nairobi, crossing the Victoria Nile via the Nalubaale dam and passing just north of Jinja. Site access will be achieved from two roads that run parallel to the Victoria Nile on each bank. A newly constructed road on the west bank will be permanent, while a newly constructed road on the east bank will be temporary only and used to access the east embankment during construction and for occasional inspections. The east bank road links Jinja with Kamuli, passing through Ivunamba. The west bank road links Jinja with Kayunga via Njeru and Kikubamutwe. Settlements straddle these roads at intermittent intervals.

These roads intersect with the Kampala to Nairobi road at two major junctions. The intersection on the east bank is a four arm roundabout, whilst that on the west bank is a large gyrator on which priority rules (‘right of way’) apply, the Kampala to Nairobi route being the major arm. A public transport stop/taxi rank is situated within the junction. Other vehicles also park in the vicinity.

Access to the Kampala to Nairobi trunk road can also be achieved at a large roundabout some two km to the east of the Jinja Roundabout. This junction also serves the rail terminal and depots at Jinja.

Existing Road and Traffic Conditions

The existing road conditions, traffic flow and speed estimates on the main road network are summarised in Table 3.29 and 3.30 below. Table 3.29 includes peak traffic flow data collected during July 2006. Full traffic count data are presented in Appendix C.5.

All surrounding roads are of single carriageway standard. With the exception of the Buwenda to Ivunamba (east bank) road, the road system has tarmac surfaces of moderate to good quality. With regards to the Jinja to Ivunamba road, the Jinja to Buwenda section has a tarmac surface, but it is now weathered and has deteriorated to a poor quality surface.

Footways ranging from 1 m to 2 m have been created on grass verges alongside most roads, but due to constant use the grass surfaces have mostly been eroded, exposing the underlying soil strata. Pedestrians also frequently use the road pavement. This increases during the wet season when footway surfaces convert to mud.

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Figure 3.10 Schematic Diagram of Road Network Around the Project Site

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There are significant levels of pedal cycle use, particularly on the Ivunamba road on the east bank (over 50 percent pedal cycles), and the Kayunga Road on the west bank (approx. 30 percent pedal cycles). Other traffic is mostly public transport vehicles and goods vehicles. The level of personal car usage is relatively small.

The Jinja town road is the most heavily trafficked with a high proportion of heavy goods vehicles, public transport vehicles and pedal cycles. Traffic flow to and from Jinja town is tidal. The majority of local traffic (from Ivunamba and Kikubamutwe for example) during the morning is bound towards Jinja and vice-versa during the evening. Total 2-way 12-hour traffic (excluding pedal cycles) on the Jinja town road is approximately 10,000 vehicles, which is well within the previously estimated capacity of 15,000 vehicles.

The main problems with the system are that road markings and street lighting are absent on most roads and traffic junctions. In addition, the public minibuses, which run along both banks, stop on the carriageway whilst passengers board, posing increased risk of accidents.

Table 3.29: Existing Road and Traffic Conditions

Road/ Junction	Section (Approx. Length, Km)	Road Condition ¹				Traffic (July 2006)	
		Width (m) Pavement/ Footway (estimated Capacity) ¹	Pavement Surface	Footway Surface	Quality ¹	AM 2-way Peak Period – 1 hr (all vehicles)	PM 2-way Peak Period – 1 hr (all vehicles)
Kampala – Nairobi (Bridge)	Njeru – Jinja (2 km)	10/1-1.5 (15,000)	Tarmac	Grass/soil	Good	1069 (Mon 0700-0800)	1482 (Tues 1800-1900)
Jinja – Ivunamba (Jinja Town Road)	Jinja Town Centre to Jinja Roundabout" (2.5 km)	10/1-1.5 (15,000)	Tarmac	Grass/soil	Good	1175 (Fri 0800-0900)	2127 (Fri 1700-1800)
Jinja – Ivunamba (Ivunamba Road)	Jinja –Buwenda (4.5 km)	5-8/1-1.5 (7-10,000)	Tarmac	Grass/soil	Poor	349 (Mon 0700-0800)	264 (Weds 1800-1900)
	Buwenda – Ivunamba (2 km)	5-8/1-1.5 (7-10,000)	Murram	Grass	Moderate	N/C	N/C
Jinja to Kikubamutwe (Kayunga Road) – west bank	Njeru – Kikubamutwe (9 km)	6-8/1-1.5 (8-10,000)	Tarmac	Grass	Good	223 (Weds 0700-0800)	238 (Fri 1800-1900)
Jinja to Iganga (Iganga Road)	East of Jinja Roundabout"	10/1-1.5 (15,000)	Tarmac	Grass/soil	Good	389 (Mon 0700-0800)	356 (Fri 1700-1900)

¹Based on AESNP (2001) assessment. N/C = not counted at this location.

Table 3.30: Existing Vehicle Composition

Road	%	%	%	%	%
	Cars	Motor-Cycles	Buses/Taxi (Public Transport)	Pedal Cycles	HGV
Nile Bridge	29	7	29	21	14
Jinja -Ivunamba	13	17	11	56	3
Jinja - Kikubamutwe	12	41	14	29	4

HGV = Heavy Goods Vehicle.

3.7.6.2 Rail

There is a single rail track between Jinja and Kampala, extending eastwards to Kenya. This caters to freight traffic only, and there are no passenger services. Estimates of freight traffic between 1994 and 1996 are contained in Appendix C.6 and indicate a high volume of freight traffic. All delivery of materials and equipment from Mombasa to Jinja will be by rail, with the exception of abnormal loads, i.e., turbines, which will be transported by road.

3.7.6.3 Air

The Jinja air strip is located close to the Jinja to Ivunamba road on the east bank. This is mainly used by a local flying club and occasionally by private light aircraft.

3.8 Cultural Property

The construction of the Bujagali dam, and especially its resultant reservoir, will affect people's individual cultural properties as well as culturally significant aspects at the community level.

As defined by the United Nations, "cultural property" includes sites having archaeological (prehistoric), paleontological, historical, religious, and unique natural values. Cultural property thus encompasses both remains left by previous human inhabitants (for example, shrines) and unique natural environmental features such as waterfalls.

A stage 1 archaeological assessment conducted in 2006, (Appendix C8) indicates that the western approach to the river is gradual and has platforms and an extensive plateau which attracted settlement. The eastern banks along the project impact zone are made up of very sharp and steep gradients that would have forced settlement and other human activity, other than agriculture, much further back from the river. Any

artefacts collected have been found elsewhere in East Africa. The archaeological assessment report is provided as Appendix C.8 of the SEA report.

Uganda is a multicultural society with several ethnic groups. The southern reach of the Victoria Nile, i.e., south of Lake Kyoga, is made up entirely of people of Bantu descent (Fountain Publishers Ltd., 1999). The baseline socio-economic survey identified 22 ethnic groups in the project area as defined in the RAP. The Basoga are dominant on both riverbanks although there are significant numbers of Baganda, particularly on the west bank. Other significant groups are the Basamya, Teso, Banyole, Bagwere, Bagisu and Badama.

In recent years there has been a new sense of cultural pride and a renewed interest in traditional culture, particularly on the east bank. The Basoga cultural King 'Kyabazinga' was inaugurated in 1997. There is a dominance of Basoga traditions and beliefs on the east bank and Baganda traditions and beliefs on the west bank.

Along the Victoria Nile, Luganda (west of the river) and Lusoga (east of the river) are the languages that predominate south of Lake Kyoga. These languages are very similar to one another and are mutually understandable.

Religious beliefs are divided in Uganda: 33 percent are Roman Catholic, 33 percent are Protestant, 16 percent are Muslim, and 18 percent practice indigenous beliefs (CIA, 1999). Within the study area, 30 percent of households are Catholic, 30 percent are Protestant, 34 percent are Muslim and 6 percent practice other beliefs (Resettlement Action Plan).

Traditional religious beliefs remain important in the area. The belief is that spirits are in control of all aspects of life. The spirits are feared and respected but can be manipulated by those who interact with them. Spirits are often appeased through sacrifices. Traditional religion is practised through diviners, caretakers, interpreters, traditional doctors and herbalists who interact with the spirits. Charges are made for these services and gifts are also often given and received.

Spiritual beliefs exist at different levels – namely at the personal / household level and at the community level. At the household level, the spirits of ancestors are often honoured at family shrines. These can be relocated, if the household moves, through carrying out traditional ceremonies to transfer and settle the spirits.

At the wider community level, traditional beliefs and customs are associated with ecological features like rapids, trees and boulders. Each has a resident spirit that is worshipped, respected and feared. These attitudes are manifested through rituals, sacrifices and observation of taboos. There are a number of recognised dangers associated with breaking taboos or disturbing the spirit world including death, famine, sickness, drought, machinery breaking down, injury, etc. A number of such

sites will be affected by the construction of the project and by inundation. The ‘homes’ of the spirits can however be moved through carrying out certain rituals and ceremonies to transfer and settle the spirits. Details on the moving of spirits are provided in the Assessment of Past Resettlement Activities and Action Plan.

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4.0 Identification and Evaluation of Alternatives

4.1 Need and Rational for the Project

Uganda has suffered for many years from shortages of electricity and this situation has been exacerbated in recent times as drought and over-abstraction of water has led to a significant reduction in the level of Lake Victoria, and a reduction in the available generation of the existing Nalubaale and Kiira hydro plants.

Throughout the 1990s the demand was greater than generating capacity, and therefore load shedding was required to balance the system. In 2000 the increased capacity provided by the commissioning of the first two 40 MW units at Kiira power station relieved the load shedding. However, the recent drop in water levels in Lake Victoria due to the drought and increased flow through the two dams, has led to reductions in the availability of water for power generation, forcing more severe load shedding.

The generation available from Kiira and Nalubaale dropped from 265 MW peak capacity in 2004 to 120 MW in 2006⁵. As the peak demand is about 360 to 390 MW the severity and frequency of load shedding has increased. The load shedding trend between January 1999 and Aug 2006 is provided as Figure 4.1. The current typical daily load curve provided as Figure 4.2 shows that current peak demand is about 360 to 390 MW compared to the current peak generating capacity of about 200 MW. Overall, the level of load shedding required is about 175 to 190 MW during peak hours, 70 to 90 MW during shoulder hours, and 60 to 120 MW during off-peak hours. Load shedding is occurring 24 hours a day. The GoU is rationing the power with concessions to the industrial and commercial sectors.

The demand for electricity has steadily increased in step with the strengthening and expansion of the economy. The total domestic demand grew from about 250 MW in 2001 to about 340 MW in 2006, and it is possible that a shortage of capacity could occur in the future even with the Bujagali HPP in service.

To address the short term load shedding the government is implementing a costly emergency thermal generation programme using high-speed reciprocating engines fuelled with diesel oil to generate 100 MW of power. This power will be costly due to the need to import relatively expensive diesel fuel, and the high operating cost of high-speed units. Therefore, the high-speed units are only planned to operate until 2010 when more economical, renewable and clean power becomes available from the Bujagali HPP.

⁵ The system data in this section was taken from unpublished data provided by UETCL, Sept 2006

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Figure 4.1 Load Shedding Trend in Uganda

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Figure 4.2 Current Typical Daily Load Curve (2006)

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Even so, the Bujagali HPP will not address the full shortfall of energy, thus the GoU is pursuing additional generation from medium-speed reciprocating engines field with heavy fuel oil (100 MW), cogeneration at sugar works (15 MW), and mini hydro (41 MW).

The alternatives to developing Bujagali are to do nothing, or to develop an alternative source or sources of power.

The do nothing alternative would mean that the up to 250 MW to be provided by Bujagali would be supplied by extending indefinitely the operation of the expensive high-speed emergency thermals, and by increased load shedding. This would have a long term significant effect on the economy and the people of Uganda.

At present, the only feasible alternative for large scale power generation in Uganda appears to be thermal power. However, thermal power is not only more costly than hydro, it also has negative environmental effects including air pollution, noise, potential for spills, and greenhouse gas emissions. Details on the alternative generation technologies, including wind, solar, geothermal, and thermal are provided in the following section.

The final two subsections demonstrate why Bujagali is the preferred next large hydro project on the Victoria Nile, and why the proposed configuration at the site is the preferred design for the facility.

4.2 Alternative Generation Technologies for Uganda

The general conclusions from the evaluation of generation alternatives from various studies that have been completed on the energy sector in Uganda are:

- **WIND AND SOLAR:** There is little potential for wind-generated electricity to contribute to the national network, as Uganda is not favoured with a windy climate (Mubiru, 1999; ESMAP, 1999; SNC Lavalin 2006). While Uganda does have potential for solar electricity generation, the potential for solar power as a significant provider to the national network is low due to its comparatively high kW/h purchase price (Acres, 1999; Karekaho, 1999; SNC Lavalin 2006). Thus, at present in Uganda, wind and solar, along with micro and mini hydro, are considered to be viable sources of electricity primarily for rural, off-grid people but not for large-scale, reliable, base load power. For example, in Kenya, more rural homes rely on photovoltaic (pv) systems for electricity, than rely on the grid. The Photovoltaic Market Transformation Initiative (PVMTI) of the International Finance Corporation and the Global Environment Facility has been present in Kenya since 1998, with the aim to promote the sustainable commercialisation of photovoltaic technology in the developing world by providing examples of successful and replicable business models that can be financed on a commercial basis. As these models and the technology develop, use

of such systems in Uganda may help to reduce the rate of growth in demand for grid supplied electricity. However, such systems are not expected to replace the need for large scale power generation.

- **GEOHERMAL:** Ongoing analyses being completed by Power Planning Associates, a summary of which is presented herein, indicates that historical estimates of the geothermal potential of Uganda have been substantially overstated. Acres (1999) suggested the potential is 450 MW, however, Power Planning Associates work, which is expected to be published in the first quarter of 2007, indicates that the true potential is likely to be in the order of only 10 percent of this figure. Thus, while an important resource, geothermal alone is insufficient to address the present shortage of power in Uganda. This conclusion is based on the following preliminary findings of Power Planning Associates unpublished work. There are three principal geothermal resource areas in Uganda. Two of these, at Katwe and Buranga, are interpreted to be low grade resources with reservoir temperatures of only some 100°C, and consequently with no potential for commercial scale power generation. The third prospect, at Kibiro, is more promising and appears to be a medium grade geothermal resource with reservoir temperatures of about 220°C. Kibiro is therefore considered to be the only geothermal resource in Uganda with clear potential for power development. The size of a geothermal power plant that could be developed at Kibiro will depend on actual resource conditions that have yet to be proven by exploration drilling. Nonetheless, deep geothermal resource conditions can be inferred from the results of surface exploration surveys undertaken to date. By this means, it is assessed that the Kibiro resource may prove to be suitable for the future development of either a 20MWe condensing steam power plant or a 40MWe organic Rankin cycle binary plant, both with an operational life of at least 25 years.
- **SMALL TO MEDIUM HYDRO:** The total capacity for small to medium sized hydro schemes in Uganda is 130 MW. While this total is significant, only part of it can be developed and connected to the main grid in the next 10 years, and some of these will be dedicated to supply local demand only, without being connected to the grid. Feasibility level studies have been completed for two projects totalling about 18 MW. An additional 10-20 MW might be developable in the long term.
- **DEMAND MANAGEMENT:** Demand side management (DSM) programmes are normally designed to shift energy used during peak periods to off-peak periods. DSM programmes are usually associated with tariff incentives to shift demand. With higher onpeak tariffs, cost conscious customers shift their demand to off-peak hours. The total amount of energy consumed does not change but the shift in usage reduces the capacity requirements. SNC Lavalin (2006) examined the potential for DSM in the Lake Victoria Basin countries and concluded that in the

region, and particularly taking into account the present supply deficit, it is not considered that DSM is a realistic option for at least the mid term. Regardless of that conclusion, the GoU has announced a programme to distribute compact fluorescent light bulbs as a measure to manage demand. Another option to reduce demands is to reduce technical losses (reduction in non-technical losses will not reduce demand), which for Uganda is high at 21 percent (SNC Lavalin 2006). Acres (1999) estimated that improvements to the country's failing distribution infrastructure, could eliminate as much as 30 MW of losses from the grid.

- **BIOMASS GENERATION:** In the energy production industry, biomass generation refers to living and recently living biological material which can be used as fuel or for industrial production. Most commonly biomass refers to plant matter grown for use as biofuel biodegradable wastes that can be burnt as fuel. There is some potential in Uganda for the generation of electricity from wood waste, coffee husks and rice husks (ESMAP 1999). However, these biomass resources are considered to be too small and widely disbursed to be economically justifiable for large-scale power generation. There are three sugar factories in Uganda and all generate electricity from bagasse (cane residue) to meet their own factory and irrigation needs. The total installed capacity of the three plants is 7.2 MW. The Kakira Sugar Works has signed a Power Purchase Agreement (PPA) with GoU to supply 6 MW of electricity per day during peak hours (6 pm to midnight) to the Ugandan grid. A second PPA is being discussed which would expand the supply to 12 MW per day from 6 am to 6 pm. There may be potential for similar projects at the other two sugar factories which could provide a further 5-8 MW in total.
- **THERMAL GENERATION:** Thermal generation is an option to produce the required electricity to satisfy Uganda's unmet demand. However, there are no indigenous hydrocarbons (coal, oil, natural gas) presently available which can be exploited and transported to the demand centres of Uganda (e.g. Kampala) where a thermal plant would be located. Exploration for oil in western Uganda has been underway for several years and oil could eventually be available for domestic consumption (Alexander's Gas and Oil Connections, 2001). At present, hydrocarbon fuels would need to be imported resulting in relatively high cost electricity for grid-fed customers and affecting the balance of trade, both of which are significant issues for Uganda. Nevertheless, due to the low water levels in Lake Victoria, Uganda has embarked on selected thermal options to be located in the vicinity of Kampala to bridge the increasing supply deficit present in the country.
- **LARGE SCALE HYDRO:** In Uganda, the Victoria Nile provides several potential sites for development of large scale hydroelectric generation projects. Development of hydro schemes are considered to be the most economical source of reliable and sustainable electricity for the grid in Uganda in the medium to long term, with the cost of generation much less than thermal generation. The

following section provides detailed descriptions of the alternative sites for large scale hydro on the Victoria Nile, and demonstrates why Bujagali is the preferred next project on the River.

4.3 Alternative Hydropower Development Sites on the Victoria Nile

Acres (1999) examined six potential hydropower sites along the Victoria Nile, following on the work of the Hydropower Development Master Plan of Kennedy and Donkin (1997). These sites are presented in Figure 4.3.

Of the sites considered by Acres (1999), Murchison Falls and Kalagala were the “least cost” options in terms of capital costs of construction per MW generated. Bujagali ranked third in terms of least cost. However, of the remaining sites, Bujagali, with its comparatively low social and environmental impacts and potential to generate 250 MW of electrical power, emerged as the preferred location for hydropower development on the Victoria Nile. Acres (1999) recommended that the Kalagala and Karuma projects, the locations of which are shown on Figure 4.3, also be pursued as potential projects to meet the growing electricity demand in Uganda based on the demand forecasts set out in EdF (1998). The Murchison Falls and Ayago projects were dismissed by Acres, as each was in Murchison Falls National Park, a World Heritage Site, and would thus entail unacceptably high environmental impacts. The Masindi Project was also dismissed by Acres as it would have been prohibitively expensive, it precluded any downstream hydropower development projects (e.g. Karuma) and it was only at a conceptual level.

In June 2002 the Minister of Finance, Planning and Economic Development for Uganda wrote to the Vice President of the World Bank confirming the GoU’s intentions to set aside Kalagala exclusively to protect its natural habitat, environmental, and spiritual values for tourism development, and not subject the site to hydropower development. A copy of this letter is provided as Appendix D.1. This was considered as an offset to effects caused by Bujgali, as required by the World Banks policy on Natural Habitats (OP/BP 4.04).

In 2006, the Electricity Regulatory Authority (ERA) of Uganda received an application from a Malaysian entity for a permit to carry out feasibility studies on the Kalaga hydro site. On September 15, 2006 the ERA indicated in a letter to the Malaysian entity that the application was denied, and that the government position on the site is that it continues to be frozen for development purposes. A copy of the letter is provided as Appendix D.2.

BEL is proceeding with development of the Bujagali project on the basis that the Government’s commitments to protection of the Kalgala area will remain in effect. This information was not available when the historical comparative assessment work summarized below was undertaken.

The Inception Report for the Bujagali Project (WS Atkins, 1998) included a brief Comparative Assessment Study of the three potential hydropower development schemes being promoted at that time – Karuma, Kalagala and Bujagali (Figure 4.3).

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Figure 4.3 Potential Hydropower Development Sites on the on Victoria Nile

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The objective of this study was “to provide a basic comparative assessment of the proposals for the three sites on the River Nile, to determine whether the Bujagali project falls within the threshold of acceptability with respect to its environmental consequences.” The study was primarily a desk study review, based on documentation available from the various projects’ proponents at the time, supplemented by brief site visits and limited consultations. This assessment was completed in June 1998 and the report was included in Volume 2 of the EIS submitted to NEMA (WS Atkins, 1999). Table 4.1 provides a comparative summary of the impacts of the Karuma, Kalagala and Bujagali projects, as determined by WS Atkins (1999), and the text that follows the table provides a brief textual summary of each of the projects.

Table 4.1: Summary of Comparative Impacts of Karuma, Kalagala and Bujagali Projects (from WS Atkins, 1999)*

Impact	Karuma	Kalagala	Bujagali
1. Beneficial Impacts			
Energy: Installed Capacity	100 MW	500 MW	250 MW
Employment opportunities	During construction	During construction	During construction
Services and infrastructure	Regional improvement	Regional improvement	Regional improvement
Public health	No significant impact	Reduced risk of onchocerciasis	Reduced risk of onchocerciasis
Fisheries	No significant impact	Potential for lake fishery	Potential for lake fishery
Water birds	No significant impact	Increase in open water habitat	Increase in open water habitat
2. Adverse Impacts: (A) Construction and Reservoir Filling			
Reservoir area excluding river (ha)	No reservoir	1200-1300	250
Land take requirement (ha)	300	1330	238
Estimated permanent land take	50	1300	125
Number of outsees	200	4130	500
kW/land area inundated	No inundation	385	960
kW/number of outsees	500	121	480
Air quality	Deterioration in rural area and Karuma village	Deterioration in rural area and Kangulumira village	Deterioration in rural area
Water quality	Deterioration downstream	Deterioration downstream	Deterioration downstream
Noise and	Impact in rural area	Impact in rural area and	Impact in rural area

Impact	Karuma	Kalagala	Bujagali
vibration	and Karuma village	Kangulumira village	
Erosion and sedimentation	Increased short term risk	Increased short term risk	Increased short term risk
Terrestrial ecology	Loss of small area of riverine forest	Important loss of 330 ha of gazetted forest reserve	No loss of forest vegetation
	Site is located in Controlled Hunting Area, and adjacent to Karuma Sector of MFPN	Loss of 44 ha of breeding habitat for water birds on Nile islands	Loss of 27 ha of breeding habitat for water birds on Nile islands
Aquatic ecology	Reduction in fish biomass in Nile downstream of site	Reduction in fish biomass in Nile downstream of site	Reduction in fish biomass in Nile downstream of site
Social issues	Pressure on limited services	Pressure on limited services	Pressure on limited services, but mitigated by proximity to Jinja
Access	Loss of access to traditional soil, water and wood resources in 300 ha direct impact area	Loss of access to agricultural land area of some 30 ha	Loss of access to agricultural land area of some 20 ha
Transmission lines	80 km to Lira and 90 km to Masindi	24 km to Owen Falls and 70 km Owen Falls to Kampala	8 km to Owen Falls and 70 km Owen Falls to Kampala
2. Adverse Impacts: (B) During Operation			
River regime	No effect on Nile regime downstream of Karuma Falls	No effect on Nile regime downstream of Kalagala	No effect on Nile regime downstream of Dumbbell Island
	Dramatic reduction in flow over 3 km reach and Karuma Falls	Flooding of Kalagala, Busowoko and Buyala Falls	Flooding of Bujagali Falls
Water quality	No Impact	Medium term deterioration after filling	Short term deterioration after filling
Terrestrial ecology	Local effect on riverine forest due to reduction of mist zone at Falls	No direct impact but regional development may lead to further encroachment into Mabira CFR	No direct impact, but regional development may lead to further encroachment into Mabira CFR
Aquatic ecology	Change in composition of fish communities in 3 km reach, and significant impact on ecology of this reach	Potential for water weed growth and deoxygenation in reservoir area outside main Nile channel	No significant impact
Disease vectors	No significant impact	Increase in snail vectors of schistosomiasis in reservoir area	Increase in snail vectors of schistosomiasis in reservoir area

Impact	Karuma	Kalagala	Bujagali
Public health	No significant impact	Increase in risk of schistosomiasis in 1900 ha reservoir area	Increase in risk of schistosomiasis in 388 ha reservoir area
Cultural heritage	No significant impact	No significant impact	Flooding of Bujagali shrines
Tourism and visual amenity	Significant reduction of visual amenity of Karuma Falls	Loss of aesthetic value of Kalagala, Busowoko and Buyala Falls	Loss of aesthetic value of Bujagali Falls
		Loss of white-water rafting opportunity over 15 km reach of Nile below Dumbbell Island	Loss of white-water rafting opportunity over 2.5 km reach from Bujagali Falls to Dumbbell Island

*Figures have been revised since 1999, based upon more detailed site information.

4.3.1 Karuma Project

At the time of the WS Atkins Comparative Assessment Study, a project was being developed by NORPAK Power Ltd at Karuma Falls, approximately 280 km north of Kampala (Figure 4.3). NORPLAN A.S. had been commissioned to prepare a Project Concept Report (April 1996) and subsequently a preliminary EIA (October 1997). They were subsequently engaged to carry out a full feasibility study and EIA.

The project involved the construction of a run-of-the-river hydropower development 3 km upstream of the Karuma Falls, short power tunnels to an underground power station, and tailrace tunnels discharging below the falls. As a first stage, an installed capacity of 100 MW was planned with a total planned capacity of 5 x 20 MW units using a maximum diverted flow of 450 m³/s. An amenity flow of 1,040 m³/s over the falls would be maintained. The tunnels to the powerhouse would be 75 m in length and the tailrace tunnel 2,900 m. The project also included an option for a further development stage involving the construction of a regulating dam, although this was not being considered at the time the comparative study was conducted.

The permanent structures, construction works, spoil dumping areas and housing and offices would be located on the south bank of the Nile. A total length of 3.5 km of access roads would be required from the Kampala-Gulu road.

The main impacts on the natural environment were considered to be:

- The visual amenity effects of a 30 percent reduction in flow over the falls, particularly with the site being adjacent to Murchison Falls National Park;
- A change in the composition of fish communities in this reach of the river; and,
- A change in the local riverine forest structure due to a reduction in mist and spray at the falls.

It was estimated that some 35 families would be physically displaced by the project and that the influx of construction workers to this relatively remote area would bring both economic benefits (e.g. jobs, investment) and potentially adverse social impacts (e.g. “boom town effect” with inadequate social services, HIV/AIDS).

Subsequent to the WS Atkins Comparative Assessment Study, a full EIA was prepared for the Karuma Project (NORPLAN A.S., 1999). This study was submitted to NEMA in May 1999. A public hearing at the proposed project site took place in November 1999. The project, as described in NORPLAN (1999), is designed to have a 200 MW capacity (4 X 50 MW turbines) with NORPAK installing three turbines and the Government of Uganda having the option of installing the fourth. The tailrace tunnels are 2.2 km long (one for each turbine) and the amenity flow through the affected portion of the Nile will be maintained at a minimum of 50 m³/sec.

In 2004, the developer for Karuma was invited by the GoU to negotiate a power purchase agreement and by early 2006 Norpak has reported that most of the resettlement for the hydrosite was complete (Power Planning Associates, 2006). No further information was known on the status of the project as of the writing of this SEA Report.

4.3.2 Kalagala Project

The Kalagala site is located about 24 km downstream of the Nalubaale facility at Jinja (Figure 4.3). The Kalagala project evaluated in the WS Atkins Comparative Assessment report was the one proposed in the Hydropower Development Master Plan (Kennedy and Donkin, 1997), modified by discussions with Arabian International Construction who were developing the project at that time. It consisted of a combined intake dam and surface powerhouse, a gated spillway, short lengths of gravity dam and flank embankments. The project was conceived as a two-stage development, with the first stage providing 250 MW and the ultimate installed capacity being 500 MW.

The main impacts on the natural environment were considered to be: the extensive land take; the inundation of parts of three Forest Reserves totalling 330 ha; the loss of Kalagala, Busowoko and Buyala Falls; and, a beneficial impact on fisheries. It was estimated that over 4,000 persons would be displaced, and that there would be a severe impact on white water rafting activities. The risk of schistosomiasis was expected to increase whilst the risk of onchocerciasis would decrease.

Press reports in mid-2006 indicate that a sponsor was reconsidering a version of the Kalagala project, including an environmental and social impact study, for consideration by Ugandan authorities. However, the GoU has denied the application, indicating that the site remains frozen for development purposes (Appendix D.2).

Thus, BEL is proceeding with assurance from the GoU that it remains committed to preserving the Kalagala site for environmental, cultural and tourism purposes as stated in its letter of June 2002. Companies that offer rafting and other tourism activities along the Nile have already begun developing tourism infrastructure in the Kalagala area, including new tourist lodges. Development of a vibrant and sustainable tourism programme at Kalagala is expected to further strengthen the protection of the site. BEL intends to seek ways to support these initiatives.

4.3.3 Bujagali Project

At the time of the WS Atkins Comparative Assessment Report, the Bujagali project was at an early stage of development. An initial Scoping Report was produced in 1997, but the Feasibility Study (Knight Piésold /Merz and McLellan, 1998) had not yet been completed and the full EIA had just commenced.

The project configuration evaluated was described as a combined intake dam and powerhouse, a gated spillway and emergency spillway, a rockfill embankment dam abutting the east side of the spillway and a short length of embankment or concrete gravity dam on the left flank. The installed capacity would be 250 MW.

The main impacts on the natural environment from the Bujagali project were considered to be:

- The land take;
- The inundation of Bujagali Falls; and,
- A positive impact on fisheries.

It was estimated that about 500 people would be displaced and that commercial white water rafting would no longer be possible on the 2.5 km stretch of the river between Bujagali Falls and Dumbbell Island. The public health impacts were considered to be similar to those at Kalagala, but reduced in scale in proportion to the reduced reservoir size.

Based upon the actual resettlement programme completed by AES Nile Power the number of physically displaced persons was 634 individuals. As well, the footprint of the proposed Bujagali hydropower facility project has been revised, resulting in a slightly modified landtake. A detailed description of the preferred project is provided in Chapter 5 of this Report.

4.3.4 Conclusions of the WS Atkins Comparative Assessment Report

WS Atkins (1999) wrote:

‘In terms of positive economic impacts, Kalagala clearly has the greatest installed capacity, twice that of Bujagali and five times that of Karuma. A 500 MW scheme

represents a very substantial step increase in the installed capacity, by a factor of almost three, and it must remain questionable as to whether the UEB system could cope with this increase without significant alteration.

The land take and overall area of direct impact is greatest at Kalagala, and the potential number of oustees much higher. When these impacts are related to power generation capacity, the ratio of power output to the area inundated and the number of oustees (Goodland, 1997) is lowest [or least efficient] at Kalagala.

The nature of the effects on the natural environment are similar at both Kalagala and Bujagali, but the scale of the impact will be higher at Kalagala. In particular, the larger impoundment behind the Kalagala dam will result in the loss of significant areas of gazetted forest. The ecological impacts of the schemes will be least at Karuma. The impact on the landscape and potential tourism value is also likely to be highest and most widespread at Kalagala, although Karuma Falls will be dramatically affected by the Karuma scheme. The impact on the landscape at Bujagali will be less severe, and the Kalagala reservoir will drown out a greater length of the reach of the Nile currently used for white water rafting activities.

In terms of the socio-economic effects, the potential for stimulating development is possibly greatest at Karuma, due to the lower overall level of economic activity and the poorer standards of living in the surrounding area. The extent of social disruption and disturbance, especially during construction, is however likely to be greatest for the Kalagala scheme and lowest at Bujagali.

In summary, the Kalagala scheme will provide a very large increase in power, but will have the greatest overall environmental and socio-economic impacts. Karuma is likely to have the least overall environmental impact, but generates the lowest amount of power, whilst Bujagali will have a relatively low environmental impact whilst generating substantial amounts of power.'

Based on the earlier analysis, the Bujagali site was confirmed to be the most desirable site on the Victoria Nile in Uganda for the next hydropower development.

In addition and more recently, SNC Lavalin (2005, 2006 (draft)) prepared as part of the Nile Basin Initiative the "Strategic/Sectoral, Social and Environmental Assessment of Power Development Options in The Nile Equatorial Lakes Region" (SSEA). The objective of this SSEA of Power Development Options was to serve as an instrument to prepare the World Bank and other investors for possible requests to support power development programmes in the Nile Equatorial Lakes area and to assist riparian countries in Nile Equatorial Lakes Region with their selection of supply options (including interconnections) by contributing to informed and transparent decision-making before major funds to investigate individual options are committed. The expected result of the study was to be better definition of the actions

that must, in the advancement and approval of new generation and transmission projects, be taken to improve electricity supply, in terms of reliability of supply, cost, environmental and social acceptability, and regional integration.

The SSEA report states that, of all the electricity supply options studies and evaluated across the ten countries that are within the Nile Equatorial Lakes Region, Bujagali was one of three projects that “should be implemented as soon as possible,” as Uganda is suffering from serious power outages. It identified Bujagali as a project that could be installed in the short to mid-term, at low cost and with acceptable environmental and social impacts.

Most recently IFC has commissioned Power Planning Associated to prepare an Economic and Financial Evaluation Study to determine the viability of the Bujagali HPP. The preliminary results for that study, which is expected to be published in the first quarter of 2007, indicates that Bujagali is the least cost option compared to Karuma. Bujagali was costed at approximately USD 366 million, compared to approximately USD 550 million for Karuma. These costs are expected to be refined, however, it is expected that the significant difference between the costs will remain. Power Planning Associated was not costing Kalagala as the project was considered to be not feasible due to the GoU commitment to the Kalagala Offset.

4.4 Evaluation of Alternative Hydropower Development Configurations at Bujagali

The Inception Report (WS Atkins, 1998) and scope of work for the EIA included a requirement that alternative options at, and around, the Bujagali site also be investigated. The objective of the study was to “compare and evaluate options that have been developed for Bujagali, in order to provide the rationale for the selection of the preferred scheme. The key considerations in the comparison are the potential power output of the different schemes, their financial costs and their relative environmental and socio-economic implications.”

The assessment was undertaken by WS Atkins, in association with engineering consultants Knight Piésold, and was completed in June 1998. The report was included in Volume 2 of the EIS submitted to NEMA (WS Atkins, 1999). Five configurations for the dam had previously been considered by Acres in 1990 in connection with the feasibility of expanding the Owen Falls power station at Kyabirwa Falls, Bujagali Falls (the “B1 Configuration”), Buyala Falls (two alignments) and Busowoko Falls. These were briefly re-examined and costed. In addition, two further configurations were identified, one a diversion canal at Bujagali to avoid the inundation of Bujagali Falls (the “B2” configuration) and the other at Busowoko Falls with a lower full supply level (FSL), again to preserve the falls and the river downstream to Dumbbell Island. The locations of these various options are shown in Figure 4.4.

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Figure 4.4 Potential Hydropower Development Sites Around Bujagali

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The technical and economic issues considered included the cost and timescale of the Stage 1 diversion, the total project cost, the overall duration of the construction programme and the installed capacity in relation to the needs of the Ugandan electricity system. The key environmental issues considered were the loss of land through inundation, land take for permanent works, temporary occupation of land for construction purposes, displacement of the local population, potential inundation of sites of cultural significance and impact on tourism and recreation activities.

The report concluded that “the preferred [B1] option is the most favourable from a technical and economic viewpoint whilst the lower FSL option at Busowoko Falls would preserve Bujagali Falls and the river channel downstream to Dumbbell Island.” It also noted that a development at Busowoko Falls would have a major negative impact on possible future development at Kalagala downstream, a project which was being actively promoted at that time.

Following the completion of the Feasibility Study in July 1998 and, as a result of progress on the EIA for the preferred scheme, a review of the June 1998 assessment was carried out during 1999 / 2000. The review included two further options considered at Busowoko by Knight Piésold (1998) in the Feasibility Study – one designed to retain Dumbbell Island and Bujagali Falls and one for direct comparison with the preferred option, in terms of gross head and installed capacity. In addition, further consideration was given to the differences in environmental impact between the “B1” and “B2” options at Dumbbell Island. Comparative sketch designs were generated for both of the B1 and B2 options, reproduced herein as Figure 4.5 and Figure 4.6.

The results of the analysis of all options are presented in Table 4.2. The results of the more detailed analysis of the two options at Dumbbell Island (i.e. B1 vs. B2) are shown in Table 4.3.

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Figure 4.5 “B1” Alternative Configuration at Dumbbell Island

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Figure 4.6 “B2” Alternative Configuration at Dumbbell Island

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Table 4.2: Summary of Comparative Impacts of Alternative Configurations at Bujagali (Adapted from WS Atkins, 1999)

	Kyabirwa A	Bujagali B1	Bujagali B2	Buyala C	Buyala D	Busowoko E1	Busowoko E2	Busowoko E3	Busowoko E4
Scheme Characteristics									
Installed Capacity (MW)	140-200	250	200	200-280	210-300	300-400	210-300	180-260	120-180
Construction duration (yrs)	4.25-4.75	4.0-4.5	4.0-4.5	4.75-5.25	4.75-5.25	5-5.5	4.75-5.25	4.5-5	4.25-4.75
Project Cost (US\$m)	360	330	405	430	440	570	490	440	390
Reservoir Inundation Area (ha)	280	405.5	189	660	740	2437	1401	1082	426
Land take requirement (ha)	170	290	285 (+66)	460	510	2150	1340	1155	390
Full Supply Level (FSL)	1111.5 m	1111.5 m	1111.5 m	1111.5 m	1111.5 m	1111.5 m	1101 m	1097 m	1089.5 m
Impacts on Natural Environment									
Water Quality/Aquatic Ecology									
- construction	M	M	M	M	M	M/H: diversion works	M/H: diversion works	M/H: diversion works	M/H: diversion works
- operation	L: run-of-the-river	L: run-of-the-river	L: reduced downstream flow	L: run-of-the-river	L: run-of-the-river	M: low flow in reservoir arms	M: low flow in reservoir arms	L	L
Terrestrial Ecology									
- construction	M: diversion channel	M: large dam	M: head-tailrace channel	M: diversion channel	M: diversion channel	H: bridges, large dam, borrow areas	M: large area	M: large area	M
- operation	L	L	L	L	L	H+: Mabira CFR + 150 ha wetland	H: 100 ha wetland	M: 80 ha wetland	L: small wetland area
Socio Economic Impacts									
Population displacement	190-210	370 approx.*	610 approx	250-270	380-400	760-850	125-150	100-125	25-50
Agriculture (based on land take figures)	L	M	H	H	H	H+	H+	H+	M
Fisheries	L: Slight increase upstream	L: Slight increase upstream	L: Slight decrease downstream	L: Slight increase upstream	L: Slight increase upstream	M: Moderate increase upstream	M: Moderate increase upstream	M: Moderate increase upstream	L: Slight increase upstream

	Kyabirwa A	Bujagali B1	Bujagali B2	Buyala C	Buyala D	Busowoko E1	Busowoko E2	Busowoko E3	Busowoko E4
Tourism	H: Loss of 1.5 km of WWR; impact on proposed hotel	H: Loss of 3 km of WWR	M: WWR Could continue, but with reduced flow	H: Loss of 4.5km of WWR	H: Loss of 5km of WWR	H+: WWR Unviable	H+: WWR Only possible at Bujagali Falls	H+: WWR Only possible at Bujagali Falls	H+: WWR Only possible Bujagali to Dumbbell Island
Culture – Impact to <i>Amasabo</i> Sites	M: Likely to require relocation	M: Likely to require relocation	L: Unlikely to require relocation	M: Likely to require relocation	M: Likely to require relocation	M: Likely to require relocation	None	None	None
Disease vectors	L: Increase in schisto-somiasis	L: Increase in schisto-somiasis	L: simulum risk	L: Increase in schistosomiasis	L: Increase in schisto-somiasis	M: Schisto-somiasis & malaria risk	M: Schisto-somiasis & malaria risk	L: Schisto-somiasis risk	L: Schisto-somiasis risk
Landscape	M: Loss of Bujagali Falls and picnic site	M: Loss of Bujagali Falls and picnic site	M: Major impact at Bujagali Falls	M: Loss of Bujagali Falls and part of picnic site	M: Loss of Bujagali Falls and part of picnic site	H+: Loss of falls and picnic site. Loss of large number of falls and islands	H: Loss of large number of falls and islands	H: Loss of large number of falls and islands	M
Access									
-length of road (km)	4.0	3.0	2.0	3.7	3.6	7.5	7.5	7.5	7.5
-bridging required	None	None	None	None	None	4	2	1	None
Access to river									
-construction	M	M	H	M	M	M	M	M	M
-operation	L	L	H	L	L	L	L	L	L
Construction Disturbance (Noise, Air, Vibration)	H: Hgh in Kikubamu twe; medium at Buloba and Naminya	H: High in Kikubamutwe and Namizi	H: High in Kikubamutwe and Naminya	H: High in Buyala and Kikubamutwe	H: High in Buyala and Kikubamutwe	H: High in several villages on both banks	H: High in several villages on both banks	H: High in several villages on both banks	H: High in several villages on both banks

H+= VERY HIGH, H= HIGH, M= MODERATE, L= LOW

* Refer To Section 6.24 Of The Resettlement Action Plan In AESNP (2001) For Details On Why Number Of Displaced Persons Has Changed Since This Study

Table 4.3: Comparative Impacts of B1 and B2 Alternative Schemes at Dumbbell Island

Scheme Details	Scheme B1	Scheme B2
Maximum Installed Capacity (MW)	250	200
Construction Duration (Years)	4 to 4.5	4 to 4.5
Project Cost (USD million)	L	H
Construction Features	Dam 26-30 m high	2 dams 5-10 m high, 4 km of canal, spoil dump
Access Road requirements	3 km	2 km
Extent of Inundation	Higher elevations of some of islands at Bujagali remain.	All islands retained. Lower margins of islands and riverbanks exposed. Flow reduced by 80%
Reservoir Area (Ha)	405	189
Land Area Inundated (Ha)	156	33
Land Acquisition Area (Ha)	290 (100 temporary, 190 permanent)	285 plus 66 ha severed. Total 351 (165 temporary, 186 permanent)
Maximum Number of Employees	920 (Opportunities on both banks)	1040 (Opportunities mainly on west bank)
Impact On Natural Environment		
Impact on Hydrology	L (smaller water level fluctuation)	M (greater water level fluctuation)
Impact on Water Quality / Aquatic Ecology		
- Construction	M	M
- Operation	L (Run of river scheme)	L
Impact on Terrestrial Ecology		
- Construction	L	M
-Operation	L	L
Impact On Socio-Economic Environment		
Impact on Agriculture	M	H
Impact on Fisheries	L (Slight increase upstream)	H (Slight decrease downstream)

Scheme Details	Scheme B1	Scheme B2
Impact on Tourism	H (WWR not possible on 3 km section)	H (WWR may be possible but with reduced flows, 3 km section affected)
Impact on Local Economy	H (Positive)	M (Positive)
Number of plots affected	712	Likely to be similar to B1 (1)
Number of Households to be resettled	44	73 (2)
Estimated Population to be resettled	Approximately 369	Approximately 613 (2)
Impact on Landscape	M (Creation of lake landscape, one large dam)	H (Flow reduction, creation of canal and spoil dump, two smaller dams)
Impact on Culture / Heritage	L	L
Access to River		
- Construction	M	H
- Operation	L	H
Access across river	Access road probable	Access road possible
Construction Disturbance	H	H (Mainly confined to east bank)
Public Health	L (Potential increase in schistosomiasis)	L (Potential increase in onchocerciasis)

(1) Accurate estimate dependent on cadastral survey in affected area

(2) Excludes resettlement due to road on east bank

The B2 diversion canal option, if constructed, would consist of two dams 5-10 m high and a gated intake immediately upstream of Bujagali Falls. This would divert water – 80 percent of the river's flow – into a headrace canal on the west bank which would lead to a powerhouse, followed by a tailrace which would discharge below Dumbbell Island. The balance of the river's flow (20 percent) would continue down the existing river channel. The diversion canal would be 4 km in length, between 150 to 200 m in width and up to 50 m deep. The volume of material to be excavated from the canal would be approximately 8.9 million m³, necessitating an 85 ha spoil dump of 10-15 m in height. The land between the canal and the river would be inaccessible post-construction and unavailable for agricultural purposes.

In terms of the effects on the natural environment, WS Atkins concluded that, during construction, each of the two configurations would likely exacerbate sediment loading into the river, affecting aquatic life and fisheries downstream. During operation, these siltation effects were predicted to be minimal. With respect to fisheries, WS Atkins concluded that the B1 configuration's impact on fisheries would be positive due to the creation of the reservoir whereas, with B2, there would be a negative impact due to the reduction in flow downstream of the intake.

In terms of the impact on the socio-economic environment and in particular economic activities (agriculture, fisheries, tourism and development of the local economy), the impact is significantly worse for the canal option. The number of households displaced is likely to be about 66 percent worse with the canal option. Access both to, and across, the river would also be significantly worse with the canal option. The benefits of the B2 scheme in terms of employment and compensation would also be unevenly distributed between the two banks.

In terms of the landscape impact and retention of the falls, the preferred B1 option would result in the construction of a large (30 m) dam and the transformation of the river into a slow flowing lake, together with the inundation of the falls and parts of the islands at Bujagali. The B2 diversion canal option would result in the construction of two smaller dams. While the Bujagali Falls and area islands would be retained, there would be a drastic reduction in flow in the river (down to 20 percent of current flow). This configuration would also result in the construction of a large canal with concomitant spoil heap features that could only be mitigated in part. The visual impact on the landscape character and quality of the area was considered to be greater with the canal option than the B1 option (WS Atkins, 1999).

The review assessment therefore concluded that the preferred B1 option is more favourable not only on technical and economic grounds but also from an environmental perspective.

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5.0 Project Description, Construction, Operation and Decommissioning

5.1 Life Cycle Overview

A life cycle analysis identifies the major issues and concerns that are likely to evolve over the life of a project. The project life cycle includes activities that will take place and facilities that will be constructed and operated during the following phases:

- Pre-construction;
- Construction;
- Operations; and,
- Decommissioning.

The specific activities to take place include:

- Procurement and transportation to site of construction materials (e.g., concrete) and manufactured equipment (e.g., turbines);
- Activities required to construct the hydropower facility including construction of temporary haul roads and coffer dams, and operation of quarries and borrow areas;
- The permanent physical presence of the hydropower facility, including the dam and power station, spillway, ancillary buildings and substation;
- Hiring and management of construction phase and operations phase labour forces, and provisions for their accommodation and their welfare;
- Operation and maintenance of the hydropower facility; and,
- Activities related to the eventual decommissioning of the facilities.

The execution of these activities will result in the potential for environmental and social impacts. Thus, the following sections identify and describe the key activities to be completed, the environmental performance standards to be adhered to, and the facilities to be constructed and operated over the lifetime of this project. The understanding of how these activities and facilities shall affect biological, physical, and socio-economic conditions in the project affected area will form the basis for the prediction and assessment of the potential impacts of the project, as presented in Chapter 7 of this SEA Report.

BEL will hire a contractor for the detailed engineering, procurement and construction of the HPP (EPC Contractor). At the time of writing, the EPC Contractor had not been identified. Thus, the descriptions provided herein has been taken from the design developed as part of the package provided to prospective EPC Contractors. It is expected that the information provided herein will be supplemented, as appropriate and if needed, with periodic updates to this SEA once the EPC Contractor has been selected and initiated the detailed planning and design for the Project.

5.2 General Project Description

The HPP site is located at Dumbbell Island, approximately 8 km downstream of the Town of Jinja and 9 km north of the in the existing Nalubaale and Kiira dams that are located at the outlet of Lake Victoria (Figure 1.1). At Dumbbell Island the river will be dammed by an approximately 30 m high rock filled dam and associated spillway works. The dam will impound a reservoir that extends 8 km upstream to the Nalubaale dam. The reservoir will have a surface area of approximately 388 ha at Full Supply Level (FSL), which is considered to be at elevation 1,111.5 m AMSL. The reservoir, the areal extent of which is shown in Figure 5, will provide live storage of 12.8 million m³ of water. The total volume of water at FSL will be 54.0 million m³.

A powerhouse will be constructed at the dam housing 5 x 50 MW vertical-mounted Kaplan turbine generation units that together, will provide a maximum generating capacity of 250 MW of electricity. Permanent access to the facility will be from the Jinja to Kayunga road on the west bank of Nile, branching off from the main road at a point about 8 km north of the existing Nalubaale Dam. A high voltage substation, to be known as the Bujagali Substation, will be located on the west bank of the Victoria Nile adjacent to the dam and power house. This substation will be designed and constructed to allow operation at 220 kV, but initially operated at 132 kV. In the future, switching operation to 220 kV would require installation of new step-up transformers, 220 kV bus and associated circuit breakers and protective equipment and possible minor on-site relocations of some of the power lines. BEL will build and operate this facility as part of the HPP. All power from the HPP destined for the national grid will flow through this substation.

Figure 1.2 provides a general layout for the HPP showing the dam, spillway, power house, substation and access road.

Two hundred and thirty eight hectares of land has been obtained for the project. Figure 5.1 shows the extent of the land acquired for the HPP and the extent of land to be inundated. Eighty hectares will be newly inundated land, with the balance of the acquired land needed for the facilities listed above as well as temporary facilities needed during construction. These temporary facilities include haul roads, coffer dams, laydown and storage areas, and quarries.

In addition to the facilities listed above and that will be built and operated by BEL, there will also be new electrical transmission facilities built and operated by UETCL for the purposes of interconnecting the HPP with the National Grid. The associated transmission facilities, which are referred to as the Bujagali Interconnection Project (IP), are described in Section 5.11:

Figure 5.1 Permanent and Temporary Land Takes

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5.2.1 Hydropower Facility Location and Layout

The HPP site is located on the Nile River about 8 km downstream of the existing Nalubaale Hydropower Dam at a point where Dumbbell Island splits the river into two channels. The advantages of constructing a dam at this site include:

- The steep banks that limit flooding to a small area and provide for good abutments for the dam itself; and,
- The presence of Dumbbell Island facilitates the construction of cofferdams during river diversion and thus enables a short construction period.

The permanent facilities include:

- Intake structure;
- Power station, housing 5 x 50 MW turbine generator units, services bay and control building;
- Main gated spillway west of Dumbbell Island and a siphon spillway to the east of Dumbbell Island;
- Rockfill embankment, with a maximum height of 30 m;
- Abutments;
- High voltage electrical substation;
- Workshop and stores building;
- Emergency power generation;
- Water treatment plant;
- Access roads; and,
- Impoundment.

The layout comprises an embankment across the eastern channel at the downstream end of Dumbbell Island, with the powerhouse and spillway located in the western channel. The river will be diverted through the eastern channel to allow construction of the concrete structures, and then re-diverted through the spillway to allow the main embankment to be completed. The total construction time for the development will be in the order of 44 months.

Table 5.1 provides a summary of the hydropower facility's specifications. Details are provided in the following sections. Technical drawings of the general layout and the various components of the hydropower facility are provided in Appendix E.

Table 5.1: Specifications for the Bujagali Hydropower Facility

Description	Specification
Nile River existing surface area from C/L of dam to Nalubaale dam (ha)	308.0 ha
Reservoir area (ha) after inundation (excluding islands)	387.7 ha
Storage flows (in hours)	2.75 hours at peak output*
Live storage volume of impoundment	12.8 Mm ³ Live 54.0 Mm ³ Gross*
Impoundment filling time	7 to 10 days (estimate)*
Impoundment flow rate (m ³ /s)	63 m ³ /s - 90 m ³ /s*
Energy production at peak output (hrs)	5 hrs (250 MW)
Retention time of water in impoundment	0.7 - 1.2 days*
Length of shoreline	Approximately 28.7 km at FSL and approximately 37.5 km at extreme drawdown
FSL	1111.5m AMSL
Minimum Operating Level	1109.5 m AMSL
Energy water head (m)	19.7 m - 21.9 m*
Firm Energy (GWh) Min and max flows (100 yr) 95% probability	923 GWhr/yr 493 m ³ /s - 605 m ³ /s*
Average Energy (GWh) Min and max flows (100 yr) 50% probability	1438 GWhr/yr 797 m ³ /s - 937 m ³ /s*
Hydrology long term mean outflow range m ³ /s	660 m ³ /s - 1200 m ³ /s*
Median flow rate (100 yr data)	870 m ³ /s*
Plant load factor	0.66 (based on Flow of 840 m ³ /s)*
LAND TAKE	
Total land take, permanent + temporary (ha)	238 ha
Permanent land take, not inundated (ha) Total	44.9 ha
West bank	25.17 ha
East bank	6.67 ha
Islands and river D/S	13.06 ha
Permanent land take, inundated (ha) Total	80.0 ha
Islands	35.28 ha
Riverbank	44.72 ha
Temporary land take (ha) Total	113.0 ha
West bank	106.1 ha
East bank	6.9 ha
Area of access roads both temp and permanent (ha)	6.9 ha Temporary on East Bank 1.1 ha Permanent on West Bank

Description	Specification
Reservoir Characteristics: Full Supply Level Maximum Flood Level Minimum Operating Level Gross Storage Live Storage Maximum Tailwater Level	1111.5 m AMSL 1112.0 m AMSL 1109.5 m AMSL 54.0 Mm ³ (El 1111.5 m AMSL) 12.8 Mm ³ (El 1108.0 m AMSL) 1092.5 m AMSL (4500 m ³ /s)
Intake: Type Sill Invert Level Trash Screen Size Intake Stoplogs Intake Gates	Integral Intake and Power Station 1081.5 m 2 - 9 m wide x 17 m high. 2 - 9 m wide x 17 m high 5 - module stoplogs 2 – 9 m wide x 10 m high wheel gates
Power Station: Location Total Installed Capacity Number of Turbines and Type	Surface type in left channel around Dumbbell Island 250 MW 5, Vertical Axis Kaplan
Maximum Discharge Draft Tube Gate Size Tailwater Level at Station Output (250 MW)	1375 m ³ /s approx. 2 - each 9 m wide x 6 m high approx. 1089.5 m approx.
Turbines: Reservoir level 1111.5 m Output at 22.0 m gross head Discharge at 22.0 m gross head	50 MW 275 m ³ /s
Generators: Maximum Output Transformer Type	62 MVA (Power factor 0.85 lagging to 0.95 leading) Oil Immersed
Spillways: Maximum Discharge – Total for all Spillways Gated Spillway: Maximum Discharge Sill Level/Clear Width/Height Number of Gates/Type	4500 m ³ /s Flap Gate 300 m ³ /s Radial Gates 3000 m ³ /s Radial Gates 1081.5m AMSL/19 m/10.5 m Flap Gate. 1 Flap, 2 Radial

Description	Specification
Size of Gates Siphon Spillway: Maximum Discharge Crest Level/Clear Waterway Length	Flap Gate: 12 m wide x 8 m high approx Radial Gates: 9.5 m wide x 10.5 m high approx. 1,200m ³ /s 1111.5 m AMSL/80 m
Dam: Type Height (estimated maximum) Crest Level/Length Extreme Drawdown Level	Clay core rock Fill dam 30 m 1114.5 m AMSL/560 m approx. 1106.5 m AMSL
Bujagali Sub Station: Voltage Type	132 kV (initial phase) Outdoor Open Terminal, Double Busbar, Single Circuit Breaker

Source: Knight Piésold, 1998 and 1998b, updated 2000.

*Data based on currently available hydrological data.

5.2.2 Power House

The power station is designed to house the complete generation plant and all five units, and to carry out all operational and maintenance related activities.

There will be the provision for access for the maintenance and repair of the hydroelectric plant, and all essential services and components that may require frequent attention. Such equipment will be arranged such that operational, maintenance and refurbishment related activities can be undertaken swiftly and efficiently, and without affecting the remaining units in service.

The machine hall will be sized to accommodate five vertical Kaplan turbine driven generating sets together with a services and unloading bay area suitably located. The services and unloading bay will provide sufficient space to permit the future laydown, disassembly and working space for the overhaul and refurbishment of one turbine and one generator at the same time and will allow for normal access and unloading space for the routine maintenance of the remaining units in service. The layout of the machine hall will permit the power station cranes to traverse all five generating sets and the services and unloading bay with all items of equipment within the hook approach limits.

The power house will be arranged on levels creating sufficient floor area to accommodate all necessary power house and auxiliary services including cooling water systems, hydraulic pumping sets, oil purification systems, small power, lighting

and ventilation equipment, drainage and dewatering equipment, compressed air systems and control and ancillary electrical equipment.

The generator transformers will each be located in a dedicated bay, suitably separated by blast walls and confined to prevent the spread of fire. Each transformer will be mounted within a concrete enclosure capable of containing the entire contents of the oil in each unit. All drains will be valved and routed through suitably sized oil separation tanks.

The standby diesel generating set will be housed in a separate building. All drains for the standby diesel generator house and for the areas around the daily and main diesel storage tanks will be valved and routed through suitably sized oil separation tanks.

A control building will be provided as an integral part of the power house structure. The control block will include the following:

- Control Room with windows overlooking the machine hall and tailbay area;
- Office accommodations;
- Washroom facilities;
- Instrumentation and Control Engineers office (adjacent to Control Room and where the DCS engineer's console will be installed);
- General office/Conference Area (for 25 to 30 people);
- Secretarial/Reception Area;
- Copier/fax and supplies room;
- Kitchen/lunch area; and,
- Telecommunications room, relay rooms, switchgear rooms, cable spreading and battery and associated charger rooms.

The Control Room and office accommodation will be air conditioned and constructed with sound-proofing, thermal insulation and protected from vibration. All areas within the power station and control building will have a minimum of two means of exit, one of which may be in the form of an external fire escape. The main stairwell serving each floor level will be enclosed to prevent the ingress of smoke in the event of fire. The control building will have a main external entrance door and canopy independent from the power station, leading to a stairwell serving all floors. A passenger lift will be provided in the office/administration area if any of the offices or administration facilities are not located on the ground floor.

The power station machine hall will have, as a minimum, one exit door at each end for personnel use and one door leading to the control block stairwell. The services bay will be provided with at least one external door, suitably sized for fully loaded transport vehicles to load and off load all necessary items of power station equipment.

Access will be available onto a walkway at crane beam level, which extends around the perimeter of the machine hall. This walkway will provide access to the power station cranes and facilitate maintenance of the machine hall lighting and roof services.

5.2.3 Power Station Intake Structure

The power intakes will be capable of operating over the full range of Head Pond levels and turbine discharges without hydraulic instability or vortex formation. Adequate submergence will be maintained to prevent air being drawn into the water flow or floating trash being drawn against the screens from the water surface. The power intakes will be designed to operate entirely separately so that any one unit may be shutdown and dewatered while the other units remain in operation. An access bridge will be provided across the intake structure.

A grouting and drainage gallery will be located at the upstream toe of the intake structure to enable secondary remedial grouting without taking the structure out of service. Provision will be made for isolating and draining the gallery using temporary equipment.

Floating trash, water hyacinth and other forms of buoyant matter will be removed from the reservoir and prevented from reaching the power intake structure.

5.2.4 Workshop and Stores

Workshop and stores facilities will be provided with the following features:

- A workshop with a floor area of at least 250 m² and an electric overhead travelling crane. The workshop will have a large secure bay door suitable for truck access, together with two personnel doors. Services will include lighting, small power and ventilation;
- A tool shop with two personnel doors will have a floor area of at least 100 m². Services will include lighting, small power and ventilation;
- A secure stores area with a floor area of at least 150 m² will be equipped with all necessary shelving units, cabinets, pallet racking units and storage space for routine operations of a facility of this size. Services will include fire containment, lighting, small power and ventilation;
- A flammable materials stores building will be located in an area remote from the power station, for the containment of volatile materials including paint, acetylene bottles, etc.;
- Showers, toilets, locker room and mess facilities (these will be of a minimum functional standard for both men and women). Services will include lighting, small power, ventilation, hot and cold water and potable water and a suitable wastewater and domestic sewage disposal system; and,

- A first aid room suitably equipped for the power station staff.

5.2.5 Spillways

The capacity of the spillway system will be at least 4,500 m³/sec at freeboard conditions appropriate for the type of dam that is selected. The maximum permitted water level in the reservoir under any flood condition will be 1,112 m.

The spillway will be dimensioned such that the reservoir water level can be drawn down and held at 1,106.5 m with a continuous discharge of 1,500 m³/s from the Nalubaale station. To achieve this a proportion of the flow may be discharged through no more than two turbines, although this will be subject to the operational requirements specified by the manufacturer of the turbines.

The spillway system will be a gated structure. The layout will provide flexibility and reliability of operation, and will comprise a minimum of two low-level radial gate bays of approximately equal capacity and a high-level flap gate. The gate bays will be designed to operate entirely separately, such that any one bay may be taken out of service and dewatered with the other bays remaining in operation.

The crest and waterway geometry downstream of the gates will be designed to minimise the formation of sub-atmospheric pressures and preclude under all circumstances the formation of vapour cavities in the flow. Suitable energy dissipating features will be incorporated in the design of the spillway system such that the velocity of flow re-entering the natural river channel does not cause erosion of the river banks or transportation of river bed materials downstream.

A grouting and drainage gallery will be provided at the upstream toe of the spillway structure such that secondary remedial grouting may be undertaken without taking the structure out of service. Provision will be made for isolating and draining the gallery using temporary equipment.

Provision will be made in the design of the structure for all gates, stoplogs, hoists and associated equipment to be fully accessible and recoverable for inspection, maintenance refurbishment or removal from the Complex.

Floating markers to warn small boats and other lake craft not to proceed towards the structure will protect the upstream approach to the spillway. Suitable prominent warning signs will be provided both upstream and downstream of the spillway. A powerful electric horn (klaxon) will be provided to give an audible warning that spillway discharge is about to commence. BEL will meet with downstream stakeholders prior to the start of operations to discuss the operations plan and warning systems.

5.2.6 Dam Embankment

The dam across the Nile River has been designed with a crest elevation of 1,114.5 m AMSL, assuming a Maximum Flood Level (MFL) of 1,112.0 m and a FSL of 1,111.5 m. The latter elevation will allow for a maximum discharge of 4,500 m³/s. The height of the dam will be approximately 30 m.

A paved vehicular service way will be provided over the dam crest. The service way will be unimpaired by operating gantries, instrumentation access points and all other facilities associated with the operation and maintenance of the Complex.

Suitable freeboard values will be adopted in the design to suit the type of dam construction, and based on considerations of settlement, wave height, wave run up and extreme flood conditions.

Access to the crest of the dam will be provided from the west bank. A turning area will be provided on the east bank and the passage of vehicular or pedestrian traffic beyond the turning area will be prevented by an immovable barrier and security fencing. Suitable vehicle guardrails will also be provided on the dam crest and access roads.

Instrument houses, gallery access points, electrical installations and all similar operational facilities will be vandal-proof and fully secured against unauthorised access.

Areas of stagnant water created in river channels downstream of the dam which are not replenished by discharges from the power station will be drained.

If embankment type construction is adopted for sections of the dam, the following features will apply:

- The upstream face will be armoured to prevent erosion or other damage by wave action and fluctuating reservoir levels. The armouring will extend from the crest of the dam to a depth of 1.5 m below the minimum feasible reservoir draw down level;
- The downstream face will have surface protection and drainage provisions suitable for serving the 1:50 year peak ½ hour flow event without damage or overtopping. Where the drainage system comprises culverts or other forms of closed conduit they will pass the design discharge as open channel flow assuming 50 percent blockage of the inlets. All elements of the drainage system will be accessible for maintenance; and,
- Modern low maintenance instrumentation systems will be installed to monitor foundation and embankment fill pore pressures, seepage system outflows and embankment fill and crest deformations.

If concrete construction is adopted for sections of the dam the following provisions will apply:

- Lift heights and horizontal construction joint formation systems and geometry will be adopted which ensure the downstream face of the dam presents a uniform appearance entirely free of construction discoloration or seepage in service;
- If immersion vibrated gravity sections are adopted, vertical joint spacings, temperature control systems and joint compartment grouting systems will be adopted in the design to ensure positive compressive stress between monoliths under all foreseeable service conditions. Re-injectable secondary grouting systems will be provided in all compartments, the terminal points of which will remain accessible in service from galleries within the dam wall;
- A foundation drainage and grouting gallery will be provided at the upstream toe of the structure such that secondary remedial grouting may be undertaken. Provision will be made for isolating and draining the gallery using temporary equipment; and,
- Modern low maintenance instrumentation systems will be installed to monitor foundation pore pressures, crest deformations, movements across joints and seepage system outflows.

5.2.7 Dam Stability

The design of the dam will incorporate the following requirements:

- The embankment slopes will remain stable under all probable conditions of construction and reservoir operation, including steady seepage, rapid drawdown of the head pond and seismic loading;
- The dam will not overstress the foundation materials and settlement induced by imposed loads will not reduce the stability or water retention characteristics of the dam; and,
- Seepage quantities and pressures will be controlled to prevent internal erosion, piping and uplift that would lower the stability of the dam.

The design of the dam will include examination of the following load cases:

- **Steady State:** To include seepage, deformation and foundation stress analyses.
- **Rapid Drawdown:** To ensure the satisfactory performance of the dam and foundation following rapid lowering of the upstream or downstream water level.
- **Earthquake:** To investigate the satisfactory performance of the dam and foundations during peak combined horizontal and vertical ground motions resulting from seismic events.
- **End of Construction:** To ensure satisfactory performance of embankment sections of the dam with no external water loads and no dissipation of construction induced pore pressures.

The minimum required factors of safety will be as follows:

Steady state	1.5
Rapid drawdown	1.25
Maximum Design Earthquake	1.1
End of Construction	1.3

Concrete structures will be designed for all loads likely to be encountered during construction and whilst in service. Critical water retaining structures including the power station will be designed for the maximum reservoir and tailwater conditions with appropriate factors of safety.

Design assumptions will be based on the applicable provisions of the current engineering manuals issued by BSI, ICOLD, CIRIA, USBR and organisations of similar international standing.

Loading conditions will be categorised as follows:

- **Normal loading** applies to loads that can be categorised as normal operating, long term or repetitive short term;
- **Exceptional loading** applies to loads that can be categorised as maximum, minimum, short term, one off, and operating basis earthquake loads applied pseudostatically in addition to normal loading; and,
- **Extreme loading** applies to exceptional loading conditions acting in conjunction with maximum design earthquake loads.

The required minimum factors of safety against sliding are as follows:

Normal loading conditions	2
Exceptional loading conditions	1.5
Extreme loading conditions	1.33

The factor of safety against sliding on any plane of weakness within the foundation will not be less than 4 for normal loading conditions, 2.7 for exceptional loading conditions and 1.5 for extreme loading conditions.

The minimum factor of safety against overturning under extreme loading conditions will be 1.5.

In considering safety against overturning, the resultant of all forces acting on the structure will fall within the Kern of the base for normal loading conditions. For exceptional loading conditions, the resultant may fall outside the Kern, but 75 percent of the base will remain in compression and allowable foundation pressures should not

be exceeded. For extreme loading conditions, 50 percent of the base must be in compression and allowable foundation pressures should not be exceeded.

The factor of safety against flotation will not be less than 1.1 under maximum Head Pond and Tail Water conditions, assuming the under drainage system to be inoperative and a linear distribution of uplift pressure between the Head Pond and Tail Water levels.

5.2.8 Tailrace and Downstream River Bed

The tailrace canalisation will be excavated down to 1,070.5 m AMSL at the outlet of the draft tubes. Further downstream, the rock will be excavated on a slope to 1,084.0 m AMSL, approximately 70 m downstream of the draft tubes, and continue at this level as far as the location of the (temporary) cofferdam.

5.2.9 Abutments

Abutments for the dam are required on the left and right banks. Both abutments will be based on the same design as the dam.

5.2.10 Substation

A 132 kV outdoor substation will provide the means by which the power station relays its power to the Ugandan national grid. The substation will be located on the left (west) bank, adjacent to the powerhouse and immediately upstream of the main access road. The substation will be designed for operation at 220 kV, but will be equipped and operated initially at 132 kV. Future operation at 220 kV would require installation of suitable transformers, circuit breakers, and protective equipment. The layout and location of substations and substation buildings and environs will be selected to minimise their visual impact and to provide the most suitable orientation for the outgoing transmission lines.

Ducts conveying power, control and instrumentation cabling from the powerhouse and generator transformers to the substation will be suitably sized to facilitate access for inspection and maintenance along their entire length without disruption to the normal vehicular access to other parts of the Substation or to operation of the Substation. The design of the ducts will be such that they are maintained in a fully-drained and ventilated condition.

5.2.11 Access Roads

A site access road will be constructed from the Jinja to Kayunga state highway to the area of the Power Station and to the west abutment of the dam. All roads will be constructed within the boundaries of the land already acquired for the project. Where

possible, existing roads that have been constructed on the west bank at the site will be utilised, with upgrades to take place as necessary.

During construction, the road will be surfaced with a natural gravel wearing-course suitable for the requirements of the construction traffic. On completion of construction activities the road base will be refurbished and a black top wearing-course will be added.

A corridor of land with a minimum width of 30 m runs from the Jinja to Ivuanmba road to the east bank of the project area. This corridor may be used by the EPC Contractor for access to the site during construction.

5.2.12 Impoundment Area

The FSL of the reservoir impounded by the Bujagali embankment will be 1,111.5 m AMSL, the level of the Nalubaale dam tail water. This arrangement will command a gross head of 22 m and a corresponding installed capacity of 250 MW.

With this arrangement, Dumbbell Island, the rapids in the vicinity of the island, the rapids at Bujagali Falls, and most of the small islands upstream to the Nalubaale dam will be inundated, as illustrated in Figure 5.1.

The higher elevations of a number of the larger islands upstream of Dumbbell Island (namely those at Bujagali Falls) will be preserved within the reservoir. The pre-inundation area of the islands to be inundated total 48.34 ha. Of the 48.34 ha, 13.06 ha will not be flooded and will form smaller islands than exist at present. The islands and areas to be flooded can be seen on Figure 5.1. The area of inundation will largely be confined within the banks of the present Nile channel, and will amount to 388 ha, excluding islands. This represents an increase of 80 ha over the current 308 ha river surface area between the proposed Bujagali dam and the Nalubaale dam. In addition to 35.28 ha of islands that will be inundated, 44.72 ha along the riverbank will be inundated.

The impoundment will have a relatively small live storage volume of 12.8 million m³. Gross storage volume will be 54.0 million m³. The retention time of water in the impoundment will be limited to 0.5 to 0.7 days, largely depending on the installed capacity and the operating arrangements for the conjunctive use of Nalubaale and Bujagali power stations.

5.2.13 Site Security Considerations

Security gates and a guardhouse will control entrance to the Bujagali Complex from the west bank access road. The guardhouse will have a clear view of the access road and will be provided with office furnishings and services for two security officers per

shift. Services will include lighting, small power, ventilation, telephone, water supply, toilet and wastewater disposal to a suitable septic system. External lighting will be provided to the powerhouse, power intake, spillway, substation and guardhouse areas.

The boundary to the Complex on the left bank and the turning area on the right bank, will be enclosed with a 2.3-m high perimeter fence. The substation will be further enclosed by a fence with a total height of 3.2 m and provided with suitable access gates. The workshop and stores facility will be enclosed by a 2.3-m high fence that will create an outside storage yard within an area of approximately 700 m².

5.2.14 Labour Force and Accommodations

A paved parking area suitable for 12 vehicles within a minimum area of 325 m² will be provided adjacent to the control building.

A water treatment plant will be provided to supply the hot and cold water and treated water requirements of the Complex, including the powerhouse, workshop and stores washrooms, mess and toilets, kitchen facilities and to provide make-up water for cooling and for the HVAC systems and other powerhouse systems.

The water treatment plant will be fully automatic and consist of two 100 percent streams. The treatment process will be selected to address the quality of the raw water supply to produce a finished water supply that meets the requirements of the WHO for potable water. The plant will be designed to fail to a safe condition and to minimise danger to personnel from any hazardous chemicals used in treatment.

A sewage disposal system will be provided to treat all sewage arising from the installations at the Complex. The system will be designed to appropriate standards and based on a continuous population of 20 people. In addition to a minimum 24-hour retention of the maximum daily sewage flow, the septic tank system will also provide an additional capacity to retain accumulated sludge for a period of one year.

5.3 Hydro Dam Construction

5.3.1 General

The construction process can be broken down into a number of distinct components, as follows:

- Mobilisation and Site Preparation;
- Engineering, Procurement and Transportation;
- Works to set up the diversions;
- Power station construction;
- Spillway construction;

- Tailwater excavation;
- Dam construction;
- Switchyard construction;
- Transmission line construction (covered by separate EIS report); and,
- Commissioning.

The activities that make up each component are described in the following sub-sections.

5.3.2 Mobilisation and Site Preparation

The mobilisation and site preparation phase will involve establishment of the site, such that construction of temporary and permanent works can commence.

5.3.2.1 Construction Workforce

Recruitment

Current estimates are that between 600 and 1,500 personnel will be required on-site during the construction phase. They will be employed primarily by the EPC Contractor and its subcontractors and therefore the specific number will depend on the final plans of the EPC Contractor. General labourers will largely be recruited locally, with preference given to displaced landholders and labourers from affected communities if they have the necessary qualifications. A training programme will be implemented to enable affected people to qualify for positions.

The recruitment process will be managed by the EPC Contractor and sub-contractors and contractual commitments will be obtained from any sub-contractors that all workers directly employed on the project provided will be employed in accordance with the provisions of national labour law and industry practice, including those pertaining to working hours, overtime, and form and frequency of pay. As indicated above, a construction related job-training programme will be held for local people. Details are included in the Labour Force Management Plan (LFMP), a preliminary draft of which is included with the Social and Environmental Action Plan that accompanies this SEA Report. The complete plan would be developed as part of the EPC Contractor's initial work.

In addition, there will be approximately 400 expatriate workers, including semi-skilled workers from neighbouring countries whom have relevant experience from previous projects in the region. Recruitment will be carried out on the basis of workers' abilities to do the job and all workers employed in equivalent roles shall be paid at an equal rate.

Accommodation

There will be a need to provide housing for the construction phase workforce in the Jinja area. No staff, other than security guards, will be accommodated overnight on the construction site. The specific numbers to be housed and plans for accommodations are to be addressed by the EPC Contractor, as the majority of workers will be employed by the EPC Contractor or its subcontractors.

There are no camps or residential complexes suitable for housing a large workforce currently available in Jinja. The residential complex used to house the workforce that built the Kiira facility is now being used by the Military, and the remaining hotels and housing are not sufficient to house the workforce. Thus, alternative solutions will be needed.

It is expected that a variety of housing would be used, including use of the existing housing stock including hotels, as well as new purpose built housing. As indicated above, the specific size, design, and location for such housing will be determined by the EPC Contractor, under advisement from BEL and in consultation with local authorities. The housing plan will be developed keeping in mind the objective to maximise local benefits and minimise avoid and community health problems. The detailed accommodations plan for the workforce will be provided as an addendum to the SEA following the selection of the EPC Contractor by BEL.

5.3.2.2 Site Services

Electricity

The EPC Contractor will be responsible for making arrangements for the supply of electricity that will be required during the construction project.

The local electricity grid is unreliable. The Contractor will, as a minimum, have 100 percent backup generation and distribution capacity for all requirements during implementation. It is expected the power will be generated using reciprocating engine generator sets fired on diesel fuel-oil. At the completion of the construction phase, the EPC Contractor will remove the temporary electricity supply components from the site.

Drinking and Process Water Treatment

The Contractor will be responsible for providing all water supplies required during the construction of the plant, including the permanent treated water supply and the permanent clean water supply for the cooling water make-up. The water supply for the systems is expected to be river water from the Nile.

A water treatment plant of sufficient capacity will be provided to supply the hot and cold water and treated water requirements of the Complex, including the powerhouse, workshop and stores washrooms, mess and toilets, kitchen facilities and to provide make-up water for cooling and for the HVAC systems and other powerhouse systems.

The water treatment plant will be fully automatic and have 100 percent process capability. The plant design will incorporate features to prevent any potentially hazardous chemicals used in treatment from impacting operating staff and the environment.

Schematic drawings for water treatment are provided on Figure 5.2.

Storage of Hazardous Materials

Diesel fuel for the backup generators and site vehicles will be stored in bulk storage tanks. The tank area will be enclosed by secondary containment capable of storing the entire tank capacity in case of leakage or other accident, and a one cubic metre capacity sump with a central drain, to collect any diesel spilled during filling operations. Construction vehicles will be re-fuelled by tankers that will collect diesel from this central store and distribute it to vehicles around the site. Other hazardous chemicals, such as hydraulic fluid, will be stored in locked buildings, which will also be bunded to contain spills.

The site drainage will be designed so that all overland flow will pass through the settlement ponds at the lower end of the west bank complex. This will also serve as an interceptor, and will hold back oil or other chemicals from being released into the environment in the event of a significant spill. This will provide sufficient reaction time to contain and control the incident by, for example, pumping out trapped oil and disposing of it appropriately.

In accordance with Ugandan law, explosives such as the dynamite charges used to detonate the ammonium nitrate/diesel blasting compound, will be left in the custody of the Army. The Army storage site is some 30 km from Bujagali, and the Army will

Figure 5.2 Preliminary Layout - Water Handling

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deliver daily supplies of explosives to the Bujagali site. Protocols will be developed by the EPC Contractor with respect to the storage, transportation and handling of explosives. The EPC Contractor will also develop a Blasting Notification Procedure to be used to inform local persons about the blasting schedule.

It is intended that the temporary workshop buildings to be supplied by the ECP Contractor will be erected on site.

Solid Waste Management

The EPC Contractor will be required to use four options for handling of solid waste generated at the site: burial, incineration, distribution to local users, or returning to the supplier. Any burial and burning operations are to adhere to acceptable international standards for these activities. The latter option will be used for hazardous waste, and will be part of the supply contracts.

5.3.2.3 Access and Haul Roads

Implementation of the project will require construction of new and temporary roads to be constructed include the following:

Road A

Permanent access to the site from the Jinja to Kayunga road on the west bank (length 700 m from the public highway to the west bank of the Nile), branching off from the main road about 8 km north of Nalubaale. This will be the main means of access to the site from the public highway network, and will be sealed upon completion of construction, for use during operation.

Road B

A temporary road to the dam site from the public highway on the east bank (length 200 m from the existing track through Namizi, but requiring widening of approximately 1 km of the existing track). This will be used only for a limited time during abutment, foundation and grouting works at the eastern end of the dam site.

Road C

A haul road along the west bank from road A to the quarry site near Buloba (length 2.1 km). This will be established above 1,111.5 m AMSL, and therefore will provide the option of remaining after construction to give permanent access along this section of the west bank. This will be the main access route to the west bank quarry, but will only be used for haulage of quarried materials to the dam working site during Stage 2 (Road D will be used during Stage 1).

Road D

A temporary haul road along the axis of Dumbbell Island across the upstream Stage 1 coffer dam, connecting Road C and the dam/power station site and (length approximately 2.2 km including side branches for access to the western river channel, the power station and the dam working site.

Road E

An access road from road A to the rock stockpile, aggregate crushing and concrete production area (length approximately 500 m). This will be sealed upon completion of construction, and will form a permanent access road to the tailrace and spillway area of the site.

Road F

A road along the crest of the main dam, which will give a permanent river crossing after completion of the works (length 1 km along the dam crest).

The locations of the roads are shown on Drawings D103332-914-0101, 102, 103, 0105, 0113, 0114 and 0200 in Appendix E.

Road Surfacing

Areas to be provided and surfaced using the following methods will include:

- Main access road linking the power station and dam site with the State Highway;
- Access roads to the power station, switchyard, water treatment plant, workshop and store areas;
- Parking areas;
- Dam crest; and,
- Turning circle(s) on the east bank.

Two or three bulldozers working simultaneously during the first six weeks of the construction period will clear these areas. A laterite base layer will be laid using material from the future switchyard area. This will be overlain by a gravel wearing course, which will use material from the main (Buloba) quarry area, and will be crushed by a temporary crushing plant erected near the entrance to this quarry. Additional vehicles that will be needed at this stage are 5-6 excavators, approximately 10 trucks, and rollers.

In general, a single layer of coarse gravel will be placed on the prepared base for use during the construction period. Once construction traffic has ceased to operate on the access roads, and after suitable refurbishment of the surface, base and blacktop

surface layers will be beaded. As a minimum, the blacktop will consist of a tack coat followed by a double spray and chip finish coat. All roadwork will comply with the requirements of the “Government of Uganda - Ministry of Works, Transport and Communication - General Specification for Road and Bridge Works”. Roads will consist of a single, two-lane carriageway wide enough to accommodate power station service vehicles. The finished width of the second spray and chip layer will be no less than 6 m. The finished width of the tack coat and first layer will be no less than 7 m.

Pedestrian access routes will be maintained to the spring on the west bank near the site boundary, and to the existing washing areas to the immediate north and south of the site on the west bank.

Site Levelling

During the mobilisation phase, areas of the site to be occupied by permanent and temporary works will be levelled using the same earthmoving equipment as used for construction of the access roads. This process will involve excavation of land above the required level and using the spoil to fill in areas below this level. The three areas where substantial levelling will be required are:

- The rock stockpile, crushing plant, concrete and asphalt batching plant area; (to a level of approximately 1,100 m AMSL);
- The office, canteen, dispensary and marketplace area near the west gate (to level of approximately 1,137 m AMSL); and,
- The switchyard area (to a level of approximately 1,126 m AMSL).

5.3.2.4 Quarries

A total of 1,000,000 m³ of fresh rock is needed for the hydropower facility, comprising 700,000 m³ of rock fill for the dam itself, and 300,000 m³ for other purposes, such as concrete production, cofferdams and access road construction. Four potential sources of rockfill materials have been identified within the land acquisition area, as follows (refer to Drawing D103332-914-0120, Appendix E):

- The main rock quarry site, near Buloba on the west bank, with the yield dependent on the final quarry depth and area, (as shown on Table 5.1). The amount of rock taken from this site depends on the amount available from the other three sources as identified below;
- Rock from quarrying at the upstream end of Dumbbell Island (estimated at 150,000 m³ of mixed amphibolite and argillite, in unknown ratios, assuming 15 m excavation depth from present ground level);
- Rock resulting from the powerhouse excavation (estimated at 200,000 m³ of high quality amphibolite, and 40,000 m³ of medium quality argillite); and,
- Rock resulting from spillway and tailrace excavation (estimated at approximately 175,000 m³ of mixed amphibolite and argillite, in unknown ratios).

The yield from sources 3 and 4 will be determined by the extent of foundation excavation required, and is estimated to be approximately 415,000 m³, which leaves an additional 385,000 m³ required from sources 1 and 2. Assuming an excavation depth of 15 m from the present ground level, source 2 (Dumbbell Island) will yield 150,000 m³. Therefore source 1 will have to provide the remaining amount of approximately 265,000 m³, possibly more if the quality of rock from sources 2 and 4 is unsatisfactory, or less if the excavation at source 2 is deeper than 15 m.

Table 5.2 outlines three scenarios for development of the main quarry area (source 1), and illustrates how the size and depth will vary depending on the quality of rock from this and the other sources. The exact area of the main quarry will not be known until additional drilling is completed and excavation is underway, and therefore the extent of suitable fresh rock is known. However, the surface area is expected to be in the order of 20,000 square m (2 ha), assuming a 20 m excavation depth.

Table 5.2: Rock Yield from Main Quarry Area (Near Buloba) at Various Quarry Sizes and Excavation Depths

Scenario	Surface area (m ²)	Total material to be removed before fresh rock is uncovered (m ³)	Fresh rock yield with 15 m excavation depth from ground surface (m ³)	Fresh rock yield with 20 m excavation depth from ground surface (m ³)	Fresh rock yield with 25 m excavation depth from ground surface (m ³)	Fresh rock yield with 30 m excavation depth from ground surface (m ³)
1. Small quarry	(70 m x 120 m=) 8,400	33,600	92,400	134,400	176,400	218,400
2. Medium quarry	(70 m x 250 m=) 20,000	160,000	140,000	240,000	340,000	440,000
3. Large quarry	(140 x 250 m=) 35,000	350,000	175,000	350,000	525,000	700,000

Regardless of its final size, the quarry will be excavated in three areas, from north to south. The overburden and unsuitable (e.g. weathered) rock from Area 1 will be stored temporarily in Areas 2 and 3, while fresh rock is being taken from Area 1. When excavation from Area 1 is complete, it will be backfilled with the original overburden and unsuitable rock, then filled with the same materials from Area 2, likewise for Area 3.

No natural sand is available within the project site, but fine material generated by the crusher plant will be used whenever possible. However, depending on the quality of fine material generated by crushing local rock, there may be a need for high quality

natural sand to be brought in from external sources, e.g. for use in certain concrete finishes. The extent of this will not be known until the concrete mix is tested with aggregates produced on the site.

If required, natural sand is available at a number of locations within 80 km of the site. Suitable sources that have been identified include a number of sites on Lake Victoria, a site in the Nile Valley about 60 km north of the project area and a site near Iganda on the Jinja-Tororo highway (Knight Piésold, 1998), as shown on Figure 5.3. Environmental oversight of the use of these sources will be subject to the Change Management Procedure to be developed as part of the Bujagali Hydropower Project SEAP.

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Figure 5.3 Location of Possible Sand Sources

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5.3.2.5 Crusher and Batching Plants

There are no viable natural sources of coarse or fine aggregate on site. Some gravel is known to exist on the islands and in pockets on the riverbanks but quantities are small and of variable quality. Therefore, coarse aggregate required for concrete production, and fine aggregate for filters in the dam will be produced by crushing rock from the quarries on site.

A crusher plant will be required, which will produce aggregates of various grades from rock from quarries on site. Batching plants will also be required for concrete production, and for production of filters for the dam. These will be constructed adjacent to the rock stockpile area at the northern end of the site, in locations shown on Drawing D103332-914-0105, Appendix E. Figure 5.4 shows a typical concrete batching plant.

5.3.3 Engineering, Procurement and Transportation

Although of the materials for the civil engineering components of the hydropower facility will be produced on site, the mechanical and electrical components will be imported to Uganda from locations around the world.

Equipment and materials that will be procured from outside East Africa will be shipped to the port of Mombasa in Kenya. For equipment and materials other than ‘abnormal loads’ (50-250 tonnes) and a small amount of materials unsuitable for rail transport, transportation from Mombasa to Uganda will be by rail to a bonded warehouse in Jinja, a distance of approximately 900 km. There will also be a bonded warehouse within the fenced boundary at the Bujagali site, which will accept goods delivered by road from outside Uganda. Distribution from Jinja to the Bujagali hydropower facility site will be solely by road. Table 5.3 below gives estimates of vehicle movements that will be required for transportation of equipment, materials and personnel to the Bujagali hydropower facility site, from locations within and outside of Uganda.

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Figure 5.4 Typical Concrete Batching Plant

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Table 5.3: Estimated Return Journeys to Bujagali Hydropower Facility for Major Equipment, Materials and Workers

Item	Original Source	Origin of Vehicle Movement To Site	Vehicle Type	Assumed Transportation Period	No. Vehicles/ Day
Cement	Tororo or Kenya	Jinja	20 tonne truck	2 years	5
Sand	TBD (within Uganda)	TBD (within Uganda)	20 tonne truck	3 years	2
Diesel	Mombasa	Jinja	20 m ³ tanker	4 years	1
Steel	Europe or South Africa via Mombasa	Jinja	30 tonne truck	2 years	1
Heavy plant (excavators, cranes, trucks)	Various	Jinja	Truck	3 years	1 (estimate)
Miscellaneous equipment	Various	TBD (within Uganda)	Truck	4 years	2 (estimate)
Miscellaneous equipment/ materials (unsuitable for rail transport)	Various, via Mombasa	Mombasa	15 tonne truck	4 years	1 (estimate)
Abnormal loads (turbines, generators etc.) up to 300 tonnes	Mombasa via Jinja	Mombasa	Multi-axle truck)	4 years	1 per month
Senior engineering staff/visitors + light deliveries	Jinja/ Kampala	Jinja/ Kampala	Car/ 4wheel drive	4 years	250
Labourers	Jinja and local villages	Jinja/ East Bank	Bus	4 years	15

TBD = To Be Determined

Note: Equipment and materials being transported from Mombasa to Jinja will move by rail, except for abnormal loads, which will be transported by road.

5.3.4 Diversion Works

At the proposed site, the Victoria Nile divides into two fast-flowing channels that cascade down each side of Dumbbell Island. The hydropower development will be constructed in two stages, with the river flow to be diverted to either side of Dumbbell Island using coffer dams as outlined below. Drawings D103332-914-0113 and 0114 in Appendix E show the layout of road and cofferdams during stage 1 and stage 2.

Water levels have been estimated for various sections for the two stages, based on the available current information. During Stage 1 Diversion, the maximum water levels at $Q=2,200 \text{ m}^3/\text{s}$ (Q =discharge), are estimated at 1,097 m AMSL at the upstream end of Dumbbell Island and approximately 1,091 m AMSL at the downstream end. Detailed underwater surveys at the commencement of the construction phase may result in small adjustments in the predicted water levels, with the heights of cofferdams adjusted accordingly.

In order to prevent vegetation being carried downstream, it will be cleared from the respective river channel immediately prior to construction of each coffer dam, such that no vegetated land is inundated during diversion. This will require clearance up to the 1,100 m AMSL contour above the cofferdam, sloping down to the 1,091 m AMSL level at the northern tip of Dumbbell Island. After demarcation of this area, clearance will be carried out using hand tools to remove trees and shrubs at ground level. In order to minimise erosion, no digging will be carried out and root systems and grasses will be left intact. Cleared material will be made available for use by local people. Any remaining material will be transported to the works compound and disposed of by burning.

5.3.4.1 Stage 1 Diversion Works

During Stage 1, the river will initially be diverted through the eastern channel at Dumbbell Island by construction of cofferdams at the upstream and downstream ends of the western channel. As illustrated in Drawing D103332-914-0113 and 0115, Appendix E, the upper cofferdam will be placed at the neck of the falls, while the lower cofferdam will be placed at the downstream end of Dumbbell Island, near the confluence of the two river channels.

The cofferdams will be constructed by placing/tipping boulders and rocks into the river. For the upstream Stage 1 cofferdam, this will proceed from the small outcrop in the river near the main quarry on the west bank (using material from the quarry), and from the southern end of Dumbbell Island (using material excavated from Dumbbell Island) simultaneously. Large boulders or, if necessary, pre-cast concrete units will be used to protect against washout as flow velocities progressively increase with the

reduction in channel cross-sectional area. After river flow has been controlled, the permeability of the cofferdam will be controlled by the use of an impervious soil blanket. Graded material, together with fibre fabric, will be placed on the upstream side to minimise leakage. The downstream cofferdam will be easier to construct because of its location in still water.

The area between the upper and lower cofferdams will be de-watered to allow construction of the power station, services bay, control building, west bank abutment works and the main and emergency spillways during Stage 1. This will involve pumping water out of the works area into the Nile downstream of the lower coffer dam. The rock fill dam over Dumbbell Island will also be constructed during Stage 1. To reduce the amount of pumping required during the river diversion works within the Stage 1 works area, an interceptor drain will be installed along the northern fence line of the works area to channel storm water away from the site to a point in the river downstream of the site.

5.3.4.2 Stage 2 Diversion Works

During the Stage 2 diversion works, the Stage 1 cofferdams will be removed and the western channel will be reopened to allow water to pass through the newly constructed dam structure. Drawing D103332-914-0114 and 0115, Appendix E, shows the arrangements of the cofferdam during Stage 2. During the Stage 2 diversion, water levels will be a maximum of 1,097-98 m AMSL along Dumbbell Island. Since each of the main spillway gates will only pass approximately 1,000 m³/s at this water level, a third diversion passage is required. This will be provided by a temporary opening that, together with the gates, will allow a discharge of 2,750 m³/s. The material recovered from the Stage 1 cofferdams will be used to construct the Stage 2 cofferdams in the eastern channel at the upstream and downstream ends of Dumbbell Island. This will close off the eastern river channel, and the entire river flow will then pass through the main spillway gates and the temporary diversion chute. Following de-watering, the final closure section of the dam will be constructed. Upon completion of the Stage 2 works, the temporary chute will be closed with a permanent concrete slab wall. De-watering will be required throughout the closure to prevent flooding of the working area. This will involve pumping of water from the works area to a point downstream of the downstream cofferdam. To reduce the level of pumping during Stage 2 of the construction process, the small watercourse that flows into the Nile from the east bank will be diverted so that it discharges downstream of the lower coffer dam. This stream is within the land take area. Diversion of the stream has no social implications.

At the completion of construction of the dam and the power station, the Stage 2 cofferdams will be removed using backhoe excavators. Possible re-use of the spoil is discussed below in the 'Site Reinstatement' section.

5.3.5 Dam, Power Station and Reservoir Construction

5.3.5.1 Earth and Rock Fill Dam

Construction of the dam component of the hydropower facility will commence with blasting and excavation of the foundation area, approximately 20 m below the existing rock level to approximately 1,080 m AMSL (Drawing D103332-914-0125, Appendix E). Grouting with cement grout will seal the exposed rock.

The rock fill dam consists of a clay core surrounded by a processed amphibolite filter, a quarried amphibolite transition zone and quarried amphibolite supporting fill. The inclination of the dam's upstream and downstream slopes will be 1:1.6 and 1:1.6 respectively when founded on rock and 3.4:1 and 3.85:1 respectively when founded on overburden. The crest level of the dam will be 1,114.5 m AMSL, giving a maximum overall height of approximately 30 m. (Drawings D103332-914-0122, 0123, 0124, 0133, 0135 and 0136 Appendix E gives section and plan views of the dam).

The dam will be built according to the General Specifications and a Production Programme prepared by the EPC Contractor.

The foundation for the clay core requires preparatory works such as: removing overburden in the valley floor; cleaning of the bedrock surface; and, construction of concrete plinth. Grouting involves drilling holes in the rock to approximately 10 m depth and injection of cement grout, which fills fissures in the rock and thereby renders it impermeable. The concrete plinth (4 m wide and 0.5 m thick) will be cast in contact with the bedrock and bolted.

The core will be founded on the plinth and concrete wall. The clay core will be built by placing the clay core material (shown in Drawing D103332-914-0123, 0124, 0135 and 0136 Appendix E) and processed amphibolite filter in one operation, in horizontal layers of 0.2 m depth. The construction process will be performed using paving machinery, or by hand where space constraints mean the paving machinery cannot be used (e.g. adjacent to the powerhouse structure or the abutments).

The core and filter will be protected on either side by a 2-m thick transition layer of less than 200 mm quarried amphibolite (Zone 3), which will be compacted in 0.4 m layers. The bulk of the volume of the dam will consist of supporting fill (1,000 mm nominal diameter quarried amphibolite: Zone 4), which will be compacted in 1.6 m layers.

The upstream and downstream faces of the dam will be protected against wave action near the water line by a layer of riprap (400 – 800 mm nominal diameter quarried

amphibolite: Zone 5). These units will be individually placed to ensure stable contact. The downstream face will incorporate berms with drains.

The dam crest (10 m wide) will have a sealed surface access road 7.5 m wide. Site investigation works have shown that adequate quantities of soils suitable for use both in the core and shoulder zones of the dam are available in the immediate vicinity of the site. It is anticipated that much of the material excavated from the dam foundations will be suitable for re-use as dam fill. Rockfill for the dam and shoulder zones and riprap will be won from a quarry established on site and/or selected from excavations for the works.

The concrete mix design will generally be based on the "Norwegian Regulations for Planning, Construction and Operation of Dams (NRD)", English version (1986). However, concrete damage attributed to Alkali-Silica Aggregate Reactivity experienced at the Owen Falls Dam, where the same concrete aggregate materials were used (and are proposed to be used at the Bujagali hydropower facility), call for special precautions. Therefore, low alkali cement will be used in spite of results from aggregate reactivity tests being well within the recommended requirements.

Abutments for the dam are required on the east and west banks. Both abutments will follow the design of the dam and use a clay core. A grout curtain will be provided beneath the upstream end of the walls. Concrete retaining walls will be constructed to a height of approximately 10 m on the west abutment to train the water in the tailrace channel of the power station.

5.3.5.2 Power Station

Construction of the powerhouse and spillway component of the hydropower facility will commence with blasting and excavation of the foundation area, approximately 20 m below the existing rock level to an elevation of 1,062 m AMSL. Grouting with cement grout will seal the exposed rock.

Foundations will be constructed by laying reinforcing steel and installing rock bolts into the bedrock where necessary. Concrete will be poured using 'creter cranes' (Figure 5.5), which lay concrete via a conveyor belt that runs along a derrick. Two creter cranes will be mounted on rails (one upstream and one downstream) such that they can service all parts of the power station. Once the foundations have been laid, five tower cranes will be erected on rails, and will be used for erection of the superstructure, with three cranes to the downstream side of the power station, and two on the upstream side.

An example cross section of the construction site with tower cranes in place is provided in Figure 5.6.

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Figure 5.5 Creter Crane

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Figure 5.6 Tower Cranes

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The power station will be of modular construction with five machine bays, a services bay and a control building block. Prior to the erection of the power station superstructure, steel draft tubes will be installed, the bases of which will sit on the foundation at elevation 1,064.5 m AMSL. Construction of the powerhouse will proceed in three stages:

1. Construction of the superstructure up to the point where bridge cranes (gantry) can be installed. These will be used for installation of turbine and generator units;
2. Construction of the intake structure; and,
3. Construction of the spillway.

The intake and turbine block for each bay will be cast as integral units with water bars between the adjacent bays. The services bay will be located to the west of the power station and will be used initially to assemble the generating sets and later for maintenance and repairs. The main floor level will be the same as the generator floor of the power station at 1,095.0 m AMSL. Additional rooms for pumps and compressor, maintenance and storage equipment, water treatment plant etc. can be accommodated in the basement floor below the main floor.

The control building will be situated adjacent to the services bay at the west end of the power station complex. The building will be a four-storey control and administration centre, and will be constructed at the same time as the main power station structure. Construction details of the power house and spillways are shown in drawings D103332-914-0143, 0144, 0180, 0181, 0190 and 0191, Appendix E).

5.3.5.3 River Bank Training Works and Reservoir Preparation

The topography of the riverbanks is such that training works may be required to reduce the possibility of landslips. Within 50 m of the intake, the riverbed will be excavated down to 1,085 m AMSL. From this level, the riverbed will be excavated at a slope of 1:4 down to 1,078 m AMSL immediately in front of the intake. Erosion protection will be placed on excavated areas with exposed soil.

The riverbanks within 300 m upstream of the intake will be investigated and areas deemed by EPC Contractor as unstable and likely to cause minor landslips will be stabilised by excavation of critical slopes and/or protection by riprap and geotextile materials. In the inundated area all vegetation will be cleared to ground level, but will not be grubbed, i.e. no digging will be carried out. Clearance and disposal of cleared material will be carried out by the same method as previously outlined for the Stage 1 and 2 diversion channels.

5.3.5.4 Reservoir Filling

The reservoir will be filled in such a way that no more than 2.5 percent of the discharge downstream of the Kiira and Nalubaale Dams is retained in the Bujagali reservoir resulting in a 97.5 percent residual flow. Although the reservoir could in theory be filled in approximately 1 day, the ongoing checks of dam and riverbank stability will mean that the reservoir is filled slowly, and in a staged manner. In practice, the discharge downstream of Bujagali at any one time is likely to be considerably more than the 97.5 percent residual flow described above. The short term changes in flow are expected to be within the normal daily variability in flows as a result of operations at Nalubaale and Kiira.

5.3.5.5 Procedures for Drilling and Blasting During Foundation Works

The use of explosives shall at all times be in accordance with relevant Ugandan regulations. Storage and transport of explosives shall be conducted in concert with appropriate Ugandan and international protocols. The EPC contractor will also develop an appropriate Blasting Notification Procedure to inform the community when blasting is about to occur or the blasting schedule. Site specific procedures for drilling and blasting, including appropriate safety and adjacent structure stability monitoring protocols will be prepared by the EPC Contractor and approved by the appropriate government and lender agencies.

5.3.5.6 Bujagali Substation

A 132 kV outdoor open terminal substation to be known as the Bujagali substation, is to be established in close proximity to the power station, to provide the means by which the power station exports its power to the Ugandan grid system. The substation will be of double bus-bar single circuit breaker construction. In addition to the generator circuits and feeder circuits, the substation will include bus-coupler, bus-section and station transformer circuits. The control and relay equipment for the substation will be housed in a building adjacent to the substation.

Construction of the substation will require levelling of the designated area to 1,124 m AMSL. Spoil taken from the uphill part of the site will be re-used for levelling the downhill part of the site.

Work at the Bujagali substation is expected to take place over a period of about 44 months (including commissioning), commencing about month seven of the construction programme. The level of activity in the first year will be most significant, and will consist of site surfacing and other civil works. The electrical installation activities will commence around month 16. This will consist of the erection of steel structures and the installation of high voltage equipment, control

boards, wiring and control cables. Tasks required during the construction phase include:

- Civil works (levelling and drainage, drilling and excavation of footings, and preparation of crushed rock pad);
- Installation of foundations and other support structures;
- Installation of oil collection systems;
- Erection of steel structures;
- Erection of high voltage (HV) equipment;
- Construction of control building and installation of control boards;
- Installation of wiring and control cables; and,
- Testing, energising and commissioning of substation.

Commissioning activities for the substation are described in more detail in Section 5.6.

5.4 Site Reinstatement

5.4.1 Landscaping

All areas disturbed by construction activities will be restored to a natural appearance by landscaping, top soil spreading, grassing and planting of trees, as appropriate. Particular care will be exercised in restoring the power station and switchyard environs, the dam abutments and the downstream section of Dumbbell Island. All of the EPC Contractor's temporary facilities, including batching and crushing plants, crane foundations, workshops, offices and other buildings will be removed from site upon completion of the hydropower facility. All surfaces to be grassed will be prepared to a fine tilth. If topsoil is generally available, a 100 mm layer will be placed over the area to be grassed and an indigenous "runner" type grass planted. Otherwise, sprigs of grass will be planted at approximately 200 mm apart in a pocket of topsoil 75 mm deep x 75 mm diameter. Planting will be irrigated as needed until growth is established.

EPC Contractor will produce a restoration plan for the quarry on the west bank. One possibility is connecting the quarry pit with the river channel, and profiling the borrow areas in such a way that they provide spawning and nursery habitat for commercially-important fish species.

5.4.2 Access Roads

Land along the reservoir margins, as well as the west bank haul road from the main quarry to the dam site, will be owned by the Uganda Land Commission (ULC) on behalf of the Ministry of Energy. The decision about whether to maintain this road or to reinstate it to its original condition will be made during the construction phase in

consultation with the Uganda Land Commission, Ministry of Energy and the Ministry of Works, Housing and Communication.

5.4.3 Disposal of Excavated Material

Material, which has to be excavated but is unsuitable for construction purposes, will be kept separate from other materials in order to prevent contamination of material required for use in the Works. Such unwanted material will be disposed of by spreading the material in layers in designated spoil areas, such as the exhausted quarry areas. The material will be compacted to the maximum practicable extent by routing haulage traffic over the area.

Permanent spoil areas visible after completion of construction will be shaped to follow existing contours such that the tips blend in with the local topography. Such disposal areas will be kept neat and tidy. Surfaces will be finished and graded to the extent necessary to provide surface drainage, and vegetated to prevent future erosion of the materials.

5.5 Health and Safety on Site

During the construction phase, the EPC Contractor will be responsible for the prevention of unhealthy or unsafe conditions and practices and for the promotion of healthy and safe working practices at the Site. The EPC Contractor will develop an Emergency Preparedness and Response Plan and procedure that includes training of workers.

A first aid facility and clinic will be maintained on site to provide basic treatment and first aid only. Serious cases will be transferred to hospitals in Kampala or elsewhere as necessary. The clinic will be staffed and operated by the EPC Contractor. The staff will include, as a minimum:

- A doctor fluent in English and with tropical experience (part-time);
- A clinical assistant fluent in English and with tropical experience; and,
- An experienced wound dresser.

The clinic will be operated solely for personnel employed on the Bujagali hydropower facility. Measures to be undertaken by BEL to augment health facilities for the general population in the area are outlined in the Community Development Action Plan. Dental and maternity care will not be available other than advice provided by the clinic. The EPC Contractor will also provide and operate a suitable ambulance for the exclusive use of the project.

BEL is committed to measures that will reduce the risk of an increase in STDs/HIV/AIDS as a result of the project. An STD/HIV/AIDS awareness programme will be incorporated into the training package for all workers. Health education will be done in coordination with the District Health Units. A programme designed specifically for promoting safe sex for the construction workforce will be developed and condoms will be made available to workers if wanted, via the site clinic.

Malaria protection will be made available in the form of screening of accommodation, spraying the inside of houses with residual insecticide and bednets impregnated with insecticide. An awareness programme will ensure that workers are apprised of the modes and risk of infection, the monitoring programme and the importance of making health centres aware of new malaria cases. Construction techniques will include measures to avoid the creation of pools of standing water. For example, borrow pits and quarry areas will be kept well drained in order to prevent this occurring. Workers from non-malaria endemic areas will be provided with chemoprophylaxis.

Additional information on safe working practices, and health and safety management, are included in Section 7 of this Report.

5.6 Commissioning and Start-up

Start-up of the facility will be managed and directed by senior commissioning personnel from the EPC Contractor. The start-up procedures, as well as software preparation in the form of schedules, will be developed utilising both the design team from within EPC Contractor's head office and site personnel. EPC Contractor's site staff will manage and direct all testing activities on-site in accordance with the start-up programme requirements. Before reporting to the site, commissioning personnel from EPC Contractor will be assigned to the project to develop commissioning schedules. The commissioning schedules will include a master test matrix for each piece of equipment and for all systems and subsystems. Testing procedures will be developed and agreed upon in accordance with the plant functional specification. After commissioning and testing have been completed the plant operations manual will be developed. During the commissioning period; BEL operating personnel will work closely with EPC Contractor's commissioning team to make sure that the operating and testing programmes are fully integrated and understood.

During the preliminary planning and schedule development phase of the construction period, a commissioning engineer will be assigned on a part-time basis to the design engineering staff of EPC Contractor. This engineer will be responsible for reviewing engineering drawings and specifications to ensure adequate support and consideration of start-up, and that commissioning requirements are fully understood and integrated into the facility design. As the design phase nears completion but just prior to commencement of site start-up and test activities, the commissioning engineer will

assemble a site start-up team and produce the required procedures, test matrices, handover packages, and plant operating procedures manual. This test and start-up engineer will report to EPC Contractor's Construction Manager.

The test and start-up engineer will: mobilise the site start-up team; initiate site commissioning; and, complete operational testing of all systems and equipment supplied by the erection subcontractors, having satisfied himself that the systems and equipment are fit for the purpose and that the design functional specification and performance criteria have been met.

The commissioning engineer will: carry out and present formal operations training; perform pre-operational and functional testing; commence initial operation; conduct performance tests; and, handover completed operating systems and facilities to BEL. During the initial engineering phase of the project, the test and start-up engineer will develop a preliminary schedule that identifies start-up activities on a component/system basis. As the project's design progresses, this schedule will be refined to identify required component tests, system functional tests, initial operations, and facility commissioning activities on a daily basis. This schedule will be integrated with the project engineering and construction schedules to provide an integrated project schedule.

The schedule will identify the precedence and successor relationships of the start-up activities, and activity durations. It will identify the construction handover sequence needed to support the start-up testing requirements, and identify the start-up critical path. The following general component test procedures will be employed.

Mechanical Tests

- Piping and System Cleaning;
- Piping and System Integrity;
- Rotating and Reciprocating Equipment;
- Cranes and Hoisting Equipment;
- Non-Manual Valves;
- Package Lubrication Systems;
- Coupling Alignment;
- Fire Protection System; and,
- Cooling Water System.

Electrical Tests

- Insulation Resistance Testing;
- Low Resistance Testing;
- Electrical Continuity;

- Batteries and Battery Charger;
- Lighting and Distribution Panels;
- Power Transformers;
- AC Motors; and,
- Motor Control and Load Centres.

Low Voltage Circuit Breakers

- Medium and High Voltage Switchyard;
- Medium and High Voltage Circuit Breakers;
- DC Motors;
- DC Switchgear;
- DC Circuit Breakers;
- Current Transformers;
- Potential Transformers;
- HV Cables;
- Overhead HV Lines;
- Generators; and,
- Overall Plant Efficiency.

Instrumentation and Control Tests

- Protective and Control Relays;
- Transducer Calibration;
- Meters;
- Electric Motor Operators;
- Transmitters;
- Control Drives/Valves;
- Indicating/Control Loops;
- Self-Contained Control Valves; and,
- Communication and Telemetry Systems.

5.7 Operation and Maintenance

5.7.1 Spillway and Turbine Operation

5.7.1.1 Operating Manual

The EPC Contractor will provide an Operating Manual for the hydropower facility to BEL upon handover of the completed hydropower complex. Operating instructions will detail all normal starting up, running and shutting down procedures, emergency operating procedures and any precautions recommended to prevent deterioration of the hydropower facility during periods of non-operation.

Instructions for the hydro-mechanical equipment will detail procedures for all normal local and remote operations for the gates and equipment, trash raking procedures, stoplog installation and removal, and all similar activities. Instructions will also cover the filling and draining procedures for civil works such as the power waterways, water supply systems, drainage and dewatering systems and sewage systems. The operating instructions will include a comprehensive commissioning schedule for each component or structure, and check lists to record the completion of these activities. Copies of all settings and calibrations of instruments and controls, motor operated valves, DCS (Distributed Control System) logic, pressure switches and alarm settings confirmed and recorded in the commissioning schedules will be included in the operating instructions.

5.7.1.2 Overview of Operating Procedures

The spillway is designed to discharge the maximum flood of 4,500 m³/s at FSL. The selected design incorporates one flap-gate in an overflow chute and two radial gates in a separate concrete structure adjacent to the powerhouse and a siphon spillway located between east and west embankment dams (on the north part of Dumbbell Island). During operation at FSL of 1,111.5 m, the flap-gate will have a discharge capacity of 1,300 m³/s, the radial gates a combined discharge capacity of 3,000 m³/s, and siphon spillway a combined discharge capacity of 1,200 m³/s.

The flap gate will be used for normal flood conditions, simultaneously allowing floating debris to pass freely. There will always be sufficient flap gate capacity available to substitute for any sudden turbine closure. The flap gate will also be able to release the flow in an emergency by falling automatically without mechanical operation. The flap gate is designed to have 0.5 m freeboard when fully raised, allowing for wave surges.

A dedicated diesel generator will provide power for the spillway radial gates in case of disruption to the grid supply will be located adjacent to the gates of the compound.

The guidelines for operation of the spillways are as follows:

Scenario A: Operation During Normal Reservoir Inflow Conditions (700-1,375 m³/s):

Flap gate and siphon spillway discharge capacity will always be available in case of a sudden turbine closure. The turbine discharge capacity is 1,375 m³/s for five units, and no spill will be permitted except to maintain minimum flow or to clear floating debris, in which case the flap gate will be partially lowered for a short period while the debris is passed over the lowered flap gate. In the case of a power station load rejection, water levels are permitted to rise by 0.2 m to 1,111.7 m AMSL, while maintaining continuous minimum flow. If the power plant has not resumed operation

or if the reservoir level continues to rise for whatever reason, the flap gate will be opened to reduce the reservoir level to Full Supply Level (FSL) 1,111.5 m AMSL.

Scenario B: Operation During Normal High Inflow Conditions (1,375-1,720 m³/s):

Historic outflows from Lake Victoria have never exceeded 1,700-1,800 m³/s over the past century of record. Thus this scenario will cover most high flow situations in the foreseeable future. Any excess flow above the maximum turbine flow (1,375 m³/s for five turbines) will pass continually over the flap gate and siphon spillway, and the flap gate will be regulated to maintain the specified reservoir level. In the event of a power station load rejection, the total gate opening will be increased by further lowering the flap gates to prevent the reservoir level rising above the Maximum Flood Level (MFL) 1,112.0 m AMSL.

Scenario C: Operation During High and Extreme Flood Conditions (1,720-4,500 m³/s):

For flows above 1,720 m³/s, up to 3,220 m³/s, one radial gate will be opened to pass 250 - 1,500 m³/s. The remaining surplus (flow not passing through the power station) will be passed over the flap gate and siphon spillway, which will, as in Scenarios A and B, regulate the specified reservoir level. In the event of a power station load rejection, the flap gate will automatically open and siphon spillway will automatically spill to prevent the reservoir level rising above elevation 1,112.0 m AMSL. For flows above 3,220 m³/s and prolonged power station outages, the second radial gate may be fully opened, thereby passing up to 3,000 m³/s through the bottom outlets and the remainder over the flap gate and siphon spillway.

However, this situation can only occur if a series of exceptionally wet years results in Lake Victoria's levels rising to far above historic maximum level or if there is an exceptional flood release at Nalubaale/Kiira. The power station can be expected to operate even then, and both radial gates may then be fully opened for an extended time. The flap gate and siphon spillway will then be used to maintain reservoir level, or in the unlikely event of an impending Nalubaale/Kiira dam break, to lower the reservoir level.

During all periods of turbine operation, flap gate and siphon spillway total discharge capacity equivalent to the total turbine flow will always be kept available, in case of a sudden turbine closure. Only flap gate discharge capacity in excess of the total turbine discharge will be used for other release operations, e.g. release of floating debris. The excess capacity will be determined based on current prevailing operational constraints (e.g. if the flap gate is temporarily out of operation for maintenance reasons).

In the event of a load rejection and a subsequent reservoir level rise to 1,111.7 m AMSL, the total gate opening of the main spillway will be increased by further

lowering the flap gate to release an additional flow ('compensation discharge') equivalent to the decrease in total turbine discharge attributable to the load rejection.

Unless particular operational conditions require the contrary, the following rules will be applied to release the compensation discharge:

- If the entire power station is affected by a load rejection, the compensation flow will be released through flap gate and siphon spillway; and,
- If individual generating units trip, while other units continue to operate (or simultaneously start up), the compensation flow will be released using the flap gate.

Excess spill, if occurring over extended periods of time, will be released in the same manner.

The radial gates will not be left open at small openings for long periods of time at low flow and tail water levels, in order to minimise eroding forces on the spillway system. Minimum required flow through the radial gates requires an opening of at least 1.2 m. Smaller openings will therefore only occur during opening and closing of the gates.

5.7.2 Water Treatment Plant

A water treatment plant will incorporate suitable unit processes compatible with the source of water and will have sufficient capacity to supply the hot and cold water and potable water requirements of the hydropower facility, including the powerhouse, workshop and stores washrooms, mess and toilets, kitchen facilities and to provide make-up water for cooling and for the HVAC (Heating, Ventilation and Air Conditioning) systems and other powerhouse systems. The treatment plant will deliver water to World Health Organisation (WHO) drinking water standards at a rate and pressure suitable for the combined requirements for operation of the hydropower facility. The water treatment plant will be of the fully automatic type and consist of two 100 percent streams. The plant will be designed to fail to a safe condition and to minimise danger to personnel from any hazardous chemicals used in treatment of the water.

5.7.3 Sewage Disposal System

A sewage disposal system will be provided to treat all sewage arising from the installations of the hydropower facility. The system will be designed in accordance with the requirements of British Standard BS 6297 based on a continuous population of 29 people and a time interval for the removal of sludge from septic tanks of at least

one year. It will discharge at a quality that meets the requirements of both the Government of Uganda and the World Bank Group.

5.7.4 Solid Waste Management and Hazardous Materials Management

Provisions for management of solid and hazardous waste are outlined in Section 5.3.2.2.

5.8 Monitoring and Maintenance

5.8.1 Monitoring

The dam will be instrumented for continuous monitoring of pore pressure, deformation and leakage during operation.

Pore pressure will be measured in the downstream foundation of both dam abutments. Electrical piezometers will be installed in boreholes in each abutment. Readings will be made at regular intervals, with special attention during the construction of the abutment dam and during first impounding. Based on the results, a monitoring programme will be designed for normal operation. Standpipe piezometers will be placed in the downstream foundation of the central dam section and monitored by BEL.

Deformations will be measured on bolts placed on the crest and downstream slope. Approximately 100 bolts will be mounted in large rock blocks. During filling, measurements will be made at each 5 m rise of the dam. During operation, measurements will be made at 1 to 5 year intervals.

Leakage will be measured at four locations:

- At the foot of the western retaining wall;
- At the foot of the eastern retaining wall;
- In the eastern channel riverbed; and,
- In the depression east of the river (former river channel).

The leakage will be collected by means of small leading walls combined with trenches, to a small pond equipped with a measuring weir. Readings will be made daily during impounding and the beginning of the operation period. Based on the results, a monitoring programme will be developed for normal operation.

The text for the ‘Monitoring’ component of the Operating Manual will include:

- An ‘Inspection and Monitoring Timetable’ for the major elements of the hydropower facility. The timetable will include regular daily, weekly, monthly, quarterly, biannually, annually and five yearly inspections;
- A method of requesting maintenance work. Typically a pro forma ‘Maintenance Request’ sheet is used;
- A method of controlling access to typically, unsafe or confined work areas. Typically, a ‘Permit to Work’ pro-forma sheet for signature by the Plant Superintendent is used;
- A checklist of inspection work to be carried out and a method of recording the completed inspection work. Typically an ‘Inspection Report’ form is used;
- A record of completed maintenance work. Typically a ‘Maintenance Record’ sheet is used; and,
- Any other information deemed necessary to ensure satisfactory operation of the hydropower facility and associated transmission lines.

The text for the detailed inspection of each component will include the following:

- A detailed description of the inspection work to be carried out on the component. It is anticipated that the inspection work will vary in scope and thoroughness depending on the relative importance of the component and the frequency of inspection;
- Procedures for reading instruments installed for monitoring the behaviour and performance of the component;
- Service limits applicable to instruments monitoring the component. Details will be provided of when further specialist advice should be sought in the case of emergency situations; and,
- Method statements, information and data regarding specialist repairs and specialist techniques required for maintenance work.

5.8.2 Maintenance

The gates will be designed to be capable of operation by an electrically operated hydraulic system with backup power supply and will also be capable of being fully opened by independent means. It will have a roller bucket energy dissipater and will incorporate provisions for installation of upstream and downstream stoplogs to enable the temporary diversion ports to be plugged for future maintenance.

The maintenance procedures for each component will incorporate routine planned maintenance work or other work of a less routine nature that may or may not require unit outage. Instructions will be provided by EPC Contractor in the Operating Manual, prior to handover of the hydropower facility to BEL, which will describe the execution of the maintenance procedures.

Maintenance procedures will be established for each component of the civil engineering works. The procedures will define the nature and type of routine maintenance work that is envisaged for the component. For the civil works, these typically include such items as clearing drainage structures of trash, vegetation and sediment; lubrication of hinges and bearings; tending to overgrown grass; repairing damaged or flaking paintwork; or, the repair of road surfacing.

Maintenance procedures for electrical and mechanical equipment will be based on the recommendations of the equipment manufacturers and typically include procedures for the repair or replacement of seals, bearings, linkages and similar serviceable parts. Separate maintenance procedures will be established for maintenance work that is not of a routine nature, such as for components damaged during operation.

The maintenance procedures for all proprietary products will be provided within the Operating Manual and clearly referenced. A detailed list will be provided of suppliers and manufacturers for all proprietary components including those supplying instruments for monitoring the behaviour of structures, foundations and waterways. The list will include the make/model number/catalogue number, parts list and spares ordering instructions. A detailed list will also be provided of contact addresses, telephone numbers, facsimile numbers and email addresses for suppliers and manufacturers for all proprietary components.

Text will be provided describing the method of execution of the maintenance procedures and the method of recording maintenance works undertaken. Provision will be made for the recording of the location of defects, the identification source and the nature of work completed. Typically this is recorded on a pro-forma 'Maintenance Record' sheet. Provision will be made for separately recording maintenance work carried out as a result of an inspector's recommendation. Typically this work is recorded on a pro-forma 'Maintenance Record' sheet and an 'Inspection Report' sheet completed as part of the operating procedures.

5.9 Staffing

5.9.1 Organisational Structure of the Plant Operating Company

Overall operational performance, and management of the day-to-day business affairs and operation of the Bujagali hydroelectric generating station will be the responsibility of the Plant/Business Manager. The Plant/Business Manager will also be an officer of the Special Purpose Company established for operating the facilities. Reporting directly to the Plant/Business Manager will be Plant Superintendents who have overall responsibility for both operations and maintenance of the facility. The facility will be subdivided into functional areas. Each of the superintendents will be responsible for the management and maintenance of specific sections of equipment

and operating subsystems within their area. The superintendents will have individual teams that will also be associated with functional assigned equipment or subsystem.

It has proven more efficient for operating teams to have responsibility for both the operations and maintenance within their particular functional area. Decision making, authority and autonomy will be vested heavily in the individual teams assigned to and organised around major pieces of equipment and operating subsystems. Although this type of organisational structure requires a high level of skill and training, it is expected that recruitment of the majority of operational personnel will be achieved locally.

Operating and maintenance activities would typically be carried out on a continuous 24-hour shift schedule by appropriately trained teams of technicians under the supervision of the superintendents. The Plant/Business Manager will select the mode of shift operation that best suits the business. Shift patterns normally employed to maintain continuous 24-hour operational cover usually fall between the following patterns:

- 3 teams operating a daily 2 by 12 hour shifts;
- 4 teams operating a daily 3 by 8 hour shift; or,
- 5 teams operating a daily 3 by 8 hour shift.

However, due to a high level of automation and fail-safe features associated with the plant there will be minimal plant supervision required when operating.

Typical functional areas of responsibility for the operating and maintenance teams include the following, and a model of the management structure for the power plant would involve one Plant Superintendent for each of these areas:

- Station Control Room and Communication Systems;
- Turbine and Generator;
- Station Auxiliaries;
- Power Dams, Canals, Penstocks, Gates and Valves; and,
- Trash Racks and Trash Clearing Systems.

5.9.2 Plant Staffing Requirements

Operating staff will be recruited and trained prior to commissioning and handover of the facility from the Construction Contractor (EPC Contractor). It is contemplated that the plant operating people will be structured as follows:

Function	Number of People
Plant/Business Manager	1
Superintendents	4
Administrative Assistant	1
Accountant	1
Technicians	20
Labourers	2

During normal workdays, there will be about 14 persons on-site (including five technicians). At all other times, there will be about five technicians on site.

There will also be a need for support personnel, including security guards, cleaning staff and grounds keepers. The total staff is expected to be 45 to 50 persons.

5.9.3 Selection and Training of Operating Personnel

Recruiting of the area Plant Superintendents will be one of the primary responsibilities of the Plant/Business Manager. The recruitment of operators and technicians will be a joint process involving the Plant/Business Manager and all area Plant Superintendents. Recruitment will be conducted in accordance with the prevailing Ugandan labour laws and practices, and it is planned that the large majority of plant personnel will be recruited locally.

Certain senior members of the operating people will be recruited early during the construction phase of the facility. They will participate in the supervision of design, procurement, and construction of the facility. As construction progresses, future members of the operating teams will be recruited to augment the existing team.

The EPC Contractor, which includes equipment suppliers, is obligated to plan, manage, and conduct the initial training programme for the operating personnel. The training will be succinct to ensure that the plant people can effectively operate and maintain the equipment as a whole following system handover.

The EPC Contractor is obligated to provide training services that are tailored specifically to this project. The training will be interactive and consist of both formal classroom instruction and practical on-the-job training conducted as part of the facility initial start-up programme. During this phase, the operating personnel will receive on-the-job training from construction engineers in conjunction with technical direction given by the commissioning engineers during the initial start-up of equipment and systems.

The curriculum for the training programme will be as follows:

- A basic systems overview for all operations personnel that is intended to provide overall plant systems familiarity;
- All operating personnel will receive specific in-depth equipment operational and maintenance training. This training provides an increased level of understanding of system functions, capability and the safe operation and maintenance of the facilities equipment;
- All operating personnel will receive control room operator training which integrates the facility's systems in a unit philosophy;
- All of the people employed at the facility will receive training in work health and safety, as well as training in environment conservation; and,
- Training modules will be developed and presented by training specialists from the EPC Contractor and augmented by vendor personnel who will provide training on specialised equipment and systems. The schedule for training will be agreed between BEL and EPC Contractor and will be attended by all operating personnel.

5.10 Decommissioning

5.10.1 Operational Life of the Facility

The facility will be operated in accordance with the generating dispatch requirements of UETCL or its successor as detailed in the Power Purchase Agreement (PPA). The term of the PPA is for 30 years, after which time ownership of the facility will be transferred to the Ugandan government. Typically the physical life of hydro facilities is in the order of 60 to 100 years.

At this juncture in the life cycle analysis of the facility, it is difficult to predict the status of the Ugandan energy sector over such a long period. Therefore one can only assume that the options available to government having acquired an asset after 30 years will be to continue to:

1. Operate the facility in line with the future energy strategy;
2. Put the facility up for sale;
3. Grant another concession to an independent power producer; or,
4. Close and/or decommission the facility.

5.10.2 Closure/Decommissioning Plan

It would be very rare to abandon a hydropower project when that facility has operated for only one third of its design life. However, assuming that this is required at Bujagali, closure, decommissioning and making the dam safe is a relatively simple

procedure. The procedure depends on whether it is required to remove all traces of the dam or simply to make the project inherently safe.

To make the dam inherently safe it would be necessary firstly to open the spillway bottom gates and to remove or de-activate the radial gates and flap gate in the open position to allow the water to flow unregulated. The natural flow of the water would flow through the wide open gates and the power station could be left in place.

Alternatively, for complete removal of the facility, a step-by-step reversal of the construction procedure would need to be carried out. Cofferdams would be constructed to redirect the flow of water to the west side of the river. After emptying the reservoir via the bottom outlet gates in the spillway part of the dam, the wall structure would be removed. A section of the cofferdam would be removed to re-open the east channel of the river and allow the river to flow down the east channel. Cofferdams would then be placed across the west channel before demolition of the entire power station and spillway structure. Finally the cofferdams would be removed allowing the river to return to its natural state.

5.11 Associated Facilities

The Bujagali Interconnection Project proposed by UETCL is considered to be an associated facility to the HPP. There is no transmission infrastructure directly adjacent to the proposed HPP facility. Therefore, new transmission infrastructure is needed to evacuate power from the proposed HPP. Moreover, due to the fact that most of Uganda's transmission facilities are presently at, or near, capacity, new transformer stations would also need to be built to interconnect Bujagali's electricity output into the national grid. The IP would not be needed if not for the HPP, therefore the IP constitutes an "associated facility" for the Bujagali HPP according to the IFC's definition of "Area of Influence" (IFC Performance Standard 1, 2006).

The IP consists of the following facilities:

- *"Bujagali to Tororo" and "Bujagali to Nalubaale" Lines:* Two new 132 kV double circuit lines will run about 5 km south from the Bujagali Substation to a junction point along the existing Nalubaale to Tororo line. The existing line will be severed with one end reconnected to the new lines so as to create a new line between Nalubaale and Bujagali and a new line between Bujagali and Tororo. Power for Tororo would now be delivered from the Bujagali substation rather than the Nalubaale substation. Power could flow in either direction between the Bujagali and Nalubaale substation depending on the operational status of the generation stations. Series reactors will be installed for these lines at the substations to alleviate the need for an additional Bujagali to Nalubaale line.
- *"Bujagali to Kawanda" Line:* This new 70 km long line will be designed and constructed to 220 kV standard but initially operated at 132 kV. In the future

switching operation to 220 kV will only require installation of new step-up transformers, 220 kV bus and associated circuit breakers and protective equipment at the Bujagali substation and new step-up transformers at Kawanda substation – no work would be required on the lines themselves.

- *Kawanda Substation*: this station will be designed and constructed to allow operation at 220 kV, but initially operated at 132 kV. In the future switching operation to 220 kV will only require installation of new transformers. The station will be sized and laid out to allow interconnection of future lines in accordance with UETCL's longer range plans for development of the system.
- *"Kawanda to Mutundwe" Line*: a new, 17 km, 132 kV double circuit line will interconnect the Kawanda substation and the existing Mutundwe Substation and thus comprise the third interconnection point for the HPP. Internal improvements (e.g., new bay and switching gear) at Mutundwe will be needed to accommodate this new line.

All of the components listed above are collectively referred to as the IP and constitute what UETCL is seeking approval for from NEMA. Additional details on the design, construction plans and operation plans of the IP are provided in the SEA Report for that project.

6.0 Public Consultation and Disclosure

This chapter describes the Public Consultation and Disclosure Plan (PCDP) activities that were undertaken during the preparation of the SEA for the Bujagali HPP. This section also provides an outline of planned community engagement activities that are to be undertaken leading up to and during the construction of the HPP which are to be done in association with the CDAP activities. As such, a separate stand-alone HPP PCDP Report has also been prepared which includes additional details on the consultation and disclosure process.

IFC's newly adopted Sustainability Policy, Performance Standards and Disclosure Policy have guided the public consultation and disclosure procedures (these policies/standards have replaced the 1998 Environmental and Social Safeguard Policies and 1998 Disclosure Policy).

To be consistent with the new IFC policies as noted above, the PCDP is intended to be fully integrated with the project planning, design and implementation process so as to enhance community benefits. Similar to the SEA, the PCDP is not intended to be a “static” document that only describes what has been undertaken, but perhaps more importantly, it plays a role in the overall long-term social and environmental management system for the project that sets into motion a proactive plan to enhance community benefits and minimise negative effects.

The PCDP has built on public consultation and disclosure procedures carried out in 1999/2001 by the previous project sponsor, AES Nile Power (AESNP), as well as extensive public consultation carried out by the UETCL Bujagali Implementation Unit (BIU) Team since then, particularly in 2004-2005. Similar to the previous public consultations, BEL has sought to obtain alternative views on the design and construction of the hydropower facility and transmission system, including concerns of potential impacts and ways to mitigate such impacts. Based on this input, BEL has assessed alternatives and considered raised concerns in its decision-making process.

Public consultation and disclosure procedures have been, and will continue to be, carried out in an ongoing, transparent, consistent, up-to-date and equitable manner. Relevant project information has been and will be made accessible in a timely manner and in a language understandable to the groups being consulted. Information included as part of this process has been considered in the preparation of the SEA Report and associated action plans (e.g. the CDAP).

6.1 Laws, Regulations and Policies to Public Engagement

The GoU's Environmental Impact Assessment Regulations (1998) set out the minimum requirements for stakeholder consultation and engagement. The project must also address the consultation and engagement requirements of the IFIs involved

in the project. Details about the consultation requirements that apply to the project are provided in Chapter 2 of this SEA, and in the PCDP Report.

6.2 Stakeholder Analysis

6.2.1 Areas of Influence/Stakeholders

The consultation programme was developed and implemented taking into account the various areas of influence (AOIs) that were identified as part of the SEA (see Section 3.2). Based on these recognised areas of influence, Table 6.1 below outlines the stakeholder groups that were consulted with and a summary of how those consultations were undertaken.

Table 6.1: Consultation Activity Summary

Stakeholders	Consultation Activities
National Public	Project notices in national newspapers, web site and making documentation available to all interested parties.
Government Agencies	Meetings were held with various government agencies and SEA documentation was circulated through NEMA.
NGOs (national and local)	Numerous NGOs were identified and contacted to arrange meetings with to discuss their concerns and interests. Project documentation was circulated to the NGOs and offers made for additional meetings.
Local Communities	Contact was made with District and Sub-County level governments to inform them of the project. Sub-County Consultation committees were established to assist in consultation activities with local villages. Public meetings were held in the affected communities to advise people of the project and to receive their comments and concerns.
Project Affected Persons	PAPs were resettled under the previous SEA process undertaken by the former project sponsor. Socio-economic audit surveys were undertaken with the PAPs as part of this process and an action plan has been prepared to deal with remaining issues. Additional surveys were also undertaken with the “fishers” stakeholder group in the project area.
Vulnerable groups	Vulnerable group representatives were included on the Sub-county Consultation Committees. Their interests were considered based on the input provided by the Consultation Committees and through their meetings with the affected villages.
Business Operators	As part of a separate tourism impact study that was undertaken, key affected businesses were consulted through individual interviews. Subsequent discussions between the tourist operators and BEL regarding mitigation/compensation due to the flooding of Bujagali Falls have been ongoing. Discussions with the employees of the tourism industry have also occurred and actions to deal with potential loss of income (either temporary or permanent) have been proposed.

Stakeholders	Consultation Activities
Tourist/visitors	The interests of tourists were identified in the above mentioned tourism impact study.
Cultural Groups	The Kingdoms of Buganda and Busoga were directly consulted with through meetings and the submission of project documentation. These consultations are ongoing.

No indigenous peoples, as defined for the purposes of World Bank and IFC policy, were identified to be resident within the project area of influence.

6.2.2 Description of Stakeholders

The following provides a summary description of the stakeholders most affected by the project, which includes: Vulnerable Groups, Local Villages & PAPs; Tourist Operators/Tourists; and, Cultural Groups. Section 3.7 of the SEA Report and Section 2.0 of the CDAP provide a detailed description of socio-economic conditions in the study area.

Vulnerable Groups

Vulnerable groups were identified as women, the elderly, children (particularly orphans) and people with disabilities. As PAPs had already been relocated by the previous project sponsor, it was expected that there would not be significant effects on vulnerable groups as a result of the physical development of the project per se. As such, the focus on vulnerable groups in the PCDP implementation is to be in regards to recognizing their unique challenges/concerns so that they can take advantage of and benefit from the planned community development initiatives. Vulnerable group representatives were included as part of the Sub-county Consultation Committees that were formed for the project and who have/will provide input in regards to the specific interests of these individuals. As well, more direct consultation with vulnerable groups is proposed as part of the planned CDAP activities.

Local Villages & PAPs

The group of stakeholders most affected by the project include the eight villages located on either banks of the river including:

- Kikubamutwe, Buloba, Naminya, and Malindi (on west bank); and,
- Ivunamba, Bujagali, Kyabirwas, and Namizi (on the east bank).

The locations of the communities that were consulted with are shown in Figure 6.1.

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Figure 6.1 Location of Consulted Communities

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It is again noted that the previous project sponsor had undertaken resettlement activities. The resettled villagers were identified stakeholders in this consultation process as well.

The following presents a summary of the socio-economic conditions of the PAPs as presented in the APRAP:

- Along the sides of the river there exists numerous small settlements that are connected by tracks/roads;
- Most of the inhabitants along the river bank could be described as small plot peasant farmers that may supplement their income through cash crops and other income generating activities (e.g. fishing, trade, bicycle taxi driving, etc.);
- Housing is constructed mainly in family compounds. Buildings are either ‘temporary’ (built with traditional materials), ‘semi-permanent’ (with traditional walls and corrugated iron roofs) or ‘permanent’ (with brick or concrete walls). The majority of housing is owner-occupied;
- Water is obtained from the river and from boreholes, wells and springs. Sanitation is normally via traditionally built pit latrines;
- According to 2001 agricultural statistics from the Jinja District Agricultural Office, the average sustainable land holding in the District is 0.8 ha per compound/household;
- The average annual household income from fishing, according to the AESNP baseline survey is UGX 527,400 (USD 350);
- Average income per household from business activities or formal sector employment, according to the baseline survey, is UGX 3.481 m (USD 2,700);
- Agriculture is practiced as a labour intensive, intercropping system with both cash crops and subsistence crops. Women are responsible for food supply and other household duties whereas men are responsible for cash income including cash crops. In addition, women generally do not own family land but merely have access to it. All of this has inhibited women's economic advancement by blocking avenues to credit schemes; and,
- Fishing in the Nile River is an income generating activity for some farmers.

Tourist Operators and Tourists

Tourism activity in the area is based primarily on white water rafting on the Nile River. The Bujagali project will flood some of the rapids that are commercially rafted. There are four major rafting companies that operate on the affected section of the river. These companies and the tourists that they provide services to are profiled as part of the Tourism Impact study and which is documented in Appendix C.4 of the SEA. Commercial rafting will be able to continue on downstream rapids after the dam. BEL is working with the four major existing rafting companies to adapt their activities to the changed conditions.

Cultural Groups

The two main cultural groups potentially affected by the project are the Kingdom of Busoga and the Kingdom of Buganda. The Nile River has served as the historic divider of these two Kingdoms. The dam itself is reported to be located within Busoga Kingdom as the west bank of the Nile River serves as the boundary between the two Kingdoms. Kingdoms within Uganda are officially recognised cultural institutions by the Government of Uganda and each kingdom is represented by a head cultural leader or ‘King’ (Kyabazinga). The Kingdoms are organised into several “Chieftdoms” as well as smaller clans that are based on the family. An administrative government body composed of various representatives and a council governs the Kingdoms. It is noted that the Kingdom of Buganda owns a considerable amount of land of which is leased to others for various periods of time.

6.3 Stakeholder Engagement

The consultation and disclosure programme was designed and implemented so as to foster community awareness of the proposed project and SEA study and to provide opportunities for community input and involvement. Careful attention was made to the various national and international principles/policies/guidelines (as previously noted) as they relate to consultation. The approach was also designed recognising that an extensive amount of consultation was undertaken by the previous project sponsor, and more recently, consultation activities undertaken by the BIU. By all indications, the starting point was a relatively high awareness level of the project, which was confirmed through the initial community consultations undertaken in August 2006.

6.3.1 Previous Consultation Activities

From 1997 to 2001, AESNP undertook an extensive public consultation programme using methods best suited to the diverse interests of the various stakeholders and their level of literacy. Consultation was undertaken with local, regional, national and international interests and stakeholders. Methods of public consultation that were applied during the course of the project included:

- Targeted briefings;
- Displays and exhibitions;
- Project progress reports and newsletters;
- Advertising;
- Interviews with key people;
- Site visits;
- Informal at-home meetings;
- Surveys; and,
- Focus group discussions.

The AESNP ESIA reports provide summaries of all consultations that were undertaken and the major issues/concerns that were raised. The key issues from the past consultation process, as well as those raised since the project was put on hold are as follows:

- Need for and project benefits;
- Tourism impacts;
- Economic impacts;
- Environmental effects;
- Cumulative effects of other dam projects;
- Resettlement and compensation;
- Public health (disease);
- Quarrying impacts;
- Transparency of the process;
- The need for electricity to local communities and the affordability of power;
- Improvements in local community infrastructure;
- Banking procedures for stakeholders;
- Protection of women, orphans, elderly and physically challenged;
- Jobs for local people;
- Drinking water;
- Access to river during construction;
- Moving of spirits from the river/cultural concerns;
- Disruption to culture;
- Crop damage compensation;
- Importation of labour from the outside;
- EMF effects from the transmission lines;
- Public health implications (HIV/AIDS increase);
- Lake Victoria water levels;
- The condition/safety of the Nalubaale (Owens Falls) dam; and,
- The need to address unresolved issues of the resettled persons.

The information collected in the previous consultation process was used as a starting point for the preparation of this PCDP. This information was used with some caution though, recognising the changes to the project (although few), the potential for new stakeholders and the potential for new issues and concerns.

More recently, the Bujagali Implementation Unit (BIU), which has been an agent of the Uganda Electrical Transmission Co. Ltd. (UETCL), has been engaging the potentially affected communities. Consultations related to the HPP that have occurred included:

- Since 2004, the BIU have met regularly with each of the hydro dam affected villages (about every 2 months);

- Have provided advice on issues such as agri-forestry to the resettled community⁶ ; and,
- Have continued to work with a number of community associations based in the hydro dam villages including: Water Users Committees, Fisheries Associations, and Health Development Committees.

6.3.2 BEL Community Engagement Activities

Consultation activities undertaken and to be undertaken by BEL have been organised into the following phases:

- **Phase 1:** Initial consultation activities that fed into the development of the SEA Terms of Reference;
- **Phase 2:** Release of the SEA Terms of Reference and Draft PCDP;
- **Phase 3:** Release of SEA Consultation Summary Report;
- **Phase 4:** Release of the Final Draft SEA Report and Action Plans;
- **Phase 5:** CDAP Planning Consultation; and,
- **Phase 6:** Ongoing Project Consultation.

Figure 6.2 presents a schematic diagram of the key consultation activities and their timing.

The IFC Policy on Social and Environmental Sustainability introduces new requirements in relation to Community Engagement including the need for Broad Community Support (BCS). The IFC defines “Broad Community Support” as a *collection of expressions by the affected communities, through individuals or their recognized representatives, in support of the project*. There may be BCS even if some individuals or groups object to the project. It is the IFC’s responsibility to determine whether there is BCS for the project, not the project sponsor. To assist in the IFC’s determination of BCS, included in the PCDP Report (Table 3.2) is a description of the extent to which each of the IFC BCS indicators has been met.

In relation to the above, of particular interest is specification that the engagement process involves **free, prior and informed** consultation with the affected communities to enable informed participation, leading to lenders’ confirmation of broad community support (BCS) for the project within the affected communities. The need to provide *free, prior and informed* consultation was a guiding principle for the PCDP. The following presents a summary of the extent to which this was achieved:

⁶ It is noted that all households located in the area to be flooded were resettled and landowners compensated. This was done by AES prior to them dropping the project. Some outstanding commitments remain and BEL is in the process of fulfilling these commitments. Resettlement has also been completed for the Kawanda sub-station site. No other resettlement has been undertaken for the transmission system.

- All consultations have been *free* and under the observation of a witness NGO (InterAid). Stakeholders have been encouraged to attend consultation events and/or to provide comments on disclosed materials directly to BEL. There has been no evidence that stakeholder involvement and the comments provided have been as a result of coercion by another party. The review of media articles/editorials in various newspapers shows that there is much freedom to express ones views in Uganda.
- Consultations have been undertaken *prior* to project decisions being made and have had influence on the design of the project. Consultations will also continue on issues such as the CDAP design as well as other action plans in regards to mitigation prior to them being finalized and implemented.

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Figure 6.2 Public Consultation and Disclosure Activities

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There has been much information disclosed to the various stakeholders to ensure that they are *informed* about the project. Information that has been disclosed has included: the SEA ToR, the draft PCDP, a project newsletter (which was also translated into Luganda), an SEA Summary Report, presentations/meetings with the Sub-County Consultation Committees; presentations at the public meetings held in the Sub-counties; as well as presentations/meetings held with other stakeholder groups (e.g. rafting company employees). All of these items/activities contributed to created community awareness about the project. As well, the BIU has continued to work with the resettlement community and to keep them informed of actions to resolve outstanding issues. The information disclosure activities (to keep people informed) have been focussed on those who have/will be potentially affected by the project. There have also been other notifications targeted at the general public and the NGO community in the form of newspaper/radio notices and letters. All of these activities have been described in this chapter as well as in the PCDP Report. BEL is committed to keeping the local communities informed by making the SEA reports available to the local community as well as the release of future newsletters/information bulletins that are to be focussed on the CDAP and other action plans/mitigation activities.

- Information to the communities has been disclosed in a *cultural appropriate manner*. This has involved the conduct of meetings/presentations in the local language; the preparation and distribution of a project newsletter in the local language; the use of local language radio stations to advertise meetings and to notify the release of information materials; the engagement of local community leaders to assist in the meetings; the engagement of locally based Consultation Committees consisting of various community representatives; and contact with Kingdom leaders to confirm how/and with whom should consultations be conducted with.

The project sponsor retained the services of a witness NGO (InterAid) in August 2006 to assess whether or not BEL/UETCL and their affiliates abide by Ugandan law and international requirements when undertaking the PCDP activities. InterAid was required to attend a sample of the consultation activities and to establish a grievance mechanism. (See Section 6.5.1 for further details on this.)

The following sections describe the consultation phases and the activities undertaken in each Phase.

6.3.2.1 Phase 1 – Initial Stakeholder Consultation

The project sponsor has conducted two initial sets of consultations prior to the release of the SEA ToR and this draft PCDP. These consultations took place in January and March 2006 and largely involved meetings with various government agencies. Some additional meetings were also conducted in late May 2006. The purpose of these

meetings was to reintroduce the project and to identify initial comments and expectations that the agencies may have with respect to the project and SEA process.

The agencies that were met with are outlined in Table 6.2 below.

Table 6.2: Initial Government Agency Consultations

Consulting Activity	Agencies/Groups Consulted
January 2006 Consultations	<ul style="list-style-type: none"> • BIU • Ugandan Electricity Generation Co. Ltd. (UEGCL) • Ugandan Electricity Transmission Co. Ltd. (UETCL) • Ministry of Energy and Mineral Development (MEMD) • National Environmental Management Authority (NEMA) • Jinja District (reps. of Jinja, Budondo, Bujagali, Kyabirwa, and Namizi) • Mukono District (reps of Mukono, Wakisi, Kikubamutwe, Naminya, Buloba) • National Fisheries Resources Research Institute (NAFIRRI) • Uganda Wildlife Authority • Directorate of Water Development • National Forest Authority • Rural Electrification Authority • Ugandan Investment Authority • Ministry of Tourism, Trade and Industry • Electricity Regulatory Authority • Nile Basin Initiative
March 2006 Consultations	<ul style="list-style-type: none"> • BIU • Makerere University Institute of Environment and Natural Resources (MUIENR) • National Forest Authority (NFA) • Road Agency Formation Unit (RAFU) • Mukono District • NAFIRRI • Jinja District • NEMA • Ministry of Tourism, Trade and Industry (MTTI) • Uganda Wildlife Authority (UWA) • Tourism Operators (Nile River Explorers, Equator Rafting, Adrift) • Mabira Forest Tourism Ecotourism Centre • Jinja tourism businesses networking meeting • Local hotel/lodge/tourism owners and operators • Operator of Kiira and Nalubaale Hydro Dams (Eskom) • Directorate of Water Development (DWD) • LC1 and LC3 representatives of Budondo and Wakisi Sub-Counties
May 2006 Consultations	<ul style="list-style-type: none"> • BIU • National Association of Environmental Professionals (NAPE) • National Forest Authority (NFA) • Wetlands Inspection Division • National Association for Professional Environmentalist (NAPE)

Consulting Activity	Agencies/Groups Consulted
	<ul style="list-style-type: none"> Save the Bujagali Crusade

The key issues/comments raised during these initial consultation meetings include:

- The recognition of the urgent need for new reliable electrical generation sources given current rolling power blackouts;
- The concern that the lack of power is damaging the economy;
- The need to update information in regards to the river rafting companies;
- The need to resolve issues for the affected villages in the vicinity of the hydro dam (e.g. replacing the water pumps);
- The need to audit the results of the previous RAP;
- That the east bank of the river site is still to be fenced;
- The fisheries study previously undertaken in 2000 requires updating;
- The need for land to compensate the removal of land in the Mabira forest;
- Concerns remain regarding the displacement of the rafting companies and the need to improve the area as a tourist destination – what are the tourism economic effects of the project?
- Suggestions from NGOs that previous process was not transparent – it did not involve NGOs;
- The need for an EA process that promotes open dialogue;
- The need to assess the effects of the project on Lake Victoria (particularly considering the low water levels);
- The need to consider and assess other electricity generation options in the EA;
- The cumulative effects of the three dams (Nalubaale (Owen Falls), Kiira (Owen Falls extension) and Bujagali) need to be considered;
- Safety issues associated with the structural integrity of the Nalubaale Dam needs to be considered;
- The need for a more integrated EA process and examination of the issues;
- The need for an NGO forum to discuss the issues;
- The need for input from the people and not just community representatives who may be biased in their opinions;
- The need to involve both east and west bank villages in the construction employment;
- The need to provide training and employment recruitment;
- The need to provide opportunity for local women to participate during construction (e.g. breakfast/lunch/dinner kiosks); and,
- The need to consider public access to the river for subsistence, commerce and recreation.

Business/Tourism Operator Meetings

Consultations were undertaken with a variety of businesses/tourist operators potentially affected by the hydroelectric project, many of whom were associated with white-water rafting. Initial meetings were conducted in late March 2006 as part of a tourism impact study that was undertaken. The purpose of these meetings was to reintroduce the project, to develop an understanding of their operations, to understand how their operations would be affected by the project, and to explore how BEL can help the companies adapt their operations to the changed environment. Subsequent follow-up meetings between the tourist operators and BEL have been ongoing since June 2006 to work towards agreements on the way forward. The results of these ongoing discussions are documented in Chapter 8 of the SEA.

Assessment of Past Resettlement

As part of the Assessment of Past Resettlement, surveys and discussions were undertaken with a sample of those people who had been relocated in 2001 by the previous project sponsor from the hydroelectric dam site to the Naminya settlement. The purpose of these consultations was to assess the effectiveness of the previous resettlement programme and to identify concerns and issues of the resettled people that have yet to be resolved. These meetings/interviews were conducted in April 2006. The report on the work is found in the Assessment of Past Resettlement and Action Plan (APRAP) provided as Appendix I of this SEA report.

In summary, issues identified included:

- Those who were resettled to Naminya are generally satisfied with the resettlement site;
- The new houses are generally much better than their previous houses, although some criticisms were made of the houses regarding their condition;
- That the refurbishment of the existing Naminya school (as promised by the previous project sponsor) never took place – as no action was taken, people took it upon themselves to create their own school in one of the vacant houses on the resettlement site;
- Lack of health facility staff accommodation on-site jeopardises the operation of the community health centre;
- Mixed reactions regarding livelihood restoration as some suggested that they are now better off where as others have suggested that they now have less land/land is less fertile than before; and,
- Those who suggested they are “less well-off” indicated that reduced fishing opportunities (due to being located further from the river) has contributed to this.

BEL has responded to these issues as documented in the Assessment of Past Resettlement Activities and Action Plan (APRAP).

Fishers Consultations

Consultation meetings were conducted with a number of villages along the Nile in April, 2006 for the purposes of updating baseline information relating to the livelihood of the fishers and to better understand the impacts of the project on this group. These meetings were undertaken by the National Fisheries Resources Research Institute (NAFIRRI). Discussions/focus group sessions were conducted with the Kikubamutwe (Waskisi sub-county), Kirindi (Nazigo sub-county), and Namasagali (Namasagali sub-county).

Issues identified included:

- Reduced access or increased distance to former fishing sites;
- Potential effects of noise, blasting and air pollution from project construction on agricultural activities or practices;
- Reduced incomes of resettled people (due to lack of access to the river and removed from Market areas to sell products);
- Decreased agricultural productivity on replacement lands;
- Risks associated with increased traffic during project development; and,
- Lack of access to potable water due to pump malfunctions.

BEL has responded to these concerns through its APRAP process, which was undertaken as part of the SEA process.

6.3.2.2 Phase 2 - Release of the SEA Terms of Reference and Draft PCDP

The Phase 2 consultations occurred from July to August 2006 were focused on gaining input on the SEA ToR and the draft PCDP. Contact was made with various interests in order to inform them of the process, to identify issues/concerns, and to obtain input on the planned consultation programme.

Public Notice

An initial public notice that announced the initiation of the SEA study and release of the SEA ToR and draft PCDP was placed in the following three newspapers:

- New Vision (on August 5 and 8, 2006);
- The Monitor (on August 5 and 9, 2006); and,
- Bukedde (in Luganda) (on August 5 and 8, 2006).

In addition to appearing in the newspapers, the notice also was placed on the New Vision web site for a period of two weeks in early August 2006.

The public notice also identified contact information for additional information and advised that the SEA ToR and PCDP are available from the project website.

NGO Meetings

Offers were made to meet with a targeted group of NGOs in July/August 2006. The purpose of these meetings was to introduce the project and to obtain their initial feedback and concerns in regards to the project and SEA study. Initial contact was made with about 20 NGOs. Both local and national NGOs were consulted. A summary of key issues raised during the NGO meetings is provided in Table 6.3 below.

The only written comments formally submitted by an NGO (at the time of writing this report) on the SEA ToR were from NAPE. Issues raised by NAPE included:

- Request for information on studies being carried out on Lake Victoria levels;
- How cumulative effects are being dealt with;
- How safety issues regarding the aging Nalubaale facilities will be addressed;
- The need for a comprehensive assessment of all Nile River projects;
- The need for an overall assessment of energy options;
- The lack of plans and strategies to evaluate and monitor the impacts of resettlement and compensation of dam affected people; and,
- Impacts of the project on tourism.

Table 6.3: Summary of Phase 1 NGO Meetings

Meeting Date	Organisation	Summary of Comments
July 27, 2006	Uganda National NGO Forum Plot 25 Kabalagala Box 4636 Kila. 031 260373/ 041 510272/ 041 501674e-mail; ngoforum@infocom.co.ug	<ul style="list-style-type: none"> • Their interests can be represented by ACODE and NAPE.
July 27, 2006	Anti-Corruption Coalition Uganda (ACCU) Mr. Godfrey Rwakabale (Coordinator) Plot 243 Tuffnel Drive 041 535659/ 535660/ 0772611482 E:mail: rwakabale@anticorruption.or.ug	<ul style="list-style-type: none"> • Their role is mainly promotion of corporate social responsibility. • Knew the project history since the times of AES Nile Power. • Pledged their contribution to the SEA process.
July 1, 2006	International Union for the Conservation of nature and Natural resources (IUCN) Mr. Alex Muhwezi (Country Rep.) Plot 39, Acacia Avenue 041 344508/ 0772221499 e-mail; alex.muhwezi@iucn.co.ug	<ul style="list-style-type: none"> • Country Rep. was out of country but still promised to forward their input to the document. At the time of writing this report, no input has been received.

Meeting Date	Organisation	Summary of Comments
July 26, 2006	Uganda Wildlife Authority (UWA) Director, tourism business development and planning Mr. Damian B. Akankwasa Box 3530 kla. 041 355000/ 0772 790729 damian.akankwasa@uwa.or.ug	<ul style="list-style-type: none"> • Needed to look at the SEA TOR's as a guide to UWA's input and old EIA documents. • UWA is supportive of the project. Their role will be more of guidance throughout the process.
August 1, 2006	Green Watch Uganda Kanneth Kakulu/ Irene Ssekyana Suite No.5, Ground Floor -Airways House. P.O. Box 10120, Kampala- Uganda Tel: 256-41-344 613 Fax: 256-41 343 787 E:mail- irene@greenwatch.or.ug OR environment@greenwatch.or.ug website: www.greenwatch.or.ug	<ul style="list-style-type: none"> • Willing to participate. • Had concerns on whether the affected communities were consulted or if the NGO feedback would be basis for consultation. (Explained to them that community consultation is ongoing).
August 2, 2006	Uganda Debt Network Mr Kapepwe Julius 041 543974/ 041 533840/ 041 223152 jkapepwe@udn.or.ug	<ul style="list-style-type: none"> • They are willing to participate in this development. • Requested copies of the TORs to act as a basis of their input.
July 27, 2006	DENIVA Mr. Wandera Peter 041 530575/ 041531150 info@deniva.or.ug	<ul style="list-style-type: none"> • Liked the concept of involving NGOs unlike the way it was conducted previously. • Promised to have a look at the TORs as a group and give feedback. At the time of writing this report, no input has been received.

Meeting Date	Organisation	Summary of Comments
August 1, 2006	Environmental Alert Christine Nantongo (Programme Manager) Kabalagala off Gaba road P.O.Box 11259, Kla. Tel: 256 41 510215; 0772440926 e-mail envalert@envalert.org	<ul style="list-style-type: none"> Appreciated the approach the SEA team took making sure the Civil society is involved in this SEA process. Advised that all the groups under the National NGO forum umbrella should be contacted.
August, 2006	Wildlife Clubs of Uganda Tibakenya, Dr. Elly Africa Box 4596 Kampala Phone: +256.41.256534 Fax: +256.41.258351	SEA TOR and Draft PCDP sent – no comments received
July 27, 2006	National Association of Professional Environmentalist (NAPE) Frank Muramuzi 041-534453/ 0772 492362 e-mail: nape@utlonline.co.ug	<ul style="list-style-type: none"> NAPE noted that they are not against dams but would like their issues addressed. Requested a better explanation of the overall SEA process (this was provided at the meeting). Asked relationship of project to Nile Basin Initiative and World Commission on Dams. Recommended interaction with the Uganda Dams and Development Dialogue. How is the SEA process addressing falling Lake Victoria water levels and climate change? Nalubaale Dam safety issues are a concern. Need to address cumulative effects of other Nile Basin Initiatives. Need to address problems associated with previous resettlement activities from the hydro dam. Need to examine other power generation alternatives in the SEA. Need to consider tourism impacts from the project. Have the findings and recommendations of World Bank Inspection Panel and IFCs Compliance Advisor/Ombudsman been considered?

Meeting Date	Organisation	Summary of Comments
		<ul style="list-style-type: none"> • Asked about the status/disclosure of the PPA.
August, 2006	Action for Development (ACFODE). Type: Non-indigenous. Physical Address:- Plot 623/624 ACFORD House Bukoto, Kampala. Postal Address:- Telephone & Fax:- 532311 & 530460 E-mail:- ngoforum@starcom.co.ug. Contact Person:- Mrs.Annette Muwonge	SEA TOR and Draft PCDP sent – no comments received
August, 2006	Uganda Fisheries and Fish Conservation Type:- Indigenous Telephone & Fax:- E-mail:- ngoforum@starcom.co.ug.	SEA TOR and Draft PCDP sent – no comments received
July 28, 2006	Uganda Manufacturers Association (UMA) 041 220831/ 041 221034/ 0772 861147 Mr. Mawanda Robert.	<ul style="list-style-type: none"> • As an umbrella of manufacturers, they fully support the project, especially in light of the current power crisis that greatly affects the manufacturing sector. • Manufacturers only get electricity an average of 17 days per month. There is more than 50% decrease in production because of this. • Promised to convene a UMA Environment sub-committee meeting and provide input into the project document (SEA ToR). At the time of writing this report, no input has been received.

Meeting Date	Organisation	Summary of Comments
July 28, 2006	Save Bujagali Crusade (SBC) Afunaadula 0782555222	<ul style="list-style-type: none"> • SEA should address potential for Nalubaale Dam failure and project cost. • The flooding of Lake Kyoga should be considered. • Need to look into options of small dams that are easily manageable and nearer to people. • Concerns of political influence in developmental projects and the need for political support for the alternatives and removal of all barriers to such developments. • Noise being generated from the project generators is a concern. • Need to consider effects on the Busoga Kingdom. • There should be a grievance handling mechanism for the PAPs. • There is need for confidence building with the PAPs. NAPE noted that they are not against dams but would like their issues addressed. • Culture and tourism need to be boosted in the area.
August 1, 2006	ECOVIC Kefa Kaweesa (Director) 0772 2455270 kefasan@yahoo.com	<ul style="list-style-type: none"> • Due to the short notice for the meeting, they could not provide comments at the meeting though they knew about the project. • Have to share the project's TORs with the rest of the team and then come up with a proper input. At the time of writing this report, no input has been received.
August 1, 2006	Nile Basin Discourse Sarah Naigaga 0782 436700	<ul style="list-style-type: none"> • Was very interested to get involved in the exercise and on receiving project's documents, would then prepare a response. At the time of writing this report, no input has been received.
August 1, 2006	Uganda Dams Dialogue Mr. Bazira (Chairman) 0772 504173 bazirae@yahoo.com	<ul style="list-style-type: none"> • The organisation represents both the government and several civil society organisations. One of the aims is to address concerns surrounding dams developments in the Country. • They are to convene a meeting, review the TORs and provide feedback. At the time of writing this report, no input has been received.

Meeting Date	Organisation	Summary of Comments
July 31, 2006	Student Partnership Worldwide Jinja (SPW) Jimmy Innes (Country Director) jimmy.innes@spw.org 0782 974434	<ul style="list-style-type: none"> Most of their work is channelled to community based environmental programmes. Would therefore be happy to participate in this SEA process especially where community related issues are involved.
July 31, 2006	JIDDECO (Jinja) Paul Bateeze (Coordinator) 0772 408378 jiddeco@jiddeco.or.ug	<ul style="list-style-type: none"> Despite being located in Jinja (project area) they did not participate in the previous EIA process and hence have limited awareness about the project. Documentation was provided to them (SEA ToR and PCDP) for their review and input. At the time of writing this report, no input has been received.
July 31, 2006	Busoga Trust (Jinja) Frank Kumbuga & Johnson Waibi (programme manager) 0772 452693 / 043121572	<ul style="list-style-type: none"> Just like JIDDECO, it's also under the Busoga arch-dioceses. Could not provide specific comments on the process. Provided with the TORs for their review and comments.
August 4, 2006	African Institute for Energy Governance (AFIEGO) Dickens Kamugisha 041571597 - 0782407085 afiego-ug@yahoo.com	<ul style="list-style-type: none"> Would liaise with the ACODE director after getting the TORs and provide their input. At the time of writing this report, no input has been received.
August 2, 2006	Energy Plus Ltd 535 Kisaasi Road, Bukoto 041-533073- 077-2441953 eng@utlonline.co.ug	<ol style="list-style-type: none"> 1) Glad for to be considered participate in this process as they have so many concerns on the same. 2) There was need for them to consult other professional colleagues due to the professional nature of the concerns, in order to have an informed and professional input. At the time of writing this report, no input has been received. 3) Their firm did not have budgetary provision for the activity this financial year. 4) Needed some funding from the project sponsor for them to carry on the activity. (Note that BEL is not providing funding to NGOs)

Meeting Date	Organisation	Summary of Comments
August 4, 2006	ACODE Plot 96 Kanjokya Street Tumushabe Godba 041 530798 – 0782 202816	5) Would liaise with the AFIEGO director after getting the TORs and give their input. At the time of writing this report, no input has been received.

Nile Basin Discourse (NBD) Forum

On September 21, 2006 a BIU representative was invited to attend and to make a presentation to a forum organised by the Ugandan Nile Discourse Forum. This forum was not focused on the Bujagali project, but none the less, there is interest in the project by the NBD. The workshop was attended by over 30 participants representing different NGOs and CBOs. One objective of the forum was to help better understand how ECOVIC (a umbrella organisation of environmental NGOs in Uganda) could work with the Bujagali project to promote environmental sustainability. The Nile Basin Initiative is an inter-governmental partnership focused on the fighting of poverty, socio-economic development and the management of the Nile water resources. Some key issues raised by the participants at the meeting included:

- The public availability of the power purchase agreement;
- The need for independent project monitoring to ensure that the proposed measures are actually implemented;
- Interest in establishing linkages with technical people working on the project;
- Interest in ensuring that environmental issues/restoration are included as a component of the CDAP;
- Interest in developing proposals for community development in the area for submission and consideration by BEL;
- Capacity building of the CSOs so that they can access funding;
- That micro enterprise development should be integrated into the CDAP; and,
- Creating linkages with InterAid (the witness NGO for the project).

Community Meetings

Local governments/communities potentially affected by the hydropower project included:

- Jinja and Mukono District (LC5);
- Budondo and Wakisi sub-counties (LC3); and,
- Communities of Kikubamutwe, Buloba, Naminya and Malindi (on west bank) and Ivunamba, Bujagali, Kyabirwas and Namizi (on the east bank) (LC1 level).

To consult with the potentially affected villages, Sub-County level (LC3) consultation committees were established. The composition of these committees is noted in Table 6.4:

Table 6.4: Sub-county Committee Composition

Area of Representation	Composition
Political	L.C 3 Chairperson Sub-county Chief L.C 1s of the affected villages.
Technical	Environment Health/Education Works/Production/Community development
Special Interest/ Vulnerable Groups	Women People with Disability Youth Elderly Directly affected persons (in case none of the above is)

The purpose of these committees was to sensitise the affected villages regarding the project and to obtain their concerns & suggestions. In Phase 2 of the PCDP process, these committees met with the villages in the form of village meetings and in some cases consulted with local leaders such as teachers and vulnerable groups.

The SEA ToR and the draft PCDP were provided to the Sub-County Committees in late July 2006 along with a list of issues/questions to explore with the villages including:

- 1) What general concerns do people have regarding the proposed development of the HPP?
- 2) Is there any specific information regarding your village that the project team should be aware of?
- 3) What types of information are people interested in receiving?
- 4) Are there any specific issues/topics that people would like more information on?
- 5) How would people like to receive information about the project and the SEA study results in the future?
- 6) How should the results of the draft SEA and other project information be made available to the villages?
- 7) Is the use of sub-county committees to consult with the villages appropriate?
- 8) Are there other consultation approaches/methods that could be used?
- 9) What mitigation measures should be undertaken to reduce negative effects?
- 10) How do the villages/people want to be involved in the future?
- 11) Are there any specific local interest groups that we should be consulting with?
- 12) What expectations do the villagers have regarding community development opportunities as a result of the project?
- 13) Do people have any comments/concerns with respect to the proposed study schedule?

These initial meetings were undertaken in late July/August 2006. A summary of key issues raised in these meetings is provided in Table 6.5.

Kingdom Meetings

Introductory meetings were held with representatives of the Kingdoms of Busoga (August 11 & 18, 2006) and Buganda (August 15, 2006). The purpose of these meetings was to reintroduce the project/study, to identify concerns and identify how the Kingdoms would like to be involved in subsequent steps of the process. Although the dam itself is within Busoga Kingdom, dam infrastructure will be within Buganda Kingdom. Both Kingdoms were provided with the SEA ToR and Draft PCDP and were requested to provide their comments. Key issues raised during these initial meetings are summarised in Table 6.6.

Buganda's interest relates primary to the associated transmission line as land has already been acquired for the HPP. As such, more detailed comments from the Buganda Kingdom follow-up meetings are documented in the SEA and PCDP for the Transmission Line project for which UETCL is the project sponsor.

Several follow-up meetings were held with representatives of Busoga Kingdom to discuss impacts and impact management, including the need for further measures to appease Spirits and monetary compensation or royalties from the Project for the Kingdom. Ongoing consultations are taking place with the Kingdom on these issues.

Table 6.5: Summary of Phase 2 HPP Community Discussions

Sub-County/ Division Consultation Committee	Communities Represented	Meeting Date	Attendees	Discussion Summary
Budondo Sub-County	Ivunamba, Bujagali, Kyabirwa, Namizi	Aug 7/06	BPIU, InterAid, Consultant Rep	<ul style="list-style-type: none"> • The Sub-County indicated support for the project and see it as a means to community improvement. • The Sub-County suggested several community improvement initiatives as follows: <ul style="list-style-type: none"> ○ Need for improved water supply to the villages as sections of the river are being cut-off; ○ Need to improve roads among the communities in the sub-county and to tarmac the main road from Jinja; ○ Need for upgrading of health facilities; ○ Greater distribution of/access to electrical power; ○ An employment centre on the east bank of the river; ○ Technical school/vocational centre to train people to take advantage of new jobs; ○ Provide support for a cultural resource centre directed at youth; and, ○ Improvement of the sub-county office. • The Committee also made suggestions for future consultation activities that included the use of radio programmes and newsletters. The Committee indicated a willingness to work with BEL and conduct future consultation with the villages on their behalf. They suggested that it would be useful to have a BPIU rep attend the village meetings as well. • The Committee requested a schedule for future consultations.

Sub-County/ Division Consultation Committee	Communities Represented	Meeting Date	Attendees	Discussion Summary
Wakisi Sub-County	HPP Villages Kikubamutwe, Buloba Naminya, Malindi IP Villages Wabyinga, Lukaga, Kiyunga, Scoul	Aug 7/06	BPIU, InterAid, Consultant	<ul style="list-style-type: none"> It was noted that the sub-county is affected by both the dam and the transmission line. The Committee indicated support for the project and look forward to the benefits from the project. It was noted that the Committee was established to sensitise the community regarding the project. There key issue relates to the compensation to provide for the transmission line corridor. Some landowners expressed concern on the need to undertake revaluation of the affected properties. The concern being that after the AES valuation was completed, residents/landowners were told not to use the land and these areas were not kept up in many cases. New property value rates should be applied though. Several issues were also raised regarding the resettlement community: <ul style="list-style-type: none"> Poor road into the community The need for improved schools/health facility The need for improved water supply The latrines get filled in during the rains Some houses are cracking Property boundary conflicts with the host community Uncertainty with land titles. The community is not close to markets – making it difficult to sell their products Houses not conforming to the model home/no kitchens in the houses Other comments made include: <ul style="list-style-type: none"> That residents be given priority for jobs The need for piped water to accommodate the large construction workforce Rural electrification and road lighting Alternative roads for school children to travel along as the existing road

Sub-County/ Division Consultation Committee	Communities Represented	Meeting Date	Attendees	Discussion Summary
				<p>will become too busy with truck traffic</p> <ul style="list-style-type: none"> ○ Improvements for the fishers and provision of fish ponds in the affected villages • The committee asked whether funds could be released for community improvement prior to project initiation. • Regarding consultation, it was suggested that dam and transmission related issues be separated among the respective affected communities. <p>The use of newsletters through a Q&A format was also suggested as a means of communication.</p>

Table 6.6: Summary of Issues from Kingdom Meetings

Meeting	Summary of Issues
Busoga Kingdom Prime Minister and Permanent Secretary (Aug. 11/06)	<ul style="list-style-type: none"> • Official Kingdom position is that they support the project. • Feel that previous project sponsor was dismissive of social and cultural issues – did not adequately engage the Kingdom. • Pleased that BEL has engaged them to hear their issues. • Felt that the previous EIA did not adequately capture the effects of the Bujagali Falls inundation and the effects on the spirits in the Falls & tourism impacts. • The spirits in the Falls, have not be adequately released – there needs to be a collective belief of this among their community • Suggested that a meeting be held with the Busoga cultural leaders to identify the way forward. Should also hold a meeting with Council to sensitise them of the Project. • Need to address the potential workforce impacts of the project on the community. • Feel that the project needs to result in tangible benefits for the Kingdom. There should be increase access to power /reduced tariffs for the community hosting it. (Also, what alternatives exist to provide power to our community?) • Communication materials need to be in the local language.
Busoga Kingdom Cultural Leaders (Aug. 18/06)	<ul style="list-style-type: none"> • Nine cultural leaders were met. • Confirmed that the cultural issues of the project were not adequately addressed process the past process. Spirits in the Falls and shrines need to be relocated. • Noted that the Falls are entire within Busoga Kingdom. • The cultural leaders indicated a willingness to work with BEL and are to meet among themselves to determine the appropriate path to address the spiritual issues associated with Bujagali Falls. All 11 cultural leaders of the Kingdom will need to be involved. • Commented that there needs to be benefits to the Kingdom. The project headquarters should be on the east side of the river & not the west; there should be a reduced tariff for power within the project site; should be priority given to people in this community for employment; main road on east bank should be tarmaced; public health issues of the project need to be addressed – public education required; training to bring people into the workforce. Perhaps provides assist in the form of Lusoga Language development. • The Kingdom wants to play a role in the process.

Meeting	Summary of Issues
Buganda Kingdom – Partial Technical Committee (Aug. 15/06)	<ul style="list-style-type: none"> • The Kingdom has not yet familiarised themselves with the project and its potential issues. Are willing to do this but will require assistance. • A key concern is the impact on their land – they noted that they are undertaking a land tenant audit at this time. • Want to avoid misinterpretation of the project; the parish chiefs need to be made aware of it. • Public confidence in the project needs to be restored. • It was suggested that the Parish Chief might want to sit in on the Sub-County Consultation Committees. • Additional meetings with the technical committee will be required as well as with the Kingdom Parish Chiefs. • It was suggested to the TC that a Buganda representative might want to monitor the land valuation process (for the T-line).
Buganda Kingdom Technical Committee Meetings Aug. 31/06 and Sept. 5/06	<ul style="list-style-type: none"> • The Kingdom has agreed to work closely with BEL to ensure the successful implementation of this project. • The Kingdom's key concern relates to the impact of the project on land that the King and Kingdom owns. • Advised that BEL should work with the Kabuka's officers and Buganda Land Board. • The Kingdom appears to have greater interest in the IP than the HPP.
Busoga Kingdom PM, PS and Royal Chiefs Meeting Oct. 26/06	<ul style="list-style-type: none"> • Meeting attended by the Kingdom's Prime Minister, Permanent Secretary and Royal Chiefs. • The key issues discussed included the need for spiritual appeasement and the Kingdom's request for long term economic benefit from the project. • The Kingdom is to provide BEL with an updated outline of cost to facilitate the appeasement of spirits. • Future consultations will be required to address their expectations for economic benefits.

National Government Agency Meetings

During this phase of the study, some discussions were held with NEMA as part of their review and approval process of the EA ToR. As well, related to the HPP, discussions were held with:

- Department of Fisheries Resources;
- DWD Water Resources Management Department;
- Mukono District Agriculture Officer;
- Mukono District District Entomologist (re: vector control);
- Jinja Vector Control Officer;
- Jinja District Agriculture Officer;
- Uganda Wildlife Authority; and,
- NAFIRRI.

Issues raised at these meetings are as follows:

- The need for a fish pass the Bujagali dam (for potomadromous species);
- Project could support cage culture of fish (form of fish farming) as a community compensation measure;
- That DWD can provide assistance in project monitoring regarding water levels/groundwater;
- District agriculture offices can provide support in the CDAP as it relates to improving agricultural capacity through demonstration plots, implementation of NAADS projects, soil conservation, introduction of new crops, bee keeping, etc.;
- Suggestion to increase tsetse control on both banks particularly in advance of vegetation clearing in the reservoir;
- UWA confirmed that the Jinja wildlife sanctuary is in name only – no precedence that UWA being asked to give approval for developments in WS areas;
- Suggestion by NAFIRRI that the reservoir will increase opportunities for fisheries; and,
- NAFIRRI can assist in the fishers capacity building activities proposed as part of the CDAP.

Public Inquiries

A telephone number was provided in the public notices for the purposes of information requests and to address inquiries to the project team. As well, an email address was provided on the project website (www.bujagali-energy.com) for people to send in comments and ask questions. Although the numbers were widely publicised only a few calls were received during Phase 2. Most of the inquiries were related to employment opportunities.

6.3.2.3 Phase 3 – Release of SEA Consultation Summary Report

The Phase 3 consultation activities occurred from September to October 2006 and were focused on the release of the draft SEA findings in the form of a SEA Consultation Summary Report for the purpose of obtaining input from various interests. A copy of the SEA Consultation Summary Report is provided with the PCDP Report (Appendix H). The SEA Consultation Summary Report was produced in English as well as Luganda. Activities that were undertaken and the input that was received are outlined below.

SEA Summary Release Advertisements/Distribution

A public notice regarding the release of the SEA Consultation Summary Report, and its availability for review, was placed in the New Vision and Monitor newspapers (English) on September 23/27 and 23/26, respectively. The same advertisement, but in Luganda was placed in the Bukedde newspaper on September 23/27, 2006. In addition to advertising the release of the SEA Consultation Summary Report, contact information was provided should people have comments or questions regarding the project. Copies of the public notices are included with the PCDP Report.

The availability of the SEA Consultation Summary Report was also advertised on national radio (CBS and Radio One stations). The ads ran from October 2 to October 11, 2006.

The SEA Consultation Summary Report was distributed to the Sub-County Consultative Committees and provided to the LC3/LC1 level governments.

Newsletter

A 4-page newsletter was prepared which provided an overview of the project as well as a summary of key SEA findings to date. A copy of this newsletter is provided in the appendices of the PCDP. The newsletter was distributed to people who attended the public meetings (see below), provided to the Sub-County Community Development Officers and copies were left with the LC3 and LC1 government levels. The Newsletter was produced in English and Luganda.

Community Meetings

Community meetings were held in Budondo Sub-County on October 5, 2006 and Wakisi Sub-County on October 6, 2006. The purpose of the meetings was to present:

- A project update;
- The initial findings of the SEA;
- The PCDP; and,
- The proposed community development initiatives.

There was also an opportunity for the participants to provide their input and ask questions. The meetings were held with the assistance of the Sub-County Consultation Committees. The meetings were advertised through letters sent to the Villages (through the Sub-County Committees), posters in public places and radio advertisements in the local area (on CBS and NBS (local language) stations from October 2 to October 6, 2006).

About 150 people attended each meeting. Also present were representatives of BEL, BIU, UETCL, Burnside Consulting team, LC3/LC1 governments, Buganda and Busoga Kingdoms as well as a representative from MIGA. A presentation on the SEA findings to date was made at the meeting (Appendix D.5 of Appendix H). After the presentation, an opportunity was provided for people to ask questions/provide comments and project representatives provided responses to the questions.

By in large, the sub-counties, as well as those who attended the meeting, indicated their support for the project. Nevertheless, many questions and issues were raised. Table 6.7 summarises the input/comments received at these meetings and responses to the comments.

Table 6.7: Key Issues/Actions from October 5 and October 6, 2006 Budondo and Wakisi Community Meetings⁷

Issue	Responses/Actions
Significant interest in employment & training opportunities. Priority should be given to local communities for jobs.	Workforce training opportunities would be provided as part of the CDAP. A Resource Centre is to be developed on both sides of the river. As well, preference to local qualified individuals would be given by the EPC contractor for employment.
Workforce accommodation – community has offered to house workers in Wakisi area. Feel that workers do not all need to live in Jinja Town area. Expressed concern that local people would need to live in Jinja to work on project (in response to comment that there would be no workers specific camp and that housing would be provided in Jinja area).	BEL's proposal to house migrant workers in Jinja is to avoid the creation of a construction camp. However, if existing housing is insufficient it may be necessary to create a camp or build new housing in the area. BEL is open to workers being housed in the local villages if the communities were in favour of this. Local people who are working on the project would not need to stay in Jinja Town.

⁷ As Wakisi Subcounty will also have the transmission line passing through, some of the issues raised at the meeting related to the transmission project as report in the table. These issues were considered in the preparation of the SEA for the IP.

Issue	Responses/Actions
Request for guarantees regarding proposed community development initiatives, jobs and other sponsor commitments. Need to live up to the old (AES) CDAP.	The implementation of the CDAP activities would be monitored by BEL, NEMA, and international lenders.
Safety concerns for pedestrians/children along access roads, particularly the west bank road which is heavily used by pedestrians.	BEL will examine options to address safety issues associated with construction traffic using the west bank road. Mitigation options are presented within the SEA and will be discussed with the LCs.
Suggestion that resettlement people in Naminya were “dumped” there.	Resettlement activities were undertaken by the previous project sponsor. An Assessment of Past Resettlement Activities and Action Plan has been prepared.
Concerns expressed regarding safety standards for construction workers.	All construction activities will adhere to Ugandan and IFC/World Bank worker health and safety requirements.
Concerns regarding community health issues from workforce during construction.	An AIDS/HIV/Malaria education, prevention and treatment programme will be implemented with the assistance of local institutions/NGOs.
Rural Electrification – communities feel that they should benefit from increased electrical supply through the provision of electricity to the villages.	UMEME is responsible for the distribution of electricity in Uganda. BEL will lobby UMEME and work with them to facilitate rural electrification in the study area.
Impacts on fishers – suggested that they have already been affected – Asked if compensation to be offered to the fishers?	Although there have been some river access restrictions, fishers are still able to access the river at other locations. As part of the CDAP, several fisher related activities will be undertaken including developing new beach landing facilities, the provision of training to improve fishing practices and the provision of fishing equipment to the Beach Management Committees.
Effects on the Bujagali swimmers should be taken into account.	Discussions with the Bujagali swimmers along with other tourism related workers have been initiated. The potential for effects on these individuals is being addressed in the APRAP.
Need to expand CDI beyond the affected communities – entire sub-County should benefit.	CDAP activities such as skills training and improvements to health care facilities will be available to all in the Sub-County.

Issue	Responses/Actions
More than just new wells should be provided – we want piped water.	Beyond the immediate programme of improving water supply in the 8 affected villages prior to construction initiation, it is proposed that an additional well be provided in each community to further improve water supplies. Piped water is not being proposed due to maintenance requirements, the high cost and the need for electrical power.
Increased population in area is increasing the demand for public services – funding needed to increase level of services to accommodate increased population (people are already coming to the area because of the project).	A portion of the CDAP fund has been allocated to social infrastructure such as water, health facilities and schools.
Need for improved roads in the area (request for tarmac main road on east side?).	The current CDAP does not propose road improvements although BEL is open to reallocating funds from other programmes if this is a priority for a community.
We support the project - our communities are willing to work with BEL in the development of the project.	Comment noted.
Employment impacts on WWR guides – feel that some will lose their jobs – this impact needs to be considered.	Discussions with the WWR guides along with other tourism related workers has been initiated. The potential for effects on these individuals is being addressed in the APRAP.
Loss of river access – how to compensate this loss.	Although river access will be reduced, particularly during the construction period, river access points will still be available to the local communities. Formal beach landing points will be developed for the fishers.
Safety issues along river (to children) from changing water levels.	Depending on hydrology and operations, water levels will fluctuate about 1 to 2 meters per day. BEL will consult with downstream stakeholders about safety issues and how to manage them.
Need to consult with villages in the CDAP implementation.	Prior to the finalisation of the CDAP and its implementation, consultation will be undertaken with the communities to help them prioritise their needs and to confirm their participation in programme development.
Need to consider building a new public road over the dam.	At this time, BEL is not proposing to develop a new access road across the river.

Issue	Responses/Actions
Concerns over land valuation process/fairness.	A grievance mechanism will be set up so that landowners and tenants have a process available to them to dispute valuation/compensation amounts once they are released.
People (along the T-line) should be compensated within a few months of the valuation process.	Compensation by UETCL to PAPs along the T-line is to be provided once the project sponsors have received the necessary project approvals and financing has been confirmed.
Asked why the project construction was not to start until late 2007.	The construction date is influenced by the SEA approval timelines. If SEA approvals by all lenders is obtained by 2 nd quarter 2007 then construction could commence by mid 2007.
As part of the CDAP, get women involved with tree planting and help to build fish ponds due to Nile River access restrictions. Poverty alleviation should be part of the CDAP.	BEL is willing to explore this suggestion in future consultations to develop the CDAP implementation plan.
A community needs assessment should be done prior to CDAP implementation.	BEL will hold additional consultations with the communities to further develop the CDAP prior to its implementation.
Training initiatives should be long-term that go beyond the construction period.	The primary purpose of training will be to develop skills needed for the project. However, it is expected that these skills will be of lasting benefit and applicable to other projects and needs.
Money needs to be put into education – we need computers for our schools.	A portion of the CDAP funds is to be allocated to education. Future consultations with the communities and schools boards are proposed to establish needs and priorities for funding.
Concerns that the east side of the river will receive less benefit than the west side – yet, Busoga lands will be affected more from the dam.	BEL is committed to providing community development funds equitably among both the east and west side communities.
A resident claims to be very close to new east side access road but have not been offered resettlement – concerned about truck traffic impacts along this new road.	This is to be investigated by the BIU.
Representative from Busoga Kingdom indicated that the correct Kingdom representative should be dealt with.	Communication has been established with the PM and PS of Busoga Kingdom and meetings also held with the cultural leaders.

Issue	Responses/Actions
People asked about whether downstream communities would be compensated for water quality impacts (assumed during construction).	Minimal downstream effects from the project are anticipated. Appropriate sedimentation control measures will be put in place to prevent water quality impacts. In the event of any fuel or other hazardous materials spills, spill clean-up procedures will be implemented. Should effects be detected, through its EPC Contractor, BEL will have the problem addressed.
NEMA policies should be followed and NEMA involved.	Applicable NEMA policies will be followed. Project approval will be required by NEMA prior to construction initiation.
Question asked how WWR activity could continue during dam construction.	Water flow will be maintained through the right channel while the power house is being constructed. It may be possible to float this section depending on water levels. Otherwise, raft trips will need to start below the dam as will be necessary during the dam operations period.
A spiritual leader indicated that there is a location within the river (an island?) that is of spiritual significance.	BEL will raise this with the Busoga Kingdom.

Other Public Meetings

WWR Tourism Employees

In follow-up to the community meetings, a meeting was held with representatives of the white water rafting/tourism industry employees. The meeting was held at the Jinja BIU office on October 13, 2006. BIU and Burnside representative were present at the meeting. About 30 people attended. A brief introduction to the project was made to clarify people's understanding of the project. Questions were then posed and responses provided. Key issues/comments raised by the representatives included:

- It is reported by the WWR tourism employees that about 300 to 400 people are employed by the tourism industry in the area which is focused around white water rafting; this include the guides, kayakers, restaurateurs, taxi motorcycle (boda boda) drivers, Bujagali swimmers and dancers, rafting photographers, ATV guides, etc.;
- The employees of the various companies are concerned about their jobs as the owners have indicated that some will be laid off when the dam is built – the owners have informed the employees on the nature of their discussions with BEL regarding compensation;

- The group indicated support for the project but are worried about their jobs;
- Concerns that there will be less opportunity for jobs for those that live on the east side of the river;
- That their employment “contracts” are verbal – nothing written so they have little long term security;
- Concerned that their skills are not directly applicable to other types of employment – although interest was expressed in working on the dam construction project;
- That these tourism workers have provided much to the local community. The farmers and fishers have been identified as a vulnerable and affected group but there seems to be no initiatives targeted at the employees of the tourism industry; and,
- Concerned that if the rafting operations are moved downstream that access to employment will be reduced – owners will employ people more local to the new base of operations.

BEL recognises the concerns of the formal and informal workers of the tourist industry in the project vicinity. The APRAP Report has considered the potential for loss of income to these stakeholders and suggests mitigation to address potential effect/loss of income.

The AIDS Support Organisation

The Aids Support Organisation (TASO) is the largest indigenous NGO providing HIV/AIDS services in Uganda and the region. To-date a total of 83,000 people with HIV/AIDS have been registered and 22,000 directly receive care and support.

TASO had developed an AIDS/HIV management programme for the Bujagali project for the previous project sponsor. The programme was however never implemented.

A meeting with TASO representatives was held with representatives of BEL, BIU and Burnside attending on October 13, 2006. The purpose of the meeting was to confirm TASO’s interest in assisting in the AIDS/HIV programme for the project – TASO confirmed their interest to participate.

It was indicated that has much has changed when the first programme was developed about five years ago. As a result, TASO reviewed the previous programme and provided an updated conceptual plan for BEL.

NGO Consultation

SEA Summary documentation and Newsletter #1 was sent to NGOs and a request for comments made. An initial email was sent on October 1, 2006 to 36 NGOs with an attached electronic copy of the SEA Consultation Summary Report and a request for comments made by October 19, 2006. A follow-up letter and hard copy of the SEA

Consultation Summary Report was subsequently sent to the NGOs in October and a request for comments made. The comment period was extended to October 26, 2006, as well as an offer to receive comments after that date, should the organisation be unable to respond by the specified date.

No NGO comments had been received at the time of writing this report.

A follow-up meeting was held on October 13, 2006 with representatives of the Nile Basin Discourse Forum, ECOVIC and the Ugandan Wildlife Society. Representatives of the BIU and the Burnside consultant team attended. The purpose of the meeting was to identify concerns that these agencies may have and to gauge their interest level in participating in social development and environmental restoration activities associated with the project. Some comments made at this meeting included:

- Important to engage in dialogue with the affected communities to ensure that their needs are being met;
- The people need to be properly informed of the process and potential opportunities;
- Need to assess the skills/ability for stakeholders to participate in the process;
- That NBD/ECOVIC are interested in being involved with the implementation of the CDAP initiatives;
- There is a need to start mitigation/restoration/CDAP activities early in the process as they take time to develop and to be effective;
- NGOs are interested in reviewing the PPA for the project; and,
- That UWS would be interested in participating in the monitoring of environmental restoration activities.

National Government Agency Meetings

Copies of the SEA Consultation Summary Report were sent to various GoU organisations including:

- National Environment Management Authority (NEMA);
- Ministry of Energy and Mineral Development (MEMD);
- Ministry of Water and Environment;
- Ministry of Tourism, Trade and Industry;
- Ministry of Lands and Urban Development;
- Ministry of Gender, Labour and Social Development;
- Ministry of Agriculture;
- Directorate of Water Development;
- Fisheries Resources Research Institute (FRRI);
- Uganda Wildlife Authority;
- Directorate of Water Development;
- National Forest Authority;
- Rural Electrification Agency;

- Ugandan Investment Authority;
- Ugandan Electricity Generation Co. Ltd. (UEGCL);
- Ugandan Electricity Transmission Co. Ltd. (UETCL);
- UMEME Ltd.; and,
- Commissioner for Disaster Management.

No comments on the SEA Consultation Summary Report were provided. NEMA indicated that they would not provide comments until the full SEA Report was submitted.

Public Inquiries

A telephone number was provided in the public notices for the purposes of information requests and to address inquiries to the project team. As well, an email address was provided on the project website (www.bujagali-energy.com) for people to send in comments and ask questions. The few calls that were received during Phase 3 were primarily from job seekers. At the time of the writing of this report, only a few inquiries regarding the HPP were sent to BEL through the project email address. Comments were submitted by the IRN, ECOVIC, NAPE and self-employed workers at the Bujagali Falls camp site. Responses were provided to those who submitted comments.

Associated Activities Consultation

The main associated project to the Bujagali HPP is the Bujagali Interconnection Project (IP), which involves the development of new transmission lines and associated facilities to evacuate the power from the HPP site. A separate, yet complementary SEA and PCDDP programme was undertaken for the IP. The PCDDP programme was run concurrently with the consultation programme for the HPP. The IP programme did involve a larger study area and a separate set of communities that could be affected. The results of this consultation programme have been documented in the IP SEA Report (Chapter 6) and a separate IP PCDDP report. Feedback received from the IP consultation activities related to the HPP (as some of the IP project area overlaps with the HPP project area) was considered as part of the HPP process.

6.4 Summary of Key Issues

As a result of Phase 1-3 engagement and consultation activities, an number of issues were identified and which were taken into account in the preparation of the of the SEA. The key issues and how these issues were addressed are presented in Table 6.8 below:

Table 6.8: Summary of Key Issues and Responses

Issue	Response
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Issue	Response
Issue 1: Past resettlement activities	<p>The 8 affected communities and people resettled by the previous project sponsor indicated that some of the commitments of the previous project sponsor were unfulfilled. An audit of the past resettlement activities was undertaken and an <i>Assessment of Past Resettlement Action Plan</i> (APRAP) report prepared that outlined the concerns/issues and proposed activities to be undertaken. BEL has committed to resolve certain of these past resettlement issues in the immediate future and prior to construction initiation. Some actions have already been taken such as the installation of new pumps at the boreholes in each village. Consultation on resolving these past problems has been occurring by the BIU and is expected to continue into 2007.</p>
Issue 2: Community development opportunities	<p>The local residents and local governments have clearly indicated an interest to take advantage of development opportunities as a result of dam construction. As an example residents have expressed interest in offering housing to the construction workers. As part of the CDAP, it is proposed that a market area be developed near the construction site where local products could be sold to the workers. As well, a resource/job skills centre is to be developed on both banks and a micro credit scheme to allow people to develop their own business enterprises.</p>
Issue 3: Cultural impacts	<p>Consultation with the local communities, as well as the Busoga Kingdom, have indicated that spirits associated with the Bujagali Falls, and perhaps other sites in the area, have not been adequately appeased. BEL has initiated consultations with the Kingdom's Prime Minister and cultural leaders to develop a programme to address their concerns. BEL is willing to work with the Kingdom and will be supportive of the activities required to address cultural concerns. The spiritual appeasement programme and the costs involved to undertake the appropriate ceremonies/ relocation of spirits is to be submitted to BEL. Ceremonies associated with graves on land to be newly inundated and not completed by the previous sponsor will also be undertaken.</p>
Issue 4: Construction workforce impacts	<p>The project is expected to attract large numbers of migrants looking for employment opportunities through the project. Local residents have expressed concerns in regards to the social and health consequences of migrant workers coming into their community.</p> <p>There are no camps or residential complexes suitable for housing a large workforce currently available in Jinja. It is expected that a variety of housing would be used, including use of the existing housing stock including hotels, as well as new purpose built housing.</p>

Issue	Response
	<p>The specific size, design, and location for such housing will be determined by the EPC Contractor, under advisement from BEL and in consultation with local authorities. The housing plan will be developed keeping in mind the objective to maximise local benefits and minimise avoid and community health problems. The detailed accommodations plan for the workforce will be provided as an addendum to the SEA following the selection of the EPC Contractor by BEL.</p> <p>As well, a comprehensive Aids/HIV programme is to be implemented (with the assistance of the Ugandan Aids/HIV NGO TASO or similar organisation) which is to involve education programmes for both the local community and the workers.</p> <p>Further details regarding how this issue will be managed is outlined in Sections 7.5.10 and 7.5.13 of the SEA.</p>
Issue 5: Local community access to electricity	<p>Access to electricity in the local area is very limited. Recognising that this is a power project, the local communities have expressed interest in getting improved access to electricity as a community development initiative. It has been explained to the communities that electrical distribution is under the authority of UMEME, which is a private company. BEL or the GoU cannot simply direct UMEME to improve electrical connection in the area. Nevertheless, BEL has committed to discuss with UMEME (who have access to an international funded programme) to improve electrical access in the area. This might include first providing electrical connections to community facilities in each of the 8 villages.</p>
Issue 6: Employment opportunities/training	<p>There is considerable interest among the community members to be employed by the project. There is also an expectation that local community members would receive priority in employment opportunities. As part of the CDAP, BEL has committed to implementing training programmes (with the assistance of local institutions) to assist local people in gaining access to employment. BEL will also direct the EPC Contractor and its sub-contractors to give preferential treatment to the local community in their hiring practices.</p>
Issue 7: The need to consult with Communities in implementing the CDAP	<p>The communities and NGOs have indicated the need to engage the communities in the finalisation of the CDAP and the formation of the implementation plan for it. BEL is committed to undertake ongoing consultation activities with the local community to help prioritise community needs and to finalise the CDAP.</p>

Issue	Response
Issue 8: Potential for job loss by the tourism industry employees and by self-employed and informal workers in the tourism industry	<p>A key finding of the PCDP process is a large concern among the tourism industry workers that they will lose their jobs once the dam project begins. BEL has begun consultations with these two groups of stakeholders. The APRAP Report makes recommendations to address this impact should it occur.</p> <p>Consultation with the tourism company owners has not indicated that they expect to experience significant decreases in tourist numbers - in fact, many are anticipating growth. Furthermore, BEL is undertaking to support additional tourism initiatives, particularly those which will ensure continuity of employment of existing employees. (Note that discussion with the tourism company owners have not indicated that they expect to experience significant decreases in tourist numbers – in fact, many are anticipating growth).</p>
Issue 9: Safety issues from construction traffic along the west bank road	<p>The communities on the west bank are very concerned about the safety risks associated with construction traffic along the main west bank roadway. The road is heavily used by pedestrians including school children. BEL is aware of this issue and will consult with local community leaders in the development of the Construction Traffic Management Plan. Discussions will continue with the local communities to develop appropriate measures to manage and monitor the issue.</p>
Issue 10: That the local community needs to benefit from the project	<p>BEL agrees that the local communities should benefit socially and economically from the project. As such, a comprehensive CDAP is to be implemented based on future needs assessment work. Overall, the employment benefits (direct and indirect) and induced economic benefits from the project are expected to be significant for these communities.</p>
Issue 11: Concerns from the east bank communities that they will not benefit as much as the west bank communities	<p>As most of the project facilities and the construction activities will be focused on the west bank, east bank communities are concerned that they will receive much less benefit from the project. This appears to be a concern of the Busoga Kingdom in light of the dam being reported to be within their Kingdom (the west bank is reported to be the boundary between the Busoga and Buganda Kingdoms). BEL is committed to providing programmes and opportunities to both east and west bank communities. As an example, resource centres will be developed on both banks of the river.</p>

Issue	Response
Issues 12: Local institution interest in participating in the project	NGOs, CBOs and GoU agencies have indicated an interest in participating in the project such as through assisting in the delivery of the CDAP and environmental monitoring of mitigation/restoration activities. BEL is willing to work with the existing institutions and will engage them in dialogue beginning in early 2007 as part of the process to develop the project implementation plans.
Issue 13: Loss of access to the river	Some (particularly the Fishers) have indicated that river access has been limited (due to fencing) and are concerned about further access restrictions once the construction period begins. Although some fencing along the west bank has been installed, access to the river has not been cut off and use of the river in the vicinity of the project has continued as has been observed on several occasions by the consulting team. Once construction is initiated more formal “beach land facilities” will be developed so as to allow a location to access the river for fishing. As such, the project has not nor will it substantially reduce access to the river.
Issue 14: That the Bujagali project will exacerbate the low water levels in Lake Victoria	There is concern that once operational, the Bujagali Dam would create additional pressure for increased releases from Lake Victoria. The Bujagali project will reuse of the same water that the existing hydro facility at Jinja uses. By reusing this same water twice, the amount of power will be generated from the same amount of water. Water levels in Lake Victoria will continue to be determined by rainfall, evaporation and rate of discharge at the Nalubaale and Kiira Dams.
Issue 15: How have safety issues associated with the aging Nalubale facilities been addressed?	To address safety issues, BEL will form the Bujagali Dam Safety Panel (BDSP). The BDSP, consisting of up to three technical experts, will provide advice through final design, construction, initial filling and start-up phases of the dam. Safety risks will be addressed as part of the Panel’s terms of reference.

6.5 Future Consultation Events

6.5.1 Phase 4 – Release of the SEA Report and Action Plans

In Phase 4, the focus of the consultation will be on the release of the SEA Report and associated Action Plans. This consultation period will be undertaken in conjunction with the review and approval process of the SEA Reports by both NEMA and the international lenders and is expected to last from the SEA submission date to financial closing. Phase 4 consultation activities are to include:

- Notices (by NEMA) in early December 2007 advising the public of the availability of the SEA Report for review and comment. These notices will appear in national newspapers including the New Vision, Monitor and Bukedde (in local language);
- The HPP SEA Report and Executive Summary will be made available at public locations such as libraries, government offices and BEL offices;
- The SEA documentation will be accessible through the project website: www.bujagali-energy.com;
- A letter will be sent to the identified NGOs advising them of the release of the SEA Reports and a request made for their comments. Offers to provide them with a CD copy of the report and to meet with them will be made;
- Meetings will be set up with the Wakisi and Budondo Sub-County Consultation Committees (that have already been formed) to run through the SEA results. An issues based presentation will be made, followed by a discussion period. The purpose of the meeting is to ensure that local government representatives are aware of the key project findings and understand how the project will affect their communities;
- BEL will continue to consult with the key affected tourism business operations regarding the mitigation and compensation plan. Employees of these businesses, as well as informal tourism based workers will be met with as required to address their concerns and to receive their feedback;
- BEL will consider comments received regarding the SEA Report and action plans;
- BEL will offer the opportunity to meet with interest groups/government agencies to discuss their concerns; and,
- The need for additional community meetings will be assessed during this period and if need necessary, meetings will be held.

In addition to the above notifications, farmers who continue to use the land within the fenced area on both the east and west banks of the river shall be given adequate notifications of when the land will no longer be accessible due to the initiation of the construction activities.

To meet the requirements of the international lenders, the SEA Report and associated actions plans will be placed on the World Bank “Infoshop”, which is accessible through the Internet.

It is noted that NEMA’s review and approval process requires:

- Advertising the availability of the SEA Report through national newspaper(s). The report will be made available for a period of time not less than 14 days. Comments on the SEA Report are due within 21 days of the public notice;
- The release and distribution of SEA summary reports to public accessible locations;
- The project sponsor (BEL) may have to respond to some of the comments received as requested by NEMA; and,

- An optional public hearing may be held at the discretion of NEMA.

Table 6.9 summarises how each stakeholder group will be consulted with in Phase 4.

Table 6.9: Summary of Future Consultation Activities per Stakeholder Group

Stakeholders	Consultation Activities
National Public	Advertisements of the release of the SEA reports will be placed in national newspapers. Documents will be available for review at public places such as libraries. The public will be encouraged to provide comments.
Government Agencies	NEMA will distribute the reporting to GoU agencies for review and comment. NEMA to consider their comments in making an approval decision.
NGOs (national and local)	Letters/emails being sent to about 50 NGOs advising them of SEA Report release and offers to meet with them.
Local Communities	Meetings with the Sub-County Consultation committees to explain key SEA findings and to receive their feedback. Purpose is to ensure that they understand the implications of the project on their communities.
Project Affected Persons (PAPs)	The BIU continues to deal with past resettlement issues. These issued are to be resolved prior to construction initiation.
Vulnerable groups	Vulnerable group interests are represented through the Sub-County Consultation Committees. Input on how their interests should be have been taken into account will be considered at the above noted meetings. The need for specific meetings (in regards to the SEA) with vulnerable group representatives of the affected villages will be reviewed.
Business Operators	Consultations are continuing with the owners of key tourism based business to confirm the mitigation and compensation plan. Employees of these operations as well as the informal tourism workers will be met with to address their concerns and to receive their feedback.
Tourist/visitors	The interests of tourists are being addressed through consultation with tourism business associations as well as agencies such as the Uganda Tourism Association who will be kept informed of the project.
Cultural Groups	Meetings with Busoga and Buganda Kingdom will continue to address their concerns particularly as they relate to spiritual appeasement as a result of river flooding.

Grievance Management Mechanisms

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, p. 5). To respond to this requirement, BEL has appointed a Witness NGO (InterAid) to receive grievances and to oversee the process to address these concerns.

The availability of a Grievance Mechanism will be advertised with the other project notifications regarding the release of the SEA Report. The advertisements will include InterAid contact information should an individual have a grievance with the SEA process. A grievance form has been prepared and will be available through the chairpersons of the local villages. The Sub County Committees will also be used to channel the forms and vet the grievance issues. They will identify which ones can be solved locally or one that has to go to higher level, beyond the village and Sub-county. The community leaders know the PAPs very well and have the political and social responsibility for the community members. InterAid will advise BEL on how to respond to received grievances. Responses and actions (if necessary) to resolve the grievance will be communicated to the individual who submitted the grievance. A written record of all grievances received, and how they were dealt with, will be kept by InterAid and BEL.

6.5.2 Phase 5 – CDAP Planning Consultation

Phase 5 of the consultation programme is anticipated to commence once SEA approval has been obtained.

Included as part of the SEA Report is the Community Development Action Plan (CDAP), which describes the proposed community development initiatives to be implemented as part of the project. The initiatives in the CDAP are to be considered as draft and are in need of confirmation/further definition prior to their implementation. A clear message that was received from the communities is the need to work with us to finalise the community development initiatives. In meeting with the communities, lists of community development requests were provided to BEL. There is a need to refine these lists and prioritise their expectations. The communities also need to be aware that the CDAP fund, while generous, is of a finite amount and thus there is a need to focus on the most urgent needs for the communities. The following is a proposed list of activities to be undertaken:

- Identify and retain of the BEL Community Liaison Manager who would oversee the community consultation/engagement activities;
- Meet with and confirm membership on the Wakisi and Budondo Sub-County Consultation Committees. Develop the role of the Consultative Committees;

- Keep the public informed on the progress of CDAP development and implementation through the preparation and release of information bulletins/newsletters;
- Meet with vulnerable group representatives of the consultative committees and explore the needs of vulnerable peoples in the area;
- Meet with and explain the proposed CDAP to each of the 8 villages with the assistance of the Consultation Committees. Obtain initial feedback;
- Undertake a community development initiatives prioritisation exercise in each of the 8 villages. With this input, roll-up their input to the Sub-County level and with the assistance of the Consultation Committees. Finalise the CDAP;
- Present the final CDAP to each of the villages;
- Establish Community Sub-Committees to assist in the development of the implementation plan and an implementation schedule for each of the key community development initiatives;
- Identify and meet with existing NGOs/CSOs to present the CDAP and to identify potential roles in CDAP implementation;
- Prepare draft implementation plans for each of the initiatives through the Community Sub-Committees and with NGO/CBO input;
- Present the implementation plans to the 8 communities as well as the wider Sub-County. Receive feedback and finalise the implementation plans; and,
- Oversee the start-up of the CDAP initiatives that should be implemented prior to construction start-up (e.g. job training activities).

As well, during this period, the Community Liaison Manager will work with InterAid in responding to and resolving any received grievances.

It will also be important to keep the communities informed on the project progression. In particular it will be important to communicate job training opportunities so that community members can take advantage of these opportunities.

6.5.3 Phase 6 – Ongoing Project Communication

Once the project has begun the construction phase it will be important to regularly communicate to the public on the progress of the project including the CDAP and other action plan activities. During this period, the Community Liaison Officer will:

- Coordinate the release of regular project information/updates with the EPC contractor during the construction period;
- Advise the community well in advance of planned blasting activities;
- Advise downstream reparia communities of future changes in water levels from dam releases during the construction and operation periods (during the detailed design, BEL will be in consultation with the GoU and downstream stakeholders, devise a water release notification procedure to ensure safety for downstream stakeholders);
- Provide updates to the project website: www.bugagali-energy.com;

- Work with the Sub-County Consultation Committees on the release of project information and obtaining community feedback;
- Work with InterAid in the ongoing Grievance response process;
- Receive and respond to questions from the local community;
- Communicate the results of CDAP activities;
- Coordinate the release of Annual Reports which will among other things, report on CDAP activities, environmental management activities and environmental/social monitoring activities; and,
- Work with TASO (and possible other CSOs) in regards to the development and release of AIDS/HIV education materials.

6.6 Disclosure Plan

In promoting transparency and accountability, BEL has, and will continue to *“provide relevant material in a timely manner prior to consultation and in a form and language that are understandable and accessible to the groups being consulted”*. To date, BEL has disclosed the following:

- SEA ToR and the draft PCDP;
- Summary of draft findings of SEA for consultation and feedback;
- The final draft HPP SEA Report, SEA Summary (that integrates the findings of the HPP and IP SEAs);
- PCDP Report;
- Assessment of Past Resettlement Action Plan (APRAP); and,
- Community Development Action Plan (CDAP).

The SEA ToRs and draft PCDP were distributed in July 2006 to the National government (NEMA) and local government stakeholders (sub-county level).

The draft SEA Consultation Summary Report was released in late September 2006.

The final draft SEA Report was released in early December 2006.

There may be a need to prepare and release SEA addendum/update reports depending on issues that surface during the review of the Draft Final SEA Report.

BEL has submitted the final draft SEA Report, Summary Report and Action Plans to the IFC, who we understand will in turn distribute the summaries to the members of IFC’s Board of Directors. The IFC will make the summaries available through the WB InfoShop.

The SEA Report and Actions Plans are being made available to the other identified stakeholders and the public at large at publicly accessible locations as well as through the project web site: www.Bujagali-energy.com.

In addition to the above, an Environmental and social Action Plan (ESAP) will be prepared and released to the local communities after the EPC Contractor has been selected. ESAP “update reports” will be released quarterly during construction and an annual ESAP Report released during the operations period.

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7.0 Impact Identification, Management and Monitoring

7.1 Introduction

This SEA adopts a project life cycle assessment format. It focuses on the development of specific management initiatives for all phases of the project to ensure that: i) the people closest to the project receive the projected benefits; ii) potentially negative environmental and socio-economic impacts are minimised; and iii) potentially negative health and safety impacts are kept to a minimum. To optimise the life cycle assessment, linkages between potential impacts (i.e., key environmental issues), mitigation measures (i.e. management actions), net effects (i.e. residual effects), and monitoring programmes (i.e. management decision tools) are explicitly made.

The section provides:

- Compliance screening of the project against Government of Uganda Legislation, International Treaties and Conventions Ratified by Uganda, and Project Applicable Performance Standards (Section 7.2);
- Identification and analysis of community benefits (Section 7.3) and economic and developmental benefits (Section 7.4);
- Identification and analysis of “Key Project Issues” (Section 7.5); and,
- A net effects analysis (Section 7.6) in tabular format summarising the key project issues from Section 7.5, as well as the balance of issues and concerns that are of a more routine nature, the impacts of which are well understood and manageable using proven techniques (Section 7.7).

The mitigation and management tables provided in Section 7.7 provide the basis for development and implementation of the project specific Social and Environmental Action Plan presented in Section 8.

7.2 Compliance Screening

7.2.1 Government of Uganda Legislation and Regulations

The applicable Government of Uganda statutes and regulations to the Bujagali hydropower facility (discussed in detail in Section 2.1), along with a brief statement indicating compliance with each, are provided in Table 7.1.

Table 7.1: Compliance of the Bujagali Hydropower Facility with Government of Uganda Legislation and Regulations

Act or Regulation	Project Status: Rationale
The Constitution of the Republic of Uganda, 1995	Complies: The Bujagali hydropower facility has been planned in accordance with all relevant government enacted laws to protect and preserve the environment from abuse, pollution and degradation, and to manage the environment for sustainable development. The Government of Uganda executed the Power Purchase Agreement with BEL in December 2005.
The Investment Code No. 1/91	Complies: BEL, being a foreign company, has applied for and been granted an Investment Licence by the Uganda Investment Authority.
The Electricity Act, 1999	Compliance Underway: BEL will require a generation license for the hydropower facility, under S.52 of the Act. Under S.76 (7). This license can only be granted after the SEA report has been approved by NEMA. BEL, as a holder of a license for hydropower generation, will pay royalties to the Jinja and Mukono District governments, as agreed upon by the Electricity Regulatory Authority. BEL will provide compensation for affected people, determined in accordance with the Land Act, 1998 and the Land Acquisition Act, 1965. Where an interest in land greater than the right of use is required for purposes of construction, the Government of Uganda may exercise compulsory acquisition.
The National Environment Management Statute, 1995 and its Regulations	Complies: Social and Environmental Assessment Study was prepared following the requirements of the EIA Regulations. Under S.35 (2), NEMA must grant a written waiver to BEL of the prohibitions in S. 35 (1) of in-river construction activities. A requirement of the National Environment (Wetlands, Riverbanks and Lakeshores) Management Regulations states that rivers like the Victoria Nile shall have a protection zone of one hundred metres from their highest watermark. This will be upheld by BEL following inundation of the reservoir and this zone shall be regulated by NEMA.
The Water Statute, 1995 and its Regulations	Complies: BEL hereby makes its applications for permits under S.6 and S.18 of the Statute, to acquire the right to use water and to construct/operate a hydraulic works on a waterway, respectively.
The Rivers Act (CAP 347)	Compliance Underway: BEL hereby applies for a dredging license.
The Land Act, 1998	Complies: As required under the Constitution of Uganda, prompt payment of fair and adequate compensation where land is compulsorily acquired will be made by BEL, as laid out in S.78 of the Land Act. S.41 (7) sets out that BEL, being a non-citizen and can only acquire leasehold for the affected lands for the 30 year period agreed upon with the government. The permit granted to BEL under the Water Statute is also a permit under S.45 (5) of the Land Act for licenses, permits in respect of a natural resource. BEL, being holder of a generation license, is an authorised undertaker under the Act, licensed to execute public works.
The Town and Country Planning Act (CAP 30)	Complies: The Town and Country Planning Board declared the Bujagali project site a Planning Area and re-zoned the site from agricultural use to hydropower generation use by statutory instrument of 2000.

Act or Regulation	Project Status: Rationale
The Uganda Wildlife Statute, 1996	Complies: The Bujagali hydropower facility will be consistent with the requirements of the Uganda Wildlife Statute, 1996, including preparation of an EIS/SEA. Impacts to the Jinja Wildlife Sanctuary, established under this Statute, and mitigation measures to be taken to minimise these impacts, are addressed in this SEA. Save from the above, no approvals for implementation of the project will be required from the Uganda Wildlife Authority.
Fisheries Act	Complies: The requirement of the Act to carry out a socio-economic impact analysis to determine the impact of the proposed project on the fish catches in the project area was carried out as part of the project SEA.
The Local Government Act No.1/1997	Complies: BEL has consulted extensively with the pertinent LC5, LC3 and LC1 Chairmen of Jinja and Mukono Districts, as set out in the Act, with respect to the devolved powers they administer, namely: land administration, physical planning, forests and wetlands.

7.2.2 International Treaties and Conventions

Relevant international environmental treaties and conventions, along with a brief statement indicating project compliance with each, are provided in Table 7.2.

Table 7.2: Compliance of the Bujagali Hydropower Facility with International Treaties and Conventions Ratified by Uganda

Treaty/Convention	Status: Rationale
1958 Convention on Fishing and Conservation of the Living Resources of the High Seas	Not Applicable: The Bujagali Hydropower Facility will not involve activities within the high seas.
1968 African Convention on the Conservation of Nature and Natural Resources	Complies: The project does not involve significant effects to areas considered strict nature reserves
Convention on Wetlands of International Importance Especially as Waterfowl Habitat	Complies: The Bujagali Hydropower Facility will not involve activities within a wetland of international importance.
1985 Vienna Convention for the Protection of Ozone Layer	Complies: The Bujagali Hydropower Facility will not produce or emit significant amounts of ozone-depleting compounds.
1987 Montreal Protocol on Substances that Deplete the Ozone Layer	Complies: The Bujagali Hydropower Facility will not produce or emit significant amounts of ozone-depleting compounds.
1973 Convention on International Trade in Endangered Species of Wild Fauna and Flora	Complies: The Bujagali Hydropower Facility will not import or export endangered species.

Treaty/Convention	Status: Rationale
1992 International Convention to Combat Desertification	Complies: Activities associated with the Bujagali Hydropower Facility will not promote desertification.
1992 Convention on Biological Diversity	Complies: The Bujagali Hydropower Facility addresses effects on biodiversity.
1992 Convention on Climatic Changes	Complies: Under the convention, developing countries are not bound by formal emission requirements. Regardless, electricity production by hydropower is considered to release relatively low CO ₂ emissions compared to main alternative of electricity production by combustion of fossil fuels, and therefore contributes positively to an overall strategy to minimise CO ₂ emissions.
Lusaka Agreement on Cooperative Enforcement Operations Directed at Illegal Trade in World Flora and Fauna	Complies: The Bujagali Hydropower Facility will not involve importation or exportation of flora or fauna. Measures are in place to manage illegal take of bushmeat during construction.
Intergovernmental Authority on Drought and Desertification	Complies: Activities associated with the Bujagali Hydropower Facility will not promote desertification.
Riparian Agreements	Complies: There is no formal regulatory regime to comply with as Uganda repudiated the colonial-era treaties respecting the river Nile Agreements following independence (Appendix B.1). In February 2000, the Government of Uganda notified the governments of Nile riparian states of the intended construction of the Bujagali hydropower project. Further notifications were issued in 2006 (Appendix B.3). Written agreement was received from the Government of Egypt (Appendix B.2), and this is the only country from which approval is required. None of the other countries has expressed any objections to the project.

7.2.3 Compliance with Project Applicable Performance Standards

Table 7.3 provides a compliance screening against the project applicable standards as determined from the concordance analysis of the environmental performance standards and guidelines applicable to the project, as provided in Chapter 2 of this SEA Report.

Table 7.3: Summary of World Bank Group and Government of Uganda's Environmental Standards and Guidelines applicable to the Proposed Bujagali HPP

Parameter to be Measured or Environmental Management System Requirement to be Met	Project Standard or Requirement	Project Response; Where Addressed in SEA
Air Emissions		
Air emissions – dust control measures for materials handling and storage	Equipment related to material handling and storage (such as conveyor systems, silos and all transfer points) should be covered and equipped with dust collectors.	Complies. Section 7.5.4 of the HPP SEA.
Ambient Air Quality		
Ground level concentrations of particulate matter (PM)	Annual arithmetic mean < 50 µg/m ³ (at plant boundary) Maximum 24 hour average: 70 µg/m ³ (95 % of the time, at plant boundary).	Complies. Table 7.15 (General Construction Related Issues – Air Quality) of the HPP SEA.
Workplace Air Quality		
Workplace air quality: monitoring	Periodic monitoring of workplace air quality should be conducted for air contaminants relevant to employee tasks and the plant's operations.	Complies. Table 7.15 (General Construction Related Issues – Air Quality) of the HPP SEA.
Workplace air quality: maintenance of protective equipment	Ventilation, air contaminant control equipment, protective respiratory equipment and air quality monitoring equipment should be well-maintained	Complies. Section 8.4.6 of the HPP SEA.
Workplace air quality: use of protective respiratory equipment	Protective respiratory equipment must be used by employees when the exposure level for welding fumes, solvents and other materials present in the workplace exceed the following threshold limit values (TLVs): Asbestos (all forms, >5 mm length): 0.5 fibers/cm ³ Coal dusts (<5% SiO ₂): 2 mg/m ³ Coal dusts (>5% SiO ₂): 0.1 mg/m ³ Gypsum (Calcium Sulfate): 10 mg/m ³ Mineral Wool Fibre: 10 mg/m ³ Particulate (Inert or Nuisance Dusts) 10 mg/m ³ Portland Cement: 10 mg/m ³ Silica/Crystalline Quartz: 0.1 mg/m ³ .	Complies. Section 8.4.6 of the HPP SEA.
Limits for Liquid Effluents (process wastewater, domestic sewage and contaminated storm water discharged to surface waters)		
pH	6 to 8	Complies. Section 5.3.2.2, 5.7.2 and 5.7.3 of the HPP SEA.
BOD	50 mg/l	
COD	100 mg/l	
Oil & Grease	10 mg/l	
Total Suspended Solids	50 mg/l	
Heavy Metals (Total)	10 mg/l	
Arsenic	0.1 mg/l	
Cadmium	0.1 mg/l	
Chromium – Hexavalent	0.05 mg/l	
Chromium – Total	0.5 mg/l	
Copper	0.5 mg/l	
Iron	3.50 mg/l	
Lead	0.1 mg/l	
Mercury	0.01 mg/l	
Nickel	0.5 mg/l	

Parameter to be Measured or Environmental Management System Requirement to be Met	Project Standard or Requirement	Project Response; Where Addressed in SEA
Selenium	0.1 mg/l	
Silver	0.5 mg/l	
Zinc	2.0 mg/l	
Cyanide – Free	0.1 mg/.l	
Cyanide – Total	1.0 mg/l	
Ammonia	10 mg/l	
Fluoride	20 mg/l	
Chlorine – Total residual	0.2 mg/l	
Phenols	0.2 mg/l	
Phosphorous	2.0 mg/l	
Sulfide	1.0 mg/l	
Coliform bacteria	<400 MPN/100 ml	
Temperature increase (measured either at the end of the initial dilution and mixing zone, or, if this not defined, 1,000m from the point of discharge).	<3°C increase, with discharge temperature in range 20-35°C	
Pesticides, dioxins, furans and other toxicants such as polynuclear aromatic hydrocarbons.	Either 100 times the WHO guidelines for drinking water or 0.05 mg/l.	
Other pollutants not specified above.	No values specified by WBG	
Environmental Management Considerations for Hazardous Materials and Wastes		
Hazardous material handling and storage: Storage and labelling	All hazardous (reactive, flammable, radioactive, corrosive and toxic) materials must be stored in clearly labelled containers or vessels	Complies. Table 7.15 (General Construction Related Issues –Management of Hazardous and Contaminating Material; General Operation Related Issues –Management of Hazardous and Contaminating Material) and section 8.4.5 of the HPP SEA.
Hazardous material handling and storage: local/international standards	Must be in accordance with local regulations or international standards and appropriate to their hazard characteristics.	Complies. Table 7.15 (General Construction Related Issues –Management of Hazardous and Contaminating Material; General Operation Related Issues –Management of Hazardous and Contaminating Material) and section 8.4.5 of the HPP SEA.

Parameter to be Measured or Environmental Management System Requirement to be Met	Project Standard or Requirement	Project Response; Where Addressed in SEA
Hazardous material handling and storage: spill containment	Storage and liquid impoundment areas for fuels, raw and in-process materials, solvents, wastes, and finished products should be designed with secondary containment (e.g. dikes, berms) to prevent spills and the contamination of soil, groundwater and surface waters.	Complies. Table 7.15 (General Construction Related Issues –Management of Hazardous and Contaminating Material; General Operation Related Issues –Management of Hazardous and Contaminating Material) and section 8.4.3 and 8.4.5 of the HPP SEA.
Hazardous materials handling and storage: fire prevention systems	Fire prevention systems and secondary containment should be provided for storage facilities, where necessary or required by regulations, to prevent fires or the release of hazardous materials to the environment.	Will comply. Level of detail to be addressed by EPC Contractor subsequent to SEA (8.3.6 and 8.4.5 of the HPP SEA).
Hazardous materials and wastes: asbestos	Processes, equipment, materials and products involving the use or potential release to the environment of asbestos or asbestos containing materials (ACMs) should not be installed.	Will comply. Level of detail to be addressed by EPC Contractor subsequent to SEA (Section 8.4.5 of the HPP SEA).
Hazardous materials and wastes: chromates	Formulations containing chromates should not be used in water treatment processes	Will comply. Level of detail to be addressed by EPC Contractor subsequent to SEA (Section 8.4.5 of the HPP SEA).
Hazardous materials and wastes: PCBs	Transformers or equipment containing polychlorinated biphenyls (PCBs) or PCB-contaminated oil should not be installed.	Will comply. Level of detail to be addressed by EPC Contractor subsequent to SEA (Section 8.4.5 of the HPP SEA).
Hazardous materials and wastes: ozone depleting substances	Processes, equipment and central cooling systems involving the use or potential release to the environment of chlorofluorocarbons (CFCs), including halon, should not be installed.	Will comply. Level of detail to be addressed by EPC Contractor subsequent to SEA (Section 8.4.5 of the HPP SEA).
<i>Solid Wastes</i>		
Solid wastes: recycling/reclamation	Solid waste materials are to be recycled or reclaimed where possible.	Complies. Table 7.15 (General Construction Related Issues –Management of Solid Waste; General Operation Related Issues – Management of Solid Waste) and section 8.4.2 of the HPP SEA.
Solid wastes: disposal	If recycling or reclamation is not practical, solid wastes must be disposed of in an environmentally acceptable manner and in compliance with local laws and regulations.	Complies. Table 7.15 (General Construction Related Issues –Management of Solid Waste; General Operation Related Issues – Management of Solid Waste) and section 8.4.2 of the HPP SEA.

Parameter to be Measured or Environmental Management System Requirement to be Met	Project Standard or Requirement	Project Response; Where Addressed in SEA
Solid and liquid wastes: hazardous materials	All hazardous materials, process residues, solvents, oils, and sludges from raw water, process wastewater and domestic sewage treatment systems must be disposed of in a manner to prevent the contamination of soil, groundwater and surface waters.	Complies. Table 7.15 (General Construction Related Issues –Management of Hazardous and Contaminating Material; General Operation Related Issues –Management of Hazardous and Contaminating Material) and section 8.4.2 and 8.4.5 of the HPP SEA.
Ambient Noise		
Ambient Noise – Construction period	75 dBLAeq daytime 65 dBLAeq night time	Complies. Section 7.5.5 of the HPP SEA.
Ambient Noise – Operational Period	55 dB(A) in the day and 45 dB(A) in the night in residential/ institutional or educational areas; 70 dB(A) in the day or night in industrial or commercial areas; or a maximum increase in background levels of 3 dB(A).	Operation of the hydro facility is not expected to contribute significant noise to any sensitive receptors
Workplace Noise		
Workplace noise: control measures	Feasible administrative and engineering controls, including sound-insulated equipment and control rooms should be employed to reduce the average noise level in normal work areas.	Will comply. Level of detail to be addressed by EPC Contractor subsequent to SEA (Section 8.4.6 of the HPP SEA).
Workplace noise: plant maintenance	Plant equipment should be well maintained to minimise noise levels.	Complies. Section 5.8 of the HPP SEA.
Workplace noise	Personnel must use hearing protection when exposed to noise levels above 85 dBA	Complies. Table 7.15 (General Construction Related Issues –Public and Worker Health and Safety; General Operation Related Issues – Public and Worker Health and Safety) and section 8.4.6 of the HPP SEA.
Work in Confined Spaces		
Work in confined spaces: dangerous gases and lack of oxygen	Prior to entry and occupancy, all confined spaces (e.g. tanks, sumps, vessels, sewers, excavations) must be tested for the presence of toxic, flammable and explosive gases or vapours, and for the lack of oxygen.	Will comply. Level of detail to be addressed by EPC Contractor subsequent to SEA (Section 8.4.6 of the HPP SEA).
Work in confined spaces: ventilation	Adequate ventilation must be provided before entry and during occupancy of these spaces.	Will comply. Level of detail to be addressed by EPC Contractor subsequent to SEA (Section 8.4.6 of the HPP SEA).
Work in confined spaces: use of respirators	Personnel must use air-supplied respirators when working in confined spaces which may become contaminated or deficient in oxygen during the period of occupancy.	Will comply. Level of detail to be addressed by EPC Contractor subsequent to SEA (Section 8.4 of the HPP SEA).

Parameter to be Measured or Environmental Management System Requirement to be Met	Project Standard or Requirement	Project Response; Where Addressed in SEA
Work in confined spaces: requirement for observers/ assistants	Observers/assistants must be stationed outside of confined spaces to provide emergency assistance, if necessary, to personnel working inside these areas.	Will comply. Level of detail to be addressed by EPC Contractor subsequent to SEA (Section 8.4.6 of the HPP SEA).
Quarry Reclamation Plan		
Preparation and implementation of a Quarry Reclamation Plan	The plan should include reclamation of settling ponds, and abandoned access roads and campsites. The reclamation plan should ensure that the land is restored, to the extent practical and feasible, to conditions capable of supporting prior land use, or uses that are equivalent.	Complies. Section 5.4 and 7.5.2.5 of the HPP SEA.
Quarry reclamation plan – effects on water resources	The reclamation plan should ensure that significant adverse effects on adjacent water resources are prevented or remedied	Complies. Section 5.4 and 7.5.2.5 of the HPP SEA and Appendix F. Detailed plan will be developed by EPC Contractor subsequent to SEA.
Quarry reclamation plan – components of plan	The plan should have the following components: i) conserve, stockpile, and use topsoil and overburden for reclamation ii) recontour slopes of more than 30% to minimise erosion and runoff iii) plant native vegetation to prevent erosion and encourage self-sustaining development of a productive ecosystem iv) schedule and budget for pre-and post-abandonment reclamation activities	Complies. Section 5.4 and 7.5.2.5 and Appendix F of the HPP SEA.
Quarry reclamation plan – final grading	The final grading for the quarry closure should ensure that stormwater run-off does not accumulate and become stagnant, potentially contaminating surface waters.	Quarry slope will be re-vegetated at an angle that storm water will not collect. Wetland reinstatement at slope/water interface will contain and polish storm water, preventing sedimentation. Geotextile fabric will underlie wetland vegetation, further preventing sedimentation. Details in Appendix F of HPP SEA.
Health and Safety		
Health – General: sanitary facilities	Sanitary facilities should be well equipped with supplies (e.g., protective creams) and employees should be encouraged to wash frequently, particularly those exposed to dust, chemicals or pathogens.	Complies. Table 7.15 (General Construction Related Issues –Public and Worker Health and Safety; Construction Related Issues –Management of Solid Waste, General Operation Related Issues – Public and Worker Health and Safety) and section 8.4.6 of the HPP SEA.

Parameter to be Measured or Environmental Management System Requirement to be Met	Project Standard or Requirement	Project Response; Where Addressed in SEA
Health – General: workplace ventilation	Ventilation systems should be provided and appropriately maintained to control work area temperatures and humidity.	Complies. Table 7.15 (General Construction Related Issues –Public and Worker Health and Safety; General Operation Related Issues – Public and Worker Health and Safety) and section 8.4.6 of the HPP SEA.
Health – General: work in high temperature/humidity	Personnel working in areas of high temperature and/or humidity should be allowed to take frequent breaks away from these areas.	Complies. Table 7.15 (General Construction Related Issues –Public and Worker Health and Safety; Construction Related Issues –Management of Solid Waste, General Operation Related Issues – Public and Worker Health and Safety) and section 8.4.6 of the HPP SEA.
Health – General: medical examinations	Pre-employment and periodic medical examinations should be conducted for all personnel, and specific surveillance programmes instituted for personnel potentially exposed to toxic or toxic or radioactive substances.	Will comply. Level of detail to be addressed by EPC Contractor subsequent to SEA (Section 5.5 and 8.4.6 of the HPP SEA).
Safety – General: prevention of mechanical injuries	Shield guards or guard railings should be installed and maintained to eliminate human contact with moving parts, or hot or cold items.	Will comply. Level of detail to be addressed by EPC Contractor subsequent to SEA (Section 8.4.6 of the HPP SEA).
Safety – General: prevention of falling injuries	Elevated platforms and walkways, and stairways and ramps should be equipped with handrails, toeboards and non-slip surfaces.	Will comply. Level of detail to be addressed by EPC Contractor subsequent to SEA (Section 8.4.6 of the HPP SEA).
Safety – General: prevention of electrocution by electrical equipment	Electrical equipment should be grounded, well insulated and conform with applicable codes.	Will comply. Level of detail to be addressed by EPC Contractor subsequent to SEA (Section 8.4.6 of the HPP SEA).

Parameter to be Measured or Environmental Management System Requirement to be Met	Project Standard or Requirement	Project Response; Where Addressed in SEA
Safety – General: protection from dust and hazardous materials	Personnel should use special footwear, masks and clothing for work in areas with high dust levels or contaminated with hazardous materials.	Complies. Table 7.15 (General Construction Related Issues –Management of Hazardous and Contaminating Material; General Operation Related Issues –Management of Hazardous and Contaminating Material; General Construction Related Issues –Public and Worker Health and Safety; General Operation Related Issues – Public and Worker Health and Safety) and section 8.4.5 and 8.4.6 of the HPP SEA.
Safety – General: high temperature materials	For work near molten or high temperature materials, employees should be provided with non-slip footwear, gloves, safety glasses, helmets, face protection, leggings and other necessary protective equipment.	Will comply. Level of detail to be addressed by EPC Contractor subsequent to SEA (Section 8.4.6 of the HPP SEA).
Safety – General: eye protection	Eye protection should be worn by personnel when in areas where there is a risk of flying chips or sparks, or where intense light is generated.	Will comply. Level of detail to be addressed by EPC Contractor subsequent to SEA (Section 8.4.6 of the HPP SEA).
Safety – General: protection from dangerous materials	Personnel should wear protective clothing and goggles when in areas where corrosive, reactive, ignitable or toxic materials are stored or processed.	Will comply. Level of detail to be addressed by EPC Contractor subsequent to SEA (Section 8.4.6 of the HPP SEA).
Safety – General: eyewashes.	Emergency eyewash and showers should be installed in areas containing corrosive materials.	Will comply. Level of detail to be addressed by EPC Contractor subsequent to SEA (Section 8.4.6 of the HPP SEA).
Safety – General: safety programme	A safety programme should be established for construction and maintenance work.	Will comply. Level of detail to be addressed by EPC Contractor subsequent to SEA (Section 8.4.6 of the HPP SEA).
Safety – General: fire prevention and fire safety programme	A fire prevention and fire safety programme should be implemented and include regular drills.	Will comply. Level of detail to be addressed by EPC Contractor subsequent to SEA (Section 8.3.6 and 8.4.6 of the HPP SEA).
Site Drinking Water	When sponsors are responsible for the project's drinking water supply, they should use drinking water standards published by the World Health Organisation in "Guidelines for Drinking Water Quality, Health Criteria and the Supporting Information".	Complies. Section 5.7.2 and 5.7.3 of the HPP SEA.

Parameter to be Measured or Environmental Management System Requirement to be Met	Project Standard or Requirement	Project Response; Where Addressed in SEA
Training		
Training: harmful materials	Employees should be trained on the hazards, precautions and procedures for the safe storage, handling and use of all potentially harmful materials relevant to each employee's task and work area.	Complies. Table 7.15 (General Construction Related Issues – Management of Hazardous and Contaminating Material; General Operation Related Issues – Management of Hazardous and Contaminating Material) and section 8.4.5 of the HPP SEA.
Training: Material Safety Data Sheets	Training should incorporate information from the Material Safety Data Sheets (MSDSs) for potentially harmful materials, which can be obtained from the supplier(s) of the chemicals being used.	Complies. Table 7.15 (General Construction Related Issues – Management of Hazardous and Contaminating Material; General Operation Related Issues – Management of Hazardous and Contaminating Material) and section 8.4.5 and 8.4.6 of the HPP SEA.
Training: environmental health and safety	Personnel should be trained in environmental, health and safety matters including accident prevention, safe lifting practices, the use of MSDSs, safe chemical handling practices, and proper control and maintenance of equipment and facilities.	Complies. Table 7.15 (General Construction Related Issues –Public and Worker Health and Safety; General Operation Related Issues – Public and Worker Health and Safety) and section 8.4.6 of the HPP SEA.
Training: emergency response	Training should also include emergency response, including the location and proper use of emergency equipment, use of personal protective equipment, procedures for raising the alarm and notifying emergency response teams, including local and regional hospitals, and proper response actions for each foreseeable emergency situation.	Complies. Table 7.15 (General Construction Related Issues –Public and Worker Health and Safety; General Operation Related Issues – Public and Worker Health and Safety) and section 8.3.6 and 8.4.6 of the HPP SEA.
Record Keeping and Recording		
Occupational health and safety monitoring	Records of job related accidents and illnesses shall be maintained. The records shall include all incidents resulting in an incapacity to work for at least one full workday beyond the day on which the accident or illness occurred. Records must also include the total number of days of absence from work as the result of an incident.	Complies. Table 7.15 (General Construction Related Issues –Public and Worker Health and Safety; General Operation Related Issues – Public and Worker Health and Safety) and section 8.4.6 and 8.5.4 of the HPP SEA.

Parameter to be Measured or Environmental Management System Requirement to be Met	Project Standard or Requirement	Project Response; Where Addressed in SEA
Environmental/ occupational health and safety records and reporting	The sponsor should maintain records of significant environmental matters, including monitoring data, accidents and occupational illnesses, and spills, fires and other emergencies. This information should be reviewed and evaluated to improve the effectiveness of the environmental, health and safety programme. An annual summary of the above information should be provided to IFC.	Complies. Table 7.15 (General Construction Related Issues –Public and Worker Health and Safety; General Operation Related Issues – Public and Worker Health and Safety) and section 8.4.6 and 8.5.4 of the HPP SEA.

7.3 Community Benefits

The Bujagali hydropower facility will result in many community benefits at the national, regional and community levels. In addition to the resettlement and compensation package that each directly affected person will receive, BEL is committed to providing community benefits in a sustainable manner by means of the CDAP, one of the component plans of the SEAP.

Section 7.4.1 summarises the macro-economic and developmental benefits of the project, while the sections below outline the micro-economic and developmental benefits.

7.3.1 Community Development Strategy

The accompanying CDAP outlines measures which it is proposed to implement, to benefit the wider communities in the project area, beyond those individuals and households who have been or will be directly affected, e.g. by loss of land, crops or other assets. A summary of the CDAP is presented below.

The area that will benefit from the CDAP consists mainly of the eight directly-affected villages: four on the West Bank (Mukono District): Naminya, Buloba, Malindi, Kikubamutwe; and, on four the East Bank (Jinja District): Bujagali, Ivunamba, Kyabirwa and Namizi.

The following criteria were considered when the CDAP was developed:

- Programmes should be based on local conditions and the needs of directly affected communities, using culturally appropriate means of consultation;
- Programmes are to be sustainable; and,
- Partnerships are to be established with credible local NGOs.

The objectives of the CDAP are as follows:

- To improve opportunities for higher incomes or living standards of Project-Affected Persons and the affected area as a whole;
- To improve quality of life in the affected area; and,
- To provide a safety mechanism for vulnerable persons.

BEL proposes to support long-term sustainable development initiatives, rather than to generate them. The CDAP was developed, based on the following strategy:

- Construction of the hydropower facility will provide direct sources of employment to directly-affected persons;
- Local communities should benefit from indirect employment opportunities;
- Water supply within the directly affected communities will be improved;
- Improved marketing of farm produce can improve farm incomes;
- New sources of non-agricultural income are needed for women and young people, given the current land scarcity;
- Financial services and training to directly-affected persons is required in order that sudden access to cash compensation is handled wisely;
- Better access to credit is critical for development of small-scale businesses;
- Recreational facilities are important for a good quality of life; and,
- A social safety mechanism is needed for those Project-Affected Persons who may have difficulties due to the displacement/compensation/resettlement process.

The following sub-sections discuss the regional and community benefits that are expected to occur as a result of the hydropower facility project. The key areas where benefits are expected include:

- Health care facilities;
- Employment opportunities;
- Water supply;
- Electricity;
- Fisheries;
- Training and financial services;
- Education;
- Tourism; and,
- Community resources.

7.3.1.1 Health Care Facilities

As previously discussed in Section 3.4.3, there are two existing health facilities located close to the project site: Wakisi Dispensary and Maternity Unit (DMU) on the west bank in Mukono District and Budondo DMU on the east bank in Jinja District. In addition, Jinja Hospital, which is a government general hospital that serves the district, will handle any medical emergencies arising at the project site. All of these

facilities are currently under pressure. Although the anticipated influx of new workers and some of their families is expected to represent a small increase in the populations of Jinja and Mukono Districts, measures will be implemented to strengthen the local health facilities.

BEL is committed to strengthening health facilities on both the east and west bank, so that the wider project-affected-population (and not just those compensated or employed as a result of the project) can enjoy improved health care services. Consequently, BEL has committed to providing assistance to the Level 2 health centres at Naminya on the west bank and Ivunamba on the west bank. Initial support is based upon construction and/or procurement of accommodation facilities for health workers, so that they can be resident within the communities rather than having to travel on a daily basis. Details of this and further initiatives are provided in the CDAP.

7.3.1.2 Employment

It is expected that a minimum of 10 percent of the unskilled workforce will originate from the affected villages for the construction phase of the project. This phase will employ 600-1,500 people at the peak period. The Ministry of Education & Sports and the Vocational Training Institute in Jinja, in conjunction with BEL, is developing skills refresher courses in motor vehicle repair, electrical installation and fitting, welding and fabrication, plumbing and pipe fitting, metal fabrication and brick/block laying. Courses will be designed to meet the needs of interested PAPs. BEL and the EPC Contractor will pursue an apprenticeship programme that can provide additional job opportunities during the operational phase.

A commercial area will be created in the vicinity of the contractor's base in the dam area. This market would aim primarily at selling food and basic goods to construction workers. The area would be provided with drinking water, latrines, proper run-off water, sanitation and made accessible to matatu mini-buses. This commercial area would provide indirect job opportunities (i.e., it is estimated that 50 jobs could be created, mainly for women) in addition to those created directly by the project.

7.3.1.3 Water

BEL will contribute to the establishment of modern water schemes in the area. Upgrades to community-level borehole facilities are proposed for all eight affected villages, and were being implemented at the time of writing this SEA. The boreholes were previously developed by AESNP in conjunction with the World Bank National Water Project for rehabilitation of small rural water and sanitation schemes, but the hand pumps had been unreliable, and as of mid-2006 only one of eight pumps was still functioning. It is intended that in the long-term the schemes will be community-managed in compliance with the Ugandan Rural Water Supply national policy. The implementation of this project will have positive impacts on general public health,

will make the water collection easier and less time-consuming to women and children who are generally in charge of it, and may have a positive impact on the firewood consumption (since water would not need to be boiled for health reasons).

Additional details are provided in the APRAP and CDAP, which are provided as Appendices I and J.

7.3.1.4 Electricity

When AESNP was project sponsor, it undertook to provide electricity to a step-down transformer in each of the eight affected villages, but connection of individual dwellings to this transformer would be the responsibility of the respective landowners. At that time, this undertaking was relatively straightforward, as there was a single authority (UEB) responsible for the generation, transmission, distribution and retail elements of the sector, and the Project Sponsor would provide funds to this authority to bring the distribution lines to the villages.

With the breaking up and privatisation of the Ugandan electricity sector since 2001, the situation is now more complex, with these functions now delegated to UEGCL, UETCL and UMEME, and new authorities having been established to provide rural electrification and regulation functions. As any rural electrification initiative would have to fit within the strategic plan of all of these authorities, there is considerably less flexibility for the Project Sponsor to provide electricity to specific villages than there was in 2001. Furthermore, while BEL is in the process of obtaining an electricity Generation Licence, it will not have a Distribution Licence and thus will not be authorised to provide electricity distribution systems in its own right. So any planned electrification would need to be executed by UMEME. Furthermore, at present there is a shortage of electricity in the Country, and thus electrification by connecting to the Grid is not realistic in the short term.

The GoU, along with International Financial Institutions (IFIs), have provided a USD 30 million rural electrification fund. The funds are earmarked to meet the 10 year electrification goals for Uganda. BEL understands that much of this funding has yet to be allocated. Given their proximity to the source of electricity, and considering the actual and expected levels of economic growth in the Jinja area, it is reasonable that the affected villages could be given high priority for receiving electrification if there is a reasonable market for electricity there. BEL intends to facilitate this process, but must operate within the now-established rural electrification framework.

To this end BEL is consulting with, and will continue to consult with, the Rural Electrification Authority (REA) and UMEME to design and support investments that improve community access to electricity in the area. Consultation with REA is essential both for implementation, design and materials authorisation and for the appropriate methodology for sensitisation and community management within the framework of the existing Rural Electrification Policy in Uganda.

To facilitate possible electrification, BEL will undertake a needs assessment within the affected villages, and identify and support targeted electrification projects (e.g. electrification of leadership offices, schools, medical centres or other community facilities), which might create sufficient market demand in the affected villages to warrant electrification. If the relevant authorities can be influenced to bring distribution lines to the villages to supply such initiatives, it will be relatively simply for individual households to connect to this system should they desire and have ability to pay, as was envisaged under the AESNP proposal.

7.3.1.5 Fisheries

As a result of previous studies and ongoing consultations, the following Community Development actions are being proposed to the local community in the field of fishery development:

- Training and contribution to improved organisation of fishermen, and improved stock management and marketing;
- Provision of appropriate fishing equipment to fishermen to enable them to better exploit the expected fish populations in the new reservoir; and,
- Ongoing monitoring of fish stocks and fisheries livelihoods in the reservoir and downstream.

Also, access to the reservoir may be more difficult to fishermen after inundation due to the operational drawdown of water within the reservoir, which may leave a muddy margin on the bank. It is proposed to build 3 landing site structures (metallic, rock, concrete or wood). Two of the landing sites will be on the west bank of the river, by Kikubamutwe and Buloba villages. These landing areas will be upstream and downstream of the cofferdams. The third landing site will be on the east bank at Namizi village, outside the area that will be eventually isolated by the eastern channel cofferdams. Temporary landing areas will be prepared, i.e., areas will be cleared and flattened if necessary, when construction of the hydropower facility commences (i.e. within one month of financial close), in order to ensure that fishermen have unimpeded access to the river during construction of the facility. Prior to the reservoir being filled, the permanent landing structures, described above, will be constructed. The construction of these landing sites is actually an impact mitigation measure, but will provide the opportunity for more developments in terms of facilities, equipment and training.

Further details are provided in the CDAP, which is provided as Appendix J.

7.3.1.6 Training and Financial Services

This component benefits two different categories of affected people: those who will receive compensation, part of which may be in cash; and people from the area who do

not lose assets and will not receive cash compensation, but can benefit from the project. The expected results of the comprehensive training programme are:

- Improved Inputs and Business Practices;
- Planning and Record Keeping;
- Savings and Credit; and,
- Small Holder Associations.

BEL support with respect to Financial Services will be based upon existing financial services, which at present are available in Jinja from commercial banks, Credit Unions and Micro-Finance Institutions (NGOs).

As a result of aforementioned training efforts, the development of savings and credit associations is expected. A public relations effort will be developed to publicise the existence of the savings and credit associations, and technical assistance will be provided. Further details are provided in the CDAP, which is provided as Appendix J.

7.3.1.7 Education

BEL is committed to strengthening education opportunities in the affected villages. Planned activities and support include:

- Improvement of the existing school structures (i.e., classrooms, library, administration blocks, staff quarters, school / college halls, recreation and sanitation facilities);
- Construction of new structures; and,
- Provision of equipment.

Two institutions on the west bank of the Nile and three institutions on the east bank have been identified as the primary candidates for developmental activities. Further details are provided in the CDAP, which is provided as Appendix J.

7.3.1.8 Community Resources

The implementation of the Community Development Action Plan will be facilitated through two community based resource centres – one located on the East Bank and one on the West Bank. Currently the Sub-County (LC3) offices in Wakisi and Budondo are under-utilised and have been put forward as possible centres. It is therefore proposed to use these offices as Community Resource Centres, which will have a positive impact on long-term capacity building for the LC3s in the affected area.

These community resource centres will provide:

- Library services;

- Classroom training facilities for the aforementioned training programmes;
- Financial information and services;
- Resettlement information and services;
- Services to vulnerable people;
- Health information; and,
- Fax, phone, email and photocopying.

The Community Resource Centres will be the key points for implementation by BEL of all actions planned under the Community Development Action Plan.

7.4 Economic and Developmental Benefits

7.4.1 Country Wide Benefits

The project will give rise to a number of economic and development benefits at both the macro-economic level and the local level. The key macro-economic benefit of the project is proving the infrastructure necessary to meet the incremental demand for power in Uganda in a least cost manner. If Bujagali were not built, then either lack of electricity will persist, or more expensive alternatives will be needed to be built. Electricity demand in Uganda is growing by about 6percent per year. Bujagali is expected to be the next least cost main generation project that will contribute to meeting demand from the time it comes online around 2010/11. The reliable, low cost power to be provided by the project will in turn be a boost to the economy by:

- Reducing electricity rationing and the associated costs of alternative self-generation;
- Create conditions to attract direct foreign investment to Uganda;
- Increase productivity and lower costs for government, education, health, business and industry;
- Facilitate rural electrification; and,
- Minimise cost of electricity for consumers.

The HPP will to the extent it alleviates local shedding, also alleviate the need for self-generation by industry, business and households, and thereby reduce noise and air pollution. Lastly, the transmission lines to be built by UETCL to interconnect the HPP to the grid, shall also strengthen the grid, and thereby improve the reliability of the system and strengthen the ties to the grid in Kenya. Additional details are provided in the following subsections.

7.4.1.1 Reduced Electricity Rationing and Associated Costs

In the last few years the demand for electricity has outstripped the capacity of the generation system to deliver power. To deal with the shortage the Government has had to ration electricity by imposing rotating blackouts. This is also known as load

shedding. The frequent load shedding and voltage fluctuations have eroded consumer confidence, increased production costs and curtailed investment.

The GoU is currently pursuing several short and medium term strategies to deal with the crisis, including:

- Reduce losses in the system;
- Manage demand by, for example, distributing compact fluorescent light bulbs to replace less efficient incandescent bulbs;
- Purchase of power from emergency thermal power plants;
- Development of small scale hydro and cogeneration projects (including purchase of power from sugar processing facilities); and,
- Promotion of solar technology.

The Bujagali HPP is part of the long-term electricity supply strategy. To the extent that there is still any load shedding by the time that Bujagali comes online, it will alleviate that shortage. Ongoing work being undertaken by Power Planning Associates estimates that unserved energy has a cost of USD 0.37/kWh to the Ugandan economy.

7.4.1.2 Increased productivity

Unreliable and inadequate power constrains the activities of most sectors of the economy, including government, health care, education, industry and services. Inadequate power supplies are a major constraint to domestic and foreign inward investment. From consultations with Government and representatives of the business community including Uganda Manufacturers Association (UMA), Uganda Investment Authority (UIA), and Uganda National Chamber of Commerce and Industry (UNCCI), it is apparent that economic growth has been constrained by inadequate and unreliable sources of power. Based on growth and investment data for recent years, a reduction of 10 percent in the volume of private sector investment leads to a reduction in national income of at least 1 percent.

7.4.1.3 Implementation of Rural Electrification Programmes

A very small proportion of the population currently has access to grid-connected electricity. In the major urban areas of Kampala, Jinja and Entebbe 21.2 percent of the population had grid connections in 1997. In other smaller, urban areas 14.3 percent were connected whilst in the rural areas 0.4 percent were connected. Establishing new connections to the grid requires that there is an adequate supply of power. For example, an analysis of rural electrification in 16 countries (in Africa, Eastern Europe, Asia and Central America) shows that there is a significant correlation between total power output per capita and rural electrification rates. The increase in generating capacity provided for by Bujagali, together with ongoing rural

electrification programmes, will facilitate improved access to electricity for the Ugandan population with associated downstream benefits.

7.4.1.4 Reduced Costs of Power

Much of the non-hydropower current generating capacity in Uganda is provided by private industrial concerns, private stand-by generators and UEGCL thermal generation. The use of off-grid private power supplies results in high comparative costs. Power from diesel and petrol generators can cost as much as seven times the cost of power supplied by UEGCL, whilst power from photovoltaic cells costs approximately six times the cost of UEGCL supplies. The implementation of the project is therefore likely to result in the displacement of more costly generating capacity and reduced costs to consumers.

7.4.1.5 Reduced Air & Noise Emissions

The HPP will, to the extent it alleviates local shedding and/or displaces thermal generation from diesel engine power plants, reduce noise and air emissions. Use of hydro power instead of thermal power shall also avoid the carbon emissions associated with combustion of fossil fuels.

7.4.2 Local Benefits

Local economic benefits from the project are those, which accrue to employees and the wider community, over and above the benefits accruing from alternative income-generating activities. These include:

- Direct employment of Ugandan's during construction and operation of the project;
- Induced employment and increased trade in service industries, particularly during the dam construction period; and,
- Benefits from indirect employment and trade, in industries and commercial activities, which become established as a result of the greater availability of electricity.

These are above and beyond the community development benefits to be provided by BEL including the provision of a commercial area, water supplies, facilities for fisheries development and training and financial services, as has been discussed in the previous section.

It is estimated that construction of the HPP will result in the following direct expenditures in Uganda on labour and non-payroll related purchases:

Expenditures for labour (payroll)	USD 11,400,000
<u>Non-payroll Expenditures</u>	<u>USD 40,600,000</u>
Total direct expenditures	USD 52,000,000

The estimated number of jobs for Ugandan nationals during construction is estimated to be 600 to 1,100 (depending on the specific plan to be developed by the preferred EPC Contractor), and during operations about 50.

There are no economic input-output model or tables for Uganda that would allow calculation of the economic multiplier effect from a large construction project such as the HPP. However, an analysis of 4 small foreign investment projects by the Common Fund for Commodities (CFC) in Uganda (The Evaluation Partnership Limited, 2005) indicated that “for each direct job, five indirect local jobs are created as well as 10 jobs through the ‘multiplier effect’ i.e. the money spent in the local economy by people benefiting from the direct and indirect jobs.” Whilst this estimate may not be directly applicable to Bujagali, it does suggest that the project will have a significant effect on employment and incomes in the region. Based on 15 to 1 multiplier for jobs from the CFC projects the total new employment created during the construction period in the Country can be estimated to be between 9,000 and 16,500. During operations the total number of direct, indirect and induced jobs created in the Jinja area would be about 250.

Procedures for recruitment and training will be provided in a Labour Free Management Plan, a summary of which is provided in Section 8. Training will substantially increase the expertise of the labour force within the area. Following construction, employees will be equipped with the knowledge and experience to assist them in obtaining further employment in the construction sector.

During the construction phase, the generation of local employment opportunities will act as a catalyst to stimulate the local economy. Increased incomes in the area will encourage the formation and growth of local businesses, which will in turn create new indirect employment opportunities.

Similarly the availability of cash from employment and provision of goods and services will result in opportunities for investment. In combination with programmes for assistance and advice (as explained in the Resettlement and Community Development Action Plan) opportunities will arise both to improve agricultural productivity and to develop new businesses.

Studies of the local economy undertaken by ACDI-VOCA pointed to the seasonal nature of financial problems experienced by a large proportion of the population and the inability of many families to cope with unexpected or unplanned costs. The potential for increasing savings and for investment of ‘new’ cash, as a result of the project, will help to alleviate these problems and thus significantly improve standards of living in the area. The report concludes that ‘there are multiple opportunities to

leverage the economic boom period into lasting and accelerated economic growth in the area' (2000).

During the operation phase, in addition to employment, the main economic benefits of the project will be those resulting from increased power availability locally. From discussions with UIA, the Chamber of Commerce, UMA and local businesses in Jinja, it is clear that there is considerable potential for development in the retail, construction, hotel and industrial sectors in the town. The lack of reliable, economic power supplies is considered to be constraining development in Jinja.

7.5 Key Project Issues

The following key project issues have been identified based on comments received by project stakeholders, and the experience of the study team with similar assignments. Each of the issues is dealt with, in turn, in the following subsections. Issues of a more routine nature that are common to large construction projects, and for which effective mitigation measures are well known, are dealt with directly in the summary impacts, mitigation and monitoring table (Table 7.15), provided at the end of this Chapter.

- Resettlement and Land Compensation;
- Effects on Land;
- Effects on Water;
- Effects on Air Quality;
- Effects on Noise Levels;
- Access Roads and Traffic;
- Effects on Managed and Protected Areas;
- Effects on local economy;
- Tourism, White-water Rafting and Aesthetics;
- Effects on Cultural Property;
- Community Health, Safety and Security;
- Risk Assessment;
- Labour and Working Conditions;
- Associated Facilities
- Other Construction Related Issues; and,
- Other Operations Related Issues.

7.5.1 Resettlement and Land Compensation

Resettlement and Land Compensation activities in the area of the Bujagali Hydropower Facility were planned and implemented by AESNP between 1999 and 2002. The results of the planning phase were documented in the Resettlement and Community Development Action Plan (RCDAP) released to the public in April 2001, which AESNP started implementing shortly thereafter. These activities were carried out in compliance with the then applicable World Bank Group policy, OD 4.30 (Involuntary Resettlement). They included in summary the following:

- Identification of all Project-Affected People;
- Valuation of all affected assets;
- Development of a comprehensive Hydropower Facility Resettlement Action Plan (RAP), included in the above-mentioned RCDAP;
- Compensation of affected assets, including cash compensation packages and/or resettlement packages; and,
- Monitoring.

After interests in this land were compensated by AESNP, titles for the land affected by the Bujagali Hydropower Facility were transferred to the Uganda Lands Commission (ULC). AESNP was supposed to be granted a 30-year occupation lease on this land by the ULC.

After AESNP withdrew from the country, affected land has remained in the custody of the ULC, which holds a formal freehold title on it. The area has been fenced (West Bank) or watched (East Bank) to maintain it free of settlers and of cultivation. No new settlement was observed.

An assessment of past resettlement activities carried out by AESNP has been completed and is provided as Appendix I. The APRAP presents details about a small number (about 25 in total) of outstanding compensation claims, which were not resolved prior to AESNP's withdrawal and are still pending at Court.

7.5.1.1 Project Land Requirements

Land required for the construction and operation of the hydropower facility totals 238 ha and falls within two categories: permanent land take and temporary land take, as shown in Figure 5.1.

Permanent land take will include a total of 125 ha, comprised of:

- 45 ha of land that will not be inundated:
 - 25 ha on the west bank;
 - 7 ha on the east bank;
 - 13 ha on the islands; and,

- 80 ha of land that will be inundated:
 - 35 ha on islands;
 - 44 ha along the riverbank.

Temporary land take will include 113 ha, composed of:

- 106 ha on the west bank; and,
- 7 ha on the east bank.

Temporary land take will potentially become available for local people to use again, once construction is completed. After the completion of the works and reinstatement of the land by the EPC Contractor, the leasehold title to the temporary land take will be transferred to ULC.

In accordance with Section 41 of the Land Act, non-citizens of Uganda cannot hold land under freehold regime, but can acquire a lease. Consequently, the Government of Uganda acquired the land required for the development from its previous owners, with AESNP paying compensation for previous interests in the land. The land is now held by the Uganda Land Commission and will be leased to BEL for a 30-year term. At the end of the 30-year term, when BEL transfers the hydropower facility to the GoU in accordance with its BOOT (Build, Own, Operate, Transfer)-type Implementation Agreement, the leased land will also be transferred to the GoU. The Uganda Land Commission, the body charged with holding the land belonging to the GoU, will acquire the land on behalf of the Government and be responsible for implementing all required procedures thereafter.

The Bujagali Project (via AES Nile Power) compensated people for a total of 223.8 ha of land at the project site, based upon the cadastral survey conducted in 2000. There was a slight difference of approximately 14 ha between the total amount of land required for the project, and the amount of compensation to be paid to landowners, which is attributed to communal paths, roads and streams within the project-affected area that are not individually owned.

Interests, which AESNP paid compensation for, included the following:

- Landowners' loss of land, crops and buildings (residential or otherwise);
- Tenants' (as defined by the Land Act) loss of land, crops and buildings; and,
- Sharecroppers' (licensees) loss of crops. Usually sharecroppers did not lose residential buildings since they are not allowed to reside on plots where crops are shared with the owner.

With regards to land, plots can fall either completely or partially within the land take area. If there is a building on the plot, it can be either within the land take area or outside the area.

Project-Affected Persons (PAPs)

A Project-Affected Person (PAP) is any person who, as a result of the implementation of the Project, loses the right to own, use, or otherwise benefit from a built structure, land (residential, agricultural, or pasture), annual or perennial crops and trees, or any other fixed or moveable asset, either in full or in part, permanently or temporarily. Not all PAPs need to move due to the Project. PAPs may include:

- Physically Displaced People, i.e. people subject to Physical Displacement as defined hereunder; and,
- Economically Displaced People, i.e. people subject to Economic Displacement as defined hereunder.

Physical Displacement is the loss of shelter and assets resulting from the acquisition of land associated with the Project that requires the affected person(s) to move to another location.

Economic Displacement is the loss of income streams or means of livelihood resulting from land acquisition or obstructed access to resources (land, water or forest) caused by the construction or operation of the Project or its associated facilities. Not all economically displaced people need to relocate due to the Project.

The total number of PAPs who were affected in one way or other by the Bujagali Hydropower Facility is 1,288 households, or 8,700 individuals. This number includes all “dependents” declared as such by the household head during the socio-economic survey, some of whom may be children over 18 years, or other dependents who are not household members in sociologic or economic terms. When these latter are deducted, the number of project-affected persons is 5,158.

The Assessment of Past Resettlement Activities and Action Plan (APRAP) is provided as Appendix I.

Displaced Persons

Displaced persons are those Project-Affected Persons who have had to relocate as a result of the project. They may have been either physically-displaced or economically-displaced. The number of Displaced Persons that have moved their domicile was 634 individuals from 85 households.

Amongst the 85 households who were displaced:

- 34 households elected to resettle to a site specifically developed for resettlement by AESNP, located within Naminya LC1 near the affected area to the south-west; and,

- 51 households elected to be relocated by their own means without resettlement assistance, using the cash compensation paid by AESNP to relocate, 16 of which have relocated to the unaffected part of their plot.

Comparison of Bujagali's Environmental Effects with Other Large Dams

The Bujagali hydropower project was compared with other large dams around the world to gauge the magnitude of its effects relative to its benefits. A tool to undertake this comparative analysis was developed by World Bank Environment Group staff using the two key criteria of hectares flooded per MW generated and number of oustees per MW generated. When these two values are known for a proposed dam, they can be plotted on a graph and compared with those of other large dams. In Figure 7.1, the Bujagali project compares favourably relative to other large dams around the world when considering the criteria of ha flooded per MW generated and number of oustees per MW generated.

Businesses Affected

Small businesses run by Project-Affected People have usually not been affected, as either the business itself was simply not affected, or if it was, people were able to re-establish these businesses elsewhere.

Medium businesses that will be affected by the Project include:

- Four white water rafting companies (Adrift, Nile River Explorers, Nalubaale and Equator Rafts); and,
- A company running the Speke Camp at Bujagali Falls, the lower part of which is to be affected by the inundation zone.

None of these operations was compensated for potential business losses by AESNP. Land at the Speke Camp was however compensated to its owner (the Jinja District) and transferred to the ULC.

During consultations in September 2006, All Terrain Adventures Uganda contacted BEL to express concern about potential impacts on their operations. BEL will meet with this company to better understand their concerns and determine if any actions are warranted.

The project sponsor undertakes to provide notice to the people who are currently growing crops on project lands to harvest their existing crops prior to construction, but they will not be compensated for the crops.

Public Facilities Affected

A Baptist Church in Namizi was the only public building within the project affected area, although the building itself lies outside the land acquisition boundary.

The only recreational facility situated within the project-affected area is the Speke camp and picnic site at Bujagali Falls, mentioned in the previous section. School children regularly visit this site. However, the site is used mostly by tourists versus local people, due to the cost of admission.

Figure 7.1 Hydropower “Efficiency” Ratio of Bujagali Compared to Other Large Dams in the World

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7.5.1.2 Principles for Compensation and Resettlement

Compensation and resettlement packages were based on a census of affected people and a census and valuation of affected assets conducted in 2000 by AESNP in liaison with relevant authorities of the Government of Uganda. Any household identified during the census as having interests affected by the project was eligible to resettlement and compensation packages proportionate to the level of impact, regardless of land tenure regime (formal or customary, ownership or tenancy). The compensation and resettlement process provided a range of options from which households could choose. Figure 7.2 summarises the numbers and categorisation of PAPs and the resettlement and compensation packages offered. The process itself was overseen by a witness NGO and included provision of legal advice to households, as required.

A resettlement area of 48.6 ha was identified in Naminya village, which is one of the eight affected villages. The resettlement area is located close to Jinja and the main West Bank road. In addition, a primary school is situated in the vicinity. Houses within the resettlement area are serviced by roads and a borehole. A clinic has been established by the Mukono Health District in one of the resettlement houses.

Consultations held with the residents of Naminya indicate that there is no opposition from either the village leaders or the general public. Additional details are provided in the Resettlement Audit.

A full resettlement package was offered to resettlers. The package included:

- A residential and agricultural plot within the resettlement area on the West Bank;
- The provision of a replacement house, based upon a model developed in Uganda by the NGO “Habitat for Humanity”, including a corrugated iron roof, a concrete floor, and a ventilated pit latrine;
- Agricultural inputs such as seeds, seedlings and fertilisers;
- Cash compensation for the value of lost perennial crops;
- A disturbance allowance of 15 percent if notice to vacate is 6 months or more, and 30 percent if notice to vacate is less than 6 months; and,
- Cash compensation for the cost of the actual move.

Households who decide not to resettle, or who are not eligible to resettle, received cash compensation for their land, perennial crops, and their buildings. All compensations were calculated according to Ugandan laws, with an “uplift” from AESNP as required to meet WB/IFC requirements.

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Figure 7.2 Numbers of Categorisation of Project-Affected Person and Resettlement and Compensation Packages

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Additional assistance was provided to vulnerable persons. Grievance, monitoring and evaluation procedures were partly implemented by AESNP, partly by the Bujagali Implementation Unit after AESNP left.

An APRAP has been completed and is provided as Appendix I. This APRAP identified the shortcomings in the previous compensation and resettlement process, and contains proposed corrective actions to be implemented by BEL. The APRAP sets out the programme and budgets for implementation of these corrective actions.

7.5.2 Effects on Land

7.5.2.1 Temporary Land Take

The 113 ha of temporary land take required for the project comprises the following components:

- East bank access road;
- West bank temporary works area;
- West bank stockpile area; and,
- Area of west bank south of the power station, including the area surrounding the Buloba quarry.

The aerial extent of these areas can be seen on the site plans provided in Appendix E. BEL will have a leasehold title to the area of land encompassed by the Setting Out Points (SOP) boundaries on both banks for a period of five years. At the end of this leasehold period, the 'radical title' (113 ha of land above the 1,116 m AMSL contour not taken by the permanent works) will pass to ULC.

Mitigation/monitoring measures: As a requirement of the EPC contract, the temporary land take areas will be reinstated to a condition that will make it possible for the land to be used for agriculture, forestry or industry, although the riparian strip (at least 5 m measured vertically) will be re-vegetated with native species. The ultimate decision as to the final uses for this land will rest with ULC.

7.5.2.2 Permanent Land Take

The 125 ha of permanent land take required for the project comprises the following components (rounded to nearest ha):

- 25 ha on the west bank;
- 77 ha on the east bank;
- 13 of islands that will not be inundated; and,
- 80 ha that will be inundated (including islands and riverbank).

As mentioned above, this land has already been compensated and vacated. It is currently fenced, to prevent encroachment or unauthorised access and use. This land has been transferred from its previous owners to the Uganda Lands Commission (ULC), which holds a freehold title in respect thereof. This land will be leased to BEL for a period of 30 years by the ULC. Similarly, the land between the Full Supply Level (1,111.5 m MSL) and the 1,116 m contour will be managed by BEL for the 30-year operating concession period.

7.5.2.3 Terrestrial Ecology

The upper reaches of the Nile valley contain a number of islands, covering a total area of approximately 48 ha. Some of the smaller or less accessible islands have retained remnant natural riparian vegetation. Of this area, approximately 35 ha will be submerged (this includes islands located within the Jinja Wildlife Sanctuary, which are addressed in more detail in Section 7.5.7) when the reservoir is filled. The inundation will result in the loss of terrestrial vegetation in the submerged areas.

No areas of Critical Habitat for terrestrial species will be affected by the project.

The new shorelines of islands partially submerged will experience an approximate 2 m daily fluctuation in water levels. The fluctuating water level will restrict vegetation to tolerant species, such as Vossia grass (FIRRI, 2001). The inundation of riverbanks and islands will result in a loss of habitat for birds, bats and other animals. Neither of the two aquatic bird species found in the area that were identified as regionally vulnerable (the darter and the white-collared pratincole) requires running water habitat, and therefore is not expected to be significantly negatively affected. The loss of habitat will be compensated for through enrichment planting to regenerate forest vegetation on island land not inundated but previously cleared for agriculture, as well as land along the mainland shore.

Mitigation/monitoring measures: BEL will plant native and medicinal tree species in areas of the riparian strip between the FSL (1,111.5 MSL) and the 1,116 m contour that are currently bare or planted with cash and/or subsistence crops, in order to control erosion and to provide (in the long term) roosting sites for birds and bats. In addition, BEL will undertake planting through the wider 100 m marginal strip along the banks of the reservoir, in consultation with land-owners and with NEMA, the government authority charged with management of this area. This is intended not only as an erosion control and general catchment protection measure, but also to offset the loss of ecological habitat on the Bujagali islands and river banks as a result of the project. The 100 m strip is administered by NEMA, and a permit will be required from NEMA pursuant to Section 23(1) of The National Environment (Wetlands, River Banks And Lake Shores Management) Regulations, No. 3/2000 (under section 107 of the National Environmental Act Cap 153).

NFA will also be consulted, and will advise as to the preferred tree species to be used. As indicated in a report prepared by Muramira (2000), several NGOs within the region have the capacity, and interest, to undertake tree planting in this area, including: the Jinja-based environmental NGO, AUXFOUND; Africa 2000; Environmental Alert, Uganda Farm Family Development Association; and, the Busoga Youth Development Association. These NGOs are capable of supplying large numbers of seedlings. If necessary, supplemental supplies of seedlings can be purchased from the NFA. The NGOs will be encouraged to hire people from the immediate vicinity to plant the trees, with at least one-half of the planters being women. Positive benefits of this mitigation measure include: provision of employment to local people; enhancement of the landscape, reducing erosion; and, improving the biodiversity of the area by re-establishing indigenous tree species and planting fruit trees.

7.5.2.4 Agriculture

Approximately 75 percent of the land within the 125 ha permanent land take was under agricultural production, as described in detail in AESNP (2001). The land on level terrain has high agricultural productivity and agriculture practices were well developed, including horticultural production for urban markets. Project Affected People have been compensated for loss of agricultural revenue.

The District Agricultural Officers (DAOs) in Jinja and Mukono are running extension services covering both banks. Of particular relevance to the Bujagali project is the erosion control programme. This programme will be supported by BEL if erosion increases as a result of the hydropower facility project. BEL proposes to provide funds for the establishment of demonstration plots to demonstrate good husbandry and appropriate measures to minimise erosion.

7.5.2.5 Borrow Areas

The main area where excavation and re-profiling will take place is the Buloba quarry, which is located on the west bank immediately upstream of the proposed dam. A portion of this quarry will ultimately be submerged. The exact size of the area to be quarried is dependent on the quality of material and this will not be known until excavation has been completed. For this reason, the 'shoreline', which is shown on Figure 5.1 is only indicative at this stage.

The portion of the quarry to be submerged will be configured in such a way that, once need for quarried material has been met, the north-westerly and south-easterly corners of the quarry will be blasted in order to permit unimpeded flow of river water through the quarry. This will ensure that no stagnant water collects in the quarry, which could otherwise provide a breeding habitat for vectors of parasitic diseases (as is the case for the fishponds on the east bank). Thus, the quarry will form part of the riverbed.

Mitigation/monitoring measures: The portion of the quarry that will remain above water level, i.e. will form the new riverbank, will be re-profiled such that it has a similar landscape to equivalent areas above the water line prior to construction, and blends in with the profile of undisturbed areas. Refer to the preliminary restoration plan in Appendix F. The NFA recommends re-colonising this area with species that were formerly present in the area and species, which are of medicinal value locally. The most important of these species are: *Bidens pilosa*, *Synedenum gratii*, *Vernonia amydagalina*, *Phyranthus voscheli*, *Bersama alba*, *Leonotis spp.*, *Phytoracca dodicandra*, and *Mimosa pigra*. In addition, the only species found at the site that is classified as rare in Uganda, *Helinus intergrifolius*, would be re-introduced. See ‘Effects on Terrestrial Ecology’ section above.

Any off-site sand quarries will also be rehabilitated according to specific procedures to be developed in consultation with existing operators and/or authorities and reviewed under the Change Management procedure as outlined in Chapter 8.

7.5.3 Effects on Water

7.5.3.1 Hydrology and Hydrogeology

Downstream Flows During Construction and Reservoir Filling

Outside of the immediate diversion area (i.e. the vicinity of Dumbbell Island), the flow of the Nile during the construction phase will remain governed by the operating regime of the Nalubaale and Kiira dams. The diversion works at Bujagali are not expected to have any significant effect on river flows outside of the immediate construction area.

The diversion of the west channel of the Nile River at Dumbbell Island into the east channel during the first stage of construction will result in higher water levels and increased flow velocities in the east channel. Water depth will increase by up to 6 m along the non-diverted (east) channel alongside Dumbbell Island; the ‘backwater’ effect is expected to extend up to about 500 m upstream. Some localised scouring and erosion, and possibly some downcutting of the riverbed, are anticipated. The effect on water quality is discussed further in Section 7.5.3.2.

Mitigation/monitoring measures: On completion of the dam and power station, the reservoir will be filled in such a way that no more than 2.5 percent of the instantaneous flow downstream of the Nalubaale and Kiira facilities is retained in the Bujagali reservoir. Therefore, during the filling period the Minimum Residual Flow (MRF) downstream of the Bujagali Dam will be no less than 97.5 percent of the flow downstream of Nalubaale and Kiira. Although the reservoir could in theory be completely filled in about one day, the ongoing checks of dam and riverbank stability will mean that the reservoir is filled slowly, and in a staged manner, over a period of

several weeks. Thus, changes in the discharge downstream of Bujagali during filling are likely to be imperceptible.

Reservoir Level Fluctuation During Operation

Detailed model runs of the Bujagali reservoir in conjunction with the Nalubaale power station were carried out by Knight Piésold (1998). The daily fluctuation of the reservoir levels is expected to be in the order of 2 m at the Bujagali dam face. The water level fluctuation will be less pronounced upstream of the Bujagali Falls area as the effect lessens with distance from the dam face, and the shallow water depth and constant inflow from upstream further dampen the effect. It is expected that, normally, lowest reservoir levels are likely to occur towards the end of the afternoon. The magnitude of the fluctuation will depend on the level of Lake Victoria, as shown in Table 7.3.

Table 7.3: Rate of Rise and Fall of Bujagali Reservoir Levels During Operation

Lake Victoria Level (m AMSL)	Change in Level (m)	Rise or Fall	Over
1132.6	2	Rise Fall	1 hr 1 hr
1133.1	2	Rise Fall	2 hrs 1 hr
1133.6	1.6	Rise Fall	12 hrs (two phases) 1 hr

Source: Knight Piésold (1998).

The daily water level fluctuations that already occur in the upper reaches of the Nile due to operation of the Kiira Dam was modelled to be on the order of 2 m, and site observations and anecdotal reports from villagers support this. No significant adverse effects of this fluctuation have been reported by potentially-affected parties such as fishers or rafting operators. The situation after Bujagali is not expected to differ greatly from the existing conditions and water fluctuations in the reservoir are not expected to result in a significant negative impact. To confirm this BEL will consult further with downstream stakeholders prior to operations to determine if there may be any potential impacts that have not been identified to date.

As part of the measure to protect public safety, suitable prominent warning signs will be provided both upstream and downstream of the spillway. A powerful electric horn (klaxon) will be provided to give an audible warning that spillway discharge is about to commence. BEL will consult with downstream stakeholders prior to the start of operations to discuss the operations plan and warning systems.

As well as the level of Lake Victoria, the actual magnitude of the daily fluctuations will depend on the conjunctive use of Nalubaale, Kiira and Bujagali power stations.

Changes in Shoreline

At full supply level, the shoreline of the reservoir will measure approximately 28 km, and at extreme drawdown level, will measure approximately 36 km, compared with the present shoreline of 42.2 km. The reduction in shoreline is due to the effects of islands in the Namizi-Kikubamutwe area being completely submerged, and to upstream islands being partially submerged, with attendant reduction in shoreline length.

Downstream Flow Regime During Operation

The Bujagali HPP is not expected to significantly alter or affect the hydrology of the Victoria Nile. The following qualitative analyses, prepared in response to concerns raised during consultations, show that the only significant concern related to hydrology is fluctuating water levels immediately downstream of the HPP. Further analyses and a stakeholder engagement program are proposed to address these outstanding concerns.

The quantity and timing of water released will continue to be controlled by the operation of the Nalubaale and Kiira facilities. Because the reservoir for the HPP is small, it can only hold back a few hours of flow, and therefore it will essentially pass-through whatever flows are released by Nalubaale and Kiira.

In simple terms, according to international agreement, the average rate of release is determined by a rating curve, known as the “Agreed Curve”, which was designed to mimic the natural flow of water were there no hydro facilities present. The Agreed Curve has been in place since Nalubaale dam’s construction (1954) and specifies the average flow over the course of a 24 hour period, depending on the level of water in the Lake. Within any 24 hour period flows can vary, as long as the average discharge rate is met.

The dispatch and control of the Nalubaale, Kiira and Bujagali power stations are outside of BEL’s control, and therefore BEL cannot predict with accuracy what the future hourly river flow variations will be. Up until the commissioning of the Kiira facility there is believed to have been excess water above the generating capacity of the Nalubaale facility, and thus the discharge rates from Nalubaale had been relatively constant. However, with low lake water levels, and the added generating capacity of the Kiira facility, the operations of the facilities shifted towards varying the flow, and hence generation, to better match the fluctuations in the demand for power. For example, in 2006 instantaneous flow released from Nalubaale/Kiira power stations varied over the course of a typical day, and certainly more than would have

been the natural situation. Nevertheless, it is believed that joint operations of the two projects' releases strive to be in accordance with the 'Agreed Curve.'

The presence and operation of the Bujagali HPP is not expected to have a significant effect on existing downstream flows because the Bujagali reservoir has very limited storage capacity (enough for only a few hours of operations), and therefore, at any given point in time, Bujagali will be releasing about the same amount of water it receives from Nalubaale/Kiira. At low water levels, as exists at the time of writing this SEA, the plants may be operated as peaking units, and thus flow would vary throughout the day.

Thus, it is expected that the flow of the Nile downstream of Bujagali will be very similar to the flow downstream of Nalubaale/Kiira, which is itself still regulated, as it has been since the construction of Owen Falls dam in 1954, by the "Agreed Curve" to assure downstream flows.

Concern has been expressed that fluctuating water levels immediately downstream of the Bujagali dam may pose a safety hazard. Studies associated with the development of the tailwater rating curve for Bujagali (e.g. Knight Piesold, 1998) have provided information which can be used to assess likely changes in water levels immediately downstream of Bujagali during operation. These show that the maximum expected short term change in water level at a point 250 m downstream of the toe of the dam would be a few meters, and this would occur over a period of 1-2 hours, rather than instantaneously. Similar short term changes in water level currently occur downstream of Nalubaale/Kiira, and are experienced at, and downstream of, Dumbbell Island, albeit at a lower magnitude than would be the case after construction of the Bujagali project. Public safety implications can be managed by a management plan developed through consultation with and education of local communities with particular focus on river users (fishers), including things such as audible warning devices which are sounded when flow is about to be increased. These measures are described within the Mitigation and Public Consultation sections of this SEA report; BEL has committed to their development and implementation progressively during the project's pre-construction and construction stages so that they are fully operational by the time the project goes into service.

Concern has also been expressed about the potential of the HPP to reduce the flow of the Nile downstream in Sudan, and for daily flow fluctuations should the plants be used as peaking units to occur at this border as a result of the Bujagali project. Analyses carried out by SNC-Lavalin (draft, 2006) provide qualitative assurances that no such effects are likely; should the final version of the SNC-Lavalin report not confirm quantitatively their qualitative conclusions in the draft documents, BEL will revisit this question in consultation with the WBG, the sponsors of the SNC Lavalin work. Overall, however, neither is expected to occur, as the Bujagali reservoir will only have a few hours of live storage, and there is considerable buffering capacity

within the water bodies between the dam site and Sudan, which would absorb any daily flow fluctuations. These water bodies comprise:

- 110 km of Victoria Nile channel between Dumbbell Island and Lake Kyoga;
- Lake Kyoga, which has an hydraulic retention time of approximately 100 days;
- 200 km of Victoria Nile channel between Lake Kyoga and Lake Albert;
- Lake Albert (although this is largely “short-circuited” due to the Victoria Nile inflow and Albert Nile outflow being only a few kilometres apart); and,
- 200 km of Albert Nile channel between Lake Albert and the Uganda-Sudan border.

Even disregarding the storage capacity of Lakes Kyoga and Albert, the estimated time of travel between Dumbbell Island and the border is approximately 5 days – which on its own would be sufficient to buffer any daily flow fluctuations. When the hydraulic retention time of the two lakes is also considered, it becomes extremely unlikely that the Bujagali project would have the potential to affect cross-border flows.

Concern has also been expressed about the fluctuation in Bujagali outlet flows having the potential to cause daily fluctuations in the level of Lake Kyoga. Although other work in progress may address this issues (see below), simple mass balance calculations based on the likely flow variation and the storage capacity of Lake Kyoga (and disregarding any buffering capacity of the Victoria Nile between Dumbbell Island and Lake Kyoga) indicate that the maximum effect that daily variations in river flow would have on Lake Kyoga would be at most a few centimetres. This is not considered to be significant, especially against a background of significant natural seasonal and inter-annual variations in the level of Lake Kyoga. The historical fluctuations in the levels of Lake Kyoga, which during the period 1912 to 1977 fluctuated between 9.7 m and 13.5 m on the Masindi Port gauge, i.e. 3.8 m range (Sutcliffe & Parks, 1999), tend to confirm that these variations due to Bujagali HPP would not be significant. Recently, significant level fluctuations have occurred, at least partly due to temporary blockages of the outflow by water hyacinth.

SNC Lavalin and Power Planning Associates are both preparing reports for the World Bank Group that are tasked with addressing certain hydrological implications of the Bujagali HPP, including in its regional and Nile basin context. Once the final versions of these reports become available, BEL will review this issue in consultation with the sponsors of these reports to ascertain whether further hydrological analyses are required. Future updates of the SEAP for this SEA (which will be publicly released) will address the issue further, should it be required.

Lake Victoria Levels

The water level of Lake Victoria is the subject of much discussion and debate, as outlined in Chapter 3 of this SEA. A detailed hydrological analysis of the Bujagali project is outside the scope of this SEA, principally because such studies are being

carried out by others (e.g. WREM, 2004, 2005; Power Planning Associates, ongoing studies). However, in recognition that the potential impacts of the Bujagali project on water levels in Lake Victoria are a subject which has been raised by a number of stakeholders during the scoping and consultation phases of this SEA, it is appropriate to summarise the issues, and the main issue, and the findings of these other studies within the framework of this SEA report.

The main issue is that over recent years, Lake Victoria has experienced a dramatic reduction in water level. This is due to a combination of factors, including regional drought, abstraction of water, and releases of water from Lake Victoria via the Nalubaale and Kiira power plants. WREM indicate that releases of water from Nalubaale and Kiira in excess of the agreed curve account for approximately half of the reduction in water levels in Lake Victoria, the drought accounting for the other half.

During low lake levels the pressure for the GoU to release water from Lake Victoria in excess of the Agreed Curve was increased with the commissioning of the Kiira power station, which effectively operates ‘in parallel’ to the Nalubaale power station.

The Bujagali HPP is located downstream of Kiira and Nalubaale, and therefore only uses water that has already been used once at Kiira or Nalubaale. Thus, the Bujagali project offers the opportunity to generate approximately twice as much power with the same amount of water than with Kiira and Nalubaale alone. To quote from the WREM (2004) report:

“If Bujagali were on line, the release required to meet the power targets would be less than that of the Agreed Curve, reducing annual lake drawdown to about 0.17 meters without load shedding; Thus, during droughts, Bujagali would enhance lake management as well as power production.”

The report by Mason (2006) goes further, stating that:

“Unless another major rainfall event occurs, such as the one which occurred in the 1960s, it is inevitable that the power availability of the Jinja power stations [Nalubaale and Kiira] will revert back to long-term output of around 150 MW. The only solution would appear to be another station further downstream, which can make use of the same water again, such as that currently planned at Bujagali.”

Groundwater Levels

Consultations with DWD staff have indicated that groundwater in the immediate project area is mainly contained in lenses of weathered rock overlying unweathered bedrock (C Tindimugaya, DWD, pers. comm.). Water bearing strata are not believed to be extensive, but there are significant layers of permeable material such as sand

and gravel above the existing water table (Knight Piésold, 1998). Raising of water levels in the river channel, particularly between Bujagali Falls and Dumbbell Island where the increase will be greatest, will eventually cause these strata to become saturated. As the reservoir will be confined within the deeply-incised river channel, and the surrounding countryside is of higher elevation than FSL, the water table will not rise above the ground surface. Therefore, no increase in the risk of flooding from rising groundwater is expected.

The higher water table could result in flooding of pit latrines, but only those that are located within the land take area for the project. Therefore, it is expected that latrines located off-site will not be affected.

7.5.3.2 Water Quality

Suspended Solids During Construction

The main impact on water quality during the construction phase is anticipated to arise from inputs of suspended matter to the river as a result of coffer dam construction and erosion of the banks of the river channels by the higher velocity flows during diversion.

Suspended matter in the river could have two main effects downstream of the site. The first, is siltation in areas remote from the site, particularly in areas of shallow gradient and on the inside of bends, where flow velocity is low. This may have some impacts on navigation and fishing activity, although these are expected to be insignificant due to the high volume of water that passes down the River Nile.

Of greater concern are the potential adverse impacts of suspended matter on aquatic life downstream, and on fish species in particular. Suspended particles can clog fish gills, and at high levels cause death by suffocation, although the dose-response varies greatly amongst fish species. Regardless, it is generally difficult to maintain a freshwater fishery in water with long-term suspended solids concentration exceeding 80-100 mg/l (Alabaster & Lloyd, 1982).

In general, fish species of the Nile are expected to be relatively tolerant of suspended matter as there are existing high silt loads during the wet seasons, and they are expected to demonstrate avoidance behaviour. For the purposes of this assessment, the precautionary principle was applied, and a desktop study was carried out to quantify the magnitude of any suspended solids plume downstream of the construction site. Briefly, the study looked at three worst-case estimates for sources of sediment to the river: erosion of coffer dam facings, erosion of the river bed, and erosion of newly submerged river banks. Appendix G.1 contains the details of the siltation desk study.

To summarise, the results of the study showed a maximum elevation in suspended solids concentration immediately downstream of the site to be 33 mg/l. This reduces to 15 mg/l at a point 7 km downstream of the site. As baseline levels are generally low, it is concluded that the in-channel suspended solids concentration would not approach the critical level of 100 mg/l. Therefore, there will be no significant impact of this suspended sediment load on aquatic species.

Mitigation/monitoring measures: Mitigation measures to be undertaken in order to minimise increase in suspended solids include:

- No digging or grubbing will be done during clearance of the reservoir. Trees in the area to be flooded will be harvested prior to inundation; and,
- Site drainage systems will include sedimentation basins.

Water quality downstream will be monitored visually on a daily basis, with samples taken and analysed on periodic basis.

Inputs of Pollutants to the River During Construction

Three possible ‘streams’ of contaminated water from the site are identified, as follows:

- Foul water, from the site sewerage system;
- ‘Process water’ such as the excess from concrete batching, washing, etc.; and,
- Surface and seepage water run-off from site.

The EPC Contractor will be required to treat these streams in order to achieve an effluent quality that complies with Ugandan national standards for discharge of effluent to water or land. The Ugandan standards are comparable to, and for some determinands more stringent than, international standards including World Bank Group guidelines. They are also more stringent than standards derived under EU Directives, which are based on the objectives for river quality, and therefore would allow a relatively high ‘end of pipe’ pollutant concentration at this site given its considerable dilution potential. For this reason, it is expected that compliance with the NEMA discharge quality standards will be sufficient to ensure that there will be no significant impairment of water quality in the River Nile.

There is a risk of contamination of the river and its environs by accidental spills or discharges of construction-related chemicals such as oil, diesel fuel, concrete additives or solvents. Provisions for secure storage of such substances, including interceptors and sumps in case of spillage, are outlined in Chapter 5. Provisions for pollutant spill response plans (including provision of training and equipment) are outlined in Table 7.15. The EPC contractor will be contractually required to implement these management measures, which will minimise the risk of a significant release of chemicals into the environment.

Water Quality and Eutrophication of the Reservoir

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

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

The risk of eutrophication for a body of water can be evaluated using the Organisation for Economic Co-operation and Development (1982) model. The model is based on the total amount of phosphorus discharged in a reservoir and the retention time of the reservoir. Based on 1) an average phosphorus concentration in the Upper Victoria Nile of 41 mg/m^3 and 2) a predicted reservoir retention time of 0.7 days, the OECD model predicts a mean in-lake phosphorus concentration of 32.5 mg/m^3 . This phosphorus concentration is consistent with the river's present mesotrophic status (or mid-eutrophic status), indicating no change in trophic status will arise from the modification to river flow. Therefore, there is no evidence of a shift towards a eutrophic state following completion of the hydropower facility. This is largely attributable to the short retention time of the reservoir.

The actual risk will depend on several factors including nutrient loads from upstream and terrestrial run-off. Although there are no forecast data available for these factors, and therefore it is not possible to apply the OECD model to predict future critical nutrient concentrations, it is not anticipated that the hydropower development alone will cause the upstream nutrient load to increase. As the new NEMA effluent quality standards are now in force, discharge of nutrients into the Upper Victoria Nile should decrease from current levels. Therefore, the risk of future development making this stretch of the Victoria Nile more susceptible to eutrophication should be reduced.

7.5.3.3 Impacts on Aquatic Ecology and Fisheries

Section 3.6.4 describes the current status of fish species in the Upper Victoria Nile and their conservation and commercial importance. Potential effects on fish species of commercial and conservation importance are discussed below.

The surveys carried out by FIRRI identified two macrohabitat types in the upper Victoria Nile: fast-flowing habitats and slow-flowing habitats. The fast flowing zone

habitats are the section of the Upper Victoria Nile between Nalubaale and a point approximately 40 km downstream of Dumbbell Island. This section has steep slopes, a predominantly rocky shoreline and contains several rocky islands. The river bottom is also rocky with some of the outcrops resulting in rapids. The most prominent of these are the Bujagali, Busowoko, Kalagala and Itanda Falls, and the falls around Kirindi.

The slower flowing zone habitats commence about 10 km upstream of Namasagali (approximately 40 km downstream of Dumbbell Island), and stretch downstream towards Lake Kyoga. In these reaches, the Upper Victoria Nile has a more uniform flow and occupies a wide valley characterised by floodplain features. The riverbanks are densely vegetated with papyrus (*Cyperus papyrus*) as the dominant species. There are generally fewer rocky outcrops and the river bed is mostly of mud with sandy patches.

The potential impacts of the Bujagali project on fish resources in the River Nile arise through a number of direct and indirect mechanisms, as depicted in Figure 7.3, and outlined below. Each of the potential mechanisms labelled (i) to (v) and (a) to (f) are discussed in the subsequent sections.

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Figure 7.3 Mechanisms by Which Bujagali Project Can Affect Fish Resources and Biodiversity

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- (i) Effects on water quality:
 - Increased suspended sediment (and decreased transparency) downstream of the site during construction;
 - Decreased suspended sediment (and increased transparency) in the reservoir during operation;
 - Potential for increased nutrients (eutrophication) in the reservoir due to increased retention time; and,
 - Potential for dissolved oxygen depletion in the reservoir due to reduced turbulence.
- (ii) Effects on invertebrate prey species:
 - Change in habitat availability on the basis of water depth, flow velocity and diurnal water level fluctuations.
- (iii) Effects on macrophyte species:
 - Change in macrophyte cover and species composition on the basis of water depth, transparency, flow velocity and diurnal water level fluctuations.
- (iv) Effects on juvenile life stages (including prey species):
 - Change in food availability (phytoplankton and invertebrates);
 - Change in habitat availability on the basis of water depth, flow velocity, diurnal water level fluctuations and effects on macrophyte species; and,
 - Change in feeding efficiency due to changes in transparency of the water column.
- (v) Effects on feeding and spawning habitat:
 - Changes in availability of habitat on the basis of water depth, water transparency, flow velocity and water level fluctuations; and,
 - Lack of access to 8 km of potential feeding and spawning habitat downstream of the proposed hydropower facility.

A further potential effect is a direct physical effect of the dam, via potentially blocking migration paths of fish.

The importance of each of the potential changes outlined above is assessed in Table 7.4 for the reaches above (Nalubaale to Bujagali Hydropower Facility) and below Bujagali Falls during operation of the facility, and for downstream reaches during construction.

In summary, the major changes that will occur during construction and operation of the hydropower facility will be increased suspended sediment concentrations downstream during construction (as previously examined in Section 7.3.3.2) and changes in habitat type within the impounded reach to a habitat more representative of that currently found at Namasagali, 60 km downstream of the site. The Namasagali

habitat has slower flow velocities than at the upstream sites, a more sandy and silty (rather than rocky) substrate, and is characterised by a higher diversity of both plant and animal (including fish) species.

Table 7.4: Importance of Potential Changes on Fish Resources in the River Nile

Parameter	Downstream of Bujagali (Construction Phase)	Upstream of Bujagali (Operation Phase)	Downstream of Bujagali (Operation Phase)
(i) Water Quality	Increased suspended solids (up to 33 mg/l above baseline)	Little potential for eutrophication (according to OECD (1982) model). Slight decrease in suspended sediment and increase in transparency (due to decreased flow velocity) – comparable to that measured at Namasagali. Slight decrease in dissolved oxygen due to decreased turbulence	Slightly decreased suspended solids and increased transparency due to ‘settlement pond’ effect in Bujagali reservoir.
(ii) Invertebrates	No change	Change in species composition to an assemblage more representing that at Namasagali. Some loss of non-mobile species due to reservoir level fluctuation. Reduction in lake margin habitat due to reduction in shoreline and daily water level fluctuation. Reduction in species inhabiting shoreline macrophytes (including disease vectors)	No change
(iii) Macrophytes	No change	Decrease in overall habitat due to reduction in total shoreline. Increase in species tolerant to water level fluctuation e.g. <i>Vossia</i> , <i>Phragmites</i> . Decrease in species sensitive to water level fluctuation.	No change
(iv) Juvenile fish	No change	Reduction in total habitat due to loss of shoreline, but local increases in biodiversity due to creation of habitat similar to Namasagali.	No change
(v) Adult fish habitat	Potential minor impacts due to increased suspended solids, e.g. reduced hunting efficiency	Change in habitat to one more representing that at Namasagali (slower flowing, less turbulent areas)	No change
(vi) Fish migration	No impact	Obstacle to migration	Obstacle to migration

Changes in the parameters listed in (i) to (v) above may affect fish populations by a number of mechanisms as outlined on Figure 7.3, and listed below:

- (a) Water quality effects:
 - Fouling of gills by suspended solids;
 - Effects of lowered dissolved oxygen concentrations within reservoir due to reduced turbulence; and,
 - Ammonia toxicity due to eutrophication of impoundment.
- (b) Phytoplankton:
 - Change in availability of a food resource for some species/life stages.
- (c) Invertebrates:
 - Change in availability of a food resource for some species/life stages.
- (d) Macrophytes:
 - Change in availability of spawning habitat for some species; and,
 - Change in availability of cover from predators for smaller species/life stages.
- (e) Juvenile (prey) life stages:
 - Effects on a sensitive life stage, possibly affecting population age structure; and,
 - Change in availability of a food resource for larger species/life stages.
- (f) Habitat availability:
 - Effects on feeding success due to changes in feeding habitat;
 - Effects on breeding success due to changes in spawning habitat; and,
 - Obstruction of migration to feeding or spawning habitats.

FIRRI (2001) recognised five microhabitat types in the Upper Victoria Nile, and identified the main fish taxa associated with each. Table 7.5 outlines these habitat types and related fish species, and whether each microhabitat is expected to change in availability upstream or downstream of the dam.

Table 7.5: Microhabitat Types and Associated Fish Species in the Upper Victoria Nile, and Predicted Changes after Construction of the Bujagali Hydropower Facility

Habitat Description	Associated fish Species	Change in Occurrence Upstream of Dam	Change in Occurrence Downstream of Dam
Shallow, calm embayments and backwaters over generally mud and sandy bottoms, with some rocks	<i>O. niloticus</i> M. <i>kannume</i> R. <i>argentea</i> , <i>B. jacksonii</i> , <i>M. victoriae</i> , <i>Haplochromines</i>	Increase	No change

Habitat Description	Associated fish Species	Change in Occurrence Upstream of Dam	Change in Occurrence Downstream of Dam
Sub-littoral to mid-channel habitats in fast current over hard bottom contained in steep slopes	<i>L. niloticus</i> <i>M. kannume</i> <i>B. altianalis</i>	Decrease	No change
Mid-channel habitats over rocky outcrops forming rapids	<i>B. altianalis</i> <i>B. docmak</i> <i>L. niloticus</i> <i>M. kannume</i>	Decrease	No change
Uniform channels with vegetation – (papyrus, reeds, crops) dominated banks and indications of flood-plain morphology	<i>S. afrofisheri</i> <i>S. victoriae</i> <i>O. niloticus</i> <i>M. macrocephalus</i> <i>L. niloticus</i>	Increase	No change
Vegetated river margins and calm shallow water occupied by macrophyte beds	Juvenile fish <i>O. niloticus</i> <i>L. niloticus</i> <i>R. argentea</i>	Decrease	No change

The habitat impacts, and impacts on feeding and spawning have been assessed in relation to the nine keystone species that were identified in the Upper Victoria Nile during studies carried out by NA/FIRRI (2000a to 2000d; 2001; 2006). The results are discussed for each taxon below, and summarised in Table 7.5.

***Lates niloticus* (Nile perch):**

This species has been shown to be well-adapted to both lake and river habitats, as demonstrated by the speed with which it has become the dominant species in Lake Victoria and the Victoria Nile since its introduction in the 1950s. Its rapid establishment has been to the detriment of populations of small prey species. While baseline monitoring in early 2006 tentatively indicates a downturn in the importance of this species between 2000 and 2006, the differences in catch sizes were too small to conclude that there has been any significant change. Construction of the hydropower facility will not affect either its feeding or reproductive ecology, and it will remain the dominant species both above and below the impoundment.

Conclusion: no significant impact upstream or downstream

***Oreochromis niloticus* (Nile tilapia):**

This species is also well-adapted to both lake and river habitats, and is able to switch between feeding modes involving plant and animal (especially insect) material; therefore, no impact anticipated on habitat and feeding ecology. Spawning habitat may be limited in the downstream end of the reservoir due to fluctuations in water level, but will still be possible in embayments in the upstream end, where the

fluctuation will be less pronounced. There will also be scope for creation of spawning habitat as a part of the quarry restoration. No impact expected on habitat, feeding or spawning downstream of the site.

Conclusion: possible decrease in spawning habitat upstream of power station. No downstream impact.

Mormyrus kannume and M. macrocephalus:

These species use a range of bottom substrates for feeding grounds, including soft and hard bottoms. Smaller individuals prefer areas of slower water flow, such as embayments, and therefore, will be suited to the conditions in the new reservoir, subject to 'top down' pressure from Nile perch predation. Breeding involves upstream migration into tributaries for spawning, and appears not to have been negatively affected in the Victoria Nile by the presence of the Nalubaale dam. Individuals in the reservoir will be able to migrate into the tributaries that flow into this section of the river. Spawning individuals downstream of the reservoir will be obstructed by the dam, but will be able to migrate into tributary streams in that section of the river.

Conclusion: possible negative impact on migration for spawning

Synodontis spp.:

These are small (rarely longer than 15 cm) species that can adapt to both lake and river conditions; therefore, no impact on habitat availability is predicted either upstream or downstream of the dam. Their omnivorous diet means that they will likely be able to adapt to any changes in food type that occur as a result of the hydropower facility, for example any increase in zooplankton biomass in the impoundment as a result of reduced flow velocities. Chironomid larvae are an important part of the diet, and these are unlikely to be affected upstream or downstream of the dam.

Conclusion: No change.

Barbus altianalis:

Adults prefer fast flowing river habitats, while juveniles prefer slow flowing areas with marginal vegetation. Although the new reservoir will provide habitat for juveniles, it is unlikely to suit adult Barbus due to the reduction in water velocity, except in faster flowing areas around the former Bujagali Falls and near the dam intake. Downstream habitat will not be affected. Feeding is primarily on insects and some small fish (especially haplochromines); therefore it will be sensitive to changes in sedimentation pattern in the reservoir (which will affect insect habitat). During the

rainy season, adults move to floodplains of rivers and streams to spawn, and this will still be possible within both the Nile river channel and tributary streams.

Conclusion: negative impact on adult habitat in reservoir. No significant downstream impact.

Bagrus docmak:

This species is suited to a variety of water flow regimes and depths, and has been recorded throughout the East African rift lakes, and the River Nile. Unlikely to be affected either upstream or downstream of the dam, but populations will continue to be limited by Nile perch predation.

Conclusion: no significant impact upstream or downstream.

Rastrineobola argentea:

Juveniles of this species prefer riverbank habitats with macrophyte beds, while adults prefer turbulent waters with hard substrate. Without mitigation measures such as riverbank habitat creation, habitat for juveniles will decrease in the reservoir, due to the reduction of available shoreline as the islands within the river channel are at least partly submerged. Suitable habitat for adults will be limited to areas near the former Bujagali Falls and the intake structures of the dam. Therefore populations are likely to decrease in the reservoir, although no downstream impact is predicted.

Conclusion: reduction in habitat availability within the reservoir (unless habitat created). No downstream impact.

Haplochromines, B. jacksonii, M. victoriae:

Habitat and food availability are unlikely to be adversely affected downstream of the site. There may be a slight increase in suitable habitat in the reservoir, as faster-flowing habitats are converted to the slower-flowing habitats which are preferred by these species. However, populations will continue to be controlled by Nile perch predation, and by fishing pressure in the case of *M. victoriae*.

Conclusion: no significant impact downstream. Possible minor benefit upstream through creation of habitat.

Fisheries Yield of the Reservoir

The overall fisheries yield of the reservoir can be estimated using published empirical models. The potential natural fish yield in the reservoir has been estimated at approximately 8.1 tonnes/year (using the FAO methodology outlined in Marshall, 1984), which is a slight (3 percent) increase on the current estimated yield of this

section of the river, using the same model. This increase is solely attributable to the increased surface area of the reservoir, and therefore, the additional habitat that it represents. The fact that the predicted increase is so slight reflects the small increase in reservoir area over the area of the existing river channel.

This minor increase in fisheries yield in the reach between Nalubaale and Dumbbell Island translates to approximately a 1.7 million UGX increase in catch value (c. USD 1,000) at 2006 prices, which is roughly the average income of three full-time fishers.

Overall Conclusions Regarding Fish Resources and Fisheries

Overall, the studies have concluded that the project will result in minor changes to the balance between populations of certain fish species upstream of the dam, and no noticeable change downstream of the dam. However, the reservoir has potential to produce a slightly higher fisheries yield than the existing river supports between Nalubaale and Dumbbell Island.

The project area is within the known range of occurrence of three species that are listed as endangered according to the IUCN Red List of Threatened Species. The main threats to these species are competition and predation from introduced fish species (notably Nile Perch) and fish harvesting, including the use of illegal nets. Habitat reduction is a comparatively minor threat. All three species are known to prefer lake or slow-flowing water habitats to fast-flowing (rapids) habitats, and the main habitats for two of the species are listed by IUCN as inshore areas of lakes (principally Lake Victoria) and quiet parts of rivers. The 8 km reach of the Victoria Nile that will be affected by the Bujagali HPP is not considered to be critical habitat for any of these species. As the project is not located in an area of critical habitat, and is unlikely to cause the loss of any preferred habitat, we consider that the project will not have any significant adverse impact on these species.

The Nalubaale dam is an existing barrier to fish migration. However, the FIRRI studies indicate that migratory species continue to exist in the Victoria Nile despite the presence of the Nalubaale dam. Therefore, the fish either use the accessible parts of the Victoria Nile, or its tributaries for spawning, or they are not obligatorily migratory.

Mitigation/monitoring measures: For the reasons outlined above, no specific mitigation measures are proposed to address impacts on fish resources. However, a monitoring programme will be implemented to confirm the accuracy of these predictions, and remedial action will be taken in consultation with private and institutional stakeholders, should this be necessary.

In addition to the above provisions for improving access to fish resources, BEL is committed to implementing additional measures to support local fisher folk, as outlined in the accompanying CDAP.

7.5.3.4 Access to Water

Access to Water Supplies

At present (late 2006), the West Bank land take area has been fenced and people have no formal access to the River Nile within that section. On the East Bank, such fencing is planned to take place shortly. The findings of the socio-economic surveys indicate that the majority of households in the project area collected water from the River Nile, and therefore, the river used to represent an important source of water for drinking, washing, bathing and other domestic uses.

The Stage 1 diversion works will isolate a section of the western river channel approximately 2 km in length, which will impede access to water for residents of the west bank. During the Stage 2 diversion works, an approximate 1 km length of the eastern river channel will be isolated, thus restricting access to water for residents of the east bank.

Mitigation measures which were implemented by AESNP, and further measures which are being implemented by BEL are outlined below.

Mitigation/monitoring measures: at present (July 2006), the West Bank land take has been fenced and people have no access to the River Nile. On the East Bank, such fencing is planned to take place shortly. As a mitigation for this loss of access to water, AESNP provided one drilled well, equipped with an “Orbit” hand pump to each of the eight affected communities on both banks. However, these hand pumps were not fully reliable and the maintenance system was not effective, and all eight pumps quickly broke down. BEL is undertaking to replace these hand pumps with a more reliable pump (India Mark II or similar), after each of the wells has been tested and re-developed as appropriate. Depending on communities’ reactions to this first phase, a second phase could be implemented later, whereby between six and 10 additional wells may be drilled to fully mitigate this impact and improve community water supply.

In addition, BEL will provide a formal, defined pedestrian access way through the fenced area to the river during the periods when this access would be beneficial (i.e., outside of the times when water will be temporarily diverted from the respecting river channel). For safety reasons, the point where the access way will cross the site haul road will be manned during construction hours.

Access to Fish Landing Sites

Construction activities and temporary diversion works will preclude use of the Dumbbell Island area for boat landing sites during the construction period. Filling of the reservoir will result in the loss of access to existing fish landing sites upstream of Dumbbell Island.

Mitigation/monitoring measures: To address the issue of permanent loss of existing fish landing sites upstream of the dam, BEL is committed to providing alternative boat launching sites that will be accessible regardless of diurnal water level fluctuations during operation of the power station. Consultation has been carried out with Fishing Associations/Beach Management Committees on both banks as to the design and location of these landing sites. The proposal at the time of writing is for new landing sites at Namizi on the east bank, and Buloba and Kikubamutwe on the west bank, which will include facilities for the sale of fish to local communities.

In addition to the direct mitigation of the loss of landing sites, BEL is committed to providing support to local fishing communities. These commitments are detailed in the CDAP.

7.5.4 Effects on Air Quality

7.5.4.1 Air Emissions

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

Uganda currently has no legislative air quality standards, although in 1997 NEMA produced a draft document 'Proposed Environmental Air Quality Standards for Uganda'. The proposed Uganda standard does not contain a nuisance dust criteria. For the purpose of this assessment, a dust deposition rate of 400 mg/m²/day will be used as the nuisance threshold. This value is twice as high as that generally used in residential areas of the United Kingdom, on the basis that the project area is largely agricultural and has murram roads, and therefore has higher ambient dust levels than the UK.

The WB/IFC has general guidelines for minimum ambient air conditions to be maintained, as measured immediately outside the project property boundary. The limits are shown in Table 7.6. These guidelines will be adhered to by the Bujagali project.

Table 7.6: WB/IFC General Guidelines for Minimum Ambient Air Conditions

Pollutant	Concentration, micrograms per cubic metre (g/m³)
Particulate matter	
• Annual arithmetic mean	50
• Maximum 24 hour average	70
Sulfur dioxide	
• Annual arithmetic mean	50
• Maximum 24 hour average	125

Traffic-Generated Dust

During construction, generation of dust along off-site access routes during importation of construction materials and staff travel is of concern, particularly during the dry season periods of June to August and December to February. Murram roads, such as those near the project site, can yield large amounts of airborne particulates during dry weather, and there is potential for nuisance levels to be reached at the properties adjacent to the east bank access road (DoE, 1995).

Most of the heavy goods vehicle (HGV) movements associated with construction are within the project area. This includes the 450 movements per day during dam construction to transport rock from the quarry area to the crushing plant.

Dust from Other Sources

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

Mechanical handling of construction materials such as unloading, loading and the formation of stockpiles or overburden storage mounds provides the energy required to suspend in the atmosphere a proportion of the material having an appropriate particle size range. Aggregate crushing and grading has a high potential for dust emissions unless the plant is suitably enclosed. Blasting operations release dust emissions, but these are not likely to be significant in the context of emissions from the materials handling processes.

The effects of these emissions are likely to be confined to relatively small areas to the north or north-west of the sources due to the prevailing wind direction and low wind speeds. The major sources (quarry, crushing plant, concrete batching plant and access road) are located on the south-west side of the Nile, low down in the river valley. In order for dust emissions at these points to reach nuisance levels at residences, dust will need to be transported upwards and out of the river valley, for a distance of at least 500 m. Given the prevalent low wind conditions, mobilisation of particulates over such a long distance is unlikely to occur.

7.5.4.2 Impacts of Dust on Agriculture

A review of published information (DoE, 1995) found few detailed studies of the effects of dust deposition on agriculture. Studies of the effects of particle deposition on vegetation have almost all addressed limestone dust from quarries, cement kilns and smelting plants. These studies however found reduced plant growth at extremely high (up to 10,900 mg/m/day) rates of dust deposition, although this was largely due to the alkaline nature of the dust, which will not be a factor at Bujagali. Although vegetation in the general vicinity of the crushing plant and the immediate vicinity of the access roads is expected to show signs of dust deposition, this is not expected to adversely affect the health or viability of crops.

7.5.4.3 Greenhouse Gases

Recent research indicates that, in addition to emissions from construction machinery, reservoirs can emit greenhouse gases (GHGs) as a result of decomposition of organic material caught in the impoundment. The World Commission on Dams (2000) report concludes that precise assessments of emissions are important in selecting climate friendly options, and particularly if hydropower projects seek to benefit from any form of carbon credit.

Although Uganda is a signatory to the 1992 Convention on Climatic Change, it does not currently have a system of carbon permitting or trading. Therefore a detailed budget of carbon sources and sinks in relation to the project is not needed; however, an assessment has been made which compares the project to a thermal generation option in terms of carbon equivalents (Faller, 1999). The results of this study are included in Appendix G.3 of this SEA, and are summarised in Table 7.7.

Table 7.7: Comparison of GHG Emissions from the Bujagali Hydropower Facility and an Equivalent Thermal Generation Plant

Plant	Source of Emission	CO ₂ Emission (tonnes)	Frequency
Bujagali Hydropower	Construction phase	162,900	Once
	Decomposition of biomass in reservoir	76,500	Once
	Total	239,400	Once
Typical thermal plant*	Construction	Not quantified	Once
	Operation	1,180,000	Per year
	Total	1,180,000	Per year

*assumes equal proportions of coal, oil and gas are burned Source: Failer (1999)

By burning fossil fuels to generate the same amount of electricity as the Bujagali Hydropower Facility, some 1.18 million tonnes of CO₂ per year would be released into the atmosphere (Table 7.7). Over a period of 50 years (a worst-case estimate of the commercial life of the Bujagali project), this would result in the emission of a total of 59.2 million tonnes of CO₂.

Consequently the generation of hydro-electric energy at Bujagali will result in CO₂ emissions approximately 250 times less than if the same energy were to be generated by burning fossil fuels. Bujagali also avoids the potential local health risks of CO₂, NO_x and SO_x emissions from the thermal plants

Mitigation/Monitoring measures: Dust will be controlled by following standard good site practices, including:

- Stockpiles of friable material will be grassed in order to prevent windthrow (and sediment run-off to the river during wet weather);
- During dry conditions, access roads will be wetted or treated with a biodegradable (e.g. lignin-based) road sealing product to prevent dust generation;
- Batching plant, conveyors, etc. to be suitably contained to minimise offsite dust;
- Trucks containing friable material will be covered if using public highways; and,
- A maintenance programme for plant and vehicles will be implemented, to ensure emissions of particulates, SO₂ and NO₂ are minimised.

7.5.5 Effects on Noise Levels

The World Health Organisation (1980) and World Bank/IFC (WBG, 1998) recommend generalised environmental noise standards aimed at minimising the potential long-term adverse effects of noise. They conclude that general daytime outdoor noise levels of less than 55 dBLAeq are desirable in order to prevent any significant community annoyance. At night, a lower level is desirable to meet sleep criteria; depending upon local housing conditions and other factors this would be in

the order of 45 dBLAeq, corresponding to an internal level of about 35 dBLAeq at the ear of the sleeper. These desirable long-term levels are reflected in the NEMA (1997c) draft standard for the Control of Noise Pollution in relation to general environmental noise and in the WBG's General Environmental Guidelines (World Bank Pollution Prevention and Abatement Handbook).

While the WBG guidelines do not provide guidelines for noise during construction, the Ugandan noise standards do include maximum permitted general construction noise levels for residential buildings. The recommended façade noise levels are 75 dBLAeq during the day (0600-2200) and 65 dBLAeq at night (2200-0600 h).

Information contained in Chapters 8 and 9 of Knight Piésold (1998b) was used as the basis for the construction noise predictions. Plant and machinery schedules were ascribed to each activity and typical sound power levels extracted from British Standard 5228 or from manufacturers' data. Typical equipment includes concrete batchers, concrete pumps, poker vibrators, rock crusher, excavators, dozers, tracked loaders, dump trucks and cranes. Based on this information, typical construction noise levels, and their variations through the construction period, have been predicted at five representative locations in the vicinity of the embankment works. The five sample locations are shown on Figure 3.4 and described below:

- A. Scattered properties in Namizi, on the east (right) bank of the river, about 830 m from the powerhouse.
- B. Scattered properties in Kikubamutwe, on the west (left) bank of the river, about 550 m from the powerhouse.
- C. Scattered properties in Malindi, on the west (left) bank of the river, about 360 m from the powerhouse.
- D. Scattered properties in Malindi, in the vicinity of the state highway and about 730 m from the powerhouse.
- E. Scattered properties in Kyabirwa, on the east (right) bank of the river, about 1,230 m from the powerhouse.

The distances between each sample point and the centre of each activity area were then used to predict the monthly activity levels. The overlapping activity levels were then combined to give the total construction noise levels for each month. The results of these calculations are shown in Table 7.8.

General construction noise levels in the extreme western outskirts of Namizi (Location A) will be below 60 dBLAeq. Properties clustered around the north western end of the Kyabirwa Falls Road (Location E) will experience noise levels typically in the mid 50s dBLAeq, as will those in the area of Malindi, more remote from the hydropower facility site (Location D). The closest properties to the construction works, typified by locations B and C in the eastern areas of Kikubamutwe and Malindi, respectively, will have noise levels generally in the mid 50s to low 60s dBLAeq. Predicted noise levels are therefore within the derived (long-term)

construction noise standards at all locations. The table also shows that, in noise terms, the construction works are effectively of about three years duration, from months four to 41.

In addition to the noise from these more general construction activities, there will be intermittent, generally higher, noise levels due to the operation of rock drills used to make the charge holes for rock blasting and subsequent removal of the rock. Quarrying and rock excavation may require up to about two or three blasts per day, primarily in the main quarry area on the west bank and at the southern end of Dumbbell Island.

Some drilling and blasting is also likely to be needed during the excavations for the powerhouse and spillway foundations and during the left abutment works. When the rock drills are operating, noise levels may increase to the low 60s dBLAeq at locations A and B, the mid 60s dBLAeq at locations C and E and the upper 50s dBLAeq in areas more remote from the works, such as Location D.

As the drill and blasting method of rock removal is being used only as a construction tool, the size and number of charges in any one blast will be fairly limited. The noise from blasting is therefore likely to be of a comparatively low level and heard as a series of low frequency "thuds" or "rumbles" in the background. It is unlikely to achieve the maximum intermittent noise level outlined in the national noise standards.

Table 7.8: Predicted Monthly LAeq Construction Noise Levels (General)

Month	Location				
	A (Namizi)	B (Kikubamutwe)	C (Malindi)	D (Malindi- West)	E (Kyabirwa)
4	50	46	48	45	52
5	51	51	50	47	52
6	51	52	51	48	54
7	55	58	62	54	54
8	55	58	62	54	54
9	55	58	62	54	54
10	55	58	62	54	54
11	56	59	64	56	54
12	54	60	60	53	54
13	54	60	60	53	54
14	54	60	60	53	54
15	54	60	60	53	54
16	54	60	60	53	54
17	54	60	60	53	54
18	56	61	61	55	55
19	60	61	62	56	56
20	59	61	61	55	55
21	59	60	60	55	55
22	59	60	60	55	55
23	59	60	60	55	55
24	59	60	60	55	55
25	59	60	60	55	55
26	59	60	60	55	55
27	59	60	60	55	55
28	57	60	59	54	54
29	56	56	58	53	54
30	55	56	58	52	54
31	53	55	58	51	53
32	54	54	56	50	53
33	54	54	56	50	53
34	58	59	58	52	54
35	58	59	58	52	54
36	57	58	57	51	48
37	57	58	57	51	48
38	57	58	57	51	48
39	57	58	57	51	48
40	57	58	57	51	48
41	55	52	56	48	49

The noise impact of more localised construction activities, such as the building or upgrading of roads to connect the project site to the existing left and right bank roads, will depend upon their detailed alignments and the locations of individual properties.

These short-term construction activities are unlikely to cause significant noise intrusion at distances of more than 50-100 m from the point of working.

These connecting roads will be used to transport persons and materials to and from the construction sites during both the construction and operational periods of the project. The majority of traffic to the site will be via the Jinja-Kayunga highway, which runs along the western bank of the Nile. However, there will be a limited amount of traffic accessing the site from the Jinja-Kamuli road on the east bank.

Traffic noise level changes adjacent to these roads have been calculated from the existing traffic flows and the projected flows during the busiest Stage 1 and Stage 2 periods. Traffic noise levels adjacent to the west bank state highway are predicted to increase by no more than 2 dBLAeq, while those adjacent to the east bank road will increase by about 3 dBLAeq. These changes are not considered acoustically significant, as the resulting daily traffic flows will not increase a considerable amount above baseline.

Mitigation/monitoring measures: The EPC Contractor will be contractually bound not to exceed the construction noise standards outlined above, and is committed to compliance with these standards. Although the noise impact modelling has concluded that the general noise standard will not be exceeded, the EPC Contractor will monitor incident noise levels at locations outside the site boundary, as required by the Ugandan noise standards. If monitoring at these points indicates that the noise standard has been exceeded, the EPC Contractor will take additional measures to reduce noise emissions to acceptable levels.

A change management process will be used to modify operations, as necessary, to address noise issues. These measures will include identification of the equipment of process(es) causing exceedance of the standard, and proposed abatement options, including:

- Relocation of equipment;
- Provision of screens, bunds, casings or temporary building to deflect or absorb noise;
- Repair of faulty machinery or vehicles; and,
- Changes to operating times to allow compliance with night-time standards.

In addition, a complaints procedure will be put in place to identify significant nuisance noise effects. The change management process set out in Chapter 8 will be used to modify operations, as necessary, to address noise issues.

7.5.6 Effects on Access Roads and Traffic

The main traffic issues are road capacity, safety of road users and structural strength of roads.

Baseline traffic counts, measured in 2006 (Figure 7.4), were used as the base for impact assessments. Assessments have been carried out for conditions when staff levels and consequently construction activity are at average levels, using the estimates of vehicle type, origin and number previously presented in Chapter 5. As all vehicles will access the main construction site via the west bank road during Stage 1 diversion, and only a few vehicles will access the site via the east bank road during the Stage 2 diversion, the Stage 1 situation has been used as the basis for impact prediction.

Predictions to changes in traffic patterns have been made for five locations, as follows:

- The west bank road between Njeru and the project site (Kayunga Road);
- The road between Njeru gyratory and ‘Jinja Roundabout’ (where the east bank road leaves Jinja and heads north), including the road over the crest of the Nalubaale Dam and the bridge over the Kiira headrace channel (Bridge);
- The road between the Jinja Roundabout and Jinja town centre (Jinja Town Road);
- The road between Jinja Roundabout and the ‘Terminal Roundabout’ (on the eastern side of Jinja, heading towards Tororo) – “Iganga Road”; and,
- The east bank road, between Jinja and Ivunamba (Ivunamba Road).

This assessment has not considered traffic impact within Jinja town centre in detail.

Capacity

Detailed projections of construction traffic using these roads each day, and traffic levels during construction, are contained in Figures 7.5 and 7.6 respectively. Construction traffic numbers were sourced from AESNP (2001). Figure 7.6 includes predictions of HGV, car, public transport, pedal cycle and motorcycle traffic. On an average construction day there will be a 29 percent increase in traffic on the west bank road, but less than a 1 percent increase in traffic on the east bank road.

A summary of the traffic forecast is included in Table 7.9.

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Figure 7.4 Baseline Traffic Counts (2006) 12 Hour Movements: Weekdays

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Figure 7.5 Predicted Project Traffic During Construction 12 Hour Movements: Weekdays

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Figure 7.6 Total Predicted Traffic During Construction 12 Hour Movements: Weekdays

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Table 7.9: Increases in Traffic on Public Highways During Construction Phase of Bujagali Hydropower Facility

Road	Increase in HGV traffic over 2006 Baseline	Increase in total traffic over 2006 Baseline
1. Kayunga Road	28%	29%
2. Bridge	2%	5%
3. Jinja Town Centre Road	No change	3%
4. Iganga Road	4%	5%
5. Ivunamba Road	No change	<1%

The west bank road is a good quality sealed road, and has relatively low traffic levels for a road of such quality. It is considered to have sufficient capacity to carry site traffic without upgrading, provided the site access road is connected to the highway in a safe manner.

Njeru Gyratory, Jinja Roundabout and Jinja Terminal Roundabout have relatively high carrying capacity, and these increases in traffic flow are unlikely to be significant.

Road Safety

The main effects of increased traffic volumes concern the additional safety risks that all road users would be exposed to whilst competing for road space.

Pedestrians and pedal cyclists, regarded as vulnerable road users, currently constitute a substantial proportion of traffic on the east and west bank roads (currently; there are two pedal cyclists for every three motorised vehicles on the west bank road). Traffic generated as a result of construction activity would increase the traffic on the west bank roads, nearly doubling the number of "other" vehicles when compared to pedal cycles. This shift in traffic composition increases the risk of accidents involving cyclists and pedestrians.

Deteriorating footway surfaces, particularly during wet weather, sometimes bring about pedestrian movements on the carriageway itself. Clearly, if this practice were to continue, increased traffic levels, particularly on narrow sections (5 m wide sections), means that pedestrians including significant numbers of children, would be exposed to increased traffic accident risk. Similarly, pedestrians around settlements straddling the east and particularly the west bank roads who frequently cross the roads would be exposed to increased traffic accident risk. Concern for pedestrian safety was raised during consultation activities.

Increased traffic movements would also exacerbate safety problems associated with the current practice where passengers board and alight from public transport vehicles ('matatus') within the carriageway.

All of the effects highlighted above will be magnified during night-time operations.

Mitigation/monitoring measures: A traffic management plan will be developed, in consultation with community representatives. It is expected to include:

- All drivers to undergo driving and vision tests prior to recruitment;
- All drivers to receive training on the operation of their specific vehicle, and in awareness of pedestrians and cyclists;
- Repair of road shoulders and appropriate markings to separate pedestrian have vehicular to traffic on public roads;
- Appropriate speed limits for project vehicles;
- All vehicles to be lit front and back at night; and,
- Vehicle safety classes will be held in the affected villages, in particular for pedestrians and bicyclists.

A public complaints procedure in line with the project grievance mechanism as discussed in section 6.5.1 will be developed as part of the Traffic Management Plan to be implemented by the EPC Contractor, which will require documentation and review of complaints, and a transparent decision-making process for modification of traffic management provisions. Further management wetlands, which will require agreement with the two District Administrations and potentially the Road Agency Foundation Unit (RAFU) will be discussed and agreed upon mobilisation of the EPC Contract.

Structural Strength of Roads

The increased heavy goods vehicle traffic on the west bank road will contribute to the rate of structural deterioration. The transportation of abnormal loads will further contribute to this.

Two processes are proposed for assuring that there is no net adverse effect on the structural integrity of roads from movement of construction-related traffic.

- The EPC Contractor will catalogue the state of all public highways to be used, prior to commencement of construction, including photographs. The EPC Contractor will be responsible for making good any damage attributable to construction traffic, in a timely manner so as not to endanger members of the general public using the road; and,
- Prior to transporting of abnormal loads (up to 300 tonnes), the EPC Contractor will, in collaboration with the relevant local or national authorities in Uganda or Kenya, make inspections of all road structures such as bridges and culverts. The

EPC Contractor will be responsible for carrying out any strengthening works necessary for safe transport of the load without endangering the integrity of the structure.

7.5.7 Effects on Managed, Natural, and Protected Areas

7.5.7.1 Jinja Wildlife Sanctuary

Issue

The location and characteristics of the Jinja Wildlife Sanctuary are described in Section 3.6.6.1. When the reservoir is at full supply level, all land up to 1111.5 m AMSL will be flooded. Within the wildlife sanctuary, approximately 15.8 ha of the islands out of a total of 26.8 ha (59 percent) will be inundated.

BEL will obtain a lease for the land take area shown in Figure 5.1, which includes all inundated land (up to 1,111.5 m AMSL) as well as 5 m above the maximum perceivable high water level, i.e., 1,116.5 m AMSL. Once construction is completed, title to the temporary land take (total of 45 ha, none of which falls within the Jinja Wildlife Sanctuary) will pass to ULC. The permanent land take (of which 11 ha falls within the wildlife sanctuary, consisting wholly of islands) will be leased to BEL for the 30-year term of its contract. Inundated land (of which 28.6 ha falls within the sanctuary) will be deemed to be held in trust by ULC.

Correspondance with the Uganda Wildlife Authority indicates that the mitigation measures presented below will be sufficient to offset impacts to the Sanctuary (Appendix C.7).

Mitigation/Monitoring measures: Mitigation measures that will be undertaken within the Jinja Wildlife Sanctuary include:

- Enhancement planting will be undertaken on the residual islands and the 100 m riparian strip along the reservoir margins. Preference will be given to planting a variety of indigenous tree species, including: *Maesopsis eminii*, *Markhamia lutea*, *Melicia excelsa*, *Antiaris toxicaria*, *Ficus spp.*, *Funtumia elastica*, *Terminalia spp.*, *Celtis spp.* and *Albizia spp.*
- Additional measures to enhance natural habitats at the Kalagala-Itanda offset site will also replace habitats lost from the upper Victoria Nile due to both the presence of the Bujagali dam, and to past agricultural activities.

7.5.7.2 Kalagala Offset

The Kalagala Falls and Nile Bank Central Forest Reserves (CFRs) have been identified as appropriate areas for maintaining an ecologically similar protected area

to offset the impacts on Bujagali Falls and the Jinja Wildlife Sanctuary (e.g. Chemusto, 2000; Appendix D.4 to the AESNP Transmission Line EIS).

The Chemusto (2000) study provided:

- A quick inventory of the forest reserve;
- General description of the size and condition of the forest;
- An overview of current land use practices in the area;
- Survey of need for additional management activities; and,
- The legal history of the Kalagala Falls CFR.

The study concluded that there is the potential for the Project Sponsor to assist in the further development of the Kalagala Falls CFR.

A proposal was being considered by the Forest Department (now the NFA) at the time of the AESNP (2001) EIA, entitled, Analysis of Future Options for Forest Department Eco-Tourism Development, (Roberts, 2000). Consultation with the NFA during 2006 indicates that this is still the main guiding document for eco-tourism development. Under this document, NFA would grant concessions to operators who would develop the reserve into an ecotourism site, including possible cycling paths, camp sites, bandas and enhancement planting. It considers a plan of collaborative forest management with the local communities within the surrounding villages of Kalagala, Kasambya and Naluvule. In recognition of the project's potential impacts on the Busoga Kingdom and the Jinja District, the proposals have been expanded to take in the Nile Bank CFR, on the eastern bank of the Nile opposite the Kalagala Falls CFR.

Mitigation/Monitoring measures: The potential role for BEL, which has agreed in principle to further involvement, will be discussed and reviewed as the NFA moves forward with the plan to appoint a concessionaire to develop the site. The discussions could also include provision of selected improvements in access to the CFR or for future white-water rafting activities, as deemed appropriate and consistent with the overall plan. These suggestions are discussed further in the attached Tourism Impact Assessment (Fletcher, 2006).

7.5.8 Tourism and Recreational Activities and Experiences

Development of the Bujagali hydropower complex has the potential to affect a number of tourism, eco-tourism and recreational activities and their associated experiences. These include:

- White-water rafting;
- Eco-tourism and general tourism;
- Aesthetics; and,
- Ecologically Protected Areas.

They are addressed in turn, below.

7.5.8.1 White-water Rafting

Issue: Development of the Bujagali hydropower facility will result in the inundation of Bujagali Falls and preclude white-water rafting (WWR) on Bujagali Falls and on the rapids upstream of Dumbbell Island.

In 2001, two companies operated WWR excursions at Bujagali: Adrift and Nile River Explorers (NRE). Both initiated their Victoria Nile operations in 1996/1997 at a time when it was general knowledge that the Bujagali area was a potential site for hydropower development (Duncan Garrick International, 1998). White-water rafting operations at Bujagali were regarded, in business terms, as relatively non-capital intensive, ‘high yield’ per unit of sales, and relatively ‘high profit’ in terms of generated cash earnings. For business profiles of these companies, refer to Section 3.

The Duncan Garrick study (1998) estimated that the total number of white-water rafters in Uganda was in the range of 7,000-8,000 per annum. The total gross direct value of white-water rafting was estimated to be in the range of USD 600,000 to 650,000 at 1997/98 prices. A total of some 80+ direct local jobs were estimated to have been created by the two companies, as well. The Duncan Garrick study cautioned that the rapid growth in white-water rafting numbers experienced since the introduction of the sport into Uganda would not necessarily continue into the future. Under the circumstances current at the time of the study, the white-water rafting companies felt it was unlikely that white water rafting ventures elsewhere than Bujagali, in Uganda, would be commercially viable.

Since 2001, two further WWR companies have become established: Equator Rafting and Nalubaale Rafting. Tourism-oriented activities have been expanded to include river-based recreation such as ‘family floats’ and kayaking, and land-based activities such as quad-biking, mountain biking and bungee-jumping. Research carried out in 2006 as part of this SEA (Appendix C.4) indicates that total rafter numbers are approximately 10,000 per year, with Adrift and NRE each carrying 4,000 to 5,000 per year, and 800 to 1,000 per year being carried by Equator and Nalubaale combined. This, the cautionary note from the Duncan Garrick (1998) study, that rapid growth in rafting numbers may not necessarily continue into the future, appears to be correct, at least for the eight years since that study was carried out.

The principal negative economic impact of the Bujagali hydropower facility on the tourism sector will be on these four WWR companies. While in 1998, the two WWR companies predicted profound negative impacts arising from the Bujagali Dam, both have diversified activities as well as putting together plans to re-locate their operations downstream of Dumbbell Island. Consequently neither now believes that a serious economic impact will arise from the Bujagali project. The two new WWR

companies have a similar view, although the Speke campsite, which is a sister operation to Equator Rafting, would lose its site at Bujagali Falls.

As shown on Figure 3.9, Bujagali Falls and the rapids upstream from Dumbbell Island form part of the current one-day and two-day WWR trips. Due to their proximity to one another, the rapids in this stretch of the river provide a near-continuous, thrilling WWR experience. WWR in this location will not be possible after the construction of the Bujagali hydropower facility, as this area will be in the project's proposed reservoir. However, three of the four class five rapids on the current one-day WWR trip will not be affected by the Bujagali project as they are downstream of the proposed dam. Adrift and NRE could continue to offer half-, one- or two-day rafting trips below Dumbbell Island. Section 3.7.5 provides more detail on the classification of the rapids of the upper reaches of the Victoria Nile. There are several Class 4 and 5 rapids which would be available downstream of Itanda/The Bad Place, which, would allow the start of the one-day rafting trip to be moved 4 km downstream from where it is presently situated, and for further rapids to be added to the end of the one-day trip. However, the two-day rafting trips now end at Malalu, as there is only one relatively small set of rapids, several kilometres downstream of here, which are considered too far downstream to make it worthwhile travelling this far. Thus, while the one-day trip could continue to be just as thrilling as the present one-day trip, it is the two-day trips which are most likely to be affected. However, these represent only a small percentage of total trips sold by the WWR operators.

In addition to the potential derogation of the WWR product, more tangible impacts will arise for each of the four WWR operators, in that launching sites upstream of Dumbbell Island will no longer be useful, and launching sites (and probably exit sites) will need to be re-located downstream.

Mitigation measures for the WWR impacts of the Bujagali project are discussed in Section 7.5.8.5 below.

7.5.8.2 Eco- and General Tourism

According to the World Travel and Tourism Council (1998), the fastest growing sector of tourism in the world is nature-based tourism. Tourists from the more developed parts of the world are increasingly seeking undisturbed, natural tourism destinations and experiences.

The Government of Uganda tourism policy is one of product and market diversification, in which eco-tourism is prioritised (including white-water rafting). The Uganda Tourist Board has also provided active assistance and support for the development and operation of white water rafting in Uganda. Interviews with the then-Minister of Tourism, Trade and Industry and the Regional District Commissioner indicated that the Province of Jinja and Government of Uganda fully

appreciate the value and positive impacts of white water rafting, but also recognise the essential need for increased, reliable power generation capability in the country.

The “source of the Nile” area (including Bujagali Falls), Murchison Falls National Park and the western mountains in Uganda are considered the major centres for eco-tourism in Uganda (Aulo, 1999). Aulo, a Senior Tourist Officer in Uganda, expressed some concern over the potential loss of tourism investment and tourism diversification in Uganda resulting from hydropower development on the Nile. Once again, the need for balancing -- and optimising -- the development options for the River Nile in both the regional and national context is evident.

A more detailed description of the existing tourism conditions in the vicinity of the Bujagali project is provided in Section 3.7.5 of this report.

Issue: In addition to the white-water rafting impacts summarised in the previous section, the construction of the Bujagali hydropower facility and its associated reservoir will affect present-day tourist sites and activities, including:

- Bujagali Falls Picnic Site: located on the east bank of the Nile overlooking Bujagali Falls (refer to Figure 3.5). The primary reason people visit the site is for views of the river and rapids. A portion of the site will be submerged and the rapids will no longer be visible. With the rise in water level by the formation of the new reservoir, the site could be used as an access point for recreational activities on the reservoir.
- Jinja Nile Resort: This high quality hotel is located approximately 2 km upstream of Bujagali Falls, on the east bank, with views of Nalubaale and Kiira dams to the south, and of open countryside to the north. The site is understood to have been selected with full knowledge of the proposed Bujagali hydropower facility. The anticipated rise in water level by the formation of the new reservoir will be only minor, and is not likely to have any significant effect on the visual or recreational amenity values of this resort.
- Commissions Paid to Overland Tour Operators and Drivers: currently, these operators benefit significantly from commissions paid to them by WWR companies. Such operators are generally European, North America and Australasia-based, and operate adventure and overland tours in which WWR is one component of the itinerary. Frequently, these are ‘East Africa tours’ including Kenya, Tanzania, Malawi and other countries. WWR is normally sold as an optional excursion/activity and is thus commissionable at 10 percent commission. It is expected that these companies will continue to market WWR and ancillary activities as part of their itineraries after the Bujagali HPP project is complete, so impacts on these operations are predicted to be negligible.
- Birdwatching in the Area: Some breeding bird habitats in the project area would be inundated and may result in the migration of certain individuals. However, the reservoir is not expected to have an overall effect on bird populations, or on the presence of species of bird watching or conservation importance. In fact, there may be a benefit to bird populations in terms of increased fish supply, and increased roosting/breeding habitat arising from re-vegetation of the remaining islands and the reservoir margins.

- **Other Identified Areas of Potential Impact:** Jinja hotels, hostels, campsites and local businesses were briefly visited and owners interviewed to determine the potential impact of the Bujagali hydropower facility. It was found that WWR clients generally prefer to stay in hostel accommodation, revenues for which were previously forecast to be negatively impacted by the Bujagali hydropower facility (Duncan Garrick International Ltd., 1998). However, as the WWR operations have diversified so much since 1998, and the WWR operators have plans in place to continue rafting ‘post-Bujagali’, the impacts are likely to be much smaller than previously anticipated. Hotels, local businesses and land based tourism operations such as horse riding and quad bike riding, on the other hand, are not likely to be significantly impacted, and will likely experience an increase in trade during the construction phase, with workers and professionals requiring accommodation and recreational activities. The proposed tourism mitigation measures, presented in Section 7.5.8.5, may enhance the attractiveness of Bujagali and Jinja for a variety of recreational uses, leading to increases in visitor numbers, length of stay and overall expenditures by visitors.

Table 7.10 summarises the impacts of the Bujagali hydropower facility in the tourism sector, including the effects on the white-water rafting companies presented in the previous section.

Table 7.10: Summary Tourism Impacts of the Bujagali Hydropower Project

Stakeholder/Affected Parties	Nature of the Impact	Scale of the Impact	Financial Impact
White Water Rafting Companies	Loss of the Staircase Feature and a Grade 5 Rapid	Partial Diminution of the Existing Rafting Trip	Neutral
White Water Rafting Companies	Loss of Existing Individual Rafting Company Entry Points to the River	Need to Facilitate Replacement of Individual Entry Points to the River below the Dam	Negative but Minor
White Water Rafting Companies	Replacement / Relocation of Equipment to new Rafting Company Operational Bases	Only Equator Rafting Will Have to Relocate	Negative but Minor
White Water Rafting Company Employees	Loss of Some Part-Time Jobs Due to Re-Positioning of the Rafting Route	Limited Because Only One Company to Re-Locate and Jobs May be Created along the New Route	Neutral
East Bank Communities	Loss of Bujagali Falls Recreation/Picnic Site	Loss of a Significant Community Riverside Recreation Facility	Negative but Serious

Stakeholder/Affected Parties	Nature of the Impact	Scale of the Impact	Financial Impact
East Bank Communities	Loss of Bujagali Falls Recreation/Picnic Site	Loss of Economic Benefit to Shops/Stalls outside Entrance to Bujagali Falls Site	Negative but Minor
East Bank Communities	Increase in Numbers of Visitors Travelling Along the East Bank	Benefits from Attracting Visitors to Stop and Spend Money	Positive but Moderate
East Bank Communities	Development of new rafting launch and exit Riverside locations	Possible creation of casual employment to assist rafting companies	Positive but minor
West Bank Communities	Development of new rafting launch and exit Riverside locations	Possible creation of casual employment to assist rafting companies	Positive but minor
West Bank Communities	Increase in Numbers of Visitors Travelling Along the West Bank	Benefits from Attracting Visitors to Stop and Spend Money	Positive but Moderate
Hairy Lemon Island Backpacker Campsite	Increase in Rafters Passing Downstream	Benefits from Attracting Rafting Company Rafts	Positive but Minor
Jinja Tourism Sector	Cessation of Electricity Load Shedding	Reduction in Energy Costs Due to Lower Diesel Generator Use	Positive but Minor

7.5.8.3 Aesthetics

Issue: At project commissioning, Bujagali Falls will be inundated and a new reservoir will be created upstream of the hydropower infrastructure at Dumbbell Island (see Figure 1.2). The aesthetic appeal of the Victoria Nile at the dam location will be altered by the presence of the facility infrastructure. Aesthetics of the Victoria Nile upstream of the dam will be changed due to the new reservoir; islands that currently exist in this stretch of the river will be partially or wholly submerged. Flow in the reservoir will be noticeably reduced from that in the existing river. Flows in the River Nile downstream of the hydropower facility will be little-changed from the present condition.

The development of the new reservoir will result in a new habitat that is expected to attract and support water birds and other fauna that may be attractive to tourists (Aulo, 1999; MUIENR, 2006). Nearby, accessible sites along the river, such as in the villages of Namizi and Bujagali, will offer visually attractive vistas and have significant potential to be developed as tourist sites.

7.5.8.4 Ecologically Protected Areas

Issue: As discussed in detail in the SEA for the Bujagali Interconnection Project and summarised in Section 7.5.7.2 (above), BEL has studied the possibility of facilitating eco-tourism developments in the Kalagala Falls Central Forest Reserve (CFR) as a

potential means of offsetting the environmental and social impacts of the project's construction and operation.

7.5.8.5 Management of Impacts on Tourism and Recreational Activities and Experiences

In recognition of the impacts of the Bujagali project on white-water rafting, eco-tourism, aesthetics, and other tourism and recreational activities, including the loss of natural habitats, BEL has committed to supporting the following initiatives:

- *Cultural centre*: a cultural centre will be constructed either within the Bujagali picnic site or on the islands at the site that will not be inundated. The cultural kiosk will provide information regarding the cultural history, beliefs, religions, practices, properties and heritage trails that exist both in the local area and throughout Uganda. Books, crafts and postcards/ pictures will also be available. Information on the peoples of Uganda, traditional dances, dress, living styles and traditional foods will all be available. Guides will be available to conduct tours of the area. As an extension to the above, an African-style village with craft shops and restaurant is being considered with bridges linking the islands.
- *Visitors' Centre*: A Bujagali HPP visitors' centre will also be constructed at the HPP Site. The centre will run tours of the facility, provide information on the history and method of construction along with demonstrations of how electricity is produced at the site.
- *Launching Facilities for White Water Rafting*: New raft launching facilities for WWR will be provided downstream of the dam. The location of these launch sites will be agreed upon by the WWR operators and BEL upon financial close. The launch sites will be constructed prior to Phase II of construction.
- *Other initiatives to support White Water Rafting Operators*: BEL is working with the four existing rafting operators in adapting their operations to the changed environment. This is an ongoing process, and BEL is committed to supporting reasonable requests, and particularly those which:
 - Provide benefits to the local community;
 - Allow continuity of employment for existing WWR employees;
 - Support the protection of the Kalagala/Itanda offset;
 - Link with other environmental mitigation, enhancement or community development initiatives that BEL is implementing; and/or,
 - Provide benefits to the wider tourism sector.

These proposals are commercially sensitive, and on the request of the WWR operators, BEL has undertaken not to disclose their details in this SEA report. Further details are available on request, but will only be released under a confidentiality agreement.

The cultural centre is a four-year long programme, including producing and gathering all relevant information, and culminating in the centre's construction after the

reservoir is inundated. The visitors centre will be constructed after commercial operation of the hydropower facility starts.

BEL has agreed in principle to continuing discussions with the NFA and the World Bank Group, as appropriate, on its role in the future management of the Kalagala Falls and Nile Bank Central Forest Reserves and/or any other ecologically similar protected area proposals that may proceed with respect to the natural habitats converted as a result of the development of the Bujagali project.

7.5.9 Effects on Cultural Property

The construction of the Bujagali dam, and especially its resultant reservoir, affects people's individual cultural properties as well as culturally significant aspects at the community level. Affected cultural properties were pro-actively identified by AESNP between 1999 and 2001. This process was reflected in the 2001 Cultural Property Management Plan, which was a part of the 2001 RCDAP. Mitigations were devised after a long consultation process with many different stakeholders, including the owners of the cultural sites, the communities where these are located, mediums specialising in interceding between humans and spirits, and Ugandan and international cultural property specialists. For the most part, this mitigation programme was implemented by AESNP between 2000 and 2002. All activities committed upon in the 2001 RCDAP were implemented by AESNP prior to its withdrawal from Uganda, save the interdenominational service intended to commemorate those buried in the islands and in the affected area of both banks whose graves could not be located or otherwise identified.

Within the Cultural Property Management Plan, the culture and traditional religion(s) of the Bujagali area, and the effect the project might have on them, have been addressed at three levels:

- The individual or household;
- The local community; and,
- The wider (national and international) community.

At the individual household level, the cultural property issue relates primarily to family graves and *amasabo* (loosely translated as “shrines”). Generally, Project-Affected People have no objection to moving either graves or *amasabo*, as this has been done in the past as people moved into, and out of, the area. It is necessary to conduct certain ceremonies, at both the current sites and the sites to which the cultural properties are being transferred. Households were offered compensation as per Ugandan law using applicable rates for the cost of graves. In addition, as an uplift, AESNP paid compensation for the performance of transfer ceremonies.

Extensive studies have been undertaken at the local community level to obtain a detailed understanding of the workings of the spirit world and to identify features of

spiritual importance within the area. The methodology that has been used in the various surveys and studies and the extensive consultations that have been undertaken have ensured that the proposals for mitigation have emanated directly from the affected persons themselves and were agreed upon by the affected spiritual entities. It was generally agreed that it is possible to move the dwelling places of spirits, as long as the necessary transfer and resettlement rituals are carried out. Such ceremonies have been carried out when requested by either the owner of the *amasabo* or the local medium.

Further to AESNP's implementation of mitigation measures planned in the 2001 RCDAP, BEL remains committed to ensuring that the Bujagali hydropower facility's impacts to cultural property are dealt with satisfactorily. BEL will complete the implementation of those mitigation measures that AESNP could not implement prior to leaving Uganda (interdenominational remembrance service), and prepare a Code of Practices that will guide all persons involved in the construction and implementation of the project, on customs and traditions to be respected.

Prior to construction, BEL and the EPC Contractor will undertake transect walks on the site with cultural representatives and specialists, in order to map and tag all cultural property.

7.5.9.1 Measures for Compensation for Loss of Individual Graves and Shrines

Compensation was paid to allow graves to be relocated in accordance with normal practice in Uganda. Households were offered compensation as per Ugandan law, using applicable rates for the cost of graves. In addition, as a BEL uplift, compensation was paid for performance of appropriate transfer ceremonies. This was agreed through negotiation in accordance with the procedures and programme set out in the 2001 RCDAP. Amasabos have been compensated at rates for non-permanent structures in accordance with the rates set in the 2001 RCDAP, which cover materials and labour.

Many graves may have been destroyed by cultivation within the area or are no longer marked in any way. As a further mitigation measure, AESNP had proposed an inter-denominational remembrance service to be carried out in the project area to commemorate all those buried in the area in the past. A structure or monument was to be erected, either at the site of the remembrance service or elsewhere, in accordance with the wishes expressed by the local communities. This mitigation remains to be implemented, as no such service could be organised before AESNP withdrew from the Project. BEL will implement this mitigation measure.

7.5.9.2 Measures for Appeasement and Resettlement of Spirits at the Community Level

It had been established that the dwelling places of a number of spirits will require relocation either before construction commences or before the reservoir area is

inundated. The following steps were taken (additional details are provided in Chapter 16 of the 2001 RCDAP):

- Local consultants were appointed to manage the entire cultural mitigation programme, in association with AESNP;
- Village committees were set up to oversee the process;
- Committees then met to determine the number of spiritual sites / dwelling places to be relocated, what had to be done in terms of ceremonies, who should conduct the ceremonies (either a medium “muswezi”, or the villagers themselves), when they should be carried out, what was required in terms of physical items and approximate costs of these items; and,
- Transfer rituals were then be carried out followed by settlement rituals for each spiritual site.

During specific focus group meetings held in 2000, a large number of instances were cited (Synergy, 2000) of unfortunate and undesirable happenings as a result of the spirits being upset by certain forms of behaviour. It is therefore proposed that a code of practice be prepared which gives guidance and advice to all persons involved in the construction and implementation of the Bujagali project on spiritual customs and traditions to be respected. Advice will relate mainly to the following:

- Visiting/bathing in the river;
- Removing vegetation;
- Preparing and consuming food;
- Respecting local shrines; and,
- Sexual behaviour and other forms of personal behaviour.

The Code of Practice will be prepared in draft by local specialist consultants. The draft will then be discussed with village committees before being finalised, prior to any construction work commencing.

The EPC contractor will carry out cultural awareness training for all employees from outside the project area who are unfamiliar with local conditions. The Code of Practice will be used during training sessions.

7.5.9.3 Cultural Loss of Bujagali Falls

At the wider community level, it was acknowledged by AESNP that the rapids at Bujagali Falls would be inundated and that this was an unavoidable impact of the hydropower facility. Consultation with the parties directly involved with the spiritual value of the site – namely Nabamba Bujagali, Lubaale Nfuudu, the Leader of the Ntembe Clan, and the Kyabazinga of Busoga – indicated that the issue was a local one and that the impact was manageable.

Consultations and negotiations were done with several custodians/diviners for the Bujagali Falls spirits:

- Nabamba (the living Bujagali) who is the medium;
- Ntembe Waguma and Nfuudu who are caretakers (East Bank); and,
- Nalongo Nakisita who is also a medium for the same spirit but known as Kiira (West Bank).

During these consultation meetings, each of the mediums and caretakers was required to come up with a plan detailing the ceremonies and requirements they needed for the appeasement of the spirits of Bujagali. The three teams above came up with their respective lists and facilitation was provided to them by AESNP. Individually, they conducted their appeasement ceremonies on different days. These ceremonies were witnessed by multitudes of people. Appeasement could have been done jointly, but the three groups never agreed. The process was facilitated by a group of Ugandan cultural property specialists (Synergy).

Ceremonies that attracted followers of the three groups were organised in September 2001. Animals were slaughtered, their blood being offered to the spirit, and various rituals were undertaken. As required by agreements concluded after the above-mentioned negotiations with the mediums and caretakers, AESNP paid all expenses related with these ceremonies, including such expenditures as the transportation of followers from other areas of Uganda.

BEL will embark on a consultative and participative process similar to that followed by AESNP to re-confirm that the appeasement process was completed appropriately. Initial consultations with the Kingdom indicate that additional appeasement measures will be appropriate.

7.5.9.4 Measures for Addressing Chance Archaeological Finds

A Stage 1 archaeological assessment was undertaken in 2006 at the HPP project site as well areas to be inundated. The report is found in Appendix C.8. The study made the following conclusions:

- There are no archaeologically important features that will be adversely impacted in the Namizi area due to inundation or other project activity;
- Further investigation is unnecessary at Kyabirwa since there is no apparent threat to any archaeological resource there;
- There is little or no adverse effect to the archaeological resource at Bujagali or the adjacent Ivunamba village; and,
- At the villages of Kikubamutwe and Malindi there is already a good representative sample of the archaeological resource of the area of proposed Bujagali Hydropower Project in Jinja and Mukono.

If any new sand deposits are utilised outside the project area (possible sites to be developed are shown in Figure 5.3), these sites will also be inspected by an archaeologist prior to work commencing on them.

A protocol will be developed with the Department of Antiquities to address how the discovery of an archaeological remain is to be handled. Construction workers and staff will also receive training on how to recognise an archaeological remain, and the procedure to be followed in the event of a discovery being made. This training will be part of the orientation that new employees and staff receive. It will be the responsibility of the EPC's Site Environmental Officer (SEO) and the Environmental Manager to report any relevant finds to the Department of Antiquities. The Department of Antiquities will advise on measures to be taken to ensure preservation of the finds.

7.5.10 Community Health, Safety and Security

7.5.10.1 Communicable and Infectious Diseases

This section examines concerns for public health related to HIV/AIDS and other sexually transmitted diseases (STDs), vector-borne diseases, actions to be taken in the event of an Ebola outbreak and impacts on available health care facilities in the project area and Jinja town. Health and safety issues related to traffic are dealt with in Section 7.5.6 and Chapter 8 of this report.

Sexually Transmitted Diseases

The spread of HIV/AIDS was identified as a key public health issue in the First Report of the International Environmental and Social Panel of Experts (February 25, 1998) (www.bujagali.com). Concern was expressed that the already high prevalence of HIV found in Uganda could be exacerbated through spread of the disease by construction workers, truck drivers and prostitutes attracted to worker camps.

Mitigation/Monitoring measures: BEL is committed to measures that will reduce the risk of an increase in STDs/HIV/AIDS as a result of the project. For this reason, the following human resource management policies will be adopted.

- No construction camp will be erected at the project site;
- Unskilled workers (labourers) will be recruited, as available, from the local population and particularly from the villages affected by the project. Therefore these workers will remain resident in their homes, which will reduce the need for accommodation for single male unskilled workers. The EPC Contractor will operate buses from Jinja, and along the east and west banks to the construction site at every shift change, which will transport labourers between their home villages and the site;

- An STD/HIV/AIDS awareness and prevention programme will be incorporated into the training package for all workers. This will be developed and delivered by an NGO such as TASO (The AIDS Support Organisation) or similar NGO with solid track record in Uganda;
- A programme designed specifically for promoting safe sex for the construction workforce will be developed. Condoms will be made available to workers if wanted, via the site clinic; and,
- An STD/HIV/AIDS awareness and prevention programme will be delivered to local communities. This will be developed and delivered by the same NGO) in co-ordination with the District Health Officers.

The measures outlined above are intended to minimise the risk of an increase in STDs as a result of the project. Additional measures intended to supplement health facilities in the area are outlined in the accompanying CDAP.

Vector-borne Diseases

Impoundments in narrow, steep-sided valleys, such as at Bujagali, create significantly fewer vector breeding sites when compared with impoundments with extensive, shallow shorelines. Due to the inundation of islands near Bujagali, there will be (at FSL) a 34 percent reduction in the length of shoreline available for vector habitat, as outlined in Section 7.5.3.1. In addition, daily fluctuations of water level will strand vectors, including mosquito larvae and snails, and expose both the vectors (adults and egg masses) and potential breeding sites to the drying effects of the sun. These factors all mitigate against significant increases in vector breeding success, and have been documented as mechanisms by which hydropower projects have contributed to reduced vector-borne disease incidence in the past (e.g. Jobin, 1986, 2005)

More specific comments on the effects of the project on individual disease vectors are given below.

Schistosomiasis (Bilharzia)

In general, the snail vectors of schistosomiasis (*Biomphalaria* and *Bulinus spp.*) are only able to establish themselves in flow rates below about 0.4 m/s. There is a risk of more snails being introduced into the impoundment, either carried on the current or more likely on mats of water hyacinth or *Pistia*. Mats of water hyacinth are most likely to occur in slack water areas along the banks and on the downstream sides of the remaining islands.

Snails are most likely to become established in areas where there is marginal vegetation. A potential effect of the project is increased establishment of such vegetation due to slowing of river flows upstream of the dam. However, the fluctuation in water level arising from operation of the hydropower plant will make it

difficult for such vegetation to become established in any greater density than currently exists, and will represent a controlling factor for vector populations.

Clearance of trees and shrubs from the reservoir area before inundation will remove potential anchorages for weed mats and thus potential breeding sites for snails.

Mitigation/Monitoring measures: A regular programme will be instituted to monitor the possible development of snail habitat along the banks of the impoundment, particular attention being given to those areas where there are comparative shallows and backwaters, and where there is likely to be human contact with water. Where necessary, floating vegetation will be eradicated by manual removal and disposal to land (e.g. as fertiliser), as is currently carried out at the Nalubaale and Kiira dams. Workers will be screened through the regular worker pre-screening process. Those who have shistosomiasis will be treated.

The channel between Dumbbell Island and the east bank will be closed by the eastern section of the dam, and as the main flow descends through the west channel, will become a backwater immediately downstream of the dam. Unless mitigation measures are carried out, this will provide an ideal site for the aggregation of floating vegetation and quite probably infestation by snails.

A possibility for dealing with this problem is for the material used for the Stage 2 cofferdams to be re-used for filling in this former section of river channel. This will be the preferred option, and will be implemented if sufficient material is available after other parts of the reinstatement programme (such as the west bank quarry) have been completed. If sufficient material is not available, a floating boom will be installed across the eastern channel from the downstream end of Dumbbell Island to the east bank, which will prevent accumulation of floating plant material in the channel.

Onchocerciasis (River Blindness)

The vector for river blindness is the black fly *Simulium damnosum*, which prefers waters with high flow velocity – typically in the range of 0.5 – 3.0 m/s. Jobin (2005) documents the benefits that appear to have arisen from the Nalubaale/Owen Falls dam, in that *Simulium* breeding sites were eliminated in the areas of Owen/Ripon Falls. This species has all but disappeared from the Upper Victoria Nile, and as a consequence, onchocerciasis is not a problem in the area at present.

Re-invasion of the Bujagali reservoir by *Simulium* flies is unlikely. Rapid fluctuations in river level during operation will alternately expose and drown potential natural breeding sites, making breeding and establishment of a viable population very unlikely.

The Bujagali spillway may provide a breeding site if water flows over it regularly. Providing the spillway dries out completely and at intervals of not more than about five days, breeding is not expected to occur.

Mitigation/Monitoring measures: Although the onchocerciasis risk is minimal, incidence in the spillway area will be monitored. If the species is found to increase, measures such as insecticide dosing of the spillway will be considered.

Malaria

Malaria is already hyperendemic in the area and there are unlikely to be any significant changes in incidence within the local community resulting from the project. However, a potentially serious situation applies to those without immunity (such as expatriate workers from non-malarious areas). These need particular protection.

Mitigation/Monitoring measures: Protection will be made available to all workers in the form of screening of accommodation, spraying the inside of houses with residual insecticide and bednets impregnated with insecticide. Workers from non-malarious areas will be provided chemoprophylaxis. Chloroquine is still the first choice for prophylaxis as chloroquine resistance is generally very low. There is some evidence that there are increased levels of parasite resistance to chloroquine in urban areas as compared with rural areas, and it is suggested that this is due at least in part to self-medication, easier access to chloroquine (which is readily available in local shops), frequent use for treatment of fevers, whether due to malaria or not, and the failure by many to complete the regime recommended by the Ministry of Health.

An awareness programme will ensure that workers are apprised of the modes and risk of infection, the monitoring programme and the importance of making health centres aware of new malaria cases. It is envisaged that this will be delivered along with the STD/HIV/AIDS programme described above.

Construction techniques will include measures to avoid the creation of pools of standing water. For example, borrow pits and quarry areas will be kept well drained in order to prevent this occurring.

Trypanosomiasis

Although still present, human and animal trypanosomiasis are no longer considered to be a problem in the area and the Bujagali project is unlikely to result in any change to this situation (Dr. G. Bayenda, Jinja District Vector Control Officer, pers. comm.).

Ebola Outbreak

Contact has been made with the Jinja District Health office on measures to be put in place should an outbreak of Ebola fever occur within the project area. Any suspected cases of Ebola will be immediately isolated and treated within the same locality that the person acquired the disease, i.e., if a worker is suspected of being infected, his/her entire family will be quarantined, with movement into and out of the family restricted until adequate measures have been taken and the person is proven to be free of the virus. All emergency measures will be coordinated by the Ministry of Health. Training on detection and protective measures to be taken in the event of an Ebola outbreak will be given to all staff and workers as part of their orientation training.

7.5.10.2 Dam Safety/Risk Assessment: Bujagali

World Bank Operational Policy 4.37 and Bank Procedure 4.37 require an independent Panel of Experts to be commissioned to review and advise the project proponent on matters relative to dam design and safety as part of the planning process for any dam project greater than 15 m in height.

To address this requirement, BEL will form the Bujagali Dam Safety Panel (BDSP). The BDSP, consisting of three technical experts, will provide advice through final design, construction, initial filling, and start-up phases of the dam. The BDSP will provide input on several key issues, which include:

- Determination of maximum ground acceleration values;
- Spillway discharge capacity is adequate;
- Back-up power systems for the spillway and main power station are adequate provided they are subject to regular testing;
- Acknowledgement that the vibrations induced by the planned rock blasting at Bujagali will have no effect on the safety or performance of the Nalubaale structures;
- Determination of potential effects of a failure at Nalubaale or Kiira on the Bujagali dam and any necessary design or operational precautions; and,
- That river diversion structures used during construction are more than adequate to meet the 1% AEP flow.

7.5.10.3 Labour and Working Conditions During Operations

It is envisaged that there will be approximately 50 staff attached to the HPP facility (Section 5.9) with 14 on site at any time. Unlike the indirect labour impact of the project, the direct labour impact on the local economy is relatively small, although it is planned that the large majority of plant personnel will be recruited locally through an open recruitment procedure and will receive appropriate training. BEL is committed to complying with good employment standards and providing decent working conditions for its staff. BEL will undertake to comply with all relevant

national legislation and international standards, which are applicable to its operations.

BEL will develop a human resource policy including provisions on written particulars of employment, payment, working hours, form and frequency of wage payment, and non-discrimination.

7.5.11 Associated Facilities

The Bujagali IP being planned and developed by UETCL is closely associated with the HPP Project. The IP is needed to allow the electricity generated by the HPP to be transmitted into the National Grid.

A closed aligned but separate SEA is being prepared for the IP, with the objective to generally meet the same regulations and guidelines as are being applied to the HPP SEA.

A similar set of SEA documents has been prepared for the IP, including:

- SEA Executive Summary;
- SEA Main Report;
- Public Consultation and Disclosure Plan;
- Assessment of Past Resettlement Activities and Action Plan for Kawanda Substation; and,
- Resettlement and Community Development Action Plan (needed for acquisition of the transmission line wayleaves).

Compliance screening for the IP indicates that the project complies with GoU Legislation, international treaties and conventions ratified by GoU, and the Project Applicable Performance Standards.

The key project issues that have been identified in the IP SEA, and for which detailed analyses have been completed, are:

- Resettlement and Compensation (for which a Resettlement and Community Development Action Plan has been prepared);
- Impacts on Lands within Central Forest Reserves, including the Mabira Forest (for which mitigation and offset measures have been developed through consultation with the National Forestry Authority);
- Impacts on the Lubiji Swamp and other wetlands (for which specific design and mitigation measure apply);
- Aesthetics (for which impacts are unavoidable, although a route adjustments is under consideration to lessen visibility along the Nile River);
- Labour Force Management (for which a labour force management plan is proposed);

- General Construction related issues (for which the EPC Contractor will prepare and adhere to a Traffic Management Plan, Waste Management Plan, Health and Safety Plan, and Environmental Mitigation and Monitoring Plan); and,
- Cumulative Effects (which have been minimized by routing the new line adjacent to an existing line through the Mabira Forest).

The management measures highlighted above will be incorporated into a Social and Environmental Action Plan, to be finished and disclosed following selection of the IP EPC Contractor.

7.5.12 General Construction Related Issues

As part of project planning, a number of construction-related issues were identified, which are addressed within the context of this SEA. These are issues that are common to most large-scale construction projects and for which potential effects are well-known and effective mitigation available.

The issues identified are:

- Public and Worker Health and Safety;
- Management of Hazardous and Contaminating Material;
- Management of Solid Waste;
- Soils and Agriculture;
- Air quality; and,
- Archaeological Sites.

The EPC Contractor will be responsible for measures to mitigate and manage the potential effects related to construction activities. Project specific plans and programmes to be developed by the EPC Contractor are more fully described in Chapter 8 of this report. The mitigation, management and monitoring measures for all of the issues identified above are set out in Table 7.15.

7.5.13 General Operations Related Issues

As part of the general project planning activities, a number of operational-related issues were identified that required further discussion within the context of this SEA report. These are issues that are common to most large-scale hydro projects and for which the potential effects are well documented and effective management measures available. These issues identified are:

- Public and worker health and safety;
- Management of hazardous and contaminating material; and,
- Management of solid waste.

BEL, as operator of the facility, will be responsible for the implementation of measures to protect, mitigate, and manage the potential effects related to the operation of the hydropower facility. Project specific plans and programmes to be developed by BEL are described in Chapter 8 of this SEA report. The various management measures, net effects, and monitoring activities that will be undertaken by BEL during the operation of the hydropower facility to address the issues identified above are set out in Table 7.15.

7.5.14 Labour Issues and Working Conditions During Construction Phase

The construction phase of the HPP will create significant employment, estimated to rise to between 600-1,500 people at the peak period. BEL is committed to ensuring that decent employment standards are complied with, and to providing decent working conditions for staff and sub-contracted workers employed during construction and, at a minimum, in line with Ugandan national labour law.

Potential Labour Risks

Various potential risks have been identified which have a regional prevalence and which have arisen from analysis of similar projects:

- Worker health and safety;
- Forced labour;
- Payment of minimum wage; and,
- HIV impact.

Worker Health and Safety

Fatal accidents have occurred at several construction projects in Uganda due to poor safety management policy and practice. There is also a potential risk of non-compliance with lender standards on access to healthcare and suitable accommodation if appropriate safeguards are not put in place.

Freedom of Association

Ugandan law provides for recognition of a union where a minimum 51 percent of the workforce supports it and there are at least 1,000 workers. The latter restriction is due for statutory review. However, these regulations could be construed as a limitation on workers' right to organise. Lenders' policies require that where there are such limitations, parallel means should be provided to allow for freedom of association – such as a workers' committee.

Forced Labour

Under Lenders' standards on forced labour, prison labour is unacceptable where the beneficiary is a private-sector party and the work is not performed to rehabilitative ends. The LFMP will include provisions to prevent this occurring.

Payment of National Minimum Wage

The current national minimum is 6,000 shillings/month but evidence suggests that this is not strictly enforced. Appropriate steps should be taken to verify procedures for payment of the statutory minimum wage and the existence and provisions of any collective bargaining agreements – at either company- or industry-level – on wages and other terms of employment.

HIV Impact

There is significant risk of HIV impact from the Bujagali project – to workers and, especially, to neighbouring communities. A policy on HIV testing and awareness-raising will be implemented project wide.

Measures for Addressing Labour Issues

BEL is committed to implementing various processes, business commitments and measures to address the various labour risks identified and additional issues required in lender policies.

The contract and terms of reference to be agreed between BEL and the EPC contractor will specify labour and occupational health and safety commitments to be observed by the Contractor and sub-contractors, as well as responsibilities for monitoring the implementation of these commitments, which will lie primarily with the EPC contractor. BEL is committed to establishing its own procedures and reviewing the EPC contractor's procedures, and assessing the performance of both parties on these issues, including ensuring that sub-contractors' contracts commit them to compliance with relevant labour and health and safety legislation and guidelines.

Policies and procedures to be implemented by BEL and the EPC contractor will include:

- Adoption and implementation of a human resources policy in line with the requirements of IFC Performance Standard 2, including provision of information to all employees on terms and conditions, relevant employment policies and training opportunities;
- Maintenance of accurate records in relation to each worker's employment covering issues such as payment of wages and social security, and working hours;

- Recognition of trade unions where workers request this in line with national legislation and international standards, no activity to discourage workers from forming unions, and policy towards other forms of collective organisation;
- Respect for any collective bargaining agreements;
- Adherence with the principles of non-discrimination at work;
- Provision of reasonable terms and working conditions for employees including avoidance of excessive working hours, payment of at least the national minimum wage and seeking to provide a wage which will provide sufficient disposable income to qualify with the requirements of lenders' policies;
- Establishment of an effective and confidential grievance mechanism;
- Prohibition of forced labour and child labour – including verification procedures to check employees' age and safeguards that labourers are not recruited so as to accrue unacceptable debt or limit access to essential documents; and,
- Implementation of a health and safety policy based on national law and including hazard identification, preventative and protective measures, training, documentation and reporting of accidents and emergency procedures.

Procedures for management of these issues will be articulated in Labour Force Management Plans (LFMPs) which are being developed by BEL, and which will be required of the EPC Contractor when appointed. Frameworks for these LFMPs are discussed further in Chapter 8, and are provided in the Social and Environmental Action Plan, which accompanies this SEA report.

7.6 Cumulative Effects

7.6.1 Context

A number of studies have been carried out with relevance to the cumulative effects of hydropower development on the Victoria Nile in Uganda. Each has been of different scope and has used a somewhat different methodology. In this section, the approaches and major findings of those studies are summarised. The analysis of project alternatives presented in Section 4.2 of this SEA is also relevant to the assessment of cumulative effects in the area.

Cumulative effects can be defined as “the impacts on the environment that result from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions, regardless of what agency or person undertakes such actions” (Council on Environmental Quality, US 1978). With respect to cumulative effects, IFC's Performance Standard 1 specifies that the area of influence for a project should consider the “areas potentially impacted by cumulative impacts from further planned development of the project, any existing project or condition, and other project related developments that are realistically defined at the time the SEA is undertaken”.

The main area of concern as identified in the various studies that have been conducted to date and which are discussed herein is the Victoria Nile River within Uganda, although not all the studies included in this review considered a geographical area as wide as that. Time frames have tended to be in the order of 10 to 20 years, a fairly standard time horizon for such analyses.

The current state of development, in particular hydropower development, within the area has been presented earlier in this SEA. In summary, the Nalubaale dam, commissioned in 1954, was constructed close to the outlet of Lake Victoria downstream of Ripon Falls and resulted in their modification (blasting) and inundation. The Nalubaale dam continues to operate at that location. During the 1990s, a second hydropower facility (Kiira) was constructed adjacent to the original Nalubaale project with its own, separate intake channel. Of the five turbines that the Kiira project was built to accommodate, two went into service during 2000, an additional unit in 2002 and the final two in March 2006.

Section 4.1 of this SEA documents the need for additional sources of electricity in Uganda and summarises the system planning and least-cost analyses carried out to identify and quantify that need. In general, those studies have concluded that additional hydropower generation facilities are required in the short-to-medium term and have identified the technically and economically preferred approaches and projects. The cumulative effects analyses, among others, allow the incorporation of environmental and social considerations into the decision-making about the future of hydropower development in Uganda.

The various cumulative effects studies carried out in the Victoria Nile basin to date have not resulted in a set of precise, clear and unequivocal conclusions. Differing objectives, approaches and methodologies among the studies have resulted in a variety of conclusions, at least some of which either contradict or are inconsistent with one another. There is no single over-riding consensus.

Studies that have addressed cumulative effects and/or development alternatives issues in the study area, and that provide context for the cumulative effects assessment completed as part of this SEA include: the Karatunga Study (Karatunga, 1997); the WS Atkins Study (in ESG International & WS Atkins, 2001); the NORPLAN EIA on Karuma (NORPLAN, 1999), the Acres Study (Acres, 2000) and the Nile Basin Initiative study authored by SNC Lavalin International et al (2005, 2006 (draft)). Each is summarised in the following sections. The cumulative effects study completed for this SEA is provided as Section 7.7

7.6.2 Karatunga Study

In this alternatives study (Karatunga, 1997), two of the potential hydropower sites on the Victoria Nile were compared and assessed by integrating remote sensing, geographical information system (GIS), and multicriteria evaluation or analysis

(MCA) techniques, while incorporating the views of selected, relevant stakeholders. The projects reviewed were Bujagali and Kalagala.

To accomplish this objective, the study was divided into three main activities: impact identification, quantification and final evaluation. Remote sensing and GIS techniques were applied to identify and quantify the spatial impacts. Environmental resources potentially affected by the hydropower projects were categorised into four environmental aspects:

- Physical impacts;
- Ecological impacts;
- Human use; and,
- Quality of life values.

Twenty-four stakeholders assigned weights to the different environmental criteria and assigned them to the four environmental aspects. Their viewpoints were then translated into four visions:

- Nature vision;
- Quality of life vision;
- Economic vision; and,
- Equal weight vision.

The assignment of weights according to the first three visions is summarised in Table 7.11. The equal weight vision assigns the same weighting for each criterion.

Table 7.11: Criteria Weights According To Different Visions

Environmental Aspect	Criteria	Vision		
		Nature	Economic	Quality of Life
Physical	Soil Surface	20.0	2.0	4.7
	Water	30.0	3.0	5.3
Ecological	Forestry	7.8	5.1	2.9
	Vegetation	7.8	2.8	2.1
	Fisheries	7.8	4.5	2.9
	Wildlife	6.6	2.6	2.1
Quality of Life	Cultural Sites	2.3	5.1	6.0
	Employment	2.2	7.3	13.0
	Tourism	1.6	5.5	10.0
	Public Health	1.9	5.9	11.0
	Displacement	2.0	6.2	10.0

Environmental Aspect	Criteria	Vision		
		Nature	Economic	Quality of Life
Human Use	Agriculture	2.0	9.5	5.9
	Transport	2.1	10.1	6.1
	Electricity	2.4	12.5	6.9
	Industry	2.1	10.1	6.1
	Water Use	1.4	7.8	5.0
Total		100.0	100.0	100.0

The following assumptions were made in assigning weights to the visions:

- The Nature Vision attaches the highest importance to the physical aspect, followed by the ecological aspect, while the quality of life and human use aspects are assumed to be of equal importance;
- The Quality of Life Vision attaches most importance to the quality of life aspect, followed by the human use values, while the physical and ecological aspects have the same importance; and,
- The Economic Vision attaches most importance to the human use values, followed by the quality of life and then the ecological aspect. Some of the ecological resources such as fish and forestry can be used for economic benefits as well. Least importance is attached to the physical aspect.

The two potential sites were ranked according to the four visions formulated in this study. This was done by transforming the weights assigned by each vision into an ordinal ranking. Effects that have the same weight were assumed to be equally important, while those with a lower weight were assumed to be less important. The ordinal weights were then multiplied with the effects' scores, and an index was calculated for each vision to determine which alternative was better than the other. The results of the overall ranking of the two sites are shown in Table 7.12.

Table 7.12: Probability Table for Ranking of the Sites

Vision	Bujagali	Kalagala
Nature	1.00	0.00
Economic	0.99	0.01
Quality of Life	0.81	0.19
Equal Weight	1.00	0.00

From this table, it can be seen that from all viewpoints, the Bujagali site is better than Kalagala. A sensitivity analysis was carried out, but since the probability of Kalagala outranking Bujagali was always low, a further analysis was not required.

Ranking of the two sites was also done according to the first approximation method adopted from Goodland (1997). It gives a quick but crude way of ranking the

alternatives based on the ratios of installed capacity, number of people to be displaced, and amount of area to be inundated by the reservoir. These ratios were calculated for both sites and were then converted to a logarithmic scale and plotted on a graph compiled by Goodland (1997). The graph showed that the Bujagali site is better than Kalagala both in terms of kW/people displaced and kW/area inundated.

Overall, the results of the Karatunga study confirm those of the earlier hydropower master plan studies by Kennedy and Donkin (1996) in that of all the hydropower sites on the Victoria Nile, the Bujagali site is the most environmentally compatible location for a dam project.

The Uganda hydropower master plan considered the impacts at Bujagali and Kalagala to be the same. This is true in regard to the nature of the impacts, but large differences exist in the magnitude of the effects at each site. Also, the two sites were regarded in the master plan as having no ecological importance, but this fact is not true especially for the Kalagala site where the natural vegetation was still more or less intact, and two Central Forest Reserves lie on the banks of the river.

Although the Bujagali site may be considered to be of less ecological importance, construction of a dam at this site will affect the ecologically sensitive area of Mabira Central Forest Reserve. The main impact will be the construction of the transmission line cutting through this Forest Reserve. Inundation of the islands, an important source of fuelwood, will increase the pressure for woodfuel on the existing forests.

The magnitude of the negative environmental effects at the Kalagala site far outweigh those of Bujagali even if the two sites were to be developed in cascade. However, this magnitude will be much higher if only Kalagala were to be developed without Bujagali. Development of Bujagali after Kalagala is not possible, since the Kalagala option would require utilisation of the head at the existing Nalubaale dam to maximise power generation.

The Karatunga study also proposed four options for decision making and suggested mitigation measures against the adverse effects at the two sites reviewed.

7.6.3 WS Atkins Study

7.6.3.1 Background of the Study

The WS Atkins study (in ESG International and WS Atkins, 2001) is a cumulative impact assessment carried out in the context of the Bujagali project impact assessment. It was designed by WS Atkins to consider, as a minimum, the existing Nalubaale project, the Kiira project, the Bujagali project and at least one other future project. In the absence of a definitive up-to-date plan for the development of hydropower in Uganda it was considered that to be both robust and comprehensive, the comparative assessment should consider a range of future scenarios:

- Scenario 1 – Nalubaale, Kiira, Bujagali and Kalagala;
- Scenario 2 – Nalubaale, Kiira, Bujagali and Karuma; and,
- Scenario 3 – Nalubaale, Kiira, Bujagali, Kalagala and Karuma.

A Terms of Reference was drawn up and reviewed by IFC prior to the assessment being undertaken. The objective of the assessment was to identify and assess the cumulative impacts of each of the above sets of projects on the Bujagali project area and to set out the incremental effects of the Bujagali project in relation to the total effects. Firstly, each project was assessed individually, and secondly, an analysis of the sum of the effects of the projects including the interactions between the effects of individual projects was carried out.

7.6.3.2 Results of the Study

Baseline Conditions

The Nalubaale, Kiira, Bujagali and Kalagala project sites are all located on the upper reaches of the Victoria Nile (all within 30 km of the source of the Nile), whilst the Karuma site lies on the lower reaches between Lake Kyoga and Lake Albert (Figure 7.7). Baseline conditions are somewhat different in the two stretches of the river. The upper reaches are highly fertile and densely settled and the area is strongly influenced by Jinja town, which acts as a focus for employment and a market and service centre. Other activities are fishing and whitewater rafting. The natural environment has been degraded and there is little natural forest remaining.

In contrast, the lower reaches of the river in the vicinity of Karuma Falls are less densely settled and agriculture is less developed due partly to drier and less fertile conditions. The area is more remote and less accessible to the main population centres in Uganda. Its human settlers include ‘internally displaced persons’ (IDPs) from lands to the north, many of whom have only recently moved to the area. Many of them occupy the Community Wildlife Area, formally under the jurisdiction of the Uganda Wildlife Authority. Grazing is an important activity. There are fewer community or commercial services in this area than in the upper reaches, the main

ones being in the trading centres of Karuma and Kamdini. Standards of living and public health are below those on the upper reaches. The project site is adjacent to the Murchison Falls National Park and the Karuma Wildlife Reserve.

Cumulative Assessment

Summary Table 7.13 contains a summary of the cumulative impacts of the three development scenarios. The data upon which Atkins based their table are now dated by at least 10 years; in addition, the Kalagala offset had not yet been agreed. Furthermore, the benefits of the project assumed that the hydrology of the 1990's would continue. Given these changes an updated appraisal is provided in brackets where deemed relevant. For each 'theme', impacts of each scenario have been assigned a rating of low (L), medium (M) or high (H), based strictly on comparison with the other two scenarios. The ratings are not based on any judgment of the importance of themes, e.g. a medium land take impact is not necessarily deemed to be of the same importance as a medium impact on cultural heritage.

Figure 7.7 Location of Existing and Proposed Hydropwer Projects on the Victoria Nile

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Table 7.13: Summary of Comparative Impacts of Combined Development Scenarios (Adopted from ESG International & WSAI, 2001). (Effects are considered negative unless otherwise stated.)

Theme	Scenario 1 (Nalubaale + Kiira + Bujagali + Kalagala)	Scenario 2 (Nalubaale + Kiira + Bujagali + Karuma)	Scenario 3 (Nalubaale + Kiira + Bujagali + Kalagala + Karuma)
Installed capacity	M (H 930MW)	L (H 830MW)	H (H1130MW)
<i>Major Impacts</i>			
Cost	M	L	H
Land take	M (H)	L	H
Population Displacement	M (H)	L	H
Cost per megawatt	L (H)	H(L)	M
<i>Lesser Impacts</i>			
Fisheries	M (positive)	L (positive)	M (positive)
Terrestrial ecology	H	L	H
Tourism	M (H)	L	M (H)
Health (construction)	M	M	M
Health (operation)	M	L	M
Cultural Heritage	L (H)	M	H
Landscape	M	L	H

Table 7.13 above shows that, although Scenario 2 has the highest development cost per megawatt produced, it generally has a lower environmental impact than either Scenario 1 or 3. There are two main reasons for this. Firstly, only a small land take area is required for the Karuma project, resulting in a low number of displaced persons subject to involuntary resettlement. Secondly, the addition of Kalagala to a development scenario adds 1400 ha to the total land take area, which dwarfs the area required by the other project options. This reservoir area has ‘knock-on’ impacts on other themes such as population displacement, terrestrial ecology and effects associated with the reservoir itself, including fisheries and disease vectors. The impacts of the Kalagala project are greater than those of the Bujagali project due primarily to the larger area of direct impact and the flatter nature of the topography upstream from the site (resulting in a larger area being inundated). The impacts of the Karuma project are low due to the smaller scale and the different design of the project, which utilises an underground power station.

There are significant cumulative effects associated with Scenario 1 (which considers the development of Nalubaale, Kiira, Bujagali and Kalagala and therefore results in concentrated hydropower development on the upper reaches of the Nile). These impacts mainly relate to changes to the landscape, the development of the economy,

transportation improvements, tourism impact (particularly in terms of whitewater rafting) and cultural effects. The effects on the economy arise from economies of scale and are positive impacts. The Bujagali project plays a smaller role than Kalagala in the total adverse cumulative impacts primarily because of the smaller land take area and resultant smaller number of displaced persons.

Scenario 3 consists of the development of all the schemes on the upper reaches and the Karuma project on the lower reaches of the Nile River. However, the cumulative impacts are similar to those for Scenario 1. As set out in the analysis of Scenario 2, the inclusion of the Karuma project creates few cumulative impacts within the area as a whole.

A summary of the major benefits and environmental costs of the five hydropower projects (including Phases I and II at Kiira and Bujagali) as well as the combined projects is provided graphically on Figure 7.8. On Figure 7.8, the negative impacts of the original (1950s) Nalubaale dam are excluded, on the grounds that the project has been completed for nearly 50 years and no impact assessment is known to have been carried out to provide the requisite data. The benefits of Nalubaale in terms of generation capacity are known and have been included.

It can be seen that, although the Kalagala scheme has the greatest potential power output, it also has disproportionately high environmental and social impacts, as measured by population displacement and permanent land take area. Karuma has the smallest environmental impact in terms of displaced persons and land take, but has a cost comparable to that of Kalagala despite its much smaller generation capacity.

Of the combined analyses, Scenarios 1 and 3 have environmental impacts much higher than Scenario 2, simply because the impacts of the Kalagala scheme are included.

7.6.4 NORPLAN EIA – Karuma

The Karuma EIA (Norplan, 1999) noted that the cumulative effects from other developments in the vicinity of the Karuma project or from other hydropower projects along the Nile River “are difficult to predict as there is little data available about future plans” (p. 5-25).

With respect to the Karuma project itself, the Karuma EIA noted “There are not expected to be any significant cumulative impacts caused by the various project components. This is mainly because the construction phase is relatively short (2.5 years) and the project has an underground power station and tunnel system.”

With respect to economic activities, the Karuma EIA said that “Negative cumulative environmental impacts might arise if various industries and other economic activities

are encouraged in the area surrounding the KFHP [Karuma Falls Hydropower Project].

Figure 7.8 Major Benefits and Environmental Costs of Five Hydropower Options and Combinations of Options

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This, however, will to a large extent be dependent upon the priority for development and electricity distribution governed by the Ugandan authorities. Should there be a long-term significant increase in economic activities in the project area this may result in serious encroachment on the conservation areas unless problems of food and energy supply are properly dealt with and patrolling and awareness are strengthened significantly. Monitoring activities recommended in this EIA will discover any increase in encroachment of the conservation areas and appropriate measures will have to be implemented accordingly.”

“On the other hand, the cumulative impacts of such a development with increased economic activities might from a socio-economic and welfare point of view be considered positive. At present there are no clear political priorities that make it possible to predict these impacts. The future situation in Northern Uganda is likely to be of major importance for the extent of such cumulative impacts.”

With respect to the potential for development of as many as six hydropower projects along the Victoria Nile, the Karuma EIA said: “Development of several dams and reservoirs along the River may result in serious cumulative impacts which might not be taken into consideration when considering the impacts of each of the projects individually. River flow, water quality, water hyacinth, wetlands, fish migration and tourism are issues of great concern should several large-scale dams be built.

“The present run-of-the-river design for the Karuma Falls Hydropower Project is not likely to contribute significantly to such impacts, with the possible exception of reduced tourism potential linked to the scenic beauty of rapids and falls along the Nile. Should all six projects mentioned above be developed, Uganda could suffer a major loss with respect to this kind of tourism. The Karuma Falls are not a tourist attraction at the moment, but clearly have tourism potential. As the Karuma Falls are not suitable for white water rafting, the KFHP does not contribute to cumulative impacts with respect to such tourist activities.

“As the KFHP would not contribute significantly to cumulative impacts on aquatic ecology, no detailed study of cumulative aquatic impacts has been included in this SEA. However, development of several hydropower projects along the Nile involving dams and reservoirs should be studied with such impacts in mind. Developing several reservoir projects could affect aquatic ecology through impacts not considered to be significant during development of each individual project, but their cumulative impacts might be substantial over time.”

7.6.5 Acres Study

7.6.5.1 Objectives

The main objective of this study (Acres, 2000) was to provide an assessment of the alternative electric generating projects in Uganda in order for the IFC to determine if

such projects are appropriate for development of the Uganda National Network and are compliant with IFC environmental policies.

Assessment of the hydroelectric projects on the Victoria Nile was the central element of the study. However, alternative modes of power generation were also assessed, including thermal, wind and solar power.

To achieve its objectives, the study team:

- Reviewed existing reports and assessed the technical, economic and environmental issues of the competing projects on a comparable basis;
- Conducted public consultations to determine the stakeholders' views and major concerns with each project;
- Developed evaluation criteria in conjunction with the stakeholders and IFC policies in order to analyse the viability of each project; and,
- Assessed the technical and economic feasibility for each project and associated social and biophysical environmental impacts against the established criteria.

7.6.5.2 Study Approach

The study was carried out in three phases. The main approach in each phase was as follows:

- In Phase 1, the study team reviewed the available reports and other documents relevant to the study, and developed the methodology and work plan for the study. A Review and Scoping Report was prepared at the conclusion of Phase 1, in January 1999;
- In Phase 2, the study team visited Uganda in May 1999 to carry out public consultation meetings with the stakeholders. Technical and environmental issues were reviewed with the stakeholders and a set of criteria was developed for assessment of the projects. A report on the public consultations, entitled "Report of First Round Stakeholders Meetings," was submitted by the study team to the IFC in June 1999; and,
- Phase 3 provided for the analysis of the information obtained from stakeholders and overall assessment of generation alternatives.

7.6.5.3 Conclusions

Bujagali

- There are no technical issues that would preclude the development of the Bujagali Hydropower project (HPP);
- Environmental issues for the Bujagali HPP, without considering cumulative effects, are minor or moderate and should be acceptable in consideration of the power benefits; and,

- Development of Bujagali HPP, in conjunction with other new hydroelectric projects on the upper reach of the Victoria Nile, would have a major negative cumulative impact on cultural homogeneity and community identity, aesthetics, natural heritage and tourism for the country. This issue should be addressed (by government) or at least initiated before approval to proceed with implementation.

Kalagala

- There are no technical issues that would preclude development of the Kalagala HPP;
- With the exception of involuntary resettlement, which is considered a major issue, environmental issues for the Kalagala HPP (without considering cumulative effects) are minor or moderate and should be acceptable in consideration of the power benefits. A major resettlement plan, in particular finding comparable replacement land, is required for Kalagala; and,
- Development of Kalagala HPP in conjunction with other hydroelectric projects on the Victoria Nile would have a major negative cumulative impact on the cultural homogeneity and community identity, aesthetics, natural heritage and tourism for the country. This issue should be addressed (by government) or at least initiated before approval to proceed with implementation.

Karuma

- There are no technical issues that would preclude development of the Karuma HP;
- Environmental issues for the Karuma HPP (without considering cumulative effects) are minor or moderate and should be acceptable in consideration of the power benefits; and,
- Development of Karuma HPP in conjunction with other hydroelectric projects on the Victoria Nile would have a moderate negative cumulative impact on the aesthetics and natural heritage for the country. This issue should be addressed (by government) or at least initiated before approval to proceed with implementation.

7.6.6 Nile Basin Initiative

Draft reports prepared for the Nile Basin Initiative has also considered selected cumulative effects implications of hydropower developments on the river Nile in Uganda (SNC Lavalin International et al., 2005 and 2006 (draft)).

These reports noted that the main cumulative effects from “environmental issues that are identified for the SEA hydroelectric options are related to:

- Change in flow regime;
- Sedimentation, erosion and water quality;
- Proliferation of invasive aquatic vegetation; and,
- Habitats and natural resources.

The report states: “Socio – economic impacts of hydroelectric projects ... are generally quite local and do not really generate cumulative effects with other activities in the target area. The only significant negative cumulative socio-economic impact in this region (including Karuma and Bujagali options) will be on aesthetics and tourism concerns”.

In addition, “A Cumulative Impact Assessment requires an Environmental Impact Assessment as a pre-requisite. The level of data available is very limited for most projects. Only Bujagali, Mutonga and Karuma Falls have full EIAs; Kalagala, Ruhudji and Rumakali have preliminary EIAs. Little information is available on environmental impacts of other options”.

The SSEA report’s assessment of cumulative effects is based upon its Portfolio 2.1 (Kiira units 14-15 (Owen Falls extension) be put into service in 2005, Bujagali 1-4 in 2012, Bujagali 5 in 2014 and Karuma Falls in 2016:

The report states: “Change in Flow Regime: The arm of the Victoria Nile where Kiira units 14-15 and the Bujagali option are located is separated by Lake Kyoga from the arm where the Karuma Falls option is located. Because of the distance separating these projects and the presence of Lake Kyoga between the two stretches of the river, the projects on the first stretch are not likely to have a cumulative effect downstream on the second stretch as Lake Kyoga will act as a buffer zone”.

“Furthermore, these projects being run-of-river, they would not affect the hydrology of the Victoria Nile River; the effect of dally peaking would not likely be seen after 5 km downstream of the tailrace”.

“The addition of these hydroelectric options on the Victoria Nile River in addition to the existing Owens Falls dam would also decrease the pressure to use more water to produce more power (by adding more capacity, more energy may be produced from the same quantity of water by re-using the same water further downstream). It is imperative that the options above be designed in a manner not to increase the water need, to avoid adding more pressure on Lake Victoria’s water levels”.

“For all these reasons, and considering the numbers of falls on the Victoria Nile in the downstream portion, particularly Murchison Falls, it is not expected that the hydroelectric options in this basin would have any cumulative impacts on Lake Albert and further downstream”.

With respect to Sedimentation, Erosion and Water Quality the report states: “No significant sediment load is present in the Victoria Nile River, most sediment having deposited in Lake Victoria. Changes in population densities and distribution along the Victoria Nile River as well as changes in agricultural practices could lead to soil erosion, a more important sediment load and a change in water quality in the Victoria

Nile. A change in urban population densities and changes in agricultural practices in the Victoria Lake Basin could have an effect on the water quality flowing to the Victoria Nile. The dams of each of the proposed options would trap much of the sediment, in addition to Lake Kyoga, thereby attenuating these negative impacts”.

“Proliferation of Invasive Aquatic Vegetation: Water hyacinths are trapped upstream from Owen Falls Dam in Lake Victoria and will not create a cumulative impact downstream. There is already a reduction of 80 percent of surface covered by water hyacinths on Lake Victoria as compared to the 1997 figures.”

For the report’s “Portfolio 2.2 (Technological Diversification) “is defined as regional cooperation approach with enhanced technological diversification with medium load growth. The difference between this strategy and the Portfolio 2.1 (regional cooperation approach with maximized use of the most attractive resources with medium load growth) is that Songwe and Mutonga hydroelectric options are replaced by four coal-fired steam plants (Mchuchuma, Mombasa I, II and III) located in Tanzania and Kenya”. Notably hydroelectric options on the Victoria Nile are not discussed in the portfolio.

For the SSEA report’s Portfolio 2.3 (Geographical Diversification) that represents a regional cooperation approach with enhanced geographical diversification with medium load growth the report concludes with respect to aesthetics: “the combined presence of Bujagali and Owen’s Falls dam on the same stretch of river would have a cumulative impact on issues such as aesthetics and existing and potential tourism”.

7.7 Cumulative Effects Methodology

The cumulative effects assessment methodology adopted for this SEA was developed by ESG International (ESG 2000). ESG was retained by the IFC to build on the Acres work (summarised above) and develop a methodology for assessing cumulative effects further. This was to be done within a strategic social and environmental framework for hydroelectric development in the Victoria Nile basin, and with an eye to facilitating decision-making on the timing and selection of the next project for development.

Appreciating IFC’s request that the methodology developed not be highly quantitative or statistical in nature, and that it be easy to convey to a variety of stakeholders, ESG chose to adapt the “Limits of Acceptable Change” (LAC) approach to cumulative effects assessment for this assignment.

LAC requires a clear definition of spatial and temporal boundaries. It also requires selection of key criteria that reflect peoples' social, economic, and environmental priorities for the study area. For this project, the study area was the Victoria Nile basin and the time period was a 20-year planning horizon, consistent with similar time frames used by others for electricity planning in Uganda.

Because “limits of acceptable change” implies that all human-induced change causes negative impacts, ESG International modified the terminology traditionally used in LAC. Since development activities can also bring about positive changes (e.g. employment), which are to be encouraged, the LAC terminology was modified from ‘limits of acceptable change’ to ‘change management objectives’ (CMO).

In summary, the advantages of using an “adapted LAC” approach to appraise cumulative social and environmental effects on the Victoria Nile are that LAC:

- Is a straight-forward concept to understand and to convey to a variety of stakeholders;
- Presumes that change will occur and focuses on how that change should be optimally managed, i.e., it is not static or preservationist;
- Does not require complex mathematical modelling or statistical measurement to work, i.e. it uses peoples’ perceptions to set qualitative thresholds on how much change should occur in critical variables in a defined area over a given period of time;
- Is rooted in public participation; and,
- Generates a “preferred vision” for how the basin area should be managed; and, thus provides a strategic framework within which individual projects can be assessed.

7.7.1 Development of Methodology

The overall methodology incorporated the CMOs into a framework for decision-making on hydroelectric projects in the Victoria Nile basin. The major steps of this methodology were:

- Define major parameters, including study area, timeframe and decision-making criteria for the study;
- Determine CMOs, including their directions and priorities, for each of the study’s decision-making criteria;
- Assess individual (target) project's effects with respect to CMOs;
- If possible, compare and contrast alternative projects and/or project configurations with target project's effects; and,
- Provide judgments on cumulative and strategic implications of the target project proceeding.

In order to assist in development and testing of the methodology, a two-day workshop attended by informed stakeholders was held in Kampala, Uganda on November 30th and December 1, 1999. The Workshop developed Change Management Objectives for the basin based upon a preliminary list of criteria developed by the study team. Participants were asked individually to:

- Assess how comprehensive the list was and add to or subtract from the existing list of criteria as they saw fit;
- Determine if the listed criteria were “negative” (i.e. indicators of negative change resulting from hydropower projects), “positive” (i.e. indicators of positive change) or “neutral” (i.e. could be either positive or negative); and,
- Identify their top ten criteria in order of importance.

The results indicated that six of the “top 10” criteria identified by workshop participants were seen as “positive” (i.e., indicators of positive effects resulting from hydroelectric developments). All six of these criteria point to poverty alleviation as the overriding consideration when evaluating hydroelectric development proposals on the Victoria Nile. These were:

- Regional economic development (1);
- Access to electricity (2);
- Health services (5);
- Education services (6);
- Land valuation/compensation (8); and,
- Employment (9).

Cultural and spiritual sites (10) was perceived as “negative” (i.e., an indicator of negative effects resulting from hydroelectric developments). No consistent data for the important criteria of human relocation (3), tourism (4) and natural river flow (7) were obtained. The next three highest ranking criteria (11-13) followed in close succession to the “top 10” and were: impacts to wildlife; impacts to agriculture; and, the degree of transmission line infrastructure needed to facilitate a project. There was a significant gap between the “top 13” and the next highest-ranked criteria.

This methodology provides a means to inform decision-making on individual hydropower development projects on the Victoria Nile by taking into account their strategic, basin-wide implications over a long term planning horizon. Particular emphasis was placed on the potential for these projects’ cumulative social and environmental effects.

Change Management Objectives for key decision-making criteria in the Victoria Nile basin were identified and prioritised through consultations with informed stakeholders. The next step in this analysis was to assess the performance of the target project with respect to these CMOs. Comparison of the target project alternative projects assists in determining the potential for cumulative effects in the basin.

7.7.2 Application of Methodology to the Bujagali HPP

The projects selected for inclusion in the cumulative effect assessment were selected based on IFC’s guidance that SEAs address “areas potentially impacted by

cumulative impacts from further planned development of the project, any existing project or condition, and other project related developments that are realistically defined at the time the SEA is undertaken,” supplemented by other hydroelectric projects realistically defined at the time of the analysis, i.e. Karuma. The projects identified for inclusion are:

Project status	Project
Existing Project	Nalubaale
Existing Project	Kiira
Planned Project	Bujagali
Realistically defined future project	Karuma

A Kalagala hydroelectric scheme is not included because the Government of Uganda has agreed to protect the site from hydropower development as an ‘offset’ for the residual impacts of the Bujagali HPP.

The locations of the projects reviewed and their chronology is shown on Figure 7.9. Table 7.14 summarizes the predicted effects of the project developments on the Victoria Nile using the CMO criterion developed by ESG International. Figure 7.9 provides further graphical context to the predicted cumulative effects identified in Table 7.14.

**Figure 7.9 Cumulative Effects of Hydropower Development on the Victoria Nile in Uganda
(1954 – 2012)**

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Table 7.14: Cumulative Effects Assessment in the Victoria Nile Basin Based on “Change Management Objectives”

CHANGE MANAGEMENT OBJECTIVES			PREDICTED EFFECTS of Existing, Planned, and Realistically Defined Projects ¹			
Criterion	Value	Magnitude ²	Existing		Planned	Realistically Defined
			Owen Falls (Nalubaale)	Owen Falls Extension (Kiira)	Bujagali	Karuma
Regional Economic Development	Positive	Major	Provided considerable economic boost to region and country as a whole by providing a reliable source of power/electricity. Jinja becomes industrial centre for Uganda.	Supplemented power from aging Owen Falls facility to meet growing regional and national power needs.	Will provide additional power to the national grid to sustain economic growth and to reduce reliance on hydrocarbon fueled power generation.	Additional power to national grid allowing economic growth to be sustained. Better access to markets and services with the construction of access roads.
Access to Electricity	Positive	Very Much	Impact upon users connected to the grid	Impact upon users connected to the grid	Impact upon users connected to the grid; BEL to work with UMEME to increase rural electrification options.	Unknown.
Health Services	Positive	Very Much	Unknown	Unknown	Health services improved in communities adjacent to the project through implementation of the CDAP.	Unknown
Education Services	Positive	Very Much	Unknown	Unknown	Education services improved in communities adjacent to the project through implementation of the CDAP.	Unknown

CHANGE MANAGEMENT OBJECTIVES			PREDICTED EFFECTS of Existing, Planned, and Realistically Defined Projects ¹			
Criterion	Value	Magnitude ²	Existing		Planned	Realistically Defined
			Owen Falls (Nalubaale)	Owen Falls Extension (Kiira)	Bujagali	Karuma
Land Valuation/ Compensation	Positive	Major	Unknown	Compensation provided for loss of agricultural crops and housing.	Comprehensive land valuation/compensation program undertaken and documented in AES RAP and BEL APRAP.	Unknown.
Employment	Positive	Major	Unknown	Local hiring.	Approximately 600 to 1,500 persons to be hired for construction phase with large component to be hired locally. Increased spin-off employment anticipated.	Unknown.
Transmission Line Infrastructure	Positive	Very Much	New transmission infrastructure constructed	No new infrastructure required.	New transmission facilities from Bujagali to Kampala via Nalubaale-Tororo interconnection. Will allow upgrade to 220 kV if required in the future.	[Karuma to Masindi 220kV. Karuma to Lira 132kV.
Human Relocation	Negative	Minor	Unknown	Approximately 25 families were relocated from the canal area.	Relocation of 85 households carried out. Review of resettlement and current situation assessed in APRAP.	35 households would need to be resettled.

CHANGE MANAGEMENT OBJECTIVES			PREDICTED EFFECTS of Existing, Planned, and Realistically Defined Projects ¹			
Criterion	Value	Magnitude ²	Existing		Planned	Realistically Defined
			Owen Falls (Nalubaale)	Owen Falls Extension (Kiira)	Bujagali	Karuma
Tourism	Negative	Minor	Unknown.	Unknown, but given the absence of tourism amenities (rapids, accommodations etc.) in the proximity of the project little impact likely.	Some temporary disruption to white water rafting (WWR) enterprises, but WWR to continue downstream of project. Some subjective aesthetic impact from dam.	Some reduction of visual amenity of Karuma Falls. No current WWR activity in area.
Natural River Flow	Negative	Minor	Yes. Removal of Ripon Falls altered hydrology of the river at the mouth of the Nile. Construction of Owens Falls dam results in the adoption of the “Agreed Curve”.	Additional hydroelectric facility results in greater discharges from L. Victoria.	Changed between Bujagali and Nalubaale/Kiira. Downstream flows continue to be controlled by Nalubaale/Kiira (Agreed Curve).	Reduced flow for 2.8km between dam and tailrace. Downstream flows continue to be controlled by Nalubaale/Kiira.
Cultural/Spiritual Sites	Negative	Moderate	Unknown	Unknown	Mitigation of effects addressed in project’s SEAP; Kalagala offset addresses residual impacts	Unknown
Wildlife Population	Negative	Some	Unknown but likely.	Unknown	A portion of the approximately 125 hectares of land permanently taken by the project provided wildlife habitat.	Unknown (approximately 7 hectares of land will be taken by the project)

CHANGE MANAGEMENT OBJECTIVES			PREDICTED EFFECTS of Existing, Planned, and Realistically Defined Projects ¹			
Criterion	Value	Magnitude ²	Existing		Planned	Realistically Defined
			Owen Falls (Nalubaale)	Owen Falls Extension (Kiira)	Bujagali	Karuma
Agricultural Lands	Negative	Some	Unknown but likely.	Loss of approximately 20 hectares of small holder garden plots.	Approximately 75% of the 125 hectares of land permanently taken by the project was under agricultural production; mitigation proposed in SEAP.	Unknown (approximately 7 hectares of land will be taken by the project)
¹ Predicted effects should be described individually in each cell in as specific/quantified manner as possible to facilitate comparisons between alternatives						
² Magnitude: None at all = 0 %; Minor = 0 to 15%; Some = 15 to 30%; Moderate = 30 to 50%; Very Much = 50 to 80%; Major = 80 to 100%						

7.7.3 Preliminary Conclusions

The potential cumulative effects of the Bujagali hydroelectric project have been evaluated in the context of other existing and proposed hydroelectric projects on the mainstem Victoria Nile in Uganda. The timeframe is on the order of 20 years, though conceptually, the timeframe extends to the end of the operational life of the projects under review, more on the order of 50 years, at least.

As illustrated in Table 7.14 and on Figures 7.9, the projects assessed are Nalubaale (Owen Falls), Kiira (Owen Falls Extension), Bujagali, and Karuma. A Kalagala scheme is not included as the Kalagala offset agreed by the Government of Uganda to offset the residual impacts of the Bujagali project precludes such development there.

Overall, based on the CMOs identified in the ESG (2000) study, the cumulative effects of Bujagali include:

- Developmental benefits at the local, regional and national levels, including:
 - Economic benefits associated both with:
 - the project's construction (short term), and;
 - the operation of the project (medium and long term).
- Increased supply of electricity, including poverty alleviation benefits to the extent that the new electricity be accessible to those living with poverty;
- Compensation to people economically affected or physically relocated by the project; and,
- Employment and small business opportunities for Ugandans in the short, medium and long terms.

The above impacts are judged to be significant and positive.

The following impacts are considered to be negative cumulative impacts of the Bujagali HPP based on the ESG (2000) CMOs; all are judged to be of minor significance:

- Relocation of people with compensation to accommodate the project's construction, facilities and operations;
- Aesthetic impacts from the presence of another dam with the potential for knock-on tourism impacts (potentially positive, as well, however);
- Some disruption of the natural flow regime over an ~8-km stretch of the river Nile downstream of and as a result of Nalubaale and Kiira (see Section 7.5.3):
 - with associated impacts on aquatic organisms and communities (also potentially positive if productivity of reservoir increased); and,
 - river users (fishers) – also potentially positive if increased productivity in reservoir is reflected in fishers' catches.
- Losses of wildlife populations and habitats, as well as agricultural lands, due to inundation of terrestrial habitats.

It is unknown, based on currently available data and information, whether cumulative effects on health and educational services or on cultural/spiritual sites might be identified. It seems unlikely that there are cumulative effects on white water rafting, as these activities are not believed to have been commercially available at the time of Kiira's approval. The cumulative effects of transmission system infrastructure associated with the Bujagali hydroelectric project are addressed in the companion SEA.

Other cumulative effects of the Bujagali HPP could include:

- Disruption of fish migrations in the river Nile in the vicinity of the project, given Nalubaale's impacts on fish movements between Lake Victoria and the river Nile since 1954;
- Insignificant changes in the levels of Lake Kyoga and in flows downstream of it (Section 7.5.3); and,
- Reduced operational need to increase flows through Nalubaale and Kiira due to efficiencies from Bujagali HPP (a positive cumulative effect, should it occur).

With respect to cumulative effects with other non-hydroelectric projects in the Ugandan energy sector, there could be a reduced need to dispatch thermal and emergency sources of electricity to the Ugandan grid and by individual consumers (generators) with cost savings, air emissions reductions, and likely human health benefits (another positive effect). Another such effect could be some reduced demand for other fuels (including firewood) where access to electricity is available and cost-competitive.

There are no changes (including cumulative effects) anticipated in the 'Agreed Curve' hydrological regime for the river Nile.

7.7.4 Ongoing Evaluation

BEL intends to consult with key stakeholders in Uganda and elsewhere, as appropriate, on the preliminary conclusions reached in this cumulative effects analysis and report on the results and any associated mitigation or monitoring implications, as appropriate, in the SEAP update documentation to be released on a regular basis.

In addition, the final version of the Strategic/Sectoral, Social and Environmental Assessment of Power Development Options in the Nile Equatorial Lakes Region (SNC-Lavalin International, 2006 (draft)) commissioned by the Nile Basin Initiative is expected to become available after the disclosure of this SEA report. The update of this cumulative effects analysis' of preliminary conclusions will include any implications for this analysis from the final version of that report, as well as modifications resulting from consultations with key stakeholders.

7.8 Summary of Impact Management, Net Effects and Monitoring Measures

Table 7.15 summarises the potential impacts associated with construction and operation of the hydropower facility, along with the key impact management measures and effects monitoring measures to be implemented, and the expected net effects. Further detail is provided in the accompanying Social and Environmental Action Plan.

Table 7.15: Impact Mitigation, Net Effects Analysis, and Effects Monitoring Activities

Issue	Location	Mitigation Measures	Net Effects	Monitoring/ Follow-Up
1. Resettlement and Land Compensation				
1. Physical dislocation of persons and acquisition of land or land rights for the project	Reservoir and hydropower facility site	BEL to implement corrective actions identified and recommended by the APRAP.	The compensation and resettlement measures provided were designed to ensure that project affected persons be better off or at least no worse off as a result of the project. Some follow-up may be needed as the RAP was only partly implemented.	BEL to implement corrective, grievance, monitoring and evaluation procedures as prescribed in the APRAP
2. Effects on Land				
2a. Permanent and temporary loss of land, including agricultural land	Reservoir and hydropower facility site	Temporary land take areas will be reinstated by BEL/EPC Contractor to a condition that will make it possible for the land to be used for agriculture, forestry or industry. The ultimate decision as to the final uses for this land will rest with ULC. Other actions will be implemented as set out in the APRAP	Permanent conversions of 45 ha of land to industrial uses and inundation of 80 ha to form the reservoir. Loss of agricultural productivity on land affected.	BEL to monitor reinstatement. Follow up with consultation with ULC.
2b. Loss of terrestrial habitat	Reservoir	Enrichment planting to regenerate forest vegetation on island land not inundated but previously logged or cleared for agriculture, as well as land along the mainland shore. BEL will plant native and medicinal tree species in areas of the riparian strip between the FSL (1,111.5 MSL) and the 1,116 m contour that are currently bare or planted with cash and/or subsistence crops, in order to control erosion and to provide (in the long term) roosting sites for birds and bats. Re-planting will be carried out in consultation with the NFA, who will advise as to the preferred tree species to be used.	Regeneration expected to offset effect to terrestrial habitat	BEL to conduct periodic monitoring of success of regeneration efforts

Issue	Location	Mitigation Measures	Net Effects	Monitoring/ Follow-Up
2c. Disturbance of land at borrow areas	Rock quarry	The portion of the quarry that will remain above water level, i.e. form the new riverbank, will be profiled and planted by the EPC Contractor such that it has a similar landscape to equivalent areas above the water line prior to construction, and blends in with the profile of undisturbed areas.	In long term quarry slope face will appear as natural landscape feature	BEL to conduct periodic monitoring of success of regeneration efforts
3. Effects on Water: Hydrology and Hydrogeology				
3a. Decrease in downstream flow during reservoir filling	River Nile downstream of Bujagali	No more than 2.5% of Nalubaale discharge to be retained in Bujagali impoundment.	Temporary small reduction in wetted perimeter downstream	BEL to monitor downstream discharge and water level at Mbulamuti Gauging station.
3b. Rise in water level in wells and pit latrines	Reservoir margins, to where present water table meets 1111.5 m AMSL contour.	Although no adverse effects are anticipated, any latrines or wells negatively affected will be replaced or compensated for, including possible provision of alternative water supply	Effect expected to be isolated to wells and latrines located within the land take area – no off-site wells or latrines are expected to be affected	BEL to monitor bacterial quality of wells.
4. Effects on Water: Water Quality				
4a. Increase in suspended solids resulting from coffer dam construction, water level rise during diversion and site activities	River Nile downstream of site	No digging or grubbing by the EPC Contractor during reservoir clearance. Site drainage systems will include sedimentation basin, with option for chemically-assisted flocculation if required to meet NEMA standard. Trees in areas to be flooded as result of coffer dam installation and water diversion to be cleared prior to inundation.	No widespread significant effects expected on aquatic species	BEL to conduct daily visual inspection downstream, plus weekly sampling and analysis.
4b. Increased rates of erosion due to fluctuating water level during operation	Reservoir and immediately downstream of dam	Indigenous aquatic grasses (e.g. Vossia) will be planted by the EPC Contractor within the water fluctuation zone (2 vertical metres between FSL at 1111.5 m and drawdown height) if not re-established naturally. Piers and/or docks and concrete steps will be constructed to provide access to water by local people.	Minor, temporary increase in erosion	BEL to monitor reservoir bank stability and stabilise problematic areas as necessary

Issue	Location	Mitigation Measures	Net Effects	Monitoring/ Follow-Up
4c. Reservoir water quality and eutrophication	Nalubaale tail water to Bujagali intake (operational phase)	Trees and shrubs will be harvested prior to the reservoir being filled, to minimise water quality effects associated with rotting vegetation, and to prevent fouling of fishing gears.	Eutrophication not anticipated due to short retention time of reservoir. Risk will be reduced further due to implementation of NEMA standards with respect to upstream discharges. Stratification not anticipated due to shallow water depth and high degree of mixing.	Operational water quality monitoring programme to be implemented by BEL.
4d. Public access to drinking water	Kikubamutwe and Namizi villages	Alternative drinking water source provided. As a mitigation for this loss of access to water, AESNP provided one drilled well equipped with an “Orbit” hand pump to each of the eight affected communities on both banks. However, these hand pumps were not fully reliable and the maintenance system was not effective, and all eight pumps quickly broke down ⁸ . BEL is in the process of replacing these with more reliable pumps for which spare parts and maintenance expertise is more readily available.	Replacement water source provided to the two villages most affected by reduced access to the river. Improved access to drinking water for the remaining six villages.	BEL to monitor yield and quality of supply. Monitor ongoing maintenance programme by village committees.
4e. Public access to river (for washing and other purposes) during diversion	Kikubamutwe and Namizi villages	BEL will ensure permanent access points be maintained upstream and downstream of coffer dams, with designated pedestrian access routes including crossing points on site haul roads. Road crossings to be posed with warning signs and crossing guards employed to control traffic.	Access maintained for the public, although access routes may be less direct than previously. Potential safety issues at crossings.	BEL to check EPC Contractor compliance with safety requirements at road crossings.

⁸ A similar ninth pump has been provided to the resettlement site in Naminya and is still operational.

Issue	Location	Mitigation Measures	Net Effects	Monitoring/ Follow-Up
5. Effects on Water: Aquatic Ecology and Fisheries				
5a. Access to fish landing sites	Kikubamutwe and Namizi villages (construction phase); all upstream villages (operational phase)	BEL is committed to providing alternative boat launching sites that will be accessible regardless of diurnal water level fluctuations during operation of the power station. The proposal at the time of writing is for new landing sites at Namizi on the east bank, and Buloba and Kikubamutwe on the west bank, which will include facilities for the sale of fish to local communities.	Improved landing sites and trading facilities.	BEL to liaise with Beach Management Committees on east and west banks.
5b. Deleterious effect of fish populations	Upstream and downstream of Bujagali scheme	Stocking programme to be carried out in the reservoir by BEL, if required, to establish healthy populations of desirable species.	Expected increase in productivity of the fishery in the stretch of river to be inundated. No significant effect expected on fisheries downstream of the reservoir.	BEL to conduct fisheries surveys post-construction.
5c. Damage to aquatic organisms through entrainment and subsequent passage through the turbines.	Reservoir	The installation of fish screens prior to the water intakes will reduce the rate of entrainment by fish.	Fish mortality caused by entrainment will be limited; however, small mortality rates cannot be precluded. No significant effect on the local fish population is anticipated.	During initial operation, BEL will inspect the materials removed from the fish screens to determine the success of the management measure. The results of this monitoring programme will determine if additional management measures are required.
5d. Changes in amount of available fish habitat for Nile tilapia, Rastineobola argentea and Haplochromines.	Reservoir and borrow area	Creation of new habitat by the EPC Contractor for Nile tilapia and Rastrineobola argentea as a part of the quarry and river bank restoration. A slight increase in suitable habitat for Haplochromines in the reservoir, as faster-flowing habitats are converted to the slower-flowing habitats which are preferred by these species	Overall, the studies have concluded that the project will result in minor changes to the balance between populations of certain fish species upstream of the dam, and no noticeable change downstream of the dam.	BEL to monitor ongoing success of rehabilitation.

Issue	Location	Mitigation Measures	Net Effects	Monitoring/ Follow-Up
6. Effects on Air				
6a. Impairment of air quality from nuisance dust	Construction area and transport routes	<p>Dust will be controlled by the EPC Contractor by following standard good site practices, including:</p> <ul style="list-style-type: none"> • Stockpiles of friable material will be grassed in order to prevent windthrow (and sediment run-off to the river during wet weather) • During dry conditions, access roads will be wetted or treated with a biodegradable (e.g. lignin-based) road sealing product to prevent dust generation • Trucks containing friable material will be covered if using public highways • A maintenance programme for plant and vehicles will be implemented, to ensure emissions of particulates, SO₂ and NO₂ are minimised. 	Short-term, localised effects on air quality, primarily in relation to fugitive dust.	Daily inspection by the EPC Contractor of construction areas for excessive nuisance dust. Instrumental monitoring of particulates outside site boundary. BEL/EPC Contractor to maintain records of complaints on air quality, and follow-up corrective measures.

Issue	Location	Mitigation Measures	Net Effects	Monitoring/Follow-Up
Effects on Noise				
6b. Nuisance noise at adjacent sensitive receptors	Villages adjoining the construction site, particularly Kikubamutwe, Namizi and Buloba.	<p>Implement noise management measures as specified in the EPC Contractor's Action Plan. In addition the following practices may be adhered to:</p> <ul style="list-style-type: none"> • All internal combustion equipment will have properly functioning silencers or mufflers; • Landowners in the vicinity to be notified about the construction schedule and activities, including blasting, as required; • Noise generating activities that take place near residential or sensitive institutional receptors will be restricted to the period between 0600 and 2200 h, which is defined as 'daytime' in the draft Ugandan noise standards; • The EPC Contractor will comply with standards derived from Ugandan national noise standards. If necessary, measures to be taken to reduce noise emissions from the site will include provision of screens or bunds to absorb noise and deflect it away from receptors. <p>A change management process will be used to modify operations, as necessary, to address noise issues. These measures will include identification of the equipment of process(es) causing exceedance of the standard, and proposed abatement options, including:</p> <ul style="list-style-type: none"> • Relocation of equipment; • Provision of screens, bunds, casings or temporary building to deflect or absorb 	Transitory short-term nuisance noise effects, primarily during daytime.	Liaison by the EPC Contractor with adjacent residents and landowners to identify nuisance noise issues and resolve complaints. Instrumental monitoring of noise outside site boundary. Monthly Environmental Inspection report to be completed.

Issue	Location	Mitigation Measures	Net Effects	Monitoring/Follow-Up
		noise; <ul style="list-style-type: none"> Repair of faulty machinery or vehicles; and, Changes to operating times to allow compliance with night-time standards. In addition, a complaints procedure will be put in place to identify significant nuisance noise effects.		
6c. Blasting noise	Villages adjoining the construction site, particularly Kikubamutwe, Namizi and Buloba.	The EPC Contractor will develop an appropriate blast notification protocol as part of its Blasting Plan.	Transitory short-term nuisance noise effects.	Further information every 12 months.
7. Effects on Traffic and Roads				
7a. Effects on road capacity and safety	Off site transportation routes and access roads, primarily Jinja-Kayunga highway	<ul style="list-style-type: none"> The EPC Contractor will prepare and implement a Traffic Management Plan (TMP) that contains appropriate strategies for: moving materials, equipment and workers to and from the Site, including abnormal loads; and, management of connection points between access roads and main public highways. The TMP will include procedures for: Parking and on-site traffic movement; Training and testing of heavy equipment operators and drivers, including vision tests, with records kept of all trainings; Use of project buses to transport workers to reduce pressure on existing public transport; All vehicles to be lit front and back and to be properly maintained; Enforcement of maximum load 	Risk of serious traffic accidents minimised. Project related traffic will not exceed the capacity of existing roads	EPC Contractor to maintain records of all accidents involving project vehicles. BEL and EPC Contractor to implement a traffic complaints and corrective action procedure.

Issue	Location	Mitigation Measures	Net Effects	Monitoring/Follow-Up
		restrictions; <ul style="list-style-type: none"> • Posting and enforcement of speed limits; • Compliance with all relevant Applicable Laws; • Executing movements of abnormal loads to minimise traffic congestion; and, • Vehicle safety classes in the affected villages for villagers, in particular pedestrians and bicyclists. 		
7b. Deterioration of structural integrity of roads due to project traffic and passage of HGVs and abnormal loads	Off-site transportation routes: primarily Jinja-Kayunga highway	Regular inspection of access road conditions. Traffic-related construction damage to be repaired as soon as practical. When abnormal loads (e.g. large transformers and turbines) are to be transported, the EPC Contractor will, along with the relevant District Engineer or his representative, inspect structures along the roads to be used before and after movement of the load(s). The EPC Contractor will make good any damage to structures and road surfaces caused by the transporting of these loads.	No significant deterioration in road conditions expected. There may be slight improvements to the capacity or strength of roads and related bridges and culverts.	EPC Contractor to inspect road conditions weekly
7c. Disruption of traffic at access points to access roads	Transportation routes and access roads	EPC Contractor plans for connection of any upgraded access roads to the public highway network will be submitted for approval by the District Engineer or other appropriate Relevant Authority before construction commences. Any proposals for management of highway traffic (such as speed humps or tidal flow) will be submitted for approval to the Ministry of Works, Housing and Communications at the District Engineer level. It will be demonstrated that any new junction will not be a safety hazard, and that adequate signage, warnings and speed controls will be in place.	Net improvement in road infrastructure and safety due to project upgrades	The EPC Contractor to implement a traffic complaints and corrective action procedure

Issue	Location	Mitigation Measures	Net Effects	Monitoring/Follow-Up
8. Effects on Managed and Protected Areas				
8a. Loss of terrestrial habitat within Jinja Wildlife Sanctuary	28.6 ha of island and mainland shoreline will be inundated between Bujagali Falls and Nalubaale Dam	<p>Enhancement planting will be undertaken by BEL/EPC Contractor on the residual islands land area using indigenous species. The NFA has expressed interest in having the residual islands gazetted into, or added to, a central or district forest reserve, together with area that will be planted near Dumbbell Island and in the 100 metre protected zone along the banks of the River Nile, to mitigate for land lost to permanent and temporary land take. May not be practicable due to requiring parliamentary and ULC approval, but re-vegetation in these areas can be carried out. Institutional strengthening to develop UWA's ability to manage the Jinja Wildlife Sanctuary.</p> <p>BEL is committed to assisting in the further development of the Kalagala CFR to help offset impacts on Bujagali Falls, Mabira CFR and Jinja wildlife sanctuary, particularly those developments which have tourism or community development benefits.</p>	Enhancement planting and protection of the islands is expected to offset the initial loss of habitat	BEL will conduct periodic monitoring of success of the riparian margin planting programme. Follow up with ULC re: re-vegetation of all temporary land take areas.

Issue	Location	Mitigation Measures	Net Effects	Monitoring/Follow-Up
9. Effects on Tourism, White-water Rafting and Aesthetics				
9a. Inundation of Bujagali Falls and rapids below that form a portion of the white-water rafting (WWR) route	Jinja	<p>The existing WWR operators are re-designing their rafting routes to take advantage of rapids downstream of Dumbbell Island. BEL is also open to further consultations with WWR operators. BEL is working to enhance existing attractions and develop viable recreation/tourism alternatives.</p> <p>New raft launching facilities for WWR will be provided downstream of the dam. The location of these launch sites will be agreed upon by the WWR operators and BEL within one month of financial close. The launch sites will be constructed prior to Phase II of construction.</p> <p>BEL initiated programmes developed in consultation with affected stakeholders, including ongoing consultations to address identified issues are being set out in the PCDP, APRAP and CDAP.</p>	Permanent loss of the existing half-day WWR route; the 1 and 2 day routes will remain viable	No monitoring proposed
9b. Aesthetic Change to River Resulting from Reservoir Inundation and dam installation	Dumbbell Island to Tailrace of Nalubaale Facilities	BEL will construct a cultural centre near current Bujagali Falls. BEL will construct a visitor centre at dam site to explain how facility works and to allow long term pedestrian traffic on the dam from both banks of the river.	Significant change in aesthetics will result from inundation of the rapids and falls. The dam introduces a new industrial element into a primarily natural and rural landscape.	Ongoing consultation by BEL with operators on results of programme implementation
10c. Inundation of Bujagali rapids	Bujagali rapids	Relocation of resident spirits through transfer and resettlement ceremonies facilitated by BEL.	Short term disruption during relocation of spirits to new location	BEL and EPC Contractor to implement a public complaints and corrective action procedure

Issue	Location	Mitigation Measures	Net Effects	Monitoring/Follow-Up
10. Effects on Cultural Property				
10a. Inundation of household graves and amasabo	Within land acquisition area	Relocation as part of overall RAP programme through compensation payments by BEL. Remembrance service to commemorate those buried in the area. A structure or monument may be erected by BEL, either at site of remembrance or elsewhere, in accordance with wishes expressed by local communities.	Minor disturbance to individual households	No monitoring anticipated
10b. Inundation of dwelling sites of spirits important to the local community	Within land acquisition area	Minimise impact on cultural property through mapping and tagging of sites by the EPC Contractor. Relocation through carrying out transfer and settlement ceremonies.	Short term disruption during relocation of spirits to new location	BEL and EPC Contractor to implement a public complaints and corrective action procedure
10c. Inundation of Bujagali rapids	Bujagali rapids	Relocation of resident spirits through transfer and resettlement ceremonies facilitated by BEL.	Short term disruption during relocation of spirits to new location	BEL and EPC Contractor to implement a public complaints and corrective action procedure
10d. Potential for incoming employees to offend spirits	Project area	Preparation of Code of Practice. Cultural awareness training for incoming employees by the EPC Contractor.	Minor risk of serious effects	BEL and EPC Contractor to implement a public complaints and corrective action procedure
11. Impacts on Public Health				
11a. Spread of HIV/AIDS and other sexually transmitted diseases (STDs)	Site workers (all levels)	The EPC Contractor will bus labourers to site each day from Jinja and surrounding villages. A programme will be developed and implemented specifically to promote safe sex for the construction workforce. Family accommodation to be provided for expatriate workers including Third Country Nationals. EPC Contractor to distribute condoms at no cost to project workers.	The project is not expected to have a significant effect on prevalence or transmission of HIV/AIDS and other communicable diseases	BEL and EPC Contractor to maintain a record of each worker's orientation and HIV/AIDS awareness education. Maintain records of condom distribution programme.

Issue	Location	Mitigation Measures	Net Effects	Monitoring/Follow-Up
11b. Increased malaria risk to immigrant workers	Site workers (all levels)	Accommodation provided for immigrant workers will be screened, bed nets provided and insecticides will be made available for spraying the inside of houses. EPC Contractor to make malaria prophylactics available to immigrant work force at no cost. Training programme will include briefing on malaria risk and preventive methods, including behavioural.	Malaria risk managed effectively.	BEL and EPC Contractor to maintain a record of malaria incidence and follow up with additional interventions if appropriate..
11c. Increase in prevalence of vector born parasitic disease due to reservoir	Vicinity of Reservoir	The narrow, steep-sided valley of the impoundment will create significantly fewer vector breeding sites when compared with impoundments with extensive, shallow shorelines. Daily fluctuations of water levels will strand vectors, including mosquito larvae and snails, and to expose both the vectors (adults and egg masses) and potential breeding sites to the drying effects of the sun. Trees and shrubs will be cleared from the reservoir area by the EPC Contractor before inundation to remove potential anchorages for weed mats that are favourable habitat for snail vectors. The backwater created immediately downstream of the dam will be filled in using excess coffer dam material. Floating booms and mechanical removal will be used to control vegetation in any remaining backwater areas.	Minimal risk of increase in prevalence of vector born parasitic diseases	BEL to conduct regular monitoring for development of snail colonies along the banks of the impoundment, particular attention being given to those areas where there are comparative shallows and backwater, wherever there are colonies of water hyacinth or Nile cabbage, and where there is likely to be human water contact. Where necessary, floating vegetation will be eradicated by manual removal and disposal to land. Presence for incidence of the black fly vector for Onchocerciasis will be monitored at the spillway of the Dam.

Issue	Location	Mitigation Measures	Net Effects	Monitoring/Follow-Up
12. General Construction Related Issues: Public and Worker Health and Safety				
12a. Adherence to labour standards and well-being of construction workers	Dam site	EPC contractor will be required to adopt policies and procedures that comply with national legislation and address all aspects of labour standards relevant to the project as specified by IFC policies. Sub-contractors will be contractually required to comply with labour and health and safety legislation.	Rights of workers employed during construction phase will be respected	Contractor to keep accurate employment records. On-going monitoring by BEL of EPC contractor's performance. Investigation and corrective action for reported incidence of labour abuses.
12b. Public safety issues regarding: accidental contact with power lines, collision with construction equipment, quarry excavations, material storage	Active Construction Areas	The EPC Contractor will secure equipment and demarcate any excavations in such a way as to prevent accidents when construction not in progress; Keep non-authorised persons away from any construction activities/sites/yards/equipment; Fence critical areas and post warning signs with appropriate text and graphics; Begin educational programmes in schools and communities to educate people of hazards and safe practices.	Risk of serious injury or health effects managed to internationally acceptable levels.	The EPC Contractor to maintain records of any incidents, investigations and corrective actions.

Issue	Location	Mitigation Measures	Net Effects	Monitoring/Follow-Up
12c. Work related injury or health effects	All project areas	<p>The EPC Contractor will comply with relevant WB/IFC health and safety requirements, including specific provisions for:</p> <ul style="list-style-type: none"> • Introduction and use of poisonous or other chemicals injurious to health; • Handling dangerous goods and special waste; • Training; • Working environment committee; • Use of helmets; • Personal injuries and accidents; • Damage to material, equipment and buildings; • Poison treatment, chemical and fire injuries; • Safety audit; • Work done by hired personnel or firms; 	Risk of serious injury or health effects managed to internationally acceptable levels, and to meet all Ugandan standards and WB/IFC guidelines	EPC Contractor to complete Monthly Environmental Inspection report. the EPC Contractor to maintain records of inspections, incidents, investigations and corrective actions
		<ul style="list-style-type: none"> • Operating cranes; • Working with heat in confined places; • Corrective action; and; • Protective action. 		
12d. Drinking water for construction workers	Project site	A water treatment plant will be established within the permanent land take area (taking raw water either from aquifer or the River Nile)	No impacts anticipated.	EPC Contractor to maintain weekly water quality inspection forms during construction, and BEL to maintain during operation, unless site is connected to municipal supply.

Issue	Location	Mitigation Measures	Net Effects	Monitoring/Follow-Up
13. General Construction Related Issues: Management of Hazardous and Contaminating Material				
13a. Potential for microbial contamination of surface water and soil	Construction site	<p>A Waste Management Programme will be developed by the EPC Contractor as part of the SEAP including:</p> <ul style="list-style-type: none"> • Provision of an appropriate number of toilets at worksites; • Sewage system will be designed to accommodate the sewage level at the site; • Treatment to NEMA standards of effluent (defined as ‘foul water arising from the sanitary system and any process water’) at the site; and, • Training construction employees on project sanitation practices. 	Minimal risk of environmental or human health impacts. NEMA and WB/IFC standards for effluent quality will be met.	Construction effluent shall be monitored daily by the EPC Contractor at the discharge point to the receiving water. Operational effluent to be monitored monthly. Additional treatment to be provided if NEMA standard breached. Monthly Environmental Inspection report completed.

Issue	Location	Mitigation Measures	Net Effects	Monitoring/ Follow-Up
13b. Environmental contamination from spillage or disposal of fuels, lubricants, oils and solvents on the construction site	All construction sites	<p>The EPC Contractor shall dispose of materials defined as hazardous waste (e.g. hydraulic oil) in a responsible way, and where reasonable, shall return such materials to the manufacturer for recycling. The risk of release of contaminating material will be reduced through implementation and enforcement of the Pollutant Spill Contingency Procedures of the EPC Contractor's Action Plan, including:</p> <ul style="list-style-type: none"> • Prohibition of dumping of any contaminating material product into the environment/onto the ground, including waste oils, in accordance with NEMA regulations; • Storage and routine handling of fuels, lubricants, and other potentially contaminating substances in a weather-protected area equipped with a secondary containment system for spills; • Storage areas shall be designed such that they will contain 110% of the largest container/vessel stored in the storage area; Have available on-site all equipment and materials required to execute a clean-up; • All wastes recovered during cleanup operations to be collected and stored for subsequent disposal; • Supply agreement will include responsibility for supplier to take waste oil; 	Negligible risk of significant contamination	Monthly Environmental Inspection form to be completed by the EPC Contractor.

Issue	Location	Mitigation Measures	Net Effects	Monitoring/ Follow-Up
		<ul style="list-style-type: none"> The EPC Contractor will verify each supply/disposal subcontractor(s) has adequate arrangements or facilities for proper disposal, treatment or recycling of these wastes; and; Personnel will be educated on proper use and disposal of hazardous materials. 		
14. General Construction Related Issues: Management of Solid Waste				
14a. Visual and environmental contamination from improper disposal of solid wastes. Air pollution from on-site burning of solid waste.	Construction site	<p>The EPC Contractor will manage solid waste according to its WMP. In addition, the following management measures may be implemented:</p> <ul style="list-style-type: none"> Waste management training for all workers; The EPC Contractor shall identify a suitable site for the disposal of solid waste from messing facilities and construction activities in general in agreement with the District Council and shall ensure that such a site is used properly; Wood etc. e.g., cable reels, may be sold for a nominal fee to local persons; Burning will be used as a last resort and only when material cannot be disposed of at a licensed disposal location. Burning will not occur within the wayleave, but at the hydropower station under controlled combustion; and; Only dry, clean-burning material (wood, cardboard, paper, dry vegetal material) will be burned. 	Minor short-term decrease in air quality. Minor incremental impacts on soil, groundwater, and surface water at municipal disposal location due to improper storage.	Monthly Environmental Inspection form to be completed by the EPC Contractor.

Issue	Location	Mitigation Measures	Net Effects	Monitoring/ Follow-Up
15. General Construction Related Issues: Soils and Agriculture				
15a. Topsoil compaction, rutting and mixing from: grading, excavations and transportation of equipment, concrete and steel.	Construction site, access roads.	The EPC Contractor will strip and store topsoil separated from subsoil for major excavations; In agricultural areas, movement of heavy equipment will be restricted during wet-soil conditions to prevent sub-soil compaction; Rehabilitation of exposed soils following the EPC Contractor's Reinstatement Plan.	Short term loss of agricultural productivity of disturbed soils	Following construction, the EPC Contractor to check for compaction on cultivated soils and remediate as necessary.
15b. Erosion of soils on steep slopes disturbed by excavation	Steep slopes along extent of transmission lines	Steep slopes to be identified on the "Detailed sensitivities mapping". Where practical, steep slopes will be avoided by the EPC Contractor; Areas susceptible to erosion shall be properly sloped and compacted to reduce the effect of runoff and shall be seeded immediately	Minor decrease in slope stability due to initial site and access preparation. No long-term net effects with proper construction and remediation measures.	Periodic inspection by the EPC Contractor of steep slopes during construction and rehabilitation measures following construction.
15c. Loss of agricultural land		Project Affected People have been compensated for loss of agricultural revenue. The District Agricultural Officers (DAOs) in Jinja and Mukono are running extension services covering both banks. Of particular relevance to the Bujagali project is the erosion control programme. This programme will be supported by BEL if erosion increases as a result of the hydropower facility project. BEL proposes to provide funds for the establishment of demonstration plots to demonstrate good husbandry and appropriate measures to minimise erosion.		

Issue	Location	Mitigation Measures	Net Effects	Monitoring/ Follow-Up
16. General Construction Related Issues: Air Quality				
16a. Impaired air quality from exhaust of heavy equipment, motor vehicles and other equipment with internal combustion engines	Transportation routes, construction sites	<p>The following measures may be utilised by the EPC Contractor to control exhaust emissions:</p> <ul style="list-style-type: none"> • Maintain equipment in good running condition – no vehicles to be used that generate excessive black smoke; • Enforce vehicle load restrictions to avoid excess emissions from engine overloading; and, • Where practical switch off engines when not in use. 	Short-term, localised effects on air quality	The EPC Contractor to make spot visual inspections of exhaust and vehicle loads Instrumental monitoring of particulates/SO ₂ /NO ₂ outside site boundary. Monthly Environmental Inspection report to be completed. the EPC Contractor to maintain records of corrective action taken.
17. General Construction Related Issues: Archaeological Sites				
17a. No archaeological sites identified during a 2006 survey within dam system vicinity	An archaeological site(s) may be uncovered during excavation.	BEL will ensure that the site will be walked by an archaeologist upon approval of the SEA and prior to construction. Mitigation measures to be agreed upon by Ministry of Tourism, Wildlife and Antiquities (MTWA) and the EPC Contractor. Prior to construction, the EPC Contractor will undertake detailed environmental mapping of the hydropower facility site and borrow pits (including any sand sources utilised outside of the project area) and identify (in consultation with BEL and relevant authorities which may include the District Forest Officer or District Environment Officer) sensitive areas to be avoided, trees to be marked for preservation, etc. The unearthing of archaeological remains will be monitored during excavation. The EPC Contractor will seek the advice of the Department of Antiquities as to the type of relics that might be found in the area, and include a briefing on this issue within the training	Any discovered archaeological features will be thoroughly excavated and studied.	BEL/EPC Contractor to ensure that workers receive training on importance of archaeological sites and how to identify. Finds to be included in Monthly Environmental Report.

Issue	Location	Mitigation Measures	Net Effects	Monitoring/ Follow-Up
		programme for construction workers. Construction workers will be vigilant to such relics during excavation. The SEO and Environmental Manager will report any relevant finds to the Department of Antiquities, who will advise on measures to be taken to ensure their preservation.		
18. General Operation Issue: Public and Worker Health and Safety				
18a. Risks to the public associated with the operation of the hydro station.	Dam site	In-water booms will be utilised by BEL to prevent boaters, other recreational users, and local persons from entering into the near-structure headpond area. Land access will be controlled through gated/monitored access roads. Automated surveillance systems will also be incorporated into the design of the hydro station and its ancillary facilities. Where appropriate, warning signs may be posted to warn both land and water users of the hydro station and its ancillary facilities.	No significant danger to public safety is anticipated.	Periodic checks by the BEL maintenance technicians associated with the Dam, Penstock, Gates, and Valves systems team.
18b. Health and well-being of station staff.	Facility Site	The EPC Contractor will design an occupational health and safety programme (OHSP), which addresses all aspects of worker health and safety relevant to the operation of the hydro facilities. If deemed necessary by BEL, a facility-specific safety manual may be designed.	Staff who adhere to the OHSP should be able to work at the hydro station for an indefinite period of time without experiencing any chronic health problems. Risks and hazards to workers and chance of lost-time accidents minimised to internationally acceptable levels	BEL to conduct on-going monitoring of employee health status. Investigative/corrective action taken on all lost time incidents

Issue	Location	Mitigation Measures	Net Effects	Monitoring/ Follow-Up
19. General Operation Issue: Management of Hazardous and Contaminating Material				
19a. Release of waste oil, hydraulic fluid, paints, solvents, and similar materials into the environment.	Site area and disposal location	EPC Contractor shall ensure storage areas shall be designed such they will contain 110% of the largest container/vessel in the storage area. The EPC Contractor will develop a facility-specific Spill Prevention, Control, and Contingency Plan, which outlines hydro station design features, spill prevention, and control procedures On-site dumping or burial of any potentially contaminating waste product will be strictly prohibited. All other potentially contaminating wastes will be recovered in sound, properly labelled containers and disposed of off-site at the appropriate facilities where available. Training of personnel who operate systems that use potentially contaminating materials	Limited/negligible risk of significant contamination	On going monitoring by BEL operational staff to ensure effective separation of inert solid waste from potentially contaminating hazardous waste
20. General Operation Issue: Management of Solid Waste				
20a. Incremental effect at disposal location.	Local landfill	Implementation of good site practices by BEL operational staff consisting of: <ul style="list-style-type: none"> • Systematic collection and protected storage on-site; and; • A waste management programme consisting of reduction, reuse, and; recycling of materials where possible. 	Minor incremental impacts on soil, groundwater, and surface water at municipal disposal location.	On going monitoring by BEL operational staff to ensure effective separation of inert solid waste from potentially contaminating of hazardous waste

Issue	Location	Mitigation Measures	Net Effects	Monitoring/ Follow-Up
21. Cumulative Effects				
21a. Cumulative effects of the proposed hydropower facility on ecological and social conditions, aesthetics, and land development patterns	Victoria Nile River basin	Recent analysis has not identified a consensus on cumulative effects. If some such conclusions were to emerge, then the details of mitigation and optimisation measures associated with the preferred project(s) would need to be worked out in order to assure that the cumulative effects of the development(s) on the basin and region were controlled and managed within acceptable limits. The measures presented in this SEA provide the Bujagali project's commitments to date to advancing that process	The Bujagali project's cumulative effects appear to be intermediate between those of Kalagala and Karuma, the two other prime hydropower projects under recent, serious consideration, suggesting that Bujagali might proceed without excessive effects on environmental and social resources upstream of Lake Kyoga on the Victoria Nile system.	BEL report on status of mitigation measures taken in yearly progress report.
22. Local Community and Developmental Benefits				
22a. Allocation of benefits of the project to local, host communities	Directly affected villages and greater Jinja area	BEL to implement a Community Development Action Plan to ensure local communities derive benefits associated with: <ul style="list-style-type: none"> • Health services; • Employment opportunities; • Water supply; • Electricity; • Fisheries; • Training and Financial Services; • Education; • Tourism; and, • Community Resources. 	A significant net positive effect on socio-economic conditions is expected in the directly affects villages	BEL will encourage local business leaders to form a project liaison group to assist BEL in monitoring local procurement practices

Issue	Location	Mitigation Measures	Net Effects	Monitoring/ Follow-Up
23. Macro Economic Benefits				
23a. Creation of macro economic benefits to Uganda	Uganda	Development of the project in accordance with the corporate policies of BEL corporation and in adherence with the Implementation and Power Purchase agreements entered into between BEL and the Government of Uganda	Development of the project is expected to result in: <ul style="list-style-type: none"> • Reduced electricity rationing and associated negative effects; • Increase in investment and national income; • Increase in export revenues; • Implementation of rural electrification programmes; and, • Lower energy costs to the consumer. 	No monitoring anticipated

8.0 Social & Environmental Action Planning

The management and monitoring actions proposed to avoid or minimise impacts during construction and operation of the Bujagali Hydropower Project were identified and detailed in Chapter 7 of this SEA. This chapter presents the framework for implementing the management and monitoring requirements within the framework for a Social and Environmental Action Plan (SEAP) that will be developed for the project. The SEAP will be completed in the period between public disclosure of the SEA Report and the start of construction.

At the time this SEA was written, certain detailed planning and design activities relevant to the SEAP were still to be completed. Thus, this section describes the SEAP at the level of detail available at the time of writing. When the detailed activities are completed, they will be integrated within the framework of the SEAP to be prepared by BEL. Currently, the SEAP framework presented herein addresses the following key components:

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

8.1 Environmental Management

BEL is the project sponsor and will have overall responsibility for design and building of the Hydropower Facility. BEL will own and operate the hydropower facility for a 30 year period, after which time ownership will be transferred to the GoU. BEL is in the process of selecting a contracting consortium, which will construct the hydropower facility on an Engineer, Procure and Construct (EPC) basis.

As Project Sponsor, the ultimate responsibility for the project's compliance with Ugandan and international lender legislation and guidelines for environmental and social performance will lie with BEL. However, day-to-day responsibility for implementing environmental and social mitigation, compensation and monitoring actions will in many cases be devolved to the EPC Contractor or to third parties.

The specific means by which Environmental Management will occur during the construction phase will be finalised upon appointment of the EPC Contractor. However, it is possible to outline BEL's planned environmental management team structure, and means for implementing actions which it will be the responsibility of BEL to implement. It is also possible to outline the general environmental management framework under which the EPC Contractor will be required to operate. While specific methods which are envisaged will be used by the EPC Contractor to

carry out its responsibilities may also be provided (and are, below), it must be recognised that specific implementation methods are likely to be modified by the EPC Contractor on appointment. A Change Management System is therefore proposed, by which such changes will be documented and if necessary, input sought from NEMA and international lenders, prior to being implemented.

The SEAP will address both the construction and operational phases of the hydropower facility for a 30-year period, until UEGCL, or its successor, assumes ownership and responsibility of the hydropower facility. As such, the SEAP is intended to be a living document, to be updated and revised as appropriate. BEL will continue to meet its social responsibilities for an additional 5 years after the hydropower facility is handed over to UEGCL (or its successor). In other words, BEL's support to community development projects, which has commenced in 2006 will cover a period of at least 40 years. BEL is committed to executing its responsibilities in an environmentally responsible manner and in compliance with all applicable environmental laws, regulations, and guidelines.

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

A significant percentage of the unskilled labour force during the construction phase is expected to originate from villages within the project area. The EPC Contractor will implement a Local Training Programme that is intended to provide local unskilled, unemployed persons the skills necessary to be hired to work on the hydropower project.

BEL is committed to the creation and implementation of programmes to reduce the probability of occurrence of deleterious environmental incidents. Contingency plans will be developed for dealing with such adverse incidents, if they occur.

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

8.2 Relationship of the SEAP to Other Project Plans

The SEAP is an umbrella plan that is comprised of several components that are to be integrated and implemented by BEL and the EPC Contractor with regard to the Bujagali Hydropower Facility. These components are shown in Figure 8.1 below.

While this SEA includes working versions of three of the Sponsor's Action Plans (namely the PCDP, the APRAP and the CDAP), those which are the responsibility of the Contractor, and those of the sponsor not included herein will be developed after an EPC Contractor has been appointed. However, outline requirements for these action plans are provided in Section 8.4 below.

8.3 Sponsor's Action Plans

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

8.3.1 Regulatory and Management Framework

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

The Management Framework will include a Change Management process, whereby proposed changes to social and environmental management procedures are reviewed and assessed prior to being implemented, and a comprehensive register of such changes is kept. Further detail on the Change Management process is provided in Section 8.5.6.

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

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Figure 8.1 SEAP Component Plans

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8.3.2 Public Consultation and Disclosure Plan (PCDP)

A PCDP has been developed in order to bring continuity to the consultation and disclosure process that has been completed to date, as described in Chapter 6 of this SEA Report. The PCDP and the results generated by it to date have been used to guide the impact assessment and mitigation measures outlined in Chapter 7. The PCDP is provided as Appendix H.

Specific elements of the PCDP are described in Chapter 6, and will continue to be executed by BEL, based upon the schedule set out in the PCDP, throughout the construction and operational phases of the project's life. Where appropriate, the relevant component plans of the SEAP will be updated by BEL based upon the outcome of future consultation and disclosure activities.

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

8.3.3 Assessment of Past Resettlement Activities and Action Plan (APRAP)

The APRAP, copy of which is provided as Appendix I to this SEA, includes an assessment of the past resettlement activities that were carried out by AESNP, describes any shortcomings that have been highlighted by this assessment, and sets out measures to be implemented by BEL and others for correcting these shortcomings.

8.3.4 Community Development Action Plan (CDAP)

In order to minimise, compensate and mitigate effects on the wider project-affected community, BEL will implement the Community Development Action Plan (CDAP) provided as Appendix J to this SEA Report. This will include procedures to deal with cultural property issues as identified in Chapter 7 of this SEA Report. The CDAP outlines the measures to be carried out to ensure that the affected community as a whole will benefit from the presence of the project. These measures are intended to go above and beyond direct compensation for lost assets, and include strengthening of health and educational services in the area, and provision of water and electricity supplies.

The CDAP was developed based on an audit of the implementation of the Resettlement Action Plan, and consultations with affected communities. Where further revisions are required, based upon stakeholder comments or ongoing

monitoring and consultation, they will be incorporated into the CDAP through the Change Management process outlined in Section 8.5.6.

8.3.5 Labour Force Management Plan (LFMP)

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

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

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

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

8.3.6 Emergency Response and Preparedness Plan (EPRP)

BEL will prepare an EPRP, which will assess the risks and impacts from project activities, set out the methods for dealing with emergencies arising during both construction and operation, and particularly those with potential effects on the neighbouring and wider communities, i.e. persons not directly involved with the

project. The EPRP will also set out the means by which these measures will be communicated to affected communities in a culturally appropriate manner..

8.3.7 Environmental Mitigation & Monitoring Plan (EMMP)

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

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

8.4 Contractor's Action Plans

The controlling documents for all of the EPC Contractor's activities (including environmental responsibilities) will be its Action Plans. While the Sponsor's Action Plans are reasonably well developed at the time of writing, an EPC Contractor has not yet been appointed and thus, the Contractor's Action Plans are conceptual. This framework is described in the sections which follow. It is intended that once the EPC Contractor has been appointed, this framework will be taken and developed into a stand-alone Action Plan which will be complementary to the Sponsor's Action Plan, but will form a component of the overall SEAP for the project. The EPC Contractor's Action Plan will be comprised of a set of method statements covering all critical construction and environmental management tasks.

The key components of the Contractor's Action Plan are outlined in the following sections.

8.4.1 Traffic/Access Management Plan (TMP)

The EPC Contractor will produce a Traffic Management Plan (TMP) that contains appropriate strategies for moving materials and persons to, from and within construction areas, including abnormal loads. It will also contain provisions for management of connection points between site access roads and the main public highways, and for any upgrading work to be carried out. Specific traffic management

measures will include, but not be limited to, those provided in Chapter 7 of this SEA Report.

The TMP will also specify the procedures for monitoring construction-generated traffic movements, and associated environmental problems.

8.4.2 Waste Management Plan (WMP)

The EPC Contractor will produce a Waste Management Plan (WMP), for dealing with waste generated as a result of construction. The WMP will specify provisions for disposal, re-use or recycling of solid waste, hazardous waste, foul and process water. Specific waste management measures will include, but not be limited to, those provided in Chapter 7 of this SEA Report.

8.4.3 Pollutant Spill Contingency Plan (PSCP)

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

8.4.4 Contractor's Labour Force Management Plan

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

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

Under the Contractor's LFMP, the EPC contractor will:

- Commit, where requested, to provide a copy of employment registers and records including details of hours/overtime worked, wages paid and the employment status of workers, both those employed directly and indirectly;
- Assume primary responsibility for day-to-day monitoring of the implementation of labour standards requirements placed by project financiers on the Project Proposer (BEL) and thereby designate a manager who is responsible for ensuring labour and health and safety legislation is complied with, both in the direct and indirectly-employed workforce (namely, sub-contracted labour);

- Provide or ensure that training is carried out on health and safety issues with regard to all workers, direct and indirectly employed;
- Put in place a mechanism for checking the age of workers;
- Carry out risk assessments in relation to all employees who are under the age of 18;
- Put in place a worker grievance mechanism and details of any complaints lodged under the procedure in the last year;
- Undertake to inform BEL – and thereafter the project financiers – of all serious accidents that take place in relation to the project; and,
- Provide BEL – and thereafter the project financiers – with sample copies of payslips for direct and sub-contracted workers indicating payment of wages and social security contributions.

8.4.5 Hazardous Materials Management Programme

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

8.4.6 Health and Safety Management Plan

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

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

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

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

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

The monitoring component of the EMMP will identify:

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

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

8.5 Implementation of the Social and Environmental Action Plan

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

8.5.1 BEL's Commitments and Resourcing

In order to discharge its commitments with respect to management of biophysical impacts of the project, BEL will designate a suitably qualified and experienced Environmental Manager. The Environmental Manager's key responsibilities will include the following:

- Point of contact for the EPC Contractor's Site Environmental Officer;
- Ensuring that all environmental protection procedures are followed as planned;
- Review and approval of the Environmental components of the Construction Contractor's Project Plan;
- Auditing the CEMMP;
- Liaison with members of the public, local organisations and governmental and non-governmental organisations;
- Liaison with other businesses potentially affected by the project; and,

- Reporting results of mitigation and monitoring activities to NEMA, the lenders and other applicable parties.

The Environmental Manager shall report directly to BEL's Implementation Manager, and will be provided with sufficient support staff and facilities to allow all of BEL's environmental commitments to be discharged appropriately. The Environmental Manager and his team will be members of the overall Implementation Team for the project. The planned structure for the overall Implementation Team is outlined in Figure 8.2. Further details of the staff required for implementation of compensation, resettlement, cultural property management and community development plans are provided in the relevant subsections of the SEAP.

Biophysical impacts and mitigation activities fall into two broad areas: the construction environment and the operational environment. A Task Manager will be appointed to deal with each of these. Construction environment issues are those short-term issues arising directly from construction activities, e.g. traffic, noise, air quality and waste issues, and will be managed by the Construction Environment Task Manager. The Operation Environment Task Manager will be responsible for management of long-term and non-construction related issues including fisheries and agriculture.

The Community Liaison Manager will be responsible for implementing the ongoing consultation and resultant SEAP development requirements during project construction and operation.

Staff requirements for management of interconnection project issues are outlined in the separate SEAP for the interconnection project. However, it is envisaged that as UETCL's Authorised Agent for the Interconnection Project, BEL will provide staff with environmental management responsibilities during the construction and commissioning phases. It is anticipated that these will be mobilised as part of an Environmental Team covering both the hydropower and interconnection projects.

Details of activities to be carried out by the Socio-Economic Environment Team are provided in the APRAP, and CDAP, which are provided as Appendices I and J.

8.5.2 EPC Contractor's Commitments and Resourcing

The EPC Contractor will designate an appropriately experienced and qualified Site Environmental Officer (SEO), who will be responsible for implementation of the measures set out in the Contractor's EMMP. The SEO's key responsibilities will include the following:

- Ensuring that all environmental protection procedures are followed;

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Figure 8.2 Sponsor's Implementation Team Structure (Indicative)

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- Co-ordination of environmental monitoring of site-related activities required to discharge the EPC Contractor's obligations;
- Liaison with and reporting to the Environmental Manager;
- The monitoring of hazardous substances on-site to ensure that the possibility of accidental release is minimised;
- Ensuring, where appropriate, that monitoring equipment required for the execution of the obligations of the EPC Contractor are calibrated and maintained as required;
- Promoting on-site environmental awareness;
- Liaison with other businesses and industry; and,
- Maintaining an Environmental Management System based on ISO 14001.

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

The proposed structure of the EPC Contractor's Environmental Department (to be headed by the SEO) is outlined in Figure 8.3. The Environmental Field Inspectors will be appointed during the mobilisation phase, and will be local staff with relevant environmental/engineering experience, who are fluent in local languages. The number of field inspectors may be adjusted upwards according to the environmental issues on-site.

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

8.5.3 Reporting Lines and Decision-Making

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

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

On a quarterly basis, the SEO will provide the Environmental Manager with a report containing monitoring results (and a summary of these), a synopsis of environmental issues encountered, and the efficacy of solutions to these issues. The Environmental Manager will use these as the basis for BEL's quarterly environmental reports. BEL's quarterly reports will also include commentary on the implementation and efficacy of environmental mitigation actions implemented by BEL.

Figure 8.3 EPC Contractor's Environmental Team Structure (Indicative)

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

A limited number of hard copies of the quarterly reports will be made available to local stakeholders at BEL's Jinja and Kampala offices. In addition, BEL will post the reports on its website (www.bujagali-energy.com). All monitoring and reporting documents will be kept on file for the life of the project, and will not be disposed of without permission from NEMA.

8.5.4 Social and Environmental Auditing and Reporting

Auditing of the environmental compliance of the project will be carried out at two levels: internal and external.

BEL will carry out annual internal audits of its compliance with the requirements of the SEAP, and any other environmental requirements, such as those imposed by NEMA and/or the international lenders. The responsibility for implementing these audits will lie with the Environmental Manager, who may elect to employ external consultants.

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

It is a requirement of NEMA and the lenders that annual environmental reports ('self-auditing') be submitted for review. The Environmental Manager will be responsible for compiling and submitting these reports, and will consult with NEMA to determine any additional mitigation measures or monitoring that is considered to be required. Self-audit reports will be compiled from internal and external audits carried out by both BEL and the EPC Contractor. It should be noted that the EIA Regulations and the National Environment (Audit) Regulations require the names and qualifications of persons carrying out 'self-auditing' to be approved by the Executive Director of NEMA, and for these persons to be duly certified by NEMA before commencing work. Therefore the Environmental Manager and the SEO will have to be approved by NEMA before official appointment.

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

will be submitted to the Social and Environmental Review Panel and Social and Environmental Panel of Experts (see below) for review and feedback.

8.5.5 Social and Environmental Oversight

The project will have ongoing accountability to, and will be monitored by, both the lenders and NEMA (the latter via the District Environmental Officers for Jinja and Mukono). However, in order to ensure that issues are identified early, and resolved in an equitable fashion, BEL undertakes to support independent oversight of the project at several levels, as follows, and described in further detail below.

- Social and Environmental Panel of Experts; and,
- Dam Safety Review Panel.

Social and Environmental Panel of Experts

It is a requirement of lender policies that the Project Sponsor engages a Social and Environmental Panel of Experts (PoE), to provide ongoing oversight of compliance with the relevant Safeguard Policies and Performance Standards. BEL is in the process of engaging the PoE for the Bujagali project. Terms of Reference for the PoE are provided in Appendix G.4.

Dam Safety Review Panel

Under World Bank Group policies, BEL is required to assemble a Dam Safety Review Panel (DSRP) acceptable to the World Bank Group. At financial close, BEL will develop a Terms of Reference and assemble a 3-member DSRP. Although not strictly a “Social and Environmental” panel, it is appropriate to describe its function here.

The panel’s mandate will be to review the investigation, design and construction of the proposed Bujagali hydro dam and the start of its operations. The panel will include recognised experts with expertise in technical fields relevant to the safety aspects of the proposed dam. The main functions of the panel will be to review and advise BEL on dam safety matters and other critical aspects of the dam, its structures, catchment area, reservoir surroundings and downstream areas (World Bank, 2001). BEL may request the panel to provide expert review of associated issues such as the safety of the power generation facilities, river diversions during construction, the implications on safety of the upstream dams – Nalubaale and Kiira, and potential effects of a failure at either of these facilities on the Bujagali Dam.

8.5.6 Change Management

During the implementation of the project, change may be required to address unforeseen or unexpected conditions or situations. A change management process

will be applied to ensure environmental and social issues are addressed as part of any significant changes to project procedures, processes, design or activities. Both BEL and the EPC Contractor will be responsible for managing changes within their respective areas of responsibility. BEL will incorporate into its Action Plan, and the EPC Contractor will incorporate into its Action Plan, a change management process similar to the following:

- Identification of item/situation potentially requiring change;
- Preparation of a Change Request Document that;
 - a. Outlines the nature of the item/situation requiring change;
 - b. Outlines impacts of the change (e.g., cost, schedule, safety, operability); and,
 - c. Identifies potential biophysical, socio-economic, or health concerns.
- Review of the Change Request for compatibility with BEL's or the EPC Contractor's Action Plan, as applicable;
 - a. At the task manager level for minor changes;
 - b. By the Social and Environmental Review Panel for significant changes; and,
 - c. Review by NEMA and international lenders for significant changes, to confirm it will not compromise ongoing compliance with Ugandan regulations, nor with lender policies and performance standards.
- Documentation of the approval or rejection of the change request;
- Application for, and receipt of, any approvals required to effect the change under Ugandan Law;
- Implementation of the approved change, including communication to appropriate parties concerning the nature, scope, and timing of the change; and,
- Summary of project changes and status to be included in quarterly reports to the Social and Environmental Review Panel, NEMA and lenders.

8.6 Responsibilities and Costs for Environmental Mitigation Measures

Table 8.1 below outlines the overall package of environmental mitigation measures that will be implemented in relation to the Bujagali hydropower facility (as outlined in detail in Chapter 7). The table also assigns general responsibilities for implementing each group of mitigation measures. A detailed implementation schedule will be developed once the EPC Contractor is selected, and it will be submitted as an SEA update.

Consistent with the Bujagali Project's contracting strategy of integrating environmental protection and mitigation activities into the EPC Contractor's Scope of Work, the specifications for many of the activities were included in the bid package upon which the EPC Contractor is developing its base rates. Therefore, since many of the costs associated with environmental protection and mitigation activities are included in the EPC Contractor's base rates, it is not possible to present a detailed accounting of all the monies devoted to the project's construction phase environmental protection and mitigation activities. These costs are therefore described as 'Within EPC contract budget' in Table 8.1. Similarly, mitigation or

monitoring measures that will be carried out by BEL staff, with no additional expenditure required, are described as ‘Within operational budget’ in Table 8.1.

Table 8.1: Responsibilities, Timing and Budgets for Social and Environmental Actions

Issue	Action/s	Timing	Responsibility	Estimated Cost (USD)
Staffing for SEAP Implementation	Recruit SEAP Implementation Team	Months 1-3 after Financial Close	BEL - Implementation Manager	1,125,000
Social and Environmental Oversight – International Lenders	Appoint S&E Panel of Experts	Prior to Financial Close	BEL - Implementation Manager	300,000
Dam Safety	Appoint DSRP	Prior to Financial Close	BEL - Implementation Manager	450,000
Resettlement Corrective Actions	Implement APRAP	Year 1 after Financial Close	BEL – Social Unit	497,000
Community Development	Implement CDAP	Throughout Construction Phase	BEL - Social Unit	3,817,000
Public Consultation/Community Liaison	Implement PCDP	Throughout Construction Phase	BEL - Community Liaison Manager	Included in salary for SEAP implementation team
Labour Force Management	Develop Sponsor’s LFMP	Months 1-3 after Financial Close	BEL – H&S/HR Managers	20,000
Labour Force Management	Develop EPC Contractor’s LFMP	Months 1-3 after appointment	EPC Contractor	Within EPC contract price
Mitigation of biophysical impacts – not construction-related	Implement Sponsor’s EMMP	Preconstruction	BEL (Environmental Manager)	321,000
		Construction Phase	BEL (Environmental Manager)	1,476,200
		Operations Phase (first 2 years)	BEL (Environmental Manager)	361,880
Mitigation of biophysical impacts –construction-related	Implement Contractor’s EMMP	Throughout Construction Phase	EPC Contractor (SEO)	Within EPC contract price
Institutional Strengthening (Plant and Environmental Management within UEGCL)	Assess need prior to handover to UEGCL.	Years 29 and 30 of BEL’s concession.	BEL	TBD (funded from Bujagali HPP operating budget)

8.7 Responsibilities for Environmental Monitoring Measures

Chapter 7 of this SEA Report outlines the monitoring requirements for the project. An Environmental Management and Monitoring Plan (EMMP) will be developed as part of the SEAP that details the specific procedures to be carried out. The EMMP

will also assign responsibilities for each monitoring activity, and specify the parties who are capable of carrying out the monitoring, on behalf of the responsible body.

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

8.8 Institutional Strengthening

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

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

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

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

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

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

- Monitor the effectiveness of institutional strengthening measures, and carry out any further measures as required.

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

8.8.1 Uganda Electricity Generation Company Limited (UEGCL)

After 30 years, ownership of the hydropower facility, together with responsibility for environmental management, will be transferred from BEL to UEGCL or its successor organisation. Prior to the transfer, UEGCL may need assistance to develop in-house expertise to operate and maintain the facility. A programme will be put in place well in advance of the transfer to ensure UEGCL has the capability to assume ownership and operational responsibility for the facility.

8.8.2 National Fisheries Resources Research Institute (NAFIRRI)

Although NAFIRRI is mandated to carry out fish stock assessment, the monitoring programme that has been recommended here is outside the scope of its routine monitoring activities. Discussions with NAFIRRI have indicated that although the Institute has sufficient staff and expertise to carry out the recommended programme, some specialised sampling equipment will need to be purchased. Some fishing equipment has been provided already as part of the baseline surveys, and further support of this nature will be required for operations. Further discussions are required with NAFIRRI to establish their capability vis-à-vis the monitoring plan.

8.8.3 Directorate of Water Development - Water Resources Management Department

DWD has been the beneficiary of European Union funding which has supported the Water Resources Assessment Programme. While primarily concerned with compiling a national inventory of surface and ground water resources, this project has also funded the establishment of an international-standard testing laboratory at Entebbe. DWD now has the capability to carry out all of the monitoring exercises that have been assigned to it under the EMMP. The laboratory operates on a commercial basis, and will require payment per sample analysed. The estimated costs presented in the EMMP are based on quotations for analyses provided by DWD management, and will be met by BEL. It is understood that no additional funding is required to strengthen capacity within DWD.

8.8.4 District Health Offices/Vector Control Units

In Mukono District, screening of patients for schistosomiasis and other vector-borne diseases is currently carried out at the Nyenga Mission Hospital, near Njeru. Mukono DHO has indicated that it would like to take over this screening role as part of the

EMMP, but is precluded from doing so by lack of a few basic pieces of equipment (e.g. a microscope). Mukono DHO will be assisted in obtaining the necessary equipment. A budget for equipment is included in the cost estimates for disease and vector monitoring.

The Vector Control Unit in Jinja works closely with the DHO in monitoring vector and disease incidence in the district. No additional staff resources will be required to undertake the monitoring recommended in this EMMP. However, there is a requirement for financial assistance to obtain specialist field equipment and to cover fuel costs and daily staff allowance. The provisional budgets that have been set out in this SEA report are based upon initial consultation with the District Vector Control Officer. Further consultation will be undertaken to confirm the specific equipment needs and to establish the capabilities of staff to operate and maintain the equipment.

8.8.5 District Environmental Offices

DEOs in Jinja and Mukono report they have sufficiently qualified senior staff to deal with the environmental aspects of the project. However, as considerable field visits and consultation with residents may be required during the construction phase, it may be necessary for one or more administrative assistants to be employed by these organisations. BEL will consult further with the DEOs to ascertain their specific needs and capabilities.

8.8.6 Health Centres

Through consultations, BEL has confirmed that the existing health centres in the area of the hydropower facility are inadequate to meet required needs. BEL is in the process of enhancing the existing health centres at Naminya on the west bank and Ivunamba on the east bank. Measures proposed to support these centres are set out in the Community Development Action Plan, which is a component of the SEAP.

8.8.7 NFA

The NFA offices in Jinja and Mukono have reported that they have adequate numbers and calibre of staff to advise on conservation and restoration of forest areas associated with the project. However, the NFA expects the developer to meet the cost of planting borrow areas, river banks and islands with indigenous vegetation. The cost for these has been incorporated into the cost estimates presented herein.

8.8.8 District Agriculture Offices

The District Agricultural Officers in Jinja and Mukono run extension services covering their respective banks of the Nile. Of particular importance for the project are the erosion control programmes operating in this area that will be able to assist the project. In the longer term, the Department will be able to advise on land

restoration, possible use of irrigation, and methods for increasing income-generating activities. An appropriate means for enabling the delivery agricultural extension services would be a Memorandum of Understanding between the District, the sub county, and the project Sponsor.

The Mukono District has access to funds via the National Agriculture Advisory Service (NAADS) programme, but this programme has not yet been extended to the Jinja District. The NAADS programme provides for employment of external service providers on a contract basis, to deliver agricultural extension services on behalf of the District. Because it has the ability to engage external service providers (once funds have been identified), no specific institutional strengthening needs have been identified for the Mukono District. However, in Jinja District, extension service delivery is the responsibility of District Agriculture Office staff. The institutional strengthening needs of both Districts will be re-assessed as part of the proposed agriculture extension programme. The proposed budget for the CDAP allows for recruitment and training of agricultural extension service providers.

8.8.9 National Environmental Management Authority (NEMA)

NEMA has a dedicated Environmental Impact Assessment group, which has full capability to assess EIAs, and to monitor the compliance of projects with environmental regulations. Consultations with NEMA has indicated that no strengthening of its capabilities will be required in order to oversee the environmental aspects of this project.

8.8.10 Uganda Wildlife Authority

The Uganda Wildlife Authority may be required to monitor the effects of the project on wildlife and wildlife habitat, and specifically the effects on habitat and wildlife within the Jinja Wildlife Sanctuary. From consultations with UWA during the development of this SEA, it is understood that UWA has sufficient capacity to carry out these tasks. However, BEL will consult further with UWA to ascertain the exact capabilities of the UWA to monitor project activities and administer its responsibilities in the Jinja Wildlife Sanctuary.

9.0 References

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