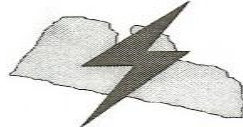


*Economic Community
Of West African States*



*Communauté Economique
Des Etats de l'Afrique de l'Ouest*

WEST AFRICAN POWER POOL
SYSTEME D'ECHANGES D'ENERGIE ELECTRIQUE OUEST AFRICAIN
General Secretariat / Secrétariat Général



ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT STUDY

on the MAN (Côte d'Ivoire) - SANNEQUILLE (LIBERIA) - NZÉRÉKORE (GUINEA) -
BUCHANAN (LIBERIA) - MONROVIA (LIBERIA) - BUMBUNA (SIERRA LEONE) - LINSAN
(GUINEA) INTERCONNECTION PROJECT

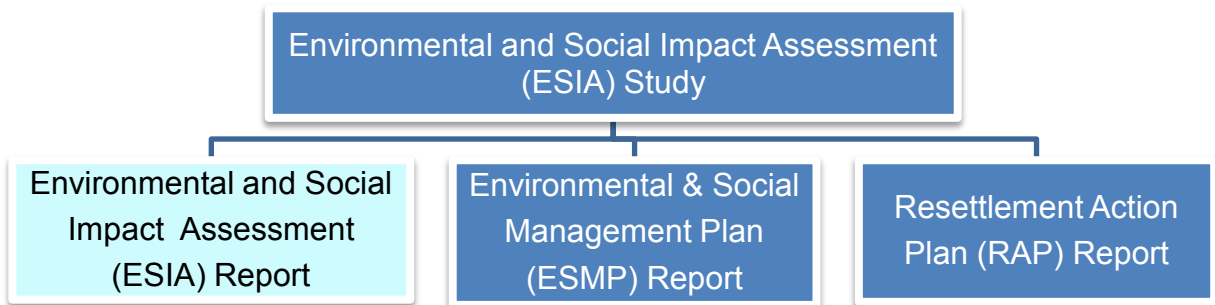


FINAL ESIA REPORT (LIBERIA SECTION)

December 2011



Organization of reports for Environmental and Social Impact Assessment (ESIA) Study



Environmental and Social Impact Assessment (ESIA) Report: This report contains the results of the Environmental and Social Impact Assessment (ESIA). The ESIA is a formal process to predict the environmental consequences of human development activities and to plan appropriated measures to eliminate or reduce adverse effects and enhances positive effects.

Environmental & Social Management Plan (ESMP) Report: This report contains the measures to be taken during the implementation and operation of a project to eliminate or offset adverse environmental impacts or to reduce them to acceptable levels, and the actions needed to implement these measures.

Resettlement Action Plan (RAP) Report: This report contains the resettlement action plan which is based on up-to-date and reliable information about the proposed resettlement and its impacts on the displaced persons and other adversely affected groups, and the legal issues involved in resettlement.

1

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List of Acronyms

AfDB	African Development Bank
AP	Angle Points
CBD	Convention on Biological Diversity
CDO	Community Development Officer
ECRU	Environment & Community Relations Unit
ECOWAS	Economic Community of West African States
ESIA	Environmental & Social Impact Assessment
ESIS	Environmental & Social Impact Statement
ESMP	Environmental and Social Management Plan
IEC	Information, Education and Communication
EPA	Environmental Protection Agency
FAO	Food and Agriculture Organization
FDA	Forestry Development Authority
FPCO	Firestone Plantation Company
IUCN	International Union for Conservation of Nature and Natural Resources
JIC	Joint Implementation Committee
KEPCO	Korea Electric Power Corporation
LAC	Liberia Agriculture Company
LEC	Liberia Electricity Corporation
LI	Legislative Instrument
MCD	Municipal Coordinating Director
MCE	Municipal Chief Executive
MDPO	Municipal Development Planning Officer
NECOLIB	National Environmental Commission of Liberia
NGO	Non-Governmental Organization
PAPs	Project-Affected Persons
PIU	Project Implementation Unit
PVS	Property Valuation Section
RoW	Right of Way
SEST	Socio-Economic Studies Team
SPC	Special Purpose Company
TL	Team Leader
TOR	Terms of Reference
UNEP	United Nations Environment Programme
WB	World Bank

EXECUTIVE SUMMARY

1 Introduction/Background

1.1 Overview of the Proposed Project

The West African Power Pool (WAPP) organization was established by the highest decision making body of ECOWAS, the Authority of Heads of State and Government of Member States, as a mechanism and institutional framework for integrating the national power systems of ECOWAS member countries. The objective of the WAPP is to establish a regional electricity market in West Africa through the judicious development and realization of key priority infrastructure that would permit the accessibility to economic energy resources, to all member states of the ECOWAS and help meet the energy needs of the ECOWAS citizenry by providing least cost reliable and sustainable electricity supply for economic development.

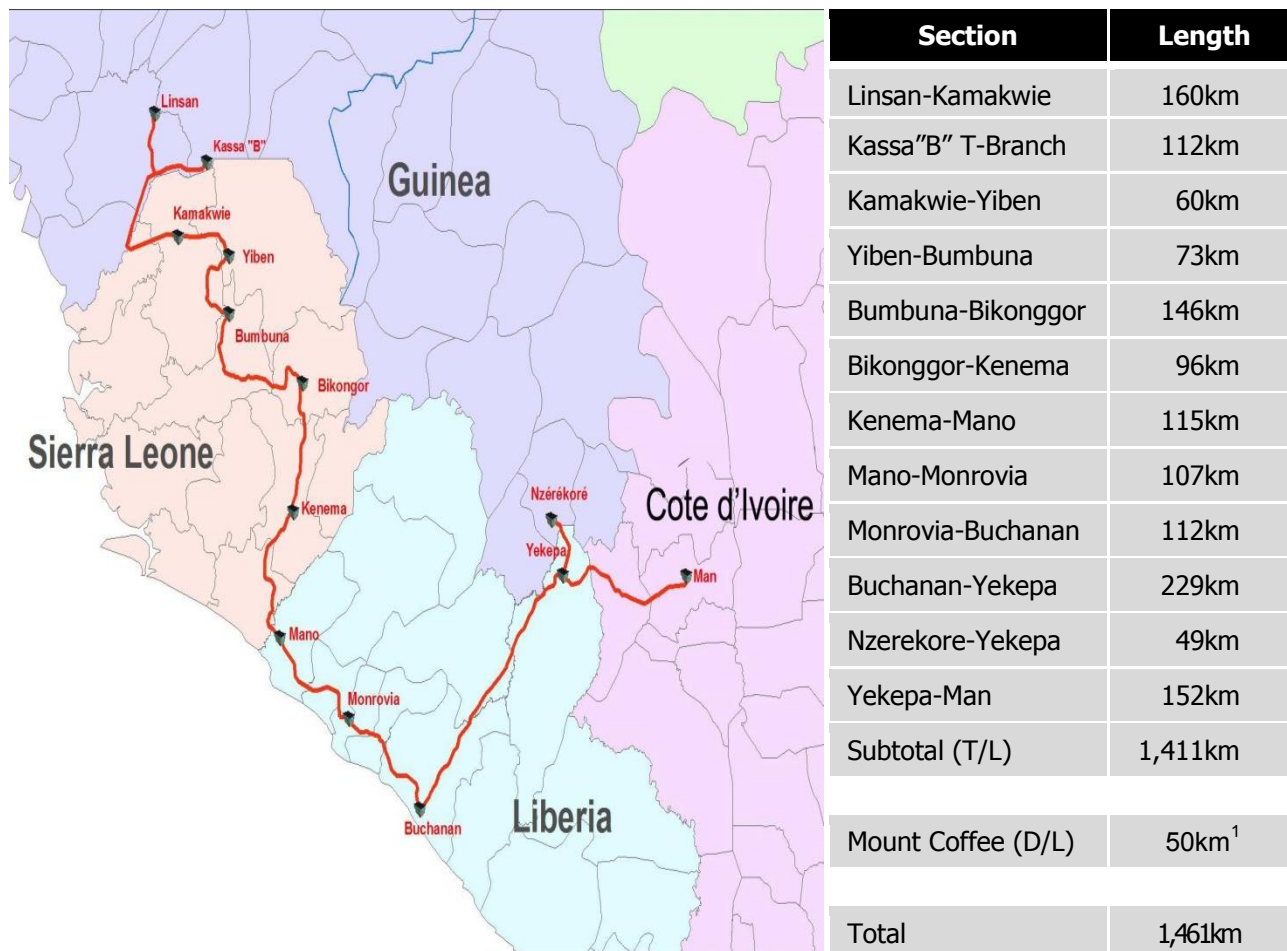
The Implementation Strategy of WAPP is based on developing complementary and mutually reinforcing infrastructure sub-programs, which when realized, will result in an integrated electricity system and market in West Africa.

Prominent among the infrastructure sub-programs to be developed is the WAPP Cote d'Ivoire – Liberia – Sierra Leone – Guinea Redevelopment Subprogram that aims to integrate the post-conflict countries of Liberia, Sierra Leone and Guinea into the WAPP regional electricity market. The situations in the three countries require that their energy supply capacities be urgently augmented and reinforced. The development of the Bumbuna hydro power plant in Sierra Leone, the development of hydropower resources in Guinea and the re-development of the Mount Coffee hydro power plant in Liberia in addition to utilization of gas-generated electricity from Cote d'Ivoire will permit the exchange of low cost power between Cote d'Ivoire, Liberia, Sierra Leone and Guinea. This power exchange will however require a high capacity transmission interconnection from Côte d'Ivoire to Guinea through Sierra Leone and Liberia. Accordingly, the WAPP Secretariat, the Société d'Opération Ivoirienne d'Electricité (SOPIE) of Côte d'Ivoire, the Electricité de Guinée (EDG) of Guinea, the Liberia Electricity Corporation (LEC) of Liberia and the National Power Authority (NPA) of Sierra Leone are undertaking a project that will comprise the construction of a high voltage transmission line from Man (Côte d'Ivoire) to Linsan (Guinea), through Yekepa (Liberia), Buchanan (Liberia), Monrovia (Liberia), Nzérékoré (Guinea) and Bumbuna (Sierra Leone), with associated high voltage substations. This project, which would greatly facilitate the power exchanges among the countries in the West African sub-region, is known as the Côte d'Ivoire – Liberia - Sierra Leone - Guinea Interconnection Project (the proposed Project). The proposed project, which would be executed in Côte d'Ivoire, Guinea, Sierra Leone and Liberia, will result in the following:

- Construction of approximately 1,411 km of high voltage transmission line
- Extension of a new high voltage substation in Man (Côte d'Ivoire)
- Construction of a new high voltage substation in Yekepa (Liberia)
- Construction of a new high voltage substation in Nzérékoré (Guinea)
- Construction of a new high voltage substation in Buchanan (Liberia)
- Construction of a new high voltage substation in Monrovia (Liberia)
- Construction of a new high voltage substation in Mano (Liberia)
- Construction of a new high voltage substation in Kenema (Sierra Leone)
- Construction of a new high voltage substation in Bikongor (Sierra Leone)
- Construction of a new high voltage substation in Bumbuna (Sierra Leone)
- Construction of a new high voltage substation in Yiben (Sierra Leone)

- Construction of a new high voltage substation in Kamakwie (Sierra Leone)
- Construction of a new high voltage substation in Linsan (Guinea)
- Rehabilitation of two 66 kV transmission lines from Mount Coffee substation to Bushrod (in Monrovia) and Mount Coffee substation to Paynesville (in Monrovia)

Figure ES-1 Transmission Line Route of the Proposed Project



With funding from the EU-Africa Infrastructure Trust Fund through the European Investment Bank (EIB) and the Kreditanstalt für Wiederaufbau (KfW), the Korean Electric Power Corporation (KEPCO) was contracted on September 8th, 2008 to implement consulting services that included the following:

- Line Route Study:
 - Study and determination of line route and substation locations;
 - Undertake detailed survey and profiling of line route and substations;
 - Drafting and preparation of maps and drawings.
- Environmental and Social Impact Assessment (ESIA):
 - Study of Existing Environment;
 - Identification & Assessment of Potential Environmental Impacts;
 - Identification of Mitigation Measures;
 - Conduct Public Consultations;
 - Preparation of an Environmental & Social Management Plan (ESMP) and a

¹ The Mount Coffee to Monrovia distribution lines consist of two 66 kV lines from Mount Coffee to Bushrod in Monrovia (24 km) and to Paynesville in Monrovia (26 km).

Resettlement Action Plan (RAP).

The Republic of Liberia was engulfed in a series of civil war between 1989 and 2003 when finally civil authority was re-established. Prior to the commencement of the Civil wars, the economy of the Country was supported primarily by mining of iron ore and diamonds as well as timber industries.

The West African Power Pool (WAPP) therefore will help the Liberian economy by providing needed power at a time major users of electric power are presently investing in the Liberian economy.

The Liberia section of the proposed Project comprises the construction of four (4) substations and 532km of 225kV transmission lines. One substation in Sannequille town, one in Buchanan, one to be located at Mount Coffee in Monrovia and the other one to be located near Mambo Town in Grand Cape Mount County. The construction of the substations and high tension electric transmission lines from Yekepa to Mano River run across the entire length and breadth of Liberia. The line passes through seven (7) administrative subdivisions in Liberia (Nimba, Bong, Bassa, Margibi, Montserrado, Bomi and Grand Cape Mount Counties) within a narrow corridor of 40 m.

The proposed Project has to meet the environmental requirements of the rules and regulations governing the protection of the environment in Liberia.

This ESIA evaluates and presents the environmental impacts that are expected to result from construction and operation of the proposed Project, and in accordance with the related guidelines from World Bank, AfDB, EIB and KfW, this ESIA identifies alternatives in the proposed Project that could avoid or minimize significant environmental impacts associated with the proposed Project. It presents recommended mitigation measures that for the environmental impacts identified. These measures are taken to ensure that environmentally sound practices are adhered to in order to safeguard the safety and health of all categories of people within the project area. In addition, the environmental monitoring and evaluation program herein is developed to determine the constant monitoring and evaluation the impacts of the project on the biological, physical socio-economic and cultural environments within the project area.

It is in this light that this ESIA (The Environmental and Social Impacts Assessment) is prepared in order for the proposed Project to ensure the sustainable or wise use of the natural resources in pursuance of social and economic development within the ecosystem's renewal and re-supply process. Also the intent of this ESIA is to inform the public and meet the needs of permitting agencies that are considering the proposed Project. The proposed Project is described briefly below and in detail in Section 2 (Project Description) of this ESIA.

The content of this ESIA reflects relevant input received from government officials, agencies, nongovernmental organizations, and concerned members of the public during the ESIA study. Please see Section 1.4 of this Executive Summary for a more detailed description of public involvement activities.

The ESIA highlights the most important environmental issues such as the environmental mitigation measures that take into consideration the minimization of potential adverse environmental impacts and the maximization of beneficial impacts that associated with the implementation of the proposed Project, these measures are taken to ensure that environmentally sound practices are adhered to in order to safeguard the safety and health of all categories of people within the project area.

In addition, the environmental monitoring and evaluation program herein is developed to determine the constant monitoring and evaluation the impacts of the proposed Project on the biological, physical socio-economic and cultural environments within the project area.

This action will ensure the environmental conformity of the proposed Project with the environmental rules and regulations of the Republic of Liberia.

1.2 Statement of Objectives/Purpose and Need

The related organizations for this proposed Project each have a unique jurisdiction and subsequently unique objectives, or purpose and need. Therefore, the statement of objectives or purpose and need for the electricity companies and the Environmental Protection Agency (EPA), related Ministry are described in detail separately in Section 1 (Introduction) of this ESIA, and are summarized below.

WAPP

As per the decision by ECOWAS, WAPP's purpose and need for the approval and implementation of the proposed Project is to meet the urgent augmentation and reinforcement of the infrastructure within Liberia, Sierra Leone, Guinea connecting with the Cote d'Ivoire transmission network. This Redevelopment Subprogram is to integrate the post-conflict countries of Liberia, Sierra Leone, and Guinea as a WAPP regional electricity market. WAPP has two primary aspects, as follows:

- 1) Provide electricity connection to Liberia, Sierra Leone, and Guinea by connecting with the existing Man substation (Cote d'Ivoire).
- 2) Utilization of the Bumbuna hydro power plant (Sierra Leone), and the re-development of the Mount Coffee hydro power plant (Liberia), and the hydro power resources in Guinea in addition to utilization of gas-generated electricity from Cote d'Ivoire

Environment Protection Agency (EPA)

The EPA's primary purpose and objective in approving the proposed Project is to protect the environmentally sensitive areas within each country and to manage minimizing the adverse impacts to the protected areas by the proposed project by reviewing this ESIA report in depth complying with the environmental and socio-economic guidelines.

Ministry of Agriculture (MOA), Forestry Development Authority (FDA)

The purpose and need for action by the MOA and FDA is to respond to WAPP and each country's Power utility's request for a special use authorization to construct the proposed Project on agricultural area and on the forest and ensure the proposed Project is in compliance with the Land Management Plan (Forest Plan). The purposes (objectives) are to minimize adverse impacts on agricultural lands and the forest to minimize adverse impacts to forest management activities.

1.3 Approval Process of the ESIA

This ESIA has been prepared by the Consultant in compliance with WAPP, EPAs and the Funding Agencies requirements.

Because the proposed transmission line would pass beside the several environmental sensitive areas managed by the FDA and being watched by the international environmental groups, the

proposed Project would also require an environmental permit from the EPA for the portion of the proposed Project within a 40 meter-wide easement across forest and agriculture area. The EPA proposed action is to respond to the scoping report through the issuance of the approval of the scoping report. This action triggers certain legal and policy frameworks such as Conservation of the forest act, Forestry Development Authority Act, Environment Protection Agency Act, National Environmental Policy process. In addition, the proposed Project would include one or more temporary use for any ground disturbing activities on each region that would occur during construction activities and would be located outside the proposed 40m RoW (Right of Way).

Therefore, this ESIA presents the environmental and social impacts of the proposed Project and alternatives in comparative form, defining the issues and providing a clear basis for choice by decision-makers and the public. The ESIA discloses the environmental impacts expected to result from the construction and operation of WAPP's proposed Project and mitigation measures, which if adopted by the LEC or other responsible agencies, could avoid or minimize significant environmental effects. In accordance with WB and the other Funding Agency guidelines, the ESIA also evaluates alternatives to the proposed Project that could avoid or minimize the significant environmental effects. The ESIA provides a comparison of the environmental effects of the proposed Project and the alternatives, and identifies the Environmentally Alternative per the Funding Agencies' requirements.

The purpose of the ESIA is to inform the public and deciding officials on the environmental setting and impacts of the proposed Project and alternatives. The ESIA will be used by the relevant authorities in conducting the proceeding to determine whether to grant WAPP's requested Project and by the EPA to determine whether or not to issue an approval on the Environmental & Social Impacts Assessment report. This Executive Summary provides an overview of the proposed Project and alternatives considered, and the environmental findings and mitigation measures of the ESIA.

1.4 Summary of Public Involvement Activities

To date, there have been extensive public participation efforts on the Côte d'Ivoire – Liberia - Sierra Leone - Guinea Interconnection Project (the proposed Project). These activities are summarized below:

- The EPA scoping process for the proposed Project began with the LEC's issuance of the Scoping report of the ESIA on November 13, 2009.
- During the site survey, the consultant held several public consultation meetings to collect and to receive opinions, as well as to provide an opportunity for the public to provide input on alternatives to the proposed Project and potential mitigation measures including members of the public, government and public agencies, and organizations and private companies.

1.4.1 Methodology of the Public Consultation

The communities predicted to be affected by the proposed project were identified with the help of the relevant County Assemblies, the Survey Consultants and from field work carried out to identify the communities.

Various stakeholders were consulted during the preparation of the ESIA. These include local communities, city authorities, environmental specialists, county authorities and others. The project received high degree of acceptability in that implementation of the line will boost local

economy due to the availability of electricity hence more exposure and increased benefits as more people would receive power through the line and in a way increase economic opportunities.

Some of the concerns were however raised, and these include the followings:

- The contractors to employ people around their respective surrounding villages.
- The contractors to consider replacing trees which will be destroyed during construction.
- Electricity to be provided at an affordable rate.

1.5 Areas of Controversy and Issues to be Resolved

A discussion of areas of controversy included, as well as identification of issues that need to be resolved. These may include issues raised by other agencies and the public during the public consultation process, as well as issues realized during the environmental analysis process. Various issues of concern were expressed at public consultation meetings for the proposed Project.

Some areas of controversy that were raised during the public consultation process include the following:

- Potential impacts to private property, including general aesthetics and property value;
- Potential health impacts due to the generation of new electric and magnetic fields (EMFs);
- Construction-related concerns such as land disturbance, noise, and air quality impacts;
- Biological resources, including wildlife corridors and sensitive species;
- Geology and soil conditions such as potential erosion and compaction; and
- Various other concerns related to environmental issue areas including traffic, public services, and utilities.

Many of the areas of controversy and issues identified in the list above would be resolved through the implementation of applicable mitigation measures, which are summarized and discussed in detail in Section 5 of this ESIA.

2. Description of Proposed Project and Project Alternatives

This summary provides a physical description of the proposed Project and alternatives. A more detailed description is provided in Section 2 of this ESIA report.

2.1 Proposed Project

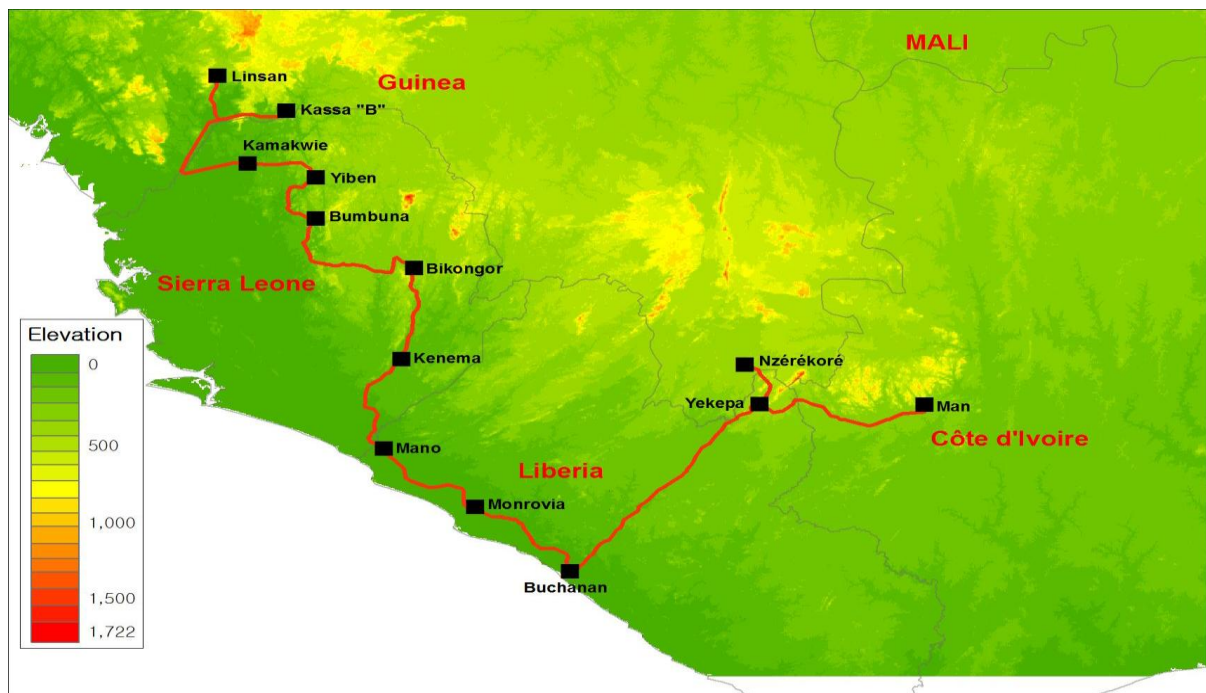
The proposed Project would involve the construction of a new 1,411km 225kV transmission line and its associated substations between SOPIE's existing MAN Substation and new LINSAN Substation in Guinea. Section 1.1 in the Executive summary provides details of the proposed Project's major components (along with the proposed Project alternatives).

Location/Proposed Route

The total length of Cote d'Ivoire-Liberia-Sierra Leone-Guinea interconnection line is approximately 1,411km and the section in Liberia is 532km. The entire geography of interconnection line is mountainous except the Buchanan to Mano coastal area in Liberia. Specially, the section, Linsan

in Guinea to Bikongor in Sierra Leone, is hard to access the existing road. Figure ES-2 presents the geographic features in entire project area. The Man (Cote d'Ivoire) –Yekepa (Liberia) - Nzérékoré (Guinea) section is a mountainous area of height around 500m~1100m. Buchanan to Mano in Liberia is flat area under 50m height and some swamp and rubber farms are in this area. The Saint John River, which is over 600m width, and several other rivers exist in this section. Kenema to Kamakwie in Sierra Leone is hilly area. This section is hard to access the existing roads with transmission line route. This section has several big rivers (Moa, Sewa rivers etc.) over 400~600m width.

Figure ES-2 Geographic Features of the Project Area



2.2 Project Alternatives

Initially, eight (8) alternative line routes for the 3 environmentally sensitive areas (Hotspots) in Liberia section were developed. These alternatives were identified by the Consultant in its line route study report; suggested by the Funding Agencies, Power utility company and public and government agencies during the Study or developed by the ESIA consulting team.

A comprehensive screening analysis was employed to focus on alternatives that would be capable of meeting most of the proposed Project objectives/purpose and need, considered feasible, and would avoid or substantially lessen any significant effects of the proposed Project.. Following is a brief description of each of these Hotspots (Nimba Nature Reserve, Gbedin Wetlands and proposed Lake Piso Multiple Protected Area) and analysis of alternative line routes.

- **Nimba Nature Reserve**

The Funding Agencies recommended that the transmission Line should be located more to the south away from the nature reserve, since this whole area is a global biodiversity hotspot as determined by the biodiversity studies carried out by Arcelor Mittal. Also they recommended that the Yéképa Substation should be located more to the south closer to the mines and the iron-ore

concentrator, in between the mines and Sannequille town, which are both load centers to avoid the Nimba Nature Reserve;

In order to minimize the adverse impact on these protected areas, enough buffer was taken into consideration when organized the Alternative Option 1. So, the previous transmission line and proposed Yekepa substation were adjusted to move further southwest to avoid the Nimba Nature Reserve. Alternative Option 1 is identical to the proposed Project as shown in Section 1.6.2.3.1

- **Gbedin Wetland.**

The Funding Agencies recommended that the proposed line route should be moved further from the proposed Ramsar site, the Gbedin wetland.

In Alternative Option 1, the location of selected line route near the Gbedin wetland area, proposed as RAMSAR site, was adjusted to be located further away from the sensitive area. This alternative would relocate most of the towers further west-north.

Alternative Option 1 is identical to the proposed Project as shown in Section 1.6.2.3.2.

- **Proposed Lake Piso Multiple Protected Area.**

The previous line route does not pass through the Lake Piso itself and is stood 5.8km away from the lake. However, according to the future plan of FDA of Liberia, the wider area surrounding the Lake Piso will be designated as a multiple protected area. In that case, previously selected line will pass through 35km of that protected area.

Alternative Option 2 has merit that it will go through the hilly area making the construction and maintenance of transmission line easier than the other options. Therefore, Alternative Option 2 is considered most preferable line route in this area as shown in Section 1.6.2.3.3.

3. Summary of Impacts and Mitigation Measures

Although the line route is 532km long, the actual area affected by the transmission line project is relatively small. Four (4) substations will be built each in a small area of 200m x 200m. These should be built on flat well drained land, thus no major topographical changes will occur; the land used will invariably have been used for cultivation. The land in the tower footprint will not be usable, however as there is some flexibility for the tower location no major topographical changes will occur. Thus the proposed transmission line project will impact minimally on the environment in most cases.

This section summarizes the environmental impacts and mitigation measures for the proposed Project. The impacts and mitigation measures discussed in this section are described in full detail in Section 5 of this ESIA. In accordance with the Funding Agencies' policy and guidelines, the impact assessment methodology considers the existing regulatory setting, direct and indirect effects of the Project, any potential growth-inducing impacts, and cumulative impacts

This section presents a summary of the environmental impacts and applicable mitigation measures in Section 3.2; Summary of Impacts to proposed line route corridor in Section 3.3; a summary of cumulative impacts for the proposed Project and alternatives in Section 3.4; and a summary of indirect effects of the proposed Project and alternatives in Section 3.5 of present Executive Summary.

3.1 Impact assessment methodology

The proposed transmission line project will impact minimally on the environment in most cases. The impact assessment methodology used for this project consists of five major steps:

- **Step 1** : Identification and description of project activities and their interaction with environmental media;
- **Step 2**: Comprehensive preliminary identification of potential impacts;
- **Step 3**: Screening or comparative assessment of impact importance, identification of impacts that are likely to be significant (i.e. identification of focus areas for further study) through application of a basic set of impact significance criteria to the preliminary information available about each impact;
- **Step 4**: Detailed assessment of the identified focus area impacts characterization techniques, quantification of impacts to the extent possible and rigorous qualitative characterization of impacts that cannot be quantified; and
- **Step 5**: Final assessment of the severity levels of impacts through application of the results of the rigorous quantitative and qualitative characterization of impacts developed in Step 4 to a set of objective impact severity criteria; identification of impact warranting mitigation.

3.2 Summary of Impacts and Mitigation Measures

The ESIA describes feasible mitigation measures that could minimize adverse impacts. In addition, within each issue area described in Section 4 of this ESIA, mitigation measures are recommended where environmental effects could be substantially minimized for all classes of impacts (except beneficial impacts). The major findings of the ESIA analysis are summarized below according to resource issue area. Impact findings and mitigation measures from the construction and operation of the proposed Project and all alternatives are summarized in Table ES-2.

3.3 Summary of Impacts to proposed line route corridor

Implementation of either the proposed Project or any of its action alternatives would involve both temporary and permanent land disturbances on the proposed line route corridor. Permanent land take due to the tower election (25m² per tower) and the placement of substations (40,000m² per substation) would be approximately 0.2km². For the rest of the RoW, new or improved access and spur roads would be taken temporarily during the construction or operation stage.

The main potential impacts, which require mitigation measures, have been identified for the proposed project. These are loss of land, destruction of buildings, other structures and crops, noise pollution, waste management, water pollution, impacts on flora and fauna, public safety and health, occupational safety and health issues and socio-economic/socio-cultural issues.

3.4 Summary of Indirect Effects

In accordance with the World Bank guideline (Environmental Assessment Sourcebook), “indirect effects” may include any effects that would be caused by the proposed action but which occur later in time or farther in distance from the action. Analysis of the direct and indirect effects of the proposed Project and alternatives is provided for each environmental issue area in Section 1.4. The proposed Project is expected to cause indirect effects in the following environmental issue areas:

- Hydrology and Water Quality
- Socioeconomics
- Land Use and Public Recreation
- Utilities

The proposed Project and alternatives would result primarily in direct effects to the other environmental issue areas, including Air Quality; Biological Resources; Cultural Resources; Geology, Soils; Noise; Public Health and Safety; Public Services; Traffic and Transportation. To the degree that the transmission project inhibits aggressive fire fighting, greater impacts could result from wild land fires, such as larger fires potentially causing destruction of biological resources and cultural resources, and leading to greater soil erosion after fire events.

Indirect effects may be represented by a variety of potential impacts, projects, or actions, including growth-inducing effects such as residential and commercial development, and infrastructure and public works projects, among others.

3.5 Summary of Cumulative Impacts

Cumulative impacts refer to the impact on the environment which results from the incremental impact of the Project when added to other past, present and reasonably foreseeable future actions. The relevant projects along our proposed RoW are described in Table ES-1

Table ES-1 Infrastructure Development Project in the Project Area

Project Type	Project Name	Implementing Agencies	Status
Road	Liberia Road Asset Management Project	Infrastructure Implementation Unit (IIU)	Planned
Road	Ganta-Zwedru-Fish Town-Harper Road Construction	Infrastructure Implementation Unit (IIU)	Planned
Road	Ganta-Yekepa Road Construction Project	Arcelor Mittal	Ongoing
Road	Urban and Rural Infrastructure Rehabilitation Project (URIRP)	Infrastructure Implementation Unit (IIU)	Ongoing
Electrification	WAPP Cross Border Project	LEC	Ongoing
Mining	Mining Development Project	Arcelor Mittal and other private mining company	Planned
Waste Management	Emergency Monrovia Urban Sanitation Project (EMUS)	Monrovia City Corporation (MCC)	Planned
Water and Sanitation	Liberia Water Sewerage Corporation	Liberia Water Sewerage Corporation	Planned

The increase in regional growth in Liberia may indirectly contribute to potential cumulative impacts in the proposed Project area. An increase in population growth directly affects the demand for jobs and housing, which may increase the number of planned development and

improvement projects, such as public service facilities or transportation system expansions, in Liberia. Substantial population or employment increases near the area of the proposed Project also substantially increase the population potentially exposed to an accident or other hazard.

3.6 Summary of Mitigations

The Consultant held public consultations with communities affected by the project as well as meetings with members of the stake holders to insure that necessary procedures were put in place to mitigate impacts. Mitigations differ according to the different phases of the project.

During the pre-constructional phase a detailed list of all potential project-affected persons was compiled for the purposes of the payment of fair, adequate and prompt compensation.

During constructional phase adequate and regular maintenance of machinery and the avoidance (as much as possible) of constructional activities in the vicinity of local communities at night will minimize noise nuisance impacts on the local communities. Daytime noise levels are not expected to be a nuisance. The management of waste in the work camp and the construction sites have been planned to exert minimum adverse effects on the environment. The SPC will carry out the monitoring of such parameters as noise, water quality, socio-economic issues and occupational safety and health issues.

The proponent acknowledges that the proposed investment in the transmission line project would be worthless if the safety, health and welfare of the employees are not safeguarded. Management will therefore do its utmost to ensure that safety, health and welfare provisions.

The use of personal protective equipment will be strictly enforced in order to protect workers and prevent accidents. In addition the SPC will ensure the provision of, among others, a first aid box, drinking water and sanitary facilities at the construction sites and the health and welfare of all employees engaged on the project by providing clinic, doctor and ambulance in the work camp with the responsibilities of the Contractors.

During operational phase regular maintenance of the line route will be needed. This will include removing potential hazards from RoW, measures and regulations related to dangerous substances (Transformer oils), security, fire, noise, birds, and extreme weather. The substations shall be fenced and provided with technical and security personnel for operation and security purposes.

During the decommissioning phase the towers, cables and substations will be dismantled and removed; the materials should be reused or recycled as much as possible, in addition all concrete and steel debris should be removed from the site. During the decommissioning stage, the negative impacts that may result from decommissioning activities will need to be mitigated, these will be similar to the construction phase. The activities in this phase will be similar to project construction activities, and the timeframe and deconstruction workload is expected to be similar to that of the construction phase. After the structures and their foundations have been removed the area should be re-vegetated, where farming may be resumed without restriction.

Consultations

Consultations were made with some regulatory agencies, Counties' Officials, project-affected persons and local communities prior to the preparation of this ESIA. The communities predicted to be affected by the proposed Project were identified and consulted to determine the potential impacts the implementation of the proposed project might have on them.

Table ES-2 Summary of Impacts and Mitigation Measures and Monitoring

Project Activity	Potential Impacts	Location	Proposed Mitigation	Net Effects	Monitoring
Line route survey & Design stage	Impact on potential sensitive ecological and inhabited area	Entire RoW	Adequate selection of RoW by avoiding these areas with detailed line route survey during the design stage	Negligible	Monitoring and Identifying the potential sensitive ecological or inhabited areas located along the RoW
During the entire project	Loss of crops	Almost entire RoW & access tracks	Prompt, fair compensation payment	Negligible	During construction & operation
During the entire project	Loss of structures	Certain parts of line route	Prompt, fair compensation payment for resettlement	Removal from historical/ancestral roots	Monitoring during construction & operation to ensure all PAPs are adequately and fairly catered for
During the entire project	Loss of land	Entire RoW & access tracks	Prompt, fair compensation payment	Removal from historical/ancestral roots	Monitoring during construction & operation to ensure all PAPs are adequately and fairly catered for
Construction	Noise impacts	Communities and settlements close to RoW	Avoidance (as much as possible) of work at night	Minor disturbance during daytime	Ambient noise levels shall be measured once every week in communities close to RoW
Construction	Air quality	Communities and settlements close to RoW	Spray the exposed soil surfaces of the tower corridor track as and when needed	Negligible	Monitoring – none
Construction	Potential soil erosion	Entire RoW & access tracks	Limit land clearance to minimum area required and early revegetation	Negligible	Monitor land clearance
Construction & operation	Public safety 1. Open excavations 2. Potential electrocution 3. Potential collapse of towers 4. Others	Entire RoW & access tracks	Tower base excavations in or near settlements or farms will be clearly marked and made inaccessible to the public. All towers will be clearly marked with a red inscription on white background - "DANGER – 225,000 Volts" to warn off trespassers, etc.	Negligible	Routine inspections of towers during operational phase
Construction & operation	Flora and Fauna	Entire RoW & access tracks	Limit clearance of vegetation	Negligible	Monitored carefully to ensure that the minimum area requirements are not exceeded
Construction & operation	Occupational safety and health	Entire RoW & access tracks	Provision of personal protective equipment at construction All work to be done according to Safety Rules and Regulations of LEC as well as the World Bank Group EHS Guidelines of 2007 (General and Electric transmission and Distribution)	Negligible	Availability and use of protective equipment
Construction	Impacts on cultural and	Cultural/historical/archaeological	Chance finds to be reported to appropriate authorities as	Negligible	Areas of chance finds will be monitored and

Project Activity	Potential Impacts	Location	Proposed Mitigation	Net Effects	Monitoring
	historical/archaeological sites/items	ecological chance finds	a part of the contractor's contract		secured in order to be handed over to Museums and Monuments Board.
Construction	Public health-STDs/HIV AIDS	Mainly settlements along RoW	Education of workers to avoid casual sex Supply sufficient quantities of good quality free condoms to workers	Potential single mothers, transmission of STDs/AIDS	Keep close contact with communities during construction to detect incidences of STDs/AIDS
Construction	Traffic impacts	Relevant roads indicated in report	Use of traffic wardens to control traffic at road crossings Development of Traffic Control Plan	Negligible	Presence of traffic wardens at all times during construction. Review the contractor's Traffic Control Plan
Construction	Water pollution	Rivers indicated in the report	Minimize erosion and manage excavated materials, wastewater from excavations and accidental spillage of oil, fuel and paints	Negligible	Streams close to the site(s) of construction to be sampled and analyzed weekly. During the maintenance phase monitoring will be carried out twice yearly.
Construction	Work camp management	Work camp sites	Establish far away from water bodies and settlements Provision of mobile toilet, clinic, doctor and ambulance at work camp sites	Negligible	Distance from each work camp site to nearest water body and settlement. Availability of mobile toilet, clinic, doctor and ambulance;
Construction & operation	Solid Waste generation	Entire RoW & access tracks	Trees, tree stumps and wooden containers not to be given out to the local communities as fuel wood . Usable trees and wood from the RoW clearing should be given out to the local communities. Metal wastes to be collected and disposed of appropriately and/or recycled in consultation with relevant government agencies	Negligible	Collection and disposal of solid waste to be monitored
Operation	Effects of rust treatment and painting of towers	Tower locations	Spilt paint to be quickly mopped up with rags and/or sawdust. The used sawdust and rags will be disposed of at appropriate public waste dumping sites.	Negligible	No monitoring
Operation	Micro shock from a spark discharge	RoW	Minimized by multiple earthlings	Negligible	Monitor earthing cables
Operation	Fire hazards	RoW	Public education on hazards of bush burning	Negligible	Routine patrols to discourage bush burning
Construction & operation	Employment generation and incomes	Settlements along RoW	Encourage contractors to engage local labour	Standard of living improved	None

4. Project Affected Persons

Consultations have been held with regulatory agencies, County Development Committees and local communities prior to the preparation of the Scoping Report and the Environmental

and Social Impacts Assessment.

The land to be affected by the implementation of the proposed Project has the following categories of land-uses:

- Agricultural lands with perennial crops
- Agricultural lands with non-perennial crops
- Potential Agricultural (or fallow agricultural lands)
- Residential lands (affecting building /structures and residential plots)

4.1 Compensation

For the most part the line route goes through non-residential government owned land which is in use as farmland. Upon completion of the T-line some farming will be permitted, thus compensation will only be required for perennial crops or annual crops if construction takes place during the growing season.

Table ES-3, 4 and Appendix 6 show the numbers of people and the types of properties to be affected by the proposed project. The environmental and social impacts are expected to affect about 113 households and a total of 710 persons

Table ES-3: Summary of PAPs

County	Trees		FoodCrops		Houses		Huts		Buildings		Lands		Total Cost (USD)
	Count	Cost	Area(ac)	Cos (USD)t	Count	Cost (USD)	Count	Cost (USD)	Count	Cost (USD)	Area(m2)	Cost (USD)	
Nimba	30,681	183,996	7.6	119	-	-	1	1,100	-	-	40,000	20,000	205,215
Margibi	38,217	229,302	-	-	-	-	-	-	-	-	-	-	229,302
Bomi	1,011	6,066	-	-	1	4,850	3	3,300	1	35,000	-	-	49,216
Bong	10,203	61,218	-	-	-	-	-	-	-	-	-	-	61,218
GrandBassa	11,929	71,307	-	-	2	9,700	14	14,200	2	20,000	40,000	20,000	135,207
Montserrado	3,207	19,089	7.0	42	3	14,550	1	1,100	2	55,000	40,000	20,000	109,781
GrandCape	2,635	15,285	-	-	-	-	-	-	-	-	40,000	20,000	35,285
Total	97,883	586,263	15	161	6	29,100	19	19,700	5	110,000	160,000	80,000	825,224

- Trees include rubber, coffee, cocoa, oil palm, plantain
- Food crops include rice, eddoes, cassava
- Unit cost of Huts / Houses and Buildings include its land cost

Table ES-4: Summary list of Affected Households and Dependents

County	Householders	Dependents	Total
Nimba	61	318	379
Margibi	1	-	1
Bomi	3	101	104
Bong	7	55	62

Grand Bassa	22	77	99
Montserrado	12	18	30
Grand Cape	7	28	35
Total	113	597	710

Table ES-5 Environmental and Social Management & Resettlement Action Plan Cost

○ ESMP Cost

Activity	No	ITEM	Cost (USD)
Activities for ESMP	1	Review & Disclosure of Environmental Impact Assessment Report	68,040
	2	Audit for RAP and ESMP	53,200
	3	Environmental Monitoring	441,480
	4	Training of environmental management team in house	32,400
	5	Public Health & Safety (including HIV/AIDS Programmes)	216,720
	6	Measuring device for air/water/soil pollution and vehicle, laptop etc.	81,000
	Total ESMP Cost		

○ RAP Cost

DESCRIPTION	No	ITEM	Cost (USD)
Compensation	1	Compensation for lands	80,000
	2	Compensation for trees	586,263
	3	Compensation for food crops	161
	4	Huts / Houses / Buildings	158,800
	5	Constructional damage for plants outside of the ROW, inside access road $(=(2+3)*10\%)$	58,642
	6	Compensation for loss of income $(=(1+2+4)*10\%)$	41,253
	7	Add-on amounts for vulnerable project affected persons $(=(1+2+3+4)*5\%)$	41,261
	8	Professional fees, reimbursement for permits etc $(=(1+2+3+4)*10\%)$	82,522
	9	Contingency allowances to cater for the effect of probable increases in property values $(=(1+2+3+4)*10\%)$	82,522
	Subtotal		
Activities for RAP	10	Social action plan, community support	57,659
	11	Livelihood restoration program	19,701
	12	Community infrastructure Program $(=(1+2+3+4)*5\%)$	41,261
	13	External monitoring and Evaluation	26,600
	14	Purification rites / ceremonies	7,000
	15	Indirect cost $(=(10+11+12+13+14)*10\%)$	15,222
	Subtotal		
Total RAP Cost			1,298,867

○ Total

Total ESMP & RAP Cost	2,191,707
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4.2 Cut-off date

The public consultation has been held since November 2009 and the PAP inventory list was verified by the Consultant, LEC, MLME (Ministry of Lands, Mines and Energy), MIA (Ministry of Internal Affairs) in December 2011. So the beginning of census (Cut-off date) is November 2009 by the definition of the World Bank OP 4.12. During the public consultation with the PAPs, the consultant clearly informed and explained the concept of the "cut-off date" to the PAPs in the presence of the village's population. The consultant also informed that no one shall be registered on the PAPs after the cut-off date. Modification of the PAPs will be made if there are any changes on current RoW

4.3 Grievance Redress Mechanism and Committee

There are three ways in which grievances shall be resolved. These are:

- Grievance Redress Committee
- Arbitration.
- Courts of Law.

During the PAPs investigations, the Consultant held several interviews, the Consultant held several interviews with local authorities and it was founded that the superintendents took the complaints of mediation during the PAPs investigations. Therefore the Consultant indicated that a committee which is responsible for settling complaints between local communities should be organized and functioned for the smooth implementation of project.

In order to set up the Grievance Redress Committee (GRC) responsible for handling grievance arising from resettlement of the Project, KEPCO team accompanied with the representatives of MIA (Ministry of Internal Affairs), MLME (Ministry of Lands, Mines and Energy) and LEC were organized and carried out meaningful consultation meetings with the superintendents of seven affected counties. During the meetings, details of the Project, environmental and social impacts, compensation process were briefed. KEPCO requested the superintendents to give a written acceptance of the position for the GRC member as required by the Funding Agencies. In response to the request from 1st to 5th of December 2011, all superintendents of seven affected counties gave their consent to KEPCO's request.

The list of the chairs of the GRC established in the seven affected counties is in Table ES-6 below.

Table ES-6 Chairs of the Grievance Redress Committees

County	Chair of GRC	Position
Nimba	Christina Dagadu	Superintendent
Bong	Lucia F. Herbert	Superintendent

County	Chair of GRC	Position
Bomi	Samuel F. Brown	Superintendent
Margibi	Levi Z. Piah	Superintendent
Montserrado	Grace Tee-Kpaan	Superintendent
Grand Bassa	Julia Duncan-Cassell	Superintendent
Grand Cape Mount	Catherine N. Watson-Khasu	Superintendent

4.4 Livelihood Restoration Programme

Livelihood restoration measures have been designed to assist severely affected farmers and others lose productive/income generating assets, including those losing their house and for vulnerable households. These measures may include the following

- Provision of agricultural extension services: Severely affected farmers will be assisted to improve productivity on remaining agricultural land, by linking them with government driving programmes such as West Africa Agricultural Productivity Program funded by World Bank. The Consultant recommends that links will be facilitated by LE C and Ministry of Agriculture to the local agricultural and rural development when a detailed PAPs investigation has been carried out.
- West Africa Agricultural Productivity Program (WAAPP-1C): Approved 24-Mar-2011, \$83.8million of total project cost, To generate and accelerate the adoption of improved technologies in the participating countries' top agricultural commodity priority are as that are aligned with the sub-region's top agricultural commodity priorities.
- Skills training: Displaced PAPs will be provided the skills training programme such as soap or baskets production in the job training centres and social organisations in and out of District, which would help them to maintain and/or improve their income generation potential. The skills training programme will be designed during project implementation.
- Project related job opportunities: PAPs will be prioritized in gaining employment in the works linked to the project including the short pre-recruitment training. Information about the employment opportunities will be comprehensively available at to local community

5. Environmental and Social Management Structure

WAPP-SPC (Special Purpose Company) will be set-up to implement and operate the Project and the proposed structure in the SPC in charge of dealing with environmental and social issues is shown as below.

Project Implementation Unit (PIU)

Although the WAPP-SPC Establishment Study has been initiated it is certain that the formation of the actual WAPP-SPC would take some time. It is therefore proposed that a Project Implementation Unit (PIU) should be set up to be broadly responsible for preparing

the implementation and operation of the project until the SPC is formed. The primary mandate of a PIU under this setup is to oversee the construction of the project and ensure compliance with the terms of the construction contract.

Environment & Community Relations Unit (ECRU)

It is necessary to set up the Environment & Community Relations Unit (ECRU) as a substructure of PIU to deal with environmental and social aspects of the Project. The ECRU will be responsible for ensuring project's compliance with all relevant environmental, social, health and safety regulations and liaising with all relevant regulatory bodies and organizations.

Construction Contractor

Prior to the commencement of construction works all contractors should be required to prepare their own ESMPs (CESMP), alos it shall be adequately implemented. The plan should specify environmental targets and objectives as outlined in the ESIA/ESMP and how these could be achieved. The Contractor's ESMP (CESMP) shall include, to the extent practicable, all steps to be taken by the Contractor to protect the environment in accordance with the current provisions of national environmental regulations, the World Bank Groups Environmental Health and Safety General Guidelines and the Environmental, Health and Safety Guidelines for Electric Power Transmission and Distribution, 2007 as well as the ESIA/ESMP for this project. Also, for more complex environmental management aspects, the Contractor needs to prepare and implement Method of Statement which needs to be approved by the Supervising Engineer and the SPC upon request

Owner's Engineer

The Owners Engineer shall have full technical responsibility for the Pre-Award tasks; ie., preparation, issuance and clarification of bidding documents; as well as serve as the technical expert for the Evaluation of Bids, Negotiation and Award of construction contracts.

The role of the Owner's Engineer shall however change after the award of contracts to become one of providing technical support to the PIU for the construction phase.

They need to be made responsible, by contractual arrangement for the supervision of adequate implementation of the CESMP (Contractor's own Environmental and Social Management Plan) and the Method of Statement to be prepared by the construction contractor.

During the constructional phase, cultural/archaeological 'chance finds' - sites of cultural significance such as sacred woods or trees or rock outcrops and historical or archaeological heritage/items or sites which the local residents may not have mentioned at the survey stage will be monitored to ensure that such sites or items are properly managed to the satisfaction of both the local communities, the Owner's Engineer, EPA and/or other relevant authorities

6. Conclusion

This Environmental and Social Impacts Assessment has identified potential impacts on the physical, biological, socio-economic/cultural environments, occupational safety, health and welfare of the employees. Mitigation and potential remedial measures have also been

outlined. These will be actively pursued in order to minimize or, if possible, eliminate the identified negative impacts.

The transmission line project cannot be carried out without any impacts on the environment. Indeed, some of the impacts are unavoidable. However, the mitigation measures put forward are expected, as far as possible, to be able to minimize the impacts so as to make them pose no threats to the continued sustainability of the environment.

A review of the identified impacts shows that there will be some significant adverse irreversible impacts on the environment (e.g. land ownership and land-use characteristics). Other impacts will be minimal and temporary.

The benefits to be derived from the implementation of the proposed Project are immense, especially considering the problems of supply experienced in Liberia in the recent past. The implementation of the proposed Project will ensure that the objective of ECOWAS to establish a regional electricity market in West Africa through the judicious development and realization of key priority infrastructure that would permit accessibility to economic energy resources, to all member states of the ECOWAS shall be realized.

The proposed transmission line is therefore designed to fulfill the objective of providing a more reliable and secure transmission of power to meet the expected increase in demand of electrical power within the ECOWAS sub region.

The key drivers for increasing electricity consumption are growth in per capita GDP, growth in population, urbanization, development of basic industries, more opportunities for the education, enhancement of women right, rural electrification towards poverty alleviation and the attainment of the Millennium Development Goals.

The Liberia Electricity Corporation believes that this ESIA has sufficiently dealt with the significant issues on the ground and will therefore meet the expectations of the EPA and warrant the issuance of an Environmental Permit to enable it to proceed with the implementation of the proposed Project without delay.

1. INTRODUCTION

With much of the infrastructure destroyed during the turmoil. Liberia currently does not have a transmission system, just a distribution system. The Liberia Electricity Corporation (LEC) now operates a 9.64 MW plan under the Emergency Power Program in the city of Monrovia. This first phase was the installation of a 2 MW plan to provide street lighting and to supply major health facilities. The second phase now currently underway is the installation of a 7 MW engine and the expansion of the current distribution system to include commercial establishments and some residential areas. A project to commence the reconstruction of the transmission network in and around Monrovia is in progress. Approximately 28 km of 66KV lines will be built and 17 km of 22 KV distribution lines will also be built. Four (4) substations (66KV) with total transformer capacity of 40 MVA (4X10MVA) will be built. Plans are underway to expand power generation to 50 MVA with the installation of Heavy fuel Oil (HFO) diesel generation. With a population of over 3 million and only 1.4 living in and around the capital of Monrovia, the potential demand growth is very high.

Further plans are underway to rehabilitate the Mt. Coffee Hydro Plant Electric plant on the St. Paul River. The first phase of the rehabilitation of Mt. Coffee plant foresees power output of 100 MW. Liberia has substantial hydro power potential. Major river systems that include the: St Paul River, St. John River, Cavalla River, Lofa River have substantial capacity that can be developed. The St. Paul has known capacity of over 1000 MW.

Substantial investment is being made in the Mining Sector of Liberia. Mittal Steel, a world leader in the steel industry is investing about a billion US dollars in mining iron ore in Liberia. The previous mine has a total power demand of 60 MW. Other iron ore mines that will be commissioned within the next five (5) years are: Bong Mines, the Western cluster that includes, Bomi Hill, Mano River, and Bear Mountain Mines. The power demand for these mines will form the base load for sales.

The Agriculture Sector with high demand for electric power is natural rubber processing. The Firestone Plantation Company (FPCO), the Liberia Agriculture Company (LAC) and Guthrie Rubber Plantation have all resumed operations in Liberia culminating in a demand by this sector in excess of 10 MW.

1.1. Purpose and objectives of the proposed Project

Members of the Economic Community of West African States (ECOWAS) established articles of agreement establishing a new West African Power Pool (WAPP) organization in January 2006. The objective of the WAPP is to establish a regional electricity market in West Africa through the judicious development and realization of key priority infrastructure that would permit accessibility to economic energy resources, to all member states of the ECOWAS.

In order to further advance the implementation of the priority projects of the West African Power Pool (WAPP), the WAPP Secretariat (temporarily located in Cotonou) and the WAPP Members have commenced preparatory works towards the implementation of the following priority interconnection projects:

- 330 kV Volta (Ghana)-Mome Hagou (Togo)-Sakete (Benin) interconnection Project;
- 330 kV Aboadze (Ghana)-Volta (Ghana) Transmission Project;
- 225 kV OMVG Interconnection Project (Guinea, the Gambia and Guinea Bissau, Senegal) including development of hydropower sites at Kaleta (Guinea) and Sambangalou (Senegal);
- Man (Côte d'Ivoire)-Yekepa (Liberia)-Nzerekore (Guinea)-Buchanan (Liberia)-Monrovia (Liberia)-Bumbuna (Sierra Leone)-Linsan (Guinea) interconnection project.
- Rehabilitation of two 66 kV transmission lines from Mount Coffee substation to Bushrod (in Monrovia) and Mount Coffee substation to Paynesville (in Monrovia)

The Republic of Liberia was engulfed in a series of civil wars between 1989 and 2003 when finally civil authority was re-established. Prior to the commencement of the civil wars, the economy of the country was supported primarily by the mining of iron ore and diamonds as well as the rubber and timber industries. A direct consequence of the civil war and political instability has been the decimation of the economy.

The recovery of economic activity is in turn linked to the availability of electricity. In addition, electricity supply affects the general sense amongst civil society of progress and improvement in the standard of living which is essential for the continued stability of the Republic. During this fourteen year period of civil disorder the country's physical infrastructure, particularly electricity, suffered from lack of maintenance, widespread destruction and looting. Despite the cessation of armed hostilities from 2003, the pilferage of electrical materials has continued. The net result was commissioned in 2006, which came

about as a result of support from the US Government (USAID), the European Union, and Government of Liberia through the Liberia Electricity Corporation .

Public supply is therefore virtually absent and the only electricity primarily available in the country is from self-generation. The services obtained through self-generation are particularly costly and predictably patchy to such an extent that currently only a very limited part of society has access.

The situation in Liberia countries requires that energy supply capacities be urgently augmented and reinforced. The development of the Bumbuna hydro power plant in Sierra Leone, the re-development of the Mount Coffee hydro power plant in Liberia, the future development of potential hydropower resources of regional interest in Guinea, Sierra Leone and Liberia in addition to utilization of gas-generated electricity from Côte d'Ivoire will permit the exchange of low cost power between Côte d'Ivoire, Liberia, Sierra Leone and Guinea through a high voltage interconnection line from Man (Côte d'Ivoire) to Linsan (Guinea) through Yekepa (Liberia), Nzerekore (Guinea), Buchanan (Liberia), Monrovia (Liberia) and Bumbuna (Sierra Leone).

With the implementation of the West African Power Pool (WAPP), which is expected to foster power exchanges among the countries in West African sub-region, a high capacity transmission interconnection from Côte d'Ivoire to Guinea through Sierra Leone and Liberia will be required, which will also be in line with the adopted WAPP Master plan. The implementation of the Man-Yekepa-Nzerekore-Bumbuna-Monrovia-Bumbuna-Linsan interconnection (the proposed Project) will also further reinforce the interconnection of "Zone A" and "Zone B" of the WAPP through Côte d'Ivoire thereby increasing opportunities for trade and the establishment of a regional power market.

1.2. Background Information on the proposed Project

The proposed Project component in Liberia comprises the construction of (4) four substations and 532km of 225kV transmission lines. One substation in Sannequille town, one in Buchanan one to be located at Mount Coffee in Monrovia and the other one to be located near Mambo Town in Grand Cape Mount County. The construction of the substations and the running of the high tension electric transmission lines from Yekepa to Mano River are indeed cutting across the entire length and breadth of Liberia. The line

passes through seven (7) important political subdivisions in Liberia (Nimba, Bassa, Bong, Margibi, Montserrado, Bomi and Grand Cape Mount Counties.

1.3. Purpose and scope of the study

It is a legal requirement in Liberia under the Environmental Protection Act, and the Environmental Assessment Regulations that development project of this nature should be subjected to Environmental and Social Impacts Assessment (ESIA). In addition, it is the policy of the LEC to ensure the welfare of the people perceived to be adversely affected by its operations as well as to assist in the sustainable development of the environment within which it operates.

The ESIA will enable the LEC to:

1. Obtain the necessary environmental permit for construction and implementation of the proposed Project.
2. Comply with the requirements on environmental protection of the Funding Agencies and government.
3. Implement the proposed Project with minimum adverse effects on the physical, biological, socio-cultural and socio-economic environments.

Prior to the preparation of this ESIA, a Scoping report was submitted to the EPA. The main purpose of the Scoping report was to outline the key issues to be addressed in the ESIA in order to eliminate the insignificant issues and focus on those that are significant. In essence, the scoping process provided a preliminary assessment of the:

- ❖ Potential impacts of the proposed Project
- ❖ The parameters that should be included in the study
- ❖ The availability and usefulness of existing information and the appropriate field survey methods for collecting new information.
- ❖ Potential monitoring parameters
- ❖ Potential stakeholders

This Environmental and Social Impact Assessment has therefore been submitted as a result of the aforementioned activities. The official approval document for the scoping report to implement the detail Environmental and Social Impact Assessment Study from the EPA of Liberia is attached as Appendix 4.

1.4. Legal and administrative, policy framework and International Requirement

Liberia has put in place several policies and signed a number of protocols aimed at improving environmental management in the country. These range from National laws, regulations, policies, strategies and action plans to multilateral agreements. As the government tries to put the country back on the path of sustainable development, the challenge is the effective implementation of these various laws and regulations. The Environmental Protection Agency (EPA) is the Government authority mandated by law to monitor, coordinate and supervise environmental issues in the country.

There are also many other stakeholders involved in the sector. Several ministries, agencies have a stake in environmental governance, but the primary institutions are Ministry of Agriculture(MOA), Ministry of Lands, Mines and Energy(MLM&E), The Forestry Development Authority(FDA), and the Environmental Protection Agency (EPA).

The following relevant regulations guide the implementation of the undertaking:

- ❖ Conservation of the forest of Liberia Act of 1953
- ❖ Supplementary Act for the Conservation of Forests of 1957
- ❖ Forestry Development Authority Act of 1976
- ❖ National Resources Laws of 1979
- ❖ Wildlife and Natural Parks Act of 1988
- ❖ New Mineral and Mining Laws of April 2000
- ❖ Enactment of the Forestry Law
- ❖ Public Health Act
- ❖ Water Resources Management Laws of 1981
- ❖ Environmental Protection Agency Act of 2002 and Environment Protection and Management Law
- ❖ Land Act 1856
- ❖ County Act 1969
- ❖ Land Acquisition Act 1929
- ❖ Protected Forest Area Network Law, the Sapo National Park Act of 2003
- ❖ National Environmental Policy of Liberia of 2002
- ❖ National Environmental Policy Act of 2003
- ❖ European Investment Bank Social guidelines on involuntary resettlement
- ❖ World Bank Operational Policy 4.01, Environmental Assessment
- ❖ World Bank Operational Policy 4.11, Physical Cultural Resources

- ❖ World Bank Operational Policy 4.12, Involuntary Resettlement”
- ❖ World Bank Operational Policy 4.36, Forests
- ❖ World Bank Group Environmental Health and Safety General Guidelines, April 2007
- ❖ World Bank Group Environmental, Health and Safety Guidelines for Electric Power Transmission and Distribution, April 2007
- ❖ African Development Bank (AfDB) Groups’ Policy on the Environment, February 2004
- ❖ African Development Bank (AfDB) Involuntary Resettlement Policy, November 2003
- ❖ African Development Bank (AfDB) Environmental and Social Assessment Procedures, June 2001
- ❖ KfW Sustainability Guidelines
- ❖ International Finance Corporation, Environmental, Health and Safety Guidelines for Electric Power Transmission and Distribution

1.4.1. Legal and administrative framework

Constitution of Liberia. The constitutional basis for environmental law is found in Article 7 of the 1986 constitution of Liberia, which provides for public participation of all citizens in the protection and management of the environment and natural resources in Liberia. The clause embraces environmental protection as a fundamental rule according to which the country must be governed. It binds state institutions in particular the legislative and executive to adopt and activate environmental policy and to formulate national development plans that are environmentally sustainable.

Conservation of the Forest of Liberia Act of 1953. Early legislation establishing forest reserves and conservation area were included in the Conservation of the Forests of the Republic of Liberia Act of 1953. This Act and a supplementary Act for the Conservation of the Forest of 1957 provided the framework for the use of forests and wildlife resources and allowed for the creation of government reserves, native authority reserves, Communal Forests, National Parks, and Wildlife refuges.

Forestry Development Authority Act of 1976. In 1976, the Act that created the Forestry Development Authority established and defined the responsibilities of the Forest Development Authority, outlined offences and penalties in connection with the Act, made provisions for an Advisory Conservation Committee and Specified power of forest officers with regard to trees in reserve areas.

The National Resources Law of 1979 includes chapters on forests, fish, wildlife, soil, water and minerals. The Law gave the FDA to create and establish government forest reserves and national parks where logging hunting or mining are strictly prohibited.

However the World Bank Transmission Line RoW Guidelines state that minimal farming and vegetable gardening may be permitted along the RoW except for the area occupied by tower foundations and 3.0 m RoW maintenance track as this will help reduce maintenance cost of the RoW.

The two respecting regulations are in conflict with each other. However, farmers cultivating under the line and maintaining the ROW has been shown to be an effective way of protecting the ROW from encroaches and maintaining the land use and vegetation, reducing costly ROW line monitoring. Therefore it is recommended to encourage to farm inside RoW after the construction of transmission line is complete but not to allow planting of trees to meet the vertical clearance limit as stipulated in World Bank Transmission Line RoW Guidelines.

The law also covered matters such as the control and prevention of soil erosion, reserving and improving soil fertility, adequate use of water resources and controlling pollution of public and private waters from industrial or agricultural wastes.

The Wildlife and National Parks Act of 1988 identified a number of protected areas and specified policies and objectives regarding wildlife conservation in the country. Regulations to be declared by the FDA under the new Act concerning wildlife and protected area conservation have been drafted and it cover hunting, internal and international trade, and procedures for establishing new protected areas. The FDA is re-establishing its protection program for the National Forests.

The Enactment of the Forestry Law of 2000 also provides for environmental protection. It states in chapter 8 that “all forestry operations and activities shall be conducted so as to avoid waste and loss of biological resources and to protect natural biological resources against damage, as well as to prevent pollution and combination of the environment. The Law provides for the establishment of protected areas, research in the conservation of forest resources, reforestation and afforestation programs, and the conduct of education and

awareness programs on forest resources conservation and management. A provision in the Forestry Law also prohibits the waste of forest resources.

The Public Health Act contains provisions for the protection of the sources of drinking water and the inspection of potential sources of pollution. The law has limitations in terms of its enforcements. The Act does not address the total management aspect of water resources. In 1981, with the assistance of UNDP, the Government of Liberia, through the Liberian Hydrological Service Bureau of the Ministry of Lands, Mines and Energy prepared a draft water law. The law laid down a complete framework for water resources management in Liberia, but was not enacted.

The Environment Protection Agency Act of 2002 established the Environment Protection Agency (EPA) and the institutional arrangement that support the Agency. The main bodies created under the Act are the Policy Council, the Agency, the Board of Directors, and County and county Environmental Committees. It also provides for the formulation and periodic update of a National Environment Action Plan, which will incorporate county and county environmental action plans. The National Environment Action Plan (NEAP) is intended to be an integral part of the National Plan for Sustainable Economic Development in Liberia. In addition, the act mandates the institution for enforcing the law and provides the tools through which the environment will be managed. It provides for an Environmental Administrative Court to hear cases from aggrieved parties. It requires that environmental and social impact assessment (ESIA) be carried out for all activities and projects likely to have an adverse impact on the environment. It provides for a mechanism for ordering a person responsible to restore degraded environment. The act requires that formulation of environmental protection standards, guidelines and procedures; and economic incentives to encourage environment-friendly using practices. The Environmental Court has the provision to meet in counties capitals and in Monrovia. The act also foresees the establishment of a national environment fund for revenues received by the Agency, such as fees for permits, fines, contributions and donations.

The Environment Protection and Management Law is a parallel bill to the Environmental Protection Agency Act. The Environment Protection and Management Law enable the EPA to protect the environment through implementing the law. The EPA is responsible to ensure that all sectoral laws confirm to the framework law. The Environmental Protection Agency Act of 2002 arranges the rules, regulations and procedures for environmental impact

assessment, auditing and monitoring. It establishes regulations for environmental quality standards; pollution control and licensing; guidelines and standards for the management of the environment and natural resources. It also addresses the protection of biodiversity, national heritage and the ozone layer. Other areas covered include environmental restoration orders; inspections; international obligations; and information access; education and public awareness. Several subjects comprised in the Environmental Protection and Management Law anticipated stand-alone, sector-specific statutes, rules and regulations that may be required to facilitate implementation of this law.

In 2003, the Government of Liberia signed three new laws aimed at protecting Liberia's forests from deforestation, fragmentation and degradation. These laws- the protected Forest Area Network Law, the Sapo National Park Act and the Nimba Nature Reserve Act – has come into force. Preparation of the laws was led by Fauna Flora International with technical input from many Liberian and international partners, and financial support from the European Commission, the Critical Ecosystems partnership fund and the patron Trust.

The third law creates the Nimba Nature Reserve. It is approximately 13,400 hectares. This mountainous reserve is contiguous with the Nimba Nature Reserves of Guinea and Cote d'Ivoire, which together were declared a Nature World Heritage site UNESCO in 1981.

Land Act 1856. Prior to independence, land acquisition and distribution was done on the basis of relationship and class system. Opposition to this system of land tenure led to the establishment of a set of rules known as the "digest of law to govern the affairs of the settlers in terms of land distribution." This later culminated into the Land Distribution Act of 1856 which removed the restriction to land distribution based on citizenship. This Act was repealed by the 1950 Land Act which restricted land ownership to citizens and naturalized citizens especially those of Negro decent.

County Act 1969. This Act officially distributed and demarcated land boundaries in Liberia. Prior to the Act, counties were created through political means. For instance the four oldest counties in Liberia - Montserrado, Sinoe, Grand Bassa and Maryland were all products of political events.

Land Acquisition Act 1929. The Act lays down the procedure for obtaining rights to any piece of land in Liberia through purchase. The Act distinguishes land in Liberia into two categories Viz: the Hinterland, and the County area.

1.4.2. Policy Framework

Liberia has been operating fragmented environmental policies before 2000. Each public agency governed its own policies it had set. Under the auspices of the National Environmental Commission of Liberia (NECOLIB), established in 1999, a National Environmental Policy of the Republic of Liberia was prepared and submitted to the office of the President in August 2001. The document was approved in November 2002.

The objectives of the National Environmental Policy of Liberia are to ensure the improvement of the physical environment, improve the quality of life of the people and ensure reconciliation and coordination between economic development and growth with sustainable management of natural reserves. The policy focuses on the following areas:

- ❖ Socio-economic dimensions and cross-cutting issues;
- ❖ Sustainable management of sectoral systems;
- ❖ Working with and through people; and
- ❖ Policy implementation

In order to promote effective implementation of sectoral environmental policies and strategies, the National Environmental Policy, among other things, calls for the strengthening of institutional mechanisms and reviewing and where necessary formulating environmental legislation. It also calls for establishing a national environmental council and an autonomous government agency. It seeks to develop and implement systems and guidelines for assessing environmental impacts of development economic activities and to increase environmental education and public awareness. Other goals include developing capacity for environmental management, empowering local communities in the management of natural resources through community participation, and involving the private sector and non-governmental organizations (NGOs) in all aspects of management of their natural resources and the environment.

The Environmental Policy defines policy goals, objectives and principles for sustainable development, but does not include measures and actions to address the priority problems.

Liberia is a party to Convention of Biological Diversity, the Cartagena Protocol on Bio-safety and the Abidjan Convention for the protection and development of the Coastal and Marine Environment. The EPA is mandated to function as focal point for conventions on the environment.

The Environmental Protection Agency (EPA) formerly the National Environmental Commission of Liberia (NECOLIB) has participated in the Development of a Collaborative Institutional Data Framework for Integrated Environmental Assessment and Reporting for West Africa and with the assistance of UNDP and UNEP prepared a State of the Environment Report in November 2002, which has been approved and published.

Besides these environmental policy documents, other strategies and plans that address environmental protection include National Energy Strategy (1984), the Ten-year Forestry Sector Development Program, policies in the agricultural sector, the mining/mineral resources sector and the National Plan of Action for the protection of the Coastal and Marine Environment from Land and sea-based activities (2005).

Liberia has an environmental agenda and has therefore signed a number of Multilateral Environmental Agreements and Conventions. The obligation of the Government of Liberia to the CBD (Convention on Biological Diversity) and CITES (Convention on the International Trade of Endangered Species) Conventions requires the proponent to respect the principles of sustainable environmental management in its construction and maintenance undertakings of the transmission line. The principles of these MEAs and the World Bank OP 4.12 (as revised in April, 2004) are applicable to this project. Due consideration has been taken of them in the preparation of this document. In selecting the line route, the over-riding consideration has been the avoidance of environmentally sensitive areas and settlements and the minimization of the destruction of property and farms.

1.4.3. International Environmental Requirement

World Bank Operational Policy 4.01 Environmental Assessment. The policy helps to ensure the environmental and social soundness and sustainability of investment projects. It also supports integration of environmental and social aspects of projects into the decision-making process. The policy promotes environmentally sustainable development by supporting the protection, conservation, maintenance, and rehabilitation of natural habitats and their functions. The proposed development belongs to the category of projects that require mandatory ESIA as it may have implications on natural habitats and forest areas.

World Bank Operational Policy 4.04 Natural Habitats. All natural habitats have important biological, social, economic and existence value. Important natural habitats may occur in tropical humid, dry, and cloud forests; temperate and boreal forests; Mediterranean-type shrub lands; natural arid and semi-arid lands; mangrove swamps, and other wetlands; estuaries; sea grass beds; coral reefs; freshwater lakes and rivers; alpine and sub alpine environments, including herb fields and grasslands. The Bank does not support projects involving the significant conversion of natural habitats unless there are no feasible alternatives for the project and its sitting, and comprehensive analysis demonstrates that overall benefits from the project substantially outweigh the environmental costs.

World Bank Operational Policy 4.11 Physical Cultural Heritage: The policy aims to ensure that projects contribute to the preservation of cultural property and seeks to avoid their elimination. If projects cannot avoid affecting cultural property negatively the policy requires mitigation activities to be undertaken to limit adverse impacts to the maximum extent possible.

World Bank Operational Policy 4.12 Involuntary Resettlement. The main focus of this operational guideline is to seek to avoid project affected people experiencing negative effects associated with the project such as loss of security, loss of land or assets on land, or being put into a detrimental life situation due to a Bank supported development project.

World Bank Operational Policy 4.36 Forests. The management, conservation, and sustainable development of forest ecosystems and their associated resources are essential for lasting poverty reduction and sustainable development, whether located in countries with abundant forests or in those with depleted or naturally limited forest resources. The objective of this policy is to assist borrowers to harness the potential of forests to reduce poverty in a sustainable manner, integrate forests effectively into sustainable economic development, and protect the vital local and global environmental services and values of forests

African Development Bank Involuntary Resettlement Policy. The African Development Bank's involuntary resettlement policy has been developed to cover involuntary displacement and resettlement of people caused by the African Development Bank financed project and it applies when a project results in relocation or loss of shelter by the persons residing in the project area, assets being lost or livelihoods being affected. The policy is set

within the framework of the African Development Bank's Vision in which poverty reduction represents the overarching goal. Within this goal, the strategic action to achieve sustainable development will be pursued. It reaffirms therefore the commitment of the African Development Bank to promote environmental and social mainstreaming as a means of fostering poverty reduction, economic development and social well being in Africa. It is therefore meant to assist African Development Bank and borrowers to address resettlement issues in order to mitigate the negative impacts of displacement and resettlement and establish sustainable economy and society

African Development Bank Environmental and Social Assessment Procedures (ESAP).

The ESAP has been developed to improve decision-making and project results in order to ensure that African Development Bank-financed projects plans and programs are environmentally and socially sustainable as well as in line with African Development Bank's policies and guidelines. The ESAP intend to replace the current procedures and integrate all crosscutting considerations into the new assessment process. The ESAP propose to regional member country and Bank staff various instruments for assessing projects. The ESAP also formalise the use of Environmental and Social Impact Assessment (ESIA), Environmental and Social Management Plan (ESMP) and Environmental and Social Audits as instruments to enhance project benefits and (in order of priority) to prevent, minimise, mitigate, or compensate for adverse impacts.

1.5. Project Categorization

The present ESIA is part of the compliance process as detailed in the World Bank's Operational Policy 4.01 and African Development Bank's Environmental and Social Assessment Procedures.

World Bank classifies the project into one of four categories, depending on the type, location, sensitivity, and scale of the project and the nature and magnitude of its potential environmental impacts as.

- ❖ **Category A:** A project is classified as Category A if it is likely to have significant adverse environmental impacts that are sensitive, diverse, or unprecedented. These impacts may affect an area broader than the sites or facilities subject to physical works.
- ❖ **Category B:** A project is classified as Category B if its potential adverse environmental impacts on human populations or environmentally important areas--

including wetlands, forests, grasslands, and other natural habitats--are less adverse than those of Category A projects.

- ❖ **Category C:** A project is classified as Category C if it is likely to have minimal or no adverse environmental impacts. Beyond screening, no further EA action is required for a Category C project.
- ❖ **Category FI:** A project is classified as Category FI if it involves investment of World Bank funds through a financial intermediary, in subprojects that may result in adverse environmental impacts.

The African Development Bank's Environmental and Social Assessment Procedures also provides for classification of the proposed projects into categories 1, 2, 3 and 4 depending on the magnitude of its potential environmental impacts and required report.

- ❖ **Category 1** projects are those that are likely to have the most severe environmental and social impacts and require a full ESIA.
- ❖ **Category 2** projects are likely to have detrimental and site-specific environmental and social impacts that can be minimized by the application of mitigation measures included in an ESMP.
- ❖ **Category 3** shall not induce any adverse environmental and social impacts and do not need further ESA action.
- ❖ **Category 4** projects involve investment of Bank's funds through Financial Intermediaries (FIs) in subprojects that may result in adverse environmental or social impacts. Specific requirements for this type of project include an assessment of FI capacities to handle environmental and social considerations.

The present ESIA is part of the compliance process as detailed in operational Policy 4.01 and 4.12 of World Bank, Involuntary Resettlement Policy of African Development Bank as well as other concerned agencies' guidelines. The construction of the 225 kV transmission line and associated substation facilities classified as Category A of World Bank or Category 1 of African Development that call for ESIA, because the proposed Project will be implemented in broad areas and likely to have many impact on the project area.

1.6. Line route selection of the project

Parallel with the ESIA study of the proposed Project, the line route study for the proposed Project was implemented by the Consultant at the same time. The purpose of the line route

study of the proposed Project was to examine and determine the optimum line route for the proposed Project and prepare the maps and drawings for the selected line route.

1.6.1. Methodology for line route and substation site selection

As a first step of the line route study, the Consultant collected transmission line route and substation selection guidelines from LEC.

Then the preliminary line route proposed by WAPP was reviewed and general line route selection criteria have been taken into consideration to organize the draft line route. Also, the existing environmental data and obstacles were evaluated using information from field trips, topographical maps, and data collection activities.

Based on that data, the length of Cote d'Ivoire-Liberia-Sierra Leone-Guinea draft interconnection line was estimated minimum 1,200 km to maximum 1,300km in total and 532km in Liberia section respectively.

The consultant developed several options of transmission line route and substation sites. In the process of developing the each option, the Consultant has also taken into account the following constraints and general considerations, which have repercussions on the feasibility and cost of project implementation.

[Considerations for Transmission Line Selection]

- ❖ To avoid crossing protected areas, such as parks, nature reserves, etc
- ❖ To be as short and as direct as possible, to minimize costs
- ❖ To stay a reasonable distance from urbanized areas
- ❖ To avoid crossing tourist areas or important panoramic sites
- ❖ To avoid sterilizing fertile land with a commercial agricultural potential
- ❖ To avoid wetlands for tower location as much as possible during design stage

[Considerations for Substation Site Selection]

- ❖ **Availability of Land:** Land area measurements would normally be demanded for present and future substation requirements
- ❖ **Proximity to Load Centers:** The substation should feed medium voltage power (34.5kV) to minimize overall system losses and development costs. This will require that new substations be located close to loads.

- ❖ **General Flatness of Terrain:** Where substations are to be constructed, terrain should be generally flat in order to reduce the cost for civil works
- ❖ **Out-Of-Town Locations:** Out-of-town locations, preferably on the outskirts of townships, will help to avoid resettlement, compensation and land use conflict issues. This will minimize the substation's visual impact on the environment.
- ❖ **Proximity to Major Roads:** Easy access during construction and periodic maintenance carried out at the substation demands that it be close to a major road for easy accessibility.
- ❖ **Natural Drainage:** Natural drainage generated by the terrain would help the free flow of rainwater, so that the substation does not become flooded.
- ❖ **Connection to an Existing Transmission Line:** The substation site should be close to an angle tower so that it can tie into an existing transmission lines.

In addition Criteria linked to the choice of corridors, the Consultant made an effort to avoid the sensitive areas inside the zone of study as far as possible by adopting some environmental constraint. These elements taken into considered are as follows:

[Environmental Constraints]

- ❖ Areas Protected by Law
 - National Parks (current or anticipated)
- ❖ Reserves (flora, fauna, ornithological)
- ❖ Protected forests
- ❖ Forest Areas and Vegetation
 - Forests and forest grove
 - Plantations (pines, cashew trees, fruit trees)
 - Gallery-forests and coastal vegetation hedges
 - Mangroves
 - Other humid or tropical ecosystems
 - Areas containing threatened species and species of social, economic, cultural and scientific interest
- ❖ Faunal Areas
 - Bird migration corridors and flock areas
 - Recognized faunal habitats
 - Threatened species
- ❖ Human habitat

- Populated areas (cities, villages, hamlets, etc.)
- Land use
- Anticipated development zones
- ❖ Cultural Areas
 - Sacred forests and woods
 - Archaeological or historical sites
 - Panoramic and tourists sites
 - Shrines/religious site/cemeteries
- ❖ Critical natural habitat as specified in the World Bank OP 4.04

The satellite images used for the RTLAD (Route Transmission Line Aided Designer) program to select the transmission line route from Man in Cote d'Ivoire to Linsan in Guinea were 65 photographs (23km×23km/scene) that were high resolution color (Pan-sharpened Color) Cartosat Satellite images (IRS-5m + Resourcesat) with spatial resolution of 2.5 m. Based on proposed options of the line route and the substations selected by RTLAD program, the Consultant verified suitability of the proposed line route and the substations by site visits. As a result of site visit with authorities concerned, the optimal line route and the substation sites were suggested.

1.6.2. Line route selection in the Hotspot areas

1.6.2.1. Introduction

The potential Funding Agencies dispatched their specialists to Monrovia, Liberia (30th August ~ 3rd September, 2010) in order to review and examine the previously selected line route, and to do site visits of the affected communities identified along the selected line route in Liberia section.

Also, the potential Funding Agencies interested in the proposed Project such as WB, AfDB, EIB and KfW organized a video conference on 15th September, 2010 in Cotonou, Benin to discuss their findings and concerns with WAPP and the Consultant. During the conference, the two environmentally sensitive areas (Hotspots) along the selected line route in Liberia were identified and the concerned Funding Agencies gave their comments and recommendations for the modification of the previously selected line route and substation site.

In addition to the Funding Agencies recommendations, the Consultant identified another one environmentally sensitive area in Liberia so-called Lake Piso which will be designated as a

multiple protected area in near future during the meeting with Forestry Development Agency (FDA) of Liberia.

Comments and recommendations from relevant authorities regarding the identified sensitive areas in Liberia were summarized as below.

❖ **Recommendations from the concerned Funding Agencies**

In general the proposed transmission Line Route is acceptable. There are however a few global biodiversity hotspots for which a more in-depth Analysis of Alternatives will be required. There are areas where the line route will have to avoid or moved further away: Nimba Nature Reserve and proposed RAMSAR site south of Sannequille (Gbedin Wetlands) in Liberia

❖ **Comment from the Forestry Development Agency (FDA) of Liberia**

FDA will designate the Lake Piso as a multiple protected area in the near future. Therefore the necessity of relocation of the selected line route within the boundary of the Lake Piso multiple protected areas should be discussed with FDA

The location of Hotspots along the previously selected transmission line route in Liberia is shown in the map below.

Figure 1: The Location of the Hotspots in Liberia



1.6.2.2. Consultation with related stakeholders

After receiving the comments and recommendations from relevant authorities, the Consultant held several meetings with related stakeholders to get their opinion and to

investigate further alternative options for the environmentally sensitive areas in Liberia as the table below.

Table 1 Consultation with Related Stakeholders

Organizations	Date	Remarks
LEC	22 nd , 28 th December 2010	
Environment Protection Agency	28 th December 2010	
Forestry Development Agency	28 th December 2010	
Ministry of Lands, Mines and Energy	30 th , December 2010	
Ministry of Agriculture	14 th , January 2011	
Ministry of Planning and Economic Affairs	17 th January 2011	

In addition to the discussion with related stakeholders, the Consultant visited the sites to examine and verify possible alternative line routes in the field in October, December 2010 and January 2011.

1.6.2.3. Comparison of alternatives in Hotspots

This section provides a comparison of the alternatives in the 3 Hotspots along the transmission line RoW. The comparative analysis presented in this section focuses on the differences among the various alternatives estimated in terms of environmental, social, technical and financial aspects. This section is intended to provide the relevant stakeholders with information about the merits and disadvantages of the alternatives that will assist them in their consideration of determination of transmission line route of the proposed Project and to assist the public in understanding the differences between the alternatives.

The detailed criteria applied to evaluate each alternative line routes was described as below

- Environmental aspect: Existence of protected area inside or near the alternative, the distance from the nearest protected area
- Social aspect: Number of resettlement within the distance of 300m from each alternative.
- Technical aspect: surrounding topographical condition, number of river-crossing point, level of difficulty during the construction and operation phases.
- Financial aspect: length of suggested alternative line routes.

LEC recommends that minimum 1km distance between the RoW and protected areas is required to minimize the potential adverse impacts might be arisen from the implementation or operation of the Project. In order to ensure that the selection of the line route is in full compliance with national regulations specifying minimum distance between the line route and protected areas, the Consultant held several meetings with the Ministry of Lands, Mines and Energy (MLME). During the meeting, the Assistant Minister of MLME indicated that there are not national regulations in MLME or LEC specifying the minimum distance between the route and protected areas, however it was confirmed that the minimum 1km distance adopted for Study would be appropriate and acceptable.

To facilitate a clear understanding of the various alternatives, this section provides a summary of the detailed descriptions for each alternative presented in Section 1.6.2.3.1 through 1.6.2.3.3. And primary features of each alternative are presented in the table to allow for ease of comparison.

1.6.2.3.1. Alternative line route in the Nimba Nature Reserve

Description of Nimba Nature Reserve

Created in October 2003, Mount Nimba Nature Reserve brings another protected area in Liberia. Dominated by a semi-montane and deciduous forest, it is one of the 14 centers of plant endemism within the Upper Guinea Hotspot. The Mount Nimba Massif is located within the Sanokole quadrangle and is found on the northeastern border of Liberia.

Due to the influence of the mountains, the area has a milder temperature during most of the year than the rest of the country. The hills and mountain ranges with their special vegetation are the favorite migration and wintering sites of palearctic migrants such as European pied flycatcher, *Ficedula hypoleuca*, spotted flycatcher, *Muscicapa striata*, Garden warbler and rock thrushes *monticola* found in rocky areas. It is believed that the Nimba Range does not have the full height to develop a true montane rainforest. The Nimba slope between 500 and 700 meters contains a large number of plant species, representing not fewer than 82 genera of trees and bushes. *Piptadeniastrum*, *Heritiera*, and *Lophira* are common. Between 700 and 900 meters *Parinari* are becoming increasingly common, as well as *Parkia* and associated species. There is an ecological boundary at about 850 meters from where a dense layer of clouds usually covers the slope and ridges except during the dry months. Nimba is an important bird area and a designated world heritage site.

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In 1968, the German Forestry Mission to Liberia conducted the Nimba National Forest Inventory, which described the Nimba Range as containing a forest of transitional belt between lowland and mountain evergreen forest. As a result, the Government proclaimed two national forests, the East and West Nimba National Forests. The study shows that the Nimba Range is not high enough for the development of true montane rainforest. There is an ecological boundary at about eight hundred fifty (850) meters up wards, a dense layer of clouds usually cover the slopes and ridges except in the dry months. To date, only small remnants of forest are now left above 1200 meters dominated by Parinari and Garcinia polyanatha.

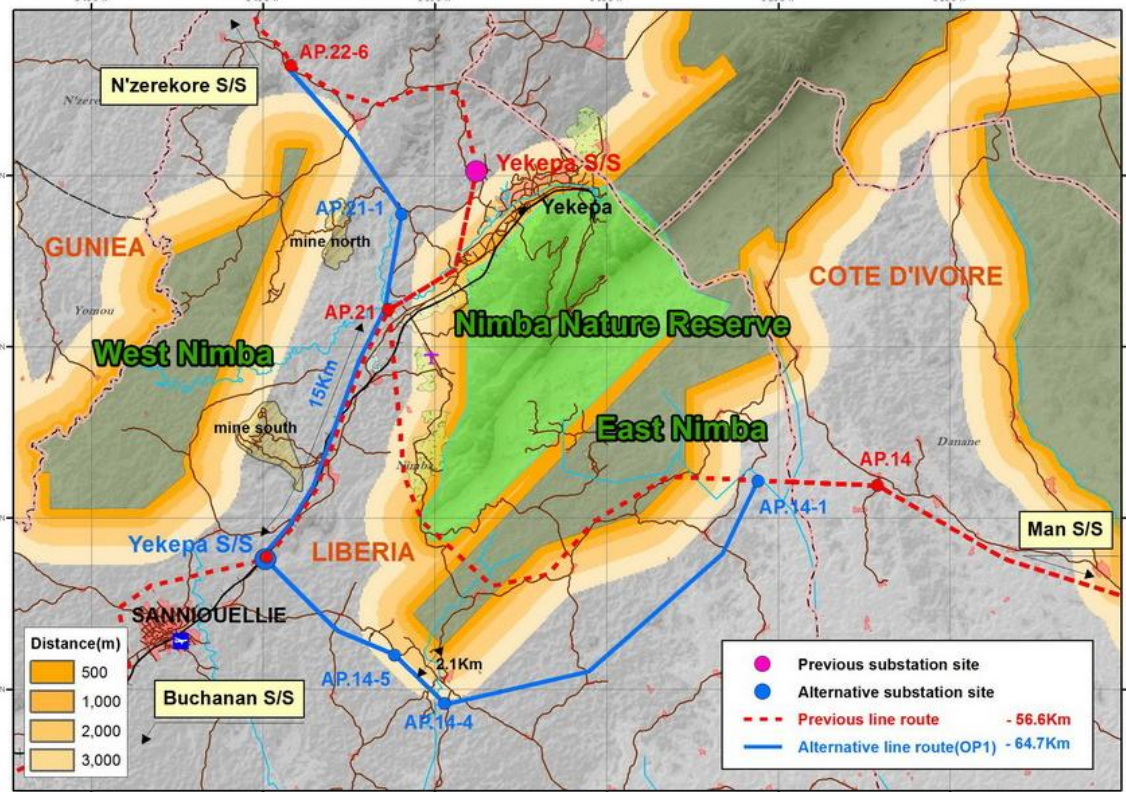
In the 1970s, the IUCN conducted a detailed survey and as a result the area was proposed as a Nature Reserve. Beginning in 1971, the Forestry Development Authority, the Agency of Government responsible for forestry in Liberia, saw the need to rehabilitate portions of the area already degraded by logging activities and shifting cultivation. They began a tree-planting programme, which later extended to large areas of plantations. In December 1996 and January 1997, a German Forester, Mr. Wulf Gatter, with interest in ornithology, traveled to Liberia during the civil war (1989 – 2001) to begin actual work on the Mount Nimba Range. At the end of his work, he recorded many species of birds around the Nimba Range

Major Considerations

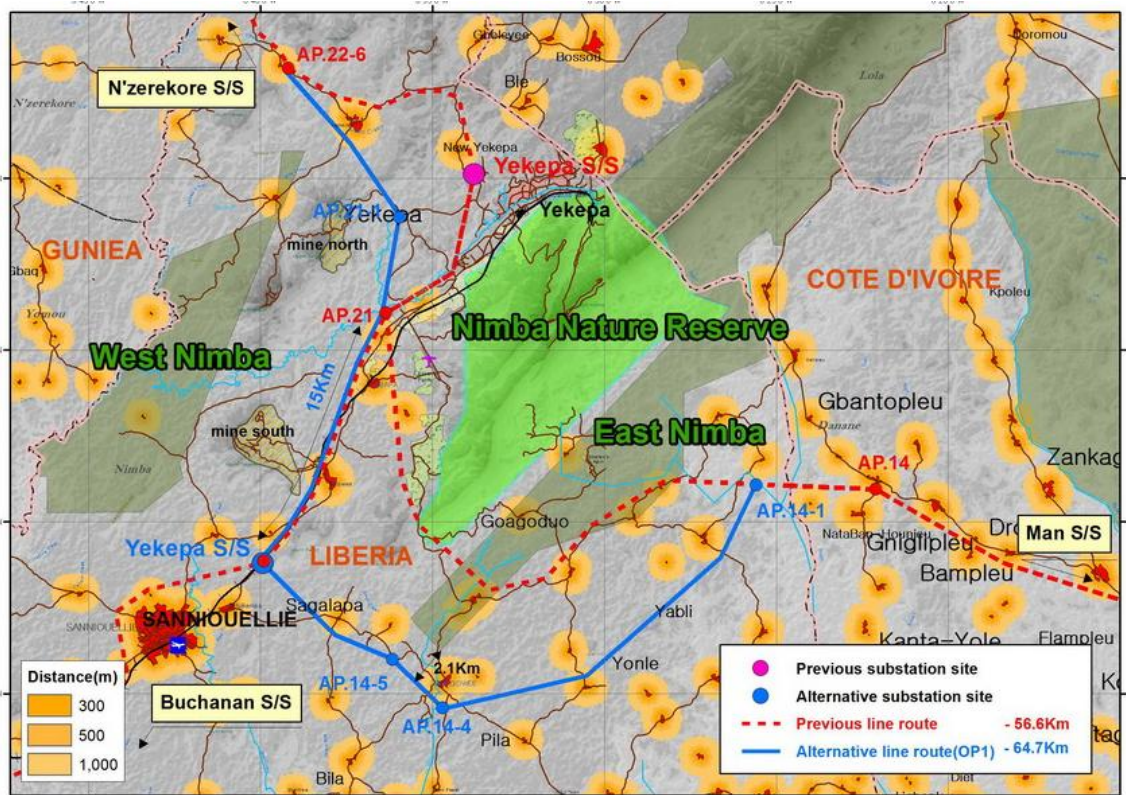
1. The Funding Agencies recommended that the previously selected transmission line should be located more to the south away from the nature reserve, since this whole area is a global biodiversity hotspot as determined by the biodiversity studies carried out by Arcelor Mittal.
2. The Funding Agencies recommended that the Yekepa substation to be located closer to the mines and the iron-ore concentrator, in between the mines and Sannequille town, which are both load centers.

Analysis of the Alternative Line Route

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[Analysis of the Alternative - Distance from Protected Area]



[Analysis of the Alternatives - Communities within 300m distance from the Alternatives]

[Previously Selected Line]

There are two protected areas near the previously selected transmission line route; the Nimba Nature Reserve and the East Nimba. The previously selected line routes traverses the southern part of the East Nimba 11.1km and pass through the outskirts of the Nimba Nature Reserve to the southwest approximately 1.7km, and then continue to the previous Yekepa substation site. The Yekepa substation site has been proposed between the Yekepa town and mining site (North) occupied by Arcelor Mittal mining company which is considered as one of the major load centre of this area and it has been located 0.6km away from the Yekepa town in expectation of possible future expansion of the town.

Taking 300m as a buffer between this previous option and local communities, this line route encounters one village.

This line was made to follow the existing road as much as possible. Even though this area is located between mountainous areas, the road condition is relatively good and considered wide enough to equip the traffic which will arise due to the construction of transmission line or future regular maintenance. Therefore, it is expected that the delivery of tower materials, construction and maintenance of towers is favorable compared to Alternative Option 1.

The line length of this previous line will be 56.6km. Consequently, total construction cost for this line route will be approximately 6.14 million Euros.

[Alternative Option 1 - Selected]

In order to minimize the adverse impact on these protected areas, enough buffer was taken into consideration when organized the Alternative Option 1. So, the previous transmission line section AP14-1 ~ AP21 was adjusted to move further southwest to avoid the East Nimba and the Nimba Nature Reserve. In an effort to compose the economical line route, section AP21 ~ AP22-6 was moved to the west. Based on the recommendation of the Funding Agencies, the location of the Yekepa substation has been moved to the south to be located closer to another mining area (South) and Sannequille town, which is another major load center.

Taking 300m as a buffer between proposed option and local communities, this alternative line route encounters one village.

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Alternative Option 1 is located in hilly and partially swampy area. And there is no access road to be used during the construction in the section AP14-1 ~ AP14-4(OP1) approximately 20km. Due to this site features, many difficulties in delivery of tower materials, construction and maintenance of towers are to be expected.

The line length of Alternative Option 1 will be 64.7km which is 8.1km longer than previously selected line. Consequently, total construction cost for this alternative line route will be 7.06million Euros approximately.

Condition		Previous Line	Alternative OP1
Environmental Condition	Protected Area	Not Avoided	Avoided
	Adjacent Protected Area (Distance)	Nimba Nature Reserve (Passing through) East Nimba (Passing through)	Nimba Nature Reserve (6.5km) East Nimba (2.1km)
Social Condition	No. of Communities within 300m	1	1
	No. of Communities Within 500m	2	2
Technical Condition	Terrain (Altitude)	Hilly (360-615m)	Hilly and swampy (360-585m)
	River Crossing Point	1 (Dayea River)	7 (Dayea River)
	Length of T-line without existing access road (km)	3	20
	Construction and Future Maintenance	Easy	Difficult
Financial Condition	T-Line Length(km) (Difference, km)	56.6	64.7 (▲8.1)
	Cost Estimation(Euro)	6,140,000	7,064,200

[Conclusion]

The previous line includes construction of 56.6km transmission line and one substation in the vicinity of the Nimba Nature Reserve and the East Nimba. It was composed by following existing road as much as possible in order to minimize adverse impacts on neighboring environment and thus to facilitate favorable construction and maintenance of the transmission line and substation. However, it will pass though the outskirts of two protected areas; the total distance will be about 12.8km. The Nimba Nature reserve is a sensitive area, therefore consideration of its protection needs to be taken into account as recommended by the concerned Funding Agencies.

Alternative Option 1 was made in an effort to avoid the Nimba Nature Reserve and the East Nimba. It comprises construction of 64.7km transmission line, which is 8.1km longer than previous line route, and one substation in this area. The construction and maintenance activities of in the Alternative Option 1 are expected to be more difficult than previous line route, because for a length of 20km (out of the 64.7km) there is no access to and existing road nearby. However, Option 1 is considered more preferable to the previous line route because it is possible to avoid the Nimba Nature Reserve and the East Nimba as mentioned by the Funding Agencies.

1.6.2.3.2. Alternative line route in the Gbedin Wetlands

Description of the Gbedin Wetlands

Gbedin Wetlands which is a proposed RAMSAR site, (25 ha) is situated in Nimba county in the north of Liberia - the area is largely a swamp but also includes a man-made wetland with an irrigation system that includes channels, ditches, dams and drainages. It is largely a swamp at the lower part of the Nimba Mountain. It is inhabited by the Gio and Mano tribes of Liberia with a small population of Mandingo tribe crossed over from Guinea. The most practiced religions are Christianity and Islam with Christianity being the dominant.

The Gaye Creek running across the site is a tributary of one of the major rivers in Liberia, the St. John. The soil type is lateritic and rocks common in this area are those of the Precambrian.

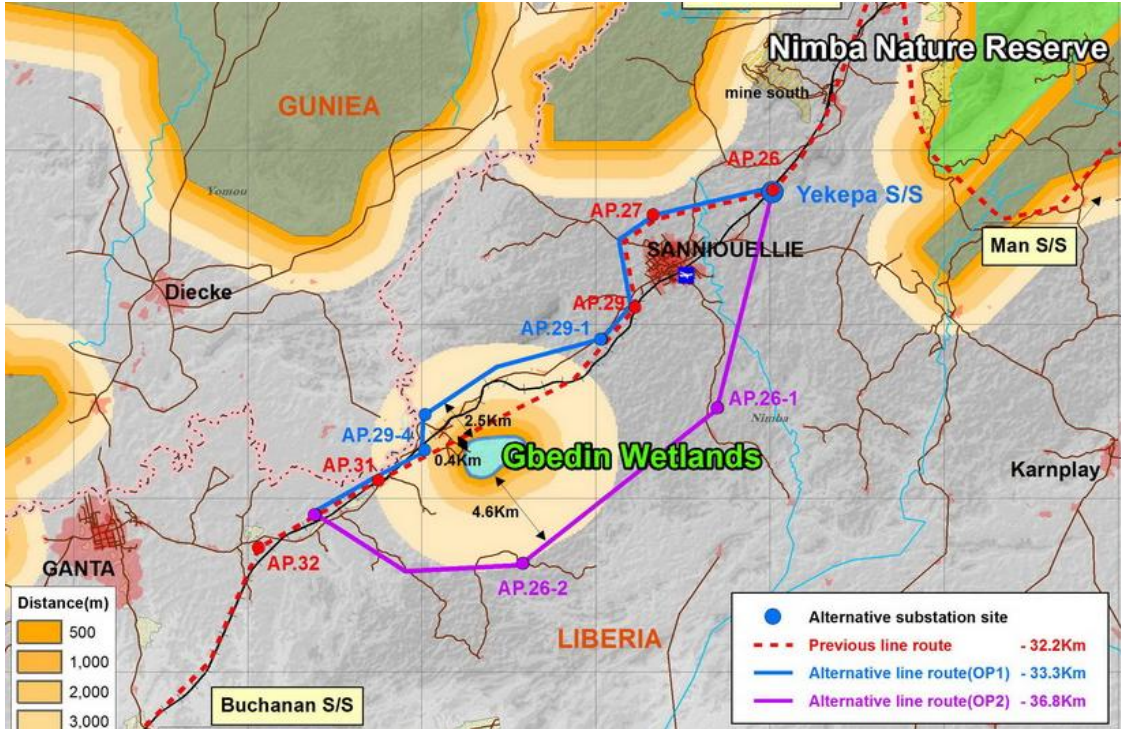
The area is humid, with low humidity during the dry season from December to February-March. Relative humidity varies from 99-94%. The annual rainfall is between 3,825mm-1,818mm. The main maxima and minima temperature is 30°C-24°C around Ganta.

The paddy fields provide a good feeding ground for many bird species including Palaearctic and Nearctic migrants as well as resident breeders such as the Plover (*Charadrius dubius*), Bar-Godwit (*Limosa lapponica*) and the Forbes' Plover (*C. forbesi*). The endemic otter shrew (*Micropotamogale lamottei*) also occurs in the area. The suitability of the swamp for rice cultivation prompted the government in 1960 to solicit technical assistance to introduce modern agricultural methods to local rice farmers in order to discourage shifting cultivation. The project, the Gbedin Swamp Rice Project, has employed a large number of local people, especially up to the onset of the civil war in 1990. The site is currently used for subsistence farming (rice), hunting and fishing, while the surroundings are used for logging and mining, as well as multiple crop farming. The use of fertilizers and pesticides are potential threats.

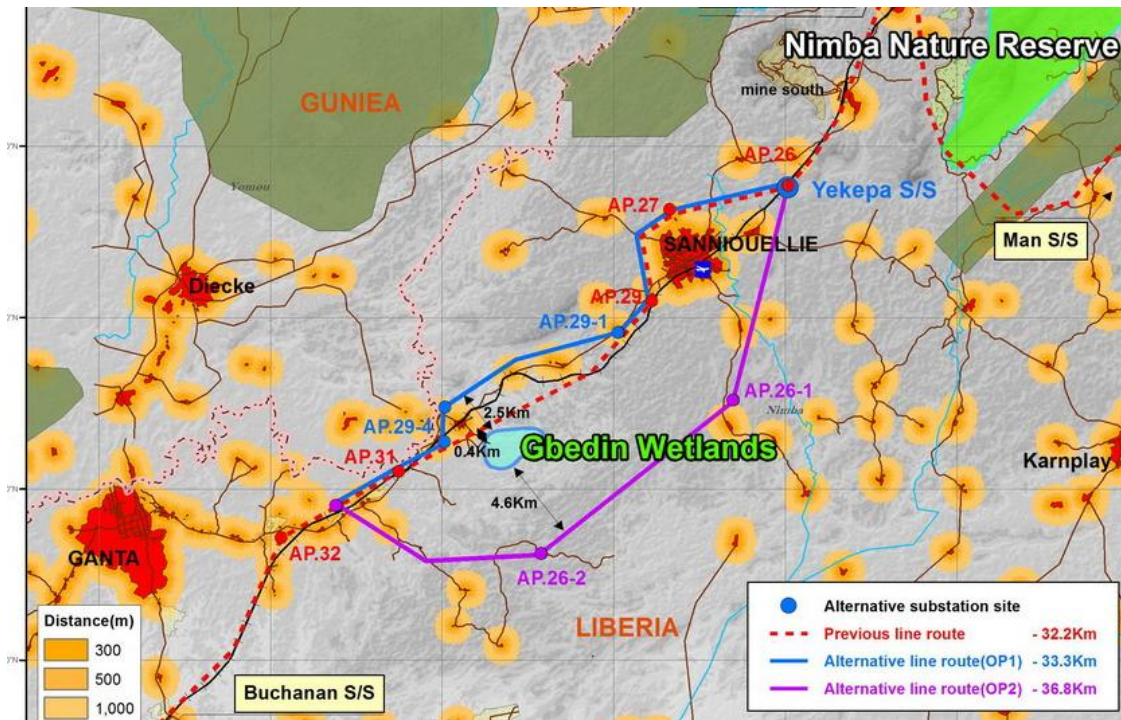
Major Consideration

The Funding Agencies mentioned that there is an area where the line route will have to avoid or moved further away: proposed RAMSAR site south of Sannequille (Gbedin)

Analysis of the Alternative Line Route



[Analysis of the Alternatives - Distance from Protected Area]



[Analysis of the Alternatives - Communities within 300m distance from the Alternatives]

[Previously Selected Line]

There is a protected area near the previously selected transmission line route section AP29 ~ AP31; the Gbedin Wetlands which is a proposed Ramsar site and a largely swampy area including a man-made wetland with irrigation system that includes channels, ditches, dams and drainages.

Taking 300m as a buffer between the previous line route and local communities, no villages are encountered.

This previous line is located generally grassy and flat area. And the width of the potential access road to be used during the construction is generally 6~6.5m. Because the line was selected close to an existing highway to be used for the potential access road for the construction, this condition will be favorable to transport construction material and maintain the transmission line.

The line length of this previous line will be 32.2km. Consequently, total construction cost for this line route will be approximately 3.46 million Euros.

[Alternative Option 1-Selected]

In this alternative, the previous line was moved to further north to avoid the Gbedin wetlands. The geographical features were taken into consideration in order to minimize the adverse impact on this area. As drawn in the map above, there is an existing highway between the Gbedin Wetlands and this option. This composition aims to prevent the adverse impacts from spreading up to the Gbedin Wetlands as much as possible by keeping to the north of the existing highway.

Taking 300m as a buffer between Alternative Option 1 and local communities, no villages are encountered.

Alternative Option 1 generally passes through flat area. And the width of potential access road to be used during the construction is generally 6~6.5m. The potential access road is currently wide enough, and it is currently being used by mining company and the large local villages and located close to this Alternative Option 1. So, the construction and future maintenance in this option will be easier than Alternative Option 2.

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The line length of Alternative Option 1 will be 33.3km which is 1.1km longer than previously selected line. Consequently, total construction cost will be approximately 3.58 million Euros.

[Alternative Option 2]

This alternative avoids the Gbedin Wetlands by detouring to the south and uses surrounding existing road as much as possible for the future access road. And this alternative option is approximately 5km to the south of the previously selected line route.

Taking 300m as a buffer between Alternative Option 2 and local communities, no villages are encountered.

Alternative Option 2 is in relatively lower and flatter area than Alternative Option 1, but there are a lot of small swamps scattered on the east side of Gbedin Wetlands which are likely to be flooded during the rainy season. Considering that Alternative Option 2 is located in the vicinity of the riverside and swampy area in general, many difficulties in delivery of tower materials, construction and maintenance of towers are expected compared to Alternative Option 1.

The line length of Alternative Option 2 will be 36.8km which is 3.6km longer than previously selected line. Consequently, total construction cost will be approximately 3.96 million Euros

Condition		Previous Line	Alternative OP1	Alternative OP2
Environmental Condition	Protected Area	Avoided	Avoided	Avoided
	Adjacent Protected Area (Distance)	Gbedin Wetlands (0.4km)	Gbedin Wetlands (2.5km)	Gbedin Wetlands (4.6km)
Social Condition	No. of Communities within 300m	-	-	-
	No. of Communities Within 500m	3	3	4
Technical Condition	Terrain (Altitude)	Flat (280-470m)	Flat (280-470m)	Riverside, swampy (280-485m)
	River Crossing Point	-	-	-
	Length of T-line without existing access road (km)	3	-	20
	Construction and Future Maintenance	Easy	Easy	Difficult

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Financial Condition	T-Line Length(km) (Difference, km)	32.2	33.3 (▲1.1)	36.8 (▲3.6)
	Cost Estimation(Euro)	3,460,000	3,580,000	3,960,000

[Conclusion]

The previous line involves construction of 32.2km transmission line. This line was made to detour the Gbedin Wetlands to the North with the distance of only 0.4km. The Gbedin Wetlands is an ecological sensitive area, so protection of these areas should be taken into consideration, as recommended by concerned Funding Agencies. The line route should maintain a greater distance from this area.

Alternative Option 2 involves 36.8km transmission line construction and has merit that at least 4.6km buffer zone from the Gbedin Wetlands can be created. However this option needs to traverse the swampy areas scattered between AP26-2(OP2) and AP32, which will additionally make the construction and maintenance more difficult.

Alternative Option 1 comprises construction of 33.3km transmission line which is 1.1km longer than the previous line. This option relocates the previously line route to further north in order to put enough distance (at least 2.5km) from the Gbedin Wetlands. There are not many differences in terms of environmental, social, technical, financial conditions between previous line and Option 1. Moreover, an existing highway is located between Option 1 and Gbedin Wetlands, thus this option will not have a noticeable damaging effect on that Hotspot. Thus Option 1 is considered the most preferable line route among the possible alternatives.

1.6.2.3.3. Lake Piso Multiple Protected Area

Description of the Lake Piso

The Lake Piso is one of the proposed Ramsar sites in Liberia. It is located in southern Grand Cape Mount County north-western Liberia and covers about 31,000 hectares. It lies within Latitudes 6°30' – 7°00' and Longitudes 10°55' – 11°30', this site extends from the Mano River at Liberia's border with Sierra Leone to the Lofa River between Grand Cape Mount and Bomi Counties. It is about 72 miles west of Monrovia.

The climate in the area is tropical, as in all parts of Liberia, with two major seasons: dry (sunny) and rainy (wet) seasons which occur from September through April of the following year and from April through September of the same year respectively. The area falls within Liberia's maximum rainfall zone receiving up to about 4000-4800 mm of rain annually. The

daily temperature falls between 27 and 32°C and the daily humidity may rise up to about 80% during the dry season.

The site rises in altitude from 0 to about 322 meters above sea level with Cape Mount rising to the highest point. Except Cape Mount with rough and steep terrain, the rest of the site is generally flat and very low in altitude. Sand soil (regosol) extends 8-10 km from the sea shore towards inland.

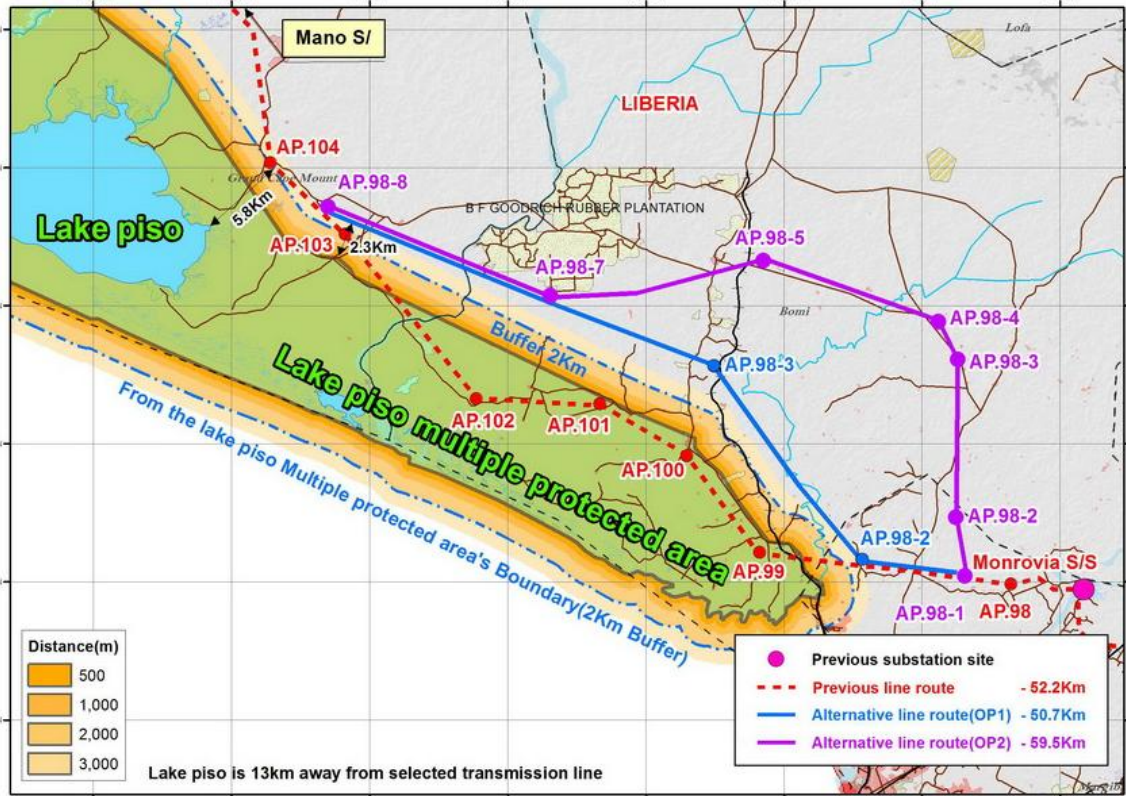
Beyond 8-10 km other soils begin to appear (e.g. sandy clay, clayish loam, sandy loam and laterite). Also, alluvial soil occurs along the banks of rivers and creeks/streams. The bulk of the present Lake Piso Nature Reserve is wetlands consisting of Lake Piso, rivers, creeks/streams, lakelets and lagoons. Mano, Maffa, Mawua, Manii, Moffe, Maa and Lofa are rivers and creeks in the area. The Lofa, one of Liberia's major rivers, is in the southeast and forms the boundary between Grand Cape Mount and Bomi Counties. In the northwest is the Mano River, another major river of Liberia; it forms the border of Liberia with Sierra Leone. The other rivers are minor but important for navigation and travelling in the Lake Piso region. Lake Piso, one of Liberia's gifts from Mother Nature and a pride to Grand Cape Mount County. This water body covers an area of approximately 100km² (c. 40sq miles) and has a maximum depth of approximately 4-5m (Gatter, 1997). It is an important water catchment area with rivers and streams flowing into it (e.g. the Maffa, Mawua, Manii and Moffe Rivers). An interesting feature of the lake is the famous Massatin Island with an area of about 3.6 km². The site was abandoned during World War II; the cows remained there and changed to wild buffalos. Another interesting feature is the floating (or Moving) Island. It is a small island (less than a hectare in size).

Vai and Mendi are the two ethnic groups in the region with Vai dominating. The human population up to 2004 is estimated at about 16,000 – 21,000.

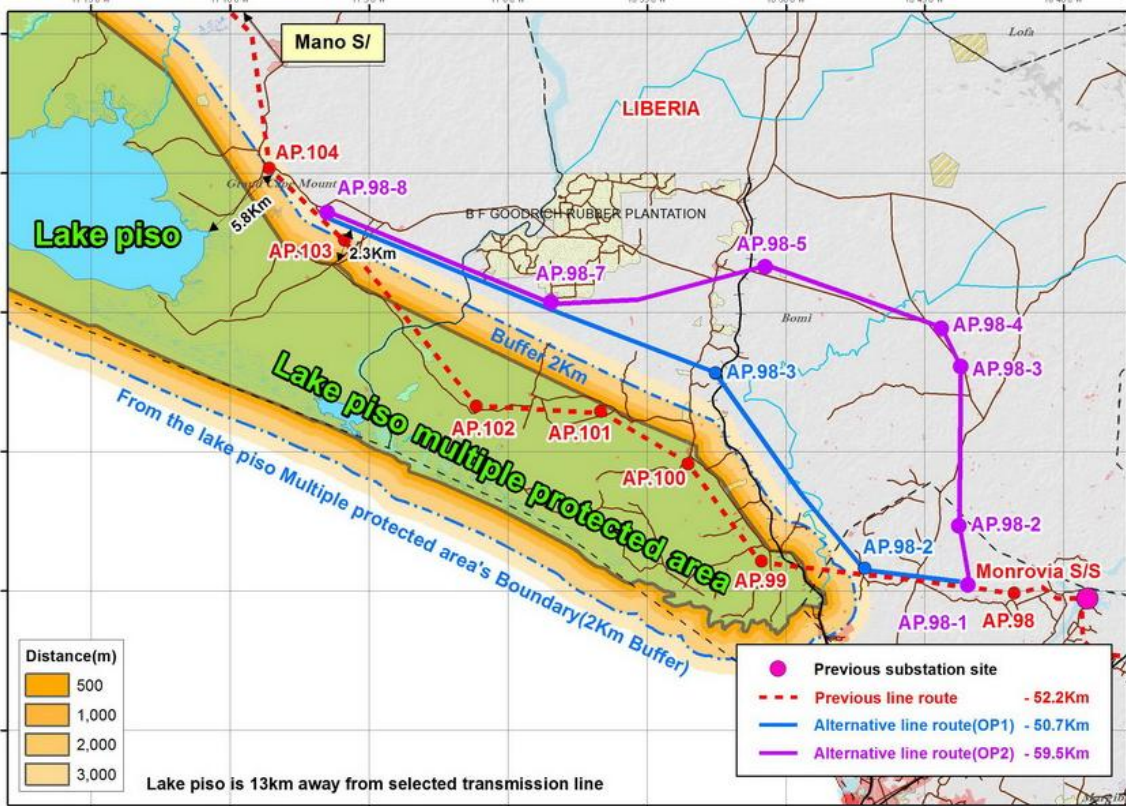
To protect the lake Piso, FDA (Forestry Development Authority) of Liberia developed a plan to designate the Lake Piso as a multiple protected area

Major Consideration

FDA of Liberia will designate the Lake Piso as a multiple protected area in the near future. Therefore the necessity of relocation of the selected line route within the boundary of the Lake Piso multiple protected areas should be discussed with FDA



[Analysis of the Alternatives - Distance from Protected Area]



[Analysis of the Alternatives - Communities within 300m distance from the Options]

[Previously Selected Line]

There is a protected area in the vicinity of the AP104 previously selected transmission line route; the Lake Piso which is one of the largest lake in Liberia and proposed as a Ramsar site. The previous line route does not pass through the Lake Piso itself and is stood 5.8km away from the lake. However, according to the future plan of FDA of Liberia, the wider area surrounding the Lake Piso will be designated as a multiple protected area. In that case, previously selected line will pass through 35km of that protected area in the section from AP99 to AP103.

Taking 300m as a buffer between the previous line and local communities, this line route encounters 3 villages.

This previous line is located in generally lower and swampy area. And this line route was made to follow the existing road as much as possible. There will not be many difficulties in delivery of tower materials, construction and maintenance of towers.

The line length of the previous line will be 52.2km. Consequently, total construction cost for this line route will be approximately 5.58 million Euros

[Alternative Option 1]

In this alternative, the previously selected line route passing through the future protected area was adjusted to be located further north of the Lake Piso. This Alternative Option 1 was made to be located further away from the future protected area by detouring to the north-west with the distance of at least 2km and detours the existing Goodrich rubber plantation concession.

Taking 300m as a buffer between proposed option and local communities, this alternative line route encounters 1 village.

This Option 1 is located near the riverside and swampy area. For the 10km (out of 50.7km) of this line route, there is no useful potential access road near Alternative Option 1. So, it will be necessary to build a new road to approach the transmission line for the project implementation. Due to these site features, many difficulties in delivery of tower materials, construction and maintenance of towers are expected.

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The line length of this option will be 50.7km which is 1.5km shorter than previously selected line. Consequently, total construction cost will be approximately 5.58 million Euros.

[Alternative Option 2 - Selected]

In this alternative, the previously selected line route passing through the future protected area was adjusted to be relocated further north east from the Lake Piso and Alternative Option 1. In an effort to avoid the swampy largely located between AP98 and AP98-2(OP1) and to take the existing road for the future access road as much as possible, Alternative option 2 took the north direction and continued to AP104. Also, it detours the existing Goodrich rubber plantation concession around AP98-7(OP2).

Taking 300m as a buffer between proposed option and local communities, this alternative line route encounters 1 village.

This Alternative Option 2 is located the outskirts of a mountainous area and relatively higher than the option 1. For 15km of transmission line (out of 59.5km), there is no useful potential access road near this Alternative. Because this line route avoids many small swamps scattered between AP98 and AP98-2(OP1), the delivery of tower materials, construction and maintenance of towers are expected relatively easier than Alternative Option 1.

The line length of this option will be 59.5km which is 7.3km longer than previously selected line. Consequently, total construction cost will be approximately 6.41 million Euros.

Condition		Previous Line	Alternative OP1	Alternative OP2
Environmental Condition	Protected Area	Not Avoided	Avoided	Avoided
	Adjacent Protected Area (Distance)	Lake Piso (Passing through)	Lake Piso (2.3km)	Lake Piso (2.3km)
Social Condition	No. of Communities within 300m	3	1	1
	No. of Communities Within 500m	14	8	12
Technical Condition	Terrain (Altitude)	Lower and Swampy (10-55m)	Riverside and Swampy (10-50m)	Hilly (10-60m)
	River Crossing Point	2 (Po, Lofa River)	2 (Po, Lofa River)	2 (Po, Lofa River)
	Length of T-line without existing access road (km)	-	10	15

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	Construction and Future Maintenance	Medium	Difficult	Medium
Financial Condition	T-Line Length(km) (Difference, km)	52.2	50.7 (▼1.5)	59.5 (▲7.3)
	Cost Estimation (Euro)	5,580,000	5,580,000	6,410,000

[Conclusion]

The previous line involves construction of 52.2km transmission line. This option was made to follow the existing road to avoid the Goodrich rubber plantation site and then it passed through the future Lake Piso Multiple Protected Area to be created by FDA of Liberia. Thus it is desirable to avoid this area.

Alternative Option 1 comprises construction of 50.7km transmission line. This is shorter than the previous line and at least 2.3km buffer can be made from the future Lake Piso Multiple Protected Area. However, the construction and maintenance of transmission line route is expected more difficult than other options because it will have to traverse the swampy areas situated between AP98-1 and AP98-2(OP1).

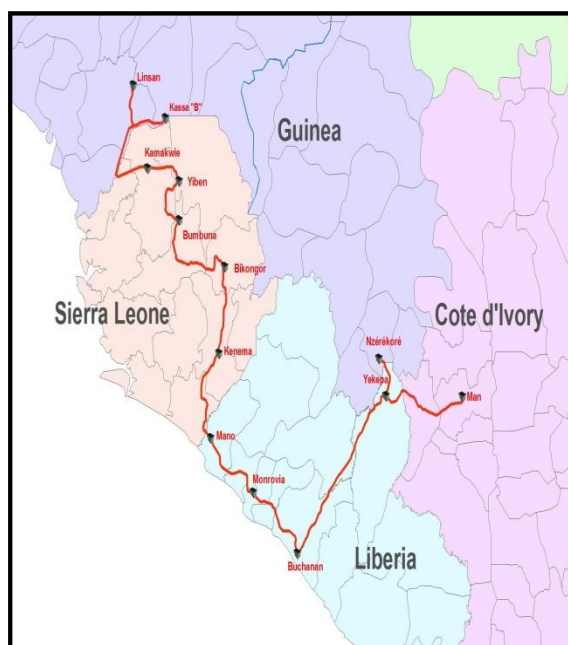
Alternative Option 2 involves construction of 59.5km transmission line and keeping at least 2.3km from the neighboring protected areas. Also, it has merit that it will go through the hilly area making the construction and maintenance of transmission line easier than the other options. Therefore Option 2 is considered most preferable line route in this area.

2. PROJECT DESCRIPTION

2.1. Côte d'Ivoire – Liberia – Sierra Leone – Guinea Interconnection Project

The proposed Project component in Liberia comprises the construction of (4) four substations and 532km of 225kV transmission lines. One substation in Sannequille town, one in Buchanan one to be located at Mount Coffee in Monrovia and the other one to be located near Mambo Town in Grand Cape Mount County. The construction of the substations and the running of the high tension electric transmission lines from Yekepa to Mano River are indeed cutting across the entire length and breadth of Liberia. The line passes through seven (7) important political subdivisions in Liberia (Nimba, Bassa, Bong, Margibi, Montserrado, Bomi and Grand Cape Mount Counties (see Figure 3).

Figure 2: General location of proposed line route (225kV) in Liberia



Section	Length
Sierra Leon Border -Mano	11km
Mano-Monrovia	107km
Monrovia-Buchanan	112km
Buchanan-Yekepa	229km
Guinea Border -Yekepa	37km
Yekepa-Côte d'Ivoire Border	36km
Total	532km

- ✓ The Mount Coffee to Monrovia distribution lines consist of two 66 kV lines from Mount Coffee to Bushrod in Monrovia (24 km) and to Paynesville in Monrovia (26 km).

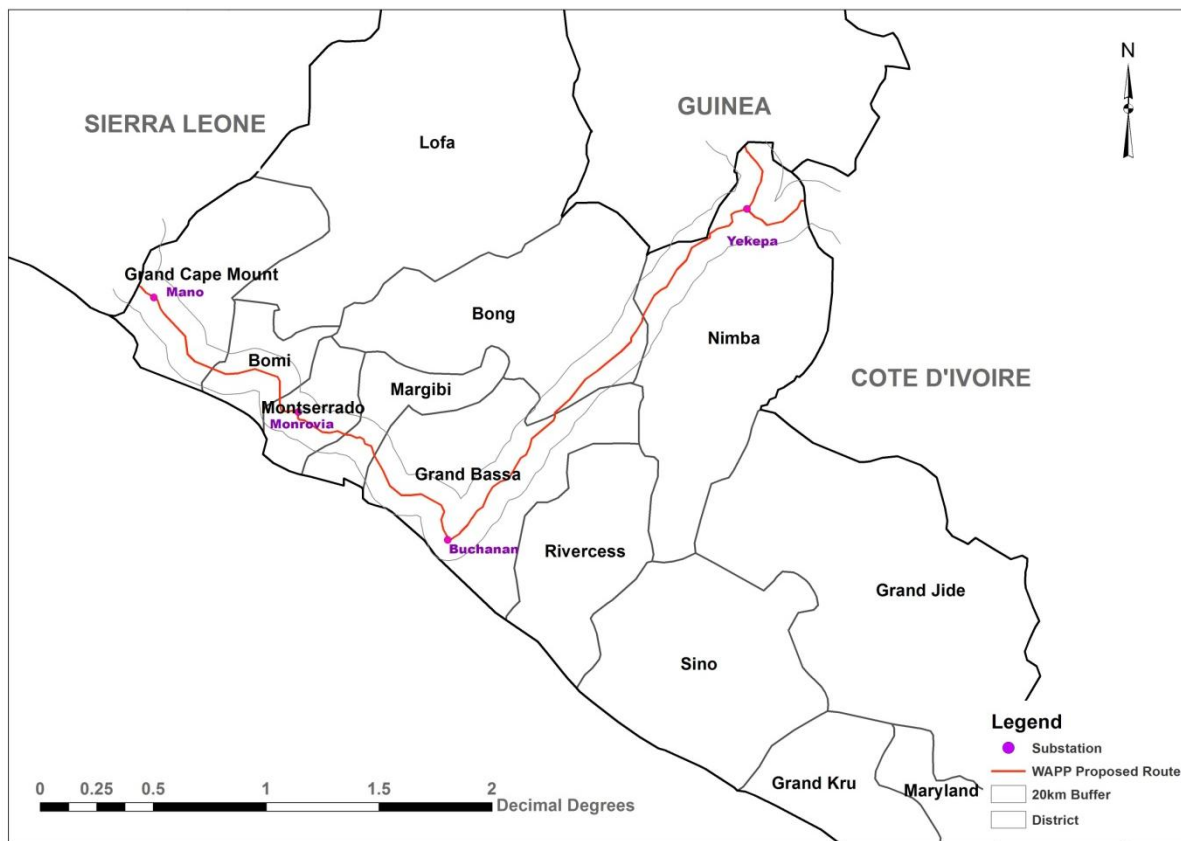
The elements of the proposed Project that have already been carried out during the pre-construction stage are the preparation of feasibility reports, land surveying and pillaring to identify the route to be taken by the proposed transmission line.

The Environmental and Social Impacts Assessment has concentrated on environmental issues that relate to delivery to site of equipment and materiel, erection of towers, stringing of lines, testing and commissioning of a 532 km 225 kV transmission line. The line will be

fitted with an optic fiber conductor (OPGW), which will be used for power system protection, control and communication purposes.

The proposed Project will, among others, consist of the erection of steel transmission towers along the route. The height of the towers will be such as to provide a minimum of 8.0 meters clearance between the lines and open ground or house and 20 meters clearance for roads. Typically, as with the existing system, the towers will be about 35 ~ 40 meters high.

Figure 3: Counties affected by the proposed transmission line



The transmission lines shall be constructed within a narrow corridor of 40 m that will span the counties named above (and some of their communities) for a distance of about 535 Km. The proposed Project may therefore be termed a 'linear' one.

In the alignment of the proposed transmission line, the proponent has ensured that environmentally sensitive areas have been avoided. Deliberate efforts were made to avoid as many communities as possible.

2.2. Technical description

2.2.1. Description and characteristics of the transmission line

Voltage level

The voltages considered for the whole interconnection are the following:

- ❖ Transmission: 225 kV

The low voltages used for the auxiliary substations are the following:

- ❖ Various supplies: 400/230 V AC
- ❖ Protection relay: 127 V DC
- ❖ Telecommunications: 48 V DC
- ❖ Radio communications: 12 V DC.

Conductor characteristics

The 225kV line will be double circuit with a single installed circuit in first step. The phase conductors will be in Almelec (AAAC) ASTER 570mm² section. The ground cables will be in aluminum steel (AACSR) PHLOX (56mm² aluminum, steel 60mm²), One of them is equipped with an optical fiber (24 fibers). They will be isolated to allow the rural electrification at medium voltage.

Characteristics of insulators

They will be in toughened glass.

- ❖ Class: U160
- ❖ Nominal diameter: 280mm
- ❖ Unit spacing: 146mm

Along the Atlantic coast (between Buchanan – Monrovia – Mano) the insulators will be “anti-fog” type. Taking into account the insulation level of 1050 kV adopted for the 225 kV lines, the insulator strings could be simple or double and are composed of 14 elements for suspension strings and 15 elements for tension strings.

Characteristics of towers

- ❖ The 225 kV towers are metallic lattice type (autos table)
- ❖ Choice of formation 225kV
 - ✓ The results of load consumption forecast studies, load flow studies and economic studies have allowed to determine that the most adapted type is be double circuit with one circuit installed
 - ✓ The 245 kV assigned voltage is about the limit of several choices of formation.

- ✓ The choice of 225 kV formations (cat, triangle, horizontal, or vertical) will be left to the Contractor.
- ❖ Calculation of Span
 - ✓ Considering the relatively flat profile of the line route, the calculation spans are the following:

Table 2 Calculation of Span

Tower type	Angle	Wind span	Weight span	Maximum geometric span
A - suspension	0°	550 m	700 m	750 m
A – suspension	0° - 3°	reduced	reduced	
B – Small angles	0° - 30°	500 m	600 m	750 m
B – section tower	0°			750 m
C–Large a and dead end	30° - 60°	500 m	600 m	750 m

- ❖ Tower grounding
 - ✓ Due to the importance of the line, the failure rate and the number of tripping should be reduced to a minimum. A low grounding resistance should be reached; it has been fixed to a maximum of 20 Ohms per tower. In urban area, an additional grounding rod or radial cable should allow staying under less than 10 Ohms.

2.2.2. Description and characteristics of substations

General Description

The 225 kV substations will be outdoor open-terminal type, with the necessary stages such as 66, 33 and 34.5 kV, with a control building containing all the auxiliary equipment, all installed inside a walled enclosure.

The substations are designed to satisfy minimum safety and working distances. The busbars will be air-insulated tubular aluminum, in a single busbar configuration and designed for extension to a double busbar.

The breakers will be insulated with sulfur hexafluoride (SF6) and mechanically tripped via a motorset spring; the equipment will be insulated for servicing purposes by manually controlled or motorized air-insulated isolators, with earth isolators on line isolators.

The auxiliaries will be supplied with 400-230 V AC, from a 33/0.4 kV auxiliary transformer situated in the 33 kV substation. The 400V voltage supplies local requirements of 230/400 V, and of 127 & 48 V for DC. A backup diesel genset will start up automatically to supply 400-230 V in case of loss of the primary 400-230 V source. Each substation will be controlled by means of a built-in control-command and data acquisition system (SCADA), which will enable the substations to be selected and controlled either locally or remotely by a future control center. It will also be possible to select manual control of the substation if operation independent of the centralized system is required. Communication links for the centralized system will be set up either by fiber optic, preference, or by means of a carrier line(CPL). Furthermore, a radio communications system will be installed at the main substations.

A telephone link to the national networks will be installed if necessary, according to network availability.

2.3. Description of activities

2.3.1. Pre-construction phase

The activities to be undertaken during this phase of the proposed Project include:

- ❖ Project planning and design
- ❖ Line route survey
- ❖ Consultations
- ❖ Sourcing of funds and contractors
- ❖ Collection of baseline data such as flora and fauna survey, socio-economic and other baseline data for the preparation of the ESIA report.
- ❖ Preparation and submission of an Environmental and Social Impacts Assessment report.
- ❖ Acquisition of Environmental Permit
- ❖ Acquisition of the right-of-way (RoW)

2.3.1.1. Project planning and design

This phase of the proposed Project cycle involves the conceptualization, feasibility survey and preparation of feasibility report.

2.3.1.2. Line route survey

Line route survey activities were carried out by survey consultants from KEPCO. They carried out the survey of routes, establish land profiles and select the best route from several

different options taking several factors into consideration. Some of the factors considered for the choice of the proposed line route included overall route distance and the avoidance of the potential destruction of properties and other environmentally sensitive areas by the alignment of the route off industrial, residential and commercial areas, cultural resources such as sacred groves, cemeteries, and other potentially sensitive areas.

The details of transmission line route and substations site selection are indicated in Section 5 and 6 of the "Amended Final Line Route Study Report (September 2011)".

2.3.1.3. Consultations

During the environmental and social impact studies, some traditional authorities, communities, opinion leaders, County Officials and regulatory agencies were consulted. This was to enable the survey team gain access to the proposed routes since they had to clear vegetation and crops to make way for the survey.

2.3.1.4. Sourcing of funds and award of contracts

Another activity that will depend to a large extent on the issuance of an environmental permit will be the sourcing of funding for such a major development. The proponent may source funding from the major Funding Agencies such as the European Investment Bank, World Bank, African Development Bank and KfW. The ESIA will have to be prepared in accordance with internationally acceptable standards. With the availability of funds, the proponent may then go ahead and award the contract for the actual construction of the proposed transmission line.

2.3.1.5. Preparation and submission of an ESIA.

Collection of baseline data such as information on flora and fauna, potential project-affected people, types and sizes of farms, socio-economic status of the inhabitants of the project area and other baseline data necessary for the preparation of the ESIA report including an Environmental and Social Management Plan (ESMP) and a Resettlement Action Plan (RAP) was carried out by the environmental consultants with the support of LEC.

2.3.1.6. Acquisition of Project Environmental Permit

After submitting the ESIA report including an Environmental and Social Management Plan (ESMP) and a Resettlement Action Plan (RAP) to responsible authorities, Project

Environmental Permit will be issued from the Environmental Protection Agency (EPA) of Liberia.

2.3.1.7. Acquisition of the right-of-way (RoW)

Based on the issuance of an environmental permit from the EPA, the proponent may then go ahead and acquire the right-of-way in compliance with all laws, regulations, operational directives and guidelines. The mode of acquisition of the RoW is as set out below:

The procedures to be used by the SPC (Special Purpose Company) to ensure that all persons affected by the transmission line project are catered for are outlined below:

- ❖ Referencing of all properties, land, crops and buildings, by officers of the Property Valuation Section (PVS) in the Ministry of Finance to be monitored by Valuation Officer of SPC.
- ❖ Assessment of the compensable values by the Property Valuation Section (PVS) and the valuation advice forwarded to SPC.
- ❖ The assessed report would be vetted and corrections effected where necessary to ensure that the amounts are accurate and fair to both claimants and the Authority. These would then be processed for payment.
- ❖ Offers would be made to the claimants on the basis of the PVS's advice.
- ❖ Claimants dissatisfied with the offer have a right to petition for reconsideration.
- ❖ In this regard, such claimants are required to submit counter proposals supported by valuation opinion prepared by private valuers of their choice. The private reports are considered by SPC in conjunction with the PVS to ensure that claimants are treated fairly.
- ❖ Where necessary, the dissatisfied victims would be invited to negotiate and arrive at acceptable figures.
- ❖ Project affected persons may resort to legal action in order to have their grievances addressed.

2.3.2. Overview of constructional phase

The characteristics of the proposed Project involve several activities and components. These will involve activities such as have been discussed below.

2.3.2.1. Tower spotting

Another activity that will be contingent upon the issuance of an environmental permit and the availability of funds will be tower spotting. This is the determination of the individual sites for the installation of the towers. It must be pointed out here that tower spotting will take place over the whole length of the transmission line.

Activities that go along with tower spotting will include final survey and soil investigation. These activities necessitate intrusive access and some clearing of vegetation, leading to possible destruction of crops. Geotechnical survey and tower spotting are therefore activities that shall be carried out subsequent to the issuance of an environmental permit and availability of funds from the lending agencies to identify the optimum foundation design for each tower. The selection of the foundation design type will follow the collection and analysis of the data of each tower location after soil investigations. At this stage minor adjustments may be made to the final tower location, due to the vertical profile of the transmission line corridor, and to avoid buildings that may have been constructed subsequent to the collection of baseline data on structures in the proposed RoW. Such adjustments will be limited to a few metres in either direction.

2.3.2.2. Construction of access and tower corridor tracks

A tower corridor track of approximately 3 m width shall be constructed under the towers almost continuously along the centerline of the line route. Agricultural access tracks shall be used to gain access to the proposed line. Where there are no such tracks, access tracks will be constructed from the closest public roads to the RoW at intervals along the proposed line route. New access tracks, which will be constructed during the constructional phase, in addition to the tracks constructed during the line route survey will be retained and maintained for the operational phase. This measure will prevent the clearing of additional vegetation to make way for new access tracks for the operational phase. The tracks will be used for this phase of the project cycle for the transportation of men and material to the line route for the installation of towers and the stringing of the lines.

The tracks will be so constructed as to have a width of about 3 m and will be cleared of tree stumps, shrubs and other vegetation likely to obstruct the transport of construction machinery, equipment and operational and maintenance staff to the tower corridor. Cut trees will be neatly stacked to one side of the proposed tracks for the use of, or sale by, the communities close to the site of clearance.

2.3.2.3. Clearing of Right-of-Way

The construction and operation of the proposed line will require a right-of-way of 20 m on each side of the centre line of the transmission line. The width of Right-of-Way will therefore be 40 m. This total of 40 m wide corridor, which will run the total length of the transmission line shall be cleared of vegetation to a height of about 1.25 m above ground level.

Trees considered being potentially capable of threatening the proposed transmission line beyond the 20 m width on each side of the centre line of the transmission line will be cut down or pruned as appropriate. These will be trees, which could damage the transmission line if they fall on it or those whose branches may grow so big as to foul the lines. Cut trees will be neatly stacked to one side of the proposed tracks for the use of, or sale by, the communities close to the site of clearance. All vegetation clearance will be done by physical means.

2.3.2.4. Clearing and excavation of tower base and foundation

Areas to be cleared will be the proposed tower base areas. These will be selected spots within the RoW for mounting the towers. The area to be cleared for a single tower will be made up of the dimensions of the tower base (5 m x 5 m). So the total tower base area will be approximately 25m² per tower. The average span time between towers is about 400 m and the proposed transmission line length of Liberia is 532km. Thus, the total number of towers, approximately 1,330 towers/units will be needed for the purposes of the construction of the transmission line. This total area to be cleared will not be in addition to the total area to be cleared for the RoW but will be within the RoW.

The area to be cleared for a single tower will be made up of the dimension of the tower base (5 m x 5 m) with an additional buffer of 2 m on two sides of the base.

Tower foundations will vary according to the prevailing geology. A majority of them will however have footings of the pad and chimney type, which will be excavated mechanically. By this method, a concrete pad will be constructed at the bottom of the excavation, and each foot of the tower erected within its own 'chimney' of steel reinforced concrete. After about two days, the formwork will be removed, and the excavation will then be backfilled to original ground level and compacted.

The ground surfaces of the tower sites will be so graded as to gently provide drainage away from the tower legs and to avoid the collection of water (leading to the creation of stagnant pools) at the tower bases. Where necessary, (particularly on hillsides), terracing, cribbing or riprap may be used to provide protection for tower foundations.

In areas prone to flooding (swampy areas) a raft foundation for transmission line towers may be used. The raft foundation is similar in concept to the pad and chimney foundation except all four feet of each tower will be set on a single raft of concrete.

2.3.2.5. Clearing of tower track

A track of about 3 m width will be cleared and maintained under sections of the proposed line as far as is practicable. This track will be cleared of all obstructing tree stumps and roots in order to allow the unimpeded movement of light maintenance vehicles for patrolling the line and for the transportation of tools and maintenance crew during the constructional and operational phases of the transmission line.

2.3.2.6. Clearing and excavations for substation

A total of four substations will be constructed in the Liberia side due to the implementation of the proposed Project. An average of 200m x 200m land space will be required for each substation. A total land area of about 160,000m² shall be required for the construction and operation of the proposed substations.

This total land area required for the construction of the facilities shall be cleared of all vegetation in order to afford access to construction sites. Sites shall be graded and landscaped.

2.3.2.7. Storage and transportation of equipment and materials

Almost all the materials to be used in the construction of the transmission line will be imported. Such components include tower steel and its components in broken down form, conductors, insulators, transformers, switchgear, etc. Materials that will be procured locally will include aggregates, cement, sand, stone and other miscellaneous supplies and services.

During the construction, the materials will be transported to the site via public roads and access tracks. Vehicle movements will be minimal since the work camps will be sited close to the proposed sites.

The locations of the work camps cannot be specified now but their construction will not involve extensive vegetation clearance. In addition, the work camp will be constructed:

- ❖ At least 1 km from natural water courses and marshlands
- ❖ At least 1 km from settlements and on relatively level ground

The location of the work camp will not impact negatively on cultural properties, and on forest reserves. It will also be so located as to avoid the destruction of crops and buildings.

2.3.2.8. Erection of towers and stringing of transmission lines

After transporting the steelwork and its components from the yards to the site, erection of the transmission towers will proceed. The towers will have concrete footings with foundation depths of 2–3 m or more depending on the nature of soils at the selected tower spots. Once the towers are erected, the conductors and shield wires will be strung and appropriately 'tensioned' to provide the minimum clearance between ground level and the wires.

The proposed line is expected to cross overhead power transmission lines, highways, roads, and rivers and streams. In crossing such lines, guard structures will be used when installing the conductor to ensure that the line does not cause hazards and nuisances to the public and construction staff alike. Due notification will be communicated to the appropriate authorities in cases where these lines will have to cross roads and utility lines.

Once the towers have been erected and the lines strung, tests and measurements shall be carried out to ensure that the line performs as expected. Minimum distances such as clearances between the lines and the ground level shall be checked and the lines shall be 'tensioned' as per specification. After the construction of the line, the soil conditions along the right-of-way will be assessed for such problems as compaction and erosion and mitigative action taken as appropriate. Areas of bare soil are expected to be re-colonized by native cover plants to stabilize the soil, reduce erosion and prevent invasion by undesirable plant species. It must be pointed out here that no chemicals will be used for the control of vegetation and that all vegetation control measures shall be done manually.

As indicated in section 2.1, the line will be fitted with an optic fiber cable (OPGW), which will be used for system protection and control and communication purposes.

2.3.3. Operational phase

The operational phase of the proposed Project will involve the commissioning of the line and maintenance of the RoW, the power lines and the towers.

The operation and maintenance of the transmission line will be based on accepted international standards, such as those of the International Electrotechnical Commission (IEC). The LEC has its own specific procedures for the operation and maintenance of its lines as set out in the 'LEC Rules and Regulations'. This document concerns itself with issues, which are considered of paramount importance such as public safety and the safety, health and welfare of maintenance crew.

The main activities to be carried out during the operating life of the transmission line include surveillance of the condition of the transmission line, towers and RoW; routine and emergency maintenance and repairs; and vegetation control.

The LEC maintains a Transmission Department with headquarters in Monrovia that is responsible for the operation and maintenance of its transmission network in Liberia. The Department carries out its duties under three broad categories. These are discussed below.

2.3.3.1. Routine running maintenance

Routine maintenance will be carried out by the SPC which is responsible for the implementation and operation of the proposed Project to ensure the integrity and safety of the lines. The maintenance activities to be carried out include:

- ❖ **Foot patrol.** The Line Maintenance team carries out routine physical examination of the transmission line and its component parts to ensure the safety, security and integrity of the line. Such activities are carried out at least twice a year.
- ❖ **Security patrol.** This is done to check on segments of the line close to populated areas for signs of vandalism, tampering, and general security of the lines. It is to ensure an early detection of and rapid response to acts of vandalism and to rectify such situations as promptly as possible.
- ❖ **Tower auditing and repairs.** This provides a means of assessing the ageing process of towers. It starts one year after the commissioning of a line section and it follows a one-year cycle. In a cycle of tower auditing, 10% of all suspension towers and all dead-end towers are thoroughly examined. As the line ages, it is subjected to wear and fatigue which may not be noticeable by a distant visual inspection.

Detection and tightening of loose bolts on supports and hardware can reduce premature wear and indicate for replacement of worn components before failure.

In the course of operation defects that are identified are repaired. Such defects may include the replacement of defective conductors, flashed over insulators, defective dampers, vandalized components, and maintenance of access tracks and RoW.

2.3.3.2. Major maintenance

These are scheduled maintenance programs that are carried out on the transmission line as a result of the ageing of towers, the lines and other accessories. The repairs may also arise out of the running maintenance activities. These maintenance programs usually become necessary as a result of the lines running through aggressive environments (mining areas, industrial and coastal areas). Some of the activities carried out under the major maintenance program include:

- ❖ Replacement -insulation of sections of the transmission line
- ❖ Treatment of rust and re-painting of tower components
- ❖ Replacement of corroded towers and transmission line components
- ❖ Replacement of conventional bolts and nuts with anti-theft fasteners on older line sections
- ❖ Rehabilitation of access roads and tracks

2.3.3.3. Emergency maintenance

These are activities relating to correction of sustained line faults. These could span a whole spectrum of minor faults (e.g. insulator failure) to such major defects as tower failures. Some of the activities carried out under this program include the construction of temporary by-pass line to replace collapsed sections of lines, reconstruction of the collapsed section, and aerial and ground patrols to locate sustained line faults.

2.3.4. Summary of project life cycle phases

Table 3 shows the key phases of the proposed Project and relative timing.

Table 3: Life cycle phases of project

Project Phase	Activity description	Estimated Duration	Comments
Construction	Clearing of tower tracks,	36 months	Typical industrial construction

	excavation of tower base, erection and stringing grading, substation building erection, equipment installation		methods; Construction lay down areas to be landscaped (trees/grass) at end of construction
Commissioning	Testing and first operation of equipment frequent start and stops Operation	9 months	Frequent start and stops
Operation	operation and maintenance of equipment	Indefinite	LEC operational manuals to be strictly followed during operation of substation transmission line
Decommissioning	Removal of equipment and pulling down of buildings	-	Plant and equipment may be potentially recyclable

2.4. Consideration of alternatives

During the project planning stage, various alternatives were considered in terms of line route and substation site selection, equipment and the feasibility of the proposed Project itself. This chapter describes and compares the alternatives considered for the line route and substation project. This section also presents the alternatives in comparative form, defining the differences between each alternative and providing a clear basis for choice among options by the decision maker and the public. Some of the information used to compare the alternatives is based upon the design of the alternative and some of the information is based upon the environmental, social, and economic effects of implementing each alternative. Factors considered that informed the decisions of the proponent included:

❖ Substation site selection

● *The “no development scenario”*

Taking no action would, naturally, be a feasible option. The purposes and objectives of the proposed Project have been spelt out under section 1.1. The main objective is to increase the spare capacity of Liberia and Côte d'Ivoire and to utilize that capacity to reinforce the energy supply capacities of Sierra Leon and Guinea thereby fostering cheaper energy exchanges between some countries of the sub-region.

In the event of the failure of the proponent to carry out the proposed development, the laudable objectives discussed in section 1.1 may not be achieved. This may result in severe inability to meet the energy demands of some of our sub-regional neighbors as demand

exceeds supply. In addition, the economic challenges of some of the participating countries operating their own thermal power plants with their attendant high and ever-increasing costs of production coupled with their significantly negative impacts on the environment may be too high a cost to bear by their individual economies.

The advantages of the “no development” scenario are:

- ✓ That land that would otherwise be occupied by the substation and transmission line (or other project alternatives) would continue to remain available; in some instances, the population employs this land for income-earning activities (e.g., agriculture). With the reduced need for land acquisition and development, the likelihood of people being displaced would be reduced.
- ✓ No increase in likelihood of environmental impacts.
Potential impacts that may be avoided if the No-Project Alternative were implemented include:
 - Habitat disruption;
 - Contamination associated with construction;
 - Air quality deterioration
 - Removal of vegetation
 - Visual resources, etc

● **The proposed action**

Under the Proposed Action, the Environmental Protection would allow the proponent to carry out the construction of an electrical substation and associated facilities and the 535 km transmission line. Reliable electrical power shall be provided to meet the current and projected electrical energy needs for the sub-region.

Negative environmental and socioeconomic impacts indicated above that may be associated with the proposed Project would have to be mitigated.

Criteria that informed the decision to site the proposed 4 substations (Yekepa, Buchanan, Monrovia, and Mano) in Liberia include the following:

- ✓ Availability of land: Land would have to be acquired for the proposed Project, so its availability is critical to the sitting of a project such as the present one, especially for the substation.

Côte d'Ivoire - Liberia - Sierra Leone - Guinea Interconnection Project (Liberia ESIA)

- ✓ Proximity to load centers: The substation should be able to feed medium voltage power (34.5kV) when necessary, to minimize overall system losses and development costs. This will require that new substations be located close to load centers.
- ✓ General flatness of terrain: Where substations are to be constructed, the terrain should be generally flat in order to reduce the construction costs due to earthworks.
- ✓ Out-of-town locations: Out-of-town locations, preferably on the outskirts of townships, will help to avoid resettlement, huge compensation costs and land use conflict issues. It will minimize the substation's visual impact on the environment.
- ✓ Proximity to major roads: Easy access during construction and periodic maintenance carried out at the substation demands that it be close to a major road for easy accessibility.
- ✓ Natural drainage: Natural drainage generated by the terrain would help the free flow of rainwater, so that the substation does not flood or become filled with water.
- ✓ Connected to an Existing Transmission Line: The substation site should be close to an angle tower so that it can tie into either a proposed or an existing transmission line.

● ***Possibility of the use of alternate mode of transmission (underground transmission)***

Other alternative means of transmission such as laying of underground cables over long distances is not practicable and might entail financial and environmental costs that might be too high to bear.

3. DESCRIPTION OF EXISTING ENVIRONMENT

3.1. General description of existing environment

3.1.1. Topography, geology and soils

3.1.1.1. Topography

The topographical condition of the planned transmission line from the border of Côte d'Ivoire and Guinea to Sierra Leon and the four substations (Yekepa, Buchanan, Monrovia, Mano) is relatively flat except for the Yekepa area. The line will pass through lateritic soil of Nimba and Bassa, the sandy soil of the coastal areas including some alluvial soils of major rivers and swamp soil.

3.1.1.2. Geology

According to Bibliography of Liberian Earth Science Liberia is surrounded by rocks of probable Archean age. Rocks of Pan African age extend northwesterly along most of the Liberian coastline from the Cestos shear zone. Along the Atlantic Ocean, the coastline is characterized by lagoons, mangrove swamps, and river-deposited sandbars. Inland, the grassy plateau supports limited agriculture.

3.1.1.3. Soil

The soils in Liberia have been grouped into six soil associated by the Topographic Engineering Center US Army Corps of Engineers.

Shallow and coarse lithosols, in the hilly and rugged terrain, cover about 16 to 17 percent of the land in Liberia. Lithosols are a thin soil consisting of rock fragments, and is a soil with poorly defined layer horizons that consists mainly of partially weathered rock fragments. Infertile regosols, or sandy soils, are found along Liberia's coastal plains. Regosols cover about 2 percent of Liberia, and are found along the coast that is generally infertile, although they support large numbers of coconut trees, as well as oil palms. Highly fertile alluvial soils represent only about 3 percent of the land area of Liberia, and these soils are utilized largely for agriculture. Alluvial soils are found in the river bottoms, and in swamp soils. Swamp soils, especially those known as half bog soils, are naturally rich in humus, and when drained they provide excellent conditions for swamp rice and similar crops.

3.1.2. Climate and Air quality

3.1.2.1. Climate

Liberia has two seasons such as a rainy and a dry season. Rainy season starts from April to October while dry season starts from November to March.

Climate of Liberia is known for its sustained heat and heavy rainfall. Because the republic lies south of the Tropic of Cancer and only a few degrees north of the equator, the days vary little in length. The tropical solar radiation is intense and the radiation is uniform across the country. Temperatures remain warm throughout the country, and there is little change in temperature between seasons. The mean annual temperatures in Fahrenheit range from the 70s to the 80s.

The continental and maritime masses of air alternate their movements back and forth, and from north to south. This brings some seasonal differences in rainfall intensity. The coastal region has the heaviest rainfall, from between 155 to 175 inches annually in the west, and with nearly 100 inches of rain annually in the south-eastern part of the country. Monrovia receives almost 180 inches of rain annually. Rainfall decreases going north and inland.

The average rainfall near the coastal zone of the proposed Project amounts to 4,770mm while towards the interior (up to Yekepa) the amount of rainfall decreases to an average of 2,080mm.

3.1.2.2. Climate Proofing

Climate Change

Climate change is becoming increasingly well understood by both the scientific and wider civil communities, and the extent of potential impact is rapidly becoming more widely acknowledged.

Recent Climate Trends of Liberia

❖ Temperature

- Mean annual temperature has increased by 0.8°C between 1960 and 2006, an average rate of 0.18°C per decade.
- There are insufficient daily data available to determine trends in daily temperature extremes for all seasons. Available data, however, indicate that despite the observed increases in mean temperature, there is no significant increase in the frequency of 'hot' days.
 - The average number of 'hot' nights per year in Liberia has increased by 57 (an additi

onal 15.7% of nights between 1960 and 2003.

- Available daily data do not indicate decreases in the frequency of cold days, but do indicate significant decreases in the annual frequency of cold nights.
 - The average number of 'cold' nights per year has decreased by 18 (4.8% of days).

❖ **Precipitation**

- Mean annual rainfall over Liberia has decreased since 1960, but it is difficult to determine whether this is part of a long term trend because of the variable nature of rainfall in this region. The rainfall record is punctuated by wetter and drier periods; the 1960s and late 1970s were particularly wet, whilst the early 1970s and 1980s were very dry. Rainfalls in 2005 and 2006 have been very low.
- There are insufficient daily rainfall observations available from which to determine changes in extremes indices of daily rainfall.

❖ **Rising sea level and beach erosion**

- According to the address for the 2009 Consultation on Climate Change, Human Rights, Peace and Security in Monrovia (June 15, 2009) by the president Ellen Johnson Sirleaf, the global climate change is posing a serious threat to Liberia such as rising sea level and beach erosion which continues to affect the coastal terrain of Liberia.

Verification of sustainability of the proposed Project Facilities against Climate Changes

- Within the implementation of the proposed Project, 535km of high voltage transmission line and four associate substations will be constructed in Liberia
- Because of no significant increase in the frequency of 'hot' days and decrease in mean annual precipitation, the climate change will not significantly affect the transmission line and substations to be constructed. Any increase in temperature should still be within the working limits of the equipment.
- The proposed line route and substations in Liberia is far away from the coastline, so the proposed Project infrastructure can withstand rising sea level and beach erosion.

Further consideration to be considered during the engineering design stage

Even though the global climate change will not seriously affect on the proposed Project, it is necessary to prepare adequate measures based on the local climate conditions. It is possible to enhance the sustainability (e.g., lifetime) of projects at risk to climate change by "climate proofing" such projects at the design stage. To ensure that "the transmission line

and substations are climate proofed” some elements should be taken into consideration during the design stage.

- Substation facilities suitable for the tropical condition (e.g. temperature, humidity, sunshine) should be considered
- For levelling of tower and substation base, highest flood level should be considered to avoid the flooding. As the line mostly route goes through mountainous areas flooding is not expected to be a problem there. Considerations, however, should be taken for towers in flat areas should severe flooding occur due to sudden rain after a dry spell.
- Drainage system of substations should be designed enough to prevent flood damage.
- To determine the tower height and safety clearance around the river, the level and width of river during the rainy season should be considered.

3.1.2.3. Air Quality

Air quality is good along the transmission line. This can be attributed to the fact that the planned transmission line passes a rural area and very few vehicles ply the route. During the dry season there might be slight increase in the dust levels, but it will not be above International Standards.

3.1.3. Noise

Noise level is very low along the transmission line except for the location near the road and the town area. And the planned transmission line and planned substations are built with full clearance from the existing village. So, no significant impact will be expected during the construction and maintenance. According to the recent assessments of existing substations in the metropolitan area indicate that generated noise could be heard up to only about 60 m from substation sites. The length will be slightly longer than metropolitan area at the suburbs.

3.1.4. Ground and surface water

Water supplies have been improved in both rural and urban areas so that some 40 percent of the population has access to potable water. Surface water is abundant, and groundwater reserves are ample and regularly replenished by the country's heavy rainfall. Rivers The major rivers of Liberia are the Cavalla, the Cestos, the Lofa, the Mano, the Morro, the Saint John and the Saint Paul. The Mano and Morro rivers in the northwest and the Cavalla River in the southeast are boundary lines for part of the country. Most of the rivers of Liberia flow from the mountains inland in the northeast to the coast in the southeast, and parallel each

other. Among the low mountains and hills, the river beds are steep and irregular, with frequent falls or rapids.

The line route corridor crosses many important rivers and streams in Liberia. The major ones include St. John, St. Paul, Lofa River, Mafa River and several creeks and streams. Sufficient ground water of good quality is present in and around the four substations.

3.1.5. Electromagnetic Frequencies

According to the World Environmental Library, WEL 1.1, information derived from prolonged observations and experiments in numerous countries indicate that the electric and magnetic fields around power transmission and distribution facilities exhibiting frequencies between 50 and 60 Hz have no harmful effects on human health. Magnetic field strengths below 0.4.mT at 50 – 60 Hz induce no detectable biological reaction in humans; the magnetic fields acting on the ground below overhead lines develop maximum field strength of only 0.055mT for frequencies between 50 and 60 Hz. Hence the potential effects of EMFs on human health are non-existent according to current knowledge.

However, an electrically grounded person touching an ungrounded metallic object or a conductor in a static or oscillating field may draw electric current from the object and may experience a micro shock from a spark discharge. The potential effect will be minimized by the consultants/contractors, as usual, by multiple earthings. Protective multiple earthings minimize the chances of people getting electric shocks and the chances of such shocks being fatal.

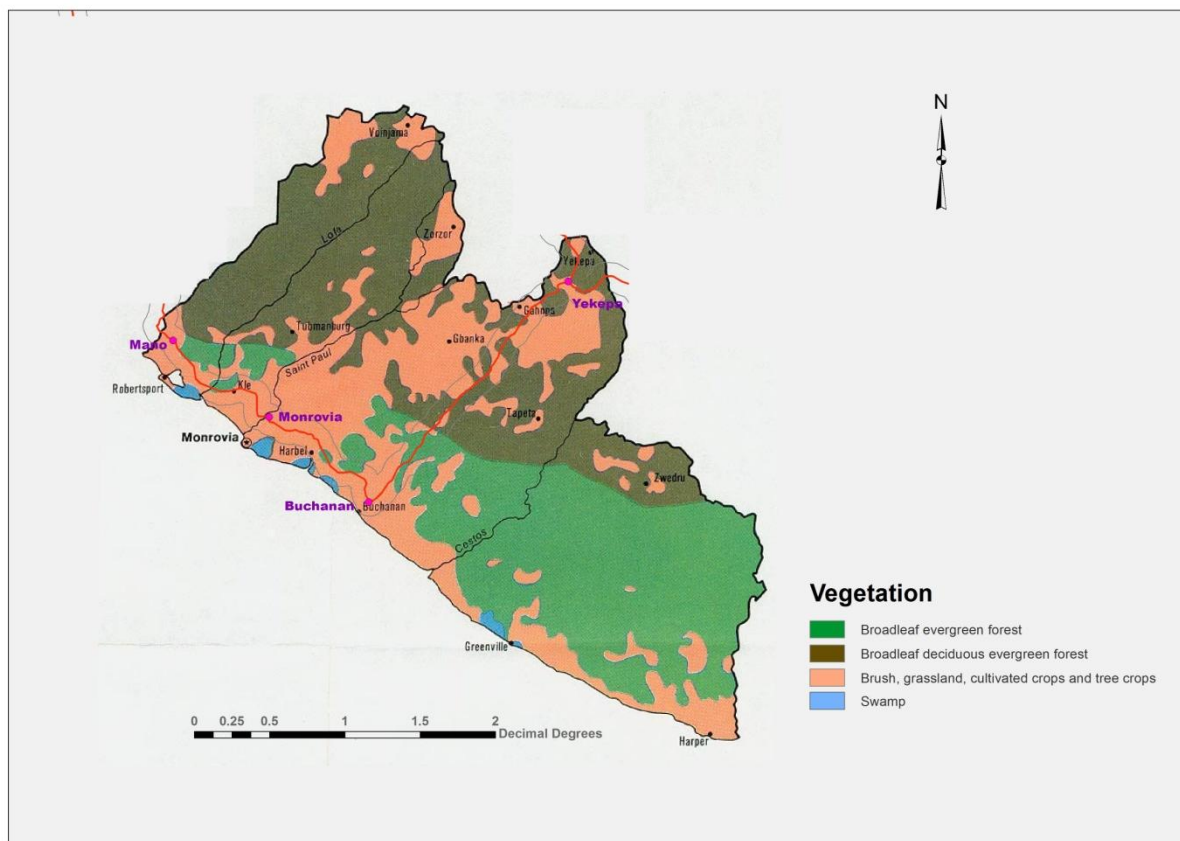
In order to debunk the misconception that EMFs may cause cancer or harm children and minimize fear and avoid panic among the local populations, the SPC will undertake public education and create awareness in the local communities wherever such concerns are expressed. The SPC will also ensure that dwelling houses and other structures are not built within the RoW in contravention of existing regulations.

3.1.6. Terrestrial Vegetation

According to estimates of the Food and Agriculture Organization (FAO) in the early 1980s, only about 1,430 square miles of the country's total land area (roughly 3.9 percent) were used for cultivation. Permanent tree crops, such as rubber, coffee, and cacao, occupied 946 square miles, or two-thirds of the cultivated area; short-life crops, mainly foods, were

produced on about 485 square miles. The FAO also calculated that more than 21,000 square miles of additional land was in a temporary bush and tree fallow state, and much of this is at a stage available for agricultural use. There was little pressure on the fallow areas in the less heavily populated rural regions, and about 80 percent of the subsistence farmers in those regions were reportedly using for crops new land on which the age of the tree or bush stands was seven or more years.

Figure 4: Vegetation Map of Liberia



3.1.7. Wildlife

3.1.7.1. Flora and Fauna of the RoW area

A large percentage of the land within and adjacent to the transmission line corridors is under natural forest, secondary forests and savanna grasses. Because towers generally will be located on hilltops and the conductors strung over the intervening valleys, the lost of vegetation will be much less. Very few woodland will be lost. Table 4 shows the survey results of the RoW area.

3.1.7.2. Biodiversity

3.1.7.2.1. Methodology

The data for biodiversity were obtained by a combination of desk studies and field observation used to establish the presence and distribution of biodiversity which could potentially be affected. The results were also used to identify important biodiversity. Surveys were undertaken to identify important biodiversity areas, features and resources that might be sensitive to, and affected by, proposed activities within Line corridor. Biological Preliminary Assessment (BioPA) surveys at different areas of the line route and:

Footprint verification studies within the line corridor.

3.1.7.2.2. Biological Preliminary Assessment (BioPA)

BioPA is a reconnaissance-level method of species sampling based on the Rapid Appraisal Programme (RAP) survey methodology developed by Conservation International (CI) in 1990 in order to improve biodiversity assessment prior to large development projects. It involves intensive searching for species' specimens within focal taxonomic groups and within areas supporting relatively homogenous conditions/habitat. Survey methods differ between taxonomic groups. The intention is to gain relatively reliable information concerning which species are represented in the area of search, identifying as high a proportion of the total number of species present as possible. The BioPA approach was considered appropriate in this context due to the limited amount of recent or reliable information available for the proposed Line Route Corridor areas.

3.1.7.2.3. Footprint verification studies

These studies were intended to provide more comprehensive coverage for the proposed line route. Specialists conducted walk-overs in the footprint areas and held discussions with taxonomic specialists to quantify potential loss of species through consideration of the habitats that supported them. These walkovers revealed that the habitats within the footprint are very fragmented so that it was not possible to extrapolate species potential presence within them to a sufficient degree of certainty. It is therefore proposed to make this quantification as part of the follow up surveys for species of high conservation concern.

3.1.7.2.4. Baseline appraisal

The baseline studies provided information about possible receptors in the line route corridor potential impact areas. It is not possible to carry out detailed impact assessment for all receptors. In order to determine which aspects of biodiversity to consider in the impact

assessment, criteria were developed to identify important biodiversity. These reflect international guidance and standards as there are no nationally-established criteria. The criteria developed include conservation priority, levels of formal designation or protection, threat status, provision of ecosystem services and ecological function or role.

3.1.7.2.5. Consultation

Throughout the ESIA process, consultation has been undertaken with organizations and individuals concerned with the biodiversity implications. This included:

- ❖ National organizations responsible for biodiversity conservation or protection, notably the FDA;
- ❖ National Agency (EPA);
- ❖ International nongovernmental organizations (NGOs) with an interest in Liberia's biodiversity; and
- ❖ Local community representatives consulted.

The following issues were discussed relating to initial findings, mitigation strategy, biodiversity offsets and the need for capacity development and training with:

- ❖ FDA, Fauna and Flora International (FFI), and CI;
- ❖ Discussion of mitigation requirements and likely strategy through adoption of the mitigation hierarchy. Review of potential role of biodiversity offsets for impacts which cannot be avoided or mitigated.

3.1.7.2.6. Vegetation and higher plant species

This section considers the baseline composition and condition of vegetation as well as the status of individual plant species found in the study area.

There are moist evergreen forest communities found in the surveys that may be unique to Liberia, including many species of very limited global distribution, making the forests of global significance. *Guibourtia leonensis* and *Tessmannia baikiaeooides* (both species of high conservation priority) are characteristic trees for this kind of forest which appears to include species characteristic of slightly wetter conditions, these are found in the Yekepa forest area

Floristic variation across the study area correlates markedly with altitude. Analysis revealed a separation between vegetation samples taken from below or above around 800 to 900m. Analysis of indicator species within the high altitude forest (>800m) sample found relatively

few species which are truly characteristic of high altitude and a predominance of species commonly found in secondary and often semi-deciduous forest

Of the plants so far identified, some are classified as Endangered and as Vulnerable by the IUCN. Only a very small proportion of all African plants have been assessed by the IUCN.

Timber species of commercial value

There is extremely limited potential timber resource of commercial value due to the relatively brief period of secondary re-growth that has followed earlier forestry clearances and continuing clearance of land for agriculture. There are, however, scattered individual trees that have commercial and/or local traditional use and should be conserved if at all possible. There are species classified as Vulnerable – black afara *Terminalia ivorensis* which is common in the area, and *Albizia ferruginea* and *Nauclea diderrichii* which are both under pressure locally as a result of logging and farming. *Triplochiton scleroxylon* is classified as a commercial species by the FDA.

3.1.7.2.7. Mammals

The BioPA surveys confirmed the presence of few primate species: an ape (the West African chimpanzee – *Pan troglodytes verus*), anthropoid monkeys (the Western black-and-white colobus – *Colobus polykomos polykomos*, Campbell's guenon – *Cercopithecus campbelli campbelli*, the lesser spot-nosed guenon – *C. petaurista buettikoferi*, and the Sooty mangabey – *Cercocebus atys atys*) and prosimian species (the Western potto – *Perodicticus potto*, Prince Demidoff's bush baby – *Galago demidoff*, and the Northern lesser bush baby – *G. senegalensis*). Some of these primate species are common in the study area. The most frequent direct observations were for West African chimpanzee and for Campbell's guenon

In 2007, Flora and Fauna International (FFI) conducted a biological survey on the Kitoma Mountains southwest of Sanniquellie for BHP Billiton. One group of Western Chimpanzee was reported in the forest covering these mountains, especially south west of a town near Sanniquellie called Kitoma, which is located on the Ganta-Sanniquellie Highway. The exact number is not known but local people say they are confined to this area. However, the substation located in Yekepa is far from the area described above where the chimpanzee groups are located. It is assumed that the chimpanzees referred to above will not migrate

close to the substation. The substation is located near the railroad and motor road to Yekepa which has very frequent with human population.

Several species of global conservation concern and/or species protected under Liberian Law were either recorded from the sites through direct or indirect observation, or were suspected to be present based on interviews with hunters and on past records, despite lack of direct observations in these surveys.

Species classified as Endangered by IUCN was recorded, the West African chimpanzee *Pan troglodytes verus*. Further work will be necessary to confirm home ranges for different troops so that likely impacts can be quantified and suitable mitigation defined.

Species were confirmed as present on the basis of direct observations or through indirect methods (tracks, signs or camera traps). Species confirmed or suspected to occur were identified through interviews with experienced hunters from surrounding villages.

In addition, the BioPA surveys confirmed or suspected different species of mammal to be present, including a high proportion of the mammals protected legally in Liberia and several of global conservation concern.

Protected species were recorded or suspected to be present (see list of protected species). Liberian Mongoose (*Liberictis khuni*), Bournalon's Genet (*Genetta bournaloni*) and Leighton's Linsang (*Poinana leightoni*) – are endemic to the region.

Few species of small mammals were identified over both survey periods. Species were recorded regardless of global conservation status since relatively few small mammal species are sufficiently well-surveyed to be assigned any status.

Guinean bat communities are generally composed of more species and is currently known to occur in Liberia as a whole (Monadjem & Fahr, 2007) so the numbers found in these surveys are slightly below expectation and are considered likely to be an under-estimate.

3.1.7.2.8. Birds

Two biological surveys were conducted between 2007 and 2009 in the ArcelorMittal concession area. ArcelorMittal ESIA/ESMP report (Western Range DSO Iron Ore Project

Volume 1: Main Environmental and Social Impact Assessment / Environmental and Social Management Plan Report) reported a total of 243 bird species, including Laughing Dove (*Streptopelia senegalensis*). Also another survey conducted in 2010 added a further 32 bird species.

In the book 'Birds of Liberia' by Wulf Gatter (1997), Gatter reported seeing Grey parrots (*Psittacus erithacus*) near Ganta and southern Nimba County.

Also, a few species of birds observed in the Mesurado Wetlands communities are listed on the table below.

No.	Scientific Name	English Name
1	<i>Ceryle rudis</i>	Pied Kingfisher
2	<i>Egretta ardesiaca</i>	Black Heron
3	<i>Milvus migrans</i>	Black Kite
4	<i>Phalacrocorax africanus</i>	Long-tailed Cormorant
5	<i>Corvus albus</i>	Pied Crow
6	<i>Gypohierax angolensis</i>	Palm Nut Vulture
7	<i>Bubulcus ibis</i>	Cattle Egret
8	<i>Ploceus cucullatus</i>	Village weaver
9	<i>Alcedo cristata</i>	Malachite Kingfisher
10	<i>Egretta intermedia</i>	Intermediate Egret
11	<i>Turdus pelios</i>	African Thrush
12	<i>Pycnonotus barbatus</i>	Common Bulbul
13	<i>Gallinula chloropus</i>	Common Moorhen
14	<i>Passer griseus</i>	Northern Grey-headed Sparrow
15	<i>Egretta gularis</i>	Western Reef Egret

3.1.7.2.9. Reptiles and amphibians

Many species of amphibians belonging to seven families including Bufonidae (true toads), Ranidae (true frogs), Arthroleptidae (commonly known as squeaker frogs), Astylosternidae (Cameroonian stream frogs), Petropedetidae (African water frogs), Hyperoliidae (African reed frogs) and Rhacophoridae (bush frogs) were recorded along line route.

Some species of reptiles were identified of which one – Serrated Hinge-backed Tortoise (*Kinixys erosa*). Of the few amphibian species identified as being of conservation concern, *Phrynobatrachus annulatus* (Endangered) was recorded only at the ENNR.

Those amphibian species of global conservation concern are almost all associated with forest habitat. One Data Deficient species (*Ptychadena submascareniensis*) is found in degraded forest or savannah areas.

3.1.7.2.10. Butterflies, moths, bats

Species identification is incomplete because some species require a detailed examination by dissection to confirm their identity with certainty. Others require long and detailed bibliographical researches. Analyses to date have confirmed the presence of many butterfly species, confirming that this is a particularly diverse taxonomic group for the BioPA study area. Most of the species found are specific to the forest/savanna transition zone, with a clear dominance of sylvan species (species typically found in woodland).

The ArcelorMittal ESIA report indicated that the Nimba Mountain Range holds two species of mammals found nowhere else: Lamotte's Roundleaf Bat and Nimba Otter Shrews; the latter species' stronghold is the Nimba Mountain Range. Both species are listed as globally threatened on the IUCN Red List, and contribute towards the designation of Mount Nimba as the highest-ranking AZE (Alliance for Zero Extinction) site in Africa.

3.1.7.2.11. Ants and Termites

The BioPA surveys did not reveal ant or termite species of particular conservation concern. However one of the reasons why ants and termites were considered an important taxonomic group to include in the surveys was that as they can be very effective indicators of ecosystem health it was useful to establish if this could be applied in the current context. Since arthropods play important roles in the functioning of tropical ecosystems (many species are primary food sources of other animals and perform important ecological services, such as pollination, soil development, and turnover or decomposition of organic matter), they can be used as early warning bio-indicators of habitat perturbation. Since arthropods comprise many important taxa, one approach is to focus on certain groups termed as "surrogate" for biodiversity monitoring. Ants and termites are part of these groups because they constitute the major biotic components in tropical ecosystems, have several links with other organisms, and have a number of characteristics making them relatively straightforward to survey. The results obtained here will act as a baseline against which the

results of future monitoring will be compared. Possible indicators could be the number of active ant/termite mounds on areas where soils have been reinstated or re-vegetated and also the number of different species represented with respect to a pre-disturbance condition.

Table 4: Flora and Fauna of RoW Area (Various Plants)

Common Name	Scientific name	Nimba	Bong	Bassa	Mon	Migi	C/Mount	Bomi	IUCN Status
Euphorbiaceae	Uapaca chevalieri	x	x	x			x	x	
	Anthonotha vignei	x	x		x			x	VU
Scented Guarea	Guarea cedrata	x							VU
Lauraceae	Guibourtia leonensis	x	x	x		x	x	x	
Melastomataceae	Heterotis jacquesii	x	x	x	x				
Acanthaceae	Asystasia scandens	x	x	x		x	x		
Anacardiaceae	Trichosypha smythei	x	x	x	x		x	x	
Apocynaceae	Hunteria simii	x	x	x					
Aristolochiaceae	Pararistolochia leonensis	x	x	x		x	x		
Celastraceae	Tristemonanthes nigrisilvae	x	x	x	x	x		x	
Commelinaceae	Buforrestia obovata	x		x					
Connaraceae	Cnestis rademosa	x	x						
Cyperaceae	Mapania coriandrum	x	x	x		x		x	
Dracaenaceae	Dracaena adamii	x		x					
Euphorbiaceae	Amanoa bracteosa	x	x	x					VU
	Hymenocardia lyrata	x	x						
Flacourtiaceae	Homalium smythei	x	x	x					VU
Lauraceae	Anthonotha vignei	x	x	x					VU
	Cryptosepalum tetraphyllum	x	x	x			x	x	VU
	Tessmannia baikieaoides	x		x			x		
Marantaceae	Hypselodelphys velutina	x	x	x		x	x		
Melastomataceae	Warneckea golaensis	x	x	x		x	x	x	
Meliaceae	Trichilia djaloni								
Rapateaceae	Maschalocephalus dinklagei	x		x					
Rubiaceae	Ixora nimbana	x	x						
	Morinda geminate			x					
	Pausinystalia lane-poolei	x	x	x					
	Pavetta platycalyx	x							
	Psychotria rufipilis	x	x	x					
	Schizocolea linderi	x	x	x					
	Stelecantha ziamaeana	x	x	x					

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Common Name	Scientific name	Nimba	Bong	Bassa	Mon	Migi	C/Mount	Bomi	IUCN Status
Rutaceae	Glenniea adamii	x	x	x					
Sapotaceae	Neolemonniera citrandrifolia		x	x					EN
Zingiberaceae	Aframomum longiscapum	x	x	x	x		x		
Doe Leaf	Eupatorieum Odorata	x	x	x	x				
Fems	Fems	x	x						
	Justicia								
Guinea grass	Panicum maximum	x							
Baboo	Bambusa vulgaris	x	x	x					
	Greenwayodendron Oliveri								
	Dracaena adanii								
Plam trees	-	x	x	x	x	x	x	x	
Bush pepper	Xylophia staudtii	x	x	x	x	x	x	x	
	Albizia Adianthifolia								
	Berlinia Confuse								
Bush rubber	Funtumia elastic	x	x	x			x		
	Alstonia Boonei								
Orange	Citrus Sinensis	x	x	x	x	x	x	x	
Cassava	Manihot esculenta	x	x	x	x	x	x	x	
Coconut	Cocos nucifura	x	x	x	x	x	x	x	
Banna	Musa Pradisiasapietum	x	x	x	x	x	x	x	
Commom rubber	Hevea brasiliensis	x	x	x	x	x	x	x	
Cola	Cola nitida	x	x	x	x	x	x	x	
Cork wood	Musanga cecropioides	x	x	x		x	x	x	
Abura		x	x	x				x	
	Pentaclethra macrophylla								
	Chlorophora regia								
Cotton tree	Bombax buonopozense	x	x	x	x	x	x	x	
	Aubrevillea platycarpa	x	x	x					
	Upaca guineasis	x							
	Myrianthus arboreus	x		x		x	x		
	AnthocIESIAta vogelii	x		x		x		x	
	Bridelia grandis								
	Fagara macrophylla								
	Parkia bicolour								
	Terminalia ivorensis								
	Pariniri exelsa								

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Common Name	Scientific name	Nimba	Bong	Bassa	Mon	Migi	C/Mount	Bomi	IUCN Status
	Harungana madagascariensis								
	Ricinodendron heudelotii								

Fauna of RoW(Mammal species)

Yellow-backed duiker	Cephalophus silvicultor	x	x	x					
Liberian mongoose	Liberictis kuhni	x	x	x					VU
Leopard	Panthera pardus	x	x	x				x	NT
African white bellied pangolia	Phataginus tricuspis	x		x				x	NT
West African Chimpanzee	Pan troglodytes verus	x						x	
Western black-and-white colobus		x	x						VU
Sooty mangavey	Cercocebus atys	x							VU
Cmpbell guenon	Ceropithecus campbelli	x	x	x					
Western potto	Perodicticus potto	x		x					
Demidof bush baby	Galagoides demidoff	x		x					
Northern lesser bush baby	Galago senegalensis	x	x						
Common giant rat/pouched	Cricetomys gambianus	x	x	x	x	x	x	x	
Ground squirrel	Xerus erythropus	x	x	x	x	x	x	x	
Duiker	Cephalophus								
Grass cutter	Phrynomys	x	x	x	x	x	x	x	
Bushtailed porcupine	Artherurus africanus	x	x	x	x	x	x	x	
Western palm squirrel	Expixerux ebii	x	x	x					
Pandolin		x		x					

Fauna of RoW Area : Amphibian and Reptiles

Dwarf crocodile	Osteolaemus tetraspis	x	x	x	x	x	x	x	VU
Ringed river frog	Phrynobaprachus annulatus	x	x	x	x	x	x	x	EN
	Kassina aroricola								
Allen slippery frog	Conraua alleni	x	x	x	x	x	x	x	VU
	Annirana fonensis								DD
	Ptychadena subnascareniensis								DD
	Bulo togoensis								NT
	Kassina cochranæ								NT
	Leptopelis nacrois								NT
Liberian river frog	Phrynobaprachus liberiensis	x	x	x	x	x	x	x	NT
Common toad	Bufo regularis	x	x	x	x	x	x	x	
Giant toad	Bufo superciliaris	x	x	x	x	x	x	x	

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Common Name	Scientific name	Nimba	Bong	Bassa	Mon	Migi	C/Mount	Bomi	IUCN Status
Black cobra	<i>Naja melanoleuca</i>	x	x	x	x	x	x	x	
Adama lizard	<i>Agama agama</i>	x	x	x	x	x	x	x	

Fauna of Row area : (Birds Species)

Green-tailed bristlebill	<i>Bleba eximius</i>	x	x	x					VU
Yellow-bellied greenbul	<i>Crinifer olivaceus</i>	x	x	x					VU
Nimbi flycatcher	<i>Melaenoides annamarulae</i>	x	x						VU
Sierra Leone prinia	<i>Sciscolaptes leontica</i>	x	x	x	x	x	x	x	VU
Black-headed rufous warbler	<i>Bathmocercus cerviniventris</i>	x	x	x					NT
Rufous winged Illagopsis	<i>Illavopsis rufescens</i>	x		x					NT
Copper-pailed glossy starling	<i>Lanprotonotus cupreocauda</i>	x		x					NT
Harrier hawk	<i>Polyboroides radiatus</i>	x	x	x		x	x	x	
West African black kite	<i>Milvus migrans</i>	x	x	x	x	x	x	x	
Black throated coucal	<i>Centropus leucognaster</i>	x	x	x	x	x	x	x	

Fauna of the RoW area (Invertebrates Species)

Butterfly	<i>Graphium polycenes</i>	x	x	x	x	x	x	x	
Grasshopper	<i>Zonoceros variegatus</i>	x	x	x	x	x	x	x	
Ant	<i>Tetramorium sericeiventris</i>	x	x	x	x	x	x	x	
Lugde river crab	<i>Liberonates lugbe</i>	x	x	x	x	x	x	x	EN
Lobscor claw crab	<i>Liberonates rubiginamus</i>	x	x	x	x	x	x	x	EN
Dwars river crab	<i>Liberonates nanoides</i>	x	x	x	x	x	x	x	EN

Key: x = Presence confirmed; NT=Near-threatened, EN=Endangered, VU= Vulnerable, IUCN Categories=IUCN CR= Critically Endangered, DD = Data Difficient

3.1.7.3. Protected areas near the proposed line route

Preliminary line route was selected by the desk study and basic site investigation. It comprises several protected areas inside or near the RoW.

- ❖ There is one officially protected area near the line route corridor for the purpose of nature conservation- the Nimba Nature Reserve created from the East Nimba National Forest by the East Nimba Reserve Act in 2003. The line corridor passes through the outskirts of Nimba Nature Reserve to the southwest approximately 1.7km (see map).
- ❖ The second protected area is the Gbedin Wetlands which is a proposed Ramsar site and a largely swampy area including a man-made wetland with irrigation system that includes channels, ditches, dams and drainages.

- ❖ There is another protected area near the previously selected transmission line route; Line Corridor of the proposed Project passes at the fringe of the Lake Piso Multiple protected Area, the previous line crosses the Po River from the proposed Mount Coffee Substation and the previous line route does not pass through the Lake Piso itself and is stood 5.8km away from the lake. However, according to the future plan of FDA of Liberia, the wider area surrounding the Lake Piso will be designated as a multiple protected area. In that case, previously selected line will pass through 35km of that protected area (see map below).

Faunal and floral species play a very important role and sometimes critical role in food chains and other uses. Because of their role in our ecosystem activities that may impact negatively on their direct or their habitats may pose problems for the survival of other species. Therefore, any human development within their habitats should be carried out with due consideration for environmental concerns.

Figure 5 Nimba Nature Reserve

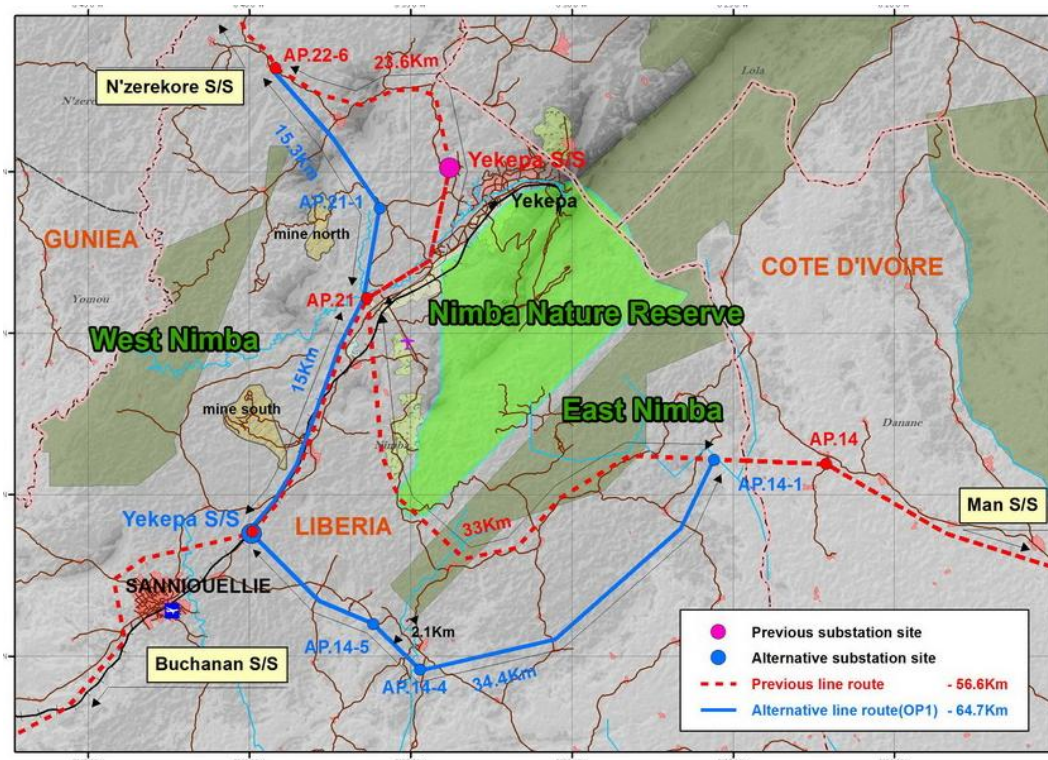


Figure 6 Gbedin Wetlands

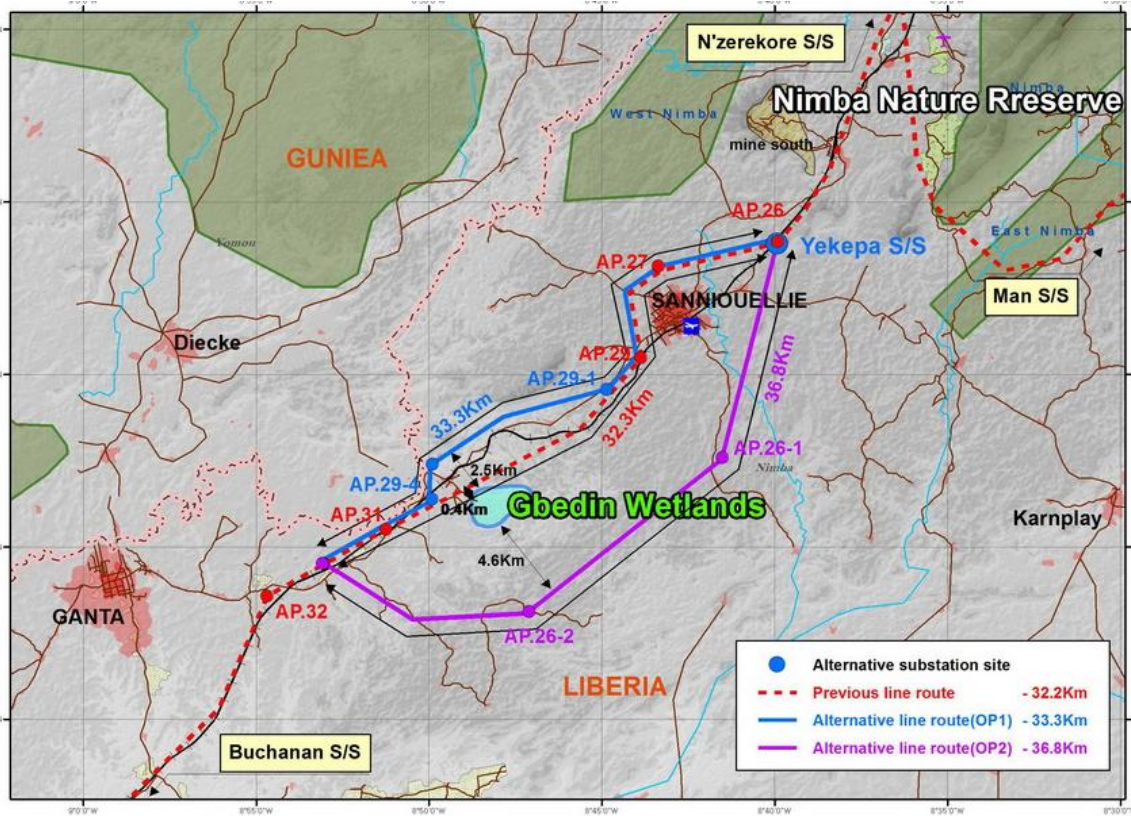
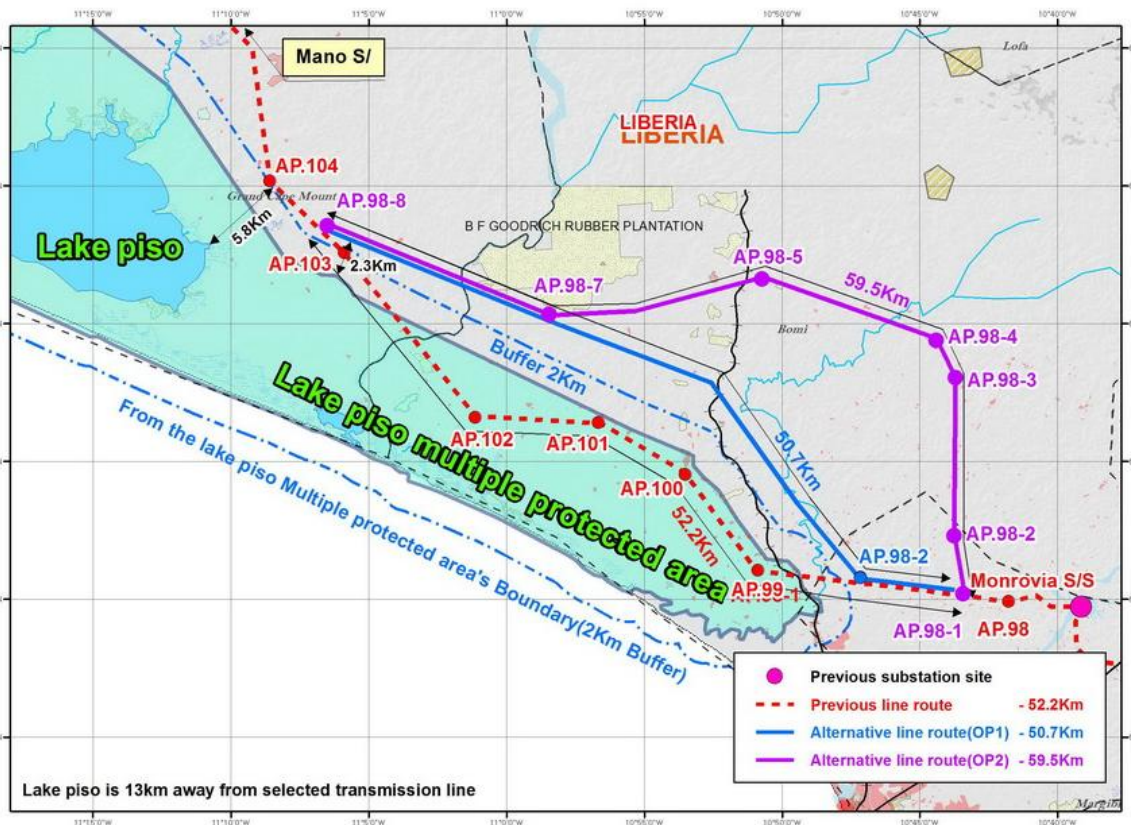


Figure 7 Proposed Lake Piso Multiple Protected Area



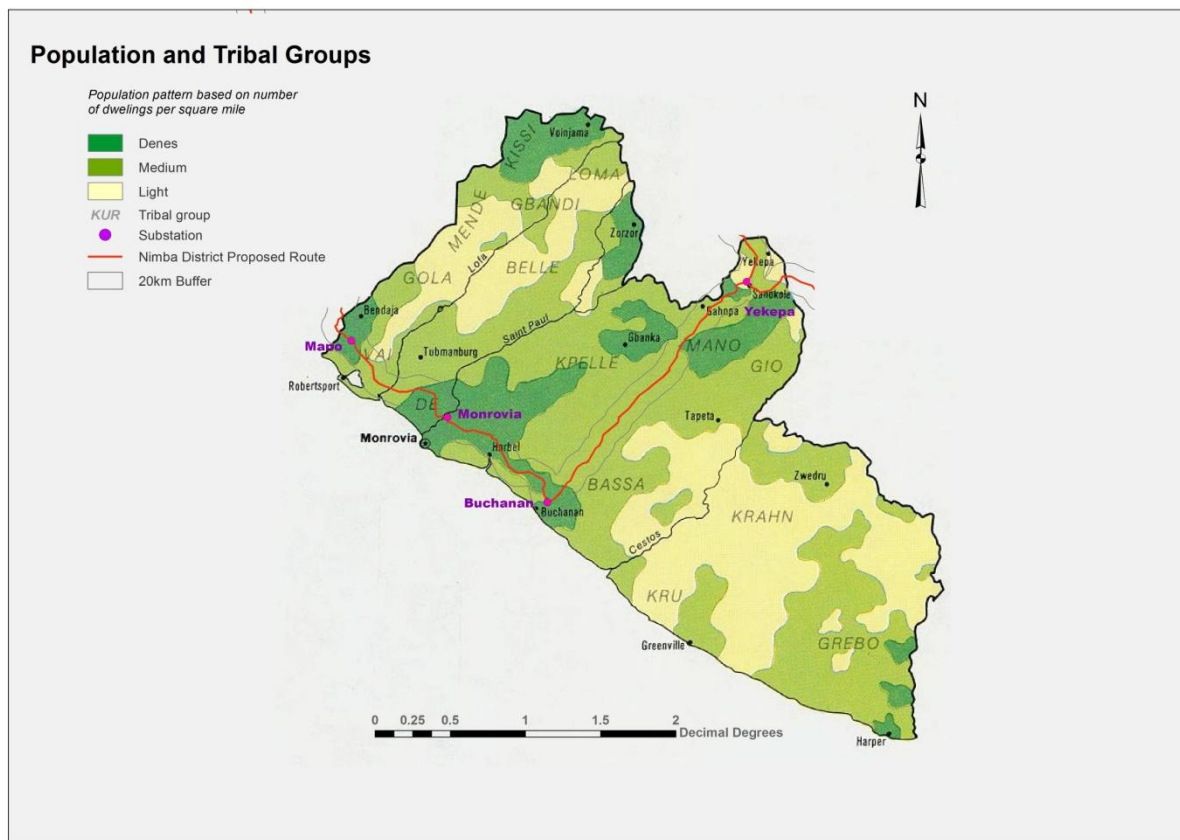
The proposed Project seriously considered the protection and safety of all flora and fauna in these areas, therefore, preliminary line route was modified by detouring these area as stated in Section 1.6.2.3

3.2. Socio-Cultural Environment

3.2.1. Population

The total population of the seven (7) counties affected by the transmission line is approximately 2,013,155. The proposed line is 532km long running from the north of the country to the south, and to the west of the country passing through Nimba, Bassa, Bong, Margibi, Montserrado, Bomi and Grand Cape Mount Counties. The total estimated population of people living within the range of 300 meters from either side of the transmission line covering approximately 43 villages/ towns/ hamlets is 24,929 (see affected villages/ towns/ hamlets). Total number of owners of properties to be affected is 113 and their dependents totaled 597.

Figure 8 Population and Tribal Groups



3.2.2. Ethnic, Religious and Cultural Heritage

There are a few religious and cultural items found. So far, the line does not pass through any society bush such as the Poro and the Sande Societies. In Grand Bassa and in Dorley-la, Bomi county two palava huts are within or near the transmission line corridor. 'A palava hut is a meeting place where the villagers usually meet to discuss pertinent issues affecting the community'.

It has also been discovered in Dorley-la, Bomi County and Grand Bassa County sporadic graves on or near the transmission line corridor; these are considered grave yards or cemeteries but not large enough to divert the line

There are also few Religious structures located within the line route. There is a small Mosque in Dorley-la, Bomi County within or near the line and also in Hydro Dirty camp, Margibi County there is a small Church is located near the line. These two structures are indeed very small.

3.2.3. Historical resources

No historical resource is found within the planned transmission line Row.

3.2.4. Aesthetics and Tourism

There are various tourist attractions within the seven counties. These include attractive mountains, valleys, waters, the Lake Piso Cape Mount, the Kpatawe water fall in Bong County etc. However, none of these are affected by the line.

3.2.5. Infrastructure

Liberia has a limited infrastructure that was severely damaged by the country's long civil war. The local drinking water supply is inadequate and volume quality of water is very poor. Most villagers rely on creeks for their major domestic water supply.

Roads in Liberia are in poor condition due to poor maintenance and heavy rains. Only 6 percent of the national road network of 10,600 kilometers (9,942 miles) is paved. There are no passenger rail services, and the iron ore rail transport links are in need of serious repair as large sections of the rail network were dismantled and sold for scrap during the civil war. The railroad rehabilitation work is planned for the transportation of material such as iron ore and coal from Yekepa to Buchanan.

The country's 5 ports of Monrovia, Buchanan, Greenville and Harper, handle 200,000 tons per year in general cargo (80 percent of which is iron-ore deposits) and 400,000 tons a year of petroleum products. Ports in the south-east of the country handle timber exports. There are four sea ports in Liberia: The Free Port of Monrovia, Buchanan Port, the Greenville Port and the Port of Harper.

Two of these ports-the Port of Buchanan and the Free Port of Monrovia are located within the seven line corridor affected counties. These two ports are strategically located to facilitate the transportation of light and heavy equipment for the line route. Also there are road networks and rail facilities closer to the line routes. The 200 miles railroad of Arcelor Mittal from Buchanan to Yekepa is now being renovated and will be in use when the proposed Project has started; therefore, materials for the line route intended for Yekepa line route to Buchanan could be served by this means while the line route running through the West and Southwest of the country could be served by the nearest port -the Free Port of Monrovia. These two ports are indeed vital in terms of transportation of goods and services within the line corridor.

Robertsport had an international airport until it was destroyed by fighting in 1990. It now carries some regional commercial flights but will need major repairs to carry international flights. Harbel, 56 kilometers (35 miles) from Monrovia, remains the only international airport.

In 1999 Liberia produced 432 million kilowatt hours (kWh) of electricity, but much of the electricity-generating infrastructure has been destroyed or damaged. Two-thirds of electricity is generated from diesel and one-third from hydro-electric sources. Access to electricity is very restricted, and those who can afford it use private diesel generators. Poor provision of electricity is a major cause of criticism of the new government.

Further plans are underway to rehabilitate the Mt. Coffee Hydro Plant Electric plant on the St. Paul River. The first phase of the rehabilitation of Mt. Coffee plant foresees power output of 100 MW.

Firestone rubber plantation in Montserrado county and Iron mine developed by ArcelorMittal in Yekepa are existed near the planned transmission line.

3.2.6. Education

The total enrolment at all levels of schools in the nation is very low. For every 100 children starting primary school in Grade 1 only 60 make it to Grade 6. Repetition rates at all school

grade levels are above 5%. Approximately 41% of resources at the primary level and 20% at junior high school level were spent on dropouts and repeaters in 2007.

The condition is more or less the same along the counties affected by the planned transmission line.

3.2.7. Land Use

The main land-use category along the Right of Way (RoW) and within the 20 km buffer zone is agriculture in general except for some concession like the Arcelor-Mittal concession at the Yahmin Village of Nimba County. The land is covered by predominantly farm bushes and in some parts with savannah grass lands. People used the land to farm where their farms fall within the line corridor and where opportunistic free seeding of rubber trees created tappable assets over time. Few non rubber farms are found encroaching on the RoW. Ownership is defined in terms of numbers of plants, the concept of plot size and ownership is only established where land is not an issue in this area. Most household tree and crop losses are very small, covering a very small percentage of crops and trees ownership. Compensation is therefore to be made on a per tree or plant basis in accordance with the Ministry of Agriculture norms and livelihood restoration.

3.2.8. Employment/Manufacturing

The main occupation of 75% of Affected Persons is subsistence agriculture, characterized predominantly by mixed cropping and animal rearing. A small percentage is engaged in a rubber plantation and mining such as Firestone rubber plantation and ArcelorMittal concession.

3.2.9. Agriculture

Vegetation in the project area includes dense and secondary vegetation; coastal savanna and scattered trees and mangroves. There are farms of rubber trees of Firestone rubber plantation in Margibi county, cocoa, Coffee trees owned by private individual and commercial farmers are scattered along the planned transmission line corridor.

3.2.10. Public Health

Medical facilities are located in big town such as Monrovia, Buchanan or inside of the big plantation like Firestone rubber plantation in Montserrado county and mining area like ArcelorMittal in Yekepa.

In Liberia the civil war increased the risk of HIV infection. At present, the HIV prevalence rate of 8.2%, is considered very conservative and yet too high for the 2.7 million Liberians, already conflict-torn and poverty ridden. With 42% of the population within the age group of 15-49 years, the country exhibits features of an in-built population momentum. These variables provide grounds for an inevitable exponential rise in the prevalence of HIV infection in the country.

3.2.11. Major Gender Issues

3.2.11.1. International Commitments and Instruments on Women's Rights and Gender Equality

Liberia is a party to various international instruments on the promotion of gender equality and women's empowerment. At the global level, treaties, declaration Commitments applicable to Liberia include:

- ❖ Convention on Elimination of All forms of Discrimination Against Women (CEDAW) 1979
- ❖ Optional protocol on CEDAW
- ❖ Convention on the Rights of the Child (CRC) 1990
- ❖ Optional protocol to the CRC
- ❖ Convention on the Rights of Persons with Disabilities 2006
- ❖ International Covenant on Civil and Political Rights 1966
- ❖ International Covenant Economics Social and Culture Rights 1966
- ❖ UN Security Council Resolution 1325
- ❖ UN Security Council Resolution 1820
- ❖ UN Security Council Resolution 1612 (Children and Armed Conflict)
- ❖ Beijing Declaration and Platform for Action 1995
- ❖ International Conference on Population and Development 1994
- ❖ United Nations declaration on Violence Against women 1993
- ❖ Millennium declaration on Human Rights 1948
- ❖ Vienna Declaration and the Plan of Action 1993

3.2.11.2. Regional Commitments on Gender

The African Charter on Human and people's rights of Women in Africa which constitutes a milestone in the promotion, protection and respect for the rights of women in Africa. This Protocol reaffirms the principle of promoting gender equality as enshrined in the Constitutive Act of AU as well as the NEPAD.

New partnership for African Development (NEPAD), underlines the commitment of the African States to ensure the full participation on African Women as equal partners in African development and states its determination to ensure that the rights of women are promoted, realized protected in order to enable them enjoy full all their human rights

3.2.12. Socio-economic conditions of Affected Counties (Counties information)

1. NIMBA COUNTY

Geography

Nimba County is situated in the northeastern part of Liberia and shares borders with the Republic of Cote D'Ivoire in the east, and the Republic of Guinea in the northwest. Nimba is bordered by the counties of Bong, River Cess, Sinoe and Nimba. The total geographic area (of land and water) of Nimba is 2,300 square kilometers, from north to south, the county stretches 230 kilometers and east to west, 100 kilometers. It has a distance of 298 kilometers from Monrovia to Sannequille.

Climate

Nimba has a tropical climate. There are two seasons: wet and dry. According to the New Geography of Liberia, average rainfall in Nimba is recorded between 12.5-25mm in January; between 100-150mm in the west and 150-200mm in the north, east and south of the county in April; and in October average rainfall is recorded between 200-250mm in the south-eastern portion and 250-300mm in the north-western portion. Prevailing wind is generally south-easterly or monsoonal.

Topography / Drainages

There are three principal topographic areas: the northern part of the county is dominated by mountains, hills and deep valleys. Prominent among the mountains is Mount Nimba. The highlands of Nimba form part of the Bleetro-Nimba Block in the Central Region of Liberia, one of three large mountain blocks of Liberia, the other being the Kpo-wologisi Block in the western region and the Tienpo-Putu Block in the eastern region. The northern highlands of Liberia are primarily found in Nimba and Lofa counties and form part of the Guinea Highlands also known as the Futa Jallon Mountains. Two relief features are characteristics of this region: long ranges and dome-shaped hills. The Nimba Range rises north of

Sannequille and after twenty miles extends into the Republic of Guinea, where it reaches an altitude of 6,083 feet. The so-called "Guest House Hill" in the Yekepa area is the highest point of the Nimba Range on the Liberian side, and at the same time the highest elevation in Liberia, with an altitude of 4,540 feet above sea level. The south of the county is dominated by plains.

Nimba has four major rivers. St. John is the largest, forming the natural boundary between Liberia and Guinea in its upper stretch. It also internally separates Nimba and Bong counties. The Yah River also has its source from Mount Nimba and flows centrally through the county from north to south-west in a stretch of 200km. The Cestos River (also known as Nooh River) has its source, too, in the eastern part of Mount Nimba. The Cestos River constitutes the natural boundary between Liberia and Cote D'Ivoire in the east. It has a stretch of over 300km and also borders Nimba with Grand Gedeh County. Other rivers in the county are the

Twah River, Bee River and Weh River. Nimba County contains one artificial lake, Lake Teeleh in Sannequille City, which is 200m long and 120m wide.

Geology / Soil

All three kinds of soil produced by different conditions of climate and vegetation in Liberia are found in Nimba: lateritic soil or latosols or upland soil, clay or swamp soil, and sandy soil. Generally, lateritic soils cover about 75% of Liberia according to W.E. Reed. They are the most typical soils of the humid tropics, where there are alternating wet and dry seasons. This soil type is predominant in Nimba. According to soil scientists, latosols have only 0.24% nitrogen (plant food) and are very acidic. Their continuous farming requires the constant use of fertilizers, an input that nearly all farming households are too poor to afford and this may explain the situation of annual bush fallowing by subsistence farmers in the county.

Nevertheless, latosols are more productive than the other soil types and they provide valuable material for road building due to their hardness.

Vegetation

Nimba's natural vegetation is composed of tropical rainforest, specifically high forest, broken forest and low brush. As in the other northern counties of Liberia the most prominent forest type is moist semi-deciduous. Three of this forest type are the nesogordonia papavertifera, limba (terminalia superba), and obechi (triplochiton sclerozylon). Low bush establishes itself in the areas of land rotation where trees are cut and burnt as a result of the shifting or bush

following method of farming. Typical trees of this vegetation type are the umbrella or corkwood tree (mussanga cecropioides) and the oil palm. Swamps are common in the county, and there is a small portion of the vegetation covered with scattered trees and dense elephant grass (pennisetum purpureum). There are, however no natural grass fields except those created by human activities through farming, habitation or the development of football fields. The original vegetation of the county would have consisted of tropical rainforest, which was cut down primarily for farming purposes and the cultivation of other cash crops such as cocoa, coffee, oil palm and rubber. The land abandoned after farming is occupied by elephant grass that slows the regeneration of forest trees.

Population

The Norwegian Refugee Council estimated the population of Nimba County in 2007 at 732,195. 98.27% of this population is made of locals, 0.31% (IDPs and refugees) returnees and 0.49% refugees. The population is mostly young. According to the 2005 voter statistics as provided in the County Information Pack, 121,844 or 64% of a total of 190,264 registered voters were between the ages of 18-39. Gender distribution is fairly close: 46.37% female and 53.72% male. More than half of the females are within the child bearing ages of 14 to 49 years, giving rise to high fertility rates in the county.

Table 5: Population of Nimba

Statutory District	Total	Population by Gender		Population Gender (%)	
		Female	Male	Female	Male
Gbehlay-Geh	146,497	68,053	78,850	46.45%	53.82%
Saniquellie Mah	116,947	54,476	62,471	46.58%	53.42%
Tappita	122,687	59,250	63,600	48.29%	51.84%
Saclepae Mah	160,424	73,560	86,864	45.85%	54.15%
Yarwein-Mehnsoneh	313,37	14,590	16,819	46.56%	53.67%
Zoe-Geh	154,303	69,570	84,733	45.09%	54.91%
Total	732,195	339,499	39,3337	46.37%	53.72%

※ Source: LISGIS 2008

Ethnic Composition

All of Liberia's sixteen (16) ethnic groups are found in Nimba, but five of the ethnic groups are represented in higher numbers: the Gio, Mano, Krahn, Gbi and Mandingo. Of the five, the Gio and Mano are the predominant ethnic groups and are members of the Mende Fu

language group, one of four language groups in Liberia. Over the years, the tribal groups of the county have been interlinked through marriage.

Religion

There are three major faiths practiced in Nimba: Christianity, Islam and the Bahai Faith. African traditional practices also have major impact in religious practices in the county. Christianity is the dominant religion, followed by Islam. The dominant local Christian denominations include the Catholic Church, Methodist Church, Baptist Church, Lutheran Church, Episcopal Church, Presbyterian Church, Pentecostal Related Churches, Seventh Day Adventist, Jehovah Witnesses, Church of Christ, Mid-Baptist Church, Church of the Lord Aladura, and Inland Church. Islam is practiced nearly in every district of the county. In addition to promoting their specific doctrines, religious institutions have served as partners to the government and local communities in providing some basic services such as schools, health services, training, etc.

Tourism

The fact that Nimba has many attractive mountains, valleys, and waters, investment in tourism has serious economic growth potential. Such investment must however be well planned to consider the infrastructure needs. Nimba attracts over 500,000 visitors annually, but the county lacks any hospitality services, despite the availability of competitive human and local material resources. Tourism potential will be harnessed with the construction of hotels, guest houses, recreational centers, and restaurants.

Agriculture

Subsistence farming is currently the main source of income of the people of Nimba. Apart from small agricultural projects undertaken by some youth and women's associations, NGOs such as LCIP and ARS, there is not yet any large-scale farming in the county. The typical farming pattern is slash-and-burn and annual bush fallowing. The main food products are rice, cassava, plantain, banana, yam, and sweet potatoes. Some 75% of farm produce is used for family consumption.

For the purposes of achieving food security, Nimba needs to produce 40,000 metric tons of rice annually. Currently the county produces only 800 metric tons of rice, due to rudimentary methods of cultivation. Continued dependence on rice is constrained on food security, and thus the production of cassava and corn must now be prioritized because of their high yield

potential and adaptability. Government and private sector intervention will be harnessed to cultivate an additional 5,000 hectares of rice, 4,000 hectares of corn, and 3,500 hectares of cassava. The implementation strategy will require that each of the 17 districts develop pilot project sites, and steps will be taken to introduce mechanized farming.

Products like corn and cassava will create added value through their processing and this will result in the employment of over 5,000 people per year. Rice processing could also generate by-products such as rice bran, a generous feed for agriculture, which is mostly practiced in other counties.

Cash crop production of rubber trees, cocoa, sugar cane and coffee is the other main source of income in the county. The cultivation of 13,500 hectares of tree crops will eventually lead to economic growth through sale of products, value addition and job creation.

Health

There are currently 41 functioning clinics, which is the same as in pre-war times. Access to healthcare facilities for the estimated population of 732,195 is 435:1 (Source: CIP, Nimba). There are 526 MoH-assigned health workers serving at these facilities. Nurse aids constitute 21.2% of all health workers in the county, followed by registered nurses (17%), and trained traditional midwives (13%). Doctors make up only 0.9% of health workers in the county.

Water and Sanitation

Access to acceptable level of sanitation and safe drinking water sources is poor. In six cities, Sannequille, Ganta, Saclepea, Tappita, Karnplay and Bahn with population of between 25-50,000 persons, there is need to construct more efficient water systems.

Roads and Bridges

Access to market and basic social services is challenged by the deplorable conditions of roads throughout the county. All internal roads are laterite roads. With less than 25km of paved road, investment in road construction and maintenance remains urgent. All seventeen districts ranked road construction or rehabilitation as their top priority. Fifty-one roads and bridges throughout the districts have been prioritized by citizens for construction or rehabilitation. Citizens say good roads will improve access to market by buyers and producers/sellers and promote trade and enhance access to basic services located outside of their communities. The railroad from Yekepa to Buchanan is being rehabilitated by ArcelorMittal under the new mining agreement between GoL and the company.

Education

There are 554 schools for a student population of 145,272 (53% male and 47% female). There are 34 upper secondary schools and no formal multilateral/vocational/college/university level institutions in the county. There are 4,114 school teachers of which only 1,311 have been reactivated.

Electricity

There is no grid system in the county, and only a tiny minority access to electricity. St. John and Cestos Rivers have the potential for hydropower generation, though production could be seasonal-probably 7/12 months out of the year. Currently, needed power is only produced with small generators privately by companies, businesses and individuals. This is very costly and contributes to high cost of goods and services.

Housing

In six cities, Sannequille, Ganta, Tappita, Karnplay and Bahn with populations of between 25-50,000 persons, there is a need to develop housing estates. Mittal Steel Company has completed the renovation of some housing units in the concession city of Yekapa, and will need to construct additional units.

HIV and AIDS

HIV and AIDS is a major challenge because the epidemic has the potential to slow the progress of many initiatives meant to build much-needed human capital and revitalize the economy. Ensuring that this does not happen requires that the citizens be empowered with the appropriate skills to arrest the spread of HIV and to minimize the impact. Integrating HIV and AIDS into poverty reduction strategies helps to create the necessary policy and planning environment for a comprehensive, multi-sectoral response.

While no county-specific data is available, a 2007 DHS estimates national HIV prevalence at 1.5 percent, or 1.8 percent for females and 1.2 percent for males. A previous estimate of 5.7 percent was based on the results of sentinel surveillance among pregnant women and girls attending ten antenatal care (ANC) clinics in urban areas. Future studies will seek to reconcile these seemingly disparate findings.

In any event, the war left most of the population severely challenged in meeting their social, cultural and economic needs, thereby making them vulnerable to a sharp increase in HIC

prevalence, the likely result of which would be a negative impact on development: increased child and adult morbidity and mortality, increased absenteeism at the workplace and in schools, and lower economic output, among other effects.

HIV and AIDS-related vulnerability impacts a broad spectrum of the population, especially young people and females in particular, such that in Liberia as elsewhere, there is an increasing feminization of the epidemic.

By strengthening the health infrastructure at the county level, the CDA works to promote human development by reducing the impact of HIV and AIDS vulnerability, morbidity and mortality. County health and social welfare authorities will participate in the development and implementation of a new national multi-sectoral strategic framework led by the NAC, reducing new HIV infections through the provision of information, and scaling up access to treatment and care services, mitigating the impact of the epidemic on those already infected and affected.

2. MARGIBI COUNTY

Geography

The county is ideally situated along the Atlantic Ocean in the south and neighbors Montserrado County on the east, Bong County on the north and Northeast, and Grand Bassa County on the west. The total land area of the county is approximately 2866.67 square miles, with an estimated 118,000 acres of this total being utilized by rubber plantations, namely Firestone and Salala, to name but two.

Climate

The climate of Margibi is hot and humid, with an average annual temperature of 80°F (27°C). There are two major seasons in Liberia, dry and rainy. The dry season lasts from December to March in the coastal areas and for a longer period in the inland areas. Annual rainfall along the coast averages 200 inches (510cm). Inland areas receive about 85 inches (220cm) of rain per year.

Topography and Drainages

A narrow coastal plain extends inland from the coastline, and the land gradually rises to the high Bong Range in the northwest, and Gibi Mountain in the north, bordering Grand Bassa County. Margibi County's most important rivers are the Farmington, which forms the border

with Grand Bassa County, and the Du River, which forms the border with Montserrado County. Both rivers have the potential for hydroelectric power generation.

Geology and Soil

The soil is excellent for agricultural production and many cash crops. The soil in the lower part is mostly sandy clay loam, with an abundance of nutrients, and that of Upper Margibi is characteristic of highland soils.

Vegetation

High-elevation regions have forests of evergreen and deciduous trees, including ironwood and mahogany. Mangrove swamps are found mainly in the coastal areas.

Population

The total population of Margibi is 240,996 of which the female population dominates 53.34% (see table below)

Table 6: Population Data Gender Distribution, Margibi County

Statutory District	Total	Population by Gender		Population by Gender (%)	
		Female	Male	Female	Male
Firestone area	41,681	19,639	22,042	47.12%	52.88%
Gibi	24,184	11,823	12,361	48.89%	51.11%
Kakata	101,903	48,142	53,761	47.24%	52.76%
Mambah-Kaba	73,228	32,840	40,388	44.85%	55.15%
Total	240,996	112,444	128,552	46.66%	53.34%

※ Source: LISGIS 2008

Ethnic Composition

The Bassa (48%) is the dominant ethnic group, though all or nearly all of Liberia's tribes are represented in the County. Kpelleh (44%) is the second dominant ethnic group in Margibi.

Religion

About 90% of the county's population is Christians, with roughly 5% Muslims and 5% Animists.

Tourism

No Tourism site is found in the county.

Agriculture

The agriculture productive capacity in the county is below average for Liberia. About 80 percent of farming is subsistence farming. Food crops production is not as widespread in this county as other counties in Liberia. Only about every second household has access to agricultural land, according to the CFSNS. In 2005, rice was only produced by 33% of farming households. The main crops cultivated in 2005 included cassava (79%), Rice (33%) and Corn (12%). This is in part explained by the local preference for the traditional dumboy dish, which is more commonly consumed than rice.

Commercial or cash crops produced in the county included rubber, produced by 52% of households; cocoa, produced by 10% of households; coconuts, produced by (14%) of households; sugarcane and pineapple, each produced by (14%); plantain/banana, produced by (34%); palm nuts, produced by (14%); and cola nuts, produced by 3%. One percent of households surveyed owned goats, another 6% owned pigs, 6% owned ducks and 39% owned chickens.

The constraints to agricultural growth are many, as shown in the below table. Chief among them is a lack of capital for purchase of the various inputs that are missing. Because the population does not have access to credit and savings products, there is little possibility for communities to increase production to match their potential.

In spite of the constraints, agriculture is a major component of economic revitalization and poverty alleviation in Liberia and Margibi County. With a population annual growth estimated at about 2.5%, the realistic objective of doubling per-capita incomes within ten years would require an average annual growth rate of close to 10% per annum. With 50% of the county's GDP coming from agriculture, achieving this objective will require a similar rate of growth in agriculture.

Strong and sustained growth in agriculture is particularly important since it can create employment for many low-skilled people, as a major engine of the rural and overall economy for many multiplier shifting workers to manufacturing and services. Strong agricultural growth is achievable during the early stages of the country's reconstruction efforts, supported by the resettlement of displaced populations and the quick recovery of very depressed agricultural production, in particular food crops. Experience in other post-conflict countries indicates that agricultural growth is a major factor in early economic recovery, reaching 4% two years after the end of conflict and accelerating to an average of nearly 8% in years 3 through 5 after the

crisis before setting down to about 4% in years 6 through 10, which is a more typical long-run growth rate for agriculture in most developing countries.

Health

Besides the Firestone medical facilities, which receive approximately 9,000 patients visits a month and at time buttresses other facilities by helping to provide storage and some medical equipment, there are two main functional government hospitals serving the county; C.H. Rennie Hospital, a referral site in Kakata; and the Mike M. Baydoun Health Center in Marshall City. Both facilities badly need ambulances, renovation and supplies for full operation. Apart from the two hospitals, the government owns 19 clinics among the 36 functioning health facilities in the county.

The most prominent among them may be the Dolo Town Community Clinic that was built by the US Embassy. All the government medical employees are on the government payroll and treatment is provided free of charge with drugs provided by government and INGOs. Firestone Liberia actively participates in vaccination campaigns for the eradication of childhood diseases.

Water, Energy and Sanitation

Water and electricity are still a wish for many communities. As typical rural Liberian county, Margibi does not have access to public power. All individuals and organizations in need of electricity, including the local authorities, have to operate their own generators. A survey has just been conducted for connection of Kakata and Marshall to the Emergency Power Program already operational in Monrovia. Prior to the war, most parts of Margibi County had a water and sewage system that has since broken down, leaving the population even in the cities without improved water and sanitation facilities. With 146 hand pumps in use in the county, an average of 1650 people are making use of each pump. Some 1685 people share each available latrine, as there are only 143 latrines in use in the county.

Roads and Bridges

Communities living in 305 villages located in remote areas such as Worhn in Gibi District and Marshall City, Larkayta and Lloydsville Townships are completely inaccessible by road during rainy season. Thus, fishing boats remain the only alternative used to cross many rivers into some parts of Lower Margibi.

Education

Margibi County is well known for its concentration of outstanding educational institutions. The most prominent among them is the Booker Washington Institute (BWI), which awards diplomas and is known for its vocational/technical training courses. The county also boasts of the Harbel Multilateral High School, where the University of Liberia is operating up to 2nd year of studies; the extension of the Gbarnga-based Cuttington University College; the Kakata Rural Teacher Training Institute, in charge of training and reactivation of teachers; and the Konola Academy, a co-educational institution and prestigious upper secondary school; among others.

The Firestone School System, owned and operated by the Firestone Rubber Company, caters to over 15,000 children within the concession area.

This school system is well-organized and effective, as not only do they have appropriate facilities and educative materials, but also boast a science laboratory at the Firestone Senior High School. 50 educational facilities among the 290 recorded by the Norwegian Refugee Council are fully functional. The government through the Ministry of Education runs several of them at primary and junior schools level, while faith-based communities and private organizations run the others.

Despite the many well-known schools, many children in remote areas of Margibi County still lack access to education because of bad road conditions, damaged facilities, and a lack of qualified teachers. Like many LNP and other civil servants, teachers are often reluctant to settle in far-flung areas because of the hardship and low salary. Some informal education targeting over-aged students and adults is also organized by women's groups as a means of skills improvement and reducing illiteracy.

Communications, Postal Services and Telecommunications

Postal services are functioning in the county, notably in Harbel. Newspapers are only found in Kakata and Harbel. There is very good cellular telephone coverage from Lonestar, Cellcom, Libercell and Comium. Besides Radio Veritas, Liberian Broadcasting Corporation, and UNMIL Radio coverage, Margibi is also covered by two community Radio Stations (in Harbel and Kakata) that were created with support from MercyCorps.

3. BOMI COUNTY

Geography

Bomi County is situated in the northwestern region of Liberia and bordered by Gbarpolu County in the north, Grand Cape Mount County in the east and the Atlantic Ocean in the south. The capital city is Tubmanburg. There are four administrative Districts (Klay, Dewien, Suehn Mecca and Senjeh), comprising five Chiefdoms and 18 Clans. Bomi County has an area of 755 square miles.

Climate

Bomi County is generally warm throughout the year. It has two seasons: the rainy season beginning in April and ending in October, and the dry season covering the months of November to March. The average annual rainfall of Bomi County is approximately 80 inches.

Topography / Drainage

Bomi County is generally hilly with a few plains and valleys. The county is endowed with ample water resources to supply fish and other livelihood options, including the Atlantic Ocean and the Po, Wlein, Mahei, Lofa and St. Paul Rivers, among others. Many of the rivers are suitable for mini hydroelectric generation to supply electricity to citizens and industry.

Geology / Soil

In general, Bomi County has a sandy clay soil type. As a coastal county it is covered by coastal plain of Liberia which is about 0-50m above sea level.

Vegetation

There are many valuable commercial timber species found in the county. However, currently there exists no large-scale logging activity. Timber processing and pit sawing are carried out only at a small scale. Bomi County is a fertile land with rolling hills. Approximately, 45% of the land is covered by grassland.

Population

The population of Bomi County will be known with greater certainty with the completion of the national census, which is currently underway. According to the 1984 National Housing and Population Census, Bomi County has a population of 99,200. A UNHCR/NRC count of December 2005 found a population of 105,345 persons. Meanwhile, the government's pre-war population count was reported at 91,615.

Ethnic Composition

The four largest ethnic groups in the county are the Gola, Vai, Kpelle and Mandingo, although all sixteen of Liberia's main ethnic groups (Dey, Gola, Gio, Vai, Kpelle, Mende, Bassa, Gbee, Grebo, Kru, Krahn, Mandingo, Sap, Lorma, Kissi and Gbandi) are thought to be represented. The Golas are in the majority, followed closely by the Vai and the Kpelle, who are mainly settled in the boundary region between Bomi and Gbarpolu. The Mandingo is found under various Clans.

Religion

The religion of Bomi County can be roughly sub-divided into two groups: Christians, estimated at 40% of the population, and Muslims, estimated at 60%.

Tourism

No Tourism site is found in the county.

Agriculture

Before the civil war, Bomi was essentially an agricultural zone, with 70% of the population actively engaged in subsistence agriculture and related activities. According to county officials, production of food crops in 2005 was very low compared to pre-war times. Rice, the staple food crop, was grown by 20% of households, while cassava and sweet potatoes/eddoes were produced by 60% and 3% respectively. About 3% of households produced corn, while 5% produced vegetables. Despite the county's great potential for agricultural production, the recent Comprehensive Food Security and Nutrition Survey points Bomi as one of the counties with the highest vulnerability to food insecurity and chronic child malnutrition.

Several NGOs working in Bomi County including NRC, CCF, and ICRC/Liberia National Red Cross Society have distributed seeds and agricultural inputs for rice and vegetables over the last three years. The Chinese and Liberian governments also distributed tools and seed rice to 50 communities with seed rice of 18,122kg.

According to the Office of the Superintendent, the major constraints to agricultural production include a lack of seeds, tools, fertilizers and pesticides, farmers' returning late for planting, and bird and ground hog attacks. Additional constraints and their corresponding percentages were taken from the Comprehensive Food Security and Nutritional Survey (CFSNS).

Majority of the crops grown in the county include rubber, oil palm plantains, vegetables, cassava etc.

Health

Currently, less than 15% of the County's population has access to health care. The County Health Team is led by the Ministry of Health and Social Services. The hospital and 16 functional clinics are providing services: nine of the clinics are run by {World Vision Liberia (WVL), three by Save the Children UK (SCUK) and two by African Humanitarian Action (AHA) part of the hospital is also occupied by the Pakistani UNMIL Battalion, who assist in rendering medical services to the community. There is one government doctor at the hospital, who is assisted by a gynecologist from St. Luke's Private clinic on an on-call basis. There is no proper pharmacy and only seven medicine stores to service the entire County.

Road and Bridges

The physical damage to roads and bridges, particularly following the rainy season continues to limit the ability of humanitarian agencies to provide critical support, hinders the displaced/refugee return process and obstructs access to markets, thus impeding economic productivity and self-efficiency. The problem is especially bad in the Suehn Mecca District. The Road Taskforce has been instrumental in the assessment of about 30 farm-to-market (feeder) roads and has mobilized communities to rehabilitate these roads with WFP assistance. NGOs involved in roads and bridges rehabilitation and construction include, GAA and Peace Winds Japan.

There is currently a free flow of transportation between Monrovia and Tubmanburg due to the good condition of the road. Transportation to other parts of the county is often severely hampered by the bad road conditions. Taxis and other commercial transport are nearly always overloaded, posing a hazard to human life.

Exact figures on the population centers that are inaccessible by vehicle are hard to come by. The NRC needs assessment report gives an insight on what the situation might look like, documenting 23 villages in Senjah District, 18 in Klay District, 37 in Suehn Mecca District and 27 in Dowein District that are all inaccessible. County-wide 105 villages are cut off from vehicular transport. Similarly, the County Assessment and Action Report (CAAR) estimates the number of persons without access to a passable road at 20,000.

Energy / Electricity

There is no grid electricity power anywhere in Bomi County. The very few consumers with access to electricity are serviced by small private generators.

Communications, Postal Services and Telecommunications

The Ministry of Posts and Telecommunications has rehabilitated the Post Office in Tubmanburg, but while it was recently opened officially by the Vice President, it is not known when the Post Office will begin operating. There is a popular community radio station "Radio Bomi", located in Tubmanburg and disseminating useful information to the people of the county. The Lonestar and Libercell private wireless GSM networks are providing the only telephone services in the county.

4. BONG COUNTY

Geography

Bong County is situated roughly at the geographic center of Liberia. It is bordered by Lofa County on northwest, Gbarpolu County on the west, Margibi County on the southwest, Grand Bassa County on the south-east, and Nimba County on the east and north-east. On the north, Bong County is bordered by the Republic of Guinea. Gbarnga the Capital city of Bong is 200km NE of Monrovia.

Climate

The climate of Bong County is tropical, hot and humid. The temperature generally ranges from 65oF to 85oF. Base on the prevailing precipitation, two seasons are differentiated: rainy and dry. The rainy season lasts from mid April to mid-October. The dry season begins in November and ends in April. However, with the planet experiencing climate change, a slight fluctuation in the timing of the seasons has been noticed.

Generally, the wind blows from northeast during the dry season and from the southwest during the rainy season. Wind mileage is normally greatest in the rainy season, sometimes bringing violent storms capable of destroying houses and crops.

Bong County has a conventional type of rainfall of around 1,780 to 2,030mm. Toward the interior, the rainfall decreases because the air loses moisture except for high areas where the air forces rise during some relief rain.

Topography / Drainage

The county is said to be well watered by six principal rivers and a number of small streams. The St. John River runs through Bong County and rises in Guinea where it is known as Mano River, north-west of the Nimba Mountains. The Mano River received much water from Naye River, the Zoi and Yja Creeks.

Geology / Soil

The soils of Bong County are mostly latosols, which occurs on undulating and rolling land and occupies about 18% of the total land area in Liberia. This soil is heavily leached and silica nutrients and humus are readily washed out.

Vegetation

Bong County is part of the high forest belt, which can be divided into an evergreen rain forest zone and the moist semi-deciduous forest zone. The evergreen forest receives an annual rainfall of 2,030mm and consists of species that do not have a marked period of leaf fall. The tallest trees reach 200 feet.

The semi-deciduous forest is a transition to the deciduous forest type found in the Ivory Coast. The long dry season (4.5-5.5 months) forces many species to drop their leaves during part of this period to minimize evaporation. The occurrence of this vegetation in Bong County is based on soil conditions.

Population

As noted above, the current population of Bong County is estimated at 520,000 based on a census of the County Health Team; while an NRC needs assessment survey put the estimated population at 378,161. The NRC estimates annual population growth in the county as 4.5 percent. Traditionally, at certain times in the year, especially during the rains, people have moved in search of alternative sources of income, especially to the rubber plantations. The population is now thought to be decreasingly transient in nature.

According to the NRC, males are estimated at 40 percent, females 51 percent, about 46 percent of females are the children bearing age (15-49 years), fertilities rate of 6.7, children under five years is 15 percent. The county's dependency ratio is 1.41 according to the Information Management Office of Bong County (IMO), marking it higher than Liberia as a whole, which has a ratio 1.37. Families or households in the county are generally headed by

males at a rate slightly higher than the national average; the sex of household head is estimated at 84% male and 16% female, while the national figures are 87% and 13%. The percentage of elder-headed households in the county is the same as the national average percentage, at 8%.

Ethnic Composition

Ethnic groups found in Bong County include all of Liberia's 16 tribes. The Kpelle people represent the largest tribal block in the county, and members of many tribes speak the Kpelle language as a result. All of the tribes have over the years been interlinked mostly through marriage.

Religion

Although both Islam and Christianity are practiced, with Christian consisting the majority, for the most part the two groups of practitioners live amicably together. The dominant Christian denominations operating in Bong County are: Catholic, Methodist, Baptist, Lutheran, Episcopal, Presbyterian, Pentecostal-Related, Seventh Day Adventist, Jehovah Witnesses, Church of Christ, Mid-Baptist Church and the Church of the Lord/Aladura. The Gbarnga Central Mosque was built in 1964, and between 1960 and 1989, Islam had reached in every District of Bong County. Religious institutions have worked over the years to buttress government efforts in the training of youth and other development activities.

Tourism

Bong County is blessed with several natural sites of interest, which when properly developed and maintained could attract tourists and generates revenues for the development of the county.

The county is fortunate to contain a number of potential tourist, draws, which when properly developed, will help boost the economy and provide jobs:

- Wonyah Falls on the St. John River, Kokoyah District
- Other sites on the St. John in Zota, Fuamah and Sanoyea Districts
- Kpatawee Waterfall, Suakoko District (though also identified as a potential hydropower generation site)
- Dobil Island and Bogn Range, Fuamah District
- Tortor and Kpingan Hills, Zota District
- Koya and Gbenyayea Forests in Jorquelleh District

The strategy for developing these tourists' sites will necessarily include in inclusive process of local economic development (LED) dialogs to ensure that the surrounding communities bring their own contributions to bear, and to ensure maximum possible benefit for all stakeholders and protection of the sites.

Agriculture

The agro-ecosystem of Liberia consists of four major zones, of which Bong County is situated in the mountain and plateau zones, where citizens traditionally grow rice, cassava, maize, oil palm, cocoa, coffee, rubber and sugarcane. Citrus and cereal crops are also cultivated in the county. The potential for these crops are quite high compared to the current output. As stated in the PRS, realizing this agricultural potential is one of the keys to reducing poverty.

In the area of livestock production, Bong County has large and small ruminants, pigs, rabbits, guinea pigs, chickens, ducks and guinea fowl, mostly raised on the domestic scale. The production of livestock has never been properly prioritized as compared to crops.

Like other counties in Liberia, Bong County is going through a seemingly unending food crisis, in spite of its great domestic agricultural potential. The agriculture sector at present is almost entirely made up of traditional smallholder farms and household gardens, and consumers in the county have long been accustomed to depending on imported rice and other staples, in spite of the fact that these crops can be readily grown in Liberia.

As shown in the below table, the main constraints to increased production reported by farmers are related to a lack of capital for seeds, tools, and other inputs. As mentioned previously, access to credit is extremely limited in the county.

Health

As in the education sector, much has improved in healthcare delivery since the end of the war, but enormous gaps remain in both access and quality of care. No formal system of health administration has been established in Bong County. Health services are mainly provided in Gbarnga at Phene Hospital with funding from the Lutheran Church and the Government of Liberia. Bong Mines Hospital in Fuamah District is run by the County Health Team. Thirty-three clinics are spread over the county, out of which 26 are supported by

international NGOs. Phebe Hospital, being the major referral hospital in the county, provides VCT services and blood bank facilities.

The only functioning X-rays machine resides at the UN BANBATT Level II Hospital. Many international NGOs collaborate with CBOs and the Government to carry out health related promotions and provide limited services, including GBV prevention and response, sexual and reproductive health education and referrals, and life skills education including hygiene and water safety, and awareness around HIV and AIDS and Lassa fever.

The healthcare delivery system is affected by a chronic lack of trained personnel and inadequate cold chain equipment. The ratio of physicians to the general population is estimated at an abysmally low 1:71,200, nurses at 1:9,800, and midwives at 1:9,300. Most qualified personnel are based in Monrovia and have little incentive to relocate to rural areas. To fill the gap and provide adequate basic coverage to the whole population, the county requires an additional 64 health posts, 2 nursing training institutes and 2 hospitals.

Water and Sanitation

According to a recent UNICEF survey, water for domestic use comes mainly from unprotected sources (65%), yet only 35% of households purify their water before consuming it. Although 45% of households indicated that they use toilets; only 15% use ventilated improved pit (VIP) latrines or flush toilets. The rest use traditional toilets: open field or bush. Gbarnga City does not have a pipe-borne water supply system. Hand pumps exist; though not in great enough numbers to serve the city and the districts and many are non-functional. In general, proper water and sanitation measures are not taken by locals.

5. GRAND BASSA COUNTY

Geography

Grand Bassa County is relatively located in south central Liberia. The Atlantic Ocean is on the South, Margibi on the Northwest, Bong County on the North, Nimba on the East and River Cess is on the Southeast. The absolute location of Grand Bassa in Liberia is latitude 6° 45' to latitude 5° 30' north and from longitude 10° 30' to longitude 9° 00' west. The total land area is approximately 3,382 square miles (8,759 square kilometers).

The county former four administrative districts are now divided into five statutory districts all headed by Statutory Districts Superintendents. Presently Grand Bassa has nine

administrative districts, eleven townships, three cities (Buchanan, Edina and St. John River city) and forty-five clans.

Climate

The climate of Bassa is tropical, hot and humid. It has average rainfall of about 4000mm per year. Like Liberia, it has two seasons-rainy season (from April-October) and dry season (from November-March).

Topography

The County has a flat coastline and narrow coastal plain which extends inland from the seashore. The hinterland comprises gradual hills and few high elevations. The coastal region does not rise more than 60 to 70 meters, excepting occasional small hills.

Drainage

The County is drained by several rivers and creeks. The major rivers are St. John, Farmington, Mechlin, New Cess, Llor, Timbo and Benson River. Owing to the low level of the coastal plain, several settlements near the sea-including Buchanan city are vulnerable to inundation and erosion. During the last rainy season, Benson and Mechlin Rivers overflowed their banks caused flooding. As a result, many villages remain inaccessible during certain time of the year due to deplorable road conditions.

Geology / Soil

The County soils can be categorized as laterite (55%), which is leached out, alluvial (19%) and sandy and loamy (26%). Two onshore sediment-filled basins are located along the coastline. Roberts Basin, which is filled with sediments of the Farmington River formation and Paynesville Sandstone; and the Bassa Basin, which is filled with materials from the St. John River formation.

Vegetation

The high elevation region of the County is generally covered by green forest such as evergreen and deciduous trees (iron wood and mahogany) while the savanna covers most part of the coastal areas. Rubber and palms trees are also planted in concession areas and on small private farms.

Population

The total population of Bassa is 221,693 with female (110,780) and male (110,913); hence a difference of (133) which shows that both males and females are equal (see below). Most of the population appears to be concentrated around Buchanan and District # 3 (Gorblee District) which is part of Wee Statutory District. The average household size is 4.8 persons.

Table 7: Population by District, Grand Bassa County

District	Male	Female	Total
Grand Bassa	110,913	110,780	221,693
Common Wealth (Buchanan)	17,334	17,559	34,893
District #1	12,555	12,057	24,612
District #2	12,724	12,998	25,722
District #3	25,281	24,244	49,525
District #4	15,315	15,139	30,454
Owen- grove	6,774	7,140	13,914
St. John River City	5,028	4,982	10,010

※ Source: LISGIS 2008

Ethnic Composition

Bassa-speaking people are in the majority, making up 94% of the County's population. Other ethnic groups in the County include the Kpelle (5%), and the Kissi (1%), and small numbers of other groups. The Kru, often originating from neighboring Sinoe County, and Fanti fishermen and traders are also a part of the population.

Religion

According to current estimates, the Christians religion is the most dominant at 93%, followed by an estimated 5% Muslim and 2% animists.

Agriculture

Palm oil and food crops production are the most important livelihood activities in the county. Currently the palm oil is mostly produced by former employees and squatters of the concession area of Liberia Incorporated (LIRINC), also known as Palm Bay Plantation.

There is a problem of low agriculture production in the county due to the lack of farm implements, seeding, etc. in the county; access to agricultural land for cultivation is estimated at 81%. Of this percentage, some 83% of the farmers cultivate crops. The main crops cultivated are cassava (87%), rice (60%) and plantain/banana (7%). Some 36% of households produced cash crops including cocoa, plantain/banana, coffee, palm nuts/oil and

coconuts. Three percent of households owned goats, another 51% owned chicken and 8% owned ducks. The main crops produced for home consumption are rice, cassava, (used to make the traditional dumboy, gari and fufu dishes which in Grand Bassa is more popular than rice), plantain/banana, sweet potatoes and corn.

Fisheries

In Buchanan one of the major economic activities is fishing, but it is carried out on a small scale. There is a great potential for fishing industry in Buchanan. These activities lack refrigeration facilities. The Kru, Fanti and market women are mainly engaged in these activities.

Health

The County has a 75-bed Government owned hospital, but it is located in Buchanan. The rural people are not served, although, there are about 31 functional health facilities in the county, they are inadequate.

Education

The available schools in the county often face a problem of over crowdedness. The availability of trained and qualified teachers is also a serious problem. Due to poor incentives, many teachers left the classrooms in search of greener pastures. Currently there are 257 functioning educational facilities in the county but many are operated by volunteers in makeshift facilities such as churches and private accommodations, and do not have desks or chairs.

Housing

As of December 2006, 4,574 families were living without proper shelter. More recently about 50 houses in Buchanan small Fanti Town are threatened by the alarming speed of coastal erosion, and a relocation plan is necessary for the whole affected community". An integrated coastal area development planning by both government and development partners is recommended.

Economic Activities

Economic development requires natural resources to be efficiently exploited. Grand Bassa County is endowed with ample exploitable natural resources including gold, timbers, diamond, uranium, sand and rocks. Investment in these areas will yield significant dividends to the people. Such investment could reduce the high rate of youth unemployment and

provide considerable income for re-investment in the county. Among these, timbers and gold have been exploited on a small scale.

There are presently three major companies in the county; Mittal Steel, Buchanan Renewable Energy and Liberia Agricultural Company (LAC) all operating on a low scale. The rehabilitation of basic infrastructure (Buchanan Port, Monrovia-Buchanan Highway and railway Buchanan-Yekepa) will facilitate the arrival of other companies in the county). The Monrovia –Buchanan high way is now under construction. The Port of Buchanan is about 2,000 to 3,000 meters from the Atlantic Street.

6. MONTSERRADO COUNTY

Geography

Montserrado is one of the smallest counties in Liberia. Its relative location is the Atlantic Ocean on the south, on the north by Bong County, Bomi County on the west and Margibi County on the east. Montserrado comprises of 2 statutory districts, 2 chiefdoms, 7 cities, 21 townships, and 1 borough. A statutory district is headed by a superintendent while an administrative district is headed by a commissioner. A statutory district comprises two or more administrative districts.

Climate

As a small territory of Liberia, Montserrado has a tropical climate with 2 seasons-rainy and dry seasons. Average temperature falls between 21 and 36 degrees Celsius while average rainfall is about 1900mm.

Topography / Drainage

The County consists of hills and valleys in the interior and lowlands along the Coast. With direct access to the sea, the county has many rivers including St. Paul River and Mesurado River.

Vegetation

The lowlands along the coast are covered with savanna grasses, mangrove woodlands and scattered palm trees. Inward are Water-logged swamps, and patches of secondary forest.

Population

Table 8: Population by District, Montserrado County

District	Male	Female	Total
Caresburg District	15,048	14,664	29,712
Common Wealth	5,752	6,124	11,876
St. Paul River(Hotel Africa area inclusive)	34,981	36,850	71, 831
Todee	17,479	16,519	31,998
Total	73,260	74,157	145,417
Greater Monrovia*	476,473	494,351	970,824

※ Source: LISGIS 2008

* Greater Monrovia is not under the political Jurisdiction of the Montserrado leadership although it is located in the region.

Ethnic Composition

At the time of its founding, Montserrado County was composed of three main tribes: the Deygbo or Dey on the coast, and Kpelle and Gola in the north. These groups were joined by the formerly enslaved people from America in 1821. Eventually all of Liberia's 16 tribes came to populate the County, so that today Montserrado, and particularly Greater Monrovia, is considered highly diverse and representative of the population of Liberia as a whole. Bassa- and Kpelle-speaking peoples are in the majority, making up 21% and 52% of the County's population respectively, but every other Liberian language and dialect can also be found. The population of a few ethnic groups does not reach the 1 percent mark, including the Sapo, Krahn and Mandingo. However, the 0% notation should not be interpreted as having no presence in the County.

Religion

An estimated 68.2% of the population is Christian, while 31.8% is Muslim, according to the County Superintendent's office.

Tourism

No Tourism site is found in the county.

Agriculture

The population is mostly engaged in subsistence agriculture. Only about 40% have access to agricultural land. The main crops cultivated include Cassava (90%), rice (16%),

vegetables (18%), sweet potatoes/eddoes (8%), plantain/banana (8%), corn (16%) and pulses (1%).

Fishing

There are seven (7) artisanal fishing communities located along the beaches of Montserrado. Those directly and indirectly engaged in fishing activities earn their livelihood from the sector. Majority of those indirectly involved are market women who buy, smoke, and sell fish on a retail basis.

Health

Currently the majority of the rural population has to walk for hours or days to access a Clinic. The county suffers shortage of health facilities; as a result, health is considered one of the needy facilities in the county. Both the facilities and the services are inadequate to meet the urgent needs of the citizens. Health is one of the priorities of the county.

Water and Sanitation

In most part of rural Montserrado access to sanitation facilities is non-existent, and locals still use the bushes to attend nature. Those along the coastal areas often use the beaches. The majority of the populations are without pipe borne water. There are hand pumps but they are not regularly maintained, as a result, there are frequent outbreaks of water-borne diseases. There is a need for maintenance to be considered in both planning and budgeting. In Montserrado there is an average of 3,014 persons to one latrine, 766 in Careysburg District, 1,777 in St. Paul and 1,634 in Today.

Education

The Ministry of Education in 2006 report, reported 252 schools in St. Paul River, 52 in Todee and 35 in Careysburg. However, many children are still forced to walk for several hours to reach the nearest educational facilities where at time they receive sub-standard education in often dilapidated buildings.

Economic Activities

Owing to the lack of factories and industries in the county, production is predominantly subsistent.

7. GRAND CAPE MOUNT COUNTY

Geography

Grand Cape Mount County is located on the West-central portion of Liberia. The country is bordered by Gbarpolu County to the northeast and Bomi County on the South Southeast, on the North by the Republic of Sierra Leone and on the South by the Atlantic Ocean.

The county has a total area of 5,162 square kilometers (1,993 square miles). The absolute location of Cape Mount is latitude 7° 10'N and longitude 11°00' W.

The county has five administrative districts; Common Wealth, Garwula, Gola Konneh, Porkpa and Tewor Districts.

Climate

Cape Mount as a coastal region has high annual rainfall because the coastline runs approximately from South-east to North-west and at right angles to the prevailing South-western rain-bearing winds. It has two seasons: rainy and dry seasons. The rainy season begins in April and ends in October with an average rainfall of 400 mm and temperatures ranging from 28 and 34 degrees Celsius, while humidity goes as high as 90 to 100 percent. The dry season is from November to March.

Topography / Drainage

Grand Cape Mount has a large natural lake called "Lake Piso", which forms a confluence with the Atlantic Ocean with beautiful shores that attract tourists. The county is also endowed with mountains such as the Bie Mountains in Porkpa and Gola Konneh Districts, which contain a large deposit of iron ore. Cape Mount has good network of rivers such as Maffa, Mani, Konja, and Lofa which separates Bomi from Cape Mount, and the Congo Mano River, separating Sierra Leone and Liberia. These rivers contain rich deposits of gold and diamonds and provide food and livelihoods for many communities. Cape Mount is richly endowed with natural resources, mainly iron ore in Porkpa and Gola Konneh Districts, and diamonds and gold in Porkpa, Gola Konneh and Tewor Districts. There is an unconfirmed report that the county has some deposit of oil.

Vegetation

The coastal belt of the county has coastal savannah, coastal mangroves, and scattered trees and farmland. Towards the interior are some semi-deciduous, rain forest and secondary forest.

Population

Cape Mount County is sparsely populated. It has a density of 25 inhabitants per square kilometer (65 persons per square mile).

Table 9: Population by District, Grand Cape Mount County

District	Male	Female	Total
Grand Cape Mount County	65,679	61,397	127,076
Garwula County	13,668	13,268	26,936
Gola Konneh County	13,157	10,361	23,518
Porkpa County	22,208	20,407	42,615
Tewor County	3,298	3,249	6,547
Common Wealth County	6,547	14,112	27,460

※ Source: LISGIS 2008

Ethnic Composition

The five major groups in the County are the Vai, Gola, Mende, Mandingo and Kissi. Other minority ethnic groups include Bassa, Gbandi, Grebo, Kru, Lorma, and Mano. The Vai vernacular is widely spoken, followed by the Gola, with percentage distributions of 60% and 23% respectively. Mende, Mandingo and Kissi languages are also spoken by sizeable minorities. The Vai script, introduced by Bokeleh, serves as means through which many locals are able to communicate and keep financial transactions and other records. Culturally, inter-marriages among the tribes are permissible and common. This leads to cultural assimilation that creates a bond of unity.

Religion

The two main religions in the County are Islam and Christianity. It is estimated that 70% of the population in Cape Mount are Muslims, while 25% are Christians and a smaller minority are practitioners of traditional religions. The relationship between the two major religious communities is largely harmonious.

Tourism

The Lake Piso region, with its fantastic biodiversity makes it very attractive to tourists. In the 1970s, tourism thrived in the county, especially after the construction of 75-bed room hotel. There are also a number of historical sites including the Tallah Township, which was a World War II allied base. To promote tourism and other commercial activities that will help to

provide employment, revenue and economic growth, the CDA process heard calls for the declaration of the Lake Piso region as a multipurpose protected area, construction on air strip, rehabilitation of Hotel Wakolor, construction of additional motels and restaurants in Robertsport along Lake Piso, on Yark Island and in Sembehun, development of the beaches and construction of public park”.

Agriculture

Approximately 78% of the rural households in the county are engaged in agricultural activities at subsistence level. Farmers cultivate various crops including oil palm, rubber, cocoa and coffee and food crops such as rice, cassava, yam and vegetables including pepper, bitter ball, okra, potato leaves, cabbages and others.

Agricultural production remains low due to limited access to extension services, traditional methods of farming, late supply of seeds, lack of capital and credit, lack of tools and other farm inputs.

Fishing

Fishing is another means of survival in the county. According to statistics about 11% of households were engaged in Ocean fishing, while 15% fished in rivers, 81% in creeks and 2% in swamps. However, the fishing industry remains underdeveloped. Fishing provides employment to about 30 per cent of the population of Robertsport and its environs.

Currently most fishing is carried out by the Fanti and Kru people who have trained many local youth. However, lack of cold storage facilities, coupled with a lack of capital continues to constrain growth in the sector. There is a need to organize fishing cooperatives and provide inputs to local fishermen to engage in commercial fishing as well as smoking and cooling.

Health

There is one hospital (the St. Timothy Government Hospital) located in Robertsport and some 32 functional health facilities-30 clinics, one health center and one health post. The African Humanitarian Agency (AHA), the Medical Teams International (MTI) and International Medical Corps are playing a pivotal role in supporting the health section. Some 74% of the local facilities are currently supported and run by INGOs with funding from UN Agencies and bilateral donors”. There is no report on the presence of donors such as

USAID, World Bank, AFDB, UNMIL, etc project in the county. World Bank promised to initiate some assistance but in January of 2010.

According to epidemiological data from health facilities the principal causes of morbidity are malaria, pneumonia, sexually transmitted diseases, diarrhea diseases, urinary tract infections, hypertension and pelvic inflammatory diseases. The current staffing gap in the County is one doctor, 35 nurses, 15 certified assistants and two technicians. The rehabilitation of medical infrastructure, provision of a regular supply of medication, recruitment and training of more health staff, especially nurses and traditional birth attendants, provision of vehicles and rehabilitation of the County hospitals are crucial in meeting with the health needs of the growing population of the county.

Water and Sanitation

Only 20% of the communities in the county have access to clean water facility. The poor water and sanitation problem has contributed immensely to the poor health of the inhabitants. Only about 35% of the pre-war wells and hand pumps have been rehabilitated to date which is inadequate. Therefore, the rehabilitation of all pre-war damaged wells and hand pumps and the construction of additional ones in nearly every town are necessary to increase accessibility of safe drinking water to the PRS goal of 50% coverage.

Road & Bridges

The County has only one paved road, leading from Monrovia to Bo Water Side, and seven major feeder roads. There exist also several farm-to-market or secondary feeder roads. With all these roads, there are still problems, the physical damage to roads and bridges mainly during rainy season usually create problems for the free movement of citizens throughout the county.

Deterioration of roads is attributed to lack of maintenance and the absence of qualified technicians, which has warranted the rehabilitation of bridges by masons and carpenters. Accessibility to some areas during the rainy season is virtually impossible due to damaged bridges.

Education

There are about 124 functional educational facilities in Grand Cape Mount County. Of this number, 107 are elementary schools, 14 are junior highs and three are senior high schools.

Enrollment is estimated at 26,748 including 13,888 boys and 12,860 girls, with a teacher population of 341, which 311 are male and 30 are female.

Housing

In many parts of the county, adequate shelter and basic housing fall seriously below the acceptable standard. "Between January and December 2006 the Norwegian Refugee Council conducted a multi-sectoral needs assessment survey in the county. A total of 348 villages with a combined population of 198,002 were surveyed, and of this group, 11,472 families without shelter were recorded. NRC has embarked on shelter assistance for approximately 1,500 households in the county with funding from DFID, USAID/LCIP through its implementing partner North West Development Association funded shelter construction for 195 beneficiaries including ex-combatants and vulnerable persons.

3.2.13. Socio-economic conditions of Affected Villages (Category II)

Socio-economic survey for the people residing within the 600 meter width band (300 meters from the center of the line route on either side) was carried out. Majority of the population along the line route base their livelihoods on agricultural, growing (a) cash crops such as rubber, oil palm, kola nuts, sugarcane, cocoa and coffee, (b) food crops such as plantains, orange, cassava, eddoes, etc. Farming method is slash and burn shifting cultivation carrying out petty trading of surplus crops and small businesses to provide monetary income. Estimated average annual income is the equivalent of US\$79. Other income earning opportunities in the area are minimal. Wage labor is available to some people within the agricultural section or as contractors with large commercial plantation.

Settlements within 600 meter band width (300 meters from the center of the line route on either side) are listed as below

Table 10 Villages/Towns within 300m range

No.	County	Town/Village	Population
1.	Nimba	Youpia	850
2.	Nimba	Mulbah Konneh Village	73
3.	Nimba	Mohnyen Village	86
4.	Nimba	Vah Village	78
5.	Nimba	Dennis Power Village	83
6.	Nimba	Mark Glee Village	97
7.	Nimba	Stanley Village	120

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8.	Nimba	Budadin Town	800
9.	Nimba	Zao Junction	425
10.	Nimba	CNC Camp	300
11.	Nimba	Sam Biepa Village	105
12.	Nimba	George Weah Farm	77
13.	Nimba	Zolowea Town	550
14.	Nimba	Darlopah	2,000
15.	Nimba	Zuakarzue #1	800
16.	Nimba	Zuakarzue #2	Not available
17.	Nimba	Zorgowee	Not available
18.	Nimba	Gbobayee	Not available
19.	Nimba	Sankimpa	Not available
20.	Nimba	Kpouh	Not available
21.	Nimba	Gbobaley	Not available
22.	Nimba	Tonwee Ganpaqua	Not available
-	Subtotal	22 Towns	6,484
23.	Margibi	Hydro Dirty Town	175
-	Subtotal	1 Towns	175
24.	Bomi	Kpormakpor Vallige	65
25.	Bomi	Golodee Lansana	1,984
-	Subtotal	2 Towns	2,049
26.	Bong	Dozen Town	475
27.	Bong	Gbarwo Kpallah	850
28.	Bong	Gbar Town	920
29.	Bong	Tarpeh Town	785
30.	Bong	Kokoya, Boepa Camp III	475
31.	Bong	Boepa Camp II	100
32.	Bong	Lorta (Kpa District)	225
-	Subtotal	7 Towns	3,830
33.	Grand Bassa	Dorwein Town	1,100
34.	Grand Bassa	Kardorpue Town	1,150
35.	Grand Bassa	Kroe Town	850
36.	Grand Bassa	Kola Tree Town	250
37.	Grand Bassa	Eye To Eye Village	125
-	Subtotal	5 Towns	3,475
38.	Montserrado	Frank Town	1,350
39.	Montserrado	Little Frank Town	148
-	Subtotal	2 Towns	1,498
40.	Grand Cape Mount	Sanjanama Town	1,500
41.	Grand Cape Mount	Vohnzwahn Town	3,618

42	Grand Cape Mount	Mambo Town	2,300
	Subtotal	3 Towns	7,418
Grand Total		42 Towns	24,249

Education

Levels of education are low across the project affected areas. Baseline studies found that approximately 25% of the population aged over 15 is illiterate. Overall women's illiteracy level is twice that of men. The educational facilities available to towns/villages are inadequate.

Table 11 Distribution of Educational facilities within the project areas

Town/Village	Elementary	Junior High
Kahnla	1 public	-
Lugbeyee	1 public	1 junior
Kardorpue	1 public	-
Zwanzhun	1 public	1 junior high
Mambo	1 public	1 junioe high (Private)
Kokoya Boepa	1 public	-

Credit

Banks are only found in County centers. Rural credit is provided by a local credit group called "SUSU" where savings are kept by a group of people with mutual understanding. Local people sometimes obtain credit from NGOs and other friendly local business people.

Housing

Rural houses are generally constructed of sun-dried mud brick with either thatched or corrugated steel sheet roofs. Generally housing constructions in the project affected area are very poor. Majority of the houses are build of mud, sticks and thatch. The houses do not have toilet facilities, not water supply. The majority used thr nearby bushes to defacate.

Health

The rural communities within this periphery lack any sanitation, and clean water provision is sporadic and confined to a few wells with hand pumps. Most people creek-water for their needs. Most households lack easy access to health services. Many households predominantly are reliant on usage of medicinal plants and traditional healing to treat

illnesses. The survey found one clinic in Luginbeye, one in MambuTown and one in Kokoya Boepa.

The baseline surveys looked at the health-care facilities that were available to households and how families were using the services that are available to them. There are no official disaggregated data on birth rates or numbers of births per woman in the survey areas, but nationally these rates are recognized as being high. There is also no published data available on rates of illness or spread of diseases in the project affected areas. Nationally the infant mortality rate is 157 per 1000 live births (2004); the main causes of death among infants under the age of 5 are due to neonatal causes, malaria or pneumonia, HIV prevalence of 15-49 year is recorded at 5.9%(2003). The total expenditure on health as a percentage of the gross Domestic Product was 4.7% in 2003 (WHO).

Many people within the project affected areas expressed that they rely on traditional medicine. Many people do not use western medical facilities such as hospitals and clinics perhaps due to lack of financial resources, physical distance to hospital or clinics. One other finding is that the people prefer traditional treatment because consultation with a herbalist is cheaper and quicker than a hospital consultation.

There are clinics in Luginbeye, Mambu, and Kokoya Boepa towns. The rest of the project affected towns/villages have no health facilities.

Land Tenure and Agriculture

Agriculture is recognized as the most important part of the Liberian Economy and in 2008 agriculture and forestry combined to produce 61% of the gross domestic product of the country. It was recorded that 70% of the national population were engaged in agricultural activities (Somah 2005).

There are two major forms of land tenure in Liberia: private land ownership with owners holding titled deed; and customary ownership. The latter is the most common in the project area. Customary land ownership plots are allocated to residents within the town quarters by the the Town Chief and elders council. As in many Liberian villages, quarters allocated in predetermined land area as associated to family lineages (patrilineal), resulting in an entwinement of farming with residence and descent. Quarters are not stable entities as family fortunes and migration in and out can change their composition. Strangers or landless

people within a community can request to use land directly to families who have an allocated quarters or the Town Chief but they may be refused. Baseline surveys found that compensation requirements for families within areas used by other community members was almost invariably said to be a 50 kg sack of seed rice irrespective of farm size. This is particularly interesting because it overlap with a request stipulation that famers on non-family land including son-in-laws are often requested, regardless of whether they pay rice or not, not to plant tree crops. Under the widespread customary practice of acquiring or asserting land claims through tree planting (Unruh, 2008), this restriction is a means of ensuring that the land lent outside the family is not at risk of leaving the family quarter.

It was found that households farm a mixture of tree crops, subsistence and cash annual and biennial crops. The type of crop and the use of the plot varies with plot size, the topography and pressure on land availability. Some households only grow cash crops, others, a mixture of cash crops and subsistence farming. Some households sell surplus, others cannot grow sufficient to feed their families for the year and have to support their households with other income.

Robber, cocoa, coffee, and plantains are usually grown as plantation- single tree stand areas cropped continuously over period of years. Rubber takes 7 years to mature and can be tapped for 25 years or more whereas plantains stands are replanted every two years. Tree crop producing households are in the minority. More households own stands of fruit trees- coconut, kola and other fruits – and sugarcane.

Some crops such as swamp rice can be repeated during the year on the same plot, other crops such as cassava can produce a crop two years running before the plot is abandoned to fallow to restore fertility. Households typically grow rice, cassava, peppers and green leafy vegetables.

Governance

Liberian society is characterized by a veneration of elders and patriarchy. Each hamlet village or town has a Town Chief. Under the traditional administrative system, rural Town Chiefs are organized under Clan Chief and Paramount Chiefs. The traditional Chief is advised by a group of Council of community elders who are invariably men. The Chief and elders are responsible for a range of duties in organizing rural life including allocating land use on communal lands giving permissions for strangers to enter and stay in the community,

permitting house building and settling disputes on all aspects of community life. The system was damaged during the civil war but is regaining strength and respect as peace continues. Increasingly male youths are invited to participate in Elders Councils in recognition of their roles in the war and experience they gained in leadership. A consultation found that a consideration number of youth or younger members of communities were given the role of Town chief.

There is an official Government Administration hierarchy of District Superintendent and District Officers, County Superintendent and Officer of line Ministries as well as Central Government Ministries. Management of rural communities is a partnership of the Governmental system and the traditional Chief and councils of Elders.

In addition, there are other structures that determine how communities operate and who is accepted in the community. Firstly, the Zoes are the traditional herbalists/ medicine men/ leaders. The Zoe recognized as controlling relations between the spirit world embodied in nature, the ancestors and living communities. They are also recognizing as medicine men carrying knowledge of plants for medicinal usage. The role is handed down through families. Secondly, the Poro and Sande Cultural societies are important aspects of community life and they are recognized under national legislation. The Poro and Sande societies are fraternities/societies of men and women organized in groups of people of the same age bands. Their purpose is to teach life skill and reinforce cultural knowledge and practices. Membership of each society determines 'belonging' and acceptance in a community.

3.2.14. Socio-economic Conditions of Properties Affected People

Properties Affected People are individuals who own properties that will be directly affected. The properties include cash crops, food crops, houses/ huts/ buildings, land, etc. These are the people among the project affected communities that will receive compensation for properties to be affected. There are approximately 113 householders whose properties will be affected and their dependents totaled 597 (see appendix 6 for numbers of people and the types of properties to be affected by the proposed Project).

It is indeed difficult to differentiate socio-economic conditions of project affected people and Properties Affected People. These two groups are residing in similar communities. They all will enjoy services such as schools (primary and secondary), water, health and road networks. With reference to employment, contractors will employ local people living in the

neighborhood of the project area to work as casual laborers. In this light, properties affected people and their dependents would be given first preference. Besides direct part time employment, other temporary job opportunities will be possible such as the provision of small commerce and services e.g. sale of agricultural products.

It is expected that Special Purpose Company (SPC) will enter into an agreement with local communities for clearing the line corridor as well as Security Services.

Again the properties Affected People and their dependents should be given preferences. The compensations they will receive including these opportunities would indeed raise their income levels and they would have better living conditions.

3.2.15. Corporate Social Responsibility

The project has to consider bearing some corporate responsibilities. The SPC as the implementing body of the project should consider providing facilities such as water supplies, schools, health facilities, housing facilities, roads, etc. for the impacted population. Specific budgetary appropriation is therefore recommended in order for SPC to meet these social responsibilities

4. IDENTIFICATION AND ASSESSMENT OF POTENTIAL ENVIRONMENTAL IMPACTS

4.1. Introduction and Methodology

4.1.1. Introduction

The proposed transmission line project has the potential to impact significantly on the environment. These potential impacts require proper management in order to minimize or eliminate the negative impacts and, if possible, maximize the beneficial ones to ensure the sustainability of the environment. In recognition of this fact and in fulfillment of the requirements of permitting and Funding Agencies, the LEC and the environmental consultant incorporated this ESIA in its project cycle.

This section of the Environmental Impacts Statement (ESIA) deals with the methodology used to assess the potential impacts of the proposed transmission line project, and the results from the application of this methodology to the proposed Project, using project information and baseline data available at the time this report was prepared.

The impact assessment methodology used for this project consists of five major steps:

- ❖ **Step 1:** Identification and description of project activities and their interaction with environmental media;
- ❖ **Step 2:** Comprehensive preliminary identification of potential impacts;
- ❖ **Step 3:** Screening, or comparative assessment of impact ; identification of impacts that are likely to be significant (i.e., identification of focus areas for further study) through application of a basic set of impact significance criteria to the preliminary information available about each impact;
- ❖ **Step 4:** Detailed assessment of the identified focus area impacts characterization techniques; quantification of impacts to the extent possible and rigorous qualitative characterization of impacts that cannot be quantified; and
- ❖ **Step 5:** Final assessment of the severity levels of impacts through application of the results of the rigorous quantitative and qualitative characterization of impacts developed in Step 4 to a set of objective impact severity criteria; identification of impacts warranting mitigation.

4.1.2. Methodology

The proposed Project may potentially result in impacts on the environment, socioeconomic conditions, and/or health and safety. Each of the specific compartments of the environment listed below in Table 12 and 13 could potentially be affected by the impacts resulting from one or more of the proposed activities discussed above. The impact identification process described in Section 4.1.1 was used to evaluate the potential impacts of each of the project activities discussed on the specific environmental compartment listed below, in order to identify and assess the potential project impacts.

Table 12 Initial scoping

Impact category	Specific environmental compartment
Environmental	Land Use
	Habitat and biological resources
	Topography, geology and soils
	Water resources
	Air quality
	Noise and Vibration
	Solid and hazardous waste
	Energy resources
Socioeconomic	Transportation

Impact category	Specific environmental compartment
	Cultural resources
	Socioeconomics
Health and safety	Occupational health and safety
	Public health and safety

This list was later updated and revised as a result of the environmental screening and scoping process. The revised list of affected environmental compartments is shown in Table 13 as follows.

Table 13: Post scoping list

Impact category	Specific environmental compartment
Environmental	Land Use
	Habitat and biological resources
	Topography, geology and soils
	Water resources
	Air quality
Socioeconomic	Transportation and infrastructure
	Cultural and social conditions
	Means of livelihood
Health and safety	Occupational health and safety
	Public health and safety

All possible potential impacts were identified through a comprehensive impact identification process using matrix of impacts and activities. The matrix arrays project activities against environmental media, and supports a methodical, comprehensive, and objective identification of the impacts each project activity may have on each environmental, socioeconomic, and health and safety medium. All potential environmental and socioeconomic impacts of the proposed Project were initially identified through this approach. The main factors used in determining whether an impact may occur at each intersection between a project activity and a specific environmental medium include:

- ❖ Literature reviews (desk study);
- ❖ Field observations;
- ❖ Discussion with project proponent health, safety, and environment departmental officers and schedule officers;

- ❖ Consultations with local experts;
- ❖ Consultations with stakeholders;
- ❖ Experience from similar projects worldwide;
- ❖ Comments on the Scoping Report from EPA; and
- ❖ Professional judgment.

4.2. Results of impact identification

Table 14 shows the expanded impact identification matrix for the various phases (and project activities) of the project cycle which identify the focus areas by project phase and activity (e.g., pre-constructional phase), project activity (e.g., line route survey), and affected media (e.g., air quality). This table summarizes the identified focus areas. Focus areas are indicated by 0, 1, 2 or 2+. If the row associated with a particular activity is 0, the impacts from that activity are considered to be negligible, or of lower significance and screened out of further consideration. The potential impacts associated with each focus area are qualitatively, and where possible quantitatively described and evaluated in the corresponding text under this section.

The potential impacts have been identified and assessed under the three main phases of the proposed Project. These are:

- ❖ Pre-constructional phase
- ❖ Constructional phase
- ❖ Operational phase

Table 14: Impact identification matrix

Activities	Bio-physical Environment									Socio-cultural Environment								
	Geology, Soils	Climate, air quality	Noise	Water Resources	Flora	Fauna	Ecological sensitive sites	Population	Cultural Heritage	Historical resources	Visual Intrusion	Infrastructure	Occupational Safety & Health	Land tenure, Ownership	Land use	Employment	Agriculture	Public Health
Pre-constructional phase																		
Project Feasibility Study	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Line Route Survey	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0/1	0
Environmental Impact Study	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Acquisition of RoW	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	2	0
Constructional phase																		
Clearing of Access Tracks	1	0	0/1	0/1	1	0/1	0	0	1	0	0	0	1	2	2	2+	2	0
Transportation of equipment to Site	1	0	0/1	1	1	0	0	0	0	0	0	0	0	0	1	0	0	1
Clearing of RoW	0	0	0/1	0/1	1	0/1	0	0	1	0	0	0	1	2	2	2+	2	0
Clearing of Tower Corridor	1	0	0/1	0/1	1	0/1	0	0	0	0	0	0	1	2	2	2+	2	0
Excavation of Tower foundations	0	0	0/1	1	0	0	0	0	0	0	0	0	0	2	2	0	2	0
Erection of Towers	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0
Stringing Lines	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Operational phase																		
EMF effects	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Vegetation Control	0	0	0	1	1	0	0	0	0	0	0	0	1	1	1	2+	1	0
Line Maintenance	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Tower Maintenance	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0

Key: 0 No potential impact or insignificant impact. 2+ Potential significant beneficial impact.
 1 Potential effect, expected to be insignificant. 2 Potential significant adverse impact

4.3. Pre-constructional phase

The activities to be undertaken during this phase of the proposed Project include:

- ❖ Project planning and design;
- ❖ Assessment of alternative routes;
- ❖ Line route survey;
- ❖ Consultations;
- ❖ Acquisition of the Right-of-Way;
- ❖ Sourcing funds and engaging contractors;
- ❖ Collection of baseline data such as flora and fauna survey, socio-economic and other baseline data for the preparation of the ESIA Report;
- ❖ Preparation and submission of an Environmental and Social Impacts Assessment Report;
- ❖ Acquisition of Project Environmental Licence;
- ❖ Preparation of a Resettlement Action Plan;
- ❖ Preparation of an Environmental and Social Management Plan;
- ❖ Payment of compensation to project-affected persons;

Most of these activities are expected to have negligible impacts on the environment and will therefore require no mitigation measures.

Trees considered being potentially capable of threatening the proposed transmission line beyond the 20 m width on each side of the centre line of the transmission line will be cut down or pruned as appropriate. These will be trees, which could damage the transmission line if they fall on it or those whose branches may grow so big as to disturb the lines. All vegetation clearance will be done by physical means.

The acquisition of the Right-of-Way (RoW) and the line route will therefore have potential effects on land ownership, land-use characteristics, flora and fauna within the project environment.

4.3.1. Loss of buildings and land ownership issues

The proposed Project is a linear one. The project footprint will be 21,400,000m² to include the area required for the towers (1,330 units), and the five substations 200m x 200 m x 5. Areas to be occupied by each tower base (5m X 5m per tower) and 4 substation sites will be permanently acquired while the rest of RoW and access track will be temporarily taken only

during the construction or operation stage. This gives a total area of 193,250 m² for permanent land take.

The acquisition of the RoW and access tracks has the potential to adversely affect land ownership and land-use characteristics, as land will have to be acquired from some individuals, communities and/or stools. The land to be affected by the implementation of the Project has the following categories of land-uses:

- ❖ Agricultural lands
- ❖ Potential agricultural lands (or fallow agricultural lands)
- ❖ Residential lands (affecting buildings and residential plots)

The proposed line passed through the 7 counties in Liberia and sometimes crosses wide rivers such as Khan, Dayea and St. John River. Alluvial soils are found in the river bottoms, and in swamp soils are utilized largely for agriculture. The proposed transmission line traverses approximately 20,800m² of the alluvial soils which can be used in the future as a farming area. Also, the total agricultural areas to be affected by the RoW will be 4,280,000 m².

This potential adverse effect on land ownership and land-use requires mitigation measures to minimize the impact on individuals, communities and stools.

There will be consultation with communities and private individuals who own land deeds. Communal land will not be paid for since the project is Government owned. Only privately owned land with deeds will be paid for. All properties on both private and communal lands removed will be paid for.

4.3.2. Line route survey and substation selection issues

Prior to the acquisition of the RoW and the start of constructional activities the proponent had to undertake a line route survey to determine the most suitable alignment for the transmission line. In addition, a site survey had to be carried out to select the optimum site for the construction of the substation sites.

During the line route and substation site surveys, Impact on flora and fauna were not considered to be significant since the line route follows, to a large extent, the existing road network in the project area. In the case of the selection of the substations, no adverse impact was realized on flora and fauna as no clearing was done and the substation sites did not include the protected forests.

4.4. Constructional phase

The constructional phase of the proposed project will involve activities such as construction of substation, access and tower corridor tracks, clearing and excavation of tower base areas, clearing of tower base buffer and RoW, cutting of trees considered too close to the RoW, transportation of equipment and materials and the erection of towers and stringing of transmission lines.

These activities have the potential to impact significantly on the physical, biological and socio-cultural/socio-economic environments within the project's area of environmental influence. The key potential issues relating to this phase of the proposed project have been identified through field visits and surveys, literature study and consultations with stakeholders. The significant potential impacts have been discussed in the following sections. It is noted here that impacts for this phase of the proposed project cycle are similar for both the substation and transmission line construction.

4.4.1. Constructional noise impacts

Noise due to construction machinery during clearing and grading of access and tower corridor tracks, clearing and excavation of tower base areas, clearing of tower base buffer and RoW, cutting of trees, transportation of equipment and materials and the conversational shouts of construction workers could increase ambient noise levels in the immediate vicinity of the project area. This potential rise in noise level could have impacts on some local communities, fauna along the RoW, and on the construction crew.

It is however expected that impacts on fauna will be temporary and will not be significant. In addition, fauna that may be scared away during this phase of the project will quickly return to the vicinity of the RoW once construction ceases. No further mitigation is proposed for potential noise impacts on fauna.

Mitigation measures have however been proposed for the management of potential noise impacts on local communities along the RoW and the construction crew.

Noise during construction of the substation may be heard by residents in the vicinity, mostly in relation to construction vehicles entering and leaving the site. Almost all of the proposed

four substations locations are a bit far from residents that actual construction-related noise will most likely not be heard or be disturbed by any area residents.

4.4.2. Impact on air quality

Constructional activities, including vegetation clearing, excavation, grading and haulage of construction equipment and materials could degrade air quality on a short term basis in the immediate environs of the proposed project. Air quality can also be affected by soot in exhaust fumes of the construction machinery. During the period of the preparation of work sites, dust will be dispersed which is arising from cutting trees.

Although this potential impact will be short-lived or temporary, limited only to the constructional phase, mitigation measures have been proposed to minimize the impact, especially on local communities.

4.4.3. Erosion

Clearing and grading of access and tower corridor tracks, excavation of tower base areas and the construction of access tracks during the constructional phase will expose the disturbed ground surface, which will at least be temporarily unprotected, to the agents of soil erosion such as heat, wind and rain. This potential impact requires mitigation measures to ensure that impacts such as soil loss, pollution of near-by streams and siltation of natural waterways are minimized.

4.4.4. Public Safety

The transportation of heavy plant and equipment through settlements and the presence of unprotected tower base excavations could pose potential safety problems for the local populace. Mitigation measures have been proposed for this potential impact. In addition, the excavated foundations, if left unguarded, will pose risks to public safety or even animal safety. Mitigation measures have been proposed for this potential impact.

4.4.5. Flora and Fauna

During the construction, the removal of vegetation for access tracks, the tower corridor track and the tower base areas will result in permanent loss of vegetation in these areas and lead to potential faunal displacement.

Other sections of the RoW outside the tower corridor track will also be partially cleared of vegetation up to a height of about 1.25 m. In addition, trees, which are located just outside

the RoW and are considered likely to threaten the safety of towers and transmission lines, will be felled. As stated earlier, this action of vegetation clearing could have potential adverse impacts on flora and fauna. As stated section 5.1.1, the proposed line route traversed some agricultural lands, potential agricultural lands (or fallow agricultural lands) and residential lands.

Measures will, however, be put in place to mitigate the potential impact on flora and fauna.

4.4.6. Occupational safety and health

During this phase of the project, there will be the potential for occupational safety and health hazards. The potential for safety and health hazards will be most acute when:

- ❖ Technical specifications relevant to safety measures are disregarded in the planning and erection of plant and equipment (e.g. the use of low quality components, inadequate sizing of cables, negligent execution of works, and general non-observance of safety rules leading to inherently unsafe systems.
- ❖ The operating personnel have not received sufficient training and experience in connection with safety measures and their observance
- ❖ Improper and insufficient supervision of workers are undertaken.

The key issues of concern here are noise pollution, machine safety, provision of sanitary/welfare facilities, injuries from falling/swinging objects, accidental fall from heights and the possibility of snakebites.

Mitigation measures are proposed to minimize the potential occupational safety and health hazards to safeguard the safety, health and welfare of the construction workers.

4.4.7. Socio-economic/cultural issues

The proposed project has the potential to impact significantly on the socio-economic, socio-cultural life of the local people within the project's sphere of environmental influence

4.4.7.1. Loss of properties and land ownership issues

As stated earlier, the acquisition of the RoW and access track areas has the potential to adversely affect land ownership and land-use characteristics, as land will have to be

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acquired from some individuals, communities and/or stools. The land to be affected by the implementation of the proposed project has the following categories of land-uses:

- ❖ Agricultural lands
- ❖ Potential agricultural lands (or fallow agricultural lands)
- ❖ Residential lands (affecting buildings/structures and residential plots)

Table 15 and Appendix 5 show the numbers of people and the types of properties that will be affected by the proposed project. Taking the head of the household to be the owner, the total number of persons with ownership of the properties that will be affected by the proposed project is 113. And total number of their dependents is 597. Therefore, total number of project affected person is 710. These persons have been referred to as Project-affected persons (PAPs) in this report. The affected properties have been categorized in the table by the types of properties. Approximately 38,217 rubber trees at Firestone Rubber Plantation will be affected.

A total of 25 houses/ huts and 5 buildings shall be impacted by the proposed project. The identities, locations, area, and the exact compensation amounts and the type of property to be impacted have been indicated in the list below.

Table 15: Summary of PAPs

County	Trees		FoodCrops		Houses		Huts		Buildings		Lands		Total Cost (USD)
	Count	Cost	Area(ac)	Cos (USD)t	Count	Cost (USD)	Count	Cost (USD)	Count	Cost (USD)	Area(m2)	Cost (USD)	
Nimba	30,681	183,996	7.6	119	-	-	1	1,100	-	-	40,000	20,000	205,215
Margibi	38,217	229,302	-	-	-	-	-	-	-	-	-	-	229,302
Bomi	1,011	6,066	-	-	1	4,850	3	3,300	1	35,000	-	-	49,216
Bong	10,203	61,218	-	-	-	-	-	-	-	-	-	-	61,218
GrandBassa	11,929	71,307	-	-	2	9,700	14	14,200	2	20,000	40,000	20,000	135,207
Montserrado	3,207	19,089	7.0	42	3	14,550	1	1,100	2	55,000	40,000	20,000	109,781
GrandCape	2,635	15,285	-	-	-	-	-	-	-	-	40,000	20,000	35,285
Total	97,883	586,263	15	161	6	29,100	19	19,700	5	110,000	160,000	80,000	825,224

Table 16: List of PAPs and type of property - Nimba County

• Trees / Crops

No.	Name	Town/ Village	No.	Property	Coordinate		Quantity (No/Acres)	Unit Cost (USD)	Total Cost (USD)	Type
					X	Y				
1	Charles T. Gluashea	Zorgowee	004NC	Rubber	547607	810022	350	6	2,100	Tree
2	Abraham Gono	Zorgowee	002NC	Sugar Cane	546178	810160	0.30	6	5	Crop
3	Zorleseh Domingo	Zorgowee	001NC	Sugar Cane	546201	810170	0.20	6	5	Crop
4	Florence Flomo	Vehyipa	026NC	Sugar Cane	533570	816857	0.10	6	5	Crop
5	Steven M. Flomo	Vehyipa	025NC	Palm	533310	816789	10	6	60	Tree
6	Alfred Gbangan	Vehyipa	030NC	Cassava	534252	817054	0.60	6	5	Crop
				Palm	534252	817054	36	6	216	Tree
7	Yor Suah	Vehyipa	029NC	Sugar Cane	533911	816970	0.10	6	5	Crop
8	Emmanuel Delee	Vehyipa	028NC	Sugar Cane	533844	816956	0.50	6	5	Crop
9	Melvin Damey	Vehyipa	027NC	Sugar Cane	533762	816921	1.50	6	9	Crop
10	Aloysius Dennis	Sehnkepa	022NC	Rubber	535777	817517	800	6	4,800	Tree
				Palm	535777	817517	40	6	240	Tree
11	Senni Kerwilliam	Sehnkepa	021NC	Rice	537792	816766	0.20	6	5	Crop
			021NC	Cassava	537792	816766	0.20	6	5	Crop
12	Alvin Dahn	Sehnkepa	020NC	Rice	537802	816739	0.05	6	5	Crop
				Cassava	537802	816739	0.05	6	5	Crop
13	Saye Dennis	Suakarzu	018NC	Rubber	539844	814695	50	6	300	Tree
14	Saye Nehwon	Suakarzu	017NC	Rice	541577	813451	0.50	6	5	Crop
				Cassava	541577	813451	0.50	6	5	Crop
15	Jeremiah Barkar, Jr.	Suakarzu	016NC	Rice	541477	813484	0.20	6	5	Crop
				Cassava	541477	813484	0.20	6	5	Crop
16	Felicia Nehwon	Suakarzu	014NC	Rice	541690	813417	0.05	6	5	Crop
				Cassava	541690	813417	0.05	6	5	Crop
17	Mark Marwean	Suakarzu	015NC	Banana	540709	813852	2	3	6	Tree
18	Koo Waenquoi	Kitoma	036NC	Rubber	523250	808331	150	6	900	Tree
				Sugar Cane	523250	808331	0.30	6	5	Crop
19	Helenia Torlon	Kitoma	037NC	Rubber	524660	808714	150	6	900	Tree
				Cassava	524660	808714	0.30	6	5	Crop
20	Nyan Kormea	Kitoma	038NC	Rubber	524267	808607	150	6	900	Tree
21	Shaffa	Kitoma	039NC	Rubber	526232	809154	3,500	6	21,000	Tree

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No.	Name	Town/ Village	No.	Property	Coordinate		Quantity (No/Acres)	Unit Cost (USD)	Total Cost (USD)	Type
					X	Y				
	Cooper									
22	Prince Belleh	Tonwee	034NC	Rubber	521031	807147	100	6	600	Tree
23	Christopher Gono	Tonwee	035NC	Rubber	520964	817117	200	6	1,200	Tree
24	Augustus Brewer	Zuluyee	040NC	Rubber	514927	801669	550	6	3,300	Tree
25	Nyan Quia	Domah	032NC	Rubber	529167	814441	1,250	6	7,500	Tree
26	Evelyn Johnson	Tondia	043NC	Palm	511495	799729	18	6	108	Tree
27	James Deline	Rancy Fram	041NC	Sugar Cane	513529	800880	0.30	6	5	Crop
28	Edwin Cooper	A.D.Cooper farm	042NC	Rubber	512743	800432	3,000	6	18,000	Tree
29	Paye Karway	Dahnlorpa	031NC	Palm	529064	814979	126	6	756	Tree
30	Joseph B. Yancy	Ganpaquoi	033NC	Banana	518697	805223	9	3	27	Tree
31	Joseph Todah	Vehyipa	024NC	palm	532672	816656	80	6	480	Tree
32	Mulbah Konneh	Duo	047NC	rubber	486181	767336	700	6	4,200	Tree
33	Victor Dennis	Duo	045NC	rubber	486181	765551	500	6	3,000	Tree
34	Wallace Gbengan	Duo	048NC	rubber	486104	765286	450	6	2,700	Tree
35	Peter Cooper Johnny	Duo	046NC	rubber	486769	766950	450	6	2,700	Tree
36	Yah Gono	Suakazue	009NC	Plantain	540617	813923	7	3	21	Tree
37	P. Clifford Dolo	Northstart Village	044NC	Rubber	503549	789081	2,500	6	15,000	Tree
38	Eric Mohnyen	Mohnyen Village	052NC	Rubber	487936	769032	1,150	6	6,900	Tree
39	Edwin Tonpea	Yoko Village	053NC	Rubber	488063	769257	1,300	6	7,800	Tree
40	John P. Quato	Zogorwee	005NC	Rubber	547703	810055	413	6	2,478	Tree
41	Andrew Gono	Gbobaye	006NC	Coffee	542686	812935	50	6	300	Tree
				Kola	542686	812935	18	6	108	Tree
42	Emmanuel Gono	Gbobaye	007NC	Banana	542816	812901	6	3	18	Tree
				Plantain	542816	812901	6	3	18	Tree
43	Freeman Zoanie	Tonwin New Town	055NC	Rubber	488191	769510	950	6	5,700	Tree
44	Nyah Boyee	Yoepa	049NC	Rubber	485756	763905	1,300	6	7,800	Tree
45	Alvin Power	Dennis Village	057NC	Rubber	489093	771089	1,000	6	6,000	Tree
46	Joseph Mehn	Mohny Village	054NC	Rubber	488578	770169	1,050	6	6,300	Tree

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No.	Name	Town/ Village	No.	Property	Coordinate		Quantity (No/Acres)	Unit Cost (USD)	Total Cost (USD)	Type
					X	Y				
47	Eric Wieh	Wieh village	051NC	Rubber	487773	768735	900	6	5,400	Tree
48	Samuel Guanquoi	Samuel Village	059NC	Rubber	502435	787886	1,050	6	6,300	Tree
49	Rufus Dahn	Sambeip a Village	060NC	Rubber	499314	782603	400	6	2,400	Tree
50	Annie Weah	Weah Farm	058NC	Rubber	502230	787547	1,300	6	7,800	Tree
51	Nyah Vah	Vah Farm	056NC	Rubber	488951	770837	1,350	6	8,100	Tree
52	Eugene Zawolo	Deegbay Village	063NC	Cocoa	498874	781867	35	6	210	Tree
				Rubber	498874	781867	75	6	450	Tree
				Coffee	498874	781867	50	6	300	Tree
53	Henry Kulah	Tunukpee village	064NC	Rubber	499615	783119	650	6	3,900	Tree
54	Rebecca Willie	Kpan Village	003NC	Rubber	543755	812526	500	6	3,000	Tree
55	Titus Boe	Tunukpuy ee	061NC	Sugar Cane	499933	783660	0.70	6	5	Crop
56	Smallwood Deemie	Deemie farm	062NC	Rubber	499188	783298	750	6	4,500	Tree
57	C.D. Jackson	Sehnkep a	023NC	Rubber	536673	817652	1,200	6	7,200	Tree
58	Mary Manwean			Cassava	540747	813778	0.40	6	5	Crop
59	Marcia Kahn	Suakarzu e	010NC	Rice	540426	814097	0.30	6	5	Crop
Sub-total		Tree					30,681		183,996	
		Crop					7.60		119	
		Total						30,689		184,115

• Houses / Huts / Buildings

No.	Name	Town/ Village	No.	Property	Coordinate		Quantity (No)	Unit Cost (USD)	Total Cost (USD)	Type	
					X	Y					
1	Yah Boyee	Topeh	050NC	Hut	485775	764162	1	1,100	1,100	Hut	
Sub-total		Houses					-		-		
		Huts					1		1,100		
		Buildings						-		-	
		Total						1		1,100	

• Land

No.	Name	Town/ Village	No.	Property	Coordinate		Quantity (m ²)	Unit Cost (USD)	Total Cost (USD)	Type
					X	Y				
1	Wilson	Sehnkepa	019NC	Landfors	538609	817656	40,000	0.50	20,000	Yekepa

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	Tokpah			ubstation						substation
Sub-total	Land						40,000		20,000	

Table 17: List of PAPs and type of property - Margibi County

• Trees / Crops

No.	Name	Town/Village	No.	Property	Coordinate		Quantity (No/Acre s)	Unit Cost (USD)	Total Cost (USD)	Type
					X	Y				
1	Firestone	Harbel	MG2	Rubber			38,217	6	229,302	Tree
Sub-total	Tree						38,217		229,302	
	Crop						-		-	
	Total						38,217		229,302	

Table 18: List of PAPs and type of property - Bomi County

• Trees / Crops

No.	Name	Town/Village	No.	Property	Coordinate		Quantity (No/Acre s)	Unit Cost (USD)	Total Cost (USD)	Type
					X	Y				
1	Gbelly Larjeh	Kpomakpor Farm	BM 001	Rubber	291951	738613	1,000	6	6,000	Tree
2	George Folley	Taar village	BM 002	Kola	292351	738705	6	6	36	Tree
				Mango	292351	738705	3	6	18	Tree
				pear	292351	738705	2	6	12	Tree
Sub-total	Tree						1,011		6,066	
	Crop						-		-	
	Total						1,011		6,066	

• Houses / Huts / Buildings

No.	Name	Town/Village	No.	Property	Coordinate		Quantity (No)	Unit Cost (USD)	Total Cost (USD)	Type
					X	Y				
1	Temas Orphanage Home	Taar Village	BM003	Building	292699	738797	1	35,000	35,000	Building
				Huts	292699	738797	3	1,100	3,300	Hut
2	George Folley	Taar Village	BM002	House	292351	738705	1	4,850	4,850	House
Sub-total	Houses						1		4,850	
	Huts						3		3,300	
	Buildings						1		35,000	
	Total						5		43,150	

Table 19: List of PAPs and type of property - Bong County

• Trees / Crops

No.	Name	Town/ Village	No.	Property	Coordinate		Quantity (No)	Unit Cost (USD)	Total Cost (USD)	Type
					X	Y				
1	William Tarpeh	Tarpeh Town	B005	Rubber	469400	743109	2,048	6	12,288	Tree
2	George Tarpeh	Tarpeh Town	B006	Rubber	468890	742722	1,844	6	11,064	Tree
3	Samuel Klembiah	Tarpeh Town	B007	Rubber	468783	742644	708	6	4,248	Tree
4	Philip P. Harris	Gbar Town	B008	Rubber	466811	741047	503	6	3,018	Tree
5	Mary K. Pearson	Pearson Farm	B002	Rubber	484630	761401	2,000	6	12,000	Tree
6	Duanah Soko	Lorta	B004	Rubber	476172	748776	2,500	6	15,000	Tree
7	James Zegbehn	Zegbehn Farm	B003	Rubber	485845	762220	600	6	3,600	Tree
Sub-total		Tree					10,203		61,218	
		Crop					-		-	
		Total						10,203		61,218

Table 20: List of PAPs and type of property - Grand Bassa

• Trees / Crops

No.	Name	Town/ Village	No.	Property	Coordinate		Quantity (No/Acre s)	Unit Cost (USD)	Total Cost (USD)	Type
					X	Y				
1	Clarence Onumah	Duwin	BS001	Rubber	427767	696460	1,633	6	9,798	Tree
2	Sam G. Bonwin	Bonwin farm	BS004	Rubber	397315	660191	2,100	6	12,600	Tree
3	Morris Tommey	Garmond eh	BS003	Rubber	409935	677466	1,200	6	7,200	Tree
4	Reubin Garway	Garmond eh	BS002	Rubber	410029	677458	500	6	3,000	Tree
5	Alexander Zikel	Corporal Village	BS13	Rubber	402505	666612	150	6	900	Tree
				Cocoa	402505	666612	100	6	600	Tree
6	Reubin G. Hill	Hill fram	BS011	Rubber	390327	655379	200	6	1,200	Tree
7	Saturday Whea	Diahbah Village	BS19	Kola	422484	689598	8	6	48	Tree
				Banana	422484	689598	36	3	108	Tree
				Coconut	422484	689598	6	6	36	Tree
				Plantain	422484	689598	48	3	144	Tree
8	Raymond Corporal	Corporal Village	BS12	Rubber	402460	6665668	200	6	1,200	Tree
				Cocoa	402460	6665668	150	6	900	Tree

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No.	Name	Town/ Village	No.	Property	Coordinate		Quantity (No/Acre s)	Unit Cost (USD)	Total Cost (USD)	Type
					X	Y				
				Kola	402460	6665668	15	6	90	Tree
				Orange	402460	6665668	5	3	15	Tree
9	Daniel Beon	Doewein Village	BS010	Rubber			25	6	150	Tree
10	JoeJoe Chenoway	Eye to Eye Village	BS005	Rubber	358490	689664	1,000	6	6,000	Tree
11	Nathaniel Gbar	Dorwein Village	BS008	Rubber	359116	688288	400	6	2,400	Tree
12	Romangar Cooper	Doewein Village	BS009	Rubber	361892	682164	1,500	6	9,000	Tree
				Cocoa	361892	682164	150	6	900	Tree
				Kola	361892	682164	3	6	18	Tree
13	John Mongar	Dorwein Village	BS007	Rubber	358754	689089	450	6	2,700	Tree
14	James Wright	Eye to Eye Village	BS006	Rubber	358399	689823	800	6	4,800	Tree
15	Moedema Peters	Dingwall Village	BS011 -B	Rubber	402194	666237	300	6	1,800	Tree
16	Charpee Boy	Compound #1		Rubber	366502	678315	500	6	3,000	Tree
17	Koko Kanque	Compound #1		Rubber	365983	678746	450	6	2,700	Tree
Sub-total		Tree					11,929		71,307	
		Crop					-		-	
		Total						11,929		71,307

• Houses / Huts / Buildings

No.	Name of PAP	Town/ Village	No.	Property	Coordinate		Quantity (No)	Unit Cost (USD)	Total Cost (USD)	Type
					X	Y				
1	Sam G. Bonwin	Bonwin farm	BS004	Hut	397315	660191	8	1,100	8,800	Hut
2	Clarence Onunah	Duwin	BS001	dilapidat ed building	427565	696525	1	10,000	10,000	Buildin g
				Rubber Reserve Structur es	427565	696525	1	10,000	10,000	Buildin g
3	Reubin G. Hill	Hill Farm	BS011 -A	Hut	390327	655379	1	1,100	1,100	Hut
4	Rachel Whea	Giabah	BS17	Hut	422470	689586	1	1,100	1,100	Hut
5	Andrew Whea	Giabah	BS16	Hut	422474	689582	1	1,100	1,100	Hut
6	Ma Gomie Whea	Giabah	BS18	Hut	422478	689585	1	1,100	1,100	Hut

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7	Alfred Borbor	Sammie Tokpah	BS 15	House	412004	680982	1	4,850	4,850	House	
				Kitchens	412004	680982	2	500	1,000	Hut	
8	Moses Bewee	Sammie Tokph	BS14	House	411975	680922	1	4,850	4,850	House	
Sub-total		Houses					2		9,700		
		Hut					14		14,200		
		Buildings						2		20,000	
		Total						18		43,900	

• Land

No.	Name	Town/Village	No.	Property	Coordinate		Quantity (m2)	Unit Cost (USD)	Total Cost (USD)	Type
					X	Y				
1	ReubinG.Hill	Buchanan	BS011-A	Landforsubstation	390327	655379	40,000	0.5	20,000	Buchanan substation
Sub-total		Land					40,000		20,000	

Table 21: List of PAPs and type of property - Montserrado County

• Trees / Crops

No.	Name	Town/Village	No.	Property	Coordinate		Quantity (No/Acre s)	Unit Cost (USD)	Total Cost (USD)	Type
					X	Y				
1	Garmeh Tokpah	Bensonville City	MS007	Mango	322359	712921	5	6	30	Tree
				Orange	322359	712921	3	3	9	Tree
				Kola	322359	712921	1	6	6	Tree
2	Ben Garnet	Careyburd City	MS001	Rubber	330637	708353	3,000	6	18,000	Tree
3	Garjay Davis	Cortor Town	MS008	Rubber	324354	711575	150	6	900	Tree
4	MA Noah	Harrisburd	MS005	Cassava	316807	717367	2	6	12	Crop
				Plantain	316807	717367	48	3	144	Tree
5	Terren Tucker	Harrisburd	MS002	Sugar cane	327372	709539	5	6	30	Crop
Sub-total		Tree					3,207		19,089	
		Crop					7		42	
		Total					3,214		19,131	

• Houses / Huts / Buildings

No.	Name	Town/Village	No.	Property	Coordinate		Quantity (No)	Unit Cost (USD)	Total Cost (USD)	Type
					X	Y				
1	Lutheran Church	Harrisburg	MS006	House	316900	7173111	1	4,850	4,850	House
2	NEC Office	Bensonville	MS001	Building	322375	712898	1	40,000	40,000	Building

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No.	Name	Town/Village	No.	Property	X	Y	Quantity	Unit Cost (USD)	Total Cost (USD)	Type	
3	Bensonville City Corporation	Bensonville City	MS009	Old dilapidated building	322250	713010	1	15,000	15,000	Building	
4	Garmeh Tokpah	Bensonville City	MS007	House	322359	712921	1	4,850	4,850	House	
5	James Tokpah	Miller Hill	MS003	Hut	332659	708135	1	1,100	1,100	Hut	
6	Esther Dickson	Miller Hill	MS004	House	332655	708151	1	4,850	4,850	House	
Sub-total		Houses					3		14,550		
		Huts					1		1,100		
		Buildings						2		55,000	
		Total						6		70,650	

• Land

No.	Name	Town/Village	No.	Property	Coordinate		Quantity (m2)	Unit Cost (USD)	Total Cost (USD)	Type
					X	Y				
1	LEC	Mt.coffee	MS011	Land for substation	317283	718271	40,000	0.5	20,000	Monrovia substation
Sub-total		Land					40,000		20,000	

Table 22 : List of PAPs and type of property - Grand Cape Mount

• Trees / Crops

No.	Name	Town/Village	No.	Property	Coordinate		Quantity (No/Acre s)	Unit Cost (USD)	Total Cost (USD)	Type
					X	Y				
1	Gopor Kaimukai	Sanjana ma	GC003	Rubber	263346	746762	350	6	2,100	Tree
				Palm	263346	746762	2	6	12	Tree
				Mango	263346	746762	3	6	18	Tree
				Pear	263346	746762	5	6	30	Tree
2	Morris Kollon	Vohnzua hn	GC006	Palm	262802	749371	150	6	900	Tree
3	Mambu Sonii	Vohnzua hn	GC005	Rubber	262854	749036	800	6	4,800	Tree
4	Musa Kaizulu	Sanjana ma	GC002	Rubber	263369	746745	500	6	3,000	Tree
5	Sando Kaimukai	Sanjana ma	GC001	Rubber	263561	746939	200	6	1,200	Tree
				Pineapple	263561	746939	150	3	375	Tree
				Palm	263561	746939	75	6	450	Tree
6	Zina Kaidii	Vohnzua hn	GC004	Rubber	262909	748564	400	6	2,400	Tree
Sub-total		Tree					2,635		15,285	

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	Crop						-		-
	Total						2,635		15,285

• Land

No.	Name	Town/ Village	No.	Property	Coordinate		Quantity (m2)	Unit Cost (USD)	Total Cost (USD)	Type
					X	Y				
1	Episcopal Church	Mambo Village	GC007	Land for substation	246839	774887	40,000	0.5	20,000	Mano substation
Sub-total		Land					40,000		20,000	

4.4.7.2. Land-use conflicts

The constructional activities will result in land-use conflicts. Agricultural lands, potential agricultural lands (or fallow agricultural lands) and residential lands (affecting buildings and residential plots) shall be affected by the RoW.

The potential Impacts of the preparations required in providing land shall be such as joint ownership of land, tenant-landlord conflicts and boundary between farm disputes and appropriate mitigation measures shall be considered.

The interconnection project includes the construction of 532km transmission line and 4 associated substation facilities in Liberia. Because the characteristics of transmission line construction project are quite different from the construction of other infrastructures such as thermal power plant or hydro power plant and it is a linear project which involves in only limited and localized resettlement, the affected lands area are relatively small compared to construction of other huge infrastructure and the affected lands are normally communally owned or cultivated together. Therefore, the potential conflicts on lands will not be significant.

However, there is a possibility that the land-use conflicts might be happen, it is necessary to take into consideration for appropriate mitigation measures for potential for conflicts between PAPs and existing owners.

4.4.7.3. Impacts on cultural and historical/archaeological sites

The implementation of the proposed project has the potential to impact significantly on cultural properties and historical sites and items. There is the potential to intrude into or

interfere with the cultural properties of some local communities. No cultural and historical/archaeological site is found to be affected within the planned transmission line RoW.

Although the constructional activities will not involve much earthmoving, it is possible to make cultural and/or archaeological 'chance finds' during the constructional phase of the proposed project as a part of the Contractor's contract. Such finds may be the following:

- ❖ Sites of cultural significance such as sacred woods or trees or rock outcrops which the local residents may have not mentioned at the survey stage
- ❖ Archaeological heritage which may have remained unnoticed in the past.
- ❖ Issues regarding cultural properties and the possibility of cultural and/or archaeological 'chance finds' are considered to be significant and require mitigation.

4.4.7.4. Impacts on population and demography

Only about 25% of the construction work-force (during the peak of constructional activities), is expected to be skilled labour, will be recruited from outside the local communities. The skilled workers from outside the local communities will be accommodated at the work camps. Potential impacts on population and demography are therefore not expected to be significant and will not require any mitigation.

4.4.7.5. Employment generation and incomes

Some employment openings are expected to be created for the local people during this phase of the proposed project. Those local people who will be employed will benefit from the payment of salaries and/or wages. This is expected to lead to improvement in local incomes. On the other hand, there is the potential for loss of income resulting from loss of crops, land and structures. Mitigation for this potential impact is required to minimize the effects on the local people.

4.4.7.6. Potential impacts on public health

The proponents intend to utilize local manpower as much as possible during this phase of the proposed project. Only about 25% of the construction work-force will be recruited from outside the local communities. The skilled workers from outside the communities will be accommodated at the work camps. Despite this small number of 'outsiders' and the fact that they will be accommodated at the work camps, the potential danger of the spread of sexually transmitted diseases (STDs) including HIV AIDS still exists. The spread of these diseases by construction workers, truck drivers and prostitutes attracted to the work camp and

construction sites could occur. Mitigation measures are required to minimize this potential impact.

4.4.7.7. Impact on vulnerable groups

Children

All children are vulnerable; however they are not a homogenous group and each category imposes unique vulnerability all of which create serious challenges for child development and growth. Street children, orphans, physically disabled children, child laborers, and former abductees require special attention in light of their intensified vulnerability. The girl child in all these categories of vulnerable children is worse off. The root of girls' vulnerability are formed very early within the family. These values are reinforced in schools, communities and institutions that support children and their families. Early intervention is necessary to stem negative consequences, such as inadequate development and damage of the self-esteem of the girl child. Lack of access to education and training is also hampering the growth of children in general and girl-children in particular.

Youth

According to the recent census, 77% of the Liberian population comprise youth below the age of 35 years. Generational inequalities impact on the livelihoods of the youth thus creating different vulnerability and opportunities for female and male youth. Generally the youth suffer from lack of education, training, skills, and unemployment. However, as a result of patriarchal culture practices, boys are more favored to own and benefit from economic assets and opportunities like land, property and training through inheritance, donation or sponsorship. Due to the low value attached to girls in society, their vulnerability extends to harmful practices such as Female Genital Mutilation (FGM), Gender Based Violence (GBV), sexual exploitation, and early marriages. They are more vulnerable to HIV and AIDS than the male youth due to their inability to negotiate safer sex, early engagement in sex, and higher risk of becoming a commercial sex worker as a result of lack of access to free education, school dropout unemployment and lack of access to information. The youth needs to be empowered with special attention paid to the female youth.

Persons with Disabilities (PWDs)

PWDs face discrimination in education and lack of user-friendly facilities and services; as well as in the job market as a result of social biases and stereotypes associated with disability generally. Women with disabilities suffer double discrimination-first as women and second as persons with disabilities and therefore they need special attention. The need to promote friendly environment for PWDs including promoting their full participation in the development of the country is critical for ensuring growth with equity. The Government has

established a National Commission for Disabilities through an Act of Legislature with an objective to protect and promote the rights of PWDs.

Elderly Persons

The elderly constitute 3.6% of the population of Liberia; they face constraints in accessing services, in increasing their incomes and improving their livelihoods. They suffer from old-age related diseases requiring special medical attention most of the time lacking from the nearest health facility. Elderly persons, especially women are burdened with care of orphans and other dependents; and are overwhelmed by the social challenges and responsibilities in the wake of HIV and AIDS, poverty and the consequences of the 14 years civil war. This calls for targeted interventions and special programs for elderly women.

People Living with HIV and AIDS

Whereas HIV and AIDS data is not disaggregated by sex, evidence indicate that women are more exposed to HIV infections due to several factors, biological, economic and socio-cultural, but most significant is the high rate of sexual violence, particularly rape. The National Health Survey shows trends of a higher degree to HIV infection among women and girls compared to men and boys (1.8% versus 1.2%). The high rate of unemployment couple with low level of education and training further make women more vulnerable to HIV infections. As a result of culture and social pressures, economic dependency, and fear of violence, women are often less able to negotiate safer sex.

Communities still do not understand issues related to HIV and AIDS and often abandon or isolate relatives living with the pandemic, at a time when they most need their support. Women particularly bear the brunt of the burden of the disease and require a multi level support although presently the country has limited 'safety nets' to assist and support them.

Fear of negative effects, stigma and discrimination prevents many women from sharing their personal experiences, with serious implications in accessing treatment and controlling HIV infections. Special attention need to be given to the unique needs of women living with HIV and AIDS. There is also need to make accessible confidential and quality Voluntary Counseling and Testing (VCT) services at all levels to the population with focus on women and youth.

Table 23 Summary of Vulnerable Groups

County	Age	Sex		Remarks
		M	F	
Nimba	0~15 years	40	32	
	65~90 years	17	3	
	subtotal	57	35	
Bomi	0~15 years	17	11	
	65~90 years	2	2	
	subtotal	41	13	
Bong	0~15 years	26	16	
	65~90 years	2	0	
	subtotal	28	16	
Montsserado	0~15 years	13	18	
	65~90 years	2	0	
	subtotal	15	18	
Grand Bassa	0~15 years	21	22	
	65~90 years	1	2	
	subtotal	22	24	
Margibi	0~15 years	13	16	
	65~90 years	0	1	
	subtotal	13	17	
Grand Cape Mount	0~15 years	31	19	
	65~90 years	19	0	
	subtotal	50	19	
Grand total		204	142	346(204+142)

4.4.8. Visual intrusion

Constructional activities have the potential to impact on scenic landscape values at the project site. The proposed transmission line will not have any impact on scenic views since the site does not have, nor form part of, any scenic views. The proposed project will not have any impact on aesthetically pleasing landscapes since the site is not part of an aesthetically pleasing landscape.

The proposed sites for the substations and transmission line are part of the regular vegetation of the area, there is no change in the type and character of the vegetation. However the large number of trees surrounding the proposed site will be left in place to provide vegetative shield and noise buffer and also ensure that no break is introduced in the type and character of the vegetation.

No further mitigation is planned for the potential visual impact from the presence of the substation. The transmission line will however not have any significant impacts on aesthetically pleasing landscapes.

It is expected that the local visual characteristics and expressions of the RoW will be affected by the presence of the transmission towers and lines. Mitigation measures have been proposed to minimize the potential 'tower-glare' effects on people.

4.4.9. Traffic impacts

Transportation of equipment and materials on public roads may result in some road safety problems. The potential hazards include vehicular-vehicular conflicts, vehicular-pedestrian conflicts and falling of improperly secured equipment and materials on roads. The potential for vehicular traffic conflict situations exists especially at the points where access tracks join the main roads.

The proposed project will cause only a short-term increase in local vehicle traffic during the construction period that will be noticed primarily by other users of the roads within the vicinity of the construction sites.

The stringing of transmission lines across these public roads may cause temporary traffic disruptions. Measures have been proposed to minimize potential traffic impacts.

4.4.10. Potential pollution of water bodies

Clearing and grading of access and tower corridor tracks, excavation of tower base areas and the construction of access tracks during the constructional phase will expose the ground surface to the agents of soil erosion. The potential for water pollution by oil, lubricants and paints also exists. This potential impact requires mitigation to minimize the possibility of water pollution and also minimize the effects on downstream water usage of these rivers, which is mainly for domestic purposes.

4.4.11. Work camps

Work camps will be established along the RoW during the constructional phase of the proposed project. The contractors will, in addition, exploit the option of renting of properties within the communities for accommodation purposes.

Issues relating to the establishment, location, waste management and decommissioning of the work camps need to be properly addressed.

4.4.12. Access Road

Construction of transmission line typically includes constructing new access roads or developing existing small tracks. Access roads to the transmission line are required not only for construction but also for maintenance. They may be paved, graveled or graded. The impact of construction of access road will be taken into consideration in the view of environmental, technical and compensation aspects

- Environmental aspects

The construction of access roads can impact the ecological sensitive areas or wetlands through vegetation clearing. These are also dominated by the unpaved road dust emissions due to the long round trip travel distances to the more remote tower construction sites.

- Technical aspects

There is a possibility that passage of heavy machinery during the construction stage can impact the existing roads and tracks which is generally used by the local communities.

- Compensation aspects

If access roads pass the private properties, access to those properties can be disrupted and it will bring conflict between property owners and implementing agencies

4.4.13. Waste generation

Solid wastes in the form of vegetative matter, damaged cables and conductors, rags, excavated materials and packaging materials such as paper cartons, wooden crates and empty containers will be generated. Also, the potential for the generation of liquid wastes due to spent oils, water from excavations and accidental spillage of fuel and paint exist. These wastes must be properly handled to avoid or minimize adverse effects on the environment. Measures have therefore been proposed for waste management.

4.4.14. Potential dewatering operations

There is potential for dewatering tower foundations, which might lead to pollution of surface water bodies due to high suspended particulate matter load during the constructional phase, especially during the rainy season. The discharge of high volumes of water to land might also create temporary swamps.

There is therefore the need to introduce mitigative measures to minimize the potential impacts.

4.4.15. Impact on temporary workers

There will also be an influx of temporary workers which will in fact have a temporary positive impact through local employment opportunities and an increased demand for local goods and services. A negative impact may occur as a result of the influx of temporary workers to the project area placing pressure on existing resources and contributing to local health problems.

Impacts to the local population are expected to begin during the construction phase as a large workforce will be brought in from outside the project area. These, often rapid, changes in local demographics can result in a number of undesirable pressures and consequences, including:

- ❖ Pressures on housing and existing minimal infrastructure.
- ❖ Development of spontaneous settlements around the project site often associated with poor sanitation conditions, inappropriate rent taking.
- ❖ Disruptions to local cultures.
- ❖ Increased incidences of sexually transmitted diseases (STDs) and HIV/AIDS associated with worker and migrant in-flux.

4.4.16. Impact of abstracting dust suppression water

Dust control will require the use of adequate measures during each construction activity and will include frequent water applications (dust suppression by water spray). Considering that the proposed project right-of-way (ROW) traverses mostly unpopulated areas and most construction activities will be undertaken remote from residential areas, the impact is not expected to be major. However there is a slight possibility that the impact of abstracting the dust suppression water from the water courses such as the water shortage near the existing village might be occurred. Therefore, mitigation measures have been put in place to minimize the adverse effects to minimize the impacts.

4.5. Operational phase

Some potential impacts have been identified and assessed for the operational phase of the proposed project. These are as follows for the transmission line and substation.

4.5.1. Transmission line

4.5.1.1. Vegetation clearing

In wooded areas, the safe operation of the overhead power lines will necessitate the maintenance of unobstructed lanes. Vegetation control measures will therefore have to be applied during the operational phase of the proposed project to manage vegetative growth within the RoW. The method to be used will be physical or mechanical clearing of vegetative growth for the maintenance of the RoW. RoW maintenance could also result in opening-up effects especially the activities of hunters and fuel-wood harvesters. These potential effects are not considered to be significant since much of the area is already extensively degraded as a result of shifting cultivation. Mitigation measures have however been put in place to minimize the effects of RoW maintenance.

4.5.1.2. Effects of rust treatment and painting of towers

Rust treatment and painting of towers, although expected to be frequent, are likely to cause pollution of nearby rivers and streams such as those mentioned above if not handled appropriately. This potential impact requires mitigation measures.

4.5.1.3. Solid waste generation

Solid wastes in the form of vegetative matter, packaging materials, damaged or broken cables, conductors and insulators will be generated during this phase. Measures have been proposed for the management of these wastes.

4.5.1.4. Liquid waste generation

Washing of equipment will result in the discharge of liquid waste during this phase of the proposed project. It is, however, not anticipated that liquid wastes from equipment washings will be generated in significant quantities. No mitigation measures have therefore been proposed for this potential impact. Accidental spillage of oil, fuel or paints will however need to be managed.

4.5.1.5. Occupational safety and health issues

Some occupational safety and health hazards are expected during the operational phase of the proposed project. These hazards could be from falling and/or swinging objects, potential collapse of towers, electrocution, falling from heights and snakebites. These hazards pose potential threat to the safety and health of the workers. However, collapse of towers is not a

common occurrence. Mitigation measures however have been proposed to minimize these potential hazards.

4.5.1.6. Public safety

Potential public safety hazards are enhanced for a project such as the proposed transmission line project when the local populace has not been properly educated with regard to the potential hazards. In addition to the hazards posed to the public due to transportation of equipment and materials, other hazards such as potential exposure to Electromagnetic field (EMF) effects, potential collapse of towers and electrocution will exist during this phase of the proposed project.

The falling of a live electrical conductor could cause severe burns of any object on which it falls. An electrical conductor could fall from the towers as a result of either a mechanical failure of an insulator string on the tower or snapping of the conductor itself. The mechanical failure of an insulator string could be the result of a lightning stroke, rusting of insulator pins or a heavy object falling on the transmission line. The failure of a conductor joint could also cause snapping of the conductor.

These potential hazards require mitigation to ensure the safety of the public.

One other potential impact of the proposed project is the perceived danger of transmission lines. Issues relating to electromagnetic fields are not normally understood by the public. The misconception that EMFs may cause cancer or harm children could create fear and perhaps panic among the local populace. This issue has been further dealt with below.

4.5.1.7. Electromagnetic field (EMF) effects

According to the World Environmental Library, WEL 1.1, information derived from prolonged observations and experiments in numerous countries indicate that the electric and magnetic fields around power transmission and distribution facilities exhibiting frequencies between 50 and 60 Hz have no harmful effects on human health. Magnetic field strengths below 0.4 mT at 50 – 60 Hz induce no detectable biological reaction in humans. The magnetic fields acting on the ground below overhead lines develop maximum field strength of only 0.055 mT for frequencies between 50 and 60 Hz. Therefore potential effects of EMFs on human health are non-existent according to current knowledge.

However, an electrically grounded person touching an ungrounded metallic object or a conductor in a static or oscillating field may draw electric current from the object and may experience a micro shock from a spark discharge. This potential effect needs to be mitigated.

Mitigation will also be required to address the notions that EMFs may cause cancer or harm children and the resulting fear and possible panic among the local populations.

4.5.1.8. Effects of weed control chemicals

The improper application or misuse of weed control chemicals could adversely affect the environment and the health of workers handling these chemicals. To avoid these potential problems, the SPC will employ only physical or mechanical clearing of weed for the maintenance of the RoW. No further mitigation measure is therefore required for this potential impact.

4.5.1.9. Effects on birds

The presence of towers and power transmission lines in the RoW has the potential to impact on birds. There is the potential danger of debasement of breeding grounds, electrocution, collision with lines and interference in the navigation of birds. No specific breeding grounds of birds have been identified within the RoW hence the potential danger of debasement of such areas does not exist. Mitigation measures for the other potential effects on birds have therefore been proposed to minimize the effects. A bird collision incident happens when a bird physically strikes either the overhead conductor or the overhead ground wire of a power line. In the case of transmission lines, the overhead ground wire is usually involved. It is generally accepted that birds can usually avoid the highly visible bundled conductors but often fail to see the thin ground wire. Bird electrocutions on electrical infrastructure are often confused with bird collisions. Bird electrocution refers to the scenario where a bird is perched or attempts to perch on electrical infrastructure, and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components. In the case of a collision, the incident takes place when a bird fails to see the conductor and/or overhead ground wire while in full flight, and collides with it in mid-air. The primary cause of death or injury is the physical impact with the line

4.5.1.10. Socio-economic issues

Potential socio-economic issues such as land ownership, land-use conflicts and compensation issues are expected to persist during this phase of the proposed project. Measures have been proposed to manage the residual effects of these potential issues. Impacts on population and demography are however not expected to be significant and will not require any mitigation.

4.5.1.10.1. Fire hazards

There is the potential for fire hazards as a result of fire related equipment and electrical faults during this phase of the proposed project. The bush fires could either originate from SPC operations during RoW maintenance or through the activities of farmers, hunters and palm wine tappers. This potential hazard will have to be mitigated to minimize the occurrence of fires.

4.5.1.10.2. Impact on telecommunications

Consultations carried out with Liberia Telecommunication company (CellCOM, Lone Star, Commium, Liber Cell, Libetelco) prior to this project indicated that in cases where telephone lines run parallel or close to high-tension lines, subscribers experience interferences as a result of induction effect. It is known also that resonance effect of power frequency fields may also affect telecommunications. However; this does not occur with the LEC transmission lines as they usually run outside settlements where interferences are likely to occur.

Some mitigation measures have however been proposed for this potential impact.

4.5.2. Impacts as a result of operation of the substation

4.5.2.1. Transformer oils

The presence of transformers on the premises of substations introduces the potential environmental impacts inherent in transformer oils. Polychlorobiphenyls (PCBs) are harmful substances to the environment. They are not produced during electricity generation or distribution, but which are contained in certain equipment -mainly in transformers and condensers-, which were purchased from the manufacturers of electrical equipment, who in turn used it because of their perfect dielectric properties. The transformers to be purchased will be required to meet all applicable safety standards and will be enclosed in separate secondary containment structures that will prevent any accidental spills or routine leakages that may occur from being released to the environment. The transformers will not be

dismantled and so the question of the disposal of the oils will not arise. The transformers are serviced outside the country. No further mitigation measures will be required.

4.5.2.2. Fire hazards

The presence, storage and use of oils, fuels and other flammable products on the premises of substations give rise to the very likely hazards of fire outbreaks. In addition, there always is a real likelihood of fire outbreaks in substations that are sited in areas where bushes surround them.

Some mitigation measures have been proposed for this impact.

4.5.2.3. Noise

This noise fluctuates on a daily basis, particularly the weekdays when vehicular use is at its peak in the vicinity. The noise level is however well within the guideline value within residential areas.

Existing trees around the proposed substation that will not pose threats to the incoming or outgoing transmission lines will be left in place to act as noise buffer to would-be residents in the future and to road users.

No further mitigation for generated noise will be proposed.

4.5.2.4. Avifauna

Potential impacts by/on bird species present in the area associated with the construction and operation of a substation include electrocutions and disturbance during the construction and maintenance of the substation. Other problems include electrical faults caused by bird excreta when roosting or breeding on electricity infrastructure within the substation.

Mitigation measures have been proposed for this potential impact.

4.5.2.5. Substation security and public safety

As indicated elsewhere in this document, the substations will be located in relatively remote area close to Han. Due to the voltages to be handled by these stations, it is important that they are made secure at all times and that unauthorized persons are kept away from the premises.

The substation shall be suitably fenced to keep off unauthorized persons from the premises. Also, Security Officers shall man the substation at all times to ensure security and report all incidents that might be out of the ordinary for prompt attention. In addition suitable warning signs, indicating the dangers within, shall be placed at regular intervals on the fencing to warn off would-be encroachers.

No further mitigation is proposed for this impact.

4.5.2.6. Storm drains

A network of storm drains shall be constructed in each substation to collect and direct storm water away from the substation. This network shall be isolated from the oil and fuel storage areas to ensure that storm water is not contaminated with oil products prior to discharge.

No further mitigation is proposed for this potential impact.

4.6. Indirect benefits arising from the proposed project (National Level)

In accordance with the World Bank guideline (Environmental Assessment Sourcebook), "indirect effects" may include any effects that would be caused by the proposed action but which occur later in time or farther in distance from the action. Indirect effects may be represented by a variety of potential impacts, projects, or actions, including growth-inducing effects such as residential and commercial development, and infrastructure and public works projects, among others. Indirect benefits will be derived from this proposed project and they include both upstream and downstream benefits. With regards to upstream benefits, the proposed project will involve the construction of electric infrastructure that will facilitate the country's participation in energy trade within the sub-region, provide opportunities for rural electrification. Employment during construction stage will be created and the country will benefit from technology transfer. The downstream benefits will include capacity building of LEC staff in operations and maintenance, and the management of power sales. Adequate and reliable electric power supply will improve security, good governance, development of industries at national and local levels, and social opportunities. Another important downstream benefit will be the reduction in the depletion of forests which leads to soil erosion, higher temperatures and the emission of CO₂, a major contributor to global warming and climate change.

The key drivers for increasing access to electricity are primarily to attain the Millennium Development Goals such as the eradication of extreme poverty and hunger, achieve universal primary education, promote gender equality and empower women, reduce child mortality, improve maternal health, combat HIV/AIDS, Malaria and other diseases, and in particular, ensure environmental sustainability towards poverty alleviation.

The benefits to be derived from the implementation of the proposed project are immense, especially considering the problems of supply experienced in Liberia in the recent past. The implementation of the proposed project will ensure that the objective of ECOWAS to establish a regional electricity market in West Africa through the judicious development and realization of key priority infrastructure that would permit accessibility to economic energy resources, to all member states of the ECOWAS shall be realized.

4.6.1. Some Anticipated Problems (Project areas)

The line route corridor will take a substantial portion of land that will completely be surrounded to the proposed Project. The rightful owners of this portion of land have to be relocated. The relocation of the landowners might not be the appropriate areas for them. In addition, those that are hunters have to perhaps lose their famous hunting spots to the proposed Project which will be difficult. Owing to the line corridor and the frequent patrol of project employees, many species previously hunted will have to relocate a distance from the line route.

The status code of the rural people in terms of cultural practices will be disturbed. Members of the Poro and Sande societies along the line route will have to relocate their society "bush" even if the line does not pass through them. They will not allow the line route near the society "bush" for fear of disturbances from non-members working on the line route.

There will be an introduction of strange behaviors that will be brought by foreign workers which might be difficult to prevent by the population of the line route. These foreign attitudes and indiscipline may disturb the daily status code of the tribal people.

Migrants from various urban areas will begin to visit the project areas and mix with the tribal people. The restriction on cultural practices that have been preserved will be disturbed by the introduction of foreign ideologies. The socialization process will greatly be disturbed with these changes that will occur. These might encourage the prostitution of the village girls,

disrespectfulness on the part of young boys and girls. The problems of married women leaving their husbands to be attracted by employees of the proposed Project and foreign visitors from various urban areas are obvious.

The traditional family structure might be disturbed. Vulnerable groups-mainly the elderly might not be catered to as usual since some of the economically active persons of the household might be engaged directly or indirectly in project activities for higher wages. Women might be engaged in other economic activities brought by the proposed Project such as commercial activities, marketing, petit trading and gainful employment.

There might be an increase of HIV and AIDS cases due to the migration of young people including male and female in and out of the project areas. These young migrants including the proposed Project employees will easily mix with the population of the project areas, the result will be unsafe sex and sex for money. The sex for US dollar could be difficult to control.

4.6.2. Benefits (Project Areas)

The proposed Project itself is a direct attack on poverty in Liberia. It obviously becomes a part of the Poverty Reduction Strategy (PRS) in Liberia. It is aware that the main objective of the proposed Project is to contribute toward raising income and productivity of the rural poor. Particularly emphasis is given to improvement in health, nutrition and basic education especially through improved and redirected public services, such as rural water supplies, sanitation facilities, primary schools, etc.

Road: the proposed Project will construct road that will be used both for the proposed Project and the population of the corridor. This accessibility is indeed part and parcel of material progress and the fact that transport plays a very major role in development. The economic benefits of the roads will include increased agricultural production, lower costs for transporting goods in and out of the area, and employment in small scale and commercial activities along the road. Social benefits will include better access to health services, a wider range of goods for sale in local shops/ stores, and easier communication with friends and relatives far and near. Social relations or interaction between people along the line route will also increase.

Basic Needs: The proposed Project will bring about the attainment of basic needs around and within the corridors.

Employment: both literate and illiterate people within the proposed Project area will be gainfully employed. This will add more to the achievement of government employment policy and reduce poverty that the average level of income will increase and the degree of inequality will be lower.

- ❖ Housing: within the project area there will be better and improved housing units not only for those that will be compensated but also other settlements that will be located along the corridor. Those who will directly and indirectly be working with the proposed Project will indeed have improved housing conditions. There will be the need for housing rather than its demand.
- ❖ Health: the entire population of the corridor will benefit from health facilities that will be provided for project employees and the general public of the corridor. Health centers and clinics will be constructed to serve the population –facilities that are now scarce within the corridors. Maternal services will be provided for woman who is presently experiencing the absence of these facilities. Good and adequate health facilities will enhance a healthy population. That will be reflected in an increased daily output of production and services.
- ❖ Education: both formal and informal education that will be brought by the proposed Project will indeed benefit the entire population of the corridor-from elementary to junior high and senior high education. This will assist senior high school parents to educate their children close to them and will indeed encourage both boys and girls to compete for education. Adult education which is scarce in the project area will be provided to elderly woman and men and will take advantage of these opportunities. Skilled and unskilled training facilities that will be provided by the proposed Project will provide the opportunities for unskilled people to improve their skills in order to earn more wages and to engage in other skillful activities such as local crafting, carpentry, etc.
- ❖ Water supplies: the provision of clean and safe drinking water supplies is a major problem in Liberia. Nowadays, there are outbreaks of water borne diseases in many parts of the country. It is expected that the population of the project areas will tap this opportunities to clean and safe drinking water supplies.
- ❖ Nutrition: it is obvious that as one income increases the quality and quantity of goods consumed in many cases increase. Those that will be gainfully employed with the project including those directly employed will change their respective nutritional

habits. Both the elderly and the children who are the victims of malnutrition will recover from changed and improved diets.

- ❖ General: according to WAPP objective, electricity is to be provided to enhance the productivities of our rural masses especially those engaged in small-scale or cottage industrial activities. The provision/availability of electricity in these areas will increase their production. In addition, electricity has both economic and social benefits. The availability of electricity in a village encourages long hours of social interaction and therefore these benefits cannot be overemphasized. It is also expected that a dendritic pattern of settlements along the corridor will be created. These settlements will tap the benefits of the proposed Project through the availability of electricity and for easier communication.
- ❖ Growth Poles: The four sub-stations of the proposed Project in Liberia will encourage the conglomeration of population from different urban centers. Employees will live in camps near and around these sub-stations where relatives and friends will also reside. The economic and social benefits of the sub-station areas will attract different investments –such as banking facilities, marketing, better housing for rent, telecommunication, stores, better transportation facilities, etc. The development of these substation areas will pull the population to these growth poles and will eventually create mini urban “centers”-“growth poles” that will indeed be beneficial to the citizenry and to the Government of Liberia.

4.6.3. Beneficiaries of the proposed Project

The CLSG project will provide electricity to the mining development project of the company Arcelor Mittal in Liberia and other mining projects such as large scale diamond mining by Koidu holdings around the proposed CLSG project area as well. They are considered main beneficiaries of the Project.

One of the main benefits of the interconnection project would be the supply of relatively cheap energy by Côte d'Ivoire to the other three countries, Liberia, Sierra Leone and Guinea during the 2013 – 2019 period and also the commissioning of an infrastructure which will facilitate the further development of hydropower sites in these same three countries. It is impossible to quantify this benefit, but an approach consists in assuming that the project will allow for reduction of future un-served energy costs in these three countries

It will be assumed that the project would allow for a reduction of un-served energy of around 20 % of demand in the three countries in 2014, decreasing to 10% in 2019, which would correspond to roughly 100 GWh/annum. The cost of un-served energy was taken at 1 Euro / kWh in the region, during the first Workshop on the present study, in May 2009 in Conakry. As an example, it is possible to evaluate this un-served energy by assuming that the interconnection would have the following benefits from 2013 / 2014:

Another sensitivity analysis can be made by taking into account an important non-monetary variable, which is the cost of CO₂ emissions. Since the CLSG project should allow for important hydrocarbons savings, it should also allow for substantial CO₂ emission reductions for the concerned countries. A reasonable and prudent assumption would be to consider a CO₂ emission cost of 20 US\$ per ton.

If we consider that the hydrocarbons used in the region would produce roughly three times their weight in CO₂, then an equivalent barrel of hydrocarbons would produce 3 equivalent « barrels » of CO₂, or ½ ton, which has therefore a 10 US\$ cost. Then, when using a 20 US\$/ton of CO₂ emission reduction cost, it is equivalent to add 10 US\$ to the cost of each equivalent “barrel” of hydrocarbons saved by the project.

Another important aspect which can be a condition for a future and real participation of private investors, will be the effective development of the main hydropower projects in the region (mainly in Guinea), which is the driving force for the future profitability of the CLSG project.

In 2013, the generation surplus in Ivory Coast will reach 440 MW and 918 GWh. The analysis of the Guinea's generation development plan shows a surplus of hydroelectric power generation of 70 MW from 2016.

The commissioning of the interconnection at the earliest date (2013 – 14) is better since it will allow for substantial reductions in fuel costs and CO₂ emissions in Guinea, Liberia and Sierra Leone, with a relatively interesting investment cost.

If the first stage of the project is realized, available surpluses in Côte d'Ivoire could be exported to the other countries and allow for substantial cost savings in them; it is economically advantageous to realize.

The technical study must show that the 225 kV proposed interconnection will allow the Ivory Coast to export its power surplus of 80 MW in 2013.

Between 2013 and 2020, the development of hydroelectric generation means will provide taking into account the hydraulic generation excess which will be exported to Ivory Coast and the countries included to the West African System.

Most of the benefits appear in the long term (from 2020 afterwards) when the hydroelectric potential of Guinea can be developed and exported to Côte d'Ivoire. The Guinea foresees to expand its exports to Mali in the framework of the Fomi project and to Senegal and Guinea Bissau in the OMVG project.

Most of the benefits appear in the long term (from 2020 afterwards) when the hydroelectric potential of Guinée can be developed and exported to Côte d'Ivoire;

In 2030, Liberia, Sierra Leone and Guinea export respectively 50 MW, 70 MW and 170 MW to Ivory Coast, is a total importation of Ivory Coast of 290 MW.

For the electrification of the village within the CLSG project area, it is logical to plan to use the HV lines passing close to the villages for supplying them. There are several existing techniques which are discussed below. It is the benefit to the villagers of the HV line since it brings them electricity, whereas otherwise it provides only drawbacks.

The Insulating Ground Cable (IGC) configuration (D in particular) can supply a 100 % three-phase load.

It can be an applicable way at a lower cost, by avoiding multiplication of HV/MV transforming equipment in each substation along the line for the rural electrification.

Under the hypothesis of equipping all the interconnection lines with insulated ground cables for the rural distribution supply (except for Ivory Coast due to its sufficiently developed conventional network), the estimated cost is 3.5 million USD.

- ❖ The Consultant referred to the Feasibility Study Report of the CLSG Project prepared by ACTS and SOGREH Consortium.

4.7. Cumulative impact

Côte d'Ivoire - Liberia - Sierra Leone - Guinea Interconnection Project (Liberia ESIA)

A “cumulative impact” is the impact on the environment which results from the incremental impact of the proposed Project when added to other past, present, and reasonably foreseeable future actions.

The process of cumulative environmental change can arise from any of the following types of events:

- ❖ Single large events, i.e. a large project;
- ❖ Multiple interrelated events, i.e. road projects within a region; and
- ❖ Catastrophic sudden events, i.e. a major landslide into a river system.

These can generate additive, multiplicative or synergetic effects, which can then result in damage to the function of one or several eco-system.

In order to investigate cumulative impact which could arise between the proposed project and other ongoing project, planned project in the project area, the Consultant referred Multi Development Bank’s plan in Liberia because most infrastructure projects are largely supported by the Multi Development Bank such as World Bank and African Development Bank.

Also, the Consultation meetings with responsible ministries and governmental agencies of Liberia were held to verify these projects. The Consultant visited the Ministry of Lands, Mines and Energy on 30th December 2010 and the Ministry of Planning and Economic Affairs on 17th January. Also, the Consultant met the Infrastructure Implementation Unit (IIU) of the Ministry of Public Works on 16th August, 2011 as it controls major infrastructure development projects of Liberia.



[Meeting with Ministry of Lands, Mines and Energy]



[Meeting with IIU]

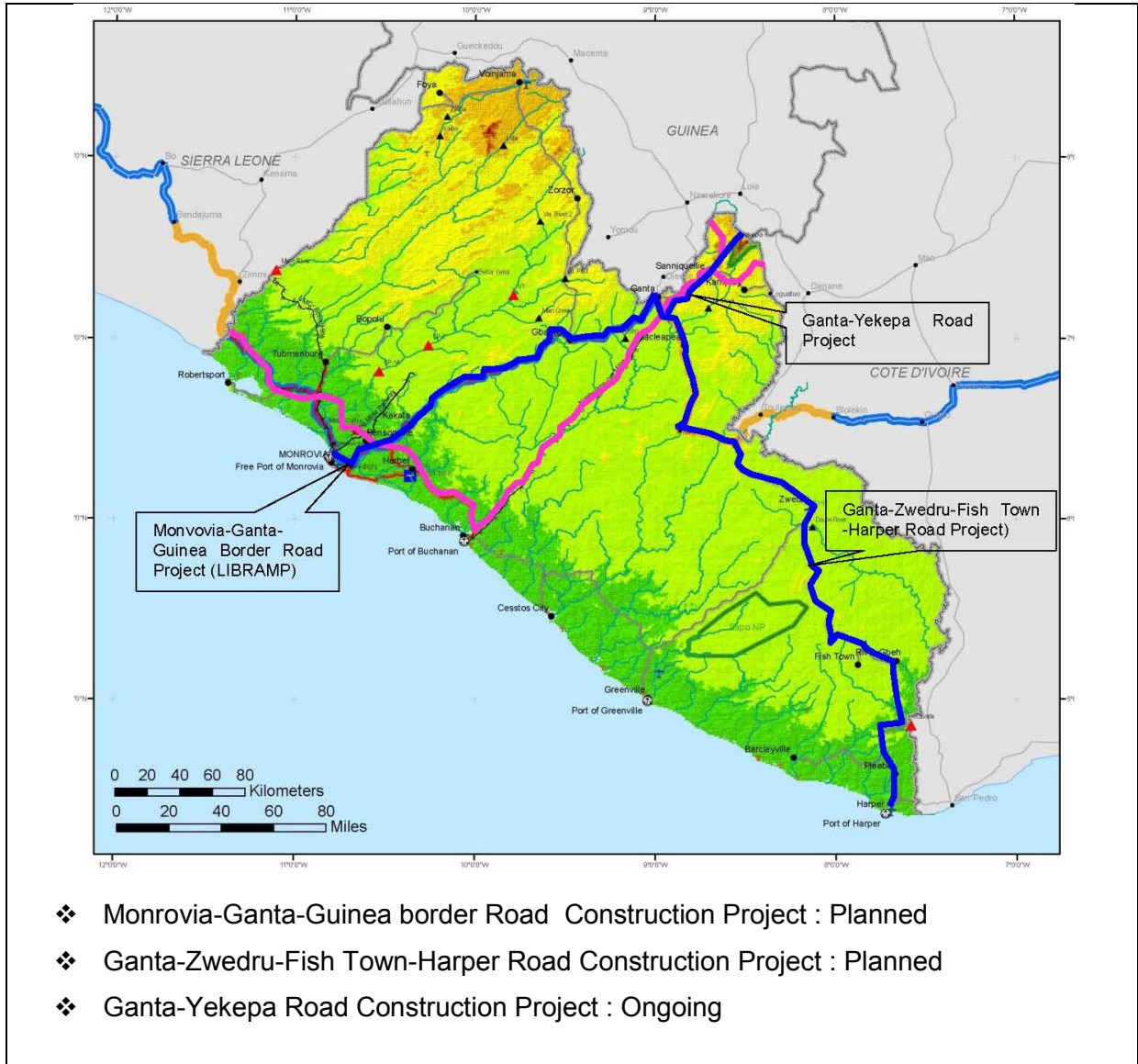
Côte d'Ivoire - Liberia - Sierra Leone - Guinea Interconnection Project (Liberia ESIA)

As a result, several development projects in the project area were identified and cumulative impacts were analyzed as below.

Road construction or management project

Project / Period	Liberia Road Asset Management Project (LIBRAMP) / 2011 ~2022
Status	Planned (Under the procurement process)
Implementing Agency	Infrastructure Implementation Unit of the Ministry of Public Works
Total Project Cost	249 M USD
Fund	Liberia Reconstruction Trust Fund(LRTF), IDA, Government of Liberia
Description of the Project	<ul style="list-style-type: none"> ✓ Component 1 – Design, Rehabilitation and Maintenance of Monrovia (Red Light) - Ganta - Guinea Border Road: This component will finance a 10-year OPRC (Output and Performance-Based Roads Contracts) for two road lots, Monrovia (Red Light) - Gbarnga (approximately 180 km) and Gbarnga - Ganta to the Guinea border (approximately 69 km). ✓ Component 2 – Consultant Services, Operating Costs, and Training
Anticipated impacts	<ul style="list-style-type: none"> ✓ The primary beneficiaries of the project are road users whose travel time and transport cost will be reduced as a result of road improvement. Currently, much of the road corridor is severely deteriorated and some sections are not readily passable during the rainy season, thereby greatly undermining transport efficiency, reliability, safety, and comfort of road users. ✓ Secondary benefits of the project are expected to be felt by the local and national economy, private sector, and the national construction industry. As the transport cost along a major road corridor reduces, prices of traded goods are likely to be lowered. This can create an enabling condition for trade facilitation and private sector development. Also, a 10-year road management project is likely to create jobs and sub-contracting opportunities related to road works and roadside development, providing income generating opportunities particularly for the rural population. ✓ This project will take place in Nimba, Bong, Margibi, Montserrado Counties. Especially, this road goes parallel with the proposed line route of the CLSG interconnection Project staying approximately 10km away from the RoW in the South-east region of Nimba county. It is certain that this project can improve the life quality of counties which the proposed road passes through and other adjacent counties and will not involve much adverse impact on neighbouring environment because it is road rehabilitation project. However, it is recommended that an effort be made to mitigate potential cumulative impact during the implementation of these projects

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Project	Urban and Rural Infrastructure Rehabilitation Project(URIRP)
Status	Ongoing
Implementing Agency	Infrastructure Implementation Unit of the Ministry of Public Works
Total Project Cost	47 M USD
Period	2010~2014
Fund	Liberia Reconstruction Trust Fund, IDA

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Description of the Project	<ul style="list-style-type: none"> ✓ Design, rehabilitation and supervision of various infrastructure, including Monrovia city streets, traffic management for a major city interchange, primary rural roads (Cotton-Tree to Bokay town, and Pleebo-Barclayville), construction of a major bridge (Caldwell), lateritic maintenance and spot improvements along sections of several primary roads of national importance (641 km), and a new fuel unloading facility in the Port of Monrovia; ✓ Activities that enhance program management function and strengthen institutional capacity - technical assistance and support for operational expenditures
Anticipated impact	<ul style="list-style-type: none"> ✓ The proposed project is not likely to have any potential impacts that are significant, large in scale, or irreversible. The impacts are site specific, and limited to: a) dust and noise due to the road upgrading operations b) establishment of base camps for contractors and resident engineers and opening or re-opening of borrow pits and solid rock quarries, which could result in soil erosion and pollution and aesthetically undesirable alterations of the landscape; and other minor adverse impacts. ✓ The primary beneficiaries of the project are road users whose travel time and transport cost will be reduced as a result of road improvement. ✓ Secondary benefits of the project are expected to be felt by the local and national economy, private sector, and the national construction industry. As the transport cost along a major road corridor reduces, prices of traded goods are likely to be lowered. This can create an enabling condition for trade facilitation and private sector development

Electrification project

Project Period	WAPP Cross Border Project / June. 2011 ~ June. 2013
Status	Ongoing
Implementing Agency	Liberia Electricity Corporation (LEC), Cote d'Ivoire
Total Project Cost	9.6 M Euros
Fund	EIB, Government of Liberia and Cote d'Ivoire
Description of the Project	<ul style="list-style-type: none"> ✓ The Cross Border Project is designed to electrify eighteen towns along the border with the Ivory Coast, within three counties of Liberia: Nimba, Grand Gedeth, and Meryland by constructing 33kV power line and connecting it to customer. ✓ Contractor : Energy Ventures;
Anticipated impacts	<ul style="list-style-type: none"> ✓ There are no significant and/or irreversible adverse environmental and social issues expected from electricity infrastructure components from the implementation of the proposed project. In general, the project is expected to positively impact the beneficiary communities and individuals in a number of ways, while potential negative environmental and social impacts of the proposed project activities are expected to be small-scale and site-specific. ✓ This project will not be connected directly with the WAPP CLSG

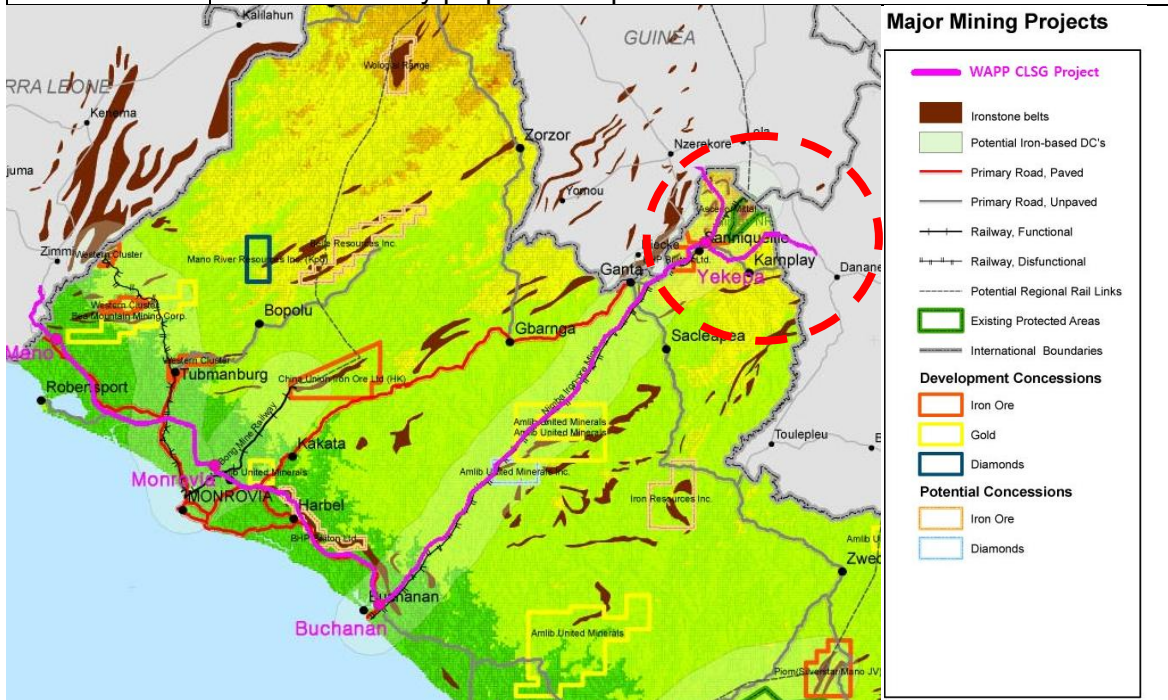
	Interconnection Project and thus not huge cumulative impacts will be generated due to these projects. And due to the operation of Cross Border Project and WAPP CLSG Interconnection project, Liberian will be able to reach easily to the electricity service with less price. And air and noise pollution will be reduced due to not using particular small generators within the project area.
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Mining Project

Project	Mining Development Project in Liberia
Description of mining activities in Liberia	<p>Because mining development project is normally planned and developed by each independent private company, it is not practical to investigate each mining company's current or future plan. So, the Consultant held meetings with relevant Ministries and as a results, the Liberia's Vision for Accelerating Economic Growth published by Ministry of Planning and Economic Affairs (MPEA) has been referred to investigate mining development project in Liberia as below</p> <ul style="list-style-type: none"> ✓ According to the <i>Liberia's Vision for Accelerating Economic Growth</i>, major mining project in Iron ore mining is set to regain its position as a mainstay of the Liberian economy and primary source of infrastructure development. ✓ Liberia used to be a significant iron ore producer, with LAMCO, Mano River and Bong Mines, but all production had ceased by the early 1990s, either due to resource depletion (LAMCO) or the deteriorating security situation. ✓ Liberia has abundant mineral resources, specifically major iron ore deposits that can fund railways and port rehabilitation as well as power and water supply. Five deposits with at least a twenty-five year life have been or are being tendered to mining companies: Nimba, Bong, the Western Cluster (Bomi Hills, Bea and Kong deposits, all along the same former rail bed), Putu and Kitoma. Wologizi is a potential, but unproven sixth mine option.
Anticipated impacts	<ul style="list-style-type: none"> ✓ Under a Minerals Development Agreement, the Government of Liberia has granted Arcelor Mittal a concession to develop iron ore mines in Northern Nimba County, while transmission line and one substation would be constructed near Sanniquellie town of Nimba County due to the implementation of the WAPP CLSG Interconnection Project. So cumulative impacts by these two projects are needed to be considered in this area. ✓ The construction of electrical facilities and stable supply of electricity will accelerate development of mining activities. Also, it is widely recognized that the country's wealth of mineral resources offers the greatest potential for economic growth and development in the long term. ✓ However, potential adverse impacts such as impacts on critical/non-critical natural habitats, wildlife and biodiversity, fragmentation of natural habitats, blocking of wildlife migratory routes, loss of surface, vegetation, land degradation, groundwater pollution and depletion, noise and air pollution, loss or damage of physical cultural resources, public health and safety, and social and cultural disturbance on local communities might result from the development of mining concession. Also, construction of other infrastructure

including power plants, transmission networks, railways, roads, waste water treatment plants and other downstream value-added activities that could have moderate to significant impacts would be necessary to operate mining project properly. For example, the Ganta-Yekepa Road is under construction by Arcelor Mittal mining company

✓ In order to minimize adverse impact might arise and to maximize benefit, all activities is managed with responsible manner and controlled by proper ESIA procedure



Because of the nature of a transmission line project the changes will be very localized. The proposed Project will allow electric power to be transmitted from distances far away, and the biggest impacts will come from the change of lifestyle resulting from social development.

Considering that surrounding circumstances of the selected line route is mostly out of town area and is going along the existing road, adverse cumulative impacts causing from the proposed Project is minimal.

Also, the increase in regional growth in Liberia may indirectly contribute to potential cumulative impacts in the proposed Project area. An increase in population growth directly affects the demand for jobs and housing, which may increase the number of planned development and improvement projects, such as public service facilities or transportation system expansions, in Liberia. Substantial population or employment increases near the area of the proposed Project also substantially increase the population potentially exposed to an accident or other hazard.

Other Infrastructure development Project

Project	Emergency Monrovia Urban Sanitation Project (EMUS)
Status	Planned
Implementing Agency	Monrovia City Corporation (MCC)
Total Project Cost	22.4 M USD
Period	2011~2014
Fund	Liberia Reconstruction Trust Fund(LRTF), IDA
Description of the Project	<p>The project aims to scale up ongoing activities in solid waste management and includes the following components:</p> <ul style="list-style-type: none"> ✓ Component 1: Solid waste collection and disposal Primary and secondary collection(construction of two transfer stations) ✓ Component 2: Technical assistance to MCC. ✓ Component 3: Development of sanitary landfill cells at Whein Town, Monrovia
Anticipated impact	<ul style="list-style-type: none"> ✓ The main impacts of the EMUS are beneficial: provision of additional space for waste disposal so that progress in expanding waste collection and improving sanitation in Monrovia can continue, and improvement in the quality of the facilities and operations of the landfill, including management of potential adverse environmental and social impacts. ✓ The potentially significant adverse impacts are possible degradation of the quality of surface water or groundwater. There are seasonal wetlands and small streams near the landfill, and groundwater is used for local water supply. Other potential impacts are fires caused by gas from biodegradation of the waste, odors, flies, vermin, increased truck traffic, blowing trash, and visual impact. ✓ This project comprises construction of two transfer stations and sanitary landfill cells. It will improve the quality of life, however, some adverse impacts is also expected. Implementation of EMUS needs to be in compliance with ESIA study as well as other international practice in order to minimize adverse impacts. Not so much connection between EMUS and CLSG project was anticipated.

Project	Water and Sanitation
Status	Planned
Implementing Agency	Liberia Water Sewerage Corporation

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Period	2011~
Fund	AfDB
Description of the Project	<ul style="list-style-type: none"> ✓ Project Components A. Infrastructure A1 - Water Supply "Increasing access to water adequate and potable water supply to 50% of residents in Monrovia and 75% in Buchanan, Kakata and Zwedru through rehabilitation and extension of the water supply infrastructure. In Monrovia this will consist of rehabilitation of the existing water treatment system and extension of the water distribution system building on from the ongoing Monrovia Water Supply and Sanitation Rehabilitation Project. In Buchanan, Kakata and Zwedru the infrastructure improvements will consist of rehabilitation of boreholes and construction of new wells, installation of treatment system and rehabilitation as well as extension of the water distribution system. A2 Sanitation "The project will rehabilitate and construct sanitation facilities in key areas such as schools, clinics, motor parks and market places. A3 Engineering Services "Engineering services for design review and construction supervision ✓ Project Components B. Capacity Development, training, capacity building support
Anticipated impact	<ul style="list-style-type: none"> ✓ The proposed project targets urban and peri-urban settlements as well as schools, markets and health centres in Monrovia, Buchanan, Kakata and Zwedru. The direct beneficiaries are 580,000 residents in Monrovia, 45,400 in Buchanan, 39,300 in Kakata and 27,000 in Zwedru; the Liberia Water and Sewer Corporation (LWSC) and the Monrovia Metropolitan Corporation (MMC). The outcomes of the project are increased coverage and functioning of water and sanitation services in the project area, and improved performance of LWSC. ✓ The residents/retail customers of the water utilities will benefit from better service, both in terms of access and quantity delivered. The capacity building component will also benefit small-scale service providers of water and sanitation (management of kiosk and public sanitation facilities), mainly targeting women groups. The adoption of improved hygienic practices and use of sanitation will lead to improved sanitary environment benefiting all the residents of the four cities.

5. MITIGATION MEASURES

This section of the ESIA presents the mitigation measures that have been proposed to minimize potential adverse, environmental impacts and maximize beneficial impacts that are associated with the implementation of the proposed Project. To ensure that environmentally sound practices are adhered to and in order to safeguard the safety and health of persons or any group of persons working on the proposed Project during project implementation, the following mitigative measures are proposed for significant potential impacts at the pre-constructional, constructional and operational phases.

5.1. Pre-constructional phase

5.1.1. Potential Sensitive ecological and inhabited area

The Consultant carried out desk study and field investigation to identify environmentally sensitive area. An effort was made to avoid these areas as much as possible when the line route was proposed.

However, there is a possibility that further ecological sensitive areas will be found during the construction stage. To prevent and minimize adverse impact on this potential sensitive area, during the design stage, line route survey should be carried out by the Contractor and relevant authorities to verify whether there is sensitive areas or not inside RoW and to ensure the adequate line route selection by avoiding this area if it is found.

5.1.2. Loss of buildings and land ownership issues

The proposed Project is a linear one. This means land ownership structures and land-use characteristics will have to change within the affected area. The LEC (Transmission Line Protection) Regulations prohibits activities such as mining, construction of buildings, crops cultivation and farming in the RoW.

However the World Bank Transmission Line RoW Guidelines state that minimal farming and vegetable gardening may be permitted along the RoW except for the area occupied by tower foundations and 3.0 m RoW maintenance track as this will help reduce maintenance cost of the RoW.

The two respecting regulations are in conflict with each other. However, farmers cultivating under the line and maintaining the ROW has been shown to be an effective way of protecting the ROW from encroaches and maintaining the land use and vegetation, reducing

costly ROW line monitoring. Therefore it is recommended to encourage to farm inside RoW after the construction of transmission line is complete but not to allow planting of trees to meet the vertical clearance limit as stipulated in World Bank Transmission Line RoW Guidelines.

In order to minimize the adverse effects of the acquisition of the substation site and RoW areas on individuals, families, communities, a detailed survey of project-affected persons was carried out as part of this ESIA for the purposes of compensation payment. Prompt, adequate and fair compensation will be paid to all project-affected persons before the commencement of constructional activities.

5.2. Constructional phase

The constructional phase of the proposed Project involves activities that have the potential to impact significantly on the physical, biological and socio-cultural/socio-economic environments within the project's area of environmental influence. The following mitigation measures have been proposed for the significant potential impacts:

5.2.1. Noise impacts

Noise impacts from constructional activities will be temporary-limited only to the constructional phase of the project. All construction machinery and equipment will be maintained regularly, paying particular attention to all noise-reducing devices or mufflers to ensure that they are in good working condition to minimize noise generation.

The unnecessary tooting of horns during transportation of equipment and materials through settlements will be avoided as much as possible. Construction site workers will also be advised to avoid unnecessary noise making. In addition, night time work especially near communities will be avoided as much as possible to prevent undue noise impacts on local communities. Construction crew near noisy machinery and power tools will be provided with earmuffs to protect them from hearing loss damage.

In addition, each substation location is remote that actual construction-related noise will most likely not be heard by any area residents. However, trees native to the area shall be planted at the frontage of the substation to act as noise buffer.

It is expected that the full implementation of the measures outlined above will minimize the potential noise impacts on local communities.

5.2.2. Impact on air quality

Wind pick up dust from exposed unprotected land surfaces will be minimized by limiting land clearance to minimum area requirements for the constructional activities. For instance, excavation of the tower base areas will be restricted to the required dimensions of 7m x 7m. To further reduce dust pollution, regular watering of the site will be carried out during construction to reduce the effect of wind pick-up dust particles. This potential impact will be short-lived or temporary since it is expected that the exposed areas will be covered quickly by vegetative re-growth. The vegetative cover will however be so maintained as to allow the passage of vehicles.

In addition, the construction machinery and equipment will be maintained regularly to minimize the release of soot in the exhaust fumes.

Furthermore, trucks that supply sand, gravel and stone aggregates will have their buckets properly covered with tarpaulin during transit to prevent wind pick-up dust, spill of materials and the release of dust into the atmosphere.

These measures, when fully implemented, are expected to minimize the potential impact of dust pollution on local communities.

5.2.3. Erosion

Activities during the constructional phase will expose the disturbed ground surface, which is at least temporarily unprotected, to the agents of soil erosion such as heat, wind and rain. Erosion of soil from exposed unprotected land surfaces will be minimized by limiting land clearance to minimum area requirements for the constructional activities. For example, excavation of the tower base areas will be restricted to the required dimensions of 7m x 7m. Also, the erection of towers/tower footings on steep slopes will be avoided as much as possible to prevent slip erosion.

This potential impact will, however, be short-lived or temporary since it is expected that the exposed areas will be covered quickly by vegetative re-growth to stabilize the soil and minimize erosion.

5.2.4. Public safety

The transportation of heavy plant and equipment through settlements will be done in a manner not to jeopardize the safety of the local people. Equipment and materials will be properly secured when being transported to prevent them from falling and posing potential danger to people. (It is important to note that it is not the constructed towers that will be transported to tower locations but rather the tower members or parts). Legally mandated speed limits on the roads and highways shall be strictly observed in all settlements.

Also, tower base excavations in or near settlements or farms will be protected or clearly marked to prevent people from inadvertently falling into these excavations. For areas with animal populations, these excavations will be guarded with boards to ensure no animals fall into the pits.

Tree felling will be done by a certified timber contractor with competent workers. Adequate warning will be given to ensure that public safety is not compromised during this activity.

5.2.5. Flora and Fauna

Care will be taken to minimize the area that will be cleared and the number of trees that will have to be cut. Construction workers will be closely supervised to ensure that only the minimum area requirements, as given earlier, for access trucks, tower corridor track and tower base areas are cleared of vegetation to minimize potential impacts on flora and fauna.

Also, surveys conducted and desk studies carried out during the baseline study have not revealed the presence of any floral and faunal species of conservation concern that will be irreversibly impacted by the proposed Project. Felling of trees will also be properly supervised to ensure that only trees that are, of necessity, to be felled are actually felled.

It is expected that impacts on fauna will be temporary and will not be significant. In addition, fauna that will be scared away during this phase will quickly return to the vicinities of the RoW once construction ceases. No further mitigation is proposed for potential impacts on fauna.

5.2.6. Occupational safety and health

Prior to the commencement of construction works, all contractors should be required to prepare their own ESMPs. The plan should be included in the bidding documents and in the contractor's contract and spell out environmental targets and objectives as outlined in the

ESIA/ESMP and how these could be achieved. The Contractor's ESMP shall include, to the extent practicable, all steps to be taken by the Contractor to protect the environment in accordance with the current provisions of national environmental regulations, the World Bank Groups Environmental Health and Safety General Guidelines and the Environmental, Health and Safety Guidelines for Electric Power Transmission and Distribution, 2007 as well as the ESIA/ESMP for this project. Provision should be made for the disposal of chemical/hazardous wastes as the local facilities do not exist for hazardous waste disposed.

The SPC will ensure that the contractor for the proposed Project carries out the work in compliance with the relevant provisions and the SPC guiding rules and regulations to minimize the potential occupational safety and health hazards and prevent or minimize accidents. To further minimize the potential safety and health hazards, the SPC will ensure that the contractor employs properly trained and experienced operatives and adhered to all technical specifications relevant to safety measures in the execution of the works. In addition, the contractor will be expected to provide an "All Risk Insurance" cover for the contractor, subcontractors, project management staff and all other employees. The specific issues considered are discussed below.

5.2.6.1. Occupational noise

Construction workers working with or near noisy equipment like pumps and power tools will be provided with earmuffs to protect them against noise-induced hearing loss damage.

5.2.6.2. Machine safety

All potentially hazardous machinery such as lifting appliances (cranes, forklifts, etc) and unfired pressure vessels (compressors, etc) will undergo statutory examination by a certified engineer. This will ensure that accidents due to material failure are pre-empted. All electrical cables of mobile or hand-held machines (electric hand drills, temporary lights) will be examined for flaws in insulation and when any flaws are detected the cables will be promptly replaced.

5.2.6.3. Sanitary/welfare facilities

Mobile toilet facilities will be provided for construction workers. This is to ensure that decent and comfortable places of convenience are provided for the workers and also to prevent environmental pollution with human waste.

In addition, lifting of excessive weights at the workplace will be prohibited. Lifting appliances (e.g. cranes and forklifts) will be provided for lifting heavy objects. First aid facilities and good drinking water will be made available for the use of workers in accordance with the National Social Security and Welfare Safety Rules.

A first aid box stocked with all the items will be provided and maintained. In addition, a vehicle will constantly be on standby for use as an ambulance for the conveyance of all persons who may sustain major injuries during the course of the implementation of the proposed Project to the nearest Health Center. Raincoats, Wellington boots, etc will be provided for construction workers who will be working in rainy or wet conditions.

5.2.6.4. Injuries from falling/swinging objects

Protective clothing such as hard hats and safety boots will be provided for all employees at the Project site for protection against falling and/or swinging objects. Tree felling will be done by competent and adequately trained workers. Adequate warning will be given to ensure that safety of workers is not compromised.

5.2.6.5. Accidental falls from height

Due to the hazard of potential accidental falls from heights during construction works all workers who will be required to climb and work on the towers will be provided with the necessary safety equipment such as body harnesses, (climbing belts).

The SPC will, in addition, ensure that only well-trained and experienced personnel work at heights on the towers.

5.2.6.6. Snakebites

Construction workers will be protected from the potential hazard of snakebites by providing them with safety boots long enough to cover the leg up to the knee. Workers will be required to wear these boots at all times during working hours. Snake bite boxes to treat snake bites also need to be present in the work camp

5.2.7. Socio-economic/cultural issues

The relevant socio-economic/cultural issues are:

5.2.7.1. Loss of properties and land ownership

The proposed Project is a linear one. Land ownership structures and land-use characteristics will have to change within the affected area. The current LEC (Transmission Line Protection) Regulations prohibit activities such as mining, construction of buildings, crops cultivation and farming in the RoW. However, according to the World Bank Transmission Line RoW Guidelines, minimal farming and vegetable gardening may be permitted along the RoW except for the area occupied by tower foundations and 3.0 m RoW maintenance track as this will help reduce maintenance cost of the RoW.

In order to minimize the adverse effects of the acquisition of four substation sites, SPC will pay adequate compensation to the land-owning families

In the case of the RoW, lands will be taken permanently only for the tower spots (approximately 5m X 5m). As towers will be put approximately every 400m along the 532km RoW, total number of towers to be erected in Liberia is approximately 1,330. Considering that each tower base will occupy approximately 25m² (5m X 5m per tower), total area of 33,125m² will be taken for the RoW

In order to minimize the adverse effects of the acquisition of the RoW and access track areas on individuals, communities and/or families or clans a detailed survey of project-affected persons was carried out as part of the ESIA for the purposes of compensation payment. Prompt, adequate and fair compensation will be paid to all project-affected persons before the start of constructional activities.

5.2.7.2. Land-use conflicts (including compensation issues)

Usually, fertile land is already being used or claimed - yet existing land uses and claims go unrecognized because land users are marginalized from formal land rights and access to the law and institutions. Therefore, mitigation measure for potential for conflicts on availability of alternative productive land or access to other resources in minor resettlement should be prepared.

Possible conflict may arise over land, these land conflicts will be solved through the joint efforts of the CLO, the chieftains, elders and the project management. With reference to employment, community people who are qualified to man positions will be given first preference over those from the outside. This preference should be part of the benefits to project affected people.

To mitigate potential for conflicts between PAPs and existing owners, any shift in land use can only take place with the free, prior and informed consent of the local communities concerned.

And adequate compensation and alternative resettlement or access to productive land should be planned and provided before resettlement with prior consultation.

Also, in line with the SPC's desire to ensure the sustainability of the environment within which it operates, the SPC should avoid intruding into or interfering with cultural properties of the local communities as much as possible,

5.2.7.3. Basis of assessment of compensation

Several valuation approaches are available for an appraisal depending upon the nature and purpose of valuation. There are normally three traditional approaches to valuation viz: the Income, Market and Cost Approaches. The SPC adopts the following methods to compensate its project-affected persons to ensure fair and adequate compensation.

Agricultural produce

Agricultural loss is generally limited to the crop loss and crop damage due to construction. Landowners who cultivate the affected plot will receive compensation for the entire crop within the right of way (ROW) whether or not the entire ROW is cleared.

The methodology for the calculation of crop compensation rates takes into account both the market value of agricultural produce and the reestablishment period of perennial crops. This method operates by the capitalization of the net income that accrues to the property at an appropriate rate. The net income is arrived at by making allowance for outgoing as land preparation, maintenance expenses, etc from the gross income accruing to the investment.

Residential properties

Two methods were adopted in the valuation of the buildings, depending on the location and other factors affecting values.

The Replacement Cost Method was adopted in the valuation of the affected structures/buildings. This method is based on the assumption that the value of the property

tends to reflect the value of the accommodation provided, plus current costs of improvement, without any consideration for depreciation due to age, architectural obsolescence, etc. This method was applied where data on current sale of property is virtually non-existent.

In the Direct Comparison Method or Market Approach, rates adopted take the market condition in the building industry into consideration. This is a direct method of comparing the property to be valued with similar properties in terms of design, quality of construction, finishes, amenities/facilities available, location, neighborhood characteristics, interest among others, which have changed hands in the recent past. The prices obtained for similar properties are thus analyzed and a unit rate per square area is adopted after making the necessary adjustments and applied to the net floor area of the subject property to arrive at its reasonable value. This approach is based on the principle of substitution, which infers that a prudent purchaser acting knowledgeably will not pay more for a property than what it will cost him to acquire a comparable substitute if these are available on the market. The comparative approach is used where there is available and reliable data on what is actually paid in the market for similar or comparable properties.

5.2.7.4. Potential destruction of sacred, cultural and/or historical/archaeological sites/items

In line with current international practice and the desire to ensure the sustainability of the environment within which the Authority operates, the SPC will avoid intruding into or interfering with cultural properties of the local communities as much as possible. To minimize the adverse impacts on potential destruction of sacred, cultural and/or historical/archaeological sites/items, a rapid archaeological survey should be done at the substation and camp sites as a part of the Contractor's contract. During the construction a chance find procedure will be enforced for all project construction sites (see chance find procedure below). The Chance Find Procedure such as rapid archaeological survey will be done by EPC (engineering, procurement and construction) contractors.

The research has identified all sacred sites, graveyards, schools in the right of way.

Archaeological chance finds

Prior consultations with the Museums and Monuments Authority/ Ministry of Information have been carried out in connection with any historical or archaeological 'chance finds'. The following procedure, for dealing with all such finds will be followed:

Upon the discovery of any such chance finds:

- ❖ Notified immediately in writing, stating the exact site or location of the item.
- ❖ Preserve the finds with no alteration, damage, destroy or remove any antiquity from its original site without the consent of the Museums and Monuments Authority.
- ❖ If removal of the item becomes immediately necessary for safety or security reasons, the exact location shall be noted and the retrieved artifacts shall be sent to the custody of the Museums and Monuments Authority.
- ❖ Through liaising with the Board, the lawful owners of the land shall be duly informed and where necessary, payment shall be made by the Board after due assessment.

Further decisions with respect to site sampling or further excavation will be under the jurisdiction of the Museums and Monuments Authority. The above will ensure that issues relating to archaeological/cultural 'chance finds' are properly handled.

Cultural "chance finds" - sites of cultural significance such as sacred woods or trees or rock outcrops which the local residents may have not mentioned at the survey stage – will be properly managed to the satisfaction of both the local communities, the EPA and the Funding Agencies. Where possible, such cultural properties will be left undisturbed or avoided. In cases where complete avoidance of such sites is impossible, every necessary step will be taken to minimize the potential impact of intruding into the site. This will be done in consultation with and to the satisfaction of the chiefs, elders and opinion leaders of the local communities.

5.2.7.5. Impacts on population and demography

The proposed Project is not expected to have significant impacts on the populations and demography within the local communities. Only about 25% of the construction work-force is expected to be skilled labour may be recruited from outside the local communities. This may only be done if such skill labour is unavailable in the local communities. To further minimize potential impacts on populations and demography of the local community's skilled workers from outside the communities will be accommodated at the work camp that will be established. It is therefore not expected that there will be any significant impacts on populations, demography and gender within the local communities during the duration of the proposed Project.

5.2.7.6. Employment generation and incomes

Some employment openings may be created for the local people. Those local people who may be employed will benefit from the payment of salaries/wages. This is expected to lead to improvement in local incomes. On the other hand, there will be loss of income resulting from loss of crops and land. Mitigation for this potential impact is provided in Section 6 of this report. It is necessary to make a work quota for local residence to maximize the beneficial impact on communities. Due to the specialty of their work, the professional workers cannot be replaced by locals. However, some local staff may be hired to take up foundation excavation, transportation of cubic meter of earth and stone, conveyance of building materials and road building and repair etc. That can offer locals some temporary work opportunities. Also, because it is expected that there will be a huge demand on building and constructing materials for the proposed Project implementation, the Contractors are encouraged to use the materials produced in local market to promote development of local building material, industry, initiate direct or indirect employment opportunities for the locals and forward the development of local economy and enhancement of living standard of local people.

5.2.7.7. Potential impacts on public health

With the introduction of migrant workers into the communities along the proposed line route, mitigation measures will be required to minimize the potential danger of the spread of sexually transmitted diseases (STDs) including HIV AIDS.

The Environment & Community Relations Unit (ECRU) or other responsible department of the SPC shall undertake HIV/AIDS education for the workforces of the contractors and consultants. The measures shall include the distribution of IEC materials and sufficient quantities of good quality free condoms to the workforce. The workers will also be continually educated about the dangers of indulging in casual unprotected sex.

Also, doctor's regular checkup for the construction workers should be arranged.

5.2.7.8. Potential impacts on vulnerable group

Members of vulnerable groups are often not able to make their voice heard effectively, and account will be taken of this in the consultation and planning processes, as well as in establishing grievance procedures. They are often physically weaker, and may need special help in the relocation/disturbance phase. In particular, female-headed households may lose

out to more powerful households when assets will be demolished to make way for the transmission line.

Therefore, old people, women and children shall be considered for additional assistance and need special attentions to ensure that they are supported to be benefited from compensation entitlement and other mitigation measures.

These actions are needed to be provided to old people, women and children:

- Vulnerable Groups including the poor, sick, orphaned and vulnerable children need to be given priority in employment opportunities arising from the proposed Project.
- Unskilled labor should be drawn from local communities among women, and income generating opportunities for women will be considered during project construction in the form of food preparation and sale to workers.
- To pay equal remuneration to men and women workers for same work or work of a similar nature is recommended at the project level.
- Households only inhabited by old or feeble shall be given full assistance in building new homes.

Further during construction, it is recommended to identify appropriate micro-programs that could be provided under the proposed Project such as revolving fund financial incentives and assistance for housing construction among others at the government level.

5.2.8. Visual intrusion

Optical impairment of the landscape by the presence of the transmission towers, lines and the substation is unavoidable and could be regarded as a residual impact. The galvanized towers tone down after two to five years of operation to a dark grey color. In addition, the line route was selected such that the lines blend with the natural landscape and mostly away from settlements. The 'glare effect' will therefore be minimal and unnoticeable.

Trees native to the area around the substation shall be planted at the frontage of the substation to act as windbreaks, noise buffer and to reduce the visual effect of having a substation located at the site.

5.2.9. Traffic impacts

Equipment and materials will be properly secured in vehicles while being transported to avoid the falling of such items on public roads to create potential hazards or safety problems for the public. Also, trucks and vehicles conveying such materials will display appropriate road safety signals - red flag and flashing amber lights. The SPC will ensure that deliveries are only made during daylight hours. Existing speed regulations shall be observed within settlements to minimize the potential for accidents.

To minimize traffic conflicts at the junction where the access tracks join public roads the SPC will ensure that road signs are erected at appropriate distances on either side of the junction to warn motorists of the potential danger of heavy-duty trucks turning into and off the main road. Obstructing vegetation at the junctions will be cleared to allow drivers to properly view and assess situations before joining main roads. Also, warning notices like "NO ENTRY" or "NO TRESPASSING ALLOWED" will be placed at entry to access tracks. In addition, random security patrols will be carried out to ensure that the local people do not unduly endanger their safety.

Prior to the start of construction, the Contractor shall submit Traffic Control Plans (TCP) to SPC and all agencies with jurisdiction over public roads that would be affected by overhead construction activities as part of the required traffic encroachment permits of each country. TCP shall define the locations of all roads that would need to be temporarily closed due to construction activities, including aerial hauling by helicopter and conductor stringing activities. The TCPs shall define the speed limit, use of flag persons, warning signs, lights, barricades, cones, etc. to provide safe work areas and to warn, control, protect, and expedite vehicular and pedestrian traffic. The measures included in the TCP shall be consistent with the standard guidelines of Liberia as well as the World Bank Group EHS Guidelines of 2007 (General and Electric transmission and Distribution). TCP shall also include measures to avoid disruptions or delays in access for emergency service vehicles and to keep emergency service agencies fully informed of road closures, detours, and delays. Police departments, fire departments, ambulance services, and paramedic services shall be notified at least two weeks advance by the Contractor of the proposed locations, nature, timing, and duration of any construction activities and advised of any access restrictions that could impact their effectiveness. Provisions shall be ready at all times to accommodate emergency vehicles, such as immediately stopping work for emergency vehicle passage, short detours, and alternate routes developed in conjunction with local agencies. TCP shall also identify all emergency service agencies, include contact information for those agencies, assign

responsibility for notifying the service providers, and specify coordination procedures. Copies of the TCP shall be provided to all affected police departments, fire departments, ambulance and paramedic services.

Furthermore, certain constructional activities like the stringing of transmission lines across public roads will cause temporary traffic disruptions. Traffic wardens will be employed to direct traffic during such times to avoid confusion and prevent accidents. In addition, in all cases, where line stringing will cross public roads due notification to the general public and appropriate authorities (County Assemblies) will be given as required.

5.2.10. Potential pollution of water bodies

Clearing and grading of access and tower corridor tracks and the excavation of tower base areas will be limited to the minimum area requirements. Other measures proposed in other sections of this report for minimizing erosion and managing excavated materials, wastewater from excavations and accidental spillage of oil, fuel and paints are valid for the prevention of pollution of water bodies.

In case towers are to be built in wetland, the access roads in the wetland need to be removed after construction is complete and the wetland needs to be rehabilitated to its original state.

The contractor will use galvanized steel pipes across water bodies to allow for access in order to avoid blockage of streams, rivers and other water bodies.

The SPC will not employ herbicides/weedicides for weed control or vegetation clearing hence any potential pollution from this source is eliminated.

The measures outlined above are expected to minimize the possibility of water pollution and also minimize the effects on downstream water usage of the streams/rivers.

5.2.11. Work camp management

First and foremost, the SPC will ensure that contractors do not establish work camps close to any water body to avoid water pollution problems. The camp will also be established at least 500m from the closest settlement to minimize noise impacts on the community. The

SPC will also ensure that employees from the local communities are not accommodated at the camp.

Mobile toilet facilities will be provided at the work camp to avoid the pollution of the environment with human waste. The holding tanks of the mobile toilets will be emptied as and when required for disposal at appropriate sites. Also, a clinic, ambulance and doctor should be provided in the work camp for emergency as a part of the Contractor's responsibilities.

5.2.12. Access road

In order to minimize the adverse impact of opening access road, mitigation measures were suggested as below.

- Environmental aspects

An effort should be made not to use any environmental sensitive areas or wetland during the design stage. Wherever practical, existing roads and tracks shall be used to gain access to the proposed line to the utmost to minimize further vegetation clearing. Access road to each construction site shall be developed to minimize unpaved road travel. However, in case that new access roads should be developed, access roads should be removed after construction and wetlands needs to be rehabilitated to its original state. It is also required to establish a vegetative ground cover (in compliance with biological resources impact mitigation measures) or otherwise create stabilized surfaces on all unpaved areas at each of the construction sites within 21 days after active construction operations have ceased.

- Technical aspects

Legally mandated capacity of each road shall be strictly observed. Traffic Control Plan to be prepared by the Contractor shall specify the location of access road to be used, period of usage and be agreed with SPC and local authorities. Any damaged road due to the Project shall be rehabilitated immediately in order not to disturb the road users. Stabilizing unpaved access road surfaces, using water to bind active soil and handling activities among other measures are necessary to reduce fugitive dust. Watering on the disturbed areas of the active construction sites are required at least three times per day and more often if uncontrolled fugitive dust is noted. Maintain unpaved road vehicle travel to the lowest practical speeds, and no greater than 15 mph, to reduce fugitive dust emissions.

- Compensation aspects

It is necessary that the compensation amount negotiated between the Contractor and the owner of property inside access road is adequate and paid timely. Also, in case that the owner's access to his asset is disrupted for longer than what he/she has been compensated for, then the additional loss of crops shall be compensated at the same rate.

5.2.13. Waste management

To handle the vegetation waste generated during the clearing of RoW, waste hierarchy should be considered at first.

Using the 'waste hierarchy' – a series of options for managing waste – will help to manage our waste more sustainably by reducing the amount produced and recovering maximum value from waste that is produced. The waste hierarchy is intended to guide choices about waste management options.

Prevention - in descending order of preference: strict avoidance of waste, reduction at source and product reuse.

Reuse - the multiple use of a product in its original form, for its original purpose or for an alternative, with or without reconditioning.

Recycling - using waste materials in manufacturing other products of an identical or similar nature.

Composting - a natural process that breaks down materials such as garden and kitchen waste

Energy Recovery - energy from waste is the recovery of energy value from waste by burning the waste directly or by burning a fuel produced from the waste.

Disposal - generally involves burying the waste in a landfill or burning it at high temperatures in an incinerator to destroy it.



The large volumes of biomass cleared from the RoW could become nuisance and an eyesore and a fire hazard if left unattended. The contractor must ensure that the biomass is stockpiled and appropriately disposed of by allowing villagers to scavenge on the useful wood and burning is the least favored option. However if it is inevitable, burning the vegetal waste should be done at selected strategic sites away from human settlements.

During maintenance of construction machinery/equipment and vehicles care will be taken to avoid accidental oil spills, which could lead to soil contamination. Accidental spillage of oil, fuel and paints will be avoided as much as possible. Any spilt materials will be quickly mopped up with rags and/or sawdust. The used sawdust and rags will be collected, put in polythene bags and disposed of at appropriate public waste dumping sites. Waste oil will be drained into impermeable sumps at the work camp for collection and disposal

Solid wastes in the form of trees, tree stumps and wooden containers will be gathered together disposed of in consultation with relevant government ministries and agencies including the Ministries of Public Works, Health and Social Welfare, Lands Mines & Energy, the Environmental Protection Agency of Liberia (EPA) and Municipal Government.

Metal wastes will be collected and in consultation with relevant agencies of government disposed of and in turn re-cycling them. Other solid wastes such as damaged cables and

conductors, rags, paper cartons and domestic wastes will be collected and disposed of at appropriate public waste dumping sites. The use of empty paint and oil containers for storage of water will be prohibited.

Wastewater from tower base excavations is not expected to be significant. No towers will be sited in permanently wet locations requiring the extraction of large volumes of wastewater. At worst, towers will only be allowed to be sited at seasonally wet locations. The required dewatering will therefore be temporary, limited and localized. Hence only small quantities of wastewater will be pumped and discharged through sediment traps or silt screens into surrounding marshlands. The effects of discharging the wastewater into the surrounding marshlands will be insignificant and short-lived.

5.2.14. Potential dewatering operations

It has been ensured that the proposed RoW has avoided permanently wet areas as much as possible. In addition, tower spotting shall be done in such a way that swamps/ marshy areas are avoided during tower installations.

Places where the towers will be located will therefore not be permanently flooded areas. In places where dewatering operations are unavoidable, such as seasonally wet areas, wastewater to be generated from such dewatering operations are therefore expected to be in small volumes. Wastewater will be pumped into existing natural watercourses. Measures to be taken prior to discharge to such watercourses will include the installation of silt traps and ramps to ensure that suspended particulate content of the wastewater is reduced prior to discharge (see also section 5.2.12).

5.2.15. Temporary workers

Measures to manage the potential effects occur as results of the influx of temporary workers have been put in place through a combination of public consultations, policies and planning.

These measures will include:

- ❖ A hiring policy giving priority to local residents.
- ❖ A procurement policy that gives preference to locally produced goods and services.
- ❖ Accommodation of non-local workers in a dedicated construction camp with independent water and waste treatment facilities.
- ❖ A code of conduct for project workers that establishes rules for interaction between the proposed Project, its workers and the local community.

- ❖ Developing a workforce HIV/AIDS management and awareness program.
- ❖ Voluntary and free-of-charge HIV testing and counseling for project workers.
- ❖ Additional policing should be arranged for the safety of local residents, in particular women.
- ❖ Adequate medical faculties need to be secured so as not to burden local hospitals, local residents should also be able to benefit from them.
- ❖ Measures should be put in place to ensure that no conflicts will arise as a result of different ethnic or racial groups meeting.

5.2.16. Use of dust suppression water

There is a slight possibility that the impact of abstracting the dust suppression water from the water courses such as the water shortage near the existing village might be occurred. So, dust control near the area where water shortage is projected should take appropriate alternatives described as below:

- ❖ control of vehicle access (adopt a freeboard to haul vehicles and covering loose material on haul vehicles)
- ❖ vehicle speed restrictions
- ❖ use of gravel and/or rattle plates at site exit points to remove carry on dirt from tires and tracks
- ❖ washing of equipment prior to site removal
- ❖ work stoppage under certain conditions (e.g., such as prohibiting construction grading when wind gusts exceed 25 mph).
- ❖ using chemical stabilizers during construction.

5.3. Operational phase

This section of the report presents the proposed mitigation measures put forward to minimize the significant potential environmental impacts that are expected to be associated with the operational or maintenance phase of the proposed Project.

5.3.1. Vegetation clearing

The method that will be used for vegetation control to manage vegetative growth within the RoW will be physical or mechanical clearing. Tree stumps will be uprooted to prevent re-growth. Threatening trees outside the RoW will be cut only to a height of 1.25m. Chemicals such as weedicides or herbicides shall not be used. This is to eliminate the potential harmful effects of these often-persistent chemicals on the environment. In addition, the physical

clearing will enable the management of vegetative growth within the RoW to be done in a more controlled manner – limiting the clearing strictly to the tower corridor track. This is expected to have a limited effect on vegetation.

In addition, the non-use of chemicals will eliminate issues of potential pollution of nearby surface water bodies and possible seepage of chemicals into ground water. In addition, all potential risks to workers arising from improper handling of these chemicals will be eliminated. The potential opening-up effects are not significant since most of the affected area is already extensively farmed and opened. Any limited effect could only be regarded as a residual impact.

5.3.2. Effects of rust treatment and painting of towers

Accidental spillage of paints will be avoided as much as possible. Any spilt paints will be quickly mopped up with rags and/or sawdust. The used sawdust and rags will be disposed of at appropriate public waste dumping sites. Painting will be done as frequently as necessary to prevent towers and tower members from rusting. The SPC will ensure that situations of extensive rusting of towers and tower members are avoided to pre-empt difficult rust treatment.

5.3.3. Waste management

During the maintenance phase, solid wastes in the form of trees, tree stumps and wooden containers will be gathered together and made available to the local communities as fuel wood.

Metal wastes will be collected and disposed of appropriately and/or recycled in consultation with relevant government agencies. Other solid wastes such as damaged cables, conductors and insulators, rags and paper cartons will be collected and disposed of at appropriate public waste dumping sites.

Accidental spillage of oil, fuel and paints will be avoided as much as possible. Any spilt materials will be quickly mopped up with rags and/or sawdust. The used sawdust and rags will be disposed of at appropriate public waste dumping sites.

5.3.4. Occupational safety and health issues

The SPC will carry out the operation and maintenance of the proposed transmission line based on accepted international standards, such as those of the International Electrotechnical Commission (IEC), the World Bank Group EHS Guidelines of 2007 (General and Electric transmission and Distribution) and the SPC's related regulations.

However some specific potential occupational safety and health hazards expected during the operational phase of the proposed Project are dealt with below:

5.3.4.1. Potential collapse of towers

As stated earlier, collapse of towers occurs only rarely. Therefore the restricting public access to the RoW by physical way such as fencing is not recommendable. Since the hazardous effects (e.g. falling on people and electrocution) of the collapse are normally felt only within the RoW public safety will be ensured by monitoring the tower shape and educate the people living in the influence of potential collapse of the tower about the potential hazard. Also, In line with existing LEC practice, all towers will be clearly marked with a red inscription on white background - "DANGER – 225,000 Volts" written in official or adequate regional language to ward off trespassers and prevent them from exposing themselves to the potential dangers of electrocution.

Regular maintenance will minimize corrosion and wearing out of parts of the towers and their accessories. The SPC needs to have a comprehensive, planned and emergency maintenance programs for the existing transmission lines. SPC shall apply the same level of care to the new transmission lines to be constructed.

In addition, tower members will be secured and improved anti-theft fasteners to check acts of vandalism and its harmful consequences on the towers. Security patrol will be conducted on sections of the transmission line especially the outskirts of urban areas and towns, which are more prone to acts of vandalism. It is expected that the patrols will ensure early detection of any acts of vandalism and signs of tower corrosion. Prompt and necessary remedial actions will be taken to repair the structures to forestall the possible collapse of towers

5.3.4.2. Falling and/or swinging objects

The measures proposed earlier to minimize the potential hazards posed by falling and swinging objects are valid for the maintenance phase of the proposed Project and will be fully implemented.

5.3.4.3. Falls from heights

Potential accidental falls from heights during the operational or maintenance phase of the proposed Project will be minimized through the provision of appropriate personal protective equipment such as body harness, climbing belts, etc. The SPC will insist that only well-trained and experienced personnel work at heights on the towers.

5.3.4.4. Machine safety

All potentially hazardous machinery such as lifting appliances (cranes, forklifts, etc) and unfired pressure vessels (compressors, etc) will undergo statutory examination by certified engineer. This will ensure that accidents due to material failure are pre-empted. All electrical cables of mobile or hand-held machines (electric hand drills, temporary lights) will be examined for flaws in insulation and when any flaws are detected the cables will be promptly replaced to forestall the hazards of electrical burns and electrocution of employees. In addition, employees will be required to wear protective clothing in the course of work to protect them from undue exposure to electrical power.

5.3.4.5. Snakebites

The measures proposed earlier to minimize the potential danger of snakebites will also be implemented during the maintenance phase of the proposed Project to safeguard the safety of employees.

5.3.5. Public safety

Tower members will be secured and improved by anti-theft fasteners to check acts of vandalism and its harmful consequences on the towers. Furthermore, anti-climbing guards will be installed to discourage adventurous individuals from endangering their lives and limbs.

The shattering of insulators, which could pose potential danger to passers-by, will be minimized by the use of quality insulators as well as the periodic washing of the insulators.

Measures proposed earlier to minimize public safety hazards relating to transportation and potential tower collapse are valid for ensuring public safety. These measures will be fully implemented to enhance public safety. Other public safety issues of potential health and other implications of electromagnetic field (EMF) effects have been dealt with below.

Threatening trees will be felled as stated earlier in the report to prevent them from falling onto the transmission lines during stormy weather conditions. This will minimize the potential of the fall of live electrical conductors, which could pose safety hazards to the public. Insulator pins will also be checked regularly for signs of rusting and any defective pins found will be promptly replaced to prevent the live electrical conductors from falling from the towers.

A potential positive public safety impact is the possible use of transmission lines and towers as landmarks to aid in “navigating” when driving through the countryside since they are clearly marked on Liberia’s topographical maps.

5.3.5.1 Electromagnetic field (EMF) effects

According to the World Environmental Library, WEL 1.1, information derived from prolonged observations and experiments in numerous countries indicate that the electric and magnetic fields around power transmission and distribution facilities exhibiting frequencies between 50 and 60 Hz have no harmful effects on human health. Magnetic field strengths below 0.4 mT at 50 – 60 Hz induce no detectable biological reaction in humans. The magnetic fields acting on the ground below overhead lines develop maximum field strength of only 0.055 mT for frequencies between 50 and 60 Hz. Hence potential effects of EMFs on human health are non-existent according to current knowledge.

However, an electrically grounded person touching an ungrounded metallic object or a conductor in a static or oscillating field may draw electric current from the object and may experience a micro shock from a spark discharge. This potential effect will be minimized by the SPC, as usual, by multiple earthings. Protective multiple earthings minimize the chances of people getting electric shocks and the chances of such shocks being fatal.

In order to debunk the misconception that EMFs may cause cancer or harm children and minimize fear and avoid panic among the local populations, the SPC will undertake public education and create awareness in the local communities wherever such concerns are

expressed. The SPC will also ensure that dwelling houses and other structures are not built within the RoW in contravention of existing regulations.

5.3.6. Socio-economic/cultural issues

5.3.6.1. Land ownership/land-use issues

Land ownership issues are expected to persist during this phase of the proposed Project. In cases where property owners could not be traced after all efforts have been made during the constructional phase additional efforts will be made during the operational phase to locate such people. Prompt compensation payment will then be effected.

5.3.6.1.1 Legislatives in connection with Land Ownership

Liberian Constitution 1986

Article 22 (a) and (b) of the Constitution vests in all individuals have the right to own property either on individual basis or in conjunction with other individuals, as long as they are Liberian Citizens. This right however does not extend to mineral resources on, or beneath the land.

Land Act 1856

Prior to independence, land acquisition and distribution was done on the basis of relationship and class system. Opposition to this system of land tenure led to the establishment of a set of rules known as the “digest of law to govern the affairs of the settlers in terms of land distribution” This later culminated into the Land Distribution Act of 1856 which removed the restriction to land distribution based on citizenship. This Act was repealed by the 1950 Land Act which restricted land ownership to citizens and naturalized citizens especially those of Negro decent.

County Act 1969

This Act officially distributed and demarcated land boundaries in Liberia. Prior to the Act, counties were created through political means. For instance the four oldest counties in Liberia – Montserrado, Sinoe, Grand Bassa and Maryland were all products of political events.

Land Acquisition Act 1929

The Act lays down the procedure for obtaining rights to any piece of land in Liberia through purchase. The Act distinguishes land in Liberia into two categories Viz: the Hinterland, and the County area.

5.3.6.1.2 Procedure for obtaining land

The procedure for obtaining land located in the Hinterland

- ❖ Obtain Consent of Tribal Authority to have a parcel of land deeded to the individual by the Government;
- ❖ Pay a sum of money as a taken of his/her intention to live peacefully with the tribesmen;
- ❖ Paramount or Clan chief signs a certificate which purchaser forwards to the office of the District Commissioner (who also acts as the Land Commissioner for the area); and
- ❖ The District Commissioner after satisfying himself that the land is not encumbered in any way approves that the land be deeded to the applicant and issues a certificate to that effect.

The procedure for obtaining land located in the County Area

- ❖ Apply to the Land Commissioner in the county in which the land is located; and
- ❖ The Commissioner shall issue a certificate if he is satisfied that the land is unencumbered.

Upon completion of the above steps, the purchaser shall pay the Bureau of Revenues the value of the land valued at a minimum rate of fifty cents per acre. He shall obtain and submit a receipt to president for an order to have the land survey. A deed will then be drawn up by the Land Commissioner, authenticated, and given to the purchaser.

5.3.6.2. Responsible Institutions

The institutions responsible for acquisition of land are highlighted below with their mandates;

Ministry of Public Works

This Ministry has the responsibility for the design, construction and maintenance of roads, highways, bridges, storm sewers, public buildings and other civil works. Other functions include urban and town planning, provision of architectural and engineering of infrastructure required for Government. The Ministry has a Special Implementation Unit (now transformed in an Infrastructure Implementation Unit) charged with the implementation of both urban and rural infrastructure works on behalf of the Ministry

Ministry of Planning and Economic Affairs

Côte d'Ivoire - Liberia - Sierra Leone - Guinea Interconnection Project (Liberia ESIA)

This Ministry is responsible for national development planning, project preparation and coordination. It provides technical guidance to all governmental agencies in preparation of development programs and projects.

Ministry of Health and Social Welfare

The Department of Environmental and Occupational Health in this Ministry handles matters relating to water and sanitation. It conducts sanitary inspections in public eating places including drinking water surveillance; construction and/or supervision of water wells and pit latrines and the promotion of community health education. The Department of social welfare handles repatriation and resettlement of internal and external displaced people in Liberia.

Ministry of Lands, Mines and Energy

The Ministry of Lands, Mines and Energy supervises the development and management of water resources and conducts scientific and technical investigations required for environmental assessments. The implementation of water and sanitation activities is done through the Department of Mineral and Environmental Research. The Ministry's mandate dictates that it must be involved in Special projects on the evaluation of urban sanitation, particularly the provision of guidance for geotechnical investigation of solid wastes landfill disposal sites. The Bureau of Land Survey of this Ministry is the technical section of the Government that handles land demarcation and land survey.

Environmental Protection Agency (EPA)

The EPA is mandated to set environmental quality standards and ensure compliance with pollution control. It is responsible for the provision of guidelines for the preparation of Environmental Assessments and Audits, and the evaluation of environmental permits. These may include certification procedures for landfill and other activities potentially dangerous to the environment.

Liberia Refugee Resettlement and Reintegration Commission (LRRRC)

The LRRRC has the mandate to resettle and reintegrate Liberian Refugees that were externally displaced during the Liberian civil war. The LRRRC is also responsible for resettlement of disaster victims in time of natural or man-made disaster. These may include acquisition of land for refugees or disaster victims.

With reference to the capacities of these institutions, it is recommended that the relevant sections of these institutions responsible for resettlement coordination and implementation be trained and the resources be provided.

5.3.6.3. Some Socio-economic Benefits

There is a need that settlements within the influence of the transmission line corridor obtain some benefits from the line such as shield wires to supply electricity for street lighting, schools, health centers, social gathering areas such as palava huts, and other public buildings, and solar systems street lighting. It is essential that this is done in order to minimize the risks of vandalism of the transmission line. Nowadays it is unacceptable that power lines go over the head of communities without any benefits, since this create conflicts

To contribute to enhancing the quality of living of the communities in the influence of the proposed Project, it is necessary to encourage the SPC to be established to manage, own and operate the entire Project to hire the properly trained local residences to as a bush clearing worker or transmission monitoring ranger during the operation phases. By creating regular employment opportunities like this, the benefit from the proposed Project will be maximized and thus it will contribute to local villages' income increase and development.

5.3.6.4. Gender issues related to the proposed Project

The government has been making efforts to spur economic growth and thereby reducing poverty and unemployment, by considering the needs and aspirations of all men, women, boys and girls across economic, social and cultural lines. Mechanisms for implementation of the Policy are currently being developed.

However, it is recommended that a Gender Officer in Special Purpose Company (SPC) represents the organization and a draft Gender Policy for SPC is in place.

Below are some aspects that the transmission line project can contribute to mitigate the gender inequalities and improve life for women:

- ❖ sensitization on the importance of electricity access on social responsibilities of importance to women such as lighting at home; assisting school going children with homework and reading;
- ❖ safer streets at night with lighting;
- ❖ water collection in the absence of electric water pumping close to home;

- ❖ child healthcare in the absence of health centers with reliable and affordable power necessary to maintain the cold chains, particularly for vaccines.

Furthermore, the SPC needs to work towards reducing gender disparity at a corporation level. This has necessitated changes in recruitment policy and training opportunities. The implications for the proposed Project are that similar equal-opportunity recruitment policies will be applied at construction and operation phases. This is expected to ensure recruitment of female employees during construction of the transmission line.

More generally, better access to electricity will promote income generating activities at home which would benefit both women and men. In addition to large scale industry growth, reliable electricity supply will enable the growth of small scale industries which employ or serve women such as grain mills and other food processing activities like sugar syrup making.

Some negative gender related impacts may also be expected, particularly resulting from the planned resettlement exercise, which will cause disruption of economic activities. Cognizant of the fact that a number of the households targeted for resettlement are headed by women, the proposed Project has put in place mechanisms to ensure that the resettlement and compensation packages are designed for equality, for example, ensuring that access to, and mode of payment for compensation packages, land access and dispute resolution system are not biased against female-headed households and other vulnerable groups.

Therefore, the gender disparities can be enhanced by the Transmission line project as described above.

5.3.6.5. Strategy for vulnerable groups

Members of vulnerable groups are often not able to make their voice heard effectively, and account will be taken of this in the consultation and planning processes, as well as in establishing grievance procedures. They are often physically weaker, and may need special help in the relocation/disturbance phase. In particular, female-headed households may lose out to more powerful households when assets will be demolished to make way for the transmission line.

Therefore, old people, women and children shall be considered for additional assistance and need special attentions to ensure that they are supported to be benefited from compensation entitlement and other mitigation measures.

These actions are needed to be provided to old people, women and children:

- ❖ Vulnerable Groups including the poor, sick, orphaned and vulnerable children need to be given priority in employment opportunities arising from the proposed Project.
- ❖ Unskilled labor should be drawn from local communities among women, and income generating opportunities for women will be considered during project construction in the form of food preparation and sale to workers.
- ❖ To pay equal remuneration to men and women workers for same work or work of a similar nature is recommended at the project level.
- ❖ Households only inhabited by old or feeble shall be given full assistance in building new homes.

Further during construction, it is recommended to identify appropriate micro-programs that could be provided under the proposed Project such as revolving fund financial incentives and assistance for housing construction among others at the government level.

5.3.6.6. Grievance resolution

Grievances are sometimes raised by some project-affected persons (PAPs) during this phase of the proposed Project. Grievance resolution procedures have therefore been put in place with the sole objective of minimizing disputes that may arise in relation to the compensation payments. The grievance/dispute processing and settlement mechanism will be based on the following:

- ❖ **Grievance Redress Committee:** There shall be a grievance redress committee made up of representatives from the counties (the county Development Committee), the County committees and the project implementers. This committee shall hear disputes regarding displacements and cases and shall only be referred to arbitration or courts of law when the grievance redress committee is unable to resolve an issue. Arbitration shall be an option for grievance redress where the parties involved in agree to resolve their dispute through arbitration.
- ❖ **Arbitration:** The parties are at liberty whether or not to name an arbitrator in the agreement. Where an arbitrator is not named in the agreement, the agreement should designate a person who would be appointed as an arbitrator.

- ❖ **Courts of Law:** It should be noted that arbitration only works where the parties to a dispute agree to resolve a difference through arbitration. Where there is no consent, then a court of jurisdiction may be used to resolve a dispute.

5.3.7. Effects on birds/animals

Mitigation techniques have generally focused on making the line more visible to birds. Many marking devices have been used worldwide, showing varying degrees of effectiveness. The two types that are commonly used are Bird Flight Diverters and Bird Flappers. A special device for night-time collisions is the Mace Bird Lite. In areas of known bird flight paths, those will be placed on the overhead transmission line. Appropriate/standard cable spacing and Installation of making devices should be done. The recommendation proposed by the World Bank was to ensure that the lines passing through the Important Bird Area (IBA). Making devices will make them more visible and reduce collisions.

- ❖ **Bird Flight Diverters**

Bird Flight Diverters (BFD's) were developed in Europe. Various studies have proven that the attachment of these devices onto powerline conductors can significantly reduce the collision rate of birds, by increasing the visibility of the powerline.

- ❖ **Bird Flapper**

Bird Flappers are a South African invention and have been used in South Africa since 1995, but only since 2001 has a mechanically acceptable product been commercially available. The Bird Flappers, if applied correctly, have proven to be more effective than the Bird Flight Diverter in comparative experiments. The Bird Flapper is available from Preformed Line Products in Pietermaritzburg.

- ❖ **Mace Bird Lite**

The Mace Bird Lite is a Perspex tube with a fluorescent tube inside. It is mounted on the overhead ground wire and the light is energized by the ambient electrical field generated by the conductors. It is reported to have worked well for curbing flamingo mortality on powerlines. No scientific data is available on the effectiveness but it is generally claimed to be effective.

Adequate grounding of towers to cater for 'step effect' on animals in the forest reserves will be provided.

5.3.8. Fire hazards

Potential fire hazards as a result of electrical faults will be minimized by adhering to technical specifications relevant to electrical safety. The use of low quality components, inadequate sizing of cables and negligent execution of works and general non-observance of safety rules will be avoided to minimize the potential hazard of electrical fires. Also, the operating personnel will be sufficiently trained in connection with electrical safety measures and their observance. Proper and sufficient supervision of workers will be undertaken.

In addition, the SPC will not allow the use of fire for the maintenance of vegetative growth within the RoW. Bush fires originating from the activities of farmers, hunters and palm wine tappers will be minimized through public education.

It is expected that the full implementation of the measures above will minimize the occurrence of fires.

5.3.9. Impact on telecommunications

A mitigating factor for this potential impact is the fact that the proposed transmission line route traverses mainly farmlands and potential agricultural lands. Efforts have been made to avoid built up areas and therefore the possibility of the transmission lines passing close to Telecom lines will be avoided.

In addition, the telephone lines normally run within road reservations, whereas the proposed transmission line has been routed outside road reservations.

Even when the transmission line crosses over telephone lines, the vertical distance between the two lines will ensure that interference is non-existent or minimal.

5.3.10. Substation

Impacts due to the operation of the substation have been discussed in section. These are some of the mitigation measures proposed for the potential impacts.

5.3.10.1. Fire hazards

The best defense against fire outbreaks is to ensure they are not caused at all. The SPC shall be well aware of the potential disastrous consequences of fire outbreaks on its

substations. Measures are therefore put in place to ensure that fires do not break out in the substations.

Prior to the operation of a substation, and as part of project planning, the in-house SPC Fire Service will carry out a fire survey on the premises to identify peculiar firefighting equipment for each substation. These pieces of equipment will be purchased and installed at vantage positions within each substation in addition to the standard water hydrants and fire extinguishers provided for all the substations. This will ensure that a substation remains in a high state of preparedness against potential fire outbreaks.

In addition, a fire buffer (vegetation break) will be created and maintained around the fencing to ensure that potential bush fires are not able to affect the substations.

5.3.10.2. Avifauna

The SPC shall ensure that good housekeeping is kept at all times in the substations. Bird nests in areas likely to cause electrical faults shall be promptly removed and transferred to nearby trees, if practicable.

5.3.10.3. Earthing of equipment

There will be adequate earthing of equipment to prevent shocks and malfunctioning of protection equipment

6. MONITORING PROGRAMME

A monitoring program has been developed to determine impacts on the physical, biological and socio-economic/cultural environments within the project's area of influence and around the proposed substations.

The monitoring results are expected to indicate whether the predictions of potential environmental impacts are accurate and also whether the mitigation measures proposed for the management of the impacts are appropriate and adequate. The program will also serve as an early warning system by revealing unforeseen impacts and allowing additional corrective measures to be implemented to arrest the situation and ensure that irreversible damage is not caused.

The program is also expected to provide useful guidance for the successful planning and implementation of future power transmission line projects that will be undertaken by the SPC.

The monitoring program has been developed for the following parameters:

It is recommended that the Consulting Engineer be given the responsibility, by contractual arrangement in order to monitor the adequate implementation of the CESMP.

The chapter for Contractors' obligation and legal requirements is included as the elements to be monitored by implementation agency.

To ensure the effective monitoring activities, some measureable indicator was taken into consideration in this chapter based on international guidelines. According to the Environmental, Health, and Safety Guidelines for the Electric Power Transmission and Distribution of the World Bank Group dated April 30, 2007, the power transmission and distribution sector does not typically give rise to significant air emissions or effluents. Thus potential air and water pollution caused by the transmission line project is expected to be negligible.

The specific guidelines regarding air and water pollution restriction at the Environmental, Health, and Safety Guidelines of the World Bank Group are only relevant for power

generation. Therefore, control of the noise level is the only suitable for the measurable performance indicator during the construction of this project.

The environmental standards and guideline of Liberia is shown in Appendix 7 as a reference.

6.1. General

6.1.1. Noise pollution

Air, water and noise pollution are not yet a serious environmental problem in the related four countries but there is some concern about the effects related from new development projects.

According to the Environmental, Health, and Safety Guidelines for the Electric Power Transmission and Distribution of the World Bank Group dated April 30, 2007, the power transmission and distribution sector does not typically give rise to significant air emissions or effluents. Thus potential air and water pollution caused by the transmission line project is expected to be negligible.

The specific guidelines regarding air and water pollution restriction at the Environmental, Health, and Safety Guidelines of the World Bank Group are only relevant for power generation. Therefore, control of the noise level is the only suitable for the measurable performance indicator during the construction of this project.

The measurable performance indicator for noise level is shown below:

Noise level Guidelines

Receptor	One Hour L _{Aeq} (dBA)	
	Daytime (7:00 - 22:00)	Nighttime (22:00 – 07:00)
Residential; institutional; educational	55	45
Industrial; commercial	70	70

6.1.2. Water quality of rivers/streams

At any point during construction the rivers and streams close to the site(s) where constructional activities are being carried out will be sampled and analyzed weekly at locations just before and just after the river or stream crosses the RoW. During the maintenance phase monitoring will be carried out twice yearly. The relevant parameters that will be considered for analysis are:

- ❖ BOD

- ❖ pH
- ❖ DO
- ❖ Turbidity
- ❖ Total suspended solids
- ❖ Conductivity
- ❖ Total coliform

6.1.3. Vegetation clearing

During the constructional phase, clearing of vegetation cover within the tower corridor and access tracks and the tower base areas will be monitored carefully to ensure that the minimum area requirements are not exceeded. Individual tree felling activities will be monitored to ensure that environmental and safety measures proposed under mitigation are fully implemented. Clearing of vegetation and cutting of trees within the RoW but outside the tower corridor track will be monitored to ensure that the specified height of 1.25m is complied with. Monitoring will also ensure that fire is not used for vegetation clearing.

These measures, apart from the clearing of tower base areas, are also relevant for vegetation maintenance during the operational phase.

6.1.4. Transportation effects

The following parameters/activities will be monitored:

- ❖ Speed limits of vehicles especially within settlements. Random checks on speed limits of vehicles will be carried out daily.
- ❖ Loading of vehicles. Vehicle loading procedures will be monitored at all loading points to ensure that materials and equipment are properly secured in truck/vehicles.
- ❖ Covering of vehicles conveying dust-generating materials. Random checks will be carried out daily on vehicles.
- ❖ Trucks/vehicle conditions and maintenance (i.e. road worthiness of vehicles). Daily checks on conditions of vehicles. A monthly check will also be conducted on vehicles to ensure that maintenance schedules are adhered to.
- ❖ Vehicular accident records. All vehicular accidents or dangerous occurrences relating to vehicles will be recorded in the accidents record book or register.

6.1.5. Occupational safety and health issues

The availability and use of personal protective equipment will be closely monitored continuously during both the constructional and operational phases. All employees who

refuse to use the protective equipment provided will be properly sanctioned. To ensure that personal protective equipment is always readily available, all equipment will be promptly replaced.

Regular safety tests as recommended by manufacturers will be conducted on equipment such as cranes and winches.

6.1.6. Fire hazards

In order to prevent any outbreak of fires construction work will be monitored continuously to ensure that the execution of works is done adhering strictly to technical specifications relevant to electrical safety. The use of low quality components, inadequate sizing of cables, negligent execution of works and general non-observance of safety rules will be monitored regularly. Proper and sufficient supervision of workers will be monitored.

6.1.7. Dewatering operations

Dewatering of tower base excavations will be monitored to ensure that de-silting of the wastewater is achieved to minimize the potential impact of polluting water bodies with suspended earth matter.

6.1.8. Waste management

Wooden containers should not be used by the local communities as fuel wood as they may contain chemicals. The collection and use of wooden wastes as fuel wood by the local communities will be monitored on monthly basis. Also, the collection and sale of scrap metal to dealers will be monitored monthly to ensure that metal wastes are managed efficiently. The management of other solid wastes will be monitored on weekly basis to ensure that the wastes are collected promptly and disposed of at appropriate public waste dumping sites.

The cleanup of accidental spills of oil, fuel and paints whenever they occur will be monitored to ensure that the cleanup is promptly and properly done.

6.2. Transmission lines

Transmission lines will be monitored annually through aerial inspections for signs of damages and/or deterioration of insulators and accessories. Replacements of any such damaged parts will be promptly carried out.

6.2.1. Public/Worker safety

Occurrences of accidents involving transmission lines and structures that affect public safety or worker safety will be monitored and recorded whenever they happen. The frequency and severity of such occurrences will be recorded. This will eventually indicate whether additional mitigation measures are required to make the system safer.

6.2.2. Identification of project-affected persons and compensation payment

Monitoring of project-affected persons will be carried out for two years to ensure that all affected persons have been identified and payment of adequate compensation duly effected without further delay.

6.2.3. Protection of Biodiversity of the project area

During constructional phase biodiversity of the project area may be affected, albeit minimally. Records of flora and fauna disturbances will however, be maintained and monitored on a quarterly basis to ensure that their environment is protected and preserved

6.3. Substations

During the operational phase of the proposed Project the substations will be monitored to ensure that they comply with all regulatory requirements. Parameters that shall be monitored shall include the followings:

6.3.1. Fire safety

Each substation will be monitored once a year to ensure that all installed fire extinguishers and water hydrants are in working conditions and that all extinguishers have been recharged. The perimeter of the substation shall also be inspected to ensure that the vegetation barrier (fire buffer) created against bush fires is well maintained.

6.3.2. Storm water quality

Storm water being discharged from the network of drains at each substation will be sampled and analyzed quarterly for the first year of operation and twice yearly for all subsequent years. Relevant parameters that will be considered for analyses are:

- ❖ BOD
- ❖ pH
- ❖ DO
- ❖ Oil and grease

6.3.3. Noise

Operating noise levels of each substation shall be monitored to ensure the levels do not go beyond the guideline limit values.

6.4. Occupational safety, health and welfare

The safety health and welfare of the workers is of paramount importance to the SPC. Monitoring shall therefore be carried out on occupational safety and health within each substation during its operational phase. Parameters to be monitored shall include, but not limited to:

6.4.1. Personal protective equipment

The provision and use of Personal protective equipment shall be monitored on a monthly basis to ensure workers are well protected against the hazards of the workplace.

6.4.2. Good housekeeping

Management will ensure that good housekeeping is maintained at all times on the premises. All weeds springing up through the stone carpet of each substation shall be physically removed. The buffer zone of each substation shall also be monitored on a daily basis to ensure that there is always a fire break at the perimeter.

The premises will be monitored to ensure that potential nesting places of birds are kept free of bird nests that are likely to cause electrical faults.

6.4.3. HIV/AIDS

In addition to the HIV/AIDS education of the workforce by the Health Services Department of the SPC, the SPC will, in close cooperation with the County Health Management Team of each of the Counties, monitor the incidence rate of the counties for any drastic changes during the construction stage of the project cycle.

Even though this monitoring program could be useful, the SPC will ensure, through its educational program that safe sex is practiced by the construction teams so that incidences of the disease due to activities of the construction crew are prevented.

6.5. Chance Find Procedure

During the constructional phase, cultural/archaeological 'chance finds' - sites of cultural significance such as sacred woods or trees or rock outcrops and historical or archaeological

heritage/items or sites which the local residents may not have mentioned at the survey stage will be monitored to ensure that such sites or items are properly managed to the satisfaction of both the local communities, the EPA and/or other relevant authorities.

The “Chance Finds” procedure will be included in the ESMP and will be covered in the contract for civil works, referring to the small areas to be occupied by towers and substations. If in case there is any archaeological site in any of the proposed camp sites, measures will be taken to change such a site.

In the event that an archaeological resource is discovered during the construction process a Chance Find Procedure such as a rapid archaeological survey will be implemented in substation and camp site. This procedure needs to be included in the Contractor’s EMP (Environmental Management Plan).

A Chance Find Procedure as described in Performance Standard 8 of IFC is a process that prevents archaeological sites from being disturbed until an assessment by a competent specialist is made and actions consistent with the requirements of PS8 are implemented. It is a project-specific procedure that outlines what will happen if previously unknown physical resources are encountered during project construction or operation. The procedure includes record keeping and expert verification procedures, chain of custody instructions for movable finds, and clear criteria for potential temporary work stoppages that could be required for rapid disposition of issues related to the finds. In accordance with this Procedure, work will cease on a site where archaeological material is found. The consulting engineer will inspect and secure the site, and will then contact the monitoring agency for advice and arrange for a survey or salvage work as appropriate.

6.6. Contractor’s obligations and legal requirements

Prior to the commencement of construction works, all contractors should be required to prepare their own ESMPs (CESMP). The plan should be included in the bidding documents and in the contractor’s contract and spell out environmental targets and objectives as outlined in the ESIA/ESMP and how these could be achieved. The Contractor’s ESMP (CESMP) shall include, to the extent practicable, all steps to be taken by the Contractor to protect the environment in accordance with the current provisions of national environmental regulations, the World Bank Groups Environmental Health and Safety General Guidelines and the Environmental, Health and Safety Guidelines for Electric Power Transmission and Distribution, 2007 as well as the ESIA/ESMP for this project. Provision should be made for

the disposal of chemical/ hazardous wastes as the local facilities do not exist for hazardous waste disposed. Also, for more complex environmental management aspects, the Contractor needs to prepare and implement Method of Statement which needs to be approved by the Supervising Engineer and the SPC upon request.

In order to ensure adequate implementation of the CESMP and specific Method of Statement, the Contractor needs to employ environmental staff for the proposed Project.

Notwithstanding the Contractor's obligation spelt out above, the Contractor shall, in addition, endeavor to implement all measures necessary to restore the project sites to acceptable standards and abide by environmental performance indicators specified in the ESIA/ESMP to measure progress towards achieving objectives during execution or upon completion of any works. These measures shall include but not limited to the following:

- ❖ Minimizing the effect of dust on the surrounding environment resulting from earth mixing sites, asphalt mixing sites, dispersing coal ashes, vibrating equipment, temporary access roads, etc. to ensure safety, health and the protection of workers and communities living downwind of dust generating activities.
- ❖ Ensuring that noise levels emanating from machinery, vehicles and noisy construction activities are kept at a minimum for the safety, health and protection of workers within the vicinity of high noise levels and communities near rock-blasting areas.
- ❖ Ensuring that existing water flow regimes in rivers, streams and other natural or irrigation channels is maintained and/or re-established where they are disrupted due to civil works being carried out.
- ❖ Preventing bitumen, oils, lubricants and waste water used/produced during the execution of works from entering into rivers, streams, irrigation channels and other natural water bodies/reservoirs and also ensure that stagnant water in uncovered borrow pits is treated in the best way to avoid creating possible breeding grounds for mosquitoes.
- ❖ Preventing and minimizing the impacts of quarrying, earth borrowing, piling and building of temporary construction camps and access roads on the biophysical environment including protected areas and arable lands; local communities and their settlements. In as much as possible restore/rehabilitate all sites to acceptable standards.

- ❖ Ensuring that the discovery of ancient heritage, relics or anything that might or believed to be of archeological or historical importance during the execution of works is reported to the Museums and Monuments Board in fulfillment of measures aimed at protecting such historical or archaeological resources.
- ❖ Discouraging construction workers from engaging in the exploitation of natural resources such as hunting, fishing, and collection of forest products or any other activity that might have a negative impact on the social and economic welfare of the local communities.
- ❖ Implementing soil erosion control measures in order to avoid surface run off and prevents siltation etc.
- ❖ Ensuring that garbage, sanitation and drinking water facilities are provided in construction workers camps.
- ❖ Ensuring that in as much as possible, local materials are utilized to avoid importation of foreign material and long distance transportation.
- ❖ Ensuring public safety and meeting traffic safety requirements for the operation of moving machinery in order to avoid accidents.
- ❖ Discouraging the use of foul or infuriating words on project-affected persons (PAPs) or any other persons seeking information on the proposed Project by construction workers. All such persons and grievances should be politely referred to the appropriate authority for redress.
- ❖ In the event that an archaeological resource is discovered during the construction process a Chance Find Procedure such as a rapid archaeological survey will be implemented in substation and camp site.

6.6.1. Contractor's obligation and legal requirement for the protection of animals in the project area

Prior to the commencement of construction works all contractors should be required to prepare their own EMPs. The plan shall spell out environmental targets and objectives in so far as the protection of animals is concerned in the project area. The Contractors EMP shall include, to the extent practicable, all steps to be taken by the Contractor to protect the animals in the project area in accordance with the current provisions of Forestry Act, 1988, its Regulations, 1989, Wildlife Act, 1972 and the Environment Protection Agency Act, 2008. Notwithstanding the Contractor's obligation spelt out above, the contractor shall, in addition, endeavour to:

- (a) Ensure that the animals, especially those detailed in Table 12 and 13, be preserved and protected. In situations where construction phase of the project disturbs these animals, the Contractor shall ensure that requirements of the C.B.D., CITES, Forestry and Wildlife Acts and Regulations are applied;
- (b) Prevent and minimize the disturbance to the specific habitats of mammals, birds, amphibians, snakes and insects that are considered vulnerable and endangered.
- (c) Ensure re-forestation, limit of 1.25 m cutting of grass, and caution in cutting down of trees;

Table 24: Summary of impact, mitigation, net effect analyses and monitoring

Project Activity	Potential Impacts	Location	Proposed Mitigation	Net Effects	Monitoring
Line route survey & Design stage	Impact on potential sensitive ecological or inhabited area	Entire RoW	Adequate selection of RoW by avoiding these areas with detailed line route survey during the design stage	Negligible	Monitoring and Identifying the potential sensitive ecological or inhabited areas located along the RoW
Line route survey & Construction	Loss of crops	Almost entire RoW & access tracks	Prompt, fair compensation payment	Negligible	Monitoring the loss of crop to be minimized the loss of crops as much as possible
Construction	Loss of structures	Certain parts of line route	Prompt, fair compensation payment for resettlement	Removal from historical/ancestral roots	Monitoring during construction & operation to ensure all PAPs are adequately and fairly catered for
	Loss of land And land use conflict	Entire RoW & access tracks	Prompt, fair compensation payment	Removal from historical/ancestral roots	Monitoring during construction & operation to ensure all PAPs are adequately and fairly catered for
	Noise impacts	Communities and settlements close to RoW	Avoidance (as much as possible) of work at night	Minor disturbance during daytime	Ambient noise levels shall be measured once every week in communities close to RoW
	Oil and grease	Entire RoW & access tracks	Regular maintenance of the heavy machinery	Negligible	Monitoring during the construction whether harmful oil or grease are leaked
	Air quality	Communities and settlements close to RoW	Spray the exposed soil surfaces of the tower corridor track as and when needed	Negligible	Monitoring – none
Construction	Potential soil erosion	Entire RoW & access tracks	Limit land clearance to minimum area required and early revegetation	Negligible	Monitor land clearance
Construction & operation	Public safety 1. Open excavations 2. Potential electrocution	Entire RoW & access tracks	Tower base excavations in or near settlements or farms will be clearly marked and made inaccessible to the public.	Negligible	Routine inspections of towers during operational phase

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Project Activity	Potential Impacts	Location	Proposed Mitigation	Net Effects	Monitoring
	3. Potential collapse of towers 4. Others		All towers will be clearly marked with a red inscription on white background - "DANGER – 225,000 Volts" to warn off trespassers, etc.		
	Flora and Fauna	Entire RoW & access tracks	Limit clearance of vegetation	Negligible	Monitored carefully to ensure that the minimum area requirements are not exceeded
	Occupational safety and health	Entire RoW & access tracks	Provision of personal protective equipment. All work to be done according to Safety Rules and Regulations of LEC as well as the World Bank Group EHS Guidelines of 2007 (General and Electric transmission and Distribution)	Negligible	Availability and use of protective equipment.
Construction	Impacts on cultural and historical/archaeological sites/items	Cultural/historical/archaeological chance finds	Chance finds to be reported to appropriate authorities as a part of the contractor's contract	Negligible	Areas of chance finds will be monitored and secured in order to be handed over to Museums and Monuments Board.
	Public health-STDs/HIV AIDS	Mainly settlements along RoW	Education of workers to avoid casual sex. Supply sufficient quantities of good quality free condoms to workers	Potential single mothers, transmission of STDs/AIDS	Keep close contact with communities during construction to detect incidences of STDs/AIDS
	Traffic impacts	Relevant roads indicated in report	Use of traffic wardens to control traffic at road crossings Development of Traffic Control Plan	Negligible	Presence of traffic wardens at all times during construction. Review the contractor's Traffic Control Plan
	Water pollution	Rivers indicated in the report	Minimize erosion and manage excavated materials, wastewater from excavations and accidental spillage of oil, fuel and paints	Negligible	Streams close to the site(s) of construction to be sampled and analyzed weekly. During the maintenance phase monitoring will be carried out twice yearly.
Construction & operation	Solid Waste generation	Entire RoW & access tracks	Trees, tree stumps and wooden containers not to be given out to the local communities as fuel wood. Usable trees and wood from the RoW clearing should be given out to the local communities. Metal wastes to be collected and disposed of appropriately and/or recycled in consultation with relevant government agencies.	Negligible	Collection and disposal of solid waste to be monitored
Operation	Effects of rust treatment and painting of	Tower locations	Spilt paint to be quickly mopped up with rags and/or sawdust. The used	Negligible	No monitoring

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Project Activity	Potential Impacts	Location	Proposed Mitigation	Net Effects	Monitoring
	towers		sawdust and rags will be disposed of at appropriate public waste dumping sites.		
	Micro shock from a spark discharge	RoW	Minimized by multiple earthings	Negligible	Monitor earthing cables
	Fire hazards	RoW	Public education on hazards of bush burning	Negligible	Routine patrols to discourage bush burning
Construction & operation	Employment generation and incomes	Settlements along RoW	Encourage contractors to engage local labour	Standard of living improved	None
	Vulnerable group	Settlements along RoW	Given the priority in employment	Standard of living improved	None
	Gender disparities	Settlements along RoW	Sensitization on the important Equal job opportunities for women	Standard of living improved	None

7. PROVISIONAL EMP, INSTITUTIONAL ARRANGEMENTS AND TRAINING

The Provisional Environmental Management Plan (PEMP) details active remedial measures and monitoring activities to be continuously carried out to prevent or minimize impacts on the physical, biological and socio-economic/socio-cultural environments as well as to promote occupational safety and health of employees.

7.1. Policy on Environment, Safety and Health

The SPC and its employees will be committed to minimizing the impact of its operations on the environment. SPC will accordingly adhere to the principles of sustainable energy development and contribute to the welfare of people (or communities) adversely affected by its operations.

SPC to be established to manage, own and operate the entire Project will:

- ❖ Comply with all relevant and existing legal obligations on environment, particularly:
 - Promote open communication and dialogue in addressing environmental issues.
 - Establish an environmental management system (EMS) with a view to ensuring continuous improvement, through:
 - ✓ Collaboration with other agencies in pursuit of its environmental management objectives and programs.
 - ✓ Support for research, development and technology applications to enhance efficiency of resource management.
 - ✓ Contribution to the formulation of public policy and programs that promote sustainable development especially in areas affecting its core business and those of its subsidiaries.
- ❖ Educate, train and motivate its employees about environment.
- ❖ Assist in improving the standard of living of communities adversely impacted by its operations.

Specific Objectives

- ❖ Establish an environmental management system (EMS), which ensures integration of environmental concerns in all areas of planning and decision-making, due diligence, risk minimization, monitoring and continuous improvement of the environment.
- ❖ Comply with both national and international conventions of the environment.
- ❖ Actively promote environmental awareness and individual sense of responsibility through education, training, and motivation.
- ❖ Promote open communication on environmental issues.

- ❖ Support research, development and technology applications to enhance efficiency of resource management.
- ❖ Contribute actively to the formulation of public policy and programs that promote sustainable development in the energy sector.
- ❖ Assist in improving the standard of living of communities in the SPC's areas of operation.

7.2. Environmental management system

In order to maintain control over the implementation of the proposed Project and also ensure that commitments made in the ESIA are acted upon in a comprehensive and acceptable manner, an Environmental Management System and Training Programme is developed in this section. This program will help to identify personnel, responsibilities and training requirements for the proposed Project Environmental Management Team to be constituted.

7.2.1. Environmental management structure

The Authority of ECOWAS Heads of State and Government in January 2008 enacted the WAPP Transmission Line Implementation Strategy (TLIS), which gave authority to the WAPP Organization to use SPCs (Special Purpose Companies) as means to accelerate the implementation of a number of cross-border transmission projects among its member power utilities, in particular the WAPP CLSG Power System Re-Development Sub-program.

Although the WAPP-SPC Establishment Study has been initiated it is certain that the formation of the actual WAPP-SPC would take some time. It is therefore proposed that a Project Implementation Unit (PIU) should be set up to be broadly responsible for preparing the implementation and operation of the proposed Project until the SPC is formed. The details of how this PIU is best to be set up are not yet clear. Therefore, a study, named "*Establishing the WAPP CLSG Project Implementation Unit*", has been carried out to develop a suitable structure of the WAPP CLSG PIU and to make well-founded recommendations on how this PIU is best to be set up and operated by the separated consultant. The present structure of PIU in this report is based one of the options regarding the PIU establishment suggested on that study.

7.2.1.1. Organisational structure of the PIU

Project Implementation Unit (PIU)

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The primary mandate of a PIU under this setup is to oversee the construction of the proposed Project and ensure compliance with the terms of the construction contract. The PIU setup therefore must cover all the functions and be fully in place when field work is about to commence; ie about six months after contract award.

The set of skills required (by the PIU) to perform its construction oversight mandate is significantly different from the skills required for project preparation, bidding, evaluation and award. Therefore;

- ❖ Pre-Award tasks are best assigned to a competent Owners Engineer.
- ❖ A representative of the SPC or project sponsors however needs to be assigned to provide the administrative focus, coordination and follow-up necessary for the preparation on schedule of such a complex project. This role could best be performed by the Project Director of the PIU.

To provide the required day-to-day follow-up, coordination and facilitation of the Pre-award activities to be performed by the Owners Engineer and others, the Project Director of the PIU (eg. the Project Director) should be recruited and available during the Pre-Award phase if the project is not to be delayed.

It is recommended that the PIU be headed by a Project Director who has overall responsibility for the proper implementation of the proposed Project as well as the management and functioning of all the other PIU staff and resources. The Director being the head of the PIU is to be stationed at the Head Office. The Director is expected to make quarterly visits to the project site or field offices.

Environment & Community Relations Unit (ECRU)

It is necessary to set up the Environment & Community Relations Unit (ECRU) as a substructure of PIU to deal with environmental and social aspects of the proposed Project.

The ECRU will be responsible for the following:

- ❖ Ensuring project's compliance with all relevant environmental, social, health and safety regulations
- ❖ Liaising with all relevant regulatory bodies and organizations - EPA, Ministry of Land Mines and Energy and the National Social Security and Welfare Corporation (NASSCORPS)

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- ❖ Formulation and review of environmental and social policies and practices associated with projects
- ❖ Liaising with relevant LEC Departments on all health, environmental, safety and social matters connected to the proposed Project
- ❖ Assisting in the education and training of project staff in environmental, social and safety awareness
- ❖ Making budgetary provisions for projects' environmental programs
- ❖ Undertaking environmental and social monitoring activities for projects

Owner's Engineer

The Owners Engineer shall have full technical responsibility for the Pre-Award tasks; ie. preparation, issuance and clarification of bidding documents; as well as serve as the technical expert for the Evaluation of Bids, Negotiation and Award of construction contracts. They need to be made responsible, by contractual arrangement, for the adequate implementation of the ESMP of the proposed Project.

The role of the Owner's Engineer shall however change after the award of contracts to become one of providing technical support to the PIU for the construction phase. Accordingly, the Owners Engineer is expected, during the construction phase, to:

- ❖ Undertake the review and approval of detailed designs by experts at its Home Office while supporting with occasional site advisory visits as needed.
- ❖ Provide a Resident Team in the field (e.g. comprising Project Engineer and one other expert) to provide technical direction for works supervision.
- ❖ Review, approve and monitor Implementation of the Contractor's EMP (CESMP)
- ❖ Request the Contractor to submit Traffic Control Plan (TCP) and specific Method of Statement for complex environmental management aspects if necessary
- ❖ Day to Day supervision and surveillance of environmental and social activities in the field
- ❖ Report the monitoring results to PIU regularly

7.2.1.2. Job description of PIU staff

Project Director

The Project Director bears overall and executive responsibility for achieving the desired project objectives on time and within budget. He/she is to coordinate all project activities

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from initiation to completion; using appropriate project management tools, techniques, creativity and suitable management skills to reach the predetermined objectives.

As the executive head of the units, the Project Director is also to provide leadership to the Project Implementation Unit, whose functions include engineering design approvals, construction supervision, quality assurance/quality control, cost control, payment certification, contracts management, health & safety and environment compliance for the satisfactory execution of the proposed Project works.

The detailed job description of the Project Director includes the following:

- ❖ Coordinate all pre-award and preparatory activities, especially of the Owners' Engineer, and also expedite the actions of all project sponsors/stakeholders for the effectiveness and availability of the funding for the proposed Project.
- ❖ Coordinate tendering, evaluation, negotiation, award and execution of construction contracts for the works.
- ❖ Conceptualize and prepare the overall project plan & execution strategies for review and approval, and manage the approved plan to achieve project deliverables and objectives.
- ❖ Provide technical and administrative direction during the implementation of the proposed Project.
- ❖ Engage, procure, deploy and effectively manage all human and material resources of the PIU.
- ❖ Manage the interface between the proposed Project and project affected persons.
- ❖ Liaise with SPC Management, WAPP-JIC (Joint Implementation Committee), National Authorities and Funding Partners on project related matters.
- ❖ Monitor and report regularly on the status/progress of work, cost, schedule, anticipated challenges and risk facing the proposed Project as well as the evolution of any contractual issues.
- ❖ Develop a cost report per month that details costs and expenditure for the period, forecast for completion of the proposed Project with an aim of minimizing the variance.
- ❖ Promote team work and a spirit of co operation among PIU employees and guide, drive and motivate the team to achieve project goals.

The Project Director will supervise and control all PIU staff and will be answerable and subject to the authority of the SPC for the performance of the PIU. The Director would have to coordinate the work of the Owners' Engineer.

Environmental Coordinator

The primary responsibility of this staff is the acquisition of environmental permits and Right of Way (RoW) and ensuring of environmental compliance by the project team. He/she is to arrange crop and property enumeration and facilitate the prompt payment of due compensation. He/she is to ensure adherence to the Environmental and Social Impact Assessment and report on the Environmental Management Plan and Resettlement Action Plan, and oversee community relation activities.

- ❖ Facilitate processes for acquisition of environmental permits and Rights of Way (RoW)
- ❖ Arrange the preparation and review of Environmental Management Plans and Resettlement Action Plans and coordinate their implementation.
- ❖ Coordinate the activities of the relevant institutions for the enumeration of crops and property and the processing of compensation payments
- ❖ Coordinate community interactions and activities with Project Affected Persons.
- ❖ Enforce environmental mitigation measures as well as social safeguards on the proposed Project
- ❖ Supervise the implementation of all recommendations in the Environmental and Social Impact Assessment report

The environmental coordinator reports to the Project Director and supervises all field environmental officers.

Field Environmental Officers

In pursuance of the objective of ensuring compliance with environmental regulations, Environmental officers will be staffed to supervise environmentally related activities of the proposed Project in the field.

Environmental officers are responsible for:

- ❖ Monitoring all environmental and social programs for pre-construction, construction and operational phases of the proposed Project, including those related to bio-physical and socio-economic/cultural components in the field;
- ❖ Working closely and coordinating efforts with the EPA and other enforcement bodies to ensure full compliance with all legal and regulatory requirements;

He will report directly to the Project Director through Liason Officer. Also he will work closely with the member of Owner's Engineer.

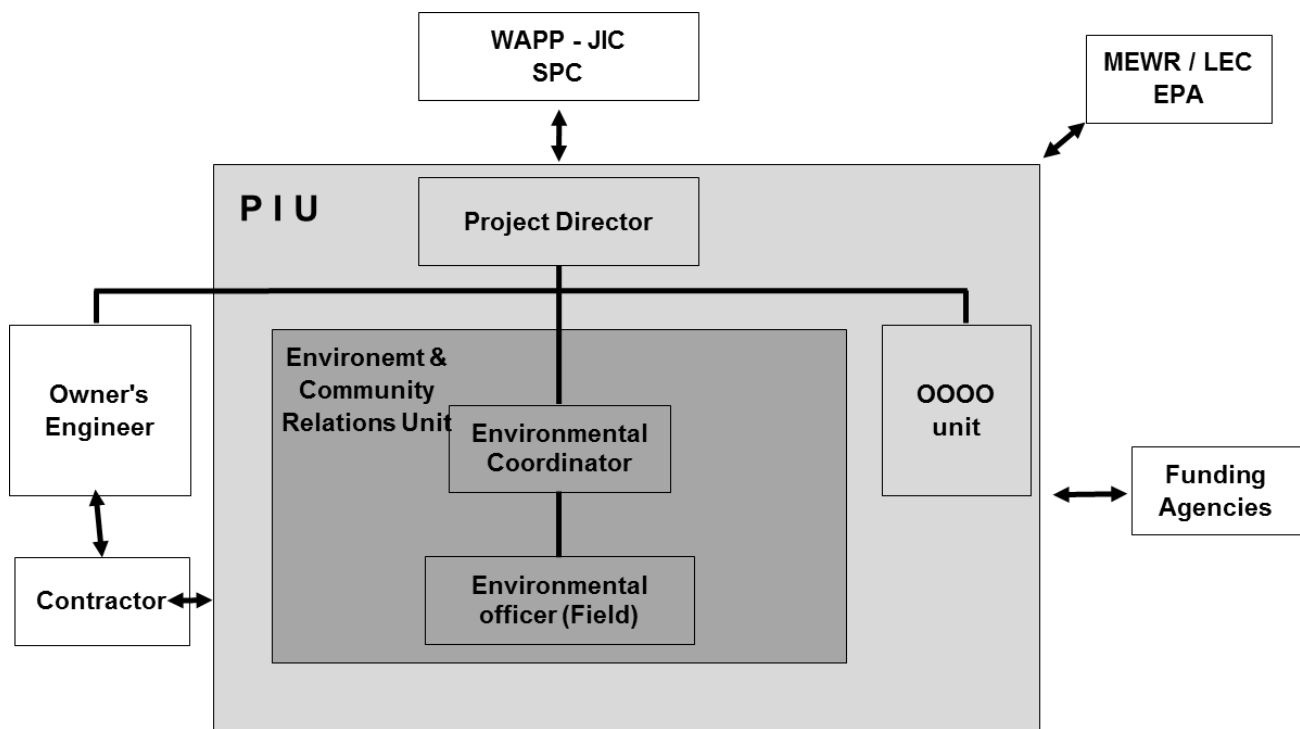


Figure 9: Organizational Chart-Project Environment Management

7.2.1.3. Inter-relationships between the PIU and other organizations

The primary role or mandate of the PIU, as defined earlier, is to oversee and supervise the field implementation of the proposed Project to ensure that it is constructed in accordance with the contract specifications and terms. The PIU will therefore assume its full mandate after the construction contract has been signed. The PIU will be expected thereafter to respect and enforce the provisions of the written contract agreement without undue interference.

From the above, the functions of the PIU are fundamentally technical in nature and apart from continuous communication with the Owners Engineer and regular progress reporting to the Funding Agencies and the SPC, the other significant form of interaction that is anticipated are those with the environmental protection agencies as well as the proposed Project Affected Persons (PAP). Minimal other interactions are foreseen with other entities. This is considered as an advantage since it would enable the PIU to focus its attention on the technical work of constructing the CLSG infrastructure without too many distractions.

In addition to the daily interactions with the Contractor, the PIU will also communicate with i) the SPC on Progress of work, Cost review, Project challenges and issues; ii) the OE on Technical issues, Specifications, Design reviews and approvals; iii) MEWR/LEC /EPA on Project impact and Mitigation arrangements; and, iv) the Funding Agencies on Payment requests, Cost review, Progress of Work, Challenges and Issues.

7.2.2. Environmental Auditing

The environmental auditing for the ESIA, RAP, and ESMP should be done by a specialist consultant. It is recommended that the auditing should be done one or two months before actual construction work of the line corridor begins. This should be monitored by SPC.

7.3. General health and safety procedures

It is recommended that SPC prepare Safety Rules and Regulations. Procedures relating to occupational safety and health should be guided by the SPC Safety Rules and Regulations which should be buttressed by the occupational safety and health recommendations in the ESIA. The relevant environmental and occupational safety and health issues to be covered in the SPC "Safety Rules and Regulations" include:

- ❖ Manual lifting
- ❖ Hearing protection
- ❖ Protective equipment
- ❖ Good housekeeping
- ❖ Fire prevention
- ❖ Prevention of falls from heights
- ❖ Electrical hazards
- ❖ Machinery safety
- ❖ Welding safety
- ❖ Head protection

- ❖ Feet protection
- ❖ Provision of first aid items

The mitigation measures recommended in the ESIA will also be fully implemented. The areas covered include:

- ❖ Hearing loss protection
- ❖ Protection against falling/swinging objects
- ❖ Snakebites
- ❖ Electrical protection
- ❖ Accidental falls from height
- ❖ Manual lifting
- ❖ Fire hazards
- ❖ Protection against dangerous machinery
- ❖ Provision of sanitary/welfare facilities

7.4. Fire prevention system

The general fire precautions to be taken include:

- ❖ The posting of “no smoking” signs at fire sensitive areas (e.g. fuel storage areas at the work camp, etc)
- ❖ Provision of appropriate and adequate number of fire extinguishers
- ❖ Proper storage of rags used in cleaning hands and containing flammable liquids (e.g. in metal containers for safe disposal)
- ❖ Handling of flammable materials by competent persons only
- ❖ Provision of emergency fire alarm systems
- ❖ In addition, fire prevention training would be carried out for selected project employees. At the end of the training, the personnel would have adequate knowledge of all fire prevention systems recommended in the ESIA.

7.5. Pollution prevention

Proper management of waste oils/lubricants, excavated earth materials and paint as recommended in the ESIA will be enforced. Measures to be adopted will include:

- ❖ Collection, storage and disposal of waste oils and lubricants
- ❖ Proper management of excavated materials
- ❖ Prevention and management of oil, fuel and paint spills

To ensure the success of pollution prevention, the environmental team will be trained to identify and appreciate what hazards there are in relation to improper storage and disposal of polluting substances.

7.6. Vegetation management plan

Vegetation Management Plan is needed to improve the reliability of the electric transmission systems by preventing outages from vegetation located on transmission rights-of-way (RoW) and minimizing outages from vegetation located adjacent to RoW, maintaining clearances between transmission lines and vegetation on and along transmission RoW.

Vegetation control shall be practiced periodically throughout the life of a transmission line to prevent vegetations become a threat to line operation and maintenance.

Mechanical method such as Mowing (Brush Bulls) using rubber tired or tracked tractor units equipped with a special mower head or flail type cutting head or hand cutting to clear new rights-of-way (RoW) before building the lines and to maintain the existing RoW instead of using herbicides.

Vegetation Management Plan is also necessary to promote sustainable plant communities that are compatible with the intended use of the site. Except for the area which might cause outages to transmission line, other area is recommended to be revegetated.

It is recommended to develop the Vegetation Management Plan considering aspects described as below:

- ❖ Selective removal of trees favoring crown closure;
- ❖ Removing cut material or cutting up small enough so as not to interfere with animal
- ❖ Movement in the travel lane;
- ❖ Promoting compatible species of trees and shrubs;
- ❖ Favoring the continued growth and reproduction of broad-leaved forest.
- ❖ Detection of alien species
- ❖ Identification and protection of endangered and protected species;
- ❖ Revegetation of residual construction footprints
- ❖ Erosion control

7.6.1. Mitigation measures

Measures to be employed to ensure a reduction of erosion, loss of cover for agricultural purposes, restoration of embankments, re-vegetation:

- ❖ Construction of new tracks will be kept to the barest minimum. Track routes will be selected in such a way as to minimize any damage to farms and crops.
- ❖ Mechanical control will be used for all vegetation clearing.
- ❖ The access tracks will be selected so as to avoid crossing streams and other water bodies.
- ❖ Where stream crossings are unavoidable, suitable culverts will be constructed over them. Under no circumstances will water bodies be blocked to provide for construction access.
- ❖ Removal of stream bank vegetation (especially bamboo/mangrove) will be avoided as much as possible.
- ❖ Compaction of soils along the graded tracks will be reduced by regulating the number of passes of heavy trucks to and from the sites.
- ❖ The ground surface at each tower site will be graded to provide drainage away from the tower legs. Where necessary (particularly on hillsides), terracing, cribbing or riprap may be used to provide protection for tower foundations.
- ❖ Cutting of trees will be done by a certified timber contractor, and strictly in line with the prescribed safety guidelines. The landing area of falling trees will be carefully selected to minimize damage to farms. Adequate warning will be given to ensure that public safety is not compromised.
- ❖ The Contractor will place warning notices ("NO ENTRY", "NO TRESPASSING ALLOWED" etc.) at entry to access roads. In addition, random security patrols shall be carried out. The public in construction active areas shall be continuously educated through the beating of gong-gong to avoid the construction areas as much as possible.

7.6.2. Invasive species control

In order to prevent damage to the ecosystem native species of plant and animal need to be protected; and alien species need to be prevented from gaining a foothold in the locality.

Invasive species are defined as "an alien (or non-native) species whose introduction does, or is likely to cause economic or environmental harm or harm to human health". Some invasive species may be too widespread to contain and/or eradicate. However, control and management efforts slow and/or reduce their impacts.

Prevention is the first line of defense against invasive species. While prevention is the first line of defense, even the best prevention efforts will not stop all invasive species. Early Detection and Rapid Response (EDRR) efforts increase the likelihood that invasions will be halted and eradicated.

According to the National Invasive Species Council of America, these are the EDRR actions categorized by three groups:

❖ **Early Detection;**

Early detection can be achieved by "active detection networks" comprised of individuals that have a specific job responsibility to find invasive species. They typically focus on species of concern, high-risk pathways, and locations. The identification of species is essential to early detection efforts.

❖ **Rapid Assessment;**

The detection of an invasive species initiates the Rapid Assessment process. Rapid assessment may recommend that a response be initiated. In addition, assessments of potential invasions can be conducted in advance of their detection. The rapid assessment process is an essential aspect of timely EDRR.

❖ **Rapid Response**

Rapid Response efforts contain, and where possible, eradicate invasive populations.

As a final step, control and management of invasive species is accomplished using modern resource management methods. Several complementary methods may be implemented in an overall strategy to protect ecosystems and aid in their recovery.

Taking the above into account, methods to prevent invasion of alien species need to be implemented particularly during construction of the power system. Possible methods could include: cleaning of mud off vehicles before traveling long distances; care taken to ensure that any imported materials do not come into contact with local watercourses either directly or indirectly; imported products must be treated to ensure that fungus, plant life, rodents, insects, spiders etc. are not carried to the site; prohibit the keeping of domestic pets by site workers; use local products, especially timber, wherever possible.

Encourage local residents to report any unusual [deaths of] animals, water-life or plant-life. During ROW maintenance the crew should be trained and vigilant to spot any unusual [deaths of] animals, water-life or plant-life.

If alien an alien species is spotted swift action must be taken to prevent its spread and if possible eliminate it.

7.6.3. Budget

Budgetary provision for vegetation management during construction will be part of the contractor's cost.

7.7. Archaeological and Historical site Management

In line with current international practice and the desire to ensure the sustainability of the environment within which the Authority operates, the SPC will avoid intruding into or interfering with cultural properties of the local communities as much as possible.

Archaeological chance finds

Prior consultations with the Museums and Monuments Authority have been carried out in connection with any historical or archaeological 'chance finds'. The following procedure, for dealing with all such finds will be followed:

Upon the discovery of any such chance finds:

- ❖ Notified immediately in writing, stating the exact site or location of the item.
- ❖ Preserve the finds with no alteration, damage, destroy or remove any antiquity from its original site without the consent of the Museums and Monuments Authority. If removal of the item becomes immediately necessary for safety or security reasons, the exact location shall be noted and the retrieved artifacts shall be sent to the custody of the Museums and Monuments Authority.
- ❖ Through liaising with the relevant authorities, the lawful owners of the land shall be duly informed and where necessary, payment shall be made by the responsible agencies after due assessment.

Further decisions with respect to site sampling or further excavation will be under the jurisdiction of the Museums and Monuments Authority. The above will ensure that issues relating to archaeological/cultural 'chance finds' are properly handled.

Cultural "chance finds" - sites of cultural significance such as sacred woods or trees or rock outcrops which the local residents may have not mentioned at the survey stage – will be properly managed to the satisfaction of both the local communities, the EPA and the Funding Agencies. Where possible, such cultural properties will be left undisturbed or

avoided. In cases where complete avoidance of such sites is impossible, every necessary step will be taken to minimize the potential impact of intruding into the site. This will be done in consultation with and to the satisfaction of the chiefs, elders and opinion leaders of the local communities.

7.8. Environmental and Social Management Monitoring

The monitoring parameters and the recommended frequency proposed in the ESIA will be strictly adhered to. The parameters to be monitored will be:

- ❖ Noise pollution
- ❖ Air quality
- ❖ Oil and grease
 - The relevant parameters to be monitored on weekly basis (in spite of measures to be carried out to suppress dust uptake by air currents) shall include:
 - ✓ Total Suspended Particulates (TSP)

The EPA has specifically asked that it be furnished with results of all weekly measurements of these parameters. This shall be done during the constructional phase of the project cycle.

- ❖ Water quality
 - The relevant parameters that will be considered for analysis are:
 - BOD
 - pH
 - DO
- ❖ Availability and use of personal protective equipment
- ❖ Fire safety
- ❖ Management of solid and liquid wastes

The frequency of monitoring of the abovementioned parameters has been indicated in the Table 26.

It must be noted that the baseline established by the ESIA team will enable the proponent to indicate the thresholds that will signal the need for corrective actions and the detection limits.

The Environmental Monitoring Unit members will be trained adequately to understand and appreciate the choice of parameters, sampling sites, methods of sampling/measuring and analysis and frequency of monitoring.

Method for water quality analyses

Temperature should be measured in situ with a portable temperature probe. Turbidity, pH and color determinations may also be measured in situ. Methods of analysis should be based on those outlined in “Standard Methods for the Examination of Water and Wastewater” (APHA-AWWA-WEF 1998) and the methods normally used for analyses are summarized in Table 25.

Table 25 Methods of analyses of selected parameters

Parameters	Method	APHA Method Number
Color	Visual comparison method	2120 B
pH	Direct measurement with a pH meter	-
Turbidity	Direct measurement with a turbidity meter	-
Total Dissolved solids, TDS	Filtration and drying at 180oC in an oven	2540 C
Suspended solids, SS	Filtration and drying at 105oC in an oven	2540 D
Dissolved Oxygen, DO	Winkler’s method with Azide modification	4500-O.C
Biochemical Oxygen Demand (BOD)	Determination of DO before and after 5 days incubation at 20oC	4500-0.C

7.9. Training and development

To ensure the successful implementation of all the environmental management programs, a training program is recommended for the SPC, personnel of the contractor and other relevant authorities. The program will cover the creation of environmental awareness and occupational safety and health issues. The main issues of concern will be:

7.9.1. Environmental awareness

The areas earmarked for environmental awareness creation include:

- ❖ Proper usage and definitions of basic environmental terminologies
- ❖ Liberia ESIA procedures, provisions of Environmental Act
- ❖ Environmental laws, regulations and environmental compliance in Liberia
- ❖ General environmental policies
- ❖ Introduction to environmental management planning
- ❖ Environmental impact assessment
- ❖ Mitigation measures
- ❖ Monitoring plans

- ❖ Environmental audit
- ❖ ESIA case studies

7.9.2. Occupational safety and health

The relevant areas for consideration are:

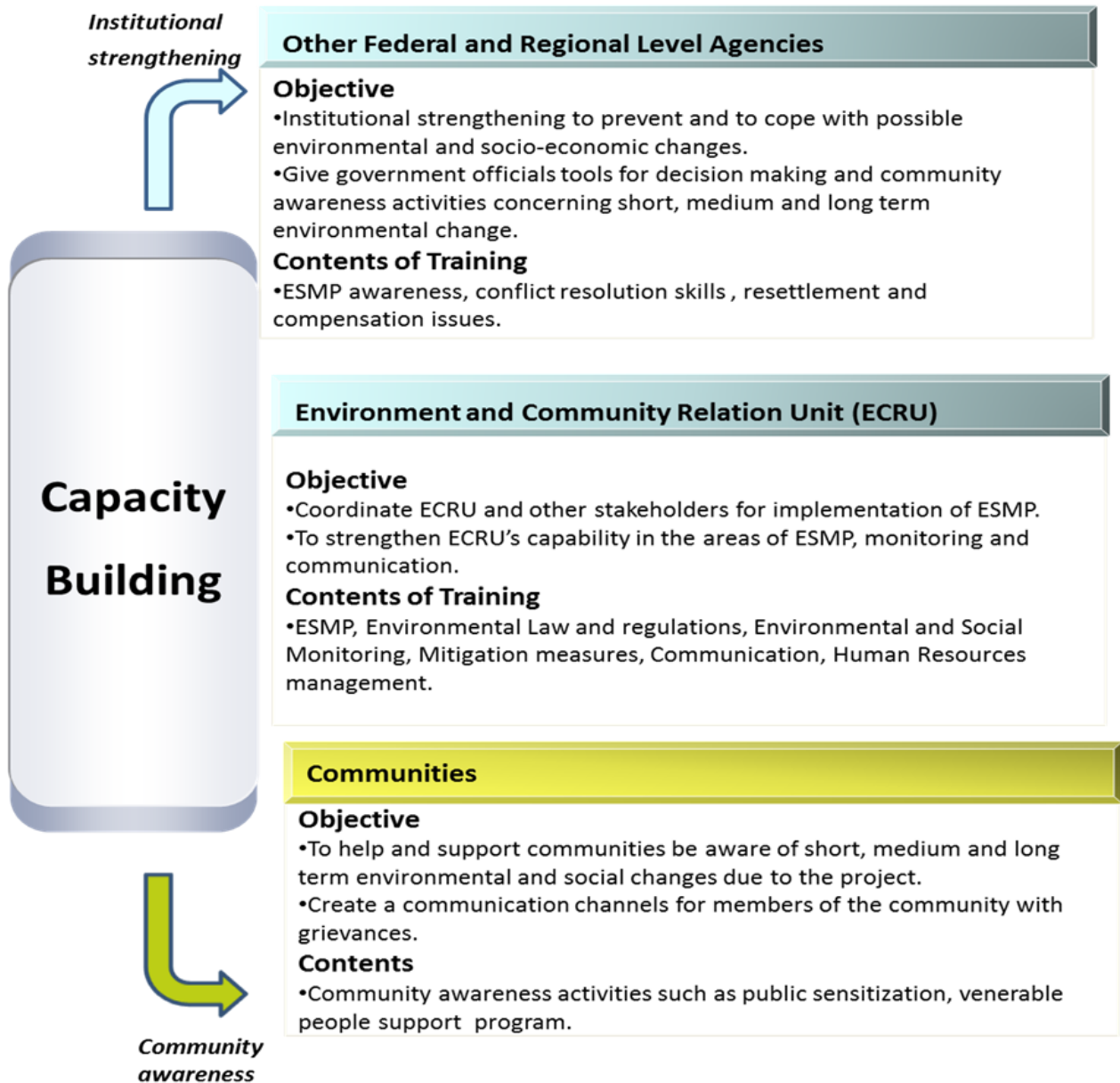
- ❖ National Social Security and Welfare Corporation Act. The provisions for safety, health and welfare.
- ❖ Fire prevention and fighting methods

7.9.3. Capacity building

The SPC (Special Purpose Company) will be set up for the implementation of the proposed Project. The SPC, the governmental agencies involved by the project will all need to be endowed with satisfactory environmental and social safeguards. The SPCs will need to have a special Environmental and Community Relations Unit (ECRU) which will be responsible for implementing the ESMP.

In order for these units to work effectively, proper capacity building will be needed. There are two aspects to the Capacity building- 'Institutional Strengthening' for SPCs, the governmental agencies, and 'Community Awareness' to publicize the project.

The proposed capacity building program strategy is shown in the diagram below.



For the successful implementation of Environmental management and monitoring program, it is essential for a range of training to start as soon as possible.

Capacity building of the Environmental and Community Relation Unit (ECRU) in SPC

In general, training can be composed of workshops, in-service training & technical assistance, in-service formal courses, and to a certain degree, awarding of scholarship for university degree and certificate studies.

Considering the efficiency, In-service Training & Technical Assistance will facilitate adequate on-the-job training and technology transfer, enabling the ECRU staff in SPC to undertake their monitoring activities during the Construction and Operation Phases of the proposed Project.

Capacity building of Other Federal and Regional Level Agencies

Several government agencies at both Regional and Federal levels will be responsible for ongoing monitoring of construction and operational conditions and activities. All stakeholders involved in the project must receive support through capacity building programs. This capacity building needs to be designed for the different target groups by specific institutes, universities or consultancy companies specialized in environment, training, human resources management and change management.

It is recommended that further detail assessment of involved agencies for developing the customized training in line with the current status in Liberia

7.9.4. Information, Education and Communication (IEC)

In addition to the provision made in 8.13 for continuous public education during the construction phase and subsequent posting of "Warning Signs", sustained information, education and communication (IEC) programs to ensure overall community safety shall be implemented on yearly basis. The purpose of the IEC program is to remind community members about project related risks and activities that will endanger their lives such as uncontrolled bush burning, climbing of towers, especially by children, as well as the need to adhere to warning signs and all rules governing the right of way.

7.10. Proper and adequate records keeping

The SPC will keep a General Register in the. Records that will be kept, as prescribed by the abovementioned law will include, inter alia:

7.10.1. Accidents and dangerous occurrences

Particulars to be entered in the Register will include the following:

- ❖ Date of mishap
- ❖ Name(s) of employees involved
- ❖ Sex and Age
- ❖ Usual Employment

- ❖ Precise occupation at the time of mishap
- ❖ How mishap was caused
- ❖ Period of disablement

7.10.2. Testing and examination of fire warning systems

Particulars to be entered in the Register will include the following:

- ❖ Description of fire warning system
- ❖ Date of test or examination
- ❖ Particulars of defects found
- ❖ Particulars of action taken and date

7.10.3. Particulars of Pressure vessels and lifting appliances

Particulars to be entered in the Register will include the following:

- ❖ Date of last thorough examination
- ❖ Maximum safe working pressure
- ❖ Particulars of defects (if any) reported by the certified engineer/surveyor
- ❖ Particulars of action taken to remedy defect indicated in iii. (If applicable)
- ❖ Name and other particulars of engineer/surveyor including signature

Table 26 Description of Environmental Monitoring Activities

Project Activity	Parameters to be monitored	Location	Measurement	Frequency of measurement	Institutional Responsibilities [incl. Enforcement & coordination]
Pre-construct ion	Line Route Survey Clearing of vegetation cover during line route survey. • Clearing of farms lands • Tree felling (forest reserves)	Entire proposed route of the Transmissi on Line	Hectares (area cleared in project area)	Throughout line route survey	SPC/Surveyors
	Public Information Disclosure of Environmental Impact Statement Document	Entire proposed route of the Transmissi on Line	Disclosure in the National Dailies Disclosure to members of the public	As and when required	LEC / EPA

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Project Activity	Parameters to be monitored	Location	Measurement	Frequency of measurement	Institutional Responsibilities [incl. Enforcement & coordination]
Construction	<p><u>Transportation</u></p> <p>Guidelines provided under section IV of the SPC Safety Rules and regulations concerning equipment, motor vehicles and transportation of personnel and materials should be applied and closely monitored and recorded. These should include monitoring the following activities:</p> <ul style="list-style-type: none"> • Speed Limits of vehicles, traffic congestion on main roads (near project sites) • Trucks conditions and maintenance • Vehicular accident records • Vehicle safety signals (flares, warning lights, reflectors etc) • Vehicle fuelling procedures • Vehicle loading/off loading procedures • Vehicle daily check outs • Driving licenses and permit to drive • First Aid and Fire Extinguishing kit 	Entire Project location	<p>Km/hr</p> <p>No. of Preventive Maintenance.</p> <p>Number</p> <p>Number</p> <p>Number</p> <p>Number</p> <p>Number</p> <p>Quantity</p>	<p>Daily</p> <p>Monthly</p> <p>Daily</p> <p>Daily</p> <p>Daily</p> <p>Daily</p> <p>Monthly</p> <p>Daily</p> <p>Monthly</p>	Contractor/SPC (Project Progress Report)
Construction	<p><u>Civil Works</u></p> <p>Activities to be monitored under civil works should cover safe working practices in accordance with SPC Safety Rules and Regulations. Monitoring criteria would include:</p> <ul style="list-style-type: none"> • Protective clothing and working gear • Plant and equipment maintenance • Safety Test - lifting plant gears (wires, hoisting blocks etc,) • Dewatering operations • Concrete works • Fire patrols (site camps) • Dust levels (settlements/watercourses) • Waste Management and Disposal 	Entire Project location	<p>Quantity</p> <p>Number</p> <p>Number</p> <p>Number</p> <p>Number</p> <p>mg/l</p> <p>Kg.</p>	<p>Daily</p> <p>Weekly</p> <p>Daily</p> <p>Daily</p> <p>Weekly</p> <p>Weekly</p> <p>Weekly</p> <p>Daily</p>	Contractor/SPC (Project Progress Report)
Construction	<p><u>Vegetation Clearing</u></p> <p>Clearing of vegetation cover at tower tracks, construction accesses, and right-of-way should be monitored under the following activities:</p> <ul style="list-style-type: none"> • Tree felling • Clearing of farms lands • Clearing of right of way (vegetation cut only to 1.25m height) • Clearing of tower track (graded width 2.5m-3m) • Clearing access tracks (graded width 3.5m) 	Entire Project location	<p>No. of trees</p> <p>Hectares</p> <p>Hectares</p> <p>Hectares</p> <p>Hectares</p>	<p>Daily</p> <p>Daily</p> <p>Daily</p> <p>Daily</p> <p>Daily</p>	Contractor/SPC (Project Progress Report)

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Project Activity	Parameters to be monitored	Location	Measurement	Frequency of measurement	Institutional Responsibilities [incl. Enforcement & coordination]
Construction	<p>Water quality Selected rivers, streams, and other water bodies in the project areas of environmental influence shall be sampled and analyzed for establishment of baseline water quality conditions. These same water bodies shall be monitored during construction phase to ensure compliance with anti-pollution legislation. The following parameters shall be monitored:</p> <ul style="list-style-type: none"> • Biological oxygen demand (BOD5) • pH • Oil and grease • Total suspended solids • Conductivity • Total coliform • Turbidity <p>Noise Noise levels shall be measured at the same positions as those for the ESIA in communities close to the proposed line.</p>	<p>Relevant water bodies in the way of the proposed RoW</p> <p>Communities close to the line route and having been identified as likely to undergo noise disturbance</p>	<p>mg/l Number mg/l mg/l µS/cm MPN/100ml N.T.U</p> <p>dB(A)</p>	<p>Every week during construction phase and once a year during operational phase after maintenance operations</p>	<p>Contractor/SPC (Project Progress Report)</p>
Construction	<p>Waste Management</p> <ul style="list-style-type: none"> • Waste bush handling • Waste water handling • Waste segregation • Disposal of conductor drums • Disposal of metallic waste • Disposal of empty chemical containers <p>Socio-economic/cultural issues</p> <ul style="list-style-type: none"> • Shrines • Sacred Grove • Identifying all affected persons • Assessment of compensation • Payment of compensation (adequate amounts, timely payments); • Archaeological chance finds • Conflicts over land • Identification of interested stakeholder • Employment equity (community vs. labour from outside); • Employment and job creation • HIV/AIDS Education program 	<p>Entire Project location</p> <p>“</p> <p>“</p> <p>“</p> <p>“</p> <p>“</p> <p>Entire Project location</p> <p>“</p> <p>“</p> <p>“</p> <p>“</p> <p>“</p>	<p>Kgs. Cm3 Kgs. Number Kgs. Number</p> <p>Number Number Number Amount Amount</p> <p>Number Number Number</p> <p>Share amount</p> <p>Share amount Number of programs</p>	<p>Daily</p> <p>Daily</p> <p>Daily Annually Annually</p> <p>Annually</p> <p>Annually Annually</p>	<p>Contractor/SPC (Project Progress Report)</p>

Project Activity	Parameters to be monitored	Location	Measurement	Frequency of measurement	Institutional Responsibilities [incl. Enforcement & coordination]
Operational and Maintenance Phase	<p><u>Routine ground/aerial inspection of lines</u></p> <ul style="list-style-type: none"> • Towers (vandalism, corrosion) • Insulators and accessories (damages, Replacements) • Accidents involving lines and structures • Occupational hazards and accidents • Accidents affecting public safety • Substations – oily wastes, transformer oil (PCBs) 	Substations & Entire Project Area	Number Number Number Number Cm3	As and when necessary during operational phase of the project cycle	
Project Activity	Parameters to be monitored	Location	Measurement	Frequency of measurement	Institutional Responsibilities [incl. Enforcement & coordination]

7.11. Scheduling & reporting

The monitoring program shall include a documented monitoring plan, which shall detail all data handling, storage and analyses requirements. SPC shall identify the location where all data is to be held, staff responsibilities for data handling and analysis and appropriate reporting lines for ensuring management are aware of the current status of site operations. This is particularly important with respect to resettlement negotiation, compensation payment and monitoring of implementation of these activities. Compensation schemes can suffer post construction claims from unsatisfied project-affected persons and detailed records keeping of all actions are essential to try to resolve any such issues.

Results of environmental monitoring activities will be reported to allow for identification of mitigation measures that need corrective action. From pre-construction to operation/maintenance phases, the Special Purpose Company (SPC) will carry the ultimate responsibility of ensuring that environmental reporting procedures are undertaken. The SPC will carry out monthly discussions on the proposed Project which will form a forum for discussions on environmental issues, and decision making with regard to further mitigation, monitoring, or changes to construction practices.

The Environmental Coordinator will report directly to the Project Director on all environmental activities for inclusion in the project monthly reports. The Environmental Coordinator will use these monthly reports as the basis for the preparation of an annual

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environmental report (as a requirement of the Environmental Impact Assessment Regulations) to be submitted to the Environmental Protection Agency and relevant international agencies.

All monitoring and reporting documents will be kept on file, as part of the SPC documentation procedures. The project-reporting schedule is presented in Table 27.

Table 27 Project reporting schedule

Activities in Mitigation Measure	2012				2013			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Pre-construction								
- Line route survey								
- Acquisition of right of way								
- Line Route Survey Report/ ESIA Report								
Construction								
- Access tracks					X	X	X	X
- Transportation of Machinery					X	X	X	X
- Full grading of tower tracks					X	X	X	X
- Clearing of RoW					X	X	X	X
- Erection of towers					X	X	X	X
- Erection of conductors, Shield wires and accessories					X	X	X	X
- Modification works at substations					X	X	X	X
- Acquisition of right of way					X	X	X	X
- Compensation					X	X	X	X
- Project Monthly Progress Reports					X	X	X	X
Operation								
- Dropping of conductor					X	X	X	X
- Shattering of insulator units					X	X	X	X
- Project Monthly Progress Reports								X
Maintenance Phase								
- Control of vegetation re-growth	X	X			X	X	X	X
- Rust treatment	X				X	X	X	X
- Replacing faulty components		X			X	X	X	X
- Quarterly Reports								
Construction – Maintenance Phases								
- Management of liquid and solid waste					X	X	X	X
- HIV/AIDS Outreach program					X	X	X	X
- Project Monthly Progress Reports					X	X	X	X

Activities in Environmental Monitoring	2012				2013			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Pre-construction								
- Line route survey				X	X			
- Public information				X	X	X	X	
- Project Monthly Progress Reports				X	X	X	X	

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Activities in Environmental Monitoring	2012				2013			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Construction								
- Transportation of Machinery						X	X	
- Civil Works						X	X	
- Vegetation clearing						X	X	
- Waste Management						X	X	
- Socio-economic/Cultural issues						X	X	
- Compensation						X	X	
- Project Monthly Progress Reports				X	X	X	X	
Operation - Maintenance								
- Dropping of conductor							X	
- EMF Levels							X	
- Quarterly Reports							X	
Institutional strengthening								
- National Power Authority	X	X	X	X	X	X	X	X
- Contractor			X	X	X	X	X	X
- PMU	X	X	X	X	X	X	X	X
- EPA	X	X	X	X	X	X	X	X
- Dept. of Museum	X	X	X	X	X	X	X	X
- Land Valuation Board	X	X	X	X	X	X	X	X
- District Councils	X	X	X	X	X	X	X	X
- Project Monthly Progress Reports	X	X	X	X	X	X	X	X
Training								
- EMP Implementation, Redesign, Conflict	X	X	X	X	X	X	X	X
- Resolution, etc.	X	X	X	X	X	X	X	X
- Environmental Processes, Methods & Equipment	X	X	X	X	X	X	X	X

7.12. Cost of environmental management

The proponent will make human resources available for environmental management and enhancement. In addition, financial provision shall be made to ensure that mitigation measures (including compensation), monitoring and training programs are effectively implemented. The proponent will make the necessary budgetary provisions to cover all commitments for the Transmission Line Project.

The estimated total budget for environmental and compensation management is 2,191,707 USD as shown in Table below.

Table 28 Environmental and Social Management Cost

○ ESMP Cost

Activity	No	ITEM	Cost (USD)
Activities	1	Review & Disclosure of Environmental Impact Assessment Report	68,040

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for ESMP	2	Audit for RAP and ESMP	53,200
	3	Environmental Monitoring	441,480
	4	Training of environmental management team in house	32,400
	5	Public Health & Safety (including HIV/AIDS Programmes)	216,720
	6	Measuring device for air/water/soil pollution and vehicle, laptop etc.	81,000
	Total ESMP Cost		

○ RAP Cost

DESCRIPTION	No	ITEM	Cost (USD)
Compensation	1	Compensation for lands	80,000
	2	Compensation for trees	586,263
	3	Compensation for food crops	161
	4	Huts / Houses / Buildings	158,800
	5	Constructional damage for plants outside of the ROW, inside access road $(=(2+3)*10\%)$	58,642
	6	Compensation for loss of income $((1+2+4)*10\%)$	41,253
	7	Add-on amounts for vulnerable project affected persons $(=(1+2+3+4)*5\%)$	41,261
	8	Professional fees, reimbursement for permits etc $(=(1+2+3+4)*10\%)$	82,522
	9	Contingency allowances to cater for the effect of probable increases in property values $(=(1+2+3+4)*10\%)$	82,522
Subtotal			1,131,424
Activities for RAP	10	Social action plan, community support	57,659
	11	Livelihood restoration program	19,701
	12	Community infrastructure Program $(=(1+2+3+4)*5\%)$	41,261
	13	External monitoring and Evaluation	26,600
	14	Purification rites / ceremonies	7,000
	15	Indirect cost $(=(10+11+12+13+14)*10\%)$	15,222
Subtotal			167,443
Total RAP Cost			1,298,867

○ Total

Total ESMP & RAP Cost	2,191,707
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*trees include rubber, Cocoa, Coffee and Oil Palm and Plantain

*Corps includes Rice, Cassava, Eddoes

*Building include Churches, Mosques, Palava huts

7.13. Recommended Compensation for Huts/Houses

Huts

Approximately 90% of the dwelling structures to be removed and subsequently replaced are considered “huts” and not houses in the Liberian context. A “hut” is made of locally produced materials such as sticks, mud, thatches planks, earth floor sometimes with plank doors and windows.

At present, the market value for a three room hut could be:

Table 29 Proposed Cost Estimation of a hut

Description	Unit Cost (USD)	Remarks
Sticks	150	
Mud	200	
Thatch	300	
Planks	250	
Workmanship and others	200	
Total	1,100	

Figure 10: Mixture of huts with thatch roof and others with corrugated sheet roof



Figure 11: Huts with purely thatch roof



Figure 12 Huts with mixture of thatch and corrugated roof



Proposed Unit (sun dried bricks house)

With reference to the World Bank compensation policy on affected persons who are to be re-settled should received an improved shelter better than the previous ones in which he or she lived. In this light, the below type of structure is being proposed (Sun- dried-brick house) which is more durable than a “hut”.

Figure 13 Sun dried bricks house under construction



Figure 14 In the back ground sun dried bricks house under construction using Mud (earth) as cement with corrugated sheet roof



Figure 15 Sun dried bricks house near completion constructed with cement & corrugated sheet roof



Table 30: Proposed Cost Estimation of a three (3) bed room Sun-dried-brick house

Description (Item)	Quantity	Unit cost at marketvalue(USD)	Total Cost (USD)
Mud 3 bricks for LD \$10	5,000	0.143	715
corrugated sheet/zinc (bundles)	4	75	300
Cement (bags)	50	10	500
Nail (packs)	40	0.5	20
Doors	5	30	150
Windows	6	20	120
Door Frames	5	25	125
Window Frame	6	20	120
Ceiling	100	7	700
Floor plastering (cement)	50	10	500
Workmanship			700
Others			500
Land (Town lot)	0.5	800	400
Total			4,850

Table 31: Cost Estimation for Buildings

Description	Remarks
It varies according to the size and other conditions and the amount for compensation of each building will be verified by Ministry of Finance	

Table 32 : Proposed Cost Estimation of Buildings

Description	Unit	Total Cost (USD)
Houses	6	29,100
Huts	19	19,700
Buildings	5	110,000
Total	30	158,800

7.14. Basis of Land Compensation Cost

Tower Spot. For the transmission line route, only tower spots will be acquired permanently, Even though dimensions and locations of each tower has not fixed yet, the Consultant identified that most of the RoW passes communally land. Therefore, the compensation of

land to be taken for the each tower spot is not necessary. However, the provisional budget shall be allocated as a contingency in case of building a tower in private area.

Substations: there are four substations in Liberia and the land for all of them will be purchased from the private owners based on market value in Liberia. There is no fixed price for land in Liberia. Government does not have much control over the various prices of land both in urban and rural areas.

The entire four (4) substations will cover approximately 160,000 square meters which is 40,000 square meters per substation. See below for the cost of land of each substation and the land area:

Table 33 : Cost Estimate for Land (SUBSTATIONS)

Substation	Area (m ²)	Area (acres)	Area (lots)	Unit Cost per Lot (USD)	Total Cost (USD)
Buchana (Bassa)	40,000	10	40	500	20,000
Mt. Coffee (Montserrado)	40,000	10	40	500	20,000
Yekepa (Nimba)	40,000	10	40	500	20,000
Momo Town (Cape Mount)	40,000	10	40	500	20,000
Total	160,000	40	160		80,000

In Monrovia and its environs, one lot ranges from US\$1,000 to US\$3,000 depending on the location of the land. In rural Liberia the cost of a lot ranges from US\$600 to US\$1000. The average cost of one town lot is approximately US\$ 500.00

7.15. Basis of Compensation for Trees and Crops

Landowners who cultivate the crops within the RoW of the proposed Project before the official announcement of the cut-off day are entitled to receive compensation for the entire crops or economic trees whether or not the their plantations are cleared as far as they are registered in PAP inventory list. However, In general, farming method in the project area is slash and burn shifting cultivation carrying out petty trading of surplus crops and small businesses to provide monetary income, there is a possibility that cultivation is changed after the Consultant complete the PAP investigation. Therefore, joint site visit with the EPA, the

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LEC and other responsible agencies should be made to verify the draft PAP inventory list along with their ownership in the field before issuing the Environmental Permit.

As shown in Section 7.12, compensation for trees and crops to be affected will be 586,263 USD and 161 USD respectively. Also, provisional budget shall be provided as a contingency in case of damages on trees or crops outside of RoW during the construction

8. CONSULTATIONS

Consultation is an essential element of the study. It gives a broad view of the concerns of the people who will be impacted by the project and others who may be directly and indirectly affected. In this light, communities within the range of 300 meters of the line route corridor were usually asked to assemble (elders, women, men, children, youths, etc.) in order to brief them on the objectives of the project and indeed what benefits they will receive during construction, and the operation of the project. Our recording experts have recorded the methodology used to discuss issues related to the line route corridor with the community people, the concerns raised by the people, compensation issues for properties to be affected, social programmes to be implemented, etc.

Consultations have been held with regulatory agencies, County Development Committees and local communities prior to the preparation of the Scoping Report and the Environmental Impacts Statement. Consultation

8.1. Methodology

The communities predicted to be affected by the proposed Project were identified with the help of the relevant County Assemblies, the Survey Consultants and from field work carried out to identify the communities. A summary of the survey methodology is discussed below.

A Team comprising the LEC, the survey and environmental/compensation consultants carried out very useful initial consultations with the potential project-affected County Assemblies and communities along the proposed RoW. The outcomes of such consultations have been incorporated in this report.

Using maps of the proposed transmission line provided by the surveyors and contractors, a team of Consultants traveled to the various affected counties along the line route corridor to initially explain the aims and objectives of the proposed Project. In this light, formal meetings were planned and held with the help of the community elders and the project affected people.

The community elders who usually received the messages prior to the meetings usually request the cooperation of their community members and formally asked the team to explain their mission. The meeting usually begins with a normal traditional greetings and exchanges during which period an interpreter is selected to interpret English to the local dialects.

The survey consultation instruments used were questionnaires, maps, sketches, etc. in order to carefully guide the process. Every member of the survey consultants used note book/pads to take note of what is being discussed for processing and for future records keeping pertinent to the conclusion of the meetings and the concerns of the communities and the affected people.

Majority of the local languages of the project area are verbal and not written; therefore, consultations with project affected people are done in English with an interpreter usually interpreted from English to local dialects. This method of communication is done because majority of the villagers do not understand nor speak English. Also, majority cannot read or write their local languages/dialects; they can only speak these dialects. This makes the public consultation process difficult. It is therefore recommended that signed communications be used intensively in order for more villagers to understand what is expected of them.

8.2. Major Concerns raised

Various stakeholders were consulted during the preparation of the ESIA. These include local communities (men, women, youths, elders and private persons), city authorities, environmental specialists, county authorities and others. Key concerns included compensation issues, employment and the invisible line route that cannot be physically seen.

The proposed Project received high degree of acceptability in that implementation of the line will boost local economy due to the availability of electricity hence more exposure and increased benefits as more people would receive power through the line and in a way increase economic opportunities. Communities also indicated that transportation problem will be eased including road safety as the line corridor will facilitate the construction and rehabilitation of road networks.

Compensation for economic trees

A member of the community asked how economic trees were to be compensated for in case they were to be felled.

It was explained that trees were to be felled only when very necessary. All felled trees were to be compensated for fully using rates that was to comply with rates of the regulatory

agency for such exercises. This would be done prior to commencement of construction activities.

Ownership of economic trees

An important question that arose flowing from the issue above was the question about ownership of the economic trees. This issue had to be stood down for the chief to help in resolving.

At the second meeting the chief explained that if the trees are located on an active farm then the owner is presumed to be the farmer. On the other hand, if they are not located on a farm, then they should be considered community property. Compensation would then have to be paid to the chief.

Possibility of sale of land to LEC

The chief wanted to know whether the LEC wanted land to buy for the substation.

It was explained that land for the substation had to comply with certain specifications for engineering purposes. The proponent has with the consent of the County Assembly identified a piece of land within the chief's jurisdiction. With the acquisition of an environmental permit the proponent would come forward and negotiate for that piece of land.

Social responsibility programs

A member of the community wanted to know whether the LEC would carry out social responsibility programs just like what some mines do in some mining communities.

It was explained that the LEC has so many transmission lines and substations scattered over the whole country. It would therefore be impossible for it to carry out such programs for each community the lines pass through.

Some of the concerns were however raised, and these include the followings:

- ❖ The contractors to employ people around their respective surrounding villages
- ❖ The contractors to consider replacing trees which will be destroyed during construction.
- ❖ Electricity to be provided at an affordable rate

9. DECOMMISSIONING

It is anticipated that the transmission line will be continuously maintained and repaired and will be operated for several decades. Towers may be upgraded based on cost/benefit analysis and the prevailing new technologies. Because of its long life span, the circumstances under which the transmission line might be ultimately decommissioned are difficult to foresee. However, if decommissioning becomes necessary and it is to be carried out, the following will be done:

- ❖ The conductors and shield wires will be lowered to the ground.
- ❖ All cables will be spooled and removed from the RoW and salvaged for re-use.
- ❖ Insulators will be collected for re-use or disposal at approved refuse dumping sites
- ❖ The towers will be removed from the RoW and salvaged for re-use or sold as scrap metal.
- ❖ The concrete tower foundations will be demolished, collected and dumped at approved refuse-dumping sites
- ❖ The tower base areas will be seeded with local plant species to stabilize the soil and minimize erosion.

The work camp, on the other hand, will be immediately decommissioned at the end of the constructional activities. The wooden structures, which will be raised as offices, workshop, accommodation and storage rooms will be dismantled and the planks of wood, doors and other materials will be carted away for re-use at other project sites of the contractor. The concrete floors will also be removed and disposed of at an approved landfill site. All mobile toilet facilities for the construction site workers will be removed from the site on completion of constructional works. Constructional equipment will all be transferred to the contractor's premises. The work campsite will then be filled, leveled and re-vegetated.

10. CONCLUSIONS

The WAPP Project is a development initiative launched in accordance with the Government of Liberia energy policy. The proposed Project is to produce adequate electricity per annum, which will make a significant contribution to reducing the electricity supply-demand gap and promoting economic development in Liberia.

The proposed Project is adopting best technology and design practices to minimize the proposed Project's impact on air quality. Gas emissions will meet national standards and World Bank emission guidelines for new thermal power plants, with the net impact on ambient air quality predicted to be low in the project area.

The proposed Project facilities will not substantially reduce local agricultural production. It will not have any major ecological impacts as it will be constructed on land that is neither ecologically-nor culturally-sensitive.

Land is being acquired for four substations mainly on communal land by the Government of Liberia. The impact on the livelihoods of households selling land is expected to be minimal due to the low production value of the land and the proposed Project's mitigation measures. The adverse impact on the livelihoods of affected households will be mitigated by the payment of rates for the land. In addition, livelihood improvement programs will be developed and implemented as necessary. Public consultations have been undertaken in line with Government requirements through LEC and the environmental consultants.

Special Purpose Company (SPC) will establish an environmental management system for the proposed Project based on a project-specific EMP. This will be overseen, monitored, and audited by SPC and implemented by each contractor. The proposed Project will comply fully with all relevant national laws and regulations regarding the environment, health, and safety.

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APPENDIX